

SERVICE VENDOR PROFILES  
HARDWARE MANUFACTURERS

INPUT






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SERVICE VENDOR PROFILES  
HARDWARE MANUFACTURERS

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## VENDOR SERVICE PROFILES HARDWARE MANUFACTURERS

### ABSTRACT

Service from computer hardware manufacturers represents almost 90% of today's \$13 billion service market. And as this market grows, INPUT expects manufacturers to accumulate an even larger proportion of the total service dollar. The service methods that manufacturers are now using and will use in the future are the subject of this report.

The report studies the service organizations of the top 31 U.S. manufacturers. Each service vendor is analyzed individually in a profile format that includes:

- Listing of corporate service officers.
- Company background.
- Service demographics.
- Organizational structure.
- Detailed description of hardware and software support options.
- Revenues.
- Impact of third-party maintenance.
- Future trends in service.

The report includes profiles on almost all major vendors in the U.S. market who together represent over 90% of the U.S. service market.

This report contains 178 pages, including 43 exhibits.



SERVICE VENDOR PROFILES  
HARDWARE MANUFACTURERS

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**SERVICE VENDOR PROFILES  
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## I INTRODUCTION



## I INTRODUCTION

- This report was produced by INPUT as part of the 1985 Customer Service Program in the U.S. for clients of that program. This is just one in a series of reports INPUT produces on the service markets. Other reports include an analysis of user requirements for service and a forecasts/trends analysis of the overall service market.
- The top hardware manufacturers that provide service represent the focus of this report. Of course, all the major vendors, such as IBM, DEC, and Burroughs, are included. However, INPUT has also included vendors who are particularly innovative in their service offerings. Manufacturers from all product segments are represented in this report, including microcomputer, minicomputer, mainframe, and peripherals manufacturers.
- The vendors included in this report are listed in Exhibit I-1.
- Each manufacturer is described in a standard profile format. This profile includes:
  - Company name, address, principal offices, and 1984 revenues.
  - A background on corporate activities over the last year including new product introductions and significant news items.



EXHIBIT I-1

CSP VENDOR PROFILES

Apple	National Advanced Systems
AT&T	NCR Corporation
BTI	Perkin-Elmer
Burroughs	Prime
CalComp	Reynolds & Reynolds
Centronics	Sperry
Control Data Corporation	Stratus
Data General	Tandem
Digital Equipment Corp. (DEC)	Tandy
Gould	Tektronix
Harris Corporation	Telex Computer Products, Inc.
Hewlett-Packard	Texas Instruments
Honeywell	Triad Systems
Intellogic Trace	Wang
IBM	Xerox
Mohawk Data Sciences	

- Service demographic, such as number of field engineers, service offices, and centralized support centers.
  - A four-year summary of the company's overall and service revenue growth.
  - A description of the company's service organization, including an organization chart.
  - An in-depth analysis of hardware and software support options, including a description of basic and premium services offered along with selected pricing information.
  - A discussion of the future trends of service as they affect individual manufacturers.
- INPUT has designed this report as a reference volume for the reader who may require a rapid overview of the market at one time and an in-depth analysis of a particular vendor at another time.

#### A. METHODOLOGY

- Primary research for this study was conducted between June and September 1985 and included both on-site and telephone interviews. The interviews ranged from 30 minutes to over 2 hours and frequently resulted in extended call-backs for additional information.
- The questionnaire used for the manufacturer interview is included in Appendix A.

- In addition to vendor interviews, this report also is based on extensive secondary research including analysis of annual reports, 10K reports, and information in the trade press. Over 1,300 user interviews conducted by INPUT in 1985 were analyzed to identify service performance for each of the 31 vendors included in this report.

## B. DEMOGRAPHICS

- The 31 manufacturers were selected for inclusion in this report based on a number of factors. First, major vendors, such as IBM, DEC, and Burroughs, were necessarily included because of their overwhelming influence on the market. A second group was added because of the importance of these vendors on a particular aspect of the service market. Some of these companies are Intellogic Trace, Tandem, and Xerox. The vendors in the final group were selected because they displayed innovative service techniques. Stratus, BTI, and Reynolds & Reynolds are examples of these companies.



## II VENDOR PROFILES



## SERVICE VENDOR PROFILE

**APPLE COMPUTER, INC.**  
20525 Mariani Avenue  
Cupertino, CA 95014

President & CEO: John Scully  
Vice President, Operations Management:  
Jim Beam  
Revenues, Fiscal Year 1984:  
\$1,516 Million

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### THE COMPANY

- Since 1977, when it helped spark an entirely new industry with the introduction of the Apple II personal computer, Apple has been correctly identified as one of the most innovative and successful companies in America. Often perceived as the "underdog," waging a "David versus Goliath battle" against IBM, Apple has grown to a \$1.5 billion company in 1984, hardly qualifying as a "little guy" anymore. However, the battle lines remain as firmly entrenched in their war against "Big Blue," a battle in which, until recently, they were at least maintaining ground.
- 1984 proved to be a critical year for Apple. While sales continued to grow at a rapid rate (up 54% over 1983), net income dropped 17% from 1983. Although Apple was quick to point out that the long predicted industry shake-out was solely to blame for their own slump, clearly many of Apple's problems were caused internally.
- The foremost of these internal problems culminated in a drastic reorganization of Apple in 1985, which in essence removed founder and chairman Steve Jobs from the day-to-day operations of Apple to a more "advisory" role at a "global" level. The product that he placed most of Apple's marbles behind in 1984, the MacIntosh, was clearly de-emphasized in this reorganization, with the elevation of the aging but still popular Apple II to a more equal footing with the Mac.
- More significantly, the reorganization signaled a departure from the 1984 goal of capturing corporate America with the "MacIntosh office" strategy. Instead, Apple appears to have conceded big business to IBM and has returned to its past strengths: small business, education, and individual users. Apple laid off the direct sales force implemented in 1984 as its access to corporate America, and returned the responsibility for all sales to retail dealers.
- Apple has also placed most of the responsibility of service on their distributors. Apple offers no direct service to their end users. Instead, Apple relies almost exclusively on their dealers who must qualify as an Apple dealer by offering service to their users. In addition, Apple requires that dealers of their MacIntosh office products provide on-site service to their customers. Beyond this, Apple places no other requirement on their dealers, and places little, if any, control on pricing of service.

- At the close of first quarter 1985, Apple announced the end of their "exclusive" third party service arrangement with RCA and the selection of Honeywell as their new "preferred" third party service provider. The agreement provides Honeywell with access to Apple parts at guaranteed levels (and presumably discounted prices), and provides Apple with a respected third party organization to handle corporate accounts. Honeywell, with 250 service centers and more than 3,700 total service staff, was originally to handle direct sales accounts of MacIntosh office and other large corporate accounts. With Apple's abandonment of the direct sales force, Honeywell's goal will undoubtedly be to attract small businesses with their extensive carry-in service center network. How successful they are in doing this, given the competition that already exists for these users from Apple's existing dealer network, is open to conjecture.
- The bulk of Apple's involvement in service is in the support of their dealers. Apple offers training to their dealer's service personnel in the form of a three and one-half hour video tape sent to each servicing dealer. In addition, Apple will provide access to an on-line "bulletin board," known as AppleLink, which will contain service information on both past and current Apple products. Also, Apple is developing training materials and course work on telecommunications maintenance for their "MacIntosh office" dealers.

## SERVICE VENDOR PROFILE

**AT&T INFORMATION SYSTEMS**  
Morristown, NJ 07054

Chairman: Robert Allen  
President, Services Division:  
Peter T. Milano

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### THE COMPANY

- The data processing industry marveled at the prospect of a new \$40 billion-strong competitor entering the market when AT&T split up in 1983-1984. While AT&T has not dominated the market, it certainly has made an impression through the introduction of a wide variety of products and extensive exposure.
- The communications giant entered the market with some internally developed computer products, such as the 3B20 line, some externally developed products, such as the UNIX PC, and a reputation as one of the best service vendors in the U.S. That AT&T could have a nearly complete product line just 16 months after entering the market is an exceptional accomplishment. Maintaining a high level of service performance on this equipment is a strong AT&T commitment.
- AT&T's data processing product line can be divided into six categories:
  - 3B20 is the top of AT&T's line. The 3B20s can be configured with up to 16MB of main memory and can support up to 256 workstations. Performance is rated at up to 1.8 MIPS. The 3B20 is also available in a fault-tolerant version.
  - 3B5 can support 48 simultaneous users and has up to 16MB of main memory and a performance rating of 1.0 MIPS.
  - The new 3B15 permits up to 60 simultaneous users and has a MIPS rating of 1.4.
  - The 3B2 ranges from 16 to 25 concurrent users and up to 4MB of main memory, and has a performance rating of 1.0 MIPS.
  - UNIX PC Model 7300 is available with up to 1MB of main memory and an internal 1,200 baud modem. The machine, designed by AT&T and Convergent Technologies, is aimed primarily at the user-friendly, personal workstation market.
  - PC 6300 is the U.S. version of Olivetti products (the M-24 and M-21). The 6300 is a standalone PC utilizing the MS-DOS operating system. With Context Switching software, the 6300 can be used as a 3B2 workstation.



- Because all of AT&T's major computer product lines (except for the PC 6300) are UNIX-based machines, the company can point to a high level of software compatibility. However, there is only limited hardware compatibility--only the 3B5/100 and 3B205 can be upgraded. In addition, although standardization around UNIX is natural since AT&T developed that operating system, UNIX has not established itself as the industry standard and applications software selection is still limited.
- The lack of applications software and the still-developing distribution channels have limited the number of potential markets currently open to AT&T. The company has stated that office automation is its major opportunity due to its strength in communications and data processing. Other markets, such as hospital/medical information systems and manufacturing, have also been identified as potentially lucrative markets.
- Clearly, access to any particular market will be dependent on AT&T's ability to build on the company's major strengths--communication and service experience. INPUT believes that AT&T's service reputation, based primarily on telecommunications products, must adjust to the data processing environment in order to be successful. Key data processing service areas which must be addressed include:
  - Service pricing which is far more competitive in data processing than in telecommunications.
  - Logistics operations.
  - Engineer skill level.
  - Operational structure, including escalation and dispatching procedures as well as remote support networks.

## SERVICE DEMOGRAPHICS

- AT&T's Information Systems Service Division installs and maintains communications, computer products, systems, and custom networks for the company. Before divestiture, AT&T had 22 separate operating company service organizations and 350 service districts. Currently, the company has 3 regions and 70 districts.
- To date, telecommunications continues to dominate Service Division activities. The company currently employs 20,000 system technicians (who respond to 35 maintenance and service calls per day). In August 1985, the company announced its intention to eliminate over 24,000 positions in the next 18 months, 8,500 of which are service positions, but even with the cuts, the Service Division's workforce will total to 40,000 in more than 1,000 locations--one of the largest in the U.S.

- The company is rapidly expanding the number of technicians trained on installation and maintenance of DP equipment--currently numbering over 1,000 technicians.
- While AT&T's National Service Center for new product support is located in Denver, the company currently maintains six regional diagnostic and repair centers called "Customer Service Support Operation."
- In addition to hardware voice and data support centers, AT&T also maintains six software support centers, discussed below.

## SOFTWARE SUPPORT

- The Service Division of AT&T offers a variety of software support services bundled with hardware support or sold separately.
  - AT&T software is covered by a 90-day warranty period.
  - Basic software service includes toll-free hotline assistance 8 a.m. to 5 p.m., Monday through Friday.
  - Business Day Service includes toll-free hotline assistance plus on-site coverage 8 a.m. to 5 p.m., Monday through Friday.
  - Around-the-Clock Service includes toll-free hotline assistance plus technician on-site service 24 hours-a-day, seven days-a-week.
- User involvement in software support is encouraged by AT&T, particularly in the interaction between the user and the company's hotline staff. AT&T allows any customer employee to access their hotline staff, in contrast to other vendors that require a central contact point at the user's site.
- Customized applications software support is available from six centers in the U.S. located in New York, Pennsylvania, Georgia, Colorado, Illinois, and California. These application support centers provide custom programming, applications and custom implementation services, consulting, and training.
- The UNIX operating systems are bundled into the hardware purchase price, although UNIX RTR (for the 3B20D) is priced separately. Applications software is purchased on a one-time use license fee with monthly maintenance fees optional.

## HARDWARE SUPPORT

- Hardware support options include:
  - Basic toll-free hotline service which includes remote diagnostics.
  - Business Day Service (described above).

- Around-the-Clock Service (described above).
  - Dedicated Service, which includes full-time, on-site support.
  - Time and Materials Service.
  - Depot Service, which includes module swapping on a mail-in basis with an optional phone-in exchange service.
- Personal computer service does not include installation, although a variety of on-site services are available for a service premium.
  - Dispatching is handled at the local level, which offers the advantage of a high degree of client contact. AT&T also has extensive coordination between service, design, and manufacturing, resulting in very rapid escalation procedures.

### THIRD-PARTY MAINTENANCE

- In June 1985, AT&T announced Integrated Service Management (ISM), a new service which will include selected TPM services. As described by the company, ISM will offer customers a single point of contact for merging disparate technologies, accommodating multiple vendor systems, designing customer's networks, and administering and managing total service support operations.
- The company has not identified, at least publicly, a list of third-party products which will be serviced under ISM. However, it seems likely that AT&T will select products which result in increased account control rather than selecting products which simply increase service revenues. INPUT believes that AT&T will not service competitive products in either data processing or telecommunications, but will focus on complimentary products leading to single source control of the user's service contracts.

### FUTURE SERVICE TRENDS

- As noted above, AT&T has one of the finest service reputations in the U.S., but that reputation is based primarily on telecommunications, not data processing, service.
- While INPUT acknowledges the merging of these two industries, we believe that AT&T must establish a separate identity in the data processing services market. In order to establish this identity, INPUT expects AT&T to emphasize:
  - Increased engineer training.
  - Improved logistics and operational support.
  - Greater centralization of the service structure.

- The Integrated Service Management program clearly points to the company's long-term goal of account control through expanded service coordination. The company is building on its strength and experience in the area of telecommunications in order to enter a key data processing submarket--network management. Success in this area will promote other single-source services, such as system administration, operations management, consulting, and site planning.
- AT&T's goal of site control is not significantly different than the goal of most other service vendors. However, experience in telecommunications, an excellent reputation for service, and vast financial and human resources will make AT&T a major force to be reckoned with in the service market.



## SERVICE VENDOR PROFILE

**BTI COMPUTER SYSTEM**  
870 W. Maude Avenue  
Sunnyvale, CA 94086

President: Mr. Thomas C. Poulter  
Director, Operations: Mr. Carol Steel  
Revenues, Fiscal Year 1984:  
\$24 Million

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### THE COMPANY

- BTI was founded in 1968 and initially specialized as a timesharing services vendor (hence the company's original name, Basic Timesharing, Inc.). The company expanded into turnkey systems in 1970, starting with a modified Hewlett Packard computer, but soon went on to build their own 16- and 32-bit system. By 1975 the company had discontinued its timesharing service and devoted all its resources to the design and development of timeshared computer systems. There are currently over 4,000 BTI systems installed primarily in the U.S., Canada, and Europe. The company produces two major product lines:
  - BTI 6000. A 16-bit multi-user system capable of supporting up to 32 users. The 6000 is the latest in a series of 16-bit machines built by BTI and has a number of advanced service features such as remote diagnostics capability and modular design.
  - BTI 8000. A 32-bit multiprocessor that can support up to 200 users, the 8000 can be configured with up to 8 CPUs and 16 Mbytes of main memory. The 8000 is described as "fail-safe" in its multiprocessor mode in that the loss of one CPU will slow but not stop system processing.

### SERVICE DEMOGRAPHICS

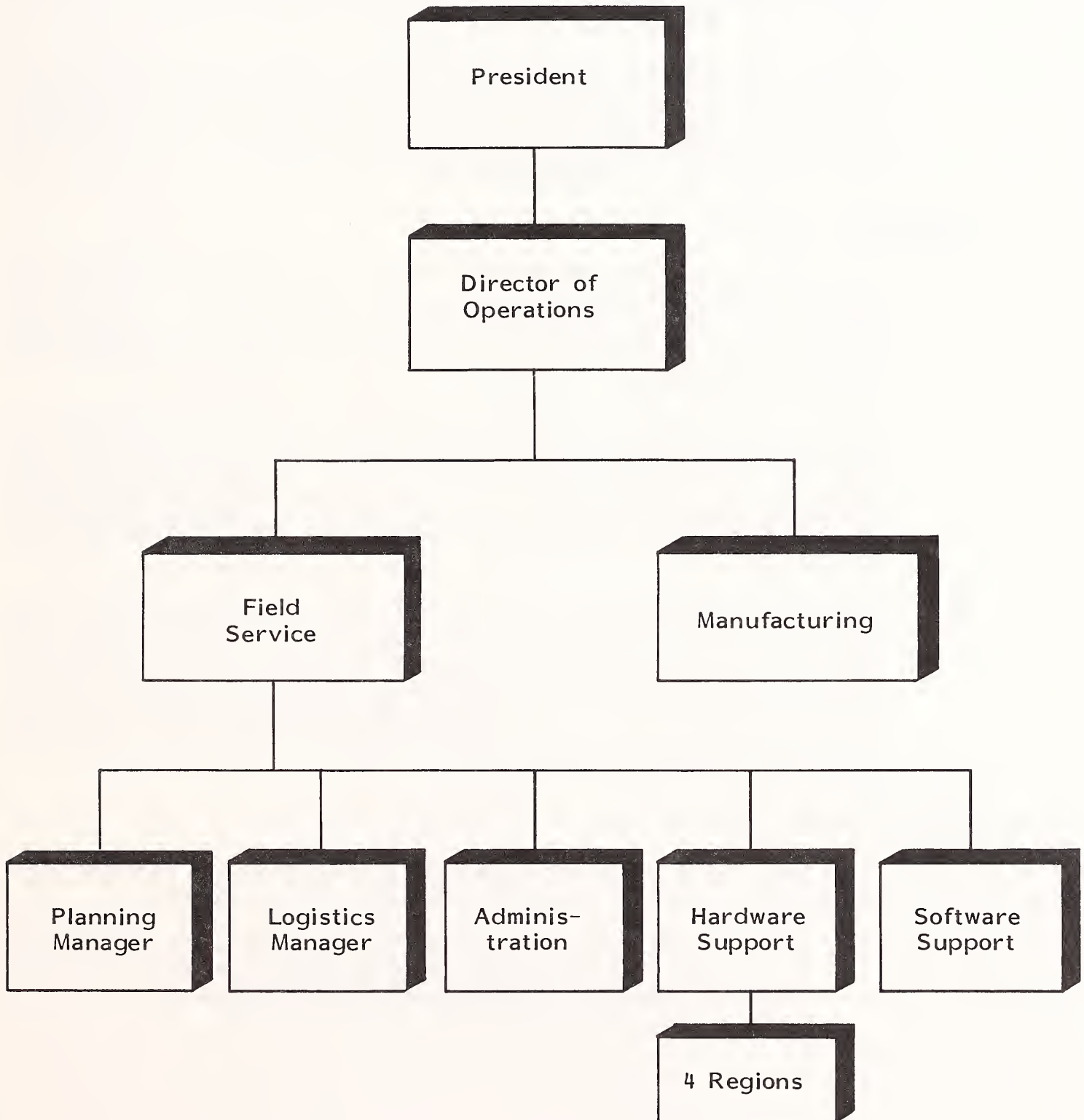
- BTI service headquarters are in Sunnyvale (CA), and the company has four regional service locations in the U.S. Total number of field service employees is just over 100, approximately 70% of whom are engineers. The company has an elaborate parts network including the national service center (Sunnyvale), regional service offices, and roving repair vans.

### SERVICE ORGANIZATION

- As Exhibit II-1 demonstrates, BTI's service organization does perform some administrative functions; however, it is primarily a service organization. Marketing and sales of service as well as end user documentation are all handled outside the service group. The organization is highly centralized, primarily as a result of the company's dependence on remote diagnostics.

EXHIBIT II-1

BTI COMPUTER SYSTEM  
FIELD SERVICES





## SOFTWARE SUPPORT

- Software support is offered by BTI primarily on the company's proprietary operating systems software. The company offers very little applications software at this time, and they are not currently supporting software produced by other vendors.
- Most of BTI software support is performed from their company's software support center in Sunnyvale. All BTI systems have remote support capability and the company is heavily dependent on this service feature to maintain rapid response rates and at the same time keep service costs low.
- Users are typically not involved in operating systems software support or maintenance. Patches and new releases are downloaded from BTI's support center or are installed on-site by a software engineer. The company indicated that on-site software support is used infrequently because of the cost and the effectiveness of remote support offerings.

## HARDWARE SUPPORT

- As with software support, BTI is dependent on remote support to maintain the high-level hardware response/repair time expected by users. The company indicated that "most" hardware-related problems are corrected over the telephone or by dispatching a part. Response time (using remote diagnostics) is less than 20 minutes.
- BTI depends on a high level of user involvement in hardware support, particularly when exchanging system modules. Under a program called "Customer Cooperation Maintenance," the user will install plug-in replacement parts and become the company's "hands" on-site. As a result of this program, BTI has indicated that their field engineers are needed on-site for less than 10% of all problems calls.
- Unlike many other vendors, BTI does not plan to unbundle hardware and software services. The company feels that per-call service can be used for those users that are price sensitive, but that most users (over 90%) will require a comprehensive service agreement. Despite the company's commitment to a bundled maintenance plan, INPUT believes that cost consideration will force BTI to explore at least limited unbundling in the future, particularly in the areas of planning and consulting.

## THIRD-PARTY MAINTENANCE

- Third-party maintenance encroachment into BTI's service market is not a serious threat, according to company officials, for two major reasons:
  - BTI software is proprietary and reliance on remote support makes the system relatively secure. This will make it very difficult for other vendors to diagnose and correct problems on BTI systems.

- Although BTI has over 4,000 systems installed, product density is low in comparison to other minicomputer systems.
- TPM is not considered a threat to BTI; in fact, the company has been performing maintenance on a number of non-BTI products, including Ohio Scientific and Disk Tech disk drives. The company's TPM service contract includes telephone hotline, depot and on-site repairs, and parts exchange. Although TPM is not a significant revenue generator at this time, BTI is exploring this as an opportunity area.

## SERVICE VENDOR PROFILE

**BURROUGHS CORPORATION**  
Burroughs Place  
Detroit, MI 48232

CEO: W. Michael Blumenthal  
Vice President, Field Engineering:  
Conrad Strelau  
Revenues, Fiscal Year 1984:  
\$4,876 Million

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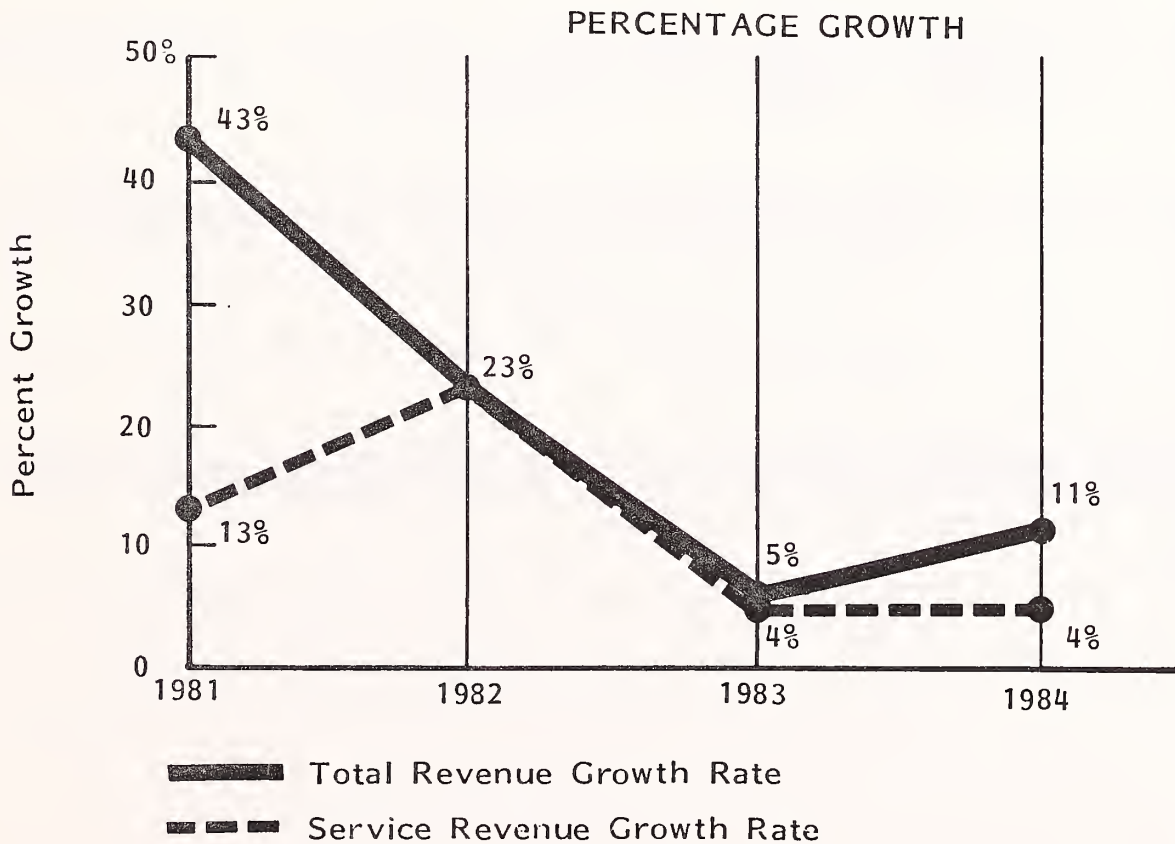
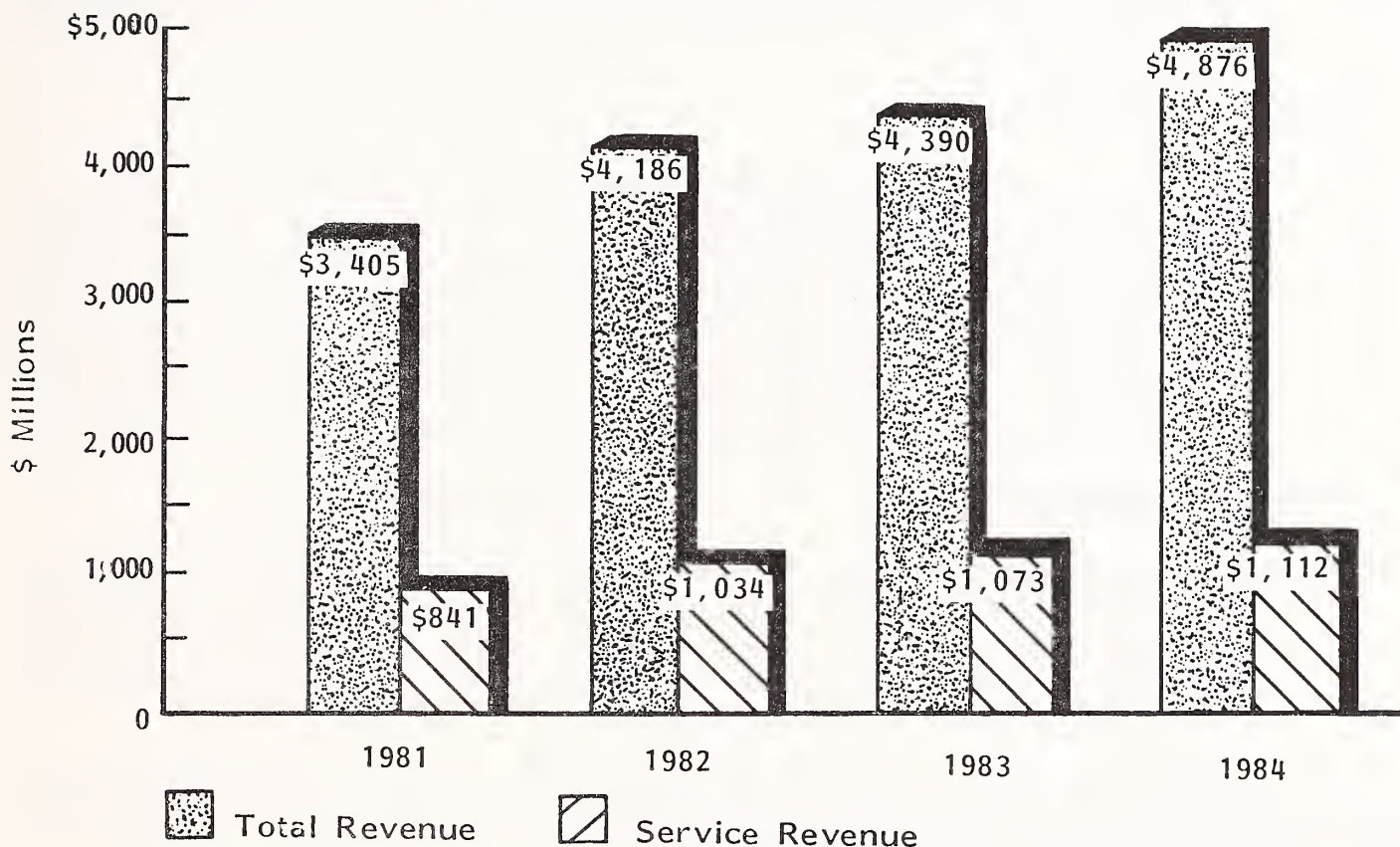
### THE COMPANY

- Burroughs has struggled over the last few years as the result of an aging product line and internal competition. 1984, however, was a good year for the company. As Exhibit II-2 demonstrates, revenues were up 11% over 1983 (ending a three-year decline in revenue growth rate) and net income was \$245 million, a 24% increase over 1983.
- The company's new "A" series of mid-range and high-end mainframes has been a major contributor to revenue growth in 1984. The A-9 is fully compatible with the older B6900, but operates at up to 2.5 MIPS. The recently introduced A-3 utilizes the latest 256K chip technology and is significantly faster than earlier "B" series processors.
- In March 1985, Burroughs introduced the new high-end A15 line. The A15 is said to be two to six times faster than the B7900 and, in multiprocessor configuration, can exceed \$8 million. A principal advantage of the A15, which is clearly leading to a high level of Burroughs user acceptance, is software compatibility with older products. This compatibility, in addition to 28 MIPS performance, is likely to prevent further erosion of Burroughs' high-end user base.
- Office automation products also contributed to Burroughs' revenue growth. Products such as the B25 workstation and XE500 multi-user systems were particularly popular and contributed to a growth rate of nearly 30% in 1984.

### SERVICE DEMOGRAPHICS

- Burroughs has approximately 5,500 field service employees in the U.S., just over 4,000 of whom are direct field service engineers. Field service engineers are dispatched from one of eight regional RESPOND centers, and are supported by a network of Field Technical Centers strategically located throughout the U.S. They also have access to national product support "hot lines" and a nationwide parts logistic system which includes 17 parts depots and a national parts center in Holland (OH). Overall, Burroughs has 835 service points in the U.S., organized under 96 branch offices.

BURROUGHS CORPORATION  
REVENUE GROWTH





- SDC and Memorex, Burroughs' subsidiaries, maintain their own field engineering staffs.
- Retail personal computer dealers are supported by a series of 19 repair depots and five customer education centers, as well as a national dealer technical support "hot line."

## SERVICE ORGANIZATION

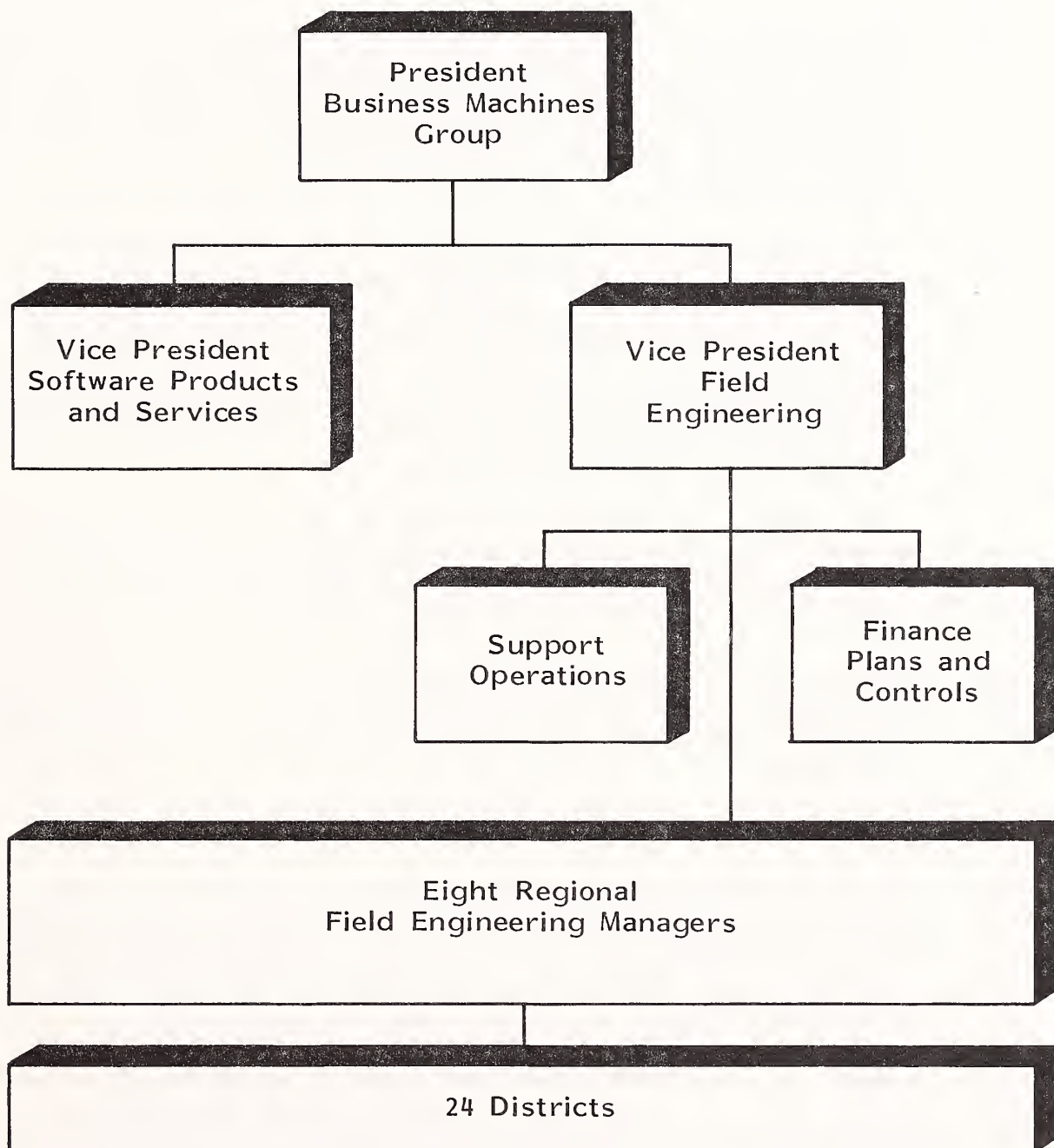
- Exhibit II-3 demonstrates Burroughs' service organizational structure. Software Products and Services (Consulting, Customer Education, and Applications Software Support) and Field Engineering (Hardware and System Software Support), although part of the same Business Machines Group, are relatively autonomous groups. Field Engineering maintains most of its own administrative functions, such as finance. The field engineering organization also directly sells computer environmental products (power monitor and control, process cooling, and access flooring), as well as consumable supplies.

## SOFTWARE SUPPORT

- The Software Product and Services division was established by Burroughs in January 1983 in order to take advantage of the expanding user services market. This division has nearly 1,200 employees to service applications software as well as to provide after-sales support services in the area of consulting and customer education.
- System Software is supported by the Field Engineering organization through three product-oriented national Customer Support Centers and the network of Field Technical Centers.
- Burroughs offers multiple levels of support via Product Support Agreements (PSA) for both application and systems software for the mainframe computer products. The most common agreements are:
  - PSA 1 - provides for toll-free hotline support, updates and revisions, and problem resolution via responses to user-generated Field Communication Forms (FCF). On-site problem resolution, if necessary, is available on a time and materials charge basis.
  - PSA 2 - includes all of the above as well as standard on-site problem resolution support.
- Software support for mini and microcomputers is similar to support offered for large systems, but, as might be expected, is not as extensive. The most common levels of support are:
  - PSA 4 - provides toll-free hotline and user problem resolution, but not updates or revision.
  - PSA 5 - provides problem resolution only, but no phone support.

EXHIBIT II-3

BURROUGHS CORPORATION  
SERVICE ORGANIZATION





## HARDWARE SUPPORT

- As with software support, Burroughs offers its user base the opportunity of choosing the level of service options. User maintenance is not encouraged by the Detroit-based manufacturer; however, the company will offer some system maintenance training to its user base on a custom quote basis. Burroughs offers time and materials service which averages \$120 per hour plus parts.
- The company has invested considerable resources in the development of remote diagnostic and support tools, as evidenced on the latest "B" series such as the B4900 and 7900 and on the "A" and "V" series of processors. The company's three Customer Support Centers are able to utilize the remote support capabilities of these machines and have reported substantial resolve time improvements.
- Burroughs Customer Support centers offer telephone (hotline) support to customers eight hours a day on hardware and systems software questions and problem resolution. The centers are open 24 hours-a-day, 7 days-a-week to provide support to the Burroughs field support force. The center in Detroit, for example, has 61 hardware and software specialists who can perform remote diagnostics on products in the mini and microcomputer range including the B-20 small business computer family. Other centers in Philadelphia and Atlanta deal with mainframe products.
- Hardware service contracts at Burroughs vary according to product type and user situation. The company has indicated that it has considered the needs of users requiring extended services 24 hours-a-day, 7 day-a-week, particularly in the area of improved response time and parts availability.
- Services are becoming more unbundled for all products. For example, Burroughs offers separately priced services such as customer hotline, on-site software service, customer training and computer facilities planning, and user consulting.

## FUTURE SERVICE TRENDS

- Burroughs has publicly stated that they intend to specialize in a limited number of high growth industries, such as banking, manufacturing, and health care. This specialization will place an increased burden on service, particularly software support and professional services. This burden will come in the form of a higher demand for service from the user base.
- There are indications that Burroughs has recognized the shift in service revenue sources away from the hardware and toward software support. The company has unbundled service from almost all licensed software products, and remote support capabilities have increased dramatically. These moves will allow Burroughs to develop an accurate pricing structure for software support and at the same time reduce service costs.

- One problem Burroughs must face is that of parts supply and logistics. There is no doubt that the company's increase in new product introduction has had an impact on user evaluations in this area. It is safe to say, however, that new product introductions will continue to increase, and Burroughs is addressing the parts availability problems.

## SERVICE VENDOR PROFILE

**CALCOMP**  
2411 W. LaPalmer Avenue  
Anaheim, CA 92801

President, CalComp Group:  
William P. Conlin  
Vice President, Field Engineering:  
R. Ken Raby  
Revenues, Fiscal Year 1984:  
\$255.1 Million

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### THE COMPANY

- CalComp was founded in 1959 and in the early years derived a major portion of its revenue from consulting with the federal government. In 1962, the company introduced the model 565 plotter, a highly successful product which pointed the way toward a corporate commitment to the graphics market. In 1979 the company sold off several divisions (including Memory Products and Floppy Disk) in order to concentrate on the graphics market. CalComp was acquired by Sanders Associates (fiscal year 1984: \$746 million) in 1980.
- Major products produced by CalComp include:
  - Digital plotters.
  - Graphic displays.
  - Digitizers.
  - CAD systems.
- CalComp has continued to consolidate its position in the graphics market through the acquisition of Image Resource Corporation in February 1985 and the AEC division of Personal CAD Systems in April 1985. Image Resource and AEC both develop graphics products for IBM PCs.

### SERVICE DEMOGRAPHICS

- CalComp has 43 service locations in the U.S. Approximately 180 people are in the field, over 70% of whom are engineers. The company has 240 domestic service personnel. Spare parts are located primarily in field service offices, although 40% of total spares are in the company's central depot/refurbishment center in Anaheim. CalComp's service organization worldwide earned over \$30 million in 1985.

## SERVICE ORGANIZATION

- As noted above, CalComp is a division of Sanders Associates, Inc. Within the U.S., the company's Customer Engineering Department is essentially autonomous administratively. The department, as shown in Exhibit II-4, is divided geographically into three areas and eight districts for field support. Technical support (telephone hotline and remote service) is located centrally in California.

## SOFTWARE SUPPORT

- CalComp software support is focused primarily at system level products, such as CAD products. The company's peripheral products (including digitizers and plotters) require very little software support apart from changes in firmware instruction sets which are installed by in-field analysts.
- CAD users can receive operating system and applications software support from CalComp's central support center in Anaheim (CA), or from the company's in-field software specialists. European users may also receive some software support from hardware engineers, but this is not common in the U.S.
- The central support center is staffed by industry and product specific software analysts who can perform a variety of remote support functions, including telephone support and downline loads of new releases and upgrades. Remote diagnostics are not currently available at the system level.
- In order to reduce on-site service costs and to improve total repair time, CalComp does encourage the user to perform some diagnostics and problem determination. In addition, communication between the user and the company is promoted by telephone hotline support and access to a published list of software solutions.
- While users are encouraged to perform some diagnostics, CalComp installs all new releases and patches and otherwise maintains its proprietary systems and applications software.

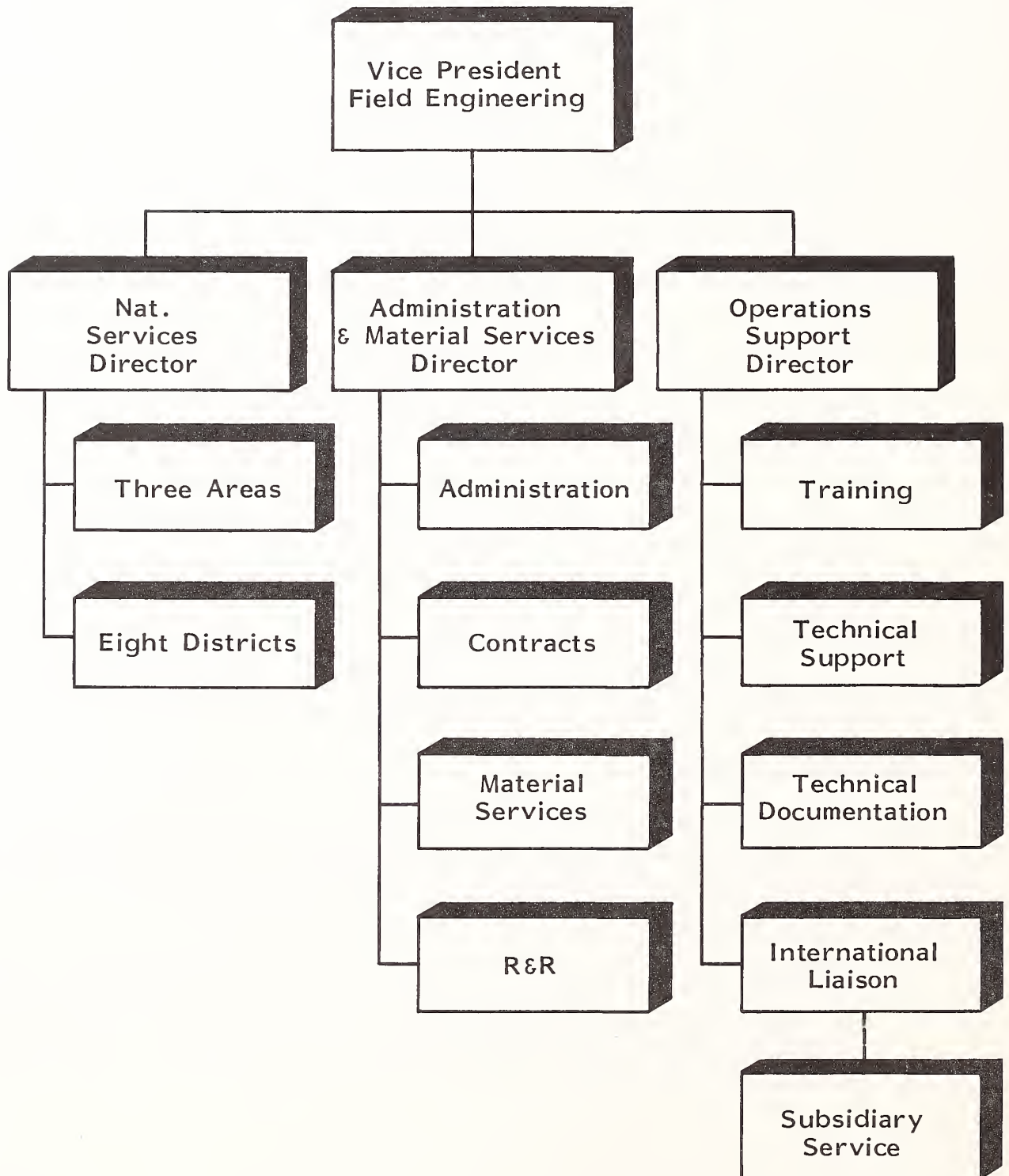
## HARDWARE SUPPORT

- As demonstrated in the organization chart, CalComp service is divided into three areas and eight districts. Central support is located in Anaheim and is product oriented. The company has 43 service outlets in major metropolitan areas in the U.S.
- Unbundling of standard hardware services such as installation, consulting, and planning is seen by CalComp as a way to improve service flexibility and at the same time control service-related costs. Controlling costs is very important, particularly in the light of the increasing competition at the low end of the CAD and graphics market.



EXHIBIT II-4

CALCOMP  
SERVICE ORGANIZATION



- As with software, hardware remote support on CalComp equipment does not include remote diagnostics, but the company has indicated that improved remote support will be necessary in the future to improve service economies of scale.
- Education and training, while not a major market at this time, may prove to be an opportunity for CalComp in the future. The company currently has extensive video training production capabilities which are being used primarily inhouse, but which could be applied to outside markets as well.
- Like many manufacturers, CalComp has investigated using third-party maintenance vendors as authorized agents to provide service in selected geographic areas in the U.S. and Europe. This "strategic partnering" allows CalComp to concentrate on providing high quality service in all areas without overlapping its own service organization. Criteria used for selecting TPM vendors include:
  - The TPM vendor must complete CalComp training.
  - The vendor must purchase adequate spares to support CalComp products.
- In addition to establishing cooperative third-party maintenance agreements, CalComp itself is providing third-party maintenance on selected products. The company indicated that this single source service was provided to improve current user satisfaction with services, but that a true third-party service offering was being considered.

## FUTURE TRENDS IN SERVICE

- A major concern at CalComp is the ability to continue providing high quality service in the face of an increasingly diversified product offering. Third-party maintenance, discussed above, is one alternative, but there are clearly others that the company is considering.
  - Continued unbundling of service contracts. This will provide the vendor with a much more flexible service offering and at the same time encourage the user to select only those services which are required.
  - Increasing use of depot service (particularly for low-end/low-margin products).
  - Increased remote support, especially in the area of hardware and software diagnostics.
  - Product improvements, particularly in the areas of documentation, training, and parts availability.



## SERVICE VENDOR PROFILE

**CENTRONICS DATA COMPUTER  
CORPORATION**  
1 Wall Street  
Hudson, NH 03051

CEO: Thomas G. Kamp  
Vice President, Field Engineering:  
Ralph P. Eichstaedt  
Revenues, Fiscal Year 1984:  
\$171 Million

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### THE COMPANY

- Incorporated in 1968, Centronics Data Computer Corporation designs, produces, and services a broad line of serial dot matrix and fully-formed character line printers. The company markets its products in 58 countries through its own sales and service offices and through a worldwide distributor network.
- 1984 proved to be a difficult year for Centronics, continuing a string of four straight years of operating in the red. Centronics made a number of major changes in an attempt to counter the trend with a reorganization of the senior staff, a discontinuance of operations in Michigan and Ireland, an acquisition of a form-feeder company (Advanced Terminals, Inc.), and an acquisition of a portion of the assets of another dot matrix company (Trilogy, Inc.). In addition, Centronics announced eleven new products, including a 6.6 pound personal computer printer and an 800 line-per-minute band printer that utilizes a linear free hammer bank system.
- Perhaps most significantly, Centronics instituted an Americanized version of the Japanese manufacturing technique called "KANBAN" or "just-in-time" inventory control system. This technique attempts to pace the manufacturing routine by not initiating a particular assembly process until the previous process is completed, thus minimizing work in processing materials and stressing coordination of all assembly processes. The implementation of such a system will improve both quantity and quality of production without requiring additional manufacturing space.
- A final area where Centronics is hoping to turn around total company sales is in the increased emphasis of OEM sales. During the past years, Centronics has finalized OEM purchase agreements with Burroughs, Data General, and IBM (the largest agreement in Centronics history). By emphasizing OEM arrangements, Centronics hopes to assure an increased and contrual flow of revenues into the company while reducing the actual costs of sales.

### SERVICE DEMOGRAPHICS

- Centronic's total sales for 1984 were \$171.5 million, up 5% from 1983. However, net loss in 1984 was \$10.4 million, representing the fourth straight

year that Centronics operated in the red. Total worldwide employment was 1,850 in 1984, reflecting a 9% increase over 1983.

- Centronics markets to 50 countries through sales and service offices and a worldwide network of distributors. U.S. sales, performed through more than 40 sales and service offices in the U.S. and Canada, represent approximately 84% of Centronics revenues.
- Service contributed just over 10% of Centronics sales, or \$17.5 million in 1984. Whereas Centronics as a whole has operated in the red for the past four years, service at Centronics has been profitable for the last three years and should expect to grow at a steady rate.
- Service at Centronics has a total employment of 225 people, including 125 service engineers and eight line managers.
- Exhibit II-5 provides Centronics sales and service figures for the last four years.

## SERVICE ORGANIZATION

- Service at Centronics exists as a separate subsidiary called Centronics Sales and Service Corporation, operating with P&L control at the district level. National service is broken down into eight districts, which are then broken down into 40 separate service locations in the U.S. In addition, Centronics offers carry-in service out of nine depot locations.
- Exhibit II-6 provides an organizational breakdown of service at Centronics. The revenue growth rate for 1981 to 1982 is artificially high, resulting from a fiscal year end change that occurred in 1982.

