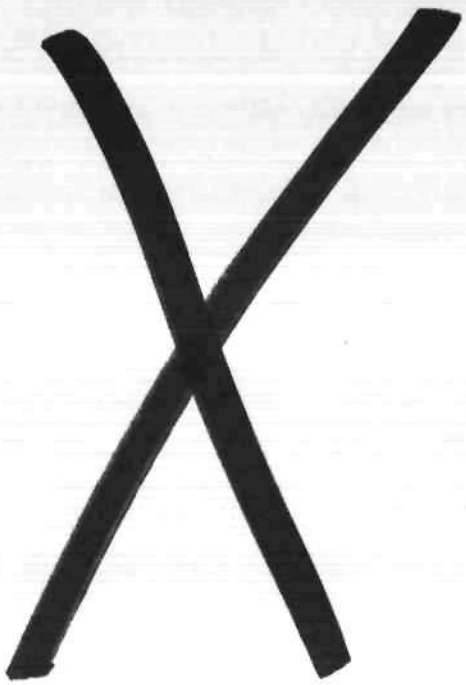
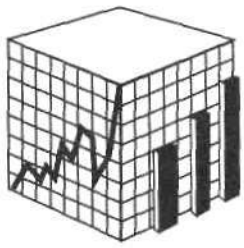


Dataquest®



Dataquest Perspective

Software

INFORMATION RESOURCE CENTER
DATAQUEST INCORPORATED
1290 Ridder Park Drive
San Jose, CA 95131-2398
(408) 437 8600

Mechanical Applications Worldwide

In This Issue

The Emerging STEP Standard
With the anticipated approval of the international STEP standard, the CAD/CAM/CAE industry is taking a huge step toward creating a seamless environment for data transfer, storage, and exchange. In this *Dataquest Perspective*, we take a cursory look at the STEP standard and discuss some of the issues surrounding STEP.
By Sharon Tan

The Emerging STEP Standard

Seamless exchange of product data is an issue that continuously troubles the CAD/CAM/CAE industry. The draft international Standard for the Exchange of Product Data (STEP) could alleviate some of the stumbling blocks of data exchange by providing a worldwide standard for storing, sharing, and exchanging product information among different CAD systems.

The Need for a Product Data Exchange Standard

STEP is an international data exchange standard encompassing the entire life cycle of a product, from design and development through manufacturing to maintenance and disposal. It differs from previous data exchange standards in that it specifies a data-sharing technology, not simply a data exchange format. Process information for specifically identified manufacturing segments such as automobile manufacturing, plant engineering, and shipbuilding is an integral part of STEP. Over time, the standard will support concept design, supplier/subcontractor integration, manufacturing, product support, maintenance, and logistics.

Although STEP can be envisioned as a glorified product data management (PDM) system, the standard is much more than a PDM. Commercially available PDMs are not a replacement for STEP because they do not include methods of representing all critical product specifications such as shape information, materials, tolerances, finishes, and product structure.

Whereas the Initial Graphics Exchange Specification (IGES) standard has been in widespread and active use for more than a decade, this standard's use has been deemed somewhat difficult because of its inability to convey

Dataquest®
a company of The Dun & Bradstreet Corporation

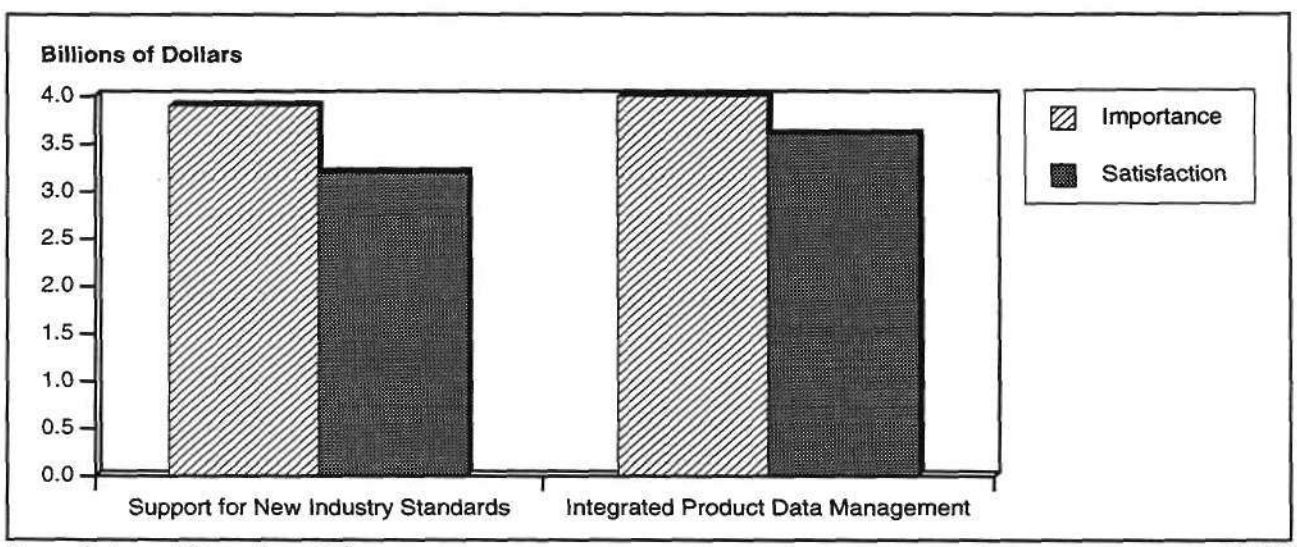
Program: Mechanical Applications Worldwide
Product Code: CMEC-WW-DP-9301
Publication Date: December 27, 1993

the extensive product information needed in the design and manufacturing cycle and the ability of IGES translators to move data from one CAD system to another. STEP is often viewed as a replacement for IGES, although IGES is still expected to remain in active use for quite some time into the future.

Dataquest's 1993 mechanical CAD/CAM/CAE end-user research has shown that a real need exists not only for product data management tools, but also for support of new industry standards such as STEP. The issue of standards support seems to weigh heavily on the minds of the end user. We asked end users to rate, on a scale of 0 to 4 (0 = not important and 4 = very important), the importance of and level of satisfaction with PDM tools and support for industry standards. As illustrated in Figure 1, respondents indicated that product data management and support for new industry standards are important, ranking these issues at nearly the top of the scale, yet satisfaction with standards support is rated considerably lower at a rating level of 3.2, leaving a gap of 0.7 between importance and satisfaction ratings for this feature.

Dataquest's end-user research of five years ago also points to the need for a comprehensive data exchange standard. At that time, we saw that approximately one-third of end users surveyed purchased their CAD systems from one vendor, one-third had used multiple vendors but had developed their own internal file translators, and one-third were using IGES as their standard for file exchange. We have seen that the group using multiple CAD vendors has been growing despite the maintenance costs needed to keep multiple systems running and communicating with one another. It is this group and those that use IGES that hold the most potential for embracing the STEP standard.

Figure 1
User Rated Importance versus Satisfaction for Industry Standards



Source: Dataquest (December 1993)

G3007257

©1993 Dataquest Incorporated

STEP Architecture

STEP architecture has four primary components, including the following:

- EXPRESS modeling language used to define all STEP data
- Actual definitions or schemas of data, including attributes such as geometry, topology, features, and tolerancing
- Application interface called STEP Data Access Interface (SDAI), which is a standard interface to enable applications to access and manipulate STEP data
- STEP database, which can take up to four different forms, as follows:
  - ASCII format file used for data exchange among systems
  - Working form file, usually in binary format, that can be shared by multiple systems (different applications can access and manipulate the data in the file)
  - Shared database, involving the use of a database management system (DBMS) and standard query languages (SQLs) (Concurrent access by multiple users of multiple applications is possible.)
  - Knowledge base, involving a knowledge base management system capable of all traditional DBMS functionality and the ability to be driven by some knowledge or set of rules

Figure 2 illustrates one implementation scheme for a STEP-compliant system.

The heart of STEP is contained in its integrated resources and application protocols. These elements can be envisioned in a matrix format as illustrated in Figure 3. In the most rudimentary terms, integrated resources are the tools used to create application protocols, the technically implementable portions of STEP. STEP's matrix format lends itself to a versatile, robust working model.

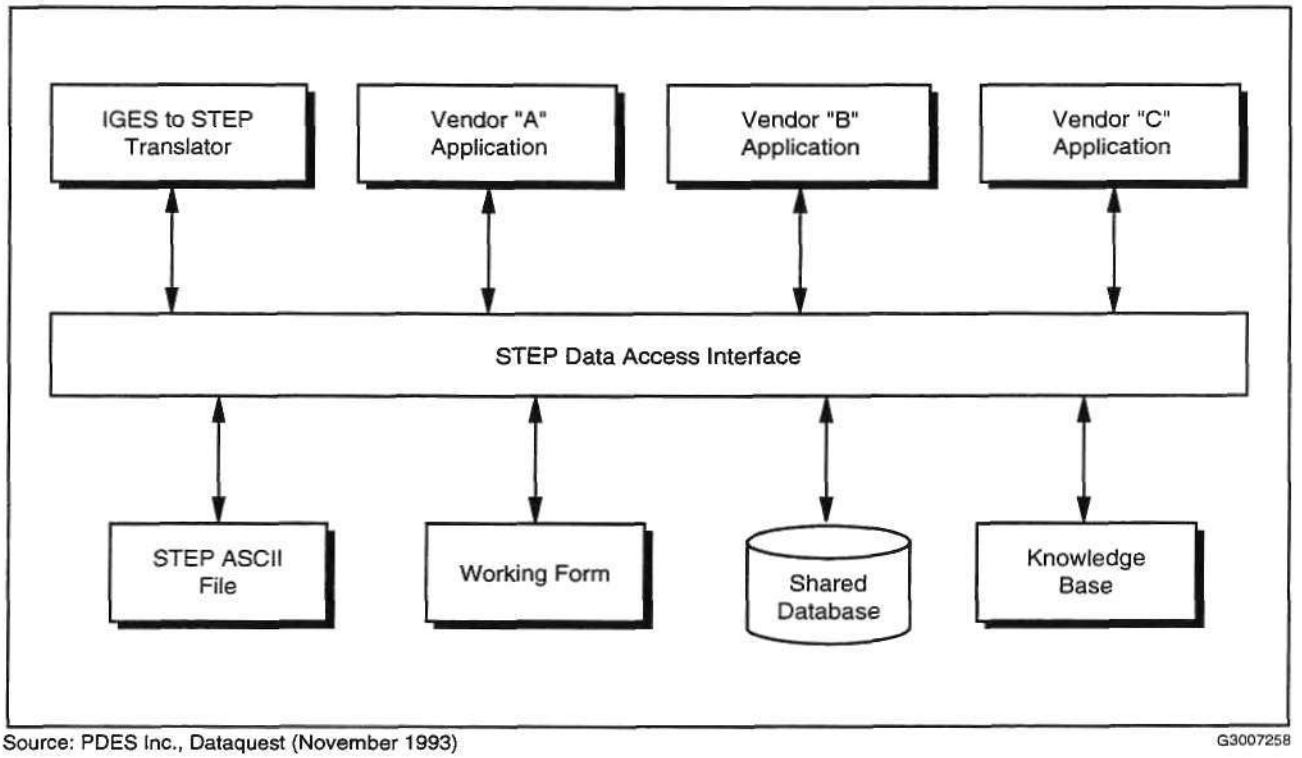
To illustrate how STEP's matrix format works, consider the following example. The proposed application protocol entitled, "Core Data for Automotive Mechanical Design Processes" targets the design of automobile bodies and power trains. To build this application protocol, it will rely on the application resources related to tolerances, surface conditions, and materials, among others.

Table 1 gives a partial listing of the currently proposed integrated resources, the conceptual information models used to build the application protocols. These integrated resources cover broad application areas such as finite element analysis as well as more specific areas such as tolerance information.

Application protocols form the essence of STEP. These are the technically implementable parts of STEP that specify the use of product data in a particular domain (such as shipbuilding and drafting) using standardized integrated resources.

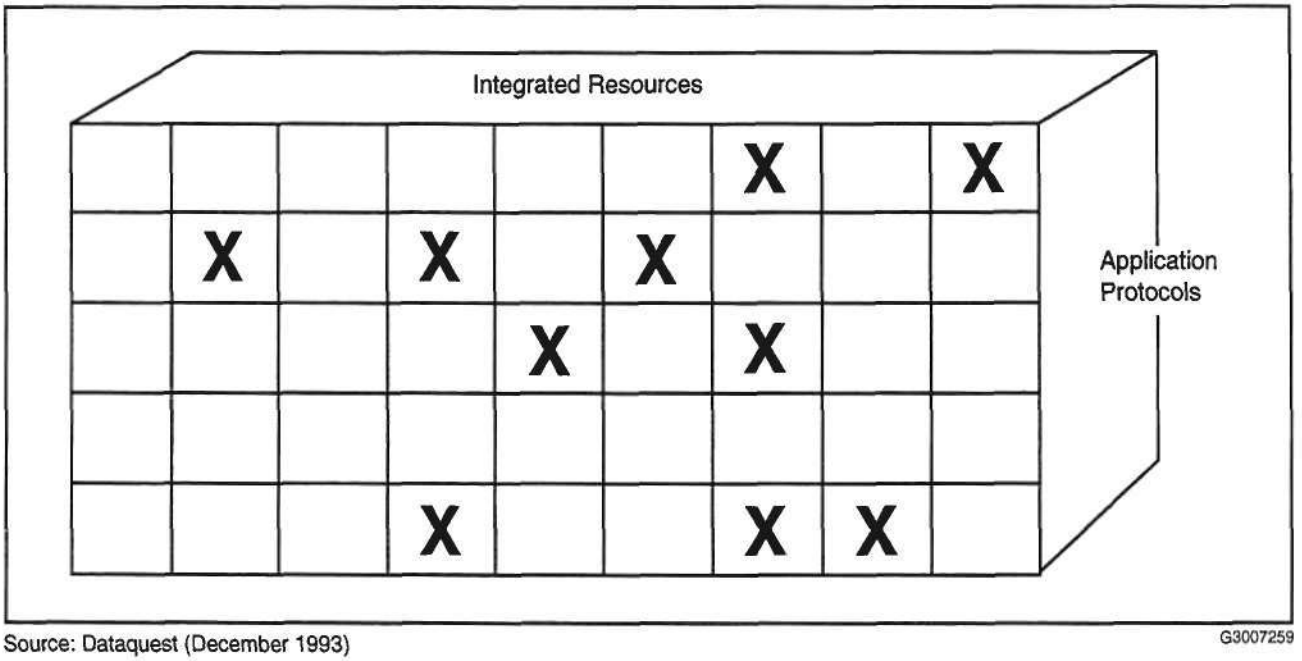
 ©1993 Dataquest Incorporated

Figure 2
STEP Architecture



Source: PDES Inc., Dataquest (November 1993) G3007258

Figure 3
STEP Model



Source: Dataquest (December 1993) G3007259

 ©1993 Dataquest Incorporated

Table 1
Proposed STEP Integrated Resources

Integrated Resources	Status
Fundamentals of Product Description and Support	Completed
Geometric and Topological Representation	Completed
Representation Structures	Completed
Product Structure Configuration	Completed
Materials	Under development
Visual Presentation	Completed
Shape Tolerances	Under development
Form Features	Under development
Drafting	Completed
Ship Structures	Under development
Finite Element Analysis	Under development
Kinematics	Under development
Product Life Cycle Support	Under development
Surface Conditions	Under development
Process Plans	Under development
Spatial Relationships	Under development

Source: Dataquest (December 1993)

As shown in Table 2, there are currently 19 proposed application protocols in various stages of completion. It is anticipated that these application protocols will be finished sometime in 1995 and more will be added as STEP develops.

Initial STEP Release

STEP was released in early 1993 as a Draft International Standard (DIS), with balloting due from the various voting committees at the end of 1993. With the passage of STEP, which is slated for early 1994, STEP will become an internationally recognized standard, and widespread commercialization can proceed. Release of STEP with DIS status indicates that the standard is "technically complete" and further additions to the standard will probably develop much more quickly now that the basic structure, content, and scope of the standard have been determined.

This initial release of STEP has four basic parts. These include the following:

- EXPRESS modeling language—All STEP data, including entities, attributes, and relationships, is defined in EXPRESS. There are commercially available EXPRESS compilers on the market right now.
- Two application protocols—Drafting and Configuration Controlled Design for Three-Dimensional Product Data
- Six application resources (listed in Table 1)

 ©1993 Dataquest Incorporated

Table 2
STEP Application Protocols

Application Protocol	Percentage Completion
Explicit Drafting	100
Associative Drafting	75
Configuration Controlled Design	100
Mechanical Design Using Boundary Representation	70
Mechanical Design Using Surface Representation	170
Mechanical Design Using Wireframe Representation	30
Sheet Metal Die Planning and Design	99
Life Cycle Product Change Process	40
Design Through Analysis of Composite and Metallic Structures	40
Electronic Printed Circuit Assembly: Design and Manufacture	40
Electronic Printed Circuit Assembly: Test, Integrated Diagnostics, and Remanufacture	10
Electrotechnical Plants	45
Numerical Control Process Plans for Machined Parts	45
Core Data for Automotive Mechanical Design Processes	35
Ship Arrangement	10
Ship Molded Forms	10
Ship Piping	20
Ship Structures	20
Inspection Process Plans	10

Source: Dataquest (December 1993)

- Conformance testing methodology and basic concepts to ensure the conformance of a product claiming to be an implementation of STEP.

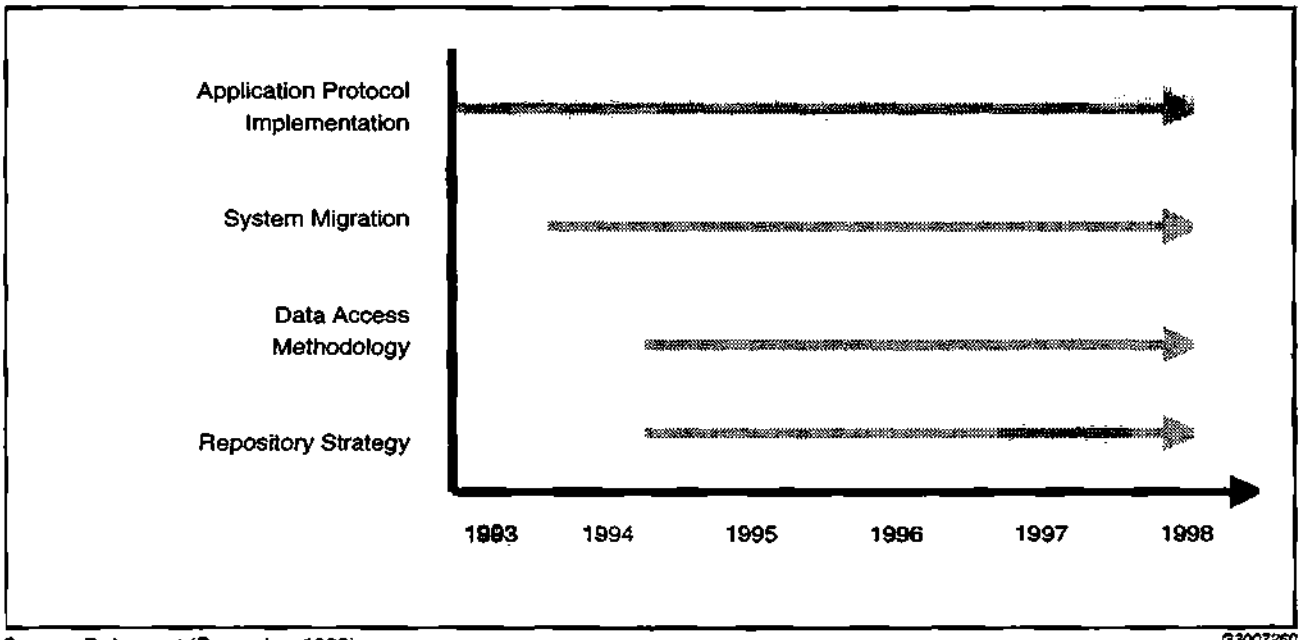
Subsequent releases of STEP will provide added functionality in terms of the kinds of products supported and the extent of the product life cycle that is supported. Although the current focus of STEP is on mechanical parts, STEP is a data exchange standard that will eventually apply to a wide range of product areas, including electronics, architectural, engineering and construction, apparel, and shipbuilding.

Estimated Timeline for Standard Completion

Implementation of STEP can be envisioned in four phases, as shown in Figure 4. It includes application protocol implementation, migration of existing systems to partial or complete STEP-compliance, data access methodologies across different computer systems, and repository strategies for a STEP database or something similar. Although application protocol projects are being deployed now in an effort to finish development of the standard, implementation of repository strategies are still far off.

 ©1993 Dataquest Incorporated

Figure 4
Estimated Timeline for STEP Standard Development



Source: Dataquest (December 1993)

Although a schedule for subsequent STEP releases has not been determined, it is anticipated that new releases will occur approximately every other year.

STEP—Its Relation to CALS

STEP is one of the many standards that fall under the Department of Defense initiative known as Continuous Acquisition and Life Cycle Support (CALS). Although CALS is a U.S.-based initiative, STEP is a European initiative, falling under the CALS umbrella through the work of a U.S. organization known as Product Data Exchange Using STEP (PDES). The goal of PDES is to ensure that the requirements of U.S. industries are incorporated into STEP.

The STEP Players

Because of its huge scope, STEP involves organizations, consortia, and committees worldwide. PDES Inc. is one of the most active consortia involved in the STEP development effort. It consists of approximately 22 international aerospace, automotive, defense, and computer companies advancing, testing, and deploying the STEP standard. In 1992, approximately 30 percent of all U.S. personnel working on STEP were involved in PDES Inc.

Other organizations in the STEP development effort include the IGES/PDES Organization, which provides a forum for exchanging information about IGES and STEP technologies; National Institute of Standards and Technology, which maintains a development lab and testbed to validate

 ©1993 Dataquest Incorporated

STEP concepts; National PDES Testbed, which coordinates implementation and testing of STEP; and International Standards Organization, which is responsible for the STEP standard.

Overseas Activity

Much of the development and deployment of STEP is centered in Europe where standards are often incorporated into local laws. ProSTEP is a German consortium of German automobile and electrotechnical CAD vendors leading development of the application protocols for electrotechnical processes and automotive mechanical design. In France, Association GOSET is the center for STEP activities. France's equivalent of STEP is known as Standard Exchange and Transfer (SET), and GOSET is active in the development of EXPRESS and the French SET standard. CAD-CAM Data Exchange Technical Center (CADDETC) is the United Kingdom center for product data exchange, and the European Strategic Program for Research in Information Technology (ESPRIT) is involved in STEP projects throughout Europe.

Asia is slowly becoming involved in STEP activities. Japan has a STEP center that focuses on multi-industry. The host contractor is Nippon Computer Graphics Association, and the Japanese STEP program has funding from the Ministry of International Trade and Industry. China recently opened a center for STEP in Beijing, focusing on the automotive, aerospace, and construction industries.

Vendor Offerings

It is anticipated that no single vendor will offer tools that satisfy the entire STEP standard simply because of its huge scope. However, there are already several vendors offering STEP-related software and tools, with most of the tools relating to EXPRESS compilation and creation of STEP data models. At least one vendor has developed an ACIS to STEP translator and an IGES to STEP translator. Some of the vendors offering STEP products include Computervision, Digital Equipment, GIDA mbH, International Technegroup Incorporated, and STEP Tools Inc. There are other companies, including major CAD/CAM vendors, developing STEP-related products that are not ready to make announcements at this time.

Unresolved Issues

Parametrics Support

The inability to transfer parametric information is often cited as a major stumbling block for the STEP standard. This issue is not being ignored; there are resources dedicated to examining how to imbed parametric information into the standard. Parametrics is expected to fall under the integrated resource known as Form Features, which is still under development. Although parametric information was not included in the initial release of STEP, it is anticipated that some parametric capability will be incorporated into future releases.

 ©1993 Dataquest Incorporated

ACIS Solid Modeling Technology

There has been some effort by ACIS OPEN to add Spatial Technology's ACIS solid modeling technology to STEP. ACIS has strong backing from some vendors in CAD/CAM, and ACIS OPEN is assessing the issues involved in adding ACIS as the geometric core to STEP. At this point in time, however, the feasibility of this addition does not look promising.

Dataquest Perspective

Clearly, STEP is under way. It is a comprehensive standard that is much broader and encompasses much more than a PDM system. The automotive industries seem to be the most active in developing and demonstrating STEP, as is Europe, mostly driven by the need to do business on an international basis.

End users see the need for software that will enable them to become STEP-compliant. They were asking for standards-based software four or five years ago and are asking for it more strongly now. The potential for converting end users from IGES and multiple vendor systems to STEP-compliant systems is growing, as end users realize the difficulties and expense of supporting multiple vendors.

Tool development should proceed at a faster rate now that the standard is out. Opportunities for tools exist in all areas of STEP. We anticipate that this standard will emerge slowly, but with all the user and industry backing and behind it, STEP will definitely begin to impact the CAD/CAM industry within this decade.

By Sharon Tan

 ©1993 Dataquest Incorporated

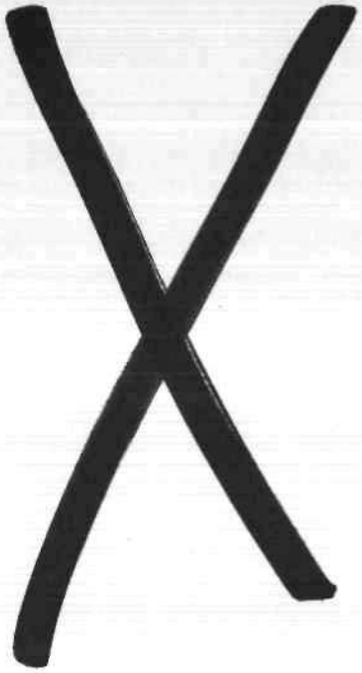
N04CMECWW CMECWWDP9301 BH: 1 N: 1
Corporate Library
Dataquest Incorporated

****
SJ - INTERNAL DISTRIBUTION
****

For More Information...
Sharon Tan, Industry Analyst ..... (408) 437-8132
Via fax ..... (408) 437-0292

This document is the property of Dataquest Incorporated. Reproduction or disclosure in whole or in part to other parties shall be made upon the written and express consent of Dataquest. This report shall be treated at all times as a confidential and proprietary document for internal use only. The information contained in this publication is believed to be reliable but cannot be guaranteed to be correct or complete.
©1993 Dataquest Incorporated—Reproduction Prohibited
Dataquest is a registered trademark of A.C. Nielsen Company 0015520

Dataquest®
a company of The Dun & Bradstreet Corporation



Market Statistics

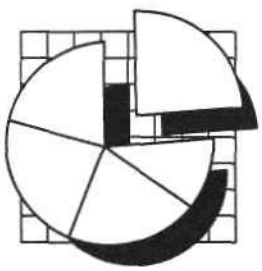
Dataquest®

INFORMATION RESOURCE CENTER
DATAQUEST INCORPORATED
1290 Ridder Park Drive
San Jose, CA 95131-2398
(408) 437-8600

Dataquest®

Software

Mechanical Applications Worldwide Forecast Update



Market Statistics

1993

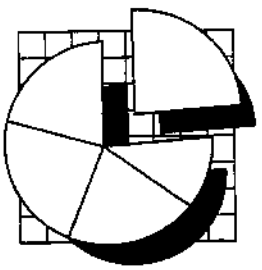
Program: Mechanical Applications Worldwide
Product Code: CMEC-WW-MS-9304
Publication Date: September 13, 1993

INFORMATION RESOURCE CENTER
DATAQUEST INCORPORATED
1290 Ridder Park Drive
San Jose, CA 95131 2398
(408) 437-8600

Dataquest®

Software

Mechanical Applications Worldwide Forecast Update



Market Statistics

1993

Program: Mechanical Applications Worldwide
Product Code: CMEC-WW-MS-9304
Publication Date: September 13, 1993

Table of Contents

	Page
Currency Changes	3
Database Changes	4
Other Information	4
Regional Forecast Assumptions	5
Worldwide Forecast Drivers	5
Macroeconomy	5
Technology	6
Indispensability	6
Late Buyers	9
Desktop Dominance	9
Unbundling of Software	9
Replacement Market	9
Software	9
North American Forecast Drivers	9
Economy	9
Cuts in Defense Spending	10
European Forecast Drivers	11
Economy	11
Growth	12
Currency	12
Asian Forecast Drivers	12
Economy	12
Currency	13
Competitive Model Change	13
Developing Asian Countries	13
Personal Computer	13
Virtual Reality	13
Application Forecast Assumptions	13
Mechanical Forecast Assumptions	13
AEC Forecast Assumptions	16
Growth Inhibitors to the AEC Industry	17
GIS/Mapping Forecast Assumptions	18
Growth Inhibitors to the GIS Industry	19
EDA Forecast Assumptions	20
Growth Inhibitors to the EDA Industry	20
Forecast Comparison	21
Forecast Methodology	22
Segmentation Definitions	24
Applications	24
Mechanical	24

©1993 Dataquest Incorporated

Table of Contents (Continued)

	Page
Architecture, Engineering, and Construction (AEC)	24
Geographic Information Systems (GIS)/Mapping	24
Electronic Design Automation (EDA)	24
Regions	25
North America	25
Europe	25
Asia	25
Rest of World	25
Platforms	25
Technical Workstation	25
Host-Dependent	25
Server	25
Personal Computer	26
Line Items	26

 ©1993 Dataquest Incorporated

List of Figures

Figure		Page
1	Software Forecast Update versus Forecast, 1992-1997	1
2	Worldwide and Regional Revenue Forecast, All Applications and All Platforms	7
3	Worldwide Revenue Forecast, by Platform, All Applications	8
4	Unit Shipments versus Retirements—History and Forecast	11
5	Worldwide Software Revenue Forecast by Application	14
6	Software Revenue Distribution Forecast by Application	15
7	CAD/CAM/CAE and GIS Forecasting Model	23

©1993 Dataquest Incorporated

List of Tables

Table		Page
1	Software Revenue Forecast Update versus Forecast	2
2	Foreign Currency per U.S. Dollar	3
3	Total Factory Revenue in Asia, Dollars as Compared to Yen	4
4	GDP/GNP Growth Rate Percentages	5
5	CAD/CAM/CAE/GIS Forecast by Region	6
6	CAD/CAM/CAE/GIS Software Revenue Forecast, by Application	10
7	Compound Annual Growth Rate, 1992-1997, Software Revenue	12
	Mechanical	
	Worldwide	
8	All Platforms	28
9	Technical Workstation	29
10	Host-Dependent	30
11	Server	31
12	Personal Computer	32
	North America	
13	All Platforms	33
14	Technical Workstation	34
15	Host-Dependent	35
16	Server	36
17	Personal Computer	37
	Europe	
18	All Platforms	38
19	Technical Workstation	39
20	Host-Dependent	40
21	Server	41
22	Personal Computer	42
	Asia	
23	All Platforms	43
24	Technical Workstation	44
25	Host-Dependent	45
26	Server	46
27	Personal Computer	47

Note: All tables show estimated data.

©1993 Dataquest Incorporated

List of Tables (Continued)

Table		Page
	Rest of World	
28	All Platforms	48
29	Technical Workstation	49
30	Host-Dependent	50
31	Server	51
32	Personal Computer	52

Note: All tables show estimated data.

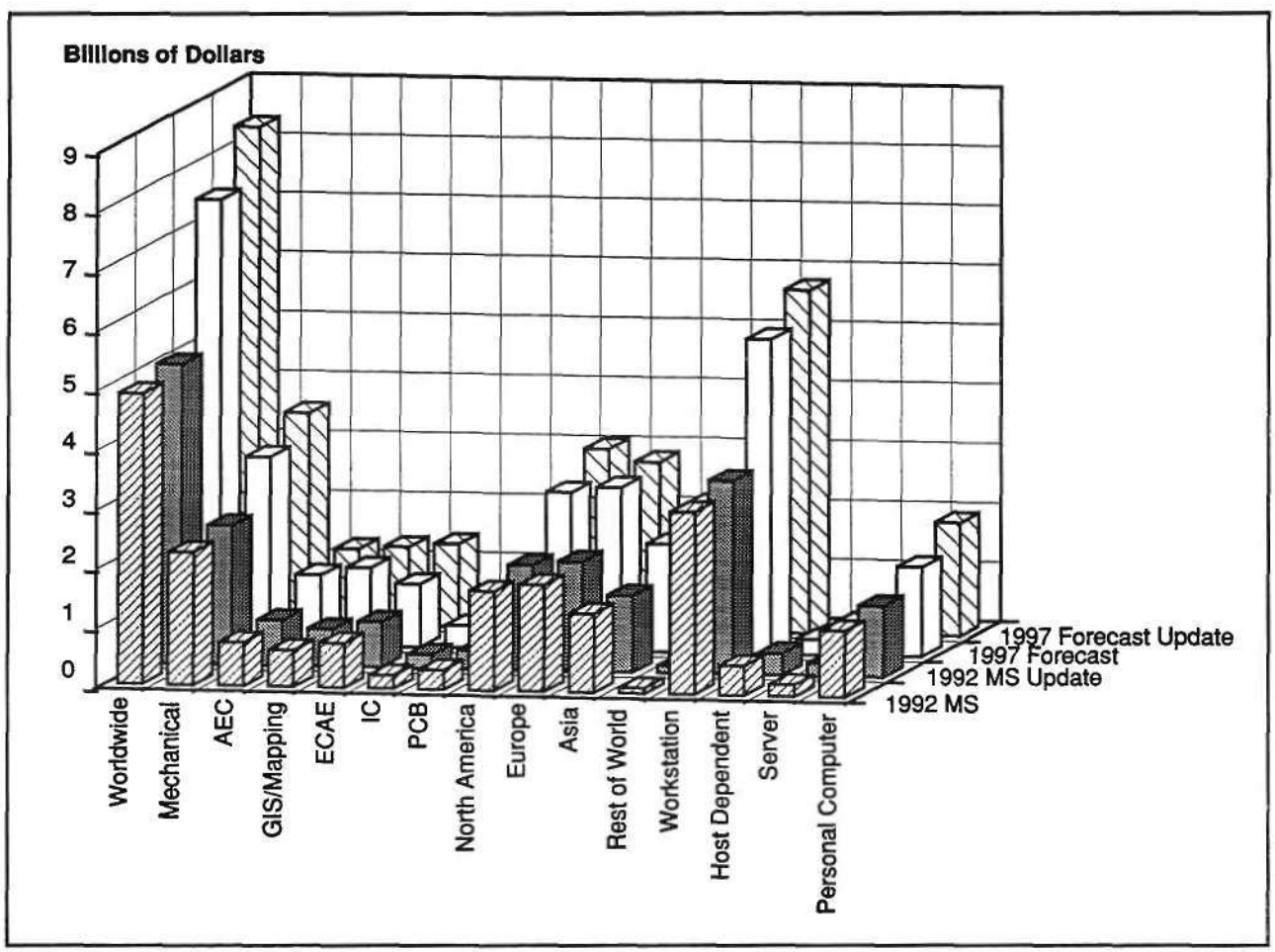
©1993 Dataquest Incorporated

Mechanical 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)

G3004189

©1993 Dataquest Incorporated

Table 1
Software Revenue Forecast Update versus Forecast

	Forecast Update		May Forecast		Market Share Update	Forecast Update		Market Share	May Forecast	
	1992-1993 Change (%)	1992-1997 CAGR (%)	1992-1993 Change (%)	1992-1997 CAGR (%)	1992 ($M)	1993 ($M)	1997 ($M)	1992 ($M)	1993 ($M)	1997 ($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)

CMEC-WW-MS-9304

©1993 Dataquest Incorporated

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)

©1993 Dataquest Incorporated

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.

 ©1993 Dataquest Incorporated

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

 ©1993 Dataquest Incorporated

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.

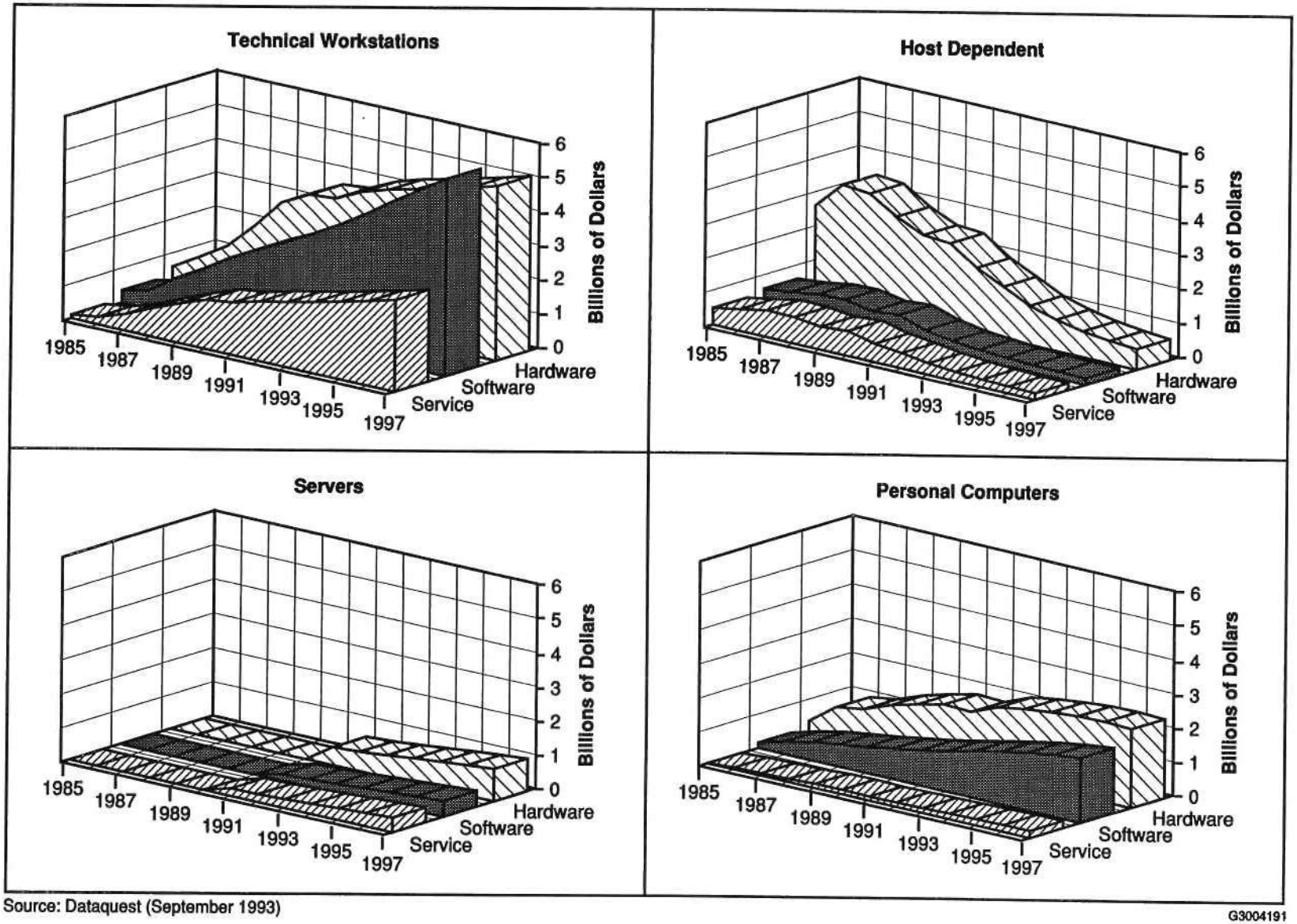
©1993 Dataquest Incorporated

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

Source: Dataquest (September 1993)

CMEC-WW-MS-9304
©1993 Dataquest Incorporated
September 13, 1993

Figure 3
Worldwide Revenue Forecast, by Platform, All Applications



Source: Dataquest (September 1993)

©1993 Dataquest Incorporated

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

 ©1993 Dataquest Incorporated

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)

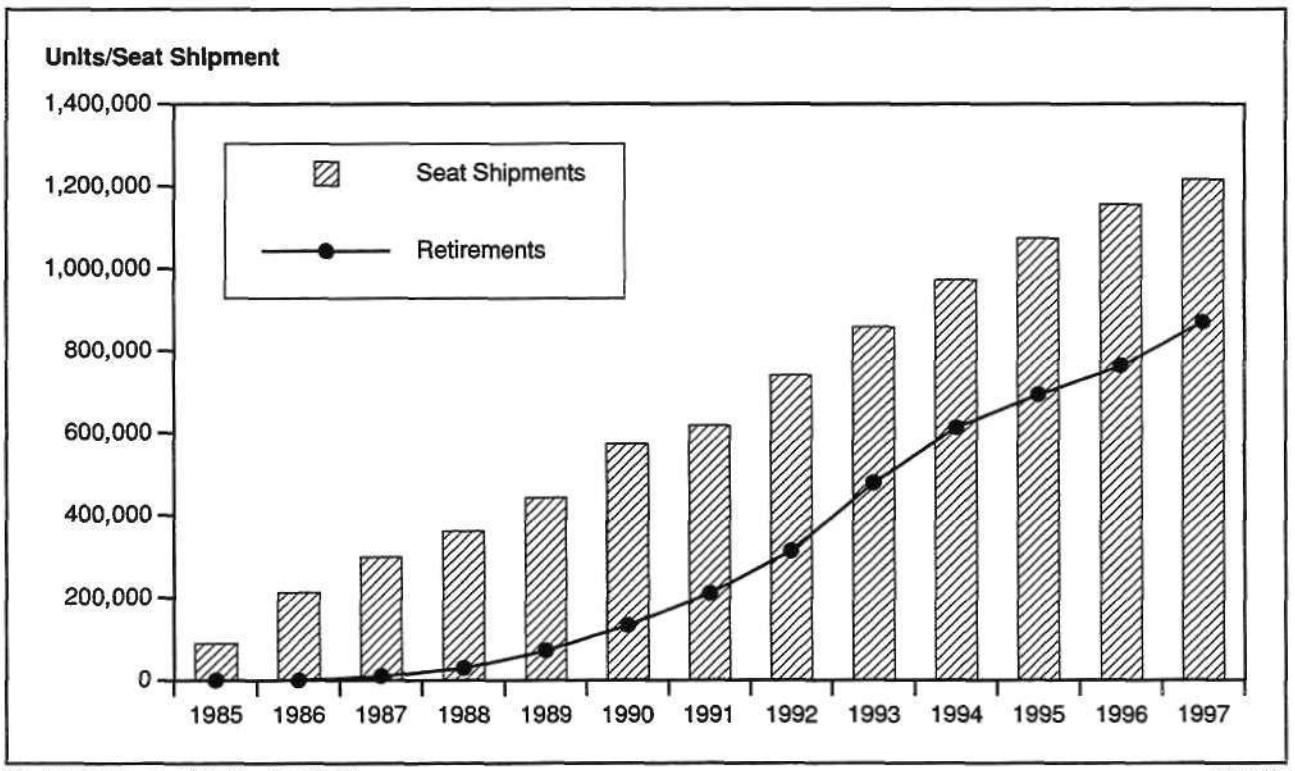
13 percent, down from the 22 percent growth of the previous four quarters. The July 1993 survey of 1,000 manufacturers nationwide indicates that reduced output has resulted in a lowering of expectations, which should continue into the third quarter.

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.

 ©1993 Dataquest Incorporated

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.

 ©1993 Dataquest Incorporated

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.

 ©1993 Dataquest Incorporated

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).

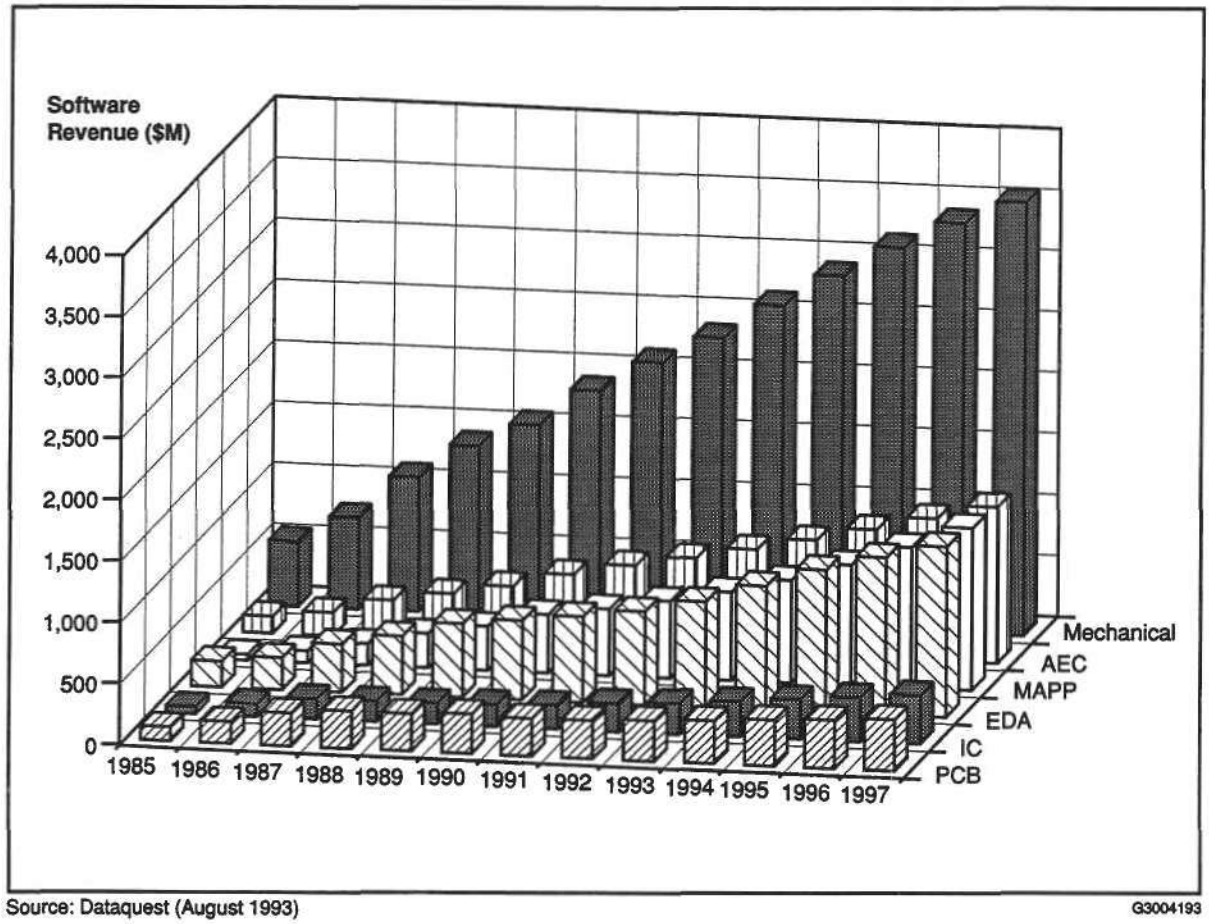
Mechanical Forecast Assumptions

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

 ©1993 Dataquest Incorporated

Figure 5
Worldwide Software Revenue Forecast by Application



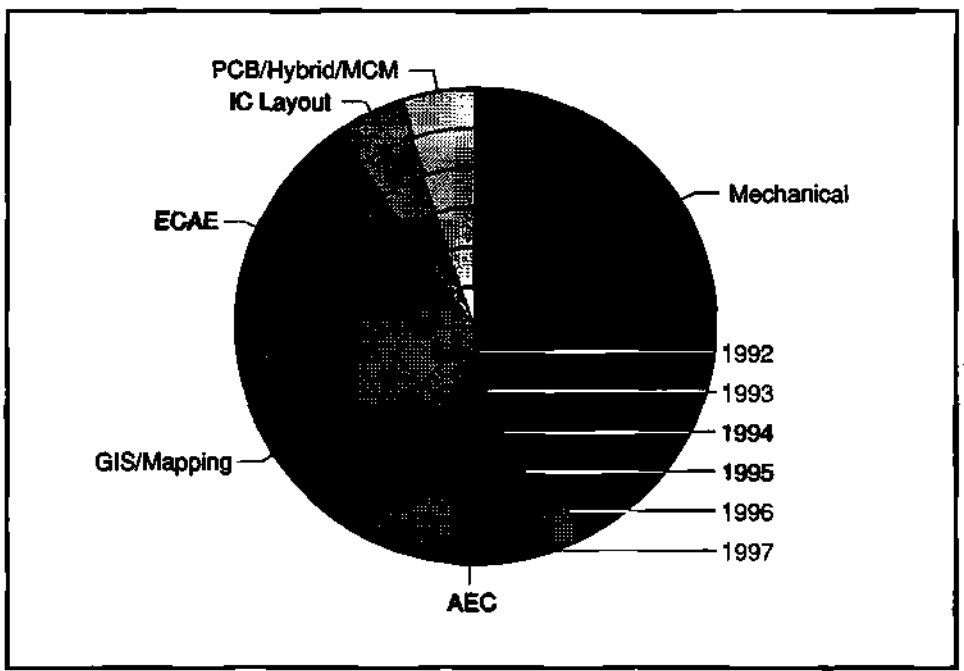
Source: Dataquest (August 1993) G3004193

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.

©1993 Dataquest Incorporated

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.

 ©1993 Dataquest Incorporated

- 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.

 ©1993 Dataquest Incorporated

- 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.

©1993 Dataquest Incorporated

- 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.

 ©1993 Dataquest Incorporated

- 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

 ©1993 Dataquest Incorporated

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.

 ©1993 Dataquest Incorporated

- 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 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 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

 ©1993 Dataquest Incorporated

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

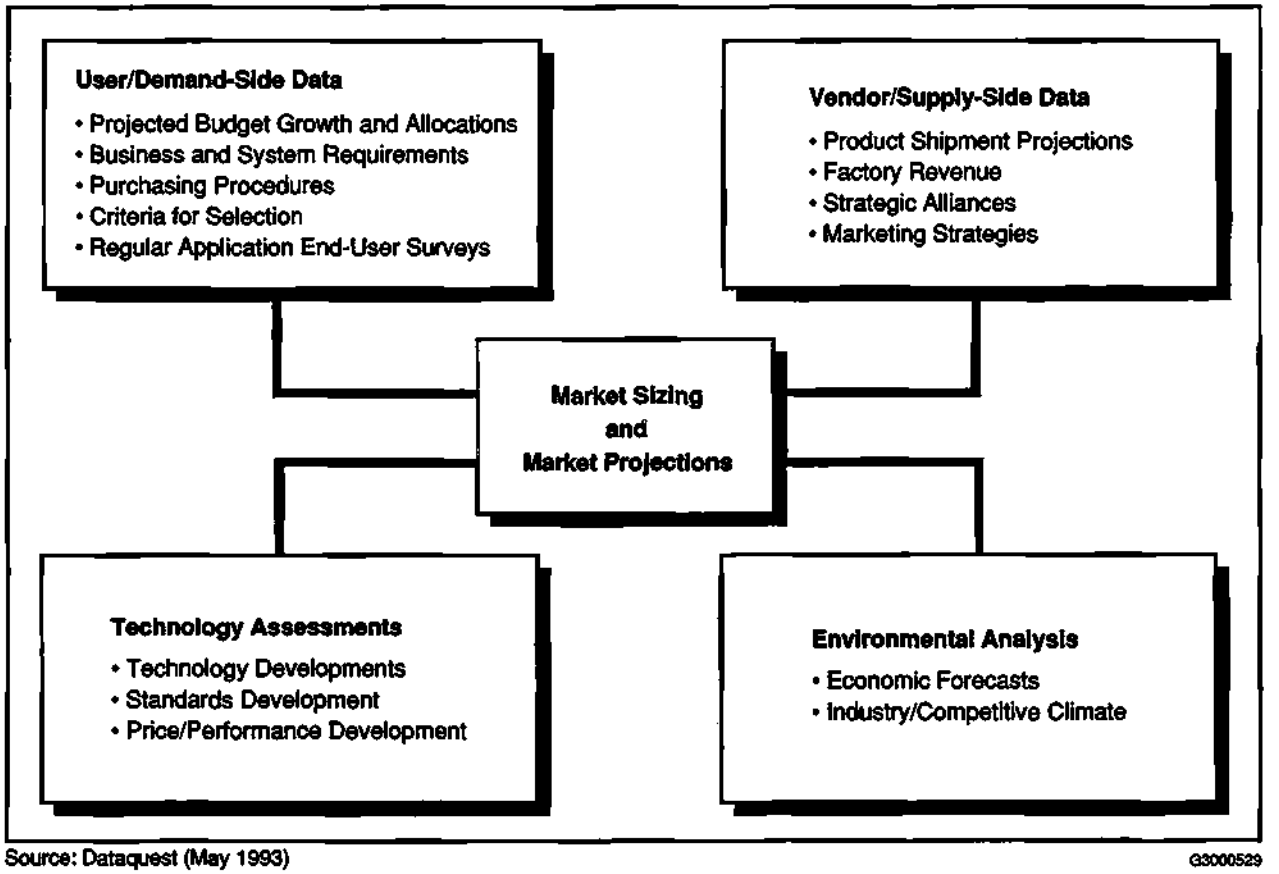
Fundamental to the way Dataquest conducts its research is an underlying philosophy that says the best data and analyses come from a well-balanced program. This program includes the following: balance between primary and secondary collection techniques; balance between supply-side and demand-side analysis; 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

 ©1993 Dataquest Incorporated

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.

 ©1993 Dataquest Incorporated

- 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.

 ©1993 Dataquest Incorporated

- 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

 ©1993 Dataquest Incorporated

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.)

 ©1993 Dataquest Incorporated

- 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).

©1993 Dataquest Incorporated

©1993 Dataquest Incorporated

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

Application: Mechanical
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	160,237	179,152	217,334	247,060	297,926	360,940	417,500	460,170	492,840	511,040	17	11
Unit Shipments or Seats	185,167	202,018	242,028	268,284	316,700	377,050	431,660	472,680	504,270	521,860	14	11
CPU Installed Base	418,810	567,893	726,572	879,213	1,041,182	1,204,940	1,377,020	1,561,460	1,745,510	1,895,690	26	13
Installed Seats	519,958	686,170	860,153	1,019,972	1,182,109	1,339,720	1,502,230	1,675,260	1,846,860	1,984,960	23	11
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	86.9	67.9	57.9	51.7	48.8	44.7	41.8	39.9	38.6	37.6	-13	-5
Hardware-Only ASP	10.2	10.9	9.2	8.4	7.8	6.8	6.1	5.7	5.5	5.5	-6	-7
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	3,584	3,799	3,963	4,005	4,095	4,188	4,240	4,264	4,280	4,280	3	1
CPU Revenue	2,468	2,889	3,077	3,198	3,308	3,426	3,503	3,554	3,594	3,615	8	2
Terminal Revenue	650	438	363	304	288	252	224	198	180	171	-18	-10
Peripheral Revenue (Turnkey)	465	471	523	503	499	510	512	512	506	494	2	-0
Software Revenue	1,374	1,561	1,869	2,117	2,341	2,628	2,889	3,141	3,365	3,548	14	9
Bundled	763	930	1,083	1,171	1,127	1,175	1,204	1,234	1,251	1,256	10	2
Unbundled	611	631	786	946	1,214	1,453	1,684	1,907	2,113	2,292	19	14
Service Revenue	856	999	1,168	1,187	1,275	1,327	1,393	1,455	1,527	1,596	10	5
Total Factory Revenue	5,813	6,359	7,000	7,308	7,711	8,142	8,521	8,860	9,172	9,425	7	4
Increase over Prior Year (%)	8	9	10	4	6	6	5	4	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)

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

Application: Mechanical
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	29,640	48,090	59,594	68,012	76,374	89,550	100,200	109,380	117,600	127,250	27	11
Unit Shipments or Seats	29,640	48,090	59,594	68,012	76,374	89,550	100,200	109,380	117,600	127,250	27	11
CPU Installed Base	64,998	109,958	163,144	218,994	275,630	334,120	393,260	448,950	503,470	554,300	44	15
Installed Seats	64,998	109,958	163,144	218,994	275,630	334,120	393,260	448,950	503,470	554,300	44	15
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	56.4	52.5	44.5	45.7	46.0	44.1	42.4	41.2	40.2	39.2	-5	-3
Hardware-Only ASP	23.4	21.4	23.8	19.2	19.2	17.4	16.0	15.0	14.5	14.0	-5	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	1,056	1,526	1,700	1,770	1,924	2,071	2,141	2,192	2,232	2,278	16	3
CPU Revenue	852	1,239	1,382	1,460	1,600	1,726	1,789	1,837	1,880	1,932	17	4
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	204	287	317	310	324	345	351	354	352	346	12	1
Software Revenue	557	803	1,028	1,248	1,477	1,710	1,915	2,118	2,303	2,470	28	11
Bundled	327	528	624	745	770	823	851	881	898	907	24	3
Unbundled	230	275	404	503	707	888	1,063	1,238	1,405	1,563	32	17
Service Revenue	355	540	635	667	793	876	947	1,012	1,078	1,143	22	8
Total Factory Revenue	1,968	2,870	3,363	3,685	4,194	4,657	5,002	5,322	5,613	5,892	21	7
Increase over Prior Year (%)	50	46	17	10	14	11	7	6	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)

©1993 Dataquest Incorporated

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

Application: Mechanical
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	5,366	7,702	9,250	5,654	4,204	3,700	3,430	3,210	3,120	3,110	-6	-6
Unit Shipments or Seats	30,296	30,568	33,944	26,878	22,978	19,810	17,590	15,720	14,540	13,930	-7	-10
CPU Installed Base	23,607	29,816	36,821	39,392	39,668	39,030	37,520	35,240	32,750	31,110	14	-5
Installed Seats	124,755	148,093	170,402	180,151	180,595	173,820	162,730	149,040	134,090	120,370	10	-8
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	430.1	324.9	270.9	259.2	289.5	271.3	257.9	249.6	242.4	236.0	-9	-4
Hardware-Only ASP	368.2	154.7	129.5	277.3	296.8	294.9	278.3	255.3	233.4	216.0	-5	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	1,882	1,579	1,551	1,249	1,043	870	759	670	614	580	-14	-11
CPU Revenue	1,065	1,019	1,054	849	683	559	483	427	392	370	-11	-12
Terminal Revenue	650	438	363	304	288	252	224	198	180	171	-18	-10
Peripheral Revenue (Turnkey)	167	122	134	97	72	59	51	45	41	39	-19	-12
Software Revenue	530	433	496	343	265	233	211	198	192	189	-16	-7
Bundled	331	313	377	242	184	160	146	137	133	132	-14	-6
Unbundled	199	120	119	101	82	72	65	61	59	57	-20	-7
Service Revenue	467	403	480	371	317	264	233	210	198	192	-9	-10
Total Factory Revenue	2,880	2,416	2,527	1,963	1,625	1,367	1,202	1,078	1,004	961	-13	-10
Increase over Prior Year (%)	-11	-16	5	-22	-17	-16	-12	-10	-7	-4		

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

©1993 Dataquest Incorporated

CMEC-WW-MS-9304

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

Application: Mechanical
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	6,582	7,287	8,770	10,660	12,340	13,840	14,870	NA	15
Unit Shipments or Seats	NA	NA	NA	6,582	7,287	8,770	10,660	12,340	13,840	14,870	NA	15
CPU Installed Base	NA	NA	NA	6,582	13,870	22,200	31,680	41,070	50,570	57,530	NA	33
Installed Seats	NA	NA	NA	6,582	13,870	22,200	31,680	41,070	50,570	57,530	NA	33
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	NA	NA	NA	67.9	68.2	65.0	62.2	59.5	56.9	54.6	NA	-4
Hardware-Only ASP	NA	NA	NA	38.3	34.7	31.6	29.0	27.6	26.7	26.1	NA	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	NA	NA	NA	262	274	305	344	374	398	409	NA	8
CPU Revenue	NA	NA	NA	234	241	267	301	329	352	364	NA	9
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	NA	NA	NA	28	33	38	42	45	46	45	NA	7
Software Revenue	NA	NA	NA	108	115	139	163	181	193	199	NA	12
Bundled	NA	NA	NA	90	88	105	123	134	139	137	NA	9
Unbundled	NA	NA	NA	18	27	33	40	47	55	61	NA	18
Service Revenue	NA	NA	NA	99	105	120	139	153	166	173	NA	10
Total Factory Revenue	NA	NA	NA	469	494	564	645	708	757	781	NA	10
Increase over Prior Year (%)	NA	NA	NA	NA	5	14	15	10	7	3		

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

Source: Dataquest (September 1993)

©1993 Dataquest Incorporated

September 13, 1993

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

Application: Mechanical
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	125,231	123,360	148,490	166,812	210,061	258,920	303,210	335,230	358,280	365,810	14	12
Unit Shipments or Seats	125,231	123,360	148,490	166,812	210,061	258,920	303,210	335,230	358,280	365,810	14	12
CPU Installed Base	330,205	428,119	526,607	614,244	712,014	809,590	914,560	1,036,200	1,158,730	1,252,760	21	12
Installed Seats	330,205	428,119	526,607	614,244	712,014	809,590	914,560	1,036,200	1,158,730	1,252,760	21	12
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	23.2	20.9	20.2	15.5	14.9	13.4	12.1	11.4	10.9	10.5	-10	-7
Hardware-Only ASP	4.4	4.8	3.8	3.6	3.4	3.2	2.9	2.7	2.6	2.5	-6	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	645	693	712	724	855	942	997	1,028	1,037	1,012	7	3
CPU Revenue	551	631	640	655	785	874	929	960	970	949	9	4
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	94	63	72	68	70	68	68	68	66	64	-7	-2
Software Revenue	287	324	345	418	483	546	600	644	676	690	14	7
Bundled	104	88	82	94	85	86	84	83	81	79	-5	-1
Unbundled	182	236	263	324	398	460	516	560	595	611	22	9
Service Revenue	33	56	53	50	60	67	75	80	85	88	16	8
Total Factory Revenue	965	1,073	1,110	1,191	1,398	1,555	1,672	1,751	1,797	1,790	10	5
Increase over Prior Year (%)	15	11	3	7	17	11	8	5	3	-0		

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

Source: Dataquest (September 1993)

CMEC-WW-MS-9304

©1993 Dataquest Incorporated

September 13, 1993

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

Application: Mechanical
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	82,180	73,761	65,347	69,272	96,790	119,570	141,850	159,670	175,740	187,370	4	14
Unit Shipments or Seats	91,105	81,180	74,953	77,768	101,798	123,130	144,780	162,250	178,140	189,650	3	13
CPU Installed Base	220,676	277,451	310,824	330,376	361,273	399,170	452,840	521,020	596,410	664,480	13	13
Installed Seats	267,027	326,903	363,848	384,206	411,529	443,520	490,650	552,330	621,370	683,600	11	11
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	90.7	77.1	73.7	56.7	50.4	47.4	45.3	43.7	42.6	41.7	-14	-4
Hardware-Only ASP	8.7	10.6	11.3	10.7	8.6	7.2	6.4	6.0	5.8	5.8	-0	-8
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	1,203	1,239	1,175	1,068	1,123	1,145	1,188	1,222	1,264	1,313	-2	3
CPU Revenue	892	963	883	834	938	988	1,041	1,081	1,126	1,177	1	5
Terminal Revenue	223	161	166	137	86	57	46	40	37	35	-21	-16
Peripheral Revenue (Turnkey)	88	115	125	98	99	100	101	101	102	102	3	1
Software Revenue	424	467	565	575	675	788	886	971	1,034	1,085	12	10
Bundled	156	196	238	211	188	197	206	213	220	226	5	4
Unbundled	268	271	327	364	487	591	679	759	815	859	16	12
Service Revenue	295	335	350	313	359	378	406	429	453	479	5	6
Total Factory Revenue	1,922	2,040	2,090	1,956	2,157	2,311	2,479	2,622	2,751	2,877	3	6
Increase over Prior Year (%)	-8	6	2	-6	10	7	7	6	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)

©1993 Dataquest Incorporated

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

Application: Mechanical
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	10,140	15,148	15,818	18,105	23,470	28,630	32,880	36,570	40,330	46,430	23	15
Unit Shipments or Seats	10,140	15,148	15,818	18,105	23,470	28,630	32,880	36,570	40,330	46,430	23	15
CPU Installed Base	26,754	40,299	53,158	66,248	82,372	100,630	120,980	141,420	163,170	186,670	32	18
Installed Seats	26,754	40,299	53,158	66,248	82,372	100,630	120,980	141,420	163,170	186,670	32	18
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	47.2	51.1	43.9	40.7	37.1	35.4	34.0	33.0	32.1	31.4	-6	-3
Hardware-Only ASP	27.1	21.4	21.8	19.0	17.6	16.0	14.7	13.8	13.3	12.9	-10	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	323	458	422	415	474	518	541	558	583	635	10	6
CPU Revenue	278	384	352	360	415	458	482	500	525	576	11	7
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	45	74	70	55	59	59	59	58	58	59	7	0
Software Revenue	163	228	300	337	393	468	532	589	631	673	25	11
Bundled	74	115	133	137	118	120	121	123	127	132	12	2
Unbundled	89	113	168	200	275	349	411	466	505	541	33	14
Service Revenue	121	191	178	172	208	237	260	278	296	318	15	9
Total Factory Revenue	607	876	900	925	1,075	1,223	1,333	1,426	1,509	1,625	15	9
Increase over Prior Year (%)	26	44	3	3	16	14	9	7	6	8		

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

©1993 Dataquest Incorporated

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

Application: Mechanical
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	1,751	2,480	2,990	1,292	1,018	770	680	650	650	670	-13	-8
Unit Shipments or Seats	10,676	9,899	12,595	9,788	6,025	4,340	3,610	3,230	3,050	2,950	-13	-13
CPU Installed Base	10,682	12,100	13,783	13,521	12,744	11,810	10,720	9,540	8,420	7,760	5	-9
Installed Seats	57,034	61,552	66,807	67,351	63,000	56,160	48,530	40,850	33,380	26,880	3	-16
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	360.5	483.8	369.6	312.9	378.0	361.1	346.3	331.8	317.8	305.1	1	-4
Hardware-Only ASP	462.7	149.4	141.1	322.0	231.5	210.8	193.5	177.4	162.4	149.4	-16	-8
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	613	515	551	362	259	185	153	135	126	121	-19	-14
CPU Revenue	348	320	342	204	159	117	97	86	81	78	-18	-13
Terminal Revenue	223	161	166	137	86	57	46	40	37	35	-21	-16
Peripheral Revenue (Turnkey)	42	33	43	22	14	11	9	8	8	8	-23	-12
Software Revenue	182	135	158	88	67	61	54	52	52	52	-22	-5
Bundled	79	78	103	48	28	26	24	23	24	25	-23	-2
Unbundled	103	57	55	41	39	35	30	28	28	27	-21	-7
Service Revenue	166	128	161	98	88	67	58	52	50	50	-15	-11
Total Factory Revenue	962	778	870	548	414	313	264	239	228	223	-19	-12
Increase over Prior Year (%)	-25	-19	12	-37	-24	-25	-16	-9	-5	-2		

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

Source: Dataquest (September 1993)

©1993 Dataquest Incorporated

©1993 Dataquest Incorporated

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

Application: Mechanical
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	2,710	3,663	4,480	5,530	6,400	7,160	7,590	NA	16
Unit Shipments or Seats	NA	NA	NA	2,710	3,663	4,480	5,530	6,400	7,160	7,590	NA	16
CPU Installed Base	NA	NA	NA	2,710	6,373	10,630	15,570	20,460	25,390	28,930	NA	35
Installed Seats	NA	NA	NA	2,710	6,373	10,630	15,570	20,460	25,390	28,930	NA	35
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	NA	NA	NA	57.0	64.0	61.1	58.6	56.2	53.8	51.7	NA	-4
Hardware-Only ASP	NA	NA	NA	32.6	34.1	31.0	28.5	27.1	26.3	25.7	NA	-5
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	NA	NA	NA	90	132	149	171	186	198	201	NA	9
CPU Revenue	NA	NA	NA	82	116	131	150	164	175	178	NA	9
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	NA	NA	NA	8	16	18	21	22	23	23	NA	7
Software Revenue	NA	NA	NA	33	56	70	84	94	101	104	NA	13
Bundled	NA	NA	NA	25	40	50	60	65	68	68	NA	11
Unbundled	NA	NA	NA	8	16	20	24	29	33	36	NA	18
Service Revenue	NA	NA	NA	35	53	61	72	80	86	89	NA	11
Total Factory Revenue	NA	NA	NA	158	242	281	327	359	385	394	NA	10
Increase over Prior Year (%)	NA	NA	NA	NA	53	16	17	10	7	2		

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

Source: Dataquest (September 1993)

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

Application: Mechanical
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	70,289	56,133	46,539	47,165	68,639	85,690	102,750	116,050	127,600	132,680	-1	14
Unit Shipments or Seats	70,289	56,133	46,539	47,165	68,639	85,690	102,750	116,050	127,600	132,680	-1	14
CPU Installed Base	183,239	225,051	243,883	247,897	259,784	276,100	305,570	349,600	399,430	441,120	9	11
Installed Seats	183,239	225,051	243,883	247,897	259,784	276,100	305,570	349,600	399,430	441,120	9	11
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	13.8	10.8	19.7	12.3	11.2	10.1	9.1	8.5	8.1	7.8	-5	-7
Hardware-Only ASP	3.7	4.7	4.3	4.2	3.7	3.4	3.1	2.9	2.8	2.7	0	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	267	267	202	201	258	293	323	343	358	357	-1	7
CPU Revenue	266	259	189	188	248	282	311	330	345	344	-2	7
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	1	8	12	13	10	11	12	12	13	13	70	5
Software Revenue	78	104	107	117	158	189	215	236	250	255	19	10
Bundled	2	3	3	2	2	1	1	1	1	1	-7	-6
Unbundled	76	101	104	115	156	187	214	235	249	254	20	10
Service Revenue	8	16	10	8	11	13	17	19	21	22	7	16
Total Factory Revenue	353	386	319	326	426	495	555	598	629	635	5	8
Increase over Prior Year (%)	10	10	-17	2	31	16	12	8	5	1		

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

Source: Dataquest (September 1993)

©1993 Dataquest Incorporated

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

Application: Mechanical
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	47,214	62,409	72,815	87,245	104,292	119,060	134,970	148,700	158,510	164,180	22	9
Unit Shipments or Seats	56,271	72,030	81,337	94,505	112,282	125,870	140,880	154,060	163,480	168,930	19	9
CPU Installed Base	116,033	170,944	228,302	289,539	354,177	411,590	465,700	521,690	577,640	623,660	32	12
Installed Seats	145,185	209,174	273,505	338,789	405,894	463,190	515,280	568,100	620,400	662,820	29	10
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	72.8	75.2	59.7	60.2	54.7	49.4	45.9	43.9	42.5	41.4	-7	-5
Hardware-Only ASP	12.5	11.6	9.5	8.3	8.2	7.4	6.7	6.2	6.0	6.0	-10	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	1,310	1,491	1,411	1,562	1,599	1,560	1,543	1,557	1,573	1,579	5	-0
CPU Revenue	929	1,124	1,118	1,258	1,287	1,271	1,270	1,293	1,315	1,328	8	1
Terminal Revenue	214	186	112	107	120	106	94	84	77	73	-13	-9
Peripheral Revenue (Turnkey)	167	180	181	197	192	183	179	180	180	179	4	-1
Software Revenue	498	614	732	907	998	1,069	1,148	1,256	1,377	1,494	19	8
Bundled	273	380	441	547	523	524	526	544	561	574	18	2
Unbundled	225	234	290	360	475	545	622	712	816	920	21	14
Service Revenue	347	439	528	587	625	629	647	680	724	767	16	4
Total Factory Revenue	2,154	2,544	2,671	3,055	3,222	3,258	3,338	3,493	3,674	3,840	11	4
Increase over Prior Year (%)	31	18	5	14	5	1	2	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)

©1993 Dataquest Incorporated

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

Application: Mechanical
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	12,344	19,246	23,386	28,279	33,456	36,600	39,720	43,180	46,600	49,850	28	8
Unit Shipments or Seats	12,344	19,246	23,386	28,279	33,456	36,600	39,720	43,180	46,600	49,850	28	8
CPU Installed Base	24,034	42,329	63,549	87,444	113,422	137,920	160,970	182,280	203,110	221,620	47	14
Installed Seats	24,034	42,329	63,549	87,444	113,422	137,920	160,970	182,280	203,110	221,620	47	14
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	53.0	53.5	46.5	46.6	46.8	44.5	42.7	41.4	40.4	39.5	-3	-3
Hardware-Only ASP	26.4	20.4	26.9	19.1	19.6	17.9	16.5	15.5	15.0	14.5	-7	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	452	636	701	744	852	857	861	881	905	925	17	2
CPU Revenue	366	525	589	623	721	728	734	752	776	795	18	2
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	86	110	112	121	131	129	127	128	129	129	11	-0
Software Revenue	237	350	465	593	719	784	859	961	1,076	1,190	32	11
Bundled	137	234	301	387	408	414	418	433	448	459	31	2
Unbundled	100	116	164	205	310	371	442	528	629	731	33	19
Service Revenue	156	257	333	358	434	455	481	516	558	599	29	7
Total Factory Revenue	844	1,244	1,499	1,695	2,005	2,097	2,201	2,358	2,540	2,714	24	6
Increase over Prior Year (%)	76	47	21	13	18	5	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 (September 1993)

©1993 Dataquest Incorporated

©1993 Dataquest Incorporated

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

Application: Mechanical
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	2,148	2,500	2,936	1,788	1,057	950	880	850	850	870	-16	-4
Unit Shipments or Seats	11,205	12,122	11,458	9,047	9,047	7,750	6,790	6,200	5,820	5,620	-5	-9
CPU Installed Base	6,878	9,196	11,697	12,750	12,752	12,250	11,460	10,540	9,620	9,040	17	-7
Installed Seats	36,030	47,426	56,900	62,000	64,470	63,850	61,050	56,950	52,380	48,200	16	-6
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	358.0	459.2	264.9	372.2	503.6	476.0	456.7	437.5	418.6	401.1	9	-4
Hardware-Only ASP	419.7	164.2	133.3	222.5	320.8	299.2	276.0	253.6	232.5	214.3	-6	-8
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	679	612	478	473	386	319	272	245	228	218	-13	-11
CPU Revenue	403	387	326	329	243	194	163	147	138	133	-12	-11
Terminal Revenue	214	186	112	107	120	106	94	84	77	73	-13	-9
Peripheral Revenue (Turnkey)	63	39	40	37	23	18	15	14	13	13	-22	-12
Software Revenue	173	157	160	130	90	76	67	64	64	64	-15	-7
Bundled	118	128	128	100	66	54	48	46	47	48	-13	-6
Unbundled	55	29	32	30	24	21	19	18	17	16	-19	-7
Service Revenue	178	162	175	164	129	106	91	83	80	78	-8	-10
Total Factory Revenue	1,031	931	813	768	605	500	429	392	371	361	-12	-10
Increase over Prior Year (%)	10	-10	-13	-6	-21	-17	-14	-9	-5	-3		

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

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

Application: Mechanical
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	2,198	2,458	2,920	3,500	4,060	4,510	4,850	NA	15
Unit Shipments or Seats	NA	NA	NA	2,198	2,458	2,920	3,500	4,060	4,510	4,850	NA	15
CPU Installed Base	NA	NA	NA	2,198	4,655	7,430	10,530	13,600	16,670	18,900	NA	32
Installed Seats	NA	NA	NA	2,198	4,655	7,430	10,530	13,600	16,670	18,900	NA	32
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	NA	NA	NA	81.8	69.4	66.2	63.4	60.7	58.1	55.8	NA	-4
Hardware-Only ASP	NA	NA	NA	51.2	36.7	33.6	30.8	29.2	28.3	27.8	NA	-5
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	NA	NA	NA	110	95	105	117	128	136	140	NA	8
CPU Revenue	NA	NA	NA	98	84	93	103	113	121	125	NA	8
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	NA	NA	NA	12	11	12	13	15	15	15	NA	6
Software Revenue	NA	NA	NA	47	34	40	45	50	53	54	NA	9
Bundled	NA	NA	NA	41	29	34	39	44	45	46	NA	9
Unbundled	NA	NA	NA	6	5	5	6	7	7	8	NA	11
Service Revenue	NA	NA	NA	44	36	41	46	51	55	57	NA	9
Total Factory Revenue	NA	NA	NA	201	166	186	208	229	243	251	NA	9
Increase over Prior Year (%)	NA	NA	NA	NA	-17	12	12	10	6	3		

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

©1993 Dataquest Incorporated

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

Application: Mechanical
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	32,722	40,662	46,492	54,981	67,322	78,600	90,870	100,620	106,540	108,610	20	10
Unit Shipments or Seats	32,722	40,662	46,492	54,981	67,322	78,600	90,870	100,620	106,540	108,610	20	10
CPU Installed Base	85,121	119,419	153,056	187,148	223,347	253,990	282,730	315,280	348,240	374,100	27	11
Installed Seats	85,121	119,419	153,056	187,148	223,347	253,990	282,730	315,280	348,240	374,100	27	11
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	14.3	28.6	25.4	22.8	19.2	16.7	15.2	14.3	13.7	13.2	8	-7
Hardware-Only ASP	4.5	4.9	4.2	3.7	3.4	3.2	2.9	2.7	2.6	2.5	-7	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	178	242	232	234	266	279	293	303	304	296	10	2
CPU Revenue	160	212	203	208	238	256	270	280	281	274	10	3
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	18	30	29	26	27	23	23	23	23	22	10	-4
Software Revenue	88	107	107	137	155	170	177	181	184	186	15	4
Bundled	18	18	12	18	19	22	21	21	22	21	2	2
Unbundled	70	89	95	119	136	148	155	159	162	165	18	4
Service Revenue	13	20	20	21	25	27	29	30	32	32	17	5
Total Factory Revenue	279	369	359	392	445	475	499	514	519	515	12	3
Increase over Prior Year (%)	22	32	-3	9	14	7	5	3	1	-1		

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

©1993 Dataquest Incorporated

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

Application: Mechanical
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	1,365	2,588	3,200	2,496	2,047	1,890	1,770	1,610	1,520	1,470	11	-6
Unit Shipments or Seats	7,512	7,899	9,160	7,360	7,361	7,130	6,590	5,740	5,170	4,890	-1	-8
CPU Installed Base	5,367	7,760	10,534	12,325	13,431	14,250	14,610	14,450	13,990	13,580	26	0
Installed Seats	28,279	35,365	42,615	46,509	48,908	49,700	49,190	47,460	44,770	41,930	15	-3
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	638.9	211.2	232.8	187.8	201.0	190.1	182.3	174.7	167.3	160.7	-25	-4
Hardware-Only ASP	155.2	131.1	79.0	297.6	559.6	511.1	469.1	430.1	394.3	362.5	38	-8
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	543	421	493	390	374	340	307	266	237	219	-9	-10
CPU Revenue	290	295	370	305	265	230	204	177	157	144	-2	-12
Terminal Revenue	193	79	73	49	75	82	78	68	61	59	-21	-5
Peripheral Revenue (Turnkey)	60	47	50	37	33	28	25	21	19	17	-14	-12
Software Revenue	168	136	174	121	102	89	81	74	69	65	-12	-9
Bundled	129	104	143	92	85	75	68	62	57	54	-10	-9
Unbundled	38	32	30	29	16	14	13	12	12	11	-19	-7
Service Revenue	113	106	136	103	92	81	74	65	59	55	-5	-10
Total Factory Revenue	824	663	802	615	568	511	462	404	365	340	-9	-10
Increase over Prior Year (%)	-9	-20	21	-23	-8	-10	-9	-13	-10	-7		

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

©1993 Dataquest Incorporated

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

Application: Mechanical
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	1,544	899	1,030	1,200	1,390	1,620	1,850	NA	16
Unit Shipments or Seats	NA	NA	NA	1,544	899	1,030	1,200	1,390	1,620	1,850	NA	16
CPU Installed Base	NA	NA	NA	1,544	2,444	3,420	4,480	5,520	6,630	7,550	NA	25
Installed Seats	NA	NA	NA	1,544	2,444	3,420	4,480	5,520	6,630	7,550	NA	25
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	NA	NA	NA	63.0	80.6	77.2	74.0	70.9	67.9	65.2	NA	-4
Hardware-Only ASP	NA	NA	NA	33.0	31.1	27.8	25.5	24.2	23.5	23.0	NA	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	NA	NA	NA	57	35	37	40	43	47	50	NA	7
CPU Revenue	NA	NA	NA	50	31	32	35	38	41	45	NA	8
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	NA	NA	NA	7	5	5	5	5	5	5	NA	2
Software Revenue	NA	NA	NA	27	19	21	25	27	29	30	NA	10
Bundled	NA	NA	NA	23	13	15	16	16	16	15	NA	2
Unbundled	NA	NA	NA	4	5	7	9	11	13	15	NA	23
Service Revenue	NA	NA	NA	18	12	13	14	16	17	19	NA	10
Total Factory Revenue	NA	NA	NA	101	66	71	80	86	93	99	NA	9
Increase over Prior Year (%)	NA	NA	NA	NA	-35	9	12	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)

CMEC-WW-MS-9304

© 1993 Dataquest Incorporated

September 13, 1993

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

Application: Mechanical
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	20,266	24,129	53,112	61,245	69,117	88,250	102,070	109,400	114,020	113,840	36	10
Unit Shipments or Seats	20,266	24,129	53,112	61,245	69,117	88,250	102,070	109,400	114,020	113,840	36	10
CPU Installed Base	56,421	76,183	120,645	168,064	214,696	261,750	304,720	345,180	380,340	402,880	40	13
Installed Seats	56,421	76,183	120,645	168,064	214,696	261,750	304,720	345,180	380,340	402,880	40	13
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	33.2	19.7	19.2	14.5	14.3	12.9	11.6	10.9	10.4	9.9	-19	-7
Hardware-Only ASP	7.0	4.7	3.0	2.9	3.1	2.9	2.6	2.5	2.4	2.3	-18	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	191	172	269	276	315	350	359	357	348	332	13	1
CPU Revenue	117	148	239	247	283	317	327	326	319	305	25	2
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	74	25	30	29	32	32	31	30	29	27	-19	-3
Software Revenue	119	109	126	155	159	174	192	207	217	215	8	6
Bundled	84	66	66	73	63	63	60	60	58	56	-7	-2
Unbundled	35	42	60	82	96	111	131	147	159	159	29	11
Service Revenue	12	20	22	21	23	25	28	29	30	31	18	6
Total Factory Revenue	322	300	418	451	497	549	578	592	595	578	11	3
Increase over Prior Year (%)	16	-7	39	8	10	10	5	2	1	-3		

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

©1993 Dataquest Incorporated

©1993 Dataquest Incorporated

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

Application:	Mechanical
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	2,596	3,309	3,257	4,569	6,473	8,220	9,690	11,610	12,910	13,830	26	16
Unit Shipments or Seats	3,396	3,824	3,864	5,174	6,934	8,720	10,190	12,060	13,310	14,200	20	15
CPU Installed Base	7,748	10,513	12,715	15,585	19,554	24,260	29,410	35,440	41,610	47,140	26	19
Installed Seats	10,481	13,503	15,988	19,081	23,032	27,630	32,650	38,490	44,460	49,780	22	17
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	70.0	60.5	45.1	37.3	47.1	49.0	48.6	46.0	44.1	42.7	-9	-2
Hardware-Only ASP	18.1	12.9	12.9	10.2	6.6	5.3	4.7	4.3	4.1	4.1	-22	-9
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	71	63	56	63	76	88	95	100	103	106	2	7
CPU Revenue	46	45	40	47	62	72	79	83	87	90	8	8
Terminal Revenue	20	12	11	11	7	6	6	6	5	5	-23	-7
Peripheral Revenue (Turnkey)	6	6	5	5	8	9	10	11	11	11	7	7
Software Revenue	15	18	18	31	51	69	87	105	122	141	35	23
Bundled	9	11	9	14	21	26	29	31	33	34	24	10
Unbundled	6	8	9	17	30	44	58	73	90	107	47	29
Service Revenue	15	16	15	19	26	33	39	43	47	52	14	15
Total Factory Revenue	102	97	89	113	153	189	221	247	273	299	11	14
Increase over Prior Year (%)	-22	-5	-9	26	36	24	17	12	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)

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

Application: Mechanical
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	539	739	787	939	1,141	1,400	1,640	1,850	2,140	2,470	21	17
Unit Shipments or Seats	539	739	787	939	1,141	1,400	1,640	1,850	2,140	2,470	21	17
CPU Installed Base	1,645	2,287	2,886	3,523	4,229	5,050	6,040	7,080	8,280	9,590	27	18
Installed Seats	1,645	2,287	2,886	3,523	4,229	5,050	6,040	7,080	8,280	9,590	27	18
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	38.6	46.4	33.8	39.9	38.5	36.7	35.3	34.2	33.4	32.6	-0	-3
Hardware-Only ASP	24.4	11.5	20.9	15.8	15.3	13.9	12.8	12.0	11.6	11.2	-11	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	16	19	18	22	24	28	30	33	36	39	11	10
CPU Revenue	13	15	15	18	21	24	26	28	30	33	13	10
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	3	4	3	3	4	4	5	5	5	6	5	8
Software Revenue	6	9	8	17	27	40	53	66	79	89	47	27
Bundled	3	6	6	10	11	13	14	16	17	19	34	12
Unbundled	2	2	3	7	17	27	39	50	61	70	62	34
Service Revenue	5	8	7	11	13	17	21	24	29	32	23	21
Total Factory Revenue	27	36	34	49	64	84	104	123	143	161	24	20
Increase over Prior Year (%)	18	34	-7	47	31	31	23	19	16	12		

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

Source: Dataquest (September 1993)

©1993 Dataquest Incorporated

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

Application: Mechanical
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	103	134	124	78	82	90	100	100	90	90	-5	2
Unit Shipments or Seats	903	649	730	683	544	590	600	540	500	470	-12	-3
CPU Installed Base	679	760	807	796	740	730	730	720	720	730	2	-0
Installed Seats	3,412	3,750	4,080	4,292	4,218	4,100	3,960	3,770	3,570	3,360	5	-4
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	482.0	601.0	401.7	287.8	400.1	382.2	366.5	351.2	336.4	322.9	-5	-4
Hardware-Only ASP	522.2	182.5	214.1	345.4	243.6	221.8	203.6	186.6	170.9	157.2	-17	-8
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	46	32	29	23	24	26	27	24	22	21	-16	-2
CPU Revenue	24	18	16	12	15	18	19	17	16	15	-10	-1
Terminal Revenue	20	12	11	11	7	6	6	6	5	5	-23	-7
Peripheral Revenue (Turnkey)	3	2	1	1	1	2	2	2	1	1	-15	1
Software Revenue	7	5	5	3	6	8	9	9	8	8	-6	6
Bundled	5	4	4	2	4	5	6	6	6	6	-7	9
Unbundled	2	2	1	1	2	2	2	2	2	2	-3	0
Service Revenue	10	7	7	5	8	10	11	10	9	9	-4	1
Total Factory Revenue	64	44	41	32	38	43	46	43	40	38	-12	0
Increase over Prior Year (%)	-33	-31	-6	-22	18	15	7	-8	-7	-5		

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

CMEC-WW-MS-9304

©1993 Dataquest Incorporated

September 13, 1993

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

Application: Mechanical
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	130	267	350	420	500	550	590	NA	17
Unit Shipments or Seats	NA	NA	NA	130	267	350	420	500	550	590	NA	17
CPU Installed Base	NA	NA	NA	130	398	730	1,110	1,490	1,870	2,160	NA	40
Installed Seats	NA	NA	NA	130	398	730	1,110	1,490	1,870	2,160	NA	40
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	NA	NA	NA	53.0	69.9	66.8	64.0	61.4	58.8	56.4	NA	-4
Hardware-Only ASP	NA	NA	NA	42.6	40.4	36.8	33.8	32.1	31.1	30.5	NA	-5
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	NA	NA	NA	5	11	14	16	17	18	19	NA	11
CPU Revenue	NA	NA	NA	5	9	11	13	15	16	16	NA	11
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	NA	NA	NA	0	2	2	3	3	3	3	NA	9
Software Revenue	NA	NA	NA	1	6	7	9	10	10	10	NA	12
Bundled	NA	NA	NA	1	5	7	8	9	9	9	NA	11
Unbundled	NA	NA	NA	0	1	1	1	1	1	2	NA	25
Service Revenue	NA	NA	NA	2	4	5	6	7	7	8	NA	13
Total Factory Revenue	NA	NA	NA	9	21	26	30	34	36	37	NA	12
Increase over Prior Year (%)	NA	NA	NA	NA	139	23	16	12	7	2		

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

©1993 Dataquest Incorporated

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

Application: Mechanical
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	1,954	2,436	2,346	3,421	4,983	6,380	7,530	9,170	10,120	10,680	26	16
Unit Shipments or Seats	1,954	2,436	2,346	3,421	4,983	6,380	7,530	9,170	10,120	10,680	26	16
CPU Installed Base	5,423	7,466	9,022	11,136	14,187	17,750	21,540	26,150	30,730	34,670	27	20
Installed Seats	5,423	7,466	9,022	11,136	14,187	17,750	21,540	26,150	30,730	34,670	27	20
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	10.0	9.7	6.2	4.8	4.8	4.3	3.9	3.7	3.5	3.3	-17	-7
Hardware-Only ASP	4.5	5.1	3.8	4.0	3.5	3.2	3.0	2.8	2.6	2.5	-6	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	9	12	9	13	17	20	22	25	27	27	17	9
CPU Revenue	9	12	9	13	16	19	21	24	25	25	16	9
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	0	0	0	0	1	1	1	1	2	2	25	7
Software Revenue	2	5	5	9	11	14	17	20	25	33	55	24
Bundled	0	1	0	1	1	1	1	1	1	0	15	-8
Unbundled	2	4	5	8	11	13	16	19	24	33	61	25
Service Revenue	0	1	1	1	1	1	2	2	2	3	52	24
Total Factory Revenue	11	18	15	23	30	36	40	47	54	63	27	16
Increase over Prior Year (%)	-15	54	-17	54	32	20	13	17	14	18		

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

CMEC-WW-MS-9304

©1993 Dataquest Incorporated

For More Information...

Linda Anderson, Market Research Analyst.....(408) 437-8135
Via fax.....(408) 437-0292

The content of this report represents our interpretation and analysis of information generally available to the public or released by responsible individuals in the subject companies, but is not guaranteed as to accuracy or completeness. It does not contain material provided to us in confidence by our clients. Individual companies reported on and analyzed by Dataquest may be clients of this and/or other Dataquest services. This information is not furnished in connection with a sale or offer to sell securities or in connection with the solicitation of an offer to buy securities. This firm and its parent and/or their officers, stockholders, or members of their families may, from time to time, have a long or short position in the securities mentioned and may sell or buy such securities.

©1993 Dataquest Incorporated—Reproduction Prohibited

Dataquest is a registered trademark of A.C. Nielsen Company 0015178

Dataquest®

a company of The Dun & Bradstreet Corporation

Dataquest®

a company of
The Dun & Bradstreet Corporation

Corporate Headquarters
Dataquest Incorporated
1290 Ridder Park Drive
San Jose, California 95131-2398
United States
Phone: 01-408-437-8000
Facsimile: 01-408-437-0292

Dataquest Incorporated
550 Cochituate Road
Framingham, Massachusetts 01701-9324
United States
Phone: 01-508-370-5555
Facsimile: 01-508-370-6262

Invitational Computer Conferences (ICC)
3990 Westerly Place, Suite 100
Newport Beach, California 92660
United States
Phone: (714) 476-9117
Facsimile: (714) 476-9969

Dataquest Japan Limited
Shinkawa Sanko Building
1-3-17, Shinkawa, Chuo-ku
Tokyo 104
Japan
Phone: 81-3-5566-0411
Facsimile: 81-3-5566-0425

Dataquest Korea
Trade Tower, Suite 3806
159 Samsung-dong
Kangnam-gu, Seoul 135-729
Korea
Phone: 011-82-2-551-1331
Facsimile: 011-82-2-551-1330

European Headquarters
Dataquest Europe Limited
Roussel House, Broadwater Park
Denham, Uxbridge
Middlesex UB9 5HP
England
Phone: 44-895-835050
Facsimile: 44-895-835260/1

Dataquest GmbH
Kronstadter Strasse 9
8000 Munich 80
Germany
Phone: 011-49-89-930-9090
Facsimile: 011-49-89-930-3277

Dataquest Europe SA
Tour Gallieni 2
36, Avenue du General de Gaulle
93175 Bagnolet Cedex
France
Phone: 011-33-1-48-97-3100
Facsimile: 011-33-1-48-97-3400

Representative Agencies in
Bangkok, Hong Kong,
Kronberg, North Sydney,
Singapore, Taipei, and Tel Aviv

©1993 Dataquest Incorporated
0015178

NU4CMECWW CMECWWMS9304 BH: 1
Corporate Library
Dataquest Incorporated

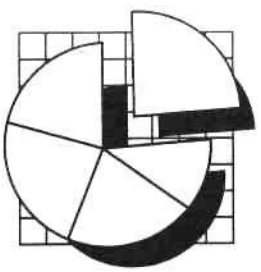
****
SJ - INTERNAL DISTRIBUTION
****

Dataquest®

Software

INFORMATION RESOURCE CENTER
DATAQUEST INCORPORATED
1290 Ridder Park Drive
San Jose, CA 95131-2398
(408) 437-8600

Mechanical Applications Worldwide Market Share Update



Market Statistics

1993

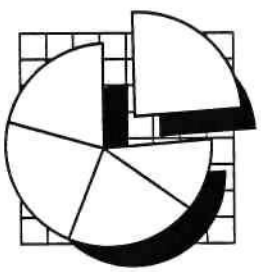
Program: Mechanical Applications Worldwide
Product Code: CMEC-WW-MS-9303
Publication Date: July 26, 1993

INFORMATION RESOURCE CENTER
DATAQUEST INCORPORATED
1290 Ridder Park Drive
San Jose, CA 95131-2398
(408) 437-8600

Dataquest®

Software

Mechanical Applications Worldwide Market Share Update



Market Statistics

1993

Program: Mechanical Applications Worldwide
Product Code: CMEC-WW-MS-9303
Publication Date: July 26, 1993

Table of Contents

	Page
Introduction	1
CAD/CAM/CAE/GIS Market Share Update	2
Software Market Grew 9.6 Percent in 1992, Revised Down from 9.7 Percent	2
Database Changes	3
Software	3
Expanded Definition for Service	3
Shift in Revenue Distribution	4
Company Changes	5
Analysis of Workstation Distribution	5
Company Additions and Deletions	6
Market Share Battles	6
Mechanical	6
AEC	8
GIS/Mapping	8
ECAE	9
IC Layout	9
PCB/Hybrid/MCM Layout	9
Market Analysis	9
Hardware Revenue Suffers	12
About This Document	12
Segmentation Definitions	13
Applications	13
Mechanical	13
Architecture, Engineering, and Construction (AEC)	13
Geographic Information Systems (GIS)/Mapping	13
Electronic Design Automation (EDA)	14
Regions	14
North America	14
Europe	14
Asia	14
Rest of World	14
Platforms	14
Technical Workstation	14
Host-Dependent	14
Server	15
Personal Computer	15
Metrics	15
Market Share Methodology	16
The Audit Process	17
Publishing Schedule	17

 ©1993 Dataquest Incorporated

List of Figures

Figure		Page
1	CAD/CAM/CAE/GIS Market Database	1
2	1992 Software Revenue Growth: Market Share versus Market Share Update	2
3	CAD/CAM/CAE/GIS Market Portfolio for Software Revenue for 1992	11

©1993 Dataquest Incorporated

List of Tables

Table		Page
1	Comparison of 1991 and 1992 Software Revenue: Market Share versus Market Share Update	3
2	1992 Service as a Percentage of Total Revenue: Market Share versus Market Share Update	4
3	Change in Distribution of 1992 Revenue: Market Share versus Market Share Update	4
4	1992 Top 20 CAD/CAM/CAE/GIS Vendors Total Revenue: Market Share versus Market Share Update	5
5	Unit Sales of Technical Workstations by Application Segment, by Top U.S. Vendors for 1992 (Including Units Sold through OEMs)	6
6	Changes in CAD/CAM/CAE/GIS Vendors with Total Revenue for 1991 and 1992	7
7	Top 10 Mechanical Software Companies Worldwide	7
8	Top 10 AEC Software Companies Worldwide	8
9	Top 10 GIS Software Companies Worldwide	9
10	Top 10 ECAE Software Companies Worldwide	10
11	Top 10 IC Layout Software Companies Worldwide	10
12	Top 10 PCB/Hybrid/MCM Software Companies Worldwide	11
13	Hardware Seats, Revenue, and Average Selling Price for 1991 and 1992	12
	Mechanical	
	Worldwide	
14	All Platforms	19
15	Technical Workstation	27
16	Host-Dependent	33
17	Server	35
18	Personal Computer	37
	North America	
19	All Platforms	42
20	Technical Workstation	46
21	Host-Dependent	49
22	Server	51
23	Personal Computer	52

Note: All tables show estimated data.

 ©1993 Dataquest Incorporated

List of Tables (Continued)

Table		Page
	Europe	
24	All Platforms	55
25	Technical Workstation	61
26	Host-Dependent	65
27	Server	67
28	Personal Computer	68
	Asia	
29	All Platforms	72
30	Technical Workstation	77
31	Host-Dependent	81
32	Server	83
33	Personal Computer	84
	Rest of World	
34	All Platforms	87
35	Technical Workstation	90
36	Host-Dependent	92
37	Server	93
38	Personal Computer	94

Note: All tables show estimated data.

©1993 Dataquest Incorporated

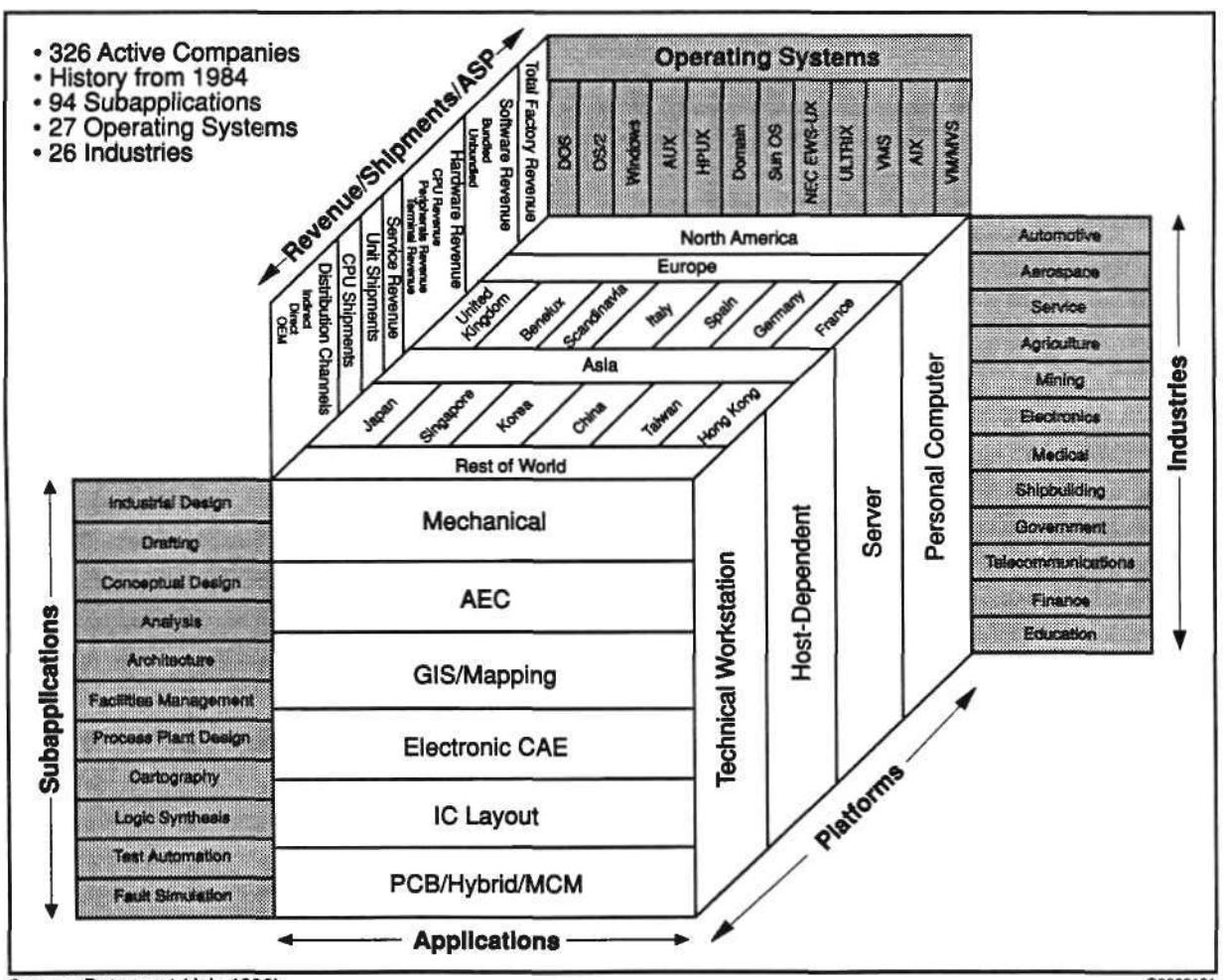
Mechanical Applications Worldwide Market Share Update

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)

©1993 Dataquest Incorporated

CAD/CAM/CAE/GIS Market Share Update

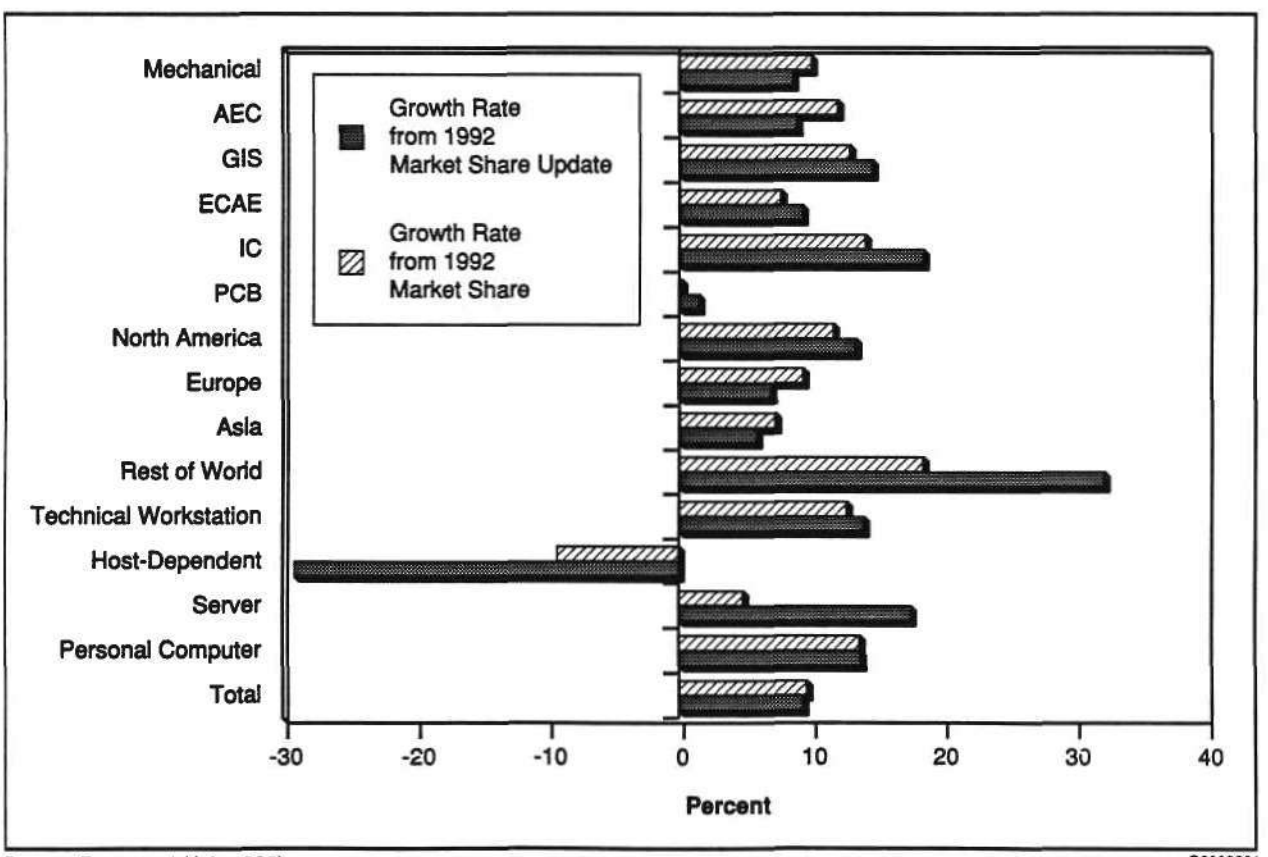
Software Market Grew 9.6 Percent in 1992, Revised Down from 9.7 Percent

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)

G3003221

©1993 Dataquest Incorporated

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)

©1993 Dataquest Incorporated

- 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)

©1993 Dataquest Incorporated

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)

©1993 Dataquest Incorporated

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)

©1993 Dataquest Incorporated

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)

©1993 Dataquest Incorporated

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)

 ©1993 Dataquest Incorporated

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

 ©1993 Dataquest Incorporated

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)

©1993 Dataquest Incorporated

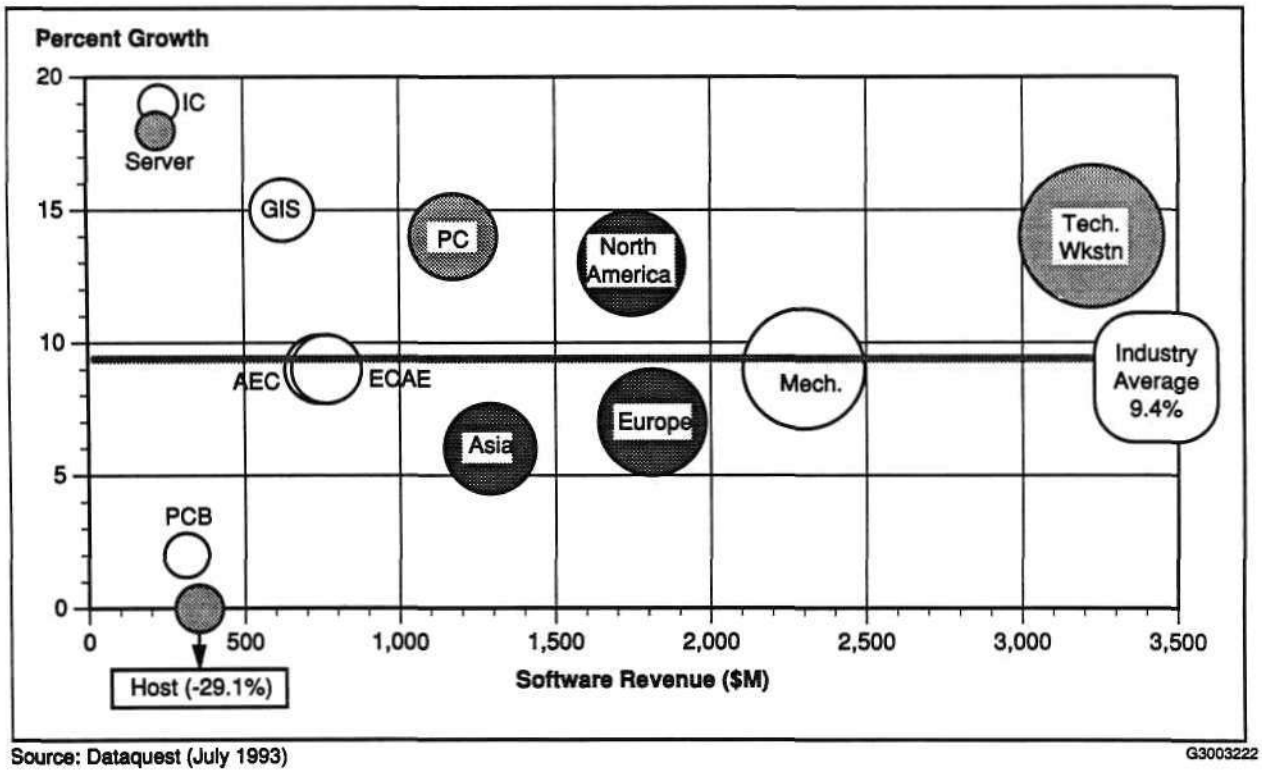
Table 12
Top 10 PCB/Hybrid/MCM Software Companies Worldwide

	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)

G3003222

©1993 Dataquest Incorporated

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)

©1993 Dataquest Incorporated

- 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.

