THE 16-BIT COMPUTER MARKET: AN ANALYSIS

CUSTOMIZED RESEARCH SERVICE

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I.   EXECUTIVE SUMMARY

The purpose of this study is to:

-   Analyze the market for 16-bit systems in general and, in
    particular, the System/36, Series/1, low-end of the HP3000
    Series, low-end of the Tower Series, Altos, PC/AT and the PS/2
    systems which are AT-compatible.

-   Identify new opportunities for 16-bit systems in regard to
    markets, customers or applications.

This research was conducted according to the methods described in
Part III. These methods were employed in an objective fashion.
Because of the qualitative nature of this research, we cannot apply
a quantitative measure of its accuracy, but the results presented
here give a comprehensive and unbiased view of these research
topics.

For the purposes of this research, the 16-bit computer market is
defined as traditional 16-bit minicomputers and 16-bit supermicros
(MicroPDP-11, Micro3000, MiniTower, DG 500, etc.).   We have
included the 286-based PS/2 systems which compete in some of the
same arenas as the traditional 16-bit mini in our analysis, but not
in our market sizing.

Although the installed base of traditional 16-bit systems continue
to grow, albeit at a declining rate, the annual shipment of
traditional 16-bit systems is declining dramatically. Between 1987
and 1988, unit shipments worldwide declined 17% and this decline is
expected to continue for the next several years. By the mid-1990s
very few of these systems will be sold.

Customers who continue to purchase and maintain 16-bit systems do
so because of:
-           Cumulative experience working with the systems
-           Software investment
-           Lower cost than 32-bit counterpart

Vendors who continue to market 16-bit systems do so because of:
-           The availability and diversity of software with proven
            reliability

-           The ability to position the systems in niche applications
            such as OAS, departmental servers for PC systems, and
            network control

-           The significant aftermarket and service revenue that the
            installed based still generates

Of the major 16-bit systems, the System/36 and the Series/1 have increased unit shipments over the last two years. Systems such as the 16-bit Altos and DPS 6 have been replaced by their 32-bit counterparts. Most vendors offer migration paths from their 16-bit systems and actively market a 32-bit system into new accounts. Unlike the companies that market 32-bit systems as replacements or offer easy migration to 32-bit systems, IBM still focuses on small, professional offices (such as legal, medical, dental) with its SolutionPacs or the S/36 Office System. IBM has also introduced new models of its 16-bit systems in the last few years. Both these tactics help explain the increase in S/1 and S/36 installations.

Some of the opportunities identified include:

-   Applications that do not need the power and speed of 32-bit systems, such as embedded processors in copy machines and fuel injection devices

-   Laptops using 16-bit microprocessors

-   Third-world and Soviet bloc countries where importing older technology is permitted, and may be adequate for the generation of applications. These countries represent 4% of the unit shipment and installed base of 16-bit systems in 1988 and 1987 and 5% of the revenue from this market. Whether this small share is due to a lack of marketing effort or a lack of demand is inconclusive.

-   Markets with low growth which do not take advantage of new software or customers who are only now beginning to automate. IBM is the only vendor that appears to be penetrating outside its customer base with non-PC class machines. However, the type of customer is generally unsophisticated, small businesses or professional offices in the medical, dental, and legal fields.

-   Construction and commercial property management are other areas that may continue to use 16-bit systems because only a small percentage of this group are automated, users are relatively unsophisticated, and they do not need much speed or power.

-   Some vendors offer 386 accelerator boards for 16-bit systems. This allows the users to off-load some applications and thereby extend the life of the processor.

—   Other potential implementations of 16-bit systems include PC host or server, network controller and communications system, remote network management and administration (an RSM-like product that supports RSX), and terminal server.

Clearly, the size of the above opportunities must be weighed against the cost and risk of pursuing them.

II. OBJECTIVES

The purpose of this study is to:

o   Perform a market analysis of the 16-bit computer market
     defined as:

     -    16-bit traditional minicomputers
     -    16-bit supermicros
     -    16-bit microcomputers (PC/AT, PS2/30, PS2/50, PS2/60)

o   Identify opportunities in the form of new markets/customers
     or new applications targeted by major vendors of selected
     16-bit computer systems. The particular systems which
     potentially compete with Digital's PDP-11/84 and
     MicroPDP-11/53, 11/53+, 11/73, and 11/83 include:

     -    NCR's MiniTower and Tower-XP
     -    IBM's System/36, PC/AT*, and PS/2 Models 30,50,60
     -    HP's 3000 Series 52,58,70 and Micro3000 Series
     -    Altos 80286-based microcomputer series*

*No longer marketed.

Other systems identified during the course of the study will be
included in the market definition and sizing and, if they appear
to compete with PDP systems, they will also be included in the
product analysis.

III. METHODOLOGY

The design of this project included the following phases:

-   Analysis of industry reports to determine the set of products that fall within the specified definition of the 16-bit computer market.

-   Analysis of customers who have installed the aforementioned 16-bit systems within the last year and a half, using the Computer Intelligence Corporation (CI) database.

-   Search of industry reports and publications for trends and information on the subject.

-   Interviews with industry analysts of computer research firms regarding 16-bit market trends and opportunities in general and major systems in particular.

-   Interviews with a small sample of customers who have recently installed one of the selected 16-bit systems, in order to profile 16-bit selection, and current and potential uses.

IV. MARKET DEFINITION

The traditional minicomputer market has undergone pressures from supermicros and superminis and the technological changes brought about by these systems. This study attempts to look at the market in which the PDP-11 participates. This market includes:

- The traditional 16-bit minicomputer market
- 16-bit supermicros, including the MicroPDP
- Select microcomputers PC/AT, PS/2 Models 30, 40, 50, and 16-bit Altos computers.

Although the PC/AT and the 16-bit Altos systems are no longer marketed, they are included because of the impact that these systems have had in the manufacturing, laboratory, and scientific areas where PDP systems have traditionally participated. It is fair to say that if the AT has had an impact upon the PDP market, then AT-compatible systems such as the PS/2 would similarly continue to compete in the PDP market.

Some of the salient characteristics of these systems include:

- Multi-user, multiprogramming, multitasking computing based on 16-bit architecture.

- Prices ranging from $10,000 to $250,000 for typical configurations.

- Performance between 1 and 2 MIPS (the exception being the current System/36 which operates at rates that range from 0.25 to 1 MIPS).

- Proprietary technology for instruction execution, system control, and I/O support for traditional 16-bit minis, and generally industry-standard processors in 16-bit supermicros and micros.

Despite the dominance of proprietary 32-bit and industry-standard architectures, major vendors continue to market and support 16-bit systems for the following reasons:

- There are close to 3 million 16-bit sysstems installed worldwide. The continued demand from current customers is the primary reason 16-bit systems are still offered. It may be unacceptably expensive for these customers to move to 32-bit technology. They have a huge investment in experience and software in their current systems and technologies.

- Software availability and diversity are other major reasons for the continued existence of 16-bit systems. Software is available for extremely specialized applications, and is a major factor in the capability of minis to maintain their presence in particular vertical market niches. This part of the market needs to be watched. If software houses are migrating their software to 32-bit systems and providing an easy and cost effective means of migrating the customers to new technology, then marketing 16-bit systems will be significantly more difficult.

- The growth of PC-based departmental processing systems has provided the mini with the role of departmental server. The mini-as-server offers shared resource system communications, file management, and applications to the attached workstations. Acting as the connection between individual microcomputers and either local or remote mainframes, these departmental servers prove highly functional at a low cost.

The major advantages that 16-bit systems have over 32-bit systems include:

- 16-bit systems can sometimes perform the same applications as 32-bit systems and are usually less expensive. 16-bit systems are suitable where low cost is more important than high precision or sophisticated instruction capabilities.

- 16-bit systems have access to a wide variety of software. The software has been proven reliable. 16-bit software is available for extremely specialized applications which allows these systems to maintain their presence in particular vertical market niches.

- Investment in 16-bit systems is a significant reason to continue using them. Customers have a huge investment in experience and software on these systems. The expense and difficulty of migrating to 32-bit can be prohibitive.

- Expandability of 16-bit systems has been addressed by major vendors. HP3000 Series 70 and Unisys System/80 can be configured to support a large number of terminals, disk drives, printers, and other peripherals. The ability to upgrade to a more powerful model with minimum disruption has also been addressed by major vendors.

Some vendors provide upgrade paths to 32-bit systems at reduced costs when the 16-bit system no longer fills the customer's needs. Examples of this are System/36 to AS/400, HP3000 16-bit models to HP3000 Series 900, and DPS6 to DPS 6 Plus.