## HARDWARE MAINTENANCE

- Hardware maintenance at Centronics reflects the changes in printer technology and manufacturing processes implemented not at only Centronics but throughout the industry. Meantime to repair (MTTR) has been reduced to below one-half hour on their current product lines, particularly the Printstation 350 series. In addition, meantime between failure for this new series of printers is estimated at four years.
- Additional indications of the concern for increased serviceability and reduced need for service through improved design of the products is the availability of self diagnostics built into certain Centronics printers, such as the Printstation 350 series, the TIP and Colorplot II series, and the Linewriter series. In addition, the TIP and Colorplot II series of impact line printers offer fault-tolerant capabilities which result from the availability of two separate print heads; should one fail, the other will operate.
- A Centronics on-site service contract holder initiates the service process by calling a national service number at Hudson, New Hampshire. The automated

EXHIBIT II-5

CENTRONICS DATA COMPUTER CORPORATION  
REVENUE GROWTH

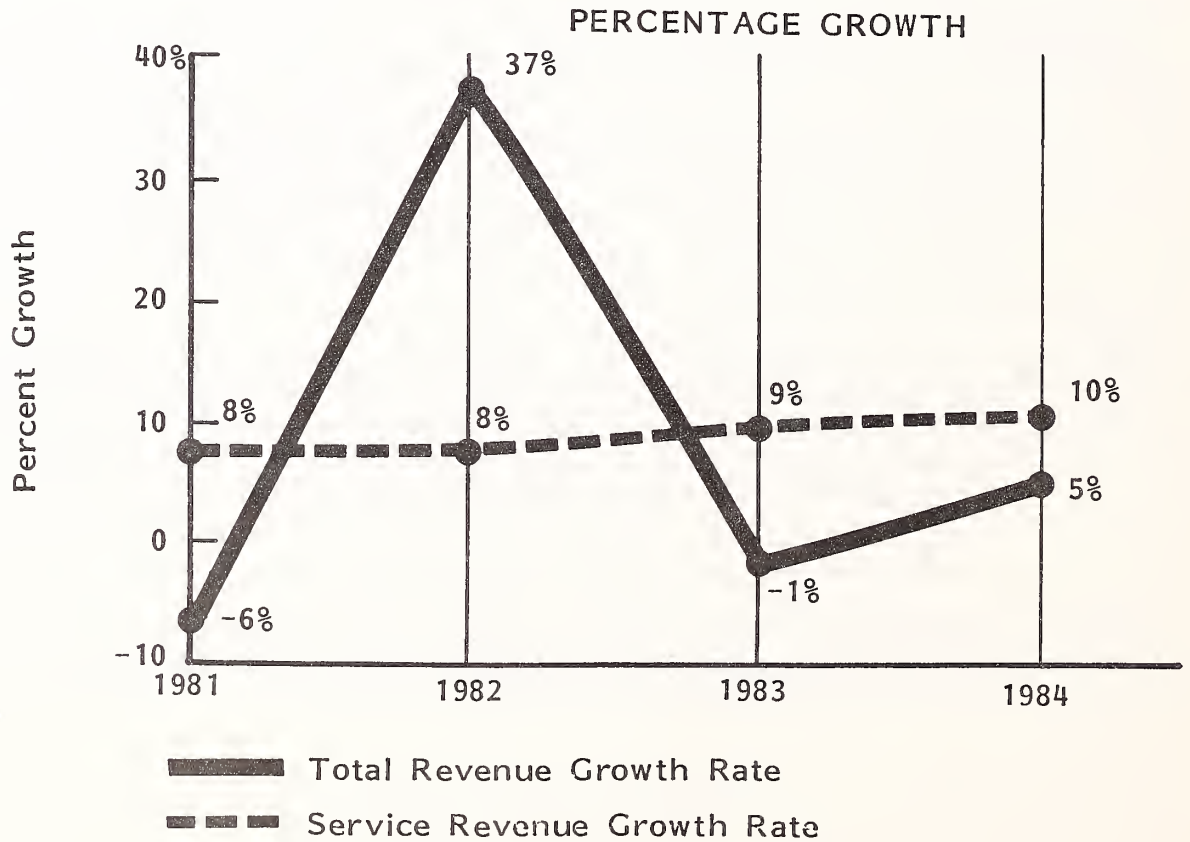
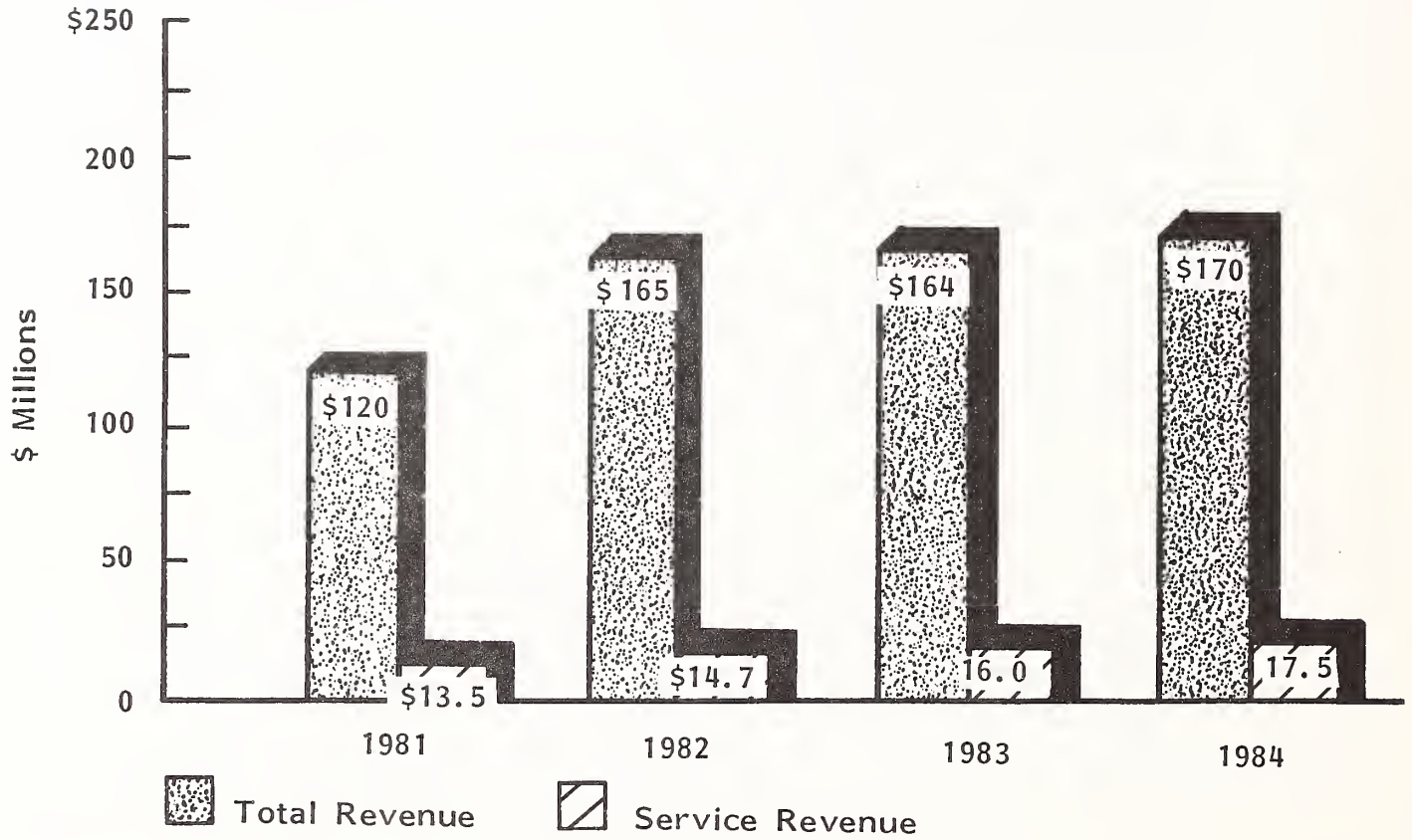
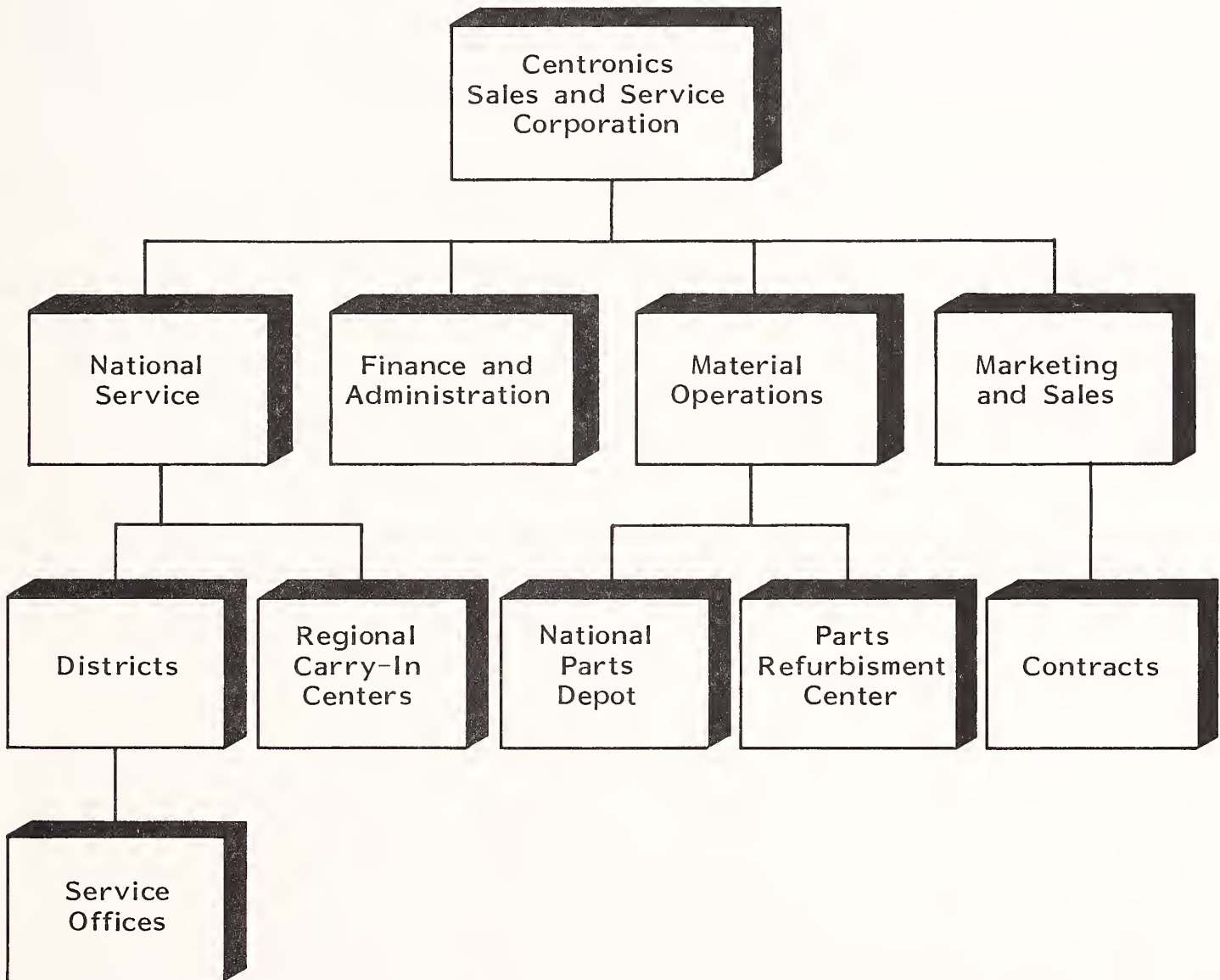




EXHIBIT II-6

CENTRONICS DATA COMPUTER CORPORATION  
SERVICE ORGANIZATION



dispatching center at Hudson will then process the call to the nearest service location. The dispatching system will track parts usage, inventory location, and service location productivity.

- Response times at Centronics are not contractually guaranteed, but can be negotiated to provide either two or four hour response for a premium. Meantime to respond is currently averaging seven hours nationally.
- Each FE carries sufficient spares to handle 85% of all trouble calls. Additional spares are stored at localized carry-in centers, providing ready access to approximately 95% of all parts necessary for repairs. The goal of these localized spares stored at regional carry-in centers is to assure that necessary parts will be available to a FE no later than "next day."

## SERVICE VENDOR PROFILE

### CONTROL DATA CORPORATION

8100 34th Avenue South

Minneapolis, MN 55420

CEO: William C. Noris

Vice President, Engineering Services:

W. Fitzgerald

Revenues, Fiscal Year 1984:

\$5,027 Million

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### THE COMPANY

- Control Data Corporation (CDC) was organized in 1957 and is currently engaged in the computer business (Information Services and Products Division) and financial and insurance services businesses (Financial Services Division). In 1984, the Information Services and Products Division produced approximately 75% of the company's total revenue. INPUT estimates that equipment service revenue in 1984 was \$361 million.
- CDC's main data processing products are in the mainframe and peripherals product areas. The majority of mainframe revenues have been derived from the 170/800 series and since April 1984, the 180/800. Two of the 170 series, the 865 and 875, will remain in production, although they will not have the NOS/VE operating system.
- CDC has traditionally served the scientific and technical markets, but with the introduction of the latest series of mainframes, the company is clearly expanding its market horizons. Some of the markets which have been targeted by the company include:
  - Manufacturing.
  - Petroleum.
  - Education.
  - Utilities.
  - Research/scientific.
  - Government.
- In September 1984, CDC announced its decision to phase out of the plug-compatible peripheral business. The company indicated that this move eliminated an ongoing profit drain and allowed the company to redirect resources to the OEM peripherals business. While this action will not have a direct impact on initial service revenues, INPUT believes there will be a negative impact in the long run as the installed base shrinks and becomes subject to competitive pressures from TPM vendors.



- Exhibit II-7 demonstrates that CDC's service revenue growth has paralleled total information services revenue growth for the past two to three years. In 1983/1984, service revenue grew at roughly twice the company's overall growth rate. Growth of the third-party maintenance market and increasingly efficient service technology were major contributors to service revenue growth and profitability.

## SERVICE DEMOGRAPHICS

- CDC's domestic service organization is separated into three regions (Western, Central, and Eastern). Overall, the company has 160 service offices in the U.S. and 23 service centers which have extensive parts inventories. In addition to the service centers and service offices (all of which stock some parts), CDC has two regional parts depots and one national depot in Minnesota. The company has an estimated 3,500 engineers (hardware and software) in the U.S. and over 6,000 field service personnel worldwide.

## SERVICE ORGANIZATION

- The Engineering Services Division at Control Data is organized as shown in Exhibit II-8. The actual service departments within Engineering Services are broken down as follows:
  - Maintenance and Services Planning: System product management and planning.
  - Central Support: Hardware and software remote and on-site support.
  - Education: Development and delivery of education and training.
  - U.S. Operations: Field operations in three regions.
  - Personnel.
  - Administration: Financial plans and controls, accounting, pricing, information systems.
  - Marketing: Domestic service marketing and sales.
  - Logistics: Repair/refurbishment, domestic and international.
  - International Operations: Western and Central Europe, Northern Europe, Pacific, developing countries.

## SOFTWARE SUPPORT

- Support for CDC software products is priced separately from the initial software license costs and also separately from hardware maintenance. The company offers four levels of software support:

EXHIBIT II-7

CONTROL DATA CORPORATION  
REVENUE GROWTH

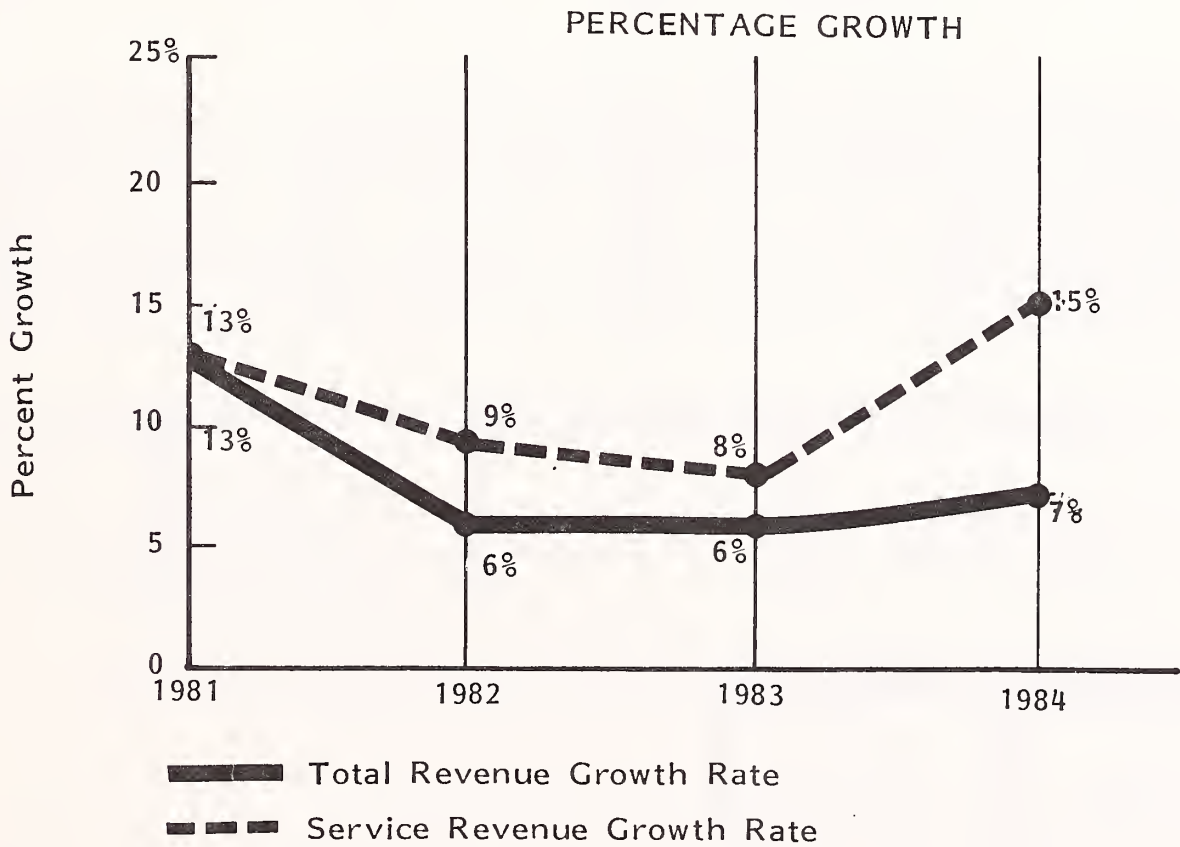
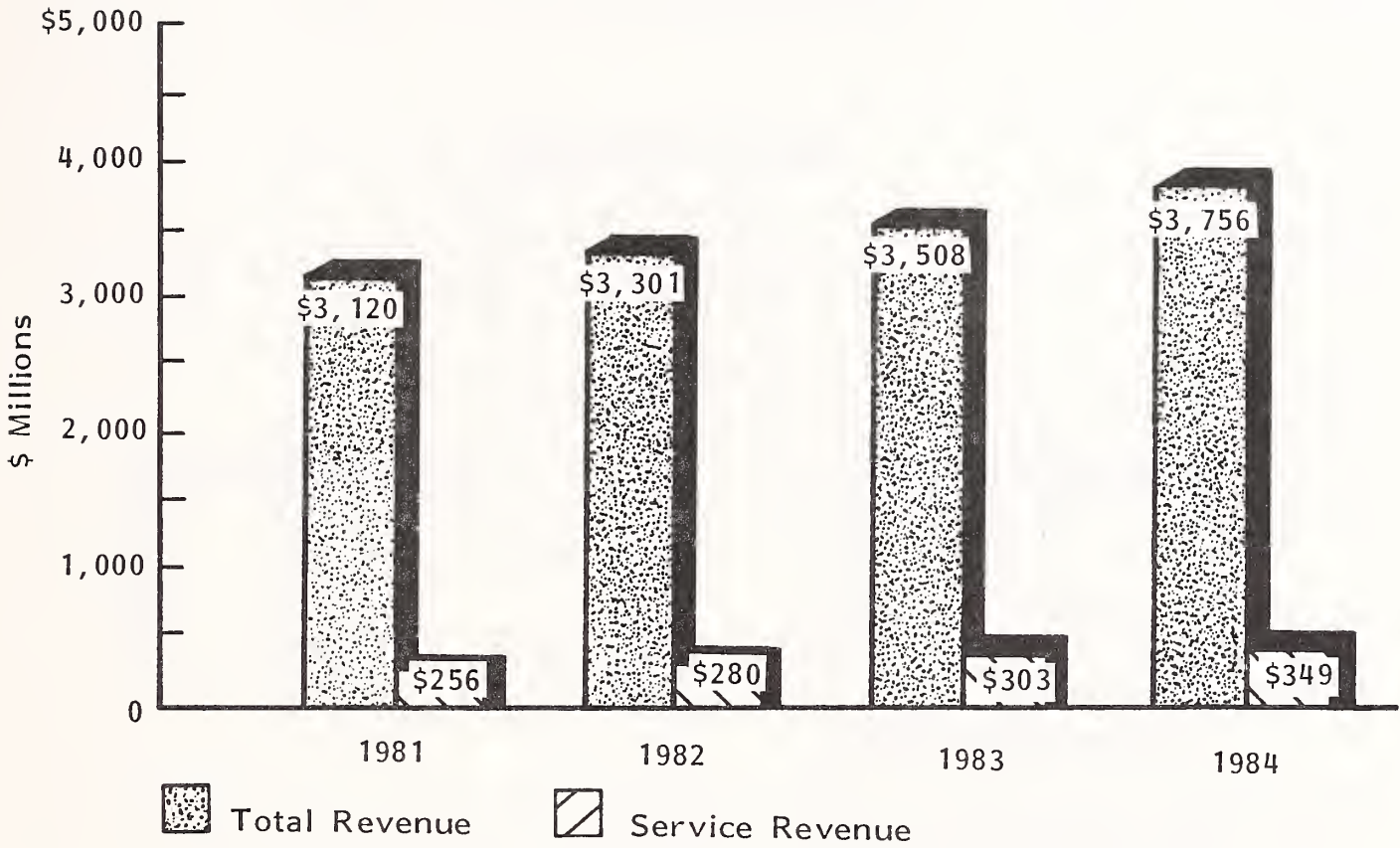
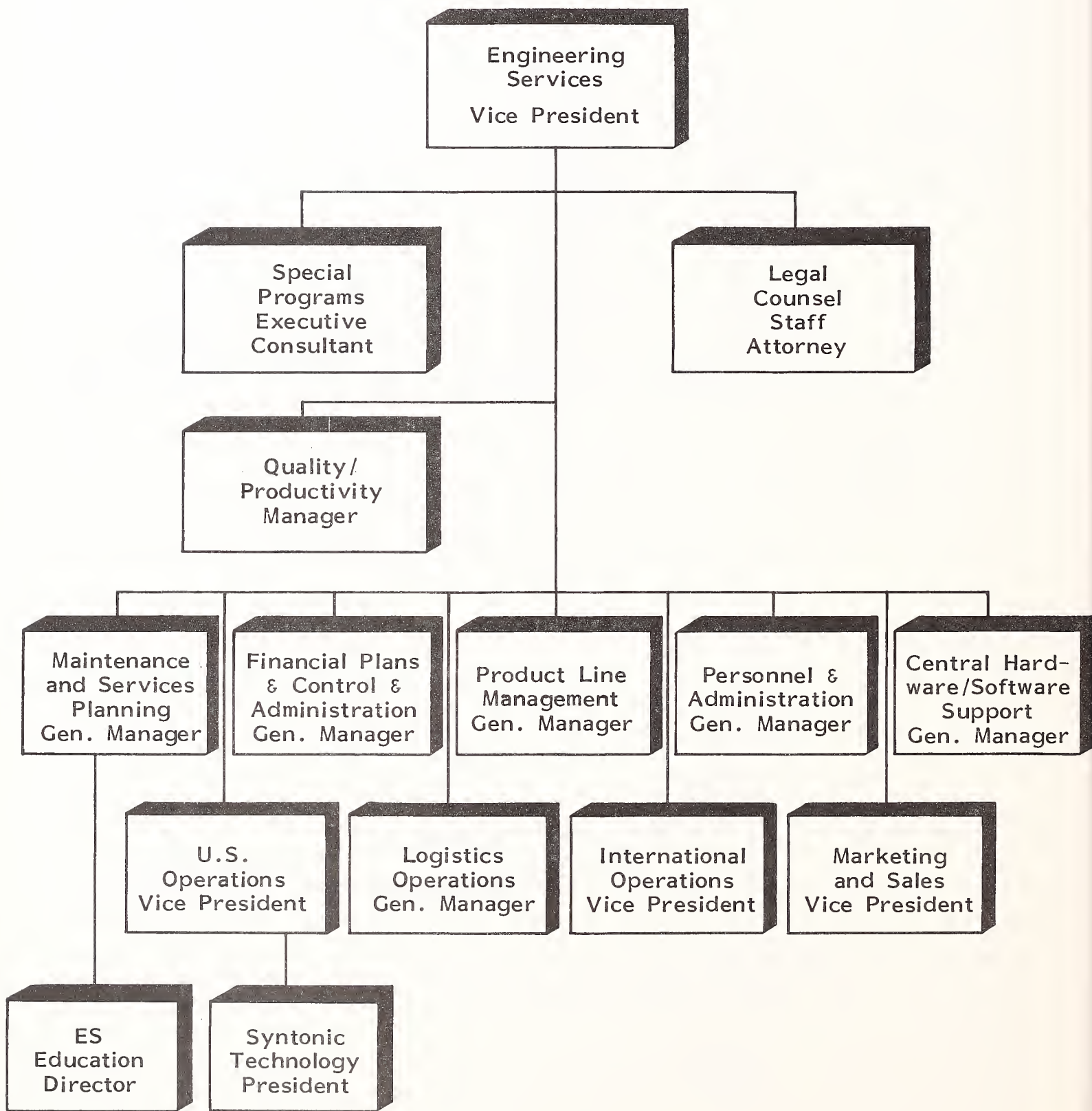


EXHIBIT II-8

CONTROL DATA CORPORATION  
ENGINEERING SERVICES





- Class I: Standard service agreement, including updates, enhancements, access to the support center, etc.
  - Class II: Similar to Class I, but with reduced obligations to CDC, especially with regard to successor products.
  - Class III: Limited coverage does not include enhancements.
  - Class IV: No support.
- Support for systems and applications software is offered through a toll-free 800 number. Support is provided directly to customers in a number of different ways.
    - Customers can access "SOLVER," a problem data base which allows the customers to search for fixes to similar software problems which have been reported by other customers. If the fix is available, the licensed customer can retrieve the fix and download it into his system. Problems being reported to CDC for the first time can be added to SOLVER by the customer.
    - In addition to access through SOLVER, CDC provides direct telephone support to its customers 12 hours-a-day, five days-a-week. Critical support is available 24 hours-a-day, 7 days-a-week via an "after hours" procedure.
  - CDC reports that user acceptance of the SOLVER data base has been increasing rapidly since its introduction in late 1982. Approximately 50% of total use of the data base now comes from end users. The remaining 50% of use comes from CDC staff.
  - A high level of user involvement in software support is required by CDC for several reasons. First, in order to become price competitive, CDC has unbundled many software support services such as installation of initial releases and upgrades. Most users now perform the unbundled support function. Second, profit margins for entry level machines are not adequate to support extensive service offerings. The company believes users expect lower prices and will become more willing to participate in software support (particularly remote support) in the future.
  - In addition to the standard software support agreements, CDC offers a number of professional services for software users.
    - Software Maintenance: Troubleshooting activities performed by CDC systems analysts two days per month to assist users in upgrades, workshops, and consulting.
    - Capacity Management/Performance Analysis Service: Designed to ensure optimization of CDC hardware and software.

- NOS System Installation: Service includes pre-installation consulting, operating system installation, and post-installation support.

## HARDWARE MAINTENANCE

- The U.S. Operations division of Engineering Services provides on-site and remote support in three regions (Western, Central, and Eastern). U.S. Operations, with over 2,000 customer engineers, services CDC, OEM, and third-party hardware.
- Although CDC officials acknowledge the increasing reliability of hardware and the adverse effect this will have on service revenue per unit, they believe overall hardware service revenue will continue to grow at 5-10% a year. Growth will be dependent on:
  - Larger volume of equipment.
  - Third-party maintenance.
  - Unbundling of service contracts.
  - New services.
- Perhaps the most important hardware service revenue generator in the next four to five years will be third-party maintenance (discussed below) and the unbundling of service contracts. CDC has indicated that it will "be responsive" to user self-maintenance, but that it does not encourage the practice because the company feels self-maintenance is not cost effective for the user.
- Remote hardware support is provided from the central support which includes three regional offices in Maryland, Minnesota, and California. The company has demonstrated a substantial commitment to remote assistance as a way to improve "first fix effectiveness."
- Hardware engineers perform little or no software service but must be conversant in software tools in order to perform problem determination. (Third-party maintenance engineers have been trained in software problem determination on IBM equipment since 1979.) CDC indicated that while hardware personnel were capable of supporting some software, keeping the engineers current on new software was the major problem preventing cross training.

## THIRD-PARTY MAINTENANCE

- CDC has been involved in third-party maintenance since 1973, when it acquired COMMA, an independent service organization specializing in IBM equipment. Since that time the company has expanded its TPM business to include service of OEM products, personal computers, and DEC products.



- Approximately 98% of CDC's TPM service is provided on-site. The remaining 2% is provided at one of the company's two depot locations located in California and Minnesota. Approximately 90-95% of CDC's TPM service is provided under contract; 5-10% is provided on a T&M basis.
- CDC's pricing is set at a discount below the manufacturer's pricing. For example, CDC reported that its pricing on the service of DEC equipment is approximately 10-15% lower than DEC's pricing; on IBM equipment, its pricing is about 20% lower than IBM's pricing.
- TPM is considered a key opportunity at CDC because it will provide the company with a high level of account control by making available the option of single source maintenance. Not only will the Minneapolis-based company be better equipped to satisfy their own customers, but they will also have the opportunity to offer an integrated, single source of service to other high growth markets, particularly for DEC and IBM equipment.

### FUTURE SERVICE OPTIONS

- INPUT does not expect any major shifts in service strategy at CDC for the next few years. Third-party maintenance will be relied on to open up new service markets and contribute to the revenue base, but the company is obviously aware of the potential danger of trying to service too many products. The company will focus on major products with high levels of product density.
- As with many other vendors, CDC will continue to unbundle service options in order to provide a "menu" of services which accurately address user requirements for maintenance.
- Unbundling is likely to improve user satisfaction with service among CDC users because it will allow the company to remain price competitive, while allowing the customer to purchase only the necessary services. However, it will be important for CDC to learn how to package and market these unbundled services or they will be faced with third-party maintenance encroachment on their own products.

## SERVICE VENDOR PROFILE

DATA GENERAL CORPORATION  
Westboro, MA 01680  
(617) 366-8911

President: Edson deCastro  
Senior Vice President, Field Engineering:  
Frank Silkman  
Revenues, Fiscal Year 1984:  
\$1.2 Billion

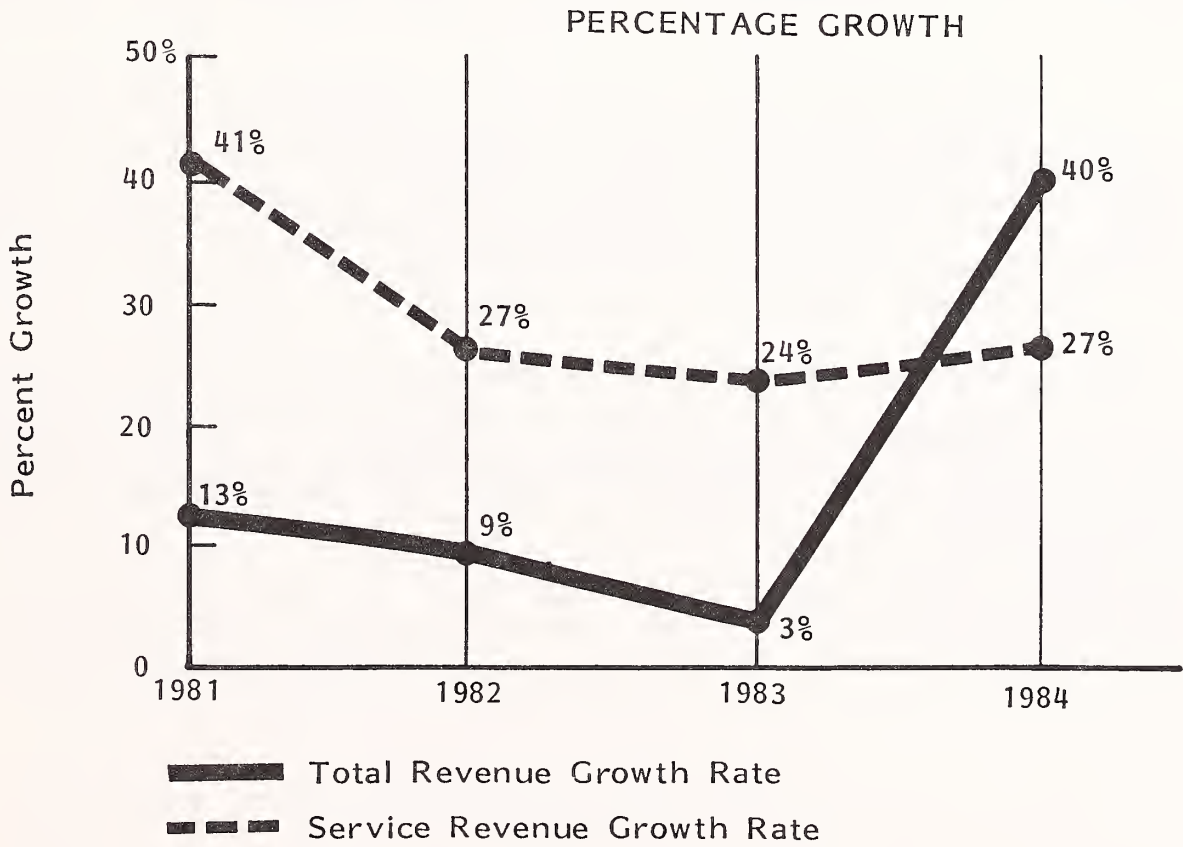
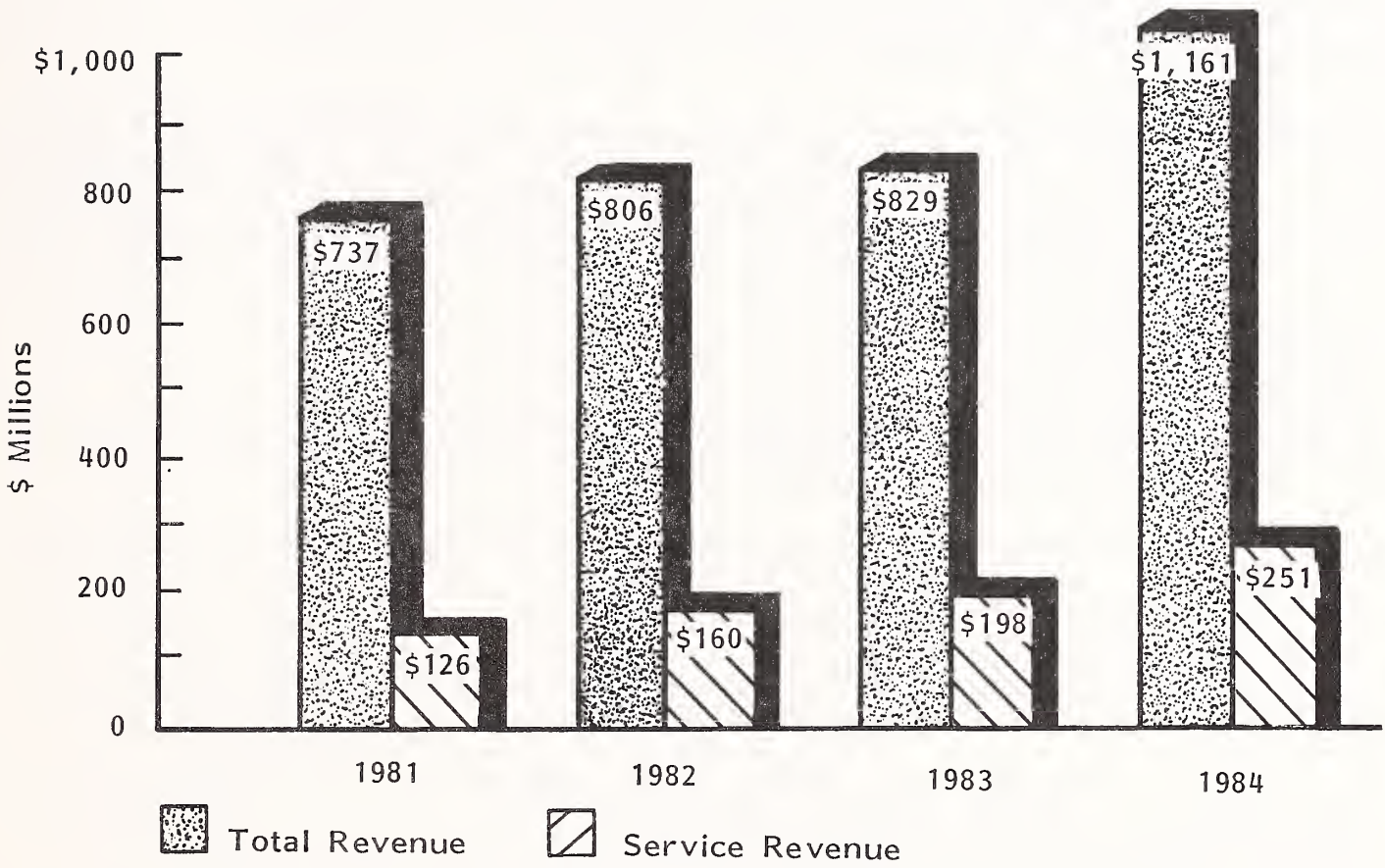
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### THE COMPANY

- Data General has long been known as a traditional 16-bit minicomputer manufacturer who primarily sells hardware to the scientific and technical communities. This reputation was not helping the company to expand into new markets. As Exhibit II-9 demonstrates, revenue growth was falling dramatically, maintenance revenue growth was slowing, and forecasts for future growth were not optimistic.
- In 1984, however, the company turned around. Revenues shot to over the \$1 billion mark, sales growth was 40%, and net income increased by 150%. This remarkable turnaround was brought about by two primary factors:
  - The growing acceptance of the company's 32-bit hardware.
  - Successful revamping of the company's marketing strategy, including more emphasis on commercial and business markets.
- The MV series of 32-bit superminicomputers has been extremely successful, representing over 50% of the company's revenues by the end of 1984. This is very impressive when one considers that the company's 16-bit product lines have dominated sales since the company's inception in 1965 and continue to represent over 85% of Data General's installed base. MV products include:
  - Eclipse MV/10000 and 10000SX, Data General's top-of-the-line, high-performance (3.6 MIPS) 32-bit supermini costing between \$150,000 and \$700,000.
  - Eclipse MV/40000 (SC and DC), a new low-end 32-bit machine costing between \$25,000 and \$80,000, with a performance rating of 0.6 MIPS, and supporting up to 64 workstations.
  - Eclipse MV/8000 (II and C), two new mid-range minis with substantially greater main memory capacity (up to 12MB) than the MV/40000.
- Changes in the marketing strategy at Data General has been under development since 1980. At one time the company was dominated by OEMs; today, however, Data General has made substantial gains in commercial and factory

EXHIBIT II-9

DATA GENERAL CORPORATION  
REVENUE GROWTH





automation which now represent over 50% of the company's revenues. Data General is obviously anticipating greater growth in this area. Company president Edson deCastro has suggested that software and services could represent up to 75% of all revenues in the future.

## SERVICE DEMOGRAPHICS

- Data General reports that the company has over 2,100 service engineers worldwide; approximately 75% are hardware engineers and 25% are software engineers. INPUT estimates that 80% of Data General's support staff (1,680) are located in the U.S. The company has just over 100 local offices in the U.S., all of which stock parts. In addition, the company has two centralized parts depots (in Massachusetts and Colorado).

## SOFTWARE SUPPORT

- Data General offers four levels of software support in addition to 90-day toll-free phone support for startup customers.
  - First Level is the highest level of support and includes updates, documentation, both telephone and on-site support, and on-site quarterly consulting.
  - Second Level is similar to Level I except it does not provide for quarterly on-site consulting.
  - Third Level is primarily remote support. This level of service does not provide for any on-site support.
  - Time and material prices range from \$80-130/hour depending on the application.
- On-line Information Services (OIS) is included with the purchase of any of the three software product services agreements. OIS is an on-line service which provides software product and service information to Data General clients. The service is available through the company's national software support center in Atlanta. OIS users can download patches and revisions as well as have access to a problem data base to check on software trouble report status.
- Despite the fact that the company has obviously invested a great deal in the OIS, not all new releases and updates can be transmitted electronically. According to Data General, mail distribution of software is still used extensively, as is on-site installation by Data General system engineers.

## HARDWARE SUPPORT

- Hardware support options available from Data General include:
  - On Call Service: Standard remedial maintenance including nine hour + coverage per day, parts, labor, installation of change orders, etc.
  - Depot Service: Circuit boards may be sent to Data General depot headquarters in Colorado or Massachusetts.
  - Hardware Subscription Service: Documentation only, supplied on a yearly basis.
  - Remote Assistance: Restricted to the MV series, remote assistance is primarily a diagnostics service at this time, although there is extensive coordination between remote diagnostics, personnel dispatching, and logistics. Data General has indicated that in the future remote diagnostics capabilities may be added to the 16-bit line.
  - Time and Materials: \$90-110/hour, parts not included.
- As the above list of services indicate, Data General has not unbundled its service offerings to any great extent, nor does the company plan to unbundle in the near future. There is, however, some indication that the company plans to offer as yet to be selected extended/premium services in order to take advantage of increasing user demand for service.
- At the low end of the service scale, Data General has accommodated user self-maintenance needs by offering a variety of reduced and shared service contracts along with education courses on a variety of maintenance topics including self-study courses and computer based training.

## THIRD-PARTY MAINTENANCE

- Data General has indicated that it has no plans at this time to initiate third-party maintenance, but like many vendors, the company is currently studying the market. Considering Edson deCastro's stated commitment to the service market, it seems unlikely that Data General will be able to resist performing at least some third-party maintenance in order to protect its user base.

## FUTURE DIRECTIONS

- Movement into new markets using high-end superminicomputers has had a very positive impact on Data General, but these new markets require a much higher level of service and support than was previously required by Data General customers. Obviously, the company has recognized this situation and is improving services. Impressive gains have been made in remote diagnostics and support, gains which will transfer directly into lower costs and more competitive service prices.



- In addition to improved services, Data General is likely to find that the new markets it is getting into require higher level and more flexible services. The office automation market, for example, will require a higher level of software support. Data General will have to accommodate user expectations for service on third-party applications software. Communications support is a second key area which affects both office and factory automation.
- Central to the new focus on service at Data General is the company's inability to offer single source maintenance. Major office automation competitors such as NCR and DEC are already moving in this direction, and it seems likely that in order to prevent further erosion of their 16-bit mini user base, Data General will have to offer some limited (perhaps brokered) service in this area.

## SERVICE VENDOR PROFILE

**DIGITAL EQUIPMENT CORPORATION**  
Maynard, MA 01754

President: Kenneth Olsen  
Vice President, Field Services:  
Richard Poulsen  
Revenues, Fiscal Year 1984:  
\$5,584 Million

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### THE COMPANY

- Digital Equipment Corporation's (DEC) performance in 1984 has been excellent compared to 1982 and 1983, as demonstrated in Exhibit II-10. Total revenues increased 31%, net income increased 16%, and service revenue grew by 35%. Financial growth has been due in large part to a corporate reorganization and an increasing number of new product introductions.
- A major new product announced by DEC in 1984 was the long-awaited VAX 8600. The 8600, using ECL gate array technology and pipeline processing, is reported to be over four times faster than the VAX 11/780. The 8600 can be configured with up to 32 MB of main memory, and high-end systems will be priced at just under \$1 million.
- The company has introduced a number of other new products in 1984/85 including:
  - Dual 785 VAX cluster configuration.
  - A new low-end PDP product (MicroPDP-11/SV) capable of supporting up to four users and compatible with other PDP software products.
  - MicroVAX II, a 32-bit system with up to 80% of the performance of a full VAX 11/780. The system will run all VAX software and is priced at under \$20,000.

### SERVICE DEMOGRAPHICS

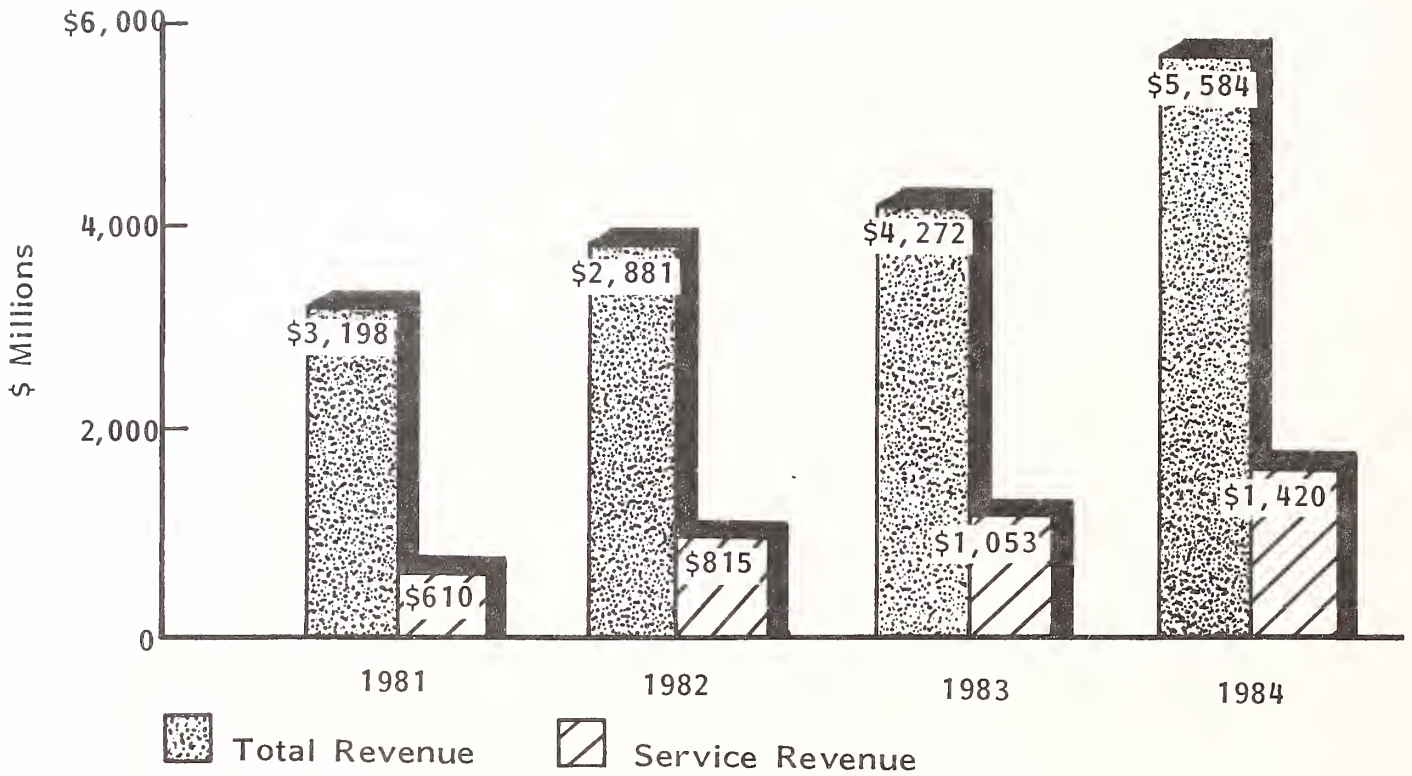
- DEC has an estimated \$19,000 field service staff worldwide, about 12,000 of whom are in the U.S. Approximately two-thirds of DEC's U.S. field service staff are engineers or "service representatives." The company maintains over 170 service offices in the U.S. in addition to 15 depot/refurbishment centers.

### SERVICE ORGANIZATION

- As Exhibit II-11 demonstrates, DEC's service organization, particularly field service, is essentially autonomous in that almost all functions (administrative and service-related) are carried out at the departmental level. Actual service

EXHIBIT II-10

DIGITAL EQUIPMENT CORPORATION  
REVENUE GROWTH



PERCENTAGE GROWTH

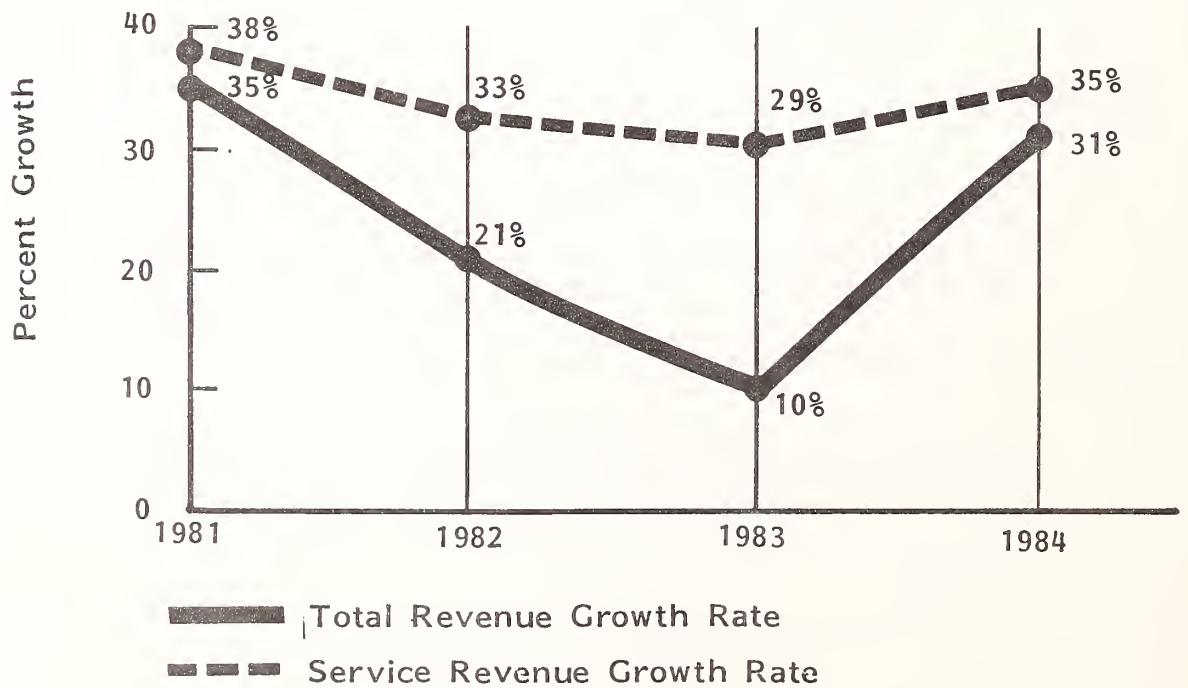
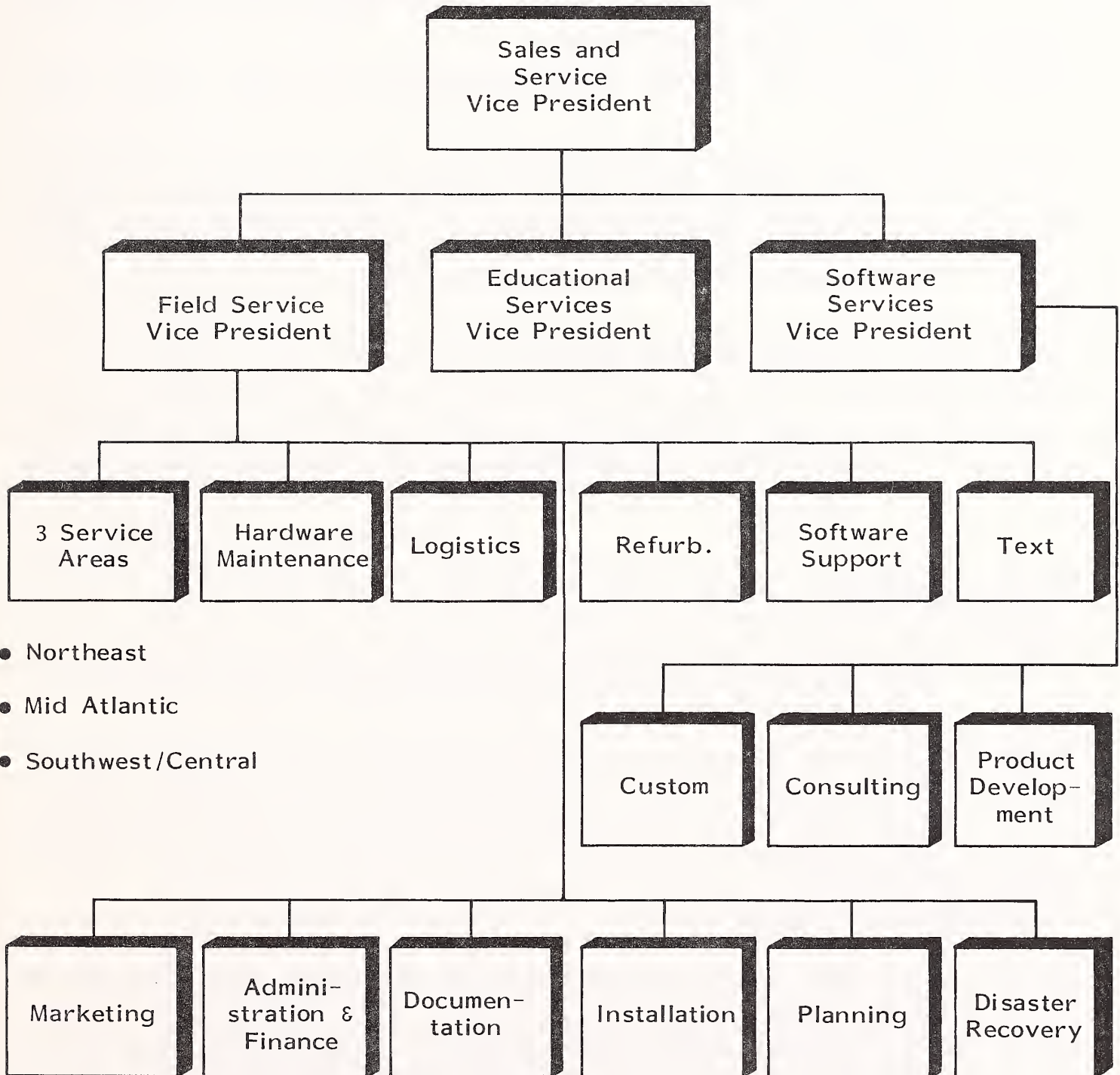


EXHIBIT II-11

DIGITAL EQUIPMENT CORPORATION  
SERVICE ORGANIZATION





delivered in the field is first separated into three geographical areas and then into districts. The field organization is responsible for both hardware and software support.

## SOFTWARE SUPPORT

- DEC software support (both applications and systems) is provided by one of two locations, depending on the hardware product type. The company's Colorado software support center services "high-end" machines such as the VAX series while other products such as the PDP line are serviced through the Atlantic software support group.
- Three levels of software support are offered to mid- and large-scale DEC systems:
  - DEC Support Service. This is the highest level of support offered by DEC and includes on-site support, updates, performance reports, hotline access, on-line support, etc. Also included is access to DSIN (Digital Software Information Network), a data base of previously reported software problems and solutions.
  - Basic Service. This includes most of the same services as DEC Support, but does not include on-site support.
  - Self Maintenance Service. This option is designed to provide assistance to users that maintain their own software. Services included are: documentation updates, newsletters, and information about enhancements. (DEC offers extensive training facilities for self-maintenance customers.)
- Software consulting is available from DEC at charges ranging from \$80-100/hour.
- DEC offers "System Support Services" for their personal computer lines. These services include integration of both hardware and software services and incorporation in the company's "Investment Protection plan."
- One of the factors that seems to be influencing DEC in the provision of software services is that the new markets that DEC is entering into, such as office automation, frequently require a higher level of software support--support which will be instrumental to overall user satisfaction with system performance.

## HARDWARE SUPPORT

- DEC offers a variety of hardware services based on customer needs and product types. On-site service is offered for most products out of DEC's 170+ service centers. Selected machines, such as the VAX and some PDP models, have additional remote support capabilities. In addition, per call service is available on-site for prices as low as \$81/hour on selected PCs and terminals.