 ©1993 Dataquest Incorporated

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.

 ©1993 Dataquest Incorporated

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.

 ©1993 Dataquest Incorporated

- 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

 ©1993 Dataquest Incorporated

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.

 ©1993 Dataquest Incorporated

- 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.

©1993 Dataquest Incorporated

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

Application: Mechanical
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
IBM	1,373.4	756.4	359.8	39,293	18.2%	19.1%	15.6%	13.7%
Computervision	623.1	189.7	206.9	6,056	8.3%	4.8%	9.0%	2.1%
Hewlett-Packard	530.0	373.8	72.1	27,605	7.0%	9.5%	3.1%	9.6%
Digital	408.1	287.7	.0	14,199	5.4%	7.3%	.0%	5.0%
Sun Microsystems	238.0	204.9	.0	13,114	3.2%	5.2%	.0%	4.6%
EDS	229.2	67.1	107.7	3,275	3.0%	1.7%	4.7%	1.1%
NEC	212.3	146.9	48.5	10,994	2.8%	3.7%	2.1%	3.8%
Silicon Graphics	204.8	187.0	.0	6,970	2.7%	4.7%	.0%	2.4%
Nihon Unisys	196.3	121.7	33.4	1,901	2.6%	3.1%	1.5%	.7%
Intergraph	185.7	84.1	49.4	2,697	2.5%	2.1%	2.1%	.9%
Fujitsu	181.2	116.0	47.1	3,588	2.4%	2.9%	2.0%	1.3%
Control Data Systems	159.9	76.9	26.3	2,155	2.1%	1.9%	1.1%	.8%
Compaq	156.5	156.5	.0	33,874	2.1%	4.0%	.0%	11.8%
SDRC	149.8	.0	129.2	0	2.0%	.0%	5.6%	.0%
Autodesk	147.1	.0	147.1	0	2.0%	.0%	6.4%	.0%
Applicon	135.0	45.3	53.2	1,452	1.8%	1.1%	2.3%	.5%
Hitachi	130.5	62.6	54.8	3,506	1.7%	1.6%	2.4%	1.2%
Parametric Technology	100.2	.0	81.2	0	1.3%	.0%	3.5%	.0%
Matra Datavision	98.2	31.4	50.1	824	1.3%	.8%	2.2%	.3%
Siemens Nixdorf Info systeme	91.4	40.0	37.7	1,332	1.2%	1.0%	1.6%	.5%
Apple Computer	80.6	80.6	.0	16,378	1.1%	2.0%	.0%	5.7%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Toshiba—No OEM	74.3	37.2	29.7	2,563	1.0%	.9%	1.3%	.9%
Hitachi Zosen Info Systems	69.8	59.6	3.3	719	.9%	1.5%	.1%	.3%
MacNeal-Schwendler	64.7	.0	64.7	0	.9%	.0%	2.8%	.0%
Mutoh Industries—No OEM	55.0	33.0	16.5	902	.7%	.8%	.7%	.3%
Swanson Analysis	45.3	.0	43.5	0	.6%	.0%	1.9%	.0%
Mitsubishi Electric	40.9	31.7	5.2	738	.5%	.8%	.2%	.3%
Hakuto	39.9	24.0	16.0	850	.5%	.6%	.7%	.3%
Cisigraph	39.3	11.0	21.6	250	.5%	.3%	.9%	.1%
STI-Straessle	37.4	11.2	18.0	303	.5%	.3%	.8%	.1%
PDA Engineering	36.1	.0	34.7	0	.5%	.0%	1.5%	.0%
Alias Research	32.7	.0	29.7	0	.4%	.0%	1.3%	.0%
Tokyo Electron—No OEM	32.3	10.7	14.5	220	.4%	.3%	.6%	.1%
ASCAD/ASCAM	30.6	18.4	9.2	450	.4%	.5%	.4%	.2%
Sharp System Products—No OEM	29.7	15.4	14.3	286	.4%	.4%	.6%	.1%
Unisys	29.6	14.6	10.4	665	.4%	.4%	.5%	.2%
Investronica SA	29.3	23.4	2.9	1,170	.4%	.6%	.1%	.4%
ISICAD	29.2	9.6	13.8	195	.4%	.2%	.6%	.1%
Cimatron	29.0	13.1	13.1	921	.4%	.3%	.6%	.3%
Delcam International	29.0	10.7	12.6	347	.4%	.3%	.5%	.1%
Wiechers Datentechnik	27.4	6.9	12.9	823	.4%	.2%	.6%	.3%
Gerber Systems	26.0	12.7	8.6	360	.3%	.3%	.4%	.1%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Cimlinc	24.0	.0	16.8	562	.3%	.0%	.7%	.2%
Mitsui Engineering	22.6	15.8	4.5	151	.3%	.4%	.2%	.1%
Auto-Trol	22.4	8.3	8.5	280	.3%	.2%	.4%	.1%
Toyo Information Systems—No OEM	20.6	12.5	6.0	219	.3%	.3%	.3%	.1%
MCS	20.2	.0	17.9	0	.3%	.0%	.8%	.0%
ADRA Systems	20.2	1.2	15.2	65	.3%	.0%	.7%	.0%
Marcus Computer Systeme	19.9	10.3	6.8	296	.3%	.3%	.3%	.1%
Tebis	19.6	3.0	13.7	112	.3%	.1%	.6%	.0%
CAD Lab	18.7	.0	15.2	0	.2%	.0%	.7%	.0%
Han Dataport	16.5	5.1	9.0	359	.2%	.1%	.4%	.1%
Digital Kienzle	16.3	8.3	4.6	239	.2%	.2%	.2%	.1%
Radan Computational	15.8	5.6	7.9	328	.2%	.1%	.3%	.1%
Graphtec Engineering	15.4	7.7	6.9	331	.2%	.2%	.3%	.1%
Sony	14.8	14.8	.0	540	.2%	.4%	.0%	.2%
Framasoft	14.8	.0	8.9	0	.2%	.0%	.4%	.0%
Omron	14.4	8.6	5.8	355	.2%	.2%	.3%	.1%
ICAD	13.5	.0	10.8	0	.2%	.0%	.5%	.0%
Aries Technology	13.4	.0	12.1	0	.2%	.0%	.5%	.0%
PAFEC	12.8	.0	12.8	0	.2%	.0%	.6%	.0%
Exapt	12.5	6.1	4.2	229	.2%	.2%	.2%	.1%
Dell Computer	12.5	12.5	.0	3,244	.2%	.3%	.0%	1.1%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Fides Industrielle Automation	12.0	3.7	5.0	70	.2%	.1%	.2%	.0%
MARC	11.8	.0	11.8	0	.2%	.0%	.5%	.0%
Sumitomo Denko Workstation	11.1	11.1	.0	569	.1%	.3%	.0%	.2%
ICL	10.6	6.2	3.6	290	.1%	.2%	.2%	.1%
Andor	10.4	2.6	7.4	80	.1%	.1%	.3%	.0%
Rasna Corporation	10.3	.0	9.3	0	.1%	.0%	.4%	.0%
ItalCad	10.3	4.8	2.5	97	.1%	.1%	.1%	.0%
Design Automation	10.2	2.0	7.6	214	.1%	.1%	.3%	.1%
CADKEY	10.2	.0	10.2	0	.1%	.0%	.4%	.0%
CAD Distribution	10.1	5.1	4.1	157	.1%	.1%	.2%	.1%
Point Control	10.0	.0	7.9	0	.1%	.0%	.3%	.0%
CAMAX Systems Inc.	9.2	1.5	5.5	161	.1%	.0%	.2%	.1%
Wacom	8.9	1.8	6.2	161	.1%	.0%	.3%	.1%
Mechanical Dynamics	8.6	.0	6.8	0	.1%	.0%	.3%	.0%
Engineering Mechanics	7.9	.4	6.7	628	.1%	.0%	.3%	.2%
Technische Computer Systeme	7.6	1.4	6.2	195	.1%	.0%	.3%	.1%
Research Machines	7.5	7.5	.0	1,208	.1%	.2%	.0%	.4%
CNC Software	6.8	.0	6.8	0	.1%	.0%	.3%	.0%
DAT Standard info ssystemes	6.7	.0	6.4	0	.1%	.0%	.3%	.0%
Ziegler Informatics	5.8	.0	5.8	0	.1%	.0%	.3%	.0%
SPATIAL Technology	5.2	.0	5.2	0	.1%	.0%	.2%	.0%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
ABB Industria	5.1	2.3	2.3	54	.1%	.1%	.1%	.0%
Algor Interactive Systems	4.9	.0	4.3	0	.1%	.0%	.2%	.0%
Serbi	4.8	.5	4.3	136	.1%	.0%	.2%	.0%
Olivetti	4.4	3.8	.0	488	.1%	.1%	.0%	.2%
Moda CAD	4.4	1.1	3.1	36	.1%	.0%	.1%	.0%
Whessoe Computing Systems	4.2	.0	4.2	0	.1%	.0%	.2%	.0%
CADSI	4.2	.6	3.1	29	.1%	.0%	.1%	.0%
Pathtrace	4.2	.9	2.7	62	.1%	.0%	.1%	.0%
Kubota Computer	4.1	3.0	.7	264	.1%	.1%	.0%	.1%
Ontos	4.0	.0	4.0	0	.1%	.0%	.2%	.0%
Ricoh—No OEM	3.9	.0	3.3	0	.1%	.0%	.1%	.0%
Anilam Electronics	3.7	.8	2.6	88	.0%	.0%	.1%	.0%
CAD Centre	3.4	.0	2.7	0	.0%	.0%	.1%	.0%
Century Research Center	3.4	1.8	1.3	12	.0%	.0%	.1%	.0%
CADIX	3.4	1.3	1.7	25	.0%	.0%	.1%	.0%
RoboCAD Solutions	3.2	.0	2.6	0	.0%	.0%	.1%	.0%
Micrografx	3.1	.0	3.1	0	.0%	.0%	.1%	.0%
American Small Business Comp.	3.1	.0	3.1	0	.0%	.0%	.1%	.0%
Vero International Software	3.1	.0	2.9	0	.0%	.0%	.1%	.0%
FEA	3.0	.7	.7	0	.0%	.0%	.0%	.0%
debis Systemhaus	2.9	.7	1.7	20	.0%	.0%	.1%	.0%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Superdraft	2.8	1.3	1.4	160	.0%	.0%	.1%	.1%
Kloeckner-Moeller	2.7	.6	1.9	0	.0%	.0%	.1%	.0%
Claris	2.7	.0	2.7	0	.0%	.0%	.1%	.0%
Computational Mechanics	2.4	.0	2.4	0	.0%	.0%	.1%	.0%
Catalpa	2.3	.4	1.5	25	.0%	.0%	.1%	.0%
Softronics	2.3	.6	1.7	206	.0%	.0%	.1%	.1%
Caroline Informatique	2.3	.4	1.2	18	.0%	.0%	.1%	.0%
ISKA	2.2	1.0	.9	41	.0%	.0%	.0%	.0%
Solbourne	2.1	2.1	.0	190	.0%	.1%	.0%	.1%
FEGS	2.1	.0	1.0	0	.0%	.0%	.0%	.0%
Uchida Yoko	1.9	1.1	.7	45	.0%	.0%	.0%	.0%
Wisdom Systems	1.8	.0	1.4	0	.0%	.0%	.1%	.0%
CAMTEK	1.7	.4	1.1	120	.0%	.0%	.0%	.0%
Softdesk	1.5	.0	1.5	0	.0%	.0%	.1%	.0%
Evolution Computing	1.2	.0	1.2	0	.0%	.0%	.1%	.0%
Valisys	1.2	.0	.0	0	.0%	.0%	.0%	.0%
Accugraph	1.1	.5	.5	39	.0%	.0%	.0%	.0%
Object Design	1.0	.0	1.0	0	.0%	.0%	.0%	.0%
Foresight Resources	1.0	.0	.9	0	.0%	.0%	.0%	.0%
Zuken	1.0	.3	.5	6	.0%	.0%	.0%	.0%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Objectivity	.9	.0	.9	0	.0%	.0%	.0%	.0%
Areon	.9	.5	.2	6	.0%	.0%	.0%	.0%
EME	.9	.2	.4	18	.0%	.0%	.0%	.0%
Innovative Data Design	.8	.0	.8	0	.0%	.0%	.0%	.0%
Engineering Systems Corp.	.8	.0	.7	0	.0%	.0%	.0%	.0%
Aura CAD/CAM Systems	.7	.0	.6	0	.0%	.0%	.0%	.0%
CADWorks	.7	.0	.6	0	.0%	.0%	.0%	.0%
A.I. Systems	.7	.0	.7	0	.0%	.0%	.0%	.0%
GRAPHSOFT	.7	.0	.7	0	.0%	.0%	.0%	.0%
CAD-Capture	.6	.1	.2	3	.0%	.0%	.0%	.0%
Graphisoft Software Dev	.5	.0	.5	0	.0%	.0%	.0%	.0%
S.T.L.D. s.r.l.	.5	.0	.5	0	.0%	.0%	.0%	.0%
IMSI	.4	.0	.4	0	.0%	.0%	.0%	.0%
Spectrum Graphics	.4	.1	.2	3	.0%	.0%	.0%	.0%
Ashlar	.4	.0	.4	0	.0%	.0%	.0%	.0%
Mc2 Engineering Software	.3	.0	.3	0	.0%	.0%	.0%	.0%
Mega CADD	.2	.0	.2	0	.0%	.0%	.0%	.0%
Georgia Tech Research Corp.	.2	.0	.2	0	.0%	.0%	.0%	.0%
DAPCO	.2	.0	.1	0	.0%	.0%	.0%	.0%
Engineered Software	.1	.0	.1	0	.0%	.0%	.0%	.0%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Lamp Software	.1	.0	.1	7	.0%	.0%	.0%	.0%
Other Companies	402.7	389.0	1.0	71,959	5.3%	9.8%	.0%	25.1%
All Companies	7,541.4	3,955.4	2,299.1	286,171	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	5,642.0	2,966.3	1,628.6	245,534	74.8%	75.0%	70.8%	85.8%
All Asian-Based Companies	1,208.0	743.2	335.8	29,237	16.0%	18.8%	14.6%	10.2%
All European-Based Companies	691.4	246.0	334.8	11,399	9.2%	6.2%	14.6%	4.0%
All Hardware Companies	1,852.1	1,617.6	5.3	202,741	24.6%	40.9%	.2%	70.8%
All Turnkey & SW Companies	5,689.3	2,337.9	2,293.8	83,430	75.4%	59.1%	99.8%	29.2%

Source: Dataquest (July 1993)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Computervision	605.9	186.6	196.8	5,775	14.7%	9.8%	13.6%	7.5%
Hewlett-Packard	484.9	333.5	72.1	14,595	11.7%	17.6%	5.0%	18.8%
IBM	277.6	133.2	105.5	6,065	6.7%	7.0%	7.3%	7.8%
Silicon Graphics	194.2	178.1	.0	6,773	4.7%	9.4%	.0%	8.7%
EDS	190.8	55.3	90.2	2,800	4.6%	2.9%	6.2%	3.6%
Sun Microsystems	183.4	159.6	.0	11,048	4.4%	8.4%	.0%	14.3%
Intergraph	162.0	75.4	39.7	2,421	3.9%	4.0%	2.7%	3.1%
SDRC	143.8	.0	124.1	0	3.5%	.0%	8.6%	.0%
Applicon	120.8	40.4	47.6	1,277	2.9%	2.1%	3.3%	1.6%
Digital	103.9	71.7	.0	5,108	2.5%	3.8%	.0%	6.6%
Parametric Technology	100.2	.0	81.2	0	2.4%	.0%	5.6%	.0%
Matra Datavision	98.2	31.4	50.1	824	2.4%	1.7%	3.5%	1.1%
Hitachi	94.0	45.1	39.5	2,032	2.3%	2.4%	2.7%	2.6%
Siemens Nixdorf Info systeme	91.4	40.0	37.7	1,332	2.2%	2.1%	2.6%	1.7%
NEC	89.2	49.0	33.0	2,940	2.2%	2.6%	2.3%	3.8%
Fujitsu	76.1	48.7	19.8	1,551	1.8%	2.6%	1.4%	2.0%
Nihon Unisys	68.7	42.6	11.7	561	1.7%	2.2%	.8%	.7%
Hitachi Zosen Info Systems	65.7	55.8	3.3	672	1.6%	2.9%	.2%	.9%
Control Data Systems	56.0	34.2	11.8	1,523	1.4%	1.8%	.8%	2.0%
Toshiba—No OEM	44.6	22.3	17.8	528	1.1%	1.2%	1.2%	.7%
STI-Straessle	37.4	11.2	18.0	303	.9%	.6%	1.2%	.4%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Cisigraph	35.4	9.9	19.4	225	.9%	.5%	1.3%	.3%
Alias Research	32.7	.0	29.7	0	.8%	.0%	2.1%	.0%
Tokyo Electron—No OEM	32.3	10.7	14.5	220	.8%	.6%	1.0%	.3%
Mitsubishi Electric	30.8	26.2	2.2	332	.7%	1.4%	.1%	.4%
ASCAD/ASCAM	30.0	18.0	9.0	436	.7%	1.0%	.6%	.6%
Sharp System Products—No OEM	29.1	15.1	14.0	268	.7%	.8%	1.0%	.3%
PDA Engineering	27.1	.0	26.0	0	.7%	.0%	1.8%	.0%
ISICAD	26.5	9.6	11.1	195	.6%	.5%	.8%	.3%
Delcam International	26.3	9.7	11.5	288	.6%	.5%	.8%	.4%
Gerber Systems	26.0	12.7	8.6	360	.6%	.7%	.6%	.5%
Swanson Analysis	25.8	.0	24.7	0	.6%	.0%	1.7%	.0%
Unisys	22.7	11.2	8.0	517	.5%	.6%	.6%	.7%
Auto-Trol	22.4	8.3	8.5	280	.5%	.4%	.6%	.4%
Mutoh Industries—No OEM	20.9	12.5	6.3	213	.5%	.7%	.4%	.3%
Mitsui Engineering	20.6	14.4	4.1	116	.5%	.8%	.3%	.1%
Cimlinc	20.4	.0	14.2	562	.5%	.0%	1.0%	.7%
Marcus Computer Systeme	19.9	10.3	6.8	296	.5%	.5%	.5%	.4%
Cimatron	17.1	7.7	7.7	352	.4%	.4%	.5%	.5%
Toyo Information Systems—No OEM	16.4	10.2	4.7	194	.4%	.5%	.3%	.3%
Digital Kienzle	16.3	8.3	4.6	239	.4%	.4%	.3%	.3%
CAD Lab	15.9	.0	12.7	0	.4%	.0%	.9%	.0%

(Continued)

CMEC-WW-MS-9303

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Radan Computational	15.7	5.5	7.8	322	.4%	.3%	.5%	.4%
Graphtec Engineering	15.4	7.7	6.9	331	.4%	.4%	.5%	.4%
ADRA Systems	15.2	1.2	11.1	65	.4%	.1%	.8%	.1%
Han Dataport	14.9	4.5	8.2	327	.4%	.2%	.6%	.4%
Sony	14.8	14.8	.0	540	.4%	.8%	.0%	.7%
Omron	14.4	8.6	5.8	355	.3%	.5%	.4%	.5%
ICAD	13.5	.0	10.8	0	.3%	.0%	.7%	.0%
Framasoft	13.4	.0	8.0	0	.3%	.0%	.6%	.0%
Aries Technology	12.1	.0	10.9	0	.3%	.0%	.8%	.0%
Fides Industrielle Automation	12.0	3.7	5.0	70	.3%	.2%	.3%	.1%
PAFEC	10.9	.0	10.9	0	.3%	.0%	.8%	.0%
ICL	10.6	6.2	3.6	290	.3%	.3%	.2%	.4%
MacNeal-Schwendler	10.4	.0	10.4	0	.3%	.0%	.7%	.0%
Sumitomo Denko Workstation	10.3	10.3	.0	516	.2%	.5%	.0%	.7%
ItalCad	10.3	4.8	2.5	97	.2%	.3%	.2%	.1%
MCS	9.3	.0	8.3	0	.2%	.0%	.6%	.0%
CAMAX Systems Inc.	9.2	1.5	5.5	161	.2%	.1%	.4%	.2%
MARC	9.0	.0	9.0	0	.2%	.0%	.6%	.0%
Autodesk	8.8	.0	8.8	0	.2%	.0%	.6%	.0%
Rasna Corporation	8.1	.0	7.3	0	.2%	.0%	.5%	.0%
Technische Computer Systeme	7.6	1.4	6.2	195	.2%	.1%	.4%	.3%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Mechanical Dynamics	7.3	.0	5.7	0	.2%	.0%	.4%	.0%
Wiechers Datentechnik	7.1	1.8	3.4	101	.2%	.1%	.2%	.1%
SPATIAL Technology	5.2	.0	5.2	0	.1%	.0%	.4%	.0%
Engineering Mechanics	4.6	.2	3.9	221	.1%	.0%	.3%	.3%
Ontos	4.0	.0	4.0	0	.1%	.0%	.3%	.0%
Ricoh—No OEM	3.9	.0	3.3	0	.1%	.0%	.2%	.0%
Kubota Computer	3.6	2.6	.7	200	.1%	.1%	.1%	.3%
CAD Centre	3.4	.0	2.7	0	.1%	.0%	.2%	.0%
CADSI	3.4	.5	2.5	15	.1%	.0%	.2%	.0%
Exapt	3.4	1.7	1.2	115	.1%	.1%	.1%	.1%
CADIX	3.4	1.3	1.7	25	.1%	.1%	.1%	.0%
ISKA	2.2	1.0	.9	41	.1%	.1%	.1%	.1%
debis Systemhaus	2.2	.5	1.3	12	.1%	.0%	.1%	.0%
Catalpa	2.1	.4	1.3	15	.1%	.0%	.1%	.0%
Hakuto	2.0	1.2	.8	23	.0%	.1%	.1%	.0%
Wisdom Systems	1.8	.0	1.4	0	.0%	.0%	.1%	.0%
Century Research Center	1.8	.9	.7	10	.0%	.0%	.0%	.0%
FEGS	1.8	.0	.9	0	.0%	.0%	.1%	.0%
Uchida Yoko	1.7	1.0	.6	36	.0%	.1%	.0%	.0%
Caroline Informatique	1.6	.3	.8	8	.0%	.0%	.1%	.0%
Wacom	1.3	.3	.9	14	.0%	.0%	.1%	.0%

(Continued)

CMEC-WW-MS-9303

©1993 Dataquest Incorporated

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

Application: Mechanical
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
FEA	1.2	.3	.3	0	.0%	.0%	.0%	.0%
Valisys	1.1	.0	.0	0	.0%	.0%	.0%	.0%
Object Design	1.0	.0	1.0	0	.0%	.0%	.1%	.0%
CADKEY	1.0	.0	1.0	0	.0%	.0%	.1%	.0%
Point Control	1.0	.0	.8	0	.0%	.0%	.1%	.0%
Accugraph	1.0	.5	.4	37	.0%	.0%	.0%	.0%
Zuken	1.0	.3	.5	6	.0%	.0%	.0%	.0%
Objectivity	.9	.0	.9	0	.0%	.0%	.1%	.0%
Computational Mechanics	.9	.0	.9	0	.0%	.0%	.1%	.0%
Solbourne	.6	.6	.0	88	.0%	.0%	.0%	.1%
EME	.4	.1	.2	6	.0%	.0%	.0%	.0%
Whessoe Computing Systems	.4	.0	.4	0	.0%	.0%	.0%	.0%
Spectrum Graphics	.4	.1	.2	3	.0%	.0%	.0%	.0%
Softdesk	.3	.0	.3	0	.0%	.0%	.0%	.0%
Engineering Systems Corp.	.2	.0	.2	0	.0%	.0%	.0%	.0%
DAPCO	.2	.0	.1	0	.0%	.0%	.0%	.0%
Algor Interactive Systems	.1	.0	.1	0	.0%	.0%	.0%	.0%
Georgia Tech Research Corp.	.1	.0	.1	0	.0%	.0%	.0%	.0%
CAMTEK	.1	.0	.1	2	.0%	.0%	.0%	.0%
CADWorks	.0	.0	.0	0	.0%	.0%	.0%	.0%

(Continued)

GMEC-WW-MS-9303

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Lamp Software	.0	.0	.0	3	.0%	.0%	.0%	.0%
Other Companies	.4	.0	.4	0	.0%	.0%	.0%	.0%
All Companies	4,128.8	1,894.7	1,446.8	77,471	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	2,956.6	1,314.2	1,010.0	59,886	71.6%	69.4%	69.8%	77.3%
All Asian-Based Companies	661.7	401.7	192.6	11,684	16.0%	21.2%	13.3%	15.1%
All European-Based Companies	510.5	178.8	244.2	5,901	12.4%	9.4%	16.9%	7.6%
All Hardware Companies	675.5	575.4	2.4	30,837	16.4%	30.4%	.2%	39.8%
All Turnkey & SW Companies	3,453.2	1,319.3	1,444.4	46,634	83.6%	69.6%	99.8%	60.2%

Source: Dataquest (July 1993)

©1993 Dataquest Incorporated

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

Application: Mechanical
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	699.4	447.6	87.4	10,304	42.9%	42.3%	35.5%	44.2%
Digital	160.6	110.9	.0	0	9.9%	10.5%	.0%	.0%
Nihon Unisys	127.6	79.1	21.7	1,340	7.8%	7.5%	8.8%	5.7%
Control Data Systems	100.7	41.3	14.1	620	6.2%	3.9%	5.7%	2.7%
NEC	70.1	53.2	11.2	152	4.3%	5.0%	4.5%	.7%
Fujitsu	68.9	44.1	17.9	959	4.2%	4.2%	7.3%	4.1%
MacNeal-Schwendler	39.2	.0	39.2	0	2.4%	.0%	15.9%	.0%
Hitachi	13.1	6.3	5.5	232	.8%	.6%	2.2%	1.0%
Exapt	9.1	4.5	3.1	114	.6%	.4%	1.3%	.5%
PDA Engineering	9.0	.0	8.7	0	.6%	.0%	3.5%	.0%
Swanson Analysis	8.5	.0	8.2	0	.5%	.0%	3.3%	.0%
Computervision	6.9	1.9	2.5	105	.4%	.2%	1.0%	.5%
MCS	6.9	.0	6.0	0	.4%	.0%	2.4%	.0%
Unisys	6.5	3.3	2.3	135	.4%	.3%	.9%	.6%
SDRC	6.1	.0	5.1	0	.4%	.0%	2.0%	.0%
Mitsubishi Electric	5.9	2.8	1.7	19	.4%	.3%	.7%	.1%
Toshiba—No OEM	5.2	2.6	2.1	74	.3%	.2%	.8%	.3%
Toyo Information Systems—No OEM	4.2	2.3	1.3	25	.3%	.2%	.5%	.1%
Hitachi Zosen Info Systems	4.2	3.8	.0	47	.3%	.4%	.0%	.2%
MARC	2.8	.0	2.8	0	.2%	.0%	1.1%	.0%
Century Research Center	1.6	.9	.6	2	.1%	.1%	.2%	.0%

(Continued)

©1993 Dataquest Incorporated

CMEC-WW-MS-9303

© 1993 Dataquest Incorporated

July 26, 1993

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

Application: Mechanical
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
Computational Mechanics	1.5	.0	1.5	0	.1%	.0%	.6%	.0%
Framasoft	1.4	.0	.9	0	.1%	.0%	.3%	.0%
Mechanical Dynamics	1.3	.0	1.0	0	.1%	.0%	.4%	.0%
Whessoe Computing Systems	.8	.0	.8	0	.1%	.0%	.3%	.0%
Intergraph	.6	.0	.5	0	.0%	.0%	.2%	.0%
Olivetti	.5	.4	.0	13	.0%	.0%	.0%	.1%
Kubota Computer	.4	.4	.0	64	.0%	.0%	.0%	.3%
debis Systemhaus	.4	.1	.2	2	.0%	.0%	.1%	.0%
FEA	.3	.1	.1	0	.0%	.0%	.0%	.0%
FEGS	.3	.0	.2	0	.0%	.0%	.1%	.0%
Georgia Tech Research Corp.	.1	.0	.1	0	.0%	.0%	.0%	.0%
Engineering Systems Corp.	.1	.0	.1	0	.0%	.0%	.0%	.0%
Valisys	.1	.0	.0	0	.0%	.0%	.0%	.0%
Accugraph	.0	.0	.0	1	.0%	.0%	.0%	.0%
Other Companies	266.1	252.8	.0	9,096	16.3%	23.9%	.0%	39.0%
All Companies	1,630.3	1,058.1	246.6	23,304	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	1,314.8	857.7	177.8	20,262	80.6%	81.1%	72.1%	86.9%
All Asian-Based Companies	301.1	195.4	62.0	2,914	18.5%	18.5%	25.1%	12.5%
All European-Based Companies	14.3	5.0	6.8	128	.9%	.5%	2.7%	.6%
All Hardware Companies	447.5	372.4	2.9	9,292	27.4%	35.2%	1.2%	39.9%
All Turnkey & SW Companies	1,182.8	685.7	243.7	14,012	72.6%	64.8%	98.8%	60.1%

Source: Dataquest (July 1993)

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

Application: Mechanical
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
IBM	231.0	108.0	78.2	2,948	44.9%	39.2%	62.4%	36.7%
Digital	114.6	79.1	.0	1,588	22.3%	28.7%	.0%	19.8%
Sun Microsystems	54.5	45.3	.0	2,066	10.6%	16.4%	.0%	25.7%
EDS	38.3	11.8	17.5	475	7.4%	4.3%	14.0%	5.9%
Intergraph	18.3	8.8	4.4	276	3.6%	3.2%	3.5%	3.4%
MacNeal-Schwendler	14.2	.0	14.2	0	2.8%	.0%	11.3%	.0%
Applicon	13.0	4.4	5.1	136	2.5%	1.6%	4.1%	1.7%
Silicon Graphics	10.6	9.0	.0	197	2.1%	3.3%	.0%	2.4%
Cisigraph	3.9	1.1	2.2	25	.8%	.4%	1.7%	.3%
Computervision	3.8	1.3	1.1	41	.7%	.5%	.9%	.5%
Control Data Systems	3.2	1.5	.4	12	.6%	.5%	.3%	.2%
Hewlett-Packard	2.9	2.4	.0	79	.6%	.9%	.0%	1.0%
Cimlinc	2.4	.0	1.7	0	.5%	.0%	1.3%	.0%
Solbourne	1.5	1.5	.0	102	.3%	.5%	.0%	1.3%
Han Dataport	.8	.4	.3	12	.2%	.1%	.3%	.1%
Sumitomo Denko Workstation	.8	.8	.0	53	.1%	.3%	.0%	.7%
Unisys	.4	.1	.1	12	.1%	.0%	.1%	.2%

(Continued)

©1993 Dataquest Incorporated

Table 17 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: Mechanical
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
Georgia Tech Research Corp.	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	.0	.0	.0	2	.0%	.0%	.0%	.0%
All Companies	514.4	275.4	125.2	8,024	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	508.8	273.1	122.7	7,934	98.9%	99.2%	98.0%	98.9%
All Asian-Based Companies	.8	.8	.0	53	.1%	.3%	.0%	.7%
All European-Based Companies	4.8	1.5	2.5	37	.9%	.5%	2.0%	.5%
All Hardware Companies	186.7	139.4	.1	4,110	36.3%	50.6%	.1%	51.2%
All Turnkey & SW Companies	327.7	136.0	125.1	3,914	63.7%	49.4%	99.9%	48.8%

Source: Dataquest (July 1993)

CMEC-WW-MS-9303

©1993 Dataquest Incorporated

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

Application: Mechanical
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
IBM	165.3	67.6	88.7	19,976	13.0%	9.3%	18.5%	11.3%
Compaq	156.5	156.5	.0	33,874	12.3%	21.5%	.0%	19.1%
Autodesk	138.3	.0	138.3	0	10.9%	.0%	28.8%	.0%
Apple Computer	80.6	80.6	.0	16,378	6.4%	11.1%	.0%	9.2%
NEC	53.1	44.6	4.3	7,902	4.2%	6.1%	.9%	4.5%
Hewlett-Packard	42.1	37.9	.0	12,931	3.3%	5.2%	.0%	7.3%
Hakuto	37.9	22.8	15.2	827	3.0%	3.1%	3.2%	.5%
Fujitsu	36.2	23.2	9.4	1,077	2.9%	3.2%	2.0%	.6%
Mutoh Industries—No OEM	34.1	20.4	10.2	689	2.7%	2.8%	2.1%	.4%
Investronica SA	29.3	23.4	2.9	1,170	2.3%	3.2%	.6%	.7%
Digital	29.0	26.2	.0	7,502	2.3%	3.6%	.0%	4.2%
Toshiba—No OEM	24.5	12.3	9.8	1,961	1.9%	1.7%	2.0%	1.1%
Hitachi	23.5	11.3	9.9	1,242	1.9%	1.6%	2.1%	.7%
Wiechers Datentechnik	20.3	5.1	9.5	722	1.6%	.7%	2.0%	.4%
Tebis	19.6	3.0	13.7	112	1.5%	.4%	2.9%	.1%
Dell Computer	12.5	12.5	.0	3,244	1.0%	1.7%	.0%	1.8%
Cimatron	12.0	5.4	5.4	569	.9%	.7%	1.1%	.3%
Swanson Analysis	11.0	.0	10.6	0	.9%	.0%	2.2%	.0%
Andor	10.4	2.6	7.4	80	.8%	.4%	1.5%	.0%
Design Automation	10.2	2.0	7.6	214	.8%	.3%	1.6%	.1%
CAD Distribution	10.1	5.1	4.1	157	.8%	.7%	.8%	.1%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
CADKEY	9.2	.0	9.2	0	.7%	.0%	1.9%	.0%
Point Control	9.0	.0	7.1	0	.7%	.0%	1.5%	.0%
Wacom	7.7	1.5	5.3	147	.6%	.2%	1.1%	.1%
Research Machines	7.5	7.5	.0	1,208	.6%	1.0%	.0%	.7%
CNC Software	6.8	.0	6.8	0	.5%	.0%	1.4%	.0%
DAT Standard info ssystemes	6.7	.0	6.4	0	.5%	.0%	1.3%	.0%
Computervision	6.5	.0	6.5	136	.5%	.0%	1.3%	.1%
Ziegler Informatics	5.8	.0	5.8	0	.5%	.0%	1.2%	.0%
ABB Industria	5.1	2.3	2.3	54	.4%	.3%	.5%	.0%
ADRA Systems	5.0	.0	4.0	0	.4%	.0%	.8%	.0%
Serbi	4.8	.5	4.3	136	.4%	.1%	.9%	.1%
Intergraph	4.7	.0	4.7	0	.4%	.0%	1.0%	.0%
Algor Interactive Systems	4.7	.0	4.2	0	.4%	.0%	.9%	.0%
Moda CAD	4.4	1.1	3.1	36	.3%	.1%	.6%	.0%
Pathtrace	4.2	.9	2.7	62	.3%	.1%	.6%	.0%
Mitsubishi Electric	4.1	2.7	1.4	387	.3%	.4%	.3%	.2%
MCS	4.1	.0	3.6	0	.3%	.0%	.8%	.0%
Olivetti	3.9	3.4	.0	475	.3%	.5%	.0%	.3%
Anilam Electronics	3.7	.8	2.6	88	.3%	.1%	.5%	.0%
Engineering Mechanics	3.3	.2	2.8	407	.3%	.0%	.6%	.2%
RoboCAD Solutions	3.2	.0	2.6	0	.3%	.0%	.5%	.0%

(Continued)

CMEC-WW-MS-9303

©1993 Dataquest Incorporated

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

Application: Mechanical
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
American Small Business Comp.	3.1	.0	3.1	0	.2%	.0%	.7%	.0%
Micrografx	3.1	.0	3.1	0	.2%	.0%	.7%	.0%
Vero International Software	3.1	.0	2.9	0	.2%	.0%	.6%	.0%
Whessoe Computing Systems	3.0	.0	3.0	0	.2%	.0%	.6%	.0%
Superdraft	2.8	1.3	1.4	160	.2%	.2%	.3%	.1%
CAD Lab	2.8	.0	2.5	0	.2%	.0%	.5%	.0%
Kloeckner-Moeller	2.7	.6	1.9	0	.2%	.1%	.4%	.0%
Delcam International	2.7	1.0	1.1	59	.2%	.1%	.2%	.0%
Claris	2.7	.0	2.7	0	.2%	.0%	.6%	.0%
ISICAD	2.6	.0	2.6	0	.2%	.0%	.5%	.0%
Softronics	2.3	.6	1.7	206	.2%	.1%	.4%	.1%
Rasna Corporation	2.2	.0	2.0	0	.2%	.0%	.4%	.0%
Mitsui Engineering	2.0	1.4	.4	34	.2%	.2%	.1%	.0%
PAFEC	1.9	.0	1.9	0	.2%	.0%	.4%	.0%
CAMTEK	1.6	.3	1.0	118	.1%	.0%	.2%	.1%
FEA	1.5	.4	.4	0	.1%	.0%	.1%	.0%
Aries Technology	1.3	.0	1.2	0	.1%	.0%	.3%	.0%
Applicon	1.3	.4	.5	40	.1%	.1%	.1%	.0%
Evolution Computing	1.2	.0	1.2	0	.1%	.0%	.3%	.0%
Cimlinc	1.2	.0	.8	0	.1%	.0%	.2%	.0%
Softdesk	1.1	.0	1.1	0	.1%	.0%	.2%	.0%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Foresight Resources	1.0	.0	.9	0	.1%	.0%	.2%	.0%
MacNeal-Schwendler	1.0	.0	1.0	0	.1%	.0%	.2%	.0%
Areon	.9	.5	.2	6	.1%	.1%	.0%	.0%
CADSI	.8	.1	.6	14	.1%	.0%	.1%	.0%
Han Dataport	.8	.2	.5	21	.1%	.0%	.1%	.0%
Innovative Data Design	.8	.0	.8	0	.1%	.0%	.2%	.0%
Aura CAD/CAM Systems	.7	.0	.6	0	.1%	.0%	.1%	.0%
GRAPHSOFT	.7	.0	.7	0	.1%	.0%	.1%	.0%
A.I. Systems	.7	.0	.7	0	.1%	.0%	.1%	.0%
Caroline Informatique	.7	.1	.3	10	.1%	.0%	.1%	.0%
CADWorks	.6	.0	.6	0	.1%	.0%	.1%	.0%
ASCAD/ASCAM	.6	.4	.2	14	.0%	.0%	.0%	.0%
Sharp System Products—No OEM	.6	.3	.3	17	.0%	.0%	.1%	.0%
CAD-Capture	.6	.1	.2	3	.0%	.0%	.0%	.0%
Engineering Systems Corp.	.5	.0	.5	0	.0%	.0%	.1%	.0%
Graphisoft Software Dev	.5	.0	.5	0	.0%	.0%	.1%	.0%
S.T.L.D. s.r.l.	.5	.0	.5	0	.0%	.0%	.1%	.0%
EME	.4	.1	.2	12	.0%	.0%	.0%	.0%
IMSI	.4	.0	.4	0	.0%	.0%	.1%	.0%
debis Systemhaus	.4	.1	.2	6	.0%	.0%	.0%	.0%
Ashlar	.4	.0	.4	0	.0%	.0%	.1%	.0%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Mc2 Engineering Software	.3	.0	.3	0	.0%	.0%	.1%	.0%
Mega CADD	.2	.0	.2	0	.0%	.0%	.0%	.0%
Catalpa	.2	.0	.1	10	.0%	.0%	.0%	.0%
Uchida Yoko	.2	.1	.1	9	.0%	.0%	.0%	.0%
Radan Computational	.2	.0	.1	5	.0%	.0%	.0%	.0%
Engineered Software	.1	.0	.1	0	.0%	.0%	.0%	.0%
Accugraph	.1	.0	.1	0	.0%	.0%	.0%	.0%
Lamp Software	.1	.0	.1	4	.0%	.0%	.0%	.0%
Other Companies	136.2	136.2	.6	62,861	10.7%	18.7%	.1%	35.4%
All Companies	1,268.0	727.2	480.6	177,373	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	861.8	521.3	318.1	157,453	68.0%	71.7%	66.2%	88.8%
All Asian-Based Companies	244.4	145.2	81.2	14,586	19.3%	20.0%	16.9%	8.2%
All European-Based Companies	161.7	60.7	81.3	5,333	12.8%	8.3%	16.9%	3.0%
All Hardware Companies	542.4	530.4	.0	158,503	42.8%	72.9%	.0%	89.4%
All Turnkey & SW Companies	725.6	196.8	480.6	18,870	57.2%	27.1%	100.0%	10.6%

Source: Dataquest (July 1993)

©1993 Dataquest Incorporated

CMEC-WW-MS-9303

©1993 Dataquest Incorporated

July 26, 1993

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

Application: Mechanical
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
IBM	343.2	182.9	97.9	10,549	16.9%	17.6%	15.0%	11.7%
Digital	163.0	114.9	.0	5,571	8.0%	11.1%	.0%	6.2%
EDS	141.4	41.2	66.3	2,061	7.0%	4.0%	10.2%	2.3%
Hewlett-Packard	128.5	94.2	14.4	8,874	6.3%	9.1%	2.2%	9.9%
Silicon Graphics	108.6	98.5	.0	3,852	5.4%	9.5%	.0%	4.3%
Compaq	106.4	106.4	.0	23,034	5.2%	10.3%	.0%	25.6%
Sun Microsystems	103.6	89.2	.0	6,238	5.1%	8.6%	.0%	6.9%
Intergraph	100.5	45.4	28.2	1,572	5.0%	4.4%	4.3%	1.7%
Autodesk	67.4	.0	67.4	0	3.3%	.0%	10.3%	.0%
Computervision	66.0	24.2	17.8	791	3.3%	2.3%	2.7%	.9%
Parametric Technology	65.1	.0	52.8	0	3.2%	.0%	8.1%	.0%
Control Data Systems	64.0	30.8	10.5	862	3.2%	3.0%	1.6%	1.0%
Applicon	51.3	16.9	20.0	548	2.5%	1.6%	3.1%	.6%
SDRC	49.4	.0	39.5	0	2.4%	.0%	6.1%	.0%
Apple Computer	38.7	38.7	.0	8,596	1.9%	3.7%	.0%	9.6%
MacNeal-Schwendler	32.2	.0	32.2	0	1.6%	.0%	4.9%	.0%
Unisys	23.4	11.9	8.2	530	1.2%	1.2%	1.3%	.6%
Swanson Analysis	22.2	.0	21.4	0	1.1%	.0%	3.3%	.0%
PDA Engineering	21.7	.0	20.8	0	1.1%	.0%	3.2%	.0%
Alias Research	21.2	.0	19.3	0	1.0%	.0%	3.0%	.0%
MCS	15.6	.0	13.8	0	.8%	.0%	2.1%	.0%

(Continued)

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

Application: Mechanical
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
Auto-Trol	15.2	5.6	5.8	190	.8%	.5%	.9%	.2%
Cimlinc	14.4	.0	10.1	337	.7%	.0%	1.5%	.4%
Gerber Systems	14.3	7.0	4.7	198	.7%	.7%	.7%	.2%
ADRA Systems	10.7	.6	8.1	36	.5%	.1%	1.2%	.0%
Aries Technology	9.4	.0	8.5	0	.5%	.0%	1.3%	.0%
Dell Computer	9.3	9.3	.0	2,433	.5%	.9%	.0%	2.7%
CADKEY	8.1	.0	8.1	0	.4%	.0%	1.2%	.0%
Rasna Corporation	8.1	.0	7.3	0	.4%	.0%	1.1%	.0%
ICAD	8.1	.0	6.5	0	.4%	.0%	1.0%	.0%
Point Control	6.5	.0	5.1	0	.3%	.0%	.8%	.0%
CAMAX Systems Inc.	6.3	1.0	3.8	111	.3%	.1%	.6%	.1%
Delcam International	4.7	1.7	2.0	87	.2%	.2%	.3%	.1%
Cimatron	4.6	2.1	2.1	149	.2%	.2%	.3%	.2%
CNC Software	4.1	.0	4.1	0	.2%	.0%	.6%	.0%
Algor Interactive Systems	4.1	.0	3.6	0	.2%	.0%	.5%	.0%
Mechanical Dynamics	4.0	.0	3.2	0	.2%	.0%	.5%	.0%
Matra Datavision	3.9	1.3	2.0	33	.2%	.1%	.3%	.0%
Cisigraph	3.9	1.1	2.2	25	.2%	.1%	.3%	.0%
Ontos	3.8	.0	3.8	0	.2%	.0%	.6%	.0%
Moda CAD	2.8	.7	2.0	23	.1%	.1%	.3%	.0%
American Small Business Comp.	2.8	.0	2.8	0	.1%	.0%	.4%	.0%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Engineering Mechanics	2.8	.1	2.4	220	.1%	.0%	.4%	.2%
CADSI	2.7	.4	2.0	18	.1%	.0%	.3%	.0%
SPATIAL Technology	2.1	.0	2.1	0	.1%	.0%	.3%	.0%
Solbourne	1.9	1.9	.0	171	.1%	.2%	.0%	.2%
Micrografx	1.7	.0	1.7	0	.1%	.0%	.3%	.0%
MARC	1.5	.0	1.5	0	.1%	.0%	.2%	.0%
Wisdom Systems	1.4	.0	1.1	0	.1%	.0%	.2%	.0%
Claris	1.3	.0	1.3	0	.1%	.0%	.2%	.0%
Softdesk	1.3	.0	1.3	0	.1%	.0%	.2%	.0%
Investronica SA	1.2	1.0	.1	48	.1%	.1%	.0%	.1%
Technische Computer Systeme	1.1	.2	.9	29	.1%	.0%	.1%	.0%
Accugraph	1.0	.4	.5	36	.0%	.0%	.1%	.0%
Valisys	1.0	.0	.0	0	.0%	.0%	.0%	.0%
Pathtrace	1.0	.2	.6	14	.0%	.0%	.1%	.0%
Evolution Computing	.9	.0	.9	0	.0%	.0%	.1%	.0%
Computational Mechanics	.9	.0	.9	0	.0%	.0%	.1%	.0%
Foresight Resources	.9	.0	.8	0	.0%	.0%	.1%	.0%
Object Design	.8	.0	.8	0	.0%	.0%	.1%	.0%
Innovative Data Design	.8	.0	.8	0	.0%	.0%	.1%	.0%
Objectivity	.8	.0	.8	0	.0%	.0%	.1%	.0%
GRAPHSOFT	.7	.0	.7	0	.0%	.0%	.1%	.0%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Engineering Systems Corp.	.7	.0	.6	0	.0%	.0%	.1%	.0%
Aura CAD/CAM Systems	.6	.0	.6	0	.0%	.0%	.1%	.0%
A.I. Systems	.6	.0	.6	0	.0%	.0%	.1%	.0%
IMSI	.4	.0	.4	0	.0%	.0%	.1%	.0%
Ashlar	.4	.0	.4	0	.0%	.0%	.1%	.0%
Mc2 Engineering Software	.3	.0	.3	0	.0%	.0%	.0%	.0%
FEGS	.2	.0	.1	0	.0%	.0%	.0%	.0%
Mega CADD	.2	.0	.2	0	.0%	.0%	.0%	.0%
Areon	.1	.0	.0	0	.0%	.0%	.0%	.0%
Georgia Tech Research Corp.	.1	.0	.1	0	.0%	.0%	.0%	.0%
Graphisoft Software Dev	.1	.0	.1	0	.0%	.0%	.0%	.0%
Engineered Software	.1	.0	.1	0	.0%	.0%	.0%	.0%
Other Companies	113.6	107.3	1.9	12,766	5.6%	10.3%	.3%	14.2%
All Companies	2,027.1	1,037.0	652.0	90,003	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	2,005.4	1,029.5	641.0	89,618	98.9%	99.3%	98.3%	99.6%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	21.7	7.6	11.0	385	1.1%	.7%	1.7%	.4%
All Hardware Companies	738.1	644.3	2.1	75,764	36.4%	62.1%	.3%	84.2%
All Turnkey & SW Companies	1,289.0	392.7	649.9	14,239	63.6%	37.9%	99.7%	15.8%

Source: Dataquest (July 1993)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
EDS	119.5	34.5	56.3	1,776	11.4%	7.5%	14.6%	7.7%
Hewlett-Packard	112.9	80.2	14.4	3,750	10.7%	17.3%	3.7%	16.2%
Silicon Graphics	103.9	94.6	.0	3,761	9.9%	20.4%	.0%	16.3%
Intergraph	84.4	39.8	20.9	1,387	8.0%	8.6%	5.4%	6.0%
Sun Microsystems	80.9	70.4	.0	5,277	7.7%	15.2%	.0%	22.9%
IBM	66.6	32.0	25.3	1,596	6.3%	6.9%	6.5%	6.9%
Parametric Technology	65.1	.0	52.8	0	6.2%	.0%	13.6%	.0%
Computervision	61.9	23.7	14.6	704	5.9%	5.1%	3.8%	3.1%
SDRC	46.9	.0	37.5	0	4.5%	.0%	9.7%	.0%
Applicon	46.2	15.2	18.0	484	4.4%	3.3%	4.7%	2.1%
Digital	41.2	28.5	.0	2,021	3.9%	6.1%	.0%	8.8%
Control Data Systems	22.4	13.7	4.7	609	2.1%	3.0%	1.2%	2.6%
Alias Research	21.2	.0	19.3	0	2.0%	.0%	5.0%	.0%
Unisys	18.0	9.2	6.3	418	1.7%	2.0%	1.6%	1.8%
PDA Engineering	16.3	.0	15.6	0	1.5%	.0%	4.0%	.0%
Auto-Trol	15.2	5.6	5.8	190	1.4%	1.2%	1.5%	.8%
Gerber Systems	14.3	7.0	4.7	198	1.4%	1.5%	1.2%	.9%
Swanson Analysis	12.5	.0	12.0	0	1.2%	.0%	3.1%	.0%
Cimlinc	12.2	.0	8.6	337	1.2%	.0%	2.2%	1.5%
Aries Technology	8.5	.0	7.6	0	.8%	.0%	2.0%	.0%
ICAD	8.1	.0	6.5	0	.8%	.0%	1.7%	.0%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
ADRA Systems	8.0	.6	5.9	36	.8%	.1%	1.5%	.2%
MCS	7.2	.0	6.4	0	.7%	.0%	1.7%	.0%
Rasna Corporation	6.5	.0	5.8	0	.6%	.0%	1.5%	.0%
CAMAX Systems Inc.	6.3	1.0	3.8	111	.6%	.2%	1.0%	.5%
Delcam International	4.2	1.6	1.8	72	.4%	.3%	.5%	.3%
Autodesk	4.0	.0	4.0	0	.4%	.0%	1.0%	.0%
Matra Datavision	3.9	1.3	2.0	33	.4%	.3%	.5%	.1%
Ontos	3.8	.0	3.8	0	.4%	.0%	1.0%	.0%
MacNeal-Schwendler	3.5	.0	3.5	0	.3%	.0%	.9%	.0%
Cisigraph	3.5	1.0	1.9	23	.3%	.2%	.5%	.1%
Mechanical Dynamics	3.4	.0	2.7	0	.3%	.0%	.7%	.0%
Cimatron	2.9	1.3	1.3	64	.3%	.3%	.3%	.3%
CADSI	2.1	.3	1.6	10	.2%	.1%	.4%	.0%
SPATIAL Technology	2.1	.0	2.1	0	.2%	.0%	.5%	.0%
Engineering Mechanics	1.6	.1	1.4	77	.2%	.0%	.4%	.3%
Wisdom Systems	1.4	.0	1.1	0	.1%	.0%	.3%	.0%
MARC	1.2	.0	1.2	0	.1%	.0%	.3%	.0%
Technische Computer Systeme	1.1	.2	.9	29	.1%	.0%	.2%	.1%
Valisys	.9	.0	.0	0	.1%	.0%	.0%	.0%
Accugraph	.9	.4	.4	34	.1%	.1%	.1%	.1%
CADKEY	.8	.0	.8	0	.1%	.0%	.2%	.0%

(Continued)

© 1993 Dataquest Incorporated

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

Application: Mechanical
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
Object Design	.8	.0	.8	0	.1%	.0%	.2%	.0%
Objectivity	.8	.0	.8	0	.1%	.0%	.2%	.0%
Point Control	.7	.0	.5	0	.1%	.0%	.1%	.0%
Solbourne	.6	.6	.0	80	.1%	.1%	.0%	.3%
Computational Mechanics	.4	.0	.4	0	.0%	.0%	.1%	.0%
Softdesk	.3	.0	.3	0	.0%	.0%	.1%	.0%
Engineering Systems Corp.	.2	.0	.1	0	.0%	.0%	.0%	.0%
FEGS	.2	.0	.1	0	.0%	.0%	.0%	.0%
Algor Interactive Systems	.1	.0	.1	0	.0%	.0%	.0%	.0%
Georgia Tech Research Corp.	.1	.0	.1	0	.0%	.0%	.0%	.0%
Other Companies	.2	.0	.2	0	.0%	.0%	.0%	.0%
All Companies	1,051.8	462.7	386.7	23,077	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	1,035.5	457.4	378.2	22,855	98.5%	98.9%	97.8%	99.0%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	16.3	5.3	8.5	221	1.5%	1.1%	2.2%	1.0%
All Hardware Companies	278.5	237.0	1.0	13,412	26.5%	51.2%	.2%	58.1%
All Turnkey & SW Companies	773.3	225.7	385.7	9,665	73.5%	48.8%	99.8%	41.9%

Source: Dataquest (July 1993)

©1993 Dataquest Incorporated

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

Application: Mechanical
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	167.9	107.4	21.0	2,629	41.3%	41.8%	32.3%	43.2%
Digital	64.5	44.5	.0	0	15.9%	17.3%	.0%	.0%
Control Data Systems	40.3	16.5	5.6	248	9.9%	6.4%	8.7%	4.1%
MacNeal-Schwendler	18.4	.0	18.4	0	4.5%	.0%	28.2%	.0%
PDA Engineering	5.4	.0	5.2	0	1.3%	.0%	8.0%	.0%
Unisys	5.4	2.8	1.9	112	1.3%	1.1%	2.9%	1.8%
MCS	5.3	.0	4.6	0	1.3%	.0%	7.1%	.0%
Swanson Analysis	4.7	.0	4.5	0	1.1%	.0%	6.9%	.0%
SDRC	2.5	.0	2.0	0	.6%	.0%	3.0%	.0%
Mechanical Dynamics	.6	.0	.5	0	.1%	.0%	.7%	.0%
Intergraph	.5	.0	.5	0	.1%	.0%	.7%	.0%
Computational Mechanics	.5	.0	.5	0	.1%	.0%	.8%	.0%
MARC	.4	.0	.4	0	.1%	.0%	.6%	.0%
Engineering Systems Corp.	.1	.0	.1	0	.0%	.0%	.1%	.0%
Valisys	.1	.0	.0	0	.0%	.0%	.0%	.0%
Georgia Tech Research Corp.	.0	.0	.0	0	.0%	.0%	.1%	.0%
FEGS	.0	.0	.0	0	.0%	.0%	.0%	.0%

(Continued)

©1993 Dataquest Incorporated

Table 21 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: Mechanical
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
Accugraph	.0	.0	.0	1	.0%	.0%	.0%	.0%
Other Companies	90.5	85.9	.0	3,093	22.2%	33.4%	.0%	50.8%
All Companies	406.9	257.2	65.0	6,082	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	406.4	257.2	64.5	6,082	99.9%	100.0%	99.2%	100.0%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	.5	.0	.5	0	.1%	.0%	.8%	.0%
All Hardware Companies	163.2	133.8	1.1	3,166	40.1%	52.0%	1.8%	52.0%
All Turnkey & SW Companies	243.8	123.4	63.9	2,917	59.9%	48.0%	98.2%	48.0%

Source: Dataquest (July 1993)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
IBM	55.6	26.0	18.8	700	30.3%	26.7%	42.0%	23.0%
Digital	45.9	31.7	.0	635	25.1%	32.5%	.0%	20.8%
Sun Microsystems	22.7	18.8	.0	961	12.4%	19.3%	.0%	31.5%
EDS	21.9	6.7	10.0	284	12.0%	6.9%	22.3%	9.3%
Intergraph	11.6	5.5	2.8	185	6.3%	5.7%	6.2%	6.1%
MacNeal-Schwendler	9.7	.0	9.7	0	5.3%	.0%	21.6%	.0%
Silicon Graphics	4.7	4.0	.0	92	2.5%	4.1%	.0%	3.0%
Applicon	4.6	1.5	1.8	48	2.5%	1.6%	4.0%	1.6%
Cimlinc	1.4	.0	1.0	0	.8%	.0%	2.3%	.0%
Solbourne	1.4	1.3	.0	92	.7%	1.4%	.0%	3.0%
Control Data Systems	1.3	.6	.2	5	.7%	.6%	.3%	.2%
Computervision	1.3	.5	.3	15	.7%	.5%	.7%	.5%
Hewlett-Packard	.9	.8	.0	29	.5%	.8%	.0%	1.0%
Cisigraph	.4	.1	.2	3	.2%	.1%	.5%	.1%
Georgia Tech Research Corp.	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	.0	.0	.0	2	.0%	.0%	.0%	.1%
All Companies	183.2	97.5	44.7	3,050	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	182.8	97.4	44.4	3,048	99.8%	99.9%	99.5%	99.9%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	.4	.1	.2	3	.2%	.1%	.5%	.1%
All Hardware Companies	76.2	57.0	.0	1,817	41.6%	58.5%	.1%	59.6%
All Turnkey & SW Companies	107.0	40.5	44.6	1,234	58.4%	41.5%	99.9%	40.4%

Source: Dataquest (July 1993)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Compaq	106.4	106.4	.0	23,034	27.6%	48.4%	.0%	39.9%
Autodesk	63.3	.0	63.3	0	16.4%	.0%	40.7%	.0%
IBM	53.1	17.5	32.8	5,624	13.8%	8.0%	21.1%	9.7%
Apple Computer	38.7	38.7	.0	8,596	10.0%	17.6%	.0%	14.9%
Hewlett-Packard	14.7	13.2	.0	5,096	3.8%	6.0%	.0%	8.8%
Digital	11.3	10.2	.0	2,915	2.9%	4.6%	.0%	5.0%
Dell Computer	9.3	9.3	.0	2,433	2.4%	4.3%	.0%	4.2%
CADKEY	7.3	.0	7.3	0	1.9%	.0%	4.7%	.0%
Point Control	5.9	.0	4.6	0	1.5%	.0%	3.0%	.0%
Swanson Analysis	5.1	.0	4.9	0	1.3%	.0%	3.2%	.0%
CNC Software	4.1	.0	4.1	0	1.1%	.0%	2.6%	.0%
Intergraph	4.0	.0	4.0	0	1.0%	.0%	2.6%	.0%
Algor Interactive Systems	4.0	.0	3.5	0	1.0%	.0%	2.2%	.0%
MCS	3.1	.0	2.8	0	.8%	.0%	1.8%	.0%
Computervision	2.9	.0	2.9	72	.8%	.0%	1.9%	.1%
Moda CAD	2.8	.7	2.0	23	.7%	.3%	1.3%	.0%
American Small Business Comp.	2.8	.0	2.8	0	.7%	.0%	1.8%	.0%
ADRA Systems	2.7	.0	2.1	0	.7%	.0%	1.4%	.0%
Micrografx	1.7	.0	1.7	0	.4%	.0%	1.1%	.0%
Cimatron	1.6	.7	.7	84	.4%	.3%	.5%	.1%
Rasna Corporation	1.6	.0	1.5	0	.4%	.0%	.9%	.0%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Claris	1.3	.0	1.3	0	.3%	.0%	.9%	.0%
Investronica SA	1.2	1.0	.1	48	.3%	.4%	.1%	.1%
Engineering Mechanics	1.2	.1	1.0	143	.3%	.0%	.6%	.2%
Softdesk	1.0	.0	1.0	0	.3%	.0%	.6%	.0%
Pathtrace	1.0	.2	.6	14	.2%	.1%	.4%	.0%
Aries Technology	.9	.0	.9	0	.2%	.0%	.5%	.0%
Evolution Computing	.9	.0	.9	0	.2%	.0%	.6%	.0%
Foresight Resources	.9	.0	.8	0	.2%	.0%	.5%	.0%
Innovative Data Design	.8	.0	.8	0	.2%	.0%	.5%	.0%
Cimlinc	.7	.0	.5	0	.2%	.0%	.3%	.0%
GRAPHSOFT	.7	.0	.7	0	.2%	.0%	.4%	.0%
MacNeal-Schwendler	.6	.0	.6	0	.2%	.0%	.4%	.0%
Aura CAD/CAM Systems	.6	.0	.6	0	.2%	.0%	.4%	.0%
A.I. Systems	.6	.0	.6	0	.1%	.0%	.4%	.0%
CADSI	.5	.1	.4	9	.1%	.0%	.3%	.0%
Applicon	.5	.2	.2	16	.1%	.1%	.1%	.0%
Delcam International	.5	.2	.2	15	.1%	.1%	.1%	.0%
Engineering Systems Corp.	.4	.0	.4	0	.1%	.0%	.3%	.0%
Ashlar	.4	.0	.4	0	.1%	.0%	.2%	.0%
IMSI	.4	.0	.4	0	.1%	.0%	.2%	.0%
Mc2 Engineering Software	.3	.0	.3	0	.1%	.0%	.2%	.0%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Mega CADD	.2	.0	.2	0	.0%	.0%	.1%	.0%
Areon	.1	.0	.0	0	.0%	.0%	.0%	.0%
Graphisoft Software Dev	.1	.0	.1	0	.0%	.0%	.1%	.0%
Accugraph	.1	.0	.1	0	.0%	.0%	.1%	.0%
Engineered Software	.1	.0	.1	0	.0%	.0%	.1%	.0%
Other Companies	23.0	21.3	1.7	9,671	6.0%	9.7%	1.1%	16.7%
All Companies	385.2	219.7	155.7	57,794	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	380.7	217.6	153.9	57,632	98.8%	99.0%	98.8%	99.7%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	4.5	2.1	1.8	161	1.2%	1.0%	1.2%	.3%
All Hardware Companies	220.3	216.6	.0	57,370	57.2%	98.6%	.0%	99.3%
All Turnkey & SW Companies	165.0	3.1	155.7	424	42.8%	1.4%	100.0%	.7%

Source: Dataquest (July 1993)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
IBM	695.6	403.0	156.2	19,673	21.5%	25.1%	16.0%	18.7%
Computervision	492.5	143.9	167.5	4,941	15.2%	9.0%	17.1%	4.7%
Hewlett-Packard	295.2	206.5	41.8	14,745	9.1%	12.9%	4.3%	14.0%
Digital	204.0	144.0	.0	7,202	6.3%	9.0%	.0%	6.8%
Sun Microsystems	101.8	87.7	.0	5,311	3.1%	5.5%	.0%	5.0%
Siemens Nixdorf Info systeme	89.6	39.2	37.0	1,305	2.8%	2.4%	3.8%	1.2%
Matra Datavision	89.4	28.6	45.6	750	2.8%	1.8%	4.7%	.7%
Control Data Systems	81.6	39.3	13.4	1,100	2.5%	2.4%	1.4%	1.0%
Applicon	76.3	25.2	29.7	824	2.4%	1.6%	3.0%	.8%
Intergraph	67.3	31.0	16.3	878	2.1%	1.9%	1.7%	.8%
EDS	62.3	18.5	29.5	882	1.9%	1.2%	3.0%	.8%
Silicon Graphics	62.3	56.4	.0	1,991	1.9%	3.5%	.0%	1.9%
Autodesk	54.9	.0	54.9	0	1.7%	.0%	5.6%	.0%
SDRC	46.7	.0	46.7	0	1.4%	.0%	4.8%	.0%
Compaq	42.3	42.3	.0	9,146	1.3%	2.6%	.0%	8.7%
STI-Straessle	37.4	11.2	18.0	303	1.2%	.7%	1.8%	.3%
ASCAD/ASCAM	30.6	18.4	9.2	450	.9%	1.1%	.9%	.4%
Cisigraph	28.8	8.1	15.8	183	.9%	.5%	1.6%	.2%
ISICAD	28.4	9.3	13.4	190	.9%	.6%	1.4%	.2%
Investronica SA	27.6	22.1	2.8	1,102	.9%	1.4%	.3%	1.0%
Wiechers Datentechnik	27.2	6.8	12.8	815	.8%	.4%	1.3%	.8%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Parametric Technology	25.0	.0	20.3	0	.8%	.0%	2.1%	.0%
Delcam International	22.2	8.2	9.5	260	.7%	.5%	1.0%	.2%
Marcus Computer Systeme	19.9	10.3	6.8	296	.6%	.6%	.7%	.3%
Tebis	19.6	3.0	13.7	112	.6%	.2%	1.4%	.1%
Cimatron	18.9	8.5	8.5	590	.6%	.5%	.9%	.6%
CAD Lab	18.7	.0	15.2	0	.6%	.0%	1.6%	.0%
Apple Computer	17.7	17.8	.0	3,223	.5%	1.1%	.0%	3.1%
MacNeal-Schwendler	17.4	.0	17.4	0	.5%	.0%	1.8%	.0%
Han Dataport	16.5	5.1	9.0	359	.5%	.3%	.9%	.3%
Digital Kienzle	16.3	8.3	4.6	239	.5%	.5%	.5%	.2%
Radan Computational	15.8	5.6	7.9	328	.5%	.3%	.8%	.3%
Swanson Analysis	13.8	.0	13.3	0	.4%	.0%	1.4%	.0%
PAFEC	12.7	.0	12.7	0	.4%	.0%	1.3%	.0%
Exapt	12.5	6.1	4.2	229	.4%	.4%	.4%	.2%
Framasoft	12.0	.0	7.3	0	.4%	.0%	.7%	.0%
Gerber Systems	10.9	5.4	3.6	151	.3%	.3%	.4%	.1%
PDA Engineering	10.8	.0	10.4	0	.3%	.0%	1.1%	.0%
ICL	10.6	6.2	3.6	290	.3%	.4%	.4%	.3%
ItalCad	10.3	4.8	2.5	97	.3%	.3%	.3%	.1%
CAD Distribution	10.1	5.1	4.1	157	.3%	.3%	.4%	.1%
Research Machines	7.5	7.5	.0	1,208	.2%	.5%	.0%	1.1%

(Continued)

© 1993 Dataquest Incorporated

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

Application: Mechanical
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
Fides Industrielle Automation	7.2	2.2	2.9	42	.2%	.1%	.3%	.0%
Cimlinc	7.2	.0	5.0	168	.2%	.0%	.5%	.2%
DAT Standard info ssystemes	6.7	.0	6.4	0	.2%	.0%	.7%	.0%
Auto-Trol	6.3	2.3	2.4	78	.2%	.1%	.2%	.1%
Technische Computer Systeme	6.2	1.1	5.1	166	.2%	.1%	.5%	.2%
Ziegler Informatics	5.7	.0	5.7	0	.2%	.0%	.6%	.0%
Alias Research	5.2	.0	4.8	0	.2%	.0%	.5%	.0%
ABB Industria	5.1	2.3	2.3	54	.2%	.1%	.2%	.1%
ADRA Systems	4.8	.3	3.7	16	.1%	.0%	.4%	.0%
Serbi	4.8	.5	4.3	136	.1%	.0%	.4%	.1%
Olivetti	4.4	3.8	.0	488	.1%	.2%	.0%	.5%
RoboCAD Solutions	3.2	.0	2.6	0	.1%	.0%	.3%	.0%
Whessoe Computing Systems	3.2	.0	3.2	0	.1%	.0%	.3%	.0%
MCS	3.2	.0	2.9	0	.1%	.0%	.3%	.0%
MARC	3.1	.0	3.1	0	.1%	.0%	.3%	.0%
Dell Computer	3.1	3.1	.0	811	.1%	.2%	.0%	.8%
FEA	3.0	.7	.7	0	.1%	.0%	.1%	.0%
CAD Centre	2.9	.0	2.3	0	.1%	.0%	.2%	.0%
debis Systemhaus	2.9	.7	1.7	20	.1%	.0%	.2%	.0%
Kloeckner-Moeller	2.7	.6	1.9	0	.1%	.0%	.2%	.0%
Pathtrace	2.5	.5	1.6	37	.1%	.0%	.2%	.0%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Catalpa	2.3	.4	1.5	25	.1%	.0%	.1%	.0%
Superdraft	2.3	1.1	1.1	132	.1%	.1%	.1%	.1%
Softronics	2.3	.6	1.7	206	.1%	.0%	.2%	.2%
Caroline Informatique	2.3	.4	1.2	18	.1%	.0%	.1%	.0%
ISKA	2.2	1.0	.9	41	.1%	.1%	.1%	.0%
Anilam Electronics	2.2	.4	1.6	70	.1%	.0%	.2%	.1%
Vero International Software	2.2	.0	2.0	0	.1%	.0%	.2%	.0%
ICAD	2.0	.0	1.6	0	.1%	.0%	.2%	.0%
FEGS	1.9	.0	.9	0	.1%	.0%	.1%	.0%
Point Control	1.8	.0	1.4	0	.1%	.0%	.1%	.0%
CAMTEK	1.7	.4	1.1	120	.1%	.0%	.1%	.1%
SPATIAL Technology	1.6	.0	1.6	0	.0%	.0%	.2%	.0%
Rasna Corporation	1.5	.0	1.4	0	.0%	.0%	.1%	.0%
Computational Mechanics	1.5	.0	1.5	0	.0%	.0%	.2%	.0%
Unisys	1.5	.3	.5	27	.0%	.0%	.1%	.0%
Micrografx	1.4	.0	1.4	0	.0%	.0%	.1%	.0%
Mechanical Dynamics	1.4	.0	1.1	0	.0%	.0%	.1%	.0%
Aries Technology	1.3	.0	1.2	0	.0%	.0%	.1%	.0%
Moda CAD	1.1	.3	.8	9	.0%	.0%	.1%	.0%
CADKEY	1.0	.0	1.0	0	.0%	.0%	.1%	.0%
CAMAX Systems Inc.	1.0	.2	.6	18	.0%	.0%	.1%	.0%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
CADSI	.9	.1	.7	6	.0%	.0%	.1%	.0%
CNC Software	.9	.0	.9	0	.0%	.0%	.1%	.0%
EME	.9	.2	.4	18	.0%	.0%	.0%	.0%
Areon	.8	.4	.2	6	.0%	.0%	.0%	.0%
Algor Interactive Systems	.7	.0	.6	0	.0%	.0%	.1%	.0%
CAD-Capture	.6	.1	.2	3	.0%	.0%	.0%	.0%
S.T.L.D. s.r.l.	.5	.0	.5	0	.0%	.0%	.1%	.0%
Graphisoft Software Dev	.4	.0	.4	0	.0%	.0%	.0%	.0%
Spectrum Graphics	.4	.1	.2	3	.0%	.0%	.0%	.0%
CADWorks	.3	.0	.3	0	.0%	.0%	.0%	.0%
Evolution Computing	.3	.0	.3	0	.0%	.0%	.0%	.0%
American Small Business Comp.	.2	.0	.2	0	.0%	.0%	.0%	.0%
Ontos	.2	.0	.2	0	.0%	.0%	.0%	.0%
Wisdom Systems	.2	.0	.1	0	.0%	.0%	.0%	.0%
DAPCO	.2	.0	.1	0	.0%	.0%	.0%	.0%
Foresight Resources	.2	.0	.1	0	.0%	.0%	.0%	.0%
Objectivity	.1	.0	.1	0	.0%	.0%	.0%	.0%
Valisys	.1	.0	.0	0	.0%	.0%	.0%	.0%
Lamp Software	.1	.0	.1	7	.0%	.0%	.0%	.0%
A.I. Systems	.1	.0	.1	0	.0%	.0%	.0%	.0%
Object Design	.1	.0	.1	0	.0%	.0%	.0%	.0%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Softdesk	.1	.0	.1	0	.0%	.0%	.0%	.0%
Engineered Software	.1	.0	.1	0	.0%	.0%	.0%	.0%
Mega CADD	.1	.0	.1	0	.0%	.0%	.0%	.0%
Accugraph	.0	.0	.0	1	.0%	.0%	.0%	.0%
IMSI	.0	.0	.0	0	.0%	.0%	.0%	.0%
Georgia Tech Research Corp.	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	140.8	137.5	.0	23,240	4.3%	8.6%	.0%	22.1%
All Companies	3,240.0	1,604.3	978.0	105,295	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	2,605.3	1,376.2	673.1	94,687	80.4%	85.8%	68.8%	89.9%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	634.7	228.2	304.9	10,608	19.6%	14.2%	31.2%	10.1%
All Hardware Companies	743.1	632.1	2.7	71,796	22.9%	39.4%	.3%	68.2%
All Turnkey & SW Companies	2,496.9	972.3	975.3	33,500	77.1%	60.6%	99.7%	31.8%

Source: Dataquest (July 1993)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Computervision	480.2	141.3	161.3	4,748	24.8%	17.2%	23.6%	13.8%
Hewlett-Packard	271.5	185.1	41.8	8,043	14.0%	22.5%	6.1%	23.4%
IBM	149.9	71.9	57.0	3,377	7.7%	8.8%	8.3%	9.8%
Siemens Nixdorf Info systeme	89.6	39.2	37.0	1,305	4.6%	4.8%	5.4%	3.8%
Matra Datavision	89.4	28.6	45.6	750	4.6%	3.5%	6.7%	2.2%
Sun Microsystems	79.6	69.3	.0	4,528	4.1%	8.4%	.0%	13.2%
Applicon	68.7	22.7	26.8	727	3.5%	2.8%	3.9%	2.1%
Intergraph	62.6	28.7	15.2	816	3.2%	3.5%	2.2%	2.4%
Silicon Graphics	56.4	51.3	.0	1,886	2.9%	6.2%	.0%	5.5%
Digital	52.1	35.9	.0	2,569	2.7%	4.4%	.0%	7.5%
EDS	49.9	14.7	23.8	732	2.6%	1.8%	3.5%	2.1%
SDRC	45.7	.0	45.7	0	2.4%	.0%	6.7%	.0%
STI-Straessle	37.4	11.2	18.0	303	1.9%	1.4%	2.6%	.9%
ASCAD/ASCAM	30.0	18.0	9.0	436	1.5%	2.2%	1.3%	1.3%
Control Data Systems	28.6	17.4	6.0	777	1.5%	2.1%	.9%	2.3%
Cisigraph	25.9	7.3	14.2	164	1.3%	.9%	2.1%	.5%
ISICAD	25.9	9.3	10.9	190	1.3%	1.1%	1.6%	.6%
Parametric Technology	25.0	.0	20.3	0	1.3%	.0%	3.0%	.0%
Delcam International	20.0	7.4	8.6	216	1.0%	.9%	1.3%	.6%
Marcus Computer Systeme	19.9	10.3	6.8	296	1.0%	1.3%	1.0%	.9%
Digital Kienzle	16.3	8.3	4.6	239	.8%	1.0%	.7%	.7%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
CAD Lab	15.9	.0	12.7	0	.8%	.0%	1.9%	.0%
Radan Computational	15.7	5.5	7.8	322	.8%	.7%	1.1%	.9%
Han Dataport	14.9	4.5	8.2	327	.8%	.5%	1.2%	1.0%
Gerber Systems	10.9	5.4	3.6	151	.6%	.7%	.5%	.4%
Framasoft	10.8	.0	6.5	0	.6%	.0%	1.0%	.0%
PAFEC	10.8	.0	10.8	0	.6%	.0%	1.6%	.0%
Cimatron	10.6	4.8	4.8	209	.5%	.6%	.7%	.6%
ICL	10.6	6.2	3.6	290	.5%	.8%	.5%	.8%
ItalCad	10.3	4.8	2.5	97	.5%	.6%	.4%	.3%
PDA Engineering	8.1	.0	7.8	0	.4%	.0%	1.1%	.0%
Swanson Analysis	8.0	.0	7.7	0	.4%	.0%	1.1%	.0%
Fides Industrielle Automation	7.2	2.2	2.9	42	.4%	.3%	.4%	.1%
Wiechers Datentechnik	7.1	1.8	3.3	100	.4%	.2%	.5%	.3%
Auto-Trol	6.3	2.3	2.4	78	.3%	.3%	.3%	.2%
Technische Computer Systeme	6.2	1.1	5.1	166	.3%	.1%	.7%	.5%
Cimlinc	6.1	.0	4.3	168	.3%	.0%	.6%	.5%
Alias Research	5.2	.0	4.8	0	.3%	.0%	.7%	.0%
MacNeal-Schwendler	5.2	.0	5.2	0	.3%	.0%	.8%	.0%
ADRA Systems	3.6	.3	2.7	16	.2%	.0%	.4%	.0%
Exapt	3.4	1.7	1.2	115	.2%	.2%	.2%	.3%
Autodesk	3.3	.0	3.3	0	.2%	.0%	.5%	.0%
CAD Centre	2.9	.0	2.3	0	.2%	.0%	.3%	.0%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
MARC	2.4	.0	2.4	0	.1%	.0%	.3%	.0%
ISKA	2.2	1.0	.9	41	.1%	.1%	.1%	.1%
debis Systemhaus	2.2	.5	1.3	12	.1%	.1%	.2%	.0%
Catalpa	2.1	.4	1.3	15	.1%	.0%	.2%	.0%
ICAD	2.0	.0	1.6	0	.1%	.0%	.2%	.0%
Caroline Informatique	1.6	.3	.8	8	.1%	.0%	.1%	.0%
FEGS	1.6	.0	.8	0	.1%	.0%	.1%	.0%
SPATIAL Technology	1.6	.0	1.6	0	.1%	.0%	.2%	.0%
MCS	1.5	.0	1.3	0	.1%	.0%	.2%	.0%
Rasna Corporation	1.2	.0	1.1	0	.1%	.0%	.2%	.0%
Aries Technology	1.2	.0	1.1	0	.1%	.0%	.2%	.0%
FEA	1.2	.3	.3	0	.1%	.0%	.0%	.0%
Mechanical Dynamics	1.2	.0	.9	0	.1%	.0%	.1%	.0%
Unisys	1.0	.2	.4	15	.1%	.0%	.1%	.0%
CAMAX Systems Inc.	1.0	.2	.6	18	.1%	.0%	.1%	.1%
CADSI	.7	.1	.6	3	.0%	.0%	.1%	.0%
Computational Mechanics	.5	.0	.5	0	.0%	.0%	.1%	.0%
EME	.4	.1	.2	6	.0%	.0%	.0%	.0%
Spectrum Graphics	.4	.1	.2	3	.0%	.0%	.0%	.0%
Whessoe Computing Systems	.3	.0	.3	0	.0%	.0%	.0%	.0%
Ontos	.2	.0	.2	0	.0%	.0%	.0%	.0%
DAPCO	.2	.0	.1	0	.0%	.0%	.0%	.0%

(Continued)

© 1993 Dataquest Incorporated

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

Application: Mechanical
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
Wisdom Systems	.2	.0	.1	0	.0%	.0%	.0%	.0%
Point Control	.2	.0	.1	0	.0%	.0%	.0%	.0%
Objectivity	.1	.0	.1	0	.0%	.0%	.0%	.0%
Valisys	.1	.0	.0	0	.0%	.0%	.0%	.0%
CAMTEK	.1	.0	.1	2	.0%	.0%	.0%	.0%
CADKEY	.1	.0	.1	0	.0%	.0%	.0%	.0%
Object Design	.1	.0	.1	0	.0%	.0%	.0%	.0%
Accugraph	.0	.0	.0	1	.0%	.0%	.0%	.0%
Lamp Software	.0	.0	.0	3	.0%	.0%	.0%	.0%
CADWorks	.0	.0	.0	0	.0%	.0%	.0%	.0%
Algor Interactive Systems	.0	.0	.0	0	.0%	.0%	.0%	.0%
Softdesk	.0	.0	.0	0	.0%	.0%	.0%	.0%
Georgia Tech Research Corp.	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	.2	.0	.1	0	.0%	.0%	.0%	.0%
All Companies	1,935.3	821.5	684.8	34,312	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	1,467.7	656.0	462.8	28,846	75.8%	79.9%	67.6%	84.1%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	467.5	165.5	222.0	5,466	24.2%	20.1%	32.4%	15.9%
All Hardware Companies	275.1	229.2	1.2	12,454	14.2%	27.9%	.2%	36.3%
All Turnkey & SW Companies	1,660.2	592.3	683.6	21,858	85.8%	72.1%	99.8%	63.7%

Source: Dataquest (July 1993)

©1993 Dataquest Incorporated

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

Application: Mechanical
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	377.7	241.7	47.2	5,740	58.0%	57.4%	56.8%	58.9%
Digital	80.1	55.3	.0	0	12.3%	13.1%	.0%	.0%
Control Data Systems	51.4	21.1	7.2	317	7.9%	5.0%	8.7%	3.2%
MacNeal-Schwendler	12.2	.0	12.2	0	1.9%	.0%	14.7%	.0%
Exapt	9.1	4.5	3.1	114	1.4%	1.1%	3.7%	1.2%
Computervision	6.9	1.9	2.5	105	1.1%	.4%	3.0%	1.1%
Swanson Analysis	2.8	.0	2.7	0	.4%	.0%	3.2%	.0%
PDA Engineering	2.7	.0	2.6	0	.4%	.0%	3.1%	.0%
Framasoft	1.2	.0	.7	0	.2%	.0%	.9%	.0%
MCS	1.1	.0	1.0	0	.2%	.0%	1.1%	.0%
Computational Mechanics	1.1	.0	1.1	0	.2%	.0%	1.3%	.0%
SDRC	.9	.0	.9	0	.1%	.0%	1.1%	.0%
MARC	.8	.0	.8	0	.1%	.0%	.9%	.0%
Whessoe Computing Systems	.6	.0	.6	0	.1%	.0%	.8%	.0%
Olivetti	.5	.4	.0	13	.1%	.1%	.0%	.1%
debis Systemhaus	.4	.1	.2	2	.1%	.0%	.3%	.0%
FEA	.3	.1	.1	0	.0%	.0%	.1%	.0%
FEGS	.3	.0	.1	0	.0%	.0%	.2%	.0%
Mechanical Dynamics	.2	.0	.2	0	.0%	.0%	.2%	.0%
Georgia Tech Research Corp.	.0	.0	.0	0	.0%	.0%	.0%	.0%

(Continued)

©1993 Dataquest Incorporated

Table 26 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: Mechanical
Platform: Host-Dependent
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
Valisys	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	101.1	96.1	.0	3,456	15.5%	22.8%	.0%	35.5%
All Companies	651.2	421.0	83.1	9,746	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	637.8	416.0	77.1	9,617	97.9%	98.8%	92.8%	98.7%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	13.4	5.0	6.0	128	2.1%	1.2%	7.2%	1.3%
All Hardware Companies	192.1	156.0	1.5	3,563	29.5%	37.1%	1.7%	36.6%
All Turnkey & SW Companies	459.1	265.0	81.6	6,183	70.5%	62.9%	98.3%	63.4%

Source: Dataquest (July 1993)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
IBM	124.8	58.4	42.2	1,715	51.2%	43.9%	76.4%	45.4%
Digital	57.1	39.4	.0	794	23.4%	29.6%	.0%	21.0%
Sun Microsystems	22.2	18.4	.0	782	9.1%	13.8%	.0%	20.7%
EDS	12.5	3.9	5.7	150	5.1%	2.9%	10.3%	4.0%
Applicon	6.9	2.3	2.7	73	2.8%	1.7%	4.8%	1.9%
Silicon Graphics	6.0	5.0	.0	105	2.4%	3.8%	.0%	2.8%
Intergraph	4.7	2.3	1.1	61	1.9%	1.7%	2.0%	1.6%
Cisigraph	2.9	.8	1.6	18	1.2%	.6%	2.9%	.5%
Computervision	2.4	.8	.8	24	1.0%	.6%	1.4%	.6%
Control Data Systems	1.6	.8	.2	6	.7%	.6%	.3%	.2%
Han Dataport	.8	.4	.3	12	.3%	.3%	.6%	.3%
Hewlett-Packard	.8	.6	.0	20	.3%	.5%	.0%	.5%
Cimlinc	.7	.0	.5	0	.3%	.0%	.9%	.0%
Unisys	.4	.1	.1	12	.2%	.1%	.2%	.3%
Other Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Companies	243.8	133.1	55.2	3,774	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	240.1	131.9	53.3	3,744	98.5%	99.1%	96.5%	99.2%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	3.7	1.2	1.9	30	1.5%	.9%	3.5%	.8%
All Hardware Companies	87.0	64.3	.0	1,717	35.7%	48.3%	.1%	45.5%
All Turnkey & SW Companies	156.8	68.9	55.2	2,057	64.3%	51.7%	99.9%	54.5%

Source: Dataquest (July 1993)

©1993 Dataquest Incorporated

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

Application: Mechanical
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	51.6	.0	51.6	0	12.6%	.0%	33.3%	.0%
IBM	43.2	31.0	9.8	8,842	10.5%	13.5%	6.3%	15.4%
Compaq	42.3	42.3	.0	9,146	10.3%	18.5%	.0%	15.9%
Investronica SA	27.6	22.1	2.8	1,102	6.7%	9.7%	1.8%	1.9%
Hewlett-Packard	23.0	20.7	.0	6,681	5.6%	9.1%	.0%	11.6%
Wiechers Datentechnik	20.1	5.0	9.4	714	4.9%	2.2%	6.1%	1.2%
Tebis	19.6	3.0	13.7	112	4.8%	1.3%	8.9%	.2%
Apple Computer	17.7	17.8	.0	3,223	4.3%	7.8%	.0%	5.6%
Digital	14.8	13.3	.0	3,838	3.6%	5.8%	.0%	6.7%
CAD Distribution	10.1	5.1	4.1	157	2.5%	2.2%	2.6%	.3%
Cimatron	8.3	3.8	3.7	381	2.0%	1.6%	2.4%	.7%
Research Machines	7.5	7.5	.0	1,208	1.8%	3.3%	.0%	2.1%
DAT Standard info ssystemes	6.7	.0	6.4	0	1.6%	.0%	4.1%	.0%
Ziegler Informatics	5.7	.0	5.7	0	1.4%	.0%	3.7%	.0%
ABB Industria	5.1	2.3	2.3	54	1.2%	1.0%	1.5%	.1%
Serbi	4.8	.5	4.3	136	1.2%	.2%	2.8%	.2%
Olivetti	3.9	3.4	.0	475	1.0%	1.5%	.0%	.8%
RoboCAD Solutions	3.2	.0	2.6	0	.8%	.0%	1.7%	.0%
Dell Computer	3.1	3.1	.0	811	.8%	1.4%	.0%	1.4%
Swanson Analysis	3.1	.0	2.9	0	.7%	.0%	1.9%	.0%
Computervision	3.0	.0	3.0	64	.7%	.0%	1.9%	.1%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
CAD Lab	2.8	.0	2.5	0	.7%	.0%	1.6%	.0%
Kloeckner-Moeller	2.7	.6	1.9	0	.7%	.2%	1.2%	.0%
ISICAD	2.6	.0	2.6	0	.6%	.0%	1.7%	.0%
Pathtrace	2.5	.5	1.6	37	.6%	.2%	1.0%	.1%
Superdraft	2.3	1.1	1.1	132	.6%	.5%	.7%	.2%
Softronics	2.3	.6	1.7	206	.6%	.3%	1.1%	.4%
Whessoe Computing Systems	2.2	.0	2.2	0	.5%	.0%	1.4%	.0%
Delcam International	2.2	.8	.9	44	.5%	.4%	.6%	.1%
Anilam Electronics	2.2	.4	1.6	70	.5%	.2%	1.0%	.1%
Vero International Software	2.2	.0	2.0	0	.5%	.0%	1.3%	.0%
PAFEC	1.9	.0	1.9	0	.5%	.0%	1.2%	.0%
Point Control	1.6	.0	1.3	0	.4%	.0%	.8%	.0%
CAMTEK	1.6	.3	1.0	118	.4%	.1%	.7%	.2%
FEA	1.5	.4	.4	0	.4%	.2%	.2%	.0%
Micrografx	1.4	.0	1.4	0	.3%	.0%	.9%	.0%
ADRA Systems	1.2	.0	1.0	0	.3%	.0%	.6%	.0%
Moda CAD	1.1	.3	.8	9	.3%	.1%	.5%	.0%
CADKEY	.9	.0	.9	0	.2%	.0%	.6%	.0%
CNC Software	.9	.0	.9	0	.2%	.0%	.6%	.0%
Han Dataport	.8	.2	.5	21	.2%	.1%	.3%	.0%
Areon	.8	.4	.2	6	.2%	.2%	.1%	.0%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Applicon	.8	.2	.3	24	.2%	.1%	.2%	.0%
Caroline Informatique	.7	.1	.3	10	.2%	.0%	.2%	.0%
Algor Interactive Systems	.7	.0	.6	0	.2%	.0%	.4%	.0%
MCS	.7	.0	.6	0	.2%	.0%	.4%	.0%
ASCAD/ASCAM	.6	.4	.2	14	.1%	.2%	.1%	.0%
CAD-Capture	.6	.1	.2	3	.1%	.1%	.1%	.0%
S.T.L.D. s.r.l.	.5	.0	.5	0	.1%	.0%	.3%	.0%
EME	.4	.1	.2	12	.1%	.0%	.1%	.0%
Graphisoft Software Dev	.4	.0	.4	0	.1%	.0%	.3%	.0%
Cimlinc	.4	.0	.3	0	.1%	.0%	.2%	.0%
debis Systemhaus	.4	.1	.2	6	.1%	.0%	.1%	.0%
CADWorks	.3	.0	.3	0	.1%	.0%	.2%	.0%
Evolution Computing	.3	.0	.3	0	.1%	.0%	.2%	.0%
Rasna Corporation	.3	.0	.3	0	.1%	.0%	.2%	.0%
American Small Business Comp.	.2	.0	.2	0	.1%	.0%	.1%	.0%
Catalpa	.2	.0	.1	10	.0%	.0%	.1%	.0%
CADSI	.2	.0	.1	3	.0%	.0%	.1%	.0%
Foresight Resources	.2	.0	.1	0	.0%	.0%	.1%	.0%
Radan Computational	.2	.0	.1	5	.0%	.0%	.1%	.0%
Aries Technology	.1	.0	.1	0	.0%	.0%	.1%	.0%
A.I. Systems	.1	.0	.1	0	.0%	.0%	.1%	.0%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Lamp Software	.1	.0	.1	4	.0%	.0%	.0%	.0%
Engineered Software	.1	.0	.1	0	.0%	.0%	.0%	.0%
Mega CADD	.1	.0	.1	0	.0%	.0%	.0%	.0%
IMSI	.0	.0	.0	0	.0%	.0%	.0%	.0%
Softdesk	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	39.5	41.4	.0	19,784	9.6%	18.1%	.0%	34.4%
All Companies	409.8	228.7	154.8	57,464	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	259.8	172.3	79.8	52,479	63.4%	75.3%	51.6%	91.3%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	150.0	56.4	75.0	4,984	36.6%	24.7%	48.4%	8.7%
All Hardware Companies	188.9	182.6	.0	54,062	46.1%	79.8%	.0%	94.1%
All Turnkey & SW Companies	220.9	46.1	154.8	3,401	53.9%	20.2%	100.0%	5.9%

Source: Dataquest (July 1993)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
IBM	282.6	139.5	94.9	7,169	13.3%	11.2%	15.3%	8.5%
NEC	212.3	146.9	48.5	10,994	10.0%	11.8%	7.8%	13.0%
Nihon Unisys	196.3	121.7	33.4	1,901	9.2%	9.8%	5.4%	2.2%
Fujitsu	181.2	116.0	47.1	3,588	8.5%	9.4%	7.6%	4.2%
Hitachi	130.5	62.6	54.8	3,506	6.1%	5.0%	8.8%	4.1%
Hewlett-Packard	97.7	67.5	14.4	3,587	4.6%	5.4%	2.3%	4.2%
Toshiba—No OEM	74.3	37.2	29.7	2,563	3.5%	3.0%	4.8%	3.0%
Hitachi Zosen Info Systems	69.8	59.6	3.3	719	3.3%	4.8%	.5%	.8%
Computervision	58.1	19.7	19.3	323	2.7%	1.6%	3.1%	.4%
Mutoh Industries—No OEM	55.0	33.0	16.5	902	2.6%	2.7%	2.7%	1.1%
SDRC	44.9	.0	35.9	0	2.1%	.0%	5.8%	.0%
Mitsubishi Electric	40.9	31.7	5.2	738	1.9%	2.6%	.8%	.9%
Hakuto	39.9	24.0	16.0	850	1.9%	1.9%	2.6%	1.0%
Silicon Graphics	33.9	32.2	.0	1,126	1.6%	2.6%	.0%	1.3%
Tokyo Electron—No OEM	32.3	10.7	14.5	220	1.5%	.9%	2.3%	.3%
Sun Microsystems	30.0	25.8	.0	1,411	1.4%	2.1%	.0%	1.7%
Sharp System Products—No OEM	29.7	15.4	14.3	286	1.4%	1.2%	2.3%	.3%
Digital	28.7	20.3	.0	999	1.4%	1.6%	.0%	1.2%
Mitsui Engineering	22.6	15.8	4.5	151	1.1%	1.3%	.7%	.2%
Autodesk	21.9	.0	21.9	0	1.0%	.0%	3.5%	.0%
EDS	20.9	6.1	9.8	265	1.0%	.5%	1.6%	.3%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Toyo Information Systems—No OEM	20.6	12.5	6.0	219	1.0%	1.0%	1.0%	.3%
Apple Computer	20.2	20.2	.0	3,663	.9%	1.6%	.0%	4.3%
Graphtec Engineering	15.4	7.7	6.9	331	.7%	.6%	1.1%	.4%
Sony	14.8	14.8	.0	540	.7%	1.2%	.0%	.6%
Omron	14.4	8.6	5.8	355	.7%	.7%	.9%	.4%
MacNeal-Schwendler	13.9	.0	13.9	0	.7%	.0%	2.2%	.0%
Control Data Systems	11.2	5.4	1.9	151	.5%	.4%	.3%	.2%
Sumitomo Denko Workstation	11.1	11.1	.0	569	.5%	.9%	.0%	.7%
Intergraph	10.5	4.5	2.8	131	.5%	.4%	.5%	.2%
Andor	10.4	2.6	7.4	80	.5%	.2%	1.2%	.1%
Design Automation	10.2	2.0	7.6	214	.5%	.2%	1.2%	.3%
Parametric Technology	10.0	.0	8.1	0	.5%	.0%	1.3%	.0%
Wacom	8.9	1.8	6.2	161	.4%	.1%	1.0%	.2%
Swanson Analysis	7.9	.0	7.6	0	.4%	.0%	1.2%	.0%
Applicon	7.4	3.2	3.5	80	.3%	.3%	.6%	.1%
MARC	7.2	.0	7.2	0	.3%	.0%	1.2%	.0%
Cisigraph	6.6	1.9	3.7	43	.3%	.1%	.6%	.1%
Alias Research	6.2	.0	5.7	0	.3%	.0%	.9%	.0%
Matra Datavision	4.9	1.6	2.5	41	.2%	.1%	.4%	.0%
Compaq	4.7	4.7	.0	1,016	.2%	.4%	.0%	1.2%
Unisys	4.4	2.3	1.6	101	.2%	.2%	.3%	.1%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Kubota Computer	4.1	3.0	.7	264	.2%	.2%	.1%	.3%
Ricoh—No OEM	3.9	.0	3.3	0	.2%	.0%	.5%	.0%
ADRA Systems	3.9	.2	2.9	13	.2%	.0%	.5%	.0%
Fides Industrielle Automation	3.6	1.1	1.6	21	.2%	.1%	.3%	.0%
Century Research Center	3.4	1.8	1.3	12	.2%	.1%	.2%	.0%
ICAD	3.4	.0	2.7	0	.2%	.0%	.4%	.0%
CADIX	3.4	1.3	1.7	25	.2%	.1%	.3%	.0%
Mechanical Dynamics	3.2	.0	2.5	0	.1%	.0%	.4%	.0%
Cimatron	3.0	1.4	1.4	99	.1%	.1%	.2%	.1%
Framasoft	2.7	.0	1.6	0	.1%	.0%	.3%	.0%
Cimlinc	2.4	.0	1.7	56	.1%	.0%	.3%	.1%
Aries Technology	2.2	.0	1.9	0	.1%	.0%	.3%	.0%
Uchida Yoko	1.9	1.1	.7	45	.1%	.1%	.1%	.1%
CAMAX Systems Inc.	1.8	.3	1.1	32	.1%	.0%	.2%	.0%
PDA Engineering	1.8	.0	1.7	0	.1%	.0%	.3%	.0%
SPATIAL Technology	1.6	.0	1.6	0	.1%	.0%	.3%	.0%
Anilam Electronics	1.5	.5	1.0	18	.1%	.0%	.2%	.0%
MCS	1.4	.0	1.3	0	.1%	.0%	.2%	.0%
Point Control	1.2	.0	.9	0	.1%	.0%	.1%	.0%
CADKEY	1.0	.0	1.0	0	.0%	.0%	.2%	.0%
Zuken	1.0	.3	.5	6	.0%	.0%	.1%	.0%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Auto-Trol	.9	.3	.3	11	.0%	.0%	.1%	.0%
Gerber Systems	.8	.4	.3	11	.0%	.0%	.0%	.0%
ISICAD	.7	.2	.3	5	.0%	.0%	.1%	.0%
Whessoe Computing Systems	.7	.0	.7	0	.0%	.0%	.1%	.0%
CNC Software	.7	.0	.7	0	.0%	.0%	.1%	.0%
CADSi	.6	.1	.5	4	.0%	.0%	.1%	.0%
CAD Centre	.5	.0	.4	0	.0%	.0%	.1%	.0%
Moda CAD	.4	.1	.3	4	.0%	.0%	.0%	.0%
CADWorks	.3	.0	.3	0	.0%	.0%	.0%	.0%
Rasna Corporation	.3	.0	.3	0	.0%	.0%	.0%	.0%
Technische Computer Systeme	.3	.1	.3	0	.0%	.0%	.0%	.0%
Investronica SA	.3	.2	.0	12	.0%	.0%	.0%	.0%
Wiechers Datentechnik	.3	.1	.1	8	.0%	.0%	.0%	.0%
Superdraft	.3	.1	.1	14	.0%	.0%	.0%	.0%
Solbourne	.2	.2	.0	19	.0%	.0%	.0%	.0%
Object Design	.2	.0	.2	0	.0%	.0%	.0%	.0%
Wisdom Systems	.2	.0	.1	0	.0%	.0%	.0%	.0%
Pathtrace	.1	.0	.1	2	.0%	.0%	.0%	.0%
PAFEC	.1	.0	.1	0	.0%	.0%	.0%	.0%
Softdesk	.1	.0	.1	0	.0%	.0%	.0%	.0%
Algor Interactive Systems	.1	.0	.1	0	.0%	.0%	.0%	.0%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Valisys	.1	.0	.0	0	.0%	.0%	.0%	.0%
American Small Business Comp.	.1	.0	.1	0	.0%	.0%	.0%	.0%
Objectivity	.1	.0	.1	0	.0%	.0%	.0%	.0%
IMSI	.0	.0	.0	0	.0%	.0%	.0%	.0%
Georgia Tech Research Corp.	.0	.0	.0	0	.0%	.0%	.0%	.0%
Mega CADD	.0	.0	.0	0	.0%	.0%	.0%	.0%
Accugraph	.0	.0	.0	1	.0%	.0%	.0%	.0%
Foresight Resources	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	141.0	137.5	.1	34,975	6.6%	11.1%	.0%	41.3%
All Companies	2,125.7	1,240.4	620.8	84,648	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	892.8	490.4	271.4	55,153	42.0%	39.5%	43.7%	65.2%
All Asian-Based Companies	1,208.0	743.2	335.8	29,237	56.8%	59.9%	54.1%	34.5%
All European-Based Companies	24.9	6.9	13.6	258	1.2%	.6%	2.2%	.3%
All Hardware Companies	335.6	310.9	.4	50,721	15.8%	25.1%	.1%	59.9%
All Turnkey & SW Companies	1,790.2	929.5	620.4	33,928	84.2%	74.9%	99.9%	40.1%

