

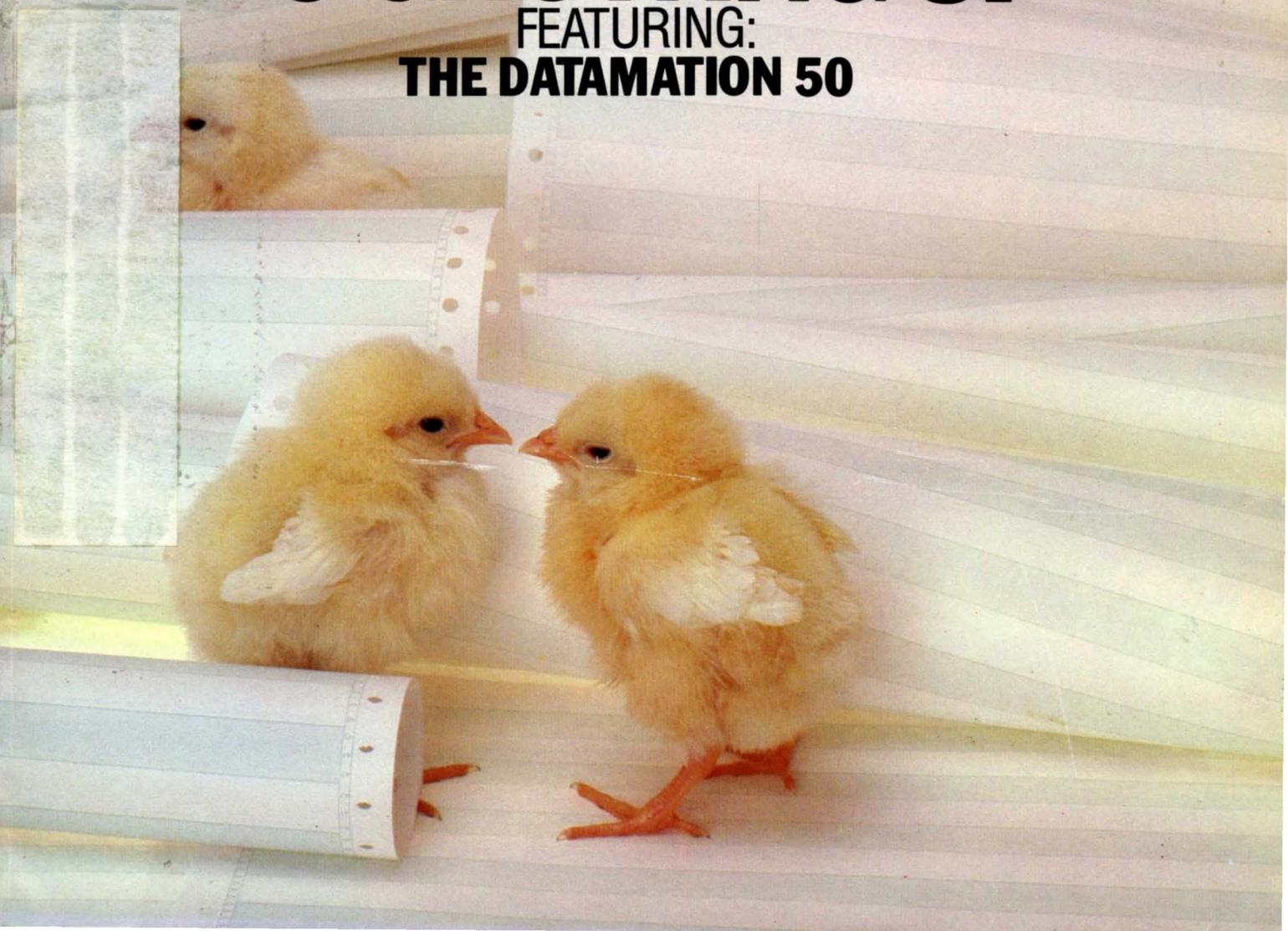
SPECIAL EDITION

DATAMATION 79 **N**®

MAY 25/ 5.00 USA

THE DP INDUSTRY PROFILE: AN INFANT INDUSTRY IS GROWING UP

FEATURING:
THE DATAMATION 50

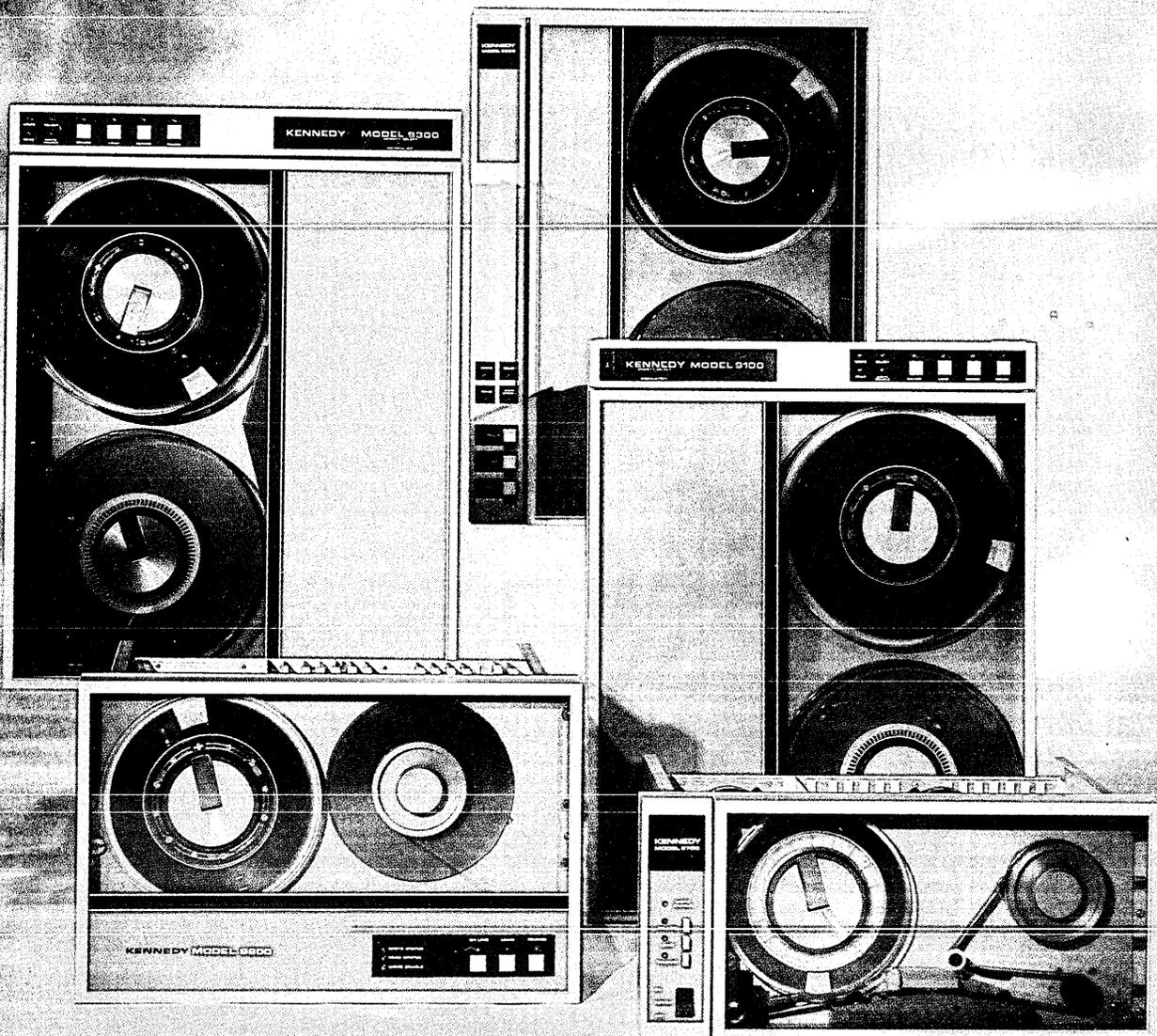


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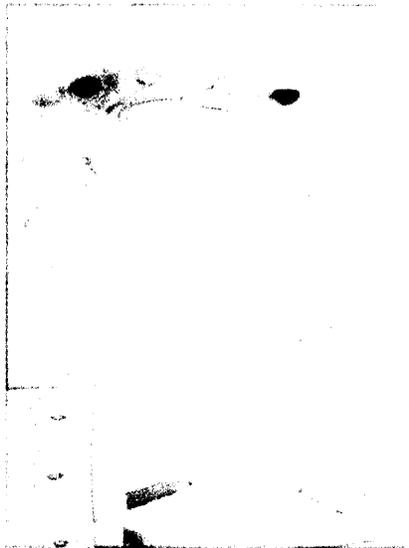
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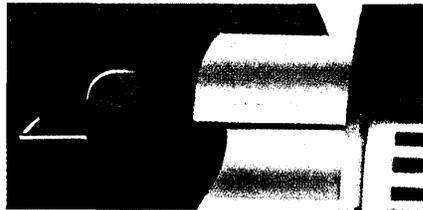
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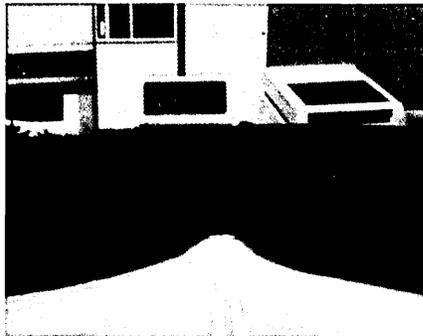
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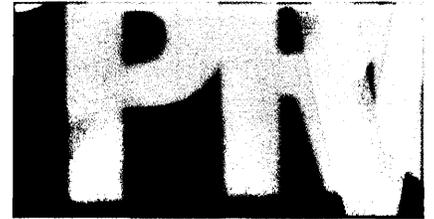
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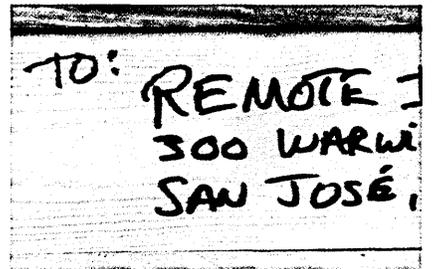
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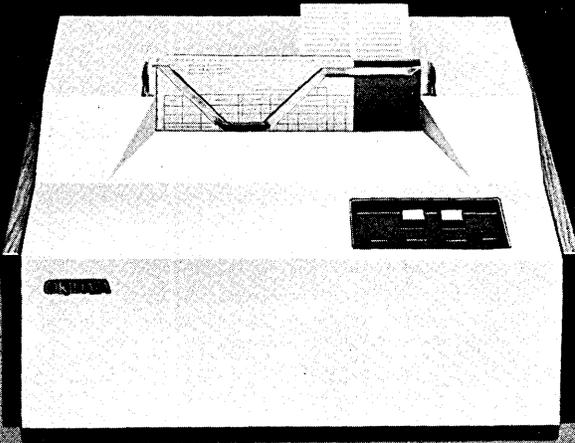


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COVER PHOTOGRAPH BY JANEART

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Design Director Steve Phillips
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Editorial Assistant Louise C. Shaw

EDITORIAL OFFICES

Headquarters: 1801 S. La Cienega Blvd., Los Angeles, CA 90035. Phone (213) 559-5111. **Eastern:** 35 Mason St., Greenwich, CT 06830, (203) 661-5400, Telex 996343. 420 Lexington Ave., New York, N.Y. 10017, (212) 682-7760. 6605 Burlington Pl., Springfield, VA 22152, (703) 569-3383. **Southwestern:** 11500 Stemmons North, Suite 152, Dallas, TX 75299, (214) 247-5221. **Western:** 2680 Bayshore Frontage Rd., Suite 401, Mountain View, CA 94043, (415) 965-8222. **Foreign:** 20 Leamington Road, Southend-on-Sea, Essex, SS1 2SN, England; phone: Southend (0702) 611648. **TELEX 996-343**

Art & Editorial Production

Director Cleve Marie Boutell
Advertising Production Manager Marilee Pitman
Art Production Manager James R. Griglak
Production Assistant Alberta R. Martin

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666 Fifth Avenue, New York, NY 10019
Circulation Manager Suzanne A. Ryan
Marketing Research Manager Deborah Dweley
Publisher James M. Morris
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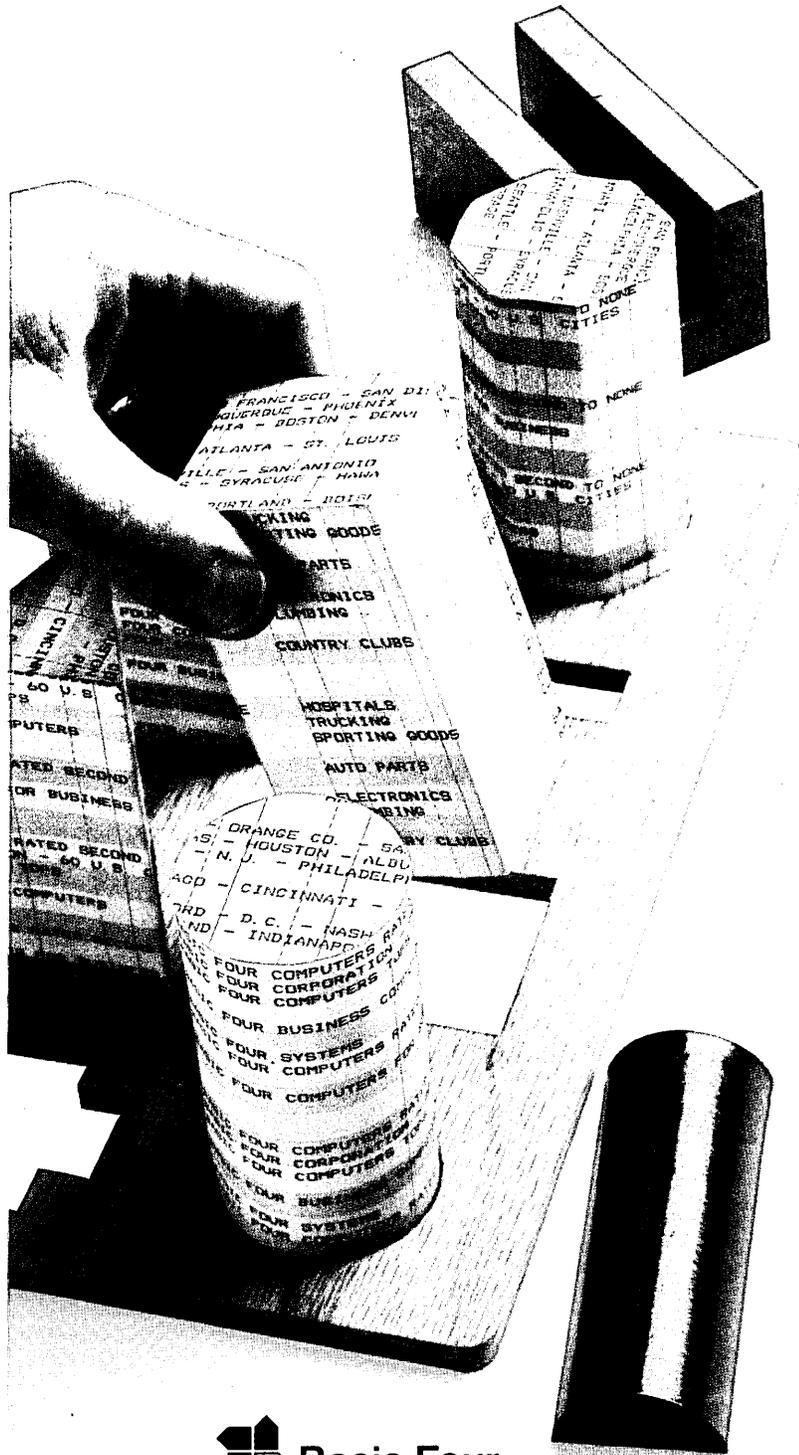
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It took Basic Four to fit distributed data processing to our business



Our company now has outlets in seven cities. And each was screaming for its own computer!

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So there were tested software applications available to us. Plus the right size computer for each of our locations. And concurrent multi-function options, like forms entry and integrated word processing.

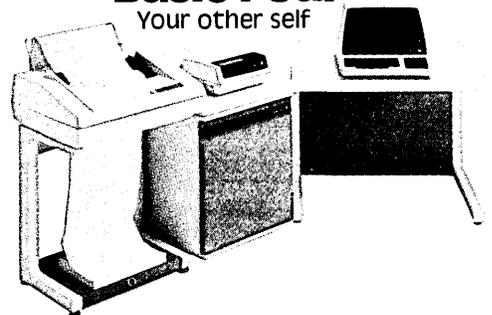
Naturally there's full communication between computers. For things like shared inventories. And easy reporting, to keep tight home office control.

Maybe most important, Basic Four doesn't just dump equipment on the doorstep and walk away. They stay with you—installing, training, debugging, even hand-holding. As long as you need them.

Distributed processing has to fit the job. And the best fit for our job was Basic Four.

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EDITOR'S READOUT

THE THIN GREEN LINE

That eerie green line worming its way up this graph may look familiar.

It's our best estimate of computer industry revenues from 1966 to the present. The unique character of this line—one that sets it apart from other growth industry curves—is that sudden leveling off in the early seventies. It was our one, and hopefully only, major recession.

The numbers reflect estimated sales of general purpose computers, minis, peripherals, terminals, leases, used computers, software, supplies . . . in short, all the elements that we have come to regard as the "traditional" computer industry.

In 1966 revenues totaled a paltry \$6 billion; in 1981 we expect more than 10 times that amount.

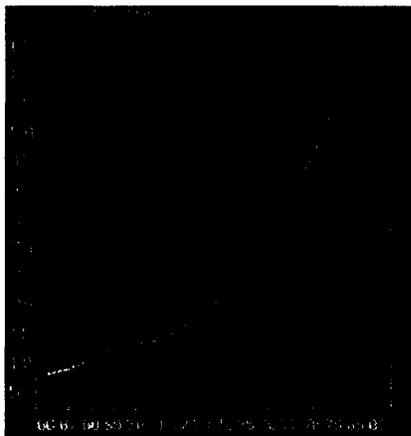
Computer industry growth has been astonishing. But be warned: in many respects that green line is very misleading.

First of all, this type of one-dimensional representation disregards inflation. *Business Week*, in a recent article, estimated that fully one-third of the earnings reported by companies in 1978 reflect illusory gains created by inflation and out-dated accounting principles. We're no exception.

And then there is the odd happenstance that, in an industry devoted to accuracy and precision, we are without precise measures.

We don't know how much equipment we have sold or how many people are actually involved in our industry.

But, as Montgomery Phister comments in his epic work, *Data Processing Technology and Economics*, "Although we can't know exactly how the population of programmers or mag-



netic tape reels or line printers or memory bytes or data service companies has changed, year by year, since 1950, we can find enough data to formulate an estimate of each of these and can gain some understanding of the relationship between them."

It would be nice, though, if the cast of characters stopped changing quite so rapidly.

For example, in the first issue of *DATAMATION*, back in October 1957, IBM was there introducing its 610 Auto Point Computer; but so was ElectroData and the 205 and Ramo Wooldridge with the RW-300.

In our September 1969 issue, an NCC spectacular as big as a Sears catalog, Viatron (with a 12-page insert), Xerox Data Systems, RCA, and General Electric had joined the pack. Ah, those were the days.

Today, attrition, mergers, and acquisitions have created a new industry mix. Giants such as AT&T and Exxon have entered the marketplace. Startups are fewer. Many of the smaller companies, and not a few of the larger ones, have succumbed.

Further complicating matters, as Ted Withington points out in his overview article, are fundamental alterations in the very structure of the industry.

We are entering an interesting

and challenging era, one of almost classical Hegelian drama. On one side we have the forces of change fueled by advancing LSI and microcomputer technology, and new user awareness. On the other, we have the equally powerful forces of conservatism and reaction.

Paradoxically, our own government is one of the most powerful roadblocks to industry growth. At a time when our balance of payments is slipping badly, at a time when foreign companies are making significant inroads into our domestic markets and buying up U.S. companies as well, the government hinders competition by excessive regulation and interminable legal proceedings. Tops on the list are the antitrust trials and the futile efforts to separately define communications and computers for the new Communications Act.

Inflation, lack of venture capital, increased mergers and acquisitions, and the high cost of conversion locking the user to a single mainframer—all contribute to moderating industry growth.

But the incredible spread of data processing throughout business, technological innovation, and the unquenchable entrepreneurial spirit that this industry seems to foster will keep that green line moving upward.

It is characteristic of this industry that, at a time when IBM product and pricing announcements have stunned the general purpose computer market, personal and small business computers are exuberantly bursting forth everywhere. And waiting to explode is another huge, untapped market—the electronic office.

Because of the industry's rapid growth and change, we have moved our traditional *DATAMATION* 50 roundup from its regular June slot into this Special Edition. The move allows us to examine the top companies in much greater depth and also to explore the many high-growth submarkets.

It's part of our recognition that the infant computer industry is growing up. *

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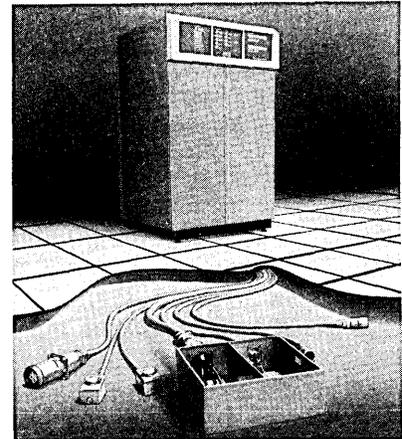
The mobility feature makes the Center a one time investment and as a fixed asset it qualifies for investment tax credit. The Center offers single source

responsibility but more significantly, it eliminates costly "hard-wired" rigid conduit systems. In addition, it's total flexibility maximizes uptime, both initially and later, during room modifications or relocation.

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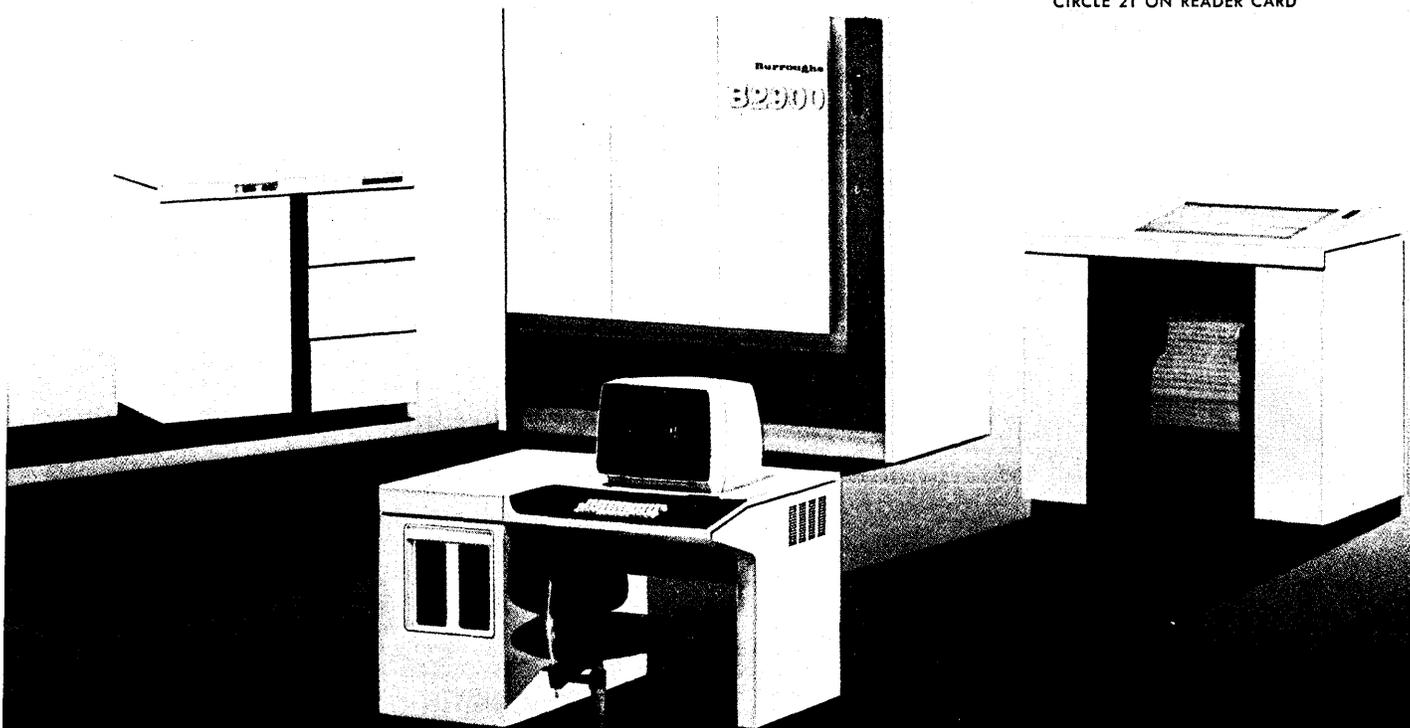
The B 2930 and B 3950 can have up to four central processors. And they are completely software-compatible with earlier Burroughs intermediate systems. No rewriting or recompiling of existing application programs is required.

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CIRCLE 21 ON READER CARD



Burroughs

Technology, user demands, governments are changing the face of the industry.

by **Frederic G. Withington**

The profile of the data processing industry is like that of a growing child. Its features are clear and can be measured more or less distinctly—the mainframe, minicomputer, peripheral, software and service, and other submarkets discussed in this Special Edition. But, during periods of rapid growth, a child's features change quickly. This article examines the changes that are occurring in the data processing industry's profile during the present explosive period.

Changing technology is affecting the profile most. Improving LSI electronics, for one thing, has reduced the large manufacturer's economies of scale. A host of small companies offering small products has entered the industry—personal computer, terminal, minicomputer manufacturers. Some of them don't stay small for long; the Tandy Corp., despite a late start, is reported to have sold 100,000 TRS-80 personal computers in 1978 through its Radio Shack retail chain. But, business pressures force many of the small companies to sell out to cash-rich large ones, enabling them in turn to change their profiles.

Another technological force for change is the increasing prevalence of microcoded computers, also made practical by improved LSI cost/performance.

Compared to the clear functional profiles of past computers, with their fixed instruction sets and register structures, microcoded computers have blurred profiles. An NCR Criterion can either emulate the earlier Century series' instruction set or operate in a COBOL-virtual executive mode; its performance characteristics are quite different in the two modes. The new

IBM 4300s can function in the System 370 DOS instruction set mode, but it appears that they will be evolving into a VM-based "application machine" mode. Whatever that turns out to be, the 4300s will surely display very different characteristics in the new mode.

A manufacturer of microcoded machines has more options than before, and the profiles of other submarkets are affected as well. Independent providers of software packages, for example, have been able to work with visible, unchanging instruction sets. How do they work with machines like the System/38 where there is no instruction set, but only a secret microcode that is likely to change without notice? Perhaps they should combine with system houses and small providers of microcoded computers to offer their own complete packages. If they do, the result will be further change in the industry's profile.

Low-cost LSI has led to new roles for digital electronics: in appliances, telephones, typewriters, and entirely new products like video games. Some of the new products spawn technology shifts that will probably feed back into the main line of data processing products. For its Speak'n-Spell portable spelling trainer, for example, Texas Instruments developed a very low-cost voice synthesis system. This system will undoubtedly appear as an auxiliary output for terminals, consoles, peripherals, and many other products. Such developments enable data processing companies to diversify, but also attract newcomers to the dp industry. The profile changes further.

Users' changing demands are also altering the industry. For one thing, over the years software lock-ins have

made users less and less willing to switch mainframe vendors. The result has been the birth of plug-compatible mainframe (PCM) vendors—Amdahl's growth over the last three years is hard to match in any industry any time. IBM's countermoves may limit further incursions by this new faction. With its 4300s, IBM has become the prime PCM competitor to itself, not only for smaller System 370s, but for System 360s and 1401s as well. It is too late for IBM to eliminate the new competitors entirely; PCM's of all types have become a permanent feature in the profile.

Users' demands for distributed networks are increasing steadily. The computer manufacturers have been forced to become communicators, evidenced in Digital Equipment's DECNET or IBM's involvement in Satellite Business Systems (SBS). They now compete with still another set of outsiders, such as AT&T, Tymnet, and Telenet. In addition, the growth of the network service companies shows that a significant part of the users' demands for distributed networks can be met by shared rather than dedicated networks. Exploiting this trend, nearly all the large network service companies now offer hardware tailored to fit their services. It appears that a new kind of hardware-software-communications company is emerging. If IBM reenters the services business, which it is now free to do, it will probably opt for such an integrated approach.

GOVERNMENTS HAVE THEIR SAY

Of course, the U.S. government may have something to say about that. All governments in developed countries are using their control of telecommunications to further national

THE CHANGING PROFILE

Sooner or later every manufacturer must match or better the new IBM standard.

interests. The result in the U.S. will be a new Communications Act. Its form is difficult to predict but its thrust is clearly pro-competition. It may even permit IBM to offer communications-based services.

In most other countries the objective is to limit competition (from foreigners, at least) through both regulation and standards. Most countries also use subsidies, buying preferences, and import restrictions to nurture local industry. Success appears to have been achieved by the British with ICL, the French with Cii-HB, and the Japanese with several companies. Whatever the degree of success, the profile of the data processing industry in each country is sharply affected by its government's competitive stance.

In the U.S., the effect of competitiveness within the government is mostly to stop anything from happening. On any significant subject, Justice, Commerce, the Securities and Exchange Commission, the Federal Communications Commission, the Congress and the Courts all appear certain to harbor opposing views, resulting in apparently endless litigation. Absurdities result like the spectacle of the Justice Department's attempts, via the antitrust laws, to diminish IBM's market power while the action of the Commerce Department, through its peripheral device interface standard, serves to increase it.

There is some consolation in the fact that most other governments appear to have similar problems. Even the usually well-organized Japanese have recently had a falling out between the Foreign Ministry and the government's Nippon Telephone and Telegraph Co. over the issue of permitting U.S. companies to bid on NTT procurement contracts.

While government actions in many countries have major effects on the profile of the data processing industry, the dawdling pace of bureaucracy makes the effects slow to emerge. In the immediate term (1978-79), the industry's profile is being shaped much more rapidly by business pressures.

IBM SETS THE PACE The price/performance of computers has been improving dramatically, as new models are announced and the prices of old ones are cut. IBM has recently been setting the pace with its counter-moves against the PCM's. The independent mainframe and minicomputer manufacturers are not affected immediately because each has a locked-in base of customers that cannot immediately switch. But sooner or later every manufacturer must match or better the new IBM standard. While this is good news for users, it is not so good for all the manufacturers. Everyone's

Table 1
COMMON STOCK OFFERINGS FOR WHICH NO PRIOR MARKET EXISTED, 1970-1977

Year	Number of Issues
1970	566
1971	446
1972	646
1973	177
1974	55
1975	24
1976	46
1977	46

Source: Investment Dealers Digest.

profit margin will be cut, and decreasing electronics cost is not enough to make up the difference.

For independent manufacturers with software and customer service costs comparable to IBM's, the leader's new unbundling policies should prove helpful. IBM now charges separately for on-site system engineering, providing old-style assistance only from regional support centers. Any manufacturer with enough customers is free to follow suit if it can. The result should be substantial cost savings for some, and a further change in the profile of the industry's product and service offerings. (Can several smaller manufacturers use pooled support centers, for example? Can they be independent companies?)

Small companies, their margins squeezed by competition, have problems raising working capital in today's business climate. Interest rates nearly preclude borrowing. The equity market, which helped so many companies get started in the 1960s, is equally dismal today. Table 1 shows how dire the situation is—in recent years one-tenth as many new stock offerings have been successful as in the early 1970s. At the same time, large companies in many industries have been generating cash. (Despite general gloom about the future, 1977 and 1978 were great profit years.) Discouraged by various factors from reinvesting in their own businesses, these large companies have been using their cash to buy up smaller firms.

ACQUISITION FEVER The acquisition fever has been heightened by the existing competitors' desire to diversify. Hardware companies acquire communications companies (Xerox-

Western Union, GTE-Telenet, NCR-Comten). Communications companies, in turn, absorb hardware companies (ITT-Qume, Northern Telecom-Data 100 and Sycor). Mainframe companies diversify their hardware offerings (Honeywell-Incoterm, Burroughs-Context, Sperry Univac-Varian). Foreign companies diversify their product lines and also enter new geographic markets through acquisitions (ICL-Singer) and partnership agreements (Siemens-Fujitsu).

This wave of acquisitions is a source of real concern. Will the industry consolidate to such a degree that innovation is stifled? Will continuing profit pressures cause such a shakeout that competition declines? Are we, in fact, going to find that there is room for no one except IBM and such plug-compatible competitors as can survive?

Perhaps history provides the answer. By 1966 it was apparent that IBM's System 360 was going to be a great success, offering an unprecedented level of price/performance. Some commentators began to question the viability of IBM's competitors, and to a degree they were right; RCA, GE and XDS soon made their exits. But, the drop-outs reckoned without innovation: minicomputers, small business systems, personal computers, intelligent terminals, network services, the plug-compatible industry.

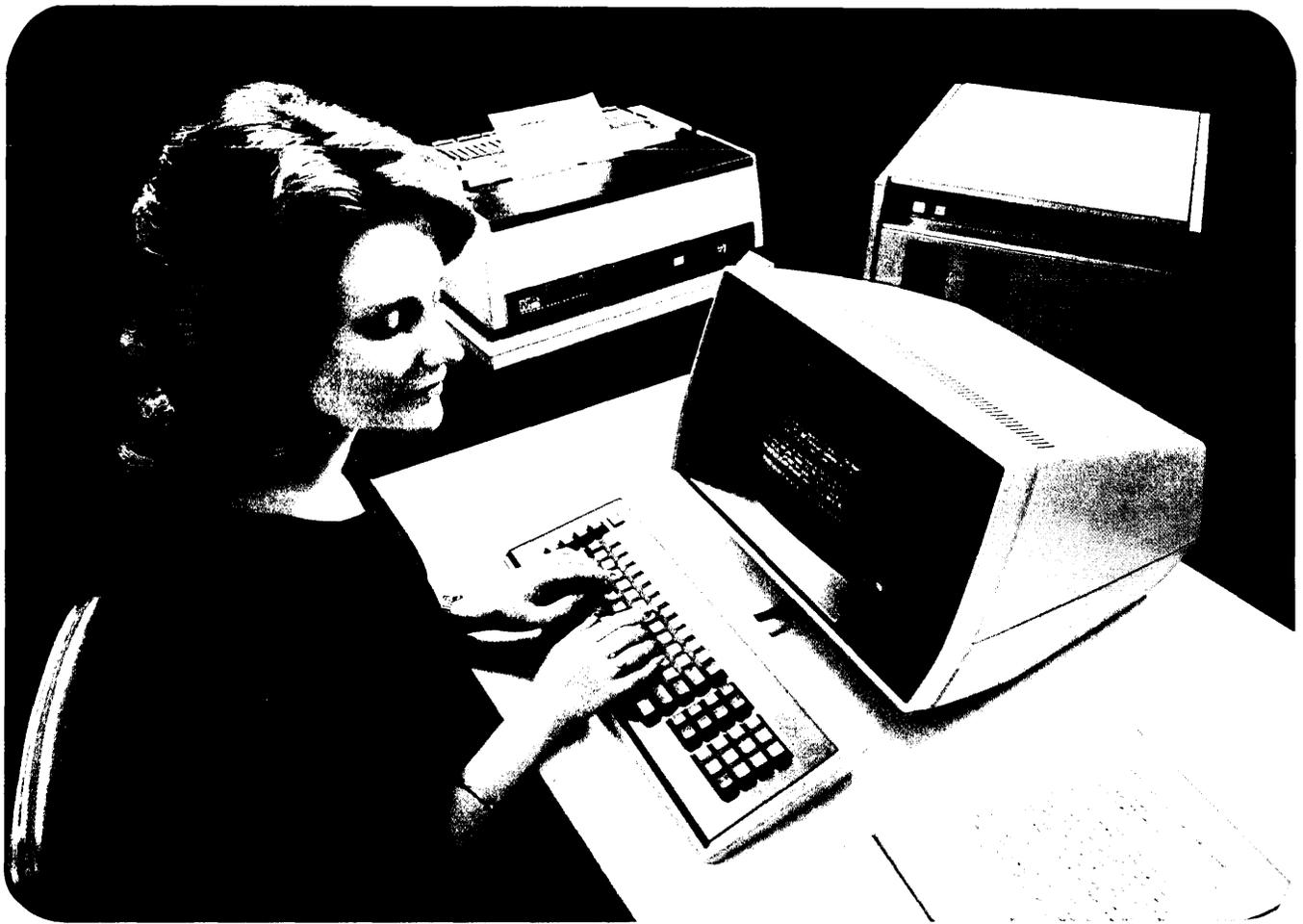
Can innovation come to the rescue again? It certainly can. Digital communications, office systems, personal computers and consumer products obviously offer great potential. And who knows what else is on the horizon? So, while consolidation and maturity will occur in some segments of the data processing industry, innovation will surely create new growth markets.

Clearly the child that emerges from this growth phase will have a very different profile. If DATAMATION publishes a Special Edition profiling the dp industry 10 years from now, I wonder what its Table of Contents will look like.*

FREDERIC G. WITHINGTON



A 25-year veteran in the computer industry, Mr. Withington heads the data processing industry analysis activities for Arthur D. Little, Inc. He has written four books and 20 articles and papers, and is a long-time contributing editor to DATAMATION.



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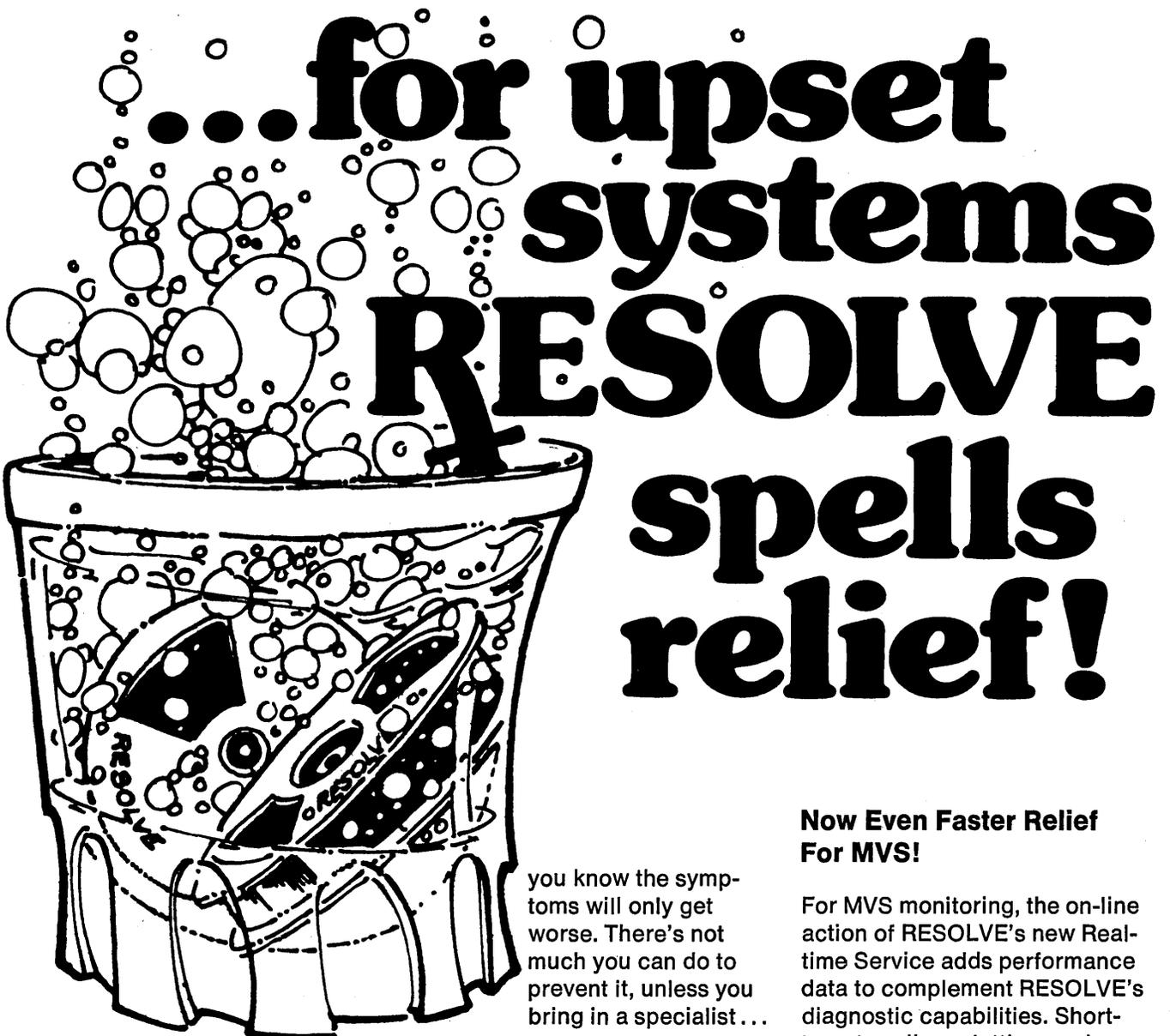
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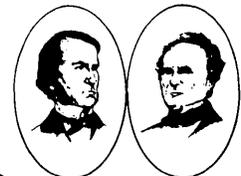
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THE DATAMATION 50

THE TOP 50 U.S. COMPANIES IN THE DP INDUSTRY

by **Becky Barna**

The U.S. data processing industry enjoyed sensational growth last year. The industry's 50 largest participants posted combined dp-related sales of \$36.1 billion for fiscal year 1978. That sum represents a hefty 22% increase over cumulative dp sales of last year's top 50 companies. For comparison, 1977 dp revenues of the 50 largest firms were 18.1% higher than 1976's.

The threshold for entry to the DATAMATION 50 was also up, from \$69 million in 1977 to \$75 million in 1978. Moreover, not one company on this year's list posted a loss for fiscal '78; losses were recorded for two companies in last year's survey.

The entire U.S. data processing industry is of course comprised of many companies below the \$75 million cut-off for the top 50 group. Nonetheless, we estimate that total dp revenues of those firms amount to less than an additional \$1.5 billion, which means the DATAMATION 50 pulled in about 95% of total industry revenues in fiscal '78. As a whole, then, the industry surpassed the \$37 billion mark last year.

The information presented in this article was compiled by the DATAMATION staff, under the supervision of Becky Barna. Information reported herein was obtained from corporate annual reports, 10-K statements, and Standard & Poor's Compustat Services Inc.

RANKED BY DP REVENUES

Rankings for the DATAMATION 50 are arrived at differently than those for other published reviews of industrial corporations. Rather than being ranked according to total revenues, the 50 largest industry participants are compared on the basis of revenues derived from dp-related goods and services only. Many of the 50 firms are involved in a number of lines of business. In fact, seven companies make the top 50 listing with less than 10% of total revenues accounted for by dp sales. Only 18 of the 50 companies obtain 100% of total revenues from dp activities. Because many of the companies do not break out such percentages in public financial statements, arriving at the amount of total dp-related revenues for each company involved considerable research, analysis, and estimation.

For purposes of this survey, we have concentrated on the activities and related revenues concerned with general purpose data processing products and services offered to the end user and oem communities. Excluded from the scope of this analysis are such specialized areas as pure data communications (where no "processing" is done) and products such as electronic cash registers.

FISCAL VS. CALENDAR COMPARISONS

Ever since DATAMATION first published a review of the 50 leading industry participants in 1975, the companies have been compared on the basis of performance during their respective fiscal years. That poses some problems considering that the fiscal year closings for many companies are long before the end of the calendar

year. For example, a company whose fiscal year ended in March 1978 is reviewed on a cycle almost a year behind companies whose fiscal years end on Dec. 31, 1978. To arrive at a more equitable treatment of the companies, as well as a more accurate picture of company-to-company comparisons, we have instituted this year a ranking of the companies by calendar year performance as well. Nonetheless, for the sake of having data on which to compare 1978's results with 1977's, companies are still pitted against each other on the basis of their fiscal '78 results for this year's review. The inclusion of calendar year rankings this year paves the way for next year's comparative analyses to be made solely on a calendar year basis.

One clear example of the difference between fiscal and calendar year rankings is in the case of Sperry Rand, whose fiscal 1978 ended in March 1978. Total dp-related sales from the firm's Univac division earned it a fifth place ranking in the fiscal year chart; on a calendar year comparison, Sperry Rand moves up to third place. That change in turn causes NCR and Control Data, both of whose fiscal years ended Dec. 31, 1978, to move down one notch each to the fourth and fifth positions respectively on the calendar year chart.

The company that makes the greatest climb from the fiscal to the calendar rankings is Centronics, a newcomer to the DATAMATION 50. On the fiscal year chart, Centronics ranks number 50; it captures the 46th slot on calendar year comparisons. Other companies that move up more than two rungs on the calendar year ladder are Wang Labs, Four-Phase Systems, Ampex, and Planning Research.

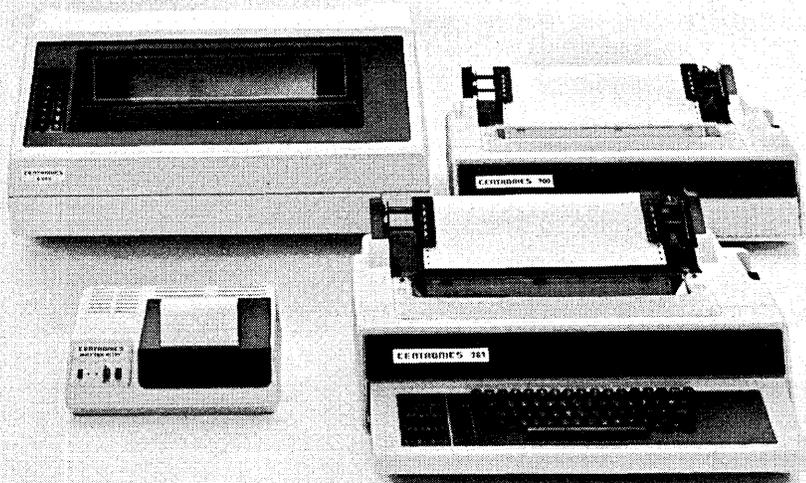
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THE "BIG SEVEN"

In the upper echelon of the group, the "big seven" remained in the same positions as last year on the fiscal chart. With '78 dp sales of \$17.1 billion, IBM captured about 47% of the dp revenues of the entire top 50 firms; in past years, IBM's share has accounted for about 50%. As a group, the seven industry leaders amassed 76% of the top 50's total dp revenues; last year those same seven garnered 78.5% of the top 50's sales. Collectively, the big seven pulled in \$27.5 billion for fiscal '78, an 18% climb over the \$23.3 billion posted the previous year.

Combined revenues of the "other 43" also underwent great growth, up 36.5% over 1977. By way of comparison, the other 43 firms cumulatively grew 30.7% between 1976 and 1977. As these 43 companies continue to take over a larger and larger share of the top 50's total revenues, it must still be remembered that revenues of the top seven firms alone stood at \$27.5 billion in '78, leaving \$8.6 billion for all the others taken together.

FOUR ENTER; TWO EXIT

There are four new names on this year's DATAMATION 50, while only two names dropped off the list—and still we have 50 firms represented. That apparent discrepancy is readily explained by a close look at Northern Telecom Systems Corp., number 17 on the fiscal chart. While this U.S. subsidiary of the Canadian firm, Northern Telecom Ltd., is a newcomer to the list, its revenues are brought in by two familiar faces from last year's survey—Data 100 (number 25 last year) and Sycor (number 44 last year). Other entrants include Tandy Corp. (number 44), Prime Computer (number 46), and Centronics (number 50).

As is the case each year, a number of companies changed their relative positions. This can happen for one of three reasons: their growth rate changed, another company's growth rate changed, or we redefined the dp contribution to total revenues.

CHANGED POSITIONS

It is, of course, more difficult to rise in rank on the upper half of the list, where an improved position of even one slot requires revenue increases of tens of millions of dollars. Thus, while some companies moved up more than five positions, the jump by Storage Technology from number 19 to number 14 constituted a rise in revenues of about \$138 million. In one year's time, Storage Tech's revenues jumped a phenomenal 85%, from \$162 million in '77 to \$300 million in

Table 1
THE INDUSTRY'S TEN
FASTEST GROWING COMPANIES

COMPANY	% GROWTH OVER CALENDAR '77	'78 CALENDAR REVENUES (\$M)
1. Tandem Computers	216%	\$ 24
2. Commodore	190%	\$ 79
3. Applied Devices	102%	\$ 56
4. Prime*	87%	\$ 94
5. Documation	86%	\$ 59
6. Storage Technology*	85%	\$300
7. Ite!*	71%	\$689
8. Amdahl*	70%	\$321
9. Systems Engineering Labs	61%	\$ 62
10. Four-Phase Systems*	53%	\$136

*A DATAMATION 50 Company

'78. Similarly, with a revenue growth rate of 70%, Amdahl climbed from number 17 to number 13. For fiscal '78, Amdahl recorded revenues of \$321 million, compared to \$189 million the year earlier.

The biggest improvement in relative position was made by Four-Phase Systems, which moved up in rank from number 41 to number 30. The company's '78 revenues rose an incredible 53% over the previous year's. Big climbs on the chart were also seen in Datapoint (from number 35 to number 26), Tymshare (from number 37 to number 28), and Per-tec (from number 39 to number 31). These three companies experienced substantial revenue growth rates from '77 to '78 of 58%, 48%, and 31% respectively.

Obviously as a number of companies moved up in rank, a number of others moved down. Those "declines," however, do not necessarily mean the companies had a bad year; it may only mean that other companies had a better year.

1978 saw sensational growth rates for many companies outside the DATAMATION 50 as well. Table 1 shows the 10 companies in the industry that witnessed the greatest growth in calendar '78 over calendar '77. Of those 10 firms, five occupy positions on the top 50 listing.

READING THE CHART

The following two-page chart shows the top 50 U.S. companies in the data processing industry for fiscal 1978. The data on the right-hand page is, in most cases, reported by the companies in their annual reports; exceptions are clearly noted. One particularly important column is labeled "year ending"; it points up some of the problems in comparing companies which report on different cycles.

The left-hand side of the chart presents data that constitutes our best estimates of data processing related revenues, the basis for our rankings.

The activities of each of the 50 companies are further described in separate corporate profiles within this article. Each profile is supplemented by a bar chart depicting our estimates of the contribution which various product and service

areas make to the company's total dp revenues. The five product and service categories include the following:

- mainframes—general purpose computers, including native memory supplied with them but excluding peripherals and terminals.
- minicomputers and microcomputers—all end user and oem minis and micros and their native memories, but exclusive of detachable peripherals and terminals.
- peripherals and terminals—all units shipped as part of complete systems or shipped separately, including data entry equipment and add-on memory but excluding equipment without functional connection to dp systems (such as standalone electronic cash registers).
- media and supplies—media such as disc packs, magnetic tapes, carbon ribbons, and incidental forms.
- software and services—software products and all types of usage, maintenance, third-party leasing, training, consulting, and customer assistance provided for a fee.

In addition to the chart and accompanying text describing the 50 firms on the basis of their fiscal '78 results, we have included the chart comparing these same companies on a calendar year basis. Much of the data for total revenues of each company by calendarization of fiscal year data was supplied by Standard & Poor's Compustat Services Inc. To those numbers we applied our estimated percentages to determine what portion of total revenues constitutes dp-related revenues.