- Hardware contracts include:
  - Basic Service, including eight to five, Monday through Friday coverage, usually next day response, planned PMs, and installation of engineering changes.
  - DEC Service, including all Basic Service coverage as well as the option for extended coverage, improved response time, extended coverage PMs, and guaranteed response time in under four hours.
  - Recoverall, an "insurance policy" which provides for repair or replacement of products damaged by accidents not covered under normal maintenance contracts.
- In addition to on-site service, DEC offers a number of depot carry-in and mail-in options. DECMailer, for example, provides a guaranteed five-day turnaround time during which the customer will mail in a failed part and receive a replacement. (DEC has indicated that because they swap parts, the turnaround time can be as short as two days.) Discounts are available for the user of mail-in depot services.
- DEC has been very active in designing and marketing new services to their customer base. Services such as "Recoverall" (discussed above) and the Records Management System are just two examples of the company's philosophy to meet the total needs of their customer. While a "menu" of services are offered, the DEC will emphasize an integrated package of services because this will appeal to most users.

### THIRD-PARTY MAINTENANCE

- DEC does not like to consider itself a third-party maintenance vendor despite the fact that the Maynard (MA)-based company services over 120 products they don't manufacture. The company prefers to think of itself as meeting the needs of its user base, and maintenance of DEC-compatible products is one of those needs.
- It is important to note that DEC will only service DEC-compatible products. INPUT believes that DEC would alienate their user base if they started to support other (competitive) products.
- Service of non-DEC equipment, however, is considered critical by DEC because of the growing importance of networks and mixed-vendor environments. DEC feels they will have an advantage in this area because of the depth of their service experience and their large user base.
- INPUT believes that DEC will continue to pursue the TPM (or DEC-compatible) service business because it will provide the company with increased revenues, higher levels of user satisfaction, and, most importantly, greater service account control.

## FUTURE TRENDS IN SERVICE

- DEC service has been quite successful over the past few years and there is no reason to suspect they will change. The company's success seems to be based on two factors:
  - Increase service flexibility.
  - Improve service efficiency.
- The vast array of service "products" DEC has introduced are a testament to the company's flexibility. However, this flexibility may be a problem area in the future. If the trend goes unchecked, a completely unbundled service agreement could be confusing to the user and counterproductive. In areas such as TPM, an overabundance of service options could lead to a serious logistics problem.
- The changing structure of service revenue away from hardware maintenance and toward software support, education, and professional services will have its affect on DEC. Users of DEC's mid-range systems, such as the PDPs, have indicated increasing price resistance for hardware service, but relatively less demand for extended services. Users of high-end machines, such as the VAX, are much less service price sensitive and appear to be more receptive to extended services. These high-end system users will, consequently, be a better target market to promote service revenue growth.



## SERVICE VENDOR PROFILE

**GOULD INC.**  
Computer Systems Division  
6901 W. Sunrise Boulevard  
Fort Lauderdale, FL 33310-9148

President: C. Shelton James  
Vice President, Customer Services:  
E. G. Sheperd  
Director, Field Operations:  
D. L. Bastress  
Revenues, Fiscal Year 1984 (Gould  
Information Systems): \$226 Million

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### THE COMPANY

- The Computer Systems Division, based in Fort Lauderdale (FL), designs, manufactures, and markets high-performance minicomputers, UNIX-based systems, and productivity systems to satisfy a wide variety of engineering, scientific, and industrial applications.
- The oldest and largest part of the division's business is the design, manufacturing, and marketing of high-performance 32-bit superminicomputers for use in the primary markets of simulation, seismic processing, scientific computation, and energy management.
- The CONCEPT/32 family of computers that serves these markets can use either of two operating systems: MPX-32, Gould's proprietary real-time operating system, or UTX/32, Gould's implementation of the UNIX operating system.
- Gould CSD also offers the multiprocessor, UNIX-based PowerNode systems, the PN6000 and PN9000. Providing mainframe performance in a supermini package, the PowerNodes run software development and production code with highly responsive performance.
- The PowerNode 6000 and PowerNode 9000 are complemented by Sun Microsystems workstations, also offered as part of the Gould computer product line. These workstations, networked to the PowerNode systems, offer powerful, state-of-the-art computing environments.
- The primary markets for the PowerNode systems include laboratory and computation, image processing, universities, and the federal government.
- Gould's Computer Systems Division has been growing at a compound annual rate of approximately 25% during the past three years. Currently the division markets the broadest family of UNIX-based products in the industry and boasts price/performance leadership in all its markets.



## SERVICE DEMOGRAPHICS

- The Customer Service Organization of Gould CSD has approximately 650 employees, of whom approximately 60% are in the field delivering service on hardware and software products directly to customers on a daily basis.
- This support is delivered from approximately 60 service and stocking locations located throughout the U.S.

## SERVICE ORGANIZATION

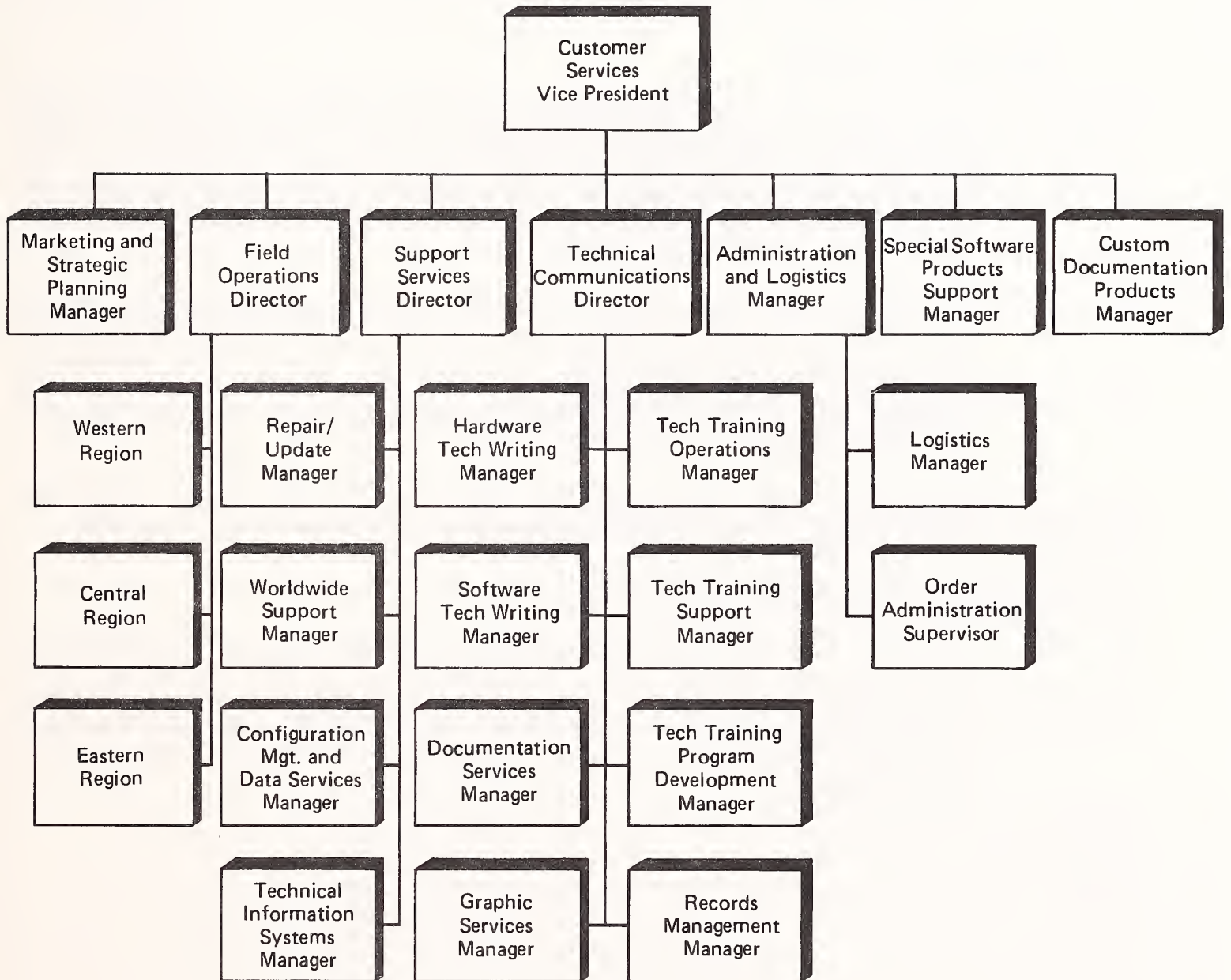
- Customer Services operates as a profit center, providing service and support for the Computer Systems Division through seven line organizations, as depicted in Exhibit II-12.
- Field Operations, the organization that delivers service in the field, is aligned along geographical regions and operates within a well-defined framework of call logging/dispatching. The management of all calls includes a documented technical and managerial escalation policy that insures that all service requests are responded to and resolved in a timely manner.
- The Support Services organization provides support to the field in terms of high level technical support, repair of failed assemblies, and configuration status accounting.
- Logistics and Administration is responsible for all material requirements within Customer Services, as well as for the administration of all service agreements.
- Technical Communications provides training to customers and Gould employees on all products from both a home office training center and satellite training centers in Los Angeles and Washington, D.C. This group is also responsible for all technical documentation, from the actual writing of the documents through the entire publishing and distribution process.
- Customer Services Marketing and Strategic Planning designs and develops new service programs to meet market requirements as well as the requirements of specific customers. They also share in the responsibility of establishing departmental pricing policy. Through this group's field arm, pre-sales support to prospective customers is delivered and direct sales of renewal service agreements is accomplished. Through its home office arm, national accounts are coordinated and managed.

## SOFTWARE SUPPORT

- In addition to the Total System Support agreement described under Hardware Support, Gould CSD offers Centralized Software Support. This program offers remote problem diagnosis, remote problem replication, on-line access to Software Problem Report data bases, and on-site support of software when required. Gould CSD can also quote hourly rates for software support in both

EXHIBIT II-12

GOULD INC.  
SERVICE ORGANIZATION



remote and on-site environments, with discounted rates for known medium- to long-term requirements.

- All support of software is coordinated through the Regional Support Centers, with backup technical expertise resident in the World Wide Support Center located in Fort Lauderdale.
- All customers receive the Software Update Service free for one year with their licensed software products. This program is the vehicle for distributing new releases of licensed products, patches to existing releases, and other software related technical data. After the one year introductory period, the service is available on an annual subscription basis.

## **HARDWARE SUPPORT**

- Gould CSD offers a wide variety of service agreements designed to meet varying user requirements at affordable prices. They range from Total System Support, a program that provides on-site support of hardware and remote support of software, to Comprehensive Hardware Maintenance and finally to Basic Hardware Maintenance, a plan that fully utilizes Gould CSD's experience in remote problem diagnosis.
- In addition, Gould CSD offers Comprehensive Subassembly Exchange to end users who are performing their own maintenance. This program provides priority access to Gould's extensive inventory, as well as priority response to requests for backup labor support. This program includes Comprehensive Configuration Management, an option that is available to other contract customers as well.
- All Gould CSD end-user support programs include pre-installation site surveys and installation of all Gould CSD-supplied hardware and software products.

## **FACTORS AFFECTING SERVICE**

- There is considerable pressure within the services market to hold the line or lower maintenance rates. For this reason, Gould is continually evaluating its pricing structure in view of its competition, costs, and productivity. Gould feels that the key to future profitability lies in an optimized labor force and increased productivity through enhancement of product reliability and maintainability.



## SERVICE VENDOR PROFILE

**HARRIS CORPORATION**  
Information Systems Sector  
16001 Dallas Parkway  
Dallas, TX 75240  
(214) 386-2000

Senior Vice President and Sector  
Executive: Jack C. Davis  
Vice President, Customer Support:  
Carleton Smith  
Revenues (Information Systems Sector),  
Fiscal Year 1984: \$320.4 Million

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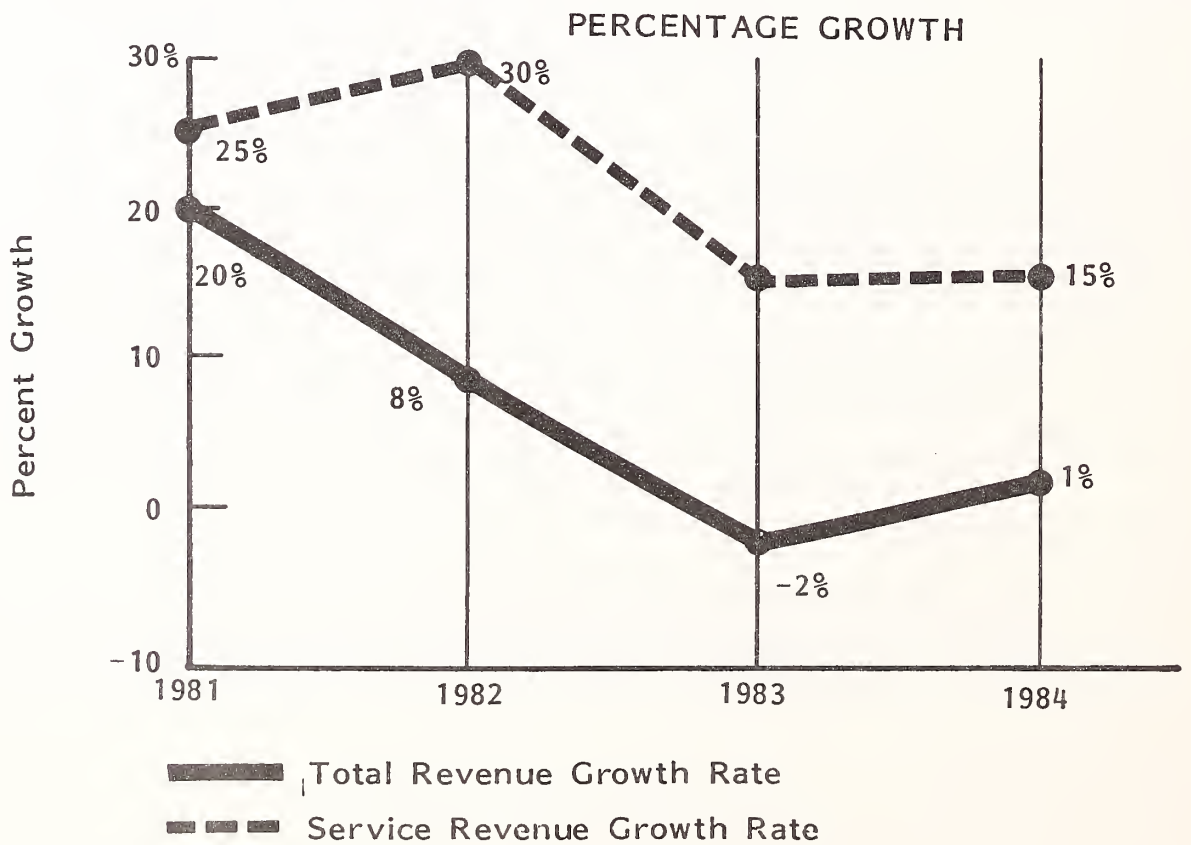
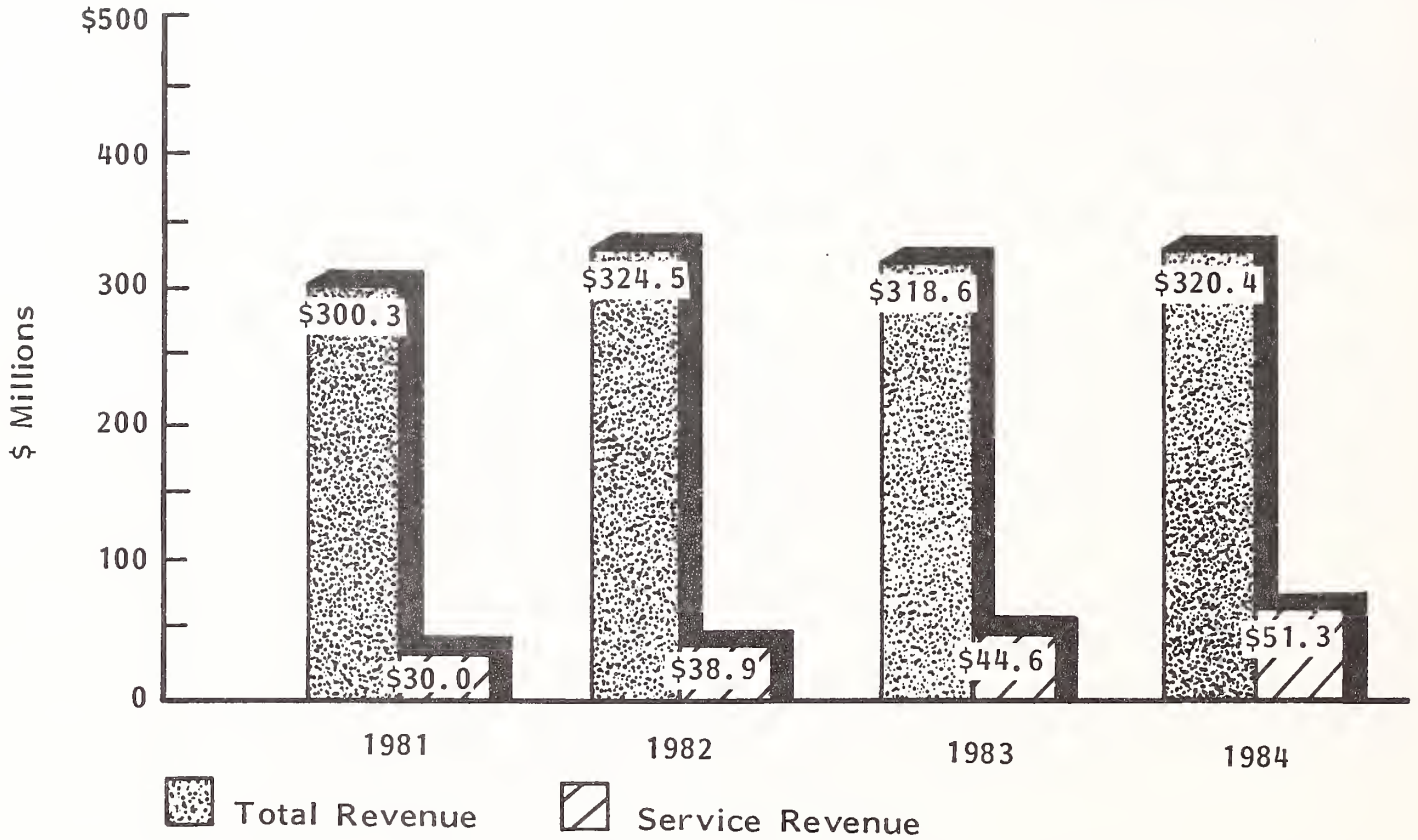
### THE COMPANY

- Harris provides a family of superminicomputers, including the Harris 60, 700, 800, and 1000, for use in scientific engineering and general business environments. Harris targets both the departmental or multi-user office environment and the large multi-user facility. All software and peripherals are compatible throughout the product line, making the conversion from the Harris 60 to a larger system, for example, a smooth transition.
- The most significant additions to the Harris product line in the past year are outlined below:
  - In late 1984, Harris entered in the market the 68010-based UNIX workstation computer line with the Harris Station 10 and Harris Station 20. Harris purchased the workstation from Mascomp.
  - In early 1985, Harris introduced three new product groups: the Harris 9300 work group system, designed to increase professional work group productivity by interconnecting PCs and mainframe terminals; the Lanier Concept 6000 office automation system, a network controller that can tie together 28 workstations; and the Harris 20-20 integrated network switch, intended to reduce voice and data communication cost.
  - In April 1985, Harris announced the design, drafting, engineering, and manufacturing software system called Harriscad that runs on Harris superminicomputers ranging from the Harris 60 to the Harris 1000.
- Harris dropped its 9000 series word processing system because of its acquisition of Lanier Corporation in October 1984. Apparently, the company did not want similar products competing in the same market. In March 1985, Lanier acquired Exxon Office System's domestic direct sales and service organization. In April 1985, Lanier Business Products became part of the Harris Information Systems Sector.
- Revenues for the Harris Information Systems Sector, not yet showing the effect of the Lanier/Information Systems combination, are outlined in Exhibit II-13. For fiscal year ended June 1984, the sector's revenues were \$320



EXHIBIT II-13

HARRIS CORPORATION  
INFORMATION SYSTEMS REVENUE GROWTH



million; net income was \$22 million. The low profit margin was attributed to the IBM-compatible terminal facility. The terminals are selling in a highly competitive, low-margin market. In March 1985, 200 employees (approximately one-quarter) were laid off from the Information Terminals division.

## SERVICE DEMOGRAPHICS

- Harris provides service from over 250 service locations throughout the U.S.; 17 are repair depots. The company's main parts distribution center is located in Dallas, Texas.
- Harris has approximately 1,100 total service employees; 750 are field engineers or other technical personnel providing hardware and software support services.

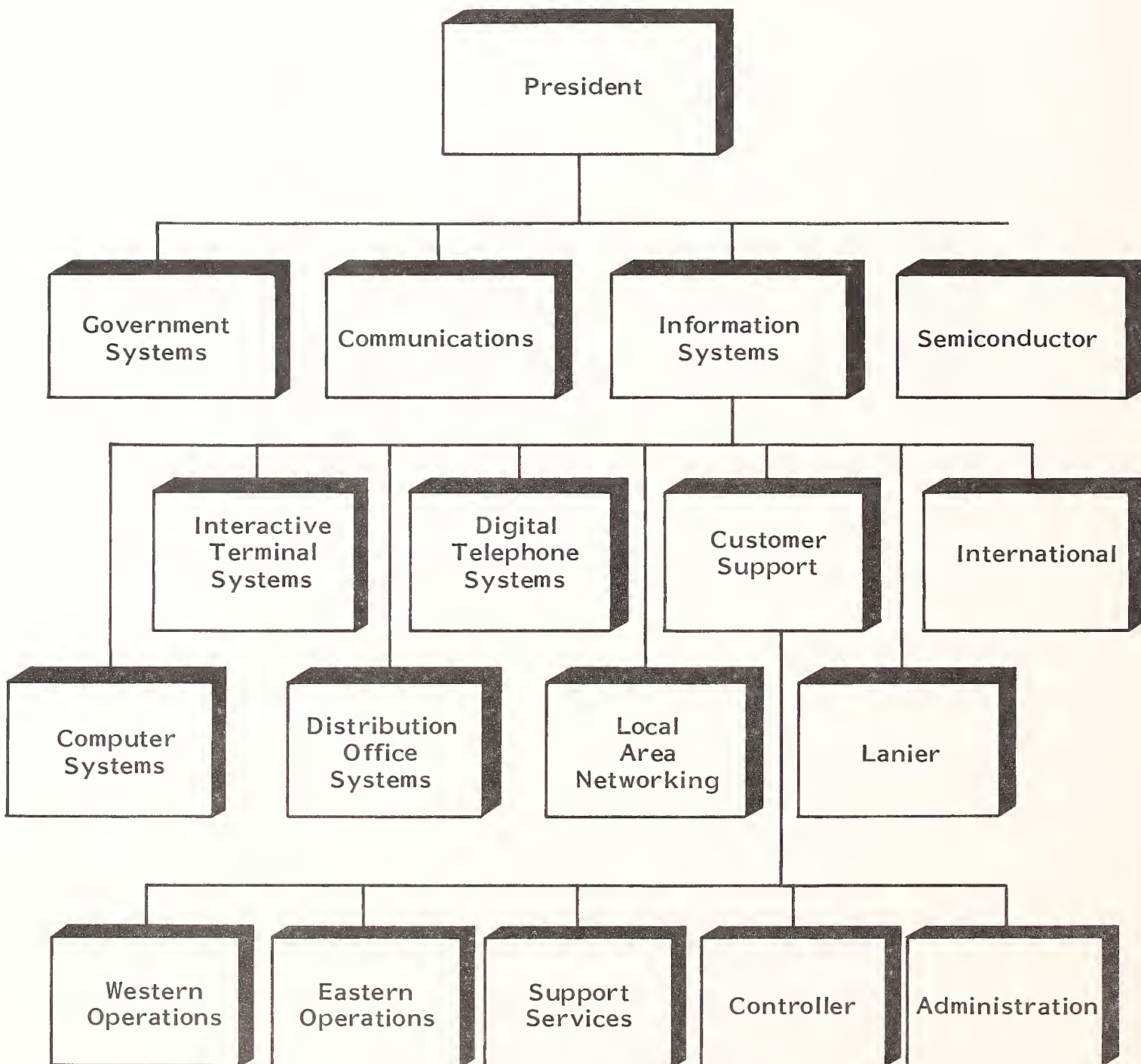
## SERVICE ORGANIZATION

- The Harris corporation's organizational chart, highlighting the Information Systems Sector, is outlined in Exhibit II-14.
- Field operations within Customer Support are divided into Western Operations and Eastern Operations. On-site hardware and limited software support as well as depot repair and refurbishment are performed by these groups.
- Centralized dispatching is the responsibility of the Administration Group.
- Education, training, and other professional services fall under the jurisdiction of support services.
- The Harris Customer Support division does not have its own marketing function. However, the division establishes pricing, discounts, and service options.

## SOFTWARE SUPPORT

- Four categories of software support are available for Harris systems:
  - Class A includes current versions.
  - Class B includes selected mature programs that are useful but do not have modifications or enhancements.
  - Class C includes software from Harris User's Exchange that is voluntarily supplied by customers and employees. Harris provides non-technical and programming support on these programs.
  - Class D includes third-party software. Documentation, maintenance, and other support is provided by the third party.

HARRIS CORPORATION  
SERVICE ORGANIZATION





- For the most part, software support is provided by each of the product divisions. In addition, hardware engineers provide on-site software support for Class A software on a limited basis.
- Users can directly access a software engineer (for example, a COBOL expert) through an 800 number. In 90% of cases, support is provided entirely over the phone because the problem involves user error. In the other 10% of cases, the error is caused by design problems. Harris claims that a vendor can never test software fully for design problems because factors such as the number and type of terminals used and the interaction with other software affect the way software works.
- For design problems, critical factors in providing support include: recognizing the design defect, developing a fix quickly, and installing changes for all users. Harris documents software problems of this nature through remote diagnostics, field engineers, or the customer.
- Only a limited number of software engineers are used on-site for problem determination. The engineer determines whether the problem is with software, communications lines, the mainframe, or other equipment. Harris noted that users do not want to call all the vendors of a multi-vendor system because they will be charged for the service call whether or not the problem lies with the vendor.
- After generating the fix, Harris sends out new releases to all users rather than waiting for each one to have a similar problem. In between generating a fix and getting the new release to all users, the company's solution data base is used.
- Harris does not usually sell source code to customers. The company maintains that customers do not want to be involved with source code any more than they want to be involved with systems design.

## HARDWARE SUPPORT

- Maintenance contracts are established on the basis of local or remote service areas. A local service area is within a 50-mile radius of a Harris service office. For non-contract maintenance, prime time hourly rates are \$60-66 with a minimum billing of four hours for local service and eight hours for remote service. Remote service area customers are charged actual travel expenses.
- Under contract, maintenance is available from 7 a.m. to 6 p.m., Monday through Friday. Additional maintenance hours are available by negotiation. Harris has two maintenance plans for local service area customers.
- Harris Standard Service (HSS) provides:
  - Service during covered hours.



- Four-hour response time.
- Continual remedial service until equipment is operational, even if the service extends beyond covered hours.
- Materials and labor used for remedial service (customer has the option of paying labor and travel expenses if outside covered hours).
- Preventive maintenance.
- All required field modifications.
- The Basic Monthly Service (BMS) includes:
  - Remedial service within covered hours.
  - Response on priority basis, generally within next covered day.
  - Materials and labor used for service within covered hours.
  - The option to extend service beyond covered hours for hourly rates.
  - Preventive maintenance.
  - All required field modifications.
- Remote support for hardware is provided for the Harris 800 and 1000 models because these models include the required Maintenance Aid Processor (MAP). Harris performs remote diagnostics by dialing into the remote user system to isolate the problem, then scheduling the appropriate personnel and parts to repair the problem.
- Each product division supplies full documentation for its own products. Customer Support provides limited documentation in the form of technical publications and quick reference guides.

### THIRD-PARTY MAINTENANCE

- Although Harris did not actively seek third-party business, the company began servicing other vendors products at customer sites last year. Harris expects significant growth in its third-party maintenance activities in the next few years.
- Harris sees third-party maintenance as a means to increase revenues and customer satisfaction. The company does not, however, wish to fill in for another vendor's inability to meet customer service needs while the customer continues to purchase the other vendor's equipment.

## EDUCATION AND TRAINING

- Support services provides education and training for Harris field engineers and systems analysts as well as customers either at the installation site or at Harris' Fort Lauderdale facility. Training courses are offered in software programming and processor and peripheral maintenance.
- Harris has a full-scale video production facility used to train personnel and meet customer video production needs.
- Teletraining provides the means to coordinate training at two or three installations at a time. By using a video connector and an electronic blackboard, interactive graphics capabilities are available.

## FACTORS AFFECTING SERVICE

- Because users are becoming increasingly dependent on software performance, expectations for software support are increasing. This is especially true for applications software support for minicomputers and superminicomputers, such as those manufactured by Harris. Vendors must determine how they can adequately support all types of software. One trend in software support is getting users more involved by providing options, such as a solutions data base, to users. Improved software support increases customers' satisfaction and decreases the cost of support.
- The trend in customer support is moving toward increased remote support services. As a result of Harris providing remote diagnostics, field engineers are better prepared to handle problems on their first on-site call. By stepping up remote support to include remote fixes, Harris could expect to improve response and repair times further, as well as improve geographic coverage. Overall, field engineer productivity would increase.
- INPUT believes that all post sale activities including documentation should be provided by the customer support group rather than by each of the product groups.
- Like many vendors, Harris began third-party maintenance at the request of customers and now must decide how to expand its TPM operations. Factors that must be considered include: what products do customers have, which of these does the company want to service, how will the required parts be obtained, and what skill level and training will be required of the field engineers.

## SERVICE VENDOR PROFILE

### HEWLETT-PACKARD COMPANY

3000 Hanover Street  
Palo Alto, CA 94304

Chairman: David Packard  
GM Customer Support: Mike Leavell  
Computer Sales, Fiscal Year 1984:  
\$3,269 million

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### THE COMPANY

- Founded in 1939 in a Palo Alto garage, Hewlett-Packard has grown to become one of the largest and most respected computer systems and measurement device companies, with total company revenues of \$6 billion for fiscal year 1984.
- HP's major emphasis is in the small systems market with the HP 3000 mini-computer line and in the office automation market with the touchscreen 150 and the portable 110. HP also manufactures a wide range of peripheral devices, data communications equipment, and software products aimed at business, engineering, and scientific markets.
- 1984 was marked by a major reorganization at HP, removing the product line separation that hindered total HP system solutions to their users' data processing needs (this reorganization will be discussed in detail in the service organization section).
- The bulk of HP's business is derived from the minicomputer and related peripheral markets, where HP ranks as the number three minicomputer manufacturer (after IBM and Digital Equipment Corporation). HP has expanded the role of their minicomputers into the office automation market with a \$592 million investment in R&D in this area in 1984. In addition, HP made strides in furthering the development of personal computer offerings, including the release of two high speed, low cost, non-impact printers.
- Even though HP saw substantial revenue growth from 1983 to 1984, the industry-wide slump of 1985 has dramatically slowed HP's new product orders. In addition, HP's main product line, the HP 3000 series, is beginning to show its age with a number of competitive products, such as the DEC VAX 8600, the IBM 4381 Model 3, the Wang VS 300, and the Prime 9995, providing much greater performance. And even though HP's recently released Series 37 has attracted a number of new customers who were drawn by its low cost (starting at \$20,000) and its small size (about the size of a two-drawer file cabinet), HP will need to release a high performance machine in order to reclaim commercial and scientific customers.
- In order to satisfy this need for a higher performance product, HP is gambling on a radically new design known as reduced-instruction set computers (RISC),



currently under development in the Information Technology Group under the name Spectrum. The simplified circuitry and software instructions will allow a much improved performance to price ratios. Speculation on the initial release predicts a speed of over five million instructions per second (MIPS), which is 25% faster than the VAX 8600, at 60% of the current DEC price.

- RISC technology is not altogether new. IBM, for example, has been studying RISC techniques since 1975. Two small firms, Ridge Computers, Inc. and Pyramid Technology Corporation, have released commercial RISC-architecture machines that run certain programs up to twice as fast as DEC VAX 11/780 machines. Most concerns about RISC technology center around the compatibility of existing software applications programs and the new machines.
- HP has stated that the Spectrum minicomputers will allow migration of users from existing 3000 lines to the new Spectrum line with less disruption than the industry has usually seen. It is implied that performance boosts will not be available to Spectrum users unless users purchase third-party compilers or develop their own. HP has indicated that Spectrum will be able to match the HP 3000 Series 68 closely enough to run current non-compiled software in Series 68 emulation.
- As shown in Exhibit II-15, HP has demonstrated fluctuating revenue growth in worldwide sales.
- Service growth at HP has been fairly steady from 1981 to 1984, with only a slight drop in 1983 as a result in the dramatic fluctuation in new product sales of that year.

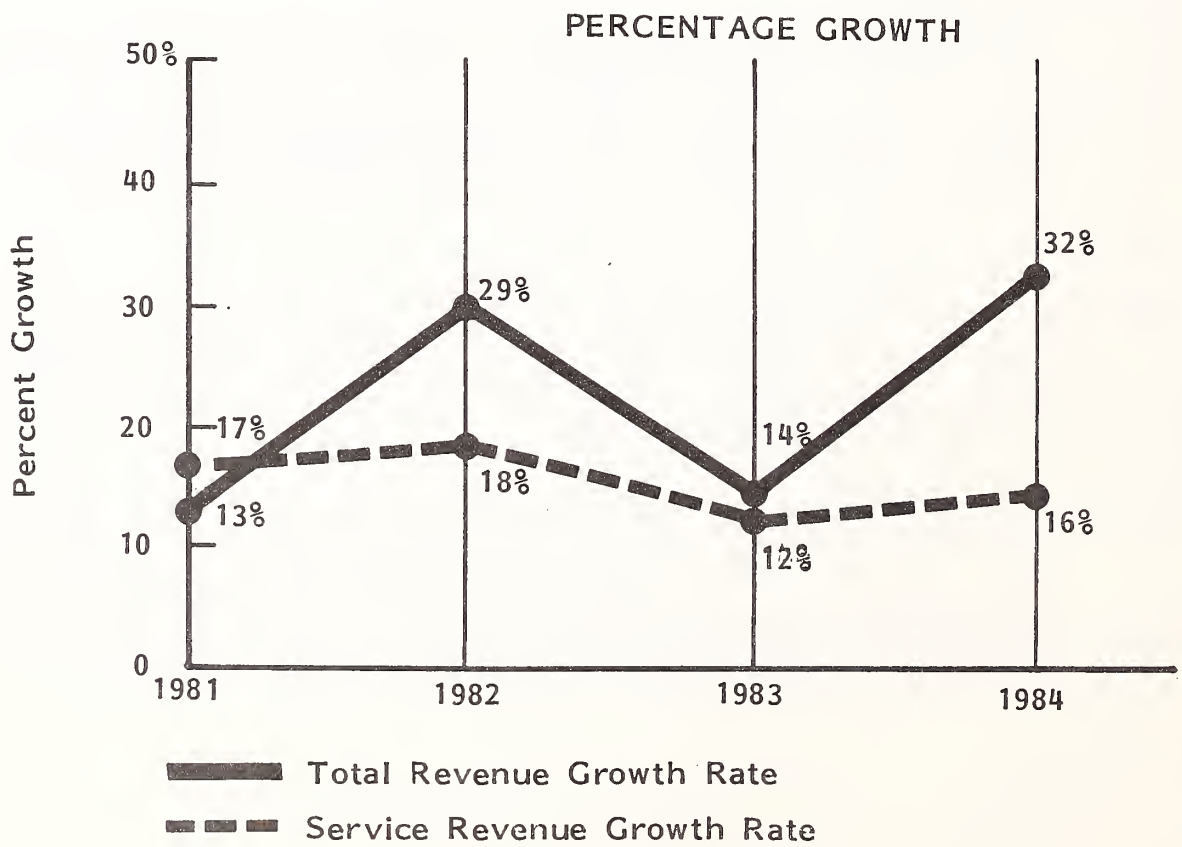
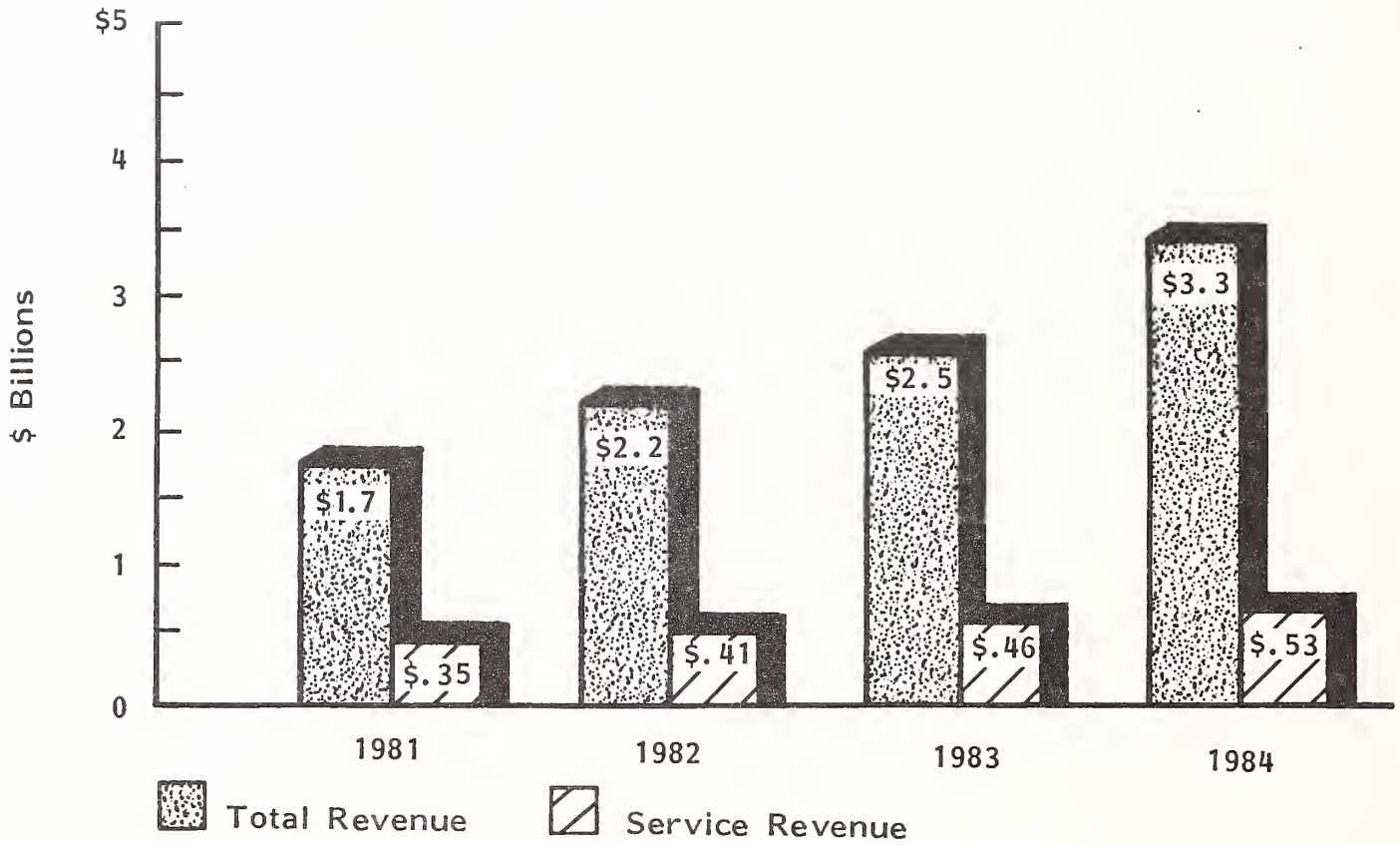
## SOFTWARE SUPPORT

- HP offers software support for both business computer and technical (scientific) computer users at three levels of service: Account Management Support, which provides personalized on-site support through an account support representative; Response Center Support, which delivers technical support over the telephone; and Software Materials Subscription, which is a materials-only support offering.
- The highest level of software support available to HP users is their Custom Support Plan, which is actually just an extension of the Account Management Support Plan. Designed for users with additional software support requirements, such as multi-site support, this option allows the user to customize this support plan to fit his exact needs.
- Account Management Support, along with providing an account support representative, offers access to HP's Response Center (with a response of two hours maximum), remote support for HP 3000 users, on-site assistance (if the Response Center and Tele-Support cannot remedy the problem), and access to all software report materials in the form of new releases, bulletins, newsletters, and manual updates.



EXHIBIT II-15

HEWLETT-PACKARD COMPANY  
REVENUE GROWTH



- Response Center Support provides the user with access to the HP Response Center, Tele-Support (HP 3000 users only), and all support materials.
- HP has emphasized educational and professional services. HP offers a wide range of training programs, communicated to their users in a number of periodic catalogs. Training courses offered cover a wide range of subjects, including programming, applications usage, computer operations, and even user self-maintenance. HP will offer training at HP Customer Training Centers located in 40 cities in the U.S. or at the user's site.
- In addition, HP offers a wide range of consulting services, both contractually and on a time-and-materials basis, covering system performance, capacity planning, installation management, implementation analysis, implementation training, and implementation assistance.

## HARDWARE MAINTENANCE

- HP provides a very extensive "menu" of service options to their minicomputer and microcomputer customers. In fact, a typical HP user might choose from as many as 11 different service offerings at graduated levels of service provided, ranging from the usual time-and-materials maintenance to various levels of depot maintenance up to and including 24 hour-a-day, seven day-a-week on-site coverage with guaranteed uptime and remote support services. A short description of the most common service offerings follows.
- The two most common service offerings at HP are Basic System Maintenance Service, which provides on-site remedial and preventive maintenance with a next day response, and Standard System Maintenance Service, which provides four-hour response time and extended coverage (8 a.m. to 9 p.m., Monday through Friday, versus 8 a.m. to 5 p.m., Monday through Friday). Standard System Maintenance customers can also contract for extended coverage up to seven-day, 24-hour coverage.
- HP offers guaranteed uptime to selected users of the HP 3000 computer system. Under this option, HP will credit a user an amount equal to one month's service charge for products covered under this contract if the system uptime falls below 99% during any three consecutive month period.
- Technical Assistance Service is a consulting service that concentrates specifically on hardware support. Subscribers to this program receive phone-in consulting service, hardware subscription service (which includes updates, newsletters, and service notes), and improved on-site response times for equipment covered under the technical assistance service.
- HP offers a wide range of support services for their workstation and microcomputer users. HP offers a lower-priced On-Site Product Maintenance Agreement which provides next-day service at savings of up to 40% of a systems maintenance agreement, but without a number of the auxiliary services that are less important to workstation users. In addition, users can

purchase prepaid "call certificates" for a cost effective, as-you-need-it basis of support.

- Workstation users can opt for Field Repair Center Service, which provides three-day turnaround of all workstation products. Field Repair Center service can provide up to 50% cost savings compared to an On-Site Product Maintenance Agreement.
- HP offers both on-site and repair center service on a fixed-price-per-incident basis under their Standard Repair Price Service, which provides five-day turnaround at a repair center or three-day response on on-site repairs. According to HP, the fixed-price aspect of these service offerings eliminates the uncertainty of time-and-materials service.

## FUTURE TRENDS IN SERVICE

- As with all other aspects of the company, the future of service hinges, to a great extent, on the yet to be released Spectrum product line. Since a major strength of the new line will be its communications and connective capabilities, HP will undoubtedly need to stress telecommunications support in their service offerings. HP has experience with tele-support, both with a remote diagnostics offering on selected models of the HP 3000 family and their utilization of remote support in scheduled "predictive (preventive) maintenance" activities. These offerings will undoubtedly require expansion for the Spectrum products.
- Coordination between hardware maintenance and software support will also be impacted by the new product line. Theoretically, the simplified design should be more serviceable on a hardware maintenance basis; however, there will be a greater strain of the software and software support side of the system, especially for those users trying to run existing HP 3000 programs on the new Spectrum computers. Post-sale support offerings such as documentation, consulting, and training will need to be emphasized by HP in order to provide a smooth transition into the new product line.
- The coordination of all post-sale support needs, such as hardware maintenance, software support, professional services (planning, consulting, etc.), and educational services (training and documentation), will culminate in a single account manager for each site. HP has worked toward that goal in the past with separate hardware and software customer engineers assigned to each site. For HP to succeed in satisfying the expected high service requirements of their new customer basis, HP will need to fully integrate hardware and software customer engineers so that a single point of contact exists between vendor and user.



## SERVICE VENDOR PROFILE

**HONEYWELL INC.**  
Honeywell Plaza  
Minneapolis, MN 56408  
(612) 870-5200

Executive Vice President:  
William Wray  
Vice President, Customer Service  
Division: Sy Kraut  
Revenue (Information Systems), Fiscal  
Year 1984: \$1,825 Million

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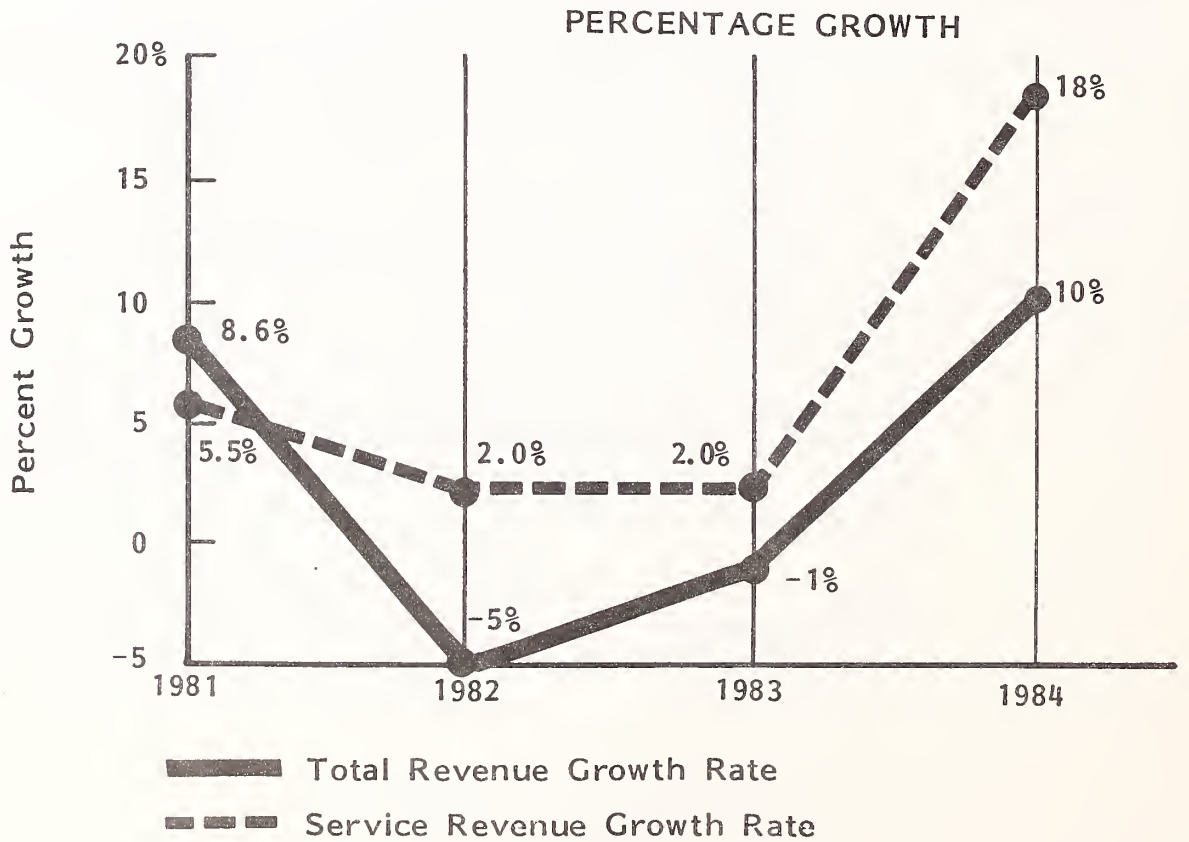
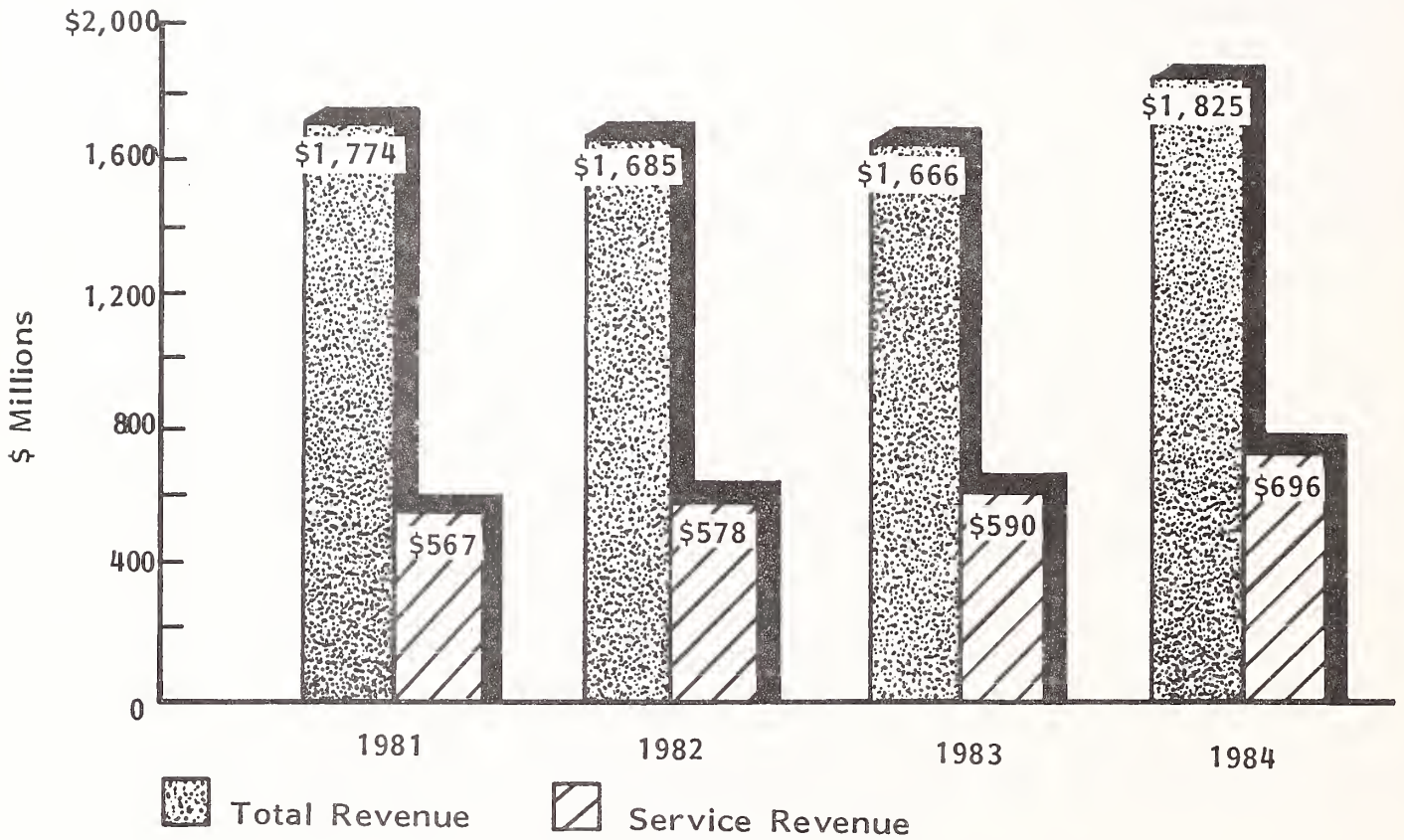
### THE COMPANY

- Honeywell Information Systems (HIS) had one of its best years in 1984, as demonstrated in Exhibit II-16. HIS revenues grew 10% to \$1.8 billion, and worldwide service revenues increased nearly 18%, the fastest growth since the late 1970s. Revenue increases are credited to three major factors: severe cost containment measures, a variety of new product introductions, and a shift in emphasis away from strict hardware orientation and toward a systems integration role.
- Cutbacks at the company date back to the 1981-1982 period when over 2,500 employees were laid off and extensive cost cutting measures were instituted. In 1985, the company temporarily closed down the Small Computer and Office Systems Group and laid off an additional 150 salaried employees. In December 1984, the company shut down its semiconductor subsidiaries (Synertek) and terminated 1,500 employees.
- The company has introduced a number of new products, particularly software products, in order to move into the role of a systems integrator as opposed to being primarily thought of as a hardware vendor only. Products such as FORUM 8 Interactive Meeting System--a realtime electronic message center--and OMS 40 and 90 office automation software are key to the company's efforts to be perceived as a "solutions supplier."
- Despite the company's current emphasis on software solutions, Honeywell has also been active in developing new hardware products as well. Some of the latest of these products include:
  - The DPS 90 line, first introduced in March 1985, which offers 70% more processing power than the company's previous top of the line--the DPS 88. The 90 features current-mode logic circuitry and 250K memory chips and can be configured with up to four processors with a fully configured cost of over \$8 million.
  - Two new mid-range DPS 88 models (the 41 and 40) which can be configured with up to 16 MB of main memory per unit and can be configured as fully redundant systems.