Source: Dataquest (July 1993)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Hitachi	94.0	45.1	39.5	2,032	8.7%	7.7%	11.3%	10.8%
Hewlett-Packard	92.5	62.9	14.4	2,568	8.6%	10.7%	4.1%	13.6%
NEC	89.2	49.0	33.0	2,940	8.3%	8.4%	9.5%	15.6%
Fujitsu	76.1	48.7	19.8	1,551	7.1%	8.3%	5.7%	8.2%
Nihon Unisys	68.7	42.6	11.7	561	6.4%	7.3%	3.4%	3.0%
Hitachi Zosen Info Systems	65.7	55.8	3.3	672	6.1%	9.5%	.9%	3.6%
Computervision	57.8	19.7	19.0	323	5.4%	3.4%	5.5%	1.7%
IBM	50.0	24.0	19.0	826	4.6%	4.1%	5.5%	4.4%
Toshiba—No OEM	44.6	22.3	17.8	528	4.1%	3.8%	5.1%	2.8%
SDRC	42.6	.0	34.1	0	4.0%	.0%	9.8%	.0%
Silicon Graphics	33.9	32.2	.0	1,126	3.1%	5.5%	.0%	6.0%
Tokyo Electron—No OEM	32.3	10.7	14.5	220	3.0%	1.8%	4.2%	1.2%
Mitsubishi Electric	30.8	26.2	2.2	332	2.9%	4.5%	.6%	1.8%
Sharp System Products—No OEM	29.1	15.1	14.0	268	2.7%	2.6%	4.0%	1.4%
Mutoh Industries—No OEM	20.9	12.5	6.3	213	1.9%	2.1%	1.8%	1.1%
Sun Microsystems	20.9	18.1	.0	1,113	1.9%	3.1%	.0%	5.9%
Mitsui Engineering	20.6	14.4	4.1	116	1.9%	2.5%	1.2%	.6%
EDS	17.6	5.1	8.3	234	1.6%	.9%	2.4%	1.2%
Toyo Information Systems—No OEM	16.4	10.2	4.7	194	1.5%	1.7%	1.3%	1.0%
Graphtec Engineering	15.4	7.7	6.9	331	1.4%	1.3%	2.0%	1.8%
Sony	14.8	14.8	.0	540	1.4%	2.5%	.0%	2.9%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Omron	14.4	8.6	5.8	355	1.3%	1.5%	1.7%	1.9%
Sumitomo Denko Workstation	10.3	10.3	.0	516	1.0%	1.8%	.0%	2.7%
Parametric Technology	10.0	.0	8.1	0	.9%	.0%	2.3%	.0%
Intergraph	8.8	3.9	2.1	115	.8%	.7%	.6%	.6%
Digital	7.4	5.1	.0	363	.7%	.9%	.0%	1.9%
Alias Research	6.2	.0	5.7	0	.6%	.0%	1.6%	.0%
Cisigraph	6.0	1.7	3.3	38	.6%	.3%	.9%	.2%
Applicon	6.0	2.6	2.8	66	.6%	.4%	.8%	.3%
MARC	5.4	.0	5.4	0	.5%	.0%	1.6%	.0%
Matra Datavision	4.9	1.6	2.5	41	.5%	.3%	.7%	.2%
Swanson Analysis	4.5	.0	4.4	0	.4%	.0%	1.3%	.0%
Control Data Systems	3.9	2.4	.8	107	.4%	.4%	.2%	.6%
Ricoh—No OEM	3.9	.0	3.3	0	.4%	.0%	1.0%	.0%
Kubota Computer	3.6	2.6	.7	200	.3%	.4%	.2%	1.1%
Fides Industrielle Automation	3.6	1.1	1.6	21	.3%	.2%	.5%	.1%
Unisys	3.4	1.7	1.2	79	.3%	.3%	.3%	.4%
ICAD	3.4	.0	2.7	0	.3%	.0%	.8%	.0%
CADIX	3.4	1.3	1.7	25	.3%	.2%	.5%	.1%
ADRA Systems	2.9	.2	2.2	13	.3%	.0%	.6%	.1%
Mechanical Dynamics	2.7	.0	2.1	0	.2%	.0%	.6%	.0%
Framasoft	2.5	.0	1.5	0	.2%	.0%	.4%	.0%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Cimlinc	2.0	.0	1.4	56	.2%	.0%	.4%	.3%
Hakuto	2.0	1.2	.8	23	.2%	.2%	.2%	.1%
Cimatron	1.9	.9	.9	43	.2%	.2%	.2%	.2%
Aries Technology	1.9	.0	1.7	0	.2%	.0%	.5%	.0%
CAMAX Systems Inc.	1.8	.3	1.1	32	.2%	.0%	.3%	.2%
Century Research Center	1.8	.9	.7	10	.2%	.2%	.2%	.1%
Uchida Yoko	1.7	1.0	.6	36	.2%	.2%	.2%	.2%
SPATIAL Technology	1.6	.0	1.6	0	.1%	.0%	.4%	.0%
MacNeal-Schwendler	1.5	.0	1.5	0	.1%	.0%	.4%	.0%
PDA Engineering	1.4	.0	1.3	0	.1%	.0%	.4%	.0%
Autodesk	1.3	.0	1.3	0	.1%	.0%	.4%	.0%
Wacom	1.3	.3	.9	14	.1%	.0%	.3%	.1%
Zuken	1.0	.3	.5	6	.1%	.0%	.1%	.0%
Auto-Trol	.9	.3	.3	11	.1%	.1%	.1%	.1%
Gerber Systems	.8	.4	.3	11	.1%	.1%	.1%	.1%
MCS	.7	.0	.6	0	.1%	.0%	.2%	.0%
ISICAD	.7	.2	.3	5	.1%	.0%	.1%	.0%
CADSI	.5	.1	.4	2	.0%	.0%	.1%	.0%
CAD Centre	.5	.0	.4	0	.0%	.0%	.1%	.0%
Technische Computer Systeme	.3	.1	.3	0	.0%	.0%	.1%	.0%
Object Design	.2	.0	.2	0	.0%	.0%	.1%	.0%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Wisdom Systems	.2	.0	.1	0	.0%	.0%	.0%	.0%
Rasna Corporation	.2	.0	.1	0	.0%	.0%	.0%	.0%
Point Control	.1	.0	.1	0	.0%	.0%	.0%	.0%
PAFEC	.1	.0	.1	0	.0%	.0%	.0%	.0%
CADKEY	.1	.0	.1	0	.0%	.0%	.0%	.0%
Wiechers Datentechnik	.1	.0	.0	1	.0%	.0%	.0%	.0%
Whessoe Computing Systems	.1	.0	.1	0	.0%	.0%	.0%	.0%
Valisys	.1	.0	.0	0	.0%	.0%	.0%	.0%
Solbourne	.1	.1	.0	9	.0%	.0%	.0%	.0%
Objectivity	.1	.0	.1	0	.0%	.0%	.0%	.0%
CADWorks	.0	.0	.0	0	.0%	.0%	.0%	.0%
Accugraph	.0	.0	.0	1	.0%	.0%	.0%	.0%
Softdesk	.0	.0	.0	0	.0%	.0%	.0%	.0%
Georgia Tech Research Corp.	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	.1	.0	.1	0	.0%	.0%	.0%	.0%
All Companies	1,077.6	586.3	348.0	18,888	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	396.0	179.2	144.8	7,060	36.7%	30.6%	41.6%	37.4%
All Asian-Based Companies	661.7	401.7	192.6	11,684	61.4%	68.5%	55.3%	61.9%
All European-Based Companies	20.0	5.3	10.6	144	1.9%	.9%	3.0%	.8%
All Hardware Companies	115.0	103.9	.2	4,610	10.7%	17.7%	.0%	24.4%
All Turnkey & SW Companies	962.6	482.4	347.9	14,279	89.3%	82.3%	100.0%	75.6%

Source: Dataquest (July 1993)

CMEC-WW-MS-9303

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Nihon Unisys	127.6	79.1	21.7	1,340	24.1%	22.4%	23.4%	19.6%
IBM	125.9	80.6	15.8	1,498	23.8%	22.8%	17.0%	21.9%
NEC	70.1	53.2	11.2	152	13.2%	15.1%	12.1%	2.2%
Fujitsu	68.9	44.1	17.9	959	13.0%	12.5%	19.3%	14.0%
Hitachi	13.1	6.3	5.5	232	2.5%	1.8%	5.9%	3.4%
Digital	11.2	7.7	.0	0	2.1%	2.2%	.0%	.0%
MacNeal-Schwendler	7.9	.0	7.9	0	1.5%	.0%	8.5%	.0%
Control Data Systems	7.1	2.9	1.0	43	1.3%	.8%	1.1%	.6%
Mitsubishi Electric	5.9	2.8	1.7	19	1.1%	.8%	1.8%	.3%
Toshiba—No OEM	5.2	2.6	2.1	74	1.0%	.7%	2.2%	1.1%
Toyo Information Systems—No OEM	4.2	2.3	1.3	25	.8%	.6%	1.4%	.4%
Hitachi Zosen Info Systems	4.2	3.8	.0	47	.8%	1.1%	.0%	.7%
SDRC	2.2	.0	1.8	0	.4%	.0%	1.9%	.0%
MARC	1.7	.0	1.7	0	.3%	.0%	1.9%	.0%
Century Research Center	1.6	.9	.6	2	.3%	.2%	.6%	.0%
Unisys	1.0	.5	.4	21	.2%	.1%	.4%	.3%
Swanson Analysis	.8	.0	.8	0	.2%	.0%	.8%	.0%
MCS	.5	.0	.4	0	.1%	.0%	.5%	.0%
Mechanical Dynamics	.5	.0	.4	0	.1%	.0%	.4%	.0%
PDA Engineering	.5	.0	.4	0	.1%	.0%	.5%	.0%
Kubota Computer	.4	.4	.0	64	.1%	.1%	.0%	.9%

(Continued)

© 1993 Dataquest Incorporated

Table 31 (Continued)
1992 CAD/CAM/CAE/GIS Market Share Update

Application: Mechanical
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
Framasoft	.2	.0	.1	0	.0%	.0%	.1%	.0%
Whessoe Computing Systems	.1	.0	.1	0	.0%	.0%	.2%	.0%
Intergraph	.1	.0	.0	0	.0%	.0%	.0%	.0%
Georgia Tech Research Corp.	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	69.2	65.7	.0	2,365	13.1%	18.6%	.0%	34.6%
All Companies	529.9	352.8	92.8	6,842	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	228.5	157.4	30.5	3,928	43.1%	44.6%	32.9%	57.4%
All Asian-Based Companies	301.1	195.4	62.0	2,914	56.8%	55.4%	66.8%	42.6%
All European-Based Companies	.4	.0	.3	0	.1%	.0%	.3%	.0%
All Hardware Companies	81.8	74.0	.2	2,378	15.4%	21.0%	.2%	34.8%
All Turnkey & SW Companies	448.2	278.8	92.6	4,464	84.6%	79.0%	99.8%	65.2%

Source: Dataquest (July 1993)

©1993 Dataquest Incorporated

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

Application: Mechanical
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	41.4	19.2	14.1	416	57.5%	52.2%	66.2%	42.3%
Sun Microsystems	9.2	7.6	.0	299	12.7%	20.7%	.0%	30.3%
Digital	8.1	5.6	.0	112	11.3%	15.1%	.0%	11.4%
MacNeal-Schwendler	4.2	.0	4.2	0	5.8%	.0%	19.6%	.0%
EDS	3.2	1.0	1.5	31	4.5%	2.7%	6.9%	3.2%
Applicon	1.5	.6	.7	14	2.0%	1.7%	3.2%	1.5%
Hewlett-Packard	1.2	1.0	.0	28	1.7%	2.8%	.0%	2.9%
Intergraph	1.2	.6	.3	16	1.7%	1.5%	1.4%	1.6%
Sumitomo Denko Workstation	.8	.8	.0	53	1.1%	2.1%	.0%	5.4%
Cisigraph	.7	.2	.4	4	.9%	.5%	1.7%	.4%
Cimlinc	.2	.0	.2	0	.3%	.0%	.8%	.0%
Control Data Systems	.2	.1	.0	1	.3%	.3%	.1%	.1%
Solbourne	.2	.2	.0	10	.2%	.4%	.0%	1.0%
Other Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Companies	72.0	36.9	21.2	985	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	70.6	35.9	20.9	928	98.0%	97.4%	98.3%	94.2%
All Asian-Based Companies	.8	.8	.0	53	1.1%	2.1%	.0%	5.4%
All European-Based Companies	.7	.2	.4	4	.9%	.5%	1.7%	.4%
All Hardware Companies	19.5	15.2	.0	502	27.0%	41.2%	.0%	51.0%
All Turnkey & SW Companies	52.5	21.7	21.2	483	73.0%	58.8%	100.0%	49.0%

Source: Dataquest (July 1993)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
IBM	65.4	15.8	46.1	4,428	14.6%	6.0%	29.1%	7.6%
NEC	53.1	44.6	4.3	7,902	11.9%	16.9%	2.7%	13.6%
Hakuto	37.9	22.8	15.2	827	8.5%	8.6%	9.6%	1.4%
Fujitsu	36.2	23.2	9.4	1,077	8.1%	8.8%	5.9%	1.9%
Mutoh Industries—No OEM	34.1	20.4	10.2	689	7.6%	7.7%	6.4%	1.2%
Toshiba—No OEM	24.5	12.3	9.8	1,961	5.5%	4.6%	6.2%	3.4%
Hitachi	23.5	11.3	9.9	1,242	5.3%	4.3%	6.2%	2.1%
Autodesk	20.6	.0	20.6	0	4.6%	.0%	13.0%	.0%
Apple Computer	20.2	20.2	.0	3,663	4.5%	7.6%	.0%	6.3%
Andor	10.4	2.6	7.4	80	2.3%	1.0%	4.6%	.1%
Design Automation	10.2	2.0	7.6	214	2.3%	.8%	4.8%	.4%
Wacom	7.7	1.5	5.3	147	1.7%	.6%	3.3%	.3%
Compaq	4.7	4.7	.0	1,016	1.1%	1.8%	.0%	1.8%
Mitsubishi Electric	4.1	2.7	1.4	387	.9%	1.0%	.9%	.7%
Hewlett-Packard	3.9	3.5	.0	990	.9%	1.3%	.0%	1.7%
Swanson Analysis	2.5	.0	2.4	0	.6%	.0%	1.5%	.0%
Mitsui Engineering	2.0	1.4	.4	34	.5%	.5%	.3%	.1%
Digital	2.0	1.9	.0	524	.5%	.7%	.0%	.9%
Anilam Electronics	1.5	.5	1.0	18	.3%	.2%	.6%	.0%
Cimatron	1.1	.5	.5	56	.2%	.2%	.3%	.1%
Point Control	1.0	.0	.8	0	.2%	.0%	.5%	.0%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
ADRA Systems	1.0	.0	.8	0	.2%	.0%	.5%	.0%
CADKEY	.9	.0	.9	0	.2%	.0%	.6%	.0%
CNC Software	.7	.0	.7	0	.2%	.0%	.4%	.0%
Sharp System Products—No OEM	.6	.3	.3	17	.1%	.1%	.2%	.0%
Whessoe Computing Systems	.5	.0	.5	0	.1%	.0%	.3%	.0%
Moda CAD	.4	.1	.3	4	.1%	.0%	.2%	.0%
Intergraph	.4	.0	.4	0	.1%	.0%	.3%	.0%
Computervision	.4	.0	.4	0	.1%	.0%	.2%	.0%
CADWorks	.3	.0	.3	0	.1%	.0%	.2%	.0%
Investronica SA	.3	.2	.0	12	.1%	.1%	.0%	.0%
MacNeal-Schwendler	.3	.0	.3	0	.1%	.0%	.2%	.0%
MCS	.3	.0	.3	0	.1%	.0%	.2%	.0%
Superdraft	.3	.1	.1	14	.1%	.0%	.1%	.0%
Aries Technology	.2	.0	.2	0	.0%	.0%	.1%	.0%
Wiechers Datentechnik	.2	.1	.1	7	.0%	.0%	.1%	.0%
Uchida Yoko	.2	.1	.1	9	.0%	.0%	.1%	.0%
Rasna Corporation	.2	.0	.2	0	.0%	.0%	.1%	.0%
CADSI	.1	.0	.1	2	.0%	.0%	.1%	.0%
Pathtrace	.1	.0	.1	2	.0%	.0%	.1%	.0%
Cimlinc	.1	.0	.1	0	.0%	.0%	.1%	.0%
Algor Interactive Systems	.1	.0	.1	0	.0%	.0%	.0%	.0%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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	.1	.0	.1	0	.0%	.0%	.0%	.0%
Softdesk	.1	.0	.1	0	.0%	.0%	.0%	.0%
American Small Business Comp.	.1	.0	.1	0	.0%	.0%	.0%	.0%
IMSI	.0	.0	.0	0	.0%	.0%	.0%	.0%
PAFEC	.0	.0	.0	0	.0%	.0%	.0%	.0%
Mega CADD	.0	.0	.0	0	.0%	.0%	.0%	.0%
Foresight Resources	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	71.8	71.7	.1	32,610	16.1%	27.1%	.0%	56.3%
All Companies	446.2	264.5	158.7	57,933	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	197.8	117.9	75.2	43,237	44.3%	44.6%	47.4%	74.6%
All Asian-Based Companies	244.4	145.2	81.2	14,586	54.8%	54.9%	51.1%	25.2%
All European-Based Companies	3.9	1.4	2.3	110	.9%	.5%	1.5%	.2%
All Hardware Companies	119.3	117.8	.0	43,231	26.7%	44.5%	.0%	74.6%
All Turnkey & SW Companies	326.9	146.7	158.7	14,702	73.3%	55.5%	100.0%	25.4%

Source: Dataquest (July 1993)

CMEC-WW-MS-9303

©1993 Dataquest Incorporated

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

Application: Mechanical
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
IBM	51.9	31.0	10.9	1,903	35.0%	42.0%	22.4%	30.6%
Digital	12.3	8.6	.0	427	8.3%	11.7%	.0%	6.9%
SDRC	9.0	.0	7.2	0	6.0%	.0%	14.8%	.0%
Hewlett-Packard	8.6	5.8	1.4	398	5.8%	7.8%	3.0%	6.4%
Intergraph	7.4	3.4	2.1	116	5.0%	4.5%	4.3%	1.9%
Computervision	6.4	1.9	2.2	2	4.3%	2.5%	4.5%	.0%
Engineering Mechanics	5.1	.3	4.4	408	3.4%	.3%	9.0%	6.6%
EDS	4.6	1.3	2.2	67	3.1%	1.8%	4.4%	1.1%
Apple Computer	4.0	4.0	.0	895	2.7%	5.5%	.0%	14.4%
Control Data Systems	3.2	1.5	.5	43	2.2%	2.1%	1.1%	.7%
Compaq	3.1	3.1	.0	677	2.1%	4.2%	.0%	10.9%
Autodesk	3.0	.0	3.0	0	2.0%	.0%	6.1%	.0%
Sun Microsystems	2.6	2.2	.0	154	1.7%	3.0%	.0%	2.5%
Cimatron	2.5	1.1	1.2	83	1.7%	1.5%	2.4%	1.3%
Delcam International	2.1	.7	1.1	0	1.4%	1.0%	2.2%	.0%
Siemens Nixdorf Info systeme	1.8	.8	.8	27	1.2%	1.1%	1.6%	.4%
PDA Engineering	1.8	.0	1.7	0	1.2%	.0%	3.6%	.0%
Swanson Analysis	1.4	.0	1.3	0	.9%	.0%	2.7%	.0%
Claris	1.3	.0	1.3	0	.9%	.0%	2.7%	.0%
MacNeal-Schwendler	1.3	.0	1.3	0	.9%	.0%	2.7%	.0%
Fides Industrielle Automation	1.2	.4	.5	7	.8%	.5%	1.1%	.1%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
CNC Software	1.2	.0	1.2	0	.8%	.0%	2.4%	.0%
Vero International Software	1.0	.0	.9	0	.7%	.0%	1.8%	.0%
ADRA Systems	.8	.2	.5	0	.6%	.3%	1.1%	.0%
Pathtrace	.6	.1	.4	9	.4%	.2%	.8%	.1%
Point Control	.6	.0	.4	0	.4%	.0%	.9%	.0%
Aries Technology	.5	.0	.5	0	.4%	.0%	1.0%	.0%
Whessoe Computing Systems	.3	.0	.3	0	.2%	.0%	.7%	.0%
Rasna Corporation	.3	.0	.3	0	.2%	.0%	.6%	.0%
Unisys	.3	.1	.1	7	.2%	.2%	.2%	.1%
Superdraft	.3	.1	.1	14	.2%	.1%	.2%	.2%
Investronica SA	.2	.2	.0	8	.1%	.2%	.0%	.1%
Engineering Systems Corp.	.1	.0	.1	0	.1%	.0%	.3%	.0%
Aura CAD/CAM Systems	.1	.0	.1	0	.1%	.0%	.2%	.0%
American Small Business Comp.	.1	.0	.1	0	.1%	.0%	.2%	.0%
Mc2 Engineering Software	.1	.0	.1	0	.1%	.0%	.2%	.0%
Softdesk	.1	.0	.1	0	.0%	.0%	.1%	.0%
Georgia Tech Research Corp.	.1	.0	.1	0	.0%	.0%	.1%	.0%
Algor Interactive Systems	.0	.0	.0	0	.0%	.0%	.1%	.0%
Ziegler Informatics	.0	.0	.0	0	.0%	.0%	.1%	.0%
Innovative Data Design	.0	.0	.0	0	.0%	.0%	.1%	.0%
Moda CAD	.0	.0	.0	0	.0%	.0%	.1%	.0%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Accugraph	.0	.0	.0	1	.0%	.0%	.0%	.0%
Areon	.0	.0	.0	0	.0%	.0%	.0%	.0%
FEA	.0	.0	.0	0	.0%	.0%	.0%	.0%
Foresight Resources	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	7.2	6.8	.1	978	4.8%	9.2%	.2%	15.7%
All Companies	148.6	73.7	48.4	6,224	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	138.4	70.2	43.1	6,076	93.2%	95.3%	89.1%	97.6%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	10.1	3.4	5.3	148	6.8%	4.7%	10.9%	2.4%
All Hardware Companies	35.4	30.3	.1	4,460	23.8%	41.1%	.2%	71.7%
All Turnkey & SW Companies	113.2	43.4	48.3	1,764	76.2%	58.9%	99.8%	28.3%

Source: Dataquest (July 1993)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
IBM	11.1	5.3	4.2	266	17.3%	22.0%	15.5%	22.3%
SDRC	8.5	.0	6.8	0	13.3%	.0%	25.0%	.0%
Hewlett-Packard	8.1	5.3	1.4	233	12.6%	21.9%	5.3%	19.5%
Intergraph	6.2	2.9	1.6	103	9.7%	12.1%	5.7%	8.6%
Computervision	6.1	1.8	2.0	0	9.5%	7.5%	7.1%	.0%
EDS	3.9	1.1	1.8	58	6.0%	4.6%	6.7%	4.8%
Digital	3.2	2.2	.0	155	4.9%	9.0%	.0%	13.0%
Engineering Mechanics	3.0	.2	2.5	144	4.6%	.6%	9.3%	12.0%
Delcam International	2.1	.7	1.1	0	3.3%	3.1%	3.9%	.0%
Sun Microsystems	2.0	1.7	.0	130	3.1%	7.1%	.0%	10.9%
Siemens Nixdorf Info systeme	1.8	.8	.8	27	2.9%	3.3%	2.7%	2.2%
Cimatron	1.6	.7	.7	36	2.5%	3.0%	2.7%	3.0%
PDA Engineering	1.4	.0	1.3	0	2.1%	.0%	4.8%	.0%
Fides Industrielle Automation	1.2	.4	.5	7	1.9%	1.5%	1.9%	.6%
Control Data Systems	1.1	.7	.2	30	1.7%	2.8%	.9%	2.5%
Swanson Analysis	.8	.0	.7	0	1.2%	.0%	2.7%	.0%
ADRA Systems	.6	.2	.4	0	1.0%	.9%	1.4%	.0%
Aries Technology	.5	.0	.4	0	.7%	.0%	1.6%	.0%
Rasna Corporation	.3	.0	.2	0	.4%	.0%	.8%	.0%
Unisys	.2	.1	.1	5	.4%	.5%	.3%	.4%
Autodesk	.2	.0	.2	0	.3%	.0%	.7%	.0%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
MacNeal-Schwendler	.1	.0	.1	0	.2%	.0%	.5%	.0%
Point Control	.1	.0	.0	0	.1%	.0%	.1%	.0%
Georgia Tech Research Corp.	.0	.0	.0	0	.1%	.0%	.1%	.0%
Whessoe Computing Systems	.0	.0	.0	0	.0%	.0%	.1%	.0%
Engineering Systems Corp.	.0	.0	.0	0	.0%	.0%	.1%	.0%
Accugraph	.0	.0	.0	1	.0%	.0%	.0%	.1%
Softdesk	.0	.0	.0	0	.0%	.0%	.1%	.0%
FEA	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Companies	64.2	24.2	27.3	1,194	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	57.4	21.6	24.2	1,125	89.4%	89.1%	88.6%	94.2%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	6.8	2.6	3.1	70	10.6%	10.9%	11.4%	5.8%
All Hardware Companies	6.9	5.4	.1	362	10.8%	22.1%	.2%	30.3%
All Turnkey & SW Companies	57.2	18.9	27.2	832	89.2%	77.9%	99.8%	69.7%

Source: Dataquest (July 1993)

©1993 Dataquest Incorporated

©1993 Dataquest Incorporated

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

Application: Mechanical
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	28.0	17.9	3.5	438	66.2%	66.0%	61.0%	69.1%
Digital	4.8	3.3	.0	0	11.4%	12.2%	.0%	.0%
Control Data Systems	2.0	.8	.3	12	4.8%	3.0%	5.1%	2.0%
MacNeal-Schwendler	.7	.0	.7	0	1.7%	.0%	12.7%	.0%
SDRC	.5	.0	.4	0	1.1%	.0%	6.3%	.0%
PDA Engineering	.5	.0	.4	0	1.1%	.0%	7.5%	.0%
Swanson Analysis	.3	.0	.3	0	.7%	.0%	4.7%	.0%
Unisys	.1	.0	.0	1	.2%	.1%	.5%	.2%
Whessoe Computing Systems	.1	.0	.1	0	.1%	.0%	1.0%	.0%
Intergraph	.0	.0	.0	0	.1%	.0%	.5%	.0%
Georgia Tech Research Corp.	.0	.0	.0	0	.1%	.0%	.5%	.0%
Engineering Systems Corp.	.0	.0	.0	0	.0%	.0%	.2%	.0%
Other Companies	5.3	5.1	.0	182	12.6%	18.6%	.0%	28.7%
All Companies	42.3	27.1	5.7	634	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	42.2	27.1	5.7	634	99.9%	100.0%	99.0%	100.0%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	.1	.0	.1	0	.1%	.0%	1.0%	.0%
All Hardware Companies	10.5	8.5	.1	186	24.9%	31.4%	1.0%	29.3%
All Turnkey & SW Companies	31.7	18.6	5.7	448	75.1%	68.6%	99.0%	70.7%

Source: Dataquest (July 1993)

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

Application: Mechanical
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
IBM	9.3	4.4	3.1	117	60.1%	55.0%	76.5%	54.7%
Digital	3.4	2.4	.0	47	22.2%	29.8%	.0%	22.1%
Intergraph	.9	.4	.2	14	5.5%	5.2%	4.9%	6.4%
EDS	.7	.2	.3	9	4.6%	2.8%	8.1%	4.3%
Sun Microsystems	.6	.5	.0	24	3.7%	5.9%	.0%	11.2%
MacNeal-Schwendler	.4	.0	.4	0	2.5%	.0%	9.5%	.0%
Computervision	.1	.1	.0	2	.8%	.6%	.7%	.7%
Control Data Systems	.1	.0	.0	0	.4%	.4%	.2%	.1%
Hewlett-Packard	.0	.0	.0	1	.2%	.3%	.0%	.4%
Other Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Companies	15.4	7.9	4.1	214	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	15.4	7.9	4.1	214	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	4.1	2.9	.0	74	26.6%	36.9%	.0%	34.5%
All Turnkey & SW Companies	11.3	5.0	4.1	140	73.4%	63.1%	100.0%	65.5%

Source: Dataquest (July 1993)

©1993 Dataquest Incorporated

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

Application: Mechanical
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	4.0	4.0	.0	895	15.1%	28.0%	.0%	21.4%
IBM	3.6	3.4	.0	1,082	13.4%	23.4%	.0%	25.9%
Compaq	3.1	3.1	.0	677	11.7%	21.8%	.0%	16.2%
Autodesk	2.8	.0	2.8	0	10.4%	.0%	24.6%	.0%
Engineering Mechanics	2.2	.1	1.8	265	8.0%	.7%	16.2%	6.3%
Claris	1.3	.0	1.3	0	5.0%	.0%	11.8%	.0%
CNC Software	1.2	.0	1.2	0	4.3%	.0%	10.2%	.0%
Vero International Software	1.0	.0	.9	0	3.6%	.0%	7.8%	.0%
Cimatron	.9	.4	.4	47	3.4%	2.9%	3.7%	1.1%
Digital	.9	.8	.0	224	3.3%	5.4%	.0%	5.4%
Pathtrace	.6	.1	.4	9	2.2%	.8%	3.5%	.2%
Point Control	.5	.0	.4	0	1.9%	.0%	3.5%	.0%
Hewlett-Packard	.5	.4	.0	164	1.8%	3.0%	.0%	3.9%
Swanson Analysis	.3	.0	.3	0	1.2%	.0%	2.7%	.0%
Intergraph	.3	.0	.3	0	1.1%	.0%	2.7%	.0%
Superdraft	.3	.1	.1	14	.9%	.7%	1.0%	.3%
Whessoe Computing Systems	.3	.0	.3	0	.9%	.0%	2.2%	.0%
Investronica SA	.2	.2	.0	8	.8%	1.0%	.2%	.2%
ADRA Systems	.2	.0	.2	0	.7%	.0%	1.4%	.0%
Computervision	.2	.0	.2	0	.7%	.0%	1.6%	.0%
Aura CAD/CAM Systems	.1	.0	.1	0	.4%	.0%	.8%	.0%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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.	.1	.0	.1	0	.3%	.0%	.8%	.0%
Engineering Systems Corp.	.1	.0	.1	0	.3%	.0%	.8%	.0%
Mc2 Engineering Software	.1	.0	.1	0	.3%	.0%	.7%	.0%
Rasna Corporation	.1	.0	.1	0	.2%	.0%	.5%	.0%
Aries Technology	.1	.0	.1	0	.2%	.0%	.4%	.0%
Softdesk	.1	.0	.1	0	.2%	.0%	.4%	.0%
Algor Interactive Systems	.0	.0	.0	0	.1%	.0%	.4%	.0%
Moda CAD	.0	.0	.0	0	.1%	.1%	.3%	.0%
Innovative Data Design	.0	.0	.0	0	.1%	.0%	.4%	.0%
Ziegler Informatics	.0	.0	.0	0	.1%	.0%	.4%	.0%
MacNeal-Schwendler	.0	.0	.0	0	.1%	.0%	.3%	.0%
Areon	.0	.0	.0	0	.1%	.1%	.0%	.0%
FEA	.0	.0	.0	0	.0%	.0%	.0%	.0%
Foresight Resources	.0	.0	.0	0	.0%	.0%	.1%	.0%
Other Companies	1.8	1.8	.1	796	6.9%	12.2%	.8%	19.0%
All Companies	26.7	14.4	11.3	4,182	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	23.5	13.6	9.2	4,104	87.8%	94.5%	81.2%	98.1%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	3.3	.8	2.1	78	12.2%	5.5%	18.8%	1.9%
All Hardware Companies	13.8	13.5	.0	3,839	51.7%	93.7%	.0%	91.8%
All Turnkey & SW Companies	12.9	.9	11.3	343	48.3%	6.3%	100.0%	8.2%

Source: Dataquest (July 1993)

©1993 Dataquest Incorporated

For More Information...

Linda Anderson, Market Research Analyst.....(408) 437-8135

Via fax.....(408) 437-0292

The content of this report represents our interpretation and analysis of information generally available to the public or released by responsible individuals in the subject companies, but is not guaranteed as to accuracy or completeness. It does not contain material provided to us in confidence by our clients. Individual companies reported on and analyzed by Dataquest may be clients of this and/or other Dataquest services. This information is not furnished in connection with a sale or offer to sell securities or in connection with the solicitation of an offer to buy securities. This firm and its parent and/or their officers, stockholders, or members of their families may, from time to time, have a long or short position in the securities mentioned and may sell or buy such securities.

©1993 Dataquest Incorporated—Reproduction Prohibited

Dataquest is a registered trademark of A.C. Nielsen Company 0014987

Dataquest®

a company of The Dun & Bradstreet Corporation

Dataquest®

a company of
The Dun & Bradstreet Corporation

Corporate Headquarters
Dataquest Incorporated
1290 Ridder Park Drive
San Jose, California 95131-2398
United States
Phone: 01-408-437-8000
Facsimile: 01-408-437-0292

Dataquest Incorporated
550 Cochituate Road
Framingham, Massachusetts 01701-9324
United States
Phone: 01-508-370-5555
Facsimile: 01-508-370-6262

Invitational Computer Conferences (ICC)
3990 Westerly Place, Suite 100
Newport Beach, California 92660
United States
Phone: (714) 476-9117
Facsimile: (714) 476-9969

Dataquest Japan Limited
Shinkawa Sanko Building
1-3-17, Shinkawa, Chuo-ku
Tokyo 104
Japan
Phone: 81-3-5566-0411
Facsimile: 81-3-5566-0425

Dataquest Korea
Trade Tower, Suite 3806
159 Samsung-dong
Kangnam-gu, Seoul 135-729
Korea
Phone: 011-82-2-551-1331
Facsimile: 011-82-2-551-1330

European Headquarters
Dataquest Europe Limited
Roussel House, Broadwater Park
Denham, Uxbridge
Middlesex UB9 5HP
England
Phone: 44-895-835050
Facsimile: 44-895-835260/1

Dataquest GmbH
Kronstadter Strasse 9
8000 Munich 80
Germany
Phone: 011-49-89-930-9090
Facsimile: 011-49-89-930-3277

Dataquest Europe SA
Tour Gallieni 2
36, Avenue du General de Gaulle
93175 Bagnolet Cedex
France
Phone: 011-33-1-48-97-3100
Facsimile: 011-33-1-48-97-3400

Representative Agencies in
Bangkok, Hong Kong,
Kronberg, North Sydney,
Singapore, Taipei, and Tel Aviv

N04CMECWW CMECWWMS9303 BH: 1
Corporate Library
Dataquest Incorporated

****
SJ - INTERNAL DISTRIBUTION
****

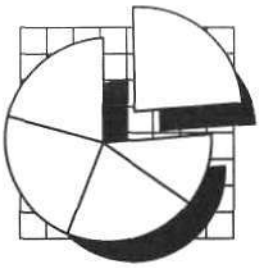
©1993 Dataquest Incorporated
0014987

INFORMATION RESOURCE CENTER
DATAQUEST INCORPORATED
1290 Ridder Park Drive
San Jose, CA 95131-2398
(408) 437-8600

Dataquest®

Software

CAD/CAM/CAE and GIS Mechanical Forecast



Market Statistics

1993

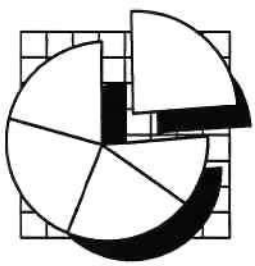
Program: Mechanical Applications Worldwide
Product Code: CMEC-WW-MS-9302
Publication Date: May 17, 1993

INFORMATION RESOURCE CENTER
DATAQUEST INCORPORATED
1290 Ridder Park Drive
San Jose, CA 95131-2398
(408) 437-8600

Dataquest®

Software

CAD/CAM/CAE and GIS Mechanical Forecast



Market Statistics

1993

Program: Mechanical Applications Worldwide
Product Code: CMEC-WW-MS-9302
Publication Date: May 17, 1993

Table of Contents

	Page
Worldwide Forecast Assumptions	1
Worldwide Forecast Drivers	1
Macro Economy	2
Currency	2
Technology	5
Indispensability	5
Late Buyers	5
Desktop Dominance	5
Unbundling of Software	5
Replacement Market	5
Software	5
North American Forecast Drivers	7
Capital Spending	7
Cuts in Defense Spending	7
European Forecast Drivers	8
Recession	8
Growth	8
Asian Forecast Drivers	8
Capital Spending	8
Business Confidence	8
Software Leads Hardware	9
Application Forecast Assumptions	9
Mechanical Forecast Assumptions	9
Software Price	9
Hardware Price Erosion	10
Second-Tier Products	11
Hardware Performance	11
Modeling Technologies	11
Technology Dependence	11
Manufacturing Industry	11
Europe	12

©1993 Dataquest Incorporated

Table of Contents (Continued)

	Page
AEC Forecast Assumptions	12
Untapped Users	12
Mandates for CAD	12
Electronic Partnering	12
Competitive Advantage	12
Software Leverage	12
New Functionality	13
Europe	13
Growth Inhibitors to the AEC CAD Industry	13
Low Payoff to Users	13
Lack of Interoperability	13
Low-Cost Solutions	13
Late Adopters	13
GIS Forecast Assumptions	13
Low Penetration	14
New Technologies	14
New Applications in Industries Such As Retail and Insurance Will Drive Growth	14
Easier and Less Expensive GIS	14
Solutions Filling a Need	14
The U.S. Government	15
Growth Inhibitors to the GIS Market	15
High Cost	15
Stuck Projects	15
Price Pressure	15
Europe	15
EDA Forecast Assumptions	16
New Tool Technologies	16
Analysis Tools	16
Migration of IC Layout	16
Europe	16
Growth Inhibitors to the EDA Market	16
Transition and Shifts	16

 ©1993 Dataquest Incorporated

Table of Contents (Continued)

	Page
Legal Issues	16
Use of PC-Based Tools Will Drop Significantly	17
Forecast Methodology	17
Forecast Accuracy	17
Segmentation Definitions	21
Applications	22
Mechanical	22
Architecture, Engineering, and Construction (AEC)	22
Geographic Information Systems (GIS)/Mapping	22
Electronic Design Automation (EDA)	22
Regions	23
North America	23
Europe	23
Asia	23
Rest of World	23
Platforms	23
Technical Workstation	23
Host-Dependent	23
Server	23
Personal Computer	24
Line Items	24

©1993 Dataquest Incorporated

List of Figures

Figure		Page
1	Worldwide and Regional Revenue Forecast, All Applications and All Platforms	3
2	Worldwide Revenue Forecast, by Platform, All Applications	4
3	Unit Seat Shipments versus Retirements Forecast	7
4	Software Revenue Distribution Forecast, by Application	9
5	Worldwide Software Revenue Forecast, by Application	10
6	1992 Actual Total Revenue versus Dataquest 1988 Forecast for 1992	18
7	1992 Actual Unit Shipments versus Dataquest 1988 Forecast for 1992	19
8	1992 Actual Installed Base versus Dataquest 1988 Forecast for 1992	20
9	CAD/CAM/CAE and GIS Forecasting Model	21

 ©1993 Dataquest Incorporated

List of Tables

Table		Page
1	CAD/CAM/CAE and GIS Forecast, by Region	2
2	CAD/CAM/CAE and GIS Software Revenue Forecast, by Application	6
	Mechanical	
	Worldwide	
3	All Platforms	26
4	Technical Workstation	27
5	Host-Dependent	28
6	Server	29
7	Personal Computer	30
	North America	
8	All Platforms	31
9	Technical Workstation	32
10	Host-Dependent	33
11	Server	34
12	Personal Computer	35
	Europe	
13	All Platforms	36
14	Technical Workstation	37
15	Host-Dependent	38
16	Server	39
17	Personal Computer	40
	Asia	
18	All Platforms	41
19	Technical Workstation	42
20	Host-Dependent	43
21	Server	44
22	Personal Computer	45
	Rest of World	
23	All Platforms	46
24	Technical Workstation	47

Note: All tables show estimated data.

©1993 Dataquest Incorporated

List of Tables (Continued)

Table		Page
25	Host-Dependent	48
26	Server	49
27	Personal Computer	50

Note: All tables show estimated data.

©1993 Dataquest Incorporated

CAD/CAM/CAE and GIS Mechanical 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.

©1993 Dataquest Incorporated

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

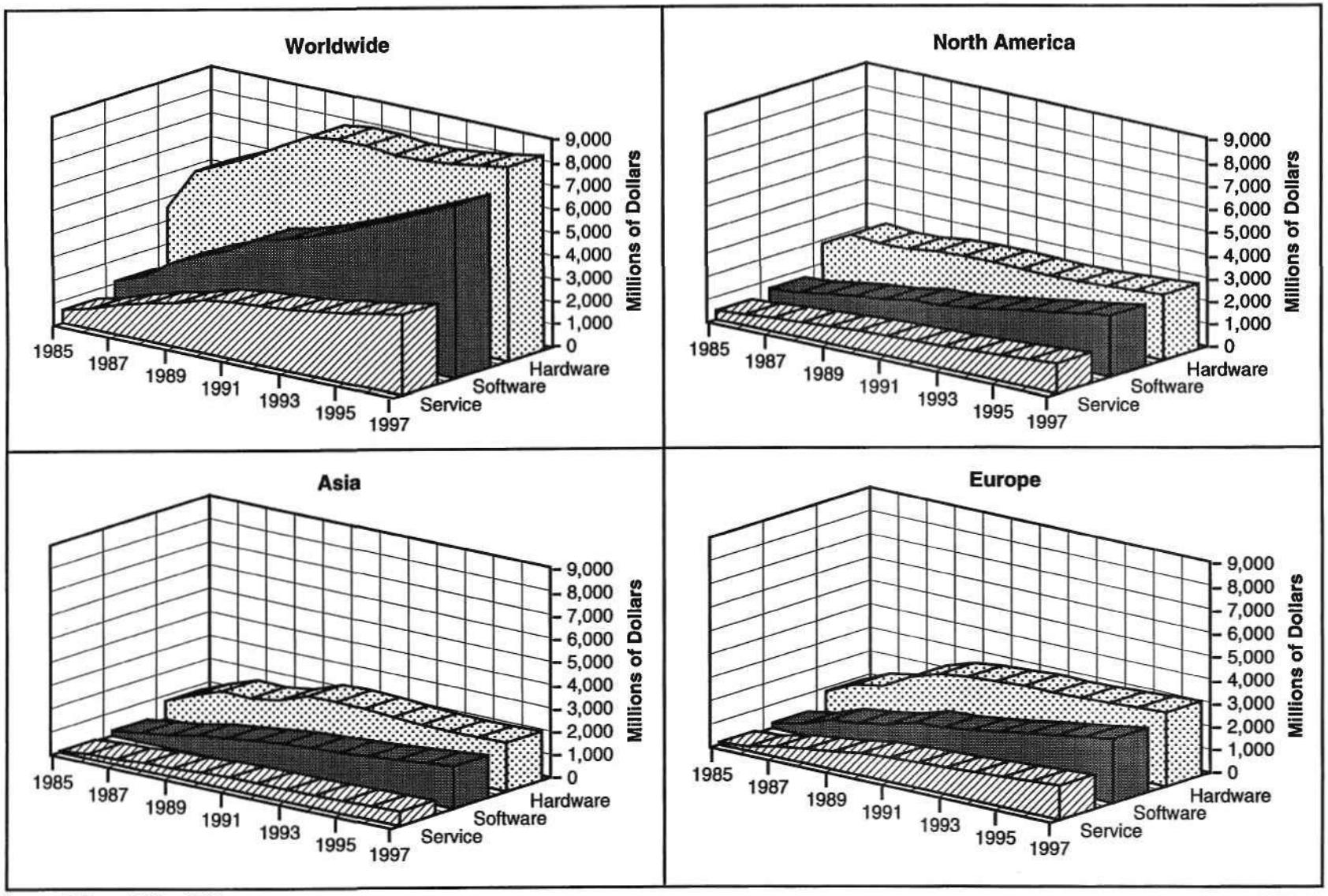
The recovery with renewed optimism from worldwide recession and increased capital spending will fuel growth gradually, beginning in the United States and the United Kingdom, and in Asian countries other than Japan.

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.

©1993 Dataquest Incorporated

Figure 1
Worldwide and Regional Revenue Forecast, All Applications and All Platforms

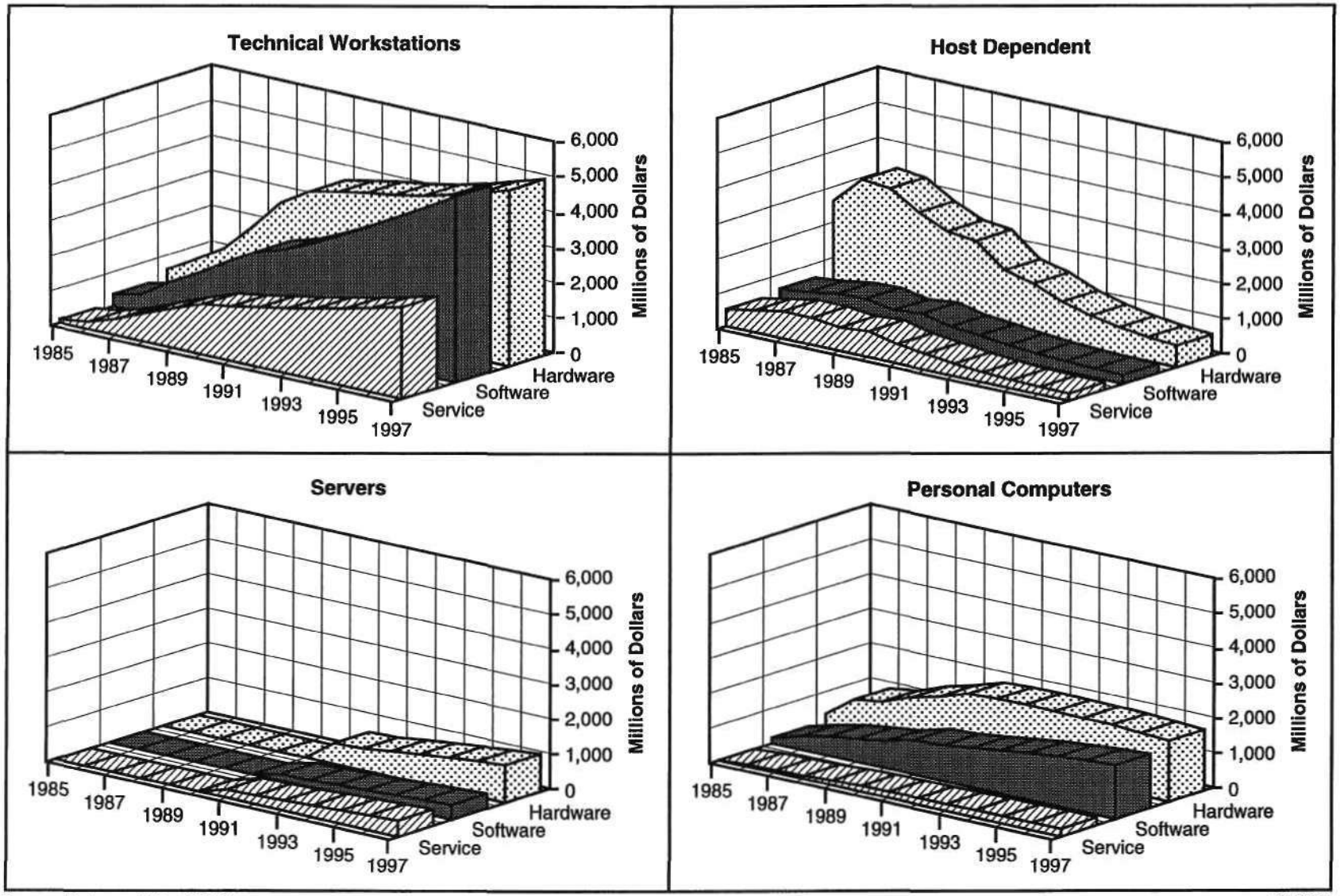


Source: Dataquest (May 1993)

G3000521

©1993 Dataquest Incorporated

Figure 2
Worldwide Revenue Forecast, by Platform, All Applications



Source: Dataquest (May 1993)

G3000522

©1993 Dataquest Incorporated

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

 ©1993 Dataquest Incorporated

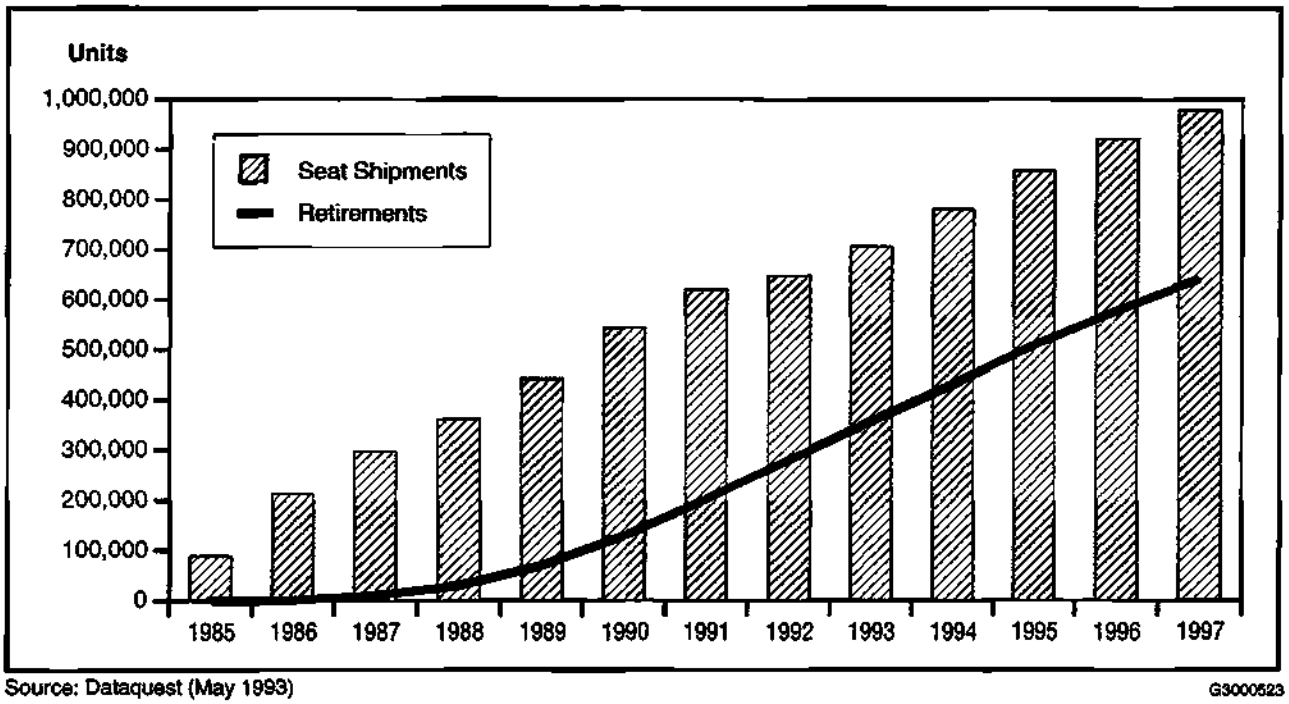
Table 2
CAD/CAM/CAE and GIS Software Revenue Forecast, by Application (Millions of Dollars)

	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)

©1993 Dataquest Incorporated

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.

 ©1993 Dataquest Incorporated

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.

 ©1993 Dataquest Incorporated

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.

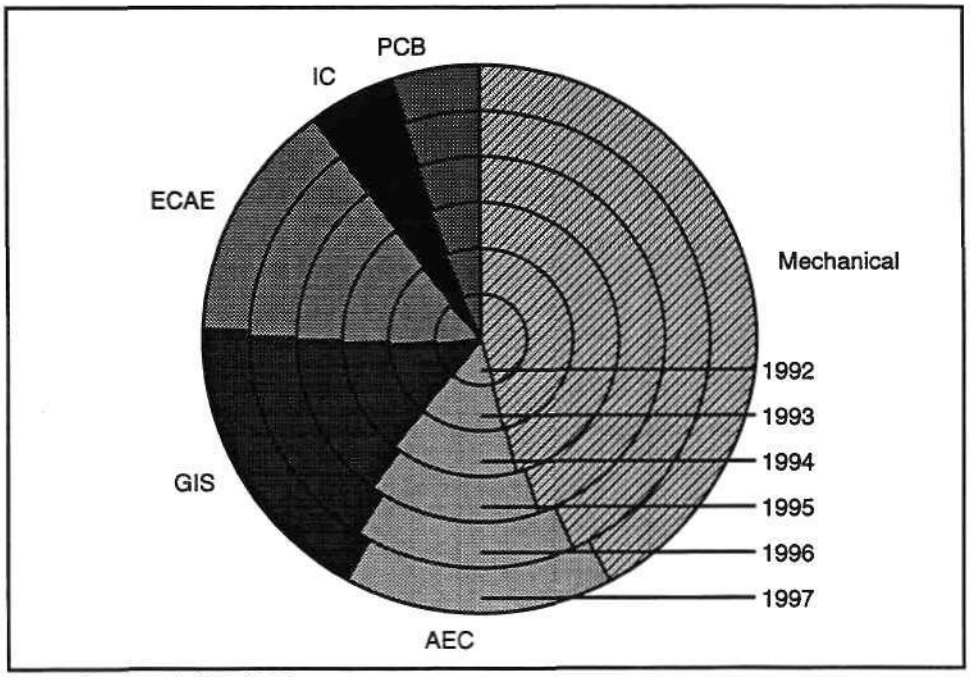
Mechanical Forecast Assumptions

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

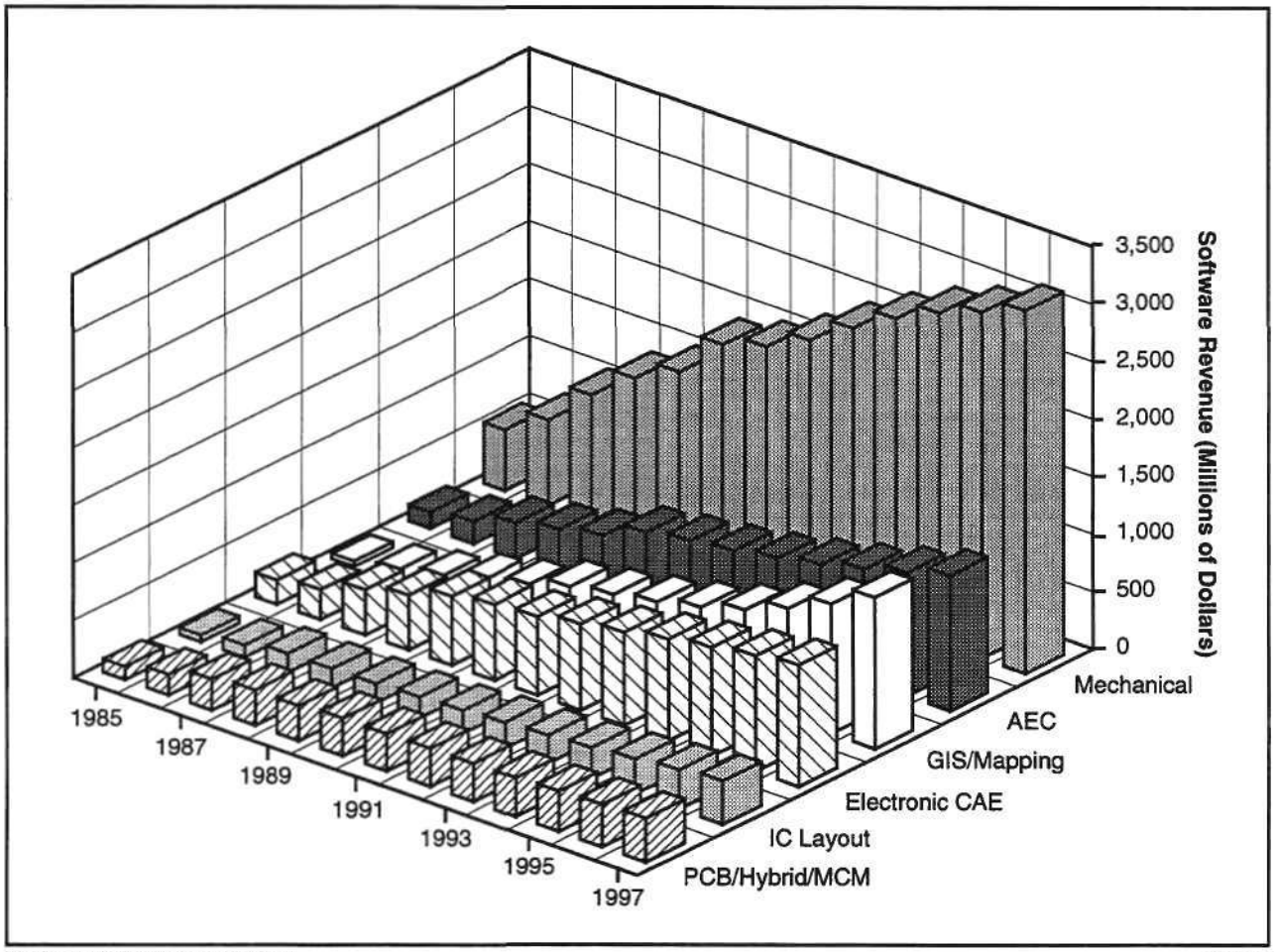


Source: Dataquest (May 1993)

G3000524

©1993 Dataquest Incorporated

Figure 5
Worldwide Software Revenue Forecast, by Application



Source: Dataquest (May 1993)

G3000525

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.

©1993 Dataquest Incorporated

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.

 ©1993 Dataquest Incorporated

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.

 ©1993 Dataquest Incorporated

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.

 ©1993 Dataquest Incorporated

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.

 ©1993 Dataquest Incorporated

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

 ©1993 Dataquest Incorporated

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

 ©1993 Dataquest Incorporated

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

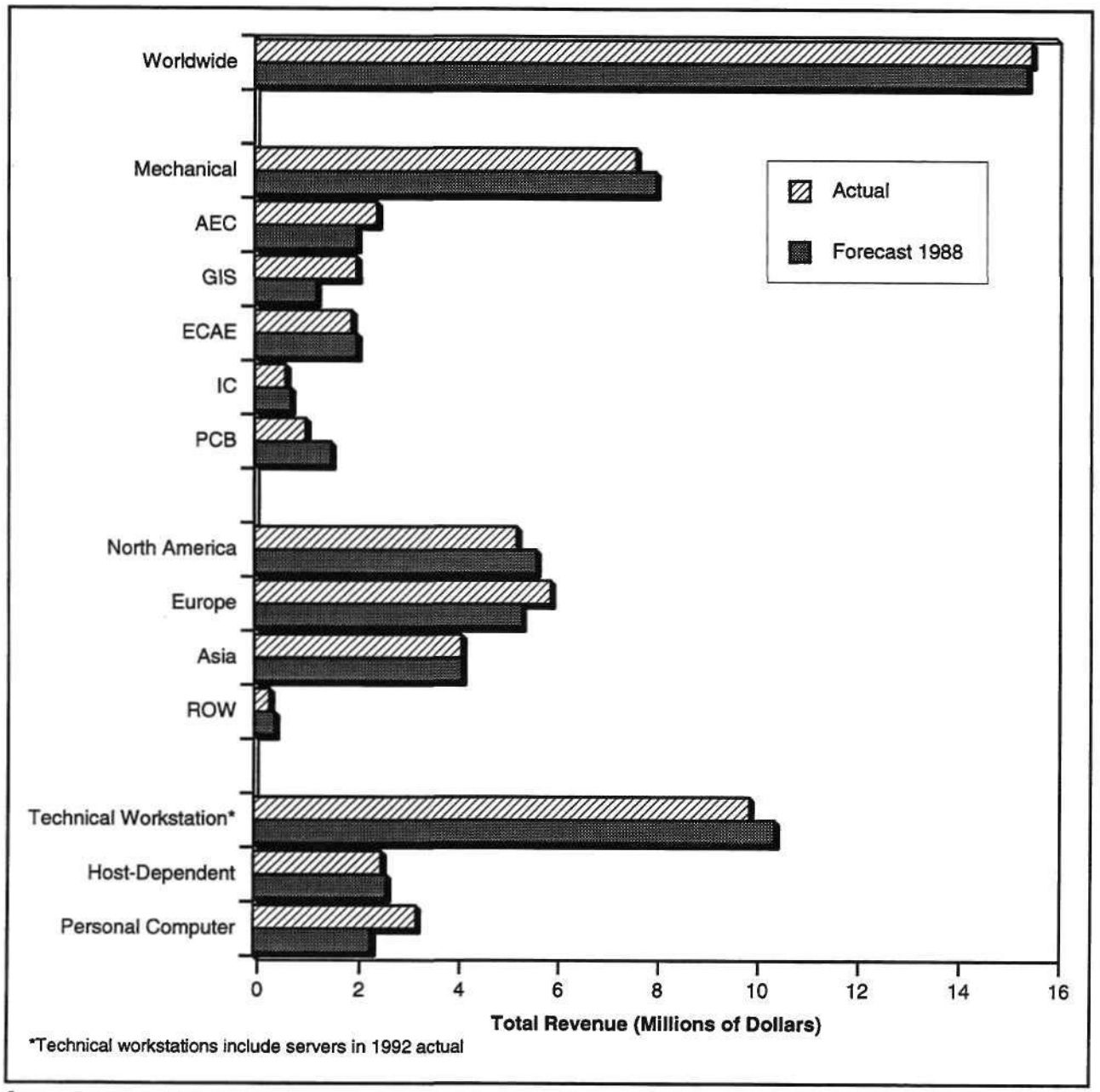
Forecast Accuracy

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.

 ©1993 Dataquest Incorporated

Figure 6
1992 Actual Total Revenue versus Dataquest 1988 Forecast for 1992



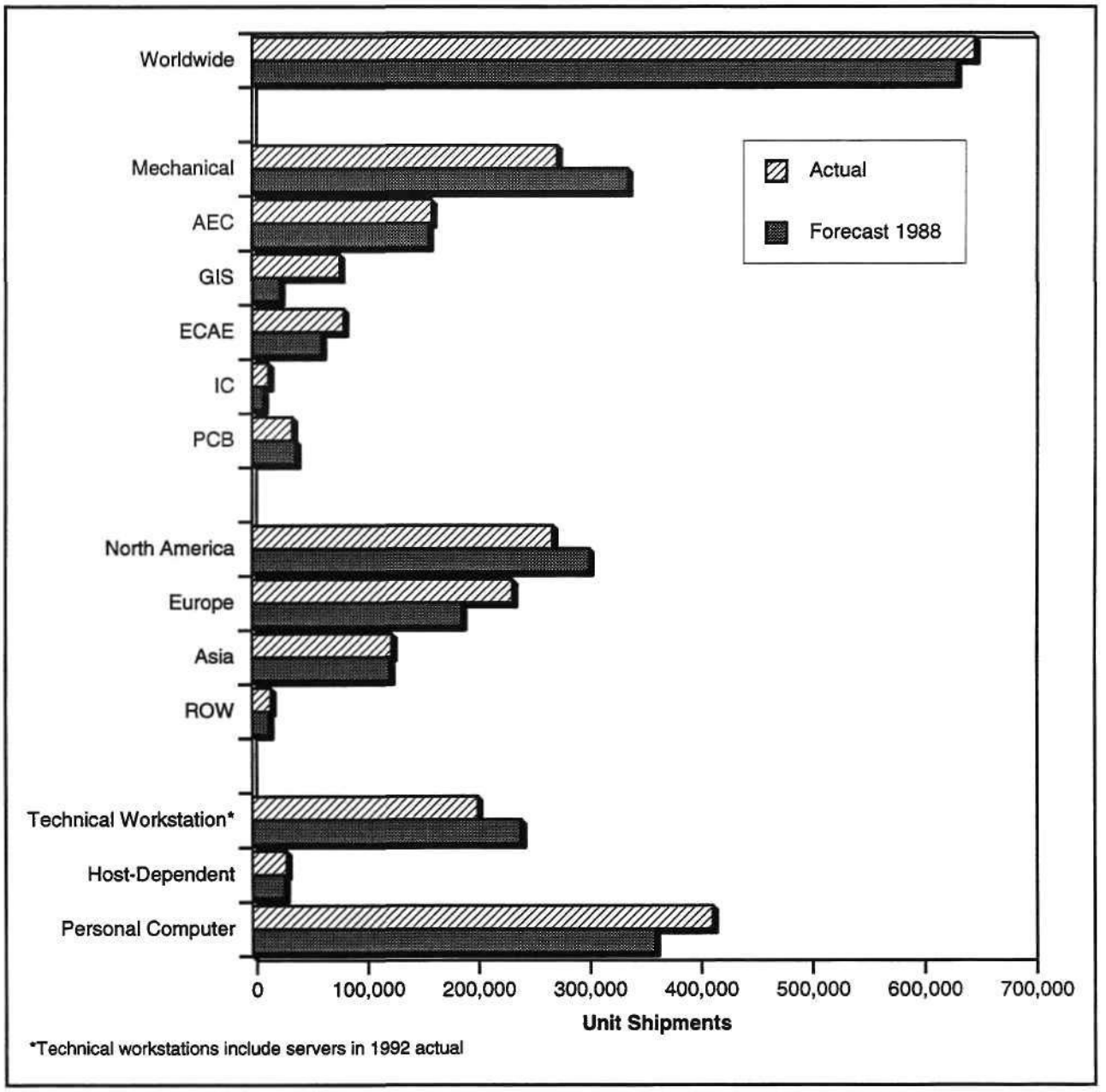
Source: Dataquest (May 1993)

G3000526

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.

©1993 Dataquest Incorporated

Figure 7
1992 Actual Unit Shipments versus Dataquest 1988 Forecast for 1992



Source: Dataquest (May 1993)

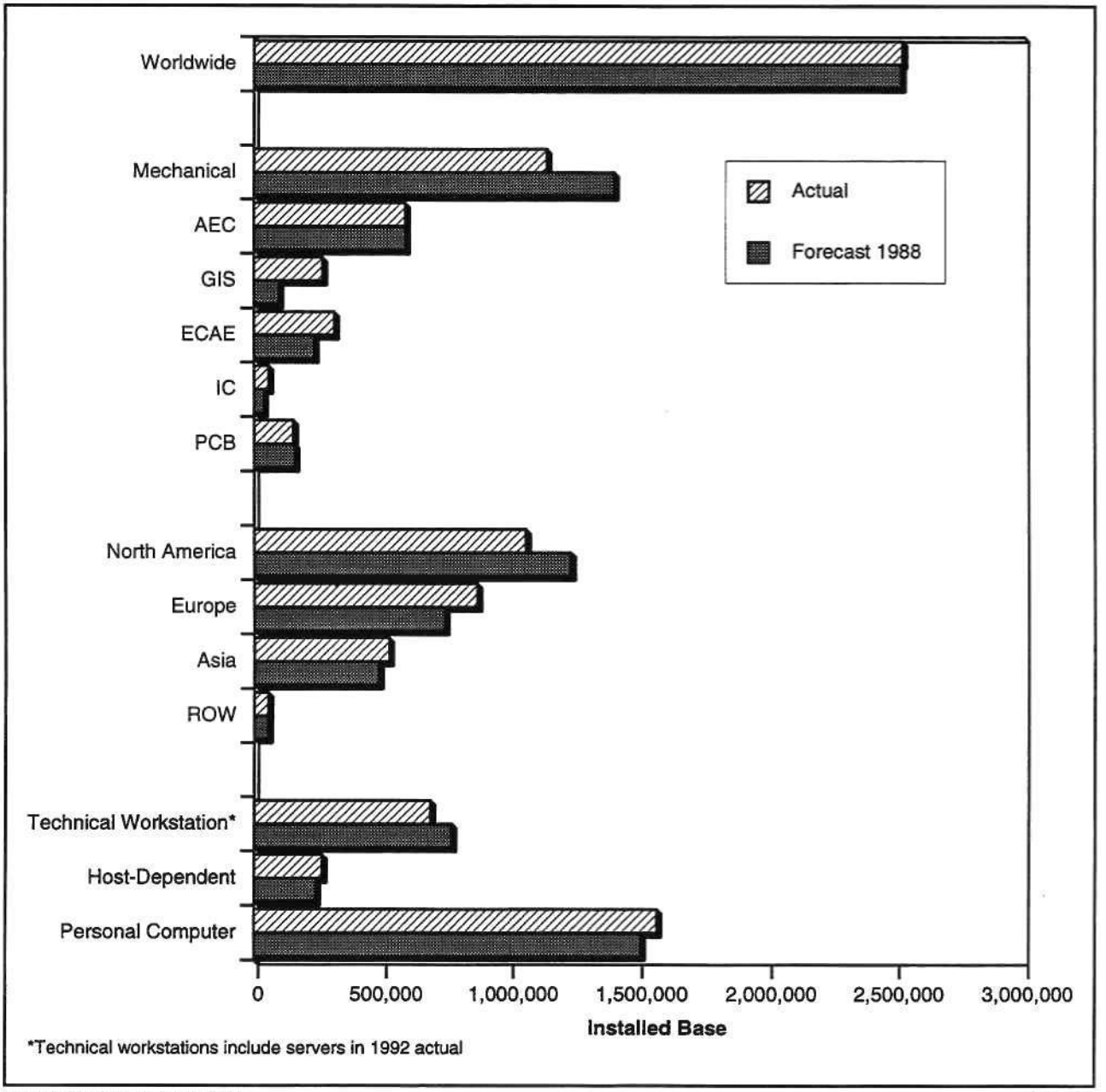
G3000527

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.

©1993 Dataquest Incorporated

Figure 8
1992 Actual Installed Base versus Dataquest 1988 Forecast for 1992



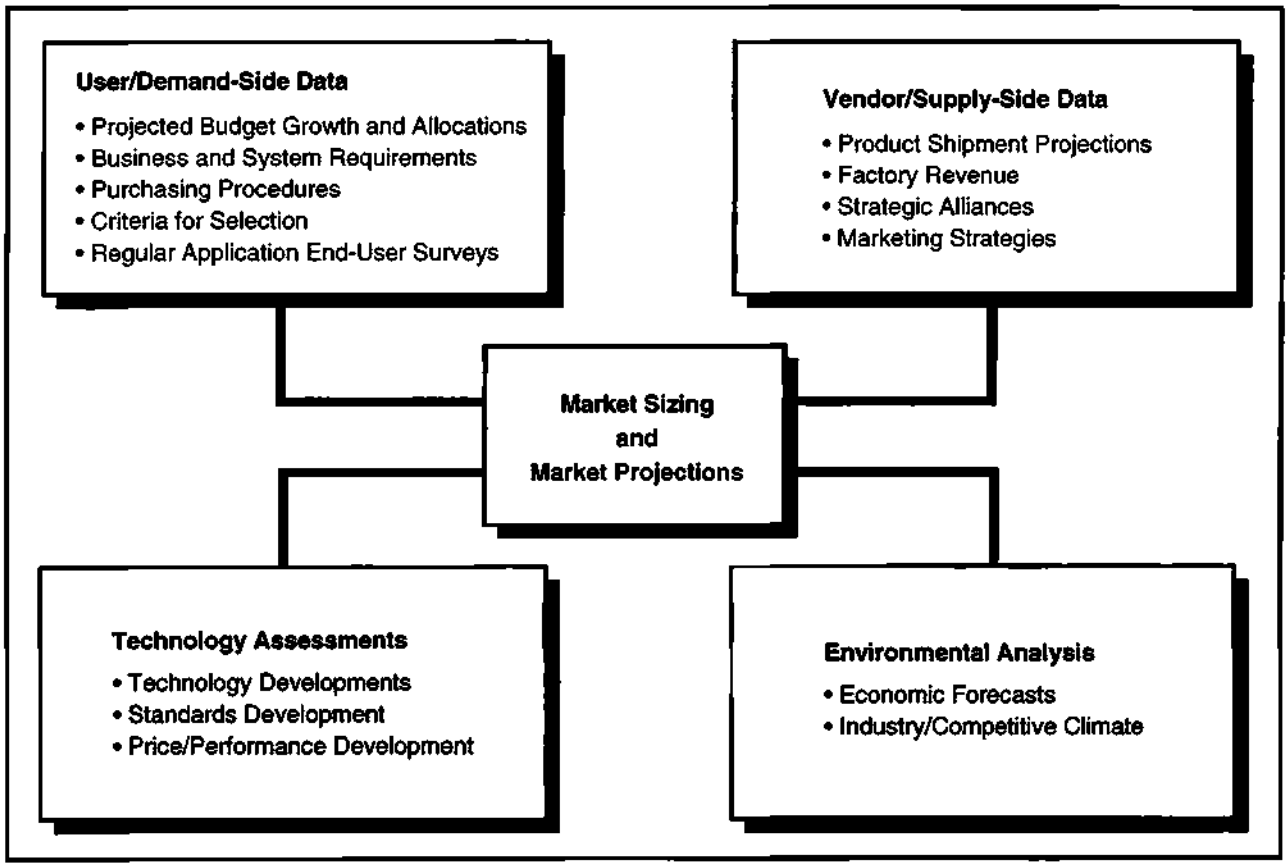
Source: Dataquest (May 1993)

G3000528

- 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.

©1993 Dataquest Incorporated

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.

©1993 Dataquest Incorporated

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.

 ©1993 Dataquest Incorporated

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.

 ©1993 Dataquest Incorporated

- 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.

 ©1993 Dataquest Incorporated

- 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).

©1993 Dataquest Incorporated

Table 3
CAD/CAM/CAE/GIS History and Forecast

Application: Mechanical
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	160,237	179,152	222,040	241,138	257,024	275,490	295,660	311,270	320,790	326,150	13	5
Unit Shipments or Seats	185,167	202,018	247,225	262,934	274,289	290,030	308,390	322,550	331,010	335,670	10	4
CPU Installed Base	418,810	567,893	731,278	877,996	1,006,230	1,123,360	1,235,570	1,336,120	1,422,920	1,494,370	25	8
Installed Seats	519,958	686,170	865,349	1,019,819	1,146,712	1,256,190	1,357,410	1,445,330	1,518,560	1,576,910	22	7
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	86.9	67.9	60.1	52.5	48.0	44.5	42.4	41.1	40.2	39.5	-14	-4
Hardware-Only ASP	10.2	10.9	9.5	9.1	9.0	8.3	7.8	7.4	7.2	7.2	-3	-4
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	3,584	3,799	4,073	4,014	4,070	3,973	3,917	3,854	3,786	3,707	3	-2
CPU Revenue	2,468	2,889	3,199	3,165	3,193	3,143	3,116	3,084	3,042	2,987	7	-1
Terminal Revenue	650	438	361	305	289	247	220	196	178	169	-18	-10
Peripheral Revenue (Turnkey)	465	471	513	543	588	583	581	575	566	552	6	-1
Software Revenue	1,374	1,561	1,930	2,043	2,233	2,469	2,688	2,868	3,007	3,154	13	7
Bundled	763	930	1,113	1,155	1,111	1,119	1,127	1,129	1,123	1,107	10	-0
Unbundled	611	631	817	888	1,122	1,350	1,561	1,739	1,883	2,048	16	13
Service Revenue	856	999	1,166	1,210	1,270	1,323	1,387	1,426	1,461	1,493	10	3
Total Factory Revenue	5,813	6,359	7,169	7,267	7,572	7,766	7,992	8,148	8,254	8,355	7	2
Increase over Prior Year (%)	8	9	13	1	4	3	3	2	1	1		

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

CMEC-WW-MS-9302

©1993 Dataquest Incorporated

May 17, 1993

Table 4
CAD/CAM/CAE/GIS History and Forecast

Application: Mechanical
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	29,640	48,090	60,881	69,838	80,055	89,150	98,720	107,390	114,470	120,550	28	9
Unit Shipments or Seats	29,640	48,090	60,881	69,838	80,055	89,150	98,720	107,390	114,470	120,550	28	9
CPU Installed Base	64,998	109,958	164,431	222,108	282,347	341,420	399,830	454,320	504,960	551,940	44	14
Installed Seats	64,998	109,958	164,431	222,108	282,347	341,420	399,830	454,320	504,960	551,940	44	14
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	56.4	52.5	47.4	46.3	42.5	40.4	38.8	37.6	36.7	35.8	-7	-3
Hardware-Only ASP	23.4	21.4	20.3	18.4	17.4	15.8	14.5	13.5	13.0	12.6	-7	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	1,056	1,526	1,730	1,839	1,961	2,007	2,041	2,063	2,072	2,063	17	1
CPU Revenue	852	1,239	1,407	1,480	1,558	1,597	1,628	1,649	1,660	1,656	16	1
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	204	287	323	359	403	410	413	414	413	407	19	0
Software Revenue	557	803	1,041	1,165	1,364	1,594	1,803	1,983	2,122	2,273	25	11
Bundled	327	528	638	686	678	703	719	729	733	726	20	1
Unbundled	230	275	403	479	685	891	1,084	1,253	1,389	1,547	31	18
Service Revenue	355	540	629	668	773	846	914	962	1,000	1,036	21	6
Total Factory Revenue	1,968	2,870	3,400	3,672	4,097	4,446	4,757	5,008	5,194	5,372	20	6
Increase over Prior Year (%)	50	46	18	8	12	9	7	5	4	3		

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

©1993 Dataquest Incorporated

©1993 Dataquest Incorporated

Table 5
CAD/CAM/CAE/GIS History and Forecast

Application: Mechanical
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	5,366	7,702	9,078	6,018	4,796	4,430	4,180	3,960	3,850	3,840	-3	-4
Unit Shipments or Seats	30,296	30,568	34,262	27,814	22,061	19,040	17,000	15,340	14,170	13,500	-8	-9
CPU Installed Base	23,607	29,816	36,648	39,583	40,451	40,550	39,800	38,240	36,400	35,250	14	-3
Installed Seats	124,755	148,093	170,719	181,405	180,933	173,380	161,640	147,450	132,040	117,780	10	-8
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	430.1	324.9	263.0	235.0	276.9	260.4	249.8	241.8	233.8	226.5	-10	-4
Hardware-Only ASP	368.2	154.7	138.9	250.3	246.4	222.4	205.3	188.7	173.2	160.3	-10	-8
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	1,882	1,579	1,524	1,127	1,013	862	762	679	619	582	-14	-10
CPU Revenue	1,065	1,019	1,047	735	649	552	486	433	396	371	-12	-11
Terminal Revenue	650	438	361	305	289	247	220	196	178	169	-18	-10
Peripheral Revenue (Turnkey)	167	122	116	86	74	63	56	50	46	43	-18	-10
Software Revenue	530	433	513	410	359	314	286	269	259	254	-9	-7
Bundled	331	313	394	311	266	232	213	200	193	189	-5	-7
Unbundled	199	120	120	99	92	82	73	68	66	64	-17	-7
Service Revenue	467	403	469	372	307	266	240	219	206	198	-10	-8
Total Factory Revenue	2,880	2,416	2,506	1,908	1,678	1,442	1,288	1,166	1,084	1,033	-13	-9
Increase over Prior Year (%)	-11	-16	4	-24	-12	-14	-11	-9	-7	-5		

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

Table 6
CAD/CAM/CAE/GIS History and Forecast

Application: Mechanical
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	5,135	6,234	7,730	9,340	10,730	12,000	12,880	NA	16
Unit Shipments or Seats	NA	NA	NA	5,135	6,234	7,730	9,340	10,730	12,000	12,880	NA	16
CPU Installed Base	NA	NA	NA	5,135	11,369	18,720	27,160	35,480	43,880	50,170	NA	35
Installed Seats	NA	NA	NA	5,135	11,369	18,720	27,160	35,480	43,880	50,170	NA	35
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	NA	NA	NA	131.5	116.7	110.3	105.4	101.0	96.5	92.6	NA	-5
Hardware-Only ASP	NA	NA	NA	35.2	33.3	30.4	27.8	26.4	25.6	25.0	NA	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	NA	NA	NA	272	310	358	400	428	446	449	NA	8
CPU Revenue	NA	NA	NA	239	269	309	346	370	388	393	NA	8
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	NA	NA	NA	33	41	49	55	58	58	57	NA	7
Software Revenue	NA	NA	NA	83	100	124	147	163	173	177	NA	12
Bundled	NA	NA	NA	65	81	100	118	128	132	131	NA	10
Unbundled	NA	NA	NA	18	20	24	30	35	41	46	NA	19
Service Revenue	NA	NA	NA	98	111	132	151	164	175	179	NA	10
Total Factory Revenue	NA	NA	NA	453	522	614	699	755	794	806	NA	9
Increase over Prior Year (%)	NA	NA	NA	NA	15	18	14	8	5	2		

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

©1993 Dataquest Incorporated

Table 7
CAD/CAM/CAE/GIS History and Forecast

Application: Mechanical
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	125,231	123,360	152,081	160,147	165,938	174,180	183,420	189,180	190,470	188,870	7	3
Unit Shipments or Seats	125,231	123,360	152,081	160,147	165,938	174,120	183,330	189,080	190,360	188,730	7	3
CPU Installed Base	330,205	428,119	530,198	611,171	672,063	722,670	768,780	808,080	837,680	857,020	19	5
Installed Seats	330,205	428,119	530,198	611,171	672,063	722,670	768,780	808,080	837,680	857,020	19	5
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	23.2	20.9	20.2	15.6	15.3	13.7	12.4	11.8	11.3	10.9	-10	-7
Hardware-Only ASP	4.4	4.8	4.5	4.1	4.0	3.7	3.4	3.2	3.0	2.9	-2	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	645	693	819	776	786	747	713	684	649	613	5	-5
CPU Revenue	551	631	745	710	716	685	656	631	600	567	7	-5
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	94	63	75	65	70	62	57	53	49	46	-7	-8
Software Revenue	287	324	376	386	410	437	452	453	453	450	9	2
Bundled	104	88	81	93	86	84	77	71	66	60	-5	-7
Unbundled	182	236	295	293	325	353	375	382	387	390	16	4
Service Revenue	33	56	68	72	79	80	82	81	81	80	24	0
Total Factory Revenue	965	1,073	1,263	1,233	1,275	1,264	1,247	1,219	1,183	1,143	7	-2
Increase over Prior Year (%)	15	11	18	-2	3	-1	-1	-2	-3	-3		

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

©1993 Dataquest Incorporated

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

Application: Mechanical
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	82,180	73,761	80,278	90,080	100,832	110,530	118,520	125,510	129,050	130,950	5	5
Unit Shipments or Seats	91,105	81,180	89,787	98,166	106,093	114,900	122,290	128,940	132,230	133,960	4	5
CPU Installed Base	220,676	277,451	325,754	366,114	402,621	440,210	481,500	523,180	560,750	590,900	16	8
Installed Seats	267,027	326,903	378,681	419,438	452,624	485,110	520,710	556,800	588,840	613,900	14	6
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	90.7	77.1	74.7	57.9	50.5	47.6	45.2	43.8	42.8	42.0	-14	-4
Hardware-Only ASP	8.7	10.6	9.8	9.1	8.4	7.7	7.3	7.0	6.9	6.9	-1	-4
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	1,203	1,239	1,209	1,140	1,181	1,181	1,188	1,194	1,189	1,178	-0	-0
CPU Revenue	892	963	937	897	960	973	986	997	997	992	2	1
Terminal Revenue	223	161	160	137	91	72	63	57	52	50	-20	-11
Peripheral Revenue (Turnkey)	88	115	111	106	131	136	139	140	139	137	10	1
Software Revenue	424	467	559	556	624	708	777	837	877	912	10	8
Bundled	156	196	233	202	200	214	223	232	237	241	6	4
Unbundled	268	271	327	354	424	495	554	605	640	671	12	10
Service Revenue	295	335	342	316	348	370	394	412	427	439	4	5
Total Factory Revenue	1,922	2,040	2,110	2,013	2,153	2,259	2,358	2,443	2,493	2,529	3	3
Increase over Prior Year (%)	-8	6	3	-5	7	5	4	4	2	1		

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

©1993 Dataquest Incorporated

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

Application: Mechanical
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	10,140	15,148	16,236	18,794	23,228	26,980	30,850	34,150	36,470	38,710	23	11
Unit Shipments or Seats	10,140	15,148	16,236	18,794	23,228	26,980	30,850	34,150	36,470	38,710	23	11
CPU Installed Base	26,754	40,299	53,575	67,354	83,211	100,070	118,630	137,050	155,140	172,290	33	16
Installed Seats	26,754	40,299	53,575	67,354	83,211	100,070	118,630	137,050	155,140	172,290	33	16
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	47.2	51.1	46.4	40.0	34.8	33.2	31.9	30.9	30.1	29.5	-7	-3
Hardware-Only ASP	27.1	21.4	19.1	18.0	18.3	16.6	15.3	14.4	13.9	13.5	-9	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	323	458	419	422	487	516	541	559	567	573	11	3
CPU Revenue	278	384	350	352	399	424	447	463	471	479	9	4
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	45	74	69	70	89	92	95	96	95	95	19	1
Software Revenue	163	228	292	311	354	426	486	539	575	608	21	11
Bundled	74	115	129	119	115	123	128	134	136	138	12	4
Unbundled	89	113	162	192	239	303	357	405	439	470	28	14
Service Revenue	121	191	174	161	187	211	233	249	261	272	12	8
Total Factory Revenue	607	876	885	894	1,029	1,153	1,260	1,348	1,402	1,453	14	7
Increase over Prior Year (%)	26	44	1	1	15	12	9	7	4	4		

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

©1993 Dataquest Incorporated

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

Application: Mechanical
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	1,751	2,480	2,811	1,470	1,340	1,180	1,110	1,090	1,100	1,130	-6	-3
Unit Shipments or Seats	10,676	9,899	12,319	9,556	6,601	5,540	4,890	4,530	4,280	4,150	-11	-9
CPU Installed Base	10,682	12,100	13,604	13,520	13,065	12,540	11,900	11,160	10,470	10,140	5	-5
Installed Seats	57,034	61,552	66,531	66,843	63,068	57,430	51,110	44,780	38,550	33,140	3	-12
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	360.5	483.8	342.6	296.8	335.5	320.5	307.3	294.5	282.1	270.8	-2	-4
Hardware-Only ASP	462.7	149.4	152.0	263.6	200.1	182.2	167.2	153.3	140.4	129.1	-19	-8
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	613	515	515	346	282	229	200	183	170	163	-18	-10
CPU Revenue	348	320	322	189	174	143	125	114	107	103	-16	-10
Terminal Revenue	223	161	160	137	91	72	63	57	52	50	-20	-11
Peripheral Revenue (Turnkey)	42	33	33	20	17	14	13	12	11	11	-20	-9
Software Revenue	182	135	154	102	101	92	82	80	79	80	-14	-4
Bundled	79	78	101	63	57	53	49	48	48	50	-8	-3
Unbundled	103	57	53	39	44	39	33	32	31	31	-19	-7
Service Revenue	166	128	150	102	96	81	72	67	64	63	-13	-8
Total Factory Revenue	962	778	819	550	478	402	354	330	313	306	-16	-9
Increase over Prior Year (%)	-25	-19	5	-33	-13	-16	-12	-7	-5	-2		

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

©1993 Dataquest Incorporated

©1993 Dataquest Incorporated

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

Application: Mechanical
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	2,234	3,123	4,100	5,090	5,880	6,610	7,090	NA	18
Unit Shipments or Seats	NA	NA	NA	2,234	3,123	4,100	5,090	5,880	6,610	7,090	NA	18
CPU Installed Base	NA	NA	NA	2,234	5,357	9,270	13,900	18,530	23,230	26,830	NA	38
Installed Seats	NA	NA	NA	2,234	5,357	9,270	13,900	18,530	23,230	26,830	NA	38
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	NA	NA	NA	110.7	90.0	86.0	82.4	79.0	75.7	72.6	NA	-4
Hardware-Only ASP	NA	NA	NA	34.2	31.2	28.4	26.1	24.8	24.0	23.5	NA	-5
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	NA	NA	NA	98	126	154	176	190	201	204	NA	10
CPU Revenue	NA	NA	NA	88	110	134	153	166	176	179	NA	10
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	NA	NA	NA	10	16	20	23	24	25	24	NA	9
Software Revenue	NA	NA	NA	26	38	50	61	68	74	77	NA	15
Bundled	NA	NA	NA	18	27	36	44	49	52	52	NA	15
Unbundled	NA	NA	NA	8	11	14	17	20	23	25	NA	18
Service Revenue	NA	NA	NA	37	46	58	68	74	80	83	NA	12
Total Factory Revenue	NA	NA	NA	161	210	262	305	333	355	364	NA	12
Increase over Prior Year (%)	NA	NA	NA	NA	31	25	16	9	7	2		

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

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

Application: Mechanical
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	70,289	56,133	61,231	67,582	73,142	78,270	81,460	84,380	84,870	84,020	1	3
Unit Shipments or Seats	70,289	56,133	61,231	67,582	73,142	78,270	81,460	84,380	84,870	84,020	1	3
CPU Installed Base	183,239	225,051	258,575	283,007	300,989	318,330	337,070	356,440	371,910	381,640	13	5
Installed Seats	183,239	225,051	258,575	283,007	300,989	318,330	337,070	356,440	371,910	381,640	13	5
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	13.8	10.8	19.7	12.3	10.8	9.7	8.7	8.2	7.8	7.5	-6	-7
Hardware-Only ASP	3.7	4.7	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	267	267	274	275	287	282	270	263	251	239	2	-4
CPU Revenue	266	259	265	268	277	273	261	254	243	231	1	-4
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	1	8	9	6	9	9	9	8	8	8	67	-4
Software Revenue	78	104	114	117	132	141	148	149	149	146	14	2
Bundled	2	3	3	2	1	1	1	1	1	1	-9	-5
Unbundled	76	101	111	115	130	139	147	148	148	145	14	2
Service Revenue	8	16	18	16	19	20	21	21	21	21	24	2
Total Factory Revenue	353	386	406	408	437	443	439	433	421	406	5	-1
Increase over Prior Year (%)	10	10	5	1	7	1	-1	-1	-3	-4		

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

CMEC-WW-MS-9302
©1993 Dataquest Incorporated
May 17, 1993

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

Application: Mechanical
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	47,214	62,409	76,977	87,959	93,229	99,040	107,640	113,000	116,790	118,250	19	5
Unit Shipments or Seats	56,271	72,030	86,057	95,902	99,235	104,300	112,400	117,300	120,740	121,960	15	4
CPU Installed Base	116,033	170,944	232,464	294,415	350,107	399,380	445,210	484,250	517,470	543,600	32	9
Installed Seats	145,185	209,174	278,225	344,907	401,082	448,680	491,260	525,970	554,510	576,150	29	8
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	72.8	75.2	68.2	62.7	52.9	48.8	46.4	44.8	43.5	42.5	-8	-4
Hardware-Only ASP	12.5	11.6	9.5	8.5	8.7	8.2	7.6	7.2	6.9	6.9	-9	-5
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	1,310	1,491	1,521	1,541	1,528	1,497	1,483	1,459	1,432	1,388	4	-2
CPU Revenue	929	1,124	1,207	1,224	1,185	1,169	1,165	1,152	1,136	1,104	6	-1
Terminal Revenue	214	186	122	105	114	103	94	84	77	72	-15	-9
Peripheral Revenue (Turnkey)	167	180	192	212	229	226	225	223	220	212	8	-2
Software Revenue	498	614	802	851	939	1,062	1,169	1,244	1,302	1,357	17	8
Bundled	273	380	473	510	462	470	477	481	483	473	14	0
Unbundled	225	234	328	340	478	592	692	763	819	884	21	13
Service Revenue	347	439	555	600	619	655	692	711	728	740	16	4
Total Factory Revenue	2,154	2,544	2,878	2,992	3,086	3,215	3,344	3,414	3,462	3,485	9	2
Increase over Prior Year (%)	31	18	13	4	3	4	4	2	1	1		

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

©1993 Dataquest Incorporated

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

Application: Mechanical
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	12,344	19,246	23,564	28,283	31,655	34,510	37,250	39,580	41,620	42,820	27	6
Unit Shipments or Seats	12,344	19,246	23,564	28,283	31,655	34,510	37,250	39,580	41,620	42,820	27	6
CPU Installed Base	24,034	42,329	63,727	87,625	111,792	134,650	155,870	174,480	191,170	205,130	47	13
Installed Seats	24,034	42,329	63,727	87,625	111,792	134,650	155,870	174,480	191,170	205,130	47	13
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	53.0	53.5	52.5	49.5	42.7	40.8	39.2	38.1	37.1	36.3	-5	-3
Hardware-Only ASP	26.4	20.4	19.7	16.6	16.2	14.8	13.6	12.7	12.3	11.9	-11	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	452	636	724	780	789	797	797	792	787	764	15	-1
CPU Revenue	366	525	605	640	630	636	636	633	629	612	15	-1
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	86	110	119	141	159	161	161	159	158	152	17	-1
Software Revenue	237	350	480	532	639	759	858	930	986	1,042	28	10
Bundled	137	234	310	339	311	323	329	331	332	323	23	1
Unbundled	100	116	170	194	328	436	529	599	654	719	35	17
Service Revenue	156	257	344	375	429	471	506	527	544	557	29	5
Total Factory Revenue	844	1,244	1,548	1,688	1,856	2,027	2,161	2,249	2,317	2,363	22	5
Increase over Prior Year (%)	76	47	24	9	10	9	7	4	3	2		

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

©1993 Dataquest Incorporated

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

Application: Mechanical
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	2,148	2,500	2,982	1,913	1,228	1,200	1,170	1,140	1,130	1,150	-13	-1
Unit Shipments or Seats	11,205	12,122	12,062	9,856	7,234	6,450	5,920	5,430	5,080	4,860	-10	-8
CPU Installed Base	6,878	9,196	11,743	12,921	13,095	12,840	12,330	11,670	10,980	10,580	17	-4
Installed Seats	36,030	47,426	57,504	63,413	64,070	62,140	58,380	53,380	48,020	43,130	15	-8
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	358.0	459.2	282.1	286.0	445.9	417.2	399.8	382.7	365.8	350.7	6	-5
Hardware-Only ASP	419.7	164.2	142.3	221.8	253.4	226.4	208.3	191.4	175.8	162.0	-12	-9
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	679	612	518	384	340	296	267	242	223	211	-16	-9
CPU Revenue	403	387	357	249	203	174	157	142	132	125	-16	-9
Terminal Revenue	214	186	122	105	114	103	94	84	77	72	-15	-9
Peripheral Revenue (Turnkey)	63	39	39	30	22	19	17	15	14	14	-23	-9
Software Revenue	173	157	186	156	123	105	97	93	90	89	-8	-6
Bundled	118	128	151	127	95	80	75	72	71	70	-5	-6
Unbundled	55	29	35	29	28	24	23	21	20	19	-16	-7
Service Revenue	178	162	187	155	114	100	92	85	81	78	-11	-7
Total Factory Revenue	1,031	931	891	695	577	501	457	419	394	378	-14	-8
Increase over Prior Year (%)	10	-10	-4	-22	-17	-13	-9	-8	-6	-4		

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

CMEC-WW-MS-9302

©1993 Dataquest Incorporated

May 17, 1993

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

Application: Mechanical
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	1,561	1,880	2,290	2,750	3,180	3,520	3,770	NA	15
Unit Shipments or Seats	NA	NA	NA	1,561	1,880	2,290	2,750	3,180	3,520	3,770	NA	15
CPU Installed Base	NA	NA	NA	1,561	3,441	5,620	8,100	10,560	13,010	14,820	NA	34
Installed Seats	NA	NA	NA	1,561	3,441	5,620	8,100	10,560	13,010	14,820	NA	34
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	NA	NA	NA	160.4	137.5	132.0	126.8	121.5	116.4	111.8	NA	-4
Hardware-Only ASP	NA	NA	NA	43.0	41.4	37.3	34.2	32.4	31.4	30.8	NA	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	NA	NA	NA	105	119	138	154	166	172	173	NA	8
CPU Revenue	NA	NA	NA	92	103	118	132	143	149	151	NA	8
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	NA	NA	NA	13	16	19	22	23	23	23	NA	7
Software Revenue	NA	NA	NA	34	38	47	55	61	64	64	NA	11
Bundled	NA	NA	NA	28	34	43	50	55	57	57	NA	11
Unbundled	NA	NA	NA	6	4	4	5	6	7	8	NA	16
Service Revenue	NA	NA	NA	40	43	51	58	64	67	69	NA	10
Total Factory Revenue	NA	NA	NA	178	201	235	267	291	303	306	NA	9
Increase over Prior Year (%)	NA	NA	NA	NA	13	17	13	9	4	1		

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

©1993 Dataquest Incorporated

©1993 Dataquest Incorporated

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

Application: Mechanical
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	32,722	40,662	50,430	56,202	58,467	61,050	66,470	69,100	70,520	70,520	16	4
Unit Shipments or Seats	32,722	40,662	50,430	56,202	58,467	61,050	66,470	69,100	70,520	70,520	16	4
CPU Installed Base	85,121	119,419	156,994	192,307	221,779	246,270	268,910	287,540	302,320	313,080	27	7
Installed Seats	85,121	119,419	156,994	192,307	221,779	246,270	268,910	287,540	302,320	313,080	27	7
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	14.3	28.6	25.4	24.0	21.9	19.4	17.5	16.5	15.8	15.2	11	-7
Hardware-Only ASP	4.5	4.9	4.8	4.3	4.2	3.9	3.6	3.4	3.2	3.1	-2	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	178	242	279	272	280	266	265	258	250	240	12	-3
CPU Revenue	160	212	245	243	248	240	239	233	226	217	12	-3
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	18	30	34	29	32	26	26	25	24	23	14	-6
Software Revenue	88	107	136	129	140	152	159	161	162	161	12	3
Bundled	18	18	12	17	21	24	24	23	23	23	4	2
Unbundled	70	89	124	112	119	128	135	137	138	138	14	3
Service Revenue	13	20	24	30	33	34	36	36	36	36	26	2
Total Factory Revenue	279	369	439	431	453	452	459	455	448	438	13	-1
Increase over Prior Year (%)	22	32	19	-2	5	-0	2	-1	-1	-2		

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

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

Application: Mechanical
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	28,248	39,674	60,324	56,955	56,716	59,010	61,890	64,480	66,010	67,390	19	4
Unit Shipments or Seats	34,395	44,984	66,317	62,153	62,463	63,730	65,910	67,860	68,950	70,040	16	2
CPU Installed Base	74,354	108,985	159,140	199,103	231,339	257,820	279,150	295,520	308,270	320,390	33	7
Installed Seats	97,265	136,590	191,255	233,654	267,615	293,610	313,340	327,450	337,280	346,250	29	5
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	107.3	57.3	49.1	43.7	43.7	40.4	38.4	37.2	36.6	36.1	-20	-4
Hardware-Only ASP	11.2	9.8	8.9	11.0	12.2	11.7	10.6	9.8	9.5	9.4	2	-5
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	1,000	1,006	1,282	1,264	1,304	1,239	1,188	1,142	1,103	1,076	7	-4
CPU Revenue	601	757	1,009	992	1,003	955	917	885	857	837	14	-4
Terminal Revenue	193	79	68	53	79	68	60	52	46	44	-20	-11
Peripheral Revenue (Turnkey)	205	170	205	218	223	216	210	205	199	195	2	-3
Software Revenue	437	462	551	607	639	662	699	736	768	814	10	5
Bundled	326	343	398	429	439	424	415	401	388	376	8	-3
Unbundled	112	118	154	178	200	238	284	335	380	438	16	17
Service Revenue	198	210	254	275	287	281	284	282	284	290	10	0
Total Factory Revenue	1,635	1,677	2,087	2,147	2,230	2,183	2,171	2,160	2,155	2,181	8	-0
Increase over Prior Year (%)	8	3	24	3	4	-2	-1	-0	-0	1		

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

©1993 Dataquest Incorporated

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

Application: Mechanical
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	6,617	12,956	20,259	21,667	24,158	26,480	29,260	32,100	34,600	37,040	38	9
Unit Shipments or Seats	6,617	12,956	20,259	21,667	24,158	26,480	29,260	32,100	34,600	37,040	38	9
CPU Installed Base	12,565	25,042	44,209	63,414	83,052	101,800	119,700	136,410	151,390	166,350	60	15
Installed Seats	12,565	25,042	44,209	63,414	83,052	101,800	119,700	136,410	151,390	166,350	60	15
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	78.3	52.6	42.6	46.4	47.7	45.5	43.7	42.3	41.3	40.3	-12	-3
Hardware-Only ASP	13.2	23.8	23.0	21.4	17.3	15.9	14.3	13.2	12.5	12.0	7	-7
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	265	413	569	615	666	673	680	688	692	698	26	1
CPU Revenue	195	315	437	471	516	522	527	534	539	544	28	1
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	71	99	131	144	151	152	153	153	153	154	21	0
Software Revenue	151	217	261	307	354	389	434	484	527	583	24	10
Bundled	112	173	193	220	245	250	253	254	253	252	22	1
Unbundled	39	44	68	87	109	139	181	230	274	331	30	25
Service Revenue	73	84	104	123	149	154	164	172	181	192	19	5
Total Factory Revenue	490	714	934	1,045	1,169	1,216	1,278	1,345	1,399	1,472	24	5
Increase over Prior Year (%)	51	46	31	12	12	4	5	5	4	5		

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

©1993 Dataquest Incorporated

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

Application: Mechanical
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	1,365	2,588	3,164	2,560	2,168	2,010	1,850	1,680	1,580	1,520	12	-7
Unit Shipments or Seats	7,512	7,899	9,157	7,758	7,915	6,790	5,960	5,170	4,620	4,310	1	-11
CPU Installed Base	5,367	7,760	10,497	12,352	13,580	14,510	14,970	14,860	14,450	14,040	26	1
Installed Seats	28,279	35,365	42,612	46,903	49,856	50,310	49,160	46,800	43,450	39,910	15	-4
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	638.9	211.2	216.9	188.8	206.6	194.9	186.7	178.8	171.1	164.2	-25	-4
Hardware-Only ASP	155.2	131.1	84.7	265.5	455.2	347.3	334.4	318.6	300.8	281.9	31	-9
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	543	421	462	375	378	326	285	246	219	201	-9	-12
CPU Revenue	290	295	352	287	265	228	199	172	152	139	-2	-12
Terminal Revenue	193	79	68	53	79	68	60	52	46	44	-20	-11
Peripheral Revenue (Turnkey)	60	47	43	36	34	30	26	22	20	18	-13	-12
Software Revenue	168	136	169	148	132	114	103	93	86	81	-6	-9
Bundled	129	104	138	119	112	97	88	79	72	68	-4	-10
Unbundled	38	32	31	30	20	17	15	15	14	14	-15	-7
Service Revenue	113	106	125	109	93	82	73	64	58	54	-5	-10
Total Factory Revenue	824	663	756	632	602	522	461	403	363	336	-8	-11
Increase over Prior Year (%)	-9	-20	14	-16	-5	-13	-12	-13	-10	-7		

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

©1993 Dataquest Incorporated

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

Application: Mechanical
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	1,216	1,126	1,200	1,330	1,470	1,630	1,750	NA	9
Unit Shipments or Seats	NA	NA	NA	1,216	1,126	1,200	1,330	1,470	1,630	1,750	NA	9
CPU Installed Base	NA	NA	NA	1,216	2,341	3,470	4,650	5,720	6,800	7,520	NA	26
Installed Seats	NA	NA	NA	1,216	2,341	3,470	4,650	5,720	6,800	7,520	NA	26
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	NA	NA	NA	125.2	136.7	131.3	125.9	120.7	115.6	111.0	NA	-4
Hardware-Only ASP	NA	NA	NA	26.9	26.9	25.9	23.3	21.7	20.8	20.3	NA	-5
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	NA	NA	NA	64	61	61	65	65	65	64	NA	1
CPU Revenue	NA	NA	NA	56	52	52	55	56	56	55	NA	1
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	NA	NA	NA	9	9	9	10	10	9	9	NA	-0
Software Revenue	NA	NA	NA	22	23	25	29	32	33	34	NA	7
Bundled	NA	NA	NA	18	19	20	22	22	22	21	NA	2
Unbundled	NA	NA	NA	4	5	6	7	9	11	13	NA	23
Service Revenue	NA	NA	NA	19	20	21	23	23	24	24	NA	4
Total Factory Revenue	NA	NA	NA	106	104	108	117	120	122	122	NA	3
Increase over Prior Year (%)	NA	NA	NA	NA	-2	4	8	3	2	-0		

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

©1993 Dataquest Incorporated

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

Application: Mechanical
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	20,266	24,129	36,901	31,512	29,264	29,330	29,450	29,230	28,200	27,090	10	-2
Unit Shipments or Seats	20,266	24,129	36,901	31,512	29,264	29,260	29,360	29,130	28,100	26,940	10	-2
CPU Installed Base	56,421	76,183	104,434	122,120	132,365	138,030	139,820	138,520	135,640	132,480	24	0
Installed Seats	56,421	76,183	104,434	122,120	132,365	138,030	139,820	138,520	135,640	132,480	24	0
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	33.2	19.7	19.2	14.5	14.3	12.7	11.4	10.8	10.2	9.8	-19	-7
Hardware-Only ASP	7.0	4.7	4.2	4.0	3.6	3.3	3.1	2.9	2.7	2.6	-15	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	191	172	251	209	200	178	158	143	127	113	1	-11
CPU Revenue	117	148	220	179	171	152	136	123	110	99	10	-10
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	74	25	31	30	29	26	22	20	17	14	-21	-13
Software Revenue	119	109	121	131	130	134	132	127	122	116	2	-2
Bundled	84	66	66	73	63	58	52	46	41	36	-7	-11
Unbundled	35	42	55	58	67	76	81	81	81	80	18	4
Service Revenue	12	20	25	24	25	25	24	23	21	20	21	-4
Total Factory Revenue	322	300	397	364	355	337	315	293	271	250	2	-7
Increase over Prior Year (%)	16	-7	32	-8	-3	-5	-7	-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)

©1993 Dataquest Incorporated

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

Application: Mechanical
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	2,596	3,309	4,461	6,145	6,246	6,900	7,600	8,280	8,940	9,560	25	9
Unit Shipments or Seats	3,396	3,824	5,064	6,713	6,497	7,110	7,790	8,450	9,090	9,700	18	8
CPU Installed Base	7,748	10,513	13,919	18,365	22,163	25,950	29,720	33,180	36,430	39,490	30	12
Installed Seats	10,481	13,503	17,188	21,820	25,391	28,790	32,100	35,100	37,930	40,610	25	10
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	70.0	60.5	45.1	34.6	29.0	27.9	27.2	26.5	26.0	25.6	-20	-2
Hardware-Only ASP	18.1	12.9	10.4	8.5	6.7	5.8	5.3	5.0	4.8	4.7	-22	-7
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	71	63	62	69	56	56	58	60	62	64	-6	3
CPU Revenue	46	45	45	52	46	46	48	50	52	54	0	3
Terminal Revenue	20	12	11	11	5	4	3	3	3	3	-30	-12
Peripheral Revenue (Turnkey)	6	6	5	7	6	6	7	7	7	8	-1	6
Software Revenue	15	18	18	29	31	37	43	51	60	71	20	18
Bundled	9	11	9	13	11	12	13	14	15	16	5	9
Unbundled	6	8	8	16	20	25	31	37	44	55	34	22
Service Revenue	15	16	14	18	15	16	18	20	22	25	-0	10
Total Factory Revenue	102	97	94	116	102	109	119	131	144	160	0	9
Increase over Prior Year (%)	-22	-5	-4	24	-12	7	9	10	10	11		

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

©1993 Dataquest Incorporated

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

Application: Mechanical
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	539	739	822	1,095	1,015	1,190	1,360	1,560	1,780	1,980	17	14
Unit Shipments or Seats	539	739	822	1,095	1,015	1,190	1,360	1,560	1,780	1,980	17	14
CPU Installed Base	1,645	2,287	2,920	3,714	4,292	4,900	5,630	6,380	7,260	8,170	27	14
Installed Seats	1,645	2,287	2,920	3,714	4,292	4,900	5,630	6,380	7,260	8,170	27	14
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	38.6	46.4	35.4	34.9	29.4	28.1	26.9	26.1	25.5	24.9	-7	-3
Hardware-Only ASP	24.4	11.5	16.0	12.6	14.0	12.7	11.7	11.0	10.6	10.3	-13	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	16	19	18	22	19	20	22	24	27	28	4	9
CPU Revenue	13	15	15	17	14	16	17	19	21	22	3	9
Terminal Revenue	0	0	0	0	0	0	0	0	0	0	NA	NA
Peripheral Revenue (Turnkey)	3	4	3	5	4	5	5	5	6	6	8	9
Software Revenue	6	9	8	15	17	21	25	30	35	39	30	19
Bundled	3	6	6	8	7	8	9	10	12	13	19	13
Unbundled	2	2	3	6	10	13	16	19	23	26	41	22
Service Revenue	5	8	7	9	8	10	11	13	15	16	11	15
Total Factory Revenue	27	36	33	46	43	51	58	67	76	83	12	14
Increase over Prior Year (%)	18	34	-9	40	-7	17	15	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)

©1993 Dataquest Incorporated

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

Application: Mechanical
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	103	134	121	76	59	50	50	50	50	50	-13	-3
Unit Shipments or Seats	903	649	723	644	311	260	230	210	190	190	-23	-9
CPU Installed Base	679	760	804	790	711	660	610	560	510	490	1	-7
Installed Seats	3,412	3,750	4,073	4,246	3,939	3,500	2,990	2,480	2,010	1,610	4	-16
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	482.0	601.0	377.4	351.9	359.8	343.7	329.6	315.8	302.5	290.4	-7	-4
Hardware-Only ASP	522.2	182.5	217.9	313.0	216.4	197.0	180.9	165.8	151.8	139.7	-20	-8
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	46	32	28	22	13	11	10	9	8	7	-27	-11
CPU Revenue	24	18	15	10	8	6	6	5	5	4	-25	-11
Terminal Revenue	20	12	11	11	5	4	3	3	3	3	-30	-12
Peripheral Revenue (Turnkey)	3	2	1	1	1	1	1	0	0	0	-27	-10
Software Revenue	7	5	5	4	4	3	3	3	3	3	-16	-4
Bundled	5	4	3	3	2	2	2	2	2	2	-19	-3
Unbundled	2	2	1	1	1	1	1	1	1	1	-12	-4
Service Revenue	10	7	7	5	4	4	3	3	3	3	-19	-9
Total Factory Revenue	64	44	39	31	21	18	16	15	13	13	-24	-9
Increase over Prior Year (%)	-33	-31	-11	-20	-32	-15	-10	-9	-9	-2		

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

©1993 Dataquest Incorporated

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

Application: Mechanical
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	124	106	130	170	200	240	270	NA	21
Unit Shipments or Seats	NA	NA	NA	124	106	130	170	200	240	270	NA	21
CPU Installed Base	NA	NA	NA	124	230	360	510	670	850	1,000	NA	34
Installed Seats	NA	NA	NA	124	230	360	510	670	850	1,000	NA	34
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	NA	NA	NA	81.7	96.8	92.5	88.7	85.0	81.4	78.1	NA	-4
Hardware-Only ASP	NA	NA	NA	33.1	32.9	30.0	27.5	26.1	25.3	24.8	NA	-5
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	NA	NA	NA	5	4	5	6	7	7	8	NA	13
CPU Revenue	NA	NA	NA	4	4	5	5	6	7	7	NA	13
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	9
Software Revenue	NA	NA	NA	2	1	2	2	2	2	2	NA	13
Bundled	NA	NA	NA	1	1	1	1	1	1	1	NA	7
Unbundled	NA	NA	NA	0	0	0	1	1	1	1	NA	25
Service Revenue	NA	NA	NA	2	2	2	2	3	3	3	NA	14
Total Factory Revenue	NA	NA	NA	9	7	9	10	12	13	14	NA	13
Increase over Prior Year (%)	NA	NA	NA	NA	-16	17	15	14	11	9		

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

©1993 Dataquest Incorporated

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

Application: Mechanical
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	1,954	2,436	3,518	4,850	5,066	5,530	6,020	6,470	6,870	7,250	27	7
Unit Shipments or Seats	1,954	2,436	3,518	4,850	5,066	5,530	6,020	6,470	6,870	7,250	27	7
CPU Installed Base	5,423	7,466	10,194	13,736	16,930	20,030	22,980	25,570	27,810	29,820	33	12
Installed Seats	5,423	7,466	10,194	13,736	16,930	20,030	22,980	25,570	27,810	29,820	33	12
CALCULATED AVERAGE SELLING PRICE DATA (Thousands of U.S. Dollars)												
Turnkey ASP	10.0	9.7	6.2	4.8	4.8	4.3	3.9	3.7	3.5	3.3	-17	-7
Hardware-Only ASP	4.5	5.1	4.5	4.2	4.0	3.7	3.4	3.2	3.0	2.9	-3	-6
REVENUE DATA (Millions of U.S. Dollars)												
Hardware Revenue	9	12	16	20	20	20	20	20	20	21	21	1
CPU Revenue	9	12	16	20	20	20	20	20	20	20	22	1
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	-1	-5
Software Revenue	2	5	5	9	10	11	13	16	20	27	48	23
Bundled	0	1	0	1	1	1	1	0	0	0	15	-11
Unbundled	2	4	5	8	9	10	13	15	20	26	54	24
Service Revenue	0	1	1	1	1	1	1	2	2	2	54	19
Total Factory Revenue	11	18	22	30	31	32	35	38	42	50	28	10
Increase over Prior Year (%)	-15	54	23	38	2	5	8	8	12	18		

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

©1993 Dataquest Incorporated

For More Information...

