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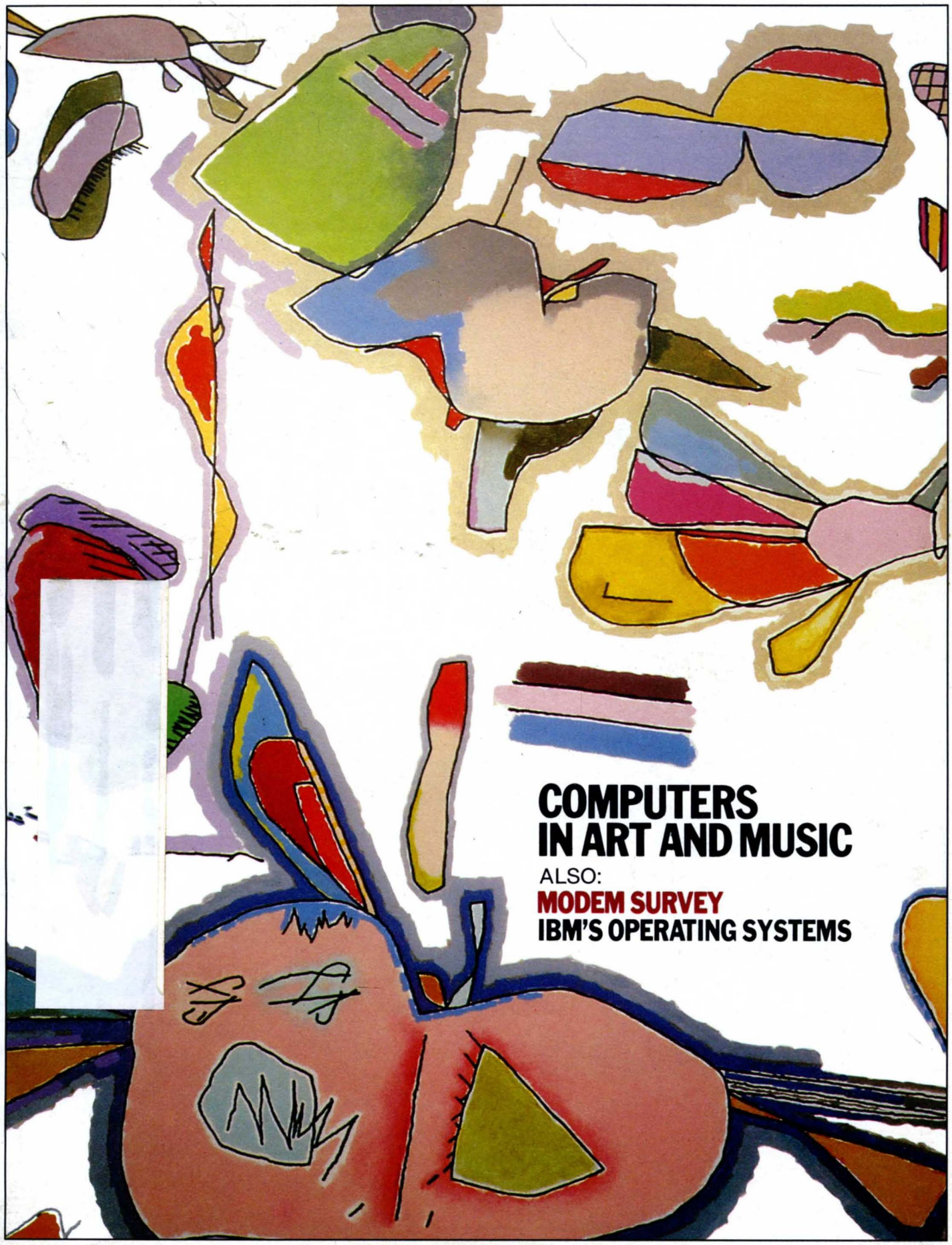

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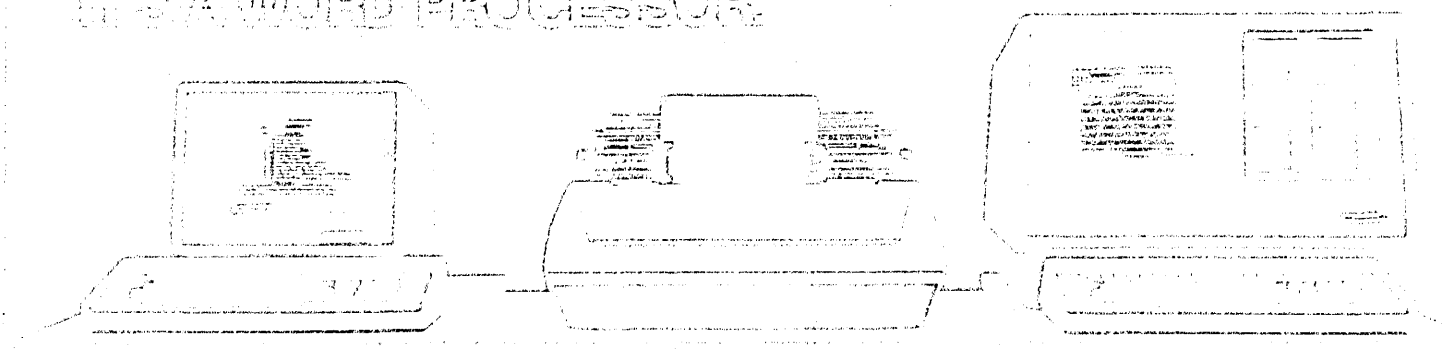
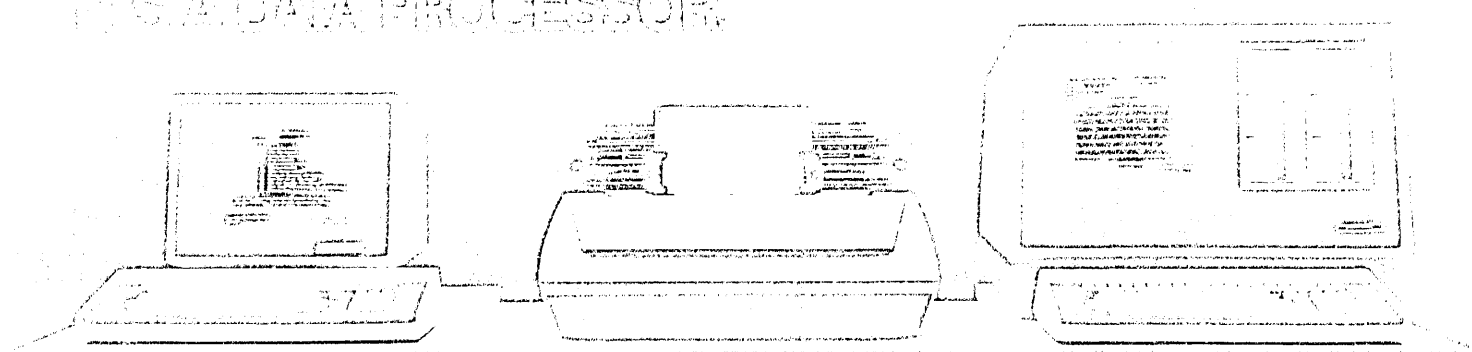


IT'S A DATA PROCESSOR.



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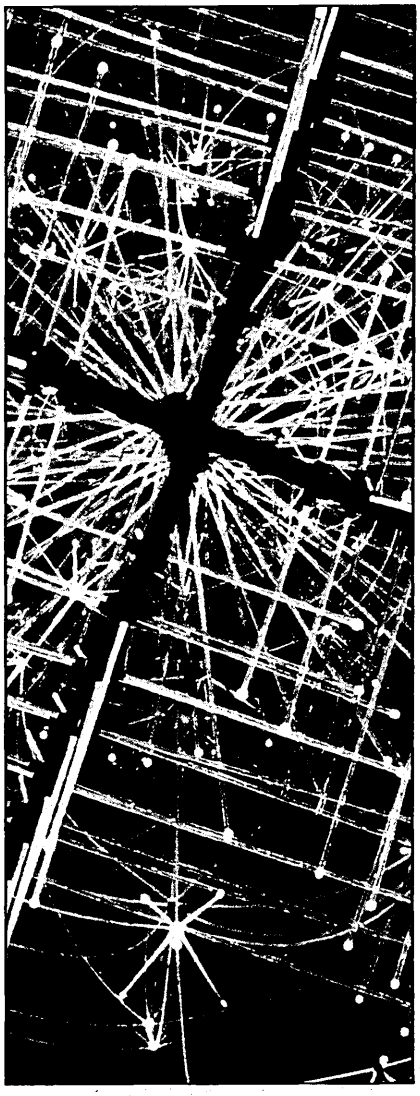
DATAMATION 81®

OCTOBER 1981/$4.00 U.S.A.
VOLUME 27 NUMBER 11
This issue, 162,520 copies

FEATURES

29
IN FOCUS
For microcomputer shoppers, we offer a survey of the major retail computer stores in the 10 largest cities in the U.S. Included are the names, addresses, and phone numbers of each outlet and the types of equipment, services, and financing offered.

118
ART? OR NOT ART?
Ken Sofer
Since the visual arts entered the computer age 25 years ago, our notions of how art can be made and viewed have changed dramatically—and will continue changing.



130
GIVE TCHAIKOVSKY THE NEWS
Leopold Froehlich
The evolution of computer-aided music from the '50s, when the computer was considered a plausible composing machine, to its present use as a memory capable of producing desired sound in exact sequence.

143
RENOVATING DINOSAURS
People in the industry complain that IBM's operating systems are bloated monsters that have gotten out of control. A panel of experts discusses modernization methods. Participants include moderator Larry Welke, Jay Michlin, Edward Miller, Jr., and Marvin Silverman.

158
MODEM SURVEY
Data Decisions
In the 2½ years since DATAMATION's last modem survey, the industry has expanded considerably. In March '79 some 50 vendors offering over 400 products were listed. The present survey identifies 70 vendors who deliver more than 500 models.

241
READERS' FORUM
"Help Wanted" is Joe M. Wiley's request, while Tony Karp offers "Babbage—the Language of the Future." Striking a more serious note, J. Harris discusses "The Kingdoms Within."

NEWS IN PERSPECTIVE

54 **MAINFRAMES**
Waiting for the B7900.

56 **STRATEGIES**
Storage for the masses.

63 **SEMICONDUCTORS**
Custom IC chips gaining.

67 **WORD PROCESSING**
One word leads to another.

71 **SUPERCOMPUTERS**
Counting on the CDC 205.

79 **PERIPHERALS**
Cii-HB hits U.S. shores.

83 **COMMUNICATIONS**
Network users unite.
Getting set for Baby Bell.

95 **SOFTWARE**
Portable software fanout.

100 **PERSONAL COMPUTERS**
Personal computer from IBM.

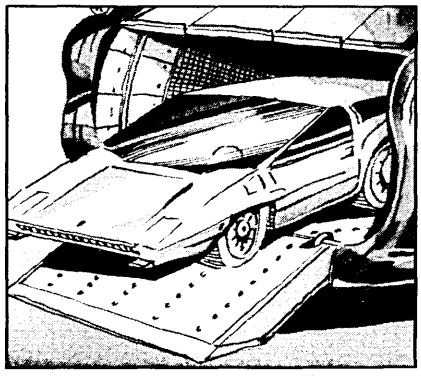
103 **GOVERNMENT**
CBEMA wins war with DOL.

110 **SMALL BUSINESS COMPUTERS**
Different from the rest.

114 **BENCHMARKS**

DEPARTMENTS

8 **LOOKING BACK**
13 **LOOK AHEAD**
18 **CALENDAR**
23 **LETTERS**
25 **EDITOR'S READOUT**



203 **HARDWARE**
215 **SOFTWARE & SERVICES**
225 **SOURCE DATA**
232 **MARKETPLACE**
238 **ADVERTISERS' INDEX**

Cover: Detail from Harold Cohen's "Primavera in the Spring," 1980, part of mural cycle "Four Seasonal Narratives," at the Digital Museum. Photo by Steve Cooper.

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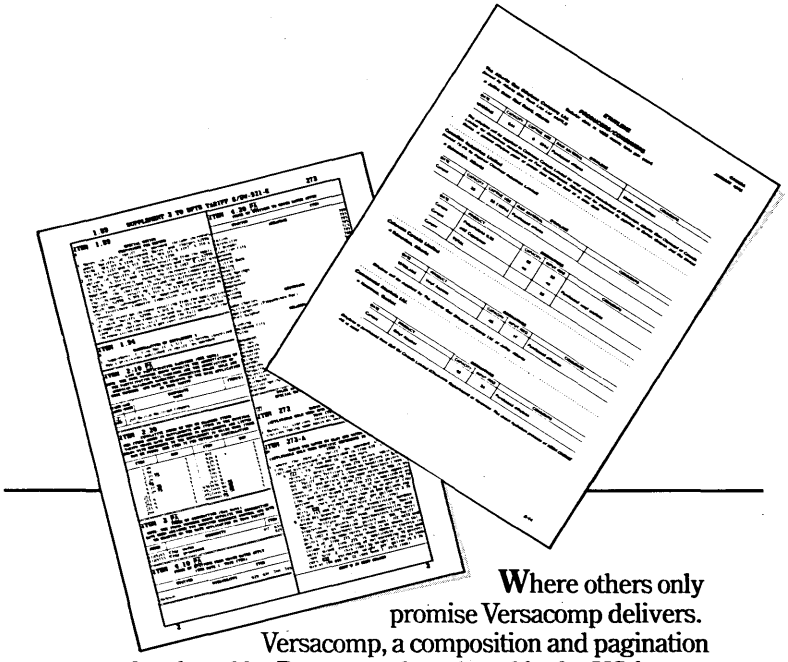

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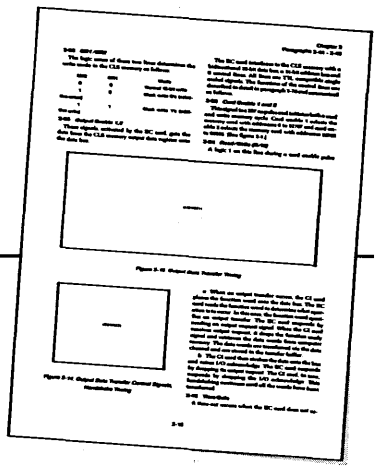

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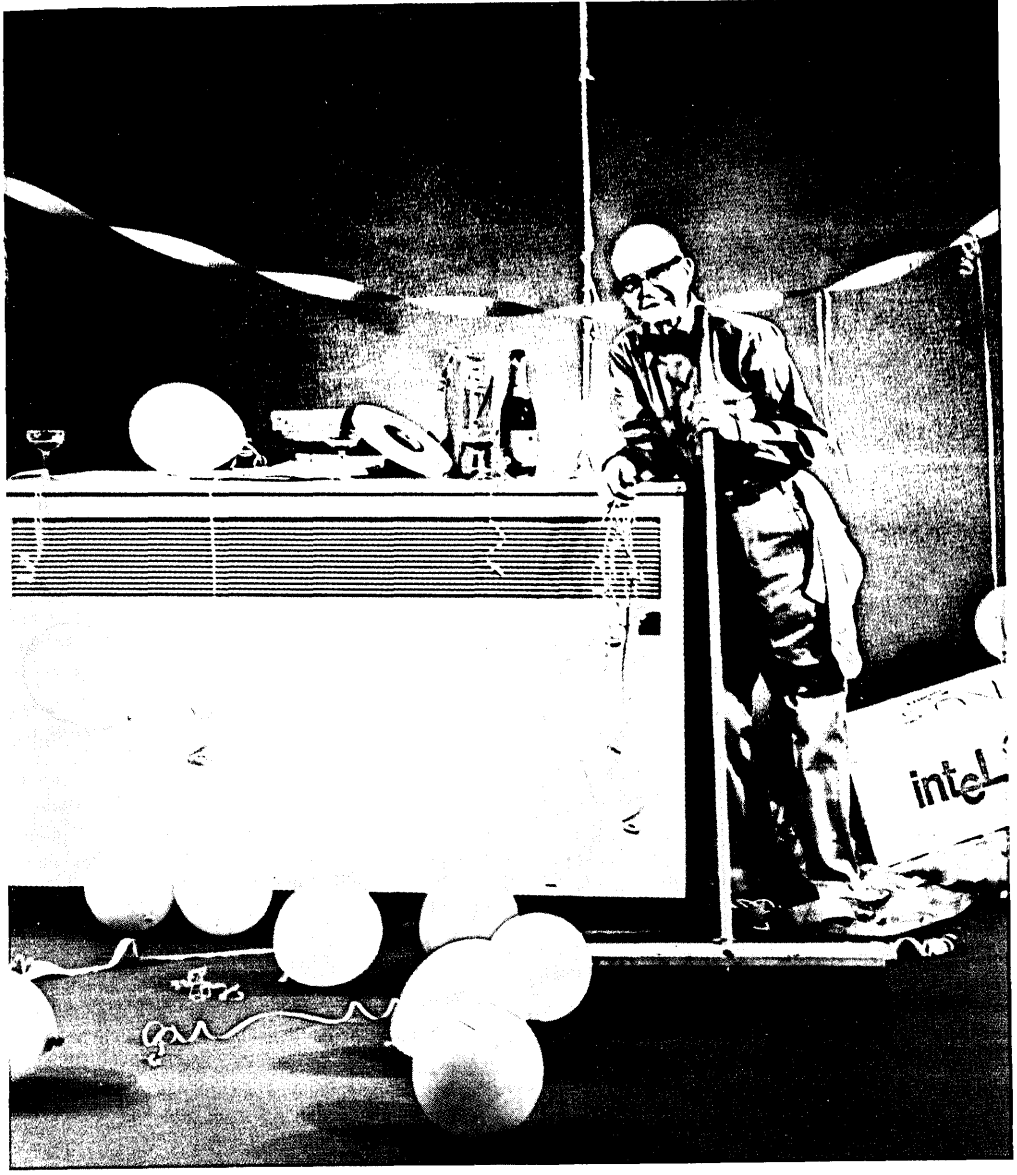

Cause for Celebration... your new 4300 with Intel's DBMS

Your DP staff is out celebrating a long-sought solution: hardware and software which work for them.

