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JUNE/4.00 U.S.A.

THE TOP 100

New from Kennedy

Model 6809 Data Streamer™

Kennedy does it again. Data Streamer is ideal for Winchester disk drive backup where fast starting and stopping is not required. Designed to emulate the performance of the IBM 8809, Data Streamer has a wide range of features:

- Tape drive includes built-in industry standard formatter—it's a compact package.
- Contains only four moving parts—hence a much higher MTBF than normal tape drives.
- Streams (read/writes) at 100 ips or, in start/stop mode, 12.5 ips.
- Data Streamer can be mounted in three ways—vertically in rack, horizontally in drawer or horizontally in a low boy console.

Model 6809 has been designed and built with all the innovative features and reliability that Kennedy products are known for. Additionally, Model 6809 is much less expensive than traditional tape transport/formatter combinations. It's the ideal answer for large capacity disk drive backup.

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CIRCLE 1 ON READER CARD

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AM Jacquard Systems

The AM Jacquard 121 entry level computer system does two things for your office. Word and data processing.

And it does a whole lot more. It interfaces to AM Varityper phototypesetters, can easily communicate with mainframes, and can handle electronic mail and a multitude of tasks that other systems can't. And all for about $13,500 per screen.

This efficient office automation system can grow with your business, too. Buy it now with only two workstations and add more, for under $5,000 per screen, as you need them. The J121 offers ease of operation, expandable on-line storage, high speed throughput, and comes with a choice of two letter-quality printers.

The AM Jacquard J121 is designed to boost your office's productivity and profitability. No one, but no one, offers so much versatility and flexibility for the money. And we know what we're talking about. Our parent company, AM International, Inc., has been designing products to modernize offices for more than 90 years.

If you want to know more—and you should—about our Datapro award-winning J121, contact AM Jacquard Systems, the Informationists, a division of AM International, Inc., Dept. 777, 3340 Ocean Park Blvd., Santa Monica, CA 90405. (213) 450-1242, Ext. 777.

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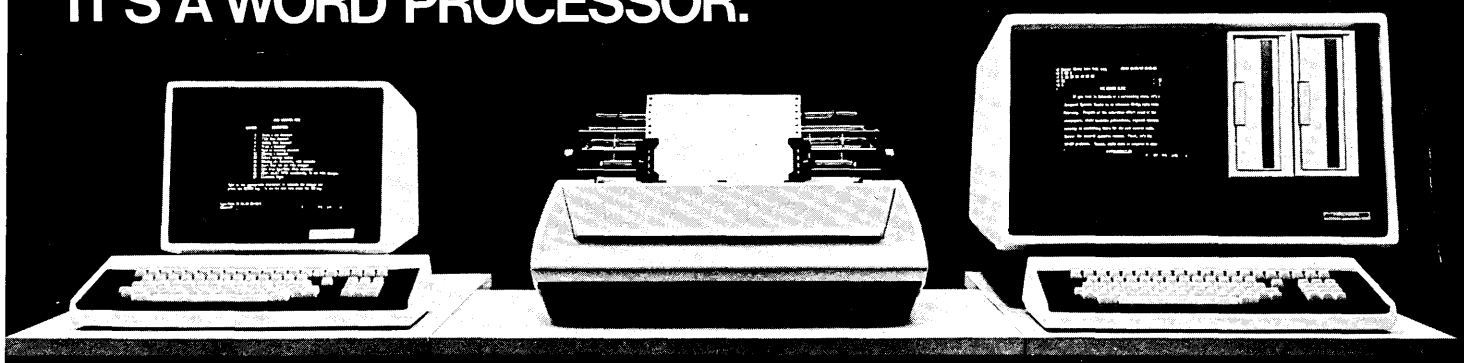
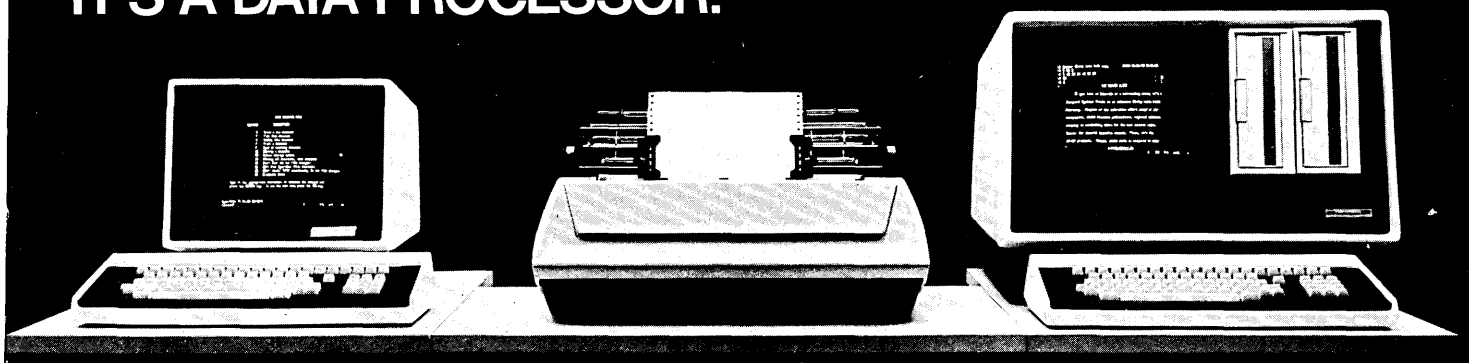


IT'S A DATA PROCESSOR.



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CIRCLE [illegible]

DATAMATION 81®

JUNE 1981/$4.00 U.S.A.
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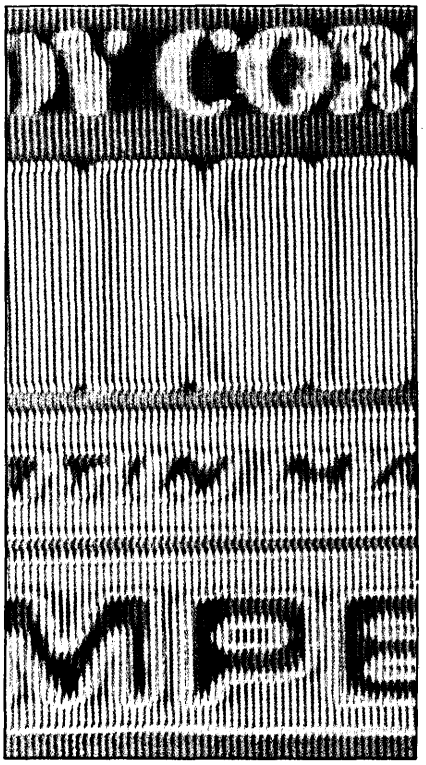
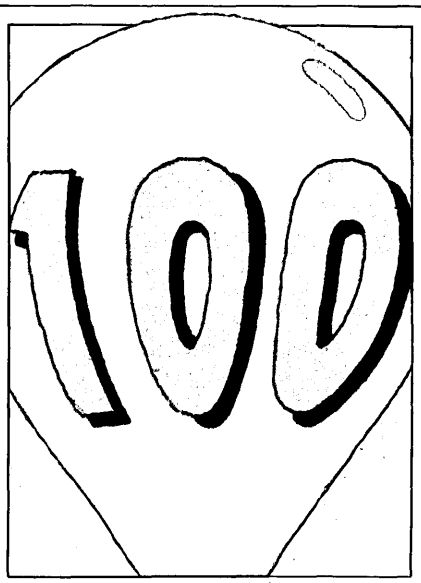
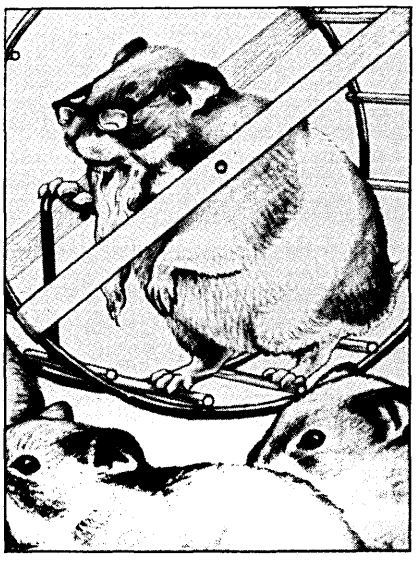
FEATURES





NEWS IN PERSPECTIVE

DEPARTMENTS



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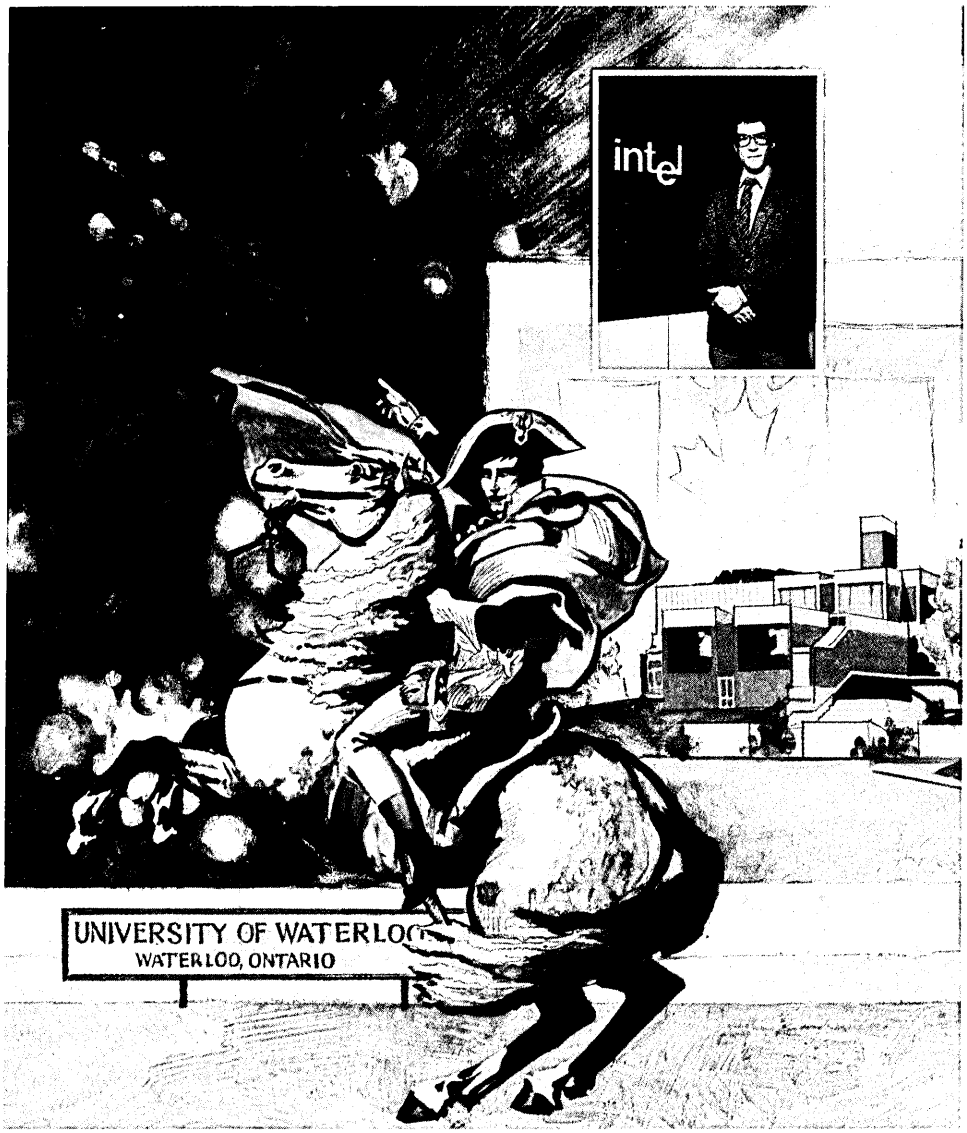

At Waterloo, Intel's FAST-3805 won.

The FAST-3805 saves the University of Waterloo thousands of dollars each month while it increases both user and system productivity. Waterloo's Associate Director-Systems, Romney White, explains how . . .

"Compared to any other DASD, the FAST-3805 in Native Mode* is the fastest thing going. It has a large enough capacity to satisfy the biggest users around, and it's a cost-effective solution. In other words, the FAST-3805 is really an ideal paging device.

"The FAST-3805 reduces paging overhead and increases paging capacity. It's an economical solution for extending current CPU resources."

Increases productivity

"We discovered that our 4341 by itself supported only 25 active users. With the FAST-3805 we were able to double the number of active users at less than half the cost of a new processor. And those users got more consistent and faster response times.

"We found the FAST-3805 eliminated page wait and the page wait that masquerades as I/O wait, as well as reduced device, controller and channel contention. The result was more users who are more satisfied."

Fast paging saves dollars

"On our 3031 we had a page wait of about three percent with two 2305s. However, when we switched to a FAST-3805—which brought in pages about two and a half times faster than the 2305s—the page wait went to zero. In our situation, switching to the FAST-3805 saved us a couple of thousand dollars a month in system and people time. But a user who has a 3033 with a 15 percent page wait could save $15,000 to $20,000 a month.

"Not only did the FAST-3805 take the place of two 2305s and a 2835 controller at Waterloo, but it helped us avoid the purchase of another 2305/2835 system. With the FAST-3805's increased capacity, we were able to stay within our budget . . . and still meet the increased needs of our users.

"Because we wanted to get the most out of our current system, we saw the FAST-3805 as a good investment. We looked at the available paging devices and determined that the FAST-3805, because of its micro-coding, offered the most flexibility.

"The installation was a breeze. Service has been good—and the unit is essentially self-diagnosing. The FAST-3805 is much more reliable than our previous disks.

"In summary, Waterloo got more capacity, better performance and better reliability for less money with Intel's FAST-3805 semiconductor disk."

If you are interested in learning how the FAST-3805 can unleash your system resources and increase your personnel and system productivity, contact Intel's Marketing Information Office at 512/258-5171. Or clip and mail the coupon below.

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CIRCLE 7 ON READER CARD

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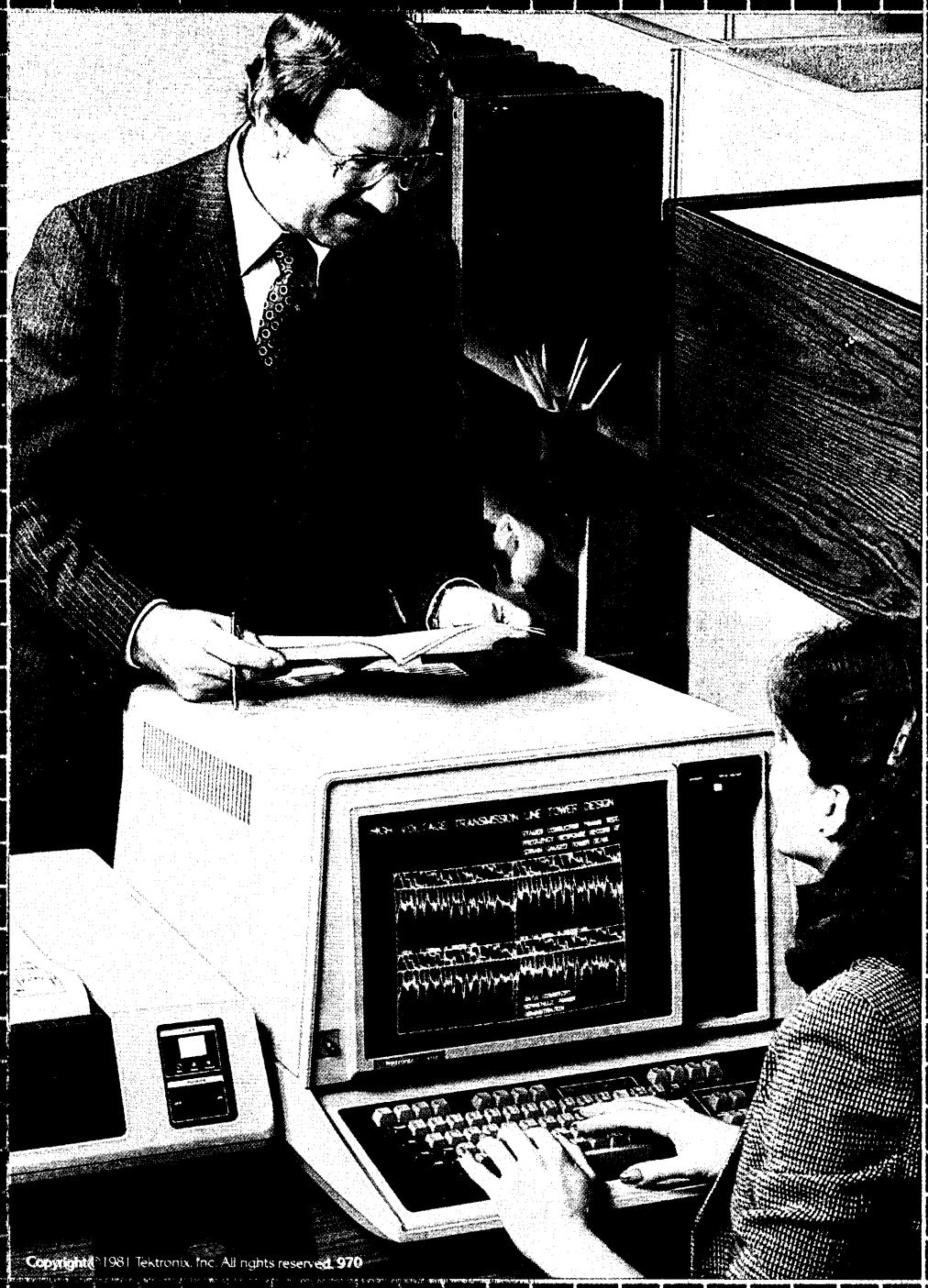
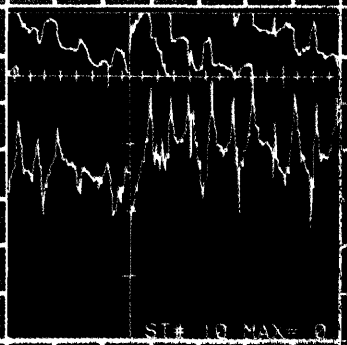
*Native Mode and 2305-emulation are two personalities of the FAST-3805 currently available.

The Tektronix 4112 Computer Display Terminal



You can define from one to sixteen viewports on the 4112's 15-inch raster display. You can use local zoom and pan capability to select and magnify any portion of the 4096 x 4096 addressable points screen. Return to the full picture, and the terminal will automatically bracket the detail section last displayed.



Zoom and pan. Overlays and gray scale. Retained segments and panel flooding.

What it does locally is international news.

The new 4112 not only reduces host connect charges and transmission traffic. It does things no raster terminal has ever done before. Zoom in on most other terminals, and all you see is the same information—only less of it. But with the 4112's 16 million point addressability, you can zoom in off-line to see many times more detail!

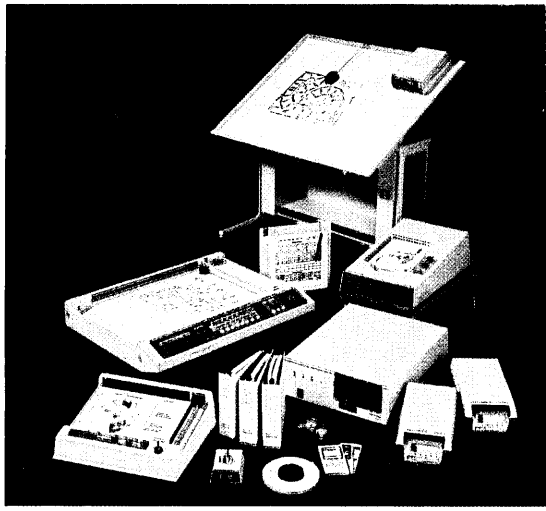
Or, pan at any magnification across the entire display. At any time, define a scrollable dialog area anywhere on screen, to keep alphanumeric commands from interfering with workspace.

Local multiple bit plane capability is unprecedented, even by terminals under host control. You can build and store displays in as many as three layers, so you can recall the same outline, for example, for several displays. Or, you can enhance displays by easily incorporating up to eight shades of gray!

Powerful local intelligence lets you retain picture segments, or design symbols and character sets, locally. You can create, then store and manipulate picture elements off-line. Store segments on expandable RAM or on optional integral flexible disk. Shade polygons quickly with an easy-to-use panel flooding feature.

Leave it to the graphics leader to offer the first raster terminal designed for high resolution graphics. Of course, Tektronix made the 4112 compatible with its entire family of terminals, including the new, intelligent 4114, so project teams can share software—such as the modular Tektronix Interactive Graphics Library—storage disks and peripherals, while building systems around individual needs.

Let your local Tektronix sales engineer show you the whole story. Or call toll-free, 1-800-547-6711 (in Oregon, 1-800-452-6773) for product information or OEM quotations.



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Information Display Division
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CIRCLE 8 ON READER CARD

Twenty Years Ago/Ten Years Ago

LOOKING BACK

TOMASH ON MEMORY

Ampex and Telemeter Magnetics merged in 1961, prompting a DATAMATION interview with the then Ampex vp Erwin Tomash. Tomash concentrated his comments on Ampex's future, but digressed occasionally to discuss the direction of the memory industry. He believed that memory would become multilevel and associative, similar to human memory. Tomash said that humans have limited direct access memory, but "great memory capacity once we trigger the various levels." He also predicted "the computer of the future is going to have, in addition to direct access storage, a small arithmetic organ, a large read-only memory storing function tables, and a number of levels of memory storing function tables, and a number of levels of memory of various characteristics." On the topic of storage elements, Tomash claimed magnetic cores rose in popularity only because there was no effective competitor, and that thin films were not currently advanced enough to present real competition; they were too expensive and too slow. The potentially most successful storage device would have to be small, fast, and inexpensive—a tall order, and a goal for Ampex's research and development labs.

REPORTEDLY, THERE WAS A REPORT ...

Frost & Sullivan, New York-based research firm, completed a report on terminals, forecasting terminal sales out to 1980. The report found that remote batch terminals were expected to account for one-quarter of terminal sales by 1975, and for one-third of the sales by 1980. Six terminal categories were cited in the report: teletypewriters, alphanumeric data display, graphic data display, audio response, remote batch, and "miscellaneous." The report predicted that, collectively, these terminals would reach a sales peak of $3 billion by 1980. Remote batch terminals—both satellite computers and specialized batch terminals—were estimated to account for $1 billion in sales by 1980. Audio response terminals were listed as the second fastest growing segment of the terminals market.

UNISIST EXISTS

"A worldwide science information system which would eliminate duplication in research and put vital scientific data at the fingertips of scientists in both developing and developed countries may be on its way." After three years of feasibility studies by a committee from the United Nations Educational, Scientific, and Cultural Organization (UNESCO) and the General Assembly of the International Council of Scientific Unions (ICSU), such a system moved into the blueprint stage. The three-year study and its ensuing report were called UNISIST. UNISIST results showed that "a world scientific information system . . . is not only feasible but desirable and necessary if the information needs of the world's scientists are to be met. . . ." The UNISIST report made 22 recommendations under six general headings: tools of system interconnection, effectiveness of information services, responsibilities of professional groups, institutional environment, international assistance to developing countries, and the organization of UNISIST. As a preliminary step, the UNESCO and ICSU committees recommended establishment of a computer-based international registry of scientific journals. To help set up the registry, the French government offered 1 million francs, and negotiations were held to speed up the development. Implementation discussions were to occur at an Intergovernmental Conference for the Establishment of a World Science Information System in October of '71, in Paris. (In January 1981, UNESCO released its latest UNISIST report. The program is based in Paris and has a total membership of 154 countries. UNISIST focuses on educational and training needs of international scientific and technological communities.)

—Deborah Sojka

New Spinwriter 3500 Series.

Birth of a new concept in letter-quality output.

NEC's new Spinwriter™ 3500 series is the first comprehensive printing system in the letter-quality office printer/terminal market. The Spinwriter 3500 series includes eight new models.

Starting with a new medium-speed 35 CPS print mechanism, the Spinwriter 3500 printer family adds five pioneering dimensions to letter-quality printers.

One: simple, elegant design. Each new Spinwriter 3500 is 30% smaller and lighter, uses 60% fewer parts, single-board electronics, a one-piece universal power supply and digital controls that replace many mechanical functions. It's the size of an office typewriter.

Two: integral forms handlers. Ten of them, designed with the mechanism. All are user changeable. Some are user upgradeable: like a single-bin sheet feeder that can add a second bin or envelope feeder. There's also a cut-sheet guide, bi-directional tractor, push tractor with tear bar and copy separator, manual inserter and bottom feed.

Three: new uptime standards. The Spinwriter 3500 has a 3,000-hour MTBF, which means about two years between failures. And no preventive maintenance or routine lubrication. Ever. With only three major spares, MTTR is reduced to 15 minutes!

Four: word processing assist. Lets the terminal perform WP systems tasks like automatic bi-directional printing, auto PS printing, auto underlining, shadowing and bold printing. Using all the Spinwriter type styles of up to 128-character thimble print elements.

Five: immediate attachability. The Spinwriter 3500 comes in eight printer or terminal models with Qume, Diablo, Centronics, RS-232C interfaces, and is functionally compatible with Spinwriter 7700 and 5500 Series.

Find out more about the light, quiet, compact, reliable Spinwriter 3500 series. Superior in every way.

NEC

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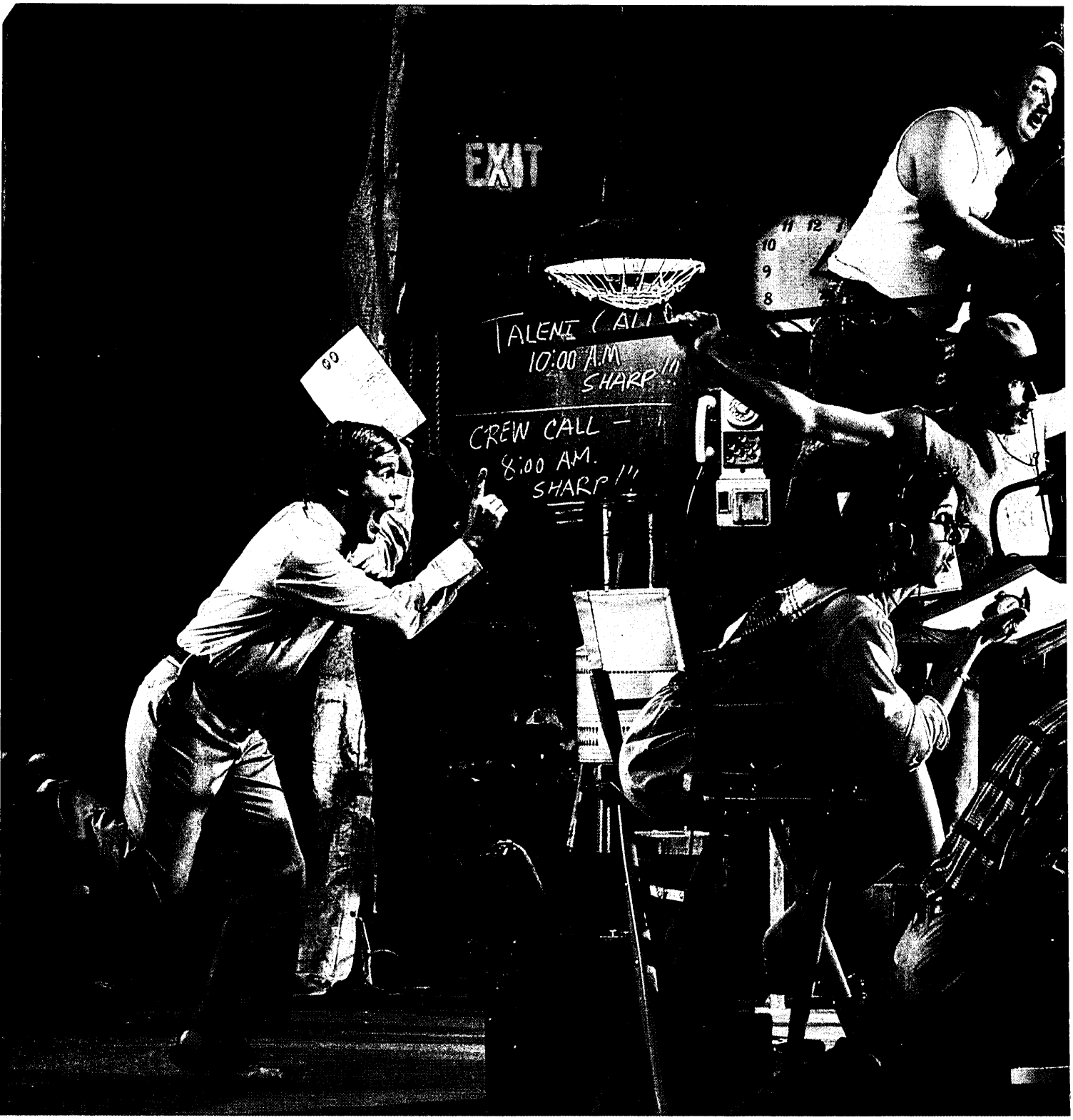
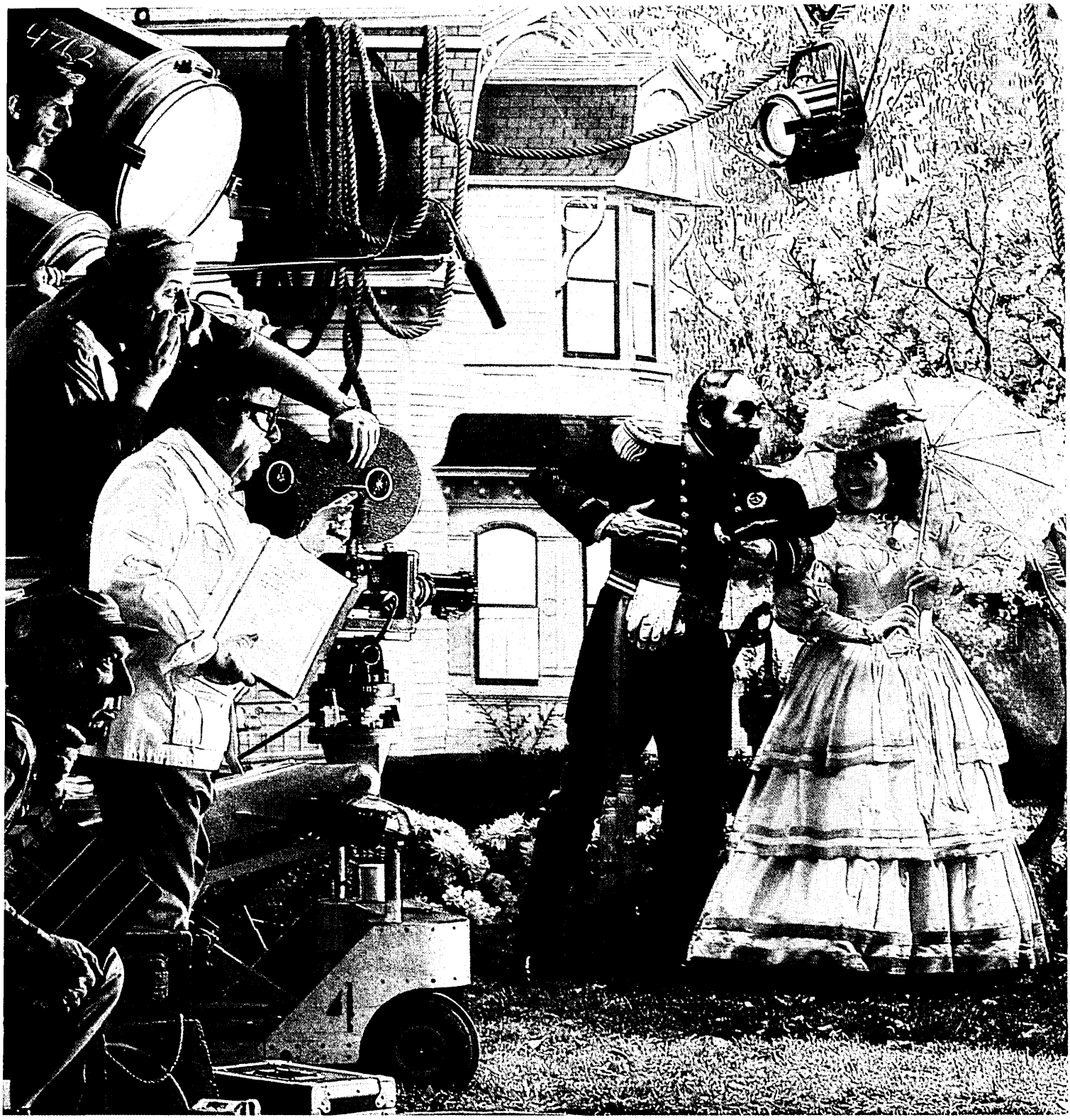
NEC. Going after the perfect printer.

CIRCLE 10 ON READER CARD



The rewrite arrived from New York at 729 times the speed of sound.



You've just changed the last act in Manhattan. But the cameras and dollar signs are rolling in Hollywood. Enter the 3M "9600" Digital Facsimile Transceiver. In just twenty seconds, this remarkable transceiver can send an exact duplicate anywhere in the world.

When 3M heard about this need for speed, and accuracy, we put our years of copier experience to work. Because at 3M, we're in the business of hearing. By listening to people's needs, we've been able to solve all sorts of problems with new ideas and innovative products like our "9600" Digital Facsimile Transceiver.

In fact, 3M has entered the voice, video and data communications field with over 600 products.

If you think you might have an application for our technologies and products, write us today for a free 3M Voice, Video and Data Communication Brochure: **Department 053206/3M, P.O. Box 4039, St. Paul, MN 55104.**

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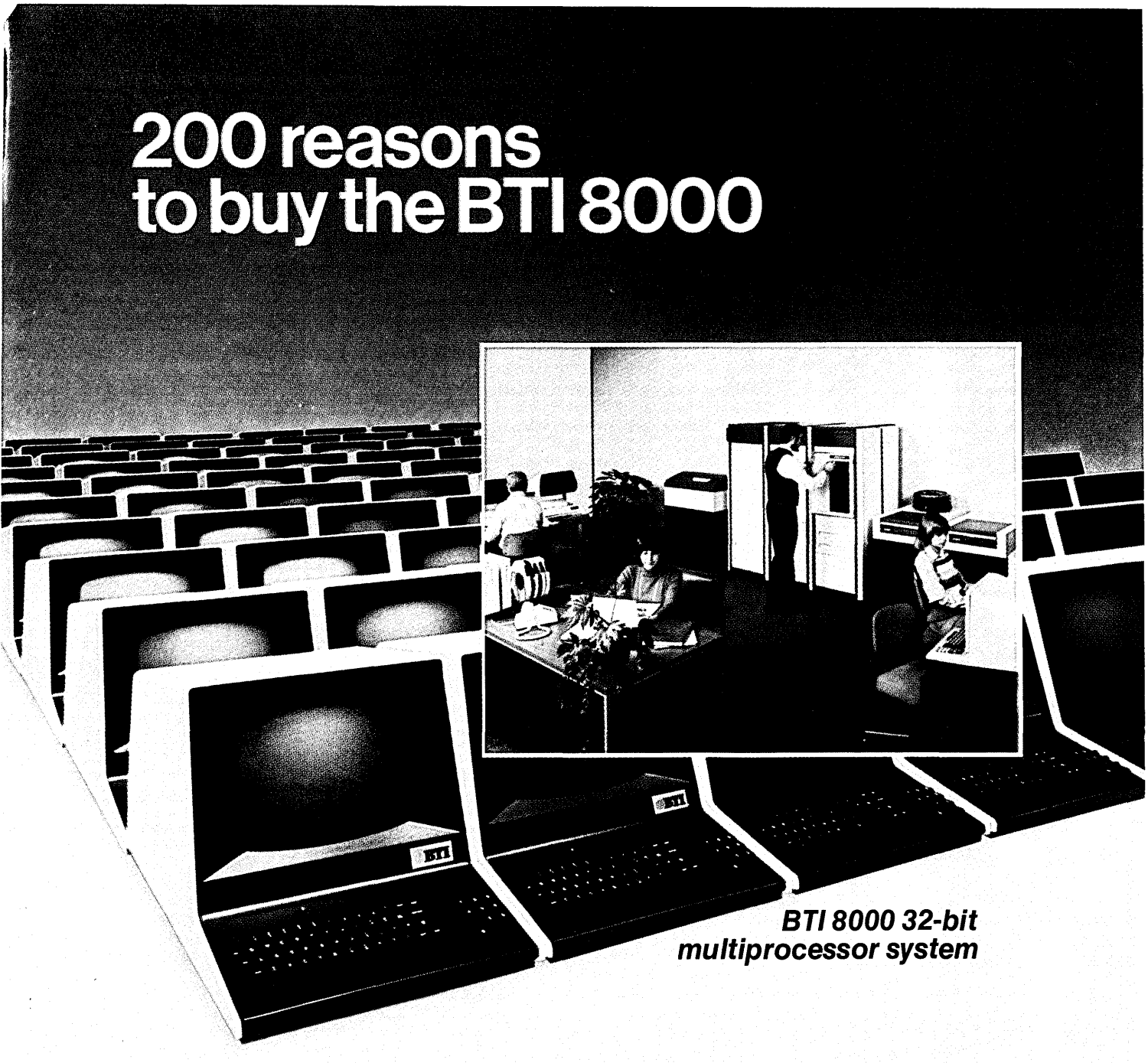
200 reasons to buy the BTI 8000



BTI 8000 32-bit multiprocessor system

With one BTI 8000, you use up to 200 terminals simultaneously running programs in COBOL, FORTRAN, BASIC and PASCAL. What's more, you can run interactive and batch jobs at the same time – in any mix!

The key is BTI's exclusive Variable Resource Architecture. Starting with an entry level system, you can increase processing power by a factor of ten, by just plugging in modules – up to 8 CPUs, up to 16 Mbytes of memory and up to 8 Gbytes of mass storage. All without rewriting any software.

The BTI 8000 also features a virtual memory environment, fail-soft architecture, built-in security and privacy, and remote diagnostics. And, if all that's not enough, consider this: the base system price for the BTI 8000 is 30% lower than that for comparable systems from other "supermini" manufacturers.

As for reliability and support, they're an established BTI tradition, thanks to more than 10 years' experience with service via remote diagnostics. BTI currently supports over 3000 systems in the U.S., Canada and the United Kingdom. For even more reasons to buy the BTI 8000, contact your nearest BTI sales office.

BTI
COMPUTER SYSTEMS

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LOOK AHEAD

WRITE ON, DISPLAYWRITER

IBM is readying dp upgrades for its Displaywriter word processor. A BASIC language processor has been developed to support user programming and applications packages from IBM and third parties. Following the unveiling of BASIC -- which IBM documents indicate may come as early as this month, the Grey Giant plans the introduction of more than a score of applications by year-end. IBM also has contracted Personal Software, the microcomputer software house, to offer the popular VisiCalc electronic spreadsheet package to Displaywriter users.

Adding BASIC to the Displaywriter brings Office Products Div. into the dp realm for the first time. Franklin Lakes may become another Atlanta on IBM's map of the world, and OPD's sales and support forces will have to face their most complex product to date. Several weeks ago, the division was still in the throes of its decision-making processes, trying to define exactly the degree of support it will be able to provide for Displaywriter BASIC users. The vast majority are expected to be first-time computer users. OPD, previously involved with essentially inert products such as typewriters and factory-programmed word processors, will find itself dealing with training new users in dp concepts and methods, tailoring tailoring user programs, and helping first-timers move records from paper to magnetic media. It's a large task, and will likely draw much attention from competitors who will be forced to reconcile their policies with IBM's.

TELEMATIQUE FRAPPE

France, Inc. may be in for a big shake-up if moderates lose out to the doctrinaire left in the new Mitterand government. Nationalization of the leading dp and telecommunications firms (including ITT, but letting IBM off the hook) are but one part of the official plan. Elimination of competition between French firms in various markets -- mainframes, communications, terminals, etc. -- also is under debate. Private sector observers fear this would cripple French industry in export markets, rather than foster technical and marketing expertise.

A WORM IN THE APPLE?

Furthering its aggressive moves in office automation, Xerox plans shortly to introduce its answer to the Apple. Nicknamed "Worm," the microcomputer is expected to fit into Ethernet local networks. It seems likely the machine's architecture will be an 8080 or 8086 derivative: plans

LOOK AHEAD

call for using outside software, including the popular CP/M operating system from Digital Research. Using CP/M will allow Worm to make use of the vast library of applications extant for that operating system, and it may give Xerox a leg up on IBM's planned 8086-based machine, which insiders say has been delayed from its original June introduction target date.

AN EARLY START ON SECURITY

In Los Angeles, Atlantic Richfield Co. has contracted with a consultant to design a password system that an ARCO spokesman says "will be the answer to every auditor's dream." It will eliminate the need for password changes. The spokesman's enthusiasm is not the least bit tempered by the fact that the consultant is a 13-year-old, Eugene Volokh. In addition to being a sophomore at UCLA, Eugene operates VESOFT Consultants in Los Angeles with his father, Vladimir.

THE ECONOMICS OF ERGONOMICS

U.S. terminal vendors are beginning to feel the effect of the crazy-quilt of ergonomic regulations covering display terminals sold in the various European markets. Unlike the relatively simple problem of slipping in a new pc card for differing communications interfaces, standards demanding black-on-white or green phosphor screens, differing keyboard depths and layouts, and the like will cost manufacturers big bucks, according to one mini maker used to selling a standard line of products worldwide.

RUMORS AND RAW RANDOM DATA

We hear IBM chairman Frank Cary stopped by the Xerox booth at NCC and stayed to view a complete demonstration of Xerox's new Star professional workstation, which led to a phone call from Cary to Xerox president David Kearns. Could the two giants be putting their heads together?...General Electric, as a large computer user, is converting from Honeywell (nee GE) mainframes to IBM gear. Word has it GE has 100 IBM 3081s on order....One of our spies recently discovered antique IBM EAM equipment -- strange grey boxes bearing numbers like 088 and 519 -- in the New York City jury selection department. With a scrap value that might cover a subway ride, it would seem to be a wide-open situation for an aggressive sales campaign. Maybe they could switch to a slightly-used 1401 or a TRS-80....AM Jacquard Systems is beta testing an electronic mail software package for its J 500 and J 100 small business systems at Johns Manville in Denver.

It's like multiplying your CICS programming staff by ten.

TRANS IV lets you increase programming productivity ten times or more – without adding CICS programmers.

This solution-oriented application development system performs CICS/VS functions automatically.

With it, programmers can write on-line application programs interactively, without referring to CICS macros or internals.

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It's an impressive system that can help you go a long way toward maximizing your CICS investment. In a very short time.

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The Information Management Company.

CIRCLE 13 ON READER CARD


TMS9995

TMS9995

The fastest 8/16-bit processor available anywhere. From anyone. 16x16-bit multiply in 7.67 µs.

All you have to do is compare and you'll see that the biggest choice in 16-bits just got bigger. Faster. More powerful.

TMS9995 joins the industry's most complete 16-bit family of microprocessors, microcomputers, microcomputer modules, peripherals, software, and software and hardware development systems.

Now you have an easy upgrade to 16 bits, while retaining the economy of 8 bits. And, you'll get all the benefits of TI's all-pervasive family compatibility that lets you move from one product level to another — from single-chips to multi-chips to modules to systems — *protecting your software investment and development systems* as you go — no translators, no code converters, no extras.

And now there's TMS9995 — with all the inherent advantages of memory-to-memory architecture, plus 256 bytes of on-chip RAM.

And now there's TMS9995 — for all those tough tasks that demand 16-bit speed and processing power.

And now there's TMS9995 — with on-chip clock, 16-bit timer/event counter and 8-bit data bus for interfacing to everything from a minimum 3-chip system to a 16-megabyte memory system (just add the 99610 memory mapper).

TMS9995. Shrinking chip count and program size. Ready for VLSI.

Logical link

TI's TMS9940 was the first single-chip 16-bit microcomputer—and the first to transcend the limitations of high-speed and high-resolution. TMS9995 adds the ability to address off-chip memory to the TMS9940 — up to 64K bytes. Together they fill the requirements from small microcomputer-based systems to medium-sized systems, using on-board RAM and off-board ROM, to larger systems needing off-board RAM and ROM.

TMS9995—Key features

- 16-bit CPU
- 12 MHz clock with on-chip clock generator
- 256-byte on-chip RAM
- 16-bit on-chip interval timer/event counter
- 7 levels of vectored interrupts
- instruction prefetch
- automatic first wait-state generation
- MID — macro-instruction detect interrupt
- single 5-V power supply
- 40-pin dual-in-line-package.

Performance plus

Three times faster than the TMS9900, TMS9995 executes a 16x16-bit multiply in just 7.67 µs. A 32-bit number divided by a 16-bit number in just 9.33 µs. TMS9995 can run with currently available fast memories of 120-ns access times, or by using automatically generated wait states, 450-ns access time memories.

256-bytes of fast on-chip RAM is organized as 128 x 16-bit words, allowing a full 16-bit word access in one clock cycle.

And, TMS9995 uses an intelligent pipelined architecture where the op code of the next instruction to be performed is prefetched. For example, the microcode for Branch and Jump instructions direct TMS9995 processors to prefetch the true next instruction instead of blindly prefetching from the next sequential memory location.

And now, a word about memory-to-memory architecture

The innovative architecture at the very heart of the 9900 Family reaches it's performance peak in the TMS9995 thanks to on-chip RAM. Comparison of execution speed benchmarks clearly show the advantages:

Support, support, support.

Necessary for any microcomputer family. TI's 9900 Family is supported by Pascal, Basic and Fortran software and software and hardware development systems, including a low-cost Evaluation Module, TMAM6095, for $800.* TI also offers training, documentation and expert field assistance. Training, service and design assistance are available at Distributor System Centers, and TI's Regional Technology Centers.

Commitment to 16-bit leadership

The continuing introduction of new, advanced, high-performance 9900 Family CPUs, with TI's state-of-the-art technology and production-proven resources, clearly demonstrates a commitment to leadership. A commitment to choice. A commitment to the future.

For more information about the new TMS9995, or any other 9900 Family member, contact the TI distributor or field sales office nearest you, or write to Texas Instruments Incorporated, P. O. Box 1443, M/S 6404, Houston, Texas 77001.

Execution Time Benchmarks

	Automated Parts Inspection (Seconds)	Computer Graphics XY Transform (Seconds)	Bubble Sort (Millisec)	Block Translation (Millisec)	16 Bit Multiply (Microsec)	Single Vectored Interrupt (Microsec)
9995 (12 MHz) w/120ns PROM	0.666	0.863	1.240	1.767	10.00	8.0
9995 (12 MHz) w/450ns EPROM	0.950	1.081	1.956	2.696	12.67	10.67
8088 (5 MHz) w/450ns EPROM	1.596	2.402	2.254	1.522	40.8	77.6
6809 (2 MHz) w/450ns EPROM	9.67	57.1	2.376	3.01	91.9	27.6

Benchmark algorithms from Intel Application Note AFN0155A.

*U.S. price, quantity one

TEXAS INSTRUMENTS
INCORPORATED

85619C

CIRCLE 14 ON READER CARD

CALENDAR

JUNE

COMDEX/Spring '81, June 23-25, New York.

"Where vendors and ISOs (independent sales organizations) get together." Contact The Interface Group, 160 Speen St., Framingham, MA 01701, (617) 879-4502.

Eighteenth Design Automation Conference, June 29-July 1, Nashville.

The major topic will be computer-aided design of digital systems. Contact Dave Hightower, Texas Instruments, Box 225621 MS3907, Dallas, TX 75265.

Syntopican IX, June 29-July 2, Atlanta.

Presented by the International Word Processing Association, conference will feature panels, sessions, and workshops on information processing topics. Contact Conference Services Dept., IWPA, 1015 North York Rd., Willow Grove, PA 19090, (215) 657-6300.

JULY

ICALP '81, July 13-17, Haifa, Israel.

This is the 8th International Colloquium on Automata, Languages, and Programming. Contact Dr. Oded Kariv, ICALP '81, Computer Science Dept., Technion - Israel Institute of Technology, Technion City, Haifa, Israel.

Eighth Cranfield International Conference on Mechanised Information Transfer, July 21-24, England.

The conference is organized by the Information Div. of the Institution of Electrical Engineers. Contact The Marketing Dept., INSPEC, Station House, Nightingale Rd., Hitchin, Herts., SG5 1RJ, England.

Symposium on Reliability in Distributed Software and Database Systems, July 21-22, Pittsburgh.

The IEEE Computer Society presents this symposium. Contact Marie S. Hreha, LRDC Bldg., University of Pittsburgh, Pittsburgh, PA 15260, (412) 624-4908.

OCR Users Association's Summer Conference, July 26-29, Minneapolis.

The conference theme is "Managing Data Entry Productivity in Turbulent Times," held in conjunction with EXPO '81. Contact OCR Users Assn., 10 Banta Pl., Hackensack, NJ 07601, (201) 343-4935.

Software Products Business Seminar, July 8, Arlington, Virginia.

A seminar for software product execs, the ADAPSO conference covers marketing, financial controls, development costs, personnel, capital formation, etc. Contact ADAPSO, 1300 N. 17th St., Arlington, VA 22209, (703) 522-5055.

Summer Computer Simulation Conference, July 15-17, Washington, D.C.

Cosponsored by the Society for Computer Simulation and the Instrument Society of America plus nine affiliated societies, over 40 sessions on simulation technology and applications will be presented. Contact William E. Buchanan, Applied Physics Lab, Johns Hopkins Rd., Laurel, MD 20810.

AUGUST

1981 ACM SIGGRAPH Conference and Exposition, August 3-7, Dallas.

ACM's Special Interest Group on Computer Graphics sponsors this annual event. This year's theme is "The Eighth Annual Conference on Computer Graphics and Interactive Techniques." Contact Henry T. Cronan, Robert T. Kenworthy, Inc., 866 United Nations Plaza, New York, NY 10017, (212) 752-0911.

Seventh International Joint Conference on Artificial Intelligence, August 24-28, Vancouver, B.C., Canada.

Computer applications for medical diagnosis, computer-aided design, robotics, programmable automation, speech understanding, and vision are some of the topics to be discussed in this five-day conference. Contact Richard Rosenberg, Computer Science Dept., U.B.C., Vancouver, B.C., Canada VT6T 1W5, (604) 228-3061.

National Small Computer Show, August 26-29, New York City.

Free lectures are presented daily, and this year there will be a five-hour seminar on the understanding, acquisition, and use of small computers in business. Contact National Small Computer Show, 110 Charlotte Place, Englewood Cliffs, NJ 07632, (201) 569-8542.

SEPTEMBER

Soft '81, September 2-4, London, England.

This is the third in the international Soft '81 series; each conference concentrates on the software market of the country in which it is held. Previous conferences were held in Paris and Munich, and the fourth (and last) in the series is scheduled for Stockholm in November. Contact Soft '81, Acorn Studios, Barnes, London SW13 9HP, United Kingdom, (01)748-0287.

Compcon Fall, September 14-17, Washington, D.C.

The IEEE's Computer Society has selected "Productivity—An Urgent Priority" as the theme for this year's conference. Contact Compcon Fall '81, P.O. Box 639, Silver Spring, MD 20901, (301) 589-3386.

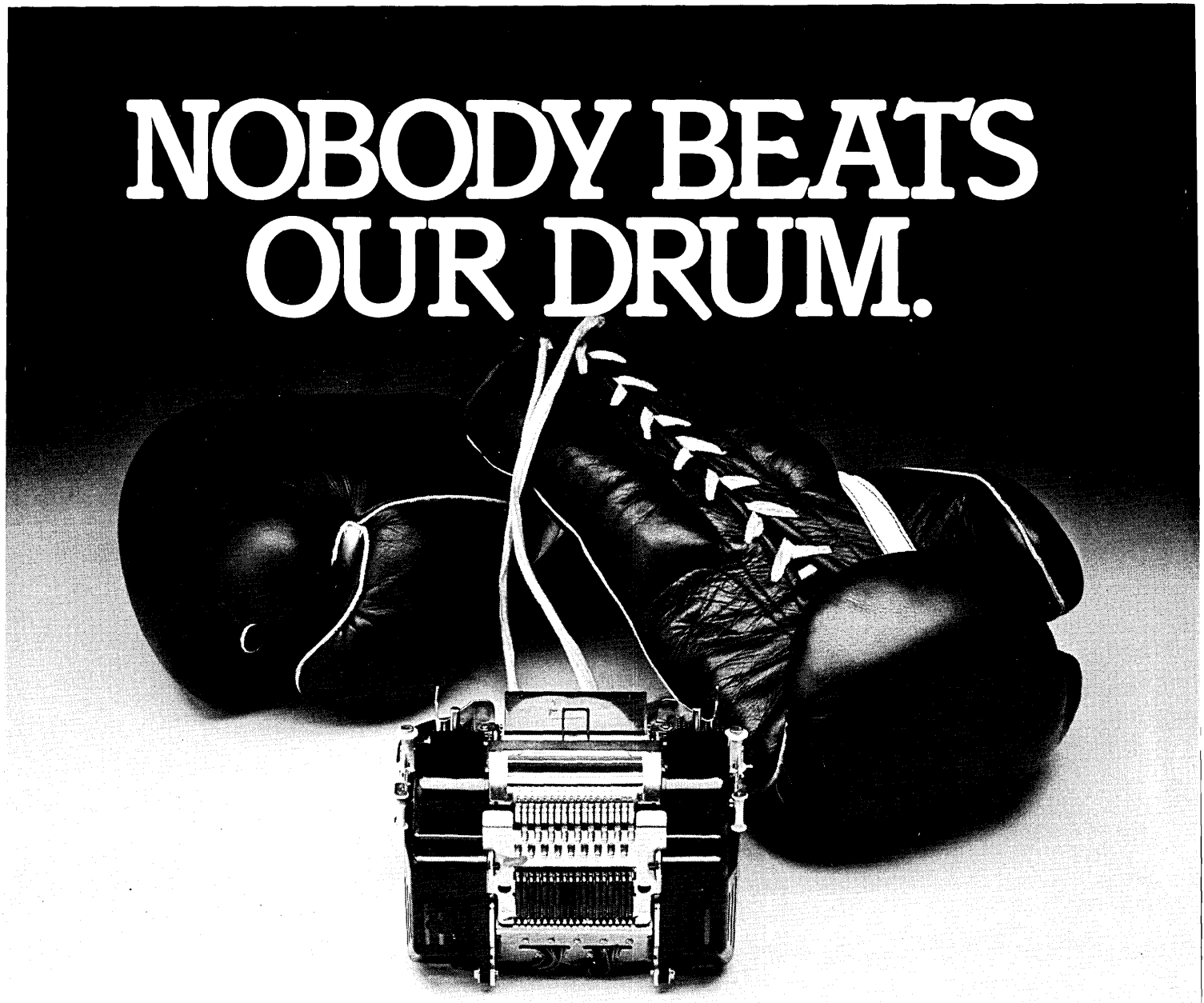
1981 International Micrographic Congress, September 21-24, Mexico City.

"Technologies Today and Tomorrow" is the theme of the congress. Contact IMC Public Relations Committee, P.O. Box 33600, St. Paul, MN 55144, (612)733-9534.

Federal Computer Conference, September 21-23, Washington, D.C.

The fourth annual conference providing a forum for information by Federal ADP users. Contact Federal Education Programs, P.O. Box 368, Wayland, MA 01778, (617)358-5181.

NOBODY BEATS OUR DRUM.



Fact. C. Itoh is a recognized leader in small printers throughout the world. And we offer one of the most complete selections of small printers in the industry. So while others do a lot of drum beating, ours is still the drum to beat. Reason?

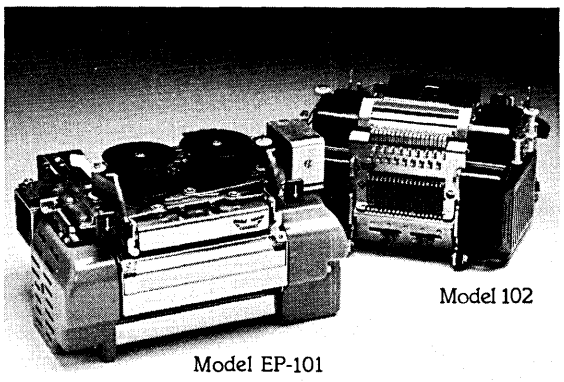
C. Itoh's compact, ultra-reliable drum printers are designed to take the punishment of real-world environments. So you get years of dependable service with an absolute minimum of downtime.

Take our Model 102 18-column digital unit, for example. It weighs a mere 3.3 pounds and prints 2.5 lines per second, yet it delivers the proven dependability of units costing far more. It's the perfect choice for today's ever shrinking data loggers.

There's our EP-101, the 21-column, 2.8 line-per-second compact with a thirteen year track record of field-proven reliability. It's built extra tough for your most demanding applications.

And, for maximum versatility, there's the AN-101F. OEM's use it for everything from computer output to label printers. Data loggers too.

C. Itoh's proven performers feature two-color printing, power-saving 15-17VDC operation and a compact design for easy bench-top or rack panel mounting. So if you're looking for a compact drum printer you can count on, get the drum to beat. Contact C. Itoh Electronics, Inc., 5301 Beethoven Street, Los Angeles, CA 90066; Tel. (213) 306-6700. New York office: 666 Third Ave., New York, NY 10017; Tel. (212) 682-0420.



Model 102

Model EP-101

C. ITOH ELECTRONICS, INC.

One World of Quality

CIRCLE 15 ON READER CARD

IBM System/38

It will make you re-think your concept of price/performance.

When managers compare the cost of computers, they often leave out the biggest factor—"people cost."

That's why standards like price/performance only begin to measure the potential productivity of IBM's System/38. This innovative system can help programmers generate more programs, sales reps generate more sales, and management generate more decisions.

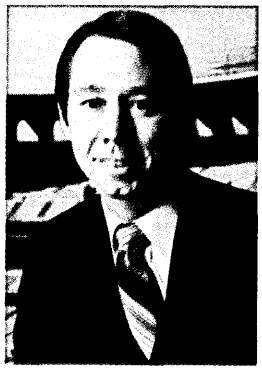
But what traditional price/performance ratios can't tell you about System/38, its users can. Here's what they're saying:

"Our programmers are excited about System/38's data base capability. Their productivity has greatly increased. Complex programs that used to take three weeks to write, we now do in three or four days. And System/38's Remote Testing Service let us test our programs before delivery, which made conversion easier."

Dave Bye, DP Manager
Border States Electric Supply Co.
Fargo, ND

"We've found that both the hardware and software of System/38 are remarkably comprehensive and powerful. And with the Remote Testing Service, we were able to train our programmers, system operators and terminal users on the 38 before it was even delivered."

Patrick A. Doman, VP
Chas. A. Strand Company
Detroit, MI



"With the System/38, we can do applications we'd never have dreamed of doing before. For instance, we've come up with coaching reports in just minutes that previously would have cost a lot of time and money. It gives both our coaches and management information they never thought possible."

Charles Reckenberg
Director of Data Processing
St. Louis Football Cardinals
St. Louis, MO

What makes System/38 so versatile and so productive? It offers large computer features integrated into a compact, easy-to-use system. Plus new features rarely found in any computer, large or small.

For a better idea of what the System/38 can do for your business, call your IBM General Systems Division representative, or write us at P.O. Box 2068, Atlanta, GA 30055.

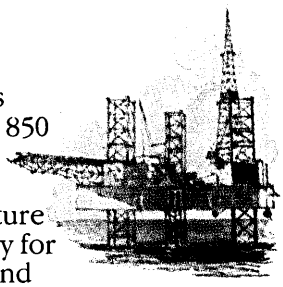
IBM®
General Systems Division

CIRCLE 16 ON READER CARD

Introducing the most powerful minicomputer ever.

The new Prime 850 multi-stream processor is the most powerful mini system ever made for multi-user environments. It sets a new standard of technological leadership for our family of high performance 32-bit systems.

The Prime 850 has ultra high density MOS memory that stores 64K on a single chip. This new system supports up to 128 interactive user terminals for outstanding cost effectiveness. And it's right at home working simultaneously on such diverse applications as energy development, product analysis and design, office automation, and general business computing.



Like all 50 Series systems, the Prime 850 combines power with ease of use. It has 32-bit architecture and virtual memory for speed, efficiency, and economy. Industry standard software for convenient program development and data management. Networking that can extend your system across the office or around the world. And the PRIMOS® operating system that makes the entire 50 Series totally compatible.

In addition to introducing the Prime 850, we've also enhanced the price/performance capabilities of other 50 Series members, including the Prime 250-II and 550-II. To meet the leader, contact the nearest Prime office or write Prime Park, MS 15-60, Natick, Massachusetts 01760. In Europe, write Prime Europe, 6 Lampton Road, Hounslow, Middlesex, TW31JL, England. Tel: 01-570-8555.

PRIME
Computer

CIRCLE 17 ON READER CARD

AD-0381

LETTERS

BREAKING UP IBM

Re: "A Separate IBM Software Company" (March, p. 275), I would like to state my strong objection to certain statements made by Martin A. Goetz. Pansophic Systems has been an active member of ADAPSO and a leading independent software products firm since 1969. For the record, Pansophic does not support Mr. Goetz's position that IBM be structurally broken up into six separate companies, including an IBM software company.

I strongly feel that "maximum separation" of IBM would prove disastrous to thousands of computer users worldwide. Worldwide dominance of computer technology by the U.S. would be set back irreversibly; our superior position in world trade would be lost. The costs for software products would be certain to rise dramatically (since Mr. Goetz believes IBM software is underpriced). There has yet to be a clear court decision against IBM to advocate structural relief, and a breakup of IBM in advance of a lawful judgment against IBM would only serve to heavily penalize many innocent computer users. Mr. Goetz even concedes that "the typical IBM user would probably be opposed to such a separation."

Pansophic and other ADAPSO members prefer to represent the more important long-range interests of our customers on this issue, rather than take a self-serving but short-lived position against IBM's competition in the free marketplace.

JOSEPH A. PISCOPO
Panasophic Systems, Inc.
Oakbrook, Illinois

Marty Goetz's proposal suffers from at least two fallacies.

The fully separate subsidiary" idea in the FCC's Second Computer Inquiry ruling is appropriate in that context because AT&T and its operating subsidiaries enjoy a monopoly position in basic telecommunications services, protected by federal and local government regulation. IBM, on the other hand, derives little revenues from regulated activities. Forcing it to spin off maximally separated subsidiaries may serve the interests of ADR and other competitors, but it cannot be justified on the same grounds as the AT&T case.

Furthermore, it is difficult to see how the elimination of "cross-subsidy" in the IBM context ("averaging" is a more accurate term) will lead to lower prices to the end user. AT&T competitors have been notably successful in recent years in forcing it to abandon the principle of averaging, under which costly services can be offered to the public at affordable rates because they are subsidized by income from more lucrative parts of the business. As a result, we are witnessing the demise of Telpak and WATS and will soon see phone installation costs and local telephone service skyrocket. The immediate beneficiaries are the "interconnects" and the would-be "long distance telephone companies."

Whether the public at large also benefits eventually is problematical. The 1969 IBM unbundling, which created the independent software industry, has clearly been beneficial to that industry. The end user, however, now pays for software that used to be free.

A second IBM unbundling, which in effect made all DPD operating system chargeable items, began in January 1979 and is now virtually complete. Thus it seems that the main objective of the proposed breakup of IBM has already been achieved.

OMRI SERLIN
President
ITOM International Co.
Los Altos, California

Mr. Goetz replies: I never intended to justify a separate IBM software company on the same grounds that the FCC has taken regarding AT&T. And I do not agree with Serlin's observations about IBM for the following reasons:

First, a "fully separate subsidiary" is as appropriate for IBM as it is for AT&T but for perhaps other reasons. The purpose of a separate IBM subsidiary would be to prevent that company from again monopolizing the software products industry. IBM currently has about a 50% share of the software products market, and its share is getting larger each year. The effects of an IBM software monopoly in the 1960s—when the company virtually controlled 100% of the market—is well known; there were no alternative sources for software, the software quality was poor, the types of software was limited and pricing ultimately *was high for the bundled hardware/software.*

Second, the elimination of IBM's "cross-subsidy" would certainly benefit the user, although not necessarily in the short run. Let me give you a real example where it could have had devastating results. In 1979, when IBM announced the IBM software product ICCF for the IBM 4300s and 370s, the company introduced the product at $60 per month. Many in the industry believe that the software was actually subsidized by higher-priced, more successful products, such as CICS and DLI. No other company could have introduced a product for such a low price.

It had the effect of driving out a great number of potential competitors. As it turns out, ICCF remains very inefficient and difficult to use. ADR and several other companies are very successfully competing against IBM's product in spite of its being subsidized. If, however, IBM had produced a successful product, the user would have had no alternative but to use that product, and IBM would have had a virtual monopoly on the on-line program development market for the IBM 4300 and DOS/VS(E) market.

This situation, I contend, would certainly not be beneficial to the user public at large. Cross-subsidization has the potential of driving out, or preventing, the development of a competitive environment. Thus, if a monopoly of the market were achieved by cross-subsidization, the end result would be very costly to the user in the long run.

The unbundling of the 1970s reduced IBM's hardware monopoly (there are now cpu PCMs) and did indeed create the independent software industry. But, my proposal for a separate IBM software company is to ensure that IBM does not again monopolize the software products market.

Unbundling was a good first step for the 1970s and eliminated the tie-ins of hardware and software. For the 1980s, the principle of maximum separation should be applied to IBM's software business to prevent its monopoly of the software products business, which is forecast to be one of the fastest growing industries of the decade.

LETTERS

NO TURNOVER

Re: Letters (April, p. 24), Mr. Mathieson's letter rang a bell that we have been ringing at ABA for five years. In 1975 we shifted from a COBOL/Assembler environment (OLIVER, On-Line Systems, Inc.). Since changing our environment, we have increased the ABA's use of the computer resource by a factor of 10 with no increase in staff. I think it is more important to note that we have had no professional (programmers, analysts, managers) turnover in five years. In a time of escalating labor costs and high turnover in the dp field, we have found that our environment has more than paid for itself.

FRANK W. SCHLIER
Director, Information Systems
American Bankers Assn.
Washington, D.C.

TAKEN TO TASK

Re: "Look Ahead" (Feb., p. 14), the story on ICL ME29 computer sales was grossly inaccurate.

The majority of ME29s are not being sold as replacements for 1903/4 computers, ICL is not writing off inventories full of ME29s as sales and is not offering discounts. On the contrary, ME29 is a highly profitable product with deliveries direct from factory output now running at 20 a week. Furthermore, ICL has not been writing off 2903/4 systems from rental assets.

Over 750 ME29 systems have been ordered since its launch in March 1980. About 35% of those have come from new customers and 10% will be used to replace competitors' equipment. Another 30% are ordered by existing customers for new applications, while only 35% replace older ICL equipment.

K.G. HOWE
Chief Media Officer
International Computers Ltd.
London, England

COOL IT

Re: "Hot and Cold Data Centers," (March, p. 176), I will concede Mr. Hassett's point that not all specialists in the field of building systems design will design the best system, but those who remain in the field for any length of time can generally design adequate systems, given the proper encouragement. Do-it-yourself building systems designs, like self-performed appendectomies, have a way of not being satisfactory.

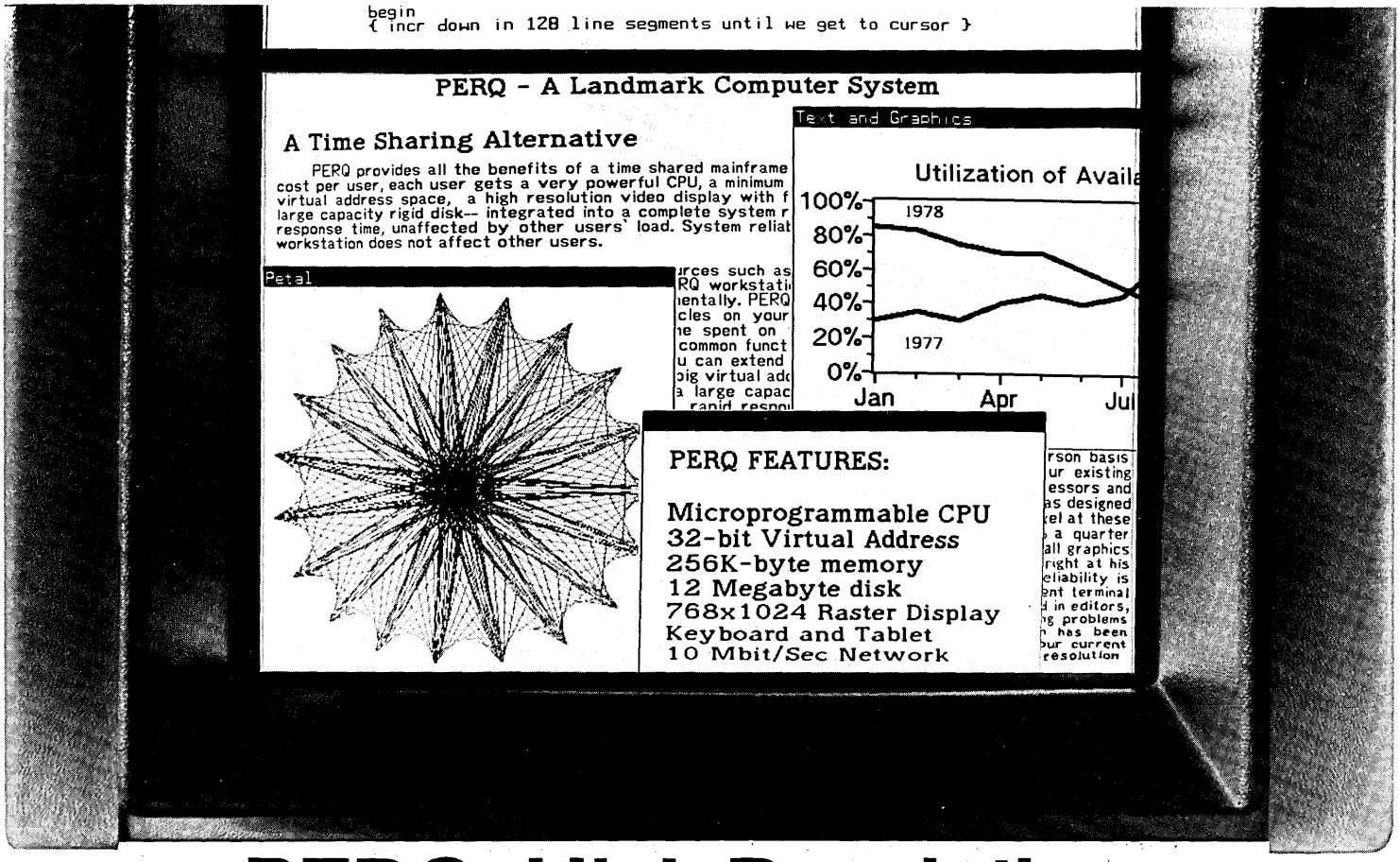
The reference to sources of "free advice" kinda bugged me. As a professional engineer in independent practice, I have given much advice on computer room air conditioning. I like to think most of it was competent, and I can guarantee you it wasn't free. Anyone who designs building systems from free advice is placing his future on a slender reed.

Advice given in the article on technical topics was in large part accurate. It was, of course, not possible to tell where any particular piece of advice was applicable to any specific system under all conditions. Care to take a guess? Just spin the chamber and pull the trigger.

Yes, equipment suppliers will run efficiency comparisons, load calculations, and all sorts of other helpful data, mostly for "free." You may find, however, that these reports are as comprehensible to you as a core dump would be to the A/C equipment salesman. And remember, he is trying to sell you his equipment. The professional engineer or the engineering contractor will likely be involved in more computer room constructions in a year than you will see in your whole career. He can advise you that a properly designed computer room will cost you a great deal of money. The only thing more expensive is an inadequate facility.

Dp managers who want the best, or even the second best, facility are well advised to consider the following recommendations (free to you, but gained at substantial expense by me):

1. Hire professional engineers and architects to generate the design and assist you in selection of acceptable contractors.
2. Provide the design team with as



PERQ. High Resolution. And all the power you need.

That's what you get with PERQ, Three Rivers' revolutionary, complete single-user computer system.

PERQ gives you an 8½" x 11" vertically oriented screen that's flicker-free. The display isn't interlaced — all 1024 lines are refreshed 60 times per second. So PERQ can display multiple fonts, proportional spaced text and graphics in a black-on-white, high-resolution presentation.

PERQ is all the power you need.

PERQ provides you with a complete single-user system — all the processor, display, disk and memory one person needs, sitting right at his desk. And because PERQ workstations provide complete computing resources on a per-person basis, installations can be expanded incrementally. PERQ's Packet Stream Local Network interconnects PERQ systems in a distributed processing environment, allowing processor-to-processor communication at 10 megabits per second over a single coaxial cable.

PERQ is more powerful than any current microprocessor-based system

PERQ's CPU is a Three Rivers-designed, sophisticated, microprogrammed minicomputer which directly executes Pascal P-Code at up to 1 million P-Codes per second. A 32-bit virtual address means that very large programs can execute with ease. Even PERQ's operating system is written in Pascal, the front-runner in high-level languages for structured programming.

Three Rivers Computer

PERQ is leading the revolution against the mainframe.

Across America, PERQ is revolutionizing the way work gets done — because it provides all the benefits of a time-shared mainframe without any of the drawbacks.

OEMs who need low-cost, highly flexible computing systems are choosing PERQ for CAD/CAM workstations, phototypeset applications, business systems and office automation applications.

Engineers and scientists are using PERQ to provide all the facilities of a good timesharing system, plus uniform response time, incremental expandability and high reliability which a timesharing system cannot provide.

Government agencies see PERQ as an ideal way to provide computing resources in command and control situations, analysis and in R&D.

Join the revolution. And find out more about what PERQ can do for you.

Three Rivers Computer Corporation
720 Gross Street

5224

CIRCLE 19 ON READER CARD

LETTERS

much and as accurate information as is available about equipment to be installed and operating requirements of that equipment. Remember, you can get control of temperature and humidity within fractions of a percent, but the cost of such close control can be a doubling or tripling of system cost. Don't ask for more than you have to have.

3. Establish a realistic budget for your facility. As a rule of thumb, about two or three times what you expected to pay will be just about right.

4. Give your consultants time and money enough to do the job right, and try not to dictate methods too much. Just tell them what results you want and skin them alive if you don't get them.

5. Absolutely vital: never attempt to wed your computer facility air conditioning to the general building system. The system requirements are too different to make it ever work satisfactorily.

6. Pay the engineer when you get his bill.

WALTER E. WALLIS
Wallis Engineering
Mountain View, California

DICTIONARY DETAILS

Re: "A Survey of Data Dictionaries" (March, p. 135), the article is both concise and informative. It fails, however, to bring out a rather important consideration in the evaluation of dictionary packages. Several of these packages (DB/DC Dictionary, IDD, UCC TEN, ADABAS Dictionary) *require* their respective DBMS software to be installed. "Interface only with DBMS" and "Requires DBMS" mean quite different things. The wall chart suffers from the same omission. The diagrams' usefulness will be enhanced if this aspect is clearly brought out. This is especially crucial for small- to medium-size installations which do not have a DBMS and/or do not plan to acquire one in the near future. Finally, a minor correction: on p. 158 (UCC TEN) under "INTERFACES," "Preliminary ADL Support" is mentioned. Shouldn't this rather be "Preliminary ADF Support" as mentioned in the chart?

V. VENKATAKRISHNAN
Software Advisor, CDP Support
Aetna Life & Casualty
Hartford, Connecticut

The author's reply: The implementation aspects of these systems were omitted from the article due to space restrictions. However, this information is supplied on the full wall chart, including which data dictionaries are dependent on a DBMS.

... A GLASS, DARKLY

Re: "Local Networks for the 1980s," "Light Through Glass" (March, pp. 98 and 108), while the background colors on the lead pages were striking, they caused eyestrain and stress due to their illegibility.

P.K. KYLE
Armonk, New York

We learned our lesson. Art yields to optics.

STANDARDS BEARERS

Re: "A Standard Squabble" (March, p. 72), standing on the sidelines, it appears to me that some companies don't like to have the government exhibit enough expertise to tell the companies to conform to its standards.

The courts are not going to tell the government agencies what they must do, from a technical point of view, to operate and carry out their functions. The issuance of the standards apparently was long overdue.

As competition among suppliers grows, the cost to the government will decrease. As a taxpayer, I hope that the purpose of the standard will be accomplished, and that mainframe suppliers will see that it is to their benefit as well.

Suppliers have for too long told their customers and the government what they will and will not supply. Competition would even be good for suppliers of dp equipment after they learn to live with it.

EMANUEL KINTISCH
Alexandria, Virginia

"Our On-Line Computer Output Microfilm Recorder is extremely fast, inexpensive to use and simple to operate."

DatagraphiX recently spoke with Mr. John E. Dye, Senior Director of Information Services, Blue Cross and Blue Shield of North Carolina, about his company's decision to install an on-line COM system.

DatagraphiX: What prompted you to consider an on-line microfilm recorder?
Dye: There were basically two major reasons. Faster turnaround and operational convenience. With on-line COM we could eliminate all of the tape handling. It doesn't require extra people and there is no throughput delay. We can get microfiche duplicates to the users much more quickly than paper reports.
DatagraphiX: Previously, you used a service bureau. Why did you decide to purchase your own unit?
Dye: We did a cost justification study and found that the money we were spending on a service bureau was just about what we would have to spend for our own COM recorder. Initially, our present needs would utilize only 20% of the machine's capabilities, so we could grow without additional equipment costs. Economically, it made sense.
DatagraphiX: Why did you choose a DatagraphiX on-line COM?
Dye: I've used DatagraphiX equipment for about 15 years. I have found DatagraphiX to be a good, solid company that supports their equipment and provides reliable service.
DatagraphiX: Did you encounter any difficulties in the transition to on-line?
Dye: We were impressed with how easy it was. Our technical librarian was able to perform most of the conversions. And DatagraphiX supplied very thorough training in hardware operation and the use of its on-line software.
DatagraphiX: So you are satisfied with the reliability of the AutoCOM II®?
Dye: Very much so. Uptime is better than 95%.
DatagraphiX: What is your overall reaction to the AutoCOM II?
Dye: It meets our most demanding data processing requirements. It saves time, material, space, and money, just to mention a few advantages. Also, we believe microfiche has great advantages over paper in cost and availability. If we experience another paper shortage, we have the secure feeling that we have a backup. Like Blue Cross and Blue Shield protection, it's reassuring to know we're covered against emergencies.

For further information on how DatagraphiX' COM systems can help, call or write for our free brochure.
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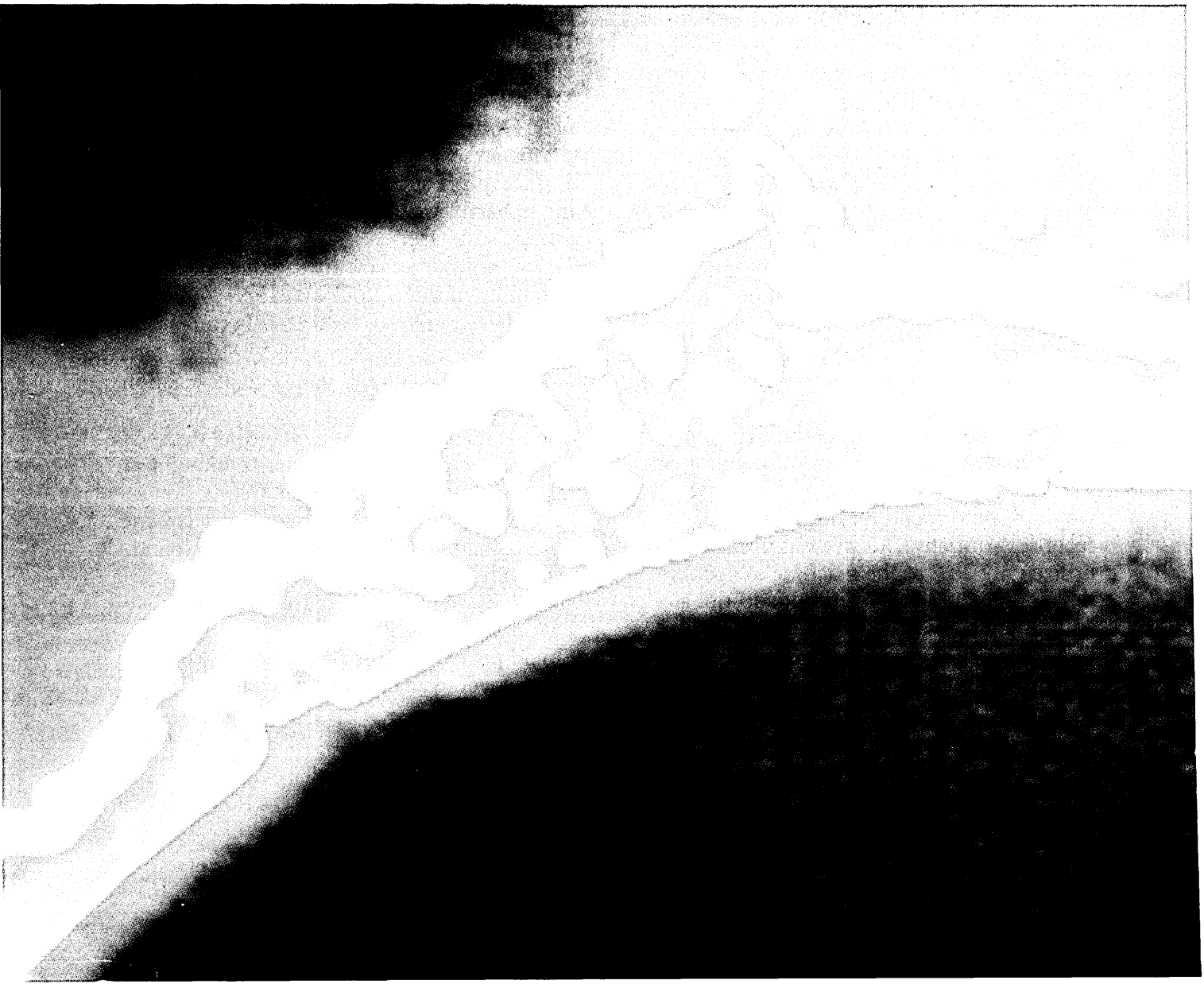
Heat. It makes life And life in your high impossible.

There's enough heat, up to 400° F, inside your Xerox 9700 to actually scorch ordinary bond paper.

That's why, when the first generation of two-copies-per-second copiers came on the market, Champion realized they would need a new breed of paper. We also realized the computer printout room was about to become as common as the typing pool.

To meet these requirements and this demand we developed Champion Xerocopy Bond.



on earth possible. speed copier nearly

A new kind of paper to serve a new kind of machine in a new kind of office.

Champion Xerocopy Bond meets the exacting performance requirements demanded by the equipment. And it's backed by a national network of merchants and Champion representatives.

People who know your needs as well as your high-speed machines and how to serve them both.

At Champion we're not only growing trees to make paper.

We're also growing ideas to meet the future.

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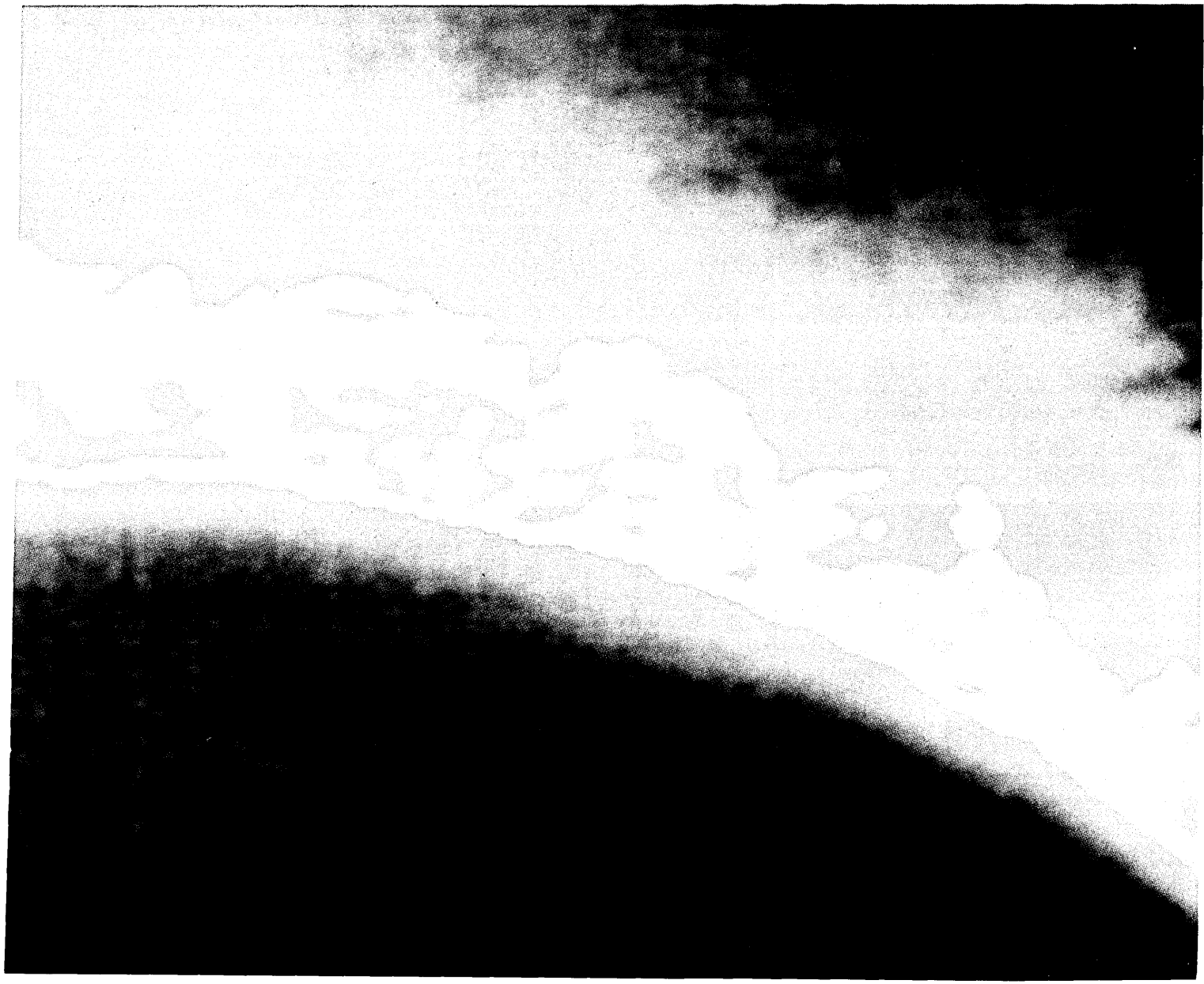
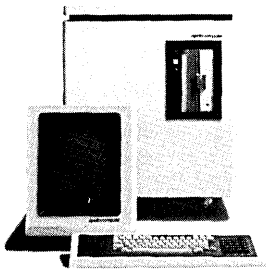
Planting seeds for the future

CIRCLE 22 ON READER CARD



DOMAIN PROCESSING



Apollo Computer has finally put an end to the computer compromise.

With the introduction of Apollo's DOMAIN, you can now get both the resource and data sharing capabilities of today's best timesharing systems with all the performance and responsiveness of a dedicated mini—all in one cost-effective system.

DOMAIN (Distributed Operating Multi-Access Interactive Network) processing is a new and dramatically different approach to computing. It's a high performance local network of dedicated computers in a distributed environment. Its unique architecture is designed to allow each user maximum autonomy within the network, while retaining the vital communications and resource sharing capability among every user.

The principal advantages of DOMAIN are greater system productivity and total system cost-effectiveness. The key to these advantages are:

A high level of predictable performance, including a VLSI CPU (with 32-bit architecture) dedicated to each user on the network, executing in a 16 megabyte demand paged virtual memory.

A new mode of user machine interactiveness, including a high-resolution bit map display permitting each user to run multiple programs simultaneously.

A network level modularity, providing a system with a very high performance level, a wide range of growth capability, and a vast improvement in system reliability and availability.

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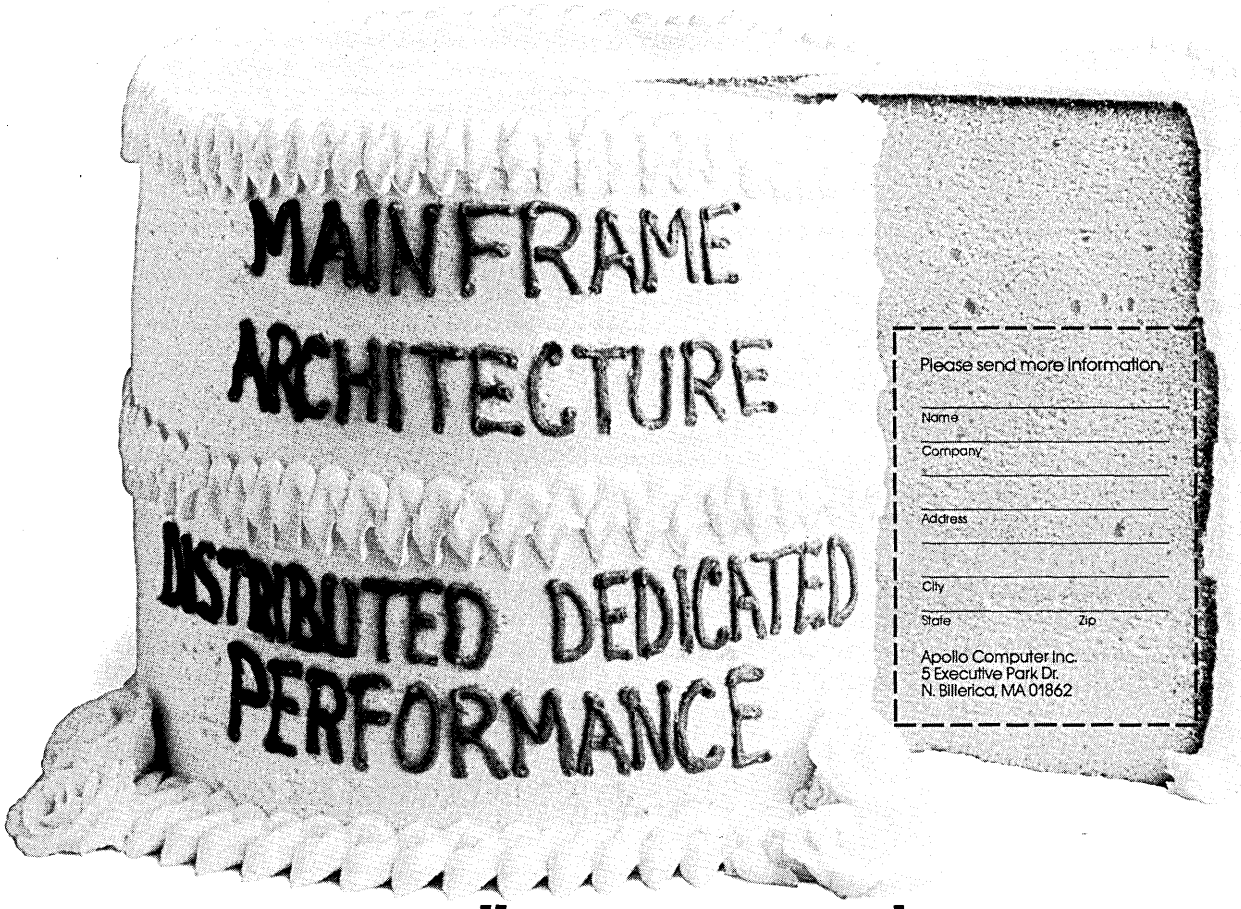
By configuring dedicated CPU's in a network architecture, Apollo's DOMAIN really does let you have your cake and eat it too.

For more information on DOMAIN processing and Apollo Computer, simply fill out and return the coupon below.

Now you can have your cake and eat it too.



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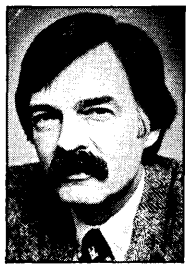
CIRCLE 23 ON READER CARD

John L. Kirkley, Editor

EDITOR'S READOUT



THE LONG MARCH TO NOWHERE

The IBM antitrust trial has been a model of justice gone awry.

Back in January, 1969, the Johnson Administration was sputtering to a close. As is the custom in the waning days of a presidential administration, those who were departing left a few souvenirs behind . . . a little something to remember them by.

One of the Johnson Administration's more memorable parting gifts to the people and business community of America was the IBM antitrust trial, now in its 12th year.

Tom Barr, the folks from Cravath, Swaine, and Moore, and Judge Edelstein are growing old together. Dust gathers in the corners of the Foley Square courthouse. Whole forests have been decimated to provide paper to record the endless depositions. It's all slightly surreal; inside the court the case plods on, dealing with issues and actions which became moot years ago; outside the world relentlessly changes.

As this is being written, Justice and IBM are meeting outside the courtroom and rumors of a settlement are flying. At the same time, we're packing up to leave for the NCC in Chicago. And DATAMATION's editors are putting the final touches on this issue's Top 100 feature. These are not unrelated events.

At the NCC, those of us who are a bit long in the tooth, will be donning black tie to attend the Pioneer's Day dinner. As we frayed and nibbled survivors sip our wine and eye each other's receding hairline, we may take some solace in the fact that we were around before the trial and the long march to nowhere began.

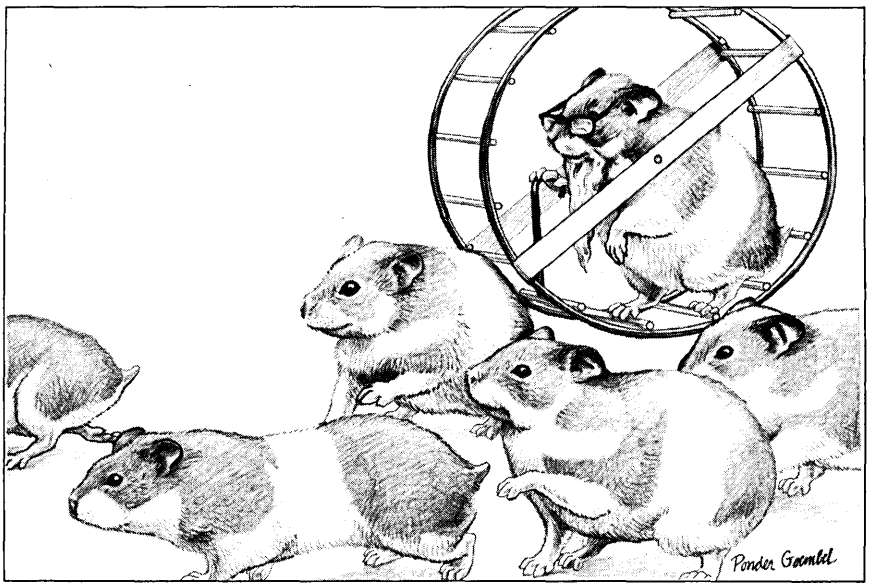


ILLUSTRATION BY PONDER CROEMBEL

But more to the point, this year's NCC will showcase how drastically the industry has changed since those days. Who would have dreamed in 1969 that something called a "personal computer" would invade the exhibit floor a dozen years later? Or that voice, word processing, communications, data processing, electronic mail, and fax would all begin to converge into a massive discipline called information processing?

This huge NCC and this year's Top 100 both indicate the healthy growth of the dp industry despite IBM's alleged machinations.

Peter Wright, in the introduction to the Top 100, says, "The dp industry had an exceptionally strong year in 1980, especially considering recessions that hit both the U.S. and European economies."

And, in this issue's lead article, Ted Withington talks about new trends in competition and concludes "Now some of the new patterns are emerging, and it is already clear that they will be radically different from the patterns of the past."

What is also clear is that the computer industry of the '80s bears little resemblance to the industry of the '60s and the '70s. The threads of the past are there, but technology and the new economics of global competition have so changed the face of our industry that one must ask what fundamental purpose the IBM antitrust trial serves.

If, by the time this editorial appears in print, the miraculous has happened and there is a settlement, we will raise a chorus of hosannas, breathe a sigh of relief, and stop flogging this nearly comatose horse.

But if, as we suspect, the hamster cage is still revolving, we can only call again for an end to this wasteful and meaningless trial.

It is obvious that IBM's competitive efforts have not throttled the U.S. computer industry. On the contrary, it is thriving and robust. Its major threat comes not from IBM's dominance but from vigorous competitive efforts of countries such as France and Japan, whose governments heartily support, rather than attempt to hinder, national industry. *

IN FOCUS

THE FOUR-MINUTE MILE

The National Computer Conference has become so big that you couldn't possibly spend more than four minutes per exhibit and still see it all.

Another year, another NCC. More than 500 exhibitors, thankfully under one roof. Booth-helping temporaries clad in tank tops and running shorts, or in whatever style that might have occurred to the booth manager. And 30 hours of exhibition time, leaving less than four minutes per exhibitor for the adventurous visitor trying to see it all.

For the first time, AFIPS acknowledged the legitimacy of personal computing by merging the erstwhile separate personal computing exhibition with the mainstream vendors traditionally found on the floor proper. As might have been expected, many of these vendors drew large crowds, with the booths of Atari and Apple Computer virtually a sea of attendees. Personal Software, developers of the widely successful VisiCalc electronic spreadsheet package, did good business off at the fringes of the main floor. The software house showed a number of new packages, including an enhanced version of VisiCalc for the Apple, companion VisiCalc packages, and VisiDex, an information storage and retrieval system.

Both IBM and Fairchild brought color to the main floor of exhibits. In addition to showing 4331 and 5280 systems, the grey giant showcased color terminals and color printers. Fairchild devoted one segment of its booth space to an F8-controlled videodisk player; when we last passed the booth, the current show was of a rock concert. (Someone in the crowd said it was the Scandinavian band ABBA, but that's outside our realm of expertise.)

The people gathered at least six deep to see demonstrations of the Star 8010 professional workstation at the Xerox booth. Ethernet also found its place in the sun at the Xerox display.

Siemens, the German giant, highlighted printing with a laser page printer and other printers using ink-jet technology. Across the floor, Honeywell announced that its page printing system controller, a Level 6 minicomputer, need no longer be dedicated to servicing a high-speed page printer. The vendor acknowledged that the controller has enough horsepower to drive additional locally connected printers and handle communications, turning the PPS into a centralized printing station for many local and remote users.

In addition, a block of stands from Great Britain showed further international influence. It was in this block that Quest demonstrated its signature verification system, an enhancement to its extant line of handprint input devices.

The Japanese also made their presence felt, though it seemed that many of their booths wound up on the lower level of the exhibition. Panasonic managed to get space on the upstairs floor, where it showed off monitors, small business systems, and its component-level multiple-overlay keyboards (described in our preshow product preview). Sony and Fujitsu wound up downstairs. Sony showed both end-user products, such as its recently announced word processing equipment (the Typecorder and the Model 35 word processor) and oem equipment—its 3 ½-inch floppies (with nearly 0.5MB capacity) and color monitors. Fujitsu again showed its Word 1000—a word processing system combined with host-based filing and retrieval. The firm also displayed bubble memory systems, with 256KB removable bubble modules.