Linda Anderson, Market Research Analyst.....(408) 437-8135

Via fax.....(408) 437-0292

The content of this report represents our interpretation and analysis of information generally available to the public or released by responsible individuals in the subject companies, but is not guaranteed as to accuracy or completeness. It does not contain material provided to us in confidence by our clients. Individual companies reported on and analyzed by Dataquest may be clients of this and/or other Dataquest services. This information is not furnished in connection with a sale or offer to sell securities or in connection with the solicitation of an offer to buy securities. This firm and its parent and/or their officers, stockholders, or members of their families may, from time to time, have a long or short position in the securities mentioned and may sell or buy such securities.

©1993 Dataquest Incorporated—Reproduction Prohibited

Dataquest is a registered trademark of A.C. Nielsen Company 0014738

Dataquest®

a company of The Dun & Bradstreet Corporation

Dataquest®

a company of
The Dun & Bradstreet Corporation

Dataquest Incorporated
1290 Ridder Park Drive
San Jose, California 95131-2398
United States
Phone: 01-408-437-8000
Facsimile: 01-408-437-0292

Dataquest Incorporated
550 Cochituate Road
Framingham, Massachusetts 01701-9324
United States
Phone: 01-508-370-5555
Facsimile: 01-508-370-6262

Invitational Computer Conferences (ICC)
3990 Westerly Place, Suite 100
Newport Beach, California 92660
United States
Phone: (714) 476-9117
Facsimile: (714) 476-9969

Dataquest Japan Limited
Shinkawa Sanko Building
1-3-17, Shinkawa, Chuo-ku
Tokyo 104
Japan
Phone: 81-3-5566-0411
Facsimile: 81-3-5566-0425

Dataquest Korea
Dacheung Building, Room 1105
648-23 Yorksam-dong
Kangnam-gu, Seoul 135-080
Korea
Phone: 011-82-2-556-4166
Facsimile: 011-82-2-552-2661

European Headquarters
Dataquest Europe Limited
Roussel House, Broadwater Park
Denham, Uxbridge
Middlesex UB9 5HP
England
Phone: 44-895-835050
Facsimile: 44-895-835260/1

Dataquest GmbH
Kronstadter Strasse 9
8000 Munich 80
Germany
Phone: 011-49-89-930-9090
Facsimile: 011-49-89-930-3277

Dataquest Europe SA
Tour Gallieni 2
36, Avenue du General de Gaulle
93175 Bagnolet Cedex
France
Phone: 011-33-1-48-97-3100
Facsimile: 011-33-1-48-97-3400

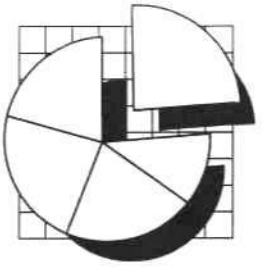
Representative Agencies in
Bangkok, Hong Kong,
Kronberg, North Sydney,
Singapore, Taipei, and Tel Aviv

©1993 Dataquest Incorporated
0014738

Dataquest®

Software

Mechanical Applications Worldwide Market Share



Market Statistics

1993

Library Copy
DO NOT REMOVE!

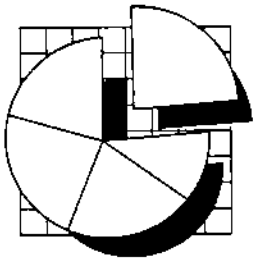
Program: Mechanical Applications Worldwide
Product Code: CMEC-WW-MS-9301
Publication Date: March 15, 1993

INFORMATION RESOURCE CENTER
DATAQUEST INCORPORATED
1290 Ridder Park Drive
San Jose, CA 95131-2398
(408) 437-8600

Dataquest®

Software

Mechanical Applications Worldwide Market Share



Market Statistics

1993

Program: Mechanical Applications Worldwide
Product Code: CMEC-WW-MS-9301
Publication Date: March 15, 1993

Table of Contents

	Page
Introduction	1
Market Analysis	1
Dataquest Perspective	1
About This Document	3
Segmentation	4
Definitions	4
Market Share Methodology	6
The Audit Process	7
Publishing Schedule	8
Notes on Market Share	8

©1993 Dataquest Incorporated

List of Figures

Figure		Page
1	CAD/CAM/CAE/GIS Market Database	2

©1993 Dataquest Incorporated

List of Tables

Table		Page
1	CAD/CAM/CAE/GIS 1992 Market Summary	3
2	Companies Renamed	9
3	Companies (or CAD Portions Thereof) Sold/Merged	9
4	Companies—Added or Deleted	9
	Mechanical	
	Worldwide	
5	All Platforms	10
6	Technical Workstation	18
7	Host-Dependent	24
8	Server	27
9	Personal Computer	28
	North America	
10	All Platforms	33
11	Technical Workstation	38
12	Host-Dependent	41
13	Server	43
14	Personal Computer	44
	Europe	
15	All Platforms	47
16	Technical Workstation	53
17	Host-Dependent	58
18	Server	60
19	Personal Computer	61
	Asia	
20	All Platforms	65
21	Technical Workstation	70
22	Host-Dependent	74
23	Server	76
24	Personal Computer	77
	Rest of World	
25	All Platforms	80
26	Technical Workstation	83
27	Host-Dependent	85
28	Server	86
29	Personal Computer	87

Note: All tables show estimated data.

©1993 Dataquest Incorporated

Mechanical 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.

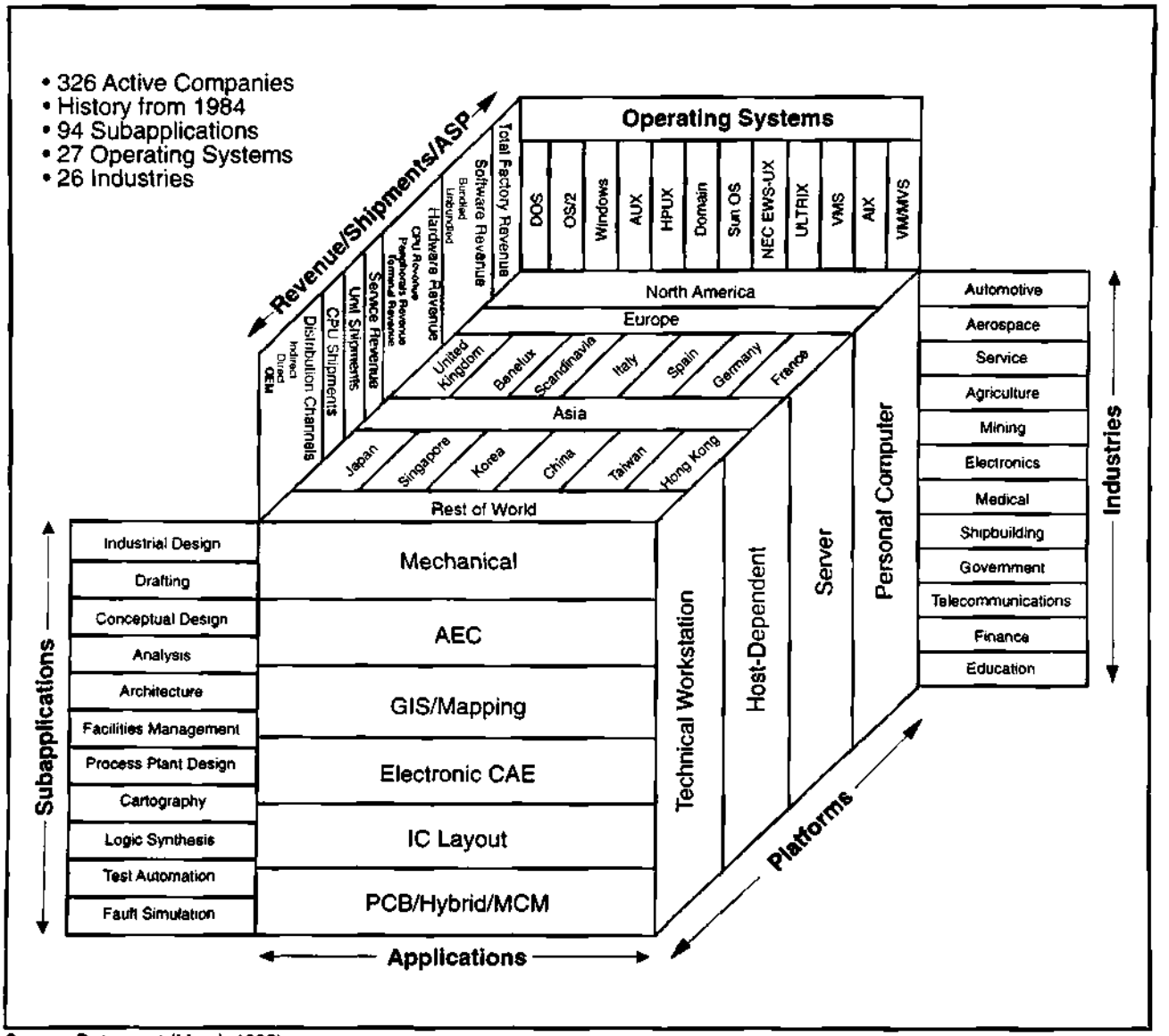
Based on our preliminary analysis, shown in Table 1, the year turned out somewhat better than expected, with a 4.2 percent growth rate in total revenue and 9.7 percent growth in software revenue. Regionally, European-based vendors enjoyed the strongest results, at 6.5 percent growth. Asian-based vendors 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.

©1993 Dataquest Incorporated

Figure 1
CAD/CAM/CAE/GIS Market Database



Source: Dataquest (March 1993)

G3000191

©1993 Dataquest Incorporated

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

©1993 Dataquest Incorporated

- 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.

 ©1993 Dataquest Incorporated

- 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.

 ©1993 Dataquest Incorporated

- 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

 ©1993 Dataquest Incorporated

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

 ©1993 Dataquest Incorporated

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.

 ©1993 Dataquest Incorporated

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)

©1993 Dataquest Incorporated

CMEC-WW-MS-9301

©1993 Dataquest Incorporated

March 15, 1993

Table 5
1992 CAD/CAM/CAE/GIS Market Share

Application: Mechanical
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
IBM	1,472.5	810.2	387.0	38,011	19.2%	19.5%	17.3%	13.7%
Computervision	628.0	239.4	186.6	5,074	8.2%	5.8%	8.3%	1.8%
Hewlett-Packard	535.5	381.0	62.8	35,864	7.0%	9.2%	2.8%	12.9%
Digital	362.8	250.3	.0	4,060	4.7%	6.0%	.0%	1.5%
Silicon Graphics	245.5	225.8	.0	6,298	3.2%	5.4%	.0%	2.3%
EDS	232.8	119.5	84.3	3,870	3.0%	2.9%	3.8%	1.4%
NEC	212.3	146.9	48.5	10,994	2.8%	3.5%	2.2%	4.0%
Intergraph	201.5	91.7	46.8	3,060	2.6%	2.2%	2.1%	1.1%
Nihon Unisys	196.3	121.7	33.4	1,901	2.6%	2.9%	1.5%	.7%
Sun Microsystems	194.3	165.2	.0	10,595	2.5%	4.0%	.0%	3.8%
Fujitsu	181.2	116.0	47.1	3,588	2.4%	2.8%	2.1%	1.3%
Control Data Systems	159.9	76.9	26.3	1,087	2.1%	1.9%	1.2%	.4%
Compaq	149.2	149.2	.0	32,333	1.9%	3.6%	.0%	11.6%
Applicon	135.0	45.3	53.2	1,452	1.8%	1.1%	2.4%	.5%
Hitachi	130.5	62.6	54.8	3,506	1.7%	1.5%	2.5%	1.3%
Autodesk	129.9	.0	129.9	0	1.7%	.0%	5.8%	.0%
SDRC	123.3	.0	123.3	0	1.6%	.0%	5.5%	.0%
Parametric Technology	100.2	.0	84.2	0	1.3%	.0%	3.8%	.0%
Apple Computer	99.7	87.7	.0	23,596	1.3%	2.1%	.0%	8.5%
Matra Datavision	95.5	33.4	43.0	744	1.2%	.8%	1.9%	.3%
Siemens Nixdorf Info systeme	89.3	44.6	31.3	1,518	1.2%	1.1%	1.4%	.5%

(Continued)

Table 5 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: Mechanical
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
Toshiba—NO OEM	74.3	37.2	29.7	2,563	1.0%	.9%	1.3%	.9%
STI-Straessle	71.0	11.1	36.6	515	.9%	.3%	1.6%	.2%
Hitachi Zosen Info Systems	69.8	59.6	3.3	719	.9%	1.4%	.1%	.3%
Mutoh Industries—NO OEM	55.0	30.7	15.7	902	.7%	.7%	.7%	.3%
MacNeal-Schwendler	54.4	.0	52.3	0	.7%	.0%	2.3%	.0%
Wiechers Datentechnik	40.9	10.8	18.9	728	.5%	.3%	.8%	.3%
Mitsubishi Electric	40.9	31.7	5.2	738	.5%	.8%	.2%	.3%
Cisigraph	39.3	11.0	21.6	250	.5%	.3%	1.0%	.1%
Hakuto	38.2	22.9	15.3	850	.5%	.6%	.7%	.3%
PDA Engineering	35.1	.0	33.7	0	.5%	.0%	1.5%	.0%
Unisys	34.8	17.7	12.1	522	.5%	.4%	.5%	.2%
Alias Research	32.7	.0	29.7	0	.4%	.0%	1.3%	.0%
Tokyo Electron—NO OEM	32.3	10.7	14.5	220	.4%	.3%	.7%	.1%
Swanson Analysis	31.4	.0	31.4	0	.4%	.0%	1.4%	.0%
ASCAD/ASCAM	30.6	18.4	9.2	450	.4%	.4%	.4%	.2%
Sharp System Products—NO OEM	29.7	15.4	14.3	286	.4%	.4%	.6%	.1%
Investronica SA	29.3	23.4	2.9	1,170	.4%	.6%	.1%	.4%
ISICAD	29.2	11.5	14.1	195	.4%	.3%	.6%	.1%
Cimatron	29.0	13.1	13.1	921	.4%	.3%	.6%	.3%
Gerber Systems	26.0	12.7	8.6	360	.3%	.3%	.4%	.1%
Cimlinc	24.0	.0	16.8	562	.3%	.0%	.7%	.2%

(Continued)

©1993 Dataquest Incorporated

Table 5 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: Mechanical
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
Mitsui Engineering	22.6	15.8	4.5	151	.3%	.4%	.2%	.1%
Auto-Trol	22.4	8.3	8.5	280	.3%	.2%	.4%	.1%
Delcam International	22.4	7.8	11.2	607	.3%	.2%	.5%	.2%
Omron	21.8	13.1	8.7	477	.3%	.3%	.4%	.2%
Toyo Information Systems-NO OEM	20.6	12.5	6.0	219	.3%	.3%	.3%	.1%
MCS	20.2	.0	17.9	0	.3%	.0%	.8%	.0%
Fides Industrielle Automation	19.3	2.9	13.5	166	.3%	.1%	.6%	.1%
ADRA Systems	18.6	1.2	13.8	64	.2%	.0%	.6%	.0%
Tebis	16.7	2.5	11.7	96	.2%	.1%	.5%	.0%
Digital Kienzle	16.3	8.3	4.6	239	.2%	.2%	.2%	.1%
Radan Computational	15.8	5.6	7.9	328	.2%	.1%	.4%	.1%
Han Dataport	15.5	4.7	8.5	313	.2%	.1%	.4%	.1%
Graphtec Engineering	15.4	7.7	6.9	331	.2%	.2%	.3%	.1%
Framasoft	14.8	.0	8.9	0	.2%	.0%	.4%	.0%
CAD Lab	14.7	.0	11.8	0	.2%	.0%	.5%	.0%
CADKEY	14.1	.0	14.1	0	.2%	.0%	.6%	.0%
ICAD	13.5	.0	10.8	0	.2%	.0%	.5%	.0%
Aries Technology	13.4	.0	12.1	0	.2%	.0%	.5%	.0%
PAFEC	12.8	.0	12.8	0	.2%	.0%	.6%	.0%
Dell Computer	12.5	12.5	.0	3,244	.2%	.3%	.0%	1.2%
Exapt	12.5	6.1	4.2	229	.2%	.1%	.2%	.1%

(Continued)

CMEC-WW-MS-9301

© 1993 Dataquest Incorporated

Table 5 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: Mechanical
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
MARC	12.0	.0	12.0	0	.2%	.0%	.5%	.0%
Sumitomo Denko Workstation	11.1	11.1	.0	1,808	.1%	.3%	.0%	.7%
ICL	10.6	6.2	3.6	290	.1%	.1%	.2%	.1%
Andor	10.4	2.6	7.4	80	.1%	.1%	.3%	.0%
ItalCad	10.3	4.8	2.5	97	.1%	.1%	.1%	.0%
Marcus Computer Systeme	10.2	5.3	3.5	296	.1%	.1%	.2%	.1%
Design Automation	10.2	.5	9.6	54	.1%	.0%	.4%	.0%
CAD Distribution	10.1	5.1	4.1	157	.1%	.1%	.2%	.1%
Point Control	10.0	.0	9.7	0	.1%	.0%	.4%	.0%
Wacom	8.9	1.8	6.2	161	.1%	.0%	.3%	.1%
Technische Computer Systeme	8.2	1.6	6.5	255	.1%	.0%	.3%	.1%
EA Systems	8.1	.0	8.1	0	.1%	.0%	.4%	.0%
Engineering Mechanics	7.9	.4	6.7	628	.1%	.0%	.3%	.2%
Mechanical Dynamics	7.7	.0	6.9	0	.1%	.0%	.3%	.0%
Research Machines	7.5	7.5	.0	1,208	.1%	.2%	.0%	.4%
Solbourne	7.4	7.2	.0	600	.1%	.2%	.0%	.2%
CNC Software	6.8	.0	6.8	0	.1%	.0%	.3%	.0%
DAT Standard *info* ssystemes	6.7	.0	6.4	0	.1%	.0%	.3%	.0%
Sony	5.8	5.1	.0	338	.1%	.1%	.0%	.1%
Ziegler Informatics	5.8	.0	5.8	0	.1%	.0%	.3%	.0%
SPATIAL Technology	5.2	.0	5.2	0	.1%	.0%	.2%	.0%

(Continued)

©1993 Dataquest Incorporated

Table 5 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application:	Mechanical
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
Algor Interactive Systems	4.9	.0	4.3	0	.1%	.0%	.2%	.0%
Serbi	4.8	.5	4.3	0	.1%	.0%	.2%	.0%
Olivetti	4.4	3.8	.0	488	.1%	.1%	.0%	.2%
Moda CAD	4.4	1.1	3.1	36	.1%	.0%	.1%	.0%
Rasna Corporation	4.3	.0	3.9	0	.1%	.0%	.2%	.0%
Whessoe Computing Systems	4.2	.0	4.2	0	.1%	.0%	.2%	.0%
Kubota Computer	4.2	2.8	.7	264	.1%	.1%	.0%	.1%
CADSI	4.2	.6	3.1	29	.1%	.0%	.1%	.0%
Pathtrace	4.2	.9	2.7	62	.1%	.0%	.1%	.0%
Ontos	4.0	.0	4.0	0	.1%	.0%	.2%	.0%
CAD Centre	3.4	.0	2.7	0	.0%	.0%	.1%	.0%
Century Research Center	3.4	1.8	1.3	12	.0%	.0%	.1%	.0%
CADIX	3.4	1.3	1.7	25	.0%	.0%	.1%	.0%
American Small Business Comp.	3.1	.0	3.1	0	.0%	.0%	.1%	.0%
Micrografx	3.1	.0	3.1	0	.0%	.0%	.1%	.0%
Vero International Software	3.1	.0	2.9	0	.0%	.0%	.1%	.0%
FEA	3.0	.7	.7	0	.0%	.0%	.0%	.0%
debis Systemhaus	2.9	.7	1.7	20	.0%	.0%	.1%	.0%
Superdraft	2.8	1.3	1.4	160	.0%	.0%	.1%	.1%
RoboCAD Solutions	2.8	.0	2.1	0	.0%	.0%	.1%	.0%
Claris	2.7	.0	2.7	0	.0%	.0%	.1%	.0%

(Continued)

©1993 Dataquest Incorporated

Table 5 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: Mechanical
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
Catalpa	2.7	.9	1.3	22	.0%	.0%	.1%	.0%
Computational Mechanics	2.4	.0	2.4	0	.0%	.0%	.1%	.0%
Caroline Informatique	2.3	.4	1.2	18	.0%	.0%	.1%	.0%
Anilam Electronics	2.3	.6	1.5	18	.0%	.0%	.1%	.0%
ISKA	2.2	1.0	.9	41	.0%	.0%	.0%	.0%
Ricoh—NO OEM	2.2	.0	1.9	0	.0%	.0%	.1%	.0%
CAMTEK	2.1	.5	1.4	0	.0%	.0%	.1%	.0%
Uchida Yoko	1.9	1.1	.7	45	.0%	.0%	.0%	.0%
Wisdom Systems	1.8	.0	1.4	0	.0%	.0%	.1%	.0%
FEGS	1.7	.0	1.5	0	.0%	.0%	.1%	.0%
Softdesk	1.5	.0	1.5	0	.0%	.0%	.1%	.0%
Evolution Computing	1.2	.0	1.2	0	.0%	.0%	.1%	.0%
Valisys	1.2	.0	.0	0	.0%	.0%	.0%	.0%
Accugraph	1.1	.5	.5	39	.0%	.0%	.0%	.0%
Object Design	1.0	.0	1.0	0	.0%	.0%	.0%	.0%
Foresight Resources	1.0	.0	.9	0	.0%	.0%	.0%	.0%
Zuken	1.0	.3	.6	6	.0%	.0%	.0%	.0%
Objectivity	.9	.0	.9	0	.0%	.0%	.0%	.0%
Areon	.9	.5	.2	6	.0%	.0%	.0%	.0%
EME	.9	.2	.4	18	.0%	.0%	.0%	.0%
Innovative Data Design	.8	.0	.8	0	.0%	.0%	.0%	.0%

(Continued)

©1993 Dataquest Incorporated

Table 5 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application:	Mechanical
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
Aura CAD/CAM Systems	.7	.0	.6	0	.0%	.0%	.0%	.0%
Ithaca Software	.7	.0	.7	0	.0%	.0%	.0%	.0%
ESDU International	.7	.0	.7	0	.0%	.0%	.0%	.0%
CADWorks	.7	.0	.6	0	.0%	.0%	.0%	.0%
GRAPHSOFT	.7	.0	.7	0	.0%	.0%	.0%	.0%
A.I. Systems	.7	.0	.7	0	.0%	.0%	.0%	.0%
Machinery Sales	.6	.0	.6	0	.0%	.0%	.0%	.0%
CAD-Capture	.6	.1	.2	3	.0%	.0%	.0%	.0%
S.T.L.D. s.r.l.	.5	.0	.5	0	.0%	.0%	.0%	.0%
Graphisoft Software Dev	.5	.0	.5	0	.0%	.0%	.0%	.0%
Uniras	.4	.0	.4	0	.0%	.0%	.0%	.0%
Cascade Graphics	.4	.0	.4	0	.0%	.0%	.0%	.0%
Engineering Systems Corp.	.4	.0	.3	0	.0%	.0%	.0%	.0%
Spectrum Graphics	.4	.1	.2	3	.0%	.0%	.0%	.0%
Ashlar	.4	.0	.4	0	.0%	.0%	.0%	.0%
Mc2 Engineering Software	.3	.0	.3	0	.0%	.0%	.0%	.0%
Synthesis	.3	.0	.3	0	.0%	.0%	.0%	.0%
Mega CADD	.2	.0	.2	0	.0%	.0%	.0%	.0%
Georgia Tech Research Corp.	.2	.0	.2	0	.0%	.0%	.0%	.0%
DAPCO	.2	.0	.1	0	.0%	.0%	.0%	.0%
Engineered Software	.1	.0	.1	0	.0%	.0%	.0%	.0%

(Continued)

©1993 Dataquest Incorporated

Table 5 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: Mechanical
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
Masta Corporation	.1	.0	.1	0	.0%	.0%	.0%	.0%
IGC Technology	.1	.0	.1	0	.0%	.0%	.0%	.0%
Lamp Software	.1	.0	.1	7	.0%	.0%	.0%	.0%
Number One Systems	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	475.7	462.4	.0	64,308	6.2%	11.1%	.0%	23.1%
All Companies	7,655.3	4,157.5	2,235.3	277,845	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	5,741.4	3,178.2	1,558.0	236,167	75.0%	76.4%	69.7%	85.0%
All Asian-Based Companies	1,203.2	733.0	337.9	30,238	15.7%	17.6%	15.1%	10.9%
All European-Based Companies	710.7	246.4	339.5	11,441	9.3%	5.9%	15.2%	4.1%
All Hardware Companies	1,912.1	1,666.9	5.3	199,800	25.0%	40.1%	.2%	71.9%
All Turnkey & SW Companies	5,743.2	2,490.7	2,230.0	78,045	75.0%	59.9%	99.8%	28.1%

Source: Dataquest (March 1993)

©1993 Dataquest Incorporated

Table 6
1992 CAD/CAM/CAE/GIS Market Share

Application: Mechanical
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
Computervision	601.4	239.0	162.2	4,927	14.8%	12.0%	12.2%	6.1%
Hewlett-Packard	466.5	325.7	62.8	20,021	11.4%	16.3%	4.7%	24.8%
IBM	298.3	165.3	74.8	7,867	7.3%	8.3%	5.6%	9.7%
Silicon Graphics	236.2	217.9	.0	6,121	5.8%	10.9%	.0%	7.6%
EDS	197.7	103.2	69.5	3,378	4.8%	5.2%	5.2%	4.2%
Intergraph	179.0	82.4	39.4	2,790	4.4%	4.1%	3.0%	3.5%
Sun Microsystems	133.4	115.5	.0	8,457	3.3%	5.8%	.0%	10.5%
Applicon	120.8	40.4	47.6	1,277	3.0%	2.0%	3.6%	1.6%
SDRC	111.0	.0	111.0	0	2.7%	.0%	8.3%	.0%
Parametric Technology	100.2	.0	84.2	0	2.5%	.0%	6.3%	.0%
Matra Datavision	95.5	33.4	43.0	744	2.3%	1.7%	3.2%	.9%
Hitachi	94.0	45.1	39.5	2,032	2.3%	2.3%	3.0%	2.5%
Siemens Nixdorf Info systeme	89.3	44.6	31.3	1,518	2.2%	2.2%	2.3%	1.9%
NEC	89.2	49.0	33.0	2,940	2.2%	2.5%	2.5%	3.6%
Fujitsu	76.1	48.7	19.8	1,551	1.9%	2.4%	1.5%	1.9%
Digital	72.6	50.0	.0	3,238	1.8%	2.5%	.0%	4.0%
STI-Straessle	71.0	11.1	36.6	515	1.7%	.6%	2.7%	.6%
Nihon Unisys	68.7	42.6	11.7	561	1.7%	2.1%	.9%	.7%
Hitachi Zosen Info Systems	65.7	55.8	3.3	672	1.6%	2.8%	.2%	.8%
Control Data Systems	56.0	34.2	11.8	760	1.4%	1.7%	.9%	.9%
Toshiba—NO OEM	44.6	22.3	17.8	528	1.1%	1.1%	1.3%	.7%

(Continued)

©1993 Dataquest Incorporated

Table 6 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application:	Mechanical
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
Cisigraph	35.4	9.9	19.4	225	.9%	.5%	1.5%	.3%
Alias Research	32.7	.0	29.7	0	.8%	.0%	2.2%	.0%
Tokyo Electron—NO OEM	32.3	10.7	14.5	220	.8%	.5%	1.1%	.3%
Mitsubishi Electric	30.8	26.2	2.2	332	.8%	1.3%	.2%	.4%
ASCAD/ASCAM	30.0	18.0	9.0	436	.7%	.9%	.7%	.5%
Sharp System Products—NO OEM	29.1	15.1	14.0	268	.7%	.8%	1.0%	.3%
Unisys	26.8	13.6	9.4	414	.7%	.7%	.7%	.5%
ISICAD	26.5	11.5	11.4	195	.7%	.6%	.9%	.2%
PDA Engineering	26.3	.0	25.3	0	.6%	.0%	1.9%	.0%
Gerber Systems	26.0	12.7	8.6	360	.6%	.6%	.6%	.4%
Auto-Trol	22.4	8.3	8.5	280	.5%	.4%	.6%	.3%
Delcam International	22.4	7.8	11.2	607	.5%	.4%	.8%	.8%
Omron	21.8	13.1	8.7	477	.5%	.7%	.7%	.6%
Mutoh Industries—NO OEM	20.9	12.5	6.3	213	.5%	.6%	.5%	.3%
Mitsui Engineering	20.6	14.4	4.1	116	.5%	.7%	.3%	.1%
Cimlinc	20.4	.0	14.2	562	.5%	.0%	1.1%	.7%
Swanson Analysis	17.6	.0	17.6	0	.4%	.0%	1.3%	.0%
Cimatron	17.1	7.7	7.7	352	.4%	.4%	.6%	.4%
Toyo Information Systems-NO OEM	16.4	10.2	4.7	194	.4%	.5%	.3%	.2%
Fides Industrielle Automation	16.4	2.5	11.5	155	.4%	.1%	.9%	.2%
Digital Kienzle	16.3	8.3	4.6	239	.4%	.4%	.3%	.3%

(Continued)

©1993 Dataquest Incorporated

Table 6 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application:	Mechanical
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
Radan Computational	15.7	5.5	7.8	322	.4%	.3%	.6%	.4%
Graphtec Engineering	15.4	7.7	6.9	331	.4%	.4%	.5%	.4%
ADRA Systems	14.3	1.2	10.4	64	.4%	.1%	.8%	.1%
Han Dataport	14.0	4.2	7.7	299	.3%	.2%	.6%	.4%
CAD Lab	13.9	.0	11.1	0	.3%	.0%	.8%	.0%
ICAD	13.5	.0	10.8	0	.3%	.0%	.8%	.0%
Framasoft	13.4	.0	8.0	0	.3%	.0%	.6%	.0%
Aries Technology	12.1	.0	10.9	0	.3%	.0%	.8%	.0%
PAFEC	10.9	.0	10.9	0	.3%	.0%	.8%	.0%
Wiechers Datentechnik	10.6	2.8	4.9	90	.3%	.1%	.4%	.1%
ICL	10.6	6.2	3.6	290	.3%	.3%	.3%	.4%
Sumitomo Denko Workstation	10.3	10.3	.0	1,640	.3%	.5%	.0%	2.0%
ItalCad	10.3	4.8	2.5	97	.3%	.2%	.2%	.1%
Marcus Computer Systeme	10.2	5.3	3.5	296	.3%	.3%	.3%	.4%
MCS	9.3	.0	8.3	0	.2%	.0%	.6%	.0%
MacNeal-Schwendler	9.2	.0	8.8	0	.2%	.0%	.7%	.0%
Autodesk	8.7	.0	8.7	0	.2%	.0%	.7%	.0%
MARC	8.4	.0	8.4	0	.2%	.0%	.6%	.0%
Technische Computer Systeme	8.2	1.6	6.5	255	.2%	.1%	.5%	.3%
Mechanical Dynamics	6.6	.0	5.9	0	.2%	.0%	.4%	.0%
Sony	5.8	5.1	.0	338	.1%	.3%	.0%	.4%

(Continued)

©1993 Dataquest Incorporated

Table 6 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: Mechanical
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
SPATIAL Technology	5.2	.0	5.2	0	.1%	.0%	.4%	.0%
Engineering Mechanics	4.6	.2	3.9	221	.1%	.0%	.3%	.3%
Ontos	4.0	.0	4.0	0	.1%	.0%	.3%	.0%
Kubota Computer	3.8	2.4	.7	207	.1%	.1%	.1%	.3%
Rasna Corporation	3.5	.0	3.1	0	.1%	.0%	.2%	.0%
CAD Centre	3.4	.0	2.7	0	.1%	.0%	.2%	.0%
Exapt	3.4	1.7	1.2	115	.1%	.1%	.1%	.1%
CADSI	3.4	.5	2.5	15	.1%	.0%	.2%	.0%
CADIX	3.4	1.3	1.7	25	.1%	.1%	.1%	.0%
Catalpa	2.7	.9	1.3	22	.1%	.0%	.1%	.0%
ISKA	2.2	1.0	.9	41	.1%	.1%	.1%	.1%
Solbourne	2.2	2.2	.0	380	.1%	.1%	.0%	.5%
Ricoh—NO OEM	2.2	.0	1.9	0	.1%	.0%	.1%	.0%
debis Systemhaus	2.2	.5	1.3	12	.1%	.0%	.1%	.0%
Hakuto	1.9	1.2	.8	34	.0%	.1%	.1%	.0%
Wisdom Systems	1.8	.0	1.4	0	.0%	.0%	.1%	.0%
Century Research Center	1.8	.9	.7	10	.0%	.0%	.0%	.0%
Uchida Yoko	1.7	1.0	.6	36	.0%	.1%	.0%	.0%
Caroline Informatique	1.6	.3	.8	8	.0%	.0%	.1%	.0%
CADKEY	1.4	.0	1.4	0	.0%	.0%	.1%	.0%
FEGS	1.3	.0	1.1	0	.0%	.0%	.1%	.0%

(Continued)

CMEC-WW-MS-9301

©1993 Dataquest Incorporated

Table 6 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: Mechanical
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
Wacom	1.3	.3	.9	14	.0%	.0%	.1%	.0%
FEA	1.2	.3	.3	0	.0%	.0%	.0%	.0%
Valisys	1.1	.0	.0	0	.0%	.0%	.0%	.0%
Object Design	1.0	.0	1.0	0	.0%	.0%	.1%	.0%
Accugraph	1.0	.5	.4	37	.0%	.0%	.0%	.0%
Zuken	1.0	.3	.6	6	.0%	.0%	.0%	.0%
Objectivity	.9	.0	.9	0	.0%	.0%	.1%	.0%
Computational Mechanics	.9	.0	.9	0	.0%	.0%	.1%	.0%
Point Control	.8	.0	.8	0	.0%	.0%	.1%	.0%
EME	.4	.1	.2	6	.0%	.0%	.0%	.0%
Whessoe Computing Systems	.4	.0	.4	0	.0%	.0%	.0%	.0%
Spectrum Graphics	.4	.1	.2	3	.0%	.0%	.0%	.0%
Softdesk	.3	.0	.3	0	.0%	.0%	.0%	.0%
Ithaca Software	.3	.0	.3	0	.0%	.0%	.0%	.0%
CAMTEK	.2	.1	.2	0	.0%	.0%	.0%	.0%
DAPCO	.2	.0	.1	0	.0%	.0%	.0%	.0%
Algor Interactive Systems	.1	.0	.1	0	.0%	.0%	.0%	.0%
Georgia Tech Research Corp.	.1	.0	.1	0	.0%	.0%	.0%	.0%
Masta Corporation	.1	.0	.1	0	.0%	.0%	.0%	.0%
CADWorks	.0	.0	.0	0	.0%	.0%	.0%	.0%
Lamp Software	.0	.0	.0	3	.0%	.0%	.0%	.0%

(Continued)

©1993 Dataquest Incorporated

Table 6 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: Mechanical
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
ESDU International	.0	.0	.0	0	.0%	.0%	.0%	.0%
Synthesis	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Companies	4,075.3	1,999.4	1,332.1	80,760	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	2,885.5	1,424.2	885.7	61,364	70.8%	71.2%	66.5%	76.0%
All Asian-Based Companies	658.5	396.3	194.2	12,746	16.2%	19.8%	14.6%	15.8%
All European-Based Companies	531.3	178.9	252.3	6,650	13.0%	8.9%	18.9%	8.2%
All Hardware Companies	610.4	524.3	2.4	32,060	15.0%	26.2%	.2%	39.7%
All Turnkey & SW Companies	3,464.9	1,475.1	1,329.7	48,700	85.0%	73.8%	99.8%	60.3%

Source: Dataquest (March 1993)

©1993 Dataquest Incorporated

Table 7
1992 CAD/CAM/CAE/GIS Market Share

Application: Mechanical
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	799.9	432.0	212.0	10,607	45.1%	40.6%	55.1%	45.8%
Digital	193.4	133.4	.0	0	10.9%	12.5%	.0%	.0%
Nihon Unisys	127.6	79.1	21.7	1,340	7.2%	7.4%	5.6%	5.8%
Control Data Systems	100.7	41.3	14.1	321	5.7%	3.9%	3.7%	1.4%
NEC	70.1	53.2	11.2	152	3.9%	5.0%	2.9%	.7%
Fujitsu	68.9	44.1	17.9	959	3.9%	4.1%	4.7%	4.1%
MacNeal-Schwendler	33.2	.0	31.9	0	1.9%	.0%	8.3%	.0%
Hitachi	13.1	6.3	5.5	232	.7%	.6%	1.4%	1.0%
SDRC	12.3	.0	12.3	0	.7%	.0%	3.2%	.0%
Exapt	9.1	4.5	3.1	114	.5%	.4%	.8%	.5%
PDA Engineering	8.8	.0	8.4	0	.5%	.0%	2.2%	.0%
EA Systems	8.1	.0	8.1	0	.5%	.0%	2.1%	.0%
Unisys	8.0	4.1	2.8	108	.5%	.4%	.7%	.5%
Swanson Analysis	7.9	.0	7.9	0	.4%	.0%	2.0%	.0%
MCS	6.9	.0	6.0	0	.4%	.0%	1.6%	.0%
Mitsubishi Electric	5.9	2.8	1.7	19	.3%	.3%	.4%	.1%
Toshiba—NO OEM	5.2	2.6	2.1	74	.3%	.2%	.5%	.3%
Toyo Information Systems-NO OEM	4.2	2.3	1.3	25	.2%	.2%	.3%	.1%
Hitachi Zosen Info Systems	4.2	3.8	.0	47	.2%	.4%	.0%	.2%
MARC	3.6	.0	3.6	0	.2%	.0%	.9%	.0%

(Continued)

CMEC-WW-MS-9301

©1993 Dataquest Incorporated

Table 7 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application:	**Mechanical**
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
EDS	3.1	.0	3.1	(12)	.2%	.0%	.8%	-.1%
Fides Industrielle Automation	2.9	.4	2.0	10	.2%	.0%	.5%	.0%
Century Research Center	1.6	.9	.6	2	.1%	.1%	.2%	.0%
Han Dataport	1.6	.5	.9	13	.1%	.0%	.2%	.1%
Computational Mechanics	1.5	.0	1.5	0	.1%	.0%	.4%	.0%
Framasoft	1.4	.0	.9	0	.1%	.0%	.2%	.0%
Intergraph	1.3	.0	1.2	0	.1%	.0%	.3%	.0%
Mechanical Dynamics	1.2	.0	1.0	0	.1%	.0%	.3%	.0%
Whessoe Computing Systems	.8	.0	.8	0	.0%	.0%	.2%	.0%
Olivetti	.5	.4	.0	13	.0%	.0%	.0%	.1%
Kubota Computer	.4	.4	.0	57	.0%	.0%	.0%	.2%
FEGS	.4	.0	.4	0	.0%	.0%	.1%	.0%
debis Systemhaus	.4	.1	.2	2	.0%	.0%	.1%	.0%
FEA	.3	.1	.1	0	.0%	.0%	.0%	.0%
Engineering Systems Corp.	.1	.0	.1	0	.0%	.0%	.0%	.0%
Georgia Tech Research Corp.	.1	.0	.1	0	.0%	.0%	.0%	.0%
Valisys	.1	.0	.0	0	.0%	.0%	.0%	.0%
ESDU International	.0	.0	.0	0	.0%	.0%	.0%	.0%
Accugraph	.0	.0	.0	1	.0%	.0%	.0%	.0%
Engineered Software	.0	.0	.0	0	.0%	.0%	.0%	.0%

(Continued)

©1993 Dataquest Incorporated

Table 7 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: Mechanical
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
Other Companies	266.1	252.8	.0	9,096	15.0%	23.7%	.0%	39.2%
All Companies	1,774.7	1,064.9	384.4	23,179	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	1,454.6	863.5	312.5	20,120	82.0%	81.1%	81.3%	86.8%
All Asian-Based Companies	301.1	195.4	62.0	2,908	17.0%	18.4%	16.1%	12.5%
All European-Based Companies	18.9	5.9	9.9	152	1.1%	.6%	2.6%	.7%
All Hardware Companies	480.3	395.0	2.9	9,179	27.1%	37.1%	.7%	39.6%
All Turnkey & SW Companies	1,294.4	669.9	381.5	14,000	72.9%	62.9%	99.3%	60.4%

Source: Dataquest (March 1993)

CMEC-WW-MS-9301

©1993 Dataquest Incorporated

Table 8
1992 CAD/CAM/CAE/GIS Market Share

Application: Mechanical
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
IBM	258.7	145.3	63.1	1,377	49.7%	46.7%	63.2%	22.5%
Digital	96.8	66.8	.0	822	18.6%	21.5%	.0%	13.4%
Sun Microsystems	60.9	49.6	.0	2,139	11.7%	16.0%	.0%	35.0%
EDS	32.1	16.3	11.7	505	6.2%	5.2%	11.7%	8.3%
Intergraph	19.3	9.4	4.4	270	3.7%	3.0%	4.4%	4.4%
Applicon	13.0	4.4	5.1	136	2.5%	1.4%	5.2%	2.2%
MacNeal-Schwendler	11.2	.0	10.8	0	2.2%	.0%	10.8%	.0%
Silicon Graphics	9.3	7.9	.0	177	1.8%	2.5%	.0%	2.9%
Solbourne	5.2	5.1	.0	219	1.0%	1.6%	.0%	3.6%
Cisigraph	3.9	1.1	2.2	25	.8%	.4%	2.2%	.4%
Control Data Systems	3.2	1.5	.4	6	.6%	.5%	.4%	.1%
Hewlett-Packard	2.9	2.4	.0	258	.6%	.8%	.0%	4.2%
Cimlinc	2.4	.0	1.7	0	.5%	.0%	1.7%	.0%
Computervision	1.3	.5	.4	12	.3%	.1%	.4%	.2%
Sumitomo Denko Workstation	.8	.8	.0	169	.1%	.3%	.0%	2.8%
Georgia Tech Research Corp.	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	.0	.0	.0	2	.0%	.0%	.0%	.0%
All Companies	521.1	311.2	99.8	6,115	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	516.4	309.3	97.6	5,921	99.1%	99.4%	97.8%	96.8%
All Asian-Based Companies	.8	.8	.0	169	.1%	.3%	.0%	2.8%
All European-Based Companies	3.9	1.1	2.2	25	.8%	.4%	2.2%	.4%
All Hardware Companies	177.7	134.0	.1	4,069	34.1%	43.1%	.1%	66.5%
All Turnkey & SW Companies	343.4	177.2	99.7	2,045	65.9%	56.9%	99.9%	33.5%

Source: Dataquest (March 1993)

©1993 Dataquest Incorporated

Table 9
1992 CAD/CAM/CAE/GIS Market Share

Application: Mechanical
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	149.2	149.2	.0	32,333	11.6%	19.1%	.0%	19.3%
Autodesk	121.2	.0	121.2	0	9.4%	.0%	28.9%	.0%
IBM	115.6	67.6	37.1	18,160	9.0%	8.6%	8.9%	10.8%
Apple Computer	99.7	87.7	.0	23,596	7.8%	11.2%	.0%	14.1%
Hewlett-Packard	66.1	52.9	.0	15,585	5.1%	6.8%	.0%	9.3%
NEC	53.1	44.6	4.3	7,902	4.1%	5.7%	1.0%	4.7%
Hakuto	36.3	21.8	14.5	816	2.8%	2.8%	3.5%	.5%
Fujitsu	36.2	23.2	9.4	1,077	2.8%	3.0%	2.2%	.6%
Mutoh Industries—NO OEM	34.1	18.2	9.5	689	2.7%	2.3%	2.3%	.4%
Wiechers Datentechnik	30.3	8.0	14.0	638	2.4%	1.0%	3.3%	.4%
Investronica SA	29.3	23.4	2.9	1,170	2.3%	3.0%	.7%	.7%
Computervision	25.3	.0	24.1	136	2.0%	.0%	5.7%	.1%
Toshiba—NO OEM	24.5	12.3	9.8	1,961	1.9%	1.6%	2.3%	1.2%
Hitachi	23.5	11.3	9.9	1,242	1.8%	1.4%	2.4%	.7%
Tebis	16.7	2.5	11.7	96	1.3%	.3%	2.8%	.1%
CADKEY	12.7	.0	12.7	0	1.0%	.0%	3.0%	.0%
Dell Computer	12.5	12.5	.0	3,244	1.0%	1.6%	.0%	1.9%
Cimatron	12.0	5.4	5.4	569	.9%	.7%	1.3%	.3%
Andor	10.4	2.6	7.4	80	.8%	.3%	1.8%	.0%
Design Automation	10.2	.5	9.6	54	.8%	.1%	2.3%	.0%
CAD Distribution	10.1	5.1	4.1	157	.8%	.6%	1.0%	.1%

(Continued)

CMEC-WW-MS-9301

©1993 Dataquest Incorporated

Table 9 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: Mechanical
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
Point Control	9.2	.0	8.9	0	.7%	.0%	2.1%	.0%
Wacom	7.7	1.5	5.3	147	.6%	.2%	1.3%	.1%
Research Machines	7.5	7.5	.0	1,208	.6%	1.0%	.0%	.7%
CNC Software	6.8	.0	6.8	0	.5%	.0%	1.6%	.0%
DAT Standard info ssystemes	6.7	.0	6.4	0	.5%	.0%	1.5%	.0%
Swanson Analysis	6.0	.0	6.0	0	.5%	.0%	1.4%	.0%
Ziegler Informatics	5.8	.0	5.8	0	.4%	.0%	1.4%	.0%
Serbi	4.8	.5	4.3	0	.4%	.1%	1.0%	.0%
Algor Interactive Systems	4.7	.0	4.2	0	.4%	.0%	1.0%	.0%
Moda CAD	4.4	1.1	3.1	36	.3%	.1%	.7%	.0%
ADRA Systems	4.3	.0	3.4	0	.3%	.0%	.8%	.0%
Pathtrace	4.2	.9	2.7	62	.3%	.1%	.6%	.0%
Mitsubishi Electric	4.1	2.7	1.4	387	.3%	.3%	.3%	.2%
MCS	4.1	.0	3.6	0	.3%	.0%	.9%	.0%
Olivetti	3.9	3.4	.0	475	.3%	.4%	.0%	.3%
Engineering Mechanics	3.3	.2	2.8	407	.3%	.0%	.7%	.2%
American Small Business Comp.	3.1	.0	3.1	0	.2%	.0%	.7%	.0%
Micrografx	3.1	.0	3.1	0	.2%	.0%	.7%	.0%
Vero International Software	3.1	.0	2.9	0	.2%	.0%	.7%	.0%
Whessoe Computing Systems	3.0	.0	3.0	0	.2%	.0%	.7%	.0%
Superdraft	2.8	1.3	1.4	160	.2%	.2%	.3%	.1%

(Continued)

©1993 Dataquest Incorporated

Table 9 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: Mechanical
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
RoboCAD Solutions	2.8	.0	2.1	0	.2%	.0%	.5%	.0%
Claris	2.7	.0	2.7	0	.2%	.0%	.6%	.0%
ISICAD	2.6	.0	2.6	0	.2%	.0%	.6%	.0%
Anilam Electronics	2.3	.6	1.5	18	.2%	.1%	.3%	.0%
Mitsui Engineering	2.0	1.4	.4	34	.2%	.2%	.1%	.0%
Intergraph	1.9	.0	1.8	0	.2%	.0%	.4%	.0%
PAFEC	1.9	.0	1.9	0	.1%	.0%	.5%	.0%
CAMTEK	1.9	.4	1.2	0	.1%	.1%	.3%	.0%
FEA	1.5	.4	.4	0	.1%	.0%	.1%	.0%
Aries Technology	1.3	.0	1.2	0	.1%	.0%	.3%	.0%
Applicon	1.3	.4	.5	40	.1%	.1%	.1%	.0%
Evolution Computing	1.2	.0	1.2	0	.1%	.0%	.3%	.0%
Cimlinc	1.2	.0	.8	0	.1%	.0%	.2%	.0%
Softdesk	1.1	.0	1.1	0	.1%	.0%	.3%	.0%
Foresight Resources	1.0	.0	.9	0	.1%	.0%	.2%	.0%
Areon	.9	.5	.2	6	.1%	.1%	.1%	.0%
Rasna Corporation	.9	.0	.8	0	.1%	.0%	.2%	.0%
CADSI	.8	.1	.6	14	.1%	.0%	.1%	.0%
Innovative Data Design	.8	.0	.8	0	.1%	.0%	.2%	.0%
CAD Lab	.8	.0	.7	0	.1%	.0%	.2%	.0%
MacNeal-Schwendler	.8	.0	.7	0	.1%	.0%	.2%	.0%

(Continued)

©1993 Dataquest Incorporated

Table 9 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: Mechanical
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
Aura CAD/CAM Systems	.7	.0	.6	0	.1%	.0%	.2%	.0%
A.I. Systems	.7	.0	.7	0	.1%	.0%	.2%	.0%
GRAPHSOFT	.7	.0	.7	0	.1%	.0%	.2%	.0%
Caroline Informatique	.7	.1	.3	10	.1%	.0%	.1%	.0%
CADWorks	.6	.0	.6	0	.0%	.0%	.1%	.0%
ESDU International	.6	.0	.6	0	.0%	.0%	.1%	.0%
ASCAD/ASCAM	.6	.4	.2	14	.0%	.0%	.0%	.0%
Machinery Sales	.6	.0	.6	0	.0%	.0%	.1%	.0%
Sharp System Products—NO OEM	.6	.3	.3	17	.0%	.0%	.1%	.0%
CAD-Capture	.6	.1	.2	3	.0%	.0%	.0%	.0%
S.T.L.D. s.r.l.	.5	.0	.5	0	.0%	.0%	.1%	.0%
Graphisoft Software Dev	.5	.0	.5	0	.0%	.0%	.1%	.0%
EME	.4	.1	.2	12	.0%	.0%	.0%	.0%
Uniras	.4	.0	.4	0	.0%	.0%	.1%	.0%
Cascade Graphics	.4	.0	.4	0	.0%	.0%	.1%	.0%
Ithaca Software	.4	.0	.4	0	.0%	.0%	.1%	.0%
debis Systemhaus	.4	.1	.2	6	.0%	.0%	.1%	.0%
Ashlar	.4	.0	.4	0	.0%	.0%	.1%	.0%
Mc2 Engineering Software	.3	.0	.3	0	.0%	.0%	.1%	.0%
Synthesis	.3	.0	.3	0	.0%	.0%	.1%	.0%
Engineering Systems Corp.	.3	.0	.2	0	.0%	.0%	.1%	.0%

(Continued)

©1993 Dataquest Incorporated

Table 9 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: Mechanical
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
Mega CADD	.2	.0	.2	0	.0%	.0%	.1%	.0%
Uchida Yoko	.2	.1	.1	9	.0%	.0%	.0%	.0%
Radan Computational	.2	.0	.1	5	.0%	.0%	.0%	.0%
Engineered Software	.1	.0	.1	0	.0%	.0%	.0%	.0%
IGC Technology	.1	.0	.1	0	.0%	.0%	.0%	.0%
Accugraph	.1	.0	.1	0	.0%	.0%	.0%	.0%
Lamp Software	.1	.0	.1	4	.0%	.0%	.0%	.0%
Masta Corporation	.1	.0	.0	0	.0%	.0%	.0%	.0%
Number One Systems	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	209.6	209.6	.0	55,210	16.3%	26.8%	.0%	32.9%
All Companies	1,284.2	782.1	419.1	167,792	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	884.9	581.2	262.2	148,762	68.9%	74.3%	62.6%	88.7%
All Asian-Based Companies	242.8	140.5	81.7	14,416	18.9%	18.0%	19.5%	8.6%
All European-Based Companies	156.5	60.5	75.1	4,614	12.2%	7.7%	17.9%	2.7%
All Hardware Companies	643.7	613.6	.0	154,491	50.1%	78.5%	.0%	92.1%
All Turnkey & SW Companies	640.5	168.5	419.1	13,300	49.9%	21.5%	100.0%	7.9%

Source: Dataquest (March 1993)

©1993 Dataquest Incorporated

Table 10
1992 CAD/CAM/CAE/GIS Market Share

Application: Mechanical
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
IBM	383.2	210.6	101.0	11,611	18.3%	18.2%	16.5%	10.9%
Digital	197.5	136.3	.0	2,156	9.4%	11.8%	.0%	2.0%
Hewlett-Packard	152.9	109.9	16.6	13,656	7.3%	9.5%	2.7%	12.8%
Silicon Graphics	120.0	109.0	.0	3,108	5.7%	9.4%	.0%	2.9%
EDS	119.3	59.6	43.3	1,899	5.7%	5.1%	7.1%	1.8%
Sun Microsystems	87.0	74.0	.0	5,483	4.1%	6.4%	.0%	5.1%
Computervision	74.0	22.5	30.8	667	3.5%	1.9%	5.0%	.6%
Compaq	70.8	70.8	.0	15,340	3.4%	6.1%	.0%	14.4%
Parametric Technology	65.1	.0	54.7	0	3.1%	.0%	8.9%	.0%
Control Data Systems	64.0	30.8	10.5	435	3.1%	2.7%	1.7%	.4%
Autodesk	63.9	.0	63.9	0	3.0%	.0%	10.4%	.0%
Apple Computer	61.8	54.4	.0	14,630	2.9%	4.7%	.0%	13.7%
Applicon	51.3	16.9	20.0	548	2.4%	1.5%	3.3%	.5%
Intergraph	49.4	21.8	12.7	805	2.4%	1.9%	2.1%	.8%
SDRC	36.9	.0	36.9	0	1.8%	.0%	6.0%	.0%
MacNeal-Schwendler	24.6	.0	23.6	0	1.2%	.0%	3.9%	.0%
PDA Engineering	22.9	.0	22.0	0	1.1%	.0%	3.6%	.0%
Unisys	21.3	10.8	7.4	318	1.0%	.9%	1.2%	.3%
Alias Research	21.2	.0	19.3	0	1.0%	.0%	3.2%	.0%
MCS	15.6	.0	13.8	0	.7%	.0%	2.3%	.0%

(Continued)

©1993 Dataquest Incorporated

Table 10 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: Mechanical
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
Swanson Analysis	15.4	.0	15.4	0	.7%	.0%	2.5%	.0%
Auto-Trol	15.2	5.6	5.8	190	.7%	.5%	.9%	.2%
Cimlinc	14.4	.0	10.1	337	.7%	.0%	1.6%	.3%
Gerber Systems	14.3	7.0	4.7	198	.7%	.6%	.8%	.2%
CADKEY	11.3	.0	11.3	0	.5%	.0%	1.8%	.0%
Aries Technology	9.4	.0	8.5	0	.4%	.0%	1.4%	.0%
Dell Computer	9.3	9.3	.0	2,433	.4%	.8%	.0%	2.3%
ADRA Systems	8.9	.5	6.6	32	.4%	.0%	1.1%	.0%
ICAD	8.1	.0	6.5	0	.4%	.0%	1.1%	.0%
Point Control	6.8	.0	6.6	0	.3%	.0%	1.1%	.0%
Solbourne	6.7	6.5	.0	540	.3%	.6%	.0%	.5%
EA Systems	6.2	.0	6.2	0	.3%	.0%	1.0%	.0%
Cimatron	4.6	2.1	2.1	149	.2%	.2%	.3%	.1%
CNC Software	4.1	.0	4.1	0	.2%	.0%	.7%	.0%
Algor Interactive Systems	4.1	.0	3.6	0	.2%	.0%	.6%	.0%
Cisigraph	3.9	1.1	2.2	25	.2%	.1%	.4%	.0%
Matra Datavision	3.8	1.3	1.7	35	.2%	.1%	.3%	.0%
Ontos	3.8	.0	3.8	0	.2%	.0%	.6%	.0%
Mechanical Dynamics	3.6	.0	3.2	0	.2%	.0%	.5%	.0%
Rasna Corporation	3.0	.0	2.7	0	.1%	.0%	.4%	.0%

(Continued)

©1993 Dataquest Incorporated

Table 10 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: Mechanical
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
Moda CAD	2.8	.7	2.0	23	.1%	.1%	.3%	.0%
American Small Business Comp.	2.8	.0	2.8	0	.1%	.0%	.5%	.0%
Engineering Mechanics	2.8	.1	2.4	220	.1%	.0%	.4%	.2%
CADSI	2.7	.4	2.0	18	.1%	.0%	.3%	.0%
MARC	2.4	.0	2.4	0	.1%	.0%	.4%	.0%
SPATIAL Technology	2.1	.0	2.1	0	.1%	.0%	.3%	.0%
Micrografx	1.7	.0	1.7	0	.1%	.0%	.3%	.0%
Dekcam International	1.5	.5	.7	25	.1%	.0%	.1%	.0%
Wisdom Systems	1.4	.0	1.1	0	.1%	.0%	.2%	.0%
Claris	1.3	.0	1.3	0	.1%	.0%	.2%	.0%
Softdesk	1.3	.0	1.3	0	.1%	.0%	.2%	.0%
Investronica SA	1.2	1.0	.1	48	.1%	.1%	.0%	.0%
Accugraph	1.0	.4	.5	36	.0%	.0%	.1%	.0%
Valisys	1.0	.0	.0	0	.0%	.0%	.0%	.0%
Pathtrace	1.0	.2	.6	14	.0%	.0%	.1%	.0%
Evolution Computing	.9	.0	.9	0	.0%	.0%	.2%	.0%
Computational Mechanics	.9	.0	.9	0	.0%	.0%	.1%	.0%
Foresight Resources	.9	.0	.8	0	.0%	.0%	.1%	.0%
Innovative Data Design	.8	.0	.8	0	.0%	.0%	.1%	.0%
Object Design	.8	.0	.8	0	.0%	.0%	.1%	.0%

(Continued)

©1993 Dataquest Incorporated

Table 10 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: Mechanical
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
Objectivity	.8	.0	.8	0	.0%	.0%	.1%	.0%
GRAPHSOFT	.7	.0	.7	0	.0%	.0%	.1%	.0%
Machinery Sales	.6	.0	.6	0	.0%	.0%	.1%	.0%
Aura CAD/CAM Systems	.6	.0	.6	0	.0%	.0%	.1%	.0%
A.I. Systems	.6	.0	.6	0	.0%	.0%	.1%	.0%
Uniras	.4	.0	.4	0	.0%	.0%	.1%	.0%
Ithaca Software	.4	.0	.4	0	.0%	.0%	.1%	.0%
Ashlar	.4	.0	.4	0	.0%	.0%	.1%	.0%
Cascade Graphics	.3	.0	.3	0	.0%	.0%	.1%	.0%
FEGS	.3	.0	.3	0	.0%	.0%	.0%	.0%
Engineering Systems Corp.	.3	.0	.2	0	.0%	.0%	.0%	.0%
Mc2 Engineering Software	.3	.0	.3	0	.0%	.0%	.0%	.0%
Mega CADD	.2	.0	.2	0	.0%	.0%	.0%	.0%
Synthesis	.2	.0	.2	0	.0%	.0%	.0%	.0%
Areon	.1	.0	.0	0	.0%	.0%	.0%	.0%
Technische Computer Systeme	.1	.0	.1	3	.0%	.0%	.0%	.0%
IGC Technology	.1	.0	.1	0	.0%	.0%	.0%	.0%
Georgia Tech Research Corp.	.1	.0	.1	0	.0%	.0%	.0%	.0%
Engineered Software	.1	.0	.1	0	.0%	.0%	.0%	.0%
Zuken	.0	.0	.0	0	.0%	.0%	.0%	.0%

(Continued)

©1993 Dataquest Incorporated

Table 10 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application:	Mechanical
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
Graphisoft Software Dev	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	199.5	195.0	.0	31,804	9.5%	16.8%	.0%	29.8%
All Companies	2,096.5	1,159.0	612.9	106,786	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	2,079.1	1,152.8	604.1	106,487	99.2%	99.5%	98.6%	99.7%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	17.4	6.2	8.7	299	.8%	.5%	1.4%	.3%
All Hardware Companies	868.9	750.1	2.1	93,636	41.4%	64.7%	.3%	87.7%
All Turnkey & SW Companies	1,227.6	408.9	610.8	13,150	58.6%	35.3%	99.7%	12.3%

Source: Dataquest (March 1993)

©1993 Dataquest Incorporated

Table 11
1992 CAD/CAM/CAE/GIS Market Share

Application: Mechanical
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
Hewlett-Packard	123.5	86.4	16.6	5,565	12.9%	18.7%	4.9%	24.6%
Silicon Graphics	115.6	105.2	.0	3,023	12.0%	22.8%	.0%	13.3%
EDS	100.2	51.1	35.1	1,648	10.4%	11.1%	10.5%	7.3%
IBM	77.3	43.3	19.0	2,771	8.1%	9.4%	5.7%	12.2%
Parametric Technology	65.1	.0	54.7	0	6.8%	.0%	16.3%	.0%
Computervision	59.4	22.1	17.7	584	6.2%	4.8%	5.3%	2.6%
Sun Microsystems	59.3	51.4	.0	4,228	6.2%	11.1%	.0%	18.7%
Applicon	46.2	15.2	18.0	484	4.8%	3.3%	5.4%	2.1%
Intergraph	39.5	18.2	8.7	709	4.1%	3.9%	2.6%	3.1%
Digital	38.8	26.8	.0	1,717	4.0%	5.8%	.0%	7.6%
SDRC	33.3	.0	33.3	0	3.5%	.0%	9.9%	.0%
Control Data Systems	22.4	13.7	4.7	304	2.3%	3.0%	1.4%	1.3%
Alias Research	21.2	.0	19.3	0	2.2%	.0%	5.8%	.0%
PDA Engineering	17.2	.0	16.5	0	1.8%	.0%	4.9%	.0%
Unisys	16.4	8.3	5.7	253	1.7%	1.8%	1.7%	1.1%
Auto-Trol	15.2	5.6	5.8	190	1.6%	1.2%	1.7%	.8%
Gerber Systems	14.3	7.0	4.7	198	1.5%	1.5%	1.4%	.9%
Cimlinc	12.2	.0	8.6	337	1.3%	.0%	2.6%	1.5%
Swanson Analysis	8.6	.0	8.6	0	.9%	.0%	2.6%	.0%
Aries Technology	8.5	.0	7.6	0	.9%	.0%	2.3%	.0%
ICAD	8.1	.0	6.5	0	.8%	.0%	1.9%	.0%

(Continued)

©1993 Dataquest Incorporated

Table 11 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: Mechanical
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
MCS	7.2	.0	6.4	0	.7%	.0%	1.9%	.0%
ADRA Systems	6.8	.5	5.0	32	.7%	.1%	1.5%	.1%
Matra Datavision	3.8	1.3	1.7	35	.4%	.3%	.5%	.2%
Ontos	3.8	.0	3.8	0	.4%	.0%	1.1%	.0%
Cisigraph	3.5	1.0	1.9	23	.4%	.2%	.6%	.1%
Autodesk	3.2	.0	3.2	0	.3%	.0%	1.0%	.0%
Mechanical Dynamics	3.1	.0	2.8	0	.3%	.0%	.8%	.0%
Cimatron	2.9	1.3	1.3	64	.3%	.3%	.4%	.3%
MacNeal-Schwendler	2.7	.0	2.6	0	.3%	.0%	.8%	.0%
Rasna Corporation	2.4	.0	2.2	0	.3%	.0%	.7%	.0%
CADSI	2.1	.3	1.6	10	.2%	.1%	.5%	.0%
SPATIAL Technology	2.1	.0	2.1	0	.2%	.0%	.6%	.0%
Solbourne	2.0	2.0	.0	342	.2%	.4%	.0%	1.5%
MARC	1.7	.0	1.7	0	.2%	.0%	.5%	.0%
Engineering Mechanics	1.6	.1	1.4	77	.2%	.0%	.4%	.3%
Delcam International	1.5	.5	.7	25	.2%	.1%	.2%	.1%
Wisdom Systems	1.4	.0	1.1	0	.1%	.0%	.3%	.0%
CADKEY	1.1	.0	1.1	0	.1%	.0%	.3%	.0%
Valisys	.9	.0	.0	0	.1%	.0%	.0%	.0%
Accugraph	.9	.4	.4	34	.1%	.1%	.1%	.2%
Object Design	.8	.0	.8	0	.1%	.0%	.2%	.0%

(Continued)

©1993 Dataquest Incorporated

Table 11 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: Mechanical
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
Objectivity	.8	.0	.8	0	.1%	.0%	.2%	.0%
Point Control	.5	.0	.5	0	.1%	.0%	.2%	.0%
Computational Mechanics	.4	.0	.4	0	.0%	.0%	.1%	.0%
Softdesk	.3	.0	.3	0	.0%	.0%	.1%	.0%
Ithaca Software	.2	.0	.2	0	.0%	.0%	.1%	.0%
FEGS	.2	.0	.2	0	.0%	.0%	.0%	.0%
Technische Computer Systeme	.1	.0	.1	3	.0%	.0%	.0%	.0%
Algor Interactive Systems	.1	.0	.1	0	.0%	.0%	.0%	.0%
Georgia Tech Research Corp.	.1	.0	.1	0	.0%	.0%	.0%	.0%
Zuken	.0	.0	.0	0	.0%	.0%	.0%	.0%
Synthesis	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Companies	960.5	461.7	335.3	22,657	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	948.0	457.5	328.9	22,507	98.7%	99.1%	98.1%	99.3%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	12.4	4.2	6.4	150	1.3%	.9%	1.9%	.7%
All Hardware Companies	268.3	228.4	1.0	13,029	27.9%	49.5%	.3%	57.5%
All Turnkey & SW Companies	692.2	233.2	334.3	9,628	72.1%	50.5%	99.7%	42.5%

Source: Dataquest (March 1993)

CMEC-WW-MS-9301

©1993 Dataquest Incorporated

Table 12
1992 CAD/CAM/CAE/GIS Market Share

Application: Mechanical
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	207.4	112.0	55.0	3,641	42.0%	38.6%	52.4%	52.6%
Digital	106.5	73.5	.0	0	21.6%	25.3%	.0%	.0%
Control Data Systems	40.3	16.5	5.6	128	8.2%	5.7%	5.4%	1.9%
MacNeal-Schwendler	14.0	.0	13.5	0	2.8%	.0%	12.8%	.0%
EA Systems	6.2	.0	6.2	0	1.3%	.0%	6.0%	.0%
PDA Engineering	5.7	.0	5.5	0	1.2%	.0%	5.2%	.0%
MCS	5.3	.0	4.6	0	1.1%	.0%	4.4%	.0%
Unisys	4.9	2.5	1.7	66	1.0%	.9%	1.6%	1.0%
Swanson Analysis	3.9	.0	3.9	0	.8%	.0%	3.7%	.0%
SDRC	3.7	.0	3.7	0	.7%	.0%	3.5%	.0%
EDS	2.4	.0	2.4	(10)	.5%	.0%	2.3%	-.1%
Intergraph	1.0	.0	.9	0	.2%	.0%	.8%	.0%
MARC	.7	.0	.7	0	.1%	.0%	.7%	.0%
Mechanical Dynamics	.6	.0	.5	0	.1%	.0%	.5%	.0%
Computational Mechanics	.5	.0	.5	0	.1%	.0%	.5%	.0%
FEGS	.1	.0	.1	0	.0%	.0%	.1%	.0%
Engineering Systems Corp.	.1	.0	.1	0	.0%	.0%	.0%	.0%
Valisys	.1	.0	.0	0	.0%	.0%	.0%	.0%
Georgia Tech Research Corp.	.0	.0	.0	0	.0%	.0%	.0%	.0%
Accugraph	.0	.0	.0	1	.0%	.0%	.0%	.0%

(Continued)

©1993 Dataquest Incorporated

Table 12 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: Mechanical
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	90.5	85.9	.0	3,093	18.3%	29.6%	.0%	44.7%
All Companies	493.9	290.5	104.9	6,919	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	493.3	290.5	104.3	6,919	99.9%	100.0%	99.4%	100.0%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	.6	.0	.6	0	.1%	.0%	.6%	.0%
All Hardware Companies	205.1	162.8	1.1	3,121	41.5%	56.0%	1.1%	45.1%
All Turnkey & SW Companies	288.7	127.7	103.7	3,798	58.5%	44.0%	98.9%	54.9%

Source: Dataquest (March 1993)

©1993 Dataquest Incorporated

Table 13
1992 CAD/CAM/CAE/GIS Market Share

Application: Mechanical
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
IBM	67.2	37.8	16.4	396	34.0%	31.4%	47.3%	13.5%
Digital	52.2	36.0	.0	439	26.4%	29.9%	.0%	15.0%
Sun Microsystems	27.7	22.6	.0	1,254	14.0%	18.8%	.0%	42.8%
EDS	16.7	8.5	5.8	261	8.4%	7.1%	16.9%	8.9%
Intergraph	7.4	3.6	1.7	95	3.7%	3.0%	4.9%	3.3%
MacNeal-Schwendler	7.4	.0	7.1	0	3.7%	.0%	20.5%	.0%
Solbourne	4.7	4.6	.0	198	2.4%	3.8%	.0%	6.7%
Applicon	4.6	1.5	1.8	48	2.3%	1.3%	5.2%	1.7%
Silicon Graphics	4.5	3.8	.0	85	2.3%	3.1%	.0%	2.9%
Cimlinc	1.4	.0	1.0	0	.7%	.0%	2.9%	.0%
Control Data Systems	1.3	.6	.2	2	.6%	.5%	.4%	.1%
Computervision	1.2	.4	.4	11	.6%	.3%	1.1%	.4%
Hewlett-Packard	1.1	.9	.0	134	.5%	.7%	.0%	4.6%
Cisigraph	.4	.1	.2	3	.2%	.1%	.6%	.1%
Georgia Tech Research Corp.	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	.0	.0	.0	2	.0%	.0%	.0%	.1%
All Companies	197.7	120.4	34.6	2,928	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	197.3	120.2	34.3	2,926	99.8%	99.9%	99.4%	99.9%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	.4	.1	.2	3	.2%	.1%	.6%	.1%
All Hardware Companies	90.7	68.3	.0	2,208	45.9%	56.8%	.1%	75.4%
All Turnkey & SW Companies	107.0	52.1	34.5	720	54.1%	43.2%	99.9%	24.6%

Source: Dataquest (March 1993)

©1993 Dataquest Incorporated

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

Application:	Mechanical
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
Compaq	70.8	70.8	.0	15,340	15.9%	24.7%	.0%	20.7%
Apple Computer	61.8	54.4	.0	14,630	13.9%	19.0%	.0%	19.7%
Autodesk	60.7	.0	60.7	0	13.7%	.0%	43.9%	.0%
IBM	31.3	17.5	10.8	4,804	7.0%	6.1%	7.8%	6.5%
Hewlett-Packard	28.2	22.6	.0	7,958	6.4%	7.9%	.0%	10.7%
Computervision	13.4	.0	12.7	72	3.0%	.0%	9.2%	.1%
CADKEY	10.2	.0	10.2	0	2.3%	.0%	7.4%	.0%
Dell Computer	9.3	9.3	.0	2,433	2.1%	3.3%	.0%	3.3%
Point Control	6.3	.0	6.1	0	1.4%	.0%	4.4%	.0%
CNC Software	4.1	.0	4.1	0	.9%	.0%	3.0%	.0%
Algor Interactive Systems	4.0	.0	3.5	0	.9%	.0%	2.5%	.0%
MCS	3.1	.0	2.8	0	.7%	.0%	2.0%	.0%
Swanson Analysis	2.9	.0	2.9	0	.7%	.0%	2.1%	.0%
Moda CAD	2.8	.7	2.0	23	.6%	.2%	1.4%	.0%
American Small Business Comp.	2.8	.0	2.8	0	.6%	.0%	2.0%	.0%
ADRA Systems	2.0	.0	1.6	0	.5%	.0%	1.2%	.0%
Micrografx	1.7	.0	1.7	0	.4%	.0%	1.3%	.0%
Cimatron	1.6	.7	.7	84	.4%	.3%	.5%	.1%
Intergraph	1.5	.0	1.4	0	.3%	.0%	1.0%	.0%
Claris	1.3	.0	1.3	0	.3%	.0%	1.0%	.0%
Investronica SA	1.2	1.0	.1	48	.3%	.3%	.1%	.1%

(Continued)

CMEC-WW-MS-9301

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Engineering Mechanics	1.2	.1	1.0	143	.3%	.0%	.7%	.2%
Softdesk	1.0	.0	1.0	0	.2%	.0%	.7%	.0%
Pathtrace	1.0	.2	.6	14	.2%	.1%	.5%	.0%
Aries Technology	.9	.0	.9	0	.2%	.0%	.6%	.0%
Evolution Computing	.9	.0	.9	0	.2%	.0%	.7%	.0%
Foresight Resources	.9	.0	.8	0	.2%	.0%	.6%	.0%
Innovative Data Design	.8	.0	.8	0	.2%	.0%	.6%	.0%
Cimlinc	.7	.0	.5	0	.2%	.0%	.4%	.0%
GRAPHSOFT	.7	.0	.7	0	.2%	.0%	.5%	.0%
Aura CAD/CAM Systems	.6	.0	.6	0	.1%	.0%	.4%	.0%
Machinery Sales	.6	.0	.6	0	.1%	.0%	.4%	.0%
Rasna Corporation	.6	.0	.5	0	.1%	.0%	.4%	.0%
A.I. Systems	.6	.0	.6	0	.1%	.0%	.4%	.0%
CADSI	.5	.1	.4	9	.1%	.0%	.3%	.0%
Applicon	.5	.2	.2	16	.1%	.1%	.1%	.0%
MacNeal-Schwendler	.5	.0	.5	0	.1%	.0%	.3%	.0%
Uniras	.4	.0	.4	0	.1%	.0%	.3%	.0%
Ashlar	.4	.0	.4	0	.1%	.0%	.3%	.0%
Cascade Graphics	.3	.0	.3	0	.1%	.0%	.2%	.0%
Mc2 Engineering Software	.3	.0	.3	0	.1%	.0%	.2%	.0%
Engineering Systems Corp.	.2	.0	.2	0	.0%	.0%	.1%	.0%

(Continued)

CMEC-WW-MS-9301
©1993 Dataquest Incorporated
March 15, 1993

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

Application: Mechanical
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
Ithaca Software	.2	.0	.2	0	.0%	.0%	.1%	.0%
Mega CADD	.2	.0	.2	0	.0%	.0%	.1%	.0%
Synthesis	.1	.0	.1	0	.0%	.0%	.1%	.0%
Areon	.1	.0	.0	0	.0%	.0%	.0%	.0%
IGC Technology	.1	.0	.1	0	.0%	.0%	.1%	.0%
Accugraph	.1	.0	.1	0	.0%	.0%	.1%	.0%
Engineered Software	.1	.0	.1	0	.0%	.0%	.1%	.0%
Graphisoft Software Dev	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	109.0	109.0	.0	28,709	24.5%	38.0%	.0%	38.6%
All Companies	444.5	286.6	138.2	74,283	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	440.6	284.6	136.7	74,137	99.1%	99.3%	98.9%	99.8%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	4.0	2.0	1.6	146	.9%	.7%	1.1%	.2%
All Hardware Companies	304.8	290.6	.0	75,278	68.6%	101.4%	.0%	101.3%
All Turnkey & SW Companies	139.7	(4.1)	138.2	(995)	31.4%	-1.4%	100.0%	-1.3%

Source: Dataquest (March 1993)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
IBM	667.6	372.9	169.5	15,477	20.8%	22.8%	17.9%	15.3%
Computervision	488.6	191.7	138.7	4,029	15.2%	11.7%	14.7%	4.0%
Hewlett-Packard	270.5	195.5	28.6	15,987	8.4%	12.0%	3.0%	15.8%
Intergraph	136.8	63.2	30.2	2,024	4.3%	3.9%	3.2%	2.0%
Digital	128.3	88.5	.0	1,491	4.0%	5.4%	.0%	1.5%
Siemens Nixdorf Info systeme	87.5	43.7	30.6	1,487	2.7%	2.7%	3.2%	1.5%
Matra Datavision	86.9	30.4	39.1	709	2.7%	1.9%	4.1%	.7%
Control Data Systems	81.5	39.3	13.4	554	2.5%	2.4%	1.4%	.5%
EDS	78.1	41.7	28.6	1,390	2.4%	2.6%	3.0%	1.4%
Applicon	76.3	25.2	29.7	824	2.4%	1.5%	3.1%	.8%
STI-Straessle	71.0	11.1	36.6	515	2.2%	.7%	3.9%	.5%
Compaq	70.7	70.7	.0	15,325	2.2%	4.3%	.0%	15.1%
Sun Microsystems	61.2	52.0	.0	2,804	1.9%	3.2%	.0%	2.8%
Silicon Graphics	52.1	47.1	.0	1,316	1.6%	2.9%	.0%	1.3%
Autodesk	43.8	.0	43.8	0	1.4%	.0%	4.6%	.0%
Wiechers Datentechnik	40.5	10.7	18.7	721	1.3%	.7%	2.0%	.7%
SDRC	39.3	.0	39.3	0	1.2%	.0%	4.2%	.0%
ASCAD/ASCAM	30.6	18.4	9.2	450	1.0%	1.1%	1.0%	.4%
Cisigraph	28.8	8.1	15.8	183	.9%	.5%	1.7%	.2%
ISICAD	28.4	11.2	13.7	190	.9%	.7%	1.5%	.2%
Investronica SA	27.6	22.1	2.8	1,102	.9%	1.4%	.3%	1.1%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Apple Computer	25.9	22.8	.0	6,135	.8%	1.4%	.0%	6.1%
Parametric Technology	22.0	.0	18.5	0	.7%	.0%	2.0%	.0%
Cimatron	18.9	8.5	8.5	590	.6%	.5%	.9%	.6%
MacNeal-Schwendler	17.0	.0	16.3	0	.5%	.0%	1.7%	.0%
Tebis	16.7	2.5	11.7	96	.5%	.2%	1.2%	.1%
Digital Kienzle	16.3	8.3	4.6	239	.5%	.5%	.5%	.2%
Delcam International	16.0	5.6	8.0	500	.5%	.3%	.8%	.5%
Radan Computational	15.8	5.6	7.9	328	.5%	.3%	.8%	.3%
Han Dataport	15.5	4.7	8.5	313	.5%	.3%	.9%	.3%
CAD Lab	14.7	.0	11.8	0	.5%	.0%	1.2%	.0%
Fides Industrielle Automation	14.4	2.1	10.1	111	.5%	.1%	1.1%	.1%
PAFEC	12.7	.0	12.7	0	.4%	.0%	1.3%	.0%
Exapt	12.5	6.1	4.2	229	.4%	.4%	.4%	.2%
Framasoft	12.0	.0	7.3	0	.4%	.0%	.8%	.0%
Gerber Systems	10.9	5.4	3.6	151	.3%	.3%	.4%	.1%
ICL	10.6	6.2	3.6	290	.3%	.4%	.4%	.3%
PDA Engineering	10.4	.0	10.1	0	.3%	.0%	1.1%	.0%
ItalCad	10.3	4.8	2.5	97	.3%	.3%	.3%	.1%
Marcus Computer Systeme	10.2	5.3	3.5	296	.3%	.3%	.4%	.3%
CAD Distribution	10.1	5.1	4.1	157	.3%	.3%	.4%	.2%
Swanson Analysis	10.1	.0	10.1	0	.3%	.0%	1.1%	.0%

(Continued)

CMEC-WW-MS-9301

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Unisys	9.0	4.5	3.1	135	.3%	.3%	.3%	.1%
Technische Computer Systeme	7.7	1.6	6.2	244	.2%	.1%	.7%	.2%
Research Machines	7.5	7.5	.0	1,208	.2%	.5%	.0%	1.2%
Cimlinc	7.2	.0	5.0	168	.2%	.0%	.5%	.2%
DAT Standard info ssystemes	6.7	.0	6.4	0	.2%	.0%	.7%	.0%
Auto-Trol	6.3	2.3	2.4	78	.2%	.1%	.3%	.1%
Ziegler Informatics	5.7	.0	5.7	0	.2%	.0%	.6%	.0%
Alias Research	5.2	.0	4.8	0	.2%	.0%	.5%	.0%
Serbi	4.8	.5	4.3	0	.1%	.0%	.5%	.0%
ADRA Systems	4.4	.2	3.3	16	.1%	.0%	.4%	.0%
Olivetti	4.4	3.8	.0	488	.1%	.2%	.0%	.5%
Whessoe Computing Systems	3.2	.0	3.2	0	.1%	.0%	.3%	.0%
MCS	3.2	.0	2.9	0	.1%	.0%	.3%	.0%
Dell Computer	3.1	3.1	.0	811	.1%	.2%	.0%	.8%
FEA	3.0	.7	.7	0	.1%	.0%	.1%	.0%
MARC	3.0	.0	3.0	0	.1%	.0%	.3%	.0%
CAD Centre	2.9	.0	2.3	0	.1%	.0%	.2%	.0%
debis Systemhaus	2.9	.7	1.7	20	.1%	.0%	.2%	.0%
RoboCAD Solutions	2.8	.0	2.1	0	.1%	.0%	.2%	.0%
Catalpa	2.7	.9	1.3	22	.1%	.1%	.1%	.0%
Pathtrace	2.5	.5	1.6	37	.1%	.0%	.2%	.0%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Superdraft	2.3	1.1	1.1	132	.1%	.1%	.1%	.1%
Caroline Informatique	2.3	.4	1.2	18	.1%	.0%	.1%	.0%
ISKA	2.2	1.0	.9	41	.1%	.1%	.1%	.0%
Vero International Software	2.2	.0	2.0	0	.1%	.0%	.2%	.0%
CAMTEK	2.1	.5	1.4	0	.1%	.0%	.1%	.0%
ICAD	2.0	.0	1.6	0	.1%	.0%	.2%	.0%
Point Control	1.7	.0	1.6	0	.1%	.0%	.2%	.0%
Aries Technology	1.6	.0	1.5	0	.1%	.0%	.2%	.0%
SPATIAL Technology	1.6	.0	1.6	0	.0%	.0%	.2%	.0%
Computational Mechanics	1.5	.0	1.5	0	.0%	.0%	.2%	.0%
CADKEY	1.4	.0	1.4	0	.0%	.0%	.1%	.0%
Micrografx	1.4	.0	1.4	0	.0%	.0%	.1%	.0%
FEGS	1.4	.0	1.2	0	.0%	.0%	.1%	.0%
Mechanical Dynamics	1.2	.0	1.1	0	.0%	.0%	.1%	.0%
Moda CAD	1.1	.3	.8	9	.0%	.0%	.1%	.0%
EA Systems	1.1	.0	1.1	0	.0%	.0%	.1%	.0%
CADSI	.9	.1	.7	6	.0%	.0%	.1%	.0%
CNC Software	.9	.0	.9	0	.0%	.0%	.1%	.0%
EME	.9	.2	.4	18	.0%	.0%	.0%	.0%
Areon	.8	.4	.2	6	.0%	.0%	.0%	.0%
Anilam Electronics	.8	.1	.6	0	.0%	.0%	.1%	.0%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Algor Interactive Systems	.7	.0	.6	0	.0%	.0%	.1%	.0%
ESDU International	.7	.0	.7	0	.0%	.0%	.1%	.0%
Rasna Corporation	.7	.0	.6	0	.0%	.0%	.1%	.0%
CAD-Capture	.6	.1	.2	3	.0%	.0%	.0%	.0%
S.T.L.D. s.r.l.	.5	.0	.5	0	.0%	.0%	.1%	.0%
Graphisoft Software Dev	.5	.0	.5	0	.0%	.0%	.0%	.0%
Spectrum Graphics	.4	.1	.2	3	.0%	.0%	.0%	.0%
CADWorks	.3	.0	.3	0	.0%	.0%	.0%	.0%
Evolution Computing	.3	.0	.3	0	.0%	.0%	.0%	.0%
American Small Business Comp.	.2	.0	.2	0	.0%	.0%	.0%	.0%
Ontos	.2	.0	.2	0	.0%	.0%	.0%	.0%
DAPCO	.2	.0	.1	0	.0%	.0%	.0%	.0%
Wisdom Systems	.2	.0	.1	0	.0%	.0%	.0%	.0%
Synthesis	.2	.0	.2	0	.0%	.0%	.0%	.0%
Foresight Resources	.2	.0	.1	0	.0%	.0%	.0%	.0%
Objectivity	.1	.0	.1	0	.0%	.0%	.0%	.0%
Ithaca Software	.1	.0	.1	0	.0%	.0%	.0%	.0%
Valisys	.1	.0	.0	0	.0%	.0%	.0%	.0%
Masta Corporation	.1	.0	.1	0	.0%	.0%	.0%	.0%
Lamp Software	.1	.0	.1	7	.0%	.0%	.0%	.0%
A.I. Systems	.1	.0	.1	0	.0%	.0%	.0%	.0%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Cascade Graphics	.1	.0	.1	0	.0%	.0%	.0%	.0%
Object Design	.1	.0	.1	0	.0%	.0%	.0%	.0%
Mega CADD	.1	.0	.1	0	.0%	.0%	.0%	.0%
Softdesk	.1	.0	.1	0	.0%	.0%	.0%	.0%
Engineered Software	.1	.0	.1	0	.0%	.0%	.0%	.0%
Accugraph	.0	.0	.0	1	.0%	.0%	.0%	.0%
Georgia Tech Research Corp.	.0	.0	.0	0	.0%	.0%	.0%	.0%
Number One Systems	.0	.0	.0	0	.0%	.0%	.0%	.0%
Zuken	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	170.7	165.7	.0	21,786	5.3%	10.1%	.0%	21.5%
All Companies	3,205.9	1,632.8	945.1	101,367	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	2,550.4	1,403.4	635.3	90,710	79.6%	86.0%	67.2%	89.5%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	655.5	229.4	309.8	10,657	20.4%	14.0%	32.8%	10.5%
All Hardware Companies	677.0	586.6	2.7	72,452	21.1%	35.9%	.3%	71.5%
All Turnkey & SW Companies	2,528.9	1,046.2	942.4	28,915	78.9%	64.1%	99.7%	28.5%

Source: Dataquest (March 1993)

CMEC-WW-MS-9301

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Computervision	477.9	191.7	128.5	3,965	25.1%	22.4%	20.5%	12.1%
Hewlett-Packard	236.3	168.2	28.6	9,981	12.4%	19.6%	4.6%	30.5%
IBM	137.7	75.4	35.5	2,810	7.2%	8.8%	5.7%	8.6%
Intergraph	127.2	58.6	28.0	1,890	6.7%	6.8%	4.5%	5.8%
Siemens Nixdorf Info systeme	87.5	43.7	30.6	1,487	4.6%	5.1%	4.9%	4.6%
Matra Datavision	86.9	30.4	39.1	709	4.6%	3.5%	6.2%	2.2%
STI-Straessle	71.0	11.1	36.6	515	3.7%	1.3%	5.8%	1.6%
Applicon	68.7	22.7	26.8	727	3.6%	2.6%	4.3%	2.2%
EDS	67.7	36.4	24.5	1,213	3.5%	4.2%	3.9%	3.7%
Silicon Graphics	47.2	43.0	.0	1,225	2.5%	5.0%	.0%	3.7%
Sun Microsystems	42.2	36.6	.0	2,359	2.2%	4.3%	.0%	7.2%
SDRC	35.4	.0	35.4	0	1.9%	.0%	5.7%	.0%
ASCAD/ASCAM	30.0	18.0	9.0	436	1.6%	2.1%	1.4%	1.3%
Control Data Systems	28.6	17.4	6.0	388	1.5%	2.0%	1.0%	1.2%
Digital	26.3	18.1	.0	1,191	1.4%	2.1%	.0%	3.6%
Cisigraph	25.9	7.3	14.2	164	1.4%	.8%	2.3%	.5%
ISICAD	25.9	11.2	11.2	190	1.4%	1.3%	1.8%	.6%
Parametric Technology	22.0	.0	18.5	0	1.2%	.0%	3.0%	.0%
Digital Kienzle	16.3	8.3	4.6	239	.9%	1.0%	.7%	.7%
Delcam International	16.0	5.6	8.0	500	.8%	.7%	1.3%	1.5%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Radan Computational	15.7	5.5	7.8	322	.8%	.6%	1.2%	1.0%
Han Dataport	14.0	4.2	7.7	299	.7%	.5%	1.2%	.9%
CAD Lab	13.9	.0	11.1	0	.7%	.0%	1.8%	.0%
Fides Industrielle Automation	12.3	1.8	8.6	104	.6%	.2%	1.4%	.3%
Gerber Systems	10.9	5.4	3.6	151	.6%	.6%	.6%	.5%
Framasoft	10.8	.0	6.5	0	.6%	.0%	1.0%	.0%
PAFEC	10.8	.0	10.8	0	.6%	.0%	1.7%	.0%
Cimatron	10.6	4.8	4.8	209	.6%	.6%	.8%	.6%
ICL	10.6	6.2	3.6	290	.6%	.7%	.6%	.9%
Wiechers Datentechnik	10.5	2.8	4.9	89	.6%	.3%	.8%	.3%
ItalCad	10.3	4.8	2.5	97	.5%	.6%	.4%	.3%
Marcus Computer Systeme	10.2	5.3	3.5	296	.5%	.6%	.6%	.9%
PDA Engineering	7.8	.0	7.5	0	.4%	.0%	1.2%	.0%
Technische Computer Systeme	7.7	1.6	6.2	244	.4%	.2%	1.0%	.7%
Unisys	6.9	3.5	2.4	107	.4%	.4%	.4%	.3%
Auto-Trol	6.3	2.3	2.4	78	.3%	.3%	.4%	.2%
Cimlinc	6.1	.0	4.3	168	.3%	.0%	.7%	.5%
Swanson Analysis	5.6	.0	5.6	0	.3%	.0%	.9%	.0%
Alias Research	5.2	.0	4.8	0	.3%	.0%	.8%	.0%
MacNeal-Schwendler	5.1	.0	4.9	0	.3%	.0%	.8%	.0%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Autodesk	4.4	.0	4.4	0	.2%	.0%	.7%	.0%
ADRA Systems	3.4	.2	2.5	16	.2%	.0%	.4%	.0%
Exapt	3.4	1.7	1.2	115	.2%	.2%	.2%	.4%
CAD Centre	2.9	.0	2.3	0	.2%	.0%	.4%	.0%
Catalpa	2.7	.9	1.3	22	.1%	.1%	.2%	.1%
ISKA	2.2	1.0	.9	41	.1%	.1%	.1%	.1%
debis Systemhaus	2.2	.5	1.3	12	.1%	.1%	.2%	.0%
MARC	2.1	.0	2.1	0	.1%	.0%	.3%	.0%
ICAD	2.0	.0	1.6	0	.1%	.0%	.3%	.0%
Caroline Informatique	1.6	.3	.8	8	.1%	.0%	.1%	.0%
SPATIAL Technology	1.6	.0	1.6	0	.1%	.0%	.2%	.0%
MCS	1.5	.0	1.3	0	.1%	.0%	.2%	.0%
Aries Technology	1.5	.0	1.3	0	.1%	.0%	.2%	.0%
FEA	1.2	.3	.3	0	.1%	.0%	.0%	.0%
FEGS	1.1	.0	1.0	0	.1%	.0%	.2%	.0%
Mechanical Dynamics	1.1	.0	.9	0	.1%	.0%	.2%	.0%
CADSI	.7	.1	.6	3	.0%	.0%	.1%	.0%
Rasna Corporation	.5	.0	.5	0	.0%	.0%	.1%	.0%
Computational Mechanics	.5	.0	.5	0	.0%	.0%	.1%	.0%
EME	.4	.1	.2	6	.0%	.0%	.0%	.0%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Spectrum Graphics	.4	.1	.2	3	.0%	.0%	.0%	.0%
Whessoe Computing Systems	.3	.0	.3	0	.0%	.0%	.1%	.0%
CAMTEK	.2	.1	.2	0	.0%	.0%	.0%	.0%
Ontos	.2	.0	.2	0	.0%	.0%	.0%	.0%
Wisdom Systems	.2	.0	.1	0	.0%	.0%	.0%	.0%
DAPCO	.2	.0	.1	0	.0%	.0%	.0%	.0%
Point Control	.1	.0	.1	0	.0%	.0%	.0%	.0%
CADKEY	.1	.0	.1	0	.0%	.0%	.0%	.0%
Objectivity	.1	.0	.1	0	.0%	.0%	.0%	.0%
Valisys	.1	.0	.0	0	.0%	.0%	.0%	.0%
Ithaca Software	.1	.0	.1	0	.0%	.0%	.0%	.0%
Masta Corporation	.1	.0	.1	0	.0%	.0%	.0%	.0%
Object Design	.1	.0	.1	0	.0%	.0%	.0%	.0%
Accugraph	.0	.0	.0	1	.0%	.0%	.0%	.0%
Lamp Software	.0	.0	.0	3	.0%	.0%	.0%	.0%
ESDU International	.0	.0	.0	0	.0%	.0%	.0%	.0%
CADWorks	.0	.0	.0	0	.0%	.0%	.0%	.0%
Algor Interactive Systems	.0	.0	.0	0	.0%	.0%	.0%	.0%
Softdesk	.0	.0	.0	0	.0%	.0%	.0%	.0%
Synthesis	.0	.0	.0	0	.0%	.0%	.0%	.0%

(Continued)

CMEC-WW-MS-9301

© 1993 Dataquest Incorporated

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

Application: Mechanical
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
Georgia Tech Research Corp.	.0	.0	.0	0	.0%	.0%	.0%	.0%
Zuken	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Companies	1,907.2	857.1	626.5	32,674	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	1,416.9	690.7	396.0	26,464	74.3%	80.6%	63.2%	81.0%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	490.2	166.4	230.5	6,210	25.7%	19.4%	36.8%	19.0%
All Hardware Companies	185.7	155.1	1.2	10,484	9.7%	18.1%	.2%	32.1%
All Turnkey & SW Companies	1,721.5	702.0	625.3	22,190	90.3%	81.9%	99.8%	67.9%

Source: Dataquest (March 1993)

©1993 Dataquest Incorporated

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

Application: Mechanical
Platform: Host-Dependent
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
IBM	369.2	199.4	97.8	3,836	58.4%	53.9%	71.1%	50.3%
Digital	67.2	46.4	.0	0	10.6%	12.5%	.0%	.0%
Control Data Systems	51.4	21.1	7.2	163	8.1%	5.7%	5.2%	2.1%
MacNeal-Schwendler	11.9	.0	11.4	0	1.9%	.0%	8.3%	.0%
Exapt	9.1	4.5	3.1	114	1.4%	1.2%	2.2%	1.5%
SDRC	3.9	.0	3.9	0	.6%	.0%	2.9%	.0%
PDA Engineering	2.6	.0	2.5	0	.4%	.0%	1.8%	.0%
Swanson Analysis	2.5	.0	2.5	0	.4%	.0%	1.8%	.0%
Fides Industrielle Automation	2.2	.3	1.5	7	.3%	.1%	1.1%	.1%
Unisys	2.1	1.0	.7	28	.3%	.3%	.5%	.4%
Han Dataport	1.6	.5	.9	13	.2%	.1%	.6%	.2%
Framasoft	1.2	.0	.7	0	.2%	.0%	.5%	.0%
MCS	1.1	.0	1.0	0	.2%	.0%	.7%	.0%
Computational Mechanics	1.1	.0	1.1	0	.2%	.0%	.8%	.0%
EA Systems	1.1	.0	1.1	0	.2%	.0%	.8%	.0%
MARC	.9	.0	.9	0	.1%	.0%	.7%	.0%
Whessoe Computing Systems	.6	.0	.6	0	.1%	.0%	.5%	.0%
Olivetti	.5	.4	.0	13	.1%	.1%	.0%	.2%
debis Systemhaus	.4	.1	.2	2	.1%	.0%	.2%	.0%
FEA	.3	.1	.1	0	.0%	.0%	.0%	.0%
FEGS	.3	.0	.2	0	.0%	.0%	.2%	.0%

(Continued)

©1993 Dataquest Incorporated

Table 17 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: Mechanical
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
Mechanical Dynamics	.2	.0	.2	0	.0%	.0%	.1%	.0%
ESDU International	.0	.0	.0	0	.0%	.0%	.0%	.0%
Valisys	.0	.0	.0	0	.0%	.0%	.0%	.0%
Georgia Tech Research Corp.	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	101.1	96.1	.0	3,456	16.0%	26.0%	.0%	45.3%
All Companies	632.2	369.7	137.6	7,632	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	615.0	363.9	129.2	7,484	97.3%	98.4%	93.9%	98.1%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	17.1	5.8	8.4	148	2.7%	1.6%	6.1%	1.9%
All Hardware Companies	179.1	147.1	1.5	3,505	28.3%	39.8%	1.1%	45.9%
All Turnkey & SW Companies	453.0	222.6	136.2	4,127	71.7%	60.2%	98.9%	54.1%