It feels good to be right. You've chosen Intel's SYSTEM 2000®/VSE data base management system to go with your 4300. It's a match that certainly calls for celebration.

SYSTEM 2000®/VSE DBMS: Made for the 4300.
Intel's DBMS is specially tailored to the IBM 4300 line and you, the user. Intel knows you have a diversity of application requirements and an urgent need to develop and maintain application software. You face a two-pronged challenge: to clear out backlogs and respond to increasing growth demands, while keeping budget and DP staffing on an even keel. Towards this end, you expect your software to relieve you of two fundamental concerns: *people productivity* and *low maintenance*.

Intel answers these people-intensive needs by providing:

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- simplified interfaces for end users;
- extensive prototyping facilities for application development; and
- flexibility to respond to modifications and change.

It's software that brings life to the party.
SYSTEM 2000/VSE DBMS, teamed with the 4300, allows you to maximize your valuable human resources by providing them with tools that make their jobs easier.

Programmers applaud Intel's versatile programming language extensions, which greatly facilitate their design efforts and free them to develop new applications as well as to update old. *End users* appreciate the free-form, English-like language that allows them to create, update and retrieve data bases without programmer assistance. Both enjoy Report Writer's comprehensive facilities which make reporting a routine and worry-free task. No programming is required.

And because SYSTEM 2000/VSE is dictionary-driven, you need never be apprehensive about changing your data base. The Integrated Data Dictionary (IDD) ensures that adjustments will not throw off the rest of the system in a "ripple effect."

Haven't had a good celebration for a long while? Call Intel's Market Information Office at 512/258-5171, or clip the coupon below. For you, the celebration has just begun. 4300 plug-compatible guests are also invited.

Please tell me more about SYSTEM 2000/VSE DBMS in 4300 (compatible) environments.

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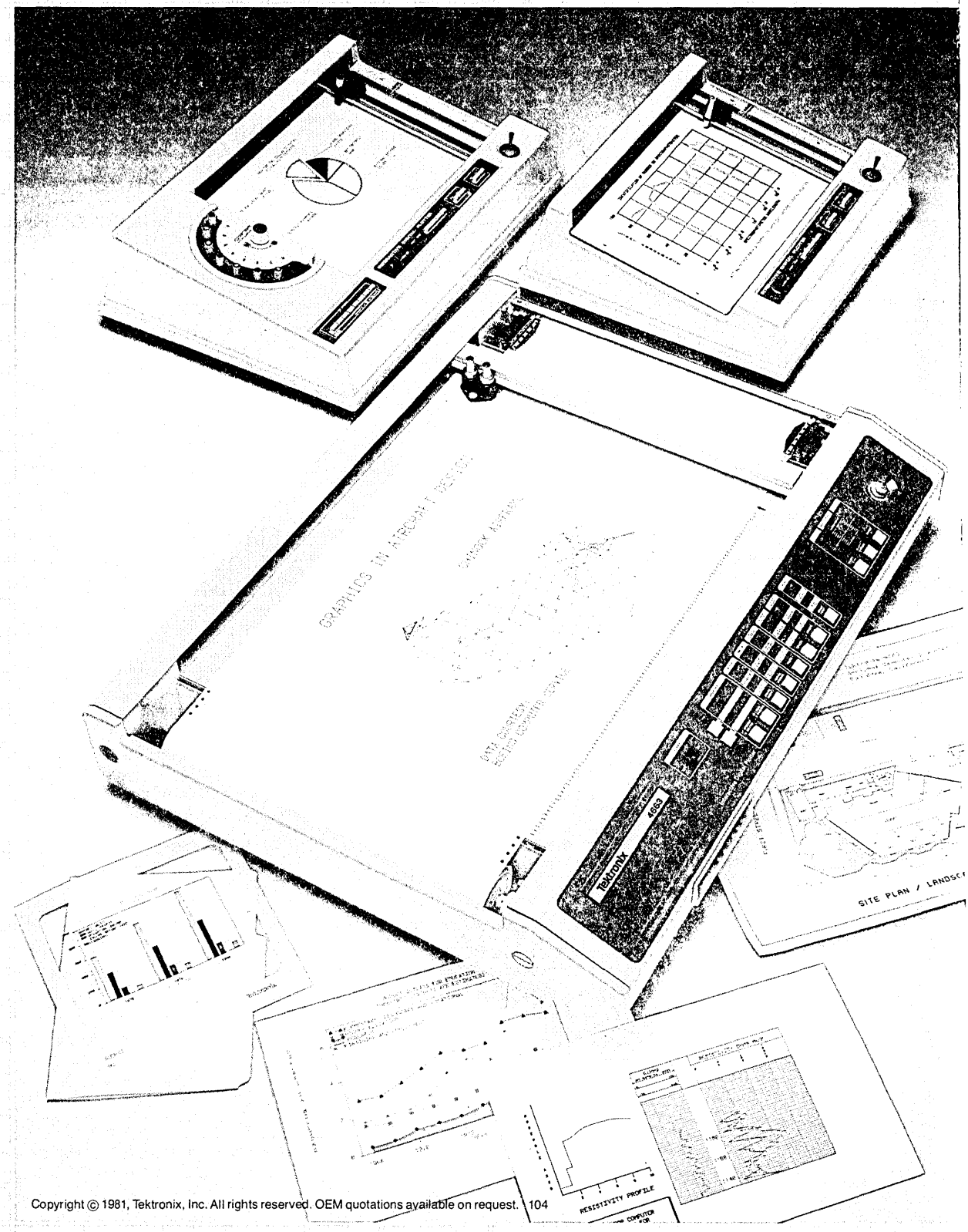

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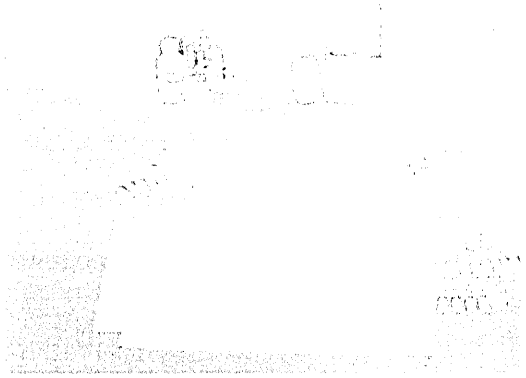

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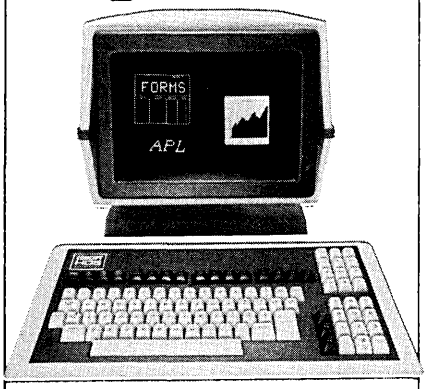

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Twenty Years Ago/Ten Years Ago

LOOKING BACK

TILTING AT WORDMILLS

October 1961: In "You Notice How No One Ever Uses Things Anymore?", Jackson W. Granholm complained of buzzword proliferation, labeling it a "cancerous and monstrous growth of quasi-verbalism." He charged that the overblown jargon then in vogue helped create confusion, misleading those who used and heard it. Granholm pointed out that apparently no one in the United States was content merely to use digital computers when instead they could "utilize data processing systems." That last word was also branded irksome and imprecise: "We may as well resign ourselves to utilizing systems and forget about using machines."

Another "new by-word of computer-oriented talk" was "instantaneous," and its ugly offspring, "practically instantaneously." On average, Granholm wrote, the construction appeared 2.67 times per paragraph in a typical computer manufacturer's press release. The pseudo adjective "solid-state" also turned up frequently, accompanied by the phrase, "virtually no moving parts." Granholm noted that when 73 electronics hardware public relations people were asked to define solid-state, only one could, and his definition was far from accurate. "Breakthrough in the state-of-the-art" heralded products that might or might not be new, and "in-house technical ability" alerted customers to the fact that the vendor had an engineering staff.

Granholm also had something to say about the 1961 WJCC, with its theme of "Extending Man's Intellect . . ." The implication, he averred, was that "those who use digital computers are smarter than those who do not." Granholm said this was true, but nonetheless difficult to prove, formally.

Software manufacturers were among the guilty, too, with their bad habits traceable back to when the drum computer was invented and "minimum latency programming" was devised to simplify the phrase "get things faster." "From this humble beginning," Granholm griped, "we have progressed to the present day when pseudo-code, macro-language, and debug time are things spoken freely across the back fence by every housewife."

RCA BOWS OUT

October 1971: In 1965, RCA expressed interest in acquiring Univac to aid in an expansion of the company's computer systems operation. The deal never materialized, and by 1971, it became evident that RCA would not be acquiring any computer firm. In early September, rumors flew that Univac would be the one doing the acquiring. There were similar rumors in circulation linking RCA with Xerox, Westinghouse, and Memorex.

RCA began cutting off programs and laying off people—sales were down, and returns of Spectra 35s and 45s from customers upgrading to the single-digit series only compounded the company's problems. Then came "Black Friday," Sept. 17, when RCA announced it would abandon the general purpose computer business. Customers were given no advance warning, nor did they receive any details on how RCA would provide support in the future. Richard Rau, president of the RCA Users Association and acting director of Pennsylvania's Bureau of Management Information Systems (with 17 RCA systems), told users not to panic, citing the "valid, enforceable contracts that will be usable for the next seven years," which would enable users to "gradually replace their systems."

On the home front, RCA employees were caught unaware. Security was tightened, and the staff was subjected to briefcase searches, the opening of all mail, and the frisking of production workers. One RCAer was even caught with an unsold house in Cherry Hill, N.J., and another with a newly purchased one in Marlboro, Mass., because of the company's relocation.

The government was also affected by RCA's bailout. In Washington, there were 180 RCA systems installed, and software support—or rather, the possible lack of it—was the feds' major fear. RCA's withdrawal was expected to boost long-term commitments with IBM, thereby giving IBM competitors yet another headache.

—Deborah Sojka

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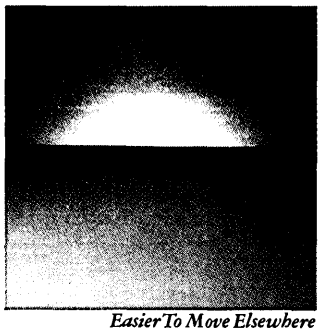
Easier To Look At

Easier To Work With

Easier To Accommodate



Easier To Move Elsewhere

It's a word that best summarizes the benefits of the Memorex 2078 Display Station. Important benefits for users of some of today's most popular CPUs, including the IBM 43XX. And of today's most advanced communications protocols, like SNA/SDLC.

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People who are more comfortable are more productive. That's why there are more "people" features designed into the 2078. A non-glare screen and keytops. Non-reflective moldings. Recessed display. And a monitor that tilts 30° up and 15° down. There are also more operational features. Like a line and column indicator. An alternate cursor. An operator information line. And keyboard click and non-click mode.

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Space is always at a premium, be it on a desktop or an entire office work area. Which is why Memorex made the 2078 both compact and versatile. The whole package measures just 17" wide by 19" high by 24" deep. And it weighs a mere 55 pounds. A detachable keyboard and a removable monitor that can be conveniently placed on a shelf, further increases workspace efficiency.

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It can be ordered with your choice of five screen capacities, from 960 to 3564 characters. With many keyboards, including 75-key EBCDIC typewriter, ASCII typewriter and EBCDIC data entry as well as 87-key ASCII typewriter and EBCDIC typewriter with numeric pad. And an impressive list of options, including selector light pen, security keylock, an unprotected field indicator and a special conditions alarm.

The 2078 Is Easier To Get When You Want It.
It's built for SNA/SDLC, right now. It's built for customer installation in a matter of minutes. But for all of the reasons the 2078 from Memorex is easier to appreciate, the biggest might be delivery. Because 2078s are available in quantity, immediately.

So take the easier way out. And the smarter way. Contact your local Memorex representative today. Or Laurie Schuler at (408) 996-9000. Memorex Communications Group, 18922 Forge Drive, Cupertino, CA 95014.

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CIRCLE 9 ON READER CARD

Intel would like to give

With light-speed paging and swapping, Intel's new FAST-3815 intelligent memory system frees your 3350s (and 3380s) for the task they were meant to perform: data storage.

Priced at only $6K a megabyte, the FAST-3815 is an intelligent Random Access Memory (RAM) *system.* And because it handles paging and swapping faster and more economically than anything else in the market, the FAST-3815 releases your large capacity disk drives for productive use.

When compared to conventional disks, Intel's FAST-3815 offers many cost-effective advantages for IBM 4300, 158, 168, 303x and PCM users. These include:

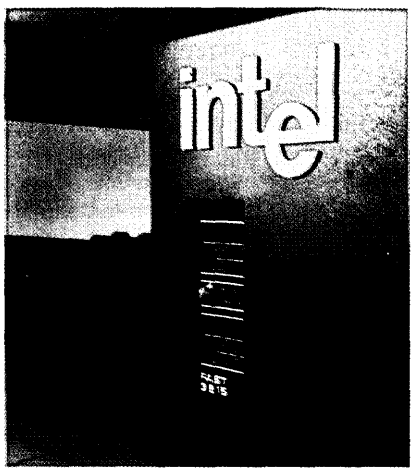
- Improving paging and swapping up to 300 percent,
- Enhancing systems performance by reducing page service time up to 67 percent (vs. a 3350),
- Reducing users' response time and/or increasing the number of users with no degradation in response time, and
- Providing environmental savings—cooling, power and space.

Intelligent memory priced at $6K a megabyte

You won't find RAM memory anywhere priced as low as $6K a megabyte...especially *intelligent* RAM memory. Intel's advanced iSBC 86/12™ single-board computer equips the FAST-3815 with unparalleled intelligence that, among other functions, handles channel protocol and performs sophisticated self-healing diagnostics.

Self-healing procedures which make the FAST-3815 virtually fail-safe include:

- The first commercial application of 'hot' spares and double-bit error correction with multiple-bit detection,



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- A unique software sweep that 'scrubs' soft errors and reallocates spare memory in place of hard errors, and
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The FAST-3815's microcomputer also ensures complete IBM compatibility and the ability to emulate numerous direct access storage devices.

Fast access

The FAST-3815's extremely fast paging and swapping performance can release 3350s (and 3380s) to perform the function they handle best—normal data storage. The FAST-3815's 0.8 milliseconds access time is considerably faster than any IBM alternative.

By moving the paging data sets of swap files onto a single FAST-3815, you can free *multiple* 3350s (and 3380s) to handle your growing data storage requirements. And, Intel's FAST-3815 is available for delivery *now.*

The FAST-3800 family

The new FAST-3815 is an entry-level version of the Intel FAST-3805 semiconductor disk. Both devices in the FAST-3800 family offer impressive environmental savings. Power costs, cooling costs and space requirements are at least half of those of conventional disks.

Intel's FAST-3815 releases your disks for more productive use, offers increased systems performance, and is available *now.* Interested? Contact Intel's Market Information Office at 512/258-5171. Or mail the attached coupon today.