Sonny Monosson, seemingly naked without his sandwich boards, made do with a fair-sized booth in the middle of the main exhibition. American Computer Group, Monosson's umbrella for marketing (via sales or lease) new terminals and used equipment from the American Used Computer Co. division, had a variety of DEC equipment on display, including one of the first PDP-8s. When asked about the absence of his sandwich boards, Monosson, who was hassled at last year's NCC for carrying his message to the streets, said that he'd leave them home until NCC visited a city more receptive to civil liberties.

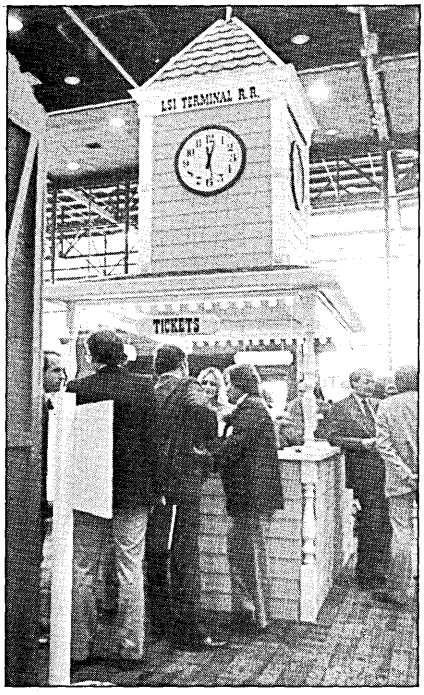
SOME KEYNOTES

It wouldn't be an NCC without keynote speeches. Highlighting the speaker lineup at this year's conference was Michael Blumenthal, former Secretary of the Treasury during the Carter Administration and now chairman of the board of Burroughs Corp. Blumenthal discussed the reasons underlying the growing wave of protectionism in foreign countries, particularly regarding the information handling industries, and the threat this protectionism poses to U.S. companies.

In addition, Marisa Bellisario, cogeneral manager of Italtel, Milan, Italy, spoke on the age of telematics, the coming together of computers and communications. Bellisario, who started her career as a program analyst at Olivetti Divisions Electronica, is now credited with being the highest ranking female line executive in the entire computer industry.

With the wide distribution of tele-

THE NUMBER of exhibitors was up by more than 100 over last year's 400-plus, but attendance was down from 80,000 to some 73,500.



TERMINAL RAILWAY was Lear Siegler's haunt, which drew a constant crowd of terminal enthusiasts.

THE MICRODATA TWINS (dubbed "dippy" by one spectator) walked, talked, and twirled in tandem.

PHOTOGRAPHS BY A.E. CROMER

phones and televisions throughout the world, she said, the stage is set for a new age of information distribution. She briefly recapped the videotex projects in the U.K. (Prestel); France's experiment in using low cost display screens linked by telephone lines to a telephone directory database, and Italy's decision to experiment with a version of Prestel.

Bellisario estimated that $9 billion has been spent worldwide on automating the office with word processing, data processing, and PBX equipment. She expects that figure to double during the next 10 years.

Richard S. Beal, special assistant to President Reagan and director of the Office of Planning and Evaluation in the White House, gave the other keynote address. He focused on the need to improve the decision-making process within government by making better use of computers and information databases.

"There have been few if any major system improvements in the federal government in the 1970s. There is a lot of catching up to do in the 1980s," said Beal. The reason behind this situation, he said, is that federal agencies have "limited" allocations for system purchases to about a 10% growth per year. The result is that the average age of federal dp equipment is about seven years. "Unless we do something about the procurement strategy, our obsolescence problem is likely to worsen," he said.

After opening with a humorous quip about his stunted stint in the Carter Administration and an axiom called Blumenthal's Law—which, he said, states that when the curve depicting the prime rate intersects the curve depicting the President's popularity, then it is time for the Secretary of the Treasury to go—Blumenthal quickly retraced the rapid growth of the computer industry and its concurrent dramatic drop in price and increase in performance.

"In 1974," he said, "the total number of computer systems in use was something over a quarter million. There are about 2 million systems currently in use, and by 1984 that figure should rise to more than 7 million."

As a result, he said, the "functional equivalent of a computer that cost $30,000 in the early '70s and cost $4,000 in 1977, will cost less than $100 in 1985."

To illustrate just how dramatic the price/performance effect has been, Blumenthal pointed out that had technology affected the car industry in the same manner, "Americans would now own half-pound cars costing less than $2.50 and getting a million and a half miles per gallon."

But the rapid proliferation of computers has brought with it confusion and fear about the effects of computerized information handling on privacy and freedom. Some countries fear "electronic colonization" or "electronic imperialism" from the more advanced countries, said Blumenthal.

While he agreed that data flow restrictions across borders may have begun with privacy issues, he believes they have taken on much wider ramifications. "Transborder data flow restrictions can be viewed frequently as simple protectionist strategies whose purpose is to facilitate the growth of a nation's domestic information processing industry." In short, what that means for U.S. computer companies, he said, is that overseas sales may be severely limited.

Politically, he conceded, countries feel vulnerable in terms of national defense as a result of sensitive national information being collected, processed, and stored abroad. Economically, he said, countries worry about the impact of foreign data processing centers on their balance of payments, the loss of domestic jobs, and the "brain drain" that can occur without an indigenous industry.

"Additionally," he added, "it is apparent that some nations see information as another commodity that can be taxed to the benefit of that country's treasury."

But such restrictions have their negative side, too, according to Blumenthal.

"They necessitate increased installations of data processing equipment within the individual countries," even though many jobs could be done cheaper and more efficiently through distributed networks flowing out from a central center.

What can U.S. companies do to foster a free exchange of information between countries? First, he suggested, America should temper its frustration with cooperation, such as creating partnerships in developed nations or establishing technology transfers in less developed countries.

Blumenthal cautioned the U.S. that it is courting disaster if companies do not act more directly to break the fall into protectionism. He urged the government to ease antitrust regulations so that companies can pool their strengths and compete effectively in overseas markets.

He called for the establishment of an intraindustry clearinghouse to monitor, compile, and disseminate information on proposed and enacted TDF legislation throughout the world.

And he urged companies to work toward the establishment of a comprehensive national communications and information policy.

"Let us use the tools of our trade to inform, to communicate, and to freely exchange the wondrous products of our new technology," he said. "In this direction lies the best hope for the future. Let us begin to establish that future."

THE PERSONAL TOUCH

McCormick Place resembles a great black aircraft carrier run aground at the edge of Lake Michigan. During NCC '81 the spacious upper deck, suitable for storing fighter planes or welcoming astronauts, was the province of the IBMs, the NCRs, and the Apples—companies with the wherewithal to construct sleek chrome exhibits and fill them with products and salespeople. Way aft those exhibits and a deck down, where the ship's laundry might be found, was the Personal Computing Festival, a varied group of people in a couple of smallish, windowless rooms that yards of gold curtains failed to brighten.

Leah O'Connor of Chicago sat beneath a sign that read "The Electric Window." She and her husband had come to demonstrate a program that allows one to draw, on a TRS-80, a picture that's larger than the crt itself, and to shift the picture around to look at a particular part of it. O'Connor said her husband used the system to design circuit boards, and she demonstrated this capability by putting a few schematic symbols on the flickering screen and hitting the G key, which caused the "ground" symbol to appear. The system included a printer, and on the table beside it were samples of lettering and the machine's masterful picture of Mickey Mouse.

Terry Jackson of Lombard, Ill., was there to show that "you can do voice recognition very simply and cheaply." He had assembled an eight-channel band pass filter, an eight-channel analog-to-digital converter, and a Motorola 6802 microprocessor onto some wooden slabs, creating a speech recognition system with 3.75K of memory and a vocabulary consisting of the numbers one to six. The system is speaker dependent and has a learning mode, but Jackson said that a Swede who'd stopped by and tried to teach it Swedish numbers had been disappointed. Jackson started work on the system in the middle of March and had hoped to demonstrate it by operating a small crane, but showtime came before the crane was functional and he had to content himself with causing the spoken numbers to appear on a crt. During demonstrations he was having some trouble with background noise; he said it was a problem easily remedied with a muting switch, "but that's not something that occurs to you when you're putting it together on the kitchen table, where it's quiet." One possible application for the system, he said, would be to enable handicapped people to play computer games.

Beneath a sign that said "Conferencing Management," Gloria Smith was exhibiting a system that prevents garrulous people from interrupting shy ones. The system was devised by D. S. Stodolsky of Stanford University. Each speaker at a conference enters his name into the machine and presses a button while he speaks; a crt displays chosen speakers and allotted speaking times, rendering all participants equal. Smith said the system was fairer and more mannerly than permitting people to pipe up whenever they want. "How can someone get mad at you," she asked, "when the machine is choosing the speaker?" She said the system would be especially useful in classrooms.

Ron Borta of Rosemont, Ill., had a complaint. He was demonstrating Edugrammer, an interactive video training program that uses an Atari 800 and videotapes. He had wanted to bring a video camera and other equipment into the hall but was annoyed to learn that McCormick Place rules required that anything more than he could carry in a single trip be transported, for a fee, by Teamsters.

"The most important demonstration at the show" was the way S. M. Radosavljevic of Purdue University characterized his exhibit, entitled "First Direct and Exact Solution of Traveling Salesman Tour Problems." The problem consists of finding the shortest route for a salesman who must depart from a base city, visit a number of other cities, and return to his base. Mathematicians have been seeking a solution since the 19th century; a young Soviet mathematician, Leonid Khachian, was reported in 1979 to have found one, but it proved not to be general. A general solution would have extremely broad ramifications for linear programming, and Radosavljevic said that the program he and his son were running on an ALTOS minicomputer was just such a solution.

Our experts are still busy checking out that claim.

A BIT OF NOSTALGIA TOO

"Three things happen when you get older," said Univac's Ted Bonn as he rose to speak at the Pioneer Day banquet. The gala affair was hosted by Sperry Univac to commemorate the 30th anniversary of the dedication of the Univac I at the Bureau of the Census.

"The first thing that happens," Bonn said, "is that you lose your memory . . . I can't remember the other two."

And then Bonn, like the other business and industry notables who were part of the program marking the introduction of the first commercial computer, vividly recalled anecdote after anecdote associated with those early days in 1951.

The over 250 invited guests, many of whom had also worked on the first Univac I, gathered in Chicago's spectacular Museum of Science and Industry for the black tie event. Dr. Carl Hammer, Univac's director of research, hosted the program. After reading a message from President Ronald Reagan, Hammer introduced Robert E. McDonald, retired chairman of Sperry Univac, who received standing applause.

McDonald quoted the Marshall McLuhan comment that computers were the LSD of the business world, transforming its business and objectives. He said that the impact of the computer had gone even beyond McLuhan's vision, creating a whole new information-based society. "We are no longer considered the oddballs of 30 years ago," he said. "We've made our mark with management at all levels."

CBS commentator Charles Collingwood recalled using the Univac I to forecast the 1952 election results. Not everyone was impressed, he said, remembering Eric Severeid's comment that the computer took all the fun out of the guessing game that used to mark the all-night vigil as the results trickled in.

Univac was the generic name for a computer in the '50s, and Collingwood quoted Arthur Godfrey's description of what a Univac really was: "Just a box with a vice president inside."

Pioneer Steve Wright recalled an interesting technical problem that plagued early systems when the switch was made from air to water cooling. The water was pumped in from Lake Michigan, which in those days was teaming with fish. They

Stop apologizing for inadequate computing capacity and get a system that will grow with your needs.

Before you trade your overloaded 370 for a 4331, consider how soon it will be before you're forced to move up to a 4331-2. And then migrate to a 4341. And on and on. Every time you change systems, you lose time and money. Not to mention productivity.

Magnuson puts an end to this costly process with a 4300-compatible mainframe that is field-upgradable.

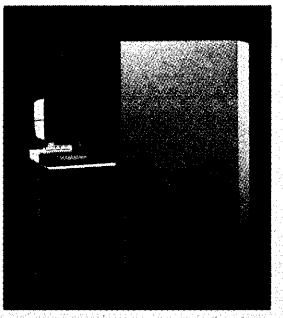
Magnuson's M80/31 gives you more throughput for less cost.

The Magnuson M80/31 provides up to 20% more throughput than the 4331-2, for as much as 20% less cost. And the M80/32 offers up to 50% more performance than the 4331-2 for about the same cost.

As your system requirements expand, Magnuson simply adds or swaps circuit boards on-site to increase your system's CPU capacity, channels or memory. There's no time-consuming conversion process, so your DP productivity continues without interruption.

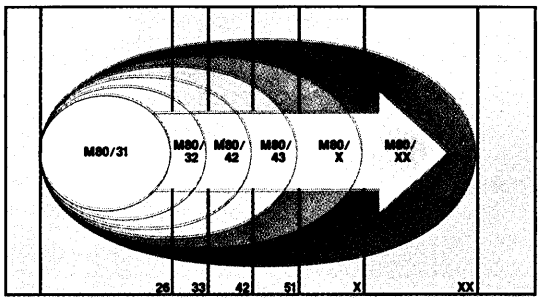
There's no need for your people to learn a new system.

And there's no waiting. Your system can be upgraded as soon as you decide you need more power.



In its compact configuration, the M80/31 occupies 70% less floor space than the 4331-2.

MAGNUSON M80 SYSTEM UPGRADE PATHS



More memory, channels and processing capacity are added as needed by simply adding or exchanging circuit boards.

M80/31 users may upgrade to our current top-of-the-line model, with four times the computing power!

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Magnuson uses microcode to emulate all the IBM target instructions and features offered by IBM or third-party vendors. We even provide special productivity enhancements for popular packages such as Cullinane's IDMS.

And we support more operating system releases than IBM supports on the 4331-2. That means that all of your existing 370 applications software will run on an M80, so you don't lose the time and money you've already invested.

Magnuson does more to support your system.

At Magnuson, we know we're not the biggest, but we give you more of the day-to-day support you need. We're more responsive when you call us, more helpful in solving problems, more flexible in our financing.

In short, you can count on Magnuson to help keep your DP operation more productive and more cost-effective for your company.

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Magnuson means never having to say you're sorry.

soon discovered that a computer full of lake trout didn't run too well, so they installed a grating in the pipe leading to the computer. But the fish clogged the grating, so, in true engineering fashion, they installed a grinder and twice a day ground the fish in the grate. Commented Wright: "This was, to my knowledge, the first computer to run on bouillabaisse."

Leading off the personal reminiscences was J. Presper Eckert, who with the late John Mauchley developed the Univac I. Kay Mauchley, the co-inventor's wife, read a personal letter that Mauchley had written to her forcefully stating his views on scientific freedom.

Perhaps the greatest outpouring of affection and nostalgia was reserved for Commander Grace Hopper, a developer of COBOL and one of the industry's most articulate spokespersons on the development of software standards.

Clad in her Navy dress whites, the venerable commander chose to look to the future, admonishing the audience in her best nautical style that "a ship in port is safe, but that is not what ships are built for."

She wished all attending "Fair winds, following seas, and good sailing."

GIMMICKS, GEAR & GADGETRY

If gladiators, chewing-gum twins, tall Texan cowboy hats, robots, and talking terminals are reasons for delight, this year's NCC exhibit floor was the place (McCormick Place, that is) to be.

More fun than the Chicago Cubs, Commodore's (scantily clad) Cuties added local color to the floor and won for their employers the dubious distinction of having the Gauchest Exhibit at the show, now an annual DATAMATION award. The much more modest Microdata Twins went away with a new award—"Dippy Display" (actually a comment made by an unsuspecting spectator).

In all fairness, we must admit to finding a few flaws in our own exhibit as well. DATAMATION's trusty robot Argon took time off to help out friends from Control Data, which occupied a nearby booth. Actually, radio-controlled Argon began picking up signals from a cordless microphone in use by a CDC spokesman. We knew things had run amok when Argon began echoing the CDC spiel, but with much less pizzazz. The big blow came when the interference affected Argon's motor controls—at one point he unexpectedly took a sharp left and headed into the crowd, bumping into a preoccupied passerby. That's when Argon was put in the corner and asked to keep quiet.

Lear Siegler's "Terminal Railway" and Verbatim's foam rubber cowboy hats complemented each other perfectly, flaunting Texas enthusiasm a year early for NCCers. (Next year's haunt will be Houston.)

COMMODORE'S CUTIES added the personal touch to the company's display of personal computers.

One complaint left over from last year's show was the "personal computer/hobbyist problem." This syndrome manifests itself in such comments from exhibitors as "please, no more Looky Lou's"; "too many students"; and "no, this is not a personal computer." Many firms were so disgruntled with last year's "parade of pilferers," as one company rep described the hobbyists, that they decided against exhibiting in this year's show, as in the case of Ramtek. But a booth rep for one exhibitor, Digital Communications Corp., remarked that "if your location is good—not near any personal computer company booths—you can't help but get valid sales leads because of the sheer size of the show."

Indeed, sales leads is the name of the game for exhibiting vendors, and company spokesmen characterized this year's interest level as "good," "better than last year's," and "better than ever." In fact, a spot survey of vendor opinions about the show attendees indicated an overwhelming belief that the '81 audience was of a higher caliber, comprised of many vps and other executives from management, engineering, and R&D disciplines.

As was noted last year, many exhibitors again commented on the large numbers of visitors from other countries. "International interest has expanded and these people are ready to buy," commented an exec from Wespercorp. And a Telex vp added that international response to this year's show was "great, and many good international contacts and sales leads were made."

QUANTITY VERSUS QUALITY

For the first time in recent years, the annual National Computer Conference couldn't be called the biggest show ever—at least not by the number of attendees. While the number of exhibiting companies was up by more than 100 over last year's 400-plus, attendance at the show was down from the more than 80,000 at the Anaheim (Calif.) Convention Center to slightly more than 73,500 at this year's McCormick Place in Chicago.

"That's preferred," commented Larry Jennings, manager of exhibit sales and operations for AFIPS (the American Federation of Information Processing Societies, Inc.), the show's sponsor. "When you decrease the attendance, you increase the quality," he claimed.

There is another aspect of the show that's growing, however—the so-called "camp followers," those companies that set up product demos and hold press conferences in the NCC host city, but that don't lease exhibit space at the show proper.

"We dislike it; we discourage it; we'd like to prohibit it," AFIPS' Jennings said. "When we're able to reserve a large hotel block, we have better control over that situation."

Next year's confab will be housed in the Houston Astrodome. According to Jennings, there will be about the same number of exhibiting companies, but there will be more exhibit space (256,000 net square feet compared to this year's 230,000). There are other promised improvements as well. Texas is a right-to-work state, meaning that exhibitors won't have to contend with the mandatory use of unionized carpenters, electricians, and setup crews that many vendors complained about in Chicago. AFIPS also plans to make sure there are adequate eating facilities at the conference center to avoid the astronomically long lines that formed around lunchtime in Chicago ("The catering service at McCormick Place had had that contract less than one month," Jennings explained. "That alone caused problems.")

And there should be enough hotel facilities for show-goers in Houston ("They may be more spread out, but then you can't really say McCormick Place has a host of hotels adjoining the conference center either," Jennings commented.).

But before AFIPS starts looking ahead to next year's big event, it plans to sit back and bask in the glory of a successful show in '81. Only one week after the show closed, an AFIPS staffer said, "It's nap time for us."

Contributing to this story were Becky Barna, Jan Johnson, John Kirkley, Ken Klee, Bill Musgrave, Deborah Sojka, and John Verity.

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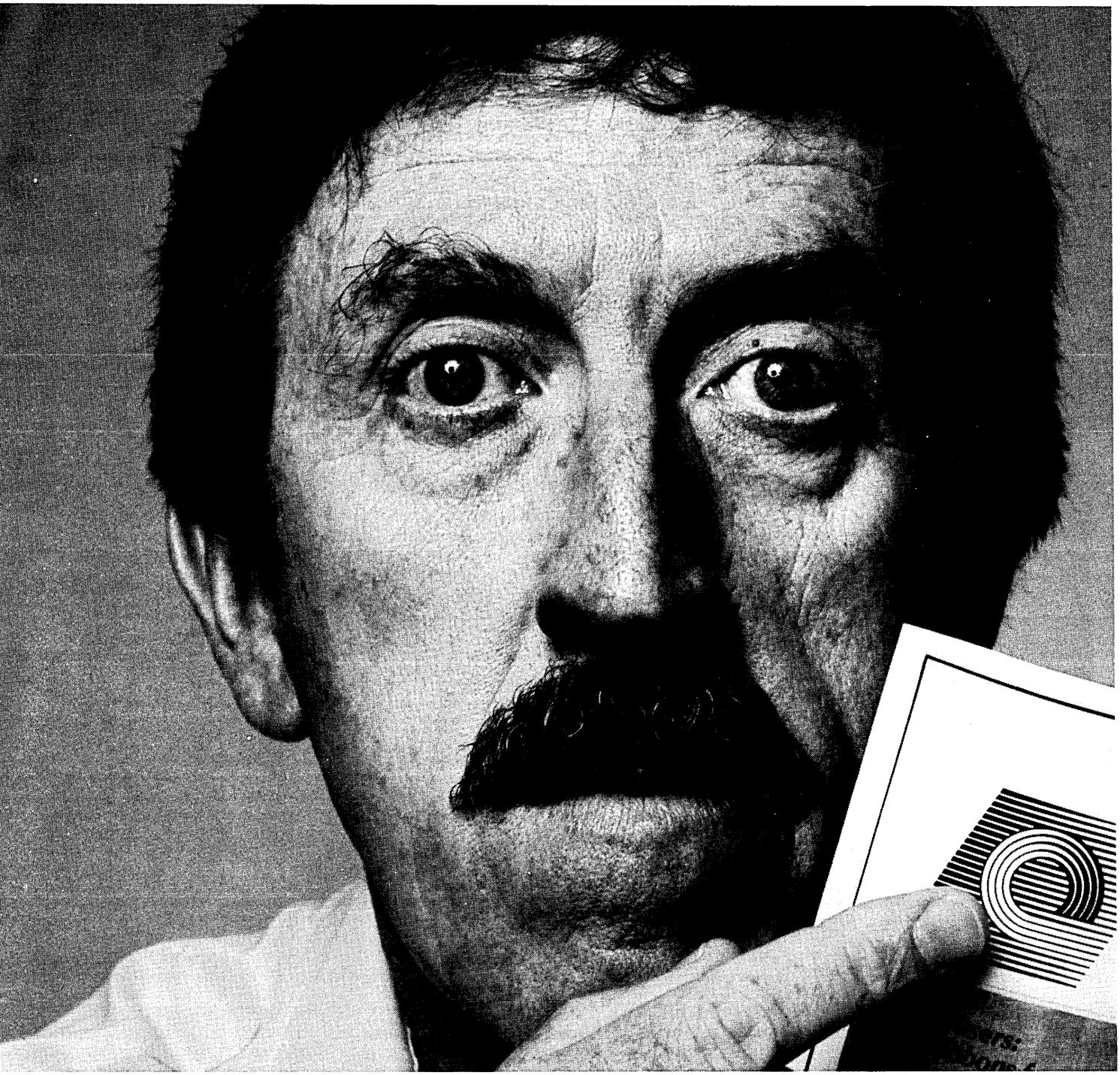

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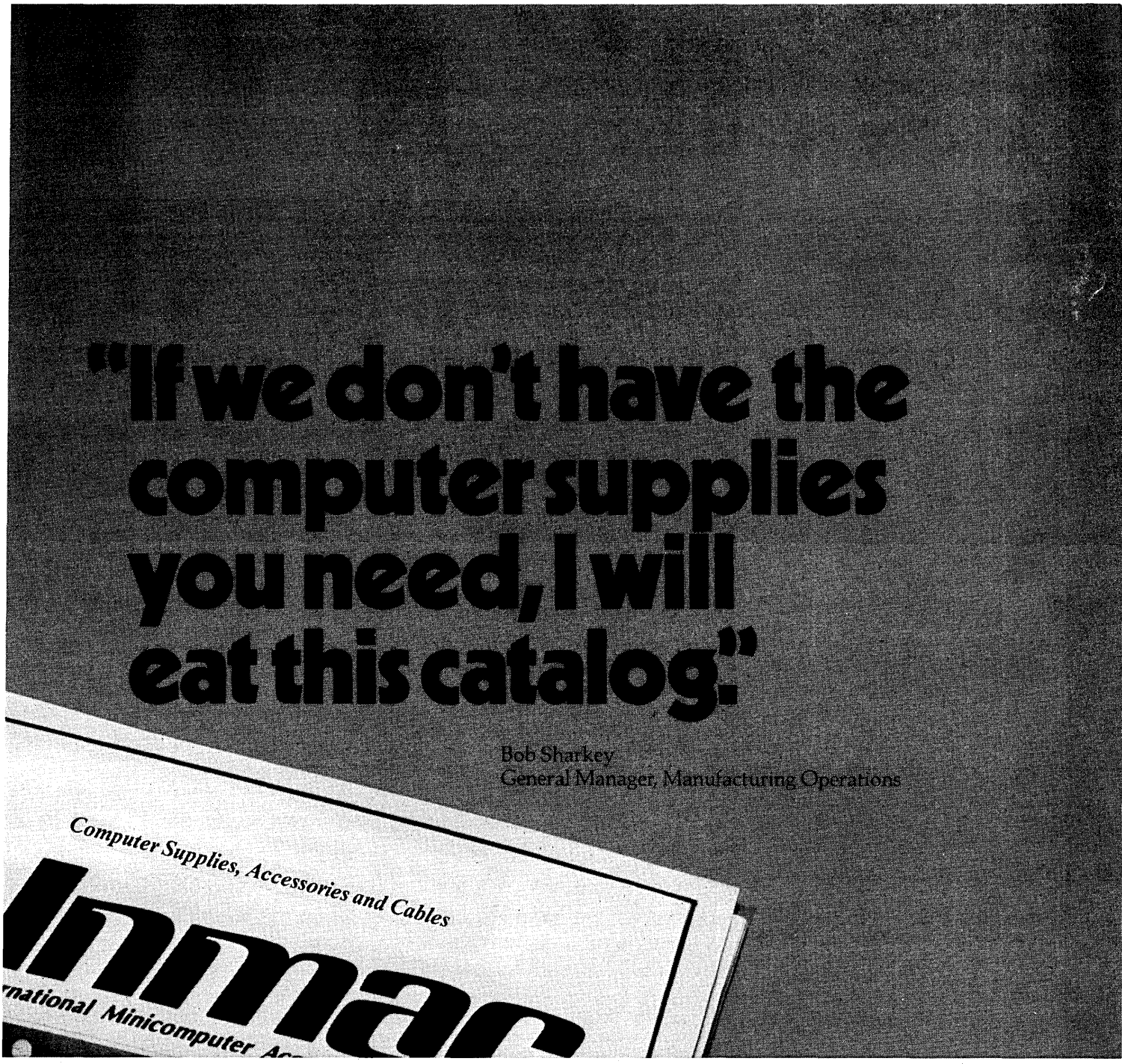

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NEWS IN PERSPECTIVE

MAINFRAMES

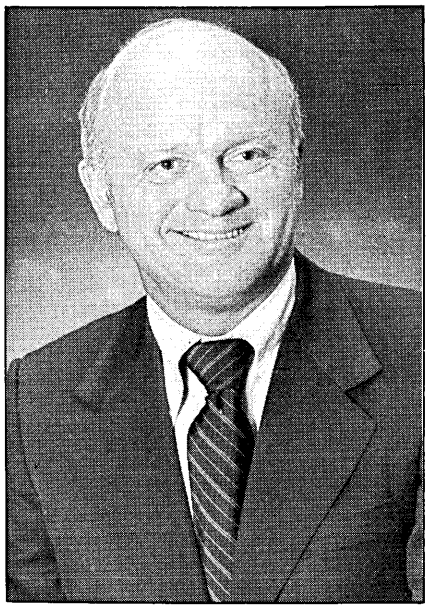
THE NEXT SYSTEMS SUPPLIER?

Storage Technology plans to push the limits of that very precarious business—selling IBM look-alikes in competition with Big Blue.

One would be hard put to name a manufacturer of high-performance computer tape drives other than IBM and Storage Technology Corp. There's Fujitsu Ltd., the Japanese mainframe maker whose drives are sold in the U.S. by Memorex Corp. And Control Data Corp. possesses the technology. But it is STC that accounts for 55% of the U.S. installed base of 6250bpi drives, more even than IBM has.

As recently as 1976, tape drives were all STC shipped. And yet this maker of IBM-compatible peripherals, now second to IBM in shipments of disk drives, stands to profit handsomely from IBM's slippage in initial shipments of the new 3380 drives, and, of all things, has begun designing a line of large scale IBM-compatible mainframes.

The Louisville, Colo., company, now in its 12th year, has succeeded in a very precarious business, selling IBM look-alike peripherals in competition with Big Blue. All the products STC is now making will soon be completely obsolete and the firm will, perforce, have a new product line three years from now.



LEE A. HARGRAVE JR.: "If we want to keep up the growth we've had over the first 12 years of our existence, I think we have to get into mainframes."

"That's high risk, because you're operating completely under the IBM umbrella," says consultant James N. Porter. He observes that STC had made it with tape drives first, then with disks, and now is shooting for PCM mainframes. "Very high risk," he adds. "But if there's any organization around that has a good shot at pulling it off, it's STC."

Storage Tech, your friendly vendor at the upper end of IBM-compatible tape and disk drive markets, is going full bore. "We are working towards becoming a full systems supplier," says chairman and president Jesse I. Aweida. From his vantage point, he sees the industry becoming an IBM world. "We believe that IBM operating systems have become (an) industry standard," he adds. At the user level, the inventory of applications programs written to run on IBM 370 hardware is so large that even IBM can-

Also considered imperative over the long haul is vertical integration, backwards into the critical components.

not do anything that would obsolete it. "It's no longer really IBM software. It's become the users' software. And that's what we're going to be compatible with."

The current line of thinking, the "main line strategy," according to Lee A. Hargrave Jr., STC's vice president for strategic planning and development, is to compete with IBM in the high-performance dp systems market with a line of mainframes having from 2mips to 40mips. But with first shipments slated for the 1984 time frame, this is subject to change; by that time, the way this industry is going, the smallest processor could well be an 8mips machine, but totally IBM code-compatible.

He sees the need for a full-line, total systems offering at the high end, meaning above the IBM 4300 series. That includes tapes, magnetic disks, whatever nonmagnetic (such as optical) storage technology follows, plus impact printers (offered by STC's new acquisition, Documation Inc.) and nonimpact line printers of the laser variety, and even a front-end processor to interface with a network. But, Hargrave emphasizes, there's no interest in terminals like the 3270 family ("That's a heck of a commodity business"), nor would he recommend that STC become a communications company or a common carrier ("That's just too much to bite off").

The strategist also sees the need to offer worldwide sales and service, at least in the developed and very advanced developing countries. Ironically, this has been one of STC's weak points. The company's principal markets have been the U.S., Canada, Japan, and Europe, and yet revenues from

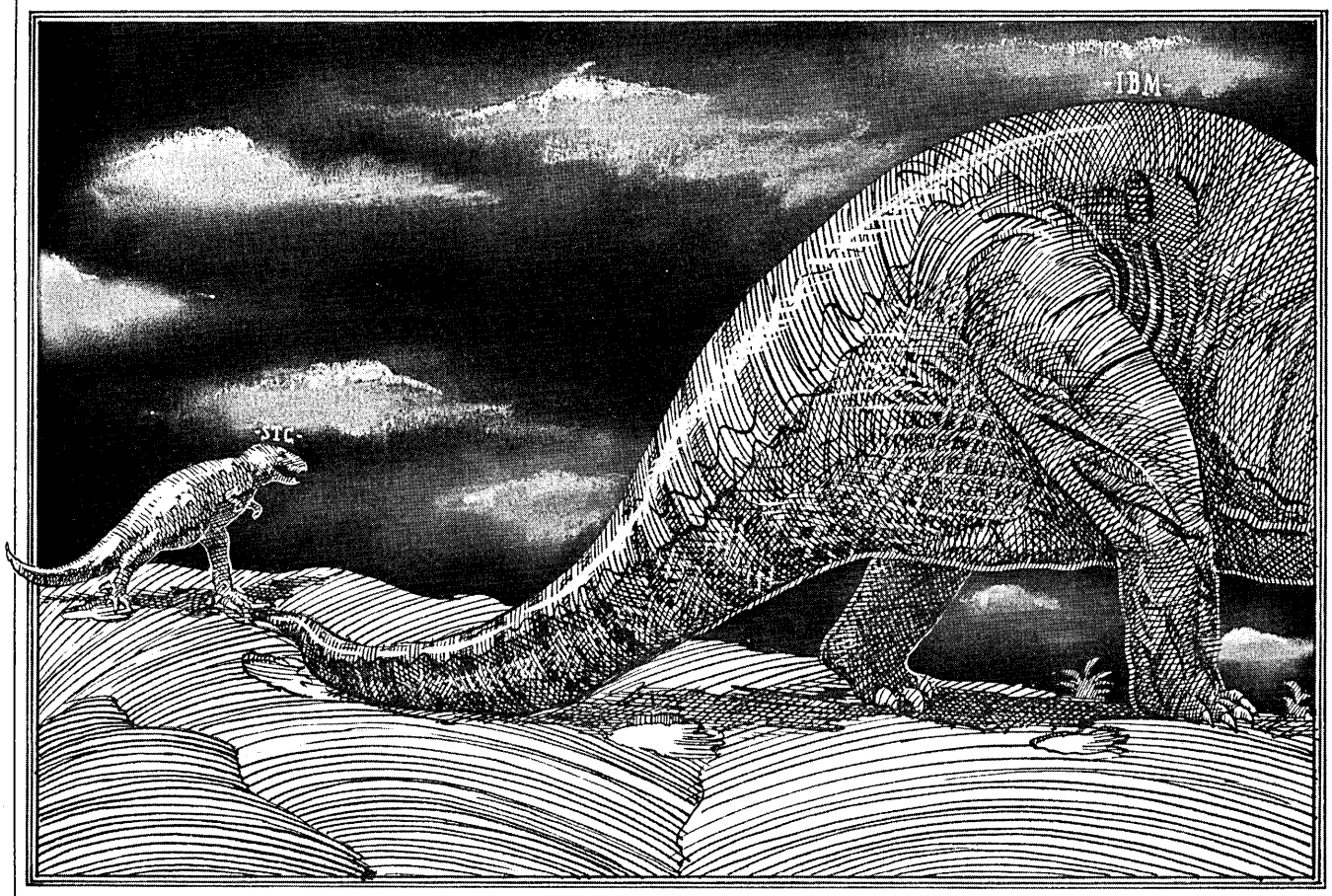


ILLUSTRATION BY ANDRZEJ DUDZINSKI

outside the U.S. comprise a mere 14% of the total. It has a ways to go.

Also considered imperative over the long haul is vertical integration, backwards into the critical components, if only to avoid becoming dependent on a sole-source supplier. Accordingly, the company several years ago acquired a small semiconductor house, invested in the last two years some $35 million in that operation, and sees it as a source not only for proprietary circuits but also for thin-film heads. STC's 3370-equivalent disk drive, scheduled for first shipments later this year, will feature these new heads.

Later this year, too, initial production of disk platters is expected from STC Media Technology Corp. The substrate maker is viewed as a secondary, not primary, source of media.

"Unless you have control of your critical components, in terms of costs and delivery schedule, you're going to be whipsawed in a dynamic market," says Hargrave.

STC's "main line strategy" is to compete with IBM in the high-performance dp systems market with a line of mainframes having from 2 to 40 mips.

This year the company will also be spending $6 million to $7 million for research in the technology of optical disks, which is considered to be the strongest candidate to replace magnetic recording. Some 65 people are working on this program. Says Aweida, "We feel we can build a machine like our disk drives with a capacity of 4 billion bytes of storage, and get it to the market in late '83 or early '84." That's equal to 40 reels of mag tape. And the expectation is they'll be able to get it up to 10 billion bytes the following year, just by implementing new coding schemes. And although that's comparable to 100 reels of tape, Aweida says the optical disk is not meant to replace tapes but rather to operate like disks today.

"But the fact that it's removable is exciting," he adds. The initial product will have a read and write capability but it won't erase. "That by itself will not make it *the* technology for the future. We think, though, that in the late '80s it's very possible you'll be able to erase and rewrite."

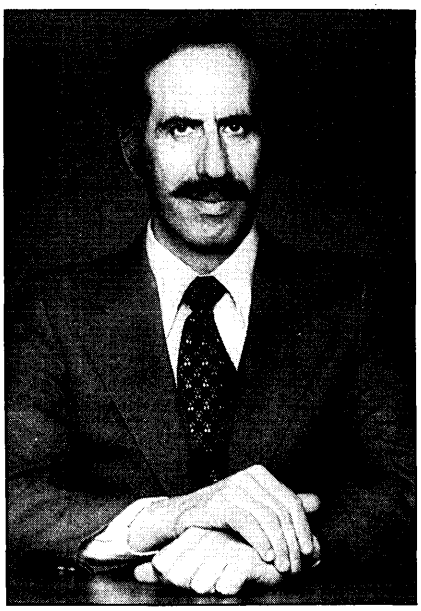
The company last year spent $40 million for R&D, 7% of total revenues. This year it will be closer to $58 million or $59 million, perhaps still at the 7% level, not counting $9 million or so for the mainframe program.

This latter sum comes out of the $50 million raised earlier this year from a limited, or tax shelter, partnership to fund the new STC Computer Systems Corp., a creative way of keeping the R&D costs off STC's balance sheet.

Under Fred K. Buelow, an early engineering vp at Amdahl Corp., the mainframe development effort already has some 75 people on board, including the eight managers who will be responsible for the architecture, design, and technology. In sharp contrast to the ECL bipolar technology used in all current high-speed mainframes, Buelow's group is staking its future on the use of CMOS circuits, which are not as fast. It is thought that some of that speed disadvantage can be reclaimed by denser packaging, CMOS being a technology that consumes less power and thus gives off less heat. Having less heat (lower power dissipation) to draw away, it's possible to crowd the chips more, and that means an electrical signal doesn't have to travel as far.

The mainframe development effort already has some 75 people on board.

In the last fiscal year, STC realized revenues of only some $90 million from the oem business, a market that accounts for more than a billion dollars for Control Data. But to STC's credit, all this business has been in tape drives, shipped to such customers as Burroughs, NCR, Univac, Siemens, and ICL, and most of the minicomputer makers. But, alas, none of it is in disk drives. A 200MB drive for this market, complete with intelligence, was dropped, reportedly be-



JESSE I. AWEIDA: "We are working towards becoming a full systems supplier."

cause of problems in manufacturing. But a possibility for this market is the IBM 3370-equivalent drive. The oem market could become a significant contributor to revenues and profits.

In the past, STC has managed to learn quickly from its mistakes. Such was the case with its first disk drive, the Super Disk. It was a flop, but as Jim Porter says, "With it, they paid their dues." And when it was necessary to develop a look-alike for the IBM 3350, the company did a superb job. "If they had not done the Super Disk," says Porter, "they would not be a hero today on 3350 drives. They learned what Winchester technology was all about by doing the other program first, even though it was not a commercial success." Had they not gone through that experience, he adds, "they would not be the company they are today."

Some in the industry question STC's decision to plunge into battle with IBM across the entire systems line. There's not only IBM but also Gene Amdahl to cope with in that same marketplace, right? Wrong, says Lee Hargrave. The distinction he makes is that STC will have a total systems offering and worldwide coverage.

"I daresay," he asserts, "that you can count on the fingers of one hand the number of companies that will be able to compete in that market by the end of the decade of the 1980s."

Who might they be? IBM, of course. And, from the so-called BUNCH (Burroughs, Univac, NCR, Control Data, and Honeywell), possibly one will switch and offer IBM-compatible systems. Of the three remaining slots, says Hargrave, two will be filled by Japanese—Fujitsu and Hitachi. And the fifth participant? "That's where my mind boggles. That company is Storage Technology."

He dismisses Amdahl Corp. as not being a systems supplier, as lacking worldwide coverage, and not being vertically integrated backwards.

This, of course, still fails to explain why Storage Tech should make mainframes at all. Why not stick with what you know best—peripherals? As seen by Hargrave, the company is approaching the limits of its market share in IBM-compatible tape drives, some 55%. After that, unable to acquire a larger market share, it will be able to grow only as the market grows. In disks, he foresees a similar happening, perhaps two or three years out. In printers, where IBM is said to have about a 95% share of market, STC (Documation, actually) is in second place in a market smaller than tapes or disks. The front-end processor market, should STC enter that fray, is not terribly large either.

"If we want to expand," says Hargrave, "we'll have to look into other markets. And the one obvious area is that very big mainframe market, which is the next big challenge we see before us. If we want to keep up the growth we've had over the first 12 years of our existence, I think we have to get into mainframes."

—Edward K. Yasaki

COMMUNICATIONS

AMDAHL'S FRONT-END FEVER

The PCM vendor is now doing with front-ends what it earlier did with mainframes—but with much less publicity.

Some years ago there was widespread interest when a relatively new plug-compatible supplier called Amdahl Corp. began to install its first mainframes. The skeptical dp community wanted to determine whether the glowing claims of full compatibility with IBM software, together with certain operating advantages, were more than just marketing hype. After careful comparisons, users found that price/performance advantages really were achievable, and a mark of validity was established for the pcm concept.

These days, the Amdahl 4705 front-end seems to be repeating the earlier scenario—but with little publicity. The Fujitsu-made replacement for the 10-year-old IBM 3705 was first installed last Fall, primarily at sites that already had Amdahl mainframes. By concentrating on existing Amdahl installations, it was reasoned that service would be close-by if needed.

Apparently those safeguards did not reckon with the reliability of the 4705. Out of a reported 25 installations, there have been only two failures and those were believed to be minor, the company claims.

Even though the 4705 is a direct replacement for the IBM front-end, it has some significant advantages due mainly to its newer technology. Because it is a faster processor, the 4705 has improved through-

Amdahl may draw on the networking expertise of its new subsidiary, Tran, to develop front-end software enhancements.

put, with Amdahl marketing representatives claiming an 80% increase in direct comparisons.

While that sounds like a startling improvement, it appears to be accurate. "It is exactly 1.8 times faster (than the 3705)," is the way Albert Bacon, vice president and manager of dp services at Union Planters Bank in Memphis, Tenn., describes the 4705 which he has had since February. Bacon also verified the cost savings claimed by Amdahl, stating that when his two-year lease ran out on the 3705, he saved about $7,000 by installing the Amdahl replacement.

Bacon also praises the ease with which the 4705 was introduced into his 600-terminal, 24-hour on-line network. "The only time we can bring the system down is midnight Saturday. They put the 4705 on the channel at that time and ran diagnostics to check out the interface. When that was completed, we switched all of the tp lines from the 3705 to the 4705 and brought the system back up. We were down about two hours," he relates matter of factly, "and it has been running ever since."

At The Southland Corp., 1,600 Seven Eleven stores around the country are interfaced to an Amdahl 470 and an IBM 3033, relates Rulon R. Brough, vice president of management information services. Southland was a Beta test site last Oct. for the Amdahl front-end, and Brough liked what he saw so much that he installed a second 4705. Both mainframes and front-ends are running with the same software they had when the site was equipped with IBM 3705s. And if anything, the maintenance of the 4705 is better now than it was when IBM was taking care of its 3705s, Brough says.

Despite the low-key marketing of the 4705, there is already a six-month delivery schedule, says Jim Baker, product manager for the front-end at Amdahl. But he adds that this is still better than the current one-year wait which he claims users now have for an IBM 3705.

While Amdahl is concentrating on direct 3705 replacements for now, Baker

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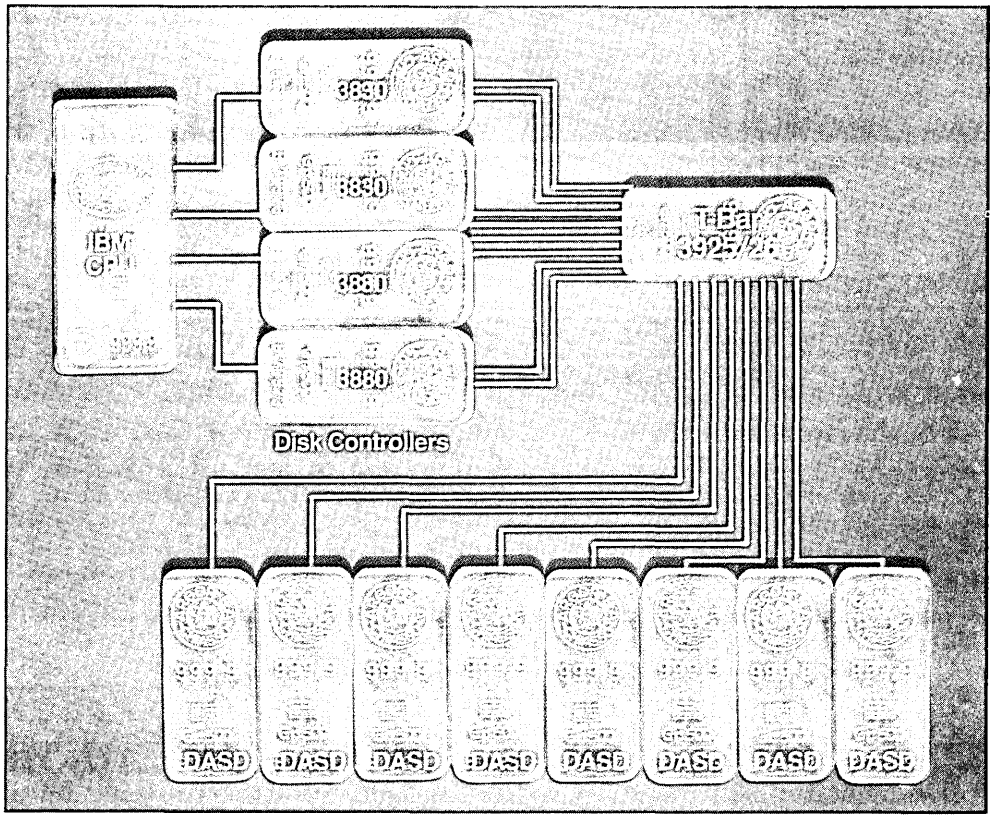

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makes it clear that there is a strong possibility added features such as X.25 compatibility may well be added in the near future. Taking note of IBM's expected 3705 upgrades, Baker said the 4705 would probably not be enhanced to include the capabilities of the new IBM front-end.

While the existing 4705 will get additional features some of which are not available on the IBM box, Baker notes that a new Amdahl front-end is also under development (presumably by Fujitsu) to match the IBM upgrades.

Amdahl may also draw on the networking expertise of its new subsidiary, Tran, to develop front-end software enhancements, although this is only one of several sources that may contribute to the 4705 upgrades, Baker indicates.

Following the pattern first established in the mainframe area, direct replacement of IBM hardware is only a first step, Baker points out. Beyond that, Amdahl has many software improvements that could be added to take advantage of the 4705's faster technology.

The front-end business may not be as interesting as cpus from a plug-compatible standpoint, but Amdahl seems to be working to assure that history repeats itself—even if it is on a somewhat smaller scale.

—Ronald A. Frank

FAXPAK PLAYS CATCH-UP

Faxpak's managers are hoping to reposition the network from left field into the batter's box.

It was supposed to be just what typical high volume facsimile users needed. When ITT first began operating its Faxpak service late in 1979, the concept was innovative and seemed to fill an important need. As originally described by ITT's Domestic Transmission Systems DTS, Faxpak would add a store-and-forward capability to the transmission of facsimile messages to give users a value-added network that could be accessed from any point in the U.S.

Many of the facsimile machines at user sites could not communicate with each other because they operated at different speeds, used different protocols, or had other incompatibilities. Thus Faxpak was designed to add computer switching and intelligence so that ultimately most fax devices could send messages to other fax devices.

Well, a funny thing happened on the road to this facsimile heaven. Apparently the usage of facsimile machines progressed much faster than the ITT DTS marketing staff expected. While the network service slowly phased into support for the slower so-called Group I, or four to six minute machines, high volume users were shifting rapidly to faster, all-digital, Group III units which typically send a normal size business document in less than one minute. In addition, many users were migrating from Group I to the faster two to three minute Group II machines which Faxpak could not handle. The group designations are a reference to efforts within the Consultative Committee for International Telegraph and Telephone (CCITT) to bring standards to the facsimile scene.

So during 1980, Faxpak concentrated on serving users of the slower four to six minute machines while the demand was shifting to higher speeds. By early 1981, seven network nodes were in operation offering dial-in service for early generation facsmile machines that users were quickly leaving behind.

"The problem was getting the network aligned with where the market was going and where the users were," comments John Mallone, national sales manager for Faxpak.

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CIRCLE 33 ON READER CARD

NEWS IN PERSPECTIVE

In order to shift the service toward the greater revenue that seemed apparent in the faster machines, ITT closed five network nodes, laid off or shifted about 65 network employees to other jobs, and consolidated the existing two nodes in Washington, D.C., to handle current traffic requirements.

Despite this upheaval and reorientation from its original slow-paced plans, Mallone feels Faxpak is still a network that can meet user needs, although he admits that "we continue to play catch-up ball."

Mallone estimates that 4,000 facsimile machines are now active on the network. About 25% of these are the Rapifax 100, which represents the latest generation of subminute digital machines. These faster digital machines are supported by one of the two nodes or specialized processors that remain in Washington. In the fourth quarter of this year, DTS intends to add support for the 3M 9600, which Mallone said is another of the subminute Group III machines becoming popular with high volume users.

Meanwhile, a second Washington processor is handling traffic from Group I and Group II machines. The Group II machines comprise an area only recently supported by the network, and Mallone concedes that this was a marketing flaw; the company simply missed the target in anticipating the needs of users. Actually, the five nodes that closed were all designed to support the slower Group I analog machines and they represented a network capacity that never matched up with user requirements.

Last year, Faxpak focused on serving users of the slower four to six minute machines while the demand was shifting to higher speeds.

Now with only the consolidated node in Washington, the original Faxpak concept to have direct local dial-in facilities in major cities has been cut back to the use of higher cost WATS lines. Whether the network again expands to have nodes in other cities will depend on demand. Right now efforts are being channeled into software development that will allow other subminute digital machines to be supported.

There are now about 60 different machine types supported on the network, and in most cases users are able to send messages between incompatible machines since all transmissions are sent through the special processors at the network node.

Rates are based on a two-tier structure with either 15 minute or two hour delivery being available. Initially an overnight delivery had also been planned but this has now been dropped, Mallone point out. The faster 15 minute delivery costs 16 cents per minute during the day and 10 cents per minute at night, while the two hour priority is 10 cents per minute during the day and six

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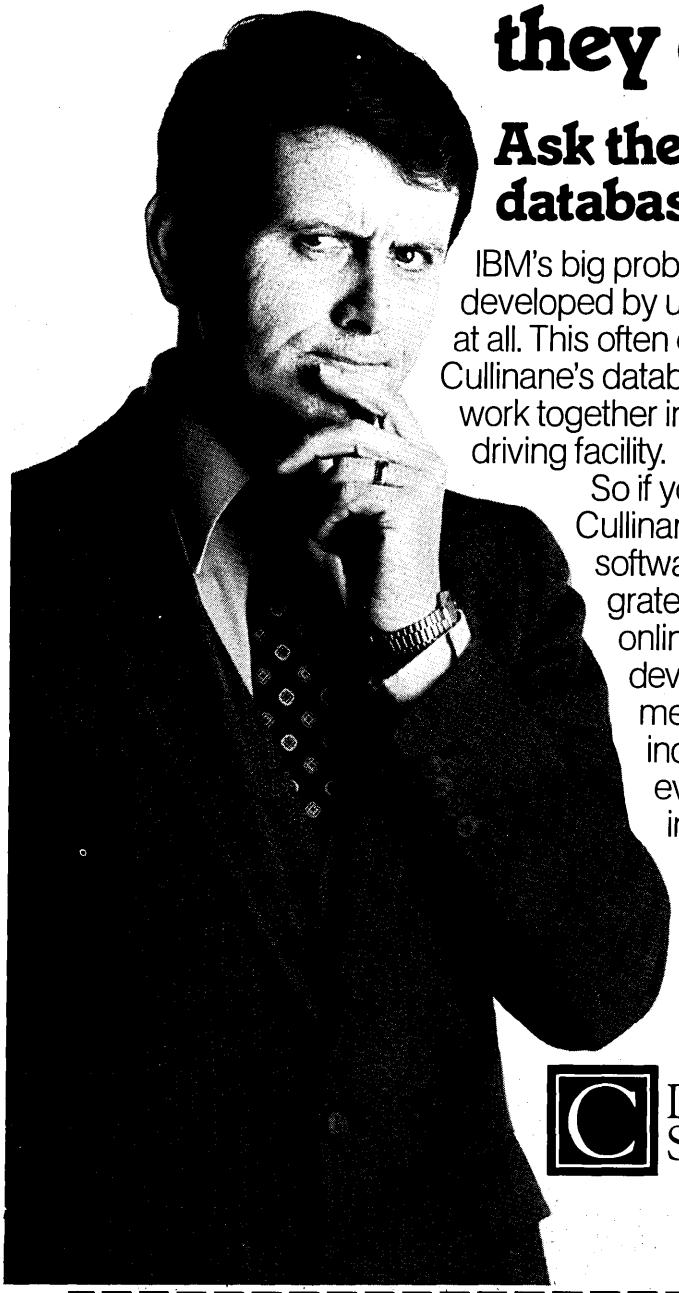

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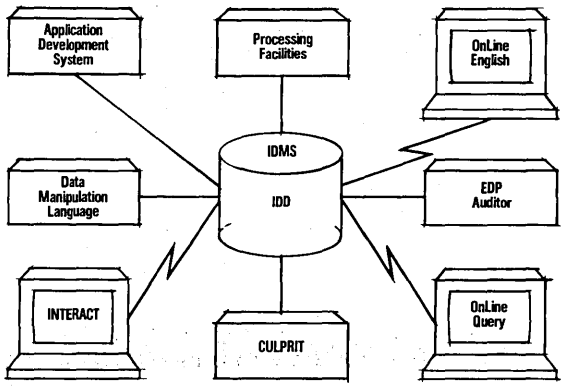

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NEWS IN PERSPECTIVE

cents per minute at night.

The Faxpak processors include a Modcomp cpu and a special front-end developed in-house by ITT. The computer control with specialized software provides the ability to automatically retry a receiving machine if a busy signal was encountered earlier.

Despite its computerized features, Faxpak will have to prove that it is now in step with the needs of users. Instead of simply making a phone call to dial a distant fax machine, a user must remember to dial the Faxpak number to take advantage of the extra cost value-added services that the network provides. Such features as the ability to send one message in "broadcast mode" to many receiving machines is available as part of the store-and-forward network.

Whether Mallone and his sales crew have found the right formula of network offerings this time around will obviously be determined by the level of Faxpak usage in the coming months.

—Ronald A. Frank

ANTITRUST

JUDGE JOINS THE CHORUS

The latest plea for an end to the U.S. vs. IBM case came from none other than Judge Edelstein.

An apparent light at the end of that long tunnel, the Justice Department's antitrust case against IBM, emerged from the gloom in April when the presiding judge offered his help in achieving an out-of-court settlement and told both sides he wanted the six-year-old trial brought to a conclusion by the end of May.

As the month of May began, court observers seemed optimistic that a settlement would be achieved, but neither side would comment officially as to whether out-of-court talks were under way.

The trial, filed in January 1969, was not without highlights during its final days. A motion was filed by IBM to have William J. Casey, director of the Central Intelligence Agency, testify after remarks he was to have delivered at a business meeting in Dallas criticized the government's efforts to split IBM into smaller entities. Casey hinted that such actions would put IBM and the U.S. computer industry at a disadvantage in competing with the Japanese in "the global economy."

Meanwhile, IBM, in a move seen as preparing it for actually splitting apart,

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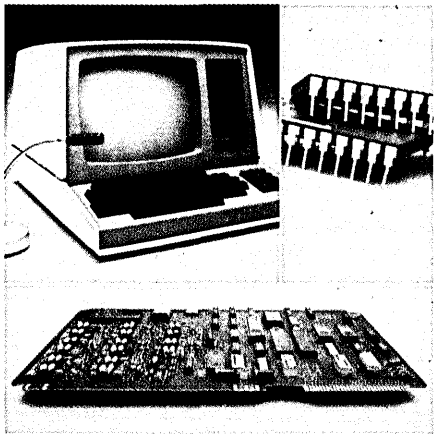

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VOICE RECOGNITION BY INTERSTATE

formed a new customer engineering division for its General Systems and Office Products operations. The move may mean, industry observers say, that the industry leader will spin out a separate marketing operation to handle low-end, non-370-type computers.

On April 17, Judge David N. Edelstein ordered IBM and the Justice Department to wind up the trial by June 1, commenting, "I don't care if you get more help, I don't care if you work morning, noon, and night. This is in effect my ruling: May 30." He noted also that he would offer all his services for an out-of-court settlement, even to fly to Washington "as often as I have to."

Court observers seemed optimistic that a settlement would be achieved, but neither side would say officially whether out-of-court talks were under way.

"Maybe we can sort of use Washington and New York. I will do whatever I can do in order to produce a settlement of this case," he said.

IBM's lead counsel, Thomas D. Barr, responded, "I think my client would agree to any kind of negotiations at any time at any place." He added, apparently in reference to previous attempts to reach an out-of-court settlement over the past few years, that the Justice Department is "simply unwilling to negotiate at any time under any circumstances."

At press time, both sides continued to decline comment when asked if out-of-court talks were underway but several sources close to the case said talks were indeed going on—and in earnest.

Shortly before the judge's setting of May 30 as the last day of the trial, IBM had asked for a dismissal of the case or declaration of a mistrial on grounds that its attorney-client privileges had been abused. It was the third time IBM had made such a motion, although the most recent motion was based on a Supreme Court ruling last January that expanded the privilege of confidentiality for communications between lawyers and clients.

In its latest motion, IBM had argued that the judge's rulings against IBM on privilege claims involving more than 20,000 documents "were plainly erroneous."

IBM lost on that motion, however, with Judge Edelstein saying, "I take a very dim view of this motion at this juncture to declare a mistrial or dismiss the complaint. The motion is denied. It may be renewed together with other motions to dismiss when this trial is concluded."

IBM has also tried to force Judge Edelstein down from the trial on charges that he was prejudiced against IBM witnesses and lawyers and had taken the government's side in the case, but the U.S. Court of Appeals turned that motion down last year.

The judge's call for serious discussions of an out-of-court settlement follows at least eight discussions between the two parties in the last year and a half, none of which have borne fruit.

IBM's counsel Thomas Barr responded to the judge's call for a May 30 end of the trial with a warning about the large findings of fact that would be required at that time.

"The findings effort is truly an enormous and monumental undertaking," Barr said. "I am very concerned about the size of the paper that we will ultimately be delivering to your Honor. . . . The problem that I would have of getting my arms, in your Honor's place, around that huge volume of material from each of us, is really quite overwhelming."

To which the judge responded, "How do you think I have managed until now? Have the physical problems been small?"

Barr replied: "By comparison to what you are now going to be faced with, your Honor, I would go so far as to say they have been tiny."

IBM's counsel was referring to the summary of facts to be delivered to Judge Edelstein, who alone is hearing the case, by the government and IBM. Each side is expected to take several months to challenge the other's findings and then the judge would be able to make a judgment. Court observers indicate that the judge would probably not be able to begin sorting through the trial documents until sometime next fall and they point out that he has in the past said it would take him about a year to make a decision.

Judge Edelstein is in his '70s and it has been suggested that he is anxious to have the case settled out of court so he won't have to deal with the massive number of documents and complex arguments that have been submitted over the past six years.

Each side is expected to take several months to challenge the other's findings, and the judge has said it could take him a year to make a judgment.

Barr at one point suggested another way out: "At least one other way occurs to me—which would be a happy day—which is that the government finally understood what the case was all about and decided to drop it. That, it seems to me, it could do."

Later in the month IBM moved to have William J. Casey, the CIA director, be a witness for its side. At presstime, that motion was being fought by the Justice Department on grounds it would unnecessarily delay the trial, especially in light of the

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April 16, 1981

judge's targeted finishing date.

Casey, whose remarks were presented in printed form to a Dallas luncheon meeting at the Center for International Business Conference when he was unable to appear in person, contrasted Japan's government-sponsored R&D in the computer field with the U.S. government's attempt to "break up IBM."

"The United States now has a comparative advantage in agriculture, services, and though the advantage is slipping, in specialized manufactures (sic) such as wide-bodied aircraft and computers," the CIA man said. "We know that Japan is taking dead aim, through government-subsidized research and government-influenced consolidations, to create more powerful competitors to take on IBM in the world market.

"At the same time our antitrust policy, ignoring the reality of a world market, seeks to break up IBM, and many antitrust rules make it difficult for U.S. companies to rearrange their affairs in a way that reduces costs and increases productivity in order to permit them to compete both here and abroad on equal terms with their foreign competitors."

IBM was quick to publicize Casey's remarks to the press, even if it couldn't get the man himself on the witness stand. The antitrust comments from a high-ranking government official seemed to echo recent comments by the Defense Department that a breakup of AT&T, which is undoubtedly a monopoly—albeit through federal regulation—would have dire consequences for national security. The Defense Department claimed that national security is dependent on a unified telecommunications network,

CIA director Casey seemed to connect preeminence in global markets by multinationals such as IBM to national security.

and questioned the Justice Department's antitrust case against AT&T.

Casey, too, seemed to connect preeminence in global markets by multinationals such as IBM to national security. He cites "increasing nationalism, increasing terrorism, and vanishing resources" as "three realities" that are threatening U.S. positions in key market arenas. The U.S. multinational, he said, is dependent on other nations for "such strategic minerals as chromite, cobalt, tantalum, and several other strange names we seldom see in a direct sense. . . . Were we to lose access to these minerals, it would mean massive shocks to our economic system and current lifestyles. Without these minerals we cannot make tv sets or computers . . . The implications for our defense capabilities are just as grim."

—John W. Verity

SUPERCOMPUTERS

HIGHBROW HARDWARE

The goal of supercomputer scientists is to improve processing speeds by a factor of 100 by the end of the decade.

In designing nuclear weapons, reactors, and the like, one class of computer jobs run is the Monte Carlo calculation. With this technique, which attempts to duplicate a process that is statistical in nature, it is possible to trace the interaction of nuclear particles with different materials and learn about, for example, radiation shielding, e.g., how thick must a concrete wall be in order to protect delicate instruments from radiation damage?

Such a calculation could run for an hour or two on a Cray-1 supercomputer and produce a result with a 20% uncertainty factor. Unfortunately, results in Monte Carlo calculations are not considered believable until they get down below 10%. But a recent job would have taken 32 hours on a Cray computer to achieve a 5% uncertainty, and to get it down to a comforting 1% would have required 800 hours.

Solving large scale calculations, which chew up exhorbitant amounts of machine cycle time, is what brought together a gathering of august users and pushers of supercomputers. The meeting, at Gleneden Beach. Ore., was sponsored by the two Dept. of Energy laboratories at Los Alamos, New Mexico (LASL) and at Livermore, Calif. (LLL). And it drew computer designers from companies like Acsys, Burroughs, Control Data, Cray, DEC, Denelcor, Floating Point System, H-P, IBM, SEL, Univac, and that maker of big machines, Intel, in addition to some academicians.

But supercomputers are not the exclusive province of the U.S. The Japanese, with encouragement and financial impetus from the government, are also working on vector machines with speeds beyond anything available today. Cognizant of this, U.S. bureaucrats have sounded a tocsin against the Administration's budget cutters, lest on-going R&D projects in this technology be cut or cancelled.

Advances in supercomputer technology were placed into historical perspective by Jack Worlton of LASL in an after-dinner presentation. He noted that 1981 marks the 38th anniversary of the founding of the Los Alamos lab, the 35th anniversary of the first "successful electronic computer"—ENIAC, and the 29th anniversary of the Livermore lab. In that period, Worlton said, the speed

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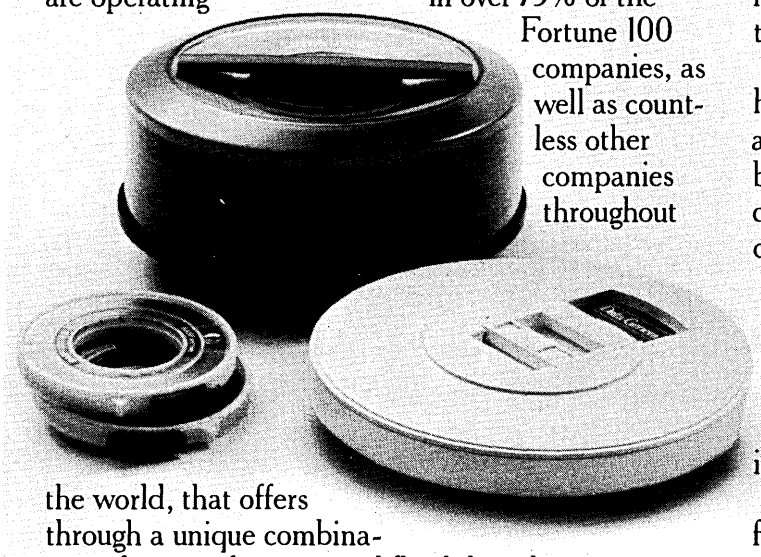

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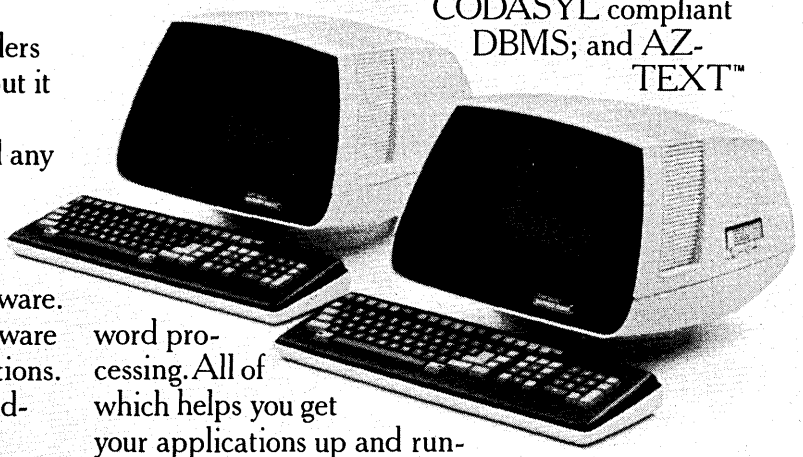

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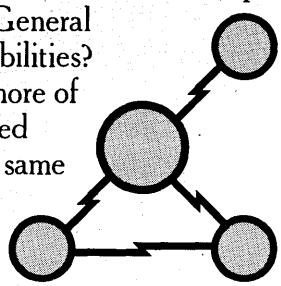

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CIRCLE 49 ON READER CARD

of computing has grown from two or three operations per second on punched card accounting machines used at Los Alamos in the World War II years to more than 10 million operations per second today. That's more than seven orders of magnitude, he pointed out, and yet this group is meeting with vendors to say, "That's all well and good, but what we need is another two orders of magnitude—and preferably in this decade, if you don't mind."

"High speed computing is more than a floating point muscle."

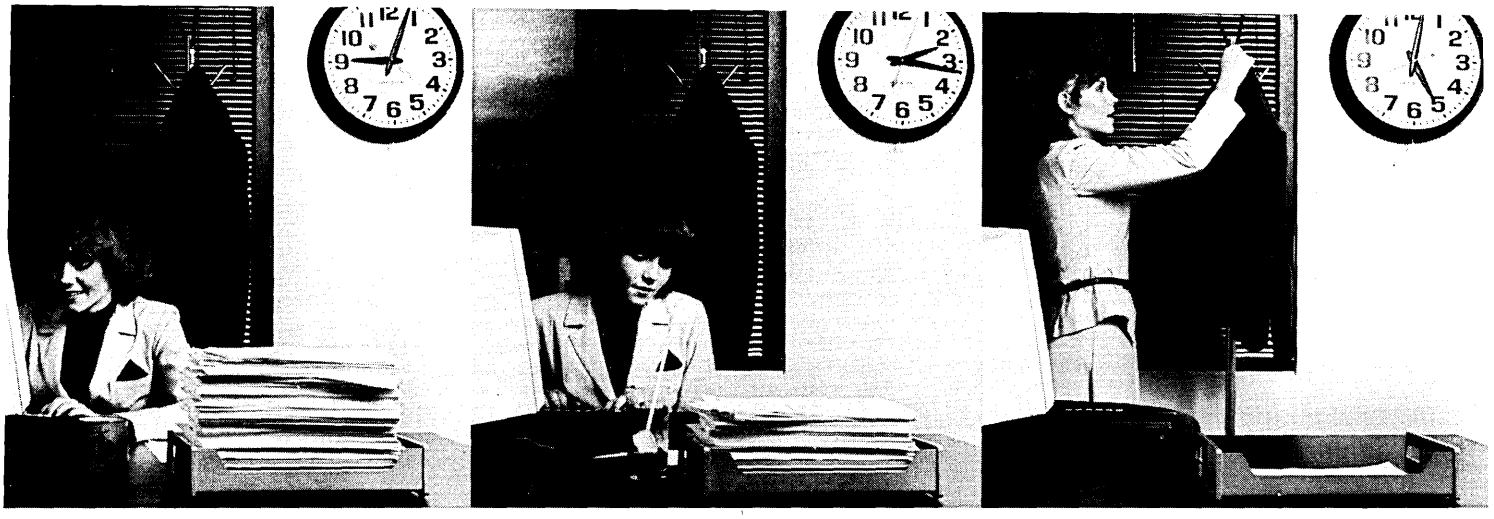
George Michael, who heads the computer research group at LLL, filled in the details. He said in the decade between 1950 and 1960, which saw the development of transistors, of Univac computers, the CDC 1604, and the IBM 7090, the lab experienced a factor of 100 (two orders of magnitude) improvement in computers. From '60 to '70, it gained another factor of 100, thanks to MSI, LSI, "and Seymour," referring to the designer of CDC's supercomputers who went off to form Cray Research. But from 1970 to 1980, Michael continued, "we barely got a factor of 10." And outwardly there is no indication that in the current decade of the '80s there will be anything more than a factor of 10 improvement—and we'll be lucky to get that. Thus the meeting—not only to push the vendors to produce the factor of 100 jump by the end of the decade but specifically a factor of 10 improvement by 1985. The decade-end goal of something 100 times faster than a Cray-1 or a Cyber 205 would be performing from three to four billion floating point operations per second.

"I believe that's an achievable goal," Michael said hopefully. The solution must have a mathematical cast (new algorithms adapted to fit strange new architectures), a language cast (how do you express your ideas?) and an architecture cast (the possibility of a data flow machine, as well as various configurations of multiprocessors). Perhaps there's salvation, as well, in the Josephson technology or in gallium arsenide to get down into the range of a nanosecond per cycle.

To the casual observer, the frontrunners would appear to be Cray and CDC, which have been the primary vendors of supercomputers to the nuclear weapons and weather bureau folks. It was said that 70% of the LASL work load was in nuclear weapons work, some 90% at LLL. And at LASL there are between a half-million and a million lines of FORTRAN code to do these design calculations. It would appear, then, that the cards are stacked in favor of Cray and CDC. But Michael denied this, noting that at Livermore they are willing to rewrite their code for a new and incompatible machine that offers a factor of five improvement in speed, but not for a factor of two. Keith Taggart of LASL, on the other hand, said it would take an order of magnitude improvement before they'd do any recoding for an incompatible machine.

Cray and Control Data have been the primary vendors of supercomputers to the nuclear weapons and weather bureau folks.

For anyone with a legitimate interest, the folks at Livermore have designed sample problems (declassified, of course) of the types of codes they run—things with names like Lagrangian and Eulerian hydrodynamic calculations, Monte Carlo calculations, and magnetohydrodynamic codes. They're complete problems including the graphics I/O requirements, and the like. These codes, in an internatinal standard FORTRAN, enable a designer to run the job on his computer to see how it compares with the Cray, for the soft ware comes with performance numbers on the Cray-1. It is available also not as code straight out of the language compiler but also with some hand coding that pro-



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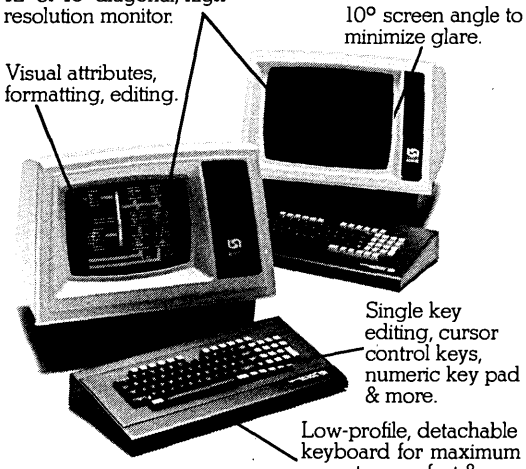

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CIRCLE 51 ON READER CARD

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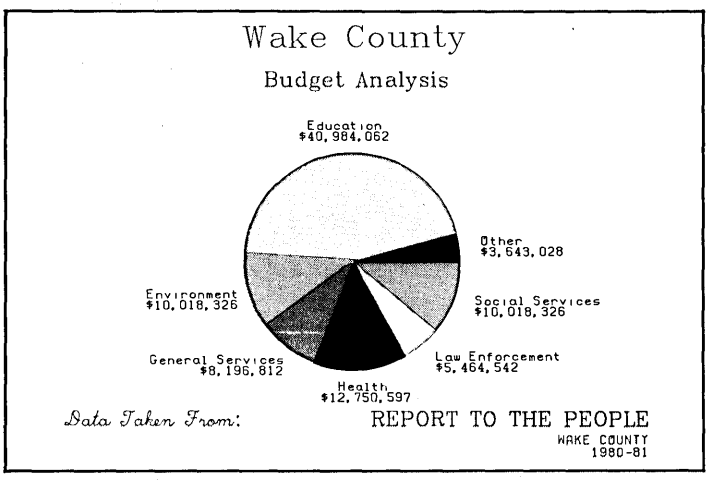

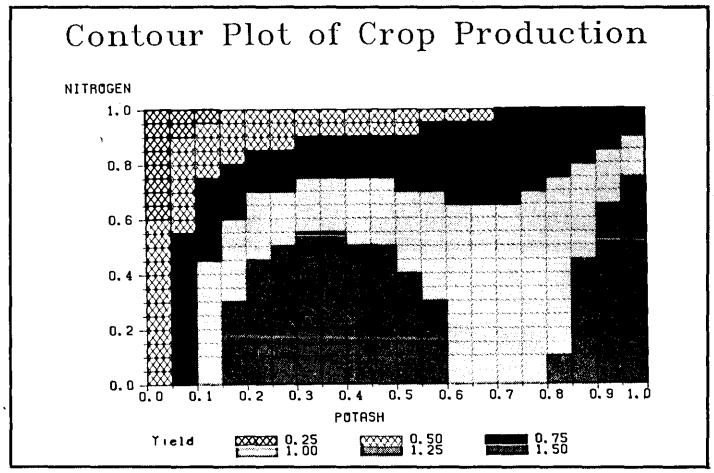

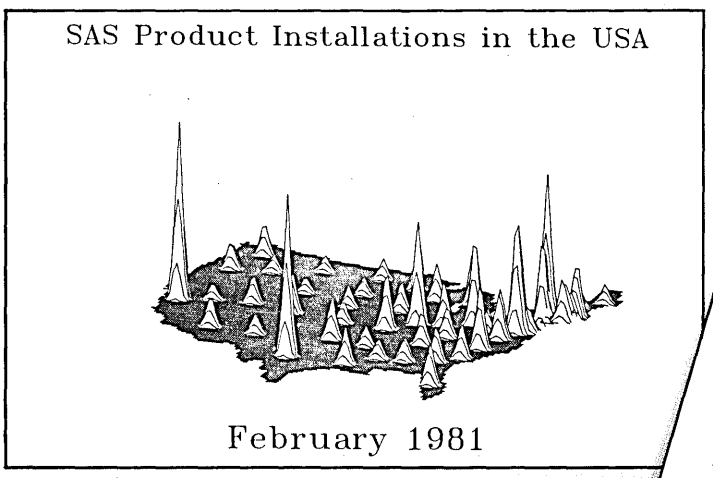

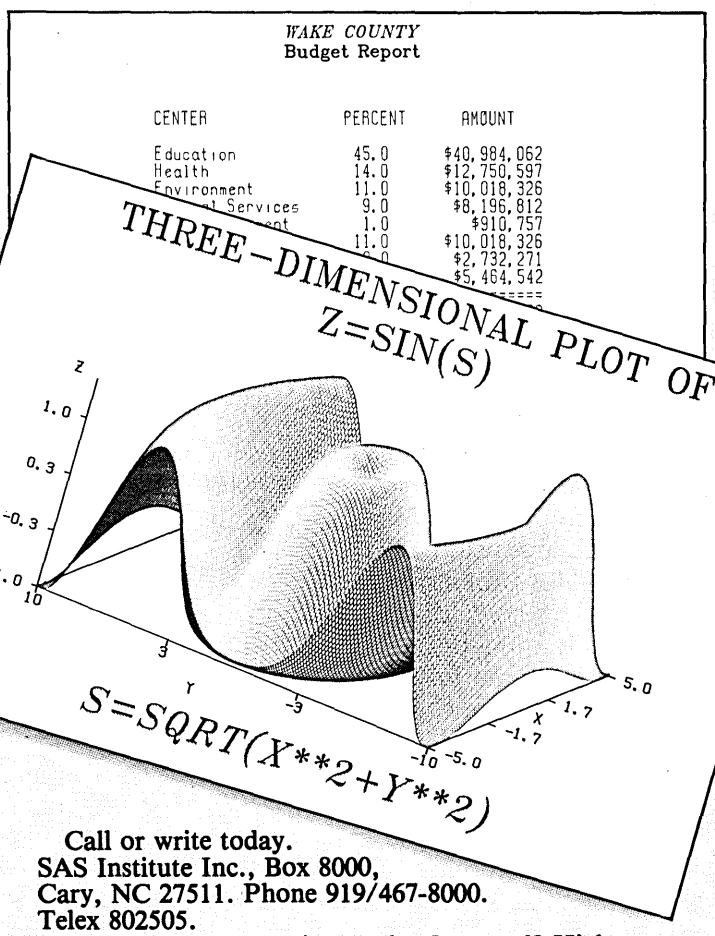

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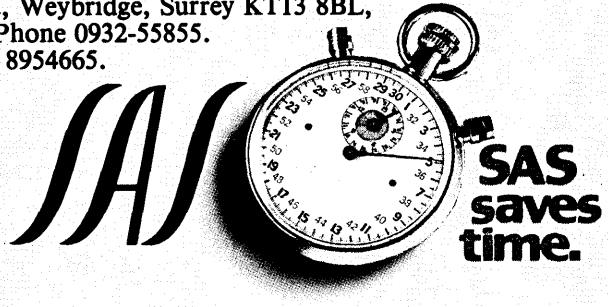

For information on the Zeta 1453, write or call Nicolet Zeta Corporation, 2300 Stanwell Drive, Concord, CA 94520 (415/671-0600).

CIRCLE 52 ON READER CARD

duces optimum run times; this so-called best-effort program, of course, will not run as is except on a Cray. According to Michael, some of these problems have been sent to CDC, Cray, Burroughs, IBM, DEC, to Europe and the U.K., and to a number of interested universities.

According to Worlton, there are four reasons why a superfast computer is needed. One is to telescope time. He explained that a job that runs for 100 hours on today's fastest computers doesn't actually get the luxury of one hundred consecutive

Supercomputers are needed to telescope time, to improve product quality, to reduce costs, and to increase scientists' productivity.

hours on the mainframe; it is more likely performed over a three-week period since other scientists are waiting for their crack at the number cruncher. If it were possible to telescope by a factor of 100, the job could be done overnight. And a one-hour job could be done in less than a minute—with a scientist being able to work at a terminal.

Secondly, fast computers help improve the quality of products produced at the labs. Worlton observed that these are not your basic consumer products, but deal instead with the safety of reactors and other equipment.

Third, they help reduce both computing and the cost of major products. It is estimated now, he explained, that the first demonstration power plant for magnetic fusion energy will cost a billion dollars. With that much money at stake one wants some very powerful simulation tools with which to model the entire plant—not just bits and pieces of it—before proceeding to build one.

And finally, it would help increase productivity of the labs' most valuable resources—scientists and engineers.

Better hardware, continued Worlton, has been based on improvements at the components level and at the structural level. He referred to the so-called Moore's Law, a prediction by Gordon Moore in 1967 that the number of components on a chip would double every year. The Intel Corp. chairman and ceo, who worked for Fairchild at the time of his prognostication, was correct until about 1975. In 1979, Moore wrote in the IEEE *Spectrum* that the doubling was occurring every two years, rather than annually, and he expressed concern that the interval might stretch out over time. Others confirm this concern, Worlton noted, saying the industry just can't supply chips that are a hundred items faster than today's.

"So, just as there's no free lunch, there's no free computer speed," observed Worlton. This means tomorrow's machines will likely be incompatible with today's applications programs, for users will have to get their speed improvements from structural change in the processors, and this probably means dealing with explicit parallelism. The speaker also noted that Gene Amdahl, in a paper at the 1967 Spring Joint Computer Conference, spoke of the dangers of parallel processors. When you build a computer with two distinct modes of operation, one high-speed and one low-speed the overall operation will be dominated by the low-speed side, Amdahl had asserted. Worlton said he thinks this basic principle is still sound.

"There's less risk in using a small number of fast processing elements than there is in using a large number of slow processing elements," he wrote, adding, ". . . The success of multiprocessing, at least in the first generation, is going to depend at least as much on compiler quality as it will on computer quality."

But Worlton noted that while one must recognize the dangers of multiprocessing, one must also admit that the necessary speeds will not be achieved without it. The speaker also referred to Marvin Minsky's Turing lecture of 1970 in which he speculated that the speedup from multiprocessing would be proportional to the binary logarithm of the number of processors used. Or, in order to get a factor of 10 improvement in speed, one must have a thousand active processors. That may be overly pessimistic, Worlton said.

But none of the speakers at this conference, including Worlton, commented on an earlier observation by the meeting's keynote speaker, C. E. Leith of the National Center for Atmospheric Research, Boulder,

Some believe that the value of computing power is only proportional to the logarithm of that power.

Colo. Leith spoke of the direction being taken in the numerical simulation of fluid dynamical systems, such as the turbulence across the surface of an aircraft's wing or in global atmospheric simulations for weather predictions. "I'm not sure that I'm particularly enthusiastic and optimistic about how we're going to be able to solve some of these problems," he said, for as the simulators find they must work with finer and finer meshes and strive for increased resolution, they also find they need exponentially increased computing power.

"I'm beginning to believe," Leith said, "that the value of computing power is only proportional to the logarithm of that power." And as result, a doubling of computing power "is just barely noticeable."

Consultant Robert S. Barton, newly departed from Burroughs Corp., said he suspected this gloomy observation was true.

A plea of sorts came from David S. Kershaw of LLL. He is concerned with what he calls "the increasingly complex software

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THE SMART ALTERNATIVE IN COMPUTER SYSTEMS

CIRCLE 55 ON READER CARD

that the computational physicist has to deal with and the increasing degree to which knowledge of computer architecture is impinging on the computational physicist's work." On the Cray, he explained, there are issues like how to turn loops inside out, or why isn't this loop vectorizing? "I never had to think of this before," he said.

Kershaw added that he was concerned about the next generation of supercomputers, the multiprocessors, and the data flow machines "where the possible ways of executing a given FORTRAN statement are multiplied." As this occurs, software becomes more complicated, and the physicist becomes more concerned with architectural issues, with physical issues, and less with numerical algorithms.

". . . To whatever degree it's possible to have the software worry about these issues for me, so I can focus my attention on physics issues and numerical algorithm issues," he told the vendors, "that would be very much appreciated."

The physicist also put his endorsement on a timesharing capability in any future system, acknowledging that some scientists disagree. Kershaw said large codes are much more easily debugged in an interactive environment than in batch. ". . . I think large programs are much more useful to the scientist if he can interact with them." This capability allows the user to question his program as it's running, thus determining what the current values are. And if the program is veering in the wrong direction, he can change parameters, alter the course of the simulation, provide a different set of initial conditions. In a batch system, he explained, one might not discover this until after the job had run for several hours.

Performance improvements stemming from improvements in algorithms

Tomorrow's machines are likely to be incompatible with today's applications.

were illustrated by Worlton. He told of a scientist who took the time to examine a job that ran for 90 minutes. Finding that it was using an inappropriate algorithm, he used a better method, reprogrammed the job, and got it to run in only five minutes. And that, he pointed out, is a factor of 18 improvement, or two supercomputer generations. "There are an awful lot of examples like that in our business," he observed, including several that have produced an order of magnitude improvement independent of hardware advances. But the labs lack the manpower in their budgets to do more of this. He lamented the government's willingness to put lots of money into new hardware instead of balancing the effort with money for numerical analysis and the development of new algorithms.

Conference co-organizer George Michael of LLL says he recognizes that high-speed computing, such as that discussed at this meeting, represents a minority of the computing community at large. But he feels there's enough interest in it to warrant forming a special interest group, perhaps within the ACM (Assn. for Computing Machinery) or the IEEE (Institute of Electrical and Electronics Engineers), to conduct similar discussions among academics, manufacturers, and users.

In recognition of the need for more than exotic hardware, he quips: "We're saying that high-speed computing is more than a floating-point muscle."

—Edward K. Yasaki

APPLICATIONS

TELETEX TO THE RESCUE

Participation in an experimental teletext project just may save the license of a public broadcast tv station in Los Angeles.

Electronic home information systems are proliferating all over the world under a variety of names and with varying effects. In Los Angeles, one such system may actually save the license of a public broadcast television station.

In this case, it is a teletex system that's being used in a cooperative project by the CBS Broadcast Group, CBS-owned KNXT-TV, public tv station KCET, the Caption Center/Los Angeles and Telediffusion de France. The latter is lending more than $1 million in Antiope Videotex Systems equipment for the project. The gear includes special page generating equipment, captioning equipment, and the French group's patented transmission system, Didon.

Whatever the project's far-reaching effects, it could have an immediate salutary effect on KCET. Last month the station found that its Federal Communications Commission license to operate was in danger of being revoked.

The license was renewed three years ago. But in a case brought before the U.S. Court of Appeals by a Los Angeles deaf person and by the Greater Los Angeles Council on Deafness (GLAD), complaints were made that the station wasn't serving viewers with hearing impairments.

Because public television stations such as KCET receive federal financing, they must demonstrate to the FCC that they are complying with the Federal Rehabilitation Act of 1973, which protects the rights of handicapped persons. The court said KCET

NEWS IN PERSPECTIVE

must meet those requirements. But now, KCET is involved in the joint teletex project, which offers captioned data as an option for persons with impaired hearing.

KCET is using what is known in simple terms as the narrow black bar that shows up at the bottom of the picture when a malfunctioning tv loses its horizontal hold and the picture starts jumping through the screen.

Below that black bar, a television user with a special decoder can receive "captioned" versions of the programs. The user also can receive a lot of other things, such as next week's television programming schedules. Or, the user can push a button after a commercial for, say, refrigerators and get a list on the tv screen of all local distributors. This is done with a keypad, like a calculator keypad, which also

With the system KCET is using, a subscriber with a special decoder can receive "captioned" versions of the programs.

can be used to get information pertaining to a public affairs broadcasting program, such as what newspaper or magazine articles, books, or videotapes are available on the subject.

Antiope Videotex Systems introduced the French broadcast teletex system to the U.S. more than two years ago. CBS began studying it, along with the British CEEFAX and ORACLE systems, in January 1979. Actual on-air testing began in March 1979 at CBS-owned KMOX-TV, St. Louis. These tests continued in other cities and on network long lines to develop transmission methods to ensure reliable service in the U.S. KCET also conducted technical tests, culminating in a public test in March 1980.

On July 29, 1980, CBS filed a petition with the FCC to establish U.S. teletex standards, based on a modified Antiope system. On approval of standards by the FCC, broadcasters will be able to acquire the equipment to transmit teletex, and receiver manufacturers can begin mass production of decoders to be used with existing television sets, along with television receivers equipped with built-in teletex decoding capability.

On the other side of the world, the Australian Broadcasting Commission has begun field trials of Antiope equipment. ABC officials said the decision to turn to Antiope followed unsaisfactory trials of a British system. They said that system, originally designed for use in UHF stations, did not test well on its low-numbered VHF channels. Data was distorted in its passage from the transmitter to the tv set, they said, leading to errors or omissions in the pages of information.

The Australian broadcaster said it would make a request to its Federal Com-

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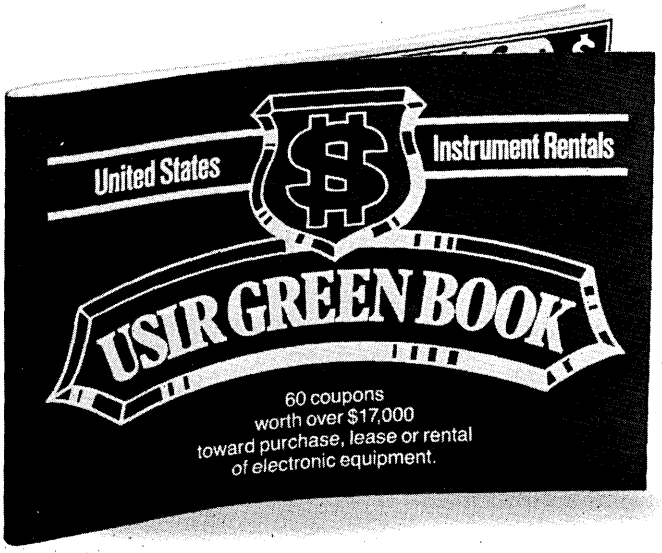

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CIRCLE 59 ON READER CARD

NEWS IN PERSPECTIVE

munications Department, similar to CBS' request here, if the Antiope tests succeed.

And in Britain, where it all started, the system first called Viewdata and now known as Prestel seems to be facing marketing problems. "The strategy behind the creation of Prestel," said Lee R. Greenhouse, director of new electronic media programs for LINK, New York City, "was that the mere presence of the system would attract users, and that service providers would pour their resources into developing applications. Neither has come true, leaving the system in a crippling chicken-and-egg dilemma. Because the system lacks users, service providers are reluctant to develop their applications, and in the absence of these applications, users see no compelling reason to regard the system seriously."

Bell Canada has been experimenting with what is generally known as the videotex concept since 1977. Its Telidon alphageometric display system stores and describes images in the database as geometric shapes—points, lines, rectangles, polygons, and arcs. Telidon has been sold in the U.S. for use by the Public Broadcasting Service in Washington, D.C., and also in Venezuela. Canada's minister of communications, Francis Fox, has expressed the conviction that "where these systems are compared, Telidon will come out ahead on all counts, including cost."

Consumers are well aware of the new electronic media, but they have had little or no hands-on experience.

France calls its Antiope-based service Télétel. And here in the U.S., GTE has a system it calls Infovision, which attempts to use local newspapers as operators in a national system linked by GTE's Telenet operation. The GTE concept calls for newspapers to serve their markets with local videotex centers tying together various host computers (banks, retailers, etc.) and having gateways to remote computers in other cities. Under this plan, GTE shares revenue generated from the newspaper's market; the newspaper collects revenue every time a user from its locale accesses the system.

Greenhouse of LINK said a study his firm conducted with Dresner, Morris & Tortorello showed that consumers have a high degree of awareness of the new electronic media but that this is tempered by a lack of hands-on (or eyes-on) experience. "The mere presence of an operational system is not sufficient in itself to create a base of users," he said.

He said the study also indicated that consumers would have no difficulty in using such entertainment devices as a tv set for performing two-way functions, but that two-way service would have to be marketed distinct from the original entertainment offerings.

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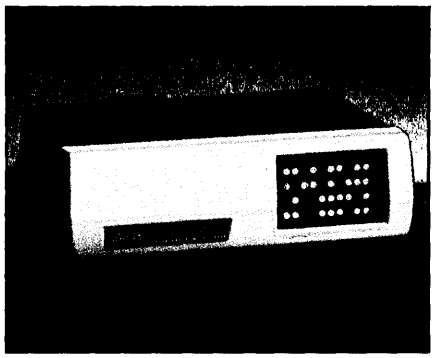

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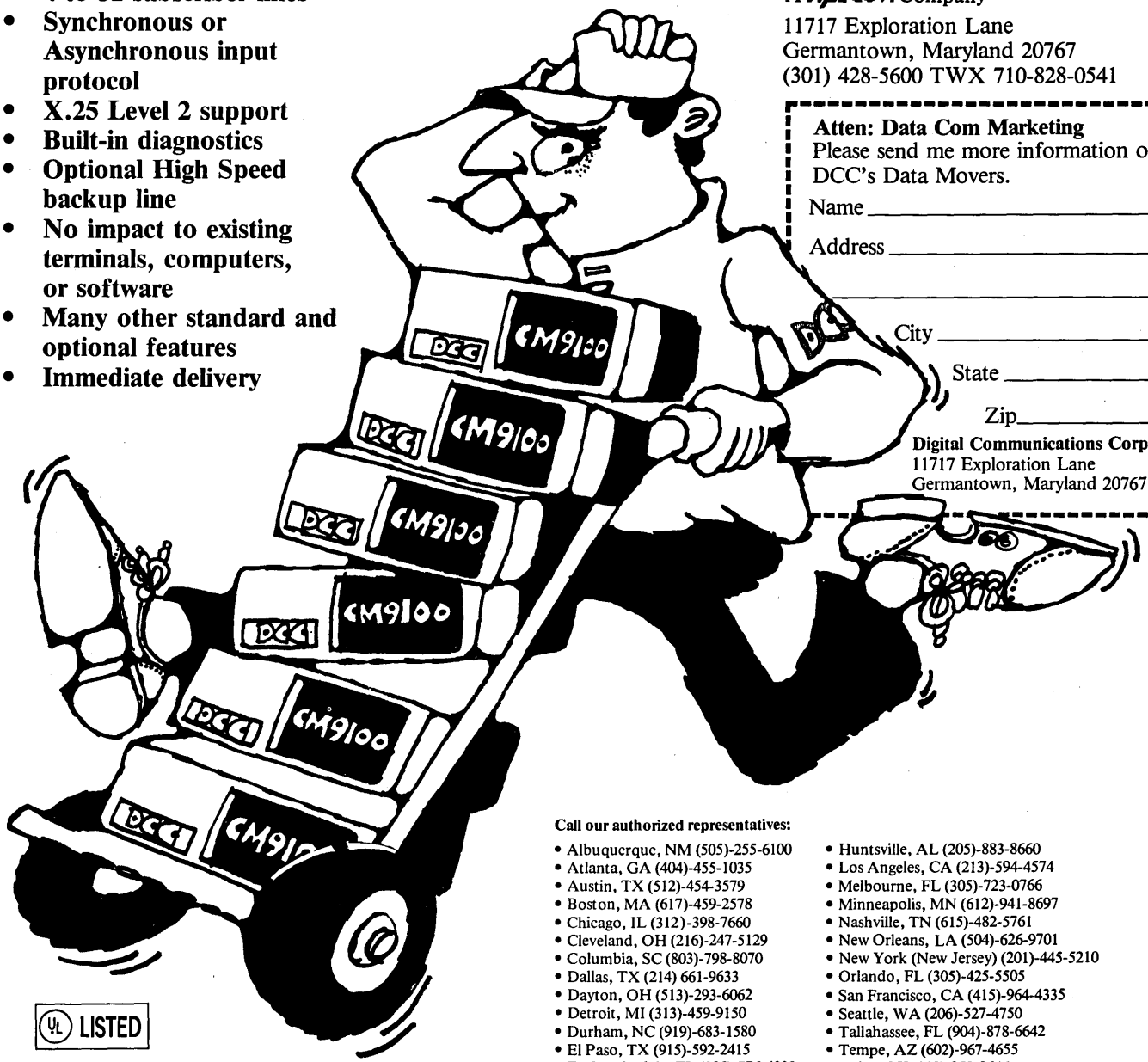

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CIRCLE 61 ON READER CARD

NEWS IN PERSPECTIVE

The service being offered in Los Angeles doesn't have to interfere with a tv picture. The additional data is tucked away under the black bar at the very bottom of the screen and is not normally visible to persons who don't have the keypad-like decoders.

For instance, KCET could, for users with a decoder, wipe out the entire picture and ask questions about a subject brought up on, say, the popular program "Sesame Street." The user would come up with an answer and push the "reveal" button on the keypad. A portion of the page on the tv screen that was blank would quickly be filled with the answer to the question.

In the L.A. test, 30 receivers equipped with teletex decoders are located in public places. By this summer, 100 additional receivers will be placed in private homes. During the life of the experiment, the number of sets may increase.

And the service being provided for the deaf might just have an impact on the Court of Appeals—in KCET's favor.

—Edith Myers

WANTED: PUBLIC OPINION

It's not clear what, if anything, people want to do with videotex, and how much they're willing to pay.

For a number of reasons, very few homes in the U.S. are equipped to receive the new information and entertainment services becoming available through their tv sets or special videotex terminals. Neither side seems willing to make the first move.

"I don't know if 'obstacle' is the right word," says Robert Plummer, "but it seems to me that the thing that stands between where we are now and mass use of electronic systems in the home is that no one really knows whether the general public gives a damn. I think it's just not clear yet what, if anything, people want to do with this kind of system." Although people have been studying the market for two-way home video services, he added, it's still not clear what the public wants and how much it's willing to pay for it.

Plummer, of the Institute for the Future, was on a panel at a two-day symposium on these systems, sponsored by Strategic Inc., San Jose, Calif. Fellow panelist Carroll Reeves of Tandy Corp. said he thought the biggest obstacle to success in this market was the superfluity of conferences and study papers on videotex systems, which tend to divert valuable man-

CIRCLE 63 ON READER CARD ▶

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L. F. Rothschild, Unterberg, Towbin	**Salomon Brothers**	**Shearson Loeb Rhoades Inc.**
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power from the implementation of such systems. Reeves, whose company brings you Radio Shack and the TRS-80 personal computers, is in favor of starting small with home video information services and growing along with the using public.

"I guarantee you, I don't know what the people want. And I don't think you'll find out if you ask them," he said. But if you test market enough systems, offering a variety of services, you'll find enough winners, popular features, and programs to determine what sells and what doesn't. "I think interchanges like this are good," he added, "but let's not forget that doing it is going to get us more information."

Concerns about the social implications of these home systems were also raised, such as the invasion of privacy, whether information services broaden or narrow the gap between the information-rich and the information-poor in our society, and whether transaction services will cut out middlemen such as travel agents and insurance salesmen.