EXHIBIT II-16

HONEYWELL INC.  
REVENUE GROWTH



- The DPS 6/42, a new low-end minicomputer which can support up to 32 users.

## SERVICE DEMOGRAPHICS

- Honeywell has 3,500-4,000 field service employees in the U.S., 2,200 of which are engineers. The company has 250 service locations in the U.S. along with 3 central parts depots and 80 regional parts centers. The company has a single national response center (Atlanta) and three Technical Assistance Centers (Massachusetts for small systems, Arizona for large systems, and Georgia for micro systems).

## SERVICE ORGANIZATION

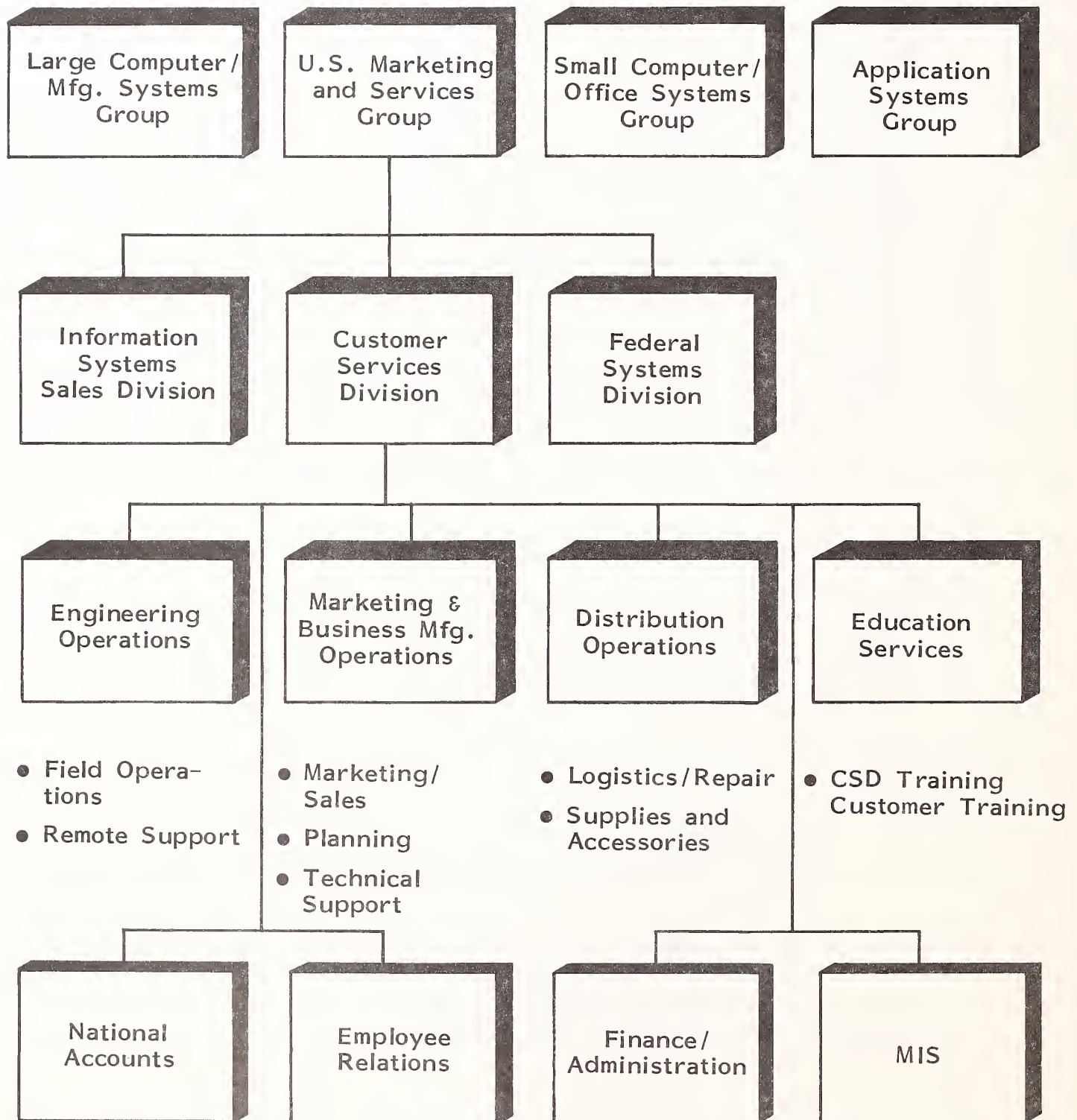
- Exhibit II-17 demonstrates that Honeywell's Customer Service Division is essentially autonomous in that most administrative and service functions are performed at the local level. Honeywell Information Systems is only one of the company's five major businesses. These major businesses share some functions at the corporate level, particularly in the areas of personnel administration, corporate financial controls, and service coordination.
- Service coordination is promoted through the establishment of a corporate "Service Council" in which service issues of mutual concern to any and all of the corporation's five major businesses are discussed. For example, the Building Services Division may utilize the Information Systems Division's Response Center in Atlanta to better support control system customers. The company has indicated that continued and expanded sharing of service resources is expected.

## SYSTEM SUPPORT

- As noted above, all problem calls (both hardware and software) are initially directed to the company's National Response Center in Atlanta. Software problems are directed to one of three Technical Assistance Centers (TAC) in Massachusetts (for small and medium systems), Arizona (for large systems), or Georgia (for micro-based systems).
- Two basic levels of software support are available from Honeywell:
  - Basic support includes access to a TAC; availability of a Remote Software Update Facility (RSUF) if applicable (for DPS 6); immediate distribution of documentation, updates, patches, new releases; and immediate processing of System Technical Action Requests (STARs).
  - Expanded Support offers the same services as Basic support plus remote support on selected systems (DPS 7, DPS 8, DPS 88/90), use of the electronic mail Incident Reporting System (IRS), and on-site customer support when necessary.

EXHIBIT II-17

HONEYWELL INC.  
SERVICE ORGANIZATION





- Supplemental support includes all of the above services as well as software installation and a systems software update service.

## HARDWARE SUPPORT

- Honeywell offers a variety of hardware support plans according to user requirements for service and the type of machine to be serviced. Large systems, such as the DPS 8, DPS 88, and DPS 90, offer the following hardware support options:
  - Basic Hardware Maintenance. Access to TACs, availability of remote support, on-site support for remedial preventative maintenance services, two-hour reponse, and eleven-hour Principle Period of Maintenance.
  - Optional Hardware Support Services. Scheduled extended maintenance (up to 24 hours/7 day per week at a premium of 40% over basic monthly maintenance) as well as the services listed above.
- Small and midrange systems (such as the DPS 6) offer a similar service structure to large systems with the following exceptions:
  - Four-hour response time (as opposed to two hours for large systems).
  - Option to contract for next-day response (at a discount).
  - Option to use the Customer Assisted Maintenance Program (CAMP, discussed below).
  - Option to utilize site planning services (standard with large systems).
- The Customer-Assisted Maintenance Program (CAMP) is available for selected DPS 6 products as well as microcomputer and peripheral products. This program is designed so users remove failed components from their Honeywell equipment, mail the equipment to Honeywell, and install the functioning part when available. Honeywell offers built-in diagnostics to assist in problem determination and expedited dispatch to cut down on turn-around times.
- Honeywell also has 32 walk-in service centers for selected terminals and microcomputers. Originally established to service Coleco "Adam" computers, the service centers now support a variety of products and can offer a 48-72 hour turnaround as opposed to a five-day turnaround for mail-in.
- Despite the fact that Honeywell has unbundled some service such as selected consulting and planning, the company's current emphasis toward systems integration precludes any massive unbundling in the near future. In fact, as a systems integrator, it is likely that Honeywell will attempt to bundle even more services into their maintenance contracts in order to promote account control.



## THIRD-PARTY MAINTENANCE

- Honeywell entered the third-party maintenance market in 1983 when it signed contracts with Printronix and Pencept. In addition, the company has announced national contracts with Apple, Convergent Technologies, Raster Technologies, Stratus, Zenith, and Zilog, among others.
- Initially, Honeywell entered the TPM market in order to utilize its current field engineering staff more efficiently and, of course, to earn additional service revenues. The company is concentrating on "complimentary" products; i.e., products most frequently found in Honeywell customer environments. In addition, the company is emphasizing national agreements in order to ensure a "favorable status" with the manufacturer in terms of parts and training.
- TPM service from Honeywell is provided by Honeywell engineers dispatched from the company's 250+ service locations nationwide.

## FUTURE TRENDS IN SERVICE

- Honeywell's transition away from a strict hardware orientation and toward a system integrator's role offers many opportunities for the company, but will require a much stronger emphasis on service, particularly software service, than in the past. Support of third-party software will be crucial because even though Honeywell may not have developed the software, users will expect the company to support it. For this reason, INPUT expects a much greater emphasis on remote support from Honeywell, along with improved post-sales support services such as documentation and custom consulting.
- The latest high-end machine from Honeywell (the DPS 90) is actually an NEC CPU. As Honeywell depends more on a remarketing and service role, problems such as field engineer training and parts availability must be considered to a much greater extent in the future. Training of FEs and SEs will be based on extensive use of "expert systems" already being developed at Honeywell.
- The third major trend for Honeywell is in the area of third-party maintenance. Clearly, this is a fast growing opportunity area for Honeywell and the company has developed a definite marketing approach to TPM. One problem area that the company must address is the impact TPM will have on Honeywell user satisfaction rates. If the Minneapolis-based company can convince current Honeywell users that third-party maintenance is in their best interest (as DEC has done), then satisfaction rates should increase. If, on the other hand, Honeywell users feel that their service is suffering because of TPM, the long-term impact could be quite damaging.

## SERVICE VENDOR PROFILE

**INTELOGIC TRACE, INC.**  
(Formerly Datapoint Corporation)  
8415 Datapoint Drive  
San Antonio, TX 78229

President: John L. Hale  
Revenues, Fiscal Year 1984:  
\$145 Million

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### THE COMPANY

- Intellogic Trace, Inc. (IT) became a wholly owned subsidiary of Datapoint Corporation in June 1985 and became an independent publicly-traded (NYSE) corporation in July 1985. Intellogic Trace will still provide service for Datapoint equipment under a Master Maintenance Agreement which designates IT as the exclusive service agent for Datapoint for an initial term of six years. Datapoint will receive a fixed royalty which will amount to two months of standard maintenance charges for all serviced equipment and will provide parts to IT at sparing levels commensurate with those prior to the spinoff.
- The spinoff will have a dramatic impact on both Datapoint Corporation and the service industry. Datapoint will be losing the division that contributed 56% of Datapoint's \$26 million profit in 1984, and 30% of all the company's revenues for the first nine months of fiscal 1985. Datapoint officials are optimistic that the clear delineation between service and the other operations will aid in the recovery of Datapoint by allowing both groups to reorganize their operations with better focus to the needs of users of both groups.
- More importantly, the spinoff paves the way for Intellogic Trace to make a significant entrance into the third-party maintenance market. The establishment of IT as a service organization wholly independent of an equipment sales organization will facilitate the establishment of third-party maintenance arrangements with equipment manufacturers who otherwise would have seen it as a potential sales competitor. As IT currently stands, they enter the TPM market with an established service base; their reported revenues of \$146 million in 1984 would rank them as the third largest TPM firm for that year. IT is the largest independent TPM.
- Exhibit II-18 demonstrates IT's revenue growth.

### SERVICE ORGANIZATION

- Even though Intellogic Trace is still in the development stage, the organizational structure has been established. A functional breakdown of IT's current service organization is presented in Exhibit II-19.

INTELOGIC TRACE, INC.  
REVENUE GROWTH

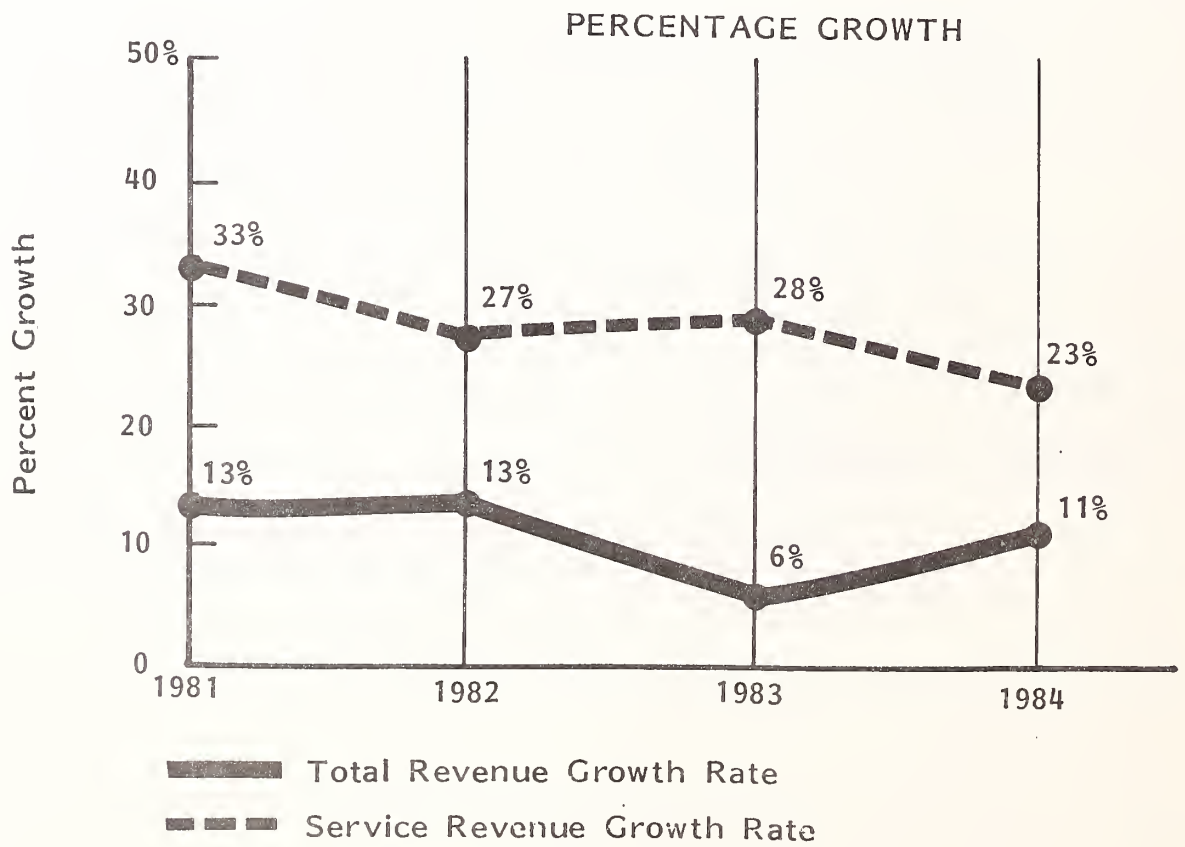
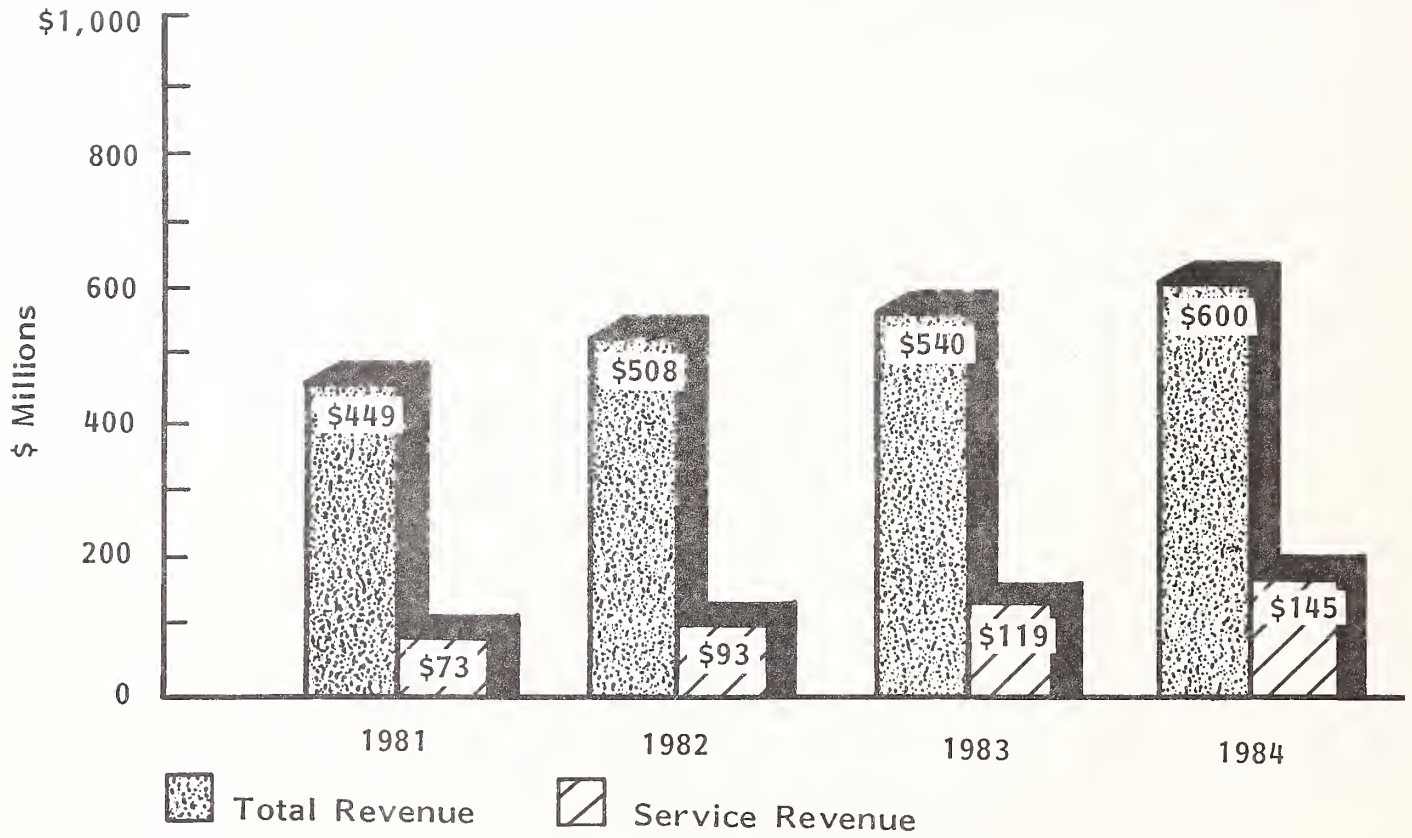
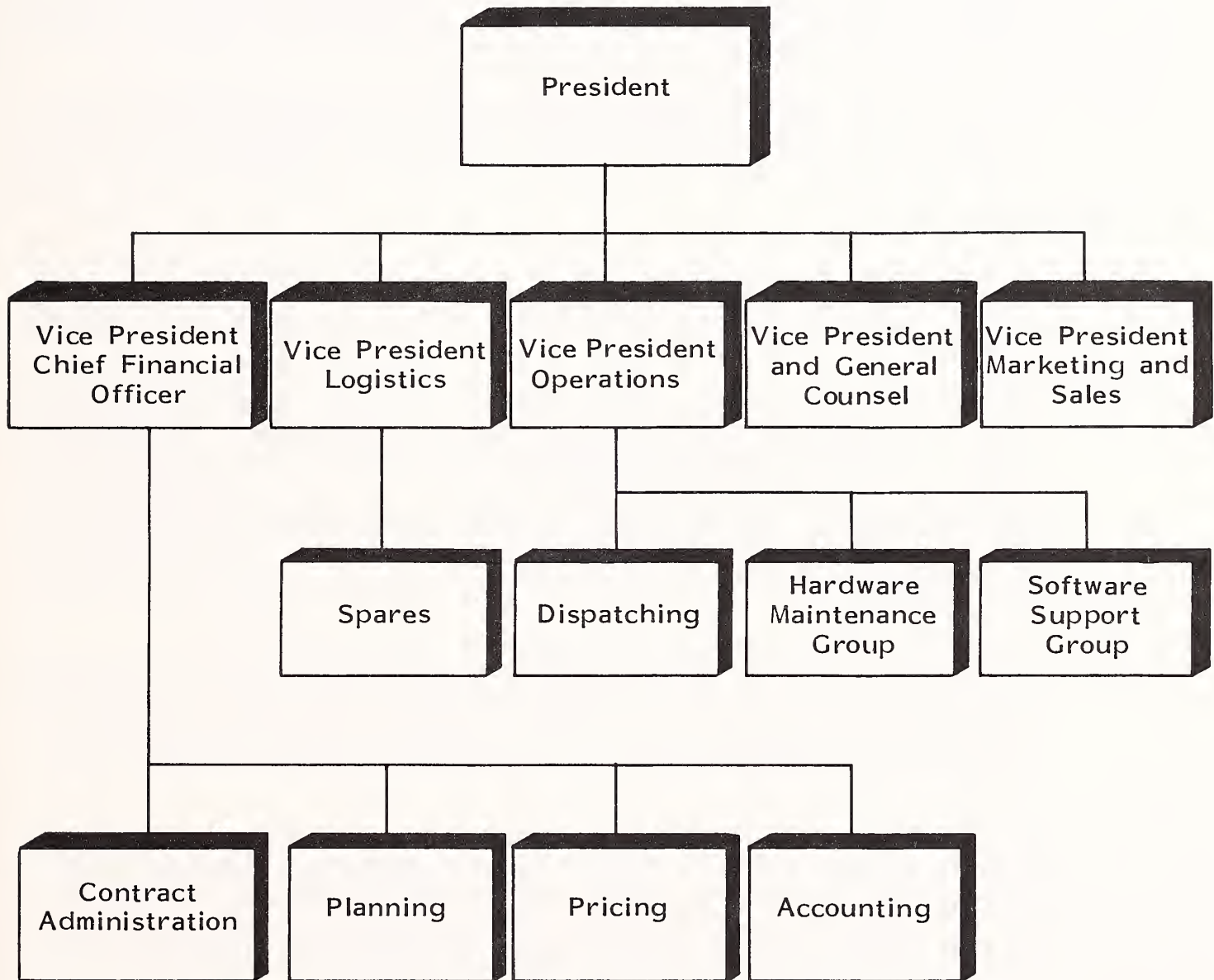




EXHIBIT II-19

INTELOGIC TRACE, INC.  
SERVICE ORGANIZATION





- As IT develops into one of the largest TPM vendors, it will be interesting to watch the development of the business side of the organization, particularly the marketing function. Before the spinoff, this function was handled, for the most part, outside of the service organization.

## SOFTWARE SUPPORT

- Prior to the spinoff, Datapoint's customers received systems software support from the systems engineer group in marketing. Users typically receive on-site support in the form of fixes and upgrades. Datapoint was in the development stages of implementing a realtime on-line data base which would be made available to end users.
- As a result of the spinoff, the source of software support is now unclear. Intelogic has plans to provide software support to TPM end users, but the delivery source and the extent of such an offering is not finalized.

## HARDWARE SUPPORT

- Intelogic Trace has approximately 2,100 total employees comprised of approximately 1,000+ customer service (field) engineers, working out of 66 district offices and 250+ local service offices.
- IT service customers can request service by calling the toll-free, 24-hour central Call Dispatching and Customer Support Center located in San Antonio, Texas. A service coordinator (dispatcher) then determines site location, system configuration, and pertinent historical data concerning the site and dispatches a local customer service engineer. The engineer usually contacts the user within one hour and attempts to schedule an on-site visit, usually by the next half day unless the customer has contracted for either four or two hour response.
- IT offers a wide range of service contracts, including multiple shift coverage and extended week coverage, in addition to time and material coverage for work performed outside of contracted coverage and for any other non-contract repairs. Ninety percent of IT maintenance revenue is derived from maintenance contracts.
- Repairs are typically performed as component exchanges called "optimum replacement unit (ORU)." After an on-site engineer tests and diagnoses a faulty system to the failed ORU, the failed ORU is replaced and then shipped to the centralized repair facility at San Antonio where it can be repaired and returned to IT's centralized spares inventory, also located in San Antonio.
- In addition to the installation and servicing of equipment, Intelogic Trace sells computer-related furniture, accessories, and supplies through catalog sales and a toll-free telephone order number. In this area, IT competes directly with Datapoint Corporation, which will also continue to provide such sales.

## THIRD-PARTY MAINTENANCE

- As a result of the spinoff, Intelogic Trace became a third-party maintenance organization even though 92% of all their current service revenues is derived from maintaining Datapoint equipment. It will continue to attempt to gain maintenance agreements, both exclusive and non-exclusive, with other manufacturers and end users in order to increase its service revenue growth.
- During the first two months of IT's existence as a wholly independent TPM company, they have signed several exclusive maintenance agreements. Among those signed are Philips Peripherals, Photophone, and Tenrekron. In addition, IT has begun support of the IBM PC products and its common peripherals. IT is presently expanding the scope of product which it will support, and INPUT expects this expansion to continue, depending on market demand.

## SERVICE VENDOR PROFILE

**INTERNATIONAL BUSINESS MACHINES**  
Armonk, NY 10504

President and CEO: John F. Akers  
President, National Service Division:  
Charles P. Biggar  
Revenues, Fiscal Year 1984:  
\$45.9 billion

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### THE COMPANY

- Recently, IBM has dispelled a number of recurring misperceptions about the company's ability to adapt quickly to new markets and to compete with lower priced products on a price and quality basis. In dispelling these misperceptions, the Armonk-based company has displayed surprising flexibility in dealing with market demands which are changing, perhaps, faster than ever before.
- 1984 and 1985 saw the announcement and/or introduction of several major products.
  - Among the large-scale systems, IBM introduced the long-awaited 3090 mainframe. A fully configured 3090 Model 400 is estimated to perform at 52+ MIPS, 80% faster than the previous top of the line 3084.
  - In April 1985 the company announced the System/88, a fault tolerant system manufactured by Stratus Computer. The 88 is priced from just over \$150,000 to over \$670,000, can be configured with up to 8 MB of main memory, and has a performance rating of up to 3 MIPS.
- The company has been very active in developing and promoting mid-range systems. However, users report substantial delivery delays with products such as the low-end System/36 (5362) and upgraded Series/1, both of which have lead times of up to 12 months.
- Incentive and promotional plans have been used by IBM to spur sales of a variety of mid-range systems. In November 1984 the company offered discounts of up to 50% on peripherals for value added remarketers selling the System/36 and System/38 products. Thirty-three percent discounts on selected software were offered to end users installing System/36, /38, or 4361s through September 1985.
- IBM has indicated that it intends to incorporate CMOS technology into its mid-range machines, such as the System/36 and 4300. As a result of the increased densities allowed by CMOS, INPUT expects much more competitive pricing of mid-range products in the future.



- Personal computers represent almost 10% of IBM's total revenue, and the company remains active in developing new products for this market. The PC/AT was introduced after several delays resulting from faulty hard disk drives. In addition, the company had earlier introduced a variety of new microcomputer products such as the 3270 Personal Computer /G and /GX, as well as expanded versions of the XT/370.
- A desktop version of the Series/1 was announced in March 1985 using the same microprocessor as in the XT and AT products.
- Increasingly, new product development, strategic partnering and acquisition of telecommunications vendors, and aggressive sales efforts have resulted in the perception of a much more competitive IBM. Service has contributed to this perception. While service is frequently used as a competitive tool, it is almost always considered a product which should, over the long term, remain profitable.
- In pricing its service product, IBM keeps the target moving. For example, between June 1983 and February 1985, IBM lowered the purchase price on its 308X system three times and lowered the maintenance price another three times. Overall, these price decreases equaled a 30% improvement in this product's price performance ratio. The 4300 product line, on the other hand, was introduced with radically lower prices than the system it replaced--the 370/138. And, at times, the company follows the traditional pattern of pricing, such as with the 3033 product line, where both purchase and maintenance prices are increased on a periodic basis.

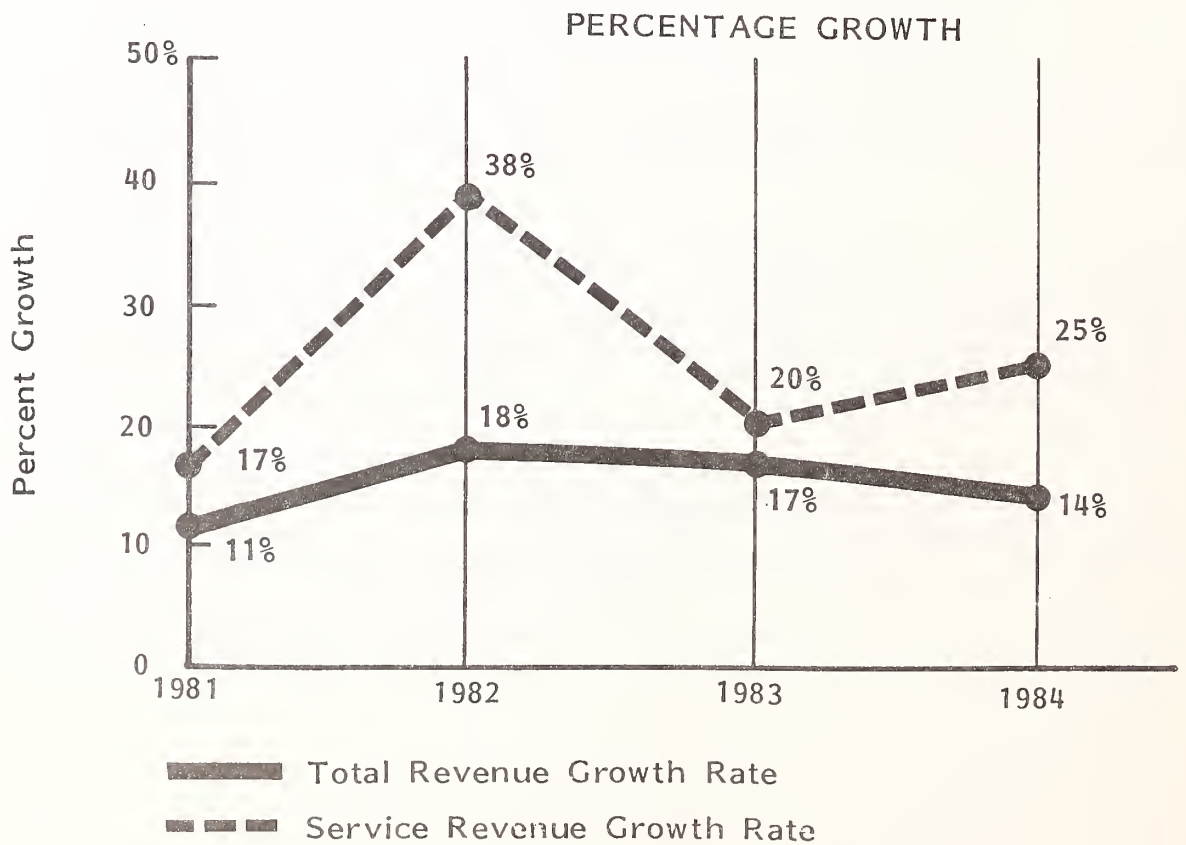
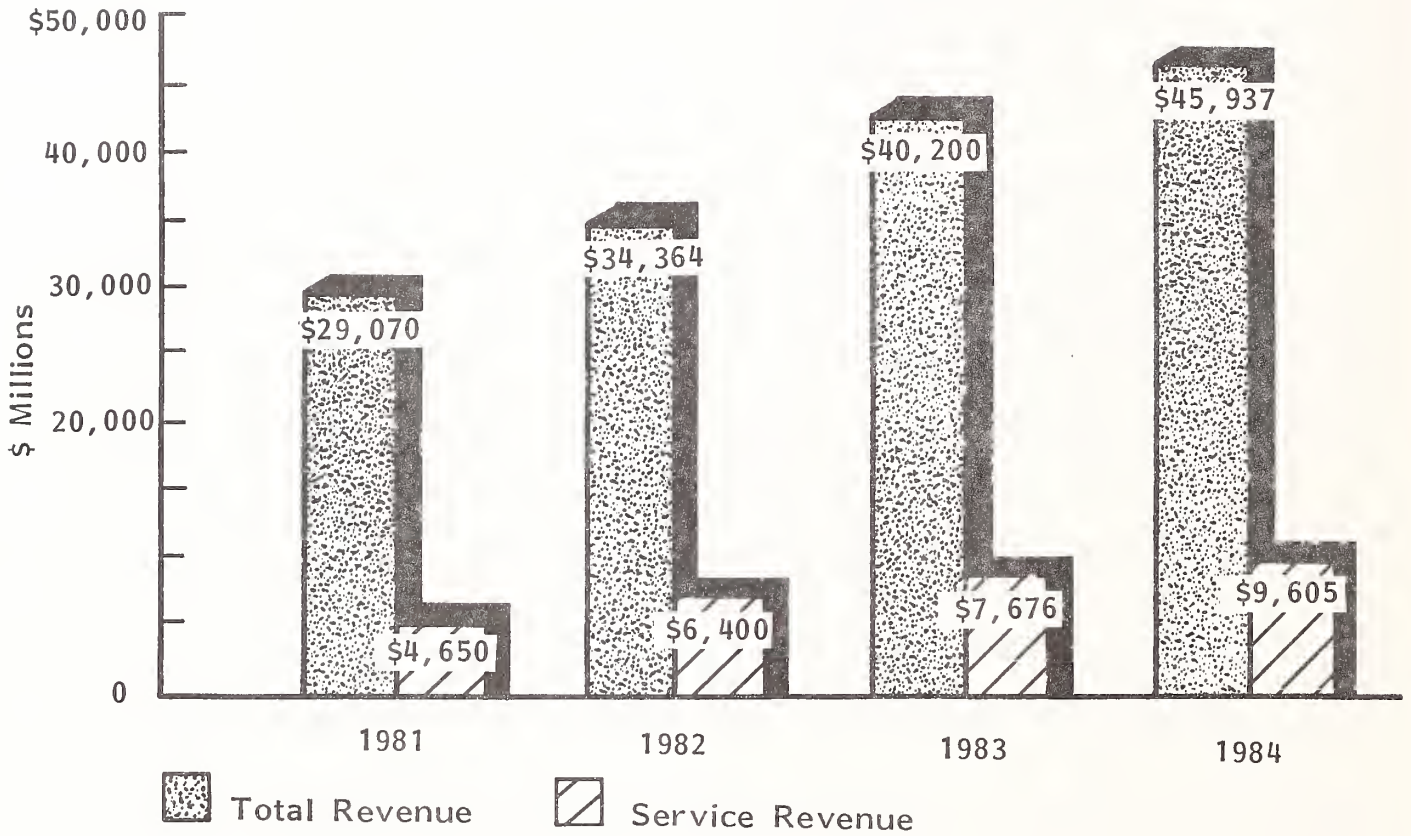
## SERVICE DEMOGRAPHICS

- In 1984 IBM announced the formation of the National Service Division with Charles Biggar as President. This move was not unexpected, particularly since the previous Field Service and Customer Service Divisions would frequently share resources and even service the other's accounts when necessary. INPUT estimates that the National Service Division has approximately 30,000 to 33,000 service personnel, 68% of which are engineers.
- The National Service Division has over 150 service branches in the U.S., 3 software support centers (in Colorado, Chicago, and Florida), and 13 hardware diagnostics centers (usually at the manufacturing site that produces the equipment). In addition, the company has one of the most elaborate personal computer support networks, with over 2,000 authorized PC dealers in the U.S. alone.
- Service revenues, as shown in Exhibit II-20, were \$9.6 billion in 1984, representing 21% of IBM's total revenues, up from 19% in 1983. Overall, service revenue grew by 25% over 1983.



EXHIBIT II-20

IBM  
REVENUE GROWTH



- In 1984 IBM reported service revenues as follows:

-	Maintenance service	\$5,266 million	54.8%
-	Program products*	3,197	33.3
-	Federal systems maintenance service	522	5.4
-	Other maintenance service	<u>620</u>	<u>6.5</u>
	Total	\$9,605 million	100.0%

\* Service revenues include both separately billed maintenance and license revenues from applications and systems software program products.

- Service profitability for IBM was \$5.3 billion in 1984, 26.1% over 1983.

## SOFTWARE SUPPORT

- As noted above, IBM maintains software support center locations in Boulder (CO), Chicago (IL), and Tampa (FL). These centers are accessed via toll-free telephone numbers and are available 24 hours a day, 7 days a week. IBM has reported that almost 90% of software service calls for mid-range systems are solved over the telephone.
- Problem resolution from the support centers is a two-stage process. The first stage is initiated by a call to the support center. Support center personnel can access an on-line software support data base in order to search for solutions and, if available, the user is supplied with the fix. New problems are referred to the second stage support group. This second group consists of more experienced specialists that deal directly with the end user.
- In addition to the central support facilities, branch offices also have access to problem tracking data files via remote hookup to the software support facility computer. The central support facility, in addition to identifying problems, will assist the user in installing temporary fixes or bypasses.
- User involvement in software support, particularly among the smaller systems, has been encouraged by IBM. Users of the System/36, for example, are given free local classes on installing IBM software. Local offices typically provide a great deal of software support. However, as the company has improved their remote support network, it has also become more rigid in pricing on-site software support. On-site program service is charged at \$158 per hour.

## HARDWARE SUPPORT

- IBM offers a wide variety of hardware support contract options for its customers. Basic monthly maintenance charge (BMMC) for mainframes and mid-range systems include:
  - Consecutive nine hour coverage, selected by the customer from between 7 a.m. and 6 p.m., Monday through Friday.
  - Scheduled preventive maintenance.
  - Spare parts, as required, to maintain normal system operating conditions.
  - Access to the IBM support center (described above).
  - Engineering changes deemed mandatory by IBM.
  - Travel to customer site if within 25 miles of an IBM branch office or designated point of service.
- In addition to basic maintenance, users can select a variety of premium services, such as:
  - Extended maintenance coverage for 12-, 16-, 20-, or 24-hours, as well as Saturday, Sunday, and holiday coverages.
  - Premium consulting and planning services.
  - Time and materials coverage (Class 3) for \$165 per hour (two hour minimum) during the standard work week and \$190 per hour during extended hours.
- Low-end computer systems, such as the IBM PC, the PC/XT, and the PC/AT, offer a number of unique hardware service options. Customers can, for example, carry-in or ship-in PCs to more than 100 IBM service/exchange centers. In addition, the company offers on-site coverage which includes:
  - Eleven hour coverage, Monday through Friday. Eighteen hour coverage is available at a 13% premium, and 24-hour coverage at a 24% premium. Overall 24-hour-a-day, 7 days-a week coverage is a 39% premium.
  - Three month warranty with a 12 month extension available.
  - Response goal of four hours (response from the depot centers averages 24-48 hours).
- One of IBM's real strengths in the PC market is their dealer network--almost 2,000 vendors strong. Dealers are required to service equipment and,



according to several dealers in the San Francisco area, it is not unusual for an IBM PC dealer to offer extended service (beyond the first 12 months) in their area. Dealers get a nine month "shelf life" warranty, which means that if the unit fails before it is sold, the dealer may return the unit to the factory.

- PC dealers performing warranty work are reimbursed in cash for labor expended and parts are replaced for free.

### THIRD-PARTY MAINTENANCE

- IBM's standard policy is to service only IBM equipment, and INPUT believes that this policy will remain in force for large and mid-range systems. In the personal computer market, however, it appears that the company is more interested in providing a single source of service than maintaining a rigid non-TPM policy.
- In August 1985 IBM announced that it would service 31 non-IBM products that are used with IBM PCs. These products include monitors, printers, modems, and feature cards. Some of the non-IBM products eligible for IBM service include:
  - Okidata ML-931.
  - Hayes Smartmodem 1200.
  - Amdek Video 300.
  - Tec Mar QIC-60 U20.
  - AST Sixpak.
  - Emulex DCP-88.
  - INS 8100 PC.
  - Epson FX-100.
  - DCA IRMA.
- While IBM clearly has modified its stance with regard to third-party maintenance on PC peripherals, INPUT believes that it is very unlikely that the company will begin to service competitive products in the future. Like DEC, IBM appears to have selected maintenance of non-competitive products as a viable alternative to developing the products in-house.

### FUTURE TRENDS IN SERVICE

- Service represents one of IBM's major products and there is little doubt that IBM will continue to focus in this area to make service more efficient and profitable in the future. There are a number of indications of the company's



drive for service efficiencies, such as development of the National Service Division to better coordinate service activities across product groups and the digital communications systems used by service representatives to receive messages directly from service coordinators.

- IBM's increased drive for service efficiency will allow the company to remain very competitive in service pricing. INPUT believes that annual maintenance as a percent of purchase price will drop to below 2% for large systems and below 4% for mid-range systems. In many cases, this type of aggressive service pricing will result in a more price sensitive user base, which may put less efficient vendors at a considerable disadvantage.
- INPUT expects IBM to continue unbundling service products, such as planning and consulting, in order to remain both price competitive and flexible to user service requirements. By unbundling services, the company will force users that require extended services to pay premium service prices and at the same time will maintain competitive basic service prices.

## SERVICE VENDOR PROFILE

### MOHAWK DATA SCIENCES CORPORATION

Seven Century Drive  
Parsippany, NJ 07054

President: Matthew E. Tutino  
President, MDS Service:  
Michael V. Bergamo  
Revenues, Fiscal Year 1984:  
\$402.5 Million

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### THE COMPANY

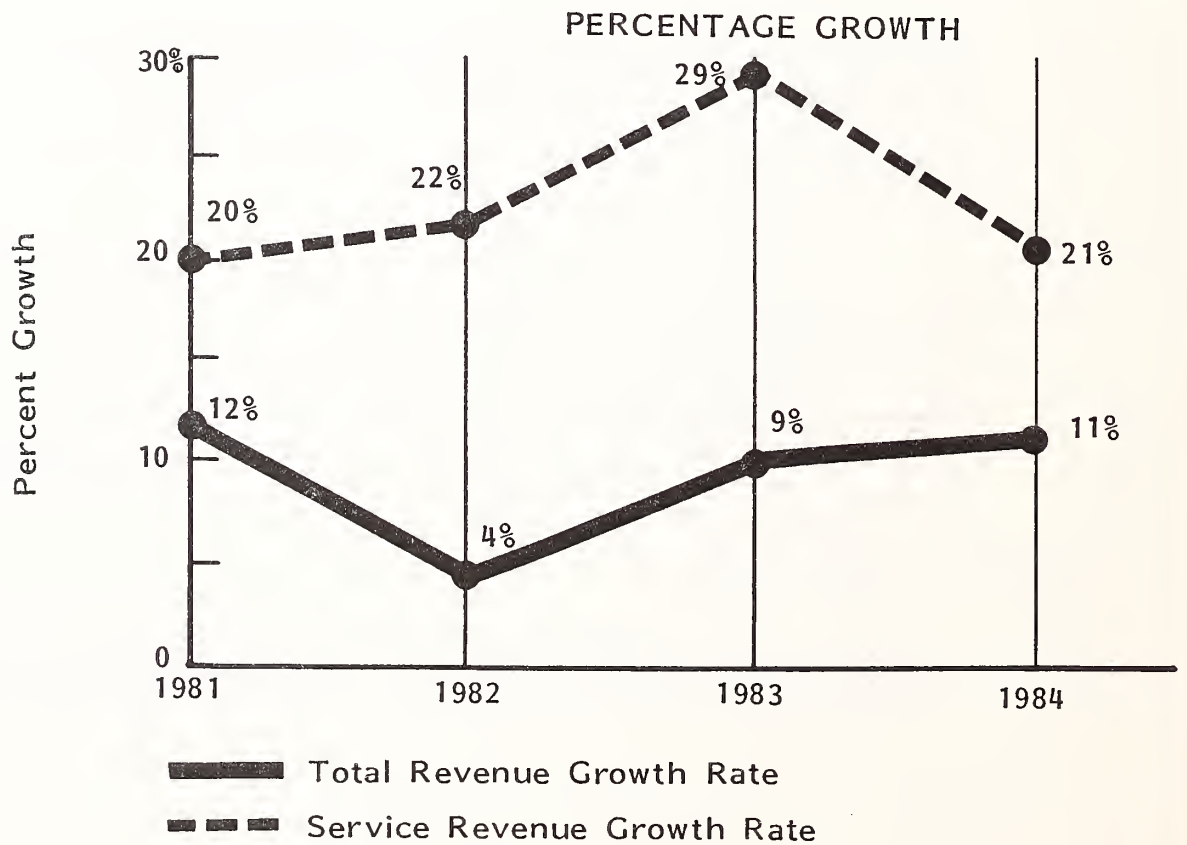
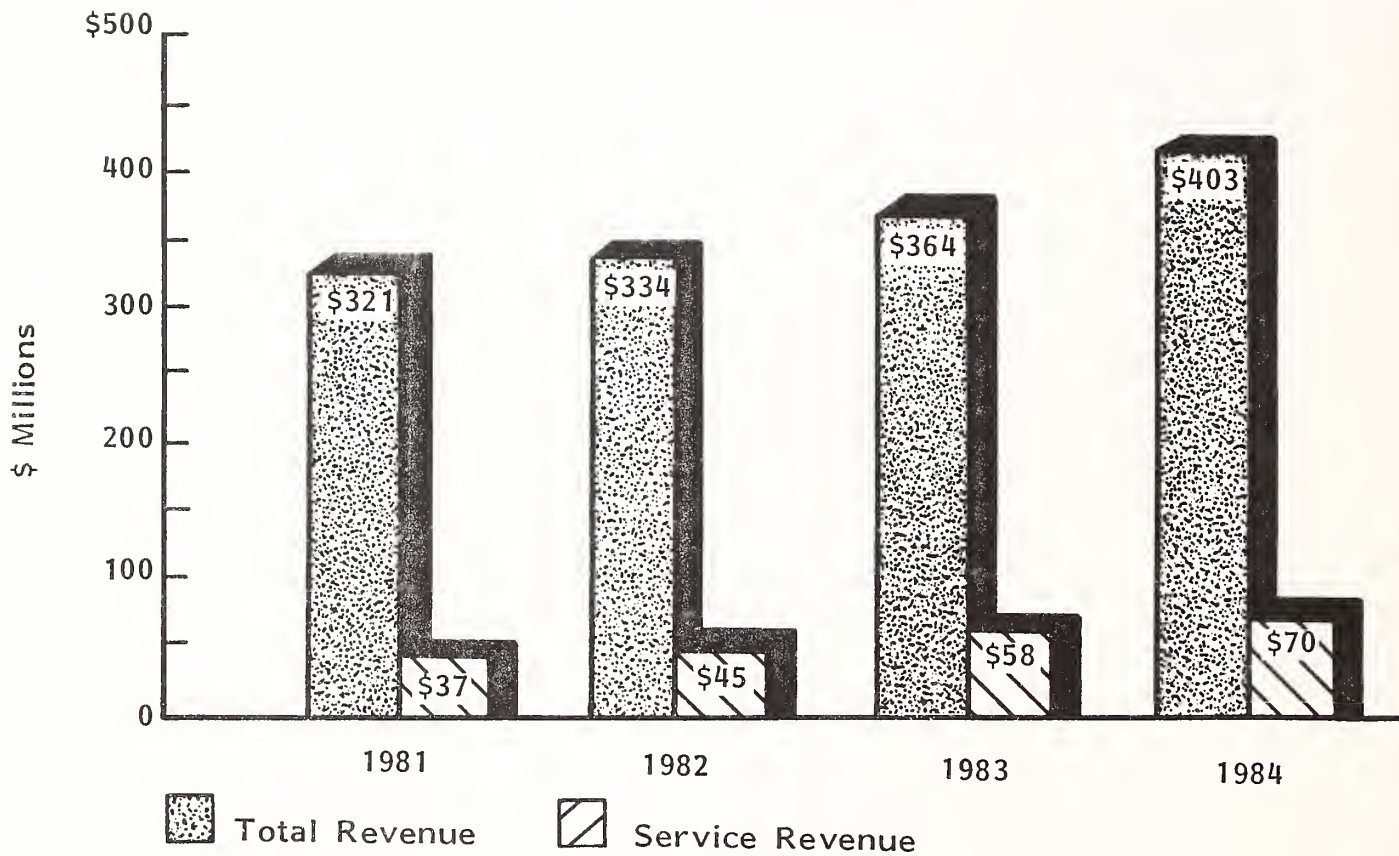
- Mohawk Data Sciences (MDS) was organized in 1964 to design and develop mid-range computer systems. Currently, the company (including MDS Systems and MDS Qantel) produces a number of products, including IBM 3270-compatible terminals, personal computers, and mid- to high-end minicomputer systems. Major products include:
  - MDS Hero. A personal computer/executive workstation designed for both standalone and micro-to-mainframe applications. The Hero can be configured with up to one MB of main memory.
  - Qantel System 10, 20, and 40. These traditional minicomputers can support up to 64 users (on the 40) and one MB of main memory.
  - Qantel System 64. The company's newest and largest system, the 64 and upgraded 264 are capable of speeds of over 1.0 MIPS and can support up to 150 workstations.
- While the expansion of the company's product line may prepare it for long-term growth, the company's short-term financial picture does not look good. Total revenues at MDS increased by 11% in 1984 (as shown in Exhibit II-21), the largest increase in three years, but net income fell dramatically. MDS reported a net loss of \$53 million in 1984, which was more than the profits from the last three years put together.
- As a result of the decline in earnings (or perhaps contributing to the decline), MDS has announced its intention to spin off the company's service division. Initially, MDS was involved in negotiations with Continental Telecom for the sale of MDS Service. More recent statements by the company, however, indicate an impending agreement with Datapoint, the Texas-based mini-computer manufacturer. Under the agreement, both MDS and Datapoint would spin off their service divisions and form a single third-party maintenance company (discussed below).

### SERVICE DEMOGRAPHICS

- MDS has approximately 800 field service employees in the U.S., 500 of which are hardware or software engineers. The company has two central parts

EXHIBIT II-21

MOHAWK DATA SCIENCES CORPORATION  
REVENUE GROWTH





depots, one in Hayward (CA) for Qantel products and another in Herkimer (NY) for MDS System products. In addition, parts are stocked in all of the 140+ service locations in the U.S.

## SERVICE ORGANIZATION

- One of the main reasons that MDS could even consider spinning the service division off as an independent company is that MDS Service is a very autonomous organization already. As Exhibit II-22 demonstrates, the division maintains most administrative and service functions. Sales of service is the most conspicuous exception in that it is handled at the time of equipment sale by MDS Systems or Qantel salespeople.

## SOFTWARE SUPPORT

- While MDS does cross-train some customer engineers (approximately 10%), most operating systems and applications software service is provided by the company's Software Support Group. This Group is located organizationally under the Sales Department, but works closely with the Service division.
- The MDS Service division has indicated that they intend to emphasize software support more in the future. The service division will concentrate primarily on systems software support in such areas as installation and revision, new products, and documentation. Custom consulting and planning will remain sales department functions.

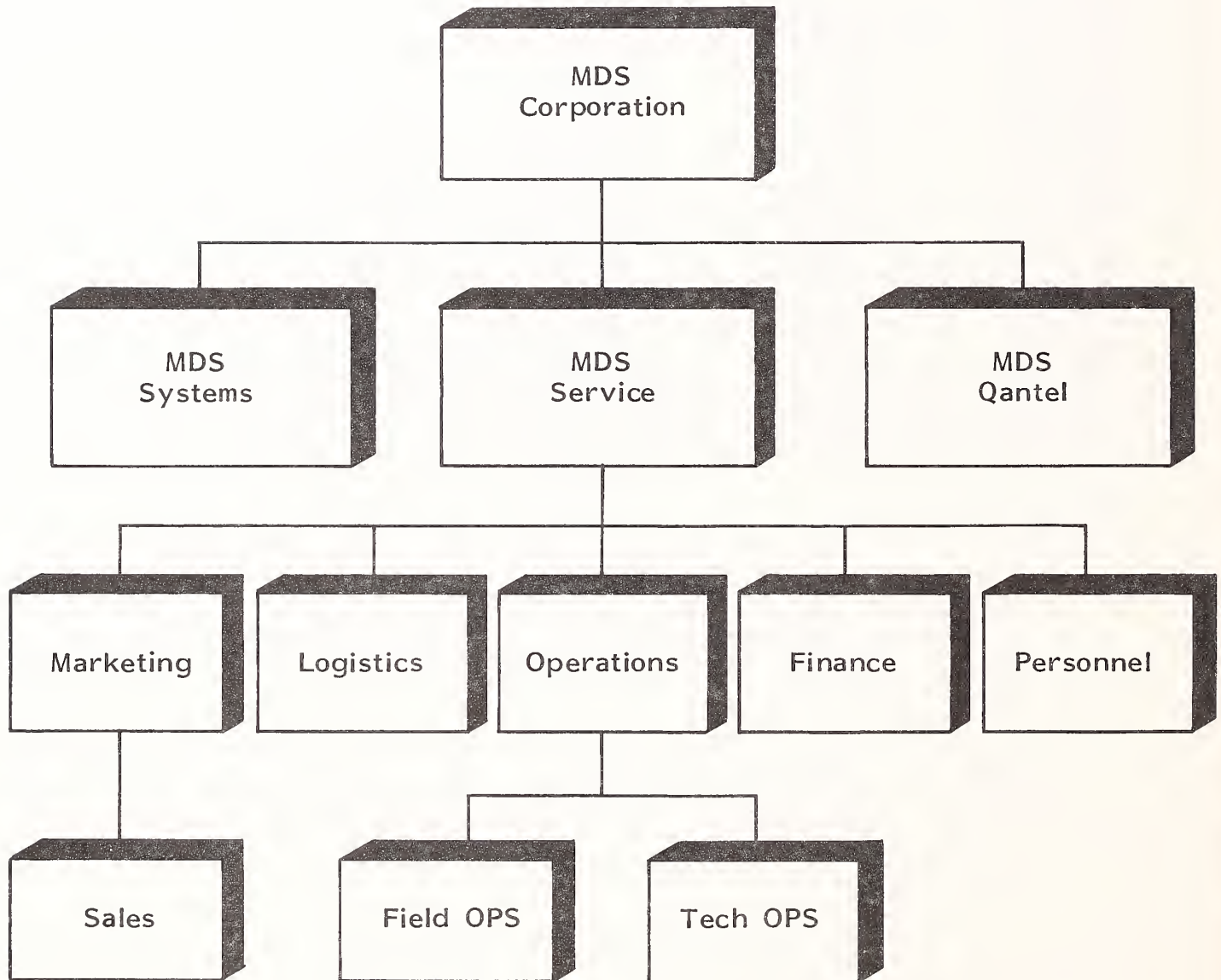
## HARDWARE SERVICE

- MDS can offer up to nine distinct service contracts to their user base making the Parsippany-based company one of the most flexible service vendors in the U.S. Company officials indicated that the nine contracts currently offered are the result of customized service packaging used by the company in TPM negotiations.
- Standard maintenance contracts at MDS are already unbundled to a limited extent in that installation, relocation, and software support are separately billed. In addition, the company offers premium services which will be described below. Price sensitive users can become involved in maintenance in order to save money, but this is not encouraged by MDS.
- The nine current service plans offered by MDS include:
  - Uptime Performance. This maintenance plan guarantees 99% CPU uptime and a three-hour response time for a 25% premium over the standard maintenance agreement.
  - Standard Maintenance. Four-hour response time, twelve hours a day, Monday through Friday.