DISCLAIMER

Finally, while many of our estimates were approved or improved by company sources, corporate policies in many instances precluded our obtaining the desired details or comments. And because our rankings are based on our best estimates rather than on publicly reported data, we cannot guarantee absolute accuracy on individual company situations. Nonetheless, we are confident that the DATAMATION 50 represents the leading industry participants in a most adequate manner. *

THE DATAMATION 50

THE TOP 50 U.S. COMPANIES IN THE DP INDUSTRY

RANK	COMPANY	ESTIMATED DATA			1976 TOTAL REVENUES \$M
		DP REVENUES \$M	DP REVENUES (% of total revenues)	U.S. DP REVENUES (% of total dp revenues)	
1	International Business Machines	\$ 17,072	81%	50%	\$ 16,304
2	Burroughs	\$ 2,107	87%	59%	\$ 1,902
3	NCR	\$ 1,932	74%	50%	\$ 2,136 ¹
4	Control Data	\$ 1,867	68%	50%	\$ 2,113
5	Sperry Rand	\$ 1,807	48%	58%	\$ 3,203
6	Digital Equipment	\$ 1,437	100%	62%	\$ 736
7	Honeywell ²	\$ 1,294	37%	63%	\$ 2,495
8	Hewlett Packard	\$ 657	38%	54%	\$ 1,112
9	Memorex	\$ 570	90%	60%	\$ 345
10	Itel	\$ 487	71%	90%	\$ 260
11	TRW	\$ 466	12%	77%	\$ 2,929
12	Data General	\$ 380	100%	69%	\$ 179
13	Amdahl	\$ 321	100%	73%	\$ 93
14	Storage Technology	\$ 300	100%	80%	\$ 122
15	Automatic Data Processing	\$ 290	97%	92%	\$ 199
16	3M	\$ 280	6%	80%	\$ 3,514
17	Northern Telecom Systems ³	\$ 275	100%	70%	NA
18	Computer Sciences	\$ 255	92%	91%	\$ 220
19	Xerox	\$ 236	4%	100%	\$ 4,418
20	Electronic Data Systems	\$ 211	97%	98%	\$ 133 ¹
21	Management Assistance	\$ 205	100%	60%	\$ 123
22	Texas Instruments	\$ 204	8%	90%	\$ 1,659
23	General Electric	\$ 190	1%	80%	\$ 15,698
24	Harris	\$ 174	20%	80%	\$ 514
25	Wang Laboratories	\$ 168	85%	56%	\$ 97
26	Datapoint	\$ 162	100%	75%	\$ 72
27	Mohawk Data Sciences	\$ 153	100%	41%	\$ 162
28	Tymshare	\$ 150	100%	95%	\$ 82
29	System Development	\$ 145	100%	95%	\$ 110
30	Four-Phase Systems	\$ 136	100%	84%	\$ 63
31	Pertec Computer	\$ 132	100%	75%	\$ 37
32	Perkin-Elmer	\$ 131	24%	73%	\$ 349
33	McDonnell Douglas	\$ 128	3%	100%	\$ 3,543
34	Tektronix	\$ 126	21%	60%	\$ 367
35	Dataproducts	\$ 125	90%	80%	\$ 85
36	Teletype	\$ 124	41%	90%	\$ 180E
37	California Computer Products	\$ 120	100%	74%	\$ 122
38	Ampex	\$ 119	37%	52%	\$ 258
39	Bunker Ramo	\$ 119	31%	85%	\$ 316
40	General Instrument	\$ 116	23%	80%	\$ 376
41	Telex	\$ 107	76%	75%	\$ 106
42	General Automation	\$ 98	100%	73%	\$ 71
43	Raytheon	\$ 97	3%	80%	\$ 2,463
44	Tandy	\$ 96	9%	90%	\$ 742
45	Planning Research	\$ 96	43%	74%	\$ 148
46	Prime Computer	\$ 94	100%	57%	\$ 23
47	Informatics	\$ 93	100%	90%	\$ 59
48	Recognition Equipment	\$ 81	93%	67%	\$ 65
49	Wyly	\$ 79	100%	49%	\$ 64
50	Centronics	\$ 75	100%	NA	\$ 52

NA = not available

E = estimated

¹restated data

²data shown excludes Cii-HB

REPORTED DATA						
1977 TOTAL REVENUES \$M	1978 TOTAL REVENUES \$M	1978 NET INCOME \$M	NUMBER OF EMPLOYEES	FISCAL YEAR ENDS	1977 RANK	1978 RANK
\$ 18,133	\$ 21,076	\$ 3,111	325,517	Dec 31	1	1
\$ 2,127	\$ 2,422	\$ 253	54,638	Dec 31	2	2
\$ 2,312 ¹	\$ 2,611	\$ 194	62,000	Dec 31	3	3
\$ 2,301	\$ 2,738	\$ 89	51,000	Dec 31	4	4
\$ 3,270	\$ 3,765	\$ 177	89,044	March 31	5	5
\$ 1,059	\$ 1,437	\$ 142	40,000	July 1	6	6
\$ 2,911	\$ 3,548	\$ 201	86,300	Dec 31	7	7
\$ 1,360	\$ 1,728	\$ 153	42,400	Oct 31	9	8
\$ 450	\$ 633	\$ 42	11,085	Dec 31	8	9
\$ 402	\$ 689	\$ 47	6,500	Dec 31	11	10
\$ 3,264	\$ 3,787	\$ 174	93,353	Dec 31	10	11
\$ 255	\$ 380	\$ 40	10,830	Sept 30	12	12
\$ 189	\$ 321	\$ 48	3,000	Dec 29	17	13
\$ 162	\$ 300	\$ 27	6,497	Dec 31	19	14
\$ 245	\$ 299	\$ 27	10,000	June 30	14	15
\$ 3,980	\$ 4,661	\$ 563	85,000	Dec 31	13	16
\$ NA	\$ 275	\$ NA	6,500	Dec 31	-	17
\$ 235	\$ 277	\$ 14	10,300	March 31	18	18
\$ 5,082	\$ 5,902	\$ 477	108,000	Dec 31	15	19
\$ 164	\$ 218	\$ 20	7,248	June 30	21	20
\$ 155	\$ 205	\$ 16	4,000	Sept 30	22	21
\$ 2,046	\$ 2,550	\$ 140	39,000	Dec 31	20	22
\$ 17,519	\$ 19,654	\$ 1,230	398,000	Dec 31	16	23
\$ 646	\$ 872	\$ 52	18,700	June 30	24	24
\$ 134	\$ 198	\$ 16	4,100	June 30	28	25
\$ 103	\$ 162	\$ 15	3,889	July 31	35	26
\$ 146	\$ 153	\$ 6	3,800	April 30	23	27
\$ 101	\$ 150	\$ 11	3,000	Dec 31	37	28
\$ 130	\$ 145	\$ 2	4,000	June 25	34	29
\$ 89	\$ 136	\$ 12	2,800	Dec 31	41	30
\$ 95	\$ 132	\$ 7	3,000	March 31	39	31
\$ 432	\$ 554	\$ 35	12,279	July 31	36	32
\$ 3,545	\$ 4,130	\$ 161	4,909	Dec 31	29	33
\$ 455	\$ 599	\$ 57	21,000	May 31	38	34
\$ 115	\$ 139	\$ 16	3,500	March 25	33	35
\$ 270E	\$ 303E	\$ NA	5,300E	Dec 31	30	36
\$ 118	\$ 120	\$ 2	2,783	June 30	27	37
\$ 287	\$ 322	\$ 20 ⁴	12,000	April 30	26	38
\$ 341	\$ 383	\$ 19	9,900	Dec 31	32	39
\$ 466	\$ 503	\$ 24	24,000	Feb 28	31	40
\$ 119	\$ 140	\$ 8	3,120	March 31	40	41
\$ 84	\$ 98	\$ 4	2,200	July 31	43	42
\$ 2,818	\$ 3,239	\$ 150	63,600	Dec 31	42	43
\$ 949	\$ 1,059	\$ 66	20,000	June 30	-	44
\$ 186	\$ 223	\$ 5	7,000	June 30	49	45
\$ 50	\$ 94	\$ 8	1,712	Dec 31	-	46
\$ 75	\$ 93	\$ 3	2,500	Dec 31	45	47
\$ 75	\$ 87	\$ 5	2,200	Oct 31	48	48
\$ 71	\$ 79	\$ 3	1,700	Dec 31	50	49
\$ 58	\$ 75	\$ 14	2,000	June 30	-	50

³represents Data 100, Sycor data

⁴after extraordinary credit

THE DATAMATION 50

THE TOP 50 U.S. COMPANIES IN THE DP INDUSTRY
BY CALENDAR YEAR RANKINGS

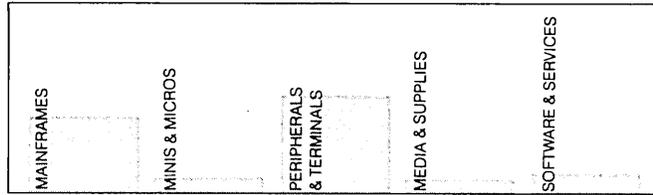
RANK	COMPANY	ESTIMATES	REPORTED DATA	
		CALENDAR '78 DP REVENUES (\$M)	CALENDAR '78 TOTAL REVENUES (\$M)	CALENDAR '78 NET INCOME (\$M)
1	International Business Machines	\$17,072	\$21,076	\$3,111
2	Burroughs	\$ 2,107	\$ 2,422	\$ 253
3	Sperry Rand	\$ 1,952	\$ 4,065	\$ 214
4	NCR	\$ 1,932	\$ 2,611	\$ 194
5	Control Data	\$ 1,867	\$ 2,738	\$ 89
6	Digital Equipment	\$ 1,601	\$ 1,601	\$ 153
7	Honeywell	\$ 1,294	\$ 3,548	\$ 201
8	Hewlett-Packard	\$ 708	\$ 1,863	\$ 166
9	Memorex	\$ 570	\$ 633	\$ 42
10	Itel	\$ 487	\$ 689	\$ 47
11	TRW	\$ 466	\$ 3,787	\$ 174
12	Data General	\$ 410	\$ 410	\$ 44
13	Automatic Data Processing	\$ 324	\$ 334	\$ 30
14	Amdahl	\$ 321	\$ 321	\$ 48
15	Storage Technology	\$ 300	\$ 300	\$ 27
16	Computer Sciences	\$ 297	\$ 323	\$ 16
17	3M	\$ 280	\$ 4,661	\$ 563
18	Northern Telecom Systems	\$ 275	\$ 275	NA
19	Xerox	\$ 236	\$ 5,902	\$ 477
20	Electronic Data Systems	\$ 231	\$ 238	\$ 22
21	Management Assistance	\$ 221	\$ 221	\$ 18
22	Wang Laboratories	\$ 209	\$ 246	\$ 20
23	Texas Instruments	\$ 204	\$ 2,550	\$ 140
24	Datapoint	\$ 195	\$ 195	\$ 20
25	General Electric	\$ 190	\$19,654	\$1,230
26	Harris	\$ 186	\$ 929	\$ 57
27	Mohawk Data Sciences	\$ 170	\$ 170	\$ 8
28	System Development	\$ 159	\$ 159	\$ 2
29	Perkin-Elmer	\$ 158	\$ 658	\$ 44
30	Tymshare	\$ 150	\$ 150	\$ 11
31	Pertec	\$ 143	\$ 143	\$ 9
32	Tektronix	\$ 142	\$ 677	\$ 64
33	Dataproducts	\$ 141	\$ 157	\$ 16
34	Four-Phase Systems	\$ 136	\$ 136	\$ 12
35	Ampex	\$ 132	\$ 356	\$ 17
36	California Computer Products	\$ 129	\$ 129	\$ 2
37	McDonnell Douglas	\$ 128	\$ 4,130	\$ 161
38	Teletype	\$ 124	\$ 303E	NA
39	General Instrument	\$ 120	\$ 522	\$ 30
40	Bunker Ramo	\$ 119	\$ 383	\$ 19
41	General Automation	\$ 110	\$ 110	\$ 4
42	Planning Research	\$ 108	\$ 252	\$ 6
43	Tandy	\$ 105	\$ 1,152	\$ 76
44	Telex	\$ 103	\$ 136	\$ 6
45	Raytheon	\$ 97	\$ 3,239	\$ 150
46	Centronics	\$ 94	\$ 94	\$ 14
47	Prime	\$ 94	\$ 94	\$ 8
48	Informatics	\$ 93	\$ 93	\$ 3
49	Recognition Equipment	\$ 82	\$ 86	NA
50	Wyly	\$ 79	\$ 79	\$ 3

NA = Not Available

E = Estimated

Source: Standard & Poor's Compustat and DATAMATION estimates

1



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(914) 765-1900

With a host of new product announcements and a series of aggressive price cuts, IBM vigorously reaffirmed its dominant position in the computer industry last year, chalking up a gross income of more than \$20 billion for the first time in its history.

Data processing revenues, which represent 81% of the firm's overall revenues, jumped by almost 16% to a record \$17.1 billion, an increase that reflected a substantial climb over strong 1977 levels and a growing percentage of purchases of dp equipment. The portion of gross income represented by purchases of dp gear has now grown to 27.7%, almost 10% more than what it was five years ago.

IBM launched a number of new products during 1978, including the 8100 for the distributed processing marketplace and the System/38 to cap the General Systems Division product line. More recently, the Data Processing Division announced the 4300 line, thereby sharply redefining the price/performance framework of the industry.

The computer giant additionally slashed prices for a number of its products including 370/138s and 148s, 3344 and 3350 disk systems, as well as 370 and 303X expansion memory. For the first time IBM also offered quantity discounts, or more accurately rebates, on its Series/1 line.

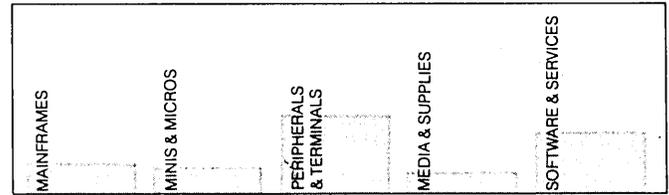
In addition to hardware, a sales growth that hit \$5.8 billion this year, rentals generated \$8.6 billion, a modest increase of 6% over 1977. Major revenue contributions also emanated from services, program products, and supplies. This area, which mostly represents maintenance on and monthly fees from purchased equipment as well as monthly fees from purchased software, has grown enormously over the past few years. In 1978, IBM garnered \$2 billion from these sources, a jump of more than 35% over 1977.

Geographically, IBM's two foreign subsidiaries, Europe/Middle East/Africa and Americas/Far East grew 21.7% and 16.2% respectively, outstripping domestic growth which jumped 11.4%. Gross income from operations outside the U.S. came to just over \$11 billion, somewhat more than income generated from U.S. operations.

On other fronts, IBM's lawsuit with Memorex resulted in a directed verdict in IBM's favor—a decision that Memorex is now appealing. At this point IBM is still engaged in litigation with Transamerica Computer Company, and is currently presenting its witnesses in the 11 year old antitrust case initiated by the Department of Justice.

Finally, IBM's Satellite Business Systems venture suffered a setback when a U.S. Court of Appeals overturned the Federal Communications Commission's earlier approval of SBS. Both SBS and the FCC have petitioned for a rehearing of that ruling and, pending a court decision in its favor, IBM hopes SBS will begin commercial operations in 1981.

2



BURROUGHS CORPORATION

BURROUGHS PLACE,
DETROIT, MI 48232
(313) 972-7442

With revenues of \$2.1 billion for data processing related products and services—an increase of more than 14% over last year—Burroughs retained its number two ranking among major U.S. computer concerns.

Total revenues came to \$2.4 billion while 1978 net income amounted to \$253 million.

Burroughs' past year was exceptionally active. The company introduced a variety of products, including four new B6800 models with improved performance at reduced price tags; five new mid-range B28-4800 models; a modular line of transistor control terminals; and the unveiling of Burroughs Network Architecture (BNA) aimed at bolstering the firm's strength in distributed processing and data communications.

Further, the company responded to IBM's System/38 announcement with the introduction of its B1800 Series of small to medium scale computers early in 1979, a period that also saw the debut of the 900 Series. With price/performance improvement three times greater than that of the 800 Series, the 900 Series features the B2930 and the B3950 as its first two members.

Cumulatively, the company's aggressive marketing strategy paid off during fiscal 1978 in the form of record pretax profit margins that were posted in the 4th quarter, as well as a record backlog of \$1.75 billion.

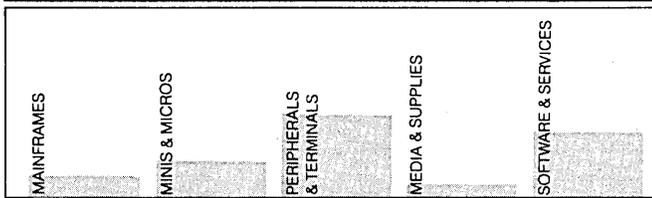
Among the customers Burroughs added for large systems were Ford Motor Co., Chrysler Corp., the New York State Dept. of Education, and the National Blue Cross and Blue Shield Assn. in Chicago.

Internally, Burroughs has restructured its marketing approach, adding a program for what it terms Designated International Accounts and Designated National Accounts. The program is designed to provide coordinated marketing support to organizations using Burroughs equipment at multiple locations by establishing a single source for information, planning assistance, and service.

Additionally, Burroughs' oem division, which completed its first full year of operation in 1978, has substantially increased its sales. Internationally, the company established a joint venture in India with Tata Sons Ltd., Burroughs' former distributor. The new company, Tata Burroughs Ltd., is now marketing Burroughs products and services in India.

To meet growing production requirements, Burroughs has added to its Rancho Bernardo, CA center for the production of integrated circuits and is doubling the size of its Tredyffrin, PA plant for the production of large scale computers. The firm has also started engineering centers in Austin, TX; Orlando, FL; and Radnor, PA. During 1978 Burroughs also began production of display terminals at Villers-Ecalles, France.

3



NCR CORPORATION

1700 S. PATTERSON BLVD.,
DAYTON, OH 45479
(513) 449-2000

NCR ended its '78 fiscal year on Dec. 31 with a 13% increase in total revenues from \$2.3 billion in 1977 to \$2.6 billion in '78. Net income climbed a staggering 61% to \$193.7 million from the \$120.6 million of the previous year.

Currently over half of NCR's revenues are generated outside the U.S. and the company expects non-U.S. revenues and income to continue upward. NCR also is looking at the marketing opportunities in China.

Revenues derived from U.S. operations were up 8% over fiscal 1977, reaching \$1.2 billion and representing 45% of the company's total revenues.

Several developments during 1978 will have continuing impact on the company's progress over the next few years. Among them are:

- The addition of 116 new hardware and software releases. Major new products include the 7500 intelligent terminal, the large scale V8650 and V8670 computers, and the mid-sized 8270 as a response to IBM's 8100.
- The sale of its Appleton Papers Division and the acquisition of Comten—a communication computer manufacturer, permitting NCR to devote all of its resources to the business of information processing.

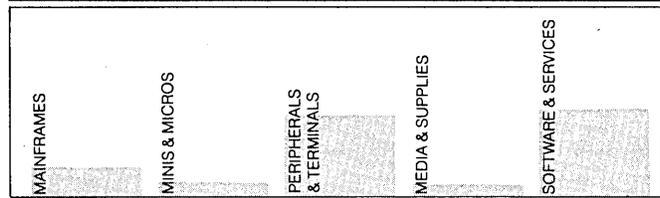
The new large scale family, the V8600, comprises the two most powerful general-purpose computers NCR has ever released. The family features the first use of 64K-bit memory chip technology in a large scale system and the first use of ultra-fast 100K emitter-coupled-logic circuitry in a commercially available, general purpose computer.

Also in the new product area, NCR introduced new financial, retail, and manufacturing terminal systems designed to further increase market share by offering more power and flexibility through the use of micro-electronics technology.

NCR now invests half of its research and development budget in basic and applied software. During the past year, the company continued to aggressively market its software as a revenue-generating product by emphasizing standardized applications, which can be readily adapted to specific customer needs.

The company's application software library continues to be one of the most comprehensive in the industry. 1978 additions to the library include the Interactive Manufacturing Control System II; new applications for MISSION, its on-line control system for very large manufacturing operations; and a new manufacturing data base system.

4



CONTROL DATA CORPORATION

P.O. BOX O, 8100 34th AVENUE,
MINNEAPOLIS, MN 55440
(612) 853-8100

Control Data's dp-related business moved toward the \$3 billion mark during 1978 as total sales increased 23% over the previous year. The strong showing by the company allowed CDC to retain its fourth place ranking in the DATAMATION 50.

At the close of fiscal '78 on Dec. 31, Control Data recorded \$2.7 billion in total revenues compared to \$2.3 billion in 1977. Net income was \$89.4 million compared to \$62.9 million the previous year.

Computer products comprise 68% of CDC's total revenues, or \$1.8 billion in 1978. The remainder of the revenues are generated in the financial services and insurance areas.

We estimate mainframes are responsible for 15% of the total dp revenues, minicomputers 5%, peripherals and terminals 35%, and media and supplies another 5%. The majority of the company's dp revenues, 40%, are generated in the software and services area.

Software continues to remain Control Data's strongest segment. This is attributable in part to the strong growth of CDC's data services which are based in large part on its Service Bureau Corp., formerly IBM's baby. Another strong contributor is the revenue which the firm derives from the unbundling of its software in 1970, especially in light of its 1974 refinement to reflect more accurately true software development costs.

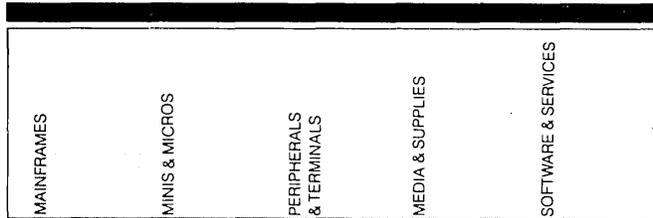
During the past year, Control Data did \$234 million worth of business with the U.S. government, which remains its largest single customer. Other markets for the company's products include education institutions and a steadily growing oem segment. Extraordinary income from the recovery of tax loss carry forwards in the area of international operations is another major reason the company enjoyed a bright '78.

Total service revenues were up 19% to \$697.3 million last year. Data services sales increased 17% to \$352.6 million, while revenue from leased computer equipment rose by 21%. Orders for large computer systems were up 36%. Sales of peripheral equipment to other computer industry manufacturers rose 56%, and the backlog expected to revenue during 1979 for oem and systems houses was up 42% from 1977.

Several new products, services and programs introduced last year will have a lasting impact on the company's ability to continue growing. Among those developments were the first deliveries of three new models of the CYBER 175 large scale computer. Also on the delivery line for the first time was a new family of disk drives capable of holding up to 635 million characters of information.

Forty new software application programs were introduced in '78. In addition, 17 new learning centers and five new Control Data Institutes were opened, bringing to 69 the number of educational service facilities the company has scattered worldwide.

5



SPERRY RAND CORPORATION
 1290 AVENUE OF THE AMERICAS,
 NEW YORK, NY 10019
 (212) 956-3273

Because its fiscal year ends in March, Sperry Univac's impressive growth and competitive position is best reflected in calendar year figures. Using this yardstick the company shows up as the number three manufacturer in the industry, generating dp revenues of \$1.95 billion.

Dp revenues for fiscal 1978 were naturally less—\$1.81 billion—and here the company's ranking dropped to the fifth position as a result. Net income for the same period was \$177 million.

These record revenues reflect a highly active as well as successful period for Univac, one that was highlighted by the introduction of a number of new products, such as the V77-800 minicomputers, the 90/40 and 90/80-4, and an enhanced 1100/10.

It also was a time when cumulative bookings for the high end 1100/80 systems reached \$550 million, and Univac's backlog hit a record \$1.5 billion. Further, the Sperry division set about expanding its growth not only in North America but in Brazil, Australia, Japan and Europe, while expanding production capabilities at Cupertino and Irvine, CA, where disc drives and minicomputers are produced.

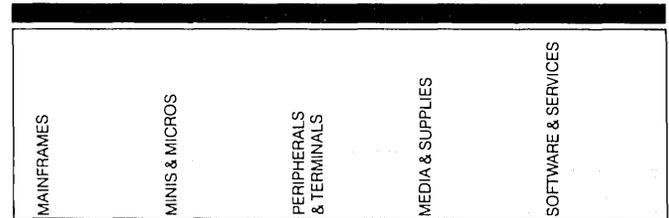
Univac also set about strengthening its position in its principal markets, notably manufacturing, federal, state and local government, the energy field, transportation, communications and banking. Of these, planned installation activity is most significant in government and manufacturing.

Having divested itself of both the single element typewriter business and its Office Systems Division, Univac is now totally devoted to the higher technology computer business. It is also banking heavily on migrating its installed base of 15,000 customers from older systems like the 1106, 1108, and the 9200 and 9300 to 1100/10s.

Univac's big winner last year was the 1100/80 which outbooked the most optimistic of Univac's sales by more than 60%. Conversely, BSM, Univac's small business system, has proven something of a disappointment, Univac executives confess. Even so, Univac has added close to 1,000 new customers with BSM.

Additionally, Univac is now going after specific industries with software applications packages that tailor a mainframe system to individual industry needs. One of Univac's most successful packages of this sort, UNIS—Univac Industrial System, has moved so well that some 250 or more such systems are now installed and more than 50 are in backlog. With UNIS, bookings in the manufacturing segment were up over 60% from the previous year.

6



DIGITAL EQUIPMENT CORPORATION
 146 MAIN STREET,
 MAYNARD, MA 01754
 (617) 897-5111

Digital Equipment still reigns in minicomputers. With its traditional market being invaded by mainframe companies and undercut by microcomputers from the semiconductor firms, Digital failed to achieve its 1978 growth projections. Nevertheless, it reported a healthy 36% growth of sales, from \$1.058 billion to \$1.437 billion.

Net income for 1978 registered \$142 million as of July 1 year-end, up 31% over the previous year's net of \$108 million. DEC, the minicomputer industry's first billion dollar business, again claims sixth place in the DATAMATION 50.

Breaking down DEC's broad product range, we estimate that 30% of the firm's revenues comes from minicomputers; 37% from peripherals and terminals; about 2% from media and supplies; and nearly 20% from software and services. Mainframes constitute 11%. Approximately 20% of the company's sales are to foreign markets.

Digital's products range from the DECSYSTEM 1090, the company's most powerful timesharing system, down through a series of new medium range DECSYSTEM 20s to the small DEC DataSystems. Although DEC's explosive growth was built on oem sales—and that market still absorbs a major portion of product volume—the company has increasingly moved into end user sales over the last several years. DEC has led the way into innovative small business system sales with pilot projects using retail store outlets in New England.

Internally, the company has taken an important step toward better targeting and servicing of its markets. With the realignment of its organization into three major marketing groups—Commercial, Technical, and Computer Products—there should be less internal overlapping within marketing groups, and a generally clearer product strategy should be possible.

The increased presence of IBM in the small computer market has both broadened the awareness of minicomputer potential among a broad range of new customers, and given Digital a strong new competitor. In light of the IBM entry, DEC has announced several new products in the last year that it hopes will broaden its base and strengthen its position. Preeminent among these are the 32-bit VAX 11/70s; other major additions include the 36-bit 2020 and the new series of terminal-based systems for the PDP-11 line.

As befits the leader of the minicomputer industry, Digital remains in the forefront of distributed data processing. After earlier troubles implementing DECnet, the company's continued development of networking software has resulted in a second generation offering—DECnet Phase II—which facilitates communication among virtually all of the DEC computer systems, irrespective of the machine's operating system.

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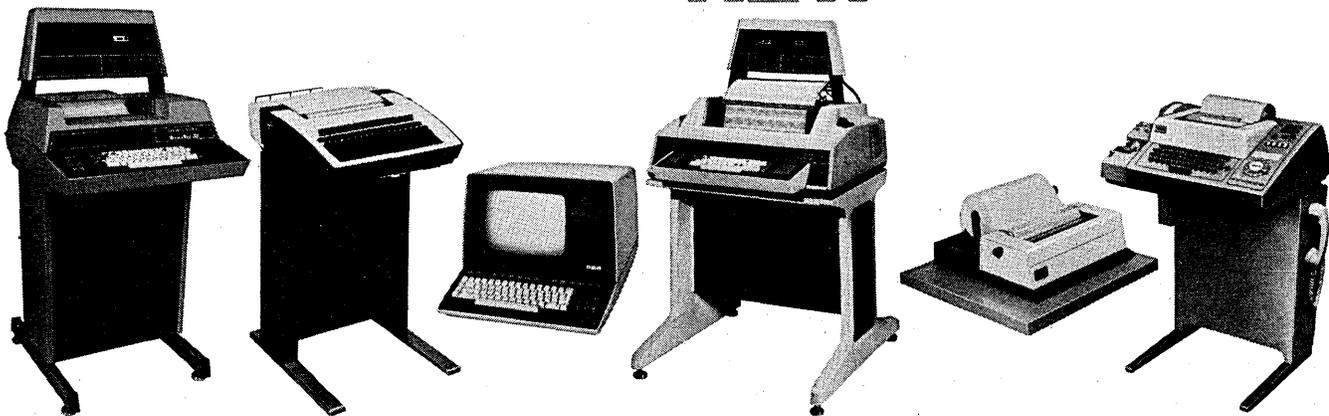
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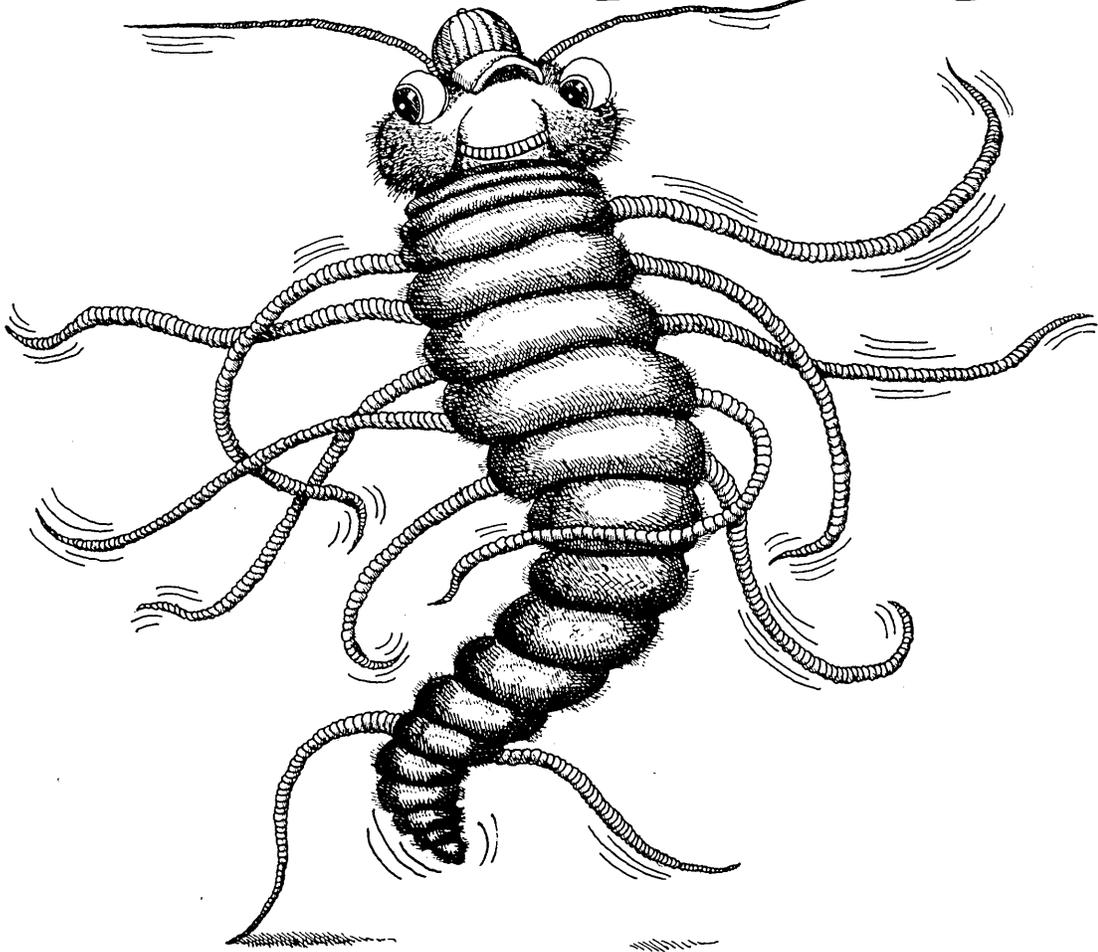
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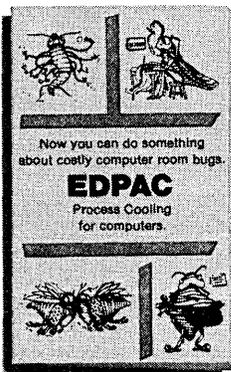
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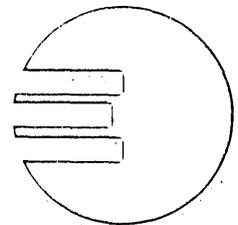
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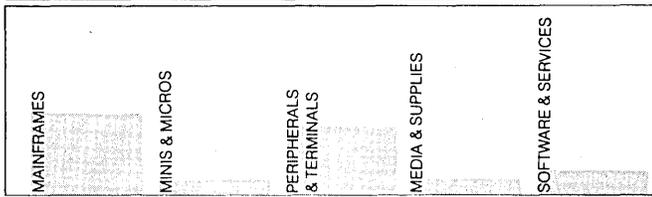
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7



HONEYWELL INC.
 HONEYWELL PLAZA,
 MINNEAPOLIS, MN 55408
 (612) 870-2700

Honeywell's computer business continued to contribute substantially to the company's overall performance during the 1978 fiscal year, which ended Dec. 31.

Computer sales, rental and service revenue were up 25% over 1977 to \$1.294 billion. This represents just over 36% of the company's total revenue figure of \$3.5 billion. Operating profits in the dp area increased 34% to \$106 million last year. Total net income was \$201.4 million as compared to \$145.1 million for the previous year.

Including the results of Cii-HB, its 47% owned European associate, computer revenue was \$2.131 billion in 1978, compared with \$1.643 billion the year before. Because Cii-HB is majority-owned by the French firm Cii, we have not included its revenues with Honeywell's for the DATAMATION 50 rankings.

New orders worldwide for Honeywell dp products surpassed the previous year, and the company entered fiscal year 1979 with the highest backlogs ever.

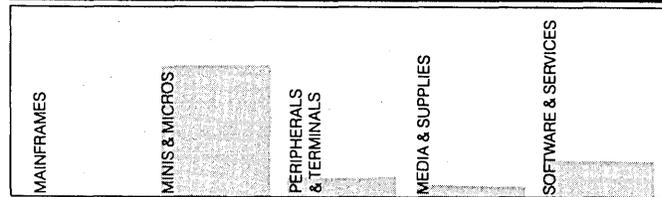
While the company does not break down its dp revenues into main product and service categories, we estimate that mainframe systems contribute 40% of dp revenues, with a similar portion generated by peripherals and terminals. Minicomputers and media/supplies added 5% each, with the remaining 10% from software and services.

In 1978, Honeywell withdrew its trouble-plagued level 66/85 system from the market and introduced the level 66/DPS Systems. Moreover, the company began to realize dividends on its multi-pronged marketing approach to the Level 6 minicomputer line. Sales here are concentrated in the oem/systems field and in the end user market through dedicated sales and support groups. Honeywell expects to continue this approach, which has produced two large contracts within the past year—a five-year rental contract with GE for 60 Level 66 DPS systems, and a \$20 million agreement with Brunswick Corp. for a Level 6 system that Brunswick will market to bowling centers.

As the unbundled approach to software and services grows stronger, Honeywell sees this area of its dp division as becoming an even larger contributor to its revenues. It expects to continue to develop software and become a strong competitor in this area.

Dp-related acquisitions in 1978 will only enhance the company's industry-wide position. The purchase of Incoterm Corp. strengthened its market position in terminals for banking, insurance, airline, and manufacturing applications. The addition of Synertek added MOS memory and microprocessor technology, while Spectronics Inc., another acquisition, adds expertise in fiber optics and optoelectronics for data transmission.

8



HEWLETT-PACKARD COMPANY
 1501 PAGE MILL ROAD,
 PALO ALTO, CA 94304
 (415) 856-2067

Hewlett-Packard ended fiscal 1978 last October with data processing sales up 31% from the previous year. That was only one of the overall company increases which enabled HP to move up a notch to number eight on this year's DATAMATION 50.

End of year figures for the company showed revenues totaling \$1.7 billion, a 27% increase from a year ago. Dp revenues amount to 38% of that total.

With its main competition coming from IBM, DEC and Data General in the high end area and from Wang for desktop computers, HP feels it has been able to meet their challenges and to strengthen its position with several new product lines and enhancements of those already on-line.

About 35% of HP's data processing product sales (excluding personal portable calculators) are in the business area, while the remainder are engineering and scientific equipment. The largest portion of the business computer sales are to manufacturing concerns, with lesser amounts to financial and educational institutions.

In fact, for the first time in the company's history, computation-related sales exceeded those of electronic test and measurement products. This jump was attributed to a large number of customers in business dp who purchased their first computers.

Use of the silicon-on-sapphire chip in its new systems will allow HP to stay at the 30% price/performance improvements the industry is experiencing each year. Use of the silicon technology in the 3000 Series cpu alone reduces the portions of nine printed circuit boards totaling 700 square inches to just three tiny chips with a total area of less than one square inch.

Other new dp products include the new range of business computers: the HP 250, the 300 and the HP 3000 Series 33 and Series III. These fall in the \$25,000 to \$250,000 price range and should increase both commercial sales and sales through oem's.

Computer networking is viewed by HP as one of the most important marketing segments today, and the company is gearing up to meet the increasing demands. Its leading product in this new growth area will be the HP 300 which uses the silicon semiconductor technology and can support up to 16 terminals.

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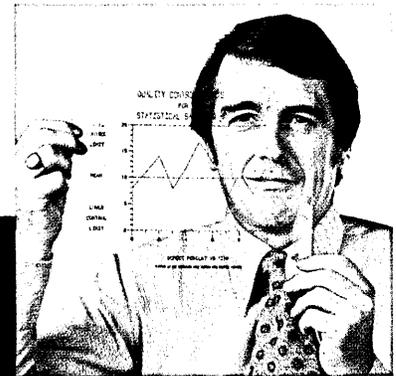
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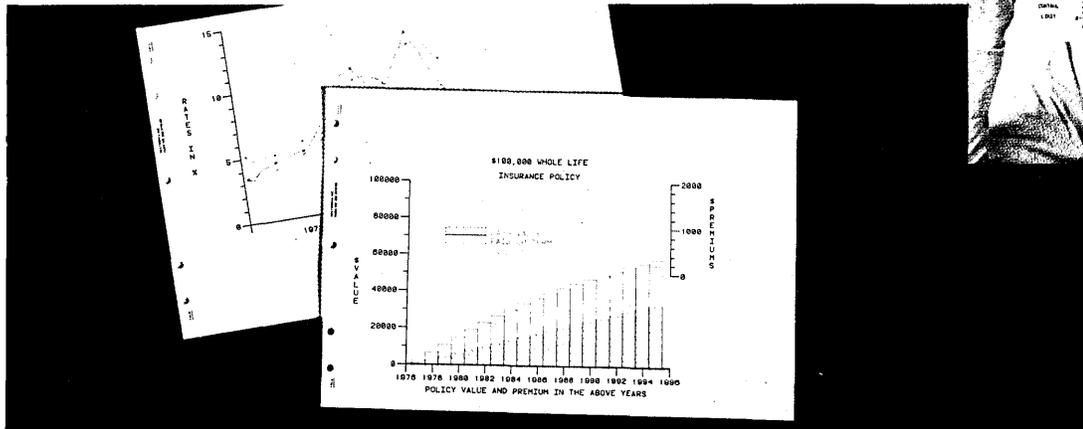
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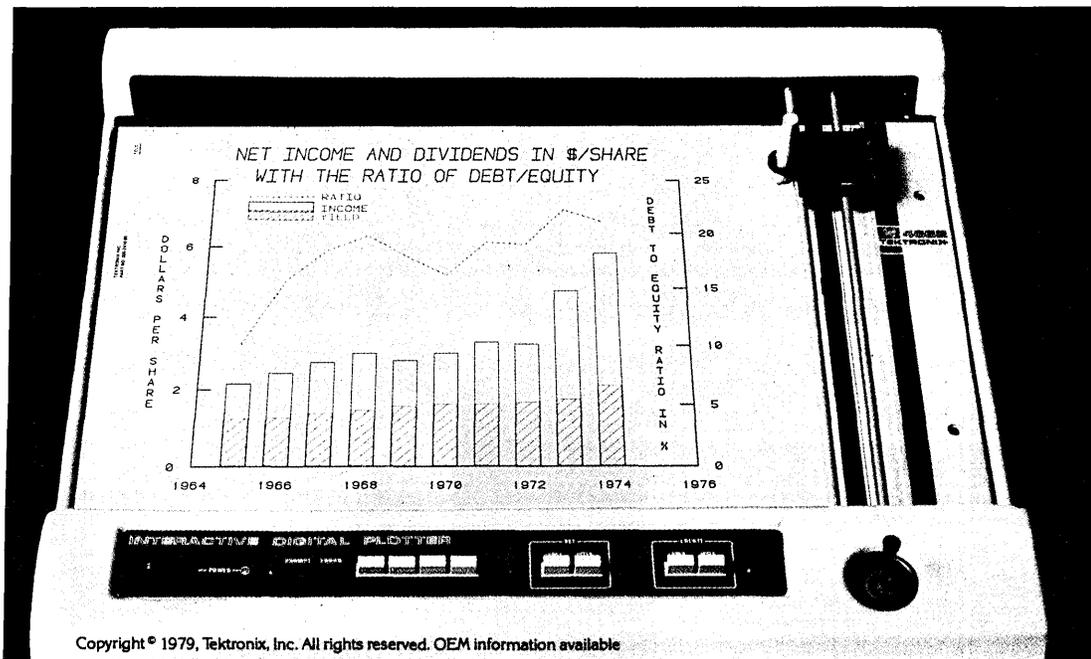
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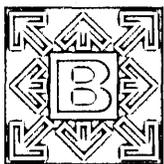
Depending upon your initial need to off-load your mainframe, you have three choices of capability: Models 50, 51, or 52. All Graphware 1000 Series Controllers are upgradable in the field, simply and quickly. The greater the capability the less demand for mainframe time.

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A very important plus, in addition to operating any two Varian printer/plotters on-line, the Graphware 1000 can also operate from a remote site over a standard telecommunications link at speeds up to 19.2 kb's.

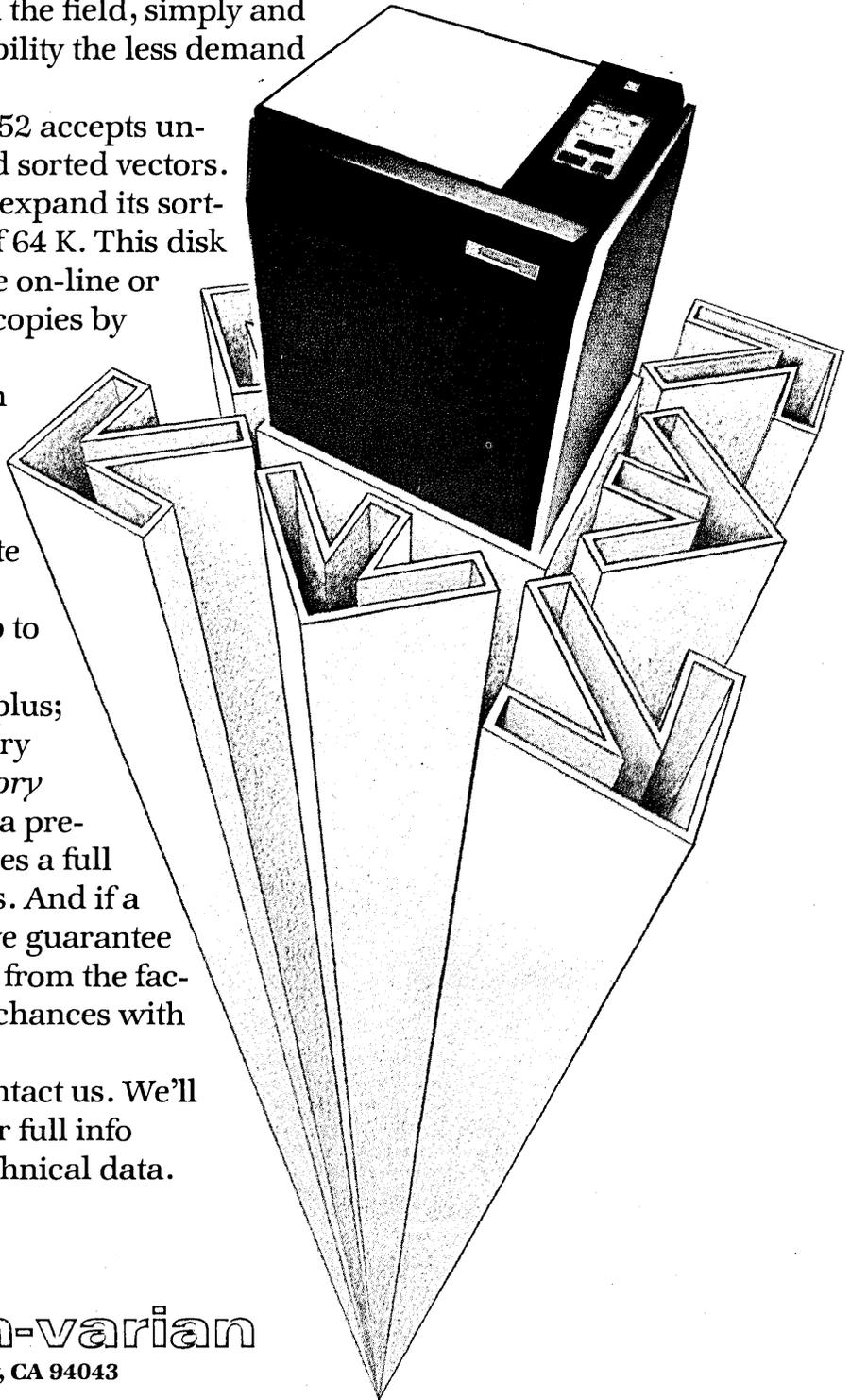
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Another first: Instant On-site Support. When your on-line data base network is down, every minute counts. Now, Instant On-site Support brings the expertise of our top DB/DC technicians right into your computer room through a remote dialup facility of Com-plete, as fast as a phone call — day or night.

All these features helped Com-plete become the first Data Communications System ever awarded International Computer Programs' "Million-in-One" Award for sales over \$1,000,000 in its first year.

3 Natural. The Interactive Data Base Language that saves you time. Natural is an exciting new departure from conventional programming languages. Designed for tomorrow's DB/DC environment, it replaces the cumbersome languages of the batch/file age.

Natural has saved 90% of the development time used by conventional languages... and it's so easy that you needn't be a programmer to use it. Natural makes it simple to design terminal screens and communicate with the data base. And you can forget things like File Definitions, OPEN's, or compilations. You just create your request and let Natural do the rest.

In conjunction with Adabas for Data Management and Com-plete for Communications Management, Natural brings you the power of a DB/DC environment quickly and easily.

Find out about the state-of-the-art. For information about these Software ag products for 360, 370, or 303X computers, simply call our nearest office or mail the coupon below. We will also be glad to arrange a presentation at no obligation.



North American Corporate Headquarters: Reston, Virginia (703) 860-5050 • **North American Offices:** Atlanta (404) 998-1990
Chicago (312) 298-4134 • Detroit (313) 354-0424 • Houston (713) 444-2651 • Los Angeles (714) 494-8410 • Miami (305) 989-4814
New York (212) 682-2780 • San Francisco (415) 332-3890 • Toronto (519) 653-6142 • Mexico City (905) 550-8033

European Corporate Headquarters: Darmstadt, West Germany 6151-82747

Software ag of North America, Inc.
Reston International Center, 11800 Sunrise Valley Drive, Reston, Virginia 22091

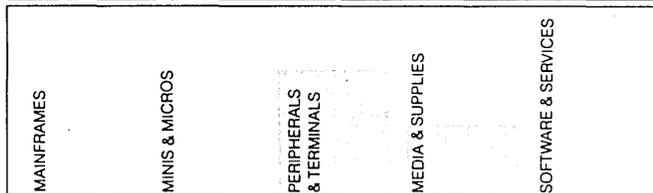
Please send details about:

<input type="checkbox"/> Adabas <input type="checkbox"/> Com-plete	<input type="checkbox"/> Natural <input type="checkbox"/> Please call to arrange a presentation.
Name _____	Company name _____
Street _____	City _____
State _____ Zip _____	Phone _____
Type of Computer _____	Operating System _____

D526 Worldwide Support



9



MEMOREX CORPORATION

SAN TOMAS AT CENTRAL EXPRESSWAY,
SANTA CLARA, CA 95052
(408) 987-1000

The voice of Ella Fitzgerald, a shattered wine glass and the question "Is it live, or is it Memorex?" have become almost a second trademark for this California-based peripherals and tape company.

Long a supplier of audio recording tapes and accessories, Memorex continues to be placed among the top leaders of dp-related products and service.

Total revenues for fiscal 1978 amounted to \$633 million, as compared to \$450 million the year before. Net income totaled \$42 million before extraordinary credits. The year-end figures gave Memorex a ninth place ranking in the DATAMATION 50, one rung below its 1977 showing.

Data processing related revenues totaled \$570 million, representing 90% of the overall figure. We estimate that peripheral products and terminals account for almost two-thirds of the company's dp revenues; media and supplies make up the remainder.

Memorex made substantial investments in research and development during 1978, with expenditures in these areas increasing by 23% over the previous year to a record \$24 million.

In the disc drive area, orders for the 3650, the company's most advanced and largest capacity disc storage system, reached record levels last year. A major enhancement was added to the 3670 disc storage subsystem, incorporating a microprocessor and advanced semiconductor memory devices. Also announced during the year was the Intelligent Dual Interface for the 3650 and 3670 subsystems.

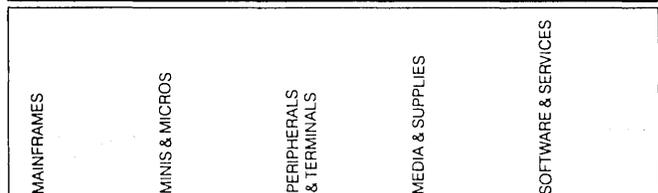
In recent years Memorex has placed more and more emphasis on data communications as a second major thrust. This product area was given a higher status within the company last year, and a separate facility has been established to handle the expanding communications operations. Memorex now becomes one of the few companies offering products for both ends of the transmission line.

Also during 1978, Memorex continued to invest in its oem equipment with a new flexible disc drive manufacturing plant in Mountain View, CA, and expanded production capacity at its two other plants. Memorex is now in full production on all of its oem equipment products.

Its line of flexible disc drives includes the single-sided model 651 which offers a storage capacity of 250 KB and the model 550 single-sided and model 552 dual-sided.

Memorex remains one of the leading suppliers of magnetic recording devices used on computer equipment. Its media line includes computer tape, rigid discs and assemblies, flexible discs, and a growing line of precision plastics for media storage and handling.

10



INTEL CORPORATION

ONE EMBARCADERO CENTER
SAN FRANCISCO, CA 94111
(415) 955-0000

Intel's 1978 revenues zoomed upwards by 71%, hitting the \$688.7 million mark and making it one of the fastest growing companies in the data processing field. Coupled with record revenues was a net income growth to \$47.2 million from the \$30.7 million of the previous year.

With 71% of Intel's total revenues generated by the computer segment, this division represented \$486.6 million of the total revenues. The phenomenal growth enabled Intel to move up to number 10 from its 11th place spot in last year's Top 50 Survey.

We estimate that 31% of dp-related sales were in the mainframe category, while 37% were peripherals and terminals, 29% software and services, and the remaining 3% between minicomputers and media and supplies.

One of the company highlights during the past fiscal year, which ended Dec. 31, was the sale of more than 1.5 million shares of common stock in public offerings, thereby adding to the company's equity base. Company officials claim that step should buffer the firm "against the consequences of the uncertainties of the money market."

Intel markets computer equipment supplied by outside vendors, often on an exclusive basis to the company. These products, all IBM-compatible, include disc and tape drives, add-on memories, and computer mainframes.

It also arranges lease financing for IBM systems. To date Intel has arranged leases for approximately \$1.7 billion of computer equipment and retains a residual interest in more than \$1.1 billion of IBM equipment.

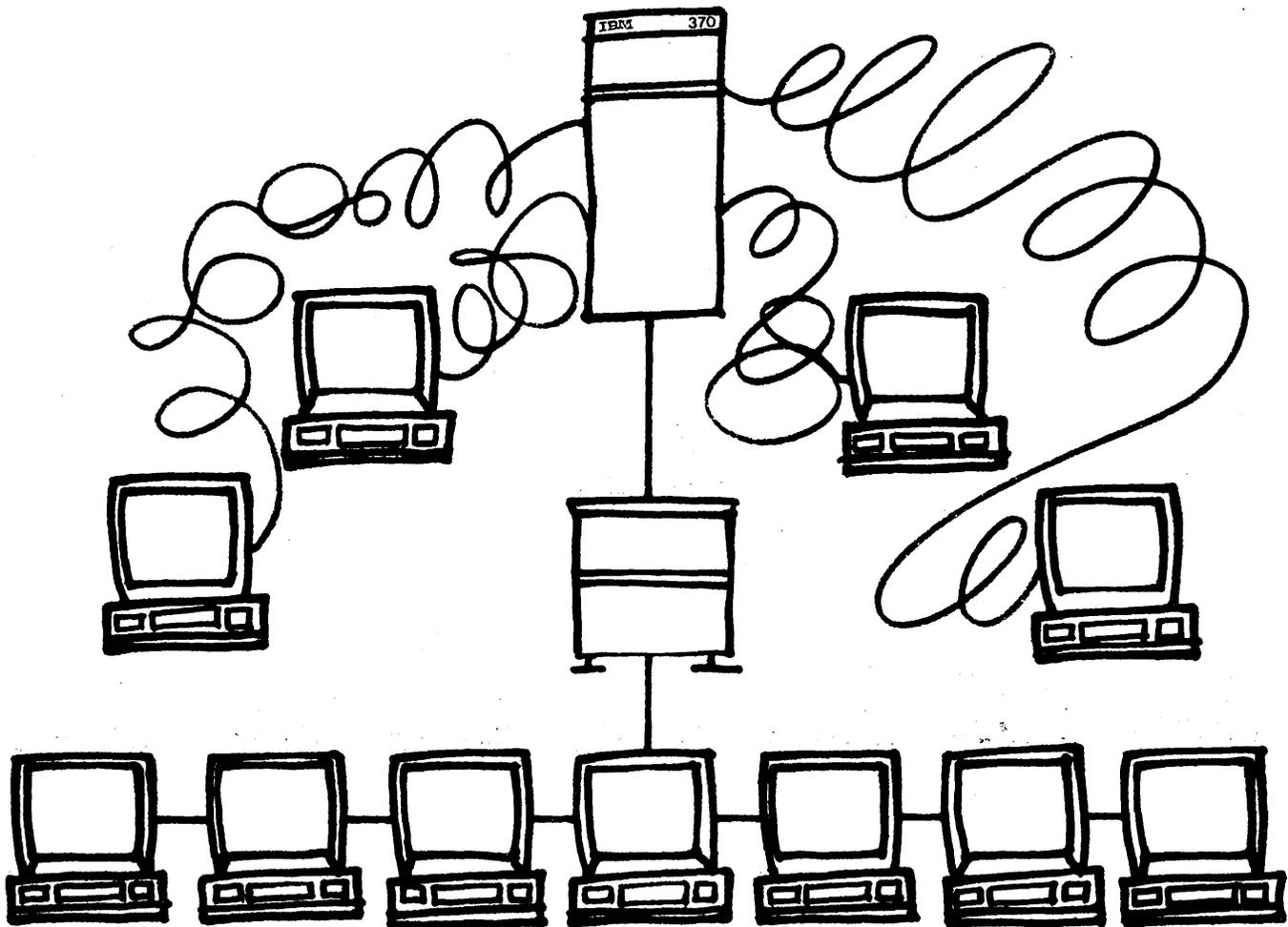
Income generated from its computer business contributes significantly to the funding needed for continued growth in the heavily capital intensive transportation business area.