☐ Send details on the FAST-3815 semiconductor disk.
☐ Have a salesman call immediately.

Name _____

Organization _____

City, State, Zip _____

Phone (____) _____

CPU _____ Operating system _____

Return to Intel Market Information Office, P.O. Box 9968, Austin, Texas 78766.

Europe: Intel Corporation S.A., Systems Group, Rue du Moulin a Papier 51, Boite 1, B1160 Brussels, Belgium, 322-660-30-10, TLX 846-24814. Canada: Intel Semiconductor of Canada, Ltd., 201 Consumers Road, Suite 200, Willowdale, Ontario M2J 4G8, 416/494-6831.

CIRCLE 10 ON READER CARD

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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

Corporate Offices: 870 West Maude Avenue, Sunnyvale, CA (408) 733-1122; Regional Offices: Piscataway, NJ (201) 457-0600; Palatine, IL (312) 397-9190; Atlanta, GA (404) 396-1630; Sunnyvale, CA (408) 749-0500. Sales Offices in major U.S. cities. In the United Kingdom: Birmingham (021)-477-3846.

BTI is a registered trademark of BTI Computer Systems

CIRCLE 11 ON READER CARD

LOOK AHEAD

ETHERNET EVER MORE

Look for a series of Ethernet-compatible products to be introduced over the next 12 months. More than 100 firms have been licensed by Xerox to use Ethernet principles. The $1,200 license has gone to companies which include IBM GSD, AT&T, and firms as far away as Japan and Finland.

Intel has implemented the first two layers of the Ethernet interface in a PC board which will be replaced by a single chip version within the next year. A microprocessor development system in the Intellec series is also available from Intel to help vendors implement the other layers needed in an Ethernet-compatible product.

CRASHING CRAYS?

Will the yet-to-be-unveiled Cray 2 be compatible with the Cray 1? "Not exactly," admits Cray Research president John Rollwagen. A FORTRAN program that runs on the Cray 1 might run two to four times faster on the Cray 2, but to take full advantage of the Cray 2's five to 10 times performance improvement, "some rewriting of the code in FORTRAN will be required," he said. Compatibility requires compromise and Seymour Cray, Rollwagen indicated, is not inclined to compromise performance.

NEWCOMER TO OEM MINI BIZ

What happens when you push the LSI 11 microcomputer architecture out to 32 bits, or better than VAX throughput, and you gain the advantages of a timesharing environment through the UNIX operating system -- all at around $20,000? Answer: you get to hustle your way into the oem minicomputer business, which is increasingly being ignored by such giants as Data General and DEC. Latest newcomer in this department will be Charles River Data Systems, Natick, Mass. Quipped one source, "Its offering sounds like the machine that DG tried to build before it settled for the Eclipse."

TURNKEY TALK

Plessey Peripheral Systems, Irvine Calif., is getting into small business computers. The first product in the three series of turnkey systems will debut at next month's Comdex show in Las Vegas, where the firm will recruit independent distributors. The SBC 210 with a DEC LSI 11/23 processor, a 20.8 megabyte dual disk drive, and system software will be priced at $32,000. Initial software will include a DIBOL-compatible language processor for emulating DEC Datasystems, a COBOL processor, and ISM-11, a MUMPS-based system with an integrated DBMS for medical and financial markets.

LOOK AHEAD

AMI BREAKS TIES WITH CALIFORNIA

We hear AM International is looking for a buyer for its AM Jacquard Systems Div., Santa Monica, Calif., a unit it said it would keep when it put a number of others on the block last spring. And it appears that AMI, newly relocated to Chicago from Los Angeles, has found a buyer from within for its only other Southern California operation, AM Documentor, a unit known to be up for grabs. Looking to buy it is a group of its own executives headed by division president Sol Zechter.

FROM LONDON TO TOKYO AND BACK

A veritable parade of British government and industry dignitaries has been passing through Tokyo this summer, stopping off not only at the Ministry of International Trade & Industry but also at Fujitsu LTD., the leading mainframe maker. We understand the folks at ICL are seeking to acquire Fujitsu's VLSI technology and have also been discussing the purchase on an oem basis of some large-scale IBM-compatible mainframes. These machines will probably be the large M series.

And sometime this month ICL is expected to announce the PERQ microprocessor-controlled, multipurpose office workstation made by Three Rivers Computer Corp., Pittsburgh.

FROM XANADU TO DATAPOINT

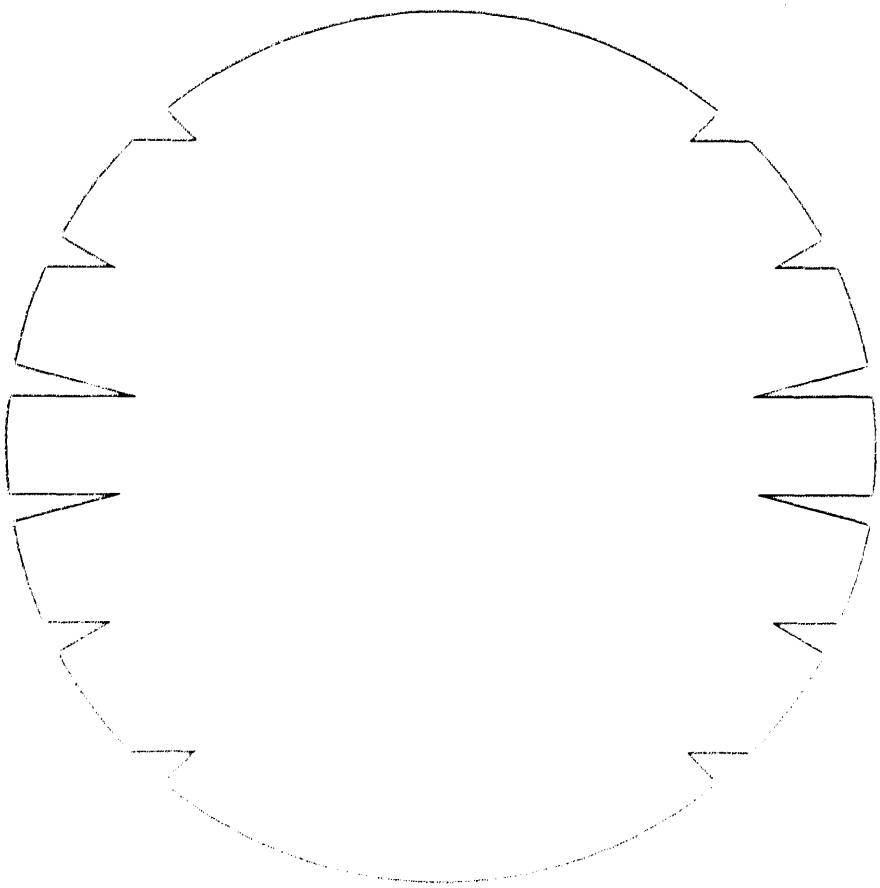
Ted Nelson of Computer Lib/Dream Machines and Project Xanadu fame is joining Datapoint this month to work on the firm's office automation products. While it's not clear what he'll be contributing to the effort, Datapoint's free-form indexing system would seem to be receptive to some of the ideas Nelson has been promoting with Xanadu/hypertext, a project which continues in Ann Arbor under the leadership of Roger Gregory.

THROUGH THICK AND THIN

At least six U.S. companies are interested in the so-called smart card, and "they're not necessarily banks," says Roy Bright, managing director of Intelmatique, the French group dedicated to the export of French technology. In fact, Bright thinks the chip-in-a-card notion, if it takes off in the U.S. at all, will begin in nonbanking sectors where the 0.030 in. thickness of the cards won't damage investments in readers and imprinters that require thicker cards.

RUMORS AND RAW RANDOM DATA

We hear IBM has about 150 orders for its large-scale 3081 processor in the Japanese market...An 1890-era building in Manhattan's fashionable Tribeca section is to become the first co-op to offer built-in computer terminals. Residents, who will pay upwards of $100,000 for their apartments, will get a crt terminal and a subscription to The Source.



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Together, because Informatics has exactly the computer professionals you need. Senior analysts and programmers to unravel your one-of-a-kind problems. Mobile teams to tackle your application backlog. Training programs to upgrade your staff.

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Your Information Management Partner.

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CIRCLE 120 ON READER CARD

What the heck is Electronic Mail

Electronic Mail is a term that's been bandied about data processing circles for years.

Simply put, it means high-speed information transportation.

One of the most advanced methods is terminals talking to one another.

Your mailbox is the terminal on your desk. Punch a key and today's correspondence and messages are displayed instantly.

Need to notify people immediately of a fast-breaking development? Have your messages delivered to their terminal mailboxes electronically, across the hall or around the world.

Electronic Mail is document distribution that's more timely, accurate and flexible than traditional methods.

There's no mountain of paperwork.

Administrative personnel are more effective.

Managers have access to more up-to-date information. Decision-making is easier.

Tomorrow's automated office will clearly include Electronic Mail. But like the rest of the Office of the Future, it's available at Honeywell today.

For more information call Mr. Laurie Reeves at (800) 225-3222/3 (within the 617 area, call 552-2048). Or write him at Honeywell Office Automation Systems, Three Newton Executive Park Drive, Newton Lower Falls, Massachusetts 02162.

Honeywell

CIRCLE 13 ON READER CARD

CALENDAR

OCTOBER

Systems '81, October 19-23, Munich.

Both the conference and exhibition at Systems '81 will strongly emphasize telecommunications. "Thinking in Systems" is the theme. Contact Kallman Associates, 30 Journal Sq., Jersey City, NJ 07306, (201) 653-3304.

CAD/CAM Graphics Users Expo, October 27-30, Fort Worth, Texas.

The expo is held in conjunction with Computer Aided Manufacturing-International, Inc.'s 10th annual meeting. The conference will focus on various graphics systems' capabilities relative to manufacturing users' needs. Contact CAM-I, Suite 1107, 611 Ryan Plaza Dr., Arlington, TX 76011, (817) 265-5329.

NOVEMBER

Federal Office Automation Conference, November 3-5, Washington.

The conference program provides coverage of issues including management, applications, technology, equipment, and systems and services. Contact Federal Office Institute, P.O. Box E, Wayland, MA 01778, (617) 358-5119.

ACM '81, November 8-11, Los Angeles.

Exhibits, tutorials, workshops, panels, plus a number of special events will be part of this year's ACM. Contact ACM '81, P.O. Box 24059, Village Station, Los Angeles, CA 90024, (213) 536-9735.

Autofact III, November 9-12, Detroit.

New technological refinements and management approaches to the automatic factory are the major subjects of this year's conference and exposition, sponsored by the Computer and Automated Systems Association of the Society of Manufacturing Engineers. Contact SME Public Relations, One SME Dr., P.O. Box 930, Dearborn, MI 48128, (313) 271-1500.

COMDEX '81, November 19-22, Las Vegas, Nevada.

This is the third annual conference and exposition geared to the needs of independent sales organizations. Contact the Interface Group, 160 Speen St., Framingham, MA 01701, (617) 879-4502.

Western Educational Computer Conference, November 19-20, San Francisco.

Sponsored by the California Educational Computing Consortium, this is the CECC's fifth year. Contact Ron Langley, Director, Data Processing Services, California State University—Long Beach, 1250 Bellflower Blvd., Long Beach, CA 90840, (213) 498-4111.

1981 National Telecommunications Conference, November 29-December 3, New Orleans.

"Innovative Telecommunications—Key to the Future" is the conference title. Topics include using communications technology to develop energy resources, and other innovative uses of telecommunications products and services. Contact Kenneth Black, New Orleans Public Service, 365 Canal St., Rm. 950, New Orleans, LA 70140, (504) 586-2173.

DECEMBER

Twelfth International Conference on Computer Performance Evaluation, December 1-4, New Orleans.

The conference is sponsored by the Computer Measurement Group, and will feature CPE sessions from three viewpoints—technical, managerial, and tutorial. Contact Donald Deese, FEDSIM, 6118 Franconia Rd., Alexandria, VA 22310, (202) 274-8461.

WSC '81, December 9-11, Atlanta, Georgia.

The annual Winter Simulation Conference is cosponsored by seven organizations, including the ACM/SIGSIM, and the IEEE's Computer Society. Contact Claude Delfosse, CACI, Inc., 1815 North Fort Myer Dr., Arlington, VA 22209.

JANUARY

Data & Telecommunications/Japan, January 20-23, Tokyo, Japan.

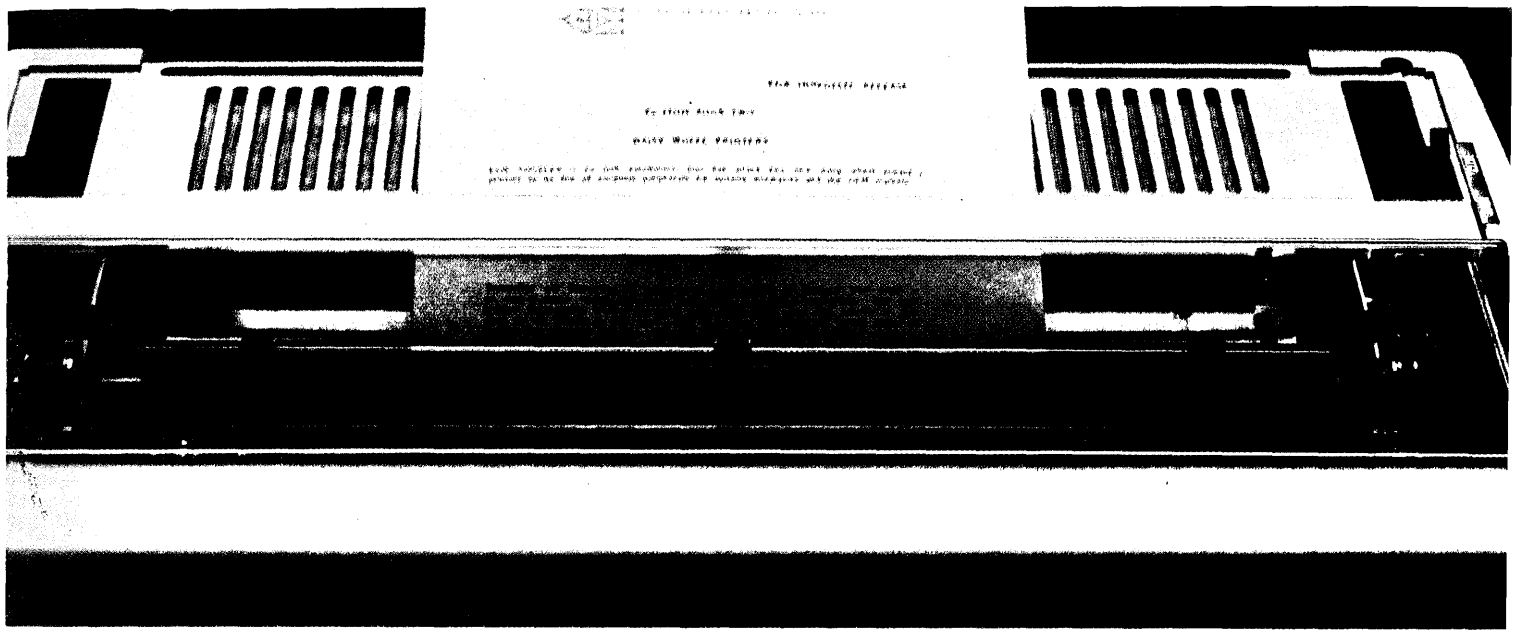
Suppliers of PABX equipment, modems, cables, etc., from all over the world will be exhibiting at the Tokyo exposition. A conference program is also scheduled. Contact Industrial & Scientific Conference Management, Inc., 222 West Adams St., Chicago, IL 60606, (312) 263-4866.

Texas Computer Show, January 20-22, Dallas, Texas.

The Texas show is scheduled to become a yearly event, covering all aspects of computer and word processing equipment, peripherals, software, and services. Contact Intercontinental Trade Shows, Inc., P.O. Box 214035, Dallas, TX 75221, (214) 761-9108.

ASEE '82, January 26-28, San Jose, California.

The Advanced Semiconductor Equipment Exposition is the fourth annual show and conference of semiconductor processing, production, and test equipment and materials suppliers. Contact Cartlidge & Associates, Inc., 491 Macara Ave., Sunnyvale, CA 94086, (408) 245-6870.



LETTER PERFECT.