Vendors such as IBM, Digital, and HP no longer position their minis as general-purpose computers. Instead, the traditional mini focuses on application-specific or well-defined niche markets. Some examples follow:

VENDOR	MODEL	APPLICATION FOCUS
IBM	Series/1	Data communications and network server in BSC and SNA environments; programmable controller on factory shop floor.
	System/36	Office automation system
DIGITAL	PDP-11/84	Application processor for factory automation applications
HP	HP3000	Specific departmental or functional applications

By changing product targets and focusing on more defined niches, the minis reduce the competition factor and extend growth.

The following table lists some of the systems that make up this market:

Table 1: Major 16-Bit Systems

Traditional 16-bit Minis

    HP 3000 Series 52, 58, 70

    HP 1000 Series

    Bull HN DPS 6 Series

    IBM System/36, Series/1

Table 1: Major 16-Bit Systems (Continued)

NCR Tower-XP

August Systems Series 330

Computer Designed Systems
     Adviser 100,600,900

McDonnell Douglas Computer
     Systems M6400,M6600

Modular Computer Systems
     System 45XP,55,58,78,43

Nixdorf Computer 8850,8870

Unisys Corp. System 80/4,6,
     8,10,20

GEAC Computer 6000,8000,

Concept 9000

16-Bit SuperMicros

     HP's Micro3000LX, Micro3000GX, Micro3000XE

     Data General DG/500

     NCR Minitower

     Alpha MicroSystem AM-1200M

     Data General DG/500 Gen. Automation Zebra 1350

     I System 1000,1100,1200,SP1000

     Unisys B26,B27,B28,B38

16-Bit Microcomputers

    *IBM PC/AT,PS/2 Models

    30,50, and 60

    *Altos 1086,2086,3086

OTHER 16-BIT MINIs

Barrister Information System	Model 145,150,160,3100,3200,3300
BTI Computer Systems	BTI 6000
Display Data Corp.	in*sight
ICL Inc.	System 25
Independent Business Systems	3075-5, 3175-5, 3300-5
MAI/Basic Four	MAI 2000
Norsk Data N.A. Inc.	ND-100 Satellite, ND-100 Compact 100/CX
Northern Telecom, Inc.	585, Meridian DV-1
TI Business System	352A, 373A, 374A, 375A, 362A, 673A, 674A, 675A, 690A, 691A, 874A, 875A, 890A/b, 891A/B
Wang	VS 5

*IBM PC/AT and Altos 16-bit systems are no longer marketed.

V. MARKET SIZE

The size of the 16-bit computer market and selected systems is based upon two sources:

o   Infocorp, which provides shipment, installed base, and revenue data for all 16-bit, multi-user systems but DOES NOT include PS/2s and PC/ATs. (However, Infocorp does include many systems which will not be analyzed in this report.) Hence, the figures represent the universe of traditional 16-bit, multi-user systems for the years 1986, 1987, 1988. Please refer to Tables 2, 3, and 4.

o   IDC, which provides shipment and installed base data only for the systems this study focuses on, particularly those systems with any significant marketing and sales activity for the last three years. Please refer to Table 5.

Note: The shipment figures from Infocorp and IDC do not agree, primarily because of the inclusion in each of different systems.

According to Infocorp, the size of the market for 16-bit systems was $17.4 billion in 1988, down from $20 billion in 1986 and $19.8 billion in 1987. This represents a compound annual growth of -6.9%. The greatest decline in revenue occurred in the US (-10.2%) compared to -5.3% in Europe and -2.5% in the Pacific Basin.

Worldwide unit shipments of 16-bit machines (excluding PS/2 and PC/AT systems) was approximately 450,000 units in 1988, down from 546,000 in 1986 and 526,000 in 1987. This is a compound annual growth rate of -9.2%. The Pacific Basin region showed the sharpest unit shipment decline at -19.4% compared to worldwide shipment decline of -9.2% over the last three years.

TABLE 2:   16-BIT MARKET SIZE BY UNITS SHIPPED (000's)

	1986	1987	1988	1986-88 CAGR
Worldwide	546	526	450	-9.2%
US	172	171	150	-6.6%
Europe	148	148	148	0.0%
Pacific Basin	203	186	132	-19.4%
Balance of World	22	21	20	-4.7%

Source: Infocorp

TABLE 3:   16-BIT MARKET - INSTALLED BASE (000'S)

	1986	1987	1988
Worldwide	2275	2624	2865
US	937	1025	1076
Europe	544	648	743
Pacific Basin	690	837	923
Balance of World	103	115	123

Source: Infocorp

TABLE 4:   16-BIT MARKET SIZE BY VENDOR REVENUE ($B)

	1986	1987	1988	1986-88 CAGR
Worldwide	$20.09	$19.78	$17.43	-6.9%
US	7.92	7.41	6.38	-10.2%
Europe	5.57	5.46	5.00	-5.3%
Pacific Basin	5.44	5.84	5.17	-2.5%
Balance of World	1.15	1.08	0.93	-10.1%

Source: InfoCorp

TABLE 5: WORLDWIDE UNIT SHIPMENT BY SELECTED SYSTEMS

	1986	1987	% Growth 86/87	1988	% Growth 87/88
Altos **	5345	5600	4.8%	2700	-51.8%
DPS6	3045	3082	1.2%	1882	-38.9%
PDP*	2480	30050		11800	-60.7%
HP1000	6625	5442	-17.9%	5805	6.7%
HP3000	2040	5900	189%	4200	-28.8%
PS/2-30,50,60		850000		1870000	120.0%
PC/AT**	555000	710000	28%	20000	-97.2%
System/36	35000	35000	0%	67000	91.4%
Series/1	6500	4500	-30.8%	11000	144.4%
Tower-XP,Mini	5965	4390	-26.4%	2020	-54%

Source: IDC

*   These numbers include only the MicroPDP-11/53, 11/53+,
     11/73, 11/83 and the PDP-11/84. In 1986, 16,000 PDP 11/03, 23,
     and 11 SV systems, 2700 PDP-11/44 systems, and 1000
     PDP/11/24 systems were shipped. For this reason, the rapid
     rise in growth between 1986 and 1987 pictured above is
     misleading.

**   Systems no longer marketed by vendor.

Other highlights of the IDC and Infocorp data include:

-    The installed base of 16-bit systems is approximately three
     million worldwide. The US has 38% of the worldwide installed
     base, followed by the Pacific Basin with 32%, Europe with
     26%, and the Balance of the World with 4%.

-    Although shipments in the Pacific Basin have declined the
     most among the various geographical regions, revenue
     generated from those systems has declined the least.

-    In 1988, the US represented 37% of the worldwide revenue for
     this market, followed by Pacific Basin and Europe with 30%
     and 29% respectively. The balance of the world comprised 5%
     of the market revenue.

-    According to IDC, unit shipment growth was impressive for
     PDP-11 systems, HP3000 and Micro3000, System/36, Series/1
     over the last two years. However, with the exception of S/36
     and Series/1, the traditional 16-bit mini experienced a sharp
     decline in the last year. Refer to Table 5 for shipment by
     selected systems.

- S/36 unit shipment grew 91% between 1987 and 1988 (35,000 to 67,000). S/1 shipment more than doubled in 1988 compared to 1987, 4,500 to 11,000. According to IDC and Datapro consultants, growth of these two systems seems to be due to new product announcements and the refocusing of the S/1 as a network and communications controller.

- 286-based microcomputers PC/AT and PS/2 systems represent substantial unit volume. 710,000 PC/AT systems shipped in 1987, the last year in which they were sold in the US. With the introduction of the PS/2 Model 30, and subsequent AT-compatible Models 50 and 60, the PS/2 unit shipments continued and surpassed the sales performance of the AT. 1988 worldwide shipments of PS/2 systems totalled 1.87 million units. Please refer to Appendix A.

- Vendors continue to support the market by introducing new or improved models. Examples: the S/36 Model 5363 introduced in the fall of 1987, the Micro3000LX and GX in April of 1988, and Data General's new DG 500, a 16-bit supermicro introduced in May, 1988.

- At the same time, 32-bit technology is also putting many 16-bit systems out of business. Currently, Altos has replaced its 16-bit line with the 32-bit Altos 386 Series and, of course, the PC/AT has been replaced by the PS/2.

- The large installed base for some of these systems is part of the reason for continued support and enhancement. Refer to Appendix B for installed base by selected systems. Despite shipment of only about 6,000 HP 1000s in 1988, the installed base of 92,530 commands by-product revenue. Similarly, the installed base of S/36 and Series/1 is 212,500 and 95,900 respectively.