Source: Dataquest (March 1993)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
IBM	119.6	67.2	29.1	599	56.7%	53.7%	72.2%	30.9%
Digital	34.8	24.0	.0	300	16.5%	19.2%	.0%	15.5%
Sun Microsystems	19.0	15.5	.0	445	9.0%	12.4%	.0%	22.9%
EDS	10.4	5.3	4.1	177	4.9%	4.2%	10.1%	9.1%
Intergraph	9.6	4.7	2.2	135	4.5%	3.7%	5.4%	6.9%
Applicon	6.9	2.3	2.7	73	3.3%	1.8%	6.6%	3.7%
Silicon Graphics	4.9	4.1	.0	92	2.3%	3.3%	.0%	4.7%
Cisigraph	2.9	.8	1.6	18	1.4%	.7%	3.9%	.9%
Control Data Systems	1.6	.8	.2	3	.8%	.6%	.5%	.2%
Cimlinc	.7	.0	.5	0	.3%	.0%	1.3%	.0%
Hewlett-Packard	.7	.6	.0	99	.3%	.4%	.0%	5.1%
Other Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Companies	211.0	125.2	40.3	1,940	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	208.2	124.3	38.8	1,922	98.6%	99.3%	96.1%	99.1%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	2.9	.8	1.6	18	1.4%	.7%	3.9%	.9%
All Hardware Companies	60.4	45.0	.0	1,104	28.6%	35.9%	.1%	56.9%
All Turnkey & SW Companies	150.6	80.2	40.3	837	71.4%	64.1%	99.9%	43.1%

Source: Dataquest (March 1993)

©1993 Dataquest Incorporated

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

Application: Mechanical
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	70.7	70.7	.0	15,325	15.5%	25.2%	.0%	25.9%
IBM	41.2	31.0	7.1	8,232	9.1%	11.0%	5.0%	13.9%
Autodesk	39.4	.0	39.4	0	8.6%	.0%	28.0%	.0%
Hewlett-Packard	33.4	26.7	.0	5,907	7.3%	9.5%	.0%	10.0%
Wiechers Datentechnik	30.0	7.9	13.9	632	6.6%	2.8%	9.9%	1.1%
Investronica SA	27.6	22.1	2.8	1,102	6.0%	7.9%	2.0%	1.9%
Apple Computer	25.9	22.8	.0	6,135	5.7%	8.1%	.0%	10.4%
Tebis	16.7	2.5	11.7	96	3.7%	.9%	8.3%	.2%
Computervision	10.8	.0	10.2	64	2.4%	.0%	7.3%	.1%
CAD Distribution	10.1	5.1	4.1	157	2.2%	1.8%	2.9%	.3%
Cimatron	8.3	3.8	3.7	381	1.8%	1.3%	2.7%	.6%
Research Machines	7.5	7.5	.0	1,208	1.6%	2.7%	.0%	2.0%
DAT Standard info ssystemes	6.7	.0	6.4	0	1.5%	.0%	4.5%	.0%
Ziegler Informatics	5.7	.0	5.7	0	1.3%	.0%	4.1%	.0%
Serbi	4.8	.5	4.3	0	1.0%	.2%	3.0%	.0%
Olivetti	3.9	3.4	.0	475	.9%	1.2%	.0%	.8%
Dell Computer	3.1	3.1	.0	811	.7%	1.1%	.0%	1.4%
RoboCAD Solutions	2.8	.0	2.1	0	.6%	.0%	1.5%	.0%
ISICAD	2.6	.0	2.6	0	.6%	.0%	1.8%	.0%
Pathtrace	2.5	.5	1.6	37	.5%	.2%	1.1%	.1%
Superdraft	2.3	1.1	1.1	132	.5%	.4%	.8%	.2%

(Continued)

© 1993 Dataquest Incorporated

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

Application: Mechanical
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
Whessoe Computing Systems	2.2	.0	2.2	0	.5%	.0%	1.6%	.0%
Vero International Software	2.2	.0	2.0	0	.5%	.0%	1.4%	.0%
Swanson Analysis	1.9	.0	1.9	0	.4%	.0%	1.4%	.0%
PAFEC	1.9	.0	1.9	0	.4%	.0%	1.4%	.0%
CAMTEK	1.9	.4	1.2	0	.4%	.1%	.9%	.0%
Point Control	1.6	.0	1.5	0	.3%	.0%	1.1%	.0%
FEA	1.5	.4	.4	0	.3%	.1%	.3%	.0%
Micrografx	1.4	.0	1.4	0	.3%	.0%	1.0%	.0%
CADKEY	1.3	.0	1.3	0	.3%	.0%	.9%	.0%
Moda CAD	1.1	.3	.8	9	.2%	.1%	.5%	.0%
ADRA Systems	1.0	.0	.8	0	.2%	.0%	.6%	.0%
CNC Software	.9	.0	.9	0	.2%	.0%	.6%	.0%
Areon	.8	.4	.2	6	.2%	.1%	.1%	.0%
Anilam Electronics	.8	.1	.6	0	.2%	.0%	.4%	.0%
Applicon	.8	.2	.3	24	.2%	.1%	.2%	.0%
CAD Lab	.8	.0	.7	0	.2%	.0%	.5%	.0%
Caroline Informatique	.7	.1	.3	10	.1%	.0%	.2%	.0%
Algor Interactive Systems	.7	.0	.6	0	.1%	.0%	.4%	.0%
MCS	.7	.0	.6	0	.1%	.0%	.4%	.0%
ASCAD/ASCAM	.6	.4	.2	14	.1%	.1%	.1%	.0%
ESDU International	.6	.0	.6	0	.1%	.0%	.4%	.0%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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	.6	.1	.2	3	.1%	.0%	.1%	.0%
S.T.L.D. s.r.l.	.5	.0	.5	0	.1%	.0%	.4%	.0%
Graphisoft Software Dev	.5	.0	.5	0	.1%	.0%	.3%	.0%
EME	.4	.1	.2	12	.1%	.0%	.1%	.0%
Cimlinc	.4	.0	.3	0	.1%	.0%	.2%	.0%
debis Systemhaus	.4	.1	.2	6	.1%	.0%	.1%	.0%
CADWorks	.3	.0	.3	0	.1%	.0%	.2%	.0%
Evolution Computing	.3	.0	.3	0	.1%	.0%	.2%	.0%
American Small Business Comp.	.2	.0	.2	0	.0%	.0%	.2%	.0%
CADSI	.2	.0	.1	3	.0%	.0%	.1%	.0%
Aries Technology	.2	.0	.2	0	.0%	.0%	.1%	.0%
Synthesis	.2	.0	.2	0	.0%	.0%	.1%	.0%
Radan Computational	.2	.0	.1	5	.0%	.0%	.1%	.0%
Foresight Resources	.2	.0	.1	0	.0%	.0%	.1%	.0%
Rasna Corporation	.1	.0	.1	0	.0%	.0%	.1%	.0%
A.I. Systems	.1	.0	.1	0	.0%	.0%	.1%	.0%
Cascade Graphics	.1	.0	.1	0	.0%	.0%	.1%	.0%
Lamp Software	.1	.0	.1	4	.0%	.0%	.0%	.0%
Ithaca Software	.1	.0	.1	0	.0%	.0%	.0%	.0%
Masta Corporation	.1	.0	.0	0	.0%	.0%	.0%	.0%
Engineered Software	.1	.0	.1	0	.0%	.0%	.0%	.0%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Mega CADD	.1	.0	.1	0	.0%	.0%	.0%	.0%
Softdesk	.0	.0	.0	0	.0%	.0%	.0%	.0%
Number One Systems	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	69.6	69.6	.0	18,330	15.3%	24.8%	.0%	31.0%
All Companies	455.6	280.8	140.6	59,121	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	310.3	224.4	71.4	54,840	68.1%	79.9%	50.8%	92.8%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	145.3	56.4	69.2	4,281	31.9%	20.1%	49.2%	7.2%
All Hardware Companies	251.8	239.4	.0	57,359	55.3%	85.3%	.0%	97.0%
All Turnkey & SW Companies	203.8	41.4	140.6	1,762	44.7%	14.7%	100.0%	3.0%

Source: Dataquest (March 1993)

CMEC-WW-MS-9301

©1993 Dataquest Incorporated

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

Application: Mechanical
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
IBM	404.6	215.9	113.0	9,722	18.0%	16.5%	17.5%	15.4%
NEC	212.3	146.9	48.5	10,994	9.4%	11.2%	7.5%	17.4%
Nihon Unisys	196.3	121.7	33.4	1,901	8.7%	9.3%	5.2%	3.0%
Fujitsu	181.2	116.0	47.1	3,588	8.1%	8.9%	7.3%	5.7%
Hitachi	130.5	62.6	54.8	3,506	5.8%	4.8%	8.5%	5.6%
Hewlett-Packard	101.9	68.9	15.9	5,695	4.5%	5.3%	2.5%	9.0%
Toshiba—NO OEM	74.3	37.2	29.7	2,563	3.3%	2.8%	4.6%	4.1%
Silicon Graphics	73.4	69.7	.0	1,874	3.3%	5.3%	.0%	3.0%
Hitachi Zosen Info Systems	69.8	59.6	3.3	719	3.1%	4.6%	.5%	1.1%
Computervision	58.7	23.0	14.6	320	2.6%	1.8%	2.3%	.5%
Mutoh Industries—NO OEM	55.0	30.7	15.7	902	2.4%	2.3%	2.4%	1.4%
Sun Microsystems	43.9	37.3	.0	2,169	2.0%	2.9%	.0%	3.4%
SDRC	42.9	.0	42.9	0	1.9%	.0%	6.6%	.0%
Mitsubishi Electric	40.9	31.7	5.2	738	1.8%	2.4%	.8%	1.2%
Hakuto	38.2	22.9	15.3	850	1.7%	1.8%	2.4%	1.3%
EDS	33.2	17.0	11.6	545	1.5%	1.3%	1.8%	.9%
Tokyo Electron—NO OEM	32.3	10.7	14.5	220	1.4%	.8%	2.3%	.3%
Sharp System Products—NO OEM	29.7	15.4	14.3	286	1.3%	1.2%	2.2%	.5%
Digital	27.1	18.7	.0	300	1.2%	1.4%	.0%	.5%
Mitsui Engineering	22.6	15.8	4.5	151	1.0%	1.2%	.7%	.2%
Omron	21.8	13.1	8.7	477	1.0%	1.0%	1.3%	.8%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Autodesk	20.6	.0	20.6	0	.9%	.0%	3.2%	.0%
Toyo Information Systems-NO OEM	20.6	12.5	6.0	219	.9%	1.0%	.9%	.3%
Graphtec Engineering	15.4	7.7	6.9	331	.7%	.6%	1.1%	.5%
Parametric Technology	13.0	.0	10.9	0	.6%	.0%	1.7%	.0%
MacNeal-Schwendler	11.8	.0	11.3	0	.5%	.0%	1.7%	.0%
Intergraph	11.3	5.0	2.9	165	.5%	.4%	.5%	.3%
Control Data Systems	11.2	5.4	1.9	76	.5%	.4%	.3%	.1%
Sumitomo Denko Workstation	11.1	11.1	.0	1,808	.5%	.8%	.0%	2.9%
Apple Computer	11.0	9.7	.0	2,596	.5%	.7%	.0%	4.1%
Andor	10.4	2.6	7.4	80	.5%	.2%	1.1%	.1%
Design Automation	10.2	.5	9.6	54	.5%	.0%	1.5%	.1%
Wacom	8.9	1.8	6.2	161	.4%	.1%	1.0%	.3%
Applicon	7.4	3.2	3.5	80	.3%	.2%	.5%	.1%
Cisigraph	6.6	1.9	3.7	43	.3%	.1%	.6%	.1%
MARC	6.6	.0	6.6	0	.3%	.0%	1.0%	.0%
Alias Research	6.2	.0	5.7	0	.3%	.0%	.9%	.0%
Sony	5.8	5.1	.0	338	.3%	.4%	.0%	.5%
Swanson Analysis	5.3	.0	5.3	0	.2%	.0%	.8%	.0%
Fides Industrielle Automation	4.8	.7	3.4	55	.2%	.1%	.5%	.1%
Matra Datavision	4.8	1.7	2.2	0	.2%	.1%	.3%	.0%
ADRA Systems	4.4	.2	3.3	16	.2%	.0%	.5%	.0%

(Continued)

CMEC-WW-MS-9301

©1993 Dataquest Incorporated

March 15, 1993

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

Application: Mechanical
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
Kubota Computer	4.2	2.8	.7	264	.2%	.2%	.1%	.4%
Unisys	4.2	2.1	1.5	63	.2%	.2%	.2%	.1%
Century Research Center	3.4	1.8	1.3	12	.2%	.1%	.2%	.0%
ICAD	3.4	.0	2.7	0	.2%	.0%	.4%	.0%
CADIX	3.4	1.3	1.7	25	.1%	.1%	.3%	.0%
Cimatron	3.0	1.4	1.4	99	.1%	.1%	.2%	.2%
Mechanical Dynamics	2.9	.0	2.6	0	.1%	.0%	.4%	.0%
Delcam International	2.8	1.0	1.4	46	.1%	.1%	.2%	.1%
Framasoft	2.7	.0	1.6	0	.1%	.0%	.3%	.0%
Cimlinc	2.4	.0	1.7	56	.1%	.0%	.3%	.1%
Ricoh—NO OEM	2.2	.0	1.9	0	.1%	.0%	.3%	.0%
Aries Technology	2.0	.0	1.8	0	.1%	.0%	.3%	.0%
Uchida Yoko	1.9	1.1	.7	45	.1%	.1%	.1%	.1%
PDA Engineering	1.8	.0	1.7	0	.1%	.0%	.3%	.0%
SPATIAL Technology	1.6	.0	1.6	0	.1%	.0%	.2%	.0%
Anilam Electronics	1.5	.5	.9	18	.1%	.0%	.1%	.0%
MCS	1.4	.0	1.3	0	.1%	.0%	.2%	.0%
CADKEY	1.4	.0	1.4	0	.1%	.0%	.2%	.0%
Point Control	1.2	.0	1.1	0	.1%	.0%	.2%	.0%
Zuken	.9	.3	.5	6	.0%	.0%	.1%	.0%
Auto-Trol	.9	.3	.3	11	.0%	.0%	.1%	.0%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
EA Systems	.8	.0	.8	0	.0%	.0%	.1%	.0%
Gerber Systems	.8	.4	.3	11	.0%	.0%	.0%	.0%
Solbourne	.7	.7	.0	60	.0%	.1%	.0%	.1%
ISICAD	.7	.3	.4	5	.0%	.0%	.1%	.0%
Whessoe Computing Systems	.7	.0	.7	0	.0%	.0%	.1%	.0%
CNC Software	.7	.0	.7	0	.0%	.0%	.1%	.0%
CADSI	.6	.1	.5	4	.0%	.0%	.1%	.0%
Rasna Corporation	.6	.0	.6	0	.0%	.0%	.1%	.0%
CAD Centre	.5	.0	.4	0	.0%	.0%	.1%	.0%
Moda CAD	.4	.1	.3	4	.0%	.0%	.0%	.0%
Wiechers Datentechnik	.4	.1	.2	7	.0%	.0%	.0%	.0%
CADWorks	.3	.0	.3	0	.0%	.0%	.0%	.0%
Investronica SA	.3	.2	.0	12	.0%	.0%	.0%	.0%
Technische Computer Systeme	.3	.1	.3	8	.0%	.0%	.0%	.0%
Superdraft	.3	.1	.1	14	.0%	.0%	.0%	.0%
Object Design	.2	.0	.2	0	.0%	.0%	.0%	.0%
Wisdom Systems	.2	.0	.1	0	.0%	.0%	.0%	.0%
Pathtrace	.1	.0	.1	2	.0%	.0%	.0%	.0%
Ithaca Software	.1	.0	.1	0	.0%	.0%	.0%	.0%
PAFEC	.1	.0	.1	0	.0%	.0%	.0%	.0%
Softdesk	.1	.0	.1	0	.0%	.0%	.0%	.0%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Algor Interactive Systems	.1	.0	.1	0	.0%	.0%	.0%	.0%
American Small Business Comp.	.1	.0	.1	0	.0%	.0%	.0%	.0%
Valisys	.1	.0	.0	0	.0%	.0%	.0%	.0%
Objectivity	.1	.0	.1	0	.0%	.0%	.0%	.0%
Accugraph	.0	.0	.0	1	.0%	.0%	.0%	.0%
Georgia Tech Research Corp.	.0	.0	.0	0	.0%	.0%	.0%	.0%
Mega CADD	.0	.0	.0	0	.0%	.0%	.0%	.0%
Foresight Resources	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	93.7	90.3	.0	8,824	4.2%	6.9%	.0%	14.0%
All Companies	2,249.8	1,308.8	646.2	63,139	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	1,017.8	568.3	292.1	32,597	45.2%	43.4%	45.2%	51.6%
All Asian-Based Companies	1,203.1	732.9	337.8	30,237	53.5%	56.0%	52.3%	47.9%
All European-Based Companies	28.9	7.6	16.3	304	1.3%	.6%	2.5%	.5%
All Hardware Companies	327.2	295.9	.4	28,397	14.5%	22.6%	.1%	45.0%
All Turnkey & SW Companies	1,922.6	1,012.9	645.8	34,741	85.5%	77.4%	99.9%	55.0%

Source: Dataquest (March 1993)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Hewlett-Packard	97.1	65.0	15.9	4,168	8.3%	9.8%	4.5%	17.1%
Hitachi	94.0	45.1	39.5	2,032	8.1%	6.8%	11.1%	8.3%
NEC	89.2	49.0	33.0	2,940	7.7%	7.4%	9.3%	12.0%
IBM	80.3	45.0	19.7	2,181	6.9%	6.8%	5.6%	8.9%
Fujitsu	76.1	48.7	19.8	1,551	6.5%	7.4%	5.6%	6.4%
Silicon Graphics	73.4	69.7	.0	1,874	6.3%	10.5%	.0%	7.7%
Nihon Unisys	68.7	42.6	11.7	561	5.9%	6.4%	3.3%	2.3%
Hitachi Zosen Info Systems	65.7	55.8	3.3	672	5.6%	8.4%	.9%	2.8%
Computervision	58.3	23.0	14.2	320	5.0%	3.5%	4.0%	1.3%
Toshiba—NO OEM	44.6	22.3	17.8	528	3.8%	3.4%	5.0%	2.2%
SDRC	38.6	.0	38.6	0	3.3%	.0%	10.9%	.0%
Tokyo Electron—NO OEM	32.3	10.7	14.5	220	2.8%	1.6%	4.1%	.9%
Mitsubishi Electric	30.8	26.2	2.2	332	2.6%	4.0%	.6%	1.4%
Sun Microsystems	30.4	26.3	.0	1,761	2.6%	4.0%	.0%	7.2%
Sharp System Products—NO OEM	29.1	15.1	14.0	268	2.5%	2.3%	3.9%	1.1%
EDS	27.9	14.7	9.3	486	2.4%	2.2%	2.6%	2.0%
Omron	21.8	13.1	8.7	477	1.9%	2.0%	2.5%	2.0%
Mutoh Industries—NO OEM	20.9	12.5	6.3	213	1.8%	1.9%	1.8%	.9%
Mitsui Engineering	20.6	14.4	4.1	116	1.8%	2.2%	1.2%	.5%
Toyo Information Systems-NO OEM	16.4	10.2	4.7	194	1.4%	1.5%	1.3%	.8%
Graphtec Engineering	15.4	7.7	6.9	331	1.3%	1.2%	2.0%	1.4%

(Continued)

CMEC-WW-MS-9301

©1993 Dataquest Incorporated

March 15, 1993

Table 21 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: Mechanical
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
Parametric Technology	13.0	.0	10.9	0	1.1%	.0%	3.1%	.0%
Sumitomo Denko Workstation	10.3	10.3	.0	1,640	.9%	1.6%	.0%	6.7%
Intergraph	9.0	4.2	2.0	133	.8%	.6%	.6%	.5%
Alias Research	6.2	.0	5.7	0	.5%	.0%	1.6%	.0%
Cisigraph	6.0	1.7	3.3	38	.5%	.3%	.9%	.2%
Applicon	6.0	2.6	2.8	66	.5%	.4%	.8%	.3%
Sony	5.8	5.1	.0	338	.5%	.8%	.0%	1.4%
Digital	5.4	3.7	.0	240	.5%	.6%	.0%	1.0%
Matra Datavision	4.8	1.7	2.2	0	.4%	.3%	.6%	.0%
MARC	4.6	.0	4.6	0	.4%	.0%	1.3%	.0%
Fides Industrielle Automation	4.1	.6	2.9	51	.4%	.1%	.8%	.2%
Control Data Systems	3.9	2.4	.8	53	.3%	.4%	.2%	.2%
Kubota Computer	3.8	2.4	.7	207	.3%	.4%	.2%	.8%
ADRA Systems	3.4	.2	2.5	16	.3%	.0%	.7%	.1%
ICAD	3.4	.0	2.7	0	.3%	.0%	.8%	.0%
CADIX	3.4	1.3	1.7	25	.3%	.2%	.5%	.1%
Unisys	3.2	1.6	1.1	50	.3%	.2%	.3%	.2%
Swanson Analysis	3.0	.0	3.0	0	.3%	.0%	.8%	.0%
Delcam International	2.8	1.0	1.4	46	.2%	.1%	.4%	.2%
Framasoft	2.5	.0	1.5	0	.2%	.0%	.4%	.0%
Mechanical Dynamics	2.4	.0	2.2	0	.2%	.0%	.6%	.0%

(Continued)

CMEC-WW-MS-9301
©1993 Dataquest Incorporated
March 15, 1993

Table 21 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: Mechanical
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
Ricoh—NO OEM	2.2	.0	1.9	0	.2%	.0%	.5%	.0%
Cimlinc	2.0	.0	1.4	56	.2%	.0%	.4%	.2%
Cimatron	1.9	.9	.9	43	.2%	.1%	.2%	.2%
Hakuto	1.9	1.2	.8	34	.2%	.2%	.2%	.1%
Aries Technology	1.8	.0	1.6	0	.2%	.0%	.5%	.0%
Century Research Center	1.8	.9	.7	10	.2%	.1%	.2%	.0%
Uchida Yoko	1.7	1.0	.6	36	.1%	.2%	.2%	.1%
SPATIAL Technology	1.6	.0	1.6	0	.1%	.0%	.4%	.0%
PDA Engineering	1.3	.0	1.3	0	.1%	.0%	.4%	.0%
MacNeal-Schwendler	1.3	.0	1.2	0	.1%	.0%	.4%	.0%
Wacom	1.3	.3	.9	14	.1%	.0%	.3%	.1%
Autodesk	1.0	.0	1.0	0	.1%	.0%	.3%	.0%
Zuken	.9	.3	.5	6	.1%	.0%	.1%	.0%
Auto-Trol	.9	.3	.3	11	.1%	.0%	.1%	.0%
Gerber Systems	.8	.4	.3	11	.1%	.1%	.1%	.0%
ISICAD	.7	.3	.3	5	.1%	.0%	.1%	.0%
MCS	.7	.0	.6	0	.1%	.0%	.2%	.0%
CADSI	.5	.1	.4	2	.0%	.0%	.1%	.0%
CAD Centre	.5	.0	.4	0	.0%	.0%	.1%	.0%
Rasna Corporation	.5	.0	.4	0	.0%	.0%	.1%	.0%
Technische Computer Systeme	.3	.1	.3	8	.0%	.0%	.1%	.0%
Solbourne	.2	.2	.0	38	.0%	.0%	.0%	.2%

(Continued)

©1993 Dataquest Incorporated

Table 21 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: Mechanical
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
Object Design	.2	.0	.2	0	.0%	.0%	.1%	.0%
Wisdom Systems	.2	.0	.1	0	.0%	.0%	.0%	.0%
CADKEY	.1	.0	.1	0	.0%	.0%	.0%	.0%
Wiechers Datentechnik	.1	.0	.1	1	.0%	.0%	.0%	.0%
PAFEC	.1	.0	.1	0	.0%	.0%	.0%	.0%
Point Control	.1	.0	.1	0	.0%	.0%	.0%	.0%
Whessoe Computing Systems	.1	.0	.1	0	.0%	.0%	.0%	.0%
Ithaca Software	.1	.0	.1	0	.0%	.0%	.0%	.0%
Valisys	.1	.0	.0	0	.0%	.0%	.0%	.0%
Objectivity	.1	.0	.1	0	.0%	.0%	.0%	.0%
Accugraph	.0	.0	.0	1	.0%	.0%	.0%	.0%
CADWorks	.0	.0	.0	0	.0%	.0%	.0%	.0%
Softdesk	.0	.0	.0	0	.0%	.0%	.0%	.0%
Georgia Tech Research Corp.	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Companies	1,165.3	661.9	354.3	24,404	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	483.8	259.7	147.2	11,471	41.5%	39.2%	41.5%	47.0%
All Asian-Based Companies	658.4	396.3	194.1	12,745	56.5%	59.9%	54.8%	52.2%
All European-Based Companies	23.1	5.9	12.9	188	2.0%	.9%	3.6%	.8%
All Hardware Companies	151.4	136.8	.2	8,246	13.0%	20.7%	.0%	33.8%
All Turnkey & SW Companies	1,013.9	525.1	354.1	16,158	87.0%	79.3%	100.0%	66.2%

Source: Dataquest (March 1993)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
IBM	215.4	116.3	57.1	2,990	34.4%	29.8%	41.3%	36.0%
Nihon Unisys	127.6	79.1	21.7	1,340	20.4%	20.2%	15.7%	16.1%
NEC	70.1	53.2	11.2	152	11.2%	13.6%	8.1%	1.8%
Fujitsu	68.9	44.1	17.9	959	11.0%	11.3%	13.0%	11.6%
Digital	14.4	10.0	.0	0	2.3%	2.5%	.0%	.0%
Hitachi	13.1	6.3	5.5	232	2.1%	1.6%	4.0%	2.8%
Control Data Systems	7.1	2.9	1.0	22	1.1%	.7%	.7%	.3%
MacNeal-Schwendler	6.7	.0	6.4	0	1.1%	.0%	4.7%	.0%
Mitsubishi Electric	5.9	2.8	1.7	19	.9%	.7%	1.2%	.2%
Toshiba—NO OEM	5.2	2.6	2.1	74	.8%	.7%	1.5%	.9%
SDRC	4.3	.0	4.3	0	.7%	.0%	3.1%	.0%
Toyo Information Systems-NO OEM	4.2	2.3	1.3	25	.7%	.6%	1.0%	.3%
Hitachi Zosen Info Systems	4.2	3.8	.0	47	.7%	1.0%	.0%	.6%
MARC	2.0	.0	2.0	0	.3%	.0%	1.4%	.0%
Century Research Center	1.6	.9	.6	2	.3%	.2%	.4%	.0%
Swanson Analysis	1.3	.0	1.3	0	.2%	.0%	1.0%	.0%
Unisys	1.0	.5	.3	13	.2%	.1%	.2%	.2%
EA Systems	.8	.0	.8	0	.1%	.0%	.6%	.0%
Fides Industrielle Automation	.7	.1	.5	3	.1%	.0%	.4%	.0%
EDS	.7	.0	.7	(2)	.1%	.0%	.5%	-.0%
MCS	.5	.0	.4	0	.1%	.0%	.3%	.0%

(Continued)

CMEC-WW-MS-9301

©1993 Dataquest Incorporated

Table 22 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: Mechanical
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
PDA Engineering	.4	.0	.4	0	.1%	.0%	.3%	.0%
Mechanical Dynamics	.4	.0	.4	0	.1%	.0%	.3%	.0%
Kubota Computer	.4	.4	.0	57	.1%	.1%	.0%	.7%
Intergraph	.2	.0	.2	0	.0%	.0%	.2%	.0%
Framasoft	.2	.0	.1	0	.0%	.0%	.1%	.0%
Whessoe Computing Systems	.1	.0	.1	0	.0%	.0%	.1%	.0%
Georgia Tech Research Corp.	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	69.2	65.7	.0	2,365	11.0%	16.8%	.0%	28.5%
All Companies	626.6	390.9	138.1	8,299	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	324.4	195.4	75.3	5,388	51.8%	50.0%	54.6%	64.9%
All Asian-Based Companies	301.1	195.4	62.0	2,908	48.1%	50.0%	44.9%	35.0%
All European-Based Companies	1.1	.1	.8	3	.2%	.0%	.6%	.0%
All Hardware Companies	85.0	76.3	.2	2,370	13.6%	19.5%	.1%	28.6%
All Turnkey & SW Companies	541.6	314.7	137.9	5,929	86.4%	80.5%	99.9%	71.4%

Source: Dataquest (March 1993)

©1993 Dataquest Incorporated

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

Application: Mechanical
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	69.4	38.9	17.0	352	66.1%	63.5%	71.8%	30.7%
Sun Microsystems	13.5	11.0	.0	408	12.9%	18.0%	.0%	35.6%
Digital	7.2	5.0	.0	60	6.9%	8.1%	.0%	5.3%
EDS	4.7	2.4	1.6	61	4.4%	3.9%	6.9%	5.4%
MacNeal-Schwendler	3.5	.0	3.4	0	3.4%	.0%	14.3%	.0%
Intergraph	1.7	.8	.4	32	1.6%	1.3%	1.7%	2.8%
Applicon	1.5	.6	.7	14	1.4%	1.0%	2.8%	1.3%
Hewlett-Packard	1.1	.9	.0	22	1.1%	1.5%	.0%	1.9%
Sumitomo Denko Workstation	.8	.8	.0	169	.7%	1.3%	.0%	14.7%
Cisigraph	.7	.2	.4	4	.6%	.3%	1.6%	.4%
Solbourne	.5	.5	.0	22	.5%	.8%	.0%	1.9%
Cimlinc	.2	.0	.2	0	.2%	.0%	.7%	.0%
Control Data Systems	.2	.1	.0	0	.2%	.2%	.1%	.0%
Other Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Companies	105.0	61.2	23.7	1,145	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	103.5	60.2	23.3	972	98.6%	98.4%	98.4%	84.9%
All Asian-Based Companies	.8	.8	.0	169	.7%	1.3%	.0%	14.7%
All European-Based Companies	.7	.2	.4	4	.6%	.3%	1.6%	.4%
All Hardware Companies	23.2	18.2	.0	681	22.1%	29.8%	.0%	59.5%
All Turnkey & SW Companies	81.8	42.9	23.7	464	77.9%	70.2%	100.0%	40.5%

Source: Dataquest (March 1993)

CMEC-WW-MS-9301

©1993 Dataquest Incorporated

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

Application: Mechanical
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	53.1	44.6	4.3	7,902	15.0%	22.9%	3.3%	27.0%
IBM	39.5	15.8	19.3	4,200	11.2%	8.1%	14.8%	14.3%
Hakuto	36.3	21.8	14.5	816	10.3%	11.2%	11.2%	2.8%
Fujitsu	36.2	23.2	9.4	1,077	10.3%	11.9%	7.2%	3.7%
Mutoh Industries—NO OEM	34.1	18.2	9.5	689	9.7%	9.3%	7.3%	2.4%
Toshiba—NO OEM	24.5	12.3	9.8	1,961	6.9%	6.3%	7.5%	6.7%
Hitachi	23.5	11.3	9.9	1,242	6.7%	5.8%	7.6%	4.2%
Autodesk	19.6	.0	19.6	0	5.5%	.0%	15.0%	.0%
Apple Computer	11.0	9.7	.0	2,596	3.1%	5.0%	.0%	8.9%
Andor	10.4	2.6	7.4	80	2.9%	1.3%	5.7%	.3%
Design Automation	10.2	.5	9.6	54	2.9%	.3%	7.3%	.2%
Wacom	7.7	1.5	5.3	147	2.2%	.8%	4.1%	.5%
Mitsubishi Electric	4.1	2.7	1.4	387	1.2%	1.4%	1.1%	1.3%
Hewlett-Packard	3.6	2.9	.0	1,505	1.0%	1.5%	.0%	5.1%
Mitsui Engineering	2.0	1.4	.4	34	.6%	.7%	.3%	.1%
Anilam Electronics	1.5	.5	.9	18	.4%	.2%	.7%	.1%
CADKEY	1.3	.0	1.3	0	.4%	.0%	1.0%	.0%
Cimatron	1.1	.5	.5	56	.3%	.3%	.4%	.2%
Point Control	1.1	.0	1.0	0	.3%	.0%	.8%	.0%
ADRA Systems	1.0	.0	.8	0	.3%	.0%	.6%	.0%
Swanson Analysis	1.0	.0	1.0	0	.3%	.0%	.8%	.0%

(Continued)

CMEC-WW-MS-9301

©1993 Dataquest Incorporated

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

Application: Mechanical
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
CNC Software	.7	.0	.7	0	.2%	.0%	.5%	.0%
Sharp System Products—NO OEM	.6	.3	.3	17	.2%	.2%	.2%	.1%
Whessoe Computing Systems	.5	.0	.5	0	.1%	.0%	.4%	.0%
Moda CAD	.4	.1	.3	4	.1%	.1%	.2%	.0%
Computervision	.4	.0	.4	0	.1%	.0%	.3%	.0%
Intergraph	.3	.0	.3	0	.1%	.0%	.2%	.0%
CADWorks	.3	.0	.3	0	.1%	.0%	.2%	.0%
Investronica SA	.3	.2	.0	12	.1%	.1%	.0%	.0%
Wiechers Datentechnik	.3	.1	.1	6	.1%	.0%	.1%	.0%
MCS	.3	.0	.3	0	.1%	.0%	.2%	.0%
Superdraft	.3	.1	.1	14	.1%	.1%	.1%	.0%
MacNeal-Schwendler	.2	.0	.2	0	.1%	.0%	.2%	.0%
Aries Technology	.2	.0	.2	0	.1%	.0%	.1%	.0%
Uchida Yoko	.2	.1	.1	9	.1%	.1%	.1%	.0%
CADSI	.1	.0	.1	2	.0%	.0%	.1%	.0%
Pathtrace	.1	.0	.1	2	.0%	.0%	.1%	.0%
Rasna Corporation	.1	.0	.1	0	.0%	.0%	.1%	.0%
Cimlinc	.1	.0	.1	0	.0%	.0%	.1%	.0%
Algor Interactive Systems	.1	.0	.1	0	.0%	.0%	.1%	.0%
Softdesk	.1	.0	.1	0	.0%	.0%	.1%	.0%
ISICAD	.1	.0	.1	0	.0%	.0%	.1%	.0%

(Continued)

CMEC-WW-MS-9301

©1993 Dataquest Incorporated

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

Application: Mechanical
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
American Small Business Comp.	.1	.0	.1	0	.0%	.0%	.0%	.0%
Ithaca Software	.1	.0	.1	0	.0%	.0%	.0%	.0%
Mega CADD	.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%
Other Companies	24.5	24.5	.0	6,460	6.9%	12.6%	.0%	22.1%
All Companies	353.0	194.8	130.2	29,291	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	106.2	53.0	46.3	14,766	30.1%	27.2%	35.5%	50.4%
All Asian-Based Companies	242.8	140.5	81.7	14,416	68.8%	72.1%	62.8%	49.2%
All European-Based Companies	4.0	1.4	2.2	109	1.1%	.7%	1.7%	.4%
All Hardware Companies	67.6	64.6	.0	17,101	19.2%	33.2%	.0%	58.4%
All Turnkey & SW Companies	285.4	130.2	130.2	12,190	80.8%	66.8%	100.0%	41.6%

Source: Dataquest (March 1993)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
IBM	17.2	10.9	3.5	1,201	16.7%	19.0%	11.1%	18.3%
Hewlett-Packard	10.3	6.7	1.8	525	10.0%	11.8%	5.8%	8.0%
Digital	9.9	6.8	.0	113	9.6%	12.0%	.0%	1.7%
Compaq	7.7	7.7	.0	1,667	7.5%	13.5%	.0%	25.4%
Computervision	6.8	2.2	2.5	59	6.6%	3.9%	8.1%	.9%
Engineering Mechanics	5.1	.3	4.4	408	5.0%	.4%	14.0%	6.2%
SDRC	4.2	.0	4.2	0	4.0%	.0%	13.4%	.0%
Intergraph	4.1	1.8	1.0	66	3.9%	3.1%	3.3%	1.0%
Control Data Systems	3.2	1.5	.5	22	3.1%	2.7%	1.7%	.3%
Cimatron	2.5	1.1	1.2	83	2.5%	2.0%	3.7%	1.3%
EDS	2.3	1.2	.8	36	2.2%	2.0%	2.6%	.5%
Sun Microsystems	2.2	1.9	.0	140	2.2%	3.3%	.0%	2.1%
Delcam International	2.1	.7	1.1	36	2.0%	1.3%	3.4%	.5%
Siemens Nixdorf Info systeme	1.8	.9	.6	31	1.8%	1.6%	2.1%	.5%
Autodesk	1.6	.0	1.6	0	1.5%	.0%	5.0%	.0%
Claris	1.3	.0	1.3	0	1.3%	.0%	4.3%	.0%
CNC Software	1.2	.0	1.2	0	1.1%	.0%	3.7%	.0%
MacNeal-Schwendler	1.1	.0	1.1	0	1.1%	.0%	3.4%	.0%
Apple Computer	1.0	.9	.0	236	1.0%	1.5%	.0%	3.6%
Vero International Software	1.0	.0	.9	0	.9%	.0%	2.8%	.0%
ADRA Systems	.8	.2	.5	0	.8%	.4%	1.7%	.0%

(Continued)

CMEC-WW-MS-9301

©1993 Dataquest Incorporated

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

Application:	Mechanical
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
Swanson Analysis	.6	.0	.6	0	.6%	.0%	2.0%	.0%
Pathtrace	.6	.1	.4	9	.6%	.2%	1.3%	.1%
Aries Technology	.4	.0	.4	0	.4%	.0%	1.2%	.0%
Point Control	.4	.0	.4	0	.3%	.0%	1.1%	.0%
Unisys	.4	.2	.1	5	.3%	.3%	.4%	.1%
Whessoe Computing Systems	.3	.0	.3	0	.3%	.0%	1.1%	.0%
Superdraft	.3	.1	.1	14	.2%	.2%	.4%	.2%
Investronica SA	.2	.2	.0	8	.2%	.3%	.1%	.1%
Aura CAD/CAM Systems	.1	.0	.1	0	.1%	.0%	.3%	.0%
American Small Business Comp.	.1	.0	.1	0	.1%	.0%	.3%	.0%
Engineering Systems Corp.	.1	.0	.1	0	.1%	.0%	.2%	.0%
Mc2 Engineering Software	.1	.0	.1	0	.1%	.0%	.3%	.0%
Ithaca Software	.1	.0	.1	0	.1%	.0%	.3%	.0%
Softdesk	.1	.0	.1	0	.1%	.0%	.2%	.0%
Georgia Tech Research Corp.	.1	.0	.1	0	.1%	.0%	.2%	.0%
Moda CAD	.0	.0	.0	0	.0%	.0%	.1%	.0%
Algor Interactive Systems	.0	.0	.0	0	.0%	.0%	.1%	.0%
Ziegler Informatics	.0	.0	.0	0	.0%	.0%	.1%	.0%
Rasna Corporation	.0	.0	.0	0	.0%	.0%	.1%	.0%
Innovative Data Design	.0	.0	.0	0	.0%	.0%	.1%	.0%
Accugraph	.0	.0	.0	1	.0%	.0%	.0%	.0%

(Continued)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Areon	.0	.0	.0	0	.0%	.0%	.0%	.0%
Fides Industrielle Automation	.0	.0	.0	0	.0%	.0%	.0%	.0%
FEA	.0	.0	.0	0	.0%	.0%	.0%	.0%
ESDU International	.0	.0	.0	0	.0%	.0%	.0%	.0%
Foresight Resources	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	11.8	11.6	.0	1,893	11.5%	20.3%	.0%	28.9%
All Companies	103.1	57.0	31.1	6,553	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	94.2	53.8	26.5	6,372	91.3%	94.4%	85.1%	97.2%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	8.9	3.2	4.7	181	8.7%	5.6%	14.9%	2.8%
All Hardware Companies	39.0	34.3	.1	5,315	37.9%	60.2%	.4%	81.1%
All Turnkey & SW Companies	64.1	22.7	31.0	1,238	62.1%	39.8%	99.6%	18.9%

Source: Dataquest (March 1993)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Hewlett-Packard	9.5	6.1	1.8	307	22.4%	32.6%	11.2%	29.9%
Computervision	5.9	2.2	1.8	58	13.9%	11.6%	10.9%	5.6%
SDRC	3.8	.0	3.8	0	8.8%	.0%	23.3%	.0%
Intergraph	3.2	1.5	.7	58	7.6%	8.0%	4.4%	5.7%
IBM	3.0	1.7	.7	107	7.0%	8.9%	4.5%	10.4%
Engineering Mechanics	3.0	.2	2.5	144	7.0%	.8%	15.7%	14.0%
Delcam International	2.1	.7	1.1	36	5.0%	4.0%	6.6%	3.5%
Digital	2.0	1.4	.0	90	4.8%	7.5%	.0%	8.8%
EDS	1.9	1.0	.6	31	4.5%	5.3%	4.0%	3.0%
Siemens Nixdorf Info systeme	1.8	.9	.6	31	4.3%	4.9%	4.0%	3.0%
Cimatron	1.6	.7	.7	36	3.8%	3.9%	4.5%	3.5%
Sun Microsystems	1.5	1.3	.0	108	3.6%	7.0%	.0%	10.6%
Control Data Systems	1.1	.7	.2	15	2.6%	3.7%	1.5%	1.5%
ADRA Systems	.6	.2	.4	0	1.5%	1.1%	2.3%	.0%
Aries Technology	.4	.0	.3	0	.8%	.0%	2.1%	.0%
Swanson Analysis	.4	.0	.4	0	.8%	.0%	2.2%	.0%
Unisys	.3	.1	.1	4	.6%	.7%	.6%	.4%
MacNeal-Schwendler	.1	.0	.1	0	.3%	.0%	.7%	.0%
Autodesk	.1	.0	.1	0	.2%	.0%	.5%	.0%
Georgia Tech Research Corp.	.0	.0	.0	0	.1%	.0%	.2%	.0%
Rasna Corporation	.0	.0	.0	0	.1%	.0%	.2%	.0%

(Continued)

©1993 Dataquest Incorporated

Table 26 (Continued)
1992 CAD/CAM/CAE/GIS Market Share

Application: Mechanical
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
Point Control	.0	.0	.0	0	.1%	.0%	.2%	.0%
Whessoe Computing Systems	.0	.0	.0	0	.1%	.0%	.2%	.0%
Accugraph	.0	.0	.0	1	.0%	.1%	.1%	.1%
Softdesk	.0	.0	.0	0	.0%	.0%	.1%	.0%
FEA	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Companies	42.5	18.7	16.1	1,025	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	36.9	16.3	13.6	922	86.8%	87.2%	84.7%	90.0%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	5.6	2.4	2.5	103	13.2%	12.8%	15.3%	10.0%
All Hardware Companies	5.1	4.0	.1	301	12.0%	21.1%	.3%	29.4%
All Turnkey & SW Companies	37.4	14.8	16.0	724	88.0%	78.9%	99.7%	70.6%

Source: Dataquest (March 1993)

©1993 Dataquest Incorporated

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

Application: Mechanical
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
IBM	8.0	4.3	2.1	140	36.1%	31.2%	54.9%	42.5%
Digital	5.2	3.6	.0	0	23.6%	26.0%	.0%	.0%
Control Data Systems	2.0	.8	.3	6	9.1%	5.9%	7.6%	1.9%
MacNeal-Schwendler	.6	.0	.6	0	2.8%	.0%	15.6%	.0%
SDRC	.4	.0	.4	0	1.9%	.0%	10.9%	.0%
Swanson Analysis	.2	.0	.2	0	.7%	.0%	4.2%	.0%
Unisys	.1	.0	.0	1	.4%	.3%	.8%	.3%
Intergraph	.1	.0	.1	0	.4%	.0%	1.8%	.0%
Whessoe Computing Systems	.1	.0	.1	0	.3%	.0%	1.6%	.0%
EDS	.1	.0	.1	(0)	.2%	.0%	1.3%	-.0%
Georgia Tech Research Corp.	.0	.0	.0	0	.1%	.0%	.8%	.0%
Fides Industrielle Automation	.0	.0	.0	0	.1%	.0%	.3%	.0%
Engineering Systems Corp.	.0	.0	.0	0	.1%	.0%	.3%	.0%
Other Companies	5.3	5.1	.0	182	24.1%	36.5%	.0%	55.2%
All Companies	22.1	13.8	3.8	329	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	22.0	13.8	3.8	329	99.6%	100.0%	98.2%	100.0%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	.1	.0	.1	0	.4%	.0%	1.8%	.0%
All Hardware Companies	11.0	8.8	.1	183	49.6%	63.7%	1.6%	55.7%
All Turnkey & SW Companies	11.1	5.0	3.8	146	50.4%	36.3%	98.4%	44.3%

Source: Dataquest (March 1993)

CMEC-WW-MS-9301
©1993 Dataquest Incorporated
March 15, 1993

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

Application: Mechanical
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
Digital	2.7	1.8	.0	22	35.5%	40.9%	.0%	21.9%
IBM	2.6	1.5	.6	30	35.4%	33.8%	50.8%	29.7%
Sun Microsystems	.7	.6	.0	32	9.4%	12.8%	.0%	31.1%
Intergraph	.6	.3	.1	8	8.2%	6.7%	11.3%	7.7%
MacNeal-Schwendler	.3	.0	.3	0	4.4%	.0%	25.0%	.0%
EDS	.3	.2	.1	5	4.3%	3.6%	8.9%	4.8%
Computervision	.1	.0	.0	1	1.6%	.9%	3.2%	1.0%
Control Data Systems	.1	.0	.0	0	.8%	.7%	.8%	.1%
Hewlett-Packard	.0	.0	.0	4	.4%	.7%	.0%	3.6%
Other Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All Companies	7.5	4.5	1.2	102	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	7.5	4.5	1.2	102	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	3.5	2.5	.0	77	46.4%	55.9%	.0%	75.1%
All Turnkey & SW Companies	4.0	2.0	1.2	25	53.6%	44.1%	100.0%	24.9%

Source: Dataquest (March 1993)

©1993 Dataquest Incorporated

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

Application: Mechanical
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	7.7	7.7	.0	1,667	24.7%	38.6%	.0%	32.7%
IBM	3.6	3.4	.0	924	11.5%	16.9%	.0%	18.1%
Engineering Mechanics	2.2	.1	1.8	265	6.9%	.5%	18.3%	5.2%
Autodesk	1.5	.0	1.5	0	4.8%	.0%	14.8%	.0%
Claris	1.3	.0	1.3	0	4.3%	.0%	13.3%	.0%
CNC Software	1.2	.0	1.2	0	3.7%	.0%	11.5%	.0%
Apple Computer	1.0	.9	.0	236	3.2%	4.4%	.0%	4.6%
Vero International Software	1.0	.0	.9	0	3.1%	.0%	8.8%	.0%
Cimatron	.9	.4	.4	47	3.0%	2.1%	4.2%	.9%
Computervision	.8	.0	.7	0	2.5%	.0%	7.3%	.0%
Hewlett-Packard	.8	.6	.0	215	2.4%	3.1%	.0%	4.2%
Pathtrace	.6	.1	.4	9	1.9%	.6%	3.9%	.2%
Point Control	.3	.0	.3	0	1.1%	.0%	3.2%	.0%
Superdraft	.3	.1	.1	14	.8%	.5%	1.1%	.3%
Whessoe Computing Systems	.3	.0	.3	0	.8%	.0%	2.5%	.0%
Investronica SA	.2	.2	.0	8	.7%	.8%	.2%	.2%
ADRA Systems	.2	.0	.2	0	.6%	.0%	1.6%	.0%
Intergraph	.1	.0	.1	0	.4%	.0%	1.1%	.0%
Swanson Analysis	.1	.0	.1	0	.4%	.0%	1.2%	.0%
Aura CAD/CAM Systems	.1	.0	.1	0	.3%	.0%	.9%	.0%
American Small Business Comp.	.1	.0	.1	0	.3%	.0%	.9%	.0%
Mc2 Engineering Software	.1	.0	.1	0	.3%	.0%	.8%	.0%
Ithaca Software	.1	.0	.1	0	.3%	.0%	.8%	.0%

(Continued)

CMEC-WW-MS-9301

©1993 Dataquest Incorporated

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

Application: Mechanical
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
Engineering Systems Corp.	.1	.0	.1	0	.2%	.0%	.5%	.0%
Softdesk	.1	.0	.1	0	.2%	.0%	.5%	.0%
Moda CAD	.0	.0	.0	0	.1%	.1%	.3%	.0%
Aries Technology	.0	.0	.0	0	.1%	.0%	.4%	.0%
Ziegler Informatics	.0	.0	.0	0	.1%	.0%	.4%	.0%
Innovative Data Design	.0	.0	.0	0	.1%	.0%	.4%	.0%
Algor Interactive Systems	.0	.0	.0	0	.1%	.0%	.4%	.0%
Areon	.0	.0	.0	0	.1%	.1%	.0%	.0%
MacNeal-Schwendler	.0	.0	.0	0	.1%	.0%	.2%	.0%
ESDU International	.0	.0	.0	0	.0%	.0%	.1%	.0%
Rasna Corporation	.0	.0	.0	0	.0%	.0%	.1%	.0%
FEA	.0	.0	.0	0	.0%	.0%	.0%	.0%
Foresight Resources	.0	.0	.0	0	.0%	.0%	.1%	.0%
Gerber Systems	.0	.0	.0	0	.0%	.0%	.0%	.0%
Other Companies	6.5	6.5	.0	1,712	20.9%	32.6%	.0%	33.6%
All Companies	31.1	19.9	10.0	5,097	100.0%	100.0%	100.0%	100.0%
All N.A.-Based Companies	27.8	19.2	7.9	5,019	89.5%	96.0%	78.8%	98.5%
All Asian-Based Companies	.0	.0	.0	0	.0%	.0%	.0%	.0%
All European-Based Companies	3.3	.8	2.1	78	10.5%	4.0%	21.2%	1.5%
All Hardware Companies	19.5	19.0	.0	4,754	62.8%	95.5%	.0%	93.3%
All Turnkey & SW Companies	11.6	.9	10.0	343	37.2%	4.5%	100.0%	6.7%

Source: Dataquest (March 1993)

©1993 Dataquest Incorporated

For More Information...

Linda Anderson, Market Research Analyst.....(408) 437-8135

Via fax.....(408) 437-0292

The content of this report represents our interpretation and analysis of information generally available to the public or released by responsible individuals in the subject companies, but is not guaranteed as to accuracy or completeness. It does not contain material provided to us in confidence by our clients. Individual companies reported on and analyzed by Dataquest may be clients of this and/or other Dataquest services. This information is not furnished in connection with a sale or offer to sell securities or in connection with the solicitation of an offer to buy securities. This firm and its parent and/or their officers, stockholders, or members of their families may, from time to time, have a long or short position in the securities mentioned and may sell or buy such securities.

©1993 Dataquest Incorporated—Reproduction Prohibited

Dataquest is a registered trademark of A.C. Nielsen Company 0014463

Dataquest®

a company of The Dun & Bradstreet Corporation

Dataquest®

a company of
The Dun & Bradstreet Corporation

Corporate Headquarters
Dataquest Incorporated
1290 Ridder Park Drive
San Jose, California 95131-2398
United States
Phone: 01-408-437-8000
Facsimile: 01-408-437-0292

Dataquest Incorporated
550 Cochituate Road
Framingham, Massachusetts 01701-9324
United States
Phone: 01-508-370-5555
Facsimile: 01-508-370-6262

Invitational Computer Conferences (ICC)
3990 Westerly Place, Suite 100
Newport Beach, California 92660
United States
Phone: (714) 476-9117
Facsimile: (714) 476-9969

Dataquest Japan Limited
Shinkawa Sanko Building
1-3-17, Shinkawa, Chuo-ku
Tokyo 104
Japan
Phone: 81-3-5566-0411
Facsimile: 81-3-5566-0425

Dataquest Korea
Dacheung Building, Room 1105
648-23 Yorksam-dong
Kangnam-gu, Seoul 135-080
Korea
Phone: 011-82-2-556-4166
Facsimile: 011-82-2-552-2661

European Headquarters
Dataquest Europe Limited
Roussel House, Broadwater Park
Denham, Uxbridge
Middlesex UB9 5HP
England
Phone: 44-895-835050
Facsimile: 44-895-835260/1

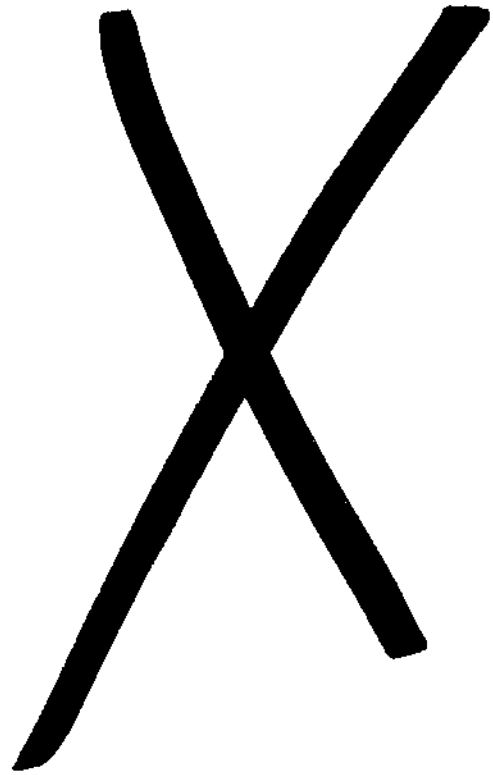
Dataquest GmbH
Kronstadter Strasse 9
8000 Munich 80
Germany
Phone: 011-49-89-930-9090
Facsimile: 011-49-89-930-3277

Dataquest Europe SA
Tour Gallieni 2
36, Avenue du General de Gaulle
93175 Bagnolet Cedex
France
Phone: 011-33-1-48-97-3100
Facsimile: 011-33-1-48-97-3400

Representative Agencies in
Bangkok, Hong Kong,
Kronberg, North Sydney,
Singapore, Taipei, and Tel Aviv

CCIS-1041067 B: 1
Library, Corporate
197-1234
Internal Distribution

©1993 Dataquest Incorporated
0014463



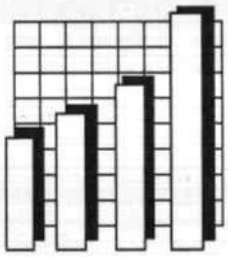
Dataquest®

INFORMATION RESOURCE CENTER
DATAQUEST INCORPORATED

Dataquest®

Software

CAD/CAM/CAE
Mechanical Applications



MarketTrends

1993

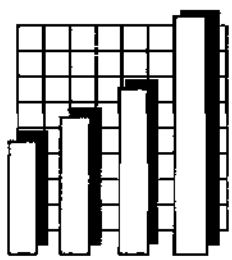
Program: Mechanical Applications Worldwide
Product Code: CMEC-WW-MT-9301
Publication Date: October 25, 1993

INFORMATION RESOURCE CENTER
DATAQUEST INCORPORATED
1290 Ridder Park Drive
San Jose, CA 95131-2398
(408) 437-8600

Dataquest®

Software

CAD/CAM/CAE Mechanical Applications



MarketTrends

1993

Program: Mechanical Applications Worldwide
Product Code: CMEC-WW-MT-9301
Publication Date: October 25, 1993

Table of Contents

Page

1. Report Overview 1-1
   Methodology 1-1
2. Executive Summary 2-1
   Major Trends and Issues 2-1
   Market Analysis 2-2
3. Trends Analysis 3-1
   Introduction 3-1
   General Overview 3-2
      The Level of Indispensability Growing in Mechanical Applications 3-3
      Cheaper and Faster Is the Law of the Land Regarding Hardware 3-4
      Market Penetration—The Race Toward a Replacement Market 3-5
      Market Penetration—by Subapplication 3-5
      Standards Committees at Work 3-6
         Continuous Acquisition and Life-Cycle Support (CALS) 3-6
         STEP 3-8
   Technology 3-9
      Windows NT—Revolution or Evolution? 3-9
      Computing and Graphics Performance, by Task 3-10
      Amazing Growth in MIPS 3-11
      Modeling Technologies 3-12
      Knowledge-Based Engineering 3-13
      Rapid Prototyping 3-14
      Virtual Reality and Multimedia 3-15
   End Users 3-15
      Product Life-Cycle Cost 3-15
      CAD/CAM/CAE Growth Trends, by Region 3-16
4. Market Analysis 4-1
   Methodology 4-1
   Definitions 4-2
      Subapplications 4-2
      Computing Platforms 4-2
   Regions 4-3
   The 1992 Mechanical CAD/CAM/CAE Market 4-3
      Mechanical CAD/CAM/CAE Market by Region 4-3
      Mechanical CAD/CAM/CAE Market, by Platform 4-4
      Mechanical CAD/CAM/CAE Market, by Industry 4-5
      The Top 10 Market Share 4-6
         Total Factory Revenue 4-6
      Leading Vendors in Software Revenue 4-7
         IBM 4-7
         Computervision 4-8
         Autodesk 4-8
         SDRC 4-9

 ©1993 Dataquest Incorporated

Table of Contents (Continued)

Page

EDS....4-9
Parametric Technology....4-9
Intergraph....4-10
Hewlett-Packard....4-10
MacNeal-Schwendler....4-10
Hitachi....4-10
Major Market Segments....4-10
Appendix A—Market Statistics—Mechanical CAD/CAM/CAE....A-1

 ©1993 Dataquest Incorporated

List of Figures

Figure		Page
3-1	Level of Indispensability Growing in Mechanical Applications	3-4
3-2	Distribution of Cost per Seat, by Hardware and Software	3-5
3-3	Mechanical CAD/CAM/CAE Installed Base	3-6
3-4	Site Penetration by Subapplication	3-7
3-5	Applications Performance Spectrum	3-11
3-6	Forecast of MIPS Shipments in Worldwide Computing, by All Applications	3-12
3-7	Revenue Forecast, by Modeling Technology	3-13
3-8	Product Life-Cycle Costs	3-16
3-9	Distribution of Mechanical CAD/CAM/CAE Total Factory Revenue, by Region	3-17
4-1	CAD/CAM/CAE Market Database	4-1
4-2	1992 Mechanical CAD/CAM/CAE Market, by Region	4-4
4-3	1992 Worldwide Mechanical CAD/CAM/CAE Market, by Platform	4-5
4-4	The 1992 Preliminary Worldwide Mechanical CAD/CAM/CAE Software Revenue, by Industry	4-6
4-5	Worldwide Top 10 Market Share by Total Revenue—All Platforms	4-7
4-6	Worldwide Top 10 Market Share, by Software Revenue—All Platforms	4-8
4-7	Asia Top 10 Market Share, by Software Revenue—All Platforms	4-11
4-8	Asia Top 10 Market Share, by Hardware Revenue—All Platforms	4-12
4-9	Europe Top 10 Market Share, by Software Revenue—All Platforms	4-12
4-10	Europe Top 10 Market Share, by Hardware Revenue—All Platforms	4-13
4-11	North America Top 10 Market Share, by Software Revenue—All Platforms	4-13
4-12	North America Top 10 Market Share, by Hardware Revenue—All Platforms	4-14
4-13	Worldwide Top 10 Market Share, by Hardware Revenue—All Platforms	4-14

©1993 Dataquest Incorporated

List of Tables

Table		Page
3-1	STEP Application Protocols	3-9
A-1	Worldwide—All Platforms—Market Leaders	A-2

©1993 Dataquest Incorporated

Chapter 1
Report Overview

The mechanical CAD/CAM/CAE 1993 *MarketTrends* book presents the results of Dataquest's research and analysis of the 1992 mechanical CAD/CAM/CAE market. It provides a comprehensive analysis of the market, as follows:

- Executive Summary—This gives a summary of the major findings of the report.
- Trends Analysis—The major trends and issues driving the market are defined, discussed, and analyzed.
- Market Analysis—A methodology and definitions are presented before the market results of 1992 are analyzed, looking at the market by region and platform. A top 10 analysis is given that identifies all of the top 10 vendors in hardware and software revenue for each major region. Profiles of leading vendors identify recent changes in strategy, highlight new product offerings, and reference changes in growth.
- Appendix A—This includes detailed market share tables showing revenue and unit shipments.

Methodology

The market and trends analysis is based upon more than 50 years of industry experience in the CAD/CAM/CAE group. We use the results of primary research to define, measure, and estimate the significant parameters of the market. Vendor and end-user-based surveys are conducted to gain further insight into significant market dynamics. First-hand discussions with end users, investors, and vendors are used to verify assumptions and to check analysis results.

Project Analyst: Michael J. Seely

©1993 Dataquest Incorporated

Chapter 2
Executive Summary

The mechanical CAD/CAM/CAE market is the largest application area in CAD/CAM/CAE. It represents about 49 percent of the total in 1992 with electronic design automation (EDA); architectural, engineering, and construction (AEC); and geographic information systems (GIS) comprising the total.

Major Trends and Issues

The following major trends and issues will be covered more fully in Chapter 3 of this book:

- The level of indispensability is raising and increasing demand for mechanical CAD/CAM/CAE products around the world.
- Expect hardware price erosion to continue at a slowing rate due to the application software complexity and performance expectation increases in mechanical CAD/CAM/CAE applications.
- Expect software prices to stabilize or increase slightly for leading products.
- Expect second-tier software products with stale technology to fight price erosion.
- Full implementation of automation technology in the engineering environment will evolve rapidly into the next millennium. The replacement market for hardware and software is gaining importance as the potential seat count approaches 50 percent saturation.
- The most aggressive manufacturing companies are deriving benefits of integrated CAD/CAM/CAE, planned as a required strategic business decision. Less-aggressive companies are now planning integration and automation upgrade projects.
- Computing performance will continue to improve at an exponential rate for the foreseeable future. This enabling resource will fuel the next-generation software tools focused on integrated solutions at the enterprise level.
- Core-modeling technologies that are aggressively developed and enhanced to support a product data structure that is growing in complexity. Next-generation, integrated solid modeling-based solutions are replacing older 3-D wireframe solutions. Continuous Acquisition and Life-Cycle Support (CALS) and the Standard for the Exchange of Product Data (STEP) will evolve as a blueprint to aid in definition of functional requirements for modeling.
- Knowledge-based engineering works well if implemented with careful planning. The success stories are growing. The cost and ease-of-implementation is improving slowly.

©1993 Dataquest Incorporated

- Virtual reality and multimedia are important to mechanical CAD/CAM/CAE. These technologies are growing quickly in mass-market applications and will bring revolutionary benefits to the engineer and designer, providing very productive user interface, training, and support.
- On a regional level, local sales opportunity in each country is dependent upon the success and health of the indigenous manufacturing industries. Multinational corporations will fuel the growth in newly industrialized countries (NICs).
- Windows NT faces challenges for rapid deployment in the mechanical application area. Little benefit is seen for price/performance improvement, or simplification of the infrastructure.
- Standards are evolving slowly under the guidance of CALS, STEP, and the Product Data Exchange using STEP (PDES) to improve the interoperability of future systems. The infrastructure that could be built on such a standardized base is what is needed to implement an efficient concurrent engineering environment.

Market Analysis

The following lists an overview of the market analysis that will be covered more fully in Chapter 4 of this book:

- Overall, the mechanical CAD/CAM/CAE market grew 5.5 in 1992, reaching $7,711 million in total factory revenue. This growth was a significant step above the 1991 rate of 1.1 percent.
- The U.S.-based vendors shipped approximately 75.0 percent of the worldwide total, Asian vendors shipped 16.7 percent, and European vendors only 9.0 percent. The vast majority of products developed in Asian countries were only sold in Asia. A few OEM agreements, such as Adra Systems/Ricoh, are bringing Japanese software into the overseas market. The European market, being more international, has many local and overseas vendors and developers. A few such as IBM's Catia and Computervision's Medusa have been very successful outside of Europe.
- As a group, the worldwide top 10 held even in 1992. In 1990 and 1991, the top 10 had 57.1 and 55.1 percent of total market, respectively. In 1992, this dropped slightly to 54.9 percent to just more than $4.2 billion.
- Two shining stars on the top 10 list are Sun Microsystems and Silicon Graphics. Each had about a 35 percent growth rate in total factory revenue. SGI had a whopping 77.3 percent increase in total mechanical unit shipments.
- The other top 10 vendors jockeyed for position with growth or decline in the ±20 percent range.
- IBM continues to lead the market in most regions for total factory, host-based, and server revenue for hardware and software. This represented $1,378 million in total mechanical CAD/CAM/CAE revenue, with an 8.1 percent drop from 1991.

 ©1993 Dataquest Incorporated

- Computervision edged out IBM for top honors in total software revenue in Europe. Computervision maintained its lead with top revenue share in total factory and software revenue on the technical workstation in the European and worldwide market. This represented $623.1 million in total mechanical CAD/CAM/CAE revenue, a 16.0 percent drop from 1991.
- Autodesk has the No. 1 position in personal computer-based software everywhere except Asia. This represented $147.1 million in total mechanical CAD/CAM/CAE revenue, a 35.9 percent growth over the previous year.
- A revenue growth of 87.2 percent in 1992 brings Parametric Technology Corporation over the $81.0 million mark in software. If PTC can maintain this growth rate for three more years, it could be the largest mechanical CAD/CAM/CAE software vendor in the world.
- Overall, the software segment grew at a 10.6 percent rate, reaching $2,332.7 million in worldwide revenue.
- A regional view of the mechanical CAD/CAM/CAE market shows Europe taking the leading position with 41.8 percent of the worldwide market. Despite poor economic conditions in the United Kingdom, Germany, and France, conditions in all of Europe supported an overall 5.5 percent growth in total factory revenue. Part of this growth in dollars is due to a shift in currency exchange. Europe-based vendors as a group did slightly worse with an overall 2.3 percent growth.
- Asia in particular slowed dramatically, dropping slightly to $2,180 million with a 0.2 percent decline in total factory revenue (measured in U.S. dollars). Market performance was actually much lower if measured in yen.
- The North American market grew in 1992 after a drop in 1991. The growth rate was 10.3 percent reaching $2,156 million.
- A view of the mechanical CAD/CAM/CAE market by platform shows the importance of the technical workstation in this market. More than half of the total and service revenue and more than 63 percent of the total software revenue is based on technical workstations.
- Sun Microsystems is leading the unit shipment market share with a dominant 36 percent. This is followed closely by Hewlett-Packard with a 23 percent share of the market.
- The market perception of the PC as a serious design and analysis platform has progressed slowly. Virtually all applications running on workstations or host-based systems are available on the PC. An amazing 70 percent of the seats shipped were PC-based, with more than 210,000 units shipped in 1992.
- Host-based systems once the basis for the entire mechanical CAD/CAM/CAE market, has evolved to a single dominate force in the market. IBM owns a 43 percent market share of host-based hardware revenue. Unfortunately, this whole market segment dropped 17.2 percent from 1991 revenue levels. IBM and Digital together represent two-thirds of the total hardware revenue.

 ©1993 Dataquest Incorporated

Chapter 3
Trends Analysis

Introduction

The ability to react to changes in the market place, to assess the change in opportunity, and to make the necessary corrections to remain competitive is fundamental in a successful manufacturing operation. Time to market, for most market-driven products, is a good indicator of the productivity or efficiency of the internal operations of a company. CAD/CAM/CAE is an enabling technology, leveraging the abilities of the organization to make changes in process with enhanced product quality and lower manufacturing cost. Although an understanding of these benefits is common at a corporate level, it is interesting to consider the larger view of operation at the industry or global level. This is in fact where CAD/CAM/CAE is now being implemented. Many trade and industry organizations are building standards to promote the sharing of product design and manufacturing information using CAD/CAM/CAE. This facilitates design and manufacturing anywhere in the world. General Motors, Ford, Toyota, and Volkswagen are good examples of companies using this strategy. Instant communications with a worldwide integrated work force is the reality of today. Because CAD/CAM/CAE is the language of change in an engineering environment, this technology has become a strategic weapon in global competition.

Several interesting observations can be made that position this technology in the context of global competition and what to expect. CAD/CAM/CAE tools are created to be used to design, simulate, and document the product development process. This applies to every consumer and commercial application. All cars, appliances, clothing, and utensils are or will be produced some day with the benefit of CAD/CAM/CAE tools. The productivity and quality improvements are well understood. Commercial applications of CAD/CAM/CAE are somewhat more sophisticated. These industries have been using CAD/CAM/CAE for more than 20 years with good results. The aerospace and industrial industries are leading the use of these tools in the commercial sector.

An exciting synergistic element of the CAD/CAM/CAE market finds the latest and best development tools being used to develop the next-generation computer processor. These computers in turn will be used to support more complex software and design/simulation algorithms that will be used to design even faster computers. This cycle has resulted in the common availability of computing resources beyond the imagination of most experts a decade ago. The exciting reality is that this trend is increasing at an accelerating rate. What the mass market does with this plethora of mips, mflops, and gigabytes will remain to be seen. Whatever the result, one can be sure that the latest and fastest computer will always be used by some engineer or designer to create the next mode of transportation, communications device, and appliance.

©1993 Dataquest Incorporated

Any evening news program will demonstrate the fundamental changes taking place in the global economic and political arena. The basic nature of global communications is forcing public awareness of the impact of these changes. In fact, it is easy to argue that communications tools are an agent of change as much as the underlying forces at work. As world markets open up to free trade, CAD/CAM/CAE technology will be used to communicate between the far-flung design, manufacturing, and assembly operations. CAD/CAM/CAE is a tool to be used in building the infrastructure of our global society.

General Overview

The major trends in the mechanical CAD/CAM/CAE arena have forced the market to a crossroad. The pressure to use automation tools is higher than ever. The quality and productivity of the tools available is also at an all-time high. The cost of implementation is lower than ever with productivity payback occurring in less than two years. So what is the problem? Well, it depends upon the view taken. If the "glass is half empty" attitude is taken, then the tools are difficult to use, too slow, too costly, unreliable, the overhead of use is not worth the effort to get the simple things done—it is too complicated and so why bother? If a positive attitude is used, then amazing things happen. The whole PC-based CAD/CAM/CAE market explosion can be explained by the fact that the people making it happen did not know they could not do it. CAD/CAM/CAE tools can be used with dramatic success, if used properly.

Unfortunately, this is a problem as well. If an implementation project is difficult and has finally been organized to yield the benefits expected, it will be difficult to change this process. The users and developers will reluctantly move to a new platform only if compelled to do so with strong incentives. Lower-cost, higher-performance systems with integrated applications are providing some of these incentives. Fortunately, some of these incentives are in place.

A fundamental change in perception needs to take place in the market. As long as CAD/CAM/CAE is positioned as a tool to make a drawing faster or to make an analysis faster, the real opportunity is lost. The crossroad decision will change the focus away from tools and will convey that CAD/CAM/CAE is a communications medium interwoven in the core processes of an enterprise's operations.

When everyone in an organization has access to the electronic information in an organized, managed, and reliable system, great economies can take place. In a very real sense, the engineering drawing is the language of design and manufacturing. It is very common for dozens of translations of this information to take place as the design intent travels from concept, to production, to purchasing, and to the shipping dock. The translations can be automated. The enhanced value will come from a system that lets the individuals focus on their value added in the process as the design intent travels through the company. This concept will mature in an envi-

 ©1993 Dataquest Incorporated

ronment with full simulation of product function and manufacturing processes.

The challenge of the next decade will organize the efforts of many: to take the value-added input, to eliminate the manual translation of data for each individual to use; and to take the engineering drawing, the 3-D solid models, the bill of materials, material specifications, process plans, and a hundred other things and form them into a usable flow of information. The sooner the users can get control of their data, the sooner they can optimize and reoptimize the process, and the sooner they will increase the profitability of the enterprise.

The Level of Indispensability Growing in Mechanical Applications

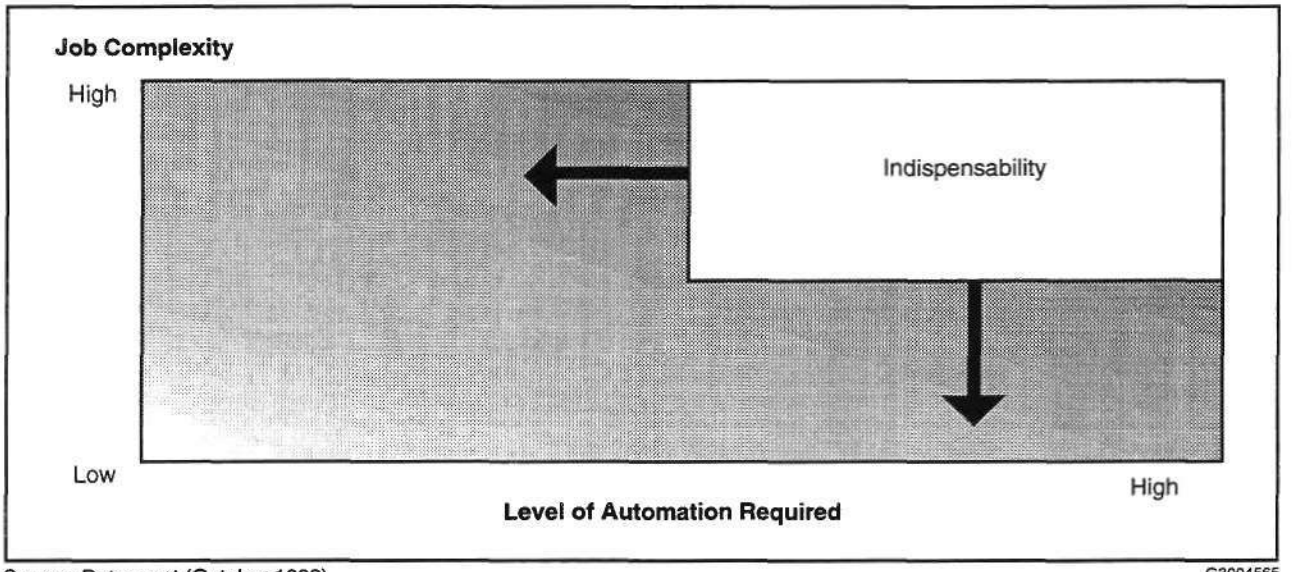
The level of indispensability of mechanical CAD/CAM/CAE tools is clearly rising because of many reasons. Significant improvements in functionality and interoperability of the tools are allowing users to tackle more complex design problems with faster results. The impact on reduced cycle time is often described with more than a 40 percent reduction in a two-year project cycle. This magnitude of savings can easily pay for the cost of the tools.

It is difficult to draw an accurate picture of indispensability for mechanical CAD/CAM/CAE. If a required task can only be accomplished using mechanical CAD/CAM/CAE, then obviously its use is indispensable. A means of illustrating the issue considers the level of job complexity for an individual task and the current level of automation required. In general, simple tasks are accomplished quickly using manual or low-tech solutions. Changing a number on a drawing can take less than a minute with an eraser and pencil. Making the same change in a CAD system may take hours if the data is not well organized. The ingenuity of the typical engineer or designer can replace millions of dollars worth of computing equipment with a sketch and a bent wire—sometimes. As the complexity of the design increases, the need to share information increases. In turn, the benefits of automation improve dramatically, and the level of indispensability increases. Coupled with market pressures to improve quality, ergonometrically correct designs with shorter production cycles are making mechanical CAD/CAM/CAE a necessity in all manufacturing industries (see Figure 3-1).

A hidden benefit when full implementation is accomplished comes from the elimination of redundant manual processes or systems. Unfortunately, this is difficult to accomplish in a mechanical design and manufacturing environment. So many people need to have access to some part of the engineering database that it is difficult to find every person with a need, let alone to actually set up a system that totally replaces the manual operation. The effort is worth the investment in systems design and implementation. A common mistake in this process is the goal of "doing it right the first time." This requires an unreasonable amount of planning and an assumption that it could be done right. In several months, something surely would change, requiring a modification in the "right" system. The

 ©1993 Dataquest Incorporated

Figure 3-1
Level of Indispensability Growing in Mechanical Applications



Source: Dataquest (October 1993) G3004565

only methodology that will work over time is to plan for changes and build interrelated processes that are easy to update.

Cheaper and Faster Is the Law of the Land Regarding Hardware

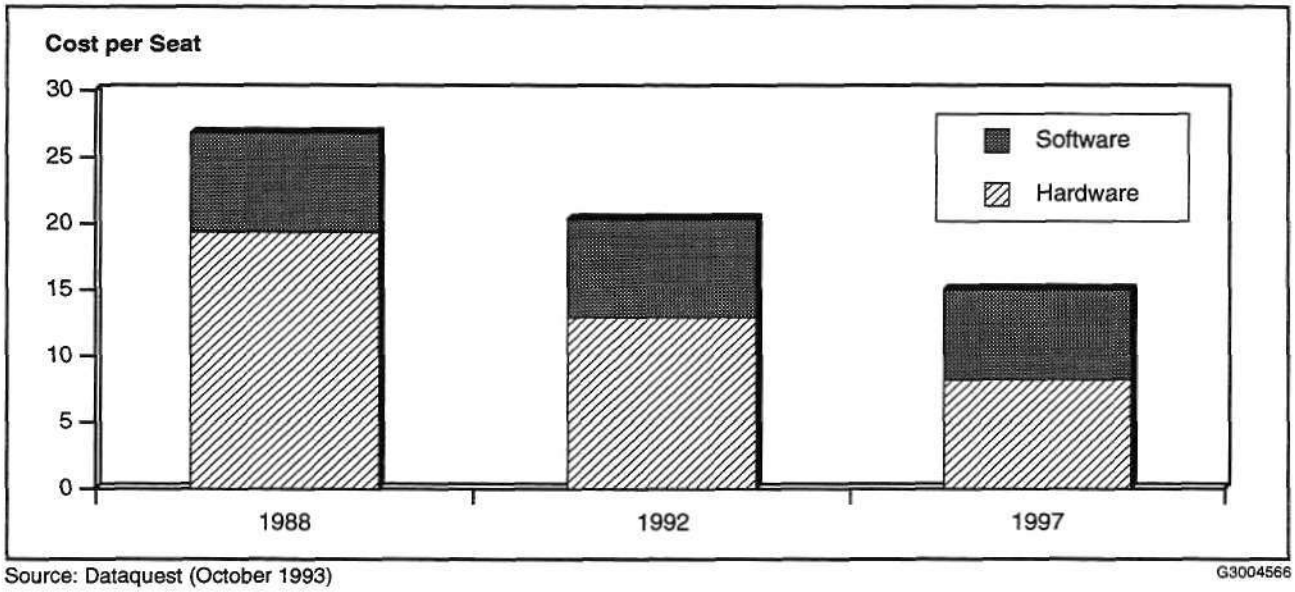
The average cost per seat for hardware has been falling at a compound annual growth rate (CAGR) of negative 9.5 percent from 1988 to 1992. This rate is expected to slow to an 8.7 percent drop per year until 1997. Software is another issue. Over this same period the corresponding drop in software has only been 0.1 percent. In the next five years this will increase slightly to an annual 1.6 percent drop per year. The average value of software shipped per seat has increased slowly. In 1988, the ratio of software to the combined hardware and software package was 27.7 percent. This has increased accordingly to 36.4 percent in 1992 and to 45.3 percent in 1997.

In 1998, total software revenue divided by total number of seats shipped was $7,420. The corresponding number for technical workstation-based software is $18,800, $2,290 for the PC, and $17,500 on host-based terminals. The average value dropped slightly to $7,390 in 1992 and is forecast to drop to $6,800 by 1997. Leading vendors on all platforms have been raising prices directly or indirectly with new pricing structures for network or site licensing. Price cutting is rampant for second-tier vendors trying to build market share. Older technology is seeing strong price erosion pressure particularly on the PC platform (see Figure 3-2).

Dataquest expects the average value of software per seat to continue to rise as more sophisticated applications and more integrated solutions are implemented. As the hardware average selling price (ASP) continues downward, Dataquest expects the performance level of the system to increase. Many of the seats installed have been purchased to run basic

 ©1993 Dataquest Incorporated

Figure 3-2
Distribution of Cost per Seat, by Hardware and Software



Source: Dataquest (October 1993) G3004566

design and documentation applications. These platforms will not run the next generation of design optimization software in an effective manner. Users will plan to upgrade or replace these systems when the economics or new baseline requirements become compelling. It is worth noting the risk for a software vendor to release a new version of its core product that requires a significant upgrade in the typical seat configuration. The unplanned cost of such a move can delay the large-scale implementation of the new software release by a year or more.

Market Penetration—The Race Toward a Replacement Market

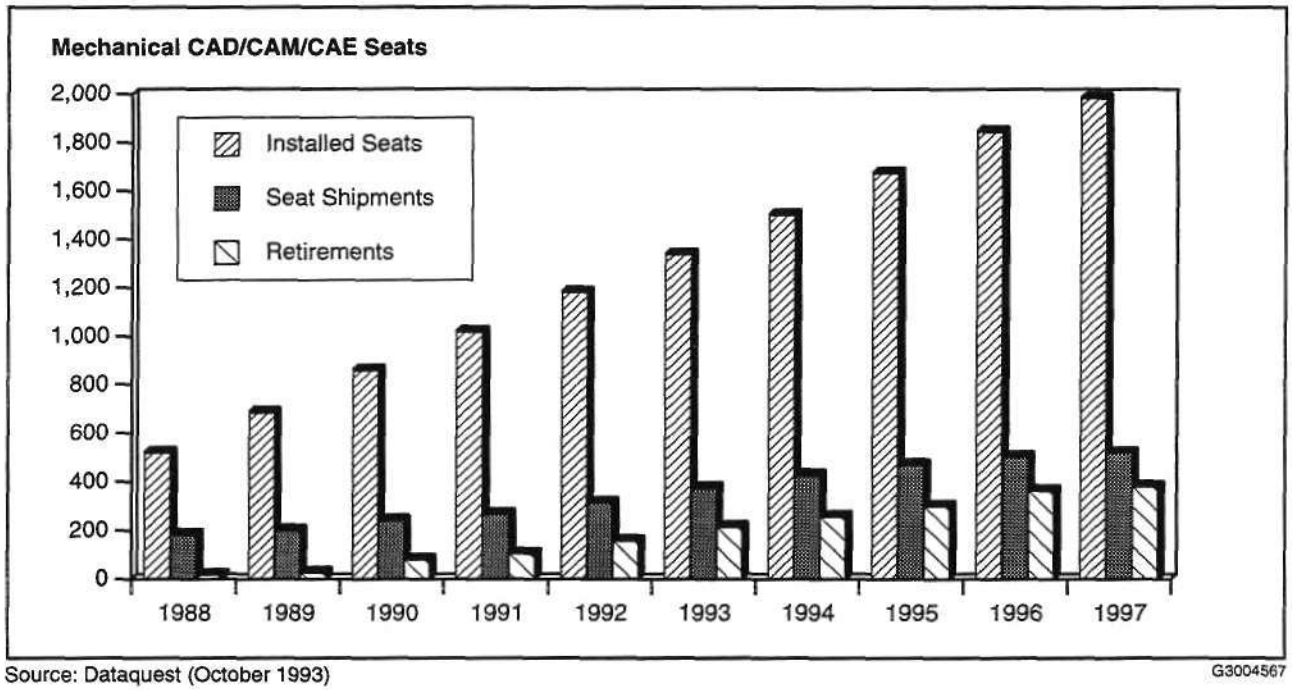
The next five years will see the mechanical CAD/CAM/CAE market evolve toward a replacement market where more than half of new system sales will be used to replace retired systems. This trend is inevitable. The question is, when will it happen? Figure 3-3 shows our analysis. The balance point came in 1992 in which 50 percent of the systems were sold as replacements. This number is expected to increase to 73 percent in 1997. As this number gets larger, it implies that the level of penetration of this technology is significantly increasing. Considering the forces at work, this should be viewed as a desirable situation in which everyone who needs access to the engineering database can have it in electronic format. This implies that many parallel manual systems can be eliminated. New applications can be developed knowing that everyone in a company will be using the system. The savings potential for this future scenario is tremendous.

Market Penetration—by Subapplication

Conventional wisdom would say that the most common and highly penetrated subapplication in mechanical CAD/CAM/CAE would be drafting. A recent survey of mechanical end users found that detail design was the most highly penetrated subapplication. This was followed by applica-

 ©1993 Dataquest Incorporated

Figure 3-3
Mechanical CAD/CAM/CAE Installed Base



Source: Dataquest (October 1993)

G3004567

tion software development, detail drafting, tool design, and linkage design. The other subapplications have more than a 100 percent expected growth rate in the next two years. These subapplications are structural analysis, conceptual design, NC tool path generation, and thermal analysis. Figure 3-4 illustrates this mix of penetration level by showing the current number of users in each subapplication and the planned number that would be using these subapplications under ideal conditions.

Standards Committees at Work

Standards work in ANSI, SET, DIN, and other national and international committees has paved the way for sharing of engineering data at the international level. These programs are well used for standards at the documentation level. These same standards are evolving to accommodate engineering information in electronic form.

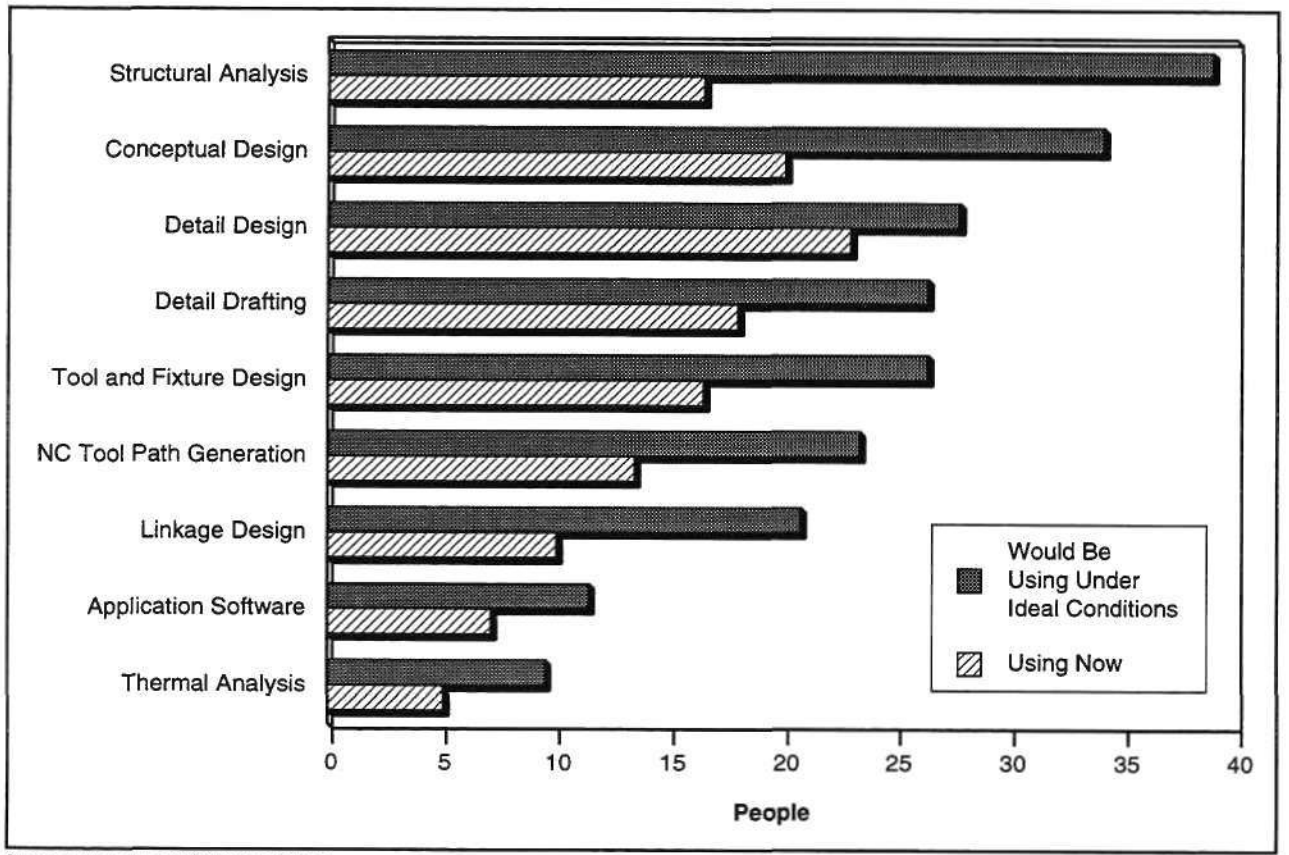
Continuous Acquisition and Life-Cycle Support (CALS)

As business competition becomes more international, governments and industries need to track information throughout a product's life cycle. While companies continue to rely heavily on CAD/CAM systems, these systems can hinder the design process if information flow becomes a bottleneck. Companies need the ability to link information smoothly from one CAD system to another in the design and manufacturing of a product.

CALS is a collection of international standards being spearheaded by the International Standards Organization (ISO) and the U.S. Department of Defense. The standards that comprise CALS enable electronic access to information over the entire life cycle of a product, from initial design, to

 ©1993 Dataquest Incorporated

Figure 3-4
Site Penetration by Subapplication



Source: Dataquest (October 1993)

G3004568

manufacturing, to maintenance and support. It is a very comprehensive set of standards, encompassing everything from the design of printed circuit boards to tooling for metal parts. CALS has strong backing in Europe, Japan, and the United States, and more than 14 nations are currently involved in the development process.

CALS is an industry-driven collection of standards. One of the original aims of the CALS committee was to work closely with industry vendors to draw upon the strengths of existing standards and to add features of its own to CALS. All those involved in the CALS initiative, including the ISO, CAD vendors, and end users, anticipate that CALS will improve product quality, reduce time to market, improve data reliability, and facilitate communication among various groups in a company.

CALS is being implemented in the following three phases:

- Current Phase (1992 to 1996)—Concentrates on CALS standards and specification development including STEP and its U.S.-based equivalent, PDES. The STEP standard, which is being developed by an ISO subcommittee responsible for STEP, is one of the largest and most comprehensive standards under CALS.

©1993 Dataquest Incorporated

- Transition Phase (1996 to 2000)—Concentrates on the transition from paper-based information to electronic information.
- Long-Term Phase (2000 and beyond)—Covers electronic data interchange (EDI) using fully distributed databases.

Although CALS is not expected to fully impact all manufacturing industries until the next century, the entire CALS initiative is continuing to march forward. CALS now includes Initial Graphics Exchange Standard (IGES, which has been in existence since 1979, and virtually all CAD vendors have some IGES read and write capability that aerospace and automobile companies are using.

STEP

The focal point of CALS right now is the STEP initiative. The initial draft specification of STEP is based on the PDES specification, and the Draft International Standard of STEP was released in early 1993. This draft standard must undergo one more voting cycle by ISO STEP committee members and other ISO committees before it is finally approved for first release, which is anticipated to take place in 1994. The significance of this 1993 Draft International version is that the STEP standard is now considered "technically complete," and vendors can begin development of STEP-compliant software tools.

STEP is viewed as a successor to IGES not only because it contains graphical information in a file-transferable format, but also because it incorporates manufacturing information on product features such as size, materials, properties, and part relationships. STEP will eventually consist of 19 application protocols that govern the technicalities of how files are represented and transferred. The initial release of STEP contains three application protocols in drafting and product configuration management, and the others are expected to be incorporated in future releases of STEP through the year 1995. The complete list of application protocols is shown in Table 3-1.

Although companies are enthusiastic about the STEP standard and are working closely with the ISO to finish development of the application protocols, no vendor has yet released a commercial product meeting complete STEP compliance. In fact, because STEP is such a comprehensive standard, it is expected that no vendor will develop a software package that is fully STEP-compliant. Instead, vendors will implement those aspects of STEP pertinent to their customers' lines of business or product applications. Internal versions of STEP are being tested in some commercial arenas. Digital Equipment Corporation already debuted a language parser based on STEP's programming language, EXPRESS, at the 1991 CALS Expo, and Ford Motor Company and AlliedSignal's recently designed and built an engine part using the draft STEP specification. Also, a consortium known as ProSTEP, whose members include automobile companies from Europe, the United States, and Japan, is focusing on the impact of STEP in the automotive industry.

 ©1993 Dataquest Incorporated

Table 3-1
STEP Application Protocols

Application Protocol	Description
Explicit Drafting	Exchange of individual technical CAD drawings Supports 2-D geometry
Associative Drafting	Information requirements to exchange, access, and archive drawings
Configuration Controlled Design	Structures for exchange between application systems of 3-D product data
Mechanical Design Using Boundary Representation	Use and exchange of boundary representation models.
Mechanical Design Using Surface Representation	Representation and exchange of surface design data
Mechanical Design Using Wireframe Representation	Transfer of wireframe models
Sheet Metal Die Planning and Design	Specification and design of dies and associated tooling used in sheet metal part production
Life Cycle Product Change Process	Identification of a product anomaly, its causes, and approval and performance of resulting changes to the product
Design through Analysis of Composite and Metallic Structures	Link of design, finite element, and detailed structural analysis applications to provide bidirectional information exchange capability
Electronic Printed Circuit Assembly (PCA): Design and Manufacture	Building of printed circuit assemblies from a detailed design specifying all components of the PCA
Electronic PCA: Test, Integrated Diagnostics, and Remanufacture	Testing, integrated diagnostics, and remanufacture of PCAs
Electrotechnical Plants	Exchange of product data among computer systems used in design and engineering of electrotechnical plants
Numerical Control Process Plans for Machined Parts	Product definition information for an NC process plan for a machined mechanical part
Core Data for Automotive Mechanical Design Processes	Development and design of vehicle components and their tools
Ship Arrangement	Commercial and naval shipbuilding design, engineering, and service life support
Ship Molded Forms	Commercial and naval shipbuilding design, engineering, and service life support
Ship Piping	Commercial and naval shipbuilding design, engineering, and service life support
Ship Structures	Commercial and naval shipbuilding design, engineering, and service life support
Inspection Process Plans	Exchange, access, and use of STEP for dimensional inspection of manufactured parts

Source: Dataquest (October 1993)

Technology

Windows NT—Revolution or Evolution?

The CAD/CAM/CAE industry has been around long enough that several operating systems have emerged, been implemented, and absorbed into the framework of the end-user environment. Each along the way has offered some benefit in improved middleware support, performance, or graphics support. This market has been eager to embrace anything that

 ©1993 Dataquest Incorporated

provides a real performance improvement. The bottom line opportunity for Windows NT is to affect a tangible price/performance benefit for the users.

The challenges for rapid Windows NT deployment are significant. The suggested price benefit is diluted by the realization that new hardware or significant upgrade will be required to get adequate performance out of the new system. The result is little or no cost savings.

Sticker shock for the current PC owners could be a problem. For those willing to make the move, an opportunity exists for Windows NT- or UNIX-based solutions. Both will take training for the user. Both have a higher price tag compared to the system being replaced. Even so, the majority of new sales of Windows NT-based products are expected to come from power users in the DOS/Windows world. Design consultants and service companies are good potential markets. For those serious about high performance, they will be drawn to the high-end graphics workstations from Hewlett-Packard, Silicon Graphics, and others. If and when these and other workstation vendors offer NT, this issue will collapse to integration, compatibility, and ease-of-use issues.

A market demographic issue adds to the softness of the Windows NT offering. Many of the workstation vendors have sold a large number of low-end workstations in the last year or two. These machines can migrate to the less needy while the power users will move up to the best price/performance package. A likely scenario then would find system managers adding several high-end workstations to an existing operation and move the two- or three-year-old workstations to the new users, or they could buy Pentium-based tools for the new users. Both scenarios are easy to believe but the workstation migration downward in the user environment to the less needy will soften the opportunity for Windows NT-based new hardware.

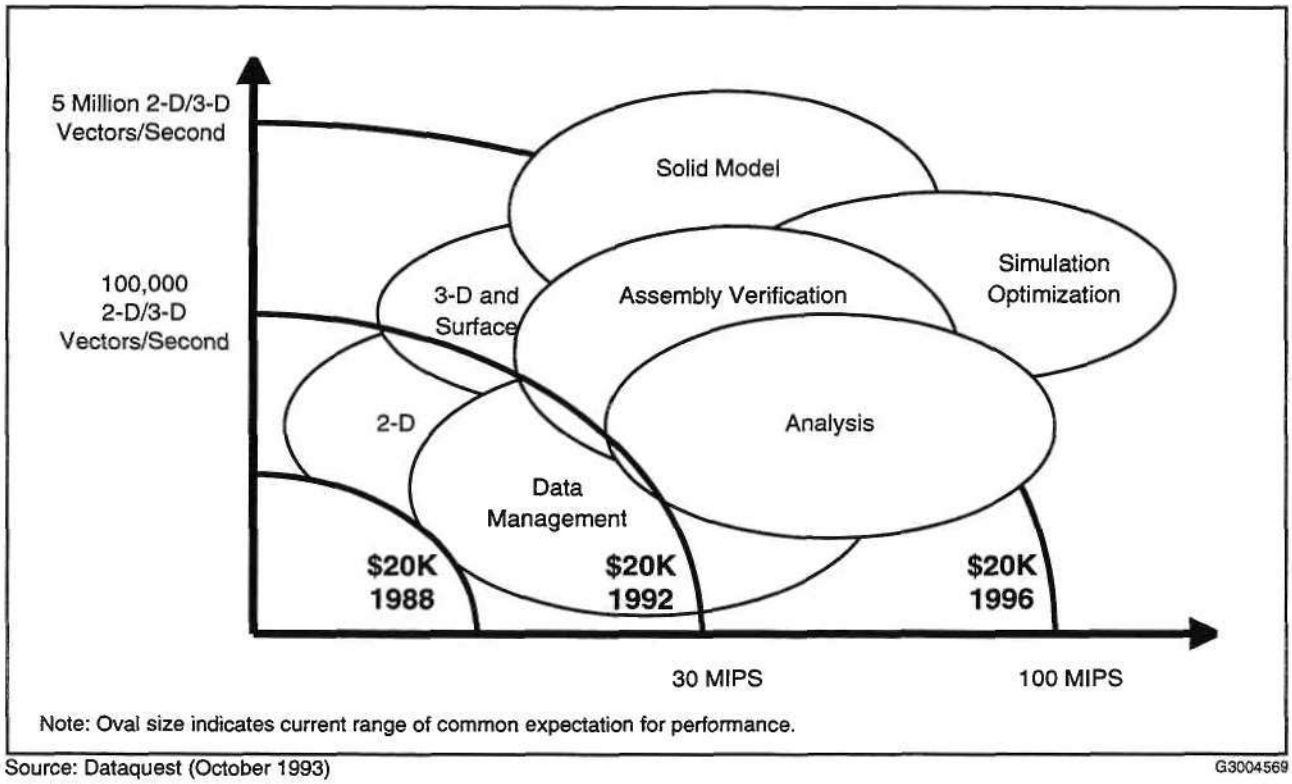
As Windows NT grows beyond Intel- and Intergraph-based hardware, this whole issue is simplified. If the user can mix and match operating systems, application code, and middleware tools in a heterogeneous environment, who cares which operating systems are used? As market penetration levels increase, people will tend to continue using what has worked in the past. Something new will be used only if the pain associated with the change is offset by a significant benefit. The Windows NT benefit is not expected to cause a stampede at this point. Any operating system supporting a rich development environment with efficient compilers, effective networking, and a growing set of applications in business and technical applications will do well. If this operating system is supported by the leading hardware vendors, then the market opportunity will greatly improve.

Computing and Graphics Performance, by Task

The expected improvements in computing and graphics performance are fueling a dramatic growth in software development. Figure 3-5 shows evolution in levels of interactive performance on a $20,000 workstation.

 ©1993 Dataquest Incorporated

Figure 3-5
Applications Performance Spectrum



Source: Dataquest (October 1993) G3004569

In 1988, a $20,000 workstation could support only the basic applications of 2-D drafting and assembly design. Currently what is shown is the growth in user expectation for baseline functionality. These new requirements for complexity and performance would not be suitable for the "old" $20,000 seat.

In 1992, all of the basic and many of the advanced applications in mechanical CAD/CAM/CAE could be used effectively on a $20,000 workstation. As the performance improves, the 1996 version will handle all that and more. The important issue is the accurate tracking of application growth in complexity and what is required for user-perceived acceptable performance. New applications will also evolve that will probably require more computing and graphics performance. The widespread interest in design optimization is a prime example of this trend. New-user interfaces developed for virtual reality products coupled with styling and design optimization will thrive in the new high-performance market. An almost insatiable need exists to continue to design more complex products in a more realistic, simulated environment. Making this full-simulation capability a reality at an affordable price will keep developers busy for many years to come.

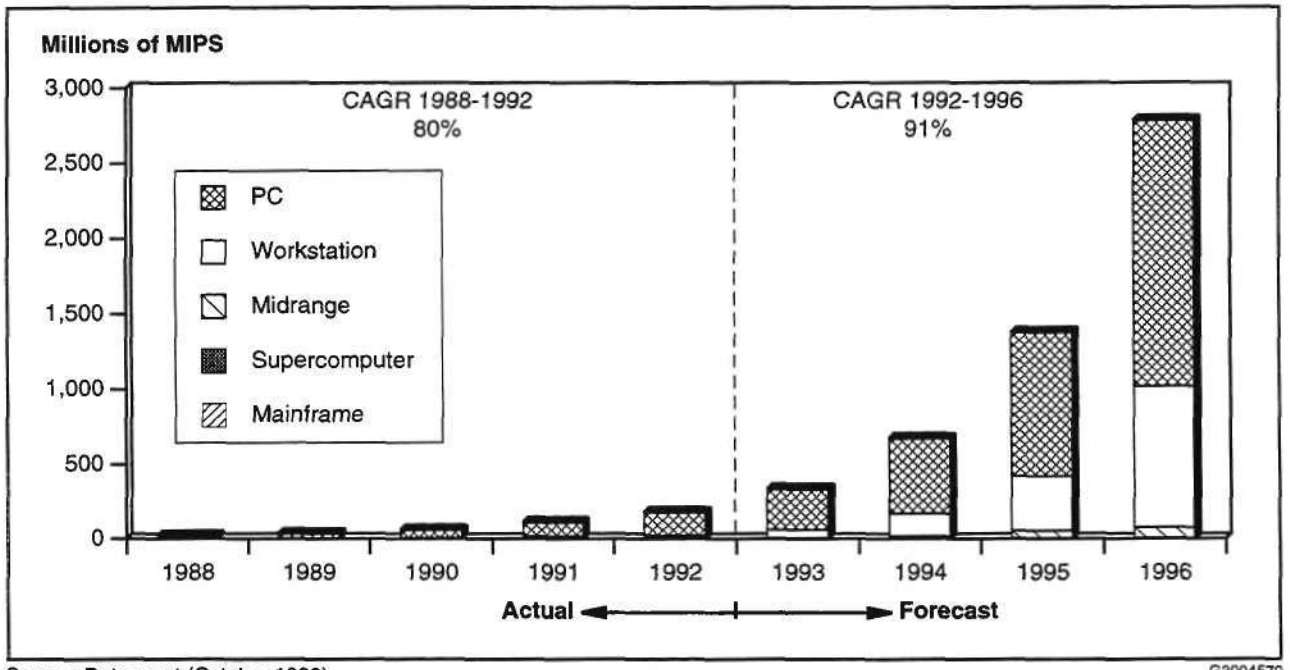
Amazing Growth in MIPS

The performance wars are continuing with greater urgency. Luckily for mechanical designers and engineers, this provides a developing arsenal of

 ©1993 Dataquest Incorporated

computing resources for a growing list of applications. The Dataquest Technical Computing group has forecast the growth in MIPS shipments for all applications. An amazing revelation comes from the forecast that the total MIPS shipped in history up to and including 1992 will be matched by the shipments in 1993. In other words, the total MIPS shipped will double in 1993 and almost double again in 1994 (see Figure 3-6). The changes this can be brought about during the next 10 years are mind-boggling. The software vendors can redefine the concept of interactive design. Designers will be able to simulate the crash of a car into another and test to see if the doors still open after impact. The value of this level of computing will change the nature of mechanical design and manufacturing. The result will allow anyone in the design and manufacturing process to simulate real problems, evaluate potential solutions, and choose the best solution. They then can communicate the change instantly to all involved.