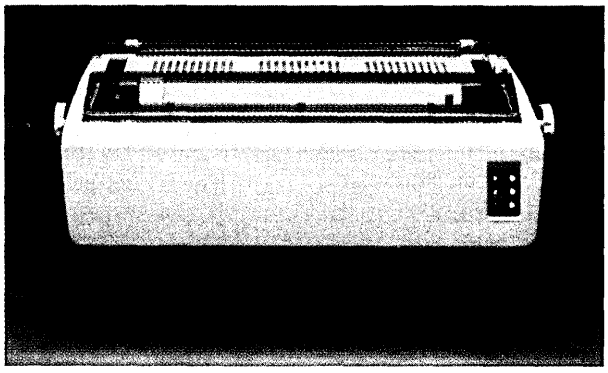
You can actually see the superior print quality when you use C. Itoh's new daisy wheel impact printers. Besides clear and crisp print characters, you also get the throughput performance you're looking for, at prices never before available to quantity buyers of Daisy Wheel printers.

C. Itoh's Starwriter offers you a print speed of 25 cps while the Starwriter II operates at 45 cps. Both machines incorporate the latest LSI technology and utilize an easy-to-change industry standard 96-character wheel. Starwriter printers are the perfect choice for multilingual and multi-discipline applications.

The two Starwriter models also feature self-test capabilities and a programmable VFU. You'll be able to print up to 163 columns on multiple copies and you can process paper widths to 381 mm (15"). Both models are equipped with front panel indicator lamps and switches.

You can put our printers to work the minute they're delivered. They're plug-compatible and meet either the industry standard parallel interface specifications or serial RS 232 C with voltage or current mode capacity.

So if you're looking for perfection in printing, let our Starwriters do the job. All printers are backed by C. Itoh's warranty and nationwide service organization. For more information, contact C. Itoh Electronics, Inc., 5301 Beethoven Street, Los Angeles, CA 90066; Tel. (213) 306-6700. Chicago Office: 240 E. Lake Street, Suite 301-A, Addison, IL 60101; Tel. (312) 941-1310. New York Office: 666 Third Ave., New York, NY 10017; Tel. (212) 682-0420. Dallas Office: 17060 Dallas Pkwy, No. 108, Dallas, TX 75248; Tel. (214) 596-2974. Represented in Canada by Canadian General Electric.



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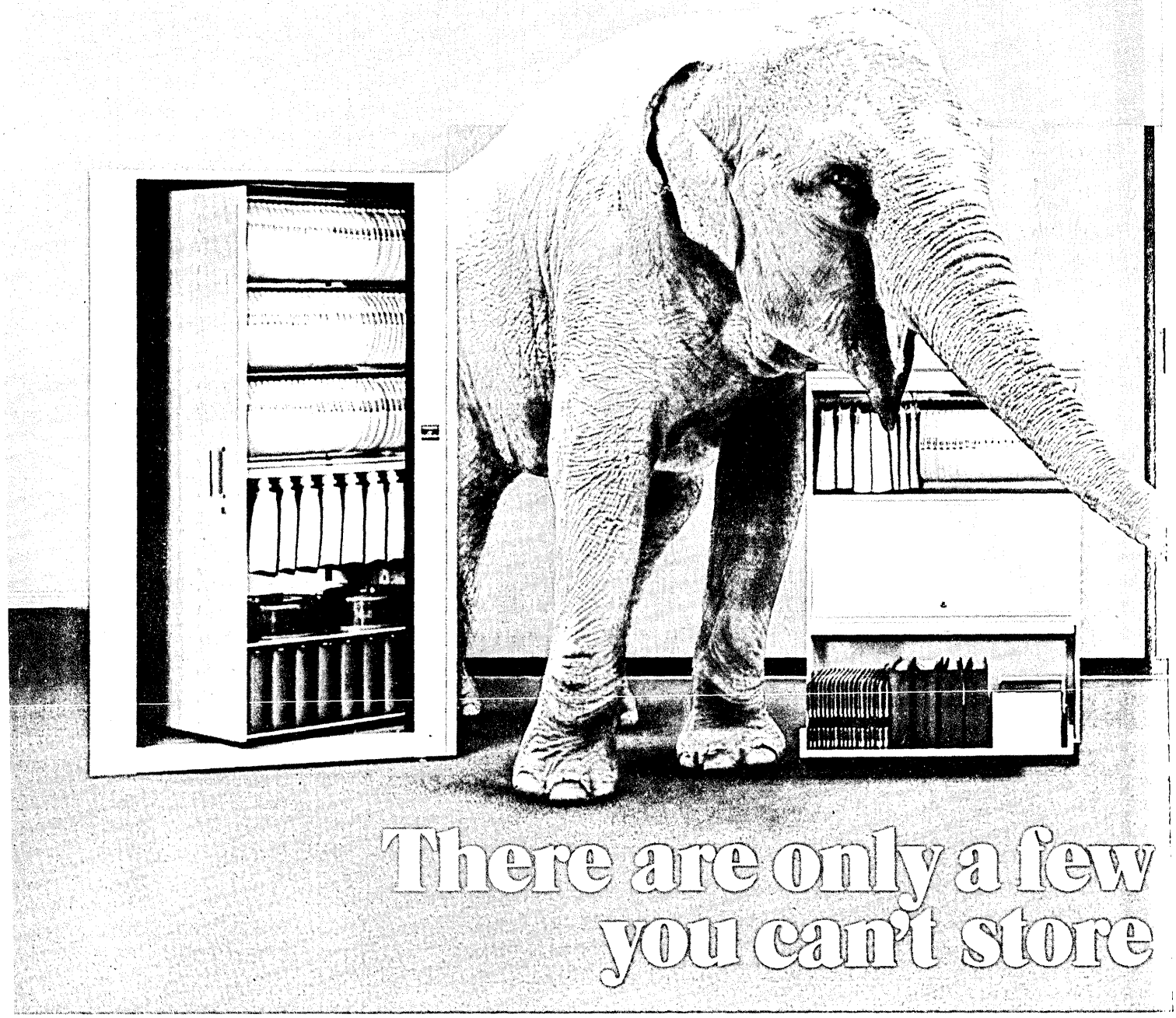
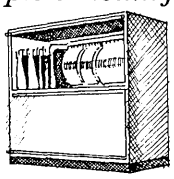
CIRCLE 14 ON READER CARD



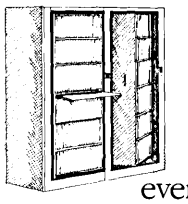
Ladies and Gentlemen: Presenting Media-Flex.™ The complete information handling system from Acme Visible.

No matter what your filing and storage needs, no matter what your space limitations, you'll find the Acme Visible Media-Flex line just what the doctor, office manager and data center ordered.

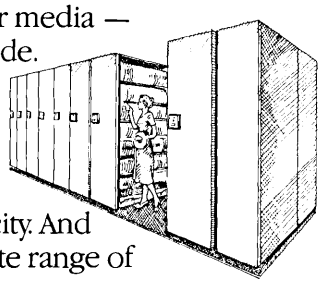
Each Media-Flex unit gives you maximum storage in an absolute minimum of space and *complete media flexibility.* And there are good-looking, hardworking work stations to match.



Consider our modular cabinets. They stand alone or can be stacked and interlocked. And instead of just offering you a choice of colors, we let you store your choice of media — disk packs, reels, cassettes, printouts and more.



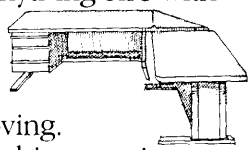
Or look into the Rotomatic,® a rotary file that uses 55% less space than conventional 4-drawer files. Presto. You get twice the space in the same old place. Rotomatic can even serve as a handsome room divider that gives you access to your media — any media — from either side.



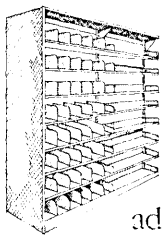
For high density filing, nothing beats our Magic Aisle.® It's compact shelving that moves on tracks to double your capacity. And still lets you store a complete range of media for added versatility.

Our Media-Flex line offers work stations

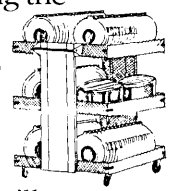
flexible enough to handle your word processors, data terminals and just about anything else with ease. And grace.



We've got open shelving and three sizes of carts to keep things moving.



One other thing we give you. The kind of quality that goes into every product bearing the Acme Visible name.



So don't file this ad away. Call us collect at (804) 823-4171 or send us the coupon and we'll send you more information. And while we're at it, we'll send you "Filing in a Nutshell," our information handling and media storage guide, free.

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CIRCLE 15 ON READER CARD

Prime.
One line of compatible systems. A whole spectrum of powerful solutions.

Just a few years ago, advanced technology and system compatibility were mutually exclusive. But when Prime began making computers, technology and compatibility became one.

Big. Better. Best. The Prime 50 Series includes the Prime 250-II, 550-II, 750, and the new Prime 850. The Series is so flexible, it can handle virtually any application you have. And so powerful, it can meet your most demanding needs.

If you're in a start-up mode, the perfect way to begin building your system is with the Prime 250-II. If you need more power, you'll find the solution in the Prime 550-II or the Prime 750. And if you're looking for maximum performance, the Prime 850 is the most powerful mini available today.

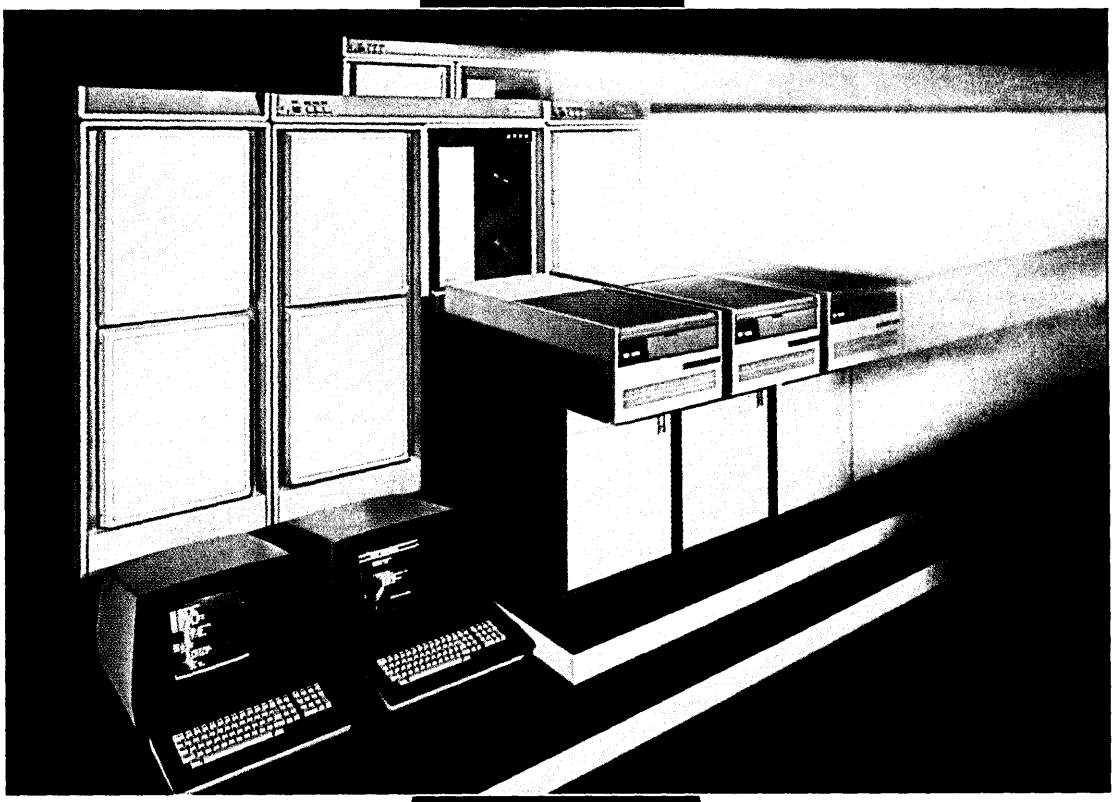
You should know too that any 50 Series system can be networked with any other. They can also communicate directly with mainframes. And all Prime systems support a broad band of industry-standard languages.

The economy of compatibility. The Prime 50 Series is designed around a single operating system, which makes all systems compatible with each other. So you can easily and economically move up to a larger system, or expand to any number of small, remote systems. And you'll have nothing new to learn because the same software goes with you.

A spectrum of solutions. The 50 Series was designed to provide a broad spectrum of solutions for just about any application you might have, including manufacturing, financial, education, utilities, engineering, energy, automated office, you name it.

Consider Prime first. Today, more than ever before, you need the compatibility and the spectrum of solutions that only Prime can offer. For more information, write to us at Prime Park, MS 15-60, Natick, Massachusetts 01760. In Europe, write Prime Europe, 6 Lampton Rd., Hounslow, Middlesex, TW3 1JL, England. Telephone: 01-570-8555.

PRIME
Computer



CIRCLE 16 ON READER CARD

LETTERS

DOG DAYS

Re: Cover Photograph, August 1981, please dispel the nasty rumor that's floating around our office about the dog on your cover. Is the dog alive or stuffed (preserved . . . like Trigger)???

The office opinion is about 50-50 as to which is true. Can you help?

SUE KILGORE
Service Coordinator
Computer Systems
Hewlett-Packard Co.
Grand Rapids, Michigan

Just saw a copy of the August DATAMATION in a friend's office and wanted to say what a really great cover!

I don't suppose it is available without all the words on it? Would make a terrific poster!

MARJORY BELL
Orlando, Florida

In distributing the mail this morning I saw a copy of your August issue, and I was impressed with the cover.

I have a fox terrier that looks like the one on your cover. He is 18 years old this summer. If you have ever had a dog, you know just how attached you can become.

Is there any way in which I could get a copy of your cover for framing?

MARION H. MESSICK
Secretary to the Principal
Folcroft Vocational-Technical School
Folcroft, Pennsylvania

Alive and well and living in New York City is Jack, the super-smart dog, trained and supplied by All-Tame Animals. Jack, who is 6½ years old, was one of the "actors" starring in the 1977 & 1980 Clio award-winning Breakstone Cottage Cheese commercials. Jack appeared in all 11 spots, produced by

Gomes/Loew, pulling vigorously at Sam Breakstone's pants leg and running out of the store carrying Sam's straw hat in his mouth. He was also featured in The Prince of Central Park, *a 1979 CBS tv special. A real trouper, he worked 10- and 11-hour days without an understudy. During the shooting of our August cover, Jack gladly posed with Susan Rasco, our assistant art director.*—Ed.

CHEAP TALK

Re: "Talk Is Getting Cheaper" (August, p.70), I feel compelled to refute Paul Masters' statement that "LPC [linear predictive coding] . . . quality is poor . . ." We know this to be untrue because we build very high quality speech products using LPC. In addition, if LPC was so bad, why would three U.S. and more than five Japanese manufacturers adopt it?

Production of high-quality LPC speech does require that much care be taken to extract correct pitch and voicing data during the encoding procedure. But since none of the LPC chip or board manufacturers require the user to do the encoding, this is unimportant.

The Centrigram PWC [parameterized wave-form coding] process is intended to improve the quality of real-time low-data-rate voice communications, a job which has been performed only moderately well using LPC. But it is unfair to ascribe to the many high-quality LPC stored-vocabulary products the deficiencies of real-time LPC encoding. Similarly, it is incorrect to imply that PWC will produce better stored-vocabulary quality than LPC. Listening tests do not support such as implication.

Technological advances are certainly needed in synthetic speech, but additional confusion is not.

DAVE GILBLOM
Sales Manager
Telesensory Speech Systems
Palo Alto, California

Re: "Loquacious Devices" (August, p. 72), we enjoyed your discussion of the voice output market, but would like to point out that you overlooked our Transaction Communications Systems audio response products, which are used in applications such as credit card authorizations and branch banking services. We introduced the TCS/500 line in April of this year.

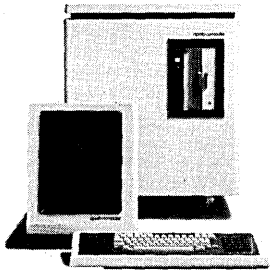
JOHN MARTIN
Engineered Systems, Inc.
Omaha, Nebraska

WRONG NUMBER

Re: Look Ahead (September, p. 13), apparently a typographical error crept into the item entitled "The Seven-Year Itch." The Computer Store first opened its doors in 1975, not 1977 as reported. It wouldn't be the seven-year itch otherwise.

DICK HEISER
President
The Computer Store
Santa Monica, California

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.