EXHIBIT II-22

MOHAWK DATA SCIENCES CORPORATION  
SERVICE ORGANIZATION



- Basic Maintenance. Eight-hour response time, 20% discount on standard prices.
  - Deferred Maintenance. Sixteen-hour response time, 30% discount on standard prices.
  - Network Maintenance. The end user is required to coordinate all problem calls from one central location and agrees to pay time and material rates for non-MDS problems. MDS offers a 15% discount on Network Maintenance.
  - Standard Depot Maintenance. Mail-in to one of the company's two depots for a 35% discount.
  - Express Depot. Similar to Standard Depot but with immediate loaner shipment available. Twenty-five percent discount on standard service prices.
  - Time and Materials. Best effort, five-business-day response.
- The ninth service plan offered by MDS is called the "Flex" maintenance program and is designed to be a risk sharing agreement. Under Flex, the user receives a 30% discount for standard coverage (8:00-8:00, Monday through Friday, four-hour response time), but then must pay a per-call charge of \$100 each time an engineer is called on-site. This plan encourages users to "save up" minor calls in order to keep per-call rates down. At the same time, the user has access to a rapid response time should it be needed. Total billing for the calendar year will not exceed 1.26 x list standard monthly maintenance.

### THIRD-PARTY MAINTENANCE

- Third-party maintenance is seen as an excellent opportunity by MDS, particularly if the company is able to focus its efforts on specific products and distribution modes. The company is currently servicing or has an agreement to service products by CTI, IPI, SCI, CIE Systems, Espirit, Compusave, ByVideo, and Term-Tronics, and it is very likely that this list will grow substantially in the future.
- MDS stresses the company's flexibility in meeting the manufacturer's service needs. In addition to the nine service contracts mentioned above, MDS will design custom service packages in order to meet specific end-user requirements. With their own extensive manufacturing experience, MDS can assist the potential TPM customer with everything from product design to packaging, marketing, and service.
- In addition to the standard hardware service MDS can offer, the company can provide a number of supplementary services, such as development of documentation and training materials, manufacturer-coded invoices, logistics networks, etc.

## FUTURE DIRECTIONS

- The two major trends at MDS Service (spinoff as an independent company and increasing emphasis on third-party maintenance) will continue to develop for the next three to five years. While the company's TPM revenues are quite small now, INPUT believes that if the merge with Datapoint service is successful, MDS/Datapoint services will be the largest TPM vendor in the U.S.
- Ironically, this anticipated change may be the major problem MDS must face in the next five years. Making the transition from a service division of a well-established manufacturer to an independent third-party vendor will not be easy. Cost containment, particularly in the areas of logistics, remote support, and personnel, will be essential. In addition, MDS must develop a service sales and marketing organization--a job previously handled by sales.
- Despite the fact that the transition to TPM will not be perfectly smooth, INPUT believes that MDS Services has correctly identified high-quality service as the essential component of the service mix. Other service vendors (both manufacturers and TPM) continue to stress price advantages; however, MDS offers a high quality of single source maintenance (often at premium prices) which is both flexible and comprehensive, key components of a successful service strategy.
- MDS Service will stress extensive experience in networking and specific vertical markets requiring highly responsive maintenance services such as insurance, financial services, computer services, banking, manufacturing (MRP), hotel management, video retailing, and services for state and federal governmental agencies.



## SERVICE VENDOR PROFILE

### NATIONAL ADVANCED SYSTEMS

P.O. Box 7300  
800 E. Middlefield Road  
Mountain View, CA 94042  
(415) 962-6100

President, NAS: Daniel N. Martin  
Vice President, Customer Service:  
Alfred R. Mascha

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### THE COMPANY

- National Advanced Systems (NAS) is a subsidiary of National Semiconductor Corporation and organizationally has been placed in NSC's Digital Systems Division. The Digital Systems Division includes NAS, Datachecker, and Data Terminal Systems. In 1984, this division had revenues of \$552 million. INPUT believes the vast majority of these revenues (approximately \$440 million) were generated by NAS.
- Sales and maintenance of IBM plug-compatible mainframes and peripherals manufactured by Hitachi, Ltd. of Tokyo is NAS' primary business. The company has shipped over 1,000 mainframes as well as peripherals to over 2,000 customers in 27 countries. NAS has just over 1,000 employees in the United States.
- Competition in the plug-compatible market has always been intense, but in 1984/1985, the pressure has increased as a result of new product introductions and announcements by the market leader, IBM. NAS was well prepared for the escalation in new competitive products in that they had their own new products to announce.
  - In July 1984, NAS introduced five new models of the AS/9100 series. The 9100s are installed in the AS/9000 processors, resulting in a system performance of 28 Mflops.
  - In September 1984, NAS announced upgrades to its AS/6600 line, including a 24-month warranty. A new high-end system, the AS/6660, was also introduced to compete with the IBM high-end 4300 series.
  - Also in September, NAS reduced purchase prices on selected 8000 and 9000 processors by 12-16%.
  - Perhaps most significantly, NAS announced two new mainframes in answer to IBM's Sierra introduction in March. The AS/XL Model 60 and Model 80 are based on VLSI technology and use gate/chip ECL devices. The Model 60 is a uniprocessor rated at 28 MIPS while the 80 is rated at up to 50 MIPS. The AS/XL line is priced at about 20% less than the IBM equivalent and is scheduled to be available in the second quarter of 1986.



## SERVICE DEMOGRAPHICS

- INPUT estimates that National Advanced Systems has between 550 and 600 total field service employees, approximately 65% of whom are engineers. The company maintains a central parts depot in San Jose (CA), as well as at 14 national locations which can be dispatched via Burlington Northern Courier service. Remote support is currently provided from a central location in San Diego (CA). NAS does not now have a centralized dispatch center; instead, calls are dispatched from each local office. INPUT believes NAS is currently developing a centralized dispatch system which will tie into the company's logistics and remote support networks.

## SOFTWARE SUPPORT

- The Hitachi equipment that NAS sells and services is IBM compatible and the Mountain View-based company depends primarily on established software to run on its products. The company has developed some software products, such as the Advanced Conversational Editing and Programming System and the NAS Performance Monitor; however, most software service resources are expended on support of IBM operating systems software.
- Licensed software users can choose NAS as their authorized service agent under an agreement between NAS and IBM. NAS offers both remote and local/on-site software service. Remote support is offered from the company's San Diego facility and is available on the vast majority of NAS machines. (Some older machines do not have remote support capabilities, according to the company.)
- The remote support facility in San Diego offers a 24-hour, 7 day-a-week hotline for customer support including telephone advice, temporary fixes, and applications assistance. This facility does have an on-line "problems" data base, but for internal use only.
- In addition to remote support, NAS offers a Local Program Support Service. This service is typically provided out of local support offices and includes on-site service. On-site software support is provided as an option for which users can contract or pay for on an hourly basis.
- NAS takes a very broad view of software support. A 1984 brochure stated "Quite simply, if your software fails, the NAS Total Support Group will take the responsibility for getting the problem resolved." Without stating that they were actually going to fix the software, NAS is emphasizing their commitment to the customer, a commitment that has resulted in extremely high user satisfaction rates with software support.

## HARDWARE SUPPORT

- The standard hardware support contract is 24 hours, 7 days a week, although reduced coverage (11 x 5) is available at 72% of the standard contract. Time

and materials coverage is also available at between \$165-190/hour. The average warranty period is one year for CPUs and three to six months for peripherals.

- Hardware engineers work closely with the company's remote support center in order to ensure proper diagnostics and parts availability. Although some hardware engineers are cross trained in software support, this is not the company's stated policy. Customer perception of engineer cross-training is enhanced, however, through the effective interaction between hardware and software support groups within NAS and because of the extensive problem determination skills of the on-site engineer.
- Like many service vendors, NAS has unbundled selected hardware services in order to make basic service prices more competitive. Reduced coverage periods (mentioned above), consulting, and planning have been unbundled and are priced separately from the standard maintenance contract.
- Despite the unbundling, NAS has committed itself to an expansion of service offered under the general heading of "Total Support Package" (TSP). TSP is a program designed to take advantage of a high level of user satisfaction with after-sale and pre-sale support services from NAS. Taken as a whole, TSP includes Total Vendor Management of a user's site ranging from hardware and software problem determination to solutions and facilities management for all equipment at a user's site.
- The Total Support Package includes:
  - Hardware and software support of NAS equipment.
  - Consulting.
  - Capacity management.
  - Education.
  - Maintenance contract planning.
  - Facilities management.
  - Third-party maintenance on selected products.
- TSP has and will continue to contribute to high levels of user satisfaction with NAS service. INPUT has found that mainframe users are, as a group, service price insensitive. NAS has capitalized on the customer's substantial requirement for services and at the same time has increased service revenues substantially.

## THIRD-PARTY MAINTENANCE

- As part of the Total Support Package (noted above), NAS will support some non-Hitachi equipment in order to promote account control, increase service revenues, or do both. Initially, third-party maintenance was restricted to Magnuson mainframes, but later was expanded to include all IBM and IBM-compatible mainframes and peripherals.
- Although account control is thought to be the prime motivation of TPM service from NAS, INPUT believes that the rapidly expanding TPM market offers too many opportunities for the company and that NAS will not restrict this offering to their own user base. Specific non-Hitachi products which have been identified as potential TPM targets include CDC, Memorex, and (particularly) STC peripherals, as well as IBM, IPL, and Magnuson mainframes.

## FUTURE TRENDS IN SERVICE

- Cost of spares has been and will continue to be a major problem for NAS. With the growth of Very Large Scale Integration and parts modularity, parts are becoming more expensive and more difficult to repair on a local basis. Since NAS must purchase spares from Hitachi in Japan, there are also time lag problems which affect the company's logistics operation.
- Parts supply for NAS' third-party operations could also prove to be a problem in competitive service situations. NAS has arranged for a steady supply of parts for Magnuson systems, but other companies, such as STC, do not appear inclined to grant similar concessions.
- On the more positive side, it seems likely that NAS will continue to expand service offerings. Programs such as the NAS Teleproduction Center expand services to far beyond its normal connotation. Similarly, the company's Curriculum Consultation Service, designed to help customers and prospects identify training needs, is an example of another expanded service.
- INPUT's latest survey of large system users clearly demonstrated that NAS users are among the most satisfied in the industry. Of course, the reliability of the company's Hitachi equipment is one of the major reasons for customer satisfaction, but users also cite innovative service techniques, such as the Total Support Package, as a cause for high satisfaction levels.
- Currently, INPUT estimates that NAS has between 600 and 650 system accounts. Although this is small by market standards, the company has indicated that it is growing rapidly. The current problem National Advanced Systems must confront in the future is maintaining the current high level of service in the face of a growing diversity in their installed base.



## SERVICE VENDOR PROFILE

### NCR CORPORATION

1700 South Patterson Boulevard  
Dayton, OH 45479

President: Charles E. Exley, Jr.  
Vice President, Corporate Customer  
Services: V. F. Bean  
Vice President, Domestic Customer  
Services: Richard B. Reese  
Revenues, Fiscal Year 1984:  
\$4.1 Billion

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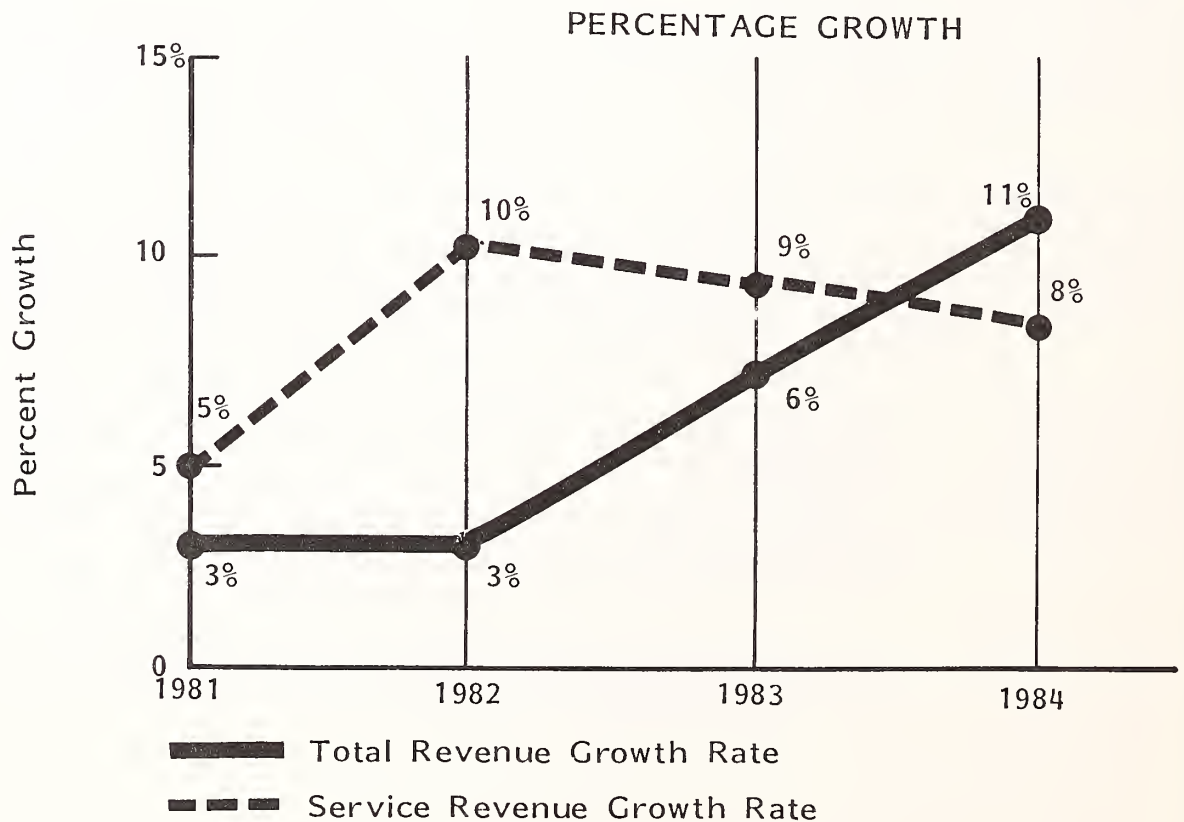
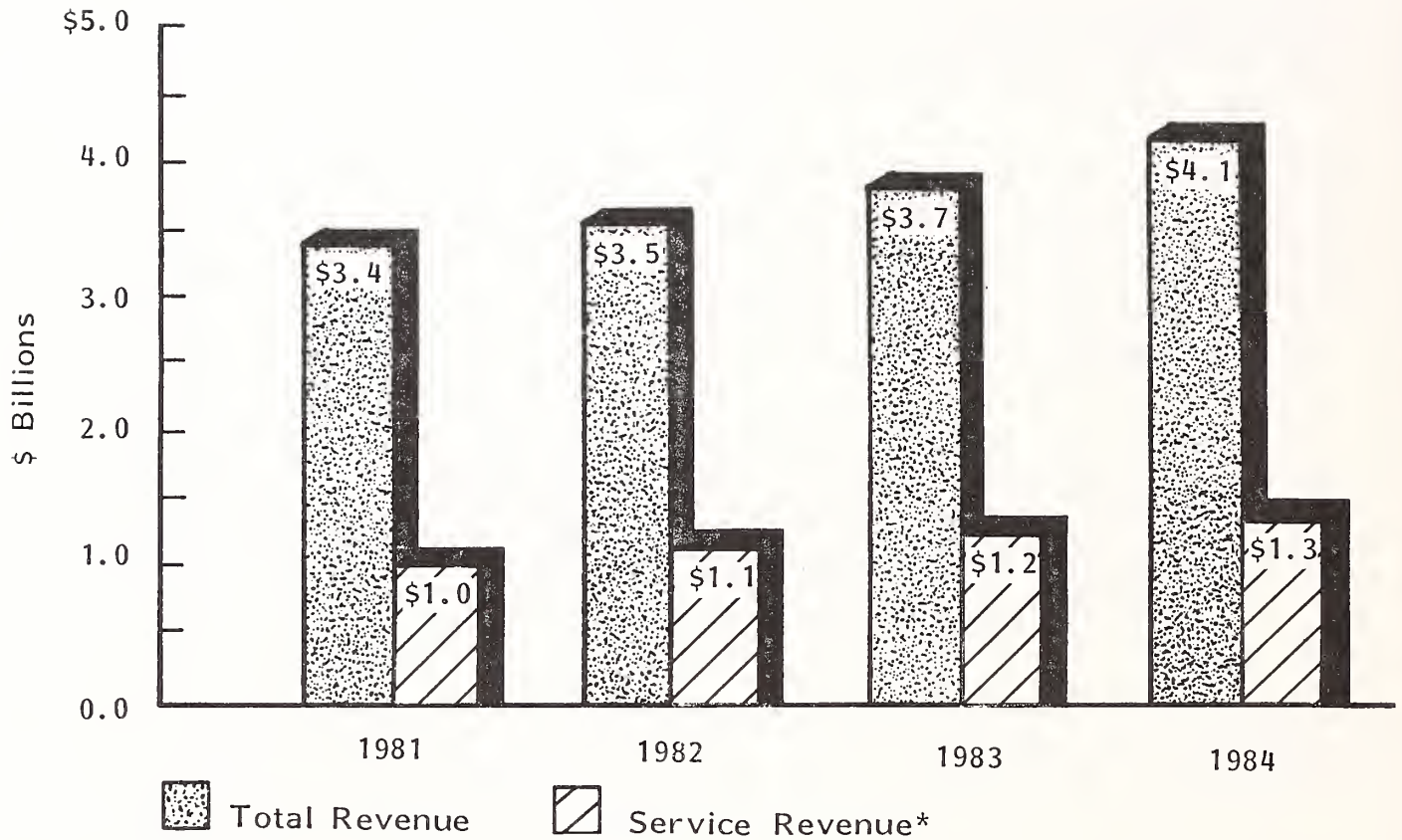
### THE COMPANY

- NCR, one of the longest established manufacturers in the computer marketplace, currently develops, markets, and services a variety of computer systems ranging from terminals and personal computers up to mainframes. NCR was one of the first vendors to pursue a "niche" strategy; e.g., a specialization in a particular market. The company has identified seven key markets in which they specialize.
  - Retail.
  - Financial.
  - Commercial.
  - Industrial.
  - Health care.
  - Education.
  - Government.
- Service revenue (shown in Exhibit II-23) is derived from a number of NCR and non-NCR products, both in the U.S. and internationally. Major NCR products serviced in the U.S. include:
  - Personal computers. 8/16-bit single user PC systems with 64-640 KB main memory.
  - TOWER. 16/32-bit supermicrocomputer which can support up to 32 workstations and 16 MB of main memory.
  - 9300. 32-bit entry level mainframe with up to 4 MB of main memory, which was introduced in 1983 and utilizes VLSI chips, resulting in a much better price/performance ratio than the 90XX series.



EXHIBIT II-23

NCR CORPORATION  
REVENUE GROWTH



\*Service revenue consists of customer services, including hardware and software maintenance, data processing services, and telecommunications services.

- V8500/V8600. The high-end of NCR's product line, the 8X00 can be configured with up to 64 MB of main memory (in multiprocessor mode) and support over 250 users per processor.

## SERVICE DEMOGRAPHICS

- NCR has over 9,000 customer service personnel in the U.S., two-thirds (6,000) of whom are field engineers. The company has 328 service locations plus over 400 resident locations in the U.S. The Worldwide Service Parts Center (WSPC) is located in Peachtree City (GA), and has a staff of over 600. According to NCR, WSPC ships 5,000 parts orders daily from a computerized inventory of 230,000 parts numbers.

## SERVICE ORGANIZATION

- Exhibit II-24 demonstrates the organizational structure of NCR's Customer Service Division. The division is essentially autonomous in terms of administrative functions, and is geographically divided internally.

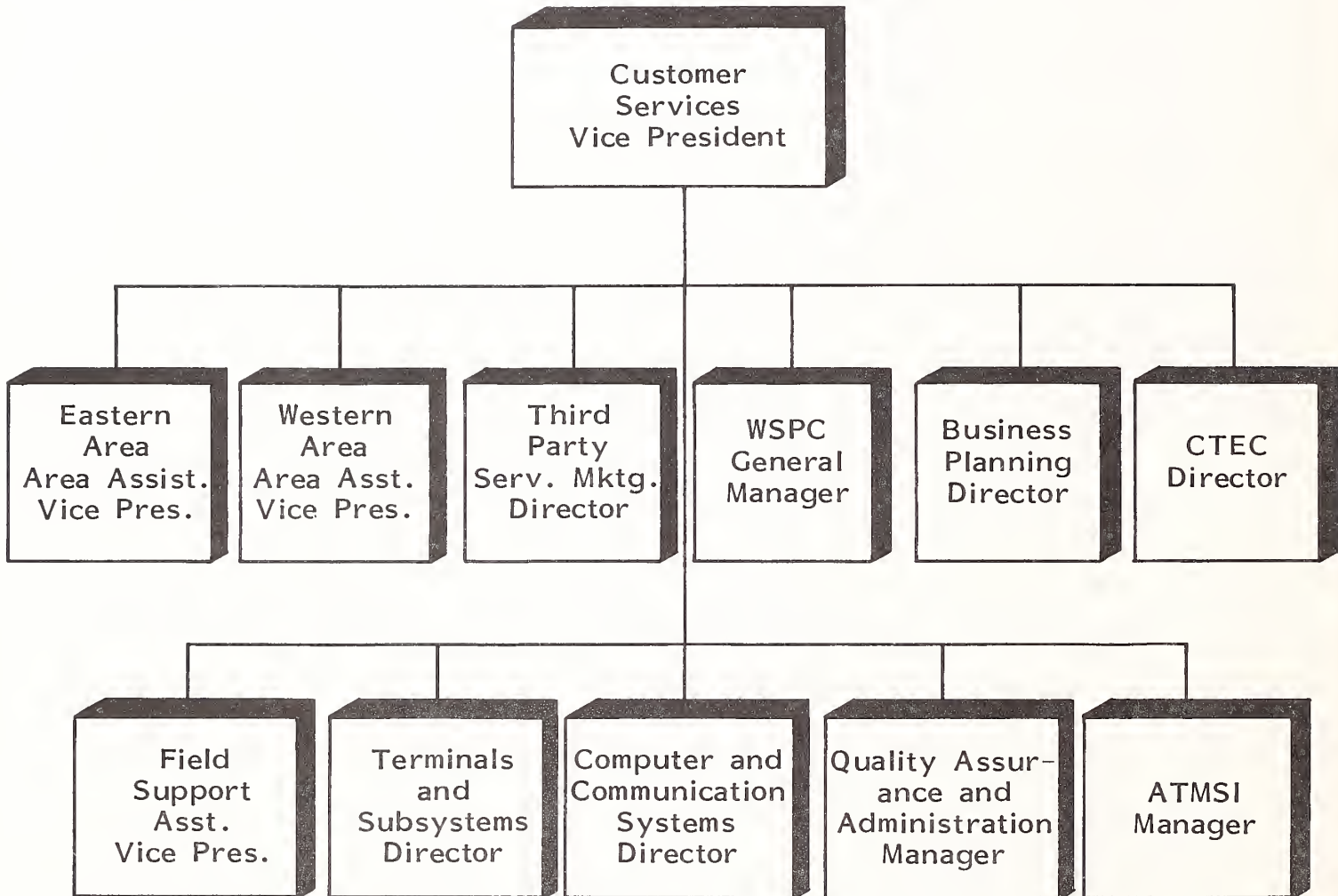
## SOFTWARE SUPPORT

- NCR offers remote software support as well as on-site support. The company's Remote Support Centers, located in Dayton, Atlanta, and San Diego, provide support for both applications and systems software. On-site assistance can be provided when the Remote Support Center's efforts fail to resolve the problem.
- Software problems are reported to a Remote Support Center via a toll-free 800 number. The company reports that problem resolution activities begin immediately. NCR is committed to ensure all software problems are resolved in the most timely manner possible.
- Currently, the company does not encourage user self-maintenance of software, nor does NCR provide access to source code.

## HARDWARE SUPPORT

- For users who subscribe to remote hardware support, initial calls are placed through a toll-free 800 number and are immediately sent to one of the Remote Support Centers. The Remote Support Center staff will perform diagnostics and dispatch a field engineer with parts when necessary.
- Customers who elect not to participate in this program can optionally contract for on-site hardware maintenance. This is offered at a 25% premium over remote hardware support.
- User involvement in hardware service is a mixed environment. While the participation of users in terminal and PC maintenance is quite extensive, self-support in mini and mainframe areas is clearly not a high priority for most users.

NCR CORPORATION  
SERVICE ORGANIZATION



- As with many other vendors, NCR has been unbundling hardware services in order to remain price competitive. Services such as site preparation, planning, and selected consulting are now priced separately. INPUT believes that this unbundling will continue, particularly as influenced by TPM competition.

### THIRD-PARTY MAINTENANCE

- Currently, NCR derives a relatively small percentage of its service revenues from third-party maintenance activities. However, this is clearly a high priority area for the Dayton-based manufacturer.
- As with many other vendors, NCR was motivated to enter the TPM market primarily to protect its customer base and improve field efficiency. The company has now expanded its Third-Party Service program to such an extent that it has an obviously offensive rather than defensive strategy. NCR now services over 200 products produced by 40 manufacturers.
- An abbreviated list of third-party products serviced by NCR includes:
  - ADDS terminals.
  - AST Research.
  - C-ITOH.
  - Data South.
  - Epson printers.
  - Florida Data printers.
  - Hayes.
  - Hewlett-Packard plotters.
  - IBM PC products.
  - NEC printers.
  - Okidata printers.
  - Quadram.
  - Televideo.
  - Texas Instrument printers.
  - Wyse.



- According to NCR, third-party maintenance customers can expect the same level of support as NCR equipment customers. The company maintains non-NCR parts in over 400 U.S. parts locations and in the Worldwide Service Parts Center in Georgia. In addition, the company has extensive training facilities to keep their field engineers current on the latest third-party vendor equipment.

## FUTURE SERVICE TRENDS

- NCR service strategy will be heavily influenced by the company's market strategy. Specific markets such as banking or health care will be looking for complete solutions rather than just hardware. The customer's demand for extra service will extend into the maintenance environment as well.
- Increased remote support is likely to be offered, particularly on new machines, in order to reduce on-site service costs. Remote support will be expanded to provide a more coordinated hardware/software solution. In addition, remote support in the form of diagnostics will be added to mid-range machines such as the 9100.
- In the area of hardware support, NCR believes that unbundling will continue, particularly in such areas as documentation, site preparation, site planning, and consulting. The field engineer will become more involved in "selling" these services after the initial hardware sale has been made.
- Software service is an area that will be expanded in the future. NCR anticipates a substantial increase in user demand for software support and is currently gearing up to meet this demand. The company indicates they expect software service prices to increase by over 20% in the next three to five years.

## SERVICE VENDOR PROFILE

**PERKIN-ELMER CORPORATION**  
Main Avenue  
Norwalk, CT 06856

President: Horace G. McDonell  
Vice President, General Manager,  
Customer Service Division  
Data Systems Group: J. Rechner  
Revenues (Data Systems Group), Fiscal  
Year 1984: \$233 Million

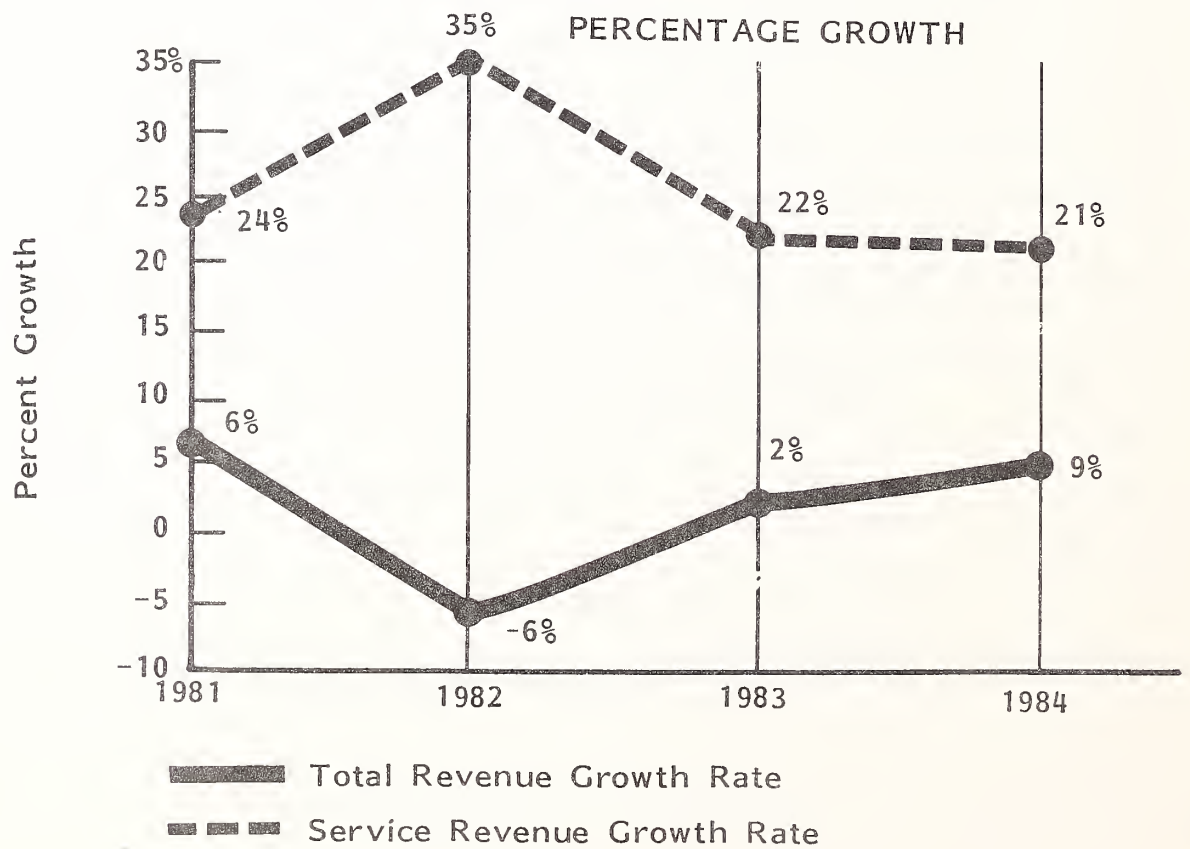
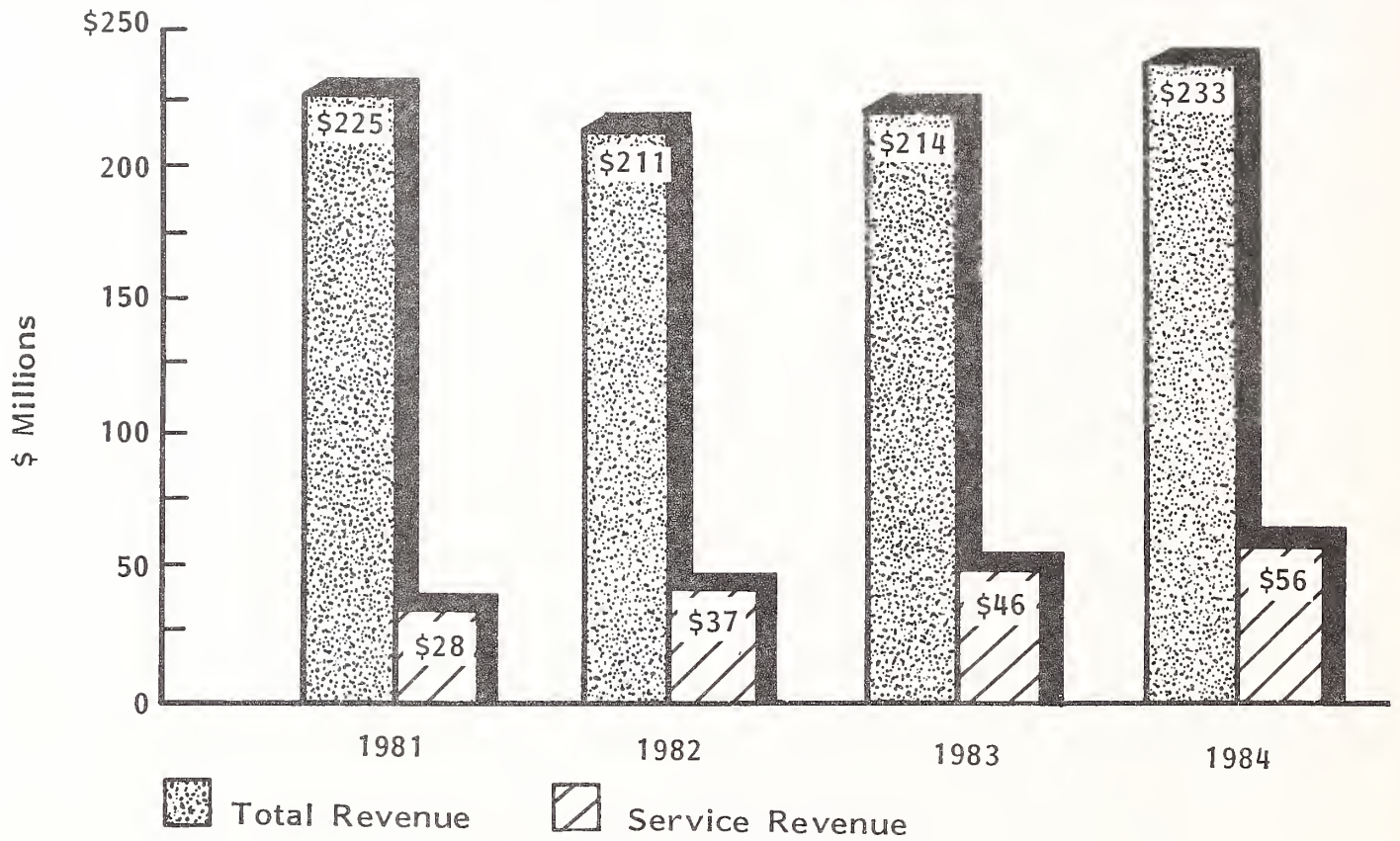
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### THE COMPANY

- The Perkin-Elmer Corporation was incorporated in 1939 and currently produces products for a wide variety of markets including scientific instrumentation, semiconductor product equipment, precision optics, avionic instrumentation, thermal spray equipment, and electronic data systems.
- The Data Systems Group designs, produces, and sells 16- and 32-bit mini and superminicomputers as well as supermicrocomputers. A majority of the company's sales are made through original equipment manufacturers (OEMs), but Perkin-Elmer is attempting to increase direct sales to end users by expanding the amount of available applications software. The revenue listed in Exhibit II-25 is confined to revenues generated by the Data Systems Group.
- Despite the fact that Perkin-Elmer pioneered the 32-bit superminicomputer market in the early to mid-1970s, its market share has been falling as a result of increasing competition in this market. In order to counter this trend, Perkin-Elmer has focused on a niche strategy, specializing in scientific and technical markets where the company is well known.
- Perkin-Elmer is currently a leader in the parallel processing field with its newly announced Model 3280 MPS multiprocessing system. The company offered its first parallel processing capability 10 years ago when it introduced its shared memory system. Three years ago it extended the line with the unveiling of its plug-in parallel processing Model 3250 MPS system. It now has some 300 parallel processing systems worldwide, 200 of which were installed within the last two years. The company is also expanding its product line in order to open up new markets. These products include:
  - XF 200 - 210 (XELOS family) supermicro.
  - XF/400, 600, 610 (XELOS family) entry level and mid-range 32-bit superminis.
  - 3203 entry level 32-bit supermini.
  - 3230 mid-range 32-bit supermini.

EXHIBIT II-25

PERKIN-ELMER  
REVENUE GROWTH



- 100 -



- 3260 multi-processor, 32-bit supermini.
- 3280 MPS high end multiprocessor 32-bit supermini.
- The XF XELOS system product line is based on UNIX System V, Release 2.

## SERVICE DEMOGRAPHICS

- Perkin-Elmer has over 600 service employees in the U.S., over 60% of whom are hardware or software engineers. The company maintains a centralized logistics center in Ocean (NJ), and also has a National Repair Center in New Jersey and over 60 service offices in the U.S.

## SERVICE ORGANIZATION

- Exhibit II-26 demonstrates the organizational structure of Perkin-Elmer's Service Division. Most administrative, marketing, and personnel functions are included within the Service Division's area of responsibility. International service is not included in the domestic service organization, but rather is represented by a liaison, reporting directly to the Vice President of Domestic Service, who coordinates service between the two service operations.

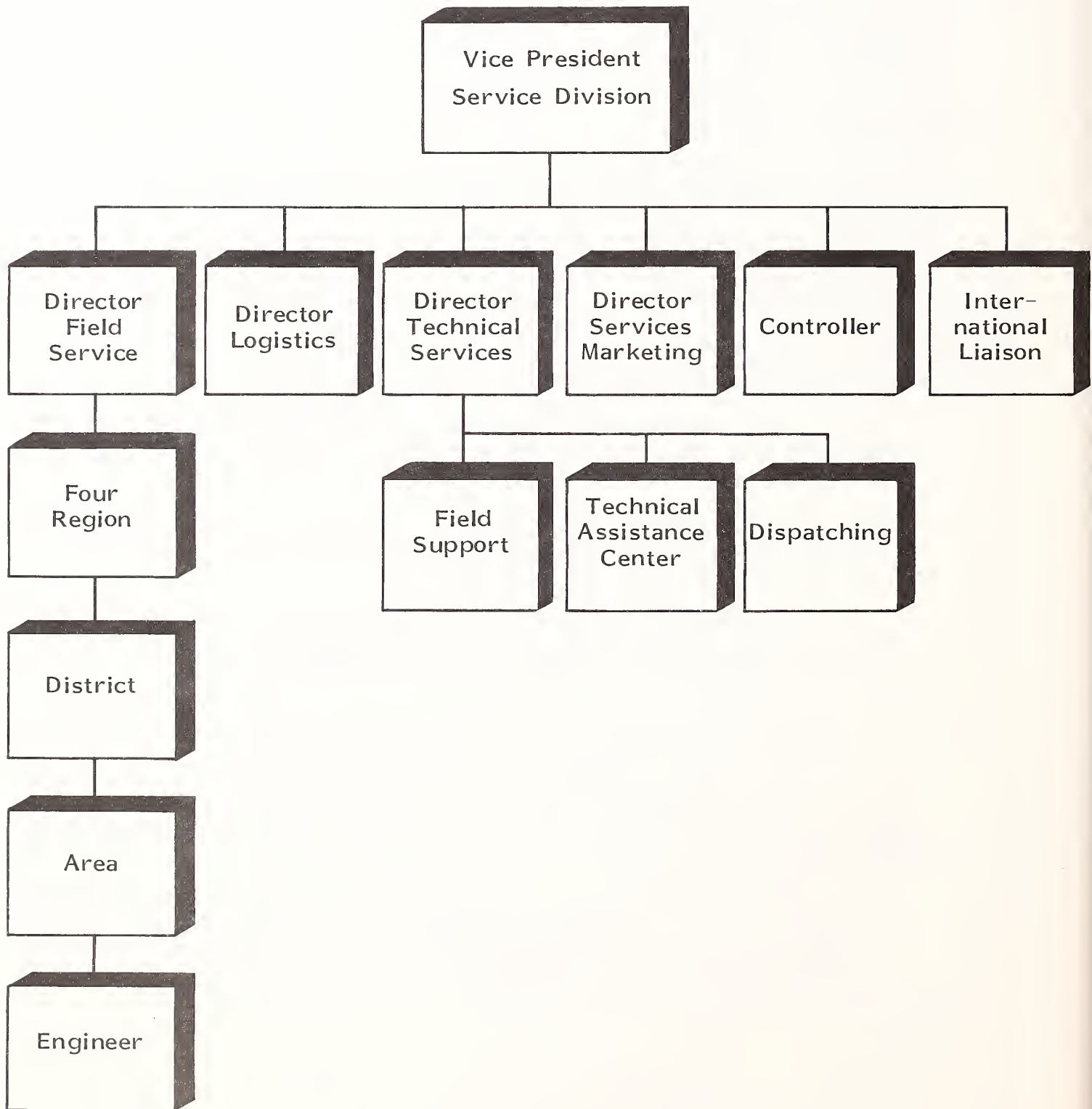
## SOFTWARE SUPPORT

- Perkin-Elmer supports both applications and systems software from a national support center in Neptune (NJ). The support center is accessed via a toll-free hotline and primarily provides telephone support for on-site software analysts, end users, and hardware engineers.
- The software support center is capable of performing remote diagnostics; however, the user is required to have a telecommunications link-up installed before remote diagnostics can be used.
- Initial installations are typically performed on-site by software analysts. Perkin-Elmer has indicated that it is developing a remote fix capability, particularly for the high-end 3200 machines such as 3250XP and 3200MPS.
- As with hardware service, Perkin-Elmer has gone to great lengths to increase the flexibility of its software support options. Users can purchase hotline support, notification of upgrades, software bulletins, revisions, etc., separately. Users who choose to perform their own software maintenance have an option to receive discounted time and material rates for a downgraded level of selected services, such as response time.
- Perkin-Elmer is one of the few companies that will guarantee not only hardware, but also software performance. By choosing either of the "Comprehensive Service" options, Perkin-Elmer users are guaranteed 95% or 98% uptime for both the hardware and the major applications running on the system.



EXHIBIT II-26

PERKIN-ELMER  
SERVICE ORGANIZATION



- In addition to the software services listed above, Perkin-Elmer offers an "Extended Software Maintenance Agreement" which provides most of the standard software service options except on-site support and free telephone assistance. This agreement is designed particularly for users who can perform their own software installation and who want lower support costs.

## HARDWARE SUPPORT

- Perkin-Elmer has just under 300 field engineers strategically located in major cities throughout the U.S. The company has over 60 field service offices in the U.S.
- Hardware support is initiated by calling a toll-free hotline. The user is connected directly to a Technical Assistance Center (TAC) operator who is familiar with Perkin-Elmer support services. The TAC operator can call on a number of resources to assist the user such as a TAC engineer, home office support group, or an engineer in the field. A large majority of customer requests for assistance are handled through the TAC and do not require on-site support.
- As noted above, Perkin-Elmer offers a wide variety of service options and is quite flexible in designing service products to meet end-user needs. The company offers eight basic hardware service options.
  - Resident Service. Provides full time on-site support of a Perkin-Elmer customer engineer or software analyst.
  - Comprehensive or Comprehensive Plus. Designed for critical applications, this option offers 95% or 98% guaranteed uptime at a fixed monthly rate.
  - Primary Service. The standard service agreement including:
    - Unlimited number of service calls.
    - Scheduled PMS.
    - Access to toll-free hotline.
    - Installation of engineering changes.
    - Optional remote diagnostic/support.
  - Limited Service. Service designed for "non-critical" environments. Maintenance prices are reduced for a downgraded demand for service.
  - Catastrophic Protection. Aimed at the self-maintenance user, this option is similar to per-call maintenance, but provides the user with a response time commitment and a fixed maximum liability for each occurrence.

- Per Call Service. \$100/hour, three hour minimum per call.
- Configuration Management Service. Provides a systematic means of monitoring and controlling hardware configuration and revision levels.
- Users who wish to perform their own hardware maintenance can purchase spare parts, make assembly emergency exchanges, or take advantage of the company's "Fastback" service. Fastback offers the user a five-day turnaround time for failed modules. Volume discounts are available up to 16% for over \$20,000/month of repair revenue.
- Customer Service also offers a wide assortment of computer supplies and accessories through its P-E/PROMPT 64-page color catalog. P-E/PROMPT features fast delivery (usually same day shipment), competitive pricing, and also a 30-day, no risk, satisfaction promise. Orders can be placed via a national toll-free number.

### THIRD-PARTY MAINTENANCE

- Although Perkin-Elmer is primarily involved in servicing its own equipment, the company has maintained foreign peripherals for over two years. As with many other manufacturers, Perkin-Elmer initially began TPM service in order to better meet the needs of its installed base, but now may be equally motivated by the revenue potential of the expanding market. Some of the products serviced by Perkin-Elmer include:
  - Macrolink memory.
  - Spectra Logic controllers.
  - MOSTEK memory.
  - Printronix printers.
  - Dataram controllers.
- In addition to peripherals integrated with Perkin-Elmer equipment, Perkin-Elmer also services Data General Nova 3 and compatible CPUs using the MICOS operating system. The company has identified this option as a real service opportunity because of its close working relationship with Mini-computer Systems Inc. (producers of MICOS) and the large installed base of Data General Novas.

### FACTORS AFFECTING SERVICE

- Perkin-Elmer has clearly recognized the value of providing service products and options which are flexible enough to meet a wide variety of user requirements. INPUT believes that Perkin-Elmer will continue to unbundle services such as installation, consulting, and planning in order to keep service prices



within competitive price ranges and at the same time offer service options required by the installed base.

- Software support is currently a problem area, but the company has indicated that it is taking steps to improve service in this area.
  - A "Problem Data Base" is being developed for users to report software problems and to search for potential solutions.
  - The company is taking a more active role in providing applications software support for third-party software. This will be difficult due to lack of control over the source code, but it is essential if overall user attitudes about support are to be improved.
  - There is increasing emphasis on developing remote support technology for systems and applications software.
- Other problem areas which the company must face include:
  - Maintaining a focused third-party maintenance operation. The company's niche strategy is working well now, but too many products might overtax logistics and field operations.
  - Perkin-Elmer has recognized the need to provide alternative service offerings for its low-end 3200 and XF 200-210 series systems and has recently introduced new offerings in support of these products.

## SERVICE VENDOR PROFILE

**PRIME COMPUTER INC.**  
Prime Park  
Natick, MA 01760

President: Joe M. Henson  
Vice President, Manufacturing and  
Service: John T. Maske  
Revenues, Fiscal Year 1984:  
\$642.8 Million

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### THE COMPANY

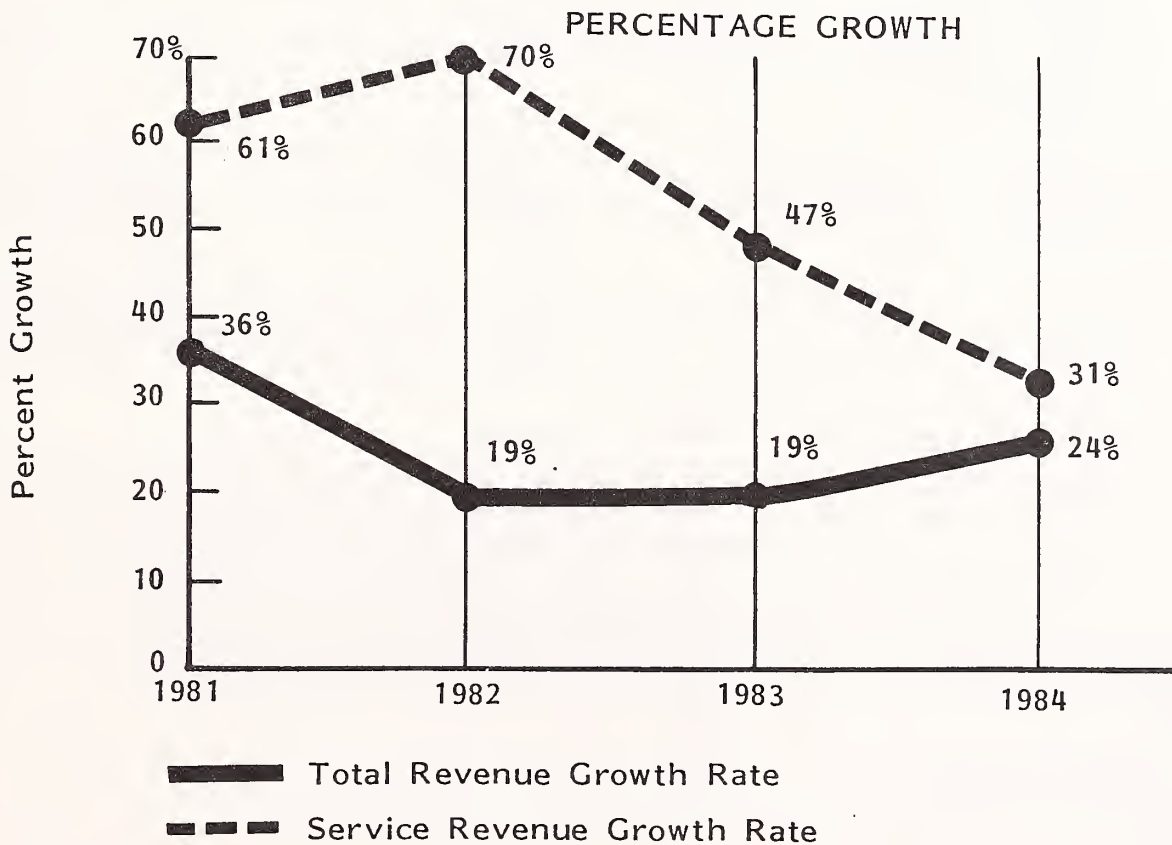
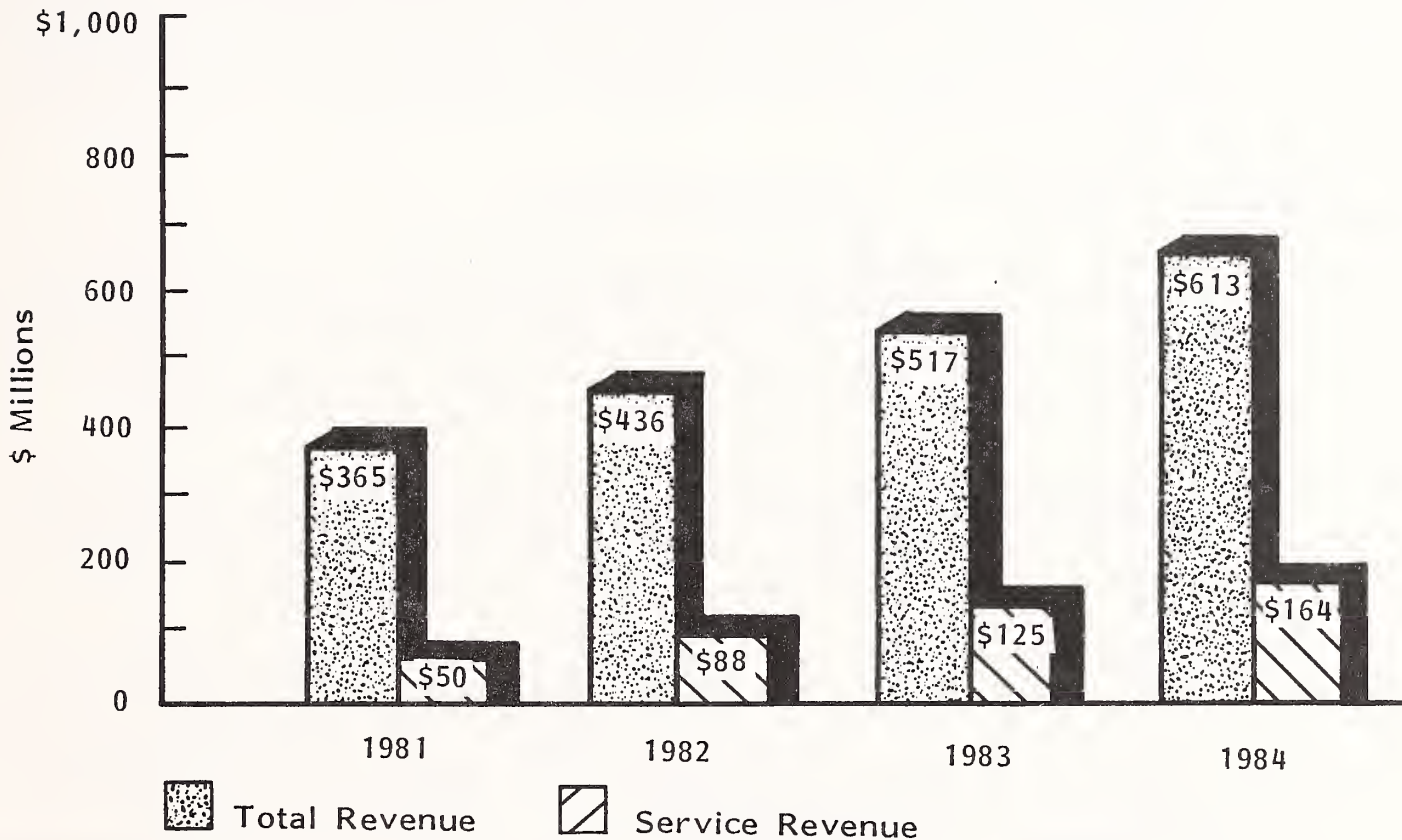
- Prime Computer Inc. was founded in 1971 and since its inception has specialized in the design and manufacture of mini and superminicomputer systems. Currently, the company is adding to and refining its "Fifty" series of 32-bit superminicomputer products which was first introduced in 1979.
- Compatibility and a clear migration path have been key selling features of Prime's product line. The company advertises that the compatibility between "50" series processor is very high and that existing peripherals, controllers, even software can be adapted for use on newer machines with little or no effort.
- New hardware products introduced in 1984/85 include the 2550, 9650, 9750, and 9955. Both the 9750 and 9950 use advanced ECL circuitry (Emitter-Coupled Logic) which provides greater processing speed than TTL circuitry (Transistor to Transistor Logic) currently used by many competitors. New software products include Prime/SNA (for communications with an IBM host), a UNIX operating system, and additional developments to its networking products, PRIMENET and RINGNET.
- Increasing competition in the superminicomputer market (particularly from IBM, Data General, and DEC) has slowed Prime's overall growth. Between 1973 and 1978 the company's net sales increased an average of 103% a year, but as Exhibit II-27 demonstrates, the current growth rate is under 25%. Under Joe Henson, Prime's president, the company is concentrating on new high growth markets (particularly CAD/CAM and office automation) to improve revenue growth, which fell to under 20% in the early 1980s.