Figure 3-6
Forecast of MIPS Shipments in Worldwide Computing, by All Applications



Source: Dataquest (October 1993)

G3004570

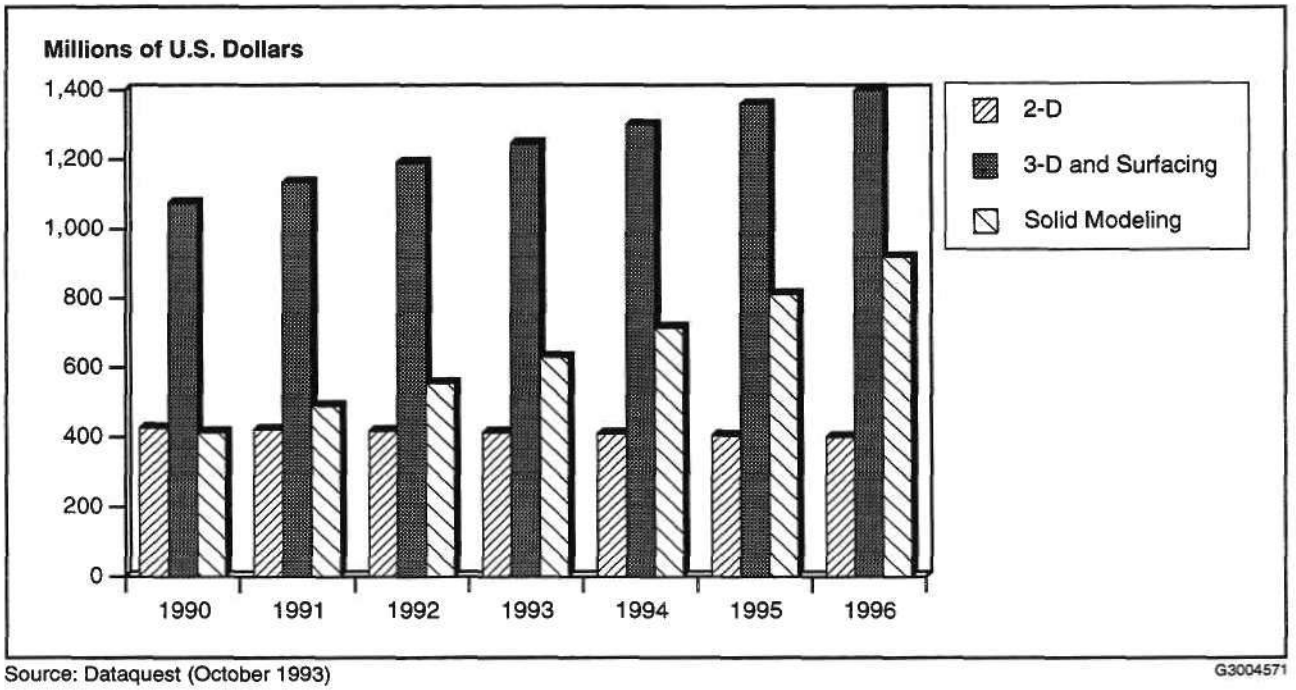
Modeling Technologies

The revenue of applications software sold in mechanical CAD/CAM/CAE totaled $2.34 billion in 1992. We asked the vendors what modeling technology is used as the core technology for each of their application packages. This survey data was combined with end-user implementation data to understand how these systems are being used. The result of this analysis is the forecast shown in Figure 3-7. Products based on 2-D-only technology are on a slight decline. The availability of 3-D-based solutions for a slight cost increase is partially to blame for the decline in 2-D. A growing interest in fully integrated and solid-based solutions a factor as well. Even if a user has few occasions for a 3-D application, the minimal

 ©1993 Dataquest Incorporated

expense and common availability on all platform types makes a reasonable alternative. A few 2-D-only products have improved market appeal by adding a significant amount of enhancements for parametric user input

Figure 3-7
Revenue Forecast, by Modeling Technology



Source: Dataquest (October 1993)

G3004571

and constraint-based modeling. This will improve the salability of these products.

Solid modeling has been promised for many years as the panacea for the design environment. The more complete data structure with improvements in performance is rapidly building a strong following. Add-on applications that use the part or assembly information are still less than optimal, but progress is being made in integration between the model and analysis applications, between the model and documentation, and further into manufacturing applications. Ease of use, performance, and the ability to model accurately any object independent of shape or manufacturing process continue to challenge all in this business. Significant progress has been made and the systems available today are very usable. Ten years from now, attendees at the Detroit Autofact Show of 2003 will gossip in the corner pub with tales of art to part systems that work in hours not weeks, which is typical of today.

Knowledge-Based Engineering

Knowledge-based engineering (KBE) is a productivity multiplier for any mechanical CAD/CAM/CAE system. The rules developed can drive automated applications, capture design intent, and automate sharing of data between applications and departments. Every production operation has task and procedural structures that can be automated and optimized with KBE. The needed improvements in ease of use, cost of implementa-

 ©1993 Dataquest Incorporated

tion, and availability of interface to a variety of mechanical CAD/CAM/CAE software products is improving slowly with time. Three years ago, our first in-depth look at KBE made some aggressive predictions. We expected the market to grow by a factor of four in the next two years. A recent analysis now shows that to be a bit optimistic. A two times growth in two years would be closer to the truth. The assumptions in the original forecast are unchanged considering the value of implementation and market opportunity. In fact, case studies are proving to be more successful than previously imagined. The complexity of the implementation has delayed the rapid growth expected.

Rapid Prototyping

The birth of a new industry is an exciting event. Rapid prototyping (RP) offers such an opportunity. Only a few years ago, the first parts were swimming in the photopolymer broth of 3D Systems' research lab. Now someone wanting a quick build of an evaluation part can select one of several manufacturers for this kind of operation. Part models built as a fully surfaced or solid model on any of the leading CAD/CAM/CAE products can be evaluated in software to be transmitted to an RP machine for buildup. After a few hours, a one-of-a-kind part can be extracted from the machine.

Several RP processes are available. Each has its own set of advantages and disadvantages in cost, selection of materials, accuracy, and so on. The leading vendor in this emerging market is 3D Systems. Others include DTM, Stratasys, Cubital, and Helisys. Still more products are being developed and sold, some just in the local markets in Japan or Europe. To the industry practitioners, it may not seem fair to describe the remarkable success of the technology and the benefits delivered as an emerging technology, but we believe that the potential of this exciting industry is well above the current level of performance. Current and new vendors are seriously planning new product offerings with significant improvements in cost per part and cycle time. New materials are being developed for direct-part production and other materials are being used in manufacturing-tool fabrication processes. Building the master part model for investment casting or spray metal tooling is a good example.

Rapid prototyping has proven its significant value in improving the conceptual design and prototype build process. This process improvement is primarily motivated by time savings. The combination of conceptual design CAD/CAE tools with RP as a fast, accurate output device can often shorten the prototype build process by a factor of two or three. This translates to a valuable competitive advantage for the companies using this technology. A simple tangible benefit in using this technology comes from an improvement in communications between tool designers and product designers. An RP model can accurately describe complex geometry that can easily be misinterpreted.

A recent announcement of a Society of Manufacturing Engineers (SME) course is strong testimony to the importance of this new industry. A

 ©1993 Dataquest Incorporated

special interest group is in the works with SME sponsorship as well. We expect future RP tools to be used in an engineering office environment. Later, some systems will produce full-size, functional mock-ups of an automotive interior. Other advances will include new materials with advanced engineering properties. The CAD/CAM/CAE vendors will need to support more advanced data models to communicate effectively with this activity.

Virtual Reality and Multimedia

These buzz words bring to mind a dusty trail and a derby-coifed huckster plying his trade to the unwary. The magic elixir will cure most general maladies—from short-attention span to lack of motivation. Improvements in training techniques, enhanced information flow, and a general well being should be expected. The allure is real. The promised benefits are compelling and needed. The proof of delivery as promised is difficult to find. Enthusiasm for new technologies, especially those with remarkable potential, is difficult to ignore. In the case of virtual reality (VR) and multimedia, mainstream development is targeted at the consumer market. These technologies will progress quickly and will be available at a reasonable price. The clever will find a way to bring the best of this technology into the CAD/CAM/CAE world.

A brief scenario can highlight a potential application. A designer responsible for a die design for an aluminum casting is having a problem. The parts are not being formed correctly; porosity and incomplete filling of the mold is the problem. Using VR techniques with real-time interactive simulation, the designer can shrink and walk inside the mold. The simulation can dynamically represent the flow of the molten aluminum. As it moves into the passage in question, the designer can see and hear a synthesized analysis of the process. He or she can hear or even feel the fluid velocity and decide to modify the shape of the mold, then run the simulation again. This scenario describes a real design problem, one that could be solved today in a few weeks. VR combined with the next-generation computing resource should reduce that design time to minutes.

The promise of virtual reality and multimedia in an engineering environment is real. The practical applications are many. The time for implementation will evolve during the next decade.

End Users

The fundamental driving force in the market comes from the users. The need for additional features and functions is a never-ending dialog between the vendor and the user. The necessary and typical focus on the next release forces the users and vendors into baby steps of significant improvement. Truly dramatic change is needed in some products to bring the functionality up to today's standards. For some vendors, starting over from a clean sheet might be more effective.

 ©1993 Dataquest Incorporated

Product Life-Cycle Cost

The major applications in mechanical CAD/CAM/CAE are defined. Product conception, development, production, operation, and support will be necessary applications areas a hundred years from now. What will change is how these applications are performed, the level of interoperability between the functions, and the speed of evaluation and automation. The pressure to effectively accomplish this change is directly related to the costs associated with the product development cycle. All significant elements for change will come from an intimate understanding of the flow of information in each of these departments and related application. Figure 3-8 illustrates the concept of cost commitment in new product production that highlights the importance of high-quality design. An internal study attributed to British Aerospace several years ago estimated that 85 percent of a product life-cycle cost is committed prior to engineering release. This is not necessarily bad as long as the design meets the design goal with good quality. Making the design commitment, ordering tooling, and then discovering the need for a major engineering change is very costly in wasted materials and in time to market. A major change after product shipment summons the dreaded specter of recall. The cost of such things in real dollars and lost market confidence is immense.

Many large manufacturing companies are working diligently to optimize this process. In a real sense, the ability of a company to implement CAD/CAM/CAE tools more effectively will determine the level of success and the ultimate ability of the company to remain competitive. If all the companies are using the same tools, no one has an advantage. If a few can implement and integrate more effectively, then time to market, costs to develop, and product quality improvements will follow.

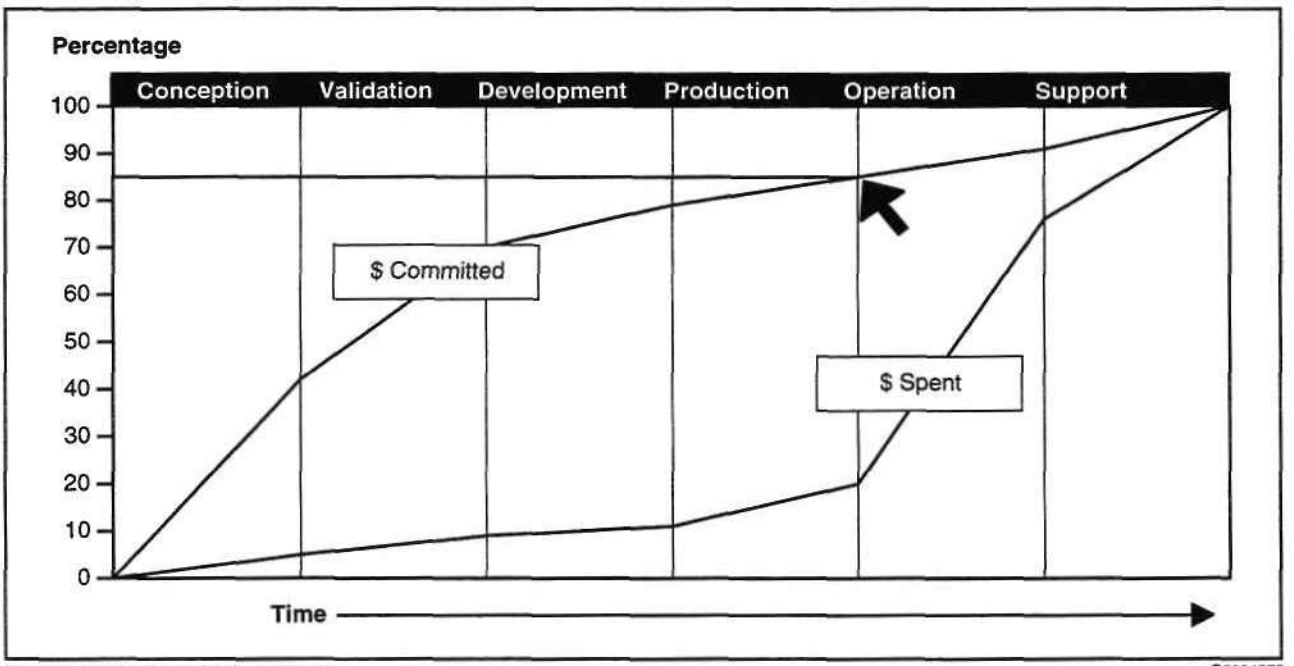
CAD/CAM/CAE Growth Trends, by Region

The forces at work in steering the development of CAD/CAM/CAE are universal. Drafting and design are the same in Spain, California, or Singapore. The evolution of user demands is similar as well. Usually, the first application mastered produces detail design faster. This is followed by automated drafting techniques and more sophisticated uses of design, analysis, and manufacturing applications.

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. The automotive industries in Japan, the United States, Germany, Italy, and France have a major influence on the local CAD/CAM/CAE market. Aerospace, a major force in the U.S. market, is less of a force in other regions 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. Specifically, the machinery industry in Japan and Germany represents a significant local CAD/CAM/CAE opportunity.

 ©1993 Dataquest Incorporated

Figure 3-8
Product Life-Cycle Costs

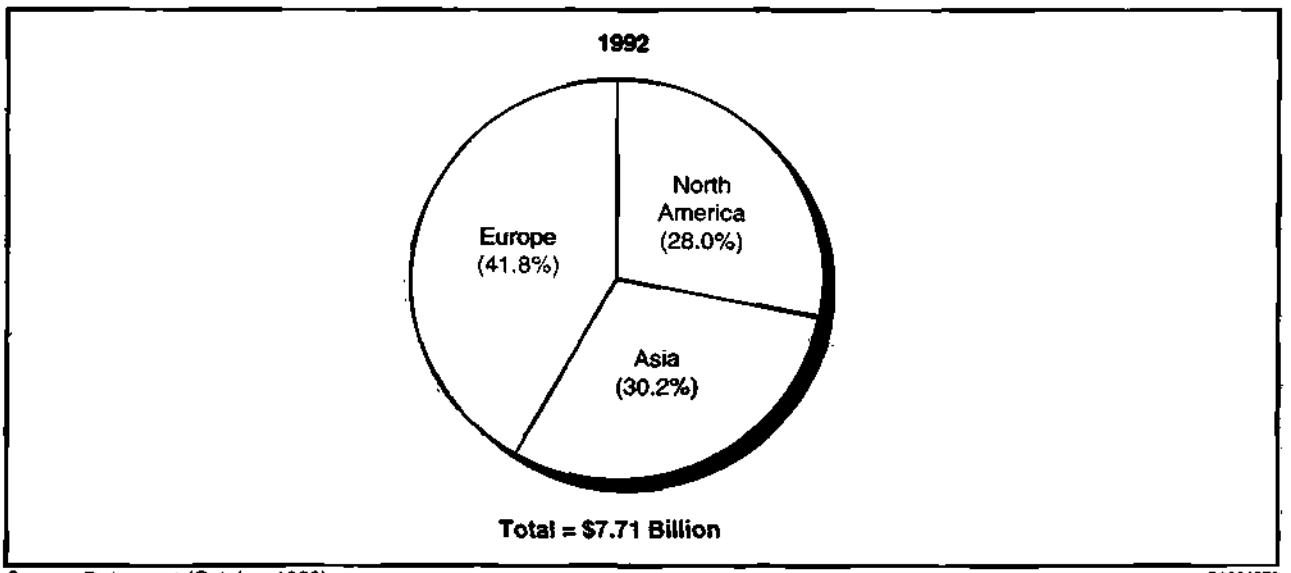


Source: Dataquest (October 1993)

The shipments of mechanical CAD/CAM/CAE products reflect the global nature of the business (see Figure 3-9). The major regions of the world are nearly balanced for revenue shipments with Europe being the largest, then Asia, and North America. This trend is expected to continue for the foreseeable future. An interesting reference point comes from our worldwide analysis. This compares the total CAD/CAM/CAE consumption to the total sales volume of the manufacturing companies. This ratio is 0.3 percent. In other words, for every $1,000 of sales revenue in a manufacturing company, companies spend $3.00 per year for use of mechanical CAD/CAM/CAE.

©1993 Dataquest Incorporated

Figure 3-9
Distribution of Mechanical CAD/CAM/CAE Total Factory Revenue, by Region



Source: Dataquest (October 1993)

G3004573

©1993 Dataquest Incorporated

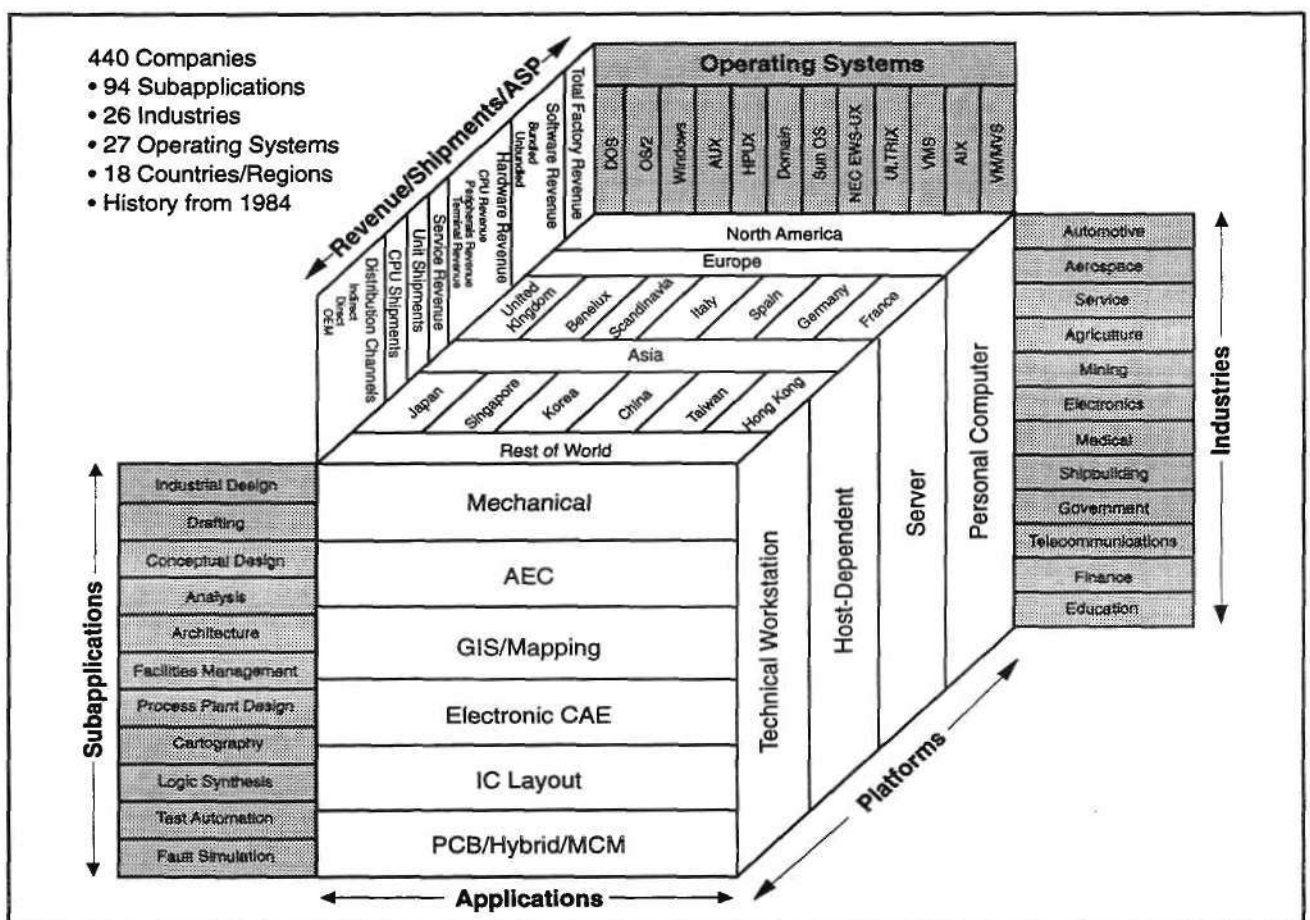
Chapter 4
Market Analysis

Methodology

Every year, the Dataquest CAD/CAM/CAE group makes two vendor surveys to define the market performance for the previous year. In the fourth quarter, the process begins with direct contact of more than 400 vendors worldwide. This information drives the preliminary market share published in February. During the first and second quarter additional survey work is completed that qualifies that published preliminary data. This results in a final market share publication in July. The information described resides in a multidimensional database as illustrated in Figure 4-1.

Having the benefit of detailed historical data, analysts generate a preliminary and final forecast using the market share results to check the sanity of earlier assumptions. These final reports are distributed in May and October. This *MarketTrends* book will describe the 1992 market performance and forecast based on the most recent updates available.

Figure 4-1
CAD/CAM/CAE Market Database



Source: Dataquest (October 1993)

©1993 Dataquest Incorporated

Definitions

Subapplications

Dataquest defines the mechanical CAD/CAM/CAE market where a set of computer-aided applications are used to design, analyze, document, and manufacture discrete parts, components, and assemblies. The computer applications used to accomplish these tasks are segmented into several functional areas. Specifically, the mechanical application set includes the following:

- Documentation and drafting—This is comprised of a related set of applications that together define the documentation and drafting application. These include detail drafting, schematics, technical illustration, and charting applications.
- Conceptual design—This includes industrial layout, design layout, and styling applications.
- Functional design—This includes component design, assembly verification, and linkage/mechanism design applications.
- Analysis—This includes mass properties calculations, stack-up, fatigue, structural, thermal, vibration, magnetic, composite, and quality control applications.
- Manufacturing engineering—This includes tool design, fixture design, and part processing design applications.
- Manufacturing process simulation—This includes numerical control part programming, coordinate measuring machines, and offline robotics applications.
- System management and tools—This includes product structure or configuration management, engineering change management, network file management, user application tools, knowledge-based tools, and training tools applications.

Most of the users of these applications are found in the discrete manufacturing industries. These industries, such as automotive, aerospace, and machinery, represent about 50 percent of the total revenue of the market. The "Others" category spans the full range of industry possibilities. Mechanical engineers can be found everywhere supporting the design activities of products and manufacturing processes in everything from toothpaste to billboard signs.

Computing Platforms

The computing platforms used for mechanical CAD/CAM/CAE include everything from notebooks to supercomputers. The Dataquest CAD/CAM/CAE database uses four platform designations, specifically technical workstations, host-dependent systems, servers, and personal computers, to track the market, which are defined as follows:

- Technical workstations—Operate as single-user computers with a large range of performance options; include a virtual, multitasking operating system (UNIX, VMS, DOMAIN), built-in functions for networking, and high-performance graphics.

 ©1993 Dataquest Incorporated

- Servers—Can be used for a variety of services that operate transparently for the user. Functions include file storage, database access, compute capability, and others.
- Host-dependent systems—Are shared logic devices with external workstations/terminals that are dependent on the host for operation.
- Personal computers—Are defined as single-user computers that have features similar to a technical workstation but are optional in the package, such as virtual operating system, networking, and high-performance graphics. Overall, performance characteristics are generally positioned lower than a workstation.

Regions

The regions covered in the service database are defined as follows:

- North America—Includes United States and Canada
- Europe—Includes the United Kingdom, Scandinavia, Benelux, France, Germany, Italy, Spain, and the Rest of Europe
- Asia—Includes Japan, Singapore, Taiwan, Korea, China, and Hong Kong
- Rest of World—Includes all other countries and regions such as Australia, New Zealand, Oceania, Africa, Central America, South America, and the Middle East

The 1992 Mechanical CAD/CAM/CAE Market

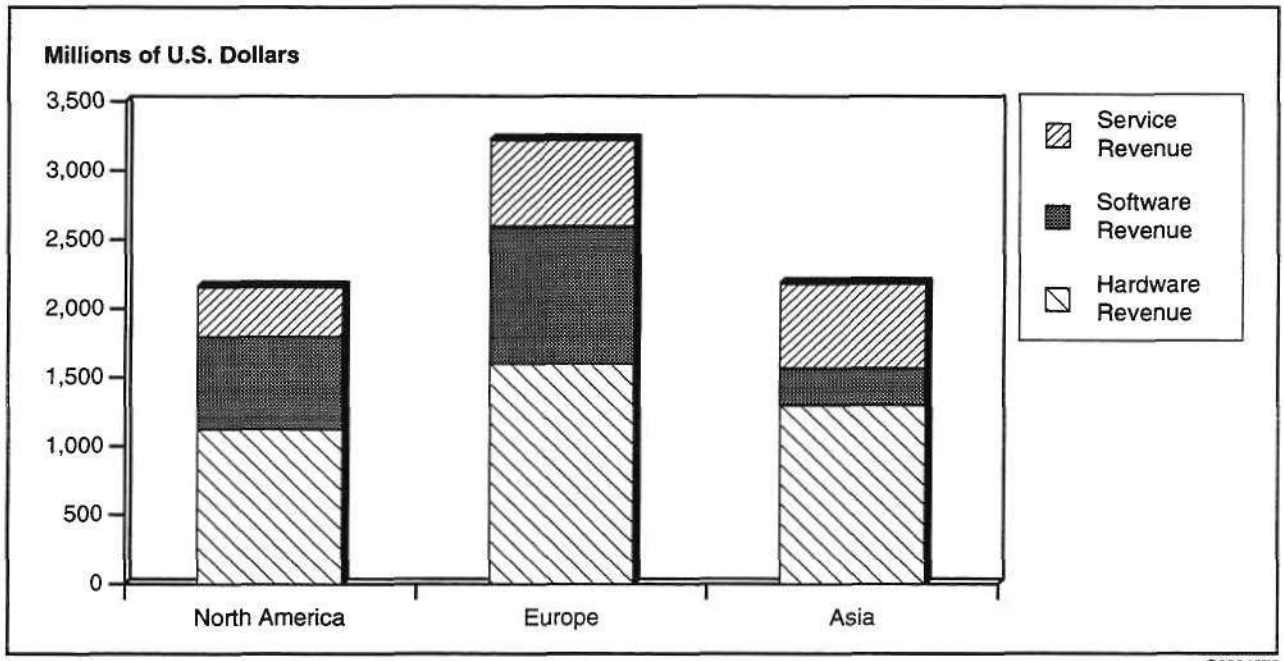
Overall, the mechanical CAD/CAM/CAE market grew 5.5 percent in 1992, reaching $7,711 million for total factory revenue. Total factory revenue is defined as the amount of money received by a manufacturer for its goods and services measured in U.S. dollars. Total factory revenue does not include revenue 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 services revenue. The software segment grew at a higher 10.6 percent rate, reaching 2,332.7 million in worldwide shipments. Software revenue is derived from the sale of bundled (part of a turnkey system) and unbundled application software.

Mechanical CAD/CAM/CAE Market by Region

A regional view of the mechanical CAD/CAM/CAE market finds Europe taking the leading position with 41.8 percent of the worldwide market (see Figure 4-2). The sluggish economy in Europe has caused this growth. Proportionally, a higher percentage of service revenue is paid in Europe, due primarily to the import of U.S.-based products into the region. Germany has the largest country market share in Europe with a typical strong interest in using mechanical CAD/CAM/CAE tools in product design and manufacturing applications. Total factory revenue in Europe grew 5.5 percent to $3,221 million.

 ©1993 Dataquest Incorporated

Figure 4-2
1992 Mechanical CAD/CAM/CAE Market, by Region



Source: Dataquest (October 1993)

Currency exchange rate fluctuations affect apparent growth (Dataquest's CAD/CAM data is expressed in U.S. dollars). Dataquest's European exchange rate tables include data from all western European countries, each of which has different and variable exchanges rates against the U.S. dollar. To cite a specific example, in 1989, 1990, and 1991, Matra Datavision grew 7.3 percent, 0.2 percent, and 8.9 percent, respectively, in French francs. This growth converted to U.S. dollars looks quite different at negative 2.4 percent, 17.8 percent, and 4.9 percent, respectively.

The Asian market slowed again, dropping 0.2 percent to $2,180 million. The North American market jumped back from a drop in 1991, growing 10.3 percent to $2,156 million.

Mechanical CAD/CAM/CAE Market, by Platform

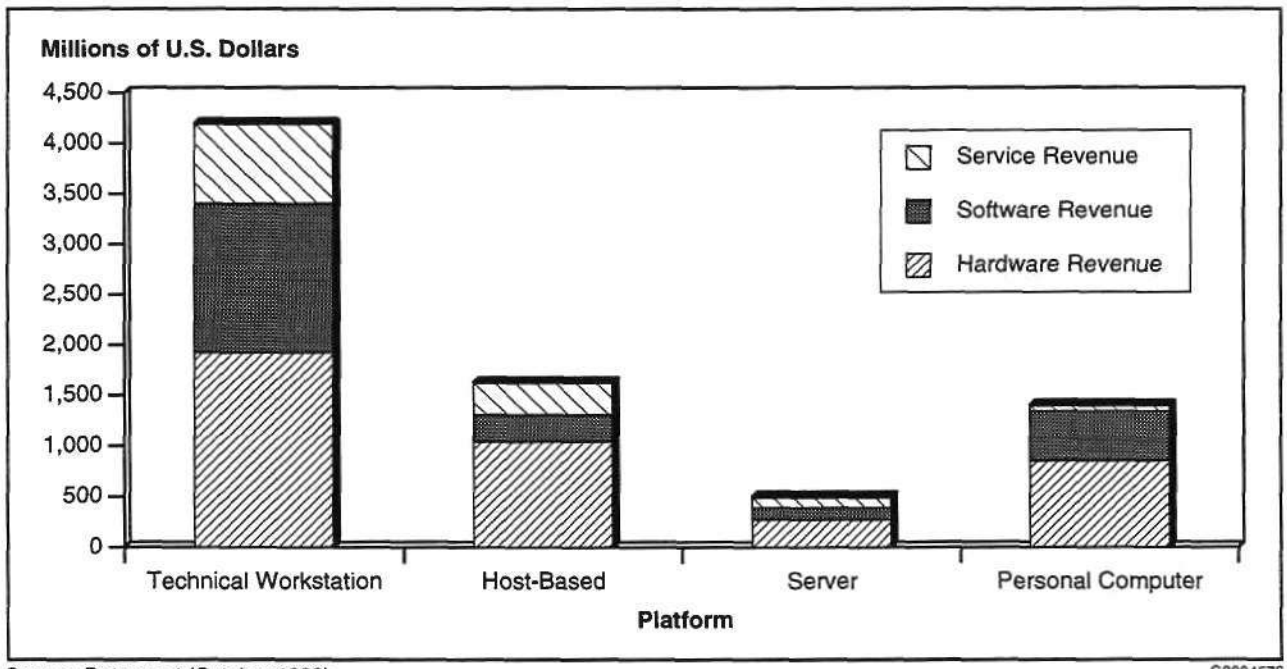
The mechanical CAD/CAM/CAE market has embraced the technical workstation as the platform of choice. A majority of software revenue is based on this platform. Most of the leading vendors are developing in a technical workstation environment.

A view of the mechanical CAD/CAM/CAE market by platform shows the importance of the technical workstation in this market. More than half of the total and service revenue and more than 63 percent of the total software revenue is represented by technical workstations (see Figure 4-3).

The personal computer has experienced rapid growth and wide acceptance because the first product offerings supplied a low-cost drafting and design solutions. The market perception of the PC as a more serious

 ©1993 Dataquest Incorporated

Figure 4-3
1992 Worldwide Mechanical CAD/CAM/CAE Market, by Platform



Source: Dataquest (October 1993) G3004576

design and analysis tool has progressed slowly. Virtually all applications running on workstations or host-based systems are now available on the PC. Many manufacturing applications have been implemented on the PC with good results. Numerical control part programming is probably the best example. The combination of a low-cost and focused application fits well in the shop floor environment. We expect the PC and workstation to continue to battle for the engineering desktop.

Host-based systems, once the basis for the entire mechanical CAD/CAM/CAE market, have evolved to a single, dominant force in the market. IBM owns a 43 percent market share in total revenue. The next three market share leaders, Digital, Nihon Unisys, and Control Data, are important suppliers in this market, but together they represent only 24.3 percent of the total factory revenue. Several Japanese vendors show considerable strength in their market with host-based offerings, but even in Japan the trend is the same. Revenue is flat to down. This bad news finds the whole market segment dropping 17.2 percent from 1991 revenue levels. IBM dropped more than 20 percent alone. Dataquest expects the mainframe solution to continue to lose ground to the workstation and PC offerings. The server market along with host-based solutions will continue to supply the large system support and maintenance security blanket that is needed in some industries. The trend is clear, however, host-based products will only represent about 10 percent of the market total by 1997.

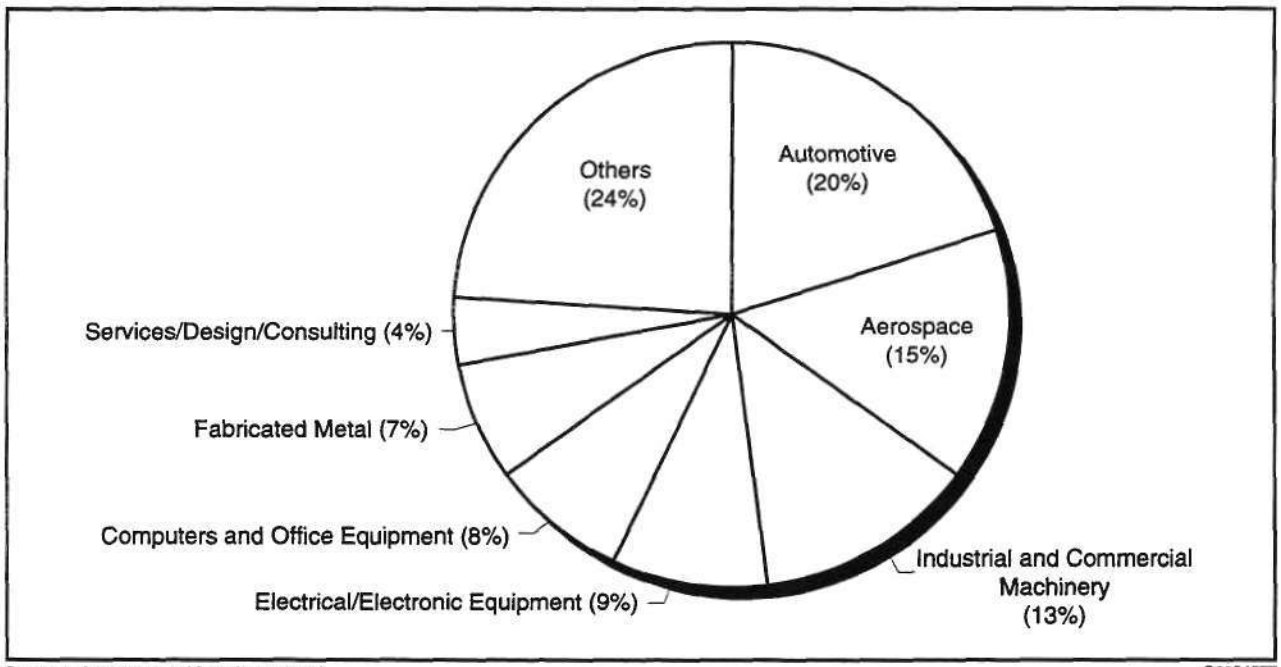
Mechanical CAD/CAM/CAE Market, by Industry

Preliminary analysis by industry finds automotive and aerospace as the two largest industrial users. These industries have been dedicated and

 ©1993 Dataquest Incorporated

longtime users of this technology. In fact, a significant amount of software developed in these industries as internal development has found its way into commercial product offerings. Most of these companies are increasing the use of commercial software and focusing internal development efforts on the customization of commercial tools to get a competitive advantage from the implementation. These industries together with fabricated metal and the "Others" group all grew 4 to 9 percent for investments in total mechanical CAD/CAM/CAE systems in 1992 over 1991. Computers represented 7.7 percent of the total with a 35.0 percent growth rate. The services/design/consulting group grew an estimated 22 percent, followed by electrical equipment and industrial machinery. All of this data is preliminary based on vendor-based research just being completed. A full analysis of the market by industry is being develop at this time (see Figure 4-4).

Figure 4-4
The 1992 Preliminary Worldwide Mechanical CAD/CAM/CAE Software Revenue, by Industry



Source: Dataquest (October 1993) G3004577

The Top 10 Market Share

Total Factory Revenue

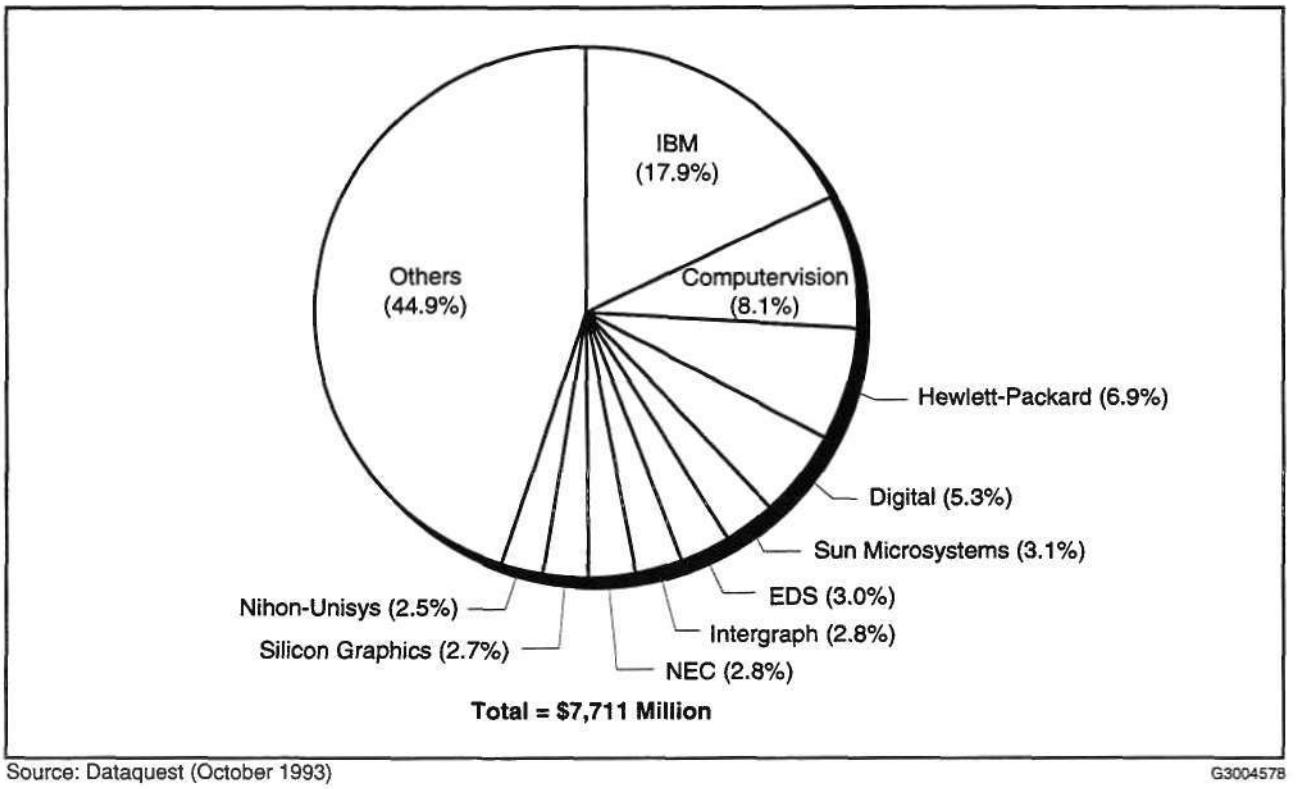
The total factory revenue for the worldwide market in 1992 was $7,711 million. The U.S.-based vendors shipped almost 75 percent of the total, Asian vendors shipped 16 percent, and European vendors only 9 percent. The vast amount of products developed in Asian countries were sold in Asia.

As a group, the worldwide top 10 slightly lost market share in 1992 (see Figures 4-5 and 4-6). In 1991, they had 55 percent of the total market. This

 ©1993 Dataquest Incorporated

held even with a 55.1 percent in 1992 with $4,237 million in revenue. The names and positions on the list have not changed dramatically. Sun Microsystems, Silicon Graphics, and Intergraph all moved up one or more places in the top 10. Two shining stars on the top 10 list are Sun Microsystems and Silicon Graphics. Each had about a 35 percent growth rate in total factory revenue. SGI had a whopping 77.3 percent increase in total mechanical unit shipments. The other top 10 vendors jockeyed for position with growth or decline in the ±20 percent range.

Figure 4-5
Worldwide Top 10 Market Share by Total Revenue—All Platforms



Source: Dataquest (October 1993) G3004578

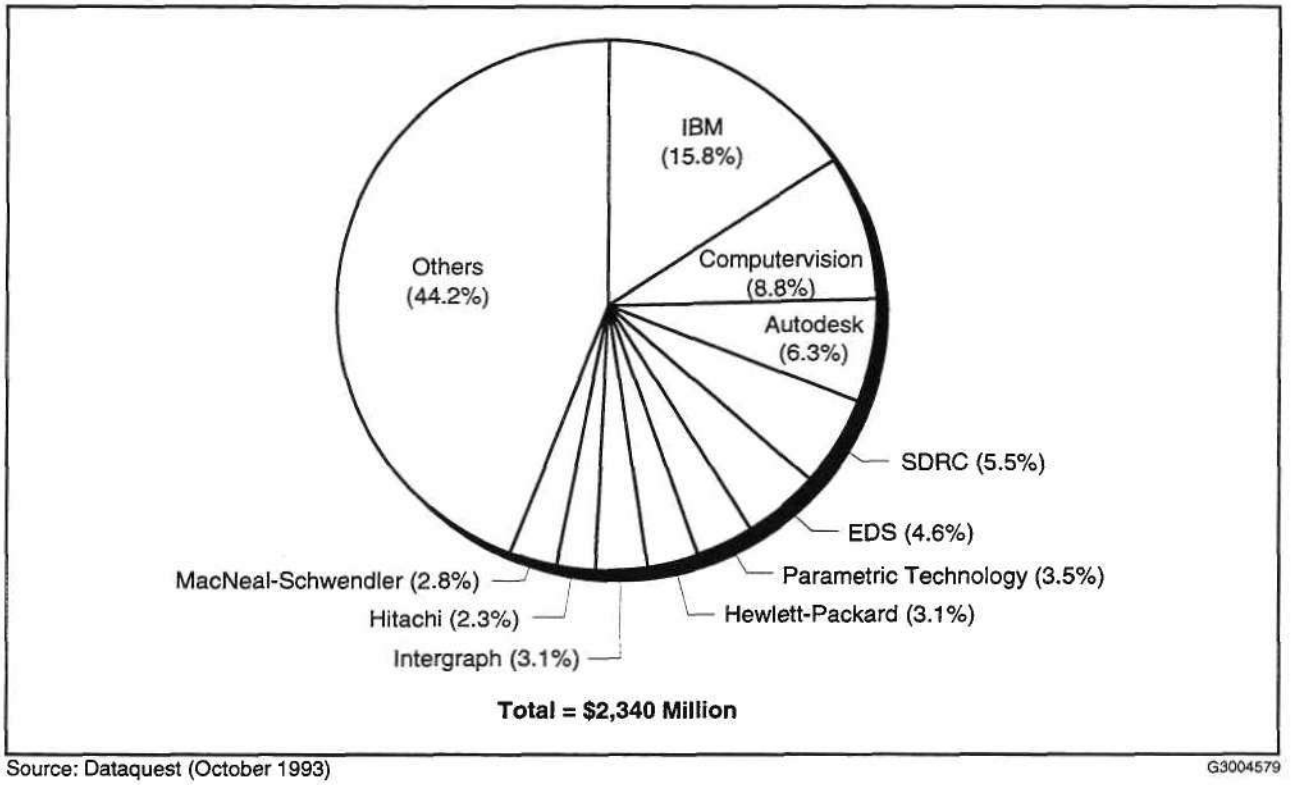
Leading Vendors in Software Revenue

IBM

IBM continues to lead the market with its CATIA, CADAM, and CAEDS product offerings. It leads the market in most regions for total factory revenue and for host-based and server revenue for hardware and software. This represented $1,378 million in total mechanical CAD/CAM/CAE revenue, with an 8.1 percent drop from 1991. Strategic investments in a variety of software companies in mechanical CAD/CAM/CAE and other industrial applications promise to maintain this position. Dassault, the primary software developer for IBM, continues to expand the application set in mechanical CAD/CAM/CAE. A major release due at the end of 1993 will improve the image of this leading design and manufacturing tool. In a surprise announcement mid-1993, Dassault moved toward a multiple platform offering. As IBM grows the system integration

 ©1993 Dataquest Incorporated

Figure 4-6
Worldwide Top 10 Market Share, by Software Revenue—All Platforms



Source: Dataquest (October 1993) G3004579

business, it will in fact sell other vendors' hardware if necessary to prove the level of commitment to the integrator mission. Dassault will port to Hewlett-Packard, Sun Microsystems, and other platforms on a case-by-case basis. IBM continues to make strategic investments in software companies to expand its influence and to add leading-edge software offerings around the CATIA core.

Computervision

Computervision edged out IBM for top honors in total software revenue in Europe. Computervision maintained its lead with top revenue share in total factory revenue and software revenue on technical workstations in Europe and in the worldwide market. This represented $623.1 million in total mechanical CAD/CAM/CAE revenue, a 6.2 percent drop from 1991. The release of CADDS5, a major update in late 1992, had some positive effects on revenue in 1993. The users as a group did not move toward the new-user interface or purchase the required hardware to run CADDS5 as fast as expected. Aggressive competition in the U.S. market, in particular, caused a revenue fall. Some reorganization and expense cutting has taken place as a result. The revenue profile has shifted more toward software and away from hardware.

Autodesk

Autodesk has the No. 1 position in personal computer-based software everywhere except in Asia. A few of the local Asian products have edged

 ©1993 Dataquest Incorporated

the company out of the lead. Worldwide, this represented $147.1 million in total mechanical CAD/CAM/CAE revenue, a 34.5 percent growth over the previous year. Aggressive acquisition and development strategies are in place to bring new technology into the company. Acquisitions of MES in Michigan and a relationship with Spatial Technology for the ASIC solid modeling technology are prime examples for this strategy. The strength of the company is perceived as its market share and distribution channel. Enhancements to the recent Release 12 were designed to improve the user interface and add functionality to the product. Reports state that Release 12 was a significant improvement.

SDRC

A healthy 27.7 percent revenue growth in software in 1992 illustrates the success of SDRC. Revenue slipped early in 1993 in anticipation of the next major software release and strong competitive pressures. Master Series has been proven to be a major improvement over earlier versions of the solid modeling-based design software. Many enhancements in user interface, geometric manipulation, and workgroup function are in place. As could be anticipated, a rewrite of core software at this level can easily bring bugs into the process. The first release was buggy. In fact, a management letter to the stockholders suggested delayed shipments and a reduction in revenue because of this problem. However, the problems have been solved, per the letter, and product shipments are back on track.

EDS

EDS made significant progress in improving software revenue in 1992 with more than 33 percent growth. At the same time, slight growth in total revenue brought worldwide revenue to the $229.2 million level with a 3.6 percent growth. Some softness in sales took place prior to the release of V10, but 1993 is shaping up as a reasonable sales year considering the state of the economy. The level of quality of the V10 release is as good as or better than average. A list of strategic relationships is growing to add capability to the Unigraphics (UG) environment. New pricing strategies are in place to encourage users to move the new release and to use solid modeling technology. Enhancements to the manufacturing side of the business are next on the agenda.

Parametric Technology

A revenue growth of 87.2 percent in 1992 brings PTC over the $81 million mark in software. If PTC can maintain this growth rate for three more years, it could be the largest mechanical CAD/CAM/CAE software vendor in the world. Will this happen? If the testimonials from the steady stream of first- and second-time buyers are any indication, the odds are getting better. Weekly announcements are made for new sales activity. Recent examples include a new order from Kohler Company valued at $1 million to be shipped in October. J.I.Case Company purchased a $2.1 million follow-on order, and Paccar with 63 seats at $ 1.4 million. The market growth of this company is the envy of those well beyond the CAD/CAM industry. Naysayers point out technological deficiencies, difficulty in editing, a reluctance to do benchmarking, and misrepresenta-

 ©1993 Dataquest Incorporated

tions in confusing licensing agreements where a site might have an evaluation license for 30 seats but only one actually installed. The facts speak for themselves. PTC is doing very well with a focused development team, a professional marketing program, and a pugnacious sales force.

Intergraph

Intergraph has quietly been building on its historic strengths in the defense, automotive, and aerospace sectors. The 1992 revenue of $72 million in software came with a 44 percent growth rate. This was one of the best sales years for mechanical CAD/CAM/CAE at Intergraph in recent history. The integrated product data model approach with comprehensive product data management is supporting this healthy growth.

Hewlett-Packard

Hewlett-Packard grew slightly above the industry average in 1992. The $72.1 million in software sales had a 12.7 percent growth rate. The ME10-based products sold well. Sales of the new solid modeling products (Precision Engineering Systems) got off to a slow start with product delays. Some of the new manufacturing-oriented modules are remarkable in the level of integration and ease of use. The sheet metal design package is a good example. Europe has remained a stronghold for these products where 57 percent of all software revenue is sold.

MacNeal-Schwendler

MacNeal-Schwendler experienced better than average growth with a 21.1 percent increase, reaching $64.7 million in software sales. New product development has fueled this growth. Recent acquisition of Aries Technology will aid the development of modeling tools to improve productivity in building analysis models. This company is well recognized for the depth of application base in the finite element analysis world. The evolutionary approach to product development has well served a large installed base. More revolutionary tactics may be needed to entice the casual user to take the analytical plunge.

Hitachi

Reaching the worldwide top 10 list by only selling products in Japan is strong testimony for the strength of Hitachi and the importance of the Japanese market. Hitachi sold $54.8 million in software in Japan with a 3.3 percent decline over the 1991 numbers. This was slightly below the total market in Japan that experienced a slight 2 percent market growth. Technical workstation-based 2-D tools have been the most popular, with some applications running on PCs and then host-based systems.

Major Market Segments

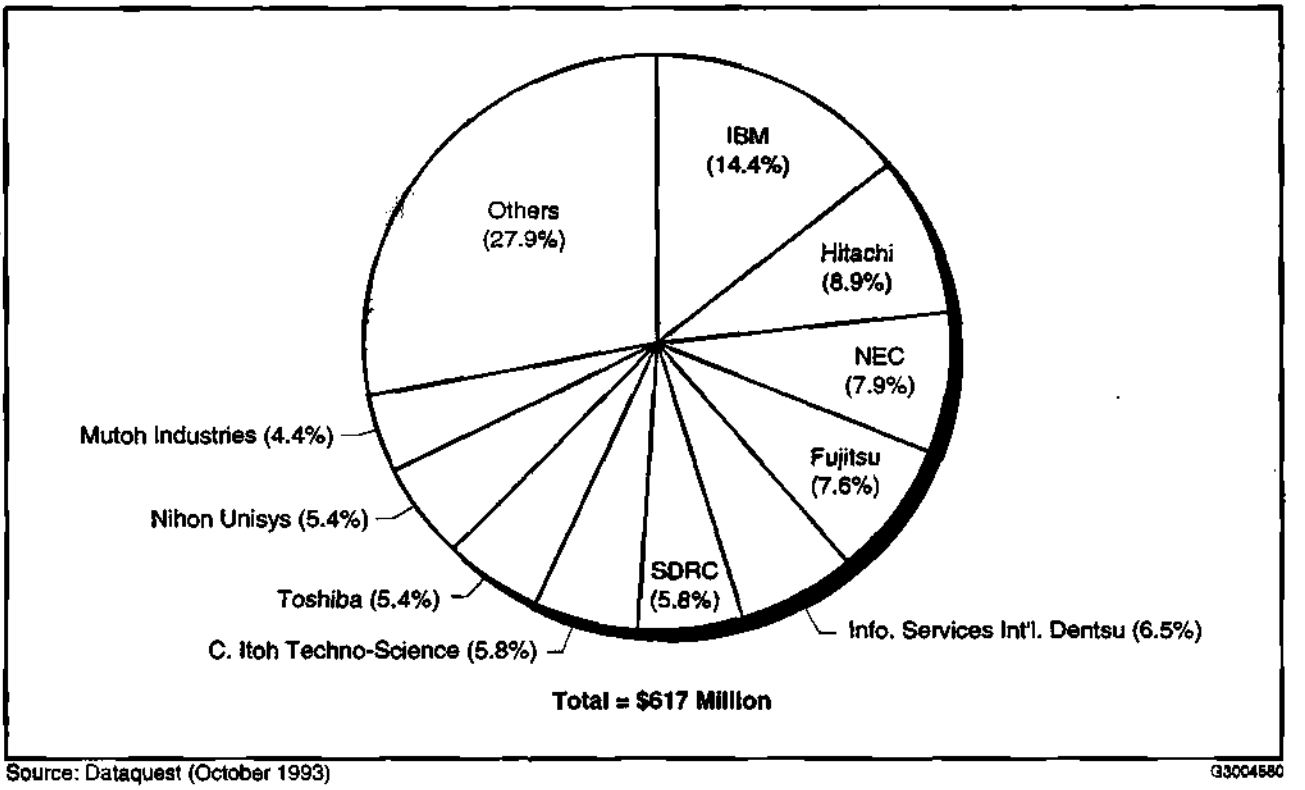
The following set of figures highlight and recognize the leading vendors around the world in each major market segment and in several selected segments of special interest:

- Asia software revenue—All platforms
- Asia hardware revenue—All platforms

 ©1993 Dataquest Incorporated

- Europe software revenue—All platforms
- Europe hardware revenue—All platforms
- North America software revenue—All platforms
- North America hardware revenue—All platforms
- Worldwide total hardware revenue—All platforms

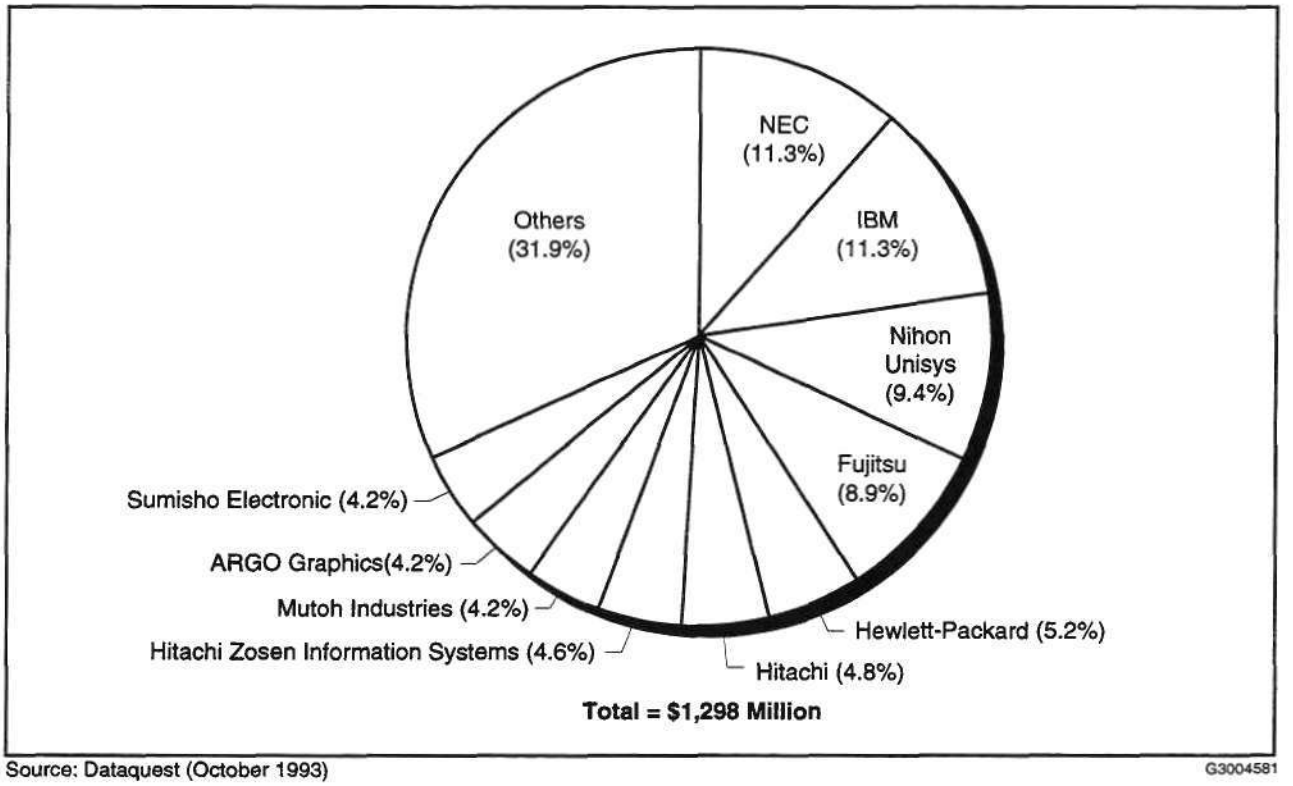
Figure 4-7
Asia Top 10 Market Share, by Software Revenue—All Platforms



Source: Dataquest (October 1993) G3004580

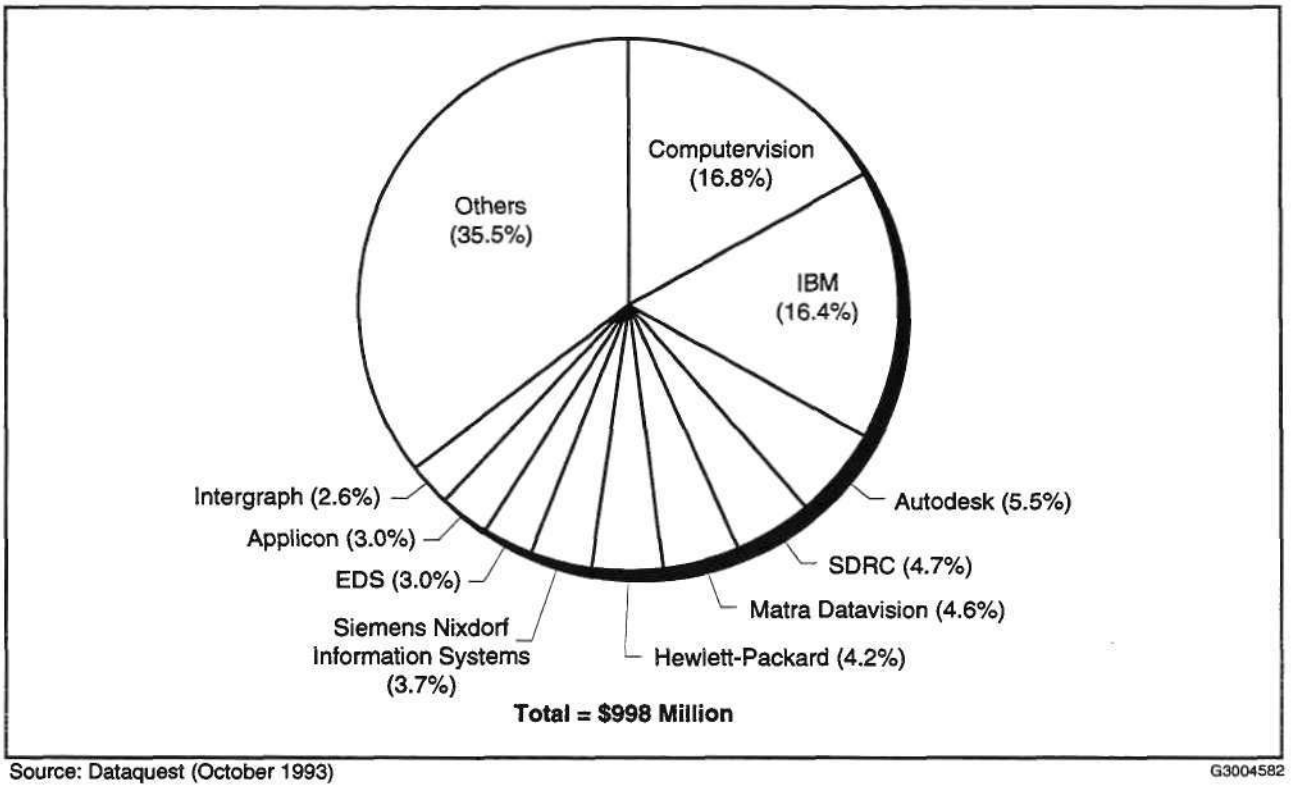
 ©1993 Dataquest Incorporated

Figure 4-8
Asia Top 10 Market Share, by Hardware Revenue—All Platforms



Source: Dataquest (October 1993) G3004581

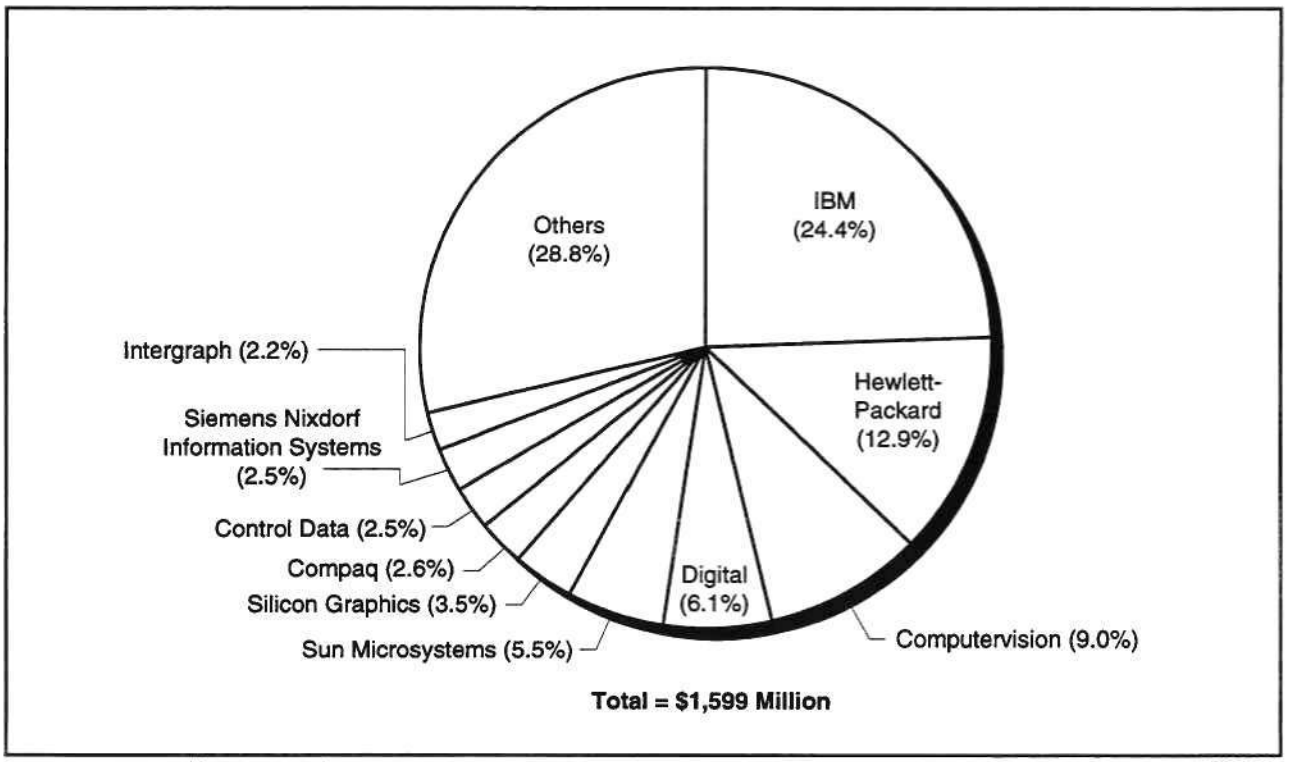
Figure 4-9
Europe Top 10 Market Share, by Software Revenue—All Platforms



Source: Dataquest (October 1993) G3004582

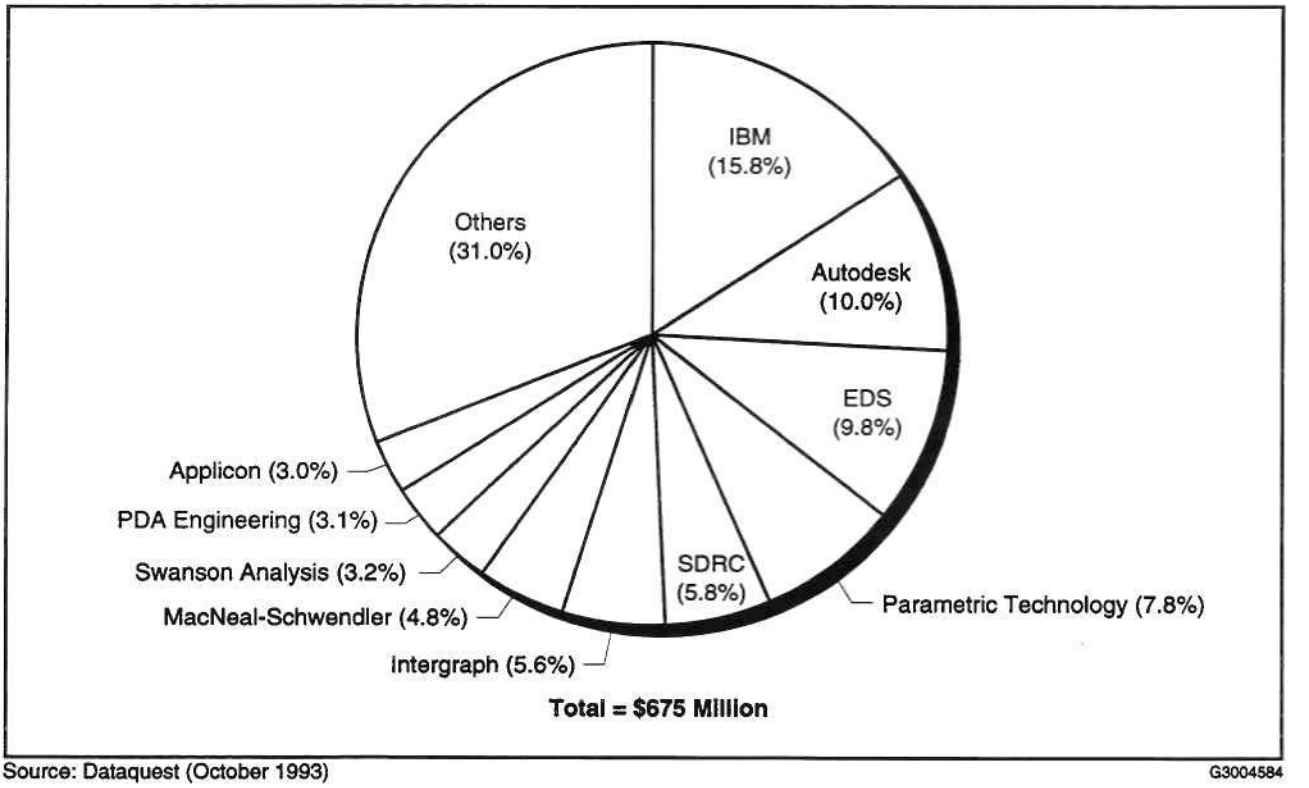
 ©1993 Dataquest Incorporated

Figure 4-10
Europe Top 10 Market Share, by Hardware Revenue—All Platforms



Source: Dataquest (October 1993) G3004583

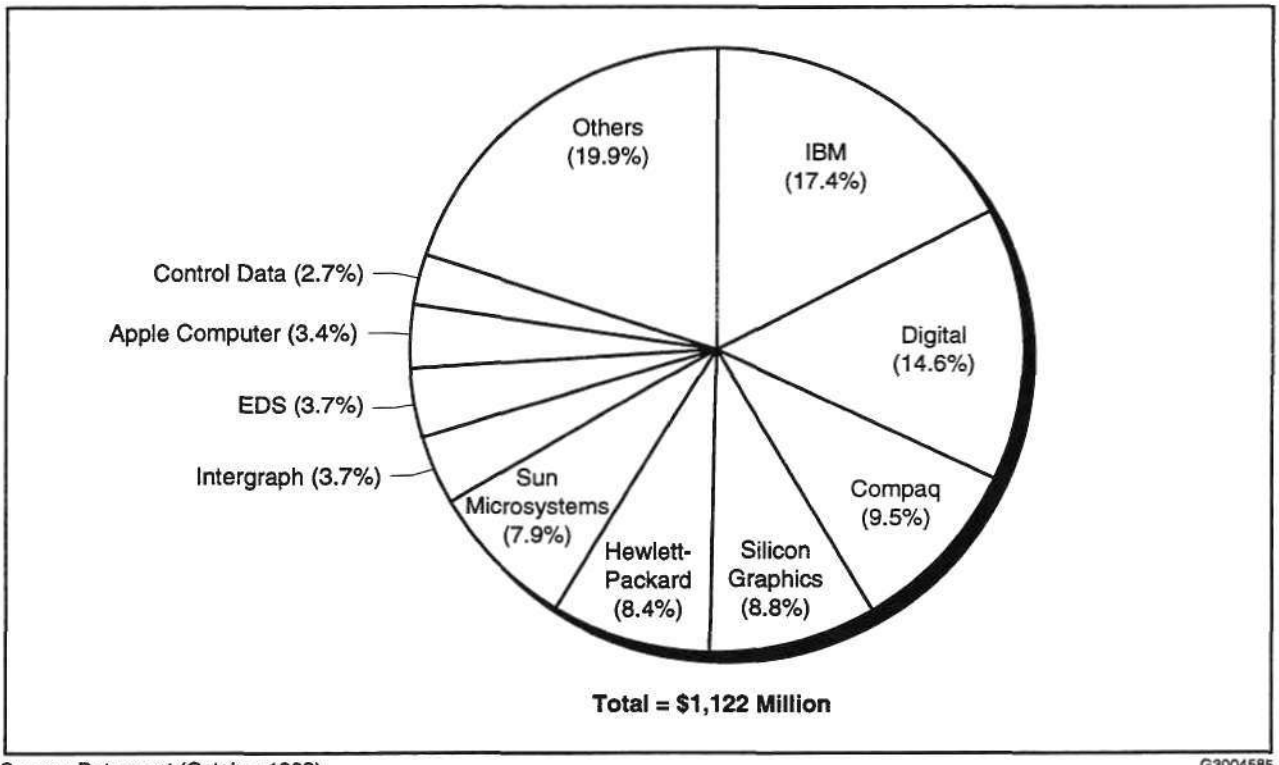
Figure 4-11
North America Top 10 Market Share, by Software Revenue—All Platforms



Source: Dataquest (October 1993) G3004584

©1993 Dataquest Incorporated

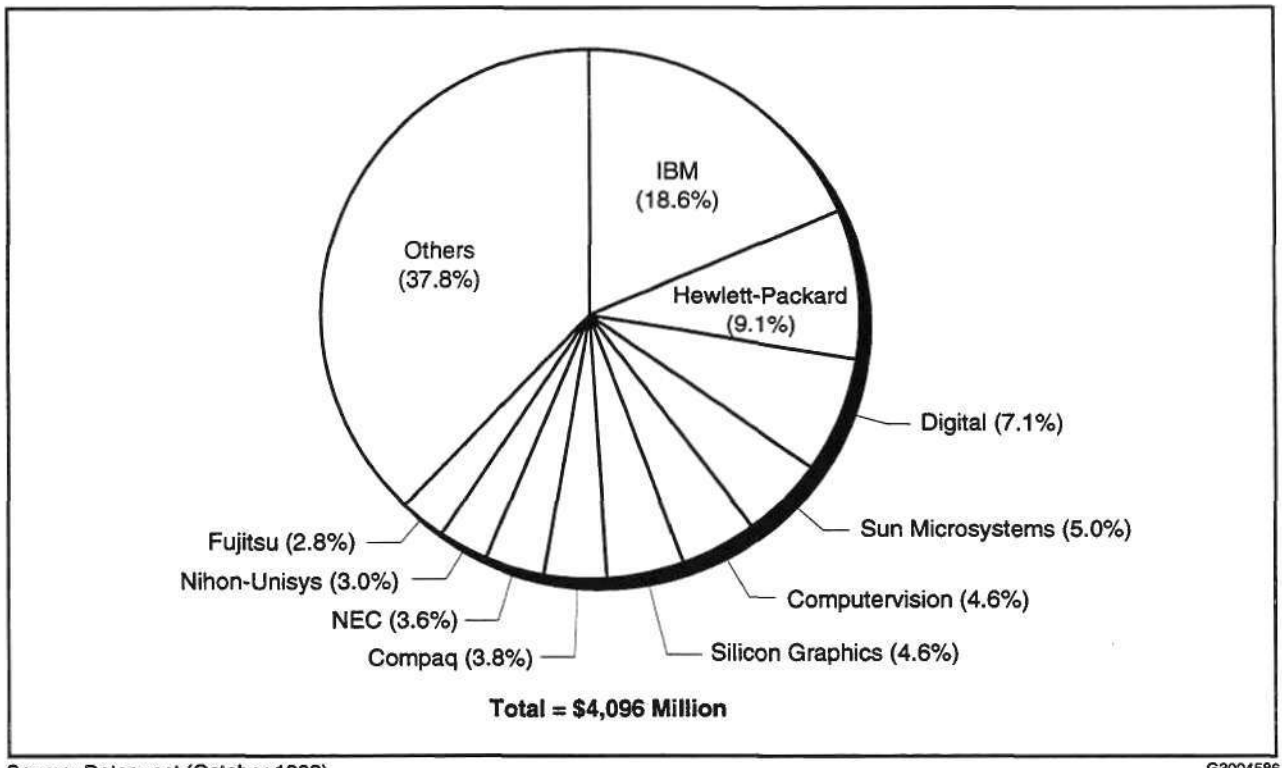
Figure 4-12
North America Top 10 Market Share, by Hardware Revenue—All Platforms



Source: Dataquest (October 1993)

G3004585

Figure 4-13
Worldwide Top 10 Market Share, by Hardware Revenue—All Platforms



Source: Dataquest (October 1993)

G3004586

©1993 Dataquest Incorporated

Appendix A
Market Statistics—Mechanical CAD/CAM/CAE

©1993 Dataquest Incorporated

Table A-1
Worldwide—All Platforms—Market Leaders

Application: Mechanical
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	Hardware Revenue	Software Revenue	Hardware Units Shipped
IBM	1,377.9	761.6	370.7	32,833	17.9	18.6	15.9	10.3
Computervision	623.1	189.7	206.9	6,056	8.1	4.6	8.9	1.9
Hewlett-Packard	530.0	373.8	72.1	27,641	6.9	9.1	3.1	8.7
Digital	411.1	289.8	0	13,628	5.3	7.1	0	4.3
Sun Microsystems	238.0	204.9	0	13,114	3.1	5.0	0	4.1
EDS	229.2	67.1	107.7	3,275	3.0	1.6	4.6	1.0
Intergraph	215.0	85.0	72.0	3,087	2.8	2.1	3.1	1.0
NEC	212.3	146.9	48.5	10,994	2.8	3.6	2.1	3.5
Silicon Graphics	204.8	187.0	0	6,970	2.7	4.6	0	2.2
Nihon Unisys	196.3	121.7	33.4	1,901	2.5	3.0	1.4	0.6
Fujitsu	181.2	116.0	47.1	3,588	2.3	2.8	2.0	1.1
Control Data Systems	159.9	76.9	26.3	2,155	2.1	1.9	1.1	0.7
Compaq	156.5	156.5	0	33,874	2.0	3.8	0	10.7
SDRC	149.8	0	129.2	0	1.9	0	5.5	0
Autodesk	147.1	0	147.1	0	1.9	0	6.3	0
Applicon	135.0	45.3	53.2	1,452	1.8	1.1	2.3	0.5
Hitachi	130.5	62.6	54.8	3,506	1.7	1.5	2.3	1.1
Parametric Technology	100.2	0	81.2	0	1.3	0	3.5	0
Matra Datavision	98.2	31.4	50.1	824	1.3	0.8	2.1	0.3
Siemens Nixdorf Info systeme	91.4	40.0	37.7	1,332	1.2	1.0	1.6	0.4
Apple Computer	80.6	80.6	0	16,378	1.0	2.0	0	5.2
Toshiba—No OEM	74.3	37.2	29.7	2,563	1.0	0.9	1.3	0.8

(Continued)

CMEC-WW-MT-9301

©1993 Dataquest Incorporated

October 25, 1993

Table A-1 (Continued)
Worldwide—All Platforms—Market Leaders

Application: Mechanical
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	Hardware Revenue	Software Revenue	Hardware Units Shipped
Hitachi Zosen Info Systems	69.8	59.6	3.3	719	0.9	1.5	0.1	0.2
MacNeal-Schwendler	64.7	0	64.7	0	0.8	0	2.8	0
Mutoh Industries—No OEM	55.0	33.0	16.5	902	0.7	0.8	0.7	0.3
Swanson Analysis	45.3	0	43.5	0	0.6	0	1.9	0
Mitsubishi Electric	40.9	31.7	5.2	738	0.5	0.8	0.2	0.2
Hakuto	39.9	24.0	16.0	850	0.5	0.6	0.7	0.3
Cisigraph	39.3	11.0	21.6	250	0.5	0.3	0.9	0.1
STI-Straessle	37.4	11.2	18.0	303	0.5	0.3	0.8	0.1
PDA Engineering	36.1	0	34.7	0	0.5	0	1.5	0
Alias Research	32.7	0	29.7	0	0.4	0	1.3	0
Tokyo Electron—No OEM	32.3	10.7	14.5	220	0.4	0.3	0.6	0.1
ASCAD/ASCAM	30.6	18.4	9.2	450	0.4	0.4	0.4	0.1
Sharp System Products—No OEM	29.7	15.4	14.3	286	0.4	0.4	0.6	0.1
Other Companies	1,415.8	808.2	474.1	127,462	18.4	19.7	20.3	40.2
All Companies	7,711.7	4,097.0	2,332.7	317,352	100.0	100.0	100.0	100.0
All North America-Based Companies	5,812.3	3,109.2	1,654.3	277,366	75.4	75.9	70.9	87.4
All Asia-Based Companies	1,208.0	743.2	335.8	29,237	15.7	18.1	14.4	9.2
All Europe-Based Companies	691.4	246.0	334.8	11,399	9.0	6.0	14.4	3.6
All Hardware Companies	1,990.2	1,754.6	5.3	236,001	25.8	42.8	0.2	74.4
All Turnkey and Software Companies	5,721.5	2,342.4	2,327.4	81,351	74.2	57.2	99.8	25.6

Source: Dataquest (October 1993)

©1993 Dataquest Incorporated

For More Information...

Michael J. Seely, Director and Principal Analyst.....(408) 437-8178
Via fax.....(408) 437-0292

The content of this report represents our interpretation and analysis of information generally available to the public or released by responsible individuals in the subject companies, but is not guaranteed as to accuracy or completeness. It does not contain material provided to us in confidence by our clients. Individual companies reported on and analyzed by Dataquest may be clients of this and/or other Dataquest services. This information is not furnished in connection with a sale or offer to sell securities or in connection with the solicitation of an offer to buy securities. This firm and its parent and/or their officers, stockholders, or members of their families may, from time to time, have a long or short position in the securities mentioned and may sell or buy such securities.

©1993 Dataquest Incorporated—Reproduction Prohibited

Dataquest is a registered trademark of A.C. Nielsen Company 0015301

Dataquest®

a company of The Dun & Bradstreet Corporation

Dataquest®

a company of
The Dun & Bradstreet Corporation

Corporate Headquarters
Dataquest Incorporated
1290 Ridder Park Drive
San Jose, California 95131-2398
United States
Phone: 01-408-437-8000
Facsimile: 01-408-437-0292

Dataquest Incorporated
550 Cochituate Road
Framingham, Massachusetts 01701-9324
United States
Phone: 01-508-370-5555
Facsimile: 01-508-370-6262

Invitational Computer Conferences (ICC)
3990 Westerly Place, Suite 100
Newport Beach, California 92660
United States
Phone: (714) 476-9117
Facsimile: (714) 476-9969

Dataquest Japan Limited
Shinkawa Sanko Building
1-3-17, Shinkawa, Chuo-ku
Tokyo 104
Japan
Phone: 81-3-5566-0411
Facsimile: 81-3-5566-0425

Dataquest Korea
Trade Tower, Suite 3806
159 Samsung-dong
Kangnam-gu, Seoul 135-729
Korea
Phone: 011-82-2-551-1331
Facsimile: 011-82-2-551-1330

European Headquarters
Dataquest Europe Limited
Roussel House, Broadwater Park
Denham, Uxbridge
Middlesex UB9 5HP
England
Phone: 44-895-835050
Facsimile: 44-895-835260/1

Dataquest GmbH
Kronstadter Strasse 9
8000 Munich 80
Germany
Phone: 011-49-89-930-9090
Facsimile: 011-49-89-930-3277

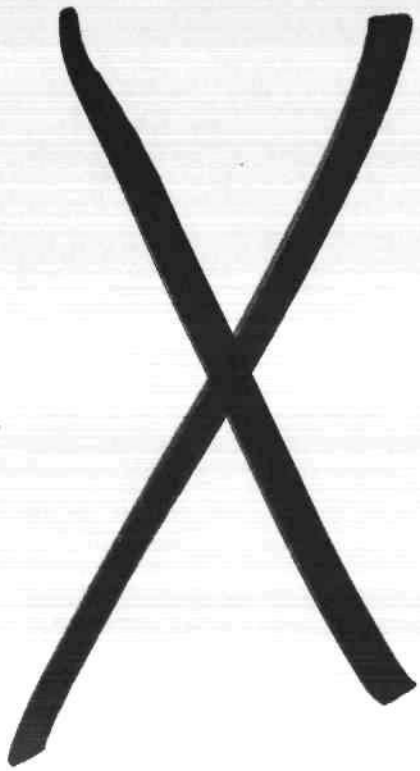
Dataquest Europe SA
Tour Gallieni 2
36, Avenue du General de Gaulle
93175 Bagnolet Cedex
France
Phone: 011-33-1-48-97-3100
Facsimile: 011-33-1-48-97-3400

Representative Agencies in
Bangkok, Hong Kong,
Kronberg, North Sydney,
Singapore, Taipei, and Tel Aviv

N04CMECWW CMECWWMT9301 BH: 1
Corporate Library
Dataquest Incorporated

****
SJ - INTERNAL DISTRIBUTION
****

©1993 Dataquest Incorporated
0015301



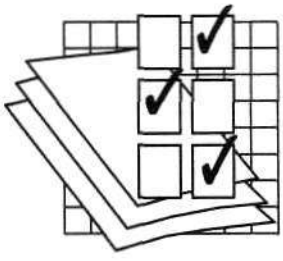
Dataquest®

INFORMATION RESOURCE CENTER
DATAQUEST INCORPORATED
1290 Ridder Park Drive
San Jose, CA 95131-2398
(408) 437-8600

Dataquest®

Software

Mechanical CAD/CAM/CAE: Complex Issues and Technologies from the Users' Perspective



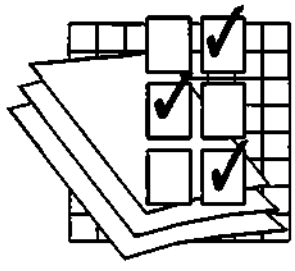
User Wants and Needs

1993

Program: Mechanical Applications Worldwide
Product Code: CMEC-WW-UW-9301
Publication Date: May 31, 1993

Dataquest®
Software

Mechanical CAD/CAM/CAE: Complex Issues and Technologies from the Users' Perspective



User Wants and Needs

1993

Program: Mechanical Applications Worldwide
Product Code: CMEC-WW-UW-9301
Publication Date: May 31, 1993

Table of Contents

	Page
1. Executive Summary	1-1
Study Objectives	1-1
Major Findings	1-2
Methodology	1-5
Structure of Report	1-6
2. Site and Respondent Demographics	2-1
Respondents Role in Their Organizations	2-1
Respondents by Industry	2-1
Respondents by Department	2-1
Respondents Experience Base	2-1
Summary	2-2
3. Current Work Environment	3-1
Applications Used and Target Market Opportunities by Subapplication	3-1
Mechatronics Activity and Target Market Opportunities	3-1
Distribution of Full-Time Users by Segment	3-2
Data Files Active by Type and Segment	3-3
Leading Vendors by Subapplication	3-3
4. Penetration	4-1
Change in Product Use Over Time	4-1
Site Penetration Under Ideal Conditions	4-1
Site Penetration by User Forecast	4-2
Site Penetration by Subapplication	4-2
5. Buying History and Plans	5-1
External Consulting Services Use and Expectations	5-1
Platform, Server, Plotter, and Printer Forecasts with Target Market Opportunities	5-2
Seat Count Forecast	5-3
New Seat Opportunities by Segment	5-3
Software Opportunities by Segment	5-3
Modeling Technology Planned for New Software Purchases	5-4
6. Importance and Satisfaction Evaluation	6-1
Strategic Business Issues	6-1
Software Issues	6-2
Point Solutions	6-2
Integrated Solutions	6-3
Future Acquisition Issues	6-3
7. Findings and Recommendations	7-1
Vendor Recommendations	7-1
User Recommendations	7-1
Investor Recommendations	7-2

 ©1993 Dataquest Incorporated

List of Figures

Figure		Page
2-1	Respondents' Job Function	2-3
2-2	Respondents' Primary Business	2-4
2-3	Respondents by Department	2-6
2-4	Experience Base of Respondents	2-8
3-1	CAD/CAM/CAE Applications Used	3-5
3-2	Mechatronic Activity	3-7
3-3	Full-Time CAD/CAM/CAE Users	3-9
3-4	Data Files Active at Site by Type	3-11
3-5	Leading Vendors by Subapplication	3-13
4-1	Change in Product Use by Industry	4-4
4-2	Site Penetration by User Under Ideal Conditions	4-5
4-3	Forecast of Site Penetration by User	4-7
4-4	Site Penetration by Subapplication	4-9
5-1	External Consulting Use	5-5
5-2	External Consulting Use	5-6
5-3	Forecast of Hardware Seats	5-7
5-4	Expected Change in Mechanical CAD/CAM/CAE Seat Count by Site	5-8
5-5	New Seat Opportunity at Sites with Positive Seat Growth	5-10
5-6	Planned Purchases of Software Modules	5-12
5-7	Planned Purchases of Software Modules by Segment	5-13
5-8	New Software Purchases by Modeling Type	5-16
6-1	Importance and Satisfaction Evaluation of Strategic Business Issues	6-4
6-2	Importance and Satisfaction Evaluation of Software Issues	6-5
6-3	Importance and Satisfaction Evaluation of Point Solutions	6-6
6-4	Importance and Satisfaction Evaluation of Integrated Solutions	6-7
6-5	Importance and Satisfaction of Future Acquisition Issues	6-8

©1993 Dataquest Incorporated

List of Tables

Table		Page
2-1	Respondents' Job Function	2-3
2-2	Respondents' Primary Business	2-5
2-3	Respondents by Department	2-7
2-4	Experience Base of Respondents	2-8
2-5	Respondents' Experience by Department and Country	2-9
3-1	CAD/CAM/CAE Applications Used	3-6
3-2	Top 5 Market Segments by Application	3-6
3-3	Mechatronic Activity	3-8
3-4	Top 5 Mechatronic Market Segments by Application	3-8
3-5	Percentage of Full-Time Users	3-10
3-6	Active Data Files by Type	3-12
3-7	Leading Vendors by Subapplication	3-14
4-1	Change in Product Use by Industry	4-5
4-2	Site Penetration by User Under Ideal Conditions	4-6
4-3	Forecast of Site Penetration by User	4-8
4-4	Site Penetration by Subapplication	4-10
5-1	Percentage of Respondents Who Have Used and Expect to Use External Consulting	5-7
5-2	Respondents' Hardware Buying Plans by Platform	5-8
5-3	Expected Change in Mechanical CAD/CAM/CAE Seat Count by Site	5-9
5-4	New Seat Opportunity	5-11
5-5	New Software Module Opportunity	5-14
5-6	Percentage of New Software Purchases by Modeling Type	5-17
6-1	Importance and Satisfaction Evaluation of Strategic Business Issues	6-4
6-2	Importance and Satisfaction Evaluation of Software Issues	6-5
6-3	Importance and Satisfaction Evaluation of Point Solutions	6-6
6-4	Importance and Satisfaction Evaluation of Integrated Solutions	6-7
6-5	Importance and Satisfaction Evaluation of Future Acquisition Issues	6-8

©1993 Dataquest Incorporated

Chapter 1
Executive Summary

Dataquest expects the worldwide market for mechanical CAD/CAM/CAE software revenue to be $2.47 billion in 1993 and forecasts the market to grow at a 7 percent compound annual growth rate in the next five years. The market is fueled by a growing perception that this technology is indispensable in a design and manufacturing environment, independent of industry or location. CAD/CAM/CAE tools have moved out of the hands of the experts and are now being used by employees in every job description and for hundreds of applications across the enterprise. The forces of downsizing are playing a significant role in forming changes in market penetration. This survey explores market penetration by site size, job description, and department in detail.

Today's purchaser of CAD/CAM/CAE tools is dealing with a complexity of issues and technologies that was unimagined a decade ago. User importance and satisfaction evaluations are key indicators of the performance of the vendors in meeting market demand and helping the user deal with the complexities of the business. Several issues are explored in this survey, from high-level strategic business and purchasing plans to application and integration issues.

The diversity of tasks considered under the mechanical CAD/CAM/CAE umbrella is immense. All major subapplications are explored in this survey to better understand the work profile and market penetration in each category. The mechanical CAD/CAM/CAE applications are measured in context with support functions and other major applications.

Software functionality is steadily improving with a focus on ease of use and an enhanced ability to deal with complex designs and optimization. Significant improvement in price/performance of the hardware has supported an evolutionary approach in which the oldest systems are replaced by more economical ones. The expected growth in software will come from improvements in point solution integration, groupware, and enterprise-level tools. Advancements at the application level must update existing systems at the modular level. Low cost will continue to motivate the mainstream buyer. The leading-edge users will pay top dollar for performance, productivity, and a competitive edge.

Study Objectives

Dataquest's goal is to provide a comprehensive understanding of the mechanical CAD/CAM/CAE market by collecting and analyzing data from vendor and end-user perspectives. This study examines the mechanical CAD/CAM/CAE market from the perspective of purchasers and managers of these resources in a corporate setting.

©1993 Dataquest Incorporated

This study was designed to provide a status report on the current work environment and to point to selected opportunities in sales and product development.

In each case, the differences among the respondents in each country, industry, and site size are considered when identifying important market distinctions and opportunities.

The specific study objectives include the following:

- Identify the levels of highest need or missed expectations by using gap analysis of importance and satisfaction rating on a variety of business, system, and application issues
- Develop a forecast of planned purchases in platform, system peripherals, software modules, and modeling technologies
- Understand the level of outside consulting services used and planned in the next two years
- Determine the current work environment considering applications used, mechatronic activity, data file storage, and leading vendor analysis by subapplication
- Evaluate penetration of user access and use of mechanical subapplications
- Identify the demographic characteristics of today's mechanical CAD/CAM/CAE end users' implementation levels, experience base, and staffing expectations

Major Findings

The major findings of this survey include the following:

- Most mechanical CAD/CAM/CAE sites are doing a significant amount of electronic design, facilities management, and plant design activity. Facilities design and management work are most likely in the telecommunications industry. Manufacturing engineering and internal service groups typically do this kind of work.
- Mechatronics is used at 25 to 45 percent of the sites. The leading market users of electronic design tools with mechanical applications include telecommunications, consumer electronics, electrical and electronic machinery, computers and peripherals, and R&D or new product development groups.
- Overall, about two of three users work full-time and the other third work part-time. Users in service/design/consulting groups and users in France are most likely to be part-time.
- All sites have a mix of 2-D, 3-D, and solid modeling files. 2-D-generated information dominated with more than 75 percent of the total in storage.

 ©1993 Dataquest Incorporated

- Many users are seasoned veterans, with the majority having more than five years of experience using mechanical CAD/CAM/CAE tools. Many of these people are learning to use their third or fourth product.
- The volume of files per user varies widely with automotive and service/design/consulting users leading the pack. The typical automotive user has three times as many files in active use compared to the typical aerospace user.
- Applicon receives the highest rating from users for supplying a full line of subapplication products, from design and analysis to manufacturing and product data management.
- Users in the computer and peripherals industry have learned to use more than five different products on average. Of these, 1.6 are still in use. This group has the highest level of unmet needs because they now plan to learn to use more than three new products in the next two years.
- Overall, the maximum growth in potential users is set at 29.3 percent for 1993. The sites with a seat-count increase expect a 58 percent increase in the number of users under ideal conditions. The small group expecting a seat decrease feels that it could live with 33.9 percent less users than it has now.
- Structural analysis users have the largest growth potential. The automotive industry has a fantastic 700 percent growth opportunity. Aerospace, consumer electronics, and electrical and electronics growth opportunities are also high.
- Conceptual design is the next highest growth area with the automotive industry showing the highest potential.
- The amount of outside consulting services is growing. Overall, the average number of sites that use external system integration support is growing from 29.4 percent of the sites to 32.3 percent in the next two years. Custom software development is done at 26.7 percent of the sites, growing to 29.4 percent. External product design is expected to grow slightly from 19.2 percent to 20 percent.
- PC-based systems are expected to have the highest growth in sites with 15 to 39 users.
- Workstation-based systems are expected to sell well in service/design/consulting sites, followed by small sites with one to seven users.
- The best markets for servers are Italy, consumer electronics, small sites with one to seven users, United Kingdom, and sites with 15 to 39 users.
- The best markets for plotters are electrical and electronic companies, Italy, Germany, small sites with one to seven users and industrial machinery companies.

©1993 Dataquest Incorporated

- The best markets for printers are electrical and electronic companies, automotive, United Kingdom, Europe as a group, and France.
- German sites are growing with more than 70 percent of the sites expecting to increase seat count. This is compared to the 49 percent average for all the sites in the survey.
- The sites with increasing seat count are planning on replacing 8 percent of the installed software modules. They are also expecting a 17 percent growth in seat count. This should net a 25 percent software module growth each year for the next two years.
- The U.K.-, Italy-, and France-based companies that are increasing seat count have the highest growth rate planned. Germany is the lowest of the groups, expecting only a 9.5 percent increase.
- Nearly 40 percent of all responsdents say they need a fully integrated solution of 2-D-, 3-D-, and solids-based product. This increased to more than 50 percent for consumer electronics, aerospace, and France-based companies.
- A gap analysis is a classic way to evaluate the relative importance and level of satisfaction among a number of related issues. It is important to note that not one of the issues is rated with the level of satisfaction above the level of importance.
- The highest-rated importance items include the following:
  - Improving product quality as a strategic business issue
  - Using software with high quality
  - Supporting the design function
  - Supporting integrated design and drafting solutions
  - Offering integrated product data management
- Dataquest believes that the users are, in general, not as happy as they should be with the ability of their automation tools to affect competitive advantage at the strategic level. Usually a gap of more than one in this type of analysis is viewed as significant. Every one of these issues has a gap of more than one. Vendors with stale products, buggy software, or poor performance should beware. The market pressure to improve has never been higher.
- The most important issues, and the one with the highest gap indicating a low level of satisfaction, concern software quality. As users develop a higher reliance on the use of these tools, hard fought gains in productivity can be quickly wiped out with buggy software, corrupted data files, and weak interface among modules. We believe that this issue could be the most serious in the minds of the users when it comes time to make a future purchasing decision.

©1993 Dataquest Incorporated

- Future acquisition decision making will strongly consider the following issues:
  - Integrated product data management
  - Design optimization
  - Support for new standards
  - IGES support
  - Parametric user interface

Methodology

Earlier survey activity identified the need to develop insight into several issues that are sensitive to the sample distribution for country, industry, department of respondent, site size, and platform type used. This survey focuses on a set of respondents selected from a filtered but random population. More than 200 sites were selected both in the United States and Europe. The four largest countries in Europe were chosen with roughly an even amount of respondents in each country. Site size was not controlled nor was industry. The result gives a broad representation across the user environment.

The specific respondent sample characteristics desired include the following:

- People involved in the decision-making process of new system purchases.
- Those who are currently or have been users of mechanical CAD/CAM/CAE tools.
- People working in a major discrete manufacturing industry.
- Employees in one of the major departments of potential use.

The survey sample was selected from the Dataquest CAD/CAM/CAE end-user database, contact names provided by the vendors, and company contacts identified with the Dun & Bradstreet Corporation's million-dollar directory. A phone survey was conducted in March and April of 1993 in the United States, France, Germany, United Kingdom, and Italy.

We suggest that users of this information evaluate the results at two levels: First, what the total group of respondents says and second, what each user group or market segment indicates. The figures and tables provide an overview analysis of the topic of interest.

Several subsegments have been used throughout this report to highlight various points of analysis. These segments are divided by the following:

- Country of the responding site, either the United States, France, Germany, Italy, or the United Kingdom.
- Department of the person answering the questions

©1993 Dataquest Incorporated

- Industry designation of the responding site
- Size of site based on the number of mechanical CAD/CAM/CAE users at that site

A follow-up study is offered as a consulting project for specific vendors that would like to make a more detailed comparison of the users of their products with the total population and users of competitive products.

Custom analysis of this United States and European end-user database is offered to our clients as described in their service agreement and to others for a fee. User requests for anonymity will be honored.

Structure of Report

This report is divided into five major analysis sections—Site and Respondent Demographics, Current Work Environment, Penetration, Buying History and Plans, and Importance and Satisfaction Evaluation. These are preceeded by an Executive Summary and succeeded by Findings and Recommendations. The figures show an overview analysis of survey results whereas the tables have more detailed information showing the variation of responses by submarket or user-group segment. In total, 401 interviews were completed.

Members of the project team include the following:

- Michael Seely
- Rebecca Thompson
- Dave Behrendt
- Tina Carpenter
- Dave Glenn
- Paul Gianotti
- Melissa Sanchez

©1993 Dataquest Incorporated

Chapter 2
Site and Respondent Demographics

The target respondents in this study are purchasing decision makers of mechanical CAD/CAM/CAE tools in the United States and Europe. There were a wide range of respondent job titles from all major departments in all major manufacturing industries.

Respondents Role in Their Organizations

The majority of respondents to this survey hold the title of CAD system manager, closely followed by senior engineers and the group of designers, engineers, and analysts. Figure 2-1 and Table 2-1 show the large population of CAD system managers in the European respondent group. These job classifications are expected to provide good insight into use of equipment, budgets, and site penetration levels. Sufficient responses were given in each of the above job-title groups to allow comparison, providing further insight into the decision-making process and work environment in mechanical CAD/CAM/CAE.

Respondents by Industry

Figure 2-2 and Table 2-2 show the distribution of the respondents' companies by industry. The intention to have the survey distribution match the Dataquest market model for installed base was partially successful. In general, the distribution matched, unfortunately the total number of completed surveys was insufficient to allow a statistically valid comparison among all industries. Comparison is made in the aerospace, automotive, consumer electronics, electrical and electronic, industrial machinery, fabricated metal parts, and service/design/consulting industries. The education and government sectors were intentionally excluded from this survey primarily because of the interest in comparing discrete manufacturing engineering activities. A large response in the industrial machinery industry and the automotive industry in Europe makes these segments particularly interesting.

Respondents by Department

Figure 2-3 and Table 2-3 show the distribution of responses by department. The design/computing/services group was the largest, which includes some outside service bureau companies, but the majority are internal service or operations groups. An analysis is given where significant differences were noticed among departments. In general, tables and figures don't include this analysis because of the similarity of responses.

Respondents Experience Base

Figure 2-4 and Table 2-4 indicate that the average answer to the question, "How long, in years, have you been using mechanical CAD/CAM/CAE software?" was 7.4 years. In general, France and the United Kingdom have the more seasoned respondents with the most

©1993 Dataquest Incorporated

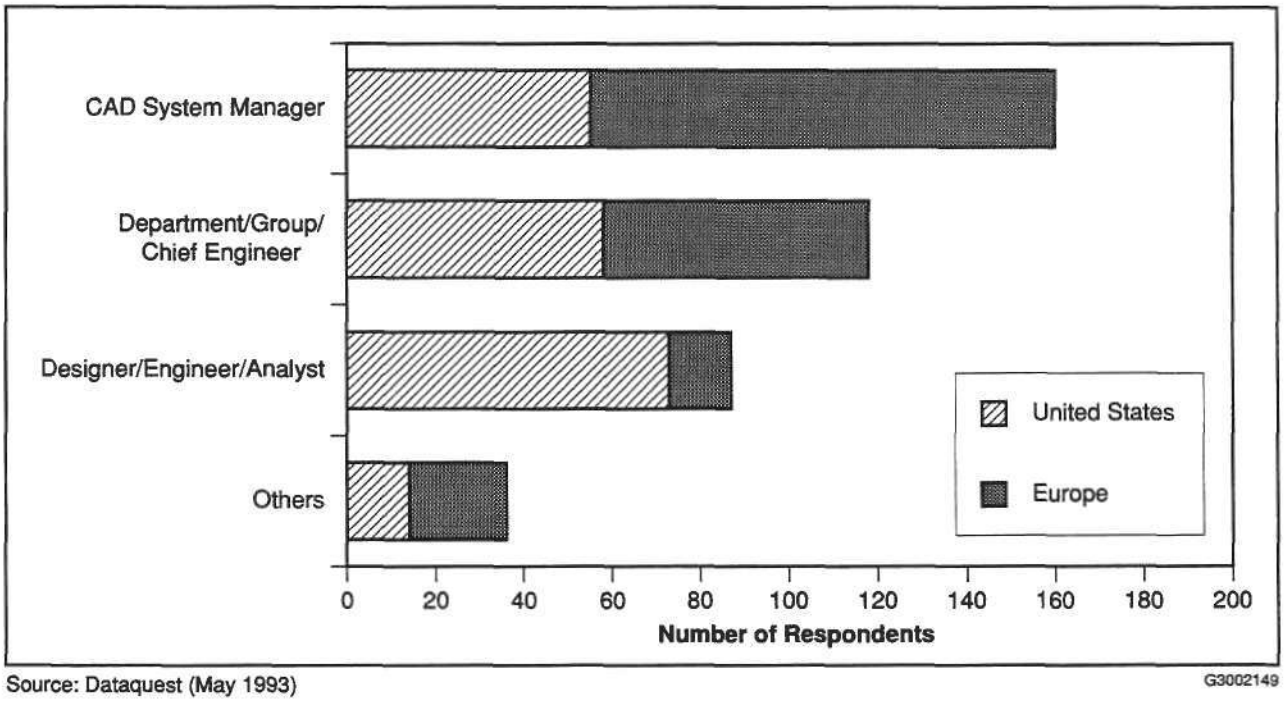
experienced group in training and education. Table 2-5 illustrates respondents' experience by department and country. No important distinction is made here other than the respondent group as a whole is well experienced with several years of hands-on use. More evidence of this is shown later when the number of software products learned, used, and expected to learn are measured.

Summary

This survey group is judged to have significant experience in using mechanical CAD/CAM/CAE and should be well suited to provide the insight and opinion requested. Readers should keep in mind that the total population of this survey is dominated by CAD system managers and senior management in the industrial machinery, automotive, fabricated metal parts, and electrical and electronic industries.