But Robert Sullivan of Warner Amex Cable Co. said an initial concern over privacy among customers of the Qube system in Columbus, Ohio, became a nonissue after the first year of operation. The system vendor is in a position to know what every Qube viewer is watching every minute of the day, he explained, a necessity because a viewer pays to see certain programs and must be charged accordingly. Qube sometimes also polls its viewers' sentiments online, if you will, like after an address by the President of the U.S. The results are immediately flashed on the screen, but expressed only as a percentage of the viewers participating, never in terms of absolute numbers. "So I think there's an overconcern about privacy," Sullivan said.

According to Joseph Roizen of Telegen, promoters of the French Antiope Videotex-System, there are two main obstacles to be overcome. One is the lack of any standards in the U.S. to assure that a teletex receiver in one part of the country picks up the same type of signal as one used in some other part of the nation. Roizen says the Electronic Industries Assn. has a teletex committee studying the different teletex systems and, hopefully, will recommend to the FCC by the end of this year the parameters for a U.S. teletex service that would apply to the entire nation. And if we're fortunate, he said, it will also be adopted by Canada and Mexico.

Secondly, Roizen sees perhaps a bigger obstacle, the incremental cost to the user to equip his tv set to receive teletex signals. But the voluble speaker was optimistic that a decoder in mass production could be offered for perhaps 20% of the price of the set. And perhaps the government will insist that all tv sets sold be so equipped, as it did with the UHF tuner.

—Edward K. Yasaki

MANAGEMENT

THE FEDS DISCOVER IRM

The federal government has finally embraced the concept of information resources management.

The concept of information resources management has been lingering on the fringe of the ADP profession for several years. But in the past two or three, IRM has metamorphosed from caterpillar to butterfly. Both public and private sectors are rushing to embrace it.

"The profession is now mature in terms of tools, organization and function," Warren Buhler, former director of the Federal Paperwork Commission, told attendees at the recent Federal DP Expo conference. "The ADP field is too ingrown. No one in it gets out into the world enough. Focus is now shifting away from that cocoon.

"IRM can take you above ADP alone. You can rise to a level of general management that wasn't possible before. But to take advantage of these opportunities, you have to set your sights and objectives beyond anything you can do in the ADP world."

Much of the current momentum behind IRM in the government derives from the passage of the Paperwork Reduction Act of 1980. That legislation, guided through the Congressional maze by the firm hand of Rep. Jack Brooks (D-Tex.) despite stringent opposition from affected federal agencies, establishes IRM as a mandatory government management concept. It is one small step in the ceaseless struggle to keep pace with the private sector, which Buhler estimates is two to three years ahead of the government in the methodology of IRM.

The Act establishes a new office, called the Office of Information and Regulatory Affairs, within the Office of Management and Budget (OMB). Headed by an administrator, it will be the focal point for federal information management policy and oversight. More importantly for IRM advocates is the establishment of a "senior official" in each agency who will be responsible for all information activities within that organization. The official will report directly to the agency head and work closely with OMB on IRM. What's more, the Act actually gives a definition to IRM. "Planning, bud-

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geting, organizing, directing, training, promoting, controlling, and other managerial activities involved with the creation, collection, use, and dissemination of information."

An OMB draft bulletin defined the official's responsibility to "oversee these agency activities associated with information resources management and ensure that those activities are carried out in an effective and efficient manner. Generally, the single official should develop policies and oversee all agency resources associated with the acquisition, management, and disposition of information." Specifically, it listed 22 duties for these fortunate folks, who will report to work July 1.

"I believe this guidance adequately meets the intent of Congress," Brooks told a DP Expo luncheon audience. "OMB has clearly and concisely described the authorities and responsibilities of the senior official." The feisty Congressman did take exception, however, to a sentence urging agencies to "take steps to ensure that information resources management does not unduly impede or interfere with the accomplishment of agency programs."

"It indicates an underlying misconception of the Act," Brooks fumed. "Taken literally, this phrase is the antithesis of what the Paperwork Act is all about. It is a contradiction in terms to suggest that information resources management could impede or interfere with the accomplishment of agency programs. The very opposite is expected to be achieved, and I hope OMB can avoid using these code words that have so often let the agencies escape through a business-as-usual loophole."

The agencies undoubtedly will not wriggle free with Brooks' eagle eye upon them. But whether they do or not is irrelevant to the future of IRM. Its elevation by the senior official to heights undreamed of four years ago is expected to serve as a model for those who wish to advance from pushing buttons to telling others what buttons to push.

"Until very recently most ADP people took a narrow view of their role and responsibility," says Robert Solomon, director of communications of Congressional Information Services, the country's leading indexer and abstracter of government information. "They viewed their job as almost strictly technical and had no foresight as to their next move. They were thinking as technicians or librarians rather than information managers.

"They have to realize that the single largest product of the United States is information, and the government is the world's leading producer of it. Now, with IRM officially adopted as a government policy, opportunities will exist as never before. And in IRM officially adopted as a government policy, opportunities will exist as never before. And in IRM you have to be aggressive and sophisticated about the role you can play."

Recent research indicates that the use of information resources is becoming a specific business tool for every area of corporate operations. One source described it as a "critical mass" which will lead to chain reactions by those companies which have been loathe to invest time, money, energy, and resources in junking the old for the new.

"In the next few years it's going to be very commonplace for companies to have to answer to stockholders about what they're doing with information techniques," the source says. "Top management is going to feel more accountable about what it's doing. More and more businesses are going public with their computer and information systems.

Much of the current momentum behind IRM in the government derives from the passage of the Paperwork Reduction Act of 1980.

"This will create a bandwagon effect. Management will want to show that what it's doing to get markets makes the company viable. As the MIS [management information services] department gets more into the limelight, it will be seen as a career path to top management. Then the question will be whether the technician is capable of expanding into the new management role."

And opportunities increase in what formerly was a closed profession, the depth and breadth of people entering IRM is growing rapidly.

"Most of us associate information gathering with a library, where you look at books on the shelf, hear 'ssshh!' and 'did you look in the card catalogue?' all the time," says Ramona Crosby, an organic chemist and supervisor of information services for Stauffer Chemical Company. "Librarians were given no thought in large corporations. If one of those companies had a library, they operated it under the same mental set as when you grew up. That meant the decision-makers gave it no resources.

"Now the management is taking an active interest in IRM. The first time I tried to hire a PhD for the library, they wanted to know why. Now they don't ask me anymore. There's a much more positive attitude about it. I think the Paperwork Reduction Act is going to help, too, because a lot of companies will use it as a model. I certainly plan to.

"I'm convinced at this point that IRM is being recognized by management as a resource within the corporation."

"That's absolutely true," agrees a private sector source. "The key to IRM is to have the tools to manage information cheaply and effectively. At its fundamental level,

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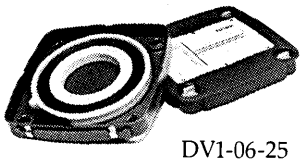

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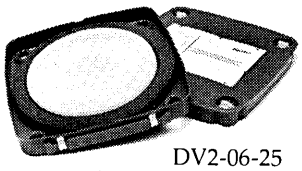

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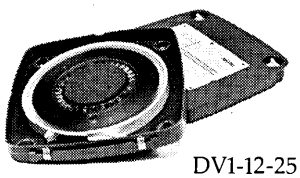

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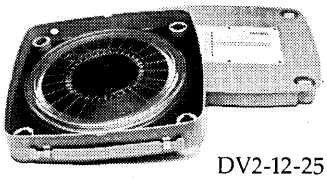

DV2-12-25
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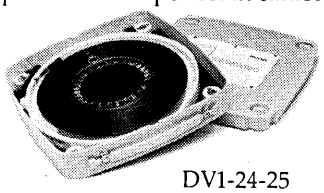

DV1-24-25
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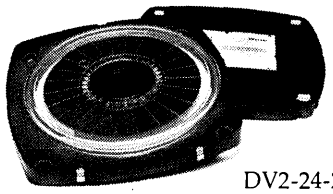
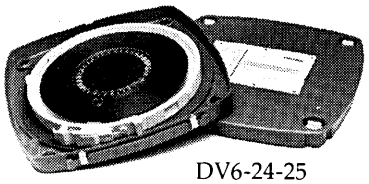
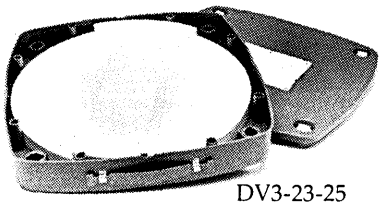


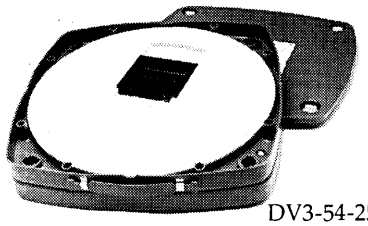
DV2-24-25
Ships one 2400' tape reel in canister



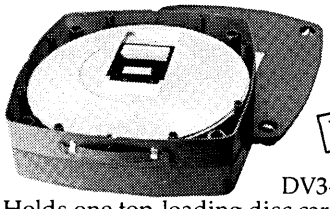
DV6-24-25
Ships one 2400' tape reel in Easy Load II seals



DV3-23-25
Holds one front-loading disc cartridge (IBM type 2315)

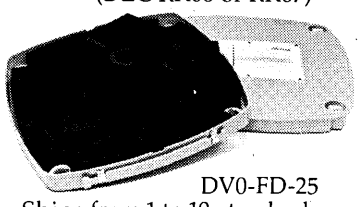


DV3-54-25
Holds one top-loading disc cartridge (IBM type 5440)

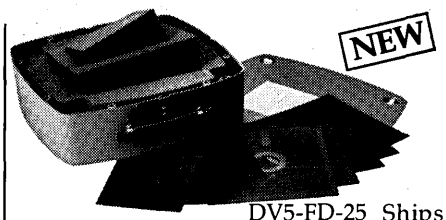


NEW

DV3-67-25
Holds one top-loading disc cartridge (DEC RK06 or RK07)



DV0-FD-25
Ships from 1 to 10 standard or mini floppy discs



NEW

DV5-FD-25 Ships up to 50 standard or mini floppy discs

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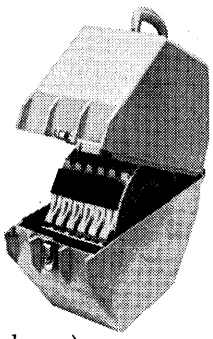

Shippers
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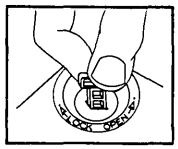
ships 1200' reels
DV4-24-01
ships 2400' reels

Carrying Cases (not shown)
DV5-06-01 holds 600' reels
DV5-12-01 holds 1200' reels
DV5-24-01 holds 2400' reels



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CIRCLE 68 ON READER CARD

IRM says that the development in computers and communications has made it possible to manage information as if it were a concrete resource. Business is getting the message."

Despite their recent phenomenal growth, MIS and IRM are not yet express lanes to the executive suite. Many corporations still regard the skills necessary in these areas as lacking in business and general management background to qualify their practitioners for high level positions.

But as information needs multiply within companies, MIS managers and execu-

Recent research indicates that the use of information resources is becoming a specific business tool for every area of corporate operations.

tives will have a greater sphere of influence and involvement in broad areas of corporate decision-making. And as more corporations turn into reality the theory of information as a resource equivalent to people, labor, and capital, the greater the role MIS executives will play. As IRM comes to the fore, requiring corporate investment, time, energy, and organization, so will its promulgators.

"MIS departments can have a leading role in IRM, but it won't happen automatically," warns Joseph Ferreira, vice president of The Diebold Group. "Unless MIS department heads take steps to free themselves of a lot of the routine, time-consuming, low-payoff activities that clog their work load, they won't be able to involve themselves in new business tools that are a crucial part of the IRM picture. The key to success will be offloading as much routine work as possible to the users and getting maximum user involvement in system development."

The hard part will be educating and training users. A recent survey by The Diebold Group indicates that MIS departments are spending less than 1% of their budgets on education and training and less than one-tenth of one percent on users. That's equivalent to less than 40 cents per year per corporate employee, which won't even get them on the subway. If IRM is to continue its good times, it's mandatory that maximum attention be paid to developing computer literacy throughout companies as a whole, not merely in the MIS department. How well that department performs the task may determine whether its employees will move up the ladder or out the door.

"For the long-term health of MIS departments, it is essential that strong efforts be made to place MIS personnel in positions within user departments," says Robert Tobey, director of Diebold's research program. "In large measure, the high turnover we see in the ranks of key MIS personnel is due to feelings of dissatisfaction and lack of appreciation because their career paths are blocked. Those firms that have actively sought to place their MIS people in key business positions already have a large measure of de facto IRM responsibility and know-how."

IRM's other major difficulty is its intangibility. It shows immediately on the debit side of the ledger, but might remain invisible for a few years on the credit side. The instant expenses of installing a new system are obvious; the savings so achieved are not. Without outside pressures from aggressive competitors or an inquisitive government seeking a plethora of health, education, welfare, and whatever other information strikes its fancy, businesses may be reluctant to part with the significant capital outlays often required to institute meaningful IRM.

"I think big business sees it as a drain on corporate resources," Solomon says. "It's still viewed as overhead. It's an overt expense but a hidden saving, and it doesn't present a tangible return. But companies that are heavily regulated and scrutinized are moving forward faster than those which aren't. Under the negative pressures of regulatory control and a hostile Congress, companies will marshal their resources to resist governmental intrusion.

"Companies will turn the corner when they realize the lack of goals to support IRM is costly, time-consuming, and wasteful. Information can only be measured from the cost of not having it."

Fewer and fewer businesses are willing to pay the unknown price. Even the government has finally gotten the hint.

"The implementation of the Paperwork Reduction Act is one possible avenue

A recent Diebold survey indicates that MIS departments spend less than 1% of their budgets on education and training.

corporations should be watching," admits a knowledgeable private sector observer. Fallout could include raising the country's overall level of competency in computer usage, if from nothing else than sheer volume of agency usage; a significant reduction in data collection demands and reporting requirements imposed on business, and learning from the government's experiences in practicing IRM.

"The agencies are starting from a different position because of their obsolete equipment and crusted-over bureaucracy," the observer says. "Most chief executive officers would say their organization is managed far better than the Post Office. But the fact that IRM has reached government levels proves it is pervasive."

—Willie Schatz

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BANKING

ATM NETS GO NATIONAL

American Express has endorsed the networking concept of automated teller machines.

It appears as if it will be a nonbank that will take electronic banking nationwide.

American Express Co. has, in a sense, put Instant Teller, a California-based Automated Teller Machine (ATM) network for independent banks, on the national scene. Amex brought up two of Instant Teller's ATMs into its gold card cash dispensing program. A link has been established between Instant Teller's computer center in Los Angeles and American Express' center in Phoenix. "We're the switch for American Express," said Nell A. Cox, senior vice president and general manager of City National Bank's computer center.

American Express gold card holders can access the two machines (one owned by City National and the other by California Canadian Bank) and get on-line verification for cash dispensing via the switch from California to Phoenix and back. Although only two machines in California are involved initially, Instant Teller is the first multiple bank ATM network to hook up with a national travel and entertainment ATM system.

And now, American Express has announced plans for a pilot system it will develop with "a number of banks" to do what amounts to the reverse. The big T&E operation is talking to banks and bank networks in Los Angeles, Houston, Washington, Dallas, Miami, and Detroit for a scheme whereby bank cards (debit cards, not charge cards) could be used in American Express travelers check dispensing machines to obtain travelers checks.

After negotiations are concluded with the first six cities, Amex plans to go into New York, Philadelphia, and Atlanta. "They can't move too fast," said Cox of City National. "They'll have to develop a lot of software to enable their system to recognize a lot of different individual debit cards. We could do it easily (take part in the pilot). All we'd have to do is reverse the software we already have."

Instant Teller is the largest multibank ATM interchange on the West Coast. Last month it became the first such network to operate interstate; the network moved into Oregon. "We're in the process of moving into Washington state and will move into Arizona very shortly," said Cox.

The Instant Teller network includes 40 banks (with 16 more committed) and 107 ATMs (with an additional 41 committed). Cox said they expect to have about 200 ATMs by the end of 1981.

"We're probably the fourth or fifth largest ATM network in the country," said Gil Davenport, head of marketing for Instant Teller. "But it's like comparing apples and oranges. We drive all of our ATMs through our central host computer. In other networks, the network center drives some ATMs and merely acts as a switch for others. In terms of the number of ATMs driven by the central host, we're the largest."

Davenport was hired by Instant Teller in 1979 from Docutel. The Instant Teller program actually was started by Community National Bank of Bakersfield in 1975 with 12 machines installed in six banks. City National acquired the name and customer base in 1977 as the first step in providing independent banks in the West with a way into electronic funds transfer (EFT). The original idea was to sell on-line teller terminals and strengthen their position in the marketplace for correspondent banking.

But City National soon realized that California banks were interested in an ATM interchange. It decided it had the size and expertise, acquired through handling data processing for 30 correspondent banks, to handle the job.

The bank charges a $7,000 initiation fee for each new bank, which covers marketing materials and training of key personnel. A minimum service charge of $495 per month is levied for each ATM installed.

City National's data processing department employs more than 400 people, with 53 working exclusively on Instant Teller. The bank's own data processing services account for only 15% of the data center's total volume.

Davenport of Instant Teller estimates that there are about 100 ATM networks across the country, "but less than 10 are of any size." Among the larger he listed: Rocky Mountain Bank Card, run by Colorado National Bank in Denver; Tyme, a cooperative of users of software by Tyme Corp., Milwaukee; MAC, run by Philadelphia National Bank; and Option, run by Tymshare, Inc., Cupertino, Calif. Tymshare built its network on one it acquired several years back from a consortium of Southern California savings and loans.

Davenport said that services firms "have the potential to be a significant factor [in the ATM networking race] but so far it's just talk."

And both national bank card organizations are in there, too. MasterCard has said it hopes to have a pilot system operating by November of this year, and Visa has indicated it will support interchange of automated teller machine transactions.

—Edith Myers

NEWS IN PERSPECTIVE

BENCHMARKS

REFRESH YOUR MEMORY: A price of one cent per byte has been established by Hewlett-Packard for its HP 1000 L-Series microcomputers, believed to be an industry first. The vendor historically lowers prices about 30% a year or increases performance by that much while holding prices steady. Back in 1978, in introducing the HP 3000 Series III system with a main memory capacity of 2MB, the company priced an incremental megabyte of memory at only $32,000—and this at a time when the going rate from IBM and the like was about $110,000. At that time, HP began using the 16K memory chip, and others were upgrading to the lower-technology 4K chip. But HP is now a big user of the 64K chip and thus has instituted a 60% drop in memory prices, the largest it has ever made. Price of a 512KB memory board was lowered from $12,600 to only $5,000.

BIG BUY: An order for Series/1 minicomputers worth as much as $70 million was placed by Aetna Life & Casualty in Hartford, Conn., with IBM's General Systems Division. Aetna plans to use the machines, numbered at more than 1,000 units, as the basis for turnkey systems it will sell to insurance agents. Each system would be valued at between $35,000 and $55,000 with the majority of the hardware ordered from GSD. Agents would be free, however, to order other equipment from the many vendors selling peripherals into the Series/1 marketplace. The order is one of several large deals GSD has won in the insurance industry, where the IBM name holds a great deal of respect.

POTENTIAL FOR PROFITS: John R. Opel, president and chief executive of IBM, told shareholders gathered for an annual meeting in Kansas City, Mo., that the firm is well positioned to take advantage of the large capital investments it has made in recent years. "We will create the kind of growth rates in earnings and revenues that you would characterize as a turnaround," he said. He declined, however, to specify when such an acceleration in profits would begin to show. The industry leader has invested more than $12 billion in capital improvements over the past two years, prompting Wall Street analysts to look forward to results on the bottom line. IBM will continue to benefit most from its traditional product lines, but expects additional benefits from retail centers, the new national marketing center for data processing products, self-service maintenance centers for typewriters and dictation units, and from new mass production manufacturing techniques. Future opportunities to be exploited include telecommunications, biomedical systems, analytical instruments, and videodisk technology. No details were provided on the expected personal computer IBM has in the works (Look Ahead, April), but the firm's official account of the meeting said it is "interested in exploring the personal computer market." For the first quarter of 1981, IBM showed a rise in net income of 7.2% to $730 million, or $1.25 a share, from the year-earlier $681 million, or $1.17 a share. The firm declared a regular dividend of $0.86 a share, adopted a new employee stock purchase plan, and reelected to 1-year terms 22 members of its board. Five stockholder proposals, including one attempting to block grants to schools employing Marxists, were defeated.

KIDS AND COMPUTERS: The last weekend of April saw the opening of the Future Center at the Capital Children's Museum in Washington, D.C. Equipped with a score of Atari 800 personal computers, donated by the manufacturer along with a $15,000 cash grant, the Future Center will provide both classes and public access for local residents and museum visitors. Future Center is but one element of a major new permanent display, Communications, currently under development. Digital Equipment has agreed to absorb 80% of the price of an 11/70 system, contingent on the museum's ability to come up with the remaining 20% within one year. The 11/70 will become a major part of the exhibit.

Inaugurating the Future Center were Theodor H. Nelson of Project Xanadu, and Alan Kay, of the Xerox Palo Alto Research Center, who jointly cut the traditional ribbon, in this case a length of punched Mylar tape. In his keynote speech, Kay described his work, ranging from the conception of powerful personal (in all but price) computers at the University of Utah more than 10 years ago, through the Dynabook conceived and prototyped (in the form of the Alto desk-sized computer) at XPARC. He went on to discuss the language Smalltalk—expected to be put in the public domain by Xerox within a year—and further advanced language concepts suggested by the Smalltalk implementation experience.

Nelson and a contingent from Project Xanadu explained their latest progress in developing a Hypetext system. Work continues in Ann Arbor, Mich., where a working back-end Hypertext system (Nelson's concept of nonsequential literature allowing multiple linked paths through text) is being programmed from the ground up. As a back-end, the system will require appropriate front-ends for each user's needs—a potential application for commercially available personal computers.

JOINING THE CROWD: Informatics, Inc., the big Woodland Hills, Calif. software and services firm, is getting into the hardware business. "We're doing what other service bureaus have been doing," said president Walter F. Bauer at a press briefing following the firm's annual meeting April 30, "buying minicomputers and selling them to customers with distributed systems." It also is offering a product it calls TAPS (Terminal Application Processing System), a $20,000 package for micros. It's portable and can be used on a variety of mainframes, minis, and micros. TAPS is touted as making it possible to build "user friendly transaction-based applications faster." It's embedded in a chip. Bauer also said the company is experimenting with a workstation to handle its Mark IV file managment system, called Information II.

MORE WORK PER WORKER?: Automation in Silicon Valley has led the semiconductor industry to outstrip the overall U.S. economy in productivity in the late 1970s, according to a report issued by the Semiconductor Industry Association. The reports shows semi makers' productivity increased an average of more than 22% annually between '75 and '79 compared to virtually no growth in the economy as a whole during that period. The productivity was measured as the value added per employee. Worldwide U.S. semiconductor company employment grew in excess of 50% to about 225,000 workers from 1975 to 1979. Capital spending in the industry grew at an annual rate of 75% during those years, the report claimed. It pointed out that manufacturing and electrical machinery industries showed a downward trend in productivity since 1977 and negative growth in 1979.

TAKE YOUR PICK: With litigation between his firm and Microdata settled (no money was exchanged), Dick Pick is back to doing what he likes best: programming. "We're seven programmers doing what we like best and having a ball," said the developer of Microdata's popular DM 512 operating system. Still in Irvine, Calif., Pick & Associates collects royalties on the operating system from several other turnkey system vendors: Applied Digital Data Systems, selling the Mentor line; Ultimate Corp., selling Honeywell Level 6-based systems; and Evolution Computer Systems, selling its Evolution line. (Pick founded and once headed Evolution, which has a French connection for hardware.) An unmarketed version of the Pick Universal Operating Systems, as he calls it, exists for the Hewlett-Packard HP 3000 minicomputer. Pick will also continue to collect royalties from Microdata until Dec. 15, 1981, all of which will put him on firmer financial footing than in 1972 when he formed his software firm.

WE'RE NUMBER TWO: National Semiconductor Corp., Santa Clara, Calif., says it has passed IBM in the number of supermarket checkout systems shipped. National said this makes its Datachecker system the number two in the marketplace behind industry leader NCR. *

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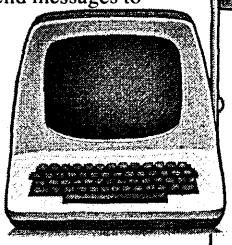

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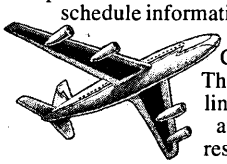

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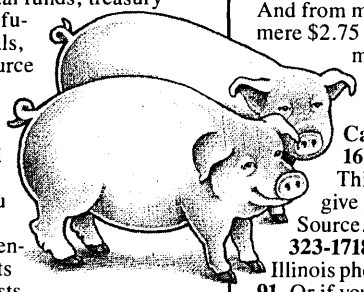

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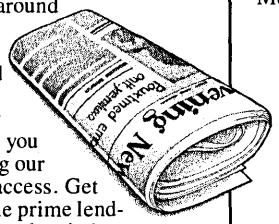

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FEATURE COMPARISON CHART

FEATURE	Visual 200	Hazeltine 1500	Hazeltine 1420	Lear Siegler ADM-3A	Digital VT-52	ADDS 520	ADDS Regent 20	ADDS Regent 40
24 x 80 Screen Format	STD	STD	STD	STD	STD	STD	STD	STD
7 x 9 Dot Matrix	STD	STD	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Background/Foreground	STD	STD	STD	**NO**	**NO**	**NO**	**NO**	STD
Insert/Delete Line	STD	STD	**NO**	**NO**	**NO**	**NO**	**NO**	STD
Insert/Delete Character	STD	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Clear End Line/Field/Page	STD	STD	**NO**	**NO**	STD	**NO**	**NO**	**NO**
Blink	STD	**NO**	STD	**NO**	**NO**	**NO**	**NO**	STD
Security Mode	STD	**NO**	STD	**NO**	**NO**	**NO**	**NO**	STD
Columnar and Field Tab	STD	**NO**	STD	**NO**	**NO**	**NO**	**NO**	STD
Line Drawing	STD	**NO**	**NO**	**NO**	STD	**NO**	**NO**	STD
Upper/Lower Case	STD	STD	STD	**OPT**	STD	**NO**	STD	STD
Numeric Pad	STD	STD	STD	**OPT**	STD	**NO**	**NO**	STD
Composite Video	STD	**NO**	**NO**	**NO**	**NO**	STD	**NO**	**NO**
Current Loop	STD	STD	**NO**	**OPT**	**OPT**	STD	STD	STD
Serial Copy Port	STD	STD	**OPT**	STD	**OPT**	**NO**	STD	STD
Hold Screen	STD	**NO**	**NO**	**NO**	STD	**NO**	**NO**	**NO**
Detachable Keyboard	STD	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Solid State Keyboard	STD	**NO**	**NO**	**NO**	**NO**	**NO**	STD	STD
Typamatic Keys	STD	STD	STD	**NO**	**NO**	**NO**	STD	STD
Cursor Addressing	STD	STD	STD	STD	STD	STD	STD	STD
Read Cursor Address	STD	STD	STD	**NO**	**NO**	**NO**	**NO**	STD
Cursor Control Keys	STD	**NO**	STD	**NO**	STD	**NO**	**NO**	STD
Secondary Channel	STD	**NO**	**NO**	STD	**NO**	STD	**NO**	**NO**
Self Test	STD	**NO**	STD	**NO**	**NO**	**NO**	**NO**	STD
Baud Rate to 19,200	STD	STD	**NO**	STD	**NO**	**NO**	**NO**	**NO**
Smooth Scroll	STD	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Microprocessor	STD	STD	STD	**NO**	STD	**NO**	STD	STD
Tilt Screen	STD	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Switchable Emulations	STD	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**

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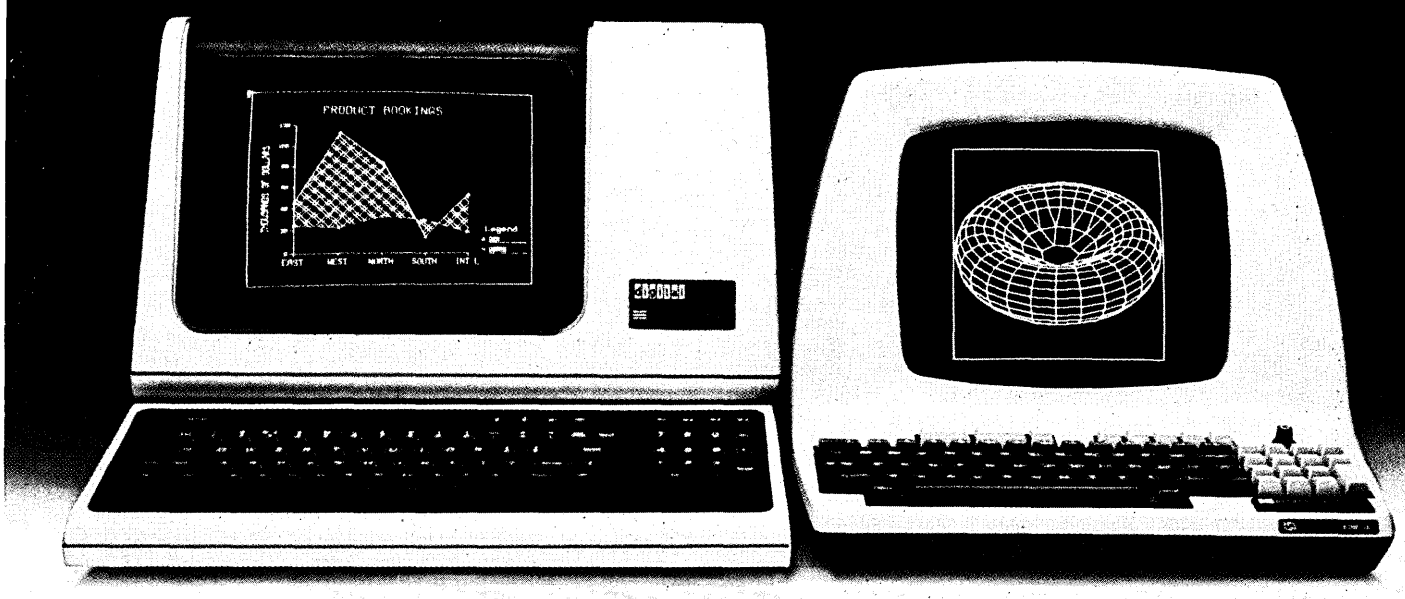

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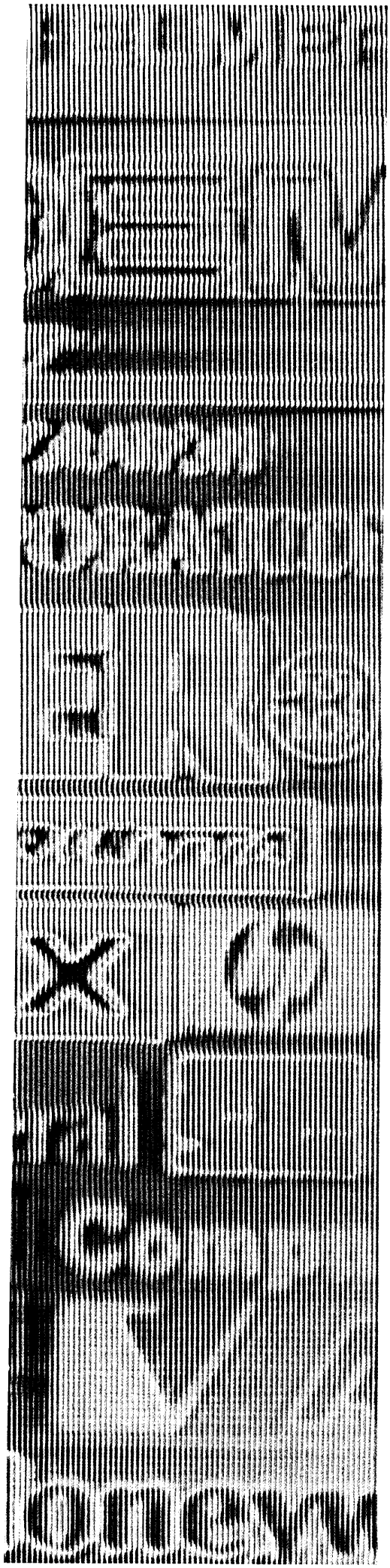

In their efforts to avoid profitless prosperity, vendors are rapidly altering industry's marketing traditions.

CHANGING PATTERNS OF COMPETITION

by Frederic G. Withington

The data processing industry looks healthier.

The revenue growth of the DATAMATION 100 was impressive in both 1979 and 1980, considering the international recession and economic uncertainty of the period. Profits, however, have been more of a problem. A couple of years ago, a pattern of "profitless prosperity" began to develop, with all competent competition steadily increasing sales, but not making much money doing so. Profits remain thin, though (with significant exceptions) they have recently been improving for most of the industry.

It's worthwhile to examine the causes of the profit squeeze and the measures the industry has taken to avoid profitless prosperity, because measures are leading to permanent changes in the patterns of competition.

Price competition. Kicked off by IBM's response to plug-compatible competitors, price competition has broadened across international boundaries as Japanese (and recently French) manufacturers have proved successful at producing high quality products at low prices.

Inflation. Salary costs for programmers, salespeople, customer support and service staffs have increased faster than the rate of inflation. (The industry has grown faster than the supply of competent people, so competition has forced salaries up.) Historically, such salary inflation has been balanced by decreasing electronic component costs, but now electronic components contribute only 10% to 20% to product costs so further improvement doesn't help much.

Vendors have responded with:

Selective price increases. The focus of price competition has been on hardware. No competitor has yet found dramatic ways of reducing the cost of providing quality software, marketing, or field service. Recognizing this, the industry (led by IBM) has moved steadily to unbundle hardware charges from those for people-intensive activities and to increase their prices frequently. (IBM's 1980 Annual Report shows that "services" revenues, including maintenance contracts and program product licenses, has increased 27% per year during the last two years, well above IBM's 12% overall growth rate. IBM has instituted two general price increases in these categories during this period.)

Redesign of products. Most new products use multilayer circuit boards (or ceramic chip carriers) with direct bonding of large-scale integrated circuits. Most companies now develop them using automated design engineering that increasingly customizes products through software (microcode or overlays on general-purpose logic chips) instead of through unique circuits. These new products are more powerful and cheaper to design and to manufacture. More significantly, they are (or should be) more reliable, which reduces maintenance cost; upgradable through software change, which reduces the number of new hardware products needed while permitting more variations in customer-oriented "packages"; and easier to support since microcoded modules can incorporate functions formerly performed by software. Neither customer support nor customer personnel need as much detailed knowledge of hardware and system programs as they used to.

No competitor has found dramatic ways of reducing the cost of providing quality software, marketing, or field service.

These redesigned products, then, should have a major impact on people-intensive costs. Unfortunately, they have proved to have an equally great impact on the engineering and manufacturing practices of their manufacturers. Everything from raw materials purchasing to maintenance procedures and software documentation practices must be changed and disciplined more tightly. (After-the-fact hardware fixes, for example, become nearly impossible.) Almost every manufacturer from IBM down has had difficulty making these changes, but most are getting better at it. Over time, these new products should relieve the profit squeeze, but it will take years to turn over much of the installed base.

In addition to these two internationally implemented responses to the profit squeeze, most vendors have been changing the areas or ways in which they compete. These new patterns of competition involve new relationships with other organzations.

USING AN OUTSIDE SUPPLIER

If you can't make something as cheaply as someone else, maybe you can buy it from him. This pragmatic idea has already revolutionized the peripheral equipment industry: companies like Control Data and Storage Technology have thrived as more and more system vendors have turned to them for peripherals. The resulting vulnerability of the system vendor can be partly offset by joint ownership of a dedicated subsidiary; Honeywell and NCR, for example, share control and profits of the subsidiaries jointly owned with Control Data that produce their peripherals. Even IBM has increasingly gone outside for peripherals: Qume and Dataproducts printers now appear in the systems of this erstwhile leader in all areas of printer technology.

More strikingly, some of the largest companies have turned to others for major products. IBM obtains its model 3101 terminals (and may at some time obtain small computers) from Matsushita, its convenience copiers from Minolta, and its hand held dictating machines from Toshiba. Siemens gets its large computers from Fujitsu, and TRW has set up a joint subsidiary with Fujitsu, which may import much of its product line to the U.S. Japanese companies are not the only offshore partners; GTE has ordered a large number of terminals for U.S. resale from Thomson-CSF in France.

Concern about the viability of U.S. hardware vendors is justified, but the battle is far from over. IBM and the other U.S.-based mainframers still lead the world in system architecture and software, and the pace of system change is accelerating. IBM's 3081 and 4300 systems are only the beginning of a slow revolution: as further models appear, as front-end and back-end IBM processors continue to evolve, and as the promised "application machines" that may revolutionize the capabilities of the existing products appear, IBM's product line will develop a very different appearance. The other U.S.-based mainframers are evolving along the same lines in their own ways, and it appears that most plug-compatible and foreign-based vendors will have to play catch-up.

Semiconductors appear to be exempt from this trend toward external sources of supply. Most vendors (from IBM down through middle-sized minicomputer vendors such as Prime) appear to be enhancing their in-house semiconductor design and manufacturing capabilities. All except IBM say they will depend on the external semiconductor industry for most commodity-type circuits (such as 64K RAMs), but all want an internal capability in case of shortages. More important, all want to be able to integrate the design and manufacture of critical logic chips at the cores of their products. System, software, and circuit designs seem to be merging into an integrated process (illustrated by Intel's decision to adopt Ada and to implement a compiler for it as an integral part of its 32-bit microprocessor project).

NEW SALES METHODS

Computer stores sprang up nationwide (to a degree, now worldwide) to market personal computers. Mainframe manufacturers have observed them with intense interest because the costs of conventional marketing are too high for the low-priced products mainframers want to offer. By now, most mainframers have established retail stores of their own on an experimental basis. More conventional electronics distributors and system houses have long been used for indirect marketing by the minicomputer companies, but the mainframers' unwillingness to discount their products has until recently made them unwilling to participate. Cost pressures have changed this; even IBM now discounts selected products competitively for resale by distributors and system houses.

AT&T has opened telephone stores; Xerox has opened fullline office equipment stores. These and comparable giants, starting from positions outside the computer industry, see retail stores both as means of cutting marketing costs and as means of adding selected computer products made by others to their competitive offerings. One wonders how far this will go—will AT&T sell personal computers in its stores, and will IBM sell telephones in its?

The retail store chains have naturally been interested in competing. Tandy with its Radio Shacks moved first and has been rewarded with the premier position in the personal computer market. Expanding, Tandy has taken on an increasing variety of hardware made by others, compatible software, and even database services (The Source). Almost all other major chains, including Sears and Montgomery Ward, are at least experimenting with computer stores.

Retailers and other kinds of local marketers have obviously attracted the attention of the entire information industry, but most vendors are proceeding cautiously. Computer systems are different from consumer electronic products: requirements for training, support, software, and service are of a different order. The average retail clerk cannot be used to sell computers, nor the average appliance serviceman to repair them—at least not yet. It will not be long, however, before the industry learns what the minimum customer requirements are, what the costs to meet them are, and what the resulting profitability of retail outlets is.

The packaged software business has been growing faster than most parts of the hardware business, and its growth is likely to accelerate as the products mature and the users' cost pressures intensify. Software can now be copyrighted, and patent protection has been extended somewhat. The mainframe packaged software business has grown without these protections (obtaining some from trade secret laws), mainly because most mainframe users want the support and maintenance that can be provided only by a package's originator. These increased protections, however, will apparently help stimulate the software industry at the personal computer level.

So far, software packages have generally been marketed much like hardware, but the pattern is changing. Already, mainframe vendors are delivering some software via down-line loading from their centers to customer machines. When most users' information appliances can be connected to most software sources, what better way to market than by live demonstration, followed by down-line loading, electronic funds transfer, and subsequent on-line maintenance—all without any face-to-face contact at all?

As the usefulness of software grows, it comes to dominate the user's vendor choice. Many of the large network service bureaus, facing increased competition from minicomputer-based standalone systems, have simply decided to offer their own. Automatic Data Processing, Xerox Computer Services, and recently, Tymshare are examples: obtaining appropriate small computers from manufacturers and offering packaged versions of their services to customers who might otherwise be lost. Software is the primary consideration; whether the hardware is local or remote is secondary.

Vendors offering on-line database services and data networks have large fixed

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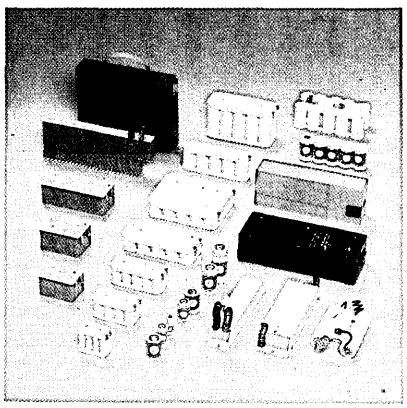

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The packaged software business has been growing faster than most parts of the hardware business, and its growth is likely to accelerate.

costs for maintenance; profits depend on distributing the services to many customers. Publishing companies are in the business of packaging and distributing information—usually in printed form to date—but few publishing companies are unwilling to consider telecommunications as a distribution medium. One of the most striking recent changes in the information industry's competitive pattern has been a combining of these two groups.

Table I lists recent combinations of publishers with varied kinds of network service firms. Software in the form of database and network services, not to mention software packages, will clearly form an important part of these publishers' future offerings.

GLUING MODULES TOGETHER

The DATAMATION 100 has been expanded this year to include word processing and telecommunications. This is very desirable. No one needs to be told that vendors that started in computers, communications, and office products are converging; that multipurpose office-oriented systems can no longer be placed in any of these traditional categories. We are used to the idea that information systems are becoming networks of distributed modules held together by the "glue" of data communications.

We are also used to the idea that specialized common carriers are offering particular varieties of glue. Telenet blazed the trail and has been followed by companies like Tymshare and Satellite Business Systems offering their own versions of digital communications services. Others will follow: Xerox with XTEN and AT&T with ACS may yet be competitors.

Newer is the idea that the user can buy its own glue from a vendor that offers few if any of the processing modules. The clearest example is Network Systems Corp. whose Hyperchannel plus adapters can interconnect a variety of processors with one another or with the SBS service. Xerox (Ethernet), DEC (DECnet), and Datapoint (ARC) will also sell glue to end users. Each hopes that a variety of its terminals and/or processors will be sold with the glue, but each has such a range of compatibility with other vendors' standards that much of the module business can be obtained by others.

IBM is beginning to find itself in a similar position. The ring network offered with the Series/1 minicomputers and the loop of the 8100 support IBM's System Network Architecture, and an increasing number of competitors offer SNA-compatible modules. This kind of glue is usually referred to as local area networks, but the term is too restrictive. A user can equip each of its sites with Ethernets, for example, and interconnect them with lines leased from the telephone company: the user effectively owns its own nationwide (or worldwide) data communications glue. This phenomenon is new and confused, but its clearly competitive implications are profound.

In their efforts to avoid profitless prosperity, then, vendors are rapidly altering the patterns of competition in the industry. It has been possible for some time to forecast that this would happen, but hard to be specific. Now some of the new patterns are emerging, and it is already clear that they will be radically different from the patterns of the past. ✲

Mr. Withington is a vice president of Arthur D. Little, Inc., Cambridge, Mass., and a contributing editor of DATAMATION.

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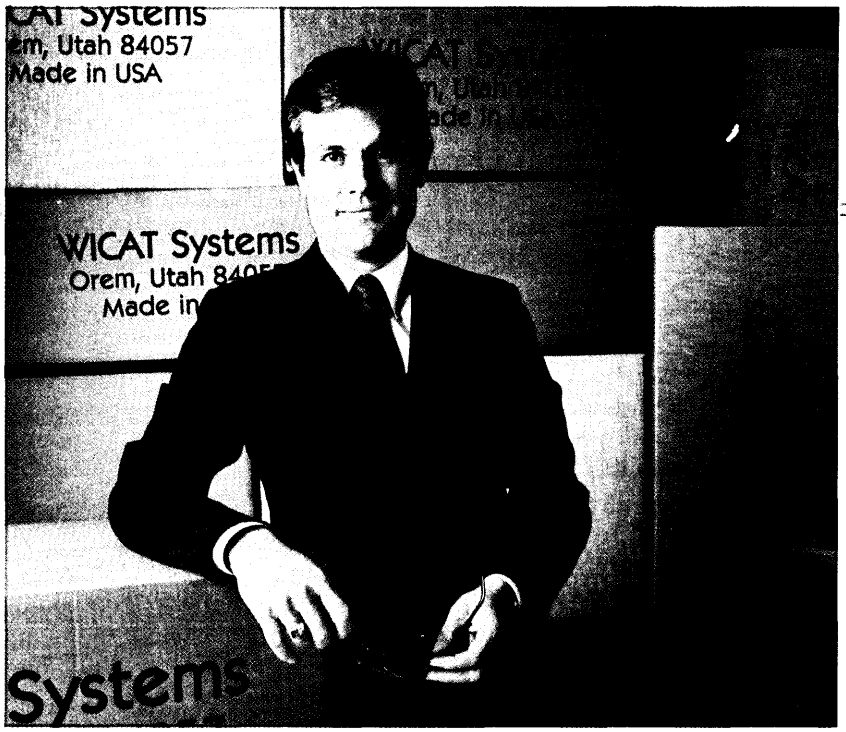

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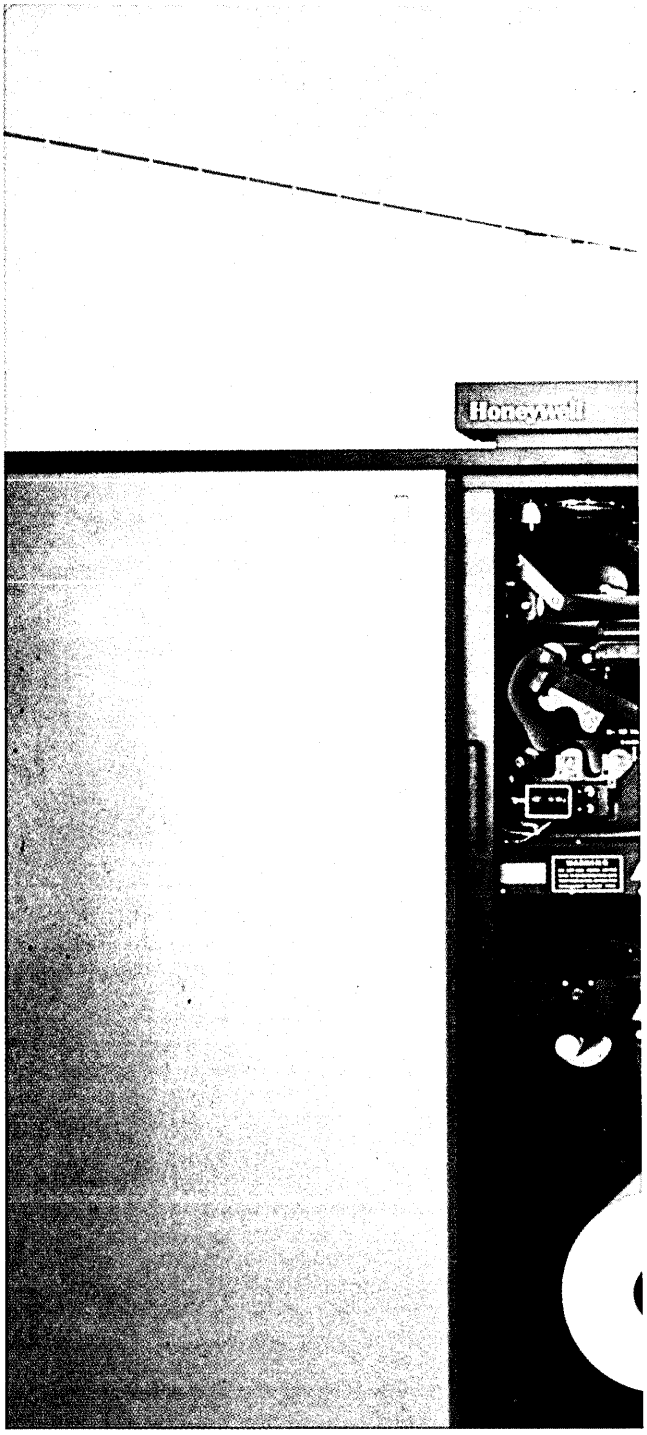

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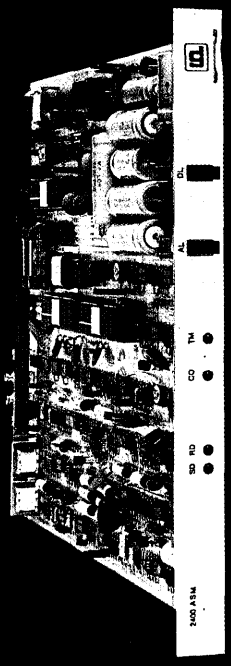

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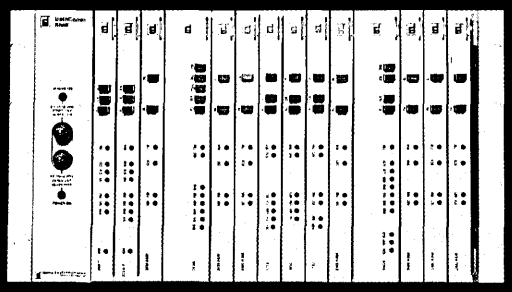

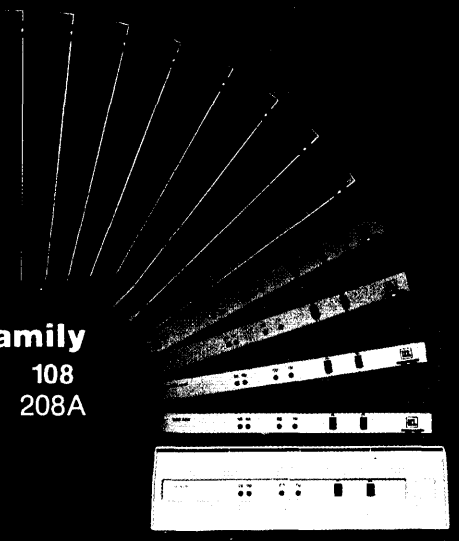

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THE DATAMATION 100

THE TOP 100 U.S. COMPANIES IN THE DP INDUSTRY

by Peter Wright

The dp industry had an exceptionally strong year in 1980, especially considering recessions hit both the U.S. and European economies. The top 100 U.S.-based companies grew 20.4% to $55.6 billion. Other highlights depict existing industry trends and may foretell future prospects. Consider that in 1980:

- IBM again lost revenue market share
- Without IBM, the DATAMATION 100 grew 24%
- Operating margins declined to 17% from 18.5%
- Microcomputers, word processing, and CAD/CAM were the fastest growth dp subsectors
- Capital expenditures increased 37%; R&D increased 22%
- Revenue per employee was up dramatically

The rankings changed significantly during 1980. Because of a broadening of the definition of dp to include word processing and data communications, and because of a very active year in corporate finance, 19 new companies joined the ranks of the DATAMATION 100. Of these, eight can be attributed to the broadened definition with four in word processing (Lanier, Exxon, CPT, and Philips Information Systems) and four in data communications (Racal Electronics, Motorola, Paradyne, and General DataComm). Remarkably, nine companies in the 1979 DATAMATION 100 survey were merged or acquired during 1980: Calcomp by Sanders Associates, Documation by Storage Technology, Inforex by Datapoint, Qantel by Mohawk Data, ADDS by NCR, Pertec by Triumph Adler, First Data Resources by American Express, Systems Engineering Labs by Gould, and Manufacturing Data Systems by Schlumberger. In reviewing this list of acquirees, we note that three were losing money, and three others were experiencing declining margins. In an era of high stock prices for growing technology companies, firms that are experiencing problems can become takeover targets as depressed stock prices can make these companies attractive asset plays.

Already in 1981, System Development Corporation has been acquired by Burroughs and The Signal Companies has announced plans to acquire Ampex.

The top 10, which generated $39.4 billion in revenues and grew at 17%, represent 71% of the total revenues of the DATAMATION 100 (Table I). IBM generated 38.4% of the total revenues, yet this marks a decline from 40% in 1979 and 43.2% in 1978. IBM's 1980 U.S. revenue market share has declined even further to just 30%.

While IBM remains perched on top of the list, other vendors in the top 10 shifted positions. On the positive side, Digital Equipment climbed two places to fourth and is now within $100 million from becoming the second leading vendor within the industry. Xerox, with a 35% gain in dp revenues, broke into the top 10, replacing Data General. On the negative side, Burroughs slipped from second to sixth. Memorex also slipped a notch to tenth and appears vulnerable for making this exclusive list in 1981, with Wang Laboratories, Data General, and Storage Technology close behind.

HIGH AND LOW FLIERS

Although growth rates are interesting, it is also important to track the absolute dp revenue gains by the top vendors. During 1980, 16 companies had gains in excess of $100 million, compared to 12 companies in 1979 (Table II). These $100 million gainers accounted for 72% of the $9.3 billion total revenues gained by the DATAMATION 100. Not surprisingly, IBM led with an increase of $3.0 billion, which was tantamount to creating, in one year, an incremental force greater than any other U.S.-based computer company.

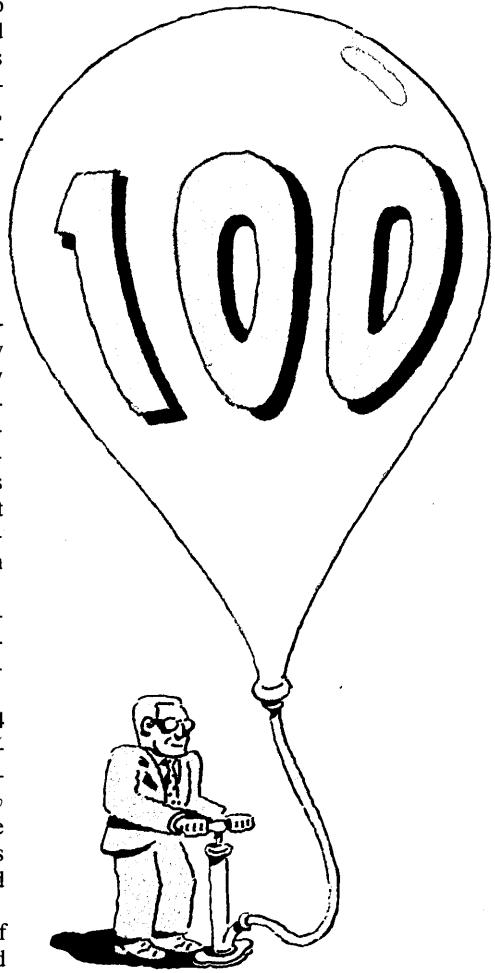

ILLUSTRATION BY STEVEN GUARNACCIA

Digital Equipment's gain of $712 million would have put it into the top 10, while Control Data had a notable gain in excess of $500 million during 1980.

In aggregate, 1980 was clearly a superior year to 1979, but in 1979 eight DATAMATION 100 companies did grow in excess of 100%, compared to just three in 1980—Sanders Associates (through acquisition of Calcomp), Apple Computer (for the second consecutive year), and Philips Information Systems (a newcomer to the DATAMATION 100). Scanning the high fliers for 1980 (Table III), one notes that the top 20 in revenue growth rate is populated by microcomputer, CAD/CAM, and word processing vendors. Two of the three microcomputer vendors made this top 20 (Tandy Corporation ranked 21), while five of the six CAD/CAM vendors and five of the six word processing vendors were also among the top 20 gainers.

The "low fliers" performed better in 1980 (Table IV). During 1979, five companies had revenue declines, while in 1980 only Northern Telecom had an absolute revenue decline. Making this less than illustrious list is clearly not a condemnation, as the thirteenth company with the lowest growth rate still showed a revenue increase in excess of 10%, which would have been considered to be a strong year for leaders of less glamorous industries. Nevertheless, the bottom 20 represents poor comparative performance, and a decline in market share. The bottom 20 includes three mainframe vendors, six small systems vendors, six peripherals vendors, and four software/service vendors.

One measure of the current health of an industry is its growth in profits (or more technically, growth in cash flow from operations) as those funds which are used for capital investments and R&D expense help to assure future growth. While not performing as abysmally as in 1979, when dp industry continued to decline in 1980 as a result of continued competitive and inflationary pressures.

While only 70 companies were available for profit analysis, these companies represented 90% of the revenues for the DATAMATION 100 (Table V), and therefore serve as a useful proxy. We have used dp operating profits (defined as revenues from dp products and services; less cost of goods sold; less R&D expenses; less selling, general and administrative expenses) as a measure of profitability, because comparisons from year to year and company to company are more meaningful since operating expenses exclude interest revenues and expenses (which is a function of the company's balance sheet and not operations) as well as taxes (which can vary dra-

matically from year to year). Operating profits increased 10% in 1980 to $8.5 billion, which translates to a decreased operating margin of 17%, from 18.5% in 1979. Of the 70 companies reporting, only 29 had an improved operating margin in 1980.

Although IBM's revenue market share declined, its operating profit market share increased by virtue of its 12.5% increase in operating profits. While accounting for 43% of the total revenues for these 70 companies reporting, IBM accounted for 62% of the operating profits. The fastest growers among the top 10 in operating profits during 1980 were Wang (up 65%), H-P (up 53%), Control Data (up 35%), and DEC (up 33%).

Although orders and backlog are often used by this industry to gauge its short term health, both measurements are elusive and can be misleading. Capital expenditure, on the other hand, is a hard dollar commitment made by management to increase productive capacity. Capital expenditures have been defined to include additions to plant, property, and equipment net of retirements. Also included is hardware purchased by service companies that increases productive capacity. Explicitly excluded are investments made by companies to finance their lease bases.

During 1979 capital expenditure grew an incredible 30%, led by a 35% increase from IBM; yet, despite a slowing of IBM's growth rate to a "mere" 28%, the industry increased its growth to 37%. The total level of dp capital expenditures reached $4.1 billion for the 60 reporting companies (which represents 87% of the DATAMATION 100 dp revenues—see Table VI). IBM dominates with almost $2.0 billion in dp capital expenditures. Equally impressive is the strong growth in expenditures by the major minicomputer and word processing vendors. Stripping away IBM from the industry total, DEC, HP, and Wang spent $565 million in 1980, up 85% for the year, and representing 27% of the remaining total.

The computer industry, because it is a technology-driven industry which is subject to short product cycles and rapid obsolescence, has traditionally been a heavy spender in R&D. We have defined R&D to only include expenses on unannounced products and services that are funded by the company (R&D projects that are funded by outside vendors are excluded). Although we only have estimates for 64 companies, the results serve as a useful proxy since the companies represented 87% of the total for dp revenues. Following an 18% increase in 1979, R&D expenses grew another 21% in 1980 to $3.7 billion (Table VII). R&D as a percentage of sales increased slightly to 7.6% from 7.5%. The subsectors experiencing the greatest growth in R&D were the word processing vendors (four companies reporting) at $65 million, up 102%, and CAD/CAM vendors (five companies reporting) at $46 million, up 78%. Only 10 companies spent 10% or more of their revenues in R&D, and four of these companies (Auto-trol, Applicon, Intergraph, and Computervision) were CAD/CAM vendors. The focus in R&D expenses has traditionally been in hardware; however, while hardware R&D continues to be important, software development will show larger R&D growth rates throughout this decade.

The total for the 83 companies reporting dp employment (representing 93% of total revenues) was 863,000, up only 57,000 or 7% during 1980 (Table VIII). IBM, which accounted for 41% of this sample's revenues and an even higher percentage of its operating profits and capital expenditures, accounted for only 32% of its employment.

The top 10 in reported dp employees accounted for 75% of the total. Interestingly, only Digital Equipment of the top 10 had an employee growth rate in excess of 12%, and all 10 companies' revenue growth was faster than its employee growth. This all translates to improved employee productivity as measured by revenue per employee which increased to $60,100 in 1980 from $53,600 in

TABLE I

TOP 10 DP REVENUES

(in $ millions)

	1980	1979	% Growth Rate
1 IBM	21,367	18,338	16.5
2 NCR	2,840	2,528	12.3
3 Control Data	2,791	2,273	22.8
4 DEC	2,743	2,032	35.0
5 Sperry	2,552	2,270	12.4
6 Burroughs	2,478	2,442	1.5
7 Honeywell	1,634	1,453	12.5
8 Hewlett-Packard	1,577	1,147	37.5
9 Xerox	770	570	35.1
10 Memorex	686	658	4.3
Total Top 10	39,438	33,710	17.0
Total	55,626	46,220	20.4
Top 10 as a Percent of Total	70.9%	72.9%	

TABLE II

$100 MILLION REVENUE GAINERS

(in $ millions)

	1980 Dp Revenue Gain	1980 % Growth Rate
1 IBM	3,029	16.5
2 DEC	712	35.0
3 Control Data	518	22.8
4 Hewlett-Packard	430	37.5
5 NCR	312	12.3
6 Sperry	282	12.4
7 Wang Labs	271	66.1
8 Xerox	200	35.1
9 Honeywell	182	12.5
10 Texas Instruments	164	41.2
11 Computer Sciences	145	34.8
12 Data General	133	24.7
13 Storage Technology	124	25.9
14 Prime Computer	115	75.0
15 Apple	105	175.1
16 Teletype	105	72.4
Subtotal	6,764	20.7
Total Dp 100	9,344	20.4

Not surprisingly, IBM led with an increase of $3.0 billion, creating an incremental force greater than any other U.S.-based company.

TABLE III

TOP 20 REVENUE GROWTH RATE

(in $ millions)

		Total Dp % Growth Rate	U.S. Dp % Growth Rate	Foreign Dp % Growth Rate	1980 Dp Rev.	1980 Earnings
1	Sanders Assoc.	208.5	91.5	NM	145.0	49
2	Apple	175.1	163.4	224.7	165.2	47
3	Philips Information Sys.	100.0	100.0	NM	50.0	98
4	Tandem	93.9	58.7	179.4	128.8	53
5	Intergraph	91.3	80.1	153.7	56.5	90
6	Dysan	86.1	79.9	127.7	62.9	85
7	Computervision	85.5	72.7	108.3	191.1	41
8	Paradyne	83.2	74.0	108.9	75.9	77
9	Prime	75.0	59.9	95.8	267.6	27
10	Teletype	72.4	62.1	NM	250.0	29
11	CPT	68.9	44.7	157.7	76.4	76
12	Wang Labs	66.1	68.8	61.5	681.8	11
13	Lanier	64.1	60.6	129.7	128.0	54
14	Triad Systems	61.0	61.0	NM	60.2	87
15	Anacomp	60.1	60.1	60.0	57.0	89
16	Commodore International	54.1	−13.2	105.2	98.7	66
17	Applicon	51.4	35.2	136.6	68.5	82
18	Auto-trol Technology	51.3	58.5	27.1	50.8	97
19	AM International	49.0	49.0	49.0	98.8	65
20	Printronix	48.8	37.7	93.0	48.9	99

NM - Not Meaningful

TABLE IV

BOTTOM 20 REVENUE GROWTH RATE

(in $ millions)

		Total Dp Growth Rate	U.S. Dp % Growth Rate	Foreign Dp % Growth Rate	1980 Dp Rev.	1980 Earnings
1	Northern Telecom	−26.0	−15.1	−31.6	217.1	36
2	Burroughs	1.5	−.3	3.8	2,478.0	6
3	Centronics	2.0	−7.7	17.5	128.9	52
4	ITT	2.0	.0	5.3	250.0	30
5	Memorex	4.3	9.1	−.6	686.0	10
6	Dun & Bradstreet	5.9	5.9	NM	96.7	67
7	American Express	6.0	6.0	NM	53.0	95
8	National Semiconductor	6.5	8.0	4.8	245.0	32
9	General Automation	7.0	6.2	8.6	126.7	56
10	Reynolds & Reynolds	7.6	7.6	7.1	117.8	60
11	Verbatim	7.6	7.4	8.0	48.4	100
12	Bunker Ramo	8.0	11.6	−9.2	146.7	48
13	Triumph Adler	10.2	−6.9	40.2	325.0	22
14	Four-Phase Systems	10.3	12.3	2.3	197.2	40
15	Informatics	12.0	8.9	32.0	125.9	57
16	Ampex	12.2	12.2	12.2	169.7	46
17	Mohawk	12.3	12.3	12.4	277.7	26
18	NCR	12.3	10.1	14.2	2,840.0	2
19	Honeywell	12.5	10.5	17.2	1,634.1	7
20	MAI	12.7	6.3	20.4	310.4	23

NM - Not Meaningful

1979. Only 16 of 83 companies showed a lower revenue per employee in 1980 compared to 1979.

THE BROAD CLASSIFICATIONS Although the breakdown of each company's revenues into 11 categories is subject to estimation and consistency errors, it still serves as a useful proxy. In Table IX, we present the aggregated results. Mainframes, minicomputers, microcomputers, and word processing systems (which include all peripherals sold at the time of the initial installation) accounted for $25.6 billion or 46% of total dp revenues. Although systems did grow at the industry rate of 21%, growth in mainframe systems lagged, up only 14%. Microcomputer system revenues (defined as fully configured systems selling for under $15,000) increased 85% in 1980, while word processing systems increased 64% to $881 million and minicomputers increased 28% to $8.8 billion. These revenue trends have been consistent over the past few years—mainframe systems continue to lose market share to minicomputer, word processing, and microcomputer systems. Since minis and micros are typically purchase-only, and mainframe systems have a greater lease propensity, shipments would be a better measure of market share. This measure would show an even greater market share erosion by mainframe systems.

Peripheral products grew at 20% to $10.9 billion (this excludes peripheral products sold initially with systems) in 1980. End user peripherals which are typically used in mainframe systems grew at 16%—greater than the growth rate in mainframes themselves. The oem market for peripherals had a 27% increase in sales (to $4 billion). This rapid growth reflects the continued proliferation of small systems. Meanwhile, sales of data communication gear (sold separately from the initial installation) grew 23% to $1.1 billion.

Software products and services in total accounted for $17.1 billion, 30.7% of the industry's total revenues. Maintenance revenues at $8.9 billion and other service revenues at $6.4 billion maintained an industry growth rate. However, software products continued to show rapid gains, growing 29% to $1.7 billion. Behind this surge is the unbundling of software by IBM starting with the 4300 announcement in 1979. We estimate IBM's software revenues at $1.3 billion, up 30%. Software products should continue an accelerated growth as the multitude of hardware offerings generate further requirements for both operating systems and applications software.

Word processing hardware revenues increased 64% to $881 million in 1980. The leading vendor, not surprisingly, was Wang

with word processing revenues of $252 million, up 112%. In Table X, we have listed the top 10 word processing companies (hardware systems revenues only). This list includes NBI as the tenth largest word processing company even though NBI did not make the DATAMATION 100, as it ranked 109.

The top 10 is filled with an assortment of vendors. In addition to Wang, the stock market has added public awareness to several of the standalone wp vendors including Lanier, CPT, and NBI. Philips Information Systems (the American marketing subsidiary of Micom) should be considered another important vendor in the class of product. If its Canadian sales were included, Micom would have been the third largest wp vendor in 1980. The list also includes several companies that have entered the wp arena through acquisition—Raytheon (Lexitron), Exxon (Vydec), and Burroughs (Redactron). Although profitability of these subsidiaries was not released, we would guess that only Lexitron is showing a profit. And finally, the other two vendors appearing on this list are DEC and Xerox, important dp names, but not necessarily commonly identified as wp vendors. Yet, according to our survey, DEC and Xerox were the third and fourth largest wp vendors. Noticeably missing from the top 10 is IBM. However, with several wp announcements in 1980, including Displaywriter and enhancements on the 5520, we suspect that in 1981 its wp sales will be large enough to place it among the top 10.

Data communications revenues in 1980 were $1.1 billion (up 23%), excluding data communications equipment purchased with initial installations. Including initial installations, we would estimate data communications revenues at $1.6 billion.

Data communications revenues have been included in this survey because of the increasing importance and decreasing distinctions of data processing and data communications. In deriving our estimates, we have defined data communications to include front-end processors, moderns, multiplexors, and network diagnostic equipment. PABXs have not been defined into the data communications and data processing definitions for 1980, although we acknowledge that it probably will be in the future, given the large amounts of data currently transferred through PABXs.

Coming up with a meaningful top 10 in data communications is more than a trivial exercise, because of the arduous task of determining which processors should be classified as communications processors. For example, with IBM the 3705 is clearly a front-end processor. However, the 8100 series of distributed data processors is less clear as some are used in the communicating as well as in the processing mode. With Digital Equipment,

TABLE V

TOP 10 DP OPERATING PROFITS

(in $ millions)

	1980	1979	% Change
1 IBM	5,231	4,649	12.5
2 DEC	434	327	32.6
3 NCR	390	348	12.0
4 Hewlett-Packard	261	184	52.7
5 Sperry	255	206	23.7
6 Control Data	238	176	35.1
7 Honeywell	186	152	21.9
8 Burroughs	145	456	−68.2
9 Wang Labs	113	70	64.7
10 Data General	105	92	14.6
Total Top 10	7,379	6,660	10.8
Total	5,500	7,715	10.2
Top 10 as a percent of total	86.8%	86.3%	
Number of Companies Reporting	70		
Total Dp Rev. Represented	49,905	41,678	
Percent of Dp Rev. Represented	89.7	90.6	

TABLE VI

TOP 10 - DP CAPITAL EXPENDITURES

(in $ millions)

	1980	1979	% Change
1 IBM	1,985	1,548	28.2
2 DEC	321	125	156.4
3 Control Data	296	208	42.8
4 NCR	156	115	36.2
5 Hewlett-Packard	148	115	28.7
6 Burroughs	147	100	47.0
7 Sperry	117	75	56.7
8 Wang Labs	96	65	48.9
9 Storage Technology	76	56	36.0
10 Automatic Data Processing	70	65	7.7
Total Top 10	3,412	2,470	38.1
Total	4,077	2,975	37.1
Top 10 as a Percent of Total	83.7%	83.0%	
Number of Companies Reporting	60		
Total Dp Rev. Represented	48,110	40,124	
Percent Dp Rev. Represented	86.5	87.2	

TABLE VII

TOP 10 R & D EXPENSES

(in $ millions)

	1980	1979	% Change
1 IBM	1,277	1,125	13.5
2 DEC	217	155	39.9
3 Sperry	216	189	14.1
4 NCR	201	171	17.5
5 Control Data	183	149	22.4
6 Burroughs	175	152	15.1
7 Honeywell	150	117	28.2
8 Hewlett-Packard	139	103	35.0
9 Data General	68	54	26.2
10 Amdahl	63	42	49.3
Total Top 10	2,688	2,257	19.1
Total	3,713	3,057	21.5
Top 10 as a Percent of Total	72.4%	73.8%	
Number of Companies Reporting	64		
Total Dp Rev. Represented	48,552	40,537	
Percent Dp Rev. Represented	87.3	88.1	

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CIRCLE 83 ON READER CARD

Dp industry profits only increased 1%; operating margins declined again in 1980 because of continued competitive and inflationary pressures.

an extra printed circuit board is added to the processor to make it communicating, yet its main function is not communications.

However, even with these definitional issues, certain trends remain evident. IBM is the leading data communications vendor with close to $1 billion in revenues. Burroughs, Memorex, and NCR are easily in the top 10, with dc revenues (generated most by front-end processors) ranging from $85 million to over $100 million. The leading modem and multiplexor suppliers, Racal (through its Milgo and Vadic subsidiaries), Motorola (mainly through its Codex subsidiary), General DataComm, and Paradyne are also among the top 10 suppliers in datacom. Refinements beyond this are difficult.

International market opportunities are still vast, although Europe is becoming very competitive and is also heading into an economic recession. In 1979, international revenues grew at almost 16%, compared to a U.S. growth rate of 10%. However, without IBM, foreign dp revenues grew at 24%, compared to a U.S. growth rate of 21%. In 1980, foreign growth excluding IBM expanded to 27% while the U.S. growth rate remained relatively flat at 22%.

Given the better international performance over the past couple of years, it is noteworthy to look at companies within the DATAMATION 100 that have a large percentage of sales generated by its overseas operations. The top 20 (foreign dp revenues as a percentage of total dp) had international revenues in excess of 40%, while seven companies had revenues in excess of 50% (Table XI). Of the 20 companies, only five had higher U.S. growth rates in 1980. Commodore International, with 76% of dp revenues generated overseas, heads the list.

METHODOLOGY: We have defined dp revenues as general purpose data processing products and services during calendar 1980. Included are mainframes, minicomputers, icrocomputers, word processors, oem peripherals and terminals, end user peripherals and terminals, data communications, software products, hardware and software maintenance, services, and disk and tape media. Explicitly excluded are communication services; electronic and mag card typewriters; electronic cash registers; instrumentation; semiconductors; printed circuit boards; automatic test equipment; telecommunications equipment such as PABXs; and dp suppliers with the exception of magnetic media for disk and tape drives. All peripherals that attach to a dp system are included. For computer-based manufacturing systems such as computer controlled machine tools, however, only the computer and hardcopy output devices are included.

Prior year results were restated to

TABLE VIII

TOP 10 DP EMPLOYMENT

(in thousands)

	1980	1979	% Change
1 IBM	278	270	2.9
2 NCR	66	65	1.6
3 DEC	60	50	21.0
4 Burroughs	57	57	1.4
5 Control Data	49	48	1.4
6 Sperry	47	46	2.8
7 Honeywell	29	29	1.8
8 Hewlett-Packard	28	25	12.0
9 Computer Sciences	15	13	10.6
10 Data General	14	14	4.8
Total Top 10	643	616	4.5
Total	863	806	7.1
Top 10 as a Percent of Total	74.5%	76.4%	
Number of Companies Reporting	83		
Total Dp Rev. Represented	51,894	43,221	
Percent Dp Rev. Represented	93.3	94.0	

TABLE IX

DP REVENUES BY PRODUCT SEGMENT

(in $ millions)

	1980 $	1980 %	1979 $	1979 %	% Growth Rate
Systems					
Mainframes	15,148	27.2	13,312	29.0	13.8
Minicomputers	8,840	15.9	6,916	15.0	27.8
Microcomputers	769	1.4	416	0.9	84.9
Word Processing	881	1.6	538	1.2	63.8
Total Systems	25,638	46.1	21,182	46.1	21.0
Oem Peripherals	3,968	7.1	3,128	6.8	26.9
End User Peripherals	6,910	12.4	5,943	12.9	16.3
Data Communications	1,141	2.1	927	2.0	23.1
Software Products	1,738	3.1	1,347	2.9	29.0
Maintenance	8,888	16.0	7,372	16.0	20.6
Service	6,432	11.6	5,329	11.6	20.7
All Other	911	1.6	772	1.7	18.0
Total	55,626	100.0	46,000	100.0	20.9

TABLE X

TOP 10 WORD PROCESSING

(in $ millions)

	1980 Wp	% Change	1980 Total Dp	Wp as a % of Dp	Dp 100 Ranking
1 Wang Labs	252.3	112.0	681.8	37.0	11
2 Lanier	110.1	48.6	128.0	86.0	54
3 DEC	82.3	102.6	2,743.3	3.0	4
4 Xerox	69.3	35.1	770.0	9.0	9
5 Raytheon	67.5	37.8	225.0	30.0	34
6 Exxon	66.2	31.9	86.0	77.0	71
7 CPT	65.7	68.9	76.4	86.0	76
8 Burroughs	49.6	1.5	2,478.0	2.0	6
9 Philips Info Systems	46.0	100.0	50.0	92.0	98
10 NBI	40.1	95.5	43.2	93.0	109

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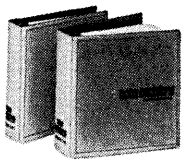

CIRCLE 84 ON READER CARD

W-602

Mainframe systems keep losing market share to minicomputer, word processing, and microcomputer systems.

reflect improved data and to maximize consistency. Thus 1979 rankings presented in the main chart are restated, and are not identical to rankings presented in last year's survey.

It was difficult to obtain data from privately held companies, dp divisions of large multinationals, and foreign held companies. Much of the data are best estimates and have not been blessed by company sources; however, we did offer companies every chance to respond.

While most companies were cooperative although subject to corporate rules, others were particularly uncooperative. Among those that would not confirm our estimates were Litton Industries, Diebold, Schlumberger (who has taken over Manufacturing Data Systems), Warner Communications (Atari), NEC, Data Printer, Grumman Corporation, and Data Terminal Systems.

Also, it is inevitable that we missed some potential companies. We invite any firm believing it merits consideration for the 1981 DATAMATION 100 to let us know.

Peter Wright is director of portfolio programs, Gartner Group, Inc., Greenwich, Conn. He was previously with IBM DPD in financial planning and IBM World Trade in product pricing. He has an MBA from Cornell Univ.

TABLE XI

TOP 20 FOREIGN REVENUES AS A PERCENT OF TOTAL DP

		1980	1979	1980 Foreign Dp Rev. (in $ mil)	Foreign Revenue Growth Rate	1980 Dp Ranking
1	Commodore International	75.7	56.8	74.7	105.2	66
2	Northern Telecom	61.0	66.0	132.4	−31.6	36
3	Mohawk	57.9	57.9	160.8	12.4	26
4	NCR	54.9	54.0	1,559.3	14.2	2
5	C. Itoh Electronics	53.3	66.2	100.8	−1.2	42
6	IBM	52.5	53.5	11,207.0	14.2	1
7	Martin Marietta	52.1	46.5	40.7	60.0	74
8	Hewlett-Packard	49.7	47.6	783.0	43.4	8
9	MAI	48.6	45.5	151.0	20.4	23
10	Memorex	47.5	49.8	326.0	−.6	10
11	Prime	47.0	42.0	125.8	95.8	27
12	Triumph Adler	46.2	36.3	150.0	40.2	22
13	National Semiconductor	44.9	45.7	110.0	4.8	32
14	Recognition Equipment	44.8	31.8	50.7	62.2	63
15	Centronics	44.1	38.3	56.9	17.5	52
16	Burroughs	44.0	43.0	1,090.0	3.8	6
17	Sperry	42.6	38.6	1,087.0	37.4	5
18	Tandem	42.1	29.2	54.2	179.4	53
19	Gerber Scientific	41.0	40.0	32.0	45.5	75
20	Ampex	41.0	41.0	69.6	12.2	46

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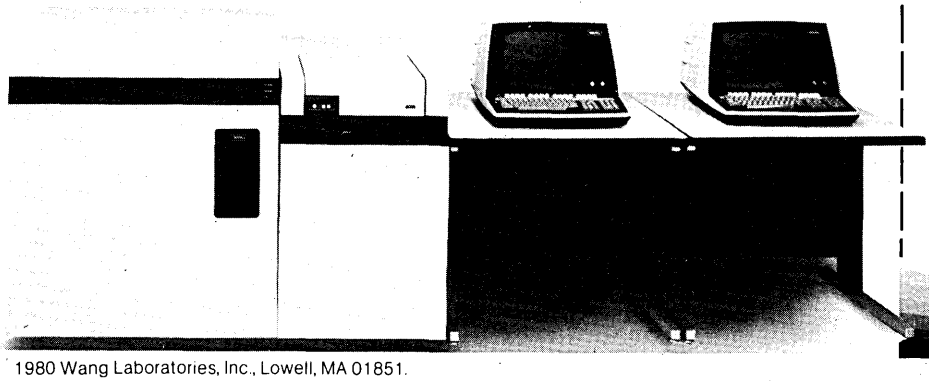

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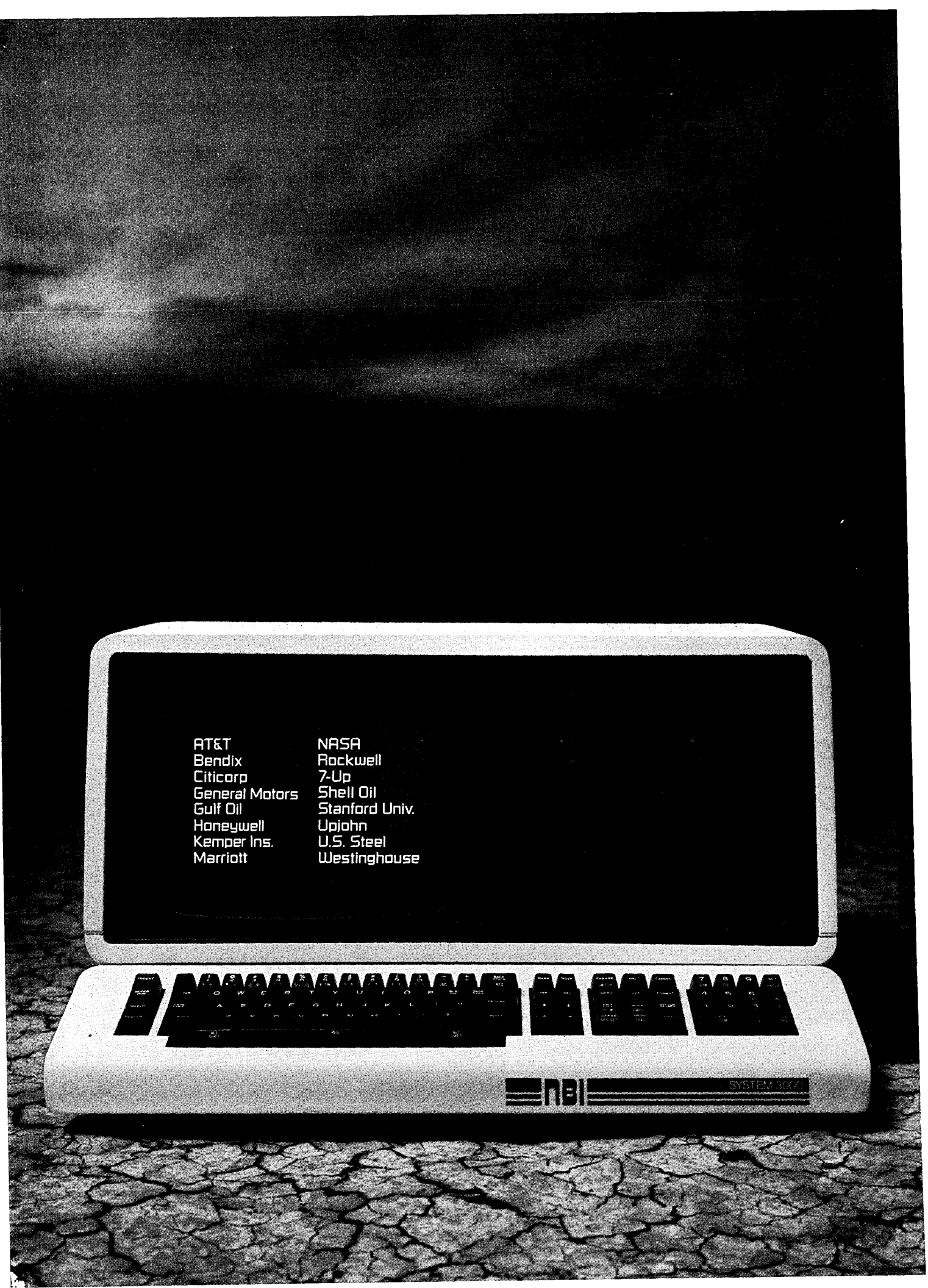
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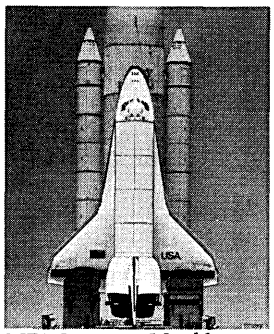

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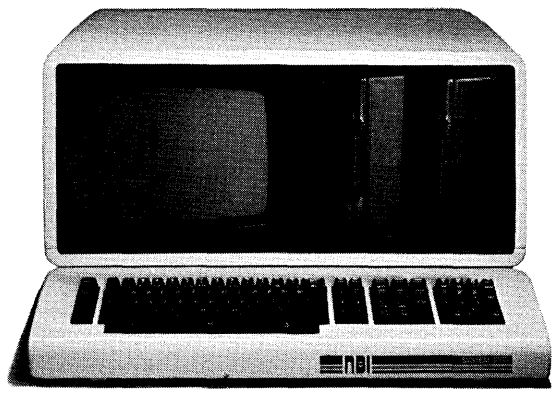
*Based on Datapro's 1980 survey among word processing system users.



NBI

NBI WORD PROCESSORS.

CIRCLE 87 ON READER CARD

THE DATAMATION 100

THE TOP 100 U.S. COMPANIES IN THE DP INDUSTRY

1980 RANK	COMPANY	1979 RANK	1980 DP REV. (MIL.)	% DP GROWTH RATE	1980 DP EMPL.	1980 TOTAL REV. (MIL.)	FISCAL YEAR ENDING
1	IBM	1	$21367	17%	278200	$26213	Dec.
2	NCR	2	2840	12	65500	3322	Dec.
3	Control Data	4	2790	23	49000	3808	Dec.
4	Digital Equipment Corp.	6	2743	35	60000	2743	Feb.
5	Sperry Corporation	5	2552	12	47435	5331	Mar.
6	Burroughs	3	2478	1	57300	2902	Dec.
7	Honeywell	7	1634	12	29000	4925	Dec.
8	Hewlett-Packard	8	1577	37	28000	3160	Oct.
9	Xerox	10	770	35	0	8197	Dec.
10	Memorex	9	686	4	10700	769	Dec.
11	Wang Laboratories	14	682	66	14000	682	June
12	Data General	11	673	25	14370	673	Sept.
13	Storage Technology	12	603	26	11536	603	Dec.
14	Texas Instruments	16	562	41	0	4075	Dec.
15	Computer Sciences	13	560	35	14668	560	Mar.
16	Automatic Data Processing	15	505	24	13500	505	June
17	General Electric	17	475	21	7500	24959	Dec.
18	Electronic Data Systems	19	408	31	6544	414	June
19	Amdahl Corporation	18	394	23	4200	394	Dec.
20	TRW	22	377	33	0	4983	Dec.
21	Datapoint	24	364	34	6000	364	June
22	Triumph-Adler	20	325	10	5200	325	Dec.
23	Management Assistance Inc.	23	310	13	5300	310	Sept.
24	Tektronix	30	286	38	0	1023	May
25	McDonnell-Douglas	27	280	14	0	6066	Dec.
26	Mohawk Data Sciences	25	278	12	4956	278	April
27	Prime Computer	39	268	75	4011	268	Dec.
28	Harris Corp.	29	260	24	3230	1453	June
29	Teletype Corp.	44	250	72	0	416	Dec.
30	ITT Corporation	26	250	2	5300	23819	Dec.
31	Dataproducts	34	248	44	4900	248	Mar.
32	National Semiconductor	28	245	7	2000	1159	May
33	Perkin-Elmer	35	226	31	3600	1044	June
34	Raytheon Company	33	225	29	4600	5002	Dec.
35	Tandy Corporation	42	220	47	1900	1515	June
36	Northern Telecom	21	217	−26	4100	1723	Dec.
37	Racal Electronics Ltd	40	212	40	3487	212	Mar.
38	Tymshare	32	211	20	3615	236	Dec.
39	3M Company	37	205	28	0	6080	Dec.
40	Four-Phase Systems	31	197	10	3748	197	Dec.
41	Computervision	52	191	86	3000	224	Dec.
42	C. Itoh Electronics	38	189	23	587	189	Dec.
43	System Development Corp	36	187	15	3897	187	June
44	Motorola	46	175	30	2300	3099	Dec.
45	General Instruments	43	172	15	0	823	Feb.
46	Ampex Corporation	41	170	12	4055	493	May
47	Apple Computer	74	165	175	1100	165	Sept.
48	Bunker Ramo	45	147	8	7050	468	Dec.
49	Sanders Associates	82	145	209	2500	318	July
50	Bradford National	48	143	19	4300	143	Dec.

1980 RANK	COMPANY	1979 RANK	1980 DP REV. (MIL.)	% DP GROWTH RATE	1980 DP EMPL.	1980 TOTAL REV. (MIL.)	FISCAL YEAR ENDING
51	Nixdorf Computer	54	138	38	2036	138	Dec.
52	Centronics	47	129	2	2600	129	June
53	Tandem Computers	66	129	94	1630	129	Sept.
54	Lanier Business Products	62	128	64	0	275	May
55	Planning Research	53	127	25	3200	307	Sept.
56	General Automation	49	127	7	0	127	July
57	Informatics	50	126	12	2500	126	Dec.
58	Boeing	57	125	30	0	9426	Dec.
59	Telex Corporation	55	118	19	2276	172	Mar.
60	Reynolds and Reynolds	51	118	8	1450	208	Sept.
61	Wyly Corporation	60	118	35	1600	118	Dec.
62	United Telecommunications	58	115	20	1728	1912	Dec.
63	Recognition Equipment	56	113	15	2700	113	Oct.
64	Shared Medical Systems	61	106	28	1246	107	Dec.
65	AM International	67	99	49	1386	936	July
66	Commodore International	71	99	54	0	150	June
67	Dun and Bradstreet	59	97	6	1500	1176	Dec.
68	Comshare	65	88	32	856	88	June
69	The Sun Company	68	87	31	1348	12945	Dec.
70	Gould	64	87	22	1650	87	June
71	Exxon	72	86	39	0	108449	Dec.
72	Computer Automation	70	81	26	1200	81	June
73	Modular Computer Systems	63	81	13	1481	81	Dec.
74	Martin-Marietta	76	78	43	2245	2538	Dec.
75	Gerber Scientific	75	78	42	1300	89	April
76	CPT Corporation	84	76	69	826	76	June
77	Paradyne Corporation	89	76	83	1617	76	Dec.
78	BASF Systems	77	75	39	0	90	Dec.
79	Lear Seigler	69	75	15	500	1489	June
80	Conrac	73	70	13	0	147	Dec.
81	Interactive Data	78	69	30	1100	69	Dec.
82	Applicon	85	68	51	1000	68	April
83	Commerce Clearing House	80	67	37	0	254	Dec.
84	Quotron Systems	81	64	35	785	64	Dec.
85	Dysan Corporation	96	63	86	1800	63	Oct.
86	Cray Research	88	61	42	761	61	Dec.
87	Triad Systems	94	60	61	818	60	Sept.
88	General Datacom	87	57	30	1050	57	Sept.
89	Anacomp Inc	95	57	60	950	87	June
90	Intergraph	99	56	91	764	56	Dec.
91	Rolm	93	53	43	0	251	June
92	MSI Data	83	53	17	852	53	Mar.
93	Nashua	91	53	34	467	671	Dec.
94	National Data	90	53	29	2175	67	May
95	American Express	79	53	6	1600	53	Dec.
96	MSA Inc.	92	52	37	799	52	Dec.
97	Auto-Trol Technology	97	51	51	660	51	Dec.
98	Philips Information Systems	100	50	100	500	50	Dec.
99	Printronix	98	49	49	838	49	Mar.
100	Verbatim	86	48	8	1200	48	June

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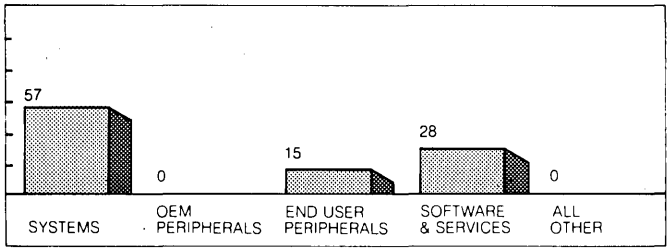


1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
1	$21,367	17	278,200	$26,213	DEC.

INTERNATIONAL BUSINESS MACHINES CORPORATION

Old Orchard Road
Armonk, NY 10504
(914) 765-1900

In 1980, IBM served notice to the industry that it has no intention of relinquishing its number one position.

Significant investments were made in plant and equipment expansion, rental machines, and R&D. Capital expenditures grew to $6.592 billion, following a record $5.991 billion in 1979. Research and development expenses amounted to another $1.520 billion vs. a record $1.360 billion in 1979.

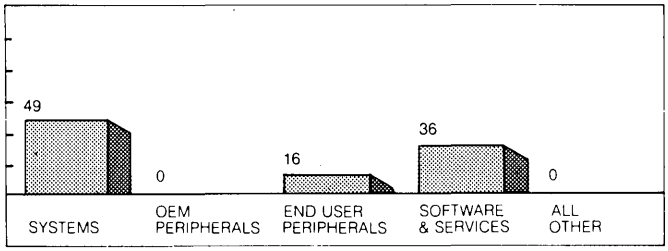
IBM completed construction of 4 million sq. ft. of manufacturing and laboratory space and 1 million sq. ft. of additional space for marketing operations. More than 8 million sq. ft. of manufacturing/laboratory space and 3 million sq. ft. of marketing space remained under construction at year-end.

IBM also tested new marketing and service techniques. Quantity discounts, outside distributors, retail stores, business computer centers, direct mail and telephone selling, customer support centers, application information centers, software distribution centers, etc. were all evaluated and expanded.

Some significant events in 1980 were:

- A cosponsored announcement in office information systems: the Displaywriter from OPD, DPP's word/data processing distributed office system for the 8100, and GSD's 5520 administrative/test/documents distribution system
- First, though delayed, shipment of the System/38, which may have reached a volume of 500 per month by year-end
- Rental price increases in June and December of approximately 12% per year (December '79, June '80, December '80)
- New models of the 4300 family
- The 3081, considered to be the first model of the new H Series, with the highest computational speed and lowest circuit packaging density yet developed by IBM (750,000 logic circuits contained in four cubic feet)
- Increased performance and price maintenance of the 3033N
- Announcement of the smallest 3033s, called model group S
- An uncharacteristic "directional statement" to reassure prospective OIS users that IBM will provide, over time, the necessary support to permit communications among office information systems product offerings
- One of the first major uses of holography in a commercial product, the 3687 supermarket checkout scanner
- A "statement of objection" by the EEC to certain IBM business practices
- The orbiting of SBS's first satellite
- A joint venture in videodisk technology called DiscoVision
- Election of John Opel to replace Frank Cary, who retains the position of chairman
- The return of Tom Watson, Jr., and Cyrus Vance to IBM's board

2



1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
2	2,840	12	65,500	3,322	DEC.

NCR CORPORATION

1700 South Patterson Boulevard
Dayton, OH 45479
(513) 445-5000

A slow start in 1980 saw lower margins in the first and second quarters, and earnings per share off more than 8% compared to the first six months of 1979. Component shortages and production startup problems on new products led to production shortfalls; resulting delivery delays had consequent revenue and earnings impact. Production problems lessened in each quarter, and NCR closed the year with revenues up 12%, net income up 12%, and earnings per share up 8%. The increases resulted from a 10% improvement in U.S. revenues and a 14% revenue gain in international markets. We estimate that dp revenues for the year increased almost 12%, despite the early production problems.

NCR's order experience for the year was the reverse of its revenue and earnings history. Worldwide orders were strong in the first quarter, but U.S. orders started to show a downturn by spring. Foreign orders were sufficiently strong in the third quarter to offset the U.S. decline, but by year-end foreign orders also turned down, due in part to the onset of a European recession. The company closed the year with a flat year-to-year order performance. Since NCR's business is strongly influenced by the retail sector, worldwide economic conditions are mirrored in the company's business levels.

The acquisition of COMTEN in 1979 was followed by the acquisition of Applied Digital Systems (ADDS) in 1980.

Financial terminals and systems showed the strongest growth in 1980 (up 27%), followed by revenues from computer systems (up 15%). Retail terminals and systems had lower revenues for the year, posting a 5% decline from the 1979 level. Service revenues were up 14%, primarily as a result of improvements in maintenance revenues.

Despite reduced revenues from retail terminals and systems, NCR further consolidated its leadership position in the retail market, particularly in universal product code scanning systems for supermarkets. As part of its plans to become a more vertically integrated supplier, NCR announced plans to begin manufacturing its own lasers.

R&D expenditures increased 17.5% to $201 million. Interestingly, for the second year in a row, considerably more than half (nearly 60%) of NCR's R&D expenditures was for software development, resulting in more software announcements during the year than new hardware products.

NCR's capital expenditures were $156.4 million during the year up more than 36% from 1979. Major projects included a new retail systems plant, a new systems engineering facility, general plant expansion, and a continuing expansion of microelectronics design and production facilities. NCR has made a commitment to in-house semiconductor capabilities and will soon be capable of supplying nearly two-thirds of its components needs, second only to IBM among the mainframe vendors.

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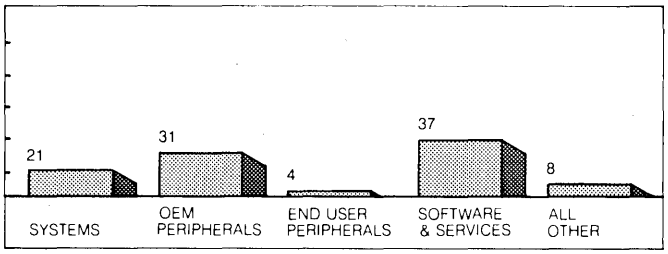

1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
4	2,790	23	49,000	3,808	DEC.

CONTROL DATA CORP.

8100 34th Avenue South
Bloomington, MN 55440
(612) 853-8100

Control Data had another good year in 1980, its sixth consecutive year of earnings improvement. Despite the recession impact on Commercial Credit Corp., combined company revenues were $3.8 billion, up 18%, while net earnings were $150.6 million, up 21%. The strong overall results emanate from computer operations: Commercial Credit reported no growth over 1979. Computer revenues were up 23%; earnings per share from computer operations grew a very strong 36% year to year.

As in past years, the strongest performance within the computer operations came in peripheral products. Peripherals accounted for 42% of computer revenues, and sported a year-to-year growth rate of 31.5%. Control data markets one of the industry's broadest lines of computer peripherals, for both its own and other companies' systems. Peripherals for other systems are marketed both to oems (up 30% in 1980) and to IBM system end users (down in 1980). Control Data manufactures nearly all of its peripheral equipment either in its own facilities or through joint ventures. The joint ventures are Magnetic Peripherals (70% owned by CDC) and Computer Peripherals (60% owned by CDC).

Computer Services (37% of computer revenues) had the next strongest performance in 1980, with revenues up 17.3%. Control Data's computer services are made up of data services (with revenues of $549 million, up 17%), engineering services (with revenues of $313 million, up 14%), and education and consulting services (with revenues of $173 million, up 25%). Education services includes the PLATO computer-based education system, which offers hardware and extensive sourceware libraries. Control Data has made a major investment, which has yet to show any commercial profit, in the PLATO system.

Computer Systems, the original business of Control Data, now represents 21% of computer operations revenue. This business grew 16.7% in 1980, with a 13% growth rate in traditional dp systems and 31% growth in government systems, which had a down year in 1979. Computer Systems operates primarily in the large-scale scientific market for engineering, educational, and scientific applications. At the top of the line is the CYBER 205, introduced in 1980 and one of the most powerful computer systems in the world. The CYBER 205 supercomputer has a claimed peak performance of 800 million floating point instructions per second.

