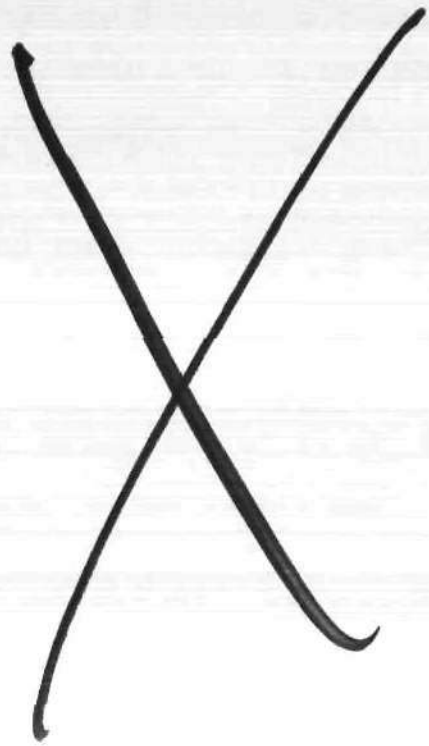


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AEC and GIS Applications Worldwide

In This Issue

GIS: The Market in the Eye of a Storm
Dataquest takes the position that events in politics, related markets, and technology developments create continual and significant impact in the GIS market; three such occurrences that support this claim are analyzed, and resulting changes to the 1994 and 1995 market forecast are projected.
By Kathryn Hale

GIS: The Market in the Eye of a Storm

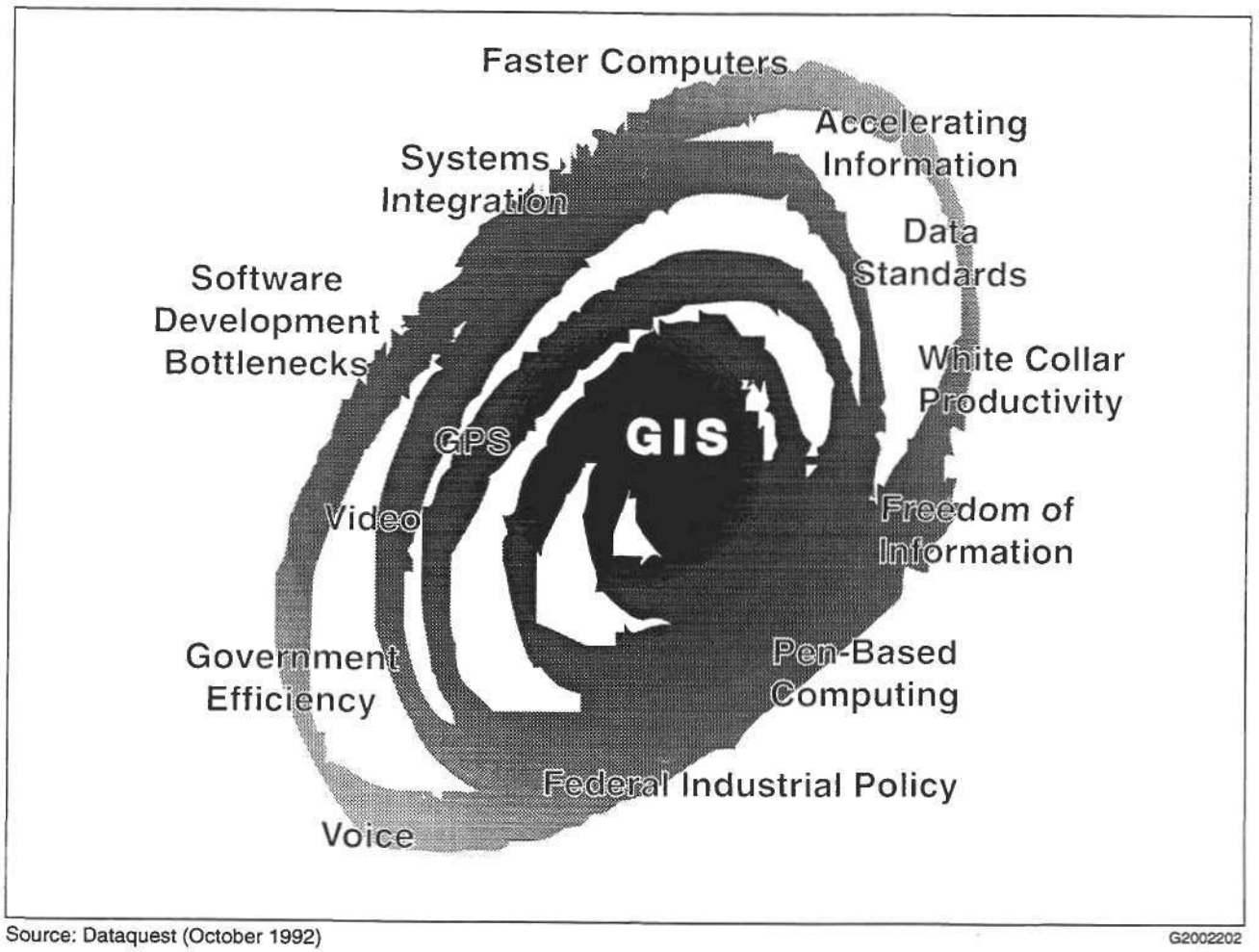
Outside events significantly affect opportunities in the GIS market—so much so that we suggest industry participants think of themselves as being positioned in the eye of a storm (Figure 1). Although it is a very interesting place to be, GIS vendors and users have limited control over the turbulence in technologies, politics, and markets that closely surround them. In a short period of time, the rules can change significantly. The three stories below each describe recent events that create risks and opportunities for any company involved in the industry.

Good News from Rockwell: GPS for the Masses

Road Scholar, a small software company in Houston Texas, announced at COMDEX/Fall that it will combine its City Streets mapping software (street price of approximately $65) with Rockwell International's just-announced global positioning system (GPS) device that comes in a Personal Computer Memory Card International Association (PCMCIA) format. Road Scholar will sell the GPS device for less than $400, creating a complete personal navigation system that displays and records position for less than $500. Shipment is expected in the first half of 1994. Road Scholar sells fleet management software and electronic street maps of 170 cities based on ETAK map data.

Finally, after years of hype and high prices, a vendor has produced a personal navigator that should be a shoo-in among vehicle-intensive business. The product uses laptop computers and is a plausible sell to the laptop-using consumer. Road Scholar negotiated a (nonexclusive) price from Rockwell International that could quickly make Rockwell's GPS products the low-end industry standard, which will in turn force virtually

Figure 1
GIS in the Eye of the Storm



Source: Dataquest (October 1992) G2002202

everyone in the mapping market to modify their product to read GPS data from Rockwell's products. Road Scholar states that incorporating the Rockwell application programming interface (API) was painless, and DeLorme Mapping and Resolution Mapping have already signed on.

This GPS card is from the same aggressive Rockwell group that produces the chipsets that dominate the modem and faxmodem market. Given its history of driving down prices on faxmodem chipsets, we can expect Rockwell to deliver even more aggressive pricing and packaging in the future.

Embedded low-cost GPS capability is obviously not far off, and we believe that laptop computers are an important place to embed that function. Although GPS receivers have a strong future embedded in a wide variety of devices and systems, we believe that computers offer an ideal medium for interpreting and leveraging GPS data. Laptop computers may prove the most cost-effective method of automating a vehicle-intensive business (such as trucking). With GPS capability inside computers, new mapping applications become possible. Once again, suppliers in a related technology are opening new doors for the GIS market.

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Bad News from Landsat 6

The Landsat 6 imaging satellite, launched by the U.S. government in October, successfully separated from its launch vehicle but failed to reach orbit. Because the spacecraft lacked telemetry instruments for sending data on its mission status, it essentially disappeared and will probably not be found. With it vanished the hopes of many suppliers that were poised to build new businesses from the new imagery. Particularly hard hit are existing users and vendors in environmental research and monitoring, which depend on continuity in the delivery of data. More complete details on the launch failure are outlined in the December issue of *GIS World* magazine.

EOSAT's New Market Positioning

The big loser, of course, is Earth Observation Satellite Co. (EOSAT), the scheduled vendor of Landsat 6 imagery. The company is left with only the aging Landsat 4 and 5 satellite imagery to sell. Landsat 6 was to have been the end of the experiment to privatize the Landsat program that produced EOSAT, and the government is set to resume direct control of sales of data from Landsat 7, which is currently scheduled for launch in 1997. Thus, EOSAT has already had to anticipate a distant future without Landsat revenue.

EOSAT claims to be unfazed by this sudden shortfall in product. The company has already signed contracts to resell imagery from both the Russian RESURS and Indian IRS satellites and suggests that there are more to come. This aggressive approach is remarkable considering that EOSAT is a joint venture of Martin Marietta, which manufactured the Landsat 6 satellite, and Hughes, which supplied its sensor. Nowhere is the difference between competing company and country interests more actively tested than in the satellite imagery market. To stay in business, EOSAT must partner with its competitors. The result is that a significant competitive loss for the United States (followed immediately by a successful French satellite launch) is being quickly capitalized upon by other countries that own imaging satellites.

The New Competitors: Countries and Companies

The loss of a core data source is a blow to the GIS market. Use of satellite imagery to build GIS systems has been growing rapidly, fueling new system buys. However, the growing global supply of imagery will mitigate the loss. EOSAT's reaction foretells the future: as more countries and private ventures launch imaging satellites, free-market forces will increasingly determine how satellite imagery is sold, by whom, and for how much. The next battle, which pits companies against countries, is well under way.

This battle began with the end of the Cold War, which led to budget cuts and cutbacks among the defense contractors that helped create satellite imagery. Because these cutbacks can erode a base of defense technology, the U.S. Land Remote Sensing Act of 1992 represents U.S. government

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recognition that one way to maintain that expertise is to encourage the continued commercial development of industries that use the same technologies. Suppliers that hope to launch their own imaging satellites, such as Lockheed, have fully articulated this compelling argument. They assert that one-meter data will eventually be sold on the open market by several world suppliers and that if the U.S. government denies U.S. vendors the chance to compete in this market, national expertise would soon decline, thus compromising the national interest.

We can almost hear similar lines of reasoning as they are fervently articulated by different participants in different countries. Despite the poker-game atmosphere, the logic is sound. Defense and civilian users of imagery have the same needs: timely, high resolution data that is easy to use and moderately priced. Right now, no products meet these requirements for commercial users. They must rely on aerial photography, manipulation of multiple imagery sources, or doing without it. This market demand is essentially for specialized, accessible information—the type of demand that in the long run governments have been able to resist, but not stop.

The Effect on Dataquest's GIS Market Forecast

In the long run, the failure of Landsat 6 is likely to help build a wider range of suppliers, both national governments and private enterprises. Competing suppliers should help improve the product and build the market. In the short run, GIS projects based on the anticipated Landsat 6 data will become temporarily derailed, reducing GIS system buys. In our most recent of GIS users, one-fourth of U.S. sites planned to use satellite imagery in their projects, and Landsat data is a common source for these users. We estimate the loss of Landsat 6 will reduce growth in the 1994 and 1995 GIS market between 1 and 3 percentage points, depending on how effectively alternative imagery suppliers step in to fill the gap.

Luck Strikes the GIS Industry

In September 1993, the Clinton administration unveiled a plan to develop a data superhighway, known as the National Information Infrastructure (NII), with funding of $1 billion to $2 billion per year to develop test programs. At the same time, an industry-led group was formed to help develop those test applications. The group is known as the National Information Infrastructure Testbed (NIIT), and members include AT&T, Hewlett-Packard, Digital Equipment Corporation, Network Systems Corporation, Sandia National Laboratories, Sprint, SynOptics Communications, and Ellery Systems. NIIT's mission is to develop a nationwide information testbed that will deliver applications to solve real-world problems.

NIIT connects nine U.S. sites using a network based on asynchronous transfer mode (ATM), FDDI, frame relay, and Ethernet, to compare their relative performance in large-scale, wide-area applications. The hardware and software is designed to be reused in subsequent NIIT applications. The first project undertaken by NIIT is the Earth Data System (EDS),

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which has already been successfully demonstrated at the Supercomputing '93 show (November 16 to 18, Portland, Oregon), approximately one month after NIIT's formal formation. Follow-on projects are planned in health care, education, access to public records, manufacturing, and financial services.

The Environmental Information Highway

EDS is a multimedia workgroup application that allows geographically separated users to work collaboratively with large amounts of environmental data and computing resources as if they were sitting side by side. The combined data holdings, analysis software, and computational resources of the participating EDS institutions appear to be locally mounted on the users' personal workstations.

EDS was built and operated using Ellery Open Systems software. Ellery Systems, a self-described middleware company, develops software for creating applications based on the Open Software Foundation's Distributed Computing Environment (OSF DCE). DCE is a set of software services and tools for distributed applications in a heterogeneous computing environment. Distributed applications involve integrating data and processes that are already distributed, or distributing processes and data that are currently centralized but are too expensive to maintain.

An accumulation of 20 years of records, the EDS information bank comprises approximately 800GB of satellite images of land and oceans, weather statistics, coastline and river data, salinity levels, and fishing yields gathered from large and small databases from a variety of public and private sources around the world. Computing services include data archives, information browsing, collaboration, visualization, and systems monitoring tools. The project is designed to deal with a fundamental problem in remote sensing: computers with huge data sets but no common access tools.

Eventually, NIIT hopes to integrate EDS with remote sensing equipment in the Pacific Ocean and in equatorial and U.S. forests. The result would be that these sophisticated remote sensing instruments would become network-addressable devices that can be remotely programmed to perform complex tasks.

Why was EDS selected as the first test application? Just plain luck—simply a case of being in the right place at the right time. The consortium wanted a quick win to demonstrate, and EDS had strong project champions and was nearly ready to go. Key to the project's selection was that it offered few political roadblocks and showcased complex applications. One of the benefits cited by participants is the opportunity to learn to work effectively on a large-scale project with small companies, large companies, government agencies, and scientists. Several participants believe that the experience is helping them articulate ways to employ information technology more broadly, beyond the workgroup.

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The EDS project is sure to advance the state-of-the-art and practice in earth sciences, and holds the potential of expanding the functionality of GIS systems. In the words of an Ellery Systems spokesperson, "EDS turns your whole network into a virtual GIS system." Although initial users are scientists and researchers, it is hoped that subsequent phases of EDS will be extended to users in industry (such as oil and gas) and governments that need similar tools and network services. As the project continues to unfold, so will new opportunities for products and services. So far, of course, the project is focused more on image processing rather than GIS. As new applications are identified, Ellery Systems hopes to encapsulate GIS software at individual sites into the environment.

A New Market Player Emerges from the Background

Research Systems Inc. of Boulder, Colorado, received no publicity in the EDS project, despite the $5 million software company's key role as the source of the software that provided the interactive, exploratory data analysis tools for imagery. Research Systems' Interactive Data Language (IDL), embedded into the Ellery Systems software, is an application development environment for applications requiring mathematical analysis and visualization. The product has a strong following among scientists and engineers working in complex image processing applications such as astronomy, earth and environmental sciences, medical imaging, and electron microscopy. IDL's predecessor, the Mariner Mars Spectral Editor, was developed in the late 1960s and early 1970s on VAX systems; today the product is also available on UNIX, Windows, and Macintosh operating systems.

Building on its strength in the scientific community, Research Systems plans to enter the GIS market with Environment for Visualizing Imagery (ENVI) image processing software. ENVI, which begins shipping January 1994, will directly compete with software from ERDAS, PCI, and Earth Resource Mapping. Pricing is aggressive ($10,000 for a workstation version and $5,000 for a PC version) and image processing capabilities are comprehensive. If the company can produce an effective marketing campaign while quickly adapting to requirements of new types of users, it should be able to give its competitors some serious trouble.

Dataquest Perspective

The fall of 1993 altered the nature of competition in the GIS industry. Rockwell International, Research Systems, and Road Scholar each appear more significant as either a partner or a threat, depending on one's market position. The EDS project can be an opportunity to expand what a GIS does or a threat to products representing the status quo, depending on one's perspective. The Landsat 6 disaster, which changes the basis of competition in the worldwide satellite imagery market, will force new alliances and create new opportunities. Although no supplier can afford to ignore all these events, no formula can describe the most effective individual response. Each industry participant must determine which event to respond to and how.

By Kathryn Hale

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AEC and GIS Applications Worldwide

In This Issue

End-User Analysis—Meeting the Needs of the AEC Community: A Focus on Key Accounts
In this article, Dataquest highlights the major findings of our architecture, engineering, and construction (AEC) industry survey. We examine users at the largest and most influential sites in the United States and evaluate their satisfaction with current CAD systems.
By Kathryn Hale

End-User Analysis—Meeting the Needs of the AEC Community: A Focus on Key Accounts

The AEC industry is often envisioned as having a number of casual users at small sites using a diverse set of applications. But on the contrary, many large sites with significant CAD budgets do exist. This study is designed to examine those large and influential sites, uncover growth opportunities for CAD vendors, and impart useful and strategic knowledge to vendors and end users at less-experienced AEC CAD sites. For more detailed information and analyses on the findings of this survey, see Dataquest's *User Wants and Needs* entitled, "CAD/CAM/CAE Architecture, Engineering, and Construction Applications."

Profile of the Largest AEC CAD Sites

Dataquest recently completed a telephone survey of 188 North American AEC CAD sites, drawn mainly from the largest firms in the Engineering News Record (ENR) 500 directory, the American Institute of Architects directory, and Dataquest's database of AEC CAD sites. A particular effort was made to reach the top 20 ENR firms.

The survey population was chosen to represent the major buyers and influencers in the market. Respondent breakdown by title is described in Table 1. More than one-half of the survey respondents are CAD managers and 7 percent of the respondents are computer system managers, which allows for good insight into the future information technology plans of these companies.

The typical AEC user in our survey has a wealth of experience, averaging seven and a half years of CAD experience with a minimum of two years of experience for all respondents. Users averaged 30.6 hours per week

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Table 1
Percentage of Survey Respondents with Each Title

Title	
CAD Manager	55
Department Manager	15
Computer Systems Manager	7
Project Engineer	5
Designer	4
Chief Engineer	4
Project Architect	4
Owner/President	3
Drafter	1
Facility Manager	1
Managing Architect	1

Source: Dataquest (July 1993)

using a computer and 20.5 hours per week using a CAD system. Despite the fact that nearly two-thirds of the users have learned more than one CAD product, they spend nearly 19 hours per week using only one brand of software.

Nearly 80 percent of the firms that were interviewed fall into the services category, as is shown in Figure 1. A breakdown of service firms by type based on ENR categories is shown in Figure 2. The nonservices sector, intentionally populated with chemical/petroleum companies and governments, consists of groups that traditionally purchase a large number of CAD systems and often contract design work to the service companies. Chemical/petroleum industries and government sites are represented in direct proportion to their buying influences.

In addition to studying sites by firm type, we also analyzed sites by primary application or work done. The types of work most frequently performed at user sites are architectural and civil/structural, each with 38 percent of respondents. Facilities design/management applications are used at 18 percent of sites and process plant design applications are used at 6 percent of sites.

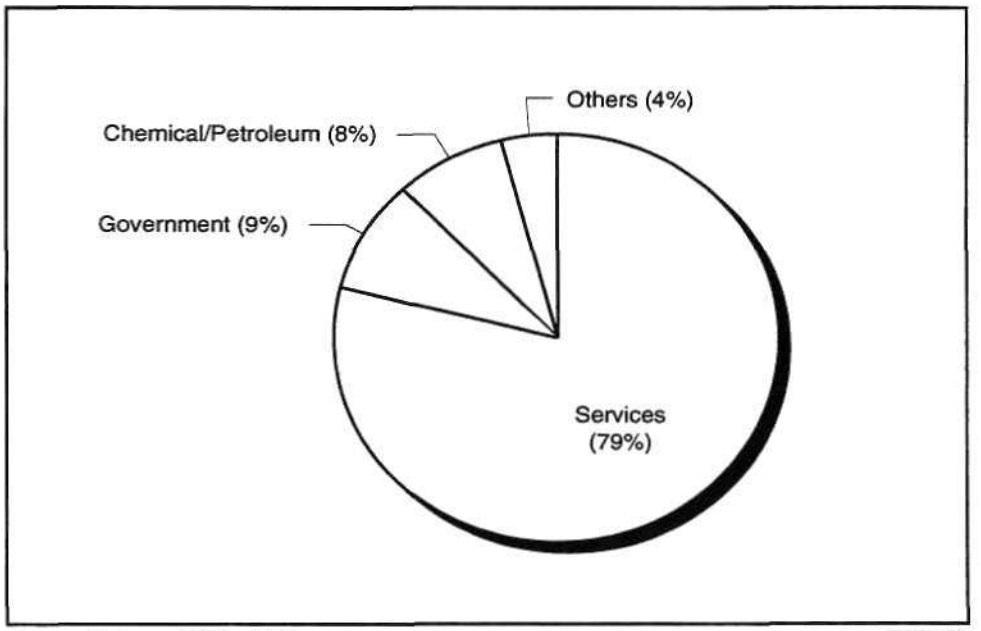
Of the products used at all sites, Autodesk's AutoCAD and Intergraph's Microstation dominate the market, as is shown in Table 2. However, in architectural and civil/structural design sites, other vendors' products have a collectively significant market share. Nearly 34 percent of civil/structural design sites use software other than AutoCAD or Intergraph products.

The Computing Terrain

The AEC industry relies heavily on personal computers for its CAD systems. DOS-based and Windows-based personal computers are the primary computers at 59 percent of the sites surveyed, as shown in Figure 3. Intergraph workstations are strongly represented at 22 percent of the sites.

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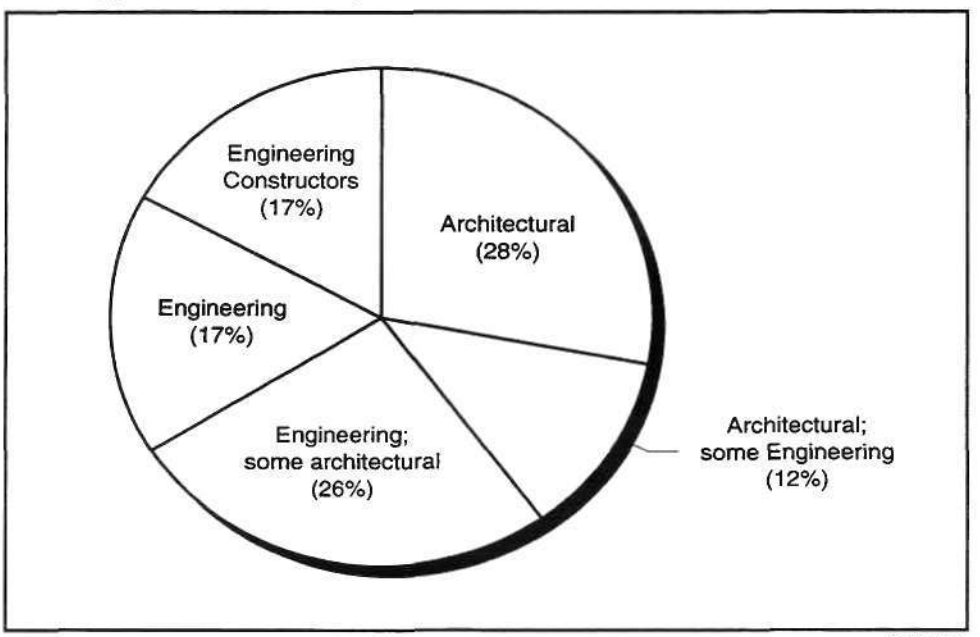
Figure 1
Respondent's Industry



Source: Dataquest (July 1993)

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Figure 2
Firm Type (Services Only)



Source: Dataquest (July 1993)

G3003054

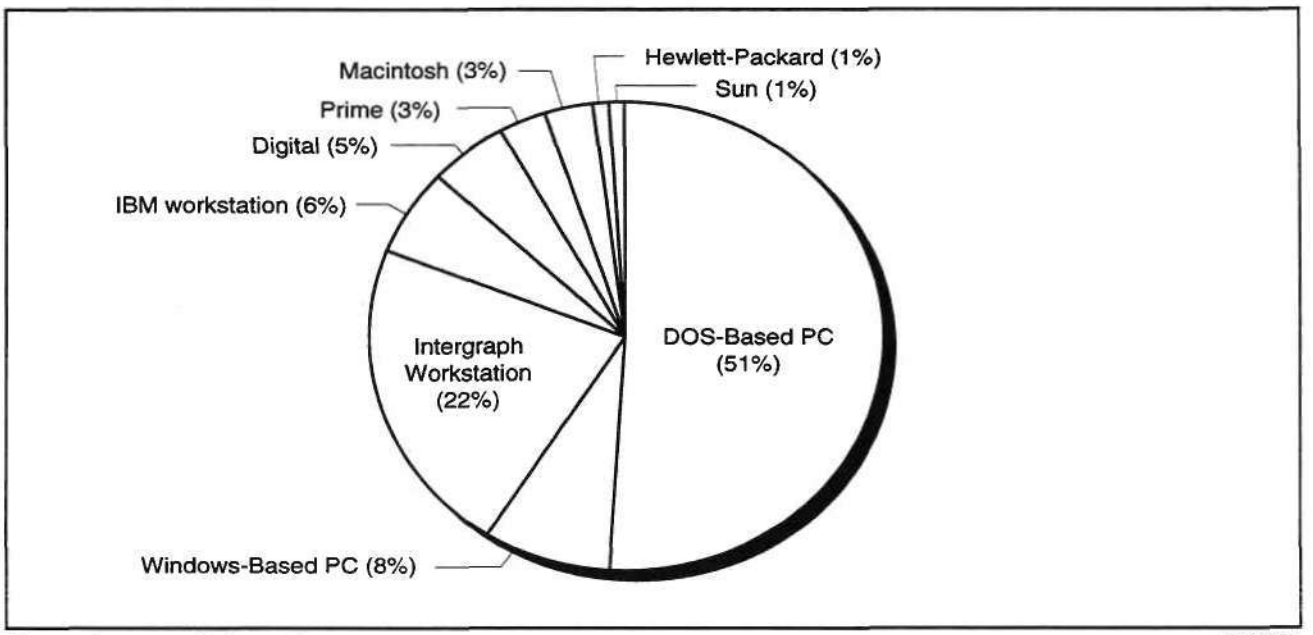
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Table 2
Products Used (All Sites)

Product Name	Percentage of Software Units	Number of Sites	Average Units per Site
Accugraph MountainTop CAD	0.3	2	5.5
Autodesk AutoCAD	37.0	83	19.5
Autodesk AutoCAD Add-On, Others	1.8	10	0
Autodesk AutoCAD Add-On, Softdesk	2.4	12	8.9
Autodesk AutoCAD Add-On, ASG	3.5	10	0
Autodesk Generic CADD	1.8	14	5.5
Auto-trol Technology	0.2	2	3.5
CADKEY Datacad	0.3	4	3.0
Claris CAD	0.1	3	1.0
Computervision Calma	2.6	2	56.5
Computervision Medusa	0.4	3	5.7
Computervision Versacad	0.2	3	2.3
EDS GDS	1.0	4	11.3
Intergraph Project Architect	0.6	4	6.5
Intergraph Civil	0.4	4	4.3
Intergraph Microstation	41.6	73	25.0
Intergraph PDS	0.2	2	3.5
Intergraph Structural	0	1	2.0
Isicad CADVANCE	0	4	3.8
Sigma Design Arris	0.2	3	2.7
Others	5.2	15	15.1

Source: Dataquest (July 1993)

Figure 3
Primary Computer at Site



Source: Dataquest (July 1993)

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Similar results are found for seat counts; nearly 70 percent of all seats are associated with personal computers. This compares to a worldwide installed base that is 79 percent personal computers.

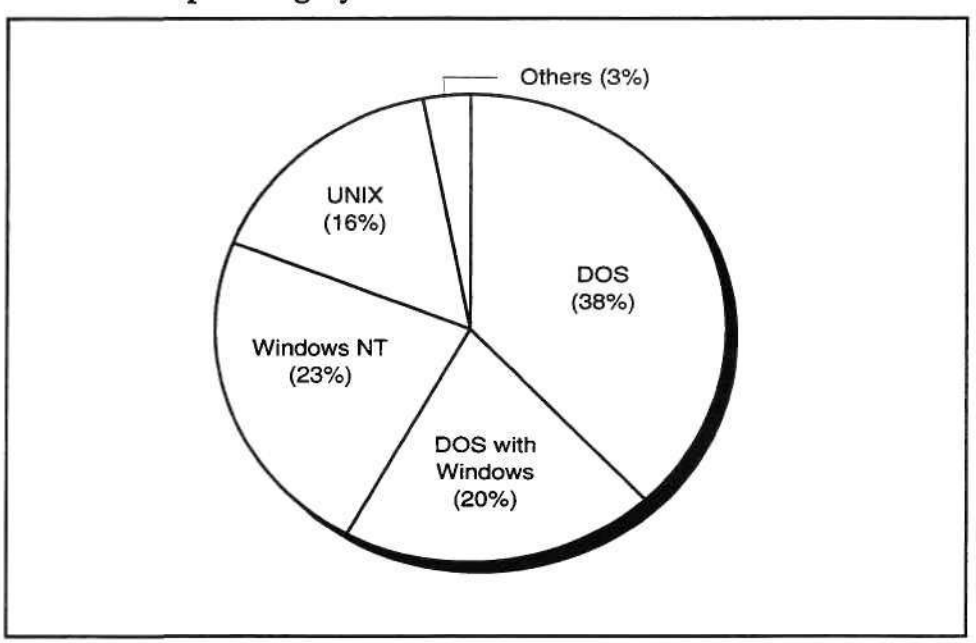
Users anticipate dropping their dependence on DOS as a major operating system and moving toward Windows and Windows NT within the next two years. As shown in Figure 4, the UNIX operating system is also expected to decline from its current 25 percent use to approximately 16 percent within the next two years. It is anticipated that the current UNIX users planning to change operating systems will switch to Windows NT, led by Intergraph's continuous Windows NT publicity campaign.

CAD Implementation at User Sites

Nearly 70 percent of the survey respondents stated that their company has corporate standards through which CAD software is bought. Nonservice companies, those in chemical/petroleum industries and governments, are the most likely to have a purchasing system in place, while those in engineering construction are least likely.

The need for CAD system usage is compelling; a sizable number of companies report a need to deliver design information in electronic form. In addition, more than one-half of the respondents must share information with two or three sites during the course of a project. Engineering/architecture and nonservice firms rely more on electronic transfer than architectural-only and engineering constructor firms. AutoCAD's DXF format essentially an industrywide standard, is the most commonly requested format for file exchange. Despite the need for electronically based design

Figure 4
Dominant Operating Systems at Sites in Two Years



Source: Dataquest (July 1993)

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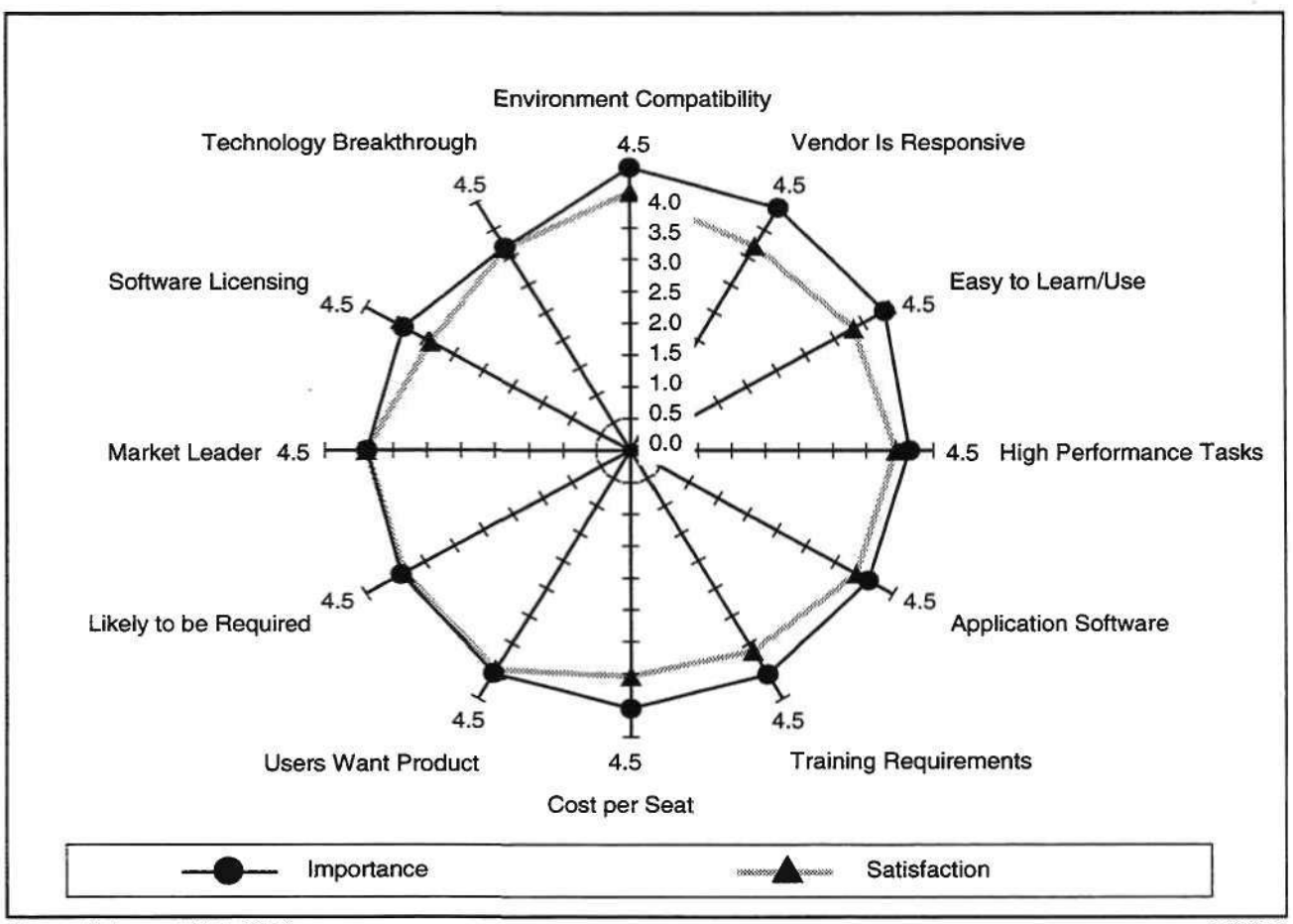
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information, 21.5 percent of the respondents plan to use paper and pencil as their primary design methodology in the next year. A small 13.4 percent plan to use 3-D CAD and 65.2 percent intend to use 2-D CAD for design activity.

What Users Want: Vendor Performance and Customer Satisfaction

We asked users to rate the importance and level of satisfaction of key CAD product attributes on a five-point scale. A classic gap analysis was performed on the data as shown in Figure 5. The most important feature in the eyes of the users is product compatibility with their current working environment, followed closely by vendor responsiveness to user needs. Overall, product attributes had a mean level of importance of 4.07 and a weighted average satisfaction level of 3.83. The largest gap, negative 0.69, occurred with respect to vendor responsiveness to user needs, indicating that users rate vendor responsiveness more highly than the level of satisfaction they actually receive. However, these gaps in satisfaction are smaller among AEC users than among mechanical or electronic designers examined on similar measures. AEC vendors are either doing a better job for their customers or AEC users are easier to please.

Figure 5
Importance versus Satisfaction with AEC CAD System for all Respondents



Source: Dataquest (July 1993)

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It is interesting to note that technology breakthroughs ranked among the lowest product features in importance—these AEC users are less interested in products that offer the latest and greatest technology breakthroughs. The message is simple: Users want products that are compatible with their current environment, easy to use, and have a good support network from the vendor.

AutoCAD versus Microstation

Because of the dominance of Autodesk's AutoCAD and Intergraph's Microstation in the AEC industry, we again asked respondents to rate importance and satisfaction of these specific products. Our results show that both products are rated nearly equal (3.1) in overall product satisfaction, and both enjoy a slightly higher-than-average level of customer satisfaction with scores of 3.96 for Microstation and 3.87 for AutoCAD, versus 3.83 for the entire sample. The largest difference in importance and satisfaction levels between the two products occurred in vendor responsiveness, with AutoCAD showing a gap of negative 0.82.

Despite nearly equal levels of satisfaction, AutoCAD and Microstation users are hardly identical. Table 3 shows key differences between the typical users for each product. Microstation users seem to value the more sophisticated product attributes, are more often in UNIX environments, and use 3-D CAD for a larger percentage of their design work. Microstation is popular among the nonservice firms and large engineering/architecture firms, whereas AutoCAD has a strong presence in architectural-only and engineering-only firms.

Satisfaction by Application

We rated customer satisfaction by application using the same gap analysis technique described earlier. Overall results are shown in Figure 6. Civil/structural users are the most demanding customer set; this group has the highest importance rating and the highest gap between what they want in

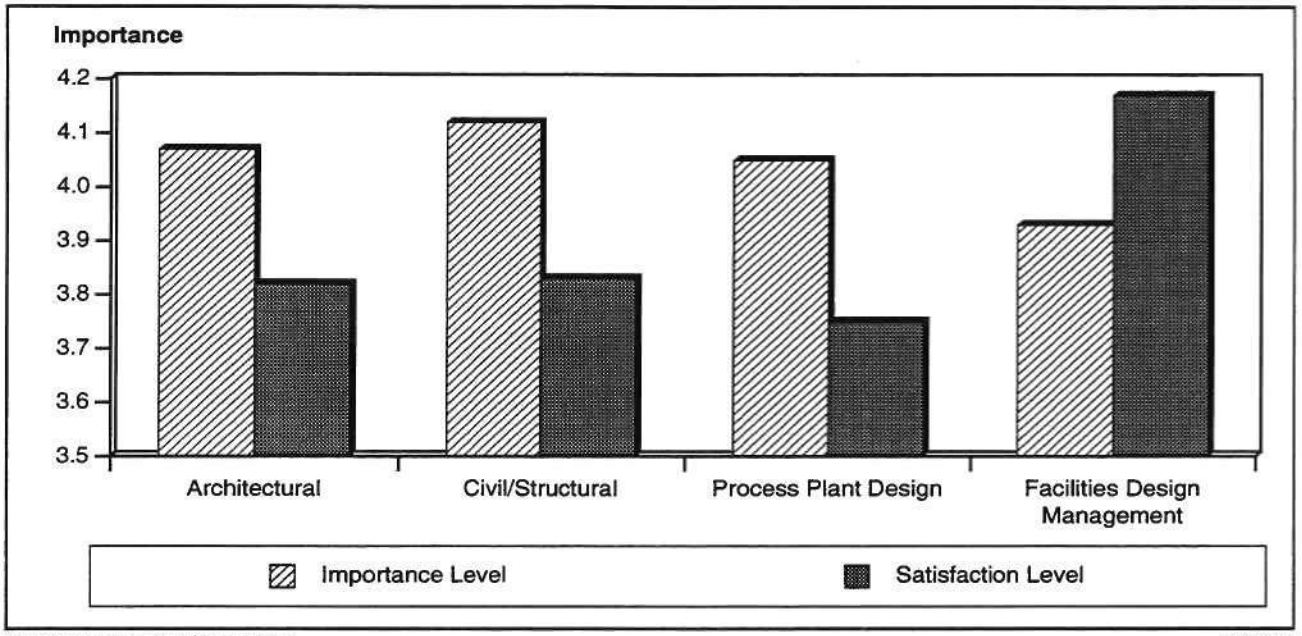
Table 3
AutoCAD versus Microstation Users: Comparison of Key Differences

	Typical AutoCAD User	Typical Microstation User
Primary computer used	90 percent PCs	20 percent PCs, 70 percent workstations
Operating system in two years	DOS	UNIX
Years of CAD experience	6.4	8.8
Next year's design that will be on paper (%)	25	17
Next year's design that will be in 3-D CAD (%)	7	20
Importance placed on use of 3-D CAD*	3.16	3.58
Importance placed on use of design constraint systems*	2.87	3.61
Able to solve more complex designs now than 3 years ago*	3.77	4.14

* Ratings based on a five-point scale: 1 = not at all satisfied/important; 5 = extremely satisfied/important.
Source: Dataquest (July 1993)

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Figure 6
Overall Importance and Satisfaction Levels by Application (1 to 5 Scale)



Source: Dataquest (July 1993) G3003070

vendor tools and what they are getting. The facilities design/management group is the least demanding, with the highest level of satisfaction and a positive gap of 0.24 between level of importance and level of satisfaction. With respect to each of the application areas, the greatest gap for architectural applications lies in training requirements. The civil/structural applications show the greatest gap in vendor responsiveness, facilities design/management indicates the greatest gap in technology breakthrough, and process plant design applications show the greatest gap in easy-to-use software.

Satisfaction by Technology

We examined user satisfaction based on the type of design activity (3-D, 2-D, or paper) performed. Leading edge (3-D) users are least satisfied with their CAD systems; they report negative gaps of greater than one for both vendor responsiveness and flexibility in software licensing. Training requirements, ease-of-use, and product performance in complex tasks also showed high negative gaps. Surprisingly, even these leading-edge users rank the importance of technological product breakthroughs last.

The mainstream users, those who do a large percentage of their design work in 2-D CAD, lie between leading-edge users and paper-based users in terms of satisfaction with their CAD tools. Although large gaps between importance and satisfaction ratings do not exist, vendor responsiveness, ease-of-use, and compatibility with environment are areas in which vendor products can be improved.

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At the low end of the spectrum, users who primarily design on paper are satisfied with their CAD tools. Satisfaction and importance match on nearly all metrics except for vendor responsiveness. In general, paper-based users place high importance on CAD products that are easy to use and that satisfy the most basic CAD needs. These users need to be enlightened as to the benefits of CAD over paper.

Will Users Switch Vendors?

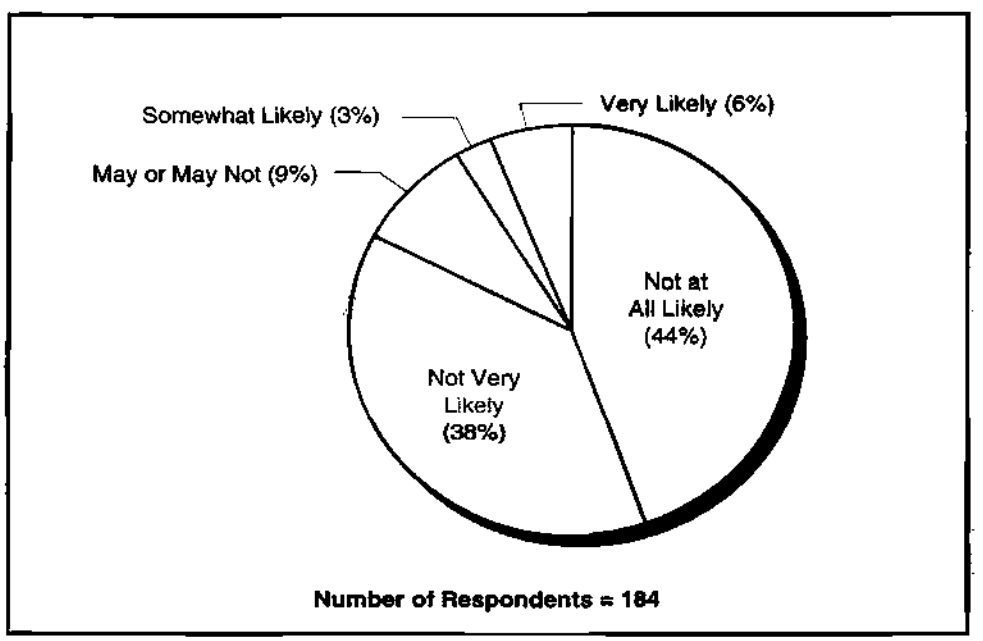
Despite some dissatisfaction among users in all groups, it is unlikely that they will change AEC CAD software vendors, as shown in Figure 7. Two characteristics stand out for those users likely to switch vendors. First, their overall satisfaction level is low, 3.72 compared to the survey average of 3.87. Second, these sites have no standards for purchasing CAD software.

What Users Need to Succeed

To understand AEC user needs better, we asked users to identify their company's key success factors for the next two years, in other words, what can their company do to stay on top of the market. Users' top concerns include the following:

- Maintaining a competitive advantage
- Responding to regulatory requirements
- Preparing timely and accurate quotes or bids
- Reducing rework at the construction site

Figure 7
Likelihood of Changing AEC CAD Software Vendors



Source: Dataquest (July 1993)

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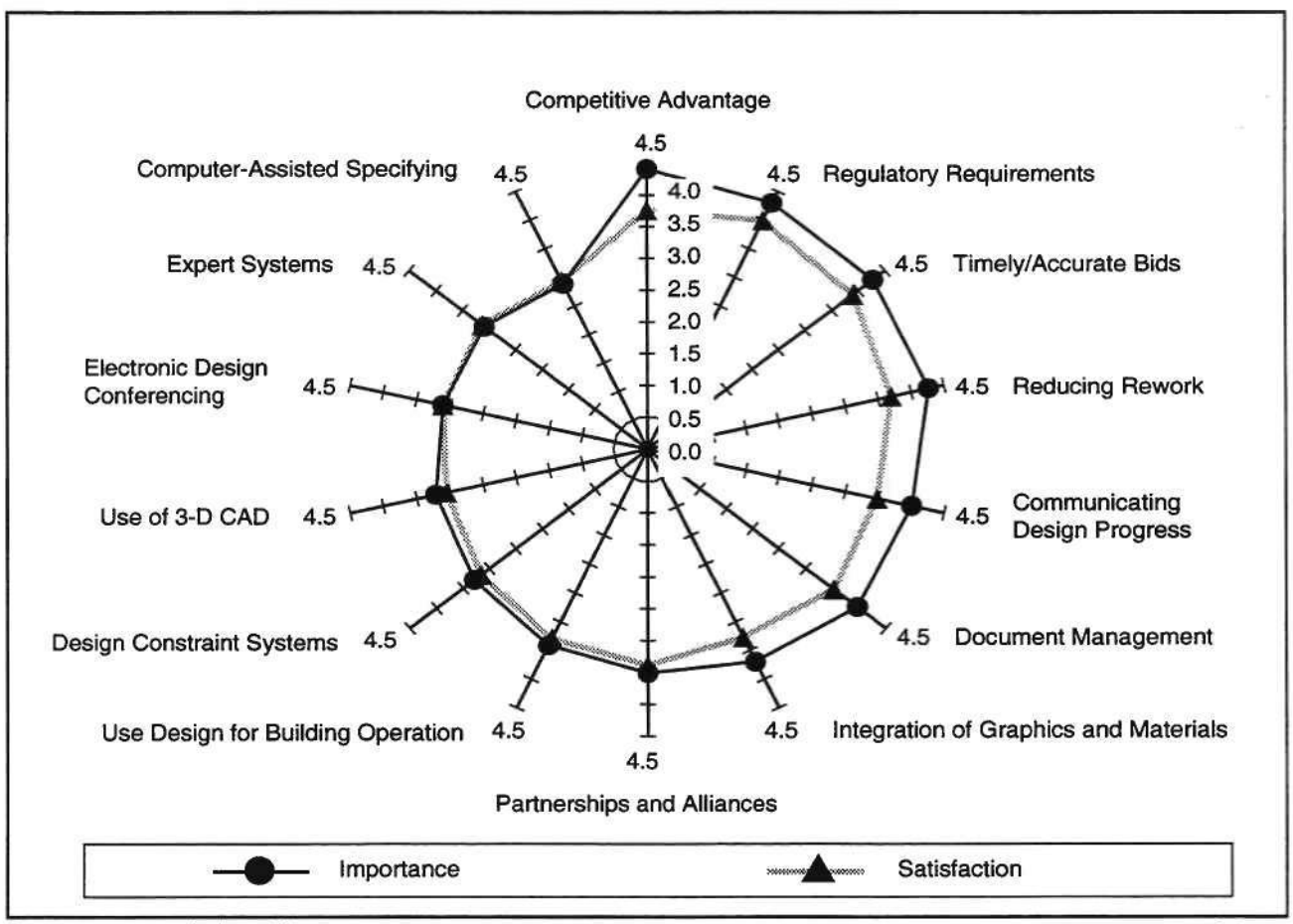
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The average rating by importance and satisfaction for each indicator is shown in Figure 8. Vendors with well-articulated positioning statements will point prospective customers to benefits the customer actually wants. Figure 8 shows that touting expert systems and computer-assisted specifying capabilities are ineffective ways to address a prospective customer's real concerns. Instead, vendors might better emphasize one of the timeless promises of CAD—that it can create a competitive advantage.

Defining Successful Sites

One of the most important results of our survey is the identification of those specific characteristics and attitudes that differentiate highly successful AEC CAD sites from active sites that have problems. Our definition of "successful" and "troubled" sites is simple. Using a five-point scale, users named the degree to which they agreed with the statement, "Our organization's progress to date in making use of CAD technology has been excellent." Those respondents who strongly or somewhat disagreed with

Figure 8
Key Success Factors at Users' Site



Source: Dataquest (July 1993)

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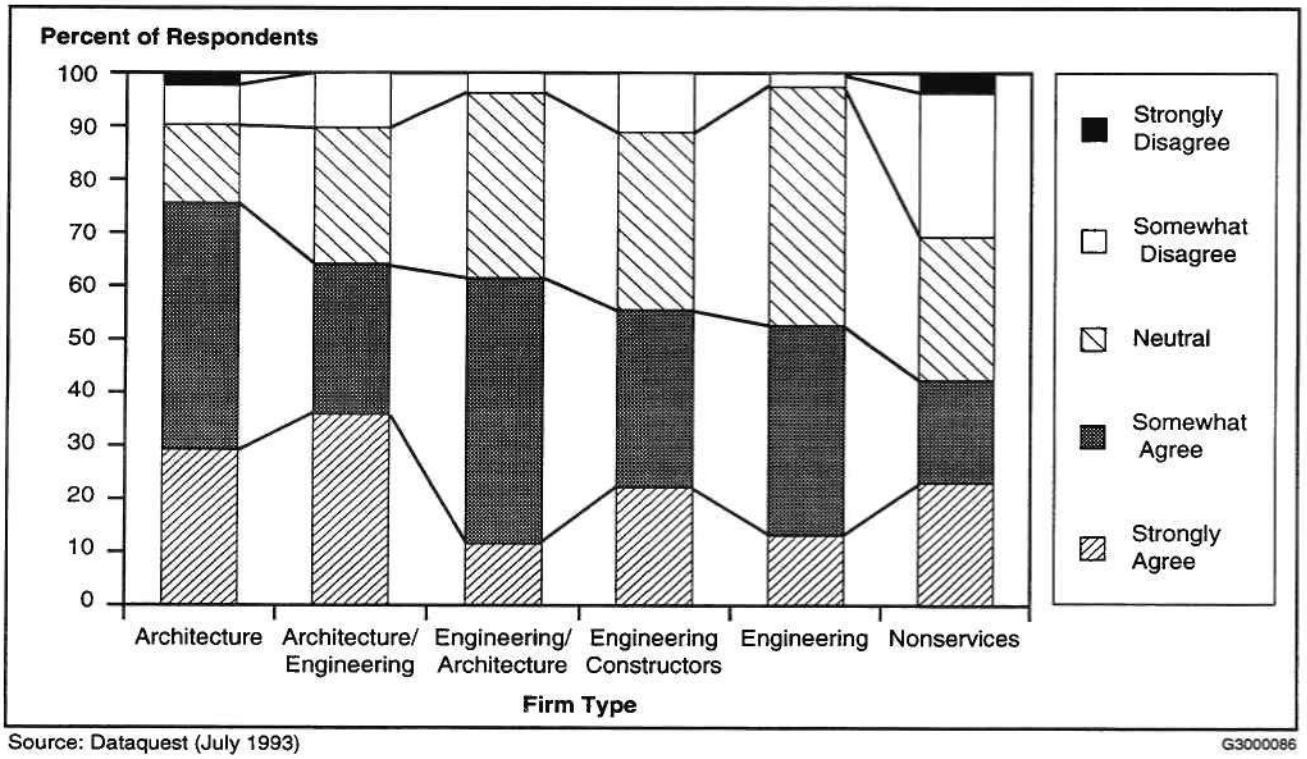
the statement were referred to as "troubled" sites. A breakdown of responses by firm type is given in Figure 9. Overall, architectural groups reveal that they are most successful with CAD, whereas nonservices are the least successful.

Those sites identified as successful are more satisfied with their company's progress on the following factors, all of which point to better management of the entire design process:

- Document management for design or engineering
- Integration of graphic design data with specifications and materials data
- Maintaining a competitive advantage
- Use of 3-D CAD
- Ability to use electronic design for operation and maintenance of structure
- Product training

In addition, there is a dramatic difference between successful and troubled sites concerning standards. Approximately 80 percent of the successful sites have corporate standards for which CAD software is purchased, whereas only 55 percent of the troubled sites do.

Figure 9
"Our Organization's Progress to Date in Making Use of CAD Technology Has Been Excellent"



Source: Dataquest (July 1993)

G3000086

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Successful companies tend to purchase CAD systems to upgrade and keep current with technology, to satisfy customer requirements, and to provide specific functionality. On the other hand, troubled sites make CAD purchases a part of a planned, formal strategy, and in order to gear up for a specific project.

The most startling difference between successful and troubled sites is the extent to which these groups agree and disagree with the statement, "Engineering management here thoroughly understands the capabilities of design software." In general, successful sites agreed with this statement, whereas troubled sites tended to strongly disagree. It is clear that having engineering management one step removed from learning the intricacies of CAD software can hinder a site's success.

Successful or unsuccessful, all sites tend to disagree with the statement, "CAD/CAM software has been oversold by vendors and the media." Evidently, CAD software, on the whole, is meeting its promises.

Spending Plans

Anticipated spending changes for 1994 are shown in Table 4. Overall, users are planning an estimated increase of 8 percent in spending in the installed base for software and computers. Spending for peripherals is anticipated to grow at a slower rate of approximately 5 percent, whereas outside services spending is expected to grow by only 1 percent.

Analysis by firm type reveals that only 16 percent of the nonservices category expect to increase software spending in 1994, whereas 46 to 59 percent of the services category anticipate an increase. The result is similar for computer spending, except that 26 percent of nonservice companies expect to increase computer purchases. Those firms not anticipating changes in spending for outside services range from 63 to 79 percent of all firm types.

The amount paid to external suppliers during the past two years ranges from less than $10,000 to $5 million. More than one-half of these purchases have gone toward hardware, nearly one-third have gone toward software, and the remainder have gone to outside consultants and support.

Table 4
Anticipated Spending Changes for 1994 at Respondents' Sites

	Spending Equal to 1993 (%)	Spending Increase in 1994 (%)	Spending Decrease in 1994 (%)	Average Increase (%)	Average Decrease (%)	Estimated Overall Change (%)
Software	43.6	44.7	9.6	26.0	42.0	8
Computers	43.1	43.6	10.6	25.0	43.0	8
Peripheral Devices	61.7	28.7	7.4	32.0	52.0	5
Outside Services	71.3	14.9	10.1	36.0	39.0	1

Source: Dataquest (July 1993)

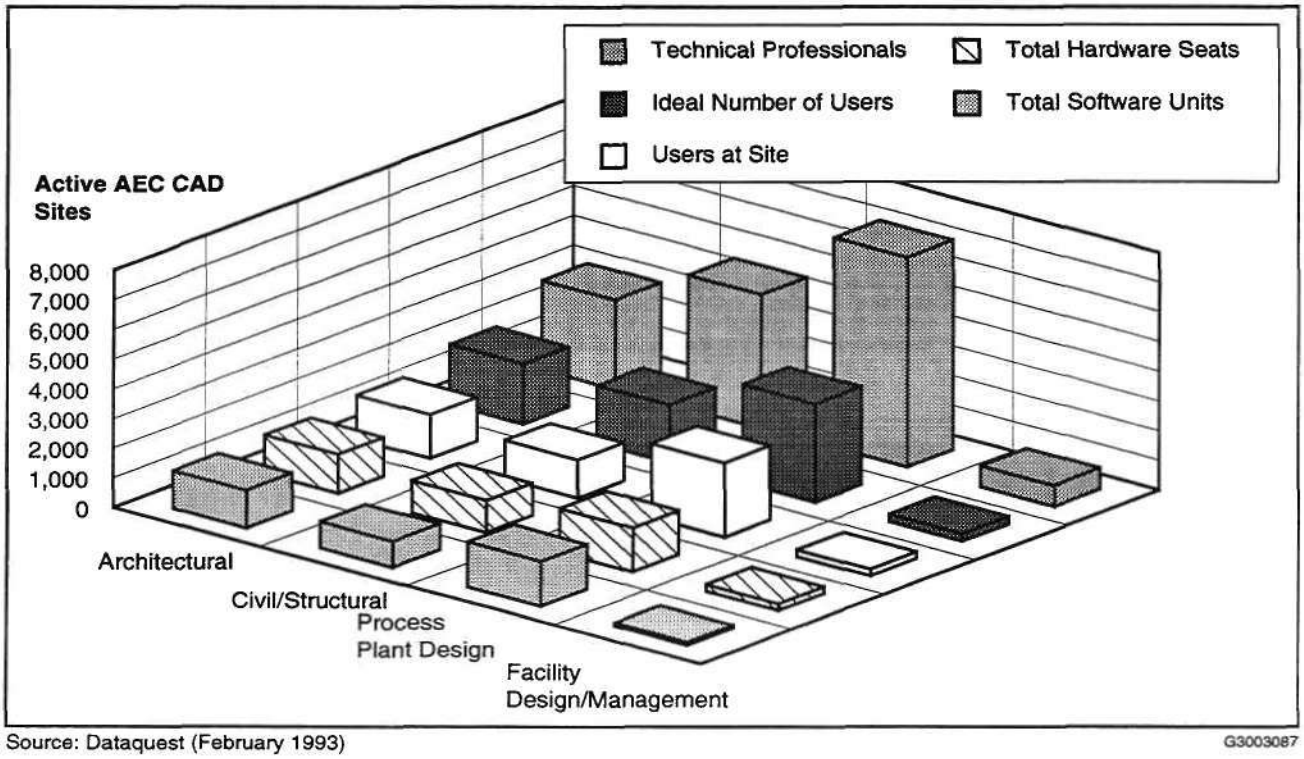
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Market Penetration at Existing Sites

To assess future growth areas for AEC CAD, we examined market penetration at existing CAD sites. The low end of market penetration is a ratio of the number of CAD seats currently installed to the level of market awareness or number of people at any given site who would, under ideal circumstances, make some use of a CAD system. The high end is similarly based on the number of installed CAD seats and the total number of technical professionals at a given site.

Using this metric, 46 percent of the software seats needed to saturate the process plant design market completely have already been purchased. This low-end penetration figure ranges from 39 percent for facilities design/management sites to 63 percent for architectural sites. Similarly, at the high end of market penetration, only 14 percent of the software seats at facilities design/management sites have been purchased. Approximately 20 percent of the seats at process plant design sites and civil/structural sites have been purchased, and 42 percent of the seats at architectural sites have been installed. Market penetration results are shown in Figure 10.

Figure 10
Penetration at Active AEC CAD Sites by Application



Source: Dataquest (February 1993)

G3003087

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Dataquest Perspective

Although the AEC industry is not driven by the latest technology, the group, as a whole, has a fair amount of experience with CAD products and knows what it wants. AEC CAD users are clamoring for easy-to-use products with high-vendor responsiveness and product-environment compatibility. While the industry has gradually shifted toward 3-D CAD, there is still a large group that does not understand the benefits of CAD systems and uses paper for its design work.

The factors that distinguish successful sites from troubled sites lie in the company's outlook on the role of CAD and information technology within the firm. Successful sites have engineering managers who understand CAD technology and make purchases based on meeting their customers' needs.

Users and vendors must work together to create user environments that are structured for success: users because they need to succeed and vendors because success helps grow the AEC CAD market.

By Kathryn Hale

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Dataquest Perspective

Software

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AEC and GIS Applications Worldwide

In This Issue

Sizing GIS Opportunities
Geographic information system (GIS) opportunities are diversifying, and new applications are appearing each year. Selling to this greater diversity will require focused efforts for smaller suppliers and a carefully balanced marketing effort for full-service suppliers. A key challenge for vendors in the next few years will be choosing which applications to develop and which to outsource. This article intends to help suppliers identify and evaluate key targets within the overall GIS market based on users' applications.
By Kathryn Hale

Sizing GIS Opportunities

GIS opportunities are diversifying, and no supplier can hope to address the needs of all potential customers. Although we define the overall GIS market as a group of potential customers that might need or want capabilities offered by some type of GIS system, further market segmentation is required to identify groups of customers that require different products or respond differently to varying marketing strategies. There is no point in identifying and analyzing market segments that lack adequate size or potential because considerable expense is involved in developing each unique market or product strategy.

The more common and greater risk, however, is in identifying market segments that actually overlap, which can result in counting on and investing in the same revenue opportunity more than once. Overlapping market segments in GIS are included in references to markets for desktop mapping, state and local government, business GIS, and AM/FM. Obviously, low-cost desktop mapping systems are widely used in state and local governments, and many utilities using AM/FM are business users.

To avoid the overcounting that is always present in haphazard market segmentation schemes, Dataquest typically develops market segments that add up to an entire market. The focus here is on the user's application—what the user does with the GIS. Application is independent of the industry that the user works in (such as telecommunications or retail) and the focus of the GIS technology used (such as raster or vector).

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Forecast Overview

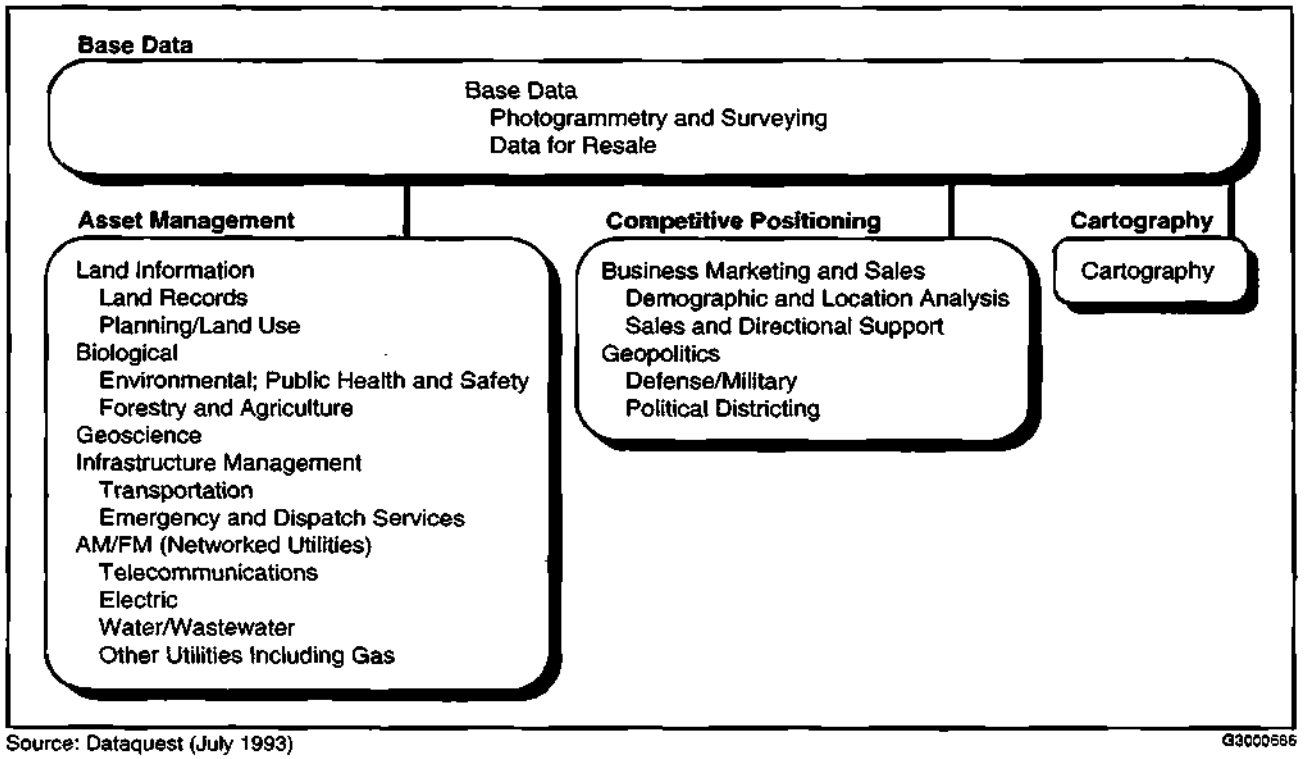
The major GIS applications tracked and analyzed by Dataquest are those that require a customized marketing approach and have generated notable revenue. Categories we have reported on previously for 1990 and 1991 data have been somewhat reorganized for clarity (see Figure 1).

GIS revenue can be categorized into the following four general applications:

- Base Data—involves revenue generated to develop a GIS system; results can be used in all other applications.
- Asset management—includes land information (arbitrary categorizations), biological (animal and vegetable), geoscience (mineral), infrastructure management (manmade), and AM/FM (networked utilities). AM/FM is a form of infrastructure management, but is treated as a separate category because it is a large, widely recognized market.
- Competitive positioning—is seeking to gain a competitive advantage in the marketplace or in the political arena.
- Cartography—is mapmaking.

Dataquest's forecast for each application in terms of market opportunity for software revenue is provided in Table 1. Table 2 provides a history and

Figure 1
GIS Applications



Source: Dataquest (July 1993) G3000586

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Table 1
GIS Worldwide Software Revenue Forecast by Application
(Millions of Dollars)

	1990	1991	1992	1993	1994	1995	1996	1997
Base Data	52.0	42.6	47.4	51.8	58.3	70.7	86.9	105.4
Photogrammetry and Surveying	36.1	30.8	32.6	35.0	38.9	46.3	56.4	65.8
Data for Resale	15.9	11.7	14.8	16.8	19.4	24.4	30.5	39.5
Land Information	140.0	132.6	141.6	154.8	175.8	195.9	220.0	250.2
Land Records	83.7	79.3	82.5	89.6	102.9	114.7	129.8	147.5
Planning/Land Use	56.4	53.3	59.1	65.1	72.9	81.2	90.3	102.7
Biological	32.3	41.2	51.1	58.1	69.7	83.1	99.3	115.9
Environmental and Public Health	23.4	27.5	32.6	37.1	47.0	56.4	67.7	79.0
Forestry and Agriculture	9.0	13.7	18.5	21.0	22.7	26.8	31.6	36.9
Geoscience	42.7	62.6	54.2	60.2	68.9	82.2	95.9	113.3
Infrastructure Management	39.1	45.8	56.0	66.5	81.8	98.4	116.2	135.6
Transportation and Logistics	24.0	28.2	33.9	39.9	48.6	58.3	70.0	81.7
Emergency Services/Dispatch	15.1	17.6	22.2	26.6	33.2	40.1	46.3	54.0
AM/FM	109.9	139.4	164.1	182.5	197.7	227.4	266.3	304.2
Telecommunications	19.7	45.1	45.5	46.2	48.6	57.3	68.8	80.3
Electric	43.0	42.3	55.4	64.4	72.9	86.0	101.6	111.9
Water/Wastewater	30.3	34.3	38.5	43.8	46.2	50.6	58.7	65.8
Other Utilities	17.0	17.7	24.6	28.0	30.0	33.4	37.2	46.1
Business Marketing and Sales	9.7	19.4	35.7	60.2	85.1	114.7	152.3	192.3
Demographic/Location Analysis	7.4	13.6	24.6	45.5	64.8	86.0	112.8	144.9
Sales and Directional Support	2.4	5.8	11.1	14.7	20.3	28.7	39.5	47.4
Geopolitics	34.9	41.0	40.0	38.5	42.1	47.8	53.0	60.6
Defense/Military	27.7	33.8	35.1	36.4	40.5	46.8	51.9	59.9
Political Districting	7.1	7.2	4.9	2.1	1.6	1.0	1.1	0.7
Cartography	22.7	23.1	25.2	27.3	30.8	35.4	38.4	39.5
Total GIS/Mapping	483.4	547.6	615.3	700.0	810.2	955.6	1,128.4	1,317.0

Source: Dataquest (July 1993)

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Table 2
GIS Worldwide Software Revenue Forecast by Application
(Percentage of Market)

	1990	1991	1992	1993	1994	1995	1996	1997
Base Data	10.8	7.8	7.7	7.4	7.2	7.4	7.7	8.0
Photogrammetry and Surveying	7.5	5.6	5.3	5.0	4.8	4.9	5.0	5.0
Data for Resale	3.3	2.1	2.4	2.4	2.4	2.6	2.7	3.0
Land Information	29.0	24.2	23.0	22.1	21.7	20.5	19.5	19.0
Land Records	17.3	14.5	13.4	12.8	12.7	12.0	11.5	11.2
Planning/Land Use	11.7	9.7	9.6	9.3	9.0	8.5	8.0	7.8
Biological	6.7	7.5	8.3	8.3	8.6	8.7	8.8	8.8
Environmental and Public Health	4.8	5.0	5.3	5.3	5.8	5.9	6.0	6.0
Forestry and Agriculture	1.9	2.5	3.0	3.0	2.8	2.8	2.8	2.8
Geoscience	8.8	11.4	8.8	8.6	8.5	8.6	8.5	8.6
Infrastructure Management	8.1	8.4	9.1	9.5	10.1	10.3	10.3	10.3
Transportation and Logistics	5.0	5.2	5.5	5.7	6.0	6.1	6.2	6.2
Emergency Services/Dispatch	3.1	3.2	3.6	3.8	4.1	4.2	4.1	4.1
AM/FM	22.7	25.5	26.7	26.1	24.4	23.8	23.6	23.1
Telecommunications	4.1	8.2	7.4	6.6	6.0	6.0	6.1	6.1
Electric	8.9	7.7	9.0	9.2	9.0	9.0	9.0	8.5
Water/Wastewater	6.3	6.3	6.3	6.3	5.7	5.3	5.2	5.0
Other Utilities	3.5	3.2	4.0	4.0	3.7	3.5	3.3	3.5
Business Marketing and Sales	2.0	3.5	5.8	8.6	10.5	12.0	13.5	14.6
Demographic/Location Analysis	1.5	2.5	4.0	6.5	8.0	9.0	10.0	11.0
Sales and Directional Support	0.5	1.1	1.8	2.1	2.5	3.0	3.5	3.6
Geopolitics	7.2	7.5	6.5	5.5	5.2	5.0	4.7	4.6
Defense/Military	5.7	6.2	5.7	5.2	5.0	4.9	4.6	4.6
Political Districting	1.5	1.3	0.8	0.3	0.2	0.1	0.1	0.1
Cartography	4.7	4.2	4.1	3.9	3.8	3.7	3.4	3.0
Total GIS/Mapping	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Dataquest (July 1993)

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forecast of the percent of change in software revenue through 1997. The 1992 data is based on estimates that will be used until complete data is collected from vendors during the summer of 1993. This data represents our current forecast, which is based on our continuous market evaluation. Figure 2, which illustrates each major market segment in terms of percent of market, clearly shows the anticipated growth of GIS used for business marketing and sales, and the relative reduction of land records as a source of market growth.

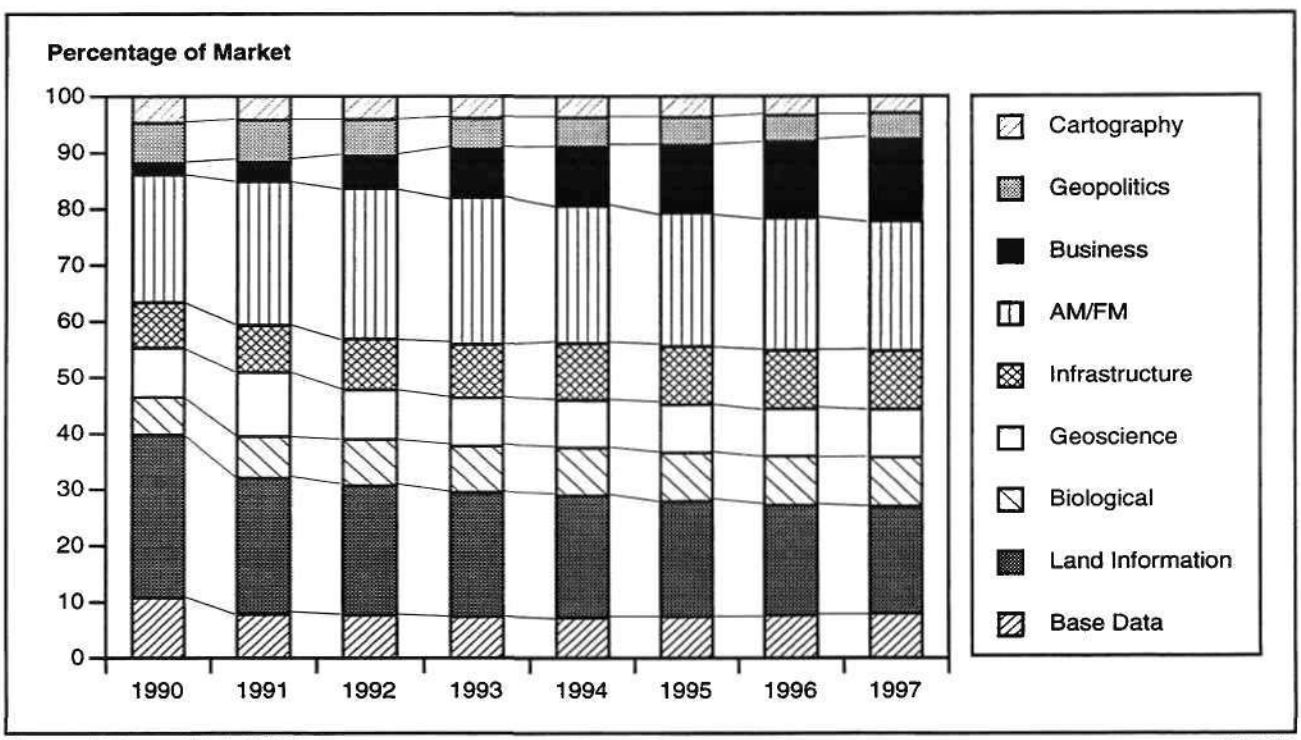
The thrust of the overall market trends is captured in Figure 3. While the 1990 GIS market was dominated by applications focusing on land data and AM/FM, the 1997 market will be significantly more diverse as a result of the expansion of previously less important market segments.

Selling to this greater diversity will require focused efforts for smaller suppliers and a carefully balanced marketing effort for full-service suppliers. Following is our analysis of and expectations for each major market segment.

The Thriving Business Marketing and Sales Segment

This service includes demographic/location analysis, sales, and directional support. Business marketing and sales is the fastest-growing sector of the GIS market, which is anticipated to grow from $10 million in 1990 to $200 million in 1997. The principal use of a GIS system in this market is to compete, as opposed to the more typical asset management functions of

Figure 2
GIS Software Revenue Forecast by Major Application

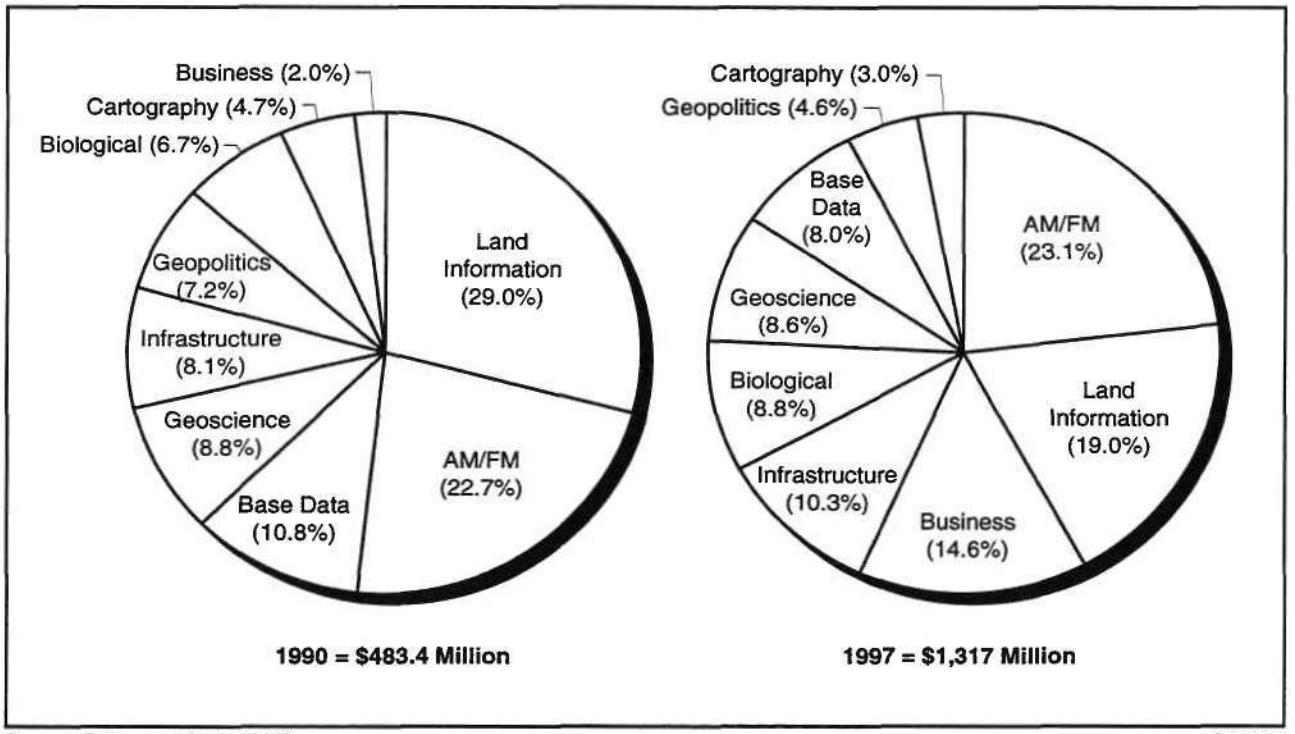


Source: Dataquest (July 1993)

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Figure 3
GIS Software Revenue Application Forecast Comparison (Percentage of Market)



Source: Dataquest (July 1993) G3000688

other applications. Customers typically use a relatively low-cost, PC-based GIS system that was created for helping an enterprise compete for resources or customers. These adventurous users tackle a variety of problems: locating new sites, territory analysis, demographics, competitor analysis, customer analysis, pricing/cost analysis, opportunity analysis, target marketing, advertising planning, sales analysis, trip planning, and supplier identification. The most likely industries that will adopt these systems include banking, insurance, retail, and real estate. However, the marketing arm of a public utility may develop a GIS to analyze existing customer demographics, which is a business marketing GIS user, not an AM/FM user. Business users are trying to compete, and they may work in any industry.

This market has been driven by the arrival of off-the-shelf data in the United States; thus, the market is mostly U.S.-based, but the United Kingdom is developing. Typical data used includes U.S. census data, TIGER street files, business location information, geographic boundaries (such as counties and ZIP codes), buying-pattern data, and privately developed demographic data (such as age, income, and business statistics for various industries). Any company that holds potentially reusable data in some tabular form can advertise it for sale to GIS users. The only widespread expectation is that the data be geocoded for latitude and longitude. From the opposite perspective, almost all users possess useful data that can also be analyzed with GIS software because a lot of data contains ZIP

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codes and street addresses. Business marketing users want to connect the relevant data for their businesses to a geographic reference when a geographic interface is the most effective way to understand the data.

Although most users are focused on some type of demographic analysis (for example, where customers are relative to a proposed site), a computer that knows who and what is where is increasingly useful to salespeople who want to plan efficient trips. It is also useful to travel agents who want to help customers get the most value for their time and money. In the future, Dataquest expects more sophisticated sales support systems to be built as more point-of-sale devices become linked to GIS systems, which will provide the ability to map and chart performance of a group of retail environments in real time. A key question is: when these systems are developed, will they be called GIS/mapping systems or sales analysis systems?

Profile of Business GIS Users

Dataquest's user data confirms many commonly held beliefs about business GIS users. These users rely more heavily on personal computers and spent less for their systems. Because their systems are relatively simple, they have been in place only 18 months (compared to 38 months for all users). GIS users are more likely to be up and running in a production system; pilot systems often only last for a fleeting moment in time. GIS users also spend less time using their system—24 percent of their computer time versus 34 percent for all users. They are more likely to work at sites where DOS is the dominant operating system than are traditional users where UNIX has a stronger presence.

The good news is that they are absolutely committed to GIS—100 percent of them strongly agree that full implementation of a GIS system in their department is inevitable. So even though they are more low-cost, casual users, GIS is producing enough to keep them strongly committed. Furthermore, none of the GIS users said that they are likely to switch software vendors during the next five years. Several users in the entire survey said that they were somewhat or very likely to switch vendors; therefore, these more casual users seem to show higher loyalty to their vendors than traditional GIS users. This is especially remarkable when the cost of switching vendors is much lower than at traditional sites where investments in training and databases are on one product. Clearly, something is working for these business GIS users. Even better from a vendor's perspective, the business GIS users are more likely to plan to increase spending in 1993 than the entire sample. They may have fewer dollars to spend than the large, traditional users, but a higher percent of them plan to increase spending. Nonetheless, there are still some issues to resolve before business GIS becomes a market force with which to reckon.

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Business GIS Market Considerations

Low-cost GIS software suppliers are increasingly teaming up with data providers—a necessary development if easy-to-build and easy-to-use systems are to emerge. Business users are not the type to spend days or even minutes poring over operating manuals. Off-the-shelf data also needs development (or even just more complete documentation); users do not always understand exactly what they are buying or have bought. Dataquest believes that GIS systems will become more practical for users as software vendors and data providers work more closely.

This leaves a few remaining problems for suppliers, which include the following:

- Data has to get cheaper to attract new and more casual users.
- GIS software needs to become more robust so that it can accommodate the needs of the now sophisticated users in the business market who are addressing problems involving larger data sets.
- To become a significant market, worldwide, off-the-shelf data must be available. Addressing this issue unleashes a host of political, cultural, and economic issues.

The largest area of uncertainty is whether GIS will become more widely recognized on its own in business applications or whether it will become embedded inside other applications. There is a parallel here: There was once something called the graphics market, but graphics was really a technology and it gradually became embedded in all the applications we use. Vendors no longer say that they are in the graphics market because there is no longer a "group of potential customers who might need or want capabilities offered by a graphics system." This statement forms the basis for the definition of a market, and part of the GIS market will disappear as users in some business applications no longer perceive that they need a GIS system for certain functions.

In the PC/Windows/NT environment, two scenarios are possible. GIS may increasingly be linked to (and embedded into) more mainstream applications, such as spreadsheets and tabular databases, allowing users to experiment with new solutions in which the GIS activity appears embedded in existing applications as background. In the alternate scenario, GIS will gradually begin to solve more meaningful problems in business settings so that business users realize that they must buy something called a GIS. The most likely outcome is that a little of both will happen. However, the more compelling the meaning of GIS becomes in nontraditional applications, the more opportunity there is for what is called the business GIS market.

Base Data (Photogrammetry and Surveying, Data for Resale)

This segment is characterized by an explosion in new technologies, new products, better accuracy, and tough price pressure. Despite a growth rate slower than other applications, expenditure needed to develop base data

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is expected to almost double over the next five years, going from $47 million in 1992 to $105 million in 1997. Cheaper and more useful GPS receivers and satellite imagery and more cost-effective aerial photography will continue to create opportunities in image-based and hybrid GIS systems. International opportunities will provide a significant source of growth.

Although digital orthophotography will occupy a more mainstream position in the market by 1997, price pressure will be relentless. Significant improvements in automation and cost of technology will be somewhat offset by the buyer demand that land information must cost less to acquire.

Revenue from GIS data for resale will expand dramatically as an activity and less dramatically as a revenue opportunity as price pressures are also brought to bear on suppliers of vector-based data by users wanting data that is also increasingly accurate, timely, and easy to use off the shelf. Sales of systems based on enhanced versions of U.S. federal land records have been inhibited because the original data was not designed for resale to local governments, either in terms of accuracy or content. It is important to note that this forecast includes the opportunity for data that would only be used in a GIS. New data sources, which can be used in multiple types of computer systems including GIS systems, are multiplying rapidly, but are outside the scope of this analysis.

Land Information

The typical buyer of a GIS system used for land records or planning is a government entity on a tight or uncertain budget. Despite the fact that planning users have been quite successful in making systems productive, local government budgets are being cut in North America and Europe, and capital equipment investments such as GIS systems are often weighed against involuntary staff reductions. As a result, applications that focus on developing land information will decrease from 29 percent of the 1990 market to 19 percent of the 1997 market. Because the overall GIS market is still growing briskly, this will translate into growth from $142 million in revenue in 1992 to $250 million in 1997. During this time, users in assessors and planning offices will increasingly link activities with each other and with CAD applications in government public works and engineering departments.

The bright spot on this horizon has been and will continue to come from improvements in raster (image)-based GIS solutions. Often combined with purchased vector-based line maps, local governments are bypassing some of the headaches and cost that have troubled their peers doing traditional conversion of existing map data.

Biological (Environmental/Public Health and Safety, Forestry and Agriculture)

This sector is expected to grow in excess of the overall market rate, from $51 million in 1992 to $116 million in 1997. Two strong trends should drive that growth: a growing worldwide concern about managing a variety of life forms and the contamination that surrounds them, and increasingly

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cost-effective, image-based systems that are a natural fit for managing plant and animal life. GIS as an analysis tool will regularly participate in a variety of environmental solutions for years to come. Significant opportunities exist for systems that can manage regulatory requirements and actually help users identify and prioritize problems that have potential to become significant issues. Former spending has been primarily in the federal government; future growth is anticipated within industry and local environmental management groups.

Although opportunities are widespread and important in environmental applications because of the complexity of variables involved in an environmental analysis, computer technology will only begin to be practical in many tasks from a price perspective toward the end of the forecast period, and this assumes that image and data analysis can also be accomplished at a lower cost. By the year 2000, the environmental GIS market should be growing even more briskly; success in that market will require continued investment in product development during the next five years in order to maintain a technological advantage in information and analysis products.

Other opportunities exist at the crop management level. Despite the U.S. Forest Service's remarkable spreadsheet error that caused it to reduce anticipated GIS acquisitions from $1.24 billion to $312 million, simple image-based applications that help people manage forests and agriculture have a small but bright future and are expected to grow from $19 million in 1992 to $38 million in 1997. The opportunity is global as long as the overall cost can meet the tight budgets of typical users in forestry and agriculture.

Geoscience (Energy Exploration)

The former category of energy exploration has been expanded to include the small number of applications outside of energy, such as mining. The hallmark of this market will continue to be its volatility. The overall trend is forecast below GIS industry averages, but there is little on which to forecast year-by-year buying in the unpredictable oil industry.

For GIS to be fully relevant to the oil and gas industry, better products are needed. The high volume of data produced by the typical oil customer cannot be processed by one type of system, whether it is a GIS or some other software tool. In the long run, unfortunately, oil and gas customers can be problem customers for GIS suppliers because of their volatility and sophisticated specialized analysis needs. There is little point in indifferent pursuit of this market: if you're not willing to fight it out for significant market share, then ignore it.

Infrastructure Management (Transportation and Navigation, Emergency Services and Dispatch)

Applications in transportation are expected to grow above the average industry growth rate, from a total of $56 million in 1992 to $136 million in 1997. GIS products have sold well to state transportation departments, as

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GIS products continue to become more useful to engineers who design, build, and maintain road networks. These users are in a similar position to AM/FM users: their management and product responsibilities have a high geographic element. Coupled with their need for digital terrain models in construction, transportation departments are an obvious target for GIS suppliers. Their typical preference for buying market leaders is a challenge to overcome; price is a likely weapon. Only a small component of this forecast is based on purchases driven by rebuilding the infrastructure. Strained world economies and widespread uncertainties in political directions in many companies make it imprudent to count on significant GIS buys based on infrastructure construction (in contrast to environmental spending, which appears to be on more solid ground among taxpayers worldwide.)

The transportation segment also includes various marine and in-car navigation systems, which will play an important role in European transportation and communication networks toward the end of the century. Automatic traffic control, automatic tolling systems, and even automatic policing of roads are expected to be implemented via these systems. Electronic road-communication networks will form the basis for efficient use of modern transport in Europe. The EC has initiated a number of wide-ranging, but interrelated R&D programs of which dedicated road infrastructure for vehicle safety in Europe (DRIVE) is the core. DRIVE envisages a common European road transport environment in which drivers are informed about road and traffic conditions and intelligent vehicles communicate and cooperate with the road infrastructure. In the United States, programs such as TravTek, a consortium effort by the American Automobile Association, General Motors, the Federal Highway Administration, the Florida Department of Transportation and the City of Orlando, Florida, is one of the most extensive intelligent vehicle/highway systems field tests to date. TravTek guides drivers to their destinations, alerts them to local traffic conditions, and offers alternative routes.

Simple in-car navigation systems are in the works worldwide, driven by the availability of data from global positioning systems. The opportunity is limited by the fact that considerable spending will be for products related to, but not in the GIS market. The rate at which car navigation systems penetrate the private and commercial sectors will be strongly determined by price, and it is unlikely to develop as a significant market until systems reach the $500 price point.

Most of us are not lost as we drive. Initially, the most likely customers for these products will be among people who actually need more information about where they are located: rental car users, courier and delivery companies that can save money off every wrong turn eliminated, and to a lesser extent, emergency response teams such as police and fire.

The infrastructure management market sector also includes emergency services and dispatch management, which is expected to advance from a $22 million GIS software market in 1992 to a $54 million market in 1997. There are several computer-based alternatives to GIS in emergency

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services, and suppliers must also compete with custom solutions developed by users. The jury is not in on whether GIS is the right solution for the environment, despite the intuitive appeal to dispatch management of seeing where vehicles are and where they are going. The opportunity is there for robust products, but this is one area where the software absolutely must deliver to customer expectations. Police and fire response serves a function that is critical and highly visible to every taxpayer. Real-time display and dispatch of emergency personnel, supported with information on the jurisdiction's environment, is quite a challenge for today's computers—and systems look a bit expensive to the typical local police force. For vendors that wish to invest over all these obstacles, there is the promise that a low-cost, robust system developed by the end of the decade would be attractive to every police and fire department in the world.

Supplying dispatch management systems to commercial enterprises, such as trucking companies, is easy by comparison. Product development can reasonably be undertaken by small vendors. The principal demonstration that must be made, beyond product utility, is return on investment.

AM/FM (Telecommunications/Telephone, Electric, Water, and Other Utilities)

AM/FM represents a core market of users who need GIS systems because their job responsibilities—managing and developing widely dispersed utility networks—have a high geographic content. Now moving down to smaller utilities, existing users are concentrated among the large utilities that could afford a strategic investment in information technology many years ago. The largest sector in the GIS market, AM/FM, is forecast to grow approximately at the market rate, from $164 million in 1992 to $304 million in 1997. Telephone and electric companies will remain the largest sectors. These well-heeled customers will continue their significant investments in GIS technology and will continue to prefer the security of buying from market leaders. Customer concern over vendor longevity and market position is understandable. These users are investing in management tools for assets and careers that will likely exist in 25 years.

Growth among utilities is more volatile than any forecast can predict; 1991 saw heavy investment by telephone companies in 1991, whereas electric buyers were the driving force in 1992. Investment, driven by long-term projects, will continue to come in waves. What is predictable, however, is that they will buy collectively. AM/FM systems are increasingly indispensable to utilities, and utilities are relatively resilient to economic recessions.

Users in telecommunications are the most sophisticated users of GIS technology, particularly among the regional Bell operating companies. These are the users who will push vendors to create more committed business partnerships and to achieve new technological feats. Their buying power and history of significant, continual investment will make vendors listen. Many of the smaller electric and telephone companies are investing in

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AM/FM. Here, the lower cost of PC-based solutions can be more easily sold, as well as in water companies, many of which are small entities with correspondingly small budgets.

All utilities are in environments that are increasingly competitive. Many have moved out of the protective cocoon of regulatory environments and have become more competitive enterprises, particularly in telecommunications, electric, and gas (most of the sales to other utilities are to natural gas and pipelines). Proven return on investment and price per seat is likely to become more important to utility buyers in the future as it becomes more difficult to simply pass capital equipment expenditure on to captive buyers.

Geopolitics

GIS was partially born in defense programs; competing for political position represents the driving goal of users. Despite the fact that defense spending is favoring information over weapons programs, defense spending worldwide in GIS will fail to stay even with market growth. Little of this market is available to suppliers that are not already entrenched.

The U.S. Department of Defense (DoD) has the capability to release accurate geographic information, either to build markets or to bring in revenue, as demonstrated by their Advanced Research Project Agency's dual use program and the Defense Mapping Agency's Digital Chart of the World, a four CD-ROM set digital base map of the world, designed to promote worldwide map standards. DoD management has not forgotten that the GPS satellite program, paid for under the aegis of defense spending, has created new markets all over the world.

Political redistricting has died down for now, but it will again become an important GIS activity toward the end of the decade with the approaching Census 2000.

Cartography

Mapmaking, the most traditional of GIS activities, is no longer a market driver. Modest continual purchases by mapmakers will keep the market going and provide better looking, more useful maps each year, but the absence of compelling new capabilities will result in a relatively low-market opportunity.

The Future for All Applications

GIS applications, in general, will grow in diversity as they become easier and cheaper to create; the PC-based, GIS products will drive this proliferation. At the same time, the traditional applications should become more successful as new users leverage the experience base of others in order to work smarter and faster as they develop new methods of developing GIS systems. Both trends will create users who expect to manage more complex problems and data with less redundancy. Users are increasingly able

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to recognize that data is a commodity for which they can share development and maintenance costs across departments and enterprises; already, joint ventures across GIS applications abound. All of these trends mean that suppliers will have to deliver products that can be used in specific GIS applications, used across GIS applications, and are susceptible to integration with information systems across an enterprise. Point solutions, such as offering links to traditional databases for data exchange, only begin to address the problem. Considerable opportunity exists for the user, consultant, or vendor who can create cost-conscious, effective integration strategies and development processes for information technology.

By Kathryn Hale

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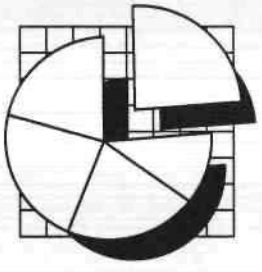
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GIS Applications Worldwide Market Share Update



Market Statistics

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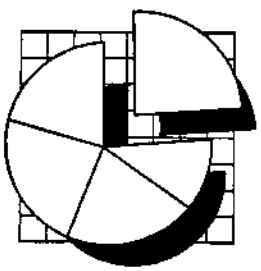
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GIS Applications Worldwide Market Share Update



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Note: All tables show estimated data.

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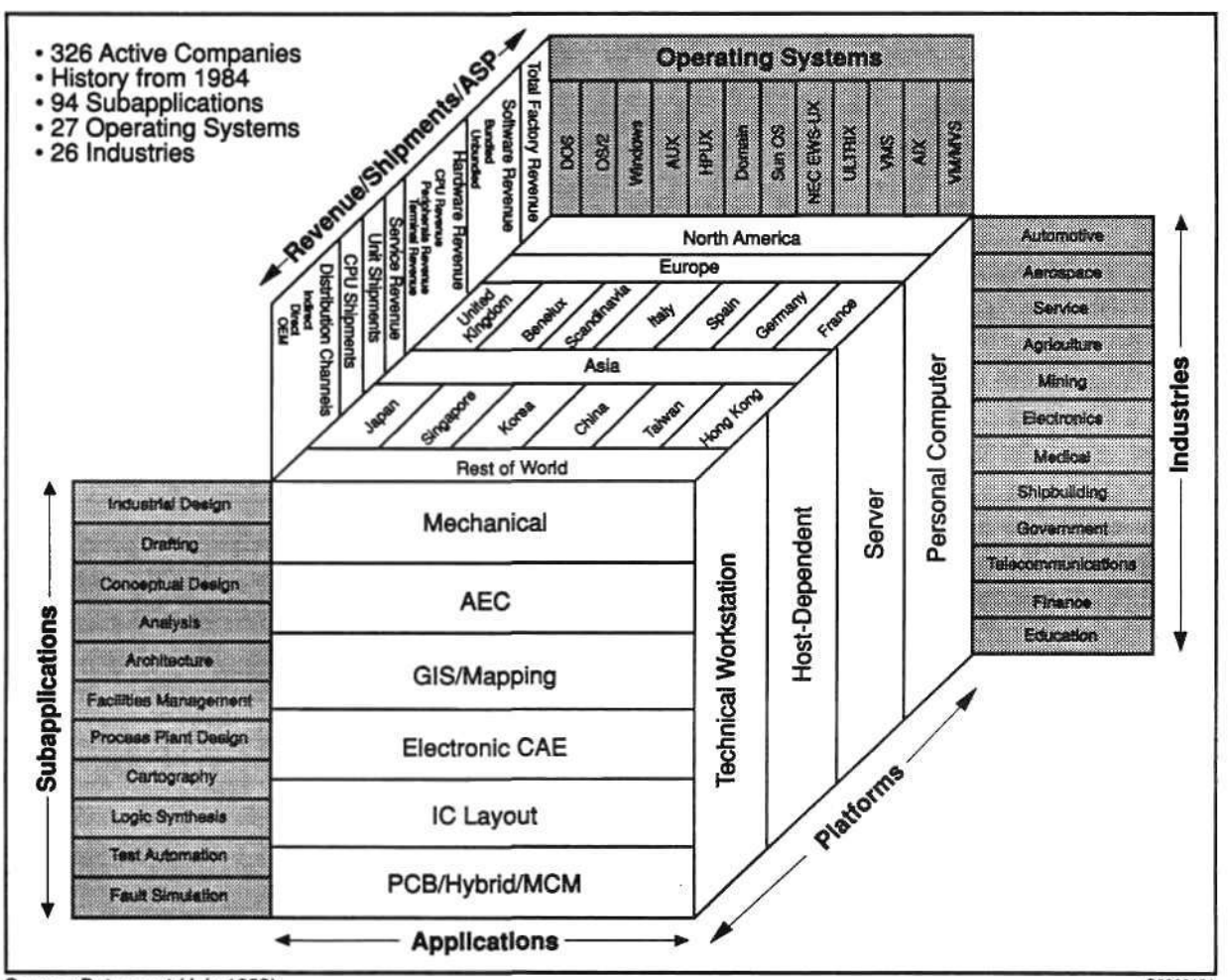
GIS Applications Worldwide Market Share Update

Introduction

CAD/CAM/CAE/GIS systems have dramatically changed the methods by which designers and production managers originate and implement products. CAD and CAE systems allow designers to create, draft, analyze, test, and manipulate products on a screen in two and three dimensions. As CAD/CAM/CAE/GIS systems continue to decrease in cost, they become more available and cost justifiable to new users.

In order to provide a comprehensive view of the CAD/CAM/CAE/GIS industry, Dataquest's CAD/CAM/CAE/GIS group maintains a large database of industry information. The type of information contained in the database is depicted in Figure 1.

Figure 1
CAD/CAM/CAE/GIS Market Database



Source: Dataquest (July 1993)

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CAD/CAM/CAE/GIS Market Share Update

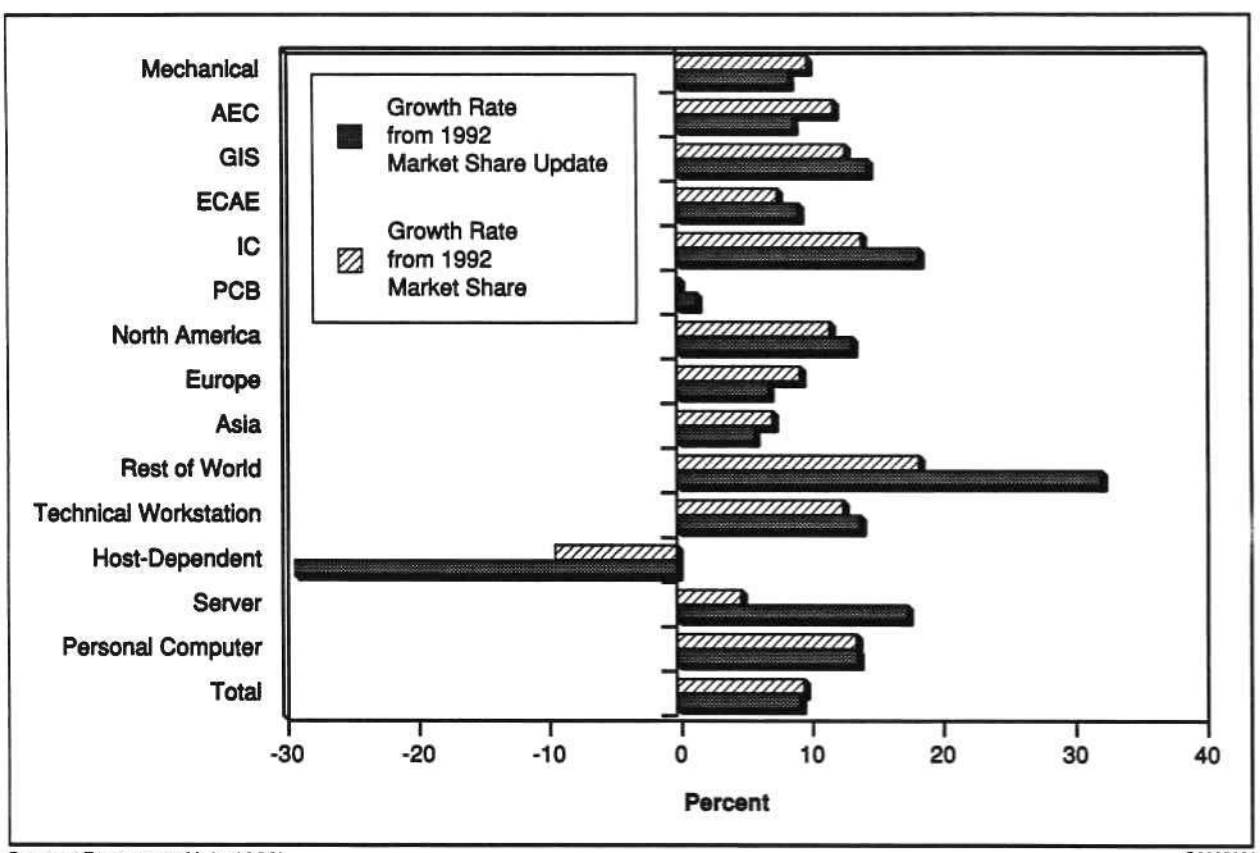
Software Market Grew 9.6 Percent In 1992, Revised Down from 9.7 Percent

Refinements of year-end figures leave the CAD/CAM/CAE/GIS markets essentially unchanged from our earlier market share data, with software revenue growth from 1991 to 1992 reduced to 9.6 percent from 9.7 percent and total factory revenue growth for the same period reduced to 4.0 percent from 4.2 percent. However, the stillness at this top level is deceptive. A look at the segment and company levels of the data and even at the database changes reveals some interesting shifts.

This market share update essentially revisits the companies in our database, seeking refinement of the previously reported market share data. Whereas much of the data from the initial survey came from vendor projections and early, year-end results, the update represents actual 1992 year-end results. From a global perspective, the results indicate that the optimists balanced the pessimists. The view from segments is a little more interesting.

Figure 2 provides a view of growth rates in software revenue by application, by region, and by platform, as well as the total market. In the area

Figure 2
1992 Software Revenue Growth: Market Share versus Market Share Update



Source: Dataquest (July 1993)

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of applications, geographic information system (GIS), electronic computer-aided engineering (ECAE), IC layout, and printed circuit board (PCB) were revised up while mechanical and AEC actually grew less than previously indicated, primarily because of overreporting of revenue for IBM in 1992 coupled with underreporting for 1991 in both areas. In the EDA arena, these revisions came about with more complete vendor input, readjusting some PCB revenue into ECAE and IC (see Table 1), and adding two companies to IC, two to ECAE, and deleting one from PCB, including past revenue.

Economic reality is confirmed by the regional picture with North America and Rest of World, previously reported with the greatest growth, now shown with greater growth, whereas Europe and Asia show less growth than our earlier view. From the view of platforms, the shift from host-dependent systems to client/server systems is occurring with greater speed than earlier indications.

Database Changes

Software

In viewing the actual market size for the above segments, looking at the earlier market share as compared with this updated version, the differences become considerable. We have continued to revise our company information with the best information available, even for past years. In addition to the growth rates changing as indicated above, the actual revenue figures have changed, as indicated in Table 1.

Expanded Definition for Service

In this survey, the service definition was expanded from hardware and software maintenance to now include:

- Hardware and software maintenance fees
- Training and education

Table 1
Comparison of 1991 and 1992 Software Revenue: Market Share versus Market Share Update

	1991 Software Revenue ($M)			1992 Software Revenue ($M)		
	Market Share	Market Share Update	% Change	Market Share	Market Share Update	% Change
Mechanical	2,033.0	2,117.0	4.1	2,235.3	2,299.1	2.9
AEC	666.1	680.2	2.1	746.1	740.8	-0.7
GIS/Mapping	555.8	545.3	-1.9	627.5	630.6	0.5
ECAE	691.2	699.8	1.2	744.1	765.8	2.9
IC	195.8	195.8	0	223.4	232.7	4.2
PCB/Hybrid/MCM	328.3	306.6	-6.6	329.1	311.4	-5.4
Total	4,470.2	4,544.4	1.7	4,905.5	4,980.3	1.5

Source: Dataquest (July 1993)

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- Service bureau operators
- Application development
- Consulting
- Systems integration

In 1991, service revenue was $2,408.6 million and was $2,611.4 million in 1992. The resulting growth of 8.4 percent in service revenue reflects growth in service and our change in definition. This change had the largest impact on the IC layout market, and considerably added to the mechanical, ECAE, and PCB markets as well (see Table 2). In mechanical, SDRC was the big foot. The database was not revised backward to reflect this change. Forecasting, however, will now be expanded to include this area of growth.

Shift in Revenue Distribution

Reflecting this expansion of services definition and extreme pressure on hardware revenue is the redistribution of revenue by hardware, software, and services as shown in Table 3.

Table 2
1992 Service as a Percentage of Total Revenue: Market Share versus Market Share Update

	Market Share	Market Share Update	% Change
Mechanical	16.5	17.1	3.4
AEC	14.1	14.0	-0.7
GIS/Mapping	18.0	17.6	-2.2
ECAE	16.6	17.4	4.8
IC Layout	19.0	21.0	10.5
PCB/Hybrid/MCM	18.5	19.0	2.7

Source: Dataquest (July 1993)

Table 3
Change in Distribution of 1992 Revenue: Market Share versus Market Share Update

	Revenue ($M)		% Distribution of Revenue	
	Market Share	Market Share Update	Market Share	Market Share Update
Hardware	8,093.8	7,765.5	52.0	50.5
Software	4,905.5	4,972.6	31.5	32.4
Services	2,578.0	2,624.2	16.5	17.1
Total	15,577.3	15,362.3		

Source: Dataquest (July 1993)

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Company Changes

Table 4 provides a listing of the top 20 vendors and the changes in the total revenue figure from the market share previously reported. IBM revenue changes were made following the prior market share but before the subsequent forecasting. Intergraph's earlier reported revenue included document imaging and other graphics software, which does not belong in CAD/CAM. Digital previously did not report its hardware revenue, and neither did Autodesk with its software revenue, whereas SDRC now includes the expanded service.

Analysis of Workstation Distribution

In addition to these changes, the CAD/CAM/CAE/GIS group significantly refined its database model for workstations. Using two years of software revenue distribution by operating system, collected by a survey

Table 4
1992 Top 20 CAD/CAM/CAE/GIS Vendors Total Revenue: Market Share versus Market Share Update

	Total Revenue 1992 ($M) Market Share	Market Share Update	Revenue Change ($M)	Final Market Share (%)	Share Difference (%)
IBM	1,861.2	1,756.9	-104.3	11.4	-0.5
Intergraph	1,171.7	1,126.6	-45.2	7.3	-0.2
Hewlett-Packard	922.4	919.9	-2.5	6.0	0.1
Digital	843.6	918.9	75.3	6.0	0.6
Sun Microsystems	876.8	869.5	-7.3	5.7	0.1
Computervision	781.7	777.3	-4.5	5.1	0.1
Fujitsu	442.0	442.0	0	2.9	0.1
Compaq	416.3	429.8	13.5	2.8	0.1
Cadence	425.6	425.4	-0.2	2.8	0.1
Autodesk	341.6	367.7	26.1	2.4	0.2
Mentor Graphics	350.8	349.4	-1.4	2.3	0
NEC	348.0	348.0	0	2.3	0.1
EDS-Unigraphics	302.9	310.1	7.2	2.0	0.1
Siemens Nixdorf Infosysteme	271.2	271.1	-0.1	1.8	0.1
Apple Computer	243.2	239.0	-4.2	1.6	0
Silicon Graphics	272.9	230.5	-42.4	1.5	-0.3
Nihon Unisys	228.3	228.3	0	1.5	0
Hitachi	174.0	174.0	0	1.1	0
Control Data	169.4	169.4	0	1.1	0
SDRC	123.3	149.8	26.5	1.0	0.2
Top 20 Companies	10,566.9	10,503.6	-63.3	68.3	0.5
All Companies	15,577.3	15,366.8	-210.5	100.0	0

Source: Dataquest (July 1993)

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of software vendors, we can estimate the distribution of workstations by hardware vendor in the various application segments (see Table 5). This analysis resulted in realignment of workstation shipments of Hewlett-Packard, Sun, and Silicon Graphics to the distribution of software revenue. (Note that these unit sales are expanded to include units sold through OEMs. They, therefore, will not match the unit sales in the market share tables where OEM is deleted to prevent double counting.)

Company Additions and Deletions

Finally, we added nine new companies to our database with a collective total revenue of $36.0 million for 1991; $46.5 for 1992 (see Table 6). We deleted LPKF and Simulation Science: upon re-evaluation, we realized that both companies are related to, but not included in the CAD/CAM/CAE/GIS market. IGC was purchased by IMSI, which was not previously in our database, so IMSI was added to include IGC for 1991 and 1992. However, we have not incorporated other company name changes (such as Cadam to Altium) or acquisitions (such as Quad Design by Viewlogic) that have occurred during 1993.

Market Share Battles

An interesting view of the CAD/CAM/CAE/GIS market is at the level of market leaders in software revenue for each application. The tables that follow provide software revenue and share of market for 1991 and 1992 as they now appear in the database.

Mechanical

An army of well-equipped companies is on the march in the mechanical market, assaulting the two old guards, IBM and Computervision (see Table 7). IBM, showing decline in its mechanical software despite its partnerships with the market leaders, Dassault, SDRC, and CADAM, is struggling to survive the squeeze of moving from high-margin, host-dependent systems to the more competitive market of technical workstations and client/servers. With losses in its host dependent business as

Table 5
Unit Sales of Technical Workstations by Application Segment, by Top U.S. Vendors for 1992 (Including Units Sold through OEMs)

	Mechanical	AEC	GIS	ECAE	IC	PCB	Total	Share of Market
Sun Microsystems	27,567	3,804	6,607	16,586	7,709	7,624	69,897	40.3
Hewlett-Packard	17,370	3,871	1,581	7,039	2,321	4,054	36,236	20.9
Digital	8,965	1,762	2,327	1,196	855	1,499	16,604	9.6
Intergraph	2,421	4,980	5,698	516	45	422	14,082	8.1
Silicon Graphics	8,574	461	478	117	0	0	9,630	5.6
IBM	6,065	717	213	0	0	244	7,239	4.2
Total Worldwide Units	77,471	22,559	20,453	26,385	11,347	15,264	173,479	100.0
Distribution (%)	44.7	13.0	11.8	15.2	6.5	8.8	100.0	

Source: Dataquest (July 1993)

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Table 6
Changes in CAD/CAM/CAE/GIS Vendors with Total Revenue for 1991 and 1992

	1991 Total Revenue ($M)	1992 Total Revenue ($M)	Application Segment
Additions:			
CAMAX Systems	7.3	9.2	Mechanical
Chronologic Simulation	1.0	1.5	ECAE
CrossCheck Technology	4.5	6.8	ECAE
Enghouse Systems	5.4	8.3	GIS/Mapping
High-Level Design System	1.5	2.5	IC Layout
IMSI	1.7	2.2	PC-Design
PCI Remote Sensing	5.0	6.0	GIS/Mapping
PiE Design	6.0	6.0	ECAE
Softronics	3.6	4.0	Spain-Design
Total	36.0	46.5	
Deletions:			
IGC	0.7	0.7	PC-Design
LPKF	15.0	14.1	PCB
Simulation Science	1.2	1.2	AEC
Total	16.9	16.0	
Gross Change	19.1	30.5	

Source: Dataquest (July 1993)

Table 7
Top 10 Mechanical Software Companies Worldwide

	1991 Software Revenue ($M)	1991 Share of Market (%)	1992 Software Revenue ($M)	1992 Share of Market (%)	Change in Software Revenue (%)
IBM	370.4	17.5	359.8	15.6	-2.9
Computervision	232.4	11.0	206.9	9.0	-11.0
Autodesk	108.3	5.1	147.1	6.4	35.9
Dassault*	133.5	6.3	146.9	6.4	10.0
SDRC	101.1	4.8	129.2	5.6	27.7
EDS-Unigraphics	80.7	3.8	107.7	4.7	33.4
CADAM*	66.3	3.1	88.7	3.9	33.8
Parametric Technology	43.4	2.0	81.2	3.5	87.2
Hewlett-Packard	64.0	3.0	72.1	3.1	12.7
MacNeal-Schwendler	53.4	2.5	64.7	2.8	21.1
Top 10 Companies	1,253.4	59.2	1404.2	61.1	12.0
All Companies	2,117.0	100.0	2,299.1	100.0	8.6

*Includes distributor and/or supplier revenue

Source: Dataquest (July 1993)

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well as in Europe and Asia, IBM is outflanked by the hardy and nimble players in the workstation platform where there is real competition.

Computervision is heavily deployed in Europe where the dark cloud of recession continues to cast its gloom. This offshore presence has weakened the company on its home front, resulting in a decrease of 11 percent in software revenue, which is a loss in market share of 2 percentage points, a big loss for a big player. Despite the losses of these two market leaders, the eight attackers grew a collective 28.7 percent, gaining a whopping 5.7 percentage points in market share.

AEC

The AEC market is quite another story, with the market leaders, Autodesk and Intergraph, cementing their leadership by growing faster than the market, gaining a combined 2.6 percentage points share of market while three of the other eight top 10 competitors declined (see Table 8). The interesting part of this picture is right in the middle: two German companies, Nemetschek and IEZ, battling tooth-and-nail for leadership. The companies are growing in stark contrast to the economic climate of Europe's home front.

GIS/Mapping

The GIS market, with its amazing growth rate of 15.6 percent, is marked by a fight for the top. In 1991, Integraph led ESRI in share of market by 5.5 percentage points, whereas in 1992 Integraph's lead was reduced to 2.6 percentage points, giving ESRI a 2.9 percentage points annual gain on Integraph (see Table 9). In the meantime, the remaining top 10 companies most grew at impressive rates, although much of GeoVision's growth resulted from acquisition during 1992.

Table 8
Top 10 AEC Software Companies Worldwide

	1991 Software Revenue ($M)	1991 Share of Market (%)	1992 Software Revenue ($M)	1992 Share of Market (%)	Change in Software Revenue (%)
Autodesk	128.2	18.9	158.1	21.3	23.3
Intergraph	100.4	14.8	111.0	15.0	10.6
IBM	40.5	6.0	41.5	5.6	2.6
Fujitsu	37.1	5.5	35.6	4.8	-3.9
Nemetschek	24.7	3.6	32.5	4.4	31.7
IEZ	19.8	2.9	32.1	4.3	62.2
Computervision	23.2	3.4	25.1	3.4	8.1
ISICAD	19.4	2.9	17.2	2.3	-11.6
NEC	16.8	2.5	11.7	1.6	-30.2
Dassault*	10.1	1.5	11.1	1.5	9.9
Top 10 Companies	420.1	61.8	476.0	64.3	13.3
All Companies	680.2	100.0	740.8	100.0	6.2

*Includes distributor and/or supplier revenue

Source: Dataquest (July 1993)

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Table 9
Top 10 GIS Software Companies Worldwide

	1991 Software Revenue ($M)	1991 Share of Market (%)	1992 Software Revenue ($M)	1992 Share of Market (%)	Change in Software Revenue (%)
Intergraph	107.2	19.7	114.4	18.1	6.7
ESRI	77.6	14.2	98.0	15.5	26.3
Siemens Nixdorf Infosysteme	49.7	9.1	53.2	8.4	7.0
Autodesk	28.5	5.2	40.5	6.4	42.0
EDS-Unigraphics	17.0	3.1	24.1	3.8	41.5
Landmark Graphics	23.2	4.3	18.8	3.0	-19.0
GeoVision Systems	8.5	1.6	14.0	2.2	64.6
Moss Systems	9.7	1.8	14.0	2.2	43.9
Genasys II	9.7	1.8	13.0	2.1	34.2
Fujitsu	13.2	2.4	12.6	2.0	-3.9
Top 10 Companies	344.3	63.1	402.6	63.8	16.9
All Companies	545.3	100.0	630.6	100.0	15.6

Source: Dataquest (July 1993)

ECAE

The electronic computer-aided engineering (ECAE) market has been shaken up with mergers and acquisitions. Cadence merged with Valid and skipped over Mentor Graphics. Viewlogic bought Vantage, but was still passed by Synopsys. The European ECAE software market grew only 2.3 percent, providing a rough road for Racal-Redac. Wacom, with its emphasis on the personal computer platform in Japan, also had a rough year in this market (see Table 10).

IC Layout

The fastest-growing and smallest application segments have few players. The top 10 comprise almost 97 percent of the market, with Cadence continuing to dominate (see Table 11). The change in growth rates versus The PCB/hybrid/MCM layout market continues to stagnate, showing previous market share is because of changes reported by Cadence. Compass Design Automation appears to be a hard charger, driven by new library development tools.

PCB/Hybrid/MCM Layout

little growth in the past two years (see Table 12). This market is drawn along geographic lines: Zuken rules the Japanese market, whereas Racal-Redac's strength lies in Europe. Neither company has a strong presence in North America where Mentor Graphics and Cadence battle it out.

Market Analysis

The final view of all this activity is shown in Figure 3, which depicts the market size and market growth rate for each segment in the CAD/CAM/CAE/GIS software industry. In Figure 3, the heavy horizontal line

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Table 10
Top 10 ECAE Software Companies Worldwide

	1991 Software Revenue ($M)	1991 Share of Market (%)	1992 Software Revenue ($M)	1992 Share of Market (%)	Change in Software Revenue (%)
Cadence (Valid)	154.2	22.0	165.6	21.6	7.3
Mentor Graphics	73.2	10.5	77.3	10.1	5.6
Synopsys	30.1	4.3	51.3	6.7	70.6
Viewlogic (Vantage)	36.2	4.4	46.7	6.1	29.0
Racal-Redac	28.5	4.1	27.2	3.6	-4.3
Wacom	25.5	3.6	23.3	3.0	-8.7
EEsof	18.1	2.6	22.1	2.9	22.2
Intergraph	17.5	2.5	20.9	2.7	19.4
Marubeni Hytech*	16.5	2.4	19.7	2.6	19.3
Autodesk	17.1	2.4	18.4	2.4	7.5
Top 10 Companies	411.6	58.8	472.5	61.7	14.8
All Companies	699.8	100.0	765.8	100.0	9.5

*Includes distributor and/or supplier revenue

Source: Dataquest (July 1993)

Table 11
Top 10 IC Layout Software Companies Worldwide

	1991 Software Revenue ($M)	1991 Share of Market (%)	1992 Software Revenue ($M)	1992 Share of Market (%)	Change in Software Revenue (%)
Cadence (Valid)	114.0	56.9	136.3	58.6	19.5
Mentor Graphics	33.7	16.8	31.5	13.5	-6.4
Compass Design	11.7	5.9	17.3	7.4	47.4
Seiko*	13.7	6.8	14.5	6.2	5.9
Sagantec	3.6	1.8	6.7	2.9	86.9
Silvar-Lisco	5.2	2.6	5.8	2.5	9.7
Cascade Design	3.0	1.5	4.7	2.0	55.9
Fujitsu	0	0	3.5	1.5	NA
Integrated Silicon Systems	2.5	1.2	3.0	1.3	21.0
Intergraph	1.6	0.8	1.9	0.8	22.2
Top 10 Companies	189.0	96.5	225.2	96.8	19.1
All Companies	195.8	100.0	232.7	100.0	18.8

*Includes distributor and/or supplier revenue

NA = Not applicable

Source: Dataquest (July 1993)

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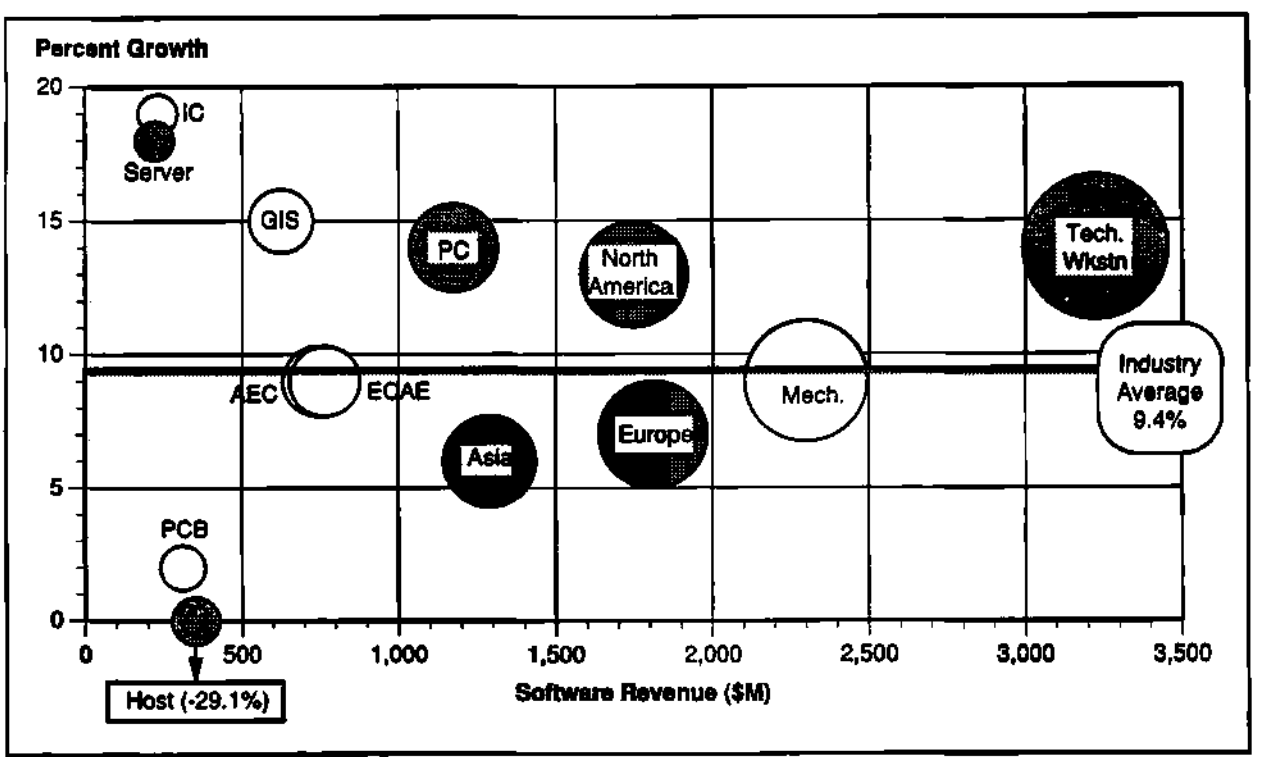
Table 12
Top 10 PCB/Hybrid/MCM Software Companies Worldwide

	1991 Software Revenue ($M)	1991 Share of Market (%)	1992 Software Revenue ($M)	1992 Share of Market (%)	Change in Software Revenue (%)
Racal-Redac	42.1	13.7	46.3	14.9	10.0
Mentor Graphics	39.5	12.9	43.0	13.8	8.7
Zuken	46.9	15.3	41.6	13.4	-11.3
Cadence (Valid)	31.5	10.3	36.5	11.7	15.8
IBM	16.3	5.3	17.1	5.5	4.7
Intergraph	12.7	4.1	16.0	5.1	25.5
Harris EDA	13.9	4.5	12.2	3.9	-11.8
CADIX	11.3	3.7	11.8	3.8	4.0
Sharp*	15.0	4.9	9.6	3.1	-35.8
Fujitsu	8.4	2.7	8.1	2.6	-3.8
Top 10 Companies	237.6	77.5	242.0	77.7	1.9
All Companies	306.6	100.0	311.4	100.0	1.6

*Includes distributor and/or supplier revenue

Source: Dataquest (July 1993)

Figure 3
CAD/CAM/CAE/GIS Market Portfolio for Software Revenue for 1992



Source: Dataquest (July 1993)

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indicates the industry average for software growth, the size of the bubbles reflects market share, and the bubbles are centered over their market size (y-axis) and market growth rate (x-axis) for 1992.

From this figure, the IC layout application segment and server platform are the two smallest and two fastest-growing segments. Workstations are the largest market segment with a higher than average growth rate of 14 percent. Notice that host-dependent platform segment is off the chart with a negative 29. 1 percent growth rate.

Hardware Revenue Suffers

In contrast to the high growth rates of software, hardware took a beating with a total growth rate of negative 0.1 percent despite an increase of seats totaling 5.9 percent (see Table 13). The hardware market continues to be pressured by decreasing margins and increasing competitiveness. Host-dependent systems are being replaced by networked, desktop systems, and distinctions between workstations and PCs are becoming increasingly blurred.

About This Document

This document contains Dataquest's detailed market share information on the CAD/CAM/CAE/GIS industry. Following is a description of the companies included in the *Market Share Update* books:

- Source—All companies in database; overview of industry
- Mechanical Applications—All companies in database with mechanical revenue
- AEC Applications—All companies in database with AEC revenue
- GIS Applications—All companies in database with GIS revenue
- Electronic Design Automation Applications—All companies in database with EDA (electronic CAE, IC layout, PCB/hybrid/MCM) revenue

Table 13
Hardware Seats, Revenue, and Average Selling Price for 1991 and 1992

	1991 Seats	1992 Seats	Growth (%)	1991 Hardware Revenue ($M)	1992 Hardware Revenue ($M)	Growth (%)	1991 Average Selling Price ($K)	1992 Average Selling Price ($K)	Growth (%)
Workstation	150,748	173,489	15.1	3,670.6	3,967.9	8.1	24.3	22.9	-6.0
Host-Dependent	39,897	31,771	-20.4	1,854.6	1,529.8	-17.5	46.5	48.2	3. 6
Server	14,830	16,301	9.9	531.0	573.8	8.1	35.8	35.2	-1.7
Personal Computer	412,406	432,848	5.0	1,718.7	1,705.4	-0.8	4.2	3.9	-5. 5
Total	617,881	654,408	5.9	7,774.8	7,776.8	0	12.5	11.9	-4.8

Source: Dataquest (July 1993)

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- Europe Overview—All Europe-based companies and all other companies with more than $1 million in European revenue
- European Countries—All companies in the European overview that report revenue by European country: Benelux, France, Germany, Italy, Scandinavia, Spain, United Kingdom, and Rest of Europe (includes Austria, Switzerland, and Eastern Europe).
- Asia—All Asia-based companies and all other companies with more than $1 million in Asian revenue
- Personal CAD and Distribution Channels—All companies in database with personal computer revenue

More detailed data on these markets may be requested through our client inquiry service.

Dataquest's policy is to continually update its market information, for current and past years, with any new data received in order to arrive at the most accurate market representation possible.

Segmentation Definitions

This section lists the definitions specific to this document. The following paragraphs define the segments.

Applications

Mechanical

The mechanical segment refers to computer-aided tools used by engineers, designers, analysts, technicians, and draftspeople working predominantly in the discrete manufacturing industries, but includes government and education. Users of mechanical CAD/CAM/CAE tools work in all departments across the typical organization, with a majority found in product design, advanced engineering, and manufacturing engineering. Common design applications include conceptual design, industrial design, structural or thermal analysis, detail design, and electromechanical design (the mechanical part of design with electrical or electronic components and mechanisms). Common manufacturing applications include tool and fixture design, numerical control part programming, off-line robotics programming, and interface to quality control systems. Management tools for database control and distribution are included in this segment, as well as user-defined application programming.

Architecture, Engineering, and Construction (AEC)

The AEC segment covers the use of computer-aided tools by architects, contractors, plant engineers, civil engineers, and other people associated with these disciplines to aid in designing and managing buildings, industrial plants, ships, and other types of nondiscrete entities.

Geographic Information Systems (GIS)/Mapping

GIS is computer-based technology, and the segment is composed of hardware, software, and data used to capture, edit, display, and analyze spatial (tagged by location) information.

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Electronic Design Automation (EDA)

The EDA segment covers computer-based tools used to automate the process of designing an electronic product, including printed circuit boards, ICs, and systems. EDA includes ECAE, IC layout, and PCB/hybrid/MCM, as follows:

- Electronic Computer-Aided Engineering (ECAE)—These are computer-aided tools used in the engineering or design phase of electronic products (as opposed to the physical layout phase of the product). Examples of electronic CAE applications are schematic capture and simulation.
- IC Layout—This is a software application tool used to create and validate the physical implementation of an IC. The IC layout category comprises polygon editors, symbolic editors, placement and routing (gate array, cell, and block), design verification tools (DRC/ERC/logic-to-layout), compilers, and module development tools.
- PCB/Hybrid/MCM—This segment covers products used to create the placement and routing of the traces and components laid out on a printed circuit board. Also included in this category are thermal analysis tools.

Regions

The following paragraphs define the regions.

North America

North America includes United States, Mexico, and Canada.

Europe

Europe includes the United Kingdom, Scandinavia, Benelux, France, Germany, Italy, Spain, and Rest of Europe.

Asia

Asia includes Japan, Singapore, Taiwan, Korea, China, and Hong Kong.

Rest of World

Rest of World includes all other countries including Australia, New Zealand, Oceania, Africa, Central America, South America, and the Middle East.

Platforms

The following paragraphs define the platforms.

Technical Workstation

A technical workstation is a single-user computer distinguished from a personal computer by its features and by the user's potential range of expansion on the platform. Features include a virtual, multitasking operating system (UNIX, VMS, or Domain); the computer is designed by the manufacturer to run high-performance graphics applications in a multiuser/multitasking environment.

Host-Dependent

Host-dependent is a shared logic system in which the external workstations' functions are dependent on a host computer.

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Server

A server is a computer that transparently provides its resources for use by other computer systems. It is a system on a network that provides specific functionality to other computer systems: the clients. Functions include file storage, database access, and compute capability. Dataquest tracks the following major categories of servers used for CAD/CAM/CAE and GIS applications:

- Compute Servers—These systems provide capabilities for solving numerical problems (for example, simulations, statistical calculations, and simultaneous partial differential equations). System features usually include high-speed computational capabilities (for example, vector and parallel processing) and large memories.
- Print Servers—These systems provide access to printers, specialized printing applications software, and print-spooling resources to a network.
- File Servers—These systems provide mass storage capability to clients on a network. Services can range from temporary storage of working files to long-term backup and archive systems.
- Database Servers—These systems manage databases as a shared resource to a network. These servers handle such functions as physical data storage, data security, and high-level queries and can access stored information at the record level.

Personal Computer

A personal computer is a single-user computer distinguished from a technical workstation by its features and by the user's potential range of expansion on the platform. Features found in technical workstations (such as a virtual operating system, networking, high-performance graphics, multiuser/multitasking capability) are optional rather than integrated by the manufacturer.

Metrics

The following paragraphs define measurements.

- Total factory revenue is defined as the amount of money received by a manufacturer for its goods and services measured in U.S. dollars. Total factory revenue does not include revenue that a company may receive from products that are sold to another company for resale (OEM revenue). Total factory revenue is the sum of software revenue, hardware revenue, and service revenue.
- Unit shipment is defined as the number of seats delivered (number of possible simultaneous users of product delivered).
- Hardware revenue is revenue derived from sales of CPUs (including operating systems), terminals (for host-dependent systems), and peripherals.
- Software revenue is revenue derived from the sale of bundled (part of a turnkey system) and unbundled application software.

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- Service revenue is defined as all revenue derived from the service and support of CAD/CAM/CAE/GIS systems. Service revenue can be calculated in the tables by subtracting hardware and software revenue from total revenue.
  - Maintenance fees for hardware and software
  - Management and Operations Services—help desk, education and training, disaster recovery, vaulting, and configuration management.
  - Service Bureau—project work, including construction of database, data conversion, product design, analysis, or manufacturing.
  - Application Development—design and development of customized software applications or the modification, enhancement of customization of existing software applications, adding new functionality.
  - Consulting Revenue—assessment of CAD/CAM/CAE/GIS business and information technology needs and the formulation of a plan based on needs identification.
  - Implemenation and Integration Services—planning, implementation, migration, and integration of software products (software network support and integration, account integration management, data center design, and construction).

Market Share Methodology

Dataquest uses both primary and secondary sources to produce our market share data. In the fourth quarter of each year and second quarter of the subsequent year, we survey all participants in each industry. Each vendor is offered the opportunity to self-report the information required. Although there is a primary contact for each company, large companies are surveyed across product lines and across geographic regions. Thus, there is a corresponding increase in the number of contacts at large companies. (Dataquest maintains a large contact database on all sources of information). Examples of the job titles of people contacted for information are the following:

- President and CEO
- Vice President and General Manager
- Vice President of Marketing
- Vice President, Strategic Product Planning
- Director of Strategic Planning
- Director of Marketing
- Director of Market Development
- Manager, CAD/CAM/CAE/GIS Marketing Programs
- Market Research Analyst

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The Audit Process

Data supplied by vendors are evaluated against information drawn from many sources, including the following:

- Revenue published by major industry participants
- Estimates made by knowledgeable and reliable industry spokespersons
- Government data or trade association data
- Published product literature and price lists
- Interviews with knowledgeable manufacturers, distributors, and users
- Relevant economic data
- Information and data from online data banks
- Articles in both the general and trade press
- Annual reports, SEC documents, credit reports
- Company publications and press releases
- Reports from financial analysts
- User studies
- Reseller and supplier reports and reports from a vendor's competitors

In addition, Dataquest sums vendor revenue across other industries covered by Dataquest to make sure that revenue is not credited twice and checks with multiple sources at one company to cross-check data on that company.

Dataquest analysts have many years of experience in how to apply the above tools to get the most accurate information possible on a particular company (such as what to use when and what industry averages are). We believe that the estimates presented here are the most accurate and meaningful generally available today. It is the CAD/CAM/CAE/GIS group's policy to continually update our market information for any year, based on any new data received, in order to arrive at the most accurate market representation possible.

Dataquest's CAD/CAM/CAE/GIS market numbers are often higher than those reported by other sources. We survey worldwide, which involves more vendors, higher total market revenue, lower market share per vendor, and a more accurate market picture—particularly useful when comparing regions or applications.

Publishing Schedule

We publish market share and forecasting, twice each year for each, allowing for both timely distribution of data and thorough analysis and forecasting. Our annual delivery schedule is as follows:

- Market share data are available January 31. All tables will be published and distributed to clients by March 31.

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- Forecasting from the market share tables provides a five-year forecast period, available after March 31. The books will be shipped by May 31.
- Final updated market share tables, based on additional data collection and analysis, will be completed by May 31. At this point, the market share database is frozen and will not be changed until the end of the year. For the next six months, supplementary market data will be based on these final market data. Books will be shipped by July 31.
- We provide complete final forecast tables by July 31. These tables take into consideration changes in the market share during the previous six months. Books will be shipped by September 31.

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Table 14
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: All Platforms
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Intergraph	439.4	200.4	114.4	6,387	22.7%	20.9%	18.1%	8.1%
Siemens Nixdorf Info systeme	150.8	74.9	53.2	1,331	7.8%	7.8%	8.4%	1.7%
Digital	112.1	78.9	.0	3,828	5.8%	8.2%	.0%	4.8%
ESRI	106.3	.0	98.0	0	5.5%	.0%	15.5%	.0%
Landmark Graphics	81.9	41.0	18.8	424	4.2%	4.3%	3.0%	.5%
IBM	74.9	55.0	9.3	10,100	3.9%	5.7%	1.5%	12.8%
Compaq	60.6	60.6	.0	13,121	3.1%	6.3%	.0%	16.6%
EDS	56.6	26.8	24.1	1,101	2.9%	2.8%	3.8%	1.4%
Sun Microsystems	56.4	48.6	.0	3,233	2.9%	5.1%	.0%	4.1%
Fujitsu	48.6	31.1	12.6	963	2.5%	3.2%	2.0%	1.2%
Autodesk	40.5	.0	40.5	0	2.1%	.0%	6.4%	.0%
Mitsubishi Electric	39.9	31.1	5.0	724	2.1%	3.2%	.8%	.9%
Data General	38.1	30.5	1.9	1,998	2.0%	3.2%	.3%	2.5%
Apple Computer	35.6	35.6	.0	7,829	1.8%	3.7%	.0%	9.9%
Computervision	32.1	12.9	7.5	372	1.7%	1.3%	1.2%	.5%
Hewlett-Packard	28.9	24.8	.0	2,516	1.5%	2.6%	.0%	3.2%
GeoVision Systems	27.0	2.2	14.0	50	1.4%	.2%	2.2%	.1%
ICL	23.8	14.0	8.1	653	1.2%	1.5%	1.3%	.8%
Uchida Yoko	22.0	13.3	7.9	522	1.1%	1.4%	1.2%	.7%
Moss Systems	19.5	.9	14.0	60	1.0%	.1%	2.2%	.1%
Genasys II	18.6	1.9	13.0	86	1.0%	.2%	2.1%	.1%

(Continued)

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Table 14 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: All Platforms
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Hitachi	17.4	8.3	7.3	468	.9%	.9%	1.2%	.6%
Mitsui Engineering	15.1	10.6	3.0	100	.8%	1.1%	.5%	.1%
Synercom	12.2	.0	6.4	0	.6%	.0%	1.0%	.0%
Silicon Graphics	11.8	10.7	.0	399	.6%	1.1%	.0%	.5%
Laser-Scan	11.6	3.9	4.7	68	.6%	.4%	.7%	.1%
Strategic Mapping	11.5	.0	10.4	0	.6%	.0%	1.6%	.0%
ETAK	10.7	.5	10.0	23	.6%	.1%	1.6%	.0%
Toshiba—No OEM	10.6	5.3	4.3	126	.5%	.6%	.7%	.2%
MapInfo	10.6	.0	8.5	0	.5%	.0%	1.3%	.0%
ERDAS	10.6	2.9	7.0	179	.5%	.3%	1.1%	.2%
Smallworld Systems	10.5	2.4	5.8	52	.5%	.3%	.9%	.1%
Sysscan	10.4	4.5	2.8	98	.5%	.5%	.4%	.1%
Unisys	10.4	2.8	3.5	199	.5%	.3%	.6%	.3%
GeoQuest	9.6	.0	9.6	0	.5%	.0%	1.5%	.0%
Infocel	9.4	1.3	7.2	197	.5%	.1%	1.1%	.2%
ItalCad	9.1	4.3	2.2	86	.5%	.4%	.3%	.1%
Enghouse Systems Ltd.	8.3	.0	7.2	10	.4%	.0%	1.1%	.0%
INS Engineering	7.2	3.6	3.6	18	.4%	.4%	.6%	.0%
NEC	7.0	4.0	2.4	310	.4%	.4%	.4%	.4%
CADIX	6.7	2.7	3.4	49	.3%	.3%	.5%	.1%
Alper Systems	6.4	3.2	1.6	45	.3%	.3%	.3%	.1%

(Continued)

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Table 14 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: All Platforms
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Radian Corporation	6.2	.0	3.7	0	.3%	.0%	.6%	.0%
PCI Remote Sensing Corp	6.0	.0	6.0	0	.3%	.0%	1.0%	.0%
Spectrum Graphics	5.8	1.7	2.9	54	.3%	.2%	.5%	.1%
Star Informatic	5.8	.9	4.1	654	.3%	.1%	.7%	.8%
Control Data Systems	5.8	3.5	1.2	157	.3%	.4%	.2%	.2%
Clemessy	5.7	4.6	.9	19	.3%	.5%	.1%	.0%
Kohns & Poppenhaeger	5.4	2.7	1.9	64	.3%	.3%	.3%	.1%
STI-Straessle	5.1	1.5	2.5	41	.3%	.2%	.4%	.1%
Century Research Center	5.0	2.6	1.8	28	.3%	.3%	.3%	.0%
Dell Computer	4.8	4.8	.0	1,262	.3%	.5%	.0%	1.6%
Dynamic Graphics	4.8	.0	4.1	0	.2%	.0%	.6%	.0%
PAFEC	4.7	.0	4.7	0	.2%	.0%	.7%	.0%
Mutoh Industries—No OEM	4.3	2.6	1.3	65	.2%	.3%	.2%	.1%
Ground Modelling Systems	4.3	2.3	1.7	379	.2%	.2%	.3%	.5%
Autometric	3.5	2.3	1.2	75	.2%	.2%	.2%	.1%
GeoGraphix	3.4	.0	2.5	0	.2%	.0%	.4%	.0%
PacSoft	3.2	.0	3.2	0	.2%	.0%	.5%	.0%
Intera Tydac	3.2	.0	3.2	0	.2%	.0%	.5%	.0%
Auto-Trol	2.9	1.1	1.1	36	.1%	.1%	.2%	.0%
Generation 5 Technology	2.6	.0	2.6	0	.1%	.0%	.4%	.0%
Facility Mapping Systems	2.4	.0	2.1	0	.1%	.0%	.3%	.0%
Terr-Mar Resource Info Svs	2.3	.6	1.3	41	.1%	.1%	.2%	.1%

(Continued)

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Table 14 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: All Platforms
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Terra Sciences	2.3	.0	2.3	0	.1%	.0%	.4%	.0%
ACDS Graphic System	2.3	.0	1.9	0	.1%	.0%	.3%	.0%
ABB Industria*	2.3	1.0	1.0	24	.1%	.1%	.2%	.0%
Kork Systems	2.0	.2	1.4	21	.1%	.0%	.2%	.0%
Softdesk	2.0	.0	2.0	0	.1%	.0%	.3%	.0%
Geometria GIS Systems House	1.8	.2	.4	15	.1%	.0%	.1%	.0%
Ziegler Informatics	1.7	.0	1.7	0	.1%	.0%	.3%	.0%
RIB/RZB	1.7	.1	1.3	11	.1%	.0%	.2%	.0%
LandCadd	1.6	.0	1.5	0	.1%	.0%	.2%	.0%
Ultimap	1.6	.6	.5	18	.1%	.1%	.1%	.0%
Geotrace Technologies	1.4	.1	1.2	21	.1%	.0%	.2%	.0%
GEOVISION Inc.	1.3	.7	.3	67	.1%	.1%	.0%	.1%
Research Machines	1.1	1.1	.0	176	.1%	.1%	.0%	.2%
DAPCO	1.1	.0	.7	0	.1%	.0%	.1%	.0%
Maptech	.9	.0	.9	0	.0%	.0%	.1%	.0%
Contract Data Research	.9	.0	.6	0	.0%	.0%	.1%	.0%
Accugraph	.9	.4	.4	31	.0%	.0%	.1%	.0%
Olivetti	.9	.7	.0	103	.0%	.1%	.0%	.1%
Triplan	.9	.3	.4	12	.0%	.0%	.1%	.0%
Solbourne	.8	.9	.0	81	.0%	.1%	.0%	.1%
Land Innovation	.8	.0	.8	0	.0%	.0%	.1%	.0%
CAD-Capture	.7	.2	.2	4	.0%	.0%	.0%	.0%

(Continued)

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Table 14 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: All Platforms
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Andor	.6	.2	.4	5	.0%	.0%	.1%	.0%
Microway	.6	.4	.2	6	.0%	.0%	.0%	.0%
EME	.5	.1	.2	14	.0%	.0%	.0%	.0%
Engineering Systems Corp.	.4	.0	.4	0	.0%	.0%	.1%	.0%
Softronics	.4	.1	.3	36	.0%	.0%	.0%	.0%
RoboCAD Solutions	.4	.0	.3	0	.0%	.0%	.0%	.0%
CAD Distribution	.3	.1	.1	5	.0%	.0%	.0%	.0%
Sigma Design	.3	.0	.3	0	.0%	.0%	.0%	.0%
American Small Business Comp.	.2	.0	.2	0	.0%	.0%	.0%	.0%
Lamp Software	.1	.0	.1	7	.0%	.0%	.0%	.0%
Innovative Data Design	.1	.0	.1	0	.0%	.0%	.0%	.0%
Foresight Resources	.1	.0	.1	0	.0%	.0%	.0%	.0%
A.I. Systems	.1	.0	.1	0	.0%	.0%	.0%	.0%
Other Companies	69.8	66.4	1.6	17,754	3.6%	6.9%	.3%	22.5%
All Companies	1,931.9	960.4	630.6	79,007	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	1,454.4	719.4	459.4	71,624	75.3%	74.9%	72.9%	90.7%
All Asian-Based Companies	184.4	115.4	53.0	3,377	9.5%	12.0%	8.4%	4.3%
All European-Based Companies	293.1	125.6	118.2	4,005	15.2%	13.1%	18.8%	5.1%
All Hardware Companies	453.5	395.8	2.2	61,772	23.5%	41.2%	.3%	78.2%
All Turnkey & SW Companies	1,478.4	564.6	628.4	17,235	76.5%	58.8%	99.7%	21.8%

Source: Dataquest (July 1993)

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Table 15
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: Technical Workstation
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Intergraph	383.5	178.1	93.8	5,698	31.8%	31.6%	23.7%	27.9%
Siemens Nixdorf Info systeme	128.1	63.2	45.7	1,186	10.6%	11.2%	11.6%	5.8%
EDS	56.6	26.8	24.1	1,101	4.7%	4.8%	6.1%	5.4%
ESRI	55.7	.0	51.4	0	4.6%	.0%	13.0%	.0%
Landmark Graphics	49.1	24.6	11.3	254	4.1%	4.4%	2.9%	1.2%
Sun Microsystems	45.7	39.8	.0	2,812	3.8%	7.1%	.0%	13.8%
Mitsubishi Electric	30.5	26.0	2.1	329	2.5%	4.6%	.5%	1.6%
Digital	29.4	20.3	.0	1,444	2.4%	3.6%	.0%	7.1%
Data General	28.2	22.6	1.4	1,620	2.3%	4.0%	.4%	7.9%
Computervision	27.3	11.3	6.1	319	2.3%	2.0%	1.5%	1.6%
ICL	23.8	14.0	8.1	653	2.0%	2.5%	2.0%	3.2%
Hewlett-Packard	23.7	20.2	.0	949	2.0%	3.6%	.0%	4.6%
Fujitsu	20.4	13.1	5.3	416	1.7%	2.3%	1.3%	2.0%
Uchida Yoko	19.8	11.9	6.9	423	1.6%	2.1%	1.7%	2.1%
Moss Systems	19.5	.9	14.0	60	1.6%	.2%	3.5%	.3%
GeoVision Systems	18.9	1.5	9.8	43	1.6%	.3%	2.5%	.2%
Genasys II	16.8	1.7	11.7	40	1.4%	.3%	3.0%	.2%
Mitsui Engineering	13.7	9.6	2.8	77	1.1%	1.7%	.7%	.4%
Hitachi	12.5	6.0	5.3	271	1.0%	1.1%	1.3%	1.3%
Laser-Scan	11.1	3.8	4.5	64	.9%	.7%	1.1%	.3%
Silicon Graphics	10.9	9.9	.0	383	.9%	1.8%	.0%	1.9%

(Continued)

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Table 15 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: Technical Workstation
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Toshiba—No OEM	10.6	5.3	4.3	126	.9%	.9%	1.1%	.6%
Smallworld Systems	10.5	2.4	5.8	52	.9%	.4%	1.5%	.3%
IBM	9.5	4.6	3.6	213	.8%	.8%	.9%	1.0%
ItalCad	9.1	4.3	2.2	86	.8%	.8%	.6%	.4%
ERDAS	8.0	2.2	5.3	45	.7%	.4%	1.3%	.2%
Synercom	7.7	.0	4.0	0	.6%	.0%	1.0%	.0%
Unisys	7.4	1.8	2.8	120	.6%	.3%	.7%	.6%
INS Engineering	7.2	3.6	3.6	18	.6%	.6%	.9%	.1%
CADIX	6.7	2.7	3.4	49	.6%	.5%	.8%	.2%
Alper Systems	6.4	3.2	1.6	45	.5%	.6%	.4%	.2%
NEC	6.3	3.5	2.3	207	.5%	.6%	.6%	1.0%
Spectrum Graphics	5.8	1.7	2.9	54	.5%	.3%	.7%	.3%
Star Informatic	5.8	.9	4.1	654	.5%	.2%	1.0%	3.2%
Control Data Systems	5.8	3.5	1.2	157	.5%	.6%	.3%	.8%
Kohns & Poppenhaeger	5.4	2.7	1.9	64	.4%	.5%	.5%	.3%
STI-Straessle	5.1	1.5	2.5	41	.4%	.3%	.6%	.2%
Century Research Center	5.0	2.6	1.8	28	.4%	.5%	.5%	.1%
GeoQuest	4.8	.0	4.8	0	.4%	.0%	1.2%	.0%
PAFEC	4.7	.0	4.7	0	.4%	.0%	1.2%	.0%
Clemessy	4.6	3.7	.7	12	.4%	.7%	.2%	.1%
Sysscan	4.2	1.4	1.5	49	.3%	.3%	.4%	.2%

(Continued)

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Table 15 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: Technical Workstation
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Dynamic Graphics	3.8	.0	3.2	0	.3%	.0%	.8%	.0%
Radian Corporation	3.7	.0	2.2	0	.3%	.0%	.6%	.0%
PCI Remote Sensing Corp	3.0	.0	3.0	0	.2%	.0%	.8%	.0%
Auto-Trol	2.9	1.1	1.1	36	.2%	.2%	.3%	.2%
Autodesk	2.4	.0	2.4	0	.2%	.0%	.6%	.0%
Mutoh Industries—No OEM	2.3	1.4	.7	23	.2%	.2%	.2%	.1%
ACDS Graphic System	2.3	.0	1.9	0	.2%	.0%	.5%	.0%
Autometric	1.7	1.1	.6	40	.1%	.2%	.1%	.2%
Intera Tydac	1.6	.0	1.6	0	.1%	.0%	.4%	.0%
Ultimap	1.6	.6	.5	18	.1%	.1%	.1%	.1%
Terr-Mar Resource Info Svs	1.4	.4	.8	17	.1%	.1%	.2%	.1%
Enghouse Systems Ltd.	1.2	.0	1.1	10	.1%	.0%	.3%	.0%
Infocel	1.1	.2	.9	11	.1%	.0%	.2%	.1%
ETAK	1.1	.0	1.0	1	.1%	.0%	.3%	.0%
DAPCO	1.1	.0	.7	0	.1%	.0%	.2%	.0%
GEOVISION Inc.	.9	.6	.2	29	.1%	.1%	.1%	.1%
Triplan	.9	.3	.4	12	.1%	.1%	.1%	.1%
Accugraph	.8	.4	.3	30	.1%	.1%	.1%	.1%
Land Innovation	.8	.0	.8	0	.1%	.0%	.2%	.0%
Microway	.6	.4	.2	6	.1%	.1%	.0%	.0%
Geometria GIS Systems House	.6	.0	.0	0	.0%	.0%	.0%	.0%

(Continued)

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Table 15 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: Technical Workstation
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Softdesk	.5	.0	.5	0	.0%	.0%	.1%	.0%
Terra Sciences	.4	.0	.4	0	.0%	.0%	.1%	.0%
RIB/RZB	.3	.0	.3	2	.0%	.0%	.1%	.0%
Solbourne	.3	.3	.0	42	.0%	.1%	.0%	.2%
Sigma Design	.2	.0	.2	0	.0%	.0%	.0%	.0%
Engineering Systems Corp.	.1	.0	.1	0	.0%	.0%	.0%	.0%
Facility Mapping Systems	.1	.0	.1	0	.0%	.0%	.0%	.0%
LandCadd	.1	.0	.1	0	.0%	.0%	.0%	.0%
Lamp Software	.0	.0	.0	3	.0%	.0%	.0%	.0%
Other Companies	1.9	.4	1.4	13	.2%	.1%	.4%	.1%
All Companies	1,205.1	563.6	395.5	20,453	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	821.6	373.2	254.9	15,435	68.2%	66.2%	64.5%	75.5%
All Asian-Based Companies	135.0	85.6	38.4	1,967	11.2%	15.2%	9.7%	9.6%
All European-Based Companies	248.5	104.9	102.2	3,050	20.6%	18.6%	25.8%	14.9%
All Hardware Companies	139.3	113.7	1.7	7,296	11.6%	20.2%	.4%	35.7%
All Turnkey & SW Companies	1,065.8	449.9	393.8	13,157	88.4%	79.8%	99.6%	64.3%

Source: Dataquest (July 1993)

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Table 16
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: Host-Dependent
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Digital	43.5	30.0	.0	0	25.4%	28.3%	.0%	.0%
IBM	24.0	15.4	3.0	359	14.0%	14.5%	9.8%	18.0%
Siemens Nixdorf Info systeme	22.6	11.8	7.5	145	13.2%	11.1%	24.5%	7.3%
Fujitsu	18.5	11.8	4.8	257	10.8%	11.1%	15.8%	12.9%
GeoVision Systems	8.1	.6	4.2	7	4.7%	.6%	13.9%	.4%
Mitsubishi Electric	5.4	2.5	1.5	17	3.1%	2.4%	5.0%	.9%
Synercom	4.5	.0	2.4	0	2.6%	.0%	7.7%	.0%
Autometric	1.8	1.2	.6	35	1.1%	1.1%	2.1%	1.8%
Hitachi	1.7	.8	.7	31	1.0%	.8%	2.4%	1.6%
Intergraph	1.4	.0	1.2	0	.8%	.0%	4.0%	.0%
Clemessy	1.2	.9	.2	7	.7%	.8%	.6%	.3%
Computervision	1.1	.3	.3	17	.6%	.3%	.8%	.9%
Geotrace Technologies	1.0	.1	.9	21	.6%	.0%	2.9%	1.0%
Dynamic Graphics	1.0	.0	.9	0	.6%	.0%	2.9%	.0%
ETAK	1.0	.0	.9	3	.6%	.0%	2.9%	.2%
ESRI	.5	.0	.5	0	.3%	.0%	1.6%	.0%
Unisys	.5	.2	.2	10	.3%	.2%	.5%	.5%
Laser-Scan	.5	.1	.2	4	.3%	.1%	.7%	.2%
Radian Corporation	.4	.0	.2	0	.3%	.0%	.8%	.0%
Kork Systems	.1	.1	.0	1	.0%	.0%	.0%	.0%
Engineering Systems Corp.	.0	.0	.0	0	.0%	.0%	.1%	.0%

(Continued)

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Table 16 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: Host-Dependent
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Accugraph	.0	.0	.0	1	.0%	.0%	.0%	.0%
Other Companies	32.5	30.3	.3	1,078	19.0%	28.5%	1.0%	54.1%
All Companies	171.3	106.1	30.5	1,993	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	121.5	78.2	15.6	1,532	70.9%	73.7%	51.1%	76.9%
All Asian-Based Companies	25.6	15.2	7.0	305	14.9%	14.3%	23.1%	15.3%
All European-Based Companies	24.2	12.7	7.9	156	14.1%	12.0%	25.8%	7.8%
All Hardware Companies	74.8	59.8	.0	1,070	43.7%	56.3%	.0%	53.7%
All Turnkey & SW Companies	96.6	46.4	30.5	923	56.3%	43.7%	100.0%	46.3%

Source: Dataquest (July 1993)

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Table 17
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: Server
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Intergraph	46.4	22.3	11.1	689	24.5%	25.3%	19.5%	28.4%
ESRI	33.8	.0	31.2	0	17.9%	.0%	54.5%	.0%
Landmark Graphics	32.8	16.4	7.5	170	17.3%	18.6%	13.2%	7.0%
Digital	31.6	21.8	.0	438	16.7%	24.8%	.0%	18.1%
Sun Microsystems	10.7	8.9	.0	420	5.6%	10.1%	.0%	17.4%
Data General	9.9	7.9	.5	378	5.2%	9.0%	.9%	15.6%
IBM	8.4	4.1	2.7	110	4.4%	4.7%	4.7%	4.6%
Sysscan	6.2	3.1	1.3	48	3.3%	3.5%	2.3%	2.0%
Computervision	3.7	1.3	1.1	36	2.0%	1.5%	1.9%	1.5%
Unisys	2.5	.8	.6	69	1.3%	.9%	1.0%	2.8%
ETAK	1.0	.0	.9	0	.5%	.0%	1.6%	.0%
Silicon Graphics	.9	.8	.0	17	.5%	.9%	.0%	.7%
Solbourne	.5	.6	.0	39	.3%	.6%	.0%	1.6%
Radian Corporation	.5	.0	.3	0	.3%	.0%	.5%	.0%
Hewlett-Packard	.2	.2	.0	6	.1%	.2%	.0%	.2%
Other Companies	.0	.0	.0	1	.0%	.0%	.0%	.0%
All Companies	189.1	88.1	57.2	2,421	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	182.9	85.1	55.9	2,373	96.7%	96.5%	97.7%	98.0%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	6.2	3.1	1.3	48	3.3%	3.5%	2.3%	2.0%
All Hardware Companies	54.4	40.6	.5	1,308	28.7%	46.1%	.9%	54.0%
All Turnkey & SW Companies	134.7	47.5	56.7	1,113	71.3%	53.9%	99.1%	46.0%

Source: Dataquest (July 1993)

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Table 18
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: Personal Computer
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Compaq	60.6	60.6	.0	13,121	16.5%	29.9%	.0%	24.2%
Autodesk	38.0	.0	38.0	0	10.4%	.0%	25.8%	.0%
Apple Computer	35.6	35.6	.0	7,829	9.7%	17.6%	.0%	14.5%
IBM	32.9	30.9	.0	9,418	9.0%	15.3%	.0%	17.4%
ESRI	16.3	.0	15.0	0	4.4%	.0%	10.2%	.0%
Strategic Mapping	11.5	.0	10.4	0	3.1%	.0%	7.0%	.0%
MapInfo	10.6	.0	8.5	0	2.9%	.0%	5.7%	.0%
Fujitsu	9.7	6.2	2.5	289	2.7%	3.1%	1.7%	.5%
Infocel	8.3	1.2	6.3	186	2.3%	.6%	4.3%	.3%
Intergraph	8.2	.0	8.2	0	2.2%	.0%	5.5%	.0%
ETAK	7.6	.4	7.3	18	2.1%	.2%	4.9%	.0%
Digital	7.5	6.8	.0	1,946	2.1%	3.4%	.0%	3.6%
Enghouse Systems Ltd.	7.1	.0	6.2	0	1.9%	.0%	4.2%	.0%
Hewlett-Packard	5.0	4.5	.0	1,561	1.4%	2.2%	.0%	2.9%
Dell Computer	4.8	4.8	.0	1,262	1.3%	2.4%	.0%	2.3%
GeoQuest	4.8	.0	4.8	0	1.3%	.0%	3.3%	.0%
Ground Modelling Systems	4.3	2.3	1.7	379	1.2%	1.1%	1.2%	.7%
Mitsubishi Electric	4.0	2.6	1.4	378	1.1%	1.3%	.9%	.7%
GeoGraphix	3.4	.0	2.5	0	.9%	.0%	1.7%	.0%
PacSoft	3.2	.0	3.2	0	.9%	.0%	2.2%	.0%

(Continued)

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Table 18 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: Personal Computer
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Hitachi	3.1	1.5	1.3	166	.9%	.7%	.9%	.3%
PCI Remote Sensing Corp	3.0	.0	3.0	0	.8%	.0%	2.0%	.0%
Generation 5 Technology	2.6	.0	2.6	0	.7%	.0%	1.8%	.0%
ERDAS	2.5	.7	1.7	133	.7%	.3%	1.1%	.2%
Facility Mapping Systems	2.3	.0	2.0	0	.6%	.0%	1.4%	.0%
ABB Industria*	2.3	1.0	1.0	24	.6%	.5%	.7%	.0%
Uchida Yoko	2.2	1.4	.9	99	.6%	.7%	.6%	.2%
Mutoh Industries—No OEM	2.0	1.2	.6	41	.6%	.6%	.4%	.1%
Kork Systems	2.0	.2	1.4	20	.5%	.1%	1.0%	.0%
Terra Sciences	1.9	.0	1.9	0	.5%	.0%	1.3%	.0%
Genasys II	1.9	.2	1.3	46	.5%	.1%	.9%	.1%
Ziegler Informatics	1.7	.0	1.7	0	.5%	.0%	1.2%	.0%
Intera Tydac	1.6	.0	1.6	0	.4%	.0%	1.1%	.0%
Radian Corporation	1.6	.0	.9	0	.4%	.0%	.6%	.0%
LandCadd	1.5	.0	1.4	0	.4%	.0%	1.0%	.0%
Softdesk	1.5	.0	1.5	0	.4%	.0%	1.0%	.0%
Mitsui Engineering	1.4	1.0	.3	23	.4%	.5%	.2%	.0%
RIB/RZB	1.3	.1	1.1	9	.4%	.1%	.7%	.0%
Geometria GIS Systems House	1.3	.2	.4	15	.3%	.1%	.3%	.0%
Research Machines	1.1	1.1	.0	176	.3%	.5%	.0%	.3%

(Continued)

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Table 18 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: Personal Computer
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Maptech	.9	.0	.9	0	.3%	.0%	.6%	.0%
Terr-Mar Resource Info Svs	.9	.2	.5	24	.3%	.1%	.3%	.0%
Contract Data Research	.9	.0	.6	0	.2%	.0%	.4%	.0%
Olivetti	.9	.7	.0	103	.2%	.4%	.0%	.2%
CAD-Capture	.7	.2	.2	4	.2%	.1%	.1%	.0%
NEC	.7	.6	.1	104	.2%	.3%	.0%	.2%
Andor	.6	.2	.4	5	.2%	.1%	.3%	.0%
EME	.5	.1	.2	14	.1%	.1%	.2%	.0%
Softronics	.4	.1	.3	36	.1%	.1%	.2%	.1%
RoboCAD Solutions	.4	.0	.3	0	.1%	.0%	.2%	.0%
Geotrace Technologies	.3	.0	.3	0	.1%	.0%	.2%	.0%
CAD Distribution	.3	.1	.1	5	.1%	.1%	.1%	.0%
GEOVISION Inc.	.3	.2	.1	38	.1%	.1%	.0%	.1%
Engineering Systems Corp.	.3	.0	.3	0	.1%	.0%	.2%	.0%
American Small Business Comp.	.2	.0	.2	0	.0%	.0%	.1%	.0%
Sigma Design	.1	.0	.1	0	.0%	.0%	.1%	.0%
Innovative Data Design	.1	.0	.1	0	.0%	.0%	.1%	.0%
Accugraph	.1	.0	.1	0	.0%	.0%	.0%	.0%
Foresight Resources	.1	.0	.1	0	.0%	.0%	.0%	.0%
Lamp Software	.1	.0	.1	4	.0%	.0%	.0%	.0%

(Continued)

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Table 18 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: Personal Computer
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
A.I. Systems	.1	.0	.1	0	.0%	.0%	.0%	.0%
Other Companies	35.4	35.8	.0	16,663	9.7%	17.7%	.0%	30.8%
All Companies	366.3	202.6	147.5	54,140	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	328.4	183.0	133.1	52,285	89.7%	90.3%	90.2%	96.6%
All Asian-Based Companies	23.8	14.7	7.5	1,105	6.5%	7.2%	5.1%	2.0%
All European-Based Companies	14.1	5.0	6.9	751	3.8%	2.5%	4.7%	1.4%
All Hardware Companies	185.0	181.7	.0	52,098	50.5%	89.7%	.0%	96.2%
All Turnkey & SW Companies	181.3	20.9	147.5	2,042	49.5%	10.3%	100.0%	3.8%

Source: Dataquest (July 1993)

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Table 19
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: All Platforms
Region: North America
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Intergraph	197.7	90.2	54.0	3,126	25.3%	23.7%	19.8%	7.1%
ESRI	78.7	.0	72.8	0	10.1%	.0%	26.8%	.0%
Digital	56.6	39.9	.0	1,899	7.2%	10.5%	.0%	4.3%
Compaq	41.2	41.2	.0	8,923	5.3%	10.8%	.0%	20.3%
Data General	36.2	29.0	1.8	1,898	4.6%	7.6%	.7%	4.3%
IBM	33.1	25.3	3.5	5,417	4.2%	6.7%	1.3%	12.3%
Sun Microsystems	32.8	28.3	.0	1,997	4.2%	7.4%	.0%	4.6%
Landmark Graphics	32.8	16.4	7.5	170	4.2%	4.3%	2.8%	.4%
Apple Computer	32.0	32.0	.0	7,111	4.1%	8.4%	.0%	16.2%
EDS	23.7	10.6	10.8	480	3.0%	2.8%	4.0%	1.1%
Autodesk	18.5	.0	18.5	0	2.4%	.0%	6.8%	.0%
Computervision	11.9	5.0	2.9	134	1.5%	1.3%	1.1%	.3%
GeoVision Systems	11.6	.9	6.0	22	1.5%	.2%	2.2%	.0%
Hewlett-Packard	9.8	8.4	.0	1,146	1.3%	2.2%	.0%	2.6%
MapInfo	8.8	.0	7.0	0	1.1%	.0%	2.6%	.0%
Infocel	8.5	1.2	6.4	177	1.1%	.3%	2.4%	.4%
Strategic Mapping	8.2	.0	7.4	0	1.0%	.0%	2.7%	.0%
ETAK	8.0	.4	7.6	17	1.0%	.1%	2.8%	.0%
Genasys II	7.4	.7	5.2	34	1.0%	.2%	1.9%	.1%
Synercom	7.3	.0	3.8	0	.9%	.0%	1.4%	.0%
GeoQuest	7.2	.0	7.2	0	.9%	.0%	2.6%	.0%
Silicon Graphics	7.2	6.5	.0	253	.9%	1.7%	.0%	.6%

(Continued)

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Table 19 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: All Platforms
Region: North America
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
ERDAS	6.6	1.8	4.3	111	.8%	.5%	1.6%	.3%
PCI Remote Sensing Corp	6.0	.0	6.0	0	.8%	.0%	2.2%	.0%
Enghouse Systems Ltd.	5.1	.0	4.5	6	.7%	.0%	1.6%	.0%
Dell Computer	3.6	3.6	.0	946	.5%	1.0%	.0%	2.2%
Autometric	3.5	2.3	1.2	75	.4%	.6%	.4%	.2%
PacSoft	3.2	.0	3.2	0	.4%	.0%	1.2%	.0%
GeoGraphix	3.2	.0	2.4	0	.4%	.0%	.9%	.0%
Intera Tydac	3.2	.0	3.2	0	.4%	.0%	1.2%	.0%
Radian Corporation	3.1	.0	1.9	0	.4%	.0%	.7%	.0%
Dynamic Graphics	2.9	.0	2.4	0	.4%	.0%	.9%	.0%
Auto-Trol	2.9	1.1	1.1	36	.4%	.3%	.4%	.1%
Laser-Scan	2.2	.8	.9	14	.3%	.2%	.3%	.0%
Generation 5 Technology	2.2	.0	2.2	0	.3%	.0%	.8%	.0%
Facility Mapping Systems	2.1	.0	1.8	0	.3%	.0%	.7%	.0%
Control Data Systems	2.1	1.3	.4	56	.3%	.3%	.2%	.1%
Terra Sciences	1.8	.0	1.8	0	.2%	.0%	.7%	.0%
ACDS Graphic System	1.8	.0	1.5	0	.2%	.0%	.5%	.0%
Softdesk	1.7	.0	1.7	0	.2%	.0%	.6%	.0%
Ultimap	1.6	.6	.5	18	.2%	.1%	.2%	.0%
Terr-Mar Resource Info Svs	1.4	.4	.7	24	.2%	.1%	.3%	.1%
GEOVISION Inc.	1.2	.7	.3	63	.2%	.2%	.1%	.1%
Geotrace Technologies	1.1	.0	1.0	17	.1%	.0%	.4%	.0%

(Continued)

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Table 19 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: All Platforms
Region: North America
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
LandCadd	1.0	.0	1.0	0	.1%	.0%	.4%	.0%
Maptech	.9	.0	.9	0	.1%	.0%	.3%	.0%
Accugraph	.8	.4	.4	29	.1%	.1%	.1%	.1%
Kork Systems	.8	.1	.6	16	.1%	.0%	.2%	.0%
Land Innovation	.8	.0	.8	0	.1%	.0%	.3%	.0%
Ground Modelling Systems	.5	.3	.2	45	.1%	.1%	.1%	.1%
Solbourne	.4	.4	.0	39	.1%	.1%	.0%	.1%
Engineering Systems Corp.	.3	.0	.3	0	.0%	.0%	.1%	.0%
Sigma Design	.3	.0	.3	0	.0%	.0%	.1%	.0%
Moss Systems	.2	.0	.1	0	.0%	.0%	.0%	.0%
American Small Business Comp.	.2	.0	.2	0	.0%	.0%	.1%	.0%
Innovative Data Design	.1	.0	.1	0	.0%	.0%	.0%	.0%
Foresight Resources	.1	.0	.1	0	.0%	.0%	.0%	.0%
A.I. Systems	.1	.0	.1	0	.0%	.0%	.0%	.0%
Other Companies	33.6	30.9	1.8	9,563	4.3%	8.1%	.7%	21.8%
All Companies	781.4	380.4	272.0	43,859	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	778.5	379.4	270.8	43,800	99.6%	99.7%	99.6%	99.9%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	2.9	1.0	1.2	59	.4%	.3%	.4%	.1%
All Hardware Companies	268.5	236.2	1.9	38,925	34.4%	62.1%	.7%	88.8%
All Turnkey & SW Companies	512.8	144.2	270.1	4,934	65.6%	37.9%	99.3%	11.2%

Source: Dataquest (July 1993)

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Table 20
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: Technical Workstation
Region: North America
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Intergraph	168.1	79.3	41.7	2,762	41.6%	43.9%	30.4%	32.8%
ESRI	41.2	.0	38.1	0	10.2%	.0%	27.8%	.0%
Data General	26.8	21.4	1.3	1,539	6.6%	11.9%	1.0%	18.3%
Sun Microsystems	26.5	23.1	.0	1,729	6.6%	12.8%	.0%	20.6%
EDS	23.7	10.6	10.8	480	5.9%	5.8%	7.9%	5.7%
Landmark Graphics	19.7	9.8	4.5	102	4.9%	5.4%	3.3%	1.2%
Digital	14.8	10.2	.0	727	3.7%	5.7%	.0%	8.6%
GeoVision Systems	8.1	.7	4.2	18	2.0%	.4%	3.1%	.2%
Computervision	7.8	3.5	1.7	90	1.9%	1.9%	1.3%	1.1%
Hewlett-Packard	7.3	6.2	.0	321	1.8%	3.4%	.0%	3.8%
Silicon Graphics	6.8	6.2	.0	244	1.7%	3.4%	.0%	2.9%
Genasys II	6.7	.7	4.7	16	1.7%	.4%	3.4%	.2%
ERDAS	5.0	1.4	3.3	28	1.2%	.7%	2.4%	.3%
Synercom	4.6	.0	2.4	0	1.1%	.0%	1.7%	.0%
IBM	3.6	1.7	1.4	87	.9%	1.0%	1.0%	1.0%
GeoQuest	3.6	.0	3.6	0	.9%	.0%	2.6%	.0%
PCI Remote Sensing Corp	3.0	.0	3.0	0	.7%	.0%	2.2%	.0%
Auto-Trol	2.9	1.1	1.1	36	.7%	.6%	.8%	.4%
Dynamic Graphics	2.3	.0	1.9	0	.6%	.0%	1.4%	.0%
Laser-Scan	2.1	.7	.8	13	.5%	.4%	.6%	.2%
Control Data Systems	2.1	1.3	.4	56	.5%	.7%	.3%	.7%

(Continued)

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Table 20 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: Technical Workstation
Region: North America
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Radian Corporation	1.9	.0	1.1	0	.5%	.0%	.8%	.0%
ACDS Graphic System	1.8	.0	1.5	0	.4%	.0%	1.1%	.0%
Autometric	1.7	1.1	.6	40	.4%	.6%	.4%	.5%
Intera Tydac	1.6	.0	1.6	0	.4%	.0%	1.2%	.0%
Ultimap	1.6	.6	.5	18	.4%	.3%	.3%	.2%
Autodesk	1.1	.0	1.1	0	.3%	.0%	.8%	.0%
Infocel	1.0	.1	.8	9	.3%	.1%	.6%	.1%
GEOVISION Inc.	.9	.5	.2	27	.2%	.3%	.2%	.3%
ETAK	.8	.0	.8	1	.2%	.0%	.6%	.0%
Terr-Mar Resource Info Svs	.8	.2	.4	10	.2%	.1%	.3%	.1%
Land Innovation	.8	.0	.8	0	.2%	.0%	.6%	.0%
Enghouse Systems Ltd.	.8	.0	.7	6	.2%	.0%	.5%	.1%
Accugraph	.7	.4	.3	28	.2%	.2%	.2%	.3%
Softdesk	.4	.0	.4	0	.1%	.0%	.3%	.0%
Terra Sciences	.3	.0	.3	0	.1%	.0%	.2%	.0%
Moss Systems	.2	.0	.1	0	.0%	.0%	.1%	.0%
Sigma Design	.2	.0	.2	0	.0%	.0%	.1%	.0%
Solbourne	.1	.1	.0	18	.0%	.1%	.0%	.2%
Engineering Systems Corp.	.1	.0	.1	0	.0%	.0%	.0%	.0%
Facility Mapping Systems	.1	.0	.1	0	.0%	.0%	.1%	.0%

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Table 20 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: Technical Workstation
Region: North America
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
LandCadd	.1	.0	.1	0	.0%	.0%	.0%	.0%
Other Companies	.8	.0	.8	5	.2%	.0%	.6%	.1%
All Companies	404.1	180.8	137.3	8,410	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	401.8	180.1	136.3	8,397	99.4%	99.6%	99.3%	99.8%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	2.3	.7	1.0	13	.6%	.4%	.7%	.2%
All Hardware Companies	82.7	67.4	1.4	4,595	20.5%	37.3%	1.0%	54.6%
All Turnkey & SW Companies	321.4	113.4	135.8	3,815	79.5%	62.7%	99.0%	45.4%

Source: Dataquest (July 1993)

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Table 21
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: Host-Dependent
Region: North America
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Digital	22.1	15.3	.0	0	39.7%	45.5%	.0%	.0%
IBM	9.1	5.9	1.1	143	16.4%	17.4%	12.9%	24.4%
GeoVision Systems	3.5	.3	1.8	3	6.3%	.8%	20.5%	.5%
Synercom	2.7	.0	1.4	0	4.9%	.0%	16.0%	.0%
Autometric	1.8	1.2	.6	35	3.3%	3.5%	7.2%	6.0%
Intergraph	1.0	.0	.9	0	1.8%	.0%	10.1%	.0%
Geotrace Technologies	.8	.0	.7	17	1.5%	.1%	7.9%	2.8%
ETAK	.7	.0	.7	2	1.3%	.1%	7.7%	.4%
Computervision	.7	.3	.2	12	1.3%	.8%	2.0%	2.1%
Dynamic Graphics	.6	.0	.5	0	1.1%	.0%	6.0%	.0%
ESRI	.4	.0	.4	0	.7%	.0%	4.1%	.0%
Radian Corporation	.2	.0	.1	0	.4%	.0%	1.4%	.0%
Laser-Scan	.1	.0	.0	1	.1%	.1%	.5%	.1%
Engineering Systems Corp.	.0	.0	.0	0	.1%	.0%	.3%	.0%
Kork Systems	.0	.0	.0	1	.0%	.1%	.0%	.1%
Accugraph	.0	.0	.0	1	.0%	.0%	.0%	.1%
Other Companies	11.8	10.6	.3	372	21.2%	31.7%	3.3%	63.4%
All Companies	55.7	33.6	8.8	586	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	55.6	33.6	8.8	585	99.9%	99.9%	99.5%	99.9%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	.1	.0	.0	1	.1%	.1%	.5%	.1%
All Hardware Companies	32.8	25.4	.0	364	58.8%	75.6%	.0%	62.1%
All Turnkey & SW Companies	22.9	8.2	8.8	222	41.2%	24.4%	100.0%	37.9%

Source: Dataquest (July 1993)