VI. COMPETITIVE ANALYSIS

A. MARKET/CUSTOMER PROFILE BY MAJOR SYSTEM

Analysis of markets/customers for each of the selected systems in this section is based on:

-   An analysis of customers from the CI database who have installed these particular systems within the last year and a half. Please refer to Appendix C for a distribution of these customers by industry.

-   System overviews by Datapro.

SYSTEM/36

IBM continues to market its System/36 (S/36), due primarily to its sizable installed base. In 1988, the installed base of S/36 was approximately 212,500, while unit shipments were 67,000. The System/36 includes models 5360, 5362, 5363, and 5364. Model 5364 is better known as the System/36 PC, which provides facilities to run both SSP and PC-DOS applications. The Model 5363 was introduced in the fall of 1987.

Although the S/36 lost much of its strategic importance with the introduction of the AS/400 in entry-level, mid-range, workgroup, departmental, and enterprise-wide computing, it has continued to be successful in the areas in which IBM has positioned it.

This positioning includes:

-   A general purpose, multi-user, communications processing system. The S/36 functions as a centralized, departmental, or distributed processing system, running MIS, office automation, decision support, data entry, and communications and networking applications in either a dedicated or integrated mode.

-   A host or server to a cluster of PCs in a LAN. In an analysis of 2347 sites in the CI database that have installed S/36 since the beginning of 1988, approximately 25% of those sites installed a S/36-PC.

Based on an analysis of recent S/36 sites in the CI database, the following characteristics describe customer sites which have recently installed the S/36 (installations between January 1988 and the present):

The S/36 is targeted to the range of general business customers with principle industry applications in manufacturing and distribution. Wholesale businesses were the largest purchasers of S/36 with 17% of 2,347 S/36 sites since 1988. Refer to Appendix C for a distribution of recent installations by industry.

- Manufacturing sites (includes automotive, building materials, electrical machinery, electronics, machinery, metal and glass, rubber and plastic, semiconductor, and transportation equipment industries) make up about 20% of S/36 sites.

- Businesses which provide engineering and/or management services represented 6.6% of S/36 sites and health care customers 6.7%.

- Customers that have recently installed S/36 are generally small, with 1-49 employees and revenue of less than $10 million. Please refer to Tables 6 and 7.

TABLE 6:   SYSTEM CUSTOMER BY BUSINESS SIZE

	1-49	50-99	100-499	500-999	1K-5K	5K-10K	>10K
			NUMBER OF EMPLOYEES				
SYSTEM/36	44.4%	17.8%	29.2%	5.1%	3.1%	0.2%	0.2%
SERIES/1	17.2%	7.8%	39.1%	14.1%	18.8%	3.1%	-
HP3000	11.5%	11.5%	40.8%	20.3%	14.3%	0.9%	0.6%
TOWER	34.4%	18.8%	36.5%	5.2%	3.1%	1.0%	1.0%
DPS6	16.1%	12.9%	51.6%	8.1%	11.3%	-	-
HP1000	12.1%	10.2%	36.9%	16.3%	21.0%	2.5%	-
ALTOS	50.0%	19.2%	25.6%	3.8%	1.3%	-	-
PC/AT	48.4%	16.4%	30.3%	4.9%	-	-	-
PS/20	31.5%	14.1%	35.5%	8.5%	9.2%	0.7%	0.6%
PDP	14.7%	5.3%	36.0%	14.0%	22.0%	4.7%	3.3%

TABLE 6: SYSTEM CUSTOMER BY REVENUE SIZE

	<10M	10-49M	50-99M	100-249M	250-499M	500-999M	>1B
SYSTEM/36	72.9%	16.5%	3.3%	3.4%	1.4%	1.3%	1.1%
SERIES/1	39.3%	8.9%	3.6%	17.9%	8.9%	7.1%	14.3%
HP3000	22.6%	32.5%	15.2%	14.4%	8.2%	2.9%	4.1%
TOWER	58.8%	17.6%	4.4%	11.8%	1.5%	2.9%	2.9%
DPS6	41.2%	29.4%	11.8%	11.8%	-	5.9%	-
HP1000	29.8%	26.2%	12.9%	14.2%	6.0%	5.0%	6.0%
ALTOS	70.6%	19.6%	5.9%	3.9%	-	-	-
PC/AT	79.0%	7.4%	7.4%	4.9%	-	-	1.2%
PS/2	70.3%	13.2%	5.4%	4.8%	2.7%	1.2%	2.4%
PDP	45.5%	21.5%	5.1%	12.7%	1.3%	2.5%	11.4%

SERIES/1

With an installed base of almost 96,000 systems and unit shipment
of 11,000 in 1988, the system has sustained market demand over the
last three years, despite the introduction of the RT PC, the 9370,
and the PS/2. With the introduction of the latter systems, the S/1
lost its strategic importance as an entry-level, mid-range
workgroup and departmental system.

Part of the Series/1 continued success is due to its position as a
data communications and network server in BSC and SNA environments,
as well as a programmable controller on the factory shop floor.

Again, based on an analysis of the recent sites which have installed S/1, the following characteristics describe the S/1 customer today:

- The major types of customers are:

Industry	% S/1 Sites
Wholesale	24.6%
Manufacturing *	15.3
Banking	10.8
Health Care	7.7
Food & Beverage	7.7

* In this and the following CI information, Manufacturing includes automotive, building materials, electrical machinery, electronics, machinery, metal and glass, rubber and plastic, semiconductor, and transportation equipment industries.

-    S/1 sites tend to be medium-sized, with 100-499 employees and revenue of less than $10M.

HP3000

The HP3000 Series 52,58,70 and the Micro3000GX, LX, and XE at the low-end are 16-bit systems that continue to be marketed by HP. The HP3000 systems are basically commercial systems. These systems compete with the high-end of the System/36.

The Micro3000 offers a low cost office system as well as increased performance. The Micro3000GX and LX are targeted to small offices and companies that have 4 to 16 users. The Micro3000XE is aimed at departments, large branch offices, and businesses with 8 to 56 users. These systems compete with the low-end of the System/36.

Based on an analysis of 323 recent customer installations of HP3000 and Micro3000 systems, the following characteristics describe these customers:

-    The customer sites cover a broad range of industries. The major industries include:

Industry	% 3000 Sites
Manufacturing	19.5%
Wholesale	9.6%
Construction	9.3%
State-Local Govt.	6.8%
Data Services	5.3%
Chemical	5.3%

- The size of the business tends to be medium, with 100-499 employees. Approximately 33% of the businesses have revenue ranging from $10 million to $49 million.

NCR TOWER-XP, MINITOWER

The Tower-XP and the MiniTower, introduced in 1984 and 1985, lost their importance with the introduction of the 32-bit Tower 32/200 in 1988. These entry-level systems serve small computing demands where UNIX is required and low-cost processing is more important than transaction processing functionality. The XP and Minitower target small sites which need more terminal connectivity than the four-terminal Tower 32/200 but do not want to incur the costs of the larger models.

The Tower line is marketed as a supplier of UNIX, industry-standard, microprocessor-based, multi-user computer systems for the small to midsized business, workgroup, corporate department, or branch office.

Despite its open system architecture, selling Tower systems against proprietary systems is difficult. Towers sell to NCR's traditional strongholds where the company has high credibility and expertise. These markets include discrete manufacturing, banking and finance, retail, wholesale, distribution, and government.

The systems are positioned in the following ways:

- Standalone or distributed departmental processor in large corporations, government agencies, and institutions

- Departmental, distributed branch, and central processing for smaller organizations

- PC server through the deployment of the Tower's PC Connect/PC Server and Multitex software

The Tower systems are most often used for routine data processing and information system tasks, office automation and Ethernet-based local area networking.

Based on an analysis of 102 sites which installed the XP and
MiniTower between January 1988 and the present, the largest
customer groups are:

Industry	% XP & MiniTower Sites
Manufacturing	19.6%
Wholesale	17.7%
Federal	15.7%
Banking	8.8%
Data Services	7.8%

In addition, these sites tend to be either very small (1-49
employees) or mid-sized (100-499 employees). Approximately 60% of
these sites have revenue of less than one million. Please refer to
Tables 5 and 6.

Bull HN DPS 6 Series

Since the introduction of the DPS 6 Plus Series in 1986 and 1987,
the DPS 6 Series lost its importance in the company's approach to
entry-level and mid-range workgroup, departmental and
enterprise-wide computing. Similar to the Tower-XP and MiniTower
systems, U.S. sales of DPS 6 are small, with increasingly declining
sales outside the U.S.

Based on an analysis of 63 sites in the CI database that have
installed DPS 6 systems since 1988, customers fall into the
following industries:

Industry	% DPS 6 Sites
Federal	15.9%
State-Local Govt.	14.3%
Manufacturing	12.8%
Wholesale	12.7%
Insurance	11.1%

Additionally, the sites tend to be medium-sized (100-499 employees)
with revenue of less than $10 million or $10 million to $49
million.