During the past year, Intel restructured its Data Products Group, establishing divisions to market exclusively computer systems and peripherals. It also took a major step in marketing minicomputer systems with the introduction of the AS/3. The company also established the Systems Development Division as a research and development base. The design, development and assembling of IBM-compatible products will take place here.

Intel admits to having had a few problems with meeting its shipping demands last year. Company officials say faster delivery schedules on the larger mainframe 3000 Series should bolster that area in 1979.

In the Data Services Group, a major program was initiated in '78 to upgrade the types of services provided customers and to consolidate operations where practical. The program of assimilation is expected to continue during 1979 and will have a tempering effect on both revenues and income during the present fiscal year.

Put a Braegen where your IBM is.



Put a Braegen where your IBM is and you've solved your 3270 system expansion problems and eliminated multiple controllers, miles of coax, complicated interfaces and redundant peripherals. With the Braegen Multi-Task Terminal System you get IBM compatibility and much more.

Only the Braegen system offers 3270 address switching which allows all CRTs to have multiple addresses and to access any partition in multiple, local and remote 360/370/303X and compatible mainframes. NCP and VTAM type software requirements can be eliminated.

Only Braegen's multi-drop feature allows attachment of up to

16 peripherals on a single coax cable—CRTs, printers, card readers—anywhere system CRTs are used.

Only the Braegen system permits local processing up to 7500 feet from the host—saving the cost and inefficiencies of remote job entry and remote 3270 controllers.

And, Braegen's exclusive TSO does editing and submit work offline to eliminate the burden on CPU memory, cycles and channel contention.

No system on the market today comes close to the Braegen Multi-Task Terminal System. Put it where the IBM is. Get full information on capabilities and configurations from

The Braegen Corporation, 20740 Valley Green Drive, Cupertino, California 95014. (408) 725-1252.

I'm interested! Send me more info on your Multi-Task Terminal System.

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Title _____

Company _____

Mailing Address _____

City _____

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Telephone _____



BRAEGEN

The Braegen Corporation
20740 Valley Green Drive
Cupertino, CA 95014

11

MAINFRAMES	MINIS & MICROS	PERIPHERALS & TERMINALS	MEDIA & SUPPLIES	SOFTWARE & SERVICES
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TRW INC.

23555 EUCLID AVENUE,
CLEVELAND, OH 44117
(216) 383-2332

Though the complexity of TRW's organizational reporting structure makes it difficult to gauge the performance of its dp-related activities, we estimate that dp-related sales totaled \$466 million for fiscal 1978, compared to \$350 million the previous year.

Total revenues for the company for fiscal '78, ended Dec. 31, were up 16% to \$3.8 billion compared to \$3.3 billion the previous year. Net income rose 13% from \$154 million to \$174 million.

An estimated 12% of TRW's total revenues are dp-related; 70% of that is thought to come from software sales and services. The remaining portion is generated by peripheral and terminal sales.

TRW bases its dp products and sales on a variety of services it provides companies which find it more effective to use TRW's extensive service organization than build up and maintain their own. These services range from computer-based information such as retail customer charge authorization systems to field service and maintenance agreements.

As general demand continues to grow, TRW's data processing microprocessor-based point of sale terminals, banking terminals, and text editing devices sales should make steady advances.

In this area, the company has developed tiny microelectronic chips capable of operating at over 10 billion cycles per second. Other large scale microelectronic circuits containing the equivalent of 30,000 circuit elements have also been developed.

Within TRW's computer division, the most widely sought-after products are found in the area of digital communication.

Its computerized consumer credit reporting for both individuals and businesses throughout the country is seen as one of its most significant marketing areas. TRW has become the market leader in consumer credit and continues to expand its communications network and computer capacity.

A new program to extend this capability into business credit reporting was made during the past year. The size and quality of the data base improved, TRW says, with over a million new business locations and two million credit experiences added to the files. There was also a sizable sales increase, although the program is still operating at a loss.

Sales in the large scale integration technology area are growing rapidly. LSI is now the basis for a series of unique commercial products, including analog-to-digital converters, multiplexers and correlators.

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MAINFRAMES	MINIS & MICROS	PERIPHERALS & TERMINALS	MEDIA & SUPPLIES	SOFTWARE & SERVICES
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DATA GENERAL CORPORATION

ROUTE 9,
WESTBORO, MA 01581
(617) 366-8911

For every month of fiscal 1978, ended last Sept. 30, Data General claimed a new addition to its product line. A year ago November, DG broadened its microNova line; two new CS/40 models previewed that winter; and even August had the S/250 and C/350 systems, major additions to the Eclipse line.

On Wall Street, the company has established an enviable reputation for profit focus. In 1978, DG pulled in a net income of \$40.3 million from sales of \$380 million. Revenues were up 49% from 1977 sales of \$255 million, and net income jumped 41% from \$28.6 million.

Data General is only 10 years old. Last year, its service and support revenues (software fees, field engineering, training, and systems engineering) contributed 11% of total sales. That \$41.9 million was roughly the size of the whole company only six years ago.

About 89% of DG's revenues came from minicomputers, peripherals and terminals. Last year, U.S. business accounted for 68.8% of sales.

Data General divides its customers into five basic categories, and markets accordingly. The Eclipse computer family is targeted at commercial markets with distributed functions (with systems priced from \$55,000 to \$520,000) and scientific and industrial applications (with systems priced from \$45,000 to \$195,000.) The CS small business systems family (priced from \$10,000 to \$150,000) is aimed at smaller commercial installations. To the general purpose market, DG sells many minicomputers at the top end (the Nova, priced \$3,000 to \$150,000) and minicomputers at the low end (the microNova, priced up to \$9,000 per system).

About 60% of DG's customers are still original equipment manufacturers, many of them blue-chip firms; the remaining 40% is divided between end users and distributors.

Like most of the larger mini vendors, Data General is investing heavily in software development. It has been making impressive R&D commitments—\$38.4 million in '78, just over 10% of the year's total revenues. The company claims the return on this investment has resulted in a 10% to 20% reduction in cost per function to users.

One tangible result in 1978 was the minicomputer industry's first PL/1. DG's subset of PL/1, a common large system language, should allow software transfer between host systems and minis with minimal conversion.



Introducing the Sperry Designed exclusively for three

The Sperry Univac V77-800 Miniframe is the newest and most powerful mini we've ever built — a high performance, multi-use, general-purpose minicomputer system designed for both commercial and scientific data processing. It has a memory range from 128K bytes to 2 megabytes (with error correcting memory) and a 150 nanosecond CPU with integrated cache of 1024 bytes. Plus 12K bytes of user programmable writable control store.

There's an optional new high speed 64-bit floating point processor that works in conjunction with a new globally optimized ANS '77 FORTRAN.

No wonder our three most important customers think so highly of it.

OUR OEM CUSTOMERS KNOW WE DESIGNED IT JUST FOR THEM.

The Miniframe is customer microprogrammable. So an OEM can implement his own firmware packages. And with the many software packages we offer, the OEM can add all the bells and whistles he wants.

The Miniframe comes with our largest instruction set ever. So OEM's with their own software have much more flexibility in design.

The Miniframe speaks PASCAL, the powerful new language for scientific, commercial, and system programming that most competitive systems still can't speak. And of course, it also speaks COBOL, FORTRAN and RPGII.

More good news is that the Miniframe is compatible with the rest of the V77 product line.

OUR SYSTEM HOUSE CUSTOMERS KNOW WE DESIGNED IT JUST FOR THEM.

Naturally, system houses want all the features OEM's do. And more.

So we gave them more.

More operating systems, for example. Choose from VORTEX or our new SUMMIT — an interactive, multi-terminal system with transaction processing and data base management. It gives you easy editing, screen formatting, and documentation aids. Plus speedy, comprehensive program development.

System houses also think PASCAL is important. Because it's more efficient, easier to maintain, expand, and modify.

The Miniframe brings systems builders a new query language called QL-77. It features inquire and report facilities. And interfaces



Univac V77-800 Miniframe. of our very best customers.

directly to TOTAL*, the data base management system. So preprocessing and intermediate handling are a thing of the past. Finally, TOTAL also gives you complete data base access and file access security.

OUR END USER CUSTOMERS KNOW WE DESIGNED IT JUST FOR THEM.

Take all the features we designed in for OEM's and system houses and say ditto for the end user.

But we didn't stop there. We also pressed a few special hot buttons just for end users.

Consider QL-77, for example. End users will love our new query language because it reduces the amount of application programming. By storing query language procedures right in the data base file. Where they can be easily and quickly recalled and executed at any time.

Once again, SUMMIT, our new operating system, helps the end user handle transaction processing. Without any additional, expensive software. It's also the right answer for a multi-tasking, "fully-implemented" distributed processing system.

Finally, the Miniframe supports DCA and conventional protocols. So you can talk to both SPERRY UNIVAC and IBM hosts.

YOU'LL KNOW WE DESIGNED THE MINIFRAME JUST FOR YOU.

No matter what your application, no matter what your need, the Miniframe may just be the answer.

For more information, write to us at Sperry Univac Mini-Computer Operations, 2722 Michelson Drive, Irvine, California 92713. Or call (714) 833-2400, ext. 536.

In Europe, write Headquarters, Mini-Computer Operations, London NW10 8LS, England.

In Canada, write Headquarters, Mini-Computer Operations, 55 City Centre Drive, Mississauga, Ontario, L5B 1M4.

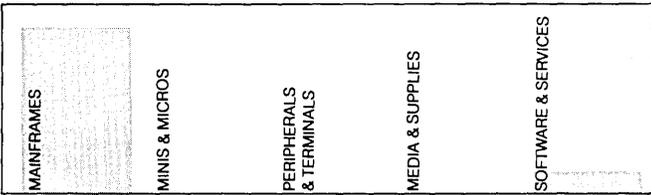
We're Sperry Univac.

And our new Miniframe is going to solve some very big problems.

SPERRY UNIVAC
SPERRY UNIVAC IS A DIVISION OF
 SPERRY RAND CORPORATION

*TOTAL is a registered trademark of Cincom, Inc.

13



AMDAHL CORPORATION

1250 EAST ARQUES AVE.,
SUNNYVALE, CA 84086
(408) 795-4011

Amdahl continues to make impressive gains in its head-on competition with IBM. The company ended fiscal 1978 on Dec. 29 with a 70% increase in total revenues to \$320.9 million. Net income increased from the 1977 figure of \$26.5 million to \$48.2 million.

Those figures show Amdahl to be one of the fastest growing companies in the industry. During fiscal '78, employment grew by 75%. Also by year-end, capital investments were up by 115%.

Riding out the waves caused by its giant competitor is nothing new for Amdahl. In 1977, it had record breaking revenues and earnings despite the introduction of a major new line of mainframes by IBM and price reductions for its systems instituted in response to market moves.

Company officials point to several factors that enabled such a positive picture for another year: several noteworthy hardware and software product announcements; expansion not only of the U. S. market but also a major increase in the number of systems installed internationally; and an increase in repeat business from the previous year.

New product announcements included the 470V/5-II for delivery this year, and the on-schedule shipment of the new 470V/7. Added to this was the announced top-of-the-line, high performance 470V/8 that is scheduled for delivery in September.

Two software products, a first-ever for Amdahl, include the MVS/SE Assist, which complements the compatible IBM software enabling a 12% increase in throughput; and the VM/Performance Enhancement System, which makes it possible to run more than one system control program concurrently.

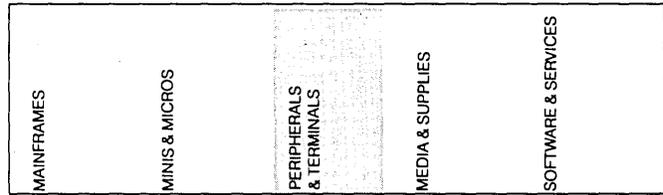
Amdahl invested 47% more during 1978 than 1977 in engineering and new product development. Part of that investment is focused on semiconductor technology at the company's integrated circuit laboratory in California.

The firm continues to seek innovative approaches to supporting installed systems and is currently cross-training field system software engineers to perform many of the hardware maintenance functions of field hardware engineers. Similarly, the Amdahl Diagnostics Assistance Center exchange program was begun last year to upgrade the skills and job interest of the firm's field hardware engineers.

International customers accounted for 29% of total 1978 shipments. In the same area, a record number of new Amdahl customers worldwide placed multiple-system orders as the company expanded its markets in Canada, Europe and Australia.

Major customers continue to be broad-based and in all industry sectors that use large scale general purpose computers. At the end of 1978, the largest number of systems were used in the manufacturing sector.

14



STORAGE TECHNOLOGY

2270 SOUTH 88th STREET
LOUISVILLE, CO 80027
(303) 666-6581

A recent study showed that Storage Technology was far and away the leading independent in the IBM-compatible tape drive and add-on market.

In fact, among the close to 6,000 mainframe sites responding to the survey (sponsored jointly by DATAMATION and G.S. Grumman/Cowen), some 24% used Storage Technology equipment. That represented 14% more of the market than held by the next leading independent.

The same study showed Storage tied with Memorex as the leading independent supplier in the disk add-on market.

The kind of success evidenced by these statistics is reflected in Storage Tech's financial figures. Last year's dp revenues almost doubled, jumping from \$162 million to \$300 million. As a result, Storage leapfrogged in the DATAMATION 50 ranking, going from 19th to 14th place.

Net income for the year also improved markedly over 1977, climbing from \$11 million to \$27 million in 1978, an increase of 135%.

Additionally, the Colorado-based company introduced a number of new products. Among them were the 8650 double density disc; the 4305 solid state disc; the 2700 mini disc; and the COM 2, a telecommunications product.

Principal markets for Storage Tech's product line include the end user domestic market—specifically "Fortune 1000" corporations, major banks, and insurance companies. The company also sells on an oem basis to a number of computer companies including DEC, Cii-Honeywell Bull, Univac, Burroughs, and Siemens. Internationally, Storage Tech sells through subsidiaries and distributors.

During fiscal 1978, Storage Tech's stock split two for one. Internally, its combined international and domestic sales force climbed to 1,400 people and its total work force totaled 6,497.

ASI/INQUIRY

The IMS DB/DC QUERY LANGUAGE

USED BY MORE IMS INSTALLATIONS THAN
ANY COMPETING PRODUCT



ASI/INQUIRY is an IMS DB/DC query language that operates completely as an interactive Message Processing Program. The design of ASI/INQUIRY is such that the *structure of the data base is transparent to the user*. Moreover, one need not have familiarity with DL/1 segment logic or the complexities of multi-pathing. Extremely rapid response time is assured.

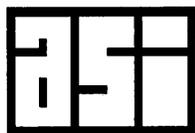
MAJOR HIGHLIGHTS

- End-user oriented
 - Easy-to-use language
 - Requires no knowledge of IMS
 - Comprehensive diagnostic messages
- Rapid response time for even the most complex queries
- Dynamic priority scheduling to maximize system performance
- Availability of default as well as user-defined screen formatting

Additional features and functions include:

- Supported under both IMS DB/DC and TSO
- Full support of IMS/VS secondary indexing
- Open-ended computation facilities
- Ability to SORT display output
- Complete security through password protection
- Comprehensive log of all session and run statistics
- Unlimited data base concatenation and referencing
- Optional usage of qualified SSA's

In summary, ASI/INQUIRY represents the state-of-the-art product in an IMS/DC or TSO-supported environment. Contact us and learn why organizations such as *Hughes Aircraft*, *Standard Oil of Indiana*, *Hydro-Quebec* and *EXXON* are processing queries like "What if" and obtaining a return on their investment many times over.



The Software Manufacturer

Applications Software, Inc.
Corporate Offices
21515 Hawthorne Boulevard
Torrance, California 90503
(213) 542-4381

OUT
THINK



Liquids, the most adaptable of all matter, shape themselves exactly to fit their containers.

In much the same way, a Datapoint ARC™ system adapts itself to fit the needs of a business.

In this day when competitive edges are frequently slight and often difficult to come by, you have to out-think your competition to gain an advantage. The Attached Resource Computer system can help by putting powerful data processing capability at the hands of those who need it most, wherever they are in the company.

Not just another network

An Attached Resource Computer system is an arbitrary number of small, powerful, inexpensive computers, each performing its assigned tasks independently, yet all are totally interconnected to share common resources and draw from a common database. For high reliability, the system is composed of proven Datapoint processors and peripherals.

One of the ARC system's strengths is its specialization of components. One or more processor in each system is dedicated to file processing and management. The others are applications processors. Internal communications are achieved by an Interprocessor Bus, using dedicated Resource Interface Modules (RIMs).

This capability frees a computer from juggling all three functions. Consequently, processing can be carried out at much higher throughput. Even though the processors are functionally dispersed, the system is a single, unified computing facility, with the processing speed and capability of a large, conventional computer.

Solves growth problems

This new, modular architecture offers easy-to-implement solutions to the problems of system planning and growth. The system manager can add (or delete) processors or file storage as workloads change.

Expansion can occur in modular, incremental steps, at predictable, affordable costs. Only enough processing power is required at a given time to accomplish the immediate

workload. Important capital is not tied up in costly overcapacity, yet the work is not delayed by a bogged-down, overworked computer.

Protects software investment

The ARC system can use your present Datapoint system software. When additions are made to the system, current software is not affected. All the Datapoint resources suitable for participation in an ARC system are completely compatible.

While direct hardware cost comparisons are difficult because of differences in architecture, our studies indicate that the cost of an ARC system may be only 50% to 70% of the cost of a more conventional system with equivalent capabilities.

Total adaptability

The applications at work in an ARC system can be as varied as the diverse functions of the business environment. The concept applies to any type of firm engaged in one or multiple endeavors. Its usefulness is equal whether it's in a corporate home office,

a division headquarters, or a remote office. Or all three can simultaneously employ their own ARC or other Datapoint systems and interconnect them through telecommunications links.

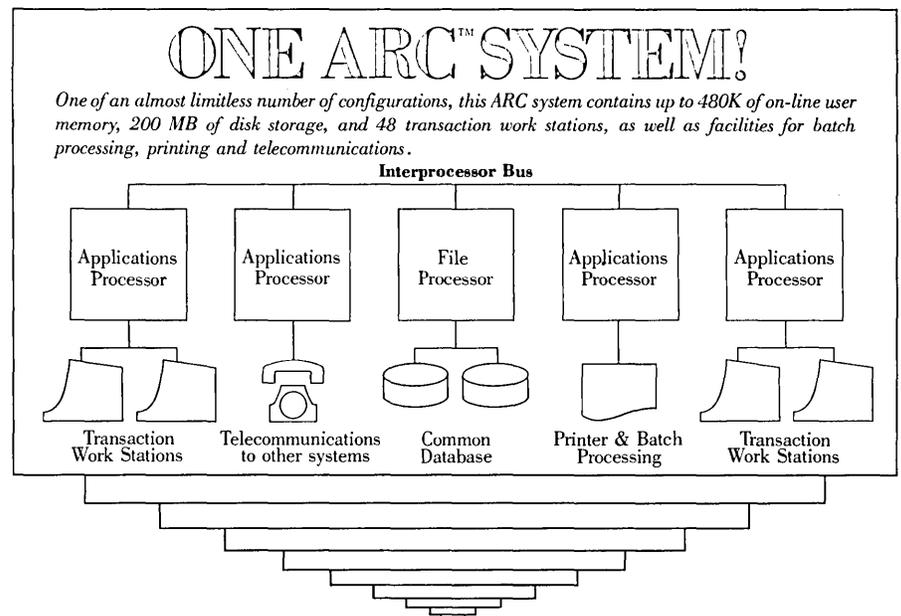
A nationwide support network

There are more than 500 Datapoint Customer Service Representatives in the field, stationed in over 130 local service area offices. The system is designed to place customer service and support as near as possible to Datapoint's 11,000 installations.

Write for more information

A Datapoint Attached Resource Computer system is the ideal solution to your business data processing needs. Datapoint has to out-think its competition. The ARC system puts us another big jump ahead.

A booklet describing the features and advantages of the ARC system is available by writing to Datapoint Corporation, Marketing Communications Dept. (M62), 9725 Datapoint Drive, San Antonio, TX 78284. Or call the Datapoint sales office nearest you.



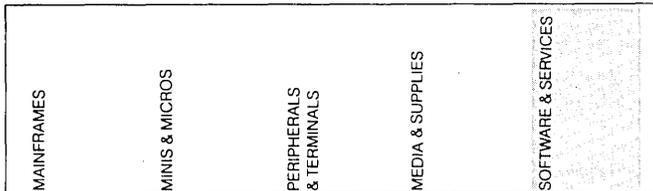
◀ The adaptability of an Attached Resource Computer™ system is another example of how Datapoint out-thinks its competition to help you out-think yours.



DATAPOINT CORPORATION

The leader in dispersed data processing™

15



AUTOMATIC DATA PROCESSING INC.

405 ROUTE 3,
CLIFTON, NJ 07015
(201) 472-1000

Automatic Data Processing ended fiscal 1978 with a 21.9% increase in revenues and an almost 18% jump in net income, marking its 29th consecutive year of growth.

The June 30 end of fiscal '78 showed total revenues reaching the \$299 million mark, as compared to \$245 million the previous year. Net income stood at \$27 million, a 17.6% increase over the \$23 million of fiscal '77.

In spite of the steady growth, ADP dropped one place in our top 50 survey to number 15.

With 100% of its dp revenues generated by software and services, ADP continues to aim its products to the business market, with customers now numbering over 60,000. During the course of the year, it beefed up its efforts in this market, adding ADP/Onsite to its Network Services. This new offering provides users with the traditional benefits of timesharing plus an in-house computer provided by ADP. To date ADP has installed 24 Onsite systems, each of which generates revenues of about \$200,000 annually.

ADP's oldest service group, Commercial Services, contributed over 50% of the company's revenues. During the third quarter, the marketing and marketing support staffs were expanded beyond the levels originally budgeted "in view of the momentum of the group's new account sales."

At year-end CSG provided payroll, accounting, and management information services to more than 60,000 firms from regional computing centers in this country, the Netherlands, Brazil, and the United Kingdom.

A new commercial service was introduced last year, Unemployment Cost Control, which is aimed at helping employers control unemployment tax costs. At year-end the annualized revenues of this service had already doubled the prior year's revenues of ADP's payroll services.

Corporate acquisition and development activities helped to open new markets for the company's existing services, to expand product offerings and to create new opportunities.

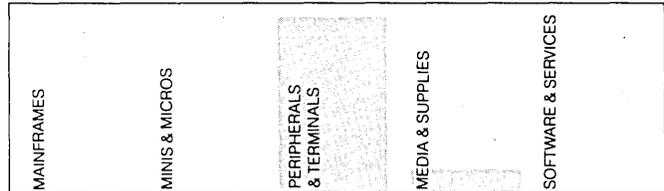
During the year new regional computing centers were opened in Phoenix, Charlotte, and Portland.

ADP also acquired the customer computing services of a large California bank and a significant number of securities industry clients from a major regional stock exchange.

1978 also saw ADP begin developing unified application packages for all its bank processing centers. The development capitalized on several acquisitions made prior to last year in the banking and thrift areas.

Moreover, ADP expanded its involvement in electronic funds transfer, providing pay-by-phone service in one computing center and establishing a remote teller service in another.

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3M COMPANY

3M CENTER
ST. PAUL, MN 55101
(612) 733-1110

With a relatively small increase in its estimated dp revenues—\$280 million in fiscal 1978 as opposed to \$240 million the previous year—3M's position on the DATAMATION 50 dropped three positions, from 13th to 16th.

Dp-related revenues, which are generated primarily by the firm's sales of computer output equipment, data entry terminal systems, disc packs, tapes, cartridges and cassettes, represent about 6% of 3M's \$4.661 billion revenues.

Net income on those revenues comes to \$563 million, compared to \$413 million in 1977.

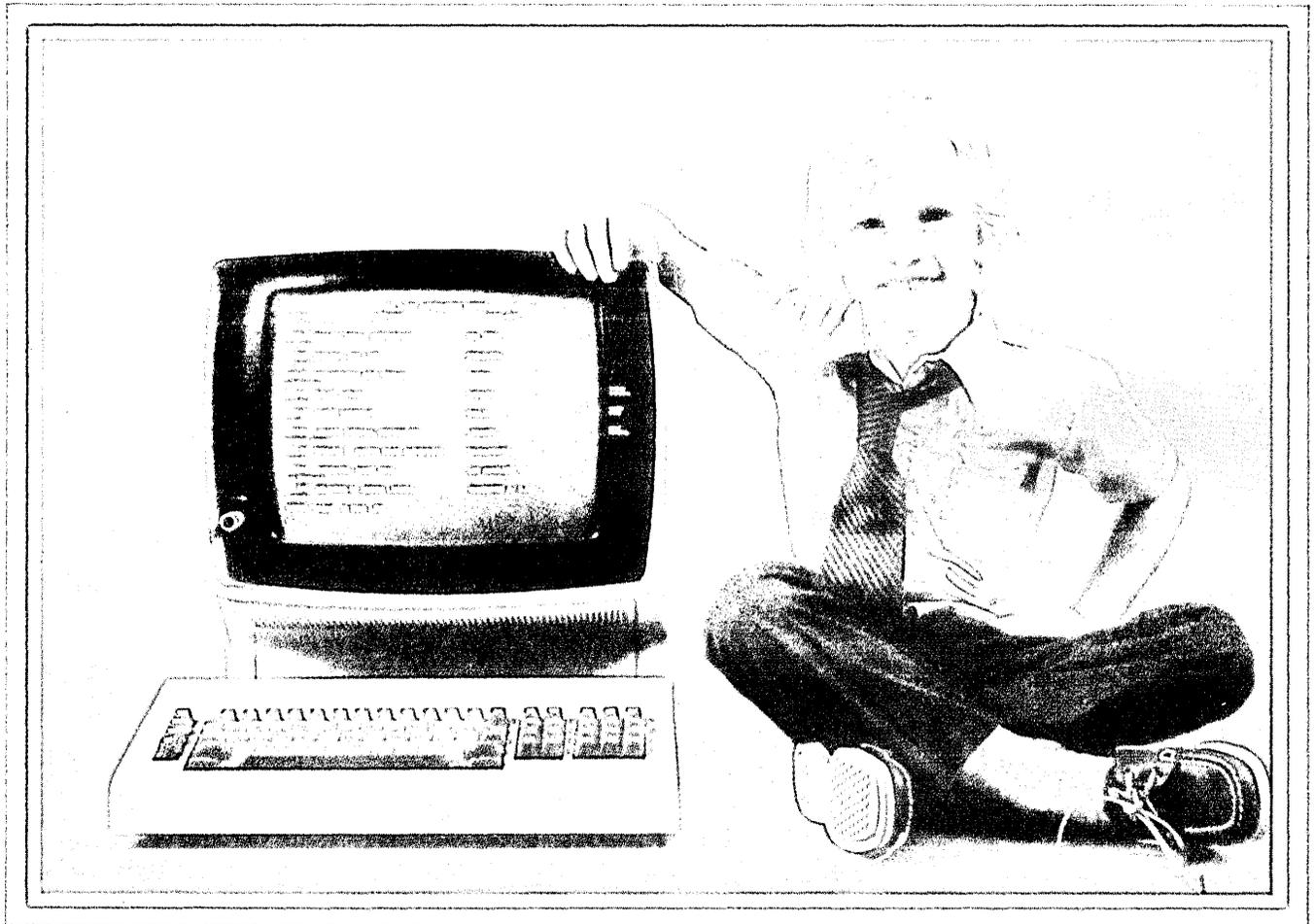
During the course of the year 3M, which spent a total of \$204 million on research and development, introduced several new dp-related products. Among them:

- A magnetic tape technology that uses pure metal particles and delivers twice the overall output of conventional audio tapes. The tape technology has great potential in the data processing markets, 3M believes.
- The first audio recording system that uses digital technology. This significantly improves the quality of the recording, the company says.
- Data cartridges and drives for the minicomputer market, as well as flexible and rigid discs for data processing applications.
- A fiber optic link for data processing applications.

During the year the company reorganized its top management, naming Lew Lehr vice chairman and chief executive officer, and John Pitblado president of U.S. operations, a position previously held by Lehr.

R. H. Herzog continues as chairman of the board and chief executive officer.

Consider Cincom



**We offer an interactive, on-line data base query facility
so easy to use - it's almost child's play.**

Experience gained from serving over 2,000 TOTAL® Data Base Management System (DBMS) users worldwide has taught us that the success of a DBMS is measured by how rapidly the data resource can be transformed into end-user information.

For many types of information requirements, traditional programming techniques are a time-consuming, costly bottleneck. Cincom's new query facility eliminates this programming need for both ad hoc and repetitive inquiries into the TOTAL® DBMS. It provides prompt decision/action information to non-programmer personnel in a logical format.

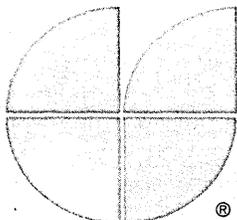
As proof, we tested our query facility's ease of use with

a random group of children. They mastered the basic inquiry capability in less than two hours. All functions in less than a day. If you consider this type of increased productivity and visibility, this type of bridge over the programming barrier, to be important to your data processing group, shouldn't you consider Cincom?

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Cincom Systems, Inc.

The TOTAL Information Systems People.

Introducing the first intelligent terminal that's ready to do business.



The DEC Datasystem 150 is here—with proven commercial software.

The Datasystem 150, with complete local computing capability, includes the PDT-11/150 hardware—processor, memory, and dual floppy disk drives. All designed and packaged for easy use by office personnel.

But what really separates the Datasystem 150 from every other intelligent terminal on the market is the software—our DEC Datasystem software, specially developed for business applications, and our CTS300 operating system, already at work in over 6000 installations. CTS300 includes:

DIBOL—Digital's comprehensive, easy-

to-use language, specifically designed for small business computers.

DECFORM—our powerful data entry and inquiry program.

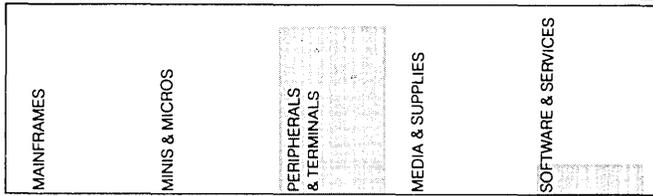
ISAM—sequential, indexed sequential, or random file access—for efficient implementation. And more.

Software options include communications protocols that turn the Datasystem 150 into an intelligent networking terminal—to communicate with other computers in either on-line interactive or batch mode.

We also offer two printer options—30 cps or 180 cps—both with multiple copy capability.

But there's more to the Datasystem 150 than impressive performance. Since it's part of a whole family of compatible DEC Datasystems, it opens the way to a wide range

17



NORTHERN TELECOM SYSTEMS CORP.

P.O. BOX 1222,
MINNEAPOLIS, MN 55440
(612) 932-8000

Northern Telecom Systems Corp. is a new name on this year's survey. But a closer look at this wholly owned subsidiary of Northern Telecom Limited shows it's no stranger among the leading dp companies.

Last year NTL purchased Data 100 and Sycor to form this 17th ranked company in the computer industry. Company officials foresaw the move as enabling NTL to capitalize on its strength as one of the leading manufacturers of telecommunications equipment by coupling it with the data processing sector.

"The new company puts us at a strengthened position in both the computer and telecommunications field," one company spokesman comments.

Northern Telecom Systems Corp. ended fiscal 1978 with total revenues at \$275 million, most of which were generated by the sale of peripherals and terminals.

Looking back, Data 100 ranked 25 last year on \$138 million of revenues and net earnings of \$6 million. Sycor made the 1977 survey listing at number 44 with total revenues of \$77 million and net earnings of \$3 million.

Company officials have called the first six months of Northern Telecom Systems Corp.'s existence a period of "settling out."

"We have been finding out the strengths, both manpower and market-wise, of each company," an official said. "We are putting together something from two foundations."

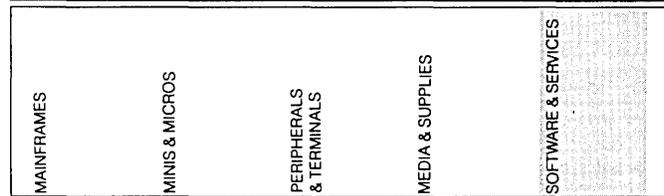
Presently the company works from two bases of operations: Ann Arbor, MI where Sycor is based, and Minneapolis, the home of Data 100. The future will bring about a combination of those facilities as logistics are worked out.

Both Data 100's and Sycor's stocks-in-trade are data entry systems such as Data 100's key-to-disc Model 74, and the model 82, an item-by-item system.

Product changes and eliminations will come over the next months as the company gears itself for the future—a future emphasizing the confluence of computers and telecommunications.

Company officials have stressed that both companies individually offer product lines which meet the full range of computer needs in today's marketplace. That factor, plus the growing distributed data processing market, puts Northern Telecom Systems Corp. in an advantageous position to capitalize on these growth areas of the industry.

18



COMPUTER SCIENCES CORPORATION

650 N. SEPULVEDA BLVD.,
EL SEGUNDO, CA 90245
(213) 678-0311

Meeting the dp needs of the federal government has enabled Computer Sciences to record another record-setting year, with revenues on a steady upswing.

Total revenues for the fiscal year ending March 31, 1978 were \$277 million, an 18% increase over the \$234.7 million in 1977. Net income totaled \$13.8 million, compared to the \$11.6 million of the previous year.

CSC generates over 90% of its total revenues from software systems and services, with less than 10% coming from communications engineering.

The federal government comprises 71% of the total market which purchases CSC products. The commercial area makes up 13% and the international market 9%, with state and local governments accounting for the balance.

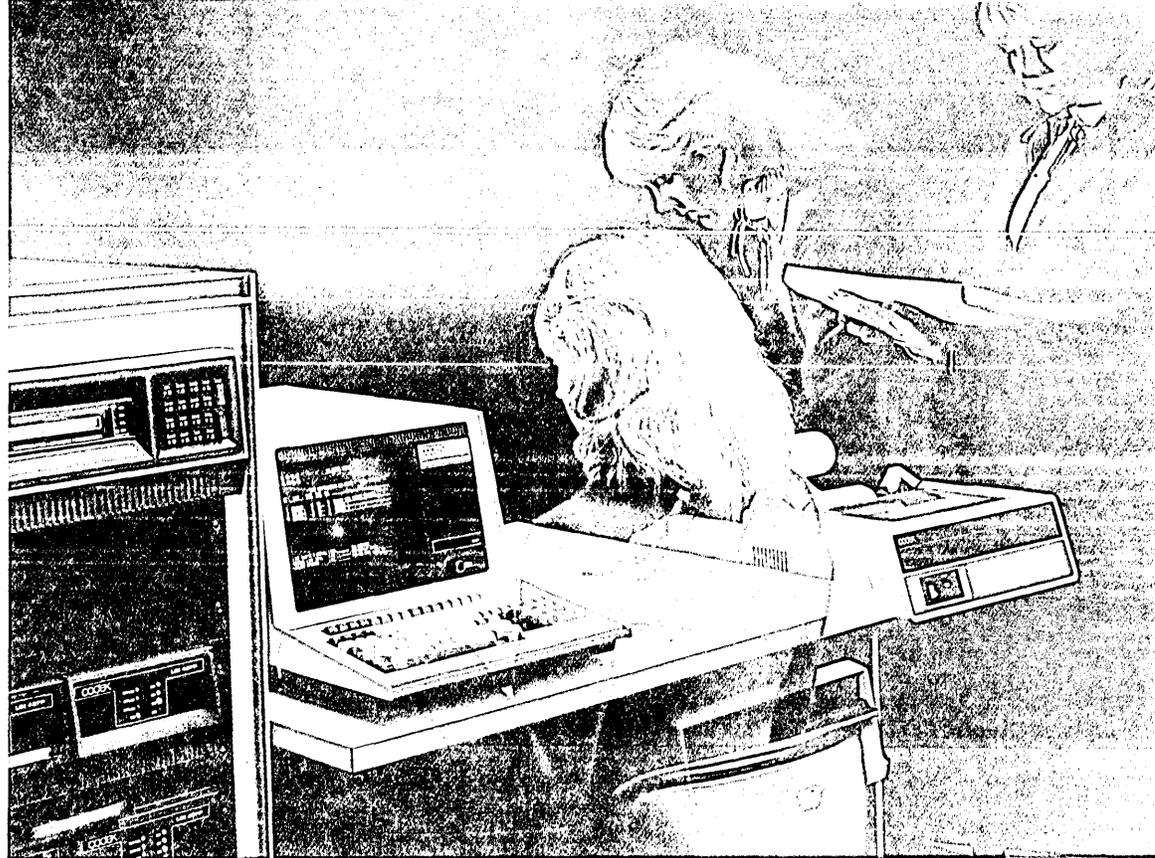
Adding to CSC's growth was the strong showing of its international timesharing service, Infonet. Infonet revenues for 1978 rose by 35% over the previous year, from \$57.8 million to \$77.8 million. This growth increased operating income to \$16.2 million from the \$13.7 million of 1977. Infonet's strong revenue growth has enabled it to be placed among the three largest network services in the timesharing industry.

Two internal corporate developments during fiscal 1978 are cited by CSC as having the most significant impact on the company's future. First, the establishment of a Data Services Group centered on the Infonet system will enable the company to concentrate on major opportunities in the data services market.

Coupled with that was CSC's initiation of an acquisition program to diversify its offerings in the dp market. The first to be bought was Paid Prescriptions, which broadens CSC's role in the health care industry. Paid serves as an intermediary between druggists and organizations offering group insurance programs with pharmaceutical benefits. CSC sees the union of its technology with Paid's operational experience as a growth opportunity not only in Paid's current market but also in related markets for other medical benefit plans.

The second acquisition brought London-based Economic Models Ltd. into the CSC fold. This puts CSC into the economic forecasting area and will add a further dimension to the Infonet services now being offered to the international market.

As CSC moves into the international field, it has no plans of abandoning the domestic area, which saw a 33% growth in revenues from contract services for the federal government. Specifics in that area in 1978 included a three-year, \$41.7 million NASA contract that contains options for two additional years.



The Codex Distributed Network Control System Your Key to Network Uptime

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As data communications networks expand, the required uptime performance can only be achieved if you are in control. The Codex DNCS is a powerful central site system which provides the essential elements of network control.

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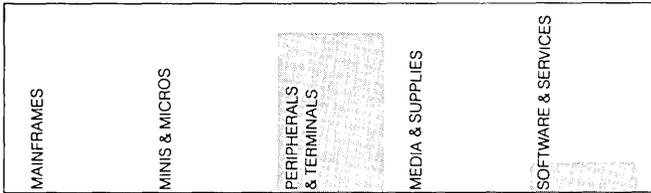
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19



XEROX CORPORATION

800 LONGRIDGE ROAD,
STAMFORD, CT 06904
(203) 329-8711

Record revenues and earnings were just two of a long list of happenings for this East Coast-based firm during the past year. Fiscal 1978 saw total revenues climb to just over the \$5 billion mark and net income reach \$477 million. Dp revenues totaled \$236 million and account for 4% of the overall figure.

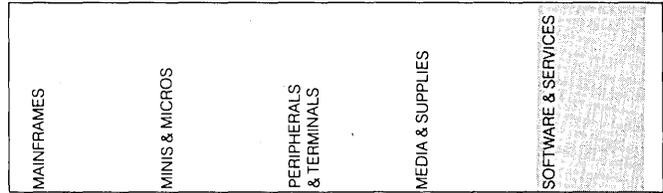
A significant data processing event in '78 found Xerox and California Computer Products agreeing that Xerox could buy substantially all of the assets of CalComp's Memory Products Division. That division supplies disc memory systems to the computer industry. The purchase price is listed at about \$25 million, and the deal was completed within the first quarter of this year. The new purchase has become part of the Xerox Information Products Group.

The copier/duplicating business continues to be Xerox's mainstay. In 1978, that section of the company produced 78% of worldwide revenues. Xerox introduced two new copiers at the low-speed end of the market, the 2600 and the 3109. Even with expansion in the dp field, Xerox expects this segment of the company to continue to produce the bulk of its revenues for as long as can reasonably be predicted.

Also in '78, Xerox announced its intention to enter the information transmission business. The company asked the Federal Communications Commission to allocate a band of radio frequencies for document distribution, teleconferencing and data transmission. If the FCC acts favorably on this request, Xerox hopes to be assigned a portion of this frequency so it can establish the Xerox Telecommunications Network, more commonly known as XTEN. Depending on the approval process and the technological and economic aspects, company officials say XTEN could be operational in some cities by 1981.

Another step taken early last year in the information transmission arena was the announcement of plans to purchase WUI Inc. through a merger in a tax-free reorganization. The merger, if approved, will go far in strengthening Xerox's place in the data communications sector. WUI Inc. is an international record carrier using worldwide networks of telecommunications facilities, and is owned by Western Union International. The acquisition is worth well over \$200 million, and must also pass federal inspection before it can be finalized.

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ELECTRONIC DATA SYSTEMS

7171 FOREST LANE,
DALLAS, TX 75230
(214) 661-6175

Designing, implementing and managing information systems for customers continues to be a very good business for EDS, which saw total revenues in fiscal 1978 climb by 32% to \$217.8 million. This growth moved the company into the 20th slot in the DATAMATION 50. Net income for the same period rose from \$16.4 million to \$19.6 million, an increase of almost 20%.

With 97% of its total revenues generated by the sale of software and services, EDS had 110 customers under contract at the end of fiscal 1978. Almost 54% of those customers have been with EDS for more than three years standing, and 27% have been with the company for more than seven years.

One of the offshoots of EDS' dp network is the growing library of proprietary software and applications systems representing almost 24 million manhours. For EDS this represents a competitive edge in providing services, eliminating many of the time and cost factors involved in development by other companies.

EDS provides its software and services to such industries as health care, insurance, finance, retailing, manufacturing, and all levels of government. In the health care field alone, EDS processed approximately 140 million insurance claims during 1978. At year-end, EDS was performing dp services under contract for 22 insurance companies.

Late in fiscal '78, EDS began two programs which will continue to impact the company over the years to come. It established an industry center for federal, state and local government agencies. The center will be in charge of actively pursuing the federal monies that will be spent on dp services from the private sector. EDS expects those total government expenditures to exceed \$5 billion per year over the next two years.

To broaden its ability to meet customer needs and demands, EDS has also established a development group to explore the opportunities in the microcomputer market area. President H. Ross Perot says the development group is "laying the groundwork for EDS to play a major role in providing software for this explosive market."

Internationally, EDS suffered a setback. The firm had reached an agreement to establish and operate a national health insurance and social welfare dp system in Iran, while recruiting and training Iranian personnel. The project, which was aborted with the Iranian political turmoil, was worth an estimated \$20 million to EDS.

OHIO SCIENTIFIC DOES IT AGAIN

Ohio Scientific has taken its standard C3 computer and married it to the new Shugart 29 Megabyte Winchester Drive. The result is the C3-C. This new microcomputer now fills the vacuum that existed for computer users who need more mass storage capability than floppies can offer — yet until now, could not justify the additional cost of a larger capacity hard disk computer such as our C3-B 74 Megabyte disk system.

Winchester Technology

Winchester hard disk drives offer small business and professional computer users the logical solution to mass storage problems that are beyond the capability of floppy disks. In addition, Winchester disks feature a track seek-time that is much better than floppies and because they spin at eight times the rate of floppies, Winchester drives have a shorter latency. Both of these points reflect one remarkable speed advantage Winchester disks have over floppies.

Coupled to the C3 Computer

Ohio Scientific's award winning C3 computer is a classic. It is the only computer series that utilizes the three most popular microprocessors — 6502A, 68B00 and Z-80. This tremendous processor versatility enables one to utilize a seemingly endless selection of quality programs available from Ohio Scientific's software library as well as from many independent suppliers.

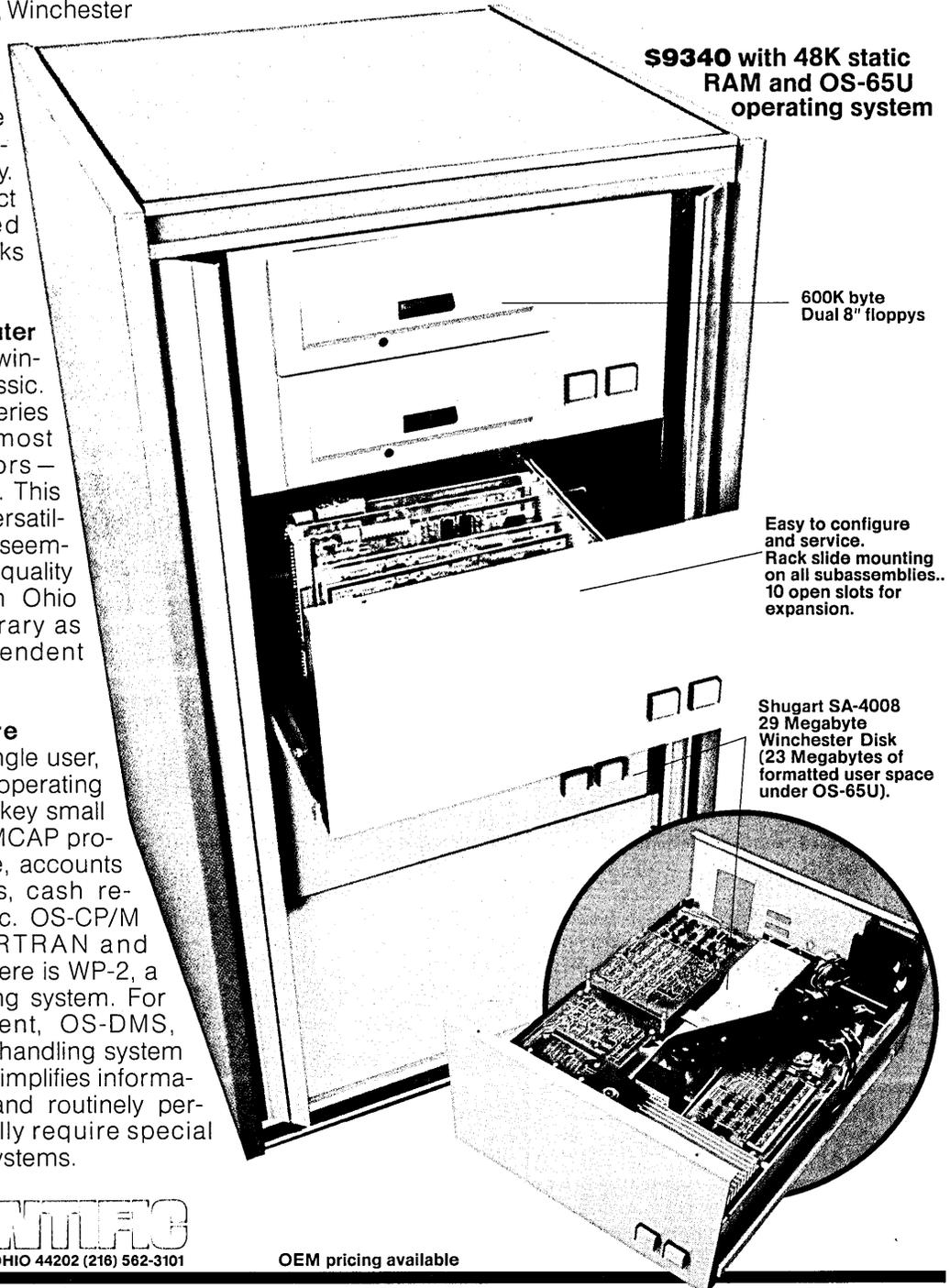
And Advanced Software

For instance, there are single user, multi-user and network operating systems. A complete turnkey small business package, OS-AMCAP provides accounts receivable, accounts payable, disbursements, cash receipts, general ledger, etc. OS-CP/M offers a complete FORTRAN and COBOL package. And there is WP-2, a complete word processing system. For information management, OS-DMS, features an advanced file handling system and program library that simplifies information storage and recall and routinely performs tasks which usually require special programming on other systems.

Yields the Microcomputer of the Future

With an eye toward the future, the C3-C, like all other C3's was designed with provisions for future generation 16 bit microprocessors via plug-in options. There are ten open slots for lots of I/O and multi-user operation. Truly, the Ohio Scientific C3-C is a computer with a future.

The new C3-C computer with 29 Megabyte Winchester Hard Disk.

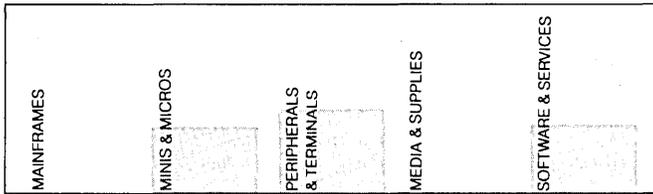


OHIO SCIENTIFIC

1333 S. CHILLICOTHE RD., AURORA, OHIO 44202 (216) 562-3101

OEM pricing available

21



MANAGEMENT ASSISTANCE INC.

300 EAST 44TH STREET,
NEW YORK, NY 10017
(212) 557-8310

A strong showing in all three of Management Assistance Inc.'s marketing areas and entry into the smaller business systems market last year added up to a 32% increase in revenues to just over \$200 million.

Exact revenues for 1978 were \$205.1 million, compared to \$155.3 million the previous year. Income before extraordinary items increased 37.7% from \$11.7 million to \$16.2 million. Net income for 1977 was \$17.9 million after extraordinary credits.

Up until 1978, MAI targeted its Basic Four minicomputer system to companies with annual revenues of somewhere between \$1 million and \$25 million. The introduction of the System 200 made MAI systems feasible for companies with revenues below the \$1 million mark. At the same time, the company began addressing itself to larger companies planning to decentralize their dp operations.

With 58% of last year's total revenues generated by Basic Four sales, that division continues to be MAI's backbone. Worldwide sales of Basic Four systems amounted to \$119 million in total revenues last year, an increase of 42% over 1977. Worldwide backlogs of orders reached a record \$57.6 million, up 65% from the end of the previous year.

MAI also continued its development of new products. The System 730 was introduced to replace the 700 as the top of the line. The 730 carries a smaller price tag and features an expanded maximum memory of 256K. The 730 also features a new central processor with twice the processing speed.

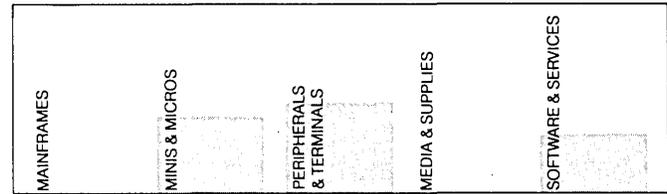
MAI's maintenance and service division, Sorbus, generated \$55.3 million in total worldwide revenues last year, which accounted for 27% of the overall. Sorbus' operating profit at the end of the year amounted to \$3.5 million, up 9% from 1977. In the U.S., Sorbus continues to be a leading supplier of third party maintenance service to the dp industry, deriving the majority of its revenues from the servicing of equipment manufactured and marketed by IBM.

The remaining 15% of MAI's overall revenues came from its word processing division, Wordstream. Revenues of \$30.8 million were generated by Wordstream from sales of word processing systems, information display terminals, and printers, as well as from rentals and sales of unit record equipment.

Price reductions on terminals and printers in response to IBM price and product announcements resulted in a decline in operating profit for the division last year. Wordstream closed out the year with \$1.9 million in net income.

With 40% of its 1978 revenues generated by international operations, MAI plans further expansion in that field. The present international marketing organization includes direct sales offices in 37 cities and distributors in 31 cities covering over 30 countries.

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TEXAS INSTRUMENTS INC.

P.O. BOX 225474,
DALLAS, TX 75265
(214) 238-2011

Texas Instruments continues to move along the growth path, becoming one of the familiar yearly names on the DATAMATION 50 survey.

Fiscal 1978, which ended Dec. 31, saw total revenues reach the \$2.5 billion mark, compared to \$2 billion the year before. The net income column reads \$140 million, a 20% increase from the \$116 million of 1977.

Long familiar in the hand-held calculator field, TI has broadened its products and marketing skills so that 8% of its total revenues now fall into the data processing category. Last year, that amounted to a substantial \$204 million.

Three areas which played a predominant role in the growth of TI last year are the development of new plant sites, advances in semiconductor manufacturing processes, and new product introductions.

In the technical and product sector, TI brought out a single-voltage 64K-bit random access memory, a one-quarter-million-bit magnetic bubble memory, and a 32K-bit fully static random access memory.

A program to build up production of the EPROM is now underway and production startup of the RAM began during the first quarter of this year.

TI strengthened its distributed computing offerings by introducing several new models in the Series 700 family. These offerings provide multistation capability for commercial applications. In the terminal field, TI brought out the Model 820 multicopy terminal designed to function either in an interactive mode or as a remote input/output unit.

New software products will allow the expansion of the 990 minicomputer user base, as well as allow larger system configurations of terminals, memories and discs. New offerings in this area included an advanced data base management system, communications packages to permit data transfer to host IBM mainframes, and high level languages.

During the past fiscal year, TI's board of directors authorized capital programs totaling \$474 million. In 1978, these same expenditures were \$311 million. Those investments have produced development of major new plant sites at Johnson City, TN; Lewisville and Temple, TX; and at a site northwest of Houston.



One of the strongest arguments for word processing from Digital is data processing from Digital.

As a computer company, we've always built on the family concept. And we've taken the same approach to word processing.

The result is the widest range of compatible word processing solutions available today. Systems that not only provide state-of-the-art capabilities, but also offer unique ways to connect different work groups, and different levels of your information processing network.

For example, every Digital word processing system — from our basic word station to our shared-logic system — offers ways to link word processing and data processing. This interconnectability lets you balance cost-per-terminal, storage capacity, and security however you want.

And because the same basic software is common to all our systems, you can grow without ever losing your original investment.

Also, remember that Digital's experience in

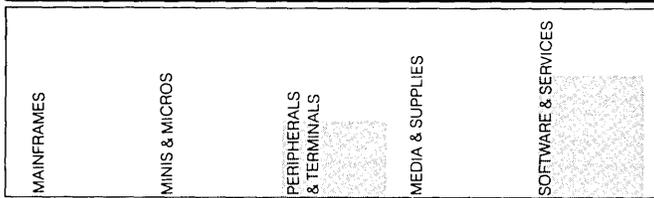
distributed processing and computer resource sharing is second to none.