For 1981, the outlook appears to mirror 1980. Peripherals, services, and computer systems should grow. Financial services (Commercial Credit Corp.) should continue to be hampered by high interest rates and a sluggish world economy.

With growth in all segments of computer operations anticipated, and another decline in the income contribution from Commercial Credit expected, the dominance of Control Data's original business—computers—has effectively been restored.

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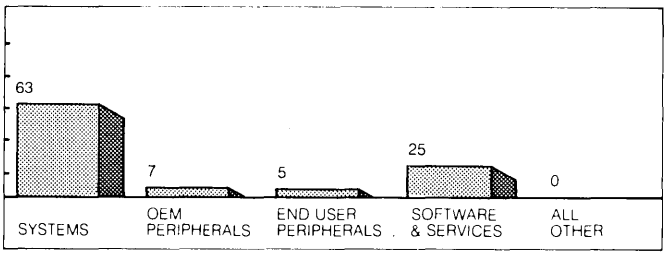

1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
6	2,743	35	60,000	2,743	FEB.

DIGITAL EQUIPMENT CORPORATION

129 Parker St., PK 3-1/552
Maynard, MA 01754
(617) 493-3631

Digital Equipment continued to breeze through the current economic uncertainties. While industry leader IBM took nine years to expand revenues from $500 million to over $3 billion, and Xerox—with a legal monopoly date derived from patent protection—required seven, DEC crossed the mark in six years. No signs of a slowdown appear. Despite management's assertion that such heady growth rates cannot continue, the company inevitably ends up trying and accomplishing the extraordinary for just one more year.

Indeed, the recession for DEC came just in time to bail the company out of problems with extended delivery lead times in 1979, only partly attributable to a case of overpopularity. DEC itself pursued a conscious course of allowing lead times to run during the upturn and refused to chase demand as it had in the past.

In one of its troubled product lines, the VT/100 crt terminal, a trebling in production capacity coinciding with a softening in demand finally broke the one-year delivery lag that prevailed in late '79. By fall, ads heralded immediate availability.

The trend affected DEC's competitors, who for the first time in three years, faced the burden of matching DEC in product capability, rather than relying primarily on availability. Data General in the December quarter, and Prime in its first quarter of 1981 succumbed to the rising pressures of increased competition in a weakening economy.

VAX software gained the software maturity required for DEC to sustain a drive into commercial markets. Seven enhancements in the spring included new BASIC native mode COBOL compilers, another release of FORTRAN, CORAL 66 support for real-time, Forms Management System (FMS), Datatrieve for inquiry, and an enhancement for the VAX/VMS operating system. At press time database management software constituted the only missing element for commercial applications.

In October DEC released the VAX-11/750, extending the VAX family downwards with 60% of the capacity of the VAX 11/780's performance at 40% of the price. Significantly, with VAX DEC is offering a processor version—only geared to oems and systems houses—as well as fully configured systems for end-users.

Customer service remained a top priority with service related revenues up 39%, almost a fourth of total corporate revenues.

DEC budgeted capital spending for the June '81 fiscal year at over $400 million, almost double the amount spent in the prior year. Employment rose from 49,600 to 60,000.

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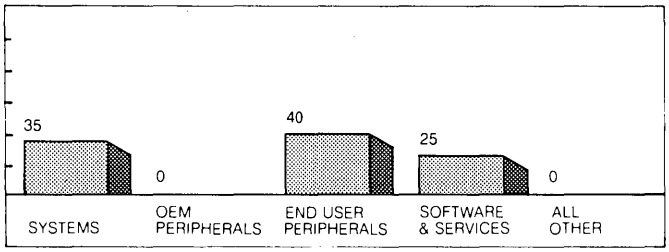

1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
5	2,552	12	47,435	5,331	MARCH

SPERRY CORPORATION

1290 Avenue of the Americas
New York, NY 10019
(212) 926-3273

Sperry Corporation is a more than $5 billion conglomerate. Sperry consists of New Holland Div., deriving more than $1 billion from farm machinery sales; Vickers Div., with more than $500 million in sales from hydraulics and fluid power equipment; Sperry and Flight Systems divisions, with combined revenues of nearly $900 million from guidance and control equipment; and Sperry Univac Div. with $2.6 billion in dp revenue.

Sperry Corp.'s calendar year revenues were $5.3 billion in 1980, up 15% from 1979, with net income increasing 18.7%. Sperry Univac contributed 48% of revenue and approximately 47% of net income. Univac's revenues in the calendar year increased by 24.5% (16% growth in U.S. business and 37% growth in foreign markets). Univac's operating income increased approximately 24%, and new order bookings and backlogs both showed a 9% gain at year-end.

Univac emphasizes a selective industry marketing and support specialization. Approximately 80% of Univac's business now comes from six major target industry markets—manufacturing, energy, airlines, distribution, financial services, and the public sector. U.S. defense systems is considered a separate major market area within Univac.

Software and service revenues are becoming increasingly important to Univac, and the company is making a substantial investment for developing new applications packages for its target industries. Unbundled software and services revenues have nearly reached the $100 million level, and growth in this area is expected to approach 50% per year.

A semiconductor division was recently formed to meet Univac's demand for special-purpose logic components. The new division began to implement an initial $50 million capital expansion program for LSI and VLSI operations in the Minneapolis area.

One of the greater product successes for Univac is the 1100/60. Since its introduction in late 1979, more than 550 orders have been received and over 500 will have been installed by the end of fiscal year '80 in March. Additional models of the 1100/60 were announced in 1980. The mid-range computer product area has likewise been strengthened. More than 500 System 80 orders have been received, and installations are already being made at a rate approaching 100 per quarter.

Distributed processing, data communications, and the office automation markets also attracted Univac's attention in 1980. A new micro processor-based distributed processing terminal family, the UTS-4000, was announced during the year, as were additional models of the V77 minicomputer family. All new hardware and software are designed to operate under Univac's own communications standard, "DCA" (distributed communcations architecture). A fully integrated office system is in development. Several test sites are already under way, and product announcements are expected in 1981.

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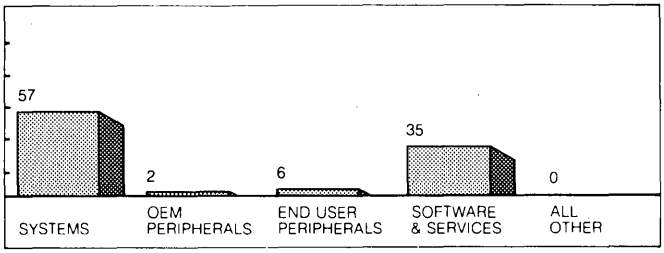

1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
3	2,478	1	57,300	2,902	DEC

BURROUGHS CORPORATION

Burroughs Place
Detroit, MI 48232
(313) 972-7000

At the end of 1979, Burroughs uncharacteristically went outside the company and selected a new top manager, W. Michael Blumenthal, to succeed the chairman and chief executive officer as of Jan. 1, 1981. Thus, the '80s began with change, and the events of 1980 forecast more to come.

Problems were evident. The rate of revenue growth slowed throughout the year and margins came under increasing pressure. In addition to Blumenthal, other new management people were brought into the company, and management emphasis was shifted to cash and asset management. By the end of the third quarter, earnings per share had declined 13.5% year to year, and management immediately began to rethink its position in the industry, and to reevaluate and initiate new strategic plans.

In the fourth quarter, the company took action that resulted in a reduction of 1980 and fourth quarter net income by $125.1 million or $3.03 per share. These actions included dropping the large-scale scientific processor development, phasing out calculators and adding machine products, closing certain manufacturing facilities and some overseas marketing operations, establishing an early retirement program, inventory write-offs and adjustments, and reserves.

As a result of these changes, revenues in 1980 were flat; 1979 earnings plummeted to $1.99 per share from $7.45 in 1979. Without write-offs and adjustments, operating earnings per share would have been approximately $5.02, a decline of 33%.

Along with management, accounting, and strategic goal changes, organizational changes were also put in place. A new office systems group was formed. Burroughs also began a major expansion of its integrated semiconductor manufacturing capability, and a refinement of its systems distribution channels. The major acquisition of Systems Development Corp. was also completed, bringing new strength to the company's integrated hardware, software, and services capabilities. As a Burroughs subsidiary, SDC will operate under its current management and retain its own identity.

Despite the turmoil of 1980, at year-end Burroughs orders showed an increase for the year as a whole, reflecting strength in the first half of 1980 and some softening in the last half of the year. Year-end backlogs were at an all-time high.

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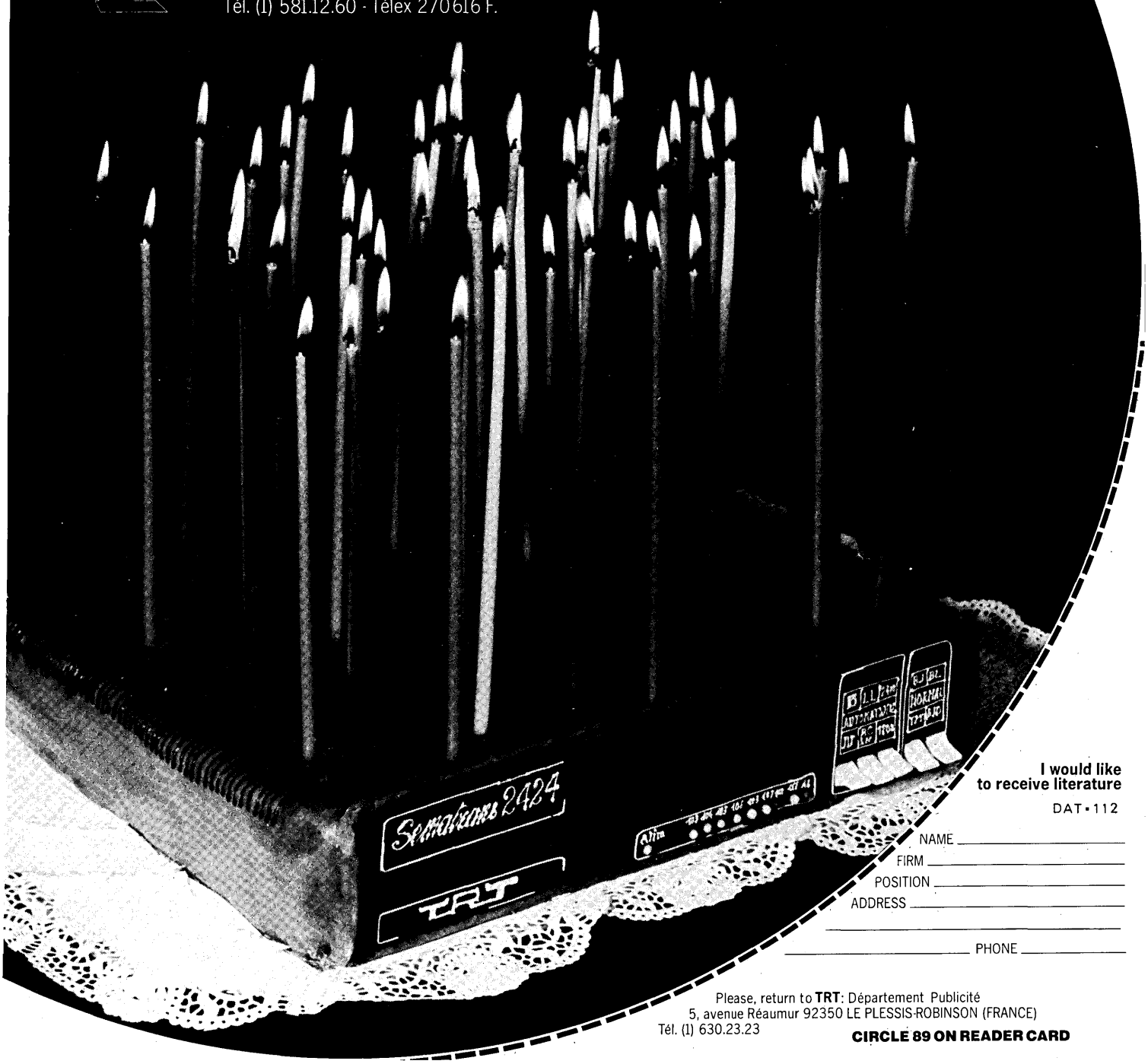

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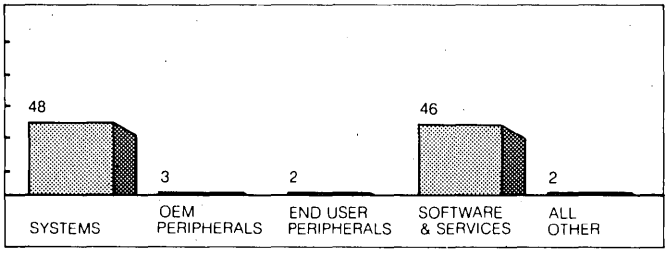

1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
7	1,634	12	29,000	4,925	DEC.

HONEYWELL, INC.

Honeywell Plaza
Minneapolis, MN 55408
(612) 870-5200

Honeywell had a strong 1980, completing its sixth consecutive year of earnings increases. Total revenues increased 17% to $4.9 billion, operating income rose 7.4%, and earnings per share were up 14.8% to $12.57. Marking its 25th year in the computer business, Honeywell's Information Systems Div., in which the company's data processing operations are centered, achieved substantial revenue and profit increases in 1980, despite generally poor economic conditions. Honeywell Information Systems (HIS), accounting for one-third of Honeywell's revenues and about 35% of profits, posted revenue gains of 12% (to $1.6 billion) and a gain of 22% in operating profits (to $186 million). Orders, shipments, revenues, and year-end backlogs hit record levels.

Honeywell's other business centers are Environmental Systems and Controls, accounting for 25% of revenue and 27% of profit; Industrial Systems and Controls, accounting for 22% of revenue and 25% of profit; and Aerospace and Defense, making up 20% and 12% of revenue and profit, respectively.

Information Systems' international operations were a major contributor to 1980 results. About a third of HIS revenues is derived from wholly owned subsidiaries, primarily in Canada, the United Kingdom, Italy, and from Cii-Honeywell Bull in France, 47% owned by Honeywell. Honeywell's share of the ordinary income of Cii-Honeywell Bull rose to $23 million in 1980 from $13.5 million in 1979. The French government program of granting subsidies to Cii-Honeywell Bull expired, as planned, in March 1980.

HIS management structure was streamlined early in the year, giving the systems division direct responsibility for worldwide product planning and for facilitating development and market responsiveness. In product announcements, HIS strengthened itself in distributed processing, small systems, and large systems. The DPS-6 family of ten small computers was announced, including two 32-bit "superminis" and four 16-bit models. HIS entered the office automation market with the introduction of integrated word processing, data processing, and communications features for both the new DPS-6 and the older Level 6 minicomputer.

In large systems, Honeywell began to ship the DPS-8, announced in 1979, and more than 100 systems were installed by year-end. A notable strength of Honeywell in large systems is the GCOS-8 and MULTICS operating systems software.

Honeywell's investment in research and development for information systems products, software and communications increased 20% to $150 million. Computer-related research and development totaled about $280 million, including $130 million spent by Cii-Honeywell Bull. Solid-state electronics and software continue to be the major focuses of Honeywell's research.

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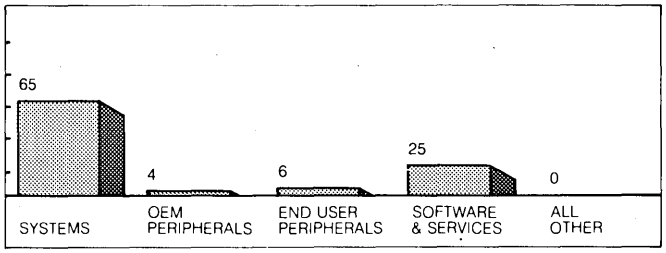

1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
8	1,577	37	28,000	3,160	OCT.

HEWLETT-PACKARD COMPANY

1501 Page Mill Road
Palo Alto, CA 94304
(415) 857-1501

In FY '78 Hewlett-Packard opted for increased growth in its dp activities. Since then, expansion in employment and revenues have continued at 27% and 36% compound rates, respectively, for the data products group, compared to 15% and 25%, respectively, for the company's medical, analytical, and test and measurement groups. With the 3000 and the Image database management software, HP established a strong position in commercial markets: over 6,000 3000 systems are installed worldwide.

The pace slowed modestly for the data products group in 1980; orders rose only 20% in the three months ending in July. The commercial products group even ran below quotas for a time before the introduction of the 3000/Series 44, which offers twice the performance of 3000/Series III at 5% higher cost. Still to come is the HP 55, employing dual 16-bit processors with reputedly four to six times the performance of the Series III.

With the Series 44, HP offers customers a money-back maintenance agreement that guarantees 9% hardware up time. Under this option, up time is evaluated monthly for the previous three months. The user is given a month's credit if 99% up time is not achieved in this period.

Even so, industry wags continue to ponder the potential remaining product life for the 3000, and, in particular, for the MPE operating system. Through at least five significant revisions, the operating system has minimally doubled in size, with 11 functional enhancements added to the data structure alone. Current efforts appear to have focused on revisions to the existing MPE software, which would not meet the need for a fundamental rewrite. Yet, a new operating system to capitalize fully on 32-bit hardware engines may be 18 months away.

Hewlett-Packard has targeted the international manufacturing industry as its prime market, and has contracted with University Computing for APT—the standard language in numerical control—and other software. New materials management/3000 software simulates new production plans, identifies critical supply problems, recommends manufacture or purchase of materials, and eliminates shutdowns for the taking of physical inventory.

Personal computers are roughly 12% of group revenues, or $180 million, recorded the best relative performance in the company last year, with more than a million of the HP 30EC family of pocket calculators now shipped. The new HP 80 series extends the concept of calculators into computers with a built-in display, graphics, and basic language programming.

With only nine months' worth of shipments made in FY '80, the HP 80 achieved the number six position on HP's list of top selling products, with sales hitting $100 million a year by January 1981. A high proportion of sales have been marketed through an independent dealer market; HP does not currently plan to open its own retail stores.

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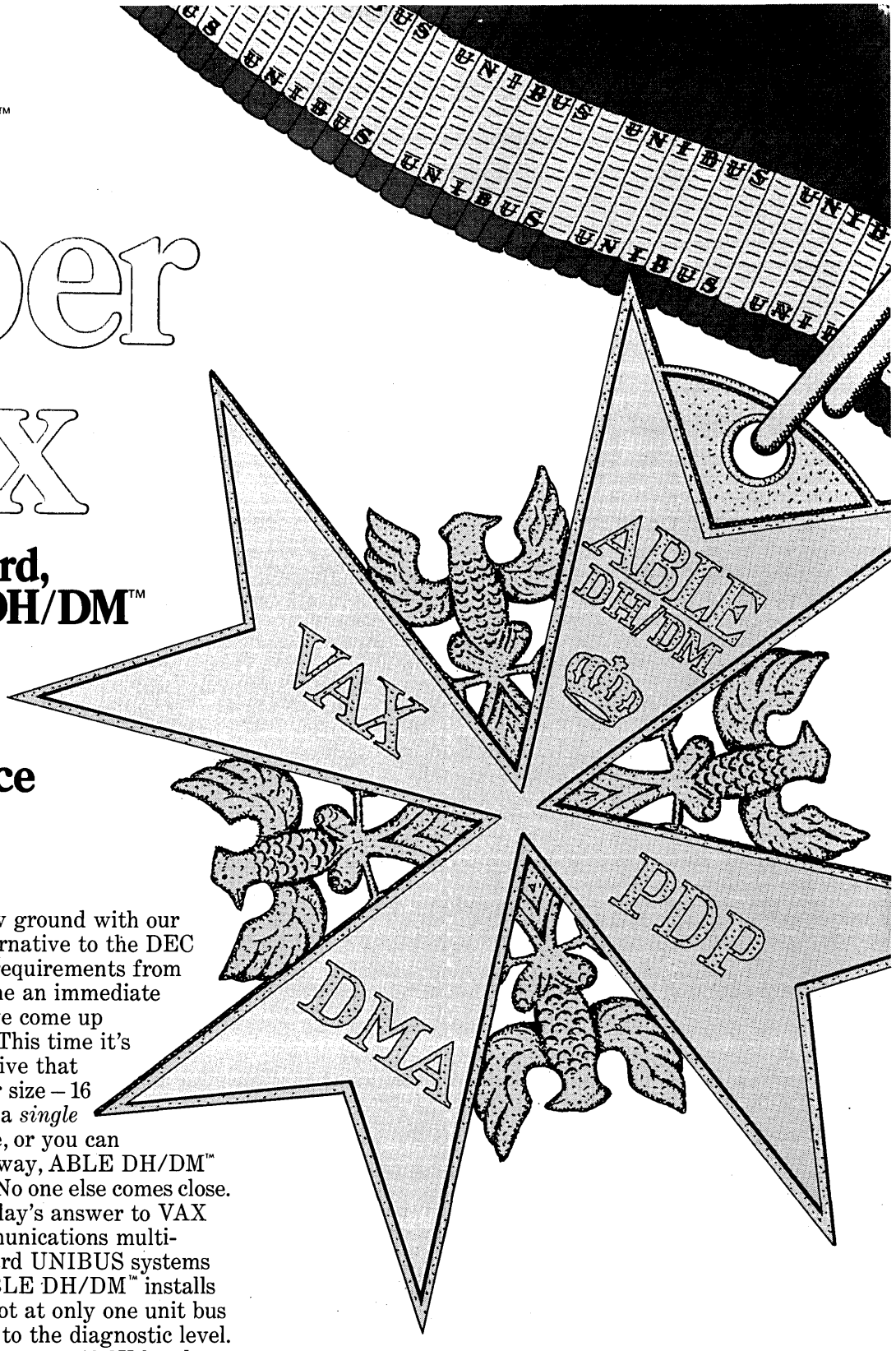

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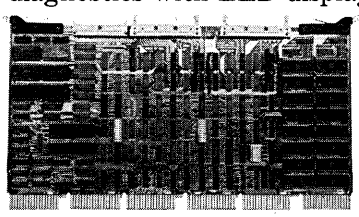

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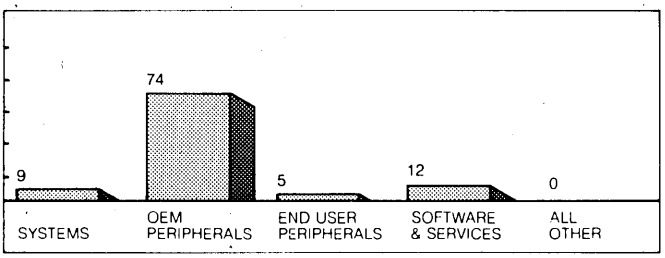

1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
10	770	35	0	8,197	DEC.

XEROX CORPORATION

800 Long Ridge Road
Stamford, CT 06904
(203) 329-8711

The scope of Xerox now includes office and information systems. Xerox Office Products Div. alone generated $400 million in revenues worldwide during 1980; there were also dp revenues from subsidiaries such as Shugart, Diablo, Versatec, and Century Data. During 1980, in office systems, Xerox introduced information processing machines communications such as the Xerox 5700 electronic printing system and the System 8000 which can be linked to Ethernet. In May 1980, in a move to position Ethernet as the potential standard network for the industry, Xerox announced an agreement with DEC and Intel to jointly develop specs for data rates, reliability, and access techniques.

Business continued strong for Versatec, which sells its electrostatic printer/plotters in markets that felt no recession, such as oil, gas, and mineral exploration businesses, and CAD/CAM. Shugart Associates, a leading supplier of floppy disk control and memory units and a growing factor in higher-capacity rigid disks, had a strong year as a result of demand related to microcomputer sales.

Diablo Systems introduced a new computer terminal-printer. Competition in daisywheel printers continues to increase.

Kurzweil Computer Products was acquired early in 1980. The Cambridge firm has proprietary software technology.

Besides office systems and peripherals, Xerox also has a rapidly growing computer services business that has reached nearly $100 million. Overall, we estimate Xerox's information processing revenues were $770 million in 1980, up 35% from $370 million in 1979.

Total Xerox revenues for 1980 were $8.2 billion, up 17%, with net income at $619 million, up 10%. Profit margins are expected to remain under pressure during 1981. Revenues from systems, components, and other businesses have increased from 15% of total revenues in 1975 to about 25% in 1980.

Xerox is experimenting with various merchandising approaches. During 1980, it opened retail stores, contracted with dealers and distributors, and tried mail order as a sales technique.

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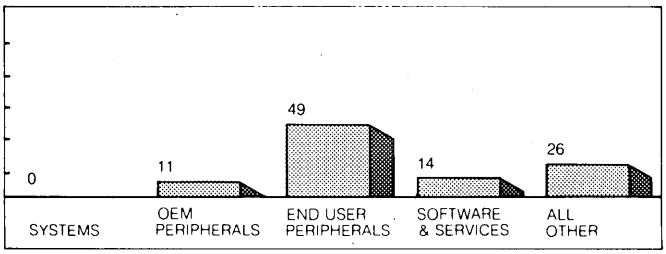

1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
9	686	4	10,700	769	DEC.

MEMOREX CORPORATION

San Tomas at Central Expressway
Santa Clara, CA 95052
(408) 987-1000

Memorex incurred its first yearly loss since 1974 as Clarence Spangle took over as president and chief executive officer. In many ways, however, 1980 was a productive year as the company refocused its corporate strategy by charting out its future market opportunities, streamlining current operations, and eliminating some of its unprofitable business.

In 1980 dp revenues were up 4.3% to $686 million, while dp operating income declined from $52.2 million in 1979 to a deficit of $92 million in 1980. Losses were reduced as the year progressed, and while the corporation still incurred a $2.8 million loss in the last quarter, dp operating income turned profitable. Results in 1980 were due in part to economic conditions—inflation, high interest rates, and recession. Dp markets remained strong, but were characterized, particularly during the first half, by tough price competition and uncertainty related to the IBM 3380 disk drive announcement. Demand for the disk drives picked up strongly after IBM's June announcement. Memorex's sub-par operating results were also due to operations (high manufacturing costs, inventory changes, and startup costs with several new products) and reduced third-party financing.

Throughout 1980, Memorex actively worked at restoring profitability. Asset management improved markedly as inventories were down $20 million in the last quarter. Accounts receivable also improved as days-collectible were the lowest in years. In addition, operating cash flow from operations in the fourth quarter was positive for the first time since the third quarter of 1977. Memorex reduced employment by 1,100 to 11,300 by year-end.

While improving asset management and reducing employment, Memorex also attempted to identify losing operations: it dropped the Business Systems Div., combined its magnetic recording media groups, and dropped its word processing supplies division.

Memorex's new strategic thrust will be in the oem market to diversify from its IBM-dependent business.

Memorex started volume shipments of its Model 101 8-inch Winchester disk drive during 1980. In addition to manufacturing these 8-inch drives in its 100,000 sq. ft. leased facility, Memorex formed a joint venture with Olivetti to manufacture drives in Italy. This European venture strengthens Memorex's position as a leading oem supplier in Europe.

Although the oem division appears to hold the key for any future Memorex success, it did have some setbacks in 1980 when it lost two key executives—Dr. John Scott, president of Memorex's mini disk drive company, went to Apple Computer, and Keith Plant, vp of oem marketing, joined a startup firm.

Despite the unprofitable operations, R&D expenses were not slashed to improve short-term results. In fact, dp R&D expenses increased 25% to $32.5 million.

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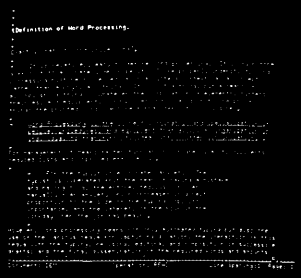

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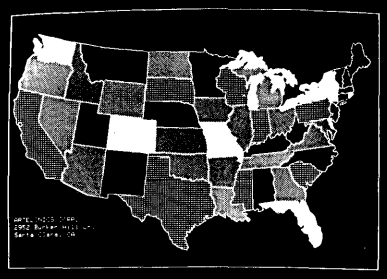

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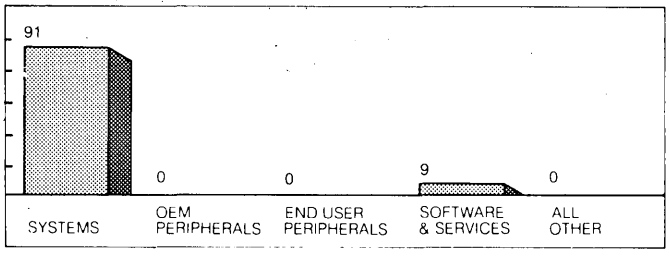

1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
14	682	66	14,000	682	JUNE

WANG LABORATORIES

1 INDUSTRIAL AVENUE
Lowell, MA 01851
(617) 459-5000

Wang continued its blitz with orders up over 50% despite IBM's mid-year introduction of the Displaywriter. Word processing paced expansion, with orders almost doubling to roughly $385 million.

New products provided the momentum. First introduced in 1979, the Office Information Systems (OIS) series was extended downwards with new low-end models 105 and 115. Entry-level configurations, priced at $19,600, support two workstations and 25 megabytes of disk storage.

The year-end introduction of the Wangwriter took the company into standalone markets. This market had suffered from benign neglect since a marketing emphasis had been given to large corporate accounts. A small business marketing group (200 salesmen) will support the effort with an expected 10,000 units to be shipped the first year. Features and functions appear competitive; pricing of $7,500 list comes in slightly under the IBM Displaywriter.

The VS family of computers enjoyed a 76% gain in orders, aided in part by the ability of the Wang sales force to cross-sell the "dp" version of "Integrated Information Systems."

In small business computers, Wang has trailed the industry pace partly because of a lack of new products; the company has concentrated on the larger VS computers and on word processing. The spring introduction of the 2200 LVP, the 2200 SVP, and PCS-III reinstilled confidence among the company's oem systems house customers who were considering shifting to other suppliers.

Also at year-end, Wang announced its intention to incorporate broadband communications capability for local networking, in sharp contrast to the base band Ethernet approach of DEC, Intel, and Xerox.

Wang's dramatic fivefold expansion in revenues, aggravated by personnel turnover, has burdened the company in service where the company's reputation suffered in 1979. The company successfully reversed the trend in 1980; the personnel turnover rate of 24% to 26% for fiscal 1979 fell to 14% for fiscal 1980, and 7.2% for the six months ending December 1980.

An extraordinarily aggressive program of outside financing supported an increase in the equity base; convertible debt increased from $118 million in June 1979 to $517 million by December 1980. The current strength in the balance sheet supports the company's product and market drives.

Wang now faces less pressure to generate dramatic gains in current earnings to support the financing program, providing increased leeway to turn to new product development. Indeed, R&D bills were $17.5 million for the December quarter alone, and included new communications and semiconductor programs. This figure is more than Wang spent for the full 1979 fiscal year.

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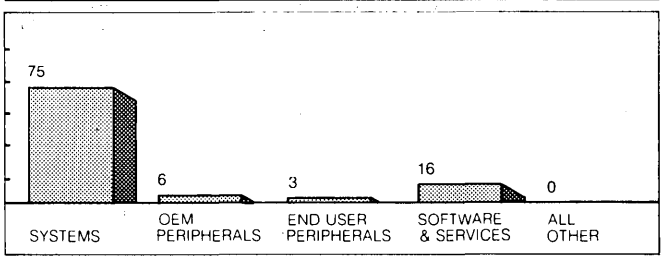

1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
11	673	25	14,370	673	SEPT.

DATA GENERAL CORPORATION

4400 Computer Drive
Westboro, MA 01580
(617) 366-8911

Data General's 21% growth in revenue to $654 million was respectable but was not a continuation of the growth that brought DG through the half-billion dollar barrier in only 10 years. Operating margins have nosedived to an all-time low of 13% in the first quarter of fiscal year 1981 from 16% in calendar year 1980 and 17% in 1979. Despite flat orders, employment expanded to 14,370.

Over the years, much of DG's minicomputer sales were due to production capacity restraints at DEC. Now, however, DEC has reduced its delivery times.

Another factor in DG's market expansion in the early '70s was an aggressive sales force which, unlike DEC's, was paid on commission. As the company grew, its salespeople had to deal with a wider range of products and customers, and marketing reorganization became inevitable. Fairly substantial disruptions resulted—sales responsibilities were specialized for scientific/industrial or commercial business, and many accounts were reassigned. Middle-level management positions were sharply reduced from 36 to 20, and turnover has been high. Small business computers are now being sold through a network of over 100 independent office equipment and retail computer stores.

Management changes at top levels have continued. In 1980, Kenneth Gregge stepped in as vice president and chief financial officer and Robert Martin took over as director of corporate planning. In February 1981, U.S. operations were broken into three divisions reporting to Herbert Richman, who was promoted to executive vice president.

Revenues from product service, customer training, and software fees are growing at roughly 50% annually. In four years, the number of field service engineers has grown to 1,400 from 877. DG is trying to save labor by replacing whole boards where it formerly had changed chips. Emphasis on servicing small systems has increased, and the spare parts inventory in remote locations has been boosted.

Despite short-term problems, DG's R&D expenditures are up 26% to $68 million in 1980. Much of this is for software development on the 32-bit minicomputer, "Eagle" (Eclipse MV/8000).

The Eagle reportedly has full software compatibility with other DG products. DG is adding a COBOL compiler which it hopes will triple the market. DEC's VAX/VMS system, however, has had more than two years of field testing and is in its second major release, while the Eagle's software will probably not become stable for another year.

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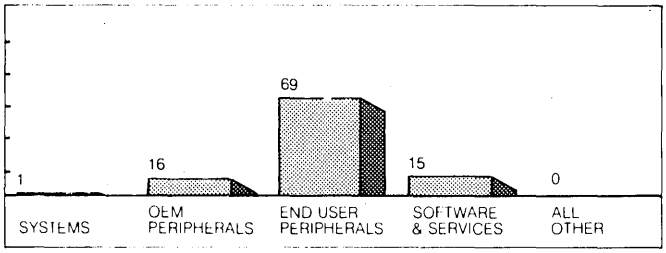

1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
12	603	26	11,536	603	DEC.

STORAGE TECHNOLOGY CORPORATION

2270 South 88th Street
Louisville, CO 80027
(303) 673-5151

The only truly strong survivor of the plug-compatible peripherals market, Storage Technology Corp. (STC) had a year that was filled with both significant accomplishments and disappointments. Strategically, however, 1980 may go down as the most fundamental turning point in its relatively successful corporate life. STC is in the midst of a high stakes game, but if successful, it could propel itself to the ranks of Digital Equipment and IBM, becoming one of the largest dp companies by the end of the decade.

In January STC opened its 65,000 sq. ft. semiconductor facility to produce ECL bipolar and C/MOS logic circuits as well as thin-film heads. This new facility supplements its STC micro technology subsidiary, a hardware and software development lab that uses advanced computer-aided design techniques. Then in April, STC tried unsuccessfully to merge with Amdahl.

Not to be thwarted in its obvious attempt to become a full-systems supplier, STC consummated a merger with Documation, a financially ailing high-speed printer manufacturer that sells to the same markets as STC. It turned out to be attractive for both parties as STC was able to capitalize on Documation's marketing, manufacturing, and international presence.

Large tapes, which accounted for almost 45% of 1979 revenues, showed little growth in 1980. Margins were hurt by a purchase price reduction implemented in October following a similar move by IBM. STC, however, did introduce the 4500 line of drives for intermediate-sized computer systems. With IBM lacking a competitive equivalent, this product showed strong market acceptance, particularly for use with the IBM 4300 computers, which were shipped in volume during the year.

STC's PCM disk business had a strong year. Volume shipments of its double-density version of IBM's 3350, the 8650, although delayed until spring, picked up dramatically, and so did the purchase propensity. STC announced answers to IBM's 3370 and 3380 disk drives, as well as a new controller.

The drive to further penetrate the oem market was stalled during 1980. Sales were up only 3%, to $3.6 million. Almost all oem sales were from tape products. Disk oem penetration was almost nil because the plagued 2700 disk drive was removed from the market. The problem appears to have been that the drive was too sophisticated for the oem market and too expensive to manufacture. We expect to see STC reenter the oem disk drive market in the near future. In October, STC established STC Peripherals, Inc., as the division in control of its oem fortunes, and named William Mansfield, formerly corporate treasurer, as president.

Financial results were respectable considering all the extraordinary corporate activities, major semiconductor investments, and turbulence in the peripherals market during the year. Revenues increased 26% to $603.5 million, while dp operating margins slipped a point to 16.8%.

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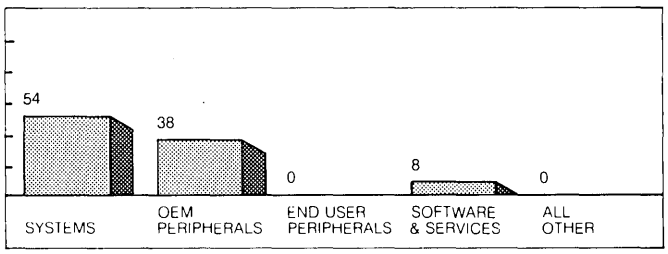


1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
16	562	41	0	4,075	DEC.

TEXAS INSTRUMENTS INCORPORATED

Post Office Box 225474
Dallas, TX 75265
(214) 995-2011

Texas Instruments had an estimated 41% gain dp-related products in 1980. Although TI does not provide breakouts of dp finances, 1980 dp revenues are estimated to be about $562 million, up from about $398 million in 1979.

More than half (53%) of the digital products group revenues are from dp products (minis, peripherals, and home computers), with the remaining 47% from consumer electronics products such as calculators and watches. The total group registered an 18.6% increase over last year, the large dp-related growth offset by a 1.5% shrinkage in consumer electronics, particularly calculators. Overall after-tax margins for the digital products group remained at the 1979 level of about 6%, although dp operating margins improved to 13.3% from 12.4%.

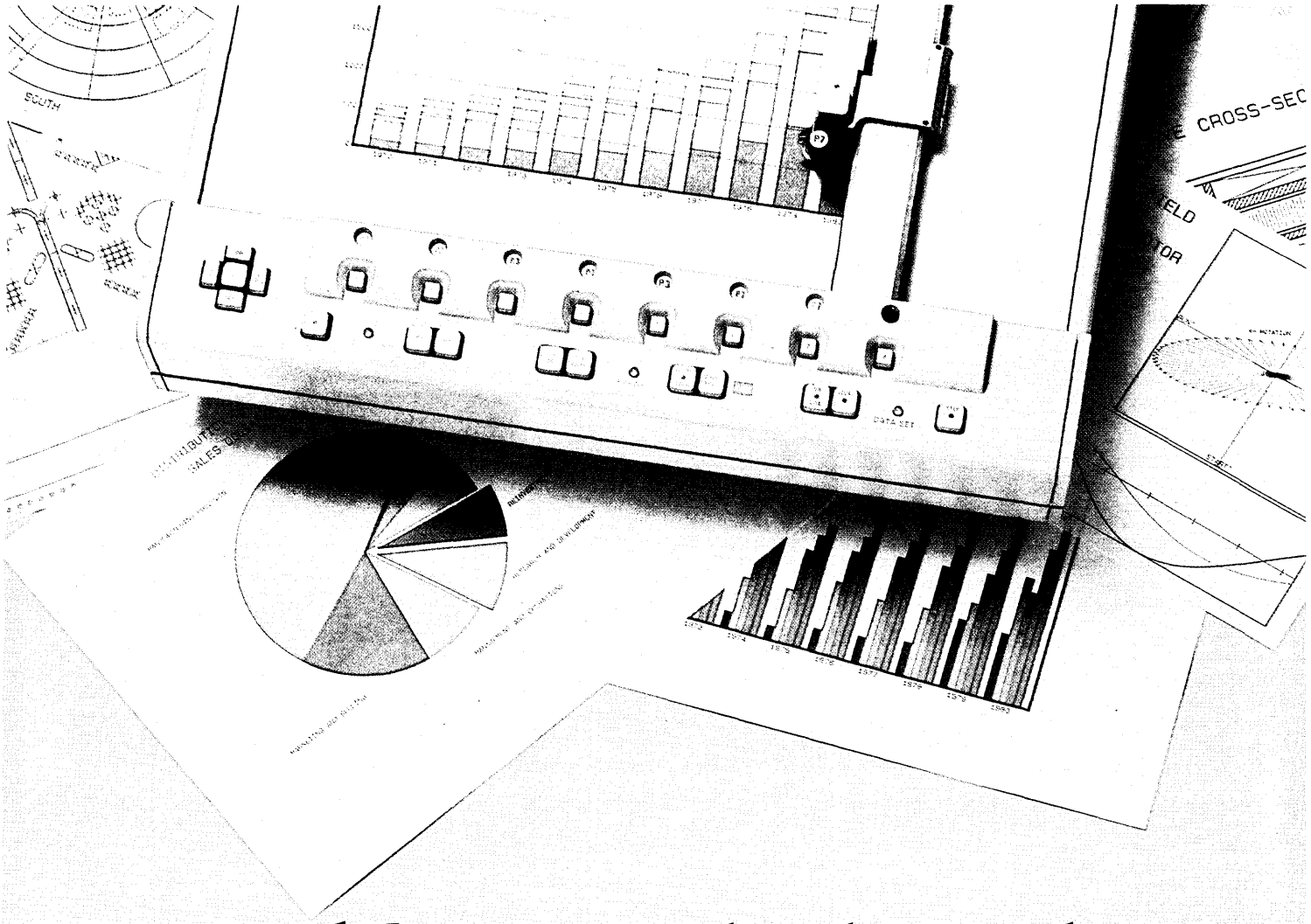
During 1980, TI concentrated on production, achieving volume shipments of the 990/12 minicomputers, and four new high-speed printing terminals. Many of their chips announced last year (voice synthesis, memory, etc.) were in volume production in 1980. Not surprisingly, shipments of the DFS*V seismic data acquisition systems are at an all-time high. TI's heritage in geophysical equipment and services is paying high dividends.

In July, TI expanded its peripheral product capabilities by acquiring production rights to Seagate Technology's 5¼-inch Winchester drive, which allows TI to add inexpensive, fast access disk capacity to the 990 line of minicomputers. TI will separately offer the drive to oems.

New TI product introductions in the microcomputer market included the TMS 9995, a higher performance 16-bit microprocessor compatible with the 9900 family that forms the nucleus of the 990 minicomputer line. Also introduced was a new family of bipolar gate arrays.

Texas Instrument's disappointing 1979 showing in the personal computer market was mitigated in 1980 by a marginally successful rebate program followed by a 30% price cut in November. This cut made the TI 99/4 price competitive with Apple and Commodore, and the 99/4 is now reportedly selling better than before.

Texas Instruments has been challenging DEC in the teleprinter production race. After establishing a position in the thermal printers market with the Silent 700 series, which was not directly competitive with DEC's matrix printers, TI was able to match or beat DEC's production in 1980 (based upon market surveys of end-user installed populations) through the 1977 introduction of its matrix (Omni 800).



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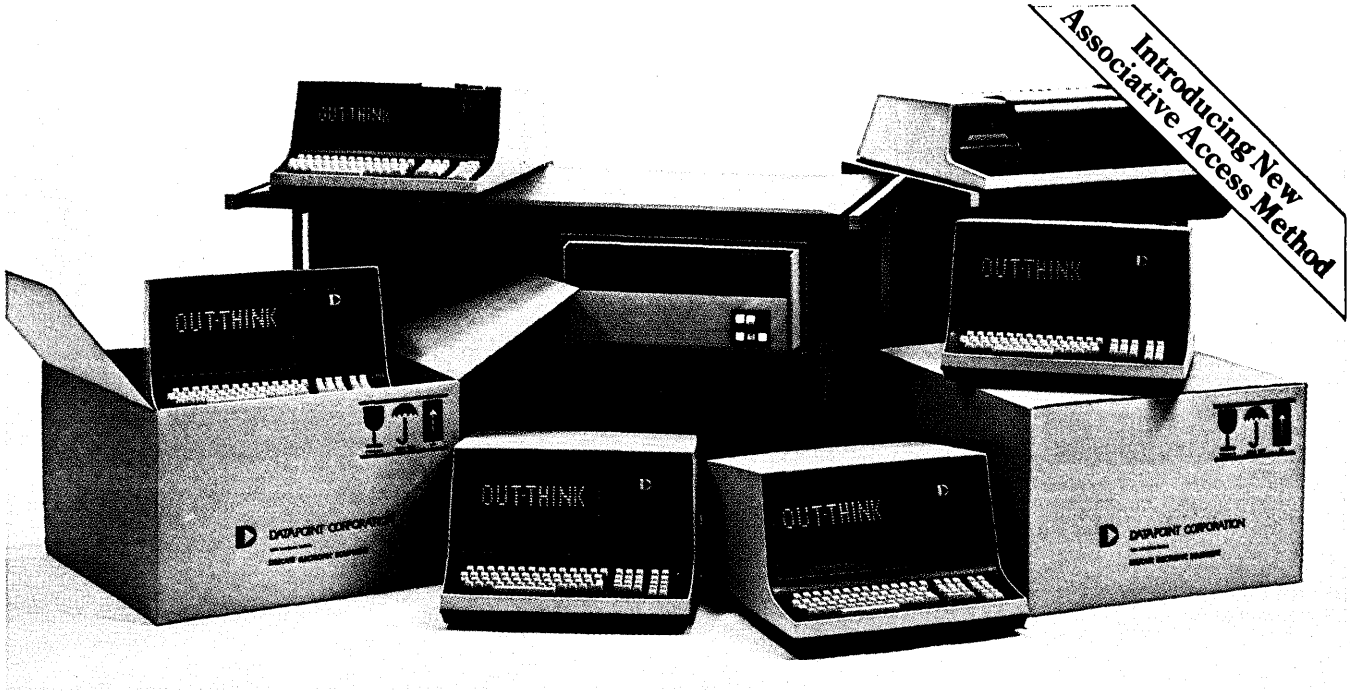

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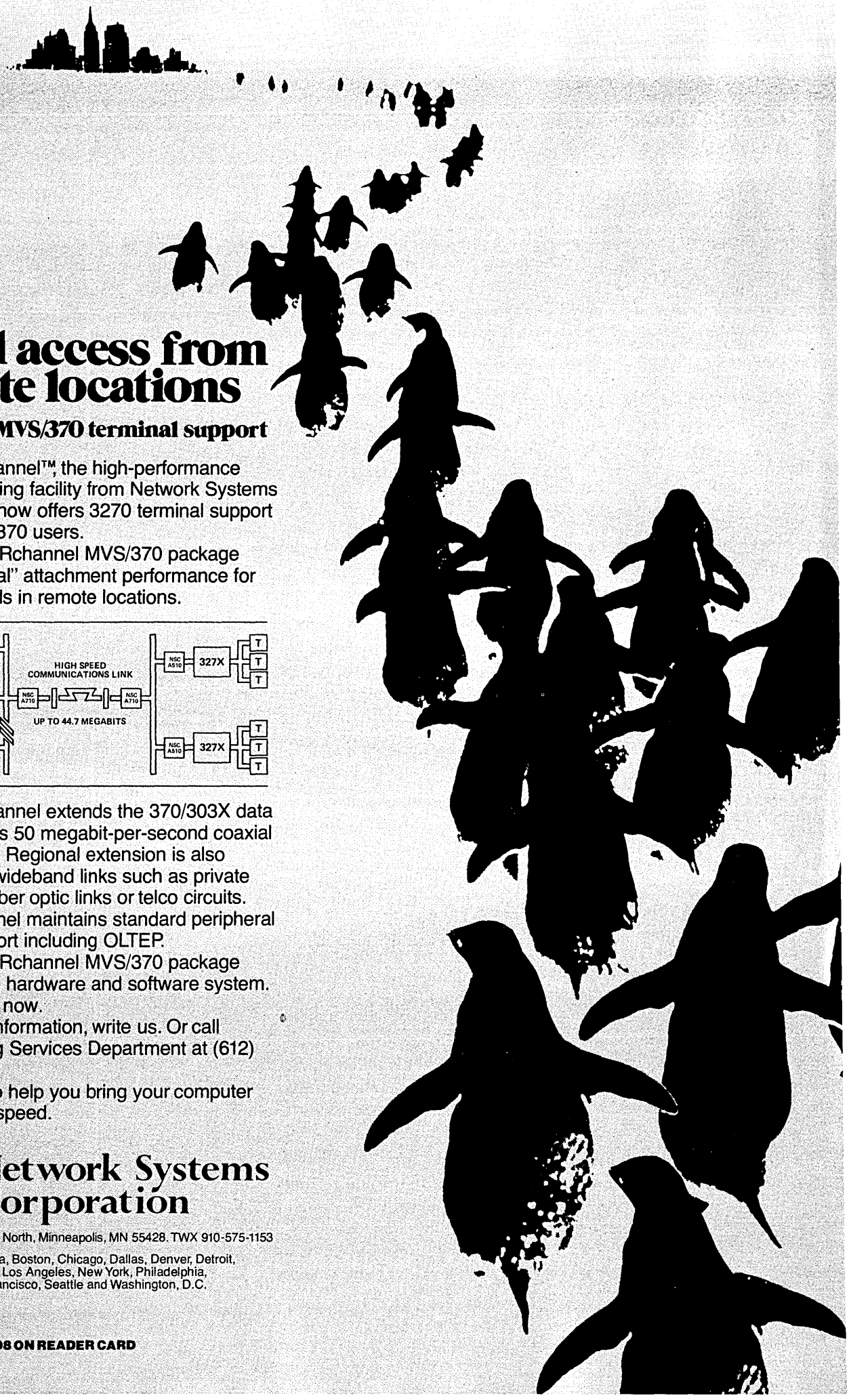
CIRCLE 97 ON READER CARD



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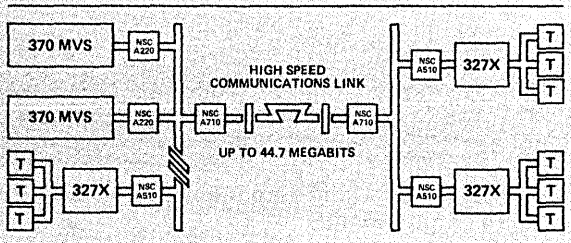

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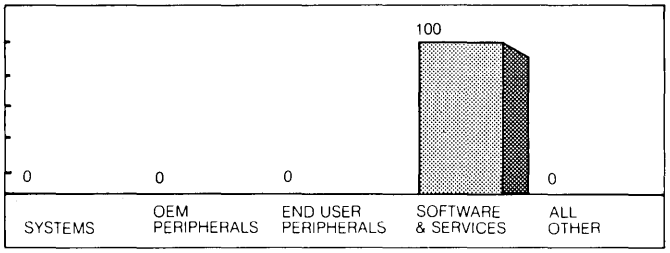


1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
13	560	35	14,668	560	MARCH

COMPUTER SCIENCES CORPORATION

650 North Sepulveda Blvd.
El Segundo, CA 90245
(213) 678-0311

Computer Sciences Corp. (CSC) breezed through the half-billion dollar revenue mark in calendar 1980, closing the year at $560 million, up 35%. Internal expansion accounted for nearly 80% of the increase in revenue; acquisitions accounted for the rest. Largely responsible for the internal growth was a buildup in activity on several large contracts, in particular the company's $129.5 million five-year contract for a claims processing system, and a $221.5 million five-year contract for a dp communications network in Saudi Arabia. Although work on the latter appears to be proceeding smoothly, the former represents CSC's first foray into the claims processing market long dominated by EDS, and implementation has been stormy.

Overall, the largest part of CSC's business is Contract Services systems development, facilities management, and provision of turnkey computer communications systems, which contributed $411 million, 73% of total revenue last year. Data Services accounted for the remaining $149 million and includes such activities as the worldwide INFONET remote computing service, on-line distribution and manufacturing services, third-party health insurance claims processing, income tax preparation, payroll, and general accounting services. Data Services is commercially oriented, whereas Contract Services is government oriented.

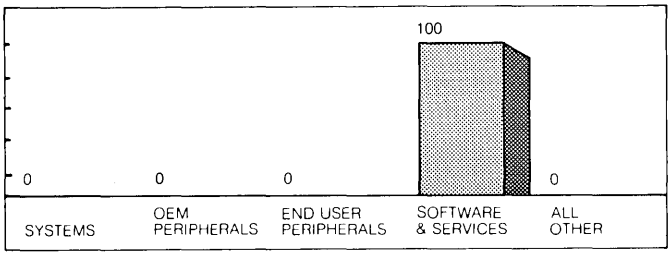
Of special significance as an enhancement to its remote computer service capability was the June announcement of Distributed Network Services (DNS), in which DEC-manufactured minicomputers and terminals are tied into the INFONET system for distributed processing applications. Prime targets for this service are the fast growing markets for order entry type services in industries such as finance, manufacturing, and distribution.

In Contract Services, noteworthy new business included a $13 million contract for a naval warfare gaming system, a $9.6 million contract for communications systems to the METRORAIL rapid transit system in Dade County, Fla., and a $22.2 million subcontract from Sperry Univac for the U.S. Air Force's base level data automation program (Phase IV).

Late in the year, CSC was hurt by a federal indictment charging the company with fraud and other misconduct in its 1972-1977 contract with the General Services Administration for timesharing services. All charges have since been dropped, but for a brief period the company lost marketing momentum because of temporary constraints on new procurement activity in certain government markets. The company has also had some difficulty hanging on to pieces of the accounting services client base it purchased from Itel late last year. Possibly as a result of this "indigestion," 1980 acquisition activity was nil.

CSC's operating margins declined to 8% from 10.8%, although its aftertax margins remained flat at 4.5% following a two-point reduction in its tax rate.

16



1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
15	505	24	13,500	505	JUNE

AUTOMATIC DATA PROCESSING

405 Route 3
Clifton, NJ 07015
(201) 365-7300

ADP posted $505 million in revenues for 1980, a gain of 24% over 1979. Net income rose to $43 million from 1979's $36 million, up over 19.5%. The company continues to hold a stable, though somewhat more distant, second place in the services industry, behind CSC. Its traditional batch services, on-line services, and on-site services to general and specialized markets all posted healthy gains in 1980.

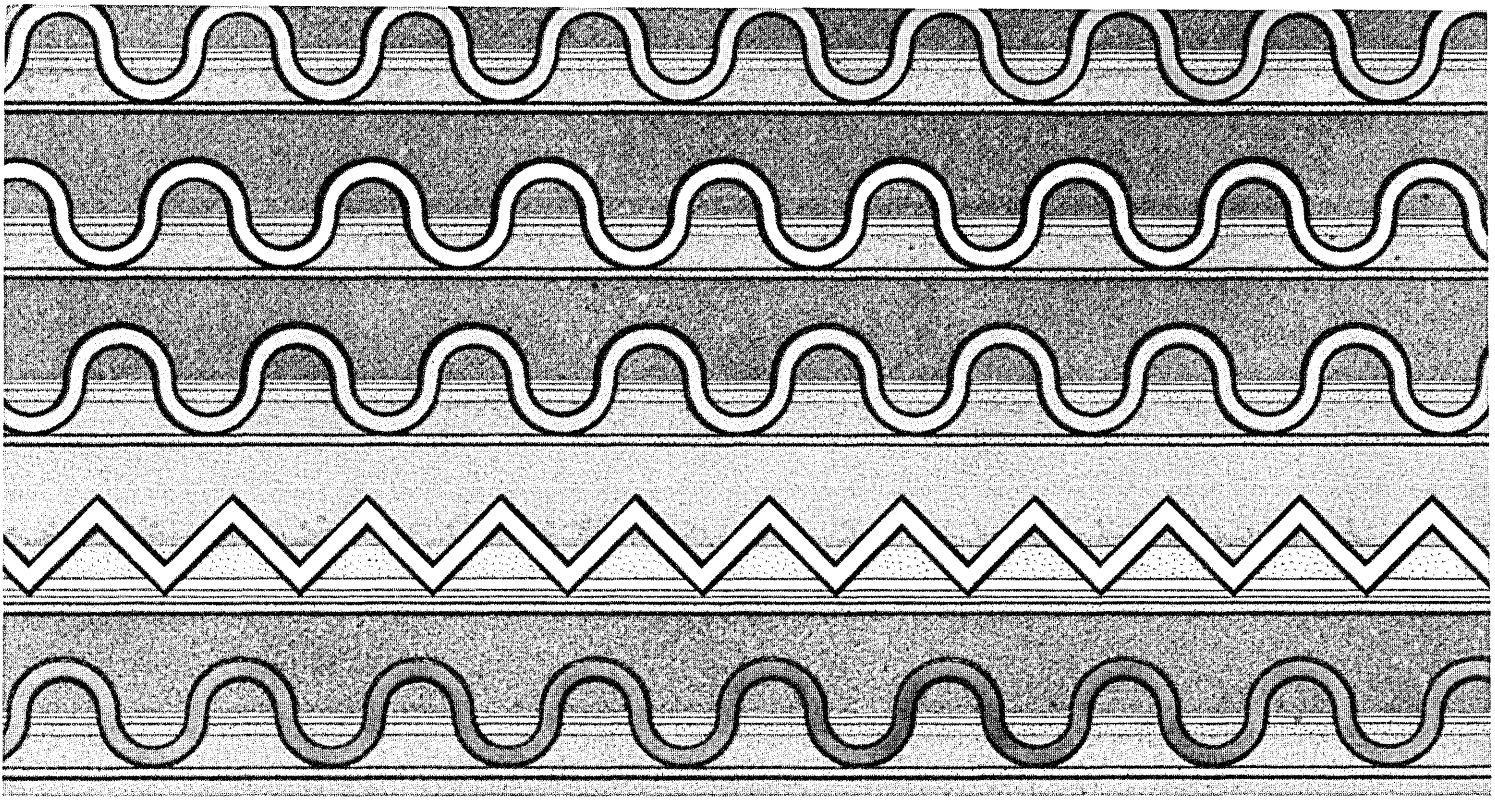
The year found ADP applying new technology to its services through both internal development and acquisition. Three divisions now offer microprocessor-based services. In the thrift division, an on-line teller system with an intelligent terminal was added to the service mix through the acquisition of Total Systems. Color graphics in a real-time system for commodities traders came with the purchase of Comtrend. Internal development within the dealer services division created the RCS service for auto dealers, which uses an intelligent terminal to produce daily reports while feeding to a remote batch system for large jobs.

Network services, ADP's timesharing division, added about 20 installations of its DEC-2020 on-site service, bringing total international installations to 50. By midyear, network's cash management services were handling over $2 billion in daily deposits for over 1,100 corporate clients at 45 banks. By year-end, the joint venture with Alan Greenspan's Townsend-Greenspan Co. to provide economic forecasting and analysis was producing revenues.

Meanwhile, the basic payroll and accounting service provided by ADP's commercial services group continued to perform well. The group's much-heralded but long-delayed interactive accounting services grew in test markets, and wider deployment is planned for 1981.

The company's services to the brokerage community was buoyed by the year's record securities trading volume. Owing to transaction pricing, ADP's traditional back office brokerage services have historically been exposed to swings in market trading activity. In recent years, ADP has aggressively added new services to support its brokerage marketing, and to dampen the impact of market fluctuations. New services accounted for nearly a fourth of brokerage revenues last year.

After an initial year of heavy losses, ADP now believes a profit turnaround is in sight for its acquisition of the Audatex division of Itel, now known as ADP Collision Estimating Services (CES). Three of the top 12 U.S. auto insurers are now CES customers.



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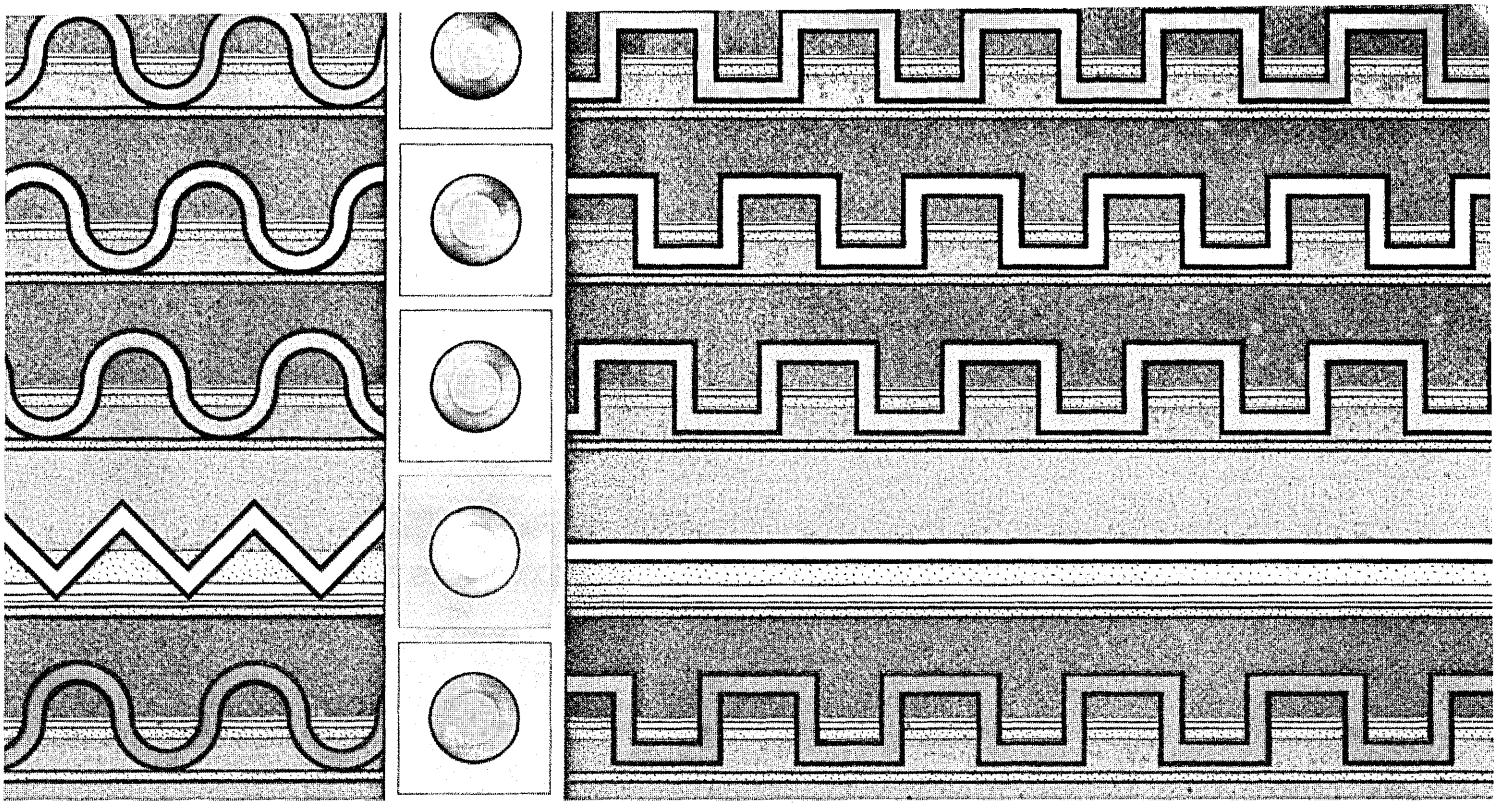


The Bell System's Dataphone® II modular data transmission subsystem gives you central monitoring, diagnosis and control of your whole data communications system, and automatically identifies system faults.

Regardless of your system's host or line protocol, Dataphone II is fully compatible, at transmission rates of 2400, 4800, or 9600 bps. Three levels of service are available, covering every level of system complexity. And because the service is fully modular, it can grow with your needs by simple addition of components.

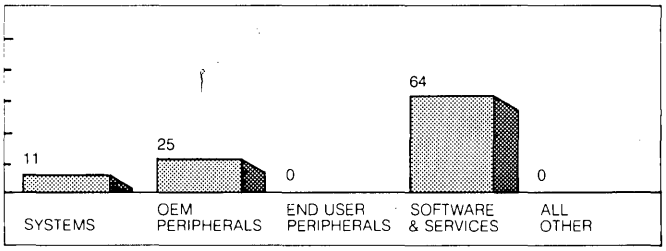
Dataphone II service is state-of-the-art in sophistication, yet extremely simple in operation, and communicates in plain English.

With its full-time assurance of operational readiness, Dataphone II service is the ideal link to integrate your system. It is a product of the world's most advanced information management system—the nationwide Bell System voice and data network.

◇ Applying our knowledge to your information management needs is a process that begins with one call to your Bell Account Executive. ▭

The knowledge business

17



1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
17	475	21	7,500	24,959	DEC.

GENERAL ELECTRIC COMPANY

3135 Easton Turnpike
Fairfield, CT 06430
(203) 373-2211

General Electric, not known as a dp company, is quickly becoming important in many subsectors of the industry. Dp revenues approached the half-billion dollar level. Growth in 1980 is attributed to continued gains in the General Electric Information Services Co. (GEISCO), which accounts for 63% of total dp revenues; the Data Communication Products Business Dept. and its line of TermiNet terminals and printers (25% of dp revenues); and the recently purchased Calma CAD/CAM subsidiary (12% of dp revenues).

General Electric has brought microelectronics and the related information-based technologies in-house. GE is investing hundreds of millions of dollars, and has established an Industrial Electronics Group as well as an Information and Communications Systems Group. GE's investments (excluding Calma) in interactive graphics in 1980 is estimated at $70 million. During 1980, GE also acquired Intersil, a semiconductor supplier, which adds to its dp presence, although not to the DATAMATION 100 revenue.

GE's data communications business grew at 20% in 1980, but equally noteworthy was its TermiNet product line extensions. GE introduced a 200-line per minute forms access printer, and a family of matrix printers ranging in speed from 30 to 120 characters per second. The TermiNet product line has traditionally been sold directly to oems, but in 1980 the division established an authorized distributor program which complements existing sales channels and provides a more effective way to reach the end-user market.

GEISCO continues an intensive program to expand its value-added services in a drive to become a single-source supplier of a full line of computing services. Among the new services announced last year was a capability for retailer/vendor order processing, called the EPO (Electronic Purchase Order) System. As part of an improved graphics and plotting capability, software for contour mapping of geological formations was added. In the major industry and functional management groups served by GEISCO, software systems have been added to further extend the value of MARK III service.

A custom applications staff of programming specialists is in place in key domestic and international locations. When acquisition of Lambda Technology, Inc., becomes final in 1981, the custom programming stall will number more than 1,500 worldwide. Lambda Technology specializes in data processing professional services on customers' in-house equipment.

Processing service include interactive and remote batch processing on both Honeywell and IBM equipment, as well as distributed data processing via the MARKLINK Intelligent Terminal. MARK III ddp includes data entry, local processing, and direct interfaces to the full line of MARK III remote computing services.

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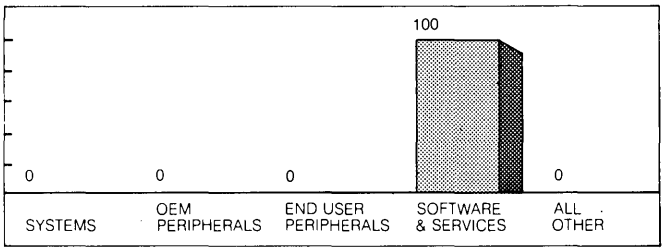


1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
19	408	31	6,544	414	JUNE

ELECTRONIC DATA SYSTEMS

7171 Forest Lane
Dallas, TX 75230
(214) 661-6000

EDS's ventures into new business areas began to pay off in 1980. Corporate revenues rose to $413.9 million, up 27.4% over last year. The company remains in third place in the services industry, behind CSC and ADP.

In the wake of retrenchment last year in which the company scaled back its entry into the "home of the future" market, EDS consolidated many of its new business ventures into its Information Technology Group. ITG is spearheading the company's thrust into the government services and small systems markets, as well as its expansion overseas. The group now has 2,300 employees and operates nearly a quarter of the company's revenues, over four times what these markets contributed two years ago. Last year's acquisitions of Potomac Research, a $20 million government research and development firm, and CompuSource, one of the biggest Data General systems houses, were significant factors in this growth. EDS continued its recently invested strategy this year with two purchases aimed at strengthening its position in industry markets. Application Programming Service, Inc. (APSI), Indianapolis, was added to EDS's banking and thrift division. APSI gives EDS a low-end, IBM Systems/34 based product for banks, with under $100 million in assets. EDS believes it now has products that address specific applications in 14,000 financial institutions in the U.S.

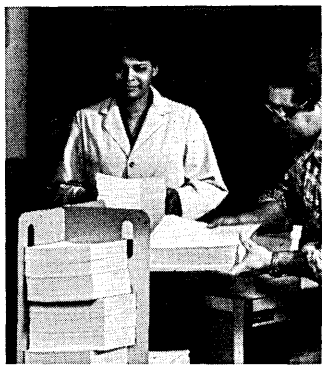
EDS also acquired Information Resource Electronics Corp., a St. Louis firm specializing in hospital management information systems. IRE adds diversity to the claims processing now performed by the company's health care group. It also moves the company into a new competitive arena, where the leaders are Shared Medical Systems and McAuto.

Of special interest during 1980 were two new activities substantially different from EDS's traditional servves business. A system software products division put EDS into the packaged software business, with products it had used internally for many years. It remains to be seen how aggressively EDS will commit investment funds to third-party software development.

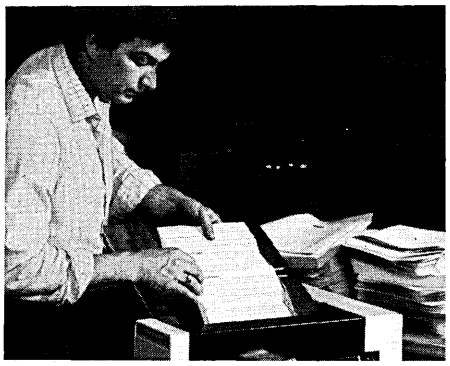
The acquisition of the $7 million Centurion Computer Corp. of Richardson, Texas, in early 1981 was another interesting diversion. Centurion markets a minicomputer system through a dealer network. With this purchase, EDS joins Tymshare, McAuto, Reynolds & Reynolds, and other services companies that no longer believe hardware assembly is inconsistent with a services marketing strategy.

Do your computer-generated mailings run into these five costly obstacles on their way to the post office?

1. Bursting

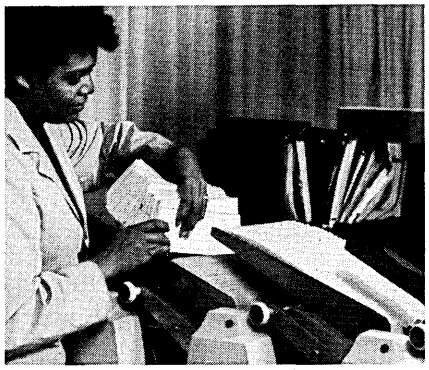


2. Loading Trays



3. Folding

4. Delivering to Inserter



5. Loading Inserter

Bursting, trimming and folding are necessary processing operations in computer-generated mailings. But it's no longer necessary to perform them in an interrupted sequence of labor-intensive steps—manually loading and unloading a series of processing machines and carting the work-in-process from point to point. Now there's a better way—the Pitney Bowes Computer Output Mailing System—specifically designed to handle computer-generated mailings with computer-age efficiency.

This cost-effective system handles the entire range of processing, inserting and mailing operations in one uninterrupted sequence. The computer-output web is simply threaded into one end of the unit and ready-to-mail envelopes are removed from the other end. It's as simple as that. Processing operations are all performed at web-fast speed, without a single interruption. Single or multiple insertions...imprinting...check signing... electronic scanning...document verification...selective collating and zip-code-sorting can all be performed with automated precision. *And* with a single pair of hands.

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I'd like more information about the Pitney Bowes Computer Output Mailing System.

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Title_____

Company_____

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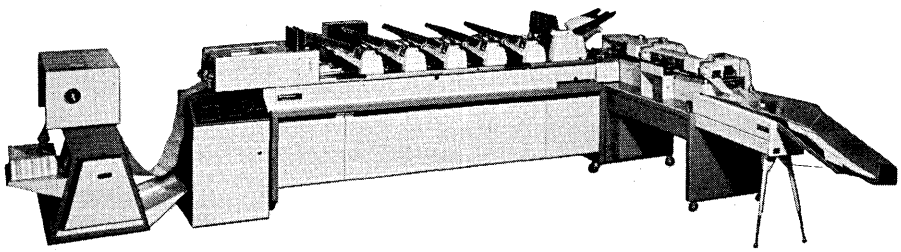

Pitney Bowes

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CIRCLE 100 ON READER CARD

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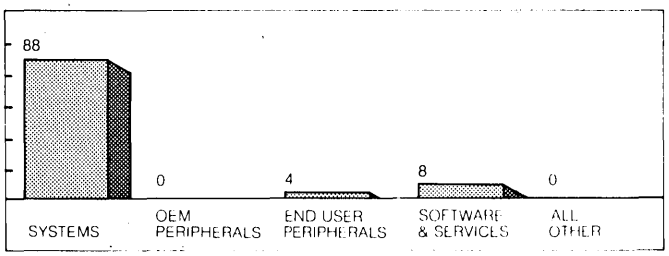

1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
18	394	23	4,200	394	DEC.

AMDAHL CORPORATION

1250 East Arques Avenue
Sunnyvale, CA 94086
(408) 746-6000

For Amdahl, the pioneer in large-scale plug-compatible mainframes, 1980 was a continuation of new initiatives and negative market influences—all of which began in 1979.

First, Amdahl was adversely affected by IBM's 1979 price reductions and the computer users' general shift toward leasing instead of purchase in anticipation of IBM's 3081. In addition, interest rates have been at record levels. Thus, Amdahl saw its customers begin the shift toward leases in the second quarter of 1979, a trend which continued through much of 1980. Despite Amdahl's high shipment levels, this development, coupled with the firm's own price reductions, had an impact on 1979 and 1980 revenues and earnings. While total 1979 revenues declined from $320.9 million in 1978 to $319.9 million, 1980 revenues rebounded to $394.4 million, up 23%. But net income was off for the second straight year, from $48.2 million in 1978 to $15.3 million in 1979 and $15.2 million in 1980.

Still, IBM's 3081 has now been announced, and delivery cycles will be long. Thus, it is reasonable to expect that in 1981, both revenues and net income will rebound, the latter more sharply. In anticipation of strong demand, Amdahl will substantially increase its capital spending later this year, while maintaining a sharp growth in R&D spending. For example, on top of Amdahl's 1979 R&D increase of 68%, to $41.9 million, came another 49% increase, to $62.5 million, in 1980. A growing percentage of this is in the software area.

Amdahl announced several new System 470 models and product enhancements, and several new software products. These new offerings are directed toward areas where Amdahl's large-scale systems users have indicated various needs. They include an increase in the maximum number of system input/output channels, the availability of high-speed channels, and an Extended Performance Accelerator, for the V/7-B. Compatible processors and two new software products, MSCC and UTS, are perhaps typical. By loosely coupling two processors, MSCC provides the resources of two processors while preserving the operating simplicity of a single system. UTS is a version of the widely used UNIX Timesharing System modified to operate on a large mainframe. But most important during 1980 was Amdahl's 580 series, its response to IBM's 3081. Substantial amounts of 580 Series components will come from Fujitsu, which increased its position in Amdahl to about 32%.

The acquisition of Tran Telecommunications Corp., a supplier of digital data communication networks, was completed in July. Tran designs, produces, installs, and services equipment (excluding transmission facilities) and software that constitute digital communication networks. Amdahl expects to offer Tran's communications networks in combination with Amdahl's 470 Series computers.

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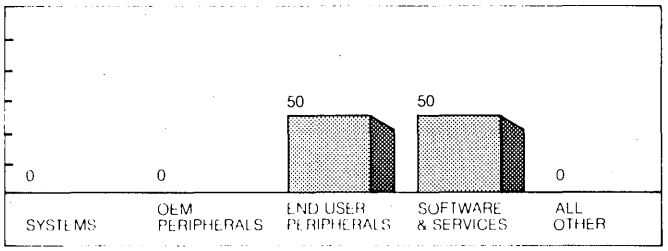


1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
22	377	33	0	4,983	DEC.

TRW, INC.

23555 Euclid Avenue
Cleveland, OH 44117
(216) 383-2121

TRW, a diversified multinational company, had 1980 revenues that were less than 10% of total revenues.

The TRW Customer Service Div., purchased from Singer in 1976, brought in $120 million. Its 3,000 employees, 2,200 of whom are in the field, maintain and service 800,000 pieces of equipment for a dozen vendors, including Dataproducts, Hazeltine, Docutel, ADDS, and Pitney Bowes. In October, TRW purchased Raytheon's IBM mainframe service operation. This will help prepare it for its future role as the service and maintenance arm for TRW-Fujitsu, a new joint venture.

The Information Services Div. had estimated 1980 revenues of $80 million and employs 1,375 people. TRW Credit Data, its consumer credit reporting group, is the largest automated consumer credit reporting company in the U.S., with a 33% market share.

TRW Business Credit is a smaller but growing part of the Information Services Div. Revenues doubled in 1980 and are expected to double again in 1981. Using an automated system and a database of over 7,000 businesses, TRW has successfully challenged Dun & Bradstreet by offering less comprehensive reports at a lower price.

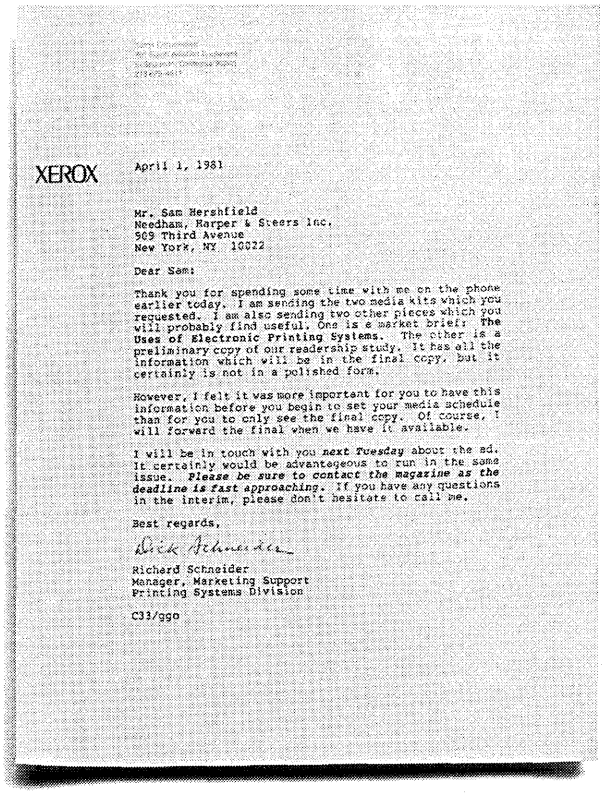
In early 1981, the Information Services Div. installed the nation's largest private telecommunications network. Built by Tymshare, the network has 30 nodes supporting 2,000 ports that support 12,000 to 15,000 terminals.

In 1980, TRW sold Datapoint to a network of 10 foreign distributors. TRW Datacomm International, which derived a major portion of its revenues from sales of Datapoint Equipment, will represent other suppliers, including Centronics, NBI and Azurdata. Revenues in 1980 were an estimated $110 million to $120 million.

TRW Operations manufactures point-of-sale (POS) equipment. This division has not performed particularly well—it is unprofitable, and we estimate 1980 revenues at only $15 million to $20 million, down from $60 million in 1979. TRW will end production of POS equipment in 1982 or 1983, but will continue to make automatic teller machines until 1987. POS equipment will be sold by TRW-Fujitsu instead, and the venture will buy this ailing division from TRW.

The TRW-Fujitsu Co. (TFC), a joint venture, was announced in mid-1980. TFC will be 51% Japanese owned, and 49% TRW owned. The company's first product will be a Fujitsu retail POS terminal, to be followed by Fujitsu's small business computers, and eventually by peripherals, data communications gear, and mainframes. TRW-Fujitsu is a good fit—Fujitsu gains easy entry to the U.S. market, and TRW gets a strong product line and financial backing.

DON'T PRINT A LETTER A LETTER AT A TIME.



XEROX

April 1, 1981

Mr. Sam Hershfield
Needham, Harper & Steers Inc.
909 Third Avenue
New York, NY 10022

Dear Sam:

Thank you for spending some time with me on the phone earlier today. I am sending the two media kits which you requested. I am also sending two other pieces which you will probably find useful. One is a market brief: The Uses of Electronic Printing Systems. The other is a preliminary copy of our readership study. It has all the information which will be in the final copy, but it certainly is not in a polished form.

However, I felt it was more important for you to have this information before you begin to set your media schedule than for you to only see the final copy. Of course, I will forward the final when we have it available.

I will be in touch with you *next Tuesday* about the ad. It certainly would be advantageous to run in the same issue. ***Please be sure to contact the magazine as the deadline is fast approaching.*** If you have any questions in the interim, please don't hesitate to call me.

Best regards,

Richard Schneider
Manager, Marketing Support
Printing Systems Division

C33/ggo

Printing word processor output can be a time-consuming process. Because most word-processing printers print a page a character at a time.

But the Xerox 5700 Electronic Printing System prints a page a page at a time. And that can be up to 40 times faster than typical printers.

CHANGE THE TYPE STYLE TO SUIT YOUR STYLE.

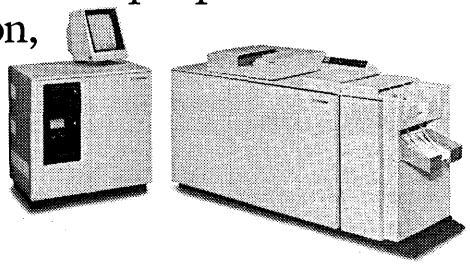
The 5700 lets you control how the printed word will appear. You can select from virtually unlimited type styles and sizes, or print certain words **bold** or in *italics*. It will even reproduce your signature or your company logo.

The 5700 can print reports, documents, proposals, or specifications directly from magnetic media. And it accepts input from communicating word processors. But it's much more than just a word-processing printer.

It can send or receive pages of text over telephone lines. And each page is a high quality xerographic original. It can print forms and computer output with charts, graphs, and variable data.

And it can deliver output collated, stacked, and stapled.

To learn more about electronic printing, talk to the people who wrote the book on the subject. Write to: Keith Davidson, Xerox Printing Systems Division, 880 Apollo St., P1-60, El Segundo, California 90245.

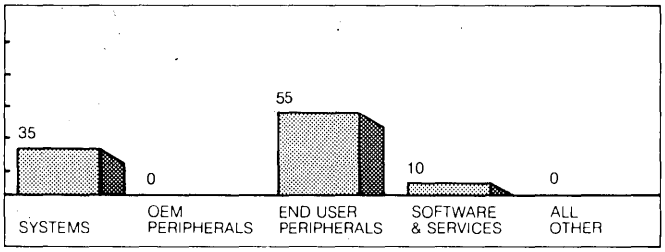


And start printing your letters an entire letter at a time.

The 5700 is currently available in the cities of Los Angeles, Dallas, New York, Chicago and Washington D.C.

XEROX

21



1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
24	364	34	6,000	364	JUNE

DATAPOINT CORPORATION

9725 Datapoint Drive
San Antonio, TX 78284
(512) 699-7000

With its announcement of a voice/data PBX in April, Datapoint advanced beyond its minicomputer peers in breadth of office automation products, offering electronic mail and filing and a line of communications management, cost control, and switching products. The company will also soon introduce voice mail.

Datapoint continued its strong performance in 1980—revenues were up 34% and earnings were up 29%. This growth, however, was slower than in 1979, when revenues grew 41% and net income soared 54%.

One of Datapoint's primary strategic weaknesses, the lack of its own overseas distribution channels, was resolved in 1980. Through its 39%-owned Flex affiliate, the company acquired Inforex, the bankrupt Burlington, Mass., terminal manufacturer. The acquisition included Inforex's eight foreign marketing and service subsidiaries. Datapoint also made an agreement with TRW to buy its international distribution network, which had been handling Datapoint's foreign sales since 1970. The transaction will be completed next month, and Datapoint will gain at least partial ownership in 10 foreign distributors and a direct sales relationship with 21 additional independent distributors. With its new international sales capability, Datapoint may be able to double its export revenues, which amounted to $69.6 million of $318.8 million total revenues in FY80 (ended July 31, 1980).

Other significant developments last year were the addition of manufacturing space and the announcement of a major facilities expansion plan which includes the construction of a 1 million sq. ft. complex in San Antonio. This will consolidate operations which are now scattered throughout San Antonio in 37 separate buildings.

Management was reorganized and decentralized at the beginning of the year, resulting in two main divisions: the computer systems group, headed by W. D. Warren, and the office systems group, headed by Don Hosage. The two groups report to the new four-man office of the president, and share common marketing and service organizations. The office systems group includes the Infoswitch communications product line, an indication of the integrated approach to office automation.

New products announced in 1980 include the 8800 computer and the RMS operating system. The 8800 is Datapoint's largest processor and the first to be offered with a separate crt. It operates standalone or as part of the ARC network. RMS (Resource Management System) is the 8800's operating system. It can also run on any other Datapoint processor with at least a 64K main memory.

Also in 1980, Datapoint entered into a venture with Tandy to jointly manufacture 5¼" disk drives. While Datapoint denies plans to enter the very small computer market, it does state that the Tandy relationship could "lead to other things."

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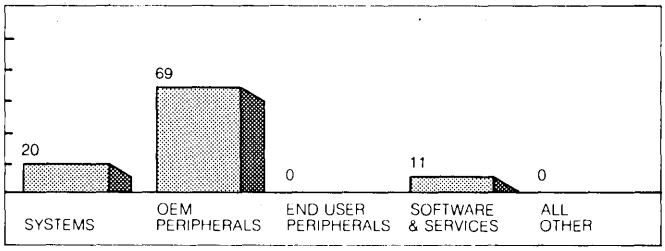

1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
20	325	10	5,200	325	DEC.

TRIUMPH ADLER, INC.
PERTEC COMPUTER CORPORATION

12910 Culver Boulevard
Los Angeles, CA 90066
(213) 822-9222

After a bidding war that included North American Philips, Pertec was purchased by Triumph Adler, a U.S. subsidiary of Triumph Werks Nurnberg AG of West Germany, in a deal that closed in January 1980. Pertec's management now handles all of Triumph's international oem activities, Royal Computer Systems, part of Triumph's engineering facility in Nuremburg, and Triumph's printer products. Decisions about future products and operations, R&D, and joint marketing are made by Triumph's management board with Ryal Poppa, former president of Pertec, and Robert Haggey of Royal Business Machines added to the board. Sales of the old Pertec in 1979 were $171 million; sales of the new Pertec with that portion of Triumph's operations were $325 million in 1980. Revenue growth compared to restated 1979 figures was only 13.6%, however, and the new Pertec suffered a net loss in 1980 of $4 million. U.S. sales of $175 million were 38% greater than restated 1979 figures.

Despite 1980 performance, this merger of U.S. and West German capabilities will eventually provide Pertec with cash for product development and technology to enhance its entry into the automated office market. Triumph has several products for the office, including multitasking wp systems and copiers.

Pertec complements Triumph Adler's office product line with systems and a line of peripheral products. End user products include small business systems and general dp systems. Peripherals include a family of tape transports for minis and micros, rigid disk drives, floppies, and printers.

Products from Pertec in distributed dp systems are the XL40, and the XL20 which is a smaller scale, floppy disk-based version of the XL40. XL40 systems accommodate up to 16 workstations, and can operate independently or as part of a larger ddp network with Pertec's remote on-line subsystem, additional XL systems, and a host computer. Sales of its ddp systems increased 29% to $49 million in 1980.

Pertec's business began in 1967 as a manufacturer of tape drive peripherals for the mini market. It now offers a line of drives with three recording technologies: PE, NRZI, or the high-density Group Code Recording (GCR). Its tape drives and interface are used for many applications involving data transfer and interchange; key-to-disk and data output requiring tape-to-printer; tape-to-plotter; tape-to-microfilm or to another peripheral device; and as backup storage for on-line disk drives. To meet small business system needs for a high-performance, high-density, compact mass storage device, Pertec offers a 20MB 8-inch rigid disk drive. Pertec also sells 8-inch and 5¼-inch floppy disk drives. In printers, the company markets matrix printers, and in 1980, it introduced daisywheel printers. Peripherals products did not do well in 1980—sales were up slightly, but still accounted for over two-thirds of its revenues.

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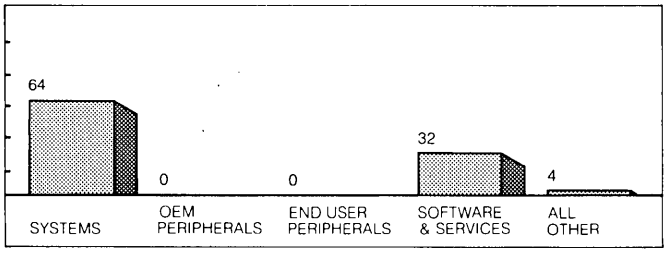
CIRCLE 102 ON READER CARD

23



1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
23	310	13	5,300	310	SEPT.

MANAGEMENT ASSISTANCE, INC.

300 East 44th Street
New York, NY 10017
(212) 557-8310

Revenues of Management Assistance, Inc., increased by 13% to $310.4 million, the lowest growth rate in three years. Sorbus, its maintenance division, now maintains over 95,000 pieces of information processing equipment, which are used by over 20,000 customers. During fiscal 1980, approximately 41% of its revenue from sales to unaffiliated parties was derived from servicing equipment manufactured by IBM, while 35% was derived from servicing equipment manufactured by MAI. It has 12 service depots for terminal repair. Considering that Sorbus now accounts for 31% of MAI's revenues and grew at 30% in 1980, it is apparent that MAI's small systems subsidiary, Basic Four, had a very disappointing year. The turnaround, however, may have started: backlogs increased 25% to $75.7 million; aftertax income from continuing operations decreased 63% to $13.3 million; total operating margins declined from 16% to 9% because of decreased employee productivity, a recession-induced order slowdown, changes in foreign exchange rates, and a higher sales mix of lower priced systems.

During the year, operations associated with the Wordstream dedicated word processing segment were discontinued. Wordstream had been losing money since its 1977 acquisition. MAI refocussed its word processing product strategies in late 1979 by introducing Dataword, an add-on to its Basic Four small systems lines consisting of a full page crt terminal with an embedded text editing program and a Diablo daisywheel printer. Originally priced at $12,500, it now sells for $9,900.

October saw the introduction of the new multiprocessing Basic Four/S80 Information System, a microprocessor-based system that performs both word and data processing. Although not ready for volume shipments, an initial order for 45 systems has been filed by a security organization. The system is intended to be the lowest priced in the line. Its cost and its flexible architecture, which allows a multiplicity of intelligent terminals and printers, may attract a broad market of small users and large companies interested in a decentralized dp capability.

International revenues accounted for almost half of 1980 revenues, but were up only 8%. Sales in France improved; those in Germany weakened. At fiscal year-end, the international direct small systems sales force numbered 285, slightly more than MAI's U.S. force. The company also has 15 international subsidiaries and nonaffiliated distributors in 18 other countries.

MAI intends to rely primarily on independent software vendors for international software development, and plans to open no new international subsidiaries in 1981. In 1980, however, it did establish a new subsidiary in Stockholm for marketing and service activities. In October, the company obtained a $3 million contract to provide Citibank's Latin American operations with small systems.

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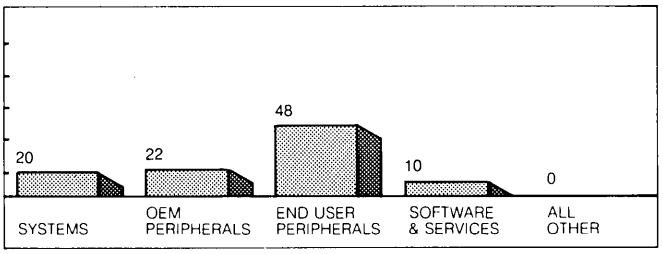


1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
30	286	38	0	1,023	MAY

TEKTRONIX, INC.

P.O. Box 500
Beaverton, OR 97077
(503) 644-0161

Tektronix's major products are cathode-ray oscilloscopes, and its engineers have adapted the screens for computer graphics. The information display group's three divisions—terminals and displays; copiers, plotters, and image-forming products; and graphic computer terminals—manufacture about 100 different products.

Sales of the information display group increased 38% to $286.4 million in 1980, and accounted for 28% of total company sales. Unfortunately, other divisions did not perform as well: operating margins continued to drop from 15.3% in 1979 to 14.7% in 1980; total sales increased only 16.5%; and net income dropped 11.7% to $79.9 million.

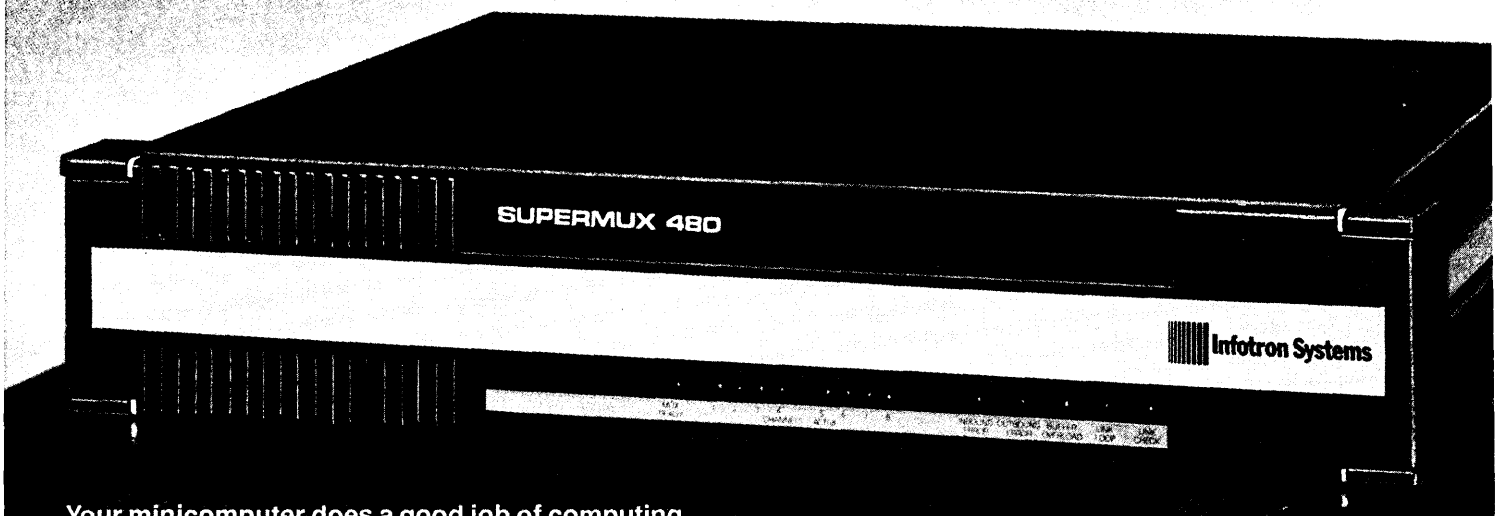
From fall 1979 through summer 1980, Tektronix was unable to meet delivery schedules, because of complications caused by fallout from Mt. St. Helens volcano and the new facility startup production problems. By March 1980, backlogs had increased to $315 million and Tektronix had solved its technical problems and had increased total employment 6% to 23,979, to meet this production schedule. Unfortunately, many customers had double ordered. Also, oems reduced purchases as a result of economic uncertainty and technical changes. Consequently, Tektronix was faced with a choice between layoffs and plant shutdowns. Wanting to keep its staff for anticipated long-term growth, it chose the latter. The plant was shut down for six days in late 1980 and 10 days in early 1981.

Historically, Tektronix has been the largest manufacturer of graphic display terminals. It built its reputation on sophisticated products for mapping, oil exploration, CAD/CAM, and other scientific and engineering applications.

The top of the line, a 4016 storage crt with a 25-inch screen selling for $19,500, offers very detailed monochromatic fine line displays of more than 15,000 characters. The 4016 and the majority of other models use the company's patented direct view storage tube, DVST, which holds a detailed image without the flicker accompanying raster-based devices.

Most of current attention in graphics development is focused on management systems displays using raster devices. These multicolored displays are less expensive, and high resolution is unnecessary for business use. Many of Tektronix's CAD/CAM customers are also going to raster devices. Firms in this market include IBM, Ramtek, Sanders, and Aydin Controls, as well as several Japanese companies. The competition is fierce. Tektronix does produce one color raster terminal, the 4027, but at $8,695 it is relatively expensive and sales are low. Management has concluded that the high-volume, low-margin competitive nature of the business graphics market is inappropriate for its technology, and is content with continued domination of the scientific graphics market. No sales force is currently aimed at the business market.

The Supermux 480 Is Smarter Than Your DEC or Data General



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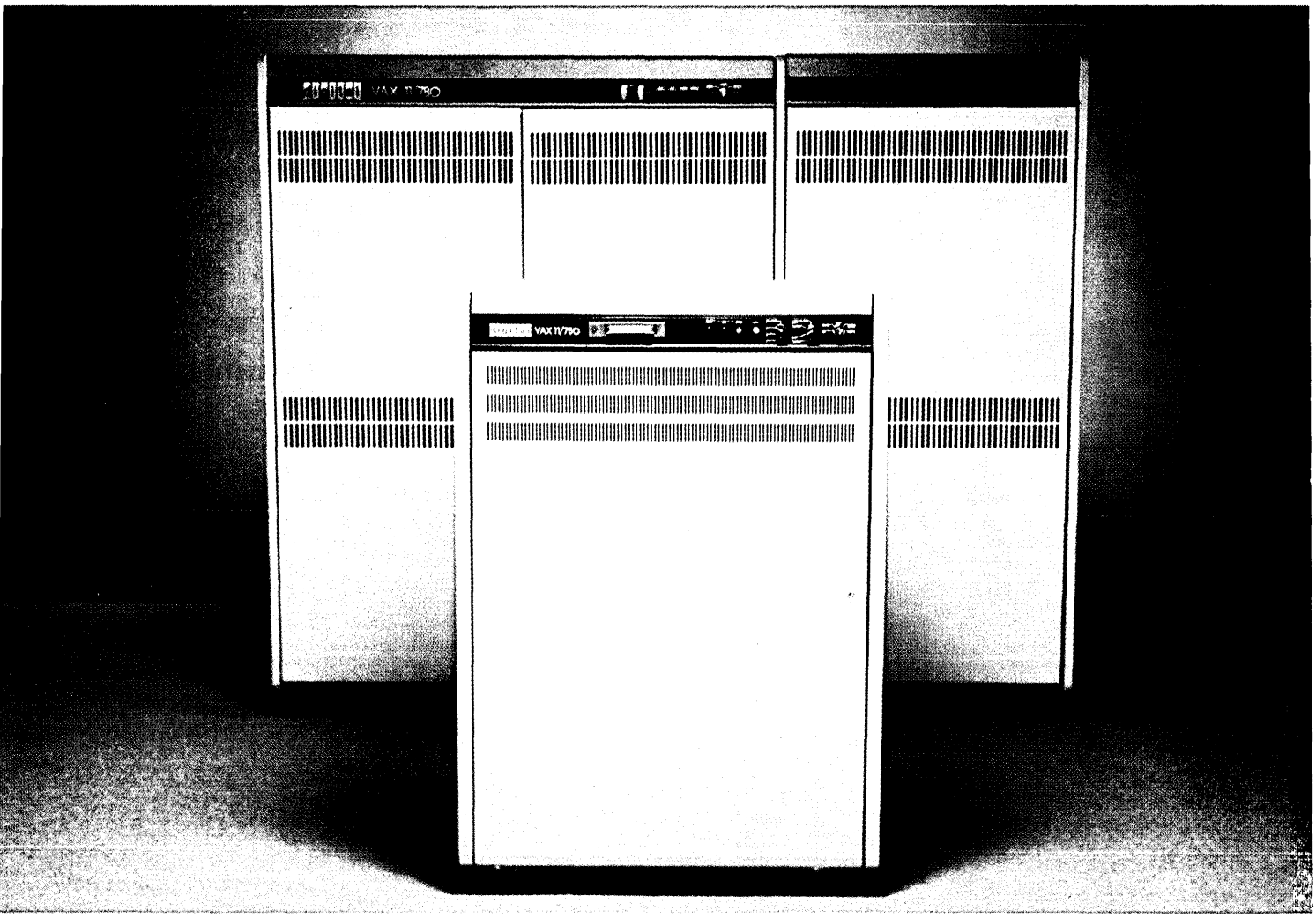
CIRCLE 103 ON READER CARD

The VAX



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family.