HP 1000

Although HP continues to market its HP 1000 Series, the series surrendered its strategic importance to HP's approach to technical and real-time computing upon the introduction of the HP 9000 Series. The market appeal of the series is limited, despite shipments of approximately 6,000 systems in 1988. However, with an installed base of over 90,000, HP will continue to support the 1000.

The HP 1000 Series is targeted to the scientific/engineering market, not to the general office environment. Based on 343 sites which have installed HP 1000 between 1988 and now, the the most concentrated industries are:

Industry	% of HP1000 Sites
Manufacturing	28.6%
Federal	7.5%
Business Services	6.7%
Chemical	6.5%
Engineering	6.3%

In addition, the sites tend to be medium sized (100-400 employees) with a revenue more disperse than many of the other 16-bit systems selected. About 56% of the sites have revenues less than $10 million or $10 million to $49 million.

Altos 1086/2086/3086

The 16-bit Altos systems 1086, 2086, and 3086 were replaced by the 32-bit 386 Series introduced in the last half of 1987 and 1988. The 16-bit systems, as are its replacements, are marketed as premier UNIX, industry standard, microprocessor-based, multi-user computer systems for the small business, workgroup, corporate department, or branch office. 100% of sales are through indirect channels.

Based on 54 sites which installed the 16-bit systems since 1988, the largest concentration of customers is in:

- Wholesale	29.6%
- Businesses Services	16.7%

50% of the sites have 1-49 employees and 70% have revenue of less than $10 million.

PC/AT, PS/2 Model 30-286, 50, 60

The PC/AT has not been marketed since the introduction of the PS/2 in 1987. The PS/2 Model 30-286, 50, and 60 are AT-compatible. Markets for the PS/2 are small businesses, as well as large corporations that need to supplement powerful desktop systems with low-end machines. IBM targets vertical markets with its SolutionPacs aimed at the traditional office automation market, desktop publishing, health care, legal, construction, and small businesses.

The profile of AT and PS/2 installations in 1988 are as follow:

Industries	% AT Sites	%PS/2 Sites
Manufacturing	18.4%	12.4%
Wholesale	10.3	8.3
Insurance	4.8	7.8
Education	1.6	7.4
Data Services	7.9	2.9
Business Svcs.	6.4	6.8
Banking	11.1	6.0

In terms of business size, AT sites tend to be small (1-49 employees) or mid-sized (100-499 employees) and have revenues of less than $10 million. PS/2 sites are similar in size and revenue.

PDP-11/53,73,83,84

Digital continues to market its PDP-11 family, although the MicroVAX has replaced the PDP-11 as the company's strategic low-end system. Based on 156 sites which installed PDP systems in the last year and a half, the profile reveals that these sites tend to be:

- Concentrated in the health care industry

Industry	% PDP Businesses
Health Care	34.0%
Manufacturing	12.5%
Data Services	9.8
Federal	7.8
Business Svcs.	6.5

- Medium-size sites with 100-499 employees and revenues of less than $10 million.

B. APPLICATION PROFILE BY MAJOR SYSTEMS

The major sources for application information on the following
systems include:

- DataPro, which provides a brief summary of the types of vendor
  applications targeted for these systems

- Analysis of the installed software on these systems from sites
  in the CI database

- Interviews with a small sample of industry analysts and
  customers who have recently installed these systems.

Please refer to Appendix E for a chart of specific software
solutions by selected systems.

SYSTEM/36

Over half of the applications running on the S/36 are general
business applications consisting of accounts payable, accounts
receivable, general ledger, inventory management, payroll,
purchasing, personnel, order processing, accounting, sales and
financial analysis. Most of these applications were developed
in-house. Vendors' packages in this area include IBM, Edwards,
Para-Research, Prentice-Hall, On-Line Solutions, and
Concord-Management.

Positioned as an office automation system, 17% of the systems
installed since 1988 are running O/A and microlink applications.
The most cited software in this area is IBM's Office Systems family
which provides a complement of office and microlink applications --
DisplayWrite/36, Personal Services/36, Query/36, and PC Support/36.

Report generation is the third-most cited application running on
the S/36. IBM's Query/36 and Retrieval/36 are the most cited
software.

Another popular application running on 10% of these systems is
MAPICS, IBM's manufacturing planning and control system,
integrating production control and costing, payroll, A/P, A/R,
inventory management, product data management, G/L, sales analysis,
order entry and invoicing, data collection system support, MRP,
capacity requirements planning, financial analysis, purchasing,
forecasting, and cross application system support. Many of the
manufacturing programs such as recertification for manufacturing
operations were in-house developed.

Industry-specific applications are in the broadcasting, wholesale, medical, aviation, insurance, and hotel industries. Columbine's BIS is cited for broadcasting and VitaServe for medical billing and A/R, while the others were in-house developed.

SERIES/1

The Series/1 is marketed as an intelligent communications processing system. Communicating with host systems as well as personal computers, the S/1 handles general-purpose, commercial, and sensor-based applications in multiprogramming environments. Applications areas include retail, financial, industrial, transportation, government, insurance, and telephone management. Positioned as a data communications and network server in BSC and SNA environments, as well as a programmable controller on factory shop floor, very few vendor solutions are identified. Applications outside of the aforementioned included general business and accounting, manufacturing and industry specific (construction). The majority of applications were in-house developed. The vendor application most cited is IBM's O/A package DisplayWrite.

HP3000 SERIES 52, 58, 70, MICRO3000GX, LX, XE

The major marketing efforts for these systems are in office automation, manufacturing, distribution, financial, and administration. The HP3000 office automation efforts are centered around the HP Personal Productivity Center which merges word processing, data processing, graphics packages, and communications facilities for a total office system.

Based on a Datapro Computer Users Survey, general business (including accounting, payroll/personnel, order processing, inventory, purchasing) is the principal application among a majority of users. Sales, distribution, and manufacturing are the second leading set of applications for these systems.

Engineering/scientific, math/statistics, and health care applications represent the smallest set of HP3000 users.

Among CI sites which have installed 16-bit HP systems recently, applications installed included:

Applications	% Systems	In-House or Vendor-Developed
General Business	28%	- 63% In-house developed - Uptime,Collier,ASK,MCBA, Comm-Associates
DBMS	24%	HP Image,Rego ADAGER
Report Generator	17%	HP, Cognos
Application Dev.	11%	HP, Cognos
Office Automation	9%	HP

Specialized applications include Time and Attendance (A. Andersen TWOS) and library system (VTLS). Other applications include distribution, machine control, transportation system, uniform system, and special education system, all of which are in-house developed.

TOWER-XP, MINITOWER

Because of the very small number of sites which have installed the Tower-XP and MiniTower recently, we looked at the entire base of Tower sites in order to determine the types of applications running on these systems.

The applications installed include:

Applications	% Systems	In-House Developed or Vendor-Developed
General Business	31%	- 91% in-house developed - Realworld
DBMS	17%	Unify, MIcrorim R-base, Informix-SQL,MicroSoft File
MicroLink	15%	Smartcom,Crosstalk, Rossdata VDrive
Office Automation	14%	WordPerfect,Softest LEX
Fin/Sales Analysis/SS	19%	Lotus, Microsoft

The only industry-specific application identified is manufacture of machinery, which was in-house developed.

Part of Tower's marketing is to users who desire an 'open systems' architecture. However, users in a DataPro Computer Users Survey identified some drawbacks of this feature:

-   Most sophisticated software for manufacturing applications has been written for Digital and IBM platforms. Availability of UNIX software is limited.

-   UNIX-based communications utilities tend to lack user-friendliness.

HP 1000 SERIES

The HP 1000 Series is oriented toward engineering, scientific, and industrial automation applications and various forms of real-time computing. The systems also accommodate a full-scale database management system.

Very few vendor applications are identified in the CI database. Those that are installed include HP's general business solutions such as General-Ledger, HP's DBMS solution Image, HP's Graphics'125, and Tominy Database+ for application development.