And the bigger your system gets, the better that background looks.

For a free booklet on how Digital word processing can help protect your future, clip your business card to this ad and send to Digital Equipment Corporation, Word Processing Systems Group, MK1-1J14, Merrimack, NH 03054.

digital

23



GENERAL ELECTRIC COMPANY

3135 EASTON TURNPIKE,
FAIRFIELD, CT 06431
(203) 373-2211

Even though only about 1% of General Electric's revenues are dp-related, the company still generated an estimated \$190 million last year from its computer services and telecommunications terminals.

Headquartered in Rockville, MD, GE Information Services expanded its massive worldwide computer network, adding several large systems, including an IBM 3033, to the 19 large scale mainframes already located in three interconnected data centers. Called MARK III, the network expanded to Hong Kong in 1978, and now serves over 600 metropolitan areas located in 22 countries.

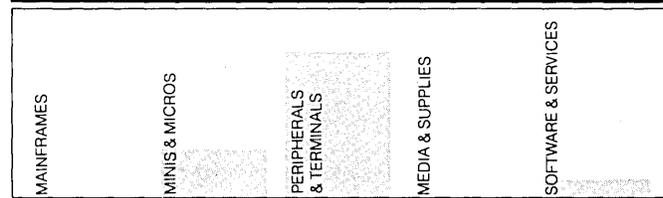
The Information Services group also added a significant new distributed processing product called MarkLink, which provides customers with on-site computer capabilities while enabling them to tie into the remote network.

Additionally, GE offers matrix printers, including the new TermiNet 200, out of its Waynesboro, VA operations. Its Apparatus Service Division in Schenectady, NY leases TermiNet printers, ADDS video display terminals, the VADIC 3400 full duplex 1200 baud modem, and the Livermore coupler.

This group also serves as the nucleus of a communications equipment service organization that extends to more than 60 locations nationwide. The group can be used for one-time maintenance and repair, or will offer a long term service contract.

Also at year-end, General Electric and Honeywell Inc. combined the worldwide operations of GE's Information Services Division and Honeywell's timesharing marketing operations that distribute the GE services in the United Kingdom, Europe and Australia. The new company is 84% owned by GE and 16% by Honeywell.

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HARRIS CORPORATION

MELBOURNE, FL
(305) 727-9100

Harris completed the move of its headquarters to Melbourne, FL last August, six weeks after closing out fiscal 1978 on June 30th.

A 1978 total revenue hike of 35% to \$872.2 million from \$646.3 million and an earnings advance of 30% to \$52.2 million from \$40.1 million reflect Harris' broad-based involvement in commercial markets and the information processing industry. New orders received in fiscal 1978 exceeded the billion dollar milestone for the first time in company history.

About 20% of total revenues were dp-related. These came from Information Systems, a group within Commercial Electronics Products, the fastest-growing of Harris' three main business segments.

Information Systems, encompassing computer systems, data communications and controls, categorized its dp business as follows: terminals and peripherals, 75%; minicomputers, 20%; and software and services, 5%. Roughly 80% of these revenues were generated domestically.

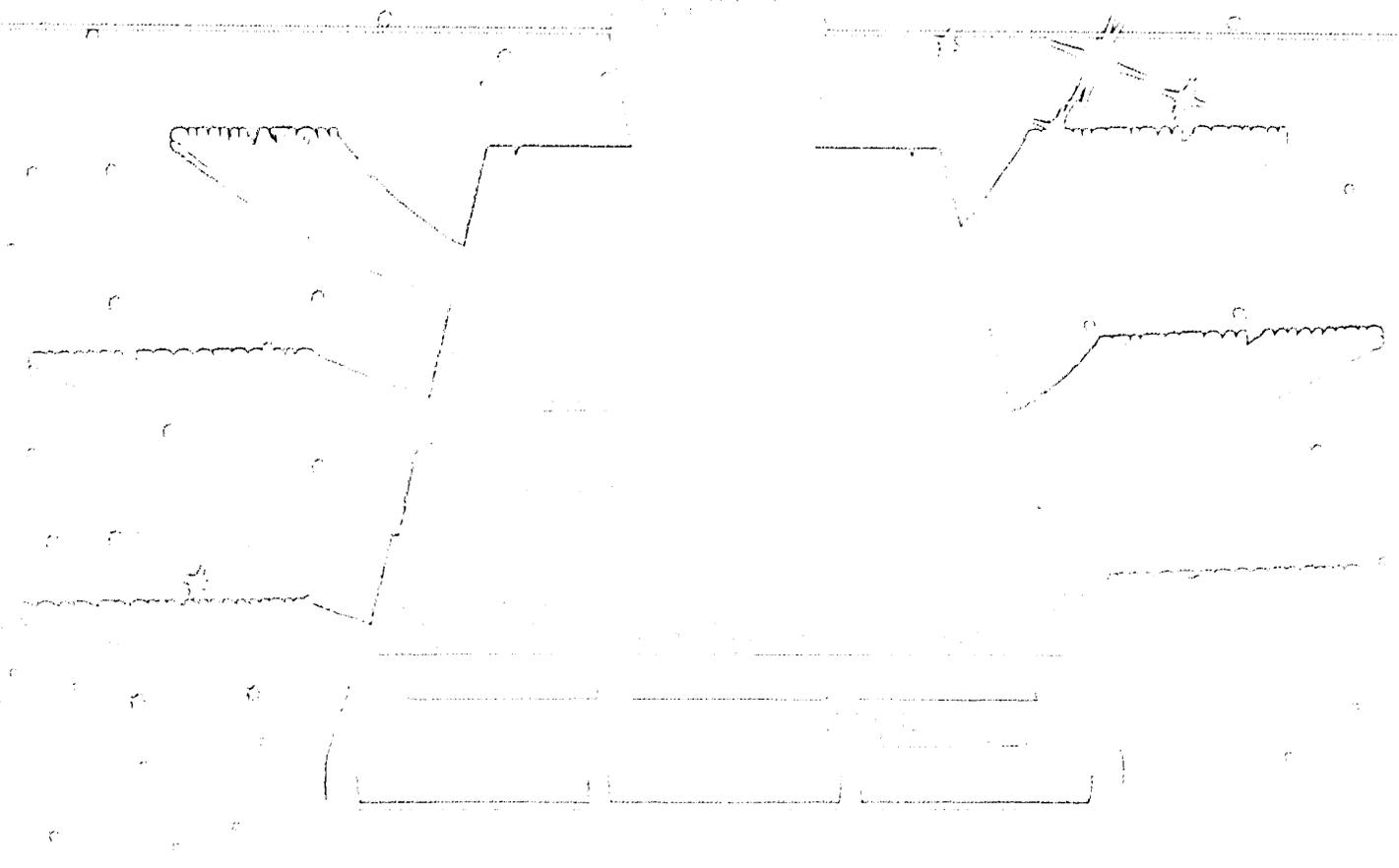
Harris is a direct supplier to several dynamic markets including Fortune 1,000 manufacturing firms, financial institutions, government agencies, utilities, transportation and publishing industries.

The current price range for Harris computer systems (\$100,000 to \$500,000), hits a happy medium between other manufacturers' minis and mainframes. In 1978 a new family of high-performers, the Series 500, and a competitively-priced entry-level system, the S-123, were introduced. The S-500, the most powerful model ever built by Harris, can be accessed by up to 64 terminals, each working on different problems simultaneously. The smaller S-123 can be accessed by eight terminals, and is capable of concurrently handling timesharing, multi-batch, remote job entry and real-time processing.

Harris also added two new language processors during the year, APL and BASIC-V. Both are compatible with the Harris VULCAN virtual memory system.

As an independent supplier of data communications products and services, the company markets a variety of products in a range of configurations to provide customers with remote batch, data entry, interactive and ddp capability. A new system combining all these functions, the Harris 1670, was developed for users requiring batch and transaction interaction with a large host computer, while performing a variety of local services. A sampling of new customers for the 1670 included Boeing, CBS, Ford, General Foods, Hughes Aircraft, Shell Oil, Westinghouse, and the states of Tennessee, Michigan and Washington.

FPS Expands the Scientific Universe of PDP-11 Applications



FPS MAKES GREAT COMPUTERS BETTER

The FPS AP-120B Array Processor

A great contribution to technology, the PDP-11B has a long and varied history of scientific applications. Now, with FPS developed the AP-120B Array Processor.

The AP-120B Array Processor gives economical multi-computer systems the extraordinary computational power of large scientific computers. For example, an AP-120B has been used in a PDP-11B system to reconstruct and analyze complex stored images. Without the AP-120B, the task would take more than 170 hours. With the AP-120B, it takes less than thirty seconds — that's a 200% improvement!

A PDP-11B and AP-120B would offer:

even greater data handling capabilities. The FPS architecture is designed for a fully simultaneous operation and several parallel I/O paths provide unmatched cost/performance, reliability and programmability. Programmable I/O units also enable exceptional features, such as direct control of disk storage and real time data flow.

Controlled by simple subroutine calls from a FORTRAN program on the PDP-11, or other host computer, FPS Array Processors can be programmed by selecting routines from the extensive FPS Math Library by writing new routines in the relatively simple AP Assembly language, or through use of the AP FORTRAN Compiler.

Hundreds of FPS Array Processors are in use today by people who want to expand the flexibility, speed and attractiveness of a multi-computer system, but require the exceptional throughput of a large main frame for their application.

Find out how this new power in computing (typically under \$50K complete) can benefit your application. For more information and an FPS Array Processor brochure, use the reader response number on coupon below. For immediate consideration, contact Floating Point Systems directly.

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25



WANG LABORATORIES INC.

1 INDUSTRIAL AVENUE,
LOWELL, MA 01851
(617) 851-4111

Wang Laboratories Inc. has placed a gold star next to fiscal 1978 saying it was "perhaps one of the best" of its past 27. Revenues were up 47% to \$198 million, and net income stood at \$15.6 million, a whopping 70% increase.

The impressive figures enabled Wang to climb to 25 in this year's DATAMATION 50. Additionally, Wang entered the Fortune 1000 as number 873.

Dp-related revenues totaled \$168.3 million, representing 85% of the total. Eighty percent of that was derived from the sale of minicomputers, 15% from peripherals and terminals, and 5% from software and services.

The company's mainline System 2200 continued its strong showing during 1978 and was broadened by the introduction of the System 2200 MVP. The addition brought multiterminal capabilities to the top end of the line. The new systems are aimed at multiuser applications, which are the fastest growing segment of the small business system market.

Word processing business more than doubled in fiscal 1978, and Wang's family of products was brought to five. Wang now offers products from under \$10,000 to \$100,000 in this line. Wang has also purchased Graphic Systems Inc., which will further enhance and broaden its product position in office systems through the addition of photocomposition capability. Wang has tagged word processing as one of the most rapidly growing applications within the small computer marketplace.

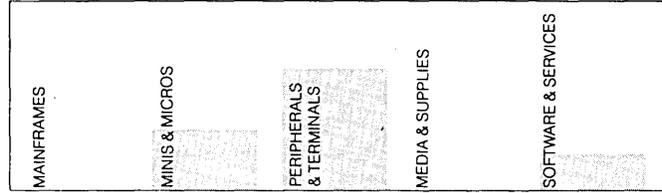
During the past year, initial deliveries of a new virtual storage computer system were made. This system offers multilanguage capabilities in interactive, multiterminal configurations. These are medium-sized business computer systems priced from \$50,000 to \$300,000.

Its sales organization continued to achieve impressive gains both in the United States and abroad, with orders up more than 53% and backlog increasing from \$36 million to \$70 million.

The company's products are marketed and serviced in Australia, Austria, Belgium, China, France, Great Britain, Hong Kong, Japan, Netherlands, New Zealand and West Germany. Sales are through wholly owned foreign subsidiaries employing approximately 450 sales and 280 service personnel. Revenues from outside the United States accounted for approximately 44% of Wang's sales in fiscal 1978.

Wang's business is concentrated in certain segments of the computer industry: information processing, problem solving, distributed data processing and word processing. System 2200 configurations are sold in the first three markets, and the WPS configurations are sold in the fourth.

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DATAPPOINT CORPORATION

7900 CALLAGHAN ROAD,
SAN ANTONIO, TX 78284
(512) 699-7000

With a 58% increase in total revenues in fiscal 1978, Datapoint continues its dramatic growth as the company moves aggressively into the "office of the future" market.

Revenues for fiscal '78, which ended July 31, were \$162.2 million as compared to \$103 million the previous year. Even more spectacular was net income which jumped 82% from \$8.3 million in 1977 to \$15.2 million during fiscal 1978.

We estimate that 30% of Datapoint's revenues comes from minicomputers, 60% from peripherals and terminals, and the remaining 10% from software and services.

Keeping its sights set on the office of the future, Datapoint continued to expand its product line throughout 1978. New products fell into two categories: distributed data processing and data communications management equipment.

In the ddp arena, the diskette-based 1500 dispersed processor made an appearance in the first quarter of fiscal '78. It took over as Datapoint's lowest cost system for intelligent data entry, local data processing, and concurrent communications with other locations. By the end of July '78, more than 2,300 orders had been placed for the system. Other new products included two new printers, an interactive version of COBOL, and the Attached Support Processor which allows IBM 360/370 mainframes to engage in remote batch telecommunications.

The company's biggest announcement last year was ARC, the Attached Resource Computer, which allows a totally integrated computing facility to be set up consisting of an almost unlimited number of interconnected small processors and peripherals, all with access to each other and a common data base.

Company officials have labeled this new ARC system as its "superstar" and the peg on which the success of its electronic office business will hang.

1979 marks Datapoint's second decade in operation. The company expects to continue growing at a high rate, pointing to the \$63.6 million backlog at the beginning of fiscal '79, compared to the \$45.5 million a year earlier, as one indication.

**it took a new company
to bring new flexibility
to distributed data processing.**

**Sycor and Data 100
become
Northern Telecom
Systems Corporation.**



Northern Telecom

More options make us more

Now one company has all the Sycor and Data 100 products to work with. And that broader choice of solutions means a better match for your particular needs. A more comprehensive solution than either company could previously offer.

Today we have more field engineers, in more places, than any comparable company.

More software support people, too. We're committed to providing the best total service in our industry. And

we won't settle for less. Right now, we have more than 60,000 hardworking systems, all over the world. We work for 95 of the top 100 firms in Fortune's 500. And we'd like a chance to work for you.

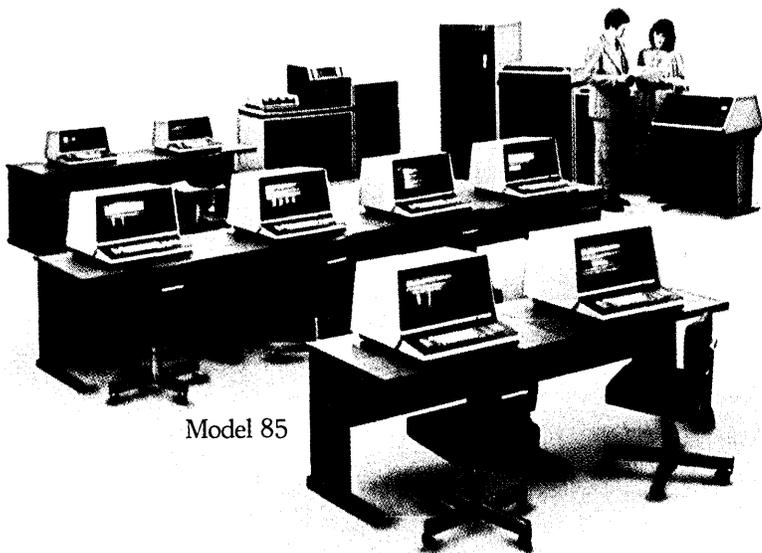
Take a look at the four ways NTSC can answer your data processing needs. For more information about any of them, write Product Marketing, Northern Telecom Systems Corporation, Box 1222, Minneapolis, MN 55440.

Distributed Processing: Why pay for more than you need?

For systems with a lot of throughput, and up to 16 video display work stations, the Model 85 is hard to beat. It has large disk storage capacity and can work with our Remote Job Entry or KEYBATCH® systems.

Our Model 445 is particularly cost-effective for up to eight work stations. Its Omnitask™ operating system can run up to 16 jobs concurrently—in multiple languages.

And our 405 is a most economical way to introduce distributed processing where it's never been before. In most entry level applications, it's all the processing power you need.



Model 85



Model 445



Model 405

Systems Corporation: cost-effective than ever before.

Data Entry: Combine key-to-disk with Remote Job Entry.

Use our Keybatch system for key-to-disk, and you won't need additional equipment to communicate with the mainframe. So one system can replace two. Keybatch gives you this twin capability without a big sacrifice in speed. And Keybatch is compatible with all major mainframes.



KEYBATCH®



Model 70 Series

Remote Job Entry: From 2,000 to 56,000 bits per second.

With that kind of flexibility, you never have to buy more capacity than you need. There's a full line of peripherals, too. And no matter where your remote locations are, we have service people nearby.



Model 290

On Line: Here's a low-cost alternative to the 3270.

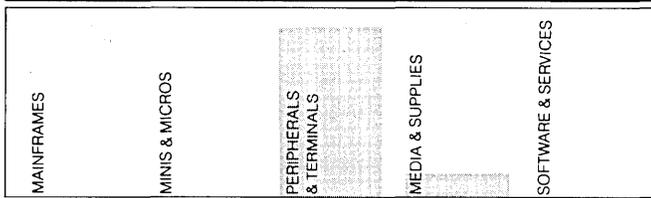
Lease or purchase, you'll find significant savings in the 290 system. Sophisticated self-diagnostics help make sure it's up and running when you need it. And best of all, it's available right now.

Sycor and Data 100 have joined to become
Northern Telecom Systems Corporation

Join us at the NCC. Booth 3400,
June 4-7, New York Coliseum.

nt northern
telecom

27



MOHAWK DATA SCIENCES CORPORATION

1599 LITTLETON ROAD,
PARSIPPANY, NJ 07054
(201) 540-9080

The introduction of a major new product line, a \$6 million jump in revenues, and the final steps towards streamlining its product offerings were all part of Mohawk Data's successful company picture for fiscal 1978.

Total revenues for the fiscal year, which ended April 30, were \$152.6 million. Net income totaled \$6.2 million as compared to \$4.5 million for the previous year.

One hundred percent of MDS' total revenues are dp-related. Last year, 91% of the total was generated by the sale of peripherals and terminals, and the remaining 9% from media and supplies.

MDS is one of the leading firms in key-to-disk products and is the fastest growing among the leading vendors of clustered processing terminals for distributed processing. Major users of any commercial data processing system are excellent prospects for MDS equipment, and the company has achieved significant penetration in the Fortune 1000 class and in banks and insurance firms.

Among MDS' clients is Shasta Beverages, the eighth largest distributor of soft drinks in the U.S. Employing MDS' new Series 21 distributed data entry and communications equipment, Shasta processes payroll information, inventory and maintenance reports, and updated information on a daily basis.

The Series 21 line used by Shasta is MDS' first commitment to the distributed processing market. The large majority of first shipments of Series 21 during 1978 were on a rental basis, which left the revenue impact of the new system negligible. Coming into 1979, the new line represented a significant portion of the company's \$150.4 million in backlog.

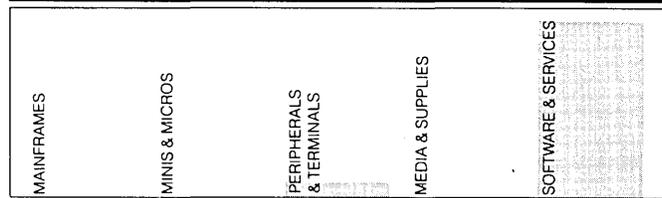
As fiscal '78 came to a close, the company announced the 21/50, which became the most powerful member of the new series. The high end model is hardware and software compatible with the 21/40, offering twice the processing speed and twice the main memory capacity.

Research and development monies have increased by 24%, a commitment the company says will enable it to solidify its position in the dp marketplace. Software development now accounts for half of the company's R&D budget.

During the year, new distributorships were opened in 12 major countries, and a new marketing and support organization was established in Germany.

The first six months of fiscal 1978 saw the discontinuation of certain product lines and the elimination of marginally profitable sales to oem markets.

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TYMSHARE INC.

20605 VALLEY GREEN DRIVE,
CUPERTINO, CA 95014
(408) 446-6000

Acquisitions in the tax processing and hospital services fields were two of the highlights for Tymshare during the past year, which saw a 48% rise in total revenues and a 32% increase in net income.

Those jumps moved this Cupertino, CA-based firm from 37th to 28th place in the DATAMATION 50. Total revenues for fiscal '78 were \$150 million, compared to the \$101 million for 1977. Net income for '78 was \$11 million.

The two acquisitions were made in the most promising of Tymshare's market sectors. Autotax was purchased from the Research Institute of America in June, and then shortly after mid-year, Tymshare bought the Dallas-based Medical Information, Inc.

Autotax had participated in the same market for computerized tax processing services as Tymshare's Dynatax and Unitax operations. Medical Information provides specialized computer services to hospitals. It becomes part of Tymshare's Medical Systems sector.

Another important growth step taken by the company last year was its expansion into the overseas marketplace with the beginning of service in Japan through its Kokusai Tymshare affiliate. With the Japan operation, Tymshare now participates in all major overseas markets through affiliates in the United Kingdom, Western Europe and now the Far East.

Companies across some 40 different industry sectors are included in Tymshare's customer base. The major market for Tymshare software encompasses companies ranging in size from roughly a quarter billion dollars in sales to the multimillion dollar level.

Tymshare's involvement in the data communications area remains one of its most dynamic of all the market sectors served. The entry of AT&T into this area has heightened the interest in Tymshare's Tymnet public packet network. In this area, Tymshare mounted a new effort focused on the market for private, intracompany networks, using the same advanced technology being incorporated into the public Tymnet network. As the trend toward distributed computing becomes stronger, this system can only provide the company with unequaled growth possibilities.

1978 was the first full year for Tymshare in the processing of credit card transactions through its Transaction Services division. The growth of product demand was steady and reflected Tymshare's continued acceptance by the financial and banking industries.

SOME PLEASANT THINGS HAPPEN IN THE DARK..... CAPACITY PLANNING IS NOT ONE OF THEM:

If you don't know when your system will run out of gas, where the bottleneck will appear, which workload will cause the crunch, and what the most cost-effective alternatives will be, YOU'RE GROPPING IN THE DARK WITH RESPECT TO CAPACITY PLANNING.

But take heart, you are not alone. Big DP shops are complex. Day-to-day performance management is difficult. And forward planning is even harder. While you're aware that over-capacity wastes dollars, you know that under-capacity may jeopardize business more.

Accounting packages and hardware/software monitors can only tell where you have been. In fact, until recently, there has not been an appropriate planning tool that tells where you are going.

Now there is BEST/1, BGS Systems' software package that compares hardware alternatives quickly, efficiently, and comprehensively. Based upon proprietary extensions to sophisticated queuing models, BEST/1 interactively provides answers to the multitude of "WHAT IF" questions posed. Originally developed as our consulting aide, BEST/1 has been commercially accepted and validated as an accurate, yet easy-to-use tool that looks into the future.

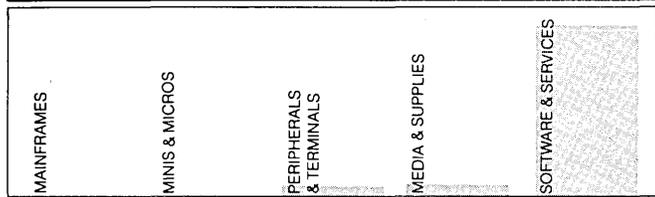
But don't take our word for it; ask those who have seen the light. Send for our literature and list of clients who have been impressed. We know that you will be too.

BGS SYSTEMS, INC.
Innovative Consultants in Computer
Capacity Planning
Box 128 Lincoln, MA 01773
617/890-0000

CIRCLE 15 ON READER CARD

BEST/1TM

29



SYSTEM DEVELOPMENT CORPORATION

2500 COLORADO AVENUE,
SANTA MONICA, CA 90406

(213) 829-7511

Fiscal 1978 was a year of continued growth for System Development in the areas of sales and new orders. Growth was so good, in fact, that the company jumped from the 34th spot to number 29 in our rankings.

The only bleak spot for the company financially showed up in net income, which dropped from 1977 levels. Total revenues were \$145 million as compared to \$130 million the year before. Net income stood at \$1.6 million as compared to \$2.4 million the previous year. In explaining the decline, company officials point to cost over-runs on the Text II electronic publishing systems and the Florida Medicaid contracts awarded during the year. Also contributing to the downtrend was an operating loss recorded in the Financial Services Division and in Aquila BST Ltd.

With almost all of its dp-related revenues generated by the sale of software and services, SDC looks to the federal government, especially the Department of Defense, as one of its major clients.

One of the company's major new customers during the past year was the state of Florida. Under a \$13 million contract, SDC will process and pay Medicaid claims in that state. The contract calls for the development of a computerized system, followed by a service phase during which SDC will operate and maintain the system. Obtaining this contract will enable the company to contend for a major position in the large Medicaid claims processing market.

Another large contract was signed with the Los Angeles Police Department to provide them with an automated dispatching system. The \$25 million contract calls for SDC to develop an improved command, control, and communications system to make more efficient the dispatching of police cars and to relieve congested radio frequencies.

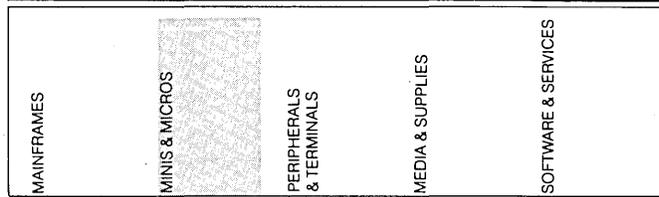
New product introductions included the Text II-20 electronic publishing system for small-to-medium size newspapers. This standardized system together with the customized Text II gives SDC one of the broadest electronic publishing systems lines in the country.

In the area of telecommunications, SDC is testing a cryptographic device for safeguarding data in telecommunications networks. Several of these systems have been built and are being used by the federal government on an experimental basis.

SDC officials are looking toward the energy market as a new area opening up for the company. Officials note that major energy contracts will be bid on during this fiscal year.

Finally, SDC completed the development of the Tiros-N ground support system for the Department of Defense and delivered it for integration testing. The next project being undertaken for DOD is a study of the design of a space defense center.

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FOUR-PHASE SYSTEMS INC.

10700 NORTH DE ANZA BLVD.
CUPERTINO, CA 95014

(408) 255-0900

Four-Phase Systems' revenues for 1978 rose by 53%, pushing the company well over the \$100 million mark and into the 30th spot on this year's DATAMATION 50. Last year it ranked 41.

Four-Phase closed its books on December 31 with \$136 million in revenues and \$12.2 million in net income. These totals compare with the 1977 figures of \$88.5 million and \$7.4 million respectively.

With 100% of its total revenues generated by the sale of distributed data processing minicomputers and software systems, Four-Phase points to several key factors that enabled it to enjoy such a successful year:

- Introduction of the MFE/IV high level dp software package;
- Emergence as one of the leading vendors of shared logic word processing systems;
- The public offering of 500,000 shares of common stock; and
- The listing of its stock on the New York Stock Exchange for the first time in the company's 10 year history.

Four-Phase today employs a total of 2,800 persons among its domestic and international offices. Eighty-four percent of its total dp related revenues for fiscal 1978 was generated in the United States.

Internationally, Four-Phase Systems Ltd. of Canada posted revenues of \$7.8 million last year, representing an increase of 75% over the 1977 levels.

Sales to international distributors and oem's increased by 86% last year and comprised 9% of consolidated revenues as compared with 7% for the previous year. An increase in the company's network of worldwide distributors added Argentina, Indonesia, Kuwait, Malaysia, and Singapore to the list. Total revenues from the international sector in 1978 amounted to \$22 million.

Four-Phase lists as principal markets for its dp systems the insurance industry; federal, state and local governments; the communications and financial industries; and the medical/health care fields.

Among the top three areas of customers, the medical field accounts for 22% of the company's installed base of equipment; the manufacturing group 20%; and the government area 11%.

Four-Phase labels its marketing strategy in these areas as an "integrated systems approach" rather than a "piecemeal effort," stressing an end user orientation to "anticipate changes that may occur in a customer's needs."

What's attractive about distributed database is that it makes data available at the local level where it is needed but still allows control of the data from a central site.

With the availability of low-cost, high-performance hardware like the IBM 4300, more and more organizations are including distributed database networks in their future plans.

That future is here *today* with Cullinane Corporation. Cullinane pioneered in distributed database technology when we designed and implemented a prototype back-end database system for four government agencies. What we learned from this project about the

unique requirements of distributed database technology led directly to the architecture of Release 5.0 of IDMS, IDMS-DC, our new powerful teleprocessing monitor, and Multiple Computer Support (MCS), a system that allows multiple IBM-compatible CPUs to share databases.

These three products—IDMS 5.0, IDMS-DC and MCS—allow applications programs to reside at remote sites and to update a central control database with user transparency and database integrity. Distributed database systems allow upper management to consolidate information from remote

databases into a central database. This is possible through the separation of the application program from the DBMS—a capability which is unique to IDMS and essential to the implementation of distributed database systems.

Distributed database is only one example of Cullinane leadership in the development of management software designed to protect today's investment while providing tools for the future. For example, we will be offering an interface which will allow IDMS to support DL/1 applications.

Another new product, the

Automatic Applications Development System (AADS), will enable users to develop applications rapidly by defining a few simple parameters as opposed to performing complex coding tasks.

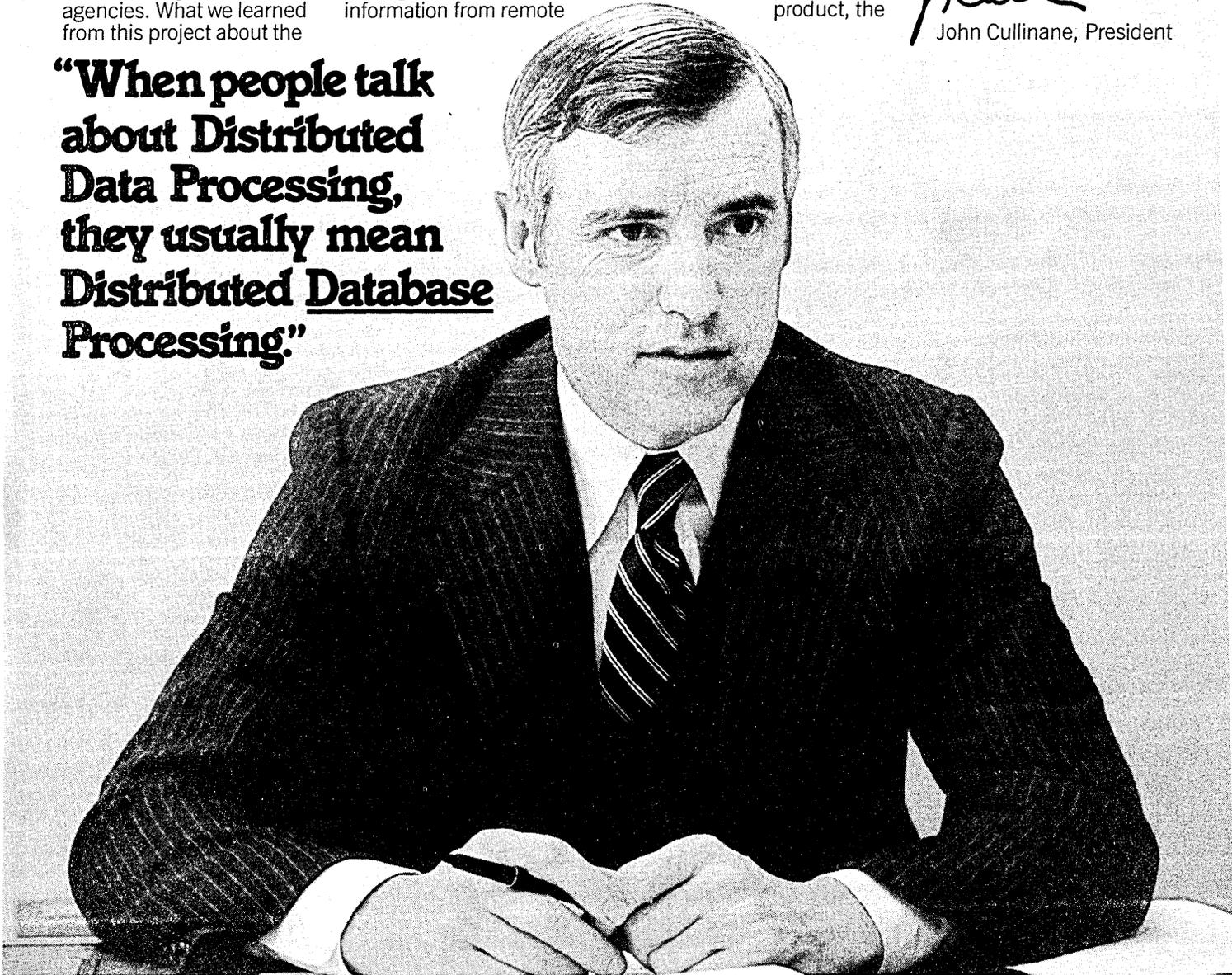
Before you make a database decision affecting your ability to manage your organization tomorrow, look at Cullinane today.

Write or call for more information on our special management briefing session or on our advanced database software products.



John Cullinane, President

“When people talk about Distributed Data Processing, they usually mean Distributed Database Processing.”



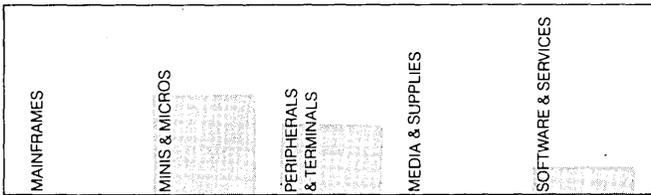
Cullinane Corporation 

20 William Street, Wellesley, Massachusetts 02181, 617-237-6600

CIRCLE 18 ON READER CARD

MAY 25, 1979 59

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PERTEC COMPUTER CORPORATION

12910 CULVER BOULEVARD,
LOS ANGELES, CA 90066
(213) 822-9222

A shift from personal computer products to small business systems, a strengthening of its maintenance and support system, and expansion of the retail dealer concept all characterize the changes taking place within Pertec.

Beginning with the purchase of Computer Machinery Corp. (CMC) in 1976, Pertec began refocusing its attention away from the home computer market to the small business system side of the industry.

Growth in fiscal 1978, ending March 30, was very good. Net revenues on the sale, lease and service of computer hardware and software were \$131.8 million, a 31% increase from fiscal 1977's \$100.6 million. Net income was \$7.1 million, a 54% rise over the \$4.6 million of 1977.

Sales, lease and service revenue contributions are derived from three areas: peripheral equipment, which accounts for 40% of total revenues; micro and minicomputer-based systems, which account for 51%; and finally the service area, which contributes 9% of total revenues.

Pertec has shipped its last personal computer kit and, with it, has closed the books on what it once considered to be the sector of the dp industry with the most growth potential.

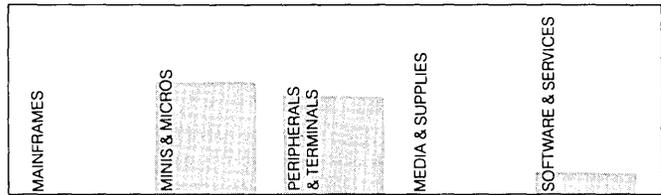
The shift in emphasis to small business systems has called for large investments in engineering and software development. These will expand the company's product offerings which are marketed under the MITS/Altair and ICOM trade names.

Revenues from the main small business products totaled just under \$12 million, almost 40% above the 1977 levels. Pertec sees the first-time computer user as making up the backbone of its new market. The company also foresees substantial growth in the peripheral area, where it already produces magnetic storage systems.

In the microsystems marketplace, Pertec is developing additional dealer support programs and expanding the retail outlet store concept. Presently there are some 50 Pertec computer centers signed up, and Pertec plans to continue adding additional centers through 1979.

Another major area of growth for Pertec is distributed data processing. Its XL40 has been introduced as the first entry into this product area. A multiterminal system, the XL40 combines data retrieval, data entry, and file management capabilities to enable these tasks to be performed at source locations. Over 500 of these systems had been installed by the end of 1978. Already major enhancements have been added to broaden the applicability of the system to additional markets and to extend further the communication network capabilities now required by most distributed processing users.

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PERKIN-ELMER CORPORATION

MAIN AVENUE,
NORWALK, CT 06856
(203) 762-1000

The revenues Perkin-Elmer obtains from its Data Systems Group increased 27% last year to \$131 million, a jump that moved the company into the 32nd slot in the DATAMATION 50. Last year Perkin-Elmer was ranked 36th.

Profitability of the Data Systems Group, however, slipped significantly, dipping to \$10.4 million for the year, almost \$2 million below the 1977 figure. This disappointing performance was due to production problems in the Wangco Division and a high level of marketing expenditures in relation to sales in the Interdata Division, Perkin-Elmer explains.

Fiscal 1978 saw the introduction of a number of new products including software dubbed Interdata Transaction Controller, a package that enables as many as 64 operators to enter transactions such as inventory or sales data concurrently for immediate processing by a single computer.

The company also unveiled its first business system, a 32-bit processor for transaction-oriented, multiuser applications.

Additionally, Perkin-Elmer's 16-bit line was expanded with the introduction of the 8/16E, a machine aimed at the original equipment manufacturer market and suited for scientific computation, process control, business data processing, and data communications.

Perkin-Elmer's Wangco division also brought out a mass storage device, the MP 80 disc drive, and began shipments on the high speed tape drive, the Mod 14, it announced in 1977. Further, Wangco moved into new headquarters in southern California.

Perkin-Elmer is also building a new plant in New Jersey for its Terminals Division and has expanded the Interdata division's computer manufacturing plant.

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MAINFRAMES	MINIS & MICROS	PERIPHERALS & TERMINALS	MEDIA & SUPPLIES	SOFTWARE & SERVICES
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MCDONNELL DOUGLAS CORPORATION

P.O. BOX 516
ST. LOUIS, MO 61366
(314) 232-0232

Total 1978 revenues for McDonnell Douglas came to \$4.13 billion and net income amounted to \$161 million. Dp-related sales, all of which are derived from its McDonnell Douglas Automation Co. (MCAUTO), are a mere 3% of the corporation's total revenues.

MCAUTO's dp revenues obtained from outside customers increased 12.5% in 1978 to \$128 million. Even so, the concern slipped to the 33rd position in the DATAMATION 50. Last year MCAUTO ranked 29th.

Over the year MCAUTO, which derives all of its revenues from software and services, bolstered its capabilities as a service company and at year-end was operating five computer centers with 137 computer systems. Collectively these machines had an original purchase value in excess of \$270 million.

Domestically, MCAUTO has 66 offices in 51 cities and 27 states. Additionally, it is active in Western Europe and Japan. It employs close to 5,000 people.

To increase MCAUTO's market penetration, the company has added distributed processing capabilities. Here MCAUTO provides customers with on-site minicomputers, video terminals, and software tied into the MCAUTO service network. The distributed approach, one that has been endorsed by a number of service firms recently, enables MCAUTO users to handle local processing tasks in their offices while employing the network for more general or ambitious applications.

Specifically, MCAUTO customers are using distributed processing for handling such tasks as financial and health insurance claims and shareholder record transactions.

Additionally, the company's graphics software is being used both within the parent company for computer-aided design and manufacturing applications, and outside by MCAUTO's commercial clients.

Also, MCAUTO's United Computing subsidiary installed 31% more of its recently enhanced Unigraphics systems in 1978 than in the previous year.

By year-end, close to 500 hospitals were using MCAUTO's shared computer services for financial processing. Through the acquisition of a medical records system that collects and analyzes statistics, MCAUTO's Health Services Division increased its number of clients to 781 hospitals in 43 states and the District of Columbia—a total that makes it the nation's largest supplier of computerized health care services.

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MAINFRAMES	MINIS & MICROS	PERIPHERALS & TERMINALS	MEDIA & SUPPLIES	SOFTWARE & SERVICES
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TEKTRONIX INC.

P.O. BOX 500,
BEAVERTON, OR 97077
(503) 682-3411

Increased peripheral and terminal sales in the dp marketplace in 1978 moved Tektronix up to the 34th spot in this year's DATAMATION 50. Last year it was number 38.

At the May 31 close of the 1978 fiscal year, Tektronix had realized a 32% increase in revenues over 1977, from \$454.9 million to \$598.8 million. Net income rose 29% from \$43.9 million to \$56.8 million.

The company's information display products are sold both to equipment users and to original equipment manufacturers. Applications for its products include uses in computer aided design, seismic data mapping, land use planning, and building design and printing layout.

Tektronix manufactures many of the special components used in its products, including cathode ray tubes, certain semi-conductors, and integrated circuits.

Tektronix divides its market areas into four categories—institutional, which includes the educational field; scientific, which covers the aerospace industry; automotive and chemical needs; and business services and timesharing.

Among 1978 corporate highlights was the appointment of John L. Landis as company vice president and manager of the international operations. He will direct the activities of Tektronix's four foreign manufacturing facilities and the sales and service organizations in 64 foreign countries. About 40% of the company's sales are made in the overseas marketplace.

In the new products arena, Tektronix introduced two new desktop computers, the 4052 and the 4054. The latter is the top of the line model for computer designing and reporting applications. Several new color graphics terminals were also announced in 1978.

After 17 years of litigation, 1978 saw what may be the end of the company's patent suit against the federal government, with a ruling handed down by the U.S. Court of Claims favoring Tektronix. The original suit charged the government with infringing on eight of the company's patents. If the court denies the government's appeal, it will have exhausted all legal recourse and the matter will have been resolved once and for all.

THE OBVIOUS ANSWER WILL COST YOU.

A traditional fixed channel hardwired multiplexer is the obvious way to handle several asynchronous terminals on a single line. It's obvious, and highly inefficient. It will cost you more, every month.

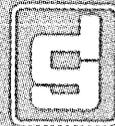
At General DataComm, we go beyond the obvious. Our microprocessor based TDM1240 statistical multiplexer far surpasses traditional multiplexing. Doubling, tripling, even quadrupling multiplexer efficiency. It will save you more, every month.

The TDM1240 uses advanced microprocessor techniques to dynamically regulate the data flow according to the load on each of the four channels. With buffer storage to accommodate temporary peak loading, this unique concept in data management achieves an unsurpassed combination of reliability, performance, efficiency, and

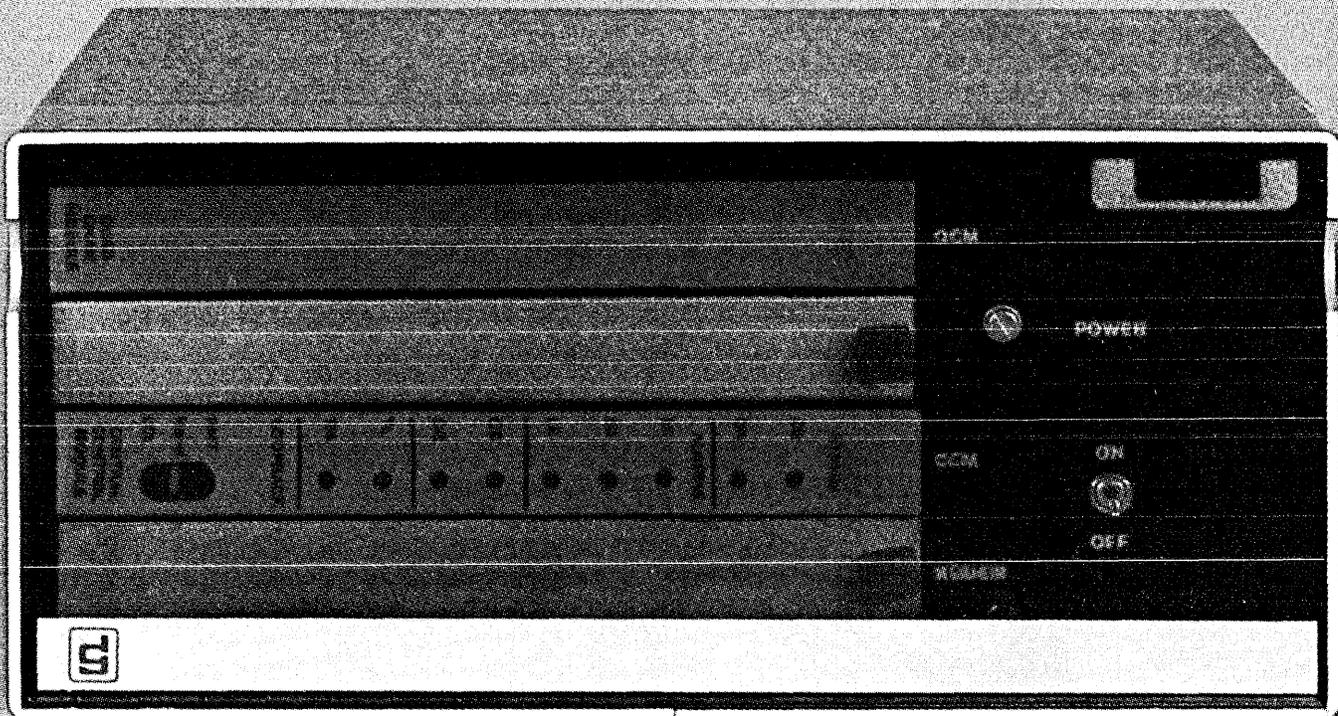
economy. The TDM is compact and easy to install, without any modification of existing hardware or software.

The TDM1240 and its big brother, the 16 channel TDM1241. Examples of the innovative product line that makes GDC the unquestioned leader in data communications.

When the obvious answer will cost you more, we'll cost you less. Contact:



General DataComm Industries, Inc.,
One Kennedy Avenue,
Danbury, CT 06810.
(203) 797-0711.



The TDM1240 microprocessor-based statistical multiplexer.

35

MAINFRAMES	MINIS & MICROS	PERIPHERALS & TERMINALS	MEDIA & SUPPLIES	SOFTWARE & SERVICES
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DATAPRODUCTS CORPORATION

6219 DESOTO AVENUE,
WOODLAND HILLS, CA 91365
(213) 887-8000

For fiscal 1978, which ended March 25, 1978, the California-based company listed record revenues and income, and entered fiscal '79 with a 40% increase in its backlog.

Total revenues for 1978 were \$138.6 million compared to \$115.2 million for 1977, a 20% increase. Net income rose to \$15.5 million, or 28% above the \$12.1 million of the previous year.

Dataproducts has three product segments—printers, core memories, and telecommunications. Printers represented 76% of the company's total revenues for '78, or \$105.8 million, a 22% increase over the previous year. A total of 12,200 printers were produced during 1978, up 16% over 1977.

Up until 1978, Dataproducts' main thrust was in the high speed printer area. In '78 the company moved downward into the 300 lpm speed range with the introduction of three new thermal and matrix printers.

Dataproducts expects the lower end of the printer market to expand rapidly, making up about \$600 million worth of sales for the company by 1985. Consequently, the company plans to spend in the neighborhood of \$11 million within the next year in engineering and development in this area.

Core memory operations achieved record results in 1978. But, the company says, continuing competition in this area from integrated circuits is expected to cause a noticeable slowdown this year.

Anticipating this trend, Dataproducts has made sure each of the facilities presently producing memories is also involved in printer programs. Core memory revenues in fiscal '78 totaled \$21.4 million and represented 16% of the company's total revenues.

Telecommunications revenues in '78 totaled \$11.2 million, or 8% of the total revenues. Substantial growth in this area is expected during the '79 fiscal year.

Principal buyers for the firm's products remain the original equipment manufacturers. Dataproducts is the largest independent manufacturer of printers for this market, presently supplying some 400 oem customers. It considers this form of distribution the "backbone" of its business. There are plans, however, to develop broader forms of distribution to serve other segments of the market; for example, the company is considering using independent distributors to reach smaller systems houses.

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MAINFRAMES	MINIS & MICROS	PERIPHERALS & TERMINALS	MEDIA & SUPPLIES	SOFTWARE & SERVICES
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TELETYPE CORPORATION

5555 TOUHY AVENUE,
SKOKIE, IL 60076
(312) 982-2000

Teletype's dp-related revenues climbed to an estimated \$124 million in fiscal 1978, and the company is seemingly becoming a more aggressive factor in the terminal product market place. Dp-related sales for fiscal '77 were estimated at \$110 million in last year's DATAMATION 50.

A wholly owned subsidiary of Western Electric Co., which in turn is owned by AT&T, Teletype has taken on the competition with its Model 43 Teleprinter family—an offspring of the Model 33—and is positioning its 4540 series of interactive synchronous terminals against the IBM 3270 data entry terminal.

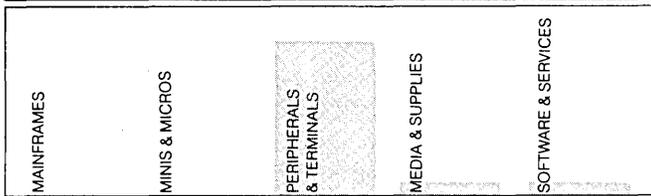
It has also brought out a new generation of 5-level buffered teleprinters for Telex applications, and is selling its Teletype model 40/4 synchronous data terminal to banks, brokerage houses, pharmaceutical chains, railroads and steel companies.

Sold for standalone or clustered displays in tandem with printers that are hardware and software compatible with remote bisynchronous communications protocol, the 40/4s are installed and maintained by Teletype's nationwide service network.

We estimate that Teletype's total revenues exceeded \$300 million this year. About 41% of that total, which constitutes the company's entire dp-related sales, comes from terminal products. About 90% of its sales are to the domestic market.

The company, which employs over 5,000 people, is greatly affected by the rulings of federal regulatory bodies, such as the Federal Communications Commission. Its future marketing and product policies will probably be impacted by the outcome of the FCC's Computer Inquiry II, as well as by the Communications Act which is currently being rewritten in Washington. One possibility being discussed by these regulatory and legislative bodies is the spin-off of Western Electric from AT&T.

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CALIFORNIA COMPUTER PRODUCTS INC.

2411 WEST LA PALMA AVENUE,
ANAHEIM, CA 92801
(714) 821-2011

The check-off list for CalComp over the past fiscal year includes a return to profitability, a broadened customer base, and an expanded product line.

Total revenues for '78 amounted to \$120 million, a 2% increase from the year before. Moreover, net income totaled \$1.5 million as compared to the previous year's loss of \$1.7 million. With other companies experiencing greater growth percentages, CalComp dropped from 27th to 37th in our rankings.

Breaking out revenues by product categories, the company derives 90% of sales from peripherals and terminals, 5% from media and supplies, and another 5% from software and services.

A complete reorganization in 1978 saw the company divided into five operating divisions along product lines as opposed to its previous functional groupings. This mode of operation will improve the visibility of its various product lines and the markets the company services.

Also during the past year, CalComp entered the minicomputer peripherals market. The company expects this market to add several tens of millions of dollars in sales within the next few years.

Also during the year, active sales of third-party maintenance contracts with other computer equipment manufacturers was begun.

Major additions to the company's plug-compatible peripherals included a line of subsystem adaptors and peripheral switch products, a model 4350 disc drive subsystem, and a high speed input/output printer system.

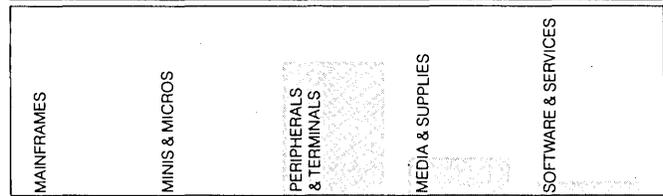
Further, CalComp Financial Inc. was established as a new subsidiary, operating within the dp area in arranging for the purchase and lease of central processors and peripherals to be packaged according to customer specifications.

Formation of the new subsidiary is seen as an avenue to increased market penetration with CalComp's growing line of IBM plug-compatible products, either alone or in combination with specified cpu's.

A strong area for sales and growth last year was in the graphics products sector. Worldwide revenues exceeded those of 1977 by 18%. The introduction of a new controller and drum plotter, and the subsequent good acceptance of the two, paved the way for record production during the last half of fiscal '78.

The graphics area was also one of the largest in the new product area, with 10 new products brought on the market. A new generation of drum plotters headed the list, each offering new levels of resolution and throughput at speeds ranging up to 30 inches per second in the high end model.

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AMPEX CORPORATION

401 BROADWAY,
REDWOOD CITY, CA 94063
(415) 367-5920

Although more familiar to the buying public for its Betamax television taping cassettes, Ampex is moving into the data processing sector with vigor.

Presently, 37% of Ampex's total revenues are dp related and in fiscal 1978 that percentage represented \$119 million. We estimate that 75% of the dp-related total was derived from the sale of peripherals and terminals, with media and supplies contributing 20% and service the remaining 5%. Total revenues reached \$322 million last year.

With core memory still its strongest offering in the dp industry, Ampex is seeking to expand its markets and offerings. Current products include central processing units, instrumentation recorders, and memory equipment such as digital disc and tape drives.

In view of the world's growing appetite for gathering, storing, and retrieving information, the need for computer peripherals and memory components has become explosive. Among the steps taken during the past year to meet increased customer demands was the expansion of its digital disc manufacturing facilities.

Fiscal 1978 was listed as the largest growth year ever in terms of total revenues for the data and memory products group. Last year's introduction of new products, such as Megastore memory and the new family of large capacity disc modules, was extremely well accepted.

Ampex's line of plug-compatible core memory products continues to be keyed to offering cost advantages and performance enhancement for major mainframe computers.

Orders for disc products continued strong throughout last year in both domestic and international markets. Deliveries were begun on approximately 1,000 disc systems to a single overseas customer.