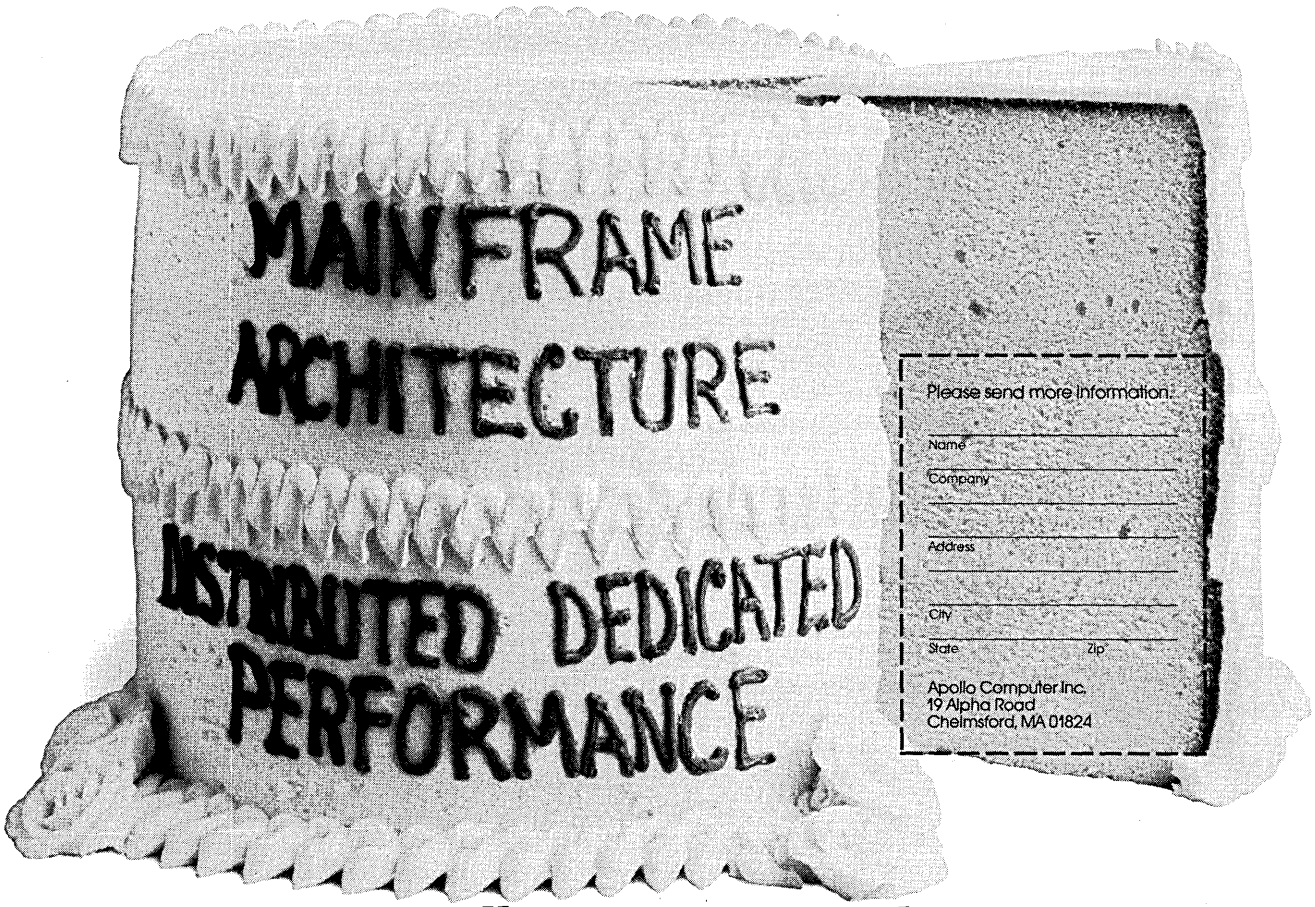
A network level modularity, providing a system with a very high performance level, a wide range of growth capability, and a vast improvement in system reliability and availability.

DOMAIN is designed to accommodate a wide range of application environments, including scientific, engineering, research, finance, CAD/CAM, text processing and transaction processing. The system is capable of running very large, single program applications, as well as multiple program applications.

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

Now you can have your cake and eat it too.

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



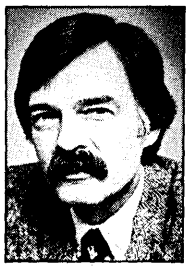
apollo computer

Apollo Computer Inc., Headquarters: Chelmsford, MA: (617) 256-6600; District Offices: Mountain View, CA: (415) 967-3231; Edina, MN: (612) 835-4541; Wayne, PA: (215) 964-8510; Dallas, TX: (214) 239-8528.

CIRCLE 17 ON READER CARD

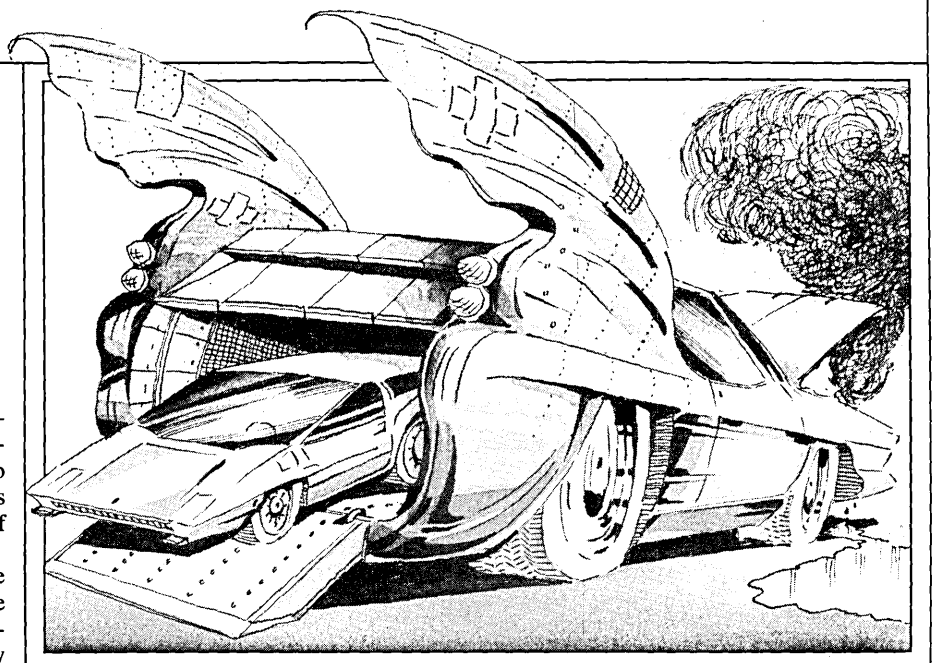
John L. Kirkley, Editor

EDITOR'S READOUT



OS REVISITED

IBM's cumbersome operating systems have been the subject of some critical scrutiny. Where do we go from here?



Last January we made some rather unflattering comments about IBM's operating systems. We quoted one of our advisors who called them "bloated monsters," systems made distended and unwieldy by decades of patching and layering.

The various products that have evolved from OS/360 and DOS/360 are like aging automobiles, eroded by time. Attempts to keep them running efficiently by adding body putty to the fenders and stop-leak to the radiators can't disguise the fact that the springs are beginning to sag, the gas mileage is lousy, and the rings have long since disappeared. But there's too much money invested in the old clunker to throw it away . . . ah, but then, look at all those mouth-watering, sporty little new models zipping around.

We said in the January editorial that we planned to convene a panel of computer experts who have wrestled with the legacy of OS, and we did. Marv Silverman of Blue Cross and Blue Shield, Jay Michlin of Exxon, and Ed Miller, president of Software Research Associates, sat down with moderator Larry Welke, president of International Computer Programs, and compared experiences and opinions. You'll find their comments in the article "Renovating Dinosaurs" on p. 143 of this issue.

Now this was not a "let's beat up on IBM session" even though they agreed that the current operating systems are all wrong for this day and age. As Silverman pointed out, MVS is a far cry from the early days of OS; the system no longer craps out with such distressing frequency, causing users to descend on the dp department like hordes of angry Goths.

"But," replied Michlin, "in the next few years you'll see all kinds of new requirements in data processing . . . And because of the nature of MVS I need a whole army to do it and an army to maintain it."

They would like to see operating systems that are simple, transportable, and are produced as a result of a creative collaboration between vendor and user. And they also agree that with the billions of dollars invested in current software, such changes will be hard to come by.

It now appears that with the adoption of the Von Neumann computer architecture and the complex approach of OS, we got off on the wrong foot. OS was developed on the assumption that it would run on a single monolithic computer system in a central site, cared for by highly trained specialists.

In the beginning this was true. Those of you who were around in the early '60s will remember the enormous glass-enclosed computer rooms; inside paced the high priests of the dp environment—engineers wearing brush cuts and white, short-sleeved shirts, nerd packs at the ready. Little did we know back then that data processing would spread to the masses and that relatively untrained users would be whanging away at terminals that were once reserved only for the initiated.

Our panelists offer no panaceas for a problem that has been building for 16 years. Their job was to air the issues and discuss potential approaches toward a solution. This they did.

So what are we to do? Do we do nothing and hope competitive forces within the marketplace will solve our problems? Do we attempt to forge an alliance between users and vendors that would call for far more cooperation than now exists between even the best of user groups and their vendor.

Do we decompose the massive systems and attempt to build simpler, standard, portable, interlocking modules, and, if so, who is to undertake (and fund) this Herculean task?

One thing we probably don't want to do is to add simpleminded layers to the existing systems, hoping to lull users into thinking that they are dealing with "friendly systems." The cracks in this facade will show all too soon.

We invite your comments. Read the article, mull it over, and drop us a line. And if you come up with ideas, and pithy comments that we think our readers will profit from, we'll find space to air your viewpoint. We think it's a problem that needs open discussion. ✲

ILLUSTRATION BY ANDREA BARUFFI

Ask a ma about his

We did. And whether it's a 30-computer installation like the one at Quaker Oats or a single-computer, first-time installation like the one at Maeward, Inc., the response was almost universal: satisfaction. Satisfied users, like those listed here, are one of the strengths of Burroughs.
Read for yourself...

"The B6800 data communications features made it possible for Keebler to implement a nationwide sales force order entry system of over 1000 terminals in less than one year."

William D. Dierkes, V.P.
Management Information Systems
Keebler Co.
Elmhurst, Illinois

"Having been a user of several computer systems, we feel diversified enough to judge the Burroughs equipment and staff to be superior in the product they deliver and the follow-up service and growth of the equipment."

Denise Luukkonen
Controller
Cameron Tool Corporation
Lansing, Michigan

"Five years after our first use of Burroughs equipment, we continue to benefit from superior operating performance and system flexibility. Burroughs technical support and knowledge of our practical business requirements have made Burroughs an integral part of our company and far more than a processing machine."

Fred D. Clarke III, V.P.
Allegheny Beverage Company
Baltimore, Maryland

"Our B1855 is easy to operate and program. With the use of DMS II, we have been able to develop real time systems that have been beneficial to our production, inventory and shipping departments without being a strain on our programmer."

Bredt J. Wilhelmsen
Data Processing Manager
Sargento Cheese Company
Plymouth, Wisconsin

"All of the benefits Burroughs promised me if I converted to a B1855 turned out to be true. The hardware was delivered when I scheduled it and the conversion was completed in less than eight hours. Since the installation of the B1855, we were able to convert from a card-oriented, batch system to an on-line real time, data base system on our major applications. Currently, over 60% of our data input now originates in the user department. We were able to accomplish this primarily because of the software provided with the B1855, such as ODESY, CANDE, and Data Base."

Robert Toth
Data Processing Manager
Sorgel Transformers
Square D Company
Milwaukee, Wisconsin

"We believe DMS (Data Base) software is a superior program product and it played a large part in our choosing Burroughs as our vendor. Burroughs has been an important factor in Inmont's success in data processing. We made the right decision in selecting Burroughs."

Michael C. Freeman, V.P.
Information & Systems
United Technologies
Inmont
Clifton, New Jersey

"The upward compatibility of our applications programs allowed us to be operational on Friday with the B1700, and the following Monday on our B1900, without any adverse impact on the business. Burroughs did an outstanding job in supporting us during the conversion of eight sites from a B1700 to a B1900 environment. Burroughs environmental software, specifically CANDE, not only increased our productivity but programmer morale as well. The SYCOM program has allowed us to achieve significant results in the area of telecommunications. Field Engineering support on the B1900 consistently meets the requirements of our Division."

John Dixon Pittman
Director, Administrative Services
Battery Products Division
Union Carbide Corporation
New York, New York

"The family concept of Burroughs computers has allowed us to upgrade our system three times when additional computer power was needed, without the usual non-productive and costly ordeal of program conversions.

"The sophistication of the MCP operating system with its automatic self-regulation concepts has provided us with a system that is easy to program and operate. This translates into manpower savings."

William A. Kamman
Corporate Manager
Computer Systems
Laclede Steel Company
St. Louis, Missouri

"The performance and Burroughs responsive support of our distributed network of thirty B800s have met all our expectations. The B800s' average uptime of over 99% has allowed us to effectively extend the power of our B7800 mainframe to our remote plants, distribution centers and sales offices."

Donald K. Stunoff, V.P.
Corporate Information Services
The Quaker Oats Company
Chicago, Illinois

"The selection of the Burroughs B92 for our first in-house computer has proven to be an excellent choice. The cost-effectiveness of the hardware is exceptional. We have experienced an excellent response by Burroughs service personnel to the only two hardware problems we have encountered since the equipment was installed over a year ago."

Ryan A. Holt
President and
Chief Executive Officer
Maeward, Inc.
Olivet, Michigan

"Our Burroughs hardware is amazingly easy to operate. We feel Burroughs operating system can't be beat. We have taken high school graduates without formal training and made them productive within a short period of time."

Bob Schmitz
Data Processing Manager
New York Twist Drill Corporation
Melville, New York

nufacturer Burroughs.

"Ensign Corporation is a manufacturer of custom transformers for television and related industries. As such, we carry no stock or shelf items, so our inventory of raw materials is quite extensive. Our B80 was originally purchased for inventory control, and it has more than filled the bill. I would not hesitate to recommend the B80 system and PCS software to any company with needs similar to ours."

J. Darrel Ensign
Purchasing Agent
Ensign Corporation
Burr Ridge, Illinois

"Burroughs hardware and software solution was critical for the first-time user like us. The B90 hardware reliability has been phenomenal. We've received timely and efficient help from Burroughs customer support representatives. The response from Burroughs is as good today as when we bought the machine. We'd definitely buy Burroughs again."

John Scholz, V.P.
Braddock Protective Coatings
Bridgewater, New Jersey

"We have found that the Burroughs B900 system has been more than adequate for our needs due to the ease of use and the ease of transition from the B800. Burroughs provided excellent technical support for our transition.... Our company has been using Burroughs equipment for more than 25 years, which indicates our satisfaction with their products and service."

Robert J. Dahl, President
Southeastern Aluminum Products, Inc.
Jacksonville, Florida

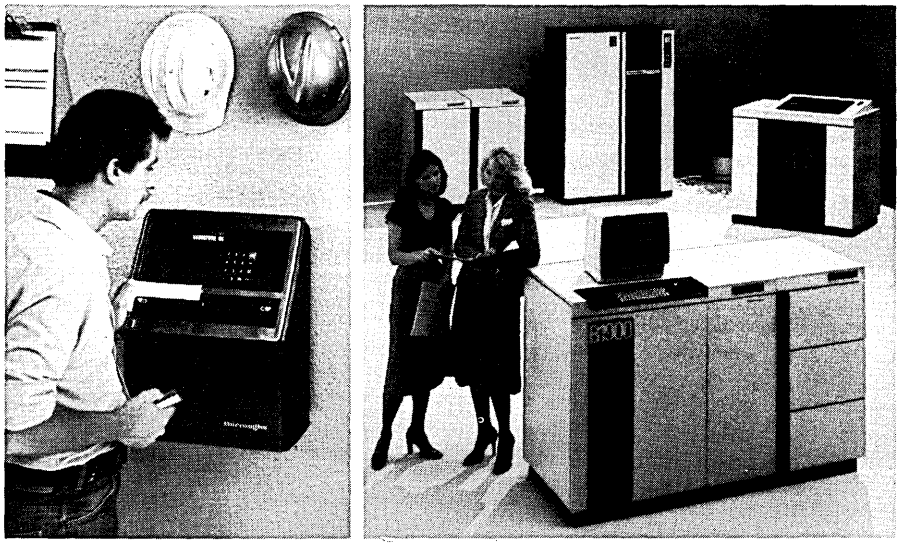
"Mirrex, Incorporated, has been a Burroughs user since 1977. We installed a B1700 system and ran satisfactorily until we upgraded to a B1855 system. The conversion from one system to another was made without interruption of service to our plant by the close cooperation of the Burroughs Team, including Field Engineers, Sales Account Representatives, Field Technical Personnel and the Mirrex Operations Personnel. There is no question that Burroughs has earned a strong position in our future data processing needs."