ALTOS 1086, 2086, 3086

Again, Altos no longer markets these 16-bit systems. However, we did look at these UNIX-based systems to identify some of the applications running on them:

Applications	Solution
Accounting	Unify Open System
Spreadsheet	SCL PROF, Lotus, Excel
Database	– In-house developed
	– Informix,DatabaseIV
Word Processing	Uniplex,WordPerfect
Chemical analysis of	
Manufacturing Products	In-house developed

PC/AT and PS/2 Model 30-286, 50, 60

The overwhelming majority of these systems are used in office automation, spreadsheet/financial analysis, and DBMS applications. More specialized applications include:

Application	Solution
CAD/CAM	Autocad
Desktop Publishing	Pagemaker,Ventura
Graphics	Free-lance,Harvard-PG,Graphwriter, PCPaintbrush,Chartmaker
Project Mgmt.	Harvard-TPM,Superproject, Timeline,Workbench
MicroLink	Crosstalk,Handshake,Procomm, Reflection,PCTalk

Other specialized applications such as engineering analysis, sales system, client manager are cited and were developed in-house.

IBM offers SolutionPacs which target vertical markets. Some of the SolutionPacs designed for vertical markets include:

- The IBM SolutionPac Personal Typing which focuses on IBM's traditional office automation market.

- The IBM SolutionPac Personal Publishing System represents IBM's entry into the low-end desktop publishing market. The system includes IBM's PostScript-compatible laser printer, MicroSoft Windows, and Aldus PageMaker.

- Other SolutionPacs designed for specific industry segments include Doctor's Office Management, Legal Profession Series, Construction Industry Series, and Business Adviser Financial Accounting.

The Models 50 and 60 are also capable of multitasking and network applications. According to IBM, applications with timing dependencies will not work on the PS/2 systems.

PDP-11/53,11/73,11/83,11/84

Approximately one-third of the PDP-11 sites analyzed from the CI database are running general business applications; in 85% of these the application was developed in-house. Beyond this, the set of applications is broad and includes microlink, office automation, DBMS, report generation, manufacturing, industry specific (medical,lab, education, business, insurance, manufacturing, etc.). Process control applications identified are in-house developed (e.g., control switching of railroad cars).

Vendor solutions outside of Digital solutions that are identified include:

Application	Solution
General Business	Compu-Share,MCBA,Timberline
DBMS	Cincom Total,POISE,
Resource Mgmt	Exec-Soft Diskeeper
Manufacture	ASK MANMAN-MMS
Insurance	IDX Billing
CAD/CAM	Vango
Data Analysis	Minitab,IMSL,Commercial Lab Sys.

BULL HN   DPS 6 SERIES

The DPS 6 position is used for departmental processing of applications in database and on-line transaction processing, networking, PC integration, and office automation. There are currently only a small number of sites with the DPS 6 installed. However, we did look at those sites that had installed DPS 6 systems over the last year and a half. The majority (59%) of these systems are running general business applications of which 88% were in-house developed. DBMS are running on 17% of these systems and office automation on 10%.

Vendor solutions that are cited include:

Application	Solution
General Business	MSA
DBMS	Cincom TOTAL, HN DM-IV
Data Entry	HN DEF-11
Application Dev.	Applic. Dev.- Cincom

VII. OPPORTUNITIES

In an attempt to gain insight into how and if competitive vendors
will be able to keep their 16-bit systems marketable with any
degree of success, we took the following approach:

-   Interviewed a small sample of customers who have purchased or
    installed one of the selected 16-bit systems between January
    1988 and April 1989.

-   Interviewed industry analysts with IDC, Gartner Group,
    InfoCorp, DataPro, and CI who either specialized in this class
    of system or in one of the vendors under consideration.

The information from these sources is qualitative, but there is
some consensus on several points.

-   The trend of a declining 16-bit computer market will
    accelerate over the next 2 to 3 years, so that by the
    mid-1990s very few of these systems will be sold.

-   IBM with its S/36 and, potentially, with its S/1, is able to
    maintain a modest degree of success in positioning these
    systems in specific applications to targeted customers.
    However, the S/36 Model 5363 is the only model that is selling
    currently. The S/36 is expected to decline significantly as
    the AS/400 takes over the S/36 market.

-   According to Infocorp, the S/36-PC and S/1-PC are basically
    dead products. It isn't clear that this is the case - CI
    indicates that about 25% of the S/36 and S/1 installations
    over the past year have been the PC models.

-   Datapro and Infocorp agree that the Tower-XP, the low-end of
    the HP3000, and the HP1000 will disappear within the next
    several years.

-   286-based PS/2 systems are overwhelmingly standalone
    workstations for DOS or OS/2. A very small percentage are used
    in multiple user situations. There is no strong evidence that
    286-based PS/2s are being used to any significant degree on
    factory shop floors or for process control in other
    environments. Analysts held different points of view on this
    issue:

    o Some indicated that PS/2 systems are not fast enough for
       real-time processing and with the price of 32-bit
       microprocessors coming down, the price advantage is going
       away.

> o Some analysts believe that factory and lab environments for automation and process control are moving in volume to 32-bit processors.
>
> o One analyst did support the claim that the 286-based PS/2 is being used in labs for process control as a data collection device.

- New applications are apt to use 32-bit rather than 16-bit technology.

CUSTOMER PERSPECTIVES

S/36, HP3000, Tower, PDP-11, 286-based PS/2, Altos, and PC/AT customers who have recently installed some of the selected 16-bit systems provided the following insights on the selection and current and potential uses of these systems.

Reasons given for selecting 16-bit as opposed to 32-bit systems:

- o Government procurement specification or headquarters made the decision

- o 32-bit (Altos) was not available at the time

- o Price advantage or significant discounting

- o Software compatibility, application driven

- o Sufficient for the customer's needs and application (e.g., HP3000 Series met requirements for OAS and front-end box for RJE; PDP-11 was better for particular real-time application than 32-bit system)

- o Remote manufacturing facilities (e.g. Philippines) that did not need the latest technology for applications such as general business.

With the exception of one customer, all were satisfied or very satisfied with the 16-bit system. The reasons were similar to those for selecting the system.

CUSTOMER APPLICAITONS

The type of applications currently running on the systems are very similar to the profile for the individual systems in the previous section. Departmental or niche markets/applications include:

- o Customized control program for tracking policy numbers in an insurance company

o Accounting and general business for construction and property management.

o Integrated 386 accelerator board for data crunching and 16-bit processor for I/O.

CUSTOMER PLANS

Plans for current and future systems include:

o Trade-in and/or upgrade to 32-bit for CAD applications or as program gets larger.

o Recycle to a branch office, remote facility in third-world country, or another department.

o Off-load data analysis or some other application from system and put on 32-bit systems.

There were few advantages for future purchase of 16-bit system other than software compatibility, software availability on 16-bit, and cost.

INNOVATIVE CUSTOMERS USES AND IMPROVEMENTS

Innovative uses of 16-bit systems are very few. Examples:

o Morgan Financial Client Services provides customized software that links its tax programs with the client's database.

o Teledyne CAE indicated its 16-bit solution for data acquisition off the shop floor is innovative in this field.

Ideas for vendors to improve their 16-bit offerings include better service, price, and improved speed and capacity of 16-bit systems in order to protect the customer's investment.

Asked whether they would use 16-bit for other applications, users responded as follows:

o One out of three interviewees could envision using a 16-bit system as a host or server to a cluster of PC systems. Some were already doing this or had plans to do so.

o Two out of five interviewees could see using their system for network control and communications. Several were already doing this (Series/1).

o A little over one-third of the interviewees were currently using their system for application development.

o PS/2, Altos, and AT users were asked if they planned to or currently used their 286-based systems for process control, continuous process control or transaction monitoring applications. None did or planned to do so.

Potential opportunities for 16-bit technology/systems include:

o Applications that do not need the power and speed of 32-bit systems such as embedded processors in copy machines and fuel injection devices, as opposed to a full system configuration.

o Laptops using 16-bit microprocessors, a market expected to experience significant growth.

o Third world and Soviet bloc countries, where importing older technology is permitted (as opposed to import restrictions on 32-bit), and where 16-bit may be adequate.

o According to IDC, markets with low growth which do not take advantage of new software or customers and are only now addressing automation offer some opportunity. IBM is the only vendor that appears to be penetrating outside its customer base with non-PC class machines. The type of customer is generally unsophisticated, small businesses or professional offices in the medical, dental, legal arenas. Construction and property management are other areas that potentially will continue to use 16-bit systems because a small percentage of this group are automated, users are relatively unsophisticated, and they do not need much speed or power.

o Some vendors offer 386 accelerator boards for 16-bit systems. This allows users to off-load some of the applications and extend the life of the processor.

o Other potential implementations of 16-bit systems include PC hosts or servers, network controllers and communications systems, remote network management and administration (an RSM-like product that supports RSX), and terminal servers.

In all of the above, cost and software will be driving factors for selecting a 16-bit versus a 32-bit system.

LIST OF SOURCES

1.   Minicomputer Systems, Datapro, 1987.

2.   Computer Intelligence Corporation database runs, June 1989.

3.   Informal survey of 16-bit computer users, conducted by CRS consultants, June 1989.

4.   Infocorp database runs, June 1989.

5.   1989 Multi-user Processor Data Book, IDC, May 1989.