©1993 Dataquest Incorporated

Figure 2-1
Respondents' Job Function



Source: Dataquest (May 1993)

G3002149

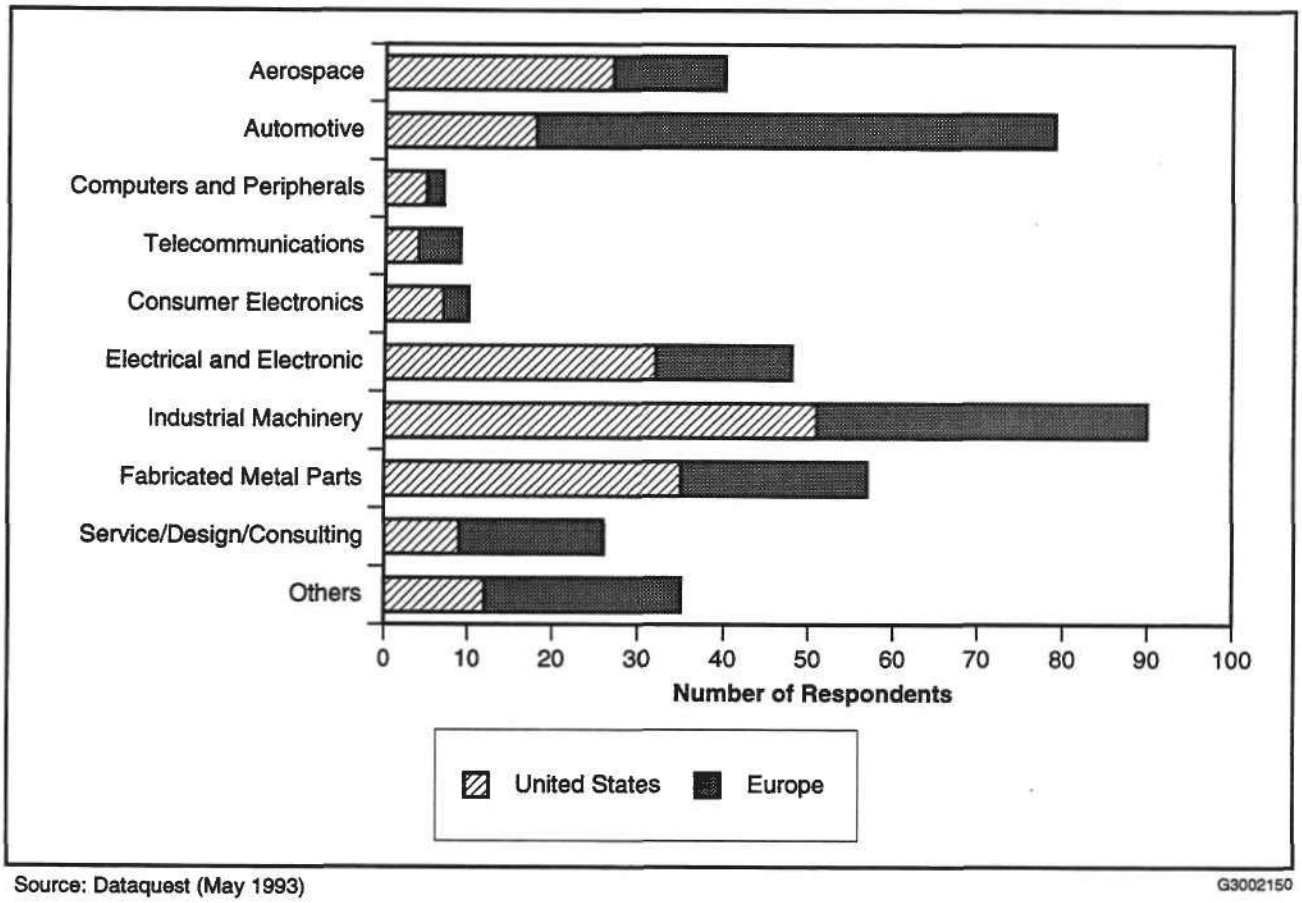
Table 2-1
Respondents' Job Function

	Total	United States	Europe	Germany	France	United Kingdom	Italy
CAD System Manager	160	55	105	22	36	29	18
Department/ Group/Chief Engineer	118	58	60	10	17	25	8
Designer/Engineer/Analyst	87	73	14	1	5	5	3
Other	36	14	22	6	3	6	7
Total	401	200	201	39	61	65	36
Distribution by Country (%)							
CAD System Manager	39.9	27.5	52.2	56.4	59.0	44.6	50.0
Department/ Group/Chief Engineer	29.4	29.0	29.9	25.6	27.9	38.5	22.2
Designer/Engineer/Analyst	21.7	36.5	7.0	2.6	8.2	7.7	8.3
Other	9.0	7.0	10.9	15.4	4.9	9.2	19.4
Distribution by Title							
CAD System Manager	100.0	34.4	65.6	13.8	22.5	18.1	11.3
Department/ Group/Chief Engineer	100.0	49.2	50.8	8.5	14.4	21.2	6.8
Designer/Engineer/Analyst	100.0	83.9	16.1	1.1	5.7	5.7	3.4
Other	100.0	38.9	61.1	16.7	8.3	16.7	19.4

Source: Dataquest (May 1993)

©1993 Dataquest Incorporated

Figure 2-2
Respondents' Primary Business



Source: Dataquest (May 1993)

G3002150

©1993 Dataquest Incorporated

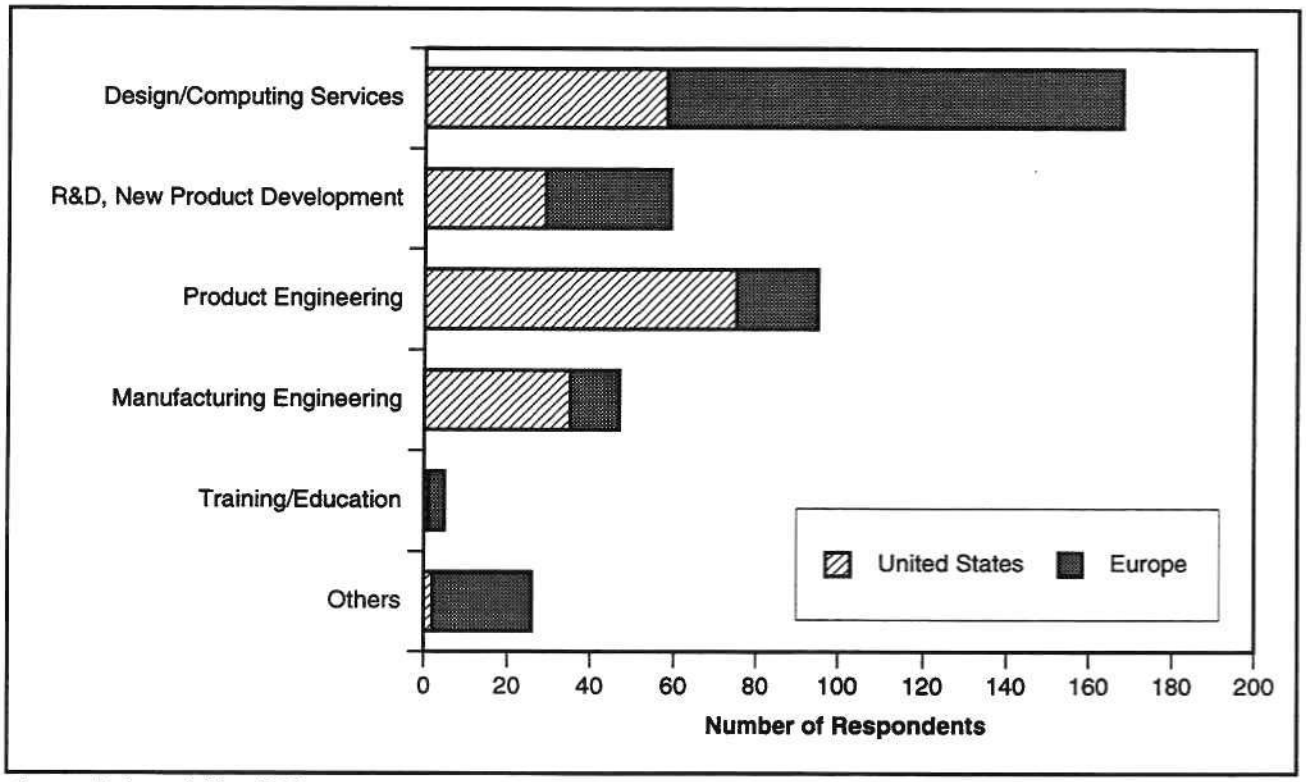
Table 2-2
Respondents' Primary Business

	Total	United States	Europe	Germany	France	United Kingdom	Italy
Aerospace	40	27	13	0	5	7	1
Automotive	79	18	61	14	15	21	11
Computers and Peripherals	7	5	2	0	2	0	0
Telecommunications	9	4	5	1	2	1	1
Consumer Electronics	10	7	3	0	3	0	0
Electrical and Electronic	48	32	16	1	7	4	4
Industrial Machinery	90	51	39	15	5	8	11
Fabricated Metal Parts	57	35	22	4	8	7	3
Service/Design/Consulting	26	9	17	0	4	11	2
Other	35	12	23	4	10	6	3
Total	401	200	201	39	61	65	36
Distribution by Country (%)							
Aerospace	10.0	13.5	6.5	0	8.2	10.8	2.8
Automotive	19.7	9.0	30.3	35.9	24.6	32.3	30.6
Computers and Peripherals	1.7	2.5	1.0	0	3.3	0	0
Telecommunications	2.2	2.0	2.5	2.6	3.3	1.5	2.8
Consumer Electronics	2.5	3.5	1.5	0	4.9	0	0
Electrical and Electronic	12.0	16.0	8.0	2.6	11.5	6.2	11.1
Industrial Machinery	22.4	25.5	19.4	38.5	8.2	12.3	30.6
Fabricated Metal Parts	14.2	17.5	10.9	10.3	13.1	10.8	8.3
Service/Design/Consulting	6.5	4.5	8.5	0	6.6	16.9	5.6
Other	8.7	6.0	11.4	10.3	16.4	9.2	8.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Distribution by Industry (%)							
Aerospace	100.0	67.50	32.50	0	12.50	17.50	2.50
Automotive	100.0	22.8	77.2	17.70	19.00	26.60	13.90
Computers and Peripherals	100.0	71.4	28.6	0	28.60	0	0
Telecommunications	100.0	44.4	55.6	11.10	22.20	11.10	11.10
Consumer Electronics	100.0	70.0	30.0	0	30.00	0	0
Electrical and Electronic	100.0	66.7	33.3	2.10	14.60	8.30	8.30
Industrial Machinery	100.0	56.7	43.3	16.70	5.60	8.90	12.20
Fabricated Metal Parts	100.0	61.4	38.6	7.00	14.00	12.30	5.30
Service/Design/Consulting	100.0	34.6	65.4	0	15.40	42.30	7.70
Other	100.0	34.3	65.7	11.40	28.60	17.10	8.60

Source: Dataquest (May 1993)

©1993 Dataquest Incorporated

Figure 2-3
Respondents by Department



Source: Dataquest (May 1993)

G3002151

©1993 Dataquest Incorporated

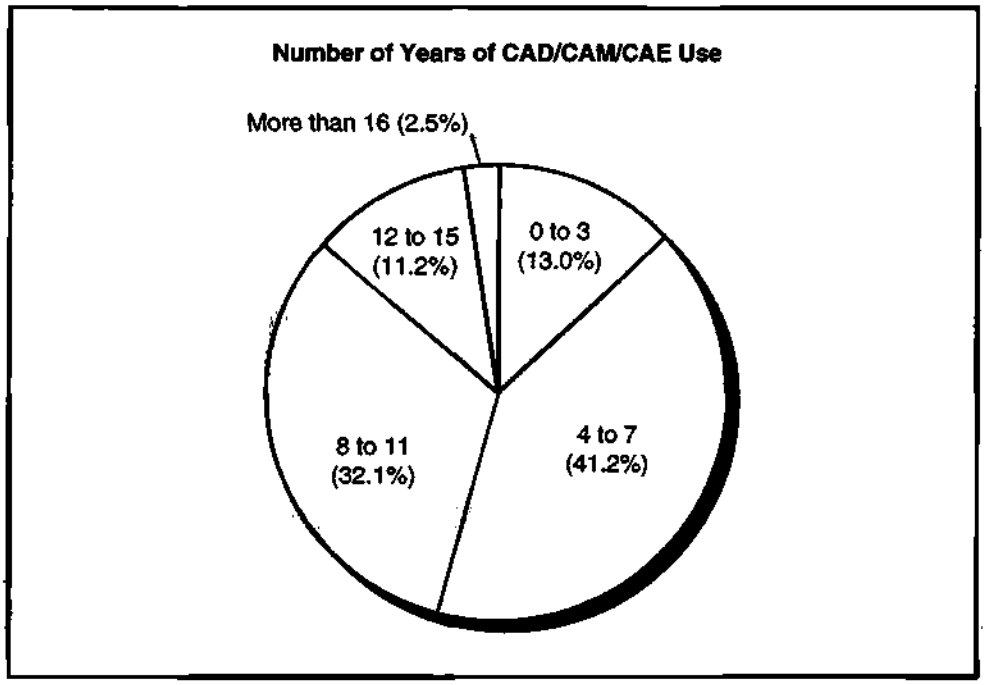
Table 2-3
Respondents by Department

	Total	United States	Europe	Germany	France	United Kingdom	Italy
Design/Computing Services	168	58	110	23	31	28	28
R&D, New Product Development	59	29	30	5	17	8	0
Product Engineering	95	75	20	2	6	10	2
Manufacturing Engineering	47	35	12	2	2	6	2
Training/Education	5	1	4	1	1	2	0
Other	27	2	24	6	4	11	3
Total	401	200	200	39	61	65	35
Distribution by Country (%)							
Design/Computing Services	41.9	29.0	55.0	59.00	50.80	43.10	80.00
R&D, New Product Development	14.7	14.5	15.0	12.80	27.90	12.30	0
Product Engineering	23.7	37.5	10.0	5.10	9.80	15.40	5.70
Manufacturing Engineering	11.7	17.5	6.0	5.10	3.30	9.20	5.70
Training/Education	1.2	0.5	2.0	2.60	1.60	3.10	0
Other	6.7	1.0	12.0	15.40	6.60	16.90	8.60
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Distribution by Department (%)							
Design/Computing Services	100.0	34.5	65.5	13.70	18.50	16.70	16.70
R&D, New Product Development	100.0	49.2	50.8	8.50	28.80	13.60	0
Product Engineering	100.0	78.9	21.1	2.10	6.30	10.50	2.10
Manufacturing Engineering	100.0	74.5	25.5	4.30	4.30	12.80	4.30
Training/Education	100.0	20.0	80.0	20.00	20.00	40.00	0
Other	100.0	7.4	88.9	22.20	14.80	40.70	11.10

Source: Dataquest (May 1993)

©1993 Dataquest Incorporated

Figure 2-4
Experience Base of Respondents



Source: Dataquest (May 1993) G3002152

Table 2-4
Experience Base of Respondents

Years of CAD/CAM/ CAE Experience	Total Respondents	Total Percentage of Respondents
0	5	1.3
1	10	2.5
2	14	3.6
3	22	5.6
4	33	8.4
5	46	11.7
6	47	12.0
7	36	9.2
8	53	13.5
9	19	4.8
10	46	11.7
11	8	2.0
12	22	5.6
13	8	2.0
14	5	1.3
15	9	2.3
17	1	0.3
18	1	0.3
19	1	0.3
20	7	1.8
Total	393	

Source: Dataquest (May 1993)

©1993 Dataquest Incorporated

Table 2-5
Respondents' Experience by Department and Country

Experience by Department	Average Number of Years
Training/Education	9.8
R&D and New Product Development	8.1
Design/Computing Services	7.8
Manufacturing Engineering	6.9
Product Engineering	6.7
Other	6.5
Experience by Country	
Total	7.4
France	8.6
United Kingdom	7.8
United States	7.4
Germany	6.6
Italy	5.4

Source: Dataquest (May 1993)

©1993 Dataquest Incorporated

Chapter 3
Current Work Environment

A series of questions were used to determine the overall use of all major CAD/CAM/CAE applications. This forms the beginning of analysis in understanding the current work profile. Specific and focused questions determined the time spent in each application area, the number of files produced, the mix of mechatronic activity, and, finally, the leading vendors are shown for each application area.

Applications Used and Target Market Opportunities by Subapplication

All of the sites surveyed are, by definition, users of mechanical CAD/CAM/CAE tools. This is indicated in Figure 3-1 and Table 3-1, which show that 100 percent of the sites are involved in this activity. As was expected, these sites are also involved with a significant amount of application work using other major applications. Electronic design is going on at nearly half of the sites. More than one-third of the sites are also doing facilities design/management and plant engineering with their CAD/CAM/CAE tools. The distribution of actual hours of use of these applications is shifted toward mechanical tasks. Nearly 80 percent of the total hours worked on a system are directed toward mechanical activities. Roughly 10 percent is electronic design and 5 percent is for each of the facilities and plant engineering tasks.

Table 3-2 illustrates the top five market segments in each category. The largest industrial users of mechanical tools on a percent-use basis are fabricated metal parts and the automotive industries. Sites with one to seven users are the second-highest user group. Product engineering departments and the user sites in France rated above the average for the survey.

The leading market users of electronic design tools with mechanical applications include telecommunications, consumer electronics, electrical/electronic machinery, computers and peripherals, and R&D or new product development groups.

Facilities design and management work is most likely in the telecommunications industry. Manufacturing engineering and internal service groups typically do this kind of work.

Plant engineering work is also typical in the service group and telecommunications industries. Large sites with more than 40 users are more inclined to be using this application.

Mechatronics Activity and Target Market Opportunities

Mechatronics or electromechanical applications combine mechanical and electrical and electronic design activity. The amount of design work in each area and the relationship between the two design areas has been a frequent topic of discussion. The respondents to the survey were asked

to segment the percent of mechanical design activity relative to four categories. These include the following:

- Mechanical only, like hand powered tools and bicycles
- Simple electrical devices, like motors
- More complex electronic devices, like VCRs
- Heavy duty electronics, like computers and test equipment

Overall, roughly three-fourths of all mechanical design activity is just that, mechanical only. The variation by industry and department is quite significant, however. The simpler parts represent more of the work effort than do the more complex. As can be seen in Figure 3-2 and Table 3-3, one-quarter of the mechanical design effort is directed toward parts or products with electronic content. This illustration shows the average ratings for the whole survey. The percent of mechanical design that is mechatronics or, in other words, the percent of mechanical design work that includes significant electrical or electronic content, is more than 40 percent at those sites in the electronics business. Table 3-4 shows more of the story. The leading industry for mechanical-only work is automotive. Electrical or electronic design is growing in the automotive sector, but this work is typically done by specialists in specific department or development groups. Many more departments are focused on design problems that are mechanical only. In this survey, Italy, France, and the United Kingdom also were highly rated as users of mechanical-only tools. The large representation of the automotive industry in these countries is a partial reason. Small sites tend to focus on one major work application, which in this case is mechanical.

Not surprising was the large amount of design work of simple electrical devices by the electrical, peripherals, and computer industries. Service/design/consulting groups do a lot of this work as well.

The high end of mechatronics is dominated by computer and consumer electronics companies. R&D and new product development groups tend to do most of this work and a high percent of U.S.-based companies are doing the computer and test equipment design work.

Distribution of Full-Time Users by Segment

The industry is progressing from a situation in which engineers, designers and technicians share workstations and terminals to where they have their own dedicated system. In the past, a large number of these users were also full-time users dedicated to the use of a system while others worked on the board in another department. We asked, "What percent of your current users are full-time? " The range of responses can be seen in Figure 3-3 and Table 3-5. Users at large sites and in the electrical and electronic industry are the most likely to be full-time. Overall, about two of three users are full-time with the other third working less than six hours per day on a system. Users in service/design/consulting groups and the users in France are most likely to be part-time. A high percent of users in the survey in France work on mainframe systems, suggesting a

 ©1993 Dataquest Incorporated

high level of sharing seats. The service/design/consulting group has a mix of activity beyond design automation tasks. They are also more likely to have their own dedicated seat.

Data Files Active by Type and Segment

The issues of data file storage is interesting for several reasons. The disk manufacturers and system integrators need to know the volume of files that need to be on-line to support the daily work activity. The mix of data file types is important to gain understanding of the level of use of the various modeling technologies and to suggest the level of graphics performance necessary to view and edit the information as it is retrieved. Figure 3-4 shows the average number of files stored for each user, sorted by type of modeling technology used to create the files. All sites have a mix of 2-D, 3-D, and solid modeling files. 2-D-generated information dominates with more than three-quarters of the total in storage. The share of 3-D- and solid modeling-based files is growing slowly as use of these tools increase. This is shown later in Chapter 5 where we ask about the mix of modeling technologies planned to be purchased in the next two years.

The volume of files varies widely with automotive and service/design/consulting users producing the largest number per user. The typical automotive user has three times the files in active use compared to the typical aerospace user. The largest number of discrete components likely to be worked on by a single user is the reason behind the variation in number. Table 3-6 shows all the detail behind the illustration in Figure 3-4. It also shows the average number of active files per site. As one might guess based on the per-user numbers, automotive leads the active-files-per-fite category with more than 54,000. Larger sites obviously have more active files than smaller sites. It is interesting that sites with 15 to 39 users typically have more files than sites with more than 40 users. We would speculate that the smaller sites have more full-time users than the larger sites.

Leading Vendors by Subapplication

User opinion varies widely concerning the feature/function and value of using a certain software product for a certain task. Many of the vendors are offering a full range of products that address some utility in each of the major subapplication areas. We asked, "Which vendor makes the primary software tool used for drafting, design, analysis, manufacturing applications, product data management and other CAD/CAM/CAE applications?" Figure 3-5 shows the leading vendors ranked by a cumulative score based on the percent of sites that said they were using that vendor's software for each task. Applicon came out on top because more than 95 percent of its sites are doing drafting, design and manufacturing, as well as a high percent that are doing analysis and product data management. All of the other top 10 vendors have high scores for drafting and design applications. The difference in ratings comes from the use of analysis and manufacturing applications. The use of product

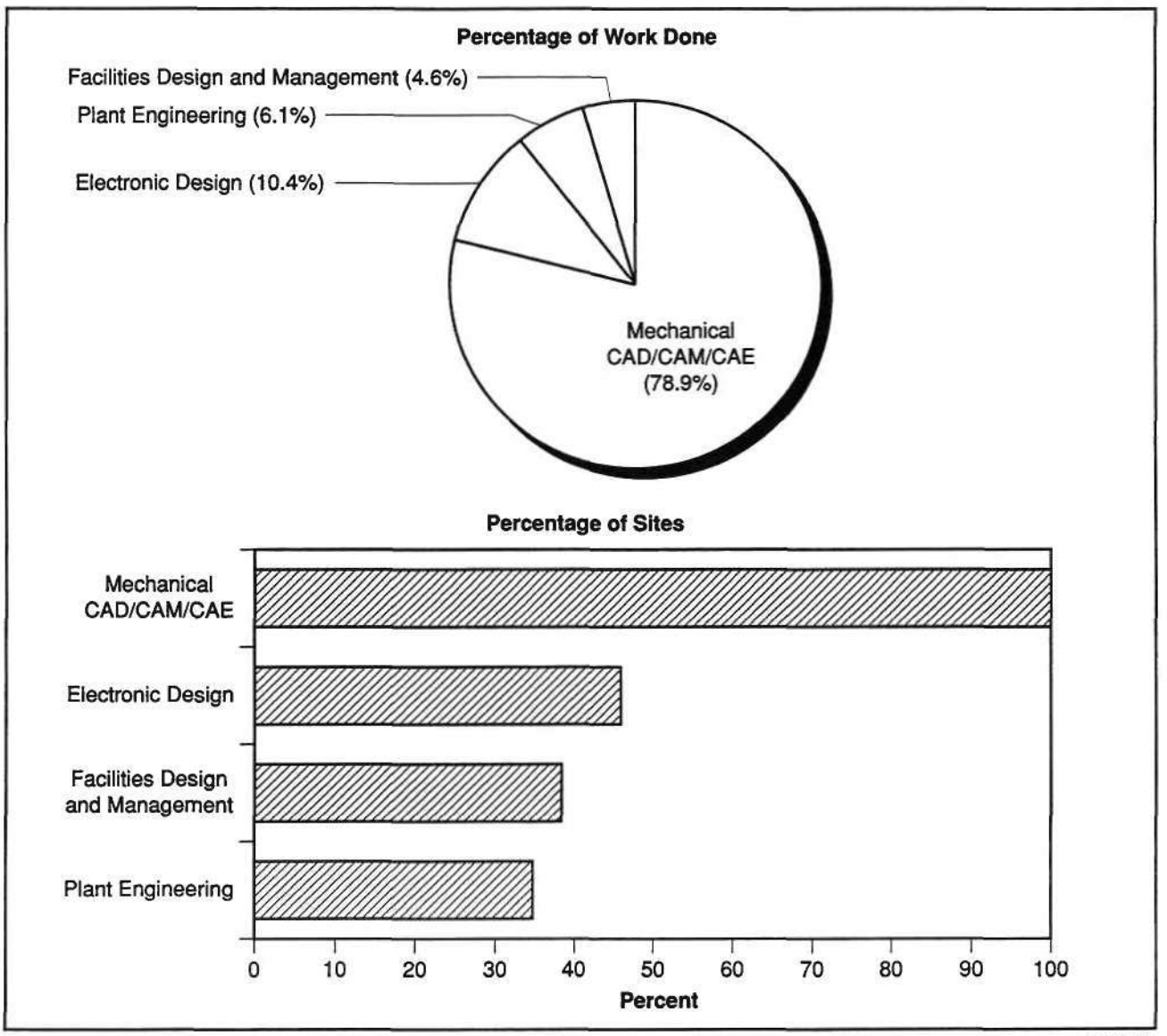
 ©1993 Dataquest Incorporated

data management was also a factor, but none of the vendors scored more than 45 percent in this category. Several of the importance and satisfaction questions discussed in Chapter 6 shed more light on the use and satisfaction with point solutions and integrated products.

Table 3-7 has the full list showing the number of sites for each vendor in each subapplication. Autodesk is well represented with 99 sites. Most of the vendors listed have 20 or more sites in the total sample; therefore, some vendor-to-vendor comparisons can be made. The numbers listed indicate the number of sites and percent of sites that are using each vendor's products for the indicated subapplication. The other group is made up of dozens of suppliers of mechanical CAD/CAM/CAE tools. An important subset of the other group provides analysis tools. Many of the leading analysis vendors are not well represented in this survey because the primary focus is on higher-level integration issues.

©1993 Dataquest Incorporated

Figure 3-1
CAD/CAM/CAE Applications Used



Source: Dataquest (May 1993)

©1993 Dataquest Incorporated

Table 3-1
CAD/CAM/CAE Applications Used

	Sites Using Applications (%)	Work Done with Application (%)
Mechanical CAD/CAM/CAE	100.0	78.9
Electronic Design	45.9	10.4
Facilities Design and Management	38.4	4.6
Plant Engineering	34.8	6.1

Source: Dataquest (May 1993)

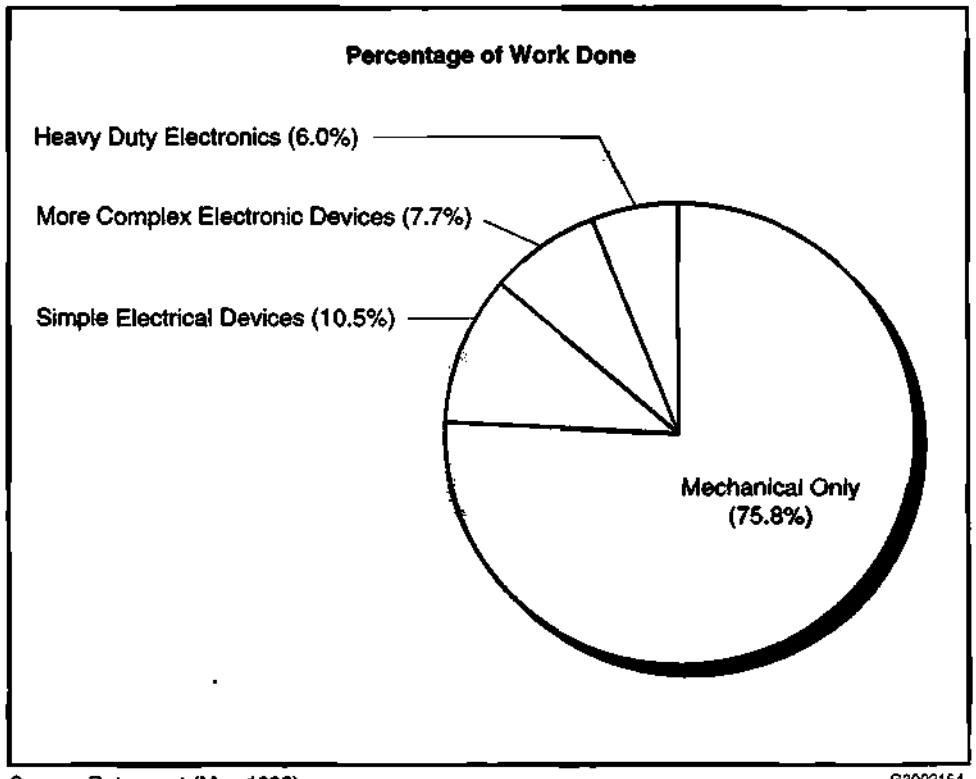
Table 3-2
Top 5 Market Segments by Application (Percentage of Work Done with Application)

Fabricated Metal Parts	89.7
Site with 1 to 7 Users	84.5
Product Engineering	83.3
Automotive	83.3
France	82.3
Electronic Design	
Telecommunications	30.7
Consumer Electronics	22.2
Electrical and Electronic Machinery	19.6
Computers and Peripherals	18.4
R&D, New Product Development	14.3
Facilities Design and Management	
Telecommunications	9.0
Manufacturing Engineering	7.9
Services/Design/Consulting	7.5
United Kingdom	6.6
Italy	6.1
Plant Engineering	
Services/Design/Consulting	14.4
Telecommunicaations	12.8
Other Industries	12.1
United Kingdom	11.7
More than 40 Users	9.5

Source: Dataquest (May 1993)

©1993 Dataquest Incorporated

Figure 3-2
Mechatronic Activity



Source: Dataquest (May 1993)

G3002154

©1993 Dataquest Incorporated

Table 3-3
Mechatronic Activity (Percent of Sites)

Mechanical Only (Hand-Powered Tools)	75.9
Simple Electrical Devices (Electric Motors)	10.5
More Complex Electronic Devices (VCRs)	7.7
Heavy-Duty Electronics (Computers and Test Equipment)	6.0

Source: Dataquest (May 1993)

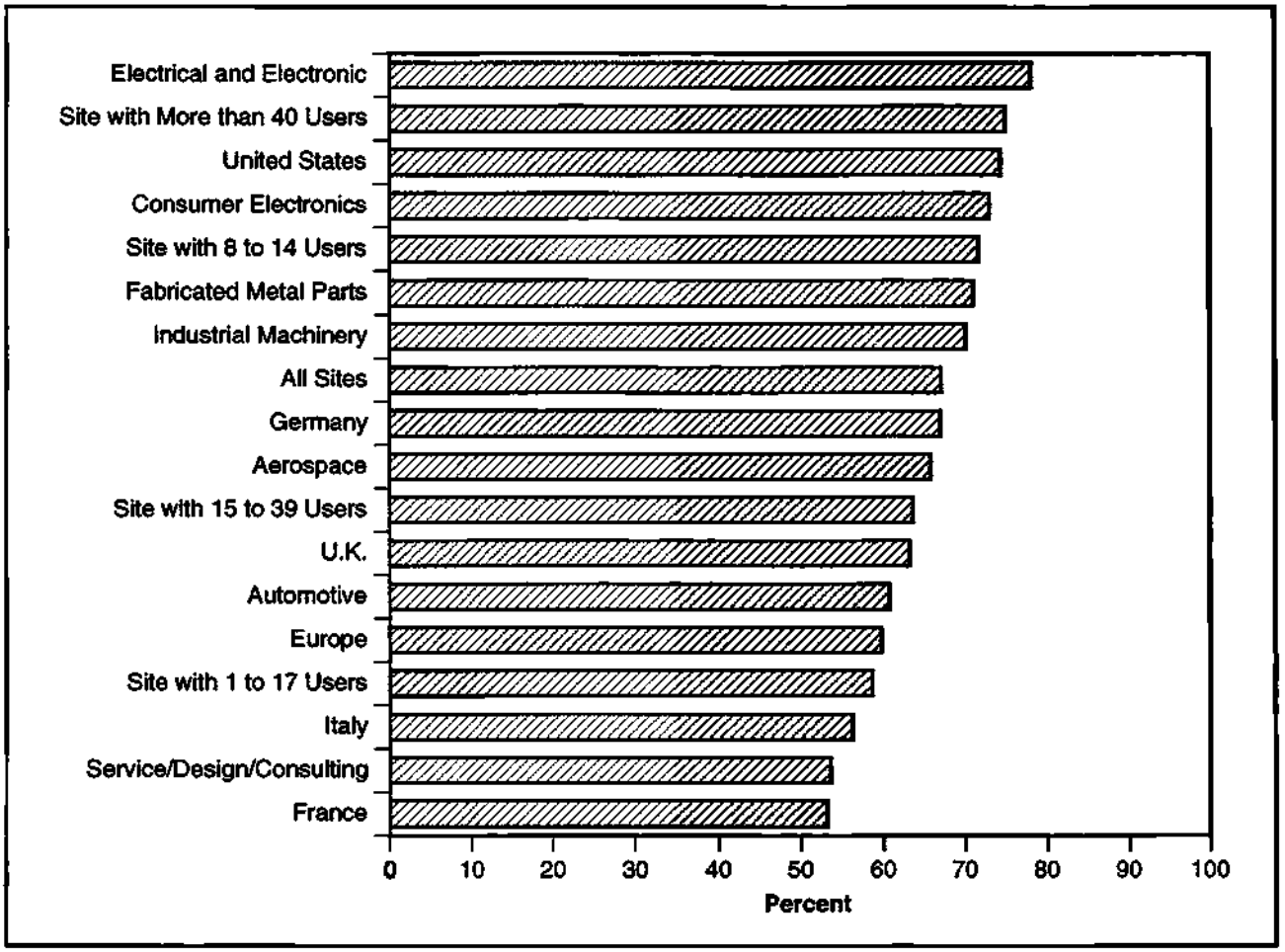
Table 3-4
Top 5 Mechatronic Market Segments by Application (Percentage of Sites)

Mechanical Only (Hand-Powered Tools)	
Italy	90.4
Automotive	90.1
France	88.8
First Quartile	84.1
United Kingdom	84.0
Simple Electrical Devices (Electric Motors)	
Service/Design/Consulting	20.2
Electrical and Electronic	19.5
Telecommunications	17.2
Computers and Peripherals	17.1
Fourth Quartile	15.1
More Complex Electronic Devices (VCRs)	
Computers and Peripherals	28.6
Consumer Electronics	20.5
Electrical and Electronic	17.1
Telecommunications	16.6
R&D, New Product Development	13.0
Heavy-Duty Electronics (Computers and Test Equipment)	
Service/Design/Consulting	12.3
United States	10.9
Electrical and Electronic	10.6
Aerospace	10.3
R&D, New Product Development	10.3

Source: Dataquest (May 1993)

©1993 Dataquest Incorporated

Figure 3-3
Full-Time CAD/CAM/CAE Users



Source: Dataquest (May 1993)

G3002155

©1993 Dataquest Incorporated

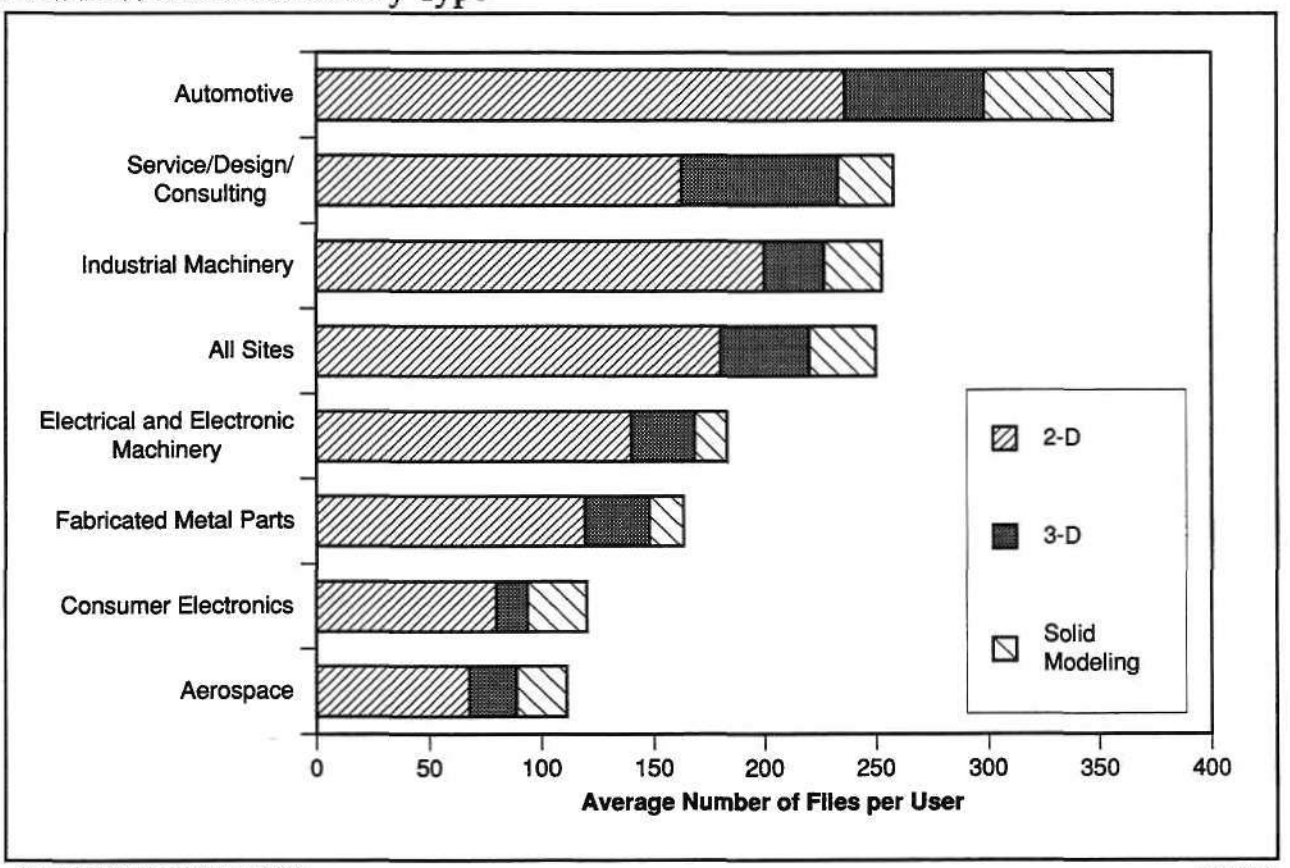
Table 3-5
Percentage of Full-Time Users

Electrical and Electronic	78.1
Site with More Than 40 Users	75.0
United States	74.4
Consumer Electronics	73.0
Sites with 8 to 14 Users	71.7
Fabricated Metal Parts	71.0
Industrial Machinery	70.1
All Sites	67.1
Germany	67.0
Aerospace	65.8
Sites with 15 to 39 Users	63.6
United Kingdom	63.2
Automotive	60.7
Europe	59.7
Sites with 1 to 7 Users	58.6
Italy	56.2
Service/Design/Consulting	53.5
France	53.1

Source: Dataquest (May 1993)

©1993 Dataquest Incorporated

Figure 3-4
Data Files Active at Site by Type



Source: Dataquest (May 1993)

G3002156

©1993 Dataquest Incorporated

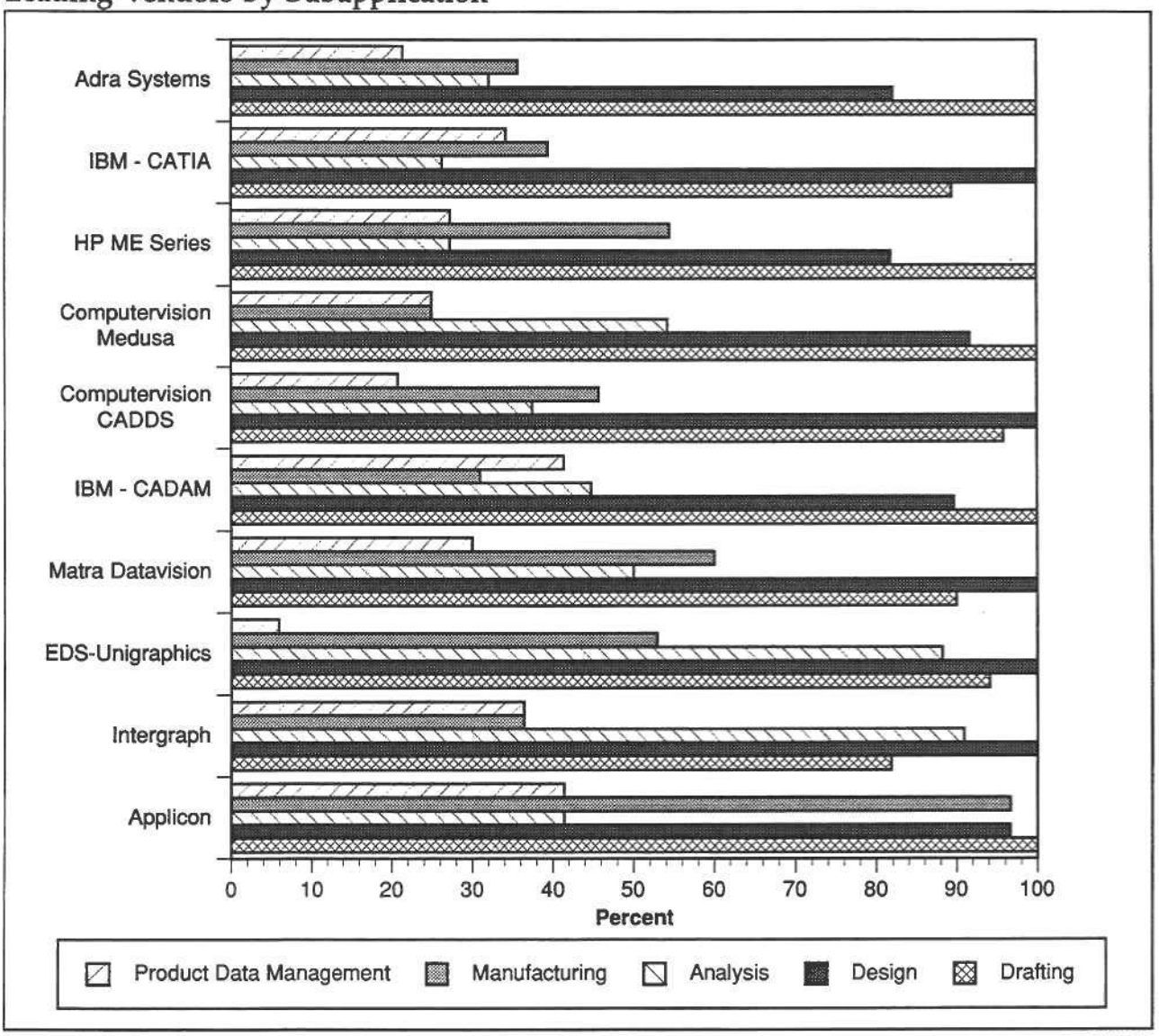
Table 3-6
Active Data Files by Type

	Active Files	Average Files Per User	2-D (%)	3-D (%)	Solid Modeling (%)
Sites with 15 to 39 Users	32,122	1,099	72.4	15.5	12.1
Sites with 8 to 14 Users	9,652	780	75.1	14.6	10.5
Sites with 1 to 7 Users	3,889	556	76.5	14.4	9.1
Automotive	54,597	356	66.4	17.5	16.3
France	56,243	347	52.3	17.7	29.0
Europe	30,624	287	69.4	15.7	14.9
Italy	24,600	281	75.7	18.2	6.5
Service/Design/Consulting	23,110	258	62.8	27.5	9.7
Industrial Machinery	12,754	253	79.2	10.7	10.1
All Sites	18,938	250	71.8	16.2	12.1
United States	8,930	200	74.0	16.5	9.5
United Kingdom	12,690	195	75.4	15.1	9.4
Germany	19,723	190	79.1	11.4	9.6
Electrical and Electronic	7,998	183	76.5	15.5	7.9
Fabricated Metal Parts	3,812	163	73.2	17.6	9.2
Consumer Electronics	3,100	120	66.5	11.4	22.1
Aerospace	12,507	111	61.3	18.8	19.9
Sites with More than 40 Users	28,368	104	62.7	20.2	17.1

Source: Dataquest (May 1993)

©1993 Dataquest Incorporated

Figure 3-5
Leading Vendors by Subapplication



Source: Dataquest (May 1993)

G3002157

©1993 Dataquest Incorporated

Table 3-7
Leading Vendors by Subapplication

Mechanical CAD/CAM/CAE (%) Software Applications	Drafting Sites	Drafting Sites (%)	Design Sites	Design Sites (%)	Analysis Sites	Analysis Sites (%)	Manufacturing Sites	Manufacturing Sites (%)	Product Data Management Sites	Product Data Management Sites (%)	Total Sites
Adra Systems	28	100.0	23	82.1	9	32.1	10	35.7	6	21.4	28
Applicon	29	100.0	28	96.6	12	41.4	28	96.6	12	41.4	29
Autodesk	99	100.0	82	82.8	25	25.3	30	30.3	11	11.1	99
Computervision CADDS	23	95.8	24	100.0	9	37.5	1	45.8	5	20.8	24
Computervision Medusa	24	100.0	22	91.7	13	54.2	6	25.0	6	25.0	24
EDS-Unigraphics	16	94.1	17	100.0	15	88.2	9	52.9	1	5.9	17
HP ME Series	11	100.0	9	81.8	3	27.3	6	54.5	3	27.3	11
IBM—CADAM	29	100.0	26	89.7	13	44.8	9	31.0	12	41.4	29
IBM—CAEDS/SDRC	4	17.4	5	21.7	23	100.0	4	17.4	4	17.4	23
IBM—CATIA	34	89.5	38	100.0	10	26.3	15	39.5	13	34.2	38
Intergraph	9	81.8	11	100.0	10	90.9	4	36.4	4	36.4	11
Matra Datavision	9	90.0	10	100.0	5	50.0	6	60.0	3	30.0	10
MCS	5	100.0	5	100.0	2	40.0	1	20.0	0	0	5
Other	59	69.4	66	77.6	85	100.0	67	78.8	52	61.2	85
Parametric Technology	7	53.8	13	100.0	7	53.8	2	15.4	2	15.4	13
PDA Engineering	0	0	0	0	2	100.0	0	0	0	0	2
Swanson Analysis	1	16.7	0	0	6	100.0	0	0	0	0	6
Total	387	85.2	379	83.5	249	54.8	208	45.8	134	29.5	454

Source: Dataquest (May 1993)

©1993 Dataquest Incorporated

Chapter 4
Penetration

One of the fundamental issues driving the mechanical CAD/CAM/CAE market is understanding the penetration of this technology into every subapplication and task. Changing user dynamics and expectations make this a moving target. This issue has been measured by comparing the number of trained users to the total population of technical professionals. It's useful to know the number of trained users compared to the number of seats installed and the distribution of user time over each of the major subapplication tasks. This survey used a simple approach that surfaced a surprising discovery.

Change in Product Use Over Time

One element of the issue of market penetration concerns the idea that users are reluctant to learn new products. Conventional wisdom suggests that a user will find something that works and then continue to use that product until forced to do something different. The results of the survey show a different picture. We asked the following questions:

- How many different vendor's products have you learned to use?
- Of these, how many are you using on a regular basis?
- How many new vendor's products do you think you will learn in the next two years?

Figure 4-1 and Table 4-1 show the split by industry. Users in the computer and peripherals industry have learned to use more than five different products on average. Of these, 1.6 are still in use. This group has the highest level of unmet need because they now plan to learn to use more than three new products. The other users share this trend, but to a lesser extent. Industrial machinery is the most stable with only 2.9 products learned, 1.6 in current use, and only 0.6 product planned for the future. Most of the industries surveyed expect to learn one new product from a new vendor in the next two years.

Site Penetration Under Ideal Conditions

Rather than ask the users to estimate the ratio of users to seats and to the total population of potential users, we asked, "How many current mechanical CAD/CAM/CAE users are there at this site?" Then we asked them to imagine an ideal situation in which a system is cheap, fast, and easy to use. The system would have complete and highly productive functionality. What would be the maximum number of users with this ideal system now and in 1995?

Overall, the maximum growth in potential users was set at 29.3 percent in 1993. So three out of 10 potential users remain to become users. A surprise was discovered while looking a bit deeper into the data. Each of the sites were asked to estimate the change in total set count, which

©1993 Dataquest Incorporated

were divided into groups: those that were growing seat count, those that were expecting to stay the same in the next two years, and those in decline. Figure 4-2 shows that the group increasing represents more than 54 percent of all the sites. About 40 percent have no change and nearly 6 percent are in decline. These numbers vary widely by industry. The differences are shown in Table 4-2.

The sites with a seat-count increase expect a 58 percent increase in the number of users under ideal conditions. The group with seat decrease said they could live with 33.9 percent less users than they have now. Some of the discussion during the phone interviewing process illustrates the point. One of the respondents said, "We have 50 users now. Under ideal conditions we would have one." This view is a bit extreme, but it signifies a shift in end-user perception regarding the future use of these systems. For many years the productivity improvements made possible with CAD/CAM/CAE systems were used to do more work. The situation evolved slowly, with significant downsizing pressure in the last two or three years, to find some companies reduce the engineering staff and pick up the added work load by using CAD/CAM/CAE tools. Currently, some of the users expect the system productivity, integration, and breadth of application coverage to be sufficient to let a few run the whole project. It would be extremely valuable for the vendors to understand the detailed system requirements for such a system. Another interesting question might ask what the price tag should be for a system that would let one do the work of 50.

Site Penetration by User Forecast

Figure 4-3 illustrates the response to the second part of the penetration question. How many current users are there and what number do you expect in 1995? The results are very similar to the previous question. The number of sites expecting seat-count growth increased slightly. Table 4-3 shows the changes expected by industry. Most of the industries thought that 40 to 50 percent of these sites would increase in user head count. These sites expected an increase in the 43 percent range. Of the few sites expecting a decrease in seats, only 3.9 percent expected a dramatic 53 percent drop. Many of the sites expecting a decrease are in the aerospace and service/design/consulting business, and many are in Europe.

Site Penetration by Subapplication

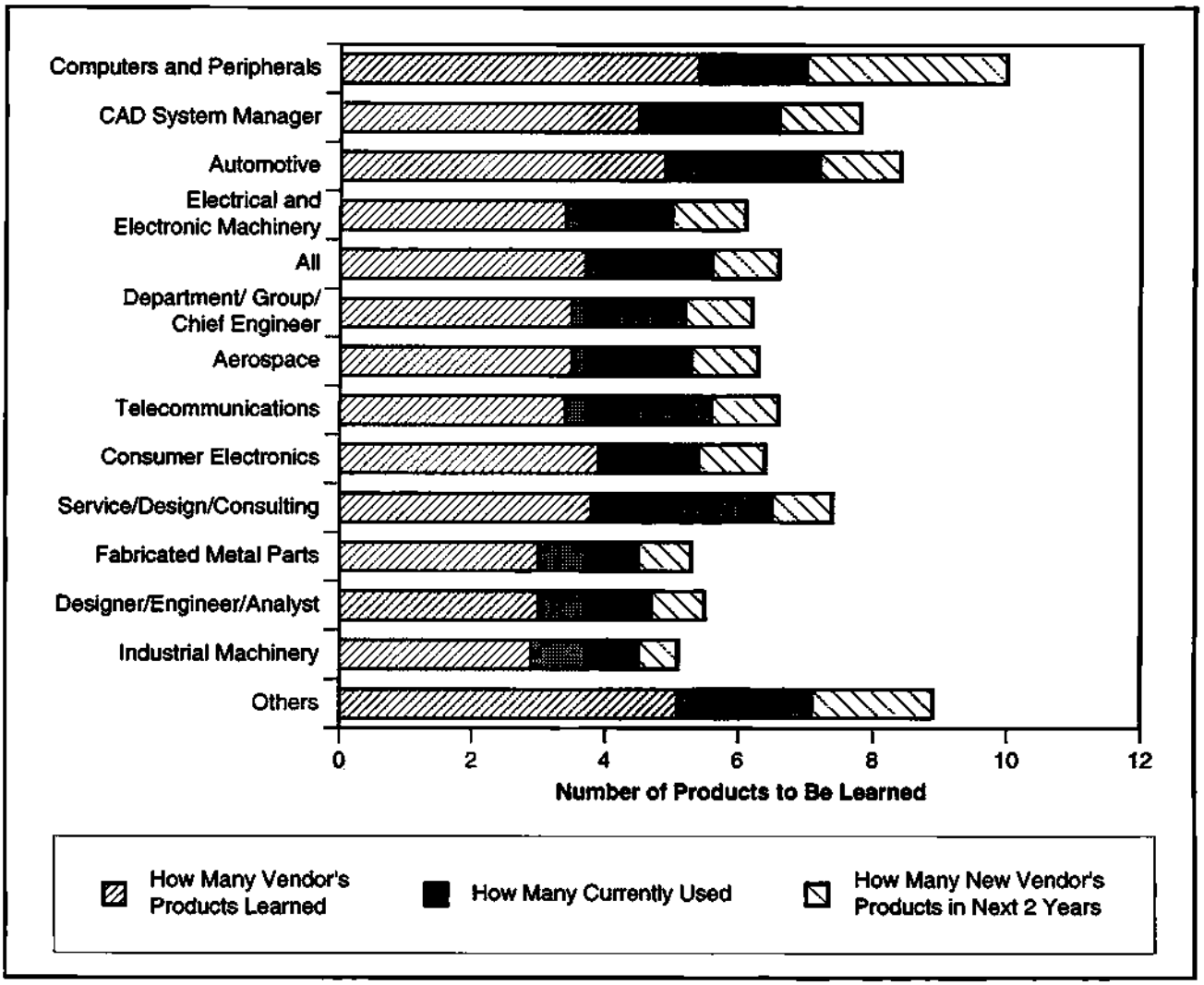
An important series of questions asked the same type of question for each of the major subapplications, "How many people are using mechanical tools in each of these areas? How many would be doing this kind of work using CAD/CAM/CAE tools under ideal conditions, with minimum usage?" Figure 4-4 shows the highest potential growth areas. Structural analysis has the largest unmet need. Table 4-4 shows the automotive industry with a fantastic 700 percent growth potential. Aerospace, consumer electronics, and electrical and electronics are also high. Conceptual design is the next highest growth area. Detail design is

 ©1993 Dataquest Incorporated

one of the most penetrated applications with industrial machinery and fabricated parts showing a decrease. Remember the ideal scenario influence in this question. The other applications show expected growth increasing the number of users by 46 percent or more. Linkage design is another bright spot of opportunity. The number of people doing this work is low, but the possible growth rate is set at more than 130 percent.

©1993 Dataquest Incorporated

Figure 4-1
Change in Product Use by Industry



Source: Dataquest (May 1993)

G3002158

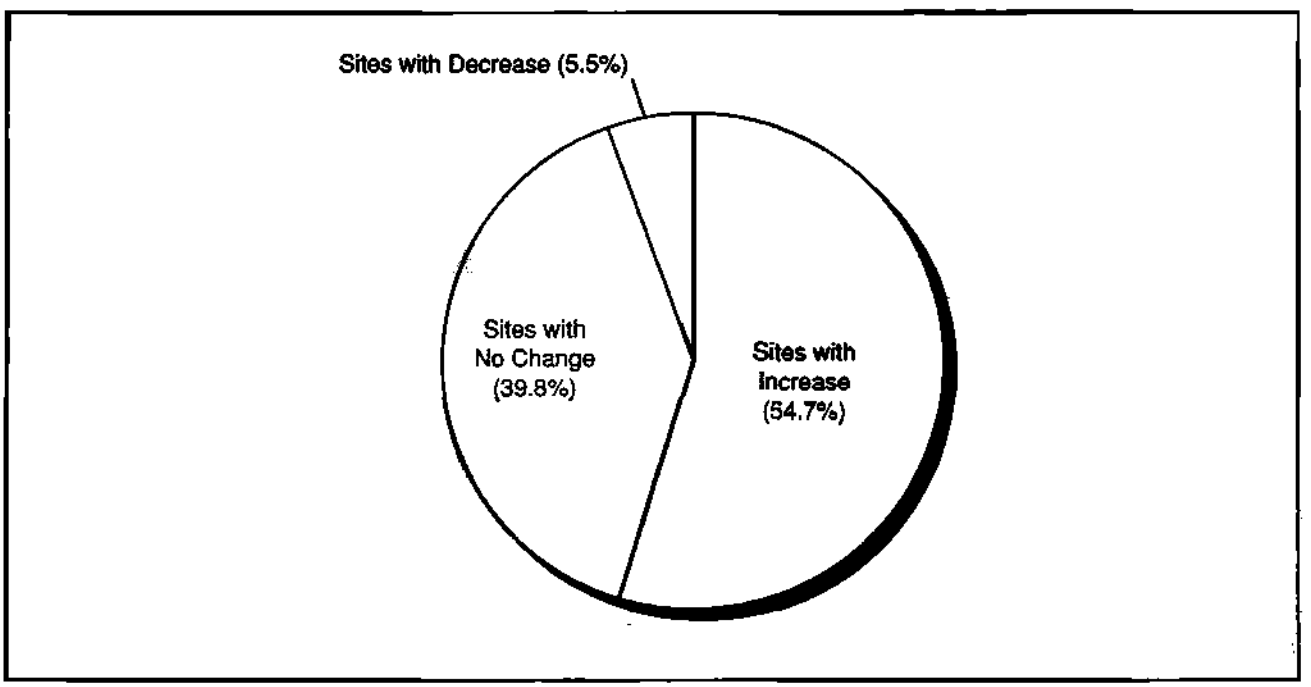
©1993 Dataquest Incorporated

Table 4-1
Change in Product Use by Industry

	Vendor's Products Learned	Retirement Rate (%)	Products Currently Used	New Vendor's Products in Next Two Years
All	3.7	50	1.9	1.0
Aerospace	3.5	47	1.8	1.0
Automotive	4.9	52	2.3	1.2
Computers and Peripherals	5.4	71	1.6	3.0
Telecommunications	3.4	34	2.2	1.0
Consumer Electronics	3.9	62	1.5	1.0
Electrical and Electronic Machinery	3.4	52	1.6	1.1
Industrial Machinery	2.9	44	1.6	0.6
Fabricated Metal Parts	3.0	52	1.5	0.8
Service/Design/Consulting	3.8	31	2.7	0.9
Other	5.1	60	2.0	1.8

Source: Dataquest (May 1993)

Figure 4-2
Site Penetration by User Under Ideal Conditions



Source: Dataquest (May 1993)

G3002159

©1993 Dataquest Incorporated

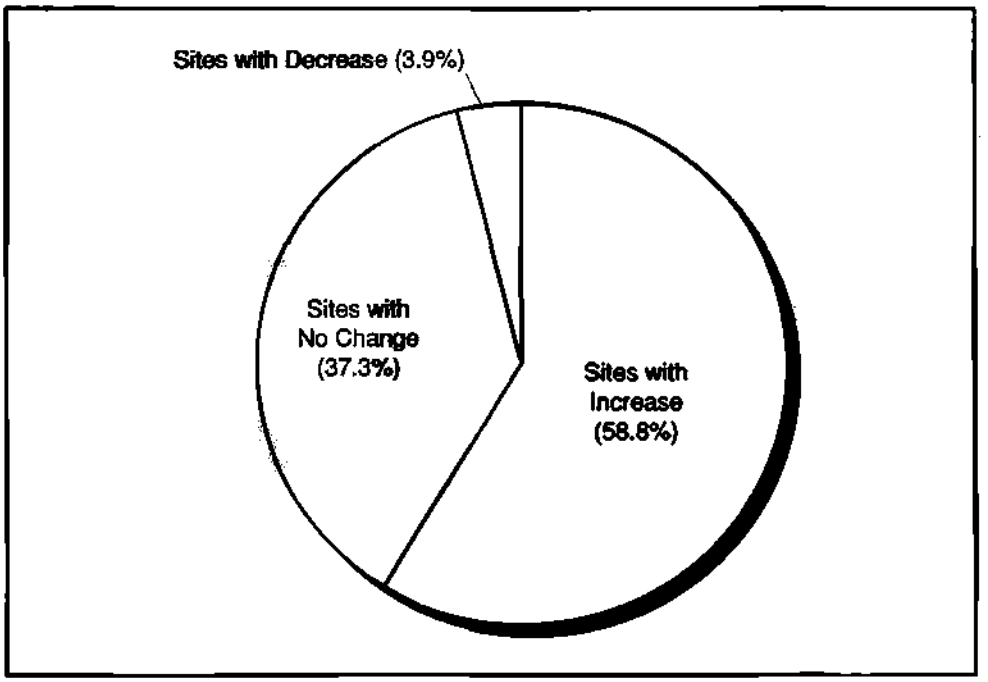
Table 4-2
Site Penetration by User Under Ideal Conditions

		Maximum Users		
	Sites (%)	Current Users	Under Ideal Conditions	Percent Change
All Sites		75	97	29.3
Sites with Increase	54.7	88	139	58.0
Sites with No Change	39.8	50	50	0
Sites with Decrease	5.5	56	37	-33.9
Aerospace				
Sites with Increase	42.1	134	160	19.4
Sites with No Change	55.3	109	114	4.6
Sites with Decrease	2.6	8	8	0
Automotive				
Sites with Increase	53.9	235	348	48.1
Sites with No Change	44.7	72	80	11.1
Sites with Decrease	1.3	30	60	100.0
Consumer Electronics				
Sites with Increase	20.0	11	14	27.3
Sites with No Change	80.0	30	50	66.7
Sites with Decrease	0	0	0	
Electrical and Electronic				
Sites with Increase	46.8	70	130	85.7
Sites with No Change	51.1	23	25	8.7
Sites with Decrease	2.1	10	10	0
Industrial Machinery				
Sites with Increase	52.8	56	67	19.6
Sites with No Change	46.1	46	76	65.2
Sites with Decrease	1.1	30	30	0
Fabricated Metal Parts				
Sites with Increase	53.7	20	30	50.0
Sites with No Change	46.3	21	23	9.5
Sites with Decrease	0	0	0	
Service/Design/Consulting				
Sites with Increase	38.5	30	45	50.0
Sites with No Change	57.7	136	32	-76.5
Sites with Decrease	3.8	40	70	75.0

Source: Dataquest (May 1993)

©1993 Dataquest Incorporated

Figure 4-3
1995 Forecast of Site Penetration by User



Source: Dataquest (May 1993)

G3002160

©1993 Dataquest Incorporated

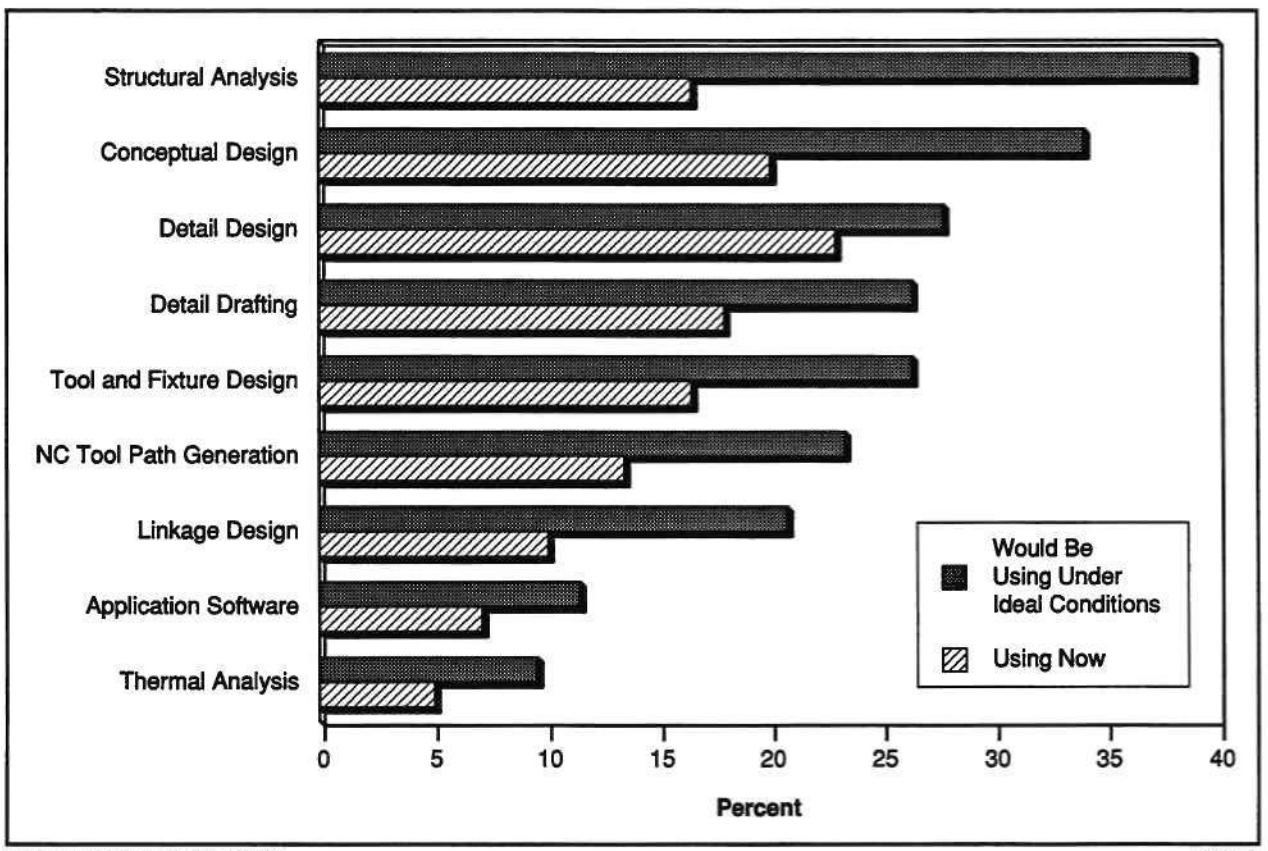
Table 4-3
Forecast of Site Penetration by User

	Sites (%)	Current Users	Expected Users In 1995	Percent Change
All Sites		97	98	1.0
Sites with Increase	54.7	79	113	43.0
Sites with No Change	39.8	79	79	0
Sites with Decrease	5.5	70	33	-52.9
Aerospace				
Sites with Increase	42.1	134	182	35.8
Sites with No Change	55.3	109	139	27.5
Sites with Decrease	2.6	8	0	-100.0
Automotive				
Sites with Increase	53.9	235	332	41.3
Sites with No Change	44.7	72	75	4.2
Sites with Decrease	1.3	30	60	100.0
Consumer Electronics				
Sites with Increase	20.0	11	14	27.3
Sites with No Change	80.0	30	60	100.0
Sites with Decrease	0	0	0	-
Electrical and Electronic				
Sites with Increase	46.8	70	98	40.0
Sites with No Change	51.1	23	27	17.4
Sites with Decrease	2.1	10	5	-50.0
Industrial Machinery				
Sites with Increase	52.8	56	54	-3.6
Sites with No Change	46.1	46	64	39.1
Sites with Decrease	1.1	30	30	0
Fabricated Metal Parts				
Sites with Increase	53.7	20	25	25.0
Sites with No Change	46.3	21	22	4.8
Sites with Decrease	0	0	0	-
Service/Design/Consulting				
Sites with Increase	38.5	30	42	40.0
Sites with No Change	57.7	136	158	16.2
Sites with Decrease	3.8	40	20	-50.0

Source: Dataquest (May 1993)

©1993 Dataquest Incorporated

Figure 4-4
Site Penetration by Subapplication



Source: Dataquest (May 1993)

©1993 Dataquest Incorporated

Table 4-4
Site Penetration by Subapplication

	Current Users	Users Under Ideal Conditions	Possible Growth (%)
Conceptual Design	20.1	34.1	69.7
Aerospace	19.7	24.8	25.8
Automotive	43.0	104.7	143.3
Consumer Electronics	10.0	12.9	29.0
Electrical and Electronic	9.6	17.4	80.5
Industrial Machinery	21.3	25.2	18.4
Fabricated Metal Parts	9.5	10.4	9.4
Service/Design/Consulting	11.8	15.7	33.2
Detail Design	23.0	27.8	20.9
Aerospace	18.4	18.6	1.1
Automotive	42.2	67.7	60.4
Consumer Electronics	11.1	12.5	12.6
Electrical and Electronic	16.3	22.5	37.9
Industrial Machinery	21.0	20.3	-3.2
Fabricated Metal Parts	24.4	12.0	-51.1
Service/Design/Consulting	11.7	18.0	54.2
Structural Analysis	16.5	39.0	136.6
Aerospace	7.5	14.9	98.5
Automotive	19.7	156.1	693.9
Consumer Electronics	4.0	6.8	70.8
Electrical and Electronic	4.6	7.8	68.0
Industrial Machinery	41.1	9.8	-76.2
Fabricated Metal Parts	3.4	4.6	35.1
Service/Design/Consulting	7.1	9.5	34.6
Thermal Analysis	5.1	9.6	88.2
Aerospace	8.2	17.6	113.5
Automotive	10.3	21.7	111.2
Consumer Electronics	2.8	4.0	45.5
Electrical and Electronic	2.5	4.8	94.8
Industrial Machinery	2.9	5.6	90.8
Fabricated Metal Parts	2.6	3.4	31.0
Service/Design/Consulting	4.2	5.2	22.2
Detail Drafting	18.0	26.4	46.7
Aerospace	16.5	18.2	9.9
Automotive	38.2	68.3	78.7
Consumer Electronics	8.6	8.9	3.5
Electrical and Electronic	14.1	19.0	34.8
Industrial Machinery	15.5	20.0	29.2

(Continued)

©1993 Dataquest Incorporated

Table 4-4 (Continued)
Site Penetration by Subapplication

	Current Users	Users Under Ideal Conditions	Possible Growth (%)
Fabricated Metal Parts	10.0	12.4	23.8
Service/Design/Consulting	12.6	21.8	73.6
Tool and Fixture Design	16.5	26.4	60.0
Aerospace	11.3	15.9	41.3
Automotive	53.4	91.5	71.5
Consumer Electronics	2.9	3.5	21.5
Electrical and Electronic	8.3	10.9	31.6
Industrial Machinery	6.3	8.3	31.6
Fabricated Metal Parts	4.2	5.4	28.7
Service/Design/Consulting	4.5	5.4	19.6
Linkage Design	10.1	20.8	105.9
Aerospace	3.5	6.6	89.4
Automotive	31.3	69.6	122.3
Consumer Electronics	2.3	3.5	55.6
Electrical and Electronic	2.3	3.5	55.5
Industrial Machinery	6.1	16.7	174.1
Fabricated Metal Parts	3.1	3.9	25.8
Service/Design/Consulting	3.0	3.3	11.0
NC Tool Path Generation	13.6	23.4	72.2
Aerospace	11.3	13.1	15.6
Automotive	44.8	90.8	102.7
Consumer Electronics	2.8	4.6	64.3
Electrical and Electronic	3.8	6.1	59.9
Industrial Machinery	4.3	4.9	14.0
Fabricated Metal Parts	5.8	6.7	14.9
Service/Design/Consulting	2.8	2.9	4.0
Application Software Development	7.2	11.5	59.7
Aerospace	7.2	9.0	25.0
Automotive	9.3	27.1	190.4
Consumer Electronics	2.8	2.8	0
Electrical and Electronic	3.8	5.3	40.8
Industrial Machinery	4.1	6.6	62.1
Fabricated Metal Parts	2.3	3.0	27.6
Service/Design/Consulting	7.3	7.6	4.2

Source: Dataquest (May 1993)

©1993 Dataquest Incorporated

Chapter 5
Buying History and Plans

Several questions were asked in the area of buying history and plans to better define the expectations of the users in future system purchases. A profile was developed that indicates the change in system retirements for hardware and software. A change in distribution of seats purchased by platform type is shown. Servers, printers, and plotter purchases were verified and future purchase plans defined.

The high-level use of CAD/CAM/CAE tools to improve productivity and time to market is complemented by various services in system integration support, custom software development, and product design. The first question in evaluating the current situation in site status and future buying plans focused on this issue.

External Consulting Services Use and Expectations

The amount of outside consulting services is growing. Overall, the average number of sites that are using external system integration support is growing from 29.4 percent of the sites to 32.3 percent in the next two years. Custom software development was done at 26.7 percent of the sites, growing to 29.4 percent. External product design is expected to grow slightly from 19.2 percent to 20 percent. Many industries use different amounts of external services, but the largest variance occurs among countries. Italy leads the way with 47 percent of the sites working with outside system integrators. This level is almost 50 percent higher than the average. France leads in external software development with 46 percent of the sites involved. France also leads with 32 percent of the sites doing external product development. The United States was almost the lowest in all areas except product design—the United Kingdom has that distinction. Figure 5-1 shows the distribution of respondents that answered "yes" to the question, "In the last two years has your site used external consulting for system integration support, custom software development, and product design?"

We also asked if they believed they would use these services in the next two years. Figure 5-2 shows the results of this question. Table 5-1 has the percent change for each item calculated. Italy expects the highest growth in product design and custom software development. Germany has the lowest growth expected. French companies expect more than a 19 percent increase in outside system integration support.

©1993 Dataquest Incorporated

Platform, Server, Plotter, and Printer Forecasts with Target Market Opportunities

The purchase of new seats in the last two years was led by the PC platform (48.5 percent), closely followed by technical workstation-based products (44.4 percent), and mainframe-based products with a distant 7.2 percent of the total. The mainframe-based product percentage is expected to drop by half in the next two years (1993 and 1994). Another shift is expected with more PC-based solutions being purchased. Overall, the respondents thought that 48.5 percent of the seats purchased were PC-based in 1991 and 1992. They expect this to increase to 56.3 percent in the next two years. Technical workstation-based seats, as a result, fall from 44.4 percent to 40.0 percent of the total. Figure 5-3 and Table 5-2 illustrate these growth rates.

PC-based systems are expected to have the highest growth in sites with 15 to 39 users. This is followed by automotive sites, smaller sites with one to seven users, and then aerospace and industrial machinery sites.

Workstation-based systems are expected to sell well in service/design/consulting sites, followed by small sites with one to seven users. We would expect these sites to currently be using PC-based solutions and to be looking for a higher performance solution to support more sophisticated software acquisitions. Consumer electronics and aerospace companies rated highly in this area. Many U.K.-based companies also expect high growth.

Mainframe-based solutions are falling in interest overall, but they have better opportunity for growth in Italy primarily because of a large installed base. Small sites had a higher expectation for purchases than the larger sites. The painful experience of networking a number of PCs might encourage use of a centralized computing resource for a small group of people. Sharing peripherals might also be encouraging this interest.

We also asked what the last two years looked like for various peripherals, such as plotters, printers, and servers. One server was purchased for every nine PCs or workstations. About the same number of plotters were purchased and one printer for every three PCs or workstations in 1991 and 1992. According to this survey, the server number drops to one in 12 in the next two years. The plotter number drops to one for each 11 PCs or workstations. The printer number drops to one for every five seats purchased.

The best markets for servers are Italy, consumer electronics, small sites with one to seven people, U.K. sites, and sites with 15 to 39 users.

©1993 Dataquest Incorporated

The best markets for plotters are electrical and electronic companies, Italy, Germany, small sites with one to seven users and industrial machinery companies.

The best markets for printers are electronic and electrical, automotive, the United Kingdom, Europe as a group, and France.

Seat Count Forecast

In the next two years, will the seat count for mechanical CAD/CAM/CAE applications increase, stay the same, or decrease? The answer to this question, with analysis by submarket segments is shown in Figure 5-4 and Table 5-3. More German sites are growing with more than 70 percent of the sites expecting to increase seat count. This is compared to a 49 percent average for all the sites in the survey. Figure 5-4 shows the next leading market segments. These are automotive, fabricated metal parts, industrial machinery, and European sites in general. The sites expecting little growth were found in the consumer electronics industry followed by service/design/consulting, aerospace, Italy-, and U.S.-based companies. Table 5-3 shows the number of sites in each group sorted by the number of sites increasing. The amount of increase or decrease is also shown for each submarket. Small sites with one to seven, or eight to 14 users have more than a 40 percent growth expectation. Electrical and electronic companies also have more than a 40 percent growth forecast.

New Seat Opportunities by Segment

Further questions were asked about the planned changes in the next two years for the number of replacement seats, the number of seats to be upgraded, and the new seats planned for addition to the total. Figure 5-5 details the results. U.K.-, Italy-, and France-based companies that are increasing seat count have the highest growth rate planned. Germany was the lowest of the group expecting only a 9.5 percent increase. New hardware seats are purchased to replace old seats as well. The market leaders in planned seat replacements are service/design/consulting companies, followed by Italy-based, aerospace, U.K.-based, and fabricated metal parts companies. In total, the largest seat shipment opportunity goes to the automotive, aerospace, and France-based companies. Table 5-4 shows this detail for percent change and actual average-number-growth per site in each market segment.

Software Opportunities by Segment

A similar analysis was done for each segment by asking what percent of existing software modules would be retired in the next two years. These seats were assumed to be replaced at the sites with a growing installed base. The new seat shipments planned were also assumed to bring along new software modules. Figure 5-6 illustrates the overview. On average, 49 percent of the sites are increasing seat count. Some 50 percent are planning no change and 1.3 percent are expecting a decline. Each of these groups was evaluated further to determine the full potential

 ©1993 Dataquest Incorporated

growth for software. This was done by considering new software sold with new seats and software replacements made for retired modules.

The sites with increasing seat count are planning on replacing 8 percent of the installed software modules. They are also expecting a 17 percent growth in seat count. This should net a 25 percent software-module growth each year for the next two years. All of these questions in the survey asked the users to forecast the expected change over the next two years. The numbers shown in Figure 5-6 were adjusted to reflect the expected annual change.

At sites with no seat-count change expected, they were expecting to replace 8.8 percent of the installed software modules. A surprising number, 12.5 percent, in planned software modules was found at sites with seat-count reductions. It would appear that new software is being brought in to make the existing seats more productive. Figure 5-7 profiles the same data by segment.

Italy has the highest planned software replacement and new module acquisition plan. Consumer electronics and German companies have the lowest planned change. Table 5-5 has the detail for each segment of the market sorted by site type, specifically if the site was planning to increase, decrease, or stay the same in seat count, and each line shows the planned software increase or decrease.

Modeling Technology Planned for New Software Purchases

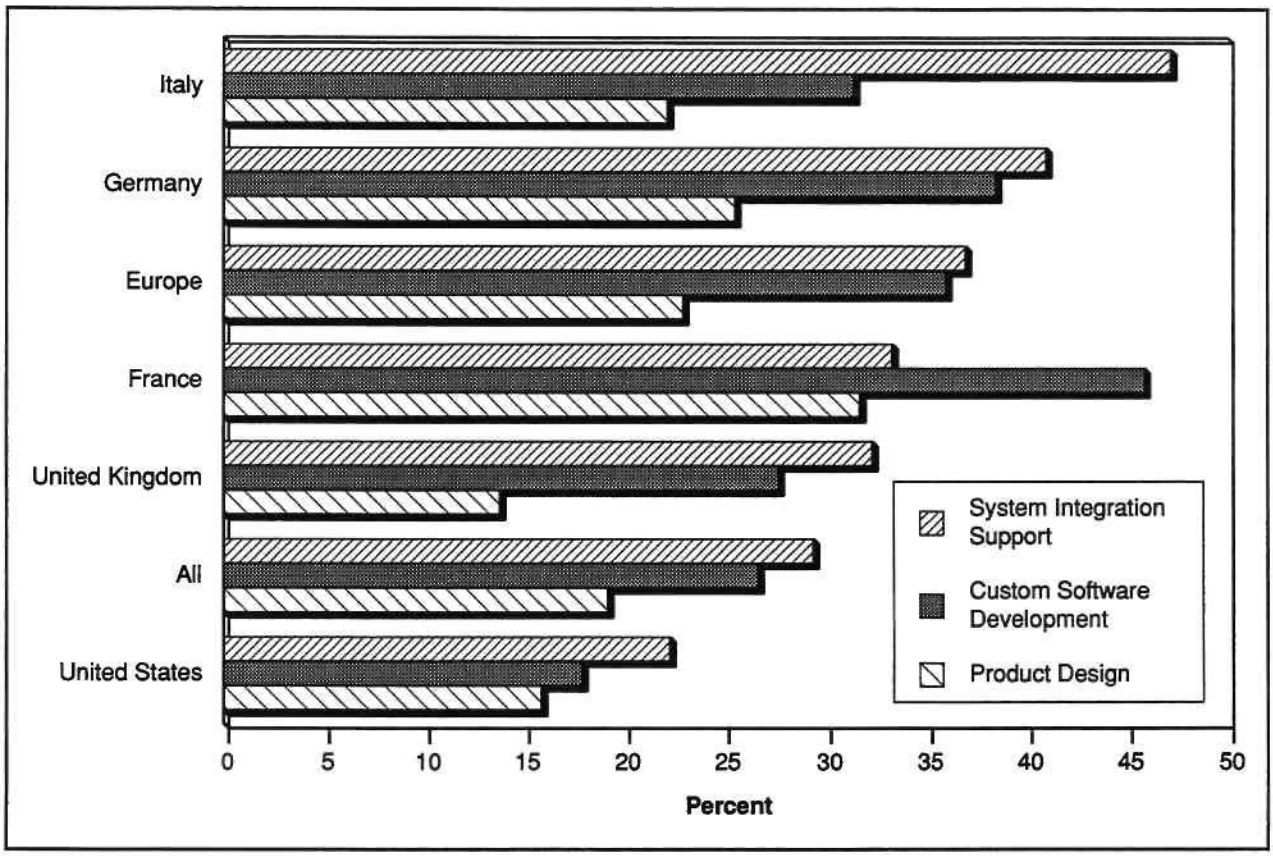
A fundamental issue in understanding the planned software acquisition activity concerns the core modeling technology supporting the application modules. Of all new software planned for purchase in the next two years, what percent falls into each of the following categories?

- 2-D only
- 3-D only
- Solid modeling-based
- A fully integrated 2-D-, 3-D-, and solids-based product

Figure 5-8 shows the surprising variation in responses. Almost 40 percent of all responses said they need a fully integrated solution. This increased to more than 50 percent for consumer electronics, aerospace, and France-based companies. Those sites showing the least interest in the fully integrated solution were in Italy, the service/design/consulting business, and electrical and electronic industries. 3-D-wireframe and solid-modeling-only products didn't attract much attention with the remainder being 2-D-based products. The U.K.-based companies lead the way with more than half planning on 2-D-based products. Industrial machinery, electrical and electronic and service/design/consulting companies have high interest as well. Table 5-6 shows the data behind Figure 5-8 for closer evaluation.

 ©1993 Dataquest Incorporated

Figure 5-1
Percentage of Respondents Who have Used External Consulting

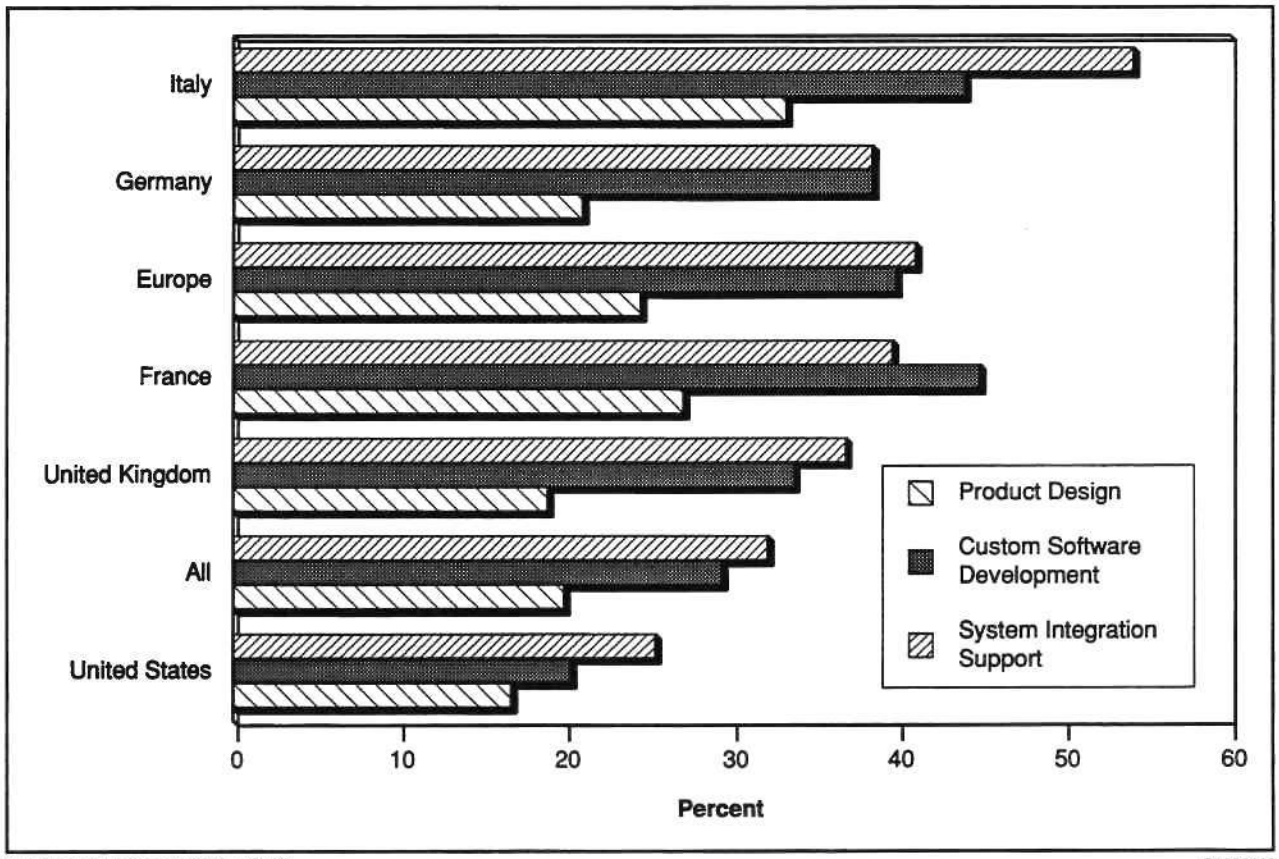


Source: Dataquest (May 1993)

G3002162

©1993 Dataquest Incorporated

Figure 5-2
Percentage of Respondents Who Expect to Use External Consulting by 1995



Source: Dataquest (May 1993)

G3002163

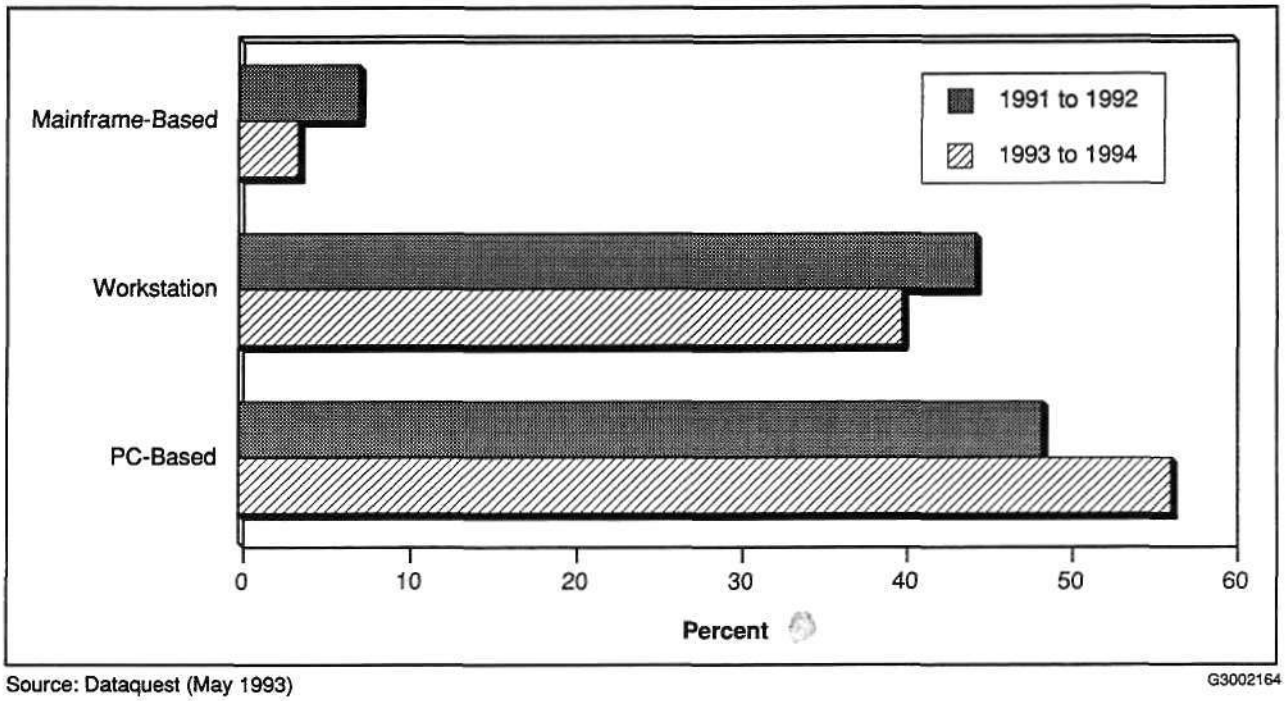
©1993 Dataquest Incorporated

Table 5-1
Percentage of Respondents Who Have Used and Expect to Use External Consulting

	Total	United States	Europe	Germany	Italy	France	United Kingdom
Users in Past Two Years							
System Integration Support	29.4	22.3	37.0	41.0	47.2	33.3	32.3
Custom Software Development	26.7	17.9	36.0	38.5	31.4	45.9	27.7
Product Design	19.2	15.9	23.0	25.6	22.2	31.7	13.8
Expect to Use in Next Two Years							
System Integration Support	32.2	25.4	41.1	38.5	54.2	39.7	36.9
Custom Software Development	29.4	20.4	39.9	38.5	44.1	45.0	33.8
Product Design	20.0	16.8	24.5	21.1	33.3	27.1	19.0
Percent Change							
System Integration Support	9.5	13.9	11.1	-6.1	14.8	19.2	14.2
Custom Software Development	10.1	14.0	10.8	0	40.4	-2.0	22.0
Product Design	4.2	5.7	6.5	-17.6	50.0	-14.5	37.7

Source: Dataquest (May 1993)

Figure 5-3
Forecast of Hardware Seats



Source: Dataquest (May 1993)

G3002164

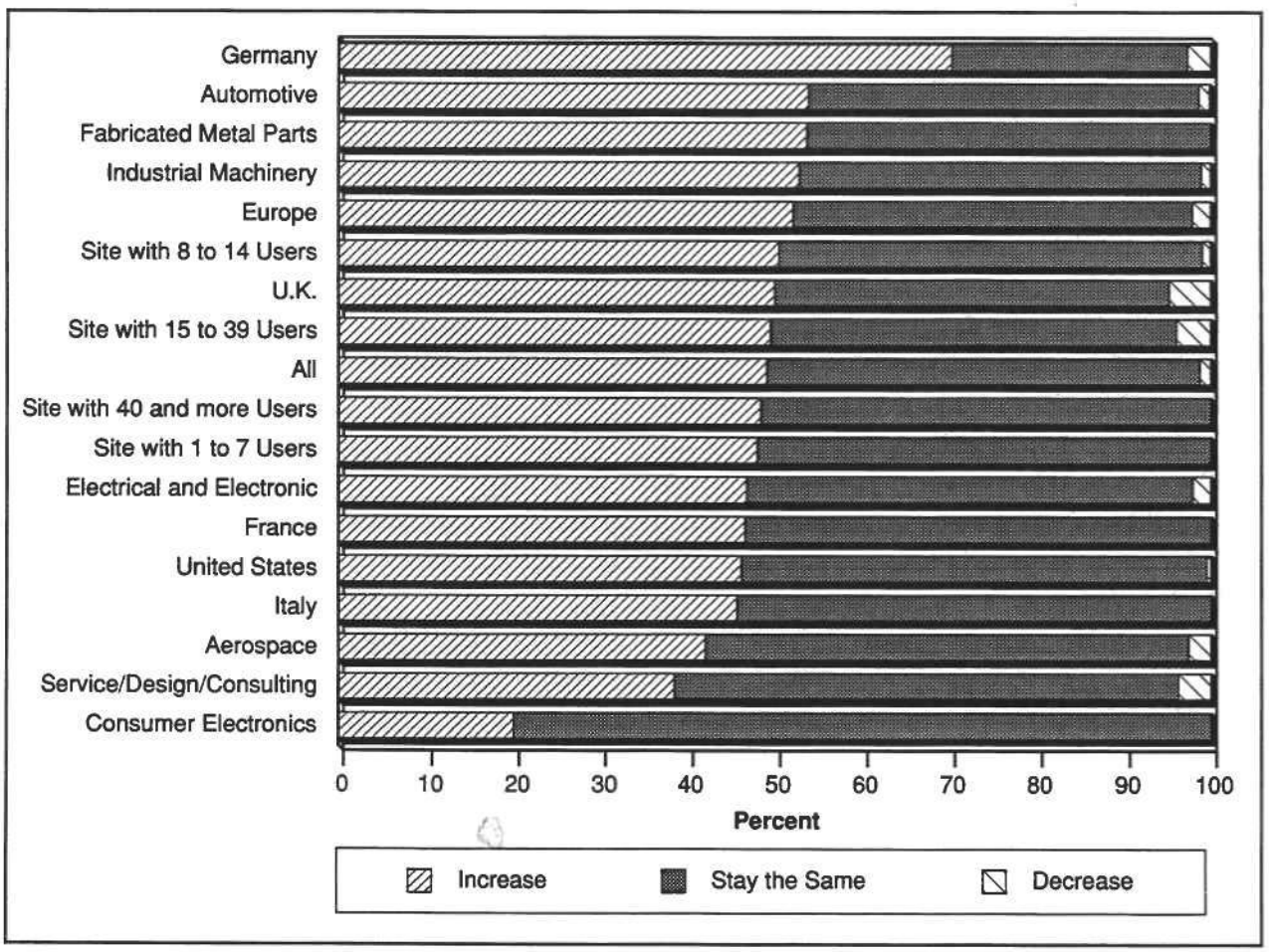
©1993 Dataquest Incorporated

Table 5-2
Respondents' Hardware Buying Plans by Platform (Percentage of Purchases)

	1991 to 1992	1993 to 1994
PC-Based	48.5	56.3
Workstation-Based	44.4	40.0
Mainframe-Based	7.1	3.7

Source: Dataquest (May 1993)

Figure 5-4
Expected Change in Mechanical CAD/CAM/CAE Seat Count by Site (Percent of Sites)



Source: Dataquest (May 1993)

G3002165

©1993 Dataquest Incorporated

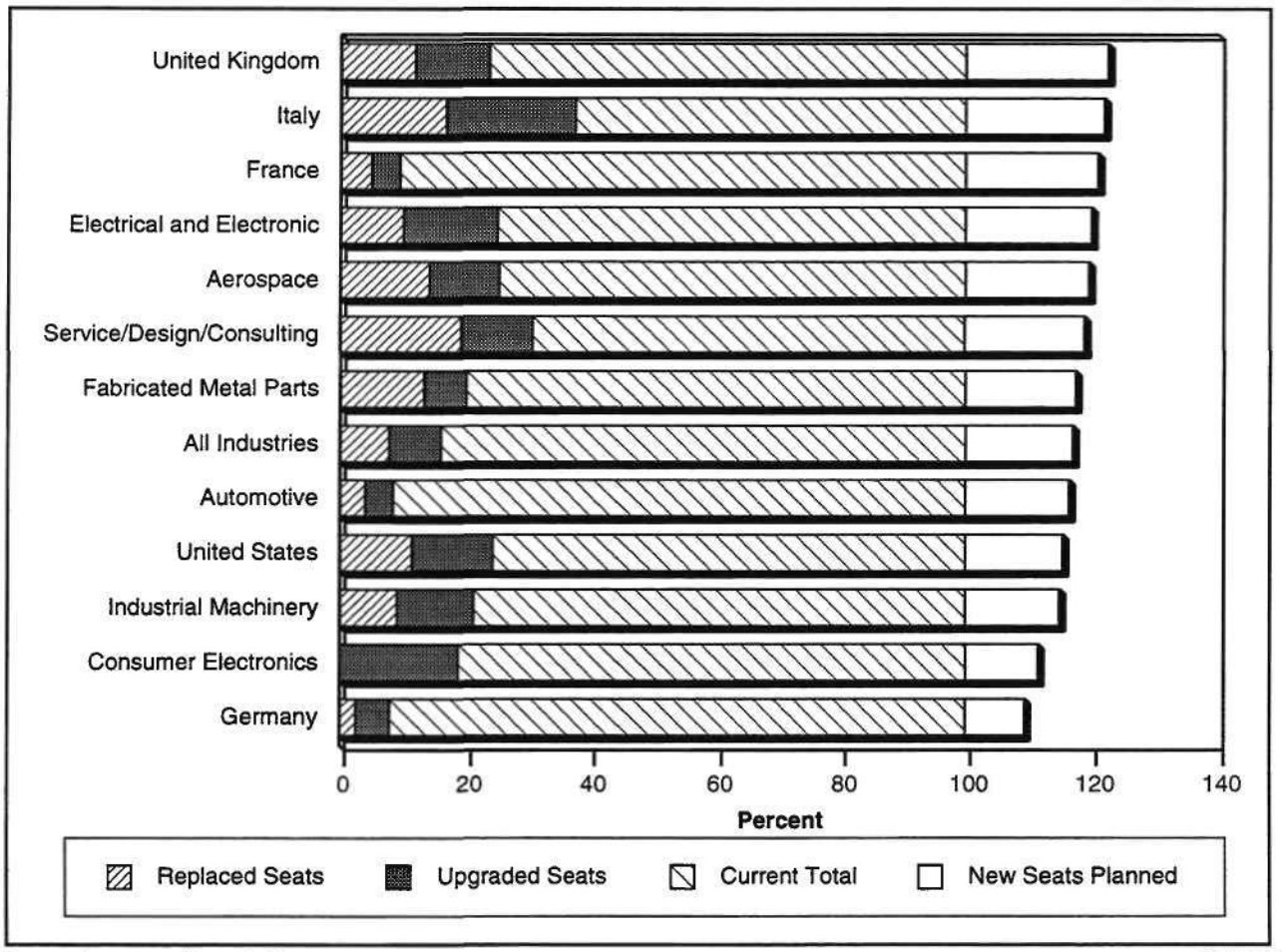
Table 5-3
Expected Change in Mechanical CAD/CAM/CAE Seat Count by Site (Percent of Sites)

	Increase	Stay the Same	Decrease	Amount of Increase	Amount of Decrease
Germany	70.3	27.0	2.7	9.4	5.0
Automotive	53.9	44.7	1.3	33.0	30.0
Fabricated Metal Parts	53.7	46.3	0	35.0	-
Industrial Machinery	52.8	46.1	1.1	30.0	10.0
Europe	52.1	45.8	2.1	18.5	23.8
Sites with 8 to 14 Users	50.5	48.5	1.0	42.0	50.0
United Kingdom	50.0	45.2	4.8	22.5	30.0
Sites with 15 to 39 Users	49.5	46.5	4.0	29.0	48.0
All	49.1	49.6	1.3	17.0	29.4
Sites with 40 and More Users	48.4	51.6	0	20.0	-
Sites with 1 to 7 Users	48.0	52.0	0	44.0	-
Electrical and Electronic	46.8	51.1	2.1	40.0	50.0
France	46.6	53.4	0	20.6	-
United States	46.2	53.3	0.5	15.4	25.0
Italy	45.7	54.3	0	21.9	0
Aerospace	42.1	55.3	2.6	39.0	100.0
Service/Design/Consulting	38.5	57.7	3.8	38.0	50.0
Consumer Electronics	20.0	80.0	0	23.0	-

Source: Dataquest (May 1993)

©1993 Dataquest Incorporated

Figure 5-5
New Seat Opportunity at Sites with Positive Seat Growth



Source: Dataquest (May 1993)

G3002166

©1993 Dataquest Incorporated

Table 5-4
New Seat Opportunity

	Percent of Sites	Current Hardware Seats	Expected Annual Change (%)	New Seats Per Year	Replacement Seats Per Year	Seats Upgraded Per Year	New Seat Opportunity
All Industries							
Sites with Increase	49.1	58	17.0	10	5	5	19
Sites with No Change	49.6	36		0	5	4	
Sites with Decrease	1.3	12	-24.5	-3	2	2	5
United States							
Sites with Increase	46.2	35	15.5	5	4	5	13
Sites with No Change	53.3	20		0	3	4	
Sites with Decrease	0.5	4	-25.0	-1	2	2	4
Germany							
Sites with Increase	70.3	95	9.5	9	3	5	14
Sites with No Change	27.0	79		0	15	2	
Sites with Decrease	2.7	25	-5.0	-1	0	0	0
Italy							
Sites with Increase	45.7	12	22.0	3	2	3	7
Sites with No Change	54.3	21		0	9	1	
Sites with Decrease	0	0	0	0	0	0	0
France							
Sites with Increase	46.6	143	21.0	30	7	7	44
Sites with No Change	53.4	45		0	5	6	
Sites with Decrease	0	0	0	0	0	0	0
United Kingdom							
Sites with Increase	50.0	51	22.5	11	6	6	23
Sites with No Change	45.2	69		0	8	3	
Sites with Decrease	4.8	19	-30.0	-6	4	4	7
Aerospace							
Sites with Increase	42.1	103	19.5	20	15	12	49
Sites with No Change	55.3	6		0	0	0	
Sites with Decrease	2.6	52	-50.0	-26	4	9	8
Automotive							
Sites with Increase	53.9	137	16.5	23	6	6	34
Sites with No Change	44.7	61		0	10	5	
Sites with Decrease	1.3	10	-15.0	-2	10	0	20
Consumer Electronics							
Sites with Increase	20.0	8	11.5	1	0	2	1
Sites with No Change	80.0	16		0	4	3	
Sites with Decrease	0	0	0	0	0	0	0
Electrical and Electronic							
Sites with Increase	46.8	70	20.0	14	7	11	28

(Continued)

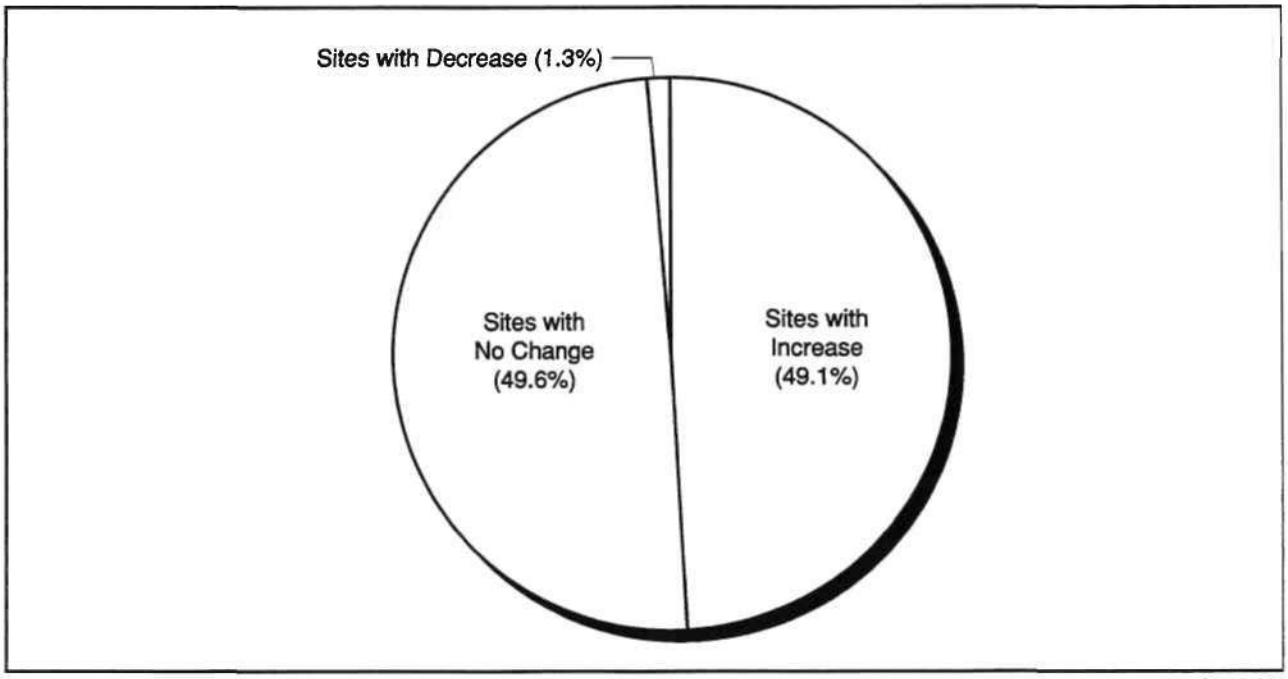
©1993 Dataquest Incorporated

Table 5-4 (Continued)
New Seat Opportunity

	Percent of Sites	Current Hardware Seats	Expected Annual Change (%)	New Seats Per Year	Replacement Seats Per Year	Seats Upgraded Per Year	New Seat Opportunity
Sites with No Change	51.1	10		0	1	2	
Sites with Decrease	2.1	4	-25.0	-1	2	2	4
Industrial Machinery							
Sites with Increase	52.8	33	15.0	5	3	4	11
Sites with No Change	46.1	29		0	6	3	
Sites with Decrease	1.1	25	-5.0	-1	0	0	0
Fabricated Metal Parts							
Sites with Increase	53.7	15	17.5	3	2	1	7
Sites with No Change	46.3	13		0	1	1	
Sites with Decrease	0	0	0	0	0	0	0
Service/Design/Consulting							
Sites with Increase	38.5	13	19.0	2	3	2	7
Sites with No Change	57.7	18		0	10	4	
Sites with Decrease	3.8	40	-25.0	-10	0	10	0

Source: Dataquest (May 1993)

Figure 5-6
Planned Purchases of Software Modules

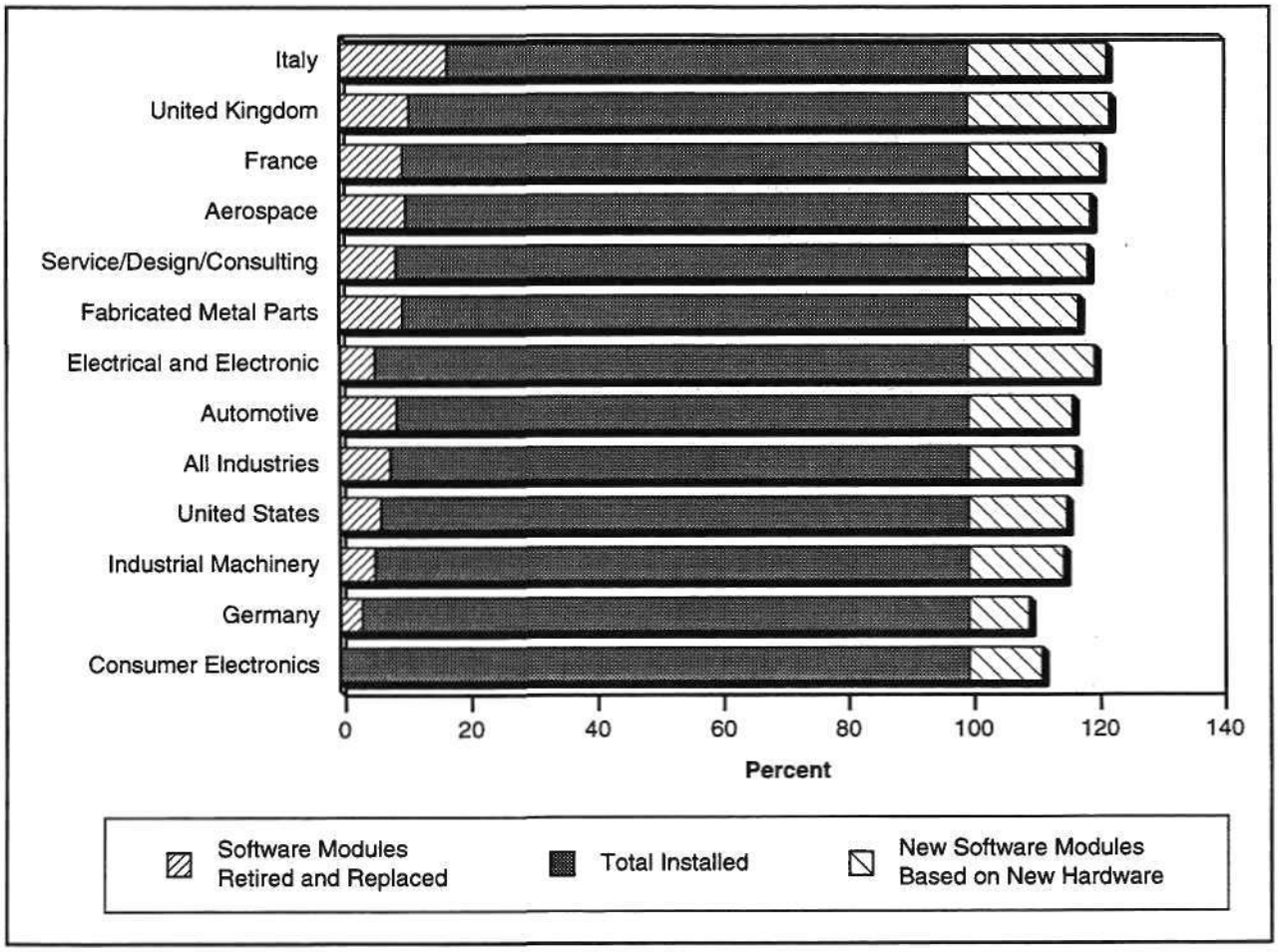


Source: Dataquest (May 1993)

G3002167

©1993 Dataquest Incorporated

Figure 5-7
Planned Purchases of Software Modules by Segment



Source: Dataquest (May 1993)

G3002168

©1993 Dataquest Incorporated

Table 5-5
New Software Module Opportunity

	Percent of Sites	Current Hardware Seats	Expected Annual Change (%)	New Hardware Seats with Software	Annual Module Change (%)	Annual Module Increase (%)
All Industries						
Sites with Increase	49.1	58	17.0	10	8.0	25.0
Sites with No Change	49.6	36		0	8.8	8.8
Sites with Decrease	1.3	12	-24.5	-3	12.5	-12.0
United States						
Sites with Increase	46.2	35	15.5	5	6.5	22.0
Sites with No Change	53.3	20		0	6.5	6.5
Sites with Decrease	0.5	4	-25.0	-1	0	-25.0
Germany						
Sites with Increase	70.3	95	9.5	9	3.5	13.0
Sites with No Change	27.0	79		0	8.5	8.5
Sites with Decrease	2.7	25	-5.0	-1	0	-5.0
Italy						
Sites with Increase	45.7	12	22.0	3	17.0	39.0
Sites with No Change	54.3	21		0	16.5	16.5
Sites with Decrease	0	0	0	0	0	0
France						
Sites with Increase	46.6	143	21.0	30	10.0	31.0
Sites with No Change	53.4	45		0	12.5	12.5
Sites with Decrease	0	0	0	0	0	0
United Kingdom						
Sites with Increase	50.0	51	22.5	11	11.0	33.5
Sites with No Change	45.2	69		0	6.5	6.5
Sites with Decrease	4.8	19	-30.0	-6	33.5	3.5
Aerospace						
Sites with Increase	42.1	103	19.5	20	10.5	30.0
Sites with No Change	55.3	6		0	11.0	11.0
Sites with Decrease	2.6	52	-50.0	-26	50.0	0
Automotive						
Sites with Increase	53.9	137	16.5	23	9.0	25.5
Sites with No Change	44.7	61		0	10.5	10.5
Sites with Decrease	1.3	10	-15.0	-2	0	-15.0
Consumer Electronics						
Sites with Increase	20.0	8	11.5	1	0	11.5
Sites with No Change	80.0	16		0	16.5	16.5
Sites with Decrease	0	0	0	0	0	0

(Continued)

 ©1993 Dataquest Incorporated

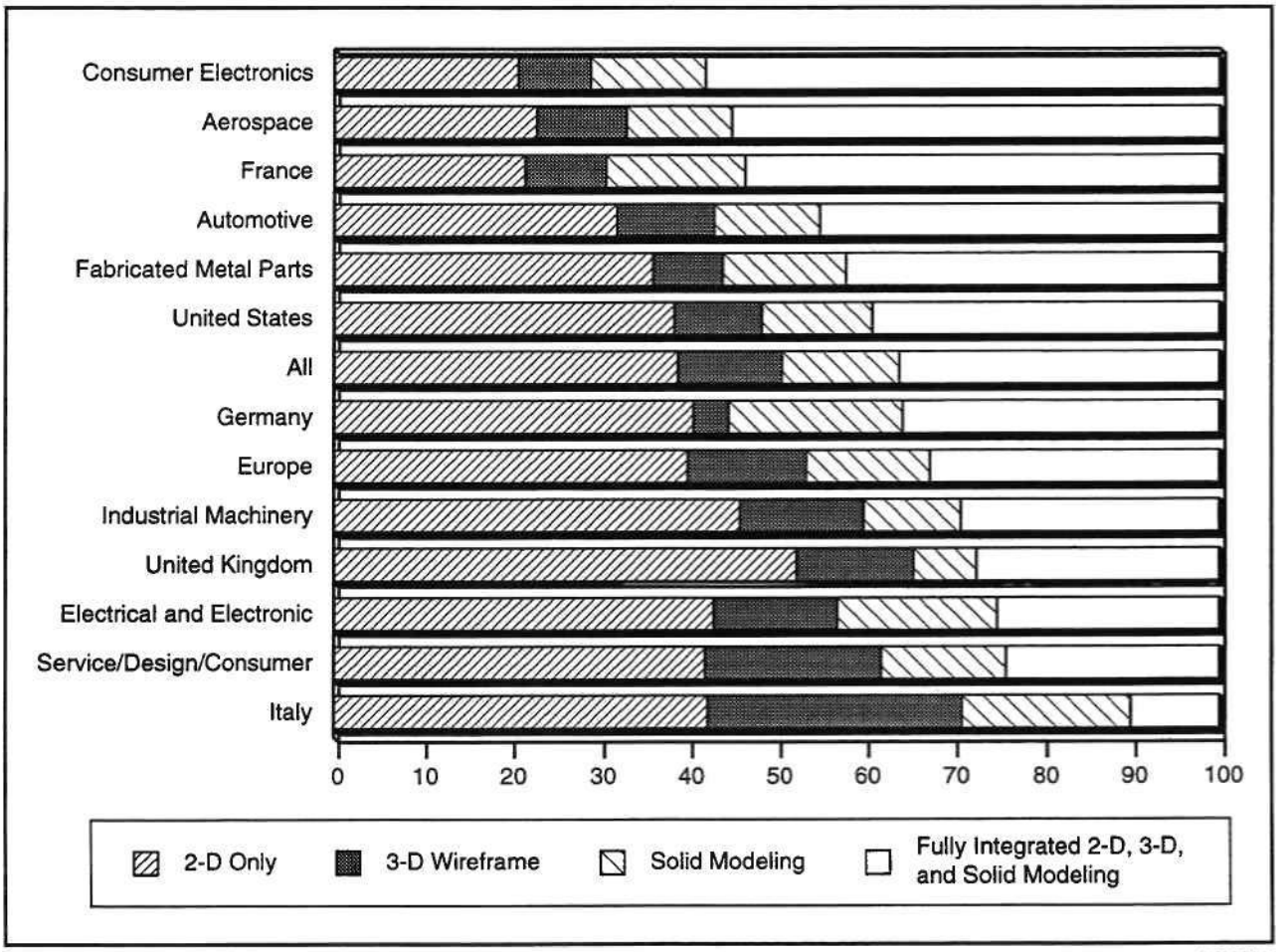
Table 5-5 (Continued)
New Software Module Opportunity

	Percent of Sites	Current Hardware Seats	Expected Annual Change (%)	New Hardware Seats with Software	Annual Module Change (%)	Annual Module Increase (%)
Electrical and Electronic						
Sites with Increase	46.8	70	20.0	14	5.5	25.5
Sites with No Change	51.1	10		0	7.5	7.5
Sites with Decrease	2.1	4	-25.0	-1	0	-25.0
Industrial Machinery						
Sites with Increase	52.8	33	15.0	5	5.5	20.5
Sites with No Change	46.1	29		0	6.5	6.5
Sites with Decrease	1.1	25	-5.0	-1	0	-5.0
Fabricated Metal Parts						
Sites with Increase	53.7	15	17.5	3	10.0	27.5
Sites with No Change	46.3	13		0	8.0	8.0
Sites with Decrease	0	0	0	0	0	0
Service/Design/Consulting						
Sites with Increase	38.5	13	19.0	2	9.0	28.0
Sites with No Change	57.7	18		0	4.5	4.5
Sites with Decrease	3.8	40	-25.0	-10	50.0	25.0

Source: Dataquest (May 1993)

©1993 Dataquest Incorporated

Figure 5-8
New Software Purchases by Modeling Type



Source: Dataquest (May 1993)

G3002169

©1993 Dataquest Incorporated

Table 5-6
Percentage of New Software Purchases by Modeling Type

	2-D Only	3-D Wireframe	Solid Modeling	Fully Integrated 2-D, 3-D, and Solid Modeling
France	21.7	9.0	15.8	53.5
United States	38.5	9.9	12.6	39.0
All	38.9	11.8	13.3	36.0
Germany	40.7	4.0	19.7	35.6
Europe	40.0	13.5	14.0	32.5
United Kingdom	52.4	13.2	7.1	27.3
Italy	42.3	28.8	18.9	10.0
Aerospace	23.0	10.0	12.0	55.0
Automotive	32.0	11.0	12.0	45.0
Consumer Electronics	21.0	8.0	13.0	58.0
Electrical and Electronic	43.0	14.0	18.0	25.0
Industrial Machinery	46.0	14.0	11.0	29.0
Fabricated Metal Parts	36.0	8.0	14.0	42.0
Service/Design/Consulting	42.0	20.0	14.0	24.0

Source: Dataquest (May 1993)

©1993 Dataquest Incorporated

Chapter 6
Importance and Satisfaction Evaluation

A gap analysis is a classic way to evaluate the relative importance and level of satisfaction among a number of related issues. We asked the respondents to rate the following questions on a scale of one to five with five being very important or satisfied and one being not at all important or satisfied. A rating of three is viewed as neutral. With the growing interest in integrated solutions and increasing competitive pressures for most CAD/CAM/CAE users, we felt that it would be useful to analyze several issues relating to strategic importance for business concerns (such as software use and expectations, evaluations or point solutions, integrated solutions, and a series of issues important to future acquisitions).