### SERVICE DEMOGRAPHICS

- INPUT estimates that Prime has just over 900 field service employees in the U.S. (1,500 worldwide), of whom 69% (625) are software and hardware engineers.
- Prime has over 110 service locations in the U.S., all of which stock some parts. The company maintains three parts depots: at corporate headquarters in Massachusetts, in Ireland, and in Puerto Rico.

EXHIBIT II-27

PRIME COMPUTER INC.  
REVENUE GROWTH





## SERVICE ORGANIZATION

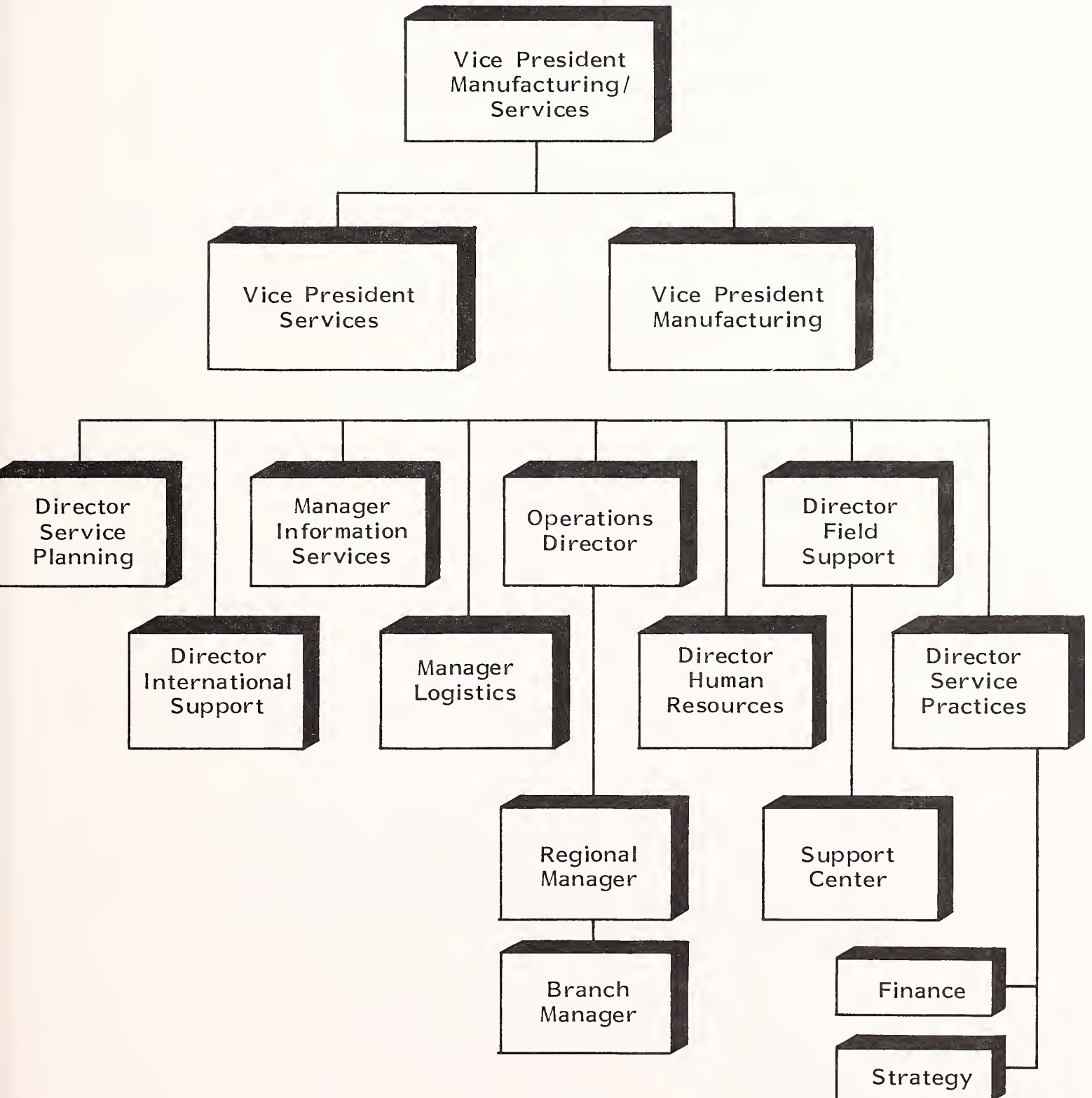
- Exhibit II-28 demonstrates that Prime's service organization is almost completely self contained in terms of administration and service functions. Actual field service is delivered by three operational groups in the United States. Within these three districts there are 13 regions and 65 branches. Service from these operational groups is supplemented by a central support center in Natick (MA).

## SOFTWARE SUPPORT

- Systems and applications software support is growing in importance at Prime as hardware becomes increasingly complex and "solutions" software motivates equipment selection. The actual support function was transferred from Prime's marketing department only just over two years ago, but already the company has made substantial progress in developing remote support.
- PRIMOS, the company's standard operating system offered on all "50" series equipment, is bundled into the hardware purchase and is typically serviced on-site via a software analyst with new releases, upgrades, etc. Maintenance of system software is bundled into the hardware maintenance fees.
- Applications software running on Prime equipment is typically unbundled. Annual maintenance on these packages ranges from 7-17% of one-time license fee. Prime has been very active in developing cooperative arrangements with third-party software manufacturers and turnkey vendors. Applications software from these vendors is usually serviced by the vendor, although Prime may perform problem determination.
- Applications software developed by Prime and those third-party packages which Prime has agreed to support are serviced with one of two maintenance agreements.
  - Standard Software Service. This includes most services such as installation of new releases and access to the remote support center in Natick (MA).
  - Supplementary Software Service. This option provides all the standard services but also includes consulting and planning services. Supplementary software service agreements are negotiated on an as-requested basis.
- Prime introduced its Customer Support Center in Natick (MA) in 1983. The center offers primarily telephone support and some remote diagnostics for high-end machines such as the 9950 and 2550. Over 80% of software calls and over 30% of hardware calls reportedly are handled via remote support. Downline loads of software are not used extensively at this time. Prime reports, for example, that software analysts perform 90% of installations on-site and hardware engineers install the remaining 10%.

EXHIBIT II-28

PRIME COMPUTER INC.  
SERVICE ORGANIZATION



## HARDWARE MAINTENANCE

- Annual hardware maintenance as a percent of purchase price ranges from 5.5% for the 9950 system to over 12% for the 2250. Prime Basic Service includes:
  - Next-day response.
  - Eight hour/five day coverage.
  - Preinstallation/installation.
  - Remedial maintenance/field change orders.
  - Access to POLERS +.
  - Access to customer support center.
- In addition to the Basic Service, Prime offers Preferred Service on selected machines.
  - Guaranteed response, two or four hours, with credit for default.
  - Twelve hour/five day coverage.
  - Continued remedial maintenance.
- Users can select three different types of board swap/repair services including board diagnostic/evaluation, board exchanges, and board repair. Turnaround ranges from two weeks (standard) to 48 hours (priority).
- POLERS + (Prime On-Line Error Reporting System) is an electronic mail-like system which allows the user to access a periodically updated problem/solution data base and to communicate with remote support staff. The system accesses both hardware and software information.
- Prime has begun to unbundle many of its hardware services. For example, the company offers a "Deferred" option on terminal maintenance in which the user will receive a discount in maintenance charges for accepting a five-day response time.
- As noted above, annual hardware maintenance prices range from 5-12% of purchase price while software support typically costs from 7-17% of the one-time license fee. Prime will negotiate service prices, usually based on volume of service revenue. Discounts of up to 20% of service prices are offered on multiple systems generating \$45,000 of service revenue monthly; discounts are proportionately less on smaller systems.



## THIRD-PARTY MAINTENANCE

- Prime, like many other manufacturers, has recognized the necessity of providing a "single source" of maintenance and support in an increasingly competitive marketplace. Initially, the company focused on complimentary products (particularly those products for which Prime was an OEM, such as Convergent Technologies and CDC).
- INPUT expects Prime to continue moving into the TPM area through the remainder of 1985 and into 1986. Probable areas of coverage include non-Prime equipment at Prime user sites. As with other vendors, the motivation behind Prime's move into this area is:
  - Protect their installed base from other manufacturers and TPM vendors.
  - Improve user satisfaction.
  - Increase FE efficiency.

## SERVICE VENDOR PROFILE

**REYNOLDS & REYNOLDS COMPANY**  
800 Germantown Street  
Dayton, OH 45407

Edwin F. Strasser, Chairman  
Thomas R. Madlinger, Director, Field  
Service  
Revenue, Fiscal Year 1984:  
\$290 Million

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### THE COMPANY

- The Reynolds & Reynolds Company (Reynolds) was founded in 1866 in Dayton (OH) to manufacture and distribute standard and custom business forms. In addition to manual business forms, Reynolds now provides batch and remote computing services, turnkey systems, and microprocessor-based terminals, primarily to vehicle dealerships. Products and services are also marketed to accountants, hospitals, medical practices, and service contractors.
- Reynolds' primary market has been in providing processing services and turnkey systems to vehicle dealerships. Although this market still generates the majority of its revenue, Reynolds has expanded its services to accountants and hospitals and now markets turnkey systems to medical practices. Terminal sales also make a significant contribution to revenue.
- Reynolds derived \$162 million (56% of the company's total revenue) from its computer systems division. The remaining 44% resulted from sales of business forms and related products.
- New products in 1984 from Reynolds' computer systems division included:
  - Medical Practice Management System, which is an integrated turnkey system for physicians utilizing NCR Tower and IBM/AT products.
  - An interactive video system, developed in conjunction with the Chevrolet Motor division, which allows customers to visually specify a vehicle option.
- Reynolds has estimated that the vertically integrated systems market will expand at an average annual growth rate of 25% through 1988, and it is clear that they intend to remain in this market. However, the company is flexible and looking for new markets. For example, in 1984 Reynolds trained more than 7,000 customers using seminars, audio-visual, and computer-based training techniques. The company has identified education and training as critical to the development of improved operations.

## SERVICE DEMOGRAPHICS

- The field support organization for Reynolds includes over 600 personnel in 90 centers serving over 3,700 turnkey systems in North America. The company has a critical repair facility located in Dayton, which also houses a central support (software) function. Dispatching is handled from the company's five U.S. regions.

## SOFTWARE SUPPORT

- Software service and support is essential to Reynolds because it is at the heart of the company's turnkey systems. The company has developed extensive remote support capabilities, which include not only diagnostics but also remote fixer for 100% of Reynolds' installed base. The central software support facility is located in Dayton and has the capability to automatically update the entire user base in less than 48 hours (usually over the weekend).
- In addition to the remote support delivery mode, Reynolds also cross-trains hardware engineers, to a limited extent, in software support. This cross-training is kept to a minimum and focuses on problem isolation. User involvement in software support is generally limited to the initial problem call and diagnostics hookup.

## HARDWARE SUPPORT

- Reynolds utilizes NCR and IBM machines for its primary turnkey products, such as the VIM/NET system and the Medical Practice Management System. The company supplies service on both a contract and per call basis. T&M rates for prime shift are \$70 per hour.
- Parts inventories are kept at all service locations, including service delivery vans. The company explains that the major reason they have established a relatively decentralized parts network is that their clients (typically automobile dealers and physicians) become so dependent on the system that high levels of uptime are required.
- In order to keep service prices competitive, Reynolds has unbundled a number of important services, such as training, consulting, and planning. In the past, the company tended to bundle these services into the system and service price, but as low-end (particularly PC) products increased, price competitiveness also increased. The company is reportedly also considering service deductibles to compensate for service not used.

## FUTURE SERVICE TRENDS

- Although Reynolds is not among the largest of the turnkey vendors, the company has been very progressive in developing an extended service network for its installed base. Particularly impressive is the level of remote support offered to clients. INPUT believes that Reynolds will continue to develop remote support services in order to maintain high levels of system uptime and to reduce on-site service expenditures.



- Training and education (particularly in the area of computer-based training) will also be an important growth service for Reynolds. Based on the company's experience in vertical markets, INPUT expects Reynolds to expand beyond systems support and to offer training as a separate product. INPUT believes that there is a substantial user demand for this type of service, particularly in the area of software support--already an area of competitive strength for Reynolds.

## SERVICE VENDOR PROFILE

**SPERRY CORPORATION**  
1290 Avenue of the Americas  
New York, NY 10104

President, Information Systems Group:  
Joseph J. Kroger  
Vice President, Customer Service:  
Vince M. Donovan  
Revenues, Fiscal Year 1985:  
\$5.7 Billion

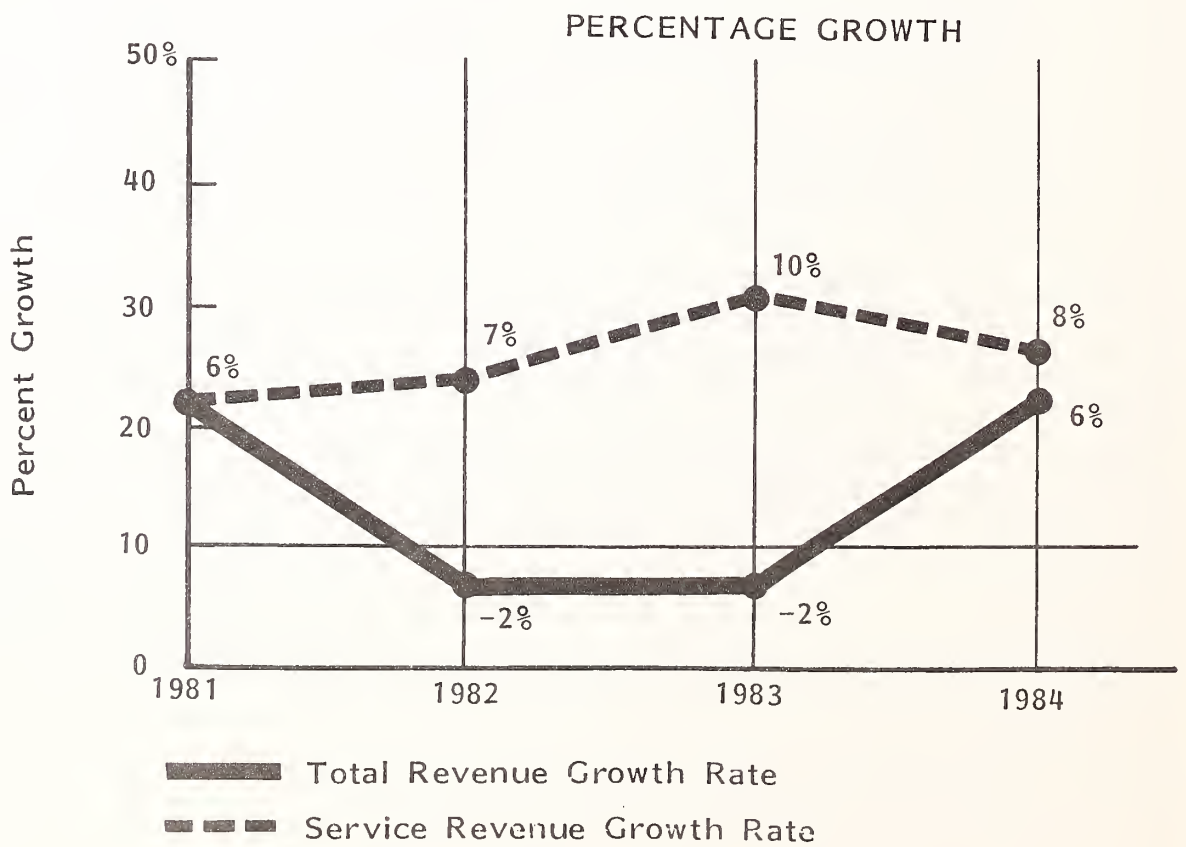
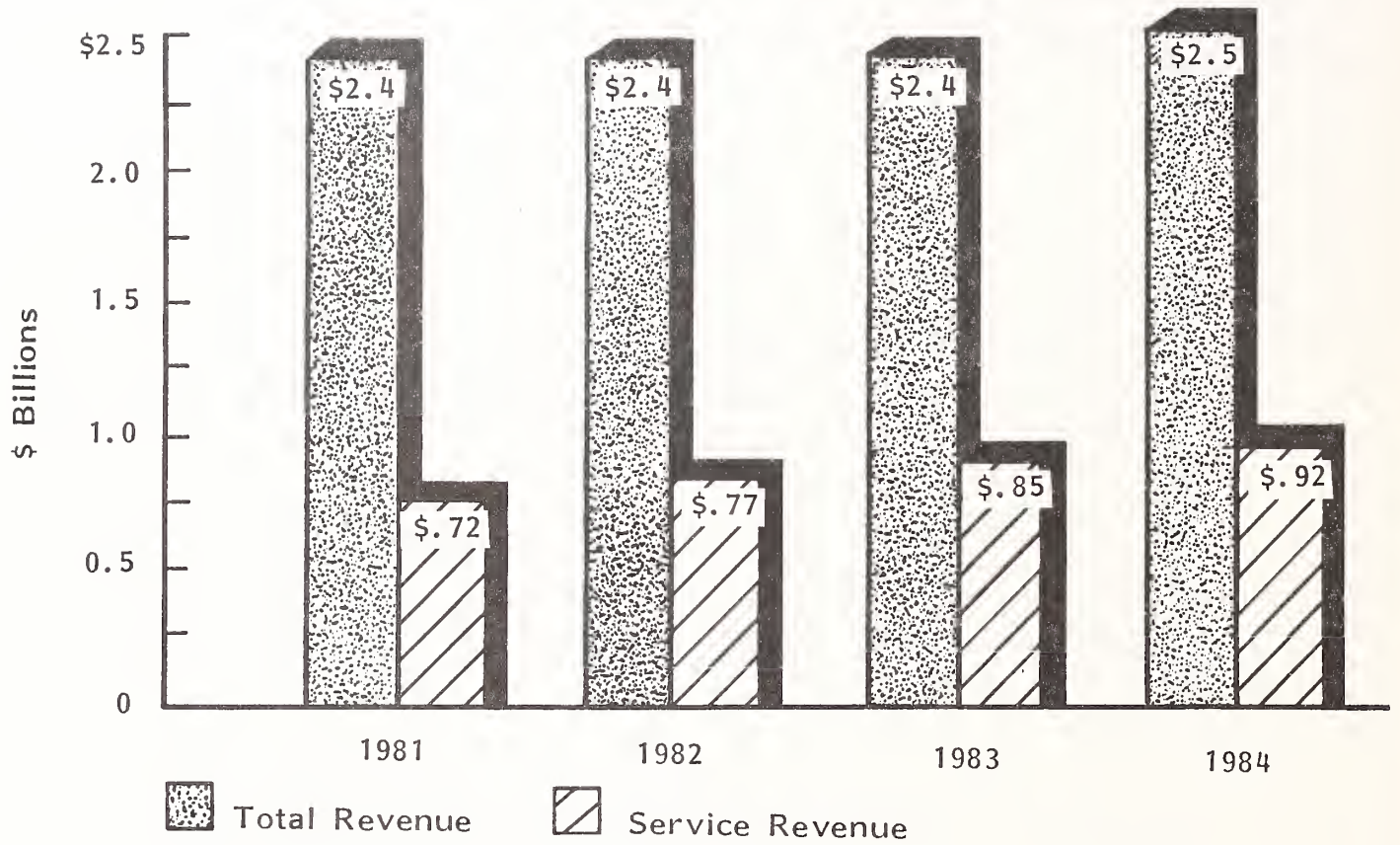
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### THE COMPANY

- Fiscal 1985 (ending March 31) was a good year for Sperry. As Exhibit II-29 demonstrates, revenues from commercial computer systems increased considerably, as did service revenues. Computer-related revenues were up by 22% and operating profit was up 52%.
- The turnaround in Sperry's performance is the result of a number of events. Perhaps the most important of which was the company's concentration on being a systems integrator. The high volume of shipments of the new 1100/900 systems also played a role. The company began to work with other vendors to improve new product development and to cut lead time for the introduction of new products.
- Among the most significant changes at Sperry was the company's commitment to a family of products based on the UNIX operating system. The company introduced a number of new products in this family, including the SPERRY 5000 Series and the SPERRY 7000 system which can support up to 128 users and 8 MB of main memory. The 5000 Series consists of four models, two supplied by NCR and two by Arete. The 7000 system is produced by Computer Consoles, demonstrating Sperry's new strategy of working with other vendors and discarding the old "not invented here syndrome." In addition, the company is working with a number of third-party software developers to ensure an adequate base of software based on the UNIX operating system for its users.
- Mainframes generate over 50% of Sperry's total computer revenues, and in this area the company continues to invest substantial internal resources. In April 1985, Sperry announced two entry level mainframes (the 1100/91SV and the 1100/92SV), with respective performance ratings of 5.5 and 10.2 MIPS.
- Sperry has also introduced a front-end scientific processor for its 1100/90 and can support high speed vector and scalar computations. The ISP is priced at \$3.5 million and has a peak performance of 133 mflops.

EXHIBIT II-29

SPERRY CORPORATION  
REVENUE GROWTH





## SERVICE DEMOGRAPHICS

- Sperry has estimated 8,000 service personnel in the U.S., including 3,500 customer service technicians and 1,500 systems analysts. The company has 200 dispatch centers, 62 of which are carry-in/mail-in centers. In addition, analysis and diagnostic support is available from Sperry central support. Sperry is currently implementing their new service management system which is a nationwide automated on-line dispatch system.

## SOFTWARE SUPPORT

- Software support is centered around the Sperry Support Center, whose mission is to provide customer problem isolation assistance and the appropriate fix.
- The Sperry Support Center is product oriented. 1100 machines, system 80s, PCs, and the latest minicomputers are supported by the center. This is done through telephone techniques whereby customer requests are routed to and responded to the appropriate system specialist.
- Actual software support offered by the Sperry Support Center facility is quite extensive, including:
  - Assistance in reporting new problems.
  - Remote diagnostics.
  - Periodic analysis of the users system profile and error logs.
- Downline loads of new releases, updates, and patches are currently being implemented.
- User involvement in software support is encouraged by Sperry. Users are expected to electronically transmit their system profile periodically. In addition, users work closely with Sperry software analysts in the development of custom software packages, reporting software problems, and installing fixes.
- Sperry has unbundled software services to some extent. For example, Extended Support Services (including on-site support) are available for a premium over the basic support fee. The company is considering new software service strategies for mid-range and small systems. One of these strategies would include a billable, measured level of service in which a customer would pay for a specific amount of support time. INPUT expects large system software support to become more dependent on remote support, but to remain a bundled package.

## HARDWARE SUPPORT

- There has been some movement at Sperry in the areas of hardware services unbundling and user self-maintenance. The company offers a basic hardware service plan, described below, with few service product options. Customers can become involved in maintenance through the use of walk-in service centers.
- A typical Sperry hardware contract would include the following:
  - Preventive and remedial maintenance.
  - On-site coverage.
  - Nine-hour coverage between 7 a.m. and 6 p.m., Monday through Friday.
  - Availability of extended coverage (at premium of up to 65% for 24 hour, 7 day coverage).
  - Replacement parts.
  - Variable warranties on new purchases.
- Time and material rates (two hour minimum) are available at \$133-160/hour.
- In addition to the standard services listed above, Sperry offers extensive remote support options for the 1100 series and System 80 mainframes. The Sperry Support Center can be accessed 24 hours a day for hardware-related problems. Additionally, the Sperry Support Center offers a total remote hookup for diagnostics and problem analysis. Support Center personnel can remotely control the user's system, access problem data bases, and track individual machine performance via error log files.
- As noted above, hardware services have been extensively unbundled, with the growth in carry-in/mail-in centers. In addition, the company has indicated that it will continue to offer a number of premium services, such as geographically unlimited travel for PC service in the future.

## THIRD-PARTY MAINTENANCE

- Sperry announced in early 1985 that it had entered the third-party maintenance market in order to better serve current customers and to enhance service revenues. The company indicated that TPM service would be provided by the current Sperry U.S. Service Network (3,500 service technicians at 200 dispatch centers), but that it had created a separate third-party marketing organization.
- Currently, Sperry is servicing 350 selected non-Sperry products from 80 vendors including Epson printers, Mitsubishi and Shugart floppy disks, Pertec Systems, Corona PCs, and certain STC products. Sperry has said that it

intends to broaden its TPM service business, and that new products will be added to expand the company's current product line.

- Sperry's target TPM markets include federal, state, and local governments and the manufacturing, energy, and transportation industries. These markets correspond to the company's main markets--another indication that Sperry wants to solidify its position in these markets by continuing to enhance satisfaction with overall service.

## FUTURE TRENDS IN SERVICE

- As Sperry increases "strategic partnering" and becomes more involved in total systems integration than in strict hardware sales, service will become significantly more important. Improving efficiency will be instrumental in making services profitable.
- Service improvements are expected in the following areas:
  - Centralized Dispatching. Dispatching was previously done from each of the company's 46 branch offices. Sperry's Service Management System features centralized call handling during all non-prime shift hours and branch call handling during prime shift hours. It is likely that a full time central dispatching system will be implemented in the future.
  - Remote Support. The company has obviously made a substantial commitment to remote support and INPUT expects continued emphasis in this area.



## SERVICE VENDOR PROFILE

**STRATUS COMPUTER, INC.**  
55 Fairbanks Blvd.  
Marboro, MA 01752

President: William Foster  
Vice President, Customer Service:  
R. James Schroeder  
Revenues, Fiscal Year 1984:  
\$43 Million (Est.)

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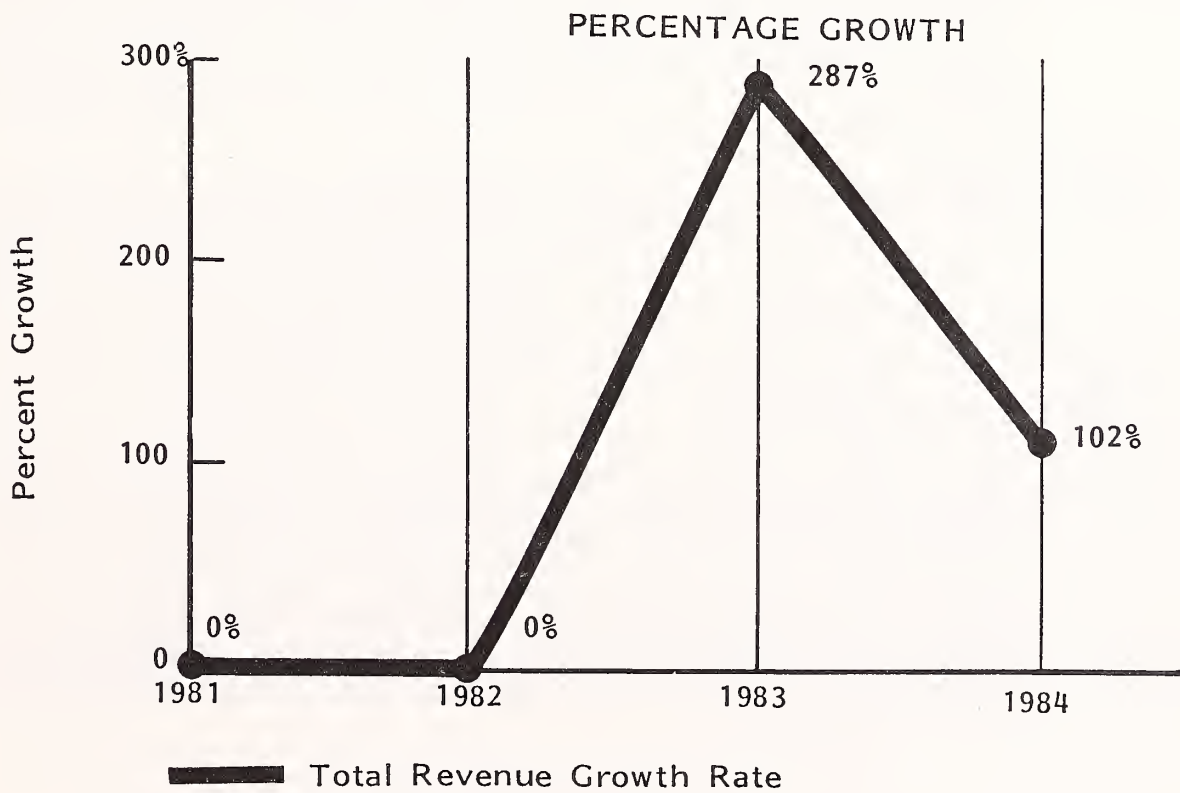
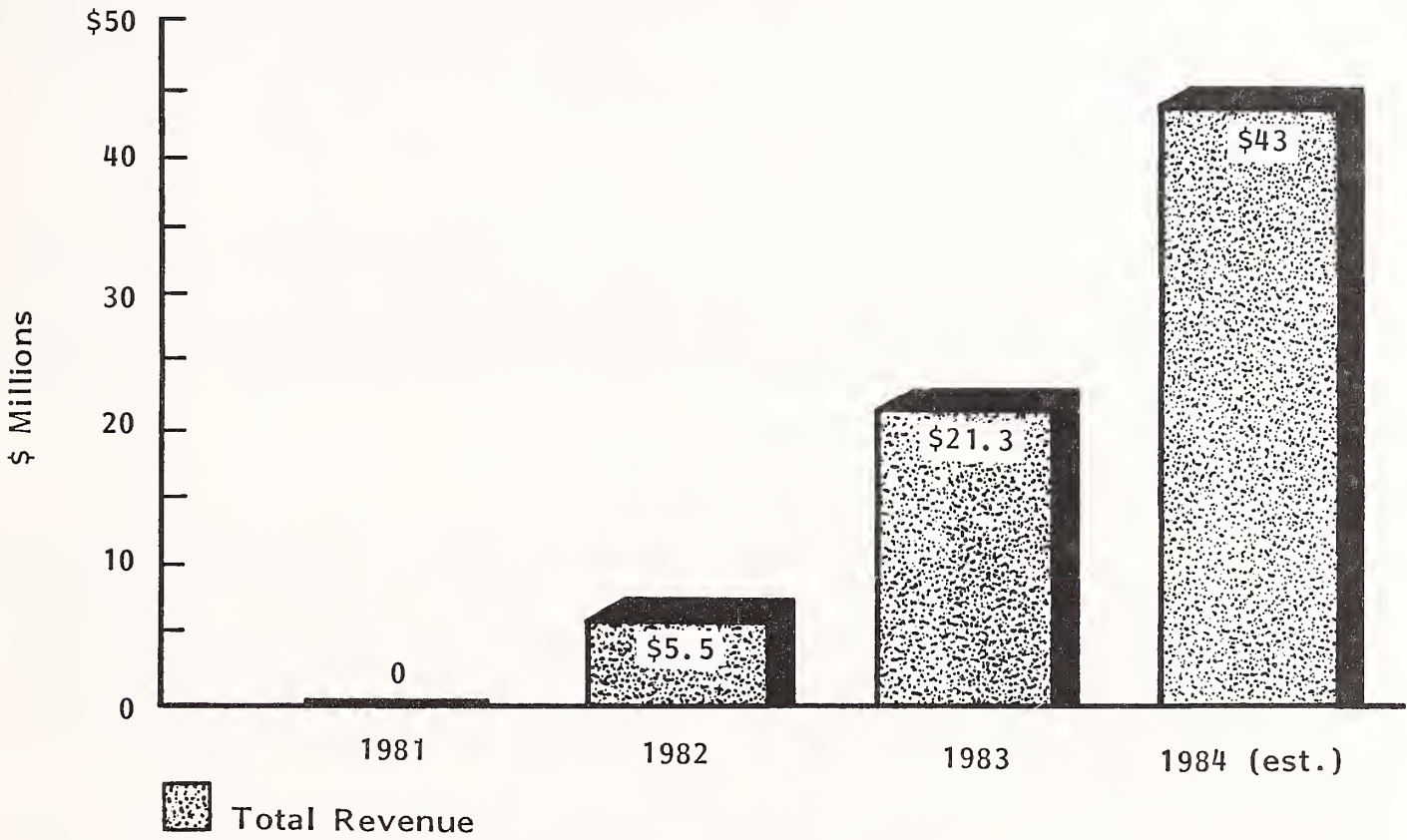
### THE COMPANY

- Stratus Computer was founded in 1980 and began shipping equipment in 1982. While the company has been growing rapidly (see Exhibit II-30), it is substantially smaller than most other competitors in this report. However, Stratus has been included here because of the unique aspects of Stratus computers and maintenance on those computers.
- Since their inception, Stratus has focused on one market: the interactive user with a high requirement for system reliability. Vertical markets such as banking, computer integrated manufacturing, health care, and government have been targeted by Stratus as growth opportunity areas because of the need for instant transaction analysis. Stratus' fault-tolerant system is ideal for this market because of the high degree of reliability available to the end user.
- Stratus hardware is heavily dependent on relatively inexpensive microprocessors to provide redundant processing. Should one series of processors fail, the system continues to function with a redundant system. Generally, the hardware solution to redundancy is considered technically superior to a software-based solution (such as those used by Tandem).
- The fault-tolerant systems produced by Stratus include:
  - FT200. Introduced in 1981 and first shipped in 1982, the FT 200 can support up to 64 workstations per processor with a main memory of up to 8 MB and a performance of 0.75 MIPS.
  - FT 250. The company's most recent low-end machine, the 250 was introduced in April 1985 and has 4 MB of main memory. The system is priced at \$115,000.
  - XA 400. A mid-range processor available with up to 8 MB of main memory and capable of supporting up to 128 users.
  - XA 600. The high end of the Stratus line, the 600 can support 256 users per processor, 44 billion bytes of storage, and 16 MB of main memory. The XA 600 has a performance rating of 3 MIPS.



EXHIBIT II-30

STRATUS COMPUTER, INC.  
REVENUE GROWTH



- Stratus has been active in promoting its fault-tolerant system both by increasing its sales force and by working with OEMs. In February 1985, Stratus signed an agreement with IBM that allows IBM to act as an OEM for Stratus systems. Only two months after the agreement, IBM announced the System 88 based on Stratus "XA" products. In addition to IBM, Stratus has signed an agreement with Systems Development Corporation under which that vendor can also OEM Stratus products.

## SERVICE DEMOGRAPHICS

- Stratus has an estimated 25 field service employees in the U.S., 20 of whom are engineers. The company maintains five parts depots (in California, New York, Illinois, Tennessee, and Massachusetts), in addition to parts at user locations and service offices. Stratus has 12 service locations in the U.S. which work dually with the company's Customer Assistance Center located in Massachusetts.

## SOFTWARE SUPPORT

- No vendor has developed a fault-tolerant software package; however, Stratus has developed a sophisticated remote support network which minimizes software interruption on their Continuous Processing System. At the heart of the remote support network is the company's Customer Assistance Center (CAC). This center, based in Marlboro (MA), allows the end user almost immediate access to support staff via remote support and electronic mail capabilities.
- All support calls are initially directed to the CAC. Since every Stratus system has the capability for remote software support, the CAC can automatically diagnose problems and send a confirmation back to the user that the support process has been initiated. End users can leave messages to software specialists on the CAC Electronic Mail system, effectively bypassing the initial dispatch contact.
- Because of the high level of remote support offered to Stratus customers, there is little or no need for user involvement in software support. In addition to remote diagnostics, the CAC can download new releases, upgrade remotely, and even access intermittent software problems automatically. According to Stratus, virtually all software problems are corrected from the CAC.

## HARDWARE SUPPORT

- As mentioned above, Stratus systems are based on redundant hardware design. Each system has four processors running the same set of instructions. When an error on a component is detected, one set (2) of the four processors is interrupted while automatic diagnostics is performed. If the problem is transient, the fault is logged and the component is put on-line again. If the problem is permanent, the component is identified (with a red light) and the customer and Stratus are notified via the Stratus Remote Service Network.

- Stratus offers three maintenance agreements:
  - Customer Maintained Maintenance Contract. The customer performs all first call remedial hardware support and Stratus supplies spare parts, backup, and software support.
  - Co-Active Maintenance. The customer works through the Remote Service Network and performs some maintenance including component exchange of processors, memories, and intelligent peripheral controllers. Stratus provides all the hardware and software support, including spares.
  - OEM. Stratus provides three-day parts replacement/repair, software support as well as central site and software redistribution license. OEM provides spares and all support to its end users.
- Remote support via the Customer Assistance Center is a key component of Stratus hardware service. The CAC computer automatically communicates with the user's system and analyzes fault logs. If maintenance is required, either on-site or remote support is initiated.
- The combination of system fault tolerance, user involvement in maintenance, and extensive remote support has helped to keep on-site visits by Stratus customer engineers to a minimum. Not only does this improve response/repair time, but it also results in lower maintenance fees. Annual maintenance on a Stratus FT 200, for example, is 5.5% of purchase price, compared to 7.5% for a Prime 9650. In addition, Stratus reports a high level of user acceptance with regard to involvement in component replacement. End users, at least in the fault tolerant market, are more concerned with improving reliability and uptime than the problems involved with replacing components.

## FUTURE DIRECTIONS

- Stratus will continue to depend upon remote support and user self-maintenance to keep service costs down. The company expects users to become much more pragmatic in terms of self-maintenance, particularly as service prices continue to increase.
- One issue that Stratus will continue to deal with as it grows into new markets is in the area of security. All Stratus systems have remote support capabilities; however, Stratus cannot access the system without user permission or participation. Despite this, users in the overall mini/superminicomputer market continue to be very concerned with security. This concern represents one of the major reasons most small system users have not opted for remote diagnostics despite the positive impact it would have on response/repair time.
- Stratus and other fault tolerant manufacturers are in a unique service position. Because the system is fault tolerant, the manufacturer can often schedule service in order to optimize service resources and at the same time

satisfy user requirements for system availability. This improved efficiency allows Stratus to be very competitive in service pricing. It is unlikely that the company will branch out into areas such as third-party maintenance or that the company will further unbundle service. Rather, Stratus will concentrate on making its service more efficient and less costly in order to improve the company's small competitive position.



## SERVICE VENDOR PROFILE

**TANDEM COMPUTERS INC.**  
19333 Vallco Parkway  
Cupertino, CA 95014  
(408) 725-6000

President & CEO: James G. Treybig  
Director, Customer Engineering:  
Roger Bier  
Revenues, Fiscal Year 1984:  
\$418.3 Million

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### THE COMPANY

- Tandem, the recognized leader in the fault-tolerant market, manufactures the Non Stop II, Non Stop TXP, and Non Stop EXT systems.
- The Non Stop II is a multiple processor computer system that supports high-volume on-line transaction processing. The Non Stop TXP, introduced in late 1984, offers more than two times the processing power of the Non Stop II and was designed to improve the performance of Non Stop II applications.
- In May 1985, Tandem introduced its entry-level processor, the Non Stop EXT, in an effort to reposition itself in the market. The system uses Tandem's Guardian control program, Encompass relational DBMS, and Expand networking software.
- Shipments of Tandem's new Guardian 90 operating system were scheduled to begin July 1985. The system requires smaller memory than Guardian and solves performance problems of the previous version. The system runs on the Non Stop II, Non Stop TXP, and Non Stop EXT.
- Shown in Exhibit II-31, Tandem's 1984 revenues were approximately \$532.6 million, an increase of 27% from 1983 revenues. Service revenues reached \$84 million in 1984, or 16% of total revenues, representing a 45% increase in service revenues since 1983.

### SERVICE DEMOGRAPHICS

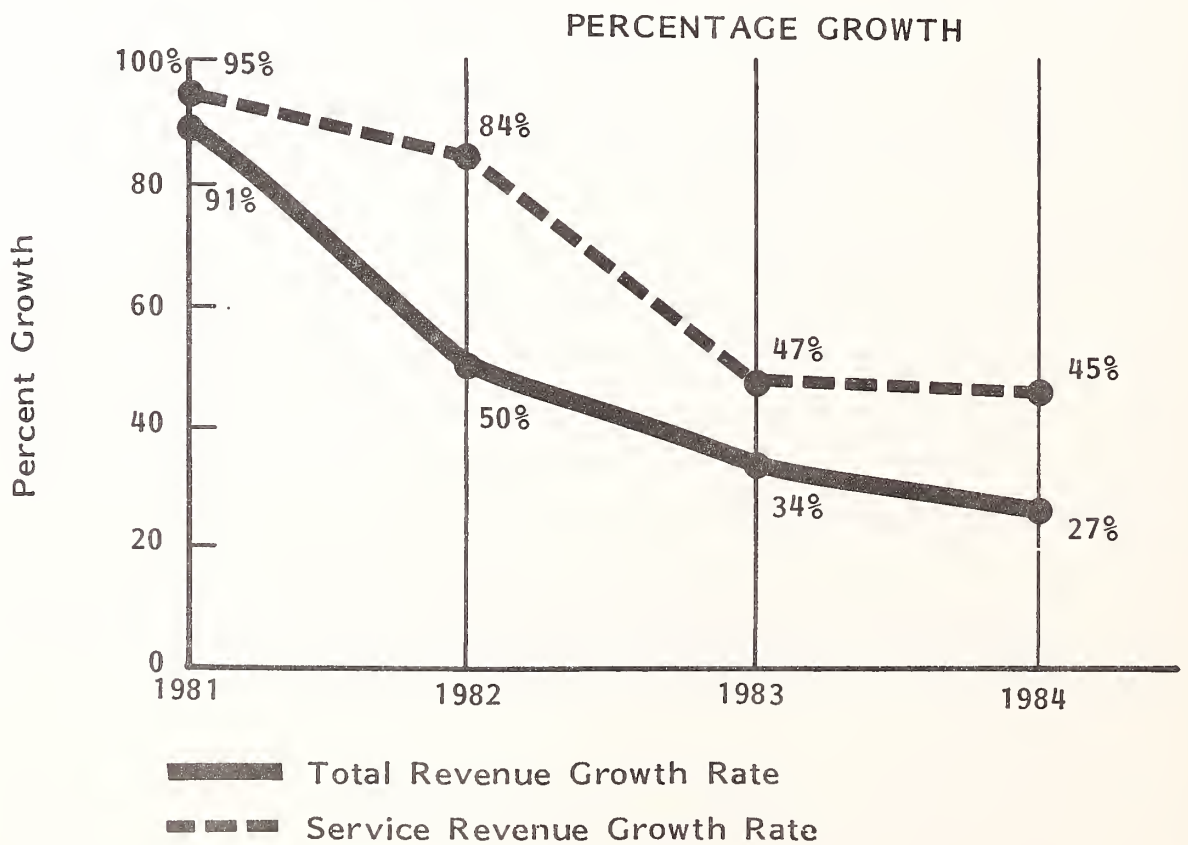
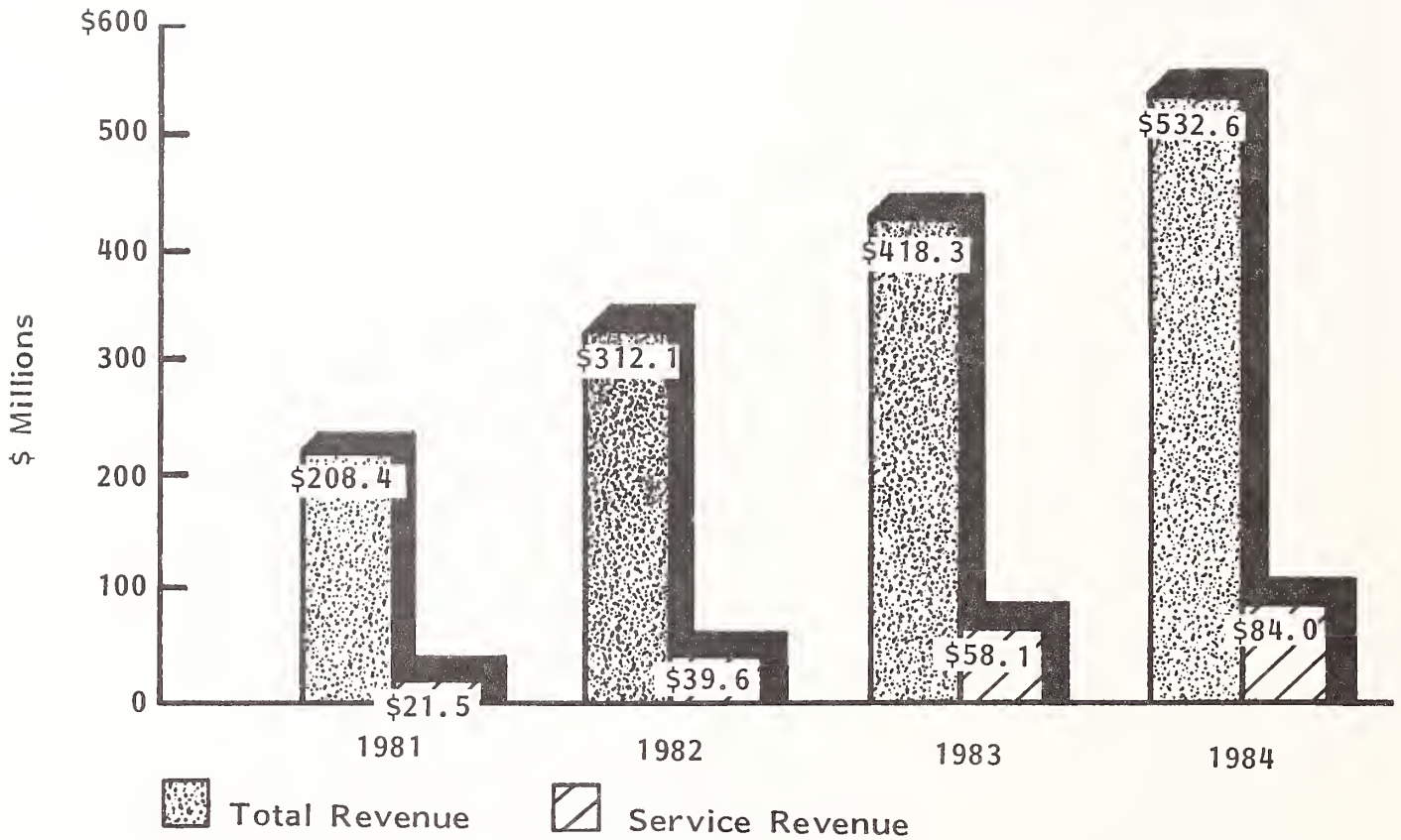
- Tandem has 84 sales and service offices within the U.S. In addition, the company has international subsidiaries and distributors in 31 countries.
- Total customer service employees at Tandem number 988; 528 are customer engineers.

### SERVICE ORGANIZATIONS

- There are three U.S. divisions and two international divisions at Tandem. Each division is headed by a vice president and general manager responsible for systems analysts, customer support, and sales.

EXHIBIT II-31

TANDEM COMPUTERS INC.  
REVENUE GROWTH



- The group's Business and Planning section provides planning for revenues and profits, although customer services is not operated as a profit center.
- Service marketing, documentation, and training and education for customer engineers and end users are performed within the headquarter's marketing organization.
- The Field Office is responsible for dispatching hardware and software support. In addition, the company also has a centralized dispatch center available in Austin (TX).
- Parts logistics is supplied by Customer Engineering. This includes parts used by customer engineers for service and those sold to customers.
- Professional services including planning, consulting, and site audits are performed by an Account Team consisting of system analysts and customer engineers.

## SOFTWARE SUPPORT

- Software analysts provide decentralized software support from the company's sales and service offices. Support is available for systems software only.
- Tandem does not sell applications software. Third-party organizations develop and market applications software for Tandem computers and are also responsible for supporting them.
- Centralized software support is available through an 800 number for Tandem's 654X workstation products. Using this remote telephone support for problem determination, the customer has four options available.
  - Express exchange: A new monitor, keyboard, disk drive, etc., is mailed to the customer for exchange, generally within 72 hours.
  - Priority exchange. The exchange is made with a 24-hour turnaround time.
  - Central site repair. Approximately once a month a Tandem representative will pick up any failed field replaceable units (FRUs).
  - On-site service. Tandem representative goes to customer site to repair or replace failed unit.
- The Customer Assistance Center, accessed through the 800 number, is used for on-site call avoidance. If the problem can be solved over the phone or identified to the extent that the customer engineer knows what parts to bring on-site, the customer support organization becomes more cost-effective.



- Currently, systems analysts usually install patches and new releases, but customers can also arrange to do it themselves.

## HARDWARE SUPPORT

- Dispatching for hardware support is done locally from the company's sales and service locations.
- Tandem offers an unbundling of its hardware support services. Customers can opt for extended coverage or reduced response times and receive credit for using remote support.
- Remote support is available for Tandem's Non Stop II, Non Stop TXP, and NON Stop EXT. The Operations and Service Processor (OSP) assists customer engineers in diagnosing the problem, reducing mean repair times. For using it, customers receive a \$200 credit.
- Users also have the option to perform self support on their Tandem hardware. Tandem provides the parts and any training/education the user requires for self support. Tandem can provide education and training at seven company locations as well as at on-site customer facilities in some instances.

## FUTURE TRENDS IN SERVICE

- Tandem is looking for ways to increase the level of customer satisfaction while keeping operating costs down. Growth in revenues from hardware maintenance is declining. Customers do not see customer engineers as often as in the past due to hardware reliability and remote support, and do not want to pay as much for service.
- Tandem is considering retraining some of its customer engineers to work in software support or sales support. Retraining would serve to expand the capabilities of customer engineers and meet the needs of the customers.



## SERVICE VENDOR PROFILE

**TANDY CORPORATION**  
One Tandy Center  
Fort Worth, TX 76102

Chairman: John Roach  
Vice President, Support Services:  
David Goyne  
Revenues (Computer), Fiscal Year 1984:  
\$916 Million

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### THE COMPANY

- In 1977 Tandy introduced the first inexpensive personal computer available through retail stores. In 1979, Tandy held 21% of the microcomputer market with \$140 million sales of microcomputer and related products. With IBM's entrance into the microcomputer market in 1981, and later entrances of PC-compatible systems, Tandy saw its market share dwindle down to 15% in 1984. Nevertheless, with a concerted effort to regain lost ground through new PC-compatible equipment of their own, Tandy continues to warrant attention in the microcomputer market.
- In 1984 Tandy took a number of steps toward recapturing lost ground. First, the number of specialized Computer Centers and Computer Centers Plus grew to over 400. Also, Tandy moved responsibility for computer and telephone products to a newly created Business Products Division. Along with sales and marketing responsibilities, the Business Products Division directs the 275 service centers and 1,200 service personnel.
- In 1985, Tandy continues to make changes in order to attract business users. Moving away from their traditionally decentralized support organization, Tandy pulled all the trained service personnel out of the Computer Centers and company-owned service centers and concentrated them in 56 regionalized service and support locations. Utilizing the "man-in-a-van" program to shuttle defective units and parts from the retail outlets and user sites (if the user contracts for on-site service) to these regionalized service locations, Tandy hopes to better serve their business and individual microcomputer customers.
- Along with the usual hardware maintenance performed at these regional support centers, Tandy has introduced two additional support offerings: consulting services provided to end users by phone or at the user's site, and training services performed either at the support center or at the user's site. With the "pooling" of Tandy's service and support personnel at these regional support centers, Tandy was able to provide these support services at a reasonable price with improved effectiveness of training and consulting resources.
- Exhibit II-32 lists Tandy revenues in 1981-1984 and Exhibit II-33 demonstrates the company's organizational structure.