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Table 22
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: Server
Region: North America
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
ESRI	25.0	.0	23.1	0	24.7%	.0%	66.2%	.0%
Intergraph	22.7	10.9	5.5	364	22.5%	24.2%	15.6%	26.1%
Digital	16.0	11.0	.0	221	15.8%	24.5%	.0%	15.9%
Landmark Graphics	13.1	6.6	3.0	68	13.0%	14.5%	8.6%	4.9%
Data General	9.4	7.5	.5	359	9.3%	16.7%	1.3%	25.8%
Sun Microsystems	6.3	5.2	.0	268	6.2%	11.6%	.0%	19.2%
IBM	3.4	1.7	1.0	44	3.3%	3.8%	2.9%	3.2%
Computervision	3.3	1.2	1.0	33	3.3%	2.6%	2.9%	2.3%
ETAK	.7	.0	.7	0	.7%	.1%	1.9%	.0%
Silicon Graphics	.4	.4	.0	8	.4%	.8%	.0%	.6%
Solbourne	.3	.3	.0	21	.3%	.7%	.0%	1.5%
Radian Corporation	.3	.0	.2	0	.2%	.0%	.4%	.0%
Hewlett-Packard	.2	.2	.0	6	.2%	.3%	.0%	.4%
Other Companies	.0	.0	.0	1	.0%	.0%	.0%	.0%
All Companies	101.1	45.0	34.9	1,393	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	101.1	45.0	34.9	1,393	100.0%	100.0%	100.0%	100.0%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Hardware Companies	33.0	25.0	.5	890	32.6%	55.4%	1.3%	63.9%
All Turnkey & SW Companies	68.2	20.1	34.5	503	67.4%	44.6%	98.7%	36.1%

Source: Dataquest (July 1993)

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Table 23
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: Personal Computer
Region: North America
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Compaq	41.2	41.2	.0	8,923	18.7%	34.1%	.0%	26.7%
Apple Computer	32.0	32.0	.0	7,111	14.5%	26.5%	.0%	21.2%
Autodesk	17.4	.0	17.4	0	7.9%	.0%	19.1%	.0%
IBM	17.0	16.0	.0	5,142	7.7%	13.2%	.0%	15.4%
ESRI	12.0	.0	11.1	0	5.5%	.0%	12.2%	.0%
MapInfo	8.8	.0	7.0	0	4.0%	.0%	7.7%	.0%
Strategic Mapping	8.2	.0	7.4	0	3.7%	.0%	8.1%	.0%
Infocel	7.4	1.0	5.7	168	3.4%	.9%	6.2%	.5%
Intergraph	5.9	.0	5.9	0	2.7%	.0%	6.5%	.0%
ETAK	5.7	.3	5.5	14	2.6%	.2%	6.0%	.0%
Enghouse Systems Ltd.	4.4	.0	3.8	0	2.0%	.0%	4.2%	.0%
Digital	3.7	3.3	.0	951	1.7%	2.7%	.0%	2.8%
Dell Computer	3.6	3.6	.0	946	1.6%	3.0%	.0%	2.8%
GeoQuest	3.6	.0	3.6	0	1.6%	.0%	4.0%	.0%
PacSoft	3.2	.0	3.2	0	1.5%	.0%	3.5%	.0%
GeoGraphix	3.2	.0	2.4	0	1.4%	.0%	2.6%	.0%
PCI Remote Sensing Corp	3.0	.0	3.0	0	1.4%	.0%	3.3%	.0%
Hewlett-Packard	2.4	2.1	.0	820	1.1%	1.8%	.0%	2.4%
Generation 5 Technology	2.2	.0	2.2	0	1.0%	.0%	2.4%	.0%
Facility Mapping Systems	2.0	.0	1.7	0	.9%	.0%	1.9%	.0%

(Continued)

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Table 23 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: Personal Computer
Region: North America
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Intera Tydac	1.6	.0	1.6	0	.7%	.0%	1.7%	.0%
ERDAS	1.6	.4	1.0	83	.7%	.3%	1.1%	.2%
Terra Sciences	1.5	.0	1.5	0	.7%	.0%	1.6%	.0%
Softdesk	1.3	.0	1.3	0	.6%	.0%	1.4%	.0%
LandCadd	1.0	.0	.9	0	.4%	.0%	1.0%	.0%
Maptech	.9	.0	.9	0	.4%	.0%	1.0%	.0%
Radian Corporation	.8	.0	.5	0	.4%	.0%	.5%	.0%
Kork Systems	.8	.1	.6	15	.4%	.1%	.6%	.0%
Genasys II	.7	.1	.5	18	.3%	.1%	.6%	.1%
Terr-Mar Resource Info Svs	.5	.1	.3	14	.2%	.1%	.3%	.0%
Ground Modelling Systems	.5	.3	.2	45	.2%	.2%	.2%	.1%
GEOVISION Inc.	.3	.2	.1	36	.1%	.1%	.1%	.1%
Geotrace Technologies	.3	.0	.3	0	.1%	.0%	.3%	.0%
Engineering Systems Corp.	.2	.0	.2	0	.1%	.0%	.2%	.0%
American Small Business Comp.	.2	.0	.2	0	.1%	.0%	.2%	.0%
Sigma Design	.1	.0	.1	0	.1%	.0%	.1%	.0%
Innovative Data Design	.1	.0	.1	0	.0%	.0%	.1%	.0%
Accugraph	.1	.0	.1	0	.0%	.0%	.1%	.0%
Foresight Resources	.1	.0	.1	0	.0%	.0%	.1%	.0%

(Continued)

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Table 23 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: Personal Computer
Region: North America
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
A.I. Systems	.1	.0	.1	0	.0%	.0%	.1%	.0%
Other Companies	20.9	20.2	.7	9,185	9.5%	16.7%	.8%	27.4%
All Companies	220.4	121.0	91.0	33,471	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	219.9	120.7	90.8	33,425	99.8%	99.8%	99.8%	99.9%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	.5	.3	.2	45	.2%	.2%	.2%	.1%
All Hardware Companies	120.1	118.5	.0	33,077	54.5%	97.9%	.0%	98.8%
All Turnkey & SW Companies	100.3	2.5	91.0	393	45.5%	2.1%	100.0%	1.2%

Source: Dataquest (July 1993)

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Table 24
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: All Platforms
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Intergraph	167.0	76.8	40.3	2,176	23.2%	22.3%	17.6%	10.6%
Siemens Nixdorf Info systeme	141.7	70.3	50.1	1,251	19.7%	20.4%	21.9%	6.1%
Digital	43.2	30.5	.0	1,512	6.0%	8.8%	.0%	7.4%
IBM	24.9	16.7	4.1	2,063	3.5%	4.8%	1.8%	10.1%
Landmark Graphics	24.6	12.3	5.7	127	3.4%	3.6%	2.5%	.6%
ICL	23.8	14.0	8.1	653	3.3%	4.1%	3.5%	3.2%
Computervision	19.3	7.5	4.3	168	2.7%	2.2%	1.9%	.8%
ESRI	19.1	.0	17.4	0	2.7%	.0%	7.6%	.0%
Sun Microsystems	19.1	16.5	.0	1,014	2.7%	4.8%	.0%	5.0%
Moss Systems	18.0	.9	13.1	60	2.5%	.3%	5.7%	.3%
Compaq	16.4	16.4	.0	3,543	2.3%	4.7%	.0%	17.3%
Autodesk	15.1	.0	15.1	0	2.1%	.0%	6.6%	.0%
EDS	13.7	6.1	6.2	268	1.9%	1.8%	2.7%	1.3%
Hewlett-Packard	13.5	11.6	.0	1,063	1.9%	3.4%	.0%	5.2%
Smallworld Systems	10.5	2.4	5.8	52	1.5%	.7%	2.5%	.3%
Sysscan	9.8	4.2	2.6	92	1.4%	1.2%	1.1%	.4%
ItalCad	9.1	4.3	2.2	86	1.3%	1.2%	1.0%	.4%
Laser-Scan	8.5	2.9	3.4	51	1.2%	.8%	1.5%	.3%
Unisys	8.3	1.7	2.8	152	1.2%	.5%	1.2%	.7%
GeoVision Systems	6.8	.5	3.5	13	.9%	.2%	1.5%	.1%
Alper Systems	6.4	3.2	1.6	45	.9%	.9%	.7%	.2%

(Continued)

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Table 24 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: All Platforms
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Spectrum Graphics	5.8	1.7	2.9	54	.8%	.5%	1.3%	.3%
Star Informatic	5.8	.9	4.1	654	.8%	.3%	1.8%	3.2%
Genasys II	5.6	.6	3.9	26	.8%	.2%	1.7%	.1%
Clemessy	5.4	4.4	.8	18	.8%	1.3%	.4%	.1%
Kohns & Poppenhaeger	5.4	2.7	1.9	64	.7%	.8%	.8%	.3%
STI-Straessle	5.1	1.5	2.5	41	.7%	.4%	1.1%	.2%
Silicon Graphics	4.6	4.2	.0	146	.6%	1.2%	.0%	.7%
PAFEC	4.6	.0	4.6	0	.6%	.0%	2.0%	.0%
Ground Modelling Systems	3.8	2.0	1.5	333	.5%	.6%	.7%	1.6%
Control Data Systems	2.8	1.7	.6	77	.4%	.5%	.3%	.4%
Synercom	2.7	.0	1.4	0	.4%	.0%	.6%	.0%
ERDAS	2.4	.7	1.6	41	.3%	.2%	.7%	.2%
ABB Industria*	2.3	1.0	1.0	24	.3%	.3%	.4%	.1%
Geometria GIS Systems House	1.8	.2	.4	15	.3%	.1%	.2%	.1%
Apple Computer	1.8	1.8	.0	323	.2%	.5%	.0%	1.6%
Ziegler Informatics	1.7	.0	1.7	0	.2%	.0%	.7%	.0%
Enghouse Systems Ltd.	1.7	.0	1.5	2	.2%	.0%	.6%	.0%
RIB/RZB	1.7	.1	1.3	11	.2%	.0%	.6%	.1%
ETAK	1.6	.1	1.5	3	.2%	.0%	.7%	.0%
Strategic Mapping	1.5	.0	1.4	0	.2%	.0%	.6%	.0%
GeoQuest	1.4	.0	1.4	0	.2%	.0%	.6%	.0%

(Continued)

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Table 24 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: All Platforms
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Dell Computer	1.2	1.2	.0	315	.2%	.4%	.0%	1.5%
Dynamic Graphics	1.2	.0	1.0	0	.2%	.0%	.4%	.0%
Research Machines	1.1	1.1	.0	176	.2%	.3%	.0%	.9%
DAPCO	1.1	.0	.7	0	.1%	.0%	.3%	.0%
Contract Data Research	.9	.0	.6	0	.1%	.0%	.3%	.0%
Olivetti	.9	.7	.0	103	.1%	.2%	.0%	.5%
Triplan	.9	.3	.4	12	.1%	.1%	.2%	.1%
CAD-Capture	.7	.2	.2	4	.1%	.0%	.1%	.0%
Microway	.6	.4	.2	6	.1%	.1%	.1%	.0%
Terra Sciences	.5	.0	.5	0	.1%	.0%	.2%	.0%
EME	.5	.1	.2	14	.1%	.0%	.1%	.1%
Solbourne	.4	.4	.0	43	.1%	.1%	.0%	.2%
ACDS Graphic System	.4	.0	.3	0	.1%	.0%	.1%	.0%
Softronics	.4	.1	.3	36	.1%	.0%	.1%	.2%
Kork Systems	.4	.0	.3	4	.1%	.0%	.1%	.0%
LandCadd	.4	.0	.4	0	.1%	.0%	.2%	.0%
RoboCAD Solutions	.4	.0	.3	0	.1%	.0%	.1%	.0%
CAD Distribution	.3	.1	.1	5	.0%	.0%	.1%	.0%
Terr-Mar Resource Info Svs	.3	.1	.2	5	.0%	.0%	.1%	.0%
Generation 5 Technology	.3	.0	.3	0	.0%	.0%	.1%	.0%
Facility Mapping Systems	.2	.0	.2	0	.0%	.0%	.1%	.0%

(Continued)

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Table 24 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: All Platforms
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Geotrace Technologies	.2	.0	.2	3	.0%	.0%	.1%	.0%
Lamp Software	.1	.0	.1	7	.0%	.0%	.0%	.0%
Softdesk	.1	.0	.1	0	.0%	.0%	.0%	.0%
GEOVISION Inc.	.1	.0	.0	3	.0%	.0%	.0%	.0%
GeoGraphix	.1	.0	.1	0	.0%	.0%	.0%	.0%
Accugraph	.0	.0	.0	1	.0%	.0%	.0%	.0%
Foresight Resources	.0	.0	.0	0	.0%	.0%	.0%	.0%
American Small Business Comp.	.0	.0	.0	0	.0%	.0%	.0%	.0%
A.I. Systems	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	17.8	17.6	.0	3,519	2.5%	5.1%	.0%	17.2%
All Companies	719.4	344.8	228.7	20,479	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	441.5	225.5	116.1	16,622	61.4%	65.4%	50.8%	81.2%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	277.9	119.2	112.5	3,856	38.6%	34.6%	49.2%	18.8%
All Hardware Companies	128.1	109.1	.1	13,552	17.8%	31.7%	.1%	66.2%
All Turnkey & SW Companies	591.3	235.7	228.5	6,927	82.2%	68.3%	99.9%	33.8%

Source: Dataquest (July 1993)

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Table 25
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: Technical Workstation
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Intergraph	151.9	69.6	36.7	1,980	29.3%	30.1%	21.3%	25.3%
Siemens Nixdorf Info systeme	120.5	59.3	43.1	1,115	23.3%	25.6%	24.9%	14.3%
ICL	23.8	14.0	8.1	653	4.6%	6.1%	4.7%	8.4%
Computervision	18.9	7.5	4.2	163	3.6%	3.2%	2.5%	2.1%
Moss Systems	18.0	.9	13.1	60	3.5%	.4%	7.6%	.8%
Sun Microsystems	15.8	13.7	.0	897	3.0%	5.9%	.0%	11.5%
Landmark Graphics	14.7	7.4	3.4	76	2.8%	3.2%	2.0%	1.0%
EDS	13.7	6.1	6.2	268	2.6%	2.6%	3.6%	3.4%
Digital	11.4	7.9	.0	560	2.2%	3.4%	.0%	7.2%
Hewlett-Packard	11.4	9.7	.0	453	2.2%	4.2%	.0%	5.8%
Smallworld Systems	10.5	2.4	5.8	52	2.0%	1.0%	3.3%	.7%
ESRI	10.0	.0	9.1	0	1.9%	.0%	5.3%	.0%
ItalCad	9.1	4.3	2.2	86	1.8%	1.9%	1.3%	1.1%
Laser-Scan	8.2	2.8	3.3	48	1.6%	1.2%	1.9%	.6%
Alper Systems	6.4	3.2	1.6	45	1.2%	1.4%	.9%	.6%
Unisys	5.8	.9	2.2	83	1.1%	.4%	1.3%	1.1%
Spectrum Graphics	5.8	1.7	2.9	54	1.1%	.7%	1.7%	.7%
Star Informatic	5.8	.9	4.1	654	1.1%	.4%	2.4%	8.4%
Kohns & Poppenhaeger	5.4	2.7	1.9	64	1.0%	1.2%	1.1%	.8%
STI-Straessle	5.1	1.5	2.5	41	1.0%	.7%	1.4%	.5%
Genasys II	5.0	.5	3.5	12	1.0%	.2%	2.0%	.2%

(Continued)

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Table 25 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: Technical Workstation
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
GeoVision Systems	4.7	.4	2.5	11	.9%	.2%	1.4%	.1%
PAFEC	4.6	.0	4.6	0	.9%	.0%	2.6%	.0%
Clemessy	4.4	3.5	.7	11	.8%	1.5%	.4%	.1%
IBM	4.2	2.0	1.6	95	.8%	.9%	.9%	1.2%
Silicon Graphics	4.1	3.8	.0	138	.8%	1.6%	.0%	1.8%
Sysscan	3.9	1.4	1.4	46	.8%	.6%	.8%	.6%
Control Data Systems	2.8	1.7	.6	77	.5%	.7%	.3%	1.0%
ERDAS	1.9	.5	1.2	10	.4%	.2%	.7%	.1%
Synercom	1.7	.0	.9	0	.3%	.0%	.5%	.0%
DAPCO	1.1	.0	.7	0	.2%	.0%	.4%	.0%
Dynamic Graphics	.9	.0	.8	0	.2%	.0%	.5%	.0%
Autodesk	.9	.0	.9	0	.2%	.0%	.5%	.0%
Triplan	.9	.3	.4	12	.2%	.1%	.2%	.2%
GeoQuest	.7	.0	.7	0	.1%	.0%	.4%	.0%
Microway	.6	.4	.2	6	.1%	.2%	.1%	.1%
Geometria GIS Systems House	.6	.0	.0	0	.1%	.0%	.0%	.0%
ACDS Graphic System	.4	.0	.3	0	.1%	.0%	.2%	.0%
RIB/RZB	.3	.0	.3	2	.1%	.0%	.2%	.0%
Enghouse Systems Ltd.	.3	.0	.2	2	.0%	.0%	.1%	.0%
Solbourne	.2	.2	.0	24	.0%	.1%	.0%	.3%
ETAK	.2	.0	.2	0	.0%	.0%	.1%	.0%

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Table 25 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: Technical Workstation
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Terr-Mar Resource Info Svs	.2	.0	.1	2	.0%	.0%	.1%	.0%
Terra Sciences	.1	.0	.1	0	.0%	.0%	.1%	.0%
GEOVISION Inc.	.1	.0	.0	1	.0%	.0%	.0%	.0%
Accugraph	.0	.0	.0	1	.0%	.0%	.0%	.0%
Lamp Software	.0	.0	.0	3	.0%	.0%	.0%	.0%
Softdesk	.0	.0	.0	0	.0%	.0%	.0%	.0%
LandCadd	.0	.0	.0	0	.0%	.0%	.0%	.0%
Facility Mapping Systems	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	1.1	.3	.6	7	.2%	.1%	.3%	.1%
All Companies	517.8	231.5	172.8	7,815	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	282.0	131.8	75.6	4,856	54.5%	56.9%	43.7%	62.1%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	235.9	99.7	97.3	2,960	45.5%	43.1%	56.3%	37.9%
All Hardware Companies	43.4	35.5	.1	2,096	8.4%	15.3%	.1%	26.8%
All Turnkey & SW Companies	474.5	196.0	172.7	5,719	91.6%	84.7%	99.9%	73.2%

Source: Dataquest (July 1993)

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Table 26
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: Host-Dependent
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hard-ware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Siemens Nixdorf Info systeme	21.3	11.1	7.0	136	32.3%	26.5%	64.6%	18.9%
Digital	16.6	11.5	.0	0	25.3%	27.4%	.0%	.0%
IBM	10.6	6.8	1.3	161	16.1%	16.2%	12.1%	22.2%
GeoVision Systems	2.0	.2	1.1	2	3.1%	.4%	9.7%	.3%
Clemessy	1.1	.9	.2	6	1.7%	2.1%	1.6%	.9%
Synercom	1.0	.0	.5	0	1.5%	.0%	4.8%	.0%
Laser-Scan	.3	.1	.2	3	.5%	.2%	1.4%	.4%
Computervision	.3	.0	.1	4	.4%	.1%	.6%	.5%
Dynamic Graphics	.3	.0	.2	0	.4%	.0%	2.0%	.0%
Geotrace Technologies	.2	.0	.1	3	.2%	.0%	1.3%	.4%
ETAK	.2	.0	.1	0	.2%	.0%	1.2%	.1%
ESRI	.1	.0	.1	0	.1%	.0%	.8%	.0%
Kork Systems	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	11.9	11.3	.0	407	18.1%	27.1%	.0%	56.3%
All Companies	65.7	41.7	10.9	722	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	43.0	29.8	3.5	577	65.5%	71.3%	32.5%	79.9%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	22.7	12.0	7.3	146	34.5%	28.7%	67.5%	20.1%
All Hardware Companies	28.5	22.8	.0	407	43.4%	54.5%	.0%	56.3%
All Turnkey & SW Companies	37.2	19.0	10.9	316	56.6%	45.5%	100.0%	43.7%

Source: Dataquest (July 1993)

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Table 27
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: Server
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hard-ware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Intergraph	15.0	7.2	3.6	196	25.3%	24.5%	24.8%	27.0%
Digital	12.2	8.4	.0	170	20.6%	28.7%	.0%	23.4%
Landmark Graphics	9.8	4.9	2.3	51	16.6%	16.7%	15.6%	7.0%
ESRI	6.1	.0	5.5	0	10.3%	.0%	38.2%	.0%
Sysscan	5.9	2.9	1.2	46	9.9%	9.7%	8.5%	6.3%
IBM	3.6	1.7	1.2	50	6.1%	5.9%	8.2%	6.9%
Sun Microsystems	3.3	2.8	.0	117	5.6%	9.4%	.0%	16.2%
Unisys	2.5	.8	.6	69	4.2%	2.7%	3.9%	9.5%
Silicon Graphics	.5	.4	.0	8	.8%	1.4%	.0%	1.1%
Solbourne	.2	.3	.0	18	.4%	.9%	.0%	2.5%
ETAK	.2	.0	.1	0	.3%	.0%	.9%	.0%
Computervision	.1	.0	.0	1	.2%	.1%	.0%	.1%
Other Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Companies	59.4	29.4	14.5	726	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	53.5	26.6	13.3	680	90.1%	90.3%	91.5%	93.7%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	5.9	2.9	1.2	46	9.9%	9.7%	8.5%	6.3%
All Hardware Companies	16.4	12.0	.0	316	27.6%	40.7%	.0%	43.6%
All Turnkey & SW Companies	43.0	17.4	14.5	409	72.4%	59.3%	100.0%	56.4%

Source: Dataquest (July 1993)

CAEC-WW-MS-9306

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Table 28
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: Personal Computer
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Compaq	16.4	16.4	.0	3,543	21.4%	38.9%	.0%	31.6%
Autodesk	14.2	.0	14.2	0	18.5%	.0%	46.6%	.0%
IBM	6.6	6.2	.0	1,757	8.6%	14.6%	.0%	15.7%
Ground Modelling Systems	3.8	2.0	1.5	333	5.0%	4.8%	5.0%	3.0%
Digital	3.0	2.8	.0	781	3.9%	6.5%	.0%	7.0%
ESRI	2.9	.0	2.7	0	3.8%	.0%	8.8%	.0%
ABB Industria*	2.3	1.0	1.0	24	2.9%	2.3%	3.3%	.2%
Hewlett-Packard	2.1	1.9	.0	610	2.8%	4.5%	.0%	5.4%
Apple Computer	1.8	1.8	.0	323	2.3%	4.2%	.0%	2.9%
Ziegler Informatics	1.7	.0	1.7	0	2.2%	.0%	5.6%	.0%
Strategic Mapping	1.5	.0	1.4	0	2.0%	.0%	4.4%	.0%
Enghouse Systems Ltd.	1.4	.0	1.2	0	1.8%	.0%	4.0%	.0%
RIB/RZB	1.3	.1	1.1	9	1.7%	.3%	3.5%	.1%
Geometria GIS Systems House	1.3	.2	.4	15	1.6%	.5%	1.3%	.1%
Dell Computer	1.2	1.2	.0	315	1.6%	2.9%	.0%	2.8%
ETAK	1.1	.1	1.1	3	1.5%	.1%	3.6%	.0%
Research Machines	1.1	1.1	.0	176	1.4%	2.6%	.0%	1.6%
Contract Data Research	.9	.0	.6	0	1.2%	.0%	2.1%	.0%
Olivetti	.9	.7	.0	103	1.1%	1.8%	.0%	.9%
GeoQuest	.7	.0	.7	0	.9%	.0%	2.4%	.0%

(Continued)

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Table 28 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: Personal Computer
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
CAD-Capture	.7	.2	.2	4	.9%	.4%	.7%	.0%
ERDAS	.6	.2	.4	31	.8%	.4%	1.3%	.3%
Genasys II	.6	.0	.4	14	.7%	.1%	1.2%	.1%
EME	.5	.1	.2	14	.7%	.3%	.8%	.1%
Terra Sciences	.4	.0	.4	0	.5%	.0%	1.4%	.0%
Softronics	.4	.1	.3	36	.5%	.3%	1.0%	.3%
Kork Systems	.4	.0	.3	4	.5%	.1%	.9%	.0%
LandCadd	.4	.0	.4	0	.5%	.0%	1.2%	.0%
RoboCAD Solutions	.4	.0	.3	0	.5%	.0%	1.0%	.0%
CAD Distribution	.3	.1	.1	5	.4%	.3%	.4%	.0%
Generation 5 Technology	.3	.0	.3	0	.4%	.0%	.9%	.0%
Facility Mapping Systems	.2	.0	.2	0	.3%	.0%	.6%	.0%
Terr-Mar Resource Info Svs	.1	.0	.1	3	.1%	.1%	.2%	.0%
Lamp Software	.1	.0	.1	4	.1%	.0%	.2%	.0%
GeoGraphix	.1	.0	.1	0	.1%	.0%	.2%	.0%
Softdesk	.1	.0	.1	0	.1%	.0%	.2%	.0%
Geotrace Technologies	.1	.0	.1	0	.1%	.0%	.2%	.0%
GEOVISION Inc.	.0	.0	.0	2	.0%	.0%	.0%	.0%
A.I. Systems	.0	.0	.0	0	.0%	.0%	.0%	.0%
American Small Business Comp.	.0	.0	.0	0	.0%	.0%	.0%	.0%

(Continued)

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Table 28 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: Personal Computer
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Foresight Resources	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	4.8	6.0	.0	3,105	6.3%	14.1%	.0%	27.7%
All Companies	**76.5**	**42.1**	**30.5**	**11,215**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
All N.A.-Based Companies	62.9	37.4	23.8	10,509	82.3%	88.8%	78.0%	93.7%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	13.6	4.7	6.7	706	17.7%	11.2%	22.0%	6.3%
All Hardware Companies	39.8	38.9	.0	10,733	52.1%	92.3%	.0%	95.7%
All Turnkey & SW Companies	36.6	3.3	30.5	482	47.9%	7.7%	100.0%	4.3%

Source: Dataquest (July 1993)

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Table 29
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: All Platforms
Region: Asia
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Fujitsu	48.6	31.1	12.6	963	15.0%	16.6%	13.5%	9.6%
Mitsubishi Electric	39.9	31.1	5.0	724	12.3%	16.6%	5.3%	7.2%
Intergraph	30.8	13.3	8.1	390	9.5%	7.1%	8.6%	3.9%
Uchida Yoko	22.0	13.3	7.9	522	6.8%	7.1%	8.4%	5.2%
Hitachi	17.4	8.3	7.3	468	5.4%	4.4%	7.8%	4.7%
EDS	16.4	8.9	5.8	296	5.1%	4.7%	6.2%	2.9%
Mitsui Engineering	15.1	10.6	3.0	100	4.7%	5.6%	3.2%	1.0%
IBM	13.5	10.5	1.3	2,097	4.2%	5.6%	1.4%	20.9%
Toshiba—No OEM	10.6	5.3	4.3	126	3.3%	2.8%	4.5%	1.3%
Siemens Nixdorf Info systeme	9.1	4.6	3.0	80	2.8%	2.5%	3.2%	.8%
Digital	9.0	6.3	.0	306	2.8%	3.4%	.0%	3.0%
Landmark Graphics	8.2	4.1	1.9	42	2.5%	2.2%	2.0%	.4%
INS Engineering	7.2	3.6	3.6	18	2.2%	1.9%	3.8%	.2%
NEC	7.0	4.0	2.4	310	2.2%	2.1%	2.5%	3.1%
CADIX	6.7	2.7	3.4	49	2.1%	1.4%	3.6%	.5%
Autodesk	6.0	.0	6.0	0	1.9%	.0%	6.4%	.0%
GeoVision Systems	5.9	.5	3.1	11	1.8%	.3%	3.3%	.1%
Hewlett-Packard	5.4	4.6	.0	274	1.7%	2.4%	.0%	2.7%
Century Research Center	5.0	2.6	1.8	28	1.5%	1.4%	2.0%	.3%
ESRI	4.4	.0	4.0	0	1.3%	.0%	4.3%	.0%
Mutoh Industries—No OEM	4.3	2.6	1.3	65	1.3%	1.4%	1.4%	.6%

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Table 29 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: All Platforms
Region: Asia
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Sun Microsystems	3.8	3.3	.0	185	1.2%	1.8%	.0%	1.8%
Synercom	2.1	.0	1.1	0	.6%	.0%	1.2%	.0%
Genasys II	1.9	.2	1.3	9	.6%	.1%	1.4%	.1%
Compaq	1.8	1.8	.0	394	.6%	1.0%	.0%	3.9%
Enghouse Systems Ltd.	1.2	.0	1.0	1	.4%	.0%	1.1%	.0%
GeoQuest	1.0	.0	1.0	0	.3%	.0%	1.0%	.0%
ERDAS	1.0	.3	.6	16	.3%	.1%	.7%	.2%
Control Data Systems	.9	.5	.2	23	.3%	.3%	.2%	.2%
Moss Systems	.8	.0	.5	0	.2%	.0%	.5%	.0%
Andor	.6	.2	.4	5	.2%	.1%	.5%	.1%
Sysscan	.6	.3	.2	6	.2%	.1%	.2%	.1%
Terr-Mar Resource Info Svs	.6	.2	.3	10	.2%	.1%	.3%	.1%
ETAK	.5	.0	.5	1	.2%	.0%	.5%	.0%
Laser-Scan	.4	.1	.2	3	.1%	.1%	.2%	.0%
Dynamic Graphics	.2	.0	.2	0	.1%	.0%	.2%	.0%
GeoGraphix	.2	.0	.1	0	.0%	.0%	.1%	.0%
Softdesk	.1	.0	.1	0	.0%	.0%	.1%	.0%
ACDS Graphic System	.1	.0	.1	0	.0%	.0%	.1%	.0%
PAFEC	.1	.0	.1	0	.0%	.0%	.1%	.0%
Geotrace Technologies	.1	.0	.1	1	.0%	.0%	.1%	.0%
Facility Mapping Systems	.1	.0	.0	0	.0%	.0%	.0%	.0%

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Table 29 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: All Platforms
Region: Asia
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Accugraph	.0	.0	.0	1	.0%	.0%	.0%	.0%
Kork Systems	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	13.1	12.7	.0	2,516	4.0%	6.8%	.0%	25.1%
All Companies	323.2	187.5	93.7	10,039	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	127.9	67.1	36.8	6,573	39.6%	35.8%	39.3%	65.5%
All Asian-Based Companies	184.4	115.4	53.0	3,377	57.0%	61.5%	56.5%	33.6%
All European-Based Companies	11.0	5.1	3.9	89	3.4%	2.7%	4.2%	.9%
All Hardware Companies	40.9	36.0	.0	5,706	12.6%	19.2%	.0%	56.8%
All Turnkey & SW Companies	282.4	151.6	93.7	4,334	87.4%	80.8%	100.0%	43.2%

Source: Dataquest (July 1993)

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Table 30
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: Technical Workstation
Region: Asia
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Mitsubishi Electric	30.5	26.0	2.1	329	14.1%	21.1%	3.4%	10.2%
Intergraph	26.1	11.6	6.2	342	12.1%	9.4%	9.7%	10.7%
Fujitsu	20.4	13.1	5.3	416	9.5%	10.6%	8.3%	13.0%
Uchida Yoko	19.8	11.9	6.9	423	9.2%	9.7%	10.9%	13.2%
EDS	16.4	8.9	5.8	296	7.6%	7.2%	9.2%	9.2%
Mitsui Engineering	13.7	9.6	2.8	77	6.4%	7.8%	4.3%	2.4%
Hitachi	12.5	6.0	5.3	271	5.8%	4.9%	8.3%	8.4%
Toshiba—No OEM	10.6	5.3	4.3	126	4.9%	4.3%	6.7%	3.9%
Siemens Nixdorf Info systeme	7.7	3.9	2.6	72	3.6%	3.2%	4.1%	2.2%
INS Engineering	7.2	3.6	3.6	18	3.3%	2.9%	5.6%	.6%
CADIX	6.7	2.7	3.4	49	3.1%	2.2%	5.3%	1.5%
NEC	6.3	3.5	2.3	207	2.9%	2.8%	3.6%	6.4%
Century Research Center	5.0	2.6	1.8	28	2.3%	2.1%	2.9%	.9%
Hewlett-Packard	4.9	4.2	.0	166	2.3%	3.4%	.0%	5.2%
Landmark Graphics	4.9	2.5	1.1	25	2.3%	2.0%	1.8%	.8%
GeoVision Systems	4.2	.3	2.2	9	1.9%	.3%	3.4%	.3%
Sun Microsystems	2.9	2.5	.0	154	1.3%	2.0%	.0%	4.8%
Digital	2.3	1.6	.0	115	1.1%	1.3%	.0%	3.6%
Mutoh Industries—No OEM	2.3	1.4	.7	23	1.1%	1.1%	1.1%	.7%
ESRI	2.3	.0	2.1	0	1.1%	.0%	3.3%	.0%
Genasys II	1.7	.2	1.2	4	.8%	.1%	1.8%	.1%
IBM	1.3	.6	.5	22	.6%	.5%	.8%	.7%
Synercom	1.3	.0	.7	0	.6%	.0%	1.1%	.0%

(Continued)

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Table 30 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: Technical Workstation
Region: Asia
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Control Data Systems	.9	.5	.2	23	.4%	.4%	.3%	.7%
Moss Systems	.8	.0	.5	0	.4%	.0%	.7%	.0%
ERDAS	.7	.2	.5	4	.3%	.2%	.8%	.1%
GeoQuest	.5	.0	.5	0	.2%	.0%	.8%	.0%
Laser-Scan	.4	.1	.2	3	.2%	.1%	.3%	.1%
Autodesk	.4	.0	.4	0	.2%	.0%	.6%	.0%
Terr-Mar Resource Info Sys	.3	.1	.2	4	.2%	.1%	.3%	.1%
Sysscan	.3	.1	.1	3	.1%	.1%	.1%	.1%
Dynamic Graphics	.2	.0	.2	0	.1%	.0%	.3%	.0%
Enghouse Systems Ltd.	.2	.0	.1	1	.1%	.0%	.2%	.0%
ACDS Graphic System	.1	.0	.1	0	.1%	.0%	.2%	.0%
PAFEC	.1	.0	.1	0	.0%	.0%	.1%	.0%
ETAK	.1	.0	.0	0	.0%	.0%	.1%	.0%
Softdesk	.0	.0	.0	0	.0%	.0%	.0%	.0%
Accugraph	.0	.0	.0	1	.0%	.0%	.0%	.0%
Other Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Companies	215.9	122.9	63.7	3,212	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	71.7	33.2	21.9	1,168	33.2%	27.0%	34.4%	36.4%
All Asian-Based Companies	135.0	85.6	38.4	1,967	62.5%	69.6%	60.3%	61.2%
All European-Based Companies	9.2	4.2	3.4	77	4.3%	3.4%	5.3%	2.4%
All Hardware Companies	10.3	8.4	.0	442	4.8%	6.8%	.1%	13.8%
All Turnkey & SW Companies	205.5	114.5	63.7	2,770	95.2%	93.2%	99.9%	86.2%

Source: Dataquest (July 1993)

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Table 31
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: Host-Dependent
Region: Asia
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Fujitsu	18.5	11.8	4.8	257	41.2%	41.8%	50.4%	40.5%
Mitsubishi Electric	5.4	2.5	1.5	17	12.0%	8.9%	15.8%	2.7%
Digital	3.5	2.4	.0	0	7.8%	8.5%	.0%	.0%
IBM	3.4	2.1	.4	40	7.5%	7.6%	4.4%	6.3%
GeoVision Systems	1.8	.1	.9	2	4.0%	.5%	9.8%	.3%
Hitachi	1.7	.8	.7	31	3.9%	2.9%	7.7%	4.9%
Siemens Nixdorf Info systeme	1.4	.7	.5	9	3.0%	2.5%	4.7%	1.4%
Synercom	.8	.0	.4	0	1.7%	.0%	4.2%	.0%
Intergraph	.2	.0	.1	0	.4%	.0%	1.5%	.0%
Geotrace Technologies	.1	.0	.0	1	.1%	.0%	.4%	.2%
ETAK	.1	.0	.0	0	.1%	.0%	.4%	.0%
Dynamic Graphics	.1	.0	.0	0	.1%	.0%	.4%	.0%
ESRI	.0	.0	.0	0	.1%	.0%	.2%	.0%
Laser-Scan	.0	.0	.0	0	.0%	.0%	.1%	.0%
Other Companies	8.1	7.7	.0	278	18.1%	27.3%	.0%	43.8%
All Companies	44.9	28.3	9.5	635	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	17.9	12.4	2.0	321	39.8%	43.9%	21.3%	50.5%
All Asian-Based Companies	25.6	15.2	7.0	305	57.1%	53.6%	73.9%	48.1%
All European-Based Companies	1.4	.7	.5	9	3.1%	2.5%	4.8%	1.4%
All Hardware Companies	11.6	10.2	.0	278	25.9%	35.9%	.0%	43.8%
All Turnkey & SW Companies	33.3	18.2	9.5	357	74.1%	64.1%	100.0%	56.2%

Source: Dataquest (July 1993)

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Table 32
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: Server
Region: Asia
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Intergraph	3.5	1.7	.9	48	26.8%	25.9%	25.1%	33.0%
Landmark Graphics	3.3	1.6	.8	17	24.8%	25.0%	22.2%	11.7%
Digital	2.5	1.7	.0	35	19.2%	26.5%	.0%	24.2%
ESRI	1.4	.0	1.3	0	10.5%	.0%	37.9%	.0%
IBM	1.1	.5	.4	11	8.3%	7.6%	11.2%	7.7%
Sun Microsystems	1.0	.8	.0	31	7.2%	12.2%	.0%	21.3%
Sysscan	.4	.2	.1	3	2.8%	2.9%	2.4%	2.0%
ETAK	.1	.0	.0	0	.4%	.0%	1.2%	.0%
Other Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Companies	13.2	6.6	3.4	145	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	12.8	6.4	3.3	142	97.2%	97.1%	97.6%	98.0%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	.4	.2	.1	3	2.8%	2.9%	2.4%	2.0%
All Hardware Companies	3.5	2.5	.0	66	26.3%	38.7%	.0%	45.5%
All Turnkey & SW Companies	9.7	4.0	3.4	79	73.7%	61.3%	100.0%	54.5%

Source: Dataquest (July 1993)

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Table 33
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: Personal Computer
Region: Asia
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Fujitsu	9.7	6.2	2.5	289	19.7%	20.9%	14.8%	4.8%
IBM	7.7	7.2	.0	2,024	15.6%	24.3%	.0%	33.5%
Autodesk	5.7	.0	5.7	0	11.5%	.0%	33.1%	.0%
Mitsubishi Electric	4.0	2.6	1.4	378	8.1%	8.9%	7.9%	6.2%
Hitachi	3.1	1.5	1.3	166	6.4%	5.0%	7.7%	2.7%
Uchida Yoko	2.2	1.4	.9	99	4.5%	4.7%	5.4%	1.6%
Mutoh Industries—No OEM	2.0	1.2	.6	41	4.1%	4.1%	3.6%	.7%
Compaq	1.8	1.8	.0	394	3.7%	6.1%	.0%	6.5%
Mitsui Engineering	1.4	1.0	.3	23	2.8%	3.2%	1.6%	.4%
Enghouse Systems Ltd.	1.0	.0	.9	0	2.0%	.0%	5.0%	.0%
Intergraph	.9	.0	.9	0	1.9%	.0%	5.4%	.0%
NEC	.7	.6	.1	104	1.4%	2.0%	.4%	1.7%
ESRI	.7	.0	.6	0	1.3%	.0%	3.6%	.0%
Andor	.6	.2	.4	5	1.3%	.5%	2.6%	.1%
Digital	.6	.5	.0	155	1.2%	1.8%	.0%	2.6%
GeoQuest	.5	.0	.5	0	1.0%	.0%	2.8%	.0%
Hewlett-Packard	.4	.4	.0	108	.9%	1.3%	.0%	1.8%
ETAK	.4	.0	.4	1	.8%	.1%	2.1%	.0%
ERDAS	.2	.1	.2	12	.5%	.2%	.9%	.2%
Terr-Mar Resource Info Svs	.2	.1	.1	6	.4%	.2%	.7%	.1%
Genasys II	.2	.0	.1	5	.4%	.1%	.8%	.1%

(Continued)

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Table 33 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: Personal Computer
Region: Asia
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
GeoGraphix	.2	.0	.1	0	.3%	.0%	.6%	.0%
Softdesk	.1	.0	.1	0	.2%	.0%	.5%	.0%
Facility Mapping Systems	.1	.0	.0	0	.1%	.0%	.2%	.0%
Geotrace Technologies	.0	.0	.0	0	.0%	.0%	.1%	.0%
Kork Systems	.0	.0	.0	0	.0%	.0%	.1%	.0%
Other Companies	4.9	4.9	.0	2,238	10.0%	16.6%	.0%	37.0%
All Companies	49.3	29.7	17.1	6,047	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	25.5	15.1	9.6	4,943	51.8%	50.6%	56.0%	81.7%
All Asian-Based Companies	23.8	14.7	7.5	1,105	48.2%	49.4%	44.0%	18.3%
All European-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Hardware Companies	15.4	14.9	.0	4,919	31.3%	50.1%	.0%	81.3%
All Turnkey & SW Companies	33.8	14.8	17.1	1,128	68.7%	49.9%	100.0%	18.7%

Source: Dataquest (July 1993)

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Table 34
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: All Platforms
Region: Rest of World
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Intergraph	43.9	20.0	12.0	695	40.7%	42.0%	33.1%	15.0%
Landmark Graphics	16.4	8.2	3.8	85	15.2%	17.2%	10.4%	1.8%
ESRI	4.2	.0	3.8	0	3.9%	.0%	10.6%	.0%
Genasys II	3.7	.4	2.6	17	3.4%	.8%	7.2%	.4%
IBM	3.3	2.5	.4	523	3.1%	5.3%	1.0%	11.3%
Digital	3.3	2.3	.0	112	3.0%	4.8%	.0%	2.4%
Radian Corporation	3.1	.0	1.9	0	2.9%	.0%	5.1%	.0%
EDS	2.8	1.3	1.3	57	2.6%	2.6%	3.5%	1.2%
GeoVision Systems	2.7	.2	1.4	5	2.5%	.4%	3.9%	.1%
Unisys	2.1	1.1	.7	47	1.9%	2.2%	2.0%	1.0%
Data General	1.9	1.5	.1	100	1.8%	3.2%	.2%	2.2%
Strategic Mapping	1.8	.0	1.7	0	1.7%	.0%	4.6%	.0%
MapInfo	1.8	.0	1.4	0	1.7%	.0%	4.0%	.0%
Apple Computer	1.8	1.8	.0	395	1.7%	3.7%	.0%	8.5%
Compaq	1.2	1.2	.0	262	1.1%	2.5%	.0%	5.7%
Computervision	1.0	.4	.2	69	.9%	.8%	.6%	1.5%
Infocel	.9	.1	.7	20	.9%	.3%	2.0%	.4%
Autodesk	.8	.0	.8	0	.8%	.0%	2.2%	.0%
Kork Systems	.8	.1	.6	1	.7%	.2%	1.5%	.0%
ERDAS	.6	.2	.4	11	.6%	.4%	1.1%	.2%
Sun Microsystems	.6	.5	.0	37	.5%	1.1%	.0%	.8%
ETAK	.5	.0	.5	1	.5%	.0%	1.3%	.0%
Moss Systems	.5	.0	.3	0	.5%	.0%	.8%	.0%

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Table 34 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: All Platforms
Region: Rest of World
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Laser-Scan	.5	.1	.2	0	.4%	.2%	.6%	.0%
Dynamic Graphics	.5	.0	.4	0	.4%	.0%	1.1%	.0%
Enghouse Systems Ltd.	.3	.0	.3	0	.3%	.0%	.8%	.0%
Clemessy	.3	.2	.0	1	.3%	.5%	.1%	.0%
Hewlett-Packard	.3	.2	.0	33	.3%	.5%	.0%	.7%
Generation 5 Technology	.2	.0	.2	0	.2%	.0%	.5%	.0%
LandCadd	.2	.0	.2	0	.1%	.0%	.4%	.0%
Synercom	.1	.0	.1	0	.1%	.0%	.2%	.0%
Terr-Mar Resource Info Svs	.1	.0	.1	2	.1%	.1%	.2%	.0%
Softdesk	.1	.0	.1	0	.1%	.0%	.2%	.0%
Engineering Systems Corp.	.1	.0	.1	0	.1%	.0%	.2%	.0%
Facility Mapping Systems	.1	.0	.0	0	.0%	.0%	.1%	.0%
Accugraph	.0	.0	.0	1	.0%	.0%	.0%	.0%
Ziegler Informatics	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	5.4	5.3	.0	2,156	5.0%	11.2%	.0%	46.6%
All Companies	107.9	47.7	36.2	4,629	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	106.6	47.4	35.6	4,629	98.8%	99.3%	98.4%	100.0%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	1.3	.3	.6	1	1.2%	.7%	1.6%	.0%
All Hardware Companies	16.0	14.4	.1	3,590	14.9%	30.3%	.2%	77.5%
All Turnkey & SW Companies	91.8	33.3	36.1	1,040	85.1%	69.7%	99.8%	22.5%

Source: Dataquest (July 1993)

CAEC-WW-MS-9306

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Table 35
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: Technical Workstation
Region: Rest of World
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Intergraph	37.3	17.6	9.3	614	55.5%	62.2%	42.7%	60.4%
Landmark Graphics	9.8	4.9	2.3	51	14.6%	17.3%	10.4%	5.0%
Genasys II	3.4	.3	2.3	8	5.0%	1.2%	10.8%	.8%
EDS	2.8	1.3	1.3	57	4.2%	4.4%	5.9%	5.6%
ESRI	2.2	.0	2.0	0	3.2%	.0%	9.3%	.0%
GeoVision Systems	1.9	.2	1.0	4	2.8%	.5%	4.6%	.4%
Radian Corporation	1.9	.0	1.1	0	2.8%	.0%	5.2%	.0%
Unisys	1.6	.8	.6	37	2.4%	2.9%	2.6%	3.7%
Data General	1.4	1.1	.1	81	2.1%	4.0%	.3%	8.0%
Digital	.8	.6	.0	41	1.2%	2.0%	.0%	4.0%
Computervision	.6	.3	.1	66	.9%	1.0%	.6%	6.5%
Sun Microsystems	.5	.4	.0	32	.7%	1.5%	.0%	3.2%
Moss Systems	.5	.0	.3	0	.7%	.0%	1.3%	.0%
ERDAS	.5	.1	.3	3	.7%	.5%	1.4%	.3%
Laser-Scan	.4	.1	.2	0	.6%	.4%	1.0%	.0%
IBM	.4	.2	.1	9	.6%	.6%	.6%	.9%
Dynamic Graphics	.4	.0	.3	0	.5%	.0%	1.5%	.0%
Clemessy	.2	.2	.0	1	.3%	.7%	.1%	.1%
Hewlett-Packard	.2	.2	.0	9	.3%	.6%	.0%	.9%
Infocel	.1	.0	.1	1	.2%	.1%	.4%	.1%
Synercom	.1	.0	.0	0	.1%	.0%	.2%	.0%

(Continued)

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Table 35 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: Technical Workstation
Region: Rest of World
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Terr-Mar Resource Info Svs	.1	.0	.0	1	.1%	.1%	.2%	.1%
Autodesk	.1	.0	.1	0	.1%	.0%	.2%	.0%
ETAK	.1	.0	.0	0	.1%	.0%	.2%	.0%
Enghouse Systems Ltd.	.1	.0	.0	0	.1%	.0%	.2%	.0%
Accugraph	.0	.0	.0	1	.0%	.0%	.0%	.1%
Engineering Systems Corp.	.0	.0	.0	0	.0%	.0%	.0%	.0%
Softdesk	.0	.0	.0	0	.0%	.0%	.1%	.0%
LandCadd	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Companies	67.3	28.3	21.7	1,016	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	66.2	28.1	21.1	1,015	98.3%	99.0%	97.6%	99.9%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	1.2	.3	.5	1	1.7%	1.0%	2.4%	.1%
All Hardware Companies	3.0	2.3	.1	163	4.4%	8.2%	.3%	16.1%
All Turnkey & SW Companies	64.4	26.0	21.6	852	95.6%	91.8%	99.7%	83.9%

Source: Dataquest (July 1993)

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Table 36
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: Host-Dependent
Region: Rest of World
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Digital	1.3	.9	.0	0	25.4%	35.3%	.0%	.0%
IBM	1.0	.6	.1	15	18.9%	24.9%	9.6%	30.7%
GeoVision Systems	.8	.1	.4	1	15.9%	2.4%	34.4%	1.5%
Unisys	.5	.2	.2	10	9.4%	9.6%	12.8%	20.4%
Radian Corporation	.2	.0	.1	0	4.3%	.0%	9.6%	.0%
Intergraph	.2	.0	.2	0	4.3%	.0%	16.0%	.0%
Dynamic Graphics	.1	.0	.1	0	2.0%	.0%	7.2%	.0%
Clemessy	.1	.0	.0	0	1.2%	1.6%	.8%	.7%
Computervision	.1	.0	.0	1	1.2%	.4%	.8%	2.0%
ETAK	.1	.0	.0	0	1.0%	.0%	3.2%	.3%
Synercom	.1	.0	.0	0	1.0%	.0%	1.6%	.0%
Laser-Scan	.0	.0	.0	0	.8%	.0%	1.6%	.0%
ESRI	.0	.0	.0	0	.6%	.0%	.8%	.0%
Kork Systems	.0	.0	.0	0	.4%	.8%	.0%	.0%
Engineering Systems Corp.	.0	.0	.0	0	.2%	.0%	.8%	.0%
Other Companies	.7	.6	.0	22	13.4%	24.9%	.8%	44.4%
All Companies	5.1	2.5	1.3	49	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	5.0	2.5	1.2	49	98.0%	98.4%	97.6%	99.3%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	.1	.0	.0	0	2.0%	1.6%	2.4%	.7%
All Hardware Companies	1.9	1.5	.0	21	37.8%	59.4%	.0%	43.7%
All Turnkey & SW Companies	3.2	1.0	1.3	28	62.2%	40.6%	100.0%	56.3%

Source: Dataquest (July 1993)

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Table 37
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: Server
Region: Rest of World
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Landmark Graphics	6.6	3.3	1.5	34	42.7%	46.3%	34.8%	21.5%
Intergraph	5.1	2.4	1.2	81	32.9%	34.1%	27.9%	51.2%
ESRI	1.3	.0	1.2	0	8.6%	.0%	28.1%	.0%
Digital	.9	.6	.0	12	5.9%	8.9%	.0%	7.9%
Data General	.5	.4	.0	19	3.3%	5.6%	.5%	12.0%
IBM	.4	.2	.1	5	2.3%	2.5%	2.5%	2.9%
Computervision	.3	.1	.1	3	1.8%	1.3%	1.8%	1.7%
Radian Corporation	.3	.0	.2	0	1.6%	.0%	3.5%	.0%
Sun Microsystems	.1	.1	.0	4	.7%	1.3%	.0%	2.8%
ETAK	.1	.0	.0	0	.3%	.0%	.9%	.0%
Hewlett-Packard	.0	.0	.0	0	.1%	.0%	.0%	.1%
Other Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Companies	15.4	7.1	4.3	158	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	15.4	7.1	4.3	158	100.0%	100.0%	100.0%	100.0%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Hardware Companies	1.5	1.2	.0	37	10.0%	16.2%	.5%	23.2%
All Turnkey & SW Companies	13.8	5.9	4.3	121	90.0%	83.8%	99.5%	76.8%

Source: Dataquest (July 1993)

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Table 38
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: Personal Computer
Region: Rest of World
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Strategic Mapping	1.8	.0	1.7	0	9.1%	.0%	18.6%	.0%
MapInfo	1.8	.0	1.4	0	8.9%	.0%	16.2%	.0%
Apple Computer	1.8	1.8	.0	395	8.8%	18.2%	.0%	11.6%
IBM	1.6	1.5	.0	494	8.2%	15.7%	.0%	14.5%
Intergraph	1.3	.0	1.3	0	6.6%	.0%	14.8%	.0%
Compaq	1.2	1.2	.0	262	6.0%	12.4%	.0%	7.7%
Infocel	.8	.1	.6	19	4.1%	1.2%	7.1%	.5%
Kork Systems	.8	.1	.6	1	3.9%	.7%	6.3%	.0%
Radian Corporation	.8	.0	.5	0	3.9%	.0%	5.3%	.0%
Autodesk	.8	.0	.8	0	3.8%	.0%	8.5%	.0%
ESRI	.6	.0	.6	0	3.2%	.0%	6.5%	.0%
ETAK	.4	.0	.4	1	1.9%	.2%	4.0%	.0%
Genasys II	.4	.0	.3	9	1.8%	.4%	2.9%	.3%
Enghouse Systems Ltd.	.3	.0	.3	0	1.4%	.0%	2.8%	.0%
Digital	.2	.2	.0	58	1.1%	2.0%	.0%	1.7%
Generation 5 Technology	.2	.0	.2	0	.9%	.0%	2.1%	.0%
LandCadd	.2	.0	.1	0	.7%	.0%	1.6%	.0%
ERDAS	.2	.0	.1	8	.7%	.4%	1.1%	.2%
Hewlett-Packard	.1	.1	.0	23	.3%	.6%	.0%	.7%
Softdesk	.1	.0	.1	0	.3%	.0%	.8%	.0%
Terr-Mar Resource Info Svs	.1	.0	.0	1	.2%	.1%	.3%	.0%

(Continued)

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Table 38 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: GIS/Mapping
Platform: Personal Computer
Region: Rest of World
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Facility Mapping Systems	.1	.0	.0	0	.2%	.0%	.4%	.0%
Engineering Systems Corp.	.0	.0	.0	0	.2%	.0%	.4%	.0%
Ziegler Informatics	.0	.0	.0	0	.0%	.0%	.1%	.0%
Other Companies	4.7	4.7	.0	2,135	23.4%	48.0%	.0%	62.7%
All Companies	20.1	9.8	8.9	3,407	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	20.1	9.8	8.9	3,407	100.0%	100.0%	99.9%	100.0%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	.0	.0	.0	0	.0%	.0%	.1%	.0%
All Hardware Companies	9.6	9.5	.0	3,368	47.9%	96.9%	.0%	98.9%
All Turnkey & SW Companies	10.5	.3	8.9	39	52.1%	3.1%	100.0%	1.1%

Source: Dataquest (July 1993)

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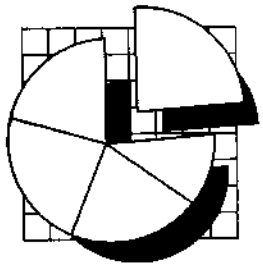
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Software

GIS Applications Worldwide Forecast Update



Market Statistics

1993

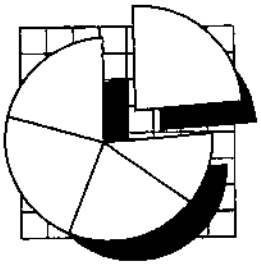
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Note: All tables show estimated data.

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Note: All tables show estimated data.

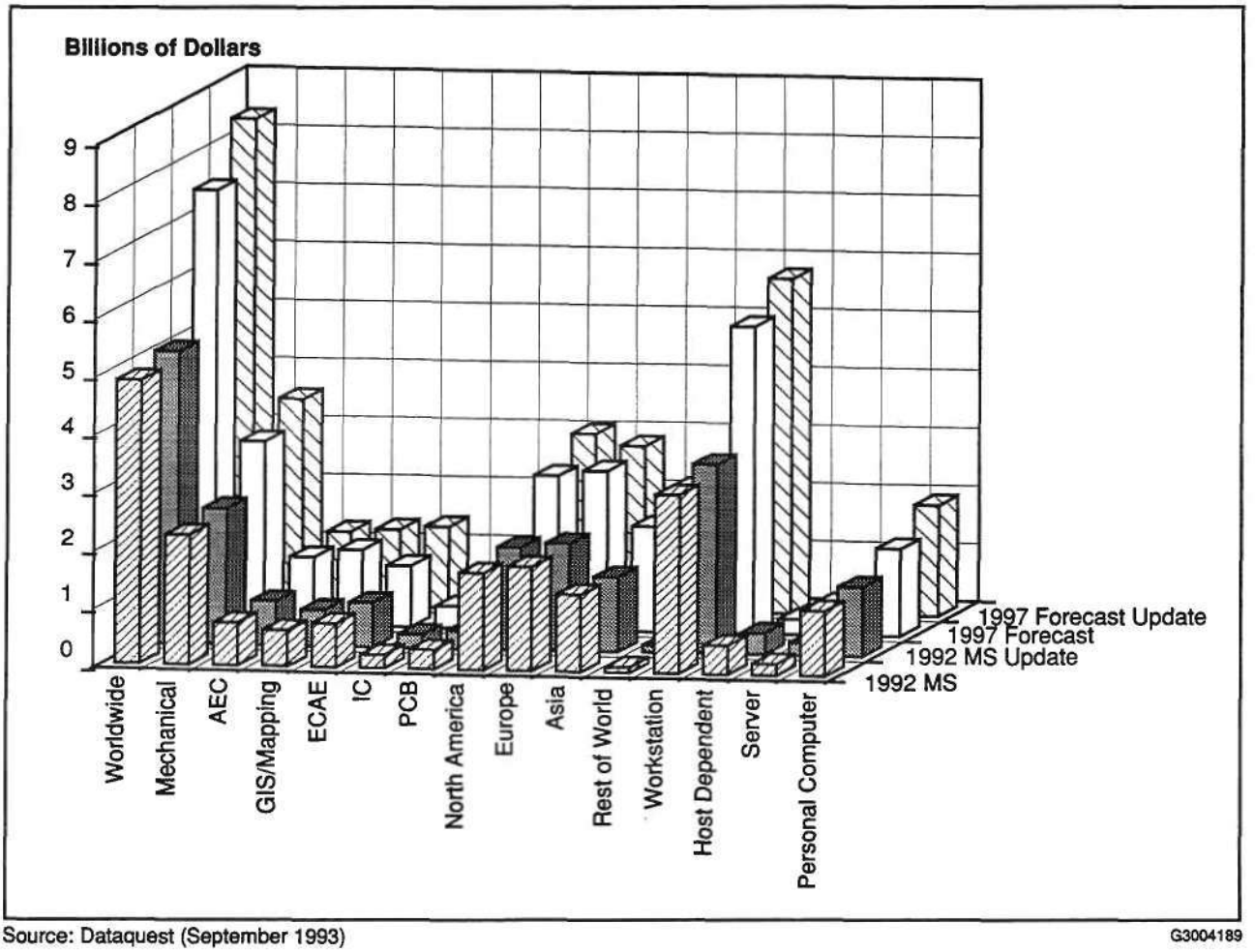
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GIS Applications Worldwide Forecast Update

This forecast update uses the market share update as the basis of a new forecast, incorporating any new information since May, including currency changes since year-end 1992. Additionally, with greater focus on country level data during the market share update process, this forecast update provides forecasts by country in Europe and Asia.

Figure 1 shows change from the 1993 forecast to this update in growth of software revenue by application, region, platform, and the total market. Table 1 provides the corresponding revenue figures and growth rates. This additional growth is divided somewhat equally among the applications, is concentrated in Asia because of currency issues, and resides primarily in the personal computer platform.

Figure 1
Software Forecast Update versus Forecast, 1992-1997



Source: Dataquest (September 1993)

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Table 1
Software Revenue Forecast Update versus Forecast

	Forecast Update 1992-1993 Change (%)	Forecast Update 1992-1997 CAGR (%)	May Forecast 1992-1993 Change (%)	May Forecast 1992-1997 CAGR (%)	Market Share Update 1992 ($M)	Forecast Update 1993 ($M)	Forecast Update 1997 ($M)	Market Share 1992 ($M)	May Forecast 1993 ($M)	May Forecast 1997 ($M)
Worldwide	12.0	10.6	9.6	8.9	5,036	5,642	8,353	4,885	5,352	7,467
Applications:										
Mechanical	12.3	8.7	10.6	7.2	2,341	2,628	3,548	2,233	2,469	3,154
AEC	11.8	11.0	9.0	10.0	758	847	1,275	730	796	1,178
GIS/Mapping	14.7	16.0	13.8	16.4	629	721	1,323	616	700	1,317
ECAE	12.7	12.7	8.0	7.1	764	861	1,390	752	812	1,057
IC	9.2	11.3	7.8	10.9	233	254	398	225	243	378
PCB	5.8	6.0	0.7	3.1	312	331	418	330	332	383
Regions:										
North America	13.2	11.5	12.0	9.8	1,767	2,000	3,041	1,669	1,869	2,659
Europe	7.7	9.0	10.9	9.0	1,848	1,990	2,840	1,793	1,988	2,753
Asia	15.1	10.6	3.8	6.4	1,288	1,483	2,134	1,327	1,378	1,813
Rest of World	27.2	20.6	22.8	20.3	132	168	338	96	118	242
Platforms:										
Workstation	13.8	12.1	13.5	11.5	3,256	3,705	5,773	3,072	3,486	5,293
Host Dependent	-19.1	-11.8	-19.2	-12.1	369	299	196	500	404	262
Server	22.8	16.8	20.3	15.5	216	265	470	197	237	405
Personal Computer	14.8	9.9	9.7	6.2	1,195	1,373	1,914	1,117	1,225	1,508

Source: Dataquest (August 1993)

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Currency Changes

Worldwide revenue estimates include data from many countries, each of which has a different and fluctuating exchange rate. Estimates of non-U.S. revenue are based on the average exchange rate for a given year, calculated as the simple arithmetic mean of the 12 average monthly values. Dataquest does not forecast exchange rates per se; however, we do forecast with the best information available. Exchange rates, for the purposes of forecasting, are calculated assuming the June 1993 exchange rate will apply throughout all future months of the year. Table 2 provides the resulting exchange rates for each European and Asian country.

Given the bleak economic climate, it is surprising that we are forecasting increased growth from our earlier forecast. The main source of this growth comes from the depreciation of the dollar against the yen of 12 percent. With 96 percent of the Asian revenue reported in Japan, the yen dominates that region's revenue figures. Table 3 shows dollar values with equivalent yen values of total factory revenue for Asia for 1992 and 1993, with growth rates, by application, using the exchange rates as shown in Table 2.

Table 2
Foreign Currency per U.S. Dollar

	Country	Currency	Actual 1992	Current 1993	Appreciation (U.S.$)
Europe	United Kingdom	Pound	0.5686	0.6606	16.2
	France	Franc	5.2712	5.5192	4.7
	Germany	Mark	1.5554	1.6334	5.0
	Italy	Lira	1,227.75	1,517.07	23.6
	Spain	Peseta	101.90	123.38	21.1
	Denmark	Krone	6.0153	6.2751	4.3
	Finland	Markka	4.4507	5.5955	25.7
	Norway	Krone	6.1824	6.9298	12.1
	Sweden	Krona	5.8105	7.4584	28.4
	Belgium	Franc	32.02	33.59	4.9
	Netherlands	Guilder	1.7512	1.8073	3.2
	Austria	Schilling	10.95	11.49	4.9
	Switzerland	Franc	1.3976	1.4727	5.4
Asia	Japan	Yen	126.45	111.23	-12.0
	Hong Kong	Dollar	7.7401	7.7327	-0.1
	Korea	Won	782.63	799.43	2.1
	Singapore	Dollar	1.6285	1.6218	-0.4
	Taiwan	Dollar	24.93	25.91	3.9
	China	Renminbi	5.5082	5.7441	4.3

Source: Dataquest (August 1993)

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Table 3
Total Factory Revenue in Asia, Dollars as Compared to Yen
(1992 Exchange Rate of U.S.$1/¥126.45; 1993 Exchange Rate of U.S.$1/¥111.23)

	1992 ($M)	1993 ($M)	Change (%)	1992 (¥M)	1993 (¥M)	Change (%)
Mechanical	2,180	2,384	9.4	275,647	265,178	-3.8
AEC	577	618	7.2	72,938	68,780	-5.7
GIS	332	375	12.8	42,016	41,683	-0.8
ECAE	508	585	15.2	64,213	65,096	1.4
IC Layout	194	208	7.5	24,491	23,154	-5.5
PCB	372	380	2.4	46,971	42,305	-9.9
All Applications	4,162	4,551	9.3	526,275	506,197	-3.8

Source: Dataquest (August 1993)

In contrast, the dollar has appreciated against all other European currencies. This forecasting has shown a corresponding decrease in the growth of the European CAD/CAM/CAE/GIS markets as compared to the earlier forecast.

Database Changes

Dataquest intends to freeze the CAD/CAM/CAE/GIS database following the market share update. However, careful scrutiny of European numbers as part of the forecasting process uncovered some discrepancies at the country and application level. Adjustments were made to IBM, Hewlett-Packard, Digital, and Intergraph. In addition, Intergraph was underrepresented in the mechanical market to an alarming extent. Its data was fixed, with a corresponding decrease in service revenue and GIS/Mapping software revenue, moving Intergraph from No. 15 to No. 9 in mechanical software revenue. Finally, ESRI was updated to reflect higher total revenue, most of which was for service. The result is that Intergraph and ESRI are now separated by $8 million in software revenue in the GIS market. There will be no more changes to this database until we begin our survey of 1993 data.

Other Information

Implicit in any forecasting are the GDP/GNP growth rates (see Table 4). We also track quarterly revenue of public companies and corresponding growth rates from previous quarters for a general view of the health of the industries.

This document contains Dataquest's detailed forecast information for the CAD/CAM/CAE and GIS industry. Included are the following:

- Five-year historical data
- Five-year forecast data

More detailed data is available through our client inquiry service, which can provide custom analysis of the mutlidimensional database.

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Table 4
GDP/GNP Growth Rate Percentages
(Constant Prices and Exchange Rates, Local Currencies)

		1992	1993	1994	1995	1996
North America	Canada	0.7	3.1	3.8	3.5	3.0
	United States	2.1	2.6	2.9	2.3	2.5
Europe	United Kingdom	-0.5	1.7	2.7	3.2	3.0
	France	1.1	-1.0	1.3	3.1	3.3
	Germany*	1.4	-1.5	1.2	2.8	3.5
	Italy	0.9	0.3	1.5	1.9	2.3
	Spain	1.0	-0.7	1.7	2.9	3.6
	Denmark	1.2	0.6	2.1	2.3	3.5
	Finland	-3.6	-0.2	1.8	2.5	3.2
	Norway	2.9	1.5	2.4	2.6	2.7
	Sweden	-1.8	-1.6	1.4	2.0	2.5
	Belgium	0.8	-0.5	1.8	2.7	3.1
	Netherlands	1.5	-0.4	1.5	2.9	2.9
	Austria	1.5	-0.1	2.0	3.7	3.9
	Switzerland	-0.6	0.2	1.5	2.1	2.4
Asia	Japan	1.5	1.3	2.7	3.6	4.1
	Korea	4.8	6.0	7.0	7.0	7.0
	Taiwan	6.1	6.5	7.0	7.0	7.0
	Singapore	5.8	6.5	6.5	6.5	6.5
	Hong Kong	5.0	5.5	5.5	5.5	5.5
	China	11.5	10.0	12.5	11.5	10.8

*Germany includes the former East Germany.
Source: The Dun & Bradstreet Corporation

Regional Forecast Assumptions

Table 5 provides the CAD/CAM/CAE/GIS forecast for total factory revenue, software revenue, and units. Following are the main worldwide forces driving this forecast.

Worldwide Forecast Drivers

The worldwide CAD/CAM/CAE/GIS market will maintain steady growth during the next five years. Figure 2 shows the forecast of hardware, software, and service revenue worldwide and by region, and Figure 3 shows the worldwide forecast by platform.

The main forces driving the CAD/CAM/CAE/GIS worldwide forecast are described in the following paragraphs.

Macroeconomy

The recovery, with its inherent renewed optimism after a worldwide recession and the resultant increased capital spending, will fuel growth

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Table 5
CAD/CAM/CAE/GIS Forecast by Region
(Revenue in Millions of Dollars; Actual Shipments)

	1992	1993	1994	1995	1996	1997	CAGR (%) 1992-1997
Worldwide							
Total Factory Revenue	15,723	16,530	17,500	18,640	19,770	20,860	5.8
Software Revenue	5,036	5,640	6,320	7,040	7,710	8,350	10.6
Unit Shipments	739,511	857,200	972,100	1,072,700	1,155,000	1,215,900	10.5
North America							
Total Factory Revenue	5,437	5,680	6,100	6,550	7,000	7,520	6.7
Software Revenue	1,767	2,000	2,270	2,540	2,790	3,040	11.5
Unit Shipments	291,743	336,300	381,800	420,700	456,600	487,100	10.8
Europe							
Total Factory Revenue	5,736	5,850	6,060	6,390	6,760	7,120	4.4
Software Revenue	1,848	1,990	2,160	2,380	2,610	2,840	9.0
Unit Shipments	245,054	271,900	304,600	337,000	359,700	374,800	8.9
Asia							
Total Factory Revenue	4,162	4,550	4,840	5,110	5,300	5,460	5.6
Software Revenue	1,288	1,480	1,680	1,870	2,020	2,130	10.6
Unit Shipments	182,151	224,000	255,300	277,900	294,800	303,500	10.7
Rest of World							
Total Factory Revenue	388	450	530	600	680	760	14.3
Software Revenue	132	170	210	250	290	340	20.6
Unit Shipments	20,563	25,000	30,400	37,200	43,900	50,600	19.7

Source: Dataquest (August 1993)

gradually beginning in the North American, U.K., and Asian countries other than Japan.

Technology

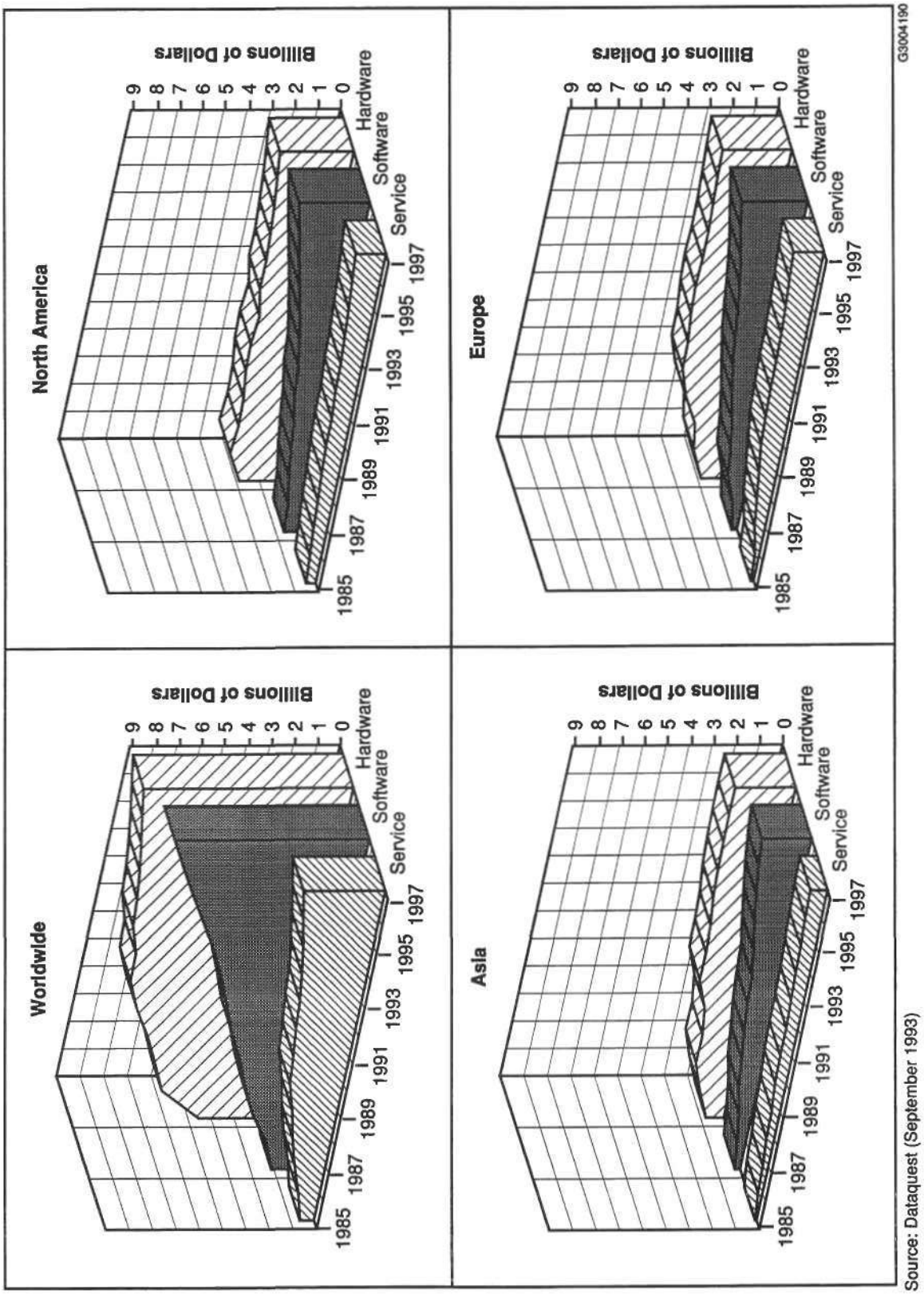
Computing performance will continue to improve at an exponential rate in the foreseeable future. The Dataquest Technical Computing group has forecast the growth in millions of instructions per second (mips) shipments: the total mips shipped in history through 1992 will be matched by the shipments in 1993. In other words, the total mips shipped will double in 1993, almost double again in 1994, and double again in 1995. This enabling resource will fuel the next-generation software tools focused on integrated solutions at the enterprise level.

Indispensability

As the complexity of the design, the need to share information, and the need to store information electronically increase, the benefits of automation improve dramatically and the level of indispensability rises. This, coupled with market pressures to produce higher quality and to reduce production cycles, is making CAD/CAM/CAE/GIS a necessity.

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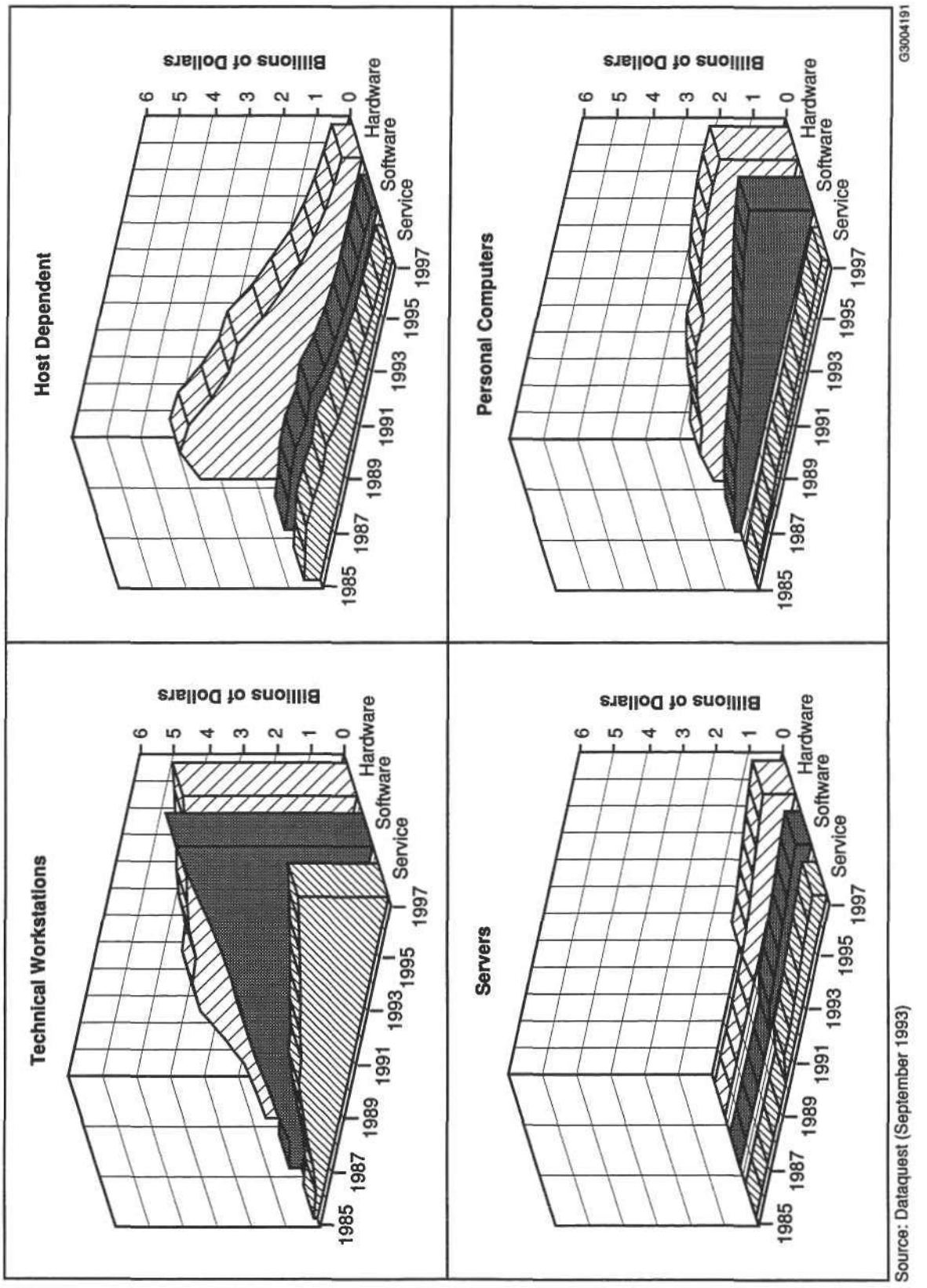
Figure 2
Worldwide and Regional Revenue Forecast, All Applications and All Platforms



Source: Dataquest (September 1993)

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Figure 3
Worldwide Revenue Forecast, by Platform, All Applications



Source: Dataquest (September 1993)

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Late Buyers

A significant pool of untapped users still exists in mechanical, AEC, and GIS applications, driving additional growth. These conservative buyers will favor market leaders and installed systems for compatibility. For vendors, therefore, the value of high market share and customer satisfaction will increase.

Desktop Dominance

The turf war for desktop dominance is building steam with the introduction of the Pentium chip and Windows NT, which will fight to take market share from the higher-priced, multiple UNIX operating systems with RISC technology. In addition, the decline of host-dependent systems is continuing with replacements going to networked, desktop systems. Vendors, whose business models depend upon high-priced workstations, are threatened by these powerful new PCs. At the same time, the replacement of host systems provides them with opportunity for growth.

Unbundling of Software

With software vendors porting to multiple platforms, software is no longer the hinge upon which hardware swings. The market is quickly moving from proprietary to open systems, resulting in a shift from bundled to unbundled software (see Table 6).

Replacement Market

The replacement market is gaining importance as replacement seats exceed 50 percent of unit sales in 1993 (see Figure 4). This saturation implies that many parallel manual systems can be eliminated and new applications developed, knowing that everyone in a company needing access to the engineering database can have it in electronic format. The savings potential is tremendous. This also implies a growing sophistication in buyers who are more informed of the strategic importance of this technology.

Software

With technological advances, growing sophistication of users, and competitive pressures, the demand for software with greater ease of use, flexibility, and interoperability is growing. This demand is driving the growth in business alliances between small innovative software niche players and major software vendors with resources to sell to the new and replacement markets.

North American Forecast Drivers

North American CAD/CAM/CAE/GIS total revenue grew a robust 11.3 percent to $5.4 billion in 1992 and is forecast to grow at a 6.7 percent compound annual growth rate (CAGR) through 1997 to $7.5 billion. The following paragraphs describe the main factors driving the North American forecast.

Economy

According to The Dun & Bradstreet Corporation's August 1993 *Economic Overview,* the growth of the economy is led by capital spending and by trade, as the economies of U.S. trading partners bottom out. Information technology growth for the first two quarters of 1993 is an annualized

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Table 6
CAD/CAM/CAE/GIS Software Revenue Forecast, by Application
(Millions of Dollars)

	1992	1993	1994	1995	1996	1997	CAGR (%) 1992-1997
All Applications							
Software Revenue	5,036	5,640	6,320	7,040	7,710	8,350	10.6
Bundled Software Revenue	1,939	1,960	2,000	2,040	2,090	2,120	1.8
Unbundled Software Revenue	3,097	3,680	4,320	4,990	5,620	6,230	15.0
Mechanical							
Software Revenue	2,341	2,630	2,880	3,140	3,360	3,550	8.7
Bundled Software Revenue	1,127	1,180	1,200	1,230	1,250	1,260	2.2
Unbundled Software Revenue	1,214	1,450	1,680	1,910	2,110	2,290	13.6
AEC							
Software Revenue	758	850	950	1,050	1,160	1,280	11.0
Bundled Software Revenue	300	310	330	340	360	380	4.9
Unbundled Software Revenue	458	540	620	710	800	900	14.3
GIS/Mapping							
16.0							
Bundled Software Revenue	267	290	320	340	370	400	8.6
Unbundled Software Revenue	362	430	520	640	770	920	20.5
Electronic CAE							
Software Revenue	764	860	1,010	1,160	1,280	1,390	12.7
Bundled Software Revenue	109	90	80	70	60	50	-13.0
Unbundled Software Revenue	655	770	930	1,090	1,220	1,340	15.3
IC Layout							
Software Revenue	233	260	290	320	360	400	11.3
Bundled Software Revenue	32	20	10	10	10	5	-28.9
Unbundled Software Revenue	201	240	280	310	350	395	14.3
PCB/Hybrid/MCM							
Software Revenue	312	330	350	380	400	420	6.0
Bundled Software Revenue	105	80	50	40	30	20	-26.3
Unbundled Software Revenue	208	250	300	340	370	400	13.7

Source: Dataquest (August 1993)

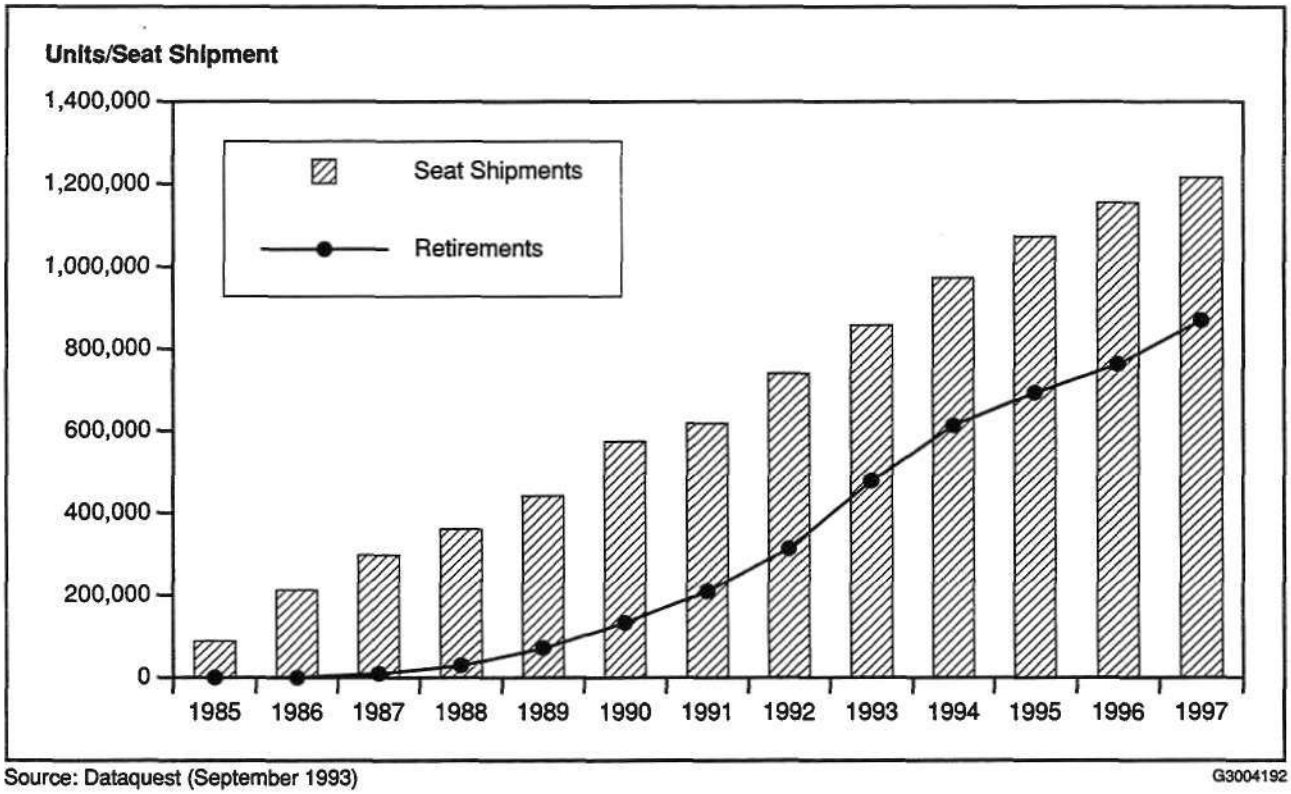
13 percent, down from the 22 percent growth of the previous four quarters. The July 1993 survey of 1,000 manufacturers nationwide indicates that reduced output has resulted in a lowering of expectations, which should continue into the third quarter.

Cuts in Defense Spending

Cuts in defense spending will tend to soften the market. However, a focus on fewer, more sophisticated weapons systems will promote use of the latest design optimization and simulation capabilities.

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Figure 4
Unit Shipments versus Retirements–History and Forecast



Source: Dataquest (September 1993) G3004192

European Forecast Drivers

The European market grew 3.6 percent to $5.7 billion in total revenue in 1992. This largest region is forecast to be the slowest growing at a mere 1.9 percent for 1993 to $5.8 billion, with a 1992 to 1997 CAGR of 4.4 percent. The major factor behind this slowing growth is the sluggish German economy, which accounts for 35 percent of the European market. A slowdown in Germany rippled through all other European industries. Table 7 provides the forecast software CAGR for 1992 to 1997 for each country for each application in Europe.

The following paragraphs describe the main factors driving the European forecast.

Economy

Hopes abound for a recovery in the second half of 1994, with the United Kingdom and the Netherlands already leading the way. Governments are struggling to contain mounting budget deficits, particularly in the United Kingdom and in Germany. Manufacturing industries are being affected by a decline in consumer spending because of high unemployment throughout Europe. Massive budget deficits will continue to influence government public spending.

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Table 7
Compound Annual Growth Rate, 1992-1997, Software Revenue (Percent)

	Mechanical	AEC	GIS	ECAE	IC	PCB	All
United Kingdom	6.0	5.2	11.8	4.6	0.9	-0.7	6.5
France	6.3	8.4	18.5	3.5	4.6	0.0	7.0
Germany	7.3	10.5	17.0	5.0	3.9	2.7	8.7
Italy	9.6	7.5	10.4	6.4	1.9	3.2	9.0
Benelux	7.2	10.0	18.4	4.1	3.7	4.0	9.3
Scandinavia	9.0	8.9	14.3	4.8	7.1	1.5	9.1
Spain	6.5	9.1	15.5	5.1	3.7	-0.5	9.0
Rest of Europe	16.5	13.9	20.2	8.8	-1.7	0.3	14.7
Europe	8.4	9.8	15.6	5.1	2.7	1.4	9.0

Source: Dataquest (August 1993)

Growth

There are a few bright spots. The European railway industry is undergoing a renaissance. Major public works projects are planned in the Netherlands and Norway. Denmark is the beneficiary of the building in the eastern Germany area. Defense spending is refocusing from the personnel needs of the cold war to the equipment needs for desert warfare, urban terrorism, and rapid response capabilities. This, with the growth of the telecommunications industry, bodes well for EDA spending.

Currency

The appreciation of the dollar against the European currencies places additional pressure on dollar growth rates for the European community. Just as the dollar growth of the Asian market is strikingly higher than growth of the yen, the dollar growth of the European market is less than the growth in local currency. Additionally, this conversion ratio forces U.S. products to sell at reduced dollar prices to remain competitive with the European products, resulting in less revenue for U.S. vendors.

Asian Forecast Drivers

The Asian market grew 2.9 percent to $4.2 billion in total revenue for 1992. This represents a decrease of 4.3 percent on a yen basis. With the further depreciation of the dollar against the yen thus far in 1993, total revenue is forecast to grow 9.2 percent to $4.5 billion, which is a decrease of 3.9 percent on the yen. The following paragraphs describe the main factors driving the Asian forecast.

Economy

After a hopeful but false recovery during the first quarter of 1993, the Japanese economy has once again taken a nosedive. According to a MITI survey, Japanese industry plans to cut capital spending for a second straight fiscal year (*Nikkei Weekly*, June 7, 1993). The survey also indicated that capital spending growth should return during the first quarter of calendar 1994.

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Currency

Just as the appreciation of the dollar against the ECU causes pricing pressure on U.S. goods in Europe, the even greater depreciation of the dollar against the yen causes pricing pressure on Japanese goods in the United States. This currency volatility creates a cauldron of price competitiveness in the Japanese markets, with U.S. software and hardware able to provide high profits at low prices relative to the Japanese competitors.

Competitive Model Change

Japanese CAD/CAM/CAE/GIS users are shifting from the large, general-purpose, computer systems to the smaller workstations and personal computers. In response, major Japanese computer manufacturers, no longer the one-stop shop, are joining forces with foreign computer companies to provide the multiple solutions that are being demanded, adding to the already complex relationships among Japanese companies.

Developing Asian Countries

Although the cheap labor of China, Vietnam, and other developing Asian countries is fueling enormous growth in manufacturing, the lack of experienced and highly educated engineers and managers prevents a corresponding growth in the CAD/CAM/CAE/GIS industries in these countries. The design function still resides in Japan, North America, and Europe.

Personal Computer

The Japanese PC platform has been a small part of the CAD/CAM/CAE/GIS market. The introduction of DOS/V and Windows NT will be generating interest in this low-cost solution, especially with the small, late buyers.

Virtual Reality

Japan is creating tools for virtual reality that will eventually lead to the development of new technology suitable to enhance CAD/CAM/CAE/GIS.

Application Forecast Assumptions

The expected growth in the next three or four years in AEC, GIS, ECAE, and IC applications is adding significantly to the total growth of the industry and is exceeding growth forecasts for mechanical and PCB applications. Market penetration, new application development, and shifting trends in average selling prices are all factors in this shift in total market application mix (see Figures 5 and 6).

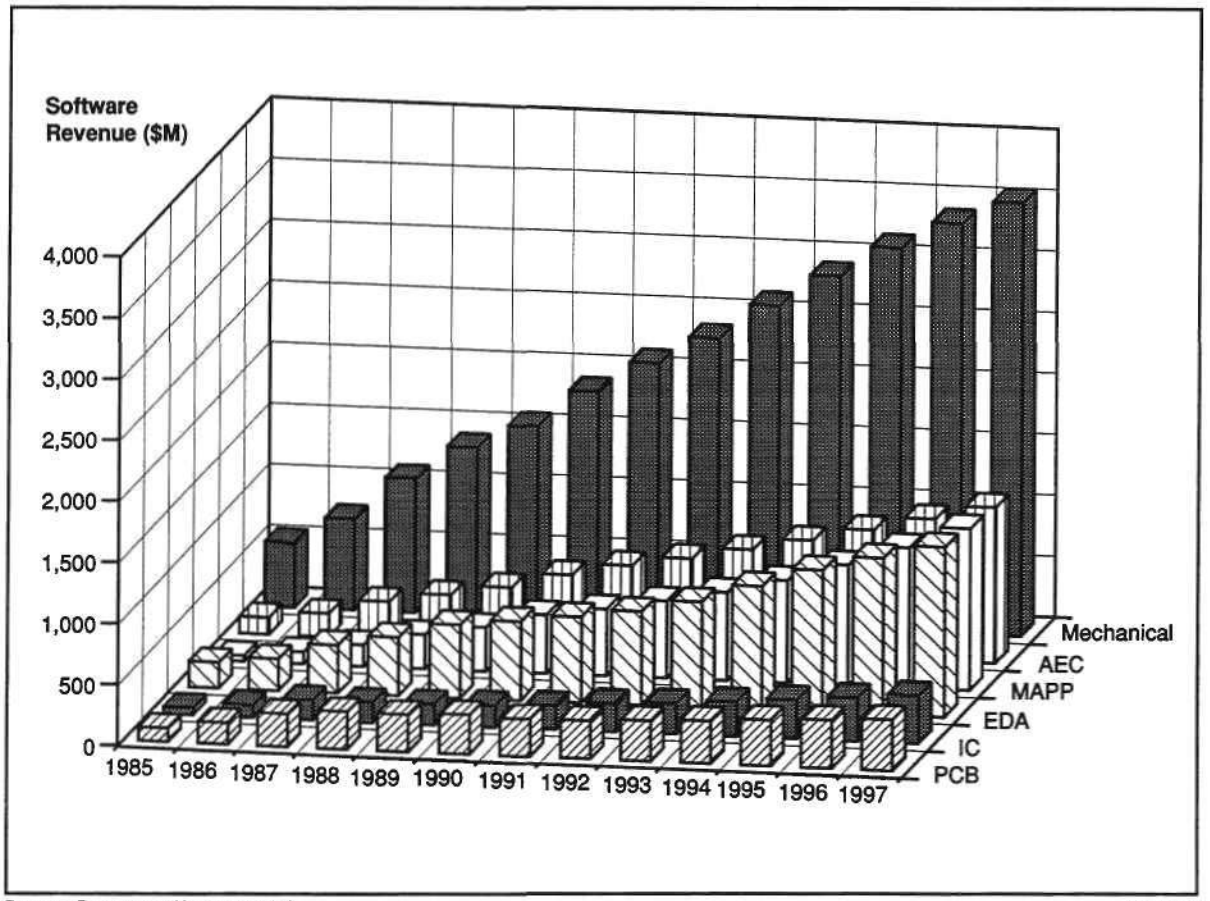
Mechanical Forecast Assumptions

The mechanical application area is the largest of the CAD/CAM/CAE/GIS market with 46 percent share of software revenue, and a software revenue growth of 12.3 percent forecast for 1993. The main issues driving the mechanical forecast are as follows:

- Software price—Dataquest expects software prices to stabilize or increase slightly for leading products. The average value of software shipped per seat has increased slowly. In 1987, total software revenue

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Figure 5
Worldwide Software Revenue Forecast by Application



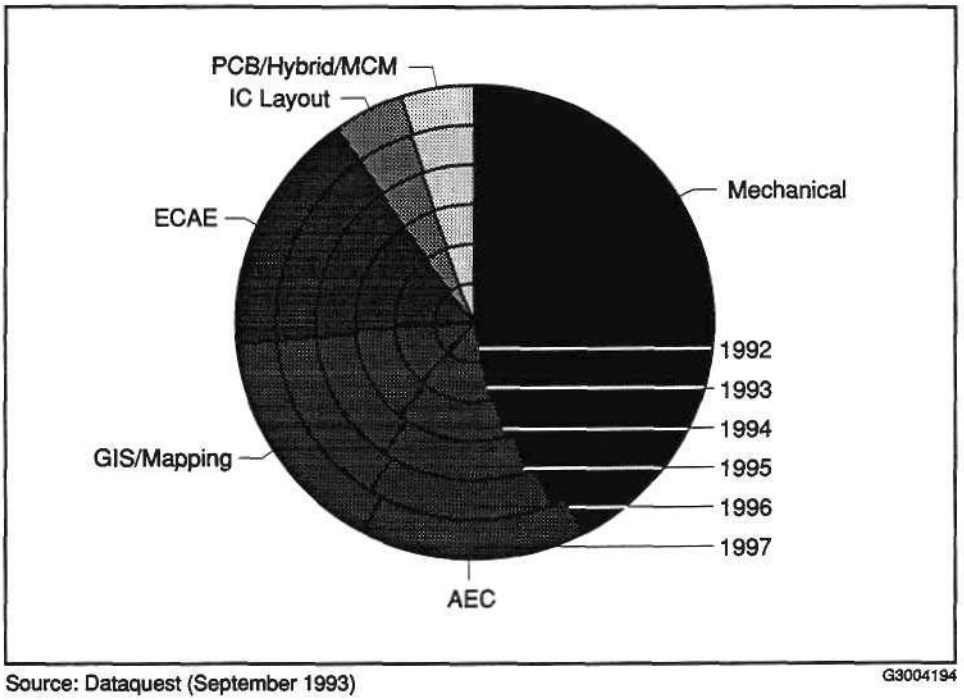
Source: Dataquest (August 1993) G3004193

divided by total number of seats shipped was $6,740. The average value has risen to $7,390 in 1992. Corresponding numbers in 1992 for technical workstation-based software are $19,338; $2,300 for the PC; and $11,544 for host-based seats. Leading vendors on all platforms have been raising prices directly or indirectly with new pricing structures for network licensing or site licensing. Microsoft's Windows NT is also expected to affect software prices, with PC vendors trying to raise prices, and workstation vendors possibly lowering prices as applications are ported to NT.

- Hardware price erosion—Dataquest expects hardware price erosion to continue at a slower rate as package complexity increases and accelerates demand for hardware purchases that provide more speed, memory, and storage. This trend can be expected on all platform configurations. Supercomputers are increasingly being used for high-end simulation and analysis applications while technical workstations range from very expensive, high-performance, real-time imaging systems to lower-cost, 2-D documentation systems. The need for integrated applications across platforms will cause significant upgrade and system replacements.

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Figure 6
Software Revenue Distribution Forecast by Application



Source: Dataquest (September 1993) G3004194

- Second-tier products—With a smaller installed base and less market share, second-tier vendors with stale technology are expected to fight forced price erosion. These second-tier vendors are struggling to build market share in an atmosphere of rampant price cutting, particularly on the PC platform. Building market share by cutting prices is becoming a more risky strategy.
- Hardware performance—With enabling technology providing increased mips, software vendors can redefine the concept of interactive design. In the future, designers will simulate the crash of one car into another and test to see if the doors still open. The value of this level of computing will change the nature of mechanical CAD/CAM/CAE.

  The result will allow anyone in the design and manufacturing process to simulate real problems, to evaluate potential solutions, and to communicate the change instantly to all involved.
- Modeling technologies—Core modeling technologies will evolve slowly to support a product data structure growing in complexity. 3-D solutions are replacing 2-D solutions, which will be replaced by next-generation, integrated, solid-modeling-based solutions. The more complete data structure with improvements in performance is rapidly building strong interest with end users. The need to have this higher level of communication among departments is growing as well. Continued progress is being made in integration between the model and analysis applications, between model and documentation, and further into manufacturing applications.

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- Technology dependence—The major mechanical applications have been defined: product conception, development, production, operation, and support will be necessary applications areas a hundred years from now. The dramatic changes taking place in the discrete manufacturing world because of competitive pressures are forcing shorter development cycles, localization and need for improved quality, resulting in a complexity that forces the users to be fully dependent upon this technology.
- Manufacturing industry—The growth opportunity in each country is dependent upon the success and health of the local manufacturing industries. Multinational corporations will fuel the growth in newly industrialized countries. Each country has a dominant industry or market segment that sets the tone for CAD/CAM/CAE use. The evolution of these industries has had an important impact on the growth of the CAD/CAM/CAE market in each region and has directed the success of many vendors trying to serve these markets. As an example, the automotive industries in Japan, the United States, Germany, Italy, and France have a major influence on these local CAD/CAM/CAE markets. Aerospace, a major force in the U.S. market, is less of a force in Europe and a minor but growing interest in Japan. All of the other manufacturing industries, such as fabricated metal, machinery, and consumer products, have strongholds in various locations around the world. For example, the machinery industry represents a significant local CAD/CAM/CAE opportunity in Japan and Germany.
- Europe—The automotive and aerospace industries, which are the largest customers of mechanical CAD/CAM/CAE tools, are suffering during the ongoing recession in Europe, experiencing budget and staff cuts. On top of this, 34 percent of the European mechanical market is in Germany where the economy is in a deep recession and manufacturing output is down. Growth for mechanical CAD software in 1992 was 10.1 percent and is expected to be 7.1 percent in 1993 as the German economy is not expected to get out of the recession before mid-1994 at the earliest.

AEC Forecast Assumptions

The AEC application area had software revenue growth in 1992 of 11.4 percent. The five-year CAGR for software is forecast to be 11.0 percent. The main factors driving the AEC forecast are as follows:

- Untapped users—A significant pool of untapped users still exists. The current relatively low market penetration of AEC CAD systems should allow steady worldwide growth during the next five years, despite constant volatility in demand for the building and infrastructure products to be designed.
- Mandates for CAD—Electronic design data is increasingly required by the designer's client, from the federal government down to the small commercial developer. In addition, design firms are growing at the expense of smaller firms. These large end users will increasingly require their employees and suppliers to adopt automation tools in the design and construction process.

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- Electronic partnering—Designers in the AEC industry are finding themselves in markets that are more regionally and globally competitive, markets that favor partnering across design disciplines. Smaller design firms will increasingly buy CAD systems or risk being dropped from consideration as a partner.
- Competitive advantage—CAD purchases are increasingly justified as a competitive advantage in sales and design reviews. The architect who cannot produce the fourth iteration of a proposed design before signing up a client will lose out to the group that can use changes in a proposal to ratchet a prospect toward closure gradually.
- Software leverage—AEC CAD vendors can fuel upgrade revenue among sophisticated users by leveraging software advances first developed in mechanical design, such as faster structural analysis tools or incorporation of design rules.
- New functionality—Data and database functions (versus graphics functions) will increase in importance in AEC design systems, creating opportunities to sell users significant and new functionality.
- Europe—AEC growth in western Europe is tied to the construction industry and improvement of the infrastructure, manufacturing plants, and power stations in eastern Europe. In particular, German and Danish construction companies are involved in projects in former East Germany and central and eastern Europe. The construction industry in other countries is rather bleak, given the overbuilding of the 1980s and high interest rates. The Netherlands and Norway have public works projects planned or in process.

Growth Inhibitors to the AEC Industry

Trends that will inhibit growth in the AEC industry are as follows:

- Low payoff to users—AEC's one-design-one-build structure means CAD provides fewer economic benefits to these users than does the one-design-build-many structure of manufacturing. Construction, which is essentially a prototype build, is fraught with uncertainties and delays that are hard to change using design systems as they exist today.
- Lack of interoperability—Designs are often split among several different companies representing different aspects of the design process. User companies often have different CAD systems that do not communicate well, and alliances and consolidations in user organizations will only highlight the issue.
- Low-cost solutions—Because most AEC design is still focused on drafting, which requires relatively little computing power, PC-based growth will be strong for the foreseeable future, and PC-based solutions will produce less revenue to the vendor than other platforms.

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- Late adopters—Attitudes of potential users inhibit market growth. Many experienced architects resist change in the design and construction processes. As this self-destructive mode of operating erodes the viability of the profession, the CAD market is also impacted because many architects who were once prospects for CAD systems simply are now unemployed.

GIS/Mapping Forecast Assumptions

The GIS application area had software revenue growth in 1992 of 15.3 percent. The five-year CAGR for software revenue is forecast to be 16.0 percent. The assumptions behind the GIS forecast are built on an optimism that during the forecast period the world economy will gradually improve and on an expectation that global competition will increase. Assumptions used to build Dataquest's GIS market forecast are as follows:

- Low penetration—Bread-and-butter prospects in government and utilities are charged with maintaining information on land and assets in perpetuity. The large number of utilities and sovereign and local governments all over the world still stuck with tabular data and paper maps, which will degrade, creates a plentiful supply of prospective buyers of the more readily changed and renewed computer maps, a first step to building a GIS system.
- New technologies—Faster, cheaper computers and developments in open, distributed systems open the door to an expanded user base. Advances in global positioning systems (GPSs) and aerial photography are making it possible to create GISs significantly more accurate and complete than existing paper maps, giving experienced users some compelling reasons to reinvest. Increasingly, portable computers, multimedia, cheaper storage, and better compression of satellite imagery will create opportunities to develop richer, more accurate, and more useful GIS systems. Although many markets will take advantage of these technologies, we can think of no other market as ready, willing, and able to put to work such a wide range of technology enhancements. Already in the last year or two, a number of users invested in image-oriented GIS systems, either supplementing or completely bypassing conversion of existing paper data that has helped provide a midlife kick to a market that has been slowed by troubled pilot projects.
- New applications in industries like retail and insurance will drive growth—Wherever there is competition for a limited prize—whether the prize is political or economic—GIS can create a competitive edge. Wherever assets or investments are geographically dispersed, GIS offers significant management capabilities. Revenue is growing more than 50 percent per year among new applications. However, we see a wide band of uncertainty surrounding future revenue opportunities. Several new applications in GIS are destined to become embedded as a relatively low revenue-producing feature in another software program (and market), rather than a standalone product in the GIS market.

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- Easier and cheaper GIS—Inexpensive spatial data, public and private, is accumulating and can be passed on to new users. Successful multi-participant projects are growing, creating larger data sets that can be profitably resold by government/industry consortia. Also, although we do not envision the technology miracle that will eliminate development costs, implementation of GIS in new sites will be easier and cheaper than it has been.
- Solutions filling a need—GIS addresses the information age's growing problem of information overload. Any product that addresses a visible problem is more certain to grow than solutions that are still looking for the problem.
- The U.S. government—GIS is one of the rare markets where relatively simple government actions can directly fuel industry growth. In fact, the GIS industry depends on government cooperation for base data development. Governments all over the world are cooperating by developing spatial data standards, more sophisticated mapping goals, and increased cooperation across federal and local governments. The U.S. federal government is in a particularly influential position—and all stars are favorably positioned. The Landsat program appears to be headed in the direction of making satellite imagery more affordable. GPS satellites are proving extremely valuable outside of defense applications. Freedom of information remains a viable U.S. federal concept, creating opportunities to exploit low-cost, government-generated spatial data.

Growth Inhibitors to the GIS Industry

Trends that will inhibit growth in the GIS industry are as follows:

- High cost—Nothing important will emerge to create a low-cost, meaningful data set for traditional customers in government and utilities. Data conversion will remain costly, despite substantially lower-scanning costs and increasingly improved automated conversion products. The high cost will remain because, as existing paper records head toward computerization, widespread minor inaccuracies begin to be examined, often for the first time. The significant cost of correcting prior errors and omissions is inevitably bundled into the cost of conversion. At the same time, increasingly complex applications require increasingly accurate data, which also raises conversion costs.
- Stuck projects—The significant number of traditional GIS/mapping projects stuck in the pilot phase will reduce demand for new products, as users struggle to implement existing purchases. Even worse, the negative publicity created by these projects will chill the buying impulse among nonusers, reducing the ability of GIS projects to compete with other applications for capital equipment dollars.
- Price pressure—Computer prices will certainly drop, even in technical applications such as GIS where higher-performance hardware will command a premium price. Software prices are likely to come under increasing pressure, despite the industry's current ability to hold overall seat prices relatively even. Our current forecast is built on declining

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hardware and steady software prices, primarily because of opportunities to add significant software data and functionality content to new sales among core, noncommodity buyers. Any significant deviation from this model would affect the forecast.

- Europe—GIS data in Europe is prohibitively expensive and not readily available, slowing down the potential growth. In addition, the current state of the various European economies, the enormous budget deficits of some of the major economies such as Germany, Italy, and the United Kingdom, and major cuts in public spending are holding back the development of GIS. However, the railway industry is a source of growth in GIS in Europe.

EDA Forecast Assumptions

The year 1992 showed a glimmer of hope in the EDA industry, with software revenue year-to-year growth rates climbing back to 8.9 percent, driven by the continued strength of the IC layout software industry and a resurgence in the CAE market. Dataquest expects EDA software revenue growth to increase to 10.4 percent year-to-year for 1993. Printed circuit board (PCB) software in particular will remain stagnant until multichip module (MCM) technologies begin to affect the market, which Dataquest anticipates will take effect in the 1994 to 1995 time frame. Factors that will help spur EDA software growth are as follows:

- New tool technologies—New tool technologies, including electronic system design automation (ESDA), signal integrity, and design automation, are becoming available, fueling growth.
- Analysis tools—Increasing clock frequencies require tighter design tolerances that require sophisticated analysis tools to ensure proper operation.
- Migration of IC layout—Migration of IC layout technologies to system designers in the form of floor planners may prove to be the vehicle to expand physical IC design into the larger ASIC design community.
- Europe—The EDA industry in Europe is now characterized by two or three big players jockeying for position. Furthermore, following the merger of Cadence Design Systems Inc. and Valid Logic Systems Inc., and several large end-user mergers, some strategic account changes have occurred and will continue. The total software revenue is unaffected, but market share is the prize for the winning EDA company.

Growth Inhibitors to the EDA Industry

Trends that will inhibit growth in the EDA industry are as follows:

- Short-term transitions and shifts—Product transition and strategy shifts will have a short-term downward effect. Difficulties at the No. 1 supplier of EDA software, Cadence, may cause a stall in the purchases of new tools as users ponder their options. Ongoing consolidations of key EDA technologies, including simulation and signal integrity, will also protract buying decisions.

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- Financial results—Decreased revenue for all of EDA is readily evident in examining public company statements. As part of the forecasting process, Dataquest analyzes the short-term, company-specific issues. There are five publicly traded EDA software companies: Cadence, Mentor Graphics, Synopsys, Viewlogic, and Silvar-Lisco. These companies represent approximately 45 percent of the worldwide EDA software market. Comparing the first six months of 1992 versus the first six months of 1993, we find that the combined revenue of these companies was essentially flat. Cadence's troubles earlier in the year contributed heavily to this fact, but we anticipate that 1993 total EDA software revenue growth will suffer accordingly. Were it not for the stellar growth of such companies as Viewlogic and Synopsys, the EDA market would indeed be posting a poor 1993.
- Legal issues—Legal issues may induce fear, uncertainty, and doubt in buyers' minds. The recent spate of legal actions (for example, Synopsys versus Cadence, Analogy versus Anacad/Mentor Graphics, and stockholders versus Cadence) may divert the attention of the buying public and will definitely garner the attention of top management at the EDA vendors.
- Use of PC-based tools will drop significantly—Looking to EDA's future, Dataquest anticipates the use of what has classically been called PC-based tools to drop significantly. The Dataquest factors determining the differentiation of technical workstations from PCs are a virtual multitasking operating system (UNIX, VMS, and DOMAIN), the ability to run high-performance graphic applications in a multi-user environment, and the user's potential range of expansion on the platform. Windows NT on the Pentium chip will challenge this differentiation.

Dataquest anticipates that use of classical PCs as EDA platforms will begin to diminish significantly in 1995. At that time, classes of tools will be differentiated not upon hardware platform or operating system, but rather upon the features and functionality of the tools themselves. The emergence of Windows NT will have a minimal impact upon the overall revenue of the EDA software industry. However, its effect upon competing operating systems, average selling prices, distributing practices, and business and marketing practices will be far-reaching.

Forecast Comparison

The CAD/CAM/CAE/GIS database has undergone enormous scrutiny through our market share, forecast, market share update, and finally forecast update. It has only slightly changed downward from the 1992 forecast. In fact, the forecast total factory revenue for 1993 of $16.5 billion is only 1.3 percent higher than last year's forecast of $16.3 billion. However, the longer-term sights have been lowered so that the current 1996 forecast total factory revenue of $19.8 billion is 6.1 percent lower

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than was forecast last year for 1996. By examining the numbers, we discovered the following lowered expectations:

- The biggest factor in this lowered forecast is in the more rapidly declining host-dependent business. This is supported by the market share update reporting a faster drop in the host-dependent platform than estimates from our earlier market share. The forecast total revenue for 1996 of $1.1 billion is 36.2 percent lower than the forecast last year for 1996.
- Regionally, the largest factor in this lowered forecast is Europe, where the 1996 forecast total factory revenue of $6.8 billion is 14.7 percent lower than the $7.9 billion forecast last year.
- As to applications, these lowered expectations apply to the AEC, GIS, IC, and PCB applications, while the mechanical and ECAE applications have been forecast to grow faster than reported in 1991.

Lowered expectations have become an economic reality, given that the recovery from this prolonged recession is not materializing as the past has taught us. However, a CAGR of 5.8 percent of this $15.7 billion industry is solid and continuing growth. The technologies provided by the CAD/CAM/CAE/GIS industry are no longer just nice ideas, but have become the ticket to compete globally. The technological improvements of software, hardware, and the increasing involvement of vendors through services will continue to fuel the growth of this CAD/CAM/CAE/GIS market.

Forecast Methodology

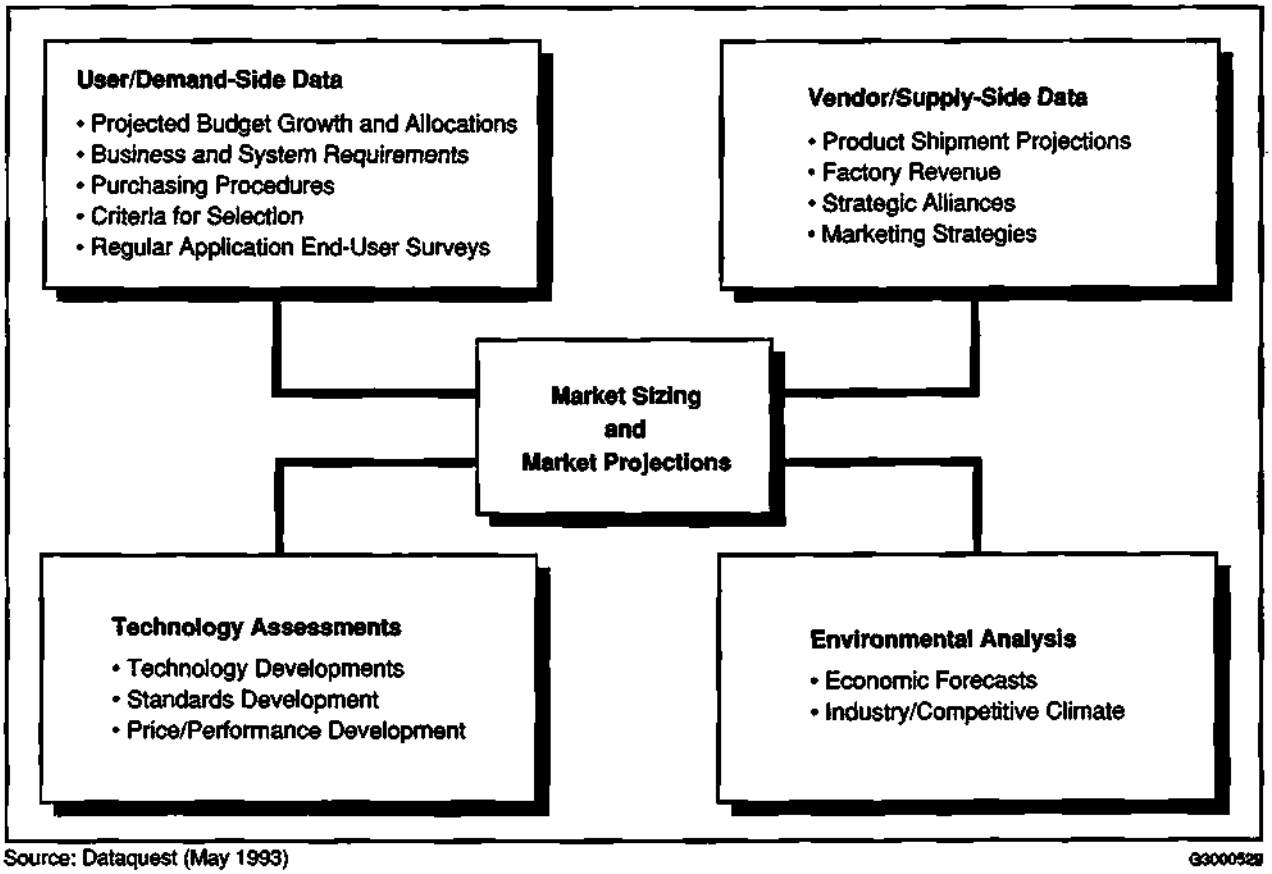
Fundamental to the way Dataquest conducts its research is an underlying philosophy that says the best data and analyses come from a well-balanced program. This program includes the following: balance between primary and secondary collection techniques; balance between supply-side and demand-side analysis; balance between focused, industry-specific research and coordinated, "big-picture" analysis aided by integration of data from the more than 25 separate high-technology industries Dataquest covers; and balance between the perspectives of experienced industry professionals and rigorous, disciplined techniques of seasoned market researchers.

Dataquest also analyzes trends in the macro environment, which can have major influences on both supply-side and demand-side forecasting. In addition to demographics, analysts look at gross national product (GNP) growth, interest rate fluctuation, business expectations, and capital spending plans. In the geopolitical arena, the group looks at trade issues, political stability or lack thereof, tariffs, nontariff barriers, and such factors as the effect on Europe from the events of 1993.

Figure 7 shows the CAD/CAM/CAE and GIS forecasting model. The overall forecasting process uses a combination of forecasting techniques

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Figure 7
CAD/CAM/CAE and GIS Forecasting Model



Source: Dataquest (May 1993)

such as time series and technological modeling. Market estimates and forecasts are derived using the following research techniques:

- "Bottom-up" aggregation—This method involves adding all relevant vendor contributions to arrive at total market estimates for all historical data.
- Segment forecasting—For each application segment tracked by the CAD/CAM/CAE and GIS group, individual forecasts are derived following the basic information model defined previously. Specifically, each design phase covered within each application is segmented by product, region, and platform. In this way, each application segment incorporates its own set of unique assumptions.
- Demand-based analysis—Market growth is tracked and forecast in terms of the present and anticipated demand of current and future users. This requires the development of a total available market model and a satisfied available market figure to assess the levels of penetration accurately. Installed base is also evaluated. Rates of product retirement are primarily based on input from end users in our ongoing survey programs. Dataquest analysts also factor in the acceptance or ability for users to consume new technology.

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- Capacity-based analysis—This method involves identifying future shipment volume constraints. These constraints, or "ceilings," can be the result of component availability, manufacturing capacity, or distribution capacity. In any case, capacity limitations are capable of keeping shipments below the demand level.

Segmentation Definitions

This section lists the definitions specific to this document. The following paragraphs define the segments.

Applications

Mechanical

The mechanical segment refers to computer-aided tools used by engineers, designers, analysts, technicians, and draftspeople working predominantly in the discrete manufacturing industries, but includes government and education. Users of mechanical CAD/CAM/CAE tools work in all departments across the typical organization, with a majority found in product design, advanced engineering, and manufacturing engineering. Common design applications include conceptual design, industrial design, structural or thermal analysis, detail design, and electromechanical design (the mechanical part of design with electrical or electronic components and mechanisms). Common manufacturing applications include tool and fixture design, numerical control part programming, off-line robotics programming, and interface to quality control systems. Management tools for database control and distribution are included in this segment, as well as user-defined application programming.

Architecture, Engineering, and Construction (AEC)

The AEC segment covers the use of computer-aided tools by architects, contractors, plant engineers, civil engineers, and other people associated with these disciplines to aid in designing and managing buildings, industrial plants, ships, and other types of nondiscrete entities.

Geographic Information Systems (GIS)/Mapping

GIS is computer-based technology, and the segment is composed of hardware, software, and data used to capture, edit, display, and analyze spatial (tagged by location) information.

Electronic Design Automation (EDA)

The EDA segment covers computer-based tools used to automate the process of designing an electronic product, including printed circuit boards, ICs, and systems. EDA includes ECAE, IC layout, and PCB/hybrid/MCM, as follows:

- Electronic Computer-Aided Engineering (ECAE)—These are computer-aided tools used in the engineering or design phase of electronic products (as opposed to the physical layout phase of the product). Examples of ECAE applications are schematic capture and simulation.

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- IC Layout—This is a software application tool used to create and validate the physical implementation of an IC. The IC layout category comprises polygon editors, symbolic editors, placement and routing (gate array, cell, and block), design verification tools (DRC/ERC/ logic-to-layout), compilers, and module development tools.
- PCB/Hybrid/MCM—This segment covers products used to create the placement and routing of the traces and components laid out on a printed circuit board. Also included in this category are thermal analysis tools.

Regions

The following paragraphs define the regions.

North America

North America includes United States, Mexico, and Canada.

Europe

Europe includes the United Kingdom, Scandinavia, Benelux, France, Germany, Italy, Spain, and Rest of Europe (which includes Austria, Switzerland, and eastern Europe)

Asia

Asia includes Japan, Singapore, Taiwan, Korea, China, and Hong Kong.

Rest of World

Rest of World includes all other countries including Australia, New Zealand, Oceania, Africa, Central America, South America, and the Middle East.

Platforms

The following paragraphs define the platforms.

Technical Workstation

A technical workstation is a single-user computer distinguished from a personal computer by its features and by the user's potential range of expansion on the platform. Features include a virtual, multitasking operating system (UNIX, VMS, or Domain); the computer is designed by the manufacturer to run high-performance graphics applications in a multiuser/multitasking environment.

Host-Dependent

Host-dependent is a shared logic system in which the external workstations' functions are dependent on a host computer.

Server

A server is a computer that transparently provides its resources for use by other computer systems. It is a system on a network that provides specific functionality to other computer systems: the clients. Functions include file storage, database access, and compute capability. Dataquest tracks the following major categories of servers used for CAD/CAM/ CAE and GIS applications:

- Compute Servers—These systems provide capabilities for solving numerical problems (for example, simulations, statistical calculations, and simultaneous partial differential equations). System features

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usually include high-speed computational capabilities (for example, vector and parallel processing) and large memories.

- Print Servers—These systems provide access to printers, specialized printing applications software, and print-spooling resources to a network.
- File Servers—These systems provide mass storage capability to clients on a network. Services can range from temporary storage of working files to long-term backup and archive systems.
- Database Servers—These systems manage databases as a shared resource to a network. These servers handle such functions as physical data storage, data security, and high-level queries and can access stored information at the record level.

Personal Computer

A personal computer is a single-user computer distinguished from a technical workstation by its features and by the user's potential range of expansion on the platform. Features found in technical workstations (such as a virtual operating system, networking, high-performance graphics, multiuser/multitasking capability) are optional rather than integrated by the manufacturer.

Line Items

Line item definitions are as follows:

- Average selling price (ASP) is defined as the average price of a product, inclusive of any discounts.
- CPU revenue is the portion of revenue derived from a system sale that is related to the value of the CPU. (In the case of technical workstations and personal computers, CPU revenue contains the terminal revenue.)
- CPU shipment is defined as the number of CPUs delivered.
- CPU installed base is defined as the total number of CPUs in active, day-to-day use.
- Unit shipment is defined as the number of products delivered (that is, seats).
- Seats are defined as the number of possible simultaneous users.
- Installed seats are defined as the total number of seats in active, day-to-day use.
- Hardware revenue is defined as the sum of the revenue from the hardware system components: CPU revenue, terminal revenue, and peripherals revenue.
- Peripherals revenue is defined as the value of all the peripherals of a turnkey sale. (Peripherals in this category typically are input and output devices.)

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- Terminal revenue is defined as revenue derived from the sale of terminals used to graphically create, analyze, or manipulate designs. The term is applicable only to the host-dependent platform, as terminal revenue is contained within CPU revenue for technical workstations and PCs.
- Software revenue is revenue derived from the sale of bundled (part of a turnkey system) and unbundled software.
- Service revenue is defined as revenue derived from the service and support of CAD/CAM/CAE or GIS systems. Service revenue can be calculated in the tables by subtracting hardware and software revenue from total revenue.
- Total factory revenue is defined as the amount of money received by a manufacturer for its goods measured in U.S. dollars and is the sum of hardware, software, and service revenue. Total factory revenue does not include revenue that a company may receive from products sold to another company for resale (OEM revenue).

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Table 8
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: Worldwide
Platform: All Platforms

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	20,538	39,542	61,509	65,706	91,983	111,370	133,820	156,030	176,930	197,620	45	17
Unit Shipments or Seats	23,547	42,126	64,981	68,182	93,269	112,040	134,120	156,170	177,000	197,640	41	16
CPU Installed Base	37,972	76,272	134,026	191,084	263,571	334,720	408,480	488,880	573,440	657,770	62	20
Installed Seats	49,251	89,471	149,685	207,721	279,494	348,790	420,030	497,750	579,540	661,300	54	19
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	83.6	69.3	57.6	52.8	49.4	46.4	44.1	42.7	41.9	41.3	-12	-4
Hardware-Only ASP	11.7	8.8	6.8	7.1	6.1	5.1	4.5	4.2	4.1	4.1	-15	-8
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	563	728	904	951	1,035	1,074	1,137	1,216	1,304	1,395	16	6
CPU Revenue	429	576	727	808	896	942	1,006	1,080	1,161	1,244	20	7
Terminal Revenue	69	44	42	36	26	14	6	3	2	1	-22	-53
Peripheral Revenue (Turnkey)	64	108	135	107	112	118	125	133	141	150	15	6
Software Revenue	281	359	477	545	629	721	838	983	1,145	1,323	22	16
Bundled	138	182	240	266	267	290	316	343	373	403	18	9
Unbundled	144	177	237	279	362	431	522	640	772	920	26	21
Service Revenue	180	213	280	323	322	341	376	418	471	531	16	11
Total Factory Revenue	1,024	1,300	1,660	1,819	1,985	2,136	2,351	2,618	2,920	3,249	18	10
Increase over Prior Year (%)	32	27	28	10	9	8	10	11	12	11		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (September 1993)

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Table 9
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: Worldwide
Platform: Technical Workstation

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	5,512	9,361	14,260	17,364	21,166	24,580	28,450	32,520	37,050	41,910	40	15
Unit Shipments or Seats	5,512	9,361	14,260	17,364	21,166	24,580	28,450	32,520	37,050	41,910	40	15
CPU Installed Base	9,024	18,145	31,661	47,427	65,246	83,990	103,380	123,460	144,530	166,340	64	21
Installed Seats	9,024	18,145	31,661	47,427	65,246	83,990	103,380	123,460	144,530	166,340	64	21
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	63.3	58.8	53.6	51.9	51.1	49.2	47.4	46.2	45.3	44.4	-5	-3
Hardware-Only ASP	32.6	18.9	19.5	14.6	16.4	14.9	13.8	13.0	12.5	12.1	-16	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	250	360	498	506	599	649	701	751	808	865	24	8
CPU Revenue	216	284	397	432	516	558	602	645	695	745	24	8
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	34	75	101	74	84	91	98	105	113	120	26	7
Software Revenue	135	198	287	327	388	448	521	606	704	812	30	16
Bundled	83	132	182	199	219	246	274	299	327	354	27	10
Unbundled	51	67	105	128	169	202	247	307	377	458	35	22
Service Revenue	90	130	193	213	230	256	289	322	361	403	26	12
Total Factory Revenue	475	688	978	1,046	1,217	1,353	1,511	1,678	1,872	2,081	27	11
Increase over Prior Year (%)	140	45	42	7	16	11	12	11	12	11		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (September 1993)

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Table 10
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: Worldwide
Platform: Host-Dependent

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	581	1,201	2,042	1,148	697	390	160	50	10	0	5	-100
Unit Shipments or Seats	3,590	3,785	5,514	3,624	1,983	1,050	460	190	80	30	-14	-57
CPU Installed Base	2,469	3,551	5,397	6,252	6,534	6,360	5,800	4,950	3,920	3,090	28	-14
Installed Seats	13,748	16,749	21,056	22,889	22,457	20,430	17,350	13,810	10,020	6,620	13	-22
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	398.2	261.0	139.9	138.6	125.8	107.7	95.6	72.0	.0	.0	-25	-100
Hardware-Only ASP	902.0	169.3	114.9	212.9	202.9	204.6	237.6	250.6	244.9	226.3	-31	2
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	231	216	216	150	95	48	19	7	3	1	-20	-59
CPU Revenue	137	145	151	101	63	31	11	3	1	0	-18	-63
Terminal Revenue	69	44	42	36	26	14	6	3	2	1	-22	-53
Peripheral Revenue (Turnkey)	25	27	23	14	6	3	1	0	0	0	-29	-72
Software Revenue	93	91	90	57	28	15	7	2	1	0	-26	-57
Bundled	46	44	48	33	15	8	3	1	0	0	-24	-100
Unbundled	47	48	42	23	13	7	4	2	1	0	-27	-50
Service Revenue	84	74	73	46	30	14	6	2	1	0	-22	-62
Total Factory Revenue	408	381	379	253	154	77	31	11	4	2	-22	-59
Increase over Prior Year (%)	-16	-7	-1	-33	-39	-50	-59	-65	-64	-58		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (September 1993)

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Table 11
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: Worldwide
Platform: Server

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	NA	NA	NA	2,699	2,399	2,730	3,180	3,750	4,340	5,040	NA	16
Unit Shipments or Seats	NA	NA	NA	2,699	2,399	2,730	3,180	3,750	4,340	5,040	NA	16
CPU Installed Base	NA	NA	NA	2,699	5,097	7,690	10,490	13,290	16,280	18,850	NA	30
Installed Seats	NA	NA	NA	2,699	5,097	7,690	10,490	13,290	16,280	18,850	NA	30
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	NA	NA	NA	61.0	63.9	61.6	59.1	56.8	54.5	52.4	NA	-4
Hardware-Only ASP	NA	NA	NA	31.8	32.0	29.0	26.6	25.3	24.5	24.0	NA	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	NA	NA	NA	108	89	93	100	111	122	135	NA	9
CPU Revenue	NA	NA	NA	100	80	84	90	100	110	122	NA	9
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	NA	NA	NA	8	9	10	10	11	12	14	NA	8
Software Revenue	NA	NA	NA	50	56	63	73	87	101	118	NA	16
Bundled	NA	NA	NA	24	23	25	28	31	34	38	NA	10
Unbundled	NA	NA	NA	26	33	38	46	55	67	80	NA	19
Service Revenue	NA	NA	NA	52	44	48	54	61	69	80	NA	13
Total Factory Revenue	NA	NA	NA	210	189	205	227	259	293	333	NA	12
Increase over Prior Year (%)	NA	NA	NA	NA	-10	8	11	14	13	14		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (September 1993)

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Table 12
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: Worldwide
Platform: Personal Computer

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	14,446	28,980	45,208	44,495	67,722	83,670	102,040	119,710	135,530	150,660	47	17
Unit Shipments or Seats	14,446	28,980	45,208	44,495	67,722	83,670	102,040	119,710	135,530	150,660	47	17
CPU Installed Base	26,479	54,577	96,968	134,707	186,693	236,690	288,810	347,180	408,710	469,490	63	20
Installed Seats	26,479	54,577	96,968	134,707	186,693	236,690	288,810	347,180	408,710	469,490	63	20
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	25.4	25.5	21.3	15.8	14.8	14.0	12.7	12.0	11.4	11.0	-13	-6
Hardware-Only ASP	4.9	4.9	3.9	3.9	3.5	3.2	3.0	2.8	2.6	2.5	-8	-7
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	82	152	190	187	251	284	317	348	372	394	32	9
CPU Revenue	76	147	179	176	238	270	302	332	355	377	33	10
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	5	5	11	11	13	14	15	16	16	17	25	5
Software Revenue	54	69	100	112	156	194	236	287	339	392	31	20
Bundled	8	7	9	10	10	11	11	12	11	11	5	3
Unbundled	46	62	90	102	146	184	225	276	328	381	34	21
Service Revenue	5	9	14	12	18	23	28	34	41	47	35	22
Total Factory Revenue	141	230	303	311	425	501	581	669	751	834	32	14
Increase over Prior Year (%)	57	64	32	3	37	18	16	15	12	11		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.

Source: Dataquest (September 1993)

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Table 13
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: North America
Platform: All Platforms

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	11,176	18,143	31,587	36,858	52,803	64,100	77,820	89,500	100,750	111,720	47	16
Unit Shipments or Seats	12,706	19,066	32,989	37,882	53,242	64,250	77,840	89,500	100,750	111,720	43	16
CPU Installed Base	19,758	37,205	66,804	99,319	142,179	185,080	229,940	276,580	324,020	369,680	64	21
Installed Seats	26,658	44,462	74,687	107,196	149,243	190,860	234,290	279,610	325,820	370,410	54	20
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	67.5	59.7	55.2	46.6	42.9	40.2	38.4	37.3	36.4	35.7	-11	-4
Hardware-Only ASP	10.3	8.7	6.5	6.6	5.9	5.0	4.4	4.2	4.1	4.1	-13	-7
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	241	279	359	381	441	445	474	506	543	582	16	6
CPU Revenue	189	225	288	325	394	403	432	462	497	532	20	6
Terminal Revenue	32	16	20	17	9	3	0	0	0	0	-27	-100
Peripheral Revenue (Turnkey)	20	38	50	38	39	39	41	44	47	50	18	5
Software Revenue	129	157	200	243	266	305	359	425	497	579	20	17
Bundled	39	53	66	80	63	65	71	76	82	89	13	7
Unbundled	91	105	134	163	204	240	288	349	415	490	22	19
Service Revenue	96	98	120	141	135	137	150	168	190	216	9	10
Total Factory Revenue	466	534	679	765	842	887	982	1,099	1,231	1,377	16	10
Increase over Prior Year (%)	24	15	27	13	10	5	11	12	12	12		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.

Source: Dataquest (September 1993)

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Table 14
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: North America
Platform: Technical Workstation

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	2,779	3,888	5,348	7,481	9,281	10,520	12,180	14,050	16,200	18,600	35	15
Unit Shipments or Seats	2,779	3,888	5,348	7,481	9,281	10,520	12,180	14,050	16,200	18,600	35	15
CPU Installed Base	4,777	8,523	13,446	20,143	27,820	35,800	44,080	52,870	62,430	72,420	55	21
Installed Seats	4,777	8,523	13,446	20,143	27,820	35,800	44,080	52,870	62,430	72,420	55	21
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	46.8	48.6	50.1	43.9	43.0	41.0	39.4	38.2	37.2	36.4	-2	-3
Hardware-Only ASP	32.2	18.7	18.7	13.8	15.3	13.9	12.8	12.0	11.6	11.2	-17	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	102	127	173	171	207	212	226	239	257	276	20	6
CPU Revenue	92	100	136	148	183	188	200	212	228	246	19	6
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	10	27	37	23	24	25	26	27	29	31	26	5
Software Revenue	51	72	103	123	129	145	169	197	229	267	26	16
Bundled	25	40	53	58	49	52	57	61	66	71	19	7
Unbundled	26	32	50	65	80	93	112	136	163	196	32	20
Service Revenue	46	60	82	91	87	93	104	115	129	145	17	11
Total Factory Revenue	198	259	358	386	423	450	498	552	615	688	21	10
Increase over Prior Year (%)	144	30	38	8	10	6	11	11	12	12		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.

Source: Dataquest (September 1993)

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Table 15
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: North America
Platform: Host-Dependent

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	277	470	770	320	245	100	20	0	0	0	-3	-100
Unit Shipments or Seats	1,806	1,394	2,171	1,344	684	250	40	0	0	0	-22	-100
CPU Installed Base	1,225	1,604	2,248	2,411	2,445	2,310	2,020	1,680	1,290	1,010	19	-16
Installed Seats	8,126	8,860	10,131	10,288	9,510	8,090	6,370	4,710	3,100	1,740	4	-29
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	288.4	248.5	155.7	152.1	119.1	113.8	109.1	104.6	100.1	96.1	-20	-4
Hardware-Only ASP	1,533.0	162.4	109.8	217.3	159.1	144.8	133.0	121.9	111.6	102.7	-43	-8
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	100	80	86	54	35	12	2	0	0	0	-23	-100
CPU Revenue	59	55	57	33	25	9	1	0	0	0	-19	-100
Terminal Revenue	32	16	20	17	9	3	0	0	0	0	-27	-100
Peripheral Revenue (Turnkey)	9	9	9	3	2	1	0	0	0	0	-34	-100
Software Revenue	46	43	38	19	8	4	2	1	0	0	-35	-100
Bundled	13	11	12	6	1	1	0	0	0	0	-42	-100
Unbundled	33	31	26	13	7	3	2	1	0	0	-32	-100
Service Revenue	47	33	32	18	14	6	1	0	0	0	-26	-100
Total Factory Revenue	193	156	156	91	58	22	5	1	0	0	-26	-100
Increase over Prior Year (%)	-23	-19	-0	-42	-36	-62	-78	-85	-100	NA		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.

Source: Dataquest (September 1993)

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Table 16
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: North America
Platform: Server

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	NA	NA	NA	1,533	1,499	1,720	2,020	2,390	2,780	3,240	NA	17
Unit Shipments or Seats	NA	NA	NA	1,533	1,499	1,720	2,020	2,390	2,780	3,240	NA	17
CPU Installed Base	NA	NA	NA	1,533	3,032	4,660	6,440	8,240	10,170	11,850	NA	31
Installed Seats	NA	NA	NA	1,533	3,032	4,660	6,440	8,240	10,170	11,850	NA	31
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	NA	NA	NA	55.7	58.3	55.7	53.4	51.2	49.0	47.1	NA	-4
Hardware-Only ASP	NA	NA	NA	27.2	30.2	27.5	25.2	24.0	23.3	22.8	NA	-5
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	NA	NA	NA	49	50	52	56	62	69	77	NA	9
CPU Revenue	NA	NA	NA	43	45	47	50	56	62	68	NA	9
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	NA	NA	NA	6	5	6	6	7	7	8	NA	9
Software Revenue	NA	NA	NA	32	33	36	42	50	59	70	NA	16
Bundled	NA	NA	NA	14	10	11	12	14	15	17	NA	10
Unbundled	NA	NA	NA	18	22	25	30	36	44	53	NA	19
Service Revenue	NA	NA	NA	26	24	26	29	34	38	44	NA	13
Total Factory Revenue	NA	NA	NA	107	107	115	128	146	166	191	NA	12
Increase over Prior Year (%)	NA	NA	NA	NA	-0	7	12	14	14	15		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (September 1993)

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Table 17
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: North America
Platform: Personal Computer

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	8,120	13,785	25,470	27,525	41,778	51,770	63,600	73,060	81,760	89,880	51	17
Unit Shipments or Seats	8,120	13,785	25,470	27,525	41,778	51,770	63,600	73,060	81,760	89,880	51	17
CPU Installed Base	13,755	27,078	51,110	75,232	108,882	142,320	177,390	213,790	250,130	284,400	68	21
Installed Seats	13,755	27,078	51,110	75,232	108,882	142,320	177,390	213,790	250,130	284,400	68	21
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	37.4	69.8	15.5	14.6	9.6	8.6	7.8	7.3	6.9	6.7	-29	-7
Hardware-Only ASP	4.6	4.9	3.9	3.8	3.5	3.2	3.0	2.8	2.6	2.5	-7	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	39	72	100	106	148	168	189	204	217	229	40	9
CPU Revenue	38	70	95	100	141	160	180	195	207	218	39	9
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	1	2	5	6	7	8	9	10	10	11	58	9
Software Revenue	33	43	59	68	96	120	146	178	209	243	31	20
Bundled	2	1	1	2	1	1	1	1	1	1	-8	-3
Unbundled	31	42	58	67	95	118	145	176	208	241	32	21
Service Revenue	2	5	7	6	9	12	16	19	23	27	40	23
Total Factory Revenue	74	119	165	181	254	300	351	401	449	498	36	14
Increase over Prior Year (%)	67	61	38	10	40	18	17	14	12	11		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (September 1993)

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Table 18
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: Europe
Platform: All Platforms

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	6,677	14,256	18,424	16,433	21,998	25,340	29,520	34,720	38,430	42,420	35	14
Unit Shipments or Seats	7,702	15,323	19,916	17,476	22,499	25,610	29,620	34,740	38,430	42,420	31	14
CPU Installed Base	12,593	26,488	43,712	57,245	72,921	86,200	99,170	115,010	132,030	149,440	55	15
Installed Seats	15,291	30,196	48,765	63,063	78,785	91,680	103,870	118,730	134,660	151,050	51	14
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	87.9	80.0	63.3	59.1	53.9	50.4	47.9	46.3	45.3	44.5	-12	-4
Hardware-Only ASP	14.0	9.2	8.0	9.0	7.2	6.2	5.3	4.9	4.8	4.8	-15	-8
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	218	292	340	337	346	359	376	398	422	446	12	5
CPU Revenue	170	236	284	298	306	323	342	364	387	410	16	6
Terminal Revenue	24	16	14	13	10	6	2	1	0	0	-19	-100
Peripheral Revenue (Turnkey)	25	39	42	26	29	31	32	33	35	36	4	5
Software Revenue	109	139	185	195	228	259	300	350	409	472	20	16
Bundled	66	90	117	121	123	134	146	156	168	178	17	8
Unbundled	43	49	68	73	106	125	154	195	241	294	25	23
Service Revenue	60	82	114	124	125	136	150	166	187	208	20	11
Total Factory Revenue	387	513	639	655	699	753	826	915	1,017	1,126	16	10
Increase over Prior Year (%)	46	32	25	3	7	8	10	11	11	11		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.

Source: Dataquest (September 1993)

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Table 19
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: Europe
Platform: Technical Workstation

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	2,171	3,627	5,778	6,199	7,593	8,890	10,230	11,480	12,870	14,310	37	14
Unit Shipments or Seats	2,171	3,627	5,778	6,199	7,593	8,890	10,230	11,480	12,870	14,310	37	14
CPU Installed Base	3,232	6,790	12,326	17,952	24,307	30,990	37,740	44,590	51,460	58,490	66	19
Installed Seats	3,232	6,790	12,326	17,952	24,307	30,990	37,740	44,590	51,460	58,490	66	19
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	68.7	66.3	54.8	54.9	53.8	51.6	49.7	48.4	47.4	46.5	-6	-3
Hardware-Only ASP	38.7	19.4	21.4	17.1	18.4	16.7	15.4	14.5	14.0	13.6	-17	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	105	150	202	197	238	261	282	299	318	335	23	7
CPU Revenue	92	123	171	179	214	236	255	270	288	304	24	7
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	13	27	31	19	24	26	28	29	30	31	16	6
Software Revenue	62	91	130	140	172	200	232	269	312	360	29	16
Bundled	40	66	92	97	105	120	133	143	154	163	27	9
Unbundled	22	25	38	43	66	80	99	126	159	197	32	24
Service Revenue	33	52	82	86	100	113	128	142	159	176	32	12
Total Factory Revenue	199	294	415	423	509	574	642	709	789	872	26	11
Increase over Prior Year (%)	129	48	41	2	20	13	12	10	11	10		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (September 1993)

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Table 20
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: Europe
Platform: Host-Dependent

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	190	582	695	342	121	70	30	10	0	0	-11	-100
Unit Shipments or Seats	1,215	1,650	2,187	1,385	621	340	130	30	0	0	-15	-100
CPU Installed Base	816	1,383	2,037	2,291	2,281	2,110	1,870	1,520	1,170	910	29	-17
Installed Seats	3,514	5,091	7,090	8,109	8,145	7,600	6,570	5,250	3,800	2,520	23	-21
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	452.4	197.3	164.9	225.2	397.4	384.8	370.1	.0	.0	.0	-3	-100
Hardware-Only ASP	2,485.9	172.6	128.3	196.3	258.8	237.1	218.6	199.2	.0	.0	-43	-100
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	88	88	82	58	31	16	6	1	0	0	-23	-100
CPU Revenue	55	62	60	40	19	9	3	1	0	0	-23	-100
Terminal Revenue	24	16	14	13	10	6	2	1	0	0	-19	-100
Peripheral Revenue (Turnkey)	10	9	8	5	1	1	0	0	0	0	-41	-100
Software Revenue	33	32	31	21	10	4	1	0	0	0	-27	-100
Bundled	23	21	23	16	7	3	1	0	0	0	-25	-100
Unbundled	11	10	9	5	2	1	0	0	0	0	-33	-100
Service Revenue	25	27	27	17	9	4	1	0	0	0	-24	-100
Total Factory Revenue	147	147	140	96	49	23	8	1	0	0	-24	-100
Increase over Prior Year (%)	1	-0	-4	-32	-49	-52	-64	-85	-100	NA		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (September 1993)

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Table 21
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: Europe
Platform: Server

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	NA	NA	NA	770	602	670	750	880	1,020	1,170	NA	14
Unit Shipments or Seats	NA	NA	NA	770	602	670	750	880	1,020	1,170	NA	14
CPU Installed Base	NA	NA	NA	770	1,372	2,000	2,660	3,310	4,000	4,570	NA	27
Installed Seats	NA	NA	NA	770	1,372	2,000	2,660	3,310	4,000	4,570	NA	27
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	NA	NA	NA	64.0	66.7	64.4	61.8	59.2	56.6	54.2	NA	-4
Hardware-Only ASP	NA	NA	NA	46.9	36.5	33.3	30.6	29.1	28.3	27.7	NA	-5
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	NA	NA	NA	40	25	26	28	31	34	37	NA	8
CPU Revenue	NA	NA	NA	38	23	24	25	28	31	34	NA	8
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	NA	NA	NA	1	2	2	3	3	3	3	NA	7
Software Revenue	NA	NA	NA	11	15	17	20	23	27	32	NA	15
Bundled	NA	NA	NA	6	8	8	9	10	11	12	NA	9
Unbundled	NA	NA	NA	5	8	9	11	13	16	20	NA	20
Service Revenue	NA	NA	NA	18	13	13	14	16	19	21	NA	11
Total Factory Revenue	NA	NA	NA	68	53	57	62	71	80	90	NA	11
Increase over Prior Year (%)	NA	NA	NA	NA	-22	6	9	14	12	13		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.

Source: Dataquest (September 1993)

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Table 22
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: Europe
Platform: Personal Computer

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	4,316	10,047	11,951	9,123	13,683	15,720	18,510	22,340	24,550	26,940	33	15
Unit Shipments or Seats	4,316	10,047	11,951	9,123	13,683	15,720	18,510	22,340	24,550	26,940	33	15
CPU Installed Base	8,545	18,315	29,348	36,231	44,961	51,090	56,900	65,580	75,400	85,470	51	14
Installed Seats	8,545	18,315	29,348	36,231	44,961	51,090	56,900	65,580	75,400	85,470	51	14
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	19.2	99.1	73.4	11.7	11.2	12.5	11.4	10.7	10.2	9.8	-13	-3
Hardware-Only ASP	5.3	5.0	4.4	4.5	3.7	3.4	3.1	2.9	2.8	2.7	-9	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	25	53	56	42	52	56	60	68	71	74	20	7
CPU Revenue	23	51	53	41	50	54	58	66	69	72	21	8
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	2	2	2	2	2	2	2	2	2	2	-1	-0
Software Revenue	14	16	23	23	31	38	47	58	69	80	23	20
Bundled	3	2	2	2	2	3	3	3	3	3	-6	8
Unbundled	11	14	21	21	29	35	44	55	66	77	28	21
Service Revenue	2	3	4	2	4	5	6	8	9	11	21	20
Total Factory Revenue	41	72	83	68	88	99	113	134	149	165	21	13
Increase over Prior Year (%)	27	76	16	-19	30	13	14	18	11	10		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (September 1993)

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Table 23
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: Asia
Platform: All Platforms

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	2,237	5,960	9,536	9,122	11,552	15,260	18,450	21,920	25,590	29,010	51	20
Unit Shipments or Seats	2,570	6,469	10,011	9,439	11,864	15,490	18,620	22,040	25,660	29,040	47	20
CPU Installed Base	4,334	10,161	19,264	27,286	36,217	45,940	56,300	68,260	81,500	95,120	70	21
Installed Seats	5,505	11,820	21,341	29,553	38,591	48,230	58,410	70,080	82,980	96,200	63	20
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	128.3	65.1	51.3	50.4	50.7	47.4	44.6	43.0	42.6	42.4	-21	-4
Hardware-Only ASP	11.9	7.7	5.7	7.0	6.1	5.1	4.4	4.0	3.7	3.4	-15	-11
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	87	130	177	189	196	216	229	246	265	285	23	8
CPU Revenue	59	93	131	147	151	169	180	195	211	228	27	9
Terminal Revenue	11	10	6	4	6	5	4	3	2	1	-12	-38
Peripheral Revenue (Turnkey)	18	27	40	38	39	42	45	49	52	56	22	7
Software Revenue	35	43	69	77	96	114	130	149	170	192	29	15
Bundled	28	33	51	54	67	74	81	90	99	110	24	10
Unbundled	6	11	18	22	29	40	49	59	71	82	47	23
Service Revenue	18	22	35	39	40	45	49	54	60	67	22	11
Total Factory Revenue	140	196	281	305	332	375	408	449	495	544	24	10
Increase over Prior Year (%)	36	40	44	9	9	13	9	10	10	10		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (September 1993)

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Table 24
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: Asia
Platform: Technical Workstation

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	401	1,516	2,725	2,974	3,259	3,990	4,670	5,410	6,170	6,950	69	16
Unit Shipments or Seats	401	1,516	2,725	2,974	3,259	3,990	4,670	5,410	6,170	6,950	69	16
CPU Installed Base	548	2,053	4,737	7,563	10,441	13,610	16,920	20,290	23,770	27,400	109	21
Installed Seats	548	2,053	4,737	7,563	10,441	13,610	16,920	20,290	23,770	27,400	109	21
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	155.7	62.7	55.6	58.5	59.9	57.2	54.9	53.3	51.9	50.8	-21	-3
Hardware-Only ASP	19.6	18.3	19.5	15.1	21.4	19.4	17.9	16.8	16.2	15.7	2	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	36	66	107	114	126	144	159	176	192	209	37	11
CPU Revenue	25	48	76	85	94	108	120	132	145	158	39	11
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	11	18	31	29	31	36	39	43	47	51	32	10
Software Revenue	19	23	38	44	65	79	92	107	123	140	37	17
Bundled	16	20	32	36	53	61	70	79	89	99	34	14
Unbundled	2	3	6	9	13	18	22	28	34	41	54	26
Service Revenue	8	10	21	23	27	33	38	43	48	54	36	15
Total Factory Revenue	62	100	165	181	219	256	289	325	364	404	37	13
Increase over Prior Year (%)	173	60	66	10	20	17	13	13	12	11		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (September 1993)

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Table 25
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: Asia
Platform: Host-Dependent

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	97	118	519	466	316	220	120	40	10	0	34	-100
Unit Shipments or Seats	430	627	995	784	628	450	290	160	80	30	10	-46
CPU Installed Base	335	446	945	1,373	1,634	1,780	1,760	1,630	1,370	1,100	49	-8
Installed Seats	1,507	2,105	3,021	3,640	4,009	4,070	3,870	3,450	2,840	2,190	28	-11
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	812.7	650.5	104.5	89.0	80.0	78.1	74.9	72.0	.0	.0	-44	-100
Hardware-Only ASP	156.6	182.5	104.1	230.8	369.5	316.6	290.5	266.6	244.9	226.3	24	-9
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	36	41	41	35	27	19	11	6	3	1	-7	-48
CPU Revenue	20	23	30	26	17	12	7	3	1	0	-3	-52
Terminal Revenue	11	10	6	4	6	5	4	3	2	1	-12	-38
Peripheral Revenue (Turnkey)	5	8	6	5	3	2	1	0	0	0	-11	-68
Software Revenue	10	14	17	14	9	7	4	2	1	0	-3	-47
Bundled	9	10	13	11	6	4	2	1	0	0	-8	-100
Unbundled	1	4	4	4	3	2	2	1	1	0	19	-33
Service Revenue	9	11	12	9	6	5	3	1	1	0	-8	-48
Total Factory Revenue	55	65	70	59	43	30	18	9	4	2	-6	-48
Increase over Prior Year (%)	-21	19	7	-16	-28	-29	-40	-49	-56	-58		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.

Source: Dataquest (September 1993)

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Table 26
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: Asia
Platform: Server

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	NA	NA	NA	230	138	170	190	220	250	290	NA	16
Unit Shipments or Seats	NA	NA	NA	230	138	170	190	220	250	290	NA	16
CPU Installed Base	NA	NA	NA	230	368	520	700	860	1,040	1,180	NA	26
Installed Seats	NA	NA	NA	230	368	520	700	860	1,040	1,180	NA	26
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	NA	NA	NA	63.6	78.2	75.6	72.5	69.5	66.6	63.9	NA	-4
Hardware-Only ASP	NA	NA	NA	42.0	41.2	37.1	34.3	32.3	31.7	30.9	NA	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	NA	NA	NA	11	6	7	8	9	10	10	NA	10
CPU Revenue	NA	NA	NA	10	6	7	7	8	9	9	NA	10
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	NA	NA	NA	0	1	1	1	1	1	1	NA	9
Software Revenue	NA	NA	NA	3	4	4	5	6	7	8	NA	16
Bundled	NA	NA	NA	2	2	2	3	3	3	4	NA	12
Unbundled	NA	NA	NA	1	2	2	2	3	4	4	NA	20
Service Revenue	NA	NA	NA	4	3	4	5	6	6	7	NA	17
Total Factory Revenue	NA	NA	NA	18	13	16	18	20	23	25	NA	14
Increase over Prior Year (%)	NA	NA	NA	NA	-26	21	13	12	12	11		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (September 1993)

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Table 27
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: Asia
Platform: Personal Computer

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	1,740	4,326	6,291	5,451	7,839	10,880	13,470	16,250	19,150	21,770	46	23
Unit Shipments or Seats	1,740	4,326	6,291	5,451	7,839	10,880	13,470	16,250	19,150	21,770	46	23
CPU Installed Base	3,451	7,663	13,583	18,120	23,774	30,030	36,930	45,480	55,330	65,440	62	22
Installed Seats	3,451	7,663	13,583	18,120	23,774	30,030	36,930	45,480	55,330	65,440	62	22
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	27.9	13.5	19.0	17.5	18.2	16.4	14.7	13.9	13.2	12.6	-10	-7
Hardware-Only ASP	5.9	4.5	2.9	3.7	3.3	3.1	2.8	2.7	2.5	2.4	-14	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	16	23	29	30	37	45	50	56	60	64	24	11
CPU Revenue	14	21	25	26	33	42	46	52	56	60	25	13
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	2	1	4	4	4	4	4	4	4	4	14	-1
Software Revenue	6	7	14	15	18	24	29	34	39	44	33	19
Bundled	3	3	6	6	6	6	7	7	7	7	17	3
Unbundled	3	4	8	8	12	18	22	27	32	37	48	25
Service Revenue	1	1	2	3	3	3	4	5	5	6	33	17
Total Factory Revenue	22	30	45	47	58	73	83	94	104	113	27	14
Increase over Prior Year (%)	116	37	48	4	23	26	14	14	11	9		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (September 1993)

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Table 28
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: Rest of World
Platform: All Platforms

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	448	1,183	1,962	3,293	5,630	6,680	8,040	9,890	12,160	14,460	88	21
Unit Shipments or Seats	569	1,267	2,066	3,385	5,664	6,690	8,040	9,890	12,160	14,460	78	21
CPU Installed Base	1,288	2,417	4,246	7,234	12,254	17,510	23,070	29,030	35,880	43,530	76	29
Installed Seats	1,796	2,992	4,892	7,909	12,874	18,020	23,460	29,320	36,070	43,630	64	28
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	90.8	80.4	65.5	60.1	46.8	44.3	42.5	41.2	40.2	39.4	-15	-3
Hardware-Only ASP	16.8	9.1	6.7	5.5	4.1	3.5	3.2	3.0	2.8	2.7	-30	-8
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	16	27	28	44	52	54	59	66	74	83	33	10
CPU Revenue	12	22	24	39	45	48	53	59	66	74	38	10
Terminal Revenue	3	1	2	2	1	0	0	0	0	0	-33	-100
Peripheral Revenue (Turnkey)	1	4	3	4	6	6	6	7	8	9	42	9
Software Revenue	8	19	23	31	38	43	50	58	68	80	46	16
Bundled	5	7	6	11	15	17	19	21	24	27	34	12
Unbundled	4	12	17	20	23	26	31	37	45	53	57	18
Service Revenue	6	11	11	19	22	24	27	30	34	39	39	12
Total Factory Revenue	31	57	62	94	112	121	135	154	177	202	38	13
Increase over Prior Year (%)	6	85	8	53	19	8	12	14	15	14		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (September 1993)

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Table 29
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: Rest of World
Platform: Technical Workstation

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	162	331	409	710	1,033	1,190	1,370	1,580	1,810	2,050	59	15
Unit Shipments or Seats	162	331	409	710	1,033	1,190	1,370	1,580	1,810	2,050	59	15
CPU Installed Base	467	779	1,151	1,769	2,677	3,600	4,640	5,710	6,870	8,030	55	25
Installed Seats	467	779	1,151	1,769	2,677	3,600	4,640	5,710	6,870	8,030	55	25
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	64.7	70.8	63.8	56.8	43.9	41.9	40.2	39.0	38.0	37.2	-9	-3
Hardware-Only ASP	129.0	16.2	16.3	12.4	15.1	13.7	12.6	11.9	11.4	11.1	-42	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	8	16	16	24	29	31	34	37	40	44	37	9
CPU Revenue	7	13	14	20	24	26	28	31	34	37	35	9
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	1	3	2	4	4	5	5	6	6	7	54	9
Software Revenue	4	13	15	19	22	25	29	33	39	45	55	15
Bundled	2	5	5	8	12	13	15	17	19	21	48	12
Unbundled	1	7	10	11	10	12	14	17	20	24	65	19
Service Revenue	3	7	8	12	16	17	19	22	25	28	49	13
Total Factory Revenue	15	36	39	55	66	73	82	92	104	117	45	12
Increase over Prior Year (%)	118	138	9	40	20	11	12	13	13	13		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (September 1993)

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Table 30
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: Rest of World
Platform: Host-Dependent

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	18	30	58	20	15	0	0	0	0	0	-4	-100
Unit Shipments or Seats	138	115	161	112	50	10	0	0	0	0	-22	-100
CPU Installed Base	92	118	168	176	174	160	140	120	90	70	17	-17
Installed Seats	600	693	814	851	794	670	540	410	280	170	7	-27
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	355.7	306.8	136.3	146.9	146.4	139.8	134.1	128.5	123.1	118.2	-20	-4
Hardware-Only ASP	6,600.0	199.3	110.2	273.9	172.9	157.4	144.5	132.5	121.3	111.6	-60	-8
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	7	6	6	4	2	1	0	0	0	0	-24	-100
CPU Revenue	3	4	4	2	2	0	0	0	0	0	-17	-100
Terminal Revenue	3	1	2	2	1	0	0	0	0	0	-33	-100
Peripheral Revenue (Turnkey)	1	1	0	0	0	0	0	0	0	0	-28	-100
Software Revenue	3	3	4	2	1	0	0	0	0	0	-22	-100
Bundled	2	1	1	0	0	0	0	0	0	0	-45	-100
Unbundled	1	2	3	2	1	0	0	0	0	0	-3	-100
Service Revenue	3	3	2	1	1	0	0	0	0	0	-18	-100
Total Factory Revenue	13	13	12	8	5	1	0	0	0	0	-22	-100
Increase over Prior Year (%)	-36	1	-2	-39	-40	-71	-83	-100	NA	NA		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (September 1993)

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Table 31
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: Rest of World
Platform: Server

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	NA	NA	NA	166	160	180	210	250	290	340	NA	16
Unit Shipments or Seats	NA	NA	NA	166	160	180	210	250	290	340	NA	16
CPU Installed Base	NA	NA	NA	166	326	500	690	880	1,070	1,250	NA	31
Installed Seats	NA	NA	NA	166	326	500	690	880	1,070	1,250	NA	31
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	NA	NA	NA	76.7	71.7	68.5	65.7	62.9	60.3	57.9	NA	-4
Hardware-Only ASP	NA	NA	NA	24.2	32.2	29.3	26.9	25.6	24.8	24.3	NA	-5
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	NA	NA	NA	8	7	8	8	9	10	11	NA	10
CPU Revenue	NA	NA	NA	8	6	7	7	8	9	10	NA	10
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	NA	NA	NA	0	1	1	1	1	1	1	NA	10
Software Revenue	NA	NA	NA	4	5	5	6	7	8	9	NA	15
Bundled	NA	NA	NA	2	3	3	4	4	5	5	NA	13
Unbundled	NA	NA	NA	2	2	2	2	3	3	4	NA	17
Service Revenue	NA	NA	NA	4	4	4	5	5	6	7	NA	13
Total Factory Revenue	NA	NA	NA	16	16	17	19	21	24	28	NA	12
Increase over Prior Year (%)	NA	NA	NA	NA	-2	10	11	13	12	15		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (September 1993)

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Table 32
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: Rest of World
Platform: Personal Computer

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	269	822	1,496	2,396	4,422	5,300	6,460	8,060	10,070	12,070	101	22
Unit Shipments or Seats	269	822	1,496	2,396	4,422	5,300	6,460	8,060	10,070	12,070	101	22
CPU Installed Base	729	1,521	2,927	5,123	9,077	13,250	17,590	22,330	27,850	34,180	88	30
Installed Seats	729	1,521	2,927	5,123	9,077	13,250	17,590	22,330	27,850	34,180	88	30
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	35.1	64.1	24.1	22.8	14.2	12.8	11.5	10.8	10.3	9.9	-20	-7
Hardware-Only ASP	5.9	4.9	3.5	3.4	3.1	2.9	2.6	2.5	2.3	2.2	-15	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	2	5	6	9	14	15	17	20	24	27	68	15
CPU Revenue	2	4	6	8	13	15	17	19	23	26	68	15
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	0	0	0	0	0	0	0	1	1	1	62	14
Software Revenue	1	3	3	6	10	12	15	18	21	26	68	20
Bundled	0	0	0	0	0	0	0	0	0	0	29	-7
Unbundled	1	3	3	6	10	12	15	18	21	26	70	21
Service Revenue	0	1	1	1	2	2	2	3	3	4	78	23
Total Factory Revenue	3	8	10	15	25	29	34	41	49	57	68	18
Increase over Prior Year (%)	15	166	16	60	64	16	17	18	19	18		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (September 1993)

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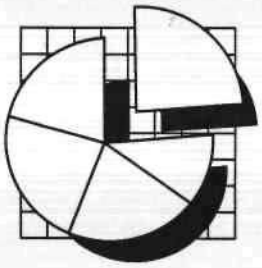
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AEC Applications Worldwide Forecast Update



Market Statistics

1993

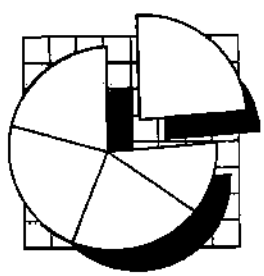
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Note: All tables show estimated data.

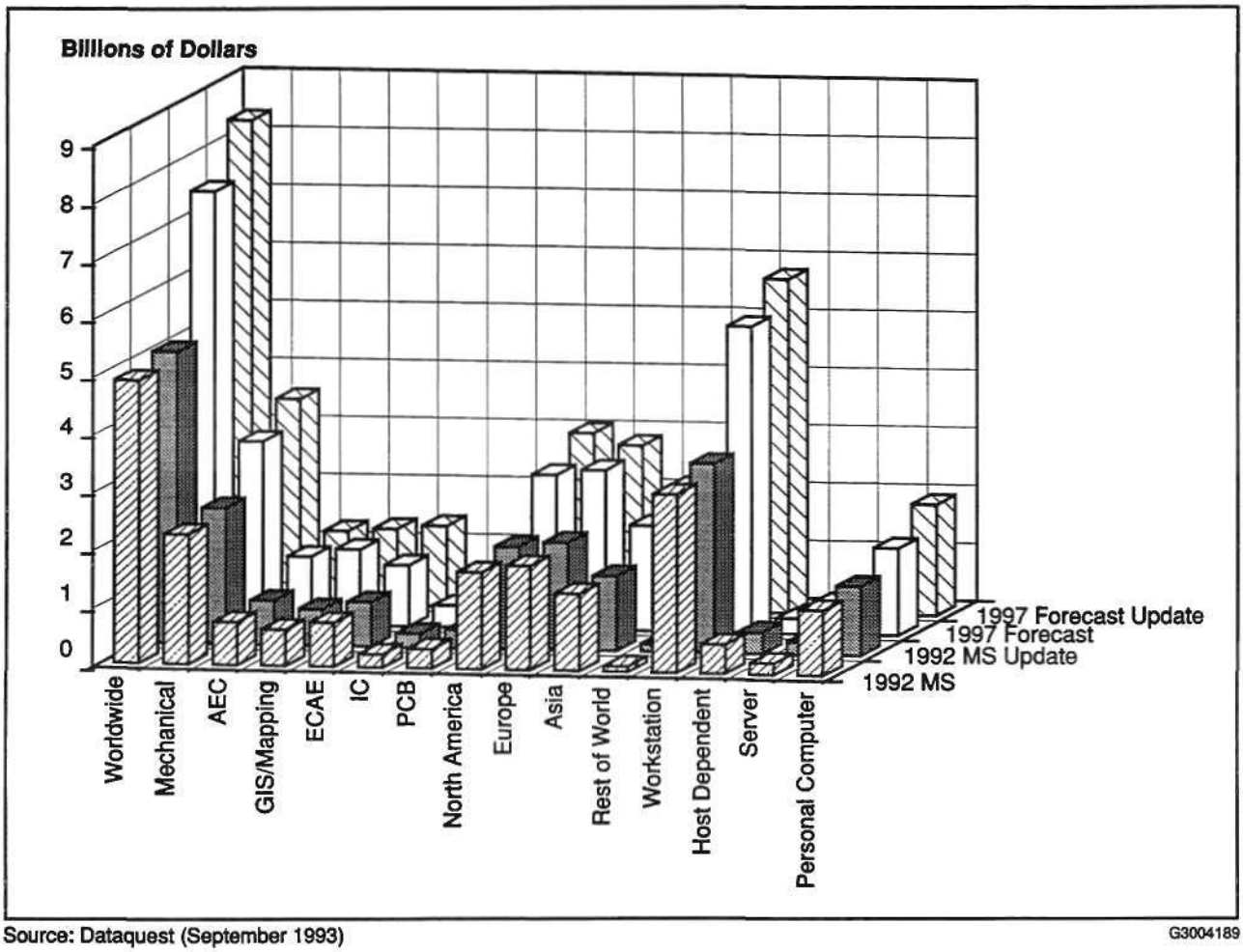
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AEC Applications Worldwide Forecast Update

This forecast update uses the market share update as the basis of a new forecast, incorporating any new information since May, including currency changes since year-end 1992. Additionally, with greater focus on country level data during the market share update process, this forecast update provides forecasts by country in Europe and Asia.

Figure 1 shows change from the 1993 forecast to this update in growth of software revenue by application, region, platform, and the total market. Table 1 provides the corresponding revenue figures and growth rates. This additional growth is divided somewhat equally among the applications, is concentrated in Asia because of currency issues, and resides primarily in the personal computer platform.

Figure 1
Software Forecast Update versus Forecast, 1992-1997



Source: Dataquest (September 1993)

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Table 1
Software Revenue Forecast Update versus Forecast

	Forecast Update 1992-1993 Change (%)	Forecast Update 1992-1997 CAGR (%)	May Forecast 1992-1993 Change (%)	May Forecast 1992-1997 CAGR (%)	Market Share Update 1992 ($M)	Forecast Update 1993 ($M)	Forecast Update 1997 ($M)	Market Share 1992 ($M)	May Forecast 1993 ($M)	May Forecast 1997 ($M)
Worldwide	12.0	10.6	9.6	8.9	5,036	5,642	8,353	4,885	5,352	7,467
Applications:										
Mechanical	12.3	8.7	10.6	7.2	2,341	2,628	3,548	2,233	2,469	3,154
AEC	11.8	11.0	9.0	10.0	758	847	1,275	730	796	1,178
GIS/Mapping	14.7	16.0	13.8	16.4	629	721	1,323	616	700	1,317
ECAE	12.7	12.7	8.0	7.1	764	861	1,390	752	812	1,057
IC	9.2	11.3	7.8	10.9	233	254	398	225	243	378
PCB	5.8	6.0	0.7	3.1	312	331	418	330	332	383
Regions:										
North America	13.2	11.5	12.0	9.8	1,767	2,000	3,041	1,669	1,869	2,659
Europe	7.7	9.0	10.9	9.0	1,848	1,990	2,840	1,793	1,988	2,753
Asia	15.1	10.6	3.8	6.4	1,288	1,483	2,134	1,327	1,378	1,813
Rest of World	27.2	20.6	22.8	20.3	132	168	338	96	118	242
Platforms:										
Workstation	13.8	12.1	13.5	11.5	3,256	3,705	5,773	3,072	3,486	5,293
Host Dependent	-19.1	-11.8	-19.2	-12.1	369	299	196	500	404	262
Server	22.8	16.8	20.3	15.5	216	265	470	197	237	405
Personal Computer	14.8	9.9	9.7	6.2	1,195	1,373	1,914	1,117	1,225	1,508

Source: Dataquest (August 1993)

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Currency Changes

Worldwide revenue estimates include data from many countries, each of which has a different and fluctuating exchange rate. Estimates of non-U.S. revenue are based on the average exchange rate for a given year, calculated as the simple arithmetic mean of the 12 average monthly values. Dataquest does not forecast exchange rates per se; however, we do forecast with the best information available. Exchange rates, for the purposes of forecasting, are calculated assuming the June 1993 exchange rate will apply throughout all future months of the year. Table 2 provides the resulting exchange rates for each European and Asian country.

Given the bleak economic climate, it is surprising that we are forecasting increased growth from our earlier forecast. The main source of this growth comes from the depreciation of the dollar against the yen of 12 percent. With 96 percent of the Asian revenue reported in Japan, the yen dominates that region's revenue figures. Table 3 shows dollar values with equivalent yen values of total factory revenue for Asia for 1992 and 1993, with growth rates, by application, using the exchange rates as shown in Table 2.

Table 2
Foreign Currency per U.S. Dollar

	Country	Currency	Actual 1992	Current 1993	Appreciation (U.S.$)
Europe	United Kingdom	Pound	0.5686	0.6606	16.2
	France	Franc	5.2712	5.5192	4.7
	Germany	Mark	1.5554	1.6334	5.0
	Italy	Lira	1,227.75	1,517.07	23.6
	Spain	Peseta	101.90	123.38	21.1
	Denmark	Krone	6.0153	6.2751	4.3
	Finland	Markka	4.4507	5.5955	25.7
	Norway	Krone	6.1824	6.9298	12.1
	Sweden	Krona	5.8105	7.4584	28.4
	Belgium	Franc	32.02	33.59	4.9
	Netherlands	Guilder	1.7512	1.8073	3.2
	Austria	Schilling	10.95	11.49	4.9
	Switzerland	Franc	1.3976	1.4727	5.4
Asia	Japan	Yen	126.45	111.23	-12.0
	Hong Kong	Dollar	7.7401	7.7327	-0.1
	Korea	Won	782.63	799.43	2.1
	Singapore	Dollar	1.6285	1.6218	-0.4
	Taiwan	Dollar	24.93	25.91	3.9
	China	Renminbi	5.5082	5.7441	4.3

Source: Dataquest (August 1993)

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Table 3
Total Factory Revenue in Asia, Dollars as Compared to Yen
(1992 Exchange Rate of U.S.$1/¥126.45; 1993 Exchange Rate of U.S.$1/¥111.23)

	1992 ($M)	1993 ($M)	Change (%)	1992 (¥M)	1993 (¥M)	Change (%)
Mechanical	2,180	2,384	9.4	275,647	265,178	-3.8
AEC	577	618	7.2	72,938	68,780	-5.7
GIS	332	375	12.8	42,016	41,683	-0.8
ECAE	508	585	15.2	64,213	65,096	1.4
IC Layout	194	208	7.5	24,491	23,154	-5.5
PCB	372	380	2.4	46,971	42,305	-9.9
All Applications	4,162	4,551	9.3	526,275	506,197	-3.8

Source: Dataquest (August 1993)

In contrast, the dollar has appreciated against all other European currencies. This forecasting has shown a corresponding decrease in the growth of the European CAD/CAM/CAE/GIS markets as compared to the earlier forecast.

Database Changes

Dataquest intends to freeze the CAD/CAM/CAE/GIS database following the market share update. However, careful scrutiny of European numbers as part of the forecasting process uncovered some discrepancies at the country and application level. Adjustments were made to IBM, Hewlett-Packard, Digital, and Intergraph. In addition, Intergraph was underrepresented in the mechanical market to an alarming extent. Its data was fixed, with a corresponding decrease in service revenue and GIS/Mapping software revenue, moving Intergraph from No. 15 to No. 9 in mechanical software revenue. Finally, ESRI was updated to reflect higher total revenue, most of which was for service. The result is that Intergraph and ESRI are now separated by $8 million in software revenue in the GIS market. There will be no more changes to this database until we begin our survey of 1993 data.

Other Information

Implicit in any forecasting are the GDP/GNP growth rates (see Table 4). We also track quarterly revenue of public companies and corresponding growth rates from previous quarters for a general view of the health of the industries.

This document contains Dataquest's detailed forecast information for the CAD/CAM/CAE and GIS industry. Included are the following:

- Five-year historical data
- Five-year forecast data

More detailed data is available through our client inquiry service, which can provide custom analysis of the mutlidimensional database.

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Table 4
GDP/GNP Growth Rate Percentages
(Constant Prices and Exchange Rates, Local Currencies)

		1992	1993	1994	1995	1996
North America	Canada	0.7	3.1	3.8	3.5	3.0
	United States	2.1	2.6	2.9	2.3	2.5
Europe	United Kingdom	-0.5	1.7	2.7	3.2	3.0
	France	1.1	-1.0	1.3	3.1	3.3
	Germany*	1.4	-1.5	1.2	2.8	3.5
	Italy	0.9	0.3	1.5	1.9	2.3
	Spain	1.0	-0.7	1.7	2.9	3.6
	Denmark	1.2	0.6	2.1	2.3	3.5
	Finland	-3.6	-0.2	1.8	2.5	3.2
	Norway	2.9	1.5	2.4	2.6	2.7
	Sweden	-1.8	-1.6	1.4	2.0	2.5
	Belgium	0.8	-0.5	1.8	2.7	3.1
	Netherlands	1.5	-0.4	1.5	2.9	2.9
	Austria	1.5	-0.1	2.0	3.7	3.9
	Switzerland	-0.6	0.2	1.5	2.1	2.4
Asia	Japan	1.5	1.3	2.7	3.6	4.1
	Korea	4.8	6.0	7.0	7.0	7.0
	Taiwan	6.1	6.5	7.0	7.0	7.0
	Singapore	5.8	6.5	6.5	6.5	6.5
	Hong Kong	5.0	5.5	5.5	5.5	5.5
	China	11.5	10.0	12.5	11.5	10.8

*Germany includes the former East Germany.
Source: The Dun & Bradstreet Corporation

Regional Forecast Assumptions

Table 5 provides the CAD/CAM/CAE/GIS forecast for total factory revenue, software revenue, and units. Following are the main worldwide forces driving this forecast.

Worldwide Forecast Drivers

The worldwide CAD/CAM/CAE/GIS market will maintain steady growth during the next five years. Figure 2 shows the forecast of hardware, software, and service revenue worldwide and by region, and Figure 3 shows the worldwide forecast by platform.

The main forces driving the CAD/CAM/CAE/GIS worldwide forecast are described in the following paragraphs.

Macroeconomy

The recovery, with its inherent renewed optimism after a worldwide recession and the resultant increased capital spending, will fuel growth

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Table 5
CAD/CAM/CAE/GIS Forecast by Region
(Revenue in Millions of Dollars; Actual Shipments)

	1992	1993	1994	1995	1996	1997	CAGR (%) 1992-1997
Worldwide							
Total Factory Revenue	15,723	16,530	17,500	18,640	19,770	20,860	5.8
Software Revenue	5,036	5,640	6,320	7,040	7,710	8,350	10.6
Unit Shipments	739,511	857,200	972,100	1,072,700	1,155,000	1,215,900	10.5
North America							
Total Factory Revenue	5,437	5,680	6,100	6,550	7,000	7,520	6.7
Software Revenue	1,767	2,000	2,270	2,540	2,790	3,040	11.5
Unit Shipments	291,743	336,300	381,800	420,700	456,600	487,100	10.8
Europe							
Total Factory Revenue	5,736	5,850	6,060	6,390	6,760	7,120	4.4
Software Revenue	1,848	1,990	2,160	2,380	2,610	2,840	9.0
Unit Shipments	245,054	271,900	304,600	337,000	359,700	374,800	8.9
Asia							
Total Factory Revenue	4,162	4,550	4,840	5,110	5,300	5,460	5.6
Software Revenue	1,288	1,480	1,680	1,870	2,020	2,130	10.6
Unit Shipments	182,151	224,000	255,300	277,900	294,800	303,500	10.7
Rest of World							
Total Factory Revenue	388	450	530	600	680	760	14.3
Software Revenue	132	170	210	250	290	340	20.6
Unit Shipments	20,563	25,000	30,400	37,200	43,900	50,600	19.7

Source: Dataquest (August 1993)

gradually beginning in the North American, U.K., and Asian countries other than Japan.