The highest-rated importance items in each area include the following:

- Improving product quality as a strategic business issue
- Using software with high quality
- Supporting the design function
- Supporting integrated design and drafting solutions
- Offering integrated product data management

It is important to note that not one issue was evaluated in which the level of satisfaction was above the level of importance. This is unusual for an analysis of this type and indicates a general performance of product delivery below expectations or needs. The dynamics of this situation create an opportunity for innovative developers to make the installed products obsolete and to be chosen as the next supplier in the technology food chain. Vendors with stale products, buggy software, or poor performance should beware because the market pressure to improve has never been higher.

Strategic Business Issues

A variety of issues can be used to evaluate the importance of strategic issues in the success of a business. Reducing time to market is often used as a justification issue for automation tool acquisition. This was rated fourth on the list behind the following:

- Improving product quality
- Lowering manufacturing cost
- Lowering design cost

Using the CAD/CAM/CAE productivity tools to improve product quality is the most important benefit expected. Perceived product quality can justify higher purchase pricing. Real product quality can lower potential litigation expense. Reducing cost is always a strategic issue. The importance ratings of each of these issues was similar and high. The

©1993 Dataquest Incorporated

gap of satisfaction was also similar and less than might be expected. Figure 6-1 and Table 6-1 show this result. Usually a gap of more than one in this type of analysis is viewed as significant. Every one of these issues has a gap of more than one. We believe that the users are, in general, not as happy as they should be with the ability of their automation tools to affect competitive advantage at the strategic level. Vendors that can demonstrate an ability to provide these tools will have a significant advantage in the next five years.

Software Issues

The most important software issue has the highest gap, indicating a low level of satisfaction concerning software quality. As users develop a higher reliance on the use of these tools, hard fought gains in productivity can be quickly wiped out with buggy software, corrupted data files, and weak interface among modules. We believe that this issue could be the most serious in the minds of the users when it comes time to make a future purchasing decision. Experience has taught the expense of poor performance in this area.

Having access to software that is easy to learn is the next most important software issue. The level of satisfaction is improved over the software quality issues, but expectations still are not fully met. Many vendors can rest on the recent laurel of improved graphical user interfaces or an infusion of parametric or variational user input technology. We believe that the expectation will shift forward again as new interface, on-line help and training devices are introduced. Virtual reality development will bring some useful technology to this area.

Having access to the most advanced product was rated about half-way between very important and neutral. This issue had the lowest gap, but still the level of satisfaction was lower. Having access to data management tools is rated almost as high with a lower satisfaction rating. Figure 6-2 and Table 6-2 provide detail for these issues.

Point Solutions

Considering the overall productivity at each site, the importance and level of satisfaction for each of the following high-performance CAD/CAM/CAE tools were rated: design, drafting, manufacturing applications, and then analysis—ranked in that order for importance. The range in values is quite narrow, suggesting a similar level of importance. The level of satisfaction is fairly uniform falling behind 0.6 of a point. Design applications have the largest gap of 0.9 behind the importance rating. See Figure 6-3 and Table 6-3 for detailed evaluation.

©1993 Dataquest Incorporated

Integrated Solutions

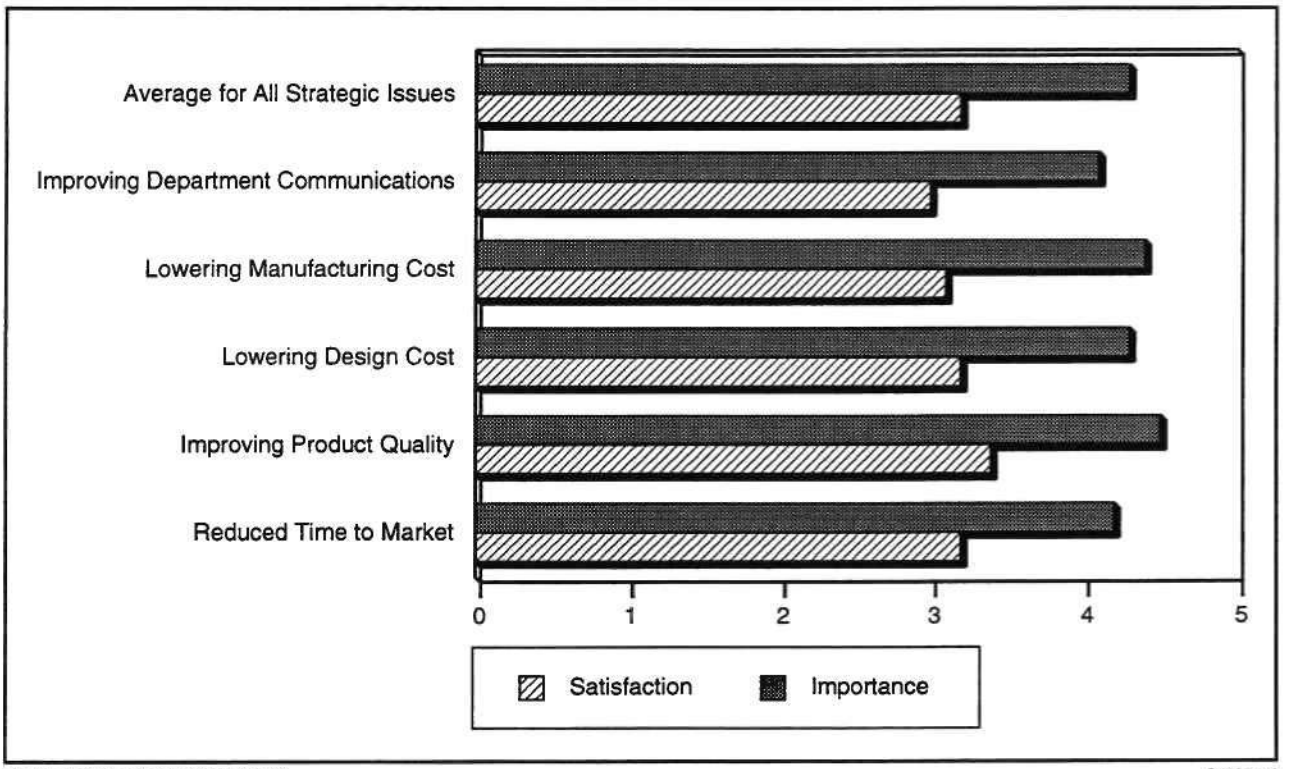
Integrated solutions were rated a bit higher in importance than point solutions. Figure 6-4 and Table 6-4 show that all had a four-point rating or higher. All had a 0.6 to a 0.9 gap in satisfaction. The drafting/design combination was seen as the most valuable. A fully combined design, analysis, drafting, and manufacturing package was desirable, but had the lowest satisfaction rating.

Future Acquisition Issues

We asked what is important when making future system and software acquisition plans to develop an idea of some of the critical decision making issues at work in the minds of today's purchasers. The first five or six issues listed in Figure 6-5 will clearly be considered in the future acquisition decision-making process. Table 6-5 shows this data in more detail. Integrated product data management, design optimization, and support for new industry standards, such as PDES and STEP are the top three issues. The level of satisfaction in integrated product data management indicates that the vendors are doing a reasonable job at managing their own data. One of the biggest gaps is shown for parametric user interface. Clearly an opportunity exists for vendors to develop a more productive solution in this area. High-performance 3-D graphics and large format laser printing were next on the importance list, each with a 0.6 or 0.7 gap in satisfaction, respectively. A high rating for interface to rapid prototyping indicates the great success that this technology has developed in the minds of the users. Some work needs to be done in improving the interface, but the expectation is there to drive this exciting output technology.

©1993 Dataquest Incorporated

Figure 6-1
Importance and Satisfaction Evaluation of Strategic Business Issues (1=Not Important/Satisfied; 5=Very Important/Satisfied)



Source: Dataquest (May 1993)

G3002170

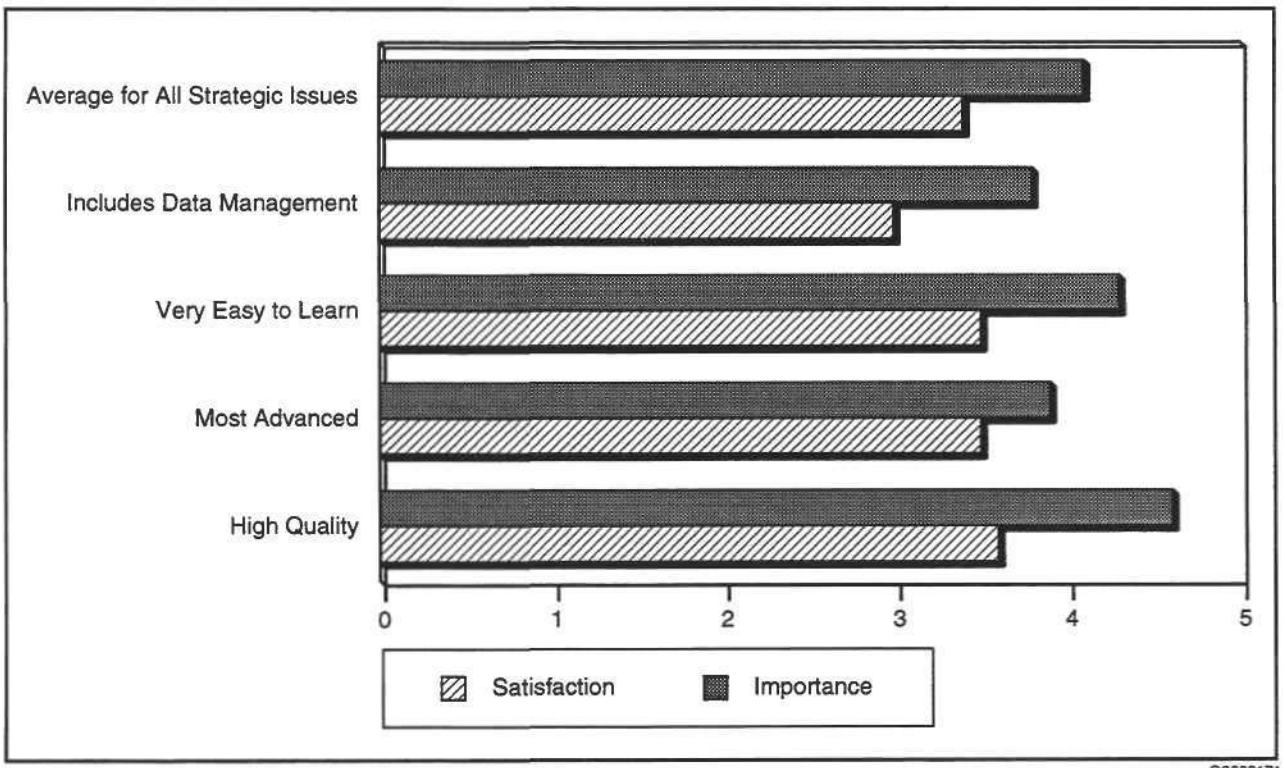
Table 6-1
Importance and Satisfaction Evaluation of Strategic Business Issues (1=Not Important/Satisfied; 5=Very Important/Satisfied)

	Satisfaction with Importance to Company	Related Vendor Tools	Gap
Reduced Time to Market	4.2	3.2	1.0
Improving Product Quality	4.5	3.4	1.1
Lowering Design Cost	4.3	3.2	1.2
Lowering Manufacturing Cost	4.4	3.1	1.3
Improving Department Communications	4.1	3.0	1.1
Average for All Strategic Issues	4.3	3.2	1.1

Source: Dataquest (May 1993)

©1993 Dataquest Incorporated

Figure 6-2
Importance and Satisfaction Evaluation of Software Issues (1=Not Important/Satisfied; 5=Very Important/Satisfied)



Source: Dataquest (May 1993)

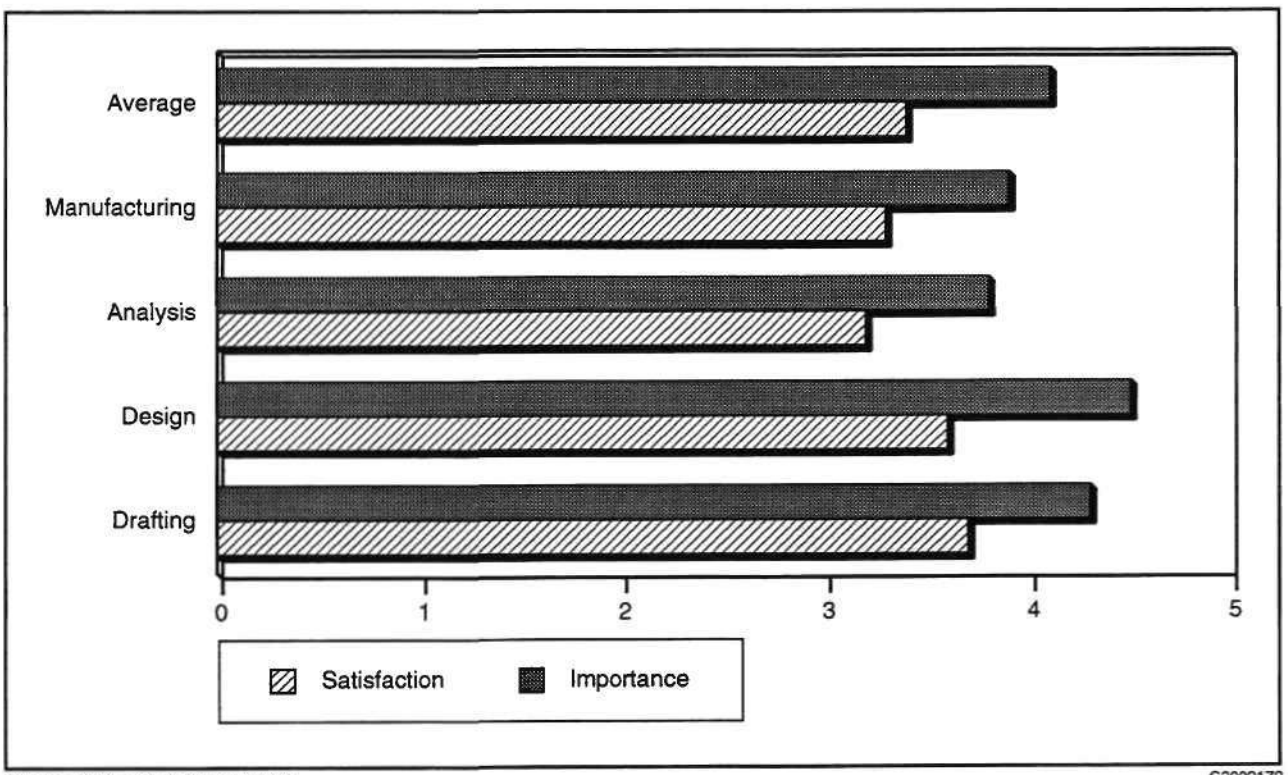
Table 6-2
Importance and Satisfaction Evaluation of Software Issues (1=Not Important/Satisfied; 5=Very Important/Satisfied)

	Importance to Company	Satisfaction with Related Vendor Tools	Gap
High Quality	4.6	3.6	1.0
Most Advanced	3.9	3.5	0.4
Very Easy to Learn	4.3	3.5	0.8
Includes Data Management	3.8	3.0	0.8
Average for All Strategic Issues	4.1	3.4	0.7

Source: Dataquest (May 1993)

©1993 Dataquest Incorporated

Figure 6-3
Importance and Satisfaction Evaluation of Point Solutions
(1=Not Important/Satisfied; 5=Very Important/Satisfied)



Source: Dataquest (May 1993)

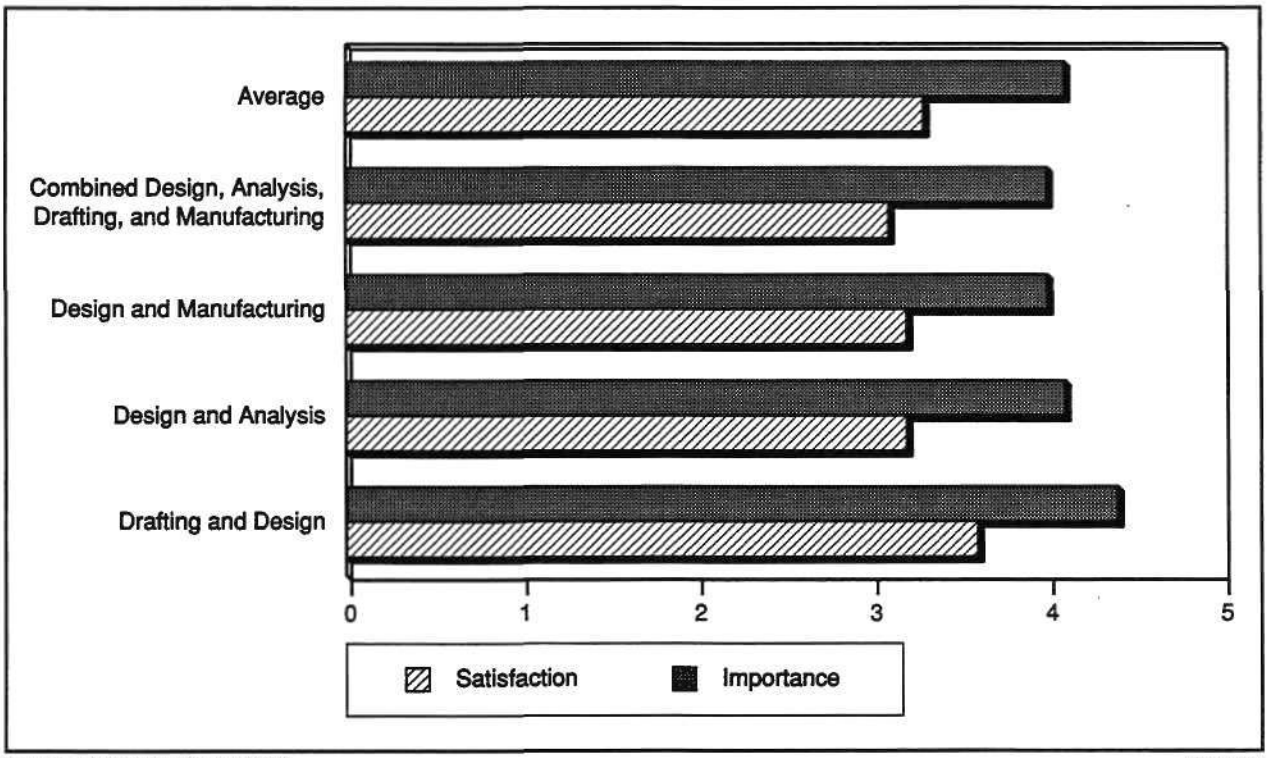
Table 6-3
Importance and Satisfaction Evaluation of Point Solutions
(1=Not Important/Satisfied; 5=Very Important/Satisfied)

	Importance to Company Productivity	Satisfaction with Related Vendor Tools	Gap
Drafting	4.3	3.7	0.6
Design	4.5	3.6	0.9
Analysis	3.8	3.2	0.6
Manufacturing	3.9	3.3	0.6
Average	4.1	3.4	0.7

Source: Dataquest (May 1993)

©1993 Dataquest Incorporated

Figure 6-4
Importance and Satisfaction Evaluation of Integrated Solutions
(1=Not Important/Satisfied; 5=Very Important/Satisfied)



Source: Dataquest (May 1993)

G3002173

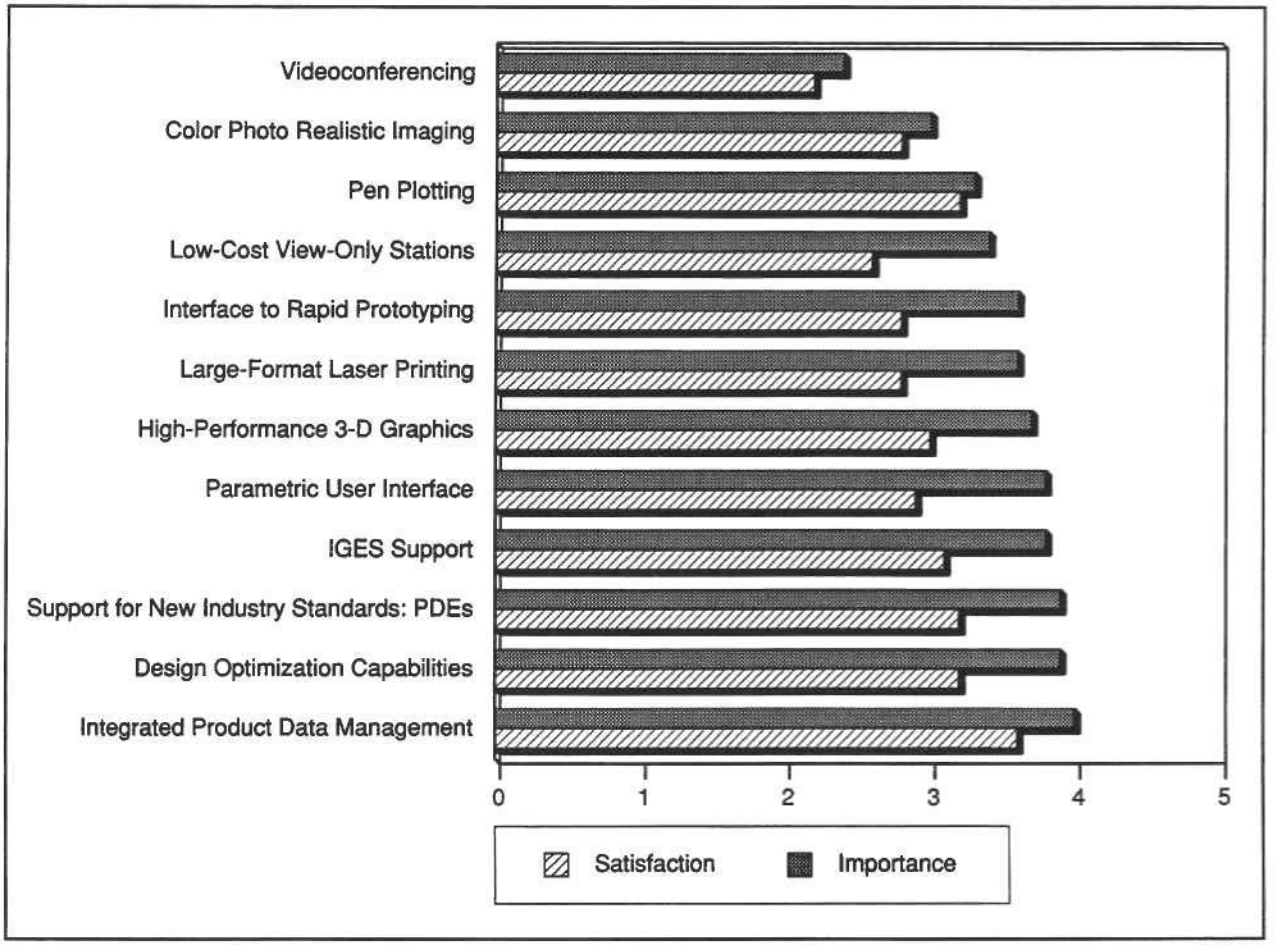
Table 6-4
Importance and Satisfaction Evaluation of Integrated Solutions
(1=Not Important/Satisfied; 5=Very Important/Satisfied)

	Importance to Company Productivity	Satisfaction with Related Vendor Tools	Gap
Drafting and Design	4.4	3.6	0.9
Design and Analysis	4.1	3.2	0.8
Design and Manufacturing	4.0	3.2	0.9
Combined Design, Analysis, Drafting and Manufacturing	4.0	3.1	0.9
Average	4.1	3.3	0.9

Source: Dataquest (May 1993)

©1993 Dataquest Incorporated

Figure 6-5
Importance and Satisfaction of Future Acquisition Issues
(1=Not Important/Satisfied; 5=Very Important/Satisfied)



Source: Dataquest (May 1993)

G3002174

©1993 Dataquest Incorporated

Table 6-5
Importance and Satisfaction Evaluation of Future Acquisition Issues
(1=Not Important/Satisfied; 5=Very Important/Satisfied)

	Importance to Future Systems and Software Acquisitions	Satisfaction with Related Vendor Tools	Gap
Integrated Product Data Management	4.0	3.6	0.4
Design Optimization Capabilities	3.9	3.2	0.7
Support for New Industry Standards:			
PDES, STEP, ISO	3.9	3.2	0.7
IGES Support	3.8	3.1	0.7
Parametric User Interface	3.8	2.9	0.9
High Performance 3-D Graphics	3.7	3.0	0.7
Large Format Laser Printing	3.6	2.8	0.8
Interface to Rapid Prototyping	3.6	2.8	0.8
Low Cost View-Only Stations	3.4	2.6	0.8
Pen Plotting	3.3	3.2	0.1
Color Photo Realistic Imaging	3.0	2.8	0.2
Video Conferencing	2.4	2.2	0.1

Source: Dataquest (May 1993)

©1993 Dataquest Incorporated

Chapter 7
Findings and Recommendations

Vendor Recommendations

Many opportunities exist to develop a better solution based on newer technology and higher performance platforms. The users want more reliable software with improved integration among the modules, better data management, and enhanced design and analysis capability, particularly in the structural analysis area. The recommendation in this case is to design easy-build software with these qualities for the installed base and for new customers before the competition does.

Even with the poor economic trend in Europe, don't ignore this important market. Particularly outside of Germany, many companies are considering how to upgrade to the next generation hardware platform and software combination. Every vendor with high-performance 2-D drafting and design tools should put extra staff in the United Kingdom to help meet market demand. Those with high-performance 3-D/Solid Modeling-based products might ask why the interest in 2-D tools.

User Recommendations

Develop a technology enrichment plan that systematically removes old systems from use and replace them with the best of the best. The price competition common in this industry borders on insanity. The resulting marginal profit levels may not allow the vendors to make investments for R&D, high-quality product releases and high-quality services. In general, the leading vendors in broad or niche markets are systematically raising prices, protecting the R&D budget. The remainder of the vendor population is limping behind. If the available talent in one's product design and manufacturing environment can fully utilize the best technology, then take full advantage of the offerings from the leaders. If a less robust solution will fit the need, then price shopping can be effective to a point. We don't believe the world class manufacturing companies will be ordering their automation tools from a mail-order catalog.

Be aggressive in using this technology. The automation of a group effort is exponentially better than the incremental improvement of the individual. The leading manufacturing companies of the world have been working hard to understand this issue for at least the last five years. Everyone needs a plan supported from the top down.

Understand the full cost of ownership. Some vendors are clever in getting in the door with low installation fees and then charging high monthly service fees. Check a full three-year ownership and support-cost model. Size the tool for the job.

©1993 Dataquest Incorporated

Investor Recommendations

Find the people who understand this business and have demonstrated an ability to move with it.

The market needs to invest more than $10,000 for every engineer, designer, and technician on an annual basis for the foreseeable future. Overall, expenditures are below this level but are growing.

The design, analysis and manufacturing industry is becoming more complex, more diverse, and cross-pollinated with ideas from other technical applications. Developments in multimedia and virtual reality will have an impact on mechanical CAD/CAM/CAE. The next generation products will make any product more than five years old obsolete.

Education and training are perhaps the biggest stumbling blocks to the full potential of mechanical CAD/CAM/CAE. The users need to break through the mental mush of focusing on, "How do I get this command to work, or how to get this information to manufacturing?" Think about what is possible from a personal value-added scenario. Users need tools that help them do high-quality work more competitively. This may sound like the better mouse trap story, but a company like Parametric Technology with an 80 percent annual growth rate makes the point, find the next PTC.

©1993 Dataquest Incorporated

For More Information...

Mike Seely, Director, Principal Analyst .....(408) 437-8178
Via fax.....(408) 437-0292

The content of this report represents our interpretation and analysis of information generally available to the public or released by responsible individuals in the subject companies, but is not guaranteed as to accuracy or completeness. It does not contain material provided to us in confidence by our clients. Individual companies reported on and analyzed by Dataquest may be clients of this and/or other Dataquest services. This information is not furnished in connection with a sale or offer to sell securities or in connection with the solicitation of an offer to buy securities. This firm and its parent and/or their officers, stockholders, or members of their families may, from time to time, have a long or short position in the securities mentioned and may sell or buy such securities.

©1993 Dataquest Incorporated—Reproduction Prohibited

Dataquest is a registered trademark of A.C. Nielsen Company 0014892

Dataquest®

a company of The Dun & Bradstreet Corporation

Dataquest®

a company of
The Dun & Bradstreet Corporation

Corporate Headquarters
Dataquest Incorporated
1290 Ridder Park Drive
San Jose, California 95131-2398
United States
Phone: 01-408-437-8000
Facsimile: 01-408-437-0292

Dataquest Incorporated
550 Cochituate Road
Framingham, Massachusetts 01701-9324
United States
Phone: 01-508-370-5555
Facsimile: 01-508-370-6262

Invitational Computer Conferences (ICC)
3990 Westerly Place, Suite 100
Newport Beach, California 92660
United States
Phone: (714) 476-9117
Facsimile: (714) 476-9969

Dataquest Japan Limited
Shinkawa Sanko Building
1-3-17, Shinkawa, Chuo-ku
Tokyo 104
Japan
Phone: 81-3-5566-0411
Facsimile: 81-3-5566-0425

Dataquest Korea
Trade Tower, Suite 3806
159 Samsung-dong
Kangnam-gu, Seoul 135-729
Korea
Phone: 011-82-2-551-1331
Facsimile: 011-82-2-551-1330

European Headquarters
Dataquest Europe Limited
Roussel House, Broadwater Park
Denham, Uxbridge
Middlesex UB9 5HP
England
Phone: 44-895-835050
Facsimile: 44-895-835260/1

Dataquest GmbH
Kronstadter Strasse 9
8000 Munich 80
Germany
Phone: 011-49-89-930-9090
Facsimile: 011-49-89-930-3277

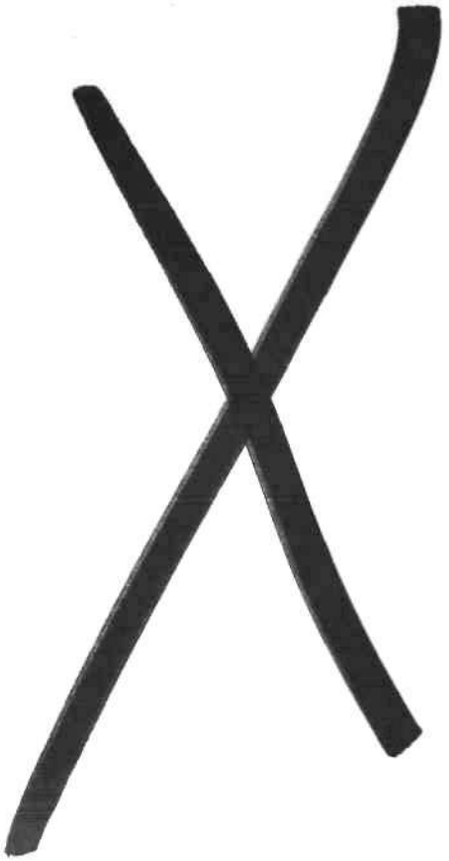
Dataquest Europe SA
Tour Gallieni 2
36, Avenue du General de Gaulle
93175 Bagnolet Cedex
France
Phone: 011-33-1-48-97-3100
Facsimile: 011-33-1-48-97-3400

Representative Agencies in
Bangkok, Hong Kong,
Kronberg, North Sydney,
Singapore, Taipei, and Tel Aviv

N04CMECWW CMECWWUW9301 BH: 1
Corporate Library
Dataquest Incorporated

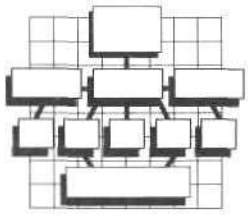
****
SJ - INTERNAL DISTRIBUTION
****

©1993 Dataquest Incorporated
0014892



Vendor Profiles

Dataquest®



Dataquest Vendor Profile

Software

INFORMATION RESOURCE CENTER
DATAQUEST INCORPORATED
1290 Ridder Park Drive
San Jose, CA 95131-2398
(408) 437-8600

Mechanical Applications Worldwide

Intergraph Corporation

Corporate Statistics

Location	Huntsville, Alabama
Chairman and CEO	James W. Meadlock
Number of Employees	10,300 (1992) (7,400 United States, 2,900 international)
1992 Corporate Revenue	$1.116 billion
1992 Software Revenue	$323.0 million
1992 Mechanical Software Revenue	$72.3 million
Founded	1969
1992 CAD/CAM/CAE Software Market Share	6.5 percent
1992 Mechanical Software Market Share	3.1 percent

Intergraph Corporation develops, manufactures, markets, and supports interactive computer graphics systems for the CAD/CAM/CAE/GIS markets. The company offers a complete line of computer systems, including workstations, servers, applications software, peripheral devices, and services. It is currently one of the leaders in the CAD/CAM/CAE/GIS market because of its diverse and comprehensive product line.

Corporate Overview and Market Position

Founded in 1969 as a consulting firm developing missile guidance software for the U.S. Army, the company changed its name to Intergraph Corporation (INTERactive GRAPHics) in 1980. Today the company ranks among the key players in the CAD/CAM/CAE/GIS market, with revenue increasing from $800 million in 1988 to $1.116 billion in 1992. Net income per share, however, has dropped substantially in recent years, from $1.47 in 1991 to $0.18 in 1992.

Recently released operating results for Intergraph's third quarter ending September 30 indicate quarterly revenue of $250.6 million as shown in Figure 1. This represents a decline of $52.0 million from the same period last fiscal year, with a loss of $19.9 million for this quarter. The company incurred $9.5 million in restructuring charges relating to the closing of manufacturing facilities, asset write-offs, and severance payments. This quarter's reduction of 94 manufacturing positions was the culmination of

a year-long evaluation of cost-cutting measures. In a move that represented the first layoff in the company's history, Intergraph let 100 employees go in 1992 from Dazix, an Intergraph subsidiary.

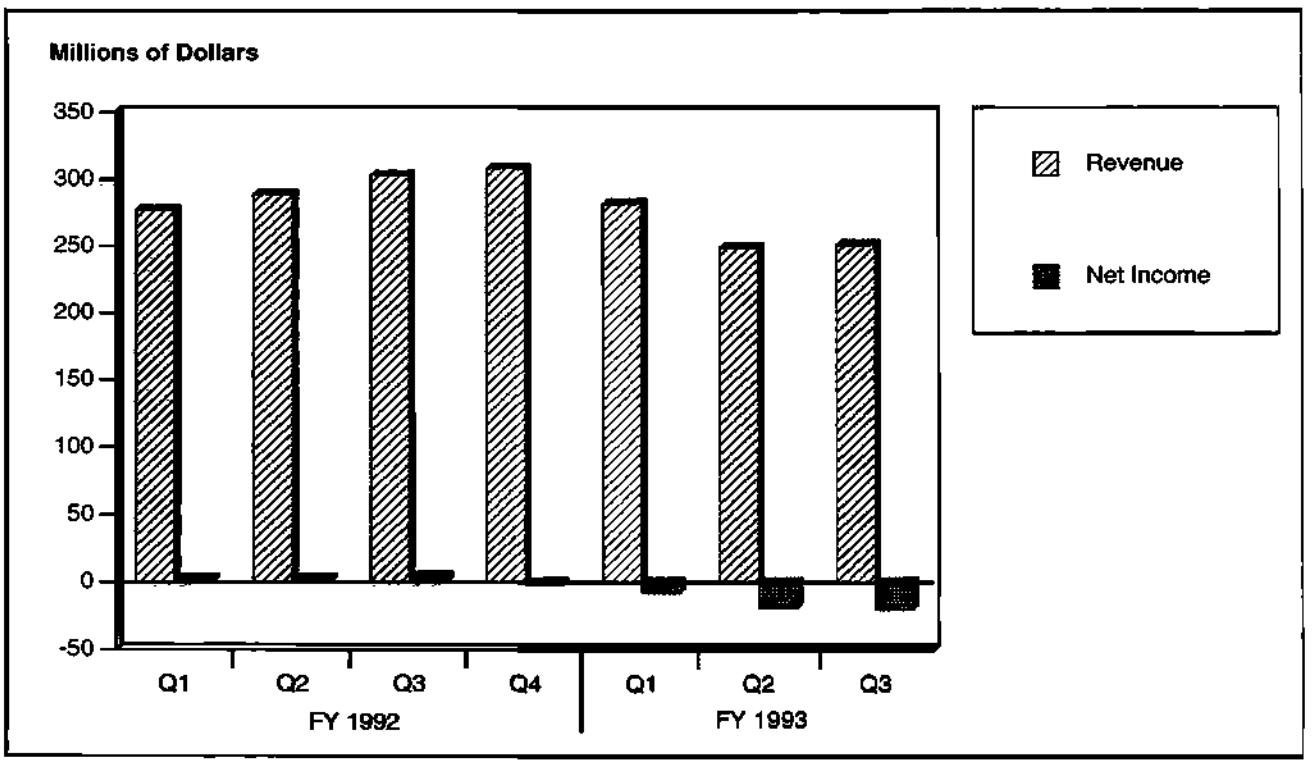
Growth rates and market share of Intergraph's application areas have varied considerably as seen in Table 1. The company derived nearly 80 percent of its 1992 software revenue from workstation applications and less than 15 percent from PC applications. More than half of its 1992 revenue came from sales outside of the United States. Revenue contributions for 1992 from the company's various divisions is shown in Figure 2.

One of Intergraph's greatest strengths revolves around the detailed attention it gives to its customers. The company has traditionally gone to great lengths to ensure customer satisfaction with Intergraph's products and will invest the necessary resources to develop a particular application to suit a customer's needs. As a result of this strategy, however, Intergraph finds itself supporting a multitude of software products.

Corporate Mission and the Move to Windows NT

Historically, Intergraph has focused its resources on proprietary systems technology. This label has stuck, despite Intergraph's movement away from the VAX-based proprietary software offered in the company's early days. In an attempt to definitively shed this proprietary image, Intergraph has embarked on a new marketing strategy. In June 1993, the company

Figure 1
Intergraph Quarterly Revenue and Net Income



Source: Intergraph

G3006096

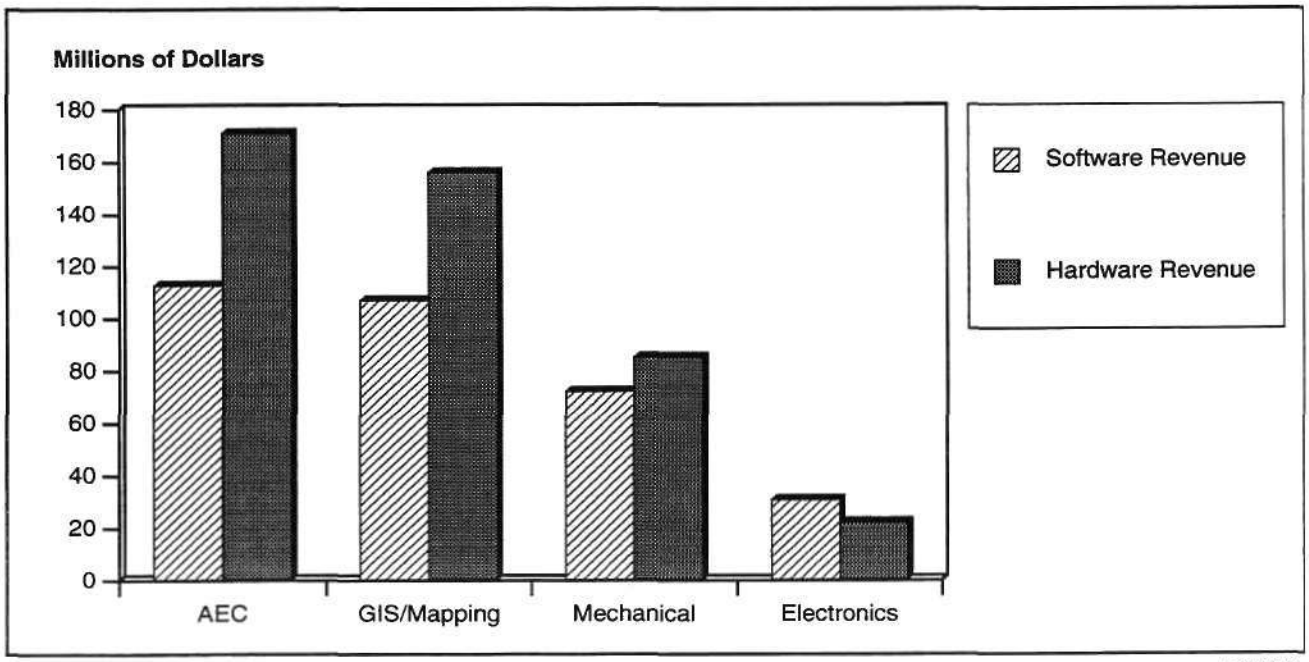
©1993 Dataquest Incorporated

Table 1
Intergraph Revenue Overview

Application	1991 Software Revenue ($M)	1992 Software Revenue ($M)	1991-1992 Revenue Growth (%)	1992 Market Share (%)	1992 Ranking
AEC	105.2	112.8	7.2	15.1	2
GIS/Mapping	94.1	107.0	13.7	17.7	1
Mechanical	50.1	72.3	44.3	3.1	7
EDA	30.8	30.9	0.1	2.4	7
All Applications	280.3	323.0	15.3	6.5	4

Source: Dataquest (November 1993)

Figure 2
Intergraph Revenue by Application



Source: Dataquest (November 1993)

G3006097

announced plans to deliver and support products on the Windows NT operating system. Product deliveries will begin with a Windows NT version of MicroStation, its low-end CAD/CAM product, scheduled for release on November 30, 1993.

While the company remains unequivocally committed to supporting products for the UNIX operating system for Sun and Intergraph workstations, going forward, all of its workstations will allow the user to choose between UNIX and Windows NT. Depending on the application, Intergraph will supply applications on Intel-based workstations, DEC Alpha Windows NT systems, and Intergraph RISC-based Windows NT workstations. Intergraph will also support Silicon Graphics' RISC-based workstations, which run SGI's UNIX variant, IRIX. For the same tools running on different platforms and operating systems, there will be no price difference between applications for the two operating systems. Intergraph is

 ©1993 Dataquest Incorporated

currently the largest independent development site for applications running under the Windows NT operating system.

While the lack of standardization in the UNIX environment has rendered the support of multiple hardware architectures expensive, the availability of Windows NT on multiple architectures enables hardware platform consistency, and as Intergraph Electronics Division Vice President of Sales and Marketing Jeff Edson believes, this will lower hardware prices: "Initially, the most compelling reason for users to look at Windows NT applications will be the price of hardware. For the first time, a workstation on every engineer's desk will be feasible." Portability among architectures is evolving as a key component of Intergraph's market strategy.

Finally, the addition of Windows NT technology is the impetus behind the company's higher profile at trade shows and press tours, promotional vehicles infrequently exploited by Intergraph's founder and Chairman, James W. Meadlock, who now grants more interviews to the trade press. Also, because the company is proactively seeking to shed its image as a proprietary solutions provider, it behooves Intergraph to promulgate its adoption of the Windows NT operating system as frequently as it can.

Sales Channels Organization

The company's headquarters are located in Huntsville, with regional sales and support offices in 49 other countries, and a Federal Systems Division that sells to government agencies around the world. The regional offices are grouped into four territories, each with its own headquarters. Additionally, Intergraph Electronics Division has its own sales channel.

With the decision to create Windows NT product offerings, the company has galvanized to expand its direct and indirect channels. Intergraph's direct U.S. sales force has been reorganized along industry lines (such as government, utilities, transportation, electronics, and manufacturing), emulating its European channels model that has been in operation for three years. This "industry solutions" approach to distribution reinforces Intergraph's time-tested approach of providing a comprehensive CAD/CAM/CAE/GIS solution, including hardware, software, service, and support.

In addition to a direct sales force, Intergraph has been opening its doors to the outside world by expanding its value-added reseller (VAR) network. VARs have traditionally only sold MicroStation, its low-end solution, but will now be selling some of Intergraph's core high-end products and applications. In 1992, VARs contributed less than 5 percent to the company's sales; the goal is to expand this contribution to about 25 percent by 1995. In conjunction with the expanded VAR network, Intergraph has been creating partnerships with distributors that in turn, distribute the products to qualified resellers.

Recent Alliances—A Move Toward Open Systems

In an attempt to shed some of its proprietary image, Intergraph has forged several relationships with highly visible partners—among them Microsoft

 ©1993 Dataquest Incorporated

and Sun Microsystems. In July 1993, Intergraph announced an alliance with Sun to develop the next generation of SPARC processors and to help port the Windows NT operating system to the Sun SPARC hardware platform. Under this agreement, both companies will have the right to use the 64-bit processor in system-level products. As much as the company asserts that there will be at least two more releases of the Clipper hardware architecture, the SPARC development effort clearly implies a smooth migration of resources away from Clipper.

Also, last year the company released Technical Desktop 1 (TD•1), a workstation based on Intel Corporation's 486 microprocessor running DOS instead of Intergraph's proprietary Clipper microprocessor operating its own special version of UNIX, known as CLIX UNIX.

Intergraph Mechanical Division

In 1992, revenue for the mechanical division comprised approximately 22 percent of total software revenue for Intergraph, although Intergraph's share of the total mechanical CAD market was approximately 3 percent last year. However, with an annual revenue growth rate of 44 percent for 1992, mechanical software represented the fastest growing of all Intergraph's applications last year. Hardware sales continue to comprise a significant portion of total mechanical revenue, as depicted in Figure 3. The EMS (Engineering Modeling System) software product for mechanical design automation continues to drive mechanical product sales with its integrated tools for computer-aided design, engineering, manufacturing and product data management (PDM).

As seen in Table 2, Intergraph's mechanical market share for 1992 varies significantly by region and platform.

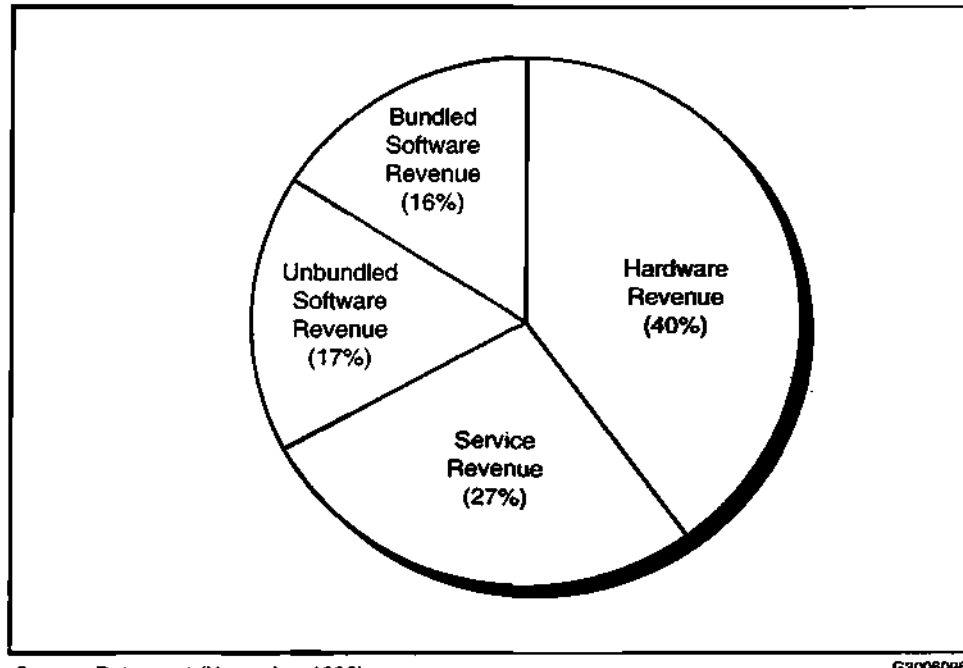
Table 2
Intergraph's 1992 Mechanical Software Market Share by Region and Platform

Region	Platform	Market Share (%)
Rest of World	Technical Workstation	9.1
North America	Technical Workstation	8.1
North America	Server	4.4
Rest of World	Personal Computer	4.3
Europe	Server	3.9
North America	Personal Computer	3.9
Europe	Technical Workstation	3.9
Rest of World	Server	3.2
North America	Host Dependent	2.9
Rest of World	Host Dependent	2.6
Asia	Server	1.5
Asia	Technical Workstation	0.9
Asia	Personal Computer	0.4
Asia	Host Dependent	0.2

Source: Dataquest (November 1993)

 ©1993 Dataquest Incorporated

Figure 3
Intergraph Mechanical Worldwide Revenue for 1992



Source: Dataquest (November 1993)

G3006098

Mechanical Product Offerings

CAD/CAM Software

The I/EMS mechanical design, engineering, and manufacturing suite consists of drawing, drafting, product management, kinematics, and plastics analysis package modules. EMS provides a designing solution that streamlines the concurrent engineering process by linking all product development information from design constraint drawings and drafting to solid geometry via its PDM module so that every change made during the design stages is automatically reflected in all the related data.

The focus of the division continues to be the I/EMS line. In March of 1993, the company implemented a new product strategy by unbundling the EMS line into separate functional modules that can be purchased separately (see Table 3). Modularization of the EMS line has lowered the entry price point from $20,000 to $9,900 for EMS Foundation, the core for all other modules. Intergraph hopes that customized solutions and increased functionality will help to increase its user base in markets where price has been a barrier to penetration. Intergraph has also bundled some of its key EMS components into prepackaged solutions for design tasks: EMS Cornerstone (includes the Foundation, Detail, Advanced Features, and I/DXF modules) for modeling and detailing without freeform geometry; EMS Modeler (includes Foundation, Advanced Features, Freeform, and I/DXF) for modeling with freeform capabilities, and EMS PowerPak (includes Foundation, Advanced Features, Freeform, Detail and I/DXF), a comprehensive toolset for mechanical design engineering.

 ©1993 Dataquest Incorporated

Table 3
Intergraph's EMS Product Modules

Product	Function
EMS Foundation	Core modeling for EMS Family including parametric, variational, and feature-based design
EMS Freeform	Sculptural and functional freeform surface, and solid geometry
EMS Advanced Features	Productivity tools for 3-D design
EMS Detail	Tools for engineering drawings from 3-D models
EMS Revise	Links EMS with data from hard-copy drawings
I/Render	Provides shading and rendering
I/DXF	Provides porting of files into EMS design environment

Source: Dataquest (November 1993)

Product Enhancements

At Autofact '93 in November, Intergraph demonstrated its latest version of EMS, EMS 3, which includes the following major enhancements:

- SmartSketch—A new utility that provides profile creation and constraint definition
- Machine language output—Which creates machine-ready code from graphic toolpath for manufacturing
- EMS PCB Integrator—An interface providing two-way transfer of designs

EMS 3 will ship in January at an entry price of $9,900. With its new features, EMS may be the best candidate to enhance Intergraph's reputation as an integrated mechanical solutions provider.

Microstation—Mechanical Applications

MicroStation, a low-end computer-aided design software package, has several application packages in the mechanical area for design, analysis, and manufacturing, although MicroStation is a separate product division at the company. Intergraph has worked with third-party developers such as Rasna Corporation, CAD Technology Corp., and Pathtrace Systems Inc. to provide a variety of solutions that operate in conjunction with the company's software solutions to afford users the most cost-effective customized solutions. MicroStation applications operate mostly on the PC platform, whereas 86.4 percent of the company's Mechanical Division revenue was from applications that operate on a technical workstation.

Hardware Platforms

Intergraph's mechanical software currently runs on Clipper UNIX (Intergraph's proprietary hardware solution) and Sun UNIX with commitments in place to deliver applications to run on Silicon Graphics UNIX (by the end of the fourth quarter of this year) and Clipper/Intel Windows NT and DEC Alpha Windows NT sometime in early 1994.

 ©1993 Dataquest Incorporated

Mechanical Strategy and Windows NT

Although Intergraph plans to make its mechanical applications available on Windows NT in the last half of 1994, its current focus remains on the EMS 3 product. However, according to Barry Nance, director of marketing and pre-sales support for the Mechanical Division, Intergraph is committed to its investment in Windows NT: "The transition to NT is a portability issue ... it reduces overhead and it allows more applications to be run than on UNIX. But the mechanical focus is not on NT right now. We will move to NT much slower than the other divisions by letting them pave the way for the transition. With the new EMS 3 product supporting open GL on UNIX, the mechanical group is not ready to be the NT pioneer for the company." Given Intergraph's current ranking, an increase in market share requires a victory among the market's entrenched UNIX base.

Yet, the company is banking on the future promise of Windows NT. Specifically, Windows NT will promote portability between architectures, and it is primarily this capability that Intergraph believes will convert market potential into market share. As stated, Intergraph believes that it must first succeed with EMS 3 as a UNIX solutions provider, and the EMS 3 product has some formidable features with its roughing functions, mold techniques, and SmartSketch drawing capabilities. Once it has successfully overcome its image as a pricey, AEC company, the availability of Windows NT applications for mechanical products will provide a bridge to a new base of users on other hardware platforms on which the company may be able to capitalize. For now, Intergraph envisions a coexistence for some time among the operating systems and consequently plans to price its Windows NT software the same as its UNIX application software.

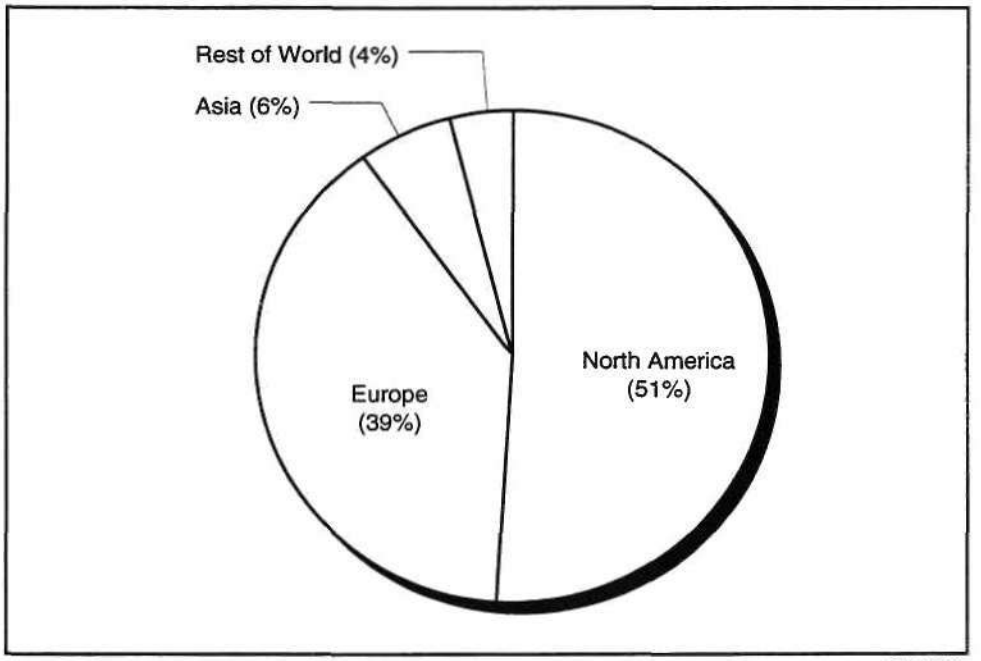
It is the belief of Dataquest, however, that Windows NT faces some obstacles to rapid adoption. As mentioned in Dataquest's annual Mechanical Applications *MarketTrends* publication, Windows NT offers no significant improvement in performance over UNIX thus far. To catalyze propagation of the operating system throughout the mechanical CAD world, Microsoft must first demonstrate a tangible price/performance benefit at the system level.

Future Directions

Intergraph has established several partnerships with its mechanical technology that augur well for the company. First, in an effort to expand its mechanical line indirect sales channels, the company has entered into a liaison with Control Data Systems as a VAR for its EMS products. CDS will sell the software under the ICEM product name and use the EMS software formats in its CDS product. This move is consonant with the corporate goal of increasing VAR sales contribution to 25 percent by 1995. In 1992, VARs comprised 7 percent of the Mechanical Division's software sales, whereas direct sales accounted for 93 percent. Half of its sales occurred in North America (see Figure 4), though Europe boasted the highest revenue growth last year, as shown in Figure 5.

 ©1993 Dataquest Incorporated

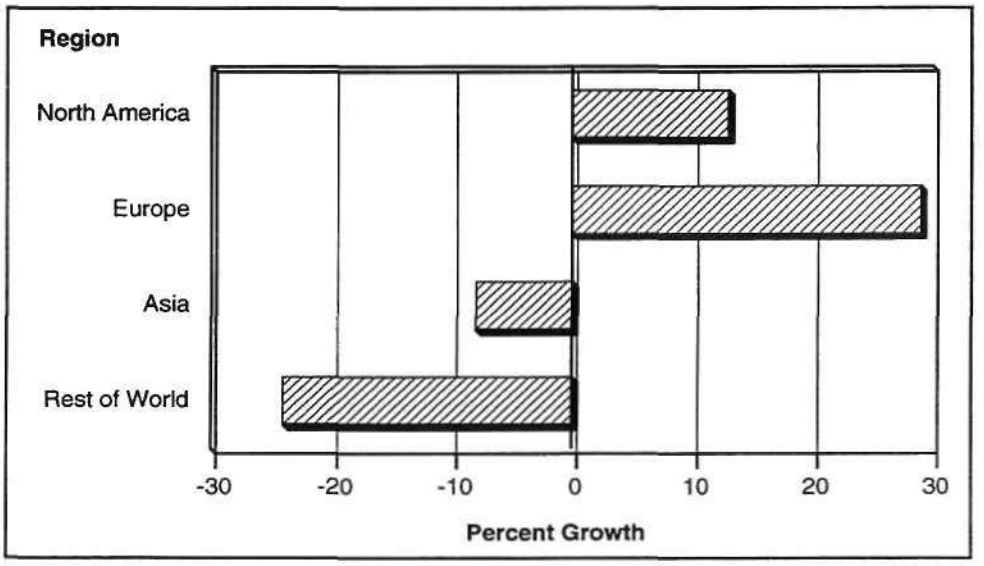
Figure 4
Intergraph Mechanical 1992 Sales by Region



Source: Dataquest (November 1993)

G3006099

Figure 5
Mechanical Revenue Growth by Region



Source: Dataquest (November 1993)

G3006100

©1993 Dataquest Incorporated

On the medical science frontier, Intergraph has teamed up with Surgicad Corporation in New Hampshire to develop and introduce Surgicad Design, a vanguard software package for 3-D medical visualization and implant modeling, which reduces the time for implant design. The company feels that its 3-D modeling technology is a logical fit with the medical industry and that the synergy provided by combining medical imaging with CAD tools could revolutionize orthopedic surgery, radiology, and implant device manufacturing.

Dataquest Perspective

Albeit the company has endured some fiscal challenges in the last several quarters, Intergraph has taken a step in the right direction with its decision to abandon its reliance on proprietary systems and move toward open systems technology. The stigma of proprietary technology, however, is being lifted by its announced plans to port all of its technical applications to Windows NT. Clearly, this sets a new tone for the company. Although the move to Windows NT has less of an immediate impact in the mechanical arena, the ramifications of the new strategy seem to suggest a strong future. EMS 3 is a well-integrated, full-functional product and the company is poised for an aggressive attack of this market. But several issues must first be considered in the battle plan. How will the positioning of the Windows NT offering evolve relative to the successful UNIX offering? How will other partners be brought into the team to add new application expertise or synergistic offerings? What will the non-CAD-related Windows NT market expansion offer in terms of new opportunities? The answers to these questions will influence the success of the mechanical products division into the next millennium.

 ©1993 Dataquest Incorporated

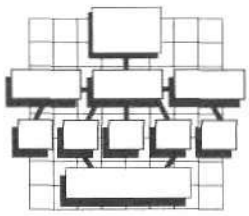
N04CMECWW CMECWWVP9302 BH: 1
Corporate Library
Dataquest Incorporated

****
SJ - INTERNAL DISTRIBUTION
****

For More Information...
Kathy Klotz, Industry Analyst ..... (408) 437-8243
Via fax ..... (408) 437-0292

This profile is the property of Dataquest Incorporated. Reproduction or disclosure in whole or in part to other parties shall be made upon the written and express consent of Dataquest. This report shall be treated at all times as a confidential and proprietary document for internal use only. The information contained in this publication is believed to be reliable but cannot be guaranteed to be correct or complete.
©1993 Dataquest Incorporated—Reproduction Prohibited
Dataquest is a registered trademark of A.C. Nielsen Company 0015441

Dataquest®
a company of The Dun & Bradstreet Corporation



Dataquest Vendor Profile

Software

INFORMATION RESOURCE CENTER
DATAQUEST INCORPORATED
1290 Ridder Park Drive
San Jose, CA 95131-2398
(408) 437-8600

Mechanical Applications Worldwide

IBM Corporation

Corporate Statistics

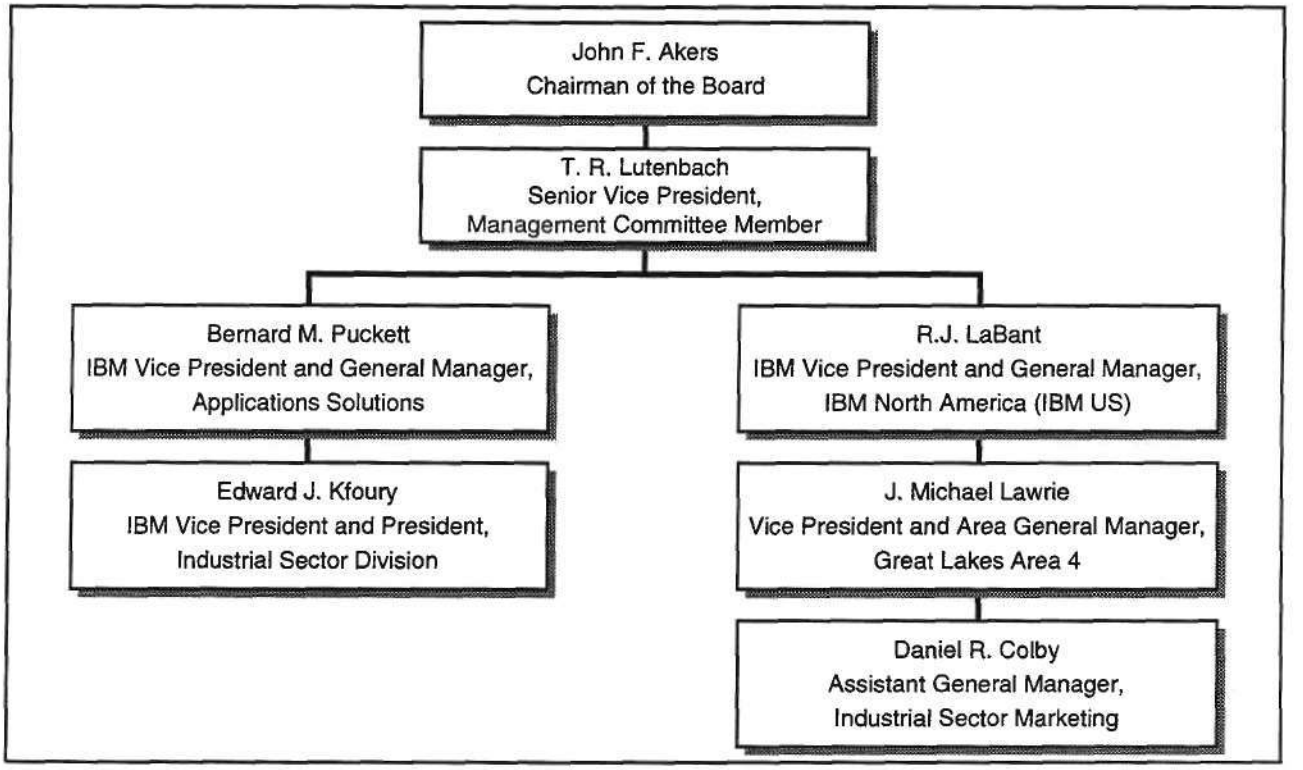
Location	Armonk, New York
CEO (acting), President, and Chairman	John F. Akers
Number of Employees	344,396
Number of IBM CAD/CAM/CAE Specialist and Marketing Personnel	More than 9,500 worldwide

The winds of change are blowing in Armonk at gale force 9. John F. Akers has resigned as CEO after seven years at the helm, and the hot seat is scheduled to be filled before the end of May. President Jack Kuehler and CFO Frank Metz also have stepped aside. More cuts in head count are expected, mostly targeted in the sales, general, and administrative areas. For the first time, hardware revenue has dropped below 50 percent of total revenue, with a decline in revenue growth of 10 percent. Fortunately, the nonhardware-related revenue is increasing and the growth rate is positive. The rate of change in this company is beyond imagination, but the company is weathering the storm and will evolve into a more agile and aggressive operation. The next six months will define the future of IBM as a world leader in the computer business.

The software component of IBM business is aimed at the full spectrum of business and technical applications. IBM's $15 billion operation, about five times the size of Microsoft in software sales, is difficult to characterize. The organizational chart (see Figure 1) illustrates some of the complexity and diverse nature of this business. The CAD/CAM/CAE portion of this business is estimated at just less than $2 billion in hardware, software, and services revenue in 1992. This is a strategic business area supporting other ventures in the shop floor, data processing, and enterprisewide computing services.

In a recent interview, Mr. Akers said, "Our financial results are not acceptable to us or to our shareholders." He then went on to add, "We are taking aggressive actions to improve our competitiveness and profitability by addressing the accelerating changes that are sweeping our industry, while adjusting for weakened business conditions throughout the world. These actions include reallocating resources to growth businesses, increasing the autonomy of our businesses, and reducing

Figure 1
IBM Corporation—Executive Management for Industrial Sector



Source: IBM Corporation G3000175

costs." Dataquest believes that the IBM strategy of investment in growth businesses will include CAD/CAM/CAE/GIS. This technology is a fundamental component of the reengineering taking place in the United States and around the world.

This vendor profile is focused on several primary issues. The result of massive organizational changes (still in progress) is shown with the impact on CAD/CAM/CAE business. Most of the significant changes in the CAD/CAM/CAE area appear to have been made. A complete analysis of the revenue profile in the CAD/CAM/CAE business is given with growth analysis. And finally, we provide a description of the partnership arrangements with strategic direction assessment in the major CAD/CAM/CAE application areas.

Corporate Overview

IBM is the world's largest supplier of information technology to business and government enterprises. IBM designs, manufacturers, sells, and supports a wide range of information processing systems, including mainframes, minicomputers, workstations, personal computers, operating systems and application software, display terminals, storage devices, communications systems, printers, typewriters, educational and training materials, and related supplies and services.

 ©1993 Dataquest Incorporated

IBM's corporate revenue experienced a 0.6 percent decrease between 1991 and 1992, from $64.8 billion to $64.4 billion (see Table 1). In most areas of its businesses, IBM experienced tough competition and felt the impact of a slumping world economy. The company response to this increased competition and economic pressure is to streamline operations, reorganize into functional business units, and reduce overhead.

Table 1
IBM Total and CAD/CAM/CAE Revenue, 1991 to 1992

Fiscal Year (January to December)	IBM Total ($B)	CAD/CAM/CAE Total Factory ($B)	CAD/CAM/CAE Total Software ($M)
1991	64.8	1.71	379
1992	64.4	1.77	418
Percentage Change	-0.6	3.5	10.4

Source: IBM Corporation

IBM was one of the first computer companies to get involved with CAD/CAM/CAE applications, beginning in the early 1970s. The first mainframe installations using CADAM software have been the foundation of this growing and significant business activity for IBM. With this early success, IBM began supplying a large set of design, documentation, and manufacturing tools with almost every major manufacturing company.

IBM strengthened its position by first acquiring CADAM Inc., then selling a part of the company to dassault systemes (CADAM Host and Professional CADAM) in return for an equity position. This agreement has been further complemented by a key nonexclusive marketing arrangement with SDRC for the last 11 years.

Other business relationships have been made in the last several years to further strengthen the overall tool set available to users of the IBM, CATIA, and CADAM environment. Each of these products is bundled with interface and integration supplied by IBM, and each brings a world class component of software technology to assist the engineer or designer in everyday work problems.

The unbundled side of the business has developed relationships with many of the other leading software vendors to further expand the IBM hardware business opportunities. This has the benefit of bringing a larger set of software tools into the IBM camp and reducing the potential loss of hardware revenue due to customer preference for a software product other than CATIA or CADAM.

Corporate Organization

The CAD/CAM/CAE business activity is developed and marketed by two separate business entities. The development responsibility falls in .

 ©1993 Dataquest Incorporated

the Applications Solutions Business, which is one of nine worldwide manufacturing and development businesses. The marketing role is taken by IBM United States, which is one of five marketing and services companies. Both are led by the management committee comprised of four members, including Mr. Akers.

Figure 1 illustrates the highest levels of the corporate structure for the CAD/CAM/CAE business. Significant changes are taking place at all senior levels of management. Bernard Puckett is responsible for the Applications Solutions group, which manages worldwide market segments, including all industry market segments such as finance, insurance, manufacturing, and other selected segments such as image and technical computing. This group also develops offerings for those segments, including application software and specialized hardware; supports the development of new businesses, such as multimedia and consulting practices; and leads IBM's services businesses worldwide. The Industrial Sector division, led by Edward J. Kfoury, has development responsibility for all applications in the industrial sector.

The group responsible for marketing is led by R. J. LaBant. This organization includes Areas/Trading Areas, Federal Systems Co., National Distribution Division, Integrated Systems Solutions Corporation, Employment Solutions Corporation, and EduQuest. From a management standpoint, this organization is chartered with the sales and support activity for all IBM CAD/CAM/CAE customers. This group, which is centered in the Midwest, is close to the critical mass of CATIA and CADAM users in the United States and works closely with dassault systemes services to service the installed base.

Table 2 shows both the development and marketing organization for the Industrial Sector Division. The development group, led by Robert M. Williams, is responsible for all internal product development, for developing and maintaining all business relationships with outside software developers, Strategic Development Partners, and other potential partners.

The marketing group, led by Daniel R. Colby, is chartered with the task of strategic direction, implementation strategies, and bringing the message to the marketplace as the focal point for all IBM-driven CAD/CAM/CAE. This group works closely with other CIM marketing efforts to develop a working relationship of capability as more IBM users evolve into concurrent engineering operations. John D. Sarsgard has responsibility for all marketing activity for engineering applications including CAD/CAM/CAE, third-party marketing and business partner solutions. Besides providing the classic role of marketing, this group operates an extensive national pre- and postsales support organization. The customer support group is centered in Dallas, with experts located in other locations, depending upon customer or employee requirements. The primary sales support group is in Los Angeles. Hotline support is maintained with a question and answer online system.

 ©1993 Dataquest Incorporated

Table 2
Industrial Sector Development and Marketing Organization

	Industrial Sector Development
Edward J. Kfoury	IBM Vice President and President, Industrial Sector Division
Tom Krywe	Vice President, Operations
John Klein	Vice President, Worldwide Market Selection and Market Development
Bjorn Andersen	AS Director, CIM Architecture and Integration
Jim Stifler	Vice President, Industrial Sector Consulting Services
Robert M. Williams	Vice President, Worldwide Development
P.J. (Patrick) O'Neil	Development Advisor
Don A. Nelson	Manager, Engineering Development
R.A. (Bob) Munro	Manager, Business Planning
Joe Kaddis	Manager, Development Operations
Dick Cook	Lab Director, CIM Development Atlanta/Houston
Jimmie Warren	Lab Director, Plant and Production Operations Development
Ken West	Program Manager, Support Delivery
Niel Horikoshi	Staff Counsel
Barbara Young	Manager, Product Assurance/Strategic Skills Assessment
John E. Sims	Manager, CATIA Product Management
Wesley E. Miga	Manager, CATIA Acceptance
Michael R. Zick	Manager, CATIA Application
R.A. (Rich) Arco	Manager, Engineering Development—Kingston
Mark Z. Solomon	Manager, AEC Application Development
Alan C. Larsen	Manager, CAEDS Development Support
E.I. (Beth) Sulander	Manager, Framework Development
T.A. (Tom) Gezo	Manager, VALISYS Development Support
Randy A. Tamura	Manager, Engineering Development—Santa Monica
Daniel P. Bell	Manager, Administration/IS Services
Timothy N. Teigler	Manager, CAD/CAM Vendor and Support
R. B. (Bob) Jones	Manager, CADAM Liaison
S. L. (Sherrie) Panozzo	Manager, Graphics Program Support
Richard A. Rizzo	Manager, Graphics Program Support
Hasan G. Erbay	Manager, Data Exchange Development
Frank G. Xiong	Manage, Graphics Department
S. R. (Robert) Chang	Manager, IGES Development
Ralph Rea	Manager, Numerical Control Development

(Continued)

 ©1993 Dataquest Incorporated

Table 2 (Continued)
Industrial Sector Development and Marketing Organization

	Industrial Sector Marketing
Daniel R. Colby	Assistant General Manager, Industrial Sector Marketing
John D. Sarsgard	Director, Engineering Solutions Marketing
H. J. (Shen) Baxter	Manager, Business Partner Solutions
John D. Bennett	Manager, Marketing Support
(Open)	Manager, National Marketing Programs
Ed C. Riedinger	Manager, Marketing Support Services
J. M. (Mike) Robertson	Manager, Mechanical CAD/CAM Marketing
Lee W. Jorgenson	Manager, CAEDS/IBM CAD/Micro CAD Marketing
Chuck W. Masur	Manager, CAD/CAM Software Marketing
Chuck E. Page, Jr.	Manager, Valisys/Engineering Prods H/W Marketing
Ralph E. Springer	Manager, CATIA/CADAM Host and W/S Marketing
Michael A. Barney	Program Manager

Source: IBM Corporation

The key executives in this organization, who are fundamentally responsible for content and direction of the CAD/CAM/CAE business, include Mr. Kfoury, Bjorn Andersen, Mr. Williams, Mr. Colby, and Mr. Sarsgard.

Company Financials

The financial model in the CAD/CAM/CAE business area is very complex, with many strategic development relationships, distribution agreements, and joint marketing projects.

Table 3 shows the breakout of CAD/CAM/CAE-related revenue. These applications define the total CAD/CAM/CAE/GIS market. Total factory revenue is defined to be the amount of money received for goods, not including revenue for products sold to another company for resale (OEM). Software revenue comes from bundled or unbundled sales. The percent change from 1991 to 1992 is shown for both total factory revenue and software revenue.

 ©1993 Dataquest Incorporated

Table 3
IBM's CAD/CAM/CAE/GIS Revenue (Millions of Dollars)

	1992 Total Factory	1992 Total Software	Percentage Change 1991 to 1992 Total Factory	Percentage Change 1991 to 1992 Total Software
Application				
Mechanical	1,472.5	387.0	6.6	8.3
AEC	182.2	40.5	0.9	7.8
GIS	93.8	15.7	-6.6	2.8
EDA	112.7	20.8	2.6	4.1
Total	1,861.2	464.0	5.0	7.9
Platform				
Host-Based	957.9	253.8	-1.9	-1.9
Workstation	341.8	85.8	40.0	40.1
Server	293.2	71.0	19.8	20.9
Personal Computer	268.3	53.4	-12.6	4.0
Region				
Europe	843.7	201.3	7.3	10.5
Asia	509.9	138.1	-5.7	-3.2
North America	481.4	120.6	14.9	18.6
Rest of World	26.3	4.1	-3.2	8.2

Source: Dataquest (February 1993)

Applications

The CAD/CAM/CAE business of IBM is dominated by the mechanical application area. At more than 83 percent of the total, mechanical applications are expected to continue to lead the product mix for the foreseeable future. CATIA is the keystone of this marketing effort. All add-on software from strategic development partners will enhance the basic CATIA functionality. CADAM is stepping out from under the IBM umbrella by porting its low-end products to other vendors' platforms. This provides an interesting mix of bundled products with enough overlap and synergy to meet the most discerning user. Many of the CAD/CAM/CAE software market leaders including AutoCAD, ESRI, MacNeal-Schwendler, and PDA Engineering have ported to one or more of the IBM platforms.

Platforms

Host-based systems still support 54 percent of the software business. This is expected to be the most vulnerable part of the business in the next few years. Massive interest in desktop solutions with lower cost per unit expectations will further erode the host-based solutions position. Technical workstation and server growth was very high, reaching more than 40 and 20 percent, respectively. Personal computers had negative

 ©1993 Dataquest Incorporated

growth in revenue due to rapidly falling price pressure. The technical workstation is expected to lead revenue growth in the near future.

Regions

Europe is the largest regional market, followed by Asia, and then North America. The European and Asian markets have historically been large users of host-based systems, showing above-average revenue growth. The North American market gained some market share with a higher revenue growth for 1992. Fluctuation in currency valuation in the year tended to reduce the actual value of this growth. Growth in domestic and overseas markets will be determined by changing preferences in platform mix and evolution in local application requirements.

Business and Product Strategy

Mission

IBM's mission is to remain the dominant worldwide provider of CAD/CAM/CAE systems. To accomplish this, IBM has selected markets where it has a significant market share and is working to expand the base. This is being accomplished by systematic investments in mission-critical application software and value-added application software. This leverages the information generated to run the core business with ancillary business or technical applications.

Strategy

IBM is working to create complete product offerings that meet the varied needs of design and manufacturing customers. CATIA is used as the centerpiece or keystone product. CATIA's recognized strengths in 3-D applications are being leveraged by continued development of existing and new applications, and development of an open software architecture designed to support internal and external enhancement. This is intended to allow the existing customers to use their base of design expertise in new ways, rather than require them to start over from scratch. This is difficult to measure, but an important element of the strategy exists in the IBM operating system environment that is enhanced to provide leverage or competitive advantage for the software user and developer.

Industry Focus

The automotive and aerospace industries are strategic to the success of IBM's future CAD/CAM/CAE business. The large installed base in these industries has become a stepping stone of growth in two directions—protecting the existing installed base and pushing into new markets. Tremendous effort is directed toward protecting this installed base with directed customer support and needs analysis. The products developed to meet the needs of these complex and dynamic industries are then being used to push into other industrial markets. New strategic business partners may assist this growth into nontraditional industrial markets. The skills of industry-specific marketing business partners apply to large and small business opportunities.

 ©1993 Dataquest Incorporated

Large Enterprise

A strategic business element focuses attention on key large customers by careful requirements analysis and the process of mutual business alliance. An extensive investment in IBM hardware, software, and service buys some influence over the strategic directions of hardware and software development. IBM uses these accounts to showcase the solutions offered and encourages these accounts to publicize their success. Companies such as Boeing, Honda, Chrysler, Black and Decker, Lockheed, Rockwell, and Snap-On Tools are often mentioned in this context. Extended enterprise relationships are used to grow the installed base by further penetration into supplier companies and industries.

Smaller Operations

It is risky to look only to the large account for direction and requirements specification. The lessons learned in a complex enterprise can be scaled to meet the needs of a small operation. IBM is using its smaller customers to help influence product content, packaging, usability, and terms and conditions. The level of success IBM attains with smaller operations will measure its ability to remain No. 1 in the mechanical CAD/CAM/CAE market. The competitive dynamics of this market are more tactical and less strategic than for larger companies. The solutions installed must operate effectively and quickly. These competitive pressures will force the ability to recognize and meet the needs of a quickly evolving market.

Strategic Development Partner Relationships

The IBM Strategic Development Partner relationships, in general, follow a simple strategy. A vendor will develop a product for IBM with minor customization to make the software product somewhat unique in an IBM environment. This might entail an enhanced user interface to operate efficiently in a VM or AIX environment. It might add features or develop a seamless interface with CATIA or CADAM for compatibility. In return for this, the vendor would receive an investment in the company, giving IBM a minority ownership position. IBM in turn would sell and provide all customer support services for installation, training, and follow-up. The developer receives a royalty payment for each transaction. Usually, the support, training, and follow-up services represent about the same revenue stream as the initial software purchase.

Table 4 shows the estimated revenue distribution of IBM software revenue for each major Strategic Development Partner. Clearly dassault systems is committed to this relationship with 100 percent reliance on IBM as the only sales channel. CADAM is doing almost half of its business through IBM, the rest in direct end-users sales. SDRC operates on all major platforms. As the developer of CAEDS, this OEM relationship contributes about 15 percent to SDRC's overall software business. This represents a solid and reliable business component but clearly positions SDRC differently from dassault and CADAM. The other SDP's represent a significant and growing share of the business. Each brings a unique or strategic application supporting the leading software offerings.

©1993 Dataquest Incorporated

Table 4
Strategic Development Partners' Revenue Distribution in 1992

Company	Share of Total IBM Software Revenue (%)	Software Business Share with IBM (%)
dassault systemes	41	100
CADAM	45	48
SDRC	5	15
Others, including Accugraph, ICAD, PDA Engineering, Thomson Digital Image, and Valysis.	9	-

Source: Dataquest (February 1993)

Several other types of business relationships have been defined to provide varying amounts of support and development between IBM and the software vendor. The most relevant to this analysis of the CAD/CAM/CAE/GIS business environment are described and listed in Table 5. Hundreds of other software vendors have products that can be used on one or more IBM platforms, but they have not developed a Business Partner (contractual) relationship with IBM. Table 5 lists many of the leading Industry Remarketers, Application Specialists, Industry Application Specialists, and Cooperative Software Suppliers.

- The Industry Remarketers (IRs) are independent companies that buy designated products from IBM and add value with their own industry-specific offerings. These remarketers then market, install, and otherwise support the IBM product, including IBM software. IRs set their own prices and their own terms and conditions.
- The Application Specialists (ASs) are organizations that generally operate within a local area and have expertise in one or more industries. They are selective, contracted, assigned, and paid by local IBM branch offices to assist IBM marketing personnel in marketing and installing IBM hardware, along with either IBM or their own software. They may also engage in joint marketing activities with IBM personnel.
- The Industry Application Specialists (IASs) are regional or national organizations that combine marketing and installation capabilities with specific industry expertise and vertical application software. Some may support IBM application software. Still others may offer specific skills in such areas as system connectivity or competitive conversions. Once selected, IBM Industry Marketing works closely with the company to develop market exposure. The decision to use an Industry Application Specialist is made by the local IBM branch office, which also pays the fees.

©1993 Dataquest Incorporated

Table 5
Industry-Sponsored Business Partners for CAM/CAM/CAE/GIS

Company	IBM Relationship
Accugraph Corp.	CSS
Advantage Computing	AS
Aerobotics	IR/IAS
Alias America Corp.	IR
Balrae Associates	IR
Bechtel Software Inc.	IR
Cadence Design Systems Inc.	IAS
Cadtronics	IR/AS
CGTech	AS
Cimage Corp.	AS
Cimlinc Inc.	AS
Cimplex Corp.	AS
Computer Design Inc.	CSS
Computer Design Services	IR/AS
Communication Technical Systems	IR
Computer Aided Design Software Inc.	AS
dassault systemes services	IAS
Dickens Data	IR/IAS
DSP Development Corp.	AS
Entre Computer Center	IR
ESRI Inc.	IAS
FAB Consulting	IA
FCI	IR
Formtek Inc.	CSS
GeoVision Systems Inc.	IAS
Grumman	IR/AS
Integrated Systems Development	IAS
Integrated Systems Technologies	IR/IAS
Les-Work Computer Aided Design	IR
Lexmark	IAS
The MacNeal-Schwendler Corp.	AS
MCS	AS
Mission Systems Technologies	IR/AS
Norwood & Williamson	IR/AS
Parametric Technology Corp.	AS
PDA Engineering	AS
SDRC	IAS
SEMCOR	IR/AS

(Continued)

©1993 Dataquest Incorporated

Table 5 (Continued)
Industry-Sponsored Business Partners for CAM/CAM/CAE/GIS

Company	IBM Relationship
Stone and Webster	IAS
Swanson Analysis Systems Inc.	IAS
UES	AS
Valid Logic Systems Inc.	IAS
Valisys Corp.	AS
Viewlogic Systems Inc.	IAS

IR = Industry Remarketer
AS = Application Specialist
IAS = Industry Application Specialist
CSS = Cooperative Software Supplier
Source: IBM Corporation

- Cooperative Software Suppliers (CSSs) enter into contracts for IBM to sell their application solutions along with IBM hardware and software. The IBM marketing representatives can quote CSS prices, along with CSS terms and conditions, as well as take orders for the product without CSS direct involvement. These suppliers retain complete control over their products, providing IBM with the prices, terms and conditions, and product descriptions to be used during marketing activities.

Product Offerings

This section lists products and the corresponding strategic development partner, location of the partner, and a brief product description.

CATIA, dassault systemes, Suresnes, France

This is a general-purpose surfacing, solids, and wireframe program supporting a large set of applications for product design and manufacturing tasks. Basic subapplications include drafting, solids, advanced surfacing, kinematics, FEM, robotics, and numerical control part programming. AEC/mechanical applications include structures, building design, schematics, and piping and tubing. The cornerstone of IBM's CAD/CAM/CAE product offering, this program forms the base to be leveraged by other strategic development partners.

CADAM, CADAM, Burbank, California

This is a general-purpose 2-D and 3-D mechanical CAD/CAM program that is used to compete with PC and workstation-based drafting, documentation, design, and manufacturing products. CADAM is often used with CATIA as a design and documentation tool.

CAEDS, SDRC, Milford, Ohio

This is a general-purpose solid-modeling-based conceptual and functional design tool with extensive analysis and test features. This family of products is used to capture design intent and to verify the functional

performance of the design. It is used to complement CATIA and CADAM for advanced design verification.

CBDS, IBM, Milford, Ohio
This is a set of applications created to accelerate the design and manufacture of PCBs and thick-film HMCs. CBDS has a central component database and can pass completed design descriptions between modules.

CIEDS, IBM, Milford, Ohio
The Circuit Board Design System is an integrated system for design, physical layout, and manufacturing data generation of printed circuit boards and thick-film hybrid substrates.

MountainTop, Accugraph Corp., El Paso, Texas
This is a number of independent yet integrated modules to provide functions for facility management, civil engineering, information management, and architectural design.

The ICAD System (KBE), ICAD, Cambridge, Massachusetts
Knowledge-based engineering tool set that is integrated with CATIA for end-user creation of high-productivity rule-driven applications in design, analysis, and manufacturing. These tools have been proven to offer significant flexibility and dramatic return to the users who have implemented them.

Patran, PDA Engineering, Costa Mesa, California
This offers world class pre- and postprocessing for a wide variety of finite element analysis tools. Some of these tools are unique to PDA such as a materials library with thousands of material specifications to accurately define the material properties at the start of an analysis process.

TDImage, Thompson Digital Image, New York, New York
This is a fully integrated set of software for 3-D imagery. It has interactive tools for modeling, animation, material editing, rendering, and image editing.

Valisys, Valisys, Santa Clara, California
Valisys offers a step-by-step systematic way to validate that dimension and tolerance information is correctly specified in the design phase and adhered to during the manufacturing and quality assurance phases. This information can then be used to drive gauge design, interface coordinate measuring machines, and verify the actual component to the design file.

Something New

A major release of CATIA is scheduled for release in the first quarter of 1993. Version 4 (V4) is heralded as a major upgrade worthy of a new product designation. The V4 designation will probably prevail. A series of industry-specific application configurations will be packaged using the new set of V4 program modules. These modules are fully compatible with models built with the current V3 program.

©1993 Dataquest Incorporated

New features will include parametric and variational user input. Flexibility in constraint management will allow users to add or modify the appropriate tangency, perpendicularly, or anchor point as needed. Feature-based modeling will be offered with the option of user-defined features. A top-down approach is supported for modeling complex assemblies where the designer can build a black box as a subassembly for later functional detailing. This enhances the design process by organizing the complete project, allowing for work to progress as the resources or design constraints are developed. Other enhancements in the product data management will support the overall system function to design and manufacture products of any complexity.

New features in tolerancing, analysis, and manufacturing applications are expected in a phased release of V4.

Other Items about the Company

Other items about the company are as follows:

- IBM is the largest user of CATIA. 10,000 seats are in current use in IBM design centers located around the world. These design center develop a wide variety of computer systems, subcomponents, display, and workstation products.
- CATIA has driven the sale of 15 percent of RS/6000 shipments. The installed base of CATIA includes 4,000 mainframes and 15,000 workstations.
- It is very common for CATIA or CADAM to be used together. In general, 60 percent of CATIA users are using CADAM. Also, 39 percent of all CADAM users have CATIA. The largest CATIA customer has a 7,000-seats installation.

Dataquest Perspective

IBM is likely to remain the largest supplier of CAD/CAM/CAE technology for the foreseeable future. Some niche markets such as mechanical CAD/CAM and document imaging are dominated by the suite of products offered by IBM. Most markets are getting some serious competition, but overall, the depth and breadth of IBM's offerings are difficult to match. This is particularly true if the combination of business and technical applications are considered. This fundamental strength of IBM in enterprisewide product coverage is difficult to evaluate. The largest customers certainly understand and have invested the future success of their company in a strategic alliance, betting on the continued success of the investment. IBM is not likely to lose this strategic position. The current midnight oil being burned by the senior management seems destined to refine a strategic direction that will ensure the safety of its strategic customers and profit from the streamlining and customer focus that is sure to result.

The general trend in manufacturing toward concurrent engineering and verification of design intent to meet market needs supports the core of

©1993 Dataquest Incorporated

the IBM strategy. As the market awareness of the benefits of CAD/CAM/CAE are widely known and experienced, expect a rapid evolution in end users' expectations. The best of new point-solution applications will be quickly assimilated into a larger operation of integrated engineering design, manufacturing, and management tools. Any emerging world class software vendor should not be surprised to be invited to participate in the IBM environment as a strategic partner.

As positive as this sounds, IBM has its challenges. More than 54 percent of the mechanical CAD/CAM/CAE software revenue in 1992 was sold on the host-based platform. IBM's market share of the host-based market has been going up, but the growth of the overall market is elsewhere. The reputation of host-based solutions with high cost of ownership and limited performance options has crippled the general viability of this platform. The economic pressures to downsize computing resources are prevalent in all application areas. It is worth noting the real market pressure in downsizing is reducing the cost of ownership as more and more people get plugged into the system.

Another risk is based in the complexity of the situation. As users find procedures to get the job done, most are reluctant or do not make the time to try something new that may lead to a more productive overall process. The incremental improvements in system enhancements probably are often not compelling enough to force a significant change. Ironically, big operating budgets can support a small experimentation budget for anything new. This scenario will work to keep even the most dedicated IBM user up-to-date concerning the latest CAD/CAM/CAE or peripheral offerings. This awareness will keep pressure on the IBM Strategic Business Partners to provide a highly efficient solution set.

IBM has the enviable position of owning the most valuable installed base of CAD/CAM/CAE users. The intense price/performance competition in this market can turn this group into a battlefield if not well tended. CATIA V4 to be delivered in early 1993 is key to the continued success of this business.

©1993 Dataquest Incorporated

CCIS-1528071 B: 1
Library, Corporate
197-1234
Internal Distribution

For More Information...
Michael J. Seely, Director.....(408) 437-8178
Via fax.....(408) 437-0292

The content of this report represents our interpretation and analysis of information generally available to the public or released by responsible individuals in the subject companies, but is not guaranteed as to accuracy or completeness. It does not contain material provided to us in confidence by our clients. Individual companies reported on and analyzed by Dataquest may be clients of this and/or other Dataquest services. This information is not furnished in connection with a sale or offer to sell securities or in connection with the solicitation of an offer to buy securities. This firm and its parent and/or their officers, stockholders, or members of their families may, from time to time, have a long or short position in the securities mentioned and may sell or buy such securities.
©1993 Dataquest Incorporated—Reproduction Prohibited
Dataquest is a registered trademark of A.C. Nielsen Company 0014488

Dataquest®
a company of The Dun & Bradstreet Corporation