6.   Preliminary 1988 PC numbers, IDC, June 1989.

7.   1988 Multi-user Processor Data Book, IDC, March 1988.

8.   1987 Processor Data Book, IDC, Feb. 1987.

9.   PC Market Review and Forecast, IDC, June 1988.

10. Interview with Bruce Stephen of IDC, June 26, 1989.

11. Interview with Jeanette Sil-Holeman of Infocorp, June 26, 1989.

12. Interview with Bill Kirwin of Gartner Group, June 27, 1989.

13. Interview with Donald Bellomy of IDC, June 27, 1989.

14. Interview with Myron Kerstetter of Gartner Group, June 27, 1989.

APPENDIX A: UNIT SHIPMENT BY SELECTED SYSTEMS

	1986	1987	1988	1986-88 CAGR
Altos **				
Worldwide	4135	3300	900	-53.3%
US	2445	1600	850	
International	1690	1700	50	
AM-1200M				
Worldwide	925	1670		80.5%
US	650	1000		
International	275	670		
BTI 6000				
Worldwide	30	15	17	-24.7%
US	20	15	12	
International	10		5	
DPS6				
Worldwide	3045	3082	1882	-21.4%
US	1800	487	122	
International	1245	2595	1760	
DG 500				
Worldwide			800	
US			400	
International			400	
PDP				
Worldwide	2480	30050	11800	118.1%
US	1600	20900	6500	
International	880	9150	5300	
HP1000				
Worldwide	6625	5442	5805	-6.4%
US	3980	1765	3255	
International	2645	3177	2550	
HP3000				
Worldwide	2040	5900	4200	43.5%
US	1210	3300	2750	
International	830	2600	1400	
PS/2-30,50,60				
Worldwide		850000	1870000	120.0%
US		595000	1215000	
International		255000	645000	

PC/AT

Worldwide	555000	710000	20000	-81.0%
US	367000	450000		
International	188000	260000	20000	

System/36

Worldwide	35000	35000	67000	38.4%
US	16000	16000	27000	
International	19000	19000	40000	

Series/1

Worldwide	6500	4500	11000	30.0%
US	3500	2300	7000	
International	3000	2200	4000	

ICL System 25

Worldwide	190	150	200	2.6%
US	190	150	200	
International	-	-	-	

MAI 2000

Worldwide	1700	1215	423	-50.1%
US	815	625	218	
International	885	590	205	

MOD Classic

Worldwide	63	44	31	-29.9%
US	45	35	25	
International	18	9	6	

Nixdorf 8850,8870

Worldwide	250	150	75	-45.2%
US	250	150	75	
International	-	-	-	

Tower-XP,Mini

Worldwide	5965	4390	2020	-41.8%
US	3265	1767	725	
International	2700	2630	1195	

TI 1000,1100,1200,SP1000

Worldwide			5900	-
US			4000	
International			1900	

Unisys S80,B27,28,38,39

Worldwide	13143	34500	8698	-18.6%
US	8340	17000	3449	
International	4803	17500	5249	

Source: IDC

APPENDIX B: INSTALLED BASE BY SELECTED SYSTEMS

	1986	1987	1988
Altos **			
Worldwide	5955	9500	10400
US	3750	5500	6350
International	2205	4000	4050
AM-1200M			
Worldwide		925	3055
US		650	1970
International		275	1085
BTI 6000			
Worldwide	30	45	62
US	20	35	47
International	10	10	15
DPS6			
Worldwide	6170	12066	13938
US	3500	3936	4048
International	2670	8130	9890
DG 500			
Worldwide			800
US			400
International			400
PDP			
Worldwide	4285	53950	26535
US	2705	39605	16905
International	1580	19430	9630
HP1000			
Worldwide	94842	99994	92530
US	52873	55008	50462
International	41969	44986	41068
HP3000			
Worldwide	2214	4694	12114
US	1367	5517	7267
International	933	3014	4935
PS/2-30,50,60			
Worldwide		850000	2243000
US		595000	1835000
International		255000	911000

PC/AT
Worldwide	901000	1616000	1636000
US	649000	1099000	1099000
International	257000	517000	537000

System/36
Worldwide	105000	145500	212500
US	54000	70000	97000
International	51000	75500	115500

Series/1
Worldwide	49000	53500	95890
US	28700	31000	57940
International	20300	22500	37950

ICL System 25
Worldwide	600	900	1128
US	600	900	1128
International	–	–	–

MAI 2000
Worldwide	4200	5415	5699
US	2200	2825	2972
International	2000	2590	2727

MOD Classic
Worldwide	868	950	976
US	588	623	643
International	280	327	333

Nixdorf 8850,8870
Worldwide	1840	1990	2085
US	1840	1990	2085
International	–	–	–

Tower-XP,Mini
Worldwide	16665	19055	23075
US	9515	9275	12000
International	7150	9780	11075

TI 1000,1100,1200,SP1000
Worldwide			7900
US			5600
International			2300

Unisys S80,B27,28,38,39
Worldwide	13925	47600	16330
US	8762	25300	7590
International	5163	22300	8740

Source: IDC

APPENDIX C1: SYSTEM DISTRIBUTION BY INDUSTRY

Industries	System/36	Series/1	HP3000 MICRO3000	TOWER-XP MINITOWER	DPS6
AEROSPACE	0.4%	3.1%	1.9%	–	–
AIR-AUTO SVC	0.1%	–	0.6%	–	–
APPAREL	3.0%	3.1%	0.6%	–	1.6%
AUTOMOTIVE	2.5%	3.1%	1.2%	–	3.2%
BANKING	2.7%	10.8%	0.6%	8.8%	4.8%
BROADCAST	1.6%	–	0.9%	–	–
BUILD-MATER.	1.7%	–	2.8%	2.9%	1.6%
BUSINESS	6.6%	6.2%	4.6%	5.9%	3.2%
CHEMICAL	2.0%	–	5.3%	1.0%	3.2%
CONSTRUCTION	3.1%	1.5%	9.3%	2.9%	1.6%
CPU&BUSINESS	0.3%	–	1.9%	2.0%	–
CREDIT AGENCY	0.8%	–	0.3%	1.0%	1.6%
DATA SERVICES	4.0%	3.1%	5.3%	7.8%	4.8%
DRUGS-MED.	0.5%	1.5%	2.2%	–	–
EDUCATION	3.0%	–	4.3%	2.9%	–
ELECT-MACH	2.1%	3.1%	4.6%	1.0%	–
ELECTED	0.9%	–	0.6%	–	–
ELECTRONICS	0.6%	1.5%	3.7%	1.0%	–
ENGINEER	0.3%	–	0.6%	–	–
FEDERAL	0.3%	3.1%	1.6%	15.7%	15.9%
FINANCE	0.1%	–	0.3%	–	–
FOOD-BEVERAGE	4.0%	7.7%	3.1%	3.9%	6.4%
HEALTH CARE	6.2%	7.7%	2.8%	2.0%	1.6%
HOTELS-ENTER.	2.2%	–	–	–	–
INSURANCE	7.0%	3.1%	1.9%	1.0%	11.1%
LEGAL SERVICE	0.9%	–	0.6%	–	–
MACHINERY	1.5%	1.5%	3.7%	3.9%	–
METAL-GLASS	3.6%	4.6%	3.7%	6.9%	4.8%
MINING	0.4%	–	0.3%	–	–
MISC-MFG	2.4%	1.5%	5.0%	3.9%	–
NEWSPAPER	0.2%	–	1.9%	–	–
OIL-GAS-EXTRACT	0.9%	1.5%	1.2%	–	1.6%
PAPER	1.5%	3.1%	4.0%	1.0%	–
PRINTING	1.3%	–	0.9%	1.0%	3.2%
REAL-ESTATE	1.2%	–	0.3%	–	–
RUBBER-PLASTIC	1.2%	–	2.2%	–	–
SCI-TEST	0.6%	–	1.2%	1.0%	1.6%
SEMI-CON	0.0%	–	0.6%	–	–
SHIPPING	2.1%	–	0.6%	1.0%	–
STATE-LOCAL	4.3%	–	6.8%	2.0%	14.3%
TELECOMM	0.6%	1.5%	1.6%	2.0%	–
TRANS-EQ	2.8%	–	1.6%	–	1.6%
UTILITIES	1.1%	3.1%	1.2%	–	–
WHOLESALE	17.1%	24.6%	9.6%	17.7%	12.7%
SITES	2347	65	323	102	63

Based on analysis of data from CI database.