Technology

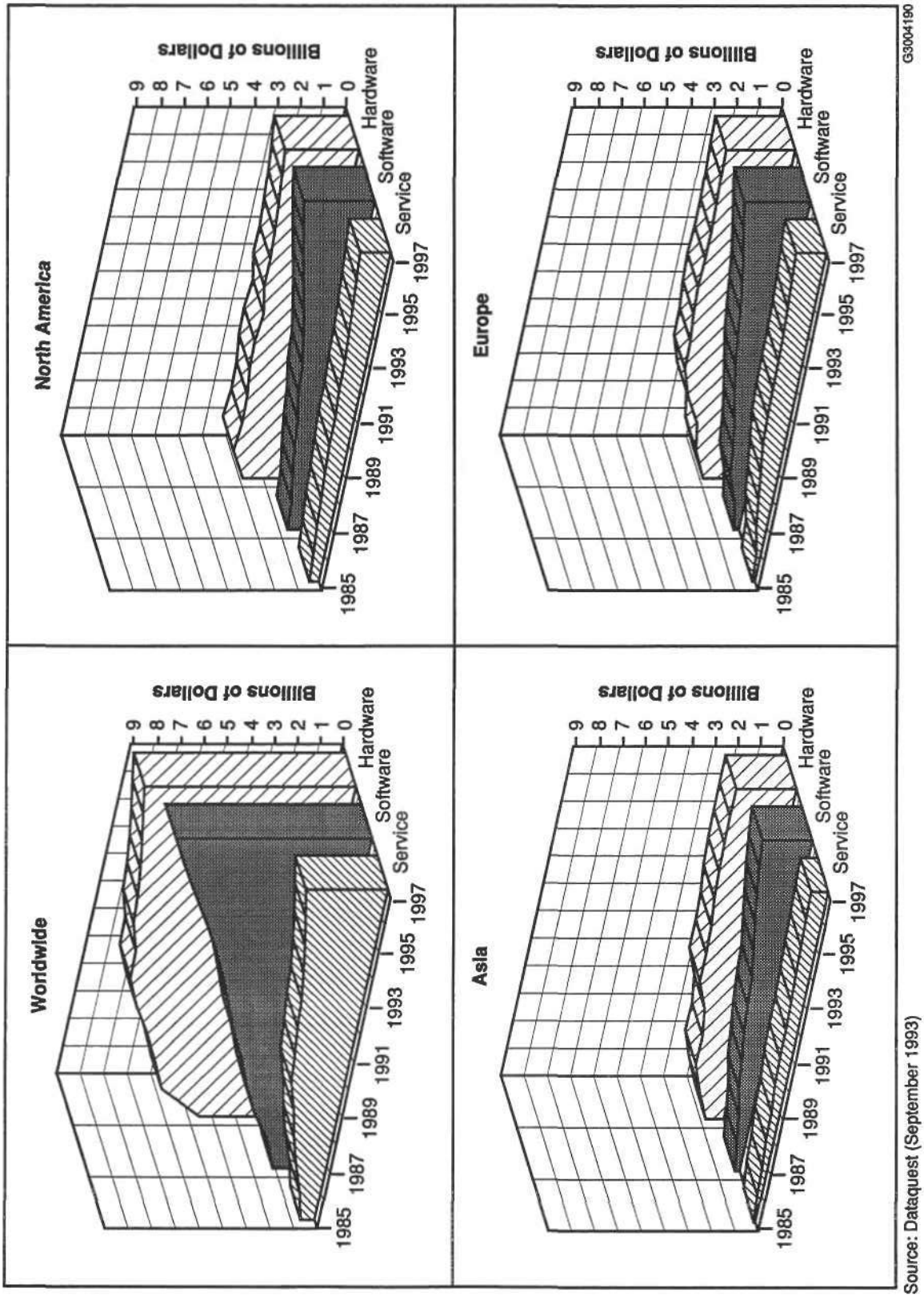
Computing performance will continue to improve at an exponential rate in the foreseeable future. The Dataquest Technical Computing group has forecast the growth in millions of instructions per second (mips) shipments: the total mips shipped in history through 1992 will be matched by the shipments in 1993. In other words, the total mips shipped will double in 1993, almost double again in 1994, and double again in 1995. This enabling resource will fuel the next-generation software tools focused on integrated solutions at the enterprise level.

Indispensability

As the complexity of the design, the need to share information, and the need to store information electronically increase, the benefits of automation improve dramatically and the level of indispensability rises. This, coupled with market pressures to produce higher quality and to reduce production cycles, is making CAD/CAM/CAE/GIS a necessity.

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Figure 2
Worldwide and Regional Revenue Forecast, All Applications and All Platforms



Source: Dataquest (September 1993)

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Figure 3
Worldwide Revenue Forecast, by Platform, All Applications

Source: Dataquest (September 1993)

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Late Buyers

A significant pool of untapped users still exists in mechanical, AEC, and GIS applications, driving additional growth. These conservative buyers will favor market leaders and installed systems for compatibility. For vendors, therefore, the value of high market share and customer satisfaction will increase.

Desktop Dominance

The turf war for desktop dominance is building steam with the introduction of the Pentium chip and Windows NT, which will fight to take market share from the higher-priced, multiple UNIX operating systems with RISC technology. In addition, the decline of host-dependent systems is continuing with replacements going to networked, desktop systems. Vendors, whose business models depend upon high-priced workstations, are threatened by these powerful new PCs. At the same time, the replacement of host systems provides them with opportunity for growth.

Unbundling of Software

With software vendors porting to multiple platforms, software is no longer the hinge upon which hardware swings. The market is quickly moving from proprietary to open systems, resulting in a shift from bundled to unbundled software (see Table 6).

Replacement Market

The replacement market is gaining importance as replacement seats exceed 50 percent of unit sales in 1993 (see Figure 4). This saturation implies that many parallel manual systems can be eliminated and new applications developed, knowing that everyone in a company needing access to the engineering database can have it in electronic format. The savings potential is tremendous. This also implies a growing sophistication in buyers who are more informed of the strategic importance of this technology.

Software

With technological advances, growing sophistication of users, and competitive pressures, the demand for software with greater ease of use, flexibility, and interoperability is growing. This demand is driving the growth in business alliances between small innovative software niche players and major software vendors with resources to sell to the new and replacement markets.

North American Forecast Drivers

North American CAD/CAM/CAE/GIS total revenue grew a robust 11.3 percent to $5.4 billion in 1992 and is forecast to grow at a 6.7 percent compound annual growth rate (CAGR) through 1997 to $7.5 billion. The following paragraphs describe the main factors driving the North American forecast.

Economy

According to The Dun & Bradstreet Corporation's August 1993 *Economic Overview,* the growth of the economy is led by capital spending and by trade, as the economies of U.S. trading partners bottom out. Information technology growth for the first two quarters of 1993 is an annualized

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Table 6
CAD/CAM/CAE/GIS Software Revenue Forecast, by Application
(Millions of Dollars)

	1992	1993	1994	1995	1996	1997	CAGR (%) 1992-1997
All Applications							
Software Revenue	5,036	5,640	6,320	7,040	7,710	8,350	10.6
Bundled Software Revenue	1,939	1,960	2,000	2,040	2,090	2,120	1.8
Unbundled Software Revenue	3,097	3,680	4,320	4,990	5,620	6,230	15.0
Mechanical							
Software Revenue	2,341	2,630	2,880	3,140	3,360	3,550	8.7
Bundled Software Revenue	1,127	1,180	1,200	1,230	1,250	1,260	2.2
Unbundled Software Revenue	1,214	1,450	1,680	1,910	2,110	2,290	13.6
AEC							
Software Revenue	758	850	950	1,050	1,160	1,280	11.0
Bundled Software Revenue	300	310	330	340	360	380	4.9
Unbundled Software Revenue	458	540	620	710	800	900	14.3
GIS/Mapping							
16.0							
Bundled Software Revenue	267	290	320	340	370	400	8.6
Unbundled Software Revenue	362	430	520	640	770	920	20.5
Electronic CAE							
Software Revenue	764	860	1,010	1,160	1,280	1,390	12.7
Bundled Software Revenue	109	90	80	70	60	50	-13.0
Unbundled Software Revenue	655	770	930	1,090	1,220	1,340	15.3
IC Layout							
Software Revenue	233	260	290	320	360	400	11.3
Bundled Software Revenue	32	20	10	10	10	5	-28.9
Unbundled Software Revenue	201	240	280	310	350	395	14.3
PCB/Hybrid/MCM							
Software Revenue	312	330	350	380	400	420	6.0
Bundled Software Revenue	105	80	50	40	30	20	-26.3
Unbundled Software Revenue	208	250	300	340	370	400	13.7

Source: Dataquest (August 1993)

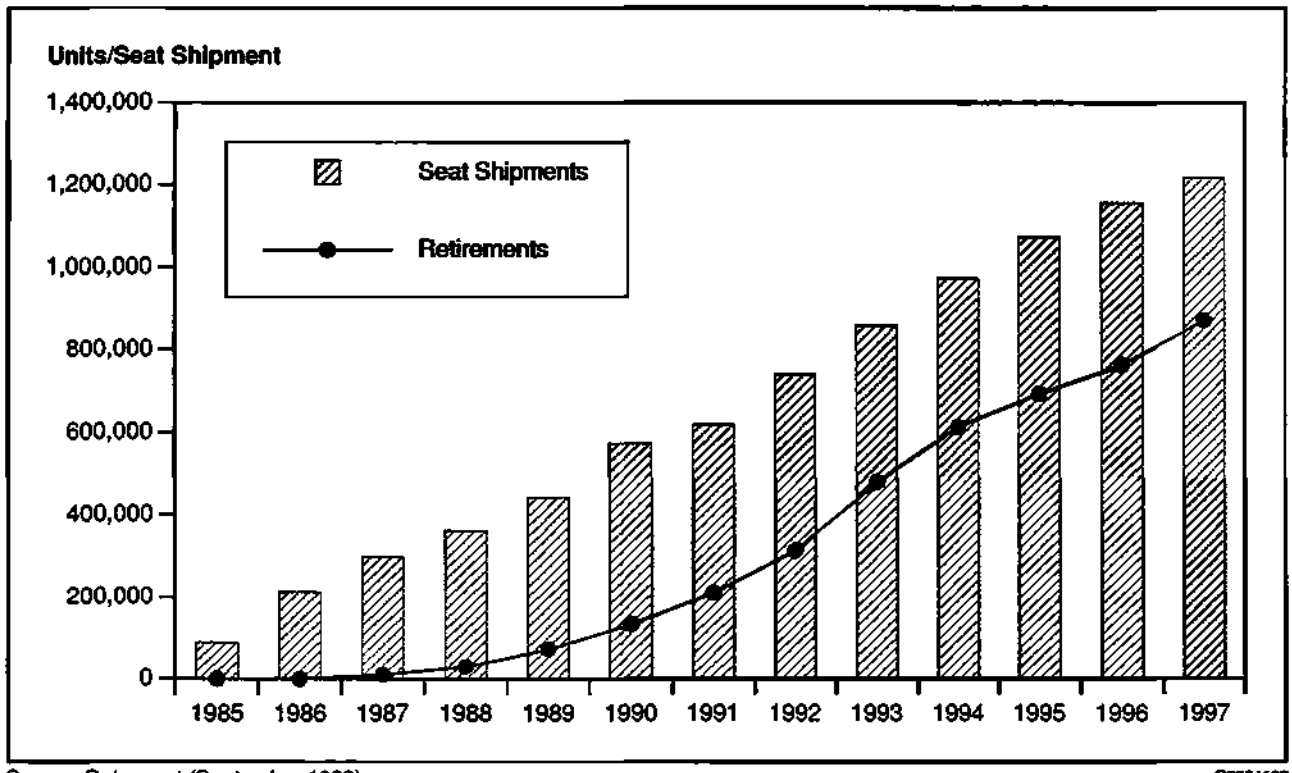
13 percent, down from the 22 percent growth of the previous four quarters. The July 1993 survey of 1,000 manufacturers nationwide indicates that reduced output has resulted in a lowering of expectations, which should continue into the third quarter.

Cuts in Defense Spending

Cuts in defense spending will tend to soften the market. However, a focus on fewer, more sophisticated weapons systems will promote use of the latest design optimization and simulation capabilities.

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Figure 4
Unit Shipments versus Retirements–History and Forecast



Source: Dataquest (September 1993) G3004192

European Forecast Drivers

The European market grew 3.6 percent to $5.7 billion in total revenue in 1992. This largest region is forecast to be the slowest growing at a mere 1.9 percent for 1993 to $5.8 billion, with a 1992 to 1997 CAGR of 4.4 percent. The major factor behind this slowing growth is the sluggish German economy, which accounts for 35 percent of the European market. A slowdown in Germany rippled through all other European industries. Table 7 provides the forecast software CAGR for 1992 to 1997 for each country for each application in Europe.

The following paragraphs describe the main factors driving the European forecast.

Economy

Hopes abound for a recovery in the second half of 1994, with the United Kingdom and the Netherlands already leading the way. Governments are struggling to contain mounting budget deficits, particularly in the United Kingdom and in Germany. Manufacturing industries are being affected by a decline in consumer spending because of high unemployment throughout Europe. Massive budget deficits will continue to influence government public spending.

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Table 7
Compound Annual Growth Rate, 1992-1997, Software Revenue (Percent)

	Mechanical	AEC	GIS	ECAE	IC	PCB	All
United Kingdom	6.0	5.2	11.8	4.6	0.9	-0.7	6.5
France	6.3	8.4	18.5	3.5	4.6	0.0	7.0
Germany	7.3	10.5	17.0	5.0	3.9	2.7	8.7
Italy	9.6	7.5	10.4	6.4	1.9	3.2	9.0
Benelux	7.2	10.0	18.4	4.1	3.7	4.0	9.3
Scandinavia	9.0	8.9	14.3	4.8	7.1	1.5	9.1
Spain	6.5	9.1	15.5	5.1	3.7	-0.5	9.0
Rest of Europe	16.5	13.9	20.2	8.8	-1.7	0.3	14.7
Europe	8.4	9.8	15.6	5.1	2.7	1.4	9.0

Source: Dataquest (August 1993)

Growth

There are a few bright spots. The European railway industry is undergoing a renaissance. Major public works projects are planned in the Netherlands and Norway. Denmark is the beneficiary of the building in the eastern Germany area. Defense spending is refocusing from the personnel needs of the cold war to the equipment needs for desert warfare, urban terrorism, and rapid response capabilities. This, with the growth of the telecommunications industry, bodes well for EDA spending.

Currency

The appreciation of the dollar against the European currencies places additional pressure on dollar growth rates for the European community. Just as the dollar growth of the Asian market is strikingly higher than growth of the yen, the dollar growth of the European market is less than the growth in local currency. Additionally, this conversion ratio forces U.S. products to sell at reduced dollar prices to remain competitive with the European products, resulting in less revenue for U.S. vendors.

Asian Forecast Drivers

The Asian market grew 2.9 percent to $4.2 billion in total revenue for 1992. This represents a decrease of 4.3 percent on a yen basis. With the further depreciation of the dollar against the yen thus far in 1993, total revenue is forecast to grow 9.2 percent to $4.5 billion, which is a decrease of 3.9 percent on the yen. The following paragraphs describe the main factors driving the Asian forecast.

Economy

After a hopeful but false recovery during the first quarter of 1993, the Japanese economy has once again taken a nosedive. According to a MITI survey, Japanese industry plans to cut capital spending for a second straight fiscal year (*Nikkei Weekly*, June 7, 1993). The survey also indicated that capital spending growth should return during the first quarter of calendar 1994.

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Currency

Just as the appreciation of the dollar against the ECU causes pricing pressure on U.S. goods in Europe, the even greater depreciation of the dollar against the yen causes pricing pressure on Japanese goods in the United States. This currency volatility creates a cauldron of price competitiveness in the Japanese markets, with U.S. software and hardware able to provide high profits at low prices relative to the Japanese competitors.

Competitive Model Change

Japanese CAD/CAM/CAE/GIS users are shifting from the large, general-purpose, computer systems to the smaller workstations and personal computers. In response, major Japanese computer manufacturers, no longer the one-stop shop, are joining forces with foreign computer companies to provide the multiple solutions that are being demanded, adding to the already complex relationships among Japanese companies.

Developing Asian Countries

Although the cheap labor of China, Vietnam, and other developing Asian countries is fueling enormous growth in manufacturing, the lack of experienced and highly educated engineers and managers prevents a corresponding growth in the CAD/CAM/CAE/GIS industries in these countries. The design function still resides in Japan, North America, and Europe.

Personal Computer

The Japanese PC platform has been a small part of the CAD/CAM/CAE/GIS market. The introduction of DOS/V and Windows NT will be generating interest in this low-cost solution, especially with the small, late buyers.

Virtual Reality

Japan is creating tools for virtual reality that will eventually lead to the development of new technology suitable to enhance CAD/CAM/CAE/GIS.

Application Forecast Assumptions

The expected growth in the next three or four years in AEC, GIS, ECAE, and IC applications is adding significantly to the total growth of the industry and is exceeding growth forecasts for mechanical and PCB applications. Market penetration, new application development, and shifting trends in average selling prices are all factors in this shift in total market application mix (see Figures 5 and 6).

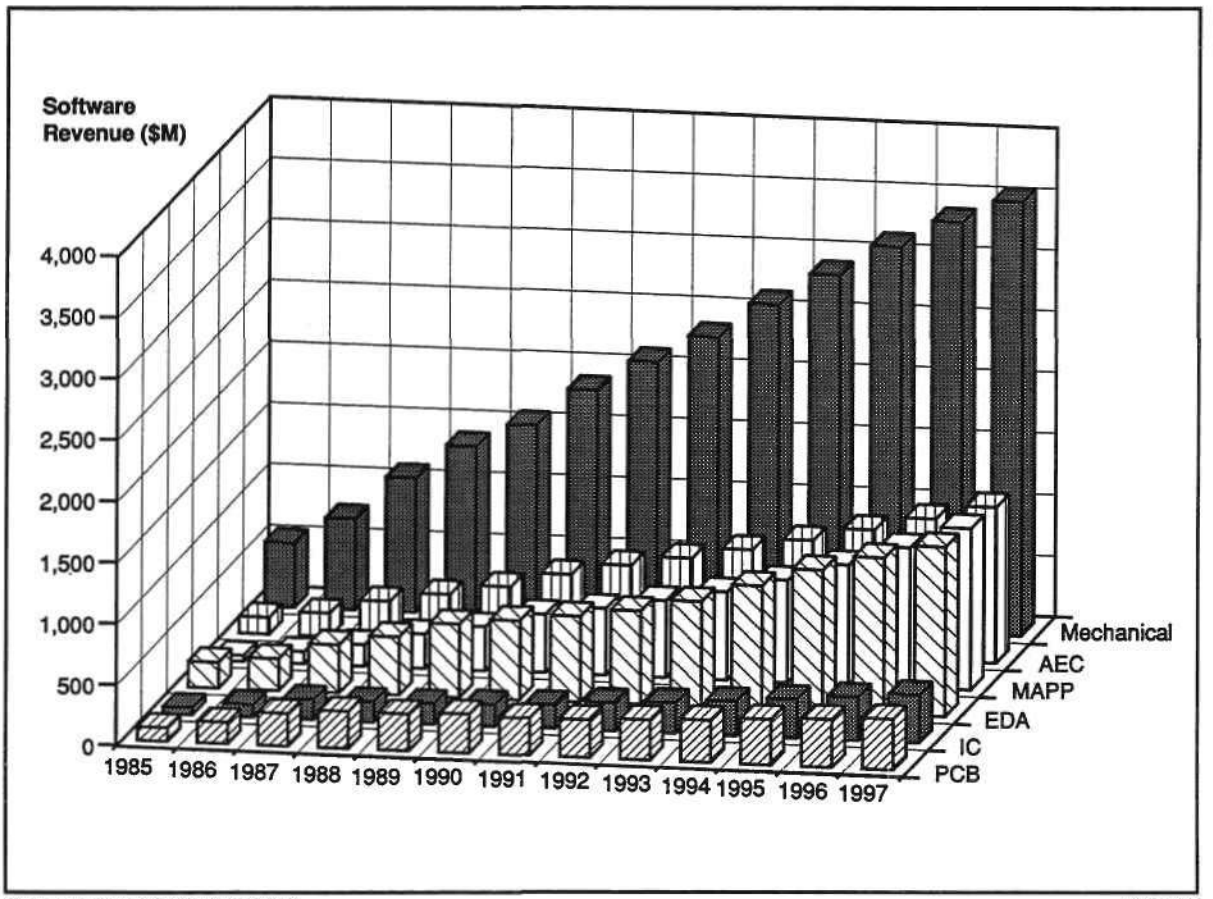
Mechanical Forecast Assumptions

The mechanical application area is the largest of the CAD/CAM/CAE/GIS market with 46 percent share of software revenue, and a software revenue growth of 12.3 percent forecast for 1993. The main issues driving the mechanical forecast are as follows:

- Software price—Dataquest expects software prices to stabilize or increase slightly for leading products. The average value of software shipped per seat has increased slowly. In 1987, total software revenue

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Figure 5
Worldwide Software Revenue Forecast by Application



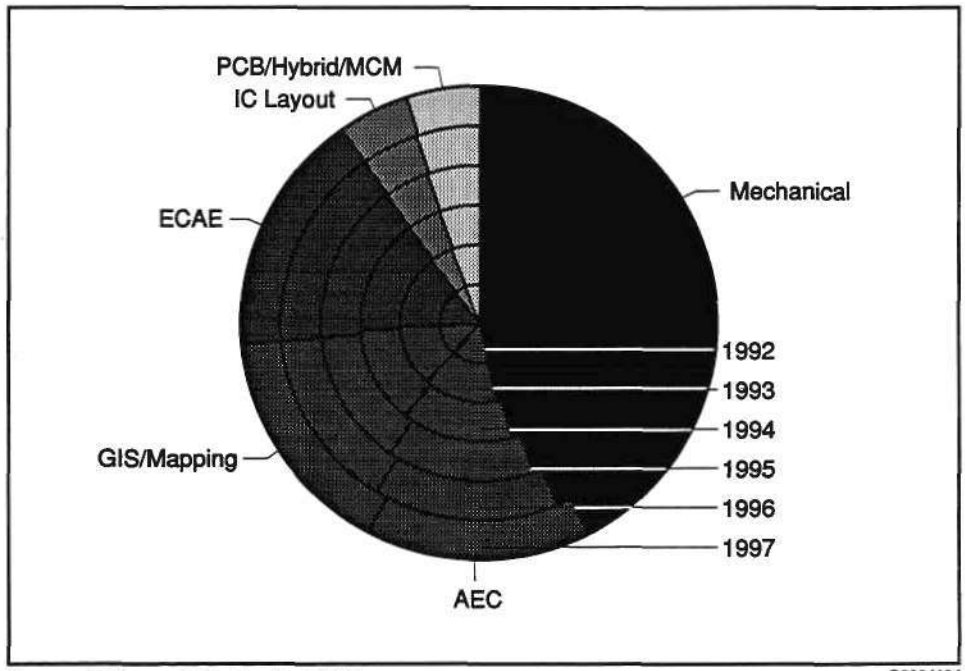
Source: Dataquest (August 1993) G3004193

divided by total number of seats shipped was $6,740. The average value has risen to $7,390 in 1992. Corresponding numbers in 1992 for technical workstation-based software are $19,338; $2,300 for the PC; and $11,544 for host-based seats. Leading vendors on all platforms have been raising prices directly or indirectly with new pricing structures for network licensing or site licensing. Microsoft's Windows NT is also expected to affect software prices, with PC vendors trying to raise prices, and workstation vendors possibly lowering prices as applications are ported to NT.

- Hardware price erosion—Dataquest expects hardware price erosion to continue at a slower rate as package complexity increases and accelerates demand for hardware purchases that provide more speed, memory, and storage. This trend can be expected on all platform configurations. Supercomputers are increasingly being used for high-end simulation and analysis applications while technical workstations range from very expensive, high-performance, real-time imaging systems to lower-cost, 2-D documentation systems. The need for integrated applications across platforms will cause significant upgrade and system replacements.

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Figure 6
Software Revenue Distribution Forecast by Application



Source: Dataquest (September 1993) G3004194

- Second-tier products—With a smaller installed base and less market share, second-tier vendors with stale technology are expected to fight forced price erosion. These second-tier vendors are struggling to build market share in an atmosphere of rampant price cutting, particularly on the PC platform. Building market share by cutting prices is becoming a more risky strategy.
- Hardware performance—With enabling technology providing increased mips, software vendors can redefine the concept of interactive design. In the future, designers will simulate the crash of one car into another and test to see if the doors still open. The value of this level of computing will change the nature of mechanical CAD/CAM/CAE.

  The result will allow anyone in the design and manufacturing process to simulate real problems, to evaluate potential solutions, and to communicate the change instantly to all involved.
- Modeling technologies—Core modeling technologies will evolve slowly to support a product data structure growing in complexity. 3-D solutions are replacing 2-D solutions, which will be replaced by next-generation, integrated, solid-modeling-based solutions. The more complete data structure with improvements in performance is rapidly building strong interest with end users. The need to have this higher level of communication among departments is growing as well. Continued progress is being made in integration between the model and analysis applications, between model and documentation, and further into manufacturing applications.

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- Technology dependence—The major mechanical applications have been defined: product conception, development, production, operation, and support will be necessary applications areas a hundred years from now. The dramatic changes taking place in the discrete manufacturing world because of competitive pressures are forcing shorter development cycles, localization and need for improved quality, resulting in a complexity that forces the users to be fully dependent upon this technology.
- Manufacturing industry—The growth opportunity in each country is dependent upon the success and health of the local manufacturing industries. Multinational corporations will fuel the growth in newly industrialized countries. Each country has a dominant industry or market segment that sets the tone for CAD/CAM/CAE use. The evolution of these industries has had an important impact on the growth of the CAD/CAM/CAE market in each region and has directed the success of many vendors trying to serve these markets. As an example, the automotive industries in Japan, the United States, Germany, Italy, and France have a major influence on these local CAD/CAM/CAE markets. Aerospace, a major force in the U.S. market, is less of a force in Europe and a minor but growing interest in Japan. All of the other manufacturing industries, such as fabricated metal, machinery, and consumer products, have strongholds in various locations around the world. For example, the machinery industry represents a significant local CAD/CAM/CAE opportunity in Japan and Germany.
- Europe—The automotive and aerospace industries, which are the largest customers of mechanical CAD/CAM/CAE tools, are suffering during the ongoing recession in Europe, experiencing budget and staff cuts. On top of this, 34 percent of the European mechanical market is in Germany where the economy is in a deep recession and manufacturing output is down. Growth for mechanical CAD software in 1992 was 10.1 percent and is expected to be 7.1 percent in 1993 as the German economy is not expected to get out of the recession before mid-1994 at the earliest.

AEC Forecast Assumptions

The AEC application area had software revenue growth in 1992 of 11.4 percent. The five-year CAGR for software is forecast to be 11.0 percent. The main factors driving the AEC forecast are as follows:

- Untapped users—A significant pool of untapped users still exists. The current relatively low market penetration of AEC CAD systems should allow steady worldwide growth during the next five years, despite constant volatility in demand for the building and infrastructure products to be designed.
- Mandates for CAD—Electronic design data is increasingly required by the designer's client, from the federal government down to the small commercial developer. In addition, design firms are growing at the expense of smaller firms. These large end users will increasingly require their employees and suppliers to adopt automation tools in the design and construction process.

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- Electronic partnering—Designers in the AEC industry are finding themselves in markets that are more regionally and globally competitive, markets that favor partnering across design disciplines. Smaller design firms will increasingly buy CAD systems or risk being dropped from consideration as a partner.
- Competitive advantage—CAD purchases are increasingly justified as a competitive advantage in sales and design reviews. The architect who cannot produce the fourth iteration of a proposed design before signing up a client will lose out to the group that can use changes in a proposal to ratchet a prospect toward closure gradually.
- Software leverage—AEC CAD vendors can fuel upgrade revenue among sophisticated users by leveraging software advances first developed in mechanical design, such as faster structural analysis tools or incorporation of design rules.
- New functionality—Data and database functions (versus graphics functions) will increase in importance in AEC design systems, creating opportunities to sell users significant and new functionality.
- Europe—AEC growth in western Europe is tied to the construction industry and improvement of the infrastructure, manufacturing plants, and power stations in eastern Europe. In particular, German and Danish construction companies are involved in projects in former East Germany and central and eastern Europe. The construction industry in other countries is rather bleak, given the overbuilding of the 1980s and high interest rates. The Netherlands and Norway have public works projects planned or in process.

Growth Inhibitors to the AEC Industry

Trends that will inhibit growth in the AEC industry are as follows:

- Low payoff to users—AEC's one-design-one-build structure means CAD provides fewer economic benefits to these users than does the one-design-build-many structure of manufacturing. Construction, which is essentially a prototype build, is fraught with uncertainties and delays that are hard to change using design systems as they exist today.
- Lack of interoperability—Designs are often split among several different companies representing different aspects of the design process. User companies often have different CAD systems that do not communicate well, and alliances and consolidations in user organizations will only highlight the issue.
- Low-cost solutions—Because most AEC design is still focused on drafting, which requires relatively little computing power, PC-based growth will be strong for the foreseeable future, and PC-based solutions will produce less revenue to the vendor than other platforms.

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- Late adopters—Attitudes of potential users inhibit market growth. Many experienced architects resist change in the design and construction processes. As this self-destructive mode of operating erodes the viability of the profession, the CAD market is also impacted because many architects who were once prospects for CAD systems simply are now unemployed.

GIS/Mapping Forecast Assumptions

The GIS application area had software revenue growth in 1992 of 15.3 percent. The five-year CAGR for software revenue is forecast to be 16.0 percent. The assumptions behind the GIS forecast are built on an optimism that during the forecast period the world economy will gradually improve and on an expectation that global competition will increase. Assumptions used to build Dataquest's GIS market forecast are as follows:

- Low penetration—Bread-and-butter prospects in government and utilities are charged with maintaining information on land and assets in perpetuity. The large number of utilities and sovereign and local governments all over the world still stuck with tabular data and paper maps, which will degrade, creates a plentiful supply of prospective buyers of the more readily changed and renewed computer maps, a first step to building a GIS system.
- New technologies—Faster, cheaper computers and developments in open, distributed systems open the door to an expanded user base. Advances in global positioning systems (GPSs) and aerial photography are making it possible to create GISs significantly more accurate and complete than existing paper maps, giving experienced users some compelling reasons to reinvest. Increasingly, portable computers, multimedia, cheaper storage, and better compression of satellite imagery will create opportunities to develop richer, more accurate, and more useful GIS systems. Although many markets will take advantage of these technologies, we can think of no other market as ready, willing, and able to put to work such a wide range of technology enhancements. Already in the last year or two, a number of users invested in image-oriented GIS systems, either supplementing or completely bypassing conversion of existing paper data that has helped provide a midlife kick to a market that has been slowed by troubled pilot projects.
- New applications in industries like retail and insurance will drive growth—Wherever there is competition for a limited prize—whether the prize is political or economic—GIS can create a competitive edge. Wherever assets or investments are geographically dispersed, GIS offers significant management capabilities. Revenue is growing more than 50 percent per year among new applications. However, we see a wide band of uncertainty surrounding future revenue opportunities. Several new applications in GIS are destined to become embedded as a relatively low revenue-producing feature in another software program (and market), rather than a standalone product in the GIS market.

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- Easier and cheaper GIS—Inexpensive spatial data, public and private, is accumulating and can be passed on to new users. Successful multi-participant projects are growing, creating larger data sets that can be profitably resold by government/industry consortia. Also, although we do not envision the technology miracle that will eliminate development costs, implementation of GIS in new sites will be easier and cheaper than it has been.
- Solutions filling a need—GIS addresses the information age's growing problem of information overload. Any product that addresses a visible problem is more certain to grow than solutions that are still looking for the problem.
- The U.S. government—GIS is one of the rare markets where relatively simple government actions can directly fuel industry growth. In fact, the GIS industry depends on government cooperation for base data development. Governments all over the world are cooperating by developing spatial data standards, more sophisticated mapping goals, and increased cooperation across federal and local governments. The U.S. federal government is in a particularly influential position—and all stars are favorably positioned. The Landsat program appears to be headed in the direction of making satellite imagery more affordable. GPS satellites are proving extremely valuable outside of defense applications. Freedom of information remains a viable U.S. federal concept, creating opportunities to exploit low-cost, government-generated spatial data.

Growth Inhibitors to the GIS Industry

Trends that will inhibit growth in the GIS industry are as follows:

- High cost—Nothing important will emerge to create a low-cost, meaningful data set for traditional customers in government and utilities. Data conversion will remain costly, despite substantially lower-scanning costs and increasingly improved automated conversion products. The high cost will remain because, as existing paper records head toward computerization, widespread minor inaccuracies begin to be examined, often for the first time. The significant cost of correcting prior errors and omissions is inevitably bundled into the cost of conversion. At the same time, increasingly complex applications require increasingly accurate data, which also raises conversion costs.
- Stuck projects—The significant number of traditional GIS/mapping projects stuck in the pilot phase will reduce demand for new products, as users struggle to implement existing purchases. Even worse, the negative publicity created by these projects will chill the buying impulse among nonusers, reducing the ability of GIS projects to compete with other applications for capital equipment dollars.
- Price pressure—Computer prices will certainly drop, even in technical applications such as GIS where higher-performance hardware will command a premium price. Software prices are likely to come under increasing pressure, despite the industry's current ability to hold overall seat prices relatively even. Our current forecast is built on declining

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hardware and steady software prices, primarily because of opportunities to add significant software data and functionality content to new sales among core, noncommodity buyers. Any significant deviation from this model would affect the forecast.

- Europe—GIS data in Europe is prohibitively expensive and not readily available, slowing down the potential growth. In addition, the current state of the various European economies, the enormous budget deficits of some of the major economies such as Germany, Italy, and the United Kingdom, and major cuts in public spending are holding back the development of GIS. However, the railway industry is a source of growth in GIS in Europe.

EDA Forecast Assumptions

The year 1992 showed a glimmer of hope in the EDA industry, with software revenue year-to-year growth rates climbing back to 8.9 percent, driven by the continued strength of the IC layout software industry and a resurgence in the CAE market. Dataquest expects EDA software revenue growth to increase to 10.4 percent year-to-year for 1993. Printed circuit board (PCB) software in particular will remain stagnant until multichip module (MCM) technologies begin to affect the market, which Dataquest anticipates will take effect in the 1994 to 1995 time frame. Factors that will help spur EDA software growth are as follows:

- New tool technologies—New tool technologies, including electronic system design automation (ESDA), signal integrity, and design automation, are becoming available, fueling growth.
- Analysis tools—Increasing clock frequencies require tighter design tolerances that require sophisticated analysis tools to ensure proper operation.
- Migration of IC layout—Migration of IC layout technologies to system designers in the form of floor planners may prove to be the vehicle to expand physical IC design into the larger ASIC design community.
- Europe—The EDA industry in Europe is now characterized by two or three big players jockeying for position. Furthermore, following the merger of Cadence Design Systems Inc. and Valid Logic Systems Inc., and several large end-user mergers, some strategic account changes have occurred and will continue. The total software revenue is unaffected, but market share is the prize for the winning EDA company.

Growth Inhibitors to the EDA Industry

Trends that will inhibit growth in the EDA industry are as follows:

- Short-term transitions and shifts—Product transition and strategy shifts will have a short-term downward effect. Difficulties at the No. 1 supplier of EDA software, Cadence, may cause a stall in the purchases of new tools as users ponder their options. Ongoing consolidations of key EDA technologies, including simulation and signal integrity, will also protract buying decisions.

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- Financial results—Decreased revenue for all of EDA is readily evident in examining public company statements. As part of the forecasting process, Dataquest analyzes the short-term, company-specific issues. There are five publicly traded EDA software companies: Cadence, Mentor Graphics, Synopsys, Viewlogic, and Silvar-Lisco. These companies represent approximately 45 percent of the worldwide EDA software market. Comparing the first six months of 1992 versus the first six months of 1993, we find that the combined revenue of these companies was essentially flat. Cadence's troubles earlier in the year contributed heavily to this fact, but we anticipate that 1993 total EDA software revenue growth will suffer accordingly. Were it not for the stellar growth of such companies as Viewlogic and Synopsys, the EDA market would indeed be posting a poor 1993.
- Legal issues—Legal issues may induce fear, uncertainty, and doubt in buyers' minds. The recent spate of legal actions (for example, Synopsys versus Cadence, Analogy versus Anacad/Mentor Graphics, and stockholders versus Cadence) may divert the attention of the buying public and will definitely garner the attention of top management at the EDA vendors.
- Use of PC-based tools will drop significantly—Looking to EDA's future, Dataquest anticipates the use of what has classically been called PC-based tools to drop significantly. The Dataquest factors determining the differentiation of technical workstations from PCs are a virtual multitasking operating system (UNIX, VMS, and DOMAIN), the ability to run high-performance graphic applications in a multi-user environment, and the user's potential range of expansion on the platform. Windows NT on the Pentium chip will challenge this differentiation.

Dataquest anticipates that use of classical PCs as EDA platforms will begin to diminish significantly in 1995. At that time, classes of tools will be differentiated not upon hardware platform or operating system, but rather upon the features and functionality of the tools themselves. The emergence of Windows NT will have a minimal impact upon the overall revenue of the EDA software industry. However, its effect upon competing operating systems, average selling prices, distributing practices, and business and marketing practices will be far-reaching.

Forecast Comparison

The CAD/CAM/CAE/GIS database has undergone enormous scrutiny through our market share, forecast, market share update, and finally forecast update. It has only slightly changed downward from the 1992 forecast. In fact, the forecast total factory revenue for 1993 of $16.5 billion is only 1.3 percent higher than last year's forecast of $16.3 billion. However, the longer-term sights have been lowered so that the current 1996 forecast total factory revenue of $19.8 billion is 6.1 percent lower

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than was forecast last year for 1996. By examining the numbers, we discovered the following lowered expectations:

- The biggest factor in this lowered forecast is in the more rapidly declining host-dependent business. This is supported by the market share update reporting a faster drop in the host-dependent platform than estimates from our earlier market share. The forecast total revenue for 1996 of $1.1 billion is 36.2 percent lower than the forecast last year for 1996.
- Regionally, the largest factor in this lowered forecast is Europe, where the 1996 forecast total factory revenue of $6.8 billion is 14.7 percent lower than the $7.9 billion forecast last year.
- As to applications, these lowered expectations apply to the AEC, GIS, IC, and PCB applications, while the mechanical and ECAE applications have been forecast to grow faster than reported in 1991.

Lowered expectations have become an economic reality, given that the recovery from this prolonged recession is not materializing as the past has taught us. However, a CAGR of 5.8 percent of this $15.7 billion industry is solid and continuing growth. The technologies provided by the CAD/CAM/CAE/GIS industry are no longer just nice ideas, but have become the ticket to compete globally. The technological improvements of software, hardware, and the increasing involvement of vendors through services will continue to fuel the growth of this CAD/CAM/CAE/GIS market.

Forecast Methodology

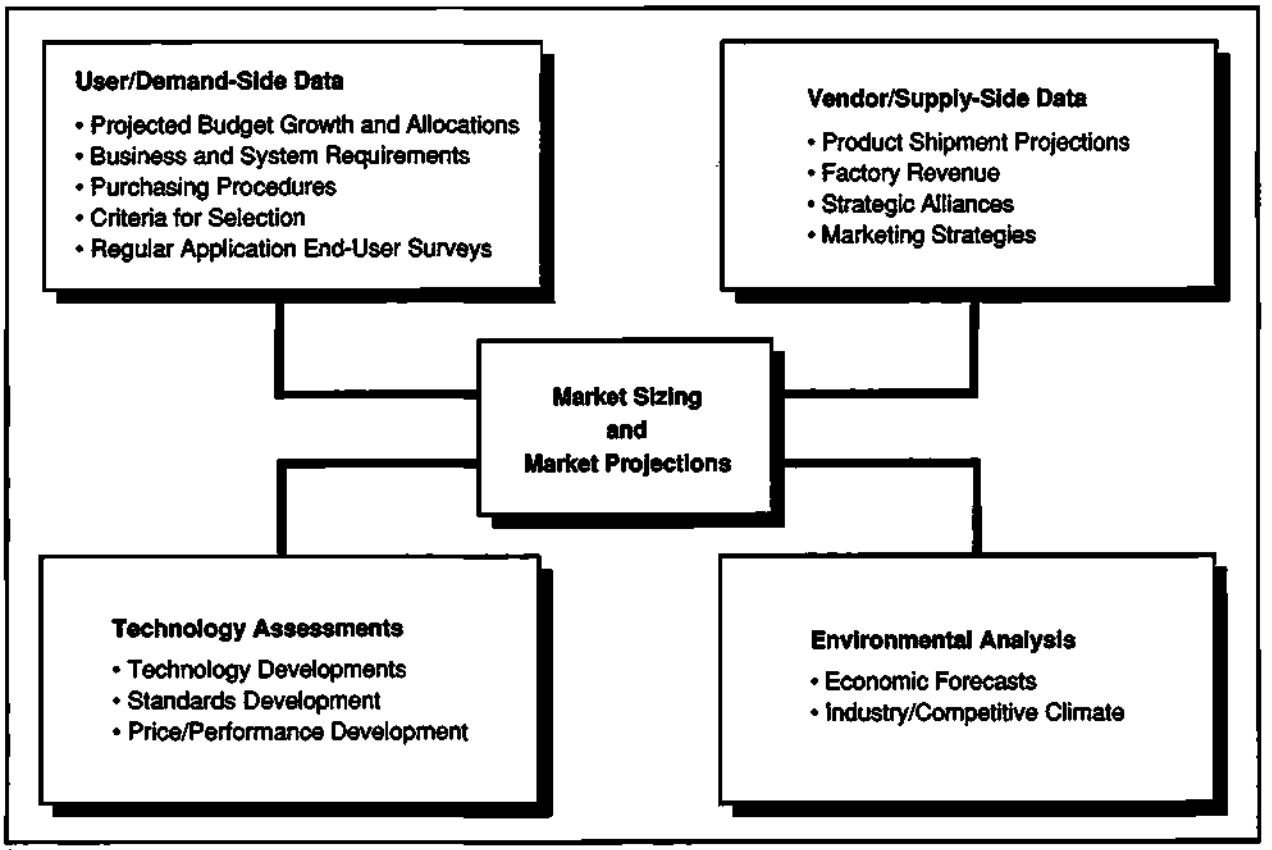
Fundamental to the way Dataquest conducts its research is an underlying philosophy that says the best data and analyses come from a well-balanced program. This program includes the following: balance between primary and secondary collection techniques; balance between supply-side and demand-side analysis; balance between focused, industry-specific research and coordinated, "big-picture" analysis aided by integration of data from the more than 25 separate high-technology industries Dataquest covers; and balance between the perspectives of experienced industry professionals and rigorous, disciplined techniques of seasoned market researchers.

Dataquest also analyzes trends in the macro environment, which can have major influences on both supply-side and demand-side forecasting. In addition to demographics, analysts look at gross national product (GNP) growth, interest rate fluctuation, business expectations, and capital spending plans. In the geopolitical arena, the group looks at trade issues, political stability or lack thereof, tariffs, nontariff barriers, and such factors as the effect on Europe from the events of 1993.

Figure 7 shows the CAD/CAM/CAE and GIS forecasting model. The overall forecasting process uses a combination of forecasting techniques

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Figure 7
CAD/CAM/CAE and GIS Forecasting Model



Source: Dataquest (May 1993) G3000529

such as time series and technological modeling. Market estimates and forecasts are derived using the following research techniques:

- "Bottom-up" aggregation—This method involves adding all relevant vendor contributions to arrive at total market estimates for all historical data.
- Segment forecasting—For each application segment tracked by the CAD/CAM/CAE and GIS group, individual forecasts are derived following the basic information model defined previously. Specifically, each design phase covered within each application is segmented by product, region, and platform. In this way, each application segment incorporates its own set of unique assumptions.
- Demand-based analysis—Market growth is tracked and forecast in terms of the present and anticipated demand of current and future users. This requires the development of a total available market model and a satisfied available market figure to assess the levels of penetration accurately. Installed base is also evaluated. Rates of product retirement are primarily based on input from end users in our ongoing survey programs. Dataquest analysts also factor in the acceptance or ability for users to consume new technology.

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- Capacity-based analysis—This method involves identifying future shipment volume constraints. These constraints, or "ceilings," can be the result of component availability, manufacturing capacity, or distribution capacity. In any case, capacity limitations are capable of keeping shipments below the demand level.

Segmentation Definitions

This section lists the definitions specific to this document. The following paragraphs define the segments.

Applications

Mechanical

The mechanical segment refers to computer-aided tools used by engineers, designers, analysts, technicians, and draftspeople working predominantly in the discrete manufacturing industries, but includes government and education. Users of mechanical CAD/CAM/CAE tools work in all departments across the typical organization, with a majority found in product design, advanced engineering, and manufacturing engineering. Common design applications include conceptual design, industrial design, structural or thermal analysis, detail design, and electromechanical design (the mechanical part of design with electrical or electronic components and mechanisms). Common manufacturing applications include tool and fixture design, numerical control part programming, off-line robotics programming, and interface to quality control systems. Management tools for database control and distribution are included in this segment, as well as user-defined application programming.

Architecture, Engineering, and Construction (AEC)

The AEC segment covers the use of computer-aided tools by architects, contractors, plant engineers, civil engineers, and other people associated with these disciplines to aid in designing and managing buildings, industrial plants, ships, and other types of nondiscrete entities.

Geographic Information Systems (GIS)/Mapping

GIS is computer-based technology, and the segment is composed of hardware, software, and data used to capture, edit, display, and analyze spatial (tagged by location) information.

Electronic Design Automation (EDA)

The EDA segment covers computer-based tools used to automate the process of designing an electronic product, including printed circuit boards, ICs, and systems. EDA includes ECAE, IC layout, and PCB/hybrid/MCM, as follows:

- Electronic Computer-Aided Engineering (ECAE)—These are computer-aided tools used in the engineering or design phase of electronic products (as opposed to the physical layout phase of the product). Examples of ECAE applications are schematic capture and simulation.

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- IC Layout—This is a software application tool used to create and validate the physical implementation of an IC. The IC layout category comprises polygon editors, symbolic editors, placement and routing (gate array, cell, and block), design verification tools (DRC/ERC/ logic-to-layout), compilers, and module development tools.
- PCB/Hybrid/MCM—This segment covers products used to create the placement and routing of the traces and components laid out on a printed circuit board. Also included in this category are thermal analysis tools.

Regions

The following paragraphs define the regions.

North America

North America includes United States, Mexico, and Canada.

Europe

Europe includes the United Kingdom, Scandinavia, Benelux, France, Germany, Italy, Spain, and Rest of Europe (which includes Austria, Switzerland, and eastern Europe)

Asia

Asia includes Japan, Singapore, Taiwan, Korea, China, and Hong Kong.

Rest of World

Rest of World includes all other countries including Australia, New Zealand, Oceania, Africa, Central America, South America, and the Middle East.

Platforms

The following paragraphs define the platforms.

Technical Workstation

A technical workstation is a single-user computer distinguished from a personal computer by its features and by the user's potential range of expansion on the platform. Features include a virtual, multitasking operating system (UNIX, VMS, or Domain); the computer is designed by the manufacturer to run high-performance graphics applications in a multiuser/multitasking environment.

Host-Dependent

Host-dependent is a shared logic system in which the external workstations' functions are dependent on a host computer.

Server

A server is a computer that transparently provides its resources for use by other computer systems. It is a system on a network that provides specific functionality to other computer systems: the clients. Functions include file storage, database access, and compute capability. Dataquest tracks the following major categories of servers used for CAD/CAM/ CAE and GIS applications:

- Compute Servers—These systems provide capabilities for solving numerical problems (for example, simulations, statistical calculations, and simultaneous partial differential equations). System features

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usually include high-speed computational capabilities (for example, vector and parallel processing) and large memories.

- Print Servers—These systems provide access to printers, specialized printing applications software, and print-spooling resources to a network.
- File Servers—These systems provide mass storage capability to clients on a network. Services can range from temporary storage of working files to long-term backup and archive systems.
- Database Servers—These systems manage databases as a shared resource to a network. These servers handle such functions as physical data storage, data security, and high-level queries and can access stored information at the record level.

Personal Computer

A personal computer is a single-user computer distinguished from a technical workstation by its features and by the user's potential range of expansion on the platform. Features found in technical workstations (such as a virtual operating system, networking, high-performance graphics, multiuser/multitasking capability) are optional rather than integrated by the manufacturer.

Line Items

Line item definitions are as follows:

- Average selling price (ASP) is defined as the average price of a product, inclusive of any discounts.
- CPU revenue is the portion of revenue derived from a system sale that is related to the value of the CPU. (In the case of technical workstations and personal computers, CPU revenue contains the terminal revenue.)
- CPU shipment is defined as the number of CPUs delivered.
- CPU installed base is defined as the total number of CPUs in active, day-to-day use.
- Unit shipment is defined as the number of products delivered (that is, seats).
- Seats are defined as the number of possible simultaneous users.
- Installed seats are defined as the total number of seats in active, day-to-day use.
- Hardware revenue is defined as the sum of the revenue from the hardware system components: CPU revenue, terminal revenue, and peripherals revenue.
- Peripherals revenue is defined as the value of all the peripherals of a turnkey sale. (Peripherals in this category typically are input and output devices.)

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- Terminal revenue is defined as revenue derived from the sale of terminals used to graphically create, analyze, or manipulate designs. The term is applicable only to the host-dependent platform, as terminal revenue is contained within CPU revenue for technical workstations and PCs.
- Software revenue is revenue derived from the sale of bundled (part of a turnkey system) and unbundled software.
- Service revenue is defined as revenue derived from the service and support of CAD/CAM/CAE or GIS systems. Service revenue can be calculated in the tables by subtracting hardware and software revenue from total revenue.
- Total factory revenue is defined as the amount of money received by a manufacturer for its goods measured in U.S. dollars and is the sum of hardware, software, and service revenue. Total factory revenue does not include revenue that a company may receive from products sold to another company for resale (OEM revenue).

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Table 8
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: Worldwide
Platform: All Platforms

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	71,310	95,913	133,579	143,262	179,665	206,870	233,700	260,020	284,960	307,740	26	11
Unit Shipments or Seats	74,788	99,916	137,650	146,734	182,264	208,230	234,340	260,240	285,000	307,750	25	11
CPU Installed Base	186,494	267,091	372,881	472,173	583,527	678,670	763,300	854,230	952,250	1,048,380	33	12
Installed Seats	203,079	286,438	394,411	494,541	605,368	698,270	779,810	867,090	961,350	1,053,930	31	12
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	64.8	47.8	42.4	35.4	34.5	31.5	29.1	27.5	26.4	25.8	-15	-6
Hardware-Only ASP	7.2	6.8	5.2	4.9	4.8	4.2	3.8	3.6	3.4	3.3	-10	-7
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	915	1,128	1,245	1,257	1,360	1,362	1,376	1,413	1,462	1,512	10	2
CPU Revenue	727	919	1,020	1,063	1,167	1,184	1,205	1,243	1,288	1,332	13	3
Terminal Revenue	99	66	57	52	42	21	10	3	1	0	-19	-65
Peripheral Revenue (Turnkey)	89	143	169	141	152	157	161	167	173	180	14	3
Software Revenue	385	466	584	680	758	847	945	1,050	1,161	1,275	18	11
Bundled	164	229	273	309	300	313	326	342	361	382	16	5
Unbundled	221	237	311	372	458	534	619	708	800	894	20	14
Service Revenue	241	266	290	313	314	316	332	351	378	407	7	5
Total Factory Revenue	1,541	1,860	2,120	2,250	2,432	2,525	2,653	2,813	3,001	3,195	12	6
Increase over Prior Year (%)	22	21	14	6	8	4	5	6	7	6		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (September 1993)

CAEC-WW-MS-9307

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Table 9
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: Worldwide
Platform: Technical Workstation

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	8,081	13,472	17,759	20,098	21,807	24,810	27,840	30,930	33,980	36,930	28	11
Unit Shipments or Seats	8,081	13,472	17,759	20,098	21,807	24,810	27,840	30,930	33,980	36,930	28	11
CPU Installed Base	17,561	29,983	45,852	62,565	78,895	95,250	111,340	126,910	142,690	157,780	46	15
Installed Seats	17,561	29,983	45,852	62,565	78,895	95,250	111,340	126,910	142,690	157,780	46	15
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	59.4	52.1	42.9	41.2	41.3	39.8	38.4	37.3	36.4	35.6	-9	-3
Hardware-Only ASP	23.4	18.3	22.3	17.1	20.8	19.1	17.7	16.6	16.0	15.5	-3	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	308	412	502	494	546	582	613	646	682	714	15	6
CPU Revenue	265	322	390	414	455	483	508	535	564	591	15	5
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	43	90	112	80	90	99	105	111	117	123	20	6
Software Revenue	146	194	245	306	334	373	416	462	512	561	23	11
Bundled	87	148	188	220	211	230	247	267	287	308	25	8
Unbundled	59	46	57	85	123	144	168	195	225	253	20	16
Service Revenue	122	151	179	202	215	229	248	269	292	315	15	8
Total Factory Revenue	576	757	926	1,002	1,095	1,184	1,277	1,377	1,486	1,590	17	8
Increase over Prior Year (%)	58	31	22	8	9	8	8	8	8	7		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (September 1993)

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Table 10
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: Worldwide
Platform: Host-Dependent

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	958	1,259	2,155	1,702	1,198	810	560	330	170	50	6	-47
Unit Shipments or Seats	4,436	5,262	6,225	5,174	3,796	2,170	1,200	540	210	50	-4	-58
CPU Installed Base	4,859	5,716	7,328	8,342	8,737	8,740	8,330	7,540	6,420	5,300	16	-10
Installed Seats	21,444	25,063	28,858	30,710	30,578	28,340	24,840	20,400	15,520	10,850	9	-19
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	322.0	398.2	138.7	132.9	139.2	123.7	108.4	96.1	83.8	80.6	-19	-10
Hardware-Only ASP	477.5	156.1	171.2	266.2	256.2	262.5	263.6	301.6	316.2	298.9	-14	3
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	288	270	262	219	166	95	54	26	11	3	-13	-56
CPU Revenue	162	177	180	149	113	67	39	20	9	2	-9	-54
Terminal Revenue	99	66	57	52	42	21	10	3	1	0	-19	-65
Peripheral Revenue (Turnkey)	27	27	25	18	11	7	5	2	1	0	-19	-52
Software Revenue	85	70	75	62	45	31	19	10	4	1	-15	-53
Bundled	54	54	57	45	31	22	14	8	4	1	-13	-49
Unbundled	31	16	18	16	14	9	4	1	0	0	-18	-100
Service Revenue	93	81	79	58	44	26	14	7	3	1	-17	-57
Total Factory Revenue	466	421	415	339	255	151	87	42	17	4	-14	-55
Increase over Prior Year (%)	-13	-10	-1	-18	-25	-41	-42	-51	-59	-74		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (September 1993)

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Table 11
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: Worldwide
Platform: Server

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	NA	NA	NA	1,686	1,674	1,890	2,080	2,290	2,510	2,720	NA	10
Unit Shipments or Seats	NA	NA	NA	1,686	1,674	1,890	2,080	2,290	2,510	2,720	NA	10
CPU Installed Base	NA	NA	NA	1,686	3,360	5,150	6,970	8,620	10,220	11,300	NA	27
Installed Seats	NA	NA	NA	1,686	3,360	5,150	6,970	8,620	10,220	11,300	NA	27
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	NA	NA	NA	50.7	55.8	53.6	51.4	49.2	47.2	45.3	NA	-4
Hardware-Only ASP	NA	NA	NA	45.8	42.8	38.7	35.5	33.7	32.7	32.1	NA	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	NA	NA	NA	68	65	68	71	74	77	81	NA	5
CPU Revenue	NA	NA	NA	62	56	59	61	64	67	70	NA	5
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	NA	NA	NA	6	9	9	9	10	10	10	NA	4
Software Revenue	NA	NA	NA	16	22	25	26	28	29	30	NA	6
Bundled	NA	NA	NA	16	22	24	26	27	29	30	NA	6
Unbundled	NA	NA	NA	NA	0	0	0	0	0	0	NA	16
Service Revenue	NA	NA	NA	28	29	31	33	35	36	38	NA	6
Total Factory Revenue	NA	NA	NA	112	116	124	129	136	142	149	NA	5
Increase over Prior Year (%)	NA	NA	NA	NA	4	7	4	5	5	5		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.

Source: Dataquest (September 1993)

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Table 12
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: Worldwide
Platform: Personal Computer

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	62,271	81,183	113,665	119,776	154,987	179,360	203,210	226,470	248,310	268,030	26	12
Unit Shipments or Seats	62,271	81,183	113,665	119,776	154,987	179,360	203,210	226,470	248,310	268,030	26	12
CPU Installed Base	164,074	231,392	319,701	399,580	492,535	569,530	636,660	711,160	792,920	874,000	32	12
Installed Seats	164,074	231,392	319,701	399,580	492,535	569,530	636,660	711,160	792,920	874,000	32	12
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	17.7	17.3	17.9	11.1	12.1	11.0	9.9	9.3	8.9	8.5	-9	-7
Hardware-Only ASP	4.8	4.7	3.7	3.6	3.4	3.2	2.9	2.7	2.6	2.5	-8	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	319	446	482	476	584	617	639	667	692	714	16	4
CPU Revenue	300	420	450	438	543	576	597	623	647	668	16	4
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	19	26	32	38	41	42	42	43	45	46	21	2
Software Revenue	154	202	264	297	356	418	485	551	617	683	23	14
Bundled	23	27	28	27	36	37	38	40	41	43	11	4
Unbundled	131	175	236	270	321	381	446	511	575	641	25	15
Service Revenue	25	35	32	24	26	30	36	41	47	53	1	15
Total Factory Revenue	499	683	778	796	966	1,066	1,160	1,258	1,355	1,450	18	8
Increase over Prior Year (%)	38	37	14	2	21	10	9	8	8	7		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.

Source: Dataquest (September 1993)

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Table 13
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: North America
Platform: All Platforms

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	41,136	44,446	49,503	54,174	71,055	81,330	90,960	100,090	110,060	119,030	15	11
Unit Shipments or Seats	42,795	45,811	51,297	55,686	71,946	81,640	91,050	100,100	110,060	119,030	14	11
CPU Installed Base	110,827	145,354	177,668	206,059	240,984	270,960	298,900	330,550	366,540	402,430	21	11
Installed Seats	120,700	155,584	188,295	216,431	250,352	278,670	304,840	334,760	369,100	403,530	20	10
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	78.5	69.6	54.6	44.1	43.3	38.8	36.2	34.7	33.7	32.8	-14	-5
Hardware-Only ASP	5.7	6.4	5.7	5.3	4.9	4.2	3.8	3.6	3.4	3.3	-4	-8
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	386	430	432	422	483	472	475	489	510	531	6	2
CPU Revenue	324	361	348	357	418	417	422	435	455	473	7	2
Terminal Revenue	40	24	28	25	15	5	1	0	0	0	-22	-100
Peripheral Revenue (Turnkey)	21	46	55	40	49	50	51	53	56	58	24	3
Software Revenue	154	159	195	223	268	306	349	394	447	502	15	13
Bundled	41	57	67	80	66	68	71	75	80	85	13	5
Unbundled	113	102	128	143	201	238	278	319	367	417	16	16
Service Revenue	109	112	106	117	121	120	126	135	147	160	3	6
Total Factory Revenue	648	702	733	762	871	898	950	1,018	1,104	1,194	8	6
Increase over Prior Year (%)	10	8	4	4	14	3	6	7	8	8		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.

Source: Dataquest (September 1993)

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Table 14
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: North America
Platform: Technical Workstation

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	3,230	4,642	5,484	6,503	6,919	7,820	8,720	9,650	10,600	11,620	21	11
Unit Shipments or Seats	3,230	4,642	5,484	6,503	6,919	7,820	8,720	9,650	10,600	11,620	21	11
CPU Installed Base	8,736	12,673	17,036	21,863	26,355	31,010	35,610	40,120	44,880	49,490	32	13
Installed Seats	8,736	12,673	17,036	21,863	26,355	31,010	35,610	40,120	44,880	49,490	32	13
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	57.9	57.1	45.7	39.5	37.9	36.2	34.7	33.7	32.8	32.1	-10	-3
Hardware-Only ASP	27.3	17.0	21.4	15.1	17.3	15.7	14.5	13.6	13.1	12.7	-11	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	131	152	165	150	162	169	175	183	191	200	5	4
CPU Revenue	117	119	129	131	134	140	145	151	158	165	3	4
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	14	33	36	19	27	29	30	31	33	35	19	5
Software Revenue	54	57	74	88	95	107	121	137	156	175	15	13
Bundled	28	43	52	62	47	51	55	59	63	68	14	7
Unbundled	27	15	22	25	48	56	66	78	93	107	16	17
Service Revenue	56	68	70	81	84	90	98	106	115	125	10	8
Total Factory Revenue	242	277	308	319	341	366	394	425	462	500	9	8
Increase over Prior Year (%)	49	14	11	4	7	8	8	8	9	8		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (September 1993)

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Table 15
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: North America
Platform: Host-Dependent

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	332	527	520	277	228	80	30	0	0	0	-9	-100
Unit Shipments or Seats	1,991	1,891	2,314	1,789	1,119	380	110	10	0	0	-13	-100
CPU Installed Base	2,492	2,708	2,876	2,760	2,576	2,290	1,960	1,580	1,240	980	1	-18
Installed Seats	12,365	12,937	13,502	13,132	11,944	10,010	7,900	5,790	3,800	2,080	-1	-30
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	273.4	330.3	225.1	239.8	344.3	328.9	315.4	302.2	289.5	277.9	6	-4
Hardware-Only ASP	804.8	151.4	189.8	277.2	191.8	174.6	160.3	146.9	134.5	123.8	-30	-8
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	112	96	93	64	50	17	5	1	0	0	-18	-100
CPU Revenue	64	63	57	36	32	11	3	0	0	0	-16	-100
Terminal Revenue	40	24	28	25	15	5	1	0	0	0	-22	-100
Peripheral Revenue (Turnkey)	7	9	8	4	2	1	0	0	0	0	-23	-100
Software Revenue	30	21	21	13	15	8	3	1	0	0	-16	-100
Bundled	13	14	14	8	5	2	1	0	0	0	-21	-100
Unbundled	16	7	7	5	9	6	3	1	0	0	-13	-100
Service Revenue	41	32	29	17	16	6	2	0	0	0	-20	-100
Total Factory Revenue	182	149	143	95	81	32	11	2	0	0	-18	-100
Increase over Prior Year (%)	-30	-18	-4	-34	-15	-61	-66	-83	-100	NA		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (September 1993)

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Table 16
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: North America
Platform: Server

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	NA	NA	NA	816	1,022	1,130	1,250	1,380	1,510	1,640	NA	10
Unit Shipments or Seats	NA	NA	NA	816	1,022	1,130	1,250	1,380	1,510	1,640	NA	10
CPU Installed Base	NA	NA	NA	816	1,838	2,910	4,000	4,990	5,960	6,610	NA	29
Installed Seats	NA	NA	NA	816	1,838	2,910	4,000	4,990	5,960	6,610	NA	29
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	NA	NA	NA	46.4	53.4	51.0	48.9	46.9	44.9	43.1	NA	-4
Hardware-Only ASP	NA	NA	NA	46.2	42.4	38.6	35.4	33.7	32.7	32.0	NA	-5
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	NA	NA	NA	28	38	39	41	43	45	47	NA	4
CPU Revenue	NA	NA	NA	25	33	34	35	37	39	41	NA	4
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	NA	NA	NA	4	5	5	6	6	6	6	NA	3
Software Revenue	NA	NA	NA	10	13	14	15	16	16	17	NA	5
Bundled	NA	NA	NA	10	13	14	15	16	16	17	NA	5
Unbundled	NA	NA	NA	NA	0	0	0	0	0	0	NA	15
Service Revenue	NA	NA	NA	14	17	18	19	20	22	23	NA	5
Total Factory Revenue	NA	NA	NA	51	69	72	75	79	83	87	NA	5
Increase over Prior Year (%)	NA	NA	NA	NA	34	5	5	5	5	4		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (September 1993)

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Table 17
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: North America
Platform: Personal Computer

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	37,574	39,277	43,500	46,578	62,887	72,300	80,960	89,050	97,940	105,770	14	11
Unit Shipments or Seats	37,574	39,277	43,500	46,578	62,887	72,300	80,960	89,050	97,940	105,770	14	11
CPU Installed Base	99,599	129,974	157,756	180,620	210,215	234,740	257,320	283,850	314,460	345,360	21	10
Installed Seats	99,599	129,974	157,756	180,620	210,215	234,740	257,320	283,850	314,460	345,360	21	10
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	9.9	18.4	21.6	13.9	10.0	9.0	8.1	7.6	7.2	6.9	0	-7
Hardware-Only ASP	3.8	4.6	4.0	3.8	3.7	3.4	3.1	2.9	2.8	2.7	-1	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	143	182	174	180	233	246	254	262	274	284	13	4
CPU Revenue	143	178	163	166	219	231	238	246	257	267	11	4
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	0	4	11	14	14	15	16	16	17	17	238	4
Software Revenue	70	81	100	113	145	176	210	241	275	310	20	16
Bundled	0	1	1	1	1	1	1	1	1	1	41	-2
Unbundled	70	80	99	112	144	176	209	240	274	309	20	17
Service Revenue	11	12	7	4	4	5	7	8	10	12	-24	27
Total Factory Revenue	224	276	282	297	382	428	471	512	559	607	14	10
Increase over Prior Year (%)	33	23	2	5	29	12	10	9	9	9		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (September 1993)

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Table 18
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: Europe
Platform: All Platforms

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	19,650	30,806	54,191	56,300	69,314	76,010	85,620	96,880	106,410	115,470	37	11
Unit Shipments or Seats	20,753	32,168	55,510	57,400	70,193	76,570	85,900	96,960	106,410	115,470	36	10
CPU Installed Base	48,520	75,885	123,242	167,956	216,788	253,970	284,310	317,310	353,870	391,130	45	13
Installed Seats	52,146	80,749	129,152	174,505	223,582	260,490	290,100	322,030	357,400	393,540	44	12
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	47.2	55.1	45.2	39.8	32.5	30.5	28.3	26.7	25.6	24.8	-9	-5
Hardware-Only ASP	9.7	7.4	4.7	4.7	4.6	4.1	3.7	3.4	3.2	3.1	-17	-8
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	309	378	441	462	482	473	473	488	505	527	12	2
CPU Revenue	255	304	374	400	422	420	424	442	459	479	13	3
Terminal Revenue	27	23	17	17	16	10	5	1	0	0	-12	-100
Peripheral Revenue (Turnkey)	28	51	49	45	44	44	44	45	46	48	12	2
Software Revenue	147	187	234	286	313	342	376	417	458	500	21	10
Bundled	59	86	101	120	130	137	142	149	158	169	21	5
Unbundled	87	101	133	166	183	205	234	268	300	331	20	13
Service Revenue	90	96	112	122	124	125	131	138	148	160	8	5
Total Factory Revenue	546	661	786	870	919	940	979	1,042	1,112	1,187	14	5
Increase over Prior Year (%)	43	21	19	11	6	2	4	6	7	7		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (September 1993)

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Table 19
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: Europe
Platform: Technical Workstation

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	3,439	5,250	6,386	7,985	9,338	10,060	10,990	12,030	13,120	14,160	28	9
Unit Shipments or Seats	3,439	5,250	6,386	7,985	9,338	10,060	10,990	12,030	13,120	14,160	28	9
CPU Installed Base	5,848	10,883	16,776	23,685	31,151	38,080	44,490	50,510	56,530	61,990	52	15
Installed Seats	5,848	10,883	16,776	23,685	31,151	38,080	44,490	50,510	56,530	61,990	52	15
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	49.4	49.1	42.7	40.2	38.3	37.4	35.8	34.7	33.8	33.0	-6	-3
Hardware-Only ASP	25.9	18.4	21.8	20.2	21.6	19.7	18.1	17.1	16.5	16.0	-4	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	114	148	177	192	211	214	219	227	238	249	17	3
CPU Revenue	99	115	144	166	186	188	193	201	210	220	17	3
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	15	33	33	26	25	25	26	27	28	29	13	3
Software Revenue	64	88	106	147	162	178	194	212	232	251	26	9
Bundled	36	60	75	94	101	108	114	121	129	138	29	6
Unbundled	28	28	31	53	61	70	80	92	103	113	22	13
Service Revenue	50	58	72	81	92	95	101	107	116	124	17	6
Total Factory Revenue	227	293	355	421	465	486	513	547	586	624	20	6
Increase over Prior Year (%)	79	29	21	18	11	5	6	7	7	7		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (September 1993)

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Table 20
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: Europe
Platform: Host-Dependent

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	360	478	474	255	116	80	40	10	0	0	-25	-100
Unit Shipments or Seats	1,463	1,840	1,792	1,355	995	650	320	90	0	0	-9	-100
CPU Installed Base	1,070	1,510	1,902	2,043	1,999	1,860	1,630	1,340	1,060	850	17	-16
Installed Seats	4,695	6,374	7,812	8,592	8,794	8,380	7,420	6,070	4,590	3,260	17	-18
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	226.6	338.8	208.0	346.3	471.2	444.9	428.2	410.7	.0	.0	20	-100
Hardware-Only ASP	613.0	158.7	161.2	237.3	322.9	304.2	279.8	258.6	.0	.0	-15	-100
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	89	94	74	65	40	26	13	4	0	0	-18	-100
CPU Revenue	54	63	50	43	23	14	7	2	0	0	-20	-100
Terminal Revenue	27	23	17	17	16	10	5	1	0	0	-12	-100
Peripheral Revenue (Turnkey)	8	8	6	4	2	1	1	0	0	0	-33	-100
Software Revenue	26	22	19	17	8	5	3	1	0	0	-26	-100
Bundled	15	18	15	12	5	3	2	1	0	0	-25	-100
Unbundled	10	4	5	5	3	2	1	0	0	0	-28	-100
Service Revenue	31	27	26	20	11	7	4	1	0	0	-24	-100
Total Factory Revenue	146	143	118	102	58	38	19	6	0	0	-21	-100
Increase over Prior Year (%)	6	-2	-17	-14	-43	-35	-49	-69	-99	-100		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (September 1993)

CAEC-WW-MS-9307

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Table 21
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: Europe
Platform: Server

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	NA	NA	NA	549	447	510	550	590	640	690	NA	9
Unit Shipments or Seats	NA	NA	NA	549	447	510	550	590	640	690	NA	9
CPU Installed Base	NA	NA	NA	549	996	1,480	1,960	2,380	2,780	3,030	NA	25
Installed Seats	NA	NA	NA	549	996	1,480	1,960	2,380	2,780	3,030	NA	25
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	NA	NA	NA	57.0	59.8	57.6	55.3	53.0	50.8	48.7	NA	-4
Hardware-Only ASP	NA	NA	NA	54.2	43.1	39.4	36.2	34.4	33.4	32.7	NA	-5
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	NA	NA	NA	27	18	20	20	20	21	22	NA	3
CPU Revenue	NA	NA	NA	26	16	17	17	18	18	19	NA	4
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	NA	NA	NA	1	2	2	2	3	3	3	NA	3
Software Revenue	NA	NA	NA	4	6	7	7	7	8	8	NA	6
Bundled	NA	NA	NA	4	6	7	7	7	8	8	NA	6
Unbundled	NA	NA	NA	NA	0	0	0	0	0	0	NA	15
Service Revenue	NA	NA	NA	10	8	9	9	9	10	10	NA	4
Total Factory Revenue	NA	NA	NA	41	33	35	36	37	38	40	NA	4
Increase over Prior Year (%)	NA	NA	NA	NA	-21	8	2	3	3	4		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (September 1993)

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September 20, 1993

Table 22
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: Europe
Platform: Personal Computer

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	15,851	25,078	47,332	47,511	59,413	65,350	74,040	84,230	92,660	100,610	39	11
Unit Shipments or Seats	15,851	25,078	47,332	47,511	59,413	65,350	74,040	84,230	92,660	100,610	39	11
CPU Installed Base	41,603	63,491	104,564	141,679	182,642	212,560	236,240	263,080	293,510	325,250	45	12
Installed Seats	41,603	63,491	104,564	141,679	182,642	212,560	236,240	263,080	293,510	325,250	45	12
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	14.9	24.7	25.7	15.1	13.4	12.2	11.0	10.4	9.8	9.4	-3	-7
Hardware-Only ASP	6.3	4.9	3.6	3.4	3.3	3.0	2.8	2.6	2.5	2.4	-15	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	107	136	190	178	213	215	222	236	246	257	19	4
CPU Revenue	102	126	181	165	197	200	207	221	230	240	18	4
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	5	10	9	13	16	15	15	15	16	17	34	1
Software Revenue	57	78	109	118	137	152	172	196	218	241	25	12
Bundled	8	9	12	10	18	19	19	20	21	22	22	5
Unbundled	49	69	97	108	119	133	153	176	197	218	25	13
Service Revenue	9	11	14	10	13	15	17	20	23	25	10	14
Total Factory Revenue	173	225	313	306	363	381	411	452	487	523	20	8
Increase over Prior Year (%)	48	30	39	-2	18	5	8	10	8	7		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (September 1993)

CAEC-WW-MS-9307

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Table 23
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: Asia
Platform: All Platforms

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	9,090	18,865	27,707	29,678	34,259	43,620	50,150	55,060	59,670	63,690	39	13
Unit Shipments or Seats	9,667	20,028	28,538	30,414	35,027	44,080	50,420	55,190	59,710	63,700	38	13
CPU Installed Base	23,062	40,300	64,830	88,833	112,764	136,980	159,380	181,730	203,460	223,090	49	15
Installed Seats	25,498	43,831	69,033	93,458	117,684	141,710	163,660	185,300	206,230	225,000	47	14
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	84.7	34.9	35.2	28.3	31.7	28.5	25.9	24.3	23.3	22.8	-22	-6
Hardware-Only ASP	9.2	6.9	5.0	4.5	5.2	4.7	4.3	4.0	3.9	3.7	-13	-7
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	197	294	352	343	362	383	392	398	405	410	16	3
CPU Revenue	130	234	280	281	297	317	325	331	336	341	23	3
Terminal Revenue	28	18	9	7	10	6	4	2	1	0	-23	-53
Peripheral Revenue (Turnkey)	39	43	62	55	55	60	63	65	67	69	9	5
Software Revenue	78	110	147	156	156	175	192	206	219	231	19	8
Bundled	60	80	102	103	98	101	106	111	115	119	13	4
Unbundled	18	30	44	54	58	74	86	95	104	112	34	14
Service Revenue	36	49	66	66	59	61	64	66	69	71	13	4
Total Factory Revenue	311	453	564	565	577	618	647	669	692	712	17	4
Increase over Prior Year (%)	21	46	25	0	2	7	5	3	4	3		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (September 1993)

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Table 24
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: Asia
Platform: Technical Workstation

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	1,230	3,259	5,582	5,147	5,130	6,450	7,580	8,610	9,540	10,340	43	15
Unit Shipments or Seats	1,230	3,259	5,582	5,147	5,130	6,450	7,580	8,610	9,540	10,340	43	15
CPU Installed Base	2,364	5,533	10,908	15,544	19,653	24,170	28,950	33,710	38,340	43,020	70	17
Installed Seats	2,364	5,533	10,908	15,544	19,653	24,170	28,950	33,710	38,340	43,020	70	17
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	104.2	50.1	40.6	44.7	50.7	48.2	46.3	44.9	43.8	42.8	-16	-3
Hardware-Only ASP	13.2	21.7	24.8	15.6	25.4	23.1	21.2	20.0	19.3	18.7	18	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	55	100	152	140	162	186	205	221	236	248	31	9
CPU Revenue	42	78	111	107	125	143	157	170	181	190	31	9
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	14	22	41	33	37	43	47	51	55	57	29	9
Software Revenue	25	45	62	65	67	78	89	99	109	117	29	12
Bundled	21	42	59	60	59	66	73	81	89	96	29	10
Unbundled	3	3	3	5	8	13	15	18	20	22	26	21
Service Revenue	13	19	34	34	32	36	41	45	49	53	26	11
Total Factory Revenue	93	164	248	239	261	301	335	366	394	418	29	10
Increase over Prior Year (%)	35	77	51	-4	9	15	11	9	8	6		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.

Source: Dataquest (September 1993)

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Table 25
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: Asia
Platform: Host-Dependent

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	244	224	1,122	1,152	841	650	490	310	170	50	36	-43
Unit Shipments or Seats	822	1,387	1,953	1,888	1,609	1,110	750	440	210	50	18	-50
CPU Installed Base	1,123	1,304	2,335	3,331	3,978	4,430	4,610	4,500	4,030	3,400	37	-3
Installed Seats	3,559	4,835	6,538	7,956	8,898	9,160	8,890	8,070	6,800	5,310	26	-10
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	594.2	560.6	102.2	91.6	99.4	95.2	91.2	87.5	83.8	80.6	-36	-4
Hardware-Only ASP	124.9	156.9	137.8	287.4	467.0	410.2	374.7	344.8	316.2	298.9	39	-9
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	81	73	90	86	73	52	36	22	11	3	-2	-48
CPU Revenue	41	46	70	69	56	40	28	17	9	2	8	-47
Terminal Revenue	28	18	9	7	10	6	4	2	1	0	-23	-53
Peripheral Revenue (Turnkey)	12	9	10	10	7	5	4	2	1	0	-11	-47
Software Revenue	27	25	33	30	22	17	12	8	4	1	-5	-46
Bundled	23	21	28	25	21	16	12	7	4	1	-3	-45
Unbundled	4	4	5	5	2	1	1	0	0	0	-19	-100
Service Revenue	19	19	22	20	16	12	8	5	3	1	-4	-47
Total Factory Revenue	126	118	145	136	111	80	57	34	17	4	-3	-47
Increase over Prior Year (%)	7	-7	23	-6	-18	-28	-29	-39	-50	-74		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.

Source: Dataquest (September 1993)

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Table 26
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: Asia
Platform: Server

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	NA	NA	NA	244	119	150	170	190	210	240	NA	15
Unit Shipments or Seats	NA	NA	NA	244	119	150	170	190	210	240	NA	15
CPU Installed Base	NA	NA	NA	244	363	500	650	790	930	1,040	NA	23
Installed Seats	NA	NA	NA	244	363	500	650	790	930	1,040	NA	23
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	NA	NA	NA	52.1	65.5	63.9	61.2	58.7	56.2	53.8	NA	-4
Hardware-Only ASP	NA	NA	NA	32.8	43.0	36.6	33.4	31.9	30.6	30.2	NA	-7
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	NA	NA	NA	9	5	6	6	7	7	8	NA	8
CPU Revenue	NA	NA	NA	8	4	5	5	6	6	7	NA	8
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	NA	NA	NA	1	1	1	1	1	1	1	NA	8
Software Revenue	NA	NA	NA	2	2	2	2	2	3	3	NA	11
Bundled	NA	NA	NA	2	2	2	2	2	3	3	NA	11
Unbundled	NA	NA	NA	NA	0	0	0	0	0	0	NA	20
Service Revenue	NA	NA	NA	3	2	2	3	3	3	3	NA	9
Total Factory Revenue	NA	NA	NA	14	9	10	11	12	13	14	NA	9
Increase over Prior Year (%)	NA	NA	NA	NA	-37	15	7	8	7	8		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (September 1993)

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Table 27
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: Asia
Platform: Personal Computer

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	7,615	15,382	21,002	23,135	28,170	36,380	41,920	45,950	49,750	53,070	39	14
Unit Shipments or Seats	7,615	15,382	21,002	23,135	28,170	36,380	41,920	45,950	49,750	53,070	39	14
CPU Installed Base	19,575	33,463	51,587	69,714	88,771	107,880	125,170	142,730	160,150	175,630	46	15
Installed Seats	19,575	33,463	51,587	69,714	88,771	107,880	125,170	142,730	160,150	175,630	46	15
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	21.7	15.9	15.5	9.8	11.5	10.4	9.3	8.8	8.3	8.0	-15	-7
Hardware-Only ASP	7.2	4.5	3.1	3.2	3.1	2.9	2.7	2.5	2.4	2.3	-19	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	61	121	110	108	122	139	145	148	151	152	19	4
CPU Revenue	47	109	99	97	112	129	134	138	140	142	24	5
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	14	12	11	11	10	11	11	11	11	10	-8	-0
Software Revenue	26	40	51	60	65	78	88	96	103	110	25	11
Bundled	15	17	16	16	17	18	19	19	20	20	3	3
Unbundled	11	23	36	44	48	60	70	77	84	90	44	14
Service Revenue	4	10	10	9	9	10	12	12	13	14	20	10
Total Factory Revenue	91	171	171	177	196	227	245	257	268	276	21	7
Increase over Prior Year (%)	32	87	0	3	11	16	8	5	4	3		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (September 1993)

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Table 28
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: Rest of World
Platform: All Platforms

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	1,435	1,796	2,178	3,110	5,037	5,920	6,960	8,000	8,820	9,560	37	14
Unit Shipments or Seats	1,573	1,909	2,305	3,234	5,098	5,940	6,970	8,000	8,820	9,560	34	13
CPU Installed Base	4,085	5,552	7,140	9,325	12,992	16,760	20,710	24,640	28,370	31,730	34	20
Installed Seats	4,735	6,275	7,931	10,146	13,750	17,390	21,210	25,010	28,610	31,860	31	18
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	78.6	68.1	53.0	44.3	49.2	44.4	41.5	39.8	38.7	37.7	-11	-5
Hardware-Only ASP	10.3	7.6	7.0	5.8	4.1	3.6	3.2	3.0	2.9	2.8	-21	-7
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	23	26	22	29	34	34	36	39	41	44	11	5
CPU Revenue	18	20	17	25	30	31	33	35	37	39	14	6
Terminal Revenue	3	2	2	2	1	0	0	0	0	0	-27	-100
Peripheral Revenue (Turnkey)	1	4	2	2	3	3	3	4	4	4	23	6
Software Revenue	7	9	9	14	21	24	28	33	38	43	31	15
Bundled	4	5	3	5	6	6	7	8	8	9	12	10
Unbundled	4	4	6	9	16	18	22	26	29	33	45	16
Service Revenue	7	8	5	9	10	10	11	13	14	16	10	10
Total Factory Revenue	37	44	36	52	65	69	76	85	93	102	15	9
Increase over Prior Year (%)	8	19	-19	47	25	6	10	11	10	9		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (September 1993)

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Table 29
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: Rest of World
Platform: Technical Workstation

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	182	320	308	463	420	480	560	640	720	810	23	14
Unit Shipments or Seats	182	320	308	463	420	480	560	640	720	810	23	14
CPU Installed Base	614	894	1,132	1,473	1,737	1,980	2,280	2,580	2,940	3,280	30	14
Installed Seats	614	894	1,132	1,473	1,737	1,980	2,280	2,580	2,940	3,280	30	14
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	56.2	57.8	45.9	40.7	43.5	41.5	39.8	38.6	37.7	36.8	-6	-3
Hardware-Only ASP	22.6	11.9	16.5	13.7	17.6	16.0	14.7	13.8	13.3	12.9	-6	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	7	12	8	11	12	13	14	15	17	18	13	9
CPU Revenue	6	9	7	10	11	11	12	13	15	16	14	9
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	1	3	2	1	1	2	2	2	2	2	12	8
Software Revenue	3	4	3	7	9	10	12	14	16	18	31	14
Bundled	2	4	2	5	4	5	5	6	6	7	23	12
Unbundled	1	1	1	2	5	6	7	8	9	11	40	16
Service Revenue	4	6	3	6	7	8	9	10	11	13	19	12
Total Factory Revenue	14	22	14	24	28	31	35	39	44	48	19	11
Increase over Prior Year (%)	90	56	-33	67	17	11	12	12	11	11		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (September 1993)

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Table 30
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: Rest of World
Platform: Host-Dependent

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	22	31	40	17	13	10	0	0	0	0	-13	-100
Unit Shipments or Seats	160	144	167	141	73	30	10	0	0	0	-18	-100
CPU Installed Base	175	193	215	208	184	160	140	110	90	70	1	-18
Installed Seats	824	917	1,006	1,029	942	800	640	480	330	200	3	-27
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	277.6	348.9	196.3	197.4	367.5	351.0	336.6	322.6	309.0	296.6	7	-4
Hardware-Only ASP	960.0	205.6	151.1	350.5	216.6	197.2	181.0	165.9	151.9	139.8	-31	-8
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	7	7	6	4	3	1	0	0	0	0	-18	-100
CPU Revenue	3	4	3	2	2	1	0	0	0	0	-11	-100
Terminal Revenue	3	2	2	2	1	0	0	0	0	0	-27	-100
Peripheral Revenue (Turnkey)	0	1	0	0	0	0	0	0	0	0	-22	-100
Software Revenue	3	2	2	1	1	0	0	0	0	0	-27	-100
Bundled	2	1	1	0	0	0	0	0	0	0	-31	-100
Unbundled	1	1	1	1	0	0	0	0	0	0	-17	-100
Service Revenue	3	2	2	1	1	0	0	0	0	0	-21	-100
Total Factory Revenue	12	11	9	7	5	2	1	0	0	0	-20	-100
Increase over Prior Year (%)	-39	-8	-19	-24	-29	-57	-69	-81	-92	-100		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (September 1993)

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Table 31
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: Rest of World
Platform: Server

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	NA	NA	NA	77	87	100	110	130	140	160	NA	13
Unit Shipments or Seats	NA	NA	NA	77	87	100	110	130	140	160	NA	13
CPU Installed Base	NA	NA	NA	77	164	260	360	450	550	620	NA	31
Installed Seats	NA	NA	NA	77	164	260	360	450	550	620	NA	31
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	NA	NA	NA	44.9	51.8	49.5	47.5	45.5	43.6	41.8	NA	-4
Hardware-Only ASP	NA	NA	NA	37.9	46.3	42.2	38.7	36.8	35.7	34.9	NA	-5
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	NA	NA	NA	3	3	3	4	4	4	4	NA	7
CPU Revenue	NA	NA	NA	3	3	3	3	3	4	4	NA	7
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	NA	NA	NA	0	0	1	1	1	1	1	NA	7
Software Revenue	NA	NA	NA	0	1	1	2	2	2	2	NA	11
Bundled	NA	NA	NA	0	1	1	2	2	2	2	NA	10
Unbundled	NA	NA	NA	NA	0	0	0	0	0	0	NA	15
Service Revenue	NA	NA	NA	1	1	2	2	2	2	2	NA	9
Total Factory Revenue	NA	NA	NA	5	6	6	7	8	8	9	NA	8
Increase over Prior Year (%)	NA	NA	NA	NA	29	9	10	8	8	7		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (September 1993)

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Table 32
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: Rest of World
Platform: Personal Computer

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	1,231	1,445	1,830	2,553	4,517	5,330	6,290	7,230	7,950	8,590	38	14
Unit Shipments or Seats	1,231	1,445	1,830	2,553	4,517	5,330	6,290	7,230	7,950	8,590	38	14
CPU Installed Base	3,297	4,464	5,793	7,568	10,908	14,360	17,930	21,500	24,800	27,760	35	21
Installed Seats	3,297	4,464	5,793	7,568	10,908	14,360	17,930	21,500	24,800	27,760	35	21
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	15.2	20.8	16.9	31.2	27.3	24.6	22.1	20.8	19.7	19.0	16	-7
Hardware-Only ASP	6.7	4.9	4.0	4.0	3.4	3.1	2.9	2.7	2.6	2.5	-16	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	8	7	7	10	16	17	18	20	20	21	17	6
CPU Revenue	8	7	7	10	15	16	17	18	19	20	15	6
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	NA	0	0	1	1	1	1	1	1	1	NA	7
Software Revenue	2	3	4	6	10	12	15	18	20	23	61	17
Bundled	0	0	0	0	0	0	0	0	0	0	19	-6
Unbundled	2	3	4	6	10	12	15	18	20	23	61	17
Service Revenue	1	0	0	0	0	0	0	1	1	1	-24	29
Total Factory Revenue	10	11	12	16	26	29	33	38	41	45	26	11
Increase over Prior Year (%)	64	2	12	38	59	12	14	13	10	8		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (September 1993)

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September 20, 1993

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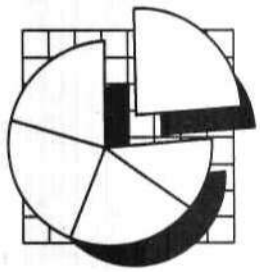
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AEC Applications Worldwide Market Share Update



Market Statistics

1993

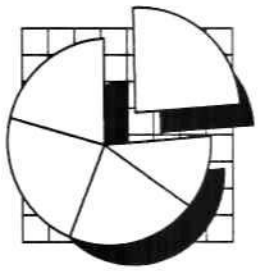
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AEC Applications Worldwide Market Share Update



Market Statistics

1993

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Note: All tables show estimated data.

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Note: All tables show estimated data.

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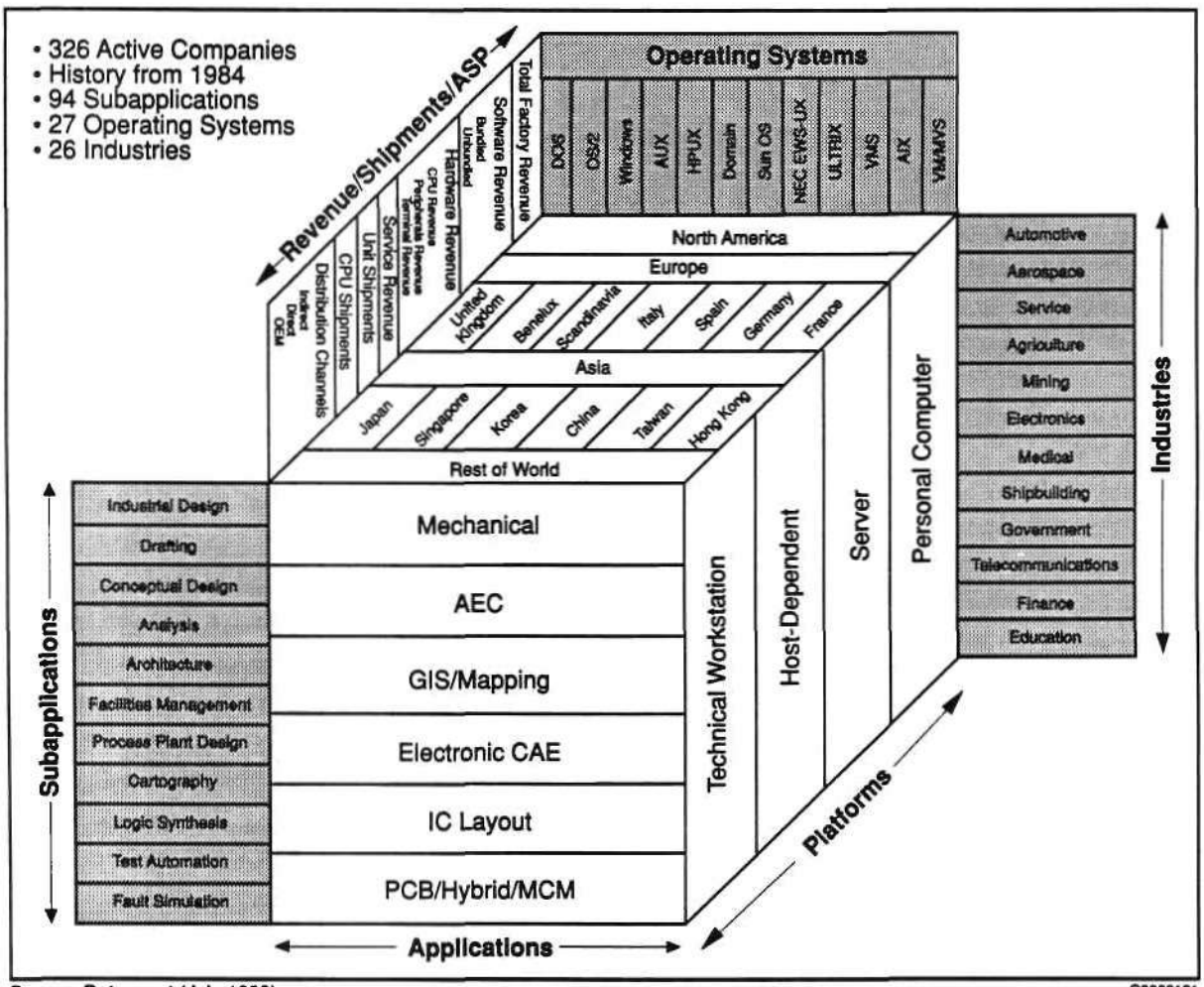
AEC Applications Worldwide Market Share Update

Introduction

CAD/CAM/CAE/GIS systems have dramatically changed the methods by which designers and production managers originate and implement products. CAD and CAE systems allow designers to create, draft, analyze, test, and manipulate products on a screen in two and three dimensions. As CAD/CAM/CAE/GIS systems continue to decrease in cost, they become more available and cost justifiable to new users.

In order to provide a comprehensive view of the CAD/CAM/CAE/GIS industry, Dataquest's CAD/CAM/CAE/GIS group maintains a large database of industry information. The type of information contained in the database is depicted in Figure 1.

Figure 1
CAD/CAM/CAE/GIS Market Database



Source: Dataquest (July 1993)

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CAD/CAM/CAE/GIS Market Share Update

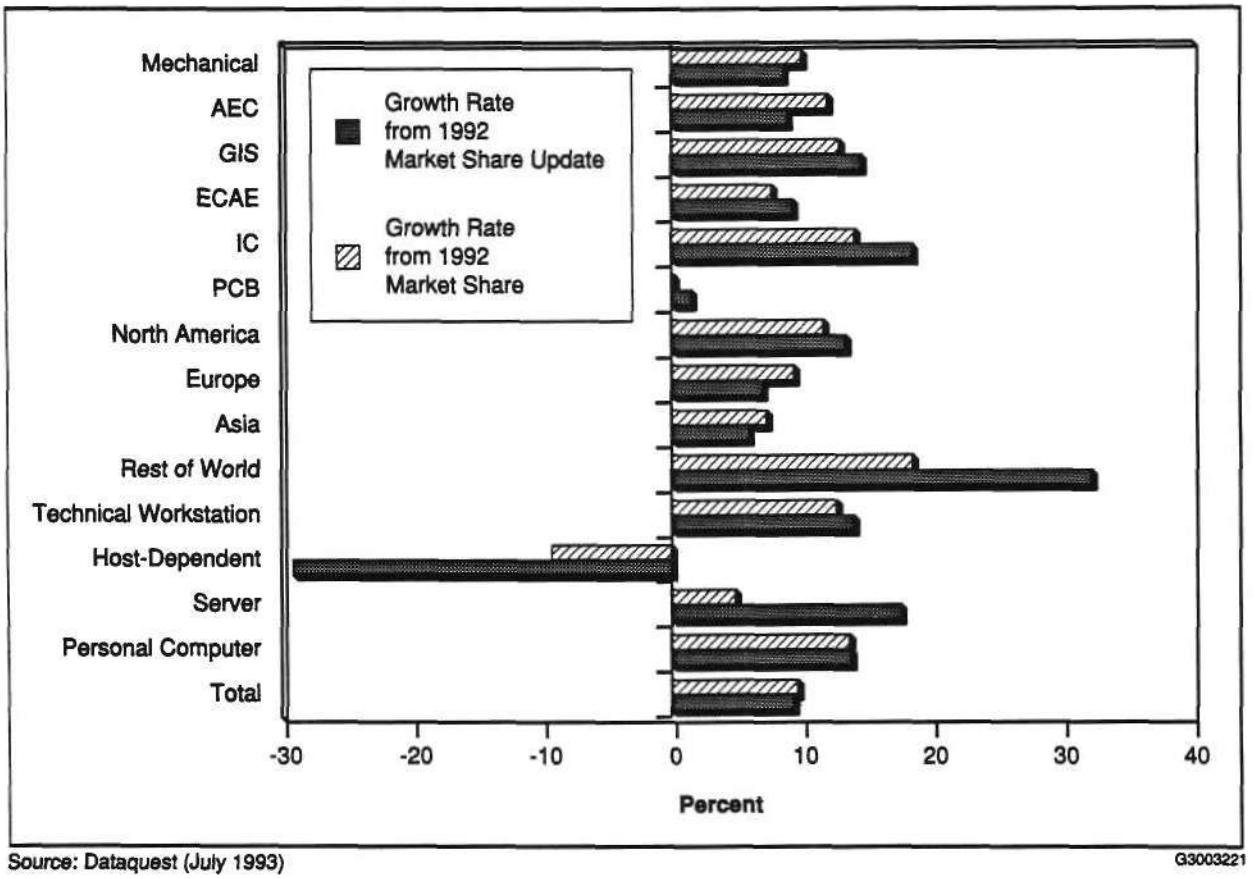
Software Market Grew 9.6 Percent in 1992, Revised Down from 9.7 Percent

Refinements of year-end figures leave the CAD/CAM/CAE/GIS markets essentially unchanged from our earlier market share data, with software revenue growth from 1991 to 1992 reduced to 9.6 percent from 9.7 percent and total factory revenue growth for the same period reduced to 4.0 percent from 4.2 percent. However, the stillness at this top level is deceptive. A look at the segment and company levels of the data and even at the database changes reveals some interesting shifts.

This market share update essentially revisits the companies in our database, seeking refinement of the previously reported market share data. Whereas much of the data from the initial survey came from vendor projections and early, year-end results, the update represents actual 1992 year-end results. From a global perspective, the results indicate that the optimists balanced the pessimists. The view from segments is a little more interesting.

Figure 2 provides a view of growth rates in software revenue by application, by region, and by platform, as well as the total market. In the area

Figure 2
1992 Software Revenue Growth: Market Share versus Market Share Update



Source: Dataquest (July 1993)

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of applications, geographic information system (GIS), electronic computer-aided engineering (ECAE), IC layout, and printed circuit board (PCB) were revised up while mechanical and AEC actually grew less than previously indicated, primarily because of overreporting of revenue for IBM in 1992 coupled with underreporting for 1991 in both areas. In the EDA arena, these revisions came about with more complete vendor input, readjusting some PCB revenue into ECAE and IC (see Table 1), and adding two companies to IC, two to ECAE, and deleting one from PCB, including past revenue.

Economic reality is confirmed by the regional picture with North America and Rest of World, previously reported with the greatest growth, now shown with greater growth, whereas Europe and Asia show less growth than our earlier view. From the view of platforms, the shift from host-dependent systems to client/server systems is occurring with greater speed than earlier indications.

Database Changes

Software

In viewing the actual market size for the above segments, looking at the earlier market share as compared with this updated version, the differences become considerable. We have continued to revise our company information with the best information available, even for past years. In addition to the growth rates changing as indicated above, the actual revenue figures have changed, as indicated in Table 1.

Expanded Definition for Service

In this survey, the service definition was expanded from hardware and software maintenance to now include:

- Hardware and software maintenance fees
- Training and education

Table 1
Comparison of 1991 and 1992 Software Revenue: Market Share versus Market Share Update

	1991 Software Revenue ($M)			1992 Software Revenue ($M)		
	Market Share	Market Share Update	% Change	Market Share	Market Share Update	% Change
Mechanical	2,033.0	2,117.0	4.1	2,235.3	2,299.1	2.9
AEC	666.1	680.2	2.1	746.1	740.8	-0.7
GIS/Mapping	555.8	545.3	-1.9	627.5	630.6	0.5
ECAE	691.2	699.8	1.2	744.1	765.8	2.9
IC	195.8	195.8	0	223.4	232.7	4.2
PCB/Hybrid/MCM	328.3	306.6	-6.6	329.1	311.4	-5.4
Total	4,470.2	4,544.4	1.7	4,905.5	4,980.3	1.5

Source: Dataquest (July 1993)

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- Service bureau operators
- Application development
- Consulting
- Systems integration

In 1991, service revenue was $2,408.6 million and was $2,611.4 million in 1992. The resulting growth of 8.4 percent in service revenue reflects growth in service and our change in definition. This change had the largest impact on the IC layout market, and considerably added to the mechanical, ECAE, and PCB markets as well (see Table 2). In mechanical, SDRC was the big foot. The database was not revised backward to reflect this change. Forecasting, however, will now be expanded to include this area of growth.

Shift in Revenue Distribution

Reflecting this expansion of services definition and extreme pressure on hardware revenue is the redistribution of revenue by hardware, software, and services as shown in Table 3.

Table 2
1992 Service as a Percentage of Total Revenue: Market Share versus Market Share Update

	Market Share	Market Share Update	% Change
Mechanical	16.5	17.1	3.4
AEC	14.1	14.0	-0.7
GIS/Mapping	18.0	17.6	-2.2
ECAE	16.6	17.4	4.8
IC Layout	19.0	21.0	10.5
PCB/Hybrid/MCM	18.5	19.0	2.7

Source: Dataquest (July 1993)

Table 3
Change in Distribution of 1992 Revenue: Market Share versus Market Share Update

	Revenue ($M)		% Distribution of Revenue	
	Market Share	Market Share Update	Market Share	Market Share Update
Hardware	8,093.8	7,765.5	52.0	50.5
Software	4,905.5	4,972.6	31.5	32.4
Services	2,578.0	2,624.2	16.5	17.1
Total	15,577.3	15,362.3		

Source: Dataquest (July 1993)

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Company Changes

Table 4 provides a listing of the top 20 vendors and the changes in the total revenue figure from the market share previously reported. IBM revenue changes were made following the prior market share but before the subsequent forecasting. Intergraph's earlier reported revenue included document imaging and other graphics software, which does not belong in CAD/CAM. Digital previously did not report its hardware revenue, and neither did Autodesk with its software revenue, whereas SDRC now includes the expanded service.

Analysis of Workstation Distribution

In addition to these changes, the CAD/CAM/CAE/GIS group significantly refined its database model for workstations. Using two years of software revenue distribution by operating system, collected by a survey

Table 4
1992 Top 20 CAD/CAM/CAE/GIS Vendors Total Revenue: Market Share versus Market Share Update

	Total Revenue 1992 ($M) Market Share	Market Share Update	Revenue Change ($M)	Final Market Share (%)	Share Difference (%)
IBM	1,861.2	1,756.9	-104.3	11.4	-0.5
Intergraph	1,171.7	1,126.6	-45.2	7.3	-0.2
Hewlett-Packard	922.4	919.9	-2.5	6.0	0.1
Digital	843.6	918.9	75.3	6.0	0.6
Sun Microsystems	876.8	869.5	-7.3	5.7	0.1
Computervision	781.7	777.3	-4.5	5.1	0.1
Fujitsu	442.0	442.0	0	2.9	0.1
Compaq	416.3	429.8	13.5	2.8	0.1
Cadence	425.6	425.4	-0.2	2.8	0.1
Autodesk	341.6	367.7	26.1	2.4	0.2
Mentor Graphics	350.8	349.4	-1.4	2.3	0
NEC	348.0	348.0	0	2.3	0.1
EDS-Unigraphics	302.9	310.1	7.2	2.0	0.1
Siemens Nixdorf Infosysteme	271.2	271.1	-0.1	1.8	0.1
Apple Computer	243.2	239.0	-4.2	1.6	0
Silicon Graphics	272.9	230.5	-42.4	1.5	-0.3
Nihon Unisys	228.3	228.3	0	1.5	0
Hitachi	174.0	174.0	0	1.1	0
Control Data	169.4	169.4	0	1.1	0
SDRC	123.3	149.8	26.5	1.0	0.2
Top 20 Companies	10,566.9	10,503.6	-63.3	68.3	0.5
All Companies	15,577.3	15,366.8	-210.5	100.0	0

Source: Dataquest (July 1993)

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of software vendors, we can estimate the distribution of workstations by hardware vendor in the various application segments (see Table 5). This analysis resulted in realignment of workstation shipments of Hewlett-Packard, Sun, and Silicon Graphics to the distribution of software revenue. (Note that these unit sales are expanded to include units sold through OEMs. They, therefore, will not match the unit sales in the market share tables where OEM is deleted to prevent double counting.)

Company Additions and Deletions

Finally, we added nine new companies to our database with a collective total revenue of $36.0 million for 1991; $46.5 for 1992 (see Table 6). We deleted LPKF and Simulation Science: upon re-evaluation, we realized that both companies are related to, but not included in the CAD/CAM/CAE/GIS market. IGC was purchased by IMSI, which was not previously in our database, so IMSI was added to include IGC for 1991 and 1992. However, we have not incorporated other company name changes (such as Cadam to Altium) or acquisitions (such as Quad Design by Viewlogic) that have occurred during 1993.

Market Share Battles

An interesting view of the CAD/CAM/CAE/GIS market is at the level of market leaders in software revenue for each application. The tables that follow provide software revenue and share of market for 1991 and 1992 as they now appear in the database.

Mechanical

An army of well-equipped companies is on the march in the mechanical market, assaulting the two old guards, IBM and Computervision (see Table 7). IBM, showing decline in its mechanical software despite its partnerships with the market leaders, Dassault, SDRC, and CADAM, is struggling to survive the squeeze of moving from high-margin, host-dependent systems to the more competitive market of technical workstations and client/servers. With losses in its host dependent business as

Table 5
Unit Sales of Technical Workstations by Application Segment, by Top U.S. Vendors for 1992 (Including Units Sold through OEMs)

	Mechanical	AEC	GIS	ECAE	IC	PCB	Total	Share of Market
Sun Microsystems	27,567	3,804	6,607	16,586	7,709	7,624	69,897	40.3
Hewlett-Packard	17,370	3,871	1,581	7,039	2,321	4,054	36,236	20.9
Digital	8,965	1,762	2,327	1,196	855	1,499	16,604	9.6
Intergraph	2,421	4,980	5,698	516	45	422	14,082	8.1
Silicon Graphics	8,574	461	478	117	0	0	9,630	5.6
IBM	6,065	717	213	0	0	244	7,239	4.2
Total Worldwide Units	77,471	22,559	20,453	26,385	11,347	15,264	173,479	100.0
Distribution (%)	44.7	13.0	11.8	15.2	6.5	8.8	100.0	

Source: Dataquest (July 1993)

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Table 6
Changes in CAD/CAM/CAE/GIS Vendors with Total Revenue for 1991 and 1992

	1991 Total Revenue ($M)	1992 Total Revenue ($M)	Application Segment
Additions:			
CAMAX Systems	7.3	9.2	Mechanical
Chronologic Simulation	1.0	1.5	ECAE
CrossCheck Technology	4.5	6.8	ECAE
Enghouse Systems	5.4	8.3	GIS/Mapping
High-Level Design System	1.5	2.5	IC Layout
IMSI	1.7	2.2	PC-Design
PCI Remote Sensing	5.0	6.0	GIS/Mapping
PiE Design	6.0	6.0	ECAE
Softronics	3.6	4.0	Spain-Design
Total	36.0	46.5	
Deletions:			
IGC	0.7	0.7	PC-Design
LPKF	15.0	14.1	PCB
Simulation Science	1.2	1.2	AEC
Total	16.9	16.0	
Gross Change	19.1	30.5	

Source: Dataquest (July 1993)

Table 7
Top 10 Mechanical Software Companies Worldwide

	1991 Software Revenue ($M)	1991 Share of Market (%)	1992 Software Revenue ($M)	1992 Share of Market (%)	Change in Software Revenue (%)
IBM	370.4	17.5	359.8	15.6	-2.9
Computervision	232.4	11.0	206.9	9.0	-11.0
Autodesk	108.3	5.1	147.1	6.4	35.9
Dassault*	133.5	6.3	146.9	6.4	10.0
SDRC	101.1	4.8	129.2	5.6	27.7
EDS-Unigraphics	80.7	3.8	107.7	4.7	33.4
CADAM*	66.3	3.1	88.7	3.9	33.8
Parametric Technology	43.4	2.0	81.2	3.5	87.2
Hewlett-Packard	64.0	3.0	72.1	3.1	12.7
MacNeal-Schwendler	53.4	2.5	64.7	2.8	21.1
Top 10 Companies	1,253.4	59.2	1404.2	61.1	12.0
All Companies	2,117.0	100.0	2,299.1	100.0	8.6

*Includes distributor and/or supplier revenue

Source: Dataquest (July 1993)

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well as in Europe and Asia, IBM is outflanked by the hardy and nimble players in the workstation platform where there is real competition.

Computervision is heavily deployed in Europe where the dark cloud of recession continues to cast its gloom. This offshore presence has weakened the company on its home front, resulting in a decrease of 11 percent in software revenue, which is a loss in market share of 2 percentage points, a big loss for a big player. Despite the losses of these two market leaders, the eight attackers grew a collective 28.7 percent, gaining a whopping 5.7 percentage points in market share.

AEC

The AEC market is quite another story, with the market leaders, Autodesk and Intergraph, cementing their leadership by growing faster than the market, gaining a combined 2.6 percentage points share of market while three of the other eight top 10 competitors declined (see Table 8). The interesting part of this picture is right in the middle: two German companies, Nemetschek and IEZ, battling tooth-and-nail for leadership. The companies are growing in stark contrast to the economic climate of Europe's home front.

GIS/Mapping

The GIS market, with its amazing growth rate of 15.6 percent, is marked by a fight for the top. In 1991, Integraph led ESRI in share of market by 5.5 percentage points, whereas in 1992 Integraph's lead was reduced to 2.6 percentage points, giving ESRI a 2.9 percentage points annual gain on Integraph (see Table 9). In the meantime, the remaining top 10 companies most grew at impressive rates, although much of GeoVision's growth resulted from acquisition during 1992.

Table 8
Top 10 AEC Software Companies Worldwide

	1991 Software Revenue ($M)	1991 Share of Market (%)	1992 Software Revenue ($M)	1992 Share of Market (%)	Change in Software Revenue (%)
Autodesk	128.2	18.9	158.1	21.3	23.3
Intergraph	100.4	14.8	111.0	15.0	10.6
IBM	40.5	6.0	41.5	5.6	2.6
Fujitsu	37.1	5.5	35.6	4.8	-3.9
Nemetschek	24.7	3.6	32.5	4.4	31.7
IEZ	19.8	2.9	32.1	4.3	62.2
Computervision	23.2	3.4	25.1	3.4	8.1
ISICAD	19.4	2.9	17.2	2.3	-11.6
NEC	16.8	2.5	11.7	1.6	-30.2
Dassault*	10.1	1.5	11.1	1.5	9.9
Top 10 Companies	420.1	61.8	476.0	64.3	13.3
All Companies	680.2	100.0	740.8	100.0	6.2

*Includes distributor and/or supplier revenue

Source: Dataquest (July 1993)

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Table 9
Top 10 GIS Software Companies Worldwide

	1991 Software Revenue ($M)	1991 Share of Market (%)	1992 Software Revenue ($M)	1992 Share of Market (%)	Change in Software Revenue (%)
Intergraph	107.2	19.7	114.4	18.1	6.7
ESRI	77.6	14.2	98.0	15.5	26.3
Siemens Nixdorf Infosysteme	49.7	9.1	53.2	8.4	7.0
Autodesk	28.5	5.2	40.5	6.4	42.0
EDS-Unigraphics	17.0	3.1	24.1	3.8	41.5
Landmark Graphics	23.2	4.3	18.8	3.0	-19.0
GeoVision Systems	8.5	1.6	14.0	2.2	64.6
Moss Systems	9.7	1.8	14.0	2.2	43.9
Genasys II	9.7	1.8	13.0	2.1	34.2
Fujitsu	13.2	2.4	12.6	2.0	-3.9
Top 10 Companies	344.3	63.1	402.6	63.8	16.9
All Companies	545.3	100.0	630.6	100.0	15.6

Source: Dataquest (July 1993)

ECAE

The electronic computer-aided engineering (ECAE) market has been shaken up with mergers and acquisitions. Cadence merged with Valid and skipped over Mentor Graphics. Viewlogic bought Vantage, but was still passed by Synopsys. The European ECAE software market grew only 2.3 percent, providing a rough road for Racal-Redac. Wacom, with its emphasis on the personal computer platform in Japan, also had a rough year in this market (see Table 10).

IC Layout

The fastest-growing and smallest application segments have few players. The top 10 comprise almost 97 percent of the market, with Cadence continuing to dominate (see Table 11). The change in growth rates versus The PCB/hybrid/MCM layout market continues to stagnate, showing previous market share is because of changes reported by Cadence. Compass Design Automation appears to be a hard charger, driven by new library development tools.

PCB/Hybrid/MCM Layout

little growth in the past two years (see Table 12). This market is drawn along geographic lines: Zuken rules the Japanese market, whereas Racal-Redac's strength lies in Europe. Neither company has a strong presence in North America where Mentor Graphics and Cadence battle it out.

Market Analysis

The final view of all this activity is shown in Figure 3, which depicts the market size and market growth rate for each segment in the CAD/CAM/CAE/GIS software industry. In Figure 3, the heavy horizontal line

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Table 10
Top 10 ECAE Software Companies Worldwide

	1991 Software Revenue ($M)	1991 Share of Market (%)	1992 Software Revenue ($M)	1992 Share of Market (%)	Change in Software Revenue (%)
Cadence (Valid)	154.2	22.0	165.6	21.6	7.3
Mentor Graphics	73.2	10.5	77.3	10.1	5.6
Synopsys	30.1	4.3	51.3	6.7	70.6
Viewlogic (Vantage)	36.2	4.4	46.7	6.1	29.0
Racal-Redac	28.5	4.1	27.2	3.6	-4.3
Wacom	25.5	3.6	23.3	3.0	-8.7
EEsof	18.1	2.6	22.1	2.9	22.2
Intergraph	17.5	2.5	20.9	2.7	19.4
Marubeni Hytech*	16.5	2.4	19.7	2.6	19.3
Autodesk	17.1	2.4	18.4	2.4	7.5
Top 10 Companies	411.6	58.8	472.5	61.7	14.8
All Companies	699.8	100.0	765.8	100.0	9.5

*Includes distributor and/or supplier revenue

Source: Dataquest (July 1993)

Table 11
Top 10 IC Layout Software Companies Worldwide

	1991 Software Revenue ($M)	1991 Share of Market (%)	1992 Software Revenue ($M)	1992 Share of Market (%)	Change in Software Revenue (%)
Cadence (Valid)	114.0	56.9	136.3	58.6	19.5
Mentor Graphics	33.7	16.8	31.5	13.5	-6.4
Compass Design	11.7	5.9	17.3	7.4	47.4
Seiko*	13.7	6.8	14.5	6.2	5.9
Sagantec	3.6	1.8	6.7	2.9	86.9
Silvar-Lisco	5.2	2.6	5.8	2.5	9.7
Cascade Design	3.0	1.5	4.7	2.0	55.9
Fujitsu	0	0	3.5	1.5	NA
Integrated Silicon Systems	2.5	1.2	3.0	1.3	21.0
Intergraph	1.6	0.8	1.9	0.8	22.2
Top 10 Companies	189.0	96.5	225.2	96.8	19.1
All Companies	195.8	100.0	232.7	100.0	18.8

*Includes distributor and/or supplier revenue

NA = Not applicable

Source: Dataquest (July 1993)

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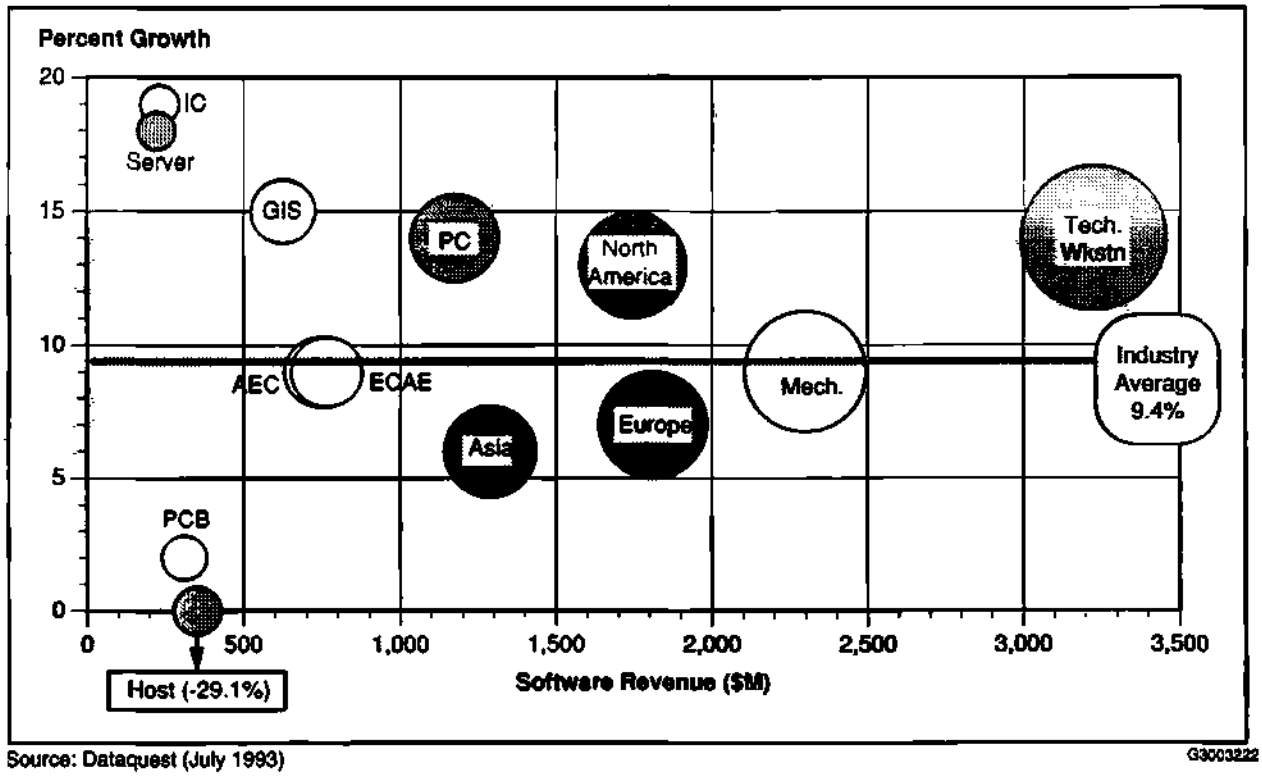
Table 12
Top 10 PCB/Hybrid/MCM Software Companies Worldwide

	1991 Software Revenue ($M)	1991 Share of Market (%)	1992 Software Revenue ($M)	1992 Share of Market (%)	Change in Software Revenue (%)
Racal-Redac	42.1	13.7	46.3	14.9	10.0
Mentor Graphics	39.5	12.9	43.0	13.8	8.7
Zuken	46.9	15.3	41.6	13.4	-11.3
Cadence (Valid)	31.5	10.3	36.5	11.7	15.8
IBM	16.3	5.3	17.1	5.5	4.7
Intergraph	12.7	4.1	16.0	5.1	25.5
Harris EDA	13.9	4.5	12.2	3.9	-11.8
CADIX	11.3	3.7	11.8	3.8	4.0
Sharp*	15.0	4.9	9.6	3.1	-35.8
Fujitsu	8.4	2.7	8.1	2.6	-3.8
Top 10 Companies	237.6	77.5	242.0	77.7	1.9
All Companies	306.6	100.0	311.4	100.0	1.6

*Includes distributor and/or supplier revenue

Source: Dataquest (July 1993)

Figure 3
CAD/CAM/CAE/GIS Market Portfolio for Software Revenue for 1992



Source: Dataquest (July 1993)

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indicates the industry average for software growth, the size of the bubbles reflects market share, and the bubbles are centered over their market size (y-axis) and market growth rate (x-axis) for 1992.

From this figure, the IC layout application segment and server platform are the two smallest and two fastest-growing segments. Workstations are the largest market segment with a higher than average growth rate of 14 percent. Notice that host-dependent platform segment is off the chart with a negative 29. 1 percent growth rate.

Hardware Revenue Suffers

In contrast to the high growth rates of software, hardware took a beating with a total growth rate of negative 0.1 percent despite an increase of seats totaling 5.9 percent (see Table 13). The hardware market continues to be pressured by decreasing margins and increasing competitiveness. Host-dependent systems are being replaced by networked, desktop systems, and distinctions between workstations and PCs are becoming increasingly blurred.

About This Document

This document contains Dataquest's detailed market share information on the CAD/CAM/CAE/GIS industry. Following is a description of the companies included in the *Market Share Update* books:

- Source—All companies in database; overview of industry
- Mechanical Applications—All companies in database with mechanical revenue
- AEC Applications—All companies in database with AEC revenue
- GIS Applications—All companies in database with GIS revenue
- Electronic Design Automation Applications—All companies in database with EDA (electronic CAE, IC layout, PCB/hybrid/MCM) revenue

Table 13
Hardware Seats, Revenue, and Average Selling Price for 1991 and 1992

	1991 Seats	1992 Seats	Growth (%)	1991 Hardware Revenue ($M)	1992 Hardware Revenue ($M)	Growth (%)	1991 Average Selling Price ($K)	1992 Average Selling Price ($K)	Growth (%)
Workstation	150,748	173,489	15.1	3,670.6	3,967.9	8.1	24.3	22.9	-6.0
Host-Dependent	39,897	31,771	-20.4	1,854.6	1,529.8	-17.5	46.5	48.2	3. 6
Server	14,830	16,301	9.9	531.0	573.8	8.1	35.8	35.2	-1.7
Personal Computer	412,406	432,848	5.0	1,718.7	1,705.4	-0.8	4.2	3.9	-5. 5
Total	617,881	654,408	5.9	7,774.8	7,776.8	0	12.5	11.9	-4.8

Source: Dataquest (July 1993)

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- Europe Overview—All Europe-based companies and all other companies with more than $1 million in European revenue
- European Countries—All companies in the European overview that report revenue by European country: Benelux, France, Germany, Italy, Scandinavia, Spain, United Kingdom, and Rest of Europe (includes Austria, Switzerland, and Eastern Europe).
- Asia—All Asia-based companies and all other companies with more than $1 million in Asian revenue
- Personal CAD and Distribution Channels—All companies in database with personal computer revenue

More detailed data on these markets may be requested through our client inquiry service.

Dataquest's policy is to continually update its market information, for current and past years, with any new data received in order to arrive at the most accurate market representation possible.

Segmentation Definitions

This section lists the definitions specific to this document. The following paragraphs define the segments.

Applications

Mechanical

The mechanical segment refers to computer-aided tools used by engineers, designers, analysts, technicians, and draftspeople working predominantly in the discrete manufacturing industries, but includes government and education. Users of mechanical CAD/CAM/CAE tools work in all departments across the typical organization, with a majority found in product design, advanced engineering, and manufacturing engineering. Common design applications include conceptual design, industrial design, structural or thermal analysis, detail design, and electromechanical design (the mechanical part of design with electrical or electronic components and mechanisms). Common manufacturing applications include tool and fixture design, numerical control part programming, off-line robotics programming, and interface to quality control systems. Management tools for database control and distribution are included in this segment, as well as user-defined application programming.

Architecture, Engineering, and Construction (AEC)

The AEC segment covers the use of computer-aided tools by architects, contractors, plant engineers, civil engineers, and other people associated with these disciplines to aid in designing and managing buildings, industrial plants, ships, and other types of nondiscrete entities.

Geographic Information Systems (GIS)/Mapping

GIS is computer-based technology, and the segment is composed of hardware, software, and data used to capture, edit, display, and analyze spatial (tagged by location) information.

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Electronic Design Automation (EDA)

The EDA segment covers computer-based tools used to automate the process of designing an electronic product, including printed circuit boards, ICs, and systems. EDA includes ECAE, IC layout, and PCB/hybrid/MCM, as follows:

- Electronic Computer-Aided Engineering (ECAE)—These are computer-aided tools used in the engineering or design phase of electronic products (as opposed to the physical layout phase of the product). Examples of electronic CAE applications are schematic capture and simulation.
- IC Layout—This is a software application tool used to create and validate the physical implementation of an IC. The IC layout category comprises polygon editors, symbolic editors, placement and routing (gate array, cell, and block), design verification tools (DRC/ERC/logic-to-layout), compilers, and module development tools.
- PCB/Hybrid/MCM—This segment covers products used to create the placement and routing of the traces and components laid out on a printed circuit board. Also included in this category are thermal analysis tools.

Regions

The following paragraphs define the regions.

North America

North America includes United States, Mexico, and Canada.

Europe

Europe includes the United Kingdom, Scandinavia, Benelux, France, Germany, Italy, Spain, and Rest of Europe.

Asia

Asia includes Japan, Singapore, Taiwan, Korea, China, and Hong Kong.

Rest of World

Rest of World includes all other countries including Australia, New Zealand, Oceania, Africa, Central America, South America, and the Middle East.

Platforms

The following paragraphs define the platforms.

Technical Workstation

A technical workstation is a single-user computer distinguished from a personal computer by its features and by the user's potential range of expansion on the platform. Features include a virtual, multitasking operating system (UNIX, VMS, or Domain); the computer is designed by the manufacturer to run high-performance graphics applications in a multiuser/multitasking environment.

Host-Dependent

Host-dependent is a shared logic system in which the external workstations' functions are dependent on a host computer.

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Server

A server is a computer that transparently provides its resources for use by other computer systems. It is a system on a network that provides specific functionality to other computer systems: the clients. Functions include file storage, database access, and compute capability. Dataquest tracks the following major categories of servers used for CAD/CAM/CAE and GIS applications:

- Compute Servers—These systems provide capabilities for solving numerical problems (for example, simulations, statistical calculations, and simultaneous partial differential equations). System features usually include high-speed computational capabilities (for example, vector and parallel processing) and large memories.
- Print Servers—These systems provide access to printers, specialized printing applications software, and print-spooling resources to a network.
- File Servers—These systems provide mass storage capability to clients on a network. Services can range from temporary storage of working files to long-term backup and archive systems.
- Database Servers—These systems manage databases as a shared resource to a network. These servers handle such functions as physical data storage, data security, and high-level queries and can access stored information at the record level.

Personal Computer

A personal computer is a single-user computer distinguished from a technical workstation by its features and by the user's potential range of expansion on the platform. Features found in technical workstations (such as a virtual operating system, networking, high-performance graphics, multiuser/multitasking capability) are optional rather than integrated by the manufacturer.

Metrics

The following paragraphs define measurements.

- Total factory revenue is defined as the amount of money received by a manufacturer for its goods and services measured in U.S. dollars. Total factory revenue does not include revenue that a company may receive from products that are sold to another company for resale (OEM revenue). Total factory revenue is the sum of software revenue, hardware revenue, and service revenue.
- Unit shipment is defined as the number of seats delivered (number of possible simultaneous users of product delivered).
- Hardware revenue is revenue derived from sales of CPUs (including operating systems), terminals (for host-dependent systems), and peripherals.
- Software revenue is revenue derived from the sale of bundled (part of a turnkey system) and unbundled application software.

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- Service revenue is defined as all revenue derived from the service and support of CAD/CAM/CAE/GIS systems. Service revenue can be calculated in the tables by subtracting hardware and software revenue from total revenue.
  - Maintenance fees for hardware and software
  - Management and Operations Services—help desk, education and training, disaster recovery, vaulting, and configuration management.
  - Service Bureau—project work, including construction of database, data conversion, product design, analysis, or manufacturing.
  - Application Development—design and development of customized software applications or the modification, enhancement of customization of existing software applications, adding new functionality.
  - Consulting Revenue—assessment of CAD/CAM/CAE/GIS business and information technology needs and the formulation of a plan based on needs identification.
  - Implemenation and Integration Services—planning, implementation, migration, and integration of software products (software network support and integration, account integration management, data center design, and construction).

Market Share Methodology

Dataquest uses both primary and secondary sources to produce our market share data. In the fourth quarter of each year and second quarter of the subsequent year, we survey all participants in each industry. Each vendor is offered the opportunity to self-report the information required. Although there is a primary contact for each company, large companies are surveyed across product lines and across geographic regions. Thus, there is a corresponding increase in the number of contacts at large companies. (Dataquest maintains a large contact database on all sources of information). Examples of the job titles of people contacted for information are the following:

- President and CEO
- Vice President and General Manager
- Vice President of Marketing
- Vice President, Strategic Product Planning
- Director of Strategic Planning
- Director of Marketing
- Director of Market Development
- Manager, CAD/CAM/CAE/GIS Marketing Programs
- Market Research Analyst

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The Audit Process

Data supplied by vendors are evaluated against information drawn from many sources, including the following:

- Revenue published by major industry participants
- Estimates made by knowledgeable and reliable industry spokespersons
- Government data or trade association data
- Published product literature and price lists
- Interviews with knowledgeable manufacturers, distributors, and users
- Relevant economic data
- Information and data from online data banks
- Articles in both the general and trade press
- Annual reports, SEC documents, credit reports
- Company publications and press releases
- Reports from financial analysts
- User studies
- Reseller and supplier reports and reports from a vendor's competitors

In addition, Dataquest sums vendor revenue across other industries covered by Dataquest to make sure that revenue is not credited twice and checks with multiple sources at one company to cross-check data on that company.

Dataquest analysts have many years of experience in how to apply the above tools to get the most accurate information possible on a particular company (such as what to use when and what industry averages are). We believe that the estimates presented here are the most accurate and meaningful generally available today. It is the CAD/CAM/CAE/GIS group's policy to continually update our market information for any year, based on any new data received, in order to arrive at the most accurate market representation possible.

Dataquest's CAD/CAM/CAE/GIS market numbers are often higher than those reported by other sources. We survey worldwide, which involves more vendors, higher total market revenue, lower market share per vendor, and a more accurate market picture—particularly useful when comparing regions or applications.

Publishing Schedule

We publish market share and forecasting, twice each year for each, allowing for both timely distribution of data and thorough analysis and forecasting. Our annual delivery schedule is as follows:

- Market share data are available January 31. All tables will be published and distributed to clients by March 31.

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- Forecasting from the market share tables provides a five-year forecast period, available after March 31. The books will be shipped by May 31.
- Final updated market share tables, based on additional data collection and analysis, will be completed by May 31. At this point, the market share database is frozen and will not be changed until the end of the year. For the next six months, supplementary market data will be based on these final market data. Books will be shipped by July 31.
- We provide complete final forecast tables by July 31. These tables take into consideration changes in the market share during the previous six months. Books will be shipped by September 31.

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Table 14
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: All Platforms
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Intergraph	401.0	179.3	111.0	5,758	17.3%	14.3%	15.0%	3.7%
IBM	194.4	121.4	41.5	14,812	8.4%	9.7%	5.6%	9.5%
Autodesk	158.1	.0	158.1	0	6.8%	.0%	21.3%	.0%
Fujitsu	137.0	87.7	35.6	2,713	5.9%	7.0%	4.8%	1.7%
Compaq	103.2	103.2	.0	22,334	4.4%	8.2%	.0%	14.3%
Hewlett-Packard	100.5	85.9	.0	6,376	4.3%	6.8%	.0%	4.1%
Apple Computer	100.3	100.3	.0	21,223	4.3%	8.0%	.0%	13.6%
Computervision	93.4	30.1	25.1	885	4.0%	2.4%	3.4%	.6%
Digital	89.6	63.0	.0	2,976	3.9%	5.0%	.0%	1.9%
IEZ	64.3	22.5	32.1	1,360	2.8%	1.8%	4.3%	.9%
Nemetschek	58.0	21.5	32.5	1,609	2.5%	1.7%	4.4%	1.0%
NEC	55.7	39.5	11.7	5,386	2.4%	3.1%	1.6%	3.5%
Nihon Unisys	32.0	19.8	5.4	319	1.4%	1.6%	.7%	.2%
Sun Microsystems	30.6	26.5	.0	1,776	1.3%	2.1%	.0%	1.1%
ISICAD	28.9	7.3	17.2	153	1.2%	.6%	2.3%	.1%
EDS	24.4	11.5	10.4	474	1.0%	.9%	1.4%	.3%
Auto-Trol	22.4	8.3	8.5	280	1.0%	.7%	1.1%	.2%
Accugraph	20.0	8.9	9.1	709	.9%	.7%	1.2%	.5%
ItalCad	18.6	8.8	4.5	176	.8%	.7%	.6%	.1%
Hitachi	17.4	8.3	7.3	468	.7%	.7%	1.0%	.3%
Mitsubishi Electric	14.3	11.2	1.7	261	.6%	.9%	.2%	.2%

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Table 14 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: All Platforms
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Soft-Tech Software Technologies	13.8	2.1	10.4	932	.6%	.2%	1.4%	.6%
Mutoh Industries—No OEM	13.0	7.8	3.9	172	.6%	.6%	.5%	.1%
Kockums Computer Systems	12.9	3.2	7.1	635	.6%	.3%	1.0%	.4%
CAD Centre	12.8	.0	10.3	0	.6%	.0%	1.4%	.0%
Toshiba—No OEM	12.8	6.4	5.1	324	.5%	.5%	.7%	.2%
Sony	12.6	12.6	.0	460	.5%	1.0%	.0%	.3%
Siemens Nixdorf Info systeme	12.5	5.5	5.1	182	.5%	.4%	.7%	.1%
Han Dataport	12.1	3.7	6.5	261	.5%	.3%	.9%	.2%
Microway	11.9	7.2	3.6	127	.5%	.6%	.5%	.1%
Dell Computer	11.1	11.1	.0	2,884	.5%	.9%	.0%	1.9%
Silicon Graphics	11.1	10.3	.0	369	.5%	.8%	.0%	.2%
Century Research Center	10.8	5.7	4.0	60	.5%	.5%	.5%	.0%
CPU	10.5	.0	9.5	0	.5%	.0%	1.3%	.0%
Star Informatic	9.6	1.5	6.8	1,066	.4%	.1%	.9%	.7%
EA Systems	8.1	.0	8.1	0	.3%	.0%	1.1%	.0%
Hitachi Zosen Info Systems	7.8	6.7	.3	81	.3%	.5%	.0%	.1%
INS Engineering	7.2	3.6	3.6	30	.3%	.3%	.5%	.0%
Hochtief	7.2	1.1	5.0	86	.3%	.1%	.7%	.1%
ASG	6.8	.0	6.8	0	.3%	.0%	.9%	.0%
RIB/RZB	6.6	.6	5.4	41	.3%	.0%	.7%	.0%
Softdesk	6.4	.0	6.4	0	.3%	.0%	.9%	.0%

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Table 14 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: All Platforms
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
BATISOFT	6.3	.9	3.2	314	.3%	.1%	.4%	.2%
Aspen Technology	5.8	.0	5.2	0	.2%	.0%	.7%	.0%
Graphisoft Software Dev	5.7	.0	5.7	0	.2%	.0%	.8%	.0%
Sigma Design	5.6	.0	5.3	0	.2%	.0%	.7%	.0%
Uchida Yoko	5.3	3.2	1.9	126	.2%	.3%	.3%	.1%
Seiko Instruments—No OEM	5.3	2.6	2.6	136	.2%	.2%	.4%	.1%
mb Programme	5.1	2.5	1.8	122	.2%	.2%	.2%	.1%
Complansoft CAD	5.0	2.5	2.5	114	.2%	.2%	.3%	.1%
CAD Distribution	4.7	2.4	1.9	73	.2%	.2%	.3%	.0%
International Software Systems	4.7	.0	4.7	0	.2%	.0%	.6%	.0%
Toyo Information Systems—No OEM	4.2	2.6	1.2	46	.2%	.2%	.2%	.0%
Andor	4.2	1.1	3.0	32	.2%	.1%	.4%	.0%
Micrografx	4.2	.0	4.2	0	.2%	.0%	.6%	.0%
Computer Services Consultants	4.2	.0	4.2	0	.2%	.0%	.6%	.0%
Gable CAD Systems	4.1	2.9	.6	45	.2%	.2%	.1%	.0%
Research Machines	4.1	4.1	.0	654	.2%	.3%	.0%	.4%
Bechtel Software	4.0	.0	3.7	0	.2%	.0%	.5%	.0%
Integrated Computer Graphics	3.9	1.5	2.1	250	.2%	.1%	.3%	.2%
Sener Sistemas Marinos	3.7	.0	3.7	0	.2%	.0%	.5%	.0%
RoboCAD Solutions	3.7	.0	3.0	0	.2%	.0%	.4%	.0%
Control Data Systems	3.7	1.7	.6	54	.2%	.1%	.1%	.0%

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Table 14 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: All Platforms
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Datagraphic	3.6	1.8	1.4	57	.2%	.1%	.2%	.0%
Triplan	3.4	1.4	1.7	50	.1%	.1%	.2%	.0%
Sweet's Electronic Publishing	3.0	.0	2.4	0	.1%	.0%	.3%	.0%
Assigraph	2.9	.0	2.3	0	.1%	.0%	.3%	.0%
Wisdom Systems	2.7	.0	2.1	0	.1%	.0%	.3%	.0%
Ground Modelling Systems	2.7	1.4	1.1	232	.1%	.1%	.1%	.1%
Design Automation	2.5	.5	1.9	53	.1%	.0%	.3%	.0%
Innovative Data Design	2.5	.0	2.5	0	.1%	.0%	.3%	.0%
Olivetti	2.3	2.0	.0	281	.1%	.2%	.0%	.2%
Elstree Computing	2.2	1.0	1.2	62	.1%	.1%	.2%	.0%
Carrier Corporation	2.1	.0	2.1	0	.1%	.0%	.3%	.0%
CADKEY	2.1	.0	2.1	0	.1%	.0%	.3%	.0%
Ziegler Informatics	2.0	.0	2.0	0	.1%	.0%	.3%	.0%
Mitsui Engineering	2.0	1.4	.4	13	.1%	.1%	.1%	.0%
Claris	1.9	.0	1.9	0	.1%	.0%	.3%	.0%
CADWorks	1.9	.0	1.7	0	.1%	.0%	.2%	.0%
Moda CAD	1.9	.5	1.3	16	.1%	.0%	.2%	.0%
MEDESIGN	1.9	.5	.7	21	.1%	.0%	.1%	.0%
Lamp Software	1.9	.5	1.3	117	.1%	.0%	.2%	.1%
Macao Systems	1.9	1.0	.6	19	.1%	.1%	.1%	.0%
Land Innovation	1.8	.0	1.8	0	.1%	.0%	.2%	.0%

(Continued)

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Table 14 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: All Platforms
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Matra Datavision	1.8	.6	.9	15	.1%	.0%	.1%	.0%
IMSI	1.8	.0	1.8	0	.1%	.0%	.2%	.0%
Radan Computational	1.8	.6	.9	36	.1%	.0%	.1%	.0%
Research Engineers—Civilsoft	1.7	.0	1.7	0	.1%	.0%	.2%	.0%
Georgia Tech Research Corp.	1.7	.0	1.7	0	.1%	.0%	.2%	.0%
ARKTEC	1.6	.2	1.3	43	.1%	.0%	.2%	.0%
Engineered Software	1.6	.0	1.6	0	.1%	.0%	.2%	.0%
Sinus Software	1.5	.8	.8	36	.1%	.1%	.1%	.0%
American Small Business Comp.	1.4	.0	1.4	0	.1%	.0%	.2%	.0%
Mucke Software	1.1	.6	.4	27	.0%	.0%	.1%	.0%
Softronics	1.1	.3	.8	101	.0%	.0%	.1%	.1%
Serbi	1.1	.1	1.0	32	.0%	.0%	.1%	.0%
PAFEC	1.1	.0	1.1	0	.0%	.0%	.1%	.0%
Spectrum Graphics	1.1	.3	.5	10	.0%	.0%	.1%	.0%
CAE-link	1.1	.0	1.1	0	.0%	.0%	.1%	.0%
Foresight Resources	1.0	.0	.9	0	.0%	.0%	.1%	.0%
Sumitomo Denko Workstation	1.0	1.0	.0	53	.0%	.1%	.0%	.0%
ABB Industria*	.9	.4	.4	10	.0%	.0%	.1%	.0%
Evolution Computing	.9	.0	.9	0	.0%	.0%	.1%	.0%
Mega CADD	.8	.0	.8	0	.0%	.0%	.1%	.0%
GRAPHSOFT	.8	.0	.8	0	.0%	.0%	.1%	.0%

(Continued)

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Table 14 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: All Platforms
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
CAD-Capture	.7	.2	.2	4	.0%	.0%	.0%	.0%
ECOM Associates	.7	.0	.7	4	.0%	.0%	.1%	.0%
Engineering Systems Corp.	.6	.0	.6	0	.0%	.0%	.1%	.0%
Kubota Computer	.6	.4	.1	36	.0%	.0%	.0%	.0%
ERDAS	.5	.1	.3	7	.0%	.0%	.0%	.0%
DAT Standard info ssystemes	.4	.0	.4	0	.0%	.0%	.1%	.0%
Mc2 Engineering Software	.4	.0	.4	0	.0%	.0%	.0%	.0%
DAPCO	.4	.0	.2	0	.0%	.0%	.0%	.0%
Aura CAD/CAM Systems	.3	.0	.3	0	.0%	.0%	.0%	.0%
Solbourne	.3	.3	.0	26	.0%	.0%	.0%	.0%
ACDS Graphic System	.2	.0	.2	0	.0%	.0%	.0%	.0%
Ashlar	.2	.0	.2	0	.0%	.0%	.0%	.0%
A.I. Systems	.1	.0	.1	0	.0%	.0%	.0%	.0%
Other Companies	163.4	157.7	3.1	54,645	7.0%	12.5%	.4%	35.1%
All Companies	2,323.7	1,257.1	740.8	155,730	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	1,639.4	928.9	462.7	136,004	70.6%	73.9%	62.5%	87.3%
All Asian-Based Companies	356.1	222.1	99.4	10,768	15.3%	17.7%	13.4%	6.9%
All European-Based Companies	328.2	106.2	178.7	8,958	14.1%	8.4%	24.1%	5.8%
All Hardware Companies	673.3	621.5	.1	126,630	29.0%	49.4%	.0%	81.3%
All Turnkey & SW Companies	1,650.4	635.7	740.7	29,100	71.0%	50.6%	100.0%	18.7%

Source: Dataquest (July 1993)

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Table 15
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: Technical Workstation
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Intergraph	331.5	154.3	81.3	4,980	30.2%	28.2%	24.8%	22.1%
Hewlett-Packard	90.1	76.5	.0	3,213	8.2%	14.0%	.0%	14.2%
Computervision	86.6	28.3	22.6	777	7.9%	5.2%	6.9%	3.4%
IEZ	64.3	22.5	32.1	1,360	5.8%	4.1%	9.8%	6.0%
Fujitsu	57.6	36.8	15.0	1,173	5.2%	6.7%	4.6%	5.2%
IBM	31.6	15.1	12.0	717	2.9%	2.8%	3.7%	3.2%
Sun Microsystems	27.4	23.8	.0	1,651	2.5%	4.3%	.0%	7.3%
Nemetschek	26.7	9.9	14.9	321	2.4%	1.8%	4.5%	1.4%
NEC	25.1	13.8	9.3	826	2.3%	2.5%	2.8%	3.7%
EDS	24.4	11.5	10.4	474	2.2%	2.1%	3.2%	2.1%
Digital	23.3	16.1	.0	1,145	2.1%	2.9%	.0%	5.1%
Auto-Trol	22.4	8.3	8.5	280	2.0%	1.5%	2.6%	1.2%
ISICAD	20.2	7.3	8.5	153	1.8%	1.3%	2.6%	.7%
ItalCad	18.6	8.8	4.5	176	1.7%	1.6%	1.4%	.8%
Accugraph	17.8	8.7	7.3	680	1.6%	1.6%	2.2%	3.0%
Kockums Computer Systems	12.9	3.2	7.1	635	1.2%	.6%	2.2%	2.8%
CAD Centre	12.8	.0	10.3	0	1.2%	.0%	3.1%	.0%
Sony	12.6	12.6	.0	460	1.1%	2.3%	.0%	2.0%
Hitachi	12.5	6.0	5.3	271	1.1%	1.1%	1.6%	1.2%
Siemens Nixdorf Info systeme	12.5	5.5	5.1	182	1.1%	1.0%	1.6%	.8%
Mitsubishi Electric	11.2	9.5	.8	120	1.0%	1.7%	.2%	.5%

(Continued)

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Table 15 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: Technical Workstation
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Silicon Graphics	11.1	10.3	.0	369	1.0%	1.9%	.0%	1.6%
Century Research Center	10.8	5.7	4.0	60	1.0%	1.0%	1.2%	.3%
Han Dataport	10.4	3.1	5.7	229	.9%	.6%	1.7%	1.0%
Toshiba—No OEM	10.2	5.1	4.1	121	.9%	.9%	1.2%	.5%
Star Informatic	9.6	1.5	6.8	1,066	.9%	.3%	2.1%	4.7%
Autodesk	9.5	.0	9.5	0	.9%	.0%	2.9%	.0%
Mutoh Industries—No OEM	9.1	5.5	2.7	93	.8%	1.0%	.8%	.4%
Microway	7.1	4.3	2.1	67	.6%	.8%	.7%	.3%
Nihon Unisys	7.0	4.4	1.2	57	.6%	.8%	.4%	.3%
Hitachi Zosen Info Systems	6.5	5.5	.3	67	.6%	1.0%	.1%	.3%
INS Engineering	6.4	3.2	3.2	17	.6%	.6%	1.0%	.1%
Complansoft CAD	5.0	2.5	2.5	114	.5%	.5%	.8%	.5%
Uchida Yoko	4.8	2.9	1.7	102	.4%	.5%	.5%	.5%
Gable CAD Systems	4.1	2.9	.6	45	.4%	.5%	.2%	.2%
Sener Sistemas Marinos	3.7	.0	3.7	0	.3%	.0%	1.1%	.0%
Toyo Information Systems—No OEM	3.5	2.2	1.0	42	.3%	.4%	.3%	.2%
Triplan	3.4	1.4	1.7	50	.3%	.3%	.5%	.2%
Sigma Design	3.1	.0	2.9	0	.3%	.0%	.9%	.0%
Wisdom Systems	2.7	.0	2.1	0	.2%	.0%	.6%	.0%
Integrated Computer Graphics	2.3	.9	1.3	128	.2%	.2%	.4%	.6%
RIB/RZB	2.0	.2	1.6	10	.2%	.0%	.5%	.0%

(Continued)

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Table 15 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: Technical Workstation
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
MEDESIGN	1.9	.5	.7	21	.2%	.1%	.2%	.1%
Land Innovation	1.8	.0	1.8	0	.2%	.0%	.6%	.0%
Matra Datavision	1.8	.6	.9	15	.2%	.1%	.3%	.1%
Mitsui Engineering	1.8	1.3	.4	10	.2%	.2%	.1%	.0%
Radan Computational	1.7	.6	.9	36	.2%	.1%	.3%	.2%
Bechtel Software	1.5	.0	1.4	0	.1%	.0%	.4%	.0%
Sinus Software	1.5	.8	.8	36	.1%	.1%	.2%	.2%
Control Data Systems	1.5	.9	.3	41	.1%	.2%	.1%	.2%
Softdesk	1.5	.0	1.5	0	.1%	.0%	.5%	.0%
Assigraph	1.4	.0	1.1	0	.1%	.0%	.3%	.0%
Macao Systems	1.1	.6	.4	12	.1%	.1%	.1%	.1%
PAFEC	1.1	.0	1.1	0	.1%	.0%	.3%	.0%
Spectrum Graphics	1.1	.3	.5	10	.1%	.1%	.2%	.0%
Sumitomo Denko Workstation	.9	.9	.0	46	.1%	.2%	.0%	.2%
Georgia Tech Research Corp.	.8	.0	.8	0	.1%	.0%	.2%	.0%
Lamp Software	.6	.2	.3	47	.1%	.0%	.1%	.2%
Kubota Computer	.5	.4	.1	27	.0%	.1%	.0%	.1%
DAPCO	.4	.0	.2	0	.0%	.0%	.1%	.0%
ERDAS	.3	.1	.2	2	.0%	.0%	.1%	.0%
ASG	.3	.0	.3	0	.0%	.0%	.1%	.0%
ACDS Graphic System	.2	.0	.2	0	.0%	.0%	.1%	.0%

(Continued)

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Table 15 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: Technical Workstation
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Research Engineers—Civilsoft	.2	.0	.2	0	.0%	.0%	.1%	.0%
ARKTEC	.2	.1	.1	11	.0%	.0%	.0%	.0%
Engineering Systems Corp.	.2	.0	.1	0	.0%	.0%	.0%	.0%
Carrier Corporation	.1	.0	.1	0	.0%	.0%	.0%	.0%
Solbourne	.1	.1	.0	12	.0%	.0%	.0%	.1%
ECOM Associates	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	.5	.0	.3	3	.0%	.0%	.1%	.0%
All Companies	1,099.3	547.3	328.3	22,559	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	712.4	362.1	173.2	14,620	64.8%	66.2%	52.8%	64.8%
All Asian-Based Companies	180.6	115.7	49.0	3,493	16.4%	21.1%	14.9%	15.5%
All European-Based Companies	206.3	69.4	106.1	4,446	18.8%	12.7%	32.3%	19.7%
All Hardware Companies	165.7	140.5	.1	6,907	15.1%	25.7%	.0%	30.6%
All Turnkey & SW Companies	933.6	406.8	328.3	15,651	84.9%	74.3%	100.0%	69.4%

Source: Dataquest (July 1993)

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Table 16
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: Host-Dependent
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
IBM	79.5	50.9	9.9	1,200	30.6%	30.0%	22.6%	31.5%
Fujitsu	52.1	33.3	13.5	725	20.0%	19.6%	30.8%	19.1%
Digital	34.8	24.0	.0	0	13.4%	14.1%	.0%	.0%
Nihon Unisys	24.9	15.5	4.2	262	9.6%	9.1%	9.6%	6.9%
EA Systems	8.1	.0	8.1	0	3.1%	.0%	18.4%	.0%
Computervision	2.6	.8	.7	42	1.0%	.5%	1.5%	1.1%
Control Data Systems	2.2	.9	.3	14	.9%	.5%	.7%	.4%
Bechtel Software	2.0	.0	1.8	0	.8%	.0%	4.1%	.0%
Hitachi	1.7	.8	.7	31	.7%	.5%	1.7%	.8%
Mitsubishi Electric	1.6	.8	.5	5	.6%	.5%	1.0%	.1%
Assigraph	1.4	.0	1.1	0	.6%	.0%	2.6%	.0%
Intergraph	1.4	.0	1.2	0	.5%	.0%	2.8%	.0%
Hitachi Zosen Info Systems	1.2	1.1	.0	14	.5%	.7%	.0%	.4%
Georgia Tech Research Corp.	.8	.0	.8	0	.3%	.0%	1.8%	.0%
Macao Systems	.8	.4	.3	6	.3%	.2%	.6%	.2%
Toyo Information Systems—No OEM	.7	.4	.2	4	.3%	.2%	.5%	.1%
Hochtief	.4	.1	.2	2	.1%	.0%	.5%	.1%
Accugraph	.2	.1	.1	19	.1%	.0%	.2%	.5%
Lamp Software	.1	.0	.0	3	.0%	.0%	.1%	.1%
Kubota Computer	.1	.1	.0	9	.0%	.0%	.0%	.2%

(Continued)

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Table 16 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: Host-Dependent
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Engineering Systems Corp.	.1	.0	.1	0	.0%	.0%	.1%	.0%
Other Companies	43.2	40.9	.1	1,471	16.6%	24.0%	.3%	38.7%
All Companies	259.9	170.0	44.0	3,807	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	174.7	117.5	23.0	2,746	67.2%	69.1%	52.2%	72.1%
All Asian-Based Companies	82.4	52.0	19.2	1,050	31.7%	30.6%	43.7%	27.6%
All European-Based Companies	2.8	.5	1.8	11	1.1%	.3%	4.1%	.3%
All Hardware Companies	78.3	65.0	.1	1,475	30.1%	38.2%	.1%	38.8%
All Turnkey & SW Companies	181.6	105.0	43.9	2,331	69.9%	61.8%	99.9%	61.2%

Source: Dataquest (July 1993)

CAEC-WW-MS-9305

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Table 17
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: Server
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Intergraph	52.1	25.0	12.5	778	46.1%	41.2%	55.4%	46.0%
IBM	26.9	12.8	8.9	340	23.8%	21.1%	39.4%	20.1%
Digital	25.8	17.8	.0	358	22.8%	29.4%	.0%	21.2%
Sun Microsystems	3.2	2.7	.0	125	2.9%	4.4%	.0%	7.4%
Computervision	3.0	1.0	.7	32	2.6%	1.6%	3.1%	1.9%
Han Dataport	.8	.4	.3	12	.7%	.6%	1.5%	.7%
Hewlett-Packard	.8	.6	.0	19	.7%	1.0%	.0%	1.2%
Solbourne	.2	.2	.0	14	.2%	.3%	.0%	.8%
Georgia Tech Research Corp.	.1	.0	.1	0	.1%	.0%	.6%	.0%
Sumitomo Denko Workstation	.1	.1	.0	6	.1%	.1%	.0%	.4%
Other Companies	.0	.1	.0	6	.0%	.1%	.0%	.3%
All Companies	113.0	60.7	22.6	1,690	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	112.1	60.3	22.3	1,672	99.2%	99.2%	98.5%	98.9%
All Asian-Based Companies	.1	.1	.0	6	.1%	.1%	.0%	.4%
All European-Based Companies	.8	.4	.3	12	.7%	.6%	1.5%	.7%
All Hardware Companies	30.8	22.1	.0	536	27.3%	36.4%	.0%	31.7%
All Turnkey & SW Companies	82.2	38.7	22.6	1,154	72.7%	63.6%	100.0%	68.3%

Source: Dataquest (July 1993)

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Table 18
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: Personal Computer
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Autodesk	148.6	.0	148.6	0	17.5%	.0%	43.0%	.0%
Compaq	103.2	103.2	.0	22,334	12.1%	21.5%	.0%	17.5%
Apple Computer	100.3	100.3	.0	21,223	11.8%	20.9%	.0%	16.6%
IBM	56.5	42.5	10.7	12,556	6.6%	8.9%	3.1%	9.8%
Nemetschek	31.3	11.6	17.5	1,288	3.7%	2.4%	5.1%	1.0%
NEC	30.6	25.7	2.5	4,560	3.6%	5.4%	.7%	3.6%
Fujitsu	27.4	17.5	7.1	815	3.2%	3.7%	2.1%	.6%
Intergraph	16.0	.0	16.0	0	1.9%	.0%	4.6%	.0%
Soft-Tech Software Technologies	13.8	2.1	10.4	932	1.6%	.4%	3.0%	.7%
Dell Computer	11.1	11.1	.0	2,884	1.3%	2.3%	.0%	2.3%
CPU	10.5	.0	9.5	0	1.2%	.0%	2.7%	.0%
Hewlett-Packard	9.7	8.7	.0	3,143	1.1%	1.8%	.0%	2.5%
ISICAD	8.7	.0	8.7	0	1.0%	.0%	2.5%	.0%
Hochtief	6.8	1.0	4.8	84	.8%	.2%	1.4%	.1%
ASG	6.5	.0	6.5	0	.8%	.0%	1.9%	.0%
BATISOFT	6.3	.9	3.2	314	.7%	.2%	.9%	.2%
Aspen Technology	5.8	.0	5.2	0	.7%	.0%	1.5%	.0%
Digital	5.7	5.1	.0	1,474	.7%	1.1%	.0%	1.2%
Graphisoft Software Dev	5.7	.0	5.7	0	.7%	.0%	1.6%	.0%
Seiko Instruments—No OEM	5.3	2.6	2.6	136	.6%	.6%	.8%	.1%
mb Programme	5.1	2.5	1.8	122	.6%	.5%	.5%	.1%

(Continued)

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Table 18 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: Personal Computer
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Softdesk	5.0	.0	5.0	0	.6%	.0%	1.4%	.0%
Microway	4.7	2.9	1.4	60	.6%	.6%	.4%	.0%
CAD Distribution	4.7	2.4	1.9	73	.6%	.5%	.5%	.1%
International Software Systems	4.7	.0	4.7	0	.6%	.0%	1.4%	.0%
RIB/RZB	4.6	.4	3.8	32	.5%	.1%	1.1%	.0%
Andor	4.2	1.1	3.0	32	.5%	.2%	.9%	.0%
Micrografx	4.2	.0	4.2	0	.5%	.0%	1.2%	.0%
Computer Services Consultants	4.2	.0	4.2	0	.5%	.0%	1.2%	.0%
Research Machines	4.1	4.1	.0	654	.5%	.8%	.0%	.5%
Mutoh Industries—No OEM	3.9	2.3	1.2	79	.5%	.5%	.3%	.1%
RoboCAD Solutions	3.7	.0	3.0	0	.4%	.0%	.9%	.0%
Datagraphic	3.6	1.8	1.4	57	.4%	.4%	.4%	.0%
Hitachi	3.1	1.5	1.3	166	.4%	.3%	.4%	.1%
Sweet's Electronic Publishing	3.0	.0	2.4	0	.4%	.0%	.7%	.0%
Ground Modelling Systems	2.7	1.4	1.1	232	.3%	.3%	.3%	.2%
Toshiba—No OEM	2.6	1.3	1.0	204	.3%	.3%	.3%	.2%
Design Automation	2.5	.5	1.9	53	.3%	.1%	.6%	.0%
Sigma Design	2.5	.0	2.4	0	.3%	.0%	.7%	.0%
Innovative Data Design	2.5	.0	2.5	0	.3%	.0%	.7%	.0%
Olivetti	2.3	2.0	.0	281	.3%	.4%	.0%	.2%

(Continued)

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Table 18 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: Personal Computer
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Elstree Computing	2.2	1.0	1.2	62	.3%	.2%	.4%	.0%
CADKEY	2.1	.0	2.1	0	.2%	.0%	.6%	.0%
Carrier Corporation	2.0	.0	2.0	0	.2%	.0%	.6%	.0%
Ziegler Informatics	2.0	.0	2.0	0	.2%	.0%	.6%	.0%
Accugraph	2.0	.1	1.7	10	.2%	.0%	.5%	.0%
Claris	1.9	.0	1.9	0	.2%	.0%	.6%	.0%
CADWorks	1.9	.0	1.7	0	.2%	.0%	.5%	.0%
Moda CAD	1.9	.5	1.3	16	.2%	.1%	.4%	.0%
IMSI	1.8	.0	1.8	0	.2%	.0%	.5%	.0%
Integrated Computer Graphics	1.6	.6	.8	122	.2%	.1%	.2%	.1%
Engineered Software	1.6	.0	1.6	0	.2%	.0%	.5%	.0%
Research Engineers—Civilsoft	1.5	.0	1.5	0	.2%	.0%	.4%	.0%
American Small Business Comp.	1.4	.0	1.4	0	.2%	.0%	.4%	.0%
Mitsubishi Electric	1.4	.9	.5	135	.2%	.2%	.1%	.1%
ARKTEC	1.4	.1	1.2	32	.2%	.0%	.4%	.0%
Lamp Software	1.2	.2	1.0	68	.1%	.1%	.3%	.1%
Computervision	1.2	.0	1.2	34	.1%	.0%	.3%	.0%
Mucke Software	1.1	.6	.4	27	.1%	.1%	.1%	.0%
Softronics	1.1	.3	.8	101	.1%	.1%	.2%	.1%
Serbi	1.1	.1	1.0	32	.1%	.0%	.3%	.0%

(Continued)

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Table 18 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: Personal Computer
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
CAE-link	1.1	.0	1.1	0	.1%	.0%	.3%	.0%
Foresight Resources	1.0	.0	.9	0	.1%	.0%	.3%	.0%
ABB Industria*	.9	.4	.4	10	.1%	.1%	.1%	.0%
Evolution Computing	.9	.0	.9	0	.1%	.0%	.2%	.0%
Han Dataport	.8	.2	.5	21	.1%	.0%	.1%	.0%
Mega CADD	.8	.0	.8	0	.1%	.0%	.2%	.0%
GRAPHSOFT	.8	.0	.8	0	.1%	.0%	.2%	.0%
INS Engineering	.7	.4	.4	13	.1%	.1%	.1%	.0%
CAD-Capture	.7	.2	.2	4	.1%	.0%	.1%	.0%
ECOM Associates	.7	.0	.7	4	.1%	.0%	.2%	.0%
Uchida Yoko	.5	.3	.2	24	.1%	.1%	.1%	.0%
Bechtel Software	.5	.0	.5	0	.1%	.0%	.2%	.0%
DAT Standard info ssystemes	.4	.0	.4	0	.0%	.0%	.1%	.0%
Engineering Systems Corp.	.4	.0	.4	0	.0%	.0%	.1%	.0%
Mc2 Engineering Software	.4	.0	.4	0	.0%	.0%	.1%	.0%
Aura CAD/CAM Systems	.3	.0	.3	0	.0%	.0%	.1%	.0%
Ashlar	.2	.0	.2	0	.0%	.0%	.1%	.0%
Mitsui Engineering	.2	.1	.0	3	.0%	.0%	.0%	.0%
ERDAS	.1	.0	.1	6	.0%	.0%	.0%	.0%
A.I. Systems	.1	.0	.1	0	.0%	.0%	.0%	.0%

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Table 18 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: Personal Computer
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Radan Computational	.0	.0	.0	1	.0%	.0%	.0%	.0%
Other Companies	119.8	116.7	2.6	53,165	14.1%	24.3%	.8%	41.6%
All Companies	851.5	479.2	345.9	127,674	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	640.2	389.0	244.3	116,967	75.2%	81.2%	70.6%	91.6%
All Asian-Based Companies	93.0	54.3	31.2	6,219	10.9%	11.3%	9.0%	4.9%
All European-Based Companies	118.3	35.9	70.5	4,489	13.9%	7.5%	20.4%	3.5%
All Hardware Companies	398.5	393.9	.0	117,711	46.8%	82.2%	.0%	92.2%
All Turnkey & SW Companies	453.0	85.3	345.9	9,963	53.2%	17.8%	100.0%	7.8%

Source: Dataquest (July 1993)

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Table 19
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: All Platforms
Region: North America
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Intergraph	217.6	96.3	64.3	3,332	25.5%	21.1%	24.1%	5.5%
IBM	103.0	60.7	23.5	5,015	12.1%	13.3%	8.8%	8.3%
Autodesk	72.4	.0	72.4	0	8.5%	.0%	27.1%	.0%
Compaq	70.1	70.1	.0	15,187	8.2%	15.4%	.0%	25.1%
Apple Computer	68.9	68.9	.0	15,302	8.1%	15.1%	.0%	25.3%
Computervision	50.0	17.6	11.3	556	5.9%	3.9%	4.2%	.9%
Digital	41.7	29.3	.0	1,356	4.9%	6.4%	.0%	2.2%
Hewlett-Packard	31.8	27.3	.0	3,061	3.7%	6.0%	.0%	5.1%
Auto-Trol	18.8	7.0	7.1	235	2.2%	1.5%	2.7%	.4%
Accugraph	18.4	8.2	8.4	653	2.2%	1.8%	3.1%	1.1%
ISICAD	15.7	4.0	9.3	85	1.8%	.9%	3.5%	.1%
Sun Microsystems	13.5	11.6	.0	843	1.6%	2.5%	.0%	1.4%
EDS	10.2	4.6	4.6	206	1.2%	1.0%	1.7%	.3%
Dell Computer	8.3	8.3	.0	2,163	1.0%	1.8%	.0%	3.6%
ASG	6.5	.0	6.5	0	.8%	.0%	2.4%	.0%
EA Systems	6.2	.0	6.2	0	.7%	.0%	2.3%	.0%
Softdesk	5.5	.0	5.5	0	.6%	.0%	2.0%	.0%
Aspen Technology	4.6	.0	4.2	0	.5%	.0%	1.6%	.0%
Integrated Computer Graphics	3.9	1.5	2.1	250	.5%	.3%	.8%	.4%
Bechtel Software	3.6	.0	3.4	0	.4%	.0%	1.3%	.0%

(Continued)

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Table 19 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: All Platforms
Region: North America
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Sigma Design	3.1	.0	2.9	0	.4%	.0%	1.1%	.0%
Sweet's Electronic Publishing	2.7	.0	2.2	0	.3%	.0%	.8%	.0%
Innovative Data Design	2.4	.0	2.4	0	.3%	.0%	.9%	.0%
International Software Systems	2.4	.0	2.4	0	.3%	.0%	.9%	.0%
Micrografx	2.3	.0	2.3	0	.3%	.0%	.9%	.0%
Wisdom Systems	2.2	.0	1.7	0	.3%	.0%	.6%	.0%
CAD Centre	2.1	.0	1.7	0	.2%	.0%	.6%	.0%
Land Innovation	1.8	.0	1.8	0	.2%	.0%	.7%	.0%
Research Engineers—Civilsoft	1.7	.0	1.7	0	.2%	.0%	.6%	.0%
IMSI	1.4	.0	1.4	0	.2%	.0%	.5%	.0%
American Small Business Comp.	1.3	.0	1.3	0	.1%	.0%	.5%	.0%
Control Data Systems	1.3	.6	.2	18	.1%	.1%	.1%	.0%
Moda CAD	1.2	.3	.8	10	.1%	.1%	.3%	.0%
CADKEY	1.1	.0	1.1	0	.1%	.0%	.4%	.0%
Kockums Computer Systems	1.1	.3	.6	53	.1%	.1%	.2%	.1%
Carrier Corporation	1.1	.0	1.1	0	.1%	.0%	.4%	.0%
Graphisoft Software Dev	1.0	.0	1.0	0	.1%	.0%	.4%	.0%
Georgia Tech Research Corp.	1.0	.0	1.0	0	.1%	.0%	.4%	.0%
Claris	1.0	.0	1.0	0	.1%	.0%	.4%	.0%
IEZ	1.0	.3	.5	20	.1%	.1%	.2%	.0%

(Continued)

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Table 19 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: All Platforms
Region: North America
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
CAE-link	1.0	.0	1.0	0	.1%	.0%	.4%	.0%
Engineered Software	.9	.0	.9	0	.1%	.0%	.4%	.0%
Foresight Resources	.9	.0	.8	0	.1%	.0%	.3%	.0%
GRAPHSOFT	.8	.0	.8	0	.1%	.0%	.3%	.0%
ECOM Associates	.7	.0	.7	4	.1%	.0%	.3%	.0%
CADWorks	.7	.0	.6	0	.1%	.0%	.2%	.0%
Evolution Computing	.6	.0	.6	0	.1%	.0%	.2%	.0%
Mega CADD	.6	.0	.6	0	.1%	.0%	.2%	.0%
Engineering Systems Corp.	.5	.0	.5	0	.1%	.0%	.2%	.0%
Mc2 Engineering Software	.3	.0	.3	0	.0%	.0%	.1%	.0%
ERDAS	.3	.1	.2	5	.0%	.0%	.1%	.0%
Aura CAD/CAM Systems	.3	.0	.3	0	.0%	.0%	.1%	.0%
Solbourne	.3	.3	.0	23	.0%	.1%	.0%	.0%
MEDESIGN	.2	.1	.1	2	.0%	.0%	.0%	.0%
Ashlar	.2	.0	.2	0	.0%	.0%	.1%	.0%
ACDS Graphic System	.2	.0	.2	0	.0%	.0%	.1%	.0%
BATISOFT	.2	.0	.1	7	.0%	.0%	.0%	.0%
Ground Modelling Systems	.1	.1	.1	12	.0%	.0%	.0%	.0%
A.I. Systems	.1	.0	.1	0	.0%	.0%	.0%	.0%
Complansoft CAD	.1	.0	.0	1	.0%	.0%	.0%	.0%

(Continued)

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Table 19 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: All Platforms
Region: North America
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Star Informatic	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	41.2	39.3	1.3	12,017	4.8%	8.6%	.5%	19.9%
All Companies	**853.7**	**456.7**	**266.8**	**60,417**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
All N.A.-Based Companies	847.9	455.9	262.8	60,321	99.3%	99.8%	98.5%	99.8%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	5.8	.8	4.0	96	.7%	.2%	1.5%	.2%
All Hardware Companies	286.7	266.4	.0	53,492	33.6%	58.3%	.0%	88.5%
All Turnkey & SW Companies	567.0	190.3	266.7	6,925	66.4%	41.7%	100.0%	11.5%

Source: Dataquest (July 1993)

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Table 20
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: Technical Workstation
Region: North America
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Intergraph	174.1	82.2	43.2	2,861	47.8%	47.6%	42.9%	38.3%
Computervision	44.2	16.0	9.2	474	12.1%	9.3%	9.1%	6.3%
Hewlett-Packard	25.4	21.6	.0	972	7.0%	12.5%	.0%	13.0%
IBM	20.0	9.6	7.6	479	5.5%	5.6%	7.5%	6.4%
Auto-Trol	18.8	7.0	7.1	235	5.2%	4.0%	7.1%	3.1%
Accugraph	16.4	8.0	6.7	626	4.5%	4.6%	6.7%	8.4%
Sun Microsystems	12.0	10.4	.0	780	3.3%	6.0%	.0%	10.4%
ISICAD	11.0	4.0	4.6	85	3.0%	2.3%	4.6%	1.1%
Digital	10.8	7.5	.0	529	3.0%	4.3%	.0%	7.1%
EDS	10.2	4.6	4.6	206	2.8%	2.6%	4.6%	2.8%
Autodesk	4.3	.0	4.3	0	1.2%	.0%	4.3%	.0%
Integrated Computer Graphics	2.3	.9	1.3	128	.6%	.5%	1.3%	1.7%
Wisdom Systems	2.2	.0	1.7	0	.6%	.0%	1.7%	.0%
CAD Centre	2.1	.0	1.7	0	.6%	.0%	1.7%	.0%
Land Innovation	1.8	.0	1.8	0	.5%	.0%	1.8%	.0%
Sigma Design	1.7	.0	1.6	0	.5%	.0%	1.6%	.0%
Bechtel Software	1.4	.0	1.3	0	.4%	.0%	1.3%	.0%
Softdesk	1.3	.0	1.3	0	.3%	.0%	1.3%	.0%
Kockums Computer Systems	1.1	.3	.6	53	.3%	.2%	.6%	.7%
IEZ	1.0	.3	.5	20	.3%	.2%	.5%	.3%
Georgia Tech Research Corp.	.5	.0	.5	0	.1%	.0%	.5%	.0%

(Continued)

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Table 20 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: Technical Workstation
Region: North America
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Control Data Systems	.5	.3	.1	14	.1%	.2%	.1%	.2%
ASG	.3	.0	.3	0	.1%	.0%	.3%	.0%
MEDESIGN	.2	.1	.1	2	.1%	.0%	.1%	.0%
ERDAS	.2	.1	.1	1	.1%	.0%	.1%	.0%
Research Engineers—Civilsoft	.2	.0	.2	0	.0%	.0%	.2%	.0%
ACDS Graphic System	.2	.0	.2	0	.0%	.0%	.1%	.0%
Engineering Systems Corp.	.1	.0	.1	0	.0%	.0%	.1%	.0%
Solbourne	.1	.1	.0	11	.0%	.0%	.0%	.1%
Complansoft CAD	.1	.0	.0	1	.0%	.0%	.0%	.0%
Carrier Corporation	.1	.0	.1	0	.0%	.0%	.0%	.0%
Star Informatic	.0	.0	.0	0	.0%	.0%	.0%	.0%
ECOM Associates	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Companies	364.4	172.7	100.7	7,478	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	359.9	172.0	97.9	7,401	98.8%	99.6%	97.2%	99.0%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	4.5	.7	2.8	77	1.2%	.4%	2.8%	1.0%
All Hardware Companies	48.3	39.6	.0	2,296	13.3%	22.9%	.0%	30.7%
All Turnkey & SW Companies	316.0	133.1	100.7	5,182	86.7%	77.1%	100.0%	69.3%

Source: Dataquest (July 1993)

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Table 21
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: Host-Dependent
Region: North America
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
IBM	50.4	32.2	6.3	789	53.6%	55.1%	38.7%	58.6%
Digital	16.4	11.3	.0	0	17.4%	19.3%	.0%	.0%
EA Systems	6.2	.0	6.2	0	6.6%	.0%	38.4%	.0%
Computervision	2.1	.7	.5	34	2.3%	1.2%	3.2%	2.6%
Bechtel Software	1.8	.0	1.6	0	1.9%	.0%	10.0%	.0%
Intergraph	1.1	.0	1.0	0	1.2%	.0%	6.0%	.0%
Control Data Systems	.8	.3	.1	5	.8%	.5%	.6%	.3%
Georgia Tech Research Corp.	.4	.0	.4	0	.4%	.0%	2.5%	.0%
Accugraph	.2	.1	.1	19	.2%	.1%	.5%	1.4%
Engineering Systems Corp.	.1	.0	.0	0	.1%	.0%	.2%	.0%
Other Companies	14.6	13.9	.0	500	15.6%	23.8%	.0%	37.2%
All Companies	94.0	58.5	16.3	1,347	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	94.0	58.5	16.3	1,347	100.0%	100.0%	100.0%	100.0%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Hardware Companies	31.2	25.3	.0	502	33.1%	43.2%	.1%	37.3%
All Turnkey & SW Companies	62.8	33.2	16.3	845	66.9%	56.8%	99.9%	62.7%

Source: Dataquest (July 1993)

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Table 22
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: Server
Region: North America
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Intergraph	29.4	14.1	7.1	471	46.6%	42.6%	52.7%	48.4%
IBM	16.8	7.9	5.6	212	26.6%	23.9%	42.0%	21.8%
Digital	12.0	8.3	.0	166	19.0%	25.0%	.0%	17.0%
Computervision	2.7	.9	.6	30	4.2%	2.8%	4.5%	3.0%
Sun Microsystems	1.5	1.2	.0	63	2.4%	3.7%	.0%	6.5%
Hewlett-Packard	.5	.4	.0	13	.7%	1.1%	.0%	1.3%
Solbourne	.2	.2	.0	12	.3%	.5%	.0%	1.3%
Georgia Tech Research Corp.	.1	.0	.1	0	.2%	.0%	.7%	.0%
Other Companies	.0	.1	.0	6	.0%	.3%	.1%	.6%
All Companies	63.0	33.1	13.4	972	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	63.0	33.1	13.4	972	100.0%	100.0%	100.0%	100.0%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Hardware Companies	14.3	10.3	.0	259	22.8%	31.1%	.0%	26.6%
All Turnkey & SW Companies	48.7	22.8	13.4	714	77.2%	68.9%	100.0%	73.4%

Source: Dataquest (July 1993)

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Table 23
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: Personal Computer
Region: North America
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Compaq	70.1	70.1	.0	15,187	21.1%	36.5%	.0%	30.0%
Apple Computer	68.9	68.9	.0	15,302	20.7%	35.8%	.0%	30.2%
Autodesk	68.1	.0	68.1	0	20.5%	.0%	49.9%	.0%
IBM	15.9	11.0	4.0	3,535	4.8%	5.7%	2.9%	7.0%
Intergraph	13.1	.0	13.1	0	3.9%	.0%	9.6%	.0%
Dell Computer	8.3	8.3	.0	2,163	2.5%	4.3%	.0%	4.3%
ASG	6.1	.0	6.1	0	1.8%	.0%	4.5%	.0%
Hewlett-Packard	6.0	5.4	.0	2,076	1.8%	2.8%	.0%	4.1%
ISICAD	4.7	.0	4.7	0	1.4%	.0%	3.4%	.0%
Aspen Technology	4.6	.0	4.2	0	1.4%	.0%	3.1%	.0%
Softdesk	4.2	.0	4.2	0	1.3%	.0%	3.1%	.0%
Sweet's Electronic Publishing	2.7	.0	2.2	0	.8%	.0%	1.6%	.0%
Digital	2.6	2.3	.0	661	.8%	1.2%	.0%	1.3%
Innovative Data Design	2.4	.0	2.4	0	.7%	.0%	1.8%	.0%
International Software Systems	2.4	.0	2.4	0	.7%	.0%	1.7%	.0%
Micrografx	2.3	.0	2.3	0	.7%	.0%	1.7%	.0%
Accugraph	1.8	.1	1.6	9	.6%	.0%	1.2%	.0%
Integrated Computer Graphics	1.6	.6	.8	122	.5%	.3%	.6%	.2%
Research Engineers—Civilsoft	1.5	.0	1.5	0	.5%	.0%	1.1%	.0%
IMSI	1.4	.0	1.4	0	.4%	.0%	1.0%	.0%
Sigma Design	1.4	.0	1.3	0	.4%	.0%	1.0%	.0%

(Continued)

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Table 23 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: Personal Computer
Region: North America
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
American Small Business Comp.	1.3	.0	1.3	0	.4%	.0%	.9%	.0%
Moda CAD	1.2	.3	.8	10	.4%	.2%	.6%	.0%
CADKEY	1.1	.0	1.1	0	.3%	.0%	.8%	.0%
Graphisoft Software Dev	1.0	.0	1.0	0	.3%	.0%	.7%	.0%
Carrier Corporation	1.0	.0	1.0	0	.3%	.0%	.7%	.0%
Computervision	1.0	.0	1.0	18	.3%	.0%	.7%	.0%
Claris	1.0	.0	1.0	0	.3%	.0%	.7%	.0%
CAE-link	1.0	.0	1.0	0	.3%	.0%	.7%	.0%
Engineered Software	.9	.0	.9	0	.3%	.0%	.7%	.0%
Foresight Resources	.9	.0	.8	0	.3%	.0%	.6%	.0%
GRAPHSOFT	.8	.0	.8	0	.2%	.0%	.6%	.0%
CADWorks	.7	.0	.6	0	.2%	.0%	.5%	.0%
ECOM Associates	.7	.0	.7	4	.2%	.0%	.5%	.0%
Evolution Computing	.6	.0	.6	0	.2%	.0%	.5%	.0%
Mega CADD	.6	.0	.6	0	.2%	.0%	.4%	.0%
Bechtel Software	.5	.0	.5	0	.1%	.0%	.3%	.0%
Engineering Systems Corp.	.3	.0	.3	0	.1%	.0%	.2%	.0%
Mc2 Engineering Software	.3	.0	.3	0	.1%	.0%	.2%	.0%
Aura CAD/CAM Systems	.3	.0	.3	0	.1%	.0%	.2%	.0%
Ashlar	.2	.0	.2	0	.1%	.0%	.1%	.0%
BATISOFT	.2	.0	.1	7	.1%	.0%	.1%	.0%

(Continued)

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Table 23 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: Personal Computer
Region: North America
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Ground Modelling Systems	.1	.1	.1	12	.0%	.0%	.0%	.0%
A.I. Systems	.1	.0	.1	0	.0%	.0%	.1%	.0%
ERDAS	.1	.0	.0	3	.0%	.0%	.0%	.0%
Other Companies	26.6	25.3	1.3	11,511	8.0%	13.2%	.9%	22.7%
All Companies	332.3	192.4	136.4	50,620	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	331.0	192.3	135.3	50,602	99.6%	100.0%	99.2%	100.0%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	1.3	.1	1.2	18	.4%	.0%	.8%	.0%
All Hardware Companies	192.9	191.3	.0	50,435	58.0%	99.4%	.0%	99.6%
All Turnkey & SW Companies	139.4	1.1	136.4	185	42.0%	.6%	100.0%	.4%