William H. Vedder, Jr., V.P.
Material Control
Mirrex, Inc.
Mount Clemens, Michigan

"We at Jockey feel that the two areas in which Burroughs is ahead of the other mainframe manufacturers are: ease of use through their operating systems and the outstanding field engineering service we receive."

Vernon Koch
Director of M.I.S.
Jockey International
Kenosha, Wisconsin

We'd like to tell you more about the strengths of Burroughs. Burroughs Corporation, Dept. D-36, Burroughs Place, Detroit, MI 48232. For an update on what's happening at Burroughs, call 1-800/521-4866. (In Michigan, call 1-800/482-2402.)



Burroughs comprehensive modular systems—including the MT 1500 Shop Floor Terminal and the B1900 computer shown above—enable manufacturers to solve the problems of production and inventory control.

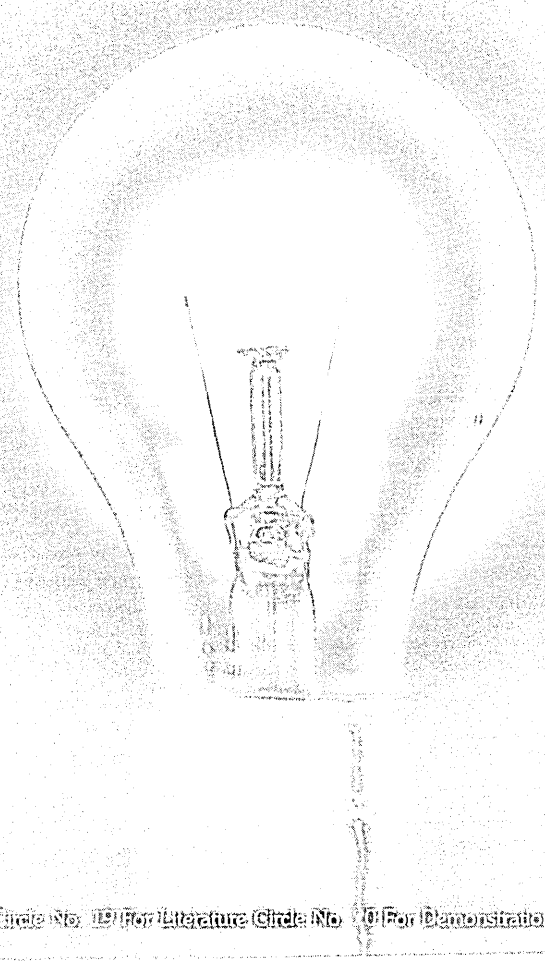
Burroughs
Building on strength.

CIRCLE 18 ON READER CARD

In a world plagued by uncertainties, it's comforting to know that some things remain constant. Take Uninterruptible Power Systems (UPS) from Franklin Electric, for example. They're available in 50, 60 and 415Hz versions, with power levels ranging from 50 to 1,000 KVA. But that's not the whole story. When you write for details about our UPS line, be sure to ask about our state-of-the-art efficiencies and quick delivery. And remember, when you need uninterruptible power, let it be from Franklin.

Franklin Electric
Programmed Power Division
995 Benicia Avenue, Sunnyvale, CA 94086
Call toll free 800-538-1770 In Calif. call (408) 245-8900
TELEX 357405

Let there be uninterruptible power!



See us at Info/81
Booth #1608

Circle No. 19 For Literature Circle No. 20 For Demonstration

RETAIL STORE LISTING

A survey of the major computer outlets in the 10 largest cities in the U.S.

With the proliferation of new products and new retail computer store outlets opening every day, shopping for a microcomputer can prove a confusing and exasperating task. To make a micro shopper's life easier, DATAMATION offers this listing of the major retail outlets in the 10 largest cities in the U.S. Included are names, addresses, and phone numbers of each outlet and types of equipment, services, and financing offered. Not included is IBM's recently announced Personal Computer, which is being sold through Computerland stores and Sears Roebuck retail outlets. The key to the computer store offerings can be found on p. 30.

BOSTON AREA

BOSTON DATA SALES
270 Concord St.,
Framingham (617) 235-5333

Equipment carried: Apple, NEC. Additional offerings: F, T, CS, MS.
Founded 17 years ago. Owner: Jim Kinkead. Hours: Mon.-Fri. 9:00-5:00. Accepts no credit cards.

COMPUMART
65 Bent St.,
Cambridge (617) 491-2700

Equipment carried: Apple, Atari, Commodore, Digital, Hewlett-Packard. Additional offerings: F, MS.
Founded 2 years ago. Manager: Ed Walter. Hours: Mon.-Fri. 9:00-5:30. Accepts: MC & V.

COMPUTERLAND
60 Congress St.,
Boston (617) 482-6033

Equipment carried: Apple, Atari, Commodore, Cromemco, Vector, Zenith. Additional offerings: F, T, MS.
Founded 3 months ago. Owner: Steve Watson. Hours: Mon.-Fri. 9:30-5:30. Accepts: MC & V.

COMPUTERLAND
214 Worcester St.,
Wellesley (617) 235-6252

Equipment carried: Apple, Atari, Commodore, Cromemco, Vector. Additional offerings: F, T, MS.
Founded 2 years ago. Owner: Steve Watson. Hours: Mon.-Sat. 10:00-6:00. Accepts: MC & V.

COMPUTER MART
1395 Main St.,
Waltham (617) 899-4540

Equipment carried: North Star, Zenith. Additional offerings: T, CS, MS.
Founded 5 years ago. Owner: Charles Dunning. Hours: Tues.-Fri. 11:00-6:00, Sat. 11:00-5:00. Accepts: MC & V.

COMPUTER SHOP
590 Commonwealth Ave.,
Boston (617) 247-0700

Equipment carried: Apple, Ohio Scientific. Additional offerings: F, T, CS, MS.
Founded 4 years ago. Manager: Bob Gross. Hours: Mon.-Sat. 9:00-5:00. Accepts: MC & V.

THE COMPUTER STORE
120 Cambridge St.,
Burlington (617) 272-8770

Equipment carried: Apple, Cromemco, Data General, Durango, Hewlett-Packard, Zenith. Additional offerings: F, T, CS, MS.
Founded 6 years ago. Manager: Marvin Goldschmidt. Hours: Mon.-Fri. 9:00-5:00, Sat. 10:00-4:00. Accepts: MC & V.

THE COMPUTER STORE
1689 Massachusetts Ave.,
Cambridge (617) 354-4599

Equipment carried: Apple, Data General, Durango, Hewlett-Packard, Zenith. Additional offerings: F, T, CS, MS.
Founded 3 years ago. Manager: Jeff Turner. Hours: Mon.-Thurs. 10:00-6:00, Fri. 10:00-8:00, Sat. 10:00-5:00. Accepts: MC & V.

THE COMPUTER STORE
680 Worcester Rd.,
Framingham (617) 879-3720

Equipment carried: Apple, Data General, Diablo, Durango, Hewlett-Packard, Intertec, Zenith. Additional offerings: F, T, CS, MS.
Founded 2½ years ago. Manager: Kathy Sperl. Hours: Mon.-Fri. 10:00-6:00. Accepts: MC, V, & AE.

DIGITAL'S COMPUTER STORES
175 Federal St.,
Boston (617) 482-0900

Equipment carried: Digital.
Manager: Rob Aston. Hours: Mon.-Fri. 9:00-5:00. Accepts no credit cards.

FERRANTI-DEGE INC.
455 Brookline Ave.,
Boston (617) 232-2550

Equipment carried: Apple, Atari, Zenith. Additional offerings: F, MS.
Founded 1½ years ago. Owners: Charlie & Tony Ferranti. Hours: Mon.-Fri. 9:00-6:00, Sat. 10:00-5:00. Accepts: MC & V.

HARVARD COOPERATIVE SOCIETY
1400 Massachusetts Ave.,
Cambridge (617) 492-1000

IN FOCUS

IN FOCUS

EQUIPMENT MANUFACTURERS

Full Name	Abbreviation
Alpha Microsystems	**Alpha**
Altos Computer Systems	**Altos**
Apple Computer Inc.	**Apple**
Archives Inc.	**Archives**
Atari, Inc.	**Atari**
California Computer Systems	**CCS**
Commodore Business Machines	**Commodore**
Compucolor	**Compucolor**
Cromemco, Inc.	**Cromemco**
Data General Corp.	**Data General**
Datapoint	**Datapoint**
Diablo-Xerox	**Diablo**
Digital Equipment Corp.	**Digital**
Durango	**Durango**
Dynabyte Business Computers	**Dynabyte**
Gimix, Inc.	**Gimix**
Godbout Electronics	**Godbout**
Hewlett-Packard Co.	**Hewlett-Packard**
IMS International	**IMS**
Industrial Micro Systems	**Industrial Micro**
Intertec Data Systems	**Intertec**
Jacquard	**Jacquard**
Microbyte	**Microbyte**
Micro Data Base Systems	**MDBS**
Morrow Designs	**Morrow**
NEC America, Inc.	**NEC**
Nixdorf Computer Corp.	**Nixdorf**
North Star Computers, Inc.	**North Star**
Ohio Scientific, Inc.	**Ohio Scientific**
Onyx	**Onyx**
Osborne	**Osborne**
Perkin-Elmer	**Perkin-Elmer**
Personal Micro Computer	**Personal Micro**
Pertec Computer Corp.	**Pertec**
Quasar Data Products, Inc.	**Quasar**
Qume Corp.	**Qume**
Radio Shack	**Radio Shack**
Sharp Computers	**Sharp**
Southwest Technical Products Corp.	**Southwest Tech.**
Swingline	**Swingline**
Texas Instruments Inc.	**Texas Instruments**
Vector Graphic Inc.	**Vector**
White Computer Co.	**White**
Zenith Data Systems	**Zenith**

COMPUTER STORES

FINANCING	**F**
TRAINING	**T**
CUSTOM SOFTWARE	**CS**
MAINTENANCE & SERVICE	**MS**

CREDIT CARDS

AMERICAN EXPRESS	**AE**
CARTE BLANCHE	**CB**
DINERS CLUB	**D**
MASTERCARD	**MC**
VISA	**V**

Equipment carried: Apple, Hewlett-Packard, Texas Instruments. Additional offerings: F, T, CS, MS.
Founded 2½ years ago. Manager: Edward Picienza. Hours: Mon.-Wed., Fri., Sat. 9:30-5:30, Thurs. 9:30-8:30. Accepts: MC & V.

IBM BUSINESS COMPUTER CENTER
400 Wyman St.,
Waltham (617) 895-2000

Equipment carried: IBM 5120.
Call for appointment.
Accepts no credit cards.

RADIO SHACK COMPUTER CENTER
730 Commonwealth Ave.,
Boston (617) 739-1704

Equipment carried: TRS-80. Additional offerings: T, MS.
Manager: Doug Flagg. Hours: Mon.-Sat. 9:00-6:00. Accepts: MC, V, & AE.

TECH-COOP/MIT STUDENT CENTER
84 Massachusetts Ave.,
Cambridge (617) 491-4230

Equipment carried: Apple, Hewlett-Packard. Additional offerings: CS, MS.
Manager: Dan Lunt. Hours: Mon.-Fri. 9:15-5:30. Accepts: MC & V.

XEROX STORE
44 Federal St.,
Boston (617) 451-5800

Equipment carried: Apple, Diablo, Hewlett-Packard. Additional offerings: F, T, MS.
Founded 6 months ago. Manager: Burnell Greene. Hours: Mon.-Fri. 9:00-6:00. Accepts: MC & V.

XEROX STORE
1244 Boylston St.,
Chestnut Hill (617) 566-1707

Equipment carried: Apple, Diablo. Additional offerings: F, MS.
Founded 8 months ago. Manager: Bonnie Gentry. Hours: Mon.-Wed., Fri. 9:00-6:00, Thurs. 9:00-9:00. Accepts: MC & V.

CHICAGO AREA

AAA CHICAGO COMPUTER CENTER
120 Chestnut Lane,
Wheeling (312) 459-0450

Equipment carried: Gimix, Southwest Tech. Additional offerings: CS, MS.
Founded 4 years ago. Owner: Jerry Koppel. Hours: Mon.-Fri. 4:00-9:00, Sat., Sun. by appointment. Accepts: MC & V.

ABC/BYTE SHOP
3361 W. Dempster St.,
Skokie (312) 673-3550

Equipment carried: Apple, Atari, Commodore, Data General, Dynabyte, Vector. Additional offerings: F, T, CS, MS.
Founded 2 years ago. Owner: Andrew Papas. Hours: Mon.-Fri. 10:00-7:00, Sat. 9:00-5:00. Accepts: MC & V.

BIES SYSTEMS INC.
7037 W. North Ave.,
Oak Park (312) 386-3323

Equipment carried: Apple, North Star. Additional offerings: F, CS, MS.
Founded 4 years ago. Hours: Mon., Thurs. 9:00-9:00, Tues., Wed., Fri. 9:00-5:00, Sat. 10:00-4:00. Accepts: MC & V.

BYTE SHOP OF LA GRANGE
7 S. La Grange Rd.,
La Grange (312) 579-0920

Equipment carried: Apple, Atari, Data General, Dynabyte, Vector. Additional offerings: F, CS, MS.
Founded 4 years ago. Owner: Andrew Papas. Hours: Mon., Thurs. 9:00-9:00, Tues., Wed., Fri., Sat. 9:00-5:00. Accepts: MC & V.

COMPUSHOP/CHICAGO
5920 W. Dempster St.,
Morton Grove (312) 967-0450

Equipment carried: Apple, Cromemco, Hewlett-Packard, Texas Instruments. Additional offerings: F, MS.
Founded 3 years ago. Owner: Jan Klodner. Hours: Mon.-Sat. 10:00-6:00. Accepts: MC, V, AE, & D.

COMPUSHOP/CHICAGO
1219 E. Golf Rd.,
Rolling Meadows (312) 593-1800

Equipment carried: Apple, Texas Instruments. Additional offerings: F, T, MS.
Founded 14 months ago. Manager: Mary Cordery. Hours: Mon.-Wed. 10:00-6:00, Thurs. 10:00-8:00, Fri. 10:00-6:00, Sat. 10:00-5:00. Accepts: MC, V, AE, & D.

COMPUTER JUNCTION
543 S. York Rd.,
Elmhurst (312) 530-1125

Equipment carried: Apple, Atari, Hewlett-Packard, Intertec, NEC, Ohio Scientific. Additional offerings: F, T, CS, MS.
Founded 1 year ago. Owners: Irv & Robin Kusel. Hours: Mon., Thurs. 9:30-8:30, Tues., Wed., Fri. 9:30-5:30, Sat. 9:30-4:30. Accepts: MC & V.

COMPUTERLAND
50 E. Rand Rd.,
Arlington Heights (312) 255-6488

Equipment carried: Altos, Apple, Commodore, Cromemco, Pertec, Vector. Additional offerings: F, T, CS, MS.
Founded 4 years ago. Owners: Keith Cook & John Gibbs. Hours: Mon., Wed., Fri. 10:00-6:00, Tues., Thurs. 10:00-8:00, Sat. 10:00-5:00. Accepts: MC & AE.

COMPUTERLAND
1500 S. Lake St.,
Mundelein (312) 949-1300

First there was data processing. Then word processing. Now there's Electronic Filing from Kodak.

With Electronic Filing, information managers can control original source documents the way DP managers controlled data. And the way WP managers controlled words.

As you read this, Electronic Filing—with the IMT-150 microimage terminal—is helping control source-document information in hundreds of offices across the country.

The IMT terminal uses its own built-in computer to retrieve source documents electronically—correspondence, purchase orders, invoices, whatever.

Your mini or mainframe computer knows the proper microfilm magazine to select; it communicates directly to the IMT terminal. And drives the terminal to the one document you're after.

In seconds, the IMT terminal displays the document, centered and automatically focused. Touch a button and it even hands you a dry paper print.

All this is possible because the IMT terminal combines the latest advances in microimage technology with the latest advances in electronic information processing.

Kodak offers a whole family of intelligent electronic filing equipment, from microfilmers to microfilm reader-printers to dry COM laser printers—all with advanced electronics.

Isn't it about time you looked into Electronic Filing from Kodak? Because after all, the question isn't whether Electronic Filing works, but whether any office can work without it.

Kodak

Eastman Kodak Company
Business Systems Markets Division
Dept. DP1638
Rochester, NY 14650

☐ Please send me more information about the Kodak IMT-150 microimage terminal.

☐ Please have a Kodak representative contact me.