APPENDIX C2: SYSTEM DISTRIBUTION BY INDUSTRY

Industries	ALTOS 1086, 20863086	PC/AT	PS/2-30,50,60	PDP11/53, 11/73/83/84	HP1000
AEROSPACE	–	1.6%	0.8%	0.7%	2.7%
AIR-AUTO SVC	–	0.8%	–	–	–
APPAREL	–	0.8%	1.4%	0.7%	1.5%
AUTOMOTIVE	–	2.4%	1.4%	2.0%	1.7%
BANKING	–	11.1%	6.0%	2.0%	0.6%
BROADCAST	1.9%	–	1.4%	–	1.0%
BUILD-MATER	–	4.0%	0.4%	–	1.7%
BUSINESS	16.7%	6.4%	6.8%	6.5%	6.7%
CHEMICAL	–	4.8%	3.3%	1.3%	6.5%
CONSTRUCTION	1.9%	3.2%	2.5%	0.7%	1.0%
CPU&BUSINESS	–	–	0.4%	0.7%	1.5%
CREDIT AGENCY	–	0.8%	0.6%	–	–
DATA SERVICES	5.6%	7.9%	2.9%	9.8%	5.6%
DRUGS-MED	1.9%	–	0.8%	–	0.4%
EDUCATION	1.9%	1.6%	7.4%	3.3%	3.3%
ELECT-MACH	–	0.8%	1.2%	1.3%	5.0%
ELECTI-DI	1.9%	–	0.4%	0.7%	1.3%
ELECTRONICS	–	1.6%	0.2%	1.3%	3.8%
ENGINEER	–	2.4%	1.0%	1.3%	6.3%
FEDERAL	7.4%	5.6%	4.1%	7.8%	7.5%
FINANCE	–	0.8%	–	–	–
FOOD-BEV	–	2.4%	6.2%	0.7%	0.6%
HEALTH CARE	1.9%	4.8%	3.3%	34.0%	4.0%
HOTELS-ENTER	–	–	0.4%	0.7%	0.2%
INSURANCE	–	4.8%	7.8%	0.7%	0.2%
LEGAL SERVICES	–	–	–	0.7%	0.2%
MACHINERY	3.7%	1.6%	2.3%	1.3%	1.7%
METAL-GLASS	7.4%	3.2%	3.3%	3.9%	6.3%
MINING	1.9%	1.6%	1.2%	–	0.4%
MISC-MFG	3.7%	2.4%	0.8%	1.3%	2.3%
NEWSPAPER	–	–	1.2%	4.6%	0.2%
OIL-GAS-EXTRA	–	1.6%	2.9%	1.3%	3.3%
PAPER	–	3.2%	3.5%	–	2.1%
PRINTING	5.6%	–	2.5%	–	0.8%
REAL ESTATE	3.7%	–	1.4%	–	0.2%
RUBBER-PLASTIC	–	–	1.4%	0.7%	1.7%
SCI-TEST	1.9%	0.8%	0.2%	1.3%	2.9%
SEMI-CON	–	–	0.2%	–	1.0%
SHIPPING	1.9%	3.2%	.0082	1.3%	0.2%
STATE-LOCAL	–	–	3.5%	2.0%	4.0%
TELECOMM	–	–	0.6%	1.3%	2.5%
TRANS-EQUIP	–	1.6%	1.0%	–	0.6%
UTILITIES	–	2.4%	3.1%	0.7%	3.3%
WHOLESALE	29.6%	10.3%	8.2%	3.9%	3.3%
SITES	54	126	486	156	480

APPENDIX D: MARKET/APPLICATION OVERVIEW BY SYSTEM

Manufacturer and Model	Principal Target Market Industry	Other Packages	32-bit Migration
Digital PDP-11/84	Bus/Technical Gen. Comm. Factory Auto.	Graphics Datatrieve W/P,e-mail	VAX, MicroVAX
HP HP1000 E/F/A Series	Scientific/Manufacturing Technical engineering measurement mfg process control graphics	HP9000	
HP3000 Series 52/58/70	Business/Manufacturing Commercial	Office auto. materials mgmt production mgmt graphics distribution	HP9000
HP3000 Micro 3000	Business/Office Auto Commercial	Financial Sales graphics manufacturing distribution	
Bull HN DPS 6/22	Technical/Office Business Data entry manufacturing	Accounting program dev.	DPS6 PLUS
DPS 6 Series 40/70	Technical/Manufacturing Business distribution pharmacy	O/A Accounting Hospital	
IBM Series/1	Business Industrial,retail financial transportation communications telephone mgmt insurance government		
System/36	Gen. Business Manufacturing Distribution	O/A	AS/400
System/38	Business/Gen. Business Commercial	Manufacturing Distribution Office/38	AS/400

APPENDIX D: MARKET/APPLICATION OVERVIEW BY SYSTEM

Manufacturer and Model	Principal Target Market Industry	Other Packages
McDonnell Douglas M6400/M6600	Business Gen. business manufacturing distribution government	MRE O/A library mgmt
Modular Computer	Scientific/Tech Industrial Auto	Query database
Systems Classic CT/15	Factory/Process Control	DI-3000 graphics MAXPAC cont. process cont.
Classic II/15,25,75		
Classic II/45	Scientific/Tech Factory automation Factory/Process Control	
Nixdorf	Business data entry, banks Law enforcement	
8850 Micro 5, 8850/85	County govt.	
8570	Business Manufacturing distribution banking	Financial mgmt mortgage banking
Northern Telecom Meridian DV-1	IVD Information Commercial workgroup <100 Unix-based applic	Telemanagement telemktg teleconferencing
Northern Telecom 585	Office auto	W/P,E-mail
Plessey Peripheral 6300/8300/Vixen	OEM/Business Scientific general purpose	Office auto
SSCI SSCI-100,-800	Scientific CAD/CAM Scientific ATE communications	
Texas Instruments 352A,373A,374A, 375A,362,673A, 675A,690A,691A, 874A,875A/B	BUSINESS	W/P, Data Dict., Query, Screen Design

APPENDIX D: MARKET/APPLICATION OVERVIEW BY SYSTEM

Manufacturer and Model	Principal Target Market Industry	Other Packages
Ultimate Corp.		
1500 Series (LSI 11)	Business Business	Varied
3000 Series (11/23)	Small Business General Business	UltiWord,Ultiplot, Ulticalc,UltiNet, UltiMation,Ultikit
6000 Series (DPS 6)	Business Commercial, Business	UltiWord,UltiPlot, UltiCalc,UltiNet
Unisys Corp.		
B90 Series	Business/comm General Business	Mfg,hospital, educ,word mgmt, reporter,Domain
B1900 Series	Commercial O/A Decision support	Accounting, wholesale/distrib. manufacturing
System 80	Commercial O/A decision support	accounting, wholesale/distrib. manufacturing
Wang		
VS 5	Automation Office Automation	
Barrister Information Systems Corp.		
Model 145,150,160	Legal Industry Legal applic.	W/P, legal, accounting, financial modeling info. mgmt.
Model 3100,3200 3300	Legal O/A & Legal applic. Practice mgmt.	W/P,law firm accounting, financial modeling, info. mgmt.,e-mail
Bonar August Sys.		
Series 330 TRI-GUARD System	Industry control Process, critical Safety shutdown HVAC control, safety shutdown	Modbus protocol, Database Builder, Ladder Logic Builder
Series 330 TRI-DAC System	Industrial control Process safety Critical Data Acq. shutdown, critical HVAC w/ colograph	Modbus protocol, Ladder,database, & graphics builder

APPENDIX D: MARKET/APPLICATION OVERVIEW BY SYSTEM

Manufacturer and Model	Principal Target Market Industry	Other Packages
BTI Computer Sys. BTI 6000	Business Accounting	
CalComp Corp. 85108600 (11/23,11/23/8086)	Technical CAD/D-mech/tech	S/S,W/P
Chrislin Industries CI-Micro-11 (11/73)	Technical Manufacturing Business	Accounting
Compulab Corp.		
Sentinel DS-140	Business Industrial distribution	medical credit union accounting
Sentinel DS-175	Business Industrial distribuion laboratory	medical credit union accounting
Computer Designed Sys		
Adviser 100,600, 900	Business Manufacturing Manufacturing distribution Distribution	medical construction fixed assets
Display Data Corp.		
in*sight	Business Auto dealer route distribution	truck dealer
GEAC Computers		
6000, 8000	Business Banking Financial Library Library	
Concept 9000	Financial,library,Banking transaction proc. Library	
ICL Inc. System 25		
Model 410,420,430	Business/retail retail controller	
Model 440	Business/retail retail controller, revenue data coll.	
Model 450, 490	business/retailer retail controller, government revenue data coll.	
Independent Business Systems		
3075, 3175, 3300	Business Publishing	Editor,linker
Integrated Digital Products Corp.		
Ally	Business Systems	