Source: Dataquest (July 1993)

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Table 24
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: All Platforms
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Intergraph	133.8	61.7	32.3	1,743	15.6%	14.3%	10.8%	2.8%
IEZ	63.3	22.2	31.7	1,340	7.4%	5.1%	10.6%	2.2%
Autodesk	59.0	.0	59.0	0	6.9%	.0%	19.7%	.0%
Nemetschek	58.0	21.5	32.5	1,609	6.8%	5.0%	10.9%	2.6%
IBM	49.4	35.3	7.2	6,015	5.8%	8.2%	2.4%	9.8%
Hewlett-Packard	47.4	40.4	.0	2,377	5.5%	9.4%	.0%	3.9%
Digital	38.1	26.7	.0	1,295	4.4%	6.2%	.0%	2.1%
Compaq	27.9	27.9	.0	6,030	3.3%	6.5%	.0%	9.8%
Computervision	25.7	6.7	8.0	244	3.0%	1.6%	2.7%	.4%
Apple Computer	21.7	21.7	.0	3,934	2.5%	5.0%	.0%	6.4%
ItalCad	18.6	8.8	4.5	176	2.2%	2.0%	1.5%	.3%
Sun Microsystems	14.7	12.7	.0	802	1.7%	2.9%	.0%	1.3%
Soft-Tech Software Technologies	13.8	2.1	10.4	932	1.6%	.5%	3.5%	1.5%
Siemens Nixdorf Info systeme	12.5	5.5	5.1	182	1.5%	1.3%	1.7%	.3%
ISICAD	12.2	3.1	7.3	63	1.4%	.7%	2.4%	.1%
Han Dataport	12.1	3.7	6.5	261	1.4%	.9%	2.2%	.4%
Microway	11.9	7.2	3.6	127	1.4%	1.7%	1.2%	.2%
Kockums Computer Systems	10.2	2.6	5.6	502	1.2%	.6%	1.9%	.8%
Star Informatic	9.4	1.4	6.7	1,066	1.1%	.3%	2.2%	1.7%
CAD Centre	7.5	.0	6.0	0	.9%	.0%	2.0%	.0%
Hochtief	6.9	1.0	4.8	84	.8%	.2%	1.6%	.1%

(Continued)

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Table 24 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: All Platforms
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
RIB/RZB	6.6	.6	5.4	41	.8%	.1%	1.8%	.1%
BATISOFT	6.0	.9	3.0	300	.7%	.2%	1.0%	.5%
EDS	5.9	2.6	2.7	116	.7%	.6%	.9%	.2%
Silicon Graphics	5.1	4.6	.0	170	.6%	1.1%	.0%	.3%
mb Programme	5.1	2.5	1.8	122	.6%	.6%	.6%	.2%
Complansoft CAD	4.9	2.5	2.5	113	.6%	.6%	.8%	.2%
CAD Distribution	4.7	2.4	1.9	73	.6%	.6%	.6%	.1%
Graphisoft Software Dev	4.2	.0	4.2	0	.5%	.0%	1.4%	.0%
Computer Services Consultants	4.2	.0	4.2	0	.5%	.0%	1.4%	.0%
Research Machines	4.1	4.1	.0	654	.5%	.9%	.0%	1.1%
Gable CAD Systems	4.0	2.9	.6	44	.5%	.7%	.2%	.1%
RoboCAD Solutions	3.7	.0	3.0	0	.4%	.0%	1.0%	.0%
Sener Sistemas Marinos	3.7	.0	3.7	0	.4%	.0%	1.3%	.0%
Datagraphic	3.6	1.8	1.4	57	.4%	.4%	.5%	.1%
Triplan	3.4	1.4	1.7	50	.4%	.3%	.6%	.1%
Assigraph	2.9	.0	2.3	0	.3%	.0%	.8%	.0%
Dell Computer	2.8	2.8	.0	721	.3%	.6%	.0%	1.2%
Auto-Trol	2.7	1.0	1.0	34	.3%	.2%	.3%	.1%
Ground Modelling Systems	2.5	1.3	1.0	221	.3%	.3%	.3%	.4%
Olivetti	2.3	2.0	.0	281	.3%	.5%	.0%	.5%
Elstree Computing	2.2	1.0	1.2	62	.3%	.2%	.4%	.1%

(Continued)

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Table 24 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: All Platforms
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Ziegler Informatics	2.0	.0	2.0	0	.2%	.0%	.7%	.0%
Control Data Systems	2.0	.9	.3	29	.2%	.2%	.1%	.0%
Micrografx	1.9	.0	1.9	0	.2%	.0%	.6%	.0%
Lamp Software	1.9	.5	1.3	117	.2%	.1%	.4%	.2%
Macao Systems	1.8	1.0	.6	19	.2%	.2%	.2%	.0%
Matra Datavision	1.8	.6	.9	15	.2%	.1%	.3%	.0%
Radan Computational	1.8	.6	.9	36	.2%	.1%	.3%	.1%
MEDESIGN	1.7	.5	.6	18	.2%	.1%	.2%	.0%
ARKTEC	1.6	.2	1.3	43	.2%	.0%	.4%	.1%
Sinus Software	1.5	.8	.8	36	.2%	.2%	.3%	.1%
Sigma Design	1.4	.0	1.3	0	.2%	.0%	.4%	.0%
Mucke Software	1.1	.6	.4	27	.1%	.1%	.1%	.0%
Softronics	1.1	.3	.8	101	.1%	.1%	.3%	.2%
Serbi	1.1	.1	1.0	32	.1%	.0%	.3%	.1%
Spectrum Graphics	1.1	.3	.5	10	.1%	.1%	.2%	.0%
PAFEC	1.1	.0	1.1	0	.1%	.0%	.4%	.0%
EA Systems	1.1	.0	1.1	0	.1%	.0%	.4%	.0%
CADKEY	1.0	.0	1.0	0	.1%	.0%	.3%	.0%
ABB Industria*	.9	.4	.4	10	.1%	.1%	.1%	.0%
Aspen Technology	.9	.0	.8	0	.1%	.0%	.3%	.0%
Accugraph	.8	.3	.4	28	.1%	.1%	.1%	.0%

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Table 24 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: All Platforms
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
CAD-Capture	.7	.2	.2	4	.1%	.0%	.1%	.0%
Carrier Corporation	.6	.0	.6	0	.1%	.0%	.2%	.0%
CADWorks	.6	.0	.6	0	.1%	.0%	.2%	.0%
Engineered Software	.6	.0	.6	0	.1%	.0%	.2%	.0%
Moda CAD	.5	.1	.3	4	.1%	.0%	.1%	.0%
DAT Standard info ssystemes	.4	.0	.4	0	.0%	.0%	.1%	.0%
DAPCO	.4	.0	.2	0	.0%	.0%	.1%	.0%
Bechtel Software	.3	.0	.3	0	.0%	.0%	.1%	.0%
Sweet's Electronic Publishing	.3	.0	.2	0	.0%	.0%	.1%	.0%
Softdesk	.3	.0	.3	0	.0%	.0%	.1%	.0%
Georgia Tech Research Corp.	.2	.0	.2	0	.0%	.0%	.1%	.0%
Evolution Computing	.2	.0	.2	0	.0%	.0%	.1%	.0%
IMSI	.2	.0	.2	0	.0%	.0%	.1%	.0%
Mega CADD	.2	.0	.2	0	.0%	.0%	.1%	.0%
Foresight Resources	.2	.0	.1	0	.0%	.0%	.0%	.0%
Wisdom Systems	.1	.0	.1	0	.0%	.0%	.0%	.0%
ASG	.1	.0	.1	0	.0%	.0%	.0%	.0%
American Small Business Comp.	.1	.0	.1	0	.0%	.0%	.0%	.0%
ERDAS	.1	.0	.1	2	.0%	.0%	.0%	.0%
CAE-link	.1	.0	.1	0	.0%	.0%	.0%	.0%
ACDS Graphic System	.0	.0	.0	0	.0%	.0%	.0%	.0%

(Continued)

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Table 24 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: All Platforms
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
A.I. Systems	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	81.1	78.0	1.7	29,082	9.5%	18.1%	.6%	47.3%
All Companies	855.2	431.5	298.8	61,452	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	539.0	326.7	128.6	52,681	63.0%	75.7%	43.0%	85.7%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	316.2	104.8	170.2	8,771	37.0%	24.3%	57.0%	14.3%
All Hardware Companies	264.5	241.1	.0	50,914	30.9%	55.9%	.0%	82.9%
All Turnkey & SW Companies	590.7	190.4	298.8	10,537	69.1%	44.1%	100.0%	17.1%

Source: Dataquest (July 1993)

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Table 25
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: Technical Workstation
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Intergraph	117.7	53.9	28.5	1,534	26.6%	27.0%	18.9%	16.3%
IEZ	63.3	22.2	31.7	1,340	14.3%	11.1%	21.0%	14.2%
Hewlett-Packard	44.6	37.9	.0	1,557	10.1%	18.9%	.0%	16.6%
Nemetschek	26.7	9.9	14.9	321	6.0%	4.9%	9.9%	3.4%
Computervision	25.2	6.6	7.8	221	5.7%	3.3%	5.2%	2.3%
ItalCad	18.6	8.8	4.5	176	4.2%	4.4%	3.0%	1.9%
Sun Microsystems	13.1	11.4	.0	747	3.0%	5.7%	.0%	7.9%
Siemens Nixdorf Info systeme	12.5	5.5	5.1	182	2.8%	2.7%	3.4%	1.9%
Han Dataport	10.4	3.1	5.7	229	2.4%	1.6%	3.8%	2.4%
Kockums Computer Systems	10.2	2.6	5.6	502	2.3%	1.3%	3.7%	5.3%
Digital	9.9	6.8	.0	490	2.2%	3.4%	.0%	5.2%
Star Informatic	9.4	1.4	6.7	1,066	2.1%	.7%	4.4%	11.3%
ISICAD	8.5	3.1	3.6	63	1.9%	1.5%	2.4%	.7%
CAD Centre	7.5	.0	6.0	0	1.7%	.0%	4.0%	.0%
Microway	7.1	4.3	2.1	67	1.6%	2.2%	1.4%	.7%
IBM	6.2	3.0	2.4	140	1.4%	1.5%	1.6%	1.5%
EDS	5.9	2.6	2.7	116	1.3%	1.3%	1.8%	1.2%
Silicon Graphics	5.1	4.6	.0	170	1.2%	2.3%	.0%	1.8%
Complansoft CAD	4.9	2.5	2.5	113	1.1%	1.2%	1.6%	1.2%
Gable CAD Systems	4.0	2.9	.6	44	.9%	1.4%	.4%	.5%
Sener Sistemas Marinos	3.7	.0	3.7	0	.8%	.0%	2.5%	.0%

(Continued)

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Table 25 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: Technical Workstation
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Autodesk	3.5	.0	3.5	0	.8%	.0%	2.3%	.0%
Triplan	3.4	1.4	1.7	50	.8%	.7%	1.1%	.5%
Auto-Trol	2.7	1.0	1.0	34	.6%	.5%	.7%	.4%
RIB/RZB	2.0	.2	1.6	10	.5%	.1%	1.1%	.1%
Matra Datavision	1.8	.6	.9	15	.4%	.3%	.6%	.2%
Radan Computational	1.7	.6	.9	36	.4%	.3%	.6%	.4%
MEDESIGN	1.7	.5	.6	18	.4%	.2%	.4%	.2%
Sinus Software	1.5	.8	.8	36	.3%	.4%	.5%	.4%
Assigraph	1.4	.0	1.1	0	.3%	.0%	.8%	.0%
Macao Systems	1.1	.6	.4	12	.2%	.3%	.3%	.1%
Spectrum Graphics	1.1	.3	.5	10	.2%	.2%	.4%	.1%
PAFEC	1.1	.0	1.1	0	.2%	.0%	.7%	.0%
Control Data Systems	.8	.4	.2	22	.2%	.2%	.1%	.2%
Sigma Design	.8	.0	.7	0	.2%	.0%	.5%	.0%
Accugraph	.7	.3	.3	27	.2%	.2%	.2%	.3%
Lamp Software	.6	.2	.3	47	.1%	.1%	.2%	.5%
DAPCO	.4	.0	.2	0	.1%	.0%	.2%	.0%
ARKTEC	.2	.1	.1	11	.0%	.0%	.0%	.1%
Wisdom Systems	.1	.0	.1	0	.0%	.0%	.1%	.0%
Bechtel Software	.1	.0	.1	0	.0%	.0%	.1%	.0%
Georgia Tech Research Corp.	.1	.0	.1	0	.0%	.0%	.1%	.0%

(Continued)

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Table 25 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: Technical Workstation
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
ERDAS	.1	.0	.1	0	.0%	.0%	.0%	.0%
Softdesk	.1	.0	.1	0	.0%	.0%	.0%	.0%
ACDS Graphic System	.0	.0	.0	0	.0%	.0%	.0%	.0%
Carrier Corporation	.0	.0	.0	0	.0%	.0%	.0%	.0%
ASG	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	.5	.0	.3	3	.1%	.0%	.2%	.0%
All Companies	442.1	200.0	150.8	9,408	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	245.4	131.7	51.1	5,121	55.5%	65.9%	33.9%	54.4%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	196.8	68.2	99.7	4,287	44.5%	34.1%	66.1%	45.6%
All Hardware Companies	72.9	60.9	.0	2,971	16.5%	30.4%	.0%	31.6%
All Turnkey & SW Companies	369.3	139.1	150.8	6,437	83.5%	69.6%	100.0%	68.4%

Source: Dataquest (July 1993)

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Table 26
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: Host-Dependent
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
IBM	15.7	10.1	2.0	238	30.0%	27.4%	36.7%	29.0%
Digital	14.6	10.0	.0	0	27.9%	27.4%	.0%	.0%
Assigraph	1.4	.0	1.1	0	2.8%	.0%	21.3%	.0%
Control Data Systems	1.2	.4	.2	7	2.3%	1.2%	3.2%	.9%
EA Systems	1.1	.0	1.1	0	2.0%	.0%	19.7%	.0%
Macao Systems	.7	.4	.3	6	1.4%	1.1%	4.9%	.8%
Computervision	.4	.1	.1	5	.7%	.2%	2.4%	.7%
Hochtief	.3	.1	.2	2	.7%	.1%	4.3%	.2%
Bechtel Software	.2	.0	.2	0	.3%	.0%	2.8%	.0%
Georgia Tech Research Corp.	.1	.0	.1	0	.2%	.0%	1.7%	.0%
Lamp Software	.1	.0	.0	3	.1%	.1%	.7%	.3%
Accugraph	.0	.0	.0	1	.0%	.0%	.0%	.1%
Other Companies	16.5	15.5	.1	559	31.6%	42.4%	2.2%	68.1%
All Companies	52.2	36.6	5.3	821	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	49.5	36.1	3.6	811	94.7%	98.7%	66.5%	98.7%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	2.8	.5	1.8	11	5.3%	1.3%	33.5%	1.3%
All Hardware Companies	31.2	25.6	.0	561	59.6%	70.0%	.4%	68.3%
All Turnkey & SW Companies	21.1	11.0	5.3	260	40.4%	30.0%	99.6%	31.7%

Source: Dataquest (July 1993)

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Table 27
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: Server
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	**Total Factory Revenue**	**Hardware Revenue**	**Software Revenue**	**Hardware Units Shipped**	**Total Factory Revenue**	**Hardware Revenue**	**Software Revenue**	**Hardware Units Shipped**
Intergraph	16.1	7.7	3.9	209	45.6%	38.8%	64.2%	41.1%
Digital	11.0	7.6	.0	154	31.3%	38.5%	.0%	30.2%
IBM	5.6	2.8	1.8	79	15.8%	14.2%	29.1%	15.5%
Sun Microsystems	1.6	1.3	.0	55	4.4%	6.4%	.0%	10.8%
Han Dataport	.8	.4	.3	12	2.4%	1.9%	5.7%	2.3%
Computervision	.2	.0	.0	1	.4%	.2%	.7%	.2%
Georgia Tech Research Corp.	.0	.0	.0	0	.1%	.0%	.3%	.0%
Other Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Companies	35.2	19.9	6.0	509	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	34.4	19.5	5.7	498	97.6%	98.1%	94.3%	97.7%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	.8	.4	.3	12	2.4%	1.9%	5.7%	2.3%
All Hardware Companies	13.0	9.3	.0	217	36.9%	46.9%	.0%	42.5%
All Turnkey & SW Companies	22.2	10.5	6.0	293	63.1%	53.1%	100.0%	57.5%

Source: Dataquest (July 1993)

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Table 28
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: Personal Computer
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Autodesk	55.4	.0	55.4	0	17.0%	.0%	40.6%	.0%
Nemetschek	31.3	11.6	17.5	1,288	9.6%	6.6%	12.8%	2.5%
Compaq	27.9	27.9	.0	6,030	8.6%	15.9%	.0%	11.9%
IBM	21.9	19.5	1.2	5,558	6.7%	11.1%	.9%	11.0%
Apple Computer	21.7	21.7	.0	3,934	6.6%	12.4%	.0%	7.8%
Soft-Tech Software Technologies	13.8	2.1	10.4	932	4.2%	1.2%	7.6%	1.8%
Hochtief	6.5	1.0	4.6	82	2.0%	.6%	3.3%	.2%
BATISOFT	6.0	.9	3.0	300	1.8%	.5%	2.2%	.6%
mb Programme	5.1	2.5	1.8	122	1.6%	1.4%	1.3%	.2%
Microway	4.7	2.9	1.4	60	1.5%	1.7%	1.0%	.1%
CAD Distribution	4.7	2.4	1.9	73	1.5%	1.4%	1.4%	.1%
RIB/RZB	4.6	.4	3.8	32	1.4%	.2%	2.8%	.1%
Graphisoft Software Dev	4.2	.0	4.2	0	1.3%	.0%	3.1%	.0%
Computer Services Consultants	4.2	.0	4.2	0	1.3%	.0%	3.0%	.0%
Research Machines	4.1	4.1	.0	654	1.3%	2.3%	.0%	1.3%
RoboCAD Solutions	3.7	.0	3.0	0	1.1%	.0%	2.2%	.0%
ISICAD	3.7	.0	3.7	0	1.1%	.0%	2.7%	.0%
Datagraphic	3.6	1.8	1.4	57	1.1%	1.0%	1.0%	.1%
Hewlett-Packard	2.8	2.5	.0	819	.9%	1.4%	.0%	1.6%
Dell Computer	2.8	2.8	.0	721	.9%	1.6%	.0%	1.4%
Ground Modelling Systems	2.5	1.3	1.0	221	.8%	.8%	.7%	.4%

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Table 28 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: Personal Computer
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Digital	2.5	2.2	.0	651	.8%	1.3%	.0%	1.3%
Olivetti	2.3	2.0	.0	281	.7%	1.1%	.0%	.6%
Elstree Computing	2.2	1.0	1.2	62	.7%	.6%	.9%	.1%
Ziegler Informatics	2.0	.0	2.0	0	.6%	.0%	1.5%	.0%
Micrografx	1.9	.0	1.9	0	.6%	.0%	1.4%	.0%
ARKTEC	1.4	.1	1.2	32	.4%	.1%	.9%	.1%
Lamp Software	1.2	.2	1.0	68	.4%	.1%	.7%	.1%
Mucke Software	1.1	.6	.4	27	.4%	.3%	.3%	.1%
Serbi	1.1	.1	1.0	32	.3%	.1%	.7%	.1%
Softronics	1.1	.3	.8	101	.3%	.2%	.6%	.2%
CADKEY	1.0	.0	1.0	0	.3%	.0%	.7%	.0%
ABB Industria*	.9	.4	.4	10	.3%	.2%	.3%	.0%
Aspen Technology	.9	.0	.8	0	.3%	.0%	.6%	.0%
Han Dataport	.8	.2	.5	21	.3%	.1%	.3%	.0%
CAD-Capture	.7	.2	.2	4	.2%	.1%	.2%	.0%
CADWorks	.6	.0	.6	0	.2%	.0%	.4%	.0%
Sigma Design	.6	.0	.6	0	.2%	.0%	.4%	.0%
Carrier Corporation	.6	.0	.6	0	.2%	.0%	.4%	.0%
Engineered Software	.6	.0	.6	0	.2%	.0%	.4%	.0%
Moda CAD	.5	.1	.3	4	.1%	.1%	.2%	.0%
DAT Standard info ssystemes	.4	.0	.4	0	.1%	.0%	.3%	.0%
Sweet's Electronic Publishing	.3	.0	.2	0	.1%	.0%	.2%	.0%

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Table 28 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: Personal Computer
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Evolution Computing	.2	.0	.2	0	.1%	.0%	.2%	.0%
Softdesk	.2	.0	.2	0	.1%	.0%	.1%	.0%
IMSI	.2	.0	.2	0	.1%	.0%	.1%	.0%
Mega CADD	.2	.0	.2	0	.1%	.0%	.1%	.0%
Foresight Resources	.2	.0	.1	0	.0%	.0%	.1%	.0%
ASG	.1	.0	.1	0	.0%	.0%	.1%	.0%
American Small Business Comp.	.1	.0	.1	0	.0%	.0%	.1%	.0%
Accugraph	.1	.0	.1	0	.0%	.0%	.0%	.0%
CAE-link	.1	.0	.1	0	.0%	.0%	.0%	.0%
Bechtel Software	.0	.0	.0	0	.0%	.0%	.0%	.0%
Radan Computational	.0	.0	.0	1	.0%	.0%	.0%	.0%
ERDAS	.0	.0	.0	1	.0%	.0%	.0%	.0%
A.I. Systems	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	64.1	62.5	1.2	28,536	19.7%	35.7%	.9%	56.3%
All Companies	325.6	175.1	136.7	50,713	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	209.8	139.3	68.2	46,252	64.4%	79.6%	49.9%	91.2%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	115.8	35.7	68.4	4,461	35.6%	20.4%	50.1%	8.8%
All Hardware Companies	147.5	145.3	.0	47,166	45.3%	83.0%	.0%	93.0%
All Turnkey & SW Companies	178.1	29.8	136.7	3,547	54.7%	17.0%	100.0%	7.0%

Source: Dataquest (July 1993)

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Table 29
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: All Platforms
Region: Asia
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Fujitsu	137.0	87.7	35.6	2,713	24.8%	25.9%	23.0%	9.1%
NEC	55.7	39.5	11.7	5,386	10.1%	11.7%	7.6%	18.1%
IBM	34.2	20.1	9.6	3,008	6.2%	5.9%	6.2%	10.1%
Nihon Unisys	32.0	19.8	5.4	319	5.8%	5.9%	3.5%	1.1%
Intergraph	25.6	10.8	7.3	315	4.6%	3.2%	4.7%	1.1%
Autodesk	23.6	.0	23.6	0	4.3%	.0%	15.2%	.0%
Hewlett-Packard	20.4	17.3	.0	846	3.7%	5.1%	.0%	2.8%
Hitachi	17.4	8.3	7.3	468	3.1%	2.5%	4.7%	1.6%
Computervision	14.9	5.0	5.0	82	2.7%	1.5%	3.2%	.3%
Mitsubishi Electric	14.3	11.2	1.7	261	2.6%	3.3%	1.1%	.9%
Mutoh Industries—No OEM	13.0	7.8	3.9	172	2.4%	2.3%	2.5%	.6%
Toshiba—No OEM	12.8	6.4	5.1	324	2.3%	1.9%	3.3%	1.1%
Sony	12.6	12.6	.0	460	2.3%	3.7%	.0%	1.5%
Century Research Center	10.8	5.7	4.0	60	2.0%	1.7%	2.6%	.2%
CPU	10.5	.0	9.5	0	1.9%	.0%	6.1%	.0%
Hitachi Zosen Info Systems	7.8	6.7	.3	81	1.4%	2.0%	.2%	.3%
Digital	7.3	5.1	.0	239	1.3%	1.5%	.0%	.8%
INS Engineering	7.2	3.6	3.6	30	1.3%	1.1%	2.3%	.1%
EDS	7.1	3.8	2.5	127	1.3%	1.1%	1.6%	.4%
Silicon Graphics	6.0	5.7	.0	198	1.1%	1.7%	.0%	.7%

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Table 29 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: All Platforms
Region: Asia
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Uchida Yoko	5.3	3.2	1.9	126	1.0%	.9%	1.2%	.4%
Seiko Instruments—No OEM	5.3	2.6	2.6	136	1.0%	.8%	1.7%	.5%
Apple Computer	4.9	4.9	.0	894	.9%	1.5%	.0%	3.0%
Toyo Information Systems—No OEM	4.2	2.6	1.2	46	.8%	.8%	.8%	.2%
Andor	4.2	1.1	3.0	32	.8%	.3%	1.9%	.1%
Compaq	3.1	3.1	.0	670	.6%	.9%	.0%	2.2%
Design Automation	2.5	.5	1.9	53	.5%	.1%	1.2%	.2%
Sun Microsystems	2.2	1.9	.0	111	.4%	.5%	.0%	.4%
Mitsui Engineering	2.0	1.4	.4	13	.4%	.4%	.3%	.0%
Kockums Computer Systems	1.6	.4	.9	80	.3%	.1%	.6%	.3%
CAD Centre	1.3	.0	1.0	0	.2%	.0%	.7%	.0%
Sumitomo Denko Workstation	1.0	1.0	.0	53	.2%	.3%	.0%	.2%
Sigma Design	.9	.0	.9	0	.2%	.0%	.5%	.0%
Auto-Trol	.9	.3	.3	11	.2%	.1%	.2%	.0%
EA Systems	.8	.0	.8	0	.1%	.0%	.5%	.0%
ISICAD	.7	.2	.4	4	.1%	.1%	.3%	.0%
Kubota Computer	.6	.4	.1	36	.1%	.1%	.1%	.1%
Control Data Systems	.5	.2	.1	7	.1%	.1%	.1%	.0%
CADWorks	.5	.0	.4	0	.1%	.0%	.3%	.0%
Carrier Corporation	.4	.0	.4	0	.1%	.0%	.3%	.0%

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Table 29 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: All Platforms
Region: Asia
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Wisdom Systems	.4	.0	.3	0	.1%	.0%	.2%	.0%
Softdesk	.4	.0	.4	0	.1%	.0%	.3%	.0%
Accugraph	.4	.2	.2	14	.1%	.1%	.1%	.0%
Aspen Technology	.3	.0	.3	0	.1%	.0%	.2%	.0%
Graphisoft Software Dev	.2	.0	.2	0	.0%	.0%	.1%	.0%
Georgia Tech Research Corp.	.2	.0	.2	0	.0%	.0%	.1%	.0%
Moda CAD	.2	.1	.1	2	.0%	.0%	.1%	.0%
IMSI	.2	.0	.2	0	.0%	.0%	.1%	.0%
BATISOFT	.2	.0	.1	7	.0%	.0%	.1%	.0%
ASG	.1	.0	.1	0	.0%	.0%	.1%	.0%
Gable CAD Systems	.1	.1	.0	1	.0%	.0%	.0%	.0%
Mega CADD	.1	.0	.1	0	.0%	.0%	.1%	.0%
Bechtel Software	.1	.0	.1	0	.0%	.0%	.0%	.0%
ERDAS	.0	.0	.0	1	.0%	.0%	.0%	.0%
American Small Business Comp.	.0	.0	.0	0	.0%	.0%	.0%	.0%
Solbourne	.0	.0	.0	3	.0%	.0%	.0%	.0%
PAFEC	.0	.0	.0	0	.0%	.0%	.0%	.0%
ACDS Graphic System	.0	.0	.0	0	.0%	.0%	.0%	.0%

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Table 29 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: All Platforms
Region: Asia
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Foresight Resources	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	37.8	37.1	.1	12,409	6.8%	11.0%	.1%	41.6%
All Companies	553.5	338.3	155.1	29,797	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	193.9	115.7	53.4	18,941	35.0%	34.2%	34.4%	63.6%
All Asian-Based Companies	356.1	222.1	99.4	10,768	64.3%	65.7%	64.1%	36.1%
All European-Based Companies	3.5	.5	2.4	88	.6%	.1%	1.5%	.3%
All Hardware Companies	105.7	98.7	.0	18,669	19.1%	29.2%	.0%	62.7%
All Turnkey & SW Companies	447.8	239.6	155.1	11,129	80.9%	70.8%	100.0%	37.3%

Source: Dataquest (July 1993)

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Table 30
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: Technical Workstation
Region: Asia
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Fujitsu	57.6	36.8	15.0	1,173	21.8%	22.7%	22.0%	22.5%
NEC	25.1	13.8	9.3	826	9.5%	8.5%	13.7%	15.9%
Intergraph	20.5	9.1	4.8	268	7.8%	5.6%	7.1%	5.1%
Hewlett-Packard	19.3	16.4	.0	654	7.3%	10.1%	.0%	12.6%
Computervision	14.7	5.0	4.8	82	5.6%	3.1%	7.1%	1.6%
Sony	12.6	12.6	.0	460	4.8%	7.8%	.0%	8.8%
Hitachi	12.5	6.0	5.3	271	4.8%	3.7%	7.7%	5.2%
Mitsubishi Electric	11.2	9.5	.8	120	4.2%	5.9%	1.1%	2.3%
Century Research Center	10.8	5.7	4.0	60	4.1%	3.5%	5.9%	1.2%
Toshiba—No OEM	10.2	5.1	4.1	121	3.9%	3.1%	6.0%	2.3%
Mutoh Industries—No OEM	9.1	5.5	2.7	93	3.5%	3.4%	4.0%	1.8%
EDS	7.1	3.8	2.5	127	2.7%	2.4%	3.7%	2.4%
Nihon Unisys	7.0	4.4	1.2	57	2.7%	2.7%	1.8%	1.1%
Hitachi Zosen Info Systems	6.5	5.5	.3	67	2.5%	3.4%	.5%	1.3%
INS Engineering	6.4	3.2	3.2	17	2.4%	2.0%	4.7%	.3%
Silicon Graphics	6.0	5.7	.0	198	2.3%	3.5%	.0%	3.8%
Uchida Yoko	4.8	2.9	1.7	102	1.8%	1.8%	2.5%	2.0%
IBM	4.1	2.0	1.6	68	1.6%	1.2%	2.3%	1.3%
Toyo Information Systems—No OEM	3.5	2.2	1.0	42	1.3%	1.3%	1.5%	.8%
Sun Microsystems	2.0	1.7	.0	106	.8%	1.1%	.0%	2.0%
Digital	1.9	1.3	.0	93	.7%	.8%	.0%	1.8%

(Continued)

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Table 30 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: Technical Workstation
Region: Asia
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Mitsui Engineering	1.8	1.3	.4	10	.7%	.8%	.5%	.2%
Kockums Computer Systems	1.6	.4	.9	80	.6%	.3%	1.3%	1.5%
Autodesk	1.4	.0	1.4	0	.5%	.0%	2.1%	.0%
CAD Centre	1.3	.0	1.0	0	.5%	.0%	1.5%	.0%
Sumitomo Denko Workstation	.9	.9	.0	46	.3%	.6%	.0%	.9%
Auto-Trol	.9	.3	.3	11	.3%	.2%	.5%	.2%
ISICAD	.5	.2	.2	4	.2%	.1%	.3%	.1%
Kubota Computer	.5	.4	.1	27	.2%	.2%	.1%	.5%
Sigma Design	.5	.0	.5	0	.2%	.0%	.7%	.0%
Wisdom Systems	.4	.0	.3	0	.2%	.0%	.5%	.0%
Accugraph	.4	.2	.1	14	.1%	.1%	.2%	.3%
Control Data Systems	.2	.1	.0	5	.1%	.1%	.1%	.1%
Georgia Tech Research Corp.	.1	.0	.1	0	.0%	.0%	.2%	.0%
Gable CAD Systems	.1	.1	.0	1	.0%	.0%	.0%	.0%
Softdesk	.1	.0	.1	0	.0%	.0%	.1%	.0%
ERDAS	.0	.0	.0	0	.0%	.0%	.0%	.0%
Bechtel Software	.0	.0	.0	0	.0%	.0%	.0%	.0%
PAFEC	.0	.0	.0	0	.0%	.0%	.0%	.0%
Carrier Corporation	.0	.0	.0	0	.0%	.0%	.0%	.0%
ACDS Graphic System	.0	.0	.0	0	.0%	.0%	.0%	.0%
ASG	.0	.0	.0	0	.0%	.0%	.0%	.0%

(Continued)

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Table 30 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: Technical Workstation
Region: Asia
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Solbourne	.0	.0	.0	1	.0%	.0%	.0%	.0%
Other Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Companies	263.7	162.1	67.9	5,206	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	80.1	45.9	17.0	1,632	30.4%	28.3%	25.0%	31.3%
All Asian-Based Companies	180.6	115.7	49.0	3,493	68.5%	71.4%	72.1%	67.1%
All European-Based Companies	3.0	.5	2.0	81	1.1%	.3%	2.9%	1.6%
All Hardware Companies	42.8	38.7	.0	1,560	16.2%	23.9%	.0%	30.0%
All Turnkey & SW Companies	220.9	123.4	67.9	3,646	83.8%	76.1%	100.0%	70.0%

Source: Dataquest (July 1993)

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Table 31
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: Host-Dependent
Region: Asia
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Fujitsu	52.1	33.3	13.5	725	48.1%	46.8%	62.7%	46.6%
Nihon Unisys	24.9	15.5	4.2	262	23.0%	21.7%	19.6%	16.8%
IBM	10.3	6.6	1.3	123	9.5%	9.3%	6.0%	7.9%
Digital	2.9	2.0	.0	0	2.7%	2.8%	.0%	.0%
Hitachi	1.7	.8	.7	31	1.6%	1.2%	3.4%	2.0%
Mitsubishi Electric	1.6	.8	.5	5	1.5%	1.1%	2.1%	.3%
Hitachi Zosen Info Systems	1.2	1.1	.0	14	1.1%	1.6%	.0%	.9%
EA Systems	.8	.0	.8	0	.7%	.0%	3.8%	.0%
Toyo Information Systems—No OEM	.7	.4	.2	4	.7%	.5%	1.1%	.3%
Control Data Systems	.3	.1	.0	2	.3%	.2%	.2%	.1%
Intergraph	.1	.0	.1	0	.1%	.0%	.6%	.0%
Georgia Tech Research Corp.	.1	.0	.1	0	.1%	.0%	.4%	.0%
Kubota Computer	.1	.1	.0	9	.1%	.1%	.0%	.6%
Bechtel Software	.0	.0	.0	0	.0%	.0%	.1%	.0%
Other Companies	11.2	10.6	.0	383	10.3%	14.9%	.0%	24.6%
All Companies	108.2	71.3	21.6	1,558	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	25.8	19.3	2.4	507	23.8%	27.1%	11.1%	32.6%
All Asian-Based Companies	82.4	52.0	19.2	1,050	76.2%	72.9%	88.9%	67.4%
All European-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Hardware Companies	14.1	12.6	.0	383	13.0%	17.7%	.0%	24.6%
All Turnkey & SW Companies	94.1	58.7	21.6	1,175	87.0%	82.3%	100.0%	75.4%

Source: Dataquest (July 1993)

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Table 32
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: Server
Region: Asia
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Intergraph	3.5	1.7	.8	47	36.3%	32.4%	41.5%	36.1%
IBM	3.4	1.6	1.2	34	35.6%	30.5%	57.5%	26.5%
Digital	2.1	1.4	.0	29	21.8%	27.7%	.0%	22.2%
Hewlett-Packard	.3	.2	.0	6	3.2%	4.5%	.0%	4.8%
Sun Microsystems	.2	.1	.0	6	1.8%	2.7%	.0%	4.4%
Sumitomo Denko Workstation	.1	.1	.0	6	.9%	1.8%	.0%	4.8%
Georgia Tech Research Corp.	.0	.0	.0	0	.2%	.0%	1.0%	.0%
Solbourne	.0	.0	.0	1	.2%	.4%	.0%	1.1%
Other Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Companies	9.5	5.1	2.0	129	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	9.4	5.0	2.0	123	99.1%	98.2%	100.0%	95.2%
All Asian-Based Companies	.1	.1	.0	6	.9%	1.8%	.0%	4.8%
All European-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Hardware Companies	2.7	1.9	.0	48	27.9%	37.1%	.0%	37.4%
All Turnkey & SW Companies	6.9	3.2	2.0	81	72.1%	62.9%	100.0%	62.6%

Source: Dataquest (July 1993)

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Table 33
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: Personal Computer
Region: Asia
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
NEC	30.6	25.7	2.5	4,560	17.8%	25.8%	3.9%	19.9%
Fujitsu	27.4	17.5	7.1	815	15.9%	17.6%	11.2%	3.6%
Autodesk	22.2	.0	22.2	0	12.9%	.0%	34.8%	.0%
IBM	16.4	9.9	5.6	2,783	9.5%	10.0%	8.7%	12.2%
CPU	10.5	.0	9.5	0	6.1%	.0%	14.9%	.0%
Seiko Instruments—No OEM	5.3	2.6	2.6	136	3.1%	2.6%	4.1%	.6%
Apple Computer	4.9	4.9	.0	894	2.9%	4.9%	.0%	3.9%
Andor	4.2	1.1	3.0	32	2.5%	1.1%	4.7%	.1%
Mutoh Industries—No OEM	3.9	2.3	1.2	79	2.3%	2.3%	1.8%	.3%
Hitachi	3.1	1.5	1.3	166	1.8%	1.5%	2.1%	.7%
Compaq	3.1	3.1	.0	670	1.8%	3.1%	.0%	2.9%
Toshiba—No OEM	2.6	1.3	1.0	204	1.5%	1.3%	1.6%	.9%
Design Automation	2.5	.5	1.9	53	1.5%	.5%	3.0%	.2%
Intergraph	1.5	.0	1.5	0	.9%	.0%	2.4%	.0%
Mitsubishi Electric	1.4	.9	.5	135	.8%	.9%	.8%	.6%
INS Engineering	.7	.4	.4	13	.4%	.4%	.6%	.1%
Hewlett-Packard	.7	.7	.0	185	.4%	.7%	.0%	.8%
Uchida Yoko	.5	.3	.2	24	.3%	.3%	.3%	.1%
CADWorks	.5	.0	.4	0	.3%	.0%	.7%	.0%

(Continued)

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Table 33 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: Personal Computer
Region: Asia
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Digital	.5	.4	.0	118	.3%	.4%	.0%	.5%
Sigma Design	.4	.0	.4	0	.2%	.0%	.6%	.0%
Carrier Corporation	.4	.0	.4	0	.2%	.0%	.6%	.0%
Softdesk	.3	.0	.3	0	.2%	.0%	.5%	.0%
Aspen Technology	.3	.0	.3	0	.2%	.0%	.4%	.0%
Graphisoft Software Dev	.2	.0	.2	0	.1%	.0%	.4%	.0%
ISICAD	.2	.0	.2	0	.1%	.0%	.3%	.0%
Moda CAD	.2	.1	.1	2	.1%	.1%	.2%	.0%
Mitsui Engineering	.2	.1	.0	3	.1%	.1%	.0%	.0%
IMSI	.2	.0	.2	0	.1%	.0%	.3%	.0%
BATISOFT	.2	.0	.1	7	.1%	.0%	.1%	.0%
Computervision	.2	.0	.2	0	.1%	.0%	.2%	.0%
ASG	.1	.0	.1	0	.1%	.0%	.2%	.0%
Mega CADD	.1	.0	.1	0	.0%	.0%	.1%	.0%
Accugraph	.0	.0	.0	0	.0%	.0%	.0%	.0%
American Small Business Comp.	.0	.0	.0	0	.0%	.0%	.0%	.0%
Foresight Resources	.0	.0	.0	0	.0%	.0%	.0%	.0%
Bechtel Software	.0	.0	.0	0	.0%	.0%	.0%	.0%

(Continued)

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Table 33 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: Personal Computer
Region: Asia
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
ERDAS	.0	.0	.0	1	.0%	.0%	.0%	.0%
Other Companies	26.6	26.5	.1	12,027	15.4%	26.5%	.2%	52.5%
All Companies	172.2	99.8	63.6	22,905	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	78.6	45.5	32.0	16,679	45.7%	45.6%	50.3%	72.8%
All Asian-Based Companies	93.0	54.3	31.2	6,219	54.0%	54.4%	49.0%	27.2%
All European-Based Companies	.5	.0	.4	7	.3%	.0%	.6%	.0%
All Hardware Companies	46.2	45.5	.0	16,677	26.8%	45.5%	.0%	72.8%
All Turnkey & SW Companies	126.0	54.4	63.6	6,228	73.2%	54.5%	100.0%	27.2%

Source: Dataquest (July 1993)

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Table 34
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: All Platforms
Region: Rest of World
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Intergraph	24.1	10.6	7.1	368	39.2%	34.7%	35.3%	9.1%
IBM	7.8	5.3	1.2	774	12.7%	17.2%	6.2%	19.0%
Apple Computer	4.9	4.9	.0	1,093	8.0%	16.0%	.0%	26.9%
Autodesk	3.2	.0	3.2	0	5.2%	.0%	15.7%	.0%
Computervision	2.8	.8	.9	3	4.6%	2.5%	4.3%	.1%
Digital	2.5	1.8	.0	86	4.1%	5.8%	.0%	2.1%
International Software Systems	2.4	.0	2.4	0	3.8%	.0%	11.7%	.0%
Compaq	2.1	2.1	.0	447	3.4%	6.7%	.0%	11.0%
CAD Centre	2.0	.0	1.6	0	3.2%	.0%	7.9%	.0%
EDS	1.2	.5	.6	25	2.0%	1.8%	2.8%	.6%
Claris	1.0	.0	1.0	0	1.6%	.0%	4.8%	.0%
Hewlett-Packard	1.0	.8	.0	93	1.6%	2.7%	.0%	2.3%
Accugraph	.4	.2	.2	14	.6%	.6%	.8%	.3%
Softdesk	.3	.0	.3	0	.5%	.0%	1.6%	.0%
Sun Microsystems	.3	.3	.0	20	.5%	.9%	.0%	.5%
ISICAD	.3	.1	.2	2	.5%	.2%	.9%	.0%
Hochtief	.3	.0	.2	2	.5%	.1%	1.0%	.1%
Georgia Tech Research Corp.	.3	.0	.3	0	.4%	.0%	1.2%	.0%
Graphisoft Software Dev	.2	.0	.2	0	.4%	.0%	1.1%	.0%
Sigma Design	.2	.0	.2	0	.4%	.0%	1.0%	.0%
CADWorks	.1	.0	.1	0	.2%	.0%	.5%	.0%

(Continued)

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Table 34 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: All Platforms
Region: Rest of World
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Engineering Systems Corp.	.1	.0	.1	0	.2%	.0%	.5%	.0%
Star Informatic	.1	.0	.0	0	.2%	.1%	.1%	.0%
Innovative Data Design	.1	.0	.1	0	.1%	.0%	.4%	.0%
Mc2 Engineering Software	.1	.0	.1	0	.1%	.0%	.3%	.0%
ASG	.1	.0	.1	0	.1%	.0%	.3%	.0%
CAE-link	.1	.0	.1	0	.1%	.0%	.2%	.0%
Aura CAD/CAM Systems	.1	.0	.0	0	.1%	.0%	.2%	.0%
American Small Business Comp.	.0	.0	.0	0	.1%	.0%	.2%	.0%
ERDAS	.0	.0	.0	0	.0%	.0%	.0%	.0%
Engineered Software	.0	.0	.0	0	.0%	.0%	.1%	.0%
Macao Systems	.0	.0	.0	0	.0%	.0%	.0%	.0%
Moda CAD	.0	.0	.0	0	.0%	.0%	.0%	.0%
Ziegler Informatics	.0	.0	.0	0	.0%	.0%	.0%	.0%
Foresight Resources	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	3.4	3.3	.1	1,137	5.6%	10.6%	.3%	28.0%
All Companies	61.3	30.7	20.1	4,064	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	58.6	30.6	18.0	4,061	95.5%	99.7%	89.4%	99.9%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	2.8	.1	2.1	3	4.5%	.3%	10.6%	.1%
All Hardware Companies	16.4	15.3	.0	3,555	26.7%	49.8%	.0%	87.5%
All Turnkey & SW Companies	44.9	15.4	20.1	509	73.3%	50.2%	100.0%	12.5%

Source: Dataquest (July 1993)

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Table 35
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: Technical Workstation
Region: Rest of World
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Intergraph	19.3	9.1	4.8	316	66.1%	72.3%	53.6%	67.8%
Computervision	2.5	.7	.8	0	8.6%	5.5%	8.4%	.0%
CAD Centre	2.0	.0	1.6	0	6.8%	.0%	17.9%	.0%
IBM	1.3	.6	.5	30	4.3%	4.8%	5.4%	6.5%
EDS	1.2	.5	.6	25	4.2%	4.3%	6.3%	5.3%
Hewlett-Packard	.8	.7	.0	29	2.6%	5.2%	.0%	6.3%
Digital	.7	.5	.0	32	2.3%	3.6%	.0%	6.9%
Accugraph	.4	.2	.1	14	1.2%	1.4%	1.6%	2.9%
Sun Microsystems	.3	.3	.0	18	1.0%	2.0%	.0%	4.0%
ISICAD	.2	.1	.1	2	.7%	.6%	1.0%	.3%
Autodesk	.2	.0	.2	0	.7%	.0%	2.1%	.0%
Sigma Design	.1	.0	.1	0	.4%	.0%	1.2%	.0%
Star Informatic	.1	.0	.0	0	.4%	.3%	.3%	.0%
Softdesk	.1	.0	.1	0	.2%	.0%	.8%	.0%
Georgia Tech Research Corp.	.1	.0	.1	0	.2%	.0%	.7%	.0%
Engineering Systems Corp.	.0	.0	.0	0	.1%	.0%	.2%	.0%
ERDAS	.0	.0	.0	0	.1%	.0%	.1%	.0%

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Table 35 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: Technical Workstation
Region: Rest of World
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Macao Systems	.0	.0	.0	0	.0%	.1%	.0%	.0%
Other Companies	.0	.0	.0	0	.1%	.0%	.3%	.1%
All Companies	29.1	12.6	8.9	467	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	27.0	12.5	7.3	467	92.6%	99.6%	81.5%	99.9%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	2.1	.1	1.7	0	7.4%	.4%	18.5%	.1%
All Hardware Companies	1.7	1.4	.0	80	5.9%	10.7%	.0%	17.1%
All Turnkey & SW Companies	27.4	11.2	8.9	387	94.1%	89.3%	100.0%	82.9%

Source: Dataquest (July 1993)

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Table 36
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: Host-Dependent
Region: Rest of World
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
IBM	3.2	2.0	.4	50	58.0%	57.1%	53.3%	61.3%
Digital	1.0	.7	.0	0	17.9%	18.8%	.0%	.0%
Georgia Tech Research Corp.	.2	.0	.2	0	3.5%	.0%	25.3%	.0%
Computervision	.1	.0	.0	2	2.2%	1.1%	4.0%	2.4%
Intergraph	.1	.0	.1	0	2.2%	.0%	14.7%	.0%
Engineering Systems Corp.	.0	.0	.0	0	.2%	.0%	1.3%	.0%
Hochtief	.0	.0	.0	0	.2%	.0%	1.3%	.1%
Macao Systems	.0	.0	.0	0	.2%	.0%	.0%	.1%
Other Companies	.9	.8	.0	29	15.7%	23.0%	.0%	36.2%
All Companies	5.5	3.6	.8	81	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	5.5	3.6	.7	81	99.6%	100.0%	98.7%	99.9%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	.0	.0	.0	0	.4%	.0%	1.3%	.1%
All Hardware Companies	1.8	1.5	.0	29	33.6%	41.7%	.0%	36.2%
All Turnkey & SW Companies	3.6	2.1	.8	52	66.4%	58.3%	100.0%	63.8%

Source: Dataquest (July 1993)

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Table 37
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: Server
Region: Rest of World
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Intergraph	3.3	1.6	.8	52	61.7%	58.4%	65.5%	65.6%
IBM	1.1	.5	.4	14	20.9%	19.5%	30.3%	17.7%
Digital	.7	.5	.0	10	13.9%	19.1%	.0%	12.7%
Computervision	.2	.0	.1	1	2.8%	1.5%	4.2%	1.7%
Sun Microsystems	.0	.0	.0	1	.6%	1.1%	.0%	1.8%
Hewlett-Packard	.0	.0	.0	0	.2%	.4%	.0%	.5%
Other Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Companies	5.3	2.7	1.2	79	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	5.3	2.7	1.2	79	100.0%	100.0%	100.0%	100.0%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Hardware Companies	.8	.6	.0	13	15.6%	22.1%	.0%	16.2%
All Turnkey & SW Companies	4.5	2.1	1.2	67	84.4%	77.9%	100.0%	83.8%

Source: Dataquest (July 1993)

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Table 38
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: Personal Computer
Region: Rest of World
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Apple Computer	4.9	4.9	.0	1,093	22.9%	41.4%	.0%	31.8%
Autodesk	3.0	.0	3.0	0	13.8%	.0%	32.1%	.0%
International Software Systems	2.4	.0	2.4	0	11.0%	.0%	25.4%	.0%
IBM	2.3	2.1	.0	680	10.5%	17.8%	.0%	19.8%
Compaq	2.1	2.1	.0	447	9.6%	17.4%	.0%	13.0%
Intergraph	1.4	.0	1.4	0	6.7%	.0%	15.6%	.0%
Claris	1.0	.0	1.0	0	4.5%	.0%	10.5%	.0%
Hochtief	.3	.0	.2	2	1.3%	.3%	2.2%	.1%
Softdesk	.3	.0	.3	0	1.2%	.0%	2.7%	.0%
Graphisoft Software Dev	.2	.0	.2	0	1.1%	.0%	2.5%	.0%
Hewlett-Packard	.2	.2	.0	63	.8%	1.3%	.0%	1.8%
Digital	.2	.2	.0	44	.8%	1.3%	.0%	1.3%
CADWorks	.1	.0	.1	0	.6%	.0%	1.1%	.0%
Sigma Design	.1	.0	.1	0	.5%	.0%	1.0%	.0%
Innovative Data Design	.1	.0	.1	0	.4%	.0%	1.0%	.0%
ISICAD	.1	.0	.1	0	.4%	.0%	1.0%	.0%
Engineering Systems Corp.	.1	.0	.1	0	.3%	.0%	.8%	.0%
ASG	.1	.0	.1	0	.3%	.0%	.6%	.0%
Mc2 Engineering Software	.1	.0	.1	0	.3%	.0%	.6%	.0%
CAE-link	.1	.0	.1	0	.2%	.0%	.5%	.0%
Aura CAD/CAM Systems	.1	.0	.0	0	.2%	.0%	.4%	.0%

(Continued)

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Table 38 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: AEC
Platform: Personal Computer
Region: Rest of World
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Accugraph	.0	.0	.0	0	.2%	.0%	.3%	.0%
American Small Business Comp.	.0	.0	.0	0	.2%	.0%	.4%	.0%
Computervision	.0	.0	.0	0	.1%	.0%	.3%	.0%
Engineered Software	.0	.0	.0	0	.1%	.0%	.3%	.0%
Moda CAD	.0	.0	.0	0	.1%	.0%	.1%	.0%
Foresight Resources	.0	.0	.0	0	.0%	.0%	.1%	.0%
Ziegler Informatics	.0	.0	.0	0	.0%	.0%	.1%	.0%
ERDAS	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	2.5	2.4	.0	1,107	11.7%	20.5%	.4%	32.2%
All Companies	21.5	11.9	9.3	3,437	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	20.9	11.8	8.8	3,434	97.2%	99.7%	94.8%	99.9%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	.6	.0	.5	3	2.8%	.3%	5.2%	.1%
All Hardware Companies	12.0	11.8	.0	3,433	56.0%	99.7%	.0%	99.9%
All Turnkey & SW Companies	9.5	.0	9.3	4	44.0%	.3%	100.0%	.1%

Source: Dataquest (July 1993)

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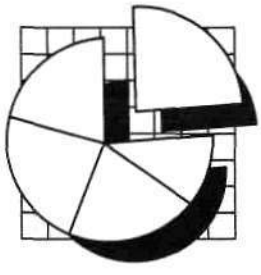
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Market Statistics
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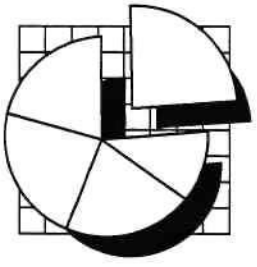
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Product Code: CAEC-WW-MS-9304
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Market Statistics
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Note: All tables show estimated data.

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Note: All tables show estimated data.

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CAD/CAM/CAE and GIS GIS Forecast

Sluggish world economic activity in 1992 caused decelerating growth in the CAD/CAM/CAE and GIS market. Dataquest expects this decelerating trend to continue in 1993. A recent survey by The Dun & Bradstreet Corporation of more than 11,000 executives in 16 countries indicated that, on a worldwide basis, optimism for sales and profits holds steady. On a regional basis, however, executives in the United States and United Kingdom measured heightened optimism, offsetting the weaker optimism of continental Europe, particularly Germany and France, and the continued pessimism of Japan. High interest rates are aggravating optimism in the European community, while Japan is suffering from weaker domestic demand and increased competitive pressures.

Despite the economy, the CAD/CAM/CAE and GIS market grew an anticipated 3.2 percent to $15.5 billion, in part because of the devaluation of the yen and ECU against the U.S. dollar (see Table 1). On the basis of the yen, the Japanese market showed a decline of 5.9 percent. Dataquest is forecasting total revenue in the worldwide market to grow 2.7 percent in 1993, with a compound annual growth rate (CAGR) of 4.6 percent through 1997. We forecast worldwide software revenue to grow 9.5 percent in 1993, with a CAGR of 9.0 percent through 1997. This forecast is based on the market share information published in March (though changed slightly as new information became available) and will be updated in July, following an update to our market share in May. It should be noted that the forecast assumes stable currency exchange rates.

This document contains Dataquest's detailed forecast information for the CAD/CAM/CAE and GIS industry. Included are the following:

- Five-year historical data
- Five-year forecast data

More detailed data is available through our client inquiry service, which can provide custom analysis of the multidimensional database.

Worldwide Forecast Assumptions

The following sections describe the main forces, worldwide, that drive the CAD/CAM/CAE and GIS forecast.

Worldwide Forecast Drivers

The worldwide CAD/CAM/CAE and GIS market will maintain consistent, steady growth during the next five years. Figure 1 shows the forecast of hardware, software, and service revenue worldwide and by region. Figure 2 shows the worldwide forecast by platform.

The following paragraphs describe the main forces driving the CAD/CAM/CAE and GIS worldwide forecast.

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Table 1
CAD/CAM/CAE and GIS Forecast, by Region
(Revenue in Millions of Dollars; Actual Shipments)

	1992	1993	1994	1995	1996	1997	CAGR (%) 1992-1997
Worldwide							
Total Factory Revenue	15,485	15,909	16,602	17,432	18,371	19,346	4.6
Software Revenue	4,885	5,350	5,860	6,390	6,920	7,470	8.9
Unit/Seat Shipments	647,716	708,400	777,500	841,800	892,800	939,100	7.7
North America							
Total Factory Revenue	5,224	5,443	5,737	6,081	6,441	6,816	5.5
Software Revenue	1,669	1,870	2,070	2,270	2,460	2,660	9.8
Unit/Seat Shipments	270,345	298,900	323,500	347,300	365,700	385,200	7.3
Europe							
Total Factory Revenue	5,862	6,078	6,389	6,702	7,060	7,386	4.7
Software Revenue	1,793	1,990	2,190	2,370	2,570	2,750	8.9
Unit/Seat Shipments	234,935	257,100	287,200	312,500	330,000	342,000	7.8
Asia							
Total Factory Revenue	4,104	4,055	4,086	4,195	4,341	4,531	2.0
Software Revenue	1,327	1,380	1,460	1,580	1,690	1,810	6.4
Unit/Seat Shipments	125,922	133,000	143,200	153,200	162,600	171,300	6.3
Rest of World							
Total Factory Revenue	296	332	390	454	528	614	15.7
Software Revenue	96	120	150	170	200	240	20.1
Unit/Seat Shipments	16,514	19,400	23,600	28,800	34,500	40,600	19.7

Source: Dataquest (May 1993)

Macro Economy

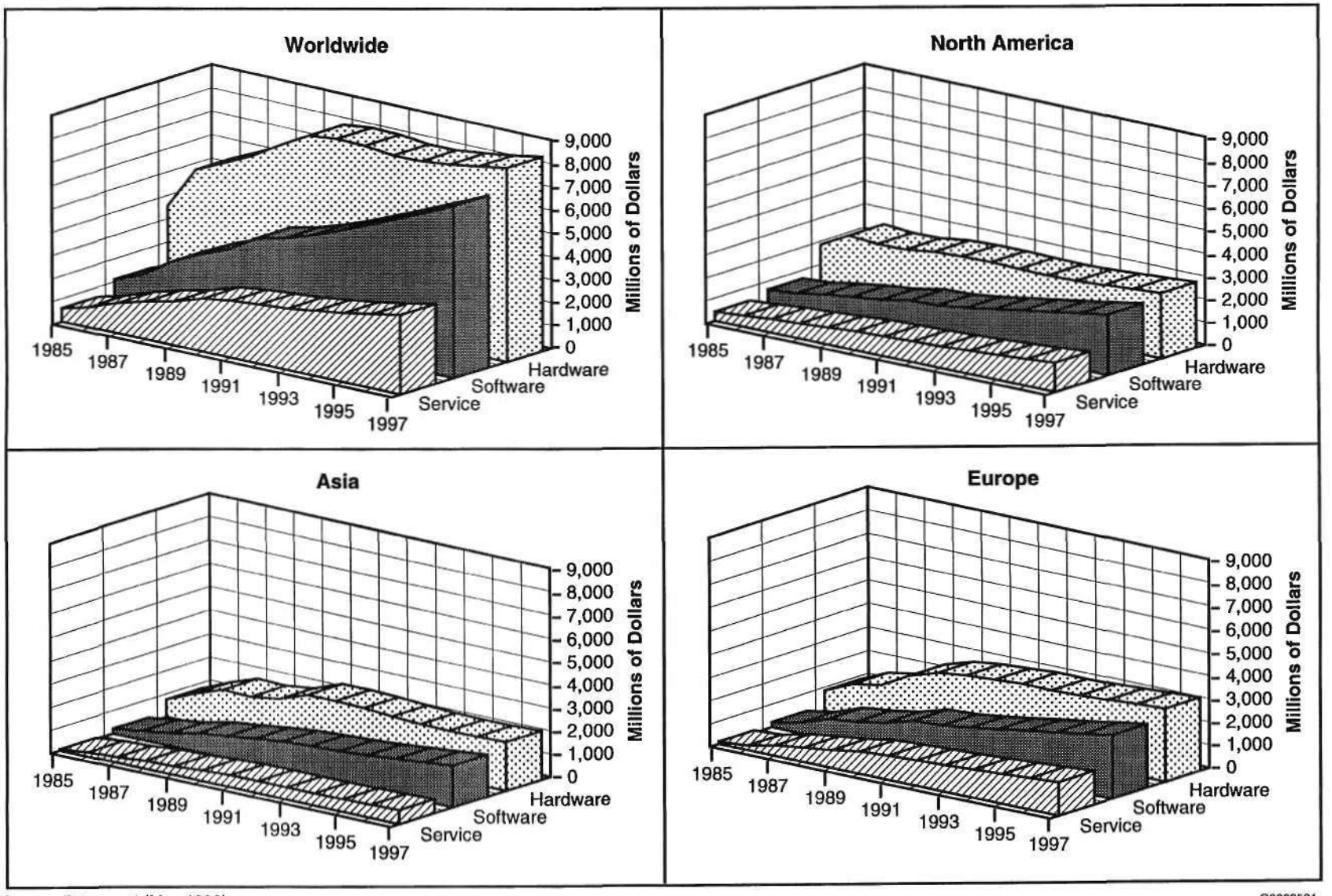
The recovery with renewed optimism from worldwide recession and increased capital spending will fuel growth gradually, beginning in the United States and the United Kingdom, and in Asian countries other than Japan.

Currency

The decline of the U.S. dollar compared to the ECU and yen from 1991 to 1992 offset sluggish economic growth for multinational corporations, particularly those with a high percentage of costs denominated in dollars. Some companies are utilizing the changes in exchange rates to lower overseas prices effectively, thus stimulating demand. This is particularly true of PC companies striving to increase unit volume gains rapidly in Japan, where the local companies are vulnerable to price competition.

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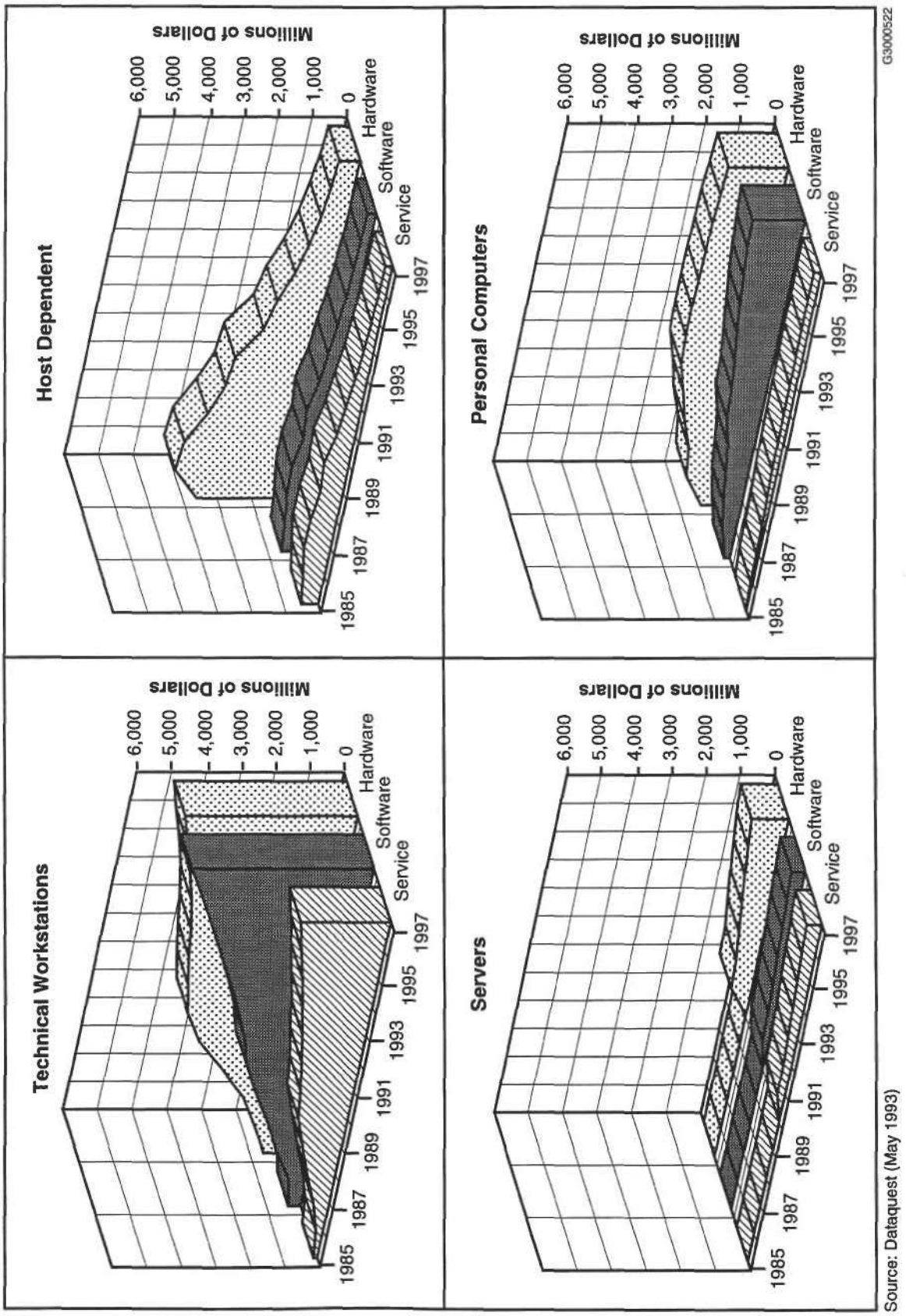
Figure 1
Worldwide and Regional Revenue Forecast, All Applications and All Platforms



Source: Dataquest (May 1993)

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Figure 2
Worldwide Revenue Forecast, by Platform, All Applications



Source: Dataquest (May 1993)

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Technology

Computing performance will continue to improve at an exponential rate in the foreseeable future. Dataquest has forecast the growth in millions of instructions per second (mips) shipments. The results show that the total mips shipped through 1992 will be matched by the shipments made in 1993. In other words, the total mips shipped will double in 1993, almost double again in 1994, and double again in 1995. This enabling resource will fuel the next-generation software tools focused on integrated solutions at the enterprise level.

Indispensability

As the complexity of the design, the need to share information, and the need to store information electronically all increase, the benefits of automation improve dramatically and the level of indispensability goes up. CAD/CAM/CAE and GIS are becoming a necessity as these factors are coupled with market pressure to produce higher quality and to reduce production cycles.

Late Buyers

A significant pool of untapped users still exists in mechanical, AEC, and GIS applications, driving additional growth. These conservative buyers will favor market leaders and installed systems for compatibility. For vendors, therefore, the value of high market share and customer satisfaction will increase.

Desktop Dominance

The turf war for desktop dominance is building steam with the introduction of the Pentium chip and Windows NT, which will fight to take market share from the higher-priced, multiple UNIX operating systems with RISC technology. The decline of host-dependent systems also is continuing, with replacements going to networked, desktop systems. The former threatens vendors whose business models depend upon high-priced workstations, while the latter provides opportunity.

Unbundling of Software

With software vendors porting to multiple platforms, software is no longer the hinge upon which hardware swings. The market is moving quickly from proprietary to open systems, resulting in a shift from bundled to unbundled software (see Table 2).

Replacement Market

The replacement market is gaining importance as replacement seats exceed 50 percent of unit sales in 1993 (see Figure 3). This saturation implies that many parallel manual systems can be eliminated and new applications developed if everyone in a company that needs access to the engineering database can have it in electronic format. The savings potential is tremendous. This saturation also implies a growing sophistication in buyers that are more informed of this technology's strategic importance.

Software

With technological advances, growing sophistication of users, and competitive pressures, the demand for software with greater ease of

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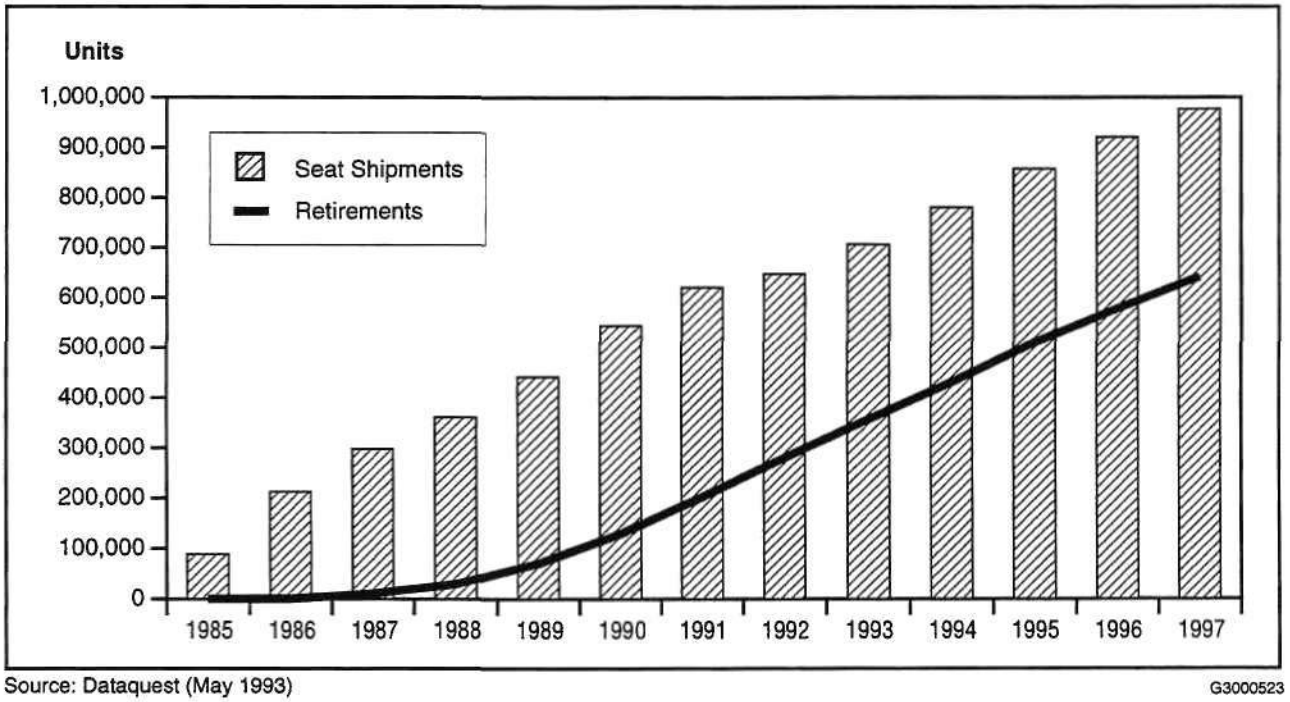
Table 2
CAD/CAM/CAE and GIS Software Revenue Forecast, by Application (Millions of Dollars)

	Revenue						CAGR (%)	Percentage Distribution (%)					
	1992	1993	1994	1995	1996	1997	1992-1997	1992	1993	1994	1995	1996	1997
All Applications													
Total Software	4,885	5,352	5,862	6,389	6,923	7,467	8.9	100.0	100.0	100.0	100.0	100.0	100.0
Bundled Software	1,917	1,935	1,973	2,037	2,118	2,201	2.8	39.3	36.2	33.6	31.9	30.6	29.5
Unbundled Software	2,968	3,416	3,890	4,352	4,804	5,266	12.2	60.7	63.8	66.4	68.1	69.4	70.5
Mechanical													
Total Software	2,233	2,469	2,688	2,868	3,007	3,154	7.2	100.0	100.0	100.0	100.0	100.0	100.0
Bundled Software	1,111	1,119	1,127	1,129	1,123	1,107	-0.1	49.8	45.3	42.0	39.4	37.3	35.1
Unbundled Software	1,122	1,350	1,561	1,739	1,883	2,048	12.8	50.2	54.7	58.0	60.6	62.7	64.9
AEC													
Total Software	730	796	875	966	1,072	1,178	10.0	100.0	100.0	100.0	100.0	100.0	100.0
Bundled Software	327	347	372	404	444	483	8.1	44.8	43.8	42.5	41.7	41.1	41.0
Unbundled Software	403	449	503	562	628	695	11.5	55.2	56.3	57.5	58.3	58.9	59.0
GIS/Mapping													
Total Software	616	700	810	956	1,128	1,317	16.4	100.0	100.0	100.0	100.0	100.0	100.0
Bundled Software	297	325	364	417	482	553	13.2	48.3	45.7	44.4	43.8	42.5	42.0
Unbundled Software	318	375	447	539	646	764	19.2	51.7	54.3	55.6	56.3	57.5	58.0
Electronic CAE													
Total Software	752	812	884	945	1,005	1,057	7.0	100.0	100.0	100.0	100.0	100.0	100.0
Bundled Software	75	61	51	43	37	35	-14.1	9.9	7.4	5.7	4.3	4.0	3.8
Unbundled Software	677	751	834	902	969	1,022	8.6	90.1	92.6	94.3	95.7	96.0	96.2
IC Layout													
Total Software	225	243	269	303	341	378	10.9	100.0	100.0	100.0	100.0	100.0	100.0
Bundled Software	17	13	9	7	6	5	-21.7	7.4	4.2	3.7	3.2	2.9	0.0
Unbundled Software	209	230	260	296	335	373	12.3	92.6	95.8	96.3	96.8	97.1	100.0
PCB/Hybrid/MCM													
Total Software	330	332	336	351	370	383	3.0	100.0	100.0	100.0	100.0	100.0	100.0
Bundled Software	91	71	51	38	26	19	-26.9	27.6	21.2	14.7	11.4	8.1	5.3
Unbundled Software	239	261	286	314	343	364	8.8	72.4	78.8	85.3	88.6	91.9	94.7

Source: Dataquest (May 1993)

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Figure 3
Unit Seat Shipments versus Retirements Forecast



Source: Dataquest (May 1993)

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use, flexibility, and interoperability is growing. This demand is driving the growth in business alliances between small innovative software niche players and major software vendors with resources to sell to both the new and replacement markets.

North American Forecast Drivers

Of the three major worldwide regions, North America CAD/CAM/CAE and GIS revenue growth was an anemic 3.4 percent to $5.2 billion in 1992 and is forecast to grow at 5.5 percent CAGR through 1997. The following paragraphs describe the main factors driving the North American forecast.

Capital Spending

According to Dun & Bradstreet's latest monthly survey of 1,000 manufacturers nationwide, optimism is at a three-year high and capital spending is expected to increase 12 percent in 1993 because of competitive global pressures, need for improved productivity, and cost of capital, which is at a three-year low. This bodes well for increased investment in CAD/CAM/CAE and GIS systems, particularly mechanical applications.

Cuts in Defense Spending

Cuts in defense spending will tend to soften the market. However, a focus on fewer, more sophisticated weapons systems will promote use of the latest design optimization and simulation capabilities.

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European Forecast Drivers

The European market grew 5.3 percent in 1992 to $5.9 billion, making Europe the fastest growing region worldwide. However, the outlook for 1993 is not quite as positive, with growth expected to be 3.7 percent. The major factor behind this slowing growth is the sluggish German economy, which accounts for 34 percent of the European market. A slowdown in Germany ripples through all other European industries. The following paragraphs describe the main factors driving the European forecast.

Recession

The general recessionary economic climate throughout much of Europe during 1991 and 1992 depressed capital investment and orders for information technology products. Most of the European countries are in or near a recession. The picture for 1993 does not look good. Many individual countries face a slowdown in domestic activity, while there is little hope of strong demand pressures from the United States or Japan to help in any economic upturn anytime soon.

Growth

On average, gross domestic product growth in Europe in 1993 is expected to be only 0.3 percent, with an upturn of 1.9 percent growth expected in 1994. Major European economies such as Germany, United Kingdom, Italy, Spain, and Sweden also have accumulated massive budget deficits that will influence governments to reduce public spending even further and to increase taxes, which in turn will reduce consumer spending. Even the recent falls in interest rates will not change this fact.

Asian Forecast Drivers

The Asian market grew 1.2 percent in 1992 to $4.1 billion. However, the Japanese market declined 6 percent on a yen basis. With 94 percent of the Asian CAD/CAM/CAE and GIS market in Japan, the Japanese economy dominates this segment. Further contraction of the market expected in 1993 will result in a CAGR through 1997 of 2.0 percent. The following paragraphs describe the main factors driving the Asian forecast.

Capital Spending

Dataquest estimates that capital spending by Japanese companies will fall 12.7 percent in 1993, following a precipitous drop of 28.7 percent in 1992. However, signs of recovery in the macro economy are starting to show.

Business Confidence

According to the Sakura Institute of Research in Japan (January 1993), business confidence is expected to brighten some in fall 1993. Recovery is expected to be fueled by small and medium-size manufacturing companies.

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Software Leads Hardware

The preference for Japanese companies investing in CAD/CAM/CAE and GIS has been for low-cost, decentralized networked systems and big central mainframes. Japan- and U.S.-supplied technical workstations are emerging as the platform of choice for most CAD/CAM/CAE and GIS applications. Strong interest in the latest high-end software offerings is dragging the necessary hardware.

Application Forecast Assumptions

Expected growth in AEC and GIS applications during the next three or four years will add significantly to the total growth of the industry and will exceed growth forecasts for all mechanical and electronic applications (see Figures 4 and 5). Factors in this shift in the total market application mix include market penetration, new application development, and shifting trends in average selling prices.

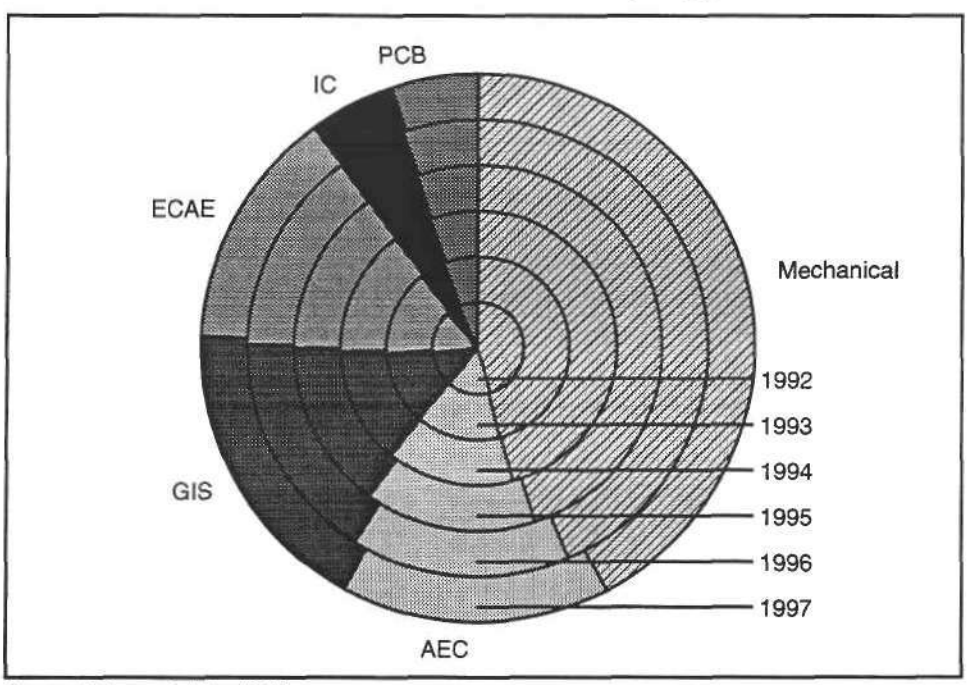
Mechanical Forecast Assumptions

The mechanical application area is the largest of the CAD/CAM/CAE and GIS market, with 49 percent share and software revenue growth of 9.3 percent in 1992. The following paragraphs describe the main issues driving the mechanical forecast.

Software Price

Dataquest expects software prices to stabilize or increase slightly for leading products. The average value of software shipped per seat has increased slowly. In 1987, total software revenue divided by

Figure 4
Software Revenue Distribution Forecast, by Application

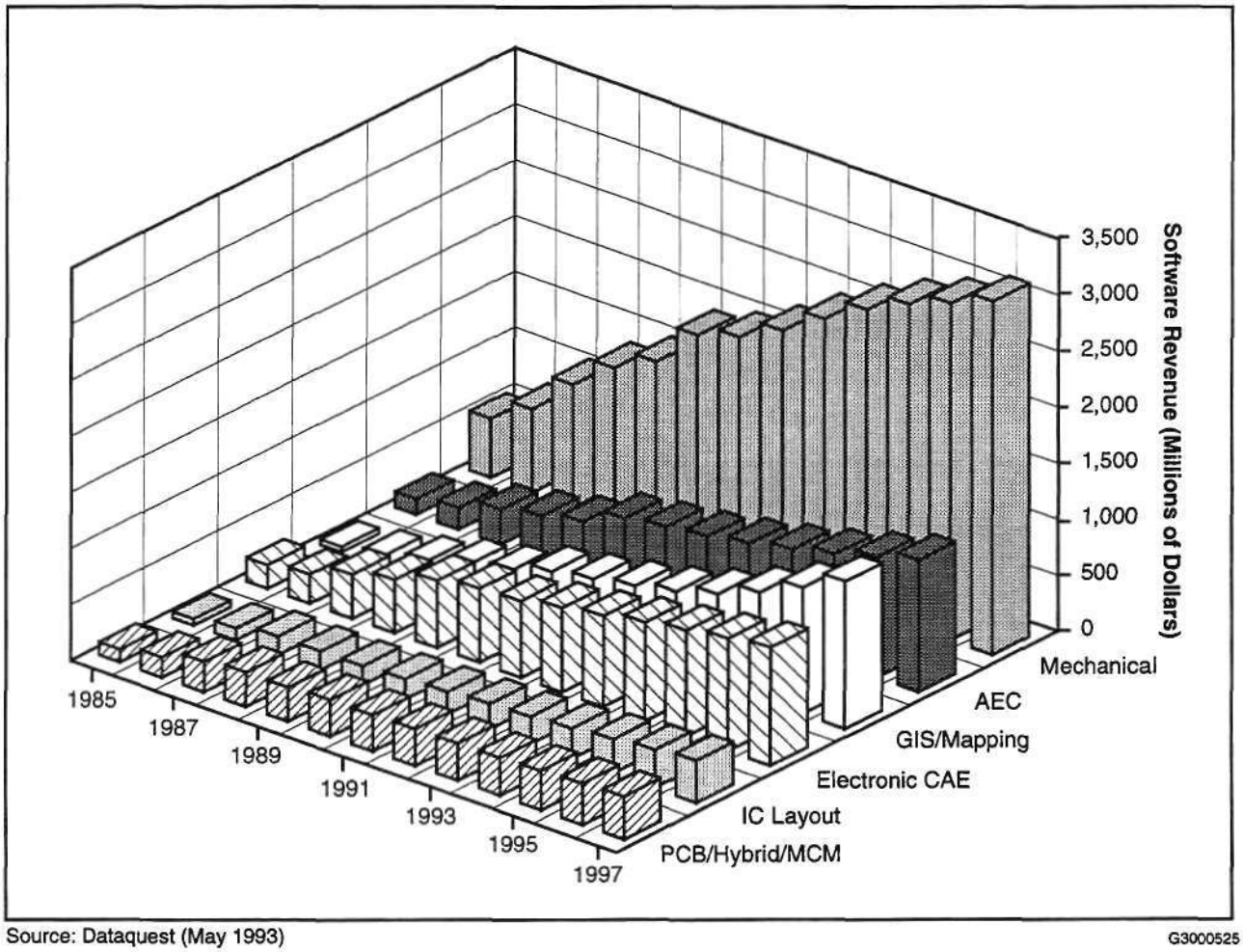


Source: Dataquest (May 1993)

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Figure 5
Worldwide Software Revenue Forecast, by Application



Source: Dataquest (May 1993)

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total number of seats shipped was $6,740. The average value rose to $8,140 in 1992 and is forecast to rise to $9,390 by 1997. Corresponding numbers in 1992 are $17,040 for technical workstation-based software, $2,470 for the PC, and $16,270 for host-based terminals. Leading vendors on all platforms have been raising prices directly or indirectly with new pricing structures for network licensing or site licensing.

Hardware Price Erosion

Dataquest expects hardware price erosion to continue, but at a slower rate as package complexity increases and accelerates demand for hardware purchases that provide speed, memory, and storage. This trend can be expected on all platform configurations. Supercomputers increasingly are being used for high-end simulation and analysis applications. Technical workstations range from very expensive, high-performance, real-time imaging systems to lower-cost, two-dimensional documentation systems. The need for integrated applications across platforms will cause significant upgrade and system replacements.

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Second-Tier Products

Dataquest expects second-tier products with "stale" technology to fight price erosion. These second-tier vendors are struggling to build market share in an atmosphere of rampant price cutting, particularly on the PC platform.

Hardware Performance

With enabling technology providing increased mips, software vendors can redefine the concept of interactive design. For example, designers will simulate the crash of one car into another and test to see if the doors still open. The value of this level of computing will change the nature of mechanical CAD/CAM/CAE. The result will allow anyone in the design and manufacturing process to simulate real problems, to evaluate potential solutions, and to communicate the change instantly to all involved.

Modeling Technologies

Core modeling technologies will evolve slowly to support a product data structure growing in complexity. Three-dimensional solutions are replacing two-dimensional solutions, which will be replaced by next-generation, integrated, and solid-modeling-based solutions. The more complete data structure with improvements in performance is rapidly building strong interest with end users. Progress is being made in integration between the model and analysis applications, between the model and documentation, and further into manufacturing applications.

Technology Dependence

The major applications in mechanical applications are defined: Product conception, development, production, operation and support will be necessary applications areas a hundred years from now. The dramatic changes taking place in the discrete manufacturing world because of competitive pressures are forcing shorter development cycles, localization, and need for improved quality, resulting in a complexity that forces the users to be fully dependent upon this technology.

Manufacturing Industry

The growth opportunity in each country depends upon the success and health of the local manufacturing industries. Multinational corporations will fuel the growth in newly industrialized countries. Each country has a dominant industry or market segment that sets the tone for CAD/CAM/CAE use. The evolution of these industries has had an important impact on the growth of the CAD/CAM/CAE market in each region and has directed the success of many vendors trying to serve these markets. As an example, the automotive industries in Japan, the United States, Germany, Italy, and France have a major influence on these local CAD/CAM/CAE markets. Aerospace, a major force in the U.S. market, is less of a force in Europe and a minor but growing interest in Japan. All of the other manufacturing industries, such as fabricated metal, machinery, and consumer products, have strongholds in various locations around the world.

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For example, the machinery industry represents a significant local CAD/CAM/CAE opportunity in Japan and Germany.

Europe

The automotive and aerospace industries, which are the largest customers of mechanical CAD/CAM/CAE tools, are suffering during the ongoing recession in Europe and experiencing budget and staff cuts. On top of this, 34 percent of the European mechanical market is in Germany, where the economy is now in recession and manufacturing output is down. Growth for mechanical CAD in 1992 was only 3.2 percent and is expected to be 3.0 percent in 1993 because the German economy is not expected to get out of its recession before mid-1994 at the earliest.

AEC Forecast Assumptions

The AEC application area had software revenue growth of 7.1 percent in 1992. The five-year CAGR for software is forecast to be 10 percent. The following paragraphs describe the main factors driving the AEC forecast.

Untapped Users

A significant pool of untapped users still exists. The current relatively low market penetration of AEC CAD systems should allow steady worldwide growth during the next five years, despite constant volatility in demand for the building and infrastructure products to be designed.

Mandates for CAD

Electronic design data is increasingly required by the designer's client, from the U.S. federal government to the small commercial developer. Design firms also are growing at the expense of smaller firms. These large end users will increasingly require their employees and suppliers to adopt automation tools in the design and construction process.

Electronic Partnering

Designers in the AEC industry are finding themselves in markets that are more regionally and globally competitive, markets that favor partnering across design disciplines. Smaller design firms will increasingly buy CAD systems, or risk being dropped from consideration as a partner.

Competitive Advantage

CAD purchases are increasingly justified as a competitive advantage in both sales and design reviews. The architect that cannot produce the fourth iteration of a proposed design before signing up a client will lose out to the group that can use changes in a proposal to ratchet a prospect gradually toward closure.

Software Leverage

AEC CAD vendors can fuel upgrade revenue among sophisticated users by leveraging software advances first developed in mechanical design, such as faster structural analysis tools or incorporation of design rules.

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New Functionality

Data and database functions (versus graphics functions) will increase in importance in AEC design systems, creating opportunities to sell users significant new functionality.

Europe

AEC growth in Western Europe is tied to the improvement of the infrastructure, manufacturing plants, and power stations in Eastern Europe. In particular, German construction companies are involved in projects in the former East Germany and in Central and Eastern Europe. The encouraging signs that the U.K. economy is picking up also positively affect the construction industry.

Growth Inhibitors to the AEC CAD Industry

The following paragraphs describe trends that will inhibit growth in the AEC CAD industry.

Low Payoff to Users

AEC's one-design/one-build structure means that CAD provides fewer economic benefits to these users than does the one-design/build-many structure of manufacturing. Construction, which is essentially a prototype build, is fraught with uncertainties and delays that are hard to change using current design systems.

Lack of Interoperability

Designs are often split among several different companies representing different aspects of the design process. User companies often have different CAD systems that do not communicate well, and alliances and consolidations in user organizations will only highlight the issue.

Low-Cost Solutions

Because most AEC design is still focused on drafting, which requires relatively little computing power, PC-based growth will be strong for the foreseeable future and PC-based solutions will produce less revenue for the vendor than will other platforms.

Late Adopters

Attitudes of potential users inhibit market growth. Many experienced architects resist change in both the design and construction processes. As this self-destructive mode of operating erodes the viability of the profession, the CAD market is also impacted because many architects that were once prospects for CAD systems are now unemployed.

GIS Forecast Assumptions

The GIS application area had software revenue growth of 12.4 percent in 1992. The five-year CAGR for software revenue is forecast to be 16.4 percent. The assumptions behind the GIS forecast are built both on optimism that the world economy will gradually improve during the forecast period, and on an expectation that global competition will increase. The following paragraphs describe assumptions used to build Dataquest's GIS market forecast.

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Low Penetration

Bread-and-butter prospects in government and utilities are charged with maintaining information on land and assets in perpetuity. A large number of utilities, and sovereign and local governments all over the world, are still stuck with tabular data and paper maps (which will degrade over time). These create a plentiful supply of prospective buyers of the more readily changed and renewed computer maps—a first step to building a GIS system.

New Technologies

Faster, cheaper computers and developments in open, distributed systems open the door to an expanded user base. Advances in global positioning systems (GPSs) and aerial photography are making it possible to create GISs significantly more accurate and complete than existing paper maps, giving experienced users some compelling reasons to reinvest. Portable computers, multimedia, cheaper storage, and better compression of satellite imagery will create more opportunities to develop richer, more accurate, and more useful GIS systems. Although many markets will take advantage of these technologies, there is no other market as ready, willing, and able to put to work such a wide range of technology enhancements. A number of users invested in image-oriented GIS systems in the last year or two, either supplementing or completely bypassing conversion of existing paper data. This has helped provide a "mid-life kick" to a market that has been slowed by troubled pilot projects.

New Applications in Industries Such As Retail and Insurance Will Drive Growth

Wherever there is competition for a limited prize—whether the prize is a political or economic reward—GIS can create a competitive edge. Wherever assets or investments are geographically dispersed, GIS offers significant management capabilities. Revenue is growing at more than 50 percent per year among new applications. However, there is a wide band of uncertainty surrounding revenue opportunities. Several new applications in GIS are destined to become embedded as a feature that will produce relatively little revenue in other software programs (and markets), rather than as a standalone product in the GIS market.

Easier and Less Expensive GIS

Inexpensive spatial data, both public and private, is accumulating and can be passed on to new users. Successful multiparticipant projects are growing, creating larger data sets that can be profitably resold by government/industry consortia. Also, although Dataquest does not envision the technology miracle that will eliminate development costs, implementation of GIS in new sites will be easier and less expensive than it previously has been.

Solutions Filling a Need

GIS addresses the information age's growing problem of overload. Any product that addresses a visible problem is more certain to grow than are solutions still looking for the problem.

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The U.S. Government

GIS is one of the rare markets where relatively simple government action can directly fuel industry growth. In fact, the GIS industry depends on government cooperation for base data development. Governments all around the world are cooperating by developing spatial data standards, more sophisticated mapping goals, and increased cooperation across federal and local governments. The U.S. federal government is in a particularly influential position, and all stars are favorably positioned. The LANDSAT program appears to be headed toward making satellite imagery more affordable. GPS satellites are proving extremely valuable outside of defense applications. Freedom of information remains a viable U.S. federal concept, creating opportunities to exploit low-cost, government-generated spatial data. The stage could not be set better for the tenure of a new U.S. president known to appreciate the importance of information technology.

Growth Inhibitors to the GIS Market

High Cost

No silver bullet will emerge to create a low-cost, meaningful data set for traditional customers in government and utilities. Data conversion will remain costly, despite substantially lower scanning costs and increasingly improved automated conversion products. The high cost will remain because, as existing paper records head toward computerization, widespread minor inaccuracies begin to be examined, often for the first time. The significant cost of correcting prior errors and omissions is inevitably bundled into the cost of "conversion." At the same time, increasingly complex applications require increasingly accurate data, also raising conversion costs.

Stuck Projects

The significant number of traditional GIS/mapping projects stuck in the pilot phase will reduce demand for new products, as users struggle to implement existing purchases. Even worse, the negative publicity created by these projects will chill the buying impulse among nonusers, reducing the ability of GIS projects to compete with other applications for capital equipment dollars.

Price Pressure

Computer prices will certainly drop, even in technical applications such as GIS, where higher-performance hardware will command a premium price. Software prices are likely to come under increasing pressure, despite the industry's current ability to hold overall seat prices relatively even. Our current forecast is built on declining hardware and steady software prices, primarily because of opportunities to add significant software data and functionality content to new sales among core, noncommodity buyers. Any significant deviation from this model would affect the forecast.

Europe

GIS data in Europe is prohibitively expensive and not readily available, slowing down the potential growth. Also holding back the

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development of GIS are the current state of the various European economies; the enormous budget deficits of major economies such as Germany, Italy, and Great Britain; and major cuts in public spending.

EDA Forecast Assumptions

The year 1992 showed a glimmer of hope in the EDA industry, with software revenue year-to-year growth rates climbing back to 8.3 percent, driven by the continued strength of the IC layout software industry and a resurgence in the CAE market. Dataquest expects EDA software revenue growth to decrease slightly to 6.1 percent year-to-year for 1993. Printed circuit board (PCB) software in particular will remain stagnant until multichip module (MCM) technologies begin to affect the market, which Dataquest anticipates will take effect in the 1994-to-1995 time frame. The following paragraphs describe the factors that will help spur EDA software growth.

New Tool Technologies

New tool technologies, including electronic system level design automation (ESDA), signal integrity, and design automation are becoming available, fueling growth.

Analysis Tools

Increasing clock frequencies require tighter design tolerances that require sophisticated analysis tools to ensure proper operation.

Migration of IC Layout

Migration of IC layout technologies to system designers in the form of floor planners may prove to be the vehicle to expand physical IC design into the larger ASIC design community.

Europe

The EDA industry in Europe is now characterized by two or three big players jockeying for position. Furthermore, following the merger of Cadence Design Systems Inc. and Valid Logic Systems Inc., and several large end-user mergers, some strategic account changes have occurred and will continue. The total software revenue is unaffected, but market share is the prize for the winning EDA company.

Growth Inhibitors to the EDA Market

Dataquest expects the factors described in the following paragraphs to have a detrimental effect on the health of the EDA market in the short term.

Transition and Shifts

Product transition and strategy shifts will have a short-term downward effect. Difficulties at the No. 1 supplier of EDA software, Cadence, may cause a stall in the purchases of new tools as users ponder their options. Ongoing consolidations of key EDA technologies, including simulation and signal integrity, will also protract buying decisions.

Legal Issues

Legal issues may induce fear, uncertainty, and doubt in buyers' minds. The recent spate of legal actions (for example, Synopsys

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versus Cadence, Analogy versus Anacad/Mentor Graphics, and stockholders versus Cadence) may divert the attention of the buying public and will definitely garner the attention of top management at the EDA vendors.

Use of PC-Based Tools Will Drop Significantly

Looking to EDA's future, Dataquest anticipates the use of what have classically been called PC-based tools to drop significantly. The Dataquest factors determining the differentiation of technical workstations from PCs are a virtual multitasking operating system (UNIX, VMS, and DOMAIN), the ability to run high-performance graphic applications in a multiuser environment, and the user's potential range of expansion on the platform. Windows NT on the Pentium chip will challenge this differentiation.

Dataquest anticipates that use of "classical" PCs as EDA platforms will begin to diminish significantly in 1995. At that time, classes of tools will be differentiated not upon hardware platform or operating system, but rather upon the features and functionality of the tools themselves. The emergence of Windows NT will have a minimal impact upon the overall revenue of the EDA software industry. However, its effect upon competing operating systems, average selling prices, distributing practices, and business and marketing practices will be far-reaching.

Forecast Methodology

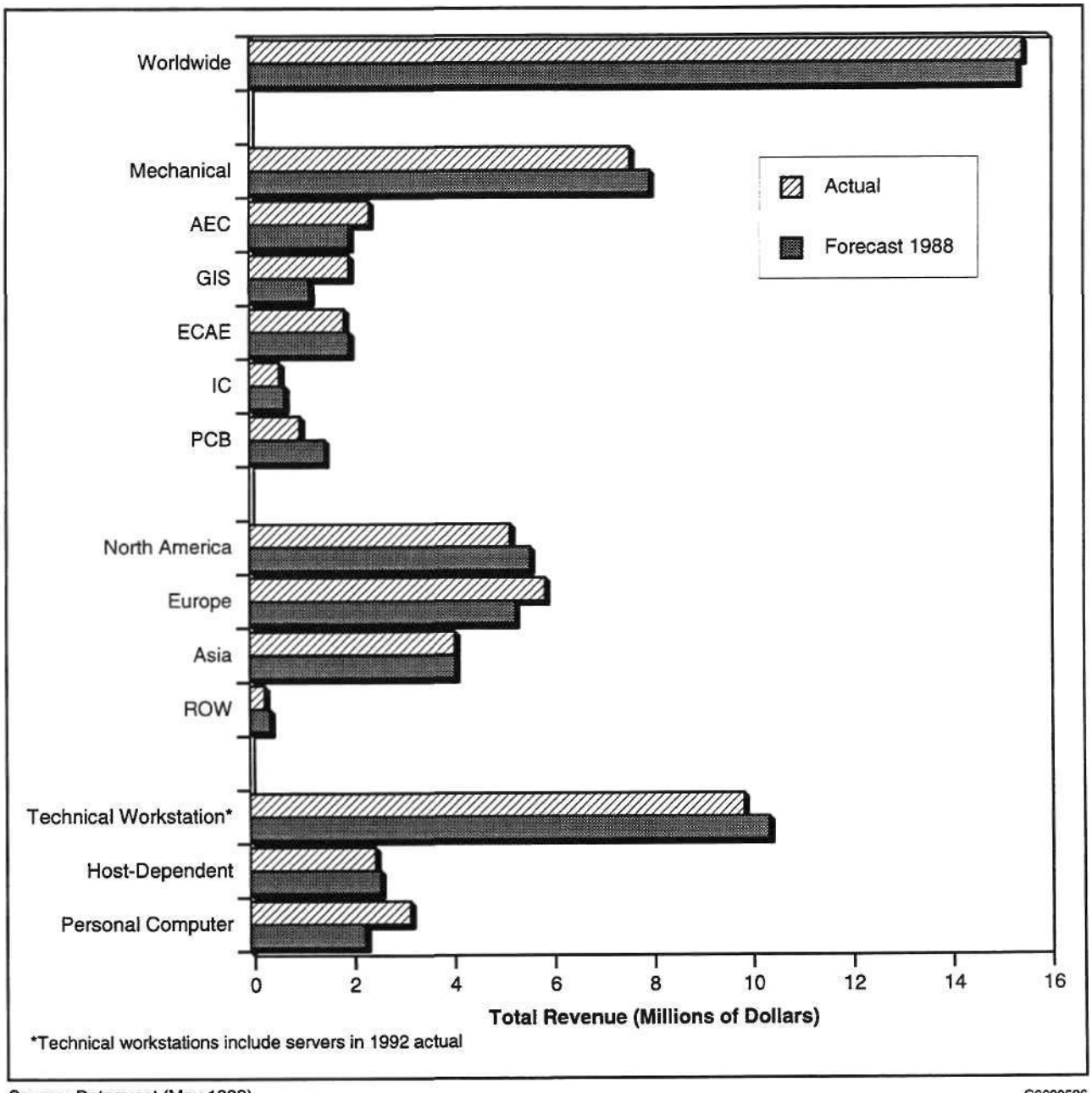
Forecast Accuracy

This forecast model for the CAD/CAM/CAE and GIS markets has withstood the test of time. Figures 6, 7, and 8 compare the 1992 market share revenue, shipments, and computed installed base with a forecast of 1992 from 1988 market share numbers. These 1988 forecast numbers were used because they were found intact (in a computer) and untouched since 1989. Comparison is shown worldwide, for each application, each world region, and each platform (servers, which were not followed in 1988, were added to workstations for the 1992 market share numbers). These figures demonstrate Dataquest's history of successfully forecasting multiple elements of the CAD/CAM/CAE and GIS markets.

Fundamental to the way Dataquest conducts its research is an underlying philosophy that says the best data and analyses come from a well-balanced program. This program includes the following: balance between primary and secondary collection techniques; balance between supply-side and demand-side analysis; balance between focused, industry-specific research and coordinated, "big-picture" analysis aided by integration of data from the more than 25 separate high-technology industries Dataquest covers; and balance between the perspectives of experienced industry professionals and rigorous, disciplined techniques of seasoned market researchers.

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Figure 6
1992 Actual Total Revenue versus Dataquest 1988 Forecast for 1992



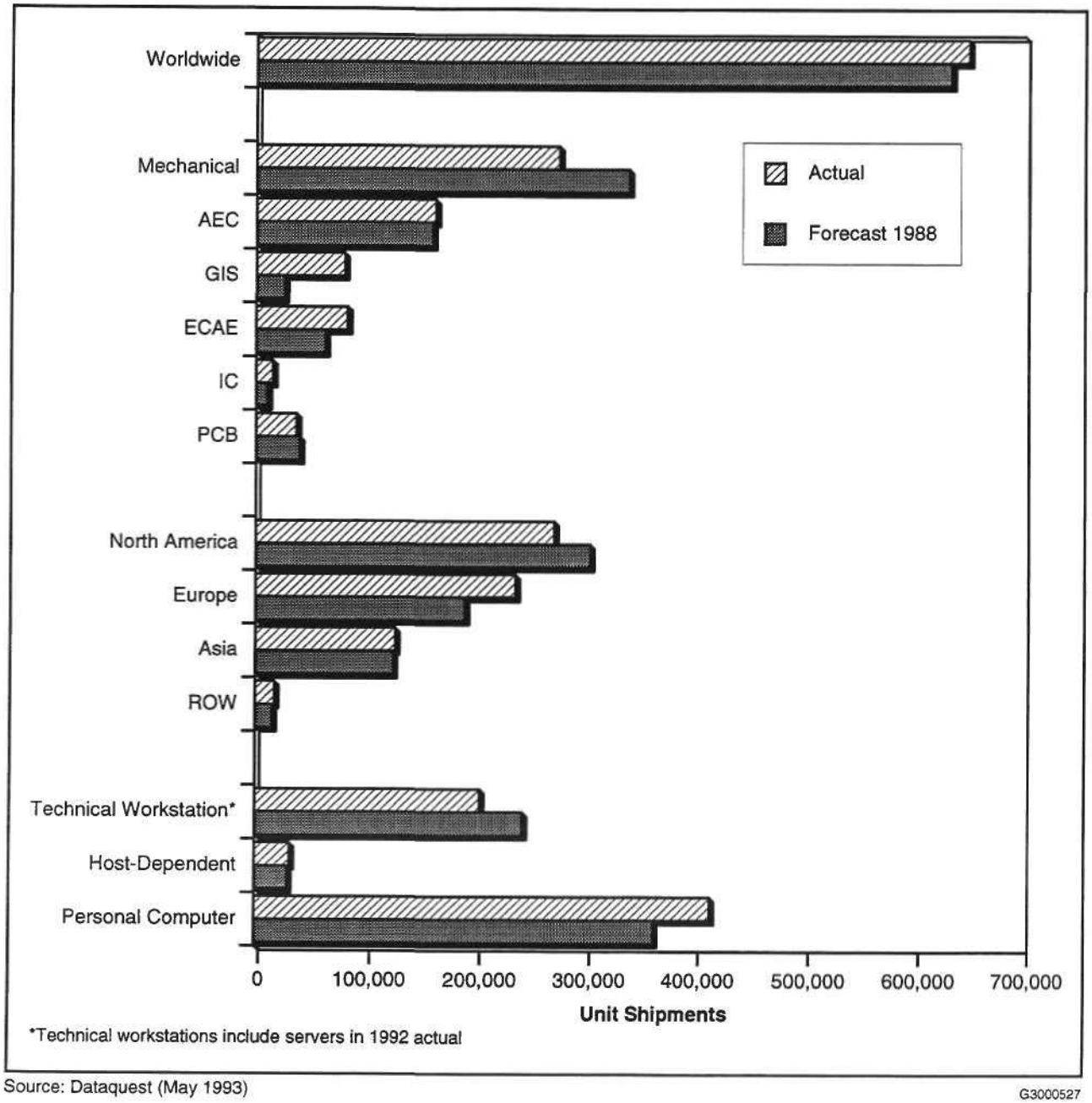
Source: Dataquest (May 1993)

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Dataquest also analyzes trends in the macro environment, which can have major influences on both supply-side and demand-side forecasting. In addition to demographics, analysts look at gross national product (GNP) growth, interest rate fluctuation, business expectations, and capital spending plans. In the geopolitical arena, the group looks at trade issues, political stability or lack thereof, tariffs, nontariff barriers, and such factors as the effect on Europe from the events of 1993.

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Figure 7
1992 Actual Unit Shipments versus Dataquest 1988 Forecast for 1992



Source: Dataquest (May 1993)

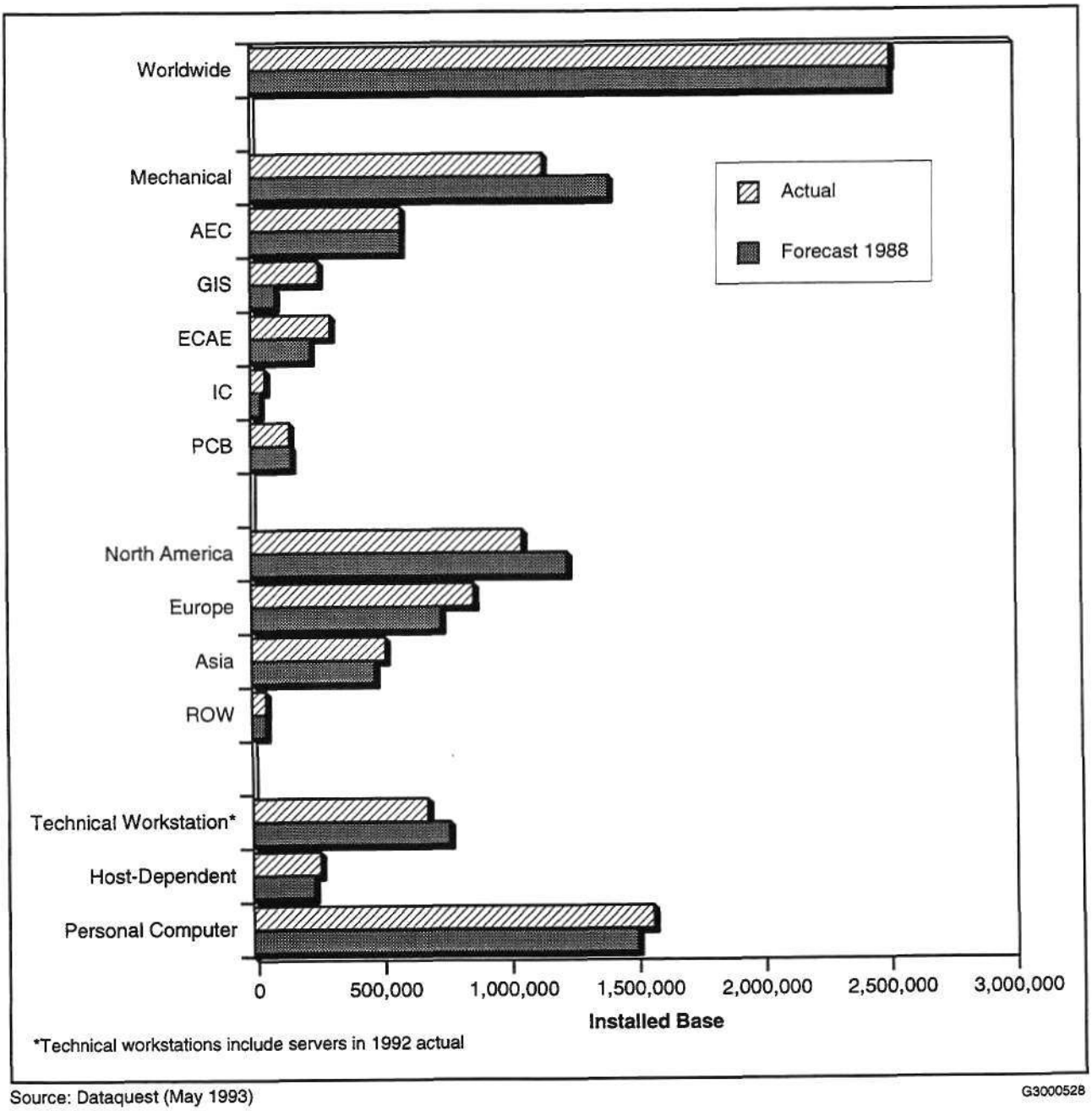
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Figure 9 shows the CAD/CAM/CAE and GIS forecasting model. The overall forecasting process uses a combination of forecasting techniques such as time series and technological modeling. Market estimates and forecasts are derived using the following research techniques:

- "Bottom-up" aggregation—This method involves adding all relevant vendor contributions to arrive at total market estimates for all historical data.

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Figure 8
1992 Actual Installed Base versus Dataquest 1988 Forecast for 1992



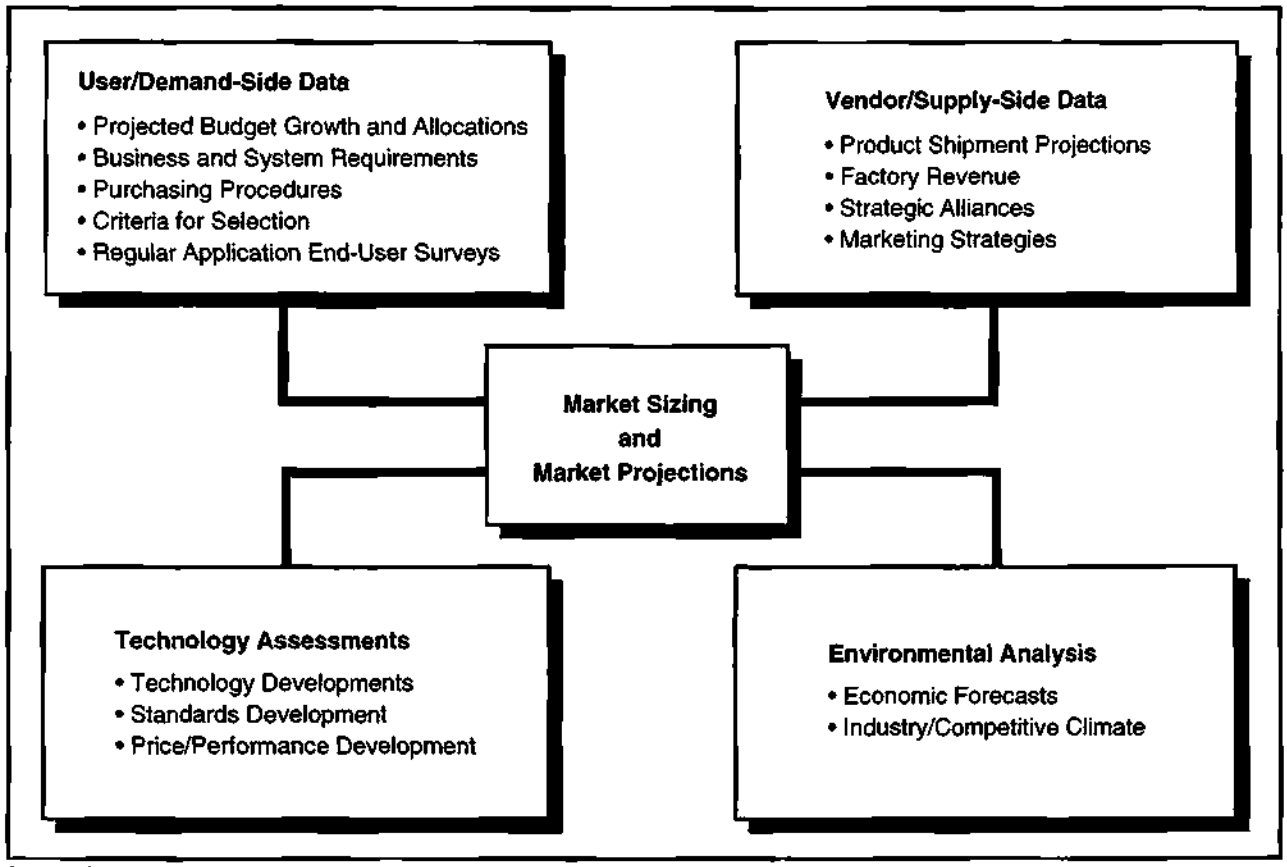
Source: Dataquest (May 1993)

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- Segment forecasting—For each application segment tracked by the CAD/CAM/CAE and GIS group, individual forecasts are derived following the basic information model defined previously. Specifically, each design phase covered within each application is segmented by product, region, and platform. In this way, each application segment incorporates its own set of unique assumptions.

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Figure 9
CAD/CAM/CAE and GIS Forecasting Model



Source: Dataquest (May 1993) G3000529

- Demand-based analysis—Market growth is tracked and forecast in terms of the present and anticipated demand of current and future users. This requires the development of a total available market model and a satisfied available market figure to assess the levels of penetration accurately. Installed base is also evaluated. Rates of product retirement are primarily based on input from end users in our ongoing survey programs. Dataquest analysts also factor in the acceptance or ability for users to consume new technology.
- Capacity-based analysis—This method involves identifying future shipment volume constraints. These constraints, or "ceilings," can be the result of component availability, manufacturing capacity, or distribution capacity. In any case, capacity limitations are capable of keeping shipments below the demand level.

Segmentation Definitions

This section lists the definitions specific to this document. The following paragraphs define the segments.

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Applications

Mechanical

The mechanical segment refers to computer-aided tools used by engineers, designers, analysts, technicians, and draftspeople working predominantly in the discrete manufacturing industries, but includes government and education. Users of mechanical CAD/CAM/CAE tools work in all departments across the typical organization, with a majority found in product design, advanced engineering, and manufacturing engineering. Common design applications include conceptual design, industrial design, structural or thermal analysis, detail design, and electromechanical design (the mechanical part of design with electrical or electronic components and mechanisms). Common manufacturing applications include tool and fixture design, numerical control part programming, off-line robotics programming, and interface to quality control systems. Management tools for database control and distribution are included in this segment, as well as user-defined application programming.

Architecture, Engineering, and Construction (AEC)

The AEC segment covers the use of computer-aided tools by architects, contractors, plant engineers, civil engineers, and other people associated with these disciplines to aid in designing and managing buildings, industrial plants, ships, and other types of nondiscrete entities.

Geographic Information Systems (GIS)/Mapping

GIS is computer-based technology, and the segment is composed of hardware, software, and data used to capture, edit, display, and analyze spatial (tagged by location) information.

Electronic Design Automation (EDA)

The EDA segment covers computer-based tools used to automate the process of designing an electronic product, including printed circuit boards, ICs, and systems. EDA includes ECAE, IC layout, and PCB/hybrid/MCM, as follows:

- Electronic Computer-Aided Engineering (CAE)—These are computer-aided tools used in the engineering or design phase of electronic products (as opposed to the physical layout phase of the product). Examples of electronic CAE applications are schematic capture and simulation.
- IC Layout—This is a software application tool used to create and validate the physical implementation of an IC. The IC layout category comprises polygon editors, symbolic editors, placement and routing (gate array, cell, and block), design verification tools (DRC/ERC/logic-to-layout), compilers, and module development tools.
- PCB/Hybrid/MCM—This segment covers products used to create the placement and routing of the traces and components laid out on a printed circuit board. Also included in this category are thermal analysis tools.

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Regions

The following paragraphs define the regions.

North America

North America includes United States, Mexico, and Canada.

Europe

Europe includes the United Kingdom, Scandinavia, Benelux, France, Germany, Italy, Spain, and Rest of Europe.

Asia

Asia includes Japan, Singapore, Taiwan, Korea, China, and Hong Kong.

Rest of World

Rest of World includes all other countries including Australia, New Zealand, Oceania, Africa, Central America, South America, and the Middle East.

Platforms

The following paragraphs define the platforms.

Technical Workstation

A technical workstation is a single-user computer distinguished from a personal computer by its features and by the user's potential range of expansion on the platform. Features include a virtual, multitasking operating system (UNIX, VMS, or Domain); the computer is designed by the manufacturer to run high-performance graphics applications in a multiuser/multitasking environment.

Host-Dependent

Host-dependent is a shared logic system in which the external workstations' functions are dependent on a host computer.

Server

A server is a computer that transparently provides its resources for use by other computer systems. It is a system on a network that provides specific functionality to other computer systems: the clients. Functions include file storage, database access, and compute capability. Dataquest tracks the following major categories of servers used for CAD/CAM/CAE and GIS applications:

- Compute Servers—These systems provide capabilities for solving numerical problems (for example, simulations, statistical calculations, and simultaneous partial differential equations). System features usually include high-speed computational capabilities (for example, vector and parallel processing) and large memories.
- Print Servers—These systems provide access to printers, specialized printing applications software, and print-spooling resources to a network.
- File Servers—These systems provide mass storage capability to clients on a network. Services can range from temporary storage of working files to long-term backup and archive systems.

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- Database Servers—These systems manage databases as a shared resource to a network. These servers handle such functions as physical data storage, data security, and high-level queries and can access stored information at the record level.

Personal Computer

A personal computer is a single-user computer distinguished from a technical workstation by its features and by the user's potential range of expansion on the platform. Features found in technical workstations (such as a virtual operating system, networking, high-performance graphics, multiuser/multitasking capability) are optional rather than integrated by the manufacturer.

Line Items

Line item definitions are as follows:

- Average selling price (ASP) is defined as the average price of a product, inclusive of any discounts.
- CPU revenue is the portion of revenue derived from a system sale that is related to the value of the CPU. (In the case of technical workstations and personal computers, CPU revenue contains the terminal revenue.)
- CPU shipment is defined as the number of CPUs delivered.
- CPU installed base is defined as the total number of CPUs in active, day-to-day use.
- Unit shipment is defined as the number of products delivered (that is, seats).
- Seats are defined as the number of possible simultaneous users.
- Installed seats are defined as the total number of seats in active, day-to-day use.
- Hardware revenue is defined as the sum of the revenue from the hardware system components: CPU revenue, terminal revenue, and peripherals revenue.
- Peripherals revenue is defined as the value of all the peripherals of a turnkey sale. (Peripherals in this category typically are input and output devices.)
- Terminal revenue is defined as revenue derived from the sale of terminals used to graphically create, analyze, or manipulate designs. The term is applicable only to the host-dependent platform, as terminal revenue is contained within CPU revenue for technical workstations and PCs.
- Software revenue is revenue derived from the sale of bundle (part of a turnkey system) and unbundled software.

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- Service revenue is defined as revenue derived from the service and support of CAD/CAM/CAE or GIS systems. Service revenue can be calculated in the tables by subtracting hardware and software revenue from total revenue.
- Total factory revenue is defined as the amount of money received by a manufacturer for its goods measured in U.S. dollars and is the sum of hardware, software, and service revenue. Total factory revenue does not include revenue that a company may receive from products sold to another company for resale (OEM revenue).

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Table 3
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: Worldwide
Platform: All Platforms

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	20,538	39,542	57,001	69,793	77,137	92,520	112,220	133,060	154,910	175,070	39	18
Unit Shipments or Seats	23,547	42,126	60,563	72,363	78,571	93,220	112,520	133,170	154,950	175,060	35	17
CPU Installed Base	37,972	76,272	129,518	190,663	250,784	315,080	385,730	463,620	550,290	643,460	60	21
Installed Seats	49,251	89,471	145,266	207,484	267,038	329,520	397,650	472,820	556,660	647,200	53	19
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	83.6	69.3	58.2	56.9	45.4	41.5	39.2	37.9	37.2	36.6	-14	-4
Hardware-Only ASP	11.7	8.8	7.8	7.3	7.2	6.1	5.4	5.0	4.9	4.8	-11	-8
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	563	728	917	1,024	1,002	1,046	1,127	1,251	1,401	1,553	16	9
CPU Revenue	429	576	741	841	829	877	953	1,061	1,190	1,318	18	10
Terminal Revenue	69	44	42	37	31	16	7	3	2	1	-18	-54
Peripheral Revenue (Turnkey)	64	108	133	147	143	153	168	187	210	234	22	10
Software Revenue	281	359	483	548	616	700	810	956	1,128	1,317	22	16
Bundled	138	182	242	282	297	325	364	417	482	553	21	13
Unbundled	144	177	242	266	318	375	447	539	646	764	22	19
Service Revenue	180	213	283	341	364	396	444	508	590	680	19	13
Total Factory Revenue	1,024	1,300	1,683	1,913	1,982	2,143	2,381	2,715	3,120	3,550	18	12
Increase over Prior Year (%)	32	27	30	14	4	8	11	14	15	14		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

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Table 4
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: Worldwide
Platform: Technical Workstation

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	5,512	9,361	14,488	18,446	24,242	29,390	35,230	42,190	50,230	58,930	45	19
Unit Shipments or Seats	5,512	9,361	14,488	18,446	24,242	29,390	35,230	42,190	50,230	58,930	45	19
CPU Installed Base	9,024	18,145	31,889	48,737	69,619	93,380	119,590	149,000	181,790	218,700	67	26
Installed Seats	9,024	18,145	31,889	48,737	69,619	93,380	119,590	149,000	181,790	218,700	67	26
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	63.3	58.8	54.1	54.6	44.1	42.1	40.5	39.3	38.4	37.7	-9	-3
Hardware-Only ASP	32.6	18.9	17.6	15.1	13.9	12.8	11.7	11.0	10.6	10.3	-19	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	250	360	499	557	576	650	728	825	938	1,057	23	13
CPU Revenue	216	284	397	448	462	522	585	663	756	852	21	13
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	34	75	102	109	114	128	142	161	183	205	36	12
Software Revenue	135	198	287	320	375	444	520	617	734	865	29	18
Bundled	83	132	182	203	232	269	311	362	423	489	29	16
Unbundled	51	67	104	117	143	175	210	255	311	377	29	21
Service Revenue	90	130	194	225	259	300	346	401	468	541	30	16
Total Factory Revenue	475	688	981	1,102	1,210	1,394	1,594	1,843	2,140	2,463	26	15
Increase over Prior Year (%)	140	45	42	12	10	15	14	16	16	15		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

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Table 5
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: Worldwide
Platform: Host-Dependent

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	581	1,201	1,966	1,242	889	510	210	70	10	10	11	-59
Unit Shipments or Seats	3,590	3,785	5,528	3,812	2,323	1,220	520	190	70	30	-10	-58
CPU Installed Base	2,469	3,551	5,321	6,269	6,745	6,690	6,190	5,350	4,310	3,430	29	-13
Installed Seats	13,748	16,749	21,070	23,090	22,999	21,130	18,110	14,550	10,680	7,160	14	-21
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	398.2	261.0	140.8	134.6	161.4	139.3	122.4	88.3	.0	.0	-20	-100
Hardware-Only ASP	902.0	169.3	126.8	189.1	171.0	162.0	172.1	184.2	194.9	182.6	-34	1
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	231	216	216	150	120	62	24	8	3	1	-15	-61
CPU Revenue	137	145	151	99	81	41	15	4	1	0	-12	-64
Terminal Revenue	69	44	42	37	31	16	7	3	2	1	-18	-54
Peripheral Revenue (Turnkey)	25	27	23	14	8	4	2	0	0	0	-25	-74
Software Revenue	93	91	92	61	48	24	11	3	1	1	-15	-60
Bundled	46	44	50	38	27	14	5	1	0	0	-13	-100
Unbundled	47	48	42	23	21	11	6	3	1	1	-18	-53
Service Revenue	84	74	74	46	38	19	8	2	1	0	-18	-62
Total Factory Revenue	408	381	381	257	206	105	43	14	4	2	-16	-61
Increase over Prior Year (%)	-16	-7	0	-33	-20	-49	-59	-68	-69	-57		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

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Table 6
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: Worldwide
Platform: Server

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	NA	NA	NA	2,708	2,767	3,250	3,910	4,710	5,630	6,560	NA	19
Unit Shipments or Seats	NA	NA	NA	2,708	2,767	3,250	3,910	4,710	5,630	6,560	NA	19
CPU Installed Base	NA	NA	NA	2,708	5,476	8,560	12,080	15,750	19,830	23,520	NA	34
Installed Seats	NA	NA	NA	2,708	5,476	8,560	12,080	15,750	19,830	23,520	NA	34
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	NA	NA	NA	70.4	61.0	58.6	56.5	54.4	52.3	50.4	NA	-4
Hardware-Only ASP	NA	NA	NA	28.6	29.4	26.6	24.4	23.1	22.3	21.9	NA	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	NA	NA	NA	104	96	103	116	131	148	166	NA	12
CPU Revenue	NA	NA	NA	89	82	89	100	113	129	144	NA	12
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	NA	NA	NA	15	13	14	16	18	20	22	NA	11
Software Revenue	NA	NA	NA	59	58	65	76	89	104	121	NA	16
Bundled	NA	NA	NA	33	30	33	38	44	50	56	NA	13
Unbundled	NA	NA	NA	26	28	32	37	45	54	65	NA	18
Service Revenue	NA	NA	NA	55	48	54	61	71	82	93	NA	14
Total Factory Revenue	NA	NA	NA	217	201	222	253	291	334	379	NA	14
Increase over Prior Year (%)	NA	NA	NA	NA	-7	10	14	15	15	14		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

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Table 7
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: Worldwide
Platform: Personal Computer

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	14,446	28,980	40,547	47,396	49,238	59,370	72,880	86,090	99,040	109,580	36	17
Unit Shipments or Seats	14,446	28,980	40,547	47,396	49,238	59,370	72,870	86,080	99,020	109,540	36	17
CPU Installed Base	26,479	54,577	92,308	132,948	168,944	206,460	247,870	293,520	344,350	397,810	59	19
Installed Seats	26,479	54,577	92,308	132,948	168,944	206,460	247,870	293,520	344,350	397,810	59	19
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	25.4	25.5	21.3	18.9	15.2	13.0	11.9	11.3	10.8	10.3	-12	-7
Hardware-Only ASP	4.9	4.9	4.6	4.2	4.0	3.7	3.4	3.2	3.0	2.9	-5	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	82	152	201	212	210	232	260	287	312	330	27	9
CPU Revenue	76	147	192	204	203	224	252	279	304	322	28	10
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	5	5	9	9	7	7	8	8	8	8	9	0
Software Revenue	54	69	105	108	136	167	203	246	290	330	26	19
Bundled	8	7	9	9	9	9	10	10	10	9	5	0
Unbundled	46	62	95	99	126	158	194	236	280	321	29	21
Service Revenue	5	9	15	16	19	23	28	34	40	45	37	19
Total Factory Revenue	141	230	321	337	365	422	492	567	641	705	27	14
Increase over Prior Year (%)	57	64	40	5	8	16	17	15	13	10		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

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Table 8
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: North America
Platform: All Platforms

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	11,176	18,143	22,927	30,421	35,287	43,220	52,620	61,310	69,880	78,120	33	17
Unit Shipments or Seats	12,706	19,066	24,324	31,418	35,605	43,340	52,640	61,310	69,880	78,120	29	17
CPU Installed Base	19,758	37,205	58,144	84,222	111,270	141,460	175,400	212,160	251,450	291,760	54	21
Installed Seats	26,658	44,462	66,023	92,068	118,181	147,050	179,560	215,010	253,090	292,350	45	20
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	67.5	59.7	55.3	54.3	38.8	36.3	34.8	33.9	33.2	32.5	-13	-3
Hardware-Only ASP	10.3	8.7	8.3	7.7	7.3	6.1	5.4	5.2	5.2	5.2	-8	-7
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	241	279	334	384	378	400	434	482	532	578	12	9
CPU Revenue	189	225	267	314	316	339	370	411	453	492	14	9
Terminal Revenue	32	16	20	18	9	3	0	0	0	0	-27	-100
Peripheral Revenue (Turnkey)	20	38	47	53	53	58	63	71	79	86	27	10
Software Revenue	129	157	198	235	267	308	358	424	495	574	20	17
Bundled	39	53	65	81	85	97	109	125	141	156	22	13
Unbundled	91	105	133	154	181	211	249	299	354	418	19	18
Service Revenue	96	98	119	148	160	174	194	222	254	288	14	12
Total Factory Revenue	466	534	651	768	805	882	987	1,128	1,281	1,440	15	12
Increase over Prior Year (%)	24	15	22	18	5	10	12	14	14	12		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

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Table 9
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: North America
Platform: Technical Workstation

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	2,779	3,888	5,312	7,405	9,514	11,640	14,050	16,920	20,020	23,110	36	19
Unit Shipments or Seats	2,779	3,888	5,312	7,405	9,514	11,640	14,050	16,920	20,020	23,110	36	19
CPU Installed Base	4,777	8,523	13,411	20,031	27,943	37,150	47,450	59,230	72,440	86,750	56	25
Installed Seats	4,777	8,523	13,411	20,031	27,943	37,150	47,450	59,230	72,440	86,750	56	25
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	46.8	48.6	50.4	51.4	39.0	37.2	35.7	34.6	33.8	33.0	-4	-3
Hardware-Only ASP	32.2	18.7	17.1	14.7	14.3	13.0	11.9	11.2	10.8	10.5	-18	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	102	127	170	192	196	222	247	278	310	340	18	12
CPU Revenue	92	100	133	153	155	176	196	220	246	271	14	12
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	10	27	37	40	41	46	51	57	64	69	44	11
Software Revenue	51	72	102	118	134	158	183	215	251	292	28	17
Bundled	25	40	52	59	66	78	88	102	115	127	28	14
Unbundled	26	32	50	58	68	80	95	114	137	165	27	19
Service Revenue	46	60	82	96	109	126	143	164	187	211	24	14
Total Factory Revenue	198	259	354	406	439	505	573	658	748	844	22	14
Increase over Prior Year (%)	144	30	37	15	8	15	13	15	14	13		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

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Table 10
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: North America
Platform: Host-Dependent

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	277	470	708	333	263	100	20	0	0	0	-1	-100
Unit Shipments or Seats	1,806	1,394	2,105	1,329	580	210	40	0	0	0	-25	-100
CPU Installed Base	1,225	1,604	2,186	2,362	2,414	2,280	2,010	1,670	1,300	1,020	18	-16
Installed Seats	8,126	8,860	10,065	10,208	9,325	7,870	6,170	4,520	2,940	1,610	4	-30
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	288.4	248.5	153.4	152.9	138.2	132.0	126.6	121.3	116.2	111.5	-17	-4
Hardware-Only ASP	1,533.0	162.4	122.8	196.4	147.3	134.1	123.1	112.9	103.3	95.1	-44	-8
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	100	80	84	53	35	13	2	0	0	0	-23	-100
CPU Revenue	59	55	55	32	24	9	1	0	0	0	-20	-100
Terminal Revenue	32	16	20	18	9	3	0	0	0	0	-27	-100
Peripheral Revenue (Turnkey)	9	9	8	4	2	1	0	0	0	0	-34	-100
Software Revenue	46	43	38	19	14	7	3	1	0	0	-25	-100
Bundled	13	11	12	6	3	1	0	0	0	0	-32	-100
Unbundled	33	31	26	13	12	6	3	1	0	0	-23	-100
Service Revenue	47	33	31	18	15	6	1	0	0	0	-25	-100
Total Factory Revenue	193	156	153	90	64	25	6	1	0	0	-24	-100
Increase over Prior Year (%)	-23	-19	-2	-41	-29	-61	-74	-83	-100	NA		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

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Table 11
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: North America
Platform: Server

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	NA	NA	NA	1,472	1,796	2,130	2,570	3,100	3,720	4,330	NA	19
Unit Shipments or Seats	NA	NA	NA	1,472	1,796	2,130	2,570	3,100	3,720	4,330	NA	19
CPU Installed Base	NA	NA	NA	1,472	3,268	5,290	7,600	10,030	12,740	15,190	NA	36
Installed Seats	NA	NA	NA	1,472	3,268	5,290	7,600	10,030	12,740	15,190	NA	36
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	NA	NA	NA	65.2	51.0	48.7	46.7	44.8	42.9	41.2	NA	-4
Hardware-Only ASP	NA	NA	NA	26.1	26.5	24.1	22.1	21.0	20.4	20.0	NA	-5
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	NA	NA	NA	50	52	57	63	72	82	91	NA	12
CPU Revenue	NA	NA	NA	42	44	48	54	61	69	77	NA	12
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	NA	NA	NA	8	8	9	10	11	12	13	NA	10
Software Revenue	NA	NA	NA	33	36	40	46	55	64	75	NA	16
Bundled	NA	NA	NA	15	16	17	20	22	25	28	NA	12
Unbundled	NA	NA	NA	18	20	23	27	32	39	47	NA	18
Service Revenue	NA	NA	NA	26	27	30	34	39	45	51	NA	14
Total Factory Revenue	NA	NA	NA	109	115	127	144	166	191	217	NA	14
Increase over Prior Year (%)	NA	NA	NA	NA	6	11	13	15	15	14		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

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Table 12
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: North America
Platform: Personal Computer

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	8,120	13,785	16,907	21,212	23,715	29,360	35,990	41,280	46,140	50,680	31	16
Unit Shipments or Seats	8,120	13,785	16,907	21,212	23,715	29,360	35,990	41,280	46,140	50,680	31	16
CPU Installed Base	13,755	27,078	42,547	60,357	77,645	96,740	118,340	141,240	164,980	188,800	54	19
Installed Seats	13,755	27,078	42,547	60,357	77,645	96,740	118,340	141,240	164,980	188,800	54	19
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	37.4	69.8	15.5	14.7	7.2	6.5	5.8	5.5	5.2	5.0	-34	-7
Hardware-Only ASP	4.6	4.9	4.6	4.1	4.0	3.7	3.4	3.2	3.0	2.9	-3	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	39	72	80	89	95	109	122	132	140	147	25	9
CPU Revenue	38	70	78	88	92	106	120	129	137	145	25	9
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	1	2	2	1	2	2	2	3	3	3	17	6
Software Revenue	33	43	58	66	83	103	126	153	180	207	26	20
Bundled	2	1	1	1	1	1	1	1	1	1	-8	-4
Unbundled	31	42	57	65	82	102	124	152	179	206	27	20
Service Revenue	2	5	7	7	10	13	16	19	22	25	42	20
Total Factory Revenue	74	119	144	163	187	224	264	303	342	379	26	15
Increase over Prior Year (%)	67	61	21	13	15	20	17	15	13	11		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

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Table 13
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: Europe
Platform: All Platforms

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	6,677	14,256	21,178	25,945	28,859	33,940	41,120	49,640	58,860	66,740	44	18
Unit Shipments or Seats	7,702	15,323	22,743	27,078	29,542	34,260	41,230	49,660	58,880	66,760	40	18
CPU Installed Base	12,593	26,488	46,466	69,510	92,505	116,480	142,510	171,950	205,520	242,310	65	21
Installed Seats	15,291	30,196	51,592	75,492	98,714	122,350	147,580	176,020	208,440	244,150	59	20
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	87.9	80.0	64.6	61.8	48.1	43.0	40.2	38.7	37.8	37.0	-14	-5
Hardware-Only ASP	14.0	9.2	7.9	7.0	6.9	6.0	5.2	4.8	4.6	4.5	-16	-8
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	218	292	365	384	389	399	429	479	545	614	16	10
CPU Revenue	170	236	307	329	331	346	376	422	481	541	18	10
Terminal Revenue	24	16	15	13	13	7	3	1	0	0	-14	-100
Peripheral Revenue (Turnkey)	25	39	43	43	44	46	50	56	64	73	16	11
Software Revenue	109	139	195	199	227	256	297	352	423	499	20	17
Bundled	66	90	119	127	132	141	157	181	213	250	19	14
Unbundled	43	49	76	72	95	115	140	171	210	249	22	21
Service Revenue	60	82	116	126	140	153	172	199	234	274	23	14
Total Factory Revenue	387	513	676	709	756	808	899	1,030	1,202	1,388	18	13
Increase over Prior Year (%)	46	32	32	5	7	7	11	15	17	15		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

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Table 14
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: Europe
Platform: Technical Workstation

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	2,171	3,627	6,049	6,946	10,078	12,160	14,500	17,290	20,750	24,760	47	20
Unit Shipments or Seats	2,171	3,627	6,049	6,946	10,078	12,160	14,500	17,290	20,750	24,760	47	20
CPU Installed Base	3,232	6,790	12,597	18,971	27,795	37,800	48,690	60,950	74,560	90,490	71	27
Installed Seats	3,232	6,790	12,597	18,971	27,795	37,800	48,690	60,950	74,560	90,490	71	27
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	68.7	66.3	55.5	53.9	42.6	40.7	39.0	37.9	37.0	36.2	-11	-3
Hardware-Only ASP	38.7	19.4	18.4	16.1	13.1	12.3	11.3	10.6	10.2	9.9	-24	-5
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	105	150	207	213	235	264	296	336	386	443	22	14
CPU Revenue	92	123	175	182	198	224	251	285	328	376	21	14
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	13	27	32	31	37	40	45	51	58	67	30	13
Software Revenue	62	91	131	136	166	198	234	279	336	402	28	19
Bundled	40	66	92	95	107	123	142	166	197	232	28	17
Unbundled	22	25	39	40	59	75	91	112	139	170	29	24
Service Revenue	33	52	83	86	108	126	146	170	202	238	35	17
Total Factory Revenue	199	294	421	435	509	588	676	785	924	1,083	26	16
Increase over Prior Year (%)	129	48	43	3	17	16	15	16	18	17		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

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Table 15
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: Europe
Platform: Host-Dependent

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	190	582	698	409	268	150	60	10	0	0	9	-100
Unit Shipments or Seats	1,215	1,650	2,263	1,542	951	460	160	20	0	0	-6	-100
CPU Installed Base	816	1,383	2,040	2,361	2,499	2,410	2,200	1,850	1,470	1,160	32	-14
Installed Seats	3,514	5,091	7,166	8,343	8,709	8,280	7,270	5,920	4,390	2,990	25	-19
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	452.4	197.3	169.7	195.7	313.7	311.3	297.7	.0	.0	.0	-9	-100
Hardware-Only ASP	2,485.9	172.6	134.5	171.2	173.1	155.4	142.9	131.9	.0	.0	-49	-100
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	88	88	85	58	50	25	9	1	0	0	-13	-100
CPU Revenue	55	62	62	40	34	17	6	1	0	0	-11	-100
Terminal Revenue	24	16	15	13	13	7	3	1	0	0	-14	-100
Peripheral Revenue (Turnkey)	10	9	8	5	3	1	0	0	0	0	-28	-100
Software Revenue	33	32	33	23	19	8	2	0	0	0	-13	-100
Bundled	23	21	24	19	15	6	2	0	0	0	-10	-100
Unbundled	11	10	9	5	4	2	1	0	0	0	-20	-100
Service Revenue	25	27	28	16	14	7	3	0	0	0	-14	-100
Total Factory Revenue	147	147	146	97	83	40	14	2	0	0	-13	-100
Increase over Prior Year (%)	1	-0	-0	-33	-15	-52	-65	-87	-100	NA		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

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Table 16
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: Europe
Platform: Server

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	NA	NA	NA	763	614	710	850	1,030	1,240	1,450	NA	19
Unit Shipments or Seats	NA	NA	NA	763	614	710	850	1,030	1,240	1,450	NA	19
CPU Installed Base	NA	NA	NA	763	1,377	2,050	2,820	3,620	4,520	5,340	NA	31
Installed Seats	NA	NA	NA	763	1,377	2,050	2,820	3,620	4,520	5,340	NA	31
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	NA	NA	NA	73.7	78.5	74.5	71.6	68.7	65.9	63.2	NA	-4
Hardware-Only ASP	NA	NA	NA	37.8	37.3	33.7	30.9	29.3	28.4	27.8	NA	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	NA	NA	NA	35	28	29	33	38	44	49	NA	12
CPU Revenue	NA	NA	NA	30	25	26	29	34	39	43	NA	12
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	NA	NA	NA	5	3	3	4	5	5	6	NA	12
Software Revenue	NA	NA	NA	16	13	15	18	21	24	28	NA	17
Bundled	NA	NA	NA	12	8	9	11	13	15	17	NA	15
Unbundled	NA	NA	NA	5	5	5	6	8	9	11	NA	19
Service Revenue	NA	NA	NA	19	14	14	17	20	23	26	NA	14
Total Factory Revenue	NA	NA	NA	70	54	59	68	79	90	103	NA	14
Increase over Prior Year (%)	NA	NA	NA	NA	-22	8	16	16	15	14		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

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Table 17
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: Europe
Platform: Personal Computer

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	4,316	10,047	14,431	17,826	17,898	20,930	25,710	31,300	36,880	40,530	43	18
Unit Shipments or Seats	4,316	10,047	14,431	17,826	17,898	20,940	25,720	31,310	36,890	40,550	43	18
CPU Installed Base	8,545	18,315	31,828	47,415	60,834	74,220	88,810	105,540	124,970	145,330	63	19
Installed Seats	8,545	18,315	31,828	47,415	60,834	74,220	88,810	105,540	124,970	145,330	63	19
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	19.2	99.1	73.4	51.2	23.7	18.0	16.2	15.2	14.5	14.5	5	-9
Hardware-Only ASP	5.3	5.0	4.9	4.3	4.1	3.8	3.5	3.3	3.1	3.0	-6	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	25	53	73	79	76	81	91	104	116	122	32	10
CPU Revenue	23	51	70	77	75	80	90	103	115	121	34	10
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	2	2	3	3	1	1	1	1	1	1	-8	-8
Software Revenue	14	16	31	23	29	35	43	52	63	69	21	19
Bundled	3	2	2	1	2	2	2	2	2	2	-7	-4
Unbundled	11	14	29	22	27	33	42	51	61	68	25	20
Service Revenue	2	3	5	5	5	5	7	8	10	11	24	19
Total Factory Revenue	41	72	109	107	110	122	141	164	188	202	28	13
Increase over Prior Year (%)	27	76	51	-1	3	11	16	16	14	8		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

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Table 18
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: Asia
Platform: All Platforms

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	2,237	5,960	11,299	10,783	10,374	12,220	14,660	17,380	20,290	23,110	47	17
Unit Shipments or Seats	2,570	6,469	11,796	11,133	10,789	12,480	14,830	17,460	20,320	23,080	43	16
CPU Installed Base	4,334	10,161	21,028	30,711	38,690	46,590	54,720	63,490	73,710	85,570	73	17
Installed Seats	5,505	11,820	23,126	33,032	41,220	49,080	57,040	65,510	75,340	86,780	65	16
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	128.3	65.1	51.3	51.6	49.8	46.1	42.8	41.3	41.1	40.8	-21	-4
Hardware-Only ASP	11.9	7.7	6.1	6.9	8.0	7.0	6.0	5.3	4.8	4.5	-9	-11
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	87	130	191	206	200	210	221	240	265	290	23	8
CPU Revenue	59	93	144	157	151	159	168	184	203	224	27	8
Terminal Revenue	11	10	5	5	8	6	4	3	2	1	-8	-40
Peripheral Revenue (Turnkey)	18	27	41	45	42	45	49	54	60	66	24	10
Software Revenue	35	43	68	80	93	103	116	134	155	177	28	14
Bundled	28	33	52	60	69	74	81	91	104	118	25	12
Unbundled	6	11	16	20	24	30	36	42	51	58	41	19
Service Revenue	18	22	37	45	45	48	52	57	65	73	26	10
Total Factory Revenue	140	196	295	331	338	361	389	431	484	540	25	10
Increase over Prior Year (%)	36	40	51	12	2	7	8	11	12	12		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

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Table 19
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: Asia
Platform: Technical Workstation

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	401	1,516	2,727	3,312	3,966	4,760	5,640	6,670	7,850	9,060	77	18
Unit Shipments or Seats	401	1,516	2,727	3,312	3,966	4,760	5,640	6,670	7,850	9,060	77	18
CPU Installed Base	548	2,053	4,739	7,903	11,489	15,450	19,730	24,260	29,150	34,550	114	25
Installed Seats	548	2,053	4,739	7,903	11,489	15,450	19,730	24,260	29,150	34,550	114	25
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	155.7	62.7	55.8	59.0	56.3	53.9	51.8	50.4	49.1	48.1	-22	-3
Hardware-Only ASP	19.6	18.3	18.2	15.0	14.5	13.3	12.2	11.3	10.9	10.5	-7	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	36	66	107	124	127	142	159	180	205	228	37	13
CPU Revenue	25	48	76	90	93	105	117	132	151	168	39	13
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	11	18	31	34	33	38	42	48	54	61	34	13
Software Revenue	19	23	38	46	60	70	82	97	115	133	34	17
Bundled	16	20	32	38	51	58	68	79	93	106	33	16
Unbundled	2	3	6	8	10	12	15	18	23	27	44	23
Service Revenue	8	10	22	27	30	33	38	44	51	58	39	15
Total Factory Revenue	62	100	166	197	216	246	280	322	372	420	36	14
Increase over Prior Year (%)	173	60	67	18	10	14	14	15	16	13		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.

Source: Dataquest (May 1993)

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Table 20
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: Asia
Platform: Host-Dependent

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	97	118	507	479	346	250	140	60	10	10	38	-51
Unit Shipments or Seats	430	627	1,004	828	760	530	320	170	70	30	15	-48
CPU Installed Base	335	446	933	1,373	1,664	1,840	1,850	1,730	1,470	1,190	49	-6
Installed Seats	1,507	2,105	3,030	3,694	4,194	4,340	4,160	3,740	3,100	2,410	29	-10
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	812.7	650.5	103.2	90.9	101.6	96.7	92.3	88.3	.0	.0	-41	-100
Hardware-Only ASP	156.6	182.5	123.9	202.7	303.8	230.7	220.4	208.3	194.9	182.6	18	-10
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	36	41	41	35	33	24	14	7	3	1	-2	-49
CPU Revenue	20	23	30	25	22	15	8	4	1	0	2	-53
Terminal Revenue	11	10	5	5	8	6	4	3	2	1	-8	-40
Peripheral Revenue (Turnkey)	5	8	6	5	4	2	1	0	0	0	-9	-69
Software Revenue	10	14	17	16	13	9	5	3	1	1	6	-48
Bundled	9	10	13	12	9	6	3	1	0	0	1	-100
Unbundled	1	4	4	4	4	3	2	2	1	1	26	-33
Service Revenue	9	11	12	10	8	6	4	2	1	0	-1	-49
Total Factory Revenue	55	65	70	61	54	39	23	11	4	2	-0	-49
Increase over Prior Year (%)	-21	19	7	-13	-11	-28	-42	-51	-60	-57		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

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Table 21
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: Asia
Platform: Server

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	NA	NA	NA	287	202	230	270	320	370	420	NA	16
Unit Shipments or Seats	NA	NA	NA	287	202	230	270	320	370	420	NA	16
CPU Installed Base	NA	NA	NA	287	489	710	950	1,200	1,450	1,670	NA	28
Installed Seats	NA	NA	NA	287	489	710	950	1,200	1,450	1,670	NA	28
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	NA	NA	NA	74.5	75.4	74.4	71.4	68.5	65.7	63.1	NA	-3
Hardware-Only ASP	NA	NA	NA	27.6	36.7	34.2	31.1	29.3	28.5	27.8	NA	-5
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	NA	NA	NA	11	9	10	11	12	13	15	NA	10
CPU Revenue	NA	NA	NA	10	8	9	10	11	12	13	NA	10
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	NA	NA	NA	1	1	1	1	1	2	2	NA	10
Software Revenue	NA	NA	NA	5	4	5	6	7	8	9	NA	15
Bundled	NA	NA	NA	3	3	3	4	4	5	5	NA	14
Unbundled	NA	NA	NA	1	1	2	2	2	3	3	NA	18
Service Revenue	NA	NA	NA	5	4	5	6	7	8	9	NA	15
Total Factory Revenue	NA	NA	NA	21	17	20	22	25	28	32	NA	13
Increase over Prior Year (%)	NA	NA	NA	NA	-17	15	11	14	12	12		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

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Table 22
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: Asia
Platform: Personal Computer

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	1,740	4,326	8,065	6,705	5,860	6,970	8,620	10,330	12,050	13,630	35	18
Unit Shipments or Seats	1,740	4,326	8,065	6,705	5,860	6,960	8,600	10,300	12,020	13,570	35	18
CPU Installed Base	3,451	7,663	15,357	21,148	25,048	28,580	32,190	36,310	41,630	48,160	64	14
Installed Seats	3,451	7,663	15,357	21,148	25,048	28,580	32,190	36,310	41,630	48,160	64	14
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	27.9	13.5	19.0	17.4	17.7	15.4	13.9	13.1	12.4	11.8	-11	-8
Hardware-Only ASP	5.9	4.5	4.2	4.0	3.7	3.4	3.1	3.0	2.8	2.7	-11	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	16	23	43	36	32	34	38	41	44	46	20	7
CPU Revenue	14	21	39	32	28	30	34	37	40	42	20	8
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	2	1	4	4	4	4	4	4	4	4	15	-0
Software Revenue	6	7	13	13	16	19	23	27	31	34	29	17
Bundled	3	3	6	6	6	6	6	7	7	7	16	2
Unbundled	3	4	6	7	10	13	16	20	24	28	41	23
Service Revenue	1	1	3	3	3	3	4	5	5	6	35	16
Total Factory Revenue	22	30	59	52	51	56	64	73	80	86	23	11
Increase over Prior Year (%)	116	37	93	-11	-3	11	14	13	10	8		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

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Table 23
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: Rest of World
Platform: All Platforms

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	448	1,183	1,597	2,644	2,616	3,140	3,820	4,740	5,880	7,100	55	22
Unit Shipments or Seats	569	1,267	1,700	2,735	2,636	3,140	3,820	4,740	5,880	7,100	47	22
CPU Installed Base	1,288	2,417	3,881	6,220	8,319	10,550	13,100	16,010	19,610	23,830	59	23
Installed Seats	1,796	2,992	4,526	6,893	8,922	11,040	13,470	16,280	19,780	23,910	49	22
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	90.8	80.4	66.1	65.0	48.4	45.9	44.2	42.9	42.0	41.1	-15	-3
Hardware-Only ASP	16.8	9.1	8.4	7.2	6.1	5.0	4.5	4.2	4.0	3.8	-22	-9
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	16	27	28	49	35	38	43	50	60	70	20	15
CPU Revenue	12	22	23	41	30	33	37	44	52	61	25	15
Terminal Revenue	3	1	2	2	1	0	0	0	0	0	-34	-100
Peripheral Revenue (Turnkey)	1	4	3	6	4	5	6	7	8	9	32	17
Software Revenue	8	19	23	34	28	32	38	46	56	68	35	19
Bundled	5	7	6	14	11	13	16	19	24	29	25	21
Unbundled	4	12	17	20	17	19	22	27	32	38	46	18
Service Revenue	6	11	11	22	19	22	26	31	37	45	35	18
Total Factory Revenue	31	57	61	105	82	92	107	127	152	183	28	17
Increase over Prior Year (%)	6	85	7	71	-22	12	16	19	20	20		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

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Table 24
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: Rest of World
Platform: Technical Workstation

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	162	331	400	783	684	840	1,040	1,300	1,610	2,000	43	24
Unit Shipments or Seats	162	331	400	783	684	840	1,040	1,300	1,610	2,000	43	24
CPU Installed Base	467	779	1,142	1,832	2,393	2,970	3,720	4,570	5,650	6,910	50	24
Installed Seats	467	779	1,142	1,832	2,393	2,970	3,720	4,570	5,650	6,910	50	24
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	64.7	70.8	64.5	62.1	46.8	44.7	42.9	41.6	40.5	39.6	-8	-3
Hardware-Only ASP	129.0	16.2	14.9	13.0	14.2	12.9	11.9	11.2	10.8	10.4	-42	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	8	16	16	29	19	22	26	31	37	45	24	19
CPU Revenue	7	13	14	24	16	18	21	26	31	37	21	19
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	1	3	2	5	3	4	5	5	7	8	44	19
Software Revenue	4	13	15	21	15	17	21	25	31	38	40	21
Bundled	2	5	5	10	8	10	12	15	19	23	35	23
Unbundled	1	7	10	11	7	8	9	10	12	15	48	18
Service Revenue	3	7	8	15	13	16	19	22	27	34	43	21
Total Factory Revenue	15	36	39	64	47	55	65	79	96	117	33	20
Increase over Prior Year (%)	118	138	9	64	-27	18	19	21	22	22		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

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Table 25
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: Rest of World
Platform: Host-Dependent

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	18	30	52	22	12	0	0	0	0	0	-9	-100
Unit Shipments or Seats	138	115	156	113	32	10	0	0	0	0	-31	-100
CPU Installed Base	92	118	163	173	167	150	130	110	80	70	16	-16
Installed Seats	600	693	808	846	770	640	510	380	250	150	6	-28
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	355.7	306.8	136.5	167.7	231.1	220.7	211.7	202.9	194.3	186.5	-10	-4
Hardware-Only ASP	6,600.0	199.3	124.2	244.0	154.9	141.0	129.5	118.7	108.7	100.0	-61	-8
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	7	6	6	4	2	0	0	0	0	0	-27	-100
CPU Revenue	3	4	4	2	1	0	0	0	0	0	-21	-100
Terminal Revenue	3	1	2	2	1	0	0	0	0	0	-34	-100
Peripheral Revenue (Turnkey)	1	1	0	0	0	0	0	0	0	0	-37	-100
Software Revenue	3	3	4	2	1	0	0	0	0	0	-22	-100
Bundled	2	1	1	0	0	0	0	0	0	0	-46	-100
Unbundled	1	2	3	2	1	0	0	0	0	0	-3	-100
Service Revenue	3	3	2	2	1	0	0	0	0	0	-20	-100
Total Factory Revenue	13	13	12	8	4	1	0	0	0	0	-24	-100
Increase over Prior Year (%)	-36	1	-3	-34	-49	-73	-88	-100	NA	NA		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

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Table 26
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: Rest of World
Platform: Server

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	NA	NA	NA	186	155	180	210	260	300	360	NA	18
Unit Shipments or Seats	NA	NA	NA	186	155	180	210	260	300	360	NA	18
CPU Installed Base	NA	NA	NA	186	341	510	710	900	1,120	1,320	NA	31
Installed Seats	NA	NA	NA	186	341	510	710	900	1,120	1,320	NA	31
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	NA	NA	NA	79.6	71.4	68.2	65.4	62.7	60.0	57.6	NA	-4
Hardware-Only ASP	NA	NA	NA	21.1	25.9	23.6	21.6	20.6	19.9	19.5	NA	-5
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	NA	NA	NA	8	6	7	8	9	10	11	NA	12
CPU Revenue	NA	NA	NA	7	6	6	7	8	9	10	NA	12
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	NA	NA	NA	1	1	1	1	1	1	1	NA	12
Software Revenue	NA	NA	NA	5	5	5	6	7	8	10	NA	16
Bundled	NA	NA	NA	3	3	3	4	4	5	6	NA	15
Unbundled	NA	NA	NA	2	2	2	2	3	3	4	NA	17
Service Revenue	NA	NA	NA	5	4	4	5	6	6	7	NA	14
Total Factory Revenue	NA	NA	NA	18	15	17	19	22	25	28	NA	14
Increase over Prior Year (%)	NA	NA	NA	NA	-17	12	14	15	15	15		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

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Table 27
CAD/CAM/CAE/GIS History and Forecast

Application: GIS/Mapping
Region: Rest of World
Platform: Personal Computer

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	269	822	1,145	1,653	1,765	2,110	2,560	3,190	3,960	4,740	60	22
Unit Shipments or Seats	269	822	1,145	1,653	1,765	2,110	2,560	3,190	3,960	4,740	60	22
CPU Installed Base	729	1,521	2,576	4,029	5,418	6,910	8,540	10,440	12,760	15,530	65	23
Installed Seats	729	1,521	2,576	4,029	5,418	6,910	8,540	10,440	12,760	15,530	65	23
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	35.1	64.1	24.1	22.3	9.3	8.4	7.5	7.1	6.7	6.5	-28	-7
Hardware-Only ASP	5.9	4.9	4.6	4.3	4.1	3.8	3.5	3.3	3.1	3.0	-9	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	2	5	6	8	7	8	9	10	12	14	44	14
CPU Revenue	2	4	6	7	7	8	9	10	12	14	44	14
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	0	0	0	0	0	0	0	0	0	0	11	4
Software Revenue	1	3	3	6	8	9	11	14	16	20	57	20
Bundled	0	0	0	0	0	0	0	0	0	0	24	-8
Unbundled	1	3	3	6	8	9	11	14	16	20	58	21
Service Revenue	0	1	1	1	1	2	2	3	3	4	75	21
Total Factory Revenue	3	8	10	15	16	19	23	27	32	38	51	18
Increase over Prior Year (%)	15	166	17	48	13	17	17	18	19	18		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

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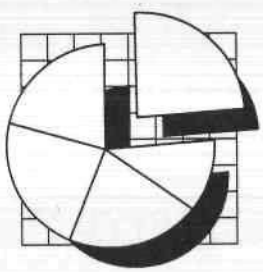
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CAD/CAM/CAE and GIS AEC Forecast



Market Statistics

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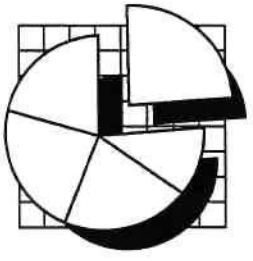
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Product Code: CAEC-WW-MS-9303
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Market Statistics

1993

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Note: All tables show estimated data.

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Note: All tables show estimated data.

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CAD/CAM/CAE and GIS AEC Forecast

Sluggish world economic activity in 1992 caused decelerating growth in the CAD/CAM/CAE and GIS market. Dataquest expects this decelerating trend to continue in 1993. A recent survey by The Dun & Bradstreet Corporation of more than 11,000 executives in 16 countries indicated that, on a worldwide basis, optimism for sales and profits holds steady. On a regional basis, however, executives in the United States and United Kingdom measured heightened optimism, offsetting the weaker optimism of continental Europe, particularly Germany and France, and the continued pessimism of Japan. High interest rates are aggravating optimism in the European community, while Japan is suffering from weaker domestic demand and increased competitive pressures.

Despite the economy, the CAD/CAM/CAE and GIS market grew an anticipated 3.2 percent to $15.5 billion, in part because of the devaluation of the yen and ECU against the U.S. dollar (see Table 1). On the basis of the yen, the Japanese market showed a decline of 5.9 percent. Dataquest is forecasting total revenue in the worldwide market to grow 2.7 percent in 1993, with a compound annual growth rate (CAGR) of 4.6 percent through 1997. We forecast worldwide software revenue to grow 9.5 percent in 1993, with a CAGR of 9.0 percent through 1997. This forecast is based on the market share information published in March (though changed slightly as new information became available) and will be updated in July, following an update to our market share in May. It should be noted that the forecast assumes stable currency exchange rates.

This document contains Dataquest's detailed forecast information for the CAD/CAM/CAE and GIS industry. Included are the following:

- Five-year historical data
- Five-year forecast data

More detailed data is available through our client inquiry service, which can provide custom analysis of the multidimensional database.

Worldwide Forecast Assumptions

The following sections describe the main forces, worldwide, that drive the CAD/CAM/CAE and GIS forecast.

Worldwide Forecast Drivers

The worldwide CAD/CAM/CAE and GIS market will maintain consistent, steady growth during the next five years. Figure 1 shows the forecast of hardware, software, and service revenue worldwide and by region. Figure 2 shows the worldwide forecast by platform.

The following paragraphs describe the main forces driving the CAD/CAM/CAE and GIS worldwide forecast.

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Table 1
CAD/CAM/CAE and GIS Forecast, by Region
(Revenue in Millions of Dollars; Actual Shipments)

	1992	1993	1994	1995	1996	1997	CAGR (%) 1992-1997
Worldwide							
Total Factory Revenue	15,485	15,909	16,602	17,432	18,371	19,346	4.6
Software Revenue	4,885	5,350	5,860	6,390	6,920	7,470	8.9
Unit/Seat Shipments	647,716	708,400	777,500	841,800	892,800	939,100	7.7
North America							
Total Factory Revenue	5,224	5,443	5,737	6,081	6,441	6,816	5.5
Software Revenue	1,669	1,870	2,070	2,270	2,460	2,660	9.8
Unit/Seat Shipments	270,345	298,900	323,500	347,300	365,700	385,200	7.3
Europe							
Total Factory Revenue	5,862	6,078	6,389	6,702	7,060	7,386	4.7
Software Revenue	1,793	1,990	2,190	2,370	2,570	2,750	8.9
Unit/Seat Shipments	234,935	257,100	287,200	312,500	330,000	342,000	7.8
Asia							
Total Factory Revenue	4,104	4,055	4,086	4,195	4,341	4,531	2.0
Software Revenue	1,327	1,380	1,460	1,580	1,690	1,810	6.4
Unit/Seat Shipments	125,922	133,000	143,200	153,200	162,600	171,300	6.3
Rest of World							
Total Factory Revenue	296	332	390	454	528	614	15.7
Software Revenue	96	120	150	170	200	240	20.1
Unit/Seat Shipments	16,514	19,400	23,600	28,800	34,500	40,600	19.7

Source: Dataquest (May 1993)

Macro Economy

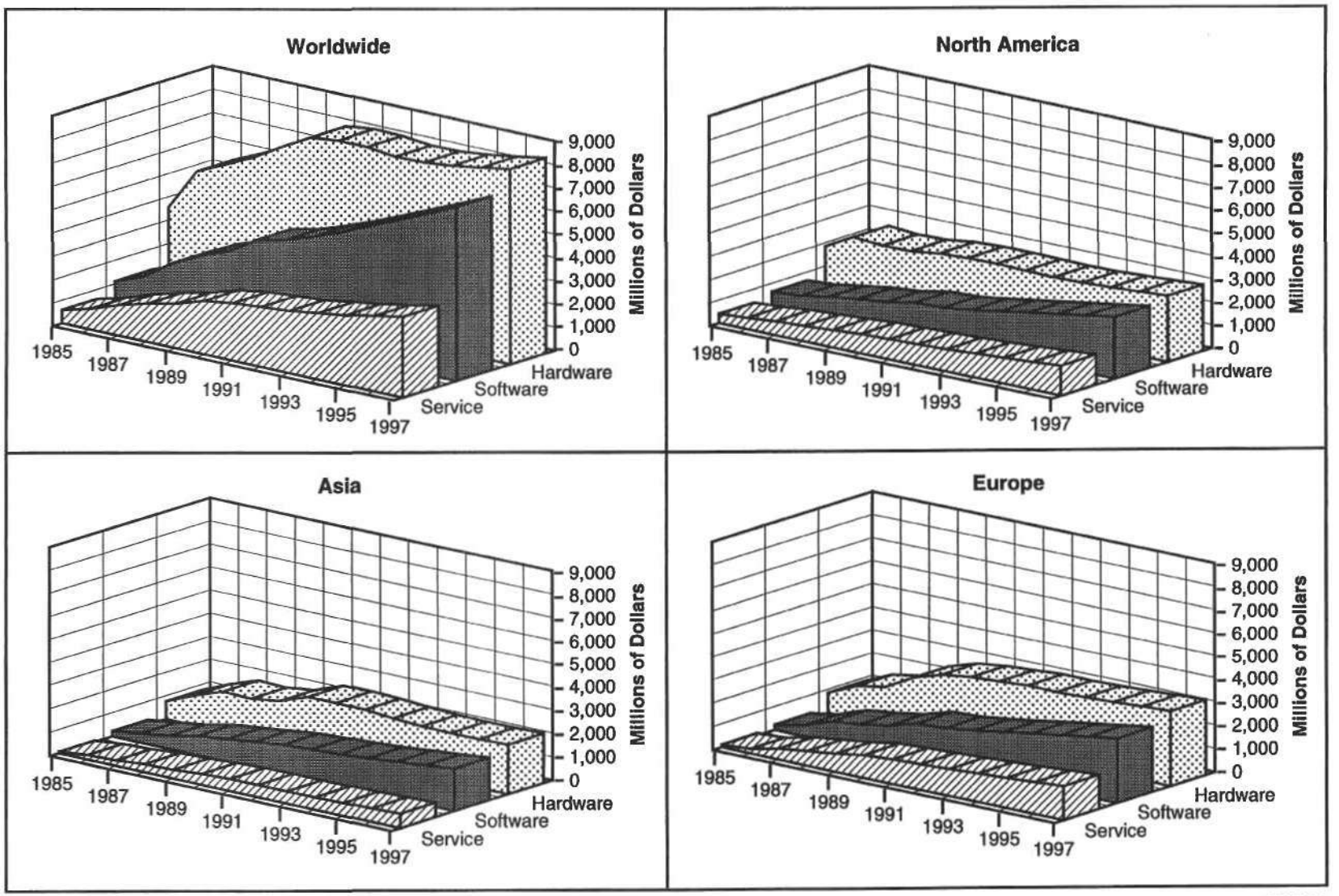
The recovery with renewed optimism from worldwide recession and increased capital spending will fuel growth gradually, beginning in the United States and the United Kingdom, and in Asian countries other than Japan.

Currency

The decline of the U.S. dollar compared to the ECU and yen from 1991 to 1992 offset sluggish economic growth for multinational corporations, particularly those with a high percentage of costs denominated in dollars. Some companies are utilizing the changes in exchange rates to lower overseas prices effectively, thus stimulating demand. This is particularly true of PC companies striving to increase unit volume gains rapidly in Japan, where the local companies are vulnerable to price competition.

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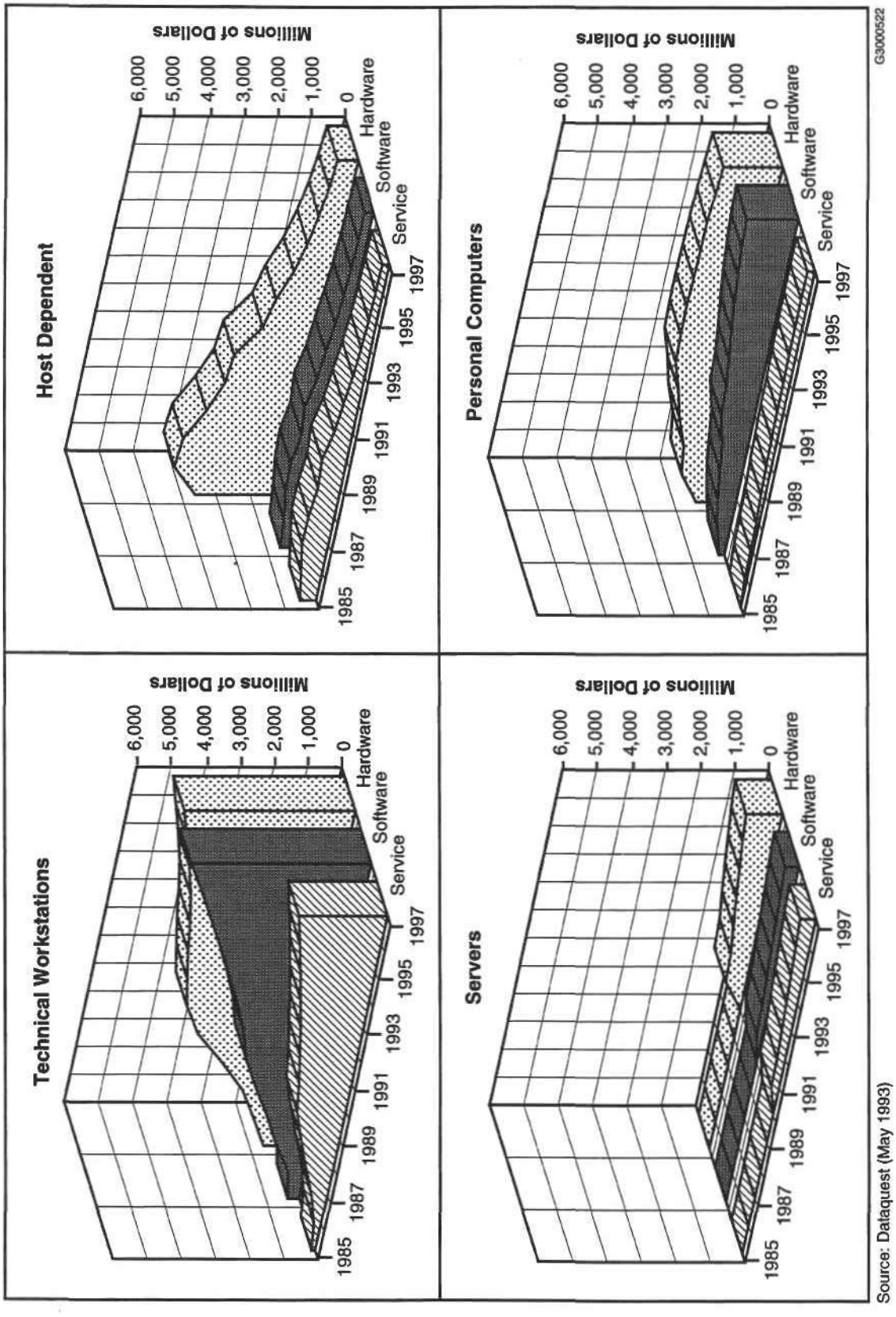
Figure 1
Worldwide and Regional Revenue Forecast, All Applications and All Platforms



Source: Dataquest (May 1993)

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Figure 2
Worldwide Revenue Forecast, by Platform, All Applications



Source: Dataquest (May 1993)

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Technology

Computing performance will continue to improve at an exponential rate in the foreseeable future. Dataquest has forecast the growth in millions of instructions per second (mips) shipments. The results show that the total mips shipped through 1992 will be matched by the shipments made in 1993. In other words, the total mips shipped will double in 1993, almost double again in 1994, and double again in 1995. This enabling resource will fuel the next-generation software tools focused on integrated solutions at the enterprise level.

Indispensability

As the complexity of the design, the need to share information, and the need to store information electronically all increase, the benefits of automation improve dramatically and the level of indispensability goes up. CAD/CAM/CAE and GIS are becoming a necessity as these factors are coupled with market pressure to produce higher quality and to reduce production cycles.

Late Buyers

A significant pool of untapped users still exists in mechanical, AEC, and GIS applications, driving additional growth. These conservative buyers will favor market leaders and installed systems for compatibility. For vendors, therefore, the value of high market share and customer satisfaction will increase.

Desktop Dominance

The turf war for desktop dominance is building steam with the introduction of the Pentium chip and Windows NT, which will fight to take market share from the higher-priced, multiple UNIX operating systems with RISC technology. The decline of host-dependent systems also is continuing, with replacements going to networked, desktop systems. The former threatens vendors whose business models depend upon high-priced workstations, while the latter provides opportunity.

Unbundling of Software

With software vendors porting to multiple platforms, software is no longer the hinge upon which hardware swings. The market is moving quickly from proprietary to open systems, resulting in a shift from bundled to unbundled software (see Table 2).

Replacement Market

The replacement market is gaining importance as replacement seats exceed 50 percent of unit sales in 1993 (see Figure 3). This saturation implies that many parallel manual systems can be eliminated and new applications developed if everyone in a company that needs access to the engineering database can have it in electronic format. The savings potential is tremendous. This saturation also implies a growing sophistication in buyers that are more informed of this technology's strategic importance.

Software

With technological advances, growing sophistication of users, and competitive pressures, the demand for software with greater ease of

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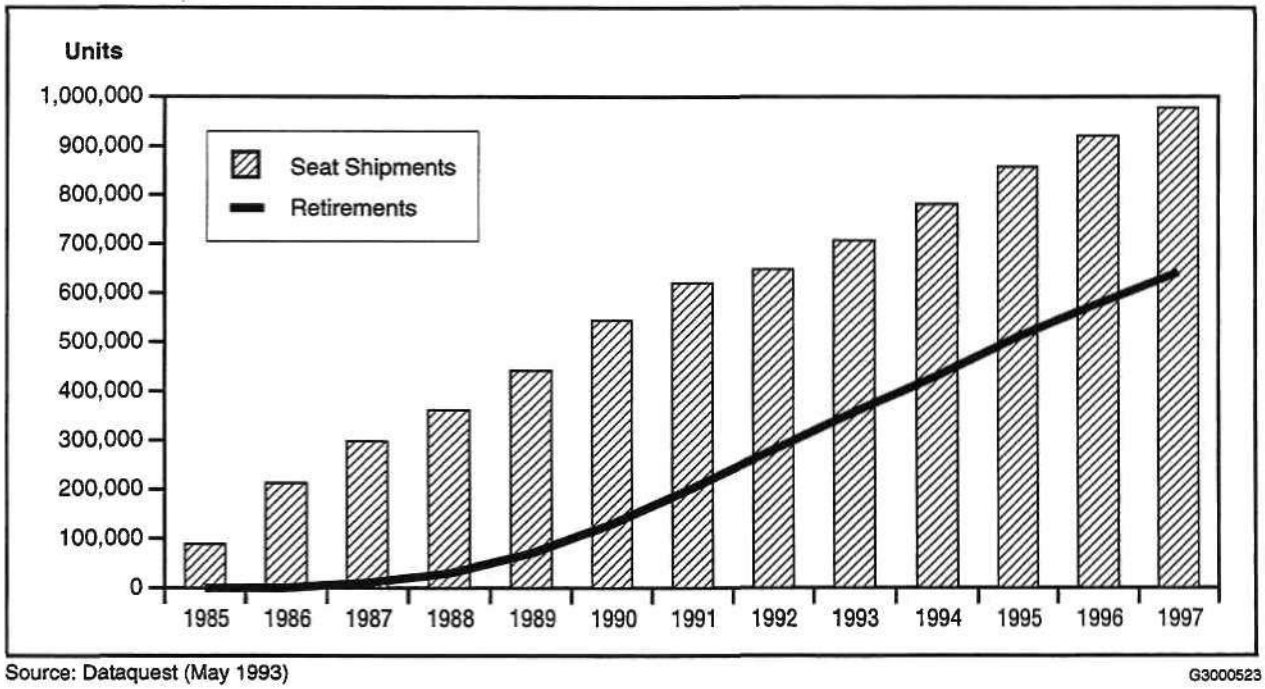
Table 2
CAD/CAM/CAE and GIS Software Revenue Forecast, by Application (Millions of Dollars)

	Revenue						CAGR (%)	Percentage Distribution (%)					
	1992	1993	1994	1995	1996	1997	1992-1997	1992	1993	1994	1995	1996	1997
All Applications													
Total Software	4,885	5,352	5,862	6,389	6,923	7,467	8.9	100.0	100.0	100.0	100.0	100.0	100.0
Bundled Software	1,917	1,935	1,973	2,037	2,118	2,201	2.8	39.3	36.2	33.6	31.9	30.6	29.5
Unbundled Software	2,968	3,416	3,890	4,352	4,804	5,266	12.2	60.7	63.8	66.4	68.1	69.4	70.5
Mechanical													
Total Software	2,233	2,469	2,688	2,868	3,007	3,154	7.2	100.0	100.0	100.0	100.0	100.0	100.0
Bundled Software	1,111	1,119	1,127	1,129	1,123	1,107	-0.1	49.8	45.3	42.0	39.4	37.3	35.1
Unbundled Software	1,122	1,350	1,561	1,739	1,883	2,048	12.8	50.2	54.7	58.0	60.6	62.7	64.9
AEC													
Total Software	730	796	875	966	1,072	1,178	10.0	100.0	100.0	100.0	100.0	100.0	100.0
Bundled Software	327	347	372	404	444	483	8.1	44.8	43.8	42.5	41.7	41.1	41.0
Unbundled Software	403	449	503	562	628	695	11.5	55.2	56.3	57.5	58.3	58.9	59.0
GIS/Mapping													
Total Software	616	700	810	956	1,128	1,317	16.4	100.0	100.0	100.0	100.0	100.0	100.0
Bundled Software	297	325	364	417	482	553	13.2	48.3	45.7	44.4	43.8	42.5	42.0
Unbundled Software	318	375	447	539	646	764	19.2	51.7	54.3	55.6	56.3	57.5	58.0
Electronic CAE													
Total Software	752	812	884	945	1,005	1,057	7.0	100.0	100.0	100.0	100.0	100.0	100.0
Bundled Software	75	61	51	43	37	35	-14.1	9.9	7.4	5.7	4.3	4.0	3.8
Unbundled Software	677	751	834	902	969	1,022	8.6	90.1	92.6	94.3	95.7	96.0	96.2
IC Layout													
Total Software	225	243	269	303	341	378	10.9	100.0	100.0	100.0	100.0	100.0	100.0
Bundled Software	17	13	9	7	6	5	-21.7	7.4	4.2	3.7	3.2	2.9	0.0
Unbundled Software	209	230	260	296	335	373	12.3	92.6	95.8	96.3	96.8	97.1	100.0
PCB/Hybrid/MCM													
Total Software	330	332	336	351	370	383	3.0	100.0	100.0	100.0	100.0	100.0	100.0
Bundled Software	91	71	51	38	26	19	-26.9	27.6	21.2	14.7	11.4	8.1	5.3
Unbundled Software	239	261	286	314	343	364	8.8	72.4	78.8	85.3	88.6	91.9	94.7

Source: Dataquest (May 1993)

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Figure 3
Unit Seat Shipments versus Retirements Forecast



Source: Dataquest (May 1993) G3000523

use, flexibility, and interoperability is growing. This demand is driving the growth in business alliances between small innovative software niche players and major software vendors with resources to sell to both the new and replacement markets.