Name _____ Title _____

Company _____

Address _____

City _____ State _____

Zip _____ Phone _____

© Eastman Kodak Company, 1981

Equipment carried: Apple, Archives, Cromemco, Dynabyte. Additional offerings: F, CS, MS.
Founded 2 years ago. Owners: Ted & Donna Essex. Hours: Mon., Thurs. 10:00-8:00, Tues., Wed., Fri. 10:00-6:00, Sat. 9:00-5:00. Accepts: MC & V.

COMPUTERLAND
9511 N. Milwaukee Ave.,
Niles (312) 967-1714

Equipment carried: Apple, Atari, Commodore, Cromemco, NEC. Additional offering: MS.
Founded 4 years ago. Owner: Chuck Faso. Hours: Mon.-Fri. 11:00-9:00, Sat. 9:00-5:00. Accepts: MC & V.

COMPUTERLAND OF DOWNERS GROVE
136 W. Ogden Ave.,
Downers Grove (312) 964-7762

Equipment carried: Apple, Atari, Texas Instruments, Vector. Additional offerings: T, MS.
Founded 2½ years ago. Owner: Bill Sadowski. Hours: Mon., Wed.-Fri. 10:00-6:00, Sat. 10:00-8:00. Accepts: MC, V.

COMPUTERLAND OF OAK LAWN
10925 S. Cicero Ave.,
Oak Lawn (312) 422-8080

Equipment carried: Altos, Apple, Atari, Commodore, Cromemco, Dynabyte, North Star, Texas Instruments, Vector. Additional offerings: F, MS.
Founded 3½ years ago. Owner: Charles Samek. Hours: Mon.-Sat. 12:00-8:00. Accepts: MC & V.

COMPUTER ROOM
638 N. Michigan St.,
Chicago (312) 337-6744

Equipment carried: Altos, Apple, NEC. Additional offering: MS.
Founded 5 years ago. Owner: William Esterling. Hours: Mon.-Sat. 9:30-6:00. Accepts: MC, V, & AE.

DATA DOMAIN OF SCHAUMBURG
1612 E. Algonquin Rd.,
Schaumburg (312) 397-8700

Equipment carried: Alpha, Apple, Archives, Hewlett-Packard. Additional offerings: F, MS.
Founded 4 years ago. Manager: Steve Shendelman. Hours: Tues.-Fri. 12:00-9:00, Sat. 11:00-5:00. Accepts: MC & V.

DIGITAL'S COMPUTER STORES
206 N. Michigan Ave.,
Chicago (312) 782-7406

Equipment carried: Digital. Additional offerings: F, T, CS, MS.
Manager: Roy Van Liew. Hours: Mon.-Fri. 8:30-5:00. Accepts: MC & V.

DIGITAL'S COMPUTER STORES
1037 E. Golf Rd., Woodfield Commons,
Schaumburg (312) 843-7857
Equipment carried: Digital. Additional offerings: F, T, CS, MS.
Manager: Kent Michaels. Hours: Mon.-Fri. 9:00-5:30. Accepts: MC & V.

FARNSWORTH COMPUTER CENTER
1891 N. Farnsworth Ave.,
Aurora (312) 851-3888

Equipment carried: Apple, Hewlett-Packard. Additional offerings: F, T, MS.
Founded 3 years ago. Owner: Luke Snyder. Hours: Mon.-Fri. 10:00-8:00, Sat. 10:00-5:00. Accepts: MC, V, AE, & D.

HAMPTON BUSINESS MACHINES
5559-61 N. Elston,
Chicago (312) 774-2556

Equipment carried: Data General, Jacquard, Swingline. Additional offerings: F, T, CS, MS.
Founded 14 years ago. President: Peter Hampton. Hours: Mon.-Fri. 9:00-5:00. Accepts no credit cards.

IBM BUSINESS COMPUTER CENTER
1701 Golf Rd., Tower 1,
Rolling Meadows (312) 728-2100

Equipment carried: IBM 5120.
Call for appointment.
Accepts no credit cards.

LILLIPUTE COMPUTER MART INC.
4446 Oakton,
Skokie (312) 674-1383

Equipment carried: Atari, CCS, Commodore, Cromemco, Gimix, Godbout, Morrow, North Star. Additional offerings: F, T, MS.
Founded 5 years ago. Owner: Jacob Farber. Hours: Mon.-Fri. 10:30-8:00, Sat. 10:00-6:00. Accepts: MC & V.

MICOBUS INC.
6146 N. Lincoln Ave.,
Chicago (312) 583-8358

Equipment carried: Alpha, Commodore. Additional offerings: F, CS, MS.
Founded 2½ years ago. Owner: Ira Kirsche. Hours: Mon.-Fri. 8:30-6:00. Accepts no credit cards.

MIDWEST MICROCOMPUTERS INC.
708 S. Main St.,
Lombard (312) 495-9889

Equipment carried: Apple, Perkin-Elmer, Texas Instruments. Additional offerings: F, CS, MS.
Founded 4 years ago. Manager: Dan Walsh. Hours: Mon., Tues., Fri. 9:30-6:00, Wed., Thurs. 9:30-9:00, Sat. 9:30-5:00. Accepts: MC & V.

MORSCH-NETZEL COMPUTERS
485 N. Main St.,
Glen Ellyn (312) 858-6692
Equipment carried: Apple, Commodore. Additional offerings: F, T, MS.
Founded 6 months ago. Manager: Bruce Mitcheltree. Hours: Mon.-Wed. 10:00-7:30, Thurs. 10:00-9:00, Fri. 10:00-5:00, Sat. 9:00-5:00. Accepts: MC & V.

NABIH'S INC.
515 Davis St.,
Evanston (312) 869-6140

Equipment carried: Alpha, Apple, Hewlett-Packard, Texas Instruments, Vector. Additional offerings: T, CS, MS.
Founded 9 years ago. Owner: Nabih Mangoubi. Hours: Mon.-Fri. 8:30-7:00, Sat. 9:00-6:00. Accepts no credit cards.

OAK BROOK COMPUTER CENTER
17 W. 426 22nd St.,
Oakbrook Terrace (312) 941-9005

Equipment carried: Apple, Atari, Hewlett-Packard. Additional offerings: F, T, MS.
Founded 3 years ago. Manager: Bill Colsher. Hours: Mon., Wed. 8:30-8:00, Tues., Thurs., Fri. 8:30-9:00, Sat. 9:00-5:00. Accepts: MC, V, & AE.

RADIO SHACK COMPUTER CENTERS

Equipment carried: TRS-80. Additional offerings: F, MS. Hours: Mon.-Sat. 9:00-6:00. Accepts: MC, V, & AE. 8349 Golf Rd., Niles, (312) 470-0670. Manager: Ray Schwartz.
208 W. Ridge Rd., Griffith, IN, (219) 838-3000. Manager: Ken Prevo.
4815 W. 95th St., Oak Lawn, (312) 425-9130. Manager: Tony Freehauf.
7206 W. Grand Ave., Elmwood Park, (312) 452-7500. Manager: Bob Newenschwander.
1300 Dundee, Buffalo Grove, (312) 394-0300. Manager: Harold Gotlieb.
329 Glenwood Lansing, Glenwood, (312) 758-0440. Manager: Brian Bedoe.

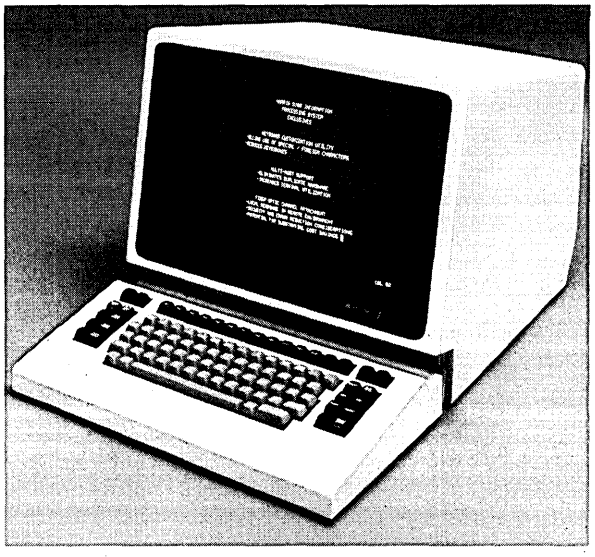
SHOP CONTROLS, INC.
2505 W. 147th St.,
Posen (312) 388-2001

Equipment carried: Apple, Atari, Texas Instruments, Zenith. Additional offerings: F, T, CS, MS.
Founded 2½ years ago. Owners: Howard & Mark Achler. Hours: Mon.-Sat. 9:00-6:00. Accepts: MC & V.

TEAM ELECTRONICS
Lakecook Rd.,
Algonquin (312) 658-8600

Equipment carried: Apple, Atari, Texas Instruments. Additional offering: F.
Founded 10 years ago. Owners: Larry Wright & Tom Bertucci. Hours: Mon.-Fri. 10:00-9:00, Sat. 10:00-5:00, Sun. 11:00-5:00. Accepts: MC, V, & AE.

Why settle for only 3274/3278 compatibility? You can have much more with Harris' 9200 Information Processing System.



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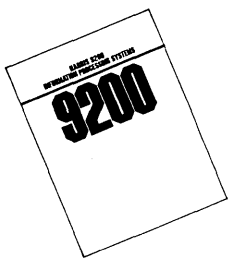

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HARRIS

CIRCLE 25 ON READER CARD

IN FOCUS

DALLAS AREA

COMPUSHOP
13929 N. Central Expressway,
Dallas (214) 234-3412

Equipment carried: Apple, Texas Instruments. Additional offerings: T, MS.
Founded 4 years ago. Owner: Rick Hartman. Hours: Mon.-Wed., Fri., Sat. 10:00-6:00, Thurs. 10:00-8:00. Accepts: MC, V, & AE.

COMPUSHOP
6353 Camp Bowie Blvd.,
Fort Worth (817) 738-4442

Equipment carried: Apple, Texas Instruments. Additional offerings: F, T, CS, MS.
Founded 5 years ago. Manager: Marvin Carter. Hours: Mon.-Sat. 10:00-6:00. Accepts: MC, V, AE, & D.

COMPUTER CENTER OF DALLAS
2629 Stemmons Freeway,
Dallas (214) 638-4477

Equipment carried: Apple, Cromemco, Hewlett-Packard, Osborne. Additional offering: MS.
Founded 6 months ago. Manager: Richard Hernland. Hours: Mon.-Fri. 9:00-5:30. Accepts no credit cards.

COMPUTERLAND
8061 Walnut Hill Lane,
Dallas (214) 363-2223

Equipment carried: Apple, Atari, Commodore, Dynabyte, Onyx. Additional offerings: T, CS, MS.
Founded 2 years ago. Owners: Jack McClure & Bill Gilmore. Hours: Tues.-Fri. 10:00-6:00, Sat. 9:30-4:30. Accepts: MC, V, & AE.

COMPUTERLAND OF NORTH DALLAS
1535 Promenade Center,
Richardson (214) 235-1285

Equipment carried: Apple, Atari, Commodore, Dynabyte, Onyx, Zenith. Additional offerings: F, T, MS.
Founded 1½ years ago. Owner: Fred Kinder. Hours: Mon.-Sat. 10:00-6:00. Accepts: MC, V, AE, & D.

CONTROL DATA BUSINESS CENTER
Equipment carried: Ohio Scientific. Additional offerings: F, T, CS, MS.
Hours: Mon.-Fri. 9:00-6:00, Sat. 10:00-1:00. Accepts: MC & V.
9100 N. Central Expressway (Caruth Plaza), Dallas, (214) 750-4595. Manager: Jeff Jasenof.
1500 Quorum Dr., Dallas, (214) 239-9826. Manager: John Cardosi.
2707 Stemmons Freeway, Dallas, (214) 634-8408. Manager: Don Wilburn.

DIGITAL'S COMPUTER STORES
1625 W. Mockingbird Mall, Suite 114
Dallas (214) 631-2520

Equipment carried: Digital.
Manager: Steve Scott. Hours: Mon.-Fri. 9:00-5:00. Accepts: MC & V.

IBM BUSINESS COMPUTER CENTER
1421 W. Mockingbird Lane,
Dallas (214) 688-8885

Equipment carried: IBM 5120.
Call for appointment.
Accepts no credit cards.

THE KA COMPUTER STORE
9090 Stemmons Freeway,
Dallas (214) 634-7870

Equipment carried: Apple, Atari, Hewlett-Packard. Additional offerings: T, CS, MS.
Founded 3 years ago. Owner: Byron Kirkwood. Hours: Mon.-Fri. 9:00-6:00, Sat. 9:00-3:00. Accepts: MC & V.

MATRIX SYSTEMS, INC.
5217 Ross Ave., Merchants Bank Bldg.,
Suite 803,
Dallas (214) 826-8331

Equipment carried: Cromemco, Data General. Additional offerings: F, T, CS, MS.
Founded 1½ years ago. Manager: John Fulligan. Hours: Mon.-Fri. 9:00-5:00. Accepts no credit cards.

MICROAGE COMPUTER STORE
1490 W. Spring Valley Rd.,
Richardson (214) 234-5955

Equipment carried: Altos, Apple, Archives, Atari, Dynabyte, North Star, Zenith. Additional offerings: T, CS, MS.
Founded 4 years ago. Owner: Jim McClain. Hours: Mon.-Sat. 10:00-6:00. Accepts: MC & V.

RADIO SHACK COMPUTER CENTERS
Equipment carried: TRS-80. Additional offerings: MS, T.
Hours: Mon.-Sat. 9:00-6:00. Accepts: MC, V, & AE.
15340 Dallas Parkway, Dallas, (214) 934-0275. Manager: Frank Reed.
202 W. Campbell Rd., Dallas, (214) 669-1494. Manager: Roy Oliver.
2930 W. Northwest Highway, Dallas, (214) 350-4144. Manager: Bruce Simms.

XEROX STORES
Equipment carried: Apple, Diablo, Hewlett-Packard. Additional offerings: F, T, MS.
Hours: Mon.-Fri. 9:00-6:00. Accepts: MC & V.
1919 Bryan St., Dallas, (214) 748-5085. Manager: Jim Roberts.
9100 N. Central Expressway, Dallas, (214) 739-5861. Manager: Mike Duggan.
15340 Dallas Parkway, Prestonwood, (214) 385-7235. Manager: Jean Simmons.

DETROIT AREA

COMPUTER CENTER
28251 Ford Rd.,
Garden City (313) 422-2570

Equipment carried: Altos, Apple, Atari, Compucolor, North Star. Additional offerings: T, CS, MS.
Founded 2 years ago. Manager: Abid Bohra. Hours: Mon.-Fri. 10:00-7:00, Sat. 11:00-6:00. Accepts: MC & V.

COMPUTER CENTER
4381 Orchard Lake Rd.,
West Bloomfield (313) 855-4220

Equipment carried: Altos, Apple, Atari, Compucolor, North Star. Additional offerings: T, CS, MS.
Founded 2 years ago. Manager: Fida Bohra. Hours: Tues.-Fri. 10:00-6:00, Sat. 11:00-5:00. Accepts: MC & V.

COMPUTER CONNECTION
38437 Grand River,
Farmington Hills (313) 477-4470

Equipment carried: Apple, Atari, Ohio Scientific. Additional offerings: F, T, CS, MS.
Founded 2 years ago. Owner: Larry Rakozy. Hours: Mon., Thurs., Fri. 10:00-8:00, Tues., Wed., Sat. 10:00-6:00. Accepts: MC, V, & AE.

COMPUTERLAND
29673 Northwestern Highway,
Southfield (313) 356-8111

Equipment carried: Altos, Apple, Archives, Atari, North Star, Onyx, Vector. Additional offerings: T, CS, MS.
Founded 3 years ago. Owner: Keith Blake. Hours: Tues.-Fri. 10:00-6:00. Accepts: MC, V, AE, & D.

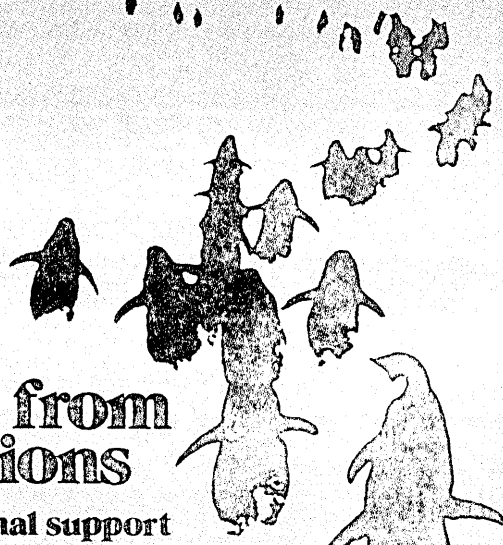
COMPUTER MART
560 W. 14 Mile Rd.,
Clawson (313) 288-0040

Equipment carried: Apple, Atari, Commodore, Data General, Hewlett-Packard. Additional offerings: T, CS, MS.
Founded 5 years ago. Manager: Rick Inatome. Hours: Tues.-Sat. 10:30-7:30. Accepts: MC & V.