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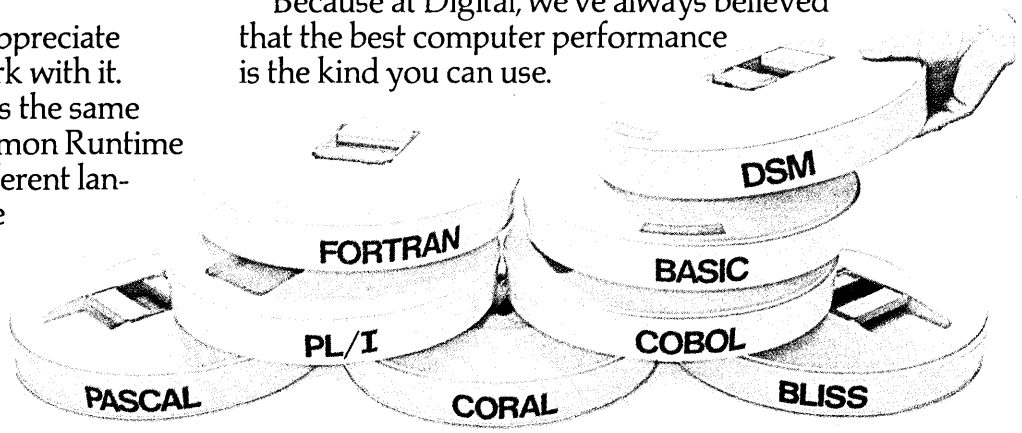

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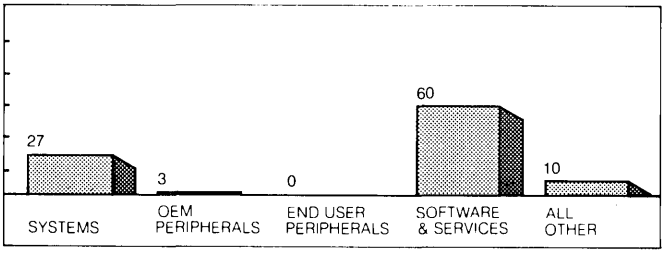

1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
27	280	14	0	6,066	DEC.

McDONNELL DOUGLAS CORPORATION

Box 516
St. Louis, MO 63166
(314) 232-0232

McDonnell Douglas would be a good deal higher in the 1980 rankings if it weren't its own best customer. McDonnell Automation (McAuto) contributed $179.6 million in commercial revenues, which, combined with Microdata's $100.4 million, places the corporate dp revenues at $279.96 million, up 14.2% from 1979. However, total captive revenues for McAuto were an additional $227 million.

McAuto recently opened the world's largest computer center in St. Louis to serve its 3,000 commercial customers (DATAMATION, May, p.75).

Rather than providing general computing capabilities, McAuto specializes in application services specific to industry. McAuto both builds its own applications packages, and acquires them from other software vendors. During 1980, McAuto licensed or acquired 15 application software products, including a number of structural engineering and construction packages, and several hospital-oriented financial packages.

McAuto's largest commercial market is the medical hospital industry, which accounts for about 46% of total noncaptive revenues, or over $82 million. Other major markets are discrete manufacturing (13%); utilities (12%); and construction, architects, and engineers (7%). All other markets account for the remaining 22% of revenues, but none for more than 3% individually. Because McAuto's largest customer is McDonnell Douglas, McAuto's largest market overall is probably in manufacturing and structural engineering applications. The marketplace for manufacturing applications is anticipated to grow rapidly, and McAuto is likely to be one of the major vendors.

Microdata increased its commercial revenues by 6% over 1979 revenues of $94.4 million, but the subsidiary was not profitable in 1980, largely because it opened nine new branch offices. Microdata now has 14 branch offices, augmenting its dealer network. Microdata plans to continue the expansion of its sales offices, but at a slower rate than in 1980.

The major new Microdata products include a line of generalized business programs. This package, called "Results," contains the standard financial applications of payroll, accounts receivable, general ledger, etc.

During 1980, Microdata shipped more than 947 Reality systems, raising its installed base total to over 4,000. These figures include the first shipments of the new Reality 8000 series, which has improved processor speed of 30%, and more than doubles the memory and on-line storage capacity of previous Reality computers.

Microdata recently signed a major oem contract with ADP to supply computers to large systems houses that custom package to vertical markets. Microdata will probably continue to concentrate on oems, and is not likely to expand into end user vertical markets.

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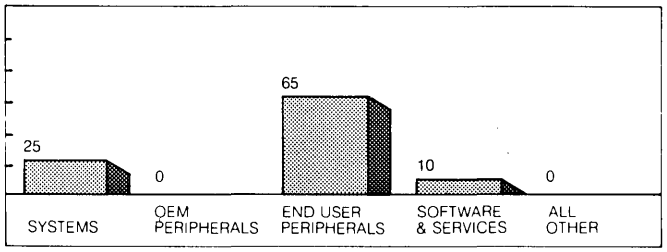

1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
25	278	12	4,956	278	APRIL

MOHAWK DATA SCIENCES

7 Century Drive
Parsippany, NJ 07054
(201) 540-9080

Mohawk made steady progress in 1980, still without demonstrating any capability to expand except through acquisitions. Nonetheless, the company has established itself as an accomplished turnaround, with potential for improvements in profitability. The company's near-disastrous losses in the mid-'70s of $41.3 million cut shareholders' equity to $13.4 million against $163.3 million in debt. By January, 1981 equity was $151.9 million (after an offering of 2 million shares) compared to debt of $47.2 million.

Moreover, Mohawk succeeded in shifting its emphasis on key-data entry equipment into more promising markets with its Series 21 general purpose terminal products and the acquisition of Qantel's small business systems. The Mohawk Series 21 was originally introduced in 1977 in two versions: the System 21/20 for basic data entry ($12,000 to $14,000 in typical configurations) and the 21/40 ($20,000 to $22,000) for customized data entry with a COBOL-like language (MOBOL) for programming. Later, a multiprogramming 21/50 was added in the $30,000 to $60,000 range. Two years ago, about 70% of the Series 21 orders were for the model 20 nonprogrammable data entry systems, with 30% for the model 40 and 50 multifunction systems. Today, the reverse is true; now approximately 70% of incoming orders are for the larger 21/40s and 21/50s. The changing mix contributed to an increase in average system value over the period.

Product enhancements included a downward push to a single station Series 21/10 intelligent terminal, as well as an upward drive. April '81 announcements include a larger Series 21/44 providing for a greater number of workstations, multiprogramming, and enhanced communications links for multiple Series 21 Systems. The company is committed to X.25 and SNA protocols, with 3274 emulation to be incorporated in the Series 21.

The acquisition of Qantel complements Mowhawk's traditional strength in small-scale systems. Qantel sells small general purpose systems with the UV Series 100 system's price averaging $12,000, the Series 200 averaging $38,000, and the Series 300 averaging $90,000.

So far, Mohawk integrated only service functions for its traditional products with the Qantel service force. Any programs to cross-sell Qantel or Mohawk products through the separate distribution arms have yet to be announced. Further, the potential adverse reaction that might derive from Qantel's established independent marketing groups might preempt such a move. As a result, the potential for improved marketing productivity through cross-selling products remains unresolved.

Through the year, Mohawk's consolidated results remained steady but unimpressive. In addition to relatively modest revenue expansion, backlogs actually declined to $210 million for the last half of 1980 from $222 million in January. Perhaps Mohawk will be able to capitalize on its improved product position with enhanced growth in revenues and earnings in the future.

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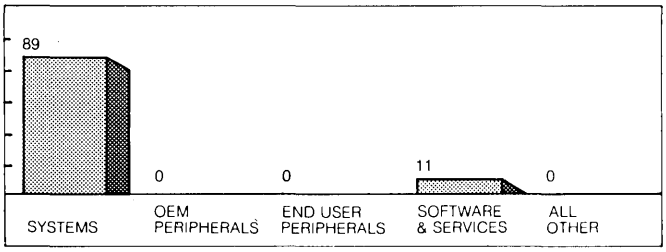

1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
39	268	75	4,011	268	DEC.

PRIME COMPUTER, INC.

Prime Park
Natick, MA 01760
(617) 655-8000

Prime, one of the hottest stocks on the NYSE last year, more than trebled from a low of $9 in the first quarter to over $40 by year-end. Per-share earnings shot up 67%; revenues climbed 75% to $268 million.

Good software has helped drive up revenues. Early on, the "Primos" operating system benefited from software development by NASA and MIT. An emphasis on expanded functions and compatability has protected both the end user and the company's investment in software. However, by locking the products into an old system architecture, the emphasis also extracts price/performance penalties. Yet, Prime created a product line with only $14.8 million in cumulative product and development engineering expenditures through 1978—a fraction of the development cost usually spent by the industry for equivalent product capability.

It was the combination of marketing and good systems that finally opened the markets, under the leadership of president and CEO Kenneth Fisher who joined Prime from Honeywell in 1975. With a repackaged system and an aggressive market expansion strategy, Prime became one of the early exploiters of the end user mini commercial market. While marketing managers at Prime's Boston-based rivals initially shook their heads at the hiring of non-engineers to sell minicomputer systems, Ken Fisher has recently taken satisfaction from the efforts of those same rivals to duplicate his programs.

The real Ken Fisher, however, paradoxically adopted a hitherto uncharacteristic low profile in 1980 as his team took center stage. With Fisher ensconced in his newly constructed Prime Park headquarters (leased for $1.2 million a year), his top executives individually reviewed their functional responsibilities before a group of over 200 members of the financial community. Indirect comparisons with the company's larger nearby rivals did not stop with the consideration of old textile mills at DEC serving as a head office. The message that Prime "ships what the market wants" drove home the contrast with "suppliers whose focus is on hardware production rather than its use."

Prime started the year with two new low-end models—the model 150 for systems builders and software houses and the model 250 for end users. The move cut Prime's low-end entry-level systems list price by 35% to $49,000 and $59,000, respectively. Office automation products followed in the spring, although the products were pitched too high—with systems cost in the hundreds of thousands of dollars in a market that is concentrated on workstations with more flexible systems packaging.

Since then, the company has been remarkably quiet in the face of the new VAX 11/750 from DEC, and rising competition from no less than six competitive systems alternatives from IBM. As VAX software gains maturity and closes the gap with existing Prime software, Prime appears vulnerable.

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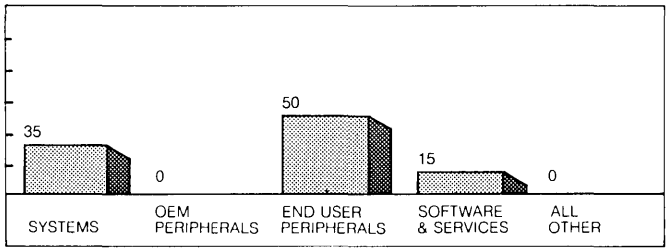

1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
29	260	24	3,230	1,453	JUNE

HARRIS CORPORATION

1025 West Nassau Boulevard
Melbourne, FL 32919
(305) 727-9100

Harris is a $1.3 billion producer of information processing and communications equipment, organized into six major operating groups of approximately 24 separate business entities. The majority of the 1980 dp-related revenues of $260 million was generated by the information systems group: computer systems, data communications, composition systems, control systems and information systems international. This group is also the primary Harris supplier of products to the office information systems market. Harris' "integrated information processing system" includes a soon-to-be-announced word processing system, minicomputers, facsimile devices, electronic filing systems, telephone systems, PABX devices, electronic document distribution, teleconferencing and imaging/output units.

The computer systems division supplies medium-scale super minicomputers targeted at scientific, educational, and business applications. The series consists of the Harris 80, 100, 300 (the newest member), 500, and 800 lines.

The data communications division provides distributed dp systems and interactive remote batch terminals. The newest family, the Harris 200, is aimed at IBM's 3270 and formatted data entry users who want to migrate to ddp applications.

The composition systems division provides systems for the newspaper and office systems environment. The major development during 1980 was the high-end distributed intelligence office wp system, targeted at users needing large document/text processing and storage capabilities and equally strong document distribution (communications capabilities).

In February 1980, Harris completed the acquisition of Farinon Corp., San Mateo, Calif. and merged Farinon into the company as an operating group. Farinon produces telecommunications equipment and systems, giving Harris a long-sought-after entry into the multibillion dollar telephone equipment market. Farinon's digital telephone systems, particularly the PBS, will be a key link as Harris begins its push into the office information systems market.

While 1980 dp revenues showed growth of more than 20%, orders and backlogs were up even more, giving Harris a strong momentum that should be sustained by new product introductions and an expanded sales service organization.

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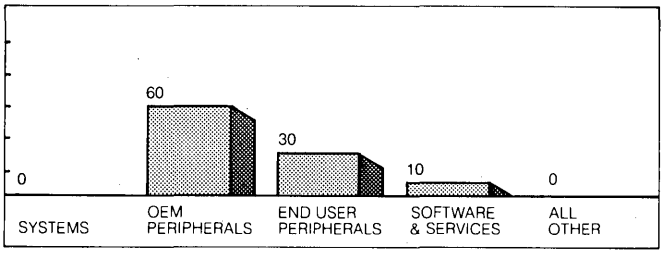


1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
44	250	72	0	416	DEC.

TELETYPE CORPORATION

5555 Touhy Avenue
Skokie, IL 60077
(312) 982-2000

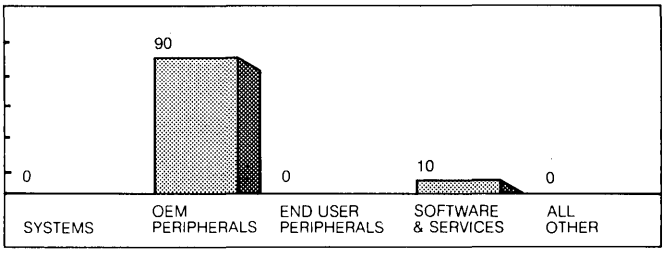
The year 1980 was significant for Teletype: it marked its 50th anniversary as a Western Electric subsidiary; it was the year in which restrictions on AT&T's activities in data processing began to be lifted, and it was a strong year financially, with sales of $416 million, up 27% over 1979 sales of $327.5 million. Data processing revenues soared as a full sales year in 1980. We estimate Teletype's 1980 dp revenues at $250 million, based on the fact that sales and maintenance of 4540 systems (terminal, display, printer, etc.) account for more than half the total revenues.

Spurred by high demand for its model 43 teleprinter and its new 4540 data communications terminal, Teletype modernized and added to its manufacturing facilities in 1980. It expanded its plastic molding and circuit board shop by 25%, enhanced its abilities in custom logic devices, and added new metal oxide semiconductor (MOS) capabilities. These new facilities resulted in a manufacturing cost reduction of $10 million.

Teletype's presence in the DATAMATION 100 is somewhat ironic: the products that qualify it for inclusion in a data processing survey have actually been classified as communications gear by AT&T in order to comply with regulations that currently prohibit the Bell System from offering dp equipment. As a subsidiary of Western Electric ($12 billion), which is the manufacturing arm of AT&T ($50.8 billion), Teletype is in a position unlike any other terminal manufacturer. Despite its efforts to increase the percentage of sales to the "outside" to 70%, Teletype still sells more than half its production through the Bell System and is thus subject to FCC regulation and tariffing. This has held it back in the past: when Teletype introduced the Dataspeed 40/4 intelligent terminal in 1976, the FCC almost barred the tariff. AT&T eventually won the debate over whether the product performed communications or data processing, and it was officially declared a communications terminal. The company has since introduced printers and terminals of increasing sophistication with bit- or character-oriented protocols, such as IBM's SDLC. The 40/4's replacement, the Dataspeed 4540, is a 3270-compatible KB, Z-80 microprocessor-based system with a controller that handles eight to 32 displays and/or printers.

The FCC's Computer Inquiry II decision, released in 1980, permits AT&T to legally enter data processing through separate and unregulated subsidiaries. Teletype Corp. will likely be one of the driving forces behind this move into computing and office automation. Its intelligent data communications terminals already function as data processing and word processing systems, despite AT&T protestations to the contrary. With the ban on dp lifted, Teletype will be able to offer even more sophisticated products. And it will be a good model for other AT&T units as they reorganize under Computer Inquiry II and the results of the AT&T antitrust suit.

30



1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
26	250	2	5,300	23,819	DEC.

ITT CORPORATION

320 Park Avenue
New York, NY 10022
(212) 752-6000

ITT derived only 1% of its 1980 sales from dp. Its total sales of $23.8 billion came from telecommunications products and services, color television, audio equipment, food products, hotels, insurance, coal, oil, gas, and finally, terminals, printers, and word processors. These last three products are manufactured by two ITT subsidiaries—ITT-Courier Terminal Systems and Qume—which, while only a small part of ITT, are major forces in the dp industry.

Courier and Qume, both purchased in 1978 as part of ITT's expansion into computer and communications equipment manufacturing, brought in combined revenues of $250 million in 1980. Courier's sales approximated $120 million, down from 1979 levels. Qume's sales of $130 million were up 13%. Margins were higher for Qume than for Courier, reflecting competitive pressures. Qume, its profits up, expects to double its R&D expenditures in 1981 and to increase its work force by 17%.

Qume manufactures and markets character printers to the oem market, data terminals to dealers, and printwheels and ribbons to the distributor market. It also sells memory products, including 5¼-inch and 8-inch double sided/double density drives, to oem manufacturers such as Texas Instruments. In 1980, Qume made its first move into the international market by establishing sales offices and service depots in London and Dusseldorf.

No new products were announced by Qume in 1980, but in March 1981, it introduced a new printer and a new printer/terminal, the SPRINT 7 and SPRINT 9, respectively.

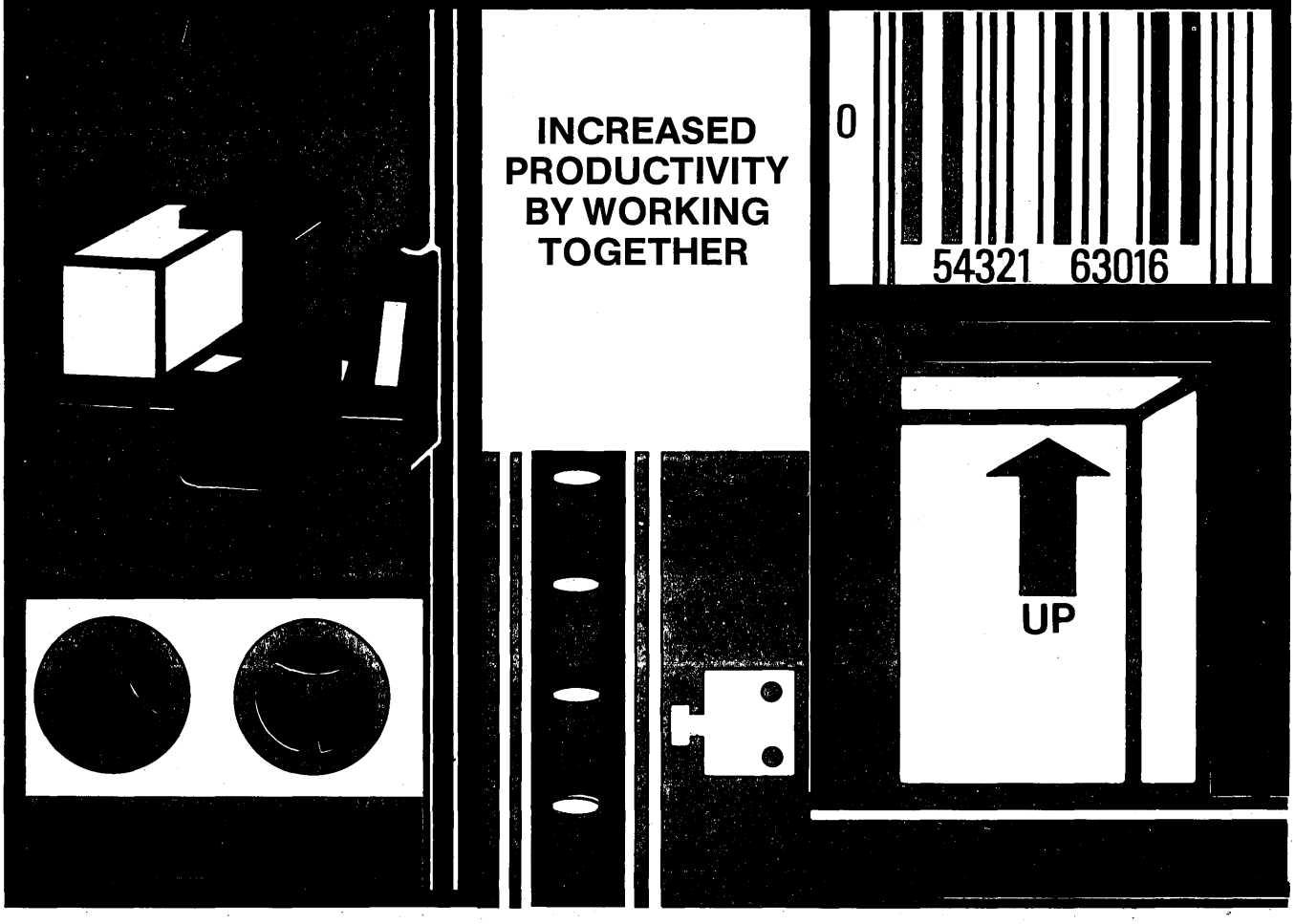
ITT-Courier Terminal Systems, Tempe, Ariz., also manufactures computer terminals and printers. Its primary business is the provision of plug-compatible IBM devices, but it also sells a line of Honeywell-compatible products. Both product lines consist of printers, terminals, and terminal controllers (boxes that are installed between a terminal and a computer or modem). There are six printers of various speeds and types, including a letter-quality model made by Qume. Courier announced two new products in early 1981, both compatible with IBM products. The Courier 2700-16 and the 2790-2A terminals emulate the IBM 3278 and 3279, respectively. The 2700-16 is a 32-column terminal, and the 2790-2A is the color version.

Courier has sold over 150,000 terminals. As of January 1981, it had established a new marketing and service arm, ITT Business Communications Systems, to sell Courier equipment and "future data communications products." These "future" products indicate a continued push by ITT into office automation.

While dp is a relatively small factor at ITT, the company is extremely active in telecommunications. In 1980, ITT's telecommunications and electronics group had revenues of $7.2 billion. ITT is the second largest telecommunications equipment company in the world, particularly in switching equipment, which accounts for half the group's sales.

1981 Automated Material Handling & Storage Systems Conference

September 16-18, 1981 Franklin Plaza Hotel Philadelphia, PA



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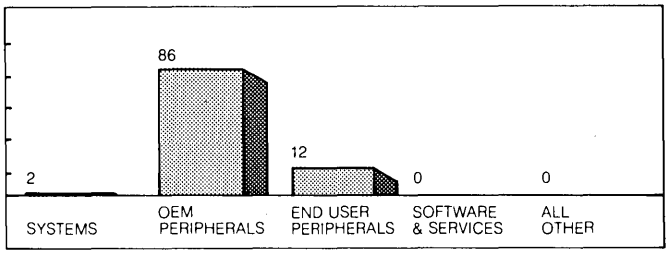
The Material Handling Institute, Inc. 1326 Freeport Road Pittsburgh, PA 15238

CIRCLE 105 ON READER CARD

MHI
THE MATERIAL HANDLING INSTITUTE, INC.

31



1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
34	248	44	4,900	248	MARCH

DATAPRODUCTS CORPORATION

6200 Canoga Avenue
Woodland Hills, CA 91365
(213) 887-8000

While 1979 was a difficult year for Dataproducts because of its costly product line expansions, 1980 was satisfying as plants came on-stream and progress was made with band and matrix printers.

Dp revenues (which now include communications revenues stated retroactively) increased 44% to $248.3 million. Operating margins improved dramatically to 8.4% from 4.5% as overhead expenses of new plants were absorbed by volume shipments.

The family of band printers was expanded in 1980 with the introduction of a 1500 line per minute (lpm) printer and a 900 lpm printer. These band printers will eventually replace Dataproducts' bread-and-butter drum printers, although the transformation has been slower than expected since oem customers are comfortable with the drum printers and are reluctant to change because of the heavy startup investments (training, spare parts, etc.). Band printers, however, offer cost advantages and are easy to maintain. In 1980, band printers accounted for approximately $50 million, down from $70 million in 1979.

The matrix printer product line also progressed in 1980, although these printers are not expected to become profitable until this year, when monthly shipments will exceed 1,000 a month.

Revenues, less than $4 million in 1979, almost tripled in 1980 and should easily exceed $30 million in 1981.

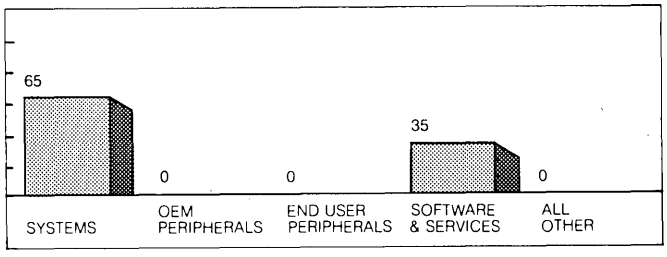
The company's daisywheel printer division has not been as successful in turning around its production problem as its band and matrix printer operations have been, and it contributed a $5 million loss in 1980. This division continues to be under pressure because of increasing competition from Japanese and European vendors.

Although traditionally an oem company, Dataproducts is attempting to expand its distributor network. In August, it signed a national distribution contract with Kierulff Electronics. In September, it signed a five-year contract with the customer service division of TRW as the exclusive authorized U.S. representative for field maintenance service.

Capital expenditures were $12.2 million, down from $14.2 million in 1979. In 1980, these were directed toward expansion of the domestic matrix printer facility and expansion of the European manufacturing plant. The Dublin plant has been doubled in size, to over 200,000 sq. ft.

Several senior management changes were consummated following the retirement of the company's chairman and founder, Erwin Tomash. Charles Dickinson, senior vp of operations, was promoted to president and ceo, and Graham Tyson, previously president, has assumed the chairmanship.

32



1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
28	245	7	2,000	1,159	MAY

NATIONAL SEMICONDUCTOR

2900 Semiconductor Drive
Santa Clara, CA 95051
(408) 737-5262

National Semiconductor designs, manufactures, and markets semiconductor devices and is one of the largest merchant manufacturers of integrated circuits in the world. National also produces and markets digital systems based on semiconductor technology: electronic watches, calculators, point-of-sale systems for supermarkets, and IBM-compatible computers and memory systems. The company recorded total sales of $1,159 billion in calendar 1981, of which roughly $310 million can be classified as digital systems. Since digital systems include certain consumer products, we have estimated that $245 million can be considered dp memory systems, IBM-compatible systems, and intelligent point-of-sale systems. This is up slightly from 1979.

The IBM-compatible business is conducted through a wholly owned subsidiary, National Advanced Systems Corp. NAS was founded in October 1979, the result of a combination of Itel's Data Products Group sales, service, support, and administrative activities with NatSemi's computer manufacturing and research and development.

The company presently has approximately 600 cpu installations worldwide and a total of approximately 2,000 sites including peripheral equipment. It presently sells products from multiple locations in the United States and Canada, and maintains direct-selling organizations in 11 European countries.

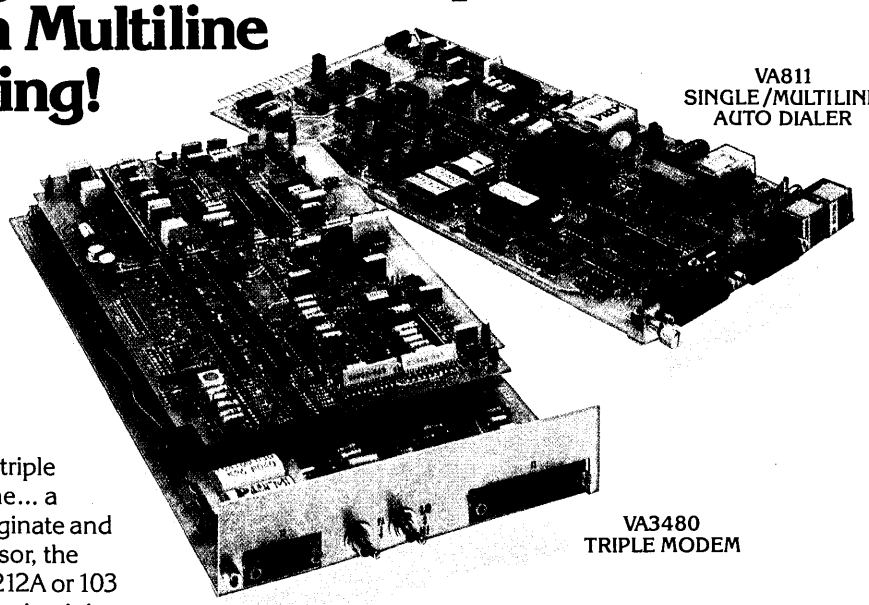
When Itel encountered financial difficulties in mid-1979, it became advantageous for NatSemi to accelerate its program to directly market and service its mainframes. It did this by transferring Itel's IBM-compatible sales, marketing, service, and support groups to the new subsidiary. For the total fiscal year 1980, computer sales were down sharply from the prior year, and a significant loss was incurred in place of the profits realized in 1978 and 1979. This change more than offset the improvements made in consumer products and point-of-sale systems, and the digital systems segment as a whole incurred an operating loss of $10.8 million in fiscal 1980. Since May, however, there has been a positive turnaround. National's second quarter report, dated Jan. 8, 1981, confirms that its computer business achieved a solid profit just one year after beginning its direct sales and service activities.

Most noteworthy is the change in emphasis from production of intermediate-scale systems which are sold by a different company to the marketing of large-scale systems which are produced by a different company. The old marketing outlet was the now-defunct Itel, while the new producer is the very vital Japanese firm Hitachi. The primary Hitachi models are the 7000 and 9000, both of which have been price adjusted and performance enhanced since the IBM 3081 announcement last November.

In R&D, National spent $20 million of a corporate total of $100 million on digital systems.

Dear Ma:

Now Racal-Vadic has an Originate/Answer Triple Modem with Multiline Dialing!



VA811
SINGLE/MULTILINE
AUTO DIALER

VA3480
TRIPLE MODEM

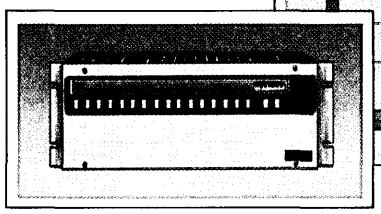
The two PC boards at the right are making it easy for computer sites to standardize on a single modem for all full duplex 1200 and 0-300 bps data transmission over your dial-up network.

Originate/Answer Triple Modem

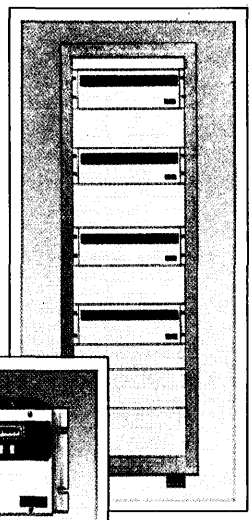
First there's Racal-Vadic's new VA3480 triple modem. Actually, Ma, it's six modems in one... a VA3400, a 212A and a 103 with automatic originate and answer. Thanks to the built-in microprocessor, the VA3480 can automatically call any VA3400, 212A or 103 remote modem, with the central computer maintaining complete control, including selection of high or low speed modes, and modem ID. In the auto answer mode, the VA3480 changes into a VA3400, 212A or 103, depending on which type modem is calling. It's really a "do everything" modem, Ma.

Single/Multiline Automatic Dialer

The other card is the new VA811 Multiline Automatic Calling Unit. You can house one of these dialers and up to 7 triple modems in Racal-Vadic's VA1616 chassis, which takes up only 7 inches of rack height. 4 of these chassis mount in a 7-foot rack cabinet, making it possible to control 28 triple modems from a single RS366 dialing port or, via an RS232C interface, using the VA831 adapter. It would take 28 of your dialers, and many racks of equipment to do the same thing. Hardly a fair comparison, is it, Ma.



VA1616 Chassis



VA1770
Rack Cabinet

VA3480 Replaces 8 of Your Modems

The VA3480 replaces 8 of your modems — the 103A/E/J, the 113A/B/C/D, and the 212A without altering hardware, software, or changing dial-up disciplines, and it can communicate with all versions of Racal-Vadic's VA3400 as well.

The VA3480 is truly a modem for all reasons, Ma. Better phone or write for full details today. Dial **(800) 543-3000, OPERATOR 510.**

Your independent thinking son,

Alexander Graham Jr.

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Sunnyvale, CA 94086
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Our new B-900 helps keep the DP department ahead of a growing demand for printout. It's the fastest member of our reliable B Series family of band printers.

Like the B-300 and B-600 models, it has Dataproducts' patented Mark V hammer system at its very heart. The system is virtually friction-free. The result is a remarkable level of reliability.

That reliability is proven, too. With over 20,000 units in the field, our B Series printers have become the industry standard for excellence.

Fast and easy.

The B-900 was designed for high performance, printing up to 1100 lpm with a 48 character set. It prints out 900 lpm with 64 characters and 670 lpm with a 96 character set.

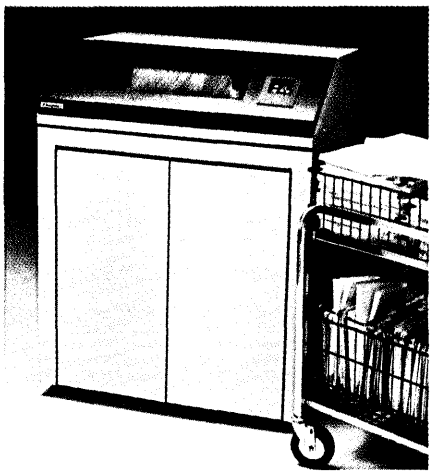
All the B Series were designed with the operator in mind. The long lasting ribbon cartridges are easy to load. The bands can be changed in less than a minute. Sophisticated self diagnostics let the operator identify problems and often correct them without a service call.

The quiet type.

With fully sound-insulated cabinets, the printers operate at only 60 dbA—even less than the noise level of a

With Dataproducts' B-900 Band Printer, every department gets what's coming to it.

GREAT MOMEN



typewriter. These cabinets are available on the B-300 and B-600, standard on the B-900.

A name you can trust.

Dataproducts is the world's largest independent printer manufacturer. For 19 years, we've built printers for the biggest OEMs in the business, putting their names on our machines. These customers make sure our printers live up to some pretty tough standards.

Now our B Series band printers are available with our name on them. Or with your name.

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We have distributors and sales representatives throughout the world. We'd love to show you how our printers can improve your systems.

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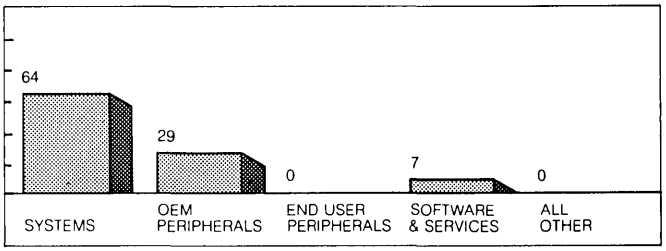
European Marketing Headquarters:
Ascot, England,
990-23377,
telex: 849426

Dataproducts

TS IN PRINTING

CIRCLE 107 ON READER CARD

33



1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
35	226	31	3,600	1,044	JUNE

PERKIN-ELMER CORPORATION

Main Avenue
Norwalk, CT 06856
(203) 762-1000

The data systems group of Perkin-Elmer boosted growth and profit margins following a period of subpar performance. Revenues were $226 million for the fiscal year ending in July, the latest available period for profit results. Overall, the group has made significant competitive progress against its minicomputer rivals in both growth and profitability. The gains in revenues and earnings, however, have yet to show up in capital spending—a key indicator of management's growth expectations. Indeed, capital expenditures for dp have declined in the past two years.

Three divisions are in the data systems group. The largest, the computer systems division, splits its business evenly between end users and oems—a sharp contrast to the predominantly oem business Perkin-Elmer acquired with Interdata. The memory products division, formed from the 1976 acquisition of Wangco, a manufacturer of disk drives and magnetic tape transports, contributed about 21% of revenues in 1980, marking a return to profitability. The terminals division contributed less than 10% of revenues. Growth for these smaller operations will be subordinated to profitability until they show an acceptable rate of return.

A target market approach at Perkin-Elmer concentrates on five markets: training simulation, CAD/CAM, siesmic analysis/exploration, scientific computing, and transaction processing. In training simulation, the award of the B-52 contract, with the potential for over 200 systems, buttresses Perkin-Elmer's strong position, with participation in 27 programs.

In seismic analysis, Perkin-Elmer has several applications with a common requirement for high performance hardware with speed, large memory addressability, and high I/O capabilities.

Perkin-Elmer has positioned itself as a specialty supplier of high performance, 32-bit minicomputers; in this market, the company has a respectable 18% share. For 1980, the company booked orders for over 1,000 32-bit computers, and claimed an installed base of over 3,500 units.

In a notable departure for a conservative company, Perkin-Elmer published impressive performance results throughout the press last year. An update to include the new (March 1981) 3230 is summarized below. Results have been substantiated in independent sites. It should be noted, however, that the 3200 series does not incorporate virtual memory, which provides a performance throughput advantage since addresses are not translated, but limits the capability of the 3200 series in dealing with large databases or timesharing applications.

In the terminal division, the focus is on the "smart" market. The outlook dimmed late in the year as orders for memory and terminal products fell below levels of prior years. Expansion for the systems group overall came in at a modest 7% for the three months ending in January 1980, down sharply from the peak gain of 42% for the April 1980 period.

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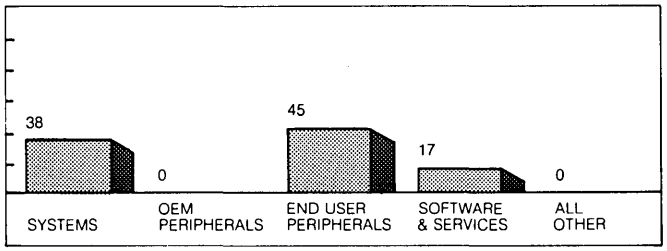

1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
33	225	29	4,600	5,002	DEC.

RAYTHEON COMPANY

141 Spring Street
Lexington, MA 02173
(617) 862-6600

Raytheon Co. enjoyed an estimated 29% growth in its dp revenues during 1980 to $225 million, up from $175 million in 1979. These figures are for Raytheon's major operation, Raytheon Data Systems (RDS). Excluded are the Raytheon Service Co., which provides computer equipment maintenance, Raytheon Equipment, which sells displays, and Raytheon Seismograph, which markets turnkey seismic analysis systems. Lack of information about operations other than RDS causes Raytheon to be ranked lower in this survey than it might be otherwise.

RDS's primary product areas are minicomputers ($18 million), word processing from Lexitron ($67 million), and terminals ($95 million). The strongest product growth area is word processing, about a 38% revenue improvement over 1979. Overseas, RDS revenues have grown at about 40%, with foreign revenues now accounting for an estimated 16% of the company total. Raytheon recently opened an Australian sales operation to complement its European and American activities.

The major RDS product lines are the Lexitron VT family of word processors, the older PTS-100 3270-compatible intelligent terminals, the PTS-1200 high-end family of 3270-compatible terminal systems, and the PTS-1200 distributed processing minicomputer systems. RDS followed the spring '80 introduction of the PTS-2000 with several fall enhancements, including extension of its communications to include SNA/SDLC and a large-cluster upgrade allowing up to 32 displays and printers to be attached to a single controller. The PTS-100 family was also enhanced early in the year with an intelligent controller that emulates the performance of large-cluster IBM 3274-type display systems.

Raytheon product lines come together in the PTS-1200 distributed processing system, which can handle up to 24 PTS-100 terminals executing data entry and retrieval operations. The PTS-2100 can communicate to a host mainframe using a wide range of IBM-compatible terminal protocols including HASP, 2780, 3780, and 3270. Additionally, the minicomputer-based PTS-1200 can operate standalone as a word processor, using the recently announced RAYWORD software. Another word processing product, PAYTEXT, combines the VT-100 Lexitron terminals with the PTS-1200 system.

RDS is expanding the terminal marketing wedge by introducing lower-cost/equivalent-function terminals (new members of the PTS-100 family) coincident with higher-cost/enhanced-function terminals (the PTS-2000 family). This wedge strategy, coupled with extensive IBM compatibility, is expected to be continued by Raytheon through enhancements of current products over the next several years. Both the PTS-100 and PTS-2000 are extensively programmable, thus flexible enough to keep pace with changing market requirements. RDS has installed more than 170,000 PTS-100, PTS-2000, and VT terminals worldwide.

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With the 2078 Display Station and the 2076 Remote Cluster Controller, Memorex re-defines savings four ways.

We save you space. The monitor of our 2078 can be removed from its stand and put on a shelf or bookcase for more room at your workstation. And since the 2078 weighs just 55 pounds (including keyboard), it's easily portable.

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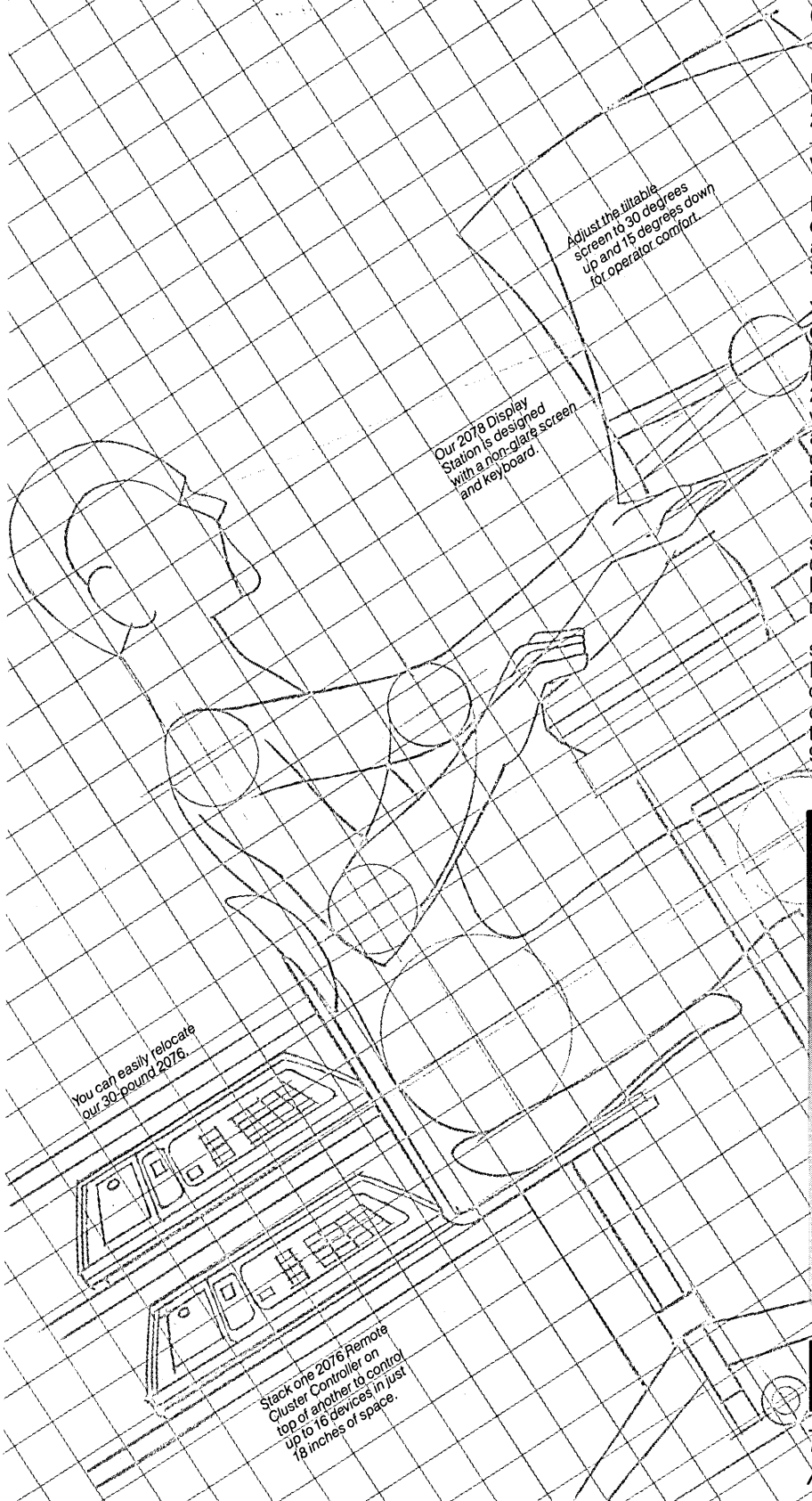
We save you money. Add it all up. You save space, you save energy and you save your operators from discomfort. You also save time—because both the 2078 and 2076 are available now. The bottom line? You save money.

There are other ways Memorex re-defines savings with the 2078 Display Station and 2076 Remote Cluster Controller. For all the information on the Memorex family of terminal controllers, communications processors, display stations, controllers and printers, call: Laurie Schuler at (408) 996-9000. Or write Memorex Communications, 18922 Forge Drive, Cupertino, California 95014.

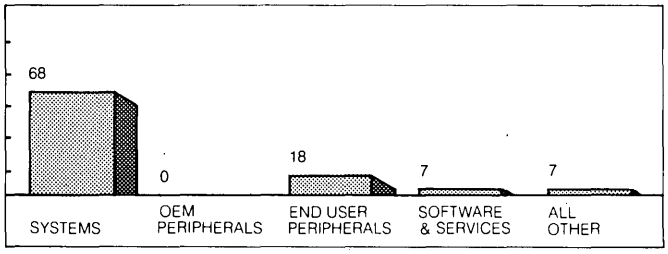


MEMOREX

TWENTY YEARS OF LEADERSHIP AND THE EDGE ON TOMORROW.

CIRCLE 108 ON READER CARD

35



1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
42	220	47	1,900	1,515	JUNE

TANDY CORPORATION

1800 One Tandy Center
Fort Worth, TX 76102
(817) 390-3700

Tandy broke into the DATAMATION Top 50 in 1979 and continued its progress in 1980 with a 47% revenue increase to $220 million. U.S. revenues increased 30%, to $175.5 million, while foreign revenues increased almost 200%, to $44.5 million.

Although Tandy is quickly becoming one of the more important dp companies, it is foremost a marketing company. Its 8,012 worldwide retail outlets are up from 7,607 in 1979. Of these, 6,117 were in the U.S. Included in these outlets are 121 dedicated computer centers. Most of these centers were established in 1980. In addition to the domestic centers, Tandy has 16 centers in Canada and 28 centers in seven other countries.

With numerous product introductions in 1980, Tandy probably has the fullest product line among microcomputer vendors. At the low end, Tandy announced the TRS-80 pocket computer, the first handheld computer that offers BASIC programming. In addition, it introduced the TRS-80 color computer, which retails for $399 and has been designed primarily for the educational and recreational markets. Also in the low end, the TRS-80 Model-III was announced.

Tandy has taken several large steps to manufacture more of its own products. In May, Tandy started a floppy disk manufacturing joint venture with Datapoint, and by year-end, the plant was shipping product. In July, Tandy purchased Lika Corp., a printed circuit board manufacturer, for $4.5 million. Tandy does not now plan to build printers inhouse, since a Japanese vendor is supplying a daisywheel model that retails for $2,000. The entire printer line is expected to be supplied by Japanese vendors by the end of 1981. Tandy is also committed to developing software in-house (currently 40% is done in-house), primarily to improve quality control.

Tandy has aggressively developed communications capabilities to serve the home and office markets. In May, Tandy announced the Videotex terminal, a two-way information retrieval system. In conjunction with Videotek, Tandy signed a marketing pact with CompuServe to sell software that enables users to gain access to the CompuServe Information Service network. Tandy has initiated the "Express Information" bank-at-home service, a joint venture of United American Service Corporation (USAC), Tandy, and CompuServe.

Tandy has named Random House, the New York-based book publisher, as distributor of its TRS-80 computers to the educational market. It is also pursuing the small business market by offering vertical packages. Tandy is encouraging purchases by larger businesses by offering volume discounts (ranging from 12% to 18%) for purchases in excess of $75,000.

John V. Roach was named president in October, and Robert Keto and Bernard Appel were appointed executive vps. Interestingly, Mr. Roach had been closely associated with the development of the computer line.

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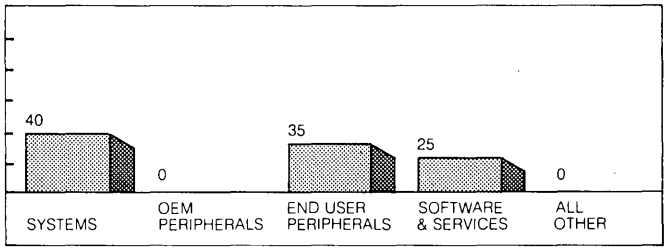

1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
21	217	-26	4,100	1,723	DEC.

NORTHERN TELECOM, INC.

Electronic Office Systems
P.O. Box 1222
Minneapolis, MN 55410
(612) 932-8000

While Bell Canada owns 55% of outstanding common stock, its relationship to Northern Telecom is analogous to Western Electric and AT&T. Northern provides most of the hardware to Bell Canada: 1980 sales to Bell Canada were $450 million (U.S.), or $32.5% of NT's worldwide sales.

Northern Telecom's Electronic Office Systems has been a sticky problem to the parent. It was created in 1978 with the acquisitions of U.S.-based Data 100 and Sycor. The two companies were merged and now share one sales and service organization. Management turnover has been high. All U.S. operations have been reorganized under the name Northern Telecom Inc. and report to new president Edmund Fitzgerald.

Products of EOS include remote data entry systems, on-line plug-compatible and remote batch terminal systems, and distributed data processing to which a word processing capability was added in early 1981.

In 1980, Electronic Office Systems revenues slumped 26% to $217.1 million. Operating profits plunged from $21.8 million in 1979 to an operating loss of $72.7 million in 1980. The losses can be attributed to slow shipments, inventory write-offs, and restructuring costs. The parent company took a $220 million write-off in 1980, including an extraordinary loss of $90 million in goodwill for Sycor and Data 100, an extraordinary loss of over $10 million in technology investment in Sycor and Data 100, and operating expense provisions of about $50 million for NTSC.

Management closed manufacturing plants in North Carolina, Michigan, and Ireland. Consequently, corporate employment has dropped 29% to 4,100. EOS sales in the U.S. continued to account for about two-thirds of total sales; regional sales offices were expanded from four to seven.

The company has nine subsidiaries in Europe and one in Australia. Under a new agreement, Olivetti will market on-line products, with expected sales of $13 million, and Redifron-CMC will market ddp products in Europe and North Africa, with expected sales of $15 million. EOS and other NTL operations ceased third-party lease financing in spring 1980.

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CIRCLE 109 ON READER CARD

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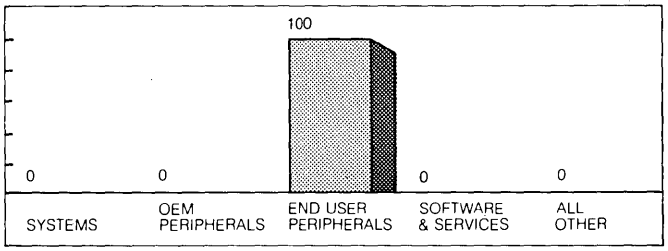

1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
40	212	40	3,487	212	MARCH

RACAL CORPORATION

8600 N.W. 41st Street
Miami, FL 33166
(305) 592-8600

Racal's two U.S. dp companies, Milgo and Vadic, are managed separately. With combined sales of $212 million in 1980, they accounted for more than one-third of total revenues of the parent.

When purchased by Racal, Milgo had sales of $64 million and pretax profits of $2 million. Revenues grew to $164 million in 1980, and operating margins improved to 20%. International sales increased 10% to $44 million. Milgo sells through Racal Milgo Ltd. in Europe and the Far East and directly in the rest of the world. In 1981, a new sales and installation subsidiary was opened in New Zealand.

In August 1980, Racal-Milgo entered the statistical multiplexor market with the introduction of omnimux.

Through its July purchase of Telesystems Network, Inc., Racal-Milgo acquired another data communications product and improved its position in the automated market. Chicago-based Telesystems has a unique protocol and code translator that enables incompatible word processors, computers, and typesetters to exchange data.

In 1980, Racal-Milgo entered a cooperative marketing plan with Diebold to offer a series of combined products to financial institutions.

Milgo also manufactures the 4270 terminal through its computer products division. The terminals are marketed both as standalones and as part of its systems. Although sales are relatively small, Milgo is committed to this product, and has recently increased the management staff.

The 12-year-old Racal Vadic is doing well, with a 55% growth rate to $48 million in 1980. Racal-Vadic's only current products are modems: 35% are sold directly to end users; 35% are sold internationally. In 1980, Vadic surpassed the Bell System as the largest supplier of small and medium-sized modems. Vadic introduced 30 new modem models in 1980, including a triple full duplex model and a 300bps full duplex modem built into a standard telephone. The company has geared up for big production increases by opening a new 45,000 sq. ft. manufacturing plant in California and by increasing manufacturing employment 73%.

Vadic's international sales grew 84% to $6.7 million. This is due in part to the international "catch up" demand which has profited many American companies; for example, Vadic received its first order from the People's Republic of China. It is also due in part to liberalization of the tight national buying policies of the government monopolies that control all telephone-related equipment in most countries. In 1979, for instance, Nippon Telephone & Telegraph began to allow importation of 1200bps full duplex modems because Fujitsu, OKI, and NEC do not produce them. Regulation of the U.K. and German markets has also been relaxed lately.

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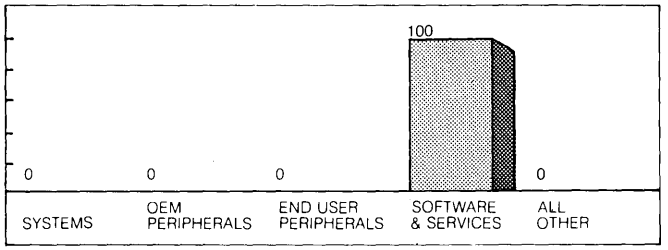

1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
32	211	20	3,615	236	DEC.

TYMSHARE, INC.

20705 Valley Green Drive
Cupertino, CA 95014
(408) 446-6000

Perhaps the most technically grounded of the major computer service companies, Tymshare invested heavily during 1980 in new products for its major markets and in maintaining its leadership in commercial applications for communications technology. Dp revenues grew 22% to $211.0 million. Major facilities expansion, two joint development agreements, four acquisitions, various new product announcements, and two public financings were among the events which highlighted the year at Tymshare.

Several noteworthy developments during 1980 exemplified the specialized product development activities in the company's Computer Services Group, which accounts for approximately 70% of revenue. Early in the year, the company formally announced AUGMENT, its "electronic briefcase," which offers online access to document preparation, electronic filing, and electronic message facilities. Acquisition of the $4 million Medistat subsidiary of Wisconsin Blue Cross/Blue Shield provided a midwestern base to Tymshare Medical Systems. Later in the year, Tymshare Travel Management Services announced an agreement to provide TWA with a multiaccess terminal service through which travel agents can access the passenger reservations systems of multiple air passenger carriers.

Among the largest of Tymshare's specialized services is credit card processing, where it currently holds 8% of the market shared by independent processors. There were several moves aimed at deepening the company's involvement in this and other strategically important Electronic Funds Transfer Service (EFTS) markets. Two acquisitions were directly EFTS related: the Bank Association of Rhode Island, a $2 million processor of VISA and Master Card transactions, and Telecheck Services, Inc., a Denver-based check guarantee service organization. The company also announced OPTION, the first automated teller network to be owned and operated totally by an independent third party.

Communications capability underpins all of Tymshare's business. Tymnet unveiled OnTyme II, its second generation electronic mail service. It also announced an important joint demonstration project with Satellite Business Systems in which Tymnet will test the feasibility of using high-frequency radio transmission and/or cable television facilities for local distribution of data communications traffic. Reinforcing the company's technical competence in local data transmission was the 1980 acquisition of Microband Corp., which owns and operates microwave transmission stations in numerous U.S. cities.

Despite Tymshare's investments in R&D, which rose 27% to $12.2 million, it was able to increase its operating margins to 15.7%, from 15.3% in 1979. With its heavy emphasis on communication services, Tymshare should easily be able to maintain a revenue growth in excess of 20% during the decade.

At last.

A new system that does everything the Tandem NonStop™ system does, and then some...

NonStop II.™ An enormous

The original NonStop™ System:

The original system set a whole series of breakthrough standards for high availability in a transaction processing system. With a level of up-time never before experienced in computer systems because no single module failure will stop the system, plus modular expandability which allows a system to increase processing power when needed, without changing any of the original hardware and without any software modification.

All this and more:

NonStop II is a brand-new system which builds on the original design and includes an enormous expansion of the system's potentials.

The keys are flexibility, for now and for the future; ease of support and service; and compatibility that puts other system evolutions to shame.

The new system utilizes 32 bit addresses, to give the user access to virtually unlimited data space. Up to one BILLION bytes of data per processor under the direct control of the Operating System.

With this extended addressability, Tandem NonStop II systems easily provide both hardware and software support for very large applications. NonStop II can handle many hundreds of terminals and communications lines interactively. With remarkable efficiency. With no down time because of a module failure.

Full serviceability:

Fault isolation and error detection have been enhanced in NonStop II as well. A new Operations and Service Processor, the OSP, is a separate, self-contained processor which can reduce hardware mean-time-to-repair by detecting and reporting problems on-line, plus providing service personnel with local and remote on-line system diagnostic capability.

A memory for the future:

Recognizing the potential user needs for larger memories, NonStop II has been designed so that each of the 2 to 16 processors per system is ultimately capable of addressing 16 megabytes of physical memory, eight times the current limit.

expansion of the system's potentials.

It was a powerful memory to begin with. The architecture can now handle even the largest, most demanding business and communications requirements.

The flexibility to offer additional capabilities in the future is provided by the new loadable control store, which allows the addition of functions to microcode as part of continuing standard software updates.

Full compatibility with existing installations:

This is not the tongue in cheek compatibility systems users are accustomed to. NonStop II is application software compatible with existing Tandem NonStop system installations and can be integrated into a Tandem EXPAND communications network without any software modification. And customers will be able to upgrade to a NonStop II system without any application software changes.

For high volume on-line transaction processing, there isn't a system out there to touch the Tandem NonStop II system.

In terms of continous system availability, data base integrity, protection against loss or duplication of transactions in process, expandability without penalty in hardware and without reprogramming or recompiling software, and a level of on-line performance that rivals the cost effectiveness of any other machine on the market—in all of these considerations, no one else even comes close.

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For full information and a demonstration of our unique capabilities, call or write Tandem Computers Incorporated, World Headquarters, 19333 Vallco Parkway, Cupertino, California 95014 U.S.A. Offices throughout the U.S.A., Canada, Europe, United Kingdom, Hong Kong, Mexico and Japan. Distributors in Australia, Finland, Greece, Korea, Taiwan and Venezuela.
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TANDEM

A whole generation ahead.

CIRCLE 110 ON READER CARD

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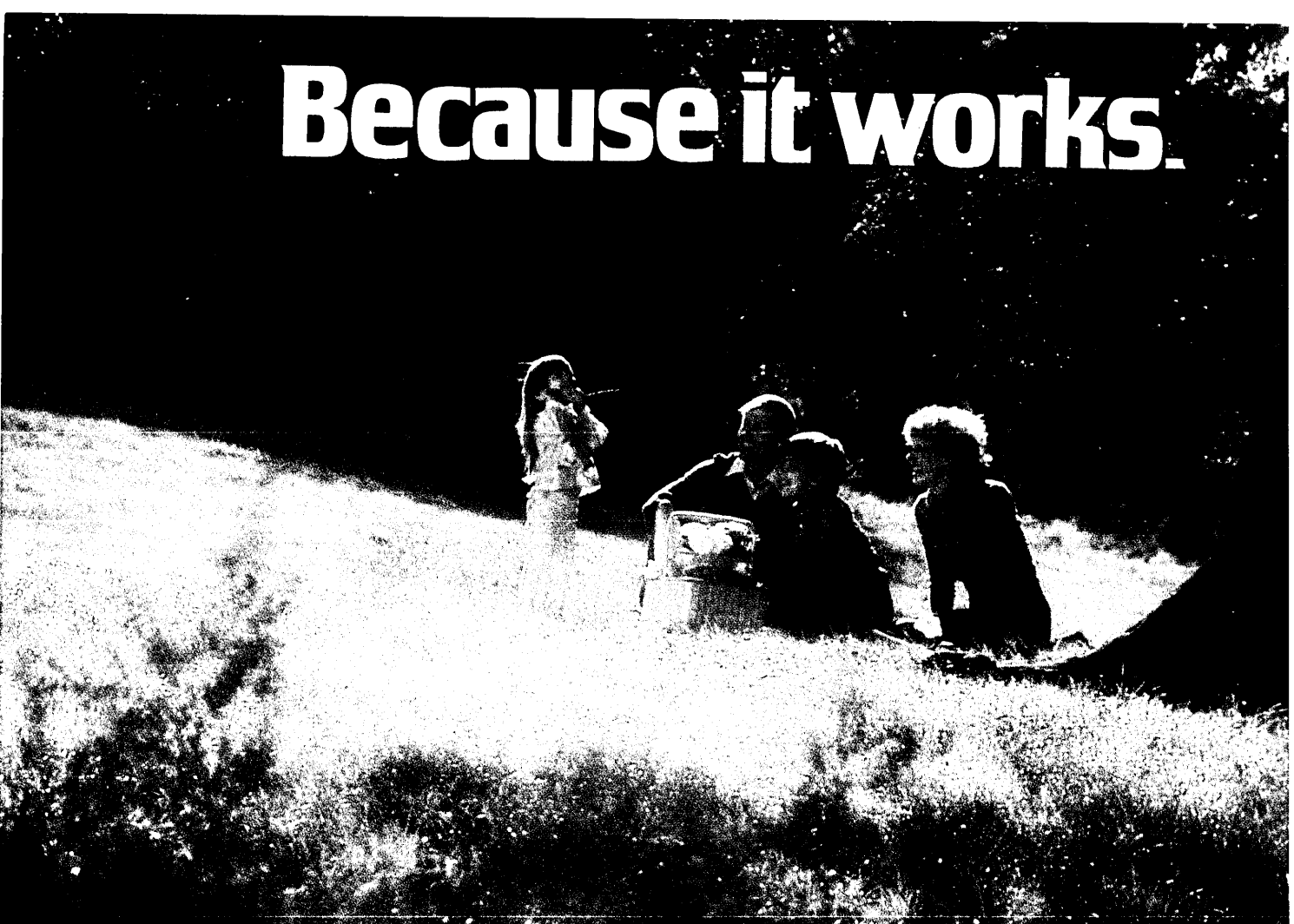

"Thanks to Epoch 480® computer tape, I can spend my free time with my family–instead of the computer."

People who use Epoch 480 computer tape tell us there have been significant improvements in their company's computer operation after they started using it.

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All that talk you hear about Epoch 480 running cleaner and longer is a lot more than just talk.

Epoch 480's modulus of toughness is superior. Its coating is smoother and more uniform. And it does have better signal strength.

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GRAHAM MAGNETICS

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CARLISLE

CIRCLE 115 ON READER CARD

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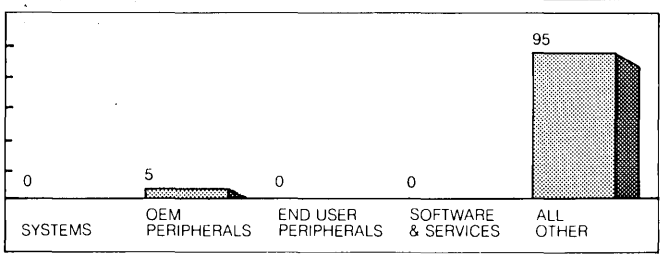


1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
37	205	28	0	6,080	DEC.

3M COMPANY

3M Center
St. Paul, MN 55101
(612) 733-1110

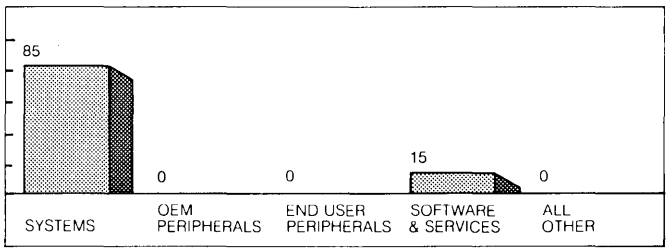
3M doesn't break out its dp revenues. For 1980, we have estimated them at $205 million, up 28% from 1979 (our 1979 estimate of $310 million has been revised downward, to $160 million). Domestic revenues were about $145 million, or approximately 70% of total dp sales.

The bulk of 3M's dp revenues come from disk and tape media. Its domestic tape business grew to $60 million, for a 25% share of the non-captive market. Most of the gain can be attributed to increased prices. Disk packs, 3M's next largest domestic business, are estimated at $50 million. The company has also been active in flexible disk media, where it has increased its market share to around 10%. During 1980, over 9 million pieces were manufactured, for $23 million in domestic sales. Finally, 3M manufactures data cartridges and small amounts of other disk drive products.

The Data Recording Products Division has enjoyed a strong turnaround the last couple of years because of its increased commitment to marketing and customer support. Although 3M does sell to oems, its main focus is the end user market, which it reaches through distributors—a cost-effective alternative to direct sales. Customer support had suffered badly, but since 1979 3M has improved its service and distribution, and this is reflected in increased market share. In 1980 it became possible for retailers of personal computers to order magnetic media and other products directly from 3M. Retail marketing support programs such as point-of-purchase displays and counter cards with free handouts have also helped, as has 3M's practice of providing retailers with preprogrammed diskettes for demonstration purposes.

3M's major products include adhesives, copiers, micrographic equipment and supplies, consumer products, and electrical supplies. Corporate revenues (which rose 12% last year, to $6.1 billion) dwarf the contribution by dp products. 3M has made several forays into data and word processing, but hasn't met with much success. Still, 3M's active participation in copiers and facsimile transmission and its established marketing channels give the company an enviable position should it decide to expand its standalone office products to a systems approach employing dp and wp technologies. 3M already employs several new communications technologies, including fiber optics. With its considerable resources and its low debt-to-equity ratio, 3M is capable of becoming an even more powerful force in the office.

40



1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
31	197	10	3,748	197	DEC.

Four-Phase Systems, Inc.

10700 North De Anza Boulevard
Cupertino, CA 95014
(408) 255-0900

Four-Phase growth rate slowed in '80, due to stiff competition in distributed processing and an unfavorable economic environment. Revenues were up only 10% and there was a small decrease in the order backlog. Four-phase had a year-end 1980 backlog of orders of $27.9 million compared to $28.2 million in 1979. Total net income declined to an estimated $3.5 million in 1980 from approximately $16.7 million in 1979.

The Four-Phase product line came under heavy competition from IBM, Wang, and Prime. Among these rival sellers, IBM provided the toughest competition.

In late 1980, Four-Phase responded to the competitive environment with the acquisition of Two Pi Corp. Two Pi manufactures IBM-compatible computers in the range of IBM System 370/138-148 and 4331 systems.

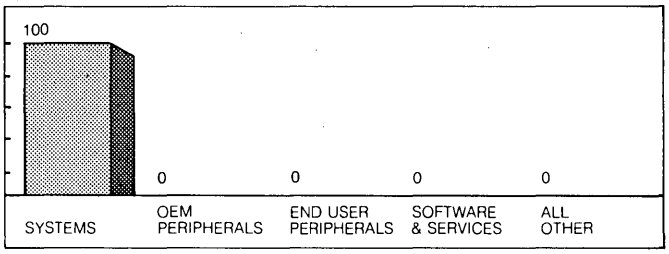
According to Lee Boysel, president of Four-Phase, the integration of the PCM systems from Two Pi into the Four-Phase product line will provide customers with IBM software-compatible batch processing in addition to the field-proven interactive capabilities. According to the Four-Phase 1980 annual report:

"This move establishes Four-Phase as the only non-IBM distributed dp supplier to offer IBM-compatible back-end processing combined with front-end interactive data and text handling." Four-Phase has stressed the fact that the Two-Pi product will complement planned Four-Phase systems at the higher end of the IBM 4300 range. This new family of Four-Phase products is expected to be announced in 1983/1984.

In 1980, spending on research and development increased to $15.9 million, 39% greater than 1979. 1980 results of this labor included two new high end systems products: the IV/95, a new video display and a new software offering called the Office Management System (OSM/IV).

Other 1980 developments included (on enhancements the following software products: Data IV, Vision, Multifunction Executive (MFE/IV) and Fore Word. The Four-Phase communications offerings were also expanded to include SNA/SDLC capabilities, DATA N, and VISION software products.

41



1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
52	191	86	3,000	224	DEC.

COMPUTERVISION CORPORATION

201 Burlington Road
Bedford, MA 01730
(617) 275-1800

Continuing in its high growth mode, Computervision exploded into the Top 50 with a dp revenue increase of 85.5% to $191.1 million. Not only did it continue as the leading supplier of computer-aided design and computer-aided manufacturing (CAD/CAM) systems, but it increased its market share to an estimated 38%. Most companies would be satisfied to maintain the leading market share in an industry projected to grow at 40% per year over the next five years, but Computervision aims to capture a larger share.

Unlike its competitors, Computervision designs and manufactures its own computers, most of its peripherals, and its own software. Competitors such as Applicon, Calma, Intergraph, Auto-trol and Gerber buy general purpose computers and combine them with their software packages, while hardware vendors such as IBM, Prime, Digital Equipment, and Control Data buy software packages and combine them with their general purpose computers. By being the most vertically integrated supplier, Computervision can control its CAD/CAM systems architecture as well as improve profit margins.

Computervision had an active year in bringing new products to market. It began shipping its newest and most powerful system, the Designer V, in June. Its new terminal, Instaview, uses a dual-bit map raster technology, which allows three-dimensional dynamics such as an on-line rotation of a complex mechanical part. Computervision also announced a color raster terminal, a graphic network architecture, and its Designer R system, which is a remote system that can support two workstations when supported by a host system.

To support its growth, Computervision more than doubled its dp capital expenditures to $30.1 million.

Although Computervision does not run a capital-intensive business, its rapid growth does require significant resources. In August, it issued 990,000 shares of stock to supplement its capital base. The equity sale permitted the company to eliminate expensive bank debt.

Since Computervision does not lease its equipment (and therefore requires cash to support a lease base), has good asset management, and probably close to $100 million between cash reserves and bank lines of credit, it is unlikely that the company will require additional equity financing until at least 1982.

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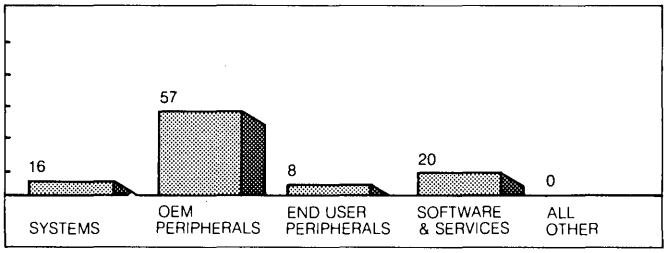


1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
38	189	23	587	189	DEC.

C. ITOH ELECTRONICS, INC.

5301 Beethoven Street
Los Angeles, CA 90066
(213) 306-6700

C. Itoh Electronics is the American subsidiary of one of the three largest trading companies in Japan. C. Itoh & Co. has assets in excess of $14 billion and sales in excess of $36 billion, and it accounted for over 6% of Japan's total imports and exports.

With sales of $189 million, the U.S. subsidiary is hardly more than a decimal point to its parent, but it is still an important U.S.-based dp company. Started in 1973, C. Itoh Electronics (CIE) did not become a dp force until 1978, when it began importing computer peripherals. In addition, CIE exports U.S.-manufactured dp products to Japan and other Asian countries through its wholly owned subsidiary, C. Itoh Data Systems of Tokyo. Among others, CIE represents Qantel, Control Data Peripherals, Inforex, Wang Labs, Calma, Xynetics, and Cray Research. Most of its exporting relationships have exclusive marketing rights; its Japanese subsidiary performs all the marketing, market support, and maintenance activities. Interestingly, CIE plans to be the pioneer for U.S. dp manufacturers in China, where it expects much of its future foreign revenue growth. In 1980, international revenue represented 53% of its total dp revenues, down from 66%.

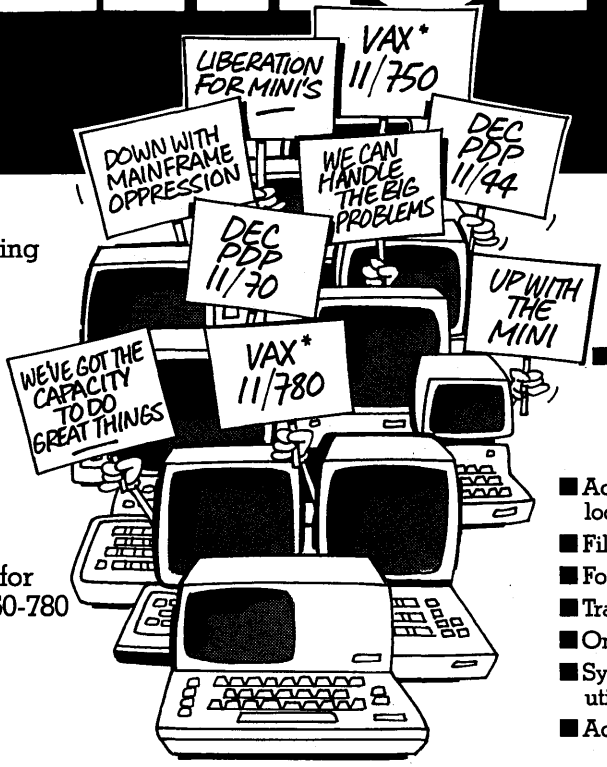
The company does not limit itself to imports and exports; it is also engaged in R&D, licensing, and venture capital investing. The company is currently invested in a laser disk research program that is being sponsored by the Stanford Research Group. CIE has also arranged a license agreement between Xynetics and Seiko for Seiko to manufacture in Japan.

Through its Century Research Center, C. Itoh Data Systems is the largest software house in Japan, employing over 400 workers, including 250 programmers.

Although CIE is very active internationally, its U.S. markets deserve greater focus. Its 1980 growth rate was a very impressive 70%. CIE sells mainly peripheral products that are targeted for the small business systems and microcomputer markets. It sells matrix and daisywheel printers manufactured by Tokyo Electric; 5¼-inch and 8-inch floppy disk drives manufactured by Toshiba; and crts that are plug-compatible to Digital Equipment's VT-100. In addition, it is anticipated that it will introduce a low-end word processing system in 1981 that will be manufactured by Hitachi. It is also discussing with Hitachi the possibility of selling 5¼-inch and 8-inch Winchester disk drives.

CIE is in a good position to expand its market share in the U.S. because its Japanese-made products are extremely reliable. Moreover, many of its products, particularly disks, will continue to be in short supply as the microcomputer industry continues its exponential growth. Strategically, CIE plans to establish deeper roots within the United States. In addition to continuing its marketing and service expansions, the company might not only begin to manufacture its own products, but to manufacture these products in the United States.

It'll cause a mini revolution in America



Systel is a unique teleprocessing system that will revolutionise the American mini-computer market.

Manufactured by Systime, the UK's largest supplier of turnkey computer systems, *Systel* provide interactive transaction processing on up to 256 terminals per processor (VAX*).

At present *Systel* is available for DEC*PDP 11 44-70 or VAX* 11/750-780 systems and will give transaction processing concurrent with other applications and a distributive processing network.

CIRCLE 116 ON READER CARD

Systel's advanced features provide:

- Efficient memory management and usage. All transactions employ multi threading.
- *Systel's* advanced transaction control language increases your processing capability while decreasing application development and implementation.
- Access security on individual terminal locations, files and records.
- File journaling and recovery.
- Forms generation. ■ Message handling.
- Training mode.
- On-line program development.
- System supplied transaction and external utility programs
- Advanced T.P. monitor features.

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If you have a DEC*PDP 11/44-70 or VAX* 11/750-780 and want to revolutionise its capability then contact:

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8980K ROUTE 108, COLUMBIA, MARYLAND 21045
Tele: 301-730 4424 Twx: 230-908273

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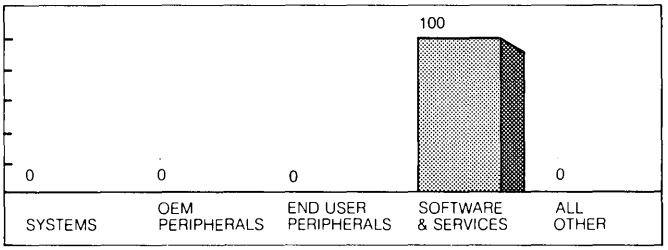

1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
36	187	15	3,897	187	JUNE

SYSTEM DEVELOPMENT CORPORATION

2500 Colorado Avenue
Santa Monica, CA 90406
(213) 820-4111

Next year, SDC will appear in the DATAMATION 100 as a subsidiary of Burroughs. The largest domestic privately held dp company, SDC was purchased by Burroughs for $98 million on Jan. 5, 1981.

Not only does the acquisition allow SDS's stockholders to cash in, but it provides Burroughs with additional financial and marketing clout in the software and services market.

SDC had revenues of $186.8 million in 1980, a 14% gain over 1979. Operating income rose 13% to $19 million. Despite these healthy figures, SDC did not have the money to handle the distribution and servicing of its first office product, the Records Manager.

The products group that sells the TEXT II Electronic Publishing System for newspapers has marketed the Records Manager. The product had its origins in the company's R&D division. It is an electronic filing system that will store 75,000 pages of text and allow access to any document by key words or phrases.

What does Burroughs gain from the acquisition? First of all, it gets Record Manager. It also expects SDC to help increase its government business, which only accounts for 5% of Burroughs' revenues. Burroughs will also use SDC to strengthen its tiny computer services operation.

The question that arises is whether the deal will work. Burroughs is not doing well, and has a poor track record with acquisitions.

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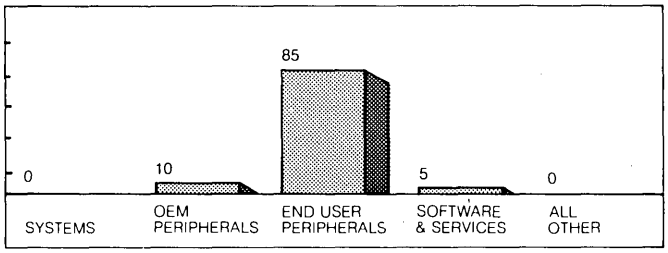


1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
46	175	30	2,300	3,099	DEC.

MOTOROLA INC. CODEX CORPORATION

20 Cabot Boulevard
Mansfield, MA 02048
(617) 364-2000

Motorola's Data Communications Group has several subsidiaries, but Codex dominates with nearly 80% of the group's $175 million dp revenues. Codex was the leading independent supplier of data communications equipment when it was bought out by Motorola two years ago. Since then, Codex has maintained its leading market share, with an average 25% growth. Operating margins were somewhat lower than 1979 because of major investments in R&D, capital expenditures, and field service. The sales-to-lease ratio also hampered profits as the division shifted toward leasing.

The group introduced several new products during 1980, including a new family of high-speed modems that range in speed up to 9600 bps. Enhancements to its existing line of network control systems were also announced. With these additions, Codex offers a full line of control systems with both passive and active communications diagnostics.

The company's international business was aided by the acquisition of Cole Electronic's products division. Located in the U.K., the acquisition became Codex Ltd., a factor in the important U.K. datacom market.

Product service has been aided by network controllers. Also, the use of remote diagnostics has reduced the service load.

In 1980, Motorola Data Communications sold many large systems, particularly in banking and insurance.

Other subsidiaries in the Data Communications Group include Universal Data Systems (UDS), Huntsville, Ala.; ESE Ltd., Toronto; and the intelligent terminal group in Phoenix. UDS manufactures modems and services accounts. During 1980, it introduced the line-power series of modems, which operates by drawing power from telephone lines. This product line is directed toward the home and personal computer markets. To handle its expected growth, UDS opened a 10,000 sq. ft. manufacturing/headquarter facility.

ESE Ltd. manufactures high-speed modems and serves the Canadian communications markets.

The Data Communications Group, a merged entity, is expected to take advantage of product and marketing synergies, and to continue to grow rapidly.

Cincom's Series 80 MANTIS helps Clark put productivity where it really counts.

Gene Clem
Lead Systems Programmer

Vince Rosenthal
Divisional Information Services Manager

Clark Equipment Company is a diversified, worldwide producer of construction machinery, material handling equipment, axles and transmissions.

Series 80 MANTIS offers application development facilities unmatched by any other system.

- Integrated directory
- Full DOS/OS Compatibility
- High level procedural language
- Conversational debugging
- Runs under CICS or ENVIRON/1
- Menu driven
- On-line documentation
- Oriented to both DP *and* end users
- Dynamic file generation
- Logical view access to files

50 sophisticated on-line applications developed in just nine months.

The Construction Machinery Division of Clark Equipment Company has used Series 80 MANTIS, the most advanced application development system, to put productivity where it really counts—at the bottom line.

"In our first four years of on-line processing we built only 150 applications. But, more and more, our ability to build new on-line applications to meet increasing demand was diminished by the never-ending requirement to maintain existing systems.

"After installing Series 80 MANTIS, our ability to build applications increased 180%, resulting in 50 new applications in nine short months. Today, we're not only keeping pace with demand, but seeking new cost saving on-line applications to build for the future. For any corporation, this is where data processing can improve productivity."

Series 80 MANTIS is Cincom's dramatic breakthrough in application development technology. Only MANTIS provides complete beginning-to-end on-line application development, without the need for batch processes.

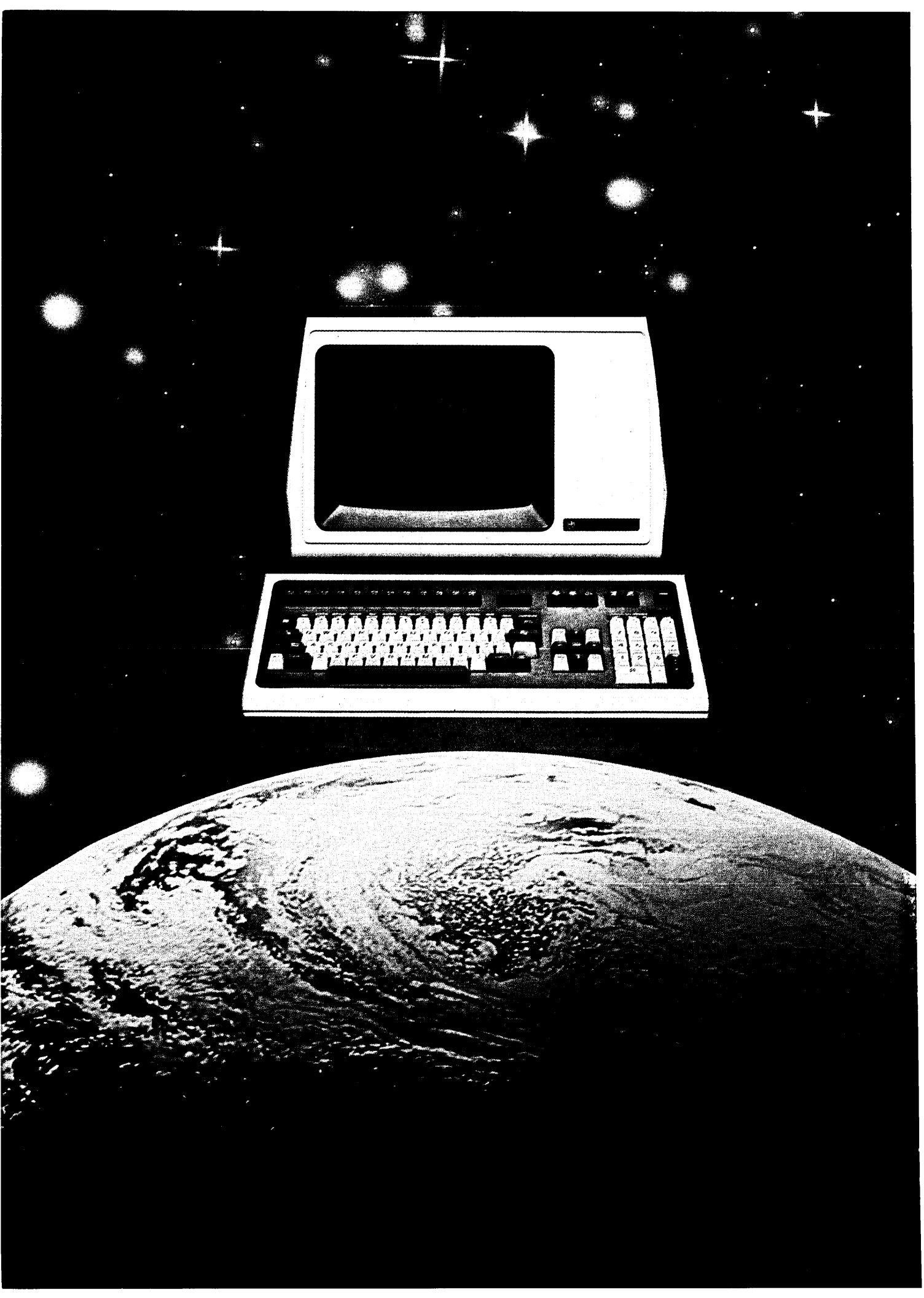
For many companies like Clark Equipment, application backlogs are becoming a thing of the past. Programmer morale is up. End-users are happier. And most important, data processing productivity is helping the corporation where it counts most—at the bottom line.

MANTIS is an integral component of Cincom's Series 80 family of data base/data communications products. To see how MANTIS can help improve your productivity, contact our Marketing Services Dept. for a demonstration. At your site or at a Cincom Service Center.

User Information Hotline:
800-543-3010.
In Ohio: 513-661-6000.

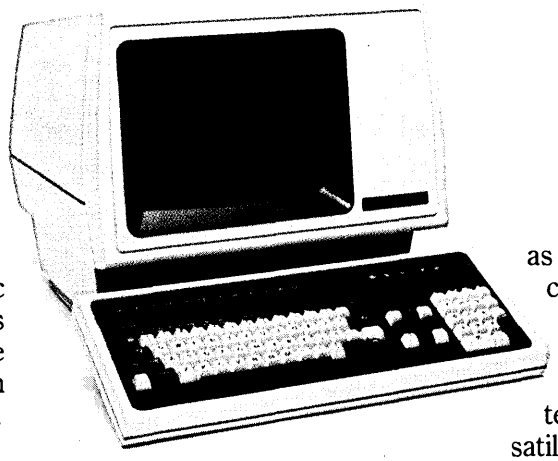
Cincom Systems, Inc.
2300 Montana Avenue
Cincinnati, Ohio 45211

CIRCLE 117 ON READER CARD



A powerful display of innovative thinking.

Introducing TI's new OPTI 900 Model 940 Electronic Video Terminal.



The OPTI 900* Model 940 is the first in a family of electronic video terminals from Texas Instruments. Combining the power of an editing terminal with the convenience of video display, the Model 940 brings new perspectives to applications including data entry, electronic mail, commercial timesharing and data base management.

The 940 offers state-of-the-art human-factor design features to help reduce operator fatigue, and a variety of versatile characteristics to enhance any business application requiring high performance editing.

Standard display features on the Model 940 include a 12-inch diagonal screen with an operator-selectable format of either 80 or 132 columns by 24 lines. A 25th status line displays information in three selectable modes for functions like tabs, margins, errors or host computer messages.

The 940's display can be split both vertically and horizontally into separate data regions allowing a user the flexibility to operate within one region without disturbing another. And for applications like process control,the Model 940 features scrolling regions for quick, effective data comparison.

There is also a transparent print feature that permits a host computer to bypass the screen and transmit data to an optional local printer, allowing the operator continued use of the screen during the printing cycle. And the Model 940's memory can store up to 1,920 characters of data.

Featuring 128 displayable ASCII characters, the versatile Model 940 includes a unique combination of double high, double wide and double high/wide characters for display emphasis and reduced visual strain. Additional video features include 7×9 dot matrix characters with true underlining and true descenders.

The Model 940's detached keyboard, designed to increase operator comfort and productivity, is connected to the display monitor with a 6-foot coiled cord and features operator-oriented functionally clustered keys. For added user convenience the Model 940 also offers detachable nonglare screen filters and a tiltable display monitor as options. Other available application-oriented options include international or graphic character sets and additional memory of up to 5,760 characters to give the 940 added versatility for data entry applications.

TI is dedicated to producing quality, innovative products like the new OPTI 900 Model 940 Electronic Video Terminal. And TI's hundreds of thousands of data terminals shipped worldwide are backed by the technology and reliability that come from 50 years of experience.

Supporting TI's data terminals is the technical expertise of our factory-trained sales and service representatives, and TI-CARE†, our nationwide automated service dispatching and field service management information system.

For more information on the new OPTI 900 Model 940, contact the TI sales office nearest you, or write Texas Instruments Incorporated, P.O. Box 202145, Dallas, Texas 75220, or phone (713) 373-1050.

We put computing within everyone's reach.

TEXAS INSTRUMENTS
INCORPORATED

In Canada, write Texas Instruments Incorporated, 41 Shelley Rd., Richmond Hill, Ontario L4C 5G4, (416) 884-9181. In Europe, write Texas Instruments, M/S 74, B.P.5, Villeneuve-Loubet, 06270, France, (93) 20 01 01. In Asia Pacific, write Texas Instruments Asia Ltd., 990 Bendeemer Rd., Singapore 1233. Telex RS 21399, or phone 2581122.

CIRCLE 118 ON READER CARD

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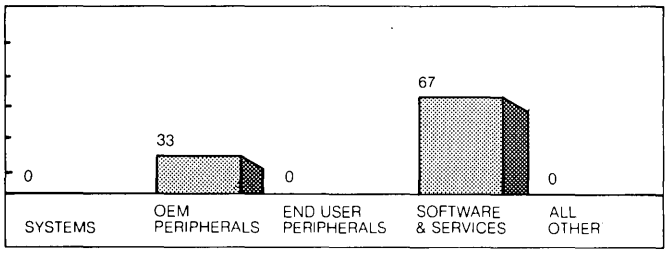

1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
43	172	15	0	823	FEB.

GENERAL INSTRUMENT CORPORATION

1775 Broadway
New York, NY 10019
(212) 974-8700

General Instrument's Data Products Div., which manufactures gambling and lottery systems, point-of-sale (POS) equipment, and military electronic gear, recorded a 23% revenue gain in 1980, down from 28% in 1979. Wagering systems gains suffered a slowdown due to increased competition and political resistance to further legalized gambling. Point-of-sale systems orders were reduced by the recession, which cut department store capital expenditures.

General Instrument's primary on-track gambling product, the AmTote 300 Totalisator System, permits selling and cashing of all bet types at any pari-mutuel window. The company operates and services pari-mutuel systems at approximately 200 racetracks and associations in North America. Service is performed in exchange for a percentage of the total amount wagered (the "handle").

In January, the Royal Hong Kong Jockey Club signed a $6.4 million contract for its second AmTote 300; a similar system was selected by the Trinidad and Tobago Racing Authority. New Zealand awarded a $7.5 million contract for 300 plus AmTote TIM 360 wagering terminals for an integrated off-track and on-track nationwide system, the first of its kind. An installation has also been made in Buenos Aires. The company has also formed a new company in Sydney, Australia, responsible for business down under.

In off-track and lottery areas, General Instrument provides OTB equipment throughout New York State and Connecticut. Of the 11 states that have on-line lottery operations, General Instruments supplies four (Ohio, Maine, New Jersey, and Vermont). It will begin supplying Massachusetts in 1981. In 1980, General Instrument announced the acquisition of OTX, Inc., a supplier of electronic slot machines in the New Jersey casino market.

The Data Products Div. contributes only one-fifth of General Instrument's total revenues. The other divisions, which are in related businesses, are Cable TV Products, Semiconductor Products, and Component Products. According to Frank G. Hickey, chairman of the board and chief executive, General Instrument is a "communications systems company." Its objective is to become "a large factor in digital transmission over broadband systems," and its "semiconductor and other components businesses are now aimed primarily at communications applications, especially in the telecom and computer markets."

In early 1981, General Instrument announced its entry into the satellite earth station market. Through a licensing agreement with SED Systems, of Canada, GI will manufacture and sell receive-only and direct broadcast home earth stations to the CATV, MATV, industrial, and consumer markets.

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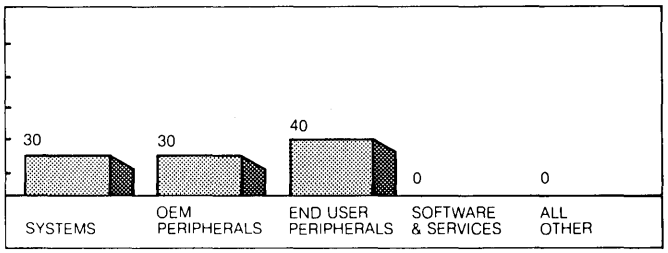


1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
41	170	12	4,055	493	MAY

AMPEX CORPORATION

401 Broadway
Redwood City, CA 94063
(415) 367-2011

In January 1981, after more than a year of courting, Ampex became Signal Corp.'s first dp subsidiary. A few management changes were announced: William B. Patton, Jr., formerly with MSI Data Corp., is now vp of business development, and Robert McAdams, Jr., was promoted to vp of finance.

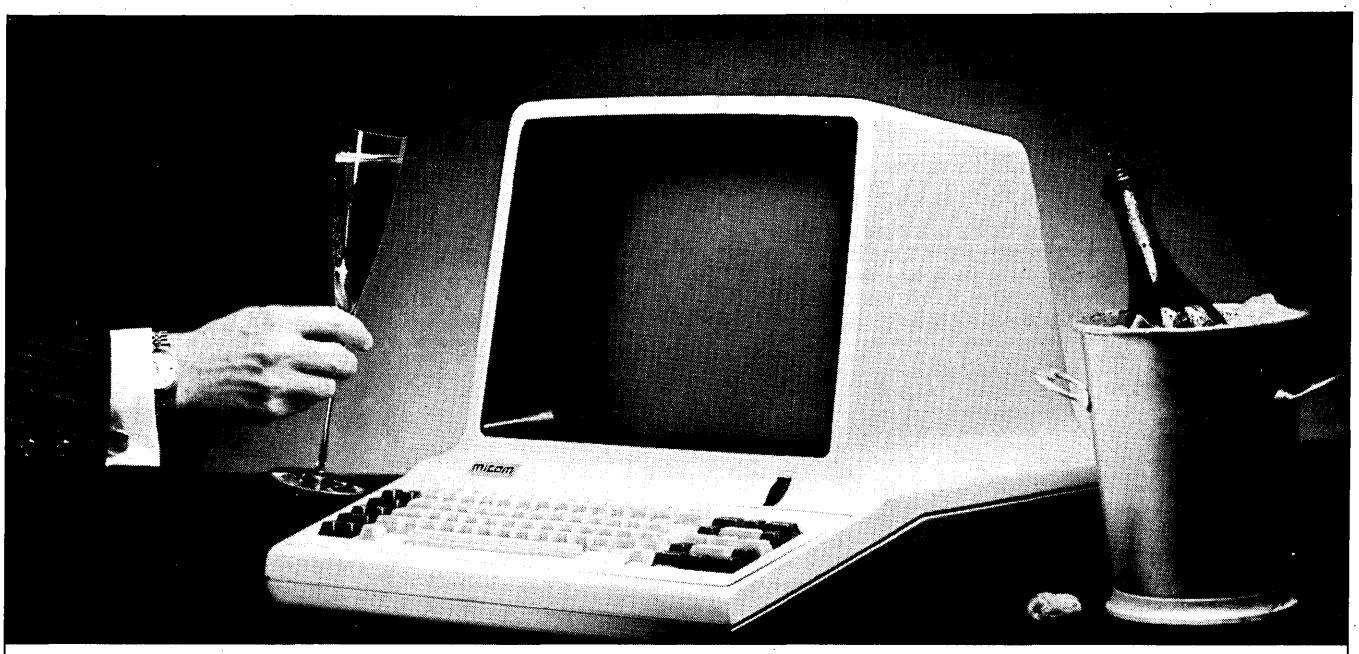
Ampex's audio and visual products account for two-thirds of total corporate revenues. Also, the company has expanded its tape drive and core memory product lines, which account for the remaining one-third of revenues. Corporate growth rate in 1980, however, barely kept pace with inflation, increasing 13% to approximately $170 million.

Part of Ampex's turnaround since its near bankruptcy in '71 is due to the development of a cheaper process to produce a faster core memory. Still, the core memory market is expected to decline because of advances and cost savings in semiconductor technology, rendering core obsolete except in situations demanding extreme memory reliability. Dataram and EM&M are Ampex's most substantial competitors.

In 1980, the company signed a manufacturing licensing agreement to produce core memory products for Control Data in Taiwan and Hong Kong. Ampex will also establish a repair and refurbishment program for the installed base of Control Data core memory products, and will purchase selected Control Data capital equipment and parts inventories related to the core memories.

Ampex has other products it hopes will take up the slack of the declining core market. Four years ago, it introduced a high-speed all-electronic alternative for fixed head drives designed to fill the "access gap" between the main memory of the Nova and Eclipse minicomputers and peripheral storage devices. Sales are good. In 1980, Ampex began shipments on a new model, the Megastore M-316, compatible with the Honeywell H3-16. The Ampex Business Computer (ABC), introduced in 1979, plug-compatible with Data General minis, and designed for the oem and turnkey systems market, is doing only fair. In 1980, Ampex introduced its first terminal, the Dialog 80, a semismart crt sold independently. So far, Computer Automation has been the largest customer. In 1980, the Dialog 30, a dumb crt was announced and is priced at about $800.