North American Forecast Drivers

Of the three major worldwide regions, North America CAD/CAM/CAE and GIS revenue growth was an anemic 3.4 percent to $5.2 billion in 1992 and is forecast to grow at 5.5 percent CAGR through 1997. The following paragraphs describe the main factors driving the North American forecast.

Capital Spending

According to Dun & Bradstreet's latest monthly survey of 1,000 manufacturers nationwide, optimism is at a three-year high and capital spending is expected to increase 12 percent in 1993 because of competitive global pressures, need for improved productivity, and cost of capital, which is at a three-year low. This bodes well for increased investment in CAD/CAM/CAE and GIS systems, particularly mechanical applications.

Cuts in Defense Spending

Cuts in defense spending will tend to soften the market. However, a focus on fewer, more sophisticated weapons systems will promote use of the latest design optimization and simulation capabilities.

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European Forecast Drivers

The European market grew 5.3 percent in 1992 to $5.9 billion, making Europe the fastest growing region worldwide. However, the outlook for 1993 is not quite as positive, with growth expected to be 3.7 percent. The major factor behind this slowing growth is the sluggish German economy, which accounts for 34 percent of the European market. A slowdown in Germany ripples through all other European industries. The following paragraphs describe the main factors driving the European forecast.

Recession

The general recessionary economic climate throughout much of Europe during 1991 and 1992 depressed capital investment and orders for information technology products. Most of the European countries are in or near a recession. The picture for 1993 does not look good. Many individual countries face a slowdown in domestic activity, while there is little hope of strong demand pressures from the United States or Japan to help in any economic upturn anytime soon.

Growth

On average, gross domestic product growth in Europe in 1993 is expected to be only 0.3 percent, with an upturn of 1.9 percent growth expected in 1994. Major European economies such as Germany, United Kingdom, Italy, Spain, and Sweden also have accumulated massive budget deficits that will influence governments to reduce public spending even further and to increase taxes, which in turn will reduce consumer spending. Even the recent falls in interest rates will not change this fact.

Asian Forecast Drivers

The Asian market grew 1.2 percent in 1992 to $4.1 billion. However, the Japanese market declined 6 percent on a yen basis. With 94 percent of the Asian CAD/CAM/CAE and GIS market in Japan, the Japanese economy dominates this segment. Further contraction of the market expected in 1993 will result in a CAGR through 1997 of 2.0 percent. The following paragraphs describe the main factors driving the Asian forecast.

Capital Spending

Dataquest estimates that capital spending by Japanese companies will fall 12.7 percent in 1993, following a precipitous drop of 28.7 percent in 1992. However, signs of recovery in the macro economy are starting to show.

Business Confidence

According to the Sakura Institute of Research in Japan (January 1993), business confidence is expected to brighten some in fall 1993. Recovery is expected to be fueled by small and medium-size manufacturing companies.

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Software Leads Hardware

The preference for Japanese companies investing in CAD/CAM/CAE and GIS has been for low-cost, decentralized networked systems and big central mainframes. Japan- and U.S.-supplied technical workstations are emerging as the platform of choice for most CAD/CAM/CAE and GIS applications. Strong interest in the latest high-end software offerings is dragging the necessary hardware.

Application Forecast Assumptions

Expected growth in AEC and GIS applications during the next three or four years will add significantly to the total growth of the industry and will exceed growth forecasts for all mechanical and electronic applications (see Figures 4 and 5). Factors in this shift in the total market application mix include market penetration, new application development, and shifting trends in average selling prices.

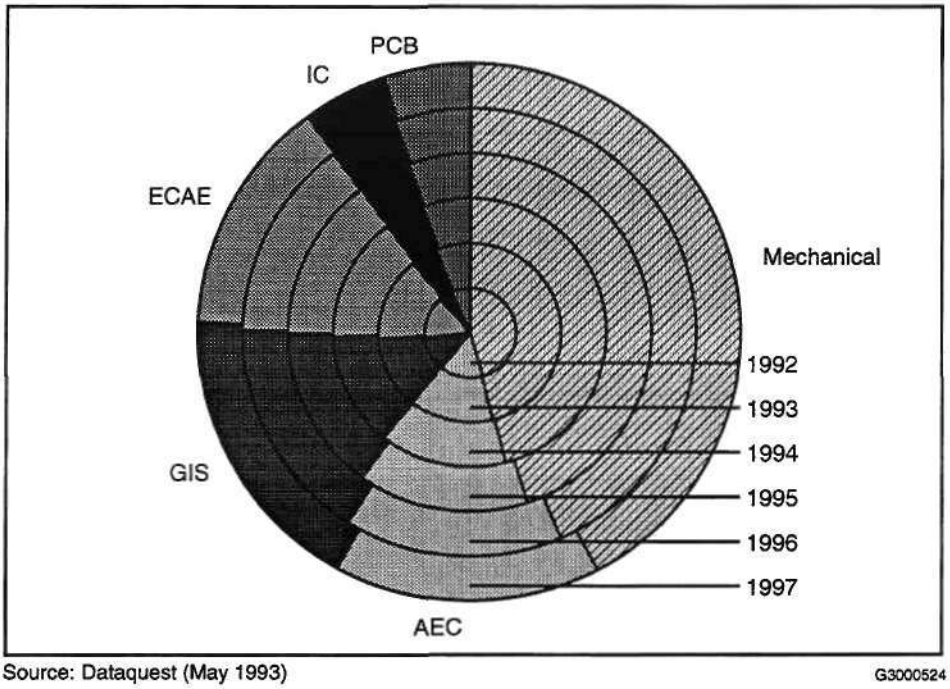
Mechanical Forecast Assumptions

The mechanical application area is the largest of the CAD/CAM/CAE and GIS market, with 49 percent share and software revenue growth of 9.3 percent in 1992. The following paragraphs describe the main issues driving the mechanical forecast.

Software Price

Dataquest expects software prices to stabilize or increase slightly for leading products. The average value of software shipped per seat has increased slowly. In 1987, total software revenue divided by

Figure 4
Software Revenue Distribution Forecast, by Application

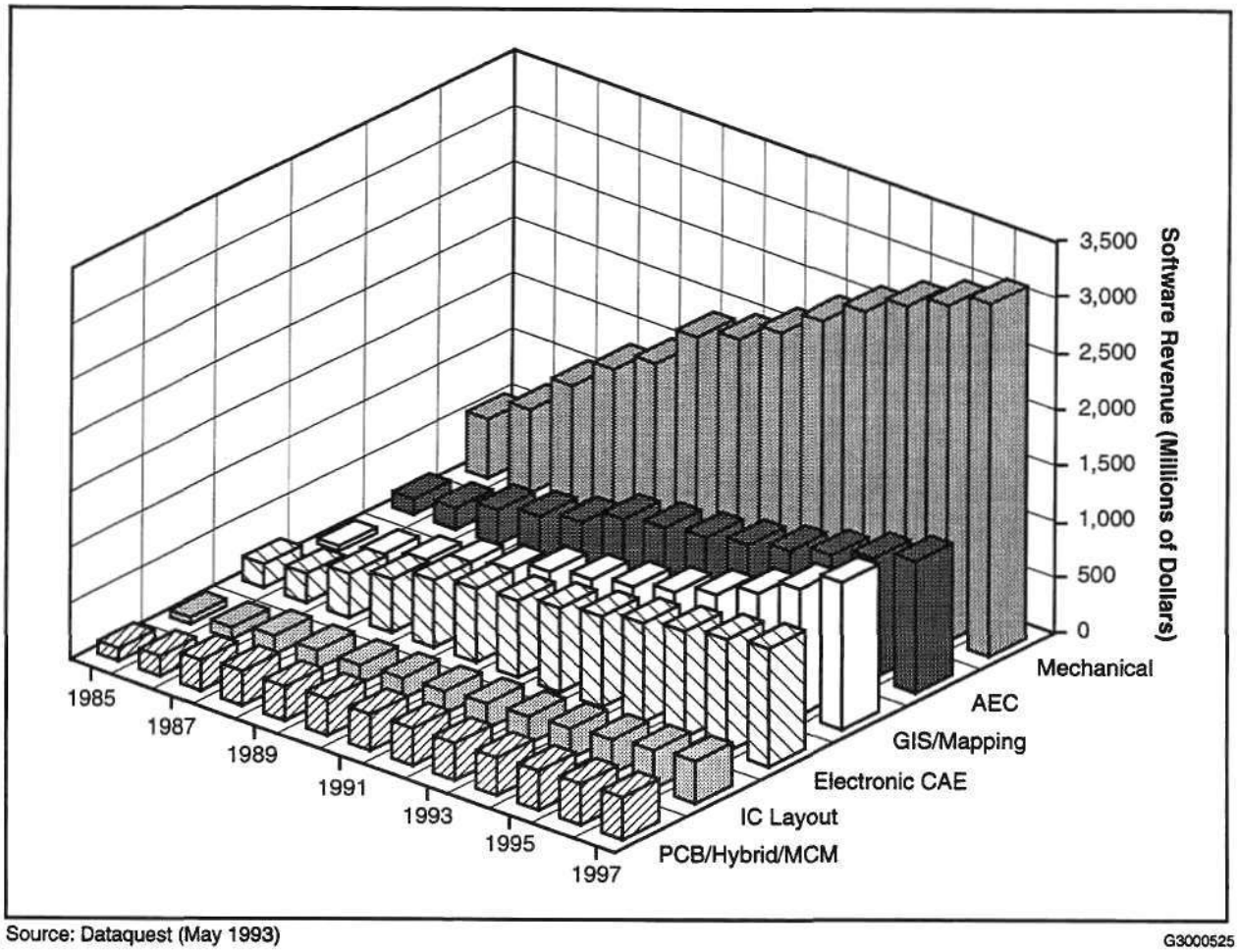


Source: Dataquest (May 1993)

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Figure 5
Worldwide Software Revenue Forecast, by Application



Source: Dataquest (May 1993)

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total number of seats shipped was $6,740. The average value rose to $8,140 in 1992 and is forecast to rise to $9,390 by 1997. Corresponding numbers in 1992 are $17,040 for technical workstation-based software, $2,470 for the PC, and $16,270 for host-based terminals. Leading vendors on all platforms have been raising prices directly or indirectly with new pricing structures for network licensing or site licensing.

Hardware Price Erosion

Dataquest expects hardware price erosion to continue, but at a slower rate as package complexity increases and accelerates demand for hardware purchases that provide speed, memory, and storage. This trend can be expected on all platform configurations. Supercomputers increasingly are being used for high-end simulation and analysis applications. Technical workstations range from very expensive, high-performance, real-time imaging systems to lower-cost, two-dimensional documentation systems. The need for integrated applications across platforms will cause significant upgrade and system replacements.

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Second-Tier Products

Dataquest expects second-tier products with "stale" technology to fight price erosion. These second-tier vendors are struggling to build market share in an atmosphere of rampant price cutting, particularly on the PC platform.

Hardware Performance

With enabling technology providing increased mips, software vendors can redefine the concept of interactive design. For example, designers will simulate the crash of one car into another and test to see if the doors still open. The value of this level of computing will change the nature of mechanical CAD/CAM/CAE. The result will allow anyone in the design and manufacturing process to simulate real problems, to evaluate potential solutions, and to communicate the change instantly to all involved.

Modeling Technologies

Core modeling technologies will evolve slowly to support a product data structure growing in complexity. Three-dimensional solutions are replacing two-dimensional solutions, which will be replaced by next-generation, integrated, and solid-modeling-based solutions. The more complete data structure with improvements in performance is rapidly building strong interest with end users. Progress is being made in integration between the model and analysis applications, between the model and documentation, and further into manufacturing applications.

Technology Dependence

The major applications in mechanical applications are defined: Product conception, development, production, operation and support will be necessary applications areas a hundred years from now. The dramatic changes taking place in the discrete manufacturing world because of competitive pressures are forcing shorter development cycles, localization, and need for improved quality, resulting in a complexity that forces the users to be fully dependent upon this technology.

Manufacturing Industry

The growth opportunity in each country depends upon the success and health of the local manufacturing industries. Multinational corporations will fuel the growth in newly industrialized countries. Each country has a dominant industry or market segment that sets the tone for CAD/CAM/CAE use. The evolution of these industries has had an important impact on the growth of the CAD/CAM/CAE market in each region and has directed the success of many vendors trying to serve these markets. As an example, the automotive industries in Japan, the United States, Germany, Italy, and France have a major influence on these local CAD/CAM/CAE markets. Aerospace, a major force in the U.S. market, is less of a force in Europe and a minor but growing interest in Japan. All of the other manufacturing industries, such as fabricated metal, machinery, and consumer products, have strongholds in various locations around the world.

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For example, the machinery industry represents a significant local CAD/CAM/CAE opportunity in Japan and Germany.

Europe

The automotive and aerospace industries, which are the largest customers of mechanical CAD/CAM/CAE tools, are suffering during the ongoing recession in Europe and experiencing budget and staff cuts. On top of this, 34 percent of the European mechanical market is in Germany, where the economy is now in recession and manufacturing output is down. Growth for mechanical CAD in 1992 was only 3.2 percent and is expected to be 3.0 percent in 1993 because the German economy is not expected to get out of its recession before mid-1994 at the earliest.

AEC Forecast Assumptions

The AEC application area had software revenue growth of 7.1 percent in 1992. The five-year CAGR for software is forecast to be 10 percent. The following paragraphs describe the main factors driving the AEC forecast.

Untapped Users

A significant pool of untapped users still exists. The current relatively low market penetration of AEC CAD systems should allow steady worldwide growth during the next five years, despite constant volatility in demand for the building and infrastructure products to be designed.

Mandates for CAD

Electronic design data is increasingly required by the designer's client, from the U.S. federal government to the small commercial developer. Design firms also are growing at the expense of smaller firms. These large end users will increasingly require their employees and suppliers to adopt automation tools in the design and construction process.

Electronic Partnering

Designers in the AEC industry are finding themselves in markets that are more regionally and globally competitive, markets that favor partnering across design disciplines. Smaller design firms will increasingly buy CAD systems, or risk being dropped from consideration as a partner.

Competitive Advantage

CAD purchases are increasingly justified as a competitive advantage in both sales and design reviews. The architect that cannot produce the fourth iteration of a proposed design before signing up a client will lose out to the group that can use changes in a proposal to ratchet a prospect gradually toward closure.

Software Leverage

AEC CAD vendors can fuel upgrade revenue among sophisticated users by leveraging software advances first developed in mechanical design, such as faster structural analysis tools or incorporation of design rules.

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New Functionality

Data and database functions (versus graphics functions) will increase in importance in AEC design systems, creating opportunities to sell users significant new functionality.

Europe

AEC growth in Western Europe is tied to the improvement of the infrastructure, manufacturing plants, and power stations in Eastern Europe. In particular, German construction companies are involved in projects in the former East Germany and in Central and Eastern Europe. The encouraging signs that the U.K. economy is picking up also positively affect the construction industry.

Growth Inhibitors to the AEC CAD Industry

The following paragraphs describe trends that will inhibit growth in the AEC CAD industry.

Low Payoff to Users

AEC's one-design/one-build structure means that CAD provides fewer economic benefits to these users than does the one-design/build-many structure of manufacturing. Construction, which is essentially a prototype build, is fraught with uncertainties and delays that are hard to change using current design systems.

Lack of Interoperability

Designs are often split among several different companies representing different aspects of the design process. User companies often have different CAD systems that do not communicate well, and alliances and consolidations in user organizations will only highlight the issue.

Low-Cost Solutions

Because most AEC design is still focused on drafting, which requires relatively little computing power, PC-based growth will be strong for the foreseeable future and PC-based solutions will produce less revenue for the vendor than will other platforms.

Late Adopters

Attitudes of potential users inhibit market growth. Many experienced architects resist change in both the design and construction processes. As this self-destructive mode of operating erodes the viability of the profession, the CAD market is also impacted because many architects that were once prospects for CAD systems are now unemployed.

GIS Forecast Assumptions

The GIS application area had software revenue growth of 12.4 percent in 1992. The five-year CAGR for software revenue is forecast to be 16.4 percent. The assumptions behind the GIS forecast are built both on optimism that the world economy will gradually improve during the forecast period, and on an expectation that global competition will increase. The following paragraphs describe assumptions used to build Dataquest's GIS market forecast.

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Low Penetration

Bread-and-butter prospects in government and utilities are charged with maintaining information on land and assets in perpetuity. A large number of utilities, and sovereign and local governments all over the world, are still stuck with tabular data and paper maps (which will degrade over time). These create a plentiful supply of prospective buyers of the more readily changed and renewed computer maps—a first step to building a GIS system.

New Technologies

Faster, cheaper computers and developments in open, distributed systems open the door to an expanded user base. Advances in global positioning systems (GPSs) and aerial photography are making it possible to create GISs significantly more accurate and complete than existing paper maps, giving experienced users some compelling reasons to reinvest. Portable computers, multimedia, cheaper storage, and better compression of satellite imagery will create more opportunities to develop richer, more accurate, and more useful GIS systems. Although many markets will take advantage of these technologies, there is no other market as ready, willing, and able to put to work such a wide range of technology enhancements. A number of users invested in image-oriented GIS systems in the last year or two, either supplementing or completely bypassing conversion of existing paper data. This has helped provide a "mid-life kick" to a market that has been slowed by troubled pilot projects.

New Applications in Industries Such As Retail and Insurance Will Drive Growth

Wherever there is competition for a limited prize—whether the prize is a political or economic reward—GIS can create a competitive edge. Wherever assets or investments are geographically dispersed, GIS offers significant management capabilities. Revenue is growing at more than 50 percent per year among new applications. However, there is a wide band of uncertainty surrounding revenue opportunities. Several new applications in GIS are destined to become embedded as a feature that will produce relatively little revenue in other software programs (and markets), rather than as a standalone product in the GIS market.

Easier and Less Expensive GIS

Inexpensive spatial data, both public and private, is accumulating and can be passed on to new users. Successful multiparticipant projects are growing, creating larger data sets that can be profitably resold by government/industry consortia. Also, although Dataquest does not envision the technology miracle that will eliminate development costs, implementation of GIS in new sites will be easier and less expensive than it previously has been.

Solutions Filling a Need

GIS addresses the information age's growing problem of overload. Any product that addresses a visible problem is more certain to grow than are solutions still looking for the problem.

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The U.S. Government

GIS is one of the rare markets where relatively simple government action can directly fuel industry growth. In fact, the GIS industry depends on government cooperation for base data development. Governments all around the world are cooperating by developing spatial data standards, more sophisticated mapping goals, and increased cooperation across federal and local governments. The U.S. federal government is in a particularly influential position, and all stars are favorably positioned. The LANDSAT program appears to be headed toward making satellite imagery more affordable. GPS satellites are proving extremely valuable outside of defense applications. Freedom of information remains a viable U.S. federal concept, creating opportunities to exploit low-cost, government-generated spatial data. The stage could not be set better for the tenure of a new U.S. president known to appreciate the importance of information technology.

Growth Inhibitors to the GIS Market

High Cost

No silver bullet will emerge to create a low-cost, meaningful data set for traditional customers in government and utilities. Data conversion will remain costly, despite substantially lower scanning costs and increasingly improved automated conversion products. The high cost will remain because, as existing paper records head toward computerization, widespread minor inaccuracies begin to be examined, often for the first time. The significant cost of correcting prior errors and omissions is inevitably bundled into the cost of "conversion." At the same time, increasingly complex applications require increasingly accurate data, also raising conversion costs.

Stuck Projects

The significant number of traditional GIS/mapping projects stuck in the pilot phase will reduce demand for new products, as users struggle to implement existing purchases. Even worse, the negative publicity created by these projects will chill the buying impulse among nonusers, reducing the ability of GIS projects to compete with other applications for capital equipment dollars.

Price Pressure

Computer prices will certainly drop, even in technical applications such as GIS, where higher-performance hardware will command a premium price. Software prices are likely to come under increasing pressure, despite the industry's current ability to hold overall seat prices relatively even. Our current forecast is built on declining hardware and steady software prices, primarily because of opportunities to add significant software data and functionality content to new sales among core, noncommodity buyers. Any significant deviation from this model would affect the forecast.

Europe

GIS data in Europe is prohibitively expensive and not readily available, slowing down the potential growth. Also holding back the

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development of GIS are the current state of the various European economies; the enormous budget deficits of major economies such as Germany, Italy, and Great Britain; and major cuts in public spending.

EDA Forecast Assumptions

The year 1992 showed a glimmer of hope in the EDA industry, with software revenue year-to-year growth rates climbing back to 8.3 percent, driven by the continued strength of the IC layout software industry and a resurgence in the CAE market. Dataquest expects EDA software revenue growth to decrease slightly to 6.1 percent year-to-year for 1993. Printed circuit board (PCB) software in particular will remain stagnant until multichip module (MCM) technologies begin to affect the market, which Dataquest anticipates will take effect in the 1994-to-1995 time frame. The following paragraphs describe the factors that will help spur EDA software growth.

New Tool Technologies

New tool technologies, including electronic system level design automation (ESDA), signal integrity, and design automation are becoming available, fueling growth.

Analysis Tools

Increasing clock frequencies require tighter design tolerances that require sophisticated analysis tools to ensure proper operation.

Migration of IC Layout

Migration of IC layout technologies to system designers in the form of floor planners may prove to be the vehicle to expand physical IC design into the larger ASIC design community.

Europe

The EDA industry in Europe is now characterized by two or three big players jockeying for position. Furthermore, following the merger of Cadence Design Systems Inc. and Valid Logic Systems Inc., and several large end-user mergers, some strategic account changes have occurred and will continue. The total software revenue is unaffected, but market share is the prize for the winning EDA company.

Growth Inhibitors to the EDA Market

Dataquest expects the factors described in the following paragraphs to have a detrimental effect on the health of the EDA market in the short term.

Transition and Shifts

Product transition and strategy shifts will have a short-term downward effect. Difficulties at the No. 1 supplier of EDA software, Cadence, may cause a stall in the purchases of new tools as users ponder their options. Ongoing consolidations of key EDA technologies, including simulation and signal integrity, will also protract buying decisions.

Legal Issues

Legal issues may induce fear, uncertainty, and doubt in buyers' minds. The recent spate of legal actions (for example, Synopsys

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versus Cadence, Analogy versus Anacad/Mentor Graphics, and stockholders versus Cadence) may divert the attention of the buying public and will definitely garner the attention of top management at the EDA vendors.

Use of PC-Based Tools Will Drop Significantly

Looking to EDA's future, Dataquest anticipates the use of what have classically been called PC-based tools to drop significantly. The Dataquest factors determining the differentiation of technical workstations from PCs are a virtual multitasking operating system (UNIX, VMS, and DOMAIN), the ability to run high-performance graphic applications in a multiuser environment, and the user's potential range of expansion on the platform. Windows NT on the Pentium chip will challenge this differentiation.

Dataquest anticipates that use of "classical" PCs as EDA platforms will begin to diminish significantly in 1995. At that time, classes of tools will be differentiated not upon hardware platform or operating system, but rather upon the features and functionality of the tools themselves. The emergence of Windows NT will have a minimal impact upon the overall revenue of the EDA software industry. However, its effect upon competing operating systems, average selling prices, distributing practices, and business and marketing practices will be far-reaching.

Forecast Methodology

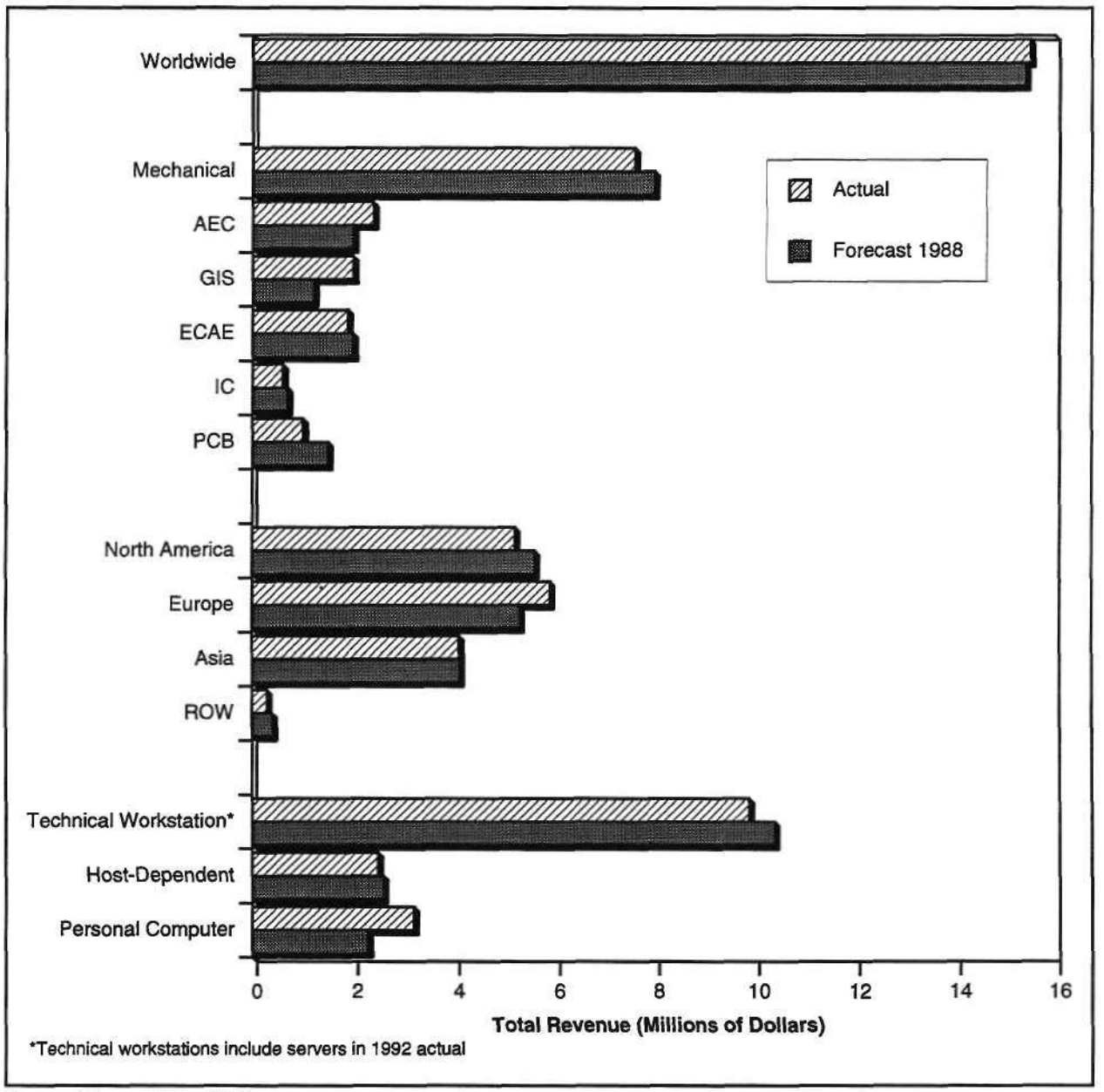
Forecast Accuracy

This forecast model for the CAD/CAM/CAE and GIS markets has withstood the test of time. Figures 6, 7, and 8 compare the 1992 market share revenue, shipments, and computed installed base with a forecast of 1992 from 1988 market share numbers. These 1988 forecast numbers were used because they were found intact (in a computer) and untouched since 1989. Comparison is shown worldwide, for each application, each world region, and each platform (servers, which were not followed in 1988, were added to workstations for the 1992 market share numbers). These figures demonstrate Dataquest's history of successfully forecasting multiple elements of the CAD/CAM/CAE and GIS markets.

Fundamental to the way Dataquest conducts its research is an underlying philosophy that says the best data and analyses come from a well-balanced program. This program includes the following: balance between primary and secondary collection techniques; balance between supply-side and demand-side analysis; balance between focused, industry-specific research and coordinated, "big-picture" analysis aided by integration of data from the more than 25 separate high-technology industries Dataquest covers; and balance between the perspectives of experienced industry professionals and rigorous, disciplined techniques of seasoned market researchers.

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Figure 6
1992 Actual Total Revenue versus Dataquest 1988 Forecast for 1992



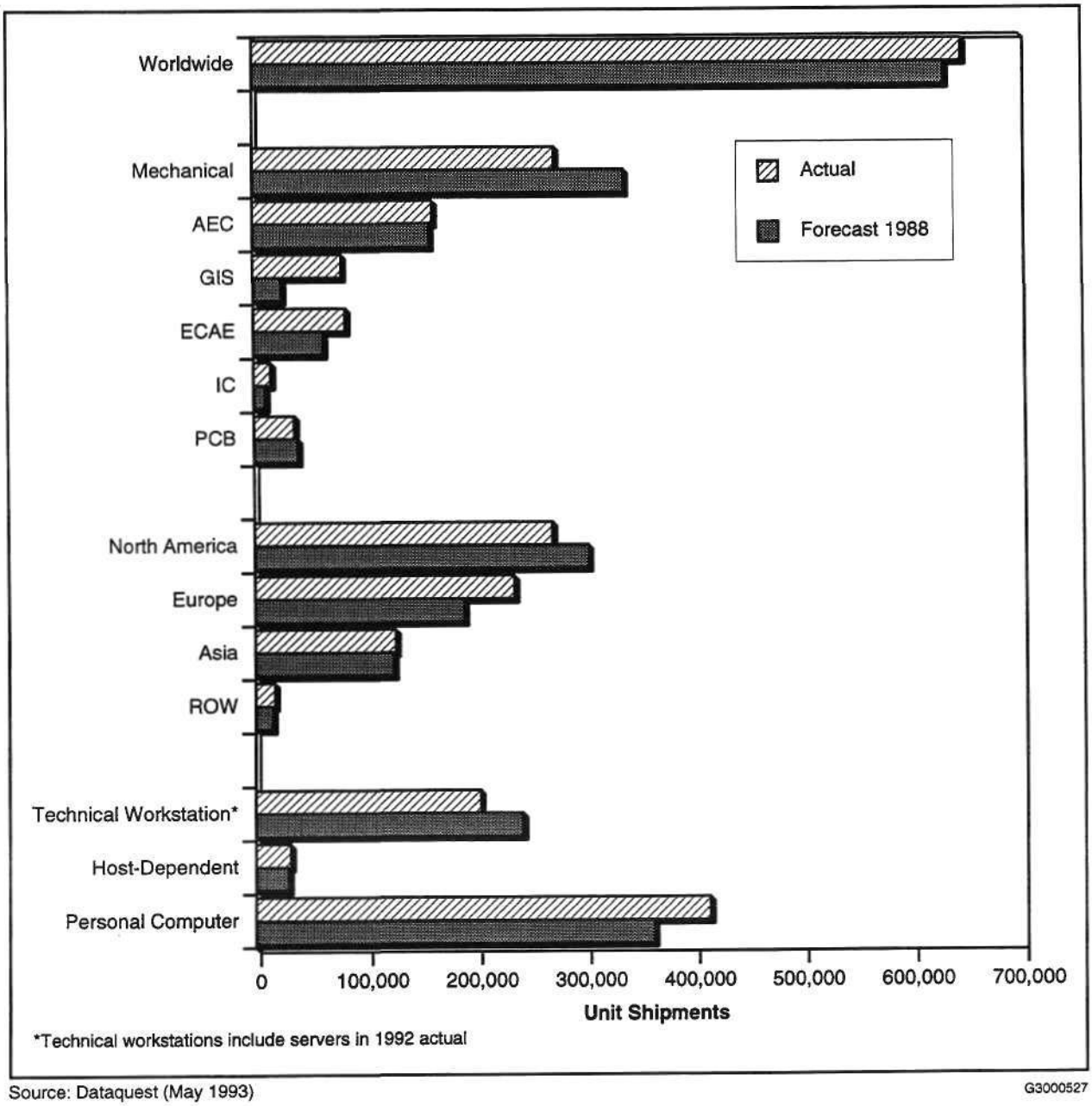
Source: Dataquest (May 1993)

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Dataquest also analyzes trends in the macro environment, which can have major influences on both supply-side and demand-side forecasting. In addition to demographics, analysts look at gross national product (GNP) growth, interest rate fluctuation, business expectations, and capital spending plans. In the geopolitical arena, the group looks at trade issues, political stability or lack thereof, tariffs, nontariff barriers, and such factors as the effect on Europe from the events of 1993.

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Figure 7
1992 Actual Unit Shipments versus Dataquest 1988 Forecast for 1992



Source: Dataquest (May 1993)

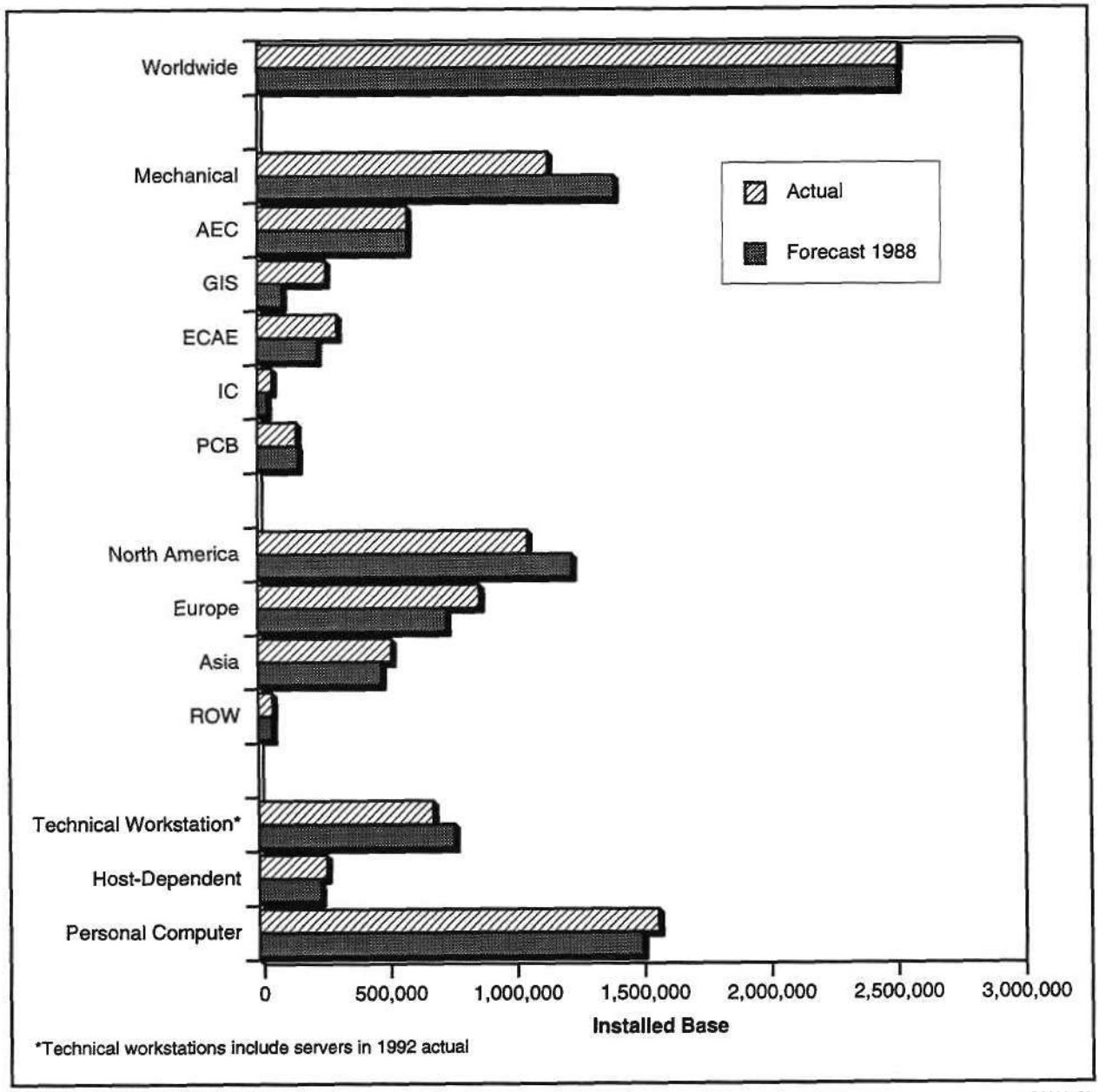
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Figure 9 shows the CAD/CAM/CAE and GIS forecasting model. The overall forecasting process uses a combination of forecasting techniques such as time series and technological modeling. Market estimates and forecasts are derived using the following research techniques:

- "Bottom-up" aggregation—This method involves adding all relevant vendor contributions to arrive at total market estimates for all historical data.

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Figure 8
1992 Actual Installed Base versus Dataquest 1988 Forecast for 1992



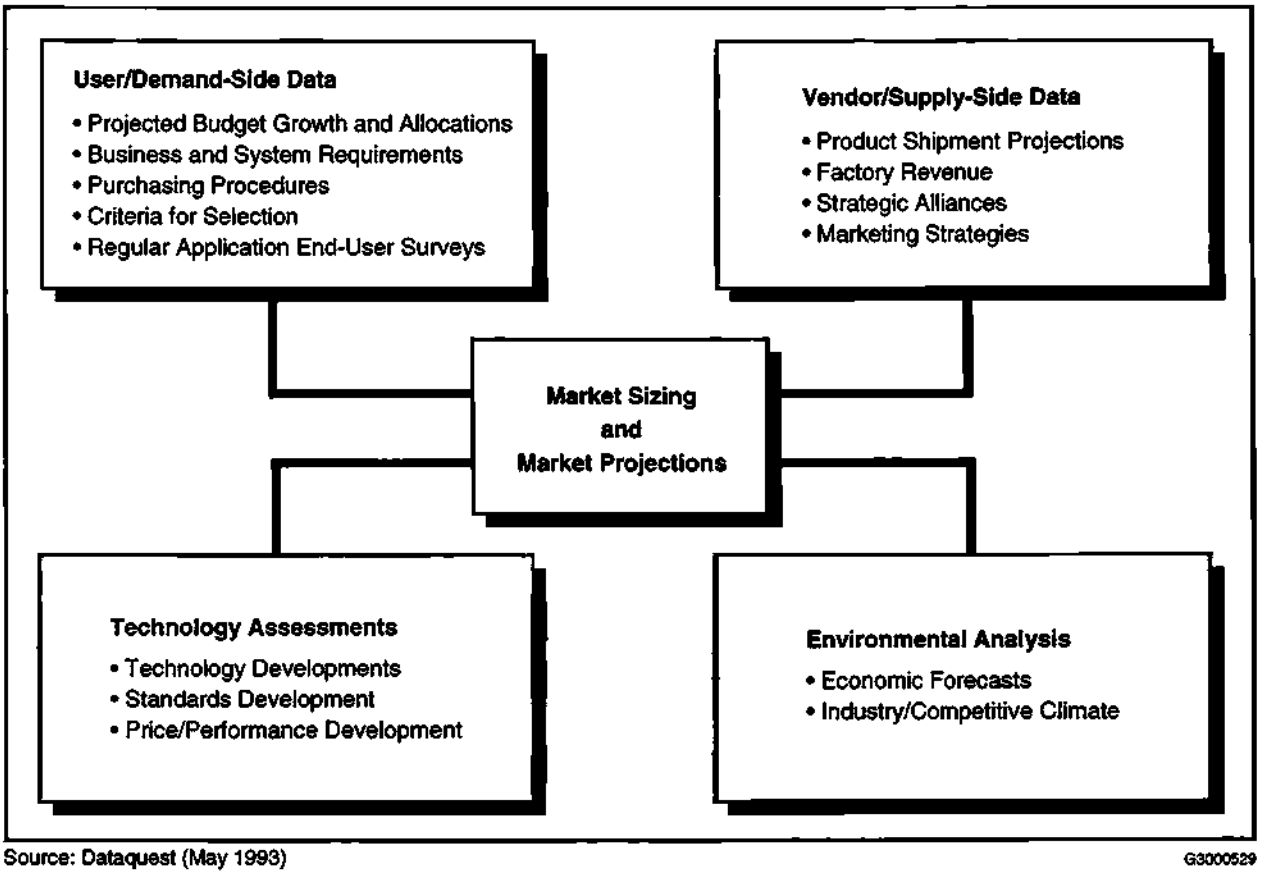
Source: Dataquest (May 1993)

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- Segment forecasting—For each application segment tracked by the CAD/CAM/CAE and GIS group, individual forecasts are derived following the basic information model defined previously. Specifically, each design phase covered within each application is segmented by product, region, and platform. In this way, each application segment incorporates its own set of unique assumptions.

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Figure 9
CAD/CAM/CAE and GIS Forecasting Model



Source: Dataquest (May 1993) G3000529

- Demand-based analysis—Market growth is tracked and forecast in terms of the present and anticipated demand of current and future users. This requires the development of a total available market model and a satisfied available market figure to assess the levels of penetration accurately. Installed base is also evaluated. Rates of product retirement are primarily based on input from end users in our ongoing survey programs. Dataquest analysts also factor in the acceptance or ability for users to consume new technology.
- Capacity-based analysis—This method involves identifying future shipment volume constraints. These constraints, or "ceilings," can be the result of component availability, manufacturing capacity, or distribution capacity. In any case, capacity limitations are capable of keeping shipments below the demand level.

Segmentation Definitions

This section lists the definitions specific to this document. The following paragraphs define the segments.

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Applications

Mechanical

The mechanical segment refers to computer-aided tools used by engineers, designers, analysts, technicians, and draftspeople working predominantly in the discrete manufacturing industries, but includes government and education. Users of mechanical CAD/CAM/CAE tools work in all departments across the typical organization, with a majority found in product design, advanced engineering, and manufacturing engineering. Common design applications include conceptual design, industrial design, structural or thermal analysis, detail design, and electromechanical design (the mechanical part of design with electrical or electronic components and mechanisms). Common manufacturing applications include tool and fixture design, numerical control part programming, off-line robotics programming, and interface to quality control systems. Management tools for database control and distribution are included in this segment, as well as user-defined application programming.

Architecture, Engineering, and Construction (AEC)

The AEC segment covers the use of computer-aided tools by architects, contractors, plant engineers, civil engineers, and other people associated with these disciplines to aid in designing and managing buildings, industrial plants, ships, and other types of nondiscrete entities.

Geographic Information Systems (GIS)/Mapping

GIS is computer-based technology, and the segment is composed of hardware, software, and data used to capture, edit, display, and analyze spatial (tagged by location) information.

Electronic Design Automation (EDA)

The EDA segment covers computer-based tools used to automate the process of designing an electronic product, including printed circuit boards, ICs, and systems. EDA includes ECAE, IC layout, and PCB/hybrid/MCM, as follows:

- Electronic Computer-Aided Engineering (CAE)—These are computer-aided tools used in the engineering or design phase of electronic products (as opposed to the physical layout phase of the product). Examples of electronic CAE applications are schematic capture and simulation.
- IC Layout—This is a software application tool used to create and validate the physical implementation of an IC. The IC layout category comprises polygon editors, symbolic editors, placement and routing (gate array, cell, and block), design verification tools (DRC/ERC/logic-to-layout), compilers, and module development tools.
- PCB/Hybrid/MCM—This segment covers products used to create the placement and routing of the traces and components laid out on a printed circuit board. Also included in this category are thermal analysis tools.

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Regions

The following paragraphs define the regions.

North America

North America includes United States, Mexico, and Canada.

Europe

Europe includes the United Kingdom, Scandinavia, Benelux, France, Germany, Italy, Spain, and Rest of Europe.

Asia

Asia includes Japan, Singapore, Taiwan, Korea, China, and Hong Kong.

Rest of World

Rest of World includes all other countries including Australia, New Zealand, Oceania, Africa, Central America, South America, and the Middle East.

Platforms

The following paragraphs define the platforms.

Technical Workstation

A technical workstation is a single-user computer distinguished from a personal computer by its features and by the user's potential range of expansion on the platform. Features include a virtual, multitasking operating system (UNIX, VMS, or Domain); the computer is designed by the manufacturer to run high-performance graphics applications in a multiuser/multitasking environment.

Host-Dependent

Host-dependent is a shared logic system in which the external workstations' functions are dependent on a host computer.

Server

A server is a computer that transparently provides its resources for use by other computer systems. It is a system on a network that provides specific functionality to other computer systems: the clients. Functions include file storage, database access, and compute capability. Dataquest tracks the following major categories of servers used for CAD/CAM/CAE and GIS applications:

- Compute Servers—These systems provide capabilities for solving numerical problems (for example, simulations, statistical calculations, and simultaneous partial differential equations). System features usually include high-speed computational capabilities (for example, vector and parallel processing) and large memories.
- Print Servers—These systems provide access to printers, specialized printing applications software, and print-spooling resources to a network.
- File Servers—These systems provide mass storage capability to clients on a network. Services can range from temporary storage of working files to long-term backup and archive systems.

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- Database Servers—These systems manage databases as a shared resource to a network. These servers handle such functions as physical data storage, data security, and high-level queries and can access stored information at the record level.

Personal Computer

A personal computer is a single-user computer distinguished from a technical workstation by its features and by the user's potential range of expansion on the platform. Features found in technical workstations (such as a virtual operating system, networking, high-performance graphics, multiuser/multitasking capability) are optional rather than integrated by the manufacturer.

Line Items

Line item definitions are as follows:

- Average selling price (ASP) is defined as the average price of a product, inclusive of any discounts.
- CPU revenue is the portion of revenue derived from a system sale that is related to the value of the CPU. (In the case of technical workstations and personal computers, CPU revenue contains the terminal revenue.)
- CPU shipment is defined as the number of CPUs delivered.
- CPU installed base is defined as the total number of CPUs in active, day-to-day use.
- Unit shipment is defined as the number of products delivered (that is, seats).
- Seats are defined as the number of possible simultaneous users.
- Installed seats are defined as the total number of seats in active, day-to-day use.
- Hardware revenue is defined as the sum of the revenue from the hardware system components: CPU revenue, terminal revenue, and peripherals revenue.
- Peripherals revenue is defined as the value of all the peripherals of a turnkey sale. (Peripherals in this category typically are input and output devices.)
- Terminal revenue is defined as revenue derived from the sale of terminals used to graphically create, analyze, or manipulate designs. The term is applicable only to the host-dependent platform, as terminal revenue is contained within CPU revenue for technical workstations and PCs.
- Software revenue is revenue derived from the sale of bundle (part of a turnkey system) and unbundled software.

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- Service revenue is defined as revenue derived from the service and support of CAD/CAM/CAE or GIS systems. Service revenue can be calculated in the tables by subtracting hardware and software revenue from total revenue.
- Total factory revenue is defined as the amount of money received by a manufacturer for its goods measured in U.S. dollars and is the sum of hardware, software, and service revenue. Total factory revenue does not include revenue that a company may receive from products sold to another company for resale (OEM revenue).

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Table 3
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: Worldwide
Platform: All Platforms

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	71,310	95,913	123,237	153,850	159,313	181,530	205,280	229,380	254,550	277,580	22	12
Unit Shipments or Seats	74,788	99,916	127,295	157,171	161,713	182,820	205,910	229,590	254,570	277,500	21	11
CPU Installed Base	186,494	267,091	362,538	472,419	569,607	669,570	771,520	874,830	981,710	1,091,750	32	14
Installed Seats	203,079	286,438	384,056	494,623	591,085	688,750	787,610	887,330	990,490	1,097,070	31	13
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	64.8	47.8	42.6	36.6	35.8	32.4	29.9	28.5	27.7	27.3	-14	-5
Hardware-Only ASP	7.2	6.8	6.1	5.4	5.4	4.7	4.3	4.0	3.8	3.7	-7	-7
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	915	1,128	1,278	1,358	1,334	1,343	1,369	1,426	1,510	1,595	10	4
CPU Revenue	727	919	1,056	1,131	1,119	1,144	1,174	1,226	1,298	1,368	11	4
Terminal Revenue	99	66	56	50	43	23	11	4	1	0	-19	-64
Peripheral Revenue (Turnkey)	89	143	166	177	172	176	185	197	212	226	18	6
Software Revenue	385	466	625	682	730	796	875	966	1,072	1,178	17	10
Bundled	164	229	278	311	327	347	372	404	444	483	19	8
Unbundled	221	237	348	371	403	449	503	562	628	695	16	11
Service Revenue	241	266	305	328	340	351	374	402	442	483	9	7
Total Factory Revenue	1,541	1,860	2,209	2,368	2,404	2,490	2,618	2,794	3,024	3,255	12	6
Increase over Prior Year (%)	22	21	19	7	2	4	5	7	8	8		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

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Table 4
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: Worldwide
Platform: Technical Workstation

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	8,081	13,472	19,142	22,967	27,319	31,730	36,770	42,240	48,250	54,260	36	15
Unit Shipments or Seats	8,081	13,472	19,142	22,967	27,319	31,730	36,770	42,240	48,250	54,260	36	15
CPU Installed Base	17,561	29,983	47,235	66,817	88,576	111,930	136,530	162,310	189,530	218,550	50	20
Installed Seats	17,561	29,983	47,235	66,817	88,576	111,930	136,530	162,310	189,530	218,550	50	20
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	59.4	52.1	43.4	44.0	39.8	38.1	36.5	35.4	34.6	33.9	-10	-3
Hardware-Only ASP	23.4	18.3	17.7	13.9	12.9	12.0	11.0	10.3	9.9	9.6	-14	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	308	412	510	540	549	596	645	703	771	836	16	9
CPU Revenue	265	322	395	417	426	465	503	548	601	651	13	9
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	43	90	115	123	123	131	142	155	170	185	30	8
Software Revenue	146	194	248	294	310	348	392	442	501	560	21	13
Bundled	87	148	190	216	229	258	289	326	368	407	27	12
Unbundled	59	46	58	78	81	91	103	116	134	153	8	14
Service Revenue	122	151	185	202	224	245	272	300	334	368	16	10
Total Factory Revenue	576	757	943	1,036	1,082	1,190	1,308	1,444	1,607	1,764	17	10
Increase over Prior Year (%)	58	31	25	10	4	10	10	10	11	10		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

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Table 5
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: Worldwide
Platform: Host-Dependent

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	958	1,259	2,161	1,723	1,314	960	640	370	180	50	8	-48
Unit Shipments or Seats	4,436	5,262	6,219	5,043	3,713	2,260	1,290	610	240	60	-4	-56
CPU Installed Base	4,859	5,716	7,334	8,370	8,881	9,030	8,710	7,950	6,830	5,670	16	-9
Installed Seats	21,444	25,063	28,852	30,573	30,359	28,210	24,800	20,450	15,620	10,990	9	-18
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	322.0	398.2	137.9	120.5	144.8	130.3	116.3	103.4	88.9	85.1	-18	-10
Hardware-Only ASP	477.5	156.1	168.9	238.3	212.8	189.6	182.6	187.6	208.2	198.6	-18	-1
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	288	270	259	197	170	106	61	29	12	3	-12	-55
CPU Revenue	162	177	179	130	115	74	45	22	10	2	-8	-54
Terminal Revenue	99	66	56	50	43	23	11	4	1	0	-19	-64
Peripheral Revenue (Turnkey)	27	27	23	17	12	9	5	3	1	0	-18	-52
Software Revenue	85	70	77	66	55	38	24	12	5	1	-10	-53
Bundled	54	54	59	49	43	30	20	11	5	1	-6	-51
Unbundled	31	16	18	17	12	8	4	1	0	0	-21	-100
Service Revenue	93	81	79	58	46	29	17	8	3	1	-16	-56
Total Factory Revenue	466	421	414	321	271	173	102	50	20	5	-13	-55
Increase over Prior Year (%)	-13	-10	-1	-23	-16	-36	-41	-51	-60	-74		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

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Table 6
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: Worldwide
Platform: Server

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	NA	NA	NA	1,619	1,682	1,880	2,160	2,480	2,820	3,170	NA	14
Unit Shipments or Seats	NA	NA	NA	1,619	1,682	1,880	2,160	2,480	2,820	3,170	NA	14
CPU Installed Base	NA	NA	NA	1,619	3,301	5,080	7,010	8,870	10,820	12,360	NA	30
Installed Seats	NA	NA	NA	1,619	3,301	5,080	7,010	8,870	10,820	12,360	NA	30
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	NA	NA	NA	62.9	55.5	53.8	51.8	49.9	48.0	46.2	NA	-4
Hardware-Only ASP	NA	NA	NA	28.8	31.8	29.2	26.6	25.1	24.2	23.7	NA	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	NA	NA	NA	60	58	61	66	72	78	85	NA	8
CPU Revenue	NA	NA	NA	49	47	50	54	59	64	69	NA	8
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	NA	NA	NA	11	10	11	12	13	14	15	NA	8
Software Revenue	NA	NA	NA	20	21	23	26	29	33	36	NA	11
Bundled	NA	NA	NA	20	21	23	25	29	32	35	NA	11
Unbundled	NA	NA	NA	NA	0	0	1	1	1	1	NA	13
Service Revenue	NA	NA	NA	28	29	32	35	38	42	46	NA	9
Total Factory Revenue	NA	NA	NA	107	108	116	127	140	153	166	NA	9
Increase over Prior Year (%)	NA	NA	NA	NA	1	7	9	10	10	9		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

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Table 7
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: Worldwide
Platform: Personal Computer

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	62,271	81,183	101,933	127,542	128,999	146,960	165,700	184,290	203,290	220,100	20	11
Unit Shipments or Seats	62,271	81,183	101,933	127,542	128,999	146,950	165,680	184,260	203,260	220,010	20	11
CPU Installed Base	164,074	231,392	307,969	395,614	468,850	543,530	619,270	695,700	774,540	855,170	30	13
Installed Seats	164,074	231,392	307,969	395,614	468,850	543,530	619,270	695,700	774,540	855,170	30	13
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	17.7	17.3	17.9	11.3	13.8	12.0	10.8	10.1	9.6	9.2	-6	-8
Hardware-Only ASP	4.8	4.7	4.4	4.1	3.9	3.6	3.3	3.1	3.0	2.9	-5	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	319	446	510	562	557	579	598	622	649	671	15	4
CPU Revenue	300	420	482	536	531	554	572	597	624	646	15	4
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	19	26	29	26	26	25	25	25	26	25	8	-0
Software Revenue	154	202	300	303	345	386	433	482	533	580	22	11
Bundled	23	27	28	27	35	36	37	38	39	39	11	2
Unbundled	131	175	272	276	310	350	396	444	494	541	24	12
Service Revenue	25	35	41	40	41	45	51	56	62	68	13	11
Total Factory Revenue	499	683	852	905	942	1,011	1,082	1,161	1,244	1,319	17	7
Increase over Prior Year (%)	38	37	25	6	4	7	7	7	7	6		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

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Table 8
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: North America
Platform: All Platforms

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	41,136	44,446	50,960	67,687	71,707	82,130	92,050	101,560	111,970	121,440	15	11
Unit Shipments or Seats	42,795	45,811	52,751	69,123	72,341	82,340	92,110	101,570	111,970	121,440	14	11
CPU Installed Base	110,827	145,354	179,126	221,029	258,703	299,750	343,390	388,130	433,980	479,720	24	13
Installed Seats	120,700	155,584	189,748	231,322	267,735	307,040	348,880	391,900	436,150	480,490	22	12
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	78.5	69.6	56.2	49.3	40.1	36.8	34.7	33.5	32.5	31.7	-15	-5
Hardware-Only ASP	5.7	6.4	6.0	5.2	4.9	4.3	3.9	3.7	3.5	3.4	-4	-7
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	386	430	457	493	463	460	469	488	515	540	5	3
CPU Revenue	324	361	380	420	406	412	422	439	462	485	6	4
Terminal Revenue	40	24	28	25	13	4	1	0	0	0	-24	-100
Peripheral Revenue (Turnkey)	21	46	50	48	44	45	46	49	52	55	20	5
Software Revenue	154	159	206	230	241	262	290	321	355	392	12	10
Bundled	41	57	72	80	73	76	80	87	95	103	15	7
Unbundled	113	102	134	150	168	187	210	234	261	289	11	11
Service Revenue	109	112	127	132	123	123	131	141	153	167	3	6
Total Factory Revenue	648	702	791	855	827	846	891	949	1,023	1,099	6	6
Increase over Prior Year (%)	10	8	13	8	-3	2	5	7	8	7		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

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Table 9
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: North America
Platform: Technical Workstation

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	3,230	4,642	5,973	7,333	8,116	9,220	10,450	11,810	13,230	14,770	26	13
Unit Shipments or Seats	3,230	4,642	5,973	7,333	8,116	9,220	10,450	11,810	13,230	14,770	26	13
CPU Installed Base	8,736	12,673	17,526	23,183	28,843	34,930	41,170	47,570	54,290	61,370	35	16
Installed Seats	8,736	12,673	17,526	23,183	28,843	34,930	41,170	47,570	54,290	61,370	35	16
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	57.9	57.1	48.1	44.4	37.4	35.7	34.3	33.2	32.4	31.7	-10	-3
Hardware-Only ASP	27.3	17.0	16.4	12.8	12.8	11.6	10.7	10.1	9.7	9.4	-17	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	131	152	172	169	154	161	170	180	192	206	4	6
CPU Revenue	117	119	134	132	122	127	134	142	152	162	1	6
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	14	33	38	36	33	34	36	38	41	44	24	6
Software Revenue	54	57	78	84	85	94	104	116	129	143	12	11
Bundled	28	43	57	61	58	62	68	74	81	88	20	9
Unbundled	27	15	21	23	27	31	36	42	48	55	0	16
Service Revenue	56	68	84	87	83	89	96	104	113	124	10	8
Total Factory Revenue	242	277	334	340	322	343	369	400	435	472	7	8
Increase over Prior Year (%)	49	14	20	2	-5	7	8	8	9	9		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

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Table 10
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: North America
Platform: Host-Dependent

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	332	527	520	287	218	80	20	0	0	0	-10	-100
Unit Shipments or Seats	1,991	1,891	2,310	1,724	852	290	90	10	0	0	-19	-100
CPU Installed Base	2,492	2,708	2,876	2,770	2,577	2,290	1,950	1,570	1,230	970	1	-18
Installed Seats	12,365	12,937	13,499	13,063	11,609	9,580	7,440	5,340	3,390	1,740	-2	-32
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	273.4	330.3	216.9	230.8	273.6	261.3	250.6	240.2	230.0	220.8	0	-4
Hardware-Only ASP	804.8	151.4	188.6	249.4	177.8	161.9	148.6	136.2	124.7	114.7	-31	-8
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	112	96	90	60	39	13	4	0	0	0	-23	-100
CPU Revenue	64	63	55	32	24	8	2	0	0	0	-22	-100
Terminal Revenue	40	24	28	25	13	4	1	0	0	0	-24	-100
Peripheral Revenue (Turnkey)	7	9	7	3	2	1	0	0	0	0	-28	-100
Software Revenue	30	21	22	15	10	5	2	1	0	0	-24	-100
Bundled	13	14	15	9	5	2	1	0	0	0	-22	-100
Unbundled	16	7	7	5	5	3	1	0	0	0	-25	-100
Service Revenue	41	32	31	19	12	4	1	0	0	0	-26	-100
Total Factory Revenue	182	149	143	94	61	22	7	1	0	0	-24	-100
Increase over Prior Year (%)	-30	-18	-4	-34	-35	-63	-67	-86	-100	NA		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

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Table 11
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: North America
Platform: Server

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	NA	NA	NA	743	917	1,020	1,150	1,310	1,470	1,620	NA	12
Unit Shipments or Seats	NA	NA	NA	743	917	1,020	1,150	1,310	1,470	1,620	NA	12
CPU Installed Base	NA	NA	NA	743	1,660	2,620	3,650	4,630	5,620	6,370	NA	31
Installed Seats	NA	NA	NA	743	1,660	2,620	3,650	4,630	5,620	6,370	NA	31
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	NA	NA	NA	58.1	45.9	43.8	42.0	40.3	38.6	37.0	NA	-4
Hardware-Only ASP	NA	NA	NA	34.3	30.9	28.1	25.8	24.5	23.8	23.3	NA	-5
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	NA	NA	NA	28	27	28	30	32	35	37	NA	6
CPU Revenue	NA	NA	NA	22	22	23	25	26	28	30	NA	6
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	NA	NA	NA	5	5	5	6	6	6	7	NA	6
Software Revenue	NA	NA	NA	9	10	11	12	13	14	15	NA	9
Bundled	NA	NA	NA	9	10	10	11	12	13	14	NA	8
Unbundled	NA	NA	NA	NA	0	0	0	1	1	1	NA	14
Service Revenue	NA	NA	NA	14	15	16	17	18	20	21	NA	7
Total Factory Revenue	NA	NA	NA	51	52	55	59	63	68	73	NA	7
Increase over Prior Year (%)	NA	NA	NA	NA	3	5	8	8	8	7		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

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Table 12
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: North America
Platform: Personal Computer

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	37,574	39,277	44,467	59,323	62,457	71,810	80,410	88,450	97,280	105,050	14	11
Unit Shipments or Seats	37,574	39,277	44,467	59,323	62,457	71,810	80,410	88,450	97,280	105,050	14	11
CPU Installed Base	99,599	129,974	158,723	194,332	225,624	259,900	296,610	334,360	372,840	411,010	23	13
Installed Seats	99,599	129,974	158,723	194,332	225,624	259,900	296,610	334,360	372,840	411,010	23	13
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	9.9	18.4	21.6	14.9	13.6	12.2	11.0	10.4	9.8	9.4	8	-7
Hardware-Only ASP	3.8	4.6	4.4	4.0	3.9	3.6	3.3	3.1	2.9	2.8	1	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	143	182	196	236	243	258	266	275	287	298	14	4
CPU Revenue	143	178	191	233	238	254	262	270	282	293	14	4
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	0	4	5	3	4	5	5	5	5	5	151	3
Software Revenue	70	81	106	122	136	153	172	191	212	234	18	11
Bundled	0	1	1	1	1	1	1	1	1	1	42	-1
Unbundled	70	80	105	121	136	152	172	191	212	233	18	11
Service Revenue	11	12	13	12	13	15	17	18	20	22	3	12
Total Factory Revenue	224	276	314	370	392	426	455	484	520	554	15	7
Increase over Prior Year (%)	33	23	14	18	6	9	7	6	7	7		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

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Table 13
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: Europe
Platform: All Platforms

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	19,650	30,806	40,542	53,504	57,825	64,660	73,510	83,160	93,570	103,290	31	12
Unit Shipments or Seats	20,753	32,168	41,857	54,556	58,688	65,210	73,780	83,240	93,570	103,290	30	12
CPU Installed Base	48,520	75,885	109,593	151,511	191,896	231,940	272,020	312,590	354,920	399,380	41	16
Installed Seats	52,146	80,749	115,499	158,008	198,621	238,370	277,700	317,210	358,350	401,710	40	15
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	47.2	55.1	46.4	41.2	37.2	34.1	31.7	30.4	29.6	29.1	-6	-5
Hardware-Only ASP	9.7	7.4	6.5	5.5	5.7	5.1	4.6	4.2	4.0	3.9	-12	-7
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	309	378	433	466	503	516	534	563	606	648	13	5
CPU Revenue	255	304	361	389	415	432	451	478	515	550	13	6
Terminal Revenue	27	23	18	16	18	11	6	2	0	0	-10	-100
Peripheral Revenue (Turnkey)	28	51	54	60	70	73	78	83	91	98	26	7
Software Revenue	147	187	268	280	317	349	384	425	477	526	21	11
Bundled	59	86	100	116	146	163	180	199	222	243	25	11
Unbundled	87	101	168	165	171	186	204	226	255	284	18	11
Service Revenue	90	96	112	118	143	153	166	181	202	222	12	9
Total Factory Revenue	546	661	812	864	963	1,017	1,084	1,168	1,286	1,396	15	8
Increase over Prior Year (%)	43	21	23	6	11	6	7	8	10	9		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

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Table 14
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: Europe
Platform: Technical Workstation

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	3,439	5,250	7,116	8,964	12,685	14,960	17,490	20,140	23,190	25,990	39	15
Unit Shipments or Seats	3,439	5,250	7,116	8,964	12,685	14,960	17,490	20,140	23,190	25,990	39	15
CPU Installed Base	5,848	10,883	17,507	25,395	36,164	48,000	60,660	74,160	88,500	103,460	58	23
Installed Seats	5,848	10,883	17,507	25,395	36,164	48,000	60,660	74,160	88,500	103,460	58	23
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	49.4	49.1	43.2	42.6	36.7	35.5	34.0	33.0	32.2	31.5	-7	-3
Hardware-Only ASP	25.9	18.4	16.7	13.2	12.9	12.1	11.1	10.5	10.1	9.8	-16	-5
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	114	148	183	196	230	260	286	314	347	374	19	10
CPU Revenue	99	115	147	154	179	204	225	246	273	294	16	10
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	15	33	36	41	52	56	62	67	75	81	37	9
Software Revenue	64	88	105	135	154	177	201	226	259	287	25	13
Bundled	36	60	72	86	108	128	148	167	191	209	31	14
Unbundled	28	28	32	49	46	49	54	59	68	78	13	11
Service Revenue	50	58	70	75	100	113	128	142	160	175	19	12
Total Factory Revenue	227	293	358	405	484	550	615	682	766	837	21	12
Increase over Prior Year (%)	79	29	22	13	20	14	12	11	12	9		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

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Table 15
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: Europe
Platform: Host-Dependent

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	360	478	481	266	217	160	90	30	0	0	-12	-100
Unit Shipments or Seats	1,463	1,840	1,796	1,317	1,079	700	350	100	0	0	-7	-100
CPU Installed Base	1,070	1,510	1,910	2,061	2,118	2,060	1,870	1,590	1,300	1,060	19	-13
Installed Seats	4,695	6,374	7,816	8,558	8,843	8,480	7,550	6,210	4,730	3,390	17	-17
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	226.6	338.8	226.6	266.8	405.6	360.5	345.1	329.4	.0	.0	16	-100
Hardware-Only ASP	613.0	158.7	157.0	211.5	213.6	191.8	176.6	162.2	.0	.0	-23	-100
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	89	94	77	51	52	34	17	5	0	0	-13	-100
CPU Revenue	54	63	52	32	31	20	10	3	0	0	-13	-100
Terminal Revenue	27	23	18	16	18	11	6	2	0	0	-10	-100
Peripheral Revenue (Turnkey)	8	8	6	4	3	2	1	0	0	0	-23	-100
Software Revenue	26	22	21	18	17	11	6	2	0	0	-10	-100
Bundled	15	18	16	13	13	9	5	2	0	0	-4	-100
Unbundled	10	4	4	5	4	3	1	0	0	0	-20	-100
Service Revenue	31	27	26	18	16	10	5	2	0	0	-16	-100
Total Factory Revenue	146	143	123	87	84	56	28	9	0	0	-13	-100
Increase over Prior Year (%)	6	-2	-14	-29	-3	-34	-49	-68	-99	-100		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

Table 16
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: Europe
Platform: Server

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	NA	NA	NA	528	541	610	710	840	980	1,120	NA	16
Unit Shipments or Seats	NA	NA	NA	528	541	610	710	840	980	1,120	NA	16
CPU Installed Base	NA	NA	NA	528	1,070	1,650	2,290	2,930	3,620	4,200	NA	31
Installed Seats	NA	NA	NA	528	1,070	1,650	2,290	2,930	3,620	4,200	NA	31
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	NA	NA	NA	69.4	66.9	64.4	61.8	59.3	56.8	54.5	NA	-4
Hardware-Only ASP	NA	NA	NA	28.9	33.7	30.3	27.6	26.2	25.2	24.7	NA	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	NA	NA	NA	20	22	23	25	28	32	35	NA	10
CPU Revenue	NA	NA	NA	17	18	19	21	23	26	28	NA	10
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	NA	NA	NA	4	4	4	5	5	6	6	NA	11
Software Revenue	NA	NA	NA	6	8	9	10	12	14	15	NA	15
Bundled	NA	NA	NA	6	8	9	10	12	14	15	NA	15
Unbundled	NA	NA	NA	NA	0	0	0	0	0	0	NA	-13
Service Revenue	NA	NA	NA	9	11	11	13	15	17	18	NA	12
Total Factory Revenue	NA	NA	NA	36	40	43	48	55	62	69	NA	11
Increase over Prior Year (%)	NA	NA	NA	NA	11	8	12	13	13	11		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

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Table 17
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: Europe
Platform: Personal Computer

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	15,851	25,078	32,945	43,746	44,382	48,940	55,220	62,160	69,400	76,180	29	11
Unit Shipments or Seats	15,851	25,078	32,945	43,746	44,382	48,940	55,220	62,160	69,400	76,180	29	11
CPU Installed Base	41,603	63,491	90,177	123,527	152,545	180,230	207,210	233,910	261,510	290,660	38	14
Installed Seats	41,603	63,491	90,177	123,527	152,545	180,230	207,210	233,910	261,510	290,660	38	14
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	14.9	24.7	25.7	17.0	19.9	16.6	14.9	14.0	13.3	12.8	8	-8
Hardware-Only ASP	6.3	4.9	4.7	4.2	4.0	3.7	3.4	3.2	3.0	2.9	-11	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	107	136	173	198	199	199	205	216	227	239	17	4
CPU Revenue	102	126	161	187	187	189	195	205	217	228	16	4
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	5	10	12	12	12	11	10	10	10	11	25	-2
Software Revenue	57	78	142	121	138	152	166	184	205	224	25	10
Bundled	8	9	12	10	17	17	17	17	18	18	21	1
Unbundled	49	69	131	111	121	134	149	167	187	206	25	11
Service Revenue	9	11	16	17	17	18	20	23	25	28	17	11
Total Factory Revenue	173	225	331	336	354	369	392	423	457	490	20	7
Increase over Prior Year (%)	48	30	47	1	6	4	6	8	8	7		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

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Table 18
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: Asia
Platform: All Platforms

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	9,090	18,865	29,199	28,502	25,616	29,840	33,970	38,040	41,710	44,920	30	12
Unit Shipments or Seats	9,667	20,028	30,026	29,216	26,485	30,360	34,260	38,170	41,730	44,840	29	11
CPU Installed Base	23,062	40,300	66,322	89,149	105,410	121,150	135,900	150,320	165,500	182,020	46	12
Installed Seats	25,498	43,831	70,521	93,749	110,407	126,020	140,360	154,110	168,490	184,140	44	11
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	84.7	34.9	34.2	28.5	32.2	28.4	25.6	23.8	23.0	22.9	-21	-7
Hardware-Only ASP	9.2	6.9	5.8	6.2	6.3	5.6	5.0	4.6	4.3	4.2	-9	-8
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	197	294	365	363	340	339	337	344	356	371	15	2
CPU Revenue	130	234	296	292	274	276	275	281	290	301	21	2
Terminal Revenue	28	18	8	7	11	7	4	2	1	0	-21	-52
Peripheral Revenue (Turnkey)	39	43	61	64	55	56	58	61	65	69	9	5
Software Revenue	78	110	142	155	157	168	182	199	216	234	19	8
Bundled	60	80	102	109	104	104	106	112	120	130	15	5
Unbundled	18	30	40	47	54	64	75	87	96	104	31	14
Service Revenue	36	49	61	67	67	67	69	71	76	82	17	4
Total Factory Revenue	311	453	568	586	565	574	587	615	648	687	16	4
Increase over Prior Year (%)	21	46	25	3	-4	2	2	5	5	6		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

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Table 19
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: Asia
Platform: Technical Workstation

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	1,230	3,259	5,734	6,117	6,164	7,140	8,360	9,760	11,220	12,800	50	16
Unit Shipments or Seats	1,230	3,259	5,734	6,117	6,164	7,140	8,360	9,760	11,220	12,800	50	16
CPU Installed Base	2,364	5,533	11,060	16,665	21,799	27,060	32,550	38,220	44,120	50,840	74	18
Installed Seats	2,364	5,533	11,060	16,665	21,799	27,060	32,550	38,220	44,120	50,840	74	18
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	104.2	50.1	39.3	45.1	48.9	46.7	44.8	43.5	42.4	41.4	-17	-3
Hardware-Only ASP	13.2	21.7	22.2	17.5	13.1	12.4	11.2	10.4	10.0	9.6	-0	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	55	100	147	161	156	167	180	199	220	244	30	9
CPU Revenue	42	78	108	119	120	128	137	152	168	186	30	9
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	14	22	39	42	37	39	42	47	52	58	28	9
Software Revenue	25	45	62	68	66	72	80	91	105	119	28	13
Bundled	21	42	59	64	60	64	70	80	91	104	29	12
Unbundled	3	3	3	4	6	8	10	12	14	15	17	20
Service Revenue	13	19	28	33	36	38	41	46	53	60	29	11
Total Factory Revenue	93	164	237	262	258	276	301	336	377	423	29	10
Increase over Prior Year (%)	35	77	44	11	-1	7	9	12	12	12		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

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Table 20
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: Asia
Platform: Host-Dependent

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	244	224	1,121	1,153	868	720	530	340	180	50	37	-43
Unit Shipments or Seats	822	1,387	1,948	1,867	1,737	1,250	850	500	240	60	21	-49
CPU Installed Base	1,123	1,304	2,334	3,331	4,004	4,520	4,750	4,680	4,220	3,570	37	-2
Installed Seats	3,559	4,835	6,533	7,931	9,000	9,390	9,220	8,460	7,210	5,700	26	-9
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	594.2	560.6	98.6	88.9	106.4	101.3	97.0	92.8	88.9	85.1	-35	-4
Hardware-Only ASP	124.9	156.9	137.0	255.4	384.5	219.7	218.0	214.4	208.2	198.6	32	-12
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	81	73	86	81	77	59	40	24	12	3	-1	-48
CPU Revenue	41	46	68	64	58	46	32	19	10	2	9	-47
Terminal Revenue	28	18	8	7	11	7	4	2	1	0	-21	-52
Peripheral Revenue (Turnkey)	12	9	10	10	8	6	4	3	1	0	-10	-47
Software Revenue	27	25	32	32	26	20	15	9	5	1	-1	-46
Bundled	23	21	27	27	25	19	14	9	5	1	1	-45
Unbundled	4	4	5	5	2	1	1	0	0	0	-17	-100
Service Revenue	19	19	21	20	17	14	10	6	3	1	-2	-46
Total Factory Revenue	126	118	140	132	121	93	65	39	20	5	-1	-47
Increase over Prior Year (%)	7	-7	19	-5	-9	-23	-30	-40	-50	-74		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

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Table 21
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: Asia
Platform: Server

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	NA	NA	NA	255	158	180	200	230	270	300	NA	14
Unit Shipments or Seats	NA	NA	NA	255	158	180	200	230	270	300	NA	14
CPU Installed Base	NA	NA	NA	255	413	580	760	940	1,120	1,260	NA	25
Installed Seats	NA	NA	NA	255	413	580	760	940	1,120	1,260	NA	25
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	NA	NA	NA	70.5	79.9	81.2	77.8	74.7	71.5	68.7	NA	-3
Hardware-Only ASP	NA	NA	NA	19.0	33.2	33.5	29.4	26.9	25.0	24.2	NA	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	NA	NA	NA	9	7	8	9	9	10	10	NA	8
CPU Revenue	NA	NA	NA	7	6	7	7	8	8	9	NA	8
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	NA	NA	NA	2	1	1	1	2	2	2	NA	7
Software Revenue	NA	NA	NA	3	2	3	3	3	4	4	NA	10
Bundled	NA	NA	NA	3	2	3	3	3	4	4	NA	10
Unbundled	NA	NA	NA	NA	0	0	0	0	0	0	NA	15
Service Revenue	NA	NA	NA	3	3	3	4	4	4	5	NA	9
Total Factory Revenue	NA	NA	NA	15	13	14	15	17	18	19	NA	9
Increase over Prior Year (%)	NA	NA	NA	NA	-14	12	7	9	7	7		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

Table 22
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: Asia
Platform: Personal Computer

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	7,615	15,382	22,344	20,977	18,427	21,810	24,880	27,710	30,040	31,780	25	12
Unit Shipments or Seats	7,615	15,382	22,344	20,977	18,427	21,800	24,860	27,680	30,000	31,690	25	11
CPU Installed Base	19,575	33,463	52,929	68,898	79,195	88,990	97,830	106,490	116,040	126,340	42	10
Installed Seats	19,575	33,463	52,929	68,898	79,195	88,990	97,830	106,490	116,040	126,340	42	10
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	21.7	15.9	15.5	9.8	11.5	10.3	9.3	8.7	8.3	7.9	-15	-7
Hardware-Only ASP	7.2	4.5	4.1	4.0	3.7	3.4	3.1	3.0	2.8	2.7	-15	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	61	121	132	112	100	106	108	113	114	114	13	3
CPU Revenue	47	109	120	101	90	96	99	102	104	104	18	3
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	14	12	12	11	10	10	10	10	10	10	-9	-0
Software Revenue	26	40	48	53	63	73	84	95	103	109	25	12
Bundled	15	17	16	16	17	18	19	20	21	20	3	4
Unbundled	11	23	32	37	46	55	65	75	82	89	42	14
Service Revenue	4	10	12	12	10	12	14	15	16	17	26	10
Total Factory Revenue	91	171	191	177	173	191	206	222	233	240	17	7
Increase over Prior Year (%)	32	87	12	-8	-2	10	8	8	5	3		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

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Table 23
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: Rest of World
Platform: All Platforms

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	1,435	1,796	2,535	4,157	4,165	4,890	5,750	6,610	7,300	7,930	31	14
Unit Shipments or Seats	1,573	1,909	2,661	4,276	4,199	4,910	5,760	6,610	7,300	7,930	28	14
CPU Installed Base	4,085	5,552	7,497	10,730	13,597	16,730	20,220	23,790	27,300	30,640	35	18
Installed Seats	4,735	6,275	8,288	11,544	14,322	17,330	20,670	24,110	27,500	30,730	32	16
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	78.6	68.1	53.3	52.0	41.8	38.7	36.6	35.3	34.3	33.4	-15	-4
Hardware-Only ASP	10.3	7.6	6.9	5.5	4.7	4.1	3.7	3.4	3.3	3.2	-18	-7
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	23	26	24	37	27	27	29	31	34	36	4	6
CPU Revenue	18	20	19	30	23	25	26	28	30	32	7	6
Terminal Revenue	3	2	2	2	1	0	0	0	0	0	-32	-100
Peripheral Revenue (Turnkey)	1	4	2	4	2	2	3	3	3	4	15	9
Software Revenue	7	9	9	16	15	17	19	21	24	26	21	11
Bundled	4	5	3	7	4	5	5	6	7	7	4	12
Unbundled	4	4	6	10	11	12	14	16	17	18	33	11
Service Revenue	7	8	5	11	7	8	8	9	11	12	2	10
Total Factory Revenue	37	44	38	64	49	52	56	62	68	73	8	8
Increase over Prior Year (%)	8	19	-13	69	-23	6	8	10	9	8		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

CAEC-WW-MS-9303

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Table 24
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: Rest of World
Platform: Technical Workstation

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	182	320	318	553	356	410	470	540	610	700	18	15
Unit Shipments or Seats	182	320	318	553	356	410	470	540	610	700	18	15
CPU Installed Base	614	894	1,143	1,573	1,771	1,940	2,160	2,350	2,620	2,880	30	10
Installed Seats	614	894	1,143	1,573	1,771	1,940	2,160	2,350	2,620	2,880	30	10
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	56.2	57.8	46.7	48.5	39.1	37.3	35.8	34.7	33.9	33.1	-9	-3
Hardware-Only ASP	22.6	11.9	13.5	11.9	13.2	12.0	11.0	10.4	10.0	9.7	-13	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	7	12	8	15	8	9	9	10	11	12	2	10
CPU Revenue	6	9	6	11	6	7	7	8	9	10	-1	10
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	1	3	2	3	2	2	2	2	3	3	18	10
Software Revenue	3	4	3	7	6	6	7	8	9	10	16	13
Bundled	2	4	2	5	3	4	4	5	5	6	16	13
Unbundled	1	1	1	2	2	3	3	3	4	4	15	13
Service Revenue	4	6	3	8	5	6	7	7	8	9	10	12
Total Factory Revenue	14	22	14	30	19	21	23	26	29	32	8	11
Increase over Prior Year (%)	90	56	-34	107	-37	10	11	12	12	12		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

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Table 25
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: Rest of World
Platform: Host-Dependent

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	22	31	40	18	11	0	0	0	0	0	-16	-100
Unit Shipments or Seats	160	144	165	136	45	20	0	0	0	0	-27	-100
CPU Installed Base	175	193	214	207	182	160	140	110	90	70	1	-17
Installed Seats	824	917	1,005	1,022	907	750	590	430	280	160	2	-29
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	277.6	348.9	188.2	214.6	292.9	279.8	268.3	257.1	246.3	236.4	1	-4
Hardware-Only ASP	960.0	205.6	151.5	315.6	190.5	173.4	159.2	145.9	133.6	122.9	-33	-8
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	7	7	6	4	2	1	0	0	0	0	-27	-100
CPU Revenue	3	4	3	2	1	0	0	0	0	0	-21	-100
Terminal Revenue	3	2	2	2	1	0	0	0	0	0	-32	-100
Peripheral Revenue (Turnkey)	0	1	0	0	0	0	0	0	0	0	-34	-100
Software Revenue	3	2	2	1	1	1	0	0	0	0	-13	-100
Bundled	2	1	1	0	0	0	0	0	0	0	-41	-100
Unbundled	1	1	1	1	1	1	0	0	0	0	15	-100
Service Revenue	3	2	2	1	1	0	0	0	0	0	-31	-100
Total Factory Revenue	12	11	9	7	4	2	1	0	0	0	-24	-100
Increase over Prior Year (%)	-39	-8	-21	-21	-42	-50	-64	-73	-70	-100		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

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Table 26
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: Rest of World
Platform: Server

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	NA	NA	NA	92	66	80	90	100	110	130	NA	14
Unit Shipments or Seats	NA	NA	NA	92	66	80	90	100	110	130	NA	14
CPU Installed Base	NA	NA	NA	92	158	230	310	380	460	520	NA	27
Installed Seats	NA	NA	NA	92	158	230	310	380	460	520	NA	27
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	NA	NA	NA	54.4	44.0	42.0	40.3	38.6	37.0	35.5	NA	-4
Hardware-Only ASP	NA	NA	NA	20.6	23.6	21.5	19.7	18.7	18.2	17.8	NA	-5
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	NA	NA	NA	3	2	2	2	2	2	3	NA	8
CPU Revenue	NA	NA	NA	2	1	1	2	2	2	2	NA	8
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	NA	NA	NA	1	0	0	0	0	1	1	NA	9
Software Revenue	NA	NA	NA	1	1	1	1	1	1	1	NA	12
Bundled	NA	NA	NA	1	1	1	1	1	1	1	NA	12
Unbundled	NA	NA	NA	NA	0	0	0	0	0	0	NA	15
Service Revenue	NA	NA	NA	2	1	1	1	1	2	2	NA	10
Total Factory Revenue	NA	NA	NA	6	4	4	4	5	5	6	NA	10
Increase over Prior Year (%)	NA	NA	NA	NA	-37	8	9	10	10	10		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

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Table 27
CAD/CAM/CAE/GIS History and Forecast

Application: AEC
Region: Rest of World
Platform: Personal Computer

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1988-1992	CAGR (%) 1992-1997
HARDWARE SHIPMENT DATA												
CPU Shipments	1,231	1,445	2,178	3,496	3,733	4,400	5,200	5,980	6,570	7,100	32	14
Unit Shipments or Seats	1,231	1,445	2,178	3,496	3,733	4,400	5,200	5,980	6,570	7,100	32	14
CPU Installed Base	3,297	4,464	6,140	8,857	11,487	14,410	17,610	20,940	24,140	27,160	37	19
Installed Seats	3,297	4,464	6,140	8,857	11,487	14,410	17,610	20,940	24,140	27,160	37	19
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	15.2	20.8	16.9	31.2	30.0	27.0	24.3	22.8	21.7	20.8	19	-7
Hardware-Only ASP	6.7	4.9	4.5	4.2	4.0	3.7	3.4	3.2	3.0	2.9	-12	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	8	7	10	15	15	16	18	19	20	21	16	7
CPU Revenue	8	7	10	15	15	16	18	19	20	20	16	7
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	NA	0	0	0	0	0	0	0	0	0	NA	6
Software Revenue	2	3	4	7	7	9	10	12	13	14	48	14
Bundled	0	0	0	0	0	0	0	0	0	0	19	-6
Unbundled	2	3	4	7	7	9	10	12	13	14	48	14
Service Revenue	1	0	0	0	0	0	1	1	1	1	-12	18
Total Factory Revenue	10	11	15	22	23	26	29	32	34	36	21	9
Increase over Prior Year (%)	64	2	38	48	5	12	12	11	7	6		

Note: In 1991, server was added as a platform. This reclassification reduced 1991 growth rates for the other platforms.
Source: Dataquest (May 1993)

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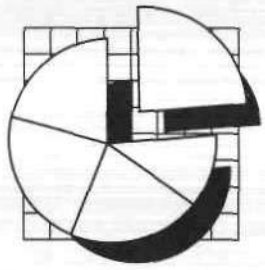
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GIS Applications Worldwide Market Share



Market Statistics

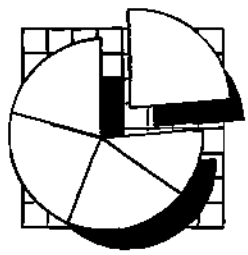
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Program: AEC and GIS Applications Worldwide
Product Code: CAEC-WW-MS-9302
Publication Date: March 22, 1993

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GIS Applications Worldwide Market Share



Market Statistics

1993

Program: AEC and GIS Applications Worldwide
Product Code: CAEC-WW-MS-9302
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Note: All tables show estimated data.

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GIS Applications Worldwide Market Share

Introduction

CAD/CAM/CAE/GIS systems have dramatically changed the methods by which designers and production managers originate and implement products. CAD and CAE systems allow designers to create, draft, analyze, test, and manipulate products on a screen in two and three dimensions. As CAD/CAM/CAE/GIS systems continue to decrease in cost, they become more available and cost justifiable to new users.

In order to provide a comprehensive view of the CAD/CAM/CAE/GIS industry, Dataquest's CAD/CAM/CAE/GIS group maintains a large database of industry information. The type of information contained in the database is depicted in Figure 1.

Market Analysis

With potentially the lowest growth rates in the history of the industry, 1992 was a year of transition. Turmoil in world economic forces caused recessionary pressures in many of the oldest and strongest markets for CAD/CAM/CAE/GIS. At the same time, competitive pressures in the end-user environment forced a higher level of integration and system complexity with fewer people. Evolution in new hardware and software technologies further added to the transitional pressures. For many, 1992 was the first year to seriously discuss and solve some of the sticky problems of integrating technologies and people. The process is painful, but the result should fuel healthy CAD/CAM/CAE/GIS market growth for the next five years.

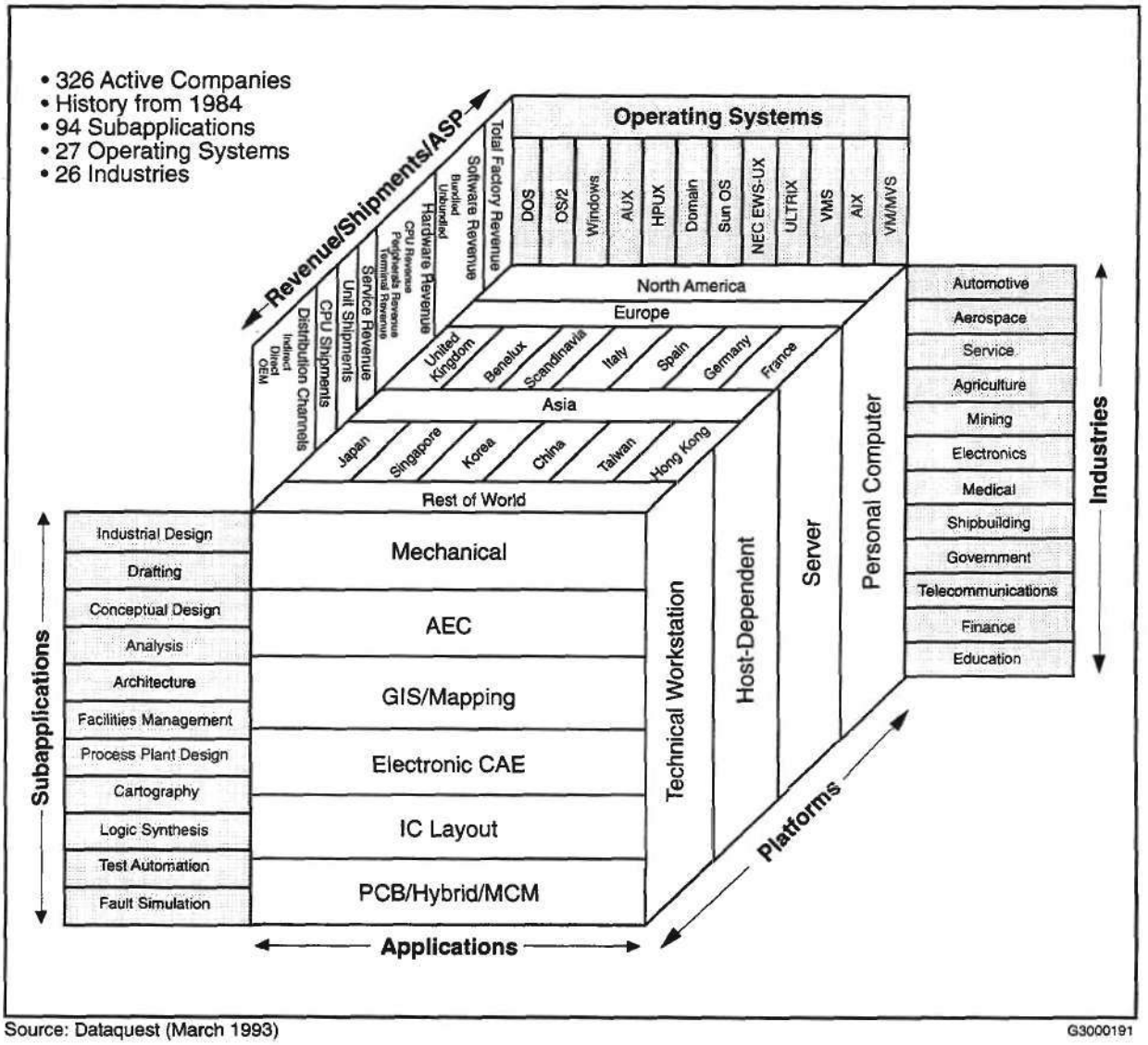
Based on our preliminary analysis, shown in Table 1, the year turned out somewhat better than expected, with a 4.2 percent growth rate in total revenue and 9.7 percent growth in software revenue. Regionally, European-based vendors enjoyed the strongest results, at 6.5 percent growth. Asian-based vendors grew 2.1 percent, with North American-based vendors in between the two, at 3.7 percent. In reality, the dollar was devalued against both the yen and the ECU, so the actual growth of both European- and Asian-based companies is lower than it appears.

Dataquest Perspective

The market dynamics in the total CAD/CAM/CAE/GIS market comprises many factors based on application-specific market needs, diverse geographical issues, and the amazing growth of computing and graphics resources. A more detailed analysis of each application area must be made to thoroughly understand the forces driving the entire market. Dataquest will discuss these forces and will provide an in-depth analysis of CAD/CAM/CAE/GIS regional issues, technology trends, and company analyses in future publications.

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Figure 1
CAD/CAM/CAE/GIS Market Database



Source: Dataquest (March 1993) G3000191

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Table 1
CAD/CAM/CAE/GIS 1992 Market Summary

	Software Revenue 1991 ($M)	Software Revenue 1992 ($M)	Growth Rate (%)	Total Revenue 1991 ($M)	Total Revenue 1992 ($M)	Growth Rate (%)
Application						
Mechanical	2,033.0	2,235.3	10.0	7,229.2	7,655.3	5.9
AEC	666.1	746.1	12.0	2,345.3	2,420.0	3.2
GIS/Mapping	555.8	627.5	12.9	1,899.4	1,974.8	4.0
Electronic CAE	691.2	744.1	7.7	1,802.7	1,875.4	4.0
IC Layout	195.8	223.4	14.1	584.7	621.0	6.2
PCB/Hybrid/MCM	328.3	329.1	0.2	1,091.1	1,030.8	-5.5
Total	4,470.2	4,905.5	9.7	14,952.5	15,577.3	4.2
Region						
North America	1,516.0	1,693.7	11.7	5,069.2	5,258.8	3.7
Europe	1,623.9	1,775.8	9.4	5,531.0	5,887.7	6.5
Asia	1,249.0	1,339.8	7.3	4,050.4	4,135.6	2.1
Rest of World	81.2	96.2	18.5	302.0	295.1	-2.3
Total	4,470.2	4,905.5	9.7	14,952.5	15,577.3	4.2
Platform						
Technical Workstation	2,712.1	3,056.2	12.7	8,078.7	8,780.1	8.7
Host Dependent	584.1	530.6	-9.2	2,852.2	2,557.0	-10.3
Server	182.7	191.7	4.9	997.9	1,056.2	5.8
Personal Computer	991.3	1,127.0	13.7	3,023.7	3,183.9	5.3
Total	4,470.2	4,905.5	9.7	14,952.5	15,577.3	4.2

Source: Dataquest (March 1993)

About This Document

This document contains Dataquest's detailed market share information on the CAD/CAM/CAE/GIS industry. Following is a description of the information reported in the *Market Share* book for each segment:

- Source—All companies in database; overview of industry
- Mechanical Applications—All companies in database with mechanical revenue
- AEC Applications—All companies in database with AEC revenue
- GIS Applications—All companies in database with GIS revenue
- Electronic Design Automation Applications—All companies in database with EDA (electronic CAE, IC layout, PCB/hybrid/MCM) revenue

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- Europe—All Europe-based companies and all other companies with more than $1 million in European revenue
- Asia—All Asia-based companies and all other companies with more than $1 million in Asian revenue
- Personal CAD and Distribution Channels—All companies in database with personal computer revenue

More detailed data on these markets may be requested through our client inquiry service.

Dataquest's policy is to continually update its market information, for current and past years, with any new data received in order to arrive at the most accurate market representation possible.

Segmentation

Dataquest defines CAD/CAM/CAE/GIS as systems used in the mechanical; architecture, engineering, and construction (AEC); GIS/mapping; and electronic design automation (EDA) application areas. The CAD/CAM/CAE/GIS market is defined according to the following segmentation scheme:

- CAD/CAM/CAE/GIS
  - Mechanical
  - AEC (Architecture, Engineering, and Construction)
  - GIS/Mapping (Geographic Information Systems)
  - EDA (Electronic Design Automation)
    - Electronic CAE
    - IC Layout
    - PCB/Hybrid/MCM

In addition, more detailed information by subapplication, by operating systems, and by industry is available, much of it published in *Dataquest Perspectives.*

Definitions

This section lists the definitions that are specific to this document.

Application definitions are as follows:

- Mechanical—Mechanical CAD/CAM refers to computer-aided tools used to design, analyze, document, and manufacture discrete parts, components, and assemblies.
- Architecture, Engineering, and Construction (AEC)—This segment covers the use of computer-aided tools by architects, contractors, plant engineers, civil engineers, and other people associated with these disciplines to aid in designing and managing buildings, industrial plants, ships, and other types of nondiscrete entities.

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- Geographic Information Systems (GIS)/Mapping—This is a computer-based technology, composed of hardware, software, and data used to capture, edit, display, and analyze spatial (tagged by location) information.
- Electronic Design Automation (EDA)—This segment covers computer-based tools that are used to automate the process of designing an electronic product including printed circuit boards, ICs, and systems. EDA includes Electronic CAE, IC Layout, and PCB/Hybrid/MCM, as follows:
  - Electronic Computer-Aided Engineering (CAE)—These are computer-aided tools used in the engineering or design phase of electronic products (as opposed to the physical layout phase of the product). Examples of Electronic CAE applications are schematic capture and simulation.
  - IC Layout—This is a software application tool that is used to create and validate the physical implementation of an integrated circuit (IC). The IC layout category comprises polygon editors, symbolic editors, placement and routing (gate array, cell, and block), design verification tools (DRC/ERC/logic-to-layout), compilers, and module development tools.
  - Printed Circuit Board (PCB)/Hybrid/Multichip Module (MCM)—This segment covers products that are used to create the placement and routing of the traces and components laid out on a printed circuit board. Also, included in this category are thermal analysis tools.

Regional definitions are as follows:

- North America—Includes United States, Canada, and Mexico
- Europe—Includes the United Kingdom, Scandinavia, Benelux, France, Germany, Italy, Spain, and Rest of Europe
- Asia—Includes Japan, Singapore, Taiwan, Korea, China, and Hong Kong
- Rest of World—All other countries including Australia, New Zealand, Oceania, Africa, Central America, South America, and the Middle East

Platform definitions are as follows:

- Technical Workstation—This is a single-user computer that is distinguished from a personal computer by its features and by the user's potential range of expansion on the platform. Features include a virtual, multitasking operating system (UNIX, VMS, DOMAIN); the computer is designed by manufacturer to run high-performance graphics applications in a multiuser/multitasking environment.
- Host-Dependent—This is a shared logic system in which the external workstations' functions are dependent on a host computer.

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- Server—A server is a computer that transparently provides its resources for use by other computer systems. It is a system on a network that provides specific functionality to other computer systems: the clients. Functions include file storage, database access, compute capability, and others. Dataquest tracks the following major categories of servers used for CAD/CAM/CAE/GIS applications:
  - Compute Servers—These systems provide capabilities for solving numerical problems (for example, simulations, statistical calculations, and simultaneous partial differential equations). System features usually include high-speed computational capabilities (for example, vector and parallel processing) and large memories.
  - Print Servers—These systems provide access to printers, specialized printing applications software, and print spooling resources to a network.
  - File Servers—These systems provide mass storage capability to clients on a network. Services can range from temporary storage of working files to long-term backup and archive systems.
  - Database Servers—These systems manage databases as a shared resource to a network. These servers handle such functions as physical data storage, data security, and high-level queries and can access stored information at the record level.
- Personal Computer—This is defined as a single-user computer that is distinguished from a technical workstation by its features and by the user's potential range of expansion on the platform. Features found in technical workstations (such as a virtual operating system, networking, high-performance graphics, multiuser/multitasking capability) are optional rather than integrated by the manufacturer.

Revenue/shipments/ASP definitions are as follows:

- Total factory revenue is defined as the amount of money received by a manufacturer for its goods measured in U.S. dollars. Total factory revenue does not include revenue that a company may receive from products that are sold to another company for resale (OEM revenue).
- Unit shipment is defined as the number of products delivered (that is, seats).
- Software revenue is revenue derived from the sale of bundled (part of a turnkey system) and unbundled software.
- Service revenue is defined as revenue derived from the service and support of CAD/CAM/CAE/GIS systems not including revenue from consulting. Service revenue can be calculated in the tables by subtracting hardware and software revenue from total revenue.

Market Share Methodology

Dataquest uses both primary and secondary sources to produce our market share data. In the fourth quarter of each year, we survey all major participants in each industry. Each vendor is offered the opportunity to self-report the information required. Although there is a primary contact

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for each company, large companies are surveyed across product lines and across geographic regions. Thus, there is a corresponding increase in the number of contacts at large companies. (Dataquest maintains a large contact database on all sources of information). Examples of the job titles of people contacted for information are the following:

- President and CEO
- Vice President and General Manager
- Vice President of Marketing
- Vice President, Strategic Product Planning
- Director of Strategic Planning
- Director of Marketing
- Director of Market Development
- Manager, CAD/CAM/CAE/GIS Marketing Programs
- Market Research Analyst

The Audit Process

Data supplied by vendors are evaluated against information drawn from many sources, including the following:

- Revenue published by major industry participants
- Estimates made by knowledgeable and reliable industry spokespersons
- Government data or trade association data
- Published product literature and price lists
- Interviews with knowledgeable manufacturers, distributors, and users
- Relevant economic data
- Information and data from online data banks
- Articles in both the general and trade press
- Annual reports, SEC documents, credit reports
- Company publications and press releases
- Reports from financial analysts
- User studies
- Reseller and supplier reports and reports from a vendor's competitors

In addition, Dataquest sums vendor revenue across other industries covered by Dataquest to make sure that revenue is not credited twice and checks with multiple sources at one company to cross-check data on that company.

Dataquest analysts have many years of experience in how to apply the above tools to get the most accurate information possible on a

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particular company (such as what to use when and what industry averages are). We believe that the estimates presented here are the most accurate and meaningful generally available today. It is the CAD/CAM/CAE/GIS group's policy to continually update our market information for any year, based on any new data received, in order to arrive at the most accurate market representation possible.

Dataquest's CAD/CAM/CAE/GIS market numbers are often higher than those reported by other sources. We survey worldwide, which involves more vendors, higher total market revenue, lower market share per vendor, and a more accurate market picture—particularly useful when comparing regions or applications.

Publishing Schedule

We publish market share and forecasting, twice each year for each, allowing for both timely distribution of data and thorough analysis and forecasting. Our annual delivery schedule is as follows:

- Market share data are available January 31. All tables will be published and distributed to clients by March 31.
- Forecasting from the market share tables provides a five-year forecast period, available after March 31. The books will be shipped by May 31.
- Final updated market share tables, based on additional data collection and analysis, will be completed by May 31. At this point, the market share database is frozen and will not be changed until the end of the year. For the next six months, supplementary market data will be based on these final market data. Books will be shipped by July 31.
- We provide complete final forecast tables by July 31. These tables take into consideration changes in the market share during the previous six months. Books will be shipped by September 31.

Notes on Market Share

CADAM has now been included in IBM's revenue for 1991 and 1992. In addition, based on our analysis of software revenue by operating system, we have changed the percent of Sun revenue allocated to CAD/CAM/CAE/GIS. The result is an increase in hardware revenue—$144 million for Sun in 1991, primarily in the AEC and GIS markets, and an overall increase in market share.

Tables 2 through 4 show other changes made to the database since the last report.

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Table 2
Companies Renamed

Old Name	New Name
ABB Trafonor	ABB Industria
Schlumberger	Applicon
Hahn & Kolb	ASCAD/ASCAM
Decad	EME
Robocom	RoboCAD Solutions
Vision 3D	Areon

Source: Dataquest (March 1993)

Table 3
Companies (or CAD Portions Thereof) Sold/Merged

Companies	Sold to/Merged with
Geographic Systems (WPS)	GeoVision Systems
Kewill Systems	Han Dataport
ISYKON Software	Intergraph
Logic Automation	Logic Modeling Systems
Micro Engineering Solutions	Autodesk
Norsk	Technovision
Sumisho Electronic Systems	Sumisho Electronics
t2 Solutions	Alias
Technovision	Intergraph
Valid	Cadence
Vantage Analysis Systems	Viewlogic

Source: Dataquest (March 1993)

Table 4
Companies—Added or Deleted

New Companies	1992 Revenue
CAD Distribution	16.9
CAE-link	1.1
Exemplar Logic	0.3
Expertest	0.5
Minc Software	3.0
Neocad	3.0
Sunrise Test Systems	2.0
Quicklogic	1.0
Deleted Companies	**1991 Revenue**
Everex	19.4
Ferranti	10.0
Nestler	11.0
XAO Industrie	3.7

Source: Dataquest (March 1993)

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Table 5
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: All Platforms
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Intergraph	484.1	206.9	134.4	7,425	24.5%	20.9%	21.4%	9.4%
Siemens Nixdorf Info systeme	153.3	78.2	54.3	2,494	7.8%	7.9%	8.7%	3.2%
ESRI	101.0	.0	91.9	0	5.1%	.0%	14.6%	.0%
Digital	94.6	65.2	.0	1,070	4.8%	6.6%	.0%	1.4%
IBM	93.8	64.3	15.7	9,262	4.8%	6.5%	2.5%	11.8%
Landmark Graphics	81.9	41.0	18.8	424	4.1%	4.1%	3.0%	.5%
Compaq	60.0	60.0	.0	13,005	3.0%	6.0%	.0%	16.5%
Sun Microsystems	52.4	44.6	.0	2,969	2.7%	4.5%	.0%	3.8%
Hewlett-Packard	49.7	41.5	.0	5,493	2.5%	4.2%	.0%	7.0%
Fujitsu	48.6	31.1	12.6	963	2.5%	3.1%	2.0%	1.2%
EDS	46.1	21.7	19.3	697	2.3%	2.2%	3.1%	.9%
Mitsubishi Electric	39.9	31.1	5.0	724	2.0%	3.1%	.8%	.9%
Data General	38.1	30.5	1.9	1,998	1.9%	3.1%	.3%	2.5%
Autodesk	34.2	.0	34.2	0	1.7%	.0%	5.4%	.0%
Computervision	31.6	12.9	8.1	290	1.6%	1.3%	1.3%	.4%
GeoVision Systems	27.0	2.1	14.1	25	1.4%	.2%	2.2%	.0%
Apple Computer	26.8	23.5	.0	6,331	1.4%	2.4%	.0%	8.0%
ICL	23.8	14.0	8.1	653	1.2%	1.4%	1.3%	.8%
Uchida Yoko	22.0	13.3	7.9	522	1.1%	1.3%	1.3%	.7%
Genasys II	18.6	1.9	15.8	125	.9%	.2%	2.5%	.2%
Hitachi	17.4	8.3	7.3	468	.9%	.8%	1.2%	.6%

(Continued)

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Table 5 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application:	GIS/Mapping
Platform:	All Platforms
Region:	Worldwide
Units:	Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Mitsui Engineering	15.1	10.6	3.0	100	.8%	1.1%	.5%	.1%
STI-Straessle	14.5	2.3	7.5	105	.7%	.2%	1.2%	.1%
Silicon Graphics	13.6	12.4	.0	347	.7%	1.3%	.0%	.4%
Synercom	12.6	.0	6.7	0	.6%	.0%	1.1%	.0%
Laser-Scan	11.6	3.9	4.7	68	.6%	.4%	.7%	.1%
Strategic Mapping	11.5	.0	10.4	0	.6%	.0%	1.7%	.0%
ERDAS	11.5	3.1	7.6	1,250	.6%	.3%	1.2%	1.6%
Moss Systems	11.3	.0	10.1	0	.6%	.0%	1.6%	.0%
ETAK	10.7	.5	10.0	23	.5%	.1%	1.6%	.0%
Toshiba—NO OEM	10.6	5.3	4.3	126	.5%	.5%	.7%	.2%
MapInfo	10.6	.0	8.5	0	.5%	.0%	1.4%	.0%
Smallworld Systems	10.5	2.4	5.8	52	.5%	.2%	.9%	.1%
Sysscan	10.4	4.5	2.8	98	.5%	.5%	.4%	.1%
GeoQuest	9.6	.0	9.6	0	.5%	.0%	1.5%	.0%
Infocel	9.4	1.9	7.1	197	.5%	.2%	1.1%	.3%
ItalCad	9.1	4.3	2.2	86	.5%	.4%	.3%	.1%
INS Engineering	7.2	3.6	3.6	18	.4%	.4%	.6%	.0%
NEC	7.0	4.0	2.4	310	.4%	.4%	.4%	.4%
CADIX	6.7	2.7	3.4	49	.3%	.3%	.5%	.1%
Alper Systems	6.4	3.2	1.6	45	.3%	.3%	.3%	.1%
Radian Corporation	6.2	.0	3.7	0	.3%	.0%	.6%	.0%

(Continued)

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Table 5 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: All Platforms
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Control Data Systems	5.9	3.5	1.2	80	.3%	.4%	.2%	.1%
Spectrum Graphics	5.8	1.7	2.9	54	.3%	.2%	.5%	.1%
Star Informatic	5.8	1.9	3.3	619	.3%	.2%	.5%	.8%
Clemessy	5.7	4.6	.9	19	.3%	.5%	.1%	.0%
Kohns & Poppenhaeger	5.4	2.7	1.9	64	.3%	.3%	.3%	.1%
Unisys	5.2	2.6	1.8	78	.3%	.3%	.3%	.1%
Century Research Center	5.0	2.6	1.8	28	.3%	.3%	.3%	.0%
Dell Computer	4.8	4.8	.0	1,262	.2%	.5%	.0%	1.6%
Dynamic Graphics	4.8	.0	4.1	0	.2%	.0%	.7%	.0%
PAFEC	4.7	.0	4.7	0	.2%	.0%	.7%	.0%
Ground Modelling Systems	4.5	2.5	1.9	37	.2%	.3%	.3%	.0%
Mutoh Industries—NO OEM	4.3	2.5	1.3	65	.2%	.2%	.2%	.1%
Autometric	3.5	2.3	1.2	75	.2%	.2%	.2%	.1%
GeoGraphix	3.4	.0	2.5	0	.2%	.0%	.4%	.0%
PacSoft	3.2	.0	3.2	0	.2%	.0%	.5%	.0%
Intera Tydac	3.2	.0	3.2	0	.2%	.0%	.5%	.0%
Solbourne	3.0	3.0	.0	270	.2%	.3%	.0%	.3%
Auto-Trol	2.9	1.1	1.1	36	.1%	.1%	.2%	.0%
Generation 5 Technology	2.6	.0	2.6	0	.1%	.0%	.4%	.0%
Facility Mapping Systems	2.5	.0	2.2	0	.1%	.0%	.4%	.0%

(Continued)

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Table 5 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: All Platforms
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Terr-Mar Resource Info Svs	2.3	.6	1.3	41	.1%	.1%	.2%	.1%
Terra Sciences	2.3	.0	2.3	0	.1%	.0%	.4%	.0%
ACDS Graphic System	2.3	.0	1.9	0	.1%	.0%	.3%	.0%
Kork Systems	2.0	.2	1.4	21	.1%	.0%	.2%	.0%
Softdesk	2.0	.0	2.0	0	.1%	.0%	.3%	.0%
Geometria GIS Systems House	1.8	.2	.4	15	.1%	.0%	.1%	.0%
Ziegler Informatics	1.7	.0	1.7	0	.1%	.0%	.3%	.0%
RIB/RZB	1.7	.1	1.3	11	.1%	.0%	.2%	.0%
LandCadd	1.6	.0	1.5	0	.1%	.0%	.2%	.0%
Ultimap	1.6	.6	.5	18	.1%	.1%	.1%	.0%
Geotrace Technologies	1.4	.1	1.2	21	.1%	.0%	.2%	.0%
GEOVISION Inc.	1.3	.7	.3	67	.1%	.1%	.0%	.1%
Secagraphics	1.2	.5	.3	8	.1%	.1%	.0%	.0%
Research Machines	1.1	1.1	.0	176	.1%	.1%	.0%	.2%
DAPCO	1.1	.0	.7	0	.1%	.0%	.1%	.0%
Geomath	1.0	.0	1.0	0	.1%	.0%	.2%	.0%
Maptech	.9	.0	.9	0	.0%	.0%	.1%	.0%
Contract Data Research	.9	.0	.6	0	.0%	.0%	.1%	.0%
Accugraph	.9	.4	.4	31	.0%	.0%	.1%	.0%
Olivetti	.9	.7	.0	103	.0%	.1%	.0%	.1%

(Continued)

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Table 5 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application:	GIS/Mapping
Platform:	All Platforms
Region:	Worldwide
Units:	Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Land Innovation	.8	.0	.8	0	.0%	.0%	.1%	.0%
CAD-Capture	.7	.2	.2	4	.0%	.0%	.0%	.0%
Hydrotec	.6	.3	.2	7	.0%	.0%	.0%	.0%
Andor	.6	.2	.4	5	.0%	.0%	.1%	.0%
Microway	.6	.4	.2	6	.0%	.0%	.0%	.0%
EME	.5	.1	.2	14	.0%	.0%	.0%	.0%
RoboCAD Solutions	.5	.0	.4	0	.0%	.0%	.1%	.0%
LEICA Heerberg	.4	.0	.3	0	.0%	.0%	.1%	.0%
Geosoft	.4	.0	.4	0	.0%	.0%	.1%	.0%
CAD Distribution	.3	.1	.1	5	.0%	.0%	.0%	.0%
Sigma Design	.3	.0	.3	0	.0%	.0%	.0%	.0%
Engineering Systems Corp.	.3	.0	.2	0	.0%	.0%	.0%	.0%
Applications in CADD	.2	.0	.1	6	.0%	.0%	.0%	.0%
American Small Business Comp.	.2	.0	.2	0	.0%	.0%	.0%	.0%
Uniras	.2	.0	.2	0	.0%	.0%	.0%	.0%
Lamp Software	.1	.0	.1	7	.0%	.0%	.0%	.0%
Innovative Data Design	.1	.0	.1	0	.0%	.0%	.0%	.0%
Foresight Resources	.1	.0	.1	0	.0%	.0%	.0%	.0%
A.I. Systems	.1	.0	.1	0	.0%	.0%	.0%	.0%
Masta Corporation	.0	.0	.0	0	.0%	.0%	.0%	.0%

(Continued)

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Table 5 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: All Platforms
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Other Companies	93.0	92.7	.0	17,639	4.7%	9.3%	.0%	22.4%
All Companies	1,974.8	992.0	627.5	78,700	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	1,494.7	747.2	455.4	70,575	75.7%	75.3%	72.6%	89.7%
All Asian-Based Companies	184.4	115.3	52.9	3,377	9.3%	11.6%	8.4%	4.3%
All European-Based Companies	295.8	129.5	119.3	4,747	15.0%	13.1%	19.0%	6.0%
All Hardware Companies	473.6	412.1	2.2	59,103	24.0%	41.5%	.3%	75.1%
All Turnkey & SW Companies	1,501.2	579.9	625.4	19,597	76.0%	58.5%	99.7%	24.9%

Source: Dataquest (March 1993)

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Table 6
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: Technical Workstation
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Intergraph	378.5	174.1	83.3	6,517	32.1%	30.9%	22.7%	26.8%
Siemens Nixdorf Info systeme	130.3	65.1	45.6	2,215	11.1%	11.6%	12.4%	9.1%
ESRI	51.5	.0	46.8	0	4.4%	.0%	12.8%	.0%
Landmark Graphics	49.1	24.6	11.3	254	4.2%	4.4%	3.1%	1.0%
Hewlett-Packard	43.5	36.5	.0	3,709	3.7%	6.5%	.0%	15.3%
EDS	41.5	21.7	14.6	712	3.5%	3.9%	4.0%	2.9%
Sun Microsystems	37.8	32.7	.0	2,432	3.2%	5.8%	.0%	10.0%
Mitsubishi Electric	30.5	26.0	2.1	329	2.6%	4.6%	.6%	1.4%
Data General	28.2	22.6	1.4	1,620	2.4%	4.0%	.4%	6.7%
Computervision	26.7	11.3	6.6	236	2.3%	2.0%	1.8%	1.0%
ICL	23.8	14.0	8.1	653	2.0%	2.5%	2.2%	2.7%
Fujitsu	20.4	13.1	5.3	416	1.7%	2.3%	1.4%	1.7%
Uchida Yoko	19.8	11.9	6.9	423	1.7%	2.1%	1.9%	1.7%
Digital	19.2	13.3	.0	858	1.6%	2.4%	.0%	3.5%
GeoVision Systems	18.9	1.5	9.8	21	1.6%	.3%	2.7%	.1%
Genasys II	16.7	1.7	14.2	87	1.4%	.3%	3.9%	.4%
STI-Straessle	14.5	2.3	7.5	105	1.2%	.4%	2.0%	.4%
Mitsui Engineering	13.7	9.6	2.8	77	1.2%	1.7%	.8%	.3%
Silicon Graphics	12.8	11.8	.0	332	1.1%	2.1%	.0%	1.4%
Hitachi	12.5	6.0	5.3	271	1.1%	1.1%	1.4%	1.1%
Moss Systems	11.3	.0	10.1	0	1.0%	.0%	2.8%	.0%

(Continued)

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Table 6 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: Technical Workstation
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Laser-Scan	11.1	3.8	4.5	64	.9%	.7%	1.2%	.3%
Toshiba—NO OEM	10.6	5.3	4.3	126	.9%	.9%	1.2%	.5%
Smallworld Systems	10.5	2.4	5.8	52	.9%	.4%	1.6%	.2%
IBM	9.7	5.3	2.4	251	.8%	.9%	.7%	1.0%
ItalCad	9.1	4.3	2.2	86	.8%	.8%	.6%	.4%
Synercom	7.9	.0	4.2	0	.7%	.0%	1.1%	.0%
INS Engineering	7.2	3.6	3.6	18	.6%	.6%	1.0%	.1%
ERDAS	6.9	1.9	4.6	750	.6%	.3%	1.2%	3.1%
CADIX	6.7	2.7	3.4	49	.6%	.5%	.9%	.2%
Alper Systems	6.4	3.2	1.6	45	.5%	.6%	.4%	.2%
NEC	6.3	3.5	2.3	207	.5%	.6%	.6%	.8%
Control Data Systems	5.9	3.5	1.2	80	.5%	.6%	.3%	.3%
Spectrum Graphics	5.8	1.7	2.9	54	.5%	.3%	.8%	.2%
Star Informatic	5.8	1.9	3.3	619	.5%	.3%	.9%	2.5%
Kohns & Poppenhaeger	5.4	2.7	1.9	64	.5%	.5%	.5%	.3%
Century Research Center	5.0	2.6	1.8	28	.4%	.5%	.5%	.1%
GeoQuest	4.8	.0	4.8	0	.4%	.0%	1.3%	.0%
PAFEC	4.7	.0	4.7	0	.4%	.0%	1.3%	.0%
Clemessy	4.6	3.7	.7	12	.4%	.7%	.2%	.0%
Sysscan	4.2	1.4	1.5	49	.4%	.3%	.4%	.2%
Unisys	4.0	2.0	1.4	62	.3%	.4%	.4%	.3%

(Continued)

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Table 6 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: Technical Workstation
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Dynamic Graphics	3.8	.0	3.2	0	.3%	.0%	.9%	.0%
Radian Corporation	3.7	.0	2.2	0	.3%	.0%	.6%	.0%
Auto-Trol	2.9	1.1	1.1	36	.2%	.2%	.3%	.1%
Mutoh Industries—NO OEM	2.3	1.4	.7	23	.2%	.2%	.2%	.1%
Autodesk	2.3	.0	2.3	0	.2%	.0%	.6%	.0%
ACDS Graphic System	2.3	.0	1.9	0	.2%	.0%	.5%	.0%
Autometric	1.7	1.1	.6	40	.1%	.2%	.2%	.2%
Intera Tydac	1.6	.0	1.6	0	.1%	.0%	.4%	.0%
Ultimap	1.6	.6	.5	18	.1%	.1%	.1%	.1%
Terr-Mar Resource Info Svs	1.4	.4	.8	17	.1%	.1%	.2%	.1%
Infocel	1.1	.2	.8	16	.1%	.0%	.2%	.1%
ETAK	1.1	.0	1.0	1	.1%	.0%	.3%	.0%
Solbourne	1.1	1.0	.0	185	.1%	.2%	.0%	.8%
DAPCO	1.1	.0	.7	0	.1%	.0%	.2%	.0%
GEOVISION Inc	.9	.6	.2	29	.1%	.1%	.1%	.1%
Geomath	.8	.0	.8	0	.1%	.0%	.2%	.0%
Accugraph	.8	.4	.3	30	.1%	.1%	.1%	.1%
Land Innovation	.8	.0	.8	0	.1%	.0%	.2%	.0%
Hydrotec	.6	.3	.2	7	.1%	.1%	.1%	.0%
Microway	.6	.4	.2	6	.1%	.1%	.1%	.0%
Geometria GIS Systems House	.6	.0	.0	0	.0%	.0%	.0%	.0%

(Continued)

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Table 6 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: Technical Workstation
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Softdesk	.5	.0	.5	0	.0%	.0%	.1%	.0%
LEICA Heerberg	.4	.0	.3	0	.0%	.0%	.1%	.0%
Terra Sciences	.4	.0	.4	0	.0%	.0%	.1%	.0%
RIB/RZB	.3	.0	.3	2	.0%	.0%	.1%	.0%
Sigma Design	.2	.0	.2	0	.0%	.0%	.0%	.0%
Facility Mapping Systems	.1	.0	.1	0	.0%	.0%	.0%	.0%
LandCadd	.1	.0	.1	0	.0%	.0%	.0%	.0%
Lamp Software	.0	.0	.0	3	.0%	.0%	.0%	.0%
Masta Corporation	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	.0	.0	.0	5	.0%	.0%	.0%	.0%
All Companies	1,178.6	562.5	366.3	24,302	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	792.6	369.7	225.9	18,298	67.3%	65.7%	61.7%	75.3%
All Asian-Based Companies	135.0	85.6	38.4	1,967	11.5%	15.2%	10.5%	8.1%
All European-Based Companies	251.0	107.3	102.0	4,036	21.3%	19.1%	27.8%	16.6%
All Hardware Companies	143.8	118.5	1.7	9,151	12.2%	21.1%	.5%	37.7%
All Turnkey & SW Companies	1,034.8	444.0	364.6	15,151	87.8%	78.9%	99.5%	62.3%

Source: Dataquest (March 1993)

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Table 7
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: Host-Dependent
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Digital	50.3	34.7	.0	0	24.3%	29.1%	.0%	.0%
IBM	41.1	22.2	10.9	538	19.9%	18.6%	21.7%	23.4%
Siemens Nixdorf Info systeme	23.0	13.1	8.7	279	11.1%	11.0%	17.4%	12.2%
Fujitsu	18.5	11.8	4.8	257	8.9%	9.9%	9.6%	11.2%
GeoVision Systems	8.1	.6	4.2	4	3.9%	.5%	8.4%	.2%
Mitsubishi Electric	5.4	2.5	1.5	17	2.6%	2.1%	3.0%	.7%
Synercom	4.7	.0	2.5	0	2.3%	.0%	4.9%	.0%
EDS	4.6	.0	4.6	(15)	2.2%	.0%	9.2%	-.7%
ESRI	4.0	.0	3.7	0	2.0%	.0%	7.3%	.0%
Intergraph	4.0	.0	3.6	0	1.9%	.0%	7.2%	.0%
Autometric	1.8	1.2	.6	35	.9%	1.0%	1.3%	1.5%
Hitachi	1.7	.8	.7	31	.8%	.7%	1.5%	1.3%
Unisys	1.2	.6	.4	16	.6%	.5%	.8%	.7%
Secagraphics	1.2	.5	.3	8	.6%	.5%	.6%	.4%
Clemessy	1.2	.9	.2	7	.6%	.8%	.4%	.3%
Geotrace Technologies	1.0	.1	.9	21	.5%	.0%	1.8%	.9%
Dynamic Graphics	1.0	.0	.9	0	.5%	.0%	1.8%	.0%
ETAK	1.0	.0	.9	3	.5%	.0%	1.8%	.1%
Computervision	.9	.3	.2	18	.4%	.3%	.5%	.8%
Laser-Scan	.5	.1	.2	4	.2%	.1%	.4%	.2%
Radian Corporation	.4	.0	.2	0	.2%	.0%	.5%	.0%

(Continued)

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Table 7 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: Host-Dependent
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Engineering Systems Corp.	.1	.0	.1	0	.0%	.0%	.1%	.0%
Kork Systems	.1	.1	.0	1	.0%	.0%	.0%	.0%
Accugraph	.0	.0	.0	1	.0%	.0%	.0%	.0%
Other Companies	31.3	29.8	.0	1,070	15.1%	24.9%	.0%	46.6%
All Companies	207.1	119.4	50.2	2,294	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	156.9	90.1	34.0	1,699	75.8%	75.5%	67.8%	74.1%
All Asian-Based Companies	25.6	15.2	7.0	305	12.4%	12.7%	14.0%	13.3%
All European-Based Companies	24.6	14.1	9.1	290	11.9%	11.8%	18.2%	12.6%
All Hardware Companies	81.6	64.5	.0	1,070	39.4%	54.0%	.0%	46.6%
All Turnkey & SW Companies	125.5	54.9	50.2	1,224	60.6%	46.0%	100.0%	53.4%

Source: Dataquest (March 1993)

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Table 8
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: Server
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Intergraph	67.7	32.8	15.5	909	33.2%	33.0%	27.6%	35.0%
Landmark Graphics	32.8	16.4	7.5	170	16.0%	16.5%	13.4%	6.5%
ESRI	29.3	.0	26.6	0	14.3%	.0%	47.3%	.0%
Digital	25.0	17.3	.0	212	12.2%	17.3%	.0%	8.2%
Sun Microsystems	14.6	11.9	.0	537	7.1%	11.9%	.0%	20.7%
IBM	10.2	5.9	2.4	171	5.0%	5.9%	4.2%	6.6%
Data General	9.9	7.9	.5	378	4.9%	8.0%	.9%	14.6%
Sysscan	6.2	3.1	1.3	48	3.1%	3.1%	2.3%	1.9%
Computervision	4.0	1.4	1.3	35	2.0%	1.4%	2.3%	1.4%
Solbourne	1.9	1.9	.0	85	1.0%	2.0%	.0%	3.3%
ETAK	1.0	.0	.9	0	.5%	.0%	1.6%	.0%
Silicon Graphics	.8	.7	.0	15	.4%	.7%	.0%	.6%
Radian Corporation	.5	.0	.3	0	.2%	.0%	.5%	.0%
Hewlett-Packard	.3	.2	.0	35	.1%	.2%	.0%	1.4%
Other Companies	.0	.0	.0	1	.0%	.0%	.0%	.0%
All Companies	204.1	99.5	56.3	2,597	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	197.9	96.4	55.0	2,548	96.9%	96.9%	97.7%	98.1%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	6.2	3.1	1.3	48	3.1%	3.1%	2.3%	1.9%
All Hardware Companies	53.0	40.4	.5	1,393	26.0%	40.6%	.9%	53.6%
All Turnkey & SW Companies	151.1	59.1	55.8	1,204	74.0%	59.4%	99.1%	46.4%

Source: Dataquest (March 1993)

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Table 9
1992 CAD/CAM/CAE/GIS Market Share

Application:	GIS/Mapping
Platform:	Personal Computer
Region:	Worldwide
Units:	Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Compaq	60.0	60.0	.0	13,005	15.6%	28.5%	.0%	26.3%
Intergraph	34.0	.0	31.9	0	8.8%	.0%	20.6%	.0%
IBM	32.9	30.9	.0	8,302	8.5%	14.7%	.0%	16.8%
Autodesk	31.9	.0	31.9	0	8.3%	.0%	20.6%	.0%
Apple Computer	26.8	23.5	.0	6,331	6.9%	11.2%	.0%	12.8%
ESRI	16.2	.0	14.7	0	4.2%	.0%	9.5%	.0%
Strategic Mapping	11.5	.0	10.4	0	3.0%	.0%	6.7%	.0%
Fujitsu	9.7	6.2	2.5	289	2.5%	3.0%	1.6%	.6%
MapInfo	8.6	.0	6.9	0	2.2%	.0%	4.4%	.0%
Infocel	8.3	1.7	6.2	181	2.2%	.8%	4.0%	.4%
ETAK	7.6	.4	7.3	18	2.0%	.2%	4.7%	.0%
Hewlett-Packard	6.0	4.8	.0	1,748	1.6%	2.3%	.0%	3.5%
Dell Computer	4.8	4.8	.0	1,262	1.3%	2.3%	.0%	2.5%
GeoQuest	4.8	.0	4.8	0	1.2%	.0%	3.1%	.0%
ERDAS	4.6	1.2	3.0	500	1.2%	.6%	2.0%	1.0%
Ground Modelling Systems	4.5	2.5	1.9	37	1.2%	1.2%	1.2%	.1%
Mitsubishi Electric	4.0	2.6	1.4	378	1.0%	1.3%	.9%	.8%
GeoGraphix	3.4	.0	2.5	0	.9%	.0%	1.6%	.0%
PacSoft	3.2	.0	3.2	0	.8%	.0%	2.1%	.0%
Hitachi	3.1	1.5	1.3	166	.8%	.7%	.9%	.3%

(Continued)

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Table 9 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application:	GIS/Mapping
Platform:	Personal Computer
Region:	Worldwide
Units:	Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Generation 5 Technology	2.6	.0	2.6	0	.7%	.0%	1.7%	.0%
Facility Mapping Systems	2.4	.0	2.1	0	.6%	.0%	1.4%	.0%
Uchida Yoko	2.2	1.4	.9	99	.6%	.7%	.6%	.2%
Mutoh Industries—NO OEM	2.0	1.1	.6	41	.5%	.5%	.4%	.1%
Kork Systems	2.0	.2	1.4	20	.5%	.1%	.9%	.0%
Terra Sciences	1.9	.0	1.9	0	.5%	.0%	1.2%	.0%
Genasys II	1.9	.2	1.6	38	.5%	.1%	1.0%	.1%
Ziegler Informatics	1.7	.0	1.7	0	.4%	.0%	1.1%	.0%
Intera Tydac	1.6	.0	1.6	0	.4%	.0%	1.0%	.0%
Radian Corporation	1.6	.0	.9	0	.4%	.0%	.6%	.0%
LandCadd	1.5	.0	1.4	0	.4%	.0%	.9%	.0%
Softdesk	1.5	.0	1.5	0	.4%	.0%	1.0%	.0%
Mitsui Engineering	1.4	1.0	.3	23	.4%	.5%	.2%	.0%
RIB/RZB	1.3	.1	1.1	9	.3%	.1%	.7%	.0%
Geometria GIS Systems House	1.3	.2	.4	15	.3%	.1%	.3%	.0%
Research Machines	1.1	1.1	.0	176	.3%	.5%	.0%	.4%
Terr-Mar Resource Info Svs	.9	.2	.5	24	.2%	.1%	.3%	.0%
Maptech	.9	.0	.9	0	.2%	.0%	.6%	.0%
Contract Data Research	.9	.0	.6	0	.2%	.0%	.4%	.0%
Olivetti	.9	.7	.0	103	.2%	.3%	.0%	.2%

(Continued)

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Table 9 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application:	GIS/Mapping
Platform:	Personal Computer
Region:	Worldwide
Units:	Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
CAD-Capture	.7	.2	.2	4	.2%	.1%	.1%	.0%
NEC	.7	.6	.1	104	.2%	.3%	.0%	.2%
Andor	.6	.2	.4	5	.2%	.1%	.3%	.0%
EME	.5	.1	.2	14	.1%	.1%	.2%	.0%
RoboCAD Solutions	.5	.0	.4	0	.1%	.0%	.2%	.0%
Geosoft	.4	.0	.4	0	.1%	.0%	.2%	.0%
Geotrace Technologies	.3	.0	.3	0	.1%	.0%	.2%	.0%
CAD Distribution	.3	.1	.1	5	.1%	.1%	.1%	.0%
GEOVISION Inc.	.3	.2	.1	38	.1%	.1%	.0%	.1%
Engineering Systems Corp.	.2	.0	.2	0	.1%	.0%	.1%	.0%
Applications in CADD	.2	.0	.1	6	.1%	.0%	.1%	.0%
Geomath	.2	.0	.2	0	.1%	.0%	.1%	.0%
American Small Business Comp.	.2	.0	.2	0	.0%	.0%	.1%	.0%
Uniras	.2	.0	.2	0	.0%	.0%	.1%	.0%
Sigma Design	.1	.0	.1	0	.0%	.0%	.1%	.0%
Innovative Data Design	.1	.0	.1	0	.0%	.0%	.1%	.0%
Accugraph	.1	.0	.1	0	.0%	.0%	.0%	.0%
Lamp Software	.1	.0	.1	4	.0%	.0%	.0%	.0%
Foresight Resources	.1	.0	.1	0	.0%	.0%	.0%	.0%
A.I. Systems	.1	.0	.1	0	.0%	.0%	.0%	.0%

(Continued)

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Table 9 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: Personal Computer
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Other Companies	61.8	62.9	.0	16,563	16.0%	29.9%	.0%	33.5%
All Companies	385.0	210.6	154.7	49,508	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	347.3	191.0	140.4	48,030	90.2%	90.7%	90.8%	97.0%
All Asian-Based Companies	23.8	14.5	7.5	1,105	6.2%	6.9%	4.8%	2.2%
All European-Based Companies	14.0	5.1	6.8	373	3.6%	2.4%	4.4%	.8%
All Hardware Companies	195.3	188.8	.0	47,490	50.7%	89.6%	.0%	95.9%
All Turnkey & SW Companies	189.8	21.9	154.7	2,018	49.3%	10.4%	100.0%	4.1%

Source: Dataquest (March 1993)

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Table 10
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: All Platforms
Region: North America
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Intergraph	341.0	147.1	92.6	5,437	39.0%	36.1%	31.9%	14.7%
ESRI	72.7	.0	66.2	0	8.3%	.0%	22.8%	.0%
Digital	50.9	35.1	.0	566	5.8%	8.6%	.0%	1.5%
Data General	36.2	29.0	1.8	1,898	4.1%	7.1%	.6%	5.1%
Landmark Graphics	32.8	16.4	7.5	170	3.7%	4.0%	2.6%	.5%
Compaq	28.5	28.5	.0	6,170	3.3%	7.0%	.0%	16.7%
Sun Microsystems	27.4	23.3	.0	1,742	3.1%	5.7%	.0%	4.7%
IBM	22.5	15.7	3.6	2,495	2.6%	3.9%	1.2%	6.8%
EDS	21.1	9.7	8.8	305	2.4%	2.4%	3.0%	.8%
Hewlett-Packard	18.0	14.9	.0	2,488	2.1%	3.7%	.0%	6.7%
Autodesk	16.8	.0	16.8	0	1.9%	.0%	5.8%	.0%
Apple Computer	16.6	14.6	.0	3,925	1.9%	3.6%	.0%	10.6%
Computervision	13.3	5.0	3.8	136	1.5%	1.2%	1.3%	.4%
GeoVision Systems	10.8	.9	5.6	10	1.2%	.2%	1.9%	.0%
Infocel	8.5	1.7	6.4	177	1.0%	.4%	2.2%	.5%
Strategic Mapping	8.2	.0	7.4	0	.9%	.0%	2.5%	.0%
ETAK	8.0	.4	7.6	17	.9%	.1%	2.6%	.0%
Genasys II	7.8	.8	6.7	52	.9%	.2%	2.3%	.1%
Synercom	7.6	.0	4.0	0	.9%	.0%	1.4%	.0%
GeoQuest	7.2	.0	7.2	0	.8%	.0%	2.5%	.0%

(Continued)

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Table 10 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: All Platforms
Region: North America
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
MapInfo	7.1	.0	5.7	0	.8%	.0%	2.0%	.0%
ERDAS	7.0	1.9	4.6	762	.8%	.5%	1.6%	2.1%
Silicon Graphics	6.6	6.0	.0	171	.8%	1.5%	.0%	.5%
Dell Computer	3.6	3.6	.0	946	.4%	.9%	.0%	2.6%
Autometric	3.5	2.3	1.2	75	.4%	.6%	.4%	.2%
PacSoft	3.2	.0	3.2	0	.4%	.0%	1.1%	.0%
GeoGraphix	3.2	.0	2.4	0	.4%	.0%	.8%	.0%
Intera Tydac	3.2	.0	3.2	0	.4%	.0%	1.1%	.0%
Radian Corporation	3.1	.0	1.9	0	.4%	.0%	.6%	.0%
Dynamic Graphics	2.9	.0	2.4	0	.3%	.0%	.8%	.0%
Auto-Trol	2.9	1.1	1.1	36	.3%	.3%	.4%	.1%
Laser-Scan	2.2	.8	.9	14	.2%	.2%	.3%	.0%
Facility Mapping Systems	2.2	.0	1.9	0	.2%	.0%	.7%	.0%
Generation 5 Technology	2.2	.0	2.2	0	.2%	.0%	.7%	.0%
Control Data Systems	2.1	1.3	.4	28	.2%	.3%	.2%	.1%
Terra Sciences	1.8	.0	1.8	0	.2%	.0%	.6%	.0%
ACDS Graphic System	1.8	.0	1.5	0	.2%	.0%	.5%	.0%
Softdesk	1.7	.0	1.7	0	.2%	.0%	.6%	.0%
Ultimap	1.6	.6	.5	18	.2%	.1%	.2%	.0%
Solbourne	1.5	1.5	.0	122	.2%	.4%	.0%	.3%

(Continued)

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Table 10 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: All Platforms
Region: North America
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Terr-Mar Resource Info Svs	1.4	.4	.7	24	.2%	.1%	.3%	.1%
GEOVISION Inc.	1.2	.7	.3	63	.1%	.2%	.1%	.2%
Secagraphics	1.2	.5	.3	8	.1%	.1%	.1%	.0%
Geotrace Technologies	1.1	.0	1.0	17	.1%	.0%	.3%	.0%
Geomath	1.0	.0	1.0	0	.1%	.0%	.4%	.0%
LandCadd	1.0	.0	1.0	0	.1%	.0%	.3%	.0%
Maptech	.9	.0	.9	0	.1%	.0%	.3%	.0%
Accugraph	.8	.4	.4	29	.1%	.1%	.1%	.1%
Kork Systems	.8	.1	.6	16	.1%	.0%	.2%	.0%
Land Innovation	.8	.0	.8	0	.1%	.0%	.3%	.0%
Ground Modelling Systems	.5	.4	.3	3	.1%	.1%	.1%	.0%
Moss Systems	.5	.0	.4	0	.1%	.0%	.1%	.0%
Geosoft	.4	.0	.4	0	.0%	.0%	.1%	.0%
Sigma Design	.3	.0	.3	0	.0%	.0%	.1%	.0%
Engineering Systems Corp.	.3	.0	.2	0	.0%	.0%	.1%	.0%
American Small Business Comp.	.2	.0	.2	0	.0%	.0%	.1%	.0%
Uniras	.2	.0	.2	0	.0%	.0%	.1%	.0%
Innovative Data Design	.1	.0	.1	0	.0%	.0%	.0%	.0%
Foresight Resources	.1	.0	.1	0	.0%	.0%	.0%	.0%
A.I. Systems	.1	.0	.1	0	.0%	.0%	.0%	.0%

(Continued)

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Table 10 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: All Platforms
Region: North America
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Other Companies	42.4	42.9	.0	8,982	4.9%	10.5%	.0%	24.3%
All Companies	873.9	407.1	290.5	36,902	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	870.7	406.0	288.9	36,885	99.6%	99.7%	99.5%	100.0%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	3.2	1.1	1.6	17	.4%	.3%	.5%	.0%
All Hardware Companies	241.7	207.6	1.9	29,251	27.7%	51.0%	.7%	79.3%
All Turnkey & SW Companies	632.3	199.5	288.6	7,651	72.3%	49.0%	99.3%	20.7%

Source: Dataquest (March 1993)

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Table 11
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: Technical Workstation
Region: North America
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Intergraph	265.9	122.3	58.5	4,779	55.3%	56.4%	41.1%	45.0%
ESRI	37.1	.0	33.7	0	7.7%	.0%	23.7%	.0%
Data General	26.8	21.4	1.3	1,539	5.6%	9.9%	.9%	14.5%
Landmark Graphics	19.7	9.8	4.5	102	4.1%	4.5%	3.2%	1.0%
Sun Microsystems	19.3	16.7	.0	1,377	4.0%	7.7%	.0%	13.0%
EDS	19.0	9.7	6.7	312	3.9%	4.5%	4.7%	2.9%
Hewlett-Packard	12.3	10.4	.0	938	2.6%	4.8%	.0%	8.8%
Digital	10.3	7.1	.0	454	2.1%	3.3%	.0%	4.3%
Computervision	8.8	3.5	2.4	87	1.8%	1.6%	1.7%	.8%
GeoVision Systems	7.6	.6	3.9	9	1.6%	.3%	2.8%	.1%
Genasys II	7.0	.7	6.0	37	1.5%	.3%	4.2%	.3%
Silicon Graphics	6.2	5.7	.0	163	1.3%	2.6%	.0%	1.5%
Synercom	4.8	.0	2.5	0	1.0%	.0%	1.8%	.0%
ERDAS	4.2	1.1	2.8	457	.9%	.5%	2.0%	4.3%
GeoQuest	3.6	.0	3.6	0	.7%	.0%	2.5%	.0%
Auto-Trol	2.9	1.1	1.1	36	.6%	.5%	.8%	.3%
Dynamic Graphics	2.3	.0	1.9	0	.5%	.0%	1.3%	.0%
IBM	2.2	1.2	.5	79	.5%	.6%	.4%	.7%
Laser-Scan	2.1	.7	.8	13	.4%	.3%	.6%	.1%
Control Data Systems	2.1	1.3	.4	28	.4%	.6%	.3%	.3%

(Continued)

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Table 11 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: Technical Workstation
Region: North America
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Radian Corporation	1.9	.0	1.1	0	.4%	.0%	.8%	.0%
ACDS Graphic System	1.8	.0	1.5	0	.4%	.0%	1.0%	.0%
Autometric	1.7	1.1	.6	40	.3%	.5%	.4%	.4%
Intera Tydac	1.6	.0	1.6	0	.3%	.0%	1.1%	.0%
Ultimap	1.6	.6	.5	18	.3%	.3%	.3%	.2%
Infocel	1.0	.2	.8	15	.2%	.1%	.5%	.1%
GEOVISION Inc.	.9	.5	.2	27	.2%	.2%	.1%	.3%
Autodesk	.8	.0	.8	0	.2%	.0%	.6%	.0%
Geomath	.8	.0	.8	0	.2%	.0%	.6%	.0%
ETAK	.8	.0	.8	1	.2%	.0%	.5%	.0%
Terr-Mar Resource Info Svs	.8	.2	.4	10	.2%	.1%	.3%	.1%
Land Innovation	.8	.0	.8	0	.2%	.0%	.6%	.0%
Accugraph	.7	.4	.3	28	.1%	.2%	.2%	.3%
Solbourne	.5	.4	.0	77	.1%	.2%	.0%	.7%
Moss Systems	.5	.0	.4	0	.1%	.0%	.3%	.0%
Softdesk	.4	.0	.4	0	.1%	.0%	.3%	.0%
Terra Sciences	.3	.0	.3	0	.1%	.0%	.2%	.0%
Sigma Design	.2	.0	.2	0	.0%	.0%	.1%	.0%
Facility Mapping Systems	.1	.0	.1	0	.0%	.0%	.1%	.0%
LandCadd	.1	.0	.1	0	.0%	.0%	.0%	.0%

(Continued)

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Table 11 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: Technical Workstation
Region: North America
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Other Companies	.0	.0	.0	5	.0%	.0%	.0%	.1%
All Companies	481.1	216.8	142.3	10,629	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	478.5	216.0	141.0	10,616	99.5%	99.7%	99.1%	99.9%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	2.6	.7	1.2	13	.5%	.3%	.9%	.1%
All Hardware Companies	75.8	62.0	1.4	4,553	15.8%	28.6%	1.0%	42.8%
All Turnkey & SW Companies	405.3	154.8	140.8	6,076	84.2%	71.4%	99.0%	57.2%

Source: Dataquest (March 1993)

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Table 12
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: Host-Dependent
Region: North America
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Digital	27.3	18.8	.0	0	40.0%	51.7%	.0%	.0%
IBM	9.4	5.1	2.5	165	13.8%	14.0%	14.9%	27.3%
Intergraph	3.4	.0	3.1	0	5.0%	.0%	18.3%	.0%
GeoVision Systems	3.2	.3	1.7	1	4.8%	.7%	10.0%	.2%
ESRI	2.9	.0	2.7	0	4.3%	.0%	15.8%	.0%
Synercom	2.8	.0	1.5	0	4.1%	.0%	8.8%	.0%
EDS	2.1	.0	2.1	(7)	3.1%	.0%	12.6%	-1.1%
Autometric	1.8	1.2	.6	35	2.7%	3.2%	3.8%	5.8%
Secagraphics	1.2	.5	.3	8	1.7%	1.4%	1.7%	1.3%
Geotrace Technologies	.8	.0	.7	17	1.2%	.1%	4.2%	2.7%
Computervision	.8	.3	.2	17	1.2%	.8%	1.3%	2.8%
ETAK	.7	.0	.7	2	1.1%	.1%	4.1%	.4%
Dynamic Graphics	.6	.0	.5	0	.9%	.0%	3.2%	.0%
Radian Corporation	.2	.0	.1	0	.3%	.0%	.7%	.0%
Laser-Scan	.1	.0	.0	1	.1%	.1%	.2%	.1%
Engineering Systems Corp.	.1	.0	.1	0	.1%	.0%	.3%	.0%
Kork Systems	.0	.0	.0	1	.0%	.1%	.0%	.1%
Accugraph	.0	.0	.0	1	.0%	.0%	.0%	.1%

(Continued)

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Table 12 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: Host-Dependent
Region: North America
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Other Companies	10.6	10.1	.0	364	15.6%	27.8%	.0%	60.2%
All Companies	68.1	36.3	16.7	604	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	68.0	36.3	16.7	603	99.9%	99.9%	99.8%	99.9%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	.1	.0	.0	1	.1%	.1%	.2%	.1%
All Hardware Companies	37.9	28.9	.0	364	55.6%	79.6%	.0%	60.2%
All Turnkey & SW Companies	30.2	7.4	16.7	240	44.4%	20.4%	100.0%	39.8%

Source: Dataquest (March 1993)

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Table 13
1992 CAD/CAM/CAE/GIS Market Share

Application:	GIS/Mapping
Platform:	Server
Region:	North America
Units:	Millions of U.S. Dollars/Actual Units

					Market Share			
Company	**Total Factory Revenue**	**Hardware Revenue**	**Software Revenue**	**Hardware Units Shipped**	**Total Factory Revenue**	**Hardware Revenue**	**Software Revenue**	**Hardware Units Shipped**
Intergraph	51.1	24.8	11.8	658	40.9%	42.1%	31.8%	37.9%
ESRI	21.1	.0	19.2	0	16.9%	.0%	51.9%	.0%
Digital	13.3	9.2	.0	112	10.7%	15.6%	.0%	6.5%
Landmark Graphics	13.1	6.6	3.0	68	10.5%	11.1%	8.1%	3.9%
Data General	9.4	7.5	.5	359	7.5%	12.8%	1.3%	20.7%
Sun Microsystems	8.1	6.6	.0	365	6.4%	11.1%	.0%	21.0%
Computervision	3.7	1.3	1.2	33	3.0%	2.2%	3.2%	1.9%
IBM	2.4	1.4	.5	55	1.9%	2.4%	1.5%	3.1%
Solbourne	1.1	1.0	.0	44	.8%	1.7%	.0%	2.6%
ETAK	.7	.0	.7	0	.6%	.1%	1.8%	.0%
Silicon Graphics	.4	.3	.0	8	.3%	.6%	.0%	.4%
Hewlett-Packard	.3	.2	.0	34	.2%	.4%	.0%	2.0%
Radian Corporation	.3	.0	.2	0	.2%	.0%	.4%	.0%
Other Companies	.0	.0	.0	1	.0%	.0%	.0%	.0%
All Companies	125.0	59.0	37.0	1,737	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	125.0	59.0	37.0	1,737	100.0%	100.0%	100.0%	100.0%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Hardware Companies	32.7	25.1	.5	968	26.2%	42.5%	1.3%	55.7%
All Turnkey & SW Companies	92.3	33.9	36.5	769	73.8%	57.5%	98.7%	44.3%

Source: Dataquest (March 1993)

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Table 14
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: Personal Computer
Region: North America
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Compaq	28.5	28.5	.0	6,170	14.3%	29.9%	.0%	25.8%
Intergraph	20.5	.0	19.2	0	10.2%	.0%	20.4%	.0%
Apple Computer	16.6	14.6	.0	3,925	8.3%	15.3%	.0%	16.4%
Autodesk	16.0	.0	16.0	0	8.0%	.0%	16.9%	.0%
ESRI	11.6	.0	10.6	0	5.8%	.0%	11.2%	.0%
IBM	8.5	8.0	.0	2,196	4.3%	8.4%	.0%	9.2%
Strategic Mapping	8.2	.0	7.4	0	4.1%	.0%	7.8%	.0%
Infocel	7.5	1.5	5.6	163	3.8%	1.6%	5.9%	.7%
MapInfo	7.1	.0	5.7	0	3.6%	.0%	6.0%	.0%
ETAK	5.7	.3	5.5	14	2.9%	.3%	5.8%	.1%
Hewlett-Packard	5.4	4.3	.0	1,516	2.7%	4.5%	.0%	6.3%
Dell Computer	3.6	3.6	.0	946	1.8%	3.8%	.0%	4.0%
GeoQuest	3.6	.0	3.6	0	1.8%	.0%	3.8%	.0%
PacSoft	3.2	.0	3.2	0	1.6%	.0%	3.4%	.0%
GeoGraphix	3.2	.0	2.4	0	1.6%	.0%	2.5%	.0%
ERDAS	2.8	.8	1.9	305	1.4%	.8%	2.0%	1.3%
Generation 5 Technology	2.2	.0	2.2	0	1.1%	.0%	2.3%	.0%
Facility Mapping Systems	2.1	.0	1.8	0	1.0%	.0%	1.9%	.0%
Intera Tydac	1.6	.0	1.6	0	.8%	.0%	1.7%	.0%
Terra Sciences	1.5	.0	1.5	0	.7%	.0%	1.5%	.0%

(Continued)

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Table 14 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: Personal Computer
Region: North America
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Softdesk	1.3	.0	1.3	0	.6%	.0%	1.4%	.0%
LandCadd	1.0	.0	.9	0	.5%	.0%	1.0%	.0%
Maptech	.9	.0	.9	0	.5%	.0%	1.0%	.0%
Kork Systems	.8	.1	.6	15	.4%	.1%	.6%	.1%
Genasys II	.8	.1	.7	16	.4%	.1%	.7%	.1%
Radian Corporation	.8	.0	.5	0	.4%	.0%	.5%	.0%
Ground Modelling Systems	.5	.4	.3	3	.3%	.4%	.3%	.0%
Terr-Mar Resource Info Svs	.5	.1	.3	14	.3%	.1%	.3%	.1%
Geosoft	.4	.0	.4	0	.2%	.0%	.4%	.0%
GEOVISION Inc.	.3	.2	.1	36	.2%	.2%	.1%	.2%
Geotrace Technologies	.3	.0	.3	0	.1%	.0%	.3%	.0%
Geomath	.2	.0	.2	0	.1%	.0%	.2%	.0%
Engineering Systems Corp.	.2	.0	.2	0	.1%	.0%	.2%	.0%
American Small Business Comp.	.2	.0	.2	0	.1%	.0%	.2%	.0%
Uniras	.2	.0	.2	0	.1%	.0%	.2%	.0%
Sigma Design	.1	.0	.1	0	.1%	.0%	.1%	.0%
Innovative Data Design	.1	.0	.1	0	.1%	.0%	.1%	.0%
Accugraph	.1	.0	.1	0	.0%	.0%	.1%	.0%
Foresight Resources	.1	.0	.1	0	.0%	.0%	.1%	.0%
A.I. Systems	.1	.0	.1	0	.0%	.0%	.1%	.0%

(Continued)

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Table 14 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application:	GIS/Mapping
Platform:	Personal Computer
Region:	North America
Units:	Millions of U.S. Dollars/Actual Units

					Market Share			
Company	**Total Factory Revenue**	**Hardware Revenue**	**Software Revenue**	**Hardware Units Shipped**	**Total Factory Revenue**	**Hardware Revenue**	**Software Revenue**	**Hardware Units Shipped**
Other Companies	31.8	32.7	.0	8,613	15.9%	34.4%	.0%	36.0%
All Companies	199.8	95.1	94.5	23,932	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	199.2	94.7	94.2	23,929	99.7%	99.6%	99.7%	100.0%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	.5	.4	.3	3	.3%	.4%	.3%	.0%
All Hardware Companies	95.3	91.7	.0	23,366	47.7%	96.5%	.0%	97.6%
All Turnkey & SW Companies	104.5	3.4	94.5	566	52.3%	3.5%	100.0%	2.4%

Source: Dataquest (March 1993)

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Table 15
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: All Platforms
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Siemens Nixdorf Info systeme	144.2	73.6	51.1	2,347	21.1%	21.0%	23.7%	8.3%
Intergraph	82.1	33.4	25.2	1,067	12.0%	9.5%	11.7%	3.8%
IBM	44.4	30.2	7.6	4,157	6.5%	8.6%	3.5%	14.7%
Digital	34.0	23.4	.0	395	5.0%	6.7%	.0%	1.4%
Compaq	28.4	28.4	.0	6,164	4.2%	8.1%	.0%	21.8%
Landmark Graphics	24.6	12.3	5.7	127	3.6%	3.5%	2.6%	.5%
ICL	23.8	14.0	8.1	653	3.5%	4.0%	3.7%	2.3%
Hewlett-Packard	23.4	19.6	.0	2,050	3.4%	5.6%	.0%	7.3%
EDS	18.1	8.7	7.7	285	2.7%	2.5%	3.6%	1.0%
Computervision	17.2	7.5	4.0	143	2.5%	2.1%	1.9%	.5%
ESRI	17.2	.0	15.6	0	2.5%	.0%	7.2%	.0%
Sun Microsystems	14.6	12.4	.0	688	2.1%	3.5%	.0%	2.4%
STI-Straessle	14.5	2.3	7.5	105	2.1%	.7%	3.5%	.4%
Autodesk	11.5	.0	11.5	0	1.7%	.0%	5.3%	.0%
Smallworld Systems	10.5	2.4	5.8	52	1.5%	.7%	2.7%	.2%
Sysscan	9.8	4.2	2.6	92	1.4%	1.2%	1.2%	.3%
Moss Systems	9.7	.0	8.7	0	1.4%	.0%	4.0%	.0%
Genasys II	9.3	1.0	7.9	63	1.4%	.3%	3.7%	.2%
ItalCad	9.1	4.3	2.2	86	1.3%	1.2%	1.0%	.3%
Laser-Scan	8.5	2.9	3.4	51	1.2%	.8%	1.6%	.2%
GeoVision Systems	8.1	.6	4.2	8	1.2%	.2%	2.0%	.0%

(Continued)

Table 15 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application:	GIS/Mapping
Platform:	All Platforms
Region:	Europe
Units:	Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Apple Computer	7.0	6.1	.0	1,646	1.0%	1.7%	.0%	5.8%
Alper Systems	6.4	3.2	1.6	45	.9%	.9%	.7%	.2%
Spectrum Graphics	5.8	1.7	2.9	54	.9%	.5%	1.3%	.2%
Star Informatic	5.8	1.9	3.3	619	.8%	.5%	1.5%	2.2%
Clemessy	5.4	4.4	.8	18	.8%	1.2%	.4%	.1%
Kohns & Poppenhaeger	5.4	2.7	1.9	64	.8%	.8%	.9%	.2%
Unisys	5.2	2.6	1.8	78	.8%	.8%	.8%	.3%
PAFEC	4.6	.0	4.6	0	.7%	.0%	2.1%	.0%
Ground Modelling Systems	4.0	2.1	1.6	34	.6%	.6%	.7%	.1%
Silicon Graphics	3.8	3.4	.0	96	.6%	1.0%	.0%	.3%
Control Data Systems	3.0	1.8	.6	40	.4%	.5%	.3%	.1%
Synercom	2.8	.0	1.5	0	.4%	.0%	.7%	.0%
ERDAS	2.5	.7	1.7	275	.4%	.2%	.8%	1.0%
Geometria GIS Systems House	1.8	.2	.4	15	.3%	.1%	.2%	.1%
Ziegler Informatics	1.7	.0	1.7	0	.3%	.0%	.8%	.0%
RIB/RZB	1.7	.1	1.3	11	.2%	.0%	.6%	.0%
ETAK	1.6	.1	1.5	3	.2%	.0%	.7%	.0%
Solbourne	1.5	1.5	.0	148	.2%	.4%	.0%	.5%
Strategic Mapping	1.5	.0	1.4	0	.2%	.0%	.6%	.0%
GeoQuest	1.4	.0	1.4	0	.2%	.0%	.7%	.0%
Dell Computer	1.2	1.2	.0	315	.2%	.3%	.0%	1.1%

(Continued)

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Table 15 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: All Platforms
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Dynamic Graphics	1.2	.0	1.0	0	.2%	.0%	.5%	.0%
Research Machines	1.1	1.1	.0	176	.2%	.3%	.0%	.6%
DAPCO	1.1	.0	.7	0	.2%	.0%	.3%	.0%
Contract Data Research	.9	.0	.6	0	.1%	.0%	.3%	.0%
Olivetti	.9	.7	.0	103	.1%	.2%	.0%	.4%
CAD-Capture	.7	.2	.2	4	.1%	.0%	.1%	.0%
Hydrotec	.6	.3	.2	7	.1%	.1%	.1%	.0%
Microway	.6	.4	.2	6	.1%	.1%	.1%	.0%
EME	.5	.1	.2	14	.1%	.0%	.1%	.1%
Terra Sciences	.5	.0	.5	0	.1%	.0%	.2%	.0%
RoboCAD Solutions	.5	.0	.4	0	.1%	.0%	.2%	.0%
LEICA Heerberg	.4	.0	.3	0	.1%	.0%	.2%	.0%
ACDS Graphic System	.4	.0	.3	0	.1%	.0%	.2%	.0%
Kork Systems	.4	.0	.3	4	.1%	.0%	.1%	.0%
LandCadd	.4	.0	.4	0	.1%	.0%	.2%	.0%
CAD Distribution	.3	.1	.1	5	.0%	.0%	.1%	.0%
Terr-Mar Resource Info Svs	.3	.1	.2	5	.0%	.0%	.1%	.0%
Generation 5 Technology	.3	.0	.3	0	.0%	.0%	.1%	.0%
Facility Mapping Systems	.2	.0	.2	0	.0%	.0%	.1%	.0%
Applications in CADD	.2	.0	.1	6	.0%	.0%	.1%	.0%
Geotrace Technologies	.2	.0	.2	3	.0%	.0%	.1%	.0%

(Continued)

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Table 15 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: All Platforms
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Lamp Software	.1	.0	.1	7	.0%	.0%	.0%	.0%
Softdesk	.1	.0	.1	0	.0%	.0%	.0%	.0%
GEOVISION Inc.	.1	.0	.0	3	.0%	.0%	.0%	.0%
GeoGraphix	.1	.0	.1	0	.0%	.0%	.0%	.0%
Accugraph	.0	.0	.0	1	.0%	.0%	.0%	.0%
Masta Corporation	.0	.0	.0	0	.0%	.0%	.0%	.0%
A.I. Systems	.0	.0	.0	0	.0%	.0%	.0%	.0%
Foresight Resources	.0	.0	.0	0	.0%	.0%	.0%	.0%
American Small Business Comp.	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	32.8	32.2	.0	5,906	4.8%	9.2%	.0%	20.9%
All Companies	681.9	350.5	215.5	28,246	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	401.4	227.5	102.8	23,672	58.9%	64.9%	47.7%	83.8%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	280.6	123.0	112.8	4,574	41.1%	35.1%	52.3%	16.2%
All Hardware Companies	164.6	144.9	.1	21,535	24.1%	41.4%	.1%	76.2%
All Turnkey & SW Companies	517.4	205.6	215.4	6,710	75.9%	58.6%	99.9%	23.8%

Source: Dataquest (March 1993)

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Table 16
1992 CAD/CAM/CAE/GIS Market Share

Application:	GIS/Mapping
Platform:	Technical Workstation
Region:	Europe
Units:	Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Siemens Nixdorf Info systeme	122.6	61.3	42.9	2,084	28.0%	30.5%	28.5%	23.3%
Intergraph	64.8	29.8	14.3	963	14.8%	14.8%	9.5%	10.8%
ICL	23.8	14.0	8.1	653	5.4%	7.0%	5.4%	7.3%
Hewlett-Packard	23.4	19.6	.0	2,050	5.3%	9.8%	.0%	22.9%
Computervision	17.2	7.5	4.0	143	3.9%	3.7%	2.7%	1.6%
EDS	16.3	8.7	5.9	291	3.7%	4.3%	3.9%	3.3%
Landmark Graphics	14.7	7.4	3.4	76	3.4%	3.7%	2.3%	.9%
STI-Straessle	14.5	2.3	7.5	105	3.3%	1.1%	5.0%	1.2%
Sun Microsystems	10.7	9.2	.0	596	2.4%	4.6%	.0%	6.7%
Smallworld Systems	10.5	2.4	5.8	52	2.4%	1.2%	3.8%	.6%
Moss Systems	9.7	.0	8.7	0	2.2%	.0%	5.8%	.0%
ItalCad	9.1	4.3	2.2	86	2.1%	2.1%	1.5%	1.0%
ESRI	8.8	.0	8.0	0	2.0%	.0%	5.3%	.0%
Genasys II	8.4	.8	7.1	44	1.9%	.4%	4.7%	.5%
Laser-Scan	8.2	2.8	3.3	48	1.9%	1.4%	2.2%	.5%
Digital	7.0	4.8	.0	317	1.6%	2.4%	.0%	3.5%
Alper Systems	6.4	3.2	1.6	45	1.5%	1.6%	1.1%	.5%
Spectrum Graphics	5.8	1.7	2.9	54	1.3%	.9%	1.9%	.6%
Star Informatic	5.8	1.9	3.3	619	1.3%	.9%	2.2%	6.9%
GeoVision Systems	5.7	.5	3.0	6	1.3%	.2%	2.0%	.1%
Kohns & Poppenhaeger	5.4	2.7	1.9	64	1.2%	1.3%	1.3%	.7%

(Continued)

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Table 16 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: Technical Workstation
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
IBM	4.7	2.5	1.2	95	1.1%	1.3%	.8%	1.1%
PAFEC	4.6	.0	4.6	0	1.0%	.0%	3.0%	.0%
Clemessy	4.4	3.5	.7	11	1.0%	1.7%	.4%	.1%
Unisys	4.0	2.0	1.4	62	.9%	1.0%	.9%	.7%
Sysscan	3.9	1.4	1.4	46	.9%	.7%	.9%	.5%
Silicon Graphics	3.4	3.1	.0	89	.8%	1.6%	.0%	1.0%
Control Data Systems	3.0	1.8	.6	40	.7%	.9%	.4%	.4%
Synercom	1.8	.0	.9	0	.4%	.0%	.6%	.0%
ERDAS	1.5	.4	1.0	165	.3%	.2%	.7%	1.8%
Autodesk	1.2	.0	1.2	0	.3%	.0%	.8%	.0%
DAPCO	1.1	.0	.7	0	.2%	.0%	.5%	.0%
Dynamic Graphics	.9	.0	.8	0	.2%	.0%	.5%	.0%
GeoQuest	.7	.0	.7	0	.2%	.0%	.5%	.0%
Hydrotec	.6	.3	.2	7	.1%	.2%	.1%	.1%
Solbourne	.6	.6	.0	108	.1%	.3%	.0%	1.2%
Microway	.6	.4	.2	6	.1%	.2%	.1%	.1%
Geometria GIS Systems House	.6	.0	.0	0	.1%	.0%	.0%	.0%
LEICA Heerberg	.4	.0	.3	0	.1%	.0%	.2%	.0%
ACDS Graphic System	.4	.0	.3	0	.1%	.0%	.2%	.0%
RIB/RZB	.3	.0	.3	2	.1%	.0%	.2%	.0%
Terr-Mar Resource Info Svs	.2	.0	.1	2	.0%	.0%	.1%	.0%

(Continued)

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Table 16 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: Technical Workstation
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
ETAK	.2	.0	.2	0	.0%	.0%	.1%	.0%
Terra Sciences	.1	.0	.1	0	.0%	.0%	.1%	.0%
GEOVISION Inc.	.1	.0	.0	1	.0%	.0%	.0%	.0%
Lamp Software	.0	.0	.0	3	.0%	.0%	.0%	.0%
Accugraph	.0	.0	.0	1	.0%	.0%	.0%	.0%
Masta Corporation	.0	.0	.0	0	.0%	.0%	.0%	.0%
Softdesk	.0	.0	.0	0	.0%	.0%	.0%	.0%
LandCadd	.0	.0	.0	0	.0%	.0%	.0%	.0%
Facility Mapping Systems	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Companies	437.9	201.1	150.6	8,936	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	199.7	98.9	54.1	5,050	45.6%	49.2%	35.9%	56.5%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	238.2	102.2	96.5	3,887	54.4%	50.8%	64.1%	43.5%
All Hardware Companies	45.7	37.7	.1	3,167	10.4%	18.7%	.1%	35.4%
All Turnkey & SW Companies	392.2	163.4	150.5	5,770	89.6%	81.3%	99.9%	64.6%

Source: Dataquest (March 1993)

CAEC-WW-MS-9302

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Table 17
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: Host-Dependent
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Siemens Nixdorf Info systeme	21.6	12.3	8.2	263	26.9%	25.5%	43.4%	29.2%
IBM	19.8	10.7	5.2	205	24.6%	22.0%	27.7%	22.8%
Digital	17.9	12.4	.0	0	22.3%	25.5%	.0%	.0%
GeoVision Systems	2.4	.2	1.3	1	3.0%	.4%	6.7%	.1%
EDS	1.8	.0	1.8	(6)	2.3%	.0%	9.7%	-.7%
Unisys	1.2	.6	.4	16	1.5%	1.2%	2.1%	1.8%
Clemessy	1.1	.9	.2	6	1.4%	1.8%	.9%	.7%
Synercom	1.0	.0	.5	0	1.3%	.0%	2.9%	.0%
ESRI	.7	.0	.6	0	.9%	.0%	3.3%	.0%
Laser-Scan	.3	.1	.2	3	.4%	.1%	.8%	.3%
Dynamic Graphics	.3	.0	.2	0	.3%	.0%	1.2%	.0%
Geotrace Technologies	.2	.0	.1	3	.2%	.0%	.7%	.4%
ETAK	.2	.0	.1	0	.2%	.0%	.7%	.1%
Kork Systems	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	11.9	11.3	.0	407	14.8%	23.3%	.0%	45.2%
All Companies	80.4	48.4	18.9	899	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	57.3	35.2	10.4	627	71.3%	72.6%	54.9%	69.7%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	23.1	13.3	8.5	272	28.7%	27.4%	45.1%	30.3%
All Hardware Companies	29.8	23.7	.0	407	37.1%	48.9%	.0%	45.2%
All Turnkey & SW Companies	50.6	24.8	18.9	492	62.9%	51.1%	100.0%	54.8%

Source: Dataquest (March 1993)

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Table 18
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: Server
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Landmark Graphics	9.8	4.9	2.3	51	20.7%	19.7%	20.6%	9.9%
Digital	9.1	6.3	.0	78	19.2%	25.1%	.0%	15.3%
Intergraph	7.4	3.6	1.7	104	15.6%	14.4%	15.3%	20.3%
Sysscan	5.9	2.9	1.2	46	12.3%	11.4%	11.2%	8.9%
ESRI	5.0	.0	4.5	0	10.5%	.0%	41.3%	.0%
IBM	5.0	2.9	1.1	94	10.5%	11.6%	10.3%	18.3%
Sun Microsystems	3.9	3.2	.0	92	8.3%	12.8%	.0%	17.9%
Solbourne	.9	.9	.0	40	1.9%	3.6%	.0%	7.9%
Silicon Graphics	.4	.3	.0	7	.8%	1.3%	.0%	1.4%
ETAK	.2	.0	.1	0	.3%	.0%	1.2%	.0%
Other Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Companies	47.5	25.0	11.0	512	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	41.6	22.1	9.7	466	87.7%	88.6%	88.8%	91.1%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	5.9	2.9	1.2	46	12.3%	11.4%	11.2%	8.9%
All Hardware Companies	14.6	11.0	.0	295	30.8%	44.1%	.0%	57.6%
All Turnkey & SW Companies	32.8	14.0	11.0	217	69.2%	55.9%	100.0%	42.4%

Source: Dataquest (March 1993)

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Table 19
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: Personal Computer
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Compaq	28.4	28.4	.0	6,164	24.5%	37.4%	.0%	34.4%
IBM	15.1	14.1	.0	3,763	12.9%	18.6%	.0%	21.0%
Autodesk	10.4	.0	10.4	0	8.9%	.0%	29.6%	.0%
Intergraph	9.8	.0	9.3	0	8.5%	.0%	26.4%	.0%
Apple Computer	7.0	6.1	.0	1,646	6.0%	8.0%	.0%	9.2%
Ground Modelling Systems	4.0	2.1	1.6	34	3.4%	2.8%	4.6%	.2%
ESRI	2.7	.0	2.5	0	2.4%	.0%	7.1%	.0%
Ziegler Informatics	1.7	.0	1.7	0	1.5%	.0%	4.9%	.0%
Strategic Mapping	1.5	.0	1.4	0	1.3%	.0%	3.9%	.0%
RIB/RZB	1.3	.1	1.1	9	1.1%	.1%	3.1%	.1%
Geometria GIS Systems House	1.3	.2	.4	15	1.1%	.3%	1.1%	.1%
Dell Computer	1.2	1.2	.0	315	1.0%	1.6%	.0%	1.8%
ETAK	1.1	.1	1.1	3	1.0%	.1%	3.1%	.0%
Research Machines	1.1	1.1	.0	176	.9%	1.4%	.0%	1.0%
ERDAS	1.0	.3	.7	110	.9%	.4%	1.9%	.6%
Genasys II	.9	.1	.8	19	.8%	.2%	2.2%	.1%
Contract Data Research	.9	.0	.6	0	.8%	.0%	1.8%	.0%
Olivetti	.9	.7	.0	103	.7%	1.0%	.0%	.6%
CAD-Capture	.7	.2	.2	4	.6%	.2%	.6%	.0%
GeoQuest	.7	.0	.7	0	.6%	.0%	2.1%	.0%

(Continued)

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Table 19 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: Personal Computer
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
EME	.5	.1	.2	14	.4%	.2%	.7%	.1%
RoboCAD Solutions	.5	.0	.4	0	.4%	.0%	1.1%	.0%
Terra Sciences	.4	.0	.4	0	.4%	.0%	1.2%	.0%
Kork Systems	.4	.0	.3	4	.3%	.0%	.8%	.0%
LandCadd	.4	.0	.4	0	.3%	.0%	1.0%	.0%
CAD Distribution	.3	.1	.1	5	.3%	.2%	.3%	.0%
Generation 5 Technology	.3	.0	.3	0	.2%	.0%	.8%	.0%
Facility Mapping Systems	.2	.0	.2	0	.2%	.0%	.6%	.0%
Applications in CADD	.2	.0	.1	6	.2%	.0%	.4%	.0%
Terr-Mar Resource Info Svs	.1	.0	.1	3	.1%	.0%	.2%	.0%
Lamp Software	.1	.0	.1	4	.1%	.0%	.1%	.0%
GeoGraphix	.1	.0	.1	0	.1%	.0%	.1%	.0%
Softdesk	.1	.0	.1	0	.1%	.0%	.2%	.0%
Geotrace Technologies	.1	.0	.1	0	.0%	.0%	.1%	.0%
GEOVISION Inc.	.0	.0	.0	2	.0%	.0%	.0%	.0%
A.I. Systems	.0	.0	.0	0	.0%	.0%	.0%	.0%
Foresight Resources	.0	.0	.0	0	.0%	.0%	.0%	.0%
American Small Business Comp.	.0	.0	.0	0	.0%	.0%	.0%	.0%
Siemens Nixdorf Info systeme	.0	.0	.0	0	.0%	.0%	.0%	.0%

(Continued)

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Table 19 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: Personal Computer
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Other Companies	20.9	20.9	.0	5,499	18.0%	27.5%	.0%	30.7%
All Companies	116.2	76.0	35.1	17,898	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	102.8	71.3	28.5	17,528	88.4%	93.8%	81.3%	97.9%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	13.4	4.7	6.5	370	11.6%	6.2%	18.7%	2.1%
All Hardware Companies	74.5	72.6	.0	17,667	64.1%	95.5%	.0%	98.7%
All Turnkey & SW Companies	41.8	3.4	35.1	231	35.9%	4.5%	100.0%	1.3%

Source: Dataquest (March 1993)

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Table 20
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: All Platforms
Region: Asia
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Fujitsu	48.6	31.1	12.6	963	14.4%	15.5%	13.6%	8.8%
Mitsubishi Electric	39.9	31.1	5.0	724	11.8%	15.6%	5.4%	6.6%
Intergraph	32.1	13.8	8.7	458	9.5%	6.9%	9.3%	4.2%
IBM	24.6	16.5	4.4	2,167	7.3%	8.2%	4.7%	19.8%
Uchida Yoko	22.0	13.3	7.9	522	6.5%	6.6%	8.4%	4.8%
Hitachi	17.4	8.3	7.3	468	5.2%	4.2%	7.9%	4.3%
Mitsui Engineering	15.1	10.6	3.0	100	4.5%	5.3%	3.2%	.9%
Toshiba—NO OEM	10.6	5.3	4.3	126	3.1%	2.7%	4.6%	1.2%
Sun Microsystems	9.9	8.5	.0	507	2.9%	4.2%	.0%	4.6%
Siemens Nixdorf Info systeme	9.1	4.6	3.2	147	2.7%	2.3%	3.5%	1.3%
Landmark Graphics	8.2	4.1	1.9	42	2.4%	2.0%	2.0%	.4%
Hewlett-Packard	7.9	6.6	.0	884	2.3%	3.3%	.0%	8.1%
Digital	7.2	4.9	.0	79	2.1%	2.5%	.0%	.7%
INS Engineering	7.2	3.6	3.6	18	2.1%	1.8%	3.8%	.2%
NEC	7.0	4.0	2.4	310	2.1%	2.0%	2.6%	2.8%
EDS	6.9	3.3	2.8	106	2.0%	1.6%	3.0%	1.0%
CADIX	6.7	2.7	3.4	49	2.0%	1.3%	3.6%	.5%
Autodesk	5.4	.0	5.4	0	1.6%	.0%	5.8%	.0%
GeoVision Systems	5.4	.4	2.8	5	1.6%	.2%	3.0%	.0%
ESRI	5.1	.0	4.6	0	1.5%	.0%	4.9%	.0%
Century Research Center	5.0	2.6	1.8	28	1.5%	1.3%	2.0%	.3%

(Continued)

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Table 20 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application:	GIS/Mapping
Platform:	All Platforms
Region:	Asia
Units:	Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Mutoh Industries—NO OEM	4.3	2.5	1.3	65	1.3%	1.2%	1.3%	.6%
Silicon Graphics	3.2	3.0	.0	80	.9%	1.5%	.0%	.7%
Apple Computer	2.9	2.6	.0	696	.9%	1.3%	.0%	6.4%
Synercom	2.1	.0	1.1	0	.6%	.0%	1.2%	.0%
ERDAS	1.2	.3	.8	125	.3%	.2%	.8%	1.1%
Moss Systems	1.1	.0	1.0	0	.3%	.0%	1.1%	.0%
GeoQuest	1.0	.0	1.0	0	.3%	.0%	1.0%	.0%
Control Data Systems	.9	.5	.2	12	.3%	.3%	.2%	.1%
Andor	.6	.2	.4	5	.2%	.1%	.5%	.0%
Sysscan	.6	.3	.2	6	.2%	.1%	.2%	.1%
Genasys II	.6	.1	.5	4	.2%	.0%	.5%	.0%
Terr-Mar Resource Info Svs	.6	.2	.3	10	.2%	.1%	.3%	.1%
ETAK	.5	.0	.5	1	.2%	.0%	.5%	.0%
Laser-Scan	.4	.1	.2	3	.1%	.1%	.2%	.0%
Dynamic Graphics	.2	.0	.2	0	.1%	.0%	.2%	.0%
GeoGraphix	.2	.0	.1	0	.0%	.0%	.1%	.0%
Softdesk	.1	.0	.1	0	.0%	.0%	.1%	.0%
ACDS Graphic System	.1	.0	.1	0	.0%	.0%	.1%	.0%
PAFEC	.1	.0	.1	0	.0%	.0%	.1%	.0%
Geotrace Technologies	.1	.0	.1	1	.0%	.0%	.1%	.0%
Facility Mapping Systems	.0	.0	.0	0	.0%	.0%	.0%	.0%

(Continued)

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Table 20 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: All Platforms
Region: Asia
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Accugraph	.0	.0	.0	1	.0%	.0%	.0%	.0%
Kork Systems	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	15.5	15.1	.0	2,216	4.6%	7.5%	.0%	20.3%
All Companies	337.4	200.1	93.0	10,929	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	141.7	79.8	35.5	7,396	42.0%	39.9%	38.1%	67.7%
All Asian-Based Companies	184.4	115.3	52.9	3,377	54.6%	57.6%	56.9%	30.9%
All European-Based Companies	11.3	5.0	4.7	156	3.4%	2.5%	5.0%	1.4%
All Hardware Companies	54.4	48.0	.0	6,386	16.1%	24.0%	.0%	58.4%
All Turnkey & SW Companies	283.0	152.1	93.0	4,543	83.9%	76.0%	100.0%	41.6%

Source: Dataquest (March 1993)

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Table 21
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: Technical Workstation
Region: Asia
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Mitsubishi Electric	30.5	26.0	2.1	329	14.3%	20.6%	3.6%	8.1%
Intergraph	25.0	11.5	5.5	368	11.7%	9.1%	9.3%	9.1%
Fujitsu	20.4	13.1	5.3	416	9.5%	10.4%	9.0%	10.3%
Uchida Yoko	19.8	11.9	6.9	423	9.2%	9.4%	11.7%	10.4%
Mitsui Engineering	13.7	9.6	2.8	77	6.4%	7.6%	4.6%	1.9%
Hitachi	12.5	6.0	5.3	271	5.9%	4.8%	8.9%	6.7%
Toshiba—NO OEM	10.6	5.3	4.3	126	5.0%	4.2%	7.2%	3.1%
Siemens Nixdorf Info systeme	7.7	3.8	2.7	131	3.6%	3.0%	4.5%	3.2%
Sun Microsystems	7.5	6.5	.0	433	3.5%	5.1%	.0%	10.7%
Hewlett-Packard	7.4	6.2	.0	695	3.5%	4.9%	.0%	17.2%
INS Engineering	7.2	3.6	3.6	18	3.3%	2.8%	6.1%	.5%
CADIX	6.7	2.7	3.4	49	3.1%	2.1%	5.7%	1.2%
NEC	6.3	3.5	2.3	207	2.9%	2.7%	3.9%	5.1%
EDS	6.2	3.3	2.1	108	2.9%	2.6%	3.5%	2.7%
Century Research Center	5.0	2.6	1.8	28	2.3%	2.1%	3.1%	.7%
Landmark Graphics	4.9	2.5	1.1	25	2.3%	1.9%	1.9%	.6%
GeoVision Systems	3.8	.3	2.0	4	1.8%	.2%	3.3%	.1%
Silicon Graphics	3.2	3.0	.0	80	1.5%	2.4%	.0%	2.0%
IBM	2.7	1.5	.7	74	1.3%	1.2%	1.1%	1.8%
ESRI	2.6	.0	2.3	0	1.2%	.0%	4.0%	.0%

(Continued)

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Table 21 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: Technical Workstation
Region: Asia
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Mutoh Industries—NO OEM	2.3	1.4	.7	23	1.1%	1.1%	1.2%	.6%
Digital	1.5	1.0	.0	64	.7%	.8%	.0%	1.6%
Synercom	1.4	.0	.7	0	.6%	.0%	1.2%	.0%
Moss Systems	1.1	.0	1.0	0	.5%	.0%	1.7%	.0%
Control Data Systems	.9	.5	.2	12	.4%	.4%	.3%	.3%
ERDAS	.7	.2	.5	75	.3%	.2%	.8%	1.9%
Genasys II	.5	.1	.4	3	.2%	.0%	.7%	.1%
GeoQuest	.5	.0	.5	0	.2%	.0%	.8%	.0%
Laser-Scan	.4	.1	.2	3	.2%	.1%	.3%	.1%
Terr-Mar Resource Info Svs	.3	.1	.2	4	.2%	.1%	.3%	.1%
Autodesk	.3	.0	.3	0	.1%	.0%	.5%	.0%
Sysscan	.3	.1	.1	3	.1%	.1%	.2%	.1%
Dynamic Graphics	.2	.0	.2	0	.1%	.0%	.3%	.0%
ACDS Graphic System	.1	.0	.1	0	.1%	.0%	.2%	.0%
PAFEC	.1	.0	.1	0	.0%	.0%	.2%	.0%
ETAK	.1	.0	.0	0	.0%	.0%	.1%	.0%
Softdesk	.0	.0	.0	0	.0%	.0%	.1%	.0%
Accugraph	.0	.0	.0	1	.0%	.0%	.0%	.0%
Contract Data Research	.0	.0	.0	0	.0%	.0%	.0%	.0%

(Continued)

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Table 21 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: Technical Workstation
Region: Asia
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Other Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Companies	214.1	126.2	59.2	4,049	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	69.6	36.6	16.7	1,945	32.5%	29.0%	28.3%	48.0%
All Asian-Based Companies	135.0	85.6	38.4	1,967	63.0%	67.8%	64.9%	48.6%
All European-Based Companies	9.6	4.1	4.0	136	4.5%	3.2%	6.8%	3.4%
All Hardware Companies	19.6	16.8	.0	1,274	9.2%	13.3%	.1%	31.5%
All Turnkey & SW Companies	194.5	109.4	59.1	2,775	90.8%	86.7%	99.9%	68.5%

Source: Dataquest (March 1993)

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Table 22
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: Host-Dependent
Region: Asia
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Fujitsu	18.5	11.8	4.8	257	34.1%	36.2%	36.4%	33.9%
IBM	11.5	6.2	3.1	160	21.3%	19.1%	23.2%	21.1%
Mitsubishi Electric	5.4	2.5	1.5	17	9.9%	7.7%	11.5%	2.2%
Digital	3.8	2.6	.0	0	7.1%	8.1%	.0%	.0%
Hitachi	1.7	.8	.7	31	3.2%	2.5%	5.5%	4.1%
GeoVision Systems	1.6	.1	.8	1	3.0%	.4%	6.4%	.1%
Siemens Nixdorf Info systeme	1.4	.8	.5	16	2.5%	2.4%	3.9%	2.2%
Synercom	.8	.0	.4	0	1.5%	.0%	3.2%	.0%
EDS	.7	.0	.7	(2)	1.3%	.0%	5.2%	-.3%
Intergraph	.3	.0	.3	0	.6%	.0%	2.2%	.0%
ESRI	.2	.0	.2	0	.4%	.0%	1.4%	.0%
ETAK	.1	.0	.0	0	.1%	.0%	.3%	.0%
Dynamic Graphics	.1	.0	.0	0	.1%	.0%	.3%	.0%
Geotrace Technologies	.1	.0	.0	1	.1%	.0%	.3%	.1%
Laser-Scan	.0	.0	.0	0	.0%	.0%	.1%	.0%
Other Companies	8.1	7.7	.0	278	15.0%	23.7%	.0%	36.6%
All Companies	54.3	32.7	13.2	760	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	27.3	16.7	5.6	438	50.3%	51.2%	42.5%	57.6%
All Asian-Based Companies	25.6	15.2	7.0	305	47.2%	46.4%	53.5%	40.2%
All European-Based Companies	1.4	.8	.5	17	2.5%	2.4%	4.0%	2.2%
All Hardware Companies	12.0	10.4	.0	278	22.1%	31.8%	.0%	36.6%
All Turnkey & SW Companies	42.3	22.3	13.2	482	77.9%	68.2%	100.0%	63.4%

Source: Dataquest (March 1993)

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Table 23
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: Server
Region: Asia
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Intergraph	4.8	2.3	1.1	91	28.3%	25.9%	27.8%	42.4%
Landmark Graphics	3.3	1.6	.8	17	19.3%	18.3%	18.9%	7.9%
IBM	2.7	1.5	.7	14	15.9%	16.9%	16.7%	6.4%
Sun Microsystems	2.4	2.0	.0	74	14.3%	22.3%	.0%	34.6%
Digital	1.9	1.3	.0	16	11.1%	14.4%	.0%	7.3%
ESRI	1.5	.0	1.3	0	8.6%	.0%	33.6%	.0%
Sysscan	.4	.2	.1	3	2.2%	2.1%	2.0%	1.4%
ETAK	.1	.0	.0	0	.3%	.0%	1.0%	.0%
Other Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Companies	17.0	9.0	4.0	214	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	16.6	8.8	3.9	211	97.8%	97.9%	98.0%	98.6%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	.4	.2	.1	3	2.2%	2.1%	2.0%	1.4%
All Hardware Companies	4.3	3.3	.0	90	25.4%	36.8%	.0%	41.9%
All Turnkey & SW Companies	12.7	5.7	4.0	124	74.6%	63.2%	100.0%	58.1%

Source: Dataquest (March 1993)

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Table 24
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: Personal Computer
Region: Asia
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Fujitsu	9.7	6.2	2.5	289	18.7%	19.3%	15.1%	4.9%
IBM	7.7	7.2	.0	1,920	14.8%	22.4%	.0%	32.5%
Autodesk	5.2	.0	5.2	0	9.9%	.0%	30.7%	.0%
Mitsubishi Electric	4.0	2.6	1.4	378	7.7%	8.2%	8.1%	6.4%
Hitachi	3.1	1.5	1.3	166	6.0%	4.7%	7.9%	2.8%
Apple Computer	2.9	2.6	.0	696	5.7%	8.0%	.0%	11.8%
Uchida Yoko	2.2	1.4	.9	99	4.2%	4.3%	5.6%	1.7%
Mutoh Industries—NO OEM	2.0	1.1	.6	41	3.9%	3.3%	3.3%	.7%
Intergraph	1.9	.0	1.8	0	3.7%	.0%	10.8%	.0%
Mitsui Engineering	1.4	1.0	.3	23	2.6%	2.9%	1.6%	.4%
ESRI	.8	.0	.7	0	1.6%	.0%	4.4%	.0%
NEC	.7	.6	.1	104	1.3%	1.8%	.4%	1.8%
Andor	.6	.2	.4	5	1.2%	.5%	2.6%	.1%
GeoQuest	.5	.0	.5	0	.9%	.0%	2.9%	.0%
ERDAS	.5	.1	.3	50	.9%	.4%	1.8%	.8%
Hewlett-Packard	.5	.4	.0	189	.9%	1.1%	.0%	3.2%
ETAK	.4	.0	.4	1	.7%	.1%	2.1%	.0%
Terr-Mar Resource Info Svs	.2	.1	.1	6	.4%	.2%	.7%	.1%
GeoGraphix	.2	.0	.1	0	.3%	.0%	.7%	.0%
Softdesk	.1	.0	.1	0	.2%	.0%	.5%	.0%
Genasys II	.1	.0	.1	1	.1%	.0%	.3%	.0%

(Continued)

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Table 24 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: Personal Computer
Region: Asia
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Facility Mapping Systems	.0	.0	.0	0	.1%	.0%	.2%	.0%
Geotrace Technologies	.0	.0	.0	0	.0%	.0%	.1%	.0%
Kork Systems	.0	.0	.0	0	.0%	.0%	.1%	.0%
Other Companies	7.4	7.4	.0	1,938	14.2%	22.8%	.0%	32.8%
All Companies	52.0	32.2	16.8	5,906	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	28.2	17.7	9.3	4,802	54.3%	55.0%	55.4%	81.3%
All Asian-Based Companies	23.8	14.5	7.5	1,105	45.7%	45.0%	44.6%	18.7%
All European-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Hardware Companies	18.4	17.5	.0	4,744	35.4%	54.3%	.0%	80.3%
All Turnkey & SW Companies	33.6	14.7	16.8	1,162	64.6%	45.7%	100.0%	19.7%

Source: Dataquest (March 1993)

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Table 25
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: All Platforms
Region: Rest of World
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Intergraph	29.1	12.6	7.9	463	35.6%	36.6%	27.7%	17.7%
Landmark Graphics	16.4	8.2	3.8	85	20.1%	23.9%	13.2%	3.2%
ESRI	6.1	.0	5.5	0	7.4%	.0%	19.4%	.0%
Radian Corporation	3.1	.0	1.9	0	3.8%	.0%	6.5%	.0%
Compaq	3.1	3.1	.0	671	3.8%	9.0%	.0%	25.6%
GeoVision Systems	2.7	.2	1.4	3	3.3%	.6%	5.0%	.1%
Digital	2.5	1.8	.0	29	3.1%	5.2%	.0%	1.1%
IBM	2.3	1.9	.2	442	2.8%	5.6%	.5%	16.9%
Data General	1.9	1.5	.1	100	2.3%	4.5%	.3%	3.8%
Strategic Mapping	1.8	.0	1.7	0	2.3%	.0%	5.8%	.0%
MapInfo	1.5	.0	1.2	0	1.8%	.0%	4.1%	.0%
Computervision	1.0	.4	.3	10	1.2%	1.1%	1.0%	.4%
Infocel	.9	.2	.7	20	1.2%	.6%	2.5%	.8%
Genasys II	.9	.1	.8	6	1.1%	.3%	2.8%	.2%
ERDAS	.8	.2	.5	88	1.0%	.6%	1.8%	3.3%
Kork Systems	.8	.1	.6	1	1.0%	.3%	2.0%	.0%
ETAK	.5	.0	.5	1	.6%	.1%	1.7%	.0%
Hewlett-Packard	.5	.4	.0	71	.6%	1.2%	.0%	2.7%
Sun Microsystems	.5	.4	.0	32	.6%	1.2%	.0%	1.2%
Laser-Scan	.5	.1	.2	0	.6%	.3%	.8%	.0%
Dynamic Graphics	.5	.0	.4	0	.6%	.0%	1.4%	.0%

(Continued)

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Table 25 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: All Platforms
Region: Rest of World
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Autodesk	.4	.0	.4	0	.5%	.0%	1.4%	.0%
Clemessy	.3	.2	.0	1	.4%	.7%	.1%	.0%
Apple Computer	.3	.2	.0	63	.3%	.7%	.0%	2.4%
Generation 5 Technology	.2	.0	.2	0	.2%	.0%	.7%	.0%
LandCadd	.2	.0	.2	0	.2%	.0%	.5%	.0%
Synercom	.1	.0	.1	0	.2%	.0%	.2%	.0%
Terr-Mar Resource Info Svs	.1	.0	.1	2	.1%	.1%	.2%	.1%
Softdesk	.1	.0	.1	0	.1%	.0%	.3%	.0%
Facility Mapping Systems	.1	.0	.1	0	.1%	.0%	.2%	.0%
Secagraphics	.1	.0	.0	0	.1%	.1%	.0%	.0%
Engineering Systems Corp.	.0	.0	.0	0	.0%	.0%	.1%	.0%
Accugraph	.0	.0	.0	1	.0%	.0%	.0%	.0%
Ziegler Informatics	.0	.0	.0	0	.0%	.0%	.0%	.0%
Toshiba—NO OEM	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	2.4	2.5	.0	535	2.9%	7.4%	.0%	20.4%
All Companies	81.6	34.3	28.5	2,623	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	80.9	33.9	28.2	2,622	99.1%	99.0%	99.0%	100.0%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	.8	.3	.3	1	.9%	1.0%	1.0%	.0%
All Hardware Companies	13.1	11.6	.1	1,931	16.0%	33.8%	.3%	73.6%
All Turnkey & SW Companies	68.6	22.7	28.4	692	84.0%	66.2%	99.7%	26.4%

Source: Dataquest (March 1993)

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Table 26
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: Technical Workstation
Region: Rest of World
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Intergraph	22.7	10.4	5.0	407	49.9%	56.5%	34.9%	59.2%
Landmark Graphics	9.8	4.9	2.3	51	21.6%	26.6%	15.8%	7.4%
ESRI	3.1	.0	2.8	0	6.8%	.0%	19.7%	.0%
GeoVision Systems	1.9	.2	1.0	2	4.2%	.8%	6.9%	.3%
Radian Corporation	1.9	.0	1.1	0	4.1%	.0%	7.8%	.0%
Data General	1.4	1.1	.1	81	3.1%	6.1%	.5%	11.8%
Genasys II	.8	.1	.7	4	1.8%	.5%	5.0%	.6%
Computervision	.7	.3	.2	6	1.5%	1.4%	1.3%	.9%
Digital	.5	.4	.0	23	1.1%	2.0%	.0%	3.4%
ERDAS	.5	.1	.3	53	1.1%	.7%	2.2%	7.6%
Laser-Scan	.4	.1	.2	0	.9%	.5%	1.5%	.0%
Dynamic Graphics	.4	.0	.3	0	.8%	.0%	2.2%	.0%
Sun Microsystems	.4	.3	.0	26	.8%	1.7%	.0%	3.7%
Hewlett-Packard	.4	.3	.0	27	.8%	1.6%	.0%	3.9%
Clemessy	.2	.2	.0	1	.5%	1.0%	.2%	.1%
IBM	.1	.1	.0	4	.2%	.3%	.1%	.5%
Infocel	.1	.0	.1	2	.2%	.2%	.6%	.2%
Synercom	.1	.0	.0	0	.2%	.0%	.3%	.0%
Terr-Mar Resource Info Svs	.1	.0	.0	1	.2%	.1%	.3%	.1%
ETAK	.1	.0	.0	0	.1%	.0%	.3%	.0%
Accugraph	.0	.0	.0	1	.0%	.1%	.0%	.1%

(Continued)

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Table 26 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: Technical Workstation
Region: Rest of World
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Softdesk	.0	.0	.0	0	.0%	.0%	.1%	.0%
Autodesk	.0	.0	.0	0	.0%	.0%	.1%	.0%
LandCadd	.0	.0	.0	0	.0%	.0%	.1%	.0%
Other Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Companies	45.5	18.5	14.3	688	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	44.8	18.2	14.0	687	98.5%	98.4%	98.3%	99.9%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	.7	.3	.2	1	1.5%	1.6%	1.7%	.1%
All Hardware Companies	2.6	2.1	.1	157	5.8%	11.4%	.5%	22.8%
All Turnkey & SW Companies	42.8	16.4	14.2	531	94.2%	88.6%	99.5%	77.2%

Source: Dataquest (March 1993)

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Table 27
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: Host-Dependent
Region: Rest of World
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Digital	1.3	.9	.0	0	30.5%	48.4%	.0%	.0%
GeoVision Systems	.8	.1	.4	0	18.4%	3.1%	31.9%	1.2%
IBM	.4	.2	.1	8	9.8%	12.0%	8.1%	23.9%
Intergraph	.3	.0	.3	0	6.6%	.0%	19.3%	.0%
ESRI	.2	.0	.2	0	5.5%	.0%	16.3%	.0%
Radian Corporation	.2	.0	.1	0	5.0%	.0%	8.9%	.0%
Dynamic Graphics	.1	.0	.1	0	2.3%	.0%	6.7%	.0%
Clemessy	.1	.0	.0	0	1.4%	2.1%	.7%	1.1%
Computervision	.1	.0	.0	1	1.4%	1.0%	.7%	4.0%
Secagraphics	.1	.0	.0	0	1.1%	1.0%	.7%	1.1%
ETAK	.1	.0	.0	0	1.1%	.0%	3.0%	.5%
Synercom	.1	.0	.0	0	1.1%	.0%	1.5%	.0%
Laser-Scan	.0	.0	.0	0	.9%	.0%	1.5%	.0%
Kork Systems	.0	.0	.0	0	.5%	1.0%	.0%	.0%
Engineering Systems Corp.	.0	.0	.0	0	.2%	.0%	.7%	.0%
Other Companies	.6	.6	.0	21	14.3%	31.2%	.0%	68.3%
All Companies	4.4	1.9	1.4	31	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	4.3	1.9	1.3	31	97.7%	97.9%	97.8%	98.9%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	.1	.0	.0	0	2.3%	2.1%	2.2%	1.1%
All Hardware Companies	2.0	1.5	.0	21	44.8%	79.7%	.0%	68.3%
All Turnkey & SW Companies	2.4	.4	1.4	10	55.2%	20.3%	100.0%	31.7%

Source: Dataquest (March 1993)

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Table 28
1992 CAD/CAM/CAE/GIS Market Share

Application:	GIS/Mapping
Platform:	Server
Region:	Rest of World
Units:	Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Landmark Graphics	6.6	3.3	1.5	34	44.6%	50.0%	34.1%	25.5%
Intergraph	4.4	2.1	1.0	56	29.7%	32.3%	22.6%	42.1%
ESRI	1.8	.0	1.6	0	12.0%	.0%	36.1%	.0%
Digital	.7	.5	.0	6	4.6%	7.2%	.0%	4.3%
Data General	.5	.4	.0	19	3.4%	6.1%	.5%	14.2%
Computervision	.3	.1	.1	2	1.9%	1.4%	2.0%	1.9%
Radian Corporation	.3	.0	.2	0	1.7%	.0%	3.4%	.0%
Sun Microsystems	.1	.1	.0	6	.9%	1.7%	.0%	4.5%
IBM	.1	.1	.0	9	.9%	1.4%	.5%	6.8%
ETAK	.1	.0	.0	0	.3%	.0%	.9%	.0%
Hewlett-Packard	.0	.0	.0	1	.1%	.0%	.0%	.7%
Other Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Companies	14.7	6.6	4.4	133	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	14.7	6.6	4.4	133	100.0%	100.0%	100.0%	100.0%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Hardware Companies	1.4	1.0	.0	40	9.2%	15.4%	.5%	30.2%
All Turnkey & SW Companies	13.4	5.6	4.4	93	90.8%	84.6%	99.5%	69.8%

Source: Dataquest (March 1993)

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Table 29
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: Personal Computer
Region: Rest of World
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Compaq	3.1	3.1	.0	671	18.1%	42.3%	.0%	37.9%
Strategic Mapping	1.8	.0	1.7	0	10.8%	.0%	19.7%	.0%
Intergraph	1.7	.0	1.6	0	10.2%	.0%	19.5%	.0%
IBM	1.6	1.5	.0	422	9.6%	21.1%	.0%	23.8%
MapInfo	1.5	.0	1.2	0	8.6%	.0%	13.9%	.0%
ESRI	1.0	.0	.9	0	5.7%	.0%	10.6%	.0%
Infocel	.8	.2	.6	18	4.9%	2.3%	7.4%	1.0%
Kork Systems	.8	.1	.6	1	4.6%	1.0%	6.7%	.0%
Radian Corporation	.8	.0	.5	0	4.6%	.0%	5.6%	.0%
Autodesk	.4	.0	.4	0	2.3%	.0%	4.6%	.0%
ETAK	.4	.0	.4	1	2.2%	.3%	4.3%	.1%
ERDAS	.3	.1	.2	35	1.9%	1.2%	2.5%	2.0%
Apple Computer	.3	.2	.0	63	1.6%	3.3%	.0%	3.6%
Generation 5 Technology	.2	.0	.2	0	1.1%	.0%	2.3%	.0%
Hewlett-Packard	.2	.1	.0	43	.9%	1.6%	.0%	2.4%
LandCadd	.2	.0	.1	0	.9%	.0%	1.7%	.0%
Genasys II	.1	.0	.1	2	.5%	.1%	1.0%	.1%
Softdesk	.1	.0	.1	0	.4%	.0%	.8%	.0%
Facility Mapping Systems	.1	.0	.1	0	.4%	.0%	.7%	.0%
Terr-Mar Resource Info Svs	.1	.0	.0	1	.3%	.1%	.4%	.1%
Engineering Systems Corp.	.0	.0	.0	0	.2%	.0%	.2%	.0%

(Continued)

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Table 29 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: GIS/Mapping
Platform: Personal Computer
Region: Rest of World
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Ziegler Informatics	.0	.0	.0	0	.1%	.0%	.1%	.0%
Other Companies	1.8	1.9	.0	513	10.3%	26.6%	.0%	29.0%
All Companies	17.1	7.3	8.4	1,771	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	17.0	7.3	8.4	1,771	99.9%	100.0%	99.9%	100.0%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	.0	.0	.0	0	.1%	.0%	.1%	.0%
All Hardware Companies	7.1	6.9	.0	1,713	41.6%	94.9%	.0%	96.7%
All Turnkey & SW Companies	10.0	.4	8.4	58	58.4%	5.1%	100.0%	3.3%

Source: Dataquest (March 1993)

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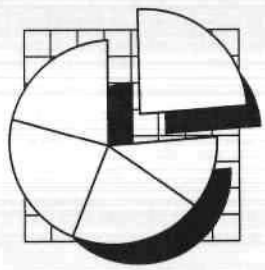
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Software

AEC Applications Worldwide Market Share



Market Statistics

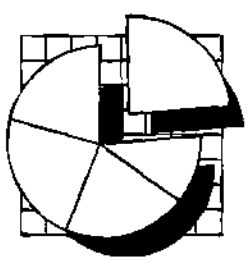
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Software

AEC Applications Worldwide Market Share



Market Statistics

1993

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Note: All tables show estimated data.