EXHIBIT II-32

TANDY CORPORATION  
REVENUE GROWTH

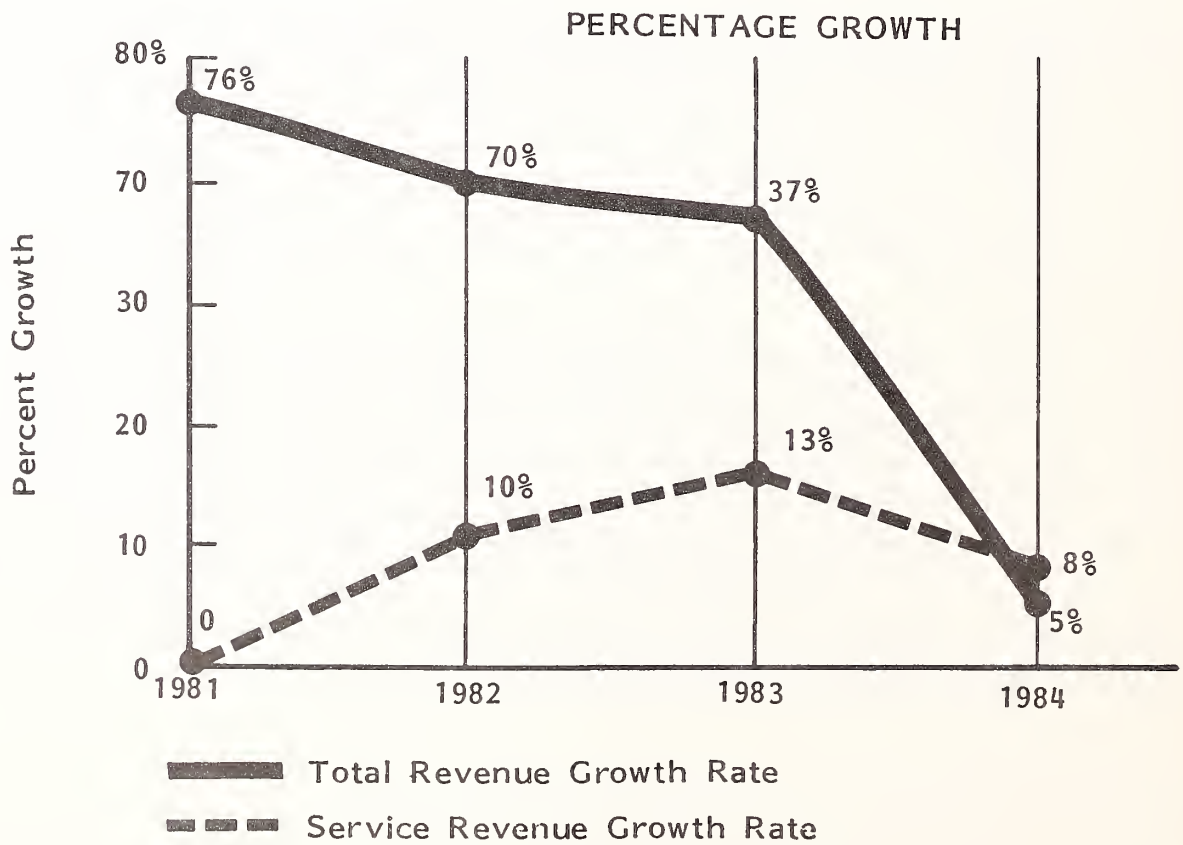
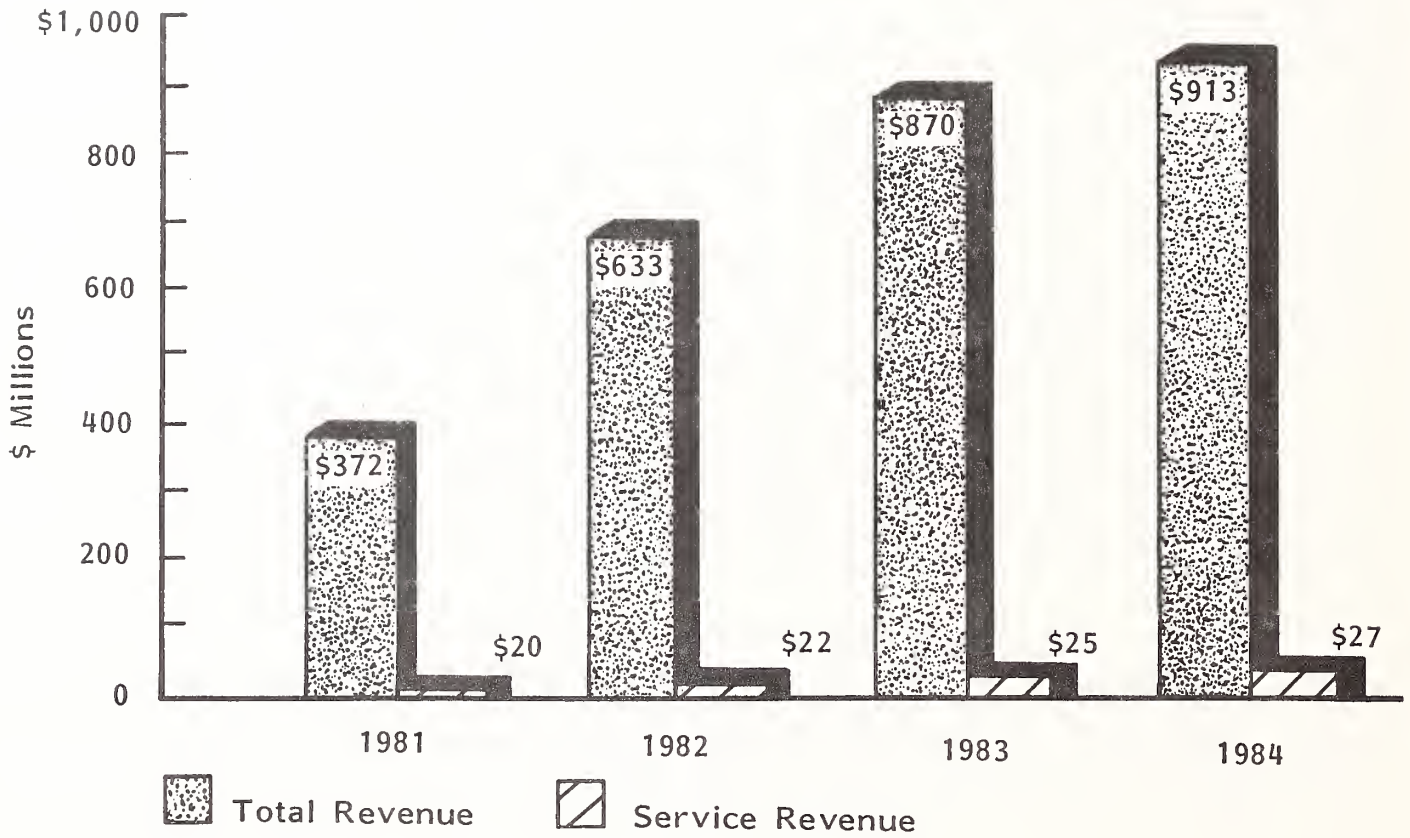
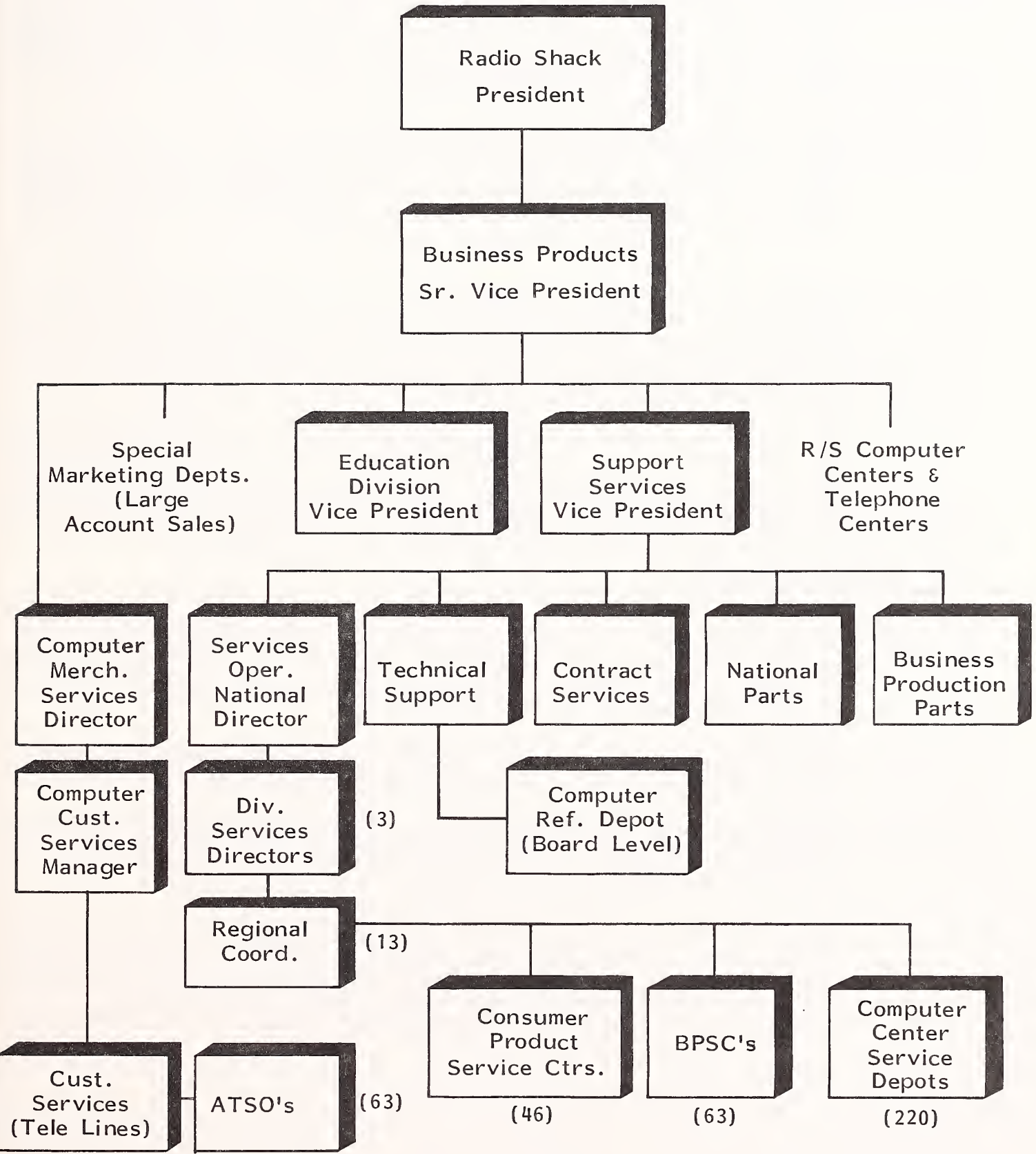


EXHIBIT II-33

TANDY CORPORATION  
SERVICE ORGANIZATION





## SOFTWARE SUPPORT

- The reorganization of the support structure at Tandy made a significant impact on the availability of delivery of software support offered to Tandy users. For most microcomputer vendors, the emphasis in software support is on consulting and training services provided to end users. Most microcomputer vendors rely on their dealers and distributors to provide whatever consulting and training support is offered the end user, which usually occurs only at the time of purchase. Some microcomputer vendors, most notably IBM, offer consulting via telephone support numbers, usually on a specified number of calls per set fee basis.
- In the past, Tandy also relied on their distribution network to provide these services. After experimenting with a toll-free telephone support number, which proved too costly (largely due to an extraordinary number of operational calls covered in documentation), Tandy placed the support responsibility on their Radio Shack and Computer Center locations.
- However, Tandy found, quite correctly, that the tremendous number of popular and home packages sold through each retail outlet made it virtually impossible for individuals working at each store to have adequate knowledge of each package, since it is realistic to expect an individual to become sufficiently knowledgeable on at most four to five programs.
- By pulling the individual support personnel from the retail locations and combining them at the regional support centers, Tandy was able to effectively train support people on the wide range of products available to Tandy customers. In doing so, Tandy then could offer both training and consulting services to end users out of these regional support centers.

## HARDWARE SUPPORT

- Hardware support was also affected by the reorganization toward more regionalized support. Since the majority of hardware problems were repaired at individual computer centers, the "pooling" of service staff allowed a greater ability to specialize service capabilities.
- Consulting is now performed, free of charge, by telephone out of the regional support center. Training, at \$30/hour, is performed at the user's site.
- Hardware maintenance is available to Tandy users through on-site contracts, at \$400 per year for a TRS-80 Model III, and depot contracts, at \$200 per year for the same system.
- An on-site service contract holder initiates the service call by contacting either a local retail outlet (who would then contact the regional support center) or directly contacting the regional support center (which is recommended by Tandy). Since the support center can be up to 150 miles away from a user, response times are not specified contractually, but eight hours is an



internal goal. Tandy uses the "man-in-the-van" approach, which allows the FE access to high failure-rate parts.

- More often, Tandy service contract holders opt for depot service, which takes place at these regional support centers. Users can deliver their faulty equipment either to the regional support center or the nearest retail outlet, which would then send the unit to the repair center (assumably by a returning "man-in-the-van"). Tandy states that depot service carries with it a 24-hour turn-around goal.
- The most relied upon source of microcomputer service is time and materials maintenance (over 80% of the user service requirement sample for Tandy used T&M). Since the current user base for Tandy equipment is weighted by individual and small business users, this is understandable. In addition, Tandy offers the lowest T&M rate in the industry, currently at \$30 per half hour with only a half hour minimum.

### FUTURE TRENDS IN SERVICE

- Tandy's position in the microcomputer market has changed dramatically in the industry's short history. From the position of past co-leader (with Apple), through a period of dropping sales as IBM entered and later controlled the market, and now through an industry-wide slump, Tandy has made gradual but significant changes in their product design, product marketing, product distribution, and product service functions, all in an attempt to re-establish their position in the microcomputer market.
- Tandy will need to continue to adjust their marketing, sales, and service delivery structures in order to achieve greater corporate acceptance. Gaining PC-compatibility was a major step forward since it is obvious that the corporate microcomputing environment has assumed an IBM standard. However, the corporate selection and purchase routine will require Tandy to increase their involvement in direct sales and value-added resellers, which currently account for only 1-2% of their sales. The VAR route also allows Tandy access to smaller companies and vertical market application needs that IBM has not addressed (at least up to now).
- Part of the desire to improve Tandy's corporate image should bring about the continued growth of Tandy service, which has only recently been marketed as a sales feature. Even though Tandy has to provide service for a wide range of products, including radios, telephones, and other electronics, the benefits of running service as a profit center (continued flow of revenues, increased profitability resulting from improved reliability, etc.) warrant the further elevation of service within the corporation.

## SERVICE VENDOR PROFILE

**TEKTRONIX**  
P.O. Box 500  
Beaverton, OR 97077  
(503) 627-7111

President: Earl Wantland  
Vice President, Corporate Service and  
Field Support: Stan Kouba  
Revenues, Fiscal Year 1984:  
\$1.331 Billion

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### THE COMPANY

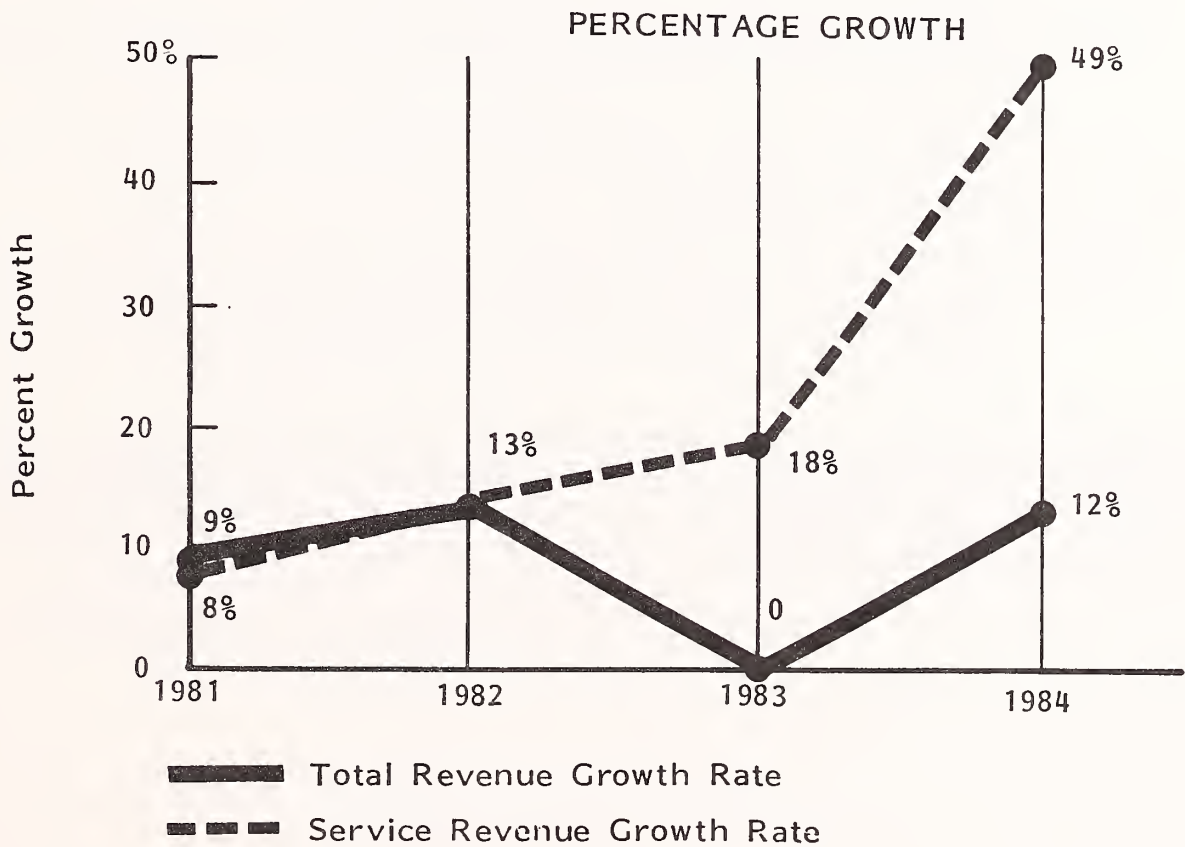
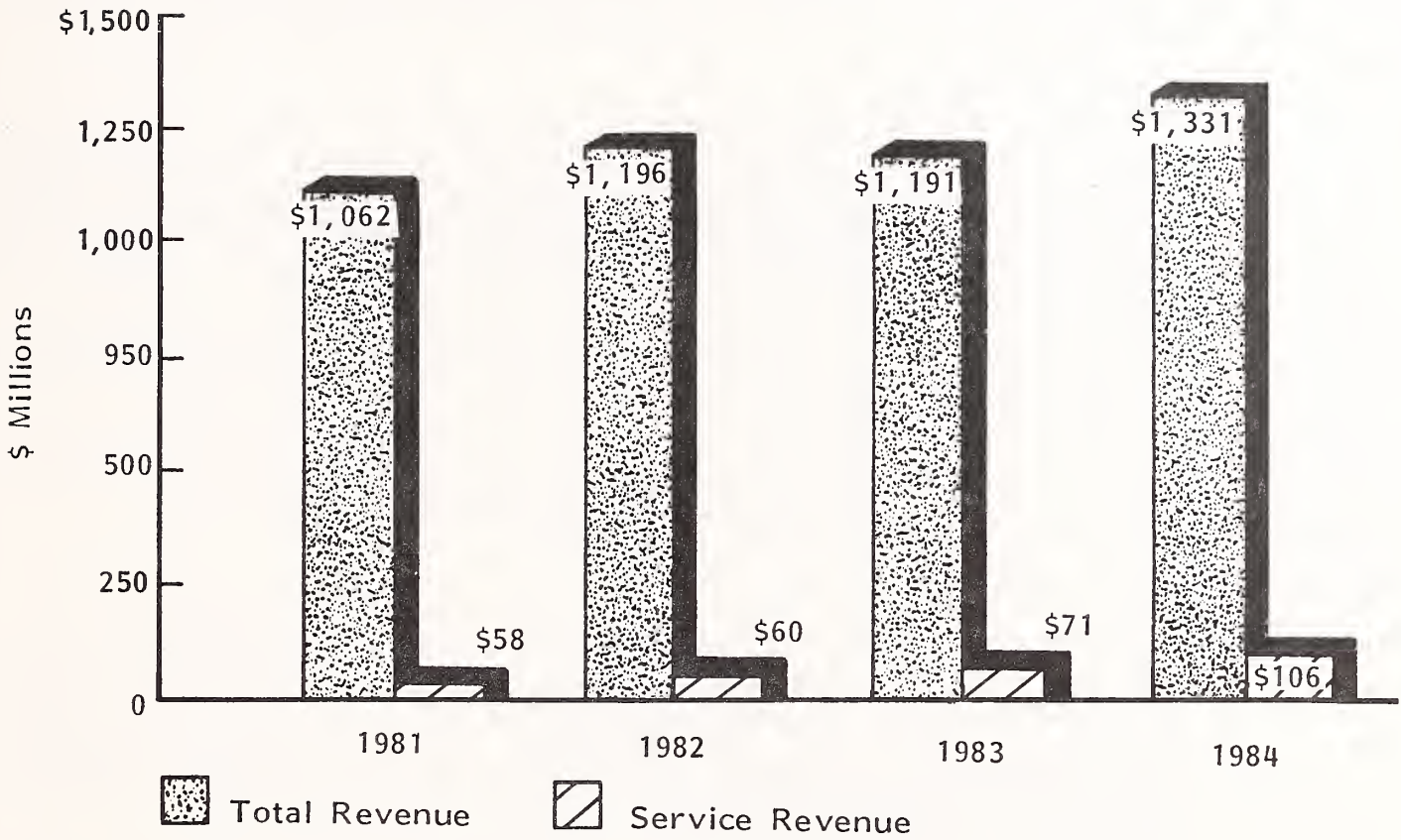
- Tektronix develops, manufactures, sells, and services products in four general categories: instruments, communications, design automation, and information display. In recent years, the company has directed its primary focus away from instrument products. During the period 1980-1984, revenues generated from communications products increased from 14.4% of total sales to 18%, while revenue generated from design automation and information display products increased from 33.7% to 39.6%.
- Information display products include the recently introduced Tektronix 6000 family of 32-bit, high performance, intelligent graphics workstations used for scientific data analysis, computer-aided engineering (CAE), and computer-aided design (CAD).
- Design automation products include the 856X family of Tektronix micro-computer development systems, with the capability to expand with users' software development needs.
- Tektronix is well known for its computer display terminals. The company's 4100 series provides a range of options including color graphics with VT100-compatible alphanumerics, a palette of 40 colors, a color graphics rasterizer, and a local graphics processing module.
- For the fiscal year ending May 26, 1984, the company reported approximately \$118 million in earnings resulting from \$1,331 billion in total revenues. This represents an increase of 13% over 1983 revenues, shown in Exhibit II-34. U.S. revenues increased 17%, reaching \$861 million in 1984.
- In January 1985, Tektronix acquired CAE Systems, Inc., of Sunnyvale (CA), for \$75 million in stock, strengthening its position in the computer-aided engineering business. CAE Systems, Inc. reported its 1984 net income at \$85.2 million.

### SERVICE DEMOGRAPHICS

- Tektronix offers depot and on-site customer support through its 45 sales and service offices. Depot support for the company's instrument products is provided at 32 of these locations.

EXHIBIT II-34

TEKTRONIX  
REVENUE GROWTH





- INPUT estimates that Tektronix has approximately 1,400 total customer service employees and approximately 800 hardware and software engineers.
- Parts are distributed from the company's principal plant, located in Beaverton (OR).

## SERVICE ORGANIZATION

- Operated as a profit center for five years, the company's field service division utilizes a geographic management structure to provide on-site and depot hardware service. Dispatching is done locally at each service location. The division has also established a unit to market its services and set prices and discounts.
- Product divisions provide their own software support, as well as documentation and sale of supplies.
- Rather than being set up as a separate function, planning is a cooperative effort by managers of the various line organizations.

## SOFTWARE SUPPORT

- Tektronix has only limited experience in software support, since in the past the company serviced mainly peripherals. Software support is provided by systems analysts and applications software engineers located at the company's 45 service centers. Each analyst or engineer is assigned to a specific product group, such as the information display product group. Software support is generally provided by telephone.
- Tektronix systems analysts provide short-term, on-site consultation to help users implement Tektronix software and solve applications problems.
- Customers can subscribe to software subscription services (SSS) to receive the most current releases on Tektronix licensed software products and updates to software documentation.
- Users are not generally involved with installing patches or new releases, that is left to the systems analysts. In addition, users cannot currently access the company's solutions data base, although Tektronix plans to make it available to users in the future.
- Currently, remote diagnostics are provided for operating systems software only. No downline loading is available, but the company sees significant growth opportunities in remote diagnostics and remote fixes, especially with its new products.

## HARDWARE SUPPORT SERVICES

- Maintenance agreements, available for Tektronix configured systems and all information display products, cover parts, labor, and travel. To minimize downtime, Tektronix also provides maintenance calls to inspect, clean, and replace parts. Response time quoted by the company is same-day service or eight work hours.
- The Tektronix Field Service division is currently unbundling its hardware services to a limited extent. For example, customers can opt for installation, installation planning, and different levels of response, such as faster response, multi-shift coverage, or weekend coverage.
- Tektronix noted that its customers have not required many options in the past and have generally been satisfied with standard service contracts. This is expected to change, however, with the company's expansion of product offerings. In the past, the company's primary business was in peripherals. With products like the 6000 family of intelligent workstations, response times, system availability, and professional services such as preinstallation planning, consulting, and user training will become more important.
- For spare parts, supplies, and accessories, users can phone in requests to an 800 number. Tektronix recommends that users purchase packaged spares for individual products or product groups. These packages are based on experienced failure rates for the products.
- Tektronix also involves users in self-support through board exchange and customer training. Users can send in information display product modules to the factory service center in Beaverton (OR) for repair. The company has established a customer service training program which includes classes on basic concepts and applications. Users can also order independent study aids such as audio tapes, video tapes, and printed materials. The company does not expect a significant increase in demand for user self-support services.
- Currently, Tektronix is not heavily involved with third-party maintenance. The company sometimes sells systems that incorporate other vendors' peripheral devices, and in those cases will provide maintenance on those products. The company stated that in the future it may provide more third-party maintenance, possibly subcontracting some business with hardware vendors.

## FACTORS EFFECTING SERVICE

- The company's major service-related problem, as well as many of its new opportunities, can be attributed to the expansion of its product line. Software support, a relatively new area for Tektronix, must be provided along with increased hardware support for the company's new products such as its design automation systems. Recruitment and training of support personnel will be a primary concern for Tektronix during this transition period.

- INPUT believes that software support should be centralized, rather than provided at each sales/service location as it is now. Customers should be able to call one location (800 number) to receive software support for any product. Software support can still be the responsibility of the various product groups, with systems analyst and application software engineers assigned to specific products.
- Remote support will play a significant part in the centralization of software support. With increased remote capabilities, the cost of providing support will decrease, since the need for on-site technical personnel will decrease.
- Parts logistics will be a critical factor in Tektronix's plans to increase its third-party maintenance (TPM) activities in the future. By setting up deals with manufacturers, Tektronix can obtain the parts it needs to step up its TPM operations. The company can increase its customer base by providing third-party maintenance to its current customers with multi-vendor systems as well as possibly providing service for the manufacturer's customers.



## SERVICE VENDOR PROFILE

**TELEX COMPUTER PRODUCTS, INC.**  
6422 E. 41st Street  
Tulsa, OK 74135

President, Telex Computer Products:  
George Bragg  
Vice President, Service Support  
Division: Roland B. Davie  
Revenues, Fiscal Year 1984:  
\$325 Million

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### THE COMPANY

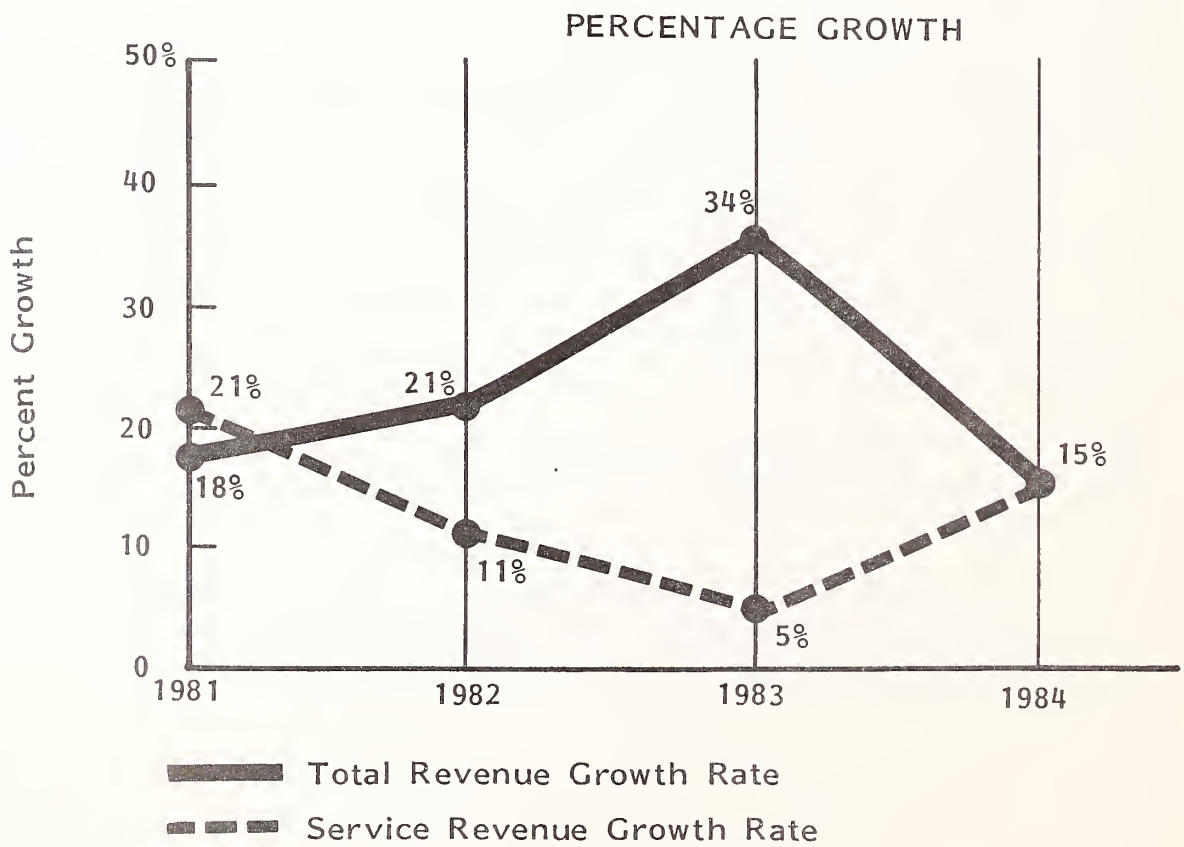
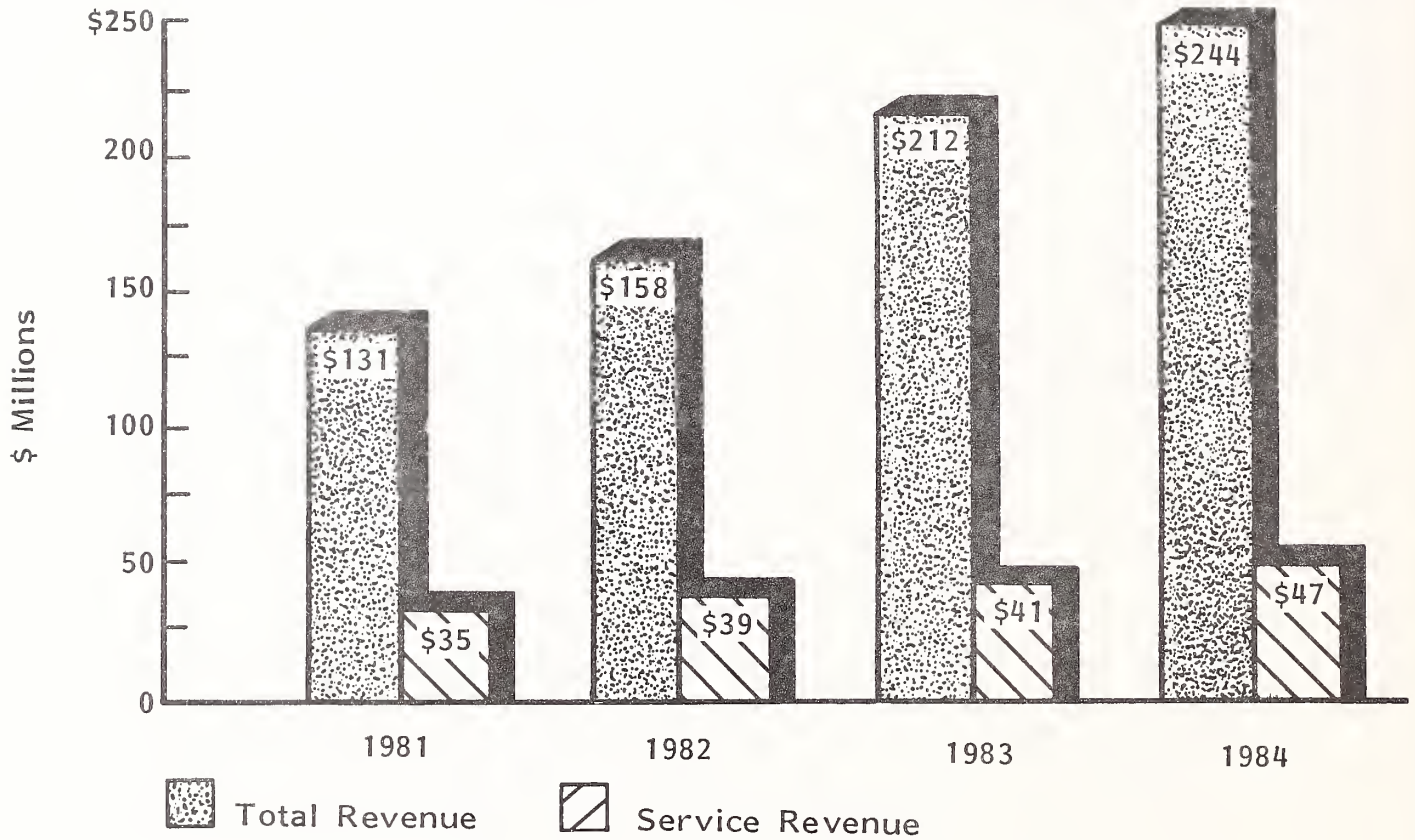
- Telex Corporation is divided into two business segments: Telex Computer Products, Inc. (TCPI) and Telex Communications, Inc. TCPI designs, manufactures, markets, and services computer terminals and peripheral equipment. Revenues are generated mostly from interactive terminals that are IBM plug compatible. In addition, TCPI's recently organized Advanced Systems Group (ASG) designs and manufactures advanced intelligent workstations. The company entered an agreement with MAD Computer Inc. that enables ASG to utilize technology developed at MAD for new products.
- In September 1984, Telex Computer Products, Inc. acquired Raytheon's Data System Division. Renamed the Telex Data Systems Division, the acquisition increased the customer service base for the company's Field Operations organization. Due to the acquisition, Telex is now the second largest manufacturer (second only to IBM) of terminals compatible with the IBM 3270. With the acquisition, Telex also entered the airline reservation terminal business and immediately held a 50% share in that market.
- TCPI's total revenues and service revenues have increased substantially over the past several years. Twelve years ago, the company experienced net losses and was heavily into debt. However, by 1984, revenues reached \$244 million, net income was \$47 million (Exhibit II-35). For the period 1980-1983, total revenues increased at an average growth rate of over 24% per year. In 1984, however, the growth rate declined to 15%. The growth rate for service revenues from 1980-1983 declined at the average rate of 11% per year, increasing to 15% in 1984.

### SERVICE DEMOGRAPHICS

- TCPI has approximately 2,000 service employees. Between 1,300 and 1,400 of these are field engineers or technicians supporting hardware, software, or both.
- The company has 75 branch offices and 300 service locations within the U.S. Although the company's eight regional offices and many of its branch offices serve as parts depots, the main parts depots are located in Forestville (MD),

EXHIBIT II-35

TELEX COMPUTER PRODUCTS, INC.  
REVENUE GROWTH



Toronto (Canada), Houston (TX), and at headquarters in Tulsa (OK). All of these facilities are repair and refurbishment centers.

## SERVICE ORGANIZATION

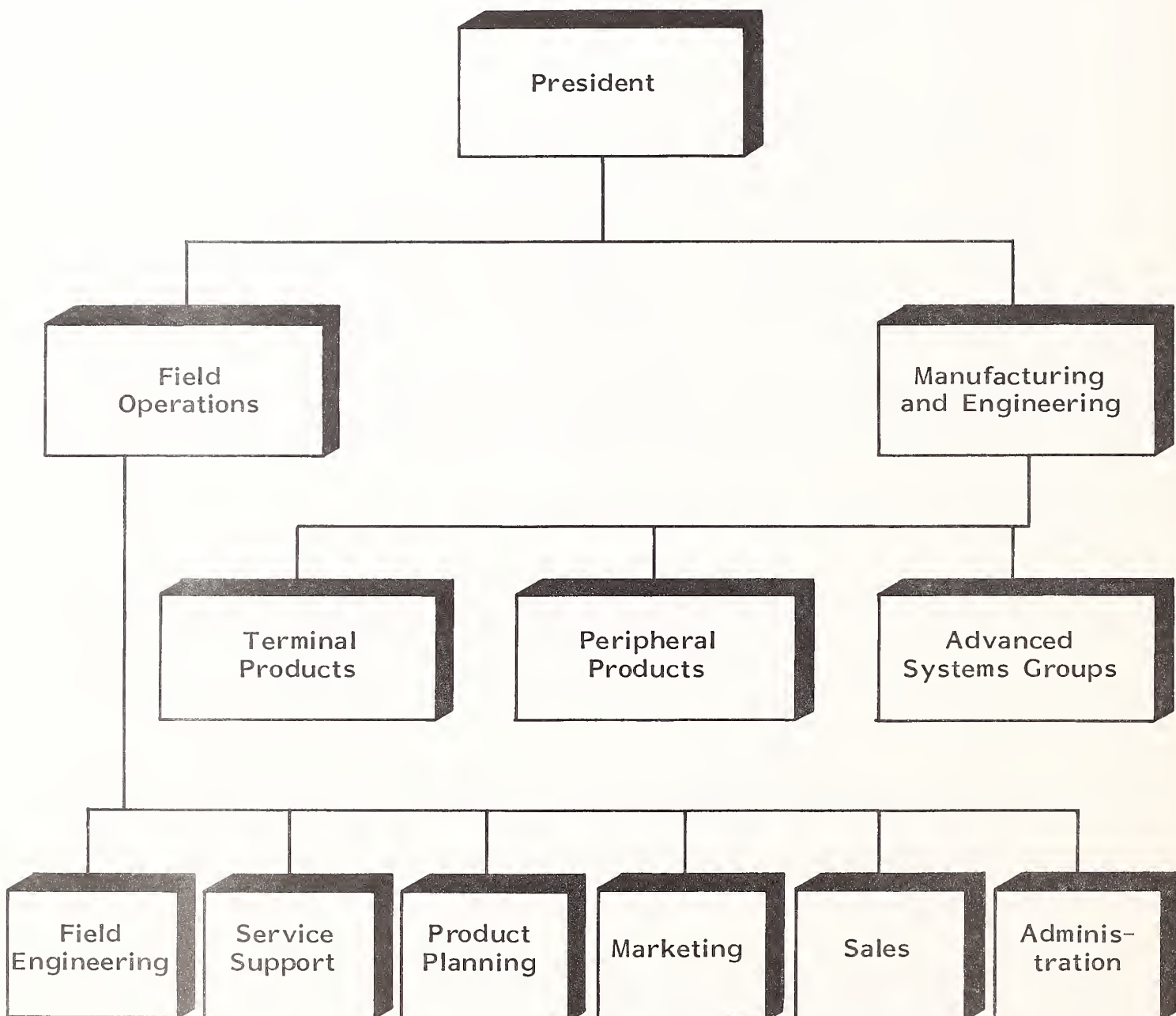
- As shown in Exhibit II-36, the company's Field Operations segment is divided into divisions. Field Operations has been a profit center since 1976.
- The Field Engineering division comprises 75 branch offices and 300 service centers, providing on-site service for both hardware and software through system analyst engineers.
- The Service Support Division involves software support during escalation as well as depot repair service. This division handles parts logistics and provides professional services including training, sale of supplies, and documentation of services. (Documentation on TCPI's products takes place in each of the three divisions within Manufacturing.) In addition, planning for revenues, profits, pricing, and discounts takes place within this division.
- In the Product Planning Division, planning for corporate revenues and profits takes place. A separate Business Planning Division was recently formed out of this division.
- The Marketing division, shared between Field Operations and Manufacturing, markets TCPI's products and provides support through systems analyst engineers. For example, this division is responsible for presale activities, including end user training.

## SOFTWARE SUPPORT

- Currently, less than 1% of TCPI's revenues are generated from software support. Because the company has been operating under the umbrella of IBM with its IBM plug-compatible terminals and other peripherals, IBM generally provides the software support. However, TCPI's new products such as local area networks (LANs) and advanced workstations will move the company into more software support.
- Under the Field Engineering division, on-site software engineers provide support for both applications and systems software; on-site hardware engineers are trained for software support only. Under the service support division, operating system software support is provided through the regional offices, the larger branch offices, and at headquarters (approximately 20 locations).
- TCPI does not make its solutions data base available to end users, nor does it plan to in the next three to four years. The reason stated is the low volume of users requiring it.
- Because of an expressed interest from end users, the company provides a variety of self-maintenance options. Instead of setting up a standard mainte-



TELEX COMPUTER PRODUCTS, INC.  
SERVICE ORGANIZATION



nance agreement, the end user can, for a fee, arrange to call the company's national support center for help with problems. (This would be for both hardware and software support.) The end user can also subscribe to a service providing technical information on self maintenance. Users are also encouraged to install patches and new releases, generally done through floppy disk exchanges.

## HARDWARE MAINTENANCE

- TCPI recognizes that the growth rate in hardware service revenues will slow. Due to requests from customers, the company has begun to unbundle services. For example, discounts are arranged for customers who wait until several terminals need repairing before requesting service. This reduces costs by lowering the 2:1 ratio of travel time to repair time.
- TCPI also has depots for parts exchange. The company sees a high growth potential in providing supplies and parts to end users. TCPI has been asked by customers to recommend inventory levels for parts and for ways to train their own employees in self-maintenance.
- TCPI provides training on-site with systems analyst engineers at most regional and branch offices. The company's worldwide training center is in Tulsa (OK).
- The company also provides remote fixes in the form of downline loading for firmware in order to speed problem resolution, reduce costs, and improve uptime.

## THIRD-PARTY MAINTENANCE

- In the early 1970s, TCPI provided third-party maintenance (TPM) for Four Phase, Computer Optics, and other companies; however, the company reduced its commitment to the TPM business in the late 1970s. The company plans to eventually get back into third-party maintenance, but does not foresee much growth in the next few years unless more manufacturers decide not to provide maintenance on their own products.
- Since the company would prefer to provide third-party maintenance for products not directly competing with its own, it is considering the computer-related medical electronics and transportation industries.

## FUTURE DIRECTIONS IN SERVICE

- TCPI identified the major service-related problem it is facing today as the cost of service. Customers resist paying more than 15% of the equipment's purchase price for service. TCPI believes that the start-up companies in the computer industry have driven labor costs up, while the cost of technology decreased. TCPI is working to take advantage of the technology.
- To make service more efficient, TCPI involves its field engineers in the design of the equipment and its service. The object is to take the mundane service requirements out and add features to facilitate remote support.

- The company attributes the increase in its engineers' productivity from 50% to 80% in the last several years to its larger installed base, national dispatching center, and experience regarding failure rates on equipment and parts.



## SERVICE VENDOR PROFILE

**TEXAS INSTRUMENTS, INC.**  
13500 North Central Expressway  
Dallas, TX 75265

President & CEO: Jerry R. Jenkins  
Service Division Manager:  
Bern Ebert  
Revenues, Fiscal Year 1984:  
\$5,742 Million

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### THE COMPANY

- Incorporated in 1930, Texas Instruments produces a wide range of high tech products and services, including semiconductors, electronics for government, and commercial computer products.
- The Data Systems Group is responsible for the design, manufacturing, and marketing of TI's minicomputers, business microcomputers, and data terminals. Sales in this market can best be described as disappointing. The minicomputer sales have been stagnant, microcomputer sales have fluctuated (TI suffered their greatest loss as a result of the failed home computer product in 1983, causing a misconception that TI had abandoned the microcomputer market altogether), and only the terminal side of the business has demonstrated steady growth. This trend will continue as a result of increased competition in the mini and microcomputer market and a slumping economy.
- In an attempt to counter the trend, TI is giving much more emphasis to designing systems for vertical market applications and taking the lead in artificial intelligence (AI) and expert system research and development.
- As a part of this, TI is moving away from retail and direct sales of their systems and moving toward value added resellers (VARs) as a primary source of systems sales. Part of the reason for this shift is the relatively poor image TI received from dealers and distributors, and the markets that these distribution points accessed as a result of TI's abrupt pulling of its home computer product, which failed despite spending huge amounts on television and print media advertising.
- Texas Instruments is offering a three-level support plan for VARs, graduated on the level of support that each VAR wants to engage in. If the VAR wants no involvement in service, TI will offer a one-time 10% "funder's fee" to any VAR who sells (or supplies a lead to sell) a service contract. If the VAR wants to maintain contractual control of a client, but does not want to actually maintain the equipment, TI will offer a 20% incentive to the VAR if the VAR screens the calls. If a VAR wants complete involvement in maintaining equipment, TI will allow them total freedom in setting policy, pay the VAR to perform warranty work, and perform any board level repairs at Houston for the VAR.

- TI revenue growth is shown in Exhibit II-37.

## SERVICE ORGANIZATION

- Service at Texas Instruments is a division that reports directly to the vice president of the Data Processing Group. The U.S. service organization is made up of 500 service engineers out of a total service staff of 1,400. Reporting to the national manager of field operations are three area managers who have 17 regional managers reporting to them.
- Profit and loss control is located at the area manager level, at which level managers also evaluate and modify service productivity as a result of TI's automated dispatching, inventory, and management system (to be described later).
- Exhibit II-38 provides details of TI's service organization.

## SOFTWARE SUPPORT

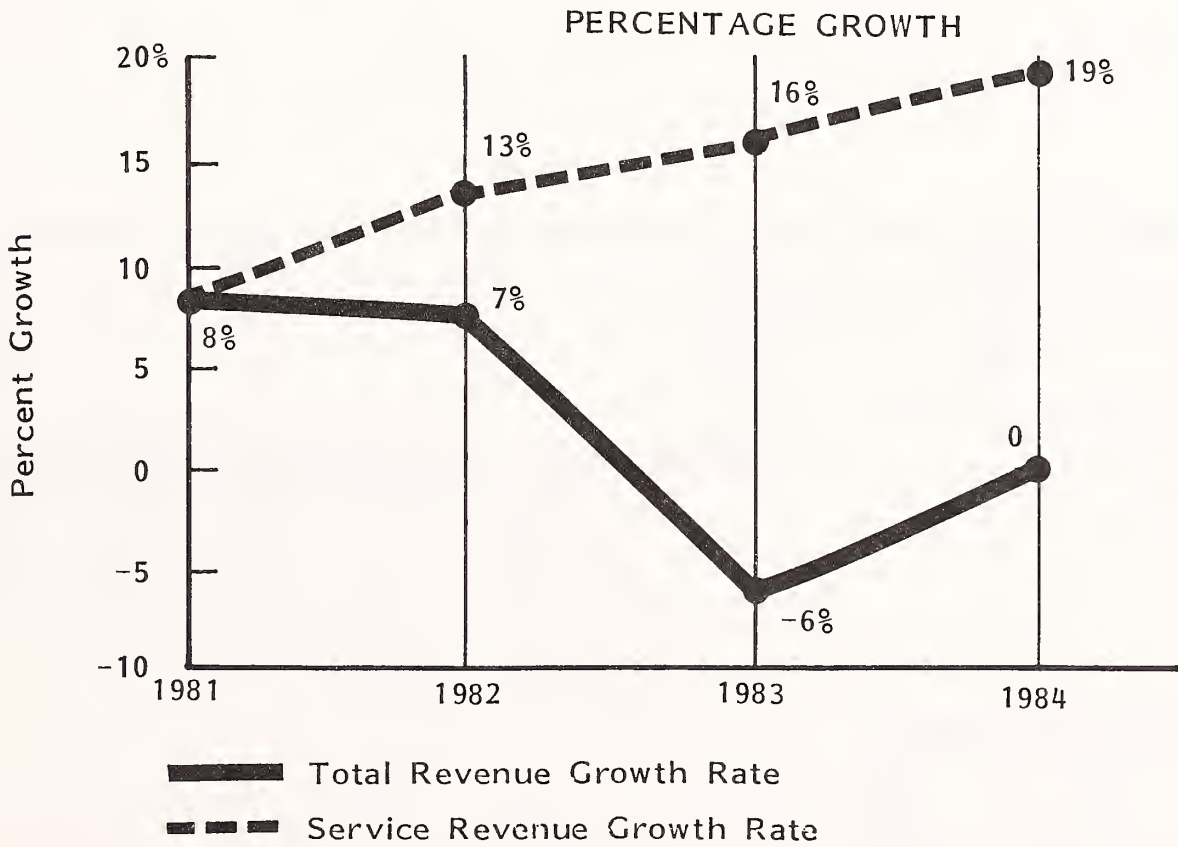
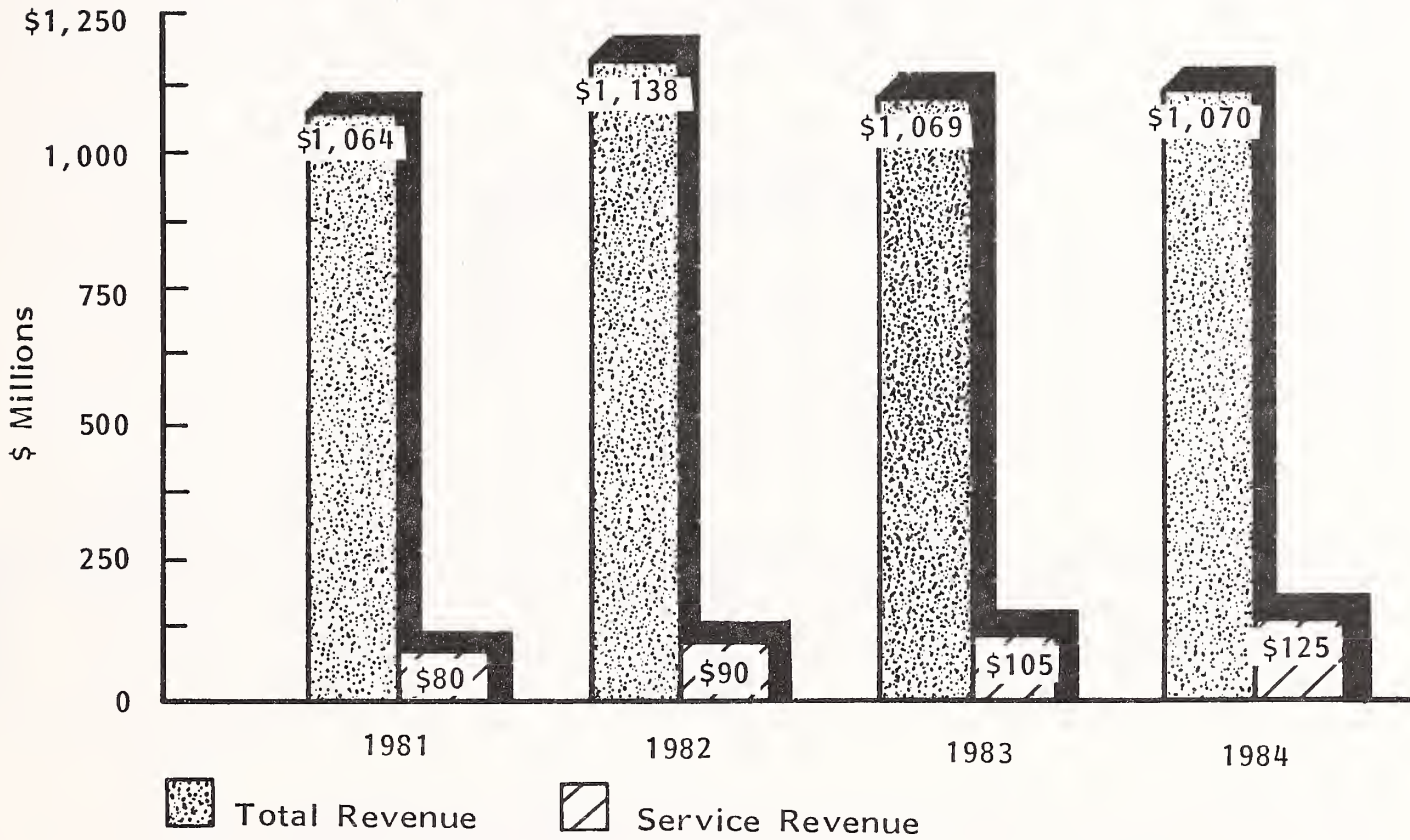
- Software support at TI is handled outside of the service division, currently through sales. TI provides software support to dealers, value-added resellers (VARs), and end users of their professional computers through a subscription service called "ProPak," which allows users 25 calls per year for a cost of \$250. These users can call a toll-free number in Austin (TX) to receive both operational and support information.
- Subscribers to "ProPak" can also qualify for a 25% discount on carry-in service on their hardware, demonstrating the coordination between hardware maintenance and software support groups at TI even though each group resides in different organizations within the company.
- Since TI's goal is to move away from the retail/carry-out marketplaces and toward vertical application markets, TI feels that the need for generalized software support will be diminished. Instead, TI sees the bulk of support necessary will be for supporting VARs, who will then be able to give much more specialized software support as a result of their understanding of each application.