Ampex also serves two additional, rapidly growing components of the memory market: the oem noncaptive digital tape drive market, expected to grow about 50% per year over the next three years, and the larger oem noncaptive disk market, expected to grow about 50% during the same period. The company reports record orders but has lost market share to Control Data.



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Or call toll-free: **800-527-0937.** In Texas call: **214-386-5580.**

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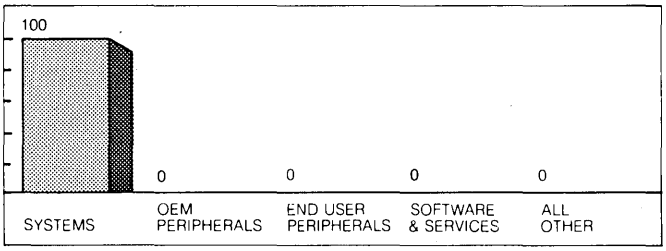

1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
74	165	175	1,100	165	SEPT.

APPLE COMPUTER, INC.

10260 Bandley Drive
Cupertino, CA 95014
(408) 966-1010

Another year of explosive growth for Apple raised revenues to $165.2 million, up 175% from '79 revenues of $60 million (a restatement from $79 million in the 1979 DATAMATION survey). Apple's rise to become a Top 50 company is one of the more remarkable accomplishments in dp history, considering that three years ago, its first year of revenue, total revenues were under $2 million.

Employment rose to 1,100 up over 80%, and R&D expenses increased to $9.5 million, up almost 100%. Management's expectations for continued near-term growth is best exemplified by its capital expenditures which grew eightfold to $10.4 million. Apple is extremely profitable (operating margins in excess of 20% and after-tax margins at 10% in 1980) and has generated enough working capital from operations to fund all its capital requirements since 1978. However, in order to ensure sufficient capital for future expansions, Apple went public in December and raised $90 million.

The main product is the Apple II, a microcomputer which retails for as little as $1,200, although fully configured systems can cost $5,000. Shipments in fiscal 1980 (year ending September) rose to 78,000 units, up from 35,000 in fiscal 1979. Shipments accelerated further in the last three months of 1980. A more powerful Apple III was introduced in May 1980, and although shipments were to begin by September, manufacturing and product engineering problems have caused delays.

Distribution and marketing have undergone several changes. In early 1980, Apple terminated independent distributors and established company-owned regional support centers. This distribution restructuring was accomplished to provide better support to Apple's 850 domestic dealers.

International distribution has also experienced a change. Prior to August, foreign sales were made exclusively through Eurapple, a U.S.-based distributor that sold to independent foreign distributors. In August, Apple acquired Eurapple's distribution rights. In September, Apple established a distribution, marketing, and education center in the Netherlands.

Several key management changes and additions were accomplished in 1980. Carl Carlson became executive vp of operations. Andre Sousan, who had been president of Eurapple, has joined the corporate staff and is expected to develop opportunities in Japan and Canada. Thomas Lawrence, formerly with Intel, joined Apple as general manager of the European operation. Finally, Dr. John Scott, a leading Winchester disk design executive from Memorex, has joined Apple as a director of engineering for peripherals.

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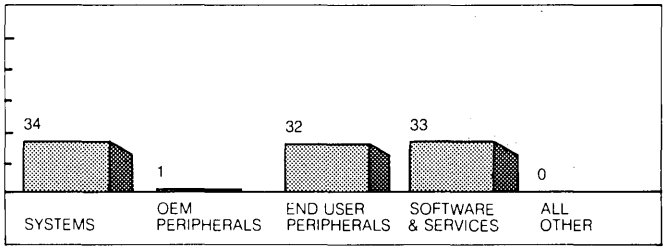


1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
45	147	8	7,050	468	DEC.

BUNKER RAMO CORPORATION

900 Commerce Drive
Oak Brook, IL 60521
(312) 986-2700

Weathering the recession with a 10% sales increase and greater employee productivity drove BR earnings up 16% to $27 million. Bunker's non-dp products: connectors, fiber optics, textiles, and sonar equipment, performed slightly better than its dp products.

For the last six years, the electronic information systems division has had an inconsistent growth record, fluctuating between 0% and 15%. Last year, dp revenues increased 8% to $146.6 million, less than 1979's 15% increase. Dp operating margins declined slightly from 10% to 9%. Although total corporate employment dropped 400 to 9,400, division employment remained constant at about 2,500.

Bunker's growth lies with the banking control systems which now account for more than 60% of revenues. It has continued to expand its standard transaction programming language.

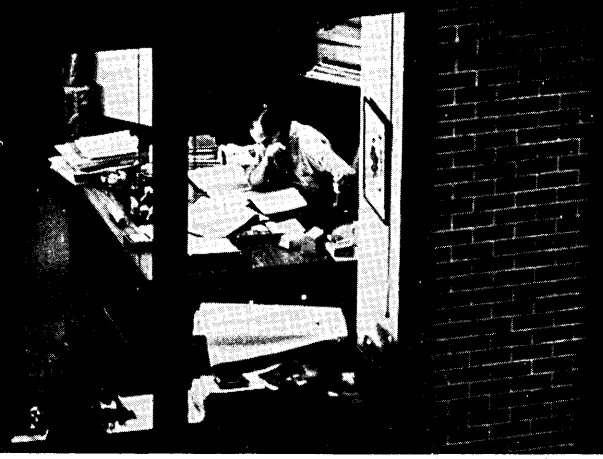
Bunker Ramo has entered into a favorable agreement with Diebold, which produces automatic teller machines (ATMs). The companies fund joint software development, engage in joint marketing, and sell each other's products as part of their systems. Bunker has also expanded sales of the banking control systems into the insurance industry which now account for about 10% of its sales. In 1980, a major contract was signed with Aetna Life and Casualty to equip branch offices with the System 90 terminals.

Bunker Ramo is continuing overseas expansion. It has been operating abroad for just a few years, but banking systems sales have slumped 70% to $23.9 million in 1980 after a 35% climb in 1979. Over 6,000 installations are now in Europe in the U.K., Germany, Spain, the Netherlands, Switzerland, Yugoslavia, and Bulgaria, in the Far East in the Philippines and Hong Kong; and in South America in Chile, Ecuador and Costa Rica.

A European distribution arrangement has been made with Plessey in the U.K.

While Bunker Ramo does sell an occasional minicomputer or terminal in the oem market, it does not plan to expand in this direction.

This ad wouldn't exist if you had it easy



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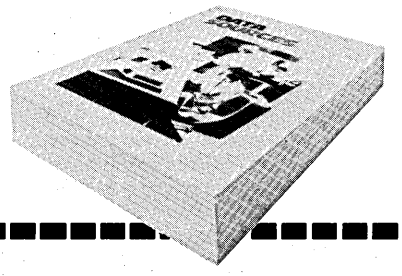

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DATA SOURCES

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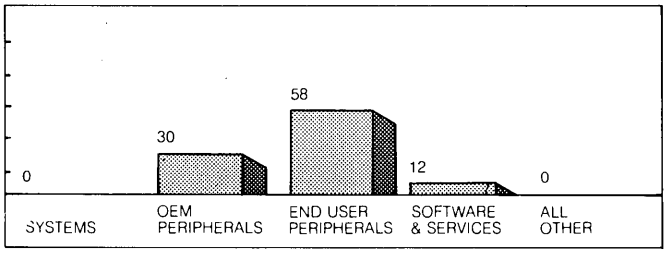


1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
82	145	209	2,500	318	JULY

SANDERS ASSOCIATES, INC.

Daniel Webster Highway South
Nashua, NH 03061
(603) 885-4321

Sanders jumped into the DATAMATION Top 50 by acquiring Calcomp and the related Talos Systems, and performed well as the leading producer of refresh stroke graphic displays. Sanders acquired a scaled-down version of Calcomp—without its PCM disk drives, add-on memory, and oem peripherals. This approximately $70 million business is the leading supplier of pen-and-ink vector plotters and an important supplier of electrostatic plotters. Talos manufactures digitizers, another important component for the fast growing computer-aided design graphics industry.

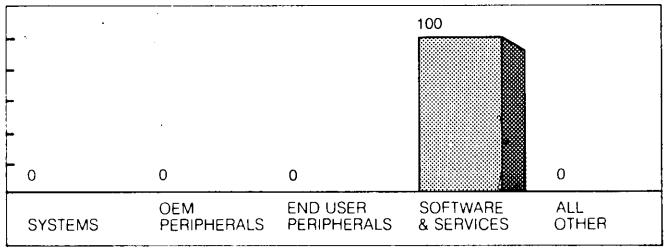
Calcomp, by selling off its losing operations, has become a profitable operation once again. Plotter sales increased for the 20th consecutive year, and are projected to continue their recent 25% growth rate. The Calcomp group introduced nine new products, including the Model 1065 drum plotter and the Model 970 beltbed plotter. In a move to combine the synergies between itself and Sanders, Calcomp began marketing the Graphic 7 interactive display systems. Previously, Sanders had been marketing the Graphic 7 on a limited basis, primarily to government agencies and a few oems. With Calcomp's worldwide sales organization, the product will be marketed directly to end users and is expected to increase the product's market share significantly. Calcomp has also been developing a turnkey graphic system for architectural and engineering design. Progress is expected to be accelerated by its financially strong parent. Calcomp sells and services its products in 42 countries, including the People's Republic of China. Close to 50% of Calcomp's sales were derived from international markets.

Sander's graphic display division increased by 60%, to around $75 million in 1980. Its displays are used for CAD applications, air traffic control, and flight simulation. Sanders also introduced the Graphic-8 refresh raster color display in 1980, which has improved resolution and can use 256 colors simultaneously.

Much of Sanders' growth in 1980 can be attributed to its success in oem graphic display terminals. During the year, Sanders received an additional $20 million order from IBM, its largest oem customer, for production of the IBM 3250 graphic display system. This system is marketed by IBM primarily for CAD applications. Sanders also signed a multi-year contract to produce graphic terminals for Control Data.

Between Sanders and Calcomp, the corporation had $145 million in dp sales, 62% derived from the domestic market. Operating margins of almost 14% are impressive considering the consolidation expenses of the market and the margin problems (deficit in '79) that Calcomp has experienced in the past.

50



1979 RANK	1980 DP REV. (MIL)	% DP GROWTH	1980 DP EMPL. (MIL)	1980 TOTAL REV. (MIL)	FISCAL YEAR ENDING
48	143	19	4,300	143	DEC.

BRADFORD NATIONAL CORPORATION

1500 Palisades Avenue
Teaneck, NJ 07666
(201) 833-1020

Bradford, a $142.7 million New York company, provides a broad array of services to financial institutions, securities firms, industry, and government. Total revenue in 1980 increased nearly 19% over 1979, following a 1.2% increase in 1979 over 1978. All market segments reflected increases, but 40%, or $8.6 million, of the increment came from health services, insurance, and government loan processing.

Bradford recently received an unfortunate setback in its health care services revenues when the Texas Board of Human Resources awarded Bradford a $3.1 million settlement to terminate a four-year contract that had a potential gross revenue value of $2 billion. The business was not expected to contribute to BNC's earnings until 1982, but its significance lies in the higher profile BNC would have assumed in the medicaid market.

Bradford is competing with Electronic Data Systems, Computer Science Corp., and other firms to provide Medicare processing services for the 20 states federal legislation may force to automate. Processing services for the New York State Medicaid program alone provided 18% of BNC's 1980 revenues.

In July 1980, the company acquired the Health Services Div. of Optimum Systems to maintain Medicare patient records and to make payments to doctors. This is known as Part B Medicare for which annual nationwide expenditures are currently about $10 billion. Bradford is also developing a computerized Medicare information processing system to maintain patient records and to make appropriate payments to institutional health service providers. This is known as Part A Medicare for which annual nationwide expenditures are about $23 billion.

In 1980, service to financial institutions grossed $96 million, up 22%. Bradford Trust Operations, an on-line accounting and reporting system, now serves 87 trust departments with over 98,000 accounts and assets. Bradford Broker Settlement, Inc., was established to offer computerized clearing and processing services to stock brokerage firms. Revenues in 1980, however, were nominal, and expenses high.

The company has functioned in the fixed income segment of the securities industry for many years through its affiliate, Bradford Securities Processing Services, Inc. (BSPS). In 1980, BSPS cleared more than $75 billion in municipal bonds and provided services to over 250 brokerage firms. To reduce costs, Bradford proposed an automated municipal bond comparison and netting service and applied for SEC approval in 1977. When National Securities Clearing Corporation (NSCC) also applied for SEC approval, Bradford proposed development of an automated interface. Various legal steps by both companies resulted in a Feb., 1981, settlement under which NSCC dropped the court action and Bradford agreed to participate in an NSCC system as a nonclearing agency participant.

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51 NIXDORF COMPUTER CORPORATION

168 Middlesex Turnpike
Burlington, MA 01803
(617) 273-0480

Nixdorf Computer, a subsidiary of the privately held West German Nixdorf Computer AG, has completed a strong year with revenues up 36.8% to $137 million. Nixdorf has done well in the U.S. with its distributed dp and its data entry systems (77.5% of 1980 revenues). Sales of dp systems grew from 1,065 systems in 1979 to 1,185 in 1980, and average sales prices increased 12.5% as a result of larger configurations. High-volume data entry service bureaus led the list of Nixdorf customer bases in both 1979 and 1980. Maintenance revenues have grown 38% to $22 million, while field service and field engineering support employment have increased 14% to 534. U.S. employment has grown an estimated 16% to 2,036 in 1980, although the firm has been troubled by turnover.

The feisty minicomputer company is facing fierce competition in its small business computer market in West Germany from IBM, Siemens, and Triumph Adler. Although U.S. sales of small business systems have increased 67% to $10 million, they still account for less than 8% of total revenues. Nixdorf markets software packages for construction packages, wholesale distributors, and insurance agencies. A mortgage closing system that simplifies form preparation was introduced, and sales are reported to be excellent.

Management sees plug-compatible as the path for growth in the U.S. In 1981, it plans to introduce a high-capacity plug-compatible mainframe to accompany its plug-compatible minicomputers and software. Nixdorf's Elbit-derived minis, 8890 model 30 and model 50, are competing against IBM's model 4331 and 4332, and its 8860 Series of ddp systems are competing against IBM's 8100. In May 1980, Nixdorf purchased Computer Software Co., Richmond, Va. Renamed Nixdorf Computer Sofware Co., NCSC absorbed Nixdorf's previous software operations; its version of IBM's DOS/VS operating system, called EDOS/VS, will be integrated with Nixdorf's other plug-compatible software. Systems support personnel were increased 23% to 215, and a new group was established to design custom software.

The Nixdorf R&D operation in Burlington, Mass., has worldwide responsibility for technological development and improvement of data entry and ddp systems. It is the major R&D center for the Nixdorf Group outside of West Germany.

52 CENTRONICS DATA CORPORATION

One Wall Street
Hudson, NH 03051
(603) 883-0111

Centronics had a very difficult year in 1980. Production problems with its new miniprinter product line, investments in Quietwriter, and diminished market share in its older product lines caused a sharp decline in operation margins. Revenues did squeak out a 2% gain to $128.9 million, but operating margins dropped precipitously to 3.7% (from 25% the year before). Operating results deteriorated as the year progressed, with the last three months of 1980 seeing a $9.3 million pretax loss, which included a $5.5 million inventory write-down of the inventories of components of older printer lines.

Although Centronic's low-priced printer market experienced a sharp increase in shipments during 1980, the real culprit appears to have been severe price competition in other lines.

Many of Centronics' problems can be traced to its line of miniprinters. Centronics had to shut down its production line for nearly six weeks when it discovered that the printer was randomly shorting and emitting static electricity. It shipped only 25,000 units in fiscal '80. As the year progressed, the production schedule improved. By the end of 1981, Centronics hopes to produce 1,000 units per day and be profitable. However, the production problem opened the way for competitors. Tandy, a client which accounted for 12% of fiscal '79 revenues, yielded less than 4% in 1980. In addition, it is believed that Tandy will only be offering Japanese-made printers in the future.

All is not bleak, although Centronics will have to fight hard to regain its lost market share. Directing the turnaround will be Michael D. Kaufman, a former Xerox executive, who has been named president, relieving Robert Howard, who remains chairman and chief executive officer. Immediately after taking his position, Mr. Kaufman reorganized Centronics into three product groups and named six new vice presidents.

In addition to miniprinters, Centronics expected to introduce a new line of dot-matrix printers that will replace its existing aged product line and compete with the more expensive daisywheel printer products.

Longer term, Centronics is betting heavily on its new typewriter technology-based printer, Quietwriter. The Quietwriter has an infinite front flexibility and multicopy capability that uses fully formed characters. It uses a stylus controlled by electromagnets, and among its most prized characteristics is its silence. The target is the computer terminal market, a market of several hundred million dollars. Scheduled to be introduced at the 1981 NCC, Quietwriter is also planned for production by year-end 1981, with volume shipments and profits expected by mid '82. Centronics named two former Digital Equipment managers as product line managers for Quietwriter.

In order to bring Quietwriter to market along with its new lines of matrix printers, Centronics has been investing heavily in R&D. Expenditures increased by 73% to $6.3 million in 1980. If Quietwriter becomes a successful product, Centronics may again be very profitable, although not as profitable as it has been. However, Centronics is likely to experience another difficult year in 1981. We would not be surprised to see the dividend, already lowered to 10 cents from 25 cents per quarter, eliminated entirely.

53 TANDEM COMPUTERS, INC.

19333 Vallco Parkway
Cupertino, CA 95014
(408) 725-6000

Tandem continues its rapid growth in revenues (94% over 1979) and profitability (115% over 1979). Calendar 1980 revenues of $128.8 million are impressive. During 1980, Tandem delivered 653 word processors to 198 customers.

Tandem products are unique in this characteristic of nonstop operation due to a redundant hardware and reliable operating software. Tandem systems contain two to 16 processors, and may participate in networks of up to 255 other Tandem systems. Because of high reliability and upgrade capabilities, Tandem products have found lucrative application markets: electronic banking, manufacturing and transportation systems.

Software products include ENCOMPASS, a relational database system introduced in 1980 in which portions of the database may reside where they are locally needed most often, yet are available to and consistent with all other systems in the EXPAND network. Other 1980 products include several data communications packages for non-Tandem systems via HYPERChannel (a product of Network Systems, Inc.).

Tandem is expected to continue its strategy of redundant and flexible hardware, adding software that capitalizes on the systems' strengths. While Tandem regards the potential market as the entire on-line transaction marketplace, it will continue to find its main growth in application niches where reliability is paramount.

In 1980, Tandem crossed that vague business boundary from a large small company to a small large company (the $100 million barrier). Historically, many minicomputer companies have had management problems at this stage of their development. The next several years are critical to Tandem, and will determine whether it is to be an industry giant or an industry specialist.

54 PLANNING RESEARCH CORP.

1850 K Street, N.W., Suite 1100
Washington, D.C. 20006
(202) 293-4700

In October 1980, Planning Research Corp. completely reorganized. Dp-related activities are now handled by both the commercial information systems group and the government information systems group. The latter group, the largest of the two, brought in approximately $73 million in 1980, an 18% increase from 1979, and 57% of total dp revenues. The firm has been awarded over 700 federal contracts in the past six years. Contracts with NASA totaled approximately $40 million in

1980. PRC's largest dp contract with NASA is for operation of STIF, (Scientific and Technical Information Facility). The project makes NASA's research accessible to other fields: to accomplish this goal, PRC abstracts catalogs and microfilms NASA's research reports so that the information can be accessed through remote terminals by private industry. PRC also has contracts for running a number of automated NASA systems, including a system that allocates space shuttle costs. PRC also performs defense intelligence system support and a number of other high-security contracts for the Department of Defense, NATO countries, Korea, and other governments.

PRC's commercial information systems accounts performed well, with a 41.7% growth to $58 million in 1980. The star performer, with sales of about $35 million, was real estate systems. The service is made familiar to more than 115,000 real estate agents and home buyers by a weekly publication of approximately 70,000 computer-generated multiple listing service reports in over 135 locations. It is accompanied by an on-line version accessible from 9,700 leased Teletype and Texas Instruments terminals tied into minicomputers in 101 geographical locations. In 1980, PRC introduced BOSS, a microcomputer-based system for real estate offices to handle financial accounting, word processing, and property management. Clients using BOSS can also access the multiple listing service database if they lease a modem, but most clients retain existing terminals and add on the microcomputer. PRC hopes to expand automation in the real estate industry to include title searches and assessments. PRC, however, still faces competition in the specialized small business system market. Nixdorf, for instance, claims to have gained a 35% market share for a specialized mortgage closing system in only one year.

The commercial business unit also handles sales of a user-oriented software package and sales of systems designed for police and fire departments. In 1980, PRC retrenched from a short venture in the European software market. It established a business in the U.K. in 1979 that provides software for Prime and DEC minis. The company phased out the operation in December 1980 because of unanticipated expenses and market softness.

55 GENERAL AUTOMATION INC.

1055 S. East Street
Anaheim, CA 92805
(714) 778-4800

It was another disappointing year for GA, with revenues up only 7% to $127 million; 1979's modest earnings of $240K turned into a $16 million loss in 1980. The work force was cut by 15%, and R&D expenditures declined 6%.

A new management team was installed over the course of 1980; the most important appointment was that of Leonard Mackenzie as president and ceo. Mackenzie was previously president and ceo of Northern Telecom Systems. He replaced Frank Grisanti, a management consultant specializing in turnarounds who had taken on the presidency in 1979. A new vice president of marketing, Stephen McKenzie of Xerox, was chosen in May, and Richard Cortese of Northern Telecom was named vice president of operations in September. In December, John Murray was promoted from corporate controller to vice president, finance, and treasurer.

General Automation is now trying to redirect its energies toward the general-purpose minicomputer business. During the past few years, its has ventured into complex specialized markets which have required unprofitably large hardware and software investments. The company's principal business (75% of revenues) is the sale of computer systems for factory automation and management, as well as systems for international telecommunications and electronic funds transfer. Some of these systems are delivered turnkey; General Automation oems the peripherals and supplies the minis and software itself. About 25% of revenues come from the sale of "products and components," including printed circuit boards, circuit board laminates, and intelligent terminals. Much of this production is used internally.

56 INFORMATICS

21031 Ventura Boulevard, Suite 800
Woodland Hills, CA 91364
(213) 887-9040

In 1980, Equitable Life Assurance sold its remaining 61% of outstanding shares of Informatics common stock. Although revenue growth slowed to 12% in 1980 from 21% in 1979, operating margins have improved dramatically to 6.6% from 5.5% in 1979 and 4.6% in 1978. Margins were helped by improved employee productivity as dp employment decreased by 7% to 2,500. Pretax income increased a whopping 47%, to $7.7 million, although a higher tax rate shaved earnings improvements to 33%, at $4.1 million.

Informatics organizes its business by three groups: software products, which grew 5% to $38 million last year; professional services, which grew 3% to $36 million, and processing and processing services, with 26% growth to $53 million.

The most widely recognized group is the company's modestly profitable software products group, whose Mark IV batch implementation-oriented system cumulatively exceeded 2,000 installations at 1980 year-end (an increase of 18%) and has contributed over $100 million in revenues since its introduction in 1967. Mark IV and related system products account for nearly half the revenues of the group. An advanced transaction-oriented on-line implementation will be introduced in 1981.

For the second consecutive year, the largest revenue gains were in information processing services. The most profitable line was litigation information services, which provide information resource management for attorneys in large-scale cases (such as antitrust and major contract disputes). Management is trying to draw on this technology and approach by establishing Info Dynamics, a joint venture with Management Analysis Co. of San Diego, providing information resource management services to utilities for regulatory compliance. The firm is also developing its industry data services and last year delivered eight turnkey systems. Early in 1981, this service was expanded by acquisition of Transportation Computing Science and its major subsidiary, Commercial On-Line Systems (COL). These companies provide a range of financial on-line services to the apparel industry.

With an eye to the future, R&D expenditures for software development were increased 34%. A portable software system for screen generation and database management was purchased and will be developed.

57 THE BOEING COMPANY

BOEING COMPUTER SERVICES COMPANY
177 Madison Avenue
Morristown, NJ 07960
(201) 540-7700

Boeing Computer Services (BCS) was formed in 1970 to service internal computing needs of all Boeing divisions; nearly two-thirds of its activities are still in-house. The company does not report division revenues and would not bless our estimate for BCS of $125 million in 1980 (less than 2% of total corporate revenue), a 30% increase from our 1979 estimate of $96 million. It now has 2,000 active accounts, and the number of commercial orders are up 28%. BCS employment has increased 10% to 7,300, and marketing has been completely reorganized. The federal region remains separate, while the Eastern and Western regions have been split into the Eastern, Central, Pacific-Northwest, and Pacific-Southwest divisions.

Boeing's financial industry services group is doing particularly well. In 1980, it had 123% more contracts than in 1979 for its thrift services, bank services, and electronic funds transfer. Financial clients use the EIS, an interactive financial planning system originally developed for in-house use. It offers budget performance tracking, product line forecasting, consolidations, cash control and foreign currency conversions.

The firm is quite active in dp education. In 1980, it opened an education and training division and now services more than 10,000 students at its national training center in Seattle. Client firms include commercial airlines, banks, and a major automotive manufacturer. In 1980 the package was expanded to include microcomputer applications, word processing in office systems, and networks and distributed data processing.

The federal system group has added a new division to market facilities management. Although GSA's federal contract revenue is significant, its growth has not kept pace with other sectors.

In 1980, GSA awarded an $8.4 million army contract to BCS and a smaller Navy contract for systems to manage enlistee data and to allocate training opportunities and class-

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room space. Under subcontract from Sandia Labs, BCS will develop a data information management system for the Department of Energy.

BSC has continued to expand its offerings of scientific packages, and has purchased another Cray I computer for its Seattle data center, bringing the market value of BSC hardware to over $400 million. New software packages from BSC include finite element modeling programs and a powerful interactive graphics program.

58 THE TELEX CORPORATION

Computer Products, Inc.
6422 East 41st Street
Tulsa, OK 74101
(918) 627-2333

Computer peripherals, the primary product of Telex Computer Products (TCP), showed a healthy growth rate of 19% to $118 million in 1980 from $103 million in 1979 and $88 million in 1978. After several years of withdrawing various plug-compatible (PC) products, the company's Telex PC tape drive and 3270 PC terminals enjoyed market acceptance. New products, including an improved financial terminal, a line of tabletop printers, and a high performance line of rack-mountable tape drives, also sold well. End-user peripheral and terminal revenues increased 14% from $57 million while oem peripheral and terminal revenues increased 40% to $18 million and hardware/software maintenance revenues increased 19% to $33 million. Revenue from financial leases surged 58% despite a decrease in unit revenues due to discounting of institutional leases because of high interest rates. TCP is successfully remarketing previously leased equipment.

Following poor profits of less than a million dollars for the fiscal year closing in March 1980, dp operating margin has been greatly improved, from 7.6% in 1979 to 9% in 1980. Employment is stable despite increased production, indicating improved productivity. R&D has not kept pace with inflation, and capital expenditures have been reduced.

International dp revenues, including the Asian and Australian markets, grew by 53% to $41.5 million. In 1981, the company will again market terminals in Europe, both directly and through distributors, to avoid expensive subsidiaries. In 1978 and 1979, Memorex marketed TCP terminals in Europe. This arrangement was terminated, however, because Memorex failed to fully honor its 1978 commitment for the purchase of TCP peripherals. Litigation regarding the sales agreement covering TCP's former European subsidiaries is continuing, and Memorex has filed claims totaling $5 million against TCP.

59 THE REYNOLDS AND REYNOLDS COMPANY

800 Germantown Street
Dayton, OH 45407
(513) 443-2000

Since Reynolds & Reynolds' (R&R) computer business is dependent upon the prosperity of automotive dealers, it comes as no surprise that 1980 did not reach management's expectations. Although dp revenues did increase by 7.6% to $117.8 million, dp operating margins for 12 months ending September decreased to 8.5% from a more lofty 17.7% level in fiscal 1979. Margins continued to worsen throughout 1980, and by year-end, the computer business was probably contributing losses.

R&R's computer business consists of both off-line (batch) and on-line computer services. Products include in-house computer systems with application software programs for general ledger accounting, parts inventory control, parts invoicing, merchandising, lease accounting, payroll, vehicle inventory control, word processing, and others. Over the years, batch and timesharing services for automobile dealerships have been decreasing in importance for R&R, from 66% of 1978 dp revenues to 37% of 1980 revenues.

R&R's turnkey minicomputer system, VIM III, first introduced in 1976, has had enhancements added every year. Sales, which have skyrocketed from $12.8 million in fiscal 1978 to $53.0 million in fiscal 1980, experienced their first quarterly decline during the last three months of 1980. R&R buys its hardware and maintenance services from BTI.

To R&R's credit, the company has not shortchanged its product development efforts in order to show improved near-term results. R&D expenses almost doubled in 1980 to $2.8 million.

R&R is expanding its computer operations in areas outside of its traditional auto dealer domain. During 1981, R&R is expected to introduce turnkey systems to the medical, legal, and contractor markets. These markets are already served by R&R's forms division, and if these customers prove receptive to the new product offering, R&R should be less vulnerable to a downturn in the auto industry.

60 WYLY CORPORATION

UCC Tower
Exchange Park
Dallas, TX 75235
(214) 353-7100

Entrance into the turnkey system marketplace and the $50 million litigation settlement with AT&T were the most significant events for the Wyly Corporation in 1980. Acquisitions and continued market penetration were important factors for Wyly's 35% revenue expansion (to $118 million), which was over 10% above management's stated target. Operating income increased 24% to $10 million as 1980 operating margins deteriorated to 8.5% compared to 1.2% in 1979. This revenue and earnings increase was achieved with zero increase in total employment, highlighting Wyly's improved employee productivity.

Wyly results are derived directly from operations of the University Computing Company (UCC), its wholly owned Dallas subsidiary specializing in computing services and software products in the U.S., Canada, and Europe. In February 1980, UCC spent $16.3 million to acquire Digital Systems of Florida, a turnkey system supplier of DEC microcomputers. Digital Systems is a much welcomed addition. Revenues have grown substantially since the acquisition.

The March 1980 resolution of the Wyly antitrust suit against AT&T resulted in approximately $25 million after tax. This money was used in part to buy UCC Reliability Plus, a computer hardware efficiency package, and interactive APT, a numerical control system designed for novice programmers.

Upgrades in 1980 in Wyly hardware at UCC's Dallas facility (now housing nine major systems) include a CDC Cyber 750, a Cyber 176 and an IBM 370/168. This new hardware will be used in part for a transatlantic link between UCC's London and Dallas computer centers. Wyly software and service development continues to maintain an emphasis on the petrochemical, electric utility, electronics and major construction industries.

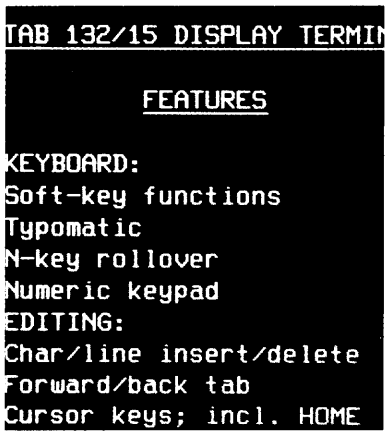
61 UNITED TELECOMMUNICATIONS, INC.

UNITED INFORMATION SYSTEMS, INC.
P. O. Box 8551
Kansas City, MO 64114
(816) 221-9700

United Information Systems dropped from 43rd place to 61st in 1980 as a result of its $63 million sale of Calma to General Electric. UIS activities now center on remote computing and network services. Dwarfed by its $2 billion parent, United Telecommunications, Inc., United Information Systems (formerly United Computing) is a rapidly growing and important part of United Telecom's business. Moreover, it provides a base for United Telecom's expansion into competitive and unregulated areas.

United Information Systems' 1980 revenues of $115 million increased 20% from $96 million in 1979 (all figures restated to exclude Calma), but net income substantially decreased to $4.8 million from $5.8 million. Profits are expected to recover in 1981, following heavy 1980 expenditures on expansion and new market development.

The Information Systems Group consists of four companies: 1) United Computing Systems, the largest of UIS' three remote computing service companies, grew 25% in 1980 to $75 million. United Computing installed a CRAY-1S computer in 1980 to enhance its services to the engineering and scientific timesharing markets. 2) United Computing International serves the overseas computer services market. 3) On-Line Systems offers business, financial, and database management products through DEC timesharing equipment. It offers an on-line project management system (OSCAR) for defense, manufacturing, and energy-related applications. On-Line, which was acquired in late 1979, had 1980 revenues of $25 million, up 15%. 4) Uninet Inc. was formed in March 1980. It is the world's third largest packet network, and was formerly used internally by United Telecom. In early 1981, UIS announced that Uninet will be offered to the public, in competition with GTE, Telenet, and Tymnet.



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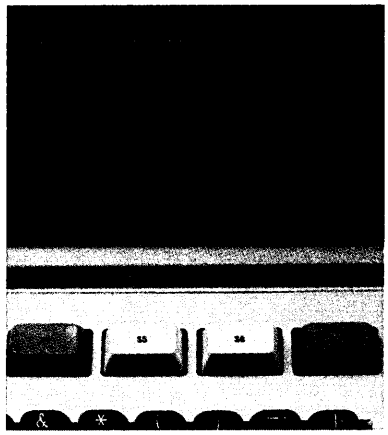
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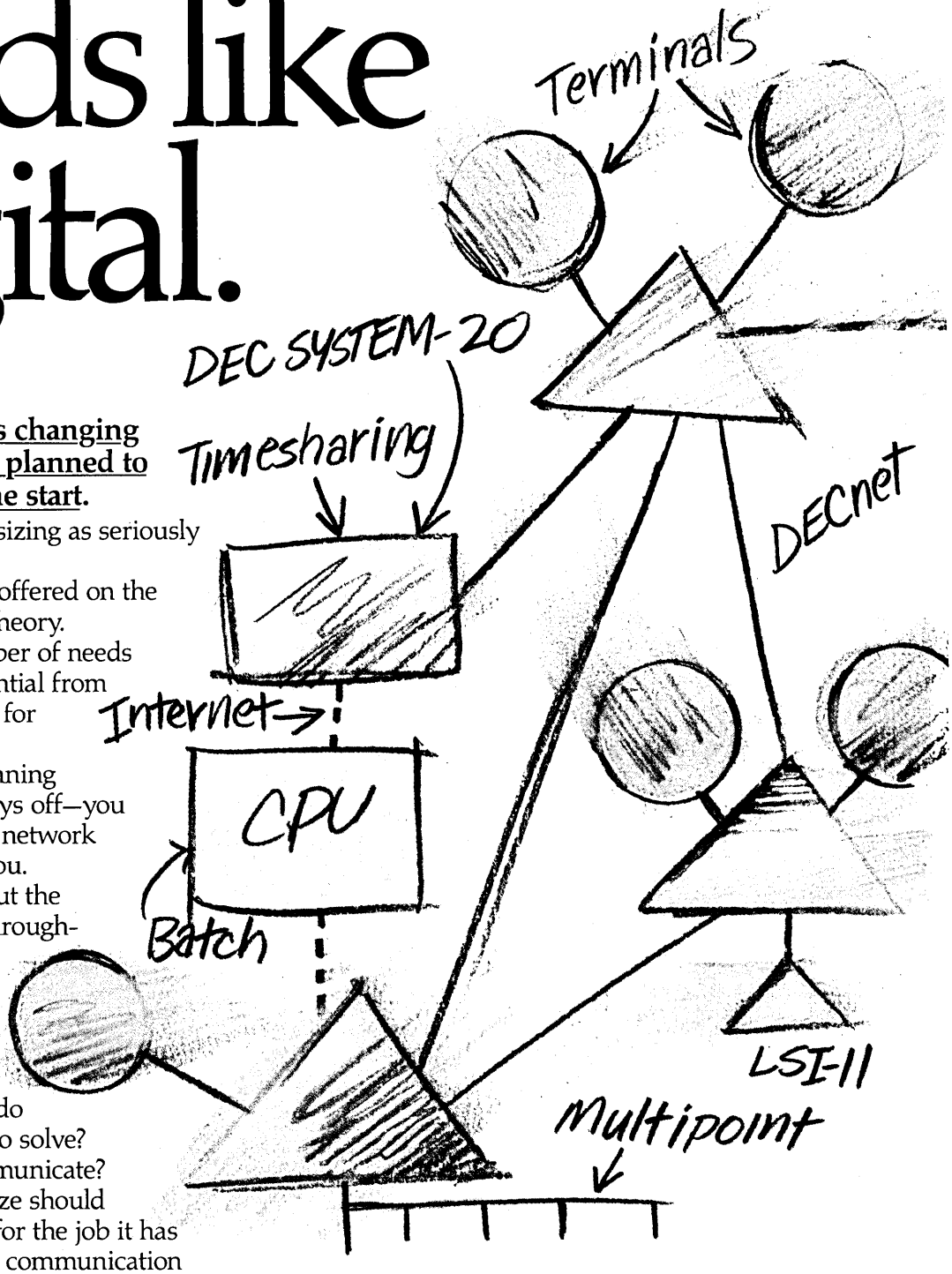

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You'll see networks offered on the "one technology fits all" theory. Networks that fill a number of needs but may not get top potential from your investment or allow for future growth.

At your earliest planning stages—where it really pays off—you can put Digital's years of network experience to work for you.

Experience works out the ideal balance of speed, throughput, cost, data integrity, flexibility, control.

Experience asks the right questions to start with. Basics such as: What business problem do you want your network to solve? What systems must communicate?

To specifics: What size should each individual node be for the job it has to do locally? How much communication

redundancy should be planned to avoid downtime? What options are possible later for future growth?

And how do you meet your requirements most economically?

Digital's range of options.

No other vendor can match Digital's broad range of flexible, cost-effective communications and processor options which allow networks to be sized to your organization's particular needs.

A few examples. Some manufacturers support only BISYNC or X.25. Digital supports Batch BISYNC, Interactive BISYNC, and other standard mainframe communications protocols.

An advanced SNA protocol emulator allows Digital systems to participate in IBM/SNA networks.

And Digital offers X.25 Packetnet™ System Interfaces so Digital systems can communicate to public packet-switched networks.

DECnet,™ Digital's highly functional networking software, provides features not available with mainframe protocols. With DECnet, you have point-to-point, multipoint, and parallel communications.

You can automatically reroute information around problem areas so network operations can continue even when communication links or nodes fail.

Even add new nodes without shutting down operations. With DECnet, you can have complete control.

Your Digital Network Profile.

A Digital team of networking experts will work closely with you, from concept through installation through support.

First, a written Profile details your network requirements. The number and location of each proposed node, each terminal. Types of network applications. Volume of data to be transferred between individual nodes. Data urgency and importance. Line and system reliability, availability, and maintainability. Costs. Network operations and security. Future growth.

Digital's Customer Support Plan.

Based on your Network Profile, our experts, working with you, document how Digital will help satisfy your needs. Installation, start-up, training, network maintenance, troubleshooting. This plan clearly spells out what Digital will do, when it will be done, and how it will be accomplished. Following this thorough preplanning, Digital field service and software support experts will install and verify the hardware and software needed at each node, and demonstrate working network connections.

Digital planning leads to Digital performance.

A working network, ready to go. Ready to perform to the maximum now. Capable of expanding later as your business grows. To date, Digital has implemented over 5,000 network nodes around the world. And we don't just install them. We support them, too, with an international team of over 14,000 service people. At Digital, we're changing the way technology works for your needs.

Digital Equipment Corporation,
129 Parker St., Maynard, MA 01754.
In Europe: 12 av. des Morgines, 1213 Petit-Lancy/Geneva. In Canada: Digital Equipment of Canada, Ltd.

digital

We change the way the world thinks.

62 RECOGNITION EQUIPMENT, INC.

2701 East Granwyler Road
Irving, TX 75061
(214) 579-6000

REI manufactures ocr equipment for centralized processing, distributed processing, and postal/mail processing. These activities account for 70%, 20%, and 10% of 1980 revenues. Revenues increased 15% over 1979 to $113.1 million. More significant was the 41% increase in dp operating income to $10.6 million (compared to $7.5 million in 1979). R&D accounted for $8.4 million; $1.6 million was received from the U.S. Postal Service for R&D related to letter sorting products.

To strengthen its capability in application software development connected with its hardware products, REI acquired the Compdata Div. of Wavetech in July 1980.

The TRACE Image (TRIM) system is the principal product in the centralized processing segment. It allows for computerized processing of image data rather than the physical documents, and it is used by institutions such as banks and credit card companies. With the acquisition of the Data Systems Div. of Cummins-Allison Corp., which was engaged in the manufacture of systems complementary to its own, REI was able to broaden the TRACE product to TRACE I, II, and III, (TRACE II) is the lower speed document transporter, and customers can upgrade it as processing volumes increase.) Other products in this segment include the Currency Verification, Counting and Sorting System (CVCS), which processes currency and issued by the U.S. Federal Reserve system, and INPUT 80, which reads data from typed or printed pages.

In the distributed processing segment, the principle product is the ocr WAND reader which, among other things, can be used in nonfood retail stores for reading and entering information from price tags. In 1980, the capabilities of the ocr WAND were expanded to allow reading of magnetic characters on the bottom of checks.

REI is faced with some formidable competition in all of its businesses, primarily from IBM, Burroughs, and NCR. In addition, various international electronics firms compete in the foreign postal mail processing market and the U.S. postal market may also become more competitive.

63 LANIER BUSINESS PRODUCTS, INC.

1700 Chantilly Drive N.E.
Atlanta, GA 30324
(404) 329-8000

Lanier is on the move. Not satisfied with the excellent results of its entry into the wp arena in 1977, Lanier has revealed an active interest in dp operations with the 1980 release of its "Alert" shop floor control system, a data collection and factory management system.

Despite operating losses reported during the early part of 1980 by AES Data Ltd., the 36.7% Canadian-owned subsidiary that makes Lanier word processors, Lanier's dp revenue increased a healthy 64% over the previous year to $128 million. Net profit for 1980 amounting to $20.2 million, representing an increase of 36% over 1979. As it did with both its dictation equipment and wp ventures, Lanier is counting on its national sales force and a heavy advertising campaign to successfully market the new systems. Its nationwide sales and service organizations are its primary competitive strength.

Lanier's total corporate revenues reached $275 million, up 28% in 1980. Dictation equipment (manufactured by the Japanese) is estimated at $80 million; copiers and microfilm products (manufactured by 3M) is estimated at $40 million; and service represents the remaining revenues not generated by dp. Lanier's profitable relationship with 3M celebrated its 25th year during 1980.

In 1981, Lanier plans to introduce six smart disks and software packages to supplement the programs for its "No Problem" shared logic systems. During 1980, the company began selling a text editing system. Additional enhancements will be required for the company to remain competitive in the hotly contested standalone word processing market as IBM, Wang, and Digital Equipment all introduced new low-cost products during 1980. As volume shipments begin, Lanier may suffer margin pressures from its wp products because of likely price reductions.

64 SHARED MEDICAL SYSTEMS CORP.

650 park Ave.
King of Prussia, PA 19406
(215) 265-7600

Capping a decade of steady growth, Shared Medical Systems' (SMS) 1980 revenues increased by 29% to $106.6 million. The company provides a broad variety of computer-based information processing services, mostly to acute-care hospitals, from which over 93% of its annual revenue was derived last year. SMS is the leading supplier of timesharing services to hospitals, with the balance of its services going to physicians' groups and other health-care organizations. Virtually all of its business comes from the sale of software products to the medical industry.

Although there has been some slippage in profit margins in each of the past few years, 1980 pretax margins were still a healthy 24.6%. Net profit increased 23.5% to $13.3 million. Dp research and development expenditures rose by 31% to $8.2 million. Total 1980 dp expenditures, however, were down 10% to $16.9 million from the previous year, primarily as a result of a $2.7 million decline in the company's spending for buildings, including construction in process. During the last five years, SMS has financed nearly all of its capital expenditures internally.

While most of SMS' revenues come from domestic sales, the company did initiate negotiations last year for establishing an international corporation, to be named SMS International. This company will market SMS technology outside North America. International buisness is not expected to make any significant contribution to earnings for the next few years.

65 AM INTERNATIONAL, INC.

1900 Avenue of the Stars
Los Angeles, CA 90067
(213) 556-9500

The big news at AM International last year was its poor performance and the resignation of chairman Roy Ash in early 1981. Total corporate revenues of $935.7 million were up 14%, but net income was a paltry $2.2 million. Dp revenues were up 49% to $98.8 million, but earnings, if any, were negligible.

Three divisions generate dp revenues —AM Jacquard Systems, AM ECRM, and AM Documentor. AM Jacquard, acquired in early 1979, provides small business computers and a line of wp equipment that ranges from intelligent typewriters to hybrid wp/dp systems. This division has been deeply troubled: it lost $22 million on sales of $44.1 million in fiscal 1980 (ending July 31). A new president, George Vosatka, was appointed in August, following the resignation of president and founder Edgar A. Bolton. Shortly thereafter, 80 salespeople and 11 engineers were laid off. The ax fell again in December, when 80 more employees were laid off, reducing the division's work force to 620. Sales continued to expand during the last half of 1980, although the division has remained unprofitable. Management has stated that it plans to slow its growth (to a "mere" 50% maybe) during 1981 so that it can return to profitability.

AM ECRM manufactures text editing terminals, optical character recognition (OCR) devices, and laser scanner camera systems. This division was acquired in 1978 and had 1980 revenues of $12 million. ECRM is a key component of AM's office automation strategy: merging AM's capability in duplicators with its laser technology to create "intelligent document generators."

The AM Documentor Div. is the world's largest producer of point-of-sale electronic management control systems for the food service industry. Its 1980 revenues of approximately $40 million gave it a 35% share of the food service industry's control systems market. In March 1981, AM disclosed that Documentor was among the several businesses and properties that the company plans to sell off.

66 COMMODORE INTERNATIONAL LTD.

950 Rittenhouse Road
Norristown, PA 19401
(215) 666-7950

Following two consecutive years of over 100% growth, Commodore's dp revenue growth rate slowed to a "mere" 54%, to $98.7 million. (Dp revenues for 1979 have been restated to $64.1 million from $55 million as reported in last year's survey). Commodore remains the dominant European supplier of microcomputers, with 1980 sales of $74.7 million, up 105% from $35.4 million in

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CIRCLE 134 ON READER CARD

1979. Its U.S. revenues, however, declined 13% to $24 million.

Commodore has set ambitious objectives to increase penetration of this market. These efforts were initiated in 1980 by eliminating independent distributors and establishing seven regional distribution centers that will also be dealer support centers. Commodore focused initially on the northeast corridor, running trade shows in Philadelphia and Boston. These trade shows were modeled on the company's successful shows in the United Kingdom. In addition, Commodore, for the first time, is running a national advertising campaign. Gains in the education market were also noteworthy.

Dp capital expenditures increased over 13-fold to $4.2 million in 1980, primarily because of construction of a German plant that opened in October. In addition, Commodore began manufacturing its new low-cost VIC-20 (retailing for $300) in Japan.

Commodore was very active in introducing new products. In addition to the VIC-20, it introduced several peripheral products, including disk drives and printers. Commodore also introduced a point-of-sale (POS) system designed around its self-manufactured 6502 microprocessor. Priced under $3,000, the product will be sold through dealers to grocery stores and later to general merchandisers. Manufacturing is expected to begin in 1981.

Commodore had several management changes in 1980, including the resignations of Bud Frye, president of the semiconductor group; Chuck Peddle, of engineering; and Dennis Burnhart, of international marketing. James Finke was named president, replacing Jack Tramiel, who became vice chairman. Most recently Mr. Finke was in senior management with Data General, and he is an alumnus of Motorola and General Electric.

67 DUN & BRADSTREET CORPORATION

National CSS
187 Danbury Road
Wilton, CT 06897
(203) 762-2511

In its first year as a wholly owned subsidiary of the Dun & Bradstreet Corp., National CSS generated revenues of $124 million, an increase of 12.7% over the $110 million revenue mark posted in 1979. However, excluding computer output microfilm (COM) revenues, the receipts increased by only 6%, to $96.7 million. With 1,875 employees in the U.S., France, and the United Kingdom, NCSS provides software and on-line computer services, image storage and retrieval technology, and computer systems for business information applications. Since becoming a subsidiary of Dun & Bradstreet, the computer network and systems have increasingly been integrated into the delivery of the products and services of other D&B subsidiaries.

NCSS's remote computing service business was strong in the first half of 1980, but slowed in the second half of the year. The database management system, NOMAD, and its recent major enhancement, NOMAD 2, continued as the company's largest revenue producers. NCSS is concentrating its efforts on services geared to functionally specific applications by introducing such products as TEXTMASTER, an information storage and retrieval system, and RESPOND, a human resources management system. Other products soon to be announced include a financial planning/modeling product and an on-line accounting package.

NCSS also markets the 3200 IBM-compatible minicomputer manufactured by Two PI Corp. (since acquired by Four Phase). This operation got off to a slow start after its inception in 1978 and has continually disappointed management in both sales and profitability. The computer operation was integrated into the Remote Computer Services Div. at midyear 1980, and 85 marketing and technical support people were laid off as part of the consolidation. NCSS remains committed to selling the 3200, however, stressing the long-term strategic benefits of a computer hardware offering. A sales acceleration in 1980 was encouraging.

Also posting revenue gains were the Software Products Group, consisting of Turnkey International and the newly acquired Program Products, Inc., of Montvale, N.J. PPI's operations were integrated with those of Turnkey International to form the Systems Products Div. of the Software Products Group. PPI specializes in the development and sale of software products that facilitate information retrieval and reporting. PPI products enable individuals without a large amount of data processing experience to use computers.

Zyton Corp., a 1978 NCSS acquisition with a computer output microfilm (COM) business, continued its revenue growth in 1980 with an estimated 22% increase over 1979. Aiding this upward trend were the acquisitions of five COM services companies, including Micro-Datamation Corp. of California; Texas Microfilm, Inc., COM, Inc., and Data Meeia, Inc., all of Texas; and COM Service Bureau, Inc., of Massachusetts. These acquisitions expanded Zytron's geographic coverage and enhanced its position as one of the industry's leading suppliers of COM services.

68 COMSHARE, INC.

3001 S. State Street
Ann Arbor, MI 48104
(313) 994-4800

Although Comshare failed to duplicate '79's 100% growth rate in revenues, it did have a 31% increase in revenues, to $88.2 million. Net income was down 14%, however, and operating income was down 10%. The company attributed the disappointing year to increased expenditures on new products and computer equipment. Comshare upgraded its computer plant by replacing old memories on its Sigma 9 equipment with 16MB Honeywell monolithic memories, and by replacing IBM gear with two Amdahl V8s.

Comshare is an international computer services company that specializes in "professional" areas, as opposed to industrial or scientific applications. The company has followed two principle strategies during the past decade: market specialization and international expansion.

The specific markets served include financial planning and control, with Comshare's "Parsec" service; human resources management, with "Profiles"; public accounting, with "Compass"; government agencies, with the "Public Services" program; telephone companies, with the "4.1.1" directory assistance administrative service; and bank trust department services, with the "Trust Services" package. In early 1981, Comshare introduced a new color graphics product, "Execuchart."

In June 1980, the French government authorized Comshare to establish a wholly owned computer services subsidiary in France, the largest European market for remote computing services. No other U.S. timesharing firm has received such an approval. Comshare's European group also adheres to the specialization strategy; it offers some U.S. products—the "public services" package is very popular in the U.K., for example—and it creates some of its own based on local market needs.

International and domestic clients connect to Comshare's Commander II computer centers in Ann Arbor, London, and Toronto over Telegrid. The Telegrid Communications Network reaches more than 90 cities in the U.S. and Europe over 25,000 miles of leased telephone circuits. Clients who are not located near a Telegrid city can access the network over GTE/Telenet, a feature which was added in 1980 and expands Comshare accessibility to more than 150 cities in 22 countries.

69 THE SUN COMPANY, INC.

SUN INFORMATION SERVICES CO.
280 King of Prussia Road
Radnor, PA 19087
(215) 293-8000

Sun Information Services Co., a five-year-old subsidiary of the Sun Oil Co., provides dp and telecommunications services, including remote computing services, software packages, and disaster recovery. Its major customers are large manufacturing companies and financial institutions, which account for 70% and 23% of revenues, respectively. It also services other Sun-affiliated companies—SIS was actually formed to serve Sun's information services needs, with a secondary goal of developing outside business.

Total SIS revenues were $97.6 million in 1980, with $86.9 million coming from dp. Dp operating income was $9.6 million, but SIS's overall operating income was only $2.7 million. Management, which accurately projected revenue growth last year, forecasts an annual growth of 25% for the next few years, with revenue reaching $150 million in 1982. Profitability should improve as the company matures and has fewer startup expenses.

Sun Information Services derives 95% of its revenues from the services sector and 5% from software. Its major competitors are

Boeing Computer Services, Martin Marietta Data Systems, the Service Bureau Co., ADP, Informatics, McAuto, and GEISCO.

SIS consists of three divisions: banking services, computer services, and electronics and telecommunications systems (ETSD). SIS has built the banking services division through a series of acquisitions: Weilard Computer Group in May 1978, a computing division of Metridata in February 1979, Applied Financial Systems in May 1979, and Cattalactics Corp. in November 1979. In June 1980, SIS bought NMF, Inc., a privately held data services trust company based in Charlotte, N.C.

The computer services division provides time and programs in distribution management and management control, database management, financial planning, and other applications. It operates three data centers. Computer services also offers the Sunguard disaster backup and recovery service, which became operational in 1979. Sunguard's two data centers in Philadelphia protect computer-dependent clients against loss of data and computing power. The centers are resistant to natural disasters, and have elaborate security systems, their own power sources, and 1,600 telecommunications lines ready. They hold duplicate data tapes for clients and take over all of the client's dp functions if necessary. A third Sunguard center will be opened in Chicago this year.

The electronics and telecommunications systems division, which had 1980 revenues of $17 million, develops software products and services for electronic and telecommunication users, and mini- or micro-based systems for supervisory control and data acquisition. SCADA, the supervisory control and data acquisition system, provides security, monitoring, and process control for remote operations, such as off-shore oil rigs or factories. ETSD also performs data and voice network planning and design, and runs an RF radio equipment engineering and service operation.

70 GOULD, INC.

SYSTEMS ENGINEERING LABORATORIES
6901 W. Sunrise Boulevard
Ft. Lauderdale, FL 33313
(305) 587-2900

Systems Engineering Labs had an estimated 22% growth in annual revenues to about $86.9 million; international sales accounted for about 27%. In September, the company was acquired by Gould, Inc., a diversified electronics manufacturer and a Systems customer prior to the acquisition.

Riding on the popular crest, Systems expanded its energy business with a number of new contracts for equipment for seismic exploration. Systems' simulator market also expanded with rising requirements for maintenance trainers.

Systems, targeted to the industrial automation market, has access to the resources of a major participant in that market in Gould's Modicon division. Modicon builds programmable controllers for factory equipment. Technical and marketing synergy between Systems and Modicon, as well as between Systems and other Gould subsidiaries, is likely to be encouraged.

During 1980, Systems announced its Concept 32, a one-board, 32-bit computer for oems. At the high end, the VPS 6400 CM combines the Systems 32/77 computer with a unique 64-bit array processor to produce an extremely powerful computing engine. This product is used for the solution of problems involving arithmetic processing of large amounts of ordered data, such as that found in image processing or waveform analysis. Software announcements for the year 1980 included Pascal.

Systems has held to its basic SEL-32 hardware architecture developed during the mid-1970s, producing variations (32/77) and reimplementations (Concept 32) but maintaining basic software and I/O compatibility through its growing family of models. Because of its heavy oem orientation, Systems is expected to continue this product strategy, adding compatible hardware at both ends of the performance spectrum and concentrating software development on tools for application implementation rather than on applications themselves.

71 EXXON CORPORATION

EXXON INFORMATION SYSTEMS
1251 Avenue of the Americas
New York, NY 10020
(212) 398-3000

Exxon, with 1980 earnings of $5.7 billion, does not release any financial information on tiny Exxon Information Systems, which accounts for less than .5% of revenues. We estimate Exxon Information Systems' 1980 revenues at $550 million, up from 1979. Earnings were negative. Dp revenues from Vydec, Periphonics, and Zilog were an estimated $86 million, up 39% over estimated 1979 revenues of $62 million.

Vydec, which has been plagued with problems, accounted for $70 million. Vydec's word processing products are generally considered to be technological laggers, and the affiliate's demise is widely predicted. As part of the Vydec/Qwip/Qyx joint sales and service operation, Vydec's standalone and clustered word processing systems could be phased out as Qyx's line of intelligent typewriters expands upward. Nevertheless, Vydec did announce two new products in 1980—the S-100 and S-200 controllers, which turn Vydec's standalone products into shared logic systems which can support up to 16 terminals.

Zilog, with estimated dp revenues of $12 million in 1980, makes the Z-80 microprocessor and a variety of small Z-80 based systems. In 1979, Zilog introduced the MCZ-1, a $7,000 to $18,000 microcomputer. In 1980, the MCZ-2 was announced. Also Z-80 based, it comes in three models. The model 50, which is the top of the line at $12,000, consists of one Z-80A microprocessing unit, a 2.4MB floppy disk system, and a crt. In 1980, Zilog also announced Z-Net, a baseband local network which links its own processors and will be Ethernet-compatible.

We estimate Periphonics at $4 million; the company makes Peripacs, a 64K add-on memory, as well as the Voicepac 2000, an audio response system for bank-at-home applications.

72 COMPUTER AUTOMATION, INC.

2181 Dupont Drive
Irvine, CA 92713
(714) 833-8830

Computer Automation's much-heralded turnaround had halted, at least temporarily, by the end of 1980. While revenues of $81.4 million were up 26% over 1979 revenues of $64.4 million, and earnings were $3.9 million as opposed to 1979's $1.7 million loss, financial results for the second half of the year were disappointing, with revenues up less than 1% and earnings down 46% over the same period in 1979.

Management attributed the poor second half showing to a combination of high operating costs and the impact of the recession on order rates for products from the firm's minicomputer division. Some customers had delayed receipt of previously ordered shipments, while others had postponed making new orders. An 8% cutback in employees of the Naked Mini Div. was made in October, and the attendant savings are expected to aid 1981 performance, although continued higher costs in other areas may force Computer Automation to raise prices for some products.

CA derives half its revenues from sales to oems, making it particularly vulnerable to the general economic climate. Best known for its Naked Mini, CA offers a full line of minicomputers, ranging from the 32K SCOUT 4/04, which costs as little as a few hundred dollars, to fully integrated computer systems capable of developing systems software in the $27K range. The Naked Mini Div. has delivered more than 35,000 computers.

CA's Commercial Systems Div. offers the SyFA distributed data processing system, and the company also sells minicomputer-based automatic test equipment through its Industrial Products Div.

73 MODULAR COMPUTER SYSTEMS, INC.

1650 West McNab Road
Fort Lauderdale, FL 33309
(305) 974-1380

Modular Computer Systems (Modcomp) had another tough year. Although revenues increased 13% to $81.1 million, operating income was down 51% to $5.4 million and net income decreased 18% to $3.8 million. The predicted turnaround has been postponed to 1981.

In the first half of 1980, Modcomp had a price hike; it gained a $20.5 million line of unsecured bank credit in March; installed a new management team; and initiated a venture with AEG-Telefunken. Management changes included promoting Alexander

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but what
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DATAMATION*

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olivetti

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To understand why, just take a closer look at some of the facts. 2,400 research workers in the Ivrea laboratories – some of the largest in Europe – are designing the future. 53,500 people are working in 28 plants distributed in 10 nations. 32 foreign subsidiaries and more than 100 general agents are engaged in direct sales throughout 140 countries.

9,300 servicing technicians, 3,000 software specialists.
By virtue of this Olivetti today offers the widest range existing of distributed data processing systems and equipment for office automation. In fact with its network of terminals and concentrators spreading from the North Pole to Australia,Olivetti does away with continental distances ensuring the organization and flow of information. And with the world's most complete line of electronic typewriters Olivetti has recently brought a new dimension into everyday office jobs – the possibility of increasing productivity while helping to make work more creative.
So, in 1980 the turnover amounted to approximately 2,540 million dollars. 65% of this is accounted for outside the Italian market.

A turnover coming from sales but also from technologies, covered by international patents, that Olivetti exports worldwide, U.S.A. and Japan included. And it is this turnover, this presence extending everywhere, the advanced solutions of its technology that make it possible to affirm that Olivetti is wherever there are people interested in finding out not just what is here today but also what is coming tomorrow. That Olivetti is wherever there's Datamation.

olivetti

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Giles, Jr., from president to chairman and ced; moving John Lobb from chairman to vice chairman (a new post); and bringing in Gabriel Rosica from Foxboro as president and ced.

Under the agreement with AEG-Telefunken, Modcomp sold approximately 1 million shares (25% ownership), for $30 million cash. In addition, the two companies set up a joint venture in Germany called A-T-M Computer GmbH. Based in Munich, A-T-M is 25% owned by Modcomp and 75% owned by AEG. It will sell both Modcomp and AEG equipment, and will serve as a vehicle for technology exchange and licensing agreements.

Modcomp introduced the Classic family of computer systems in 1980. The company announced 10 software packages for the low-to-mid-range systems, Pascal and X.25 programs, and other small products.

An issue that will likely be resolved in 1981 is the four-year-old SEC investigation into the circumstances surrounding the preparation and reporting of Modcomp's 1975 and 1976 financial statements. Modcomp indicated that certain employees may have behaved questionably, and it restated figures for 1973-1977. The accounting policy under scrutiny was one in which sales of equipment that had not yet been shipped were reported as completed sales. As of April 1981, the investigation was expected to result in a negotiated settlement to an administrative proceeding.

14 MARTIN MARIETTA CORPORATION

MARTIN MARIETTA DATA SYSTEMS
6301 Ivy Lane, Suite 300
Greenbelt, MD 20770
(301) 345-0100

Martin Marietta Data Systems is a relatively small subsidiary of the $2.6 billion Martin Marietta Corp. MM Data Systems, a leading services and applications software firm, grew 43% in 1980, to $78 million. In keeping with its parent's businesses, MMDS draws 73% of its revenues from the manufacturing industry, and 22% from the government sector.

Remote computing services account for half of sales. MMDS operates data centers in Orlando and Dnever, which provide IBM and CDC-based services. The Denver center was upgraded and expanded in 1980, and a CDC system was installed. The MMDS network transmits 1.5 billion characters per day, a 50% growth in traffic since 1979. Some subscribers use their own software, while others use MMDS-supplied applications.

Martin Marietta supplies a series of manufacturing software packages. The Modular Applications Systems (MAS) offers engineering control, master production scheduling, purchasing, order processing, and other applications in separate modules, and a variety of versions for use in IBM, Honeywell, and Univac computers. MAS-E is an on-line, interactive materials management system. MAS-H is an integrated manufacturing system for HP-3000 minicomputers.

MMDS's federal systems group has expanded rapidly since its formation in 1979. The company has also formed a professional services group.

MMDS International, England, provides services, consulting, and software to several industries, including retailers, hotels, management systems for automobile leasing, and education and training programs.

In 1980, Martin Marietta Data Systems divested itself of FIS (Financial Industry Systems), a partnership with Hartford National Bank. FIS's three groups—bank facilities management, a transit software package, and a turnkey credit union accounting system —were sold separately; MMDS bought the credit union group for itself.

15 GERBER SCIENTIFIC, INC.

83 Gerber Road West
South Windsor, CT 06074
(203) 644-1551

Gerber Scientific had a very strong year in 1980, particularly in light of the recession-level orders in Gerber Garment Technology (GGT). Dp revenues increased by 42% to $78 million. GGT manufactures a true computer-aided design/computer-aided manufacturing (CAD/CAM) system for the apparel, automotive, and aerospace industries. Prior to 1980, Gerber only participated in the CAM sector with its patented GERBERcutter, a computer-controlled system used to cut limp material. In October 1980, however, GGT purchased the AM-1 Pattern Grading and Marker Making System from Hughes Aircraft.

The AM-1 is a minicomputer-based CAD system used to size pattern pieces and to arrange them to minimize material usage. The AM-1, together with the GERBER-cutter, is one of the few totally integrated CAD/CAM systems. (Excluded from dp revenues, is 35% of this division's revenue, an estimate of that portion of revenues derived from the mechanical cutters.)

Gerber Scientific Instruments (GSI), Gerber's largest division with 42% of 1980 dp revenues, manufactures computer-controlled drafting and photoplotting systems used for CAD/CAM and other applications. Its photoplotters are used for producing master artwork for manufacturing printed circuits, microchips, large-scale integrated circuits, and other applications using high quality graphic masters. GSI also manufactures the PC-800, a low-cost turnkey graphic production system used in the production of printed circuit board master artwork. Introduced in 1980, the PC-800 earned nearly $10 million. GSI also introduced the PC-800 Model 2, an enhanced version of the original model.

Gerber Systems Technology (GST), Gerber's large-end turnkey computer graphics division, had sales of about $15 million in 1980. GST uses an Hewlett-Packard computer, and its application focus is toward mechanical designs, particularly for the aerospace, automotive, tool and die, and heavy equipment industries. This spring, GST filed with the SEC for an initial public offering of 600,000 shares (20% of its common stock). The net proceeds will be used to expand R&D and marketing.

16 CPT CORPORATION

8100 Mitchell Road
Eden Prairie, MN 55344
(612) 937-8000

CPT's revenues increased 68% to $76.4 million in 1980, 68% of which were from U.S. operations. Sales of word processing equipment account for 86% of revenues; software, maintenance, parts, etc. account for the 14% balance.

CPT's thrust is directed at the high end of the standalone word processing marketplace, offering users sophisticated word processing capabilities with both the lower end CPT 6000 and the more sophisticated CPT 8000, which can be enhanced to combine word and data processing with the company's CompuPak software. An interesting feature of the 8000 is a multilingual feature which includes Arabic. Although primarily a standalone word processing company, a new software package, WordPak, brings CPT into the shared-resource marketplace.

During 1980 the company made several changes in top management and moved its corporate headquarters to a new 110,000 sq. ft. facility. Now in the final stages of negotiations is its first overseas production facility (in Ireland).

For the six months ending Dec. 31, 1980, R&D was 3.9% of revenues, compared to 2.7% for the same period in the prior year. A large investment is also being made in electronic testing equipment aimed at improving product quality and reducing service calls.

CPT sells and services its U.S. products primarily through independent dealers, thus reducing the demand for capital expenditures. Internationally, the company markets through distributor networks and is currently represented in 50 countries.

CPT does not manufacture its wp systems and is dependent on other manufacturers for its supply of components. In its quest for market share, the company relies heavily on its ability to offer a wide range of software. Principal competitors are IBM, Xerox, Exxon, Wang, and Lanier, all of which have substantially greater resources.

17 PARADYNE CORPORATION

8550 Ulmerton Road
Largo, FL 33540
(813) 536-4771

Paradyne is a leading manufacturer of high speed data communications products, and has also established itself in the broader market of distributed data processing (ddp) with the 1980 release of the 3270-compatible PDS 270 display system.

Paradyne's revenues increased 83% to $75.9 million and operating income increased 98% to $10.9 million. Management is anticipating continued gains—capital expenditures grew over fivefold from 1979 to $11.5 million. R&D expenses reached $6.3 million, up 98%, and employment nearly doubled.

Paradyne derived 74% of its revenues

from its traditional modem business in 1980, and 26% from sales of its PIX ddp networking systems. Also in the PIX family, Paradyne began delivering its RESPONSE minicomputer in the fourth quarter. RESPONSE is a remote processing system which gives ddp users remote applications processing capability.

Paradyne introduced six new products in September 1980, attesting to its heavy R&D. Four modems were announced, one of which offers 50% more throughput than the standard 9600 bpm modem over voice-grade lines. Two network management products were announced, including the $110,000 DATALYZER system, which measures a network's performance on-line.

By year-end, backlog was up over 88% over 1979's level to $76.7 million. Paradyne completed another successful year in which operating results were up substantially, order rates continued at record levels, and new product introductions broadened its market. Prospects appear highly positive for 1981 and beyond. The company's major challenges in moving into the distributed data processing industry will be financing that expansion against the larger companies entrenched in that territory. Paradyne's management, however, has faced harder tasks in the past, as when they rescued the company from a $3.4 million loss in 1974.

78 BASF SYSTEMS CORPORATION

Crosby Drive
Bedford, MA 01730
(617) 271-4000

BASF Systems manufactures and markets a complete line of magnetic media products, including computer tape, disk packs and cartridges, cassettes and floppy disks. The media group grew 13% in 1980.

BASF Systems, formerly a division of BASF Wyandotte Corp., became a separate entity on Jan. 1, 1981. Concurrently, the company's equity was increased by $10 million in order to support continued growth opportunities in the U.S. market. Even without this additional financing, dp revenues increased by 30% to $75 million in 1980. Management fully expects the company to grow in excess of 25% in 1981.

The most significant growth came from the Peripheral Equipment Group, which soared from $1 million in 1979 to $15 million in 1980. To support this growth, BASF Systems created a separate marketing group for hardware. BASF introduced a 40 MB drive in 1980 to complement its existing 6170 family of 8-inch fixed drives. In July, after six months of production experience, quantity discounts were offered in an attempt to capture the growing opportunities in the oem market. BASF has set up its Peripheral Products Div. in Billerica, Mass., to produce 5¼-inch floppy drives. Their 8-inch fixed disk drives are manufactured in Los Gatos, Calif.

The media business will remain a steady base for BASF Systems, although its growth is not expected to keep pace with the hardware market. BASF Systems is investing $26 million over a three-year period to expand its magnetic media production facilities.

Several management changes have been implemented to help nurture the expected growth of BASF Systems. Dieter O. Heuer became president on Nov. 1, 1980, replacing Guenter J. Grochla, who was appointed chief operations officer for BASF Group in Japan. In addition, many middle management positions have been created to help insure controlled growth. With a new management team firmly in place, BASF Systems seems well positioned to enjoy the explosive growth expected in the oem rigid and flexible drive markets.

79 LEAR SIEGLER, INC.

Data Products Division
714 N. Brookhurst Street
Anaheim, CA 92803
(714) 774-1010

Despite softness in the terminal market during 1980, Lear Siegler managed to show a 15% gain (to $75 million) through its Data Products Division. One of the division's most striking accomplishments in 1980 was its improved productivity. Capital investments were channeled toward automated equipment and manufacturing efficiencies had improved by 50% by year-end. While sales increased by 15%, employment decreased by 17%.

The base product continues to be the ADM-3A Dumb Terminal, sold mainly to the dealer/distributor market with an installed base close to 150,000 units. The ADM-3A+, which was introduced in 1980, is an enhanced version with more bells and whistles. At COMDEX '80 in November, the ADM-5 Dumb Terminal with enhanced editing features was introduced for under $1,000. January 1981 saw the start of shipping for this conversational video display terminal (VDT).

Oem penetration continues to lag the dealer/distributor market, in part because Lear Siegler products have not been suited to oems. In 1980, the Data Products Division announced the ADM-32, a VDT with a detachable keyboard. The ADM-32 affords the oem an upgrade potential from the ADM-31.

Lear Siegler markets its terminals and printers through 25 major peripheral distributors. Many of these distributors have several outlets. In early 1981, Hamilton Avnet, with its 42 U.S. and Canadian outlets, signed on as an industrial distributor. European markets are handled through a wholly owned subsidiary near London, which, like its domestic counterpart, operates through various distributors.

Lear Siegler has a field service group of approximately 100 that provides on-site maintenance. During 1980, service was expanded by providing walk-in depot service for VDTs. Designated EXPRESS DEPOT, this new service enables users to bring in damaged terminals in 28 domestic cities. Service is either immediate or guaranteed within 48 hours, and is priced at $85 per year. This service is the result of an agreement between Lear Siegler and Dow Jones & Co. Initially, the depot centers will only service the ADM-3A and ADM-3A+ Dumb Terminals, although it is expected that the same service will soon be available for the company's other terminals and printers.

80 CONRAC CORPORATION

Three Landmark Square
Stamford, CT 06901
(203) 348-2100

Conrac is a $147 million diversified manufacturer that makes aerospace electronics, telecommunications equipment, dp devices, production machinery, and architectural products. The dp sector contributed 44% of sales and 34% of operating income in 1980. The telecommunications sector, which includes some dp equipment, accounted for 16% of revenues and 33% of operating income. Some dp revenues also come from the aerospace segment (23% of revenues and 5% of operating income). Dp revenues overall were $70 million, up 13% over 1979.

The main dp sector, information handling and control, did $65 million. Its line of crt terminals, sold to the CAD/CAM, medical electronics, and process design oem markets, reached a record level in 1980. Conrac has captured a 70% share of the medical electronics display market and a 65% to 70% market share in orts for process control. It has a 35% share of the CAD terminal market. The information handling and control group also makes intelligent terminals and computer management information systems displays for airlines and airports. In May 1981, Conrac introduced a line of color and monochrome crt monitors for computer graphics.

In the telecommunications sector, Conrac sells dp products through its Alston division, which supplies computer-based traffic engineering and maintenance systems to the Bell System and to the independent telephone companies (and has a 20% market share). Alston also manufactures standalone and portable traffic data terminals.

Dp revenues contributed by the aerospace segment come from its digital data acquisition systems installed on up to 20% of every aircraft type flown by the U.S. Air Force Structural Integrity Program.

81 INTERACTIVE DATA CORP.

486 Totten Pond Road
Waltham, MA 02154
(617) 890-1234

Interactive Data Corp. (IDC), a wholly owned subsidiary of Chase Manhattan Bank, is a dp services company specializing in on-line financial and economic databases. These services include econometric forecasting, financial modeling and simulation, portfolio management and informational inquiries. The Compustat and Value Line databases are among the major securities databases that can be accessed through IDC's timesharing net.

IDC underwent significant organizational changes in 1980 as the consolidation of managements and organizations of Chase Econometrics and IDC was completed. The new

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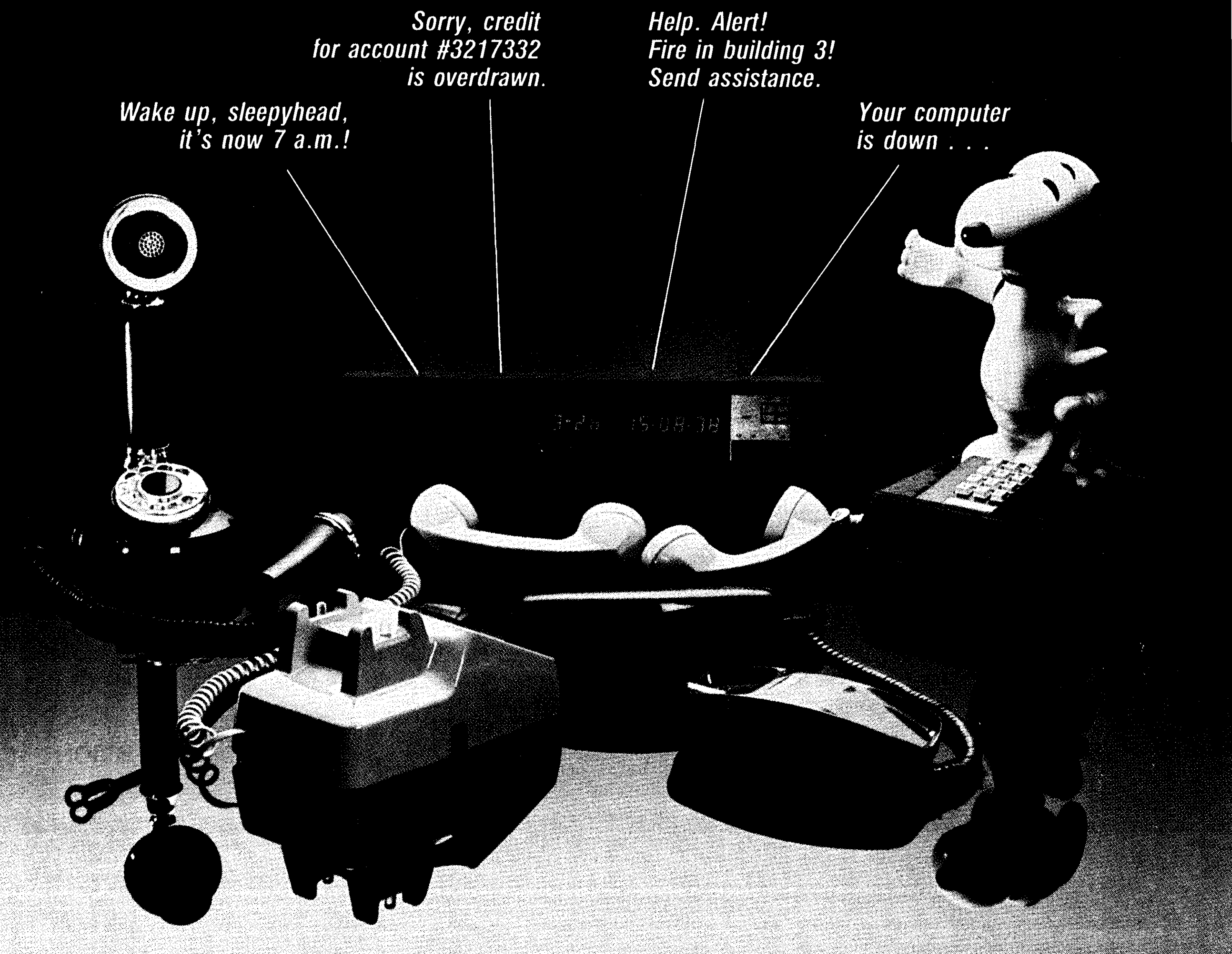

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CIRCLE 139 ON READER CARD

combined organization now consists of two primary business groups—the Business Analysis Group and the Network Services Group—comprising a total of 14 product and support divisions.

Dp revenues grew to approximately $69 million, with IDC's revenues up 30%. Chase Econometrics contributed approximately $13 million to the total and grew about 20% in 1980. Although six of IDC's 25 sales offices in 1980 were located overseas, international business represented less than 5% of revenues. However, IDC's first international sales office was established in London only four years ago. The Tokyo office was the only new international office opened in 1980. About three-quarters of IDC's annual revenue is from timesharing charges; the balance is from subscriptions, consulting, and product sales.

Four major new products or services were introduced in 1980. They were 1) the bank planning service, an integrated financial and economic planning service designed to address the diverse planning needs of commercial bankers; 2) modern portfolio service, an advanced analytical system enabling investors to estimate and control their investment risk and to evaluate the impact of past decisions on portfolio return; 3) the bond portfolio mangement service, which quantifies and analyzes the impact of economic and financial conditions on the return and risk in fixed-income securities; and 4) SHORTERM, an on-line investment management system developed to assist portfolio managers with maintenance and accounting functions.

In order to handle the demands caused by higher volumes and system utilization, IDC continued to upgrade its computing capacity. Two Amdahl 470/V8 computers were installed during the year, replacing the Amdahl 470/V7 and IBM 370/168 computers that were on-line in 1979.

82 APPLICON INC.

32 Second Avenue
Burlington, MA 01803
(617) 272-7070

Inadvertently overlooked as a DATAMATION 100 last year, Applicon's 51% revenue increase to $68.5 million in 1980 clearly makes it one of the faster growing companies. Its operating margins improved slightly to 13.2%, which is quite an accomplishment considering that Applicon increased its R&D expenses 78%, to $8 million.

Applicon is among the leading suppliers of turnkey graphic systems. Its fully configurated systems, priced on the average at over $3,000,000, use a dual processor architecture which encompasses DEC's PDP-11 operating its own 32-bit mini. Its peripherals include both raster scan and storage display graphic terminals, a variety of plotters, and communications equipment that links Applicon systems to each other as well as to mainframe computers. Applicon uses DEC's RSX-11M operating system in addition to its own two- and three-dimensional applications packages. Besides turnkey systems, Applicon manufactures an ink-jet color plotter (marketed through distributors) accounting for 5% of 1980 revenues.

In the United States and Western Europe, Applicon markets most systems through a direct sales force; in other countries it markets through distributors. Foreign sales increased dramatically to $17.1 million, up 137% from 1979, and this was accomplished with only a 45% increase in foreign employment. Service is handled by over 55 field locations.

Applicon's markets have traditionally been the electronics industry—over 60% of its revenues were generated from designing printed circuit boards and integrated circuits. New growth impetus may be derived from mechanical designs, which accounted for 30% of 1980 revenues.

At the end of 1980, Applicon moved its manufacturing organization into a new 120,000 sq. ft. leased facility in Billerica, MA. Its financial position going into 1981 is strong. Applicon's initial public offering last July raised more than $22 million, to which should be added a recently negotiated $20 million line of credit.

83 COMMERCE CLEARING HOUSE, INC.

4025 W. Peterson Avenue
Chicago, IL 60646
(312) 583-8500

Through its CCH Computax subsidiary, Commerce Clearing House (CCH) marked a 36% increase in dp revenues to $67.4 million. Computax provides computer processing services for professional income tax preparers, principally accountants and lawyers. This growth can be attributed to a record number of income tax returns, as well as to several acquisitions made during the year. Operating margins increased to 7.1% from 6.8% in 1979, despite digestion pains regarding the acquisitions.

Computax's finance activity began in January 1980, with the acquisition of the Multi-Tax Division of United Computing Systems. Multi-Tax provides computerized tax planning and tax preparation services for professionals located primarily in the New England area. In April, 1980, Computax acquired R.J. Software Systems of San Diego. R. J. markets turnkey minicomputers to accountants and has an installed base in excess of 1,000. In May of last year, Computax acquired Professional Software Consultants, Inc. (PSCI), which markets applications software to accountants and is a strong complement to R.J. Software Systems.

To capitalize on turnkey minicomputer opportunities, CCH has formed a new subsidiary, CCH Computax Systems. This subsidiary combines the recently acquired R. J. Software Systems with PSCI, and transfers CT Law Technology from CT System Corporation. This new division represents an important opportunity for growth.

CCH is investing heavily in its computer processing services, as evidenced by its 76% increase in dp capital expenditure to $2 million. Management remains confident because the market for dp services in the accounting industry has barely been penetrated. Both legal and accounting customers continually seek to automate more tax preparation and planning applications.

84 QUOTRON SYSTEMS, INC.

5454 Beethoven Street
Los Angeles, CA 90066
(213) 827-4600

Continuing its lead in the booming financial information services market, Quotron Systems expanded revenue by 36% to $63.8 million, greatly exceeding its 20% projected growth. Corporate income, however, increased by only 27% because of higher tax rates since investment tax credits have been exhausted.

Quotron has now captured 50% to 60% of the financial information services market, accounting for 94% of its revenues. In 1980, Drexel, Burnham and Lambert became a customer and the lease base grew from 24,000 to 31,932 terminals. Applications were expanded to include a Dow Jones news retrieval service and a brokerage house distributed network system. These and other customer options generated $21 million in revenues. Customer access, through Quotron Systems, to standarized statistics on the stock, bond, commodity, and option markets generated $39 million in revenues. Factory production of a faster minicomputer, the Quotron 901, is scheduled to begin in December 1981. Additional sales of the Quotron 801 (developed for use in its own systems) to Dun and Bradstreet, the Chicago Board Option Exchange, and the Commodity Exchange Center in New York, generated $2 million (2.4 times 1979 revenue), while maintenance revenues remained fairly constant at about $1.7 milllion. Anticipating continued high demand, Quotron has increased capital expenditures by 70% to $19.4 million, R&D by 26% to $4.4 million, and employment by 23% to 785.

Quotron undertook a joint venture last year to establish Insurnet, Inc. with American Information Development, Inc., and the Continental Corporation. Insurnet will provide data processing, sales support, communication and information services to independent insurance agents. Quotron has invested $600,000, and will provide executive management services to Insurnet in return for 6,000 shares of convertible preferred stock which, when converted, will provide 50% ownership.

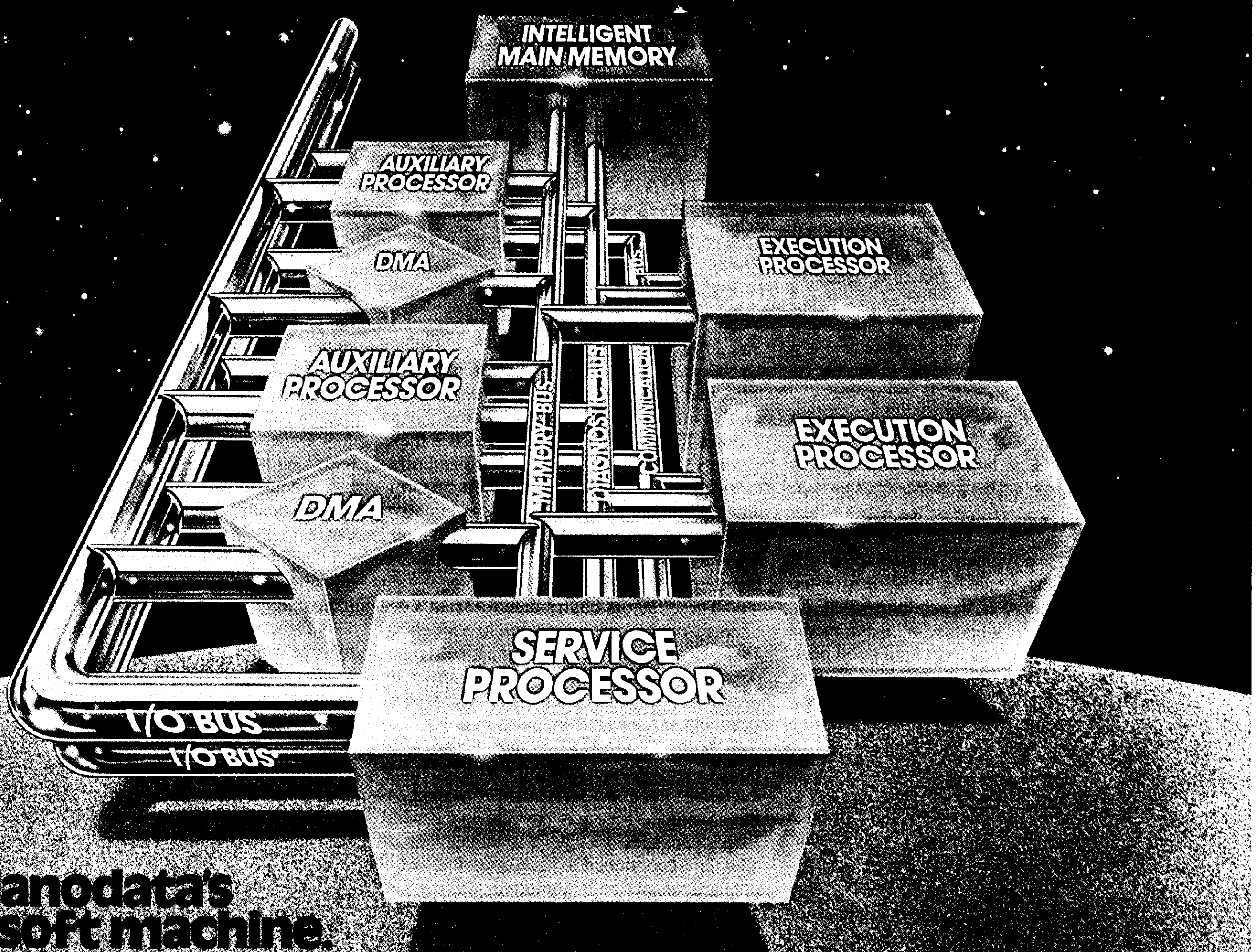
85 DYSAN CORPORATION

5440 Patrick Henry Drive
Santa Clara, CA 95050
(408) 988-3472

Dysan Corporation's 1980 sales were up 86% to $62.8 million. In 1978, revenues were $16.7 million.

Dysan manufactures magnetic media for both rigid and floppy disks. Although rigid disk media account for two-thirds of its revenues, both product lines grew at rapid rates

QMX MAINFRAME



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[illegible]

NANODATA COMPUTER CORPORATION
[illegible]
Buffalo, New York [illegible]
Telephone: (716) [illegible]
TWX: [illegible]

CIRCLE [illegible] ON READER CARD

in 1980. Dysan manufactures 14-inch, 8-inch and 5¼-inch single plates and sells them primarily to oems who incorporate the media into other Winchester-type disk drives. The company manufactures single and double-sided, and single and double density, flexible media for both 5¼-inch and 8-inch floppy drives.

Dysan, a major supplier of disk media, sells to approximately 6,000 customers. Storage Technology (at 13% of revenues) and Memorex (at 10% of revenues) were its largest clients by far. Approximately 65% of revenues were generated by oems, the predominant buyer of rigid disk media, while 10% and 25% of revenues are generated by distributors and end users.

The company has been investing heavily in its own operations as well as in several joint ventures. In February 1979, Dysan funded the startup of Dastek Corporation, and currently has a 76% interest in this thin-film head manufacturer. R&D expenses grew 185% to $10.9 million in 1980 in part because of a $5.3 million expense in R&D for Dastek. However, the investment may be paying off already in that Dastek started shipping initial production quantities of thin-film heads in September. Volume shipments are expected in 1981. With thin-film heads representing a new disk technology, Dastek could become a large company in its own right should its product prove superior to the competitors'.

In April 1980, Dysan entered in to an R&D agreement with Seagate Technology. Dysan funded a portion of the development costs of Seagate's 5¼-inch Winchester-type rigid disk drive in exchange for manufacturing rights.

Dysan is obviously bullish about its prospects for the media business. It invested $25.3 million in capital expenditures in 1980, over double its 1979 levels. With the media business looking strong, and with good positions in two high growth areas within the disk business, it came as no surprise to see Dysan successfully raise approximately $15 million in early 1981 by going public.

86 CRAY RESEARCH, INC.

1440 Northland Drive
Mendota Heights, MN 55120
(612) 452-6650

Cray Research's revenues and earnings have grown dramatically since the delivery of the first Cray-1 computer system in 1976. In 1980, revenues were up 42%, from $42.7 million to $60.7 million, and profits were up 39%, from $7.8 million to $10.9 million.

Cray has an extraordinarily high R&D rate directed toward Cray-2 and hardware and software development for the commercial exploitation of the Cray-1 and Cray-1S. Cray Labs was established in 1979 as a wholly owned subsidiary. A new engineering building has space for integrated circuit development, graphic design, system checkout, and other engineering activities.

Cray Research took several significant financial steps late in 1980. Most important was an issue of common stock during October, providing the company with over $36 million of new capital. In addition, in November 1980, the company declared a three-one stock split and began trading on the New York Stock Exchange.

Finally, the board of directors designated president John A. Rollwagen as chief executive officer of the company. Seymour R. Cray, who had been chief executive officer since the company was founded, will continue as chairman of the board and chairman of the executive committee.

Cray's marketing organization had significant 1980 growth both domestically and internationally. Three new U.S. sales offices were opened—in Chicago, Albuquerque, and Pittsburgh—enabling Cray to continue expansion of its customer base for present and future products. Additionally, a wholly owned subsidiary was established in France; Cray already has foreign subsidiaries in the United Kingdom, West Germany, and Japan.

87 TRIAD SYSTEMS CORPORATION

1252 Orleans Drive
Sunnyvale, CA 94088
(408) 734-9720

Triad Systems's 1980 revenues reached $60.2 million, up 61% over 1979's. Triad is a manufacturer of small business computer systems that are sold to specialty vertical markets. Its market strategy is to identify $50 to $150 million vertical markets, because these markets tend to be less competitive and offer more aggressive revenue and profit opportunities. Triad's initial market, the automotive aftermarket, was affected by a mild winter, high interest rates and deferred automotive maintenance.

These factors contributed to Triad's decline in dp operating margins to 15% from 18%. Yet despite these factors, it still experienced a record year in sales, opened up nearly 25 new sales offices, and increased its sales and service staff by more than 50% (to over 600). Triad also introduced new solutions to the auto-parts industry with the introduction of its Model 30 system. New applications included accounts payable and general ledger packages.

Triad continued to seek opportunities in other areas of the automotive aftermarket, particularly for warehouse distribution and for independent tire dealers. During 1980, Triad introduced the Model 80, a telecommunications-based turnkey system for medium-to-large warehouse distributors with multiple retail outlets. Triad plans to initiate a nationwide marketing effort in 1981, first focusing on automotive warehouse distribution. The company is also introducing turnkey systems to the retail hardware market.

Triad continues to spend a high percentage of sales revenues (almost 7%) on product development. Last year R&D expenses increased 67% to $4.1 million. Capital expenditures are growing even faster (almost four-fold in 1980), largely for Triad's new 50,000 sq. ft. facility adjacent to its current headquarters.

88 GENERAL DATACOMM INDUSTRIES

One Kennedy Avenue
Danbury, CT 06810
(203) 797-0711

General Datacomm completed its 10th consecutive year of increased revenue with a 30% increase, to $57.3 million. General DataComm sells a very broad line of datacommunications gear (nearly 90 different modems and multiplexors) and two lines of diagnostic equipment. Markets range from large companies requiring communications networks to smaller companies requiring only a low-speed modem to transmit data to a central computer.

Development work is directed at both the low and high ends. At the low end, General DataComm recognizes an opportunity with low-cost modems and personal computers. At the high end, it is developing equipment to use data communications technology with fiber optic telephone lines.

The company sells modems ranging in speed from 300 bits per second (bps) to 9600 bps. Multiplexors, which accept multiple digital data signals for consolidation at one end and then separate them back into multiple signals at the other end, are sold in over 15 varieties. Network and diagnostic equipment is used to monitor data transmission sites from a central computer.

General DataComm has two control systems—NETCON-2 and NETCON-5. NETCON-2 has a control unit at the central site and a diagnostic unit within each of the modems. It can test up to 31 stations. NETCON-5 is a more sophisticated system using "out-of-band" signaling techniques, which can test without interrupting data transmission.

General DataComm markets its products to three distinct markets, each accounting for approximately one-third of revenues—domestic and user sales (which include end users, oems, specialized common carriers, international record carriers, and government agencies); domestic telephone and telegraph common carriers and railroads; and international businesses. Two customers, GTE and Bell Canada, accounted for almost 30% of 1980 revenues.

The company markets its equipment primarily through its own sales and service organizations, particularly in the U.S. Internationally, the company maintains eight overseas offices.

General DataComm set up a subsidiary in the United Kingdom in February 1980 and has successfully penetrated the British end-user data communications marketplace. In addition, the company has started manufacturing in its 20,000 sq. ft. facility.

General DataComm is significantly increasing its engineering and manufacturing facilities. During 1980, the new Florida Technology Center opened and the company also purchased a 200,000 sq. ft. manufacturing facility in Waterbury, Conn. The plant is expected to be on-stream sometime during 1981.

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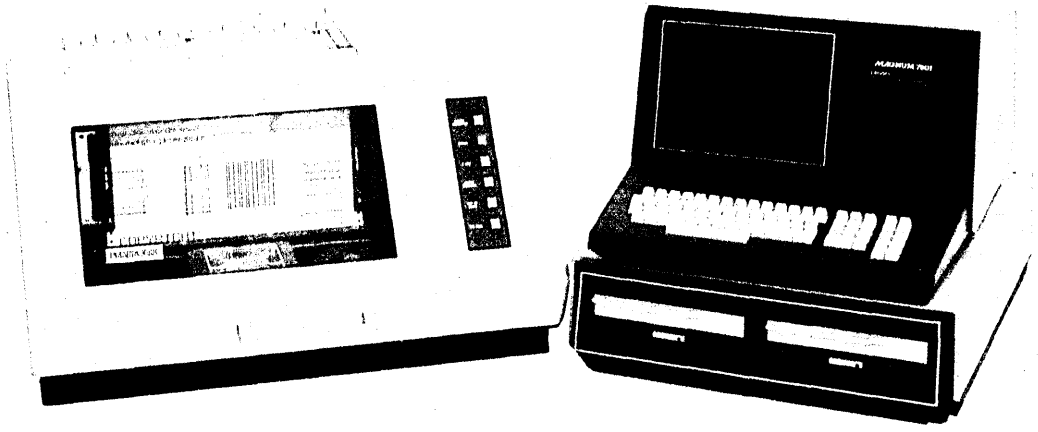


System Description

The Magnum 780F Microcomputer System provides an excellent means for printing low-cost, inhouse industrial labels, various type forms, barcodes and many other printing needs. The system utilizes the rugged, reliable Printronix Printer/Plotter and incorporates all of the powerful features of the QMS Magnum 3000 Controller. The Magnum 780F label development programs are designed to allow the user to create and print labels or forms for various applications.

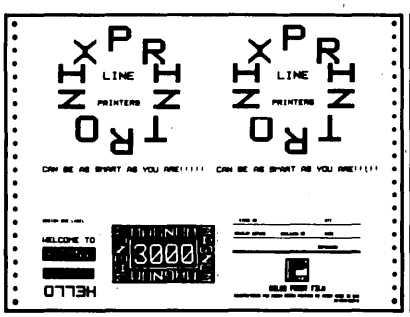
System Configuration

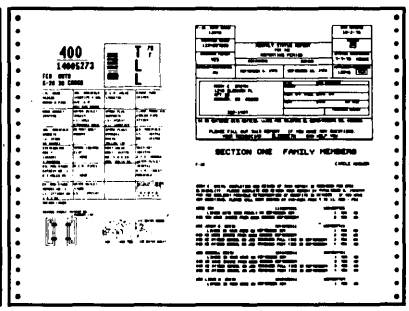
The Magnum 780F can be used as a stand alone system or can be connected via communication lines to a larger central processor either local or remote.

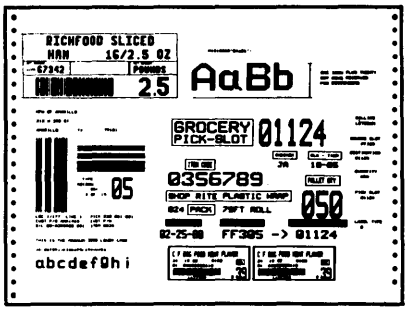
As a stand alone system, the Magnum 780F can be used to create labels via the keyboard. The user can store the labels on disk for future access or can send them directly to the printer for immediate printing. A label format (stored on disk) and variable data, entered either via the keyboard or from data files, can be merged together to create continuous labels each containing variable information.

As a remote label processor, the system can receive data from a host computer via communication lines and merge that data with label formats previously stored on disk to create labels where they are needed. The host computer may be utilized for other functions while communications is in process.

The Magnum 780F provides the user with several programming languages including Databus*, Fortran and Basic. These enable the user to create custom programs not only to meet printing needs but also for data processing and accounting functions.