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AEC Applications Worldwide Market Share

Introduction

CAD/CAM/CAE/GIS systems have dramatically changed the methods by which designers and production managers originate and implement products. CAD and CAE systems allow designers to create, draft, analyze, test, and manipulate products on a screen in two and three dimensions. As CAD/CAM/CAE/GIS systems continue to decrease in cost, they become more available and cost justifiable to new users.

In order to provide a comprehensive view of the CAD/CAM/CAE/GIS industry, Dataquest's CAD/CAM/CAE/GIS group maintains a large database of industry information. The type of information contained in the database is depicted in Figure 1.

Market Analysis

With potentially the lowest growth rates in the history of the industry, 1992 was a year of transition. Turmoil in world economic forces caused recessionary pressures in many of the oldest and strongest markets for CAD/CAM/CAE/GIS. At the same time, competitive pressures in the end-user environment forced a higher level of integration and system complexity with fewer people. Evolution in new hardware and software technologies further added to the transitional pressures. For many, 1992 was the first year to seriously discuss and solve some of the sticky problems of integrating technologies and people. The process is painful, but the result should fuel healthy CAD/CAM/CAE/GIS market growth for the next five years.

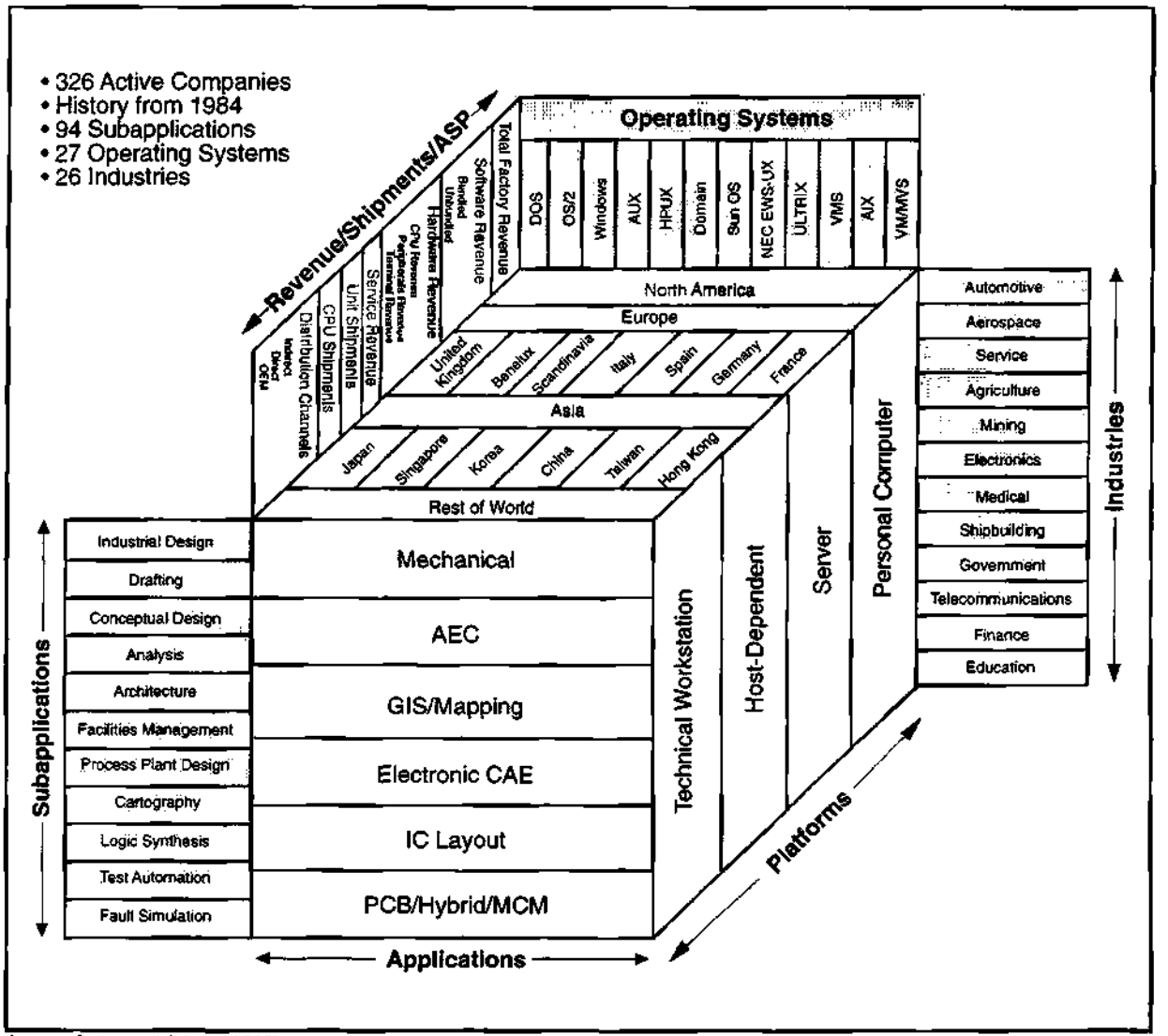
Based on our preliminary analysis, shown in Table 1, the year turned out somewhat better than expected, with a 4.2 percent growth rate in total revenue and 9.7 percent growth in software revenue. Regionally, European-based vendors enjoyed the strongest results, at 6.5 percent growth. Asian-based vendors grew 2.1 percent, with North American-based vendors in between the two, at 3.7 percent. In reality, the dollar was devalued against both the yen and the ECU, so the actual growth of both European- and Asian-based companies is lower than it appears.

Dataquest Perspective

The market dynamics in the total CAD/CAM/CAE/GIS market comprises many factors based on application-specific market needs, diverse geographical issues, and the amazing growth of computing and graphics resources. A more detailed analysis of each application area must be made to thoroughly understand the forces driving the entire market. Dataquest will discuss these forces and will provide an in-depth analysis of CAD/CAM/CAE/GIS regional issues, technology trends, and company analyses in future publications.

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Figure 1
CAD/CAM/CAE/GIS Market Database



Source: Dataquest (March 1993) G3000181

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Table 1
CAD/CAM/CAE/GIS 1992 Market Summary

	Software Revenue 1991 ($M)	Software Revenue 1992 ($M)	Growth Rate (%)	Total Revenue 1991 ($M)	Total Revenue 1992 ($M)	Growth Rate (%)
Application						
Mechanical	2,033.0	2,235.3	10.0	7,229.2	7,655.3	5.9
AEC	666.1	746.1	12.0	2,345.3	2,420.0	3.2
GIS/Mapping	555.8	627.5	12.9	1,899.4	1,974.8	4.0
Electronic CAE	691.2	744.1	7.7	1,802.7	1,875.4	4.0
IC Layout	195.8	223.4	14.1	584.7	621.0	6.2
PCB/Hybrid/MCM	328.3	329.1	0.2	1,091.1	1,030.8	-5.5
Total	4,470.2	4,905.5	9.7	14,952.5	15,577.3	4.2
Region						
North America	1,516.0	1,693.7	11.7	5,069.2	5,258.8	3.7
Europe	1,623.9	1,775.8	9.4	5,531.0	5,887.7	6.5
Asia	1,249.0	1,339.8	7.3	4,050.4	4,135.6	2.1
Rest of World	81.2	96.2	18.5	302.0	295.1	-2.3
Total	4,470.2	4,905.5	9.7	14,952.5	15,577.3	4.2
Platform						
Technical Workstation	2,712.1	3,056.2	12.7	8,078.7	8,780.1	8.7
Host Dependent	584.1	530.6	-9.2	2,852.2	2,557.0	-10.3
Server	182.7	191.7	4.9	997.9	1,056.2	5.8
Personal Computer	991.3	1,127.0	13.7	3,023.7	3,183.9	5.3
Total	4,470.2	4,905.5	9.7	14,952.5	15,577.3	4.2

Source: Dataquest (March 1993)

About This Document

This document contains Dataquest's detailed market share information on the CAD/CAM/CAE/GIS industry. Following is a description of the information reported in the *Market Share* book for each segment:

- Source—All companies in database; overview of industry
- Mechanical Applications—All companies in database with mechanical revenue
- AEC Applications—All companies in database with AEC revenue
- GIS Applications—All companies in database with GIS revenue
- Electronic Design Automation Applications—All companies in database with EDA (electronic CAE, IC layout, PCB/hybrid/MCM) revenue

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- Europe—All Europe-based companies and all other companies with more than $1 million in European revenue
- Asia—All Asia-based companies and all other companies with more than $1 million in Asian revenue
- Personal CAD and Distribution Channels—All companies in database with personal computer revenue

More detailed data on these markets may be requested through our client inquiry service.

Dataquest's policy is to continually update its market information, for current and past years, with any new data received in order to arrive at the most accurate market representation possible.

Segmentation

Dataquest defines CAD/CAM/CAE/GIS as systems used in the mechanical; architecture, engineering, and construction (AEC); GIS/mapping; and electronic design automation (EDA) application areas. The CAD/CAM/CAE/GIS market is defined according to the following segmentation scheme:

- CAD/CAM/CAE/GIS
  - Mechanical
  - AEC (Architecture, Engineering, and Construction)
  - GIS/Mapping (Geographic Information Systems)
  - EDA (Electronic Design Automation)
    - Electronic CAE
    - IC Layout
    - PCB/Hybrid/MCM

In addition, more detailed information by subapplication, by operating systems, and by industry is available, much of it published in *Dataquest Perspectives.*

Definitions

This section lists the definitions that are specific to this document.

Application definitions are as follows:

- Mechanical—Mechanical CAD/CAM refers to computer-aided tools used to design, analyze, document, and manufacture discrete parts, components, and assemblies.
- Architecture, Engineering, and Construction (AEC)—This segment covers the use of computer-aided tools by architects, contractors, plant engineers, civil engineers, and other people associated with these disciplines to aid in designing and managing buildings, industrial plants, ships, and other types of nondiscrete entities.

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- Geographic Information Systems (GIS)/Mapping—This is a computer-based technology, composed of hardware, software, and data used to capture, edit, display, and analyze spatial (tagged by location) information.
- Electronic Design Automation (EDA)—This segment covers computer-based tools that are used to automate the process of designing an electronic product including printed circuit boards, ICs, and systems. EDA includes Electronic CAE, IC Layout, and PCB/Hybrid/MCM, as follows:
  - Electronic Computer-Aided Engineering (CAE)—These are computer-aided tools used in the engineering or design phase of electronic products (as opposed to the physical layout phase of the product). Examples of Electronic CAE applications are schematic capture and simulation.
  - IC Layout—This is a software application tool that is used to create and validate the physical implementation of an integrated circuit (IC). The IC layout category comprises polygon editors, symbolic editors, placement and routing (gate array, cell, and block), design verification tools (DRC/ERC/logic-to-layout), compilers, and module development tools.
  - Printed Circuit Board (PCB)/Hybrid/Multichip Module (MCM)—This segment covers products that are used to create the placement and routing of the traces and components laid out on a printed circuit board. Also, included in this category are thermal analysis tools.

Regional definitions are as follows:

- North America—Includes United States, Canada, and Mexico
- Europe—Includes the United Kingdom, Scandinavia, Benelux, France, Germany, Italy, Spain, and Rest of Europe
- Asia—Includes Japan, Singapore, Taiwan, Korea, China, and Hong Kong
- Rest of World—All other countries including Australia, New Zealand, Oceania, Africa, Central America, South America, and the Middle East

Platform definitions are as follows:

- Technical Workstation—This is a single-user computer that is distinguished from a personal computer by its features and by the user's potential range of expansion on the platform. Features include a virtual, multitasking operating system (UNIX, VMS, DOMAIN); the computer is designed by manufacturer to run high-performance graphics applications in a multiuser/multitasking environment.
- Host-Dependent—This is a shared logic system in which the external workstations' functions are dependent on a host computer.

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- Server—A server is a computer that transparently provides its resources for use by other computer systems. It is a system on a network that provides specific functionality to other computer systems: the clients. Functions include file storage, database access, compute capability, and others. Dataquest tracks the following major categories of servers used for CAD/CAM/CAE/GIS applications:
  - Compute Servers—These systems provide capabilities for solving numerical problems (for example, simulations, statistical calculations, and simultaneous partial differential equations). System features usually include high-speed computational capabilities (for example, vector and parallel processing) and large memories.
  - Print Servers—These systems provide access to printers, specialized printing applications software, and print spooling resources to a network.
  - File Servers—These systems provide mass storage capability to clients on a network. Services can range from temporary storage of working files to long-term backup and archive systems.
  - Database Servers—These systems manage databases as a shared resource to a network. These servers handle such functions as physical data storage, data security, and high-level queries and can access stored information at the record level.
- Personal Computer—This is defined as a single-user computer that is distinguished from a technical workstation by its features and by the user's potential range of expansion on the platform. Features found in technical workstations (such as a virtual operating system, networking, high-performance graphics, multiuser/multitasking capability) are optional rather than integrated by the manufacturer.

Revenue/shipments/ASP definitions are as follows:

- Total factory revenue is defined as the amount of money received by a manufacturer for its goods measured in U.S. dollars. Total factory revenue does not include revenue that a company may receive from products that are sold to another company for resale (OEM revenue).
- Unit shipment is defined as the number of products delivered (that is, seats).
- Software revenue is revenue derived from the sale of bundled (part of a turnkey system) and unbundled software.
- Service revenue is defined as revenue derived from the service and support of CAD/CAM/CAE/GIS systems not including revenue from consulting. Service revenue can be calculated in the tables by subtracting hardware and software revenue from total revenue.

Market Share Methodology

Dataquest uses both primary and secondary sources to produce our market share data. In the fourth quarter of each year, we survey all major participants in each industry. Each vendor is offered the opportunity to self-report the information required. Although there is a primary contact

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for each company, large companies are surveyed across product lines and across geographic regions. Thus, there is a corresponding increase in the number of contacts at large companies. (Dataquest maintains a large contact database on all sources of information). Examples of the job titles of people contacted for information are the following:

- President and CEO
- Vice President and General Manager
- Vice President of Marketing
- Vice President, Strategic Product Planning
- Director of Strategic Planning
- Director of Marketing
- Director of Market Development
- Manager, CAD/CAM/CAE/GIS Marketing Programs
- Market Research Analyst

The Audit Process

Data supplied by vendors are evaluated against information drawn from many sources, including the following:

- Revenue published by major industry participants
- Estimates made by knowledgeable and reliable industry spokespersons
- Government data or trade association data
- Published product literature and price lists
- Interviews with knowledgeable manufacturers, distributors, and users
- Relevant economic data
- Information and data from online data banks
- Articles in both the general and trade press
- Annual reports, SEC documents, credit reports
- Company publications and press releases
- Reports from financial analysts
- User studies
- Reseller and supplier reports and reports from a vendor's competitors

In addition, Dataquest sums vendor revenue across other industries covered by Dataquest to make sure that revenue is not credited twice and checks with multiple sources at one company to cross-check data on that company.

Dataquest analysts have many years of experience in how to apply the above tools to get the most accurate information possible on a

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particular company (such as what to use when and what industry averages are). We believe that the estimates presented here are the most accurate and meaningful generally available today. It is the CAD/CAM/CAE/GIS group's policy to continually update our market information for any year, based on any new data received, in order to arrive at the most accurate market representation possible.

Dataquest's CAD/CAM/CAE/GIS market numbers are often higher than those reported by other sources. We survey worldwide, which involves more vendors, higher total market revenue, lower market share per vendor, and a more accurate market picture—particularly useful when comparing regions or applications.

Publishing Schedule

We publish market share and forecasting, twice each year for each, allowing for both timely distribution of data and thorough analysis and forecasting. Our annual delivery schedule is as follows:

- Market share data are available January 31. All tables will be published and distributed to clients by March 31.
- Forecasting from the market share tables provides a five-year forecast period, available after March 31. The books will be shipped by May 31.
- Final updated market share tables, based on additional data collection and analysis, will be completed by May 31. At this point, the market share database is frozen and will not be changed until the end of the year. For the next six months, supplementary market data will be based on these final market data. Books will be shipped by July 31.
- We provide complete final forecast tables by July 31. These tables take into consideration changes in the market share during the previous six months. Books will be shipped by September 31.

Notes on Market Share

CADAM has now been included in IBM's revenue for 1991 and 1992. In addition, based on our analysis of software revenue by operating system, we have changed the percent of Sun revenue allocated to CAD/CAM/CAE/GIS. The result is an increase in hardware revenue—$144 million for Sun in 1991, primarily in the AEC and GIS markets, and an overall increase in market share.

Tables 2 through 4 show other changes made to the database since the last report.

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Table 2
Companies Renamed

Old Name	New Name
ABB Trafonor	ABB Industria
Schlumberger	Applicon
Hahn & Kolb	ASCAD/ASCAM
Decad	EME
Robocom	RoboCAD Solutions
Vision 3D	Areon

Source: Dataquest (March 1993)

Table 3
Companies (or CAD Portions Thereof) Sold/Merged

Companies	Sold to/Merged with
Geographic Systems (WPS)	GeoVision Systems
Kewill Systems	Han Dataport
ISYKON Software	Intergraph
Logic Automation	Logic Modeling Systems
Micro Engineering Solutions	Autodesk
Norsk	Technovision
Sumisho Electronic Systems	Sumisho Electronics
t2 Solutions	Alias
Technovision	Intergraph
Valid	Cadence
Vantage Analysis Systems	Viewlogic

Source: Dataquest (March 1993)

Table 4
Companies—Added or Deleted

New Companies	1992 Revenue
CAD Distribution	16.9
CAE-link	1.1
Exemplar Logic	0.3
Expertest	0.5
Minc Software	3.0
Neocad	3.0
Sunrise Test Systems	2.0
Quicklogic	1.0
Deleted Companies	**1991 Revenue**
Everex	19.4
Ferranti	10.0
Nestler	11.0
XAO Industrie	3.7

Source: Dataquest (March 1993)

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Table 5
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: All Platforms
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Intergraph	372.1	165.8	92.5	5,719	15.4%	12.4%	12.4%	3.5%
IBM	182.2	112.9	40.5	13,418	7.5%	8.5%	5.4%	8.2%
Autodesk	153.7	.0	153.7	0	6.4%	.0%	20.6%	.0%
Fujitsu	137.0	87.7	35.6	2,713	5.7%	6.6%	4.8%	1.7%
Hewlett-Packard	121.2	101.0	.0	13,576	5.0%	7.6%	.0%	8.3%
Apple Computer	97.3	85.6	.0	23,021	4.0%	6.4%	.0%	14.1%
Computervision	93.8	34.0	28.4	844	3.9%	2.6%	3.8%	.5%
Compaq	92.1	92.1	.0	19,960	3.8%	6.9%	.0%	12.3%
Digital	78.1	53.9	.0	882	3.2%	4.0%	.0%	.5%
IEZ	64.3	22.5	32.1	1,360	2.7%	1.7%	4.3%	.8%
Nemetschek	58.0	21.5	32.5	600	2.4%	1.6%	4.4%	.4%
NEC	55.7	39.5	11.7	5,386	2.3%	3.0%	1.6%	3.3%
Sun Microsystems	46.1	39.7	.0	2,805	1.9%	3.0%	.0%	1.7%
Nihon Unisys	32.0	19.8	5.4	319	1.3%	1.5%	.7%	.2%
ISICAD	28.9	8.7	17.4	153	1.2%	.7%	2.3%	.1%
EDS	24.0	10.8	10.8	347	1.0%	.8%	1.5%	.2%
Auto-Trol	22.4	8.3	8.5	280	.9%	.6%	1.1%	.2%
Accugraph	20.0	8.9	9.1	709	.8%	.7%	1.2%	.4%
ItalCad	18.6	8.8	4.5	176	.8%	.7%	.6%	.1%
Hitachi	17.4	8.3	7.3	468	.7%	.6%	1.0%	.3%

(Continued)

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Table 5 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: All Platforms
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Han Dataport	15.5	4.7	8.5	313	.6%	.3%	1.1%	.2%
Mitsubishi Electric	14.3	11.2	1.7	261	.6%	.8%	.2%	.2%
Soft-Tech Software Technologies	13.8	2.1	10.4	932	.6%	.2%	1.4%	.6%
Silicon Graphics	13.8	12.8	.0	354	.6%	1.0%	.0%	.2%
Mutoh Industries—NO OEM	13.0	7.5	3.8	172	.5%	.6%	.5%	.1%
Kockums Computer Systems	12.9	3.2	7.1	635	.5%	.2%	1.0%	.4%
CAD Centre	12.8	.0	10.3	0	.5%	.0%	1.4%	.0%
Toshiba—NO OEM	12.8	6.4	5.1	324	.5%	.5%	.7%	.2%
Siemens Nixdorf Info systeme	11.9	6.0	4.2	203	.5%	.4%	.6%	.1%
Microway	11.9	7.2	3.6	127	.5%	.5%	.5%	.1%
Dell Computer	11.1	11.1	.0	2,884	.5%	.8%	.0%	1.8%
Century Research Center	10.8	5.7	4.0	60	.4%	.4%	.5%	.0%
CPU	10.5	.0	9.5	0	.4%	.0%	1.3%	.0%
Star Informatic	9.6	3.1	5.4	1,011	.4%	.2%	.7%	.6%
Hitachi Zosen Info Systems	7.8	6.7	.3	81	.3%	.5%	.0%	.0%
INS Engineering	7.2	3.6	3.6	30	.3%	.3%	.5%	.0%
Hochtief	7.2	1.1	5.0	86	.3%	.1%	.7%	.1%
ASG	6.8	.0	6.8	0	.3%	.0%	.9%	.0%
RIB/RZB	6.6	.6	5.4	41	.3%	.0%	.7%	.0%
Softdesk	6.4	.0	6.4	0	.3%	.0%	.9%	.0%
BATISOFT	6.3	.9	3.2	314	.3%	.1%	.4%	.2%

(Continued)

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Table 5 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: All Platforms
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Aspen Technology	5.8	.0	5.2	0	.2%	.0%	.7%	.0%
Sigma Design	5.6	.0	5.3	0	.2%	.0%	.7%	.0%
Graphisoft Software Dev	5.4	.0	5.4	0	.2%	.0%	.7%	.0%
Uchida Yoko	5.3	3.2	1.9	126	.2%	.2%	.3%	.1%
Seiko Instruments—NO OEM	5.3	3.8	3.8	136	.2%	.3%	.5%	.1%
Integrated Computer Graphics	5.2	2.6	2.1	208	.2%	.2%	.3%	.1%
mb Programme	5.1	2.5	1.8	122	.2%	.2%	.2%	.1%
Complansoft CAD	5.0	2.5	2.5	114	.2%	.2%	.3%	.1%
CAD Distribution	4.7	2.4	1.9	73	.2%	.2%	.3%	.0%
International Software Systems	4.7	.0	4.7	0	.2%	.0%	.6%	.0%
Toyo Information Systems-NO OEM	4.2	2.6	1.2	46	.2%	.2%	.2%	.0%
Andor	4.2	1.1	3.0	32	.2%	.1%	.4%	.0%
Micrografx	4.2	.0	4.2	0	.2%	.0%	.6%	.0%
Computer Services Consultants	4.2	.0	4.2	0	.2%	.0%	.6%	.0%
Gable CAD Systems	4.1	4.1	.8	59	.2%	.3%	.1%	.0%
Research Machines	4.1	4.1	.0	654	.2%	.3%	.0%	.4%
Bechtel Software	4.0	.0	3.7	0	.2%	.0%	.5%	.0%
Sener Sistemas Marinos	3.7	.0	3.7	0	.2%	.0%	.5%	.0%
Control Data Systems	3.7	1.7	.6	27	.2%	.1%	.1%	.0%
Datagraphic	3.6	1.8	1.4	57	.1%	.1%	.2%	.0%
Triplan	3.1	1.3	1.6	37	.1%	.1%	.2%	.0%

(Continued)

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Table 5 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: All Platforms
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Sweet's Electronic Publishing	3.0	.0	2.4	0	.1%	.0%	.3%	.0%
CADKEY	2.9	.0	2.9	0	.1%	.0%	.4%	.0%
Assigraph	2.9	.0	2.3	0	.1%	.0%	.3%	.0%
Ground Modelling Systems	2.8	1.5	1.1	23	.1%	.1%	.2%	.0%
RoboCAD Solutions	2.7	.0	2.0	0	.1%	.0%	.3%	.0%
Wisdom Systems	2.7	.0	2.1	0	.1%	.0%	.3%	.0%
Design Automation	2.5	.1	2.4	13	.1%	.0%	.3%	.0%
Innovative Data Design	2.5	.0	2.5	0	.1%	.0%	.3%	.0%
Olivetti	2.3	2.0	.0	281	.1%	.1%	.0%	.2%
Elstree Computing	2.2	1.0	1.2	62	.1%	.1%	.2%	.0%
Carrier Corporation	2.1	.0	2.1	0	.1%	.0%	.3%	.0%
Ziegler Informatics	2.0	.0	2.0	0	.1%	.0%	.3%	.0%
Mitsui Engineering	2.0	1.4	.4	13	.1%	.1%	.1%	.0%
Claris	1.9	.0	1.9	0	.1%	.0%	.3%	.0%
CADWorks	1.9	.0	1.7	0	.1%	.0%	.2%	.0%
Moda CAD	1.9	.5	1.3	16	.1%	.0%	.2%	.0%
MEDESIGN	1.9	.5	.7	21	.1%	.0%	.1%	.0%
Lamp Software	1.9	.5	1.3	117	.1%	.0%	.2%	.1%
Macao Systems	1.9	1.0	.6	19	.1%	.1%	.1%	.0%
Land Innovation	1.8	.0	1.8	0	.1%	.0%	.2%	.0%
Matra Datavision	1.8	.6	.8	0	.1%	.0%	.1%	.0%

(Continued)

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Table 5 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: All Platforms
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Radan Computational	1.8	.6	.9	36	.1%	.0%	.1%	.0%
Research Engineers—Civilsoft	1.7	.0	1.7	0	.1%	.0%	.2%	.0%
Georgia Tech Research Corp.	1.7	.0	1.7	0	.1%	.0%	.2%	.0%
ARKTEC	1.6	.2	1.3	43	.1%	.0%	.2%	.0%
Engineered Software	1.6	.0	1.6	0	.1%	.0%	.2%	.0%
Sinus Software	1.5	.8	.8	36	.1%	.1%	.1%	.0%
American Small Business Comp.	1.4	.0	1.4	0	.1%	.0%	.2%	.0%
Integer	1.2	.0	1.0	0	.1%	.0%	.1%	.0%
Simulation Science	1.2	.0	1.2	0	.0%	.0%	.2%	.0%
Sony	1.1	1.0	.0	66	.0%	.1%	.0%	.0%
Mucke Software	1.1	.6	.4	27	.0%	.0%	.1%	.0%
Serbi	1.1	.1	1.0	0	.0%	.0%	.1%	.0%
PAFEC	1.1	.0	1.1	0	.0%	.0%	.1%	.0%
Spectrum Graphics	1.1	.3	.5	10	.0%	.0%	.1%	.0%
CAE-link	1.1	.0	1.1	0	.0%	.0%	.1%	.0%
Foresight Resources	1.0	.0	.9	0	.0%	.0%	.1%	.0%
Sumitomo Denko Workstation	1.0	1.0	.0	167	.0%	.1%	.0%	.1%
CADMATIC	1.0	.1	.7	6	.0%	.0%	.1%	.0%
Solbourne	1.0	1.0	.0	81	.0%	.1%	.0%	.0%
Evolution Computing	.9	.0	.9	0	.0%	.0%	.1%	.0%
Mega CADD	.8	.0	.8	0	.0%	.0%	.1%	.0%

(Continued)

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Table 5 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: All Platforms
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
EA Systems	.8	.0	.8	0	.0%	.0%	.1%	.0%
Dynaware	.8	.0	.8	0	.0%	.0%	.1%	.0%
GRAPHSOFT	.8	.0	.8	0	.0%	.0%	.1%	.0%
CAD-Capture	.7	.2	.2	4	.0%	.0%	.0%	.0%
ECOM Associates	.7	.0	.7	4	.0%	.0%	.1%	.0%
IGC Technology	.6	.0	.6	0	.0%	.0%	.1%	.0%
Kubota Computer	.6	.4	.1	36	.0%	.0%	.0%	.0%
DAT Standard info ssystemes	.4	.0	.4	0	.0%	.0%	.1%	.0%
Cascade Graphics	.4	.0	.4	0	.0%	.0%	.1%	.0%
Masta Corporation	.4	.0	.3	0	.0%	.0%	.0%	.0%
Mc2 Engineering Software	.4	.0	.4	0	.0%	.0%	.0%	.0%
DAPCO	.4	.0	.2	0	.0%	.0%	.0%	.0%
Aura CAD/CAM Systems	.3	.0	.3	0	.0%	.0%	.0%	.0%
Engineering Systems Corp.	.3	.0	.2	0	.0%	.0%	.0%	.0%
ACDS Graphic System	.2	.0	.2	0	.0%	.0%	.0%	.0%
Applications in CADD	.2	.0	.1	6	.0%	.0%	.0%	.0%
TOOL Software	.2	.1	.1	4	.0%	.0%	.0%	.0%
Ashlar	.2	.0	.2	0	.0%	.0%	.0%	.0%
Uniras	.2	.0	.2	0	.0%	.0%	.0%	.0%
A.I. Systems	.1	.0	.1	0	.0%	.0%	.0%	.0%

(Continued)

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Table 5 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: All Platforms
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Other Companies	305.3	261.0	33.4	59,448	10.9%	19.6%	.0%	36.5%
All Companies	2,420.0	1,333.3	746.1	162,795	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	1,747.0	1,012.3	469.0	144,736	72.2%	75.9%	62.9%	88.9%
All Asian-Based Companies	344.6	210.9	100.9	10,449	14.2%	15.8%	13.5%	6.4%
All European-Based Companies	328.4	110.1	176.3	7,610	13.6%	8.3%	23.6%	4.7%
All Hardware Companies	783.5	714.2	.1	136,710	32.4%	53.6%	.0%	84.0%
All Turnkey & SW Companies	1,636.6	619.1	746.0	26,085	67.6%	46.4%	100.0%	16.0%

Source: Dataquest (March 1993)

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Table 6
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: Technical Workstation
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Intergraph	306.8	141.1	67.5	5,020	27.4%	25.7%	19.9%	17.9%
Hewlett-Packard	102.5	86.1	.0	8,743	9.2%	15.6%	.0%	31.2%
Computervision	88.2	32.8	25.6	763	7.9%	6.0%	7.5%	2.7%
IEZ	64.3	22.5	32.1	1,360	5.7%	4.1%	9.5%	4.8%
Fujitsu	57.6	36.8	15.0	1,173	5.1%	6.7%	4.4%	4.2%
Sun Microsystems	41.7	36.1	.0	2,650	3.7%	6.6%	.0%	9.4%
Nemetschek	26.7	9.9	14.9	200	2.4%	1.8%	4.4%	.7%
NEC	25.1	13.8	9.3	826	2.2%	2.5%	2.7%	2.9%
IBM	24.3	13.4	6.1	639	2.2%	2.4%	1.8%	2.3%
Auto-Trol	22.4	8.3	8.5	280	2.0%	1.5%	2.5%	1.0%
EDS	20.4	10.8	7.2	359	1.8%	2.0%	2.1%	1.3%
ISICAD	20.2	8.7	8.7	153	1.8%	1.6%	2.6%	.5%
ItalCad	18.6	8.8	4.5	176	1.7%	1.6%	1.3%	.6%
Accugraph	17.8	8.7	7.3	680	1.6%	1.6%	2.1%	2.4%
Digital	15.8	10.9	.0	705	1.4%	2.0%	.0%	2.5%
Han Dataport	14.0	4.2	7.7	299	1.2%	.8%	2.3%	1.1%
Silicon Graphics	13.8	12.8	.0	354	1.2%	2.3%	.0%	1.3%
Kockums Computer Systems	12.9	3.2	7.1	635	1.2%	.6%	2.1%	2.3%
CAD Centre	12.8	.0	10.3	0	1.1%	.0%	3.0%	.0%
Hitachi	12.5	6.0	5.3	271	1.1%	1.1%	1.5%	1.0%

(Continued)

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Table 6 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: Technical Workstation
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Siemens Nixdorf Info systeme	11.9	6.0	4.2	203	1.1%	1.1%	1.2%	.7%
Mitsubishi Electric	11.2	9.5	.8	120	1.0%	1.7%	.2%	.4%
Century Research Center	10.8	5.7	4.0	60	1.0%	1.0%	1.2%	.2%
Autodesk	10.3	.0	10.3	0	.9%	.0%	3.0%	.0%
Toshiba—NO OEM	10.2	5.1	4.1	121	.9%	.9%	1.2%	.4%
Star Informatic	9.6	3.1	5.4	1,011	.9%	.6%	1.6%	3.6%
Mutoh Industries—NO OEM	9.1	5.5	2.7	93	.8%	1.0%	.8%	.3%
Microway	7.1	4.3	2.1	67	.6%	.8%	.6%	.2%
Nihon Unisys	7.0	4.4	1.2	57	.6%	.8%	.4%	.2%
Hitachi Zosen Info Systems	6.5	5.5	.3	67	.6%	1.0%	.1%	.2%
INS Engineering	6.4	3.2	3.2	17	.6%	.6%	.9%	.1%
Complansoft CAD	5.0	2.5	2.5	114	.4%	.5%	.7%	.4%
Uchida Yoko	4.8	2.9	1.7	102	.4%	.5%	.5%	.4%
Gable CAD Systems	4.1	4.1	.8	59	.4%	.7%	.2%	.2%
Sener Sistemas Marinos	3.7	.0	3.7	0	.3%	.0%	1.1%	.0%
Toyo Information Systems-NO OEM	3.5	2.2	1.0	42	.3%	.4%	.3%	.1%
Integrated Computer Graphics	3.1	1.6	1.3	89	.3%	.3%	.4%	.3%
Triplan	3.1	1.3	1.6	37	.3%	.2%	.5%	.1%
Sigma Design	3.1	.0	2.9	0	.3%	.0%	.9%	.0%
Wisdom Systems	2.7	.0	2.1	0	.2%	.0%	.6%	.0%
RIB/RZB	2.0	.2	1.6	10	.2%	.0%	.5%	.0%

(Continued)

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Table 6 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: Technical Workstation
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
MEDESIGN	1.9	.5	.7	21	.2%	.1%	.2%	.1%
Land Innovation	1.8	.0	1.8	0	.2%	.0%	.5%	.0%
Mitsui Engineering	1.8	1.3	.4	10	.2%	.2%	.1%	.0%
Matra Datavision	1.8	.6	.8	0	.2%	.1%	.2%	.0%
Radan Computational	1.7	.6	.9	36	.2%	.1%	.3%	.1%
Bechtel Software	1.5	.0	1.4	0	.1%	.0%	.4%	.0%
Sirius Software	1.5	.8	.8	36	.1%	.1%	.2%	.1%
Softdesk	1.5	.0	1.5	0	.1%	.0%	.4%	.0%
Control Data Systems	1.5	.8	.3	20	.1%	.2%	.1%	.1%
Assigraph	1.4	.0	1.1	0	.1%	.0%	.3%	.0%
Sony	1.1	1.0	.0	66	.1%	.2%	.0%	.2%
Macao Systems	1.1	.6	.4	12	.1%	.1%	.1%	.0%
PAFEC	1.1	.0	1.1	0	.1%	.0%	.3%	.0%
Spectrum Graphics	1.1	.3	.5	10	.1%	.1%	.2%	.0%
Simulation Science	1.0	.0	1.0	0	.1%	.0%	.3%	.0%
Sumitomo Denko Workstation	.9	.9	.0	148	.1%	.2%	.0%	.5%
Georgia Tech Research Corp.	.8	.0	.8	0	.1%	.0%	.2%	.0%
Lamp Software	.6	.2	.3	47	.1%	.0%	.1%	.2%
Kubota Computer	.5	.3	.1	28	.0%	.1%	.0%	.1%
DAPCO	.4	.0	.2	0	.0%	.0%	.1%	.0%
CADMATIC	.3	.0	.2	2	.0%	.0%	.1%	.0%

(Continued)

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Table 6 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: Technical Workstation
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
ASG	.3	.0	.3	0	.0%	.0%	.1%	.0%
Solbourne	.3	.3	.0	51	.0%	.1%	.0%	.2%
ACDS Graphic System	.2	.0	.2	0	.0%	.0%	.1%	.0%
Research Engineers—Civilsoft	.2	.0	.2	0	.0%	.0%	.1%	.0%
ARKTEC	.2	.1	.1	11	.0%	.0%	.0%	.0%
Masta Corporation	.1	.0	.1	0	.0%	.0%	.0%	.0%
Carrier Corporation	.1	.0	.1	0	.0%	.0%	.0%	.0%
TOOL Software	.0	.0	.0	1	.0%	.0%	.0%	.0%
ECOM Associates	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	37.9	.0	30.0	0	.0%	.0%	.0%	.0%
All Companies	1,118.1	550.2	339.7	28,055	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	740.0	372.4	185.0	20,506	66.2%	67.7%	54.5%	73.1%
All Asian-Based Companies	169.1	104.1	49.0	3,201	15.1%	18.9%	14.4%	11.4%
All European-Based Companies	209.0	73.7	105.7	4,349	18.7%	13.4%	31.1%	15.5%
All Hardware Companies	176.4	148.2	.1	12,722	15.8%	26.9%	.0%	45.3%
All Turnkey & SW Companies	941.7	402.0	339.6	15,333	84.2%	73.1%	100.0%	54.7%

Source: Dataquest (March 1993)

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Table 7
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: Host-Dependent
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
IBM	82.9	44.8	22.0	1,099	30.4%	26.6%	37.5%	29.9%
Fujitsu	52.1	33.3	13.5	725	19.1%	19.8%	23.1%	19.7%
Digital	41.4	28.6	.0	0	15.2%	17.0%	.0%	.0%
Nihon Unisys	24.9	15.5	4.2	262	9.1%	9.2%	7.2%	7.1%
Intergraph	6.4	.0	5.8	0	2.4%	.0%	9.9%	.0%
EDS	3.6	.0	3.6	(12)	1.3%	.0%	6.2%	-.3%
Control Data Systems	2.2	.8	.3	7	.8%	.5%	.5%	.2%
Bechtel Software	2.0	.0	1.8	0	.7%	.0%	3.1%	.0%
Hitachi	1.7	.8	.7	31	.6%	.5%	1.2%	.8%
Mitsubishi Electric	1.6	.8	.5	5	.6%	.5%	.8%	.1%
Han Dataport	1.6	.5	.9	13	.6%	.3%	1.5%	.4%
Assigraph	1.4	.0	1.1	0	.5%	.0%	1.9%	.0%
Hitachi Zosen Info Systems	1.2	1.1	.0	14	.5%	.7%	.0%	.4%
Computervision	1.1	.4	.3	22	.4%	.2%	.5%	.6%
EA Systems	.8	.0	.8	0	.3%	.0%	1.4%	.0%
Georgia Tech Research Corp.	.8	.0	.8	0	.3%	.0%	1.3%	.0%
Macao Systems	.8	.4	.3	6	.3%	.2%	.4%	.2%
Toyo Information Systems-NO OEM	.7	.4	.2	4	.3%	.2%	.4%	.1%
Hochtief	.4	.1	.2	2	.1%	.0%	.4%	.1%
Accugraph	.2	.1	.1	19	.1%	.0%	.1%	.5%

(Continued)

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Table 7 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: Host-Dependent
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Masta Corporation	.2	.0	.1	0	.1%	.0%	.2%	.0%
Lamp Software	.1	.0	.0	3	.0%	.0%	.1%	.1%
Engineering Systems Corp.	.1	.0	.1	0	.0%	.0%	.1%	.0%
Kubota Computer	.1	.1	.0	8	.0%	.0%	.0%	.2%
Other Companies	44.7	40.9	1.3	1,471	15.8%	24.3%	.0%	40.0%
All Companies	272.8	168.5	58.6	3,680	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	186.1	115.6	36.8	2,607	68.2%	68.6%	62.7%	70.8%
All Asian-Based Companies	82.4	52.0	19.2	1,049	30.2%	30.8%	32.8%	28.5%
All European-Based Companies	4.3	1.0	2.7	24	1.6%	.6%	4.5%	.7%
All Hardware Companies	84.9	69.6	.1	1,473	31.1%	41.3%	.1%	40.0%
All Turnkey & SW Companies	188.0	98.9	58.6	2,207	68.9%	58.7%	99.9%	60.0%

Source: Dataquest (March 1993)

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Table 8
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: Server
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Intergraph	50.9	24.7	11.7	700	48.7%	43.1%	58.7%	47.9%
IBM	21.1	12.1	5.0	266	20.2%	21.2%	25.2%	18.2%
Digital	20.9	14.4	.0	177	20.0%	25.1%	.0%	12.1%
Sun Microsystems	4.4	3.6	.0	155	4.2%	6.2%	.0%	10.6%
Computervision	2.9	.9	1.0	25	2.8%	1.6%	5.0%	1.7%
Hewlett-Packard	.9	.7	.0	83	.9%	1.3%	.0%	5.7%
Solbourne	.7	.7	.0	30	.7%	1.2%	.0%	2.0%
Georgia Tech Research Corp.	.1	.0	.1	0	.1%	.0%	.7%	.0%
Sumitomo Denko Workstation	.1	.1	.0	20	.1%	.2%	.0%	1.4%
Other Companies	2.6	.1	2.1	6	.0%	.2%	.1%	.4%
All Companies	104.5	57.2	19.9	1,461	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	104.4	57.1	19.9	1,441	99.9%	99.8%	100.0%	98.6%
All Asian-Based Companies	.1	.1	.0	20	.1%	.2%	.0%	1.4%
All European-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Hardware Companies	27.7	20.1	.0	644	26.5%	35.1%	.0%	44.1%
All Turnkey & SW Companies	76.9	37.1	19.9	817	73.5%	64.9%	100.0%	55.9%

Source: Dataquest (March 1993)

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Table 9
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: Personal Computer
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Autodesk	143.4	.0	143.4	0	15.5%	.0%	43.7%	.0%
Apple Computer	97.3	85.6	.0	23,021	10.5%	15.3%	.0%	17.8%
Compaq	92.1	92.1	.0	19,960	10.0%	16.5%	.0%	15.4%
IBM	53.9	42.5	7.4	11,415	5.8%	7.6%	2.3%	8.8%
Nemetschek	31.3	11.6	17.5	400	3.4%	2.1%	5.3%	.3%
NEC	30.6	25.7	2.5	4,560	3.3%	4.6%	.7%	3.5%
Fujitsu	27.4	17.5	7.1	815	3.0%	3.1%	2.2%	.6%
Hewlett-Packard	17.8	14.3	.0	4,750	1.9%	2.6%	.0%	3.7%
Soft-Tech Software Technologies	13.8	2.1	10.4	932	1.5%	.4%	3.2%	.7%
Dell Computer	11.1	11.1	.0	2,884	1.2%	2.0%	.0%	2.2%
CPU	10.5	.0	9.5	0	1.1%	.0%	2.9%	.0%
ISICAD	8.7	.0	8.7	0	.9%	.0%	2.6%	.0%
Intergraph	8.0	.0	7.5	0	.9%	.0%	2.3%	.0%
Hochtief	6.8	1.0	4.8	84	.7%	.2%	1.5%	.1%
ASG	6.5	.0	6.5	0	.7%	.0%	2.0%	.0%
BATISOFT	6.3	.9	3.2	314	.7%	.2%	1.0%	.2%
Aspen Technology	5.8	.0	5.2	0	.6%	.0%	1.6%	.0%
Graphisoft Software Dev	5.4	.0	5.4	0	.6%	.0%	1.6%	.0%
Seiko Instruments—NO OEM	5.3	3.8	3.8	136	.6%	.7%	1.1%	.1%
mb Programme	5.1	2.5	1.8	122	.5%	.5%	.5%	.1%
Softdesk	5.0	.0	5.0	0	.5%	.0%	1.5%	.0%

(Continued)

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Table 9 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: Personal Computer
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Microway	4.7	2.9	1.4	60	.5%	.5%	.4%	.0%
CAD Distribution	4.7	2.4	1.9	73	.5%	.4%	.6%	.1%
International Software Systems	4.7	.0	4.7	0	.5%	.0%	1.4%	.0%
RIB/RZB	4.6	.4	3.8	32	.5%	.1%	1.2%	.0%
Andor	4.2	1.1	3.0	32	.5%	.2%	.9%	.0%
Computer Services Consultants	4.2	.0	4.2	0	.4%	.0%	1.3%	.0%
Micrografx	4.2	.0	4.2	0	.4%	.0%	1.3%	.0%
Research Machines	4.1	4.1	.0	654	.4%	.7%	.0%	.5%
Mutoh Industries—NO OEM	3.9	2.1	1.1	79	.4%	.4%	.3%	.1%
Datagraphic	3.6	1.8	1.4	57	.4%	.3%	.4%	.0%
Hitachi	3.1	1.5	1.3	166	.3%	.3%	.4%	.1%
Sweet's Electronic Publishing	3.0	.0	2.4	0	.3%	.0%	.7%	.0%
CADKEY	2.9	.0	2.9	0	.3%	.0%	.9%	.0%
Ground Modelling Systems	2.8	1.5	1.1	23	.3%	.3%	.3%	.0%
RoboCAD Solutions	2.7	.0	2.0	0	.3%	.0%	.6%	.0%
Toshiba—NO OEM	2.6	1.3	1.0	204	.3%	.2%	.3%	.2%
Design Automation	2.5	.1	2.4	13	.3%	.0%	.7%	.0%
Sigma Design	2.5	.0	2.4	0	.3%	.0%	.7%	.0%
Innovative Data Design	2.5	.0	2.5	0	.3%	.0%	.8%	.0%
Olivetti	2.3	2.0	.0	281	.3%	.4%	.0%	.2%
Elstree Computing	2.2	1.0	1.2	62	.2%	.2%	.4%	.0%

(Continued)

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Table 9 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: Personal Computer
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Integrated Computer Graphics	2.1	1.0	.8	119	.2%	.2%	.3%	.1%
Carrier Corporation	2.0	.0	2.0	0	.2%	.0%	.6%	.0%
Ziegler Informatics	2.0	.0	2.0	0	.2%	.0%	.6%	.0%
Accugraph	2.0	.1	1.7	10	.2%	.0%	.5%	.0%
Claris	1.9	.0	1.9	0	.2%	.0%	.6%	.0%
CADWorks	1.9	.0	1.7	0	.2%	.0%	.5%	.0%
Moda CAD	1.9	.5	1.3	16	.2%	.1%	.4%	.0%
Computervision	1.7	.0	1.6	34	.2%	.0%	.5%	.0%
Engineered Software	1.6	.0	1.6	0	.2%	.0%	.5%	.0%
Research Engineers—Civilsoft	1.5	.0	1.5	0	.2%	.0%	.5%	.0%
American Small Business Comp.	1.4	.0	1.4	0	.2%	.0%	.4%	.0%
Mitsubishi Electric	1.4	.9	.5	135	.2%	.2%	.1%	.1%
ARKTEC	1.4	.1	1.2	32	.2%	.0%	.4%	.0%
Integer	1.2	.0	1.0	0	.1%	.0%	.3%	.0%
Lamp Software	1.2	.2	1.0	68	.1%	.0%	.3%	.1%
Mucke Software	1.1	.6	.4	27	.1%	.1%	.1%	.0%
Serbi	1.1	.1	1.0	0	.1%	.0%	.3%	.0%
CAE-link	1.1	.0	1.1	0	.1%	.0%	.3%	.0%
Foresight Resources	1.0	.0	.9	0	.1%	.0%	.3%	.0%
Evolution Computing	.9	.0	.9	0	.1%	.0%	.3%	.0%
Mega CADD	.8	.0	.8	0	.1%	.0%	.3%	.0%

(Continued)

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Table 9 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: Personal Computer
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Dynaware	.8	.0	.8	0	.1%	.0%	.2%	.0%
GRAPHSOFT	.8	.0	.8	0	.1%	.0%	.2%	.0%
INS Engineering	.7	.4	.4	13	.1%	.1%	.1%	.0%
CAD-Capture	.7	.2	.2	4	.1%	.0%	.1%	.0%
ECOM Associates	.7	.0	.7	4	.1%	.0%	.2%	.0%
CADMATIC	.7	.0	.4	4	.1%	.0%	.1%	.0%
IGC Technology	.6	.0	.6	0	.1%	.0%	.2%	.0%
Uchida Yoko	.5	.3	.2	24	.1%	.1%	.1%	.0%
Bechtel Software	.5	.0	.5	0	.1%	.0%	.2%	.0%
Cascade Graphics	.4	.0	.4	0	.0%	.0%	.1%	.0%
DAT Standard info ssystemes	.4	.0	.4	0	.0%	.0%	.1%	.0%
Mc2 Engineering Software	.4	.0	.4	0	.0%	.0%	.1%	.0%
Aura CAD/CAM Systems	.3	.0	.3	0	.0%	.0%	.1%	.0%
Simulation Science	.2	.0	.2	0	.0%	.0%	.1%	.0%
Applications in CADD	.2	.0	.1	6	.0%	.0%	.0%	.0%
Engineering Systems Corp.	.2	.0	.2	0	.0%	.0%	.0%	.0%
Mitsui Engineering	.2	.1	.0	3	.0%	.0%	.0%	.0%
Ashlar	.2	.0	.2	0	.0%	.0%	.1%	.0%
Uniras	.2	.0	.2	0	.0%	.0%	.0%	.0%
TOOL Software	.1	.0	.1	3	.0%	.0%	.0%	.0%
Masta Corporation	.1	.0	.1	0	.0%	.0%	.0%	.0%

(Continued)

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Table 9 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: Personal Computer
Region: Worldwide
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
A.I. Systems	.1	.0	.1	0	.0%	.0%	.0%	.0%
Radan Computational	.0	.0	.0	1	.0%	.0%	.0%	.0%
Other Companies	220.1	220.1	.0	57,970	23.8%	39.5%	.0%	44.7%
All Companies	924.6	557.4	327.9	129,598	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	716.5	467.2	227.3	120,182	77.5%	83.8%	69.3%	92.7%
All Asian-Based Companies	93.0	54.8	32.7	6,179	10.1%	9.8%	10.0%	4.8%
All European-Based Companies	115.1	35.4	68.0	3,238	12.5%	6.4%	20.7%	2.5%
All Hardware Companies	494.6	476.3	.0	121,870	53.5%	85.4%	.0%	94.0%
All Turnkey & SW Companies	430.0	81.1	327.9	7,728	46.5%	14.6%	100.0%	6.0%

Source: Dataquest (March 1993)

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Table 10
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: All Platforms
Region: North America
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Intergraph	174.4	76.1	46.0	2,813	20.2%	16.3%	17.2%	3.9%
Autodesk	75.7	.0	75.7	0	8.8%	.0%	28.3%	.0%
Apple Computer	60.3	53.1	.0	14,273	7.0%	11.4%	.0%	19.5%
Computervision	51.8	17.4	17.3	521	6.0%	3.7%	6.5%	.7%
IBM	47.5	29.3	10.7	3,707	5.5%	6.3%	4.0%	5.1%
Hewlett-Packard	43.9	36.3	.0	6,109	5.1%	7.8%	.0%	8.4%
Compaq	43.7	43.7	.0	9,470	5.1%	9.4%	.0%	13.0%
Digital	40.8	28.1	.0	454	4.7%	6.0%	.0%	.6%
Sun Microsystems	21.3	18.3	.0	1,459	2.5%	3.9%	.0%	2.0%
Auto-Trol	18.8	7.0	7.1	235	2.2%	1.5%	2.7%	.3%
Accugraph	18.4	8.2	8.4	653	2.1%	1.8%	3.1%	.9%
ISICAD	15.7	4.7	9.4	85	1.8%	1.0%	3.5%	.1%
Dell Computer	8.3	8.3	.0	2,163	1.0%	1.8%	.0%	3.0%
ASG	6.5	.0	6.5	0	.7%	.0%	2.4%	.0%
Softdesk	5.5	.0	5.5	0	.6%	.0%	2.0%	.0%
Integrated Computer Graphics	5.2	2.6	2.1	208	.6%	.6%	.8%	.3%
Aspen Technology	4.6	.0	4.2	0	.5%	.0%	1.6%	.0%
Bechtel Software	3.6	.0	3.4	0	.4%	.0%	1.3%	.0%
EDS	3.5	1.5	1.6	47	.4%	.3%	.6%	.1%
Sigma Design	3.1	.0	2.9	0	.4%	.0%	1.1%	.0%

(Continued)

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Table 10 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: All Platforms
Region: North America
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Sweet's Electronic Publishing	2.7	.0	2.2	0	.3%	.0%	.8%	.0%
Innovative Data Design	2.4	.0	2.4	0	.3%	.0%	.9%	.0%
International Software Systems	2.4	.0	2.4	0	.3%	.0%	.9%	.0%
Micrografx	2.3	.0	2.3	0	.3%	.0%	.9%	.0%
Wisdom Systems	2.2	.0	1.7	0	.3%	.0%	.6%	.0%
CAD Centre	2.1	.0	1.7	0	.2%	.0%	.6%	.0%
Land Innovation	1.8	.0	1.8	0	.2%	.0%	.7%	.0%
Research Engineers—Civilsoft	1.7	.0	1.7	0	.2%	.0%	.6%	.0%
CADKEY	1.5	.0	1.5	0	.2%	.0%	.6%	.0%
American Small Business Comp.	1.3	.0	1.3	0	.1%	.0%	.5%	.0%
Control Data Systems	1.3	.6	.2	9	.1%	.1%	.1%	.0%
Moda CAD	1.2	.3	.8	10	.1%	.1%	.3%	.0%
Kockums Computer Systems	1.1	.3	.6	53	.1%	.1%	.2%	.1%
Carrier Corporation	1.1	.0	1.1	0	.1%	.0%	.4%	.0%
Georgia Tech Research Corp.	1.0	.0	1.0	0	.1%	.0%	.4%	.0%
Claris	1.0	.0	1.0	0	.1%	.0%	.4%	.0%
IEZ	1.0	.3	.5	20	.1%	.1%	.2%	.0%
CAE-link	1.0	.0	1.0	0	.1%	.0%	.4%	.0%
Engineered Software	.9	.0	.9	0	.1%	.0%	.4%	.0%
Graphisoft Software Dev	.9	.0	.9	0	.1%	.0%	.3%	.0%
Solbourne	.9	.9	.0	73	.1%	.2%	.0%	.1%

(Continued)

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Table 10 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: All Platforms
Region: North America
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Foresight Resources	.9	.0	.8	0	.1%	.0%	.3%	.0%
Dynaware	.8	.0	.8	0	.1%	.0%	.3%	.0%
GRAPHSOFT	.8	.0	.8	0	.1%	.0%	.3%	.0%
ECOM Associates	.7	.0	.7	4	.1%	.0%	.3%	.0%
CADWorks	.7	.0	.6	0	.1%	.0%	.2%	.0%
Evolution Computing	.6	.0	.6	0	.1%	.0%	.2%	.0%
IGC Technology	.6	.0	.6	0	.1%	.0%	.2%	.0%
Mega CADD	.6	.0	.6	0	.1%	.0%	.2%	.0%
Simulation Science	.4	.0	.4	0	.0%	.0%	.1%	.0%
Cascade Graphics	.3	.0	.3	0	.0%	.0%	.1%	.0%
Mc2 Engineering Software	.3	.0	.3	0	.0%	.0%	.1%	.0%
Aura CAD/CAM Systems	.3	.0	.3	0	.0%	.0%	.1%	.0%
Engineering Systems Corp.	.2	.0	.2	0	.0%	.0%	.1%	.0%
MEDESIGN	.2	.1	.1	2	.0%	.0%	.0%	.0%
Ashlar	.2	.0	.2	0	.0%	.0%	.1%	.0%
BATISOFT	.2	.0	.1	7	.0%	.0%	.0%	.0%
ACDS Graphic System	.2	.0	.2	0	.0%	.0%	.1%	.0%
Uniras	.2	.0	.2	0	.0%	.0%	.1%	.0%
Ground Modelling Systems	.1	.1	.1	1	.0%	.0%	.0%	.0%
A.I. Systems	.1	.0	.1	0	.0%	.0%	.0%	.0%
Complansoft CAD	.1	.0	.0	1	.0%	.0%	.0%	.0%

(Continued)

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Table 10 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: All Platforms
Region: North America
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Star Informatic	.0	.0	.0	0	.0%	.0%	.0%	.0%
CADMATIC	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	170.0	128.5	32.4	30,651	15.0%	27.6%	.0%	42.0%
All Companies	862.4	465.7	267.6	73,028	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	856.7	464.8	263.7	72,944	99.3%	99.8%	98.5%	99.9%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	5.7	.8	3.9	85	.7%	.2%	1.5%	.1%
All Hardware Companies	361.7	329.8	.0	68,009	41.9%	70.8%	.0%	93.1%
All Turnkey & SW Companies	500.6	135.9	267.5	5,019	58.1%	29.2%	100.0%	6.9%

Source: Dataquest (March 1993)

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Table 11
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: Technical Workstation
Region: North America
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	**Total Factory Revenue**	**Hardware Revenue**	**Software Revenue**	**Hardware Units Shipped**	**Total Factory Revenue**	**Hardware Revenue**	**Software Revenue**	**Hardware Units Shipped**
Intergraph	137.8	63.4	30.3	2,476	38.7%	41.0%	27.0%	29.6%
Computervision	46.6	16.2	14.7	458	13.1%	10.5%	13.1%	5.5%
Hewlett-Packard	29.9	25.1	.0	2,275	8.4%	16.3%	.0%	27.2%
Sun Microsystems	19.1	16.6	.0	1,363	5.4%	10.7%	.0%	16.3%
Auto-Trol	18.8	7.0	7.1	235	5.3%	4.5%	6.4%	2.8%
Accugraph	16.4	8.0	6.7	626	4.6%	5.2%	6.0%	7.5%
ISICAD	11.0	4.7	4.7	85	3.1%	3.1%	4.2%	1.0%
Digital	8.2	5.7	.0	363	2.3%	3.7%	.0%	4.3%
IBM	6.3	3.5	1.5	225	1.8%	2.3%	1.4%	2.7%
Autodesk	3.8	.0	3.8	0	1.1%	.0%	3.4%	.0%
Integrated Computer Graphics	3.1	1.6	1.3	89	.9%	1.0%	1.1%	1.1%
EDS	2.9	1.5	1.0	48	.8%	1.0%	.9%	.6%
Wisdom Systems	2.2	.0	1.7	0	.6%	.0%	1.5%	.0%
CAD Centre	2.1	.0	1.7	0	.6%	.0%	1.5%	.0%
Land Innovation	1.8	.0	1.8	0	.5%	.0%	1.6%	.0%
Sigma Design	1.7	.0	1.6	0	.5%	.0%	1.4%	.0%
Bechtel Software	1.4	.0	1.3	0	.4%	.0%	1.1%	.0%
Softdesk	1.3	.0	1.3	0	.4%	.0%	1.1%	.0%
Kockums Computer Systems	1.1	.3	.6	53	.3%	.2%	.5%	.6%
IEZ	1.0	.3	.5	20	.3%	.2%	.4%	.2%

(Continued)

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Table 11 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: Technical Workstation
Region: North America
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Control Data Systems	.5	.3	.1	7	.1%	.2%	.1%	.1%
Georgia Tech Research Corp.	.5	.0	.5	0	.1%	.0%	.4%	.0%
ASG	.3	.0	.3	0	.1%	.0%	.3%	.0%
Simulation Science	.3	.0	.3	0	.1%	.0%	.3%	.0%
Solbourne	.3	.3	.0	46	.1%	.2%	.0%	.6%
MEDESIGN	.2	.1	.1	2	.1%	.0%	.1%	.0%
Research Engineers—Civilsoft	.2	.0	.2	0	.0%	.0%	.2%	.0%
ACDS Graphic System	.2	.0	.2	0	.0%	.0%	.1%	.0%
Complansoft CAD	.1	.0	.0	1	.0%	.0%	.0%	.0%
Carrier Corporation	.1	.0	.1	0	.0%	.0%	.0%	.0%
Star Informatic	.0	.0	.0	0	.0%	.0%	.0%	.0%
ECOM Associates	.0	.0	.0	0	.0%	.0%	.0%	.0%
CAD Distribution	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	36.8	.0	29.1	0	.0%	.0%	.0%	.0%
All Companies	355.7	154.5	112.4	8,373	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	351.3	153.8	109.6	8,296	98.7%	99.5%	97.5%	99.1%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	4.5	.7	2.8	77	1.3%	.5%	2.5%	.9%
All Hardware Companies	57.6	47.7	.0	4,048	16.2%	30.8%	.0%	48.3%
All Turnkey & SW Companies	298.1	106.9	112.4	4,325	83.8%	69.2%	100.0%	51.7%

Source: Dataquest (March 1993)

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Table 12
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: Host-Dependent
Region: North America
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Digital	21.8	15.0	.0	0	31.3%	36.4%	.0%	.0%
IBM	21.5	11.6	5.7	377	30.9%	28.1%	38.7%	41.1%
Intergraph	5.2	.0	4.7	0	7.5%	.0%	32.0%	.0%
Bechtel Software	1.8	.0	1.6	0	2.5%	.0%	11.0%	.0%
Computervision	1.0	.4	.3	21	1.5%	.9%	1.8%	2.3%
Control Data Systems	.8	.3	.1	2	1.1%	.8%	.7%	.3%
EDS	.5	.0	.5	(2)	.7%	.0%	3.5%	-.2%
Georgia Tech Research Corp.	.4	.0	.4	0	.6%	.0%	2.7%	.0%
Accugraph	.2	.1	.1	19	.3%	.2%	.5%	2.0%
Engineering Systems Corp.	.1	.0	.0	0	.1%	.0%	.3%	.0%
Other Companies	16.2	13.9	1.3	500	21.1%	33.7%	.0%	54.5%
All Companies	69.5	41.3	14.7	918	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	69.5	41.3	14.7	918	100.0%	100.0%	100.0%	100.0%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Hardware Companies	36.6	29.0	.0	501	52.6%	70.2%	.1%	54.6%
All Turnkey & SW Companies	32.9	12.3	14.7	417	47.4%	29.8%	99.9%	45.4%

Source: Dataquest (March 1993)

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Table 13
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: Server
Region: North America
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Intergraph	26.2	12.7	6.0	337	51.1%	46.7%	57.9%	45.4%
Digital	10.8	7.5	.0	91	21.1%	27.5%	.0%	12.3%
IBM	5.5	3.2	1.3	85	10.8%	11.7%	12.5%	11.5%
Computervision	2.8	.9	1.0	24	5.4%	3.2%	9.2%	3.3%
Sun Microsystems	2.1	1.7	.0	96	4.2%	6.4%	.0%	13.0%
Solbourne	.6	.6	.0	27	1.2%	2.3%	.0%	3.6%
Hewlett-Packard	.6	.5	.0	76	1.2%	1.8%	.0%	10.2%
Georgia Tech Research Corp.	.1	.0	.1	0	.2%	.0%	1.0%	.0%
Other Companies	2.5	.1	2.0	6	.0%	.3%	.1%	.8%
All Companies	51.2	27.2	10.4	742	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	51.2	27.2	10.4	742	100.0%	100.0%	100.0%	100.0%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Hardware Companies	14.4	10.5	.0	351	28.1%	38.8%	.0%	47.4%
All Turnkey & SW Companies	36.8	16.6	10.4	390	71.9%	61.2%	100.0%	52.6%

Source: Dataquest (March 1993)

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Table 14
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: Personal Computer
Region: North America
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Autodesk	71.9	.0	71.9	0	18.6%	.0%	55.3%	.0%
Apple Computer	60.3	53.1	.0	14,273	15.6%	21.9%	.0%	22.7%
Compaq	43.7	43.7	.0	9,470	11.3%	18.0%	.0%	15.0%
IBM	14.2	11.0	2.2	3,019	3.7%	4.5%	1.7%	4.8%
Hewlett-Packard	13.3	10.7	.0	3,759	3.5%	4.4%	.0%	6.0%
Dell Computer	8.3	8.3	.0	2,163	2.2%	3.4%	.0%	3.4%
ASG	6.1	.0	6.1	0	1.6%	.0%	4.7%	.0%
Intergraph	5.2	.0	4.9	0	1.4%	.0%	3.8%	.0%
ISICAD	4.7	.0	4.7	0	1.2%	.0%	3.6%	.0%
Aspen Technology	4.6	.0	4.2	0	1.2%	.0%	3.2%	.0%
Softdesk	4.2	.0	4.2	0	1.1%	.0%	3.2%	.0%
Sweet's Electronic Publishing	2.7	.0	2.2	0	.7%	.0%	1.7%	.0%
Innovative Data Design	2.4	.0	2.4	0	.6%	.0%	1.9%	.0%
International Software Systems	2.4	.0	2.4	0	.6%	.0%	1.8%	.0%
Micrografx	2.3	.0	2.3	0	.6%	.0%	1.8%	.0%
Integrated Computer Graphics	2.1	1.0	.8	119	.5%	.4%	.6%	.2%
Accugraph	1.8	.1	1.6	9	.5%	.0%	1.2%	.0%
Research Engineers—Civilsoft	1.5	.0	1.5	0	.4%	.0%	1.2%	.0%
CADKEY	1.5	.0	1.5	0	.4%	.0%	1.2%	.0%
Computervision	1.5	.0	1.4	18	.4%	.0%	1.1%	.0%
Sigma Design	1.4	.0	1.3	0	.4%	.0%	1.0%	.0%

(Continued)

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Table 14 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: Personal Computer
Region: North America
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
American Small Business Comp.	1.3	.0	1.3	0	.3%	.0%	1.0%	.0%
Moda CAD	1.2	.3	.8	10	.3%	.1%	.6%	.0%
Carrier Corporation	1.0	.0	1.0	0	.3%	.0%	.8%	.0%
Claris	1.0	.0	1.0	0	.3%	.0%	.7%	.0%
CAE-link	1.0	.0	1.0	0	.2%	.0%	.7%	.0%
Engineered Software	.9	.0	.9	0	.2%	.0%	.7%	.0%
Graphisoft Software Dev	.9	.0	.9	0	.2%	.0%	.7%	.0%
Foresight Resources	.9	.0	.8	0	.2%	.0%	.6%	.0%
Dynaware	.8	.0	.8	0	.2%	.0%	.6%	.0%
GRAPHSOFT	.8	.0	.8	0	.2%	.0%	.6%	.0%
CADWorks	.7	.0	.6	0	.2%	.0%	.5%	.0%
ECOM Associates	.7	.0	.7	4	.2%	.0%	.5%	.0%
Evolution Computing	.6	.0	.6	0	.2%	.0%	.5%	.0%
IGC Technology	.6	.0	.6	0	.2%	.0%	.5%	.0%
Mega CADD	.6	.0	.6	0	.2%	.0%	.4%	.0%
Bechtel Software	.5	.0	.5	0	.1%	.0%	.4%	.0%
Cascade Graphics	.3	.0	.3	0	.1%	.0%	.3%	.0%
Mc2 Engineering Software	.3	.0	.3	0	.1%	.0%	.2%	.0%
Aura CAD/CAM Systems	.3	.0	.3	0	.1%	.0%	.2%	.0%
Engineering Systems Corp.	.2	.0	.1	0	.0%	.0%	.1%	.0%
Ashlar	.2	.0	.2	0	.0%	.0%	.1%	.0%

(Continued)

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Table 14 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: Personal Computer
Region: North America
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
BATISOFT	.2	.0	.1	7	.0%	.0%	.1%	.0%
Uniras	.2	.0	.2	0	.0%	.0%	.1%	.0%
Ground Modelling Systems	.1	.1	.1	1	.0%	.0%	.0%	.0%
A.I. Systems	.1	.0	.1	0	.0%	.0%	.1%	.0%
Simulation Science	.1	.0	.1	0	.0%	.0%	.1%	.0%
CADMATIC	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	114.5	114.5	.0	30,145	29.7%	47.2%	.0%	47.9%
All Companies	386.0	242.7	130.1	62,996	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	384.7	242.6	129.0	62,988	99.7%	100.0%	99.2%	100.0%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	1.3	.1	1.1	8	.3%	.0%	.8%	.0%
All Hardware Companies	253.2	242.6	.0	63,109	65.6%	99.9%	.0%	100.2%
All Turnkey & SW Companies	132.8	.1	130.1	(113)	34.4%	.1%	100.0%	-.2%

Source: Dataquest (March 1993)

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Table 15
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: All Platforms
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Intergraph	157.9	72.4	36.1	2,307	16.7%	14.5%	11.8%	3.9%
IBM	81.7	51.9	16.7	5,940	8.6%	10.4%	5.5%	10.1%
IEZ	63.3	22.2	31.7	1,340	6.7%	4.4%	10.4%	2.3%
Nemetschek	58.0	21.5	32.5	600	6.1%	4.3%	10.6%	1.0%
Hewlett-Packard	57.2	47.9	.0	5,322	6.1%	9.6%	.0%	9.0%
Autodesk	51.8	.0	51.8	0	5.5%	.0%	17.0%	.0%
Compaq	43.7	43.7	.0	9,460	4.6%	8.7%	.0%	16.1%
Digital	29.0	20.0	.0	336	3.1%	4.0%	.0%	.6%
Apple Computer	25.3	22.2	.0	5,985	2.7%	4.4%	.0%	10.2%
Computervision	24.3	9.7	6.5	217	2.6%	1.9%	2.1%	.4%
ItalCad	18.6	8.8	4.5	176	2.0%	1.7%	1.5%	.3%
Han Dataport	15.5	4.7	8.5	313	1.6%	.9%	2.8%	.5%
EDS	14.9	6.8	6.8	219	1.6%	1.4%	2.2%	.4%
Sun Microsystems	14.8	12.8	.0	784	1.6%	2.6%	.0%	1.3%
Soft-Tech Software Technologies	13.8	2.1	10.4	932	1.5%	.4%	3.4%	1.6%
ISICAD	12.2	3.7	7.4	63	1.3%	.7%	2.4%	.1%
Siemens Nixdorf Info systeme	11.9	6.0	4.2	203	1.3%	1.2%	1.4%	.3%
Microway	11.9	7.2	3.6	127	1.3%	1.4%	1.2%	.2%
Kockums Computer Systems	10.2	2.6	5.6	502	1.1%	.5%	1.8%	.9%
Star Informatic	9.4	3.0	5.4	1,011	1.0%	.6%	1.8%	1.7%
Silicon Graphics	7.6	6.9	.0	198	.8%	1.4%	.0%	.3%

(Continued)

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Table 15 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: All Platforms
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
CAD Centre	7.5	.0	6.0	0	.8%	.0%	2.0%	.0%
Hochtief	6.9	1.0	4.8	84	.7%	.2%	1.6%	.1%
RIB/RZB	6.6	.6	5.4	41	.7%	.1%	1.8%	.1%
BATISOFT	6.0	.9	3.0	300	.6%	.2%	1.0%	.5%
mb Programme	5.1	2.5	1.8	122	.5%	.5%	.6%	.2%
Complansoft CAD	4.9	2.5	2.5	113	.5%	.5%	.8%	.2%
CAD Distribution	4.7	2.4	1.9	73	.5%	.5%	.6%	.1%
Computer Services Consultants	4.2	.0	4.2	0	.4%	.0%	1.4%	.0%
Research Machines	4.1	4.1	.0	654	.4%	.8%	.0%	1.1%
Graphisoft Software Dev	4.1	.0	4.1	0	.4%	.0%	1.3%	.0%
Gable CAD Systems	4.0	4.0	.8	58	.4%	.8%	.2%	.1%
Sener Sistemas Marinos	3.7	.0	3.7	0	.4%	.0%	1.2%	.0%
Datagraphic	3.6	1.8	1.4	57	.4%	.4%	.5%	.1%
Triplan	3.1	1.3	1.6	37	.3%	.2%	.5%	.1%
Assigraph	2.9	.0	2.3	0	.3%	.0%	.7%	.0%
Dell Computer	2.8	2.8	.0	721	.3%	.6%	.0%	1.2%
RoboCAD Solutions	2.7	.0	2.0	0	.3%	.0%	.7%	.0%
Auto-Trol	2.7	1.0	1.0	34	.3%	.2%	.3%	.1%
Ground Modelling Systems	2.7	1.4	1.1	22	.3%	.3%	.4%	.0%
Olivetti	2.3	2.0	.0	281	.2%	.4%	.0%	.5%
Elstree Computing	2.2	1.0	1.2	62	.2%	.2%	.4%	.1%

(Continued)

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Table 15 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: All Platforms
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Ziegler Informatics	2.0	.0	2.0	0	.2%	.0%	.7%	.0%
Control Data Systems	1.9	.8	.3	14	.2%	.2%	.1%	.0%
Micrografx	1.9	.0	1.9	0	.2%	.0%	.6%	.0%
Lamp Software	1.9	.5	1.3	117	.2%	.1%	.4%	.2%
Macao Systems	1.8	1.0	.6	19	.2%	.2%	.2%	.0%
Matra Datavision	1.8	.6	.8	0	.2%	.1%	.3%	.0%
Radan Computational	1.8	.6	.9	36	.2%	.1%	.3%	.1%
MEDESIGN	1.7	.5	.6	18	.2%	.1%	.2%	.0%
ARKTEC	1.6	.2	1.3	43	.2%	.0%	.4%	.1%
Sinus Software	1.5	.8	.8	36	.2%	.1%	.2%	.1%
Sigma Design	1.4	.0	1.3	0	.1%	.0%	.4%	.0%
CADKEY	1.4	.0	1.4	0	.1%	.0%	.5%	.0%
Mucke Software	1.1	.6	.4	27	.1%	.1%	.1%	.0%
Serbi	1.1	.1	1.0	0	.1%	.0%	.3%	.0%
Integer	1.1	.0	.9	0	.1%	.0%	.3%	.0%
Spectrum Graphics	1.1	.3	.5	10	.1%	.1%	.2%	.0%
PAFEC	1.1	.0	1.1	0	.1%	.0%	.4%	.0%
CADMATIC	.9	.1	.6	6	.1%	.0%	.2%	.0%
Aspen Technology	.9	.0	.8	0	.1%	.0%	.3%	.0%
Accugraph	.8	.3	.4	28	.1%	.1%	.1%	.0%
CAD-Capture	.7	.2	.2	4	.1%	.0%	.1%	.0%

(Continued)

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Table 15 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: All Platforms
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Carrier Corporation	.6	.0	.6	0	.1%	.0%	.2%	.0%
CADWorks	.6	.0	.6	0	.1%	.0%	.2%	.0%
Engineered Software	.6	.0	.6	0	.1%	.0%	.2%	.0%
Moda CAD	.5	.1	.3	4	.0%	.0%	.1%	.0%
DAT Standard info ssystemes	.4	.0	.4	0	.0%	.0%	.1%	.0%
Masta Corporation	.4	.0	.3	0	.0%	.0%	.1%	.0%
Simulation Science	.4	.0	.4	0	.0%	.0%	.1%	.0%
DAPCO	.4	.0	.2	0	.0%	.0%	.1%	.0%
Bechtel Software	.3	.0	.3	0	.0%	.0%	.1%	.0%
Sweet's Electronic Publishing	.3	.0	.2	0	.0%	.0%	.1%	.0%
Softdesk	.3	.0	.3	0	.0%	.0%	.1%	.0%
Georgia Tech Research Corp.	.2	.0	.2	0	.0%	.0%	.1%	.0%
Applications in CADD	.2	.0	.1	6	.0%	.0%	.0%	.0%
Evolution Computing	.2	.0	.2	0	.0%	.0%	.1%	.0%
TOOL Software	.2	.1	.1	4	.0%	.0%	.0%	.0%
Mega CADD	.2	.0	.2	0	.0%	.0%	.1%	.0%
Foresight Resources	.2	.0	.1	0	.0%	.0%	.0%	.0%
Wisdom Systems	.1	.0	.1	0	.0%	.0%	.0%	.0%
ASG	.1	.0	.1	0	.0%	.0%	.0%	.0%
American Small Business Comp.	.1	.0	.1	0	.0%	.0%	.0%	.0%
Cascade Graphics	.1	.0	.1	0	.0%	.0%	.0%	.0%

(Continued)

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Table 15 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: All Platforms
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
CAE-link	.1	.0	.1	0	.0%	.0%	.0%	.0%
ACDS Graphic System	.0	.0	.0	0	.0%	.0%	.0%	.0%
A.I. Systems	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	89.4	88.6	.0	19,805	9.5%	17.7%	.0%	33.6%
All Companies	944.8	500.4	304.8	58,871	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	628.2	391.7	136.9	51,437	66.5%	78.3%	44.9%	87.4%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	316.5	108.7	167.9	7,434	33.5%	21.7%	55.1%	12.6%
All Hardware Companies	298.6	271.9	.0	49,017	31.6%	54.3%	.0%	83.3%
All Turnkey & SW Companies	646.2	228.5	304.8	9,854	68.4%	45.7%	100.0%	16.7%

Source: Dataquest (March 1993)

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Table 16
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: Technical Workstation
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Intergraph	137.6	63.3	30.3	2,044	28.4%	27.3%	19.5%	15.8%
IEZ	63.3	22.2	31.7	1,340	13.1%	9.6%	20.4%	10.3%
Hewlett-Packard	53.8	45.2	.0	4,720	11.1%	19.5%	.0%	36.4%
Nemetschek	26.7	9.9	14.9	200	5.5%	4.3%	9.6%	1.5%
Computervision	24.3	9.7	6.5	201	5.0%	4.2%	4.2%	1.6%
ItalCad	18.6	8.8	4.5	176	3.8%	3.8%	2.9%	1.4%
Han Dataport	14.0	4.2	7.7	299	2.9%	1.8%	4.9%	2.3%
Sun Microsystems	13.4	11.6	.0	751	2.8%	5.0%	.0%	5.8%
EDS	12.6	6.8	4.6	226	2.6%	2.9%	2.9%	1.7%
Siemens Nixdorf Info systeme	11.9	6.0	4.2	203	2.5%	2.6%	2.7%	1.6%
IBM	11.2	6.1	2.9	228	2.3%	2.6%	1.9%	1.8%
Kockums Computer Systems	10.2	2.6	5.6	502	2.1%	1.1%	3.6%	3.9%
Star Informatic	9.4	3.0	5.4	1,011	1.9%	1.3%	3.5%	7.8%
ISICAD	8.5	3.7	3.7	63	1.8%	1.6%	2.4%	.5%
Silicon Graphics	7.6	6.9	.0	198	1.6%	3.0%	.0%	1.5%
CAD Centre	7.5	.0	6.0	0	1.5%	.0%	3.8%	.0%
Microway	7.1	4.3	2.1	67	1.5%	1.9%	1.4%	.5%
Digital	5.9	4.1	.0	269	1.2%	1.8%	.0%	2.1%
Autodesk	5.2	.0	5.2	0	1.1%	.0%	3.3%	.0%
Complansoft CAD	4.9	2.5	2.5	113	1.0%	1.1%	1.6%	.9%
Gable CAD Systems	4.0	4.0	.8	58	.8%	1.7%	.5%	.4%

(Continued)

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Table 16 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: Technical Workstation
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Sener Sistemas Marinos	3.7	.0	3.7	0	.8%	.0%	2.4%	.0%
Triplan	3.1	1.3	1.6	37	.6%	.5%	1.0%	.3%
Auto-Trol	2.7	1.0	1.0	34	.6%	.4%	.7%	.3%
RIB/RZB	2.0	.2	1.6	10	.4%	.1%	1.0%	.1%
Matra Datavision	1.8	.6	.8	0	.4%	.3%	.5%	.0%
Radan Computational	1.7	.6	.9	36	.4%	.3%	.6%	.3%
MEDESIGN	1.7	.5	.6	18	.3%	.2%	.4%	.1%
Sinus Software	1.5	.8	.8	36	.3%	.3%	.5%	.3%
Assigraph	1.4	.0	1.1	0	.3%	.0%	.7%	.0%
Macao Systems	1.1	.6	.4	12	.2%	.3%	.2%	.1%
Spectrum Graphics	1.1	.3	.5	10	.2%	.1%	.3%	.1%
PAFEC	1.1	.0	1.1	0	.2%	.0%	.7%	.0%
Control Data Systems	.8	.4	.2	10	.2%	.2%	.1%	.1%
Sigma Design	.8	.0	.7	0	.2%	.0%	.5%	.0%
Accugraph	.7	.3	.3	27	.1%	.1%	.2%	.2%
Lamp Software	.6	.2	.3	47	.1%	.1%	.2%	.4%
DAPCO	.4	.0	.2	0	.1%	.0%	.2%	.0%
CADMATIC	.3	.0	.2	2	.1%	.0%	.1%	.0%
Simulation Science	.3	.0	.3	0	.1%	.0%	.2%	.0%
ARKTEC	.2	.1	.1	11	.0%	.0%	.0%	.1%
Wisdom Systems	.1	.0	.1	0	.0%	.0%	.1%	.0%

(Continued)

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Table 16 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: Technical Workstation
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Bechtel Software	.1	.0	.1	0	.0%	.0%	.1%	.0%
Georgia Tech Research Corp.	.1	.0	.1	0	.0%	.0%	.1%	.0%
Masta Corporation	.1	.0	.1	0	.0%	.0%	.1%	.0%
Softdesk	.1	.0	.1	0	.0%	.0%	.0%	.0%
TOOL Software	.0	.0	.0	1	.0%	.0%	.0%	.0%
ACDS Graphic System	.0	.0	.0	0	.0%	.0%	.0%	.0%
Carrier Corporation	.0	.0	.0	0	.0%	.0%	.0%	.0%
ASG	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Companies	485.3	231.6	155.3	12,959	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	285.9	159.2	56.1	8,770	58.9%	68.7%	36.1%	67.7%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	199.4	72.5	99.2	4,190	41.1%	31.3%	63.9%	32.3%
All Hardware Companies	80.9	67.9	.0	5,939	16.7%	29.3%	.0%	45.8%
All Turnkey & SW Companies	404.4	163.7	155.3	7,020	83.3%	70.7%	100.0%	54.2%

Source: Dataquest (March 1993)

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Table 17
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: Host-Dependent
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
IBM	38.3	20.7	10.1	397	49.2%	43.0%	65.7%	40.7%
Digital	15.2	10.5	.0	0	19.6%	21.9%	.0%	.0%
EDS	2.2	.0	2.2	(7)	2.9%	.0%	14.5%	-.8%
Han Dataport	1.6	.5	.9	13	2.0%	1.0%	5.6%	1.3%
Assigraph	1.4	.0	1.1	0	1.9%	.0%	7.4%	.0%
Control Data Systems	1.1	.4	.2	4	1.5%	.9%	1.0%	.4%
Macao Systems	.7	.4	.3	6	1.0%	.9%	1.7%	.6%
Hochtief	.3	.1	.2	2	.4%	.1%	1.5%	.2%
Masta Corporation	.2	.0	.1	0	.2%	.0%	.8%	.0%
Bechtel Software	.2	.0	.2	0	.2%	.0%	1.0%	.0%
Georgia Tech Research Corp.	.1	.0	.1	0	.1%	.0%	.6%	.0%
Lamp Software	.1	.0	.0	3	.1%	.1%	.3%	.3%
Accugraph	.0	.0	.0	1	.0%	.0%	.0%	.1%
Other Companies	16.4	15.5	.0	559	21.0%	32.3%	.0%	57.2%
All Companies	77.8	48.1	15.4	977	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	73.5	47.2	12.8	954	94.5%	98.0%	82.8%	97.6%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	4.3	1.0	2.7	24	5.5%	2.0%	17.2%	2.4%
All Hardware Companies	31.8	26.2	.0	560	40.9%	54.3%	.1%	57.3%
All Turnkey & SW Companies	46.0	22.0	15.4	418	59.1%	45.7%	99.9%	42.7%

Source: Dataquest (March 1993)

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Table 18
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: Server
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Intergraph	18.8	9.1	4.3	264	49.6%	42.8%	64.8%	52.3%
IBM	9.8	5.7	2.3	140	26.0%	26.5%	34.9%	27.7%
Digital	7.8	5.4	.0	67	20.7%	25.3%	.0%	13.4%
Sun Microsystems	1.4	1.2	.0	33	3.7%	5.4%	.0%	6.6%
Georgia Tech Research Corp.	.0	.0	.0	0	.1%	.0%	.3%	.0%
Other Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Companies	37.9	21.3	6.7	504	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	37.9	21.3	6.7	504	100.0%	100.0%	100.0%	100.0%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Hardware Companies	9.7	7.0	.0	206	25.5%	32.6%	.0%	40.9%
All Turnkey & SW Companies	28.2	14.4	6.7	298	74.5%	67.4%	100.0%	59.1%

Source: Dataquest (March 1993)

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Table 19
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: Personal Computer
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Autodesk	46.6	.0	46.6	0	13.6%	.0%	36.6%	.0%
Compaq	43.7	43.7	.0	9,460	12.7%	21.9%	.0%	21.3%
Nemetschek	31.3	11.6	17.5	400	9.1%	5.8%	13.8%	.9%
Apple Computer	25.3	22.2	.0	5,985	7.4%	11.2%	.0%	13.5%
IBM	22.4	19.5	1.4	5,175	6.5%	9.8%	1.1%	11.6%
Soft-Tech Software Technologies	13.8	2.1	10.4	932	4.0%	1.0%	8.1%	2.1%
Hochtief	6.5	1.0	4.6	82	1.9%	.5%	3.6%	.2%
BATISOFT	6.0	.9	3.0	300	1.7%	.5%	2.4%	.7%
mb Programme	5.1	2.5	1.8	122	1.5%	1.3%	1.4%	.3%
Microway	4.7	2.9	1.4	60	1.4%	1.5%	1.1%	.1%
CAD Distribution	4.7	2.4	1.9	73	1.4%	1.2%	1.5%	.2%
RIB/RZB	4.6	.4	3.8	32	1.3%	.2%	3.0%	.1%
Computer Services Consultants	4.2	.0	4.2	0	1.2%	.0%	3.3%	.0%
Research Machines	4.1	4.1	.0	654	1.2%	2.0%	.0%	1.5%
Graphisoft Software Dev	4.1	.0	4.1	0	1.2%	.0%	3.2%	.0%
ISICAD	3.7	.0	3.7	0	1.1%	.0%	2.9%	.0%
Datagraphic	3.6	1.8	1.4	57	1.0%	.9%	1.1%	.1%
Hewlett-Packard	3.4	2.7	.0	602	1.0%	1.4%	.0%	1.4%
Dell Computer	2.8	2.8	.0	721	.8%	1.4%	.0%	1.6%
RoboCAD Solutions	2.7	.0	2.0	0	.8%	.0%	1.6%	.0%

(Continued)

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Table 19 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: Personal Computer
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Ground Modelling Systems	2.7	1.4	1.1	22	.8%	.7%	.8%	.1%
Olivetti	2.3	2.0	.0	281	.7%	1.0%	.0%	.6%
Elstree Computing	2.2	1.0	1.2	62	.7%	.5%	1.0%	.1%
Ziegler Informatics	2.0	.0	2.0	0	.6%	.0%	1.6%	.0%
Micrografx	1.9	.0	1.9	0	.5%	.0%	1.5%	.0%
Intergraph	1.6	.0	1.5	0	.5%	.0%	1.2%	.0%
ARKTEC	1.4	.1	1.2	32	.4%	.1%	1.0%	.1%
CADKEY	1.4	.0	1.4	0	.4%	.0%	1.1%	.0%
Lamp Software	1.2	.2	1.0	68	.4%	.1%	.8%	.2%
Mucke Software	1.1	.6	.4	27	.3%	.3%	.3%	.1%
Serbi	1.1	.1	1.0	0	.3%	.1%	.8%	.0%
Integer	1.1	.0	.9	0	.3%	.0%	.7%	.0%
Aspen Technology	.9	.0	.8	0	.3%	.0%	.6%	.0%
CAD-Capture	.7	.2	.2	4	.2%	.1%	.2%	.0%
Sigma Design	.6	.0	.6	0	.2%	.0%	.5%	.0%
CADWorks	.6	.0	.6	0	.2%	.0%	.4%	.0%
Carrier Corporation	.6	.0	.6	0	.2%	.0%	.5%	.0%
Engineered Software	.6	.0	.6	0	.2%	.0%	.5%	.0%
CADMATIC	.6	.0	.4	4	.2%	.0%	.3%	.0%
Moda CAD	.5	.1	.3	4	.1%	.1%	.3%	.0%

(Continued)

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Table 19 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: Personal Computer
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
DAT Standard info ssystemes	.4	.0	.4	0	.1%	.0%	.3%	.0%
Sweet's Electronic Publishing	.3	.0	.2	0	.1%	.0%	.2%	.0%
Applications in CADD	.2	.0	.1	6	.1%	.0%	.1%	.0%
Evolution Computing	.2	.0	.2	0	.1%	.0%	.2%	.0%
Softdesk	.2	.0	.2	0	.1%	.0%	.2%	.0%
Mega CADD	.2	.0	.2	0	.0%	.0%	.1%	.0%
Foresight Resources	.2	.0	.1	0	.0%	.0%	.1%	.0%
TOOL Software	.1	.0	.1	3	.0%	.0%	.0%	.0%
ASG	.1	.0	.1	0	.0%	.0%	.1%	.0%
Masta Corporation	.1	.0	.1	0	.0%	.0%	.1%	.0%
American Small Business Comp.	.1	.0	.1	0	.0%	.0%	.1%	.0%
Accugraph	.1	.0	.1	0	.0%	.0%	.0%	.0%
Cascade Graphics	.1	.0	.1	0	.0%	.0%	.1%	.0%
Simulation Science	.1	.0	.1	0	.0%	.0%	.1%	.0%
CAE-link	.1	.0	.1	0	.0%	.0%	.0%	.0%
Bechtel Software	.0	.0	.0	0	.0%	.0%	.0%	.0%
Radan Computational	.0	.0	.0	1	.0%	.0%	.0%	.0%
A.I. Systems	.0	.0	.0	0	.0%	.0%	.0%	.0%

(Continued)

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Table 19 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: Personal Computer
Region: Europe
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Other Companies	73.1	73.1	.0	19,262	21.2%	36.7%	.0%	43.4%
All Companies	343.8	199.3	127.4	44,430	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	231.0	164.0	61.4	41,210	67.2%	82.3%	48.2%	92.8%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	112.8	35.3	66.1	3,220	32.8%	17.7%	51.8%	7.2%
All Hardware Companies	176.2	170.9	.0	42,312	51.3%	85.8%	.0%	95.2%
All Turnkey & SW Companies	167.6	28.4	127.4	2,118	48.7%	14.2%	100.0%	4.8%

Source: Dataquest (March 1993)

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Table 20
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: All Platforms
Region: Asia
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Fujitsu	137.0	87.7	35.6	2,713	24.3%	25.7%	22.5%	10.2%
NEC	55.7	39.5	11.7	5,386	9.9%	11.6%	7.4%	20.2%
IBM	49.4	28.8	12.7	3,155	8.8%	8.5%	8.1%	11.8%
Nihon Unisys	32.0	19.8	5.4	319	5.7%	5.8%	3.4%	1.2%
Intergraph	25.0	10.9	6.6	361	4.4%	3.2%	4.2%	1.4%
Autodesk	24.4	.0	24.4	0	4.3%	.0%	15.4%	.0%
Hewlett-Packard	18.9	15.8	.0	1,971	3.4%	4.6%	.0%	7.4%
Hitachi	17.4	8.3	7.3	468	3.1%	2.4%	4.6%	1.8%
Computervision	15.7	6.2	4.0	85	2.8%	1.8%	2.5%	.3%
Mitsubishi Electric	14.3	11.2	1.7	261	2.5%	3.3%	1.1%	1.0%
Mutoh Industries—NO OEM	13.0	7.5	3.8	172	2.3%	2.2%	2.4%	.6%
Toshiba—NO OEM	12.8	6.4	5.1	324	2.3%	1.9%	3.2%	1.2%
Century Research Center	10.8	5.7	4.0	60	1.9%	1.7%	2.5%	.2%
Apple Computer	10.7	9.4	.0	2,532	1.9%	2.8%	.0%	9.5%
CPU	10.5	.0	9.5	0	1.9%	.0%	6.0%	.0%
Sun Microsystems	9.5	8.2	.0	527	1.7%	2.4%	.0%	2.0%
Hitachi Zosen Info Systems	7.8	6.7	.3	81	1.4%	2.0%	.2%	.3%
INS Engineering	7.2	3.6	3.6	30	1.3%	1.0%	2.3%	.1%
Digital	6.2	4.3	.0	68	1.1%	1.3%	.0%	.3%
Silicon Graphics	6.1	5.9	.0	157	1.1%	1.7%	.0%	.6%
EDS	5.7	2.5	2.5	81	1.0%	.7%	1.6%	.3%
Uchida Yoko	5.3	3.2	1.9	126	.9%	.9%	1.2%	.5%

(Continued)

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Table 20 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: All Platforms
Region: Asia
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Seiko Instruments—NO OEM	5.3	3.8	3.8	136	.9%	1.1%	2.4%	.5%
Toyo Information Systems-NO OEM	4.2	2.6	1.2	46	.8%	.8%	.8%	.2%
Andor	4.2	1.1	3.0	32	.8%	.3%	1.9%	.1%
Design Automation	2.5	.1	2.4	13	.5%	.0%	1.5%	.1%
Mitsui Engineering	2.0	1.4	.4	13	.4%	.4%	.2%	.0%
Kockums Computer Systems	1.6	.4	.9	80	.3%	.1%	.6%	.3%
CAD Centre	1.3	.0	1.0	0	.2%	.0%	.6%	.0%
Sony	1.1	1.0	.0	66	.2%	.3%	.0%	.2%
Sumitomo Denko Workstation	1.0	1.0	.0	167	.2%	.3%	.0%	.6%
Sigma Design	.9	.0	.9	0	.2%	.0%	.5%	.0%
Auto-Trol	.9	.3	.3	11	.2%	.1%	.2%	.0%
ISICAD	.7	.2	.4	4	.1%	.1%	.3%	.0%
Kubota Computer	.6	.4	.1	36	.1%	.1%	.1%	.1%
Control Data Systems	.5	.2	.1	4	.1%	.1%	.1%	.0%
CADWorks	.5	.0	.4	0	.1%	.0%	.3%	.0%
Carrier Corporation	.4	.0	.4	0	.1%	.0%	.3%	.0%
Wisdom Systems	.4	.0	.3	0	.1%	.0%	.2%	.0%
Accugraph	.4	.2	.2	14	.1%	.1%	.1%	.1%
Softdesk	.4	.0	.4	0	.1%	.0%	.2%	.0%
Simulation Science	.4	.0	.4	0	.1%	.0%	.2%	.0%
Aspen Technology	.3	.0	.3	0	.1%	.0%	.2%	.0%
Graphisoft Software Dev	.2	.0	.2	0	.0%	.0%	.1%	.0%

(Continued)

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Table 20 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: All Platforms
Region: Asia
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Georgia Tech Research Corp.	.2	.0	.2	0	.0%	.0%	.1%	.0%
Moda CAD	.2	.1	.1	2	.0%	.0%	.1%	.0%
BATISOFT	.2	.0	.1	7	.0%	.0%	.1%	.0%
ASG	.1	.0	.1	0	.0%	.0%	.1%	.0%
Integer	.1	.0	.1	0	.0%	.0%	.1%	.0%
Solbourne	.1	.1	.0	8	.0%	.0%	.0%	.0%
Gable CAD Systems	.1	.1	.0	1	.0%	.0%	.0%	.0%
Bechtel Software	.1	.0	.1	0	.0%	.0%	.0%	.0%
Mega CADD	.1	.0	.1	0	.0%	.0%	.1%	.0%
American Small Business Comp.	.0	.0	.0	0	.0%	.0%	.0%	.0%
PAFEC	.0	.0	.0	0	.0%	.0%	.0%	.0%
Foresight Resources	.0	.0	.0	0	.0%	.0%	.0%	.0%
ACDS Graphic System	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	36.9	36.4	.0	7,165	6.6%	10.7%	.0%	26.9%
All Companies	563.2	340.7	158.1	26,682	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	215.1	129.3	54.9	16,145	38.2%	38.0%	34.7%	60.5%
All Asian-Based Companies	344.6	210.9	100.9	10,449	61.2%	61.9%	63.8%	39.2%
All European-Based Companies	3.5	.5	2.4	88	.6%	.1%	1.5%	.3%
All Hardware Companies	103.6	94.3	.0	15,772	18.4%	27.7%	.0%	59.1%
All Turnkey & SW Companies	459.7	246.5	158.1	10,911	81.6%	72.3%	100.0%	40.9%

Source: Dataquest (March 1993)

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Table 21
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: Technical Workstation
Region: Asia
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Fujitsu	57.6	36.8	15.0	1,173	22.4%	23.6%	22.8%	18.5%
NEC	25.1	13.8	9.3	826	9.7%	8.8%	14.1%	13.0%
Intergraph	19.7	9.1	4.3	290	7.7%	5.8%	6.6%	4.6%
Hewlett-Packard	18.0	15.1	.0	1,684	7.0%	9.7%	.0%	26.5%
Computervision	15.6	6.2	3.8	85	6.0%	3.9%	5.8%	1.3%
Hitachi	12.5	6.0	5.3	271	4.9%	3.8%	8.0%	4.3%
Mitsubishi Electric	11.2	9.5	.8	120	4.3%	6.1%	1.2%	1.9%
Century Research Center	10.8	5.7	4.0	60	4.2%	3.7%	6.1%	.9%
Toshiba—NO OEM	10.2	5.1	4.1	121	4.0%	3.3%	6.2%	1.9%
Mutoh Industries—NO OEM	9.1	5.5	2.7	93	3.5%	3.5%	4.2%	1.5%
Sun Microsystems	8.7	7.5	.0	504	3.4%	4.8%	.0%	7.9%
Nihon Unisys	7.0	4.4	1.2	57	2.7%	2.8%	1.8%	.9%
IBM	6.5	3.7	1.6	177	2.5%	2.3%	2.5%	2.8%
Hitachi Zosen Info Systems	6.5	5.5	.3	67	2.5%	3.5%	.5%	1.1%
INS Engineering	6.4	3.2	3.2	17	2.5%	2.1%	4.9%	.3%
Silicon Graphics	6.1	5.9	.0	157	2.4%	3.7%	.0%	2.5%
EDS	4.8	2.5	1.6	84	1.9%	1.6%	2.5%	1.3%
Uchida Yoko	4.8	2.9	1.7	102	1.9%	1.8%	2.5%	1.6%
Toyo Information Systems-NO OEM	3.5	2.2	1.0	42	1.4%	1.4%	1.5%	.7%
Mitsui Engineering	1.8	1.3	.4	10	.7%	.8%	.5%	.2%
Kockums Computer Systems	1.6	.4	.9	80	.6%	.3%	1.4%	1.3%

(Continued)

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Table 21 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application:	AEC
Platform:	Technical Workstation
Region:	Asia
Units:	Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
CAD Centre	1.3	.0	1.0	0	.5%	.0%	1.5%	.0%
Digital	1.2	.9	.0	55	.5%	.6%	.0%	.9%
Autodesk	1.2	.0	1.2	0	.5%	.0%	1.9%	.0%
Sony	1.1	1.0	.0	66	.4%	.6%	.0%	1.0%
Sumitomo Denko Workstation	.9	.9	.0	148	.4%	.6%	.0%	2.3%
Auto-Trol	.9	.3	.3	11	.3%	.2%	.5%	.2%
Kubota Computer	.5	.3	.1	28	.2%	.2%	.2%	.4%
ISICAD	.5	.2	.2	4	.2%	.1%	.3%	.1%
Sigma Design	.5	.0	.5	0	.2%	.0%	.7%	.0%
Wisdom Systems	.4	.0	.3	0	.2%	.0%	.5%	.0%
Accugraph	.4	.2	.1	14	.1%	.1%	.2%	.2%
Simulation Science	.3	.0	.3	0	.1%	.0%	.4%	.0%
Control Data Systems	.2	.1	.0	3	.1%	.1%	.1%	.0%
Georgia Tech Research Corp.	.1	.0	.1	0	.0%	.0%	.2%	.0%
Gable CAD Systems	.1	.1	.0	1	.0%	.0%	.0%	.0%
Softdesk	.1	.0	.1	0	.0%	.0%	.1%	.0%
Solbourne	.0	.0	.0	5	.0%	.0%	.0%	.1%
Bechtel Software	.0	.0	.0	0	.0%	.0%	.0%	.0%
Carrier Corporation	.0	.0	.0	0	.0%	.0%	.0%	.0%
PAFEC	.0	.0	.0	0	.0%	.0%	.0%	.0%
ASG	.0	.0	.0	0	.0%	.0%	.0%	.0%

(Continued)

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Table 21 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: Technical Workstation
Region: Asia
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
ACDS Graphic System	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Companies	257.4	156.2	65.6	6,355	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	85.3	51.6	14.7	3,072	33.1%	33.1%	22.4%	48.3%
All Asian-Based Companies	169.1	104.1	49.0	3,201	65.7%	66.6%	74.6%	50.4%
All European-Based Companies	3.0	.5	2.0	81	1.2%	.3%	3.0%	1.3%
All Hardware Companies	36.2	31.3	.0	2,619	14.0%	20.0%	.0%	41.2%
All Turnkey & SW Companies	221.3	124.9	65.6	3,736	86.0%	80.0%	100.0%	58.8%

Source: Dataquest (March 1993)

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Table 22
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: Host-Dependent
Region: Asia
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Fujitsu	52.1	33.3	13.5	725	42.9%	43.3%	50.5%	41.7%
Nihon Unisys	24.9	15.5	4.2	262	20.6%	20.1%	15.8%	15.0%
IBM	22.3	12.1	5.9	310	18.4%	15.7%	22.1%	17.8%
Digital	3.3	2.3	.0	0	2.7%	3.0%	.0%	.0%
Hitachi	1.7	.8	.7	31	1.4%	1.1%	2.7%	1.8%
Mitsubishi Electric	1.6	.8	.5	5	1.4%	1.0%	1.7%	.3%
Hitachi Zosen Info Systems	1.2	1.1	.0	14	1.0%	1.5%	.0%	.8%
EDS	.9	.0	.9	(3)	.7%	.0%	3.2%	-.2%
Intergraph	.8	.0	.7	0	.6%	.0%	2.5%	.0%
Toyo Information Systems-NO OEM	.7	.4	.2	4	.6%	.5%	.9%	.2%
Control Data Systems	.3	.1	.0	1	.2%	.1%	.1%	.1%
Georgia Tech Research Corp.	.1	.0	.1	0	.1%	.0%	.3%	.0%
Kubota Computer	.1	.1	.0	8	.0%	.1%	.0%	.4%
Bechtel Software	.0	.0	.0	0	.0%	.0%	.1%	.0%
Other Companies	11.2	10.6	.0	383	9.2%	13.8%	.0%	22.0%
All Companies	121.2	77.0	26.8	1,740	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	38.8	25.1	7.6	690	32.0%	32.6%	28.4%	39.7%
All Asian-Based Companies	82.4	52.0	19.2	1,049	68.0%	67.4%	71.6%	60.3%
All European-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Hardware Companies	14.6	12.9	.0	383	12.0%	16.7%	.0%	22.0%
All Turnkey & SW Companies	106.7	64.1	26.8	1,357	88.0%	83.3%	100.0%	78.0%

Source: Dataquest (March 1993)

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Table 23
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: Server
Region: Asia
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
IBM	5.5	3.1	1.3	28	45.2%	44.4%	60.6%	17.0%
Intergraph	3.7	1.8	.9	71	30.9%	25.6%	38.5%	43.2%
Digital	1.7	1.1	.0	14	13.6%	16.0%	.0%	8.4%
Sun Microsystems	.8	.6	.0	23	6.5%	9.0%	.0%	14.3%
Hewlett-Packard	.3	.2	.0	5	2.3%	2.8%	.0%	3.2%
Sumitomo Denko Workstation	.1	.1	.0	20	.7%	1.3%	.0%	12.2%
Solbourne	.1	.1	.0	3	.6%	.9%	.0%	1.8%
Georgia Tech Research Corp.	.0	.0	.0	0	.2%	.0%	.9%	.0%
Other Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Companies	12.1	7.0	2.2	164	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	12.0	6.9	2.2	144	99.3%	98.7%	100.0%	87.8%
All Asian-Based Companies	.1	.1	.0	20	.7%	1.3%	.0%	12.2%
All European-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Hardware Companies	2.9	2.1	.0	65	23.8%	29.9%	.0%	39.8%
All Turnkey & SW Companies	9.2	4.9	2.2	99	76.2%	70.1%	100.0%	60.2%

Source: Dataquest (March 1993)

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Table 24
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: Personal Computer
Region: Asia
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
NEC	30.6	25.7	2.5	4,560	17.8%	25.6%	3.9%	24.8%
Fujitsu	27.4	17.5	7.1	815	15.9%	17.4%	11.2%	4.4%
Autodesk	23.2	.0	23.2	0	13.4%	.0%	36.5%	.0%
IBM	15.1	9.9	3.9	2,640	8.8%	9.9%	6.1%	14.3%
Apple Computer	10.7	9.4	.0	2,532	6.2%	9.4%	.0%	13.7%
CPU	10.5	.0	9.5	0	6.1%	.0%	14.9%	.0%
Seiko Instruments—NO OEM	5.3	3.8	3.8	136	3.1%	3.7%	5.9%	.7%
Andor	4.2	1.1	3.0	32	2.5%	1.1%	4.7%	.2%
Mutoh Industries—NO OEM	3.9	2.1	1.1	79	2.3%	2.1%	1.7%	.4%
Hitachi	3.1	1.5	1.3	166	1.8%	1.5%	2.1%	.9%
Toshiba—NO OEM	2.6	1.3	1.0	204	1.5%	1.3%	1.6%	1.1%
Design Automation	2.5	.1	2.4	13	1.5%	.1%	3.8%	.1%
Mitsubishi Electric	1.4	.9	.5	135	.8%	.9%	.8%	.7%
Intergraph	.8	.0	.7	0	.4%	.0%	1.1%	.0%
INS Engineering	.7	.4	.4	13	.4%	.3%	.6%	.1%
Hewlett-Packard	.7	.6	.0	282	.4%	.5%	.0%	1.5%
Uchida Yoko	.5	.3	.2	24	.3%	.3%	.3%	.1%
CADWorks	.5	.0	.4	0	.3%	.0%	.7%	.0%
Sigma Design	.4	.0	.4	0	.2%	.0%	.6%	.0%
Carrier Corporation	.4	.0	.4	0	.2%	.0%	.6%	.0%
Softdesk	.3	.0	.3	0	.2%	.0%	.5%	.0%
Aspen Technology	.3	.0	.3	0	.2%	.0%	.4%	.0%
Graphisoft Software Dev	.2	.0	.2	0	.1%	.0%	.4%	.0%

(Continued)

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Table 24 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: Personal Computer
Region: Asia
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
ISICAD	.2	.0	.2	0	.1%	.0%	.3%	.0%
Moda CAD	.2	.1	.1	2	.1%	.0%	.2%	.0%
Mitsui Engineering	.2	.1	.0	3	.1%	.1%	.0%	.0%
BATISOFT	.2	.0	.1	7	.1%	.0%	.1%	.0%
Computervision	.2	.0	.2	0	.1%	.0%	.2%	.0%
ASG	.1	.0	.1	0	.1%	.0%	.2%	.0%
Integer	.1	.0	.1	0	.1%	.0%	.2%	.0%
Mega CADD	.1	.0	.1	0	.0%	.0%	.1%	.0%
Simulation Science	.1	.0	.1	0	.0%	.0%	.1%	.0%
Accugraph	.0	.0	.0	0	.0%	.0%	.0%	.0%
American Small Business Comp.	.0	.0	.0	0	.0%	.0%	.0%	.0%
Bechtel Software	.0	.0	.0	0	.0%	.0%	.0%	.0%
Foresight Resources	.0	.0	.0	0	.0%	.0%	.0%	.0%
Microsim	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	25.7	25.8	.0	6,783	14.9%	25.6%	.0%	36.8%
All Companies	172.5	100.5	63.5	18,424	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	78.9	45.7	30.4	12,239	45.8%	45.5%	47.8%	66.4%
All Asian-Based Companies	93.0	54.8	32.7	6,179	53.9%	54.5%	51.5%	33.5%
All European-Based Companies	.5	.0	.4	7	.3%	.0%	.6%	.0%
All Hardware Companies	50.0	48.0	.0	12,705	29.0%	47.7%	.0%	69.0%
All Turnkey & SW Companies	122.5	52.5	63.5	5,719	71.0%	52.3%	100.0%	31.0%

Source: Dataquest (March 1993)

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Table 25
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: All Platforms
Region: Rest of World
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Intergraph	14.8	6.5	3.9	238	29.8%	24.3%	25.0%	5.7%
Compaq	4.8	4.8	.0	1,029	9.6%	17.9%	.0%	24.4%
IBM	3.6	2.8	.3	617	7.2%	10.7%	2.1%	14.6%
International Software Systems	2.4	.0	2.4	0	4.7%	.0%	15.0%	.0%
Digital	2.1	1.4	.0	24	4.2%	5.4%	.0%	.6%
Computervision	2.0	.7	.6	20	4.0%	2.7%	3.9%	.5%
CAD Centre	2.0	.0	1.6	0	4.0%	.0%	10.2%	.0%
Autodesk	1.8	.0	1.8	0	3.7%	.0%	11.8%	.0%
Hewlett-Packard	1.3	1.0	.0	175	2.5%	3.9%	.0%	4.1%
Apple Computer	1.0	.9	.0	230	2.0%	3.2%	.0%	5.5%
Claris	1.0	.0	1.0	0	2.0%	.0%	6.2%	.0%
EA Systems	.8	.0	.8	0	1.6%	.0%	5.2%	.0%
Sun Microsystems	.5	.4	.0	34	1.0%	1.6%	.0%	.8%
Accugraph	.4	.2	.2	14	.8%	.7%	1.1%	.3%
Softdesk	.3	.0	.3	0	.6%	.0%	2.0%	.0%
ISICAD	.3	.1	.2	2	.6%	.3%	1.2%	.0%
Hochtief	.3	.0	.2	2	.6%	.2%	1.3%	.1%
Georgia Tech Research Corp.	.3	.0	.3	0	.5%	.0%	1.6%	.0%

(Continued)

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Table 25 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: All Platforms
Region: Rest of World
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Sigma Design	.2	.0	.2	0	.4%	.0%	1.3%	.0%
Graphisoft Software Dev	.2	.0	.2	0	.3%	.0%	1.0%	.0%
CADMATIC	.1	.0	.1	1	.2%	.0%	.4%	.0%
CADWorks	.1	.0	.1	0	.2%	.0%	.6%	.0%
Star Informatic	.1	.0	.0	0	.2%	.2%	.2%	.0%
Simulation Science	.1	.0	.1	0	.2%	.0%	.7%	.0%
Innovative Data Design	.1	.0	.1	0	.2%	.0%	.6%	.0%
ASG	.1	.0	.1	0	.1%	.0%	.4%	.0%
Mc2 Engineering Software	.1	.0	.1	0	.1%	.0%	.4%	.0%
Aura CAD/CAM Systems	.1	.0	.0	0	.1%	.0%	.3%	.0%
CAE-link	.1	.0	.1	0	.1%	.0%	.3%	.0%
Engineering Systems Corp.	.0	.0	.0	0	.1%	.0%	.2%	.0%
American Small Business Comp.	.0	.0	.0	0	.1%	.0%	.3%	.0%
Engineered Software	.0	.0	.0	0	.1%	.0%	.2%	.0%
Macao Systems	.0	.0	.0	0	.0%	.0%	.0%	.0%
Moda CAD	.0	.0	.0	0	.0%	.0%	.1%	.0%
Ziegler Informatics	.0	.0	.0	0	.0%	.0%	.1%	.0%
Foresight Resources	.0	.0	.0	0	.0%	.0%	.1%	.0%
Gable CAD Systems	.0	.0	.0	0	.0%	.0%	.0%	.0%

(Continued)

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Table 25 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application:	AEC
Platform:	All Platforms
Region:	Rest of World
Units:	Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Other Companies	9.0	7.6	1.0	1,827	15.5%	28.8%	.0%	43.4%
All Companies	49.7	26.5	15.6	4,213	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	47.0	26.4	13.6	4,209	94.6%	99.7%	86.8%	99.9%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	2.7	.1	2.1	3	5.4%	.3%	13.2%	.1%
All Hardware Companies	19.5	18.3	.0	3,912	39.3%	69.0%	.0%	92.9%
All Turnkey & SW Companies	30.1	8.2	15.6	301	60.7%	31.0%	100.0%	7.1%

Source: Dataquest (March 1993)

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Table 26
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: Technical Workstation
Region: Rest of World
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Intergraph	11.7	5.4	2.6	210	59.2%	68.1%	40.4%	57.0%
CAD Centre	2.0	.0	1.6	0	10.0%	.0%	25.0%	.0%
Computervision	1.8	.7	.5	18	9.2%	8.5%	8.3%	4.8%
Hewlett-Packard	.9	.7	.0	65	4.3%	9.0%	.0%	17.7%
Sun Microsystems	.5	.4	.0	32	2.3%	4.9%	.0%	8.8%
Digital	.4	.3	.0	19	2.2%	3.7%	.0%	5.2%
Accugraph	.4	.2	.1	14	1.8%	2.3%	2.2%	3.7%
IBM	.2	.1	.1	9	1.2%	1.6%	.9%	2.4%
ISICAD	.2	.1	.1	2	1.0%	1.1%	1.4%	.4%
Sigma Design	.1	.0	.1	0	.6%	.0%	1.7%	.0%
Star Informatic	.1	.0	.0	0	.6%	.5%	.5%	.0%
Simulation Science	.1	.0	.1	0	.5%	.0%	1.4%	.0%
Autodesk	.1	.0	.1	0	.5%	.0%	1.4%	.0%
Softdesk	.1	.0	.1	0	.4%	.0%	1.1%	.0%
Georgia Tech Research Corp.	.1	.0	.1	0	.3%	.0%	.9%	.0%
CADMATIC	.0	.0	.0	0	.2%	.0%	.5%	.1%
Macao Systems	.0	.0	.0	0	.1%	.1%	.0%	.0%

(Continued)

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Table 26 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: Technical Workstation
Region: Rest of World
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Other Companies	1.1	.0	.9	0	.0%	.0%	.0%	.0%
All Companies	19.7	7.9	6.4	368	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	17.6	7.8	4.7	368	89.1%	99.4%	74.1%	99.9%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	2.1	.1	1.7	0	10.9%	.6%	25.9%	.1%
All Hardware Companies	1.7	1.4	.0	117	8.8%	17.6%	.0%	31.6%
All Turnkey & SW Companies	18.0	6.5	6.4	252	91.2%	82.4%	100.0%	68.4%

Source: Dataquest (March 1993)

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Table 27
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: Host-Dependent
Region: Rest of World
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Digital	1.1	.7	.0	0	24.9%	36.8%	.0%	.0%
IBM	.8	.4	.2	15	19.2%	21.9%	13.0%	32.4%
EA Systems	.8	.0	.8	0	18.7%	.0%	47.9%	.0%
Intergraph	.4	.0	.4	0	10.2%	.0%	23.7%	.0%
Georgia Tech Research Corp.	.2	.0	.2	0	4.4%	.0%	11.2%	.0%
Computervision	.0	.0	.0	1	.9%	.5%	.6%	1.8%
Engineering Systems Corp.	.0	.0	.0	0	.2%	.0%	.6%	.0%
Macao Systems	.0	.0	.0	0	.2%	.0%	.0%	.1%
Hochtief	.0	.0	.0	0	.2%	.0%	.6%	.1%
Other Companies	1.0	.8	.0	29	19.9%	40.8%	.0%	65.6%
All Companies	4.3	2.0	1.7	45	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	4.3	2.0	1.7	45	99.5%	100.0%	99.4%	99.8%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	.0	.0	.0	0	.5%	.0%	.6%	.2%
All Hardware Companies	1.9	1.6	.0	29	44.8%	77.6%	.0%	65.6%
All Turnkey & SW Companies	2.4	.5	1.7	15	55.2%	22.4%	100.0%	34.4%

Source: Dataquest (March 1993)

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Table 28
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: Server
Region: Rest of World
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
Intergraph	2.2	1.1	.5	29	67.1%	62.8%	78.5%	55.5%
Digital	.6	.4	.0	5	17.5%	23.3%	.0%	9.4%
IBM	.3	.2	.1	13	7.6%	8.7%	7.7%	24.8%
Computervision	.1	.0	.0	1	3.3%	1.7%	4.6%	1.8%
Sun Microsystems	.1	.0	.0	2	1.5%	2.3%	.0%	4.2%
Hewlett-Packard	.0	.0	.0	2	.6%	1.2%	.0%	4.2%
Other Companies	.1	.0	.1	0	.0%	.0%	.0%	.0%
All Companies	3.3	1.7	.7	51	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	3.3	1.7	.7	51	100.0%	100.0%	100.0%	100.0%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Hardware Companies	.7	.5	.0	21	21.1%	29.1%	.0%	40.9%
All Turnkey & SW Companies	2.6	1.2	.7	30	78.9%	70.9%	100.0%	59.1%

Source: Dataquest (March 1993)

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Table 29
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: Personal Computer
Region: Rest of World
Units: Millions of U.S. Dollars/Actual Units

					Market Share			
Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped
Compaq	4.8	4.8	.0	1,029	21.3%	31.9%	.0%	27.5%
International Software Systems	2.4	.0	2.4	0	10.5%	.0%	33.9%	.0%
IBM	2.3	2.1	.0	581	10.1%	14.2%	.0%	15.5%
Autodesk	1.8	.0	1.8	0	7.8%	.0%	25.3%	.0%
Apple Computer	1.0	.9	.0	230	4.3%	5.8%	.0%	6.1%
Claris	1.0	.0	1.0	0	4.3%	.0%	14.0%	.0%
Intergraph	.4	.0	.4	0	2.0%	.0%	6.1%	.0%
Hewlett-Packard	.4	.3	.0	107	1.7%	2.0%	.0%	2.9%
Hochtief	.3	.0	.2	2	1.3%	.3%	2.9%	.1%
Softdesk	.3	.0	.3	0	1.1%	.0%	3.6%	.0%
Graphisoft Software Dev	.2	.0	.2	0	.7%	.0%	2.3%	.0%
CADWorks	.1	.0	.1	0	.5%	.0%	1.4%	.0%
Sigma Design	.1	.0	.1	0	.4%	.0%	1.3%	.0%
Innovative Data Design	.1	.0	.1	0	.4%	.0%	1.3%	.0%
ISICAD	.1	.0	.1	0	.4%	.0%	1.3%	.0%
CADMATIC	.1	.0	.0	1	.4%	.0%	.6%	.0%
Mc2 Engineering Software	.1	.0	.1	0	.3%	.0%	.9%	.0%
ASG	.1	.0	.1	0	.3%	.0%	.9%	.0%
Computervision	.1	.0	.0	0	.2%	.0%	.6%	.0%
Aura CAD/CAM Systems	.1	.0	.0	0	.2%	.0%	.6%	.0%
CAE-link	.1	.0	.1	0	.2%	.0%	.7%	.0%

(Continued)

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Table 29 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: AEC
Platform: Personal Computer
Region: Rest of World
Units: Millions of U.S. Dollars/Actual Units

Company	Total Factory Revenue	Hardware Revenue	Software Revenue	Hardware Units Shipped	Market Share: Total Factory Revenue	Market Share: Hardware Revenue	Market Share: Software Revenue	Market Share: Hardware Units Shipped
American Small Business Comp.	.0	.0	.0	0	.2%	.0%	.6%	.0%
Accugraph	.0	.0	.0	0	.2%	.0%	.4%	.0%
Engineering Systems Corp.	.0	.0	.0	0	.1%	.0%	.3%	.0%
Engineered Software	.0	.0	.0	0	.1%	.0%	.4%	.0%
Moda CAD	.0	.0	.0	0	.1%	.0%	.1%	.0%
Simulation Science	.0	.0	.0	0	.1%	.0%	.3%	.0%
Ziegler Informatics	.0	.0	.0	0	.0%	.0%	.1%	.0%
Foresight Resources	.0	.0	.0	0	.0%	.0%	.1%	.0%
Other Companies	6.8	6.8	.0	1,797	30.6%	45.8%	.0%	47.9%
All Companies	22.3	14.9	6.9	3,748	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	21.8	14.8	6.5	3,745	97.6%	99.7%	94.1%	99.9%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	.5	.0	.4	3	2.4%	.3%	5.9%	.1%
All Hardware Companies	15.2	14.8	.0	3,745	68.0%	99.7%	.0%	99.9%
All Turnkey & SW Companies	7.2	.0	6.9	3	32.0%	.3%	100.0%	.1%

Source: Dataquest (March 1993)

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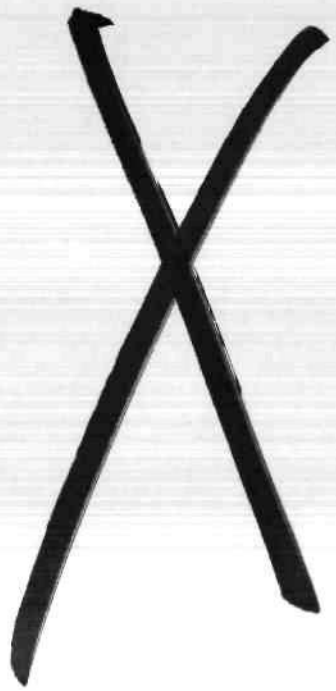
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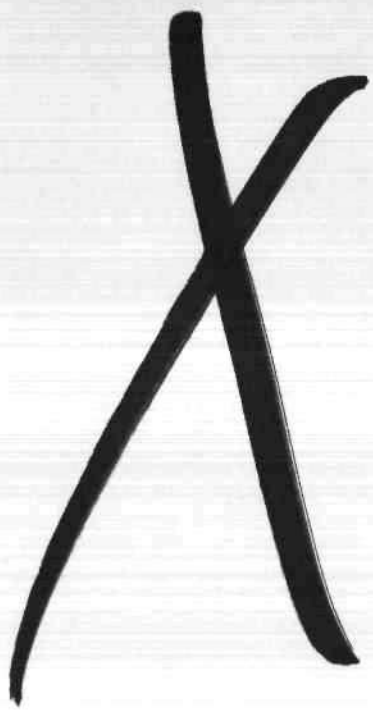
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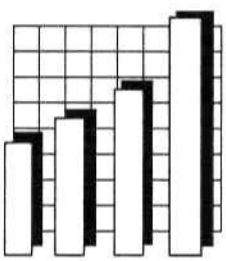
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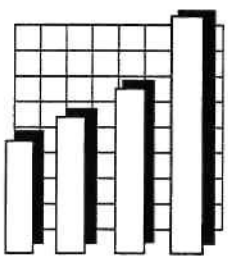
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Chapter 1
Executive Summary

Industry Performance

The worldwide geographic information systems (GIS) market, one of the fastest-growing technical applications, increased 17.9 percent in software revenue in 1992 to $614.6 million. The entire GIS market—software, hardware, and service revenue combined—reached $1.9 billion in 1992, up 9 percent from 1991. GIS applications represent approximately 1.5 percent of all commercial software. Intergraph and ESRI heavily dominate the market worldwide followed by Siemens Nixdorf, which is by far the strongest GIS vendor in Germany.

Report Organization

This "1993 Geographic Information Systems" *MarketTrends* book presents the results of Dataquest's research and analysis of the state of and outlook for the GIS market. This report provides a comprehensive analysis of the existing GIS market, as follows:

- The State of the Industry—An analysis of the evolving GIS market structure. A quantitative analysis of the GIS market is developed with an investigation of leading vendors. Major trends driving the market are defined and analyzed.
- GIS Market Forecast—Opportunities in key market segments are quantified and analyzed. Assumptions underlying the market forecast are presented with an analysis of key factors that affect market success and optimal strategy.
- Appendixes A and B—Market definitions, research methodology, and key market share tables in major market sectors used in reference in the book's text.

Key findings are as follows:

- Business marketing and sales is the fastest-growing sector of the GIS market, anticipated to grow from a mere $10 million in 1990 to $174 million in 1997.
- Profitability has emerged as a key issue among smaller vendors; several companies have been forced to retrench or change ownership.
- The solo vendor is an increasingly rare entity; vendors are pursuing alliances and investments to extend market influence.
- Vanilla GIS systems are increasingly unacceptable to users; vendors are increasingly being forced to choose which applications to develop for best future growth.
- GPS technology and improved aerial photography is dramatically increasing mapping accuracy, creating new market opportunities.

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- The number of available data sources that can be used in a GIS is growing rapidly, although actually integrating this data into a GIS remains a challenge.
- No technology has yet been identified that can dramatically reduce the high cost of data conversion.
- GIS vendors and users are destined to contend with a particularly wide variety of challenging issues in information management, computer technologies, and politics.

Project Manager: Kathryn Hale

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Chapter 2
The State of the Industry

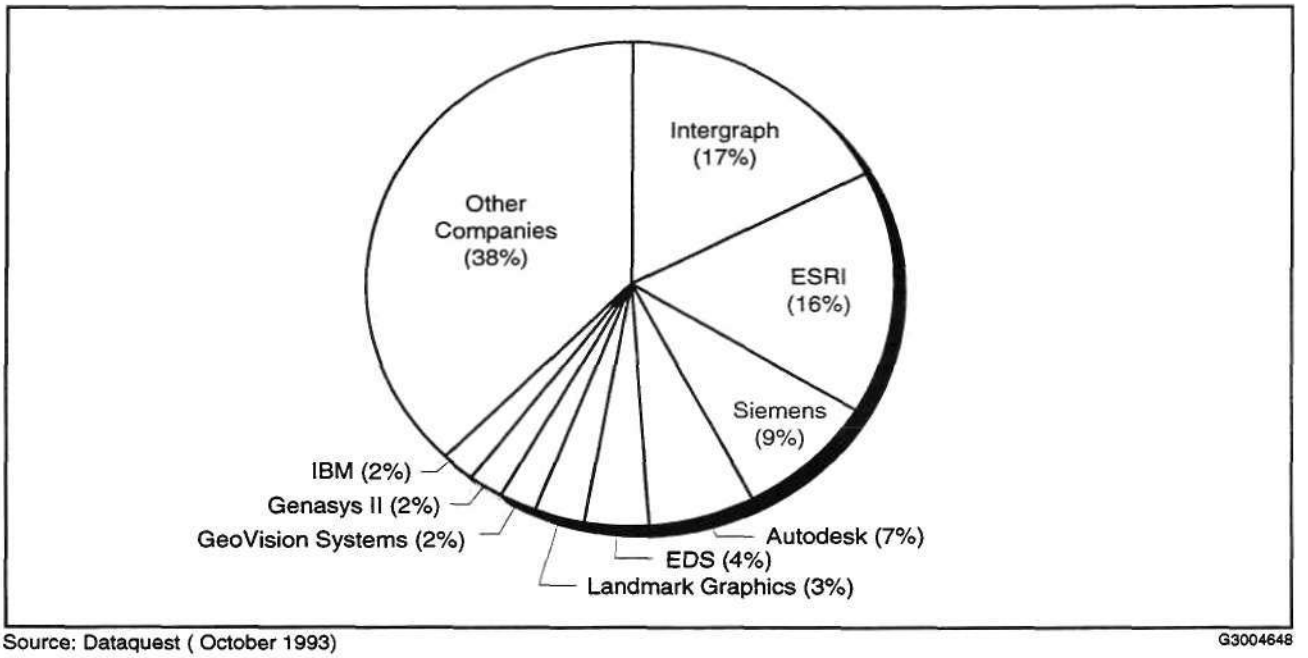
The worldwide geographic information systems (GIS) market, one of the fastest-growing technical applications, increased 17.9 percent in software revenue in 1992 to reach $614.6 million, slightly higher than the 13.3 percent growth rate of 1991. Our final GIS figures show that the entire market—software, hardware, and service revenue combined—reached $1.9 billion in 1992, up 9 percent from 1991. Despite this strong performance, growth in software has slowed considerably from the approximately 30 percent rates of 1989 and 1990. While many second-tier players struggle, shuffle, and lose ground, a few newer companies have carved out high-growth niche spots.

Competition for the No. 1 Spot: Intergraph and ESRI

Intergraph and ESRI heavily dominate the market worldwide, and each leads the market. ESRI's ARC/INFO is the world's leading GIS product, while Intergraph is the world's leading GIS software vendor. How can this be?

Intergraph's leading market share in GIS software revenue (see Figure 2-1 and Table A-1) is the sum of several product lines: Mapping Sciences Division sells the MGE line, the product that directly competes with ESRI. This division also sells systems to defense agencies, most notably the Tigris product. In addition, the division has a relatively new emergency dispatch GIS product line and also an image processing product suite.

Figure 2-1
GIS Revenue Market Leaders (1992 Market—$614.6 Million)



Source: Dataquest (October 1993)

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A separate group, representing approximately 30 percent of Intergraph's GIS software revenue, sells the company's turnkey FRAMME AM/FM product line to utility companies. Finally, a significant percentage of Intergraph's PC CAD software, MicroStation, is ultimately used in mapping applications. It is the sum of these product lines that gives Intergraph its leadership in GIS software revenue.

However, ESRI's ARC/INFO is clearly the leading product on the market in terms of software revenue and user awareness. Although the company continues to evolve its product suite, ARC/INFO dominates ESRI's sales and the GIS market. Thus, both companies can claim a No. 1 position in the GIS market.

The last chapter on this story is not yet written. Intergraph states its 1992 GIS software and software services revenue was $129.0 million; ESRI states that its software and services revenue was $116.9. Because these figures are fairly close, leadership in software revenue depends very much on the amount of revenue allocated to service. Both companies are known to have extensive services organizations, and in the absence of complete information from both companies, we have allocated equivalent percentages of revenue to software for each company, resulting in 1992 software revenue of $107.0 million for Intergraph and $99.9 for ESRI. As better information becomes available, we will adjust our historical market figures whenever necessary.

Several people have asked why Dataquest reports ESRI revenue higher than that of ESRI. Our ESRI figures include revenue from independent international ARC/INFO resellers proportional to Jack Dangermond's equity position in those resellers. Because of the way ARC/INFO is marketed internationally, this method is the only way to correctly report the reality of the product's strong international presence.

Chaos Caused by Lack of Profits

While the top two vendors fight for dominance, chaos has broken out among the second-tier vendors. Beginning perhaps with Synercom's fall into unprofitability in the 1980s and subsequent near demise as a GIS software vendor, company after company has been dragged downward or thrust into unwanted change.

IBM, once a marginal player in the GIS market, has nearly abandoned its position, after selling its interest in Geographic Systems Corp. to GeoVision Systems and greatly reducing its GIS staffing. GeoVision Systems, of course, moved from rebirth two years ago to near collapse today (GeoVision's growth in our market data is based on the acquisition). During the last year, Intera Tydac and Ultimap also were forced to retrench significantly.

At the same time, two significant products changed hands. In 1991, McDonnell Douglas sold the GDS product line last year to EDS, a sale which merely accompanied the primary purchase of a mechanical

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CAD product line. Finding a role for GDS within EDS was a challenge, several members of GDS' management soon left the company. This year, EDS sold the product to a newly formed company controlled by a venture capitalist. Almost simultaneously, Computervision sold its System 9 product to Unisys, which had long sought a GIS products of its own.

Taken together, these events suggest that investors and owners are increasingly unwilling to tolerate lacking or lackluster profits in their software ventures, no matter how intriguing the market is. At the same time that investors' standards are rising, potential users' expectations about software investments are rising as well.

Unfortunately, the GIS market still lacks a widespread base of compelling user stories of product indispensability, which can be used to justify new purchases. Every user struggling to prove a pilot project is a visible reminder to his or her peers that there may be a safer way to spend the computer budget. The real competition is other applications that win the computer budget dollar, not other GIS vendors. No vendor is large enough to compete effectively with other applications for users' capital equipment dollars, and that collaboration among GIS vendors to prove the technology better is the best way to drive market growth.

The Smaller Bright Spots: Smallworld, Autodesk, MapInfo, and Strategic Mapping

With the highest growth rate of any vendor at 220 percent, the United Kingdom's Smallworld gained worldwide attention despite its small size of $5.8 million in 1992 software revenue—mostly in AM/FM applications. The next two years will be key for the company, as the product's conceptual strengths must overcome the typical AM/FM user's conservative insistence on using established products supported by significant investment in development.

Autodesk is getting more serious about GIS, having discovered that a large number of people use the AutoCAD drafting product for GIS/mapping applications. The recently announced AutoCAD Data Extension, which allows users to query and extract data from graphic and extended entity data across multiple files, and external databases, will allow users to manage data from within a CAD environment. The result will provide competition for vendors that sell data management either from the MIS environment (DBMS and operating system vendors) and from the GIS environment (dedicated GIS vendors).

Autodesk continues to be well positioned as a GIS partner, having recently won, with partner ESRI, hunting rights to sell against Intergraph within the navy under the finally resolved NAVFAC contract, which awarded both companies an equal opportunity to sell their products. In many ways, Autodesk and ESRI are natural market allies; together they can much more effectively compete with archrival Intergraph. Both companies' products are strong brand names and can be sold as "standards."

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Autodesk's strong civil engineering installed base, especially among local governments, gives the company a natural entree into the GIS market; users regularly leverage existing AutoCAD files to contribute to building a land database. Thus, ESRI and Autodesk currently position themselves as having complementary, rather than competing, products.

Strategic Mapping and MapInfo continue their robust growth path, each growing more than 50 percent in 1992. Both companies target nontraditional environments with low-cost, easy-to-assemble systems. The existence of low-cost data sets makes it possible to offer an easy-to-learn, easy-to-create GIS environment for users who before would not otherwise have tried the technology, which has in turn built high growth in the business sector of the GIS market. The companies need each other; the successful presence of two vendors helps users feel that they have a choice from two legitimate vendors. This is an ideal time for both vendors to build market share; stiffer competition is almost assuredly on its way from slightly behind vendors (such as Tactics International), new market entrants, and GIS products essentially embedded in other software.

GIS Market by Application

Growth in the GIS market varies considerably by application (itemized in detail in Appendix A, all tables, and defined in Appendix B). Figure 2-2 illustrates this growth, ordering from higher growth segments, such as business marketing and infrastructure management to the relatively flat geoscience market. Figure 2-3 compares the applications on workstations versus PCs, illustrating the concentration of workstations in AM/FM applications and the dominance of PCs in business marketing and sales applications. The figures present our final actual results for 1992 and corrections for earlier years. The market share tables show that No. 1 vendors generally increased their lead in 1992 (see Appendix A). The only notable exception is in transportation (see Table A-9), in which ESRI pulled ahead from third to first place.

GIS Market by Platform

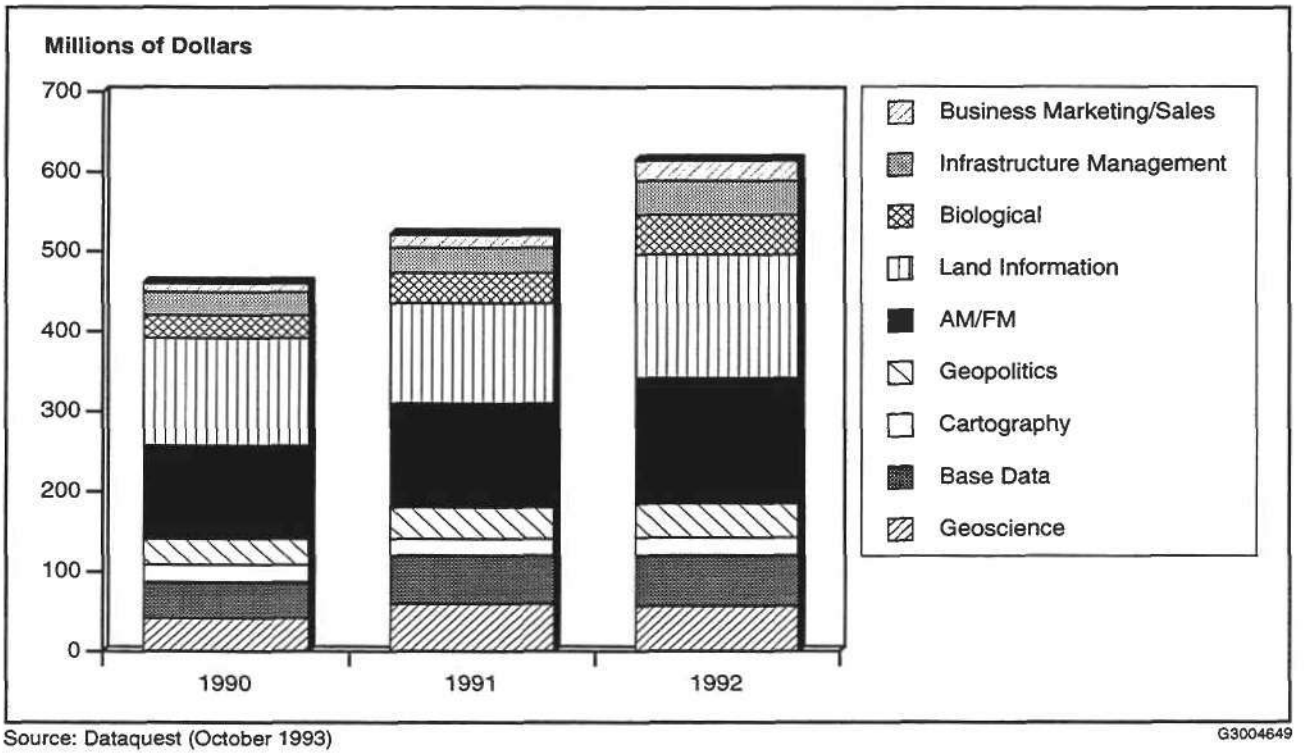
GIS is clearly dominated by technical workstations. Figure 2-4 illustrates sales by platform in 1992 and includes computer systems and services to install those systems, but not the revenue generated by independent consultants who implement GIS systems. More than 70 percent of total market revenue is derived from workstation and server platforms. Despite widespread interest in PC-based systems, workstation-based software grew at about the same rate in 1992, with growth rates of 28.6 percent for PCs and 26.2 percent for workstations (see Tables A-23 and A-24).

GIS Market by Region

GIS revenue is derived primarily from North America and Europe (see Figure 2-5), despite rapid growth in Asia (at 55 percent). Much of the growth in Asia was in Japan because of changes in the exchange rate rather than actual market growth. Japan dominates all Asian markets, and

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Figure 2-2
GIS Software Revenue by Application, Worldwide



Source: Dataquest (October 1993) G3004649

the small amount of revenue in Asia does not indicate an equal lack of activity. Rather, many users in Japan rely on internally written software or on semicustom software written by an affiliate company.

The 1992 GIS software market grew a bit faster in Europe than in North America (13 and 16 percent, respectively), but U.S.-based vendors grew at the expense of European companies, with Siemens Nixdorf being an example. Germany and the United Kingdom, the largest markets, suffered the largest declines relative to other European countries (see Figure 2-6). Eastern Europe (contained in Rest of Europe) advanced briskly in GIS, representing a relative gain in GIS sales.

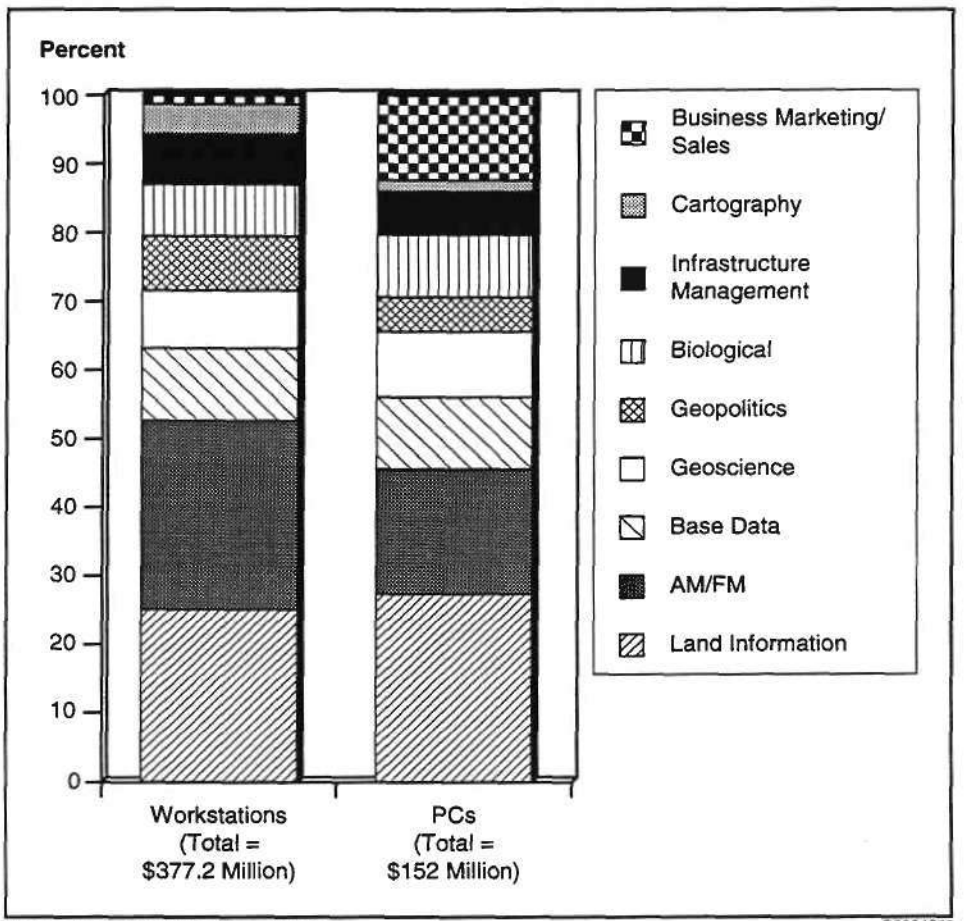
GIS Market Structure

Competition

All broad software markets support a large number of vendors, and GIS is no exception. Market leaders such as Intergraph, ESRI, and Siemens compete on the basis of full-product offerings and market strength, whereas the remaining vendors typically work to exploit a niche—which may be in a specific application, a technology, or a region. As with many other software applications, North American software vendors dominate the market, earning three-fourths of worldwide software revenue. Competition for the very high volume purchases in the GIS industry is between ESRI

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Figure 2-3
Platform Comparison of GIS Software Applications in 1992, Worldwide



Source: Dataquest (October 1993)

and Intergraph; no other vendors meet enough customer expectations to realistically expect to land the largest contracts (with the exception of Siemens in its native Germany).

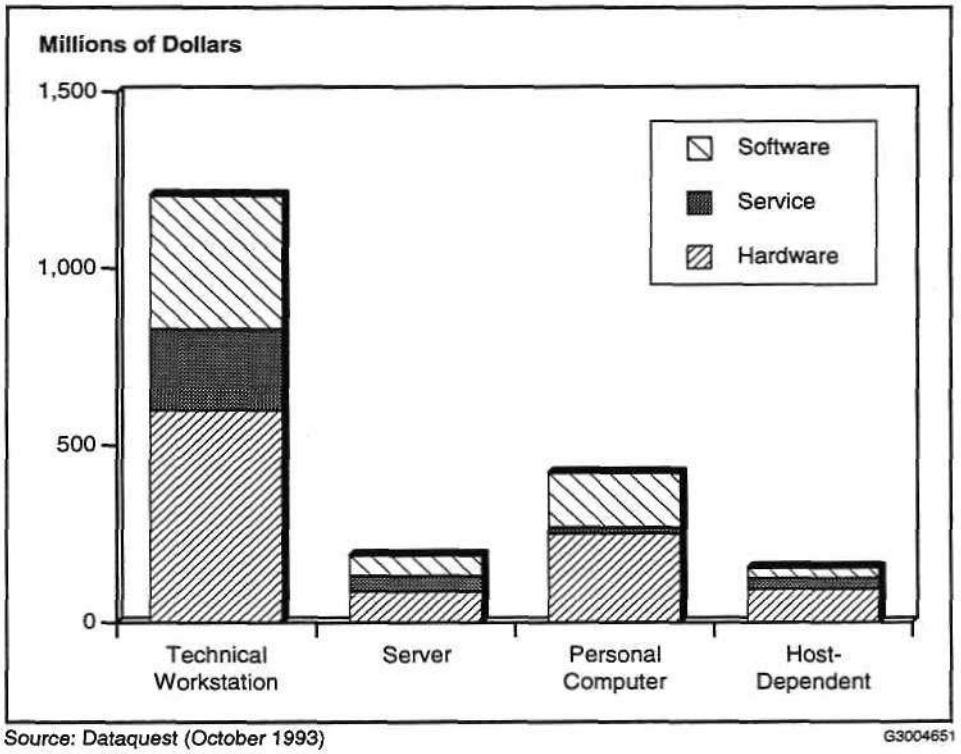
Tough economic times increased the competition for each sale during the last two years, putting increased pressure on smaller vendors of traditional GIS products. A number of second-tier players have produced poor financial results or have been sold to new owners. Considerable opportunity still exists for a new or existing vendor that can produce software with clear and compelling benefits to users.

Barriers to Entry

The GIS market is currently in its infancy relative to the opportunity; however, barriers to entry are rising. GISs are becoming an increasingly sophisticated product, with no end to complexity in sight. At this point, the R&D investment required to enter as a full-line supplier makes it unlikely that any company would make the investment. Despite vendors' obligatory claims of "open systems," switching GIS software vendors is a

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Figure 2-4
1992 GIS Revenue by Platform



Source: Dataquest (October 1993) G3004651

costly prospect. Each vendor's growing installed base will continue to raise barriers to entry in this market during the next five years.

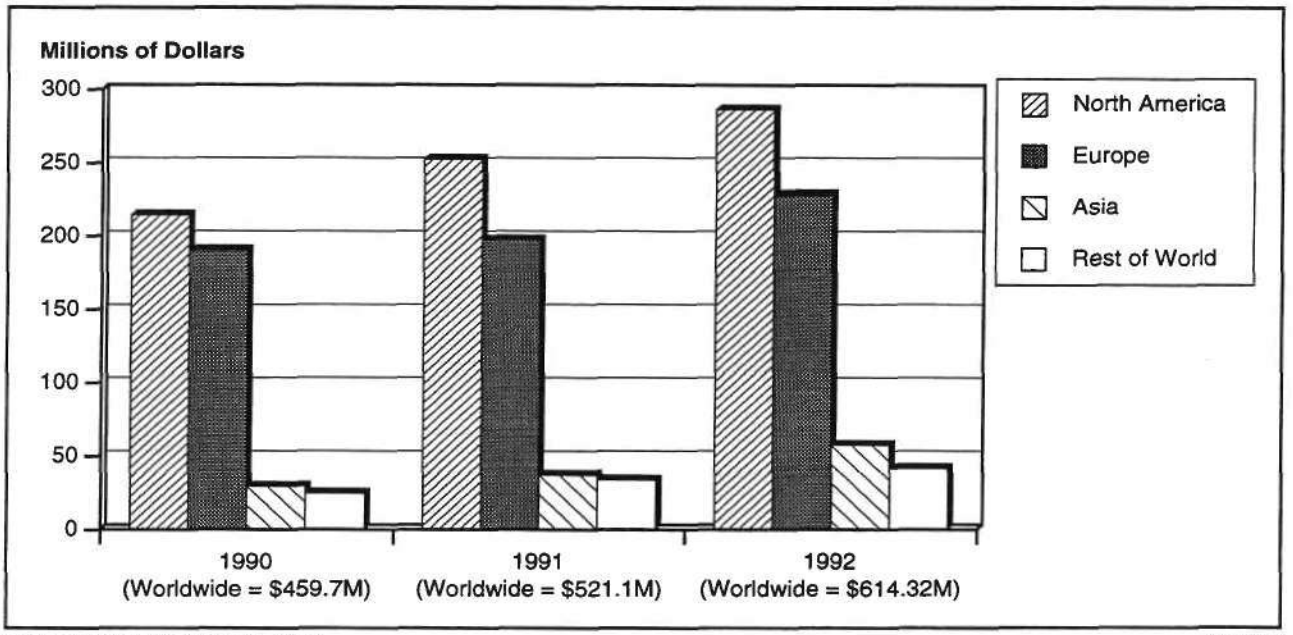
However, there is significant need for applications that augment existing products. The market opportunity and the investment required is typically relatively low, assuming one is leveraging knowledge of a specific industry (such as environmental engineering). Low-entry barriers remain for small or unique orders, and competition increases steadily with size of order. Cost of entry into the low-price market is also still relatively low.

Industry profitability is quite variable. At the top, ESRI is quite profitable, and Intergraph might well be profitable were it not laden with the cost of producing lower-priced computer hardware. Below the top vendors, the occasional visible financial quandary or change of ownership indicates that second-tier players often struggle to stay in the black. Although barriers to market entry remain low, reaching profitability requires some combination of the following:

- Mapping industry experience (often at least 10 years implementing another company's software)
- New technology or product concepts (such as Smallworld in the United Kingdom)

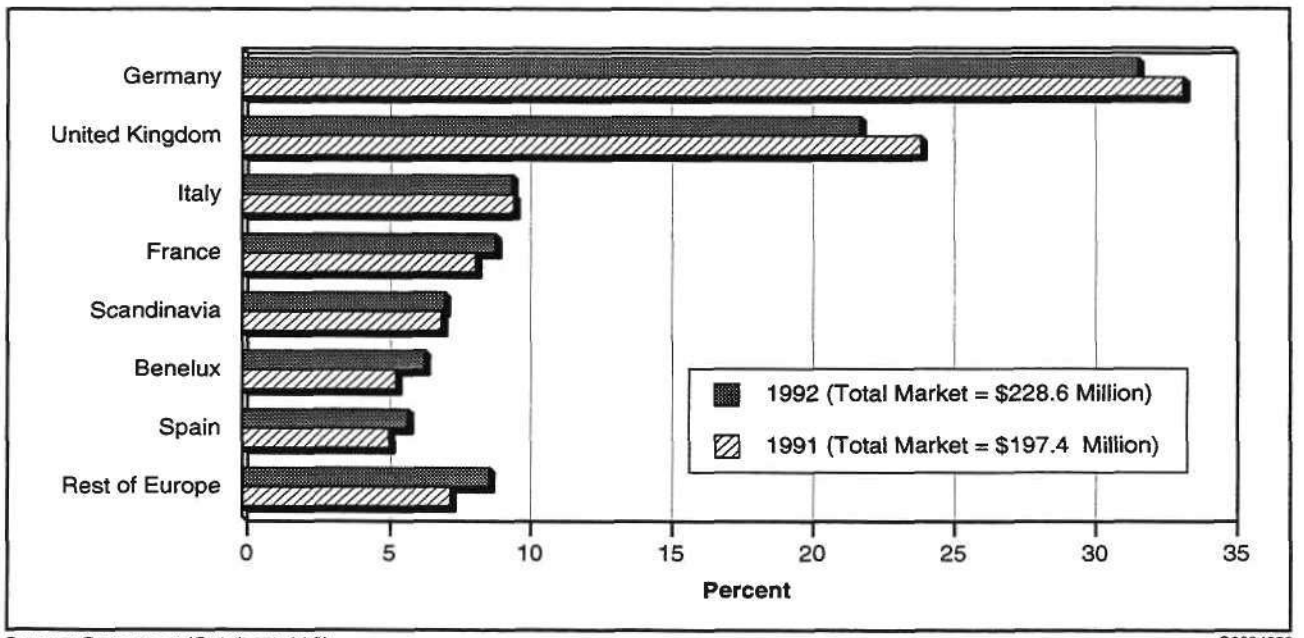
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Figure 2-5
GIS Software Revenue by Region



Source: Dataquest (October 1993) G3004652

Figure 2-6
GIS Software Revenue, European Countries



Source: Dataquest (October 1993) G3004653

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- A well-chosen niche offering (Strategic Mapping)
- Perceived vendor viability (usually translated as market share)

Substitutes for GIS

GIS is a partially unproved but very promising set of technologies. Many potential users are choosing to sit out the experimentation process, waiting for more proof of value. In the core business of GIS—governments and utilities managing geographically dispersed assets—prospective users recognize a certain inevitability in moving the world's remaining mountain of paper maps into electronic form. Paper maps simply scanned into a computer system (known as technical document image management systems, or TDIMS), offer potentially viable substitutes for expensive full GIS implementation. On the other hand, this substitute—a scanned set of maps—can eventually be converted to the intelligent data required by a GIS.

Because GISs are not indispensable in many applications, the technology also competes for capital equipment budgets with a variety of other applications, which are also positioned as improving worker performance and productivity. Typically, GIS does not emerge at the top of the list of critical applications.

Buyers

The typical GIS customer works for a government or a regulated utility. In addition, a substantial number of buyers come from service industries—people who help build GIS systems for others. Government and public utility bureaucracies have a conservative approach to procurement and agonizingly extended sales cycles. Typically, GIS "champions" in the buying organizations face uphill struggles to sell internal management on the benefits of the technology. GIS often occupies a separate entity in an organization, but projects are fundamentally linked to the IS department by the need to leverage the site's existing computer data.

Building a GIS creates a long-term relationship with a vendor; switching vendors is time-consuming and expensive. Users' understandable concerns about long-term vendor viability are putting pressure on smaller vendors. While users are not highly organized, they have shown considerable willingness to share information about projects, but somewhat less ability to drive development of useful data standards.

As with other computer technologies, success with a new GIS system requires that users change their organization; more comfortable implementations that challenge no one's position are unlikely to produce effective results. Targeting established bureaucracies with a technology that requires organizational change is an inherently challenging aspect of this market.

Market Suppliers

The computer industry has delivered faster, cheaper hardware to the compute-intensive GIS market for years and shows no signs of letting up. This

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reliable source of improved price performance for GIS systems is a core market driver, giving every GIS vendor a basis for something new to sell each year.

R&D personnel working for GIS vendors are paid somewhat less than other software engineers. In addition, many third-party consultants/ implementers in the United States operate at low margins, often in near-sweatshop mode. Thus, the costs of computers and workers in GIS is low to moderate. Supply of personnel is somewhat stretched by strong market growth.

Market Trends

GIS applications, which represent approximately 1.5 percent of all commercial software sold, are part of a larger world of technical applications, which includes CAD/CAM/CAE, software engineering, and scientific applications. Several trends are widespread in all of these technical applications, as follows:

- Computer price/performance improvements are regularly being leveraged to support more complex problems. Users are focusing on modeling and analyzing increasingly complex problems and complete realities.
- Users are not focusing just on jobs, tasks, and structures, but on the processes that make their enterprises work. This information integration effort typically includes an effort to make computer-based data pay off more than once throughout the organization, and to create links between multiple data types, such as spreadsheets, relational databases, and graphic data. Much of the focus on processes is built on what is now broad experience with computers at the task level and on the recognition that work must be restructured to leverage what information technology can provide. Business process reengineering is causing the territories of "business" and "technical" software to overlap.
- Software markets are maturing. Early adopters accepted high prices, unpredictable software, obscure user interfaces, and significant training requirements—an acceptance that allowed sophisticated applications to be brought to market and sold profitably. The next wave of casual users (that is, users who do not want to spend their day using a computer) expects the opposite: cheap, easy-to-learn, bulletproof software.