Major contract awards played a part in Ampex's overall picture. The General Services Administration awarded Ampex several supply contracts for add-on memory for IBM's 360/65 and Univac 1110, 1108, 1106 and 494 computers used throughout government installations. These contracts carry with them renewal options for three additional years.

During fiscal 1978, the PTD-9300 was brought on the scene. This series of parallel transfer disc drives provides very high data transfer rates and large storage capacity. Ampex also brought out its first peripheral control device, the DC-1000. This microprocessor-based device interfaces with 11 widely used central processing units and the Ampex DM-900/DM-9000 family of disc drives.

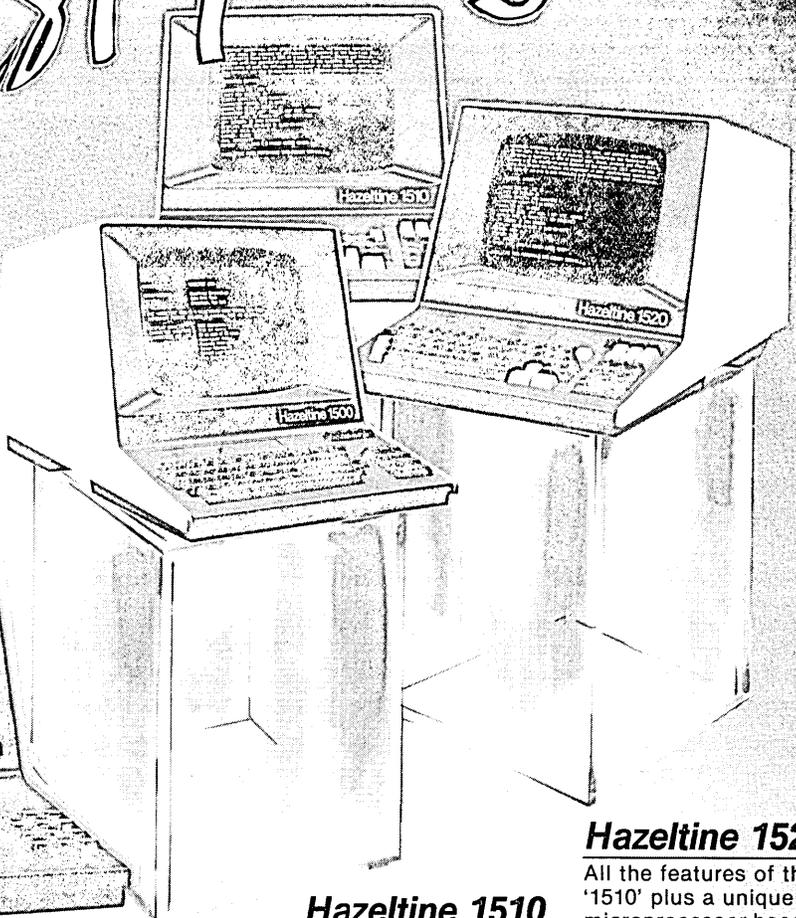
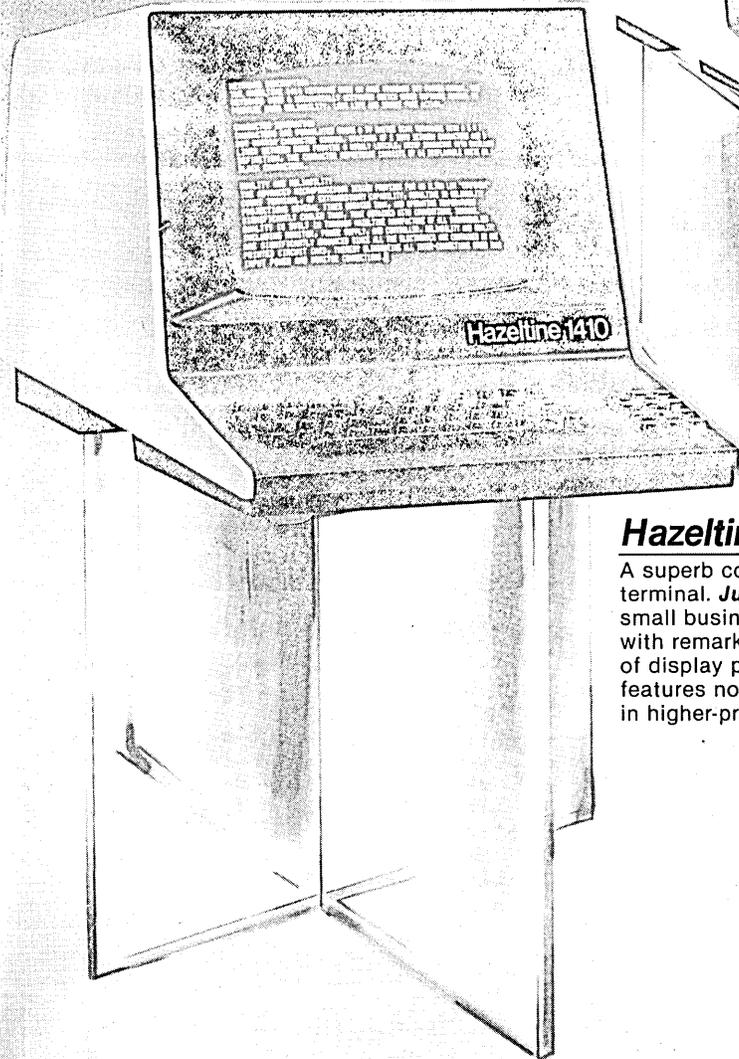
Hazeltine

Just Right!

**The Leadership Line
of Economy Terminals.**

Hazeltine 1410

A low-priced video terminal with all the features needed for data inquiry and data entry applications, and a separate numeric key pad to make numeric entry faster, easier and error-free. Its total design, from baseplate up, is for efficiency in operation and maximum operator comfort! **Just Right!**



Hazeltine 1500

A superb conversational terminal. **Just Right!** for small business systems, with remarkable clarity of display plus many features normally found in higher-priced terminals!

Hazeltine 1510

All the features of the '1500' plus buffered operation with editing. **Just Right!**

Hazeltine 1520

All the features of the '1510' plus a unique microprocessor-based printer interface. **Just Right!** for local or on-line, buffered parallel or serial printing.

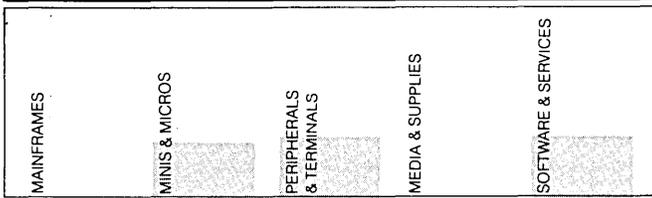


Hazeltine Corporation
Computer Terminal Equipment

Greenlawn, New York 11740 (516) 549-8800 Telex 96-1435
New York (212) 586-1970 • Chicago (312) 986-1414 • San Francisco (415) 342-6070
Atlanta (404) 952-8444 • Arlington (703) 979-5500 • Orlando (305) 628-0132
Houston (713) 783-1760 • Dallas (214) 596-2414 • Los Angeles (213) 553-1811
Columbus (614) 451-0472 • St. Paul (612) 698-0801 • Detroit (313) 296-9510
England 01-948-3111 Telex (851) 928572

CIRCLE 8 ON READER CARD

39



BUNKER RAMO CORPORATION

COMMERCE DRIVE,
OAK BROOK, IL 60521
(312) 986-2700

Bunker Ramo's Information Systems Division continues to be a major revenue contributor, with net sales in 1978 reaching the \$118.7 million mark or 31% of total revenues for the company.

BR ended the '78 fiscal year on Dec. 31 with \$383.2 million in total revenues, a 12% increase over the \$341.2 million posted the previous year. Net income totaled \$18.8 million, an 82% hike over the \$10.3 million of fiscal '77.

As for product categories, 30% of the firm's dp-related revenues were from the sale of minicomputers, 35% from peripherals and terminals, and the remaining 35% from software and services sales.

Bunker Ramo operates a nationwide network of regional computer centers and high speed data lines which disseminate stock quotations and other market information on all North American exchanges. This represents some 20,000 terminals installed at subscribing broker offices.

The banking business was particularly strong for BR in 1978. Chemical Bank, New York City; Marine Midland Bank, New York State; and Swiss Credit Bank in Switzerland were all brought on as new customers last year.

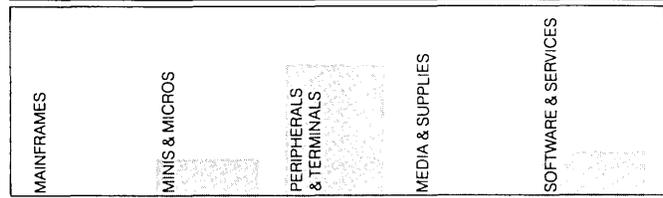
Bunker Ramo successfully interfaced its Bank Control System 90 with computers made by IBM and Burroughs, principal mainframe suppliers to the banking industry. This will enhance the product capabilities available to Bunker Ramo.

The company maintains a main data base in Trumbull, CT and four regional data centers in New York, Chicago, Atlanta and San Francisco. Customers thus have access to one of the largest and most comprehensive data bank of on-line financial information available from any single source in the country.

Bunker Ramo saw steady growth in marketing of both banking and commercial systems on a worldwide scale in 1978. Contracts were signed with large banking institutions in Western Europe, Eastern Europe, and in the Far East. The worldwide distributor network was expanded, and prospects for increased revenue over the next few years appear good.

Bunker Ramo reported a backlog at the end of fiscal 1978 of \$219 million, up nearly 16% from the previous year.

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GENERAL INSTRUMENT CORPORATION

1775 BROADWAY,
NEW YORK, NY 10019
(212) 541-8200

Point-of-sale systems and off-track betting continue to be two of the most successful dp revenue producing activities of General Instrument. So successful in fact, they helped offset \$28 million worth of marginal business elements dropped by the company during fiscal 1978, which ended February 28 of that year.

Total revenues for '78 were \$502.8 million, an 8% increase from \$466 million during the previous year. Net income rose by 47% from \$16.5 million in 1977 to \$24.3 million last year.

Dp-related revenues in fiscal '78 totaled \$115.6 million, 23% of the total. General Instrument estimates 60% of the dp revenues were from terminals and peripherals, 25% from software and services, and 15% from the minicomputer content of its systems.

Dp products and markets fall into two categories: on-line, real-time computer systems and associated equipment for the legalized gaming industry, and electronic point-of-sale systems whose users include the top 100 full-line department stores in the country.

During the past year, American Totalistor, GI's electronic gaming and wagering subsidiary, made the first installations of its new TIM 300 system, a single microprocessor-based terminal for both selling and computer-verified cashing operations. The Ontario Jockey Club, the largest operator of race tracks in North America, was the first to come on line with the new system. The TIM will enable GI to maintain its leading position in the parimutuel wagering equipment area.

For off-track betting and lotteries, GI's revenues grew 56% during fiscal 1978. By fiscal year-end, its OTB systems served a population base of approximately 15 million. In Maryland alone, the state now handles about \$5.5 million per week from over 660 GI produced terminals, with sales totaling more than \$225 million for fiscal 1978.

Electronic retail systems, marketed through GI's Unitote/Regitel Division, were selected by Federated Department Stores for installation at over 20 of its stores in Ohio, Kentucky, and Indiana. The Federated contract is valued at more than \$9 million and will involve more than 2,000 POS terminals in all.

Meanwhile, GI continued the product development in POS systems with the introduction of the Remote Store Controller and a new data capture unit which enables a higher level of reliability in retaining retail sales data. The controller system provides POS capabilities for stores previously thought to be too small to support such a system.

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MAINFRAMES	MINIS & MICROS	PERIPHERALS & TERMINALS	MEDIA & SUPPLIES	SOFTWARE & SERVICES
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TELEX CORPORATION

6422 EAST 41 STREET,
P.O. BOX 1526,
TULSA, OK 74101
(918) 627-2333

With the help of a major acquisition in 1978, Telex continues to move itself into a stronger product and market position within the dp industry.

Telex Computer Products (TCP) acquired General Computer Systems Inc. on May 1, 1978. This acquisition adds data entry terminals and word processing equipment to the product offerings of this wholly owned subsidiary of Telex Corp. (TCP manufactures, markets and services a broad spectrum of computer peripheral equipment including the 7211, a 2,000 lpm train printer.)

The GCS purchase followed hard on the heels of the sale of TCP's European operations to Memorex Corp. The transaction enabled Telex to generate cash, which in turn allowed further growth domestically and provided capital for the GCS acquisition.

1978 total revenues for the company stood at \$140 million, compared to \$119 the previous year. Net income rose to \$8 million, compared to the \$6 million of 1977.

Seventy-six percent of Telex's total revenues are generated from the computer sector and represent \$107 million. Of the total dp-related revenues, 85% are generated from the sale of peripherals and terminals while the other 15% comes from services.

The GCS acquisition added the 2100 and GCS 211 to Telex's product line. The GCS 2100 utilizes terminals employing keyboards and video display tubes linked to a central processing unit which also supports magnetic disk or tape drives. The 2100 is also supported with a library of more than 100 application-oriented software routines.

GCS also manufactures, markets, and services a word processing system known as DataText which utilizes a maximum of 32 typing stations. Also linked to the central processing unit is a series of video display tubes.

Within the main Telex line, major enhancements to its products in the 3270 terminal system marketplace have been the order of the day. Prior to 1978, cluster printers from Telex used a 30 cps daisywheel print mechanism. Last year, a 40 cps mechanism was incorporated which enhanced reliability and serviceability. Telex has also developed a matrix cluster printer which operates at 180 cps, more than double the speed of its previous printers.

Also introduced last year were two custom terminals—the graphic arts terminal and the remote access communications terminal.

Another major subsidiary of Telex is its communications division (TCI), which manufactures and markets a wide variety of communications and consumer audio electronics products. Product categories in this area are broadly divided into acoustic equipment, home entertainment products, and educational products.

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MAINFRAMES	MINIS & MICROS	PERIPHERALS & TERMINALS	MEDIA & SUPPLIES	SOFTWARE & SERVICES
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GENERAL AUTOMATION INC.

1055 SOUTH EAST STREET,
ANAHEIM, CA 92805
(714) 778-4800

Aiming its slogan "Your Automation Partner" at major corporations and financial institutions, General Automation has seen its total revenues inch closer to the \$100 million mark.

Fiscal 1978 figures showed total revenues at \$98 million, compared to \$84 million the year before. Net income reached \$4 million for fiscal '78, which ended July 31 of last year.

With 100% of its revenues dp-related, General Automation moved up one spot to number 42 in this year's survey.

Of the total revenues, 60% were generated by the sale of minicomputers; peripherals added 20%, as did software and services.

With an eye on the growing importance of the software sector, General Automation brought in Erwin Allen as vice president of software engineering to direct the development of the company's software line. He will also help establish a new software technology center which is planned for La Jolla, CA.

Several major new products were announced during the past year including Autonet, a new network architecture for the distributed processing marketplace. Also coming on line was Spectrum, a computerized numerical control system for the machine tool sector.

The company also introduced the GA-16460 minicomputer, an extension to its Solution Series that uses HYPAK memory. Additionally, a resource sharing capability for the distributed networking marketplace was announced. It is called Network Data Series.

A major step was taken in the area of electronic funds transfer, with the certification of General's funds transfer software package by the Society for Worldwide Interbank Financial Telecommunications (SWIFT). The system is earmarked for over 150 banks throughout the world.

General Automation looks to a strengthened position in its European operations, pointing to record backlogs at year-end which totaled \$38 million.

Always a step ahead in technology.

NCR announces nine

One of the industry's best price/performance ratios, plus



Multi-bus design with multiple coupled instruction processors. 4 to 12 megabytes of memory and internal cycle speed of 56 nanoseconds. Monthly rental from \$21,139.



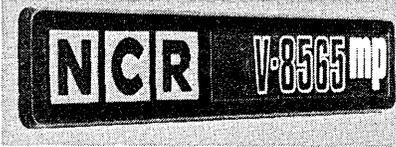
Uni-bus design with multiple coupled instruction processors. 2 to 6 megabytes of memory and internal cycle speed of 56 nanoseconds. Monthly rental from \$9,792.



Multi-bus design with multiple coupled instruction processors. 2 to 8 megabytes of memory and internal cycle speed of 56 nanoseconds. Monthly rental from \$13,323.



Uni-bus design with single instruction processor. 2 to 4 megabytes of memory and internal cycle speed of 56 nanoseconds. Monthly rental from \$5,884.



Multi-bus design with multiple coupled instruction processors. 2 to 6 megabytes of memory and internal cycle speed of 56 nanoseconds. Monthly rental from \$8,457.



Uni-bus design with single instruction processor. 1 to 3 megabytes of memory and internal cycle speed of 56 nanoseconds. Monthly rental from \$3,451.



Multi-bus design with multiple coupled instruction processors. 1 to 2 megabytes of memory and internal cycle speed of 84 nanoseconds. Monthly rental from \$6,281.



Uni-bus design with single instruction processor. 0.5 to 1 megabyte of memory and internal cycle speed of 84 nanoseconds. Monthly rental from \$2,363.



Uni-bus design with single instruction processor. 0.5 to 1 megabyte of memory and internal cycle speed of 112 nanoseconds. Monthly rental from \$1,330.

With the introduction of these nine new computers, NCR now provides the broadest line of high-performance, intermediate-to-large-range computers at dramatically lowered price levels. Monthly rentals start at only \$1,330.

If you are ready to step up from minicomputers, in need of more powerful transaction processing networks — or anywhere in between — then you're ready for the step-ahead technology of these new NCR systems.

Multiprocessing Flexibility. New, Unique, Practical.

With these new NCR systems you pay for the added capacity of multiprocessing only when you need it.

Four of the new systems (these are the M systems) can be upgraded to multiprocessing when required. Four others (the MP systems) are full-fledged multiprocessors when installed. These processors can be mixed in unique configurations to meet the most complex multiprocessing requirements.

- Now, for the first time, up to four processors can be tightly coupled to provide ultimate multiprocessing power and reliability. Coupled systems share all resources equally. But they can operate as independent processors at any time.
- For the first time, a mainframe supplier offers a family of systems that can be tightly coupled in a variety of configurations regardless of differences in internal speeds. Giving more options to the user.
- Now, for the first time, VRX-MP — NCR's newly introduced virtual operating software — uses parallel multi-tasking techniques, to provide high-level efficiency by adjusting automatically to peak-load demands.

Bus Architecture. Improving an Improvement.

Bus Architecture was recognized as a significant breakthrough in 1976 when it was incorporated by NCR into a full-scale computer for the first time. It was a major feature of the NCR 8550 and 8570. In 1978, for the first time, it was made part of large-scale computer systems. . . the NCR V-8650 and V-8670.

The advantages of Bus Architecture now have been proven by NCR systems in operation around the world. And the concept is advanced in these nine new NCR systems.

With Bus Architecture the computer system splits up the workload. The Internal Transfer Bus is an ultra-high-speed data path that channels information among as many as 12 processing elements without central monitoring. It provides high-level concurrent processing.

High-speed Logic, High-speed Links. Another Step Ahead.

These new systems feature emitter-coupled logic, the fastest commercially available circuitry. Operating at cycle speeds up to 56 nanoseconds, these systems are significantly faster than even the most recently announced competing systems. Still more for your money.

Central processor performance is complemented by bit-serial link input/output, handling high-speed peripherals with transfer rates up to 1.2 million bytes per second. This feature incorporates the latest error detection mechanisms, and allows peripheral attachment through coaxial cables.

new computers.

multiprocessing capacity.

New Software Support. Online.

Early next year, NCR will begin a comprehensive online software support service. Subscribing customers will have online access to a complete operating software information data base. In addition, regional centers will be staffed by software experts to provide dialog when needed with VRX-MP and other advanced software customers.

Migration Path Engineering. Avoiding Obsolescence.

NCR Migration Path Engineering is a unique concept in software compatibility built into each NCR 8000 Series system. Users get the easiest system-to-system transition in the industry. The climb is consistent and logical within each family.

That's why an NCR customer can easily move from one of these new systems to the next as his volume increases. Or from another V or N mode NCR system. The same software can be used. And nothing changes but the available power.

Small Size, Big Performance.

Rapidly advancing technology has made it possible to shrink computer components and reduce overall size dramatically. V-8500M systems, for example, house all processing elements and up to 6 million bytes of memory in a cabinet that occupies less than ten square feet of floor space. Compact size, use of

conventional power sources, and less stringent environmental requirements simplify installation. If the operator is comfortable, the system is comfortable.

Through NCR technology, these new systems with high-speed circuitry, large memories and concurrent processing capability offer impressive throughput at new lower price levels.

The result is one of the best price/performance packages on the market today. So if you are ready for a new computer system you now have a logical choice. Nine choices. Whichever meets your price and performance needs.

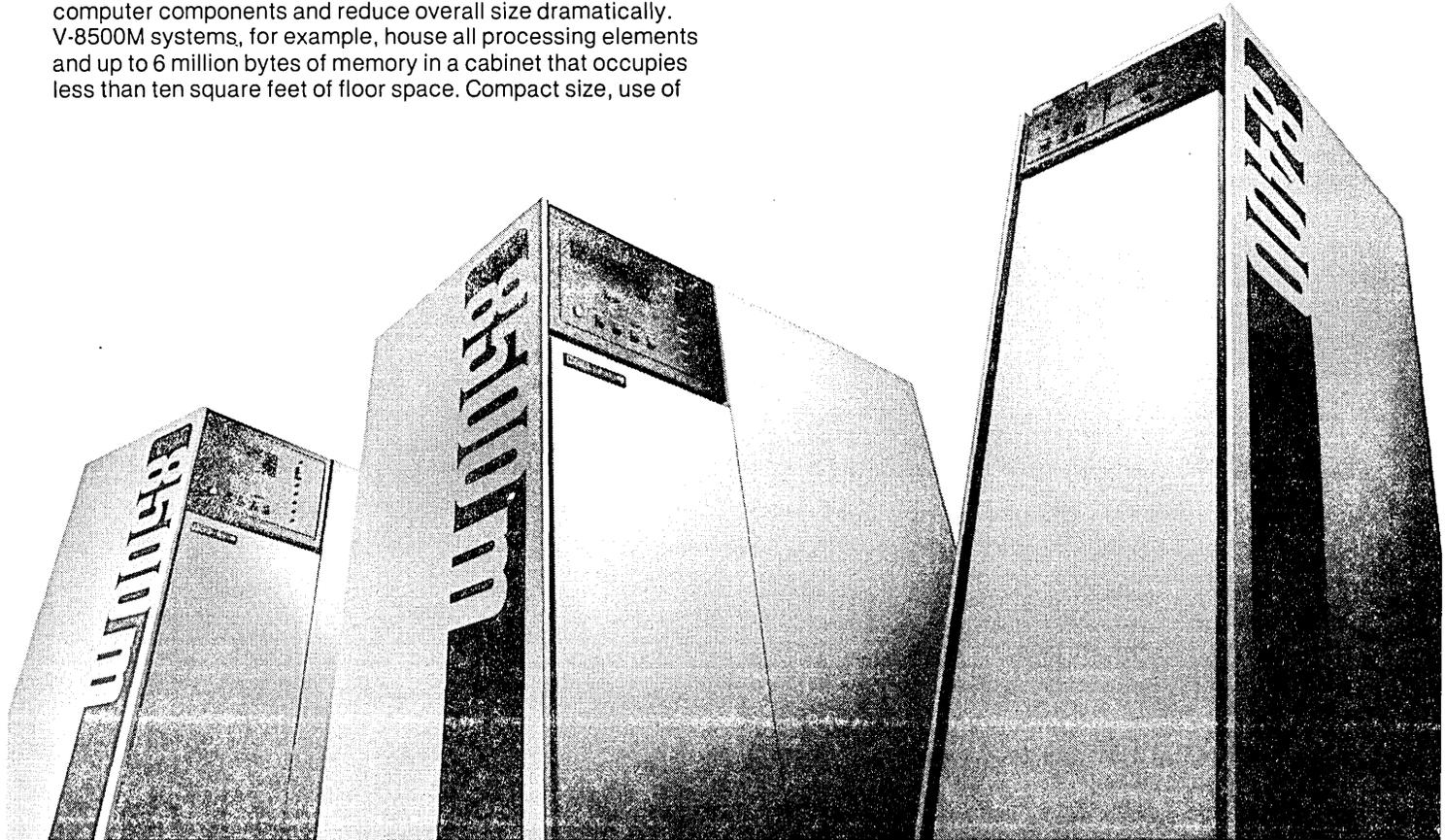
Find out which of these new systems meets those needs best. Contact your local NCR office. Or write to EDP Systems, NCR Corporation, Box 606, Dayton, Ohio 45401.

You'll be a step ahead, too.



World's second largest computer company.*
Second to none in performance.

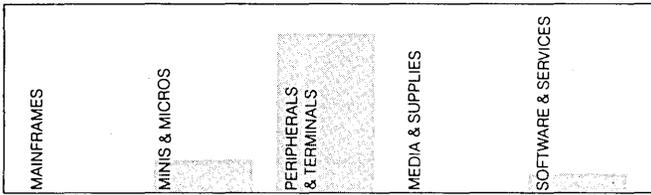
*International Data Corporation, 1978, based on revenue generated from computer operations.



Largest of the nine new low-cost, high performance systems is the V-8585MP multiprocessing system. Memory ranges up to 12 megabytes and internal cycle speed of .56 nanoseconds. Monthly rental starts at \$21,139.

The new V-8455, the smallest of the new systems, has a memory range up to 1 megabyte and internal cycle speed of 112 nanoseconds. Monthly rental from \$1,330.

43



RAYTHEON COMPANY

141 SPRING STREET,
LEXINGTON, MA 02173
(617) 862-6600

With its dp-related activities centered in its Data Systems sector, Raytheon saw another year of growth in its computer based systems and services.

The 1978 reporting period showed \$97 million in dp-related revenues for the company. This constitutes only about 3% of total revenues, which amounted to \$3 billion. Net income for the company as a whole amounted to \$150 million.

Raytheon's principal business is in the design, engineering, manufacturing and servicing of advanced electronic devices, equipment, and systems for both commercial and government customers.

In the dp area, the Data Systems division was the fastest growing element of Raytheon's commercial electronics business. RDS manufactures data terminals, distributed processing and emulation systems, and other electronic equipment.

RDS now counts among its customers some of the country's largest banks, diversified financial corporations, and insurance companies. Companies such as Equitable Life Assurance Society use Raytheon's 1200 systems to handle a wide range of customer-related tasks.

One of the major product introductions for the company last year was the RayCheck software system aimed at passenger reservation and ticketing systems used by the major airlines. With RayCheck, a passenger departure control system can be operated either on a standalone basis or as a link to the central reservation computer.

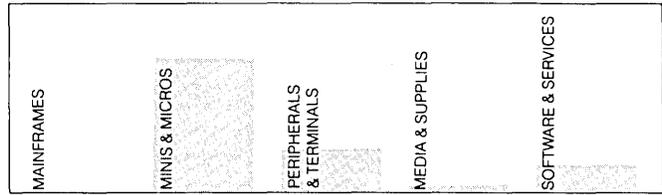
With the strong financial resources available from the company as a whole, Raytheon is able to lease its equipment directly to customers rather than relying on traditional third party leasing arrangements.

Early in 1978 RDS acquired Lexitron Corp., a leading producer of word processing systems. With added financial resources available to the new member of Raytheon, Lexitron grew well in its first year with the parent company.

At year-end, the combined base of RDS and Lexitron equipment on operating leases had a market value when shipped of more than \$120 million, with two-thirds of the leases having initial terms of two years or more.

Another area of growing commercial electronics business for Raytheon is the automation of display advertising make-up for newspapers. The Raycomp-100 system uses a video display terminal for electronic composition of display advertising. The system is now in use at 39 newspapers in the United States and Europe.

44



TANDY CORPORATION

1800 TANDY CENTER,
P.O. BOX 17180,
FT. WORTH, TX 76102
(817) 390-3021

It all started in 1963 when Tandy Corp., a small family-owned leather crafts business, bought Radio Shack and went into electronics. Today, the company is over the billion dollar mark in sales and appears to be the runaway leader in the microcomputer market.

"The computer and data processing market is huge and growing," says Tandy President Charles D. Tandy. "We see an opportunity with our distribution capabilities to become a significant participant in this industry."

Tandy enters the DATAMATION 50 this year; its number 44 position is impressive for a newcomer to the list.

On June 30, Tandy ended the 1978 fiscal year with \$1.059 billion in total revenues, a 12% jump from the \$949.2 million of the previous year. Although net income dropped 8% from \$71.8 million in 1977 to \$66.1 million in fiscal '78, the decline was attributed to the purchase by Tandy of 3.5 million shares of its own stock.

While Tandy will not break out the overall percentage of revenues that are dp-related, officials did segment dp revenues into product categories. Sixty-three percent of the company's revenues were from the TRS-80 microcomputer, released for the first time in late 1977. Peripherals accounted for 26% of the sales, software and services 10%, and media and supplies the remaining 1%.

Taking these percentages, plus the fact that Tandy reportedly sold over 100,000 TRS-80s in '78, we calculate Tandy's dp sales to be \$96 million for its last fiscal year.

Presently, Tandy manufactures close to 40% of all the dp products it sells. Company officials are fully cognizant, however, that any talk of R&D and new products must be linked with maintaining a "strong financial position" to be permitted to invest in areas that will strengthen their manufacturing capabilities.

One other way Tandy is set apart from the rest of the dp industry is its unorthodox approach to marketing. Company officials are quick to point out that there is no formal marketing department within the company's structure. The words used in-house are "let the product find the market."

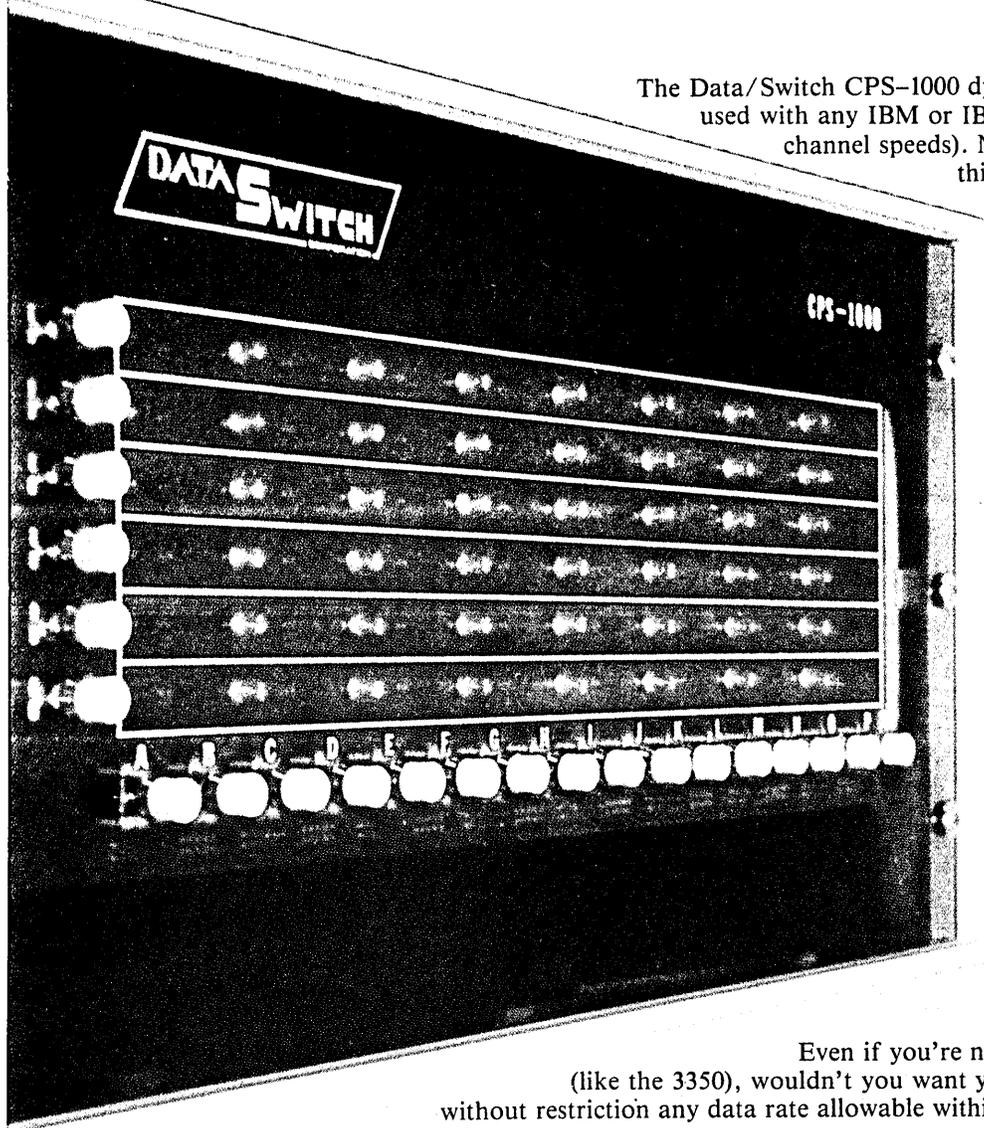
Using the TRS-80 as the prime example, Tandy says it can continue to grow by bringing out products that carry no specific audience tag. The prime audiences that have surfaced so far for the microcomputer are small businesses, first-time computer users, educational institutions, and small parts of bigger businesses that need dedicated applications.



builds peripheral switches for today's IBM computer systems

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The Data/Switch CPS-1000 dynamically switches any I/O control unit used with any IBM or IBM compatible CPU (including 2305's at channel speeds). No one else, including IBM, can provide this unrestricted channel speed switching.



- MATRIX SIZES TO 8x24 (ONE SYSTEM REPLACES SEVERAL IBM 2914's)
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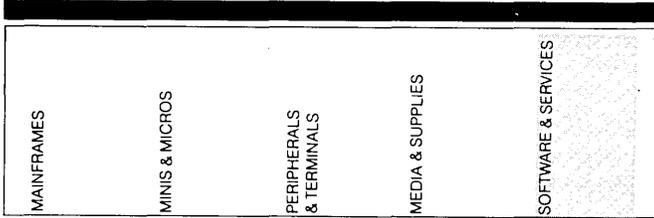
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PLANNING RESEARCH CORPORATION

1850 K STREET N.W., SUITE 1100,
WASHINGTON, DC 20006

(202) 293-4700

Planning Research celebrates its 25th anniversary this year, having started in 1954 as a small think tank and growing into one of the largest software and service companies in the country.

At the close of fiscal '78 in June of last year, PRC listed total revenues of \$223 million compared to \$186 million the previous year. Net income totaled \$5 million, 27% above the \$3.8 million of 1977.

With 43% of its total revenues derived from the sale of software and services, PRC moved from the 49th spot to the 45th on dp revenues of almost \$96 million.

PRC provides systems design and analysis, data processing, and management consulting to customers ranging from the private sector all the way to the oval office at the White House. In fact, the U.S. government remains one of PRC's largest customers.

PRC's 20 product sectors are structured functionally as two operating groups: the Information Sciences and Services Management Consulting Group, and the Planning, Economics, Engineering and Architecture Group. The revenues derived from each group are almost equal.

The Information Sciences group is a major factor in the computer software and consulting field, with work expansion in that area in fiscal 1978 amounting to 29%.

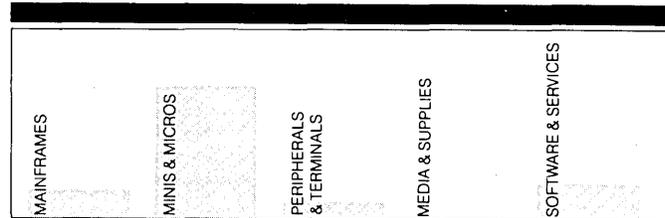
A significant internal step taken last year was the sale of Logica, PRC's partly owned affiliate in the United Kingdom. The sale by PRC was to a new corporation formed by European Logica staff members.

Other internal events included the introduction of Telefiche, which should increase the company's base in the information resource management sector. Telefiche enables the conversion of micrographic images into digital signals by combining computer, micrographics, and communications technology.

PRC entered fiscal 1979 with an increased backlog of multiyear contracts and sustained long-term client relationships which have improved its competitive position in the marketplace. The backlog at the close of '78 stood at \$175.6 million.

Also during the past year, the Securities and Exchange Commission awarded PRC a contract for a minicomputer-based system for reducing 10K's and related documents to microfilm.

46



PRIME COMPUTER INC.

40 WALNUT STREET,
WELLESLEY HILLS, MA 02081

(617) 879-2960

Over the past year Prime recorded one of the largest increases in growth of any company in the dp industry and as a result appears for the first time in the DATAMATION 50. The company ranks number 46.

Fiscal '78 revenues rose to \$93.6 million, 87% above the \$50 million of the previous year. Even more impressive, net income increased by 114% from \$3.9 million in 1977 to last year's \$8.4 million.

Over half, \$62.7 million, of total revenues was generated by the sale of large-scale minicomputers in the United States.

Prime is uniquely positioned among the minicomputer makers as an end user company. During 1978, approximately 93% of total revenues were derived from end users, with the balance attributable to oem sales.

The strength of Prime's customer base remains industrial, commercial, educational and scientific. Last year, the company significantly expanded that base with the addition of major corporations and educational institutions. During the year, no one customer accounted for more than 5% of sales.

Among 1978's highlights were the listing of the company's stock on the New York Stock Exchange, the introduction of the 350 system, and the formation of Prime de Puerto Rico, its first manufacturing subsidiary outside this country. Finally, Prime recorded quarterly sales exceeding \$100 million on an annualized basis for the first time in October of last year.

In 1978, Prime developed the widest array of new products in its history. The company announced four new compatible computers, the 450, 550, 650 and 750 systems. Prime also developed new software for debugging all of its systems, and developed a wide range of other products to upgrade or support the current line of dp systems.

In another area of growth, Prime's facilities increased just over 49% to 479,000 square feet. The company expects the physical additions to enable it to meet the demands for services and products when the company reaches the \$250 million sales level.



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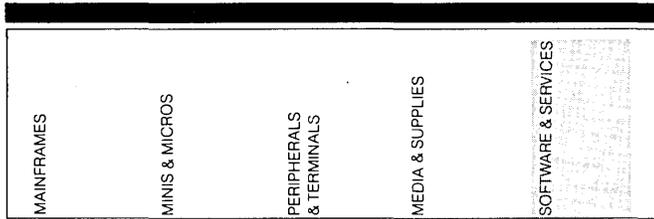
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47



INFORMATICS INC.

21031 VENTURA BLVD.,
WOODLAND HILLS, CA 91364
(213) 887-9040

Informatics is finding its software very much in demand these days as Uncle Sam and numerous private businesses turn to this fast growing Silicon Valley-based company for software and services.

Year-end fiscal figures saw total revenues climb from \$75 million in 1977 to \$93 million last year, while net income reached \$3 million as compared to \$940,000 the year before. Although it had a good financial showing, the numbers were not strong enough to move the company up on the survey chart. Instead, Informatics dropped from number 45 to number 47.

The introduction of the Series IV and Inquiry IV/IMS systems were only two of the highlights in a year which saw major contracts awarded by the U.S. Department of Transportation, NASA and the Department of Energy.

The federal government comprises 23% of Informatics' customer base, while commercial customers account for the remaining 77%.

Additionally, Mutual Trust Life Insurance Co., Oak Brook, IL, became the first of what was to be several insurers to convert to Informatics' Life-Comm System. By the end of the year the system was processing well over one million individual life insurance policies around the country.

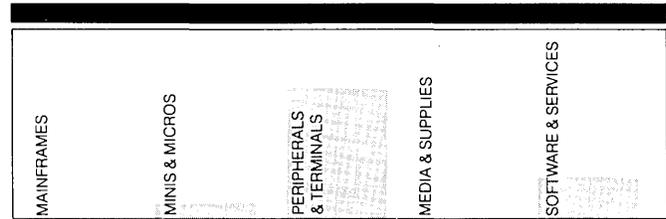
Marketing of Series IV, the new data entry and validation system, was launched in early 1978. By year-end, 56 installations had been completed in 10 countries.

In March, the corporate office of Ackland Ltd. of Winnipeg began on-line processing with the Distribution IV System at Informatics' Columbus data center. Ackland, a \$300 million distributor of automotive and industrial supplies, will use these data services at five additional Canadian sites.

Among other major contracts awarded during the past year was one totaling some \$5 million from NASA for an operations and data processing support system to the Image Processing Laboratory at Cal Tech.

In February, development work began on a new distributed data processing system as an adjunct to data services supplied to the wholesale industry. An agreement was reached with Honeywell for Informatics to supply Level 6 minicomputers to customers as hosts for the system.

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RECOGNITION EQUIPMENT INC.

2701 EAST GRAUWYLER ROAD,
IRVING, TX 75061
(214) 438-8611

Products geared to easing the steps involved in gathering data and processing paper have kept Recognition Equipment steadily moving up the ladder of success, as witnessed by the fiscal '78 figures.

With net income standing at \$5 million and total revenues at \$87 million, REI's 17th year of operation was marked by several achievements which enabled the company to maintain its 48th spot on our survey. About 93% of total revenues are dp-related.

Company highlights over the past year included new investments in marketing and new product development, the first shipments of the company's MAPS commercial mail processing system, and the signing of three large contracts including one with the Federal Reserve System for the purchase of 25 high-speed currency processors.

REI's product line encompasses the TRACE system for the processing of checks and credit cards; a coupon processor which can read, count and sort coupons at a rate of more than 30,000 per hour; and a mail sorting system, one customer of which is the French Postal Ministry.

With federal paperwork costing over \$100 billion per year, REI has installed page readers which are used to process more than 70% of the tax-related forms submitted each quarter to the Social Security Administration.

Recognition's optical character recognition system remains the company's bread and butter product. Geared toward retailers, the system enables store owners and merchandisers to quickly and accurately read numbers and letters from pages and labels attached to merchandise. This data is electronically relayed to magnetic tape or other electronic storage devices. The process eliminates the need for large volumes of tear-apart tags which require further processing. REI has installed the optical reading system in over 150 store operations.

Taking the technology involved in the OCR system one step further, REI markets a portable terminal designed for inventory tracking. Using hand-held optical character readers, store personnel are able to keep track of inventories throughout the store without being plugged into a distributed data entry system. The portable unit also eliminates a portion of the burdensome paper normally associated with inventory taking and store-to-store transfers.

On the plus side for the company was the \$57 million in backlog it had recorded going into fiscal 1979 on Oct. 31. That, coupled with a strong market position for its complete line of products and sound finances, should enable the company to weather any downturn in the economy.

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MAINFRAMES	MINIS & MICROS	PERIPHERALS & TERMINALS	MEDIA & SUPPLIES	SOFTWARE & SERVICES
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WYLY CORPORATION

P.O. BOX 6228,
DALLAS, TX 75222
(214) 688-7100

With the dust settled from threatened bankruptcy and the resignation of its founder and CEO Sam Wyly, Wyly Corp. not only retained a position on the DATAMATION 50, but has moved up a notch to number 49.

Wyly, depending on the dp services of its University Computing Co. as the source of almost all of its revenues, closed fiscal 1978 with total revenues of \$79 million and a net income of \$3 million. Total sales in 1977 were \$71 million while net income stood at a minus \$5 million.

The company escaped bankruptcy when its creditors and shareholders approved a recapitalization plan in February of last year. Without that step, the company would not have been able to afford to keep its computer services operation competitive.

With the installation of John Kason as company head, Wyly appears on the road to continued recovery.

Steps taken to ease the company's unsteady outlook included the installation of a Cyber 175 in the company's computer center to serve its nuclear, structural and piping analysis markets, and the introduction of two new software systems.

With its financial house in better order, Wyly is now able to sell higher margined computer services and wean itself away from the run-of-the-mill hardware and software which kept it in the raw computing time business, an area of high competitiveness and thin profits.

As 1978 was a time of rebuilding, consolidating, and clearing away, company officials look to 1979 as a year that rebuilding will have to continue. Moreover it will have to face and survive higher interest costs, the expense of playing catch-up in software development, and high market costs to build its market share.

Although now in a position to receive its share of 15% to 20% growth projected for the computer services industry, Wyly doesn't expect to be back on an equal footing with the rest of the industry until 1981 or as late as 1983.

In spite of its turmoil, the company was able to reduce its bank debt from approximately \$9 million in March of last year to approximately \$7 million in February of this year.

Presently the company generates half its dp-related revenues abroad, with overseas offices in Germany, Switzerland, and the United Kingdom.

A total work force of 1,700 persons is divided along a 750 to 950 international/domestic lineup.

50

MAINFRAMES	MINIS & MICROS	PERIPHERALS & TERMINALS	MEDIA & SUPPLIES	SOFTWARE & SERVICES
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CENTRONICS DATA COMPUTER CORP.

HUDSON, NH 03051
(603) 883-0111

Another new name on the DATAMATION 50 is Centronics, which takes over the 50th spot with total revenues of \$75 million, all of which are dp-related.

The New Hampshire-based company has built four years of growth and new product lines exclusively on the dot matrix printer.

Company officials see nothing but continued growth ahead as it continues production and development of new impact and character line printers and nonimpact microprinters.

Centronics closed out fiscal 1978 on June 30 with \$14 million in net income, 2,000 employees, and nearly 200 newly signed contracts with oem's. That raises the firm's customer base to more than 800 computer and system companies worldwide.

The company's growth has also allowed for consolidation and tightening up of production areas. For instance, the addition of new production facilities at Hudson has allowed the company to become its own second source for its Model 700 printer. Parts for the printer have in the past been manufactured in Japan. Company officials see this in-house capability as a step toward "greater security of supply" and a means to offset rising costs directly related to the difference in the two countries' monies.

Centronics manufactures three lines of printers beginning with the 6000 series of line printers, which is available in four versions of 75, 150, 300, and 600 lines per minute. The 700 Series of dot matrix printers includes 12 models with speeds ranging from 13 to 370 lines per minute.

In the microcomputer area, Centronics has developed non-impact desk-top models which employ advanced technology enabling them to interface with a wide range to other processing equipment.

Centronics points to marketing strength both on the domestic and, more recently, on the international scene. Domestic selling has especially been enhanced by the signing of a distributor agreement with Hamilton/Avnet. The new arrangement gives Centronics a network of 35 stocking locations and access to AV's 60,000 oem and end user company accounts.

Internationally, Centronics has subsidiaries in the United Kingdom, Germany, France and Italy. Distributor representation has been established in India, South America, New Zealand, Australia, Africa, and the Far East.

The final area of the company's overall composition is its servicing abilities. Presently it has 60 service locations in the U.S., 12 in Canada and more than 20 in Europe. In addition, an agreement with the RCA Service Company gives Centronics access to 45 additional service centers on an as-needed basis.

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 GOULD

THE TOP FOREIGN CONTENDERS

THE TOP 12 FOREIGN FIRMS IN THE DP INDUSTRY

Rank	Company	Country	DP Revenues (\$M)	DP Revenues as % of Total Revenues	Total Revenues (\$M)	Year Ending	No. of Employees
1	Hitachi Ltd.	Japan	\$1,830	17%	\$10,804	3/78	138,690
2	Toshiba	Japan	\$1,633	22%	\$ 7,847	3/78	113,800
3	Fujitsu Ltd.	Japan	\$1,248	71%	\$ 1,761	3/78	32,062
4	Cii-HB	France	\$1,061	100%	\$ 1,061	12/78	NA
5	ICL	Great Britain	\$1,019	100%	\$ 1,019	9/78	33,978
6	Olivetti	Italy	\$ 789	42%	\$ 1,879	12/78	66,073
7	Siemens AG	Germany	\$ 703	5%	\$15,675	9/78	322,000
8	Nippon Electric	Japan	\$ 672	21%	\$ 3,249	3/78	60,554
9	Philips N.V.	Netherlands	\$ 602	4%	\$14,000	12/78	400,000
10	Nixdorf AG	Germany	\$ 554	100%	\$ 554	12/78	9,200
11	Oki Electric	Japan	\$ 200	35%	\$ 575	3/78	14,201
12	Mitsubishi	Japan	\$ 190	5%	\$ 3,960	3/78	NA

NA = Not Available

by Laurence P. Solomon

With this Special Edition, DATAMATION is initiating what is to become an annual review of the leading foreign participants in the data processing industry. This year's review was prepared by Quantum Science Corp., under the direct supervision of Laurence P. Solomon.

As is the case with the U.S. data processing industry, defining the boundaries of the business for the non-U.S. based firms is no easy feat. With only three exceptions among the top 12 firms surveyed, the major foreign suppliers of data processing equipment are involved in many lines of business. Thus, breaking out data processing sales from their total revenues was attempted with care and the cooperation of the companies involved. Despite our best efforts, some discrepancies have crept into the listing, particularly in instances where sales of communications gear were included in the dp

revenues totals. Those cases, which are clearly noted in the corporate profiles, may have resulted in inflated rankings for the companies concerned.

The fact that fiscal years of all companies reported on do not end at the same time creates some distortion for a company-to-company comparison. This factor, combined with the dramatically fluctuating currency conversions, leaves room for additional discrepancies to surface. Many of the vendors supplied native currency and dollar equivalents, some supplied the conversion factor that they were assuming, and others left the conversion to us. The result is a somewhat confusing array of factors which can partially mask true growth rates, though relative size and impact can still be appreciated.

Six of the 12 companies covered are based in Japan. The other six are European-based firms from five different countries; West Germany is twice represented, with Siemens and Nixdorf.

The three largest non-U.S. data processing revenue producers are all Japa-

nese, with Hitachi, Toshiba, and Fujitsu heading the list. Although some communications products appear to have been included in each of their totals for dp-related revenues, this still is a partial measure of the success the Japanese have achieved in the decade of the '70s. From a very modest position in early 1970, the Japanese dp industry has achieved much in just eight years of concentrated effort.

With indigenous markets in Europe and Japan too small to support the R&D expenditures necessary for success in the 1980s, the multinational joint venture agreement as well as the traditional acquisition route has been and should continue to be a major factor in the growth of importance to the data processing community of many of these firms.

By way of comparison, the dp revenues for 10 of the 12 foreign-owned firms fall into the revenue category of the top 10 U.S. companies in the dp industry. Cumulatively, the top 12 foreign firms generated over \$10 billion in dp revenues during their respective 1978 fiscal years.

1 HITACHI LTD.

Hitachi is a major diversified manufacturer of electrical and electronics products. As of March 1978, the company reported total sales of \$10.8 billion. Revenues from its electronics division, whose primary product line is computers, rose 14% over fiscal 1977 to \$1.8 billion. That sum accounts for 17% of total corporate revenues.

Hitachi's computer line consists of the newly introduced HITAC L Series, which bridges the gap between the company's low-end 8000 Series and its HITAC M Series of medium and large scale general purpose systems. In the U.S., a modified version of the Hitachi-manufactured HITAC M 180 Model is marketed through ITEL Corp., which has sole marketing rights to the system as part of its own line of Advanced Systems. Marketed by ITEL as the AS/6, this plug-compatible mainframe competes with IBM's 370/168s and its newer 3032s.

Hitachi America Ltd., one of the company's 40 major worldwide subsidiaries, is chartered to sell plant and electronics equipment, including telecommunications switching gear, industrial components, automotive parts, computers, and such electronic devices as semiconductors, microprocessors, and bubble memories.

Hitachi Ltd., whose major revenues are derived from the consumer market and utility companies, recently entered into a joint venture with General Electric Co., forming General Television of America Inc. to produce and sell televisions and related items. The Japanese concern has also recently established two wholly-owned U.S. subsidiaries—Hitachi America Technical Services Co. (HATSCO) and Hitachi Semiconductors (America) Inc.

2 TOSHIBA

For its fiscal 1978, which ended in March of last year, Toshiba reported consolidated sales of \$7.8 billion, an increase of 9% over the previous year's results. Consumer products account for the largest share of revenues, or 38%. The company's industrial electronic products group, which includes the manufacture and sale of computers, copiers, electronic cash registers, and facsimile equipment, accounted for 22% of total company sales. That \$1.6 billion total represents a slight increase of 3% over the 1977 period.

Toshiba's computer line includes the ACOS Series 77, consisting of eight medium and large scale general purpose system models. In April 1978, the product line was transferred to NEC-Toshiba Information Systems Inc., based in Japan, which will handle sales and further development of the line. Toshiba also manufactures the TOSBAC line of minicomputers, office computers, peripheral and terminal

equipment, and other related products.

In the U.S., Toshiba America markets electronic components, consumer goods, and office products such as copiers. Toshiba International Corp., headquartered in San Francisco, markets telecommunication systems, broadcast electronic systems, industrial equipment, and medical systems.

3 FUJITSU LTD.

With 71% of its total revenues generated by computers and data communications equipment, Fujitsu ranks third on our list of foreign contenders with \$1.2 billion in dp-related revenues for 1978. Total revenues reached \$1.8 billion for the fiscal year ending March 1978, an 18% increase over the previous year. Domestic sales accounted for 88% of that total.

Fujitsu's FACOM M and V Series (jointly developed with Hitachi) ranges from small to large scale computers. The company also manufactures the PANAFACOM Series of micro and megaminicomputers, as well as a wide variety of terminals and other peripherals. Additionally, the firm is active in the semiconductor market.

Fujitsu's strategy for expanding its horizons beyond the domestic market is to enter into joint venture agreements with major European and U.S. companies in exchange for technical expertise and/or marketing or manufacturing capabilities. An example of this thrust is its Fujitsu America manufacturing facilities in Santa Clara, CA. This unit produces significant portions of the central processing units, channel and main storage units for the Amdahl 470V Series. In fiscal 1978, Amdahl purchased \$92.4 million worth of subassemblies and spare parts from Fujitsu, approximately 20% more than in fiscal 1977.

Other U.S. markets served by Fujitsu's subsidiary companies include telecommunications equipment, semiconductors, and other electronic components.

4 CII-HONEYWELL BULL

Cii-Honeywell Bull, the French dp firm that is 47% owned by Honeywell, crossed the \$1 billion threshold in fiscal 1978, constituting an 18% increase in revenues over the 1977 period. About half of the company's 1978 revenues were generated by equipment sales, with the remaining 50% coming from rentals and services. As of December 1978, Cii-HB reported pretax earnings of \$45 million, a 32% rise over the corresponding 1977 figure.