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CIRCLE 141 ON READER CARD

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Fold-up Keyboard		No
Self Test		Std.
Full Editing Capability		Std.
Protected Fields		Yes
Transmit Only Fields		Yes
Data Entry Checking		Yes
ANSI Complaint Mode		No
VT100 Compatibility		No
ANSI Buffered Editing		No
PF Key Combinations		8
Screen Phosphor	Grey (P-4) or Green (P-31)	Grey (P-4)
Block Mode Transmission		Yes
132 Columns		No
Screen Resolution		560x216
Character Size		7x9
Reverse Video		Std.
Blink		Opt*
Half-Intensity		Opt*
Underline		Opt*
Line Drawing Set		Opt*
Large Character Set		Opt*
Math Set		Opt*
Host Loadable Char. Sets		No
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CIRCLE 142 ON READER CARD

WINNER!

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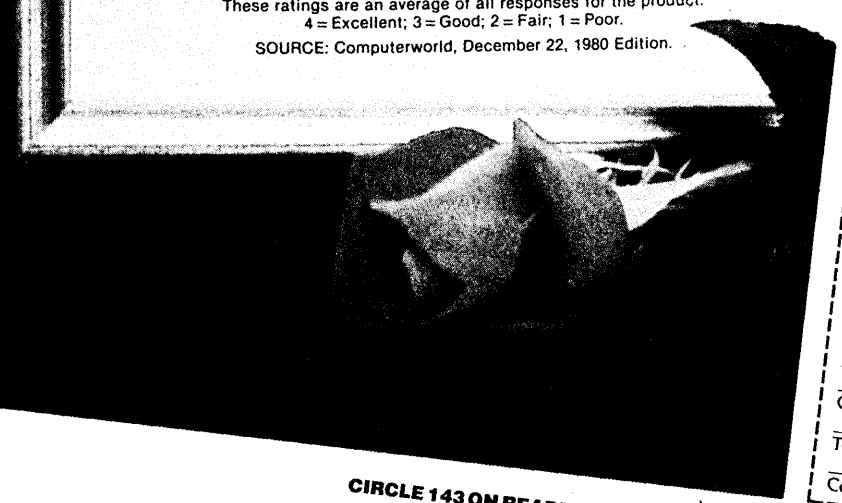
1980 DATAPRO RESEARCH CORP. USER RATINGS OF PROPRIETARY SOFTWARE

Vendor and Package Name	Mean Average User Ratings								
						Vendor's Technical Support			
	Overall Satisfaction	Reliability	Efficiency	Ease of Installation	Ease of Use	Trouble Shooting	Documentation	User Education	Vendor's Maintenance
APPLIED DATA RESEARCH									
DATACOM/DB	**3.7**	**3.7**	**3.9**	**2.9**	**3.6**	**3.5**	**2.9**	**3.4**	**3.2**
IBM Corp.									
Data Dictionary	3.0	3.3	2.0	2.5	2.8	2.8	2.8	3.3	3.0
DOS/VS DL/1	2.8	3.2	2.4	2.6	2.9	2.3	2.4	2.6	2.8
IMS	2.9	3.4	2.4	2.3	2.5	3.0	2.8	2.7	3.0
Cullinane Corp.									
IDD	2.7	3.0	2.7	3.3	2.3	2.3	2.0	2.7	2.7
IDMS	3.2	3.3	3.1	2.9	3.1	3.0	2.8	3.2	3.0
Software AG of N.A.									
ADABAS	3.3	3.8	3.1	3.4	3.5	2.9	2.7	3.1	3.2
Cincom Systems									
TOTAL	3.1	3.5	3.1	3.2	3.2	2.9	2.8	3.0	3.0
Intel Corp.									
SYSTEM 2000	3.1	3.5	2.8	2.8	3.1	2.7	2.9	2.6	3.2

These ratings are an average of all responses for the product:
4 = Excellent; 3 = Good; 2 = Fair; 1 = Poor.

SOURCE: Computerworld, December 22, 1980 Edition.



In addition to DATACOM/DB's winning ways, ADR's VOLLIE® achieved 3.8 in the important Overall Satisfaction category, LOOK® scored 3.8, The LIBRARIAN® 3.4, and ROSCOE® 3.4. ADR has led the field in Datapro awards for IBM 370/30xx/4300 products for four consecutive years.

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DATACOM/DB is one of a family of products that includes DATADICTIONARY, an expandable data dictionary and directory, DATACOM/DC™, an efficient, flexible TP monitor, DATAQUERY™ for data base retrieval, DATAENTRY for online data entry, DATASECURE™ for safeguarding data, and DATAREPORTER™, a natural-language report writer.

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APPLIED DATA RESEARCH

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- ☐ Call from salesperson.
- ☐ DATACOM product literature.

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Computer

CIRCLE 143 ON READER CARD

89 ANACOMP, INC.

11550 North Meridan Street
Suite 600
Carmel, IN 46032
(317) 844-9666

Anacomp, a computer service company specializing in software development, on-line services, facility management, micrographics, and minicomputer and microcomputer systems, continued growing as its revenues rose 70% to $86.9 million and employment doubled.

Computer services revenues represent nearly two-thirds of the company's business as dp-related revenues increased by approximately 60% to $57 million. Most of the company's dp services are in the financial industry, and services for banks and credit unions represented 62% of total dp revenues in 1980, up from 48% in 1979. About one-quarter of Anacomp's dp revenues came from services to government agencies. Less than 10% of its annual dp revenues came from non-U.S. clients.

Anacomp's proprietary customers integrated reference file (CI/RF) software system continues to be its major dp service. In 1980, development began on a software system for financial institutions called continuous integrated system (CIS). CIS is being designed to enable banks to process information on-line on a 24-hour basis.

In facilities management, Anacomp was awarded a three-year contract with a two-year renewal option by the Indiana Department of Revenue. The potential value of this award over five years is $14.6 million.

Anacomp's growth in recent years has mainly been accomplished through acquisitions. In 1980, five acquisitions were completed: one in computer services, and the other four in the micrographics business. Not surprisingly, there has been a considerable financial affect on the company resulting from its acquisition policies. Acquired companies have been financed mostly with debt and stock. A convertible subordinated debenture offering in September 1980 raised $30 million and greatly increased the company's financial leverage. Operating income margins from Anacomp's dp activities declined in 1980 to about 9%, from 10% in 1979. Dp operating income in 1980 fell to approximately 54% of total operating income vs. 73% the previous year.

90 INTERGRAPH CORPORATION

One Madison Industrial Park
Huntsville, AL 35807
(205) 772-3411

Intergraph Corporation, formerly known as M&S Computing, is another rapidly growing turnkey graphics vendor. Its business is split between AEC applications (architectural, engineering, and construction—51%), and MES (mapping and earth science—49%) AEC applications include architectural layout and design, plant design, and finite element modeling. MES applications include cartographics, inventory and thematic mapping, and, for the petroleum industry, civil engineering and processing.

Integraph's growth exceeded the estimated 70% industry average by scoring a 91% gain to $56.4 million. Operating margins remained flat at 15.4%, which is remarkable considering its 10% increase in R&D to $6.2 million. Investments in product development are expected to increase with concentration in systems software (both graphics manipulation and database management), specialized application software, design and manufacturing of graphic display terminals, and other specialized hardware devices that improve system performance. We would expect Intergraph to continue buying processors, plotters, and disk and tape drives.

Integraph markets its products through a direct sales force in the United States and through wholly-owned subsidiaries in Europe and Brazil. During 1980, it opened up subsidiaries in Holland, the United Kingdom, and in early 1981, in France. Customer support, which includes pre-installation guidance, training, preventive maintenance, and repair services, is handled by 170 specialists located in over 50 field offices.

Capital expenditures increased over fourfold to $8.3 million. To help finance expansions, Intergraph filed to go public in early 1981, which could net the corporation close to $25 million. With a backlog of $35.5 million at yearend 1980 compared to $19 million in 1979, prospects for a record 1981 appear strong.

91 ROLM CORPORATION

4900 Ironsides Drive
Santa Clara, CA 95050
(408) 988-2900

Best known for its family of digital PBXs and telephone sets and its recent forays into office automation, Rolm is also a major participant in the military computer market. In 1980, military computers, made by the mil-spec computer systems division, contributed $53.4 million, one-fifth of total revenues. The mil-spec division derives 90% of its revenues from sales to the military (U.S. and foreign) and the rest from sales to the private sector for applications where commercial computers are likely to fail, such as airplane testing and oil pipeline control.

Rolm estimates the total military computer market at $1.5 billion, with annual growth of 15%. The sector of the market Rolm serves is worth $400 million a year. Its major competitors are Norden, Sperry Univac, Control Data, and IBM.

Rolm's strategy is one of publishing its prices, providing quick turnaround (three to four months), and sticking to general purpose machines. This allows it to act like a normal minicomputer manufacturer, while selling against traditional vendors who tend to specialize their computers for one application. Rolm does not develop its own systems; it sells on an oem basis only, and avoids competition with its own customers.

There are over 5,000 Rolm mil-spec computers in use. The products fall into two principal families: ECLIPSE and AN/UYK-19 (v). The ECLIPSE computers are functionally identical to Data General's ECLIPSE line, and all of DG's operating systems, high-level languages, and software development tools will work on them without modification. Three new development tools will also work on them without modification. Three new ECLIPSE computers were announced in early 1981: the 32-bit MSW/800, the 16-bit MSE/25, and the MSE/14, which is also classified as a member of the AN/UYK-19 (v) family. This family of products comprises Rolm's older models, ranging from a single-module processor to a medium-size system.

Rolm also announced its first peripheral military spec product in 1981. The model 4050 disk is a full military disk subsystem featuring 8-inch Winchester recording tech-

92 MSI DATA CORPORATION

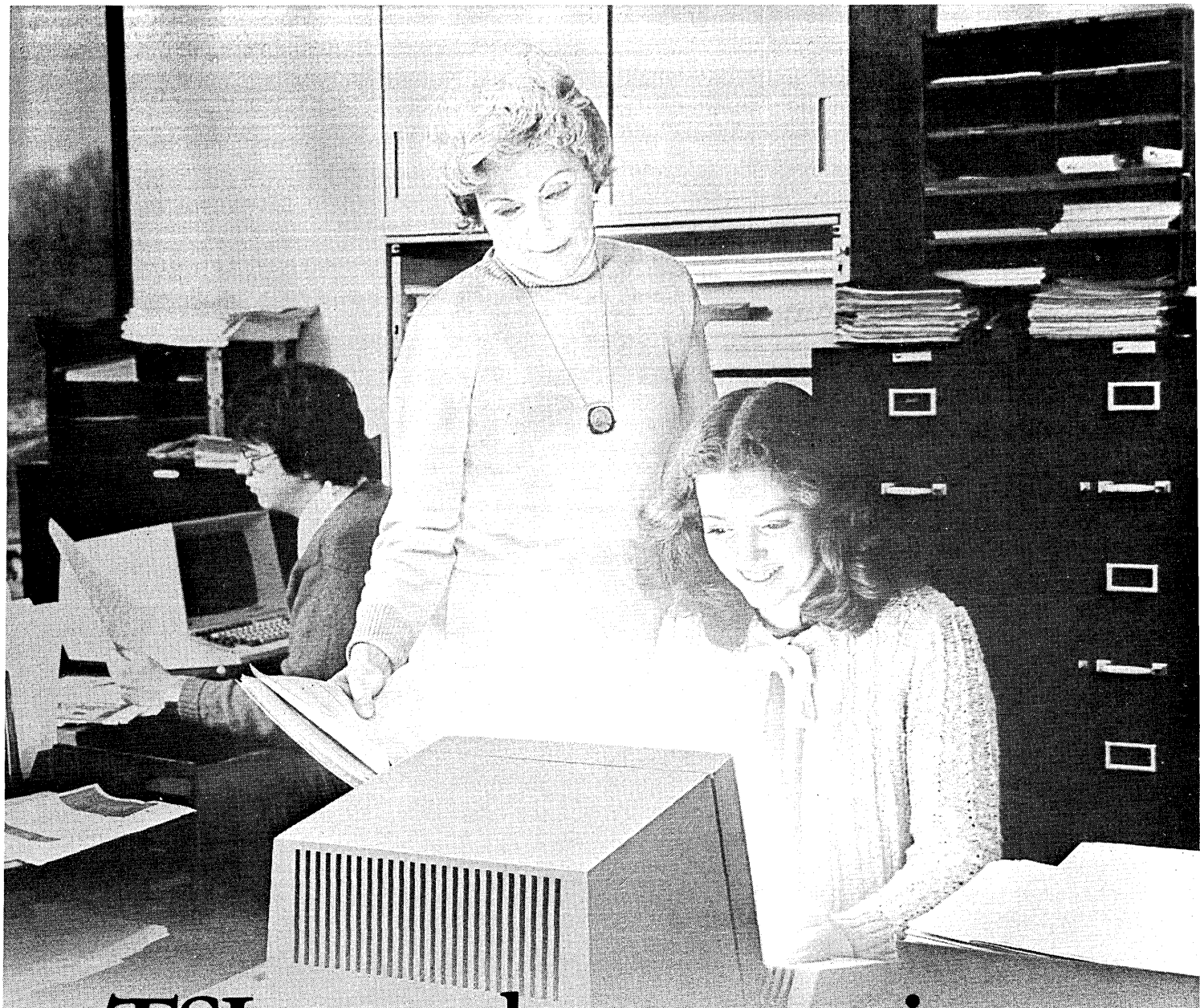
340 Fischer Avenue
Costa Mesa, CA 92626
(714) 549-6000

MSI Data has continued to expand the market for portable data entry terminals by introducing programmable portable terminals called the Omega Generation. Although the first programmable terminal was introduced in 1979, many new models were introduced during 1980. MSI's traditional markets have been in the food, drug, and hardware retail/distribution sectors. Unfortunately, these markets have limited growth opportunities and are subject to sharp downturns during recessions. With programmable portable terminals that offer communications capabilities, MSI has been able to develop several software applications that expand its markets to manufacturing and field service. The retail and wholesale industries still accounted for 96% of MSI's revenues in 1980 (down from 99% in 1979), but with MSI's 1980 product introduction, we suspect that its dependence upon these industries will decrease. Typical new manufacturing applications include inventory control, quality assurance, material control, and industrial engineering.

MSI distributes its product to end users through its own direct sales force both domestically and in Europe. Distributors are used in other countries. An important and very profitable part of MSI's business is field service, which accounted for 24% of 1980 revenues. MSI has 250 service personnel operating out of 19 domestic MSI field service centers in the U.S. and Canada, and nine service centers in Europe. Marketing and service employment was the fastest area of growth, up 20%.

MSI's revenues reached $53.2 million in 1980, up 17%; after-tax margins remained at about 6.3%. R&D expenditure remained flat, but still represented a fairly healthy 4.4% of sales. European market penetration is evidenced by a 79% revenue increase to $15 million.

MSI discontinued operations of Chase Computer (its P.O.S. subsidiary) after one year of operation because it had extensive capital



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CIRCLE 144 ON READER CARD

TSI International

System Products Division
50 Washington St., Norwalk, CT 06854

requirements and was losing money.

In August, MSI formed a program management group to identify new product applications and marketing opportunities. With existing applications gaining market momentum and new applications being developed, MSI is optimistic about its prospects for 1981.

93 NASHUA CORPORATION

44 Franklin Street
Nashua, NH 03061
(603) 880-2323

Nashua Corp. followed 1979's 59% dp revenue increase with a 1980 increase of 24%, to $53 million. Growth in 1980 reflected continued strong industry growth in disk drives and in the resultant media market.

The Computer Products Div. was reorganized during 1980 to pursue new marketing opportunities in the growing and diverging disk media markets more aggressively. Sherman I. Silverman was named director of marketing; Peter R. Steriti was named group product manager for media products. In addition, an independent research group was established. This group is currently addressing such issues as highly oriented horizontal coating, vertical magnetic recording techniques, and high-performance media that can be used with the emerging thin-film head technology. Nashua expects to explore sputtering (plated media) in the future.

Nashua continues to sell close to 40% of its products overseas through its five wholly owned subsidiaries and a network of distributors. Domestic marketing is handled by reps to the oem and system house markets, by dealers for the aftermarket, and by a direct sales force to the end-user market.

Among the 1980 product introductions, disk cartridges compatible to Control Data's cartridge module drives, Digital Equipment's RL01 and RL02 drives, and Cii-Honeywell Bull's "Cynthia" drive all became available in 1980. Nashua also started manufacturing 8-inch hard disks for the expanding Winchester drive market, and we expect introduction of a 5½-inch hard disk during 1981.

During 1979, Nashua added 140,000 sq. ft. of manufacturing space. In 1980, dp capital expenditures rose to $5.4 million (up 170%). These expenditures were directed toward automated equipment, and resulted in a doubling of capacity within the same facilities. Nashua has also initiated a quality assurance program that is already showing progress. Disks, in particular, have stringent quality requirements, and the company hopes to capitalize on an improved reputation as the disk market becomes more competitive.

94 NATIONAL DATA CORPORATION

One National Data Plaza
Corporate Square
Atlanta, GA 30329
(404) 329-8500

Continuing its impressive growth, National Data revenues were up 25% to $53 million, and net income rose 35% to $6.6 million. NDC provides data exchange and processing services for cash management, credit card authorization and collection, pharmacy management and telephone merchandising. Cash management services, used by large industrial corporations and financial institutions, contribute one-third of total revenues, while credit card and consumer services account for one-quarter of revenues.

NDC's health care service continues to be its fastest growing business, with about 380 systems installed, and a large backlog. In January 1981, the Defense Department awarded NDC a contract that could amount to over $7.5 million for the installation of the DataStat Pharmacy System at military hospitals.

Various acquisitions were announced in 1980. NDC bought E. J. Gainer & Associates, an Ann Arbor company that offers cash management, database management, and other financial services. NDC's subsidiary, Interactive Sciences Corp., bought the DEC-10 computer equipment and customer base of Call-Data Systems, Inc., a subsidiary of Grumman Data Systems. In August, NDC announced the acquisition of CISCO, Inc., a $7 million (in 1979) credit card processing and financial management company. In September, NDC announced an agreement to purchase Communication Response Service, a Reno-based subsidiary of Charles Schwab & Co., which provides toll-free telephone response and answering services to retail industry.

95 AMERICAN EXPRESS

FIRST DATA RESOURCES
Omaha, NE 68114
(402) 399-3950

First Data Resources (FDR) has completed its first year as a subsidiary of American Express, and FDR's management, which has retained sole control, is very excited about prospects with its cash-rich parent. In the last six months, FDR acquired WATS Marketing of America and the New England Bank Card Assn. NEBA services 130 banks and retail merchants; its credit authorization and bank card service software will be made compatible to FDR's. WATS Marketing is a toll-free order taking service. FDR uses toll-free lines in its credit authorization service.

FDR will continue to investigate compatible acquisition activities in WATS marketing, credit authorization, point-of-sale cash registers, and automatic teller machines.

FDR's traditional business of on-line credit authorization billing services and transaction processing and balancing still provides about 90% of revenues. New clients include Crocker Bank, First National Bank of Boston, Seattle Trust, and Oregon Bank. In the U.S., it maintains a base of 2,700 terminals installed in over 200 banks. In 1980, computer operations were consolidated in the Omaha office from branches in Atlanta, Denver, and San Mateo. FDR has developed software which allows it to string many IBM 3101 terminals into a single Series/1 that emulates IBM 3270 protocol. Automated mail processing and other postal services have also been added.

FDR has a special marketing group to handle expansion into nonbank card services, such as cash management. FDR's service helps large retailers to quickly invest deposits by daily balancing bank office deposits and by cpu-to-cpu transmission between parent and bank. Although FDR's cash management sales in 1980 were only $1 million, continued inflation will fuel this market.

TRW and other competitors in the consumer credit business had a slow year in 1980 because of cutbacks in consumer credit. FDR was not an exception, with a revenue increase of only 6% to $53 million. Its new market and product expansions, however, make FDR a company to watch.

96 MANAGEMENT SCIENCE AMERICA, INC.

3445 Peachtree Road N.E.
Atlanta, GA 30326
(404) 262-2376

Management Science America (MSA) has licensed approximately 6500 software packages for use by a broad range of customers. Included are manufacturers, distributors, banks, insurance companies, health care institutions, educational institutions, governmental units, and others. The company's products are offered for use and supported on medium and large scale IBM computer systems as well as a number of other mainframes. MSA's product line consists of nine applications software packages directed to two functional areas of business—financial management and human resources.

In 1980 the company paid $1.7 million for the Q-Pac software package, an automated payroll calculation, disbursement, and reporting package designed for paying employees outside North America. MSA's international market is developing quickly—prior to 1979, international revenues were insignificant; but they grew to $5.4 million in 1979, and to $10.9 million in 1980.

MSA's potential competition is keen both nationally and internationally. Many prospective customers choose to develop their own custom software. At the present time, MSA's primary competitors are independent software firms and major accounting firms. The accounting firms have the resources, capabilities, and customer relationships to be strong competitors. IBM has not yet chosen to be dominant in this market, but it probably could be.

Financial results in 1980 are indicative of the high growth rates which MSA has steadily achieved in the booming software industry. Revenues have almost quadrupled in the last four years, reaching $51.7 million in 1980, both through price increases and by licensing more software. Operating margins declined from 14% to 11.5% because fewer multiyear support agreements were executed, and these revenues declined to $1.6 million from 1979's $2.7 million. Software development expenses increased 50% to $12 million, and international marketing expenses were dramatically higher. Capital expenditures grew over sixfold to $5.7 million, in part for a new office in Maidenhead, U.K.

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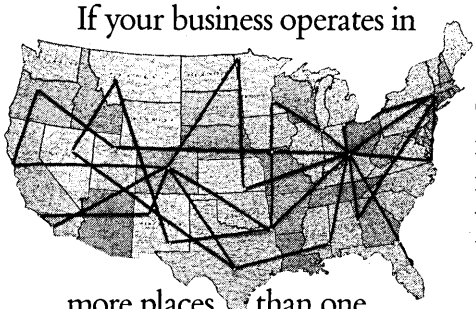

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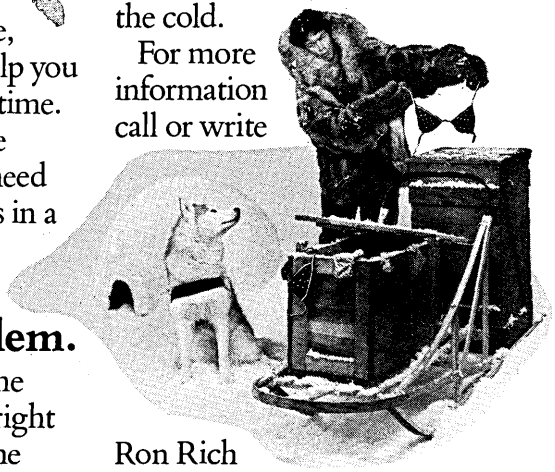

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97 AUTO-TROL TECHNOLOGY CORPORATION

12500 North Washington Street
Denver, CO 80233
(303) 452-4919

Auto-trol is a manufacturer of computer graphic systems used primarily by architects and engineers, in architectural and engineering firms (20%) and in energy-related companies (another 20%). The business has grown rapidly, with 1980 revenues at $50.8 million; revenues grew 51%. Operating margins have declined to 13% from 17.8% in 1979, primarily because of a larger commitment to R&D (up 50% to $6.1 million) and increased marketing expenditures in international operations. International revenues grew 27% to $9.8 million in 1980, but it is hoped that the large marketing expenditures made in 1980 will be fruitful in 1981 and beyond. To guide this expansion, Auto-trol has established a new management team.

During 1980, Auto-trol made several key product annnouncements. In August, it announced that it was adding Digital Equipment's VAX 11/780 as the graphics processor for its AD/380 automated design and drafting system.

To augment the system's capabilities, Auto-trol announced the GS-2000 software package that was developed by Manufacturing and Consulting Services. This product will emphasize both two- and three-dimensional mechanical design applications and should open up marketing opportunities in aerospace, automotive, and other manufacturing industries. Auto-trol hired 50 software and engineering professionals during the last six months of 1980 to expedite the implementation of this new system. It has also expanded its software capabilities in mapping and processing design.

During this transitional year for Auto-trol, several management changes were made. Most prominent was the appointment last August of Graham King as president, succeeeding Don Smith who now serves as chairman. E. J. Zenke joined Auto-trol in November as executive of field operations.

98 PHILIPS INFORMATION SYSTEMS, INC.

MICOM CO.
4040 McEwen Avenue
Dallas, TX 75234
(214) 386-5580

In early 1981, Micom Data Systems, Inc., changed its corporate name to Philips Information Systems to associate itself more closely with its partner, Philips NV of The Netherlands. Steve Dorsey, president of Canada-based Micom Co., started the company on a shoestring in 1976 with a good product idea—a user friendly programmable word processor. Micom added a second model using dual floppy disks in 1978. Total sales were $1.7 million in 1977, about $14 million in 1978, about $50 million in 1979, and about $100 million in 1980. In early 1979, Dorsey agreed to a partnership with Philips to take advantage of their name, R&D emphasis, capital resources, and large distribution network. Dallas-based Philips Information Systems is the U.S. distributor for products designed and manufactured in Montreal. U.S. sales grew 100% to $50 million in 1980.

The Micom name will remain on all existing equipment and will be used as a brand name in the U.S. for one year. Micom now uses a Philips crt screen in their word processors. Employment in the U.S. has increased over 40%, to about 500. Most senior management in the U.S. was changed at the direction of Micom Co. John Clark, formerly of Itel, has replaced Dick Grieve as president, and Darrel Baldwin is the new vice president of finance. Although there have been no additions to the 14 American direct sales offices, 18 new distributors were added in 1980, bringing the total to 70.

In September of 1980, management lowered the Micom 2001-04 price 19% to $13,500. This followed the June 1980 announcement of IBM's standalone "Displaywriter" text processing system, which sells for under $10,000 per workstation. Introduction in December of the less expensive standalone Wangwriter may spur further price cuts, although Micom addresses a more sophisticated market. Micom offers discounts of up to 23% for machines in quantities of 16 to 25. At that level, the 2000 is available for $10,400.

More than half of Micom's customers select communications options, and between 1,000 and 1,500 machines in place have the $200 electronic mail feature. The plug-compatible asynchronous option, which allows 2-way cpu communication at $1,300, is the most expensive communication option; the bisynchronous option allows only one-way communication and costs $700. Larger systems have also sold well. About a dozen systems with more than 100 workstations have been installed, and a New York bank recently ordered a system with about 200.

In summer 1980, Micom introduced Execupak, an executive workstation, with an "activities tickler" feature that provides an up-to-the-minute list of telephone calls and letters received, appointments and meetings scheduled, and prioritized tasks. Execupak prices were not reduced along with those of compatible word processors. About a hundred have been sold as add-ons for $19,095.

99 PRINTRONIX, INC.

17421 Derian Avenue
Irvine, CA 92714
(714) 549-8272

Printronix continues to grow: 1980 revenues of $48.9 million were 49% higher than '79, and earnings of $4.2 million were up 39%. Dp operating margins decreased slightly to 16.6%. International sales were particularly strong, increasing 93% to $12.8 million. To support this growth, a wholly-owned subsidiary is being established in the Netherlands for support of the European market.

Printronix participates in the medium-speed line printer market, which, according to industry estimates, is growing at 20% to 25% annually. Printronix's three matrix printers compete with similar speed band printers, but offer graphics capabilities.

Oem sales account for 53% of revenues, with Management Assistance, Prime Computer, Microdata, and Digital Equipment as the four largest customers. The other marketing channel is distributors, who sell to small oems and end users. Because of economic uncertainties, particularly as to small end users, orders from distributors are concentrated near term, reducing backlog to $14 million from over $17 million in June 1980.

Capital expenditures increased by 10% to $28 million. Spending has primarily been directed toward manufacturing process and tooling equipment, but money has also been spent on a 40,000 sq. ft. hammerbank production facility, which came on-stream in April. R&D expenses, up 19% to $1 million, should increase again in 1981.

100 VERBATIM CORPORATION

323 Soquel Way
Sunnyvale, CA 94086
(408) 245-4400

The year 1980 was a period of retrenchment for Verbatim. Although revenues improved by 7.6% to $48.4 million, order weakness in both the U.S. and Europe, lingering effects of defective raw materials, and the discontinuance of their rigid disk program resulted in a loss in excess of $700,000.

Verbatim discontinued its rigid disk program because its original supply-constrained market forcast became questionable after the Xerox Magnetics subsidiary announced plans to be a net seller, and existing companies invested heavily in expanding plant. The aborted project cost Verbatim $2.2 million.

Operations in 1980 were also affected by a depressed sales level in floppy disks, not only because of the recession, but also because current customers are taking long lead times in evaluating products. Verbatim has experienced a higher than expected level of product returns, resulting in an additional $1.5 million write-off in 1980. Part of the write-off, however, will finally clean up Verbatim's balance sheet. Verbatim is trying to regain lost market share with the introduction of a higher quality floppy disk line, Datalife. The floppy media market continues to grow in excess of 30% per year.

In other news, Verbatim has named Malcolm Northrup president and ceo, replacing Peter McCuen. Northup had been an executive in the electronic devices division of Rockwell, and brings with him his operations experience and senior background in peripherals and microelectronics. With 1980 behind them, and new management in place, Verbatim is looking forward to a sharp rebound.

This report was prepared for DATAMATION by the staff of the Gartner Group, Greenwich, Conn., under the supervision of Peter Wright and Kay Anderson.

Sam Thompson, VP/Marketing, DEI, left, and Doug Broyles, President, Onyx Systems, Inc

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And like the others, isn't this one of the Funnel Series?

And after 6 years, it is the one that's the industry standard for Winchester save and restore isn't it?

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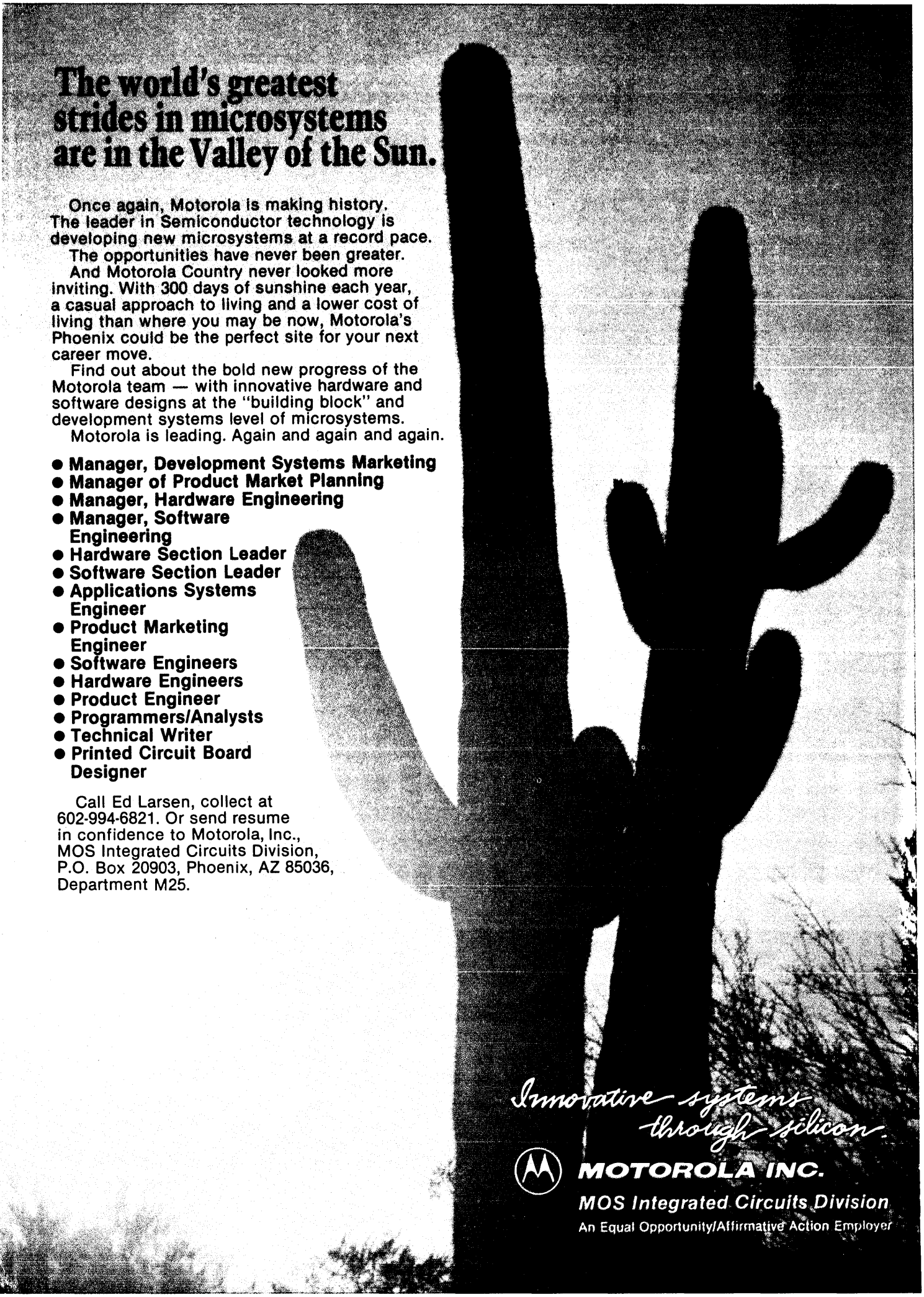

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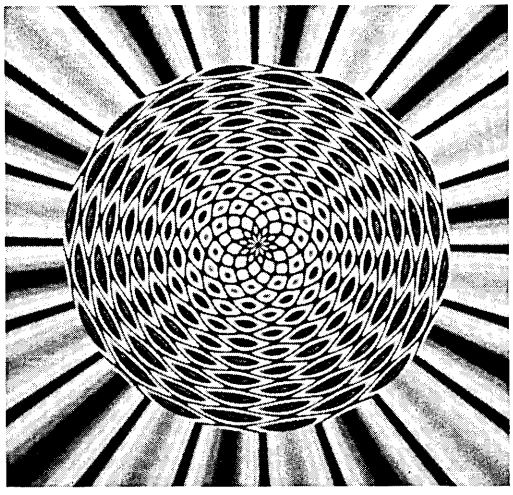

Computer graphic by M. Thompson, M. Schecter

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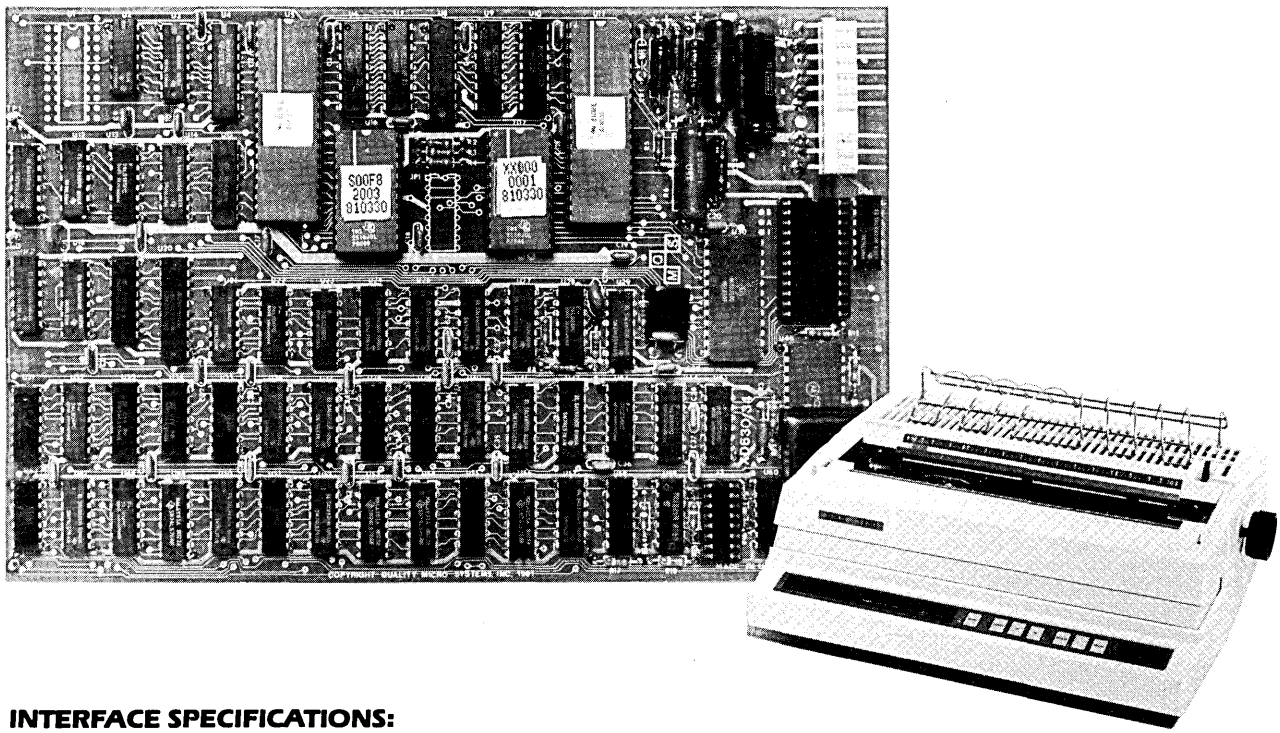
QMS Provides LETTER QUALITY PRINTING CAPABILITY ON IBM SYSTEM 34&38



INTERFACE SPECIFICATIONS:

Interface:
Interfaces to System 34 and 38 via twinaxial cable hookup emulating an IBM 5256 printer.
Self Test:
Multiple built in self test capability.
Cable Thru:
Cable thru feature is standard: Up to 6 devices may be daisy chained together on a single twinax port.

PACKAGING:

Interface is contained in a spare circuit card slot inside the printer. The twinax connectors, self test switches, address switches, cable thru/terminate switch and indicator LED's are all contained on a bracket mounted on the rear of the printer. There are no external boxes required.

PRINT FEATURES:

Supports printer features via simple easy to program sequences using printable characters. Print features include:
Variable line spacing
Variable column spacing
Bidirectional paper feed
ASCII Character set: 128 characters

Printer Description:

The Xerox Model 1730 is a reliable, high-quality full-character serial printer which provides application flexibility and superior print quality at a low cost. Innovative design features allow the 1730 user to interchange plastic and metalized print wheels on the same printer, a technological breakthrough providing greatly increased versatility in word processing and multiple forms handling applications. In addition, the 1730 mechanism has been designed to contain even fewer moving parts and adjustments than its HyType II predecessors, further enhancing the reliability and maintainability of the printer. Electronics consist of plug-in printed circuit boards, providing ease of fault isolational.

Print Wheel Interchangeability

The Xerox Model 1730 is the first serial daisy wheel printer to offer complete interchangeability between metal and plastic print wheels. Now users can freely interchange between all Diablo/ Xerox print wheels, thus having the flexibility to select the appropriate plastic or metal print wheel for the application. And the sophisticated and discerning user does not sacrifice print quality to obtain this versatility. Every aspect of the Xerox 1730 design has been focused on maintaining outstanding print quality.

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CIRCLE 154 ON READER CARD

Business opportunities and money are more abundant than ever, but putting them together is a challenge.

FUNDING THE COMPUTER INDUSTRY

by Hesh Wiener

Money: the computer industry makes a lot of it. But it's not enough. Demand for computer equipment, software, and computer-related services is growing by leaps and bounds. This is not just good; it may be too good. In order to keep on growing, industry companies can't depend on profits alone. They have to raise outside capital. In aggregate, this total amount may approximate the growth of the industry—some 15% to 30% of its annual revenues—depending on who is analyzing the figures.

Any industry supplier that can't deliver goods on time, relative to its competitors, is going to lose out, so everyone is looking for ways to increase production. This takes money. Things wouldn't be so much of a problem if funds were plentiful and the cost of obtaining money were low; however, money's tight, interest is high, buyers of stock want big returns, and banks are renting the money they lend out at rates that are usurious by historical standards. In other words, it ain't gonna be easy.

As unnerving as things might get in the computer business, high technology is likely to have less to worry about than low technology. The computer industry, in contrast to, say, the steel business, isn't saddled with technologically obsolete plants that once cost millions to build. Because computer companies are on the way up, the size of their investments in old and relatively useless equipment is small compared to their total sales. Also, computer manufacturing, until recently, has not required as much capital equipment to make a dollar's worth of product as, say, chemical production, although there are signs that this is changing as automated assembly and test equipment replaces hired help with soldering guns and oscilloscopes.

Taking pressure off corporate treasurers is the large proportion of value added that comes from thinking. The computer business, particularly software companies and service organizations, uses a lot more brains than banknotes.

Yet only a certain amount of pressure can be relieved. These days, computer industry organizations have to compete for money the way they compete for entry into new applications. For some companies, this may mean settling for slower growth as dreams of great empires turn to nightmares of inadequate cash flow. For others, a well-organized fiscal strategy may provide a real advantage over competitors.

There are no rules in financing companies; at best, there are some widely accepted generalizations. In the final analysis, each corporate treasurer must make—and live with—choices that always involve some uncertainty. The present health of the industry attests to the fact that so far, at least, these choices have been wise ones.

FUNDS AND GAINS

Computer industry companies, like all other businesses, get some of the money they need to grow from their profits. But a combination of ambition and opportunity—in the face of generally good profits—has made earnings an inadequate source of capital. Order backlogs for goods and services, emerging new markets, and other temptations have encouraged the industry to grow in size and breadth. The pace of expansion demands that outside capital be added to that which the companies can generate from their profits.

This money comes to companies basically in two forms (although there are a number of variations on the theme): equity and debt. Equity means ownership in the form of shares of an industry participant. Debt is the money the company borrows.

A hybrid form of financing, the convertible debenture, is also used quite a bit in the computer industry. This is, in essence, debt that may be turned into stock at a later date. The conversion occurs if the indebted company's stock reaches some level specified in the terms of the debenture offering. For example, a debenture may pay 8% interest as long as it's debt, but may be turned into stock, at the demand of the issuer, when the stock reaches $100 a share. At that time, each $100 of the face value of the debenture is exchanged for one share of stock. Generally, the issuing company will wait until the stock is higher, say $115 a share, and then make the swap of debt for equity as if the shares were at the $100 level. This makes holders of the debenture happy—they have gotten "bargain" stock—and it also makes the corporate treasurer happy—the balance sheet will show lower debt and greater equity.

Funds, whether debt or equity, are obtained from private investors, from financial institutions, from the investing public, or from a combination of these sources. In general, when one source of capital is in good shape, they all are; conversely, if things are bad in the economy, they are likely to be bad all over. There are, however, differences among sources of capital in terms of what they will charge (or expect) for a given amount of money they put up on behalf of a computer industry participant.

Computer industry companies, depending on the nature of their businesses, may use capital in a variety of ways. For instance, manufacturers use a lot of money to build new plants, to put more and better manufacturing and test equipment in these plants, to increase inventories of parts, subassemblies and finished products, to provide field personnel with better service equipment, and to finance receivables owed by their customers. As more companies decide to go vertical —making, for example, custom circuits they feel will give their products more bang for the buck—they have to plow a lot of money into new facilities. This capital, used wisely, enables the manufacturers to build more computer equipment and to make that equipment more efficient and reliable. In short, the money is used for growth and progress.

CAPITAL TO FUND LEASES

In the mainframe business, and in business systems, a lot of capital is also used to fund leases. End users of certain classes of equipment may prefer to rent their machinery. Once one major supplier offers to compete in the rental business —IBM, for example—other manufacturers may have to match the competition in financial as well as technical terms. This becomes very important when money is tight, because

ILLUSTRATION BY ROBERT CHRONISTER

PATTERNS OF CAPITAL USE AT SELECTED MANUFACTURERS*

		OPERATING REV $MIL	O.R. GROWTH %	CAPITAL EXPENDITURES PLANT & EQUIP $MIL	C.E. P&E GROWTH	NET INVESTMENT PLANT & EQUIPMENT $MIL	CAPITAL TURNOVER	RENTAL REVENUE $ MIL
HONEYWELL	'75	2292		e15[2]		280	8.19	460[1]
	'76	2495	8.9	18[2]	20.0	285	8.75	522[1]
	'77	2911	16.7	27[2]	50.0	327	8.90	598[1]
	'78	3548	21.9	37[2]	37.0	398	8.91	702[1]
	'79	4210	18.7	42[2]	13.5	495	8.51	705[1]
	'80	4925	17.0	69[2]	64.3	676	7.29	806[1]
CONTROL DATA (COMPUTER BUSINESS ONLY)	'75	1218		19		e113	10.78	e158
	'76	1331	9.3	25	31.6	119	11.18	e167
	'77	1493	12.2	30	20.0	126	11.85	e194
	'78	1847	23.7	65	116.7	154	11.99	228
	'79	2249	21.8	60	(7.7)	176	12.78	267
	'80	2766	23.0	88	46.7	220	12.57	312
IBM	'75	14436		659		2848	5.07	e8506
	'76	16304	12.9	682	3.5	3091	5.27	e8690
	'77	18133	11.2	920	34.9	3505	5.17	e9055
	'78	21076	12.0	1322	43.7	4224	4.99	9781
	'79	22863	8.5	1779	34.6	5266	4.34	10069
	'80	26213	14.7	2258	26.9	6634	3.95	10869
			12.7		27.9			
NCR	'75	2021		96		389	5.20	e236
	'76	2136	5.7	71	(26.0)	377	5.67	e250
	'77	2311	8.2	87	27.5	379	6.10	e267
	'78	2611	13.0	91	4.6	379	6.89	305
	'79	3002	15.0	125	37.4	432	6.95	327
	'80	3322	10.7	164	31.2	517	6.43	336
			10.5		11.3			
BURROUGHS	'75	1676		75		300	5.59	318
	'76	1871	11.6	64	(14.7)	322	5.81	386
	'77	2091	11.8	68	6.3	337	6.20	433
	'78	2422	15.8	110	61.8	386	6.27	479
	'79	2786	15.0	111	0.9	429	6.49	506
	'80	2857	2.5	163	46.8	517	5.53	497
			11.3		16.8			
XEROX	'75	4140		208		1064	3.89	3401[1]
	'76	4515	9.1	141	(32.2)	1123	4.02	3592[1]
	'77	5190	15.0	168	19.1	1109	4.68	3821[1]
	'78	6018	16.0	206	22.6	1111	5.42	4131[1]
	'79	6996	16.3	300	45.6	1222	5.73	4606[1]
	'80	8197	17.2	335	11.7	1369	5.99	5152[1]
			14.6		10.0			
DEC (JUNE FISCAL YR)	'75	534		46		124	4.31	
	'76	736	37.8	55	19.6	154	4.78	
	'77	1059	43.9	143	160.0	265	4.00	
	'78	1437	35.7	167	16.8	376	3.82	
	'79	1804	25.5	94	(43.7)	399	4.52	
	'80	2368	31.3	210	123.4	529	4.48	
			34.7		35.5			
PRIME	'75	11		1	211.8	3	3.67	
	'76	23	100.2	2	202.4	5	4.60	
	'77	50	119.5	7	35.0	11	4.55	
	'78	94	87.0	9	94.2	18	5.22	
	'79	153	63.5	18	101.8	32	4.78	
	'80	268	75.0	36		62	4.33	

NOTES: e estimated 1 rental & services 2 information systems only SOURCE: SANFORD J. GARRETT PAINE WEBBER MITCHELL HUTCHINS

users choose rental plans as a way to defer the expense of buying machines. Vendor financing (and third-party financing, too) also takes computers off the balance sheets of user companies and puts them into expenses. Treasurers often like to reduce a company's capital investment by this method.

But not all industry companies are manufacturers and not all manufacturers have to worry about rentals. Software houses use capital to fund product development, to increase marketing, and to carry receivables. This takes less capital per dollar of gross revenue than, for instance, semiconductor fabrication equipment. Thus, software companies are said to be less capital-intensive than manufacturing concerns. Also, minicomputer makers and oem suppliers generally sell their products outright. This means that they have to capitalize for production, not for the financing of customers' installations. Service bureaus have to buy machinery, but their main costs seem to be for communications —which is pay-as-you go—and for people. The funding of equipment expansion is important, but doesn't take as much capital as, for example, factories do.

Thus there are significant differences across the industry. But there are also some things various companies have in common, if you are willing to grant some generalizations.

Ulric Weil, the computer industry financial analyst at stockbrokers Morgan Stanley & Co., believes there are some common threads, at least among different classes of industry suppliers.

"At this time, most of the mainframe companies, including IBM," says Weil, "have the kind of cash flow profile that would indicate that they will have to get outside capital. Whether it's debt or equity is another matter. But all the big companies will need some external long-term funding.

"If there's some generalization, it seems to be that in computer technology it

RENTAL REVENUE GROWTH	CAPITAL EXPENDITURES RENTAL $ MIL	GROWTH IN C.E. RENT	NET INVESTMENT IN RENTAL $ MIL	CAPITAL TURNOVER RENTAL
	201[2]		506	0.91
21.4	241[2]	2.0	509	1.03
14.6	251[2]	4.1	495	1.21
17.4	261[2]	4.0	489	1.44
0.4	278[2]	6.5	469	1.50
14.3	282[2]	1.4	459	1.78
	83		e281	0.56
5.7	80	(3.6)	248	0.67
16.2	67	(16.2)	227	0.85
17.5	116	73.1	247	0.92
17.1	148	27.6	286	0.93
16.9	209	41.2	344	0.91
	1780		4194	2.03
2.2	1836	3.1	4249	2.05
4.2	2475	34.8	4384	2.07
8.0	2724	10.1	5078	1.93
2.9	4212	54.6	6927	1.45
7.9	4334	2.9	8383	1.30
5.0		19.5		
	175		339	0.70
5.9	148	(15.4)	341	0.73
6.8	109	(26.4)	277	0.96
14.2	129	18.3	245	1.24
7.2	196	51.9	254	1.29
2.8	208	6.1	277	1.21
7.3		3.5		
	211		597	0.53
21.4	203	(3.8)	623	0.62
12.2	199	(2.0)	622	0.70
10.6	276	40.2	684	0.70
5.6	323	17.0	788	0.64
(1.8)	272	(15.8)	831	0.60
9.3		5.2		
	582		1529	2.22
5.6	455	(21.8)	1430	2.51
6.4	552	21.3	1416	2.70
8.1	704	27.5	1502	2.75
11.5	927	31.7	1736	2.65
11.9	993	7.1	1922	2.68
8.7		11.3		

*The chart above depicts the gross revenues and related capital expenditures for selected information industry manufacturers. While there are many differences among the selected companies, certain similarities are clear from the table. For one thing, capital turnover as it relates to plant and equipment investment is quite consistent. The pattern at Control Data is due to its high service content, which is not nearly so capital-intensive as the company's manufacturing operations. Rentals are not a significant factor at minicomputer makers, so Digital and Prime have not been viewed from a rental standpoint. The others in the group seem to cluster rather closely in terms of capital turnover for rental, but there is more variance than for the manufacturing side of their businesses.

takes a dollar of assets to bring in a dollar of revenue."

(IBM, for example, reported assets of $26.7 billion at the end of 1980. The company's gross revenue was $28.2 billion. Similarly close figures characterize IBM's situation in other recent years, and, to a large degree, describe the way the financial reports of other industry participants look.)

Sanford J. Garrett, who advises clients of Paine Webber Mitchell Hutchins on investments in office equipment and computing, agrees with Weil, but adds, "There are a lot of real differences in the industry. A capitalization strategy that works for one company may not be best for another. There are significant differences, for instance, between capital uses for plant and for leasing within a single company."

Esther Dyson, an analyst at Oppenheimer & Co. draws distinctions between capital used by manufacturing and by service companies. She says, "The service sector just doesn't need capital the way the manufacturing group does. To some extent, the service sector can do without capital much more easily than the equipment makers. However, a number of software vendors are now going public. These companies will use the funds for several purposes, and one of the important uses of this new capital will be to fund the development of new or improved packages."

LONG AND SHORT OF IT

One key aspect of financing is its permanence. It's more convenient and less expensive for a company to borrow for the long haul than for the short. Typically, short-term debt is in the form of bonds or other similar instruments. The use of short-term money puts the borrower at the mercy of the bank's prime rate, a number that has proved unstable and unpleasant during most of the past two years. Long-term rates of interest have been lower and have moved less dramatically.

Long-term financing requires more forethought by a company. Some organizations, according to Ulric Weil, "eat into their credit lines up to a point and then go into the long-term market. They use the proceeds of a long-term issue, whether debt, convertible debenture, or equity, to repay the short-term debt that has built up."

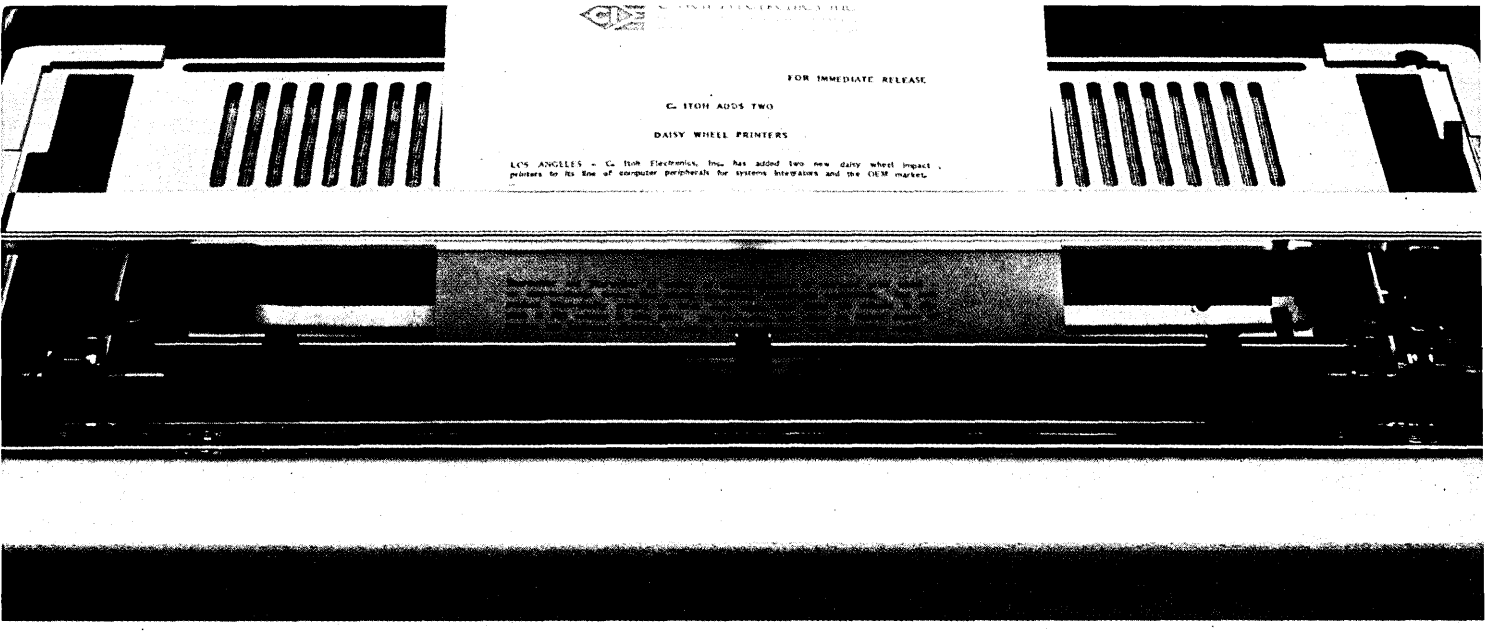
Is this the right way to work? "It's really just a matter of financial management style, if you will," says Weil. "There is no recipe."

But the problems of getting capital are more than simply a matter of choices made within a computer industry organization. External conditions have a lot to do with a company's ability to raise debt or sell equity. At any time, interest rates are a reflection of current conditions in the money markets, and recent history reveals that short-term funds can change in cost from 13% to 20% in a matter of a few months. The stock markets can be volatile, too, as investors rush to snap up hot high technology shares one week or dump computer company equities the next. A lot depends on economic conditions, not just the state of a single computer company that is searching for money. The way to get the economic picture is, logically enough, to talk to an economist.

Data Resources, Inc. is an econometric research and forecasting organization in Lexington, Mass. Its founder and chief officer, Dr. Otto Eckstein, is an economist highly regarded by financial planners in the computer industry. Right now, Dr. Eckstein sees some difficulties for any company seeking capital, plus an opportunity to make the most out of current conditions by timely action.

"We at DRI forecast that capital will remain both costly and somewhat scarce," says Eckstein, "and that improvement in the inflation picture will be quite moderate. So we are urging our clients—whether they are in the computer business or any other business—to attempt to procure long-term financing rather than live day to day on bank loans and commercial paper.

"High technology companies are hurt



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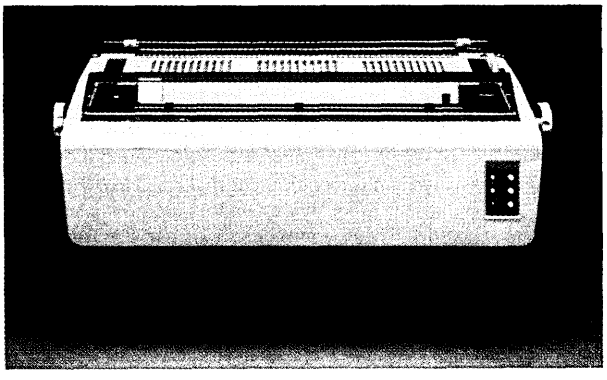

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It's likely that computer industry firms that plan to borrow in the long-term market will do so as early as they possibly can.

a lot less by this inflation," Eckstein adds, "because they are not highly capital-intensive [compared to older, low technology industries]."

But this difference may not make computer companies more attractive for investors because a lot of the proposed tax changes favor older industries over new ones. Eckstein puts it this way:

"Will 10-5-3 and related provisions [in the tax law that permit faster depreciation of capital assets] help computer sales more or less than they help, say, the modernization of steel mills? I think the answer is less. But the total infusion of money that will occur is a plus. It helps American factories versus those outside the country."

So computer companies will, it seems, have to compete head-to-head with other businesses for money. If they cannot raise funds for the long term, the short-term cost of capital, based on the prime rate, will make things difficult.

Data Resources believes that the prime rate will dip to about 13½% during 1981 and then rise, perhaps to about 15% by the end of the year. In 1982, according to the DRI forecasts, rates will be a little higher. Things won't be as bad as they have been, according to Eckstein, because it is very likely that "politics will keep the Federal Reserve from raising the rate" to 20% or more.

It's likely that computer industry firms that plan to borrow in the long-term market will do so as early as they possibly can. Near the end of the year, interest in the short-term market will go up, and this has an effect on the cost and availability of long-term funds.

As Otto Eckstein puts it, "When interest starts to rise again, companies that have not gotten out their debt offerings are out of luck. They won't go bankrupt over the situation, but they certainly will have missed the boat."

TURNOVER OF CAPITAL

There is a remarkable consistency in the way capital is used—and how effectively—among the computer manufacturers. There is also some consistency among the firms that use capital to pay for machines they will rent to customers.

Sanford J. Garrett, of Paine Webber Mitchell Hutchins, has done a detailed analysis of several leading vendors. The similarities among them are surprising, and attest to the similarity of their underlying business practices.

IBM is a good place to start.

During the past five years, Garrett points out, IBM has grown quite a bit. The average compound rate of growth between 1975 and 1980 was 12.67% as revenues went from $14.44 billion to $26.21 billion to $8.38 billion, an average compound growth rate of 14.86%.

This kind of investment may be what it takes to gain revenues and to face the future. Put another way, without lots of capital, IBM might not now enjoy its gross revenue, customer loyalty, and technological leadership. But the need for additional investment remains a key part of IBM's planning. In its 1980 annual report, IBM says its "requirement for significant capital investment is expected to continue for the next several years."

A dollar invested in factory production facilities by IBM means about $4 in revenues to IBM, based on 1980 figures. This is a drop, as IBM had been getting $5 or more in revenues for each dollar invested in plant and equipment through the latter half of the 1970s. That ratio of revenues to investment in plant—capital turnover—could well turn up again before long, says Garrett, although it is hard to predict just when the turnaround will occur.

The capital turnover rate has generally been dropping across the industry, according to Garrett's calculations, because the industry is "switching from handmade machines to assembly line production," particularly at the high end. It's not that there was no mass production until now, of course; it's just that a lot of things formerly done with labor are now being done by increasingly automated production facilities. Some of this is due to increased volume, some is due to the demands of newer and more complex technologies.

"There is increased standardization under way in the manufacturing at most office equipment and automation companies," Garrett asserts, "and the change is very important.

"It's part of a chain of events that began when the microcomputer became a component, along with the development of much improved integrated circuits of other types."

In addition to upheavals in the manufacture of information processing equipment, the past few years have been characterized by rapid and, to an extent, unpredictable swings from rental to purchase and back on all kinds of machines. IBM has been caught off guard, and so has the rest of the industry.

In 1978 alone, IBM invested $2.72 billion in its rental base. But the very next year, the company's rate of capital expenditures to support rentals rose 54.6% to $4.21 billion. It has gone up from there, too. Along the way, IBM, which had been buying its own stock on the market with cash from its once-swollen treasury, had to go out and borrow more than $2 billion via a bond issue.

Interestingly, a capital turnover in rental investments is not nearly as great as in plant and equipment. But at IBM, where the recent investments in rental base gear have reduced the turnover rate, each dollar's worth of equipment, on average, still produces $1.30 in rental revenue. This is much less than is produced by an equivalent investment in plant and equipment, but without funding its rental base, IBM could not have achieved its gross revenues. In short, IBM's financing terms have helped encourage users to acquire systems, particularly the 4300 line products with the two year rental plan.

Other companies get different rates of capital turnover, but as in manufacturing, the story is pretty much the same. It takes money to make computers, and in certain market segments—mainframes, peripherals, and small business systems—the manufacturers' rental plans are a vital part of the marketing process.

The minicomputer business is different: the products are sold outright.

Garrett points out, however, that "the manufacturing side of the full-line businesses and the full mini business are very similar in terms of capital turnover." Digital Equipment and Prime Computer, two mini makers that differ considerably in size and product diversity, show marked similarities when financial figures are examined.

When it comes to raising capital, Digital and Prime both tend to sell equity, assuming market conditions are favorable. DEC's situation is particularly interesting, because the company's stockholders are not investing for dividends but essentially for the appreciation of their shares.

All the other mini makers have similar situations, although their ability to raise money depends on their momentary financial condition as much as stock market climate. Minicomputer stocks, like minicomputer profits, are, in general, more volatile than those of the full-line companies. So if stock sales are out, the mini companies have to raise capital by borrowing.

BIG SMALL BUSINESS VENDORS

The sellers of small business systems, such as Wang, have, on a smaller scale, some of the characteristics of full-line manufacturers. They have to support rental machines to a degree, and they also have to capitalize plant and equipment. They may also encounter significant research and development expenditures, since the shorter design cycle of small machines makes for a fast pace of technological competition.

In revenue growth, this market segment may be more prone to ups and downs than mainframes, the companies in this business may use more short-term debt, simply because planning is not as easy in a volatile environment. As short-term debt mounts up, management may wish to convert it to longer-term capitalization via straight debt, equity

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CIRCLE 157 ON READER CARD

If computer industry companies don't get funds at the right time and at the right price, it can cause problems.

offerings, or the issuance of convertible debentures. This last route has been used recently by Wang.

This issuing of convertible debentures is a bit controversial, as it may be viewed as either debt or as equity. If it is seen as debt, the use of convertibles may make a company's balance sheet look weaker, while the same capitalization technique, taken as equity, looks very good.

The ratio of a company's debt to its aggregate capital is considered a measure of fiscal health in financial circles. In general —and with great caution that this is only a rough rule of thumb—a debt to total capitalization ratio of 30% to 35% is "not viewed with undue alarm," according to Ulric Weil. He adds that "beyond that, many questions may be asked. Each company's case must be examined on its own merits."

The implications of Weil's guideline is that companies like IBM, for instance, with little debt compared to equity capital, could borrow great amounts of money before anyone on Wall Street would question the company's financial philosophy. Other companies with similar ratios would be accorded similar treatment, barring unusual circumstances. By contrast, companies that have debt that is more than a third of equity are likely to have a hard time selling more debt, or, if they do not sell debt, they will not be likely to get the lowest interest rates possible.

While manufacturing businesses are relatively easy to view from a capital standpoint, those in the service and software sector are not. These organizations, because they are built on people, not machinery, need less capital per dollar of gross revenue. Looking into the books of a software house or service bureau cannot be done the way it is done in the manufacturing sectors of the computer industry.

This is not to say that software and service companies can't raise capital, but these companies have to be ready to answer different questions than manufacturers if they want to succeed.

It's easier to sell stock, says Esther Dyson, if there is a product-oriented market for a people-intensive company. Examples might be software packages that are uniform from installation to installation or service offerings that are defined with some clarity. The custom software business, particularly if it is not a large one, has a harder time telling its story, no matter how good, to investors.

FUNDS AT RIGHT TIME

If computer industry companies don't get funds at the right time and at the right price, it can cause problems. Some organizations may use expensive short-term debt if they can't raise long-term funds; the interest on this debt can be several points higher, and that interest eats up profits.

The intent of each corporate treasurer is to see that his company has funds when they are needed. With high interest, however, having money on hand that cannot be put to use becomes a luxury. So a balance has to be struck. This is aided by a financial philosophy (e.g., a bird in the hand or a buck in the bank is worth two in the bush) and, to a degree, by planning and projections that work out.

During 1980, some economists had predicted that interest would drop in the spring (which it did) and rise again through the summer and into the fall (which it did, but later than some forecasters had predicted it would). Digital Equipment, anticipating a need for increased capital, determined that conditions in the financial markets would be optimal during the second quarter of the year. So on April 1, the company issued $400 million in convertible debentures that paid 8¾% interest and were to be turned into equity on a $72 per share basis. Had DEC waited a couple of months, chances are that the interest on the convertible issue would have been lower; other similar offerings were made by various companies at lower rates later in the spring and summer.

Today, the decision only appears to have been a bit premature in the light of what Ulric Weil called "20/20 hindsight, something with which we are all so gifted." In any event, DEC's stock rose considerably during the rest of 1980 and into 1981, and the company called in its debt, and replaced it with equity before a year had passed from the time of issue. This means that DEC paid out more interest than it might have, but not an amount that had any detrimental impact on the company's business.

Had DEC hesitated and found a higher interest rate prevailing in financial markets, its financing might have been even more costly. It is really a matter of a treasurer's choice, Weil emphasizes, which cannot be blamed on economists, political events, financial market conditions or anything else. Either the company makes choices that work out, or the company has to find a new financial captain.

Expectations about the forthcoming patterns in interest rates are bringing a lot of financing issues to market before the U.S. government goes out borrowing with both hands later in the year. The result of competition for capital and the timing of each company's foray into the canyons of Wall Street will be told in year-end balance sheets and future earnings reports.

Who will end up with the healthiest figures? Nobody knows in advance. But in each industry sector, somebody will. If the companies with the strong financial position can make the rest of their businesses click, they'll continue to enjoy the fruits of a burgeoning business. But if they don't, capital shortages will force them to make hard choices regarding the opportunities that will have to be sacrificed in the name of economy.

"If I may say so, sir, a penny saved is a lot of nonsense."

CARTOON BY CHUCK VADUN

Mr. Wiener publishes *Computer and Communications Buyer* and *Mainstream* newsletters and *Technology News of America* news service.

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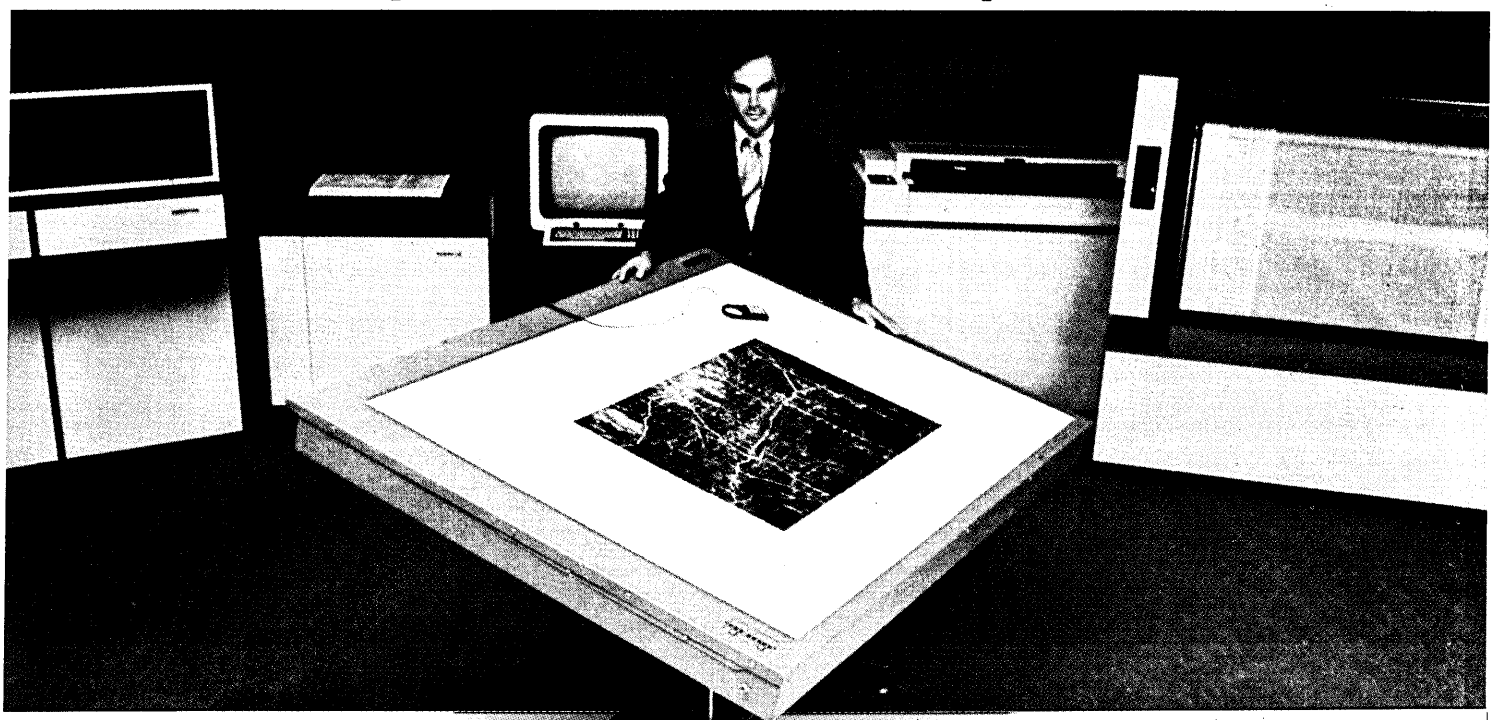

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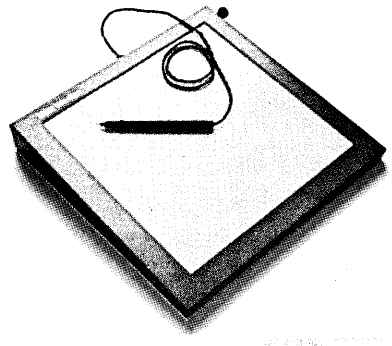

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CIRCLE 158 ON READER CARD

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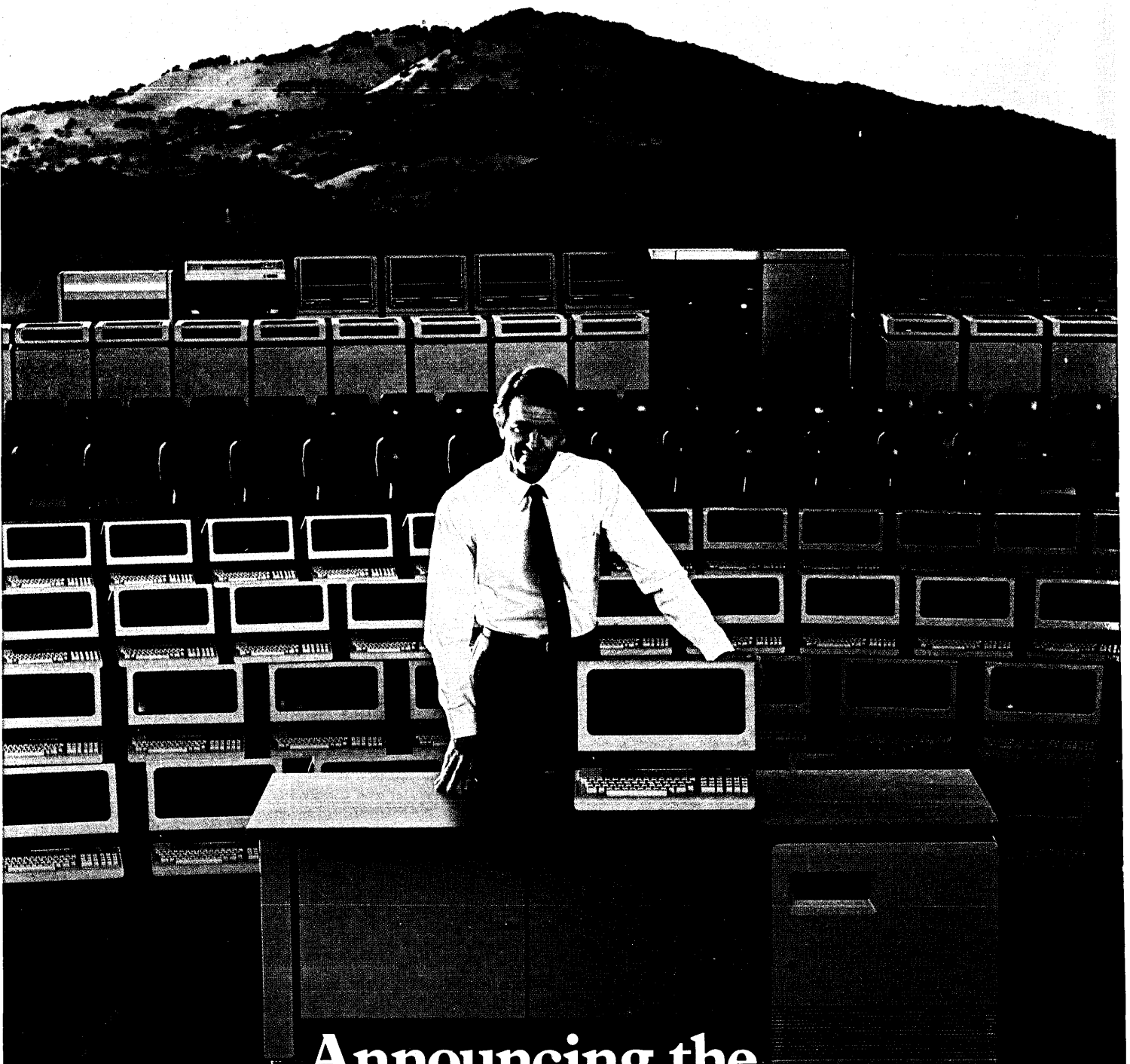

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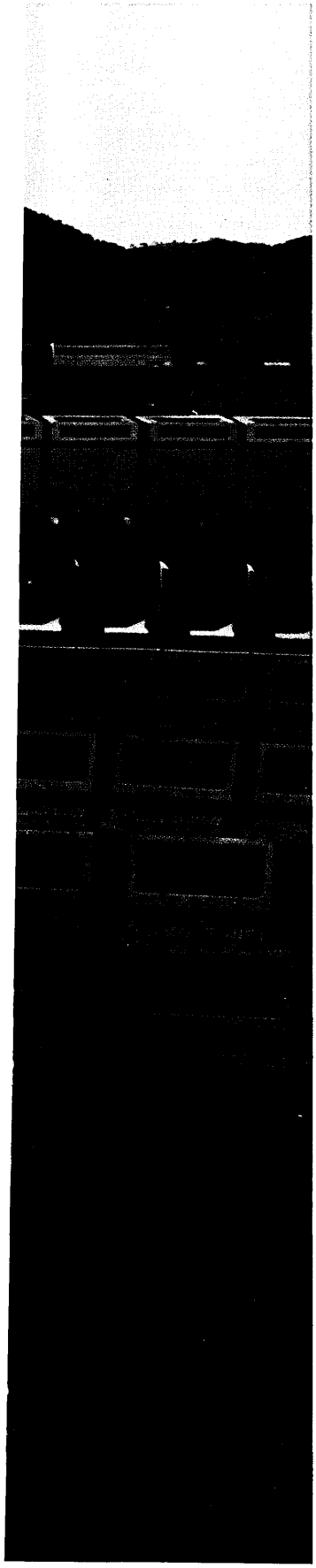

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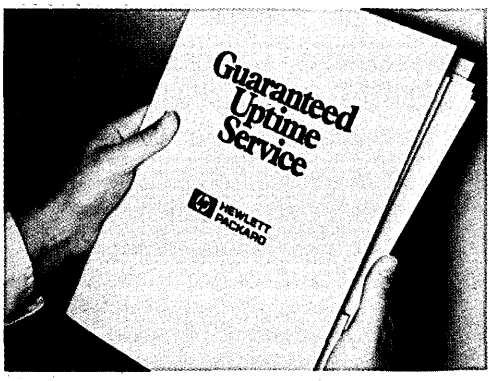

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CIRCLE 160 ON READER CARD

A panel of experts discusses hardware, software, and certain aspects of educational policy.

GROWING UP COMPUTING

The people in the art department had their radio turned up pretty loud the other day, and we noticed that they were listening to a song called "Computer Games." Some of us grew up with tunes like Wilson Pickett's "Mustang Sally," and we got to wondering: are there kids today who care as much about mag tape as an earlier generation did about mag wheels?

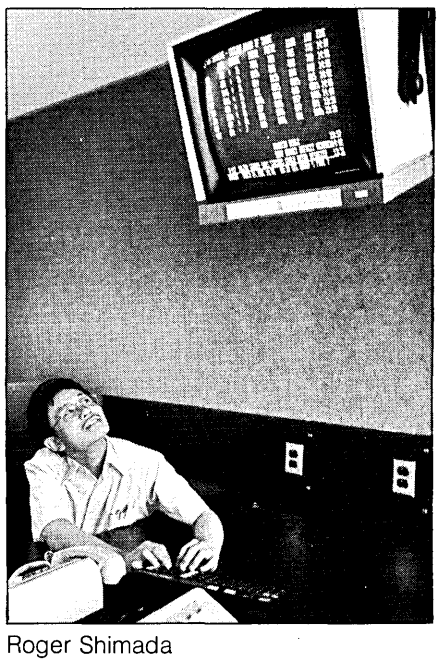
You bet there are; visit a computer store and you'll see them there. This being the case, it occurred to us that it might be interesting to see what some of these scions of Eniac had to say about computing. We decided to bring four of them to New York to discuss their field in the same roundtable format we use for other computer experts. It seemed reasonable to try to get a diverse group, but the diversity we ended up with is mostly geographic. This is not too surprising; science programs (and personal computers) remain most available to the middle and upper classes in this country, and boys still tend to take more science courses than girls.

Our panelists arrived in New York on a Monday afternoon. We dined with them at one of those high-altitude restaurants for which New York is noted, and stayed that night at a midtown hotel. Tuesday morning we crowded onto an E train—the high point of the trip for several of the panelists—and headed for the World Trade Center to see how computers are used in the commodities business.

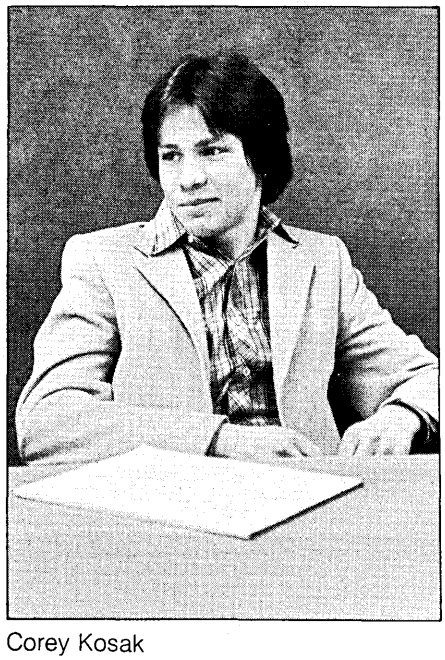
Through the good offices of Joseph DiLiberto and Jim McLain of Macro International Group, we learned a bit about what commodities brokers do. Then we hurried over to 4 World Trade where Farhad Froozan, director of computer and technical services for the Commodities Exchange Center, gave us a tour of the exchanges and an introduction to the Quotron system he uses to manage the huge volume of trading there.

Ignoring pleas that we abandon our plans for a roundtable and proceed instead to the observation deck, DATAMATION staffers Deborah Sojka, Wendy Crisp, Bill Musgrave, and Ken Klee then escorted the experts to the 89th floor offices of Macro International for some conversation. Participating were:

Jonathan Muskin and John Pencsak



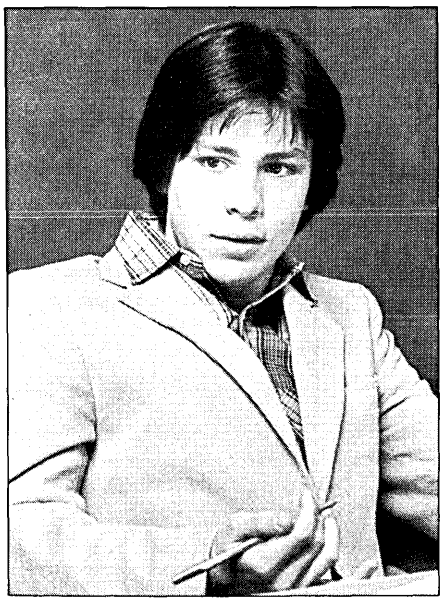
Roger Shimada



Corey Kosak

PHOTOGRAPHS BY MARC WEINSTEIN

KOSAK: I don't like working on computers fulltime. I like it as a part-time job.



• Corey Kosak, 15, a tenth grader at San Marin High School in Marin County, California. Kosak has over three years' experience in computing, and currently works with David Fox at the Marin Computer Center and with author Mitchell Waite.
• Jonathan Muskin, 13, an eighth grader at Friends Academy in Locust Valley, Long Island. Muskin has over two years' experience in computing, and has done some programming to facilitate bookkeeping in his father's medical practice.
• John Pencsak, 14, an eighth grader at Westwood Jr. High School in Dallas. Pencsak has over a year of experience in computing, and works at Computerland of Dallas.
• Roger Shimada, 16, a tenth grader at Central High School in Minneapolis. Shimada has six years' experience in computing and works at the Computer Center at Dayton's department store in Minneapolis.

How did you all get into computing?

Pencsak: I've always looked at magazines. I had a subscription to *Popular Electronics* and I'd look at the electronics ads. I used to be a calculator freak; I had like six or seven. I started out a long time ago with one from Radio Shack that cost $9.95, and I got some more for Christmas, one with an alarm on it. Then I got a little TI programmable, and I played with that for a while. Then a Computerland store opened right by where I live, and I went up there one day. They had a kids' corner and the kids would go there and play on the little Apple. So, every day after school I would go there. Finally, my Dad bought me an Apple. About a week after that I got a job at the store cleaning windows, and I started adding on to my Apple.

Shimada: I started about six years ago, with BASIC on an HP2000. Since then I've picked up FORTRAN, COBOL, and PASCAL. I learned COBOL doing Explorer's Post at General Mills. They've got an HP3000 set up there. PASCAL and FORTRAN you pick up here and there when you can. You use the manuals.

Muskin: I started out in the sixth grade. I was interested in computers, and I started out with BASIC, [TRS-80] Level I, 4K. I upgraded my system and read manuals. Now I think I've learned—mostly self-taught—a lot of languages. I know assembler for the 6502 and the Z80, BASIC, FORTRAN, some PASCAL. . .

You did all this at home?

Muskin: Yes, I started out with a TRS-80 but I gave that to my father so I could get an Apple. And I do all the work he needs for his business—payrolls, appointment keeping, all that stuff. The whole thing is computerized.

Kosak: I began about three and a half years ago, on a Teletype at my school. We were hooked up to Lawrence Hall of Science, and I started out playing Star Trek. Then the school got a PET, and I learned to program in BASIC. My first job was working for a commodities broker. With another person I did programming to keep track of customer accounts. Then David Fox, who started the Marin Computer Center, was working on this program for six micros, called the Starship, a simulation of the bridge of the Enterprise. I helped out with that as a volunteer.

You all have easy access to computers. What do you use them for?

Shimada: Well, there's a sort of a saying that if you're a good programmer there are very few applications you can do, except just to amuse yourself.

Have you constructed any games?

Shimada: Oh yes. Right now I've got this 350-line BASIC program at home. . .

Pencsak: The first thing everyone does when they get a computer is to make a game. They start out making a high-low (number guessing) program.

Muskin: Yeah, that's what I did.

Shimada: Games you can relate to.

Pencsak: I'm sure all of us can write pretty good games, but not as good as professionals, not good enough to sell.

A couple of you have worked with larger systems, haven't you?

Kosak: I've been working for Digital Telephone. They make PBXs. They have a PDP-11, and I program in FORTRAN. I just pick up the odd jobs that the programmers don't have time to do.

Shimada: I've worked with an HP 2000 and an HP 3000.

Pencsak: Did you do that over the phone?

Shimada: Of course. You know, you get pampered by CDC Cyber 73s and Burroughs 6700s, making the 2000 look like junk.

Would you rather timeshare or have your own Apple?

Shimada: Well, the Apple can be quicker.

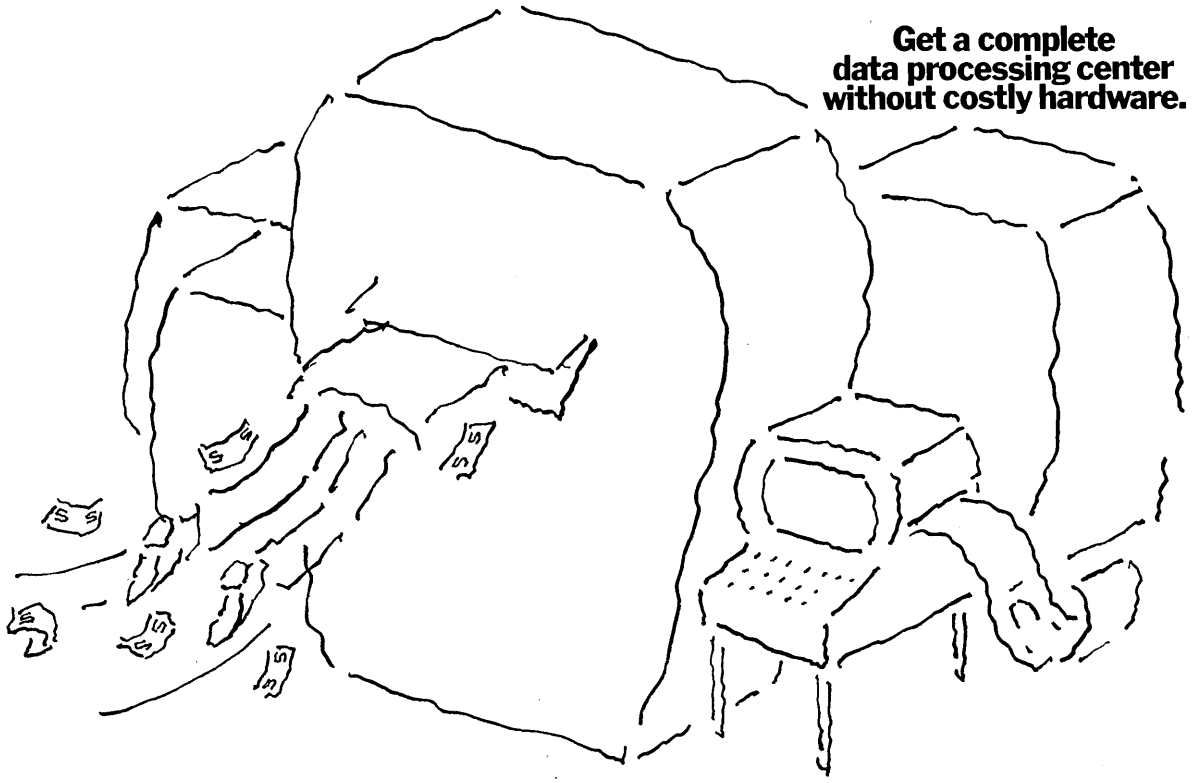
Kosak: But 10MB hard disks are more fun than 5-¼ inch floppies.

Pencsak: Timesharing can bring you more languages.

Muskin: You can run up your phone bill, too.

Do you do any homework on your computer?

Get a complete data processing center without costly hardware.



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CIRCLE 165 ON READER CARD

MUSKIN: I want a good disk operating system, and a lot of passwords so my brother can't break in.

Muskin: Not me.

Kosak: I have an Atari at home right now, on loan from the Computer Center. And I like to write programs to try out some of its features, and see what special effects I can get. The Atari has a way you can get 256 colors on the screen at the same time. You can't do that normally. It looks like a rainbow.

Pencsak: I like to play around and modify programs, just to be funny. You all know Lemonade?

(Everyone but DATAMATION is familiar with the game.)

Pencsak: It's a game that comes with the computer. And it teaches you, or it tries to teach you I should say, how to run a small business.

Muskin: It's unrealistic though. You can't expand your business. You can't sell more than 100 glasses unless it's a hot day.

Pencsak: And it gives you hot days.

Muskin: Or rainy days. And when it's cloudy it always rains. It says 30% chance of rain, but it always rains.

Pencsak: Sometimes it doesn't.

Muskin: It always does.

How many of you have computers in your schools?

Muskin: Mine has a few, but you don't use them until the ninth grade. I think they have a TRS-80 and two PETs.

Shimada: We've got eight Apples at my school, two Teletypes, which we call teletanks, and a poor excuse for a Digilog. The students learn fast. A lot of them can outprogram the teacher in no time.

Kosak: Our school has six PETs. Next year we're getting 15 Apples.

Are there required computer courses?

Muskin: At my school it's once or twice a week. Nothing major.

Pencsak: At my school it's sort of required. They take us out of our math class for three weeks and teach us about the Apple. I think they ought to take us out of history.

Muskin: Yeah, that's what I think.

Pencsak: They need to take history out and put computers in because history has no meaning. You never use history. Why would you want to use history? Do you use history in your job? No.

Kosak: Who cares if Davy Crockett discovered America?

Pencsak: They need to learn computers, because 70% of kids today will use computers when they grow up.

How many years should computers be studied?

Pencsak: A year or two.

Shimada: Enough to learn the basics.

Are computers as important as English?

Shimada: English grows increasingly redundant.

Muskin: And boring.

Shimada: You don't learn anything.

As important as math?

Muskin: Math is more important than English, I'd say.

How do the other students like the computer courses?

Shimada: Well, the course is optional. We have special funding, so. . .

Pencsak: I guess, with eight Apples.

Shimada: The Apple is a very good game player, and a lot of the kids are interested in games. So of course they decided to draw the line between use and abuse.

Pencsak: If anyone wants to buy an Apple, I have one for sale.

Kosak: You do?

Pencsak: I'm selling mine because I want to get one of the new ones that don't mess up the other tvs. When you turn on your Apple it messes up your parents' tv.

Do you think you have an advantage over other kids because you're learning about computers now?

Muskin: Maybe in the future. When we grow up we can make a career out of it.

How many of you want to make a career out of it?

Muskin: Me, probably.

Pencsak: I do.

Shimada: I want to be a computer science major.

Kosak: I don't know. I don't like working on computers full-time. I'd like it as a part-time job where I can work on it for while, then do something else.

Do you think that computers are a threat to privacy?

Shimada: Not yet. Not with the quality nowadays.

Pencsak: They're extremely dumb.

The new look in low-cost data entry.

It's the brand new HP 2622 block mode terminal from Hewlett-Packard.

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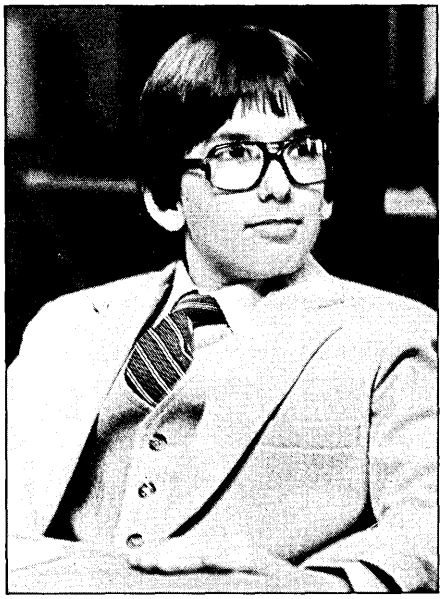
PENCSAK: They need to take history out of the schools and put computers in instead, because history has no meaning.



Shimada: They're very fast, dumb beasts.

Kosak: I heard a saying that people are smarter than computers, but computers are smarter than programmers.

Shimada: Programmers are smarter than computers, but computers think faster.

Muskin: If the machine's programmed right, it won't make any errors.

Shimada: It's never the machine's fault.

Muskin: Unless it's a "Trash-80."

Shimada: You know, the thing about the "Trash-80" is you should just get the base system from Radio Shack and leave everything else to other companies. Get your software, your disk drives, anything you can get your hands on, from somebody else.

Pencsak: What do you get if you drop an Apple off the World Trade Center?

Muskin: Applesauce.

Pencsak: No, Applesoft. I made that up myself.

Muskin: It figures.

What do you guys think of BASIC?

Muskin: Too slow. That's why I learned two machine languages.

Pencsak: It's neat, though. I like it.

Muskin: Well, it's easy to do something that doesn't require speed. But for some of the graphics programs I use, like the game Bloody Murder, where I've got to get these guys to throw knives at each other, I need machine language.

All you guys have experience on more than one kind of computer. How do you go about learning a new machine?

Kosak: Well, with this Atari I'm using now I'm in an interesting position. David Fox, the guy at the Computer Center, went to this Atari seminar with about 10 other people, and they got all this inside information. They got the source code for the operating system. So I can do some really neat things, like that color change, that other people wouldn't know how to do.

Muskin: I moved from a TRS-80 to an Apple. I was familiar with Microsoft BASIC, so I just got the Apple manual and read it that night. I skimmed the book for about an hour, basically to see what different commands they have.

Pencsak: You can read the Apple manual very quickly.

Shimada: Apple publishes the best documentation.

Do you guys read anything besides manuals? Somebody mentioned science fiction. . .

Muskin: All I ever read is manuals and computer magazines and that stuff.

Pencsak: I don't even read manuals. I figure it out. Well, machine language manuals I read a little bit. But the main thing is going up to Computerland after school. I learned the basics that way.

If you guys could design your ideal systems, what would they include?

Muskin: Well, let's see. It's got to have powerful BASIC in it. It's got to have what Atari has, many colors. Sixteen colors is suitable, with 16 luminescence values. Graphics is a necessity. It's got to have a disk drive that works, and a reliable disk system. It's got to have strong editing capabilities. And abilities for shape tables, to create shapes, then shrink them and rotate them. It's got to be fast, and it's got to have a good microprocessor, like a Z80. What else? It's got to have real-time capabilities and lower case. I need a lot of memory—48K, I guess that's good enough. A very good disk operating system, and a lot of passwords so my brother can't break in. I definitely want sound. Two voices, so you can have two notes at once. Music and speech. And I should be able to input stuff through voice recognition.

What about the languages?

Muskin: It's got to have built-in assembler and monitor. Plus it should speak other languages, like FORTRAN and PASCAL. It's got to have a built-in compiler, too.

Shimada: Staying within moderate limits, what I'd like is a Z80B microprocessor, 64K static RAM. Load BASIC, anything you want from disk. Disk has to be dual density, not necessarily dual side.

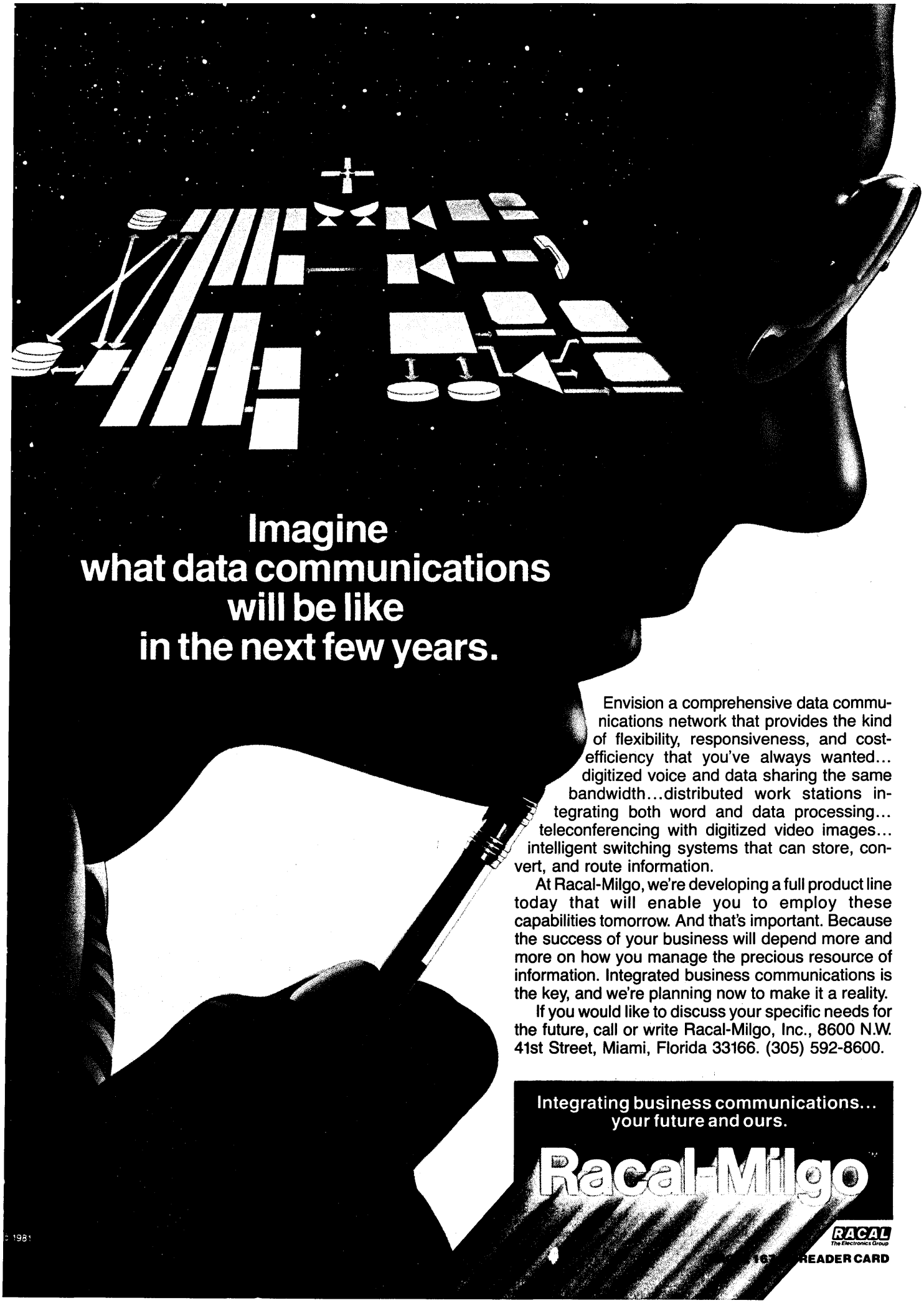
Pencsak: Dual side is bad. I wouldn't trust it.