Trends specific to the GIS market include the following:

- Core users in government are under siege. As markets and industries have become globally competitive, the collective influence of multinational corporations is growing at the expense of government; the goals, funding, and even utility of governments are under strong scrutiny by taxpayers. Overall, this trend could either increase or decrease use of GISs, it assuredly makes government procurements less predictable.

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- GIS vendors are being forced to choose applications to develop. As government markets have slowed, faster-growing applications with better funded users have caught vendors' attention—creating a challenge. These buyers often require vendors to provide fully developed systems—each one being a bit different. It is not possible for a vendor to write all the applications software needed to sell new types of users and to support the increasingly sophisticated traditional users. Choosing which applications to develop and which to outsource is a continuing challenge for vendors. Some of these new applications hold a clear potential to develop into new industries, such as the various government and industry joint ventures to develop intelligent highways and vehicle-to-vehicle communication.
- New technologies that improve data accuracy are creating new markets in GIS and new sales opportunities in the installed base. Global positioning system (GPS) receivers are increasingly being used with improved aerial photography to improve photogrammetric mapping, and GPS receivers capable of feeding data into GISs are now widely available. GPS technology has transformed surveying and has already begun a second generation of GIS development driven by higher-accuracy expectations among existing GIS users. GIS installations can also make use of several new technologies, such as pen-based computing, voice input, and video.
- New data sources are beginning to create market opportunities. Providers range from traditional information and publishing industry suppliers to the U.S. Defense Mapping Agency. The number of available data sets for sale is increasing rapidly, although difficulty in integrating separately purchased data with an existing GIS system is holding back potential market growth.
- The silver bullet that solves the high costs of map data conversion is still missing. Improvements in data conversion can be anticipated, but no technological leapfrog is on the horizon that will make GISs based on paper map conversion dramatically easier and cheaper to build.

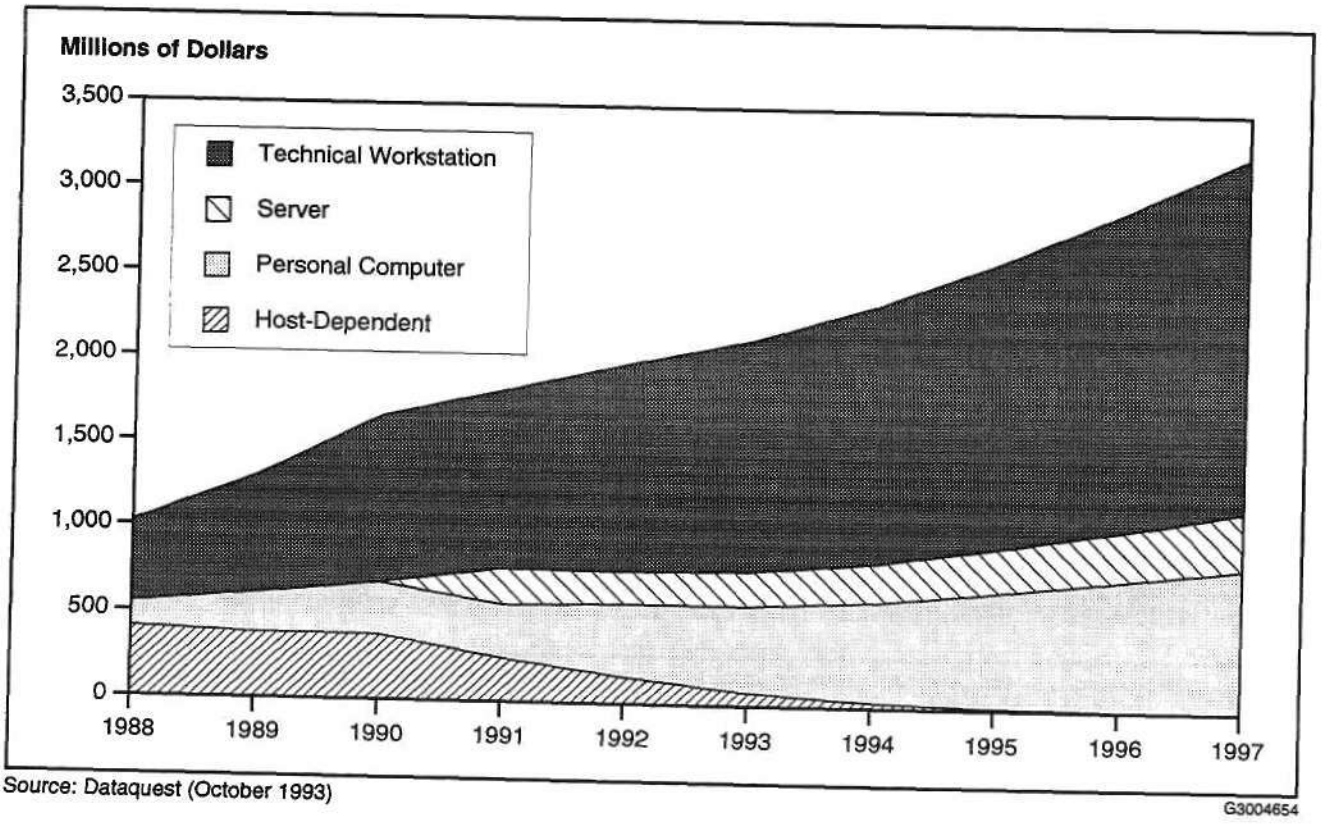
Users and vendors are confronting increasingly complex issues, beyond simply exploiting bigger, faster computers, or surviving the accelerating arrival of information. But the GIS industry's growth also depends on successfully persuading local and sovereign governments around the world to improve access to data and imagery. Added to that, users must solve problems that are among the most complex in information systems—overcoming software development bottlenecks, systems integration stalemates, and data standards wars. The GIS industry faces sophisticated data integration challenges, new technology opportunities, and political intrigue—a difficult environment to control, but an exciting place to be.

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Chapter 3
GIS Market Forecast, 1988-1997

The GIS computer systems market is forecast to grow to $3.25 billion in 1997, running at an 11.1 percent compound annual growth rate (CAGR) since 1992. The software component is forecast to grow to $1.3 billion in 1997 at a 16.1 percent CAGR. Top-level history and forecast data is presented in Figures 3-1 and 3-2 and in detail in the recently released *Market Statistics* book entitled, "GIS Applications Worldwide Forecast Update." Comparing Figure 3-1 with Figure 3-2 clearly illustrates a core reality: while a high and growing number of computer systems shipped are PC-based, the higher-priced workstation-based systems clearly present the superior revenue opportunity. It is important to note that our definition of workstations (see the Definitions section in Appendix B) means that a considerable number of Intel-based computers will be classified as workstations by 1997. Host-dependent revenue is forecast to continue its decline, taken up primarily by the emergence of servers, which are primarily based on products sold by workstation manufacturers.

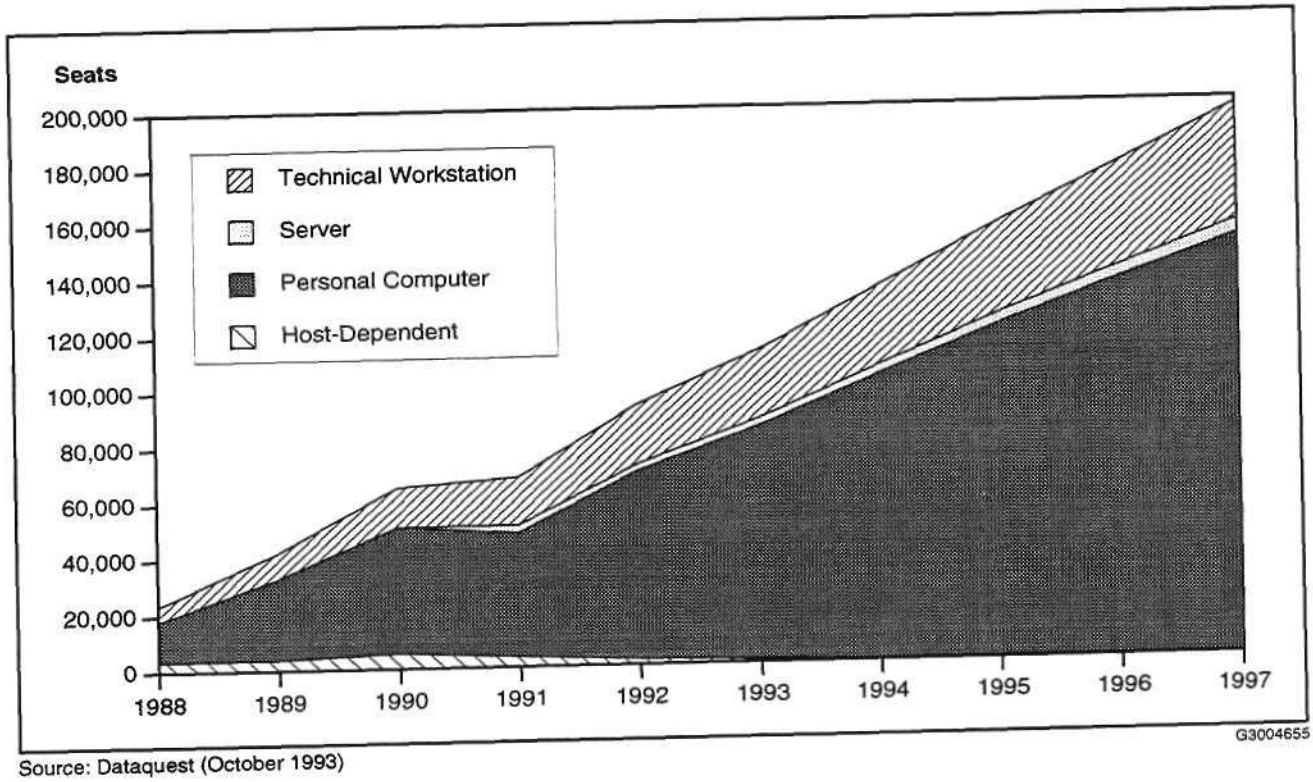
Figure 3-1
GIS Market History and Forecast, Total Revenue Worldwide



Source: Dataquest (October 1993)

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Figure 3-2
GIS Market History and Forecast, Computer Seats Shipped Worldwide



Source: Dataquest (October 1993)

GIS Market Forecast Assumptions

The assumptions behind this forecast are built on an optimism that during the forecast period the world economy will improve slightly and on an expectation that global competition will increase. Assumptions used to build Dataquest's GIS market forecast will be subsequently outlined.

Factors that should contribute to the long-term expansion of the GIS market are as follows, in decreasing order of importance:

- **Penetration is still low among core users.** Bread-and-butter prospects in government and utilities are charged with maintaining information on land and assets in perpetuity. Many of these prospective buyers are still using paper maps, which will degrade over time. This creates a certain inevitability to moving from paper maps to the more readily changed and renewed computer maps, which is a first step to building a GIS system. There are a large number of utilities and sovereign and local governments around the world still stuck with tabular data and paper maps; therefore, the supply of prospective buyers remains plentiful.

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- **Several new technologies will drive growth in the GIS market.** Faster and cheaper computers will be continually leveraged to support new software products. Widespread computer industry developments in open, distributed systems supporting high-speed networking will make it possible for GIS technology to expand its user base broadly. Advances in GPSs and aerial photography are making it possible to create GISs more complete and accurate than existing paper maps, giving experienced users some compelling reasons to reinvest. There is a real likelihood that the future will bring lower-cost, higher-resolution satellite imagery, which, in combination with the GPS network, holds the potential to drive another explosion in GIS market growth. Multimedia and portable and pen-based computers offer opportunities to develop richer and more useful GIS systems. Although many markets will take advantage of the above technologies, few other markets are as ready, willing, and able to put to work such a wide range of technology enhancements.
- **New applications in industries like retail and insurance will drive growth.** Wherever there is competition for a limited prize—whether the prize is political or economic—GIS can create a competitive edge. Wherever assets or investments are geographically dispersed, GIS offers significant management capabilities. However, we see a wide band of uncertainty surrounding the clearly growing revenue opportunity from new applications. Several new applications in GIS are destined to become a relatively low-revenue-producing feature in another software program (and market), rather than a standalone product in the GIS market.
- **Building a GIS will get somewhat easier and cheaper.** Inexpensive spatial data, public and private, is accumulating and its reuse will help dissolve a traditional obstacle to growth in GIS. This increasingly accurate knowledge base can be passed on to new users. Successful multiparticipant projects are growing, creating larger data sets that can be profitably resold by government and industry consortia. Also, although we do not envision the technology miracle that will eliminate development costs, implementation of GIS in new sites will become easier and cheaper than it has been.
- **GIS addresses the information age's growing problem of information overload.** Any product that addresses a visible problem is more certain to grow than solutions that are still looking for the problem.
- **The U.S. government has been and will continue to help the GIS market grow directly.** GIS is one of the rare markets in which relatively simple government actions can directly fuel industry growth. In fact, the GIS industry depends on government cooperation for base data development. Governments around the world are cooperating by developing spatial data standards, more sophisticated mapping goals, and increased cooperation across federal and local governments. The U.S. federal government, however, is in a particularly influential position. GPS satellites have proved their value outside of defense applications. Freedom of information remains a viable concept in the

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United States, creating opportunities to exploit low-cost government generated spatial data. These policies have created economic growth among U.S. GIS vendors, which encourages other governments to follow the example.

Several factors seriously constrain the long-term expansion of the GIS market, including the following:

- **There will remain an uncertain, but certainly high, cost of creating a working a GIS system.** No magic will emerge to create a low-cost, meaningful data set for traditional customers in government and utilities. Data conversion will remain costly, despite substantially lower scanning costs and increasingly improved automated conversion products. The high cost will remain because as existing paper records head toward computerization, widespread minor inaccuracies begin to be examined, often for the first time. The significant cost of correcting prior errors and omissions is inevitably bundled into the cost of "conversion." At the same time, increasingly complex applications require increasingly accurate data, also raising conversion costs.
- **Stuck projects will reduce market growth.** The significant number of traditional GIS/mapping projects stuck in the pilot phase will reduce demand for new products, as users struggle to implement existing purchases. Even worse, the negative publicity created by these projects will chill the buying impulse among nonusers, reducing the ability of GIS projects to compete with other applications for capital equipment dollars.
- **Price pressure will hold down total revenue.** Computer prices will certainly drop, even in technical applications such as GIS where higher-performance hardware will command a premium price. Software prices are likely to come under increasing pressure, despite the industry's current ability to hold overall seat prices relatively even. Our current forecast is built on declining hardware and steady software prices primarily because of opportunities to add significant software data and functionality content to new sales among core, noncommodity buyers. Any significant deviation from this model would affect the forecast.

Key Success Factors

Key factors to success in the GIS market in the near-term include the following:

- **Missionary selling skills**—It is still somewhat of a pioneer market. Successful selling includes a full tool kit for helping prospects sell their projects internally.
- **Products that are easy to learn and use**—Any and all improvements will gain attention, from a common user interface across platforms to breakthroughs that allow a product to present and unfold itself more intuitively.

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- **Financial staying power**—This factor will be especially in applications that primarily sell to conservative utilities and governments, whose buyers anticipate career-long partnerships with suppliers.
- **Implementation expertise**—This factor will occur in either in-house or in alliance with third parties. Prospects have figured out that GIS projects can easily be botched. Market leaders have significant investments in people with 10 or more years as implementers.
- **A global sales force, direct or indirect**—Vendors with international sales capabilities will overcome slow sales in one region with higher sales in another. Opportunities are far-flung, and hot spots for selling come and go several times a year in almost any country. GIS may have the highest "cost of airfare per unit sold" of any industry (because one has to fly all over the world to sell it), but the investment is required.

By 1997, we believe that key factors to success in the GIS market will evolve to focus on the following:

- **Technological innovation.** The GIS market is ripe for assault by a significantly superior product, which, if software market history is any guide, is likely to be provided by a newcomer. We have also said that the GIS market sits at the center of a storm of activity in information technologies, from image processing to mobile computing to multimedia to client/server computing. Successful vendors in 1996 will have made significant progress toward harnessing the power of that storm.
- **Integration into corporate information systems environment.** GIS products need to be useful to more people to offer more compelling payback to the enterprise. This is unlikely to happen without significant coordination with corporate IS. GIS products will have to reach out to IS; the reverse is unlikely to happen.
- **Relationships with customers, suppliers, and partners.** Successful vendors will depend more on others to help sell their products and to round out product lines and service capabilities. Potential for new types of partnerships with the public sector exist, as governments increasingly look to produce a return on their investment in GIS by becoming data suppliers. By 1997, many long-term relationships will be cemented; vendors without allies will almost always be at a disadvantage.
- **Low-cost software.** Price pressures cannot forever remain confined to hardware. Traditional buyers are likely to be more price sensitive in the future. Additionally, more purchases will be made by casual users who expect low prices.
- **A substantial installed base.** Switching to a new GIS supplier is time-consuming and expensive for users in terms of financial investment and training. As market penetration increases, a large and somewhat captive installed base will be an increasingly valuable source of revenue from upgrades and system expansion.

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Key Questions That Affect Strategy

Several key market uncertainties exist, the outcome of which will affect all vendors' strategies. The critical questions to track follow.

1. Will the GIS industry consolidate?

The strong leads held by Intergraph and ESRI suggest that power is already consolidated between these top two companies, and there is little likelihood that any combination of smaller companies could create a significant challenge to either company. The question then is whether opportunity will continue for the remaining players, or will the leaders simply increase their market share?

Several failures in the AM/FM market have sent competitors scrambling to capture the installed base among customers of Synercom, IBM's GFIS, and GeoVision. The outcome is almost certain to increase the market presence of Intergraph and ESRI. At the same time, we have seen strong growth at Enghouse, a low-cost AM/FM provider, and Smallworld, which offers new technology to AM/FM users. Finally, there is obviously phenomenal growth among general-purpose desktop mapping suppliers such as Strategic Mapping and MapInfo. Thus, new or unique products are creating new opportunities; the losers will continue to be companies that cling to old products and old strategies.

2. What advances will be made in database management and software development?

Traditional database solutions are inadequate for spatial data, and commercial database developers only have a peripheral interest in developing data management systems that are optimized for the complex data models, multiple applications, and large volume of data found in a typical GIS. At the same time, GIS prospects are demanding solutions, and vendors are scrambling to produce applications software that will secure that business. The most likely solution to both problems lies on the horizon. Object-oriented languages, data models, and data management software holds out the promise of better integration of spatial, graphic, and tabular data—which would improve the very nature of GIS products. The object-oriented approach is also designed to simplify applications software development greatly, a goal aligned with the general trend of pushing some applications software development from specialists down to skilled end users. Any breakthroughs in data modeling and application development will create important market opportunities.

3. How much will data cost?

This question provokes a host of others because market growth will continue to be sensitive to the cost of data acquisition. Can the cost of data conversion be reduced as an impediment perhaps through the use of expert systems? Will governments move toward the British model of data cost recovery, or instead develop along the federal U.S. philosophy of "free" information. How will information be regulated around the world? Marketing strategies will depend upon availability and cost of data.

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Where Are the Best Opportunities?

GIS opportunities are diverse and proliferating, and no supplier can hope to address the needs of all potential customers. Choosing which applications to develop and which to outsource will be a challenge for vendors in the next few years. This section is intended to help suppliers identify and evaluate key targets within the overall GIS market based on users' applications, that is, what the user does with the GIS. Application is independent of the industry in which the user works (such as telecommunications or retail) and the focus of the GIS technology used (such as raster and/or vector).

Forecast Overview

Dataquest's forecast for each application, in terms of market opportunity for software revenue, is provided in Table 3-1. This data varies slightly from the "GIS Forecast Update" *Market Statistics* book (September 1993). Since that publication, we have slightly reduced software revenue in 1990 and 1991. Figure 3-3, which illustrates this forecast for each major market segment in terms of percentage of the market, clearly shows the anticipated growth of GIS used for business marketing and sales, and the relative reduction of land information as a source of market growth. Figure 3-4 captures the thrust of overall market trends: while the 1990 GIS market was dominated by applications focusing on land data and AM/FM, the 1997 market will be significantly more diverse as a result of the expansion of previously less important market segments. Selling to this greater diversity will require focused efforts for smaller suppliers and a carefully balanced marketing effort for full-service suppliers. Following is our analysis of and expectations for each major market segment.

The Thriving Business Marketing and Sales Segment

Incorporating demographic/location analysis and sales and directional support, business marketing and sales is the fastest-growing sector of the GIS market, anticipated to grow from a mere $10 million in 1990 to $174 million in 1997. The principal use of a GIS system in this market is to compete, as opposed to the more typical asset management functions of other applications. Customers typically use a relatively low-cost, PC-based GIS system that was created for the purpose of helping an enterprise profitably compete for resources or customers. These adventurous users tackle a variety of problems: locating new sites, territory analysis, demographics, competitor analysis, customer analysis, pricing/cost analysis, opportunity analysis, target marketing, advertising planning, sales analysis, trip planning, and supplier identification. Most likely industries for adoption of these systems include banking, insurance, retail, and real estate. However, the marketing arm of a public utility may develop a GIS to analyze existing customer demographics, and this customer is a business marketing GIS user, not an AM/FM user. Business users are trying to compete, and they may work in any industry.

This market has been driven by the arrival of off-the-shelf data in the United States; thus, the market itself is mostly U.S.-based, but the United

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Table 3-1
GIS Worldwide Software Revenue Forecast by Application

	1990	1991	1992	1993	1994	1995	1996	1997	CAGR (%) 1992-1997
Base Data	44.6	60.5	63.3	67.9	72.3	77.1	82.7	89.5	7.2
Photogrammetry and Surveying	30.6	26.3	27.4	29.0	31.2	33.7	36.2	38.9	7.3
Data for Resale	14.0	34.2	35.9	38.9	41.1	43.4	46.6	50.6	7.1
Land Information	134.3	125.7	154.4	169.7	187.0	205.3	224.5	245.2	9.7
Land Records	80.2	75.5	89.1	97.6	107.7	118.6	130.2	142.7	9.9
Planning: Land Use	54.2	50.2	65.3	72.1	79.3	86.8	94.3	102.5	9.4
Biological	28.8	37.5	49.7	61.5	76.4	96.4	121.2	147.7	24.3
Environmental/Public Health and Safety	20.0	24.2	31.1	38.9	48.5	61.7	78.6	98.4	25.9
Forestry and Agriculture	8.8	13.3	18.6	22.6	27.9	34.7	42.7	49.3	21.5
Geoscience (Energy Exploration and Mining)	42.4	59.9	57.2	60.1	65.7	73.3	82.5	96.0	10.9
Infrastructure Management	28.9	32.0	43.5	56.6	71.9	91.6	115.6	149.2	27.9
Transportation and Navigation	14.9	18.6	25.8	34.7	44.4	57.8	69.6	90.8	28.6
Emergency Services and Dispatch	14.0	13.5	17.7	21.9	27.5	33.7	46.0	58.4	26.9
AM/FM	117.0	130.1	157.0	180.3	205.5	236.2	268.3	305.6	14.3
Telecommunications	20.8	43.9	49.6	56.2	62.5	72.3	80.8	90.8	12.9
Electric	45.6	42.0	51.3	60.1	69.0	81.0	94.3	110.3	16.5
Water/Wastewater	33.1	26.7	33.9	38.2	43.6	48.2	52.8	57.7	11.2
Gas and Other Utilities	17.5	17.6	22.2	25.8	30.4	34.7	40.4	46.7	16.1
Business Marketing and Sales	10.3	15.6	25.0	42.4	69.9	106.0	143.7	173.9	47.4
Demographic/Location Analysis	7.8	10.4	15.8	26.2	41.9	62.7	84.2	103.8	45.6
Sales Support	2.5	5.3	9.2	16.3	27.9	43.4	59.5	70.1	50.3
Geopolitics	31.5	38.9	42.3	45.3	48.5	52.1	56.5	61.2	7.7
Defense/Military	24.9	31.9	36.2	39.6	42.7	46.3	50.5	55.1	8.8
Political Districting	6.7	7.0	6.1	5.7	5.8	5.8	6.0	6.1	0
Cartography	22.0	20.8	22.2	23.3	24.7	26.0	27.5	29.2	5.6
Total GIS/Mapping	459.9	521.0	614.6	707.2	821.9	964.0	1,122.7	1,297.6	16.1

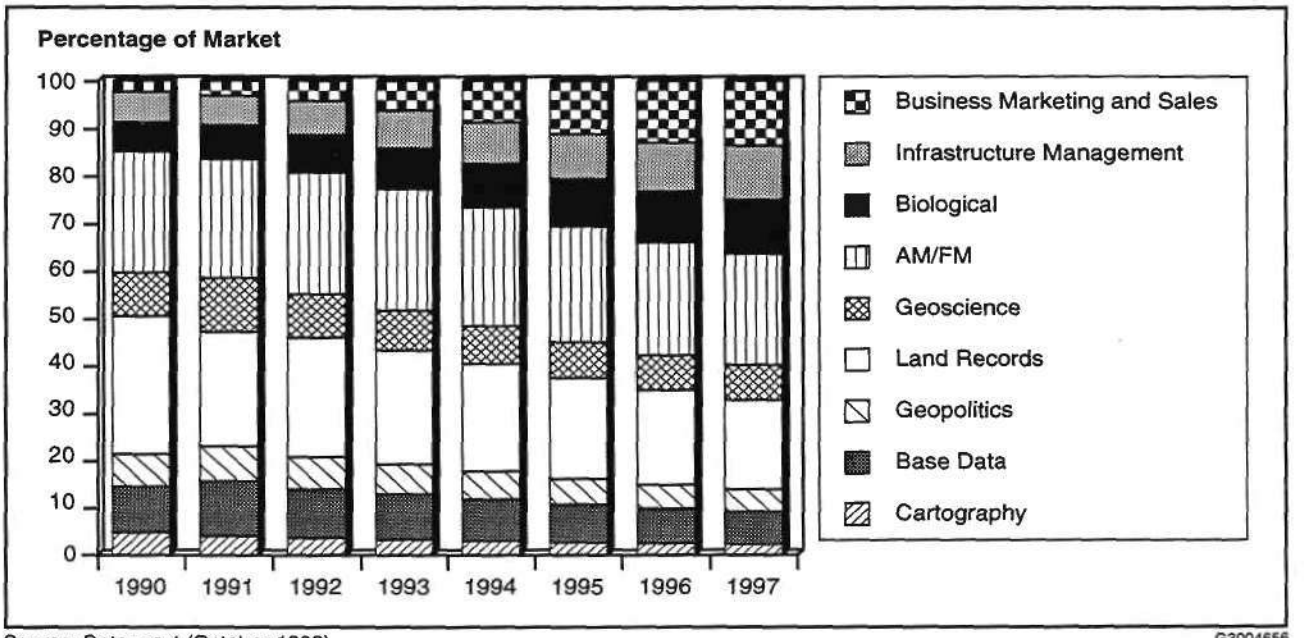
Source: Dataquest (October 1993)

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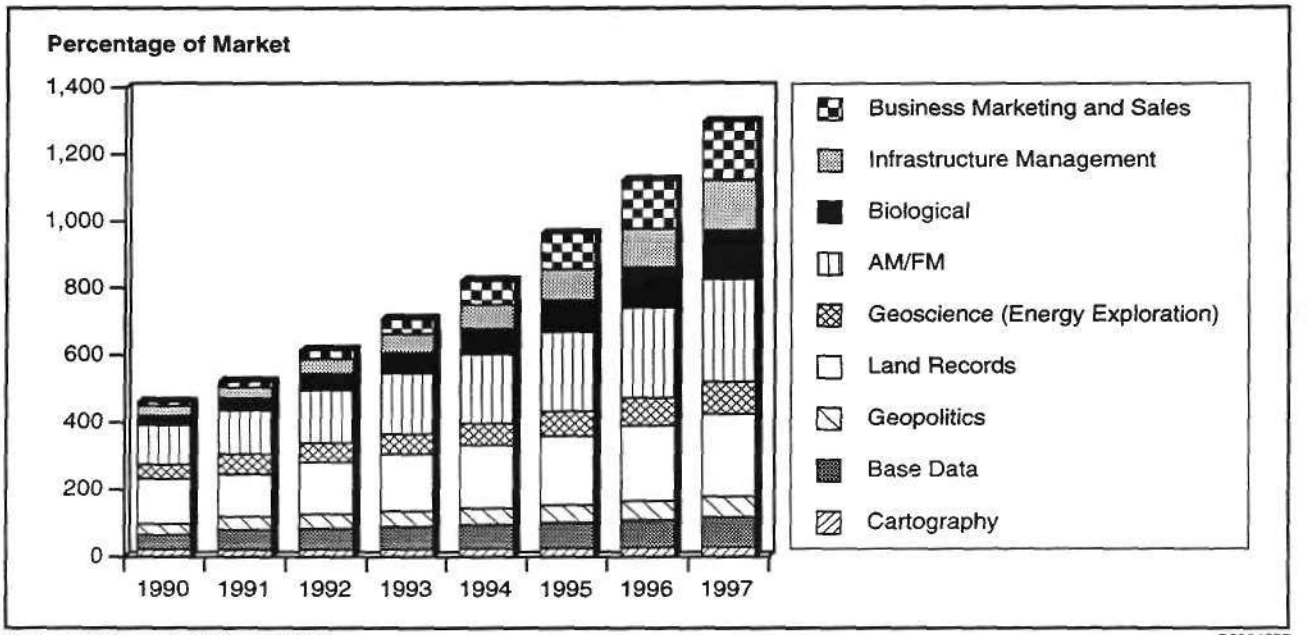
Figure 3-3
GIS Software Revenue Forecast by Application (Percent)



Source: Dataquest (October 1993)

G3004656

Figure 3-4
GIS Software Revenue Forecast by Application (Millions of Dollars)



Source: Dataquest (October 1993)

G3004657

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Kingdom's market is developing. Typical data used includes U.S. census data, TIGER street files, business location information, geographic boundaries (such as counties and ZIP codes), buying pattern data, and privately developed demographic data (such as age, income, and business statistics for various industries). Any company that holds worthwhile data in some tabular form can advertise it for sale to GIS users. The only widespread expectation is that the data be geocoded (for latitude and longitude). From the opposite perspective, almost all users possess useful data that also can be analyzed with GIS software because so much data contains ZIP codes and street addresses. Business marketing users want to connect the data that is relevant to their businesses to a geographic reference when a geographic interface is the easiest way to understand the data.

Although most users are focused on some type of demographic analysis (for example, where customers are relative to a proposed site), a computer that knows who and what is where is increasingly useful to salespeople who want to plan efficient trips and to travel agents who want to help customers get the most value for their time and money. In the future, we expect more sophisticated sales support systems to be built as more point-of-sale devices become linked to GIS systems, which will provide the ability to map and chart performance of a group of retail environments in real time. A key question is: when these systems are developed, will they be called GIS/mapping systems or sales analysis systems?

Profile of Business GIS Users

Dataquest's user data does confirm many commonly held beliefs about these business GIS users. They rely more heavily on personal computers and spent less for their system. Because their systems are relatively simple, they have been in place only 18 months (compared to 38 months for all users). Users are more likely to be up and running in a production system; "pilot systems" are often a fleeting moment in time. They also spend less time using their GIS system—24 percent of their computer time versus 34 percent for all users. They are more likely to work at sites where DOS is the dominant operating system than are traditional users, where UNIX has a strong presence.

The good news is that they are absolutely committed to GIS. One hundred percent of them strongly agree that full implementation of a GIS system in their department is inevitable. So even though they are more low-cost, casual users, GIS is producing enough to keep them strongly committed. Interestingly enough, none of them said that they are likely to switch software vendors during the next five years. Several in the entire survey said that they were somewhat or very likely to switch vendors; therefore, it looks as if these more casual users are showing higher loyalty to their vendors than are traditional users. This is especially remarkable when one considers that the cost of switching vendors is much lower than it is at traditional sites that have investments in training and databases on one product. Clearly, something is working for these business GIS users. Even better from a vendor's perspective, they are more likely to say they plan to increase spending in 1993 than the entire sample. They may have fewer

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dollars to spend than the large, traditional users, but a higher percent of them plan to increase spending. Nonetheless, there are still some issues to resolve before business GIS becomes a market force with which to reckon.

Business GIS Market Considerations

Low-cost GIS software suppliers are increasingly teaming with data providers, a necessary development if truly easy-to-build, easy-to-use systems are to emerge. Business users are not the type to spend days or even minutes poring over operating manuals. Off-the-shelf data also needs development (or even just more complete documentation); users do not always understand exactly what they are buying or have bought. We believe that GIS systems will become more practical for users as software vendors and data providers work more closely together.

This leaves the following remaining problems for suppliers:

- The data has to drop in price to attract new and more casual users.
- GIS software needs to become more robust so that it can accommodate the needs of the sophisticated users in the business market who are addressing problems involving ever-larger data sets.
- To become a significant market, worldwide off-the-shelf data must be available. Addressing this issue unleashes a host of political, cultural, and economic issues.

The largest area of uncertainty is whether GIS will become more widely recognized on its own in business applications or whether it will become embedded inside other applications. There is a parallel here: there was once something called the graphics market, but graphics was really a technology and it gradually became embedded in all the applications we use. Vendors no longer say they are in the graphics market because there is no longer a group of potential customers who might need or want capabilities offered by a graphics system. As mentioned in the beginning of this article, that statement forms the basis for the definition of a market, and part of the GIS market will disappear as users in some business applications no longer perceive that they need a "GIS system" for certain functions.

In the PC/Windows/NT environment, two scenarios are possible: GIS may increasingly be linked to (and embedded into) more mainstream applications such as spreadsheets and tabular databases, allowing users to experiment with new solutions where the GIS activity appears embedded in new or existing applications (such as in a spreadsheet). In the alternate scenario, GIS will gradually begin to solve more meaningful problems in business settings, so that business users realize they must buy something called a GIS. The most likely outcome is that a little of both will happen. However, the more compelling the meaning of GIS becomes in nontraditional applications, the more opportunity there is for what is called the business GIS market.

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Base Data (Photogrammetry and Surveying and Data for Resale)

This segment is characterized by an explosion in new technologies, new products, better accuracy, and tough price pressure. Despite a growth rate slower than other applications, expenditure to develop base data is expected to almost double between 1992 and 1997, going from 63.3 million in 1992 to $89.5 million in 1997. Cheaper and more useful GPS receivers and satellite imagery and more cost-effective aerial photography will continue to create opportunities in image-based and hybrid GIS systems. International opportunities will provide a significant source of growth.

Although digital orthophotography will occupy a more mainstream position in the market by 1997, price pressure will be relentless. Significant improvements in automation and cost of technology will be somewhat offset by buyer demand that land information must cost less to acquire.

Revenue from GIS data for resale will expand dramatically as an activity and less dramatically as a revenue opportunity as price pressures are also brought to bear on suppliers of vector-based data by users wanting data that is also increasingly accurate, timely, and easy to use off the shelf. Sales of systems based on enhanced versions of US. federal land records have been inhibited because the original data was not designed for resale to local governments in terms of accuracy or content. It is important to note that this forecast includes the opportunity for data that would only be used in a GIS. New data sources that can be used in multiple types of computer systems, including GIS systems, are multiplying rapidly, and are outside the scope of this analysis.

Land Information

The typical buyer of a GIS system used for land records or planning is a government entity on a tight or uncertain budget. Despite the fact that planning users have been quite successful in making systems productive, local government budgets are being cut in North America and Europe, and capital equipment investments such as GIS systems are often weighed against involuntary staff reductions. As a result, applications that focus on developing land information will also grow slowly from $154.4 million in revenue in 1992 to $245.2 million in 1997. During this time, users in assessors and planning offices will increasingly link activities with each other and with CAD applications in government public works and engineering departments.

The bright spot on this horizon has been and will continue to come from improvements in raster-based GIS solutions. Often combined with purchased vector-based line maps, local governments are discovering that they can bypass some of the headaches and cost that have troubled their peers doing traditional conversion of existing map data.

Biological (Environmental/Public Health and Safety and Forestry and Agriculture)

This sector is expected to outpace the overall market rate briskly, growing from $49.7 million in 1992 to $147.7 million in 1997. Two strong trends

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should drive that growth: a growing worldwide concern about managing a variety of life forms and the contamination that surrounds them and increasingly cost-effective image-based systems that are a natural fit for managing plant and animal life. GIS as an analysis tool will regularly participate in a variety of environmental solutions for the years to come. Significant opportunities exist for systems that can manage regulatory requirements and actually help users identify and prioritize problems that have the potential to become significant issues. Former spending has been primarily in the federal government; future growth is anticipated within industry and local environmental management groups.

Although opportunities are widespread and important in environmental applications, because of the complexity of the rich collection of variables involved in an environmental analysis, computer technology will only begin to be practical in many tasks from a price perspective near the end of the forecast period, and this assumes that image and data analysis can also be accomplished at a lower cost. By the year 2000, the environmental GIS market should be growing even more briskly; success in that market will require continued investment in product development during the next five years to maintain a technological advantage in information and analysis products.

Other opportunities exist at the "crop management" level. Despite the U.S. forest service's remarkable spreadsheet error that caused it to reduce anticipated GIS acquisitions from $1.24 billion to $312 million, simple image-based applications that help people manage forests and agriculture have a small but bright future and are expected to grow from $18.6 million in 1992 to $49.3 million in 1997. The opportunity is global as long as the overall cost can meet the tight budgets of typical users in forestry and agriculture.

Geoscience (Energy Exploration and Mining)

Geoscience is forecast to grow from $57.2 million in 1992 to $96.0 million in 1997. The former category of energy exploration has been expanded to include the small number of applications outside of energy, such as mining. The hallmark of this market will continue to be its volatility. The overall trend is forecast here, which is below GIS industry averages—but there is little on which to forecast year-by-year buying in the unpredictable oil industry.

For GIS to be fully relevant to the oil and gas industry, better products are needed. The high volume of data produced by the typical oil customer cannot be processed by one type of system, whether it is a GIS or some other software tool. In the long run, unfortunately, oil and gas customers can be problem customers for GIS suppliers because of their volatility and sophisticated, specialized analysis needs. There is little point in indifferent pursuit of this market: if one is not willing to fight it out for significant market share, then ignore it.

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Infrastructure Management (Transportation and Navigation, Emergency Services and Dispatch)

Applications in transportation and navigation are expected to grow above the average industry growth rate, from a total of $25.8 million in 1992 to $90.8 million in 1997. GIS products have sold well to state transportation departments, as GIS products continue to become more useful to engineers who design, build, and maintain road networks. These users are in a similar position to AM/FM users: their management and product responsibilities have a high geographic element. Coupled with their need for digital terrain models in construction, transportation departments are an obvious target for GIS suppliers. Their typical preference for buying market leaders is a challenge to overcome; price is a likely weapon. Only a small component of this forecast is based on purchases driven by "rebuilding the infrastructure." Strained world economies and widespread uncertainties in political directions in many countries make it imprudent to count on significant GIS buys based on infrastructure construction (in contrast to environmental spending, which appears to be on more solid ground among taxpayers worldwide).

The transportation segment also includes various marine and in-car navigation systems, which, toward the end of the century, will play an important role in European transportation and communication networks. Automatic traffic control, automatic tolling systems, and even automatic policing of roads are expected to be implemented via these systems. Electronic road-communication networks will form the basis for efficient use of modern transport in Europe. The European Commission (EC) has initiated a number of wideranging but interrelated R&D programs of which dedicated road infrastructure for vehicle safety in Europe (DRIVE) is the core. DRIVE envisages a common European road transport environment in which drivers are informed about road and traffic conditions and "intelligent" vehicles communicate and cooperate with the road infrastructure. In the United States, programs such as TravTek, a consortium effort by the American Automobile Association, General Motors, the Federal Highway Administration, the Florida Department of Transportation, and the City of Orlando, Florida, is one of the most extensive intelligent vehicle/highway systems field tests to date. TravTek guides drivers to their destinations, alerts them to local traffic conditions, and offers alternative routes.

Simple in-car navigation systems are in the works worldwide, driven by the availability of data from GPSs. The opportunity is limited by the fact that considerable spending will be for products related to but not in the GIS market. The rate at which car navigation systems penetrate the private and commercial sectors will be strongly determined by price and is unlikely to develop as a significant market until systems reach the $500 price point.

Most of us are not lost as we drive. Initially, the most likely customers for these products will be among people who actually need more information about where they are located: rental car users, courier and delivery

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companies who can save money off every wrong turn eliminated, and to a lesser extent, emergency response teams such as police and fire.

The infrastructure management market sector also includes emergency services and dispatch management, which is expected to advance from a $17.7 million GIS software market in 1992 to a $58.4 million market in 1997. There are several computer-based alternatives to GIS in emergency services, and suppliers must also compete with custom solutions developed by users. The jury is not in on whether GIS is the right solution for the environment, despite the intuitive appeal to dispatch management of being able to see where vehicles are and where they are going. The opportunity is there for robust products, but this is one area where the software absolutely must deliver to customer expectations. Police and fire response serves a function that is critical and highly visible to every taxpayer. Real-time display and dispatch of emergency personnel, supported with information on the jurisdiction's environment, is quite a challenge for today's computers, and systems look a bit pricey to the typical local police force. For vendors that wish to invest over all these obstacles, there is the promise that a low-cost, robust system developed by the end of the decade would be attractive to every police and fire department in the world.

Supplying dispatch management systems to commercial enterprises, such as trucking companies, is easy by comparison. Product development can reasonably be undertaken by small vendors. The principal demonstration that must be made, beyond product utility, is return on investment.

AM/FM (Telecommunications/Telephone, Electric, Water/ Wastewater, Other Utilities)

AM/FM represents a core market of users who need GIS systems because their job responsibilities—managing and developing widely dispersed utility networks—have a high geographic content. Now moving down to smaller utilities, existing users are concentrated among the very large utilities that years ago could afford a strategic investment in information technology. As the largest sector in the GIS market, AM/FM is forecast to grow approximately at the market rate, from $157 million in 1992 to $305.6 million in 1997. Telephone and electric companies will remain the largest sectors. These well-heeled customers will continue their significant investments in GIS technology and will continue to prefer the security of buying from market leaders. Customer concern over vendor longevity and market position is understandable: these users are investing in management tools for assets (and careers) that will very likely exist in 25 years.

Growth among utilities is more volatile than any forecast can predict. The year 1991 saw heavy investment by telephone companies while electric buyers were the driving force in 1992. Investment, driven by long-term projects, will continue to come in waves. What is predictable, however, is that, collectively, they will buy for two reasons: first, AM/FM systems are increasingly indispensable to utilities and second, utilities are relatively resilient to economic recessions.

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Buyers in telecommunications are the most sophisticated in use of GIS technology, particularly among the Regional Bell Operating Companies in the United States. These are the users who will push vendors to create more committed business partnerships and to achieve new technological feats. Their buying power and history of significant, continual investment will make vendors listen.

However, the nature of telecommunications is changing; advances are likely to include wireless communications that require relatively less mapping support and merged wiring with TV/home entertainment cabling. TV cable mapping is a minority component of our "Other Utilities" category. Some of the growth in the Other Utilities category is based on the assumption that some of the TV cable companies will win a few rounds in the upcoming battle for control of a "data highway" to homes.

Electric companies will continue to invest most heavily in AM/FM, primarily because they will always provide a hardwired service to customers (requiring continued maintenance of map data), and most electric suppliers are large enough to invest strategically in information technology.

Many of the smaller electric and telephone companies are investing in AM/FM. Here, the lower cost of PC-based solutions can be more easily sold—such as in water companies, many of which are small entities with correspondingly small budgets.

All utilities are in increasingly competitive environments in production/generation and in distribution. Many have moved out of the protective cocoon of regulatory environments and have increasingly become competitive enterprises, particularly in telecommunications, electric, and gas (Note: Most of the sales to "gas and other utilities" are to natural gas and pipelines). Proven return on investment and price per seat is likely to become more important to utility buyers in the future as it becomes increasingly difficult to simply pass capital equipment expenditure on to captive buyers.

Geopolitics

Geopolitics is forecast to grow from $42.3 million in 1992 to $61.2 million in 1997. GIS was partially born in defense programs; competing for political position represents the driving goal of users. Despite the fact that defense spending is favoring information over weapons programs, defense spending worldwide in GIS will fail to stay even with market growth. Little of this market is available to suppliers not already entrenched.

The U.S. Department of Defense (DoD) has the capability to release increasingly accurate geographic information, either to build markets or to bring in revenue, as demonstrated by their Advanced Research Project Agency's dual use program and the Defense Mapping Agency's Digital Chart of the World, a four CD-ROM set digital base map of the world, designed to promote worldwide map standards. It is not lost on

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DoD management that the GPS satellite program, paid for under the aegis of defense spending, has created new markets all over the world.

Political redistricting has died down for now, but it will again become an important GIS activity toward the end of the decade with the approaching Census 2000.

Cartography

Map making, the most traditional of GIS activity, is no longer a market driver. Modest continual purchases by map makers will keep the market going and provide better looking, more useful maps each year, but the absence of compelling new capabilities will result in relatively low market opportunity. This area is only forecast to grow from $22.2 million in 1992 to $29.2 million in 1997.

The Future for All Applications

GIS applications in general will grow in diversity as they become easier and cheaper to create. The PC-based GIS products will drive this proliferation. At the same time, the traditional applications should become more successful, as new users leverage the experience base of others to work smarter and faster as they develop new methods of developing GIS systems. Both trends will create users who expect to manage more complex problems and data with less redundancy. Users are increasingly able to recognize that data is a commodity for which they can share development and maintenance costs across departments and enterprises; already, joint ventures across GIS applications abound. All these trends mean that suppliers will have to deliver products that can be used in specific GIS applications, used across GIS applications, and are susceptible to integration with information systems across an enterprise. Point solutions, such as offering links to traditional databases for data exchange, only begin to address the problem. Considerable opportunity exists for the user, consultant, or vendor who can create cost-conscious, effective integration strategies and development processes for information technology.

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Appendix A
Market Statistics

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Table A-1
GIS Software Revenue ($M) Worldwide, GIS/Mapping

Company	1990 Revenue	1991 Revenue	1992 Revenue	1990-1991 Percent Change	1991-1992 Percent Change	1990 Market Share	1991 Market Share	1992 Market Share
Intergraph	80.9	92.5	107.0	14.4	15.7	17.6	17.8	17.4
ESRI	63.0	77.7	99.9	23.3	28.6	13.7	14.9	16.3
Siemens Nixdorf Info systeme	56.1	49.7	53.2	-11.4	7.1	12.2	9.5	8.7
Autodesk	23.8	28.5	40.4	19.9	41.9	5.2	5.5	6.6
EDS	18.3	17.0	24.1	-6.8	41.5	4.0	3.3	3.9
Landmark Graphics	14.6	23.2	18.8	59.6	-19.0	3.2	4.5	3.1
GeoVision Systems	9.9	8.6	14.0	-13.3	63.7	2.1	1.6	2.3
Genasys II	7.6	9.7	13.0	28.3	33.9	1.6	1.9	2.1
IBM	14.9	12.7	12.8	-14.8	0.9	3.2	2.4	2.1
Strategic Mapping	4.3	6.3	10.4	45.7	64.0	0.9	1.2	1.7
ETAK	9.7	9.7	10.0	-0.3	3.5	2.1	1.9	1.6
Geoquest	6.4	8.0	9.6	25.0	20.0	1.4	1.5	1.6
MapInfo	3.2	5.7	8.5	75.5	50.3	0.7	1.1	1.4
ICL	4.6	7.8	8.1	68.7	4.0	1.0	1.5	1.3
Computervision	7.1	7.6	7.4	6.8	-1.6	1.5	1.5	1.2
Enghouse Systems	3.3	3.9	7.2	17.3	86.3	0.7	0.7	1.2
Infocel	5.8	6.8	7.2	17.9	5.4	1.3	1.3	1.2
ERDAS	5.6	6.6	7.0	18.0	6.1	1.2	1.3	1.1
Synercom	6.4	7.8	6.4	22.2	-18.7	1.4	1.5	1.0
Smallworld Systems	0.8	1.8	5.8	138.2	219.9	0.2	0.3	0.9
Laser-Scan	5.4	4.5	4.7	-15.3	3.3	1.2	0.9	0.8
PAFEC	5.8	4.5	4.7	-22.5	3.6	1.3	0.9	0.8
Toshiba—no OEM	0	0	4.3	NA	NA	0	0	0.7
Dynamic Graphics	3.4	3.9	4.1	14.6	3.8	0.7	0.8	0.7
Radian Corporation	2.3	3.6	3.7	55.4	3.6	0.5	0.7	0.6
PacSoft	2.4	3.1	3.2	28.0	3.9	0.5	0.6	0.5

(Continued)

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Table A-1 (Continued)
GIS Software Revenue ($M) Worldwide, GIS/Mapping

Company	1990 Revenue	1991 Revenue	1992 Revenue	1990-1991 Percent Change	1991-1992 Percent Change	1990 Market Share	1991 Market Share	1992 Market Share
Intera Tydac	2.4	3.0	3.2	26.9	5.3	0.5	0.6	0.5
Spectrum Graphics	2.5	2.8	2.9	11.6	3.2	0.5	0.5	0.5
Sysscan	3.3	2.7	2.8	-18.9	4.5	0.7	0.5	0.5
Generation 5 Technology	2.1	2.6	2.7	23.8	2.7	0.5	0.5	0.4
Geographix	1.5	2.4	2.5	59.5	3.7	0.3	0.5	0.4
STI-Straessle	6.0	5.2	2.4	-12.4	-53.3	1.3	1.0	0.4
NEC	0	0	2.4	NA	NA	0	0	0.4
Terra Sciences	2.0	2.2	2.3	10.0	4.1	0.4	0.4	0.4
Facility Mapping Systems	2.0	2.1	2.1	6.6	0	0.4	0.4	0.3
Softdesk	2.2	1.9	2.0	-12.8	4.2	0.5	0.4	0.3
ACDS Graphic System	3.1	3.4	1.9	12.1	-44.3	0.7	0.7	0.3
Kohns and Poppenhaeger	1.6	1.8	1.9	14.4	3.3	0.3	0.4	0.3
Ground Modelling Systems	2.4	1.7	1.7	-28.4	0	0.5	0.3	0.3
Alper Systems	0.7	1.2	1.6	87.9	29.0	0.1	0.2	0.3
LandCadd	1.0	1.1	1.5	20.0	33.3	0.2	0.2	0.2
Kork Systems	1.2	0.9	1.4	-25.6	56.7	0.3	0.2	0.2
Other Companies	60.7	74.9	83.9	23.4	12.1	13.2	14.4	13.7
All Companies	459.9	521.2	614.6	13.3	17.9	100.0	100.0	100.0

NA = Not available
Source: Dataquest (October 1993)

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Table A-2
GIS Software Revenue ($M) Worldwide, Photogrammetry and Surveying

Company	1990 Revenue	1991 Revenue	1992 Revenue	1990-1991 Percent Change	1991-1992 Percent Change	1990 Market Share	1991 Market Share	1992 Market Share
Intergraph	11.9	10.7	11.9	-10.2	11.1	39.0	40.8	43.4
Autodesk	1.7	2.0	2.8	19.8	41.5	5.5	7.6	10.3
Siemens Nixdorf Info systeme	2.8	2.5	2.7	-11.4	7.3	9.2	9.4	9.7
Kork Systems	1.2	0.9	1.4	-25.6	56.7	4.0	3.4	5.1
EDS	0.9	0.9	1.2	-6.6	42.4	3.0	3.2	4.4
Other Companies	12.1	9.3	7.4	-22.8	-20.7	39.5	35.5	27.0
All Companies	30.6	26.3	27.4	-14.2	4.3	100.0	100.0	100.0

Source: Dataquest (October 1993)

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Table A-3
GIS Software Revenue ($M) Worldwide, Data for Resale

Company	1990 Revenue	1991 Revenue	1992 Revenue	1990-1991 Percent Change	1991-1992 Percent Change	1990 Market Share	1991 Market Share	1992 Market Share
Siemens Nixdorf Info systeme	0	18.9	20.2	NA	7.0	0	55.2	56.3
ETAK	9.7	4.8	5.5	-50.9	15.3	69.6	14.0	15.3
IBM	1.2	1.9	1.9	61.3	0	8.5	5.6	5.3
Pasco	0	0	1.5	NA	NA	0	0	4.1
ESRI	0	3.1	1.2	NA	-61.3	0	9.1	3.3
Laser-Scan	1.0	0.7	0.8	-24.0	2.7	6.9	2.1	2.1
Other Companies	2.1	4.8	4.8	129.2	0.8	15.0	14.0	13.5
All Companies	14.0	34.2	35.9	144.8	5.0	100.0	100.0	100.0

NA = Not available
Source: Dataquest (October 1993)

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Table A-4
GIS Software Revenue ($M) Worldwide, Land Records

Company	1990 Revenue	1991 Revenue	1992 Revenue	1990-1991 Percent Change	1991-1992 Percent Change	1990 Market Share	1991 Market Share	1992 Market Share
Intergraph	12.7	13.5	17.8	6.3	32.0	15.8	17.8	19.9
ESRI	13.2	11.6	16.1	-12.0	38.1	16.5	15.4	18.0
Siemens Nixdorf Info systeme	14.0	10.4	11.2	-25.5	7.0	17.5	13.8	12.5
EDS	5.3	4.9	7.0	-6.8	41.5	6.6	6.5	7.8
Autodesk	3.8	4.6	6.5	19.7	41.9	4.8	6.0	7.3
ICL	2.1	3.5	3.6	68.6	4.0	2.6	4.6	4.1
Infocel	0	1.4	2.7	NA	100.0	0	1.8	3.1
Genasys II	3.0	3.1	2.3	0.3	-23.3	3.8	4.0	2.6
Computervision	1.4	1.5	1.5	2.8	5.5	1.8	1.9	1.7
Sysscan	3.3	1.4	1.5	-57.3	4.3	4.1	1.9	1.6
GeoVision Systems	2.0	1.7	1.4	-13.2	-18.1	2.5	2.3	1.6
Softdesk	1.1	1.0	1.0	-12.8	4.2	1.4	1.3	1.1
PAFEC	1.2	0.9	1.0	-23.0	4.3	1.5	1.2	1.1
Other Companies	17.1	16.1	15.6	-5.9	-3.2	21.3	21.3	17.5
All Companies	80.2	75.5	89.1	-5.9	18.0	100.0	100.0	100.0

NA = Not available
Source: Dataquest (October 1993)

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Table A-5
GIS Software Revenue ($M) Worldwide, Planning; Land Use

Company	1990 Revenue	1991 Revenue	1992 Revenue	1990-1991 Percent Change	1991-1992 Percent Change	1990 Market Share	1991 Market Share	1992 Market Share
Intergraph	8.7	10.2	13.8	17.6	35.3	16.0	20.3	21.1
ESRI	10.1	7.8	11.2	-22.9	44.0	18.6	15.5	17.1
Autodesk	4.0	4.8	6.9	19.8	41.9	7.5	9.6	10.5
ICL	2.1	3.5	3.6	68.6	4.0	3.8	7.0	5.6
Genasys II	1.5	2.0	3.0	30.9	49.2	2.8	4.0	4.5
GeoVision Systems	1.0	0.8	2.8	-16.2	237.3	1.8	1.7	4.3
EDS	1.5	1.4	1.9	-6.8	41.9	2.7	2.7	3.0
PacSoft	1.2	1.5	1.6	27.7	5.9	2.2	3.0	2.5
LandCadd	1.0	1.1	1.5	20.0	33.3	1.8	2.3	2.3
ERDAS	0.3	1.4	1.5	385.7	6.6	0.5	2.7	2.2
IBM	1.5	1.3	1.3	-14.8	0.8	2.8	2.5	2.0
Siemens Nixdorf Info systeme	2.8	1.0	1.1	-64.6	7.1	5.2	2.0	1.6
Softdesk	1.1	1.0	1.0	-12.8	4.2	2.0	1.9	1.5
Other Companies	17.5	12.5	14.3	-28.6	14.0	32.4	24.9	21.8
All Companies	54.2	50.2	65.3	-7.3	30.1	100.0	100.0	100.0

Source: Dataquest (October 1993)

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Table A-6
GIS Software Revenue ($M) Worldwide, Environmental

Company	1990 Revenue	1991 Revenue	1992 Revenue	1990-1991 Percent Change	1991-1992 Percent Change	1990 Market Share	1991 Market Share	1992 Market Share
ESRI	6.3	7.8	11.5	23.3	47.9	31.5	32.1	36.9
Autodesk	2.1	2.6	3.6	20.1	41.6	10.7	10.6	11.7
Intergraph	0.9	1.7	1.9	100.0	9.2	4.4	7.2	6.1
Dynamic Graphics	1.0	1.2	1.4	14.6	21.2	5.2	4.9	4.6
Genasys II	0.8	1.0	1.2	29.3	20.6	3.8	4.0	3.8
Siemens Nixdorf Info systeme	2.8	1.0	1.1	-64.6	7.1	14.0	4.1	3.4
ERDAS	0	1.0	1.0	NA	-1.0	0	4.2	3.2
Other Companies	6.1	7.9	9.4	29.8	18.5	30.6	32.8	30.2
All Companies	20.0	24.2	31.1	20.9	28.7	100.0	100.0	100.0

NA = Not available
Source: Dataquest (October 1993)

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Table A-7
GIS Software Revenue ($M) Worldwide, Forestry and Agriculture

Company	1990 Revenue	1991 Revenue	1992 Revenue	1990-1991 Percent Change	1991-1992 Percent Change	1990 Market Share	1991 Market Share	1992 Market Share
ESRI	3.8	4.7	9.0	23.5	92.5	42.9	35.1	48.2
Infocel	0	1.4	1.5	NA	10.3	0	10.2	8.0
Autodesk	0.7	0.9	1.2	19.7	42.4	8.0	6.4	6.5
Genasys II	0.8	1.0	1.2	29.3	20.6	8.5	7.3	6.3
ERDAS	0	1.0	1.0	NA	5.1	0	7.4	5.6
Other Companies	3.6	4.5	4.7	24.6	6.1	40.6	33.5	25.4
All Companies	8.8	13.3	18.6	50.8	40.2	100.0	100.0	100.0

NA = Not available
Source: Dataquest (October 1993)

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Table A-8
GIS Software Revenue ($M) Worldwide, Geoscience

Company	1990 Revenue	1991 Revenue	1992 Revenue	1990-1991 Percent Change	1991-1992 Percent Change	1990 Market Share	1991 Market Share	1992 Market Share
Landmark Graphics	14.6	23.2	18.8	59.6	-19.0	34.3	38.8	32.9
Geoquest	6.4	8.0	9.6	25.0	20.0	15.1	13.4	16.8
Radian Corporation	2.1	3.2	2.9	53.6	-12.0	5.0	5.4	5.0
Geographix	1.5	2.3	2.4	60.0	3.4	3.4	3.9	4.2
Terra Sciences	2.0	2.2	2.3	10.0	4.1	4.7	3.7	4.0
Dynamic Graphics	1.7	2.0	2.0	15.3	4.1	4.0	3.3	3.6
Autodesk	1.2	1.4	2.0	19.3	42.3	2.8	2.4	3.5
ESRI	1.3	1.6	2.0	22.8	28.8	3.0	2.6	3.5
EDS	1.5	1.4	1.9	-6.8	41.9	3.4	2.3	3.4
Geotrace Technologies	0.9	1.1	1.1	13.8	4.7	2.2	1.8	2.0
Auto-Trol	1.4	1.3	1.1	-9.9	-14.2	3.3	2.1	1.9
Other Companies	8.0	12.2	11.0	53.8	-10.1	18.7	20.4	19.2
All Companies	42.4	59.9	57.2	41.1	-4.5	100.0	100.0	100.0

Source: Dataquest (October 1993)

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Table A-9
GIS Software Revenue ($M) Worldwide, Transportation

Company	1990 Revenue	1991 Revenue	1992 Revenue	1990-1991 Percent Change	1991-1992 Percent Change	1990 Market Share	1991 Market Share	1992 Market Share
ESRI	2.5	3.1	7.5	23.0	141.6	16.9	16.7	29.0
EDS	4.6	4.3	6.0	-6.8	41.2	30.7	23.0	23.4
Intergraph	2.7	4.4	4.9	62.5	10.4	18.2	23.8	18.9
Autodesk	1.4	1.7	2.4	19.6	42.1	9.6	9.2	9.4
Other Companies	3.7	5.1	5.0	36.9	-1.2	24.7	27.2	19.3
All Companies	14.9	18.6	25.8	24.2	39.2	100.0	100.0	100.0

Source: Dataquest (October 1993)

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Table A-10
GIS Software Revenue ($M) Worldwide, Emergency Services and Dispatch Management

Company	1990 Revenue	1991 Revenue	1992 Revenue	1990-1991 Percent Change	1991-1992 Percent Change	1990 Market Share	1991 Market Share	1992 Market Share
ESRI	4.4	5.4	8.5	23.1	56.4	31.6	40.3	47.9
Intergraph	4.4	3.3	2.4	-25.9	-27.5	31.6	24.3	13.4
EDS	0.7	0.7	1.0	-6.8	39.1	5.3	5.1	5.4
GeoVision Systems	0.5	0.4	0.7	-12.2	62.8	3.5	3.2	4.0
Other Companies	3.9	3.7	5.2	-6.6	42.5	28.0	27.1	29.3
All Companies	14.0	13.5	17.7	-3.5	31.6	100.0	100.0	100.0

Source: Dataquest (October 1993)

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Table A-11
GIS Software Revenue ($M) Worldwide, AM/FM (Networked Utilities)

Company	1990 Revenue	1991 Revenue	1992 Revenue	1990-1991 Percent Change	1991-1992 Percent Change	1990 Market Share	1991 Market Share	1992 Market Share
Intergraph	25.3	28.6	33.8	13.0	18.1	21.7	22.0	21.5
ESRI	7.6	14.0	17.3	85.3	23.5	6.5	10.8	11.0
Siemens Nixdorf Info systeme	22.4	11.9	12.8	-46.8	7.0	19.2	9.2	8.1
Autodesk	6.7	7.4	10.5	11.4	41.8	5.7	5.7	6.7
IBM	6.7	8.3	8.2	23.6	-0.7	5.7	6.4	5.2
Enghouse Systems	3.3	3.9	7.2	17.3	86.3	2.8	3.0	4.6
GeoVision Systems	4.9	4.3	7.0	-12.6	62.4	4.2	3.3	4.5
Synercom	6.4	7.8	6.4	22.2	-18.7	5.5	6.0	4.0
Smallworld Systems	0.6	1.6	5.2	171.7	219.6	0.5	1.3	3.3
Toshiba—no OEM	0	0	4.3	NA	NA	0	0	2.7
EDS	1.7	2.4	3.4	44.2	41.6	1.4	1.8	2.1
Computervision	1.3	2.0	1.9	49.6	-2.5	1.1	1.5	1.2
NEC	0	0	1.7	NA	NA	0	0	1.1
STI-Straessle	4.5	3.6	1.7	-20.6	-53.2	3.8	2.7	1.1
Spectrum Graphics	1.3	1.4	1.5	12.0	3.6	1.1	1.1	0.9
Infocel	0	2.7	1.4	NA	-47.1	0	2.1	0.9
Kohns and Poppenhaeger	1.2	1.4	1.4	15.0	2.2	1.0	1.1	0.9
PAFEC	1.7	1.4	1.4	-22.4	4.4	1.5	1.0	0.9
MapInfo	0.4	0.9	1.3	142.9	49.4	0.3	0.7	0.8
Control Data	1.0	1.3	1.2	28.3	-3.9	0.8	1.0	0.8
ETAK	0	1.0	1.0	NA	2.0	0	0.8	0.6
Other Companies	20.1	24.3	26.5	21.2	8.8	17.2	18.7	16.9
All Companies	117.0	130.1	157.0	11.3	20.6	100.0	100.0	100.0

NA = Not available
Source: Dataquest (October 1993)

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Table A-12
GIS Software Revenue ($M) Worldwide, Telecommunications

Company	1990 Revenue	1991 Revenue	1992 Revenue	1990-1991 Percent Change	1991-1992 Percent Change	1990 Market Share	1991 Market Share	1992 Market Share
Intergraph	7.3	10.1	10.9	37.3	8.2	35.3	23.0	22.0
IBM	0	6.4	6.3	NA	-1.3	0	14.5	12.7
ESRI	0	4.7	6.0	NA	28.5	0	10.6	12.1
Enghouse Systems	0	3.1	5.7	NA	86.3	0	7.0	11.5
Siemens Nixdorf Info systeme	2.8	3.0	3.2	6.4	7.0	13.5	6.8	6.4
Synercom	2.2	2.0	1.6	-12.6	-18.5	10.7	4.4	3.2
EDS	0.7	1.0	1.5	37.8	42.2	3.6	2.3	2.9
GeoVision Systems	2.0	1.7	1.4	-11.7	-19.5	9.5	4.0	2.8
Spectrum Graphics	1.0	1.1	1.2	12.0	3.6	4.8	2.6	2.3
Other Companies	4.7	10.9	11.9	129.4	9.5	22.7	24.7	24.0
All Companies	20.8	43.9	49.6	110.7	13.1	100.0	100.0	100.0

NA = Not available
Source: Dataquest (October 1993)

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Table A-13
GIS Software Revenue ($M) Worldwide, Electric

Company	1990 Revenue	1991 Revenue	1992 Revenue	1990-1991 Percent Change	1991-1992 Percent Change	1990 Market Share	1991 Market Share	1992 Market Share
Intergraph	8.9	9.2	12.3	3.5	33.9	19.5	21.9	24.0
ESRI	3.8	4.7	6.3	23.5	34.7	8.3	11.1	12.3
Siemens Nixdorf Info systeme	5.6	4.0	4.3	-29.1	7.0	12.3	9.5	8.3
Autodesk	2.9	2.3	3.2	-20.0	41.7	6.3	5.4	6.3
Smallworld Systems	0.1	0.9	2.9	727.3	217.6	0.2	2.2	5.6
GeoVision Systems	1.0	0.8	2.8	-16.2	237.3	2.2	2.0	5.5
Synercom	1.9	2.7	2.2	42.7	-19.0	4.2	6.5	4.3
Enghouse Systems	2.6	0.8	1.5	-69.0	86.4	5.7	1.9	2.9
STI-Straessle	4.2	3.0	1.4	-27.3	-53.1	9.2	7.2	2.8
Control Data	1.0	1.3	1.2	28.3	-3.9	2.2	3.0	2.4
Other Companies	13.6	12.3	13.1	-9.8	6.9	29.9	29.3	25.6
All Companies	45.6	42.0	51.3	-7.8	22.1	100.0	100.0	100.0

Source: Dataquest (October 1993)

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Table A-14
GIS Software Revenue ($M) Worldwide, Water/Wastewater

Company	1990 Revenue	1991 Revenue	1992 Revenue	1990-1991 Percent Change	1991-1992 Percent Change	1990 Market Share	1991 Market Share	1992 Market Share
ESRI	3.8	4.7	5.0	23.5	7.3	11.4	17.5	14.8
Intergraph	4.7	3.9	4.1	-17.4	6.4	14.2	14.5	12.2
Siemens Nixdorf Info systeme	11.2	3.0	3.2	-73.4	7.0	33.9	11.2	9.4
GeoVision Systems	2.0	1.7	2.8	-11.7	60.9	6.0	6.5	8.3
Toshiba—no OEM	0	0	2.6	NA	NA	0	0	7.5
Autodesk	1.9	1.7	2.4	-10.0	42.1	5.7	6.4	7.2
IBM	0.8	1.3	1.3	69.3	0.8	2.3	4.8	3.8
Smallworld Systems	0.3	0.4	1.2	20.0	222.2	0.9	1.3	3.4
Synercom	0.3	1.2	1.0	265.6	-18.8	1.0	4.4	2.8
Other Companies	8.2	8.9	10.4	8.8	17.0	24.7	33.3	30.7
All Companies	33.1	26.7	33.9	-19.4	27.1	100.0	100.0	100.0

NA = Not available
Source: Dataquest (October 1993)

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Table A-15
GIS Software Revenue ($M) Worldwide, Gas and Other Utilities

Company	1990 Revenue	1991 Revenue	1992 Revenue	1990-1991 Percent Change	1991-1992 Percent Change	1990 Market Share	1991 Market Share	1992 Market Share
Intergraph	4.4	5.5	6.5	24.0	17.9	25.2	31.1	29.1
Autodesk	1.4	2.9	4.0	99.3	41.8	8.2	16.2	18.2
Siemens Nixdorf Info systeme	2.8	2.0	2.1	-28.9	7.0	16.0	11.3	9.6
Synercom	1.9	2.0	1.6	1.6	-18.5	11.0	11.1	7.2
Other Companies	6.9	5.3	8.0	-23.2	50.0	39.6	30.3	36.0
All Companies	17.5	17.6	22.2	0.5	26.2	100.0	100.0	100.0

Source: Dataquest (October 1993)

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Table A-16
GIS Software Revenue ($M) Worldwide, Business, Marketing and Sales

Company	1990 Revenue	1991 Revenue	1992 Revenue	1990-1991 Percent Change	1991-1992 Percent Change	1990 Market Share	1991 Market Share	1992 Market Share
Strategic Mapping	2.9	4.4	7.3	52.1	64.4	28.1	28.3	29.0
MapInfo	2.0	3.8	5.7	92.3	50.7	19.0	24.2	22.7
ESRI	0.6	2.3	3.7	277.4	57.7	6.0	15.0	14.8
ETAK	0	0.3	1.8	NA	513.3	0	1.9	7.4
Autodesk	0.5	1.1	1.6	142.6	42.1	4.6	7.3	6.5
Other Companies	4.3	3.7	4.9	-14.0	32.4	41.7	23.7	19.6
All Companies	10.3	15.6	25	51.3	60.1	100.0	100.0	100.0

NA = Not available
Source: Dataquest (October 1993)

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Table A-17
GIS Software Revenue ($M) Worldwide, Demographics and Location Analysis

Company	1990 Revenue	1991 Revenue	1992 Revenue	1990-1991 Percent Change	1991-1992 Percent Change	1990 Market Share	1991 Market Share	1992 Market Share
Strategic Mapping	2.4	3.3	5.4	37.8	64.3	30.5	31.7	34.0
MapInfo	0.9	2	3	121.3	50.8	11.4	19.0	18.8
ESRI	0	1.6	2.5	NA	59.6	0	15.1	15.7
Autodesk	0.5	0.6	0.8	21.3	42.1	6.0	5.5	5.1
Other Companies	4.0	2.9	4.1	-27.5	41.4	51.3	27.9	25.9
All Companies	7.8	10.4	15.8	32.8	52.9	100.0	100.0	100.0

NA = Not available
Source: Dataquest (October 1993)

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Table A-18
GIS Software Revenue ($M) Worldwide, Sales Support

Company	1990 Revenue	1991 Revenue	1992 Revenue	1990-1991 Percent Change	1991-1992 Percent Change	1990 Market Share	1991 Market Share	1992 Market Share
MapInfo	1.1	1.8	2.7	68.2	50.6	42.5	34.3	29.6
Strategic Mapping	0.5	1.1	1.9	117.3	64.6	20.6	21.5	20.3
ETAK	0	0.3	1.8	NA	513.3	0	5.7	20.1
ESRI	0.6	0.8	1.2	25.8	53.8	24.6	14.9	13.1
Other Companies	0.3	1.3	1.6	333.3	23.1	12.0	24.5	17.4
All Companies	2.5	5.3	9.2	108.3	74.3	100.0	100.0	100.0

NA = Not available
Source: Dataquest (October 1993)

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Table A-19
GIS Software Revenue ($M) Worldwide, Defense/Military

Company	1990 Revenue	1991 Revenue	1992 Revenue	1990-1991 Percent Change	1991-1992 Percent Change	1990 Market Share	1991 Market Share	1992 Market Share
Intergraph	9.7	14.5	16.7	49.7	15.1	39.0	45.5	46.2
ESRI	7.6	6.2	5.7	-17.8	-8.5	30.4	19.5	15.7
Genasys II	0.8	1.8	3.6	140.0	98.9	3.0	5.6	9.9
GeoVision Systems	0.5	0.4	1.4	-10.2	218.2	2.0	1.4	3.9
Other Companies	6.3	9.0	8.8	42.9	-2.2	25.3	28.2	24.3
All Companies	24.9	31.9	36.2	28.3	13.4	100.0	100.0	100.0

Source: Dataquest (October 1993)

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Table A-20
GIS Software Revenue ($M) Worldwide, Political Districting

Company	1990 Revenue	1991 Revenue	1992 Revenue	1990-1991 Percent Change	1991-1992 Percent Change	1990 Market Share	1991 Market Share	1992 Market Share
ERDAS	0	0	1.4	NA	NA	0	0	22.1
Siemens Nixdorf Info systeme	1.1	1	1.1	-11.6	7.1	16.8	14.1	17.3
Autodesk	0.5	0.6	0.8	21.3	42.1	7.1	8.1	13.3
Strategic Mapping	0.1	0.3	0.5	146.2	62.5	2.0	4.6	8.5
Other Companies	5.0	5.1	2.3	2.0	-54.9	74.6	72.9	37.7
All Companies	6.7	7	6.1	5.6	-13.0	100.0	100.0	100.0

NA = Not available
Source: Dataquest (October 1993)

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Table A-21
GIS Software Revenue ($M) Worldwide, Cartography

Company	1990 Revenue	1991 Revenue	1992 Revenue	1990-1991 Percent Change	1991-1992 Percent Change	1990 Market Share	1991 Market Share	1992 Market Share
ESRI	3.2	3.9	5.8	23.1	49.1	14.4	18.7	26.1
Intergraph	2.3	2.7	3.2	17.1	18.4	10.4	12.8	14.2
Siemens Nixdorf Info systeme	5.6	2.5	2.7	-55.8	7.3	25.5	11.9	12.0
Computervision	1.4	1.6	1.4	9.9	-11.6	6.4	7.4	6.2
EDS	1.8	0.9	1.2	-53.6	42.4	8.3	4.1	5.5
Laser-Scan	1.3	1	1	-23.1	1.0	5.9	4.8	4.5
Other Companies	6.4	8.2	6.9	28.1	-15.9	29.1	39.4	31.1
All Companies	22	20.8	22.2	-5.5	6.7	100.0	100.0	100.0

Source: Dataquest (October 1993)

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Table A-22
GIS Software Revenue ($M), All Platforms Worldwide

Company	1990 Revenue	1991 Revenue	1992 Revenue	1990-1991 Percent Change	1991-1992 Percent Change	1990 Market Share	1991 Market Share	1992 Market Share
GIS/Mapping	459.9	521.2	614.6	13.3	17.9	100.0	100.0	100.0
Base Data	44.6	60.5	63.3	35.7	4.7	9.7	11.6	10.3
Photogrammetry and Surveying	30.6	26.3	27.4	-14.2	4.3	6.7	5.0	4.5
Data for Resale	14.0	34.2	35.9	144.8	5.0	3.0	6.6	5.8
Land Information	134.3	125.7	154.4	-6.5	22.9	29.2	24.1	25.1
Land Records	80.2	75.5	89.1	-5.9	18.0	17.4	14.5	14.5
Planning; Land Use	54.2	50.2	65.3	-7.3	30.1	11.8	9.6	10.6
Biological	28.8	37.5	49.7	30.0	32.7	6.3	7.2	8.1
Environmental	20.0	24.2	31.1	20.9	28.7	4.3	4.6	5.1
Forestry and Agriculture	8.8	13.3	18.6	50.8	40.2	1.9	2.6	3.0
Geoscience	42.4	59.9	57.2	41.1	-4.5	9.2	11.5	9.3
Infrastructure Mgmt.	28.9	32.0	43.5	10.8	36.0	6.3	6.1	7.1
Transportation	14.9	18.6	25.8	24.2	39.2	3.2	3.6	4.2
Emergency Svcs. and Disp. Mgmt.	14.0	13.5	17.7	-3.5	31.6	3.0	2.6	2.9
AM/FM (networked utilities)	117.0	130.1	157.0	11.3	20.6	25.4	25.0	25.5
Telecommunications	20.8	43.9	49.6	110.7	13.1	4.5	8.4	8.1
Electric	45.6	42.0	51.3	-7.8	22.1	9.9	8.1	8.3
Water/Wastewater	33.1	26.7	33.9	-19.4	27.1	7.2	5.1	5.5
Gas and other Utilities	17.5	17.6	22.2	0.5	26.2	3.8	3.4	3.6

(Continued)

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Table A-22 (Continued)
GIS Software Revenue ($M), All Platforms Worldwide

Company	1990 Revenue	1991 Revenue	1992 Revenue	1990-1991 Percent Change	1991-1992 Percent Change	1990 Market Share	1991 Market Share	1992 Market Share
Business, Marketing and Sales	10.3	15.6	25.0	51.3	60.1	2.2	3.0	4.1
Demo and Location Analysis	7.8	10.4	15.8	32.8	52.9	1.7	2.0	2.6
Sales Support	2.5	5.3	9.2	108.3	74.3	0.5	1.0	1.5
Geopolitics	31.5	38.9	42.3	23.5	8.6	6.9	7.5	6.9
Defense/Military	24.9	31.9	36.2	28.3	13.4	5.4	6.1	5.9
Political Districting	6.7	7.0	6.1	5.6	-13.0	1.4	1.3	1.0
Cartography	22.0	20.8	22.2	-5.5	6.7	4.8	4.0	3.6

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Table A-23
GIS Software Revenue ($M), Personal Computer Worldwide

Company	1990 Revenue	1991 Revenue	1992 Revenue	1990-1991 Percent Change	1991-1992 Percent Change	1990 Market Share	1991 Market Share	1992 Market Share
GIS/Mapping	95.3	118.2	152.0	24.0	28.6	100.0	100.0	100.0
Base Data	17.5	12.0	16.0	-31.1	32.6	18.3	10.2	10.5
Photogrammetry and Surveying	8.8	6.8	10.8	-22.7	59.1	9.2	5.7	7.1
Data for Resale	8.7	5.2	5.2	-39.6	-1.7	9.1	4.4	3.4
Land Information	31.3	32.8	41.8	4.8	27.6	32.8	27.7	27.5
Land Records	13.0	15.6	19.3	20.1	23.8	13.6	13.2	12.7
Planning; Land Use	18.3	17.2	22.5	-6.1	31.1	19.2	14.5	14.8
Biological	6.9	12.3	13.8	77.8	12.2	7.2	10.4	9.1
Environmental	5.1	7.6	8.5	48.4	11.3	5.4	6.4	5.6
Forestry and Agriculture	1.8	4.7	5.3	162.4	13.7	1.9	3.9	3.5
Geoscience	7.1	9.5	14.4	34.5	51.7	7.4	8.0	9.5
Infrastructure Mgmt.	4.4	6.9	9.5	58.6	38.1	4.6	5.8	6.3
Transportation	2.5	4.2	6.1	66.4	45.8	2.7	3.6	4.0
Emergency Svcs. and Disp. Mgmt.	1.8	2.7	3.4	47.8	26.0	1.9	2.3	2.2
AM/FM (networked utilities)	14.6	22.1	27.7	51.1	25.2	15.3	18.7	18.2
Telecommunications	0.9	7.3	9.1	719.1	24.7	0.9	6.2	6.0
Electric	7.3	5.5	7.2	-24.8	31.4	7.6	4.6	4.7
Water/Wastewater	4.4	4.9	5.3	10.7	9.2	4.6	4.1	3.5
Gas and Other Utilities	2.1	4.5	6.1	117.1	36.0	2.2	3.8	4.0

(Continued)

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Table A-23 (Continued)
GIS Software Revenue ($M), Personal Computer Worldwide

Company	1990 Revenue	1991 Revenue	1992 Revenue	1990-1991 Percent Change	1991-1992 Percent Change	1990 Market Share	1991 Market Share	1992 Market Share
Business, Marketing and Sales	6.4	12.1	18.7	87.9	54.9	6.7	10.2	12.3
Demo and Location Analysis	4.5	7.6	10.8	68.4	41.3	4.8	6.5	7.1
Sales Support	1.9	4.5	7.9	134.2	78.2	2.0	3.8	5.2
Geopolitics	4.5	6.6	7.7	45.1	16.6	4.7	5.5	5.0
Defense/Military	3.3	4.3	5.5	29.7	28.7	3.5	3.6	3.6
Political Districting	1.2	2.3	2.1	86.9	-6.1	1.3	1.9	1.4
Cartography	2.7	4.0	2.5	48.7	-37.5	2.8	3.4	1.7

Source: Dataquest (October 1993)

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Table A-24
GIS Software Revenue ($M), Technical Workstation

Company	1990 Revenue	1991 Revenue	1992 Revenue	1990-1991 Percent Change	1991-1992 Percent Change	1990 Market Share	1991 Market Share	1992 Market Share
GIS/Mapping	274.8	298.9	377.2	8.8	26.2	100.0	100.0	100.0
Base Data	22.0	38.7	39.6	75.9	2.3	8.0	13.0	10.5
Photogrammetry and Surveying	19.6	16.7	15.1	-14.7	-9.7	7.1	5.6	4.0
Data for Resale	2.4	22.0	24.5	812.9	11.4	0.9	7.4	6.5
Land Information	78.2	73.5	95.4	-6.0	29.8	28.5	24.6	25.3
Land Records	49.7	46.7	59.1	-6.1	26.7	18.1	15.6	15.7
Planning; Land Use	28.5	26.8	36.3	-5.9	35.1	10.4	9.0	9.6
Biological	16.8	19.4	28.2	15.0	45.5	6.1	6.5	7.5
Environmental	11.5	12.7	18.0	10.4	41.3	4.2	4.3	4.8
Forestry and Agriculture	5.3	6.6	10.2	24.8	53.5	1.9	2.2	2.7
Geoscience	29.0	32.2	31.8	10.8	-1.1	10.6	10.8	8.4
Infrastructure Mgmt.	18.4	18.6	27.8	0.9	49.4	6.7	6.2	7.4
Transportation	8.8	10.7	16.7	21.1	57.0	3.2	3.6	4.4
Emergency Svcs. and Disp. Mgmt.	9.6	7.9	11.0	-17.7	39.1	3.5	2.6	2.9
AM/FM (networked utilities)	71.4	74.9	103.7	4.9	38.4	26.0	25.1	27.5
Telecommunications	13.7	22.6	31.8	65.2	40.6	5.0	7.6	8.4
Electric	25.5	26.6	35.7	4.5	34.1	9.3	8.9	9.5
Water/Wastewater	22.3	15.8	23.3	-29.4	47.7	8.1	5.3	6.2
Gas and Other Utilities	10.0	9.9	12.9	-0.2	30.2	3.6	3.3	3.4

(Continued)

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Table A-24 (Continued)
GIS Software Revenue ($M), Technical Workstation

Company	1990 Revenue	1991 Revenue	1992 Revenue	1990-1991 Percent Change	1991-1992 Percent Change	1990 Market Share	1991 Market Share	1992 Market Share
Business, Marketing and Sales	3.1	2.4	4.7	-21.8	93.9	1.1	0.8	1.3
Demographics and Location Analysis	2.7	1.9	3.9	-28.9	101.5	1.0	0.6	1.0
Sales Support	0.4	0.5	0.8	28.2	64.0	0.1	0.2	0.2
Geopolitics	21.4	26.8	29.7	25.2	10.8	7.8	9.0	7.9
Defense/Military	17.9	23.5	26.1	31.2	11.1	6.5	7.9	6.9
Political Districting	3.4	3.2	3.5	-6.1	8.7	1.3	1.1	0.9
Cartography	14.4	12.4	16.4	-13.7	32.0	5.2	4.2	4.4

Source: Dataquest (October 1993)

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Table A-25
GIS Software Revenue ($M), Europe

Company	1990 Revenue	1991 Revenue	1992 Revenue	1990-1991 Percent Change	1991-1992 Percent Change	1990 Market Share	1991 Market Share	1992 Market Share
GIS/Mapping	190.7	197.4	228.6	3.5	15.8	100.0	100.0	100.0
Base Data	14.3	32.5	35.1	127.7	8.0	7.5	16.5	15.4
Photogrammetry and Surveying	11.1	9.2	9.4	-17.2	2.6	5.8	4.7	4.1
Data for Resale	3.2	23.3	25.7	635.0	10.1	1.7	11.8	11.2
Land Information	59.1	53.5	62.2	-9.5	16.2	31.0	27.1	27.2
Land Records	40.3	35.7	39.1	-11.5	9.6	21.2	18.1	17.1
Planning; Land Use	18.8	17.9	23.1	-5.0	29.5	9.9	9.0	10.1
Biological	11.2	11.4	15.5	1.5	36.7	5.9	5.8	6.8
Environmental	8.1	8.1	10.7	-1.1	33.3	4.3	4.1	4.7
Forestry and Agriculture	3.1	3.3	4.8	8.5	45.0	1.6	1.7	2.1
Geoscience	11.0	15.1	12.7	37.8	-16.1	5.7	7.6	5.5
Infrastructure Mgmt.	9.9	9.2	11.6	-7.6	26.5	5.2	4.7	5.1
Transportation	4.8	5.7	7.1	19.6	22.8	2.5	2.9	3.1
Emergency Svcs. and Disp. Mgmt.	5.1	3.4	4.6	-32.9	32.6	2.7	1.7	2.0
AM/FM (networked utilities)	58.6	53.3	64.5	-9.1	20.9	30.7	27.0	28.2
Telecommunications	10.0	17.1	19.7	70.7	15.4	5.2	8.6	8.6
Electric	21.0	18.1	21.9	-13.8	20.6	11.0	9.2	9.6
Water/Wastewater	18.7	10.8	13.8	-42.2	28.0	9.8	5.5	6.0
Gas and Other Utilities	8.9	7.3	9.1	-17.7	24.4	4.7	3.7	4.0

(Continued)

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Table A-25 (Continued)
GIS Software Revenue ($M), Europe

Company	1990 Revenue	1991 Revenue	1992 Revenue	1990-1991 Percent Change	1991-1992 Percent Change	1990 Market Share	1991 Market Share	1992 Market Share
Business, Marketing and Sales	3.3	2.2	4.1	-32.7	82.4	1.7	1.1	1.8
Demo and Location Analysis	3.1	1.6	2.9	-47.5	78.1	1.6	0.8	1.2
Sales Support	0.3	0.6	1.2	148.0	93.5	0.1	0.3	0.5
Geopolitics	10.5	11.3	13.0	8.1	14.6	5.5	5.7	5.7
Defense/Military	7.7	8.9	10.5	16.3	17.2	4.0	4.5	4.6
Political Districting	2.8	2.4	2.5	-14.5	4.7	1.4	1.2	1.1
Cartography	12.9	8.9	10.0	-30.7	11.8	6.7	4.5	4.4

Source: Dataquest (October 1993)

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Table A-26
GIS Software Revenue ($M), Asia

Company	1990 Revenue	1991 Revenue	1992 Revenue	1990-1991 Percent Change	1991-1992 Percent Change	1990 Market Share	1991 Market Share	1992 Market Share
GIS/Mapping	29.6	37.2	57.5	25.6	54.6	100.0	100.0	100.0
Base Data	3.1	3.9	5.3	28.0	34.9	10.4	10.6	9.2
Photogrammetry and Surveying	2.1	1.6	3.2	-23.5	95.1	7.2	4.4	5.5
Data for Resale	0.9	2.3	2.1	144.7	-7.8	3.2	6.2	3.7
Land Information	7.9	7.8	12.5	-0.4	59.7	26.6	21.1	21.8
Land Records	5.0	4.6	7.3	-7.1	59.1	16.7	12.4	12.7
Planning; Land Use	2.9	3.2	5.2	11.0	60.5	9.9	8.7	9.1
Biological	1.6	2.0	3.2	24.5	59.6	5.5	5.5	5.6
Environmental	1.1	1.4	2.0	29.7	37.5	3.8	3.9	3.4
Forestry and Agriculture	0.5	0.6	1.3	13.5	113.6	1.8	1.6	2.2
Geoscience	3.5	5.7	4.9	63.8	-12.7	11.7	15.2	8.6
Infrastructure Mgmt.	1.7	2.3	4.9	37.0	115.9	5.6	6.1	8.5
Transportation	0.8	1.4	3.1	69.9	117.7	2.8	3.8	5.3
Emergency Svcs. and Disp. Mgmt.	0.8	0.9	1.8	3.7	112.9	2.8	2.3	3.2
AM/FM (networked utilities)	8.3	11.8	20.5	42.3	74.4	27.9	31.6	35.7
Telecommunications	0.9	4.9	5.1	416.0	4.3	3.2	13.0	8.8
Electric	4.2	3.1	5.6	-26.2	80.3	14.2	8.3	9.7
Water/Wastewater	1.9	2.3	6.2	20.2	165.5	6.5	6.2	10.7
Gas and Other Utilities	1.2	1.5	3.7	24.4	148.6	4.0	4.0	6.4

(Continued)

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Table A-26 (Continued)
GIS Software Revenue ($M), Asia

Company	1990 Revenue	1991 Revenue	1992 Revenue	1990-1991 Percent Change	1991-1992 Percent Change	1990 Market Share	1991 Market Share	1992 Market Share
Business, Marketing and Sales	0.2	0.4	0.9	75.0	114.3	0.8	1.1	1.6
Demo and Location Analysis	0.2	0.3	0.6	36.8	134.6	0.6	0.7	1.1
Sales Support	0.1	0.2	0.3	220.0	81.3	0.2	0.4	0.5
Geopolitics	2.2	2.3	3.3	5.6	44.9	7.3	6.1	5.7
Defense/Military	1.6	1.9	2.9	23.2	52.9	5.2	5.1	5.1
Political Districting	0.6	0.4	0.4	-40.0	2.8	2.0	1.0	0.6
Cartography	1.3	1.0	1.9	-19.7	86.3	4.3	2.7	3.3

Source: Dataquest (October 1993)

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Table A-27
GIS Software Revenue ($M), Rest of World

Company	1990 Revenue	1991 Revenue	1992 Revenue	1990-1991 Percent Change	1991-1992 Percent Change	1990 Market Share	1991 Market Share	1992 Market Share
GIS/Mapping	24.8	33.9	41.6	36.4	22.9	100.0	100.0	100.0
Base Data	1.3	1.6	3.1	20.6	95.6	5.3	4.7	7.4
Photogrammetry and Surveying	0.7	0.9	2.4	34.3	156.4	2.8	2.8	5.8
Data for Resale	0.6	0.6	0.7	4.9	6.3	2.5	1.9	1.6
Land Information	8.0	8.0	9.6	0.4	20.3	32.0	23.6	23.1
Land Records	4.7	4.6	5.1	-1.3	9.3	18.8	13.6	12.1
Planning; Land Use	3.3	3.4	4.6	2.8	35.4	13.2	9.9	10.9
Biological	1.8	3.0	3.1	67.6	4.1	7.1	8.7	7.4
Environmental	1.0	1.6	1.9	59.2	17.7	4.1	4.8	4.6
Forestry and Agriculture	0.7	1.3	1.1	79.5	-13.0	2.9	3.9	2.7
Geoscience	3.9	7.9	6.7	101.0	-14.8	15.8	23.3	16.2
Infrastructure Mgmt.	1.8	1.8	2.8	1.7	53.0	7.2	5.3	6.7
Transportation	1.2	1.1	1.7	-8.7	59.0	4.6	3.1	4.0
Emergency Svc.s. and Disp. Mgmt.	0.6	0.8	1.1	20.6	44.7	2.5	2.2	2.6
AM/FM (networked utilities)	5.5	5.9	8.4	7.5	42.4	22.1	17.4	20.2
Telecommunications	1.6	1.7	2.9	10.8	66.1	6.3	5.1	6.9
Electric	1.7	2.1	2.8	26.9	30.2	6.7	6.3	6.6
Water/Wastewater	1.8	1.3	1.6	-28.2	26.0	7.1	3.7	3.8
Gas and other Utilities	0.5	0.8	1.1	61.7	50.0	1.9	2.2	2.7

(Continued)

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Table A-27 (Continued)
GIS Software Revenue ($M), Rest of World

Company	1990 Revenue	1991 Revenue	1992 Revenue	1990-1991 Percent Change	1991-1992 Percent Change	1990 Market Share	1991 Market Share	1992 Market Share
Business, Marketing and Sales	0.4	1.8	2.8	300.0	59.1	1.8	5.2	6.7
Demo and Location Analysis	0.2	1.1	1.8	438.1	58.4	0.8	3.3	4.3
Sales Support	0.2	0.6	1.0	173.9	60.3	0.9	1.9	2.4
Geopolitics	1.7	3.1	4.1	85.2	30.0	6.8	9.2	9.8
Defense/Military	1.6	2.8	3.8	79.4	36.0	6.2	8.2	9.1
Political Districting	0.1	0.4	0.3	150.0	-17.1	0.6	1.0	0.7
Cartography	0.5	0.9	1.1	77.6	27.6	2.0	2.6	2.7

Source: Dataquest (October 1993)

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Appendix B
Definitions and Methodology

What Is a GIS?

GISs are based on the concept of using geography (that is, spatial or location references) as the common denominator for linking data. A GIS is a computer system that supports acquiring, manipulating, analyzing, and presenting spatially referenced data. Applications vary widely and can be broadly classified as being in mapmaking, land records, management of natural or man-made assets (such as forests or electric utility networks), demographics, and management of a competitive position (business or military). A GIS provides a methodology for organizing geographic data; it blends graphic and alphanumeric databases in an organized manner so that users can manipulate information from multiple databases. Data used in a GIS varies widely by the user's application. Figure B-1 shows typical data sets used in various GISs.

The GIS market grew from several traditions that together allow users to assemble systems using a rich array of technologies. The earliest computer cartographic products were essentially CAD systems put to use creating maps. This vector drawing tradition laid the basis for later AM/FM systems used by utilities to manage large-scale networked assets. Raster and grid-based systems, using first plastic overlays and later computers, laid the groundwork for early geographic analysis systems. Early image processing systems, while extremely expensive, helped develop image manipulation techniques. All three markets moved slowly, dominated by turnkey vendors.

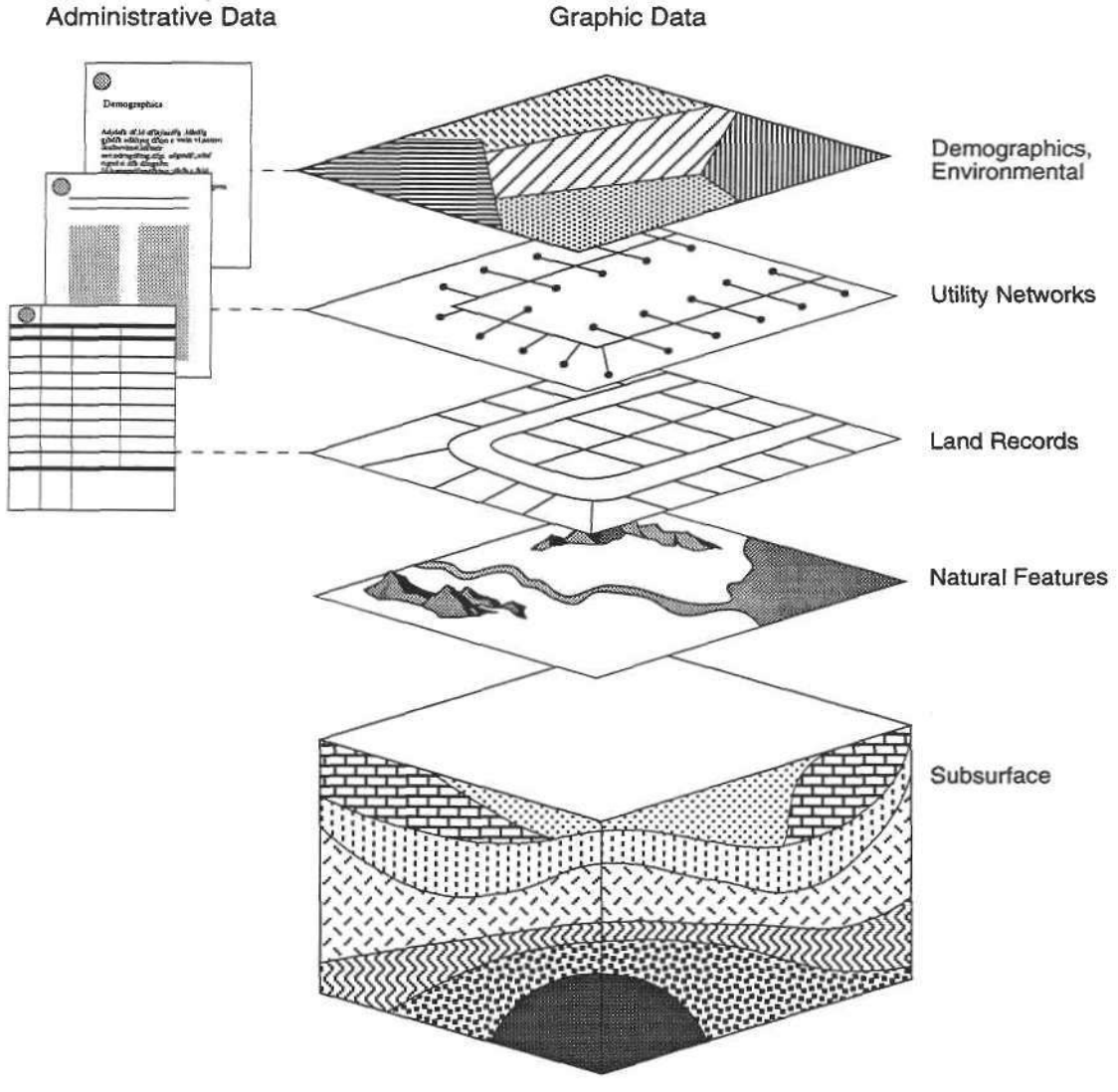
In 1982, ESRI introduced ARC/INFO, and CEO Jack Dangermond (and others) began promoting analysis-oriented software built on a topological data model. The ability to directly reference adjacent polygons, lines, or points is the core function behind the concept of a spatial database. Spatial databases are inevitably connected to tabular databases containing feature or attribute information in alphanumeric form.

Mr. Dangermond's charismatic evangelism caught the attention of university researchers and government workers tasked with managing and understanding geographically dispersed assets (such as a city or a wildlife habitat). As awareness grew, so did the market. By the late 1980s, image-recording technologies became somewhat cost-effective, and raster images from satellites or aerial photography joined the list of possible components in a typical GIS. Cross-fertilization among this combination of traditions and technologies continues to feed market growth.

GISs are occasionally confused with CAD systems because it is possible to use the same core drawing software for either application. A key difference between the two is that the CAD user starts with a blank sheet of paper on which even the first sketch may soon be put to use, whereas the

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Figure B-1
Typical GIS Database Components



Source: Dataquest (October 1993)

G2002198

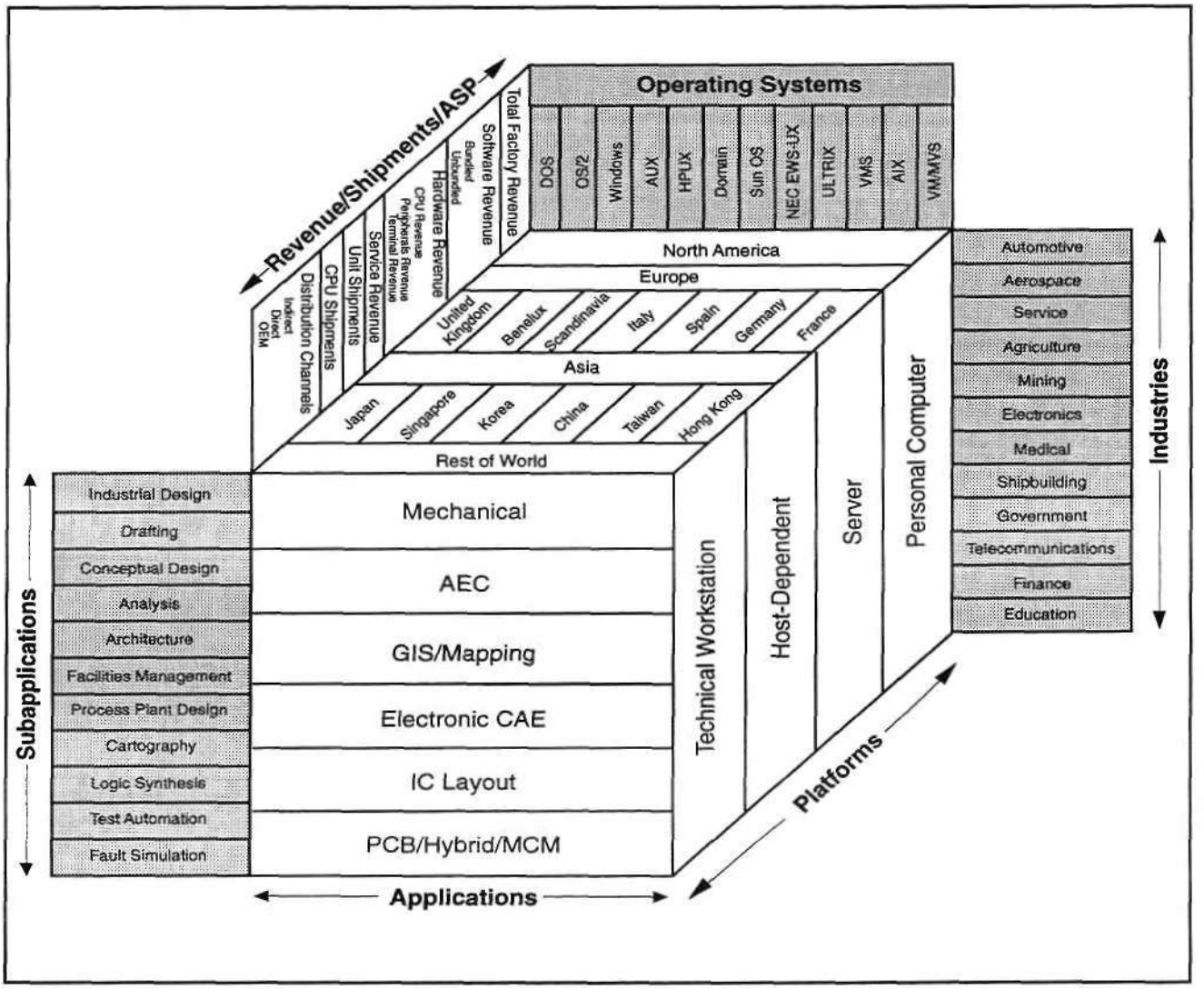
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GIS user cannot do useful work before developing an adequate base map. Also, the data necessary to represent the world as it is, is much larger and more complex than the data necessary to represent new products. Thus, compared to CAD users, GIS users must have bigger computers and more patience to reach casual user status.

Definitions

To provide a comprehensive view of the GIS industry, Dataquest's CAD/CAM/CAE/GIS group maintains a large database of industry information. The type of information contained in the database is depicted in Figure B-2. This section lists the definitions that are specific to this database and to this report.

Figure B-2
CAD/CAM/CAE/GIS Market Database



Source: Dataquest (October 1993) G2000995

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Application definitions include the following:

- **Geographic information systems (GIS)**—This is a computer-based technology, composed of hardware, software, and data used to capture, edit, display, and analyze spatial (tagged by location) information. GIS software revenue is the sum of the applications subsequently listed.
  - **Base data**—Software used to create baseline geographic data calculated as the sum of revenue from photogrammetry and surveying and data for resale applications, as follows:
    - **Photogrammetry and surveying**—Software used in developing original data for a GIS system based on ground surveying or on remotely sensed data such as aerial photography or satellite imagery.
    - **Data for resale**—Includes GIS software used to create data for resale to end users and revenue from the sale of geographic data.
  - **Land information**—The sum of revenue from land records and planning and land use applications, as follows::
    - **Land records**—GIS software used to manage land ownership or parcel information; typical user is a tax assessor.
    - **Planning and land use**—GIS software used to manage land use; typical user is a city planner.
  - **Biological**—Software used to manage and analyze plant and animal life. Calculated as the sum of revenue from environmental/public health and safety, and forestry and agriculture, as follows:
    - **Environmental: public health and safety**—GIS software used to manage natural resources and to monitor and analyze environmental factors that contribute to the welfare of the earth and its people.
    - **Forestry and agriculture**—GIS software used for management of forests and crops.
  - **Geoscience** (formerly energy exploration)—GIS software used to manage oil, gas, and mineral exploration projects. Emphasis is typically on subsurface data.
  - **Infrastructure management**—Management and analysis of man-made assets except for utilities. Calculated as the sum of revenue from transportation and logistics, and emergency services and dispatch management applications, as follows:
    - **Transportation and logistics**—GIS software used in transportation applications such as road or rail network modeling or route planning.
    - **Emergency and dispatch services**—GIS software used to manage emergency services such as "911" services and also for-profit dispatch management systems.

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- **AM/FM (automated mapping/facility management)**—GIS software used for managing utility industry networks, based on the following categories:
  - Telecommunications/telephone
  - Electric
  - Water and wastewater
  - Gas and other utilities
- **Business marketing and sales**—GIS software used to promote and sell services and products, and to identify and evaluate opportunities in a competitive environment. Calculated as the sum of demographic and location analysis, and sales and directional support, as follows:
  - **Demographic and location analysis**—GIS software used to analyze problems in demographics or site characteristics. Examples include sales territory selection, site selection, or population analysis. Typical users are in advertising and marketing organizations, insurance, banking, and real estate.
  - **Sales and directional support**—GIS software used to help salespeople locate targets of a sales effort (for example, to locate potential customers, specific properties for sale, and driving routes to the properties). It also includes software used to help customers locate establishments, typically used as travelers' aids.
- **Geopolitics**—The sum of software used in defense/military and political districting applications, as follows:
  - **Defense/military**—GIS software used to manage military or defense projects for the purpose of command and control.
  - **Political districting**—GIS software used to manage the redistricting process; based on census data.
- **Cartography**—GIS software used in mapmaking applications.

Regional definitions include the following:

- **North America**—Includes United States and Canada
- **Europe**—Includes the United Kingdom, Scandinavia, Benelux, France, Germany, Italy, Spain, and Rest of Europe
- **Asia**—Includes Japan, Singapore, Taiwan, Korea, China, and Hong Kong
- **Rest of World**—All other countries including Australia, New Zealand, Oceania, Africa, Central America, South America, and the Middle East

Platform definitions include the following:

- **Technical workstation**—This is a single-user computer that is distinguished from a personal computer by its features and by the user's potential range of expansion on the platform. Features include a virtual, multitasking operating system (UNIX, VMS, DOMAIN); the computer is designed by manufacturer to run high-performance graphic applications in a multiuser/multitasking environment.

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- **Host-dependent**—This is a shared logic system in which the external workstations' functions are dependent on a host computer.
- **Server**—A server is a computer that transparently provides its resources for use by other computer systems. It is a system on a network that provides specific functionality to other computer systems: the clients. Functions include file storage, database access, compute capability, and others. Dataquest tracks the following major categories of servers used for GIS applications: compute servers, print servers, file servers, and database servers.
- **Personal computer**—This is defined as a single-user computer that is distinguished from a technical workstation by its features and by the user's potential range of expansion on the platform. Features found in technical workstations (such as a virtual operating system, networking, high-performance graphics, multiuser/multitasking capability) are optional rather than integrated by the manufacturer.

Revenue/shipments/ASP definitions include the following:

- **Total factory revenue**—Total factory revenue is defined as the amount of money received by a manufacturer for its goods measured in U.S. dollars. Total factory revenue does not include revenue that a company may receive from products that are sold to another company for resale (OEM revenue).
- **Unit shipment**—Unit shipment is defined as the number of products delivered (that is, computer seats).
- **Software revenue**—Software revenue is revenue derived from the sale of bundled (part of a turnkey system) and unbundled software.
- **Service revenue**—Service revenue is defined as revenue derived from the service and support of GIS systems. Service revenue includes maintenance fees, software management and operations services (including help desk, education and training), service bureau, application development, consulting, and integration services.

Market Data Methodology

Dataquest uses both primary and secondary sources to produce our market size and market share data. In the fourth quarter of each year, we survey all major participants in the GIS industry. Each vendor is offered the opportunity to self-report the information required. Although there is a primary contact for each company, for large companies we survey different individuals across product lines and across geographic regions, working from a large database of contacts on all sources of information. Thus, the larger the company, the more contacts we make for the purpose of cross-checking information. We believe that this method, in which we invest more scrutiny in larger companies, is an important contributor to reliable overall market sizing. Examples of the job titles of people contacted for information are the following:

- President and CEO
- Vice president and general manager

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- Vice president of marketing
- Vice president, strategic product planning
- Director of strategic planning
- Director of marketing
- Director of market development
- Manager, CAD/CAM/CAE/GIS marketing programs
- GIS product line manager
- Market research analyst

The Audit Process

Data supplied by vendors are evaluated against information drawn from many sources, including the following:

- Annual reports, SEC documents, and credit reports
- Company publications and press releases
- Reseller and supplier reports and reports from vendors' competitors
- Interviews with knowledgeable manufacturers, distributors, and users
- Reports from financial analysts
- Estimates made by knowledgeable and reliable industry spokespersons
- Formal user studies
- Revenue published by major industry participants
- Information and data from online data banks
- Government data or trade association data
- Published product literature and price lists
- Relevant economic data
- Articles in both the general and trade press

In addition, Dataquest sums individual vendor revenue across other markets covered by Dataquest to make sure that revenue is not credited twice.

We resurvey select companies during the second quarter of the following year to verify final annual results and then publish final market share information based on this updated information. Year-end 1992 financial results released in the first half of 1993 have also been checked and incorporated into the final numbers. This report draws from that final market data.

Dataquest analysts have many years of experience in how to apply the above tools to get the most accurate information possible on a particular company (such as what technique to use when). We believe that the estimates presented here are the most accurate and meaningful generally available today.

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Dataquest's GIS market numbers may be higher than those reported by other sources. We survey worldwide, which involves more vendors, higher total market revenue, lower market share per vendor, and a more accurate market picture—which is particularly useful when comparing regions or applications.

It is Dataquest's policy to update our market information continually for any year, based on any new data received, to arrive at the most accurate market representation possible. For example, when we add a vendor to our database, that vendor's historical revenue is also added so as not to perturb total rates of growth from year to year—which then produces an increase in total revenue in the earlier years. Because our goal is to refine our existing market model, historical data may change over time whenever new information is received.

Notes on Market Data

Please note that despite the care taken in gathering and analyzing the available data and in attempting to categorize that data in a meaningful way, careful attention must be paid to the definitions and assumptions used herein when interpreting the estimates presented in this document. Various companies, government agencies, and trade associations may use slightly different definitions of product categories and regional groupings or they may include different companies in their summaries. These differences should be kept in mind when making comparisons between this data and that provided by others.

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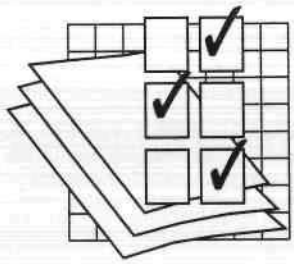
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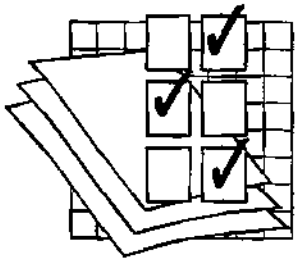
User Wants and Needs

1993

Program: AEC and GIS Applications Worldwide
Product Code: CAEC-WW-UW-9301
Publication Date: June 28, 1993

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AEC CAD
User Wants and Needs
1993 Edition



User Wants and Needs
1993

Program: AEC and GIS Applications Worldwide
Product Code: CAEC-WW-UW-9301
Publication Date: June 28, 1993

Chapter 1
Executive Summary

Introduction

CAD users in architecture, engineering, and construction are rarely examined. Small sites and casual users may be difficult to characterize because of the diversity of applications. However, many large users with correspondingly large CAD budgets do exist. This study is an attempt to characterize the larger sites that have been investing in CAD for years. These sites represent important opportunities to vendors and knowledgeable beacons of light for less experienced users.

Study Objectives

This study examines users of AEC CAD systems. This report is based on the results of a telephone survey in North America of 188 CAD managers, department managers, and responsible professionals deeply involved in AEC CAD systems. The specific objectives of this study were the following:

- To understand the importance of specific system factors from the customers' perspective
- To advance understanding of what users need to be successful
- To calibrate customer evaluations of vendor performance
- To characterize AEC CAD users at the largest and most influential sites, their environment, and their spending expectations

Key Findings

The major findings of the survey include the following:

- Users believe that the three most important considerations in choosing an AEC CAD system are as follows:
  - Product is compatible with our environment
  - Vendor is responsive to our needs
  - Product is easy to learn and use
- Because understanding what the customer needs to succeed is key to developing well-articulated positioning statements, which point to benefits the customer actually wants, users were asked to identify which indicators they believe represent key success factors for their own company. The following is what keeps AEC CAD customers awake at night:
  - Maintaining a competitive advantage
  - Responding to regulatory requirements
  - Timely and accurate quotes or bids
  - Reducing rework at the construction site

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- Intergraph Microstation product line enjoys slightly higher customer satisfaction than AutoCAD, and both products are slightly above the survey average in customer satisfaction. Both products are quite close in terms of customer satisfaction on all key indicators.
- A description of the characteristics of successful users paints a portrait of coherence and intelligence—users who are making design tools work for them at both a practical level and in ways that will help integrate their efforts with their company and their customers.
- There is a dramatic difference between successful and troubled sites on standards: 80 percent of successful sites have identified standard brands for CAD software purchases, whereas only 55 percent of troubled sites do. Standards do not appear to inhibit success.
- Sites that have no standards for purchasing CAD software are the ones that are likely to consider switching vendors. Having one's CAD software specified as "standard" at a site may be one of the most effective things a company can do to protect its installed base.
- The most startling difference between successful and troubled sites centers around agreement with the statement, "Engineering management here thoroughly understands the capabilities of design software." Results point to a potentially critical problem and suggest that engineering management must be intimately involved with the capabilities of design software if the investment is to succeed.
- Approximately 44 percent of existing sites expect computer and software spending on AEC CAD to remain the same in 1994; 44 percent expect an increase, 10 percent expect a decrease, and 2 percent are undecided. This will translate to an overall increase of 8 percent in spending in the installed base of large users.
- We estimate that 46 percent of software seats required to saturate the perceived needs of process plant design users at large sites have already been purchased, and penetration ranges from a low of 39 percent in facilities design/management sites to a high of 63 percent among architectural sites. Process plant design and civil engineering sites are relatively similar in terms of penetration, but the firms primarily engaged in civil engineering are considerably smaller.
- About one-third of the UNIX users expect to switch to NT. This corresponds with the CAD/CAM/CAE Industry Service's expectation that NT will nibble away at UNIX and DOS users, which will leave very little UNIX in the AEC CAD market in a few years. Intergraph's NT publicity campaign appears to be working within the company's user base: many of the Intergraph workstation users are the ones that plan to switch to NT.

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Recommendations

We offer the following recommendations:

- Vendors must work to be easy to get along with. The three most important indicators, "product is compatible with our environment," "vendor is responsive to our needs," and "product is easy to learn and use," point to a user base that is looking to remove the pain associated with computers rather than to drive themselves to new levels of automation.
- Key features and services that matter to experienced users have been identified. New users can use these indicators to develop their guidelines for purchase; vendors can use them to make informed decisions on where to enhance their offerings. Using the results in this survey, a targeted strategy can be developed that is oriented around either primary application or firm type.
- Factors that distinguish successful sites have been identified; users and vendors must work together to create user environments that are structured for success because users need to succeed, which helps vendors grow in the AEC CAD market. Long-term sales are built on products that work for the buyer.

Structure of this Report

The remainder of the report is organized as follows:

- *Chapter 2, Study Foundations,* provides the information required for an in-depth analysis of any of the chapters that follow, including details on survey methodology and top-level site demographics.
- *Chapter 3, The AEC CAD Environment,* provides insight into how AEC CAD system implementations are deployed; outlines details on system implementation; describes users' future expectations; examines how AEC CAD users spend their time.
- *Chapter 4, What Users Want:* Vendor *Performance* and *Customer Satisfaction,* measures vendor performance against customer preferences on 12 key indicators; identifies product improvements that all users want.
- *Chapter 5, What Users Need: Success with CAD,* identifies key success factors at user sites; compares successful and troubled sites and analyzes underlying factors that differentiate the successful sites.
- *Chapter 6, Buying Plans and System Penetration,* shows how users plan to change their spending in 1994; evaluates AEC CAD market penetration.
- *Chapter 7, Summary and Recommendations,* outlines key findings from the study; offers recommendations on how to put those findings to use the best.
- *Appendix A* provides the survey questionnaire.
- *Project Leader:* Kathryn Hale
- *Project Team: Daniel Herrera, Kim Kisling, Rick Singleton*

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Chapter 2
Study Foundations

Methodology

Dataquest developed a survey questionnaire that was administered by Dataquest's Primary Research group in San Jose, California, using an online computer-aided telephone interviewing system (see Appendix A). After the interviews were completed and checked, the participants' answers were analyzed using several different computer-based analysis tools.

The selection of these 188 North American sites was based on the presence of active use of CAD/CAM in an AEC application. The respondents were screened by the telephone interviewers to ensure that they were qualified to answer a broad range of questions about their AEC CAD system. The study sample was generated primarily from the ENR 500 directory, from the largest sites in the AIA directory, from Dataquest databases of previously identified AEC CAD sites, and from a database owned by Computer Intelligence of La Jolla, California.

A stratified sampling plan was used based on the type of firm. For service companies, firm types are the same as those used by Engineering News Record (ENR). We also specifically targeted the 25 firms that ENR identifies as being the largest. All respondents are in the service industry, except for a small group labeled "nonservices." This group is in no way a cross section of users sprinkled throughout industries, but rather it is deliberately populated with chemical and petroleum companies, and State Departments of Transportation, groups that both buy a considerable number of CAD systems and a considerable amount of design work from the service companies. Overall, the goal of this survey was to reach early adopters with money, and we believe we have succeeded.

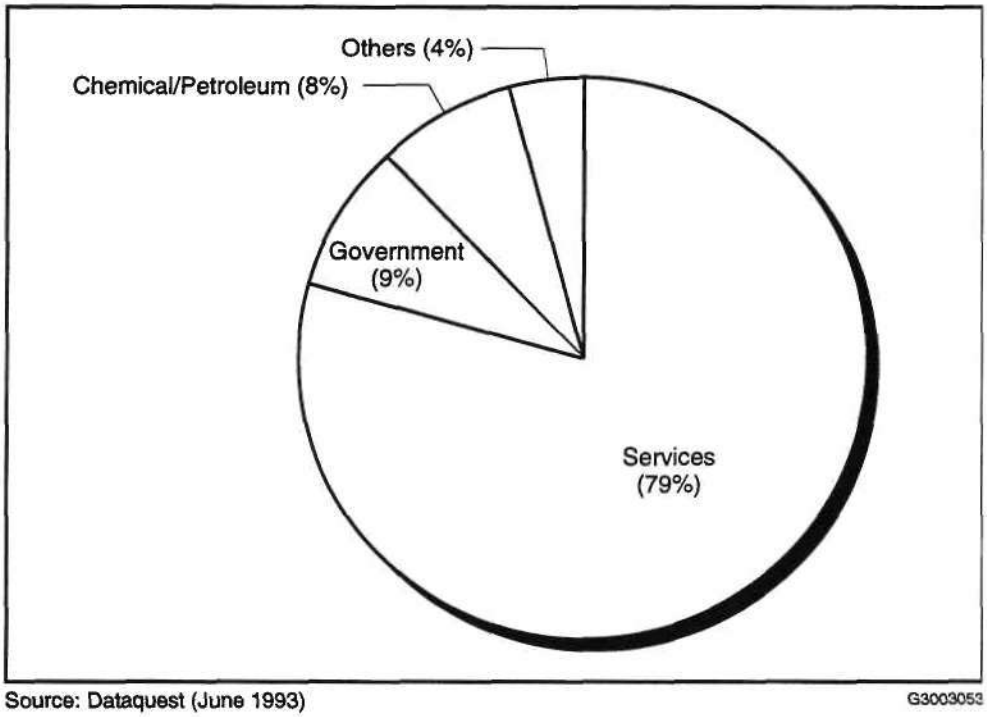
Respondent Demographics

More than 79 percent of sites were in design, consulting, or design-and-build industry (See Figure 2-1), compared with 47 percent of AEC CAD software revenue that comes from services and construction. Again, this bias is intentional: we are studying the major buyers and influencers in the market. Chemical/petroleum industries and government sites are represented almost exactly proportional to their buying influence. In the services sector, respondents identified their firm type (see Figure 2-2). Good representation from each services sector was achieved.

All services industries perform design and/or construction services for third parties. The recipients of their efforts are represented by the "nonservices" sites, each of which may elect to hire design services, do it themselves, or a combination of the two. Figure 2-3 shows that these firms are working with a diverse collection of designs and constructions they have created themselves, purchased from others, or developed in collaboration.

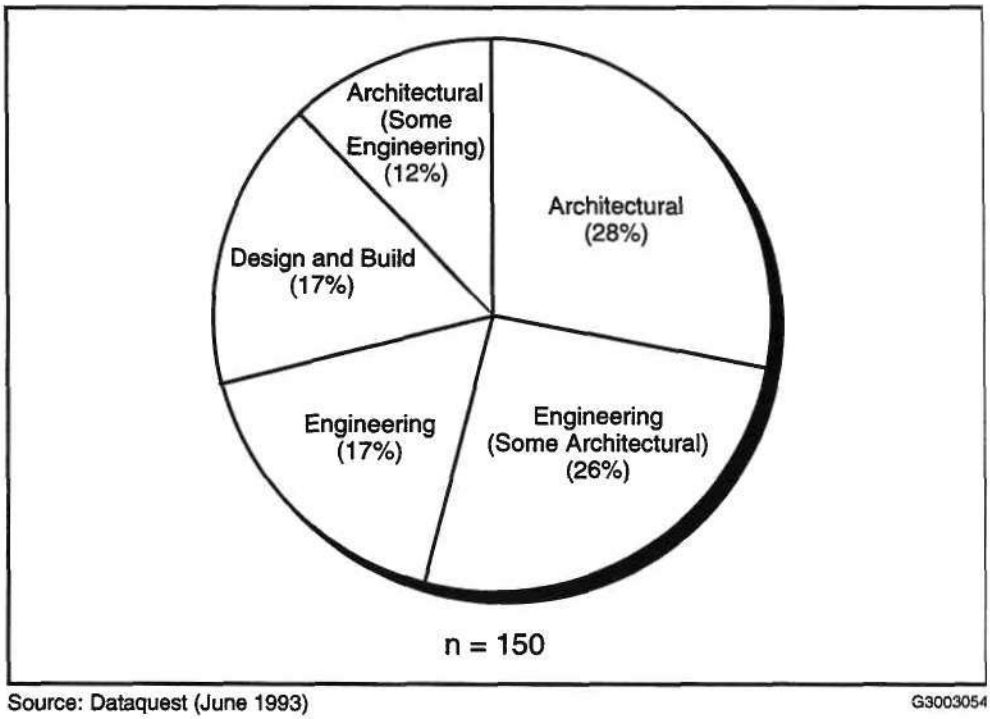
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Figure 2-1
Respondent's Industry



Source: Dataquest (June 1993) G3003053

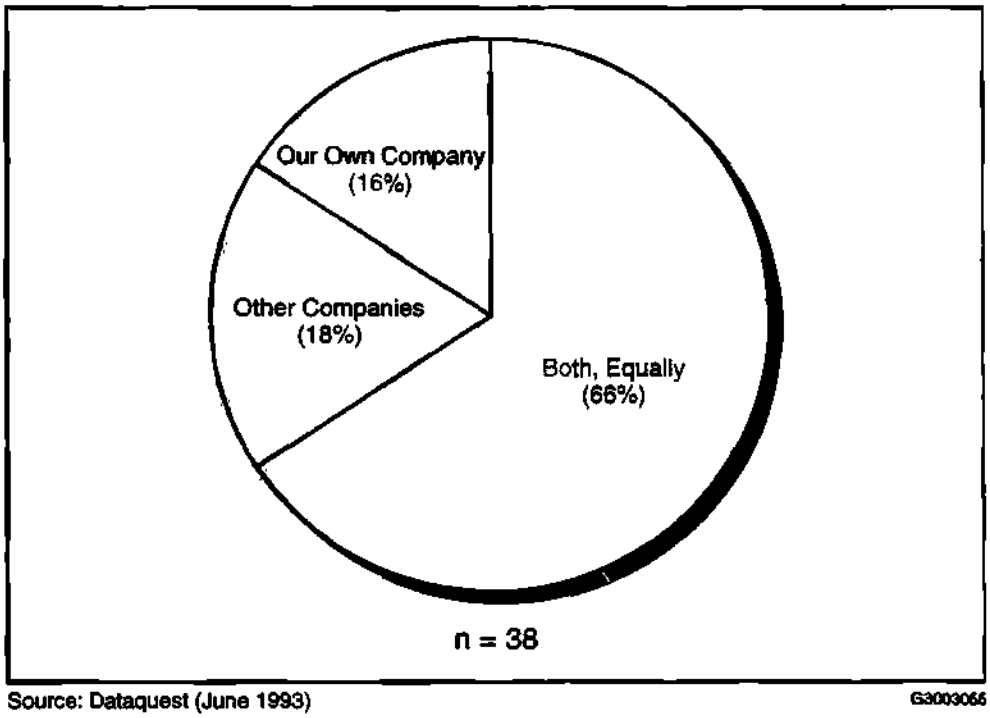
Figure 2-2
Firm Type (Services Only)



Source: Dataquest (June 1993) G3003054

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Figure 2-3
Who Designs Nonservice Site Projects



Source: Dataquest (June 1993) G3003066

Nonservice firms represent the largest sites in the sample, averaging over 1,000 employees per site, followed by engineering constructors, at 503 average employees per site (See Table 2-1). The results of recession and downsizing have visited the group. Overall, employment is down 3 percent from 1991, and down even more sharply at 10 percent among the technical professionals that represent potential CAD users. The architectural firms in this sample are much larger than the typical 1-to-10- person shop found in the United States. The firms have apparently weathered the tough financial times quite well, with technical professionals down only 8 percent during 1991. Among firms under 25 people, it is more common to hear of employment drops of 25 to 50 percent.

Respondent titles, described in Table 2-2, indicate that more than half of respondents (55 percent) manage a CAD system. Another 7 percent manage computer systems, which should make this sample especially rich in users with knowledge of information technology.

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Table 2-1
Employment Changes at AEC Sites (Site Average)

Firm Type	1991 Employees	1993 Employees	Percent Change	1991 Technical Professionals	1993 Technical Professionals	Percent Change
Architectural	39.42	35.47	-10.0	23.61	21.67	-8.2
Architectural/ Engineering	71.13	71.56	0.6	54.63	57.31	4.9
Engineering/ Architectural	142.97	127.51	-10.8	88.26	78.17	-11.4
Consulting/ Engineer	76.29	79.08	3.7	46.04	52.46	13.9
Engineering/ Construction	502.73	453.91	-9.7	253.45	192.82	-23.9
Nonservices	1,071.04	1078.21	0.7	155.36	154.25	-0.7
All Sites	314.48	305.15	-3.0	99.00	89.05	-10.1

Source: Dataquest (June 1993)

Table 2-2
Respondents' Titles

Title	Number	Percent
CAD Manager	104	55
Department Manager	28	15
Computer Systems Manager	13	7
Project Engineer	9	5
Designer	8	4
Chief Engineer	8	4
Project Architect	7	4
Owner/President	6	3
Drafter	2	1
Facility Manager	2	1
Managing Architect	1	1
Total	188	100

Source: Dataquest (June 1993)

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Chapter 3
The AEC CAD Environment

This chapter provides insight into how AEC CAD system implementations are now deployed and outlines details on that system implementation. We also describe users' expectations of their future environments. Finally, we examine AEC users' daily lives as computer users.

Users of several product lines were surveyed and are listed in Table 3-1. Only 2 products, Autodesk's AutoCAD, and Intergraph's Microstation, achieved enough representation to permit comparisons of the products and user base. It must be noted that AutoCAD's installed base is substantially larger than Intergraph's. The strong representation of Microstation in this survey is apparently a result of the sampling methodology. Large design firms, chemical/petroleum, and State Departments of Transportation represent Intergraph strongholds.

Table 3-1
Products Used (All Sites)

Product	Percentage of Software Units	Number of Sites	Average Units per Site
Accugraph	0.3	2	5.5
AutoCAD	37.0	83	19.5
AutoCAD Add-On, other	1.8	10	0
AutoCAD Add-On, Softdesk	2.4	12	8.9
AutoCAD Add-On, ASG	3.5	10	0
Autodesk Generic CADD	1.8	14	5.5
Autotrol	0.2	2	3.5
CADKEY Datacad	0.3	4	3.0
Claris CAD	0.1	3	1.0
Computervision Calma	2.6	2	56.5
Computervision Medusa	0.4	3	5.7
Computervision Versacad	0.2	3	2.3
EDS GDS	1.0	4	11.3
Intergraph Architecture	0.6	4	6.5
Intergraph Civil	0.4	4	4.3
Intergraph Microstation	41.6	73	25.0
Intergraph PDS	0.2	2	3.5
Intergraph Structural	0	1	2.0
Isicad	0.3	4	3.8
Sigma Design Arris	0.2	3	2.7
Others	5.2	15	15.1
Total	100.0		
Total Software Units	4,379	187	23.4
Total Hardware Seats	4,996	187	26.7
Users at Site	6,230	187	33.3
Ideal Number of Users	8,204	187	43.9

Source: Dataquest (June 1993)

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Table 3-1 shows that this study represents more than 6,000 users working on almost 5,000 CAD systems. Approximately 4,400 software units were identified as being used monthly—nearly as many software units as there were computer systems. This suggests that either these users have almost purchased an appropriate amount of software or that they are freely reporting illegally copied units in the count.

Tables 3-2 through 3-4 list software products used in each application environment (architectural, civil, and process plant design). Facilities design and management is not included because of the low number of respondents in this category. AutoCAD is quite dominant in the sites surveyed where architectural design is the dominant activity—48.7 percent of software units at these sites are AutoCAD. AutoCAD and Microstation are dominant at all these sites; however, at civil/structural engineering sites, vendors other than Autodesk and Intergraph have larger collective market share.

Table 3-2
Software Units, Architectural Design Sites

	Percentage of Software Units
AutoCAD	48.7
Intergraph Microstation	31.9
AutoCAD Add-On, ASG	5.3
AutoCAD Add-On, Softdesk	3.0
AutoCAD Add-On, Other	2.1
Accugraph	0.8
CADKEY Datacad	0.8
Isicad	0.8
Others	6.6

Source: Dataquest (June 1993)

Table 3-3
Products Used, Civil/Structural Design Sites

	Percentage of Software Units
AutoCAD	33.6
Intergraph Microstation	24.8
AutoCAD Add-On, ASG	4.3
Autodesk Generic CADD	1.7
Intergraph Civil	0.7
AutoCAD Add-On, Other	0.4
AutoCAD Add-On, Softdesk	0.4
EDS GDS	0.4
Others	33.6

Source: Dataquest (June 1993)

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Table 3-4
Products Used, Process Plant Design Sites

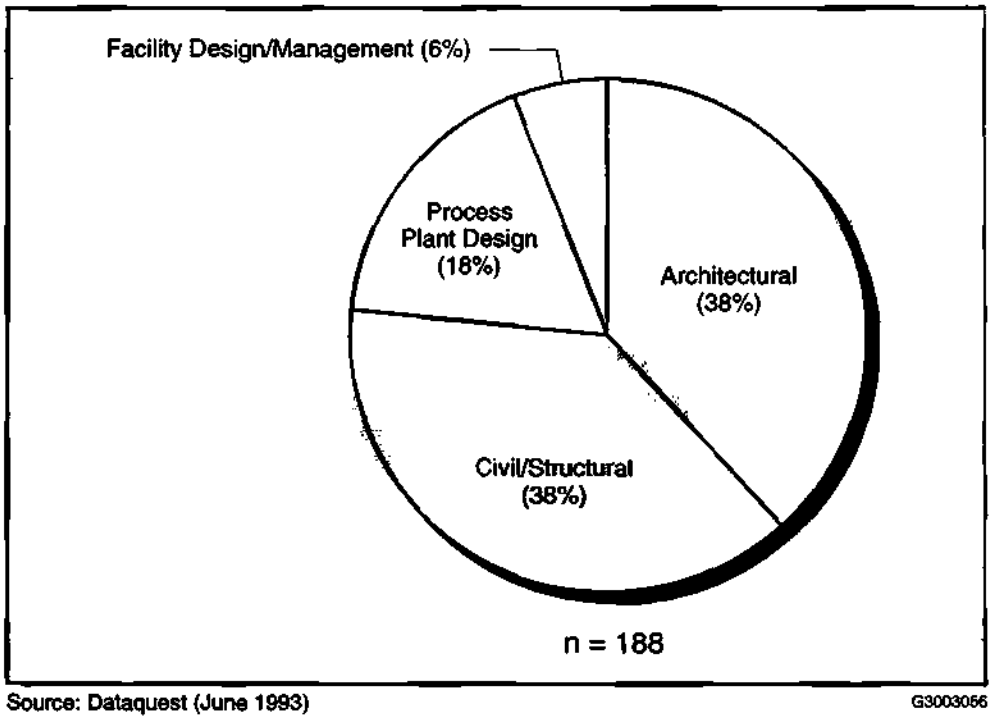
	Percentage of Software Units
AutoCAD	42.7
Intergraph Microstation	42.2
Calma	9.8
Autodesk Generic CADD	2.3
Computervision Medusa	0.9
Isicad	0.5
AutoCAD Add-On, Softdesk	0.6
EDS GDS	0.5
Other	0.6

Source: Dataquest (June 1993)

The Computing Terrain

Respondents identified the top three AEC CAD applications (see Figure 3-1). Architectural and civil/structural engineering sites each comprised 38 percent each of the sample. Process plant design, the third largest segment, represents 18 percent of sites. Facility design and management makes up the smallest group at only 6 percent of the sample.

Figure 3-1
Type of Work Most Frequently Done



Source: Dataquest (June 1993) G3003056

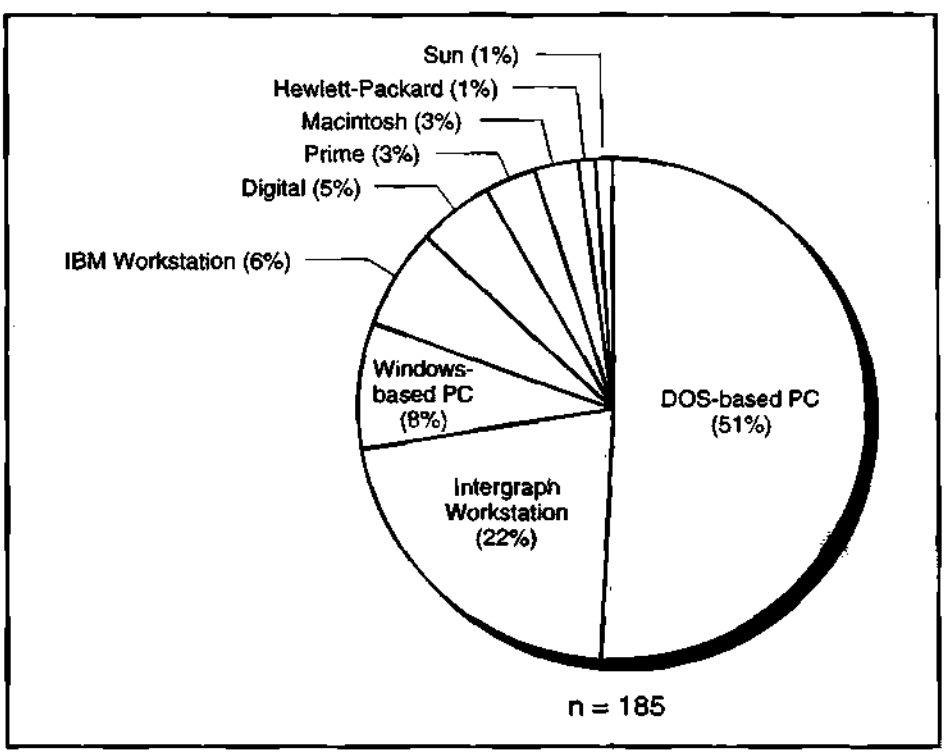
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Primary computers used in these AEC CAD systems cover a wide range, but 59 percent of users work at sites where PC-DOS systems or DOS with Windows are dominant (see Figure 3-2). Intergraph workstation users, not surprisingly, represent a significant portion of the sample at 22 percent. The remainder of sites primarily represent a variety of workstation users.

Figure 3-3 illustrates the actual seat counts: almost 70 percent of computers at these sites are personal computers, 27 percent are workstations, and approximately 4 percent are terminals. This compares to a worldwide installed base that is 60 percent personal computers, 25 percent workstations, and 15 percent terminals. Based on the results of Figure 3-2, we may estimate that UNIX is the operating system on 25 percent of seats.

Platform use varies considerably by what is being designed. Figure 3-4 shows that PCs dominate the architectural users, whereas workstations have increased usage in the civil/structural engineering, facility, and process plant design environments. The small representation of PCs at facility design sites and management is caused by the high-end emphasis of the sample and the low number of facility management sites (only 11). These are undoubtedly the most sophisticated of facility management users, which at the larger, lower end of the spectrum, are known for using lower costing products.

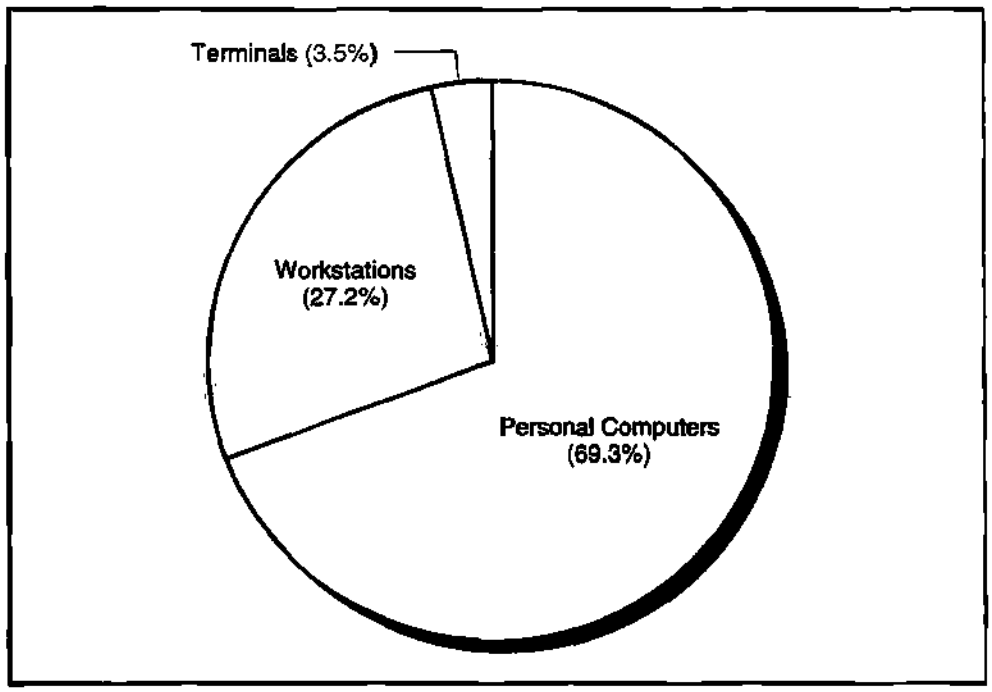
Figure 3-2
Primary Computer at Site



Source: Dataquest (June 1993) G3003057

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Figure 3-3
Percent of Seats that Are PCs, Workstations, and Terminals



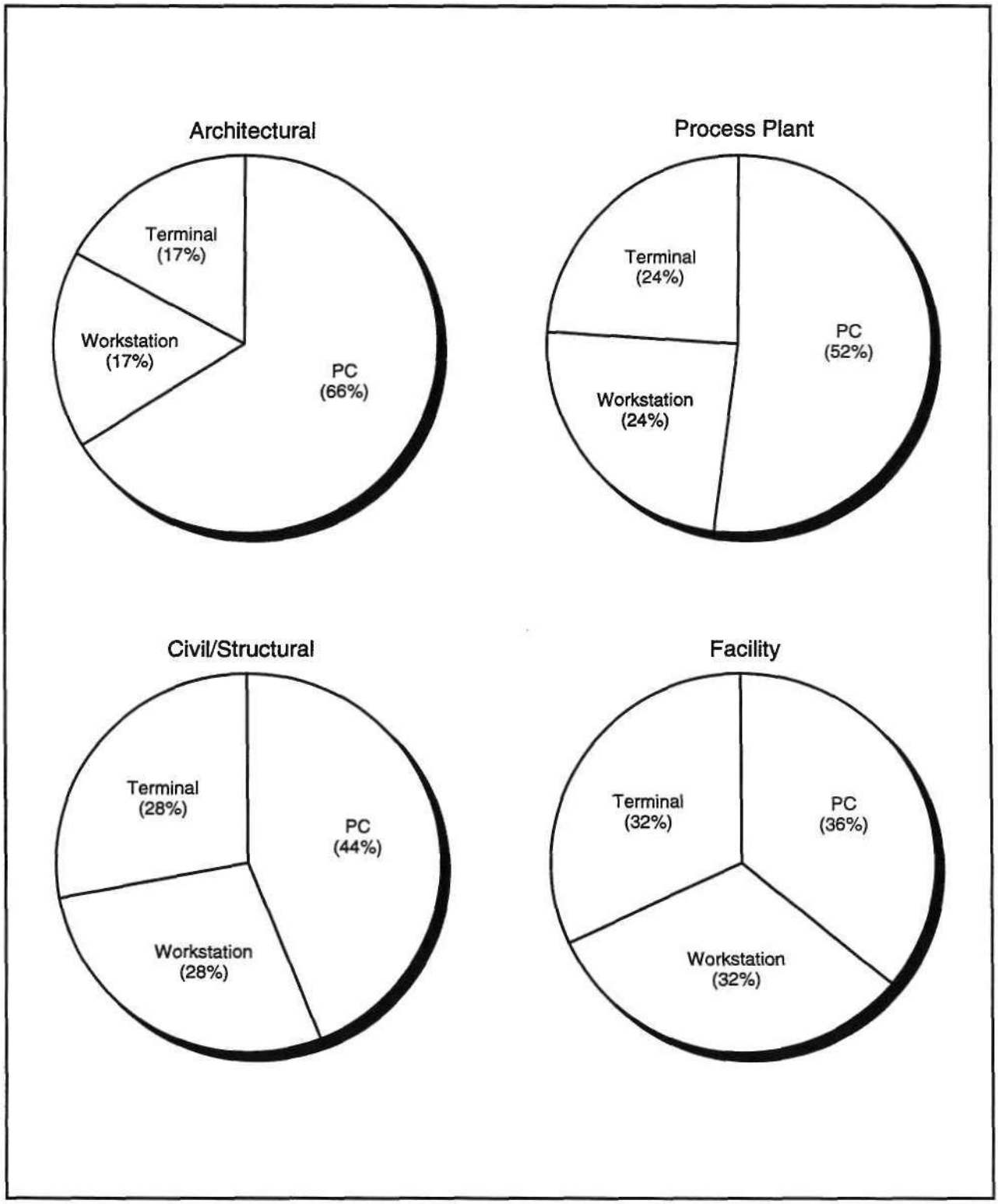
Source: Dataquest (June 1993) G3003058

We asked this group what they expected the dominant operating system to be at their site in two years (results are shown in Figure 3-5). Users expect to give up their heavy reliance on DOS (as was shown in Figure 3-2), in favor of a gradual adoption of DOS with Windows and Windows NT. These users are forecasting an equally dramatic demise of UNIX among their ranks. The previously estimated 25 percent UNIX seats are expected to drop to only 16 percent in two years, suggesting that about one-third of the UNIX users expect to switch to NT. This corresponds with the CAD/CAM/CAE industry service's expectation that NT will nibble away at UNIX and DOS users. Intergraph's NT publicity campaign appears to be working among the company's user base—many of the Intergraph workstation users are the ones who plan to switch to NT.

Considerable variation does exist among firm types on the operating system question. Figure 3-6 shows that users among consulting engineers (type "E") expect to stick with DOS or Windows, whereas UNIX can be expected to retain its hold among the "nonservices," which primarily represents large consumers of designs among chemical, petroleum, and government users.

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Figure 3-4
Primary Computer Platform for Each Primary Application

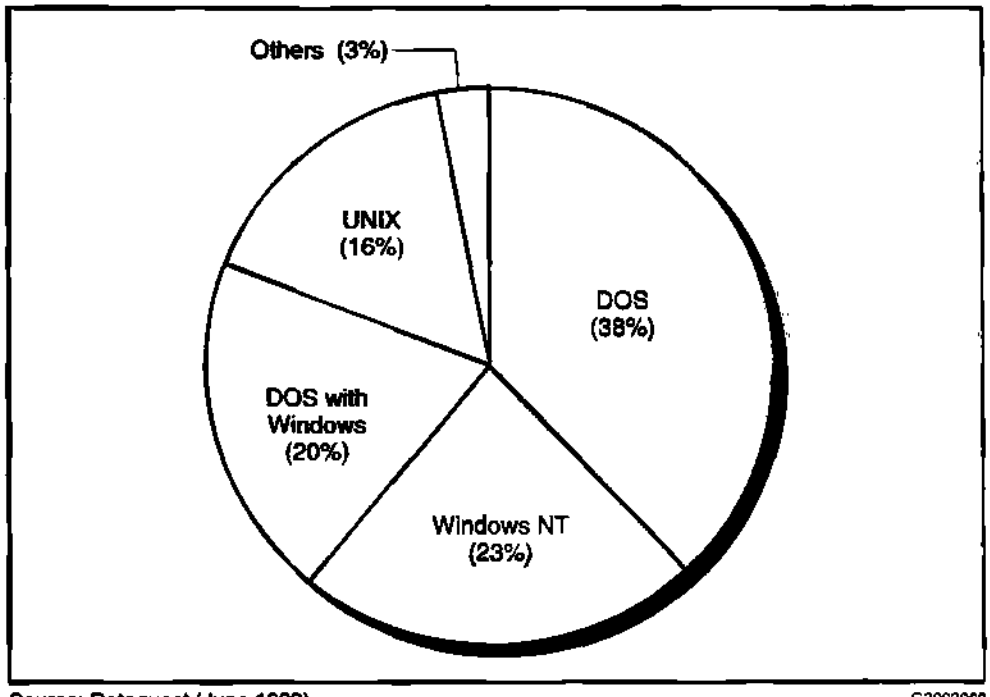


Source: Dataquest (June 1993)

G3003059

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Figure 3-5
Dominant Operating System in Two Years at Site



Source: Dataquest (June 1993) G3003060

CAD Implementation

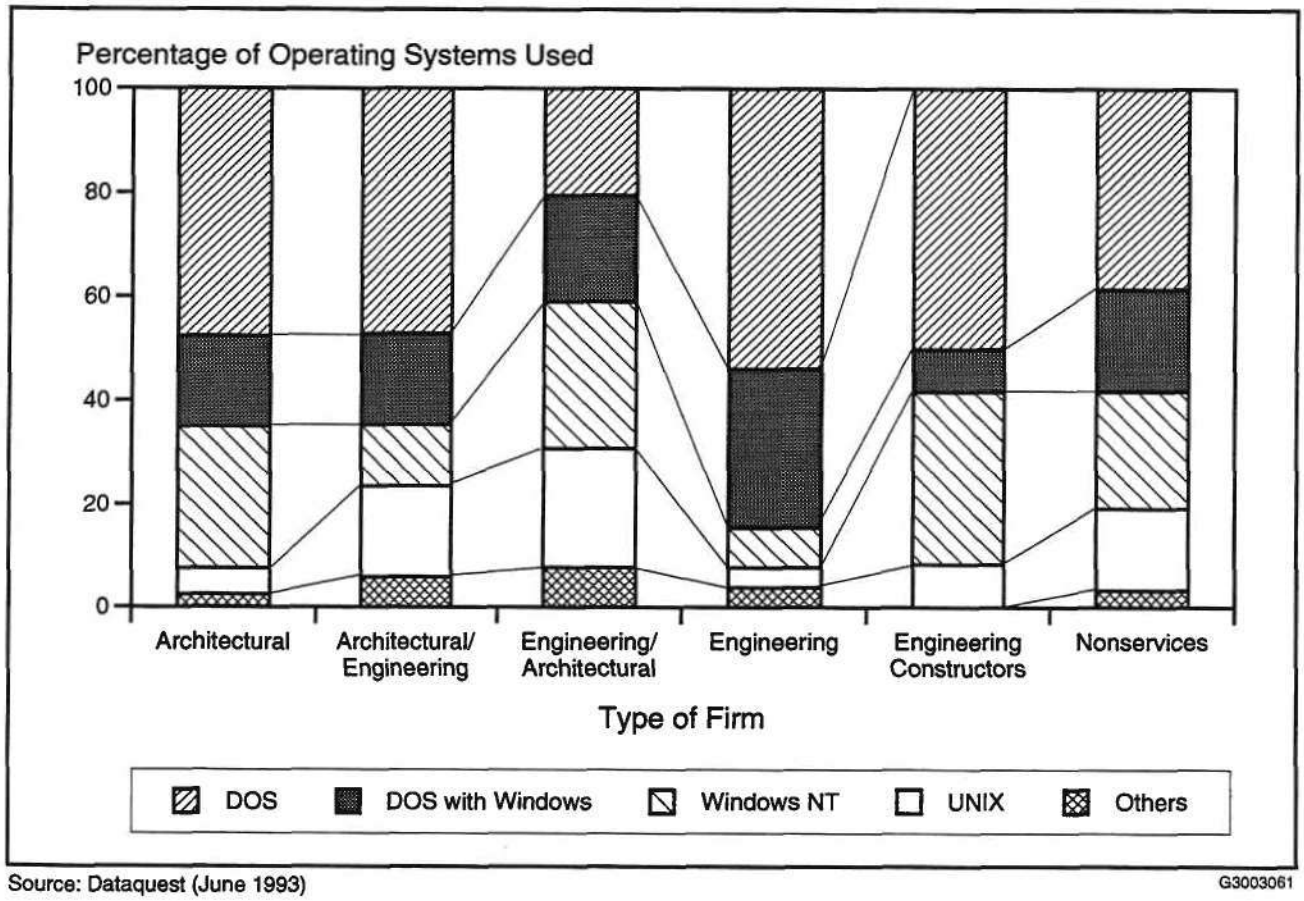
CAD systems are generally well established at these large sites. Nearly 70 percent of respondents indicated that their company has corporate standards for which CAD software will be bought (and for which productivity software, like spreadsheets, will be bought). Engineering construction companies are least likely to have developed company information technology standards, and nonservices are most likely to have such systems in place (see Figure 3-7).

The high level of standardization is likely a result of extensive CAD experience at these sites. Respondents averaged 7.45 years of CAD experience, and no one reported less than two years of experience (see Figure 3-8). Coupled with this considerable experience is a very modest degree of experimentation. Most users have learned only one or two different CAD programs, indicating a somewhat limited experience base (see Figure 3-9). These users plan to learn an average of one more program.

Experience has helped users achieve a relative independence of paper drawings. Only 21.5 percent of design activity is forecast to be on paper next year, and it is anticipated that a small, but substantial 13.4 percent of design activity will be in 3-D CAD (see Figure 3-10).

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Figure 3-6
Dominant Operating System Expected in Two Years at Site, by Firm Type



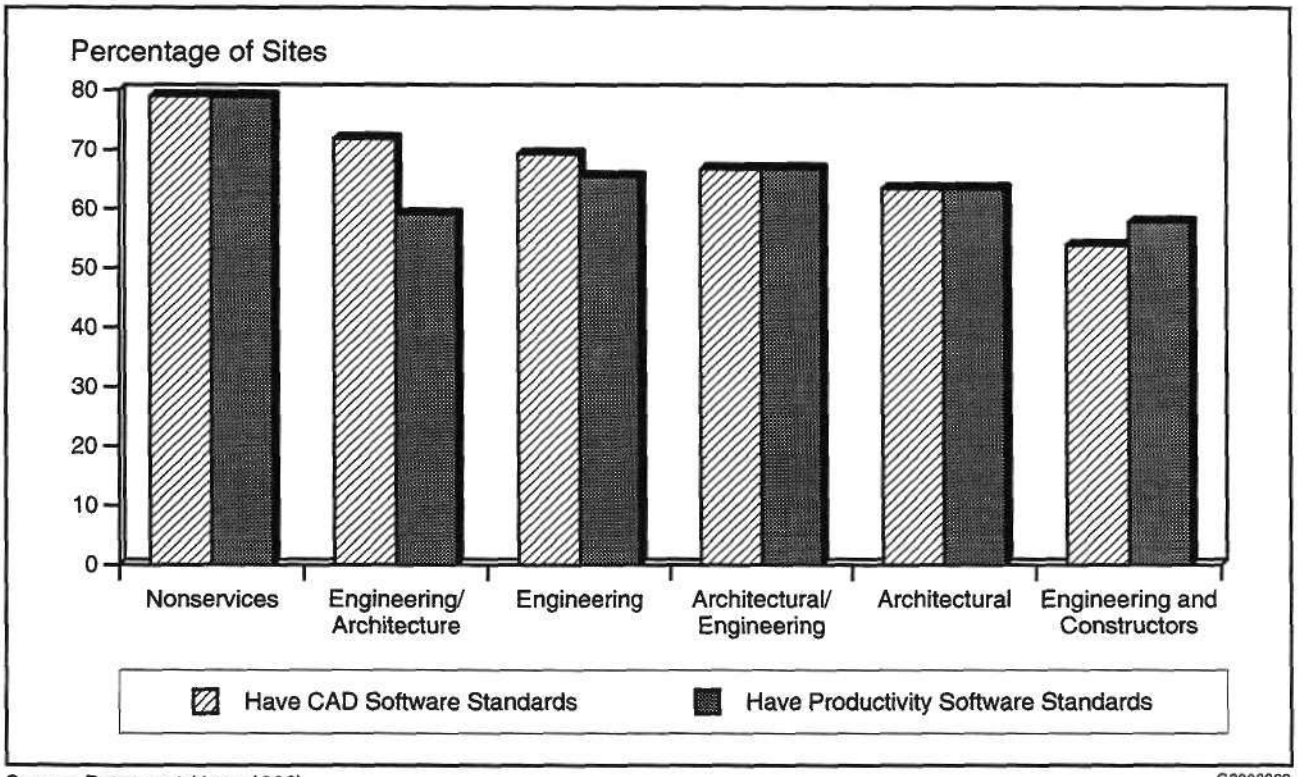
Source: Dataquest (June 1993)

G3003061

Considerable emphasis is often placed on the importance of pursuing CAD over paper in AEC because of the large number of locations, across several companies or sites, to which a design may be used or referenced before a project is finally built. Figure 3-11 indicates that most sites share design information, even if only among two or four sites. This figure suggests that a manageable number of site contacts are active, and that users should absorb experimentation in this area without undue disruption. The reported volume of partners in information did not vary particularly by firm type, application, number of CAD seats, or number of employees.

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Figure 3-7
Percent of Sites with Software Standards for which Software is Purchased



Source: Dataquest (June 1993)

G3003062

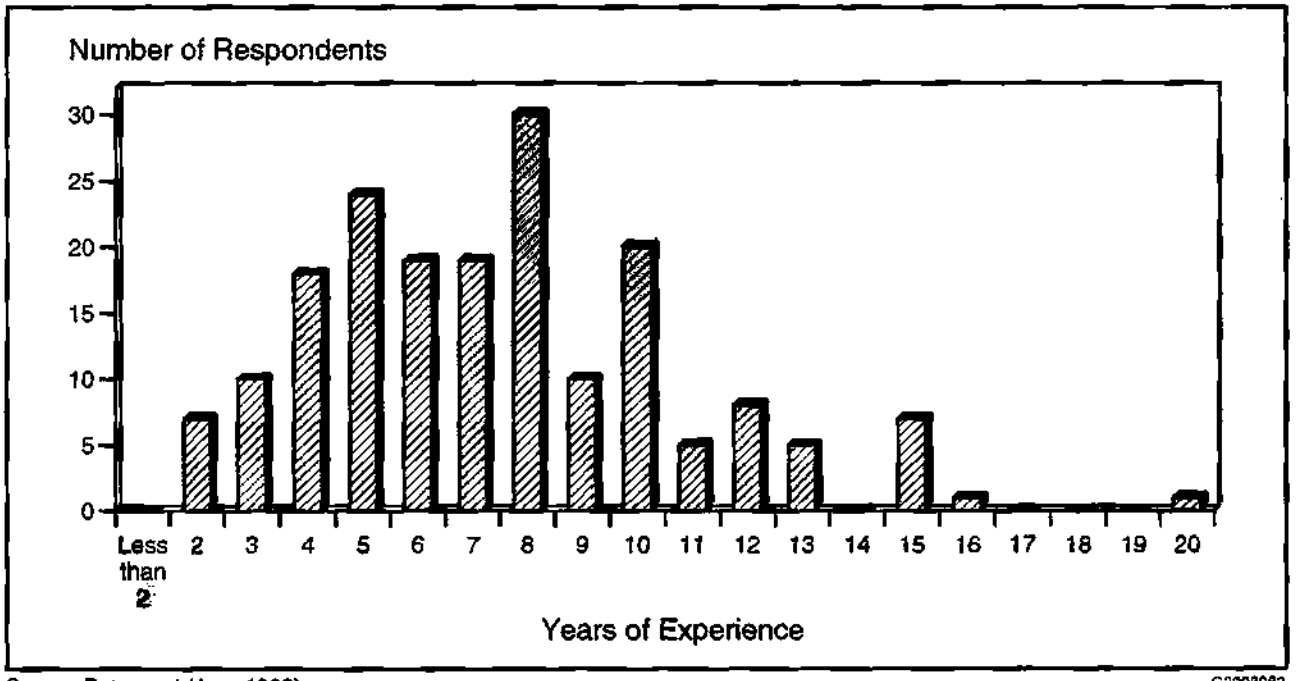
User Profile

Users averaged 30.6 hours per week using a computer, and this varied imperceptibly across all types of design. Hours per week spent using CAD averaged 20.49, again with the type of design having little impact on time spent using CAD. Users indicated that they used their most frequent software 18.5 hours per week, which suggests that most users are basically working with one brand of software in terms of time on task—even though they report that they are currently using approximately two programs.

Requirements to deliver designs in electronic form are common and vary by type of firm (see Figure 3-12). This requirement is experienced least by architectural firms and most by engineering/architectural firms and the large consumers of designs (nonservices). As one might expect, the most commonly request file format for exchange is AutoCAD's DXF format, which is effectively a widespread industry standard (see Figure 3-13). Microstation was also mentioned almost half the time because of Microstation's strong presence in this survey because Intergraph is effective at working to have its products specified at user sites.

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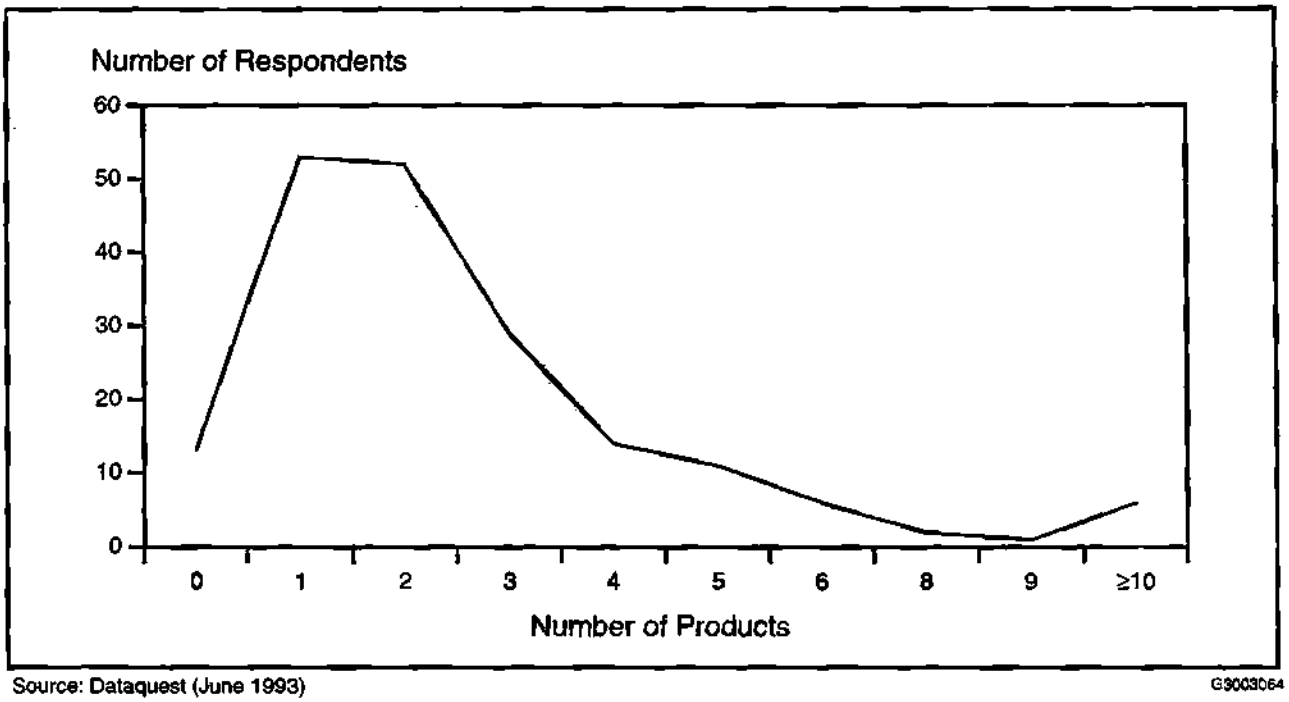
Figure 3-8
Respondents' Years of CAD Experience



Source: Dataquest (June 1993)

G3003063

Figure 3-9
Number of CAD Products Learned to Use

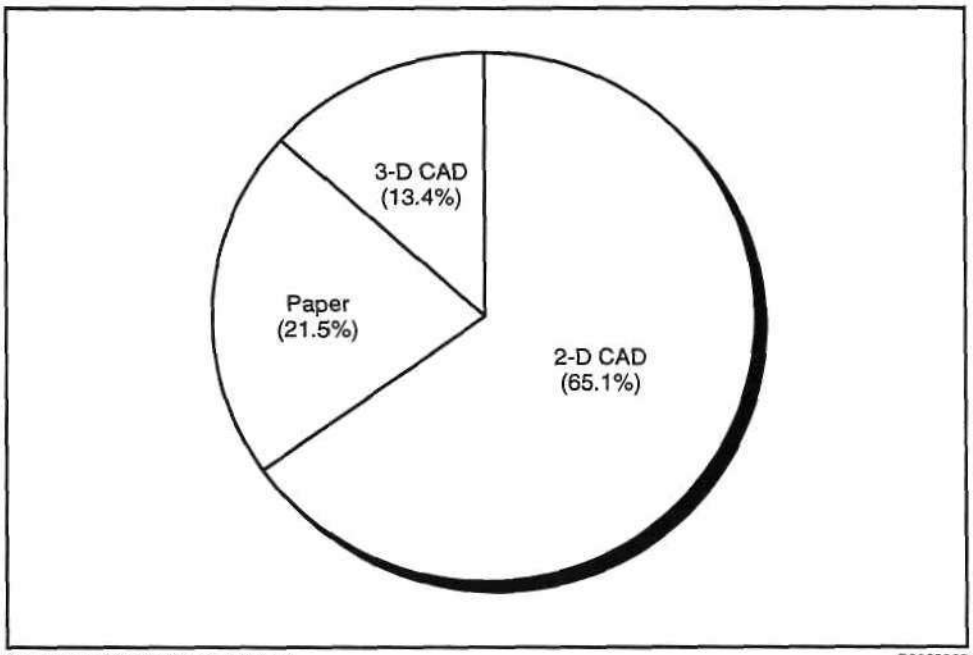


Source: Dataquest (June 1993)

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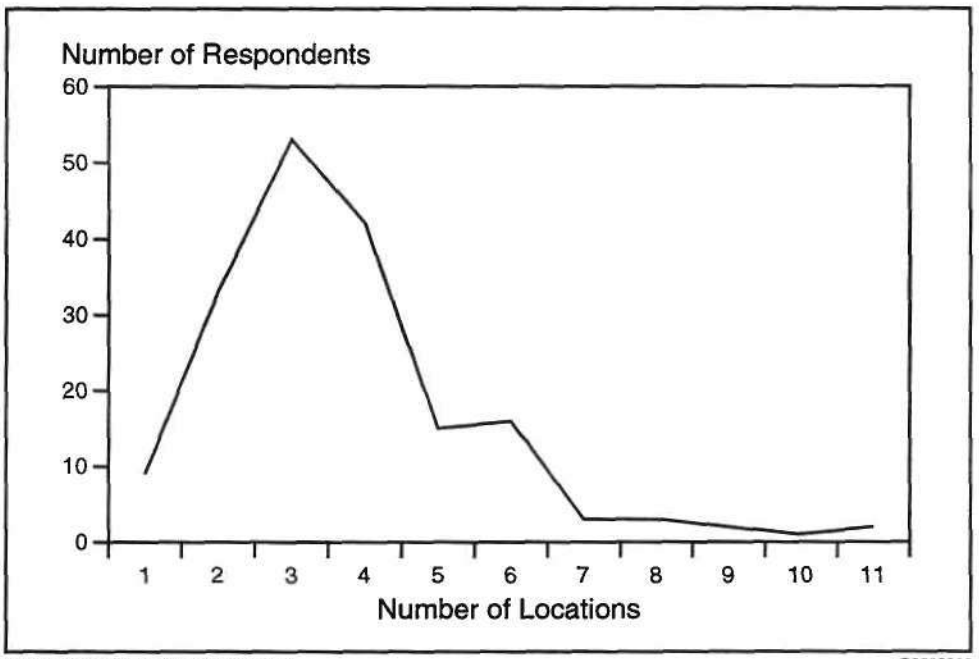
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Figure 3-10
Percent of Design Activity Next Year that Will Be on Paper, 2-D CAD, and 3-D CAD



Source: Dataquest (June 1993) G3003065

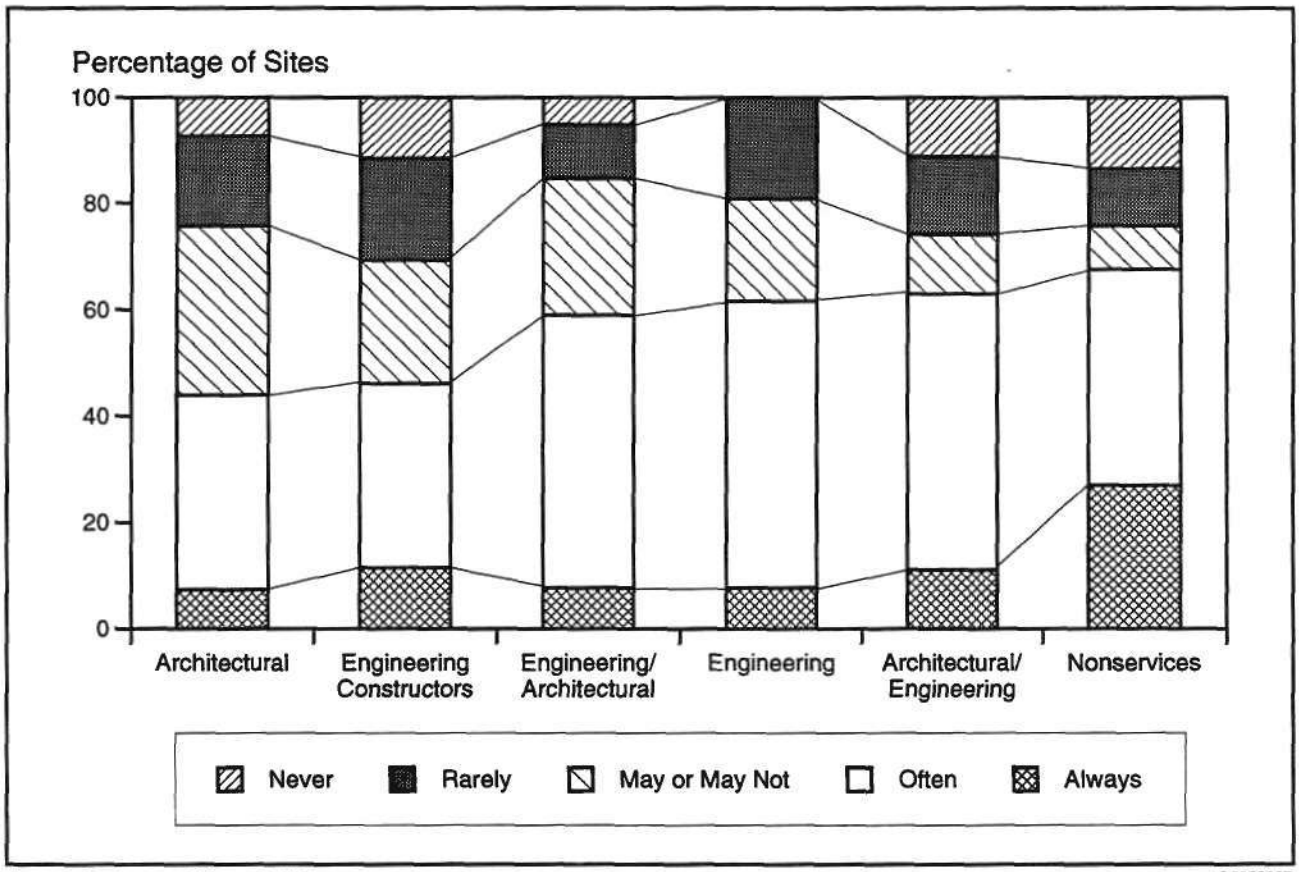
Figure 3-11
Number of Locations Sharing Design Information



Source: Dataquest (June 1993) G3003066

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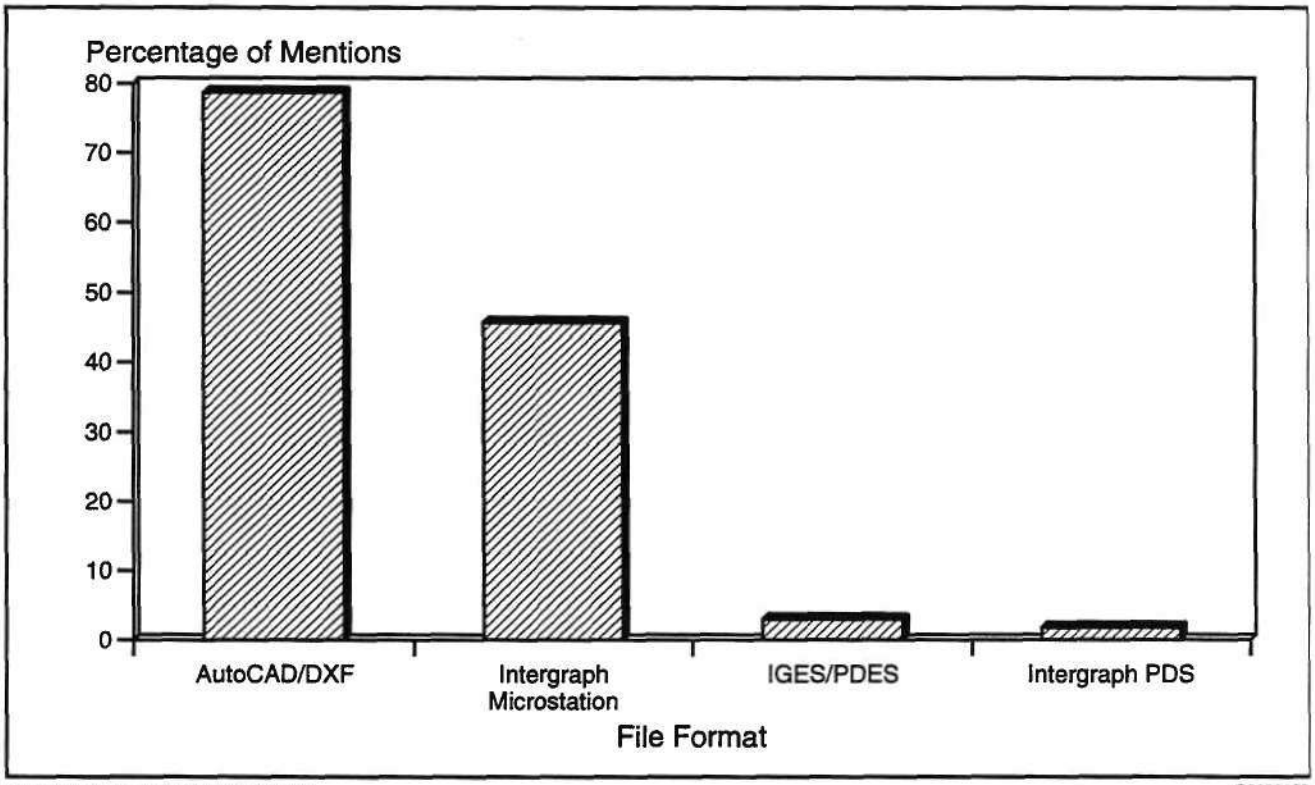
Figure 3-12
Frequency of Requirements to Deliver Design in Electronic Form



Source: Dataquest (June 1993)

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Figure 3-13
Typically Requested Electronic File Types



Source: Dataquest (June 1993)

G3003068

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Chapter 4
What Users Want: Vendor Performance and Customer Satisfaction

We asked users to rate their satisfaction with their AEC CAD system in 12 key areas of product features and vendor services, and to rate the importance they place on those key indicators by using a five-point scale. Table 4-1 lists the products they identified as most often used. In addition to the 69 AutoCAD sites located, it would be reasonable to include the various AutoCAD add-on products that were identified as the primary software (products from the newly merged ASG and Softdesk) as AutoCAD sites. We found, however, that including these sites had no real effect on satisfaction results.

Table 4-2 lists each variable, along with mean importance and satisfaction values for each indicator, for the entire sample. Indicators are listed in order of importance to the entire sample. Table 4-3 lists the same variables for Autodesk AutoCAD users and Table 4-4 for Intergraph Microstation users.

Vendor Performance

The gap in Tables 4-2 to 4-4 represents the disparity between what users want and what they are getting and is simply the difference of satisfaction and importance. The entire sample values a product that is most compatible with their environment (with a sample average importance of 4.45), followed by the vendors' responsiveness and a product that is

Table 4-1
Products Used Most Often

	Number of Sites	Percentage of Sites
ASG AutoCAD Add-On	4	2.1
Autodesk Generic CADD	7	3.7
Autodesk AutoCAD	69	36.7
ClarisCAD	2	1.1
Computervision, Various	8	4.3
Datacad	3	1.6
Intergraph Microstation	63	33.5
Intergraph, Other	6	3.2
IsiCAD Cadvance	3	1.6
Sigma Design ARRIS	4	2.1
Softdesk AutoCAD Add-On	7	3.7
Others	7	3.7
Don't Know/Refusal	5	2.7
	188	100.0

Source: Dataquest (June 1993)

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Table 4-2
Importance/Satisfaction Gap Analysis (Mean Responses)

	Importance, Total Sample (N=188)	Satisfaction, Total Sample	Gap, Total Sample
Product is compatible with our environment	4.45	4.06	-0.39
Vendor is responsive to our needs	4.40	3.71	-0.69
Product is easy to learn and use	4.37	3.83	-0.54
Product performance in complex or compute-intensive tasks	4.15	3.95	-0.20
Availability of a complete set of application software that works with the core product	4.08	3.87	-0.21
Training requirements	4.06	3.63	-0.43
Cost per seat	4.05	3.54	-0.51
Users at our company favor the product	4.04	3.98	-0.06
Product is likely to be required for a project	3.90	3.85	-0.05
Product is a market leader	3.88	3.89	0.01
Vendor's flexibility in software licensing	3.86	3.40	-0.46
Product represents a technology breakthrough not available elsewhere	3.68	3.66	-0.02
Overall	4.07	3.83	-0.24

Notes:
1. Ratings based on a five-point scale: 1 = not at all satisfied or important, 5 = extremely satisfied/important.
2. A negative gap number indicates a satisfaction deficit; a positive number indicates a surplus.
Source: Dataquest (June 1993)

easy to learn and use. Users are not getting everything they want in product compatibility (with a lower average satisfaction score of 4.06). However, it is interesting to note that these gaps in satisfaction are smaller among AEC users than among mechanical or electronic design users examined on similar measures. AEC vendors are either doing a better job for their customers or AEC users are easier to please.

To arrive at overall satisfaction scores, key indicator satisfaction scores are weighted by importance to each user. Using standard Dataquest methodology in determining customer satisfaction, this survey reveals that the Intergraph Microstation product line enjoys slightly higher customer satisfaction than AutoCAD, and both products are slightly above average in customer satisfaction (with scores of 3.96 and 3.87 versus 3.83 for the entire sample). After considerable scrutiny of the data, we are forced to conclude that both products surveyed are quite close in terms of customer satisfaction. In other words, a recommendation from satisfied users is not a strong reason to choose either product.