## HARDWARE SUPPORT

- A Texas Instrument user initiates the service call by calling a toll-free national telephone call. This national dispatching number, located in Houston, Texas, puts the user in touch with a TI operator who, using a TI Professional Computer connected to a mainframe (IBM 370) in Dallas, enters the request. Along with pulling any historical data and account information, the system automatically routes the call through one of seven regional dispatch centers, where the call gets dispatched to the appropriate service location (one of 120).

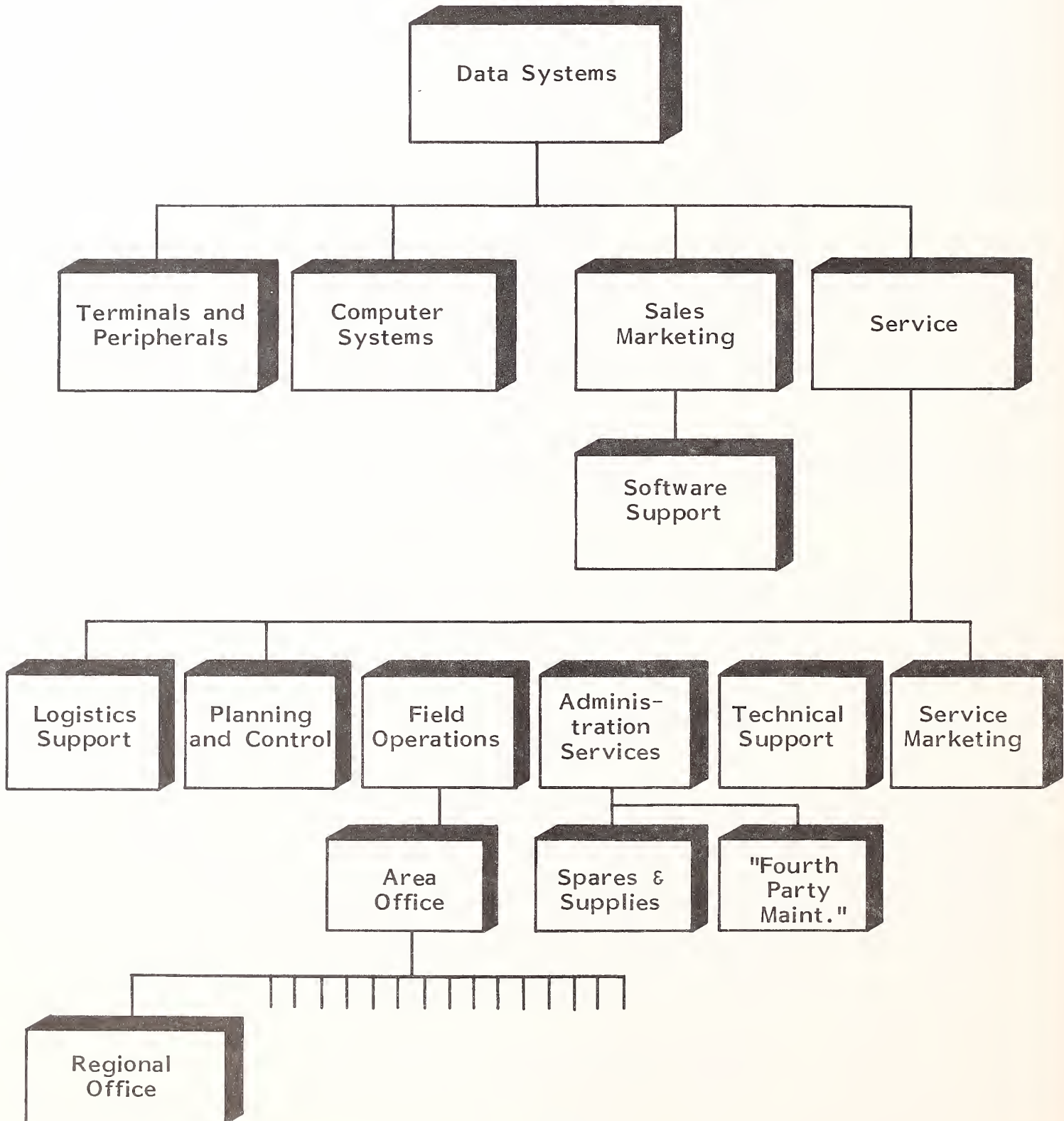
EXHIBIT II-37

TEXAS INSTRUMENTS, INC.  
REVENUE GROWTH





TEXAS INSTRUMENTS, INC.  
SERVICE ORGANIZATION



- Along with dispatching the field engineer, the automated dispatching system manages and updates spare parts inventory levels. TI's stated goal is that no more than 3% of all FE call backs result from the FE not having the correct spare. Since TI relies on the "man in the van" service technique, TI places high usage parts in each van. This has resulted in over 97% of the calls handled by parts in the van. Each FE also has access to spares stored at each service office and at the national parts depot in Houston.
- TI offers a wide range of hardware service offerings and coverages. Service availability covers 8 a.m. to 5 p.m., Monday through Friday. Coverage outside this is available at the current time-and-materials rate.
- TI offers remote diagnostics to users of the Business 300-800 series and DS990 Computer Systems models 4-36. The system requires dial-up communications (3780), DX10 (release 3.5.1) or DNOS (release 1.1.0), the respective diagnostics and communications software, and remote terminal support (940) software to run the on-line remote diagnostics. Potential problems are identified and logged and, if necessary, service specialists are dispatched.

### THIRD-PARTY MAINTENANCE

- Texas Instruments will provide third-party maintenance on high volume products associated with TI products, such as IBM PCs and printers that are attached to TI Professional Computers. In addition, TI will review any products for TPM when a TI product user is seeking a single source service provider.
- TI has also begun offering what they refer to as "Fourth Party Maintenance," which will be offered not to end users, but to existing service organizations (hence the term "fourth party"). Resulting from their own experience as to the need for inexpensive board level repairs in an automated remanufacturing environment, TI has opened their own facility in Houston (TX) to other service vendors. With 7,400 square feet, this is believed to be the largest remanufacturing facility in the U.S., and includes a class 100 clean room for sealed disk drive repair.
- Typical uses of such a facility would be remanufacturing and refurbishing of obsolete parts, particularly those that require a "clean room" environment. Service vendors would be able to expect a five-day turnaround on parts shipped to Houston, and pay for the service on a fixed-price per procedure.
- The benefit of such a service is clear cut. Since a manufacturer's first priority is to manufacture new products, service vendors often are forced to keep an extensive and thus costly inventory of spare parts. The ability to go to an outside source of parts, including those from aged or obsolete equipment, reduces the need for inventorying such parts.
- In addition, TI will perform any engineering changes required at this location.

## FUTURE SERVICE TRENDS

- The next service improvement that Texas Instruments appears to have targeted is tying together of the advances TI has made in the areas of service management automation, particularly in dispatching control and artificial intelligence, a software applications area that TI has been promoting since Autumn of 1984.
- The next logical step for TI in advancing their service management system is the integration of handheld terminals, such as those already in use by NCR and IBM, into their dispatching system. The advantages of handheld terminals are numerous: reduction of costly paperwork, reduction of parts usage reporting time, and eventually, reduction of the amount of documentation carried by each FE.
- TI can take this one step further by integrating the advances they have made in AI and expert systems development into their service management systems. Thus, the handheld terminals would be able to tie together an AI system that would track not only the current activities of FE tracking, parts inventory, and billing functions, but would also provide assistance to the FE in problem diagnosis and corrective steps necessary for problem resolution. Such systems are currently being used in other industries, such as in medicine and telecommunications, so the development of such a system for computer maintenance applications appears to be a logical and, eventually, necessary step by progressive service organizations.



## SERVICE VENDOR PROFILE

**TRIAD SYSTEMS CORPORATION**  
1252 Orleans Drive  
P.O. Box 61779  
Sunnyvale, CA 94088

President: William Stevens  
Vice President, Customer Services:  
Ralph Montelius  
Revenues, Fiscal Year 1984:  
\$120.4 Million

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### THE COMPANY

- Triad Systems markets small business computer turnkey systems developed for specific vertical markets including automotive parts wholesalers, warehouse distributors, hardware retailers, and tire dealers.
- The company's biggest selling product line, the Automotive Computer Systems, was developed for the automotive warehouse distributor/jobber. Applications include inventory management, purchasing, on-line customer order entry, accounts receivable, accounts payable, general ledger, sales analysis, automotive warehouse price updating, and more.
- Each system can be upgraded. Triad I, Series 10, or Series 12 can be added to models in flexible configurations in order to provide centrally controlled distribution for warehouse distributors with multiple distribution locations.
- Revenues and growth rates are shown in Exhibit II-39. For the fiscal year ending September 1984, revenues were in excess of \$120 million, a 33% increase from 1983.

### SERVICE DEMOGRAPHICS

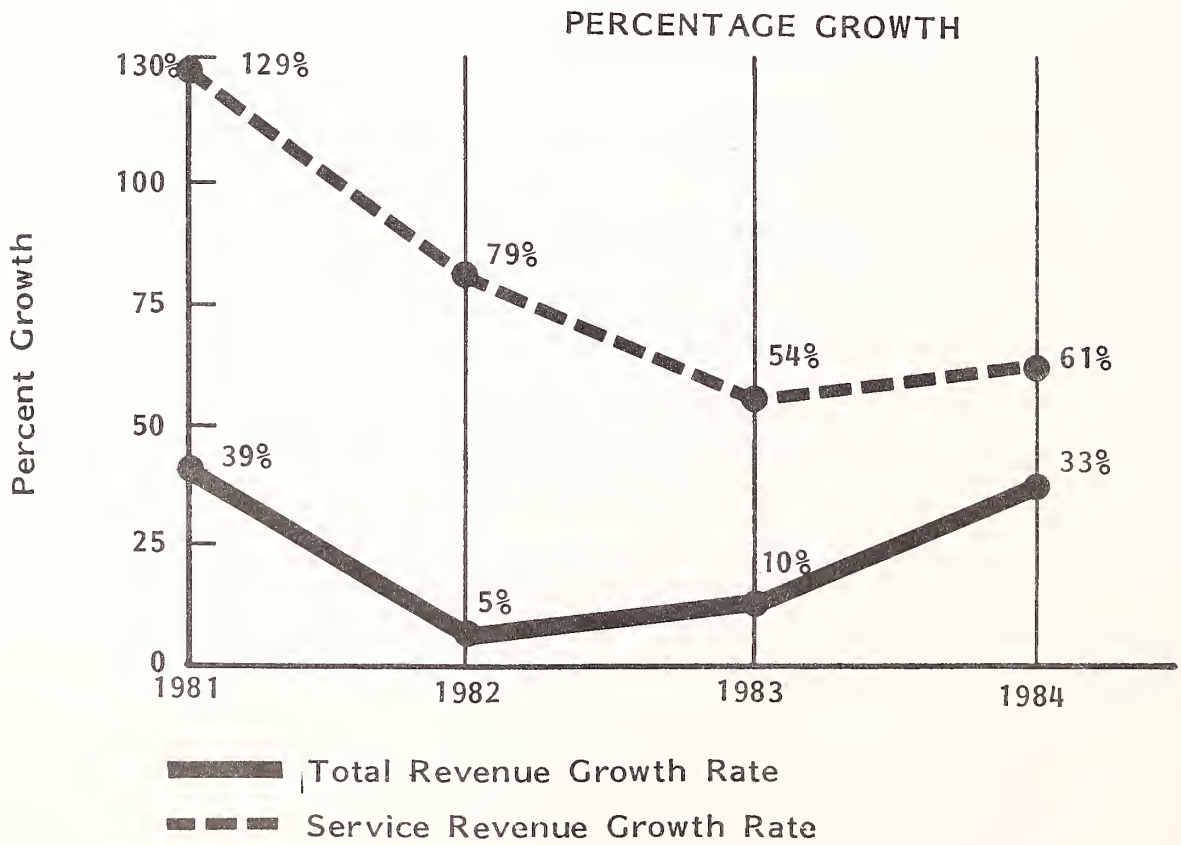
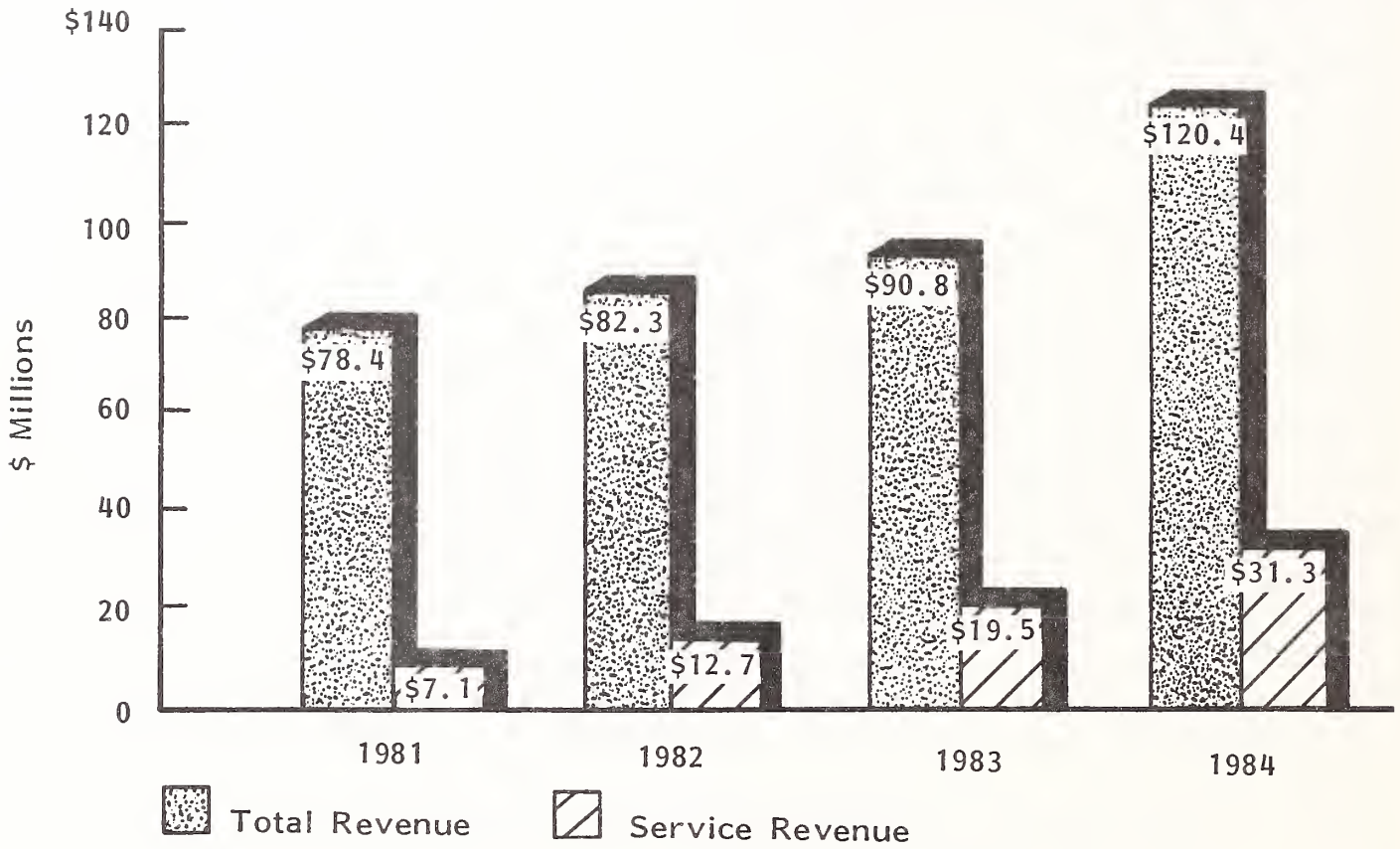
- Triad has approximately 130 service locations within the U.S. The company also has service locations in Canada and the United Kingdom.
- Triad has approximately 400 field engineers and software analysts providing customer support within the U.S.

### SERVICE ORGANIZATIONS

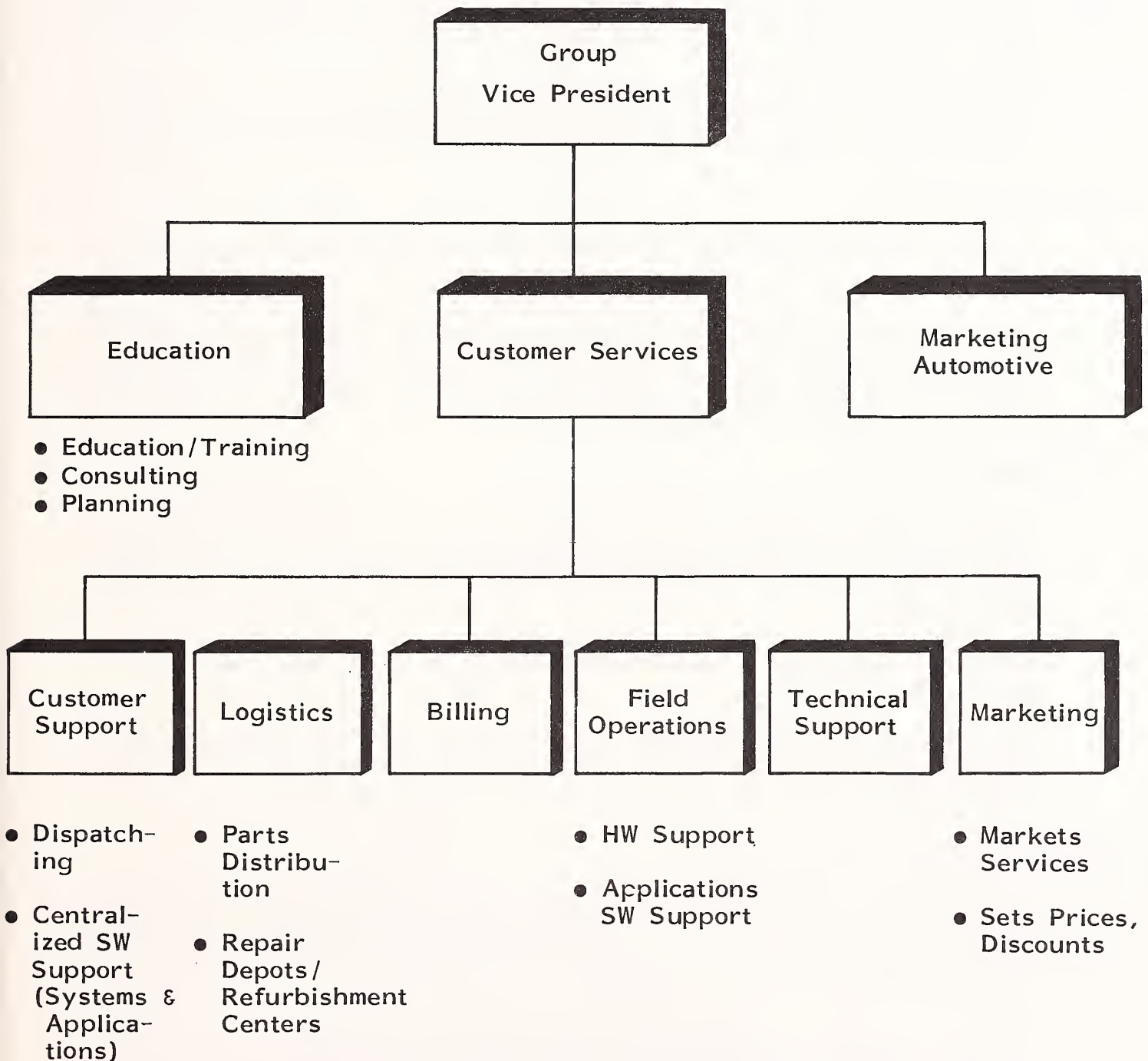
- A group vice president is responsible for the Customer Service division. The group responsible for marketing the firm's biggest seller, the Automotive Series, is outlined in Exhibit II-40.
- As shown, education is outside the Customer Service division. This division is responsible for education and training of support personnel and end users, as well as professional services such as planning, consulting, and documentation.

EXHIBIT II-39

TRIAD SYSTEMS CORPORATION  
REVENUE GROWTH



TRIAD SYSTEMS CORPORATION  
SERVICE ORGANIZATION





- Dispatching is done locally from the service locations. It is a function of Customer Services.
- Logistics handles the distribution of parts used for service. Repair depots and refurbishment centers are also operated within this unit.
- Field Operations involves hardware support and application software support. Both are provided by the field engineers working out of the 130 service locations.
- Technical Support provides centralized software support for both systems and applications software. Customers have direct access to software analysts through an 800 number.
- The marketing unit within Customer Services is responsible for setting prices and discounts in addition to marketing Triad service.

### SOFTWARE SUPPORT

- Triad's Purchase and Support Agreement is a standard contract provided for all customers. It includes hardware and software support.
- Triad's software analysts are called on for product development and maintenance. When customers call the 800 number for software support, they are put in contact with software analysts that specialize in specific products and may have a hand in their development.

### HARDWARE SUPPORT

- Triad's standard contract includes a 60-day free return option and a free 12-month warranty. Customers pay nothing for travel, parts, or labor for one year. After one year, service is provided for approximately 9% of the system's cost.
- Preventive maintenance and on-site customer training are also part of the agreement.
- Currently, there is no unbundling of services. In the future, the company could provide a menu of service options to include extended service hours, varied response times, guaranteed system availability, and more.

### FUTURE TRENDS IN SERVICE

- INPUT finds it significant that Triad cross-trains its field engineers to provide applications software support in addition to hardware support. NAS and Amdahl, also relatively small companies, cross-train their field engineers to provide both types of support as well.
- Larger companies currently involved with systems integration for specific vertical markets include NCR (banking), Honeywell (manufacturing), and

Sperry (government). These companies have separate, very well defined groups providing software and hardware support.

- NAS and Amdahl are currently receiving very high user satisfaction ratings. It is too early to tell whether these companies can continue to cross-train their field engineers, because the high cost of doing so will increase further with new product introductions and increased service requirements.
- If software support is provided remotely by software analysts, hardware engineers can assist with problem determination. By maintaining a rapport between the field engineer and the customer, user satisfaction will remain high.
- Triad might consider establishing a centralized hardware support unit to provide any possible remote hardware support. This unit could also be responsible for dispatching.

## SERVICE VENDOR PROFILE

### WANG LABORATORIES

One Industrial Avenue  
Lowell, MA 01851  
(617) 459-5000

President and COO:

Dr. An Wang

Vice President, Customer Service:

Raymond C. Cullen, Jr.

Revenues, Fiscal Year 1984:

\$2.185 Billion

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### THE COMPANY

- Wang Laboratories, Inc., headquartered in Lowell (MA), is a leading supplier of computer-based integrated information processing systems, including word, data, image, and voice processing as well as telecommunications and networking.
- Founded in 1951 by Dr. An Wang, the company has grown steadily throughout its history. The company marketed its first word processing products in the early 1970s, when it also introduced its first data processing products, a line of small business computers called the 2200 series. Wang was one of the first companies to merge word and data processing onto one system, and today's systems, while still offering advanced word processing, are optimized for data processing applications.
- Recent trends in the office automation industry have seen the convergence of office systems, communications, and host data processing--a market Wang calls Integrated Information Processing. The company now offers a complete range of interactive systems centering around the VS family of computers that provide information solutions to the user.
- Exhibit II-41 lists service and total revenue growth at Wang from 1981-1984.

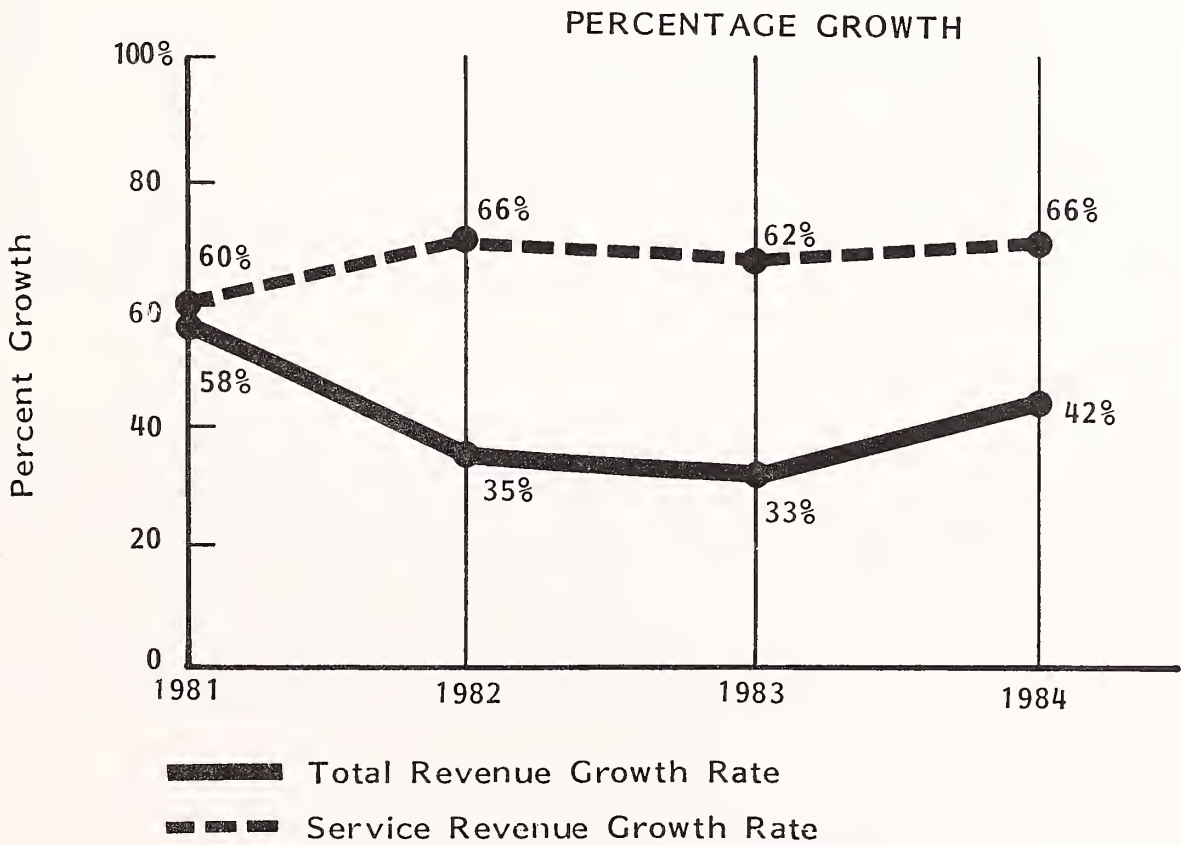
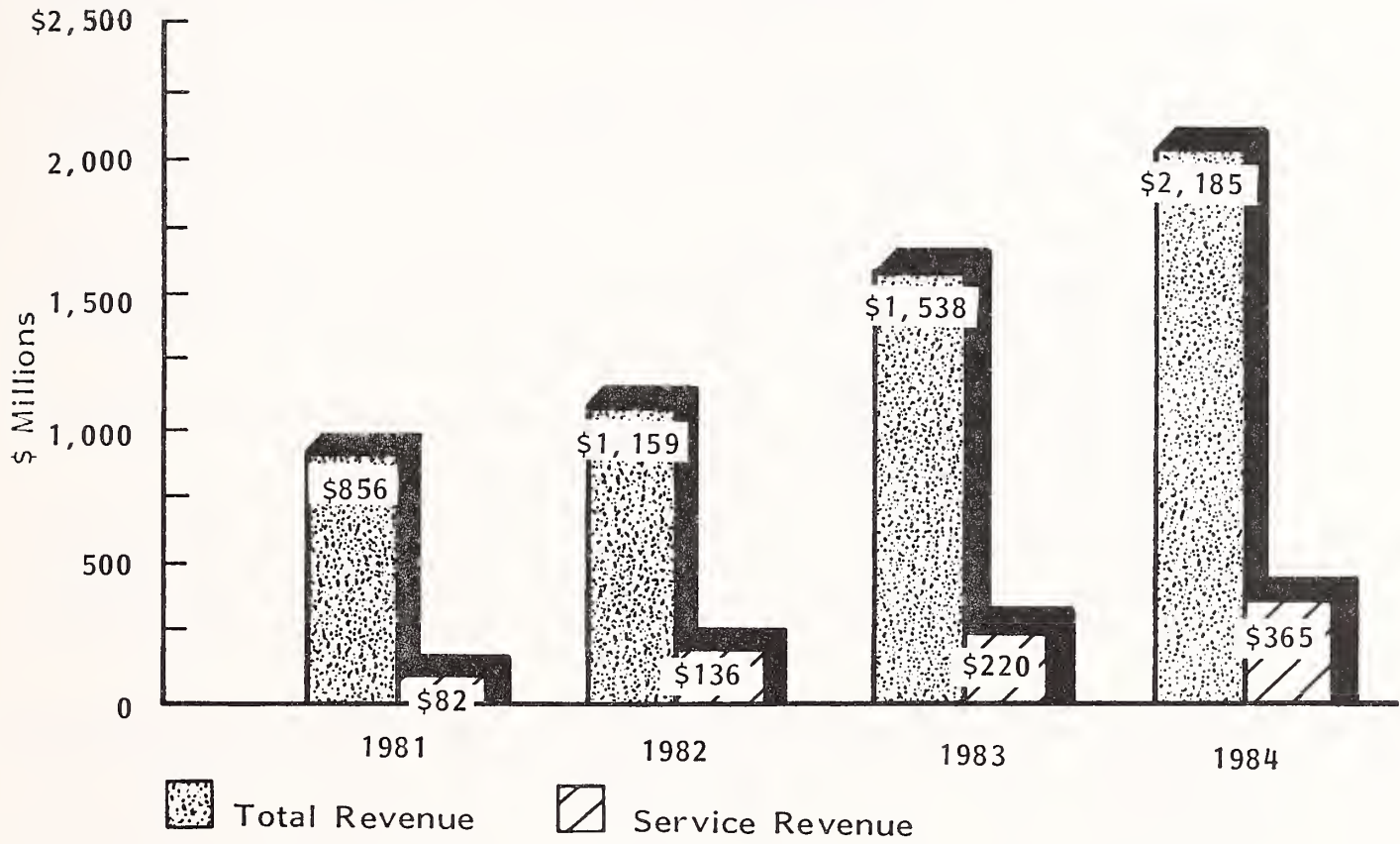
### SERVICE DEMOGRAPHICS

- Worldwide, Wang has 482 service locations and 6 parts depots. Within the U.S. the company has 375 service locations and 3 parts depots.
- The company has 8,720 service and support employees worldwide. Of those, 4,555 are customer engineers (hardware), 1,400 are software engineers, and 2,765 are sales support analysts. Within the U.S., there are approximately 2,854 customer engineers, 360 software specialists, and 1,567 sales support analysts.



EXHIBIT II-41

WANG LABORATORIES  
REVENUE GROWTH



## SERVICE ORGANIZATION

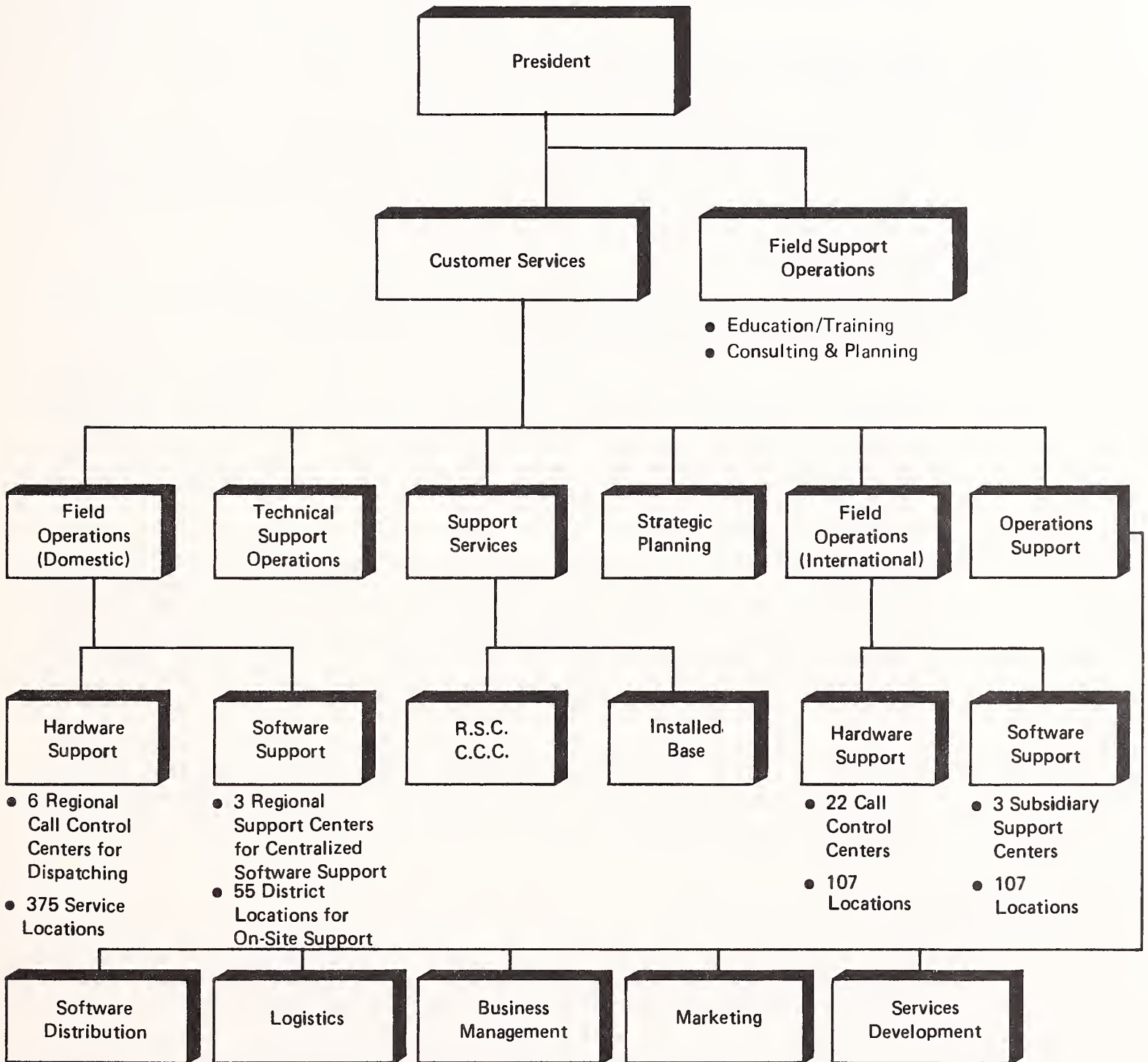
- Wang's Customer Services division, outlined in Exhibit II-42, consists of Field Operations, Support Operations, and Technical Support Operations. The division has been operated as a profit center for over five years and reports directly to the president of Wang.
- Field Operations is responsible for both hardware and software support. Within Field Operations, there are six regional call control centers responsible for dispatching customer engineers located at the 375 service locations.
- There are also six regional support centers staffed with software analysts who provide centralized software support. In addition, these centers are responsible for dispatching software support specialists on-site from the company's 55 district locations.
- Support Operations includes: Software Distribution, Parts Logistics, Business Management, Marketing, and Services Development.
- Parts Logistics is used to distribute spare parts required to service Wang equipment. Sale of supplies to customers is provided by another group outside the Customer Services organization, consisting of approximately 45 people. Customers can call an 800 number to order supplies with a 24-hour turnaround time.
- Business Services includes planning for revenues and profits. This group also works with the Customer Services marketing group in establishing prices and discounts.
- The Marketing group is involved with developing sales strategies and sales tools, marketing services, and conducting market research. The Services Development group develops new services based on the market research.
- Professional Services such as planning and consulting are managed by a sales operations group outside Customer Services.
- Technical Support Operations within Customer Services works with the Research and Development (R&D) function to identify users' technical requirements.

## SOFTWARE SUPPORT

- Wang offers centralized software support from six regional support centers worldwide and claims to be solving 60% of software problems within 30 minutes. In 90% of these cases, the software analyst is able to resolve the problem over the phone. The software analysts are specialists in their particular product line.
- Wang offers Remote Link software on its VS systems. With Remote Link the customer can use his workstation while being hooked into a Wang support

EXHIBIT II-42

WANG LABORATORIES  
SERVICE ORGANIZATION





center and the software analyst will have the customer's screen reproduced on his own.

- Wang is focusing on the use of remote maintenance to maximize system uptime. This approach allows a Wang software analyst to perform a full range of troubleshooting functions to identify problems, examine files, and monitor device communication activity.
- Wang also has a solutions data base available for use by the software analysts at the regional support centers.
- Currently, users do not have access to the solutions data base and are not usually involved with installing new releases or patches. Wang plans to involve the user in support more in the future. A customer magazine is already being mailed out which outlines typical problems and their solutions.

### **HARDWARE SUPPORT**

- Hardware support is provided by hardware customer engineers from the 375 (482 worldwide) service locations within Field Operations.
- As mentioned earlier, the regional support centers can often determine whether a customer's problem is hardware or software related. When the problem is hardware related, the customer engineer is better prepared and can bring the required parts for service when making the first on-site visit. This capability reduces the cost of service and the repair time while increasing customer satisfaction.
- Wang offers a menu of service options or an unbundling of services to its customers. For example, the customer can choose to have a 98% or 99% guaranteed uptime under the WangCare Plus program. With the Uptime 300 program, when the customer buys the VS300 and a maintenance contract, he is guaranteed 98% uptime free of charge. Wang has also extended its service from 5 p.m. to midnight without charging a premium.
- Wang recently completed a study on networking and found that customers are looking for consultation in implementing multi-vendor systems. Wang currently provides third-party maintenance on selected peripherals only, but is considering the opportunities and risks involved with expanding its third-party maintenance operations.

### **EDUCATION AND TRAINING**

- Wang currently has in progress its "pursuit of excellence" program. The program includes testing sales and support skill levels to ensure they have the marketing and technical expertise to work on assigned products.
- The company's 50 regional education centers located in major metropolitan areas provide internal training as well as training for some customers. Training on operations, applications, and troubleshooting is also available at

customer sites through self-paced material, teleconferencing, and specially designated classes where applicable.

- Wang has also collaborated with large customers such as Bank of America to train the customer's internal technical force.

## FUTURE TRENDS IN SERVICE

- INPUT supports Wang's decision to combine the six regional call control centers used for dispatching hardware engineers on-site with the three regional support centers used for software support. The company plans to have three domestic support centers providing a more centralized integrated approach to support.
- One factor weighing in favor of providing third-party maintenance is that users want service vendors that can provide service on a variety of products. Another factor is that TPM business allows the service vendor to use its service work force more efficiently. With more reliable equipment, less service is required. An important consideration, however, is parts logistics. The maintenance of extensive parts depots is expensive, but the TPM vendor must have access to parts when they are needed.

## SERVICE VENDOR PROFILE

XEROX CORPORATION  
P.O. Box 1600  
Stamford, CT 06904

President: Daniel T. Kerns  
Vice President, Field Service  
Operations: Ronald Mercer  
Revenues (Information Systems), Fiscal  
Year 1984: \$1.7 Billion

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### THE COMPANY

- The term "Xerox" has become synonymous with copiers and for good reason. Over the last 25 years, the New York-based manufacturer has dominated the copier market and led the technological development in this area. The company has attempted to diversify, however, and the Information Systems division now represents one of Xerox's major revenue sources.
- Revenue derived from the Information Systems division increased 27% in 1984 to \$1.7 billion. Information systems, as defined by Xerox, include printers, information processing systems, electronic typewriters, and facsimile transceivers. Overall, Information Systems revenue has increased from 12% of total corporate revenues in 1982 to 15% in 1984.
- Because of the company's acknowledged experience in the copier market, it came as no surprise that Xerox intended to compete primarily in the office automation market. However, a number of factors conspired to limit the success of this venture. First, the company did not have a comprehensive line of DP products to compete against established rivals, such as IBM and Wang. Second, the company lacked a comprehensive sales strategy. Frequently, different divisions' sales staff were competing with each other for a customer's account. And third, a very limited marketing strategy attempted to focus on market niches not currently served by office automation leaders. While this may be a successful long-term strategy for survival, it has not offered Xerox the desired level of revenue growth.
- Xerox has identified the major problems in its strategy and is taking steps to become more competitive in the office automation market.
  - The company's various product-dedicated sales forces have been combined to provide the user with a more uniform sales organization.
  - New products have been introduced which can interact with competitive products (see below).
  - The "Team Xerox" approach is not as dependent on niche marketing and seems more willing to compete head-on in the office automation market as a whole.



- New products introduced by Xerox to compete in the office automation market include the:
  - 6085 Professional/Personal Computer, a low-end version of the Star which can be configured with up to 3.7 MB of memory and 80 MB of storage.
  - 6067 Word Processor workstation.
  - 6064 workstation, built by Olivetti and selling for under \$3,000.
  - 3700 high-end 24 PPM printer, designed for network application, which can be shared by up to four PCs.

### SERVICE DEMOGRAPHICS

- Xerox has over 150 service offices in the U.S. In keeping with the Team Xerox concept, these offices service both reproduction and service equipment. The company has indicated that it has over 13,000 service engineers and technicians, 6-8% of whom INPUT estimates are dedicated to Xerox computer system products. Dispatching and logistics are coordinated at the local service office level.

### SOFTWARE SUPPORT

- Software support is offered both at the local level and remote locations via toll-free telephone numbers. Local support is offered out of the company's branch offices and includes both telephone support and on-site support via a software-trained field analyst. These analysts are typically cross-trained in both hardware and software problem identification, and they work closely on-site with the hardware service representative.
- Remote software support is available for selected products, such as Star and Ethernet networks. Part-to-part diagnostics are available, although the company has indicated that a high level of user involvement in support is expected, particularly on low-end machines. Remote support is used primarily by on-site field analysts rather than by customers calling directly.

### HARDWARE SUPPORT

- As noted above, computer hardware support at Xerox has been merged with reproduction equipment support. Although INPUT does not believe that engineers have been cross-trained, this still represents a major service network organization.
- Hardware engineers are dispatched from the local offices and although service is usually provided on-site, the dispatcher frequently provides selected remote support to the user. Because dispatching is carried out at the local office, response times vary considerably, but generally the local offices can offer

same-day response. For example, in a recent study of Xerox 9700 printers, user's reported an average two-hour response time.

- Xerox service options vary by product, but in general include:
  - Full service maintenance on-site, Monday through Friday, 8 a.m. to 5 p.m. coverage (after hours coverage available). This service includes all repair, parts, and retrofit activities.
  - Xerox Service Center Maintenance includes:
    - Customer carry-in or mail-in.
    - Xerox pick-up and delivery. Normally, the customer must be within 15 miles of a service branch office to utilize this option.
    - Xerox pick-up and delivery with loaner.
  - Time and Materials coverage requires a one hour minimum and rates are \$85 per hour (primo) and \$106 per hour (non-primo).

### THIRD-PARTY MAINTENANCE

- Xerox Corporation entered the third-party maintenance business in 1983 with its Xerox Americare unit. Xerox Americare, specializing in microcomputers, provides on-site, carry-in, and pick-up and delivery service for dealers and corporate customers carrying IBM computers. The organization also services computers made by Epson, Corona, Kaypro, and Osborne, and several brands of printers.
- Under its dealer program, Xerox Americare provides dealers with a one-year warranty on all parts and labor and a 20% commission on all units Xerox repairs. Xerox expects dealers to generate at least \$1,000 worth of business per month. In return, the affiliation with Xerox better equips dealers to compete for national account business.
- In addition to the dealer program, Xerox has a major accounts program which attempts to meet the needs of corporate data processing managers. Xerox views this program as one for those not serviced directly by dealers. Dealers may perceive it as a competitive program, which could affect their support of Americare.
- Total revenue generated from Xerox Corporation's third-party maintenance is estimated to be \$18 million. Expected growth rate for 1985 is 10-12%. The company has over 90 service locations with an estimated 400 field engineers dedicated to TPM activities.
- Xerox offers a wide variety of services to TPM users, including remedial and preventive maintenance, engineering changes, installation/deinstallation, consulting, training, and documentation.

- Brands serviced by the Americare unit include: Amdek, Applied Computer Sciences, Compupro, Corona, Data South, DEC, Diablo, Epson, IBM, Liberty Electronics, Morrow Designs, Okidata, Osborne, Shugart, and STM.
- Xerox utilizes a computerized system for TPM dispatching. The company's escalation procedures are to call in a technical specialist (located at that service location and specializing in that product), request assistance from one of ten technical centers, and notify the national level. In addition, the company has a computerized inventory tracking system that ties into its dispatching system. To plan inventory levels, minimum and maximum acceptable levels are established for each part, and the economic order quantity is calculated. Xerox does not obtain parts through users. It has discounted sources of spare parts available, some guaranteed by long-term contracts of up to five years.

### FUTURE TRENDS IN SERVICE

- In addition to its technical strengths, Xerox is well respected for its commitment to service, and INPUT expects this commitment to continue as the company expands the number of products aimed at the office automation market. Expanded consulting and planning services are expected as Xerox attempts to integrate their own products into markets traditionally dominated by companies such as Wang and IBM.
- Xerox has a number of advantages in the OA market, which INPUT expects the company to exploit.
  - They know the office automation market. This is the company's traditional market, unlike other, more technical vendors who are just entering the marketplace.
  - Xerox has a large service network already in place.
  - With their Americare third-party maintenance unit, Xerox can offer a variety of services to prospective customers.
- This last advantage, the ability to offer single source service, may be pivotal to the company's OA success. INPUT has found from previous studies that the office automation market is particularly demanding of highly coordinated service. Of all the major vendors in this market, only DEC and Xerox have addressed this user need, and DEC will service only non-competitive products. Xerox's service flexibility is, INPUT believes, a substantial competitive advantage which can result not only in improved service revenues, but also increased product sales and greater account control.





## APPENDIX A: QUESTIONNAIRE





APPENDIX A  
VENDOR PROFILE QUESTIONNAIRE

Manufacturer Name :

Address :

City :

State, Zip :

Interviewer :

Date :

RESPONDENT

TITLE

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.

1. Demographics

A. Total Number of Field Service Employees

B. Number of Engineers (FE and SE)

C. Number and Location of Parts Depots

D. How many service locations in the U.S.

2. Background Information

3. A. Total Company Revenue
- B. Total Service Revenue
- C. Service Revenue Growth Rate
- D. How Long Have You Been a Profit Center?
4. A. Do you service systems and applications software from the same location (where)?
- B. How is Software Support typically delivered? (1 = Never, 10 = Always)
1. Remote Diagnostics \_\_\_\_\_
  2. Down Line Load (Remote Fix) \_\_\_\_\_
  3. On-Site Hardware Engineer \_\_\_\_\_
  4. On-Site Software Engineer \_\_\_\_\_
  5. Mail \_\_\_\_\_
  6. Other \_\_\_\_\_
  7. Software Installed by FE is Charged T&M Rate \_\_\_\_\_
  8. Toll Free Numbers (PC) \_\_\_\_\_
- C. Are users encouraged to become involved in software support?
1. Install Patches, New Releases \_\_\_\_\_
  2. Access Solutions Data Base \_\_\_\_\_
  3. Direct Access to Software Engineer \_\_\_\_\_
  4. Purchase os Source Code \_\_\_\_\_
  5. Some Software is User-Installable \_\_\_\_\_



5. Does your department have responsibility for the following customer service functions? (If yes, for how long)

<u>FUNCTION</u>	<u>CONTROL (Y/N)</u>	<u>WHEN</u>
A. Planning (Revenue/Profit)		
B. Marketing		
C. Sales Support		
D. End-User Documentation		
E. Pricing		
F. Discounts		

6. Where do these service functions fit into your organization?
- A. Dispatching
  - B. Logistics/Parts Supply
  - C. Depots
  - D. Refurbishment Centers
  - E. Software Support
    - 1. Applications
    - 2. Systems
  - F. Professional Services
    - 1. Consulting
    - 2. Planning
    - 3. Etc.
  - G. Sales of Supplies
7. Could I have a copy of your service department organization chart?

8. Which of the following services offer your company the best opportunity for growth (as a percent of total service revenue)?

<u>SERVICE/MARKET</u>	<u>PERCENT GROWTH EXPECTED</u>
A. Third Party Maintenance	
B. Education/Training	
C. Professional Services	
1. Consulting	
2. Planning	
3. Custom Programming	
4. Site Audits	
5. Sales of Supplies	
D. Hardware Maintenance	
1. Installation/Deinstallation	
2. Extended Services	
3. Unbundling Basic Services	
4. User Self Support	
E. Software Support	
1. On-Site	
2. Remote	
3. Problem Data Bases	
4. Self Support	
5. Applications Software	
6. Systems Software	
7. Unbundled Contracts	

10. A. What do you see as the major service-related problem area your company must face right now?

B. In the next 2-3 years?





## APPENDIX B: DEFINITIONS



## APPENDIX B: DEFINITIONS

- APPLICATIONS SOFTWARE - Software that performs processing to service user functions.
- CONSULTING - Includes analysis of user requirements and the development of a specific action plan to meet user service and support needs.
- DISPATCHING - The process of allocating service resources to solve a support-related problem.
- DOCUMENTATION - All manuals, newsletters, and text designed to serve as reference material for the ongoing operation or repair of hardware or software.
- END USER - May buy a system from the hardware supplier(s) and do his own programming, interfacing, and installation. Alternatively, may buy a turnkey system from a systems house or hardware integrator.
- ENGINEERING CHANGE NOTICE (ECN) - Product changes to improve the product after it has been released to production.
- ENGINEERING CHANGE ORDER (ECO) - The follow-up to an ECN which includes parts and a bill of material to effect the change in hardware.



- ESCALATION - The process of increasing the level of support when and if the field engineer cannot correct a hardware or software problem within a prescribed amount of time, usually two to four hours for hardware.
- FIELD ENGINEER (FE) - For the purpose of this study, field engineer, customer engineer, service person, and maintenance person were used interchangeably and refer to the individual who responds to a user's service call to repair a device or system.
- HARDWARE INTEGRATOR - Develops system interface electronics and controllers for the CPU, sensors, peripherals, and all other ancillary hardware components. May also develop control system software in addition to installing the entire system at the end-user site.
- LARGE SYSTEM - Refers to traditional mainframes including at the low end IBM 4300-like machines and at the high end IBM 308X-like machines. Large systems have a maximum word length of 32 bits and a standard configuration price of \$350,000 and higher.
- MEAN TIME BETWEEN FAILURES (MTBF) - The elapsed time between hardware failures on a device or a system.
- MEAN TIME TO REPAIR - The elapsed time from the arrival of the field engineer on the user's site until the device is repaired and returned to the user for his utilization.
- MEAN TIME TO RESPOND - The elapsed time between the user placement of a service call and the arrival at the user's location of a field engineer.
- MINICOMPUTER - See Small System.
- OPERATING SYSTEM SOFTWARE (SYSTEMS SOFTWARE) - Software that enables the computer system to perform basic functions. Systems software,

for the purposes of this report, does not include utilities or program development tools.

- PERIPHERALS - Includes all input, output, and storage devices, other than main memory, which are locally connected to the main processor and are not generally included in other categories, such as terminals.
- PLANNING - Includes the development of procedures, distribution, organization, and configuration of support services. For example, capacity planning, "installation" planning.
- PLUG-COMPATIBLE MAINFRAME (PCM) - Mainframe computers that are compatible with and can execute programs on an equivalent IBM mainframe. The two major PCM vendors at this time are Amdahl and National Advanced Systems.
- SMALL BUSINESS COMPUTER - For the purpose of this study, a system which is built around a Central Processing Unit (CPU), has the ability to utilize at least 20 Mbytes of disk capacity, provides multiple CRT workstations, and offers business-oriented system software support.
- SMALL SYSTEM - Refers to traditional minicomputer and superminicomputer systems ranging from a small multi-user, 16-bit system at the low end to a sophisticated 32-bit machine at the high end.
- SOFTWARE ENGINEER (SE) - The individual that responds (either on-site or via remote support) to a user's service call to repair or patch operating system and/or applications software.
- SOFTWARE PRODUCTS - Systems and applications packages which are sold to computer users by equipment manufacturers, independent vendors, and others. Also included are fees for work performed by the vendor to implement a package at the user's site.

- SUPERMINICOMPUTER - See Small System.
- SYSTEM INTERRUPTION - Any system downtime requiring an Initial Program Load (IPL).
- SYSTEMS HOUSE - Integrates hardware and software into a total turnkey system to satisfy the data processing requirements of the end user. May also develop system software products for license to end users.
- TRAINING - All audio, visual, and computer-based documentation, materials, and live instruction designed to educate users and support personnel in the ongoing operation or repair of hardware and software.
- TURNKEY SYSTEM - Composed of hardware and software integrated into a total system designed to completely fulfill the processing requirements of a single application.