Shimada: I wouldn't trust it either. I want analog to digital, digital to analog. Two good joysticks, buttons, color graphics. That's basically it, besides full character keyboards. Probably a third shift key so you can generate graphic symbols. User definable fonts. Maybe even bank switching at the RAM, just for fun.

Muskin: You're nuts.

Shimada: I could be worse. I could say I want on-the-chip multiplication and division. Oh, and I also want two good, letter-quality printers. For no apparent reason.

Kosak: I want a computer with at least 64K, but you can bank switch. I want a good operating system but a good source code so I can modify it. And the operating systems aren't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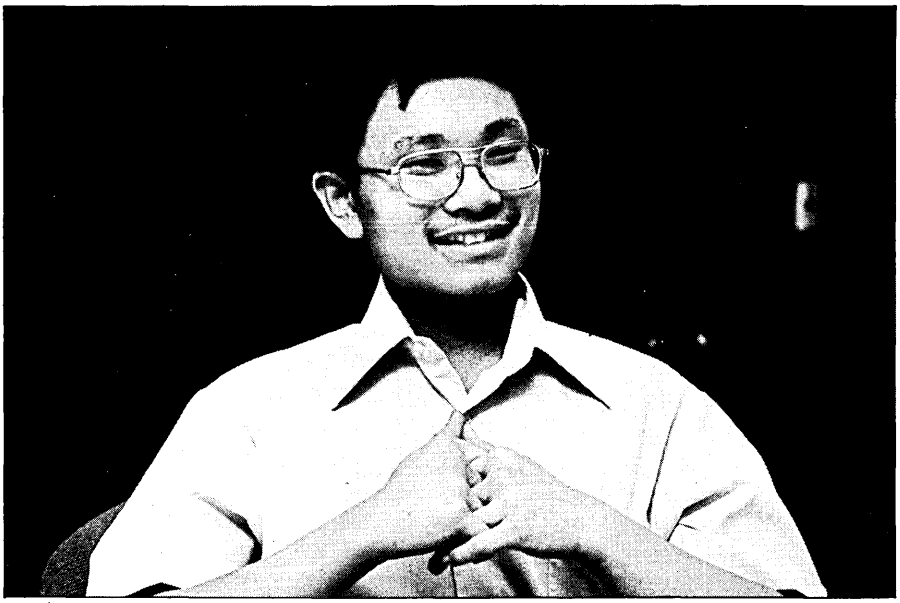
SHIMADA: The students learn fast. A lot of them can out-program the teacher in no time.



resident, I can load a different one from disk or something. And then all the languages: FORTRAN, PASCAL, BASIC.

Pencsak: Let's see, I'm just going to wipe out y'all's systems, I think. I'll have a mainframe, and it'll have ten users. . .

Shimada: That's not micro.

Pencsak: Okay, I'll do a micro. I'd like 2MB of hard disk. I would like 128K. I would like an operating system that loads in, so like Corey said, you can modify it. I would like color graphics like H-P is using. I'd like 2,655 different shades of color. Seriously, I've seen a computer that'll do that. Two microprocessors. Oh, and a voice synthesizer, and speech recognition.

What's the neatest computer application you guys have come across?

Muskin: I like computer animation. There's a college around here, the New York Institute of Technology, and they have a really sophisticated computer graphics system. It's great, they do all these commercials.

Kosak: The best program that I ever saw, I think, written for a micro, is WordStar, which is made by MicroPro. It's a word processing program that does everything. As you're typing, it centers your text for you and makes sure words don't break, and it justifies. It'll even print for you while you're typing.

Shimada: I know one program I'd really like. I heard about it back in 1976, I think it was. It's a Star Trek game where you have six players on each side, Romulans versus the Federation, because those who know Star Trek know that the Klingons and the Federation have a treaty, and they aren't supposed to fight. And so you have six players on six terminals, early in the morning before people get on the system, and you use the digitizing tablet and try to establish your dilithium trade routes here and there.

Pencsak: My favorite is VisiCalc. It's the number one program.

Kosak: Anyone here use Whatsit? It's a database. For example you tell it Joe's birthday is March 12, and it stores that on the disk. And you can cross index and ask for all the people whose birthday is March 12. A business can use it for a customer database. Phone numbers and pertinent information can be cross indexed.

What will you be doing the next time you sit down at a computer?

Pencsak: Right now I'm working on an alarm system type thing. I bought this thing from a guy in my Apple group. It's called an I/O board, and it'll read eight switches. I can use 1-bit memory locations to see which door is open. I have a picture of our house on a high-res screen, and when the door's open it shows up there.

Kosak: With David Fox at the Computer Center I'm rewriting some games so they can be played on the Apple. They're being published by a company called Adventure International. The first ones are called Six Micro Stories, and you're like a character in a novel. The plot'll be going along, and what you do affects the outcome of the story. Those are out already. There's another one that isn't out yet, and it's called His Majesty's Ship Impetuous. It's also an adventure novel, but it's a bit longer. And we're working on this big project for the Atari, which is a secret so I can't talk about it.

Shimada: I'd like to write up a catalog program for the Apple that is similar to the one developed by Lawrence Hall of Science, giving where the file begins and ends and the file length. It's not easy to write when you think about it.

Maybe to sum up, you would be willing to make some predictions about the future of computing.

Pencsak: It's going to be a way of living. It'll be like a tv. Every home's going to have one. It'll be as popular as a tv ever was. It's going to be like a telephone. Everybody will use them.

Use them for what?

Muskin: Household jobs.

Kosak: A nice thing would be a computer that does all the things you have to go places for. Like airline ticketing. Also you could get news from it, find out what's happening in the world.

Shimada: They'll be used for education, too.

Muskin: Yes. Maybe in the future all computers will be able to hook up to timesharing systems, besides being personal microcomputers. So if a kid needed help in algebra, there would be a good educational program there for him to use.

Shimada: Perhaps an on-line tutor.

Pencsak: Oh, there's going to be school at home in the future. In the future there won't be any more public schools. People will sit in front of their little crts. . .

Muskin: That's great. I love that.

Pencsak: With the teacher's little synthesizer voice saying, "Shaddup!"

Kosak: And no history. It won't teach history.

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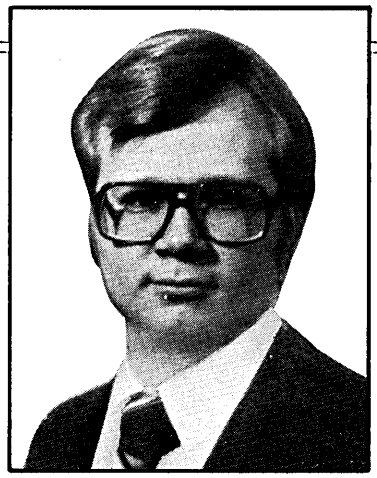

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CIRCLE 168 ON READER CARD

HARDWARE

OFF-LINE

Interaction Systems, Inc., of Newtonville, Mass., has entered into an agreement with Lear-Siegler to promote Interaction's touch-sensitive crt add-on kits. The company has designed add-ons specifically for Lear-Siegler's terminals. A demonstration of a touch-sensitive screen equipped ADM-42 terminal is planned (at the time this was written) for the Lear-Siegler booth at the Chicago NCC. The add-on kits will be offered by Interaction Systems, and also are expected to be sold by some Lear-Siegler distributors both here in the States and abroad.

People purchasing printers base nearly half of their selection criteria on print quality, according to a report from Venture Development Corp., of Wellesley, Mass. Price was the second most important factor, followed by print speed. "The High Quality Computer Printer Industry: A Strategic Analysis" covers daisywheel printers, high-resolution dot-matrix printers, golf ball printers, ink jet printers, and page printers. VDC has identified an installed base of nearly 400,000 units, which the firm says is rapidly growing. The researchers predict annual shipments of more than $2 billion in five years.

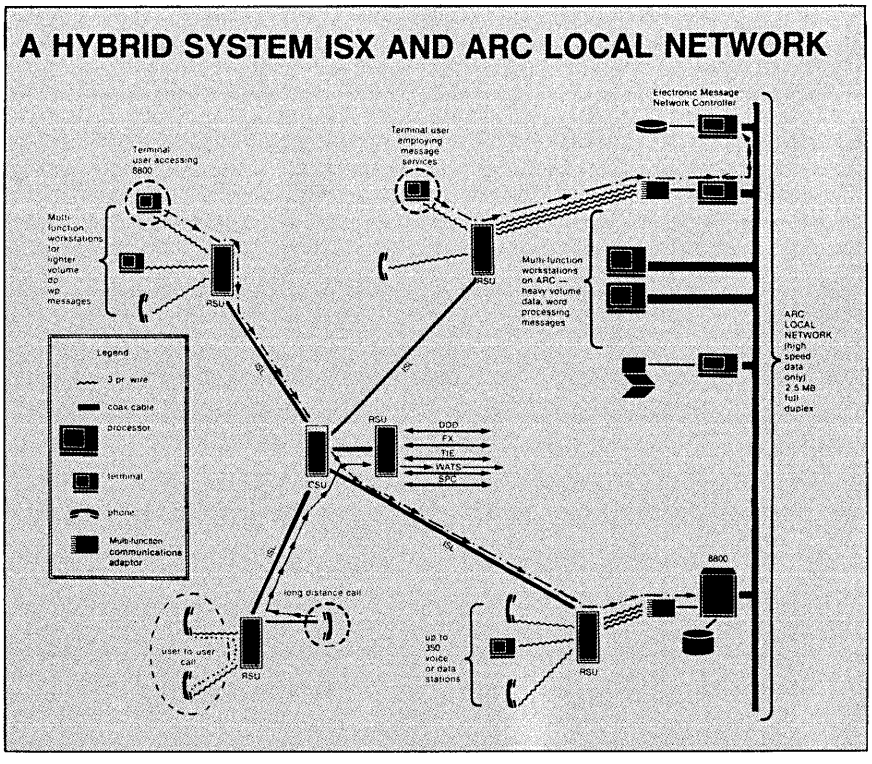
Percom Data Co., of Garland, Texas has let a contract worth nearly $2 million to Chatsworth, Calif.'s Micro Peripherals Inc. The contract calls for the delivery of 10,000 5-1/4 inch single and dual sided floppy disk drives over a two-year period. Both 48tpi and 96tpi drives are called for under the contract.

DATA AND VOICE PBX

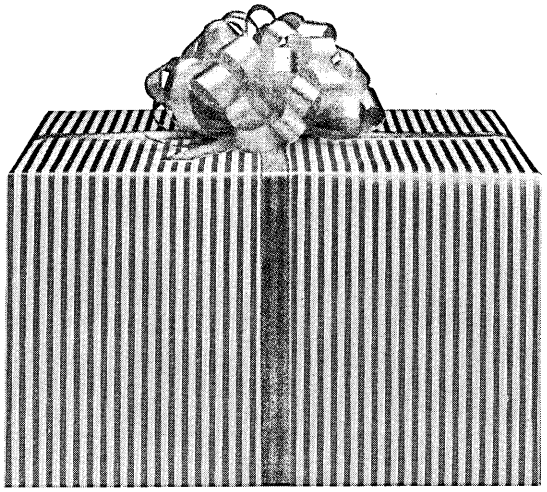
The Information Switching Exchange (ISX) from Datapoint is an entirely digital PBX that can switch any combination of data, voice, text, or other digitized traffic. Designed as a modular system, the ISX can range in capacity from 100 to more than 20,000 voice and data ports. The system can concurrently handle hundreds or thousands of connections, providing routing, selecting the least expensive carrier, and monitoring the priority of the message originator. ISX also continuously runs self-diagnostics, automatically reporting critical problems to Datapoint's national service center. Keeping with Datapoint's thrust into the office of the future, the ISX works with the firm's ARC systems, integrating the ARC local co-ax network with other Datapoint office automation products.

ISX handles voice as digitized data, using phone sets from Datapoint or other vendors. Text and data travel at up to 56Kbps (synchronous or asynchronous), using intelligent or nonintelligent Datapoint equipment or RS232-compatible terminals and computers from others.

ISX is comprised of the Data Management System (DMS) and a switching/process control subsystem, which is itself comprised of a Central Switching Unit (CSU) and one or more Remote Switching Units (RSU). ISX needs only telephone instruments and terminal devices to form a complete communications system. The CSU handles central switching, control, call processing, and external communication functions for the switching and process control subsystem. Local switching and interfacing to the CSU is performed by the RSU for



Everyone Working on Network Software Should Stop.



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DM/81

CIRCLE 169 ON READER CARD

both terminals and telephones. Communications between devices connected to the same RSU (up to 350 ports) will be routed locally, without the intervention of the CSU. Messages destined for other devices connected to the user's ISX will travel from originating RSU to the CSU and then on to the RSU connected to the destination device. Traffic to the outside world will leave via the RSU closest to the destination—either the originating RSU or, via the CSU, another RSU. Interswitch Links (ISL) between RSUs and the CSU run at 4Mbps over co-ax cable, microwave links, or a version of Datapoint's LightLink optical data link.

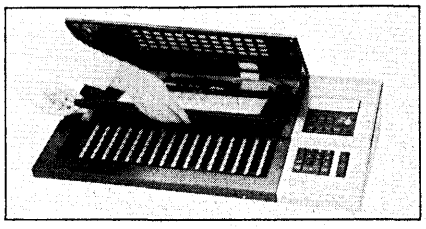
The DMS allows dynamic reconfiguration of the ISX. New phones may be added, numbers may be changed, and extensions can be moved via the DMS without interrupting the ISX.

A typical ISX with 888 ports, comprised of a CSU, three RSUs, three co-ax ISLs, a DMS (6600 processor, 20MB of disk, and a 160cps printer), five attendant consoles, and 96 central office trunks, carries a price tag of $614,010. The above equipment is all for switching; a companion complement of station equipment, consisting of 425 Datapoint Infoset Is (single-line phones), 72 multiple-line Infoset IIs, 144 standard keysets, and 75 standard single-line sets, prices out to $226,950. Typical installation charges run $26,329, while station cabling prices out around $65,500. Monthly maintenance is $3.27 per active port. DATAPOINT CORP., San Antonio, Texas.

FOR DATA CIRCLE 311 ON READER CARD

HUMAN ENGINEERED KEYBOARD

Last year at NCC, Panasonic introduced a small business computer with keyboard the likes of which we'd never before seen. Now the company is selling that keyboard assembly as an oem product here in the states (we won't call it unique because Fujitsu markets a similar unit in Europe). Dubbed the key-mat, the mechanism should appeal to oems needing a simplified man-machine interface in dp or control applications. The 8085 microprocessor-based key-mat includes a switch panel and one removable cartridge or 24 user-defined window-shade overlays. The switch panel has 96 variable keys, 24 page select keys, 12 function keys, and 48 fixed indicators with status lights. Each of the 24 pages (or overlays) can carry up to 96 user specified legends. The microprocessor controls selection of the pages, and transmits, via an RS232 interface, the page number, key identifier, and cartridge identifier.



With 96 legends per page and 24 pages, each cartridge can have up to 2,304 legends. Up to 15 cartridges can be uniquely identified, so, by switching cartridges of pages, nearly 35,000 legends are available to the designer. The key-mat also includes a numeric keypad. Pricing is still a bit soft, but Panasonic says the range should be between $1,500 and $2,000 per unit, depending on quantity. PANASONIC, Industrial Sales Div., Secaucus, N.J.

FOR DATA CIRCLE 301 ON READER CARD

MINICOMPUTER

Point 4 Data Corp. which originally started business as Educational Data Systems, offering hardware and software for Data General Novas many years ago, has introduced its second Nova-compatible computer, the Mark III. (The original Point 4 computer has been renamed the Mark V, and a higher performance Mark VIII is promised.)

The 600nsec cpu occupies a single board, which also contains 64KB of RAM. Interfacing to the cpu memory board through the backplane, a three-function peripheral interface board provides an asynchronous DMA four-port multiplexor, disk controller, and streamer tape drive interface. Each of the four interface ports can be strapped to operate at speeds of up to 9600 bps, allowing connection of terminals, modems, and printers. The disk controller can handle one or two drives with SMC/CMD in-

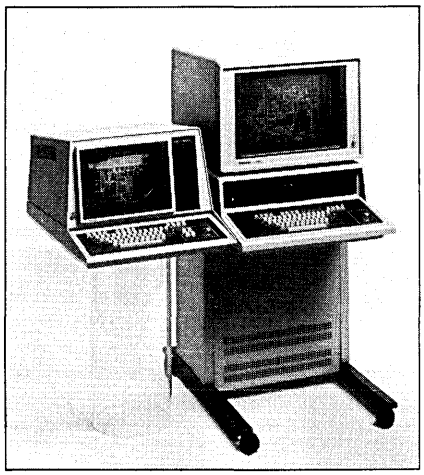
HARDWARE SPOTLIGHT

GRAPHICS TERMINALS

Tektronix has continued its forward momentum in the computer graphics market with the 4110 series of terminals. While maintaining compatibility with the firm's existing 4010 series, the new terminals—available with either storage tube or raster scan displays—offer significant local intelligence and greater communications flexibility.

The initial 4110 offerings consist of the 4112 moderate resolution 15-inch raster scan terminal, the 4114 19-inch direct view storage tube (DVST), and the 4114 Option 31, which adds color enhanced refresh to the 4114. Display technology accounts for the major differences between the terminals: raster scan is dynamic, with selective erase, and grey-scale capabilities, while DVST offers higher resolution line drawing and fill (without grey tones). Stored DVST images cannot be selectively erased: the entire stored image must be erased, but can be redrawn with the desired vectors deleted in a fraction of a second without host processor intervention. Option 31 presents refresh vectors in an orange-red, providing contrast to the standard green phosphor image of the DVST.

Both DVST and raster scan 4110s have 16-bit Intel 8086 microprocessors that provide graphics functions such as MOVE and DRAW as well as two-dimensional transforms. Each allows images to be defined as segments that can be independently manipulated. Both raster scan and DVST versions use the same graphics data structures, and each has a proprietary processor that translates these structures into displayed images (either stroke graphics for the DVST or raster scan for the 4112). The common graphics data structure allows interchanging image data from 4112s to 4114s, and vice versa. Both terminals have 4096 by 4096 addressable points, with 640 by 480 points displayable on the 4112, and 4096 by 3120 displayable points on the 4114. Panning and zooming allow 4112 users to move over the entire image area. Both terminal types allow definition of a scrolling dialog window that shows communications with the host without interfering with the graphics image. The raster scan 4112 allows definition of up to 16 independent viewports, each of which can be separately zoomed and panned.



Thirty-two KB of RAM is standard in the 4110 series, with expansion to 600KB in the 4112 and 800KB in the 4114. The 4112 can be configured with a single 512KB floppy drive, while the 4114 can have two drives. Diskettes of image data can be interchanged between 4112s and 4114s. Both terminals offer standard RS232 interfacing, with current loop optional. The 4114 can operate at sustained communications rates of up to 19.2Kbps, while the 4112 runs to 9600bps. The 4110 series can optionally use a three-port RS232 interface to connect peripherals; the interface allows concurrent operations, such as plotting and background spooling.

Base price for the 4112 is $9,600 with a single memory plane for line drawings. Two more memory planes may be added, allowing eight shades of grey or three independent line drawings. The 4114 starts at $17,500 or $19,500 when equipped with Option 31. TEXTRONIX, INC., Beaverton, Ore.

FOR DATA CIRCLE 300 ON READER CARD

CIRCLE 170 ON READER CARD ►

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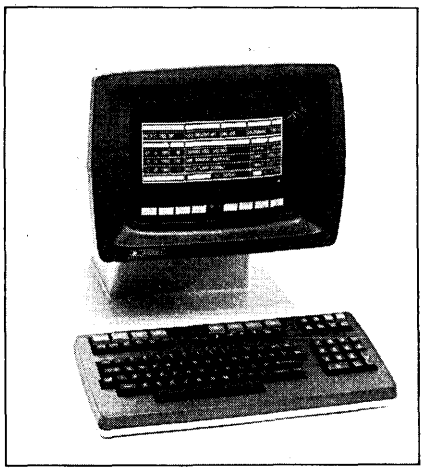
terfaces. As many as four tape drives can be attached to the peripheral interface board using a single ribbon cable. The Mark III carries an oem list price of $5,500, with quantity discounts ranging to 40%. Deliveries are quoted at 60 days. POINT 4 DATA CORP., Irvine Calif.

FOR DATA CIRCLE 304 ON READER CARD

BLOCK-MODE TERMINAL

Hewlett-Packard has broadened its display terminal line with the introduction of the HP 2622A, the least expensive block-mode terminal in the company's product line. Targeted at on-line data entry applications, the 2622A comes with two pages (of 80-character lines) of memory, screen-labeled user-programmable function keys, four display enhancement modes—reverse video, underline, blink, and half-bright—and a format mode supporting protected and unprotected fields. Options include a line-drawing character set for creating forms, and an integral thermal printer. The optional printer can copy the screen contents, including line drawing characters. It prints 60 or 64 lines per page in normal mode; in a compressed mode it can print full 132-character lines sent from the host. In addition to operating in block mode, the 2622A can operate in line-modify and character modes. RS232 interfacing is standard, with current loop available as an option. The 2622A is soft-



ware-compatible with the HP 2640. Base price for the 2622A is $2,075; the optional integrated thermal printer is $1,210, and the line drawing character set is an additional $105. Oem and volume end user discounts are offered. HEWLETT-PACKARD CO., Palo Alto, Calif.

FOR DATA CIRCLE 302 ON READER CARD

COLOR TERMINAL

Matrox Electronic Systems Ltd., a Canadian firm that has been making video interface boards and the like for several years, has now entered the intelligent terminal market with its CTM-300, an eight-color crt terminal. The ASCII terminal has a standard display format of 25 lines of 80 characters; alternate formats to 48 lines by 132 characters are user-programmable. The Z80-based terminal has firmware for its intelligent terminal functions, plus 2KB of down-line loadable RAM for user-defined operations. Capable of operating in either page or scroll mode, the CTM-300 is said to be capable of emulating any popular monochrome terminal, such as the Lear-Siegler ADM-3 and DEC VT-100. The terminal comes with a 256-character set of alphanumerics and graphics; the user can reprogram the character set by creating his own custom EPROM. The keyboard includes 18 user-programmable function keys. Communications, via an RS232 serial interface, can run to 19.2Kbps. Pricing without monitor starts at $1,275; with monitor, the unit goes for $2,830. MATROX ELECTRONIC SYSTEMS LTD., Montreal, Quebec, Canada.

FOR DATA CIRCLE 308 ON READER CARD

COMMUNICATIONS TESTER MASS STORAGE

The Network Control Div. of Digilog has developed the MSU III dual diskette mass storage unit for use with its DLM III Data Line Monitor. The storage unit can be used to trap, record, and playback over 400KB of communications data and control sequences for fault analysis, testing, and operator

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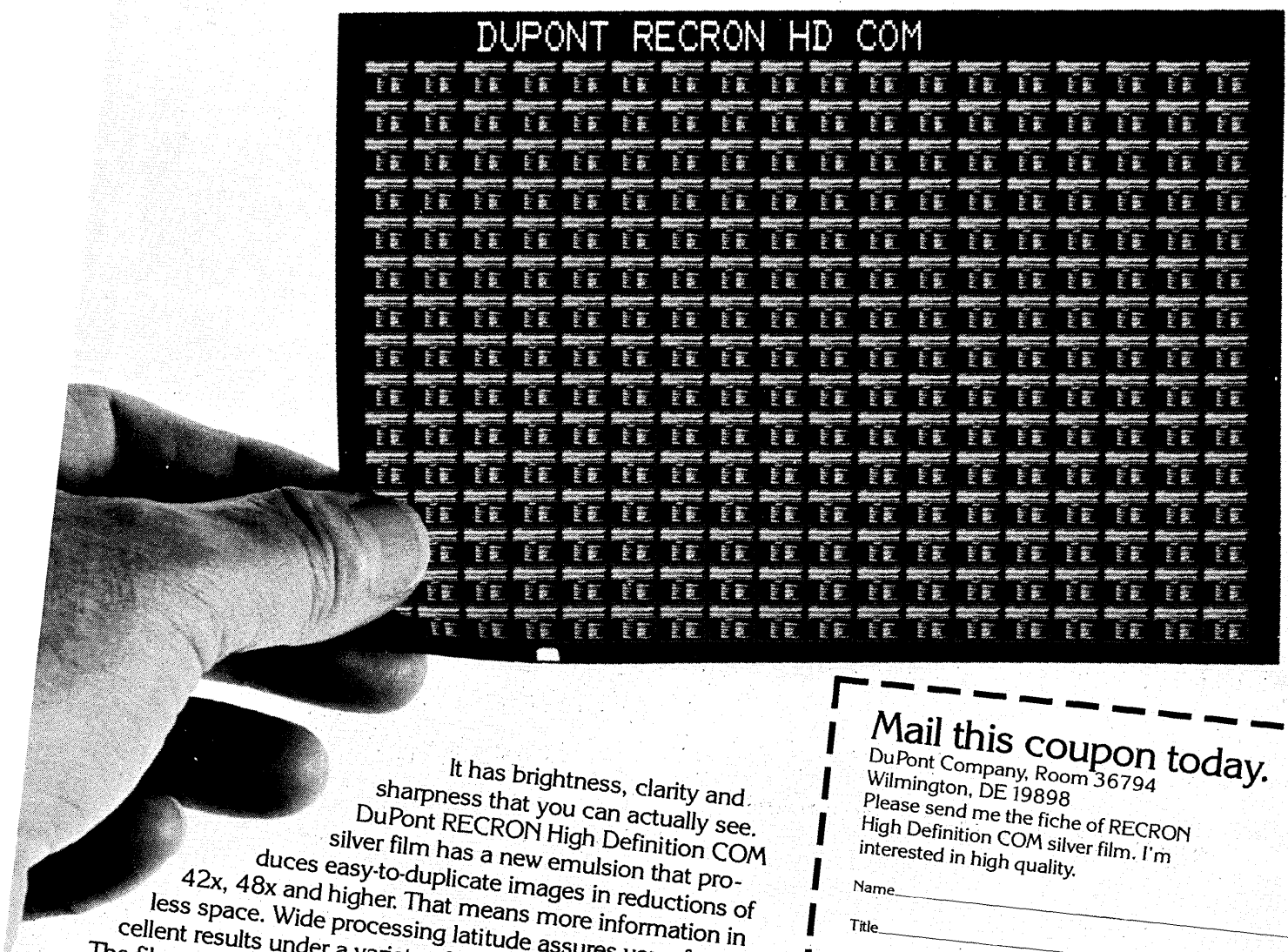

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training. The MSU III can operate unattended, trapping full-duplex traffic at rates of up to 19.2Kbps. MSU III pricing starts at $3.575 in singles. DIGILOG INC., Network Control Div., Horsham, Pa.

FOR DATA CIRCLE 309 ON READER CARD

COMPUTER SYSTEM

Harris Corp. has added the model 300 computer system to the midrange of its family of 48-bit systems. Capable of supporting as many as 48 interactive user terminals, the system can have up to 2MB of real memory and includes hardware support for virtual memory in excess of 12MB. Intended for multiple concurrent functions, the H300 handles multistream batch, multiple RJE, and sensor-based real-time processing, in addition to timesharing.

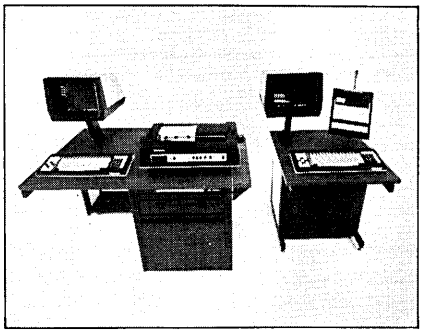
Running under Harris's Vulcan operating system, the H300 supports a number of programming languages, including FORTRAN (three versions), BASIC, COBOL, RPG, Pascal, APL, assembler, and SNOBOL. The TOTAL database management system and Task inquiry language are available, as is a query language/report writer dubbed AZ7. Communications packages are offered for a number of protocols, including CDC 200 UT, Univac 1004, IBM HASP II multileaving, 2780, 3780, and 3270 emulation.

A packaged system, including 192KB of error correcting memory, system console crt, 80MB of disk, and a 1600 bpi tape drive sells for $104,950. HARRIS CORP., Computer Systems Div., Fort Lauderdale, Fla.

FOR DATA CIRCLE 303 ON READER CARD

MULTIPROTOCOL MESSAGE TERMINAL

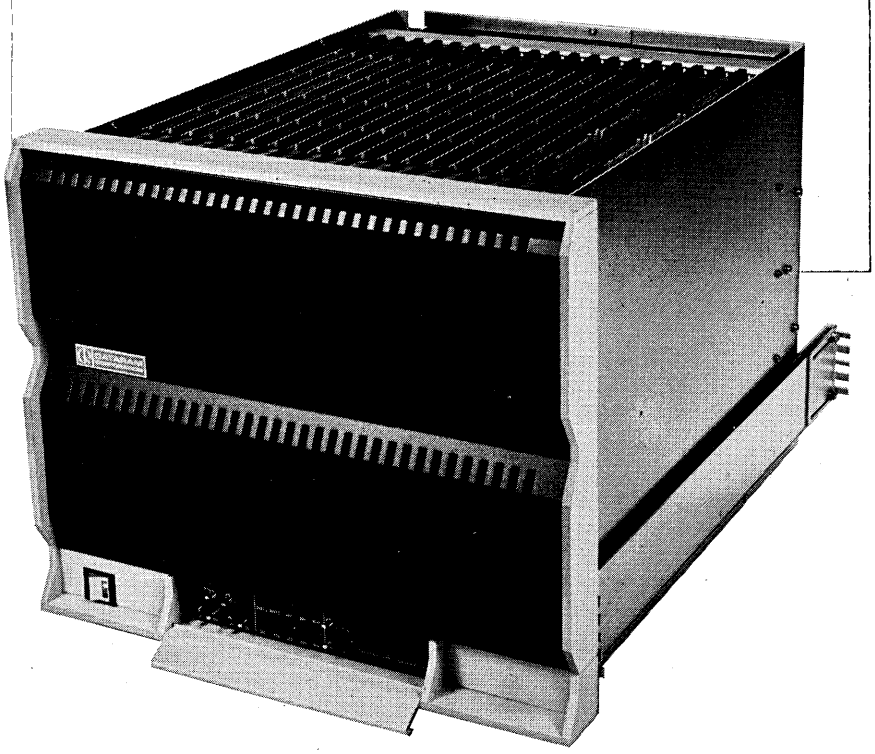
Sidereal's Micronet 6 offers dual workstations, work processing, and multiprotocol communications. Its six communications ports can be configured for any combination of Telex, TWX, DDD, or leased lines. Micronet 6 supports concurrent message preparation, transmission, and reception. It can function as a message switch, receiving a message, performing any necessary code conversion, and forwarding the message in a different protocol.



The microprocessor-based message terminal can be programmed using MAPL (Micronet Application Programming Language). The company already has a library of programs (which can be further customized by a user as desired). Applications preprogrammed include maintaining and using a directory of frequently called numbers, routing a message to multiple addresses, automatic dialing, connect, disconnect, retry, and message logging. Message logging allows the terminal to provide a daily log of messages sent and received, along with estimated billing, and a histogram of traffic volume by time period.

THE INDUSTRY STANDARD

BULK CORE BULK SEMI



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CIRCLE 174 ON READER CARD

HARDWARE

Communications protocols handled by the Micronet 6 include Telex (50bps), Gateway Telex, TWX, DDD (110bps to 300bps), InfoCom class 1, 2, 3, and 4 (50bps to 1200bps), freewheeling leased lines, 83B3, 85A1, 8A1, and 8B1 leased lines, and JBM 2780/3780 bisynchronous. Configured with a single workstation, 30cps dot-matrix printer, two 8-inch floppy drives (2.3MB total capacity), and one Telex communications port, pricing starts at $15,900. SIDEREAL CORP., Portland, Ore.

FOR DATA CIRCLE 305 ON READER CARD

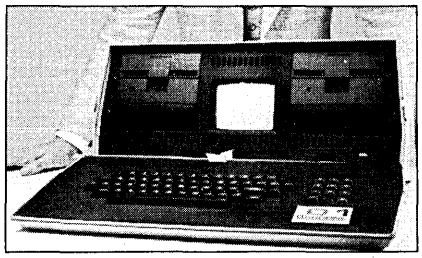
TERMINAL MATRIX SWITCH

Accommodating up to 256 synchronous or asynchronous RS232 circuits, T-Bar's Virtual Switch Matrix (VSM) can be used for configuration, monitoring, and testing connections between data terminal equipment (DTE) and data communication equipment (DCE). Code- , speed- , and protocol-transparent, the VSM can handle circuits running to 19.2Kbps. Provision is made for up to 10 monitor outputs, and 10 DCE and 10 DTE test ports. For each RS232 link, the VSM switches all 16 major EIA circuits. The VSM allows connection of any DTE port to any DCE port in the network. Master clocking is not required of the VSM, as the 16 circuits switched include—in addition to data send and receive—clock signals, control signals, and secondary receive and send data lines with associated control lines. Configurations offered are 64 by 64, 128 by 128, and 256 by 256. Price range: $100,000 to $350,000. Deliveries are quoted at six months. T-BAR INC., Wilton, Conn.

FOR DATA CIRCLE 310 ON READER CARD

PORTABLE MICROCOMPUTER

Eschewing the idea of creating yet another high-powered microcomputer, this vendor has decided to carve its niche with an inexpensive portable microcomputer using mature technology. Built around a Z80-A microprocessor, the unit includes 64KB of memory, dual 100KB minifloppies, 5-inch crt (organized as 24 lines of 52 characters), IEEE-488 interface, RS232 interface, and a typewriter keyboard with numeric keypad; the keyboard is hinged and snaps over the computer to form a weatherproof carrying case Priced at $1,795, the Osborne I computer also includes software: CP/M, CBASIC, MBASIC, the WordStar wordprocessing package with MailMerge option, and the SUPERCALC electronic calculator. OSBORNE COMPUTER CORP., Hayward, Calif.



FOR DATA CIRCLE 306 ON READER CARD

FIBER OPTIC MUX

Digital communications Corps.' Lightwave Data Multiplexor (LDM-9500) can multiplex up to 16 ports onto a fiber optic link of up to two km. The LDM-9500 uses two fibers to provide full-duplex operation; for high-availability applications, the LDM-9500 can be configured with a redundant, hot standby electro-optical transmission system (including two fall-back fiber links). The multiplexor has 16 RS232 data ports for interfacing to terminals and computer ports. Each full-duplex port can operate asynchronously or synchronously. Asynchronous rates range to 19.2Kbps, while synchronous operation run to 64Kbps. With an external clock, the synchronous rates can be any speed up to 64Kbps; an internal clock allows six switch-selectable data rates: 1200bps, 9600 bps, 19.2Kbps, 56Kbps, and 64Kbps. When configured with the backup system, switchover occurs automatically if any high-speed components fail or if a fiber breaks. A redundantly configured LDM-9500 multiplexor sells for about $6,000. DIGITAL COMMUNICATIONS CORP., A M/A-COM Company, Germantown, Md.

FOR DATA CIRCLE 312 ON READER CARD

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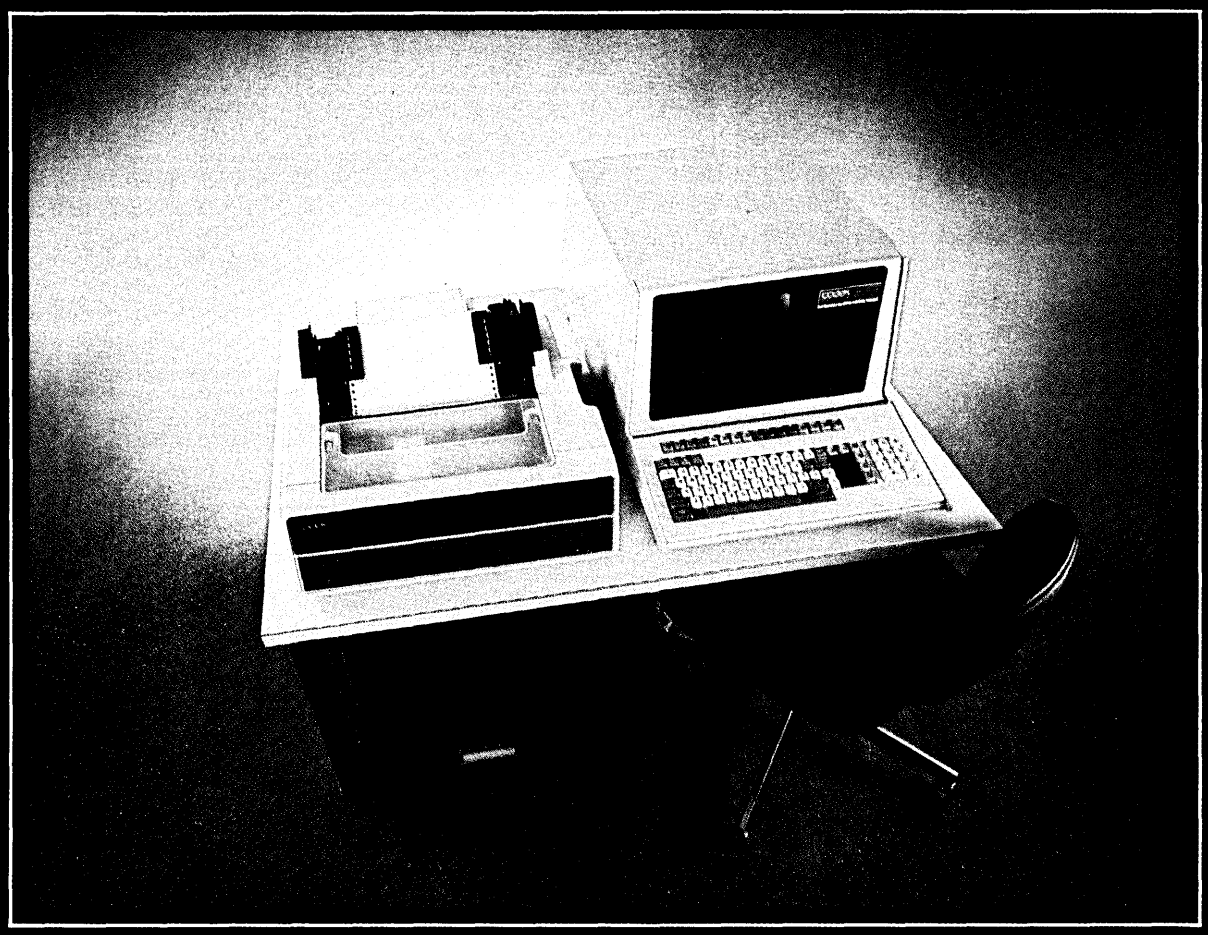

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CIRCLE 177 ON READER CARD

SOFTWARE AND SERVICES

UPDATES

Atari, the up-and-coming although relatively late entry in the personal computer market has begun a major software acquisition program. The Sunnyvale, Calif. subsidiary of Warner Communications is kicking things off with a $100,000 contest for program authors. The firm seeks personal finance, self-improvement, education, and home entertainment packages written for its Atari 400 and 800 computers. A quarterly catalog, the Atari Program Exchange, will provide Atari owners and other interested parties with descriptions of submitted programs. The first issue, due out last month, shows programs priced in the $10 to $50 range. Authors will receive quarterly royalty payments. Users group programs will be listed in a separate section of the catalog. Authors of programs listed in the catalog will be eligible for prizes totaling $75,000 in Atari products, and a grand prize of $25,000 in cash. On a quarterly basis, three prizes will go to the authors of the best programs in four categories: consumer, business, education, and systems software. The grand prize goes to the author of the best program submitted during the contest year. To help developers, the firm will set up regional centers where qualified programmers can use Atari equipment and receive technical assistance. The first such center will be in the Sunnyvale area; other sites and opening dates have yet to be determined. The company will also offer periodic technical training seminars for software developers.

BANKERS' DBMS ADJUNCT

Cullinane, developer of the IDMS database management system, has developed a companion product for the banking industry: the Customer Information System (CIS). The firm says that the integration of CIS with IDMS gives users more extensive cross referencing capabilities than any other central information file (CIF) system. CIS maintains customer and account information, including all necessary interrelationships between customers, accounts, addresses, detail transactions, and history. The software handles major bank applications, including demand deposit accounts, savings accounts, certificates of deposit, installment loans, credit cards, and automatic teller machine debit cards. Branch, affiliate, and correspondent banks can take advantage of the CIS multibank support feature allowing each operating entity access to its database. Customer information may be accessed by a system-assigned unique ID number, an account number, or a customer's full (or even partial) name. CIS is priced at $125,000. General distribution begins this summer. CULLINANE DATABASE SYSTEMS, INC., Westwood, Mass.

FOR DATA CIRCLE 326 ON READER CARD

ORDER ENTRY

Univac's Order Entry is an interactive database-oriented package for use on the company's System 80 computers. Intended for small and medium sized manufacturing operations, the package operates standalone. At a later date, the user can integrate it with a complete production and inventory control system, such as Univac's UNIS 80.

As a standalone system, Order Entry 80 performs initial order entry and validation. The package can handle data regarding customers and customer parts (with prices and terms), product and part information, inventory posting and status checking, generation of backorders and control, order retrieval, order picking, shipping, and invoicing. UNIS 80 or other applications programs can make use of this database.

Order Entry 80 licenses for $362 per month; with source code the package is called Order Entry 80E, and can be had for $483 per month. SPERRY UNIVAC, Blue Bell, Pa.

FOR DATA CIRCLE 327 ON READER CARD

PDP-11 REPORT PROGRAM GENERATOR

RIMS/MPG CO-OP (Customer Oriented Output Producer) is a report program generator for RT11 and RSTS/E-based PDP-11s; it can work with DIBOL/DBL, BASIC-Plus, or COBOL-11/COBOL-Plus. CO-OP is actually a subset of Information and System Research's (ISR) RIMS/MPG program generator; the report program generator includes the parent system's Reports, Sort, and Dictionary modules. Custom designed reports can be automatically or manually formatted, and can include summary tables, text breaks, accrual tables, and a syntax-analyzing computation capability. Since CO-OP generates report programs, the resulting code can be saved for repeated use. Given the definitions of the file structures containing report data, installation of CO-OP takes "just a few minutes," according to the vendor. ISR provides a Customer Installation Package (CIP) which includes instructions for interfacing the Sort and Report modules with Dictionary data file structures. Oems and distributors can license the package for $3,750; CO-OP's one time end user price is $2,500. Both prices are exclusive of media. INFORMATION AND SYSTEMS RESEARCH, INC., Corapolis, Pa.

FOR DATA CIRCLE 328 ON READER CARD

ON-LINE MONITOR

Cincom's T-COM on-line transaction processing monitor, designed for NCR 8000 computer systems and the VRX operating system, lets users develop interactive application systems without foreknowledge of communications or terminal characteristics.

SOFTWARE AND SERVICES

T-COM handles all network management functions outside of the user's application program. Security also is isolated from the user; the monitor's security system automatically verifies user IDs, security codes, and access levels, determining which applications are available to a given user at a given terminal.

T-COM allows programs to be written for use by a single terminal, then it provides run time control so any number of terminals can concurrently use the application. Six run time control tasks spare the developer from concerns of terminal communications and intertask control. Input control receives terminal entries, performs edits, and passes the data on to the appropriate task. Output control handles transmissions to terminals, and performs necessary screen-handling functions. Error control catches and corrects transmission errors without disturbing the user program; uncorrectable errors are identified for the user program, as well as terminal and console operators. Console control gives the system console operator a means to interact with the system. An Activity Distributor performs security checking. User Task Control distributes application program requests to the appropriate T-COM control module.

T-COM supports applications written in COBOL, NEAT, or FORTRAN using any file access method or DBMS. A CALL or INVOKE command provides application program access to on-line terminals. The system also supports interactive screen generation; screen formats are maintained outside the application program, thus allowing modification without extensive impact on the user's code. Automatic program buffer mapping creates statements for inclusion in the user's code to handle data traffic between program and terminals. Upon request, T-COM can generate documentation, including screen formats, program buffer requirements, network descriptions, user descriptions, etc.

The T-COM on-line transaction processing monitor carries an introductory price tag of $9,500. CINCOM SYSTEMS, INC., Ventures Div., Cincinnati, Ohio.

FOR DATA CIRCLE 329 ON READER CARD

OPERATING SYSTEM & COMPILERS

For use with its MC68000-based CGC 7900 color graphic computer, Chromatics released a multitasking operating system, and compilers for the programming languages C and Pascal.

Known as IDRIS, the operating system is of the general purpose variety, designed for the 16-bit Motorola microprocessor. It includes an assembler and a text editor. The operating system carries a $2,000 price tag.

Supporting the Bell Labs-developed programming language, the C compiler sells for $1,000. The Jensen and Wirth Pascal compiler also sells for $1,000. CHROMATICS, INC., Tucker, Georgia.

FOR DATA CIRCLE 331 ON READER CARD

SOFTWARE SPOTLIGHT

IDMS DATABASE TOOL

Database administrators can more easily and accurately specify and modify the embedded pointers assigned within the prefix of each IDMS record by using a schema preprocessor called Pointers. Instead of explicitly assigning positions for all possible NEXT, PRIOR, and OWNER pointers for all sets the record participates in, a Pointer user codes only minimal definitions. The preprocessor then determines a consistent assignment of pointer positions, and inserts appropriate descriptive lines into the schema. When modifying a schema, Pointers leaves all explicitly declared pointer positions as written, while generating schema lines for new set descriptions. Pointers is written in ANSI COBOL, and comes as source code on magnetic tape. A perpetual, single-site license goes for $500. COMPUTER RESULTS, Oakland, Calif.

FOR DATA CIRCLE 325 ON READER CARD

The ADABAS Answer:

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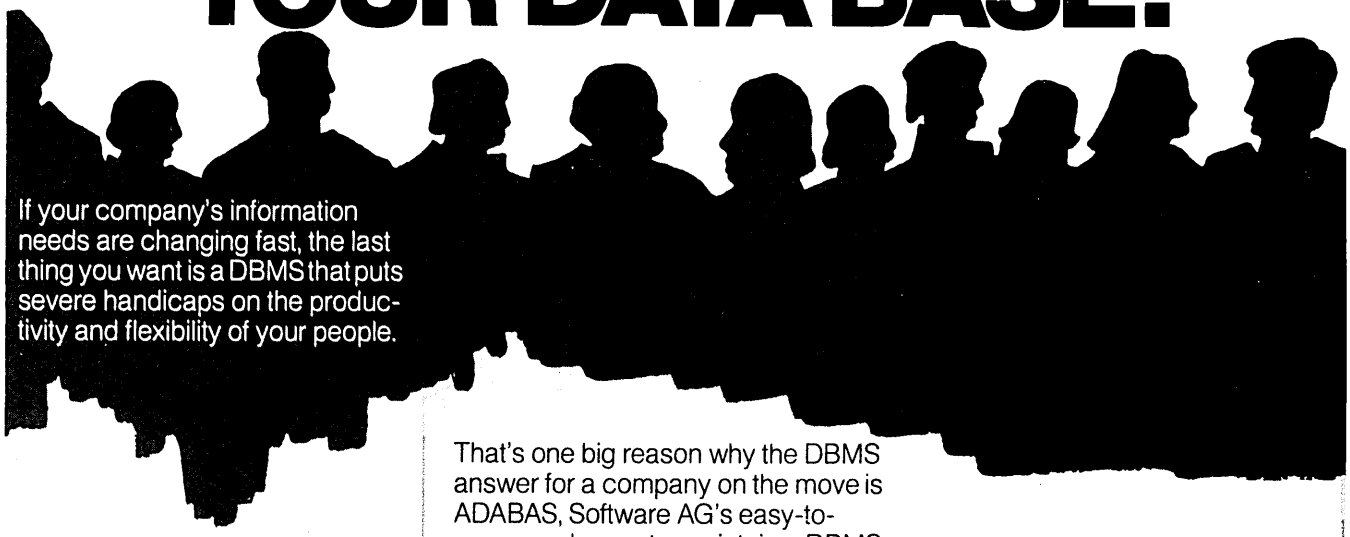

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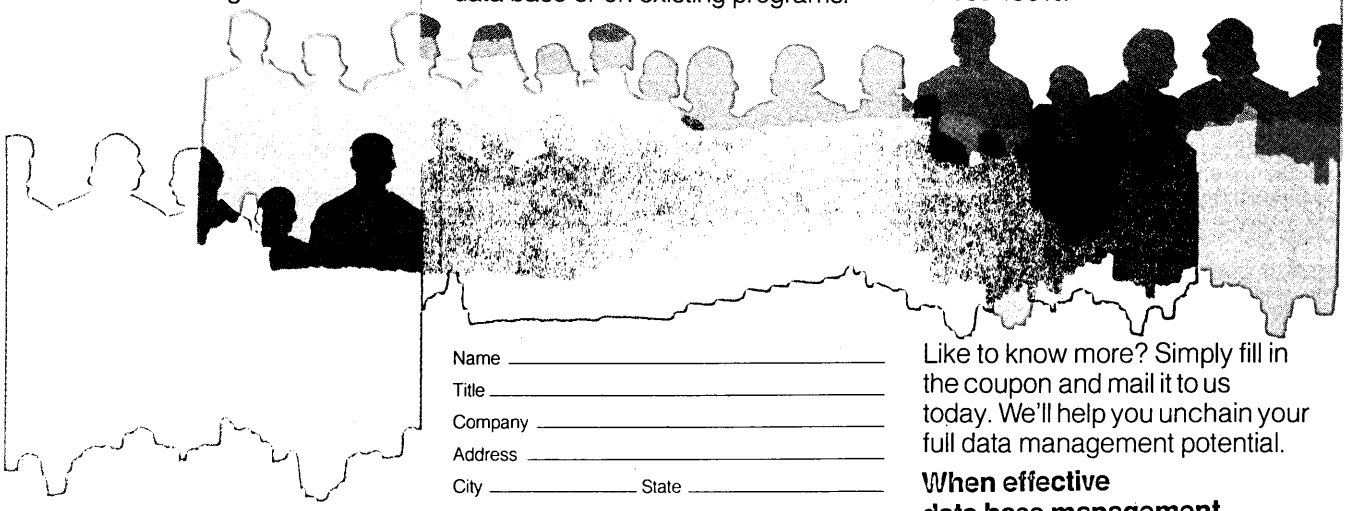

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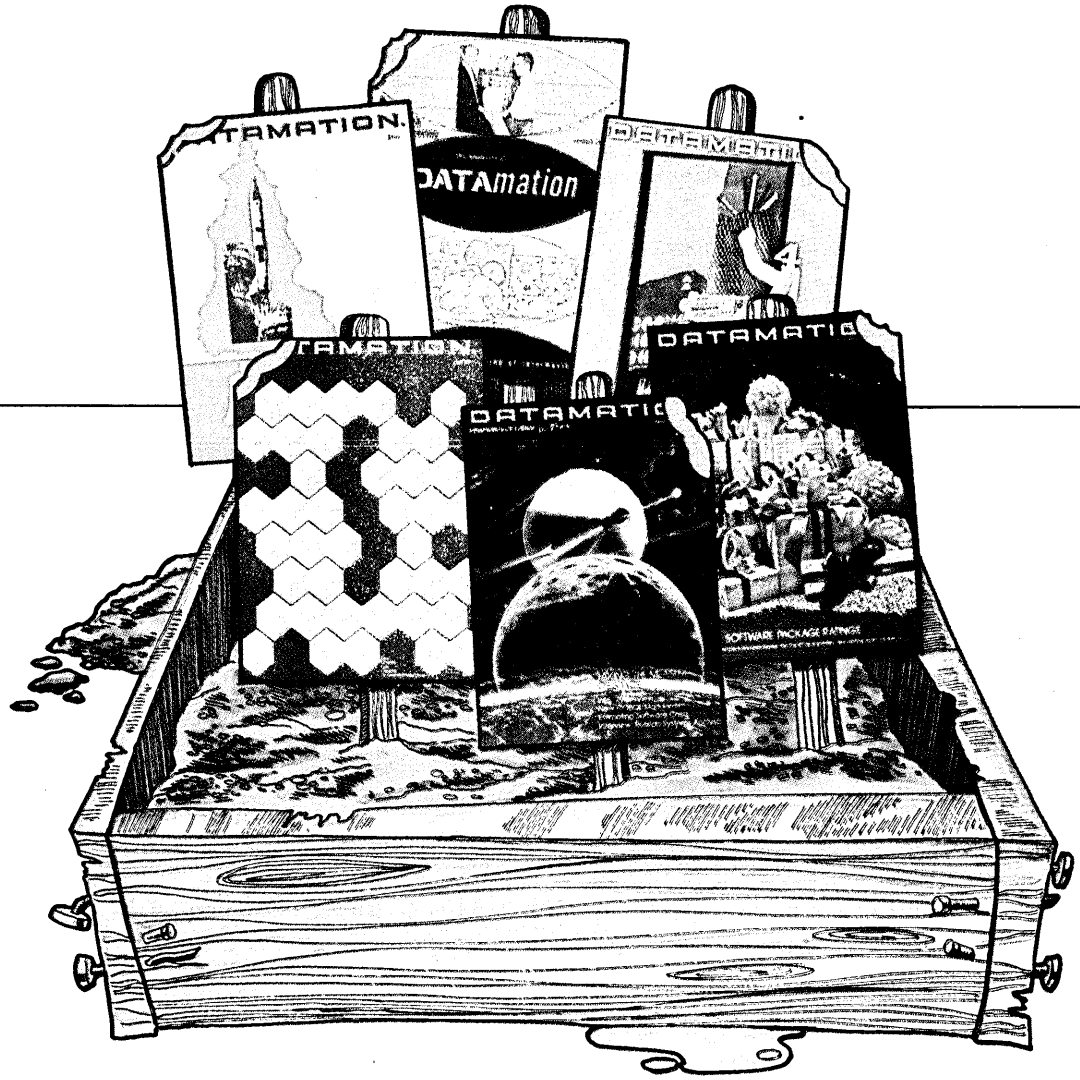
CIRCLE 180 ON READER CARD



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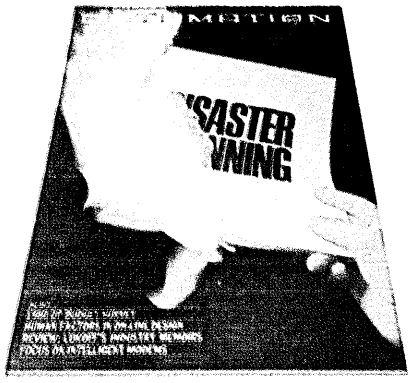

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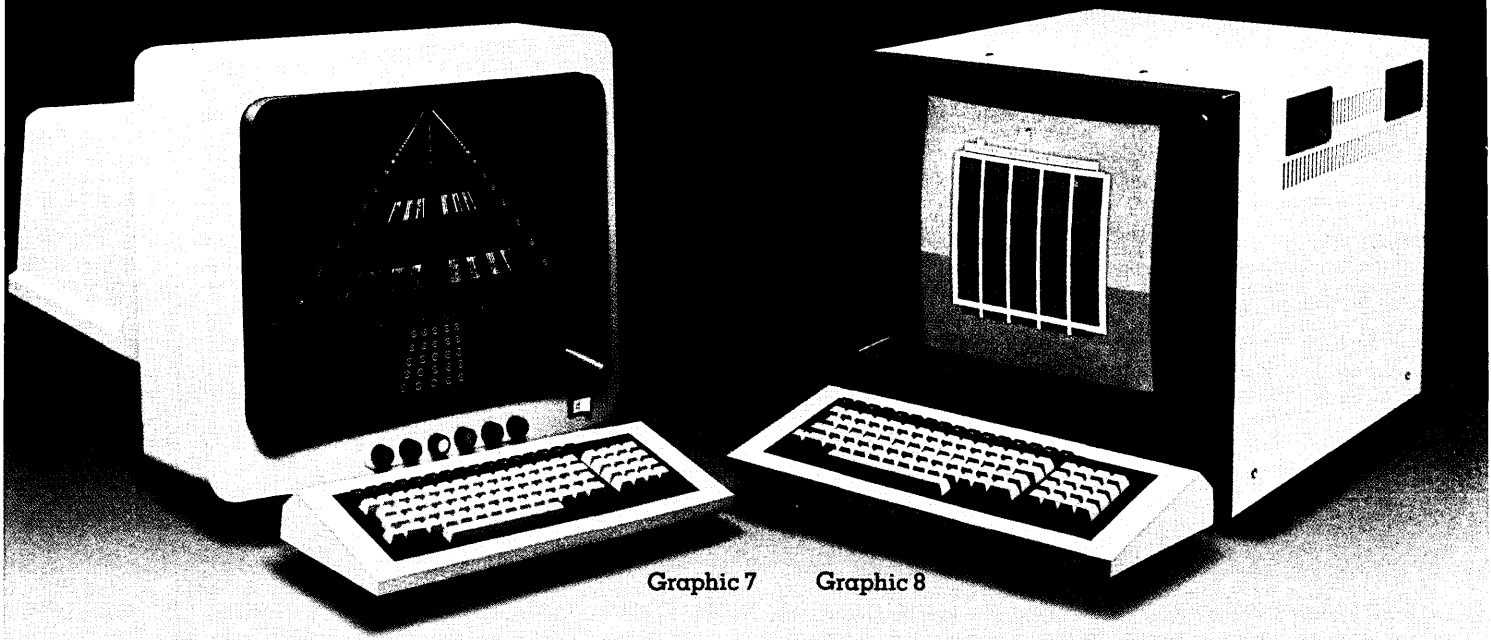

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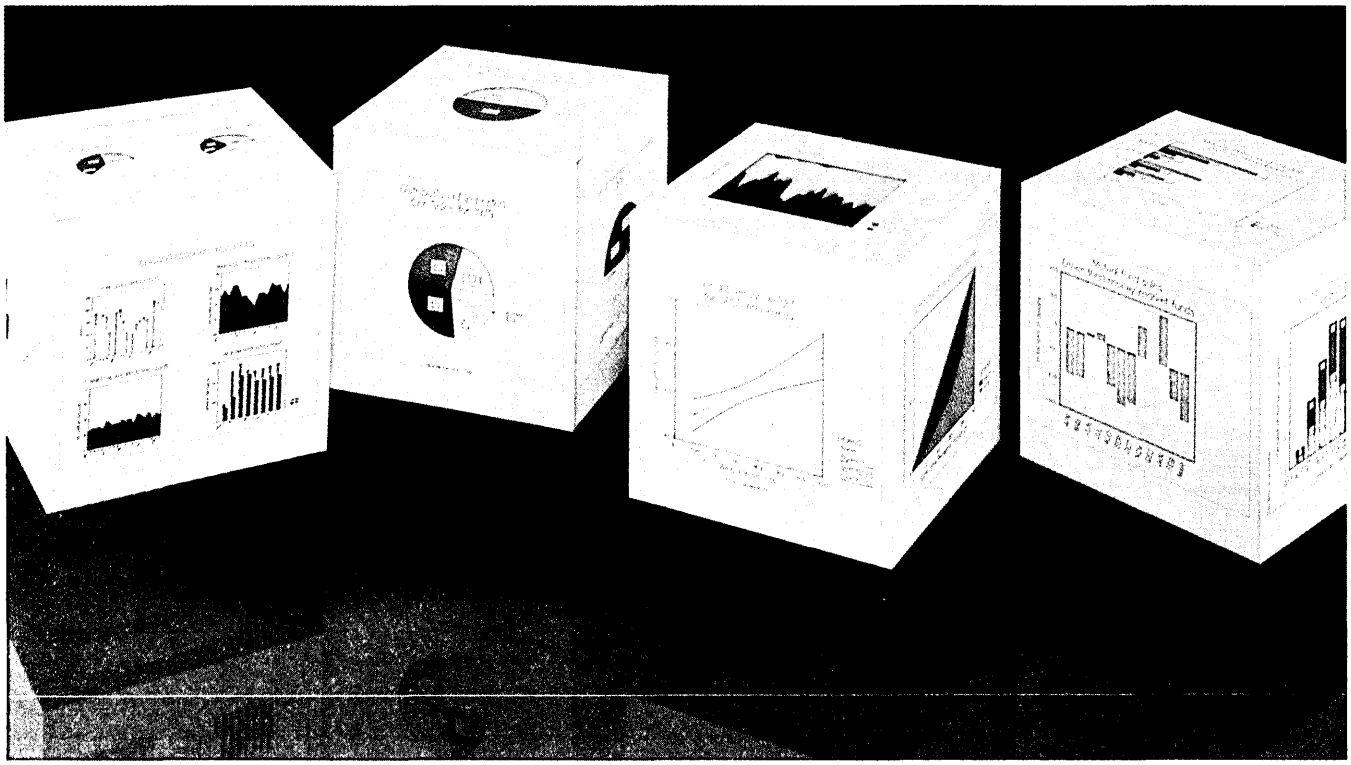

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CIRCLE 183 ON READER CARD

SOURCE DATA

BOOKS

DIGITAL HARMONY: ON THE COMPLEMENTARITY OF MUSIC AND VISUAL ART

by John Whitney

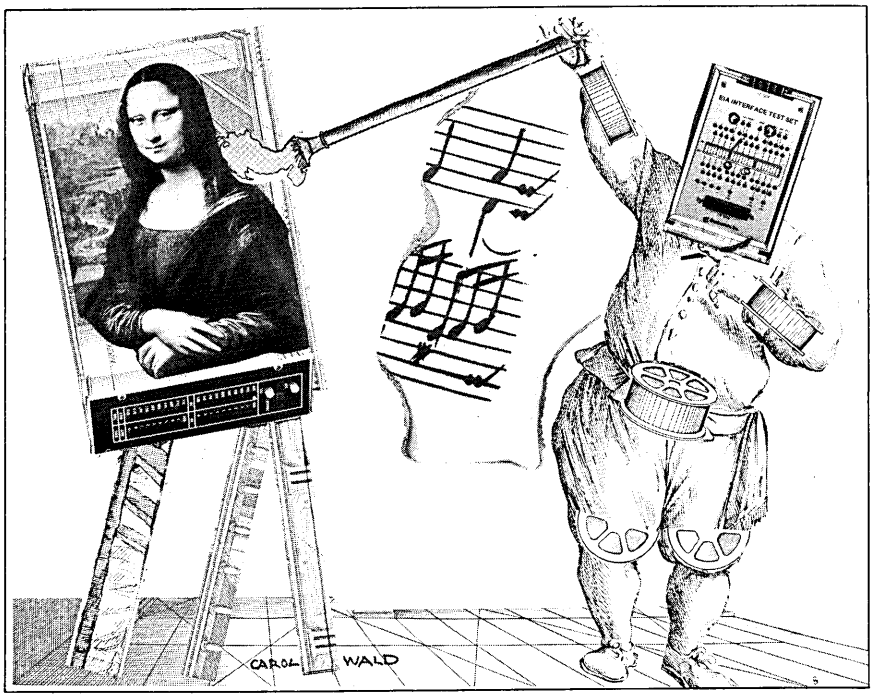

ILLUSTRATION BY CAROL WALD

John Whitney is an artist; his medium is the computer. An award-winning avant-garde filmmaker and a pioneer in computer graphics, Whitney invented the slit-scan motion control process used in such movies as *2001: A Space Odyssey, Star Wars,* and *Superman*. His work has won him grants from IBM and the National Endowment for the Arts and earned him a place in nearly everything ever written about computer art.

A driving force in Whitney's career has been his faith that the artist can use modern technology (i.e., the computer) to integrate music and visual art and thereby create a major new art form. This belief in the complementarity of music and art is nothing new, and Whitney does not claim to have invented it. It probably goes back as far as music and art themselves, and has been a major aesthetic theme during the 19th and 20th centuries. What Whitney does claim is that he is the first to actually produce "visual music," which he calls digital harmony.

In his very first sentence, Whitney defines the parameters of his book: ". . . the exploration of a single hypothesis. . . ." That is no exaggeration. With the single-minded zeal of an evangelist he explains how digital harmony differs from everything that came before, and how it is destined to be nothing less than "a major evolution of 20th century art technology." He refers to himself as a "media revolutionary training underground for the day which is dawning even as I write this book." *Digital Harmony: On the Complementarity of Music and Visual Art* is the manifesto with which he hopes to launch his revolution.

He begins with a brief description of his early, unsuccessful attempts at producing visual music through abstract films. A breakthrough finally came in the early 1940s with a series of film collaborations with his brother, James. In these, the brothers produced a sound track using an ingenious device that employed pendulums and adjustable weights. The motion of the pendulums, although soundless, was registered visually on the sound track portion of the film, producing a strange, unique "music" when played back. This invention also allowed them to create the music frame for frame, along with the action in the film. The Whitneys used this technique in their *Five Abstract Film Exercises*, which won First Prize at the First International Experimental Film Competition in Belgium in 1949.

But however exciting the results, the film medium failed to offer Whitney the key ingredient of visual music—that is, a generative building block, or "visual scale" capable of fluid movement. Then he discovered the applicability of the computer, a device that offered, for the first time in history, the power to make complex patterns flow.

Having found the proper instrument, Whitney applied the musical/mathematical rules of differential, resonance, and harmony to structure the motion of graphic elements, producing a visual scale. For the interested reader, Whitney provides a sample of such a scale, mapped out on a two-dimensional coordinate field. "RD," a radius differential factor (the Y-coordinate), and "TD," an angular differential factor (the X-coordinate), are the parameters used, and a set of dots provides the graphic element. Applying harmonic rules to determine a set of RD and TD conjuncts, Whitney uses differential motion to create a series of elegant patterns. Each pattern represents a "note" for composing visual music. Countless note variations are made possible by assigning different values to TD and RD and/or introducing ZD, for example, as a coordinate for a volumetric field.

What renders the computer-generated patterns especially useful as notes—and herein lies the major point—is the fluidity of movement between them. The computer offers this movement as no film animation technique can. Whitney films various sequences of movement, and then edits them into a composition. It is this process of structuring the final product that separates the artist from the technician.

Whitney then offers potential digital harmonists the information they need to

make the scales. He lists the equipment, and even provides a sample program. Black-and-white and full-color reproductions indicate some graphic possibilities. To illustrate how the action might look, he offers a "flip-book," a sample sequence of patterns on the upper right-hand corner of each page.

The author has produced a number of films using digital harmony theory. But for his revolution to triumph he needs recruits—converts from the more traditional, "static" art forms. We are warned that "In a technological aural/visual universe, music must become bisensory." And we are given the final command: "It's up to you, do it yourself. Do it!"

But before contemporary artists toss out their paints and brushes and replace them with Andromeda Systems LSI-11 and Tektronix 4002 graphic display terminals, a hard look at the digital artwork reproduced in the book is recommended. For the most part it is represented by full-page, multicolor circular patterns, reminiscent of kaleidoscope images—not unlike recent computer renderings of the DNA molecule. Some are quite lovely. The most intriguing visuals are the stills from Whitney's 1973 film *Arabesque*. From these 10 to 20 frame sequences, we can get an idea of the way Whitney builds an image and moves between various states of complexity and simplicity, chaos and order. All have the appearance of delicate color-line drawings. Some are arrestingly dynamic; others are more mundanely decorative, more mechanical.

But Whitney would object to this line of criticism. The book, he reminds us, is about movement—the "structuring of time"—and this cannot be shown in book form:

"The illustrations, on the page, in ink, illustrate stasis and fail totally to show the pattern of time as experience."

Now Whitney finds himself in the same bind as many artists and art historians who deplore printed reproductions of artwork but feel compelled to use them in books and articles. The format (90 pages of text, 81 pages of indexed materials, with an emphasis on visuals) and price of the book are dictated by the requirements of those expensive "static" reproductions. The importance given them by the book's very design forces one, or at least encourages one, to look at them and judge them as finished pieces.

Throughout the text, Whitney draws generously on examples from the more classical forms of art and music, citing specific artists, composers, styles, and works. This is fine—indeed, absolutely necessary. We often have to explain the new in terms of the old. Where, however, are the illustrations of these works? There are no reproductions of artworks other than Whitney's own. Odder still, a book based on the visualization of musical theory contains not one line of musical notation. These omissions do not greatly mar the book, but they represent a missed opportunity for some interesting reinforcement and variation.

When writing about the mechanics of his process, Whitney is at his best—clear and strong. In more reflective moods, he tends to rely on easy slogans (". . . 20th century music is in crisis"; "The nature of art has become uncertain"; ". . . music must become bisensory") and cumbersome prose:

"Digital systems procedures greatly improve the method of making music by several magnitudes of importance."

"The repeatability and the accessibility we gain . . . systematically improves its 'materiality'."

One needn't know much about visual art or music to understand *Digital Harmony*; the book is not burdened with loads of technical language. Whitney describes clearly the development and mechanics of a *process*—"a single hypothesis"—that may serve as a point of departure for exciting explorations in the young and ever broadening field of computer art. As a process, digital harmony has merit; as a book, it's a bit thin. As a revolutionary manifesto that aims to reshape our aesthetics . . . well,

SCIENCE/SCOPE

The first of a new breed of communications satellites is providing secure voice, video, high-speed data, and electronic mail services for U.S. business firms and industries. The powerful SBS satellite is the first domestic communications spacecraft to operate at frequencies of 12 to 14 gigahertz. This means that small antennas with diameters of 5.5 to 7.7 meters can be used in urban areas for business communications without causing interference to terrestrial microwave systems. The satellite has an outer cylindrical panel of solar cells that drops down in orbit to expose an inner panel. The telescoping feature nearly doubles the power. Hughes built SBS for Satellite Business Systems, a company owned jointly by Aetna Life & Casualty, Comsat General Corp., and IBM Corp.

New radar technology may help solve increasingly nagging problems facing military strategists. The Track-While-Scan Quiet Radar, under exploratory development at Hughes for the U.S. Army Missile Command, would stand little chance of being detected, jammed, or destroyed by enemy radiation-seeking missiles. Quiet Radar differs from conventional radars in that it does not emit huge bursts of power in a sweeping pattern. Rather, it emits a low-power continuous-waveform signal while shooting out thousands of tiny narrow beams in a rapid-fire, randomly selected sequence. Extremely low sidelobe emissions and rapid random switching between many frequencies make detection of the radar difficult.

More than 15 years after its launch, NASA's Pioneer 6 spacecraft still transmits data via a Hughes traveling-wave tube. The interplanetary probe measured the sun's corona, studied solar storms, and measured a comet's tail. It also made many discoveries about the sun, solar wind, solar cosmic rays, and solar magnetic field. Pioneer 6's primary TWT operated more than 122,000 hours from launch in December 1965 until February 1980. Then, due to a low voltage condition, the backup TWT was switched on. The Hughes Model 214H TWT, which operates in the S band with 8 watts of power, was developed under contract to TRW.

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Measuring millimeter-wave impedance is easier now by using a new IMPATT-sourced millimeter-wave reflectometer instead of slotted lines and hybrid impedance bridges. Because of its unique design, the Hughes device can sweep the full 75-to-110 GHz bandwidth automatically without time-consuming point-to-point measurements. It uses such advanced technology as broadband isolators and detectors to reduce the effects of unwanted reflections and mismatch error, a 1-KHz square wave modulator that delivers increased sensitivity and dynamic range, and a rotary vane attenuator for constant attenuation with frequency.

SOURCE DATA

Rome wasn't burned in a day. Byte Books/ A McGraw-Hill Co., Peterborough, N.H. (1980, 234pp., $21.95).

—Ken Sofer

REPORTS AND REFERENCES

ONLINE INFORMATION DIRECTORY

The "Directory of Online Information Resources," now in its seventh edition, covers nearly 280 bibliographic and nonbibliographic databases. Each of the databases is described, and the information necessary to contact the vendors and producers is listed. The directory is updated semiannually, and is available from CSG Press, 11301 Rockville Pike, Kensington, MD 20795, for $18.50 per copy (or on a two-year subscription basis, four issues for $48).

WORD PROCESSING REPORT

Delta Pi Epsilon, the business education graduate fraternity, surveyed more than 300 word processing installations managed by members of the International Word Processing Association (IWP), the organization that funded the survey. The primary objective was to determine the effectiveness of current word processing and administrative support education programs. The study results showed 55% of the supervisors surveyed felt entry-level wp operators had inadequate grammar skills, and 49% of the supervisors said operator spelling skills were not up to par. Entry-level operators were also criticized by 40% of the supervisors for poor punctuation and proofreading skills. When evaluating themselves and other entry-level word processors, the operators agreed with the supervisors. The percentages vary slightly: 70% of the operators felt grammar skills were inadequate, 62% felt punctuation skills were lacking, 58% felt that proofreading skills were poor, and 49% felt spelling skills were inadequate. A 400-page analysis of "Study of Selected Business Organizations with Word Processing Installations to Determine Implications for Business Office Education" is available for $50, or an 80-page monograph for $8 per copy from Delta Pi Epsilon, Gustavus Adolphus College, St. Peter, MN 56802.

VENDOR LITERATURE

FLOPPY CARE

If you've ever wondered exactly how to handle and care for your floppy diskettes, this vendor's brochure may clarify your questions. It lists handling and storage techniques which apply to all vendors' flexible diskette products. DYSAN CORP., Santa Clara, Calif.

FOR DATA CIRCLE 350 ON READER CARD

AUTOMATIC SURVEILLANCE

"Unattended Communications Network Surveillance," automatic alarms, and reconfiguration capability are discussed in an eight-page booklet from this vendor. The booklet illustrates how faults can be detected automatically at the central communications center and corrected before the user complains. DIGILOG, INC., Horsham, Pa.

FOR DATA CIRCLE 352 ON READER CARD

"THE FCC AND YOU"

This booklet reviews new FCC regulations that control EMI emissions rules applying to computer device manufacturers. Subjects discussed in the booklet are the devices affected, what the restrictions are, the filing and effective ruling dates, rule enforcement and penalties, EMI emission levels, and cost trade-offs on EMI suppression. SIERRACIN/ POWER SYSTEMS, Chatsworth, Calif.

FOR DATA CIRCLE 353 ON READER CARD

DSS CHECKLIST

Geared to help the manager select and evaluate decision support systems, this vendor's booklet compares decision support software in terms of modeling language, data entry, "what if" capabilities, report generator, user orientation, hierarchical consolidation, statistical and forecasting needs, etc. EPS, INC., Chicago, Ill.

FOR DATA CIRCLE 354 ON READER CARD

TELEPHONY/SYSTEMS DESIGN ENGINEERS

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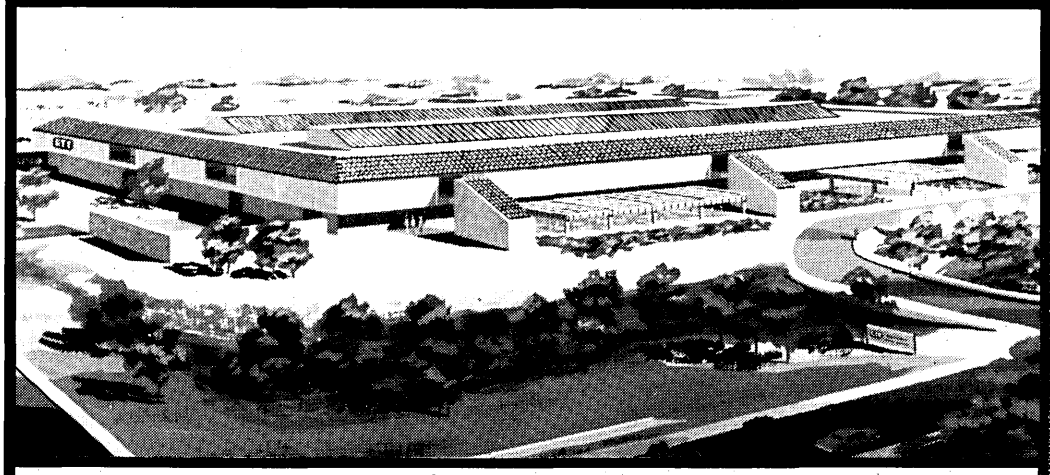

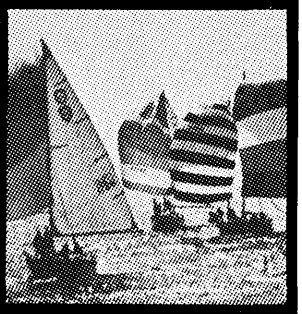

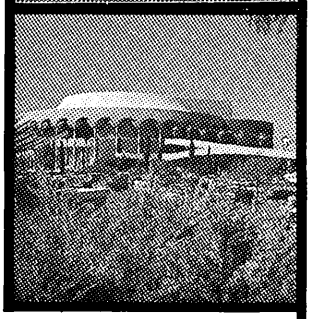

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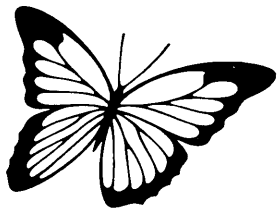

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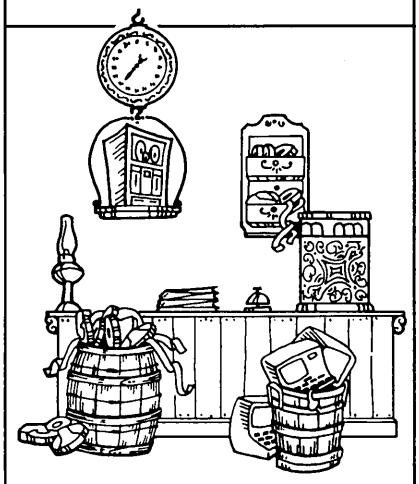

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We are also looking for a systems analyst with 4 years of DP experience, with at least 2 years on staff or the applications development areas. This position is administrative in nature involving budgeting, contracts, project control, and DP chargeback. There is an excellent opportunity for advancement to a supervisory role.

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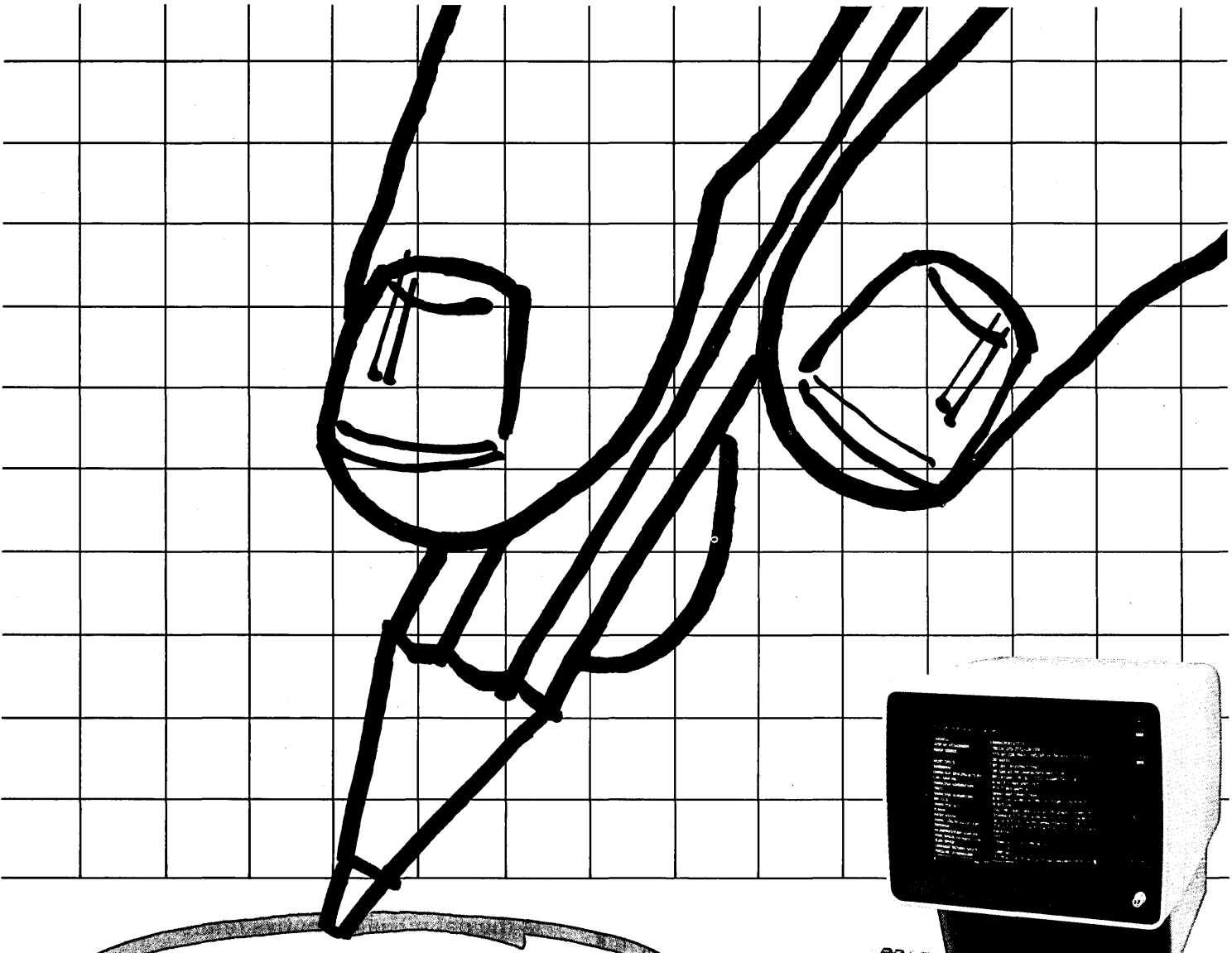

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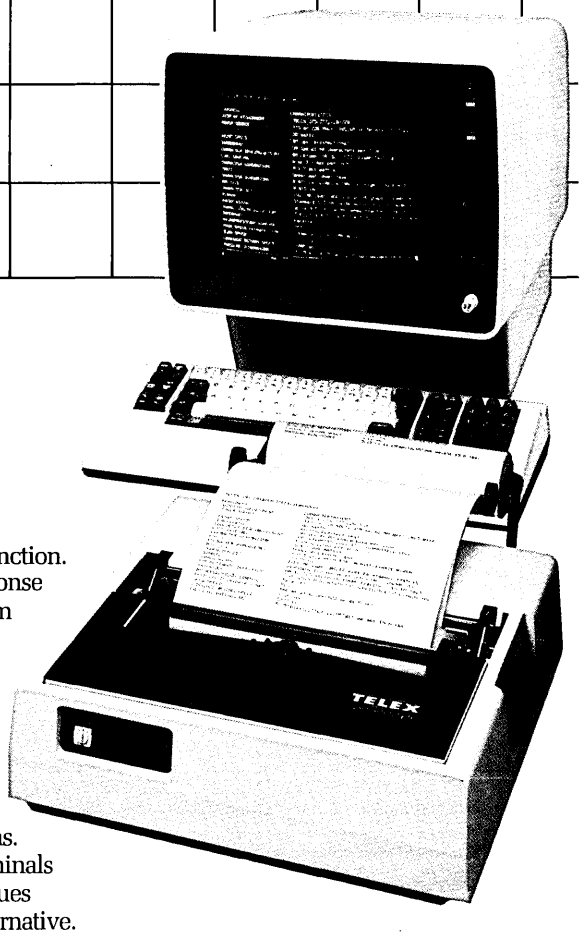

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CIRCLE 207 ON READER CARD

An exchange of readers' ideas and experiences. Your contributions are invited.

READERS' FORUM

THE MONKEY ON MANAGEMENT'S BACK

Attempts at reducing program maintenance costs have proven to be wastefully expensive and obviously unsuccessful. This is partly because currently acceptable documentation methods affect maintenance costs only minimally. There is a simple way to prove this point. Give two programmers the same modification specifications to the same program. Permit only one access to the documentation folder. Do not be shocked when you discover there is no appreciable difference in their resulting modification completion time. This in spite of the substantial price that was paid to install either the company's or the vendor's documentation package.

The blame for excessive maintenance cost must be placed at dp management's door. The heads of the corporations cannot recognize this failure because there are no successes with which to compare it. Dp publications also deserve some blame. They claim to be very aware of this overburdening budget item called maintenance cost, yet they continue to publish only articles about currently accepted (and sure to fail) program documentation methods.

The emphasis for program documentation should be where the name implies. That is, in the program (source coding) and nowhere else. Yet I know of no dp department that has its major program documentation efforts there. There's another problem: using the excuse of standardization in database processing, some dp managers have permitted the COBOL copy library (created from the database dictionary) to use the same data names as the assembler copy library. In one stroke of genius, they have nullified the most important reason for the very existence of the COBOL language—understandability through the use of English. Assembler data names are limited to eight positions and are not very meaningful.

The result is coding instructions such as:

IF MEDTRNTP = 'A' PERFORM ALL-TRN THRU EXIT-1.

(If you understand the above instruction, you are psychic.) Proper COBOL coding would have looked more like this:

IF MEDICARE-TRANSACTION-TYPE EQUAL 'A' PERFORM 150-ALLOWANCE-TRANSACTION THRU 160-ALLOWANCE-EXIT.

Multiply the former type of instruction manyfold in any given program and you can visualize a great contributor to excessive program maintenance cost.

By the way, many managers do not limit their COBOL copy library to the assembler copy library data names, but the COBOL data names they do permit are not much more meaningful; ergo, the same results.

As a project leader, I developed a system that dramatically reduces program maintenance cost at the project level. The effort needed is far less than what is necessary for current unrewarding methods.

The following is an excerpt of the new system's resulting COBOL source coding:

0300-PATIENT-ADMISSION. IF ADMIT-RECORD-ERROR-FREE EQUAL 'YES' PERFORM 0800-ADD-TO-PATIENT-FILE THRU 0850-ADD-TO-PATIENT-FILE-EXIT ELSE PERFORM 1010-REPORT-ADMIT-ERRORS THRU 1050-REPORT-ADMIT-ERRORS-EXIT. 0350-PATIENT-ADMISSION-EXIT. EXIT.

WHEN THE ADMIT RECORD IS FOUND TO BE FREE OF ERRORS IT IS ALSO AN INDICATION THE KEY TO THE PATIENT FILE WAS NUMERIC. THIS KEY MAY STILL BE INVALID AND THAT WILL BE DETECTED WHEN AN ATTEMPT IS MADE TO ADD THE PATIENT RECORD TO THE PATIENT MASTER FILE.

The time needed for the additional coding is more than made up for during debugging and testing because of the program's understandability.

This system cannot make logical programmers out of illogical programmers or structured programmers of nonstructured programmers. What it does do is to make all programmers (no matter their capabilities) write source coding which is clearly understandable, self-documented, and standardized.

At this juncture, I should say that my project was 99% COBOL. Though this new system and its processor are strictly COBOL-oriented, I feel sure the same idea can be tailored to other programming languages.

The main obstacle is dp management, and at this point, I have yet to overcome it. I have described this new package to numerous data processing managers without success. Perhaps the reason is that this system can only be utilized when writing new COBOL programs. Therefore, its effectiveness in terms of maintenance cost will not be realized until the ratio of new to old COBOL programs becomes significant. How long this takes will vary with each company's stage of development.

Most managers do not wish to expend effort or show expenditures for anything new unless it can bring immediate and apparent results. But the bottom line is that each COBOL program currently being written is another banana for the (excessive maintenance cost) monkey on management's back. Management has these alternatives: to continue as it is, risking progressive deterioration, or to accept a new, simple approach and get that monkey off its back.

—Jerry Sitner
New York, New York

MOVING ALONG...

Well the guy from the computer center was right. We do move computers and equipment around as if they were bags of potato chips. Just about the time we get all our intercomputer network communications settled down, one of the powers-that-be decides we really don't want the CDC computer "colocated" with the number one IBM system; it really should be moved to Skansonia where all the other CDC computers reside.

It's a way of life. Some computer personnel do nothing but work out the details of the next move—it's even written that way in their job descriptions. This brings me to the reason for this tale.

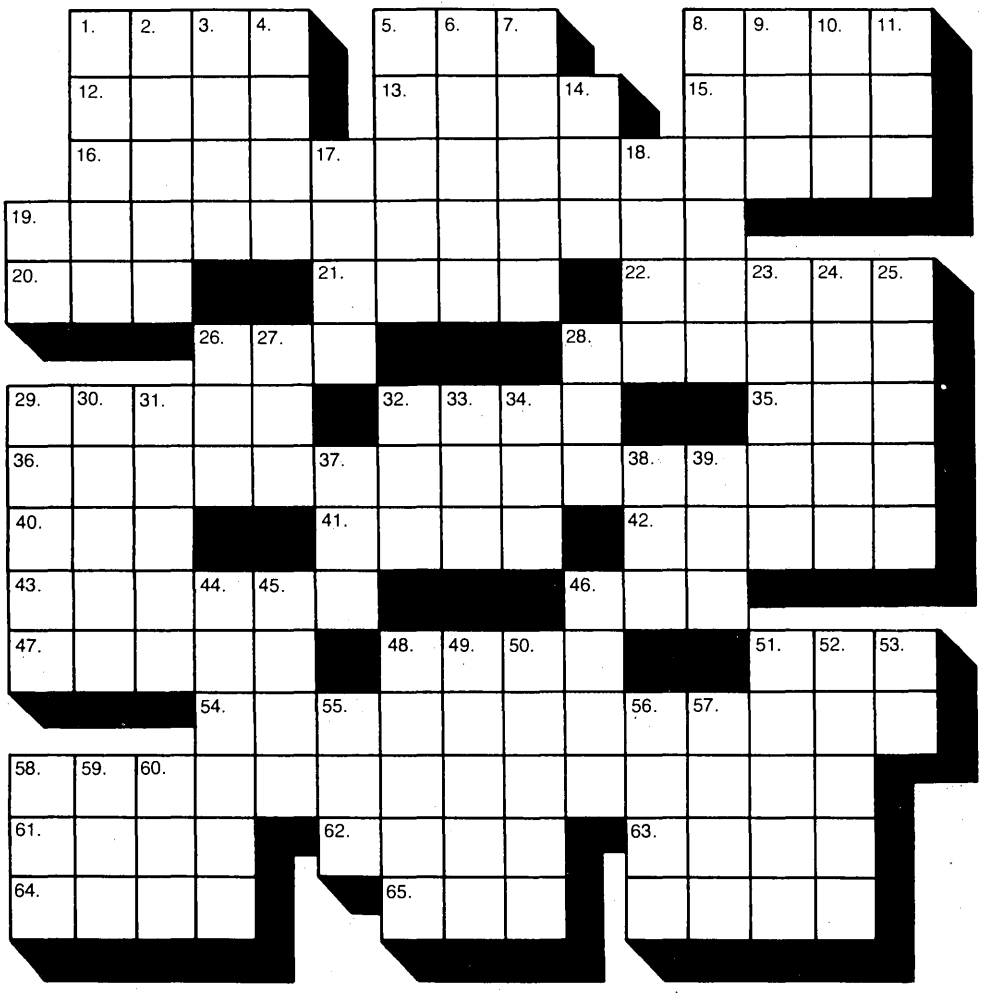
With the frequency of computer center changes, it became pretty obvious our multiple computer center network was being negatively affected. In the past, those of us at network control found out about a move just as it was happening and if (when) things went wrong, we fixed them on the fly.

After a lot of grousing, a group of us put together a case history of what had been going on for the past 18 months. After that, we met with as many computer center people as we could and tried to project what was going to happen. Once we had a plausible story, off we went to our network managers and their committees. The result was inevitable: network control was assigned the responsibility to analyze the effect of computer center moves and to ensure that no adversities befell network production.

The first few months were a nightmare. It still amazes me

DATAMATION CROSSWORD

VENDOR ENDER
by Brian Burke



ACROSS

1. Crossword clue letters
5. War, for short
8. Times
12. Boundary
13. Last word of a familiar palindrome
15. Base
16. Blue's look-alike
19. Loss leader
20. HP's Paul _____
21. Number one for Liselotte
22. Indian, e.g.
26. A-string, frequently
28. Stanley's mate
29. Reveals
32. Hindu woman's garment
35. One of Three
36. RED Inc.
40. Ad _____
41. _____ d'Azur
42. Adjective for the Selmon brothers
43. African climbing fish
46. G-man
47. Cause to feel aversion
48. Type of hawk
51. Road Town is its capital
54. Pipe dream's end
58. Play first's base
61. Region
62. MacGregors, for one
63. "Ready about, hard _____"
64. Word with put or hoe
65. Sound of disapproval, uttered twice
66. Medieval Irish foot soldier

DOWN

1. Shock: Brit.
2. Mild
3. Word with law or movie
4. I.R.C. companions, for short
5. Mother-in-law of Ruth
6. Copywriter
7. Deciduous tree of the north temperate zone
8. Prove
9. Eve, formerly
10. Nothing alternative
11. Holy _____
14. Chairman _____
17. David's partner
18. Beep
19. French egoist's concern
23. Famous cow
24. Distant
25. Female goat
26. Coalesce
27. O.J. Simpson's alma mater
28. Baronet's title
29. State of N.E. India
30. In accord
31. Activity for Brett and Phyllis
32. Letters welcome to a Broadway producer
33. Likely
34. _____ v. Wade: 1973
37. Step up, for a noncom
38. Fortas or Ribicoff
39. 1977 America Cup winner, to his friends
44. Object of a candystriper's attention
45. African lily
46. Dactyls, e.g.
48. Genuflected
49. The way _____
50. Imitate a Rodin sculpture
51. Founder of the Mogul dynasty
52. Long, flexible shoot
53. Preposition
55. Tennis group
56. Burmese tree with ternate leaves
57. Vex
58. Masher
59. Mouth: comb. form.
60. Gull

Solution on p. 256

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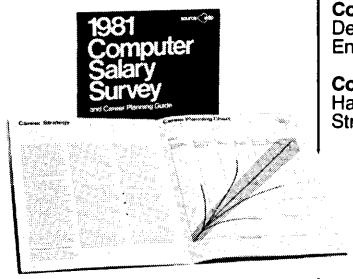

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Baltimore	301/727-4050
Massachusetts	
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Burlington	617/273-5160
Wellesley	617/237-3120
Michigan	
Detroit	313/259-7607
Southfield	313/352-6520
Minnesota	
Minneapolis	612/544-3600
St. Paul	612/291-2467
Missouri	
St. Louis County	314/862-3800
St. Louis Downtown	314/231-4880
Kansas City	816/474-3393
New Hampshire	
Nashua	603/880-4047
New Jersey	
Cherry Hill	609/482-2600
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READERS' FORUM

how many little things that are the lifeblood of a multicomputer network can be overlooked. Communications, for example. The story about moving a CDC computer to Skansonia is true. Both the CDC and the number one IBM computer used to sit side by side. Both computers are part of our network. Intercomputer communications between the two systems was accomplished via a wide-band channel-to-channel connection. Data rates on the order of 50Mbps could be supported. This rate so exceeded our needs that nobody ever thought to measure our actual transmission rates. Once the CDC computer was moved to Skansonia, none of us had any idea what rate of remote intercomputer communications would be required.

The textbook solution is to analyze current performance data for the communications link, and size the new circuit accordingly. So much for the textbook. Like many computer systems, performance data containing the specific numbers we needed wasn't available. Oh, we had some manually generated counts of the number of messages sent in each direction between the two systems, but nowhere did these counts show the size of the messages. A message could be one word or a million; there was just no way to tell. (The solution in this case was finally worked out by one of the network control people along with a bright soul from the IBM computer staff: a simulation of the past month's work was performed using data extracted from the CDC accounting tapes.)

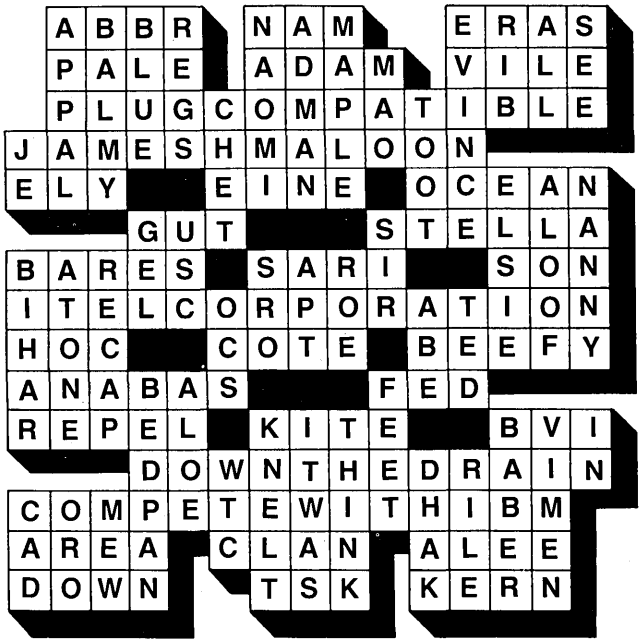
Unfortunately, the above case was typical. Almost every time we started to coordinate a move, we lacked a critical piece of data. We had to make special efforts to gather the necessary numbers. This caused delays (some of them difficult to explain to senior management), and sometimes friction among participants.

The solution is not quick, easy or inexpensive. A conscious effort must be made by all of us in the computer industry to *specify performance instrumentation as part of functional requirements*. In the case of our network, if we specify that a communications link must meet a specific data transmission rate, then the ability to monitor the actual data rate should be specified, too. This is not "gold plating"; it is a necessary tool to determine if requirements are being met efficiently and cost-effectively.

Even this approach is no panacea. It is, however, a first small step along a path that will allow us to do our jobs better and establish in the minds of our customers the notion that computer people are the professionals we claim we are.

—David A. Feinberg
Seattle, Washington

Answers to puzzle on p. 254



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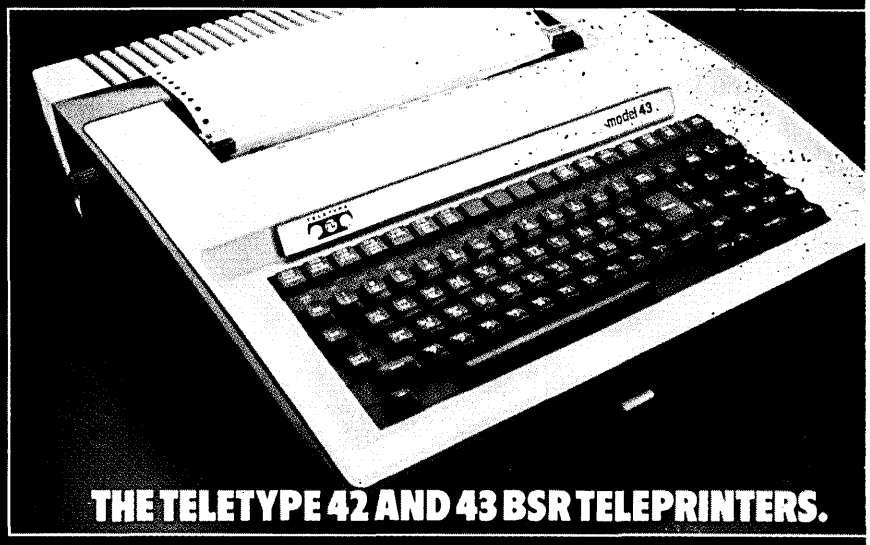

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