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The "Overall" importance level at the bottom of Table 4-2 provides a measure of how demanding the customer base is—and, here again, AutoCAD and Microstation are remarkably similar. The largest "gap" score across all three tables is over the issue of vendor responsiveness (with AutoCAD turning in the worst performance at negative 0.82).

A few examples will illustrate how to read Tables 4-2, 4-3, and 4-4. Microstation, with an overall gap of negative 0.13, has achieved an above average match between what users want and what they are getting. None of these gaps are large, so opportunities for improvement are best understood by studying the same numbers presented in Figures 4-1 and 4-2.

Table 4-3
Importance/Satisfaction Gap Analysis for Autodesk AutoCAD Users (Mean Responses)

	Importance, AutoCAD (N=69)	Satisfaction, AutoCAD	Gap, AutoCAD
Product is compatible with our environment	4.54	4.15	-0.39
Vendor is responsive to our needs	4.44	3.62	-0.82
Product is easy to learn and use	4.28	3.90	-0.38
Product performance in complex or compute-intensive tasks	4.16	4.03	-0.13
Availability of a complete set of application software that works with the core product	4.10	3.93	-0.17
Training requirements	4.18	3.58	-0.60
Cost per seat	4.01	3.40	-0.61
Users at our company favor the product	4.13	4.12	-0.01
Product is likely to be required for a project	4.01	4.07	0.06
Product is a market leader	4.00	4.13	0.13
Vendor's flexibility in software licensing	3.88	3.36	-0.52
Product represents a technology breakthrough not available elsewhere	3.58	3.58	0
Overall	4.11	3.87	-0.24

Notes:
1. Ratings based on a five-point scale: 1 = not at all satisfied or important, 5 = extremely satisfied/important.
2. A negative gap number indicates a satisfaction deficit; a positive number indicates a surplus.
Source: Dataquest (June 1993)

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Table 4-4
Importance/Satisfaction Gap Analysis for Intergraph Microstation Users (Mean Responses)

	Importance, Microstation (N=62)	Satisfaction, Microstation	Gap, Microstation
Product is compatible with our environment	4.40	4.16	-0.24
Vendor is responsive to our needs	4.48	3.90	-0.58
Product is easy to learn and use	4.48	3.97	-0.51
Product performance in complex or compute-intensive tasks	4.16	4.03	-0.13
Availability of a complete set of application software that works with the core product	4.23	4.00	-0.23
Training requirements	4.02	3.74	-0.28
Cost per seat	4.13	3.77	-0.36
Users at our company favor the product	4.08	4.08	0
Product is likely to be required for a project	3.77	3.89	0.12
Product is a market leader	3.80	4.08	0.28
Vendor's flexibility in software licensing	3.84	3.47	-0.37
Product represents a technology breakthrough not available elsewhere	3.76	3.85	0.09
Overall	4.09	3.96	-0.13

Notes:
1. Ratings based on a five-point scale: 1 = not at all satisfied or important, 5 = extremely satisfied/important.
2. A negative gap number indicates a satisfaction deficit; a positive number indicates a surplus.
Source: Dataquest (June 1993)

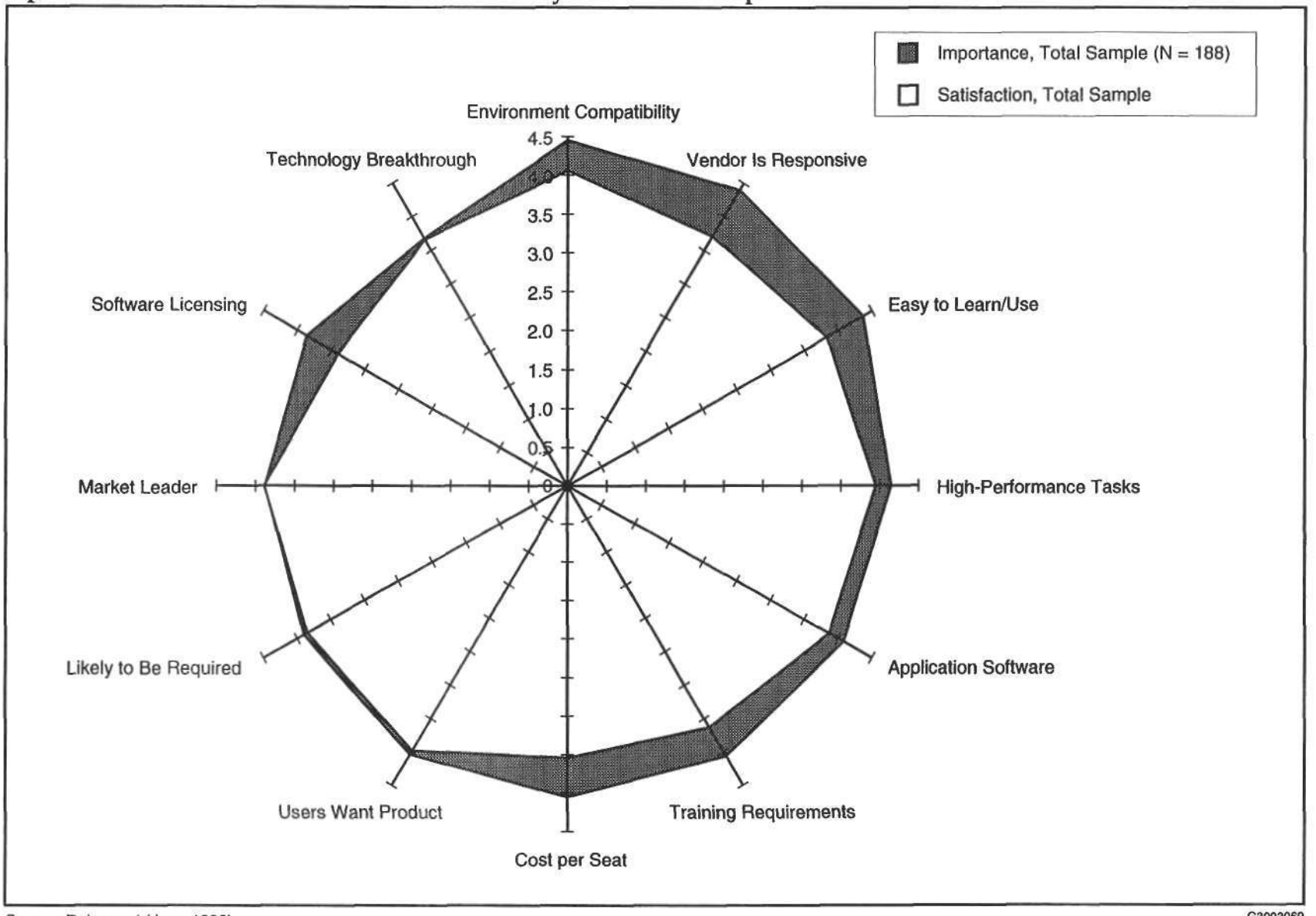
Visualizing Customer Satisfaction

Unfortunately, overall user satisfaction on the three most important variables—compatibility with environment, vendor responsiveness, and easy to learn and use—falls short of customer desire. Figure 4-1 illustrates these points by plotting the key indicators listed in Table 4-2 for all users. Each 1 to 5 scale variable is plotted clockwise in decreasing order of ranked importance, starting with "Product is compatible with our environment" (environment compatibility) at 12 o'clock. Each indicator has its own value axis stemming from the center point, with lines connecting importance ratings and satisfaction ratings. Importance ratings cover a greater area than satisfaction ratings, exposing the satisfaction gap a dark gray areas. The gray area exposes areas that need work; the earlier the gray appears in the clockwise presentation, the more important it is to bridge the gap with better product offerings.

The results are clear: vendors should work to be easy to get along with. The three most important indicators, "product is compatible with our environment," "vendor is responsive to our needs," and "product is easy to learn and use," point to a user base that is looking to remove the pain associated with computers rather than to drive themselves to new levels

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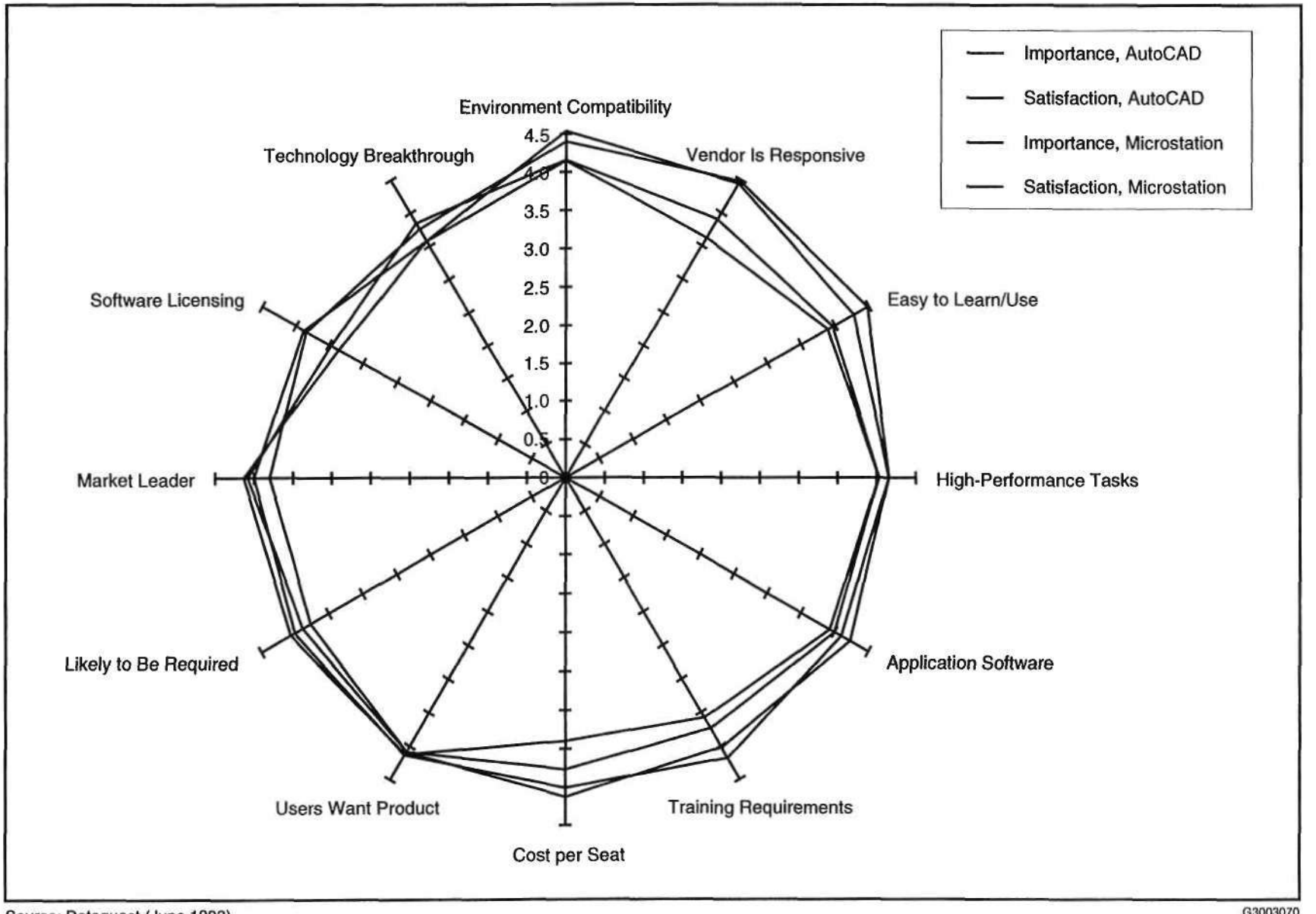
Figure 4-1
Importance versus Satisfaction with AEC CAD System for all Respondents



Source: Dataquest (June 1993)

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Figure 4-2
Importance versus Satisfaction with AEC CAD System for AutoCAD and Microstation Users



Source: Dataquest (June 1993)

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of automation. This means that vendors must keep adding compatibility aids, such as the ability to read multiple vendors' file types, keep analyzing customer support, and never let up on improving the product interface to users. It appears that AEC users want pain removed from their CAD environment—certainly more than they want technology breakthroughs.

Figure 4-2 carries this analysis further by using the same illustration tool to compare the satisfaction of AutoCAD and Microstation users with the overall importance placed on each indicator. Figure 4-2 highlights the similarities between AutoCAD and Microstation users. The respective lines tracking the importance that users place on key indicators are nearly interchangeable, as are the satisfaction scores. These two products are engaged in head-to-head and toe-to-toe competition. This close tracking of results is neither typical nor accidental. Close examination of Figure 4-2 will reveal that Autodesk could use a bit of extra work in being responsive to customers and on lowering cost per seat if the company wishes to shore up chinks.

AutoCAD and Microstation users are hardly identical. Table 4-5 lists areas where the two products had significantly different scores. Microstation users use more workstations, are more often in UNIX environments, have more experience with CAD, are working more in 3-D and less on paper, and value more sophisticated use of software products. Microstation users also plan to adopt NT with more fervor than AutoCAD users, while still retaining a strong UNIX base (see Figure 4-3). The two products are also adopted differently among users: Figure 4-4 shows that AutoCAD has a strong presence between architectural firms and consulting engineers, whereas Microstation's stronghold is among the large consumers of designs (nonservices) and the engineering/architectural large-scale and infrastructure designers.

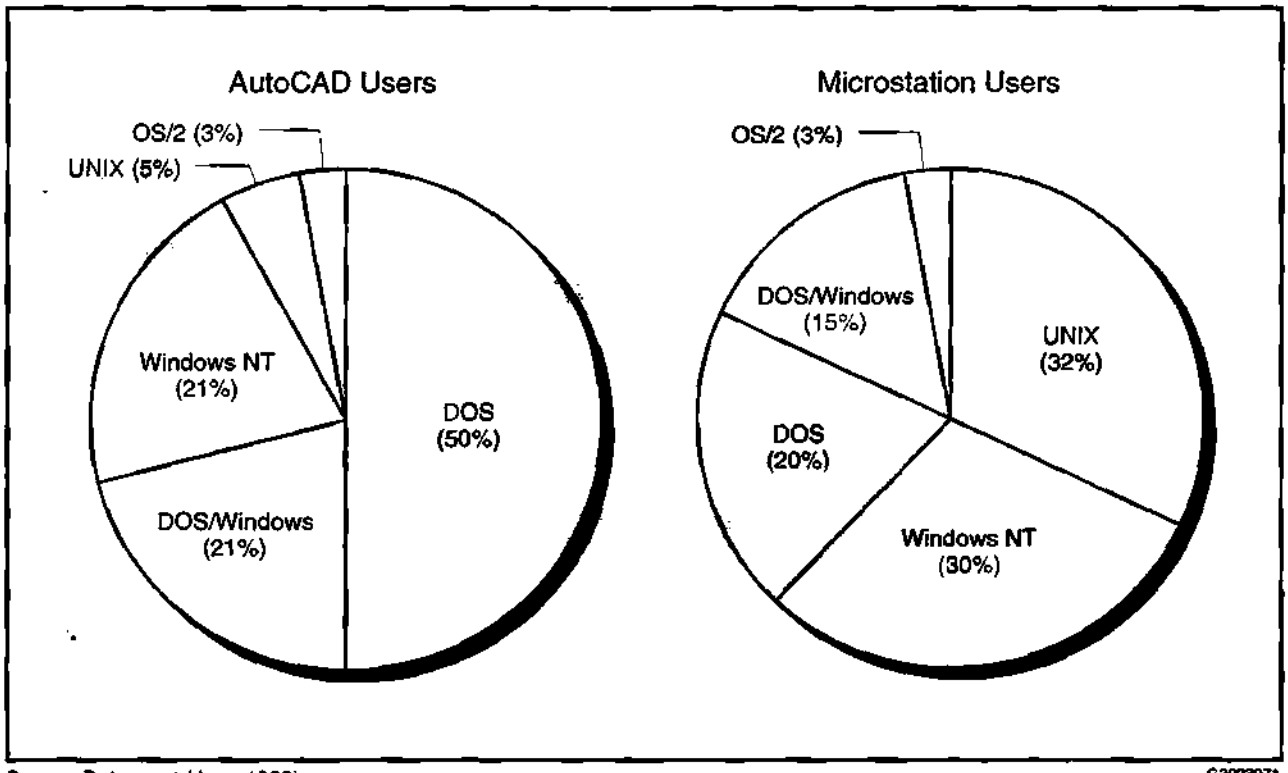
Table 4-5
AutoCAD versus Microstation Users: Comparison of Key Differences

	Typical AutoCAD User	Typical Microstation User
Primary Computer Used	90 percent PCs	20 percent PCs; 70 percent workstations
Operating System in two years	DOS	UNIX
Years using CAD	6.4	8.8
Percent of next year's design that will be on paper	25	17
Percent of next year's design that will be in 3-D CAD	7	20
Importance placed on use of 3-D CAD*	3.16	3.58
Importance placed on use of design constraint systems*	2.87	3.61
Able to solve more complex designs than three years ago*	3.77	4.14

*Ratings based on a five-point scale: 1 = not at all satisfied or important; 5 = extremely satisfied or important.
Source: Dataquest (June 1993)

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Figure 4-3
Dominant Operating System Expected in Two Years, AutoCAD versus Microstation Users



Source: Dataquest (June 1993)

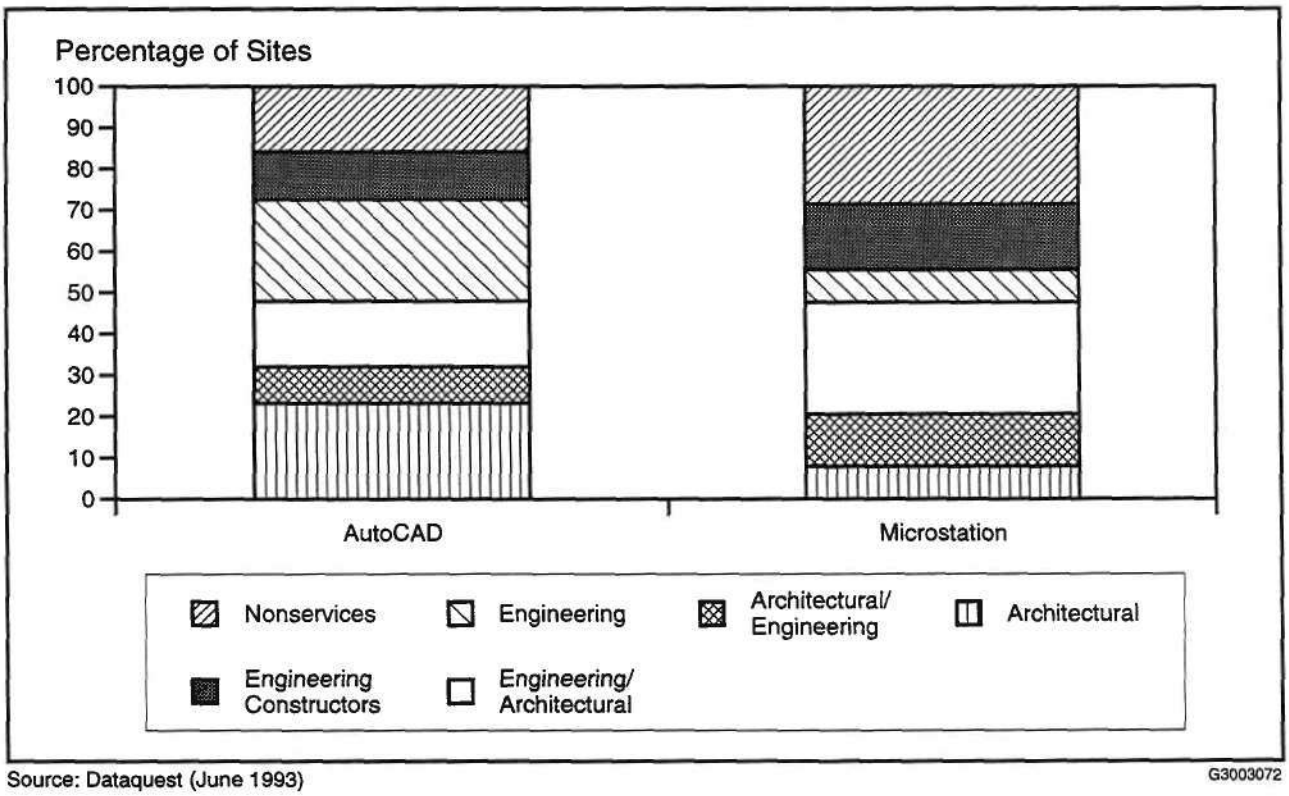
G3003071

Will Users Switch Vendors?

Neither vendor is going to be easy to unseat. Figure 4-5 shows that few users are likely to switch software vendors. We examined the users who are at least somewhat likely to switch, and they did not vary from average on a wide number of measures, such as application, type of firm, or size of firm. Users likely to switch had a slightly overall satisfaction score of 3.72 compared to the survey average of 3.87. The sites that had no standards for purchasing CAD software were likely to consider switching vendors. Therefore, the answer is clear—one should ask all prospects if they have company standards for CAD purchases. Those who answer "no" are good targets, regardless of the primary installed vendor. Conversely, getting one's CAD software listed as "standard" at a site may be one of the most effective things a company can do to protect its installed base.

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Figure 4-4
Comparison of Customer Base, AutoCAD versus Microstation



Source: Dataquest (June 1993)

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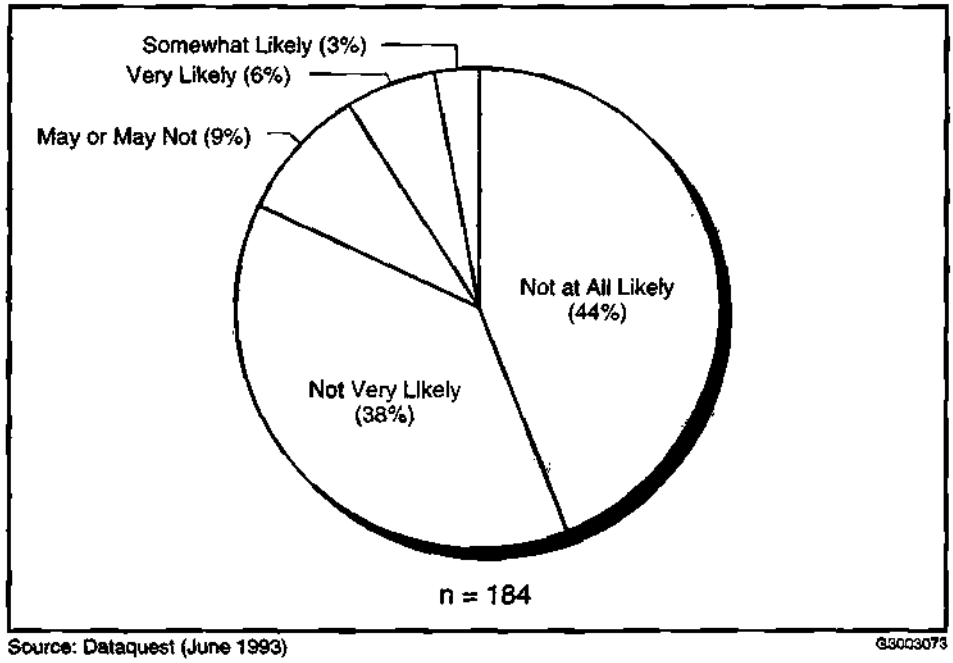
Customer Satisfaction by Application

Using the same techniques that produced Figure 4-1, customer satisfaction is plotted by primary application at the site in Figures 4-6 through 4-9. This gives the opportunity to compare what users in each application want most in their products and identifies areas that need improvement. The overall importance and satisfaction levels among users by application are shown in Table 4-6.

Civil/structural users, with a high importance score of 4.12 are the most demanding customer set. They nearly tie with process plant design users for having the highest gap between what they want and what they are getting. Facilities design/management are the least demanding, with an importance score of 3.93. This is the only group whose level of satisfaction, 4.17, is higher than their expectations. Figures 4-6 through 4-9 illustrate much the same story: For facilities design/management users (see Figure 4-9), the gap between importance and satisfaction is almost imperceptible on the most important indicators. It is only on the less important indicators that a moderate gap (shaded portion) begins to appear. This group is content with CAD products. There is little point to develop ordinary CAD products for this user group. The attention would be better spent among the visibly less satisfied users in the other applications.

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Figure 4-5
Likelihood of Changing AEC CAD Software Vendors



Source: Dataquest (June 1993) G3003073

Compatibility with the existing environment is important to all users. This validates the recent efforts made by several vendors to deliver products that can emulate and read files from competitors' products.

It is only the civil engineering users who place the highest value on vendor responsiveness. Architectural users raise training requirements to the second highest level of importance, and they are not well satisfied on this metric. For the vendor targeting a particular application, these illustrations provide information on what to tackle first for improvement.

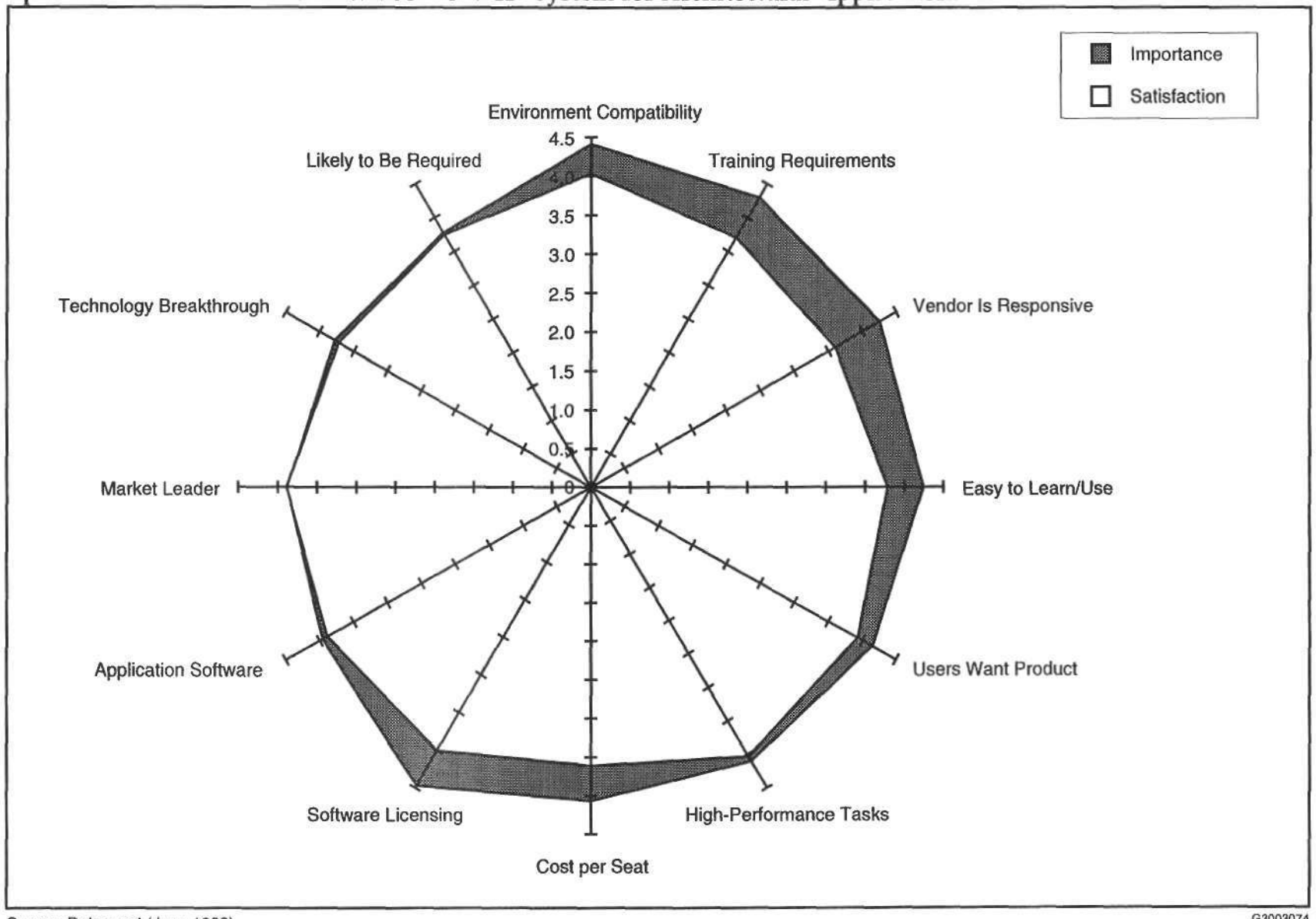
For vendors seeking to sell products to all types of users, we advocate the same product features that we have for the last four years: easy to learn, easy to use, bulletproof (bug-free), with service, support and training built into the software—this goal is difficult, unglamorous, and what users want. Costs associated with extensive training and customer support are probably not feasible in the PC-oriented AEC CAD market. The only way to meet customer needs is to deliver a product that increasingly supports itself.

Customer Satisfaction by Technology

Another way of understanding users is from the perspective of how aggressive they are in adopting CAD technology. For this measure, we were able to identify 15 leading-edge users who do more than 40 percent of their designs in 3-D CAD, 124 majority users who do more than 50 percent of their designs in 2-D CAD, and 20 laggards who do more

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Figure 4-6
Importance versus Satisfaction with AEC CAD System for Architectural Applications



Source: Dataquest (June 1993)

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Table 4-6
Overall Importance and Satisfaction Levels by Application

	Importance	Satisfaction	Gap
Architectural	4.07	3.82	-0.25
Civil/structural	4.12	3.83	-0.29
Process plant design	4.05	3.75	-0.30
Facilities design/management	3.93	4.17	+0.24

Notes:
1. Ratings based on a five-point scale: 1 = not at all satisfied or important, 5 = extremely satisfied/important.
2. A negative gap number indicates a satisfaction deficit; a positive number indicates a surplus.
Source: Dataquest (June 1993)

than 50 percent of design on paper.

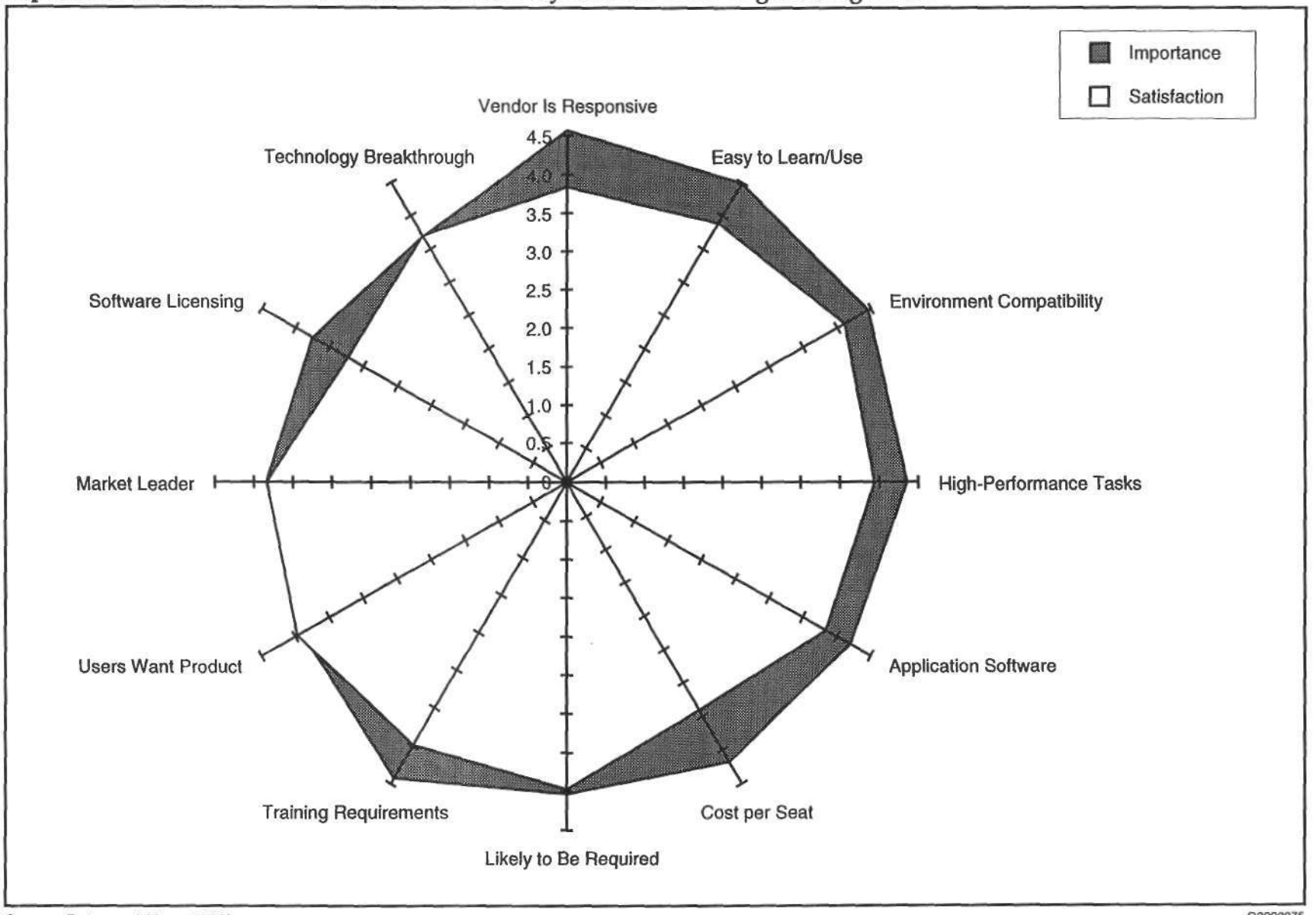
The leading edge (3-D) users are least satisfied with their CAD systems. They reported a very large negative gap of 1.27 on the number one consideration, vendor responsiveness. Although the number two consideration, environmental compatibility, received a tolerable satisfaction score, the third most important factor, vendor flexibility in software licensing, also received a negative gap in satisfaction higher than 1. Leading-edge users also see plenty of room for improvement in the next three most important factors—training requirements, ease of use and learning, and product performance in complex tasks. Cost per seat ranks only ninth in importance, but also suffers a noticeable gap in satisfaction. Finally, even among these most sophisticated users, the importance of technological breakthroughs in products ranks last. Most important is that for whatever reason, this group does not perceive their vendor as responsive to their needs. Some of this dissatisfaction may be related to the other area of substantial dissatisfaction, flexibility in software licensing. The right product and right marketing practices could attract these users to another vendor.

The mainstream user, who does more than half of designs in 2-D CAD, represents the vast majority in this study. This group lies right in between the leading edge users and the laggards in terms of satisfaction with their CAD product—one might call them somewhat satisfied. They show less than total satisfaction with the top three indicators for this group—compatibility with environment, ease of use and learning, and vendor responsiveness. There are no gaping holes to fill for this user group, but they are aware of more possibilities in CAD products than are the laggards.

At the low end of the spectrum, the users who primarily design on paper, all appears well. Satisfaction and importance nearly match on all metrics (except the ever-present vendor responsiveness in which they also placed highest importance). Next highest in importance were training requirements and ease of use/learning. In general, paper-based users appear to place high importance on a CAD product with which is easy

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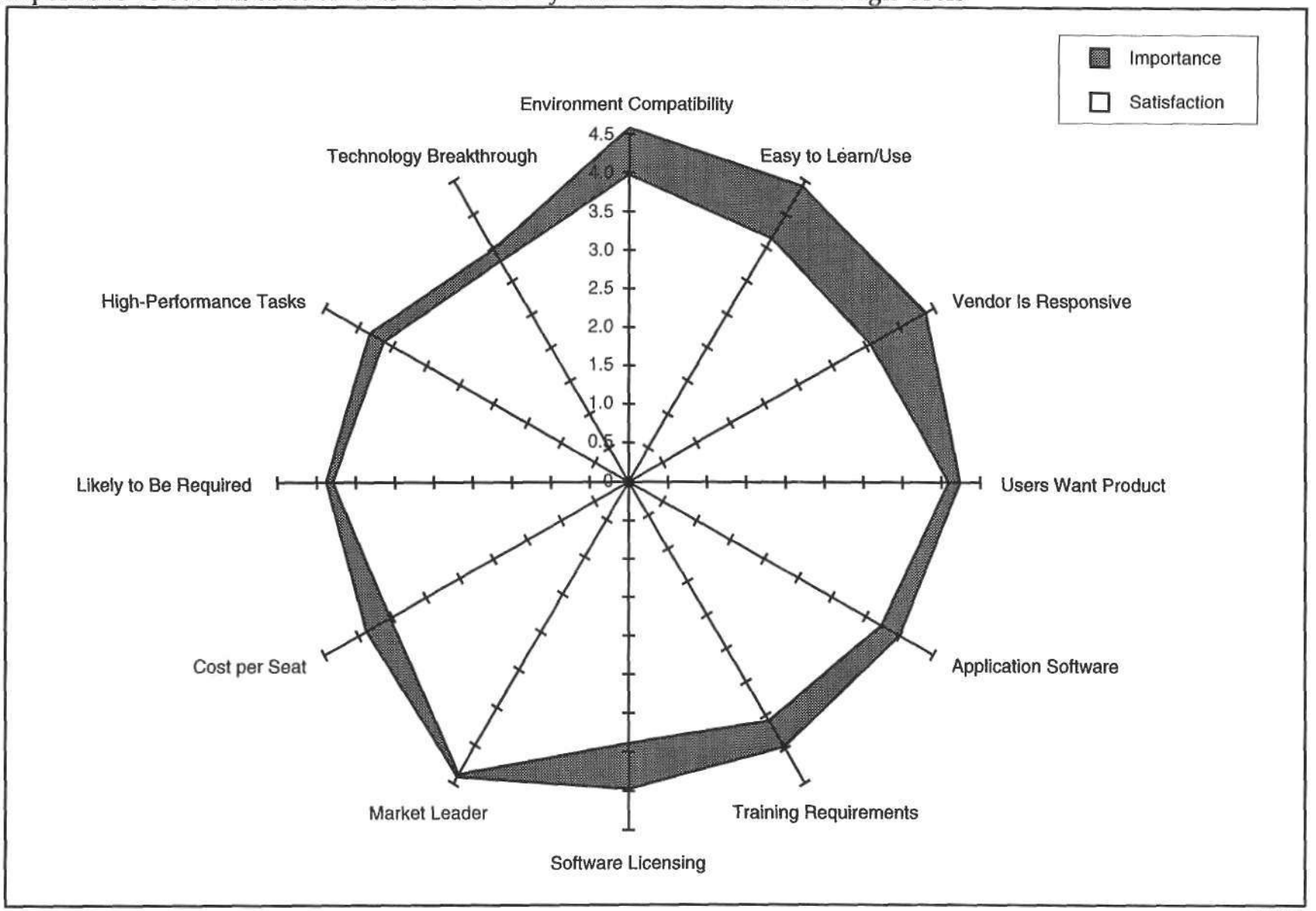
Figure 4-7
Importance versus Satisfaction with AEC CAD System for Civil Engineering Users



Source: Dataquest (June 1993)

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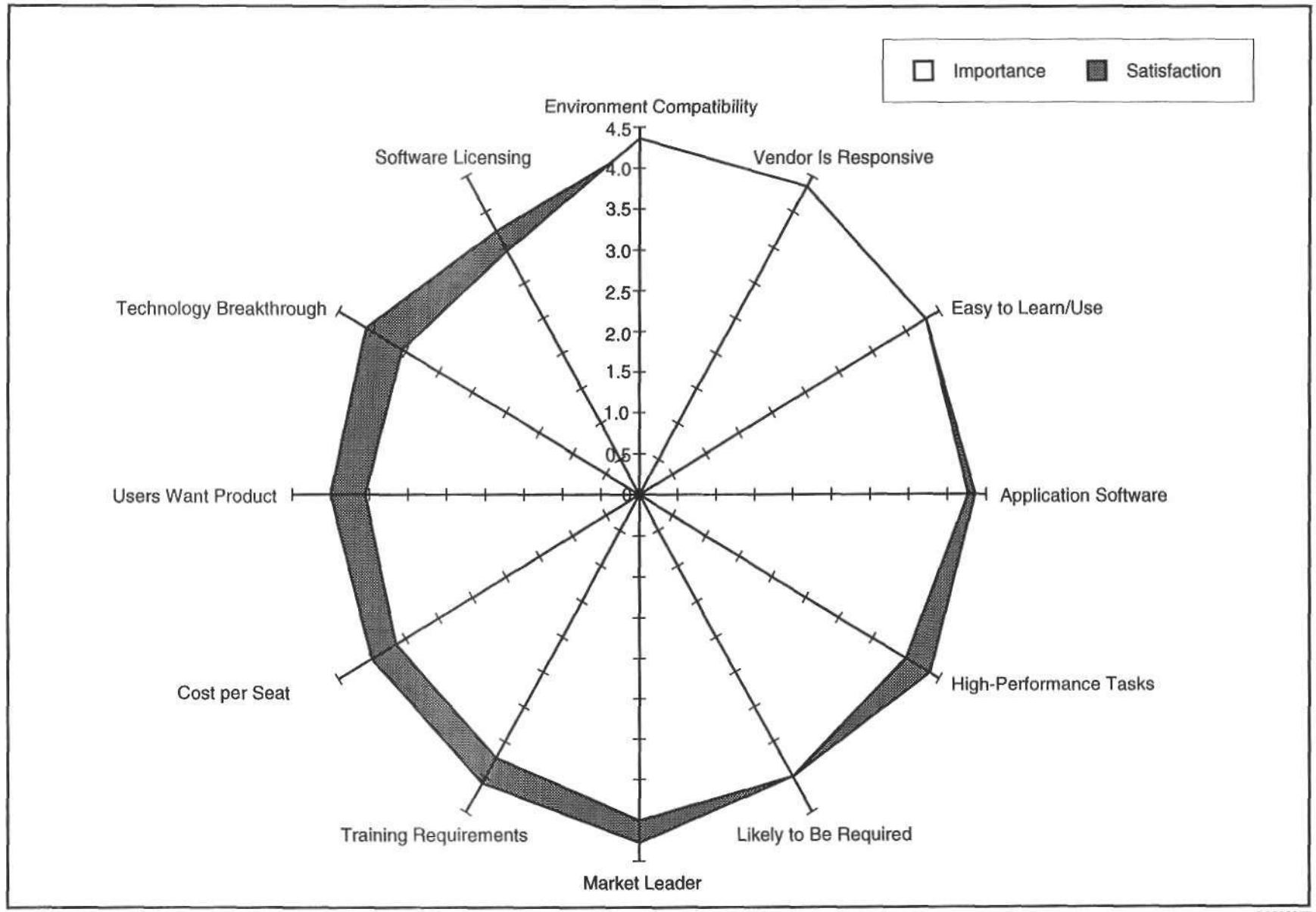
Figure 4-8
Importance versus Satisfaction with AEC CAD System for Process Plant Design Users



Source: Dataquest (June 1993)

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Figure 4-9
Importance versus Satisfaction with AEC CAD System for Facilities Design/Management Users



Source: Dataquest (June 1993)

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to get along. The bad news is that these people are happy, and right now they mostly use paper. The seeds of vision or discontent that would prod them to use more CAD do not appear to be present in terms of the product itself. They are unlikely to be tempted by better products because they are satisfied with minimum technology. For these users, a more persuasive argument will be created when they perceive more advantage to using CAD instead of paper. The surest way to create that perception is to concentrate on making sure the aggressive users actually use design tools to create a commanding competitive advantage over their more less technology-oriented peers—successful users grow markets.

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Chapter 5
What Users Need—Success with CAD

Identifying the Key Success Factors

A long-standing route to increased sales is to understand your customer. Often, benefits are presented to prospects who do not value what is offered, whereas other prospects never hear of a real benefit from a product because it is not articulated. In an effort to better understand AEC users' needs, we asked them to identify which indicators they believe represent key success factors for their own company. Understanding what the customer needs to succeed is essential to developing well-articulated positioning statements that point to benefits the customer actually wants.

Table 5-1 and Figure 5-1 present the results of this analysis, in the same form as the customer satisfaction tables in Chapter 4 (see Chapter 4 for a description of how to read these tables and charts). These illustrations show what keeps AEC CAD customers awake at night:

- Maintaining a competitive advantage
- Responding to regulatory requirements
- Timely and accurate quotes or bids
- Reducing rework at the construction site

All the potential key success factors listed in Table 5-1 can be sold as benefits of design automation. The point is that only some of them matter: the ones at the top of the list. It is particularly easy to see in Figure 5-1 that the key unmet needs are those same factors that are most important to users, and that touting "expert systems" and "computer-assisted specifying" capabilities are ineffective in terms of reaching a prospect's real hot buttons.

To further articulate these key motivations, Tables 5-2 through 5-8 and Figures 5-2 through 5-8 illustrate responses by firm type (architects, architect/engineers, engineer/architects, consulting engineers, engineering constructors, owner operators, and government). Once again, a look at the top four indicators tells us what the customer values, and areas with large gaps in highly ranked indicators tells us what the customer wants and what the customer is not getting today.

Analysis by Firm Type

From these illustrations, it can be seen that architect/engineers believe they are well positioned to succeed, based on their very low gap scores. They are likely to be open to products that help them communicate design progress (the largest unmet need), and the primary sell to this group must include features that help them meet regulatory requirements. This is the only design firm type that ranks anything but "competitive advantage" at the top of company concerns. Respondents that identified their firm as architects or engineer/architect are remarkably

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Table 5-1
Key Success Factors at User's Site: All Users

	Importance	Satisfaction	Gap
Maintaining a competitive advantage	4.41	3.76	-0.65
Responding to regulatory requirements	4.30	3.99	-0.31
Timely and accurate quotes or bids	4.27	3.89	-0.38
Reducing rework at the construction site	4.27	3.70	-0.57
Communicating design or construction progress (i.e., using videos or animations)	4.01	3.48	-0.53
Document management for design or engineering	3.96	3.52	-0.44
Integration of graphic design data with specifications and materials data	3.70	3.27	-0.43
Partnerships and alliances with other industry participants	3.51	3.39	-0.12
Ability to use electronic design for operation and maintenance of structure	3.41	3.29	-0.12
Use of design constraint systems (such as parametric input)	3.29	3.16	-0.13
Use of 3-D CAD	3.22	3.06	-0.16
Electronic design conferencing between members of the AEC design team	3.11	3.11	0
Use of rule-based or expert systems	3.09	3.13	0.04
Use of electronic product catalogs (computer-assisted specifying)	2.89	2.93	0.04

Notes:
1. Ratings based on a five-point scale: 1 = not at all satisfied or important, 5 = extremely satisfied/important.
2. A negative gap number indicates a satisfaction deficit; a positive number indicates a surplus.
Source: Dataquest (June 1993)

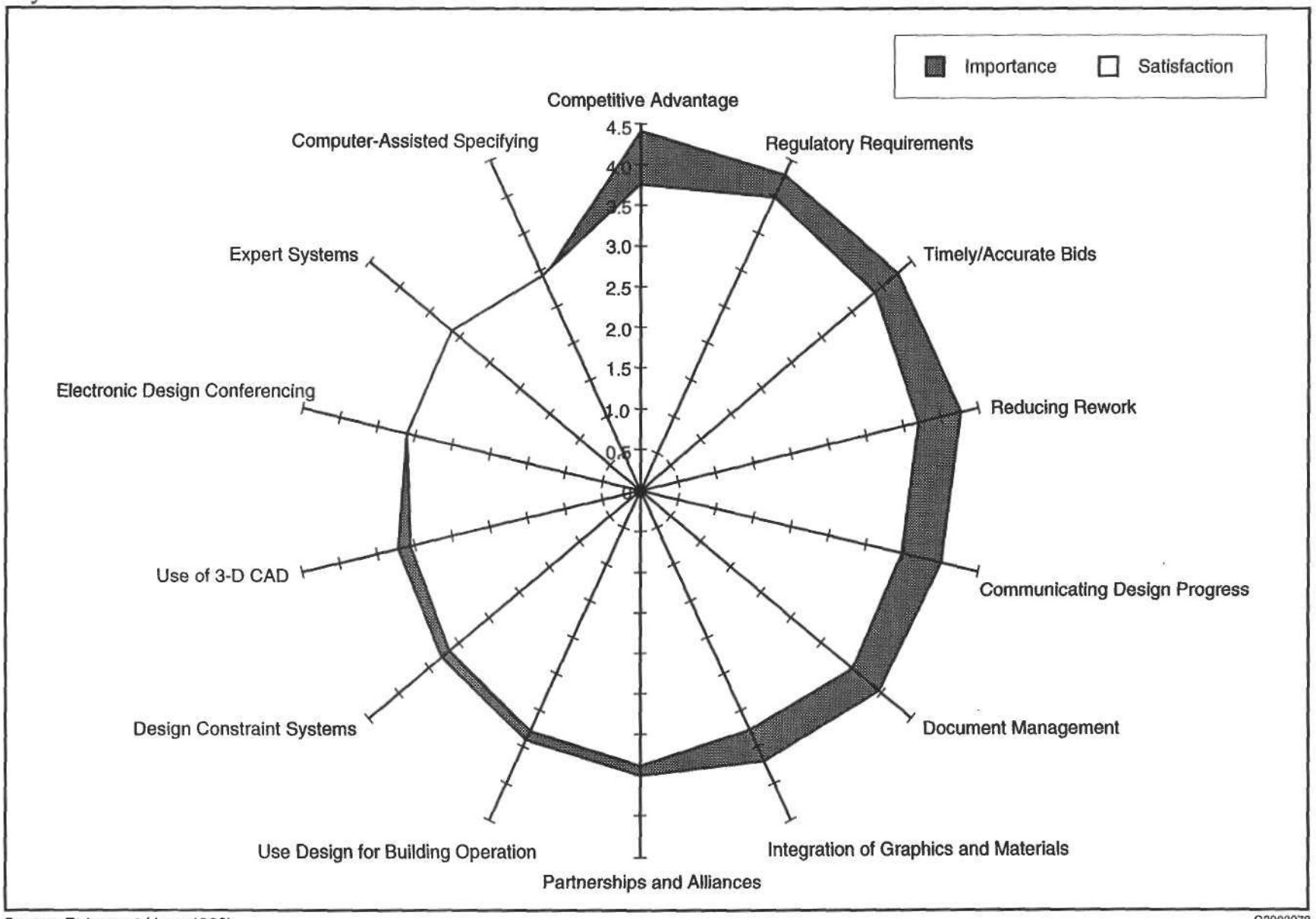
similar in profile, suggesting that marketing programs can be similar for the two groups.

Engineering constructors are experiencing the biggest gaps between what their firm can do and what they believe they need to do to succeed. This group dominates the design market, having grown for several years at the expense of other design firm types. This very successful group does not suffer from complacency. Engineering constructors also work with the full range of problems that plague design and construction—they are keenly aware of what needs fixing, such as reducing rework and communicating progress with the customer.

Nonservice users are divided into owner operators and government users because of their different success profile. Whereas the No. 1 position of "meting regulatory requirements" could be expected, user concern about using design data for building operations appears to be less than what conventional wisdom would suggest—and the satisfaction gap is not high on this metric. This is a case in which it is easy to

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Figure 5-1
Key Success Factors at User's Site



Source: Dataquest (June 1993)

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Table 5-2
Key Success Factors at User's Site: Architects

	Importance	Satisfaction	Gap
Maintaining a competitive advantage	4.49	3.98	-0.51
Timely and accurate quotes or bids	4.46	4.07	-0.39
Responding to regulatory requirements	4.27	3.69	-0.58
Reducing rework at the construction site	4.20	3.76	-0.44
Document management for design or engineering	4.12	3.85	-0.27
Communicating design or construction progress (i.e., using videos or animations)	4.12	3.71	-0.41
Integration of graphic design data with specifications and materials data	3.76	3.44	-0.32
Partnerships and alliances with other industry participants	3.66	3.51	-0.15
Use of 3-D CAD	3.51	3.02	-0.49
Ability to use electronic design for operation and maintenance of structure	3.48	3.45	-0.03
Use of electronic product catalogs (computer-assisted specifying)	3.39	3.22	-0.17
Electronic design conferencing between members of the AEC design team	3.34	3.32	-0.02
Use of design constraint systems (such as parametric input)	3.30	3.43	0.13
Use of rule-based or expert systems	3.29	3.32	0.03

Notes:
1. Ratings based on a five-point scale: 1 = not at all satisfied or important, 5 = extremely satisfied/important.
2. A negative gap number indicates a satisfaction deficit; a positive number indicates a surplus.
Source: Dataquest (June 1993)

see other areas that might deserve more attention from vendors—helping owner operators do a better job of creating a competitive advantage and reducing rework in construction.

This analysis by vendor type was initially done to investigate whether or not the surprisingly low importance scores on items like "use of 3-D CAD" and "use of expert systems" hold true among all firm types, and they do. This suggests that the bottom-ranked items for all users (Table 5-1) could profitably receive less emphasis as benefits being sold to make room more critical user concerns. It must be remembered that this is a North American survey and that interest in 3-D design may well be higher in Europe.

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Table 5-3
Key Success Factors at User's Site: Architect/Engineers

	Importance	Satisfaction	Gap
Responding to regulatory requirements	4.39	4.28	-0.11
Maintaining a competitive advantage	4.28	3.94	-0.34
Timely and accurate quotes or bids	4.11	4.00	-0.11
Communicating design or construction progress (i.e., using videos or animations)	4.00	3.50	-0.50
Reducing rework at the construction site	3.94	4.06	0.12
Document management for design or engineering	3.56	3.83	0.27
Use of 3-D CAD	3.50	3.28	-0.22
Use of design constraint systems (such as parametric input)	3.41	3.29	-0.12
Ability to use electronic design for operation and maintenance of structure	3.41	3.35	-0.06
Integration of graphic design data with specifications and materials data	3.39	3.39	0
Partnerships and alliances with other industry participants	3.30	3.56	0.26
Use of rule-based or expert systems	3.28	3.33	0.05
Electronic design conferencing between members of the AEC design team	3.11	3.39	0.28
Use of electronic product catalogs (computer-assisted specifying)	2.94	3.06	0.12

Notes:
1. Ratings based on a five-point scale: 1 = not at all satisfied or important, 5 = extremely satisfied/important.
2. A negative gap number indicates a satisfaction deficit; a positive number indicates a surplus.
Source: Dataquest (June 1993)

Defining Success

Despite the significant investments of time and money required to implement new CAD systems, little effective research has been done to uncover what works well and what does not, despite the fact that there are plenty of working sites to analyze. One of the goals of this study is to help users understand what they need to do to succeed with design automation—to capture the subtle differences between sites that are especially successful and active sites that have problems. Vendors of all information technology need to understand what helps make their products become successful with customers. Long-term sales are built on products that work for the buyer.

Dataquest's definitions of "successful" and "troubled" sites are simple. Using a five-point scale, users named the degree to which they agreed with the statement, "Our organization's progress to date in making use of CAD technology has been excellent." Those who chose "1" or "2"

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Table 5-4
Key Success Factors at User's Site: Engineer/Architects

	Importance	Satisfaction	Gap
Maintaining a competitive advantage	4.32	3.71	-0.61
Timely and accurate quotes or bids	4.16	3.79	-0.37
Reducing rework at the construction site	4.13	3.82	-0.31
Responding to regulatory requirements	4.10	3.89	-0.21
Document management for design or engineering	3.92	3.27	-0.65
Communicating design or construction progress (i.e., using videos or animations)	3.92	3.37	-0.55
Integration of graphic design data with specifications and materials data	3.71	3.35	-0.36
Ability to use electronic design for operation and maintenance of structure	3.38	3.24	-0.14
Partnerships and alliances with other industry participants	3.35	3.43	0.08
Use of design constraint systems (such as parametric input)	3.26	3.17	-0.09
Use of 3-D CAD	3.21	3.26	0.05
Use of rule-based or expert systems	3.17	3.06	-0.11
Electronic design conferencing between members of the AEC design team	3.00	3.11	0.11
Use of electronic product catalogs (computer-assisted specifying)	2.80	2.72	-0.08

Notes:
1. Ratings based on a five-point scale: 1 = not at all satisfied or important, 5 = extremely satisfied/important.
2. A negative gap number indicates a satisfaction deficit; a positive number indicates a surplus.
Source: Dataquest (June 1993)

(those that disagree strongly or somewhat with the statement) are referred to as "troubled" sites, of which there were 20. The reasoning is that users who elect to place their AEC CAD environment on the wrong side of "excellent" have some kind of problem at the site.

Similarly, 44 sites were labeled "successes" where users chose "5" (they strongly agree with the statement). Users representing truly successful sites are likely to agree that their progress has been excellent; therefore, we have captured the group we are after. This leaves only a potential group of wishful thinkers who "strongly agree" because they believe they are in better shape than an objective evaluation might support. Extricating this group from the actual successes is very difficult; leaving them in the "actually" successful group only has the result of including a few optimists whose projects are merely above average. In the end, we are still comparing a group that has more problems with a group that has fewer problems.

The successful and troubled sites were compared to determine where their attitudes are significantly different across a wide variety of

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Table 5-5
Key Success Factors at User's Site: Consulting Engineers

	Importance	Satisfaction	Gap
Maintaining a competitive advantage	4.81	3.65	-1.16
Responding to regulatory requirements	4.50	4.00	-0.50
Reducing rework at the construction site	4.50	3.81	-0.69
Timely and accurate quotes or bids	4.35	3.92	-0.43
Communicating design or construction progress (i.e., using videos or animations)	4.12	3.46	-0.66
Document management for design or engineering	4.04	3.31	-0.73
Partnerships and alliances with other industry participants	3.81	3.35	-0.46
Integration of graphic design data with specifications and materials data	3.62	2.92	-0.70
Ability to use electronic design for operation and maintenance of structure	2.92	2.85	-0.07
Use of design constraint systems (such as parametric input)	2.91	2.91	0
Electronic design conferencing between members of the AEC design team	2.81	2.64	-0.17
Use of rule-based or expert systems	2.75	2.92	0.17
Use of 3-D CAD	2.69	2.77	0.08
Use of electronic product catalogs (computer-assisted specifying)	2.64	2.68	0.04

Notes:
1. Ratings based on a five-point scale: 1 = not at all satisfied or important, 5 = extremely satisfied/important.
2. A negative gap number indicates a satisfaction deficit; a positive number indicates a surplus.
Source: Dataquest (June 1993)

questions. It is at this point, in which failure and success part company, that we are likely to discover the origins of critical problems. For example, "training" surely has value in CAD implementation. However, if the successful and unsuccessful believe that they would be slightly better off with better training, then "training" is not the variable that is contributing to the success.

Attitudes that significantly separate the "successful" from the "troubled" were identified using statistical analysis tools. Differences are highlighted as "significant" throughout this report where their probabilities are less than 5 percent. Differences significant at this level indicate that there is a 95 percent chance that the difference is real and characteristic of the population. In other words, one can be 95 percent sure that the people represented by one group would select that answer more often than the people represented by the other groups in the sample.

Success with CAD does vary by firm type (see Figure 5-9). Architects have the largest group who somewhat or strongly agree they are succeeding with CAD. Nonservices are experiencing the lowest success rates.

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Table 5-6
Key Success Factors at User's Site: Engineering Constructors

	Importance	Satisfaction	Gap
Maintaining a competitive advantage	4.69	3.50	-1.19
Reducing rework at the construction site	4.62	3.42	-1.20
Timely and accurate quotes or bids	4.40	3.76	-0.64
Responding to regulatory requirements	4.15	3.69	-0.46
Communicating design or construction progress (i.e., using videos or animations)	4.04	3.31	-0.73
Document management for design or engineering	3.88	3.35	-0.53
Integration of graphic design data with specifications and materials data	3.77	3.19	-0.58
Ability to use electronic design for operation and maintenance of structure	3.48	3.52	0.04
Use of design constraint systems (such as parametric input)	3.44	2.84	-0.60
Partnerships and alliances with other industry participants	3.23	3.12	-0.11
Use of 3-D CAD	3.12	2.85	-0.27
Use of rule-based or expert systems	3.08	2.96	-0.12
Electronic design conferencing between members of the AEC design team	3.08	3.04	-0.04
Use of electronic product catalogs (computer-assisted specifying)	2.56	2.52	-0.04

Notes:
1. Ratings based on a five-point scale: 1 = not at all satisfied or important, 5 = extremely satisfied/important.
2. A negative gap number indicates a satisfaction deficit; a positive number indicates a surplus.
Source: Dataquest (June 1993)

Successful Sites Manage the Big Picture

Successful sites are significantly more satisfied with company progress on the following factors, ranked by the amount of significant difference between successful and troubled sites:

- Document management for design or engineering
- Integration of graphic design data with specifications and materials data
- Maintaining a competitive advantage
- Use of 3-D CAD
- Ability to use electronic design for operation and maintenance of structure
- Product training

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Table 5-7
Key Success Factors at User's Site: Owner Operators

	Importance	Satisfaction	Gap
Responding to regulatory requirements	4.65	4.39	-0.26
Maintaining a competitive advantage	4.35	3.70	-0.65
Reducing rework at the construction site	4.22	3.52	-0.70
Timely and accurate quotes or bids	4.09	3.74	-0.35
Document management for design or engineering	3.95	3.41	-0.54
Ability to use electronic design for operation and maintenance of structure	3.75	3.50	-0.25
Communicating design or construction progress (i.e., using videos or animations)	3.70	3.30	-0.40
Integration of graphic design data with specifications and materials data	3.61	3.09	-0.52
Electronic design conferencing between members of the AEC design team	3.50	3.32	-0.18
Partnerships and alliances with other industry participants	3.39	3.17	-0.22
Use of rule-based or expert systems	3.14	3.19	0.05
Use of design constraint systems (such as parametric input)	3.05	3.00	-0.05
Use of electronic product catalogs (computer-assisted specifying)	3.00	3.19	0.19
Use of 3-D CAD	3.00	3.18	0.18

Notes:
1. Ratings based on a five-point scale: 1 = not at all satisfied or important, 5 = extremely satisfied/important.
2. A negative gap number indicates a satisfaction deficit; a positive number indicates a surplus.
Source: Dataquest (June 1993)

Successful users also place significantly more importance on the last two factors. There is a dramatic difference between successful and troubled sites on standards. Eighty percent successful sites have standards for CAD software purchases, whereas only fifty-five percent of troubled sites do (see Figure 5-10). Standards do not appear to inhibit success.

Successful companies also varied from their troubled counterparts over the reasons they purchased CAD systems (see Figure 5-11). Successful sites actually purchase for a wide variety of reasons. Troubled sites appear to buy quickly when they have a new project, but not because the customer required the product.

Successful companies are also significantly more likely to say that they are able to produce more complex designs than three years earlier. The above characteristics, taken together, paint a portrait of coherence and intelligence—users who are making design tools work for them at a practical level and in ways that will help integrate their efforts with their

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Table 5-8
Key Success Factors at User's Site: Government

	Importance	Satisfaction	Gap
Reducing rework at the construction site	4.31	3.43	-0.88
Timely and accurate quotes or bids	4.19	3.94	-0.25
Responding to regulatory requirements	4.13	3.93	-0.20
Communicating design or construction progress (i.e., using videos or animations)	4.13	3.69	-0.44
Integration of graphic design data with specifications and materials data	4.06	3.44	-0.62
Document management for design or engineering	4.06	3.63	-0.43
Partnerships and alliances with other industry participants	3.87	3.67	-0.20
Use of design constraint systems (such as parametric input)	3.85	3.46	-0.39
Ability to use electronic design for operation and maintenance of structure	3.63	3.06	-0.57
Maintaining a competitive advantage	3.53	3.79	0.26
Use of 3-D CAD	3.38	3.13	-0.25
Electronic design conferencing between members of the AEC design team	2.81	2.88	0.07
Use of rule-based or expert systems	2.67	3.07	0.40
Use of electronic product catalogs (computer-assisted specifying)	2.60	3.29	0.69

Notes:
1. Ratings based on a five-point scale: 1 = not at all satisfied or important, 5 = extremely satisfied/important.
2. A negative gap number indicates a satisfaction deficit; a positive number indicates a surplus.
Source: Dataquest (June 1993)

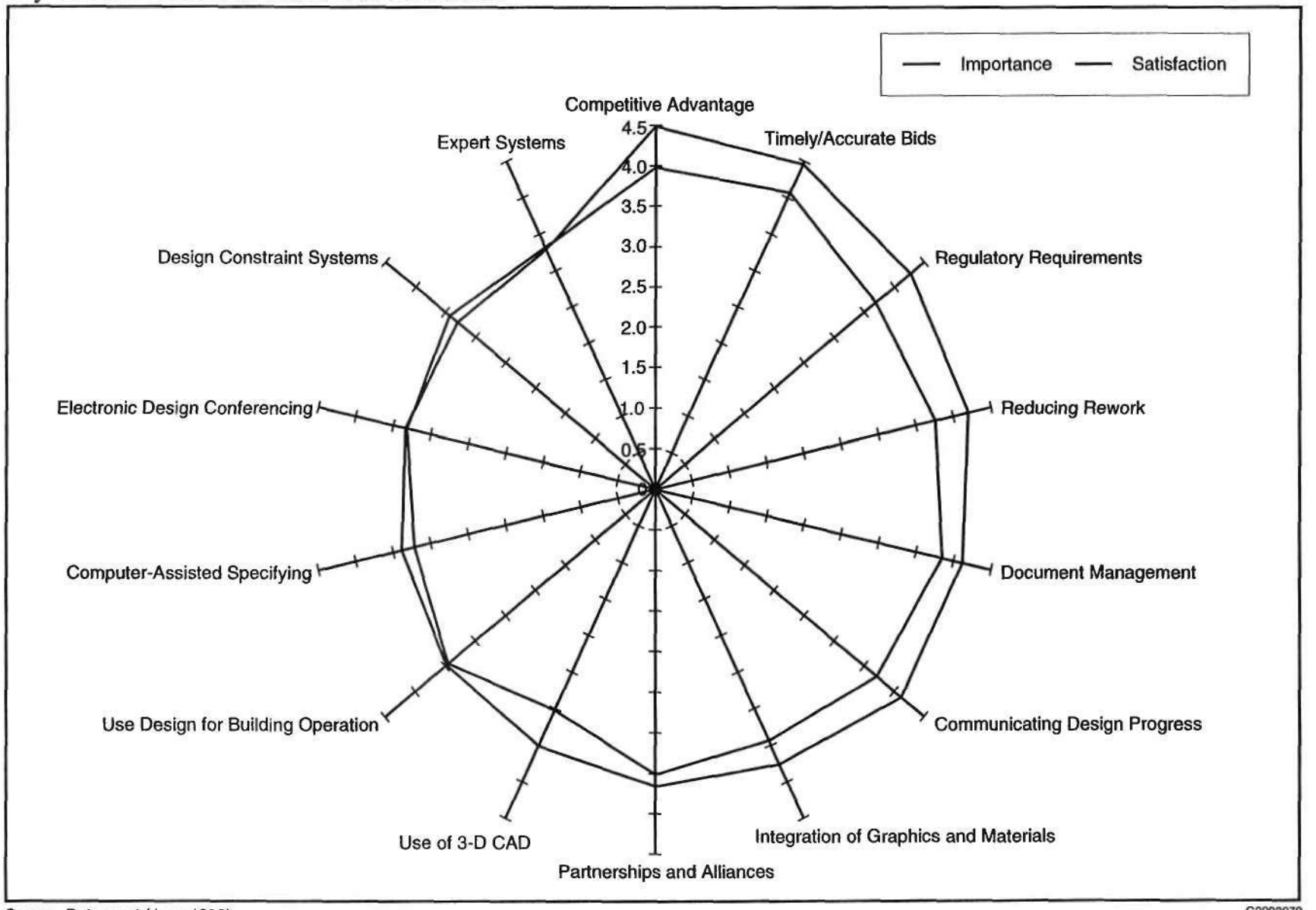
company and their customers. Technologies and requirements in this list are fairly well understood and proven, yet are a clear step above the more common focus on "more drawings faster."

Successful sites are also significantly more likely to agree with the statement, "Information networks (formal and informal) are strong in my organization." This same measure of internal communication was also associated with successful installations in a previous study of users of geographic information systems—an accumulation of evidence that poor internal communication sacrifices success with information technology, a sacrifice that few enterprises can afford in an era in which information is increasingly the source of competitive advantage.

The most startling difference between successful and troubled sites became clear when we asked users to what extent they agreed with the statement, "Engineering management here thoroughly understands the capabilities of design software." Figure 5-12, which shows the dramatic difference between the two groups, points to a potentially critical problem. As information technology has been introduced to design

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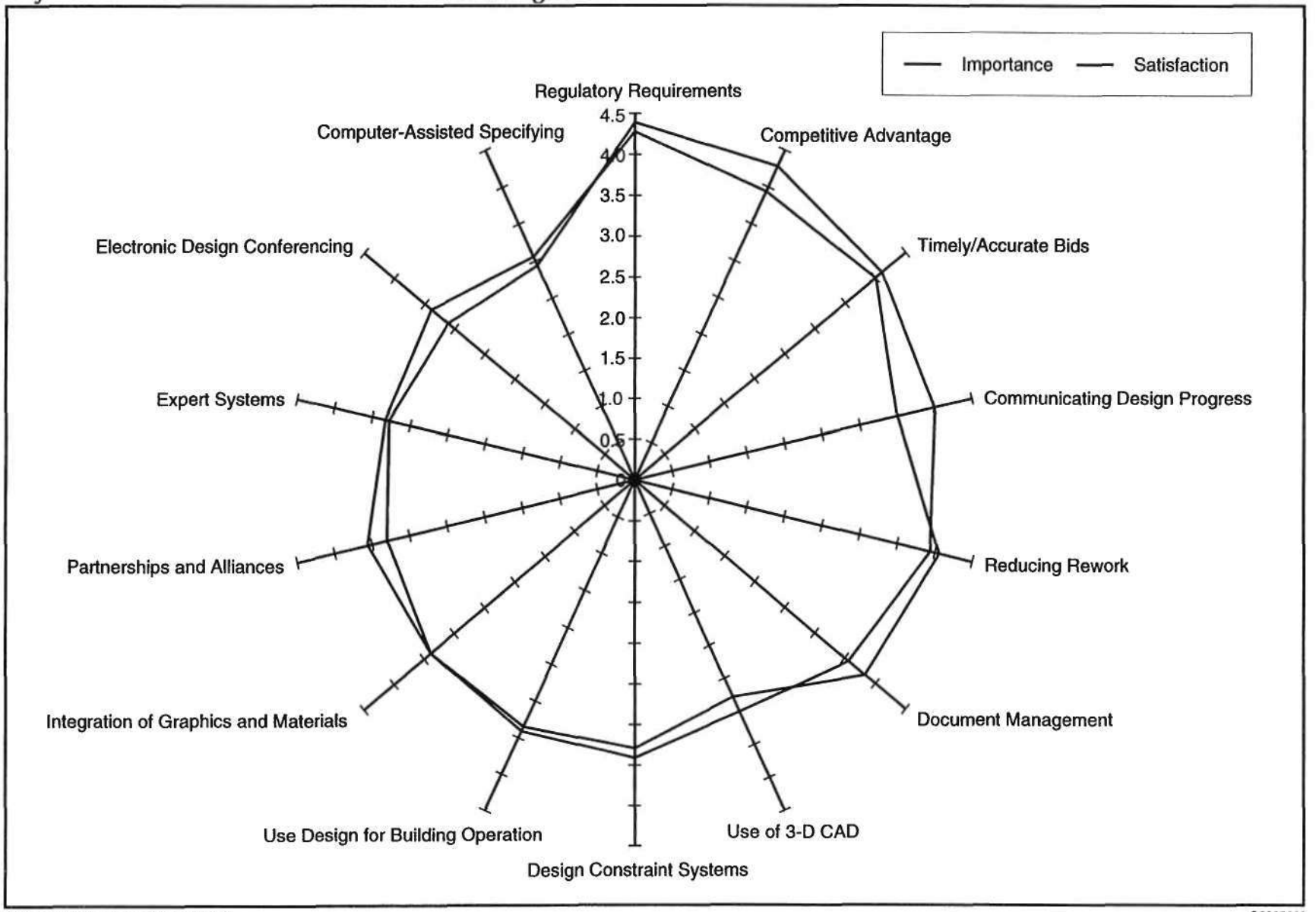
Figure 5-2
Key Success Factors at User's Site: Architects



Source: Dataquest (June 1993)

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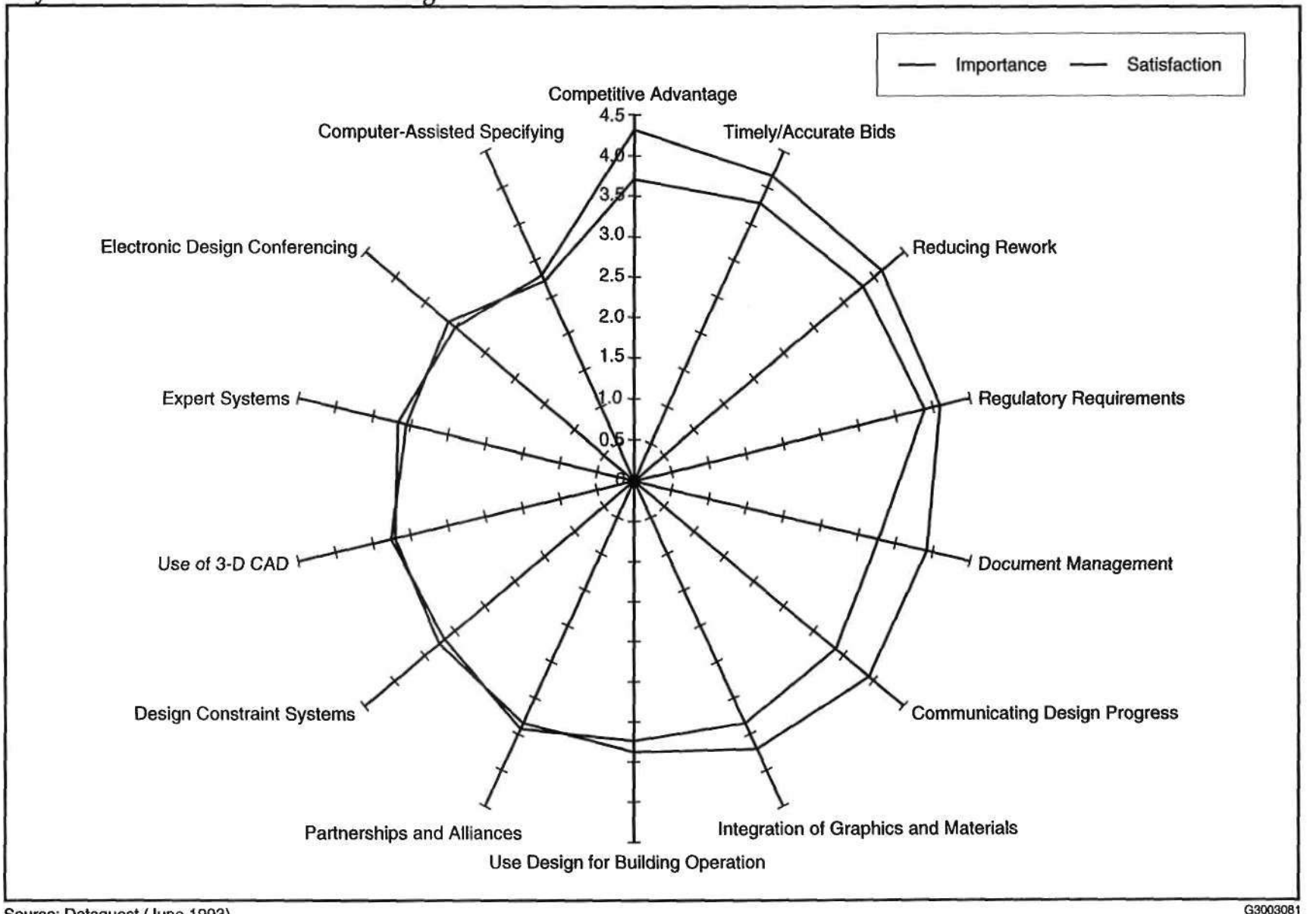
Figure 5-3
Key Success Factors at User's Site: Architect/Engineers



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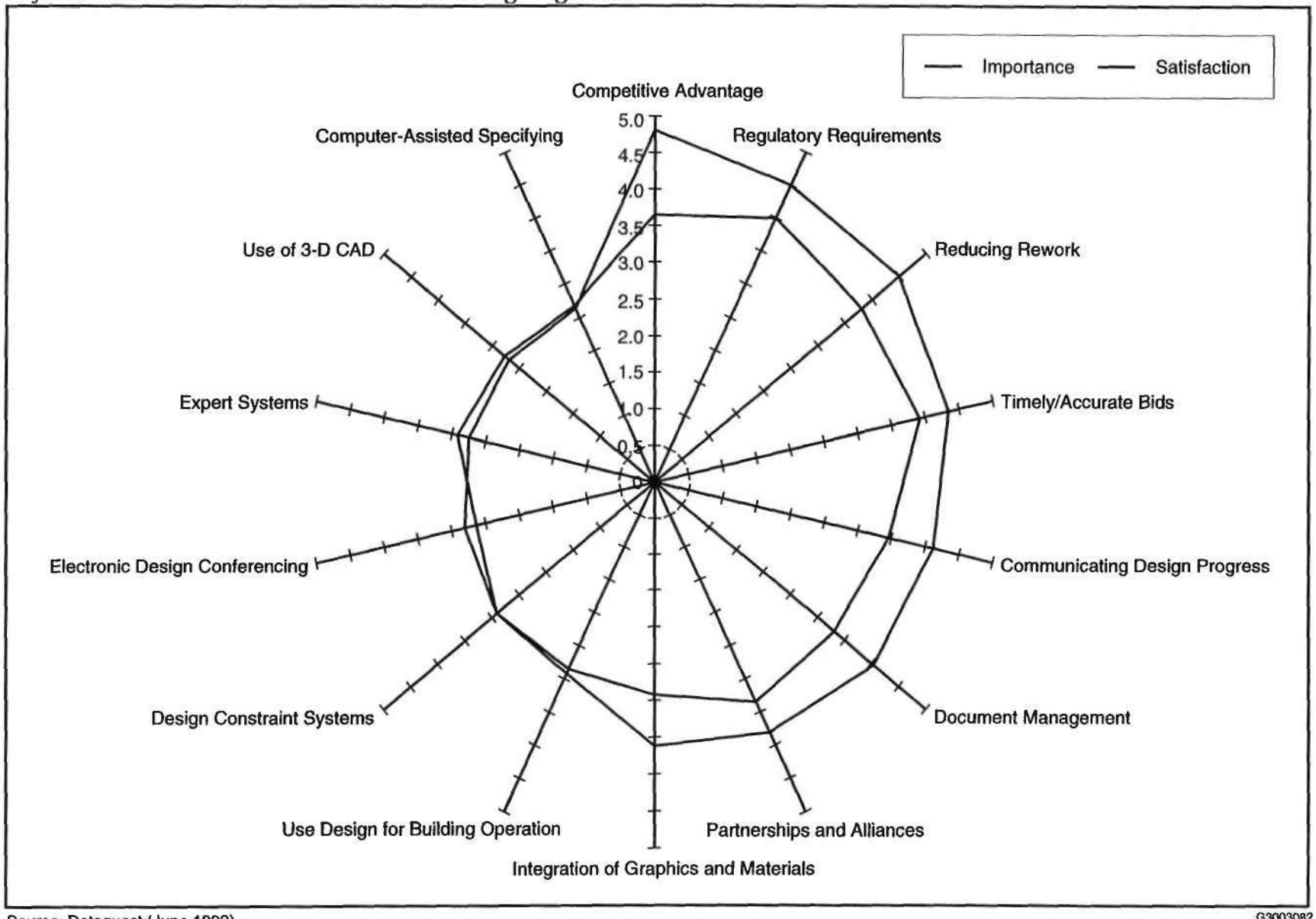
Figure 5-4
Key Success Factors at User's Site: Engineer/Architects



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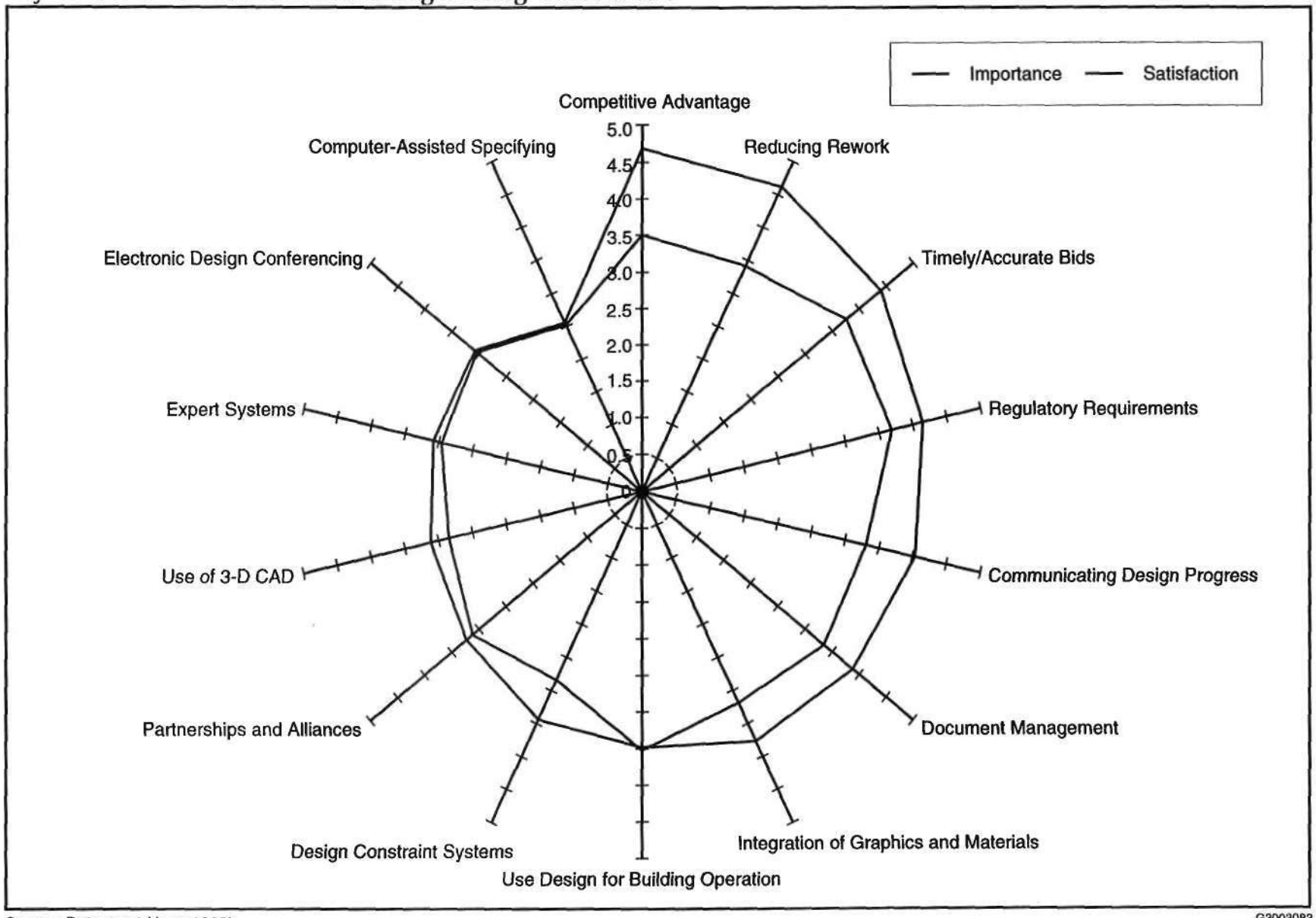
Figure 5-5
Key Success Factors at User's Site: Consulting Engineers



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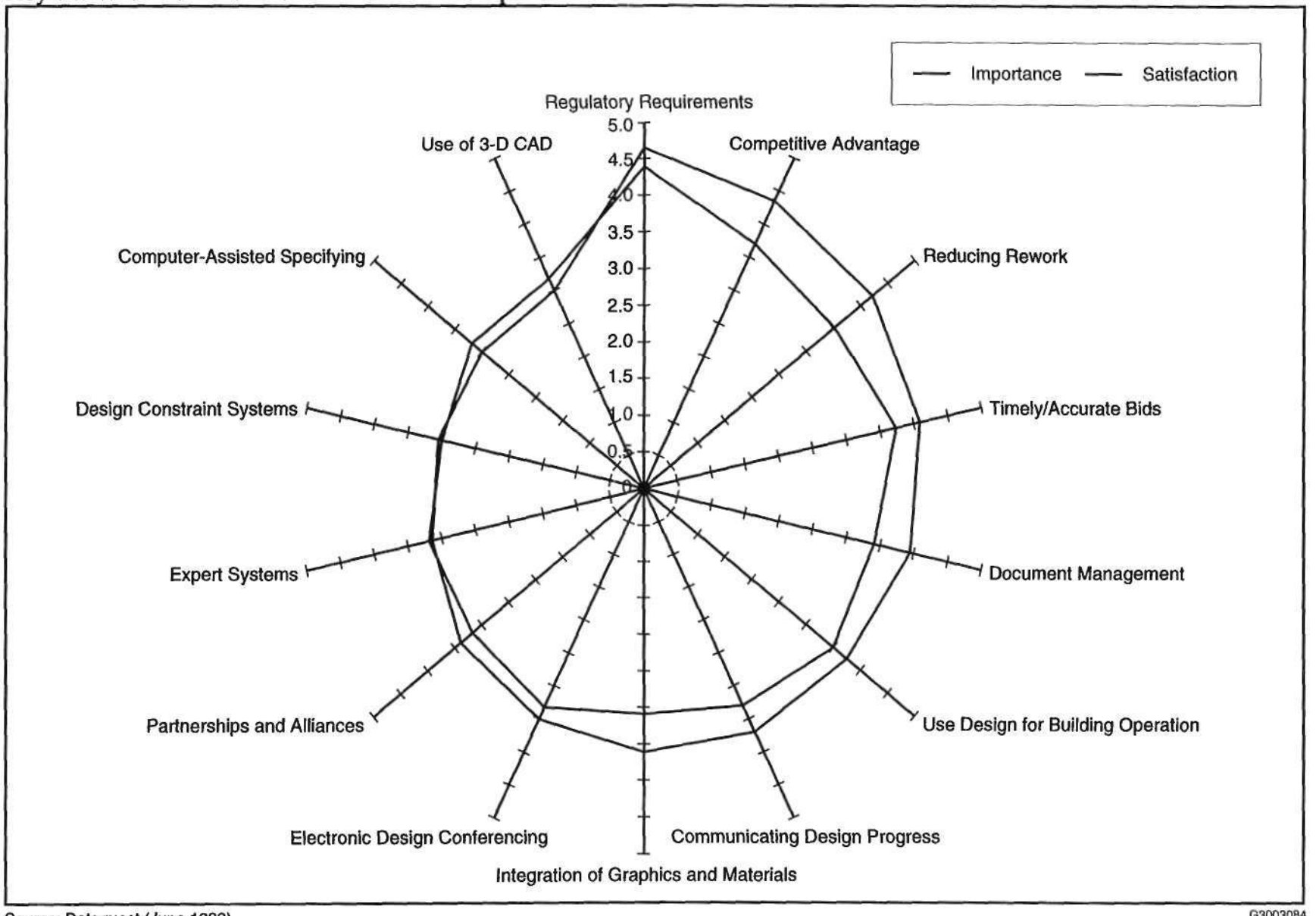
Figure 5-6
Key Success Factors at User's Site: Engineering Constructors



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Figure 5-7
Key Success Factors at User's Site: Owner Operators

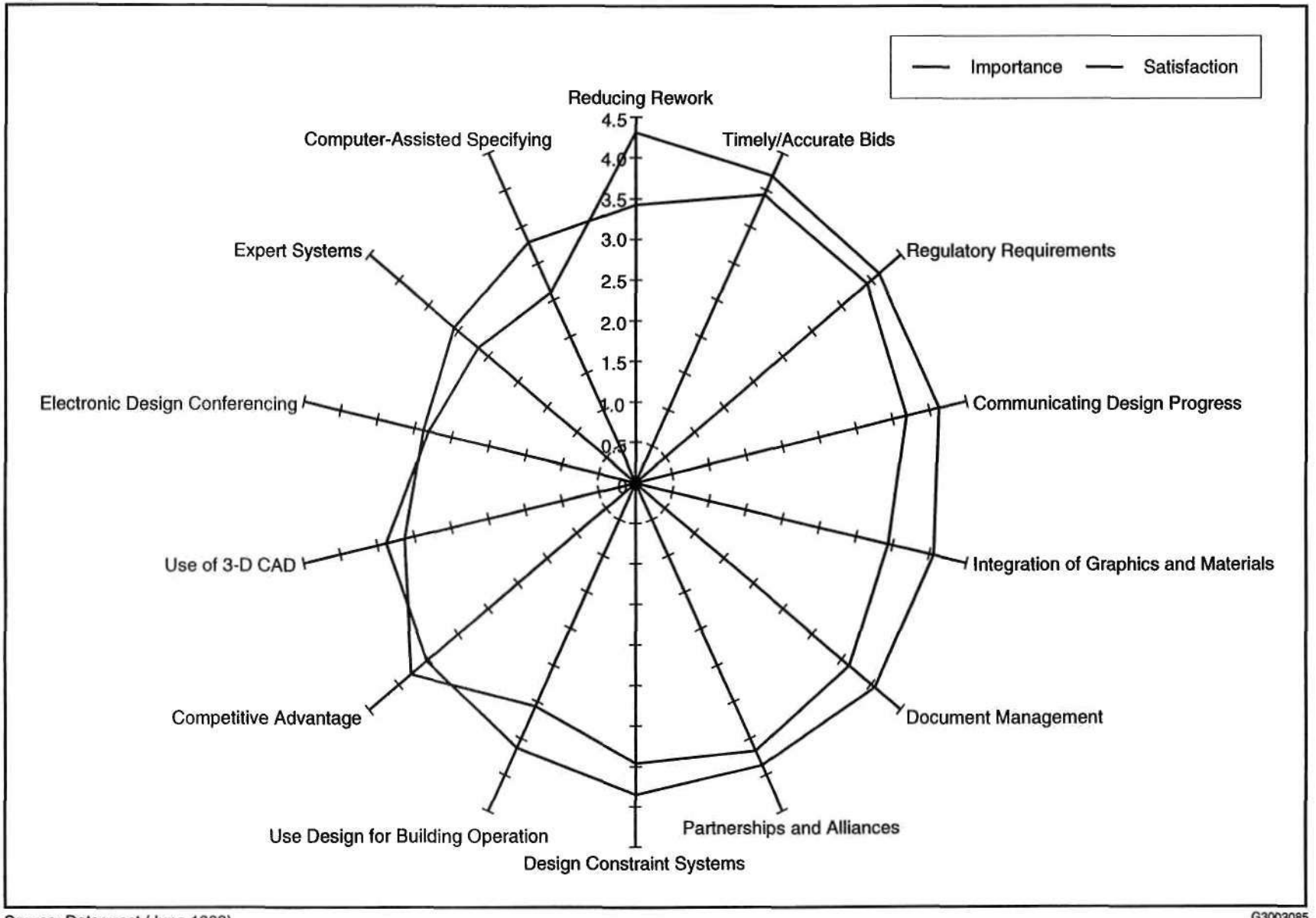


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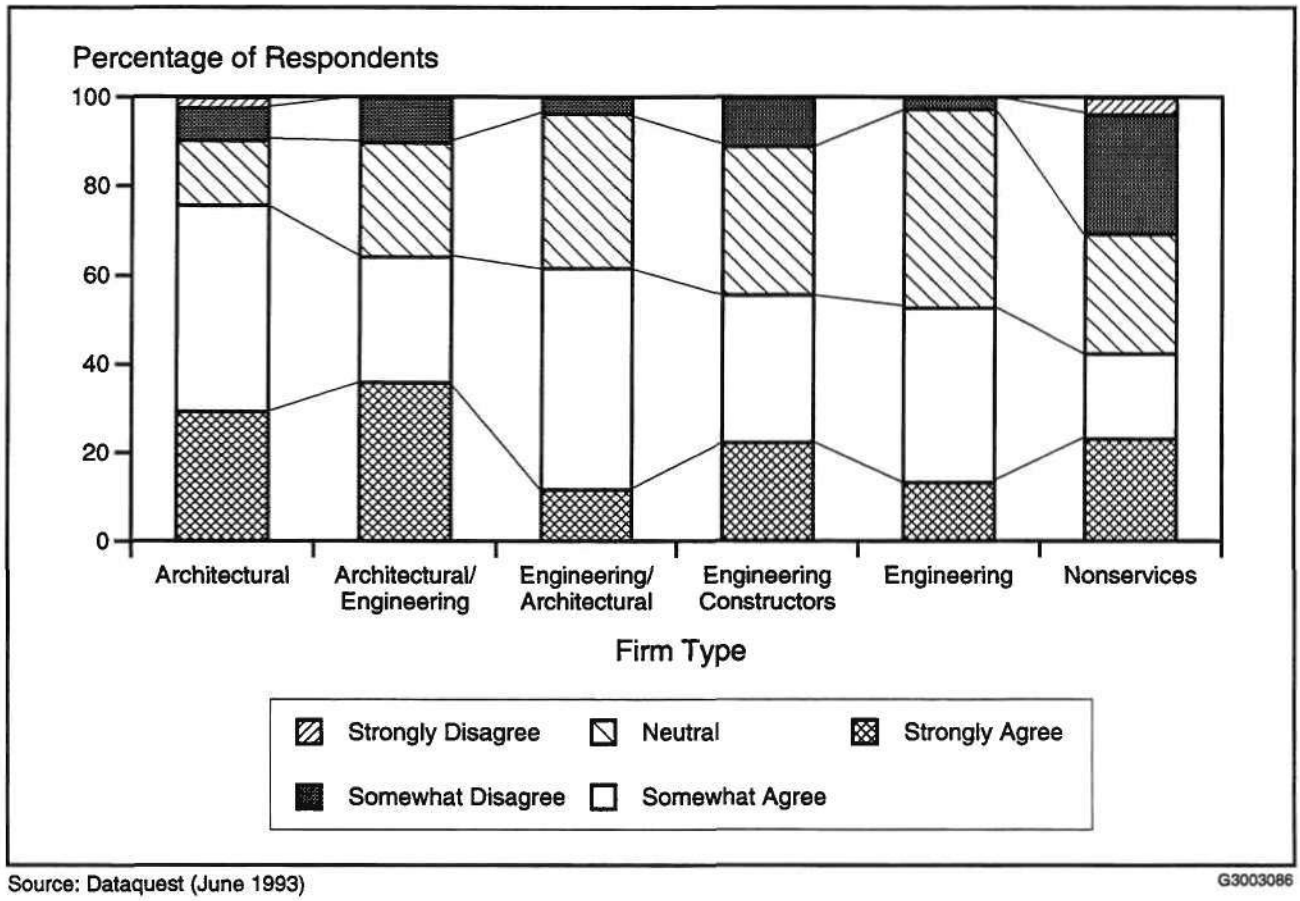
Figure 5-8
Key Success Factors at User's Site: Government



Source: Dataquest (June 1993)

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Figure 5-9
"Our Organization's Progress to Date in Making Use of CAD Technology Has Been Excellent"



Source: Dataquest (June 1993)

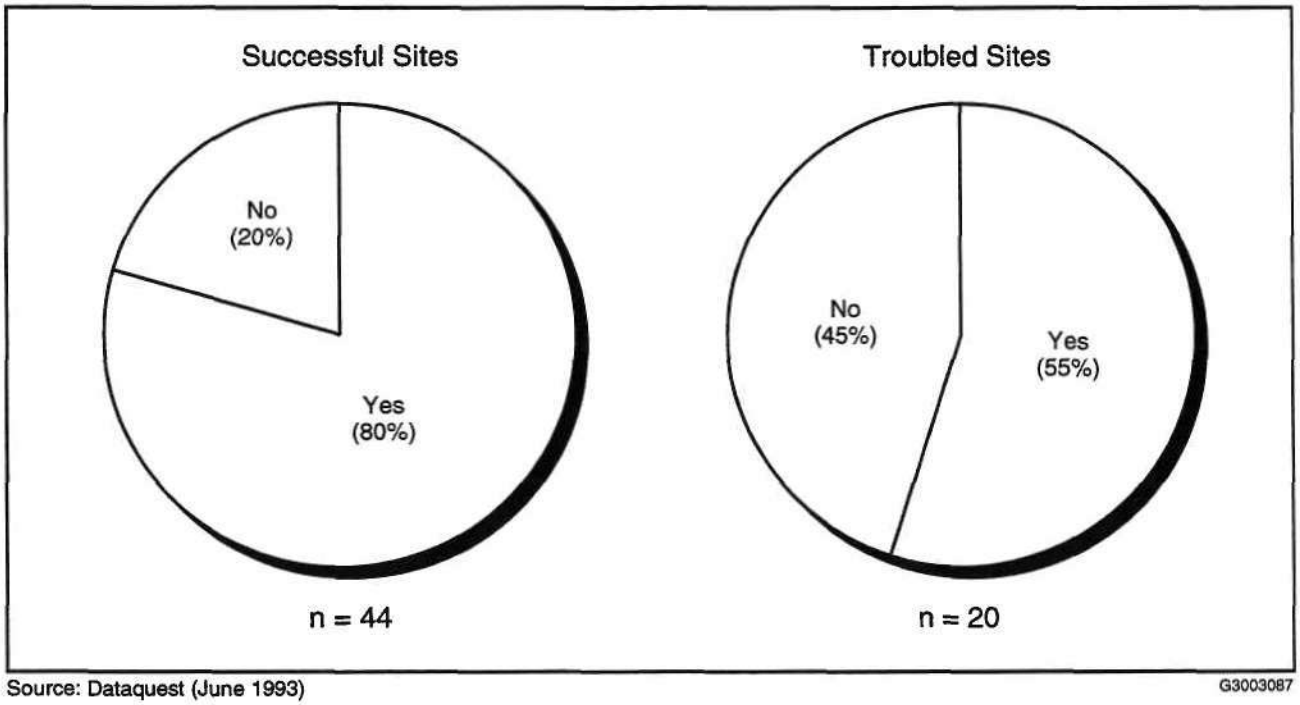
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environments, "CAD managers" have necessarily evolved to manage the increasingly complex technology. Unfortunately, this reliance on technology wizards creates an opportunity for engineering management to become one step removed from portions of the design process. Put off by the challenges of learning complex new technologies, some chief engineers and architects have allowed themselves to become increasingly removed from the changes going in the computers under their jurisdiction. Figure 5-12 suggests this route does not work, that engineering management must be intimately involved with the capabilities of design software if the investment is to succeed.

At a substantial number of firms, management is familiar with the CAD software. Figure 5-13, which shows the distribution of answers on the question, also illustrates the disturbing fact that the distribution slightly favors those who disagree that management understands the software. For comparison, Figure 5-14 illustrates the heartening trend toward agreement that more complex design problems are being solved.

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Figure 5-10
"Successful Companies Have Corporate Standards for Which CAD Software Is Purchased"

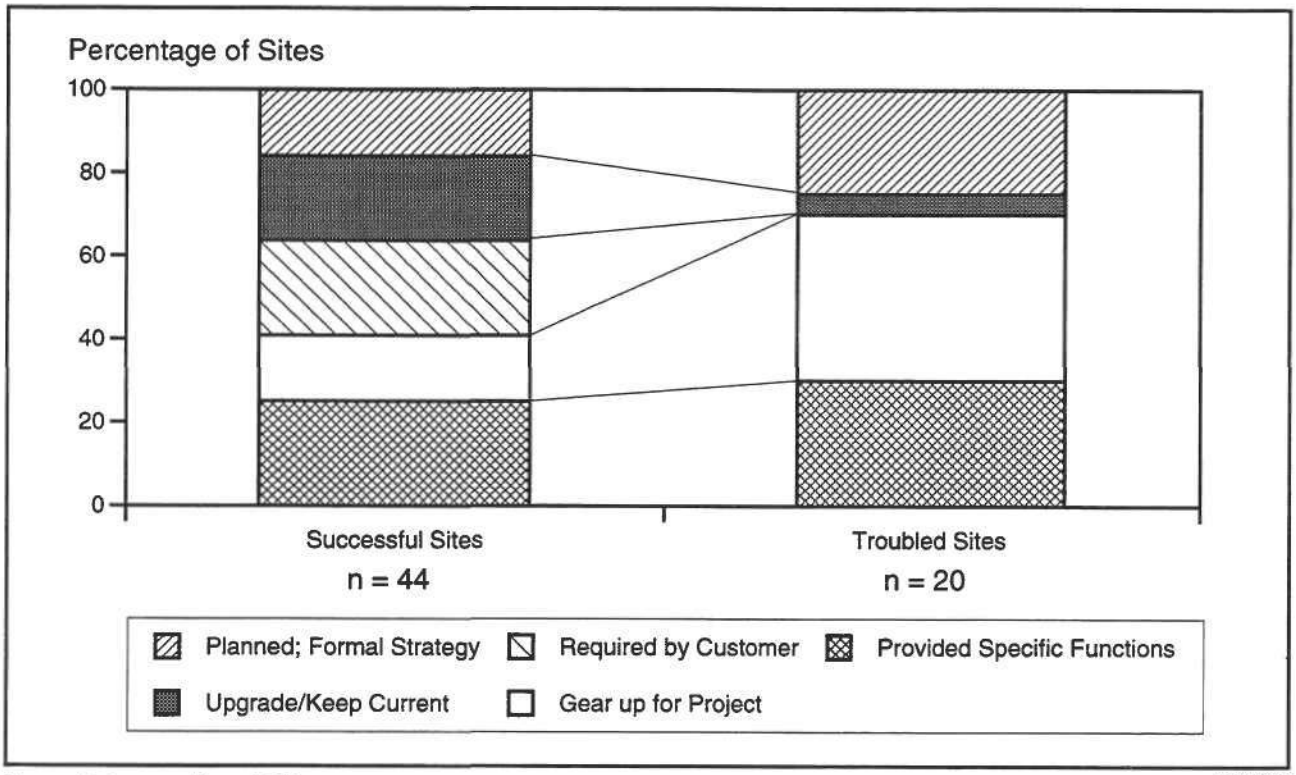


Source: Dataquest (June 1993) G3003087

Votes are heavily toward the positive side on the much-discussed proposition that small firms will use design automation tools to compete better with large firms (see Figure 5-15). Finally, it appears that CAD is working overall for these users. Figure 5-16 shows the distribution of opinion on the negative proposition that CAD has been oversold: here the distribution is solidly weighted toward those who believe CAD software has not been oversold and is meeting its promises.

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Figure 5-11
Success: Reasons for Purchase of CAD Systems

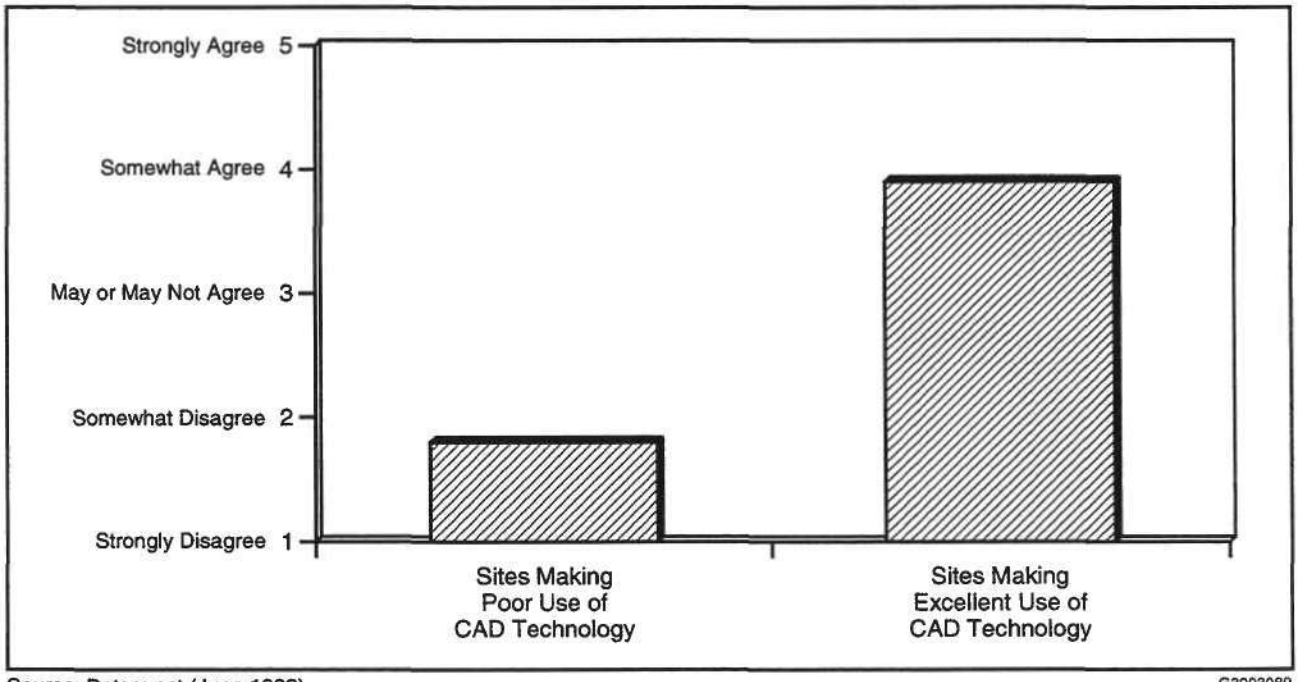


Source: Dataquest (June 1993)

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Figure 5-12
"Engineering Management Here Thoroughly Understands the Capabilities of Design"

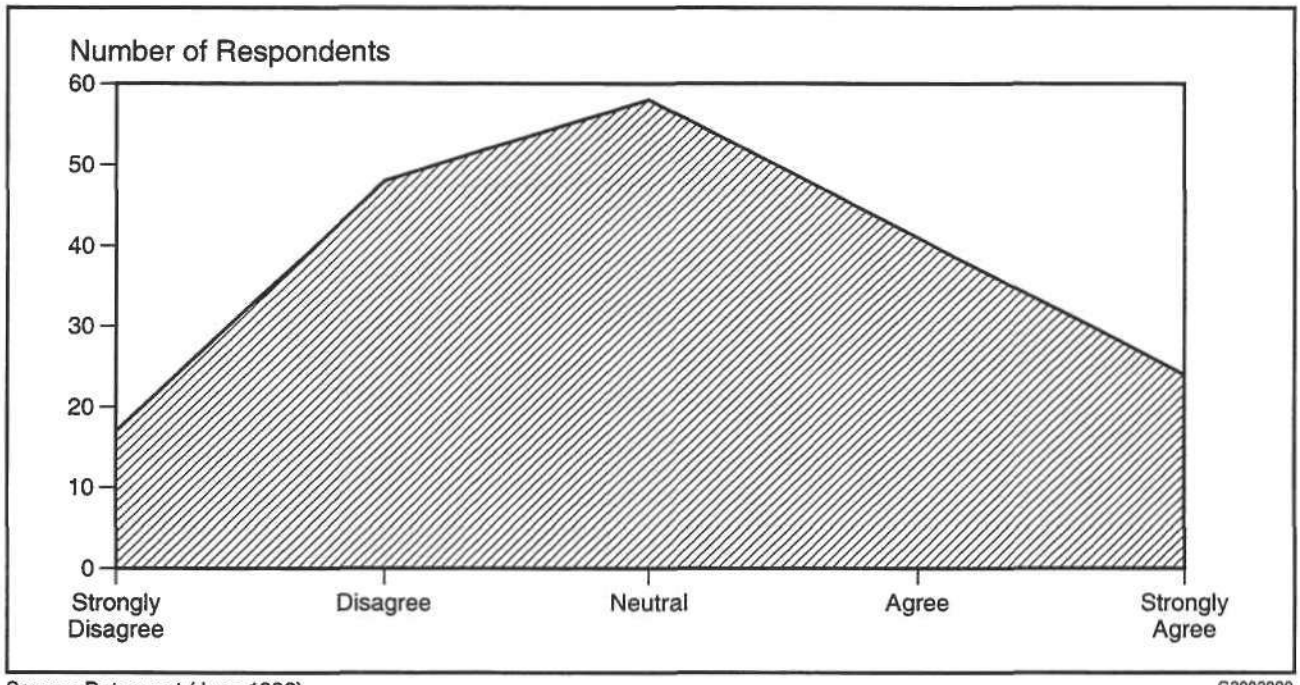


Source: Dataquest (June 1993)

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Figure 5-13
"Engineering Management Here Thoroughly Understands the Capabilities of Design Software"

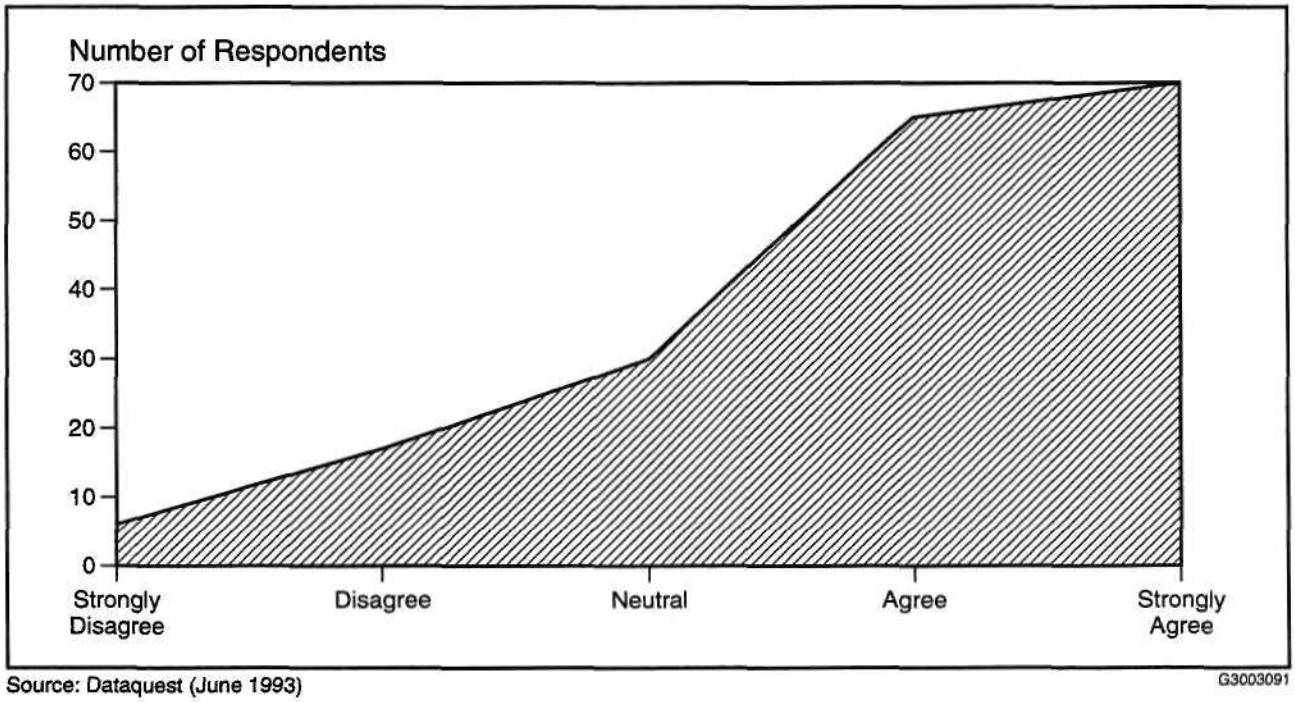


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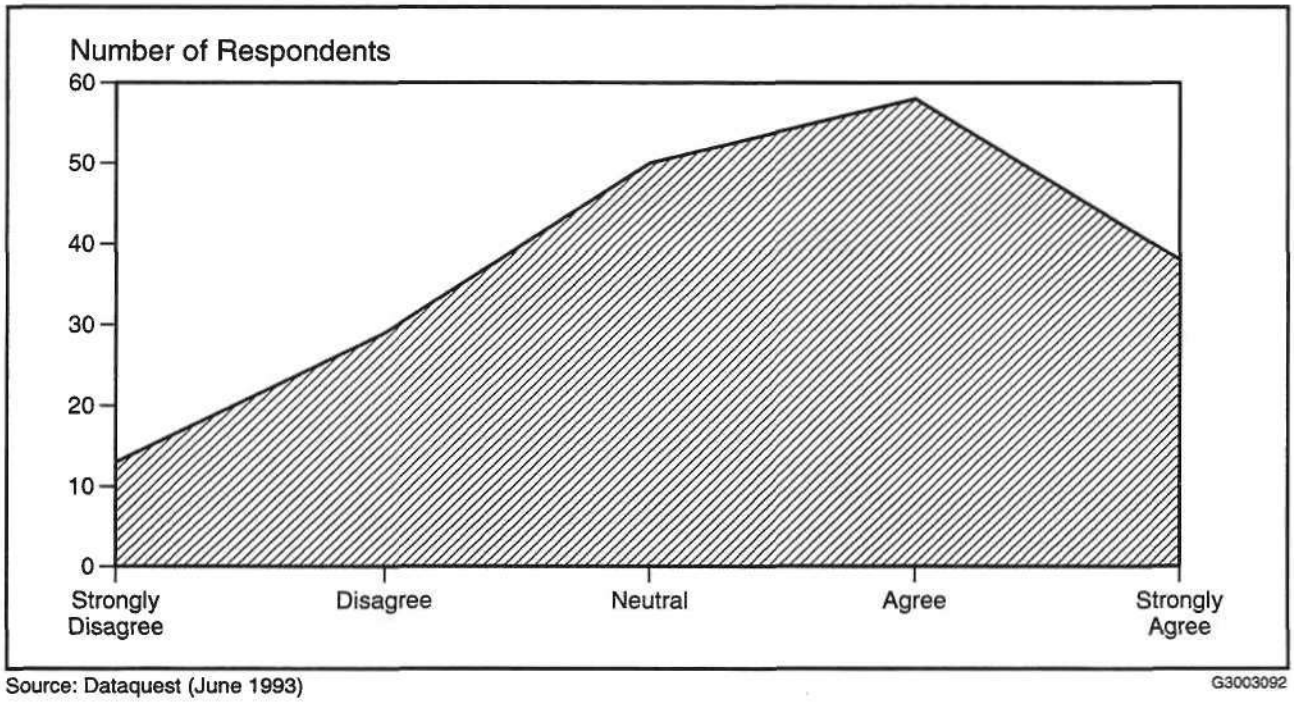
Figure 5-14
"My Company Is Able to Solve More Complex Design Problems than Three Years Ago"



Source: Dataquest (June 1993)

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Figure 5-15
"In 10 Years, Small 1-to-2- Person Design Shops Will Be Able to Produce What 10- to- 15-Person Shops Produce Today"

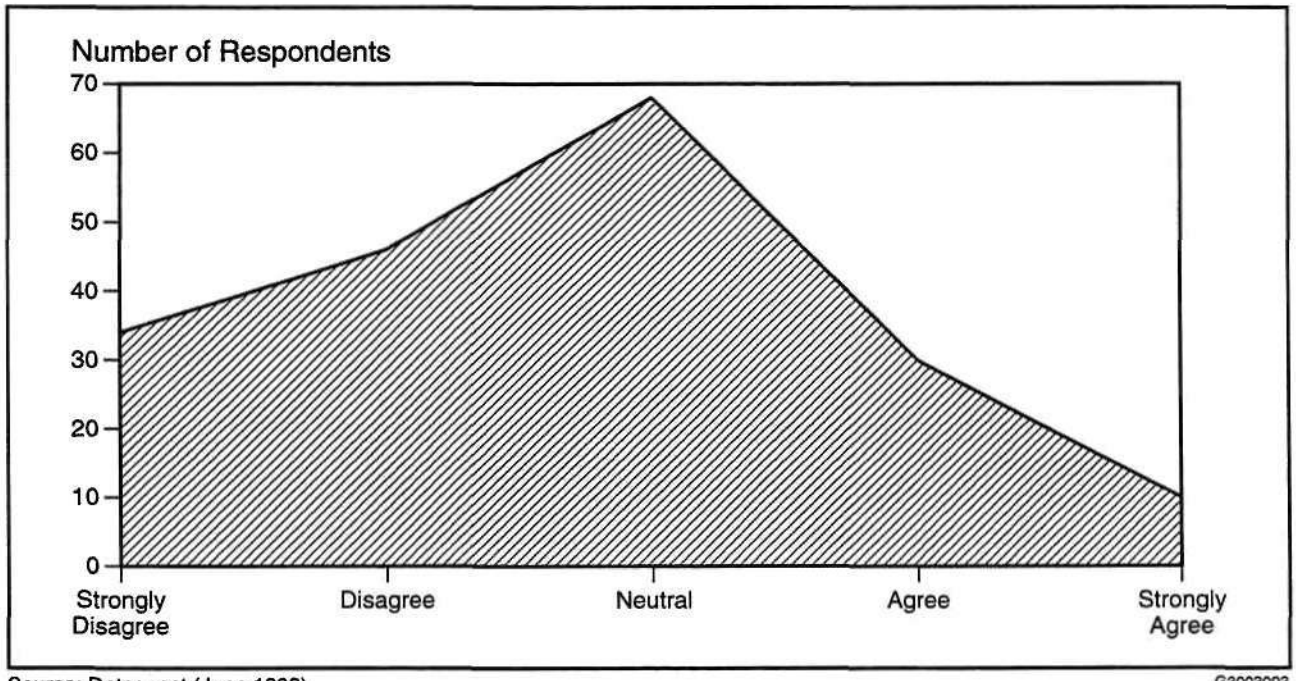


Source: Dataquest (June 1993)

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Figure 5-16
"CAD/CAM Has Been Oversold by Vendors and the Media, Compared to What Can Be Accomplished for the Investment Required"



Source: Dataquest (June 1993)

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Chapter 6
Buying Plans and System Penetration

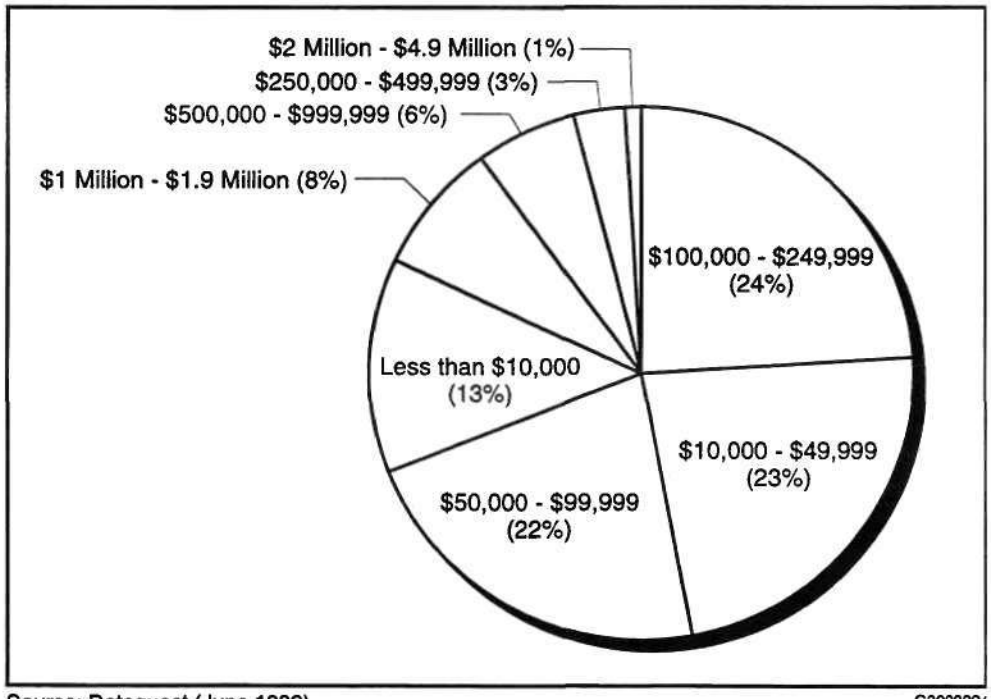
This chapter focuses on market demand by examining user buying plans in 1994 and system penetration among existing sites. It must be kept in mind that an analysis of spending plans and penetration at existing sites will not include any potential sales at new sites. Because many opportunities exist at prospective AEC sites, this chapter provides an analysis of only a portion of market opportunity.

The amount all users have paid to external suppliers during the past two years for AEC CAD tools varies widely (see Figure 6-1). Because this study focuses on large consumers of CAD, only 13 percent spend under $10,000 over the prior two years, whereas 1 percent spent between $2 million and $4.9 million. Most of the purchases have gone for hardware (52 percent), but software, at 32 percent, represents a substantial investment (see Figure 6-2).

Spending Plans at Existing Sites

Approximately 44 percent of existing sites expect computer and software spending on AEC CAD to remain the same in 1994; 44 percent expect an increase, 10 percent expect a decrease (see Table 6-1); approximately 2 percent are undecided. This will translate to an overall increase of 8 percent in spending in the installed base. Spending for peripherals is anticipated to grow at a lower rate, approximately 5 percent, and users

Figure 6-1
Amount Paid to External Suppliers During the Last Two Years

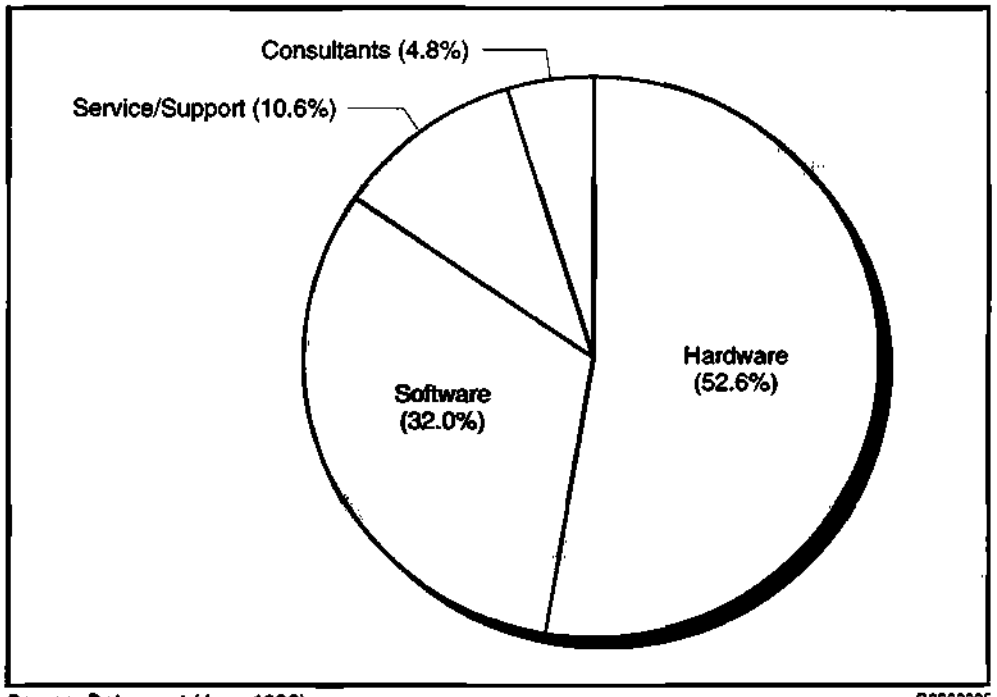


Source: Dataquest (June 1993)

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Figure 6-2
Percentage of Amount Spent on External Suppliers Going to Hardware, Software, Consultants, and Service



Source: Dataquest (June 1993) G3003095

Table 6-1
Spending Changes in 1994 by Component

Firm Type	Spending Equal to 1993	Increased Spending in 1994	Decreased Spending in 1994	Average Increase	Average Decrease	Overall Change
Software	43.6	44.7	9.6	26	42	8
Computers	43.1	43.6	10.6	25	43	8
Peripheral Devices	61.7	28.7	7.4	32	52	5
Outside Services	71.3	14.9	10.1	36	39	1

Source: Dataquest (June 1993)

report they plan to increase spending on outside services by only 1 percent. Again, this represents anticipated spending growth only in the installed base of large end users.

Software and computer purchase plans vary by type of firm. Only 16 percent of the nonservices category expect to increase software spending next year, whereas at all other types of firms a range between 46 and 59 percent of sites expect to increase software spending. Computers show a very similar pattern except that 26 percent of

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nonservice companies expect to increase computer purchases. The picture for outside services is uniform; all types of firms expect spending to remain the same (varying from between 63 and 79 percent of sites). This indicates that all types of service companies represent better short-term sales opportunities than buyers in chemical/petroleum and State Departments of Transportation.

We asked users to rank four possible reasons that prior CAD purchases have been made, which are listed in Table 6-2. The top reason that prompted CAD purchases was to provide design software required by clients (24.3 percent of respondents), followed closely by the purpose of providing specific functionality (23.8 percent). Planned purchases, as part of an overall CAD strategy, represents the least common reason for purchasing CAD systems, with 14.6 percent of the respondents.

Market Penetration at Existing Sites

Dataquest's CAD/CAM/CAE group calculates the following two levels of total available market:

- Minimum total available market based on market awareness is arrived at by asking users how many people at the site would, under ideal circumstances, make some use of a CAD system.
- Maximum total available market based on the number of technical professionals at the site, which, in other settings, is calculated from labor statistics based on job titles.

The maximum total available market is only a theoretical figure. Potential buyers must become aware that they need a product before they actually join the available market. Much of the difficulty vendors experience in developing new customers originates from primarily selling to the current level of market awareness rather than working to drive that awareness higher.

One useful mechanism to expand market awareness is to provide a product that can be licensed for a maximum number of concurrent users in a network. This allows new users to try out the software and allows

Table 6-2
Most Important Reason for Past CAD Purchases (Percent)

	Most Important	Second Most Important	Third Most Important
To provide design software required by customer	24.3	24.5	29.2
To provide specific functionality	23.8	21.9	15.0
To upgrade system or keep current	18.9	27.2	24.2
To gear up for a project	18.4	17.2	13.3
Planned purchase, part of CAD strategy	14.6	9.3	18.3
Number of respondents	185	151	120

Source: Dataquest (June 1993)

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the software to be used in new ways—which expands market awareness. At the same time, however, concurrent licensing schemes make it likely that a company will not buy one license for all possible users. In fact, the typical customer will buy only as many units as users appear to need at times of peak use. Thus, as concurrent licensing grows market awareness (the minimum total available market), the maximum total available market drops, and the band of uncertainty between the two measures shrinks. This example highlights the perils of counting total available market solely from numbers of users with the appropriate job title.

Market penetration is calculated as a percent of potential users with systems or software. Table 6-3 outlines market penetration by the site's primary design application by using data from the respondents who answered all questions in the series presented. Total software and hardware units are calculated at these sites, as well as the number of users and what respondents indicated would be the ideal number of users. A penetration figure outlining the low end of market opportunity—based on market awareness—is calculated from the difference between the number of seats installed and the ideal number of users. Using this metric, 46 percent of software seats required to saturate the needs of process plant design users in this group have already been purchased, and penetration ranges from a low of 39 percent in facilities design/management sites to a high of 63 percent among architectural sites. Process plant design and civil engineering sites are relatively similar in terms of penetration, but the firms primarily engaged in civil engineering are considerably smaller.

Table 6-3
Penetration at Active AEC CAD Sites by Application

	Architectural	Civil/ Structural	Process Plant Design	Facility Design/ Mgmt.	Total
Employees	5,369	11,112	31,621	2,812	50,914
Technical professionals	2,999	4,492	7,062	709	15,262
users at site	1,488	1,279	2,490	233	5,490
Ideal number of users	2,017	1,957	3,311	252	7,537
Total hardware seats	1,313	1,085	1,476	231	4,105
Total software units	1,268	881	1,523	99	3,771
Software penetration based on market awareness (%)	63	45	46	39	50
Hardware penetration based on market awareness (%)	65	55	45	92	54
Software penetration based on technical professionals (%)	42	20	22	14	25
Hardware penetration based on technical professionals (%)	44	24	21	33	27

Source: Dataquest (June 1993)

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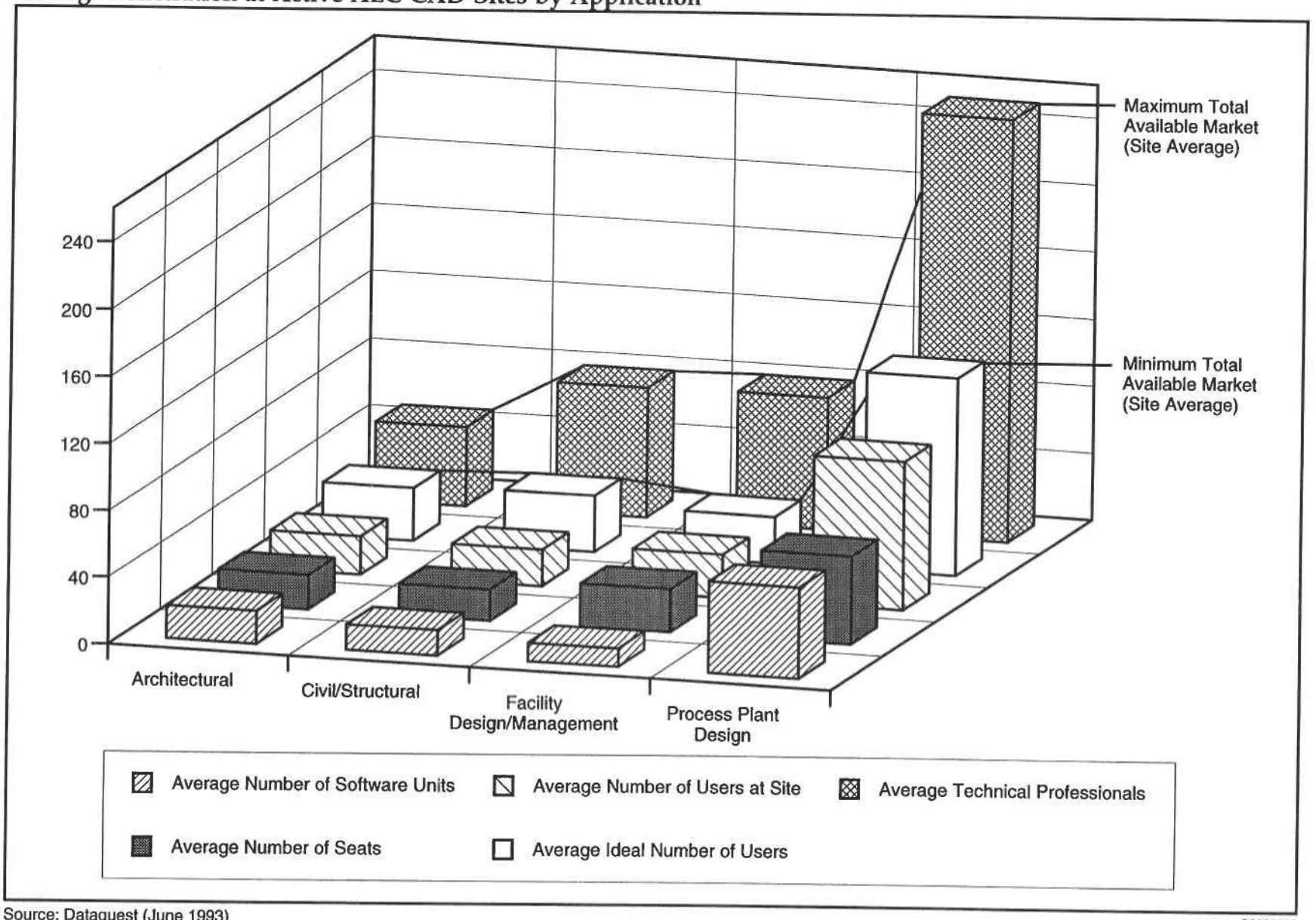
Figure 6-3 illustrates the data in Table 6-3, recalculated to reflect the typical site by dividing each number by the number of sites. Clearly, process plant design sites represent the best opportunity in terms of potential sales at the site. The ideal number of users is much larger than the number of seats, and the high number of users at the site relative to systems indicates considerable seat sharing is already happening. Facility design/management represents the lowest area of opportunity, with the number of seats nearly equaling what is perceived of as the ideal.

An analysis by firm type is provided in Figure 6-4 and Table 6-4 because what is designed (the primary application) does not always correspond to one type of design firm. Here we can see that although engineering constructors and nonservice firms have the largest number of technical professionals per site, these professionals are not currently believed to need CAD tools. The largest opportunity per site appears to exist at engineer/architects, in which there is a significant gap between the ideal number of users at each site and the number of software units or seats at the site.

It must be kept in mind that this is a sample based on large sites. Whereas it is reasonable to believe that virtually all large sites have some kind of CAD system, smaller companies may have no CAD systems or they may have purchased relatively fewer systems. This would mean that penetration in all sites throughout the world is somewhat lower than the results in this study.

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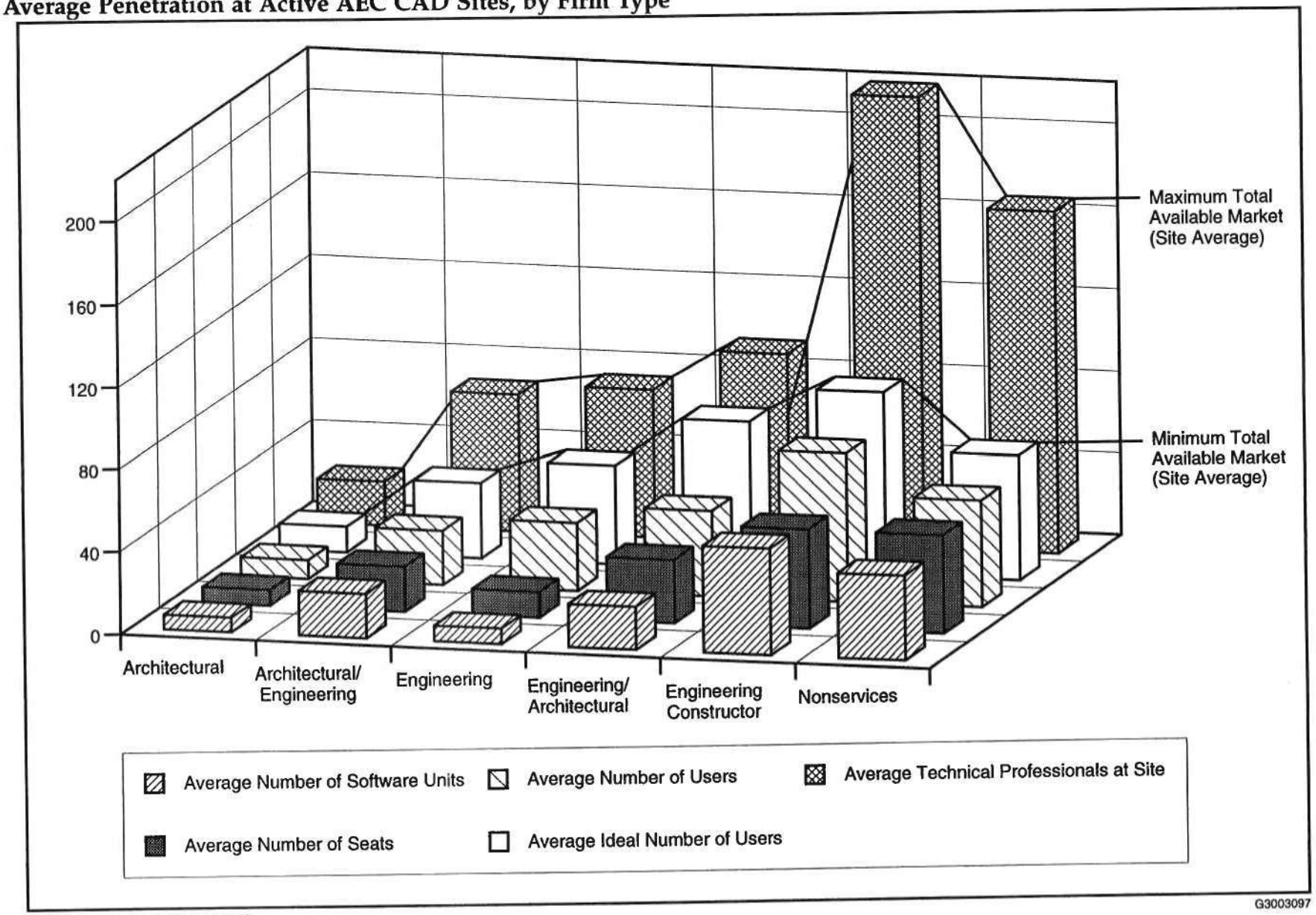
Figure 6-3
Average Penetration at Active AEC CAD Sites by Application



Source: Dataquest (June 1993)

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Figure 6-4
Average Penetration at Active AEC CAD Sites, by Firm Type



Source: Dataquest (June 1993)

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Chapter 7
Summary and Recommendations

The major findings of the survey include:

- Only 21.5 percent of design activity is forecast to be on paper next year, and it is anticipated that a small but substantial 13.4 percent of design activity will be in 3-D CAD.
- Most users share design information, typically with two to four other sites. This manageable number suggests that users will experiment with increasing the degree to which designs are shared across sites.
- Most users are working with only one brand of software.
- Requirements to deliver designs in electronic form are common and vary by type of firm. This requirement is experienced least by architectural firms and most by engineering/architectural firms and the large consumers of designs.
- About one-third of the UNIX users expect to switch to NT. This corresponds with the CAD/CAM/CAE industry service's expectation that NT will nibble away at UNIX and DOS users, which will leave little UNIX in the AEC CAD market in a few years. Intergraph's NT publicity campaign appears to be working among the company's user base—many of the Intergraph workstation users are the ones who plan to switch to NT.
- Users believe that the three most important considerations in choosing an AEC CAD system are the following:
  - Product is compatible with our environment
  - Vendor is responsive to our needs
  - Product is easy to learn and use
- Intergraph Microstation product line enjoys slightly higher customer satisfaction than AutoCAD, and both products are slightly above the survey average in customer satisfaction. Both products are quite close in terms of customer satisfaction on all key indicators.
- Because understanding what the customer needs to succeed is key to developing well articulated positioning statements that point to benefits the customer actually wants, users were asked to identify which indicators they believe represent key success factors for their own company. Following is what keeps AEC CAD customers awake at night:
  - Maintaining a competitive advantage
  - Responding to regulatory requirements
  - Timely and accurate quotes or bids
  - Reducing rework at the construction site

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- A description of the characteristics of successful users paints a portrait of coherence and intelligence—users who are making design tools work for them at a practical level and in ways that will help integrate their efforts with their company and customers.
- Successful sites are also significantly more likely to agree with the statement, "Information networks (formal and informal) are strong in my organization." This same measure of internal communication was also associated with successful installations in a previous study of users of geographic information systems—an accumulation of evidence that poor internal communication sacrifices success with information technology, a sacrifice that few enterprises can afford in an era in which information is increasingly the source of competitive advantage.
- There is a dramatic difference between successful and troubled sites on standards: 80 percent successful sites have identified standard brands for CAD software purchases, whereas only 55 percent of troubled sites do. Standards do not appear to inhibit success.
- The most startling difference between successful and troubled sites centers around agreement with the statement, "Engineering management here thoroughly understands the capabilities of design software." Results point to a potentially critical problem and suggest that engineering management must be intimately involved with the capabilities of design software if the investment is to succeed.
- Approximately 44 percent of existing sites expect computer and software spending on AEC CAD to remain the same in 1994, 44 percent expect an increase, 10 percent expect a decrease, and 2 percent are undecided. This will translate to an overall increase of 8 percent in spending in the installed base of large users.
- All types of service companies represent better short-term sales opportunities than buyers in chemical/petroleum and State Departments of Transportation.
- Sites that have no standards for purchasing CAD software are the ones to consider switching vendors. Having one's CAD software specified as "standard" at a site may be one of the most effective things a company can do to protect its installed base.
- We estimate that 46 percent of software seats required to saturate the perceived needs of process plant design users at large sites have already been purchased. Penetration ranges from a low of 39 percent in facilities design/management sites to a high of 63 percent among architectural sites. Process plant design and civil engineering sites are relatively similar in terms of penetration, but the firms primarily engaged in civil engineering are considerably smaller.

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Recommendations

We offer the following recommendations:

- Vendors must work to make their customers get along with them. The three most important indicators, "product is compatible with our environment," "vendor is responsive to our needs," and "product is easy to learn and use," point to a user base that is looking to remove the pain associated with computers rather than to drive themselves to new levels of automation.
- Key features and services that matter to experienced users have been identified. New users can use these indicators to develop their guidelines for purchase; vendors can use them to make informed decisions on where to enhance their offerings. By using the results in this survey, a targeted strategy can be developed that is oriented around either primary application or firm type.
- Factors that distinguish successful sites have been identified; users and vendors must work together to create user environments that are structured for success—users because they need to succeed, and vendors because success helps grow the AEC CAD market. Long-term sales are built on products that work for the buyer.

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Appendix A
Survey Questionnaire

Hello, this is _____ calling from Dataquest, a high-tech market research firm. We are currently conducting a study regarding CAD/CAM in architecture, engineering, and construction, with emphasis on decisions made everyday by professionals like you. We are asking for your help, by answering a few questions, which will help vendors understand your requirements better.

As a token of our appreciation for completing this questionnaire, we will provide you with a report summarizing the results of the survey.

Q.1 Would you be the person who is most knowledgeable about CAD/CAM in AEC applications at your location (examples of AEC applications: architectural, civil/structural engineering, process plant design, facility design, facility management)?

Yes ❑
No ❑

Q.2 Do you use CAD/CAM software for AEC at this site?

Yes ❑
No ❑

Q.3 Do you have a few minutes to answer some questions? Your name and the name of your company will be kept confidential.

Yes ❑
No ❑

Demographics

Q.4 What is the primary industry for your location?

Services (consulting/architect, engineering, engineering constructors)-more than 1 category ❑
Government (federal) ❑
Government (state, local, umbrella agencies) ❑
Utilities (Water, gas, electric) ❑
Chemical/Petroleum ❑
Transportation (air, rail, trucking, local) ❑
Telecommunications and Datacommunications (telephone, phone) ❑
Education ❑
Construction, contractors, builders ❑
Mining ❑
Manufacturing: Aerospace ❑
Manufacturing: Automotive ❑
Manufacturing: Other manufacturing (computers, equipment, machinery, fabricated metal, ❑

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Other service industries (retail, finance, insurance) ..... ❑
Other Public Sector ..... ❑
Don't know/Refusal ..... ❑

Q.5 How would you characterize your firm?
Architectural (A) ..... ❑
Architectural with some engineering capability (A/E) ..... ❑
Engineering with some architectural capability (E/A) ..... ❑
Design and build (engineering constructor) (EC) ..... ❑
Consulting Engineers (CE) ..... ❑
Construction only ..... ❑

Q.6 Does your site:
Primarily work with projects designed by other companies ..... ❑
Primarily work with projects designed by employees of your company ..... ❑
Work with both categories about equally ..... ❑
Don't know/Refusal ..... ❑

Q.7 How many years has your site been using CAD software?_____

Penetration

Q.8 What was the total number of employees at your site in 1991 and what is the current (1993) number?
1991_____ 1993_____

Q.9 What was the total number of technical professionals (such as architects, engineers, designers, drafters) at your site in 1991, and what is the current (1993) number?
1991_____ 1993_____

Q.10 How many of these technical professionals do work on an AEC CAD system (in 1993)?
_____

Q.11 Under ideal circumstances, how many of your technical professionals would do some work on an AEC CAD system?
_____

Q.12 How many of these current AEC CAD users are full time users (6+ hours a day)?
_____

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Site Characteristics

Q.13 How many different major AEC CAD software products have you learned to use? Of these, how many are you currently using on a regular basis? How many new major products do you think you will learn in the next two years?

Total learned to use _____

Total currently use _____

Total NEW in two years _____

Q.14 How many hours of your working time per week do you typically spend using a computer (compared to tasks that don't use a computer)?

_____hours

Q.15 How much of the above hours spent on the computer is spent performing CAD?

_____hours

Q.16 How many seats does your site have for AEC CAD?_____

Q.17 What percent of those seats are: (READ LIST; MUST EQUAL 100%)

Personal computers_____

Workstations_____

Terminals (required host computer)_____

Q.18 What is the primary computer used for this CAD system?

Apple Macintosh ❑

Digital VAX or VAXstation ❑

DECstation ❑

Hewlett-Packard (HP) ❑

PC using DOS ❑

PC using Windows ❑

IBM mainframe ❑

IBM RS/6000 ❑

Intergraph workstation or server ❑

Intergraph host-dependent system (VAX based) ❑

Sun ❑

Prime ❑

Other (specify)_____

Don't know/Refusal ❑

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Q.19 Looking ahead two years from now, what will be the dominant operating system at your site?

- DOS ❑
- DOS with windows ❑
- Windows NT ❑
- OS/2 ❑
- UNIX ❑
- Other (specify) _____
- Don't know/Refusal _____

Buying History and Plans

Q.20 Does your company have corporate standards for which CAD software will be bought? Yes❑ No❑
Don't Know ❑

Q.21 Does your company have corporate standards for which productivity software will be bought (like word processors and spreadsheets)? Yes ❑ No ❑ Don't Know ❑

Q.22 Approximately how much has your site paid to external suppliers during the last two years for AEC CAD systems (including hardware, software, systems integration, and maintenance)?

- Under $10,000 ❑
- $10,000 - $50,000 ❑
- $50,000 - $100,000 ❑
- $1000,000 - $250,000 ❑
- $250,000 - $500,000 ❑
- $500,000 - $999,999 ❑
- $1 million - $1.9 million ❑
- $2 million - $5 million ❑
- $5 million or greater ❑
- Don't know/Refusal ❑

Q.23 Please rank the top three by how much they have contributed to buying CAD systems.

RANK

- To provide specific functionality _____
- To gear up for a project _____
- To provide design software required by the customer _____
- To upgrade systems or keep them current _____
- Purchases planned as part of a formal CAD strategy _____
- Other _____
- Don't know/Refusal ❑

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Q.24 What percent of the amount spent on external suppliers went to:

Hardware_____

Software_____

Consultants or systems integrators_____

Service, support, and training_____

MUST = 100%

Thinking of your spending in AEC CAD applications for software, computers, peripheral devices like plotters, and outside services, do you anticipate that your purchases for

Q.25 Software for AEC CAD will increase, decrease, or remain the same next year?

Increase by what percent?_____

Decrease by what percent?_____

Remain the same ..... ❑

Don't know/Refusal ..... ❑

Q.26 Computers for AEC CAD will increase, decrease, or remain the same next year

Increase by what percent?_____

Decrease by what percent?_____

Remain the same ..... ❑

Don't know/Refusal ..... ❑

Q.27 Peripheral devices for AEC CAD will increase, decrease, or remain the same next year

Increase by what percent?_____

Decrease by what percent?_____

Remain the same ..... ❑

Don't know/Refusal ..... ❑

Q.28 Outside services for AEC CAD will increase, decrease, or remain the same next year

Increase by what percent?_____

Decrease by what percent?_____

Remain the same ..... ❑

Don't know/Refusal ..... ❑

Design Environment

Q.29 Of the work done at your site during the year, rank from most to least the following four types of AEC design, based on the amount of work done. What would you rank as No. 1 in terms of work done? Number 2? Number 3?

RANK

Architectural (new building design including mechanical and electrical)_____

Civil and structural engineering (roads; bridges; structural steel or concrete)_____

Process plant design (such as, power or chemical plants)_____

Facility design or management (space planning; management of or upgrades to an existing facility)_____

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Q.30 On a scale of 1 to 5, with 1 being not at all important and 5 being very important, how important do you believe are each of the following factors are to your company's success during the next two years? Please also rate your satisfaction with your company's progress to date on this factor using the 1 to 5 scale where 1 is not at all satisfied and 5 is very satisfied.

	IMP	SAT
Responding to regulatory requirements		
Partnerships and alliances with other industry participants		
Maintaining a competitive advantage		
Timely and accurate quotes or bids		
Use of design constraint systems (such as parametric input)		
Use of rule-based or expert systems		
Electronic design conferencing between members of the AEC design team		
Use of electronic product catalogues (computer-assisted specifying)		
Use of 3-D CAD		
Integration of graphic design data with specifications and materials data		
Document management for design or engineering		
Communicating design or construction progress (such as, using videos or animations)		
Reducing rework at the construction site		
Ability to use electronic design for operation and maintenance of structure		

Q.31 Of the projects your site works with, how often is there a requirement to deliver the design in electronic form? Is it:

- Never ❑
- Rarely ❑
- May or may no ❑
- Often ❑
- Always ❑
- Don't know/Refusal ❑

Q.32 What formats are typically requested?

- AutoCA ❑
- Intergraph Microstation ❑
- Intergraph PDS ❑
- IGES/PDES ❑
- Other (specify) _____
- Don't know/Refusal ❑

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Q.33 During the course of a typical design project, how many different locations does your site share information with (include sites at your own company, the customer's company, suppliers, subcontractors, and so on). _____

Q.34 Of all the design activity at your site during the next year what percent will be done

On paper ..... ❑
In 2-D CAD ..... ❑
In 3-D CAD ..... ❑
Don't know/Refusal ..... ❑
MUST = 100%

Customer Satisfaction

Q.35 What are the AEC CAD/CAM software products that your site uses at least monthly? And how many licenses or copies of each do you estimate you have? (if they have a multiuser license, ask them to count the maximum number of concurrent users as the total number of licenses)

Software used regularly (at least monthly)

_____

Licenses
(Check All That Apply)

Accugraph MountainTop CAD ..... ❑
Autodesk AutoCAD ..... ❑
Autodesk Generic CAD ..... ❑
AutoCAD Add-On #1 (SPECIFY)_____
AutoCAD Add-On #2 (SPECIFY)_____
(examples: Archibus, ASG, A/E Microsystems, Cadisys, Civilsoft, CAFM, EDA, Softdesk)
Auto-trol ..... ❑
Cadcentre PDMS ..... ❑
ClarisCA ..... ❑
Computervision Calma Dimension III ..... ❑
Computervision Medusa ..... ❑
Computervision Versacad ..... ❑
Datacad ..... ❑
EDS GDS ..... ❑
Intergraph Microstation ..... ❑
Intergraph Project Architect/Engineer Series ..... ❑
Intergraph civil engineering products (inroads, insite) ..... ❑
Intergraph structural products (Micasplus) ..... ❑
Intergraph PDS ..... ❑
IBM-AES ..... ❑
IBM-CADAM or MicroCADA ..... ❑
IBM-Catia ..... ❑
IsiCAD Cadvance ..... ❑
Sigma Design ARRIS ..... ❑

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Internally developed software ❑
Other (specify) _____
Don't know/Refusal ❑

Q.36 Which one of these products do you use most often? (Enter number from above) _____

Q.37 How many hours per week do you estimate you use this software? _____ hours

Q.38 On a scale of 1 to 5, with 1 being not at all important and 5 being very important, how important are each of the following factors in evaluating an AEC software supplier? Please also rate your satisfaction with (primary product from above) using the 1 to 5 scale where 1 is not at all satisfied and 5 is very satisfied.

	IMP	SAT
Product is compatible with our environment	_____	_____
Cost per seat	_____	_____
Training requirements	_____	_____
Product is easy to learn and use	_____	_____
Users at our company favor the product	_____	_____
Vendor is responsive to our needs	_____	
Vendor's flexibility in software licensing	_____	_____
Availability of a complete set of application software that works with the core product	_____	_____
Product represents a technology breakthrough not available elsewhere	_____	_____
Product performance in complex or compute-intensive tasks	_____	_____
Product is likely to be required for a project	_____	_____
Product is a market leader	_____	_____

Q.39 On a 1 to 5 scale where 1 is not at all likely and 5 is very likely, how likely is your organization to change your primary AEC CAD software vendor in the next two years?

Not at all likely _____
Not very likely _____
May or may not be likely _____
Somewhat likely _____
Very likely _____
Don't know/Refusal ❑

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Opinions

Q.40 In these last set of questions we would like your opinion. On a scale of 1 to 5, with 1 meaning strongly disagree and 5 strongly agree, to what extent do you agree with the following statements: (6 = don't know/refusal)

CAD/CAM has been oversold by vendors and the media, compared to what can be accomplished for the investment required._____

My company is able to solve more complex design problems than three years ago._____

Information networks (formal or informal) are strong in my organization._____

Engineering management here thoroughly understands the capabilities of design software._____

In 10 years, small 1-to-2 person design shops will be able to produce what 10-to-15 person shops produce today_____

Our organization's progress to date in making use of CAD technology has been excellent._____

Q.41 Which job title best describes your position?

Drafter ❑
Detailer ❑
Designer ❑
CAD Manager ❑
Project Architect ❑
Project engineer ❑
Department manager ❑
Chief engineer ❑
Managing architect ❑
Facility manager ❑
Owner/President ❑

Q.42 Would you like to receive an executive summary of this survey?

Yes ❑
No ❑

Q.43 Do you have a requirements' specification for a recent CAD/CAM benchmark that you could send to us?

Yes ❑
No ❑

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Respondent's Name:_____

Company:_____

Address:_____

City:_____

State:_____ Zip Code:_____

Telephone Number: (____) _____

FAX: _____

Date: _____

Int. No. _____

Quota Groups for AEC Study

Q.2 How would you characterize your firm?

	Need	Have
Architectural (A)	40	
Architectural w/some engineering Cap. (A/E)*		
Engineering w/some architectural Cap. (E/A)*		60 total
Consulting Engineers (CE)		
Design and Build (EC)	30	
and from Q1 - INDUSTRY		
Chemical/Petroleum		30
All others (except Services/Construction)		30
10 EXTRA IN ANY CATEGORY		10
TOTAL		200

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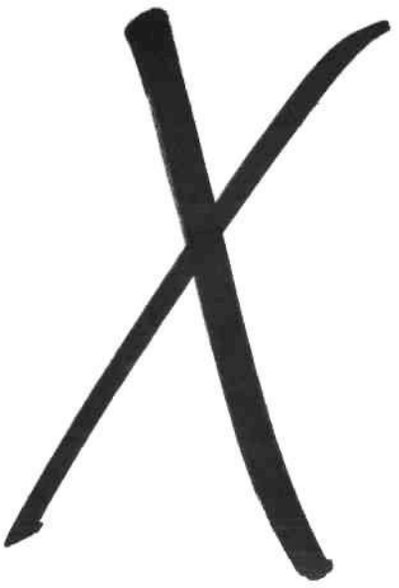
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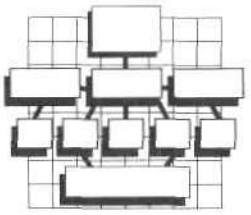
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Dataquest Vendor Profile

Software

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DATAQUEST INCORPORATED
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AEC and GIS Applications Worldwide

Environmental Systems Research Institute Incorporated

Corporate Statistics

Location	Redlands, California
President, CEO, and Founder	Jack Dangermond
Number of Employees	675 (United States)
Fiscal 1992 Revenue	$106.3 million
Fiscal Year Ends	December 31
Founded	1969

Environmental Systems Research Institute Incorporated (ESRI) is a recognized world leader in the field of geographic information systems (GIS). The company develops and markets a variety of GIS software products for use on several computing platforms. The company's founder, Jack Dangermond, is seen as a pioneer in the field of GIS and has helped to create the fast-growing marketplace for GIS applications. ARC/INFO, a mapping and spatial data management system, is the company's flagship product. Newer ESRI products, like ArcView and ArcCAD, have brought GIS to the desktop level and to more nontraditional markets.

Corporate Organization

ESRI is a privately owned software and services company that has been run by Mr. Jack Dangermond since 1969. The company, which is owned entirely by Mr. Dangermond, is profitable and has a strong cash position. Mr. Dangermond takes great pride in the team of individuals he has assembled within ESRI, and the company has been described as being part academic, part corporate. Key personnel in the company are as follows:

- Jack Dangermond, CEO and president—Mr. Dangermond is the founder of ESRI. It was his vision to create a company dedicated to improving automated mapping and handling of geographic information. Mr. Dangermond's educational background includes a B.S. in environmental science from California State Polytechnic San Luis Obispo and an M.S. in landscape architecture from Harvard University.
- Laura Dangermond, vice president—Mrs. Dangermond is responsible for the day-to-day, financial operations of the company.

- S.J. Camarata, Director of marketing and sales—Mr. Camarata's role is to oversee the marketing, sales, and business development activities of the company worldwide.

Product Portfolio

The company's current product line includes: ARC/INFO, its flagship product; PC ARC/INFO, a PC-based version of ARC/INFO; ArcView, a desktop GIS mapping system; ArcCAD, an integration of ARC/INFO with Autodesk's AutoCAD; and ArcData, a collection of databases for use with ESRI's software. Table 1 outlines the major products and the current installed base for each. Customers have heavily influenced the features and functionality of ESRI's software products. Collectively, the company's products support a wide variety of hardware platforms and operating systems.

ARC/INFO

ARC/INFO was first released in 1982. ARC/INFO stores graphics in its own internal structure and, through an embedded database integrator, connects graphic data to tabular data. INFO is ESRI's tabular data management system, which was originally developed by another company that was later purchased by ESRI. Industry standard relational database management systems such as ORACLE, INGRES, INFORMIX, or SYBASE can be used in place of INFO. Since ARC/INFO's first release, it has supported more than 20 hardware platforms and numerous operating systems.

In more recent releases of the product, modules for such functions as surface modeling, network analysis, and coordinate geometry have been incorporated into the base product. The software can be purchased by itself or as part of a turnkey system including hardware.

The primary competition for ARC/INFO is Intergraph's MGE, which is aimed at the same basic GIS markets as ARC/INFO. ARC/INFO contains more features than MGE and supports more databases and hardware

Table 1
ESRI's Product Line

Product	Licenses	Description
ARC/INFO	14,480	GIS system composed of two modules, ARC and INFO
		ARC manages cartographic data and mapping
		INFO manages relational database and tabular data
PC ARC/INFO	8,700	PC-based version of ARC/INFO
ArcView	11,700 (PC version)	Simplified GIS allowing for querying and viewing of geographic data
	2,700 (workstation version)	
ArcCAD	1,180	Combination of ARC/INFO data model with Autodesk's AutoCAD software
ArcData	Not available	Databases of geographic information from ESRI and third-party vendors

Source: ESRI

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platforms; however, it is often a more complex product from a user's perspective. ESRI has recently begun shipping a new user interface, ArcTools, with ARC/INFO. This new object-oriented interface should greatly simplify the use of ARC/INFO.

PC ARC/INFO

Released in 1987, PC ARC/INFO is ESRI's PC-based version of its main product. It provides most of the same functionality as ARC/INFO on a DOS-based machine and at a significantly lower price.

ArcView

ArcView is a desktop mapping system aimed at those with a limited GIS background and skill set. With this product, ESRI is attempting not only to sell to traditional GIS users, but also to venture into such untapped areas as banking, insurance, and market research. The software allows the user to access and visualize georelational information and manipulate topological features more easily than with ARC/INFO. The product is designed to run on both workstations and PCs.

ArcCAD

ArcCAD is the culmination of ESRI's recent alliance with Autodesk. Released in 1992, ArcCAD represents the merging of Autodesk's widely popular AutoCAD program with ESRI's ARC/INFO. The system operates within the AutoCAD operating environment while providing full GIS functionality.

ArcData

ArcData, established in 1992, is a program that makes a variety of commercial databases available to ARC/INFO users, enabling the users to build databases inexpensively and quickly. Five of these databases, which contain cartographic and census information, have been developed by ESRI. Other databases are made available from 21 different suppliers including Claritas/NPDC, Donnelley Marketing Information Services, EOSAT, Etak, Geographic Data Technology, Hughes STX Corporation, National Decision Systems, and VISTA.

Market Position

Currently, ESRI is neck-and-neck in market position with Intergraph, the company's primary competitor. Table 2 shows worldwide software revenue and market share of the leading GIS competitors. Recent years have seen ESRI's revenue climb rapidly in all regions except Asia, as is shown in Figure 1. The company's sales reached $106.3 million in 1992, with 92.5 percent of its revenue coming from software sales and 7.5 percent coming from services and consulting. Through Mr. Dangermond, ESRI owns a small percentage of each of its international sales offices. Revenue figures for the company reflect revenue from U.S. sales and a percentage of international sales commensurate with ESRI's ownership of its international offices. Revenue contribution from the company's international offices was 26 percent in 1992.

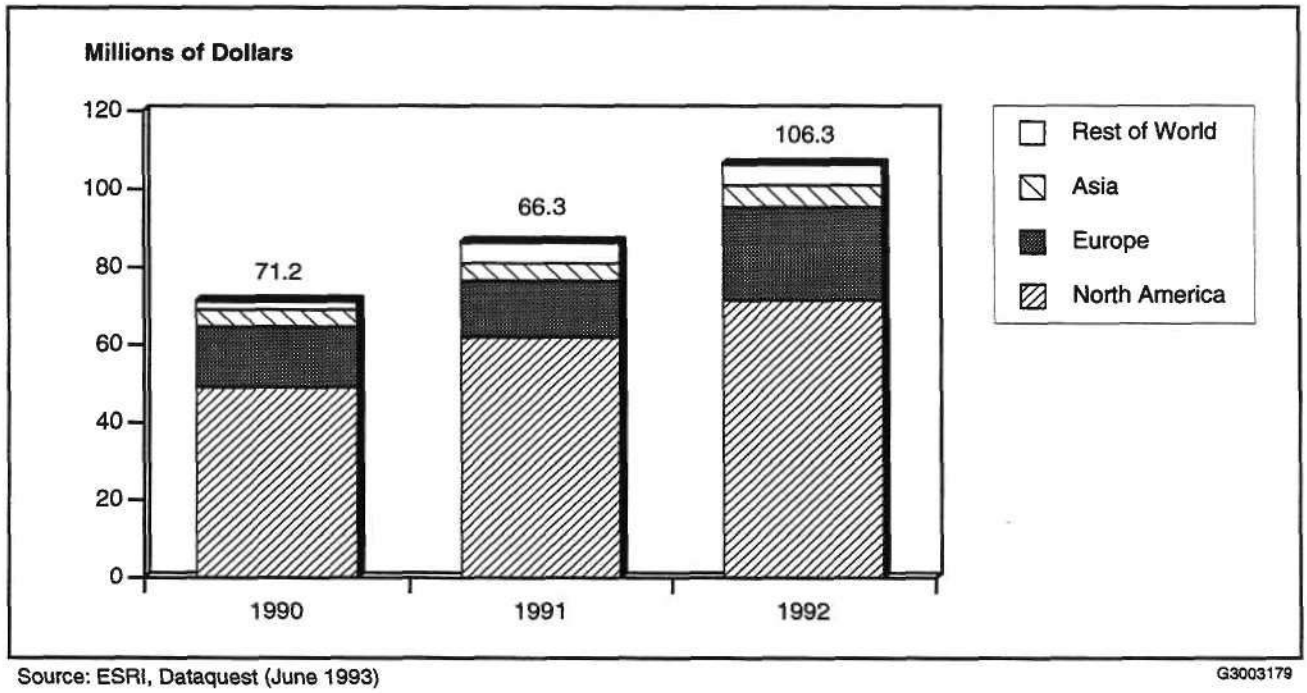
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Table 2
ESRI GIS Software Market Share

Company	1991 Software Revenue ($M)	1992 Software Revenue ($M)	Percent Change	Market Share (%)
Intergraph	107.2	108.7	1.4	17.5
ESRI	78.6	98.3	25.1	15.8
Siemens Nixdorf	49.7	53.2	7.0	8.6
Autodesk	28.5	40.5	42.0	6.5
EDS-Unigraphics	17.0	24.1	41.5	3.9
Landmark Graphics	23.2	18.8	-19.0	3.0
GeoVision Systems	8.5	14.0	64.6	2.3
Moss Systems	9.7	14.0	43.9	2.3
Genasys II	9.7	13.0	34.2	2.1
Fujitsu	13.2	12.6	-3.9	2.1
All Other Companies	200.7	226.7	13.0	36.3

Source: Dataquest (June 1993)

Figure 1
ESRI Revenue History



Source: ESRI, Dataquest (June 1993)

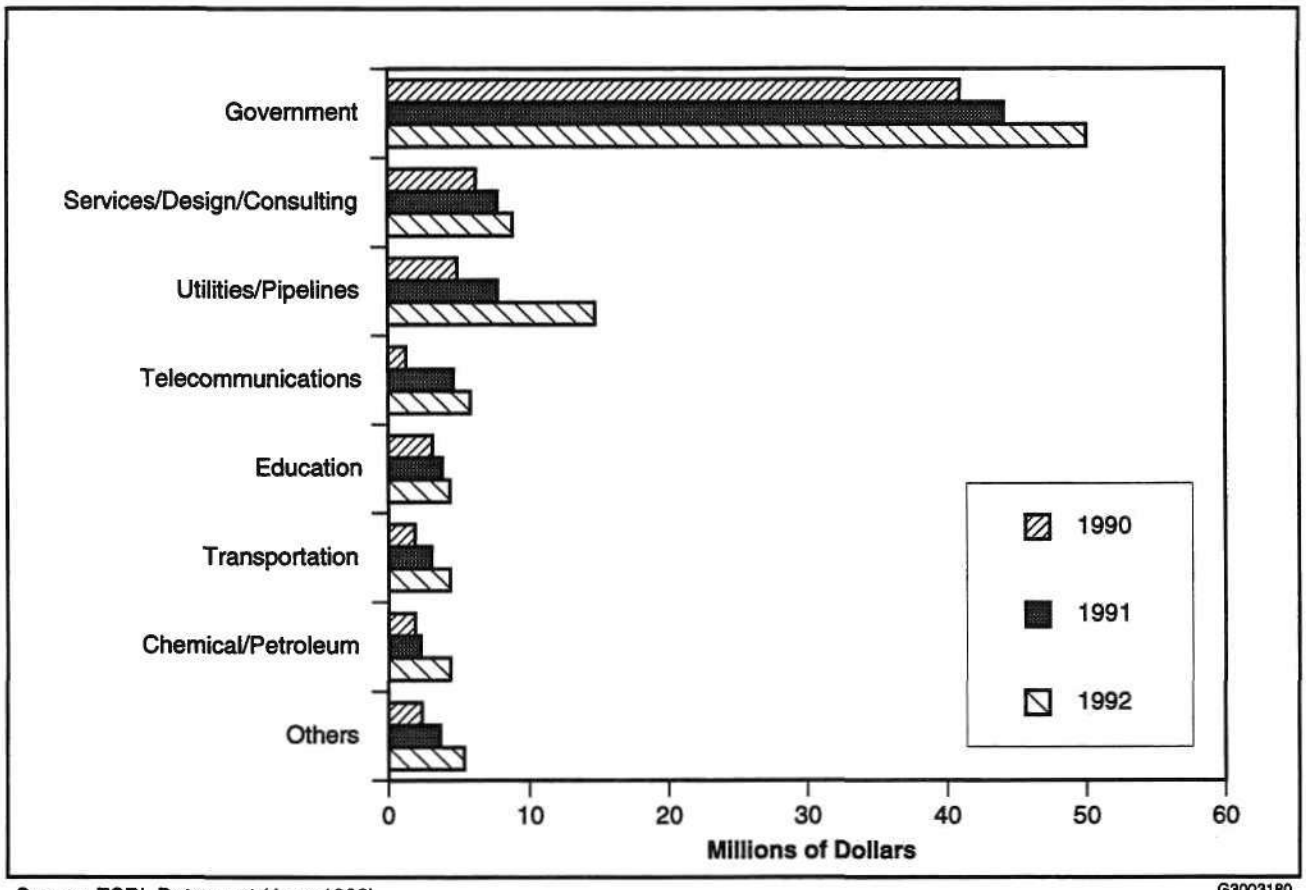
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ESRI's revenue history by industry is shown in Figure 2. Government continues to be the largest industry to which ESRI sells, comprising nearly 51 percent of its 1992 revenue.

Through clever marketing and advertising techniques, ESRI has positioned its broad-based ARC/INFO product at numerous GIS applications as shown in Figure 3. Whereas some of this positioning is essentially repackaging of the basic ARC/INFO product, ESRI has teamed with third-party developers such as Miner and Miner of Greeley, Colorado, to develop customized applications.

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Figure 2
ESRI Software Revenue History by Industry



Source: ESRI, Dataquest (June 1993)

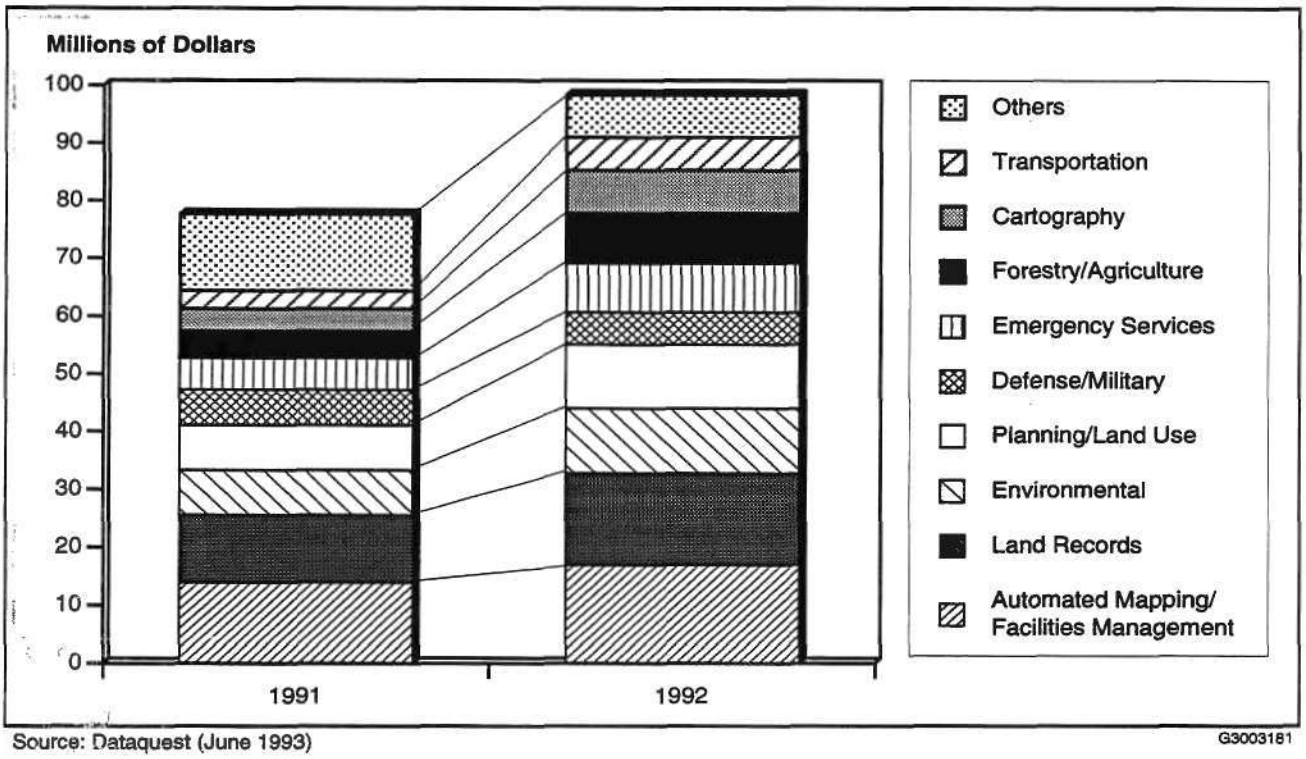
One of Jack Dangermond's original goals was to build a GIS system that was not tied to a single operating system, hardware platform, or file format. This mission is reflected in the operating system independence of all ESRI's products as shown in Table 3. The company intends to ship products using the Windows NT operating system after its general release. Figure 4 gives a breakdown of ESRI's revenue by computing platform. Technical workstations and servers make up the majority of ESRI's revenue and represent the fastest-growing computing platforms for ESRI as well as for its competitors.

Distribution and Sales

ESRI uses direct sales and a distribution network to sell its products. In 1992, ESRI derived $78.7 million in revenue from direct sales and $27.6 million in revenue from its international offices. ESRI has always relied on direct sales for ARC/INFO in the United States. Currently, there are 11 regional offices within the United States and 10 international offices that provide direct sales for ARC/INFO.

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Figure 3
ESRI Software Revenue History by Application



Source: Dataquest (June 1993)

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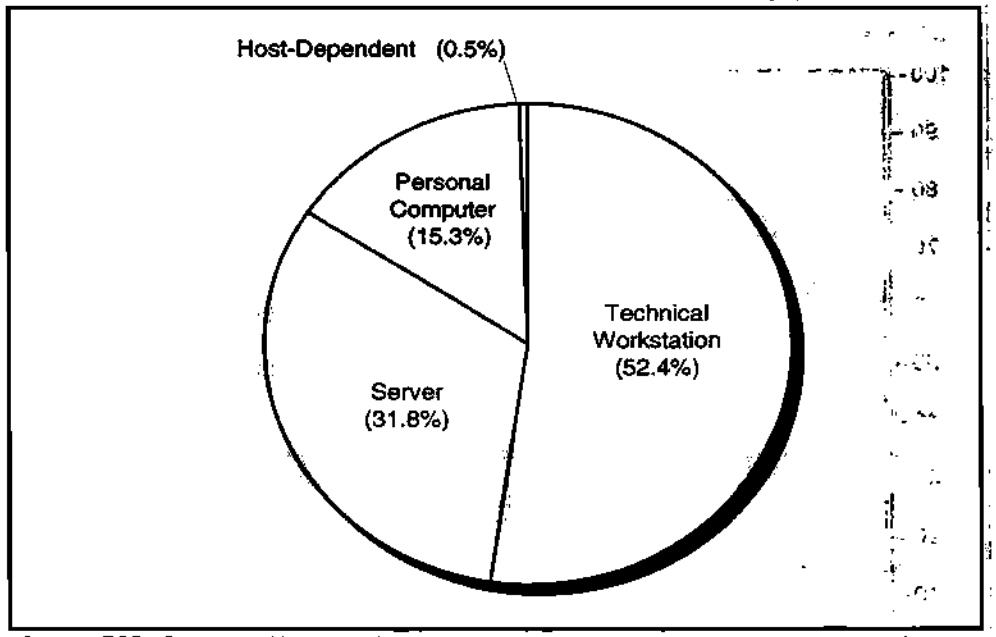
Table 3
Available Operating Platforms for Major Products

Product	Operating Platform
ARC/INFO	Data General AViiON (DG-UX)
(Release 6.1)	DEC Alpha (AXP), DECstation (Ultrix), DEC (VMS)
	Hewlett-Packard (HP-UX)
	IBM (AIX)
	Silicon Graphics (IRIX)
	Sun SPARC (SunOS), Sun SPARC (Solaris)
PC ARC/INFO	DOS
ArcView	Data General (DG-UX)
	Digital (Ultrix)
	Hewlett-Packard (HP-UX)
	IBM (AIX)
	Microsoft Windows
	Silicon Graphics (IRIX)
	Sun Microsystems SunOS
ArcCAD	DOS and Microsoft Windows

Source: ESRI

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Figure 4
ESRI 1992 Revenue Breakdown by Platform



Source: ESRI, Dataquest (June 1993)

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Recently, ArcCAD and ArcView have been bundled together and marketed as one product in an effort to target casual and experienced end users and third-party software developers.

Approximately 60 international distributors worldwide sell ESRI's entire product line.

Strategic Outlook

One of ESRI's greatest strategic assets lies in its charismatic and influential CEO, Jack Dangermond. Respected internationally as a visionary, Mr. Dangermond has created a very positive image for the company and has helped ESRI develop an enthusiastic, loyal group of users. His leadership has continued to provide a clear focus not only for the company, but for the GIS industry as well.

ESRI's original strategy still holds true today. Mr. Dangermond sees ESRI as continuing its role as a builder of generic, hardware independent GIS software that users customize. Feeling the competitiveness in the marketplace, Mr. Dangermond also believes that partnering with key developers is important to the development of future products because no one company can effectively develop all the possible applications for GIS. The company is putting a tremendous amount of energy into expanding its developer relationships for ARC/INFO, ArcCAD, and ArcView.

The desktop market is anticipated to grow rapidly for ESRI and GIS. ESRI sees the future of the industry as providing more sophisticated GIS functionality in easy-to-use packages like ArcView. In the next release of ArcView, ESRI plans to include functionality that will change the product

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from a simple viewer to a full desktop GIS. The company is also focusing efforts on linking its GIS technology to other desktop applications like word processing and business graphics. Such a strategy effectively brings GIS into the hands of a greater number of casual users.

Dataquest Perspective

ESRI is well poised to continue its strong position and influential role in the GIS industry. The market is still in its infancy, as there is not a widespread base of users. In order to maintain its dominance in the industry, ESRI must take advantage of the following situations:

- Because of the large commitment of time and money on the user's part to install GIS, there is a growing need for customized applications. ESRI is on the right track by collaborating with third-party vendors and building cooperatives that will allow access into vertical markets.
- Reliance on government procurements renders the entire GIS industry less predictable as governments worldwide begin to reassess their information system purchases. ESRI must be aware of the impact of such decisions on its revenue stream and continue to build inroads into new applications and markets.
- As acquisition technologies improve, data sources are becoming more accurate. Accuracy expectations are increasing among some existing GIS users, and opportunities exist within the installed user base for improved data accuracy.
- New data sources are appearing on the market, and integrating these sources into existing GIS systems is a challenge. Moving to new data sources will undoubtedly be easier for ESRI users under the ArcData program.

ESRI is headed in the right direction with its flexible, modular approach to GIS solutions. Continuing this strategy while striving to meet the industrywide need for customization will ensure ESRI's top spot in the industry.

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