Both Cii-HB and Honeywell Information Systems (HIS) market a common product line of Series 60 computer systems. The French firm markets its line of systems in Europe, Africa, South America, the Middle East, and Asia. During the year, it received nearly \$108 million of Honeywell-funded support for research

and development. For fiscal '78, combined sales of Cii-HB and HIS topped \$2 billion.

Sales outside of France accounted for approximately 49% of Cii-HB's revenues. It has recently embarked on a program to expand its local manufacturing facilities. With the last state subsidy payment from the French government made this past March, Cii-HB is on the verge of standing on its own financial feet.

5 ICL LTD.

Ten year old ICL posted a 22% increase in sales to over \$1 billion for the fiscal year ended September 1978. Total orders increased by one-third over the previous year, with approximately one-half derived from the U.K. market. The company, which acquired the non-U.S. Singer installed base in 1977, used that client base to leverage its new product sales in the U.S. market.

ICL reportedly has targeted a 15% to 20% yearly sales growth, with an ultimate goal of doubling its revenues by 1982. Its R&D expenditures currently are \$70 million and manufacturing costs equal more than 40% of revenues. (For comparison's sake, IBM's manufacturing costs total approximately 28% of total sales.) In recent months, however, ICL's production capabilities have been hampered by labor unrest in the U.K.

The company's product line consists of the 2900 Series of medium to large scale general purpose computers and, at the low end, the 1500 Series which includes communications terminals. During 1978, ICL introduced the 9500 Series of point of sale equipment.

ICL's products are marketed in 84 countries, including the U.S. and Canada. Systems offered in the U.S. include the smaller models of the 2900 Series, the 1500 Series, and the System 10 small business systems. ICL is a part owner (20%) in U.S.-based Computer Peripherals Inc., along with Control Data (60%) and NCR (20%).

6 OLIVETTI

Olivetti's worldwide sales rose 13% to \$1.9 billion for the fiscal year which ended in December 1978. Domestic sales accounted for about 25% of total revenues, with the remaining 75% generated outside of Italy. Revenues from U.S. operations, derived from Olivetti Corporation of America, represented close to 12% of the total, or about \$180 million.

Olivetti's business activities fall into two major categories—office equipment and data processing products. The office equipment line, which accounted for about 58% of 1978 revenues, includes typewriters, adding machines, calculators, copiers, and office furniture. During the year, the company introduced two new electronic typewriters, the ET 201 and the

ET 221.

The data processing product category generated 42% of Olivetti's sales in '78. The company markets word processing systems, microcomputers, accounting and business systems, terminals, data collection systems, and telecommunications equipment. This month, Olivetti will round out its word processing products with the top-of-the-line TES 701 that offers a full screen display. Other dp products include the 2030 business computer, the P6060 scientific/technical computer, and the TC 800 financial terminals.

7 SIEMENS AG

Siemens, the German-based manufacturer of electrical equipment, reported worldwide sales of \$15 billion for the fiscal year ended September 1978. Its data and information systems group had sales of approximately \$703 million, representing an increase of 6% over fiscal 1977 and marking the first time the group has been profitable.

The Siemens dp product line consists of 13 models in the 7.700 family of medium and large scale general purpose computers. A recent manufacturing agreement with Fujitsu will enhance the Siemens line with the addition of two high performance models above its 7.700 family. In exchange, Fujitsu will market Siemens' peripherals in Japan, starting with the ND-2 laser printer. In the small business systems market, Siemens introduced the 6000 series of office computers. It has installed over 1,000 communications computers and about 25,000 display terminals as part of its TRANSDATA teleprocessing systems line.

Siemens Corp., headquartered in Iselin, NJ, commands the company's U.S. operations. The U.S. subsidiary reported fiscal '78 sales of \$326 million, the majority of which comes from non-dp products. Its relatively modest dp activities to date include floppy disks and disk drives offered by its oem products division. Siemens recently entered into a venture with Advanced Micro Devices Inc. in Sunnyvale, CA, and formed Advanced Micro Chips (AMC) to develop, manufacture and market microprocessors.

8 NIPPON ELECTRIC CO.

Nippon Electric Co. (NEC) focuses primarily on three market areas—computers, communications, and consumer electronics. As of March 1978, revenues reached the \$3.2 billion mark, an increase of 12% over 1977 sales. Computers and communications products accounted for nearly 80% of total revenues. NEC upped its R&D expenditures 21% to \$105 million during the fiscal year, with most of it earmarked for dp systems and electronic devices. Total exports to North American markets amounted to \$102 million during the last fiscal year.

NEC's computer line includes the NEC-Toshiba developed ACOS Series 77 family of mainframes, the NEC System 100 office computer, and various mini-computers.

In the U.S., there are several NEC-affiliated, but separate, companies operating in NEC's three targeted markets. NEC America Inc. manufactures and markets PABX and key telephone systems. NEC Microcomputers Inc. produces semiconductors and microprocessors. As recently as April 1977, the wholly-owned NEC Information Systems was formed to market computers and related equipment such as printers. NEC Systems Lab Inc. and the California Eastern Labs are chartered to research and disseminate technological information in telecommunications, computer sciences, and electronic devices. Recently, NEC purchased the U.S. firm, Electronic Arrays.

9 PHILIPS N.V.

Worldwide sales for Philips N.V. exceeded \$14 billion in fiscal 1978, which ended last December. Not only is the company a leading supplier of telecommunications and other electrical equipment, but its 400,000 employees give Philips the distinction of being Europe's largest employer in the private sector.

While dp revenues from Philips Data Systems constitute only about 4.3% of total revenues, the Dutch firm is still a sizable dp contender with \$602 million in dp-related revenues. These sales come from small business systems, terminals, and discs. Philips recently entered the U.S. plug-compatible mainframe (PCM) market at the low end with a system from Two Pi, owned by U.S. Philips.

Philips is also active in the word processing market and, through its acquisition of Signetics Corp., is also a supplier of PABX equipment and semiconductors. The conglomerate also sells videodisks to the consumer market via Magnavox, a subsidiary of North American Philips, as well as computer peripherals for archival storage based on similar technologies.

10 NIXDORF AG

Nixdorf AG announced worldwide sales of \$554 million for its fiscal year ended December 1978, an increase of 21% over the previous year's results. All of Nixdorf's sales are dp-related.

The German-based firm is the parent of Nixdorf Computer Corp. (NCC) in Burlington, MA, which accounts for approximately 15% of total corporate revenues. In 1978, NCC posted revenues of \$80.7 million, an impressive 55% climb over the corresponding 1977 figure. Also, NCC's '78 sales total constituted a 31% rise in revenue per employee for the year.

Nixdorf manufactures distributed data processing systems, data entry equip-

ment, word processing systems, and general business computers. The U.S. subsidiary has over 4,000 customers in North America.

The Nixdorf product line includes the Entrex 80 Series of data entry systems, the Entrex 600 Series of distributed data processing systems, the Nixdorf 8870 business computers, and the recently announced Nixdorf Multi-Text 8840 word processing system.

11 OKI ELECTRIC CO. LTD.

OKI Electric reported a small increase of 2% in revenues for fiscal 1978 over the year earlier. Sales reached \$575 million by March 1978, when its fiscal year ended. Data processing revenues accounted for approximately 35% of that total, or about \$200 million.

The company's line of computers in the domestic market includes the COSMO Series of mainframes, and the OKI-TAC System of minicomputers and office computers. Its U.S. subsidiary, OKIDATA, markets a line of peripheral equipment, primarily printers and disc drives.

12 MITSUBISHI ELECTRIC CO.

Mitsubishi manufactures a broad range of electrical machinery, as well as a modest amount of computer equipment. Total revenues in its fiscal 1978, which ended in March of that year, amounted to almost \$4 billion. Computer-related products accounted for approximately 5% of total sales, or about \$190 million.

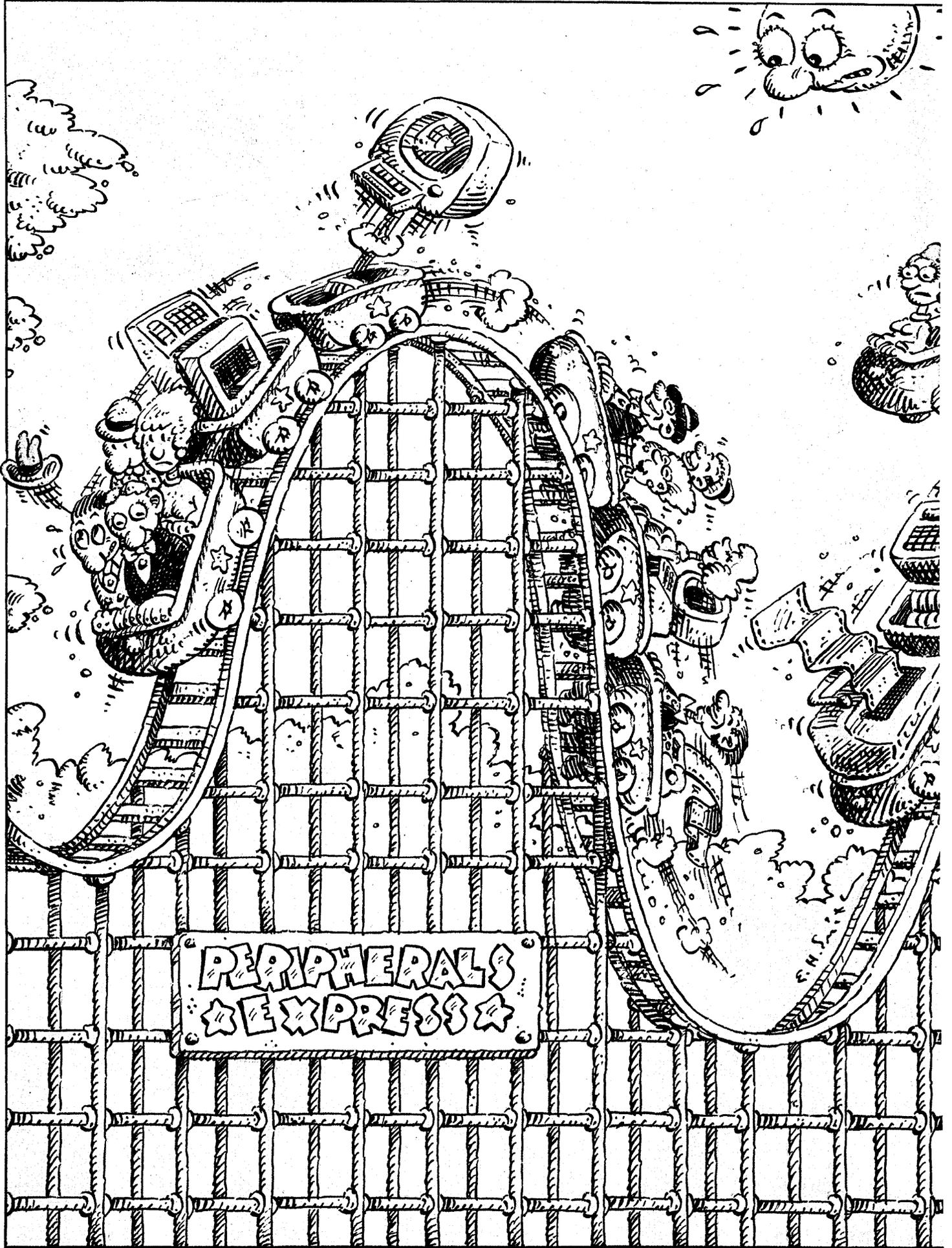
In cooperation with OKI Electric, Mitsubishi has developed the COSMO Series of mainframes, which is in the performance range of IBM's 370/115 through 158-3s. In recent years, the company has redirected its thrust towards the smaller systems market, primarily with its MELCOM line of minicomputers and office systems.

In the U.S., Mitsubishi established MELCOM Business Systems Inc. to sell small business systems initially in southern California. However, the company's major efforts are being channeled into gaining a greater share of the domestic market rather than emphasizing outlets in foreign markets, as appears to be the strategy of its fellow Japanese competitors.

LAURENCE P. SOLOMON



Mr. Solomon is a senior consultant with Quantum Science Corporation in New York. In this capacity, he directs market research and computer consulting activities for clients which are dp vendors and large scale computer system users.



**A controversial view of the ups and downs in store
for computer peripherals.**

COMPUTER PERIPHERALS: A REVOLUTION IS COMING

by Stephen A. Caswell

The computer industry loves to talk about revolution, but it normally measures its markets in relatively steady, predictable gains that extend ad infinitum. If there has indeed been a revolution, it has been one with which the computer and peripheral vendors have had a relatively easy time coping.

Around the corner, however, is a very different kind of revolution. Instead of the endlessly expanding markets of the 1960s and 1970s, there seems to be an end at hand to the elastic markets that stretch more and more with every price decrease. In short, the prognosis for computer peripherals during the next 10 years is that there are likely to be numerous fundamental market changes that will turn the industry inside out. Companies that fail to see these changes coming and to adjust accordingly will become the also-rans of the 1980s. Conversely, firms that take the necessary steps to adjust will be able to survive the coming decade. But for all in the computer industry, the writing is on the wall. Don't expect the 1980s to be one more extension of the upward mobility of past computer peripheral markets.

At the center of the coming change is the ubiquitous microprocessor that has already greatly reduced the cost of designing intelligence into machines and has sparked a marked increase in the rate that technology is moving. There are now more than a few leading industry analysts who are wondering where this rate is taking us and what it means for today's leading firms.

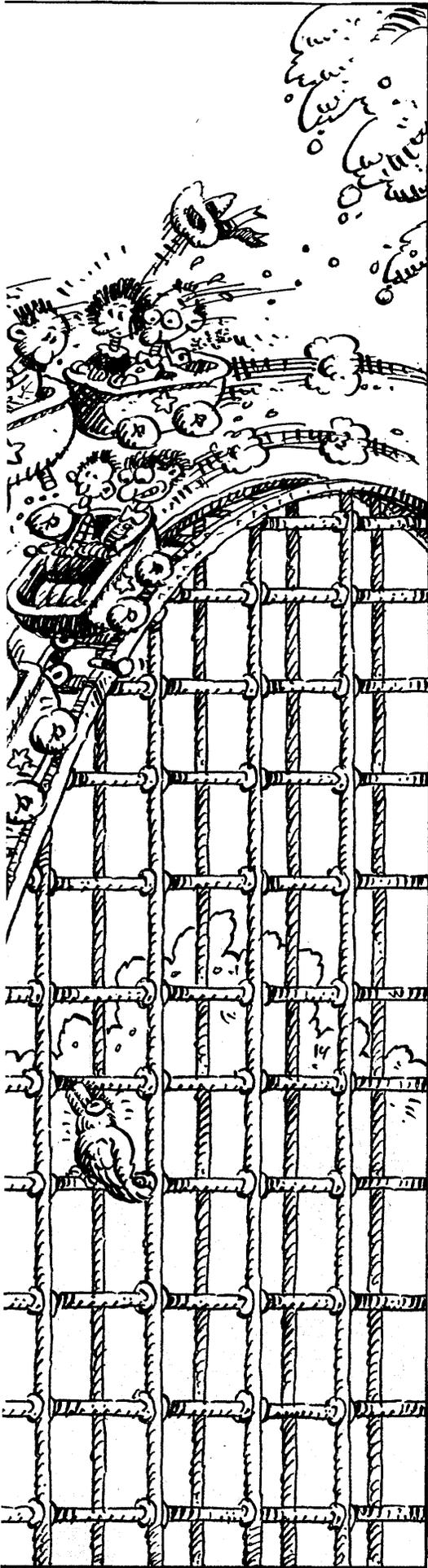
To quote Lowell Amdahl (November 15, 1978, p. 18), "For years we have been talking about the maturing computer industry. This would seem to imply an orderly, predictable environment wherein evolution has largely displaced revolution. Could anything be further from the truth? Despite the fact that computers have es-

tablished a permanent niche, the basic products and range of applications are in turmoil. Computer manufacturers, large and small, continue to have at least the same level of concern that they have had in years past for the effectiveness and life of their products."

Amdahl's commentary couldn't have been more prophetic when analyzing the latest major product introduction from IBM. While many have looked at IBM's newly introduced 4300 line of computers as leading to a further consolidation of IBM's market power, there is another interpretation that sees IBM as having to run faster and faster just to keep pace. How long will it be before IBM's traditional markets end up imploding and the rate of price decreases causes the bottom to fall right out of the mainframe computer market? Already the low end is at a level consistent with today's super minicomputers because of IBM's 4331 "mainframe" priced at \$65,000.

Is IBM really consolidating its market control or is a fundamentally different set of forces at work that will end up with the dissolution of the very markets that have made IBM what it is in computing? While it may appear that IBM is in control, it is just as possible that the force of technological change is now driving IBM and that the computer industry no longer is under control. What appears to be in store for the peripheral industry in general is two or three more years of "business as usual," with the IBM price umbrella a little tatty but still more or less in place. Then it seems that the pace of price and cost reductions, accelerated in some segments by increased competition, will outstrip the market growth, leading eventually to a continued upsurge in the number of systems and devices shipped, but at markedly lower values per unit. In some segments this will come soon, in others later. Still, numerous peripheral market segments should continue to grow in dollar value throughout the next 10 years.

According to a controversial report



During the next decade, market changes will turn the peripherals business inside out.

published by International Resource Development (IRD) titled "Computer Peripherals in the 1980s," from which this article is adapted, the overall market for computer peripherals is expected to remain virtually steady in dollar volume during the next 10 years, although the number of units will grow substantially. This is shown in Table 1, which summarizes the growth in five key peripheral categories.

DATA ENTRY DEVICES Data entry in the 1980s will be a further continuation of the trends that have been at work for the past few years. Intelligence is moving quite rapidly into typewriters and local storage is becoming common. IBM's long-awaited support of distributed data entry through its 8100 series will further heighten this trend.

The use of keyboards seems ready to mushroom. Today's rate of growth is an estimated 15% to 20% yearly. As a sign of the health of this market, there are more and more "efficiency experts" roaming around conferences trying to convince anyone who will listen about the benefits of new keyboard designs. The traditional QWERTY keyboard, it is argued, is too slow to keep pace with potential increases in keyboard productivity. While it is almost unthinkable that the QWERTY keyboard will be deposed, this indicates the level of concern among many academic/research types that the keyboard represents a limitation on productivity.

While almost every keyboard in use will be in the QWERTY style, there are five competing technologies for use in keyboard production. The five technologies are electromechanical, Hall Effect, Reed, capacitance and inductive. In today's market of an estimated \$75 million, electromechanical keyboards have about a 40% stake, Hall Effect keyboards have an estimated 20%, and the other three technologies share the remainder equally. Of the five technologies, three are true electronic keyboards (Hall Effect, capacitance and inductive), while the other two are electromechanical.

This expected boom in keyboards should be most beneficial for the almost dozen leading independent suppliers. IBM, of course, is a leading keyboard supplier. The independents include Alco Electronic Products, Cherry Electrical, Chomerics, Key-Tronics, Micro Switch (a division of Honeywell), Oak, and TEC. To see their potential, the market for keyboards now makes up an estimated 18% of the entire data entry market. We expect that by 1983, this portion of the market will represent 33%. By 1988, keyboards should represent 46%.

In addition to keyboards, there are three other data entry market segments that seem likely to grow during the next 10 years. These segments are OCR readers, sensor-based subsystems and digitizers. The market potential for OCR is particularly promising, but in a unique way. It is expected that word processing and computing will merge in large organizations within three years. This will create a central planning group that is likely to look for effective methods of bridging the gap between the firm's massive investment in nonelectronic data entry devices, such as typewriters, and the accelerating requirement to capture data at its source, rather than expend funds for retyping.

OCR meets this need quite effectively and is now growing at an astonishing rate in word processing. The major thrust behind this development is the emergence of low cost OCR machines priced at \$16,000 and capable of entering three pages of data per minute. Firms in this market include Hendrix, ECRM, Context, Compuscan and Scan-Optics. This market, incidentally, is likely to emerge as an OEM market for OCR vendors, which will sell to the word processing/computer firms. These firms, in turn, will sell to the

end user by justifying OCR as part of a total information input system to be used in tandem with complex editing systems.

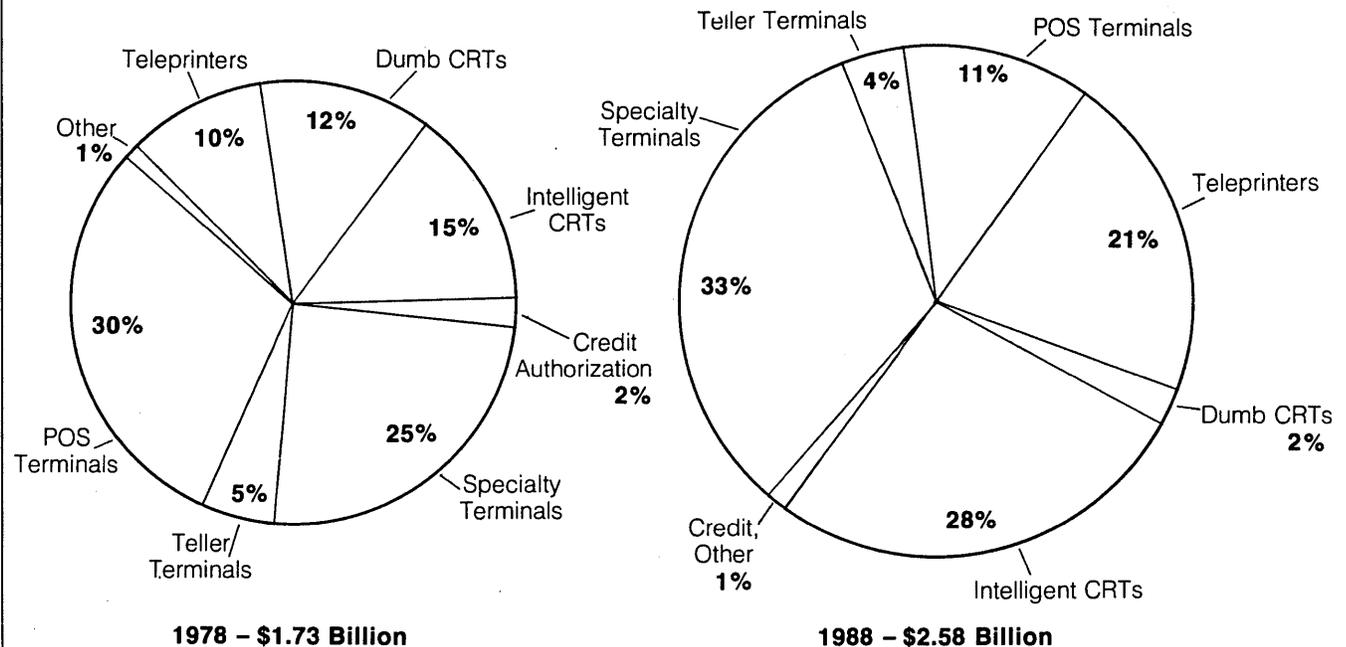
While there will be growth in the data entry field, many of today's favorite methods of entry will fade. Of course, the keypunch, card reader and paper tape punch/reader are data entry systems already in decline, but it seems likely that the off-line multistation data entry system is destined to join. Firms like Entrex, Inforex, Mohawk, Computer Machinery and others in this market will have to evolve systems that are more attuned to on-line processing.

This doesn't mean that IRD is predicting the demise of today's satellite data entry system vendors. That's not the case. The world seems to be moving at such a rate that batch, satellite data entry is being replaced by on-line entry via terminals. The action is going to shift towards this category just as data entry shifted from keypunches to disk-based, satellite data entry systems in the late 1960s. From current revenues estimated at \$140 million in 1978, this market segment is expected to begin a gradual descent to the region of \$85 million (in constant 1978 dollars) during the next 10 years.

Table 1
GROWTH OF COMPUTER PERIPHERALS
MARKETS, 1978-1988
(\$ Million)

	1978	1980	1983	1988
Data Entry Devices	425	469	601	925
Terminals	1,730	2,158	2,174	2,579
Tape & Disk Drives	3,036	2,417	1,550	890
Telecommunications Products	567	618	454	460
Printers, Plotters, COM, etc.	1,058	1,430	1,526	1,514
TOTAL	6,816	7,092	6,305	6,368

Fig.1
COMPARATIVE PIE CHARTS OF PRINTER MARKET, 1978-1988



THE AGE OF THE TERMINAL

As batch data entry declines, the coming Age of the Terminal is already on the horizon.

But we ain't seen nothing yet. This is a truly exciting world about to be invaded by bubble memories, full-strike quality matrix character printers, ink jet technology, flat panel plasma displays, color, graphics software, mouses, joy-sticks, white-on-black crt's and on and on and on. To be sure, it is difficult to even get a handle on the various markets for terminals. There are dozens and dozens of market niches where terminals are required.

The most traditional markets are:

- teleprinters for message networks, outside and in-house time-sharing services, and for computer systems either as controlling consoles or data entry devices.
- crt's of the dumb or intelligent kind, which are used for an increasingly wide variety of applications. Dumb crt's are normally used for inquiry/response applications. Intelligent terminals are used for data entry functions.
- specialized dedicated terminals designed to meet only one generic application, such as credit authorization, point of sale product price/data entry, or teller terminals.

During the next decade, numerous changes are expected in these overall mar-

kets. First, the teleprinter is going to receive a complete face-lift because of the emergence of electronic keyboards; bubble memories; lightweight but extremely durable plastics (allowing for more portability); and the microprocessor for control. The so-called communicating word processor (CWP) should emerge as the leading teleprinter device by the end of the 1980s. Such a system will offer full-strike image quality when desired, storage of as high as 100 pages (maybe more) in bubble memory, with functional editing capability and communications for somewhere in the \$1,000 price range. A micro-floppy disk should be an option at \$200 extra. While shipment rates will soar, dollar volume will be hard-pressed to keep pace.

Second, the dumb terminal seems to have peaked already in U.S. markets and should begin a decline in popularity. Intelligence is becoming so cheap that it's worth the small extra price to have its advantages. Thus, the market for intelligent terminals should explode during the 1980s as more and more companies switch from today's satellite batch entry systems to dispersed intelligent terminal configurations. Also, it seems likely that many of these terminals will have multi-function capabilities when attached to printing devices and controllers. What will emerge is the integrated Office Infor-

mation System (OIS) that is expected to hit the streets at this year's National Computer Conference from at least one vendor (Wang) and possibly a few others. These devices will be placed in functional departments in configurations necessary to meet each department's word and data processing needs.

Specialized terminal markets are likely to have a mixed performance. Traditional specialized terminals such as POS, credit verification and teller terminals are likely to decline as their markets reach saturation and recede to replacement market levels. The number of cash registers and teller locations in the U.S. is not growing substantially and, by the mid-1980s, this market should be saturated.

On the other hand, the market for newly-designed specialty terminals such as brokerage terminals, industrial badge readers, hand-held portable terminals (many connected to mobile radios so that the user can connect up remotely), and other custom devices are poised for enormous growth. In particular, the building security industry and computer terminal/radio markets are ready to zoom.

All told, the market for terminals seems ready to grow from the market share of today to a quite different mix in 1988, which is shown by the comparative pie charts in Fig. 1. In terms of units, the market is expected to double in size from

Communications peripherals, a booming market in the '70s, should decline in the next decade.

present levels in the vicinity of 750,000 terminals per year to about 1.5 million terminals in 1988.

As if this isn't enough, by the end of the next decade, if not much earlier, the ultimate data entry terminal will emerge. While a cost-effective device that understands all spoken voices is probably decades away, low cost voice recognition systems that can be tuned to understand a functional vocabulary of a single person seem well along the development path. There are already systems that can be trained to understand a limited vocabulary for data entry functions where the operator needs to use both hands.

MAGNETIC TAPE AND DISK SYSTEMS

Our forecast for magnetic tape and disk systems is destined to be the most controversial topic in this article. Everyone loves to read about booming markets; nobody likes to see stories of markets on the verge of radical decline. Storage information is not going to decline; the devices used to store information are going to go through a transformation. The key factors that are likely to determine the events in this market are the growth of semiconductor memories that should impact fixed head disks, the evolution of the bubble memory, and vast increases in the storage capacity of traditional disk products, especially the Winchester and floppy disk technologies which are likely to emerge as the most popular magnetic media. However, the price decline for both is likely to be so steep that the market size ends up declining relative to price.

During the next three or four years, disk drive manufacturers are expected to enjoy the combined benefits of a strong market for established removable-disk products coupled with a booming market for fixed-disk devices. As floppy disk technology trends upwards in terms of storage capacity, however, the lower end of both fixed and removable disk drive markets should begin to feel pressure. Other lower end disk markets, especially in the fixed head area, should begin to feel the pinch from semiconductor devices.

The almost ludicrous sounding "flubbe", a combined floppy disk/bubble memory, is also likely to contribute to an erosion of the low end of the rigid disk market. By the mid-1980s, this erosion should reach flood proportions, with most of the disk market collapsing upon itself and being replaced by floppy disks or combined floppies with bubble memory. Today's \$2 billion market for rigid disk drives has the potential to drop an order of magnitude during the next decade to \$285

million. It will not be until the early 1980s that this becomes apparent, however, so don't go looking for signs in current shipment levels.

Other storage media, such as reel-to-reel tapes, cassettes, magnetic drums and other magnetic media are now enjoying lackluster performance and have all reached peaks in their life cycles. While reel-to-reel and cassette tape drives aren't going to fade away, prices are going to drop further. Neither market has long-term growth potential.

COMMUNICATIONS PERIPHERALS

The growth in data communications has sparked a booming market for devices like modems, multiplexers, acoustic couplers and front end processing devices. All of these markets are likely to decline in the next decade, with the sole exception being multiplexers.

In the case of modems, two factors are working against this device. First, the digital datacom networks are slowly emerging. This initially increases the modem market by requiring dual links into the digital trunks from analog local loops, which is now occurring. As digital nets reach from point-to-point, however, the modem simply isn't needed. Growth of digital networks, however, isn't the major threat to the modem manufacturers. LSI production threatens to cut the bottom out of the market, making it an add-in board (or even less) to a terminal. The terminal manufacturers will make it a part of their terminals, cutting the independent market. This is the greatest threat to the modem market.

Acoustic couplers face a similar problem as more and more terminals plug into the phone network directly. Front end processors also face the same situation. Computer manufacturers are always threatening to move the front end back to the mainframe computer. Now, telephone companies are threatening to move the front end into the network itself. PBX suppliers are also designing systems that can serve as computer front ends. The greatest problem faced by front end processor vendors, however, is the microprocessor, which threatens to perform many of the front end's major tasks on a remote basis. While communications will increase, the number of front end processors required isn't likely to keep pace.

Digital multiplexing will increase, however, particularly as the Bell System and other common carriers find themselves in a veritable war for communications traffic. Each major competitor—AT&T, Satellite Business Systems, XTEN (Xerox' newly-announced system), MCI

Communications, Southern Pacific Communications, ITT and the widely-rumored Exxon network—will be using multiplexed links. From the present level of about \$105 million, multiplexers are expected to boom in unit shipments, with the shipment value almost tripling during the next 10 years.

PRINTERS, PLOTTERS, OUTPUT DEVICES

The world of printers and plotters is being expanded rapidly by numerous new technologies. Laser printers, full-strike matrix character printers, thermal printers, improved line printer designs, etc., etc., etc. If you miss a few months in this market, the world can pass you by (almost, anyway).

To mention just two new major products in printing, Royden Sanders, a well-known industry figure, designed a matrix character printer that can repress a line up to four times to produce output that is of full-strike quality. If this printer can be produced in volume quantities and still retain its print quality, Sanders will have the hottest printer of low speed applications since the development of the daisy wheel.

Another advance is the emergence of plain paper nonimpact printers in the 1,000 lpm category for prices up to 25% below comparative impact printers. Such a printer is planned by Toshiba for introduction on world markets. We received a product spec sheet reportedly given out by a company official with the price "\$7,000 in oem quantities" penciled at the top of the sheet. This price, if it holds and if the product is indeed introduced, is well below the price for 900 lpm impacts.

In addition to the rumored Toshiba device, Wang Labs has already introduced its nonimpact in this category. IBM has also announced a nonimpact in the 1,000 lpm region. Wang's unit is priced at \$32,000, while IBM's is priced at \$75,000. The IBM unit can double as an office copier and printer from word processors or computers, while the Wang device can only function as a printer.

While these are important, for the oem world Centronics will have the most important news by introducing a 1,000 lpm nonimpact printer at the NCC. According to early reports, the Centronics device is expected to sell for about 25% below comparable impact line printers from Documentation, Dataproducts and IBM. And who knows who else might be announcing such nonimpacts in the near future?

The printer market is expected to grow during the next decade, although

price decreases will cut the rate of dollar volume. There will, however, be segments of the printer market that will be impacted negatively, especially in the high-speed impact line printer market for printers from 900 to 1,500 lpm. Nonimpacts can cut a 30% slice from this market at the low end while the expected decline of the role of the centralized computer center should cut another slice from this market. Finally, high-speed nonimpacts like the IBM 3800, Siemens ND-2 and Xerox 9700 will cut a further slice by eliminating installations in many shops that operate banks of these impact printers.

A market that is likely to boom in printers is for low speed line and character matrix printers used for small business minicomputers. Prices, however, are likely to decline rapidly, causing vast increases in unit shipments, but only modest increases in the value of printers shipped.

A WORD OF CAUTION

The market projections in IRD's study are controversial. The numbers represent the estimates of IRD consultants in markets that are extremely complex to analyze. The significance of the plummeting costs for technology and radically hastened product development cycles almost necessitates a strong bias for change when projecting the markets for computer peripherals. It is this change that is of major importance, not any specific projection in a specific market. Because of the inherently risky nature of market projections in rapidly moving fields, numerous factors could alter the accuracy and timing of such projections. Thus, the strongest projection of all is that not all of our projections will come to pass.

What counts, though, is that it's now time to think boldly about the future of the computer industry. There are forces loose in the industry that are changing it almost beyond recognition before our very eyes. *

STEPHEN A. CASWELL



Mr. Caswell is the director of development for International Resource Development Inc., New Canaan, CT, where he is responsible for the management of market development studies in the fields of office automation, consumer electronics and telecommunications. He is also the editor of IRD's twice-monthly newsletter EMMS (Electronic Mail & Message Systems), and the project manager of a number of multiclient studies including "Printers and Paper in the Office of the Future" and "Telecommunications Market Opportunities in the U.S., 1978."



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COMPUTER SERVICES: A MENU OF OPTIONS

by Peter A. Cunningham
and Walter P. Smith

The scramble is on for a piece of one of the fastest growing markets in the computer industry. Computer services in 1978 crossed the \$8 billion mark in the U.S., posting an impressive 19% increase over 1977. And if current projections are correct, the compounded annual growth rate through 1983 will exceed 16%, meaning that the market will approach \$17 billion in five years' time. Included in that forecasted figure are expenditures for software and services from computer manufacturers, such as IBM.

The competition is among 3,000 firms in the United States—computer manufacturers, processing services firms, software products companies, and firms specializing in systems development, consulting, and education. They range in size from the Mom and Pop service bureau to giants like IBM, which in 1978 grossed more than \$2 billion from software packages, maintenance on purchased gear, foreign data centers, systems engineering services, and education.

The largest segment of the market, remote computing services, should grow 21% this year from a 1978 base of \$2.7 billion. While traditional computer services will continue to expand, further growth will come from several selected niches. Among them are specialized services for vertical industries, such as banking, finance, medicine, and discrete manufacturing; applications for functional specialties, such as human resources and financial planning; and services based on data base management systems (DBMS) and implementation languages used to develop new applications.

The software products segment, a \$981 million market in 1978, will grow at

21% annually through 1983. Our five-year forecast assumes an increasing, but relatively limited, level of new software products from the largest software firm in the world, IBM. Should IBM significantly step up its rate of new product introductions, that 21% forecast could prove to be conservative.

The slowest growing of the services firms are professional services, where the shortage of trained personnel is a hampering factor. Projections indicate a minimum 13% annual growth rate through 1983, although independent professional services for the private sector should post far greater increases. Certainly the demand created by current developments in computers, communications, and office equipment is stimulating the formation of innovative new companies in this market.

Of the 3,000 market contenders today, about two-thirds are processing services companies. The remainder are divided about equally between software products and professional services companies. Moreover, some 200 new companies are entering the industry each year. While about 80% of the new market entrants in the '60s were processing companies, today's newcomers are about evenly divided between processing, software products, and professional services firms. Another difference in this new breed of market entrants is that they are providing services aimed at small systems rather than at the traditional target of large systems.

IMPACT OF NEW HARDWARE

A major factor affecting future services growth is lower cost, higher capability hardware. The effect is both positive and negative. Small processing services firms feel threatened by the invasion of mini and microcomputers into their territory. On the other hand, large processing services firms, as well as software and professional service

vendors, are taking advantage of the opportunities created by this new and cheaper hardware. Indeed, by 1981, 10% to 15% of small system deliveries could be through services companies.

In 1978, several major processing services firms began marketing minicomputer-based systems linked to their communications networks. Among them were General Electric Information Systems with MarkLink, Automatic Data Processing, with ADP/Onsite, and National CSS with its 3200 System.

With configurations ranging widely in price and capability, these offerings provide the user with distributed data processing, but without the headaches of developing the required software and communications capability in-house. Forecasts for these "user site hardware services" (USHS) reveal a market that could grow to \$1 billion in revenues by 1983. If these USHS vendors can eliminate current user concerns about site preparation, maintenance, and fears of being "locked in" to a specific vendor and specific software, revenues will exceed this forecast.

Still other computer services companies are exploiting the minicomputer by offering standalone turnkey systems, such as the special system for distributors offered by United Computing Systems. Computer Task Group has attacked the entry level market with a turnkey system based on the Basic Four system; it has installed over 100 systems to date. ITEL and Anacom are offering general and industry-specialized systems.

Computer services vendors continue to emphasize industry-specialized offerings. In the hospital industry alone, McDonnell Douglas Automation Co. (MCAUTO) and Shared Medical Systems have generated over \$50 million each in revenues with sophisticated distributed data processing approaches.

Computer Consulting Services is

Within 10 years, it will be very difficult to distinguish between a computer services company and a hardware company.

also serving the medical area with a system for clinics based on the Honeywell Level 6 minicomputer. Other successful specialists include Xerox Computer Services and Martin Marietta Data Systems in the discrete manufacturing sector. Many leading vendors are concentrating on providing services to banking and finance companies; among them are Electronic Data Systems, Sun Information Services, Anacomp, ADP, Tymshare, and Citibank.

Still other areas are being seized by services vendors. In value-added network services, Tymshare, for example, recently expanded its Tymnet communications subsidiary. Control Data is aggressively offering maintenance services, an area of crucial importance and a major limiting factor for all hardware vendors. Education and training services, an area particularly crucial in view of the shortage of skilled personnel, are being actively marketed by such concerns as Boeing Computer Services, Deltak, and Control Data.

THE SOFTWARE SEGMENT

Software has become an increasingly important part of the overall computer services market. This segment of the market is populated by the hardware manufacturers, independent software companies, and processing services firms that are marketing packages not only as part of their network services, but also as direct sales to end users.

Applications software sold to end users as well as to dp managers represents a major portion of the software market. Vendors are increasingly working with end users in defining and refining their products. Management Science America, which specializes in financial applications software, has been particularly successful in this area.

The biggest package market to date, though, has been in systems software. The reason is simple: the vendors have been able to generalize and market these products across a broad base of compatible systems. Applications software, on the other hand, requires considerable initial customization before it can be readied for marketing to a profitably broad base.

For systems software vendors, the largest growth market is in the area of DBMS. Informatics' Mark IV, Cincom's TOTAL, Cullinane's IDMS, MRI's System 2000, Software AG's ADABAS count thousands among their users.

The processing services companies are also capitalizing on the DBMS market potential. National CSS' NOMAD, Tym-

**Table 1
RECENT REVENUE GROWTH OF
LEADING COMPUTER SERVICES COMPANIES***

Company	Total Revenues Calendar '77 (\$M)	% Growth Over Calendar '76	Total Revenues Calendar '78 (\$M)	% Growth Over Calendar '77
Anacomp	\$ 20	55%	\$ 27	32%
Automatic Data Processing	\$269	21%	\$334	24%
Bradford National	\$ 94	43%	\$119	27%
Computer Sciences	\$263	13%	\$323	23%
Comshare	\$ 21	46%	\$ 33	57%
Electronic Data Systems	\$191	35%	\$238	25%
National CSS	\$ 47	15%	\$ 58	24%
National Data	\$ 33	8%	\$ 40	21%
Shared Medical Systems	\$ 46	29%	\$ 63	37%
System Development	\$137	14%	\$159	16%
Tymshare	\$101	24%	\$150	48%

*Figures are derived from calendarization of fiscal year and fiscal quarter data
Source: INPUT

share's MAGNUM, and Computer Sciences' MANAGE are as advanced as the products available from traditional software companies.

In the past, many software products companies acted primarily as distributors. Now, however, they are spending 20% and more of revenues on research and development, making them true computer services companies. Implementation languages and DBMS markets are major opportunities, with projected annual user expenditures of over \$1 billion by 1983. In this area, strong relationships can be expected to develop between hardware and software companies. A case in point is Intel's recent acquisition of MRI Systems.

SOME MAJOR PROBLEMS

One of the major problems facing computer services companies is the scarcity of competent, trained personnel. While this is a problem confronting the entire computer industry, it is particularly crucial to computer services companies because they are so highly people-dependent. A high turnover rate, which exceeds 30% per year in many companies, is one aspect of the problem.

Another inhibiting factor is that the computer services industry is fragmented. Many of the vendors are small and have limited resources for development. At the same time, the problems facing their customers require solutions that are much more complex than in the past and, thus, require significantly larger resources to solve them. In order to obtain these needed resources, smaller companies are increasingly teaming up with large computer services organizations. In many cases this involves acquisition, but

it can also come in the form of joint ventures, distributorships, license agreements, or similar arrangements.

Financial resources are no longer a problem for the leading computer services companies. By 1983, at least five companies, including ADP, Control Data, Computer Sciences, and Electronic Data Systems, should have over \$500 million per year in computer services revenues.

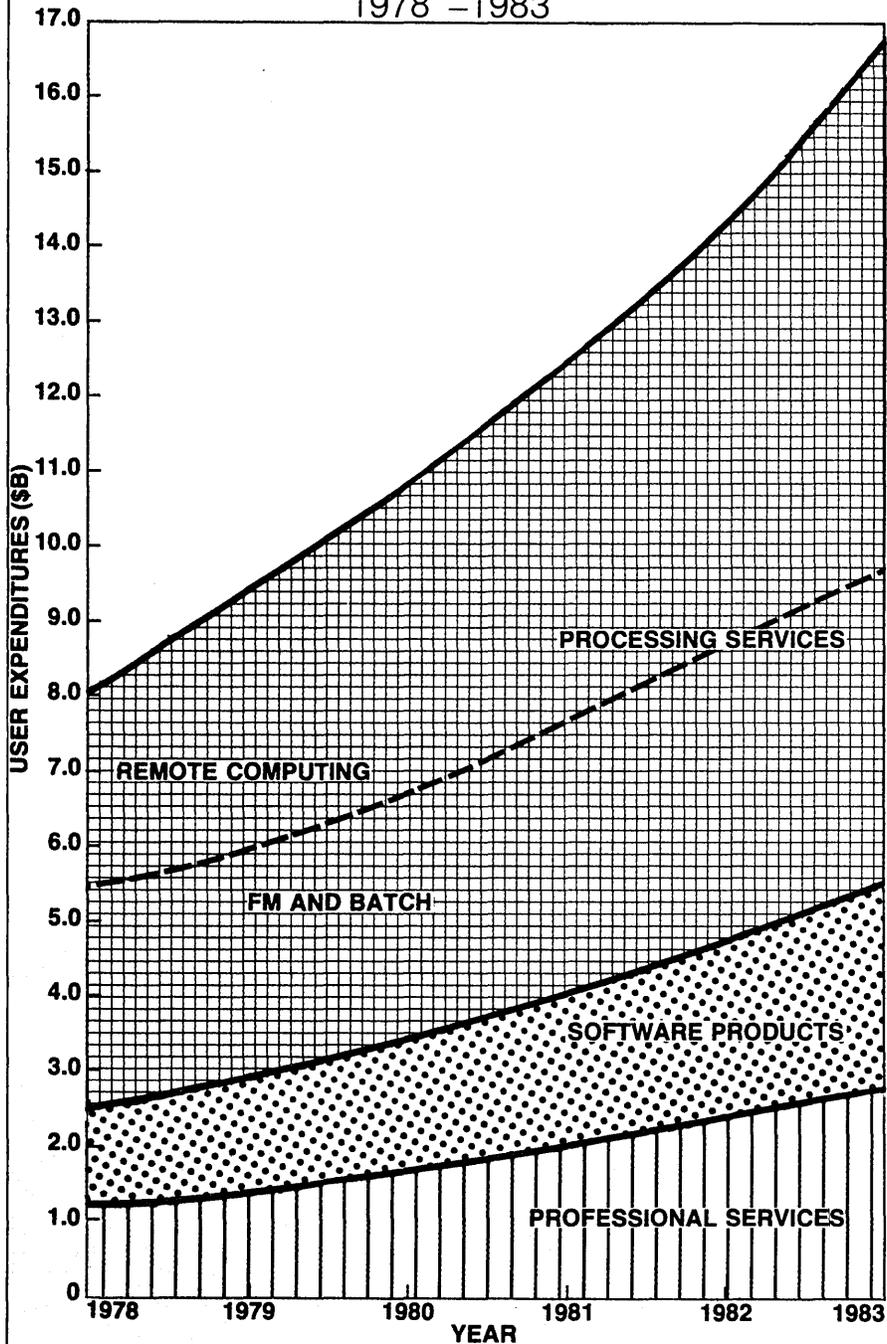
Non-traditional entrants to the market hope to emulate the success of Boeing Computer Services and MCAUTO by incorporating computer services into their major lines of business. These include financial establishments, such as Citibank and Dun & Bradstreet, whose interest in the industry reflects the increasing overlap between financial and information services.

Communications companies are another interesting group of newcomers. United Computing Systems, the United Telecommunications Industries subsidiary, has demonstrated that a communications company can succeed in computer services. And the largest company of all, AT&T, could become a dominant vendor if allowed to enter the marketplace. Already its tv advertisements look like those of computer services companies!

SERVICE IS THE SOLUTION

The computer manufacturers increasingly emphasize "service" in their marketing campaigns. Control Data and IBM are already the world's largest computer services vendors. These and other major computer manufacturers should obtain a rapidly growing share of their revenues, directly or indirectly, from service activities. Instead of all computer services ending up in hardware, as some believe, we expect

Fig. 1
**GROWTH OF COMPUTER SERVICES
 INDUSTRY**
 1978 -1983



that most hardware will become a commodity, with major vendor differentiation to be derived from service.

In five to 10 years, it will be extremely difficult to distinguish between a computer services company which offers integrated hardware, a communications network, support, software and consulting, and a hardware company which offers virtually the same menu of options. They will all be information products and services vendors, with the differences found primarily in their approaches to marketing. *

PETER A. CUNNINGHAM



Mr. Cunningham is founder and president of INPUT, Palo Alto, CA, where he provides information services to executives and planning

managers in the computer industry. He specializes in analysis and forecasting in the software and processing services areas. Before forming INPUT in 1974, Mr. Cunningham was director of the computer services department of Quantum Science Corp.

His career in the dp industry began 14 years ago with ICL in London. Mr. Cunningham came to the U.S. in 1967 with C-E-I-R. He later was a founder and president of J.W. Goodhew & Associates, a Washington, DC, dp consulting company.

WALTER P. SMITH

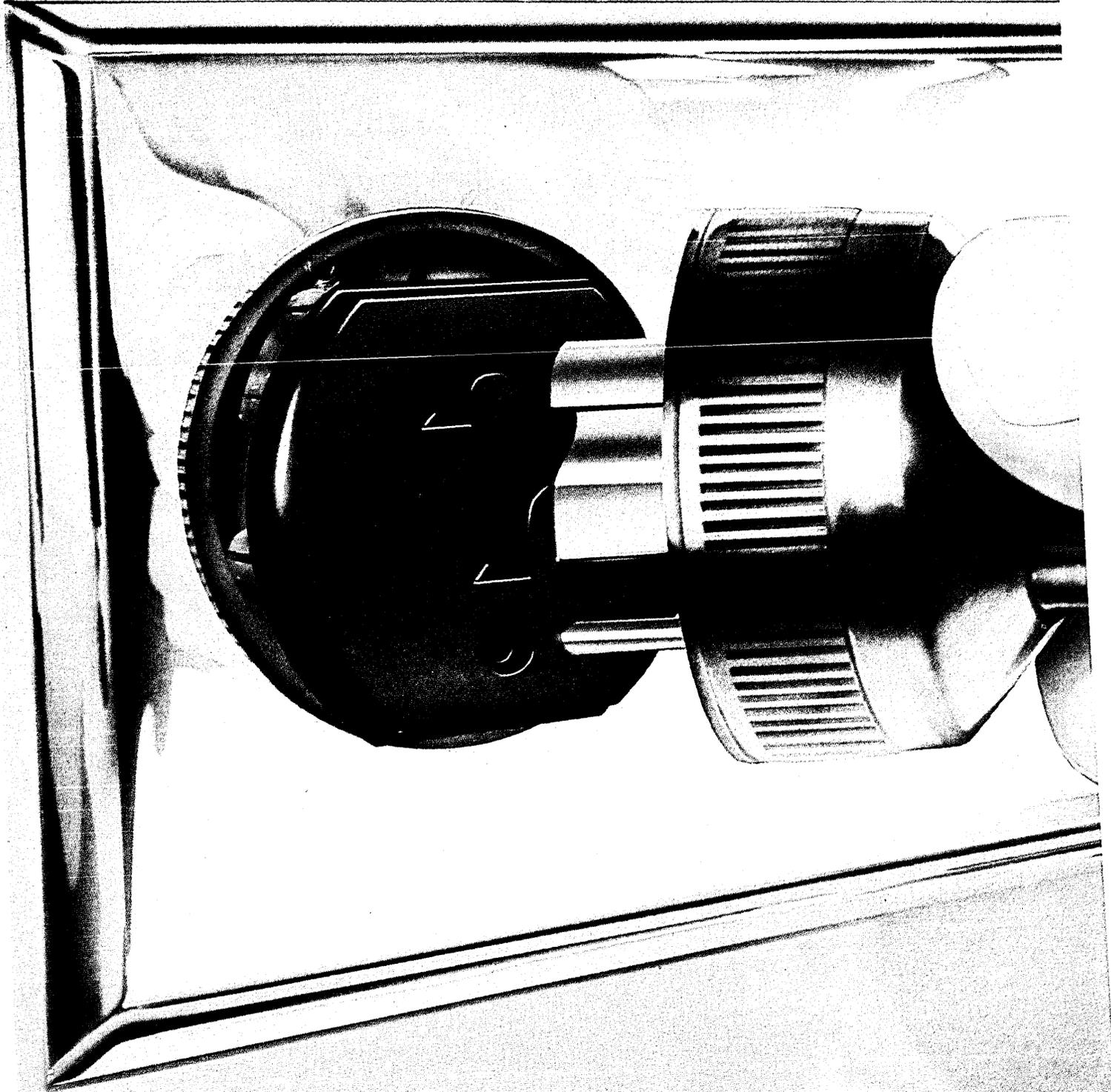


Mr. Smith is director of computer services programs at INPUT, with responsibilities for research and analysis studies in all areas of

information systems and services. Prior to joining INPUT, he served as director of U.S. marketing for Quantum Science Corp.

Mr. Smith has held a number of other management positions, including manager of national accounts for IBM, where he marketed total systems including mainframes, peripherals, communications hardware, and services.

ILLUSTRATION BY DICKRAN PALULIAN





The 4300 has sparked uncertainty for the PCM's, but this enthusiast says they can survive the shock.

THE PCM's: SO FAR, SO GOOD

by Sanford J. Garrett

In the past two years, the data processing industry has seen the rise of a phenomenon—the IBM plug-compatible mainframes (PCM's). That phenomenon is now well documented; DATAMATION even devoted an issue to the topic in February. Manufacturers and their products have been slotted into price/performance categories, and IBM's potential and actual responses have been explored in depth.

But what has not been examined is the environment that rapidly spawned so many new faces. What are the plug-compatible manufacturers bringing to the user? What is the nature of the market they are addressing? More importantly, what are the implications for the non-IBM compatible manufacturers as IBM responds aggressively, as it has with the 4300 Series, to this new competitive threat?

The evolution of the PCM owes its origin to the inflationary environment of the '70s and to the on-going price/performance improvements in technology which have made increasingly important the extraordinarily large investment in software. This software investment has caused a stability in computer architecture which assures that future generations of IBM computers will continue to maintain compatibility with older lines and, while prices will tumble, products will not be obsoleted.

Advances in electronics have facilitated the construction of machines which can emulate the software instruction set of other computers, thus allowing for greater latitude in system design. The availability, at least temporarily, of IBM operating systems as part of the public domain frees potential competitors of the onus to develop such on their own. IBM's historic policy of bundling varied support services with the cpu has created numerous indirect expenses which have had to be absorbed in the selling price. Thus, a significant price umbrella has existed for years.

Taken altogether, these factors have allowed for ease of entry into a market that was, for several years, on the verge of exploding. What sparked it to life was a newcomer's testing of the high price of IBM's 370/168. Amdahl had no trouble undercutting the 168's price tag with its 470V/6; IBM retaliated with its even lower cost, higher performance 303X line; and the race was on. With users constantly trading up equipment, there exists a ready-made opportunity for competitive selling.

Events of the past two years have demonstrated that the elasticity of demand for computers is substantially greater than many industry observers had anticipated. The outlook for growth certainly had to be revised upwards after IBM indicated last year that it had on order for its 303X Series four times the compute power it had collectively installed to date. At the same time, order books were overflowing for other mainframe manufacturers as they readjusted their price/performance curves to meet IBM's.