APPENDIX D: MARKET/APPLICATION OVERVIEW BY SYSTEM

Manufacturer and Model	Principal Target Market Industry	Other Packages
MAI/Basic Four		
MAI 2000	Business Gen. business manufacturing distribution government	MRE,O/A, library mgmt.
MDS Qantel **Business Computers** System 45XP, 55, 587843	Business Mfg,retail,hotel, transportation	S/S,W/P
Norsk Data N>A. ND-100	General purpose general purpose	O/A
SUPERMICROS		
Alpha Microsystems AM-1200M (100% dealer)	General business accounting, insurance,trade,gen.business sys, medical,legal manufacturing rec.mgmt., O/A	general acct. vertical market
Data General DG/500 (vendor/indirect)	Gen.business, manufacturing, bank/fin/invest trade,medical	
General Automation Zebra 1350 (100% VAR) (PICK O/S)	Gen. business, Accounting manufacturing, gen. business sys. bank/finance, manufacturing trade,medical, trans. monitor construction,edu,rec. mgmt., O/A hospitality,govt.	
Texas Instruments System 1000, 1100,SP1000,1200 (95% VAR,distrib)	Gen. business, Accounting, manufacturing, gen.business sys. medical, manufacturing transportation, trans. monitor, telecom/utilities rec. mgmt.,O/A	

APPENDIX D: MARKET/APPLICATION OVERVIEW BY SYSTEM

Manufacturer and Model	Principal Target Market Industry	Other Packages
Unisys Corp. B26,B27,B28,B38	Gen. business, Accounting, manufacturing, gen. business sys. bank/fin/invest rec. mgmt.,O/A trade,medical, legal,construction, govt.,edu	
Altos Computer Sys. 386 Series 500, 1000, 2000 100% VAR,distrib, dealer OEM	(32-bit systems) Manufacturing, accounting, bank/fin/invest,gen.bus.system, insurance,medical, manufacturing, legal,govt. rec.mgmt,O/A	
386 Series 500 Pick Altos 3068 Pick (100% indirect)	Manufacturing, accounting, bank/fin/invest, gen.bus.system insurance,trade, manufacturing medical,legal, construction,govt	
Micro PDP-11/53, 11/53+,11/73, 29159 (vendor & indir)	Gen.business, gen.business,mfg, manufacturing, trans. monitor, bank/fin/invest, lab automation, medical,edu,legal, process control, transportation, accounting,O/A construction	
Hewlett Packard Micro3000GX, -LX, -XE (Vendor & indir)	Gen. business, Accounting, manufacturing gen.bus.sys., bank/fin/invest, manufacturing, insurance,trade, trans.monitor, medical O/A	
NCR Minitower, Tower XP (Vendor & indir)	Manufacuring, Accounting, bank/fin/invest, gen.bus.sys, trade manufacturing, trans. monitor, rec.mgmt.,O/A	Tower 32/600 Tower 32/650

Source: DataPro

APPENDIX E: APPLICATIONS BY SELECTED SYSTEM
(Based on Analysis of CI Data)

	GENERAL BUSINESS	OAS	ACCOUNTING
SYSTEM/36	* 85% IN-HOUSE IBM A/P,A/R, Gen-Ledger, Inventory,Payroll Edwards A/P,A/R,G/L, Sales Analysis Para-Research AP,AR,GL, Inventory Prentice-Hall AP,AR,FRS, Inventory Concord-Mgmt AP,AR,GL,PR	Para-Research Easy-Text IBM DisplayWrite/36 IBM Personal Services 36	IBM CMAS,DMAS HIS Backoffice
HP3000	* 63% IN-HOUSE Uptime A/P,A/R,G/E,O/E Collier A/P,G/E ASK Manman-AP, OMAR, GL, Payroll MCBA A/P,A/R,G/L, Payroll,I/M,COP COMM-ASSOC. Fixed Assets	HP HPmail,Desk-Mgr	In-house
Tower	* 91% In-house Realworld AP,AR,GL,Payroll	Wordperfect?? SOFTEST Lex	* Inhouse
HP1000	HP Gen-Ledger		
DPS6	* 88% In-house HN DEF-11 (data-entry) MSA Gen-Ledger ??	* In-house	* in-house

APPENDIX E: APPLICATIONS BY SELECTED SYSTEM
(Based on Analysis of CI Data)

	REPORT GENERATOR	MANUFACTURE	DBMS
SYSTEM/36	IBM Query/36	IBM MAPICS	SOFT-PRO Open Access
	IBM Retrieval/36	A. Andersen MACPAC MSA MRPII	
HP3000	HP Query,Inform,View, Report Cognos Quiz	HP MGMT/3000 HP Jobscope STATCOM Boss/3000	HP Image Rego ADAGER
Tower			Unify Microrim R-BASE Informix-SQL Microsoft File??
HP1000			HP Image
DPS6		* in-house	CINCOM total HN DBMS Ashton-Tate DBIII+??

APPENDIX E: APPLICATIONS BY SELECTED SYSTEM
(Based on Analysis of CI Data)

	FINANCE	GRAPHICS	APPLIC. DEVELOPMENT
SYSTEM/36	DEXEL Credit-Union	IBM BGU	IBM PRES
HP3000	In-house	Microrim RBASE-Graph	HP Rapid/3000
		HP Graphics/125	HP Transact Cognos Powerhouse, Cognos Quick
HP1000		HP Graphics/125	TOMINY Database+??
DPS6			Cincom Applic. Dev.

	PROG. SUPPORT	MICRO-LINK	INDUSTRY SPECIFIC
SYSTEM/36	IBM POP,IDU	IBM PC Support	Columbine BIS (Broadcast) VitaServe (Medical)
HP3000	Cognos QTP	WR&Q Reflection	
Tower *Majority Inhouse		Smartcom,Crosstalk, ROSSDATA Vdrive	

	DATA ANALYSIS
HP3000	SPSS

APPENDIX F

Customer Interview Script
16-bit Computer Project

Name_____Date_____

Company_____Phone_____

Title_____System_____._____

Hello, this is _____ from ----------------------. We're
conducting a survey of 16-bit computer users. The purpose of
this survey is to determine current and future use and
selection of 16-bit systems. I'd appreciate your help in this.
I'd like to ask you some questions which should take 15
minutes.

Is this a good time?

____Yes, BEGIN No. 1

____NO, When is an appropriate time? Time/Date:_____

1. Does your organization/site use any of the following
systems?

___SYSTEM 36
___HP3000 SERIES 52,58,70 OR HP'S MICRO3000
___NCR'S MINITOWER OR TOWER-XP
___IBM PC/AT OR PS/2 MODEL 30,50, 60
___ALTOS 1086,2086,3068, OR 3086
___PDP-11/84 OR MICROPDP-11/53,11/73, 11/83

2. When was the most recent purchase of (SYSTEM IN No. 1)?

3. Why did you select this system versus a 32-bit system
that the vendor offered?

4. What applications are you running on this (these) 16-bit
system(s)?

APPLICATION(S) VENDOR/IN-HOUSE DEVELOPED   NAME OF PKG

5. How satisfied are you with this system(s) for your
particular applications?

     Very Satisfied   Satisfied   Not Very Satisfied

5a. Why?

6. Are you or do you have plans to use this (these) 16-bit system(s) for different applications?

____ YES, what are these new applications?

APPLICATION(S) VENDOR/IN-HOUSE   NAME OF PKG

_____

____NO, How long do you plan to continue to use this system(s) in the same capacity? _____MOS/YRS
How will you dispose of the system(s)? _____

7. Do you see any advantages to purchasing this 16-bit system in the future? What are they?

8. What would be the disadvantages of selecting this 16-bit system for future purchases?

9. Are you aware of any innovative uses of this 16-bit system in your profession or industry?

10. What innovative things has the vendor of these systems done to maintain and continue your investment in these systems? OR What would you recommend that the vendor do to maintain and continue your investment in these systems?

11. IF THE FOLLOWING HAVE NOT BEEN MENTIONED, THEN ASK:

Do you currently or plan to use your 16-bit system(s) in the following manner:

- Host or server to cluster of PC's   Y   N
- Network control or communications   Y   N
- Applications Development   Y   N

    What type? _____
(IF THE FOLLOWING APPLIES GIVEN THE CUSTOMER/INDUSTRY)
- Process Control   Y   N
- Continuous Process Control   Y   N
- Transaction Monitoring   Y   N
- Other _____

12. Do you have any other comments?

Thank you for your help.