WHY THE PCM?

The accelerated growth of the market stems from a number of developments, all of which suggest that the initial PCM success is sustainable rather than representing merely a short-term aberration. Among these are:

- A new generation of managers, moving into positions of power and responsibility, weaned on data processing during their undergraduate and graduate years, who are demanding ever more dp capabilities.
- The widespread acceptance of mini-computers, which is creating another large base of users who potentially could step up to mainframe demand.
- A growing backlog of applications which is building, waiting for more power, better price/performance, or both. The high level of inflation has put pressure on organizations to improve productivity, and they're counting on the computer to do just that.
- Data processing workloads which tend

Table 1
MEDIUM TO LARGE SCALE GENERAL PURPOSE MAINFRAMES

	IBM 4341 PRICE CLASS	IBM 3031 PRICE CLASS	IBM 3032 PRICE CLASS	IBM 3033 PRICE CLASS	TOTAL MARKET
Installed Base (000)					
1973E	20.7	5.6	3.7	0.9	30.8
1978E	23.1	9.6	6.8	2.2	41.6
1983E	34.2	12.6	14.6	6.9	68.3
1973-1978 GROWTH	2.2%	11.4%	13.1%	19.8%	6.2%
1978-1983 GROWTH	8.2%	5.5%	16.7%	26.3%	10.4%

Note: Discrepancies due to rounding.
Source: Paine Webber Mitchell Hutchins estimates.

to rise to fill growing department budgets. In other words, computer price cuts are not passed through as expense savings in an organization, but rather are taken as a license to acquire more compute power.

•The diminishing cost of hardware relative to software, which results in vast hardware resources being expended to reduce the burden on the programmer. The demand for virtual and on-line, rather than batch, systems is a prime example.

•Improvements in price/performance which have made economically feasible a number of applications that were heretofore only illusive dreams. These new applications, such as electronic mail systems and electronic funds transfer systems, will necessarily require increased orders for hardware.

The worldwide market for cpu's over the last five years, and how that market will change in the next five years, is shown in Table 1. As indicated, the forecast calls for greater than 10% compound growth for medium and large scale general purpose computers over the next five years. In the 1973 to 1978 period, the climb was only about 6%. More importantly, the greatest growth in the market has been and will continue to be at the very high-power end.

THE PCM APPEAL

The key to understanding the appeal of the PCM is to recognize that the market is now responding to the demands of the user rather than to the convenience of the manufacturer, as it had in the past. The PCM is providing the user with a multiple source of supply. No longer is there the spectre of lost support should IBM decide to go in a direction counter to the user's best interests. This is important not only to the current IBM customer, but also to potential new users who may be drawn away from the independent

Table 2
ESTIMATED WORLDWIDE MARKET SHARES
MEDIUM TO LARGE SCALE GENERAL PURPOSE
MAINFRAMES

	1973	1978	1983
IBM	65.8%	64.2%	60.0%
PCM*	—	1.3%	8.2%
Total IBM Compatible	65.8%	65.5%	68.2%
Honeywell	12.6%	11.0%	9.3%
Burroughs	6.6	7.6	6.8
Sperry Univac	7.1	7.1	6.0
NCR	3.8	3.9	3.4
Control Data	3.0	2.4	1.7
Others	1.1	2.5	4.5
Total Non-IBM Compatible	34.2%	34.5%	31.8%
Total	100.0%	100.0%	100.0%

* IBM Plug-Compatible Mainframe Manufacturers
Note: Discrepancies due to rounding.
Source: Paine Webber Mitchell Hutchins estimates.

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By 1983, over 8% of the market will be held by the PCM's.

mainframe manufacturers.

Typically, the PCM sale is to a user pushing the limits of his current system and looking for ways to gain more power at not much more cost. The PCM's are providing availability and upward migration for users, with significant price/performance jumps relative to IBM's own products.

Further, the PCM is bringing new capabilities to the end user. Amdahl has broken new ground in high power offerings, and Two Pi, Kardios, National Semiconductor, and Cambridge Memories are bringing System 370 compatibility down into the minicomputer area.

The PCM's are supplying software houses with more power than ever before. Purchasing machines in oem lots with oem discounts allows companies like National CSS to provide turnkey system packages to users. Prior to this, software support was provided on computers rented from IBM.

As important as anything else, the PCM is able to deliver products sooner than IBM. In today's inflationary environment, this carries a measurable financial appeal.

THE THREAT OF THE 4300

Although IBM's new 4300 line cannot be ignored, the PCM's have gained too much momentum to be brought to a screeching halt now. Every one of these companies anticipated IBM's announcement, as well as the product's price/performance aggression. Probably the most important aspect of the 4300 as it relates to the PCM's is that their ability to attract venture capital is going to be impaired. Companies such as Citel and Nanodata, which have yet to bring a product to market, are probably in the least advantageous position.

What is often overlooked is that with the 4300 line, IBM is laying the groundwork for a number of long range strategies that will make life tough for the PCM's over the next five to 10 years. But observers' worst fears about IBM putting the PCM's out of business via the 4300 are predicated on IBM doing everything it plans on doing over the next five to 10 years—tomorrow.

In spite of the 4300, the better managed and better financed PCM's will continue to grow and to gain market share. As shown in Table 2, their growth will be at the expense of both IBM and the independent manufacturers. By 1983, over 8% of the market will be held by the PCM's. In conjunction with IBM, nearly 70% of the market will belong to mainframes running IBM-compatible software.

IBM's aggressiveness in pricing the 4300 Series can be explained by the mix shift which is occurring in the market. As indicated in Table 1, the high-power, high-profit end of the market is growing much more rapidly than the rest. IBM can offset sharply reduced prices in the low to middle power segments by its own participation in the growth at the high end. This forces the non-IBM world, such as Burroughs and NCR, to introduce higher powered machines of their own, or else face substantial profit declines.

INDEPENDENTS NEED NICHES

As market share erosion continues for the independents, however, those companies will find themselves in a progressively worse competitive position. Their most broadly accepted response is to foster segmentation of the market by approaching it on a solution basis rather than a product one. This produces a number of small discrete markets in which the independents can take a leading or dominant position in those niches best suited to them. Most of the independents are already creating those niches as can be seen, for example, by NCR in the banking and retail markets, Burroughs in the financial segment, Honeywell and Control Data in energy applications, and Univac in the airlines market.

There is a danger to this approach, though. Submarkets now being established may not be able to retain their isolated nature several years down the road. As vast communications networks get put into place and office automation becomes a widespread reality, the specialized market shells that are just now coming into play may very well crumble. If not, they may become slow growth traps for those manufacturers that let themselves get caught.

A LESS PALATABLE APPROACH

A response that is clearly less palatable to the independents, near term, is to provide IBM software compatibility themselves. Control Data and Univac have already tried this tack with the Omega (IPL-built) offering and System 370 simulation, respectively. The desirability of this course of action, however, rests with the following facts: the PCM encroachment, IBM's aggressive product response, the unbundling of software and support services, and the growing strength of computer service bureaus—all mean that the pace of both new hardware and software capabilities available on IBM-compatible machines is going to accelerate sharply. Few, if any, of the independent mainframers are going to be able to keep abreast of the sundry devel-

opments through their own offerings. As users become more attracted to the system offerings of the IBM-compatible machines, the non-compatible companies are going to be faced with a loss of their loyal customer base.

The primary argument against going IBM-compatible is that the present non-IBM customer base is tied to its current manufacturer's hardware through its own investment in software. As such, these users will remain loyal, even if somewhat dissatisfied. A change to IBM compatibility by the independents could result in the loss of these customers.

The counter-argument, however, is straightforward. There is no reason to believe, in the long term, that any manufacturer is going to have proprietary software—in the sense that it can only run on that manufacturer's machine. As emulators become even easier to build, the PCM's will branch out and provide second sources for non-IBM machines, as National Semiconductor has already indicated it will do with Digital Equipment's PDP-11 line.

In sum, the data processing market is robust and will continue to provide an environment for great growth over the next few years. The handwriting is on the wall, however. Longer term, those companies that start incorporating a strategy which capitalizes on the movement towards IBM software compatibility will find themselves in a competitively superior position to those who insist on resisting. *

SANFORD J. GARRETT



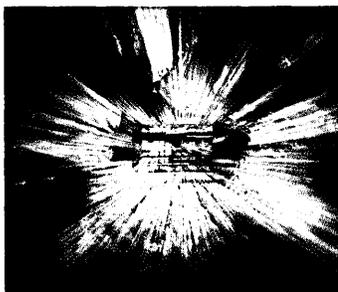
Mr. Garrett is a vice president of Paine Webber Mitchell Hutchins Inc., a leading Wall Street research firm. He is the senior analyst

responsible for coverage of the office equipment and data processing industries.

Mr. Garrett began his dp career 11 years ago as a systems analyst and programmer for IBM's components group in East Fishkill, NY, where he directed minicomputer applications for controlling the semiconductor manufacturing process and developed the pilot facility for IBM's energy management programs. He then moved to Wall Street as senior office equipment analyst at Sanford C. Bernstein and Co.

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For mainframe vendors, the successful past is not necessarily prologue; — the future will tell if mainframes can remain their mainstay.

MAINFRAMES: HOW LONG THE MAINSTAY FOR THEIR VENDORS?

by Michael J. Geran

In 1978 the mainframe computer industry entered what appeared to be the promised land. Almost all the participants had, by historical standards, exceptional ease in meeting or surpassing their order, shipment, revenue and profit targets, while—wonder of wonders—generating excess cash over and above their capital spending needs.

IBM, for example, had more than its normal share of largess: revenues crossed the \$21 billion level, with the data processing segment's operating income exceeding \$5 billion for the first time; IBM became the third industrial company to earn \$1 billion after taxes in a single quarter; and its order flow was so strong that the company added to an already historically high backlog.

The picture for the five "dwarfs" was also positive: Burroughs came within an eyelash of meeting its 10 year old 20% pretax margin goal; NCR's profits surged, and its return on equity exceeded 15% for the first time since the 1950s; Univac finally passed the \$2 billion level in revenues and \$200 million in pretax profits; and for Honeywell and Control Data, computer operations were no longer a cash drain but a major source of profit growth (See Table 1).

The recent past, however, is not necessarily prologue. The strategies which the mainframe companies used to attain their impressive 1975-78 profit growth rates will probably not work as well in the post-1979 era.

The combination of a changing dp industry environment, IBM's new product/pricing strategy, and the "growing up" of the megaminicomputer suppliers will

force the major mainframe companies to adopt a new set of strategies if they wish to continue their profit growth beyond 1979. It is almost as if these companies have trained to compete in a four minute mile competition only to find that the standard for successful completion is 3:40.

The path for continuing success in the new environment is clear. What isn't clear is how rocky the path will be and, more importantly, the costs in terms of future profit. In effect, the issue is this: the major mainframe companies must now diversify their future source of profits and accelerate the release of new models based on advanced technology. At the same time, they must perform the juggling act of protecting their older lease bases while introducing new models that are price/performance competitive with IBM's 4300 Series, not to mention IBM's still-to-be-announced "H-Series." Thus, IBM's mainframe competitors must look now to maintenance, software and peripherals for the majority of their profits in the future.

In past cycles, such a startling price/performance shift as that introduced by the 4300 Series translated into a weak profit growth for the other mainframe suppliers. But that weakness might be avoided this time, at least by the more agile suppliers. First, several computer companies have reached the critical mass point at which they can now accept a lower unit price but with a higher shipment volume and still maintain the same profit return. Second, unbundling for the other mainframe companies will turn a cost center into a profit center, as they will now be able to charge for what they were previously forced to give away. Third, the growth potential in the computer industry on a worldwide basis is likely to be as

good over the next five years as it was in the last five years, despite continuing decline in processor and memory prices. However, a greater proportion of the growth will be generated in product and price classes in which several manufacturers historically have not been too successful.

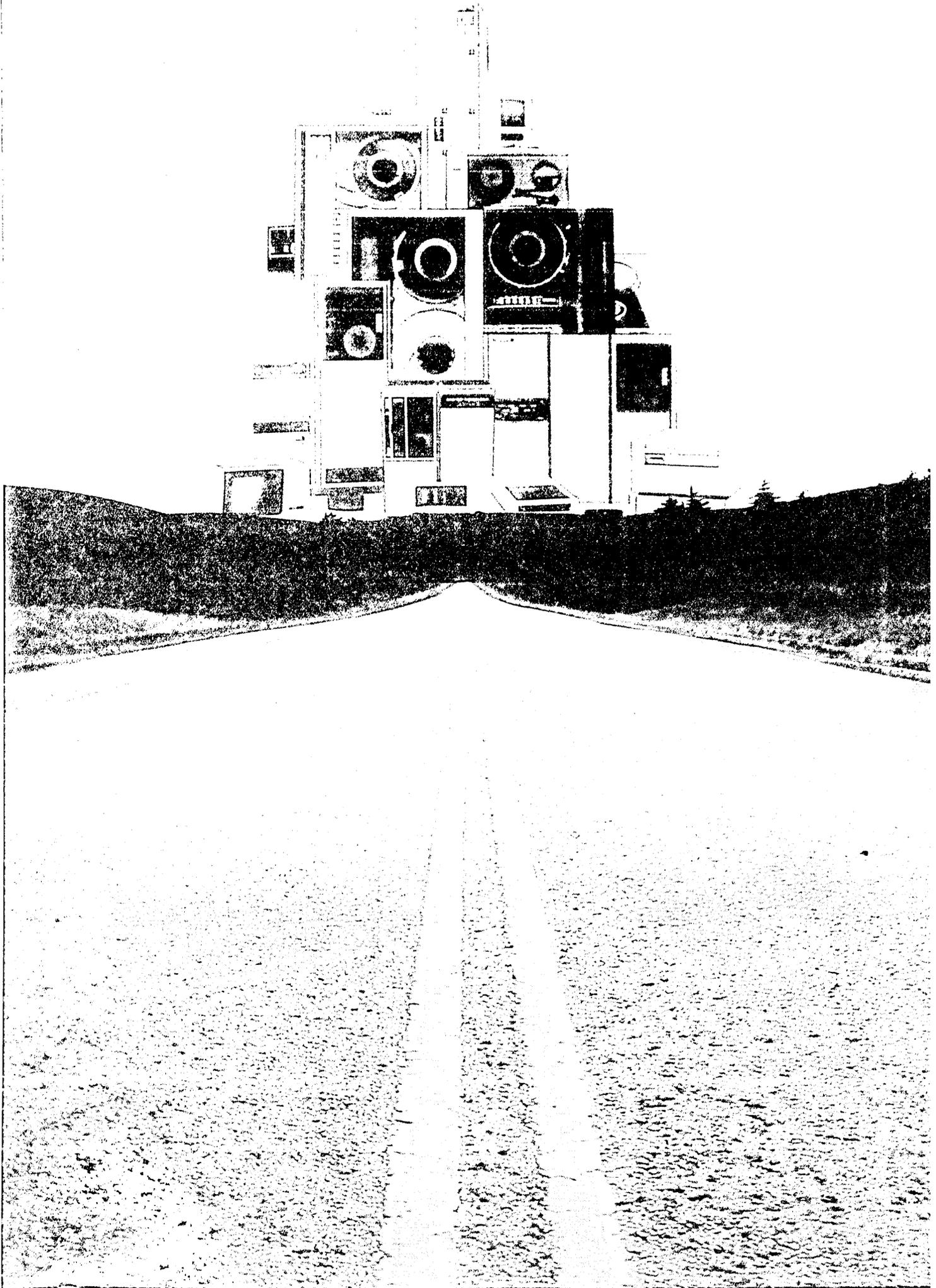
In sum, the opportunities will be as attractive in the post-1979 era as in the 1977-78 era; but for the major mainframe suppliers, the successful and profitable development of these opportunities will require a new degree of skill and luck.

IBM

IBM's recent business/product policy shifts appear on first analysis to represent a discontinuity from its action earlier in the 1970s decade. Yet, the shifts are consistent when viewed against the company's action over the longer term. The combination of external changes in the dp industry environment, financial logic, and the necessity to use new tactics to create new strata of demand has forced the shifts.

The principal difference in tactics between IBM's most recent move and its strategy during other periods of change—1959, 1964 and 1970—is that this time the company elected, or was forced, to use new technology both to reduce price and improve function. The result—as exemplified by the 4300 Series, the 3370 disk family, and the System/38 family—is "more for less" rather than "more for more," at least in terms of hardware prices. Thus, IBM is in the process of substituting a more aggressive product release strategy for its prior "revolution by evolution" strategy. That earlier strategy was based on the more cost/effective production of older technology rather than, as now, the use of advanced, mass produced, new technology which leads to

PHOTOGRAPH BY MITCHELL FUNK



Burroughs is operating at the highest pretax profit margin of all the mainframe "dwarfs."

both improved function and lower prices.

In addition to the business policy shift, IBM also combined a series of tactical product shifts including: (1) for the first time in a long while, offering multiple competitive models in the same price class but customized by market segment. For instance, the System/38, the 8100 and the 4331 models overlap in price but instead of all being "black," one is "black," another is "green," and the third is "blue" (i.e., one model is better at batch, another better at remote stand-alone transaction processing, etc.); (2) the pre-inventorying of a new system before announcement which results in very fast delivery (i.e., the 4331 model has a one quarter delivery time); (3) the smaller models rather than the bigger models again provide the greatest price/performance improvement vis a vis the predecessor IBM system; (4) the co-existence of two different price/performance curves in the 370 family at the same time (i.e., the 4300 Series curve versus the 303X price/performance family curve).

As the underpinnings to its future strategy, IBM appears to have set for itself the somewhat conflicting objectives of maximizing current profit while introducing a new family of systems designed to stimulate future growth by creating new strata of demand. To achieve these objectives, the company must follow a rolling product release strategy and at the same time gradually lower the per unit data processing cost in order to make new applications less costly. Simultaneously, IBM must transfer a larger share of its system profitability away from mainframes and memories to other faster growing parts of the total system—peripherals, maintenance, software, data terminals, etc.

The logical extension of this strategy will most likely result in the unveiling over the next two years of at least the following new products: (1) the H/Series which should offer both a lower price tag and at least a 100% power improvement over the 303X family, and be based on a new logic and memory family; (2) new improved terminal and front end processing units; (3) sometime in the early 1980s, a "back end" data storage subsystem that can better meet the needs of large data based systems users; (4) an improved MVS operating system in which the performance improvements are offered via the program package route and are priced separately; and (5) computer building blocks for the "office of the future" which can easily be integrated into existing systems for such applications as electronic mail and word processing.

This time, IBM will be better able

to control the changes to its product mix so that the company can use the cash proceeds from its older installed base to finance the investment required for the release of new systems into production, which in turn could stimulate longer term growth. In a sense, IBM now has the tools required to "have its cake and eat it too."

Translated into specifics, IBM's three year string of shipment gains—1978, 1979 and 1980—should be great enough to ensure the maintenance of strong profit growth in 1979 and 1980, on top of the company's 14.3% gain in 1978. Beyond 1980, the picture is clouded by the possibility of a recession and by other events which cannot now be foreseen.

BURROUGHS Over the past five years, Burroughs has been able to translate an average industry shipment and revenue growth trend into a much faster rate of profit growth (See Table 1). Today, it is operating at the highest pretax margin of all the mainframe "dwarfs"—19.3% in 1978. The company's consistent profit growth rate (15% compounded in the past five years) was in part the result of several favorable influences which may not exist in the future because of basic changes in the dp industry environment. Thus, to sustain its past record—the company's published objective—a new modified strategy will be needed.

For example, some of the very favorable influences for Burroughs in the 1974-78 era included: (1) in the early '70s, the almost benign neglect by the other major mainframe manufacturers toward price/performance improvements in the low end of the market; (2) the slow rate of new product introductions in the middle/intermediate mainframe segment during the 1975-77 period, which permitted Burroughs to extend the life of its older systems due in part to the comparative efficiency of their software and their ease of use; (3) the volume growth in Burroughs' older product base was great enough for the company to attain average shipment growth rates even without successful volume participation in the upper end of the mainframe market; and (4) the IBM price/performance umbrella in the lower end of the 370 family provided some protection for Burroughs' products.

Since it is unlikely that these factors will exist in the future, especially in view of the aggressive assault on the minicomputer market by all mainframe manufacturers and the newly established 4300 Series price/performance curve, it will be necessary for Burroughs to adopt a new strategy. The key components will most likely include the following: (1) a

phased but complete replacement of the current product line; (2) a rolling program of selective price reductions for its older products in order to protect its current base; and (3) once the 7800 program is out of its production difficulties, a more aggressive attack on the large scale system market. In short, Burroughs will opt for function and price changes rather than, as in the past, the repricing and repackaging of older systems.

The first example of Burroughs' new strategy came on February 27, 1979 with the announcement of two models in the new 900 family. The 900 Series has a "micro-modular concurrent" system architecture and is constructed out of standard off-the-shelf logic elements. Compared to their predecessor models, the new systems—like the IBM 4300s—are significantly cheaper and much more powerful. And, for the first time, the operating system is unbundled. New models to replace the B/80 and any of the B/6800 family can also be expected later.

NCR

Now that NCR has completed its corporate reorganization, restored an acceptable level of profitability in its basic businesses, and divested several non-related operations, the company is well positioned to enter the next growth phase—a more aggressive participation in the general purpose computer business and, probably, an increased share of that market.

In essence, the company's strategy is based upon two complementary thrusts. First, NCR has hopes to capitalize on the fact that its customer base of older systems users now needs to replace obsolete terminals, accounting machines, and computers with new products. And second, NCR will branch out into additional parts of the general purpose computer market by means of new products, including larger sized systems and smaller transaction based systems for the distributed data processing environment.

The success of the second thrust is vital to meeting the company's longer term growth goals, primarily because the amount of new business that can be generated from NCR's current user base is not great enough to meet the company's targets. Thus, to be successful, NCR must now play ball with the big boys.

In a product sense, NCR's attack machines are the V-8500 and V-8600 families, and the defense machines are the 8100/8200 and 8400 models. The 8600 family is NCR's first use of 100K emitter-coupled-logic circuitry and the 64K bit memory technology. The V-8600 family uses the newly developed virtual resource

Table 1
GROWTH OF THE MAJOR MAINFRAME COMPANIES: 1974-78
 (\$ Million)

	Revenues			Profits			Value of Product Shipped		Percent Change
	1974	1978	Percent Change	1974	1978	Percent Change	1974	1978	
IBM¹	\$10,500	\$17,074	62.6%	\$2,800 ²	\$5,113	82.6%	\$7,300	\$10,200	39.7%
Burroughs	1,532	2,460	60.5	285	475	102.1	950	1,375	44.7
NCR	1,832	2,610	42.4	141	364	158.1	350	950	72.7
Univac	1,290	2,000	55.0	102	205	100.9	850	1,700	100.0
Control Data	1,100	1,800	63.6	(67)	88	N/M	600 ⁴	975	62.5
Honeywell—HIS³	856	1,293	51.5	34 ²	105	208.8	1,050 ³	1,490	41.9

¹Data processing business only.

³Includes Cii-HB in shipments, excluded in revenues and profits.

²Operating income/profit.

⁴Includes peripheral shipments.

Source: Corporate annual reports and DLJ estimates.

executive (VRX), a system designed to provide both virtual storage and multiple virtual machine capabilities.

While the principal mission of the new 8500/8600 system is attack (i.e., competitive displacement), it also serves a subsidiary purpose as the apogee of the NCR base. It provides the NCR user with upward compatibility and direct file transportation from the smaller systems. Thus, NCR for the first time in history can offer its users a twenty-fold performance upgrading path without the need for reprogramming.

In sum, it is clear that NCR's new product offering should enable the company to do a better job in the future than it has in the past in protecting and upgrading its own user base. Successful penetration of other market segments in the general purpose business will be dependent on the effectiveness of the NCR marketing force now that it has the necessary product tools. The result will tell if the vocational marketing reorganization which NCR has undergone at great cost over the past four years was a success or not. The unknown factor in NCR's future is whether or not the company can compete on an equal footing in the computer business outside its existing user base?

UNIVAC

In 1978, for the first time in a decade, Univac easily met its ambitious shipment, revenue and profit targets and was well on its way to achieving above-average profit margins. The two major sources of this better than expected performance have been the phenomenal success of the 1100/80 program and the growing income flow from older products. The 1100/80 now appears likely to be the greatest revenue generator in the company's history, as

well as its most profitable program.

But while Univac's growth surged in '78, it could be stunted in '79—and all because of IBM's latest announcements. Now the key issue is this: given the indirect effects of the IBM 4300 Series and of the still-to-be-announced H-Series, can Univac continue to maintain its share of shipments and at the same time meet its impressive 15% to 20% profit growth target?

To satisfy these somewhat conflicting challenges, a judicious balancing act will be required, and one which will mandate a new product and lease optimization strategy, as well as product life extensions.

Fortunately for Univac, the company is now better positioned than it has been in past periods of IBM product/pricing shifts. The company possesses a number of tools which, if skillfully used, will enable it to come out of this test of fire in better shape than when it began. The Univac advantages include: (1) for the first time, over 70% of the company's order flow is coming from its existing base and from larger systems; (2) several of its startup ventures which operated in the "red" over the past two years will begin to become profitable in the 1980-81 period; (3) the five year leasing strategy, originally designed as a marketing tool, will now allow available systems to provide an upgrading path for the Univac product base; and (4) Univac has several new systems/products in advanced R&D stages which can be released into volume production such that the time lag between the new Univac models and new IBM products will be much less than it has been in the past.

Given the Univac goals and the changing dp market environment, Univac

is expected to continue to support the three different product families—the 1100 Series, the 90 Series and the minicomputer family. In addition, the following products are anticipated between now and 1982: (1) a microprocessor-based system as a replacement for the dated 1100/10 family and based on a unique form of system architecture; (2) first a "midlife kicker" for the 1100/80 in 1980-81, and then a super 1100/80 in 1981-83—both incorporating VLSI technology and using the existing OS/1100 software; (3) a double density 3350 type disk from ISS with the possibility of thin film heads in 1981; and (4) the gradual unbundling of its software in order to recapture some of the revenue which will be lost in necessary memory and price reductions.

If skillfully executed, the combination of phased new product releases and a financial lease optimization strategy could enable Univac to meet its growth target. That's contingent, however, on two external events occurring: (1) that the H-Series is not announced until late 1979 or later; and (2) that the normal recession-related slowing of orders occurs, as it has in the past, with a normal delay of about six to 12 months, especially overseas. (Univac gets about half of its volume overseas.) If such is the case, by 1980 Univac could translate its existing large order backlog into a substantially higher revenue level that will permit it to operate at an improved degree of profitability even with a lower rate of order growth.

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After a great deal of experimentation, Control Data has evolved a successful strategy for continued participation in the industry. At present, the approach is built around three distinct points: (1) becoming one of the leading suppliers of peripheral equipment in the oem market; (2) continuing growth in the data series industry; and (3) a selective but highly focused participation in part of the mainframe business.

The company's overall approach—a legacy of its past boom/bust cycle—is to compete aggressively only in those application/market segments in which the combination of the processing requirement and the company's hardware/software capabilities gives CDC's product offering an edge over other more general purpose systems (i.e., the large scale scientific/engineering markets).

To accomplish its strategy, the company is taking a twofold approach. First, it is replacing the older, smaller Cyber models with a new model based on the latest logic and memory circuitry. And second, it is significantly improving the vector processing capability of the Cyber/203 family. The need of the aged 6600 user base for more capacity and the accelerated growth in the large scale scientific market are together providing the company with a market niche which is large enough to meet the company's shipment goals.

Through diversification and selective participation in a small but rapidly growing part of the mainframe industry, Control Data has established the foundation for a solid stance in the industry despite the company's low absolute share of the mainframe business.

HONEYWELL Honeywell is once again on a fast track in its computer operations. After what seemed to be the labors of Hercules in rationalizing the diverse product strategy and reorganizing the structure of its computer operations, the company has reported strong 1978 results that indicate the effort was successful. Measured on a worldwide basis, the computer operations last year had one of the best rates of shipment and revenue growth in the mainframe industry—both exceeding 25%. Greater than expected shipments of minicomputers and large scale systems were the principal sources of the gain.

Given the company's peculiar organizational and product characteristics, it is likely that in the immediate future Honeywell must follow a two-sided business/product strategy. First, it must continue to expand the breadth of its two most successful product families—the lev-

el/66 and level/6—with one evolving down the price spectrum and the other going up. Second, in order to realize the latent cash profit potential of the older lease base, it will be necessary at the same time to update the price/performance of the older level/62 and level/64 families. Thus, at least until some time in the early 1980s, Honeywell must continue to produce and market several overlapping product families.

Now that Honeywell's computer operations have at last restored the level of profitability desired by corporate management, it is likely that the company will return to its historical free-wheeling pattern of aggressive market competition and attempt once again to capture a shipment share equal to its share of the installed base, about 8%.

It isn't likely that 1978 shipment performance was a "flash in the pan," and the probability is great that with skillful strategic execution Honeywell can continue to attain its historical shipment share in the future. Factors that should assist the company in achieving its shipment goals are the size and age of the existing Honeywell user base, its users' needs for increased capacity, and the company's improved position in three of the fastest growing market segments—terminals, minicomputers, and large systems.

The translation of shipment growth into continuing profit margin improvement will be more difficult in view of the changes in the industry and the costs associated with supporting diverse product lines. That objective can be met, however, if Honeywell's product lines remain price/performance competitive with those of the other mainframers and if Honeywell manages the migration of its installed base better than it has in the past.*

MICHAEL J. GERAN



For the past five years, Mr. Geran has observed the computer industry from the vantage point of Wall Street where he is currently the analyst re-

sponsible for the computer industry at Donaldson, Lufkin & Jenrette Securities. Prior to his move to Wall Street, Mr. Geran was involved in market planning, product planning and financial analysis with several computer companies, including IBM, Univac and General Electric.



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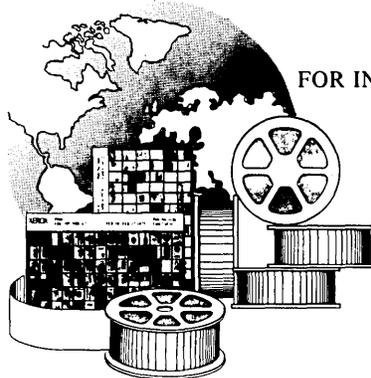
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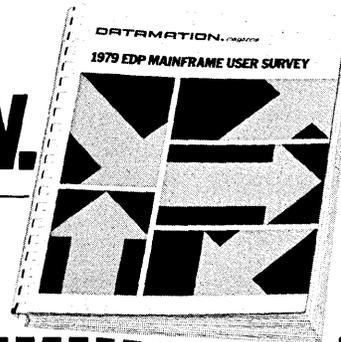
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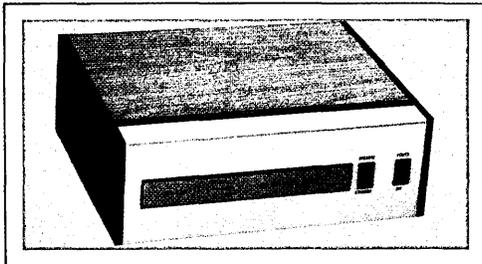
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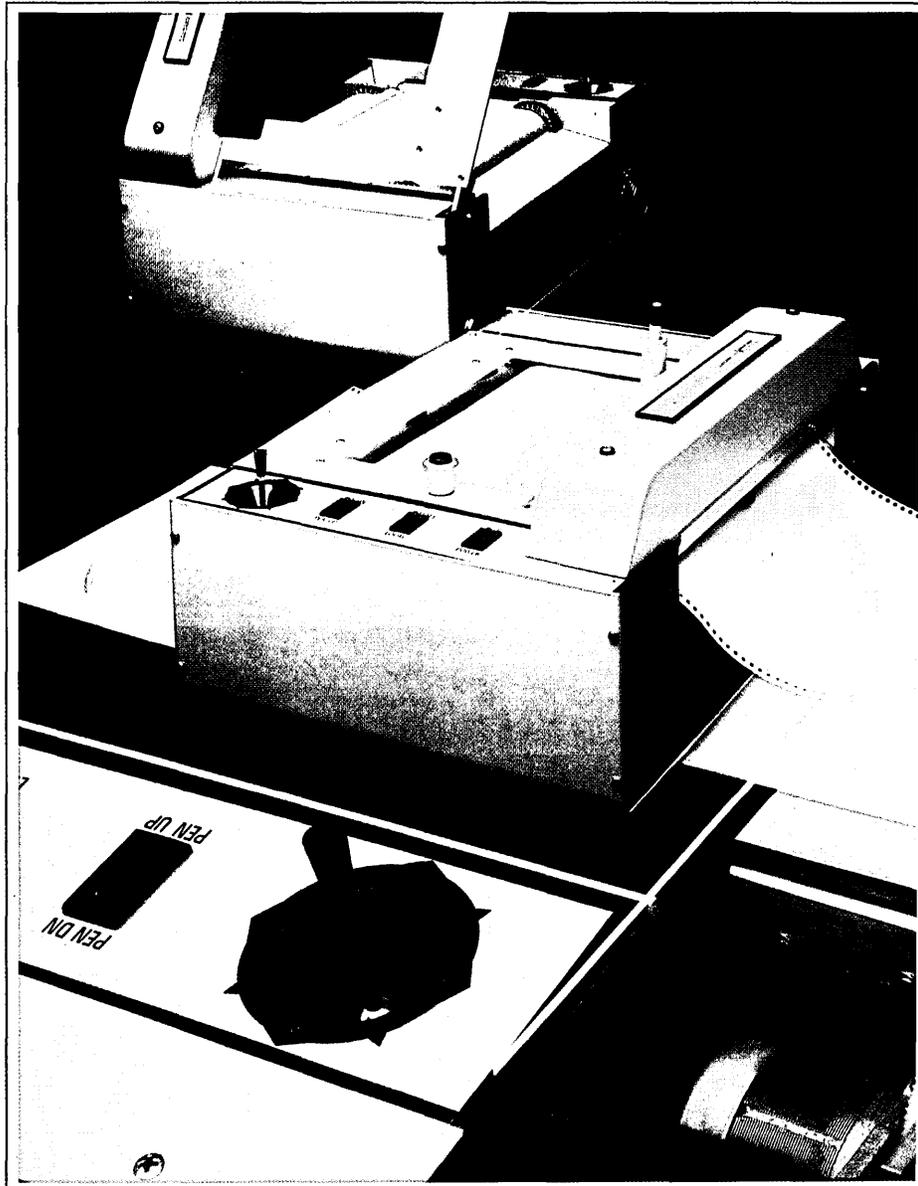
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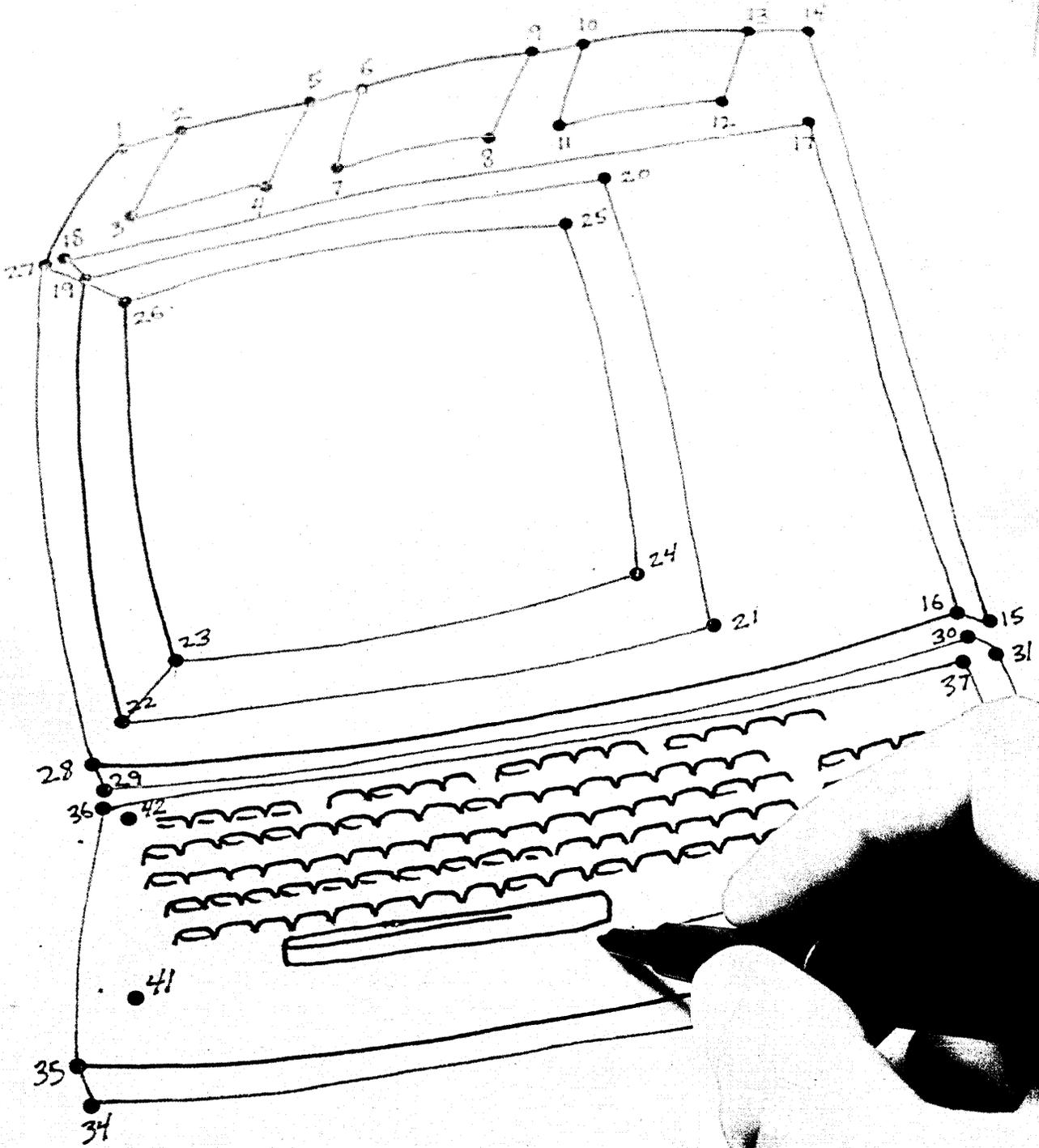
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Communications networking in the '80s will be a very competitive business; users will reap the benefits.

NETWORKS: NO MISSING LINKS

by Winston E. Himsworth

Within the next few years, communications users in the United States will be able to choose among a significantly broader range of network services to meet their voice, video and data communications applications needs. Some of these services have been introduced already and will evolve still further. Others have only been announced.

Unless unduly delayed by regulatory or judicial actions, three brand new network service offerings will be available by 1981. They are:

- **ACS**—Advanced Communications Service, a data communications network proposed by the Bell System.
- **SBS**—Satellite Business Systems, a total communications network proposed by a joint venture of IBM, Comsat, and Aetna Life and Casualty.
- **XTEN**—Xerox Telecommunications Network, an electronic message service proposed by Xerox.

EXISTING AND EVOLVING NETS

One mistake often made in assessing the likely impact of ACS, SBS or XTEN is to view them in isolation, neglecting their relationships to each other and to a variety of other network services which exist today and are growing in number, size and sophistication. A brief description of these existing and evolving networks is provided below.

- The telephone message toll network is already many times larger than anything being proposed. It is being enhanced with electronic switching and digital transmission facilities.

- Bell System offerings for internal corporate networks are being upgraded with new software packages for their electronic switching offices, and Dimension PBX's.

- Western Union is integrating a host of services using new data switches, an extensive microwave system, its WESTAR satellites, and its own local distribution facilities. A second generation digital satellite system will be added in the early '80s.

- Specialized common carriers like MCI, Southern Pacific Communications, and subsidiaries of ITT are offering both private line and switched communications services.

- Intelligent network services like Teletnet, Tymnet, and Graphnet are serving the data communications or facsimile markets.

- American Satellite, a subsidiary of Fairchild Industries, is using satellite facilities to provide 56 Kbps data services linking corporate computer centers on a rooftop-to-rooftop basis.

- RCA and Western Union domestic satellites are already used extensively for video distribution. More than half their capacity is dedicated to feeding multiple tv programs to more than 700 cable television systems and 150 tv stations. Additional distribution services are planned for hotel/motel chains, radio broadcasters, and the news services.

- Multi-point Distribution Service (MDS) is an omni-directional, 6 MHz radio transmission service already in operation or licensed in over 100 major U.S. cities, in many cases linked nationwide by satellite. Although used today primarily for pay television distribution, the system with minor rule changes could be used for a variety of communications applications, much as proposed by Xerox in its XTEN service.

- Communications users have for years built their own data networks using a variety of multiplexing and concentrating equipment. Now they are also developing their own networks for administrative (voice, fax) communications using computerized PBX's or tandem switches provided by such vendors as Rolm or Northern Telecom. Some are even planning to integrate their administrative and data nets via these programmable switches.

While these existing network services may not yet offer all the capability promised by the three new networks, they are already serving what will continue to be the biggest sectors of the communications market in the next decade. It is against this backdrop of existing services, which are becoming increasingly sophisticated and cost effective, that the three new networks must be analyzed.

SATELLITE BUSINESS SYSTEMS

SBS is designed to provide a total communications network service to multilocation corporations and government agencies. As such, it's not just a data communications service. In fact, in the early years, it is projected that at least 75% of the communications traffic on the SBS system will be voice. The other 25% would be made up of high speed data for facsimile, computer and data terminal traffic, and teleconferencing applications. The basic plan is to use satellite transmissions with earth stations directly on-site at customer locations. These earth stations will not be particularly inexpensive and, contrary to earlier expectations, they will not be particularly small. They will use 5 and 7 meter diameter antennas and, with related communication integrating electronics, will likely cost in excess of \$500,000.

The service SBS is proposing is to

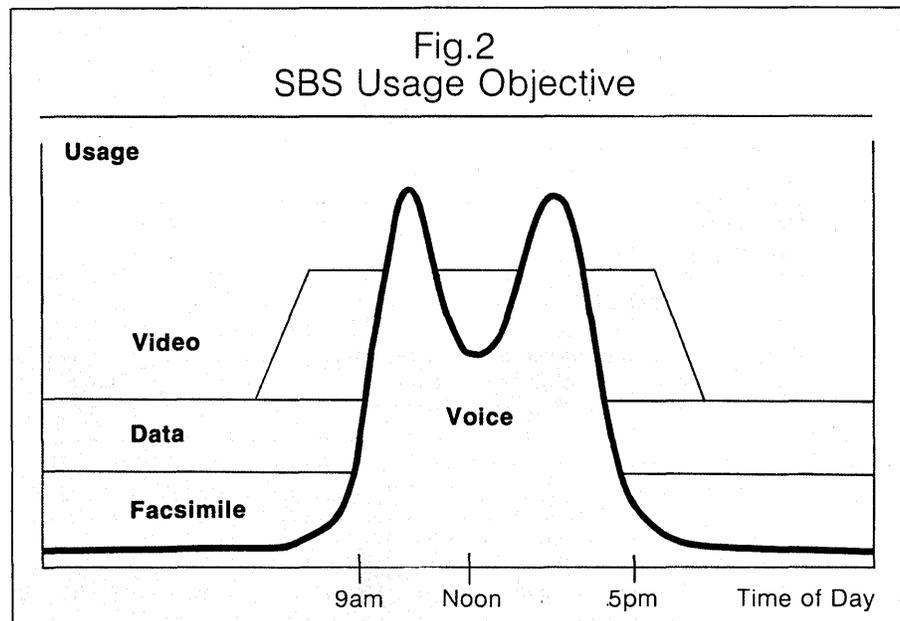
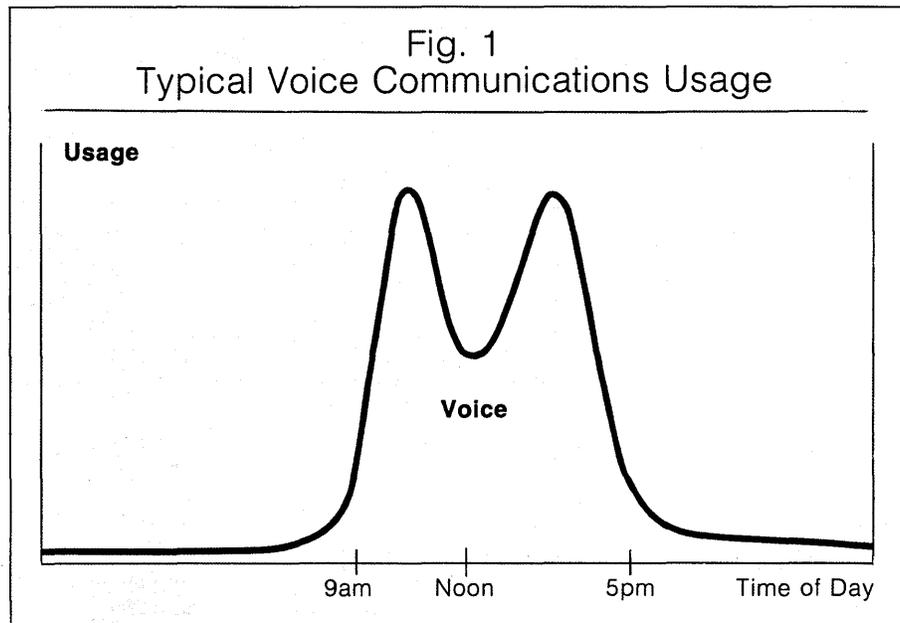
be the "Cadillac" of the communications business. It is a flexible system designed so the user's bandwidth can be dynamically allocated. A given communications capacity can be used during the day to derive a number of voice or data channels, or recombined at night to provide a single high speed data link for bulk file transfer. The capacity can also be reassigned dynamically between any of the network points in accordance with changing traffic requirements.

The high capacity and flexibility will be of great interest to SBS' expected market—those users with the largest communications requirements. Not surprisingly, those coveted top 200 or so companies and governmental organizations are the cream of IBM's (and AT&T's) existing business.

SBS hopes to launch its first satellite in 1980, and begin operation by 1981. Whether or not it can meet these schedules is presently in question. Shortly after the Federal Communications Commission (FCC) gave a go-ahead to SBS' plans in early 1977, that decision was contested in the U.S. Circuit Court of Appeals for the District of Columbia by AT&T, Western Union, Fairchild Industries, the Justice Department, and the Federal Trade Commission. The petitioners contended the FCC had not properly discharged its anti-trust policing responsibility for the common carrier industry. In August of last year, the Circuit Court agreed, and reversed the grant of authority to SBS. The court also remanded the case to the FCC for further consideration as appropriate. At this writing, the FCC and SBS have appealed to the Circuit Court "en banc" and, if that appeal is unsuccessful, might then appeal to the Supreme Court. Should those appeals be denied, there is the possibility the FCC may then be forced to conduct lengthy "full evidentiary hearings" which could impact the operational schedule of SBS.

To really understand SBS, it is necessary to understand its economics and, in particular, to recognize that the key is really not the costs of satellites, dedicated earth stations and dynamic bandwidth allocation. The real economics of SBS will be determined by system utilization. Most existing communications systems, and particularly the telephone network, are subject to severe usage fluctuations resulting from business calling patterns. System loading often looks like that shown in Figure 1, with morning and afternoon peaks, and virtually no usage outside the normal business day.

SBS' goal is to build a network aimed at specific customers and for spe-



cific applications so as to significantly improve system utilization. As shown in Figure 2, SBS hopes to fill in the usage valleys with high speed data, facsimile, and teleconferencing.

Such advanced or developing applications are the heart of the SBS strategy and also constitute the major reason IBM is involved. The biggest questions for SBS in the early '80s, however, will be how long it will take to develop user demand for these new applications, and whether necessary auxiliary equipment will be available. Additional problems to be faced by SBS include rumored cost escalation of the earth terminals, delays of the launch vehi-

cle—the space shuttle, availability of sufficient orbital satellite space, and, of course, resolution of the regulatory and judicial concerns mentioned earlier.

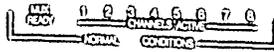
Of all the communications network services planned for the 1980s, both proposed and evolving, SBS represents the most ambitious and, from a business viewpoint, the most risky.

XEROX TELECOM NETWORK

XTEN, the most recently announced system, is to be primarily an electronic message service, but is also designed to serve new applications using high speed data communications. Such applications are document process-

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Supermux 480's replaces up to eight transmission lines with just one. Bandwidth is assigned dynamically without wasting any on idle terminals—double or better the throughput of dumb TDM's.

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Of all the nets planned for the '80s, SBS represents the most ambitious and, from a business viewpoint, the most risky.

ing and distribution, data transmission, and slow-scan teleconferencing.

Like SBS, XTEN is proposing a nationwide satellite-based system to be operational in 1981. The unique aspect of XTEN, however, is its intricacy local distribution plan using economical microwave transceivers operating in the 10 GHz range. Users will communicate from their business locations via this microwave service to hubbing points within their city. These hubs will in turn connect to an earth station per city, which will provide intercity service via the satellite. The local distribution system would work like a high speed party line or packet communications system transmitting at 256 Kbps.

XTEN is aimed at a somewhat broader market than SBS. In a market study that Xerox conducted, the company found 900 corporations in the U.S. with more than 50 domestic locations, and several thousand with more than 20 locations. The 200 city network that Xerox envisions for XTEN could reach 70% of these locations. The Xerox approach, then, is city-oriented while that of SBS is customer-oriented. SBS will serve all forms of communications and does not have to worry about what city a customer is in since individual earth terminals can be placed at whatever customer location is to be served. XTEN, on the other hand, plans to put one earth station in each of the cities it serves and then distribute locally with terrestrial microwave. This means that the XTEN terminals will be much less expensive (several thousand dollars versus several hundred thousand) and geared to a broader market.

For example, the Xerox study showed that for these multilocation companies, 80% of the locations had 50 or less employees. That means that there is probably not enough communications traffic at most of these locations to support a very expensive SBS terminal whereas an XTEN terminal might be cost justified. Thus, XTEN offers a much more evolutionary and less risky approach to the market development of new high speed applications.

The major problem for XTEN is regulatory. Xerox has asked the FCC to assign 130 MHz of the frequency spectrum for services of this type, of which XTEN would initially use one-tenth, with the remainder available for other prospective market entrants.

While Xerox claims that most of the frequency use problems can be resolved, the issue creates planning problems for XTEN. Others in the communications industry have voiced opposition to XTEN, and at least one non-traditional op-

ponent has recently emerged. Litton Industries would like to see the requested frequencies reserved for, of all things, microwave cooking products. Although fallback frequencies are a possibility, XTEN may not know until close to its 1981 proposed implementation date exactly what frequencies will be available.

Aside from this problem, XTEN appears to be a well thought out plan to serve specific new communications markets with a system that can evolve economically as the demand builds.

ADVANCED COMMUNICATIONS SERVICE

The third newly proposed network for the '80s is AT&T's ACS. This is an intelligent data network that will initially concentrate on more traditional data communications applications, and at much lower speeds (9600 bps) than in either the SBS or XTEN networks, although ACS can provide some capability for selected customers to go to 56 Kbps.

ACS is to be implemented using minicomputers at network nodes to add intelligence to existing AT&T intercity digital facilities. The unique aspect of ACS is its offering of many communications processing functions above and beyond simple transmission. This goal reflects the findings of AT&T marketing studies, which show that the proportion of the data communications market attributable to I/O devices and communications processing is growing, while the transmission portion (in relative terms) is shrinking. ACS will be offering services such as speed and code conversion so that it can support, and make interchangeable, transmissions between a variety of terminals—initially some 450 different terminal types. ACS will provide store-and-forward function, flexible addressing, and will allow corporations to establish sub-networks under their own control. As such, ACS is aimed at a broad base of potential customers, large and small data users alike.

The processing aspects of ACS are its biggest regulatory hurdle. The major question is how many of the functions to be built into ACS are data processing in nature as opposed to communications. It is important in terms of FCC policy and the 1956 Consent Decree which presently limit AT&T to regulated communications services. It is certainly true that many of the intelligent options of ACS are currently being handled by data processing industry-supplied equipment in the form of intelligent terminals, remote data entry systems, and general data processing systems. But are these dp-related options incidental to the offering of ACS as a communications service?

The issues are profound and complex; there are several possible resolutions; the interested forces are considerable and powerful. It is not at all clear as to how, when and in what form ACS may come to market. A complete resolution will require a new FCC policy (long under way and overdue) on the convergence of communications and data processing, and may even require congressional involvement to ease the 1956 Consent Decree constraints.

Although AT&T has recently reported some software problems in the ACS system, the service could be implemented for internal AT&T use on a modest scale before yearend 1979. Full development, and regulatory approval, required for commercial introduction may not be forthcoming until 1981, if then. By choosing to adapt its system to today's equipment types and applications, AT&T has chosen an evolutionary and less risky approach to communications in the '80s.

COMPETITION ABOUNDS

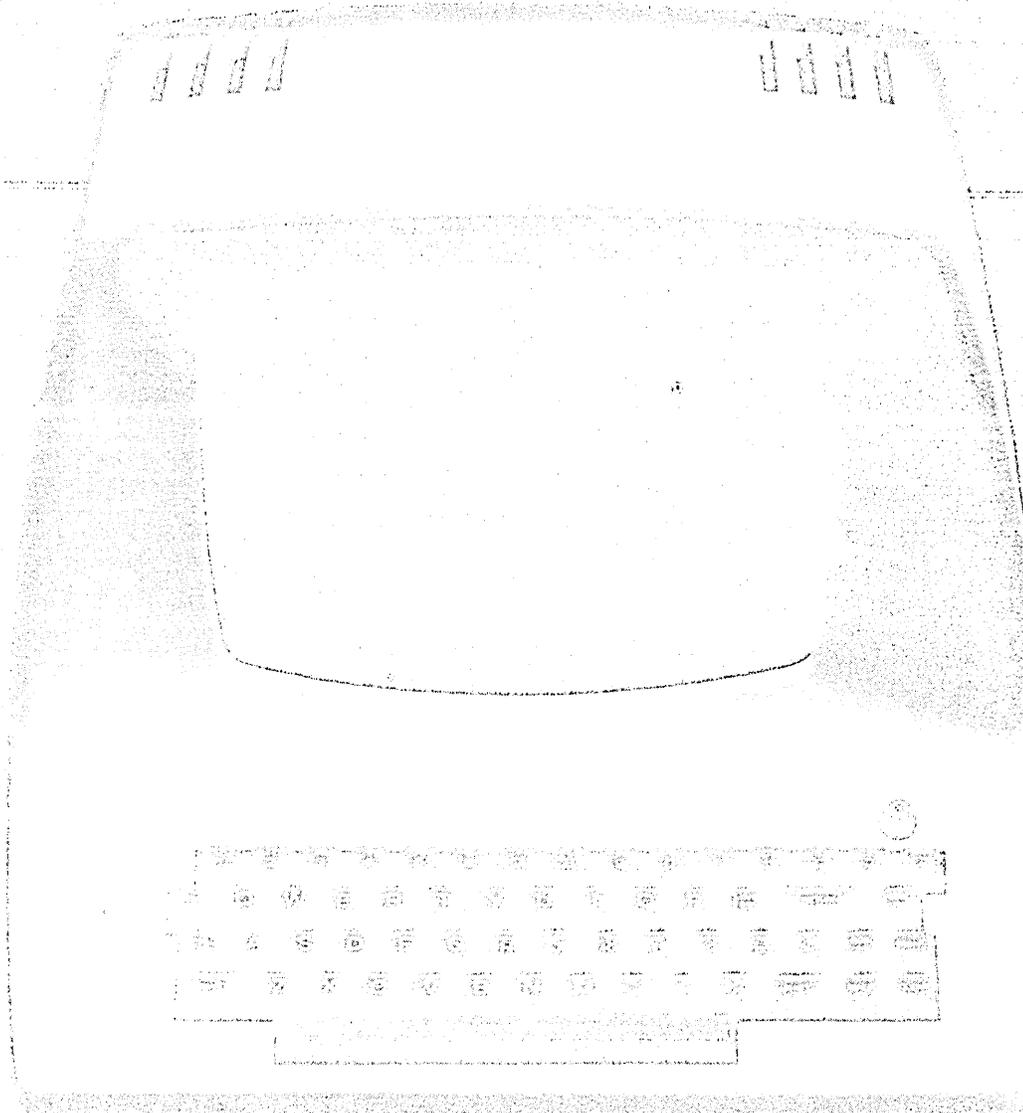
Communications networking in the '80s will be a very competitive business. Users will be in the enviable position of being able to select from an array of options not only to improve their existing businesses but to develop a variety of new applications. ACS, SBS, and XTEN are but three new services, already announced, that are likely to be available within the next decade. More new offerings can be expected, but users should not discount the many existing network services which can handle their voice, video and data needs and which are growing in both size and sophistication. *

WINSTON E. HIMSWORTH



Mr. Himsworth is a vice president of Salomon Brothers, with research responsibilities in the company's Industry and Stock Research Department.

Prior to his move to Wall Street in 1970, he worked for seven years at the Bell System in the area of computer access communications systems, and for three years at IBM in marketing and systems engineering. Mr. Himsworth has also served at various times as a marketing consultant to the U.S. Postal Service and as a manager of its extensive telecommunications operations.



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In two to three years, all mainframe and mini vendors will offer WP products.

WORD PROCESSING 1979: A MARKET IN EVOLUTION

by Amy D. Wohl

The only unchanging parameter in the word processing market is that it always changes. In the past few years, we have gone from a market where the typical system was an automatic typewriter with 5,000 characters of storage on magnetic card to a whole new world where the typical system has a multiline display, high capacity random access media (generally one or two 250,000+ character floppy disks) and a fast daisy wheel printer. Also, we have moved from a market where most products were hardwired and difficult to improve to a world where many products are software programmable and may be enhanced readily by new software.

The focus of users has changed, too. At one time, word processors were viewed as very clever typewriters that could output at high speeds without making mistakes. (In some cases, what they really did was let us mail our mistakes faster!) Now, many users look to word processors as the basis for a whole series of sweeping changes from the manual or semimanual office of today to the automated office of some not-very-distant future. They see these enhanced "typewriters" providing such functions as communications (from messages to full electronic mail capability), administrative support (through the ability to handle calendars, schedules and files), and as an interface to data processing capabilities (both as a data entry terminal and as a "window" into the giant electronic files

stored within the computer)—all this in addition to text editing.

THE MAJOR CONTENDERS

IBM continues to have the largest share of this expanding market, although that share has declined in recent years. With its huge installed base of older mag card-based equipment to protect, some of IBM's newer announcements have been aimed at integrating with this mag card market, rather than breaking completely new ground. Nevertheless, the company offers a relatively full line of products, from the new "super typewriter" IBM Electronic Typewriter, through memory typewriters and armies of mag card models, through its old OS 6 product line and its bright new 6670 copier/printer. Also IBM's Data Products Division (DPD) offers a shared logic word processing product, the IBM 3730. The General Systems Division (GSD) does not currently market a word processing product, although the Office Products Division (OPD) offers word processing on the standalone GSD wp/32. Also, independent software houses offer word processing on GSD's System/34.

IBM has left some attractive spaces, which a number of firms have rushed to fill. For instance, Xerox has a large share of the word processing market, with products in both the non-display, the standalone display (partial-line and full-page) and shared logic portions of the market. Exxon Enterprises, through its Exxon Information Systems Division, has already managed to secure a significant share of the display-based word processing market through its Vydec division. But Exxon has other strings to its bow, and this may

well be the year that its Qyx division starts making substantial shipments of its five levels of super typewriter-to-word processing systems. This innovative product line has already significantly influenced the direction of new word processing announcements through downward pricing and emphasis on modularity and upgradeability.

Wang Laboratories was the flashiest performer in the word processing market last year. It seems the company is not planning to stand still in 1979 either! Wang entered the market quietly with a line of largely me-too cassette-based products. However, in 1976 Wang changed its stance with the announcement of the WPS line of standalone, cluster, and shared logic systems. Subsequent product enhancements and additional product announcements have broadened the Wang offering to one of the largest in the industry. It now has two product lines—WPS and OIS—with OIS offering larger configurations, more storage, and more processing power. OIS may also offer full data processing power through a BASIC option and a high speed copier/printer. Additional goodies are expected soon. Wang has been so successful with its product line that the company is believed to now have the largest installed base of display word processors in the industry.

Lanier Business Products, a front-runner in the dictation business, entered the word processing market in 1976 through acquisition of the American marketing rights to the AES products, manufactured in Canada. Through a series of complex financial deals, Lanier now is a minority participant in a firm which man-

WORD

PROCESSING

PRO

CESSING

PRO

CESSING

PRO

CESSING

With enormous and expanding dollars at stake, a festival-like mood prevails in WP.

ufactures the LTE-1 and 2 and the No Problem, a highly successful display-based word processing system (distinguished by its ads, which never mention word processing at all, just easy typing). It also markets the Wordplex standalone and shared logic systems. Lanier has managed to capture a remarkable part of the market, given the short period since its entry.

Burroughs' Redactron division was once a mighty Number Two in word processing, but has become a low-profile firm since its acquisition. Redactron markets a line of mechanical and display-based word processing products that continue to be attractive, particularly in the implementation of user-oriented features. Recently, Burroughs announced the formation of an office automation division (including Redactron and its facsimile group), and we suspect that further announcements are likely to follow over the next few years.

In fact, nearly every computer manufacturer—large or small—has recognized word processing and office automation as a large, attractive market. At every office automation conference, large numbers of computer vendor planners can be observed taking notes and talking to potential customers. It is likely that over the next two to three years virtually all of the major mainframe and minicomputer vendors will have at least some offerings in this area.

REPRO FIRMS TACKLE WP

Addressograph Multi-graph, now AM International, entered the word processing marketplace via the acquisition route. It followed early acquisitions up with product refinement, the building of a marketing team and now, in 1978, the acquisition of the Jacquard word and data processing product line. AM has vowed that it is in the business to stay and that it expects to be at the forefront of the information processing industry.

A.B. Dick is often thought of in the same breath as AM, primarily because of the firms' heated rivalry in the reprographics industry. A.B. Dick entered word processing before AM, with the announcement of the Magna I, an IBM-compatible mechanical standalone. The company has since amplified its product line with a partial-line display product, the Magna II, and a shared logic cluster system, the Magna SL. British G.E. recently acquired A.B. Dick to provide it with an entree into the office automation market. This is likely to be another long-term contender.

Among other computer vendors

that offer word processing products, we would want to be sure to include:

- Digital Equipment Corporation, the most powerful minicomputer vendor, has a broad line of word processing products including standalone and shared logic word processing-only plus combined dp/wp systems. DEC does not yet seem to have made a significant dent in the word processing market, but this is probably a matter of time rather than of capability. It is one of the computer firms that has the resources to offer powerful, broadly available, full-function office automation systems.

- Raytheon acquired Lexitron several years ago, as the small display-based vendor was in the throes of trying to convert from a cassette-based line to a diskette-based line. Diskette systems are now available and first attempts at a jointly-produced, multi-function system may appear as early as this year. Lexitron was once one of the forerunners in the display portion of the word processing market and it is likely that it plans for another try at that position.

- Four-Phase entered word processing by announcing applications software for an existing data entry system. With refinements to that software—and availability of a multifunction (data entry/data processing/word processing) system, Four-Phase is likely to attract customers who are interested in performing multiple functions on a single system.

- Basic Four entered word processing in a slightly different way, by adding special full-page terminals and applications software to its small computer systems. Not intended for word processing-only environments, the systems are likely to appeal to businesses which wish to add word processing to their dp system—or purchase a multi-function system.

There are still other vendors worth mentioning. CPT is representative of the small independent manufacturer which faces and overcomes all difficulties in making it to the forefront of a highly competitive market. CPT blazed its trail with low-end cassette-based equipment. In the past few years, it has introduced a line of full- and partial-page crt equipment and met with remarkable success. Everybody's favorite for an acquisition candidate, CPT is likely to remain on its own for some time—it's just a little too successful for most acquisition shoppers.

SOME COMERS

Olivetti, long a quiet (and far-back) contender in this market, has recently changed its image with a series of inexpensive, high-performance systems. In addition to the 401 and 501 (a memory

typewriter-like system and a dual diskette word and record processor), it has recently announced a line of electronic typewriters that have elicited much favorable attention.

Two small firms are also well worth noting. Artec sells a single or dual diskette partial-line system which offers a lot of power for its relatively low price. The firm now offers leasing via Greyhound Computer Leasing and is expected to announce enhanced systems in the next year. NBI (rumor says that stands for Nothing But Initials) has a line of single and dual diskette standalone and cluster systems. Its NBI 3000 product gets high points from customers because of the ease of training on this menu-oriented system.

There are, of course, many more firms in this lively market—too many to mention individually. More will enter as the year progresses. However, it is likely that those firms that will remain, in five years or in 10, will be the large multi-product firms whose resources will permit them to be significant contenders in a highly competitive market. This is not to say that the innovative products of small firms are likely to disappear. They are much more likely to wind up on someone's "acquisition hit parade," and appear in enhanced form, under a new label. In a market with enormous and expanding dollars at stake, the festival-like mood should remain for some time. The trick will be for vendors to continue to attract new users with exciting products while maintaining a strong base of satisfied customers. *

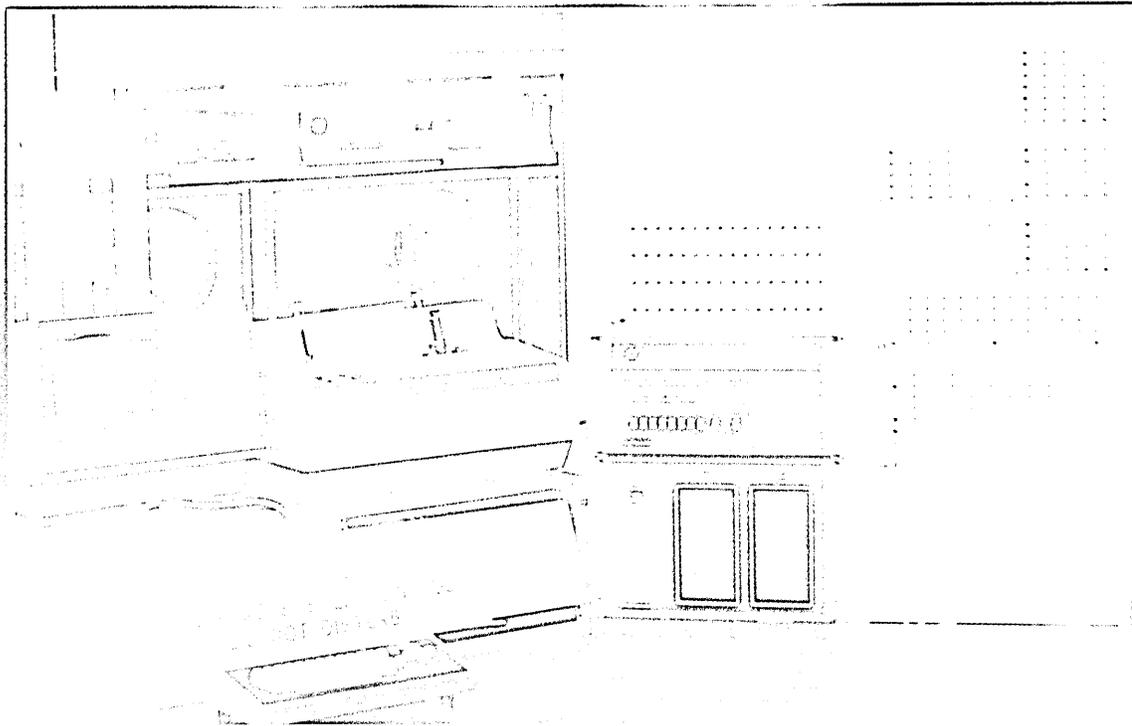
AMY D. WOHL



Ms. Wohl is employed by Datapro Research Corp., Delran, NJ, where she serves as executive editor of the Office Systems Group. In that capacity, she manages four multivolume technical reference services—"Datapro Reports on Office Systems," "Datapro Reports on Word Processing," "Datapro Reports on Copiers and Duplicators," and "Automated Office Solutions."

Ms. Wohl was founder and president of the Greater Philadelphia Chapter of the International Word Processing Assn., and currently serves on its board. She is also a member of the steering committee of the IWP Consultants Council.

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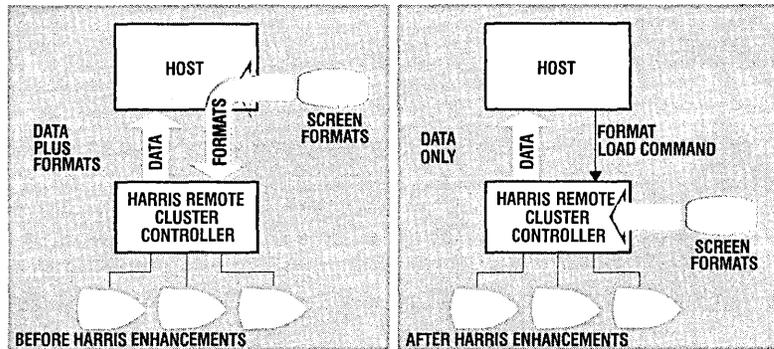
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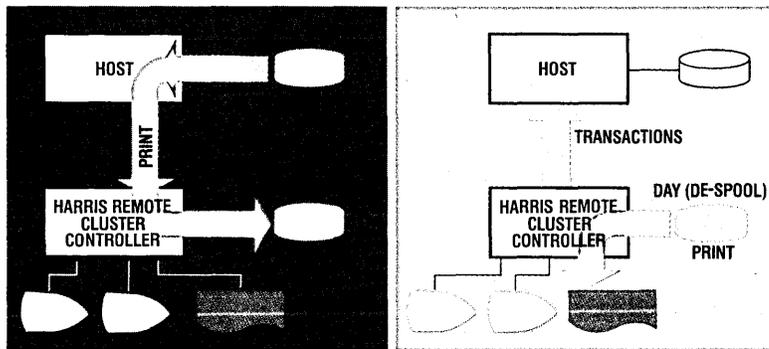


Local Format Storage reduces line loading by storing formats at Harris 8000.

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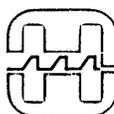
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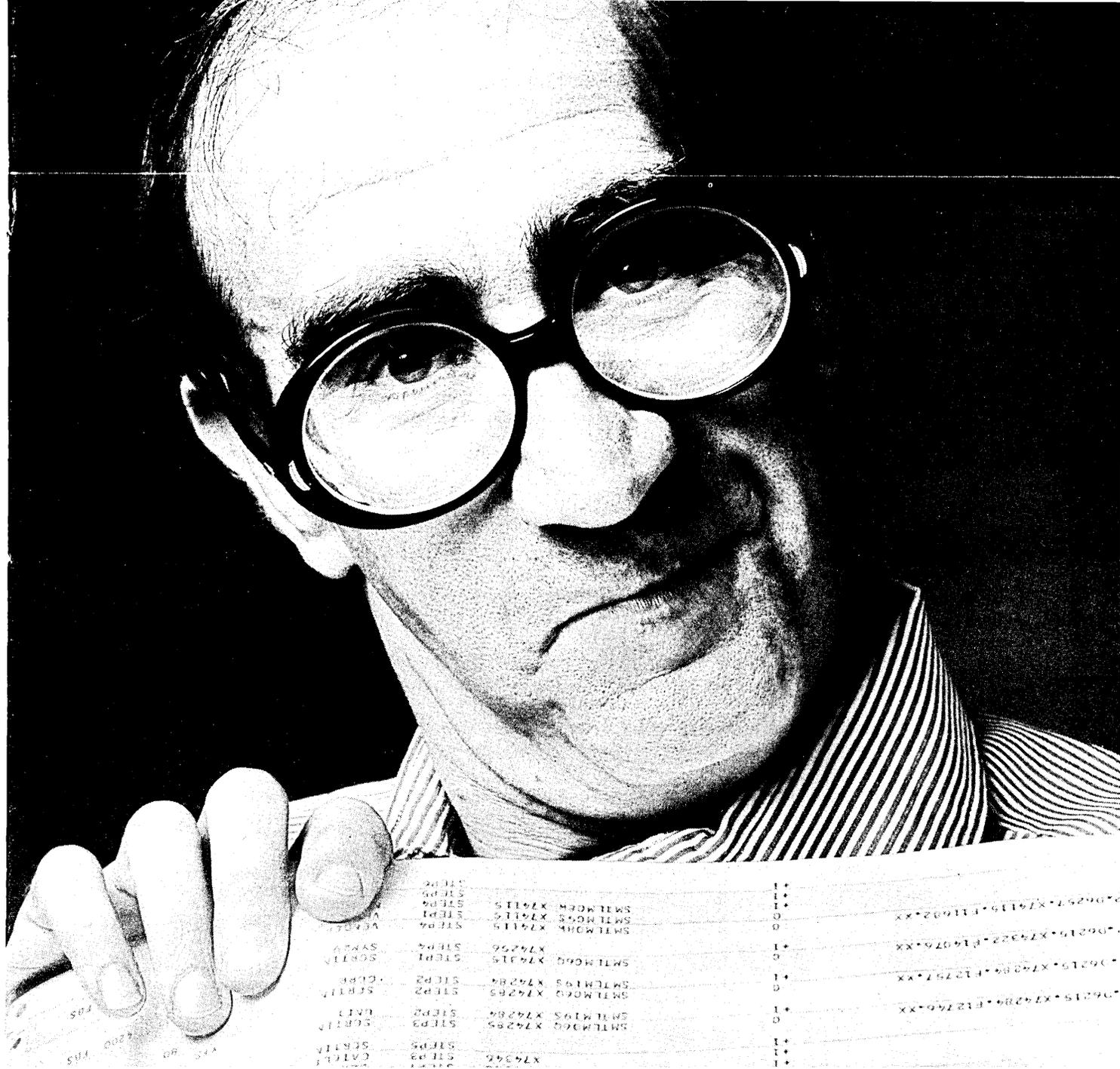


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MINICOMPUTERS: BIG BUCKS FROM SMALL SYSTEMS

by Joseph Payne

Minicomputers, the name given to a dynamic and consistently growing segment of the computer industry, must be one of the most ironic and least descriptive labels that could have befallen any product group. Shipment growth has averaged a healthy 35% per year over the past 15 years, reaching the substantial worldwide level of \$3.5 billion in 1978. Growth has persisted even through two severe recessions, 1970 and 1974, and is forecast to be sustainable at around a 30% rate of gain should another downturn materialize this year. A reasonable estimate would be \$4.5 billion this year, with a greater gain possible in 1980 to an estimated \$6.5 billion. In short, there really is not much at all that is "mini" about the minicomputer part of the computer business.

The first recognized minicomputers in the mid-'60s represented a product group that was relatively easy to define. Early applications for these systems, which sold for around \$20,000, were usually limited to scientific or engineering instrument control, data collection, and analysis. The big three vendors of traditional minicomputers—Digital Equipment, Data General, and Hewlett-Packard—collectively account for about two-thirds of current shipments, but even some of their systems now elude the traditional product definition.

Today the term minicomputer is used to encompass much more than that traditional product, and is often used synonymously with small business computers and intelligent programmable terminals. The span of products can be considered to reach from microcomputers for less than \$1,000 to supermini systems for as much as \$500,000.

Besides spanning an even greater breadth of technical applications than their counterparts of a decade ago, minicomputer-based products are now addressing the need for innovative ways to use computers in commercial applications. They are incorporated into such familiar categories as word processing, small business

computing, distributed data processing, and data communications. And there is every reason to believe that this list will expand.

Applications in both the technical and commercial markets are also spread across the diversity of functions from data capture through data base management, analysis and simulation, and other complex operations formerly the exclusive domain of medium and large scale mainframes. In fact, minicomputers attached to mainframes via teleprocessing, currently the most frequent mode of minicomputer usage, are easing the applications load of the bigger systems. The percent of minicomputers operated in a standalone mode, now the second most common use, should constantly climb as price/performance improvements make these systems cost justifiable for smaller and smaller business establishments. While networks of minicomputers still constitute a relatively small share of the usage mix, that mode too should increase, particularly as distributed processing continues to catch on.

Another new market has recently opened up. The consumer market is now being courted by these characteristically aggressive, marketing-oriented mini-makers. Present product packages include easy-to-use standardized application software, often sold directly to small businessmen through retail stores.

EVOLVING DISTRIBUTION METHODS

The move to retail stores is only one change in product distribution. Even the traditional route, via resellers, is evolving while vendors continually strengthen in-house sales forces to further enhance end user marketing capabilities. The pace of these developments has paralleled key product evolution.

OEM distribution began with the availability of the first low cost programmable processors, products that ushered in the era of computer-controlled machinery and instrumentation. The expansion of shipments to that type of reseller continues at an average pace of between 20%

and 40% per year. As vendors expanded product lines beyond processors to include peripherals and integrating basic system software, a new type of independent reselling force emerged—the software house.

Software houses are rapidly penetrating both the technical and commercial markets for minis, with shipment growth in that sector of the distribution system estimated at a 30% to 40% annual rate. One factor in their favor is a sales approach that emphasizes resolution of individual user problems, as opposed to the general solution-oriented sales pitch from hardware vendors. Another plus for the software house reseller is an apparent demand strength that is more resistant to high interest rates than the hardware-oriented reseller. While the latter is prone to carry inventories during the presale product development and integration stage, the former is marketing a more standardized, easily adapted product.

Development of the end user market seems to have been most responsive to the continuing introduction of sophisticated software, an interesting point considering that the vendors within the group are still viewed as "iron mongers." The breakthrough to significant shipment volumes may have been the introduction of higher level languages in the early 1970s. The most interesting development since then has been the evolution of product packaging into aggressively priced standard systems, first with multitask and later with multilanguage operating systems at the high end stretching far downward to intelligent terminals at the data entry level. The next step should be the introduction of innovative, value-adding applications for intelligent terminals, minicomputers, and systems.

THE MINI FORMULA

There's little doubt that leaders within all segments of the computer industry are geared up for very high volume manufacturing of standard products. Mass manufacturing and aggressive pricing are hardly new ideas for minicomputer

PHOTOGRAPH BY STEVE PHILLIPS



11

Table 1
MINICOMPUTER GROUP
 Relevant Operating Data and Rates of Return

Company	1978 Revenues (\$Millions)	Revenue Growth Rate	Cost of Revenues	Selling— Gen. & Admin. Expenses	Development Expenses	Net Interest Expenses	Pretax Profit Margin	Rate of Return— Avg. Equity
Digital Equipment	\$1,437	30%	56%	20%	8%	0.7%	16%	17%
Hewlett-Packard	500E	35	46 (1)	28 (1)	9 (1)	—	16E	17 (1)
Data General	380	40	47	22	10	—	20.5	24
Wang Laboratories	198	35	43	36	4	2.5	14.5	25
Datapoint	162	40	53	25	7	0.6	18	20
Four Phase Systems	136	35	51	27	7	1.5	12.5	20
General Automation	98	20	59	25	7	1.7	8	12
Prime Computer	94	60	39	33	8	1.6	18	42
Microdata	65	35 (2)	63	18	6	2.5	10	18
Modular Computer Systems	65E	25	60 (3)	19	6	3.5	11	36
Computer Automation	61	40	38	33	9	0.8	16 (4)	27
Systems Engineering Labs.	53	40	54	24	10	2.4	10	44
Tandem Computers	24	100	37	36	9	—	18.5	24
Weighted Average (5)	—	35	—	—	—	—	16	20

- (1) Corporate totals.
 (2) Adjusted for purchase acquisition in 1978.
 (3) Percentages based on 1977 results.
 (4) Because of recent large loss, average pretax margin for last 8 quarters used.
 (5) Weighted by percent of total revenues.
 E = Estimated

companies. In fact, the mini has always been more than just a product; it is also a pricing philosophy and operating formula: constant performance over time for a lower price, averaging about 20% less each year.

Price competition should continue to be a key part of the way companies in the minicomputer segment do business. Price reductions on newly introduced models can be justified by predictable, declining manufacturing costs. That trend, in fact, ties back to the evolving mass manufacturing nature of the standard product concept. Aggressive pricing of new as well as current model products has led to significant expansion of both unit volume and the dollar value of minicomputer product shipments. Marketing toward the objective of rapid unit volume expansion has meant that not only selling strategies but also costs are pegged to that objective.

The intensely competitive aspect of the price reduction mechanism, which is the primary driving force behind minicomputer shipment growth, has at times been viewed negatively by industry observers. These onlookers assume lower prices lead to lower unit profit margins. But if such were the case, that erosion should be evident in published financial statistics. Yet, to the contrary, group margin and rate of return results indicate that the minicomputer group is quite profitable overall.

Companies that have already achieved relatively high margins appear to be sustaining those levels while others are establishing trends toward rising margins. Consistently good results have been real-

ized not only within the competitive environment of the minicomputer market, but also under the external pressure of downward evolution of mainframe prices and upward entry of semiconductor vendor-produced microcomputers.

IMPRESSIVE PRETAX MARGINS

Table 1 shows financial performance data for 13 companies which market minicomputer-based products. In comparison to the minicomputer faction's collective average pretax margin of 16%, the four largest mainframe "dwarfs" had a calculated weighted average margin of about 14%. Moreover, the 400 companies in Standard & Poor's Industrial Group had a margin of between 10% and 11%. The minicomputer group's rate of return on average equity was 20%, while the corresponding statistic for both the mainframe "dwarfs" and the industrials was approximately 14%.

While tight control of manufacturing operations and careful setting of selling strategies are obviously key success factors, Table 1 indicates that there has been no one right combination of expense levels to sustain high profit margins. Digital Equipment, by far the largest revenue generator, has set plans into action that could lead to a considerably higher pretax profit margin and rate of return. The latter is targeted to reach 22% and the former, therefore, would probably rise to 18% or 19%. Data General has consistently generated the highest margin within the group (20.5% in 1978) and could conceivably sustain that level. Hewlett-Packard, Datapoint and Wang Laboratories have raised margins substantially over the past few

years. Two new entrants, Prime Computer and Tandem Computers, have had substantial rapid margin gains while concentrating on the market for supermini systems, one of the industry's most competitive product segments.

Overall, two trends stand out as having potential for significant influence on growth prospects for the industry. First, a greater part of the user community is making the investments of time and money to understand a wide variety of vendors' software contributions. Second, communication systems will be available in the 1980s that facilitate information exchange between different vendors' hardware. Therefore, any vendor with a good product concept should have a market audience to address. Competition has proved to be beneficial to users; it is also beneficial to good competitors. *

JOSEPH PAYNE



Mr. Payne has spent the past 10 years as an investment analyst concentrating on the minicomputer and mainframe manufacturers. In recent months he joined the Wall Street firm of Loeb Rhoades Hornblower & Co. as a vice president. Prior to that he was a vice president of Merrill Lynch Pierce Fenner & Smith Inc., where he served as an industry specialist in the securities research division.

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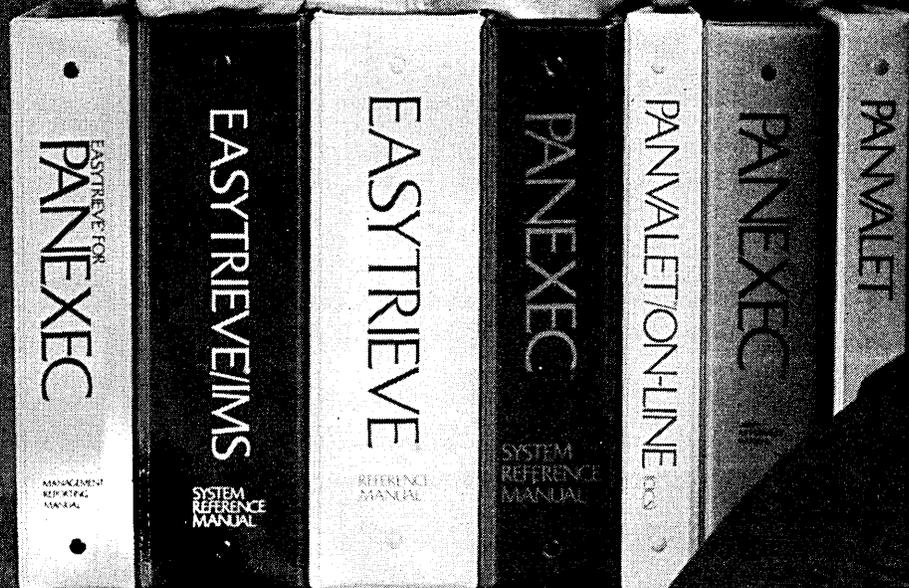
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DISTRIBUTED AND SMALL BUSINESS COMPUTING-- A FAST TRACK

by Stephen T. McClellan

Distributed data processing (ddp) and small business computer systems have exploded from virtually nonexistent markets in the mid-1970s to markets expected to pull in over \$2 billion in revenues this year. What's more, these markets are expected to surge ahead to \$5.5 billion by 1982. With anticipated growth of 35% annually over the next three or four years, it's easy to understand why new vendors are constantly coming out of the woodwork. Even the mainframers are getting into the act. IBM is not standing still either, having recently "embraced ddp with a vengeance." Still, the companies that predominate are the independents which pioneered these market areas, such as Datapoint, Four-Phase, Wang Laboratories, and Management Assistance's Basic Four.

Both the ddp and small business computer markets are presently about the same size at around \$1 billion each this year. Major independent participants are also about the same size, ranging from almost \$200 million in revenues to over \$300 million. The major difference in the two markets is software. Distributed processing equipment vendors offer considerable value added software content and sophisticated communications capability. Small business computer vendors rely more heavily, though not entirely, on systems or software houses for customer application programs.

Another similarity in the two markets is that both groups of vendors sell mainly to commercial end users. This, of course, is a major reason the independents are flourishing. The mainframers are understandably hesitant to de-emphasize customer dependence on large centralized cpu's and the minicomputer manufacturers are not particularly strong in the commercial end user markets. While the mainframe and minicomputer suppliers are far from absent in these markets, their respective drawbacks leave plenty of

room for each of the independents to do its own thing.

DDP THE WAVE OF THE FUTURE

The advantages are considerable, including reduction in central computer load and response time, improved automation and management reporting at lower levels of the user organization, and lower cost.

The concept got off to an auspicious start with the advent of the intelligent terminal in the late 1960s by Viatron Computer Systems, which subsequently went bankrupt in 1970. Viatron's concept was simply ahead of its time. By 1975, however, several companies had achieved success with the idea. Profits rolled in as revenues hovered around the \$50 million mark at many companies that year, as in the case of Datapoint, Sycor (now Northern Telecom), Four-Phase, and Incoterm (now Honeywell). Data 100 (now Northern Telecom) even had somewhat higher revenues at that point. Since '75, growth has been straight up. New players continually enter the game and many have managed to gain a noticeable foothold, including IBM, Harris, Digital Equipment, Hewlett-Packard, and Raytheon.

Datapoint is a prime example of a ddp success story. Victor D. Poor, vice president of research and development at Datapoint, pioneered disbursed processing technology at the company in 1971. This year the company's revenues will be well over \$200 million. Besides having a broad based hardware product line, its systems have a high degree of software content. Going one step beyond "disbursed" processing, Datapoint's recently announced Attached Resource Computer (ARC) system permits an arbitrary number of processors linked together to function as a single, integrated computer. This is no easy feat.

Another bold new direction is Datapoint's move into the telecommunica-

Though still a nascent concept, the trend toward ddp appears to be the wave of the future.

tions market. This is a strategy that other computer companies are also expected to take, as has already been seen in the case of Storage Technology. And, it's a natural because the technology is similar. Moreover, the telecommunications market offers an outstanding growth opportunity, expanding every bit as fast as distributed processing.

Four-Phase Systems is another leader in the distributed market. The company stresses the "clustered" concept, or a processor with several intelligent terminals clustered around it in close proximity. It has been so successful that revenues will push \$200 million this year. Four-Phase is more vertically integrated than most companies its size, manufacturing all its own LSI semiconductors. It is also taking the tack of emphasizing word processing, last year landing the largest order for word processing gear in history from the Social Security Administration.

THE MELDING OF WP WITH DP

The melding of word processing with data processing is occurring rapidly throughout the industry. Wang, Basic Four and Raytheon currently offer both capabilities, as do IBM, Burroughs, and Digital Equipment. Increasingly, these two functions will be tied together in shared logic systems at the user site. So, other ddp vendors will soon offer such products.

Other vendors are going in still different directions. The natural evolution from data entry devices to distributed processing systems has led Pertec-CMC, Inforex, Mohawk Data Sciences, and Data 100 into this area recently. Even though entering the foray late, these companies have the advantage of existing customer bases, service and support. Harris' approach to the market is with a broad range of products—remote batch, data entry and interactive terminals, the latter stemming from an acquisition of Sanders Data Systems Group in 1977.

Sycor, like Four-Phase, empha-

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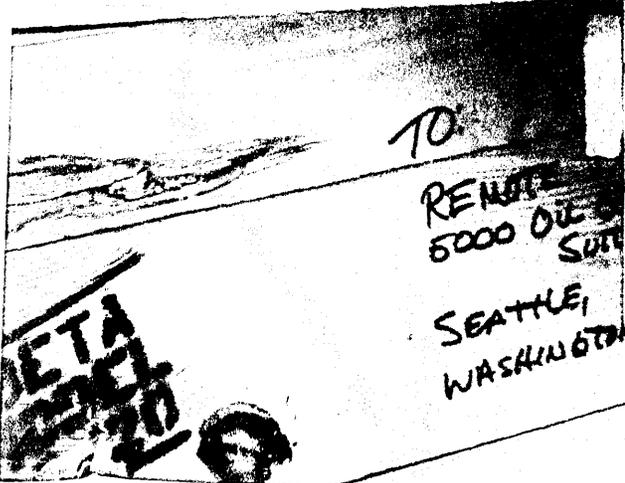
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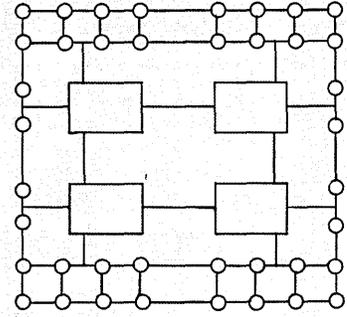
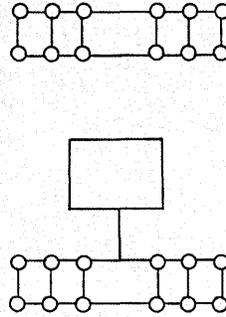
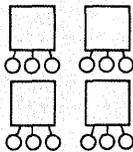
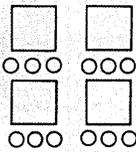
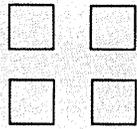
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DISTRIBUTED DATA PROCESSING EVOLUTION

□ Mainframe Computer

○ Minicomputer, Shared Processor, Intelligent Terminal



1965

Stand Alone Mainframes

1970

Mainframes and Minicomputers

1975

Mainframe and Minicomputer Networks

1980

Distributed Processing, Clustered and Centrally Controlled

1985

Integrated Distributed DP Networks, Decentralized Control

sizes the clustered intelligent terminal concept for distributed data entry and processing, but is largely oriented to host computer control. Its product line may eventually merge with Data 100's now that both comprise the Northern Telecom Systems Corp.

As for Raytheon, its niche was initially in intelligent terminals but recently the company has introduced a more complete distributed system. It has penetrated the airline reservations market effectively, and its Lexitron subsidiary is strong in word processing.

Minicomputer companies are similarly active. Digital Equipment has molded its Datasystems line out of its PDP-11 minicomputer engine and also offers "smart terminals" and PDP-8 based word processing systems. DEC's particular strength lies in the manufacturing market. Hewlett-Packard has used its 21MX desktop computer technology and evolved it into a new distributed data processing series of computers, along with a line of interactive terminals. Texas Instruments' Series 700 intelligent terminal system is aimed more toward central computer controlled networks, as evident at its United Airlines and Westinghouse installations. Data General has software which enables distributed processing on its ECLIPSE line. General Automation has put together a sizable "distributive" system for Bank of America, and Computer Automation has received a major award from Firemans Fund Insurance Companies for its SyFa system.

And, of course, IBM will not be denied. While the ddp movement has been led in large part by the independents, IBM's customers are also demanding such capability. So, the company has joined the procession in a big way, despite the potential loss of strong customer account control if user purchase decisions begin to

be made at lower levels in a decentralized data processing environment.

IBM's 8100 product line aggressively embraces "cooperative network processing," even though it still emphasizes a measure of central site control. The 8100 price is competitive, it accommodates other manufacturers' computers, and full production is scheduled for 1980. Backlogs are enormous. This and other future IBM product entries will play a major role in the distributed processing market.

SMALL BUSINESS COMPUTING

As in the ddp arena, it was the independents that pioneered the market for small business computers. Wang Laboratories introduced its 2200 model small computer in 1972. Microdata announced its REALITY in 1973. Thereafter followed IBM with the System/32, Digital Equipment with its System 310 (Datasytem), and Burroughs with its B80 computer. Basic Four and Data General have more recently become factors in this market, with both achieving noticeable market share.

Small business computers are targeted for commercial users whose revenues usually range from \$1 million to \$3 million. A typical system contains 4K of main memory, is user programmable, has some limited accounting type software application packages, and ranges in price from \$5,000 to \$100,000.

Independent vendors such as Wang and Basic Four hold a major chunk of the small business computer market. This is perhaps due to certain natural advantages over the minicomputer and mainframe computer companies: knocking on doors is expensive; selling such small ticket items, virtually one at a time, inherently causes lower profit margins; price is a key factor in the purchase decision; too

much corporate overhead is a disadvantage. In short, grass roots, local customer contact may be more important than sophisticated sales persons articulating "computerese."

IBM IS THE EXCEPTION

One exception to this theory is IBM, which rules the roost. IBM's thrust in small business computers centers around its model 5110 system, priced starting at around \$18,000. Its marketing approach relies on heavy advertising and executive seminars at its sales offices in the hope that customers will come to it rather than vice versa. This approach leaves an opening for those vendors which are willing to incur the expense of direct marketing. Questions remain, however, as to whether the IBM method may eventually prove more economical and just as effective. On balance, while it leads the market with a 30% share, IBM's presence in the small business sector is currently neither aggressive nor overwhelming. Although more products in this market are expected from IBM, the company is likely to continue putting its heaviest emphasis on somewhat larger computer systems for larger users.

Reigning second only to IBM is the leading independent, Wang, with a 20% market share. Its success stems from an early identification of and thrust into the small business sector. Wang pioneered the market back in the 1960s with its programmable desktop calculators, products which it dared not call computers for fear of customer resistance in an industry dominated by IBM. Today Wang offers a full line of processors and peripherals for this market, with prices ranging from \$5,000 up to \$60,000. Interestingly, most of its systems are interactive, allowing multiple users to simultaneously share the processing capability. This verges on dis-

tributed processing. The company is also a powerhouse in word processing. Marketing capability is formidable for a company its size.

Basic Four, which comprises 86% of parent MAI's earnings, originally approached the small business computer market with broad and effective marketing and maintenance—but as merely a distributor rather than a manufacturer. Today it is vertically integrated to where it produces its own products. Still, its major strength remains marketing and the maintenance capability afforded by MAI's Sorbus, the world's largest independent computer maintenance organization.

The vast array of other competitors in this market are also flourishing. Digital Equipment has a respectable market share, running third behind Wang and IBM. Its new computer store marketing concept seems to be taking hold. Burroughs and NCR emphasize this low end with excellent products, effective marketing, and the added advantage of large existing accounting machine customer bases. Both are gaining market share, with Burroughs currently ranking fourth behind DEC.

Hewlett-Packard, a strong early entrant with its desktop computer line, remains a factor although it currently emphasizes other markets more intensely. Microdata was also an early leader in the market and remains a viable competitor, but its share has slipped in recent years. Univac is also making bold moves here with its BC-7 machine. Companies which are currently small but are making a lot of noise include Qantel, Century Computer, Cascade Data, and Randal Data Systems.

In total, there are over 100 participants. The market is fragmented and immature, and there is abundant business for all at present. While the line-up is likely to change considerably before the dust settles, current dynamics offer excellent opportunities for those companies that are able to keep pace. *

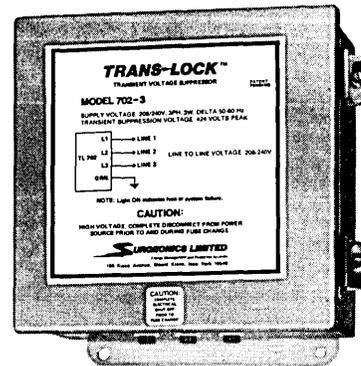
STEPHEN T. MCCLELLAN



Mr. McClellan joined Salomon Brothers as a vice president in 1977 after six years experience as a computer industry securities analyst and vice president at Spencer Trask & Co. Inc. He has been president of the Computer Industry Analysts Group and is a chartered financial analyst. Prior to Wall Street, Mr. McClellan spent four years as computer and office equipment industry analyst at the U.S. Department of Commerce, and also served as a communications and operations officer in the U.S. Navy.

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Taken from the 1978 annual report.

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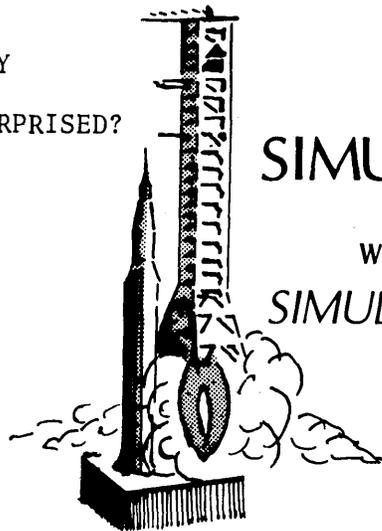
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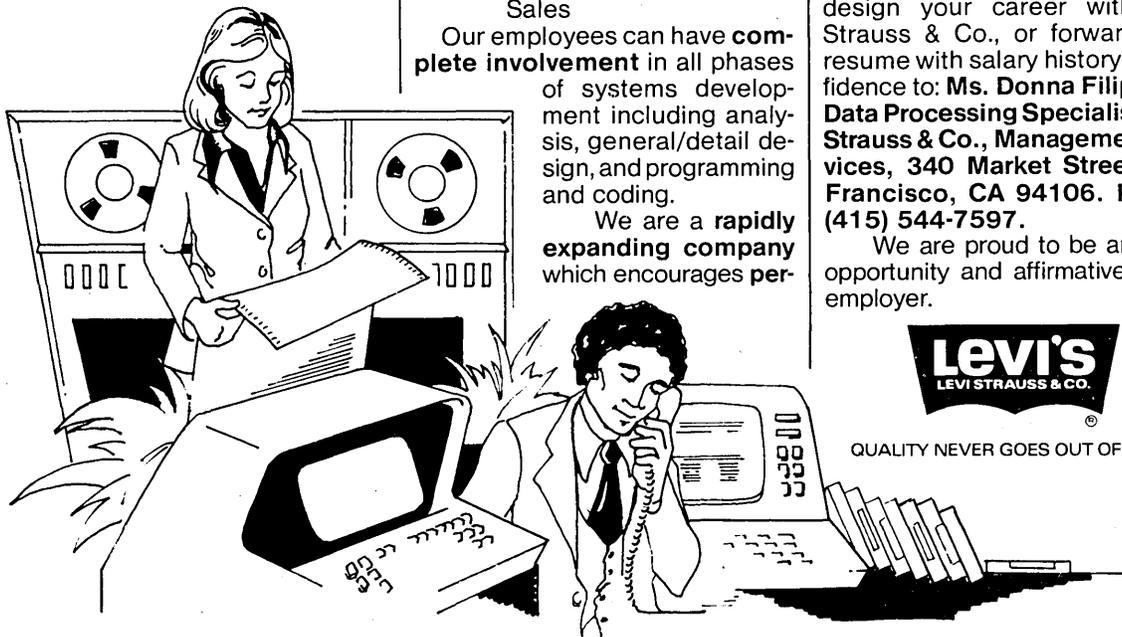
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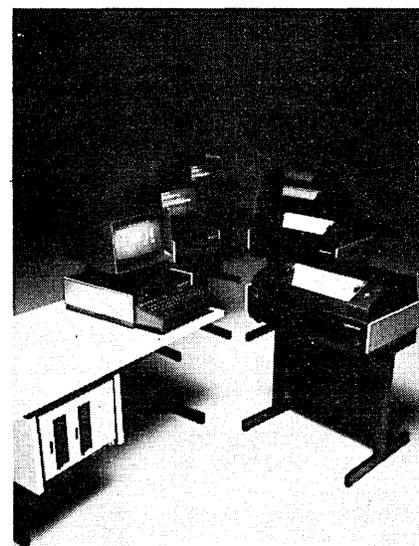
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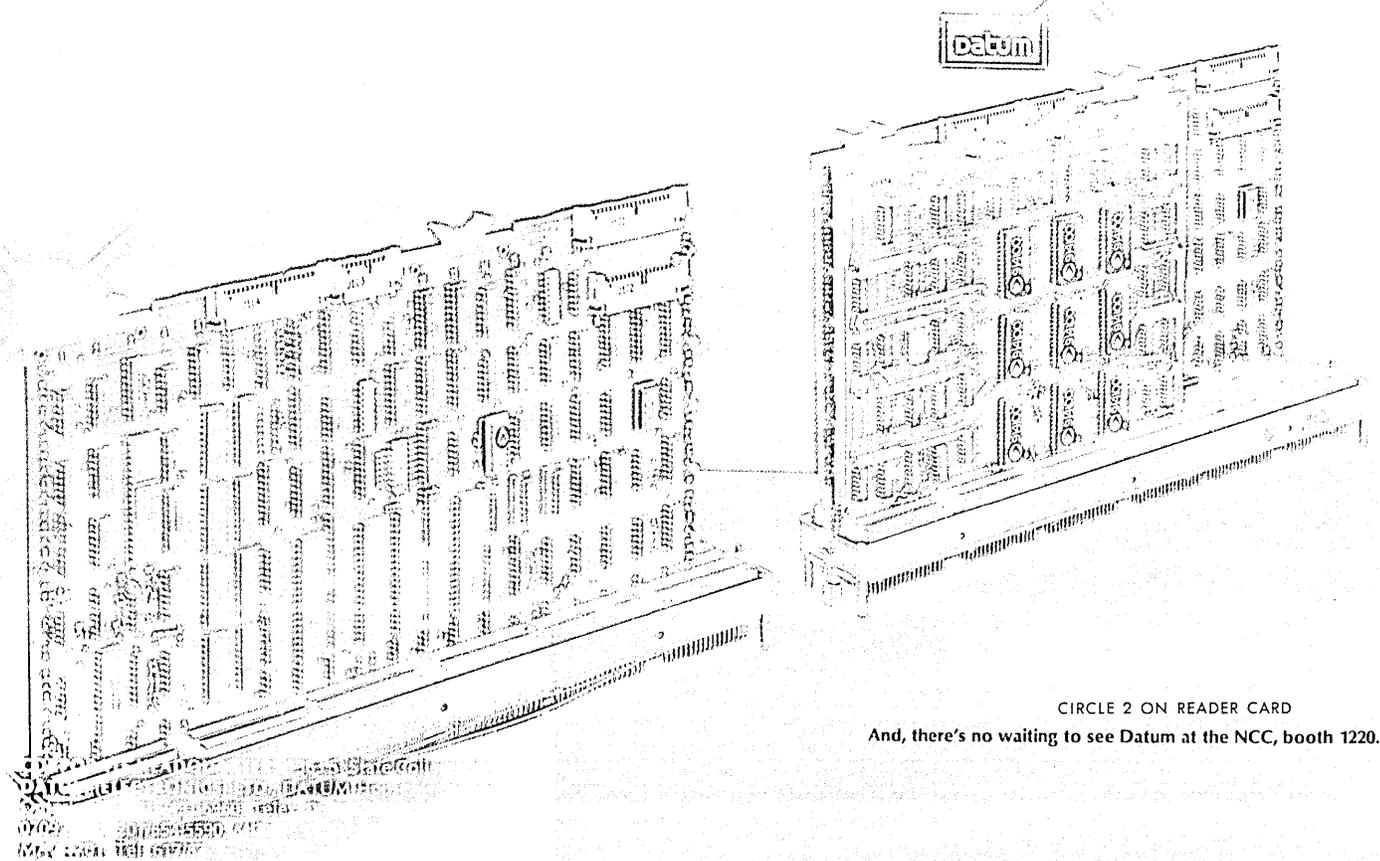
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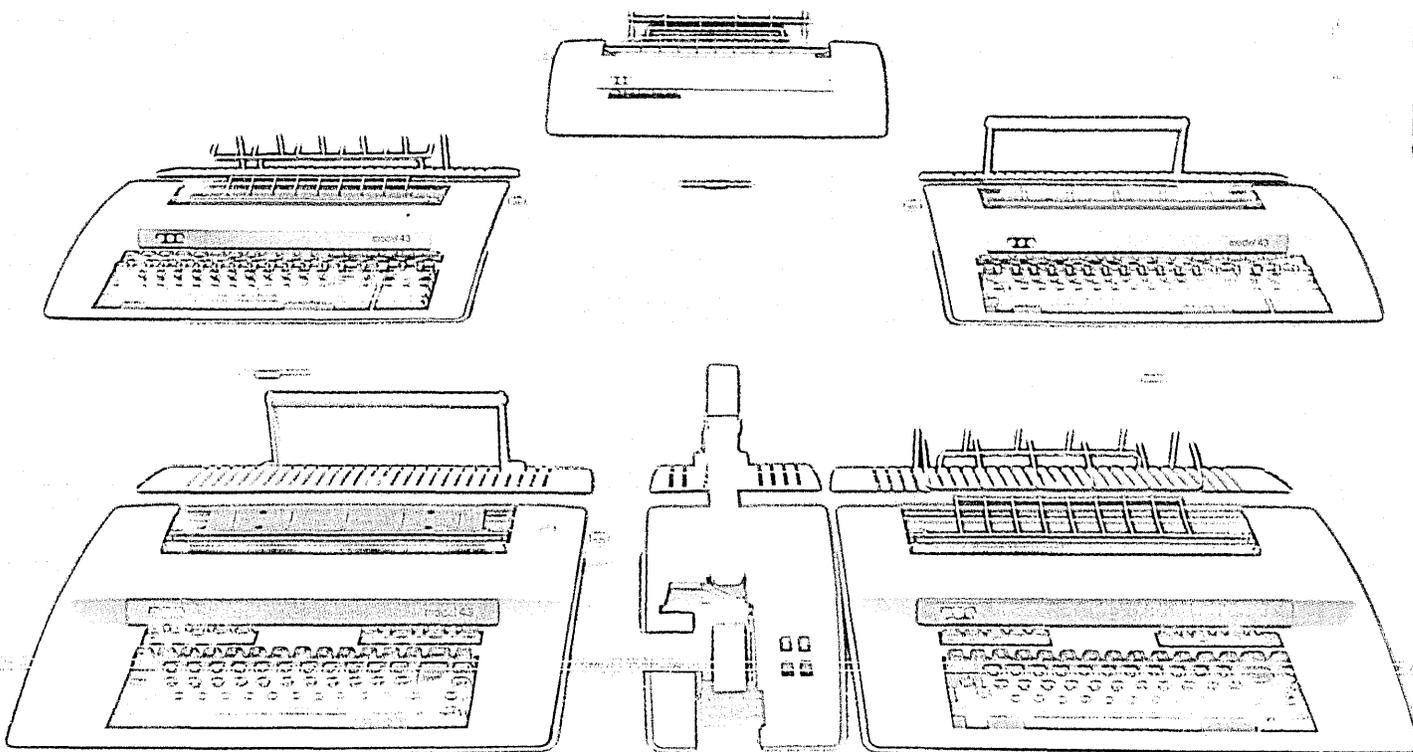


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