IBM BUSINESS COMPUTER CENTER
1800 W. 9 Mile Rd.,
Southfield (313) 552-4800

Equipment carried: IBM 5120.
Call for appointment.
Accepts no credit cards.

RADIO SHACK COMPUTER CENTERS
Equipment carried: TRS-80. Additional offerings: T, MS.
Hours: Mon.-Sat. 9:00-6:00. Accepts: MC, V, & AE.
3620 W. Maple Rd., Birmingham, (313) 647-2151. Manager: Ray Carman.
1553 Woodward Ave., Detroit, (313) 831-7561. Manager: Rich Slisinger.
33470 W. 7 Mile Rd., Livonia, (313) 476-6800. Manager: Bill Evans.
31873 Gratiot Ave., Roseville, (313) 296-6210. Manager: Victoria DeVore.



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Enhanced MVS/370 terminal support

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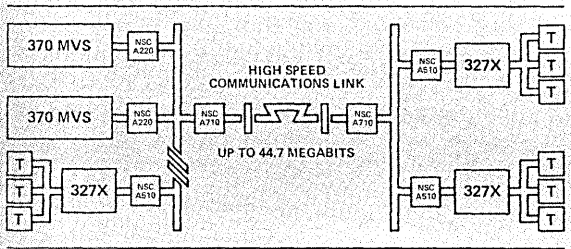

HYPERchannel extends the 370/303X data channel via its 50 megabit-per-second coaxial trunk system. Regional extension is also possible via wideband links such as private microwave, fiber optic links or telco circuits. HYPERchannel maintains standard peripheral I/O unit support including OLTEP.

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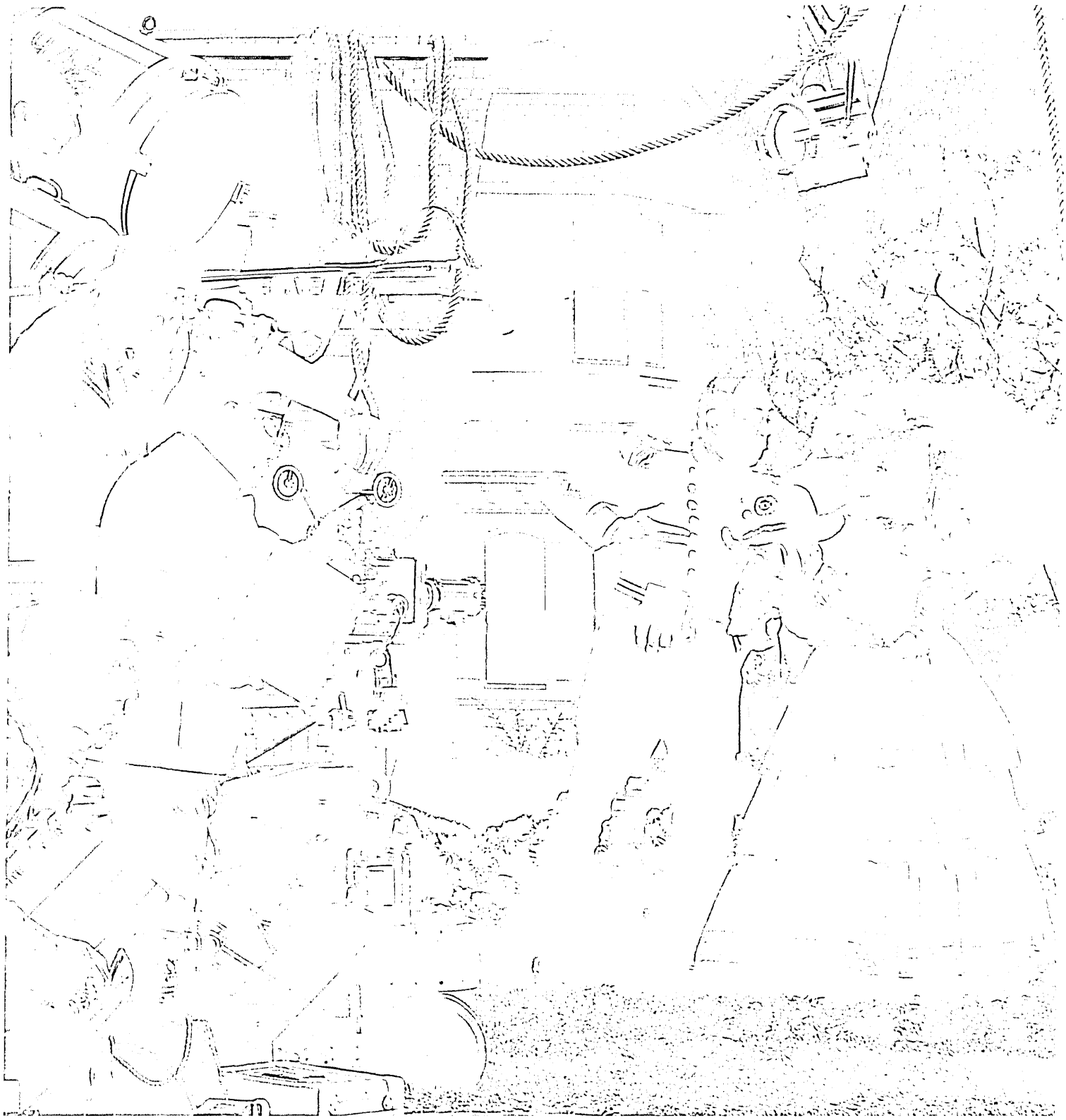

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CIRCLE 27 ON READER CARD

3M

HOUSTON AREA

COMPUSHOP
5900 N. Freeway, Suite 117,
Houston (713) 699-5301
Equipment carried: Apple, Texas Instruments. Additional offerings: F, T, MS.
Founded 6 months ago. Manager: Lou Frenzel. Hours: Mon.-Fri. 10:00-7:00, Sat. 10:00-5:00. Accepts: MC, V, & AE.

COMPUTER CENTER OF HOUSTON
2129 Westheimer Rd.,
Houston (713) 527-8008
Equipment carried: Apple, Cromemco. Additional offerings: CS, MS.
Founded 4 years ago. Manager: Avery More. Hours: Mon.-Sat. 10:00-6:00. Accepts: MC & V.

COMPUTER CITY
12704 N. Freeway,
Houston (713) 821-2702
Equipment carried: Apple, Atari, Vector. Additional offerings: F, T, CS, MS.
Founded 1½ years ago. Owner: Larry Thompson. Hours: Mon.-Thurs. 10:00-6:00, Fri. 10:00-7:00, Sat. 10:00-5:00. Accepts: MC, V, AE, & D.

COMPUTERLAND
17647 El Camino Rd.,
Houston (713) 488-8153
Equipment carried: Apple, Archives, Atari, Cromemco, North Star, Texas Instruments, Vector. Additional offerings: F, T, CS, MS.
Founded 2 years ago. Owner: John Mayer. Hours: Mon.-Sat. 10:00-6:00. Accepts: MC & V.

COMPUTERLAND
6100 Westheimer Rd.,
Houston (713) 977-0909
Equipment carried: Apple, Atari, Commodore, Dynabyte, Vector. Additional offerings: F, T, CS, MS.
Founded 4 years ago. Manager: Jack McKinstry. Hours: Mon.-Sat. 9:30-6:00. Accepts: MC, V, & AE.

DIGITAL'S COMPUTER STORES
1980 S. Post Oak, Suite G,
Houston (713) 840-0730
Equipment carried: Digital. Additional offerings: F, T, CS, MS.
Manager: Saadia Popelnik. Hours: Mon.-Fri. 9:00-5:00. Accepts no credit cards.

IBM BUSINESS COMPUTER CENTER
1 Riverway,
Houston (713) 871-6700
Equipment carried: IBM 5120.
Call for appointment. No credit cards.

RADIO SHACK COMPUTER CENTERS
Equipment carried: TRS-80. Additional offerings: T, MS.
Hours: Mon.-Sat. 9:00-6:00. Accepts: MC, V, & AE.
5900 N. Freeway, Suite 119,
Houston, (713) 695-0211. Manager: Max Girouard.
211-C FM 1960, Houston, (713) 444-7006. Manager: Dave Hansen.
5330 Eastex Freeway, Beaumont, (713) 898-7000. Manager: Fred Boelhouwer.
10543 Gulf Freeway, Houston, (713) 943-9310. Manager: Barbara Gorman.
809 Dallas St., Houston, (713) 651-3002. Manager: Oren Bentley.

XEROX STORE
12184 Greenspoint Ave.,
Houston (713) 999-5472
Equipment carried: Apple, Diablo, Hewlett-Packard. Additional offerings: F, T, CS, MS.
Manager: Culver McDonald. Hours: Mon.-Sat. 9:00-6:00. Accepts: MC & V.

XEROX STORE
1300 Main St.,
Houston (713) 651-9201
Equipment carried: Apple, Diablo, Hewlett-Packard. Additional offerings: F, T, MS.
Manager: Eunice Franklin. Hours: Mon-Fri. 10:00-6:00. Accepts: MC & V.

XEROX STORE
5880 Westheimer Rd.,
Houston (713) 972-1791
Equipment carried: Apple, Diablo, Hewlett-Packard. Additional offerings: F, T, CS, MS.
Manager: Bob Dixon. Hours: Mon.-Sat. 9:00-6:00. Accepts: MC & V.

LOS ANGELES AREA

AVIDD ELECTRONICS
2210 Bellflower Blvd.,
Long Beach (213) 598-0444
Equipment carried: Apple, Southwest Tech. Additional offering: MS.
Founded 6 years ago. Manager: Ray Montgomery. Hours: Mon.-Thurs. 8:30-5:30, Fri. 8:30-9:00, Sat. 10:00-5:30. Accepts: MC & V.

BYTE SHOP OF LONG BEACH
5453 Stearns St.,
Long Beach (213) 597-7771
Equipment carried: Apple, Commodore. Additional offerings: F, T, CS, MS.
Founded 3 years ago. Owner: Phil Morse. Hours: Mon.-Fri. 9:00-7:30, Sat. 10:00-6:00. Accepts: MC & V.

BYTE SHOP/LOS ANGELES
11611 San Vicente Blvd.,
Los Angeles (213) 820-1524
Equipment carried: Apple, Atari, Commodore, Cromemco, Data General, North Star, Vector. Additional offerings: F, T, CS, MS.
Founded 3 years ago. Owner: Dr. James Roseboro. Hours: Mon.-Fri. 11:00-7:00, Sat. 10:00-6:00. Accepts: MC, V, AE, & CB.

COMPUTERLAND
10600 W. Pico Blvd.,
West Los Angeles (213) 559-3353
Equipment carried: Altos, Apple, Atari, Commodore, Cromemco, Dynabyte, Vector, Zenith. Additional offerings: F, T, MS.
Founded 6 months ago. Owner: Drew Clausen. Hours: Mon.-Thurs. 10:00-7:00, Fri., Sat. 10:00-6:00. Accepts: MC, V, & AE.

COMPUTERLAND OF PASADENA
81 N. Lake St.,
Pasadena (213) 449-3205
Equipment carried: Apple, Commodore, Cromemco, Vector. Additional offerings: F, T, CS, MS.
Founded 2½ years ago. Owners: Dick Lev & Bill McPeak. Hours: Mon.-Fri. 10:00-6:00, Tues.-Thurs. 10:00-7:00, Sat. 10:00-5:00. Accepts: MC & V.

COMPUTERLAND OF SOUTH BAY
16720 S. Hawthorne Blvd.,
Lawndale (213) 371-7144
Equipment carried: Apple, Vector. Additional offerings: F, T, MS.
Founded 3 years ago. Owner: Jim Sadlier. Hours: Mon.-Sat. 10:00-6:00. Accepts: MC & V.

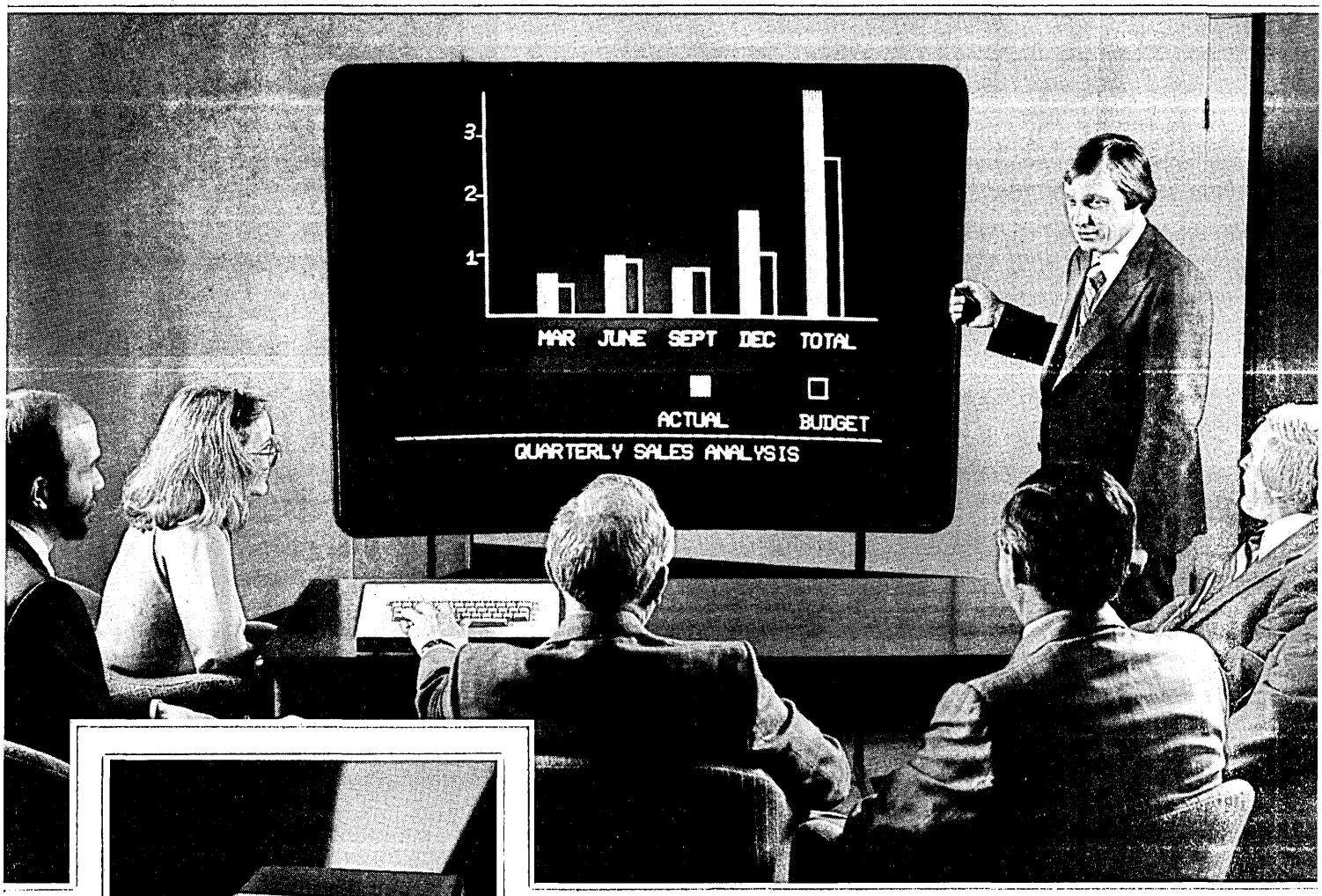
COMPUTERS ET CETERA
2940 N. Sepulveda Blvd.,
Manhattan Beach (213) 546-4564
Equipment carried: Apple, Data General, Durango, Hewlett-Packard, Vector. Additional offerings: F, T, MS.
Founded 9 months ago. Owners: Brenda & William Adams. Hours: Tues.-Fri. 10:00-6:00, Sat. 11:00-5:00, and by appointment. Accepts: MC, V, & AE.

COMPUTER SHOP
1619A Hawthorne Blvd.,
Lawndale (213) 371-4010
Equipment carried: Apple, Atari. Additional offerings: F, MS.
Founded 4 years ago. Owner: Ratan Lalchandami. Hours: Mon.-Sat. 10:00-6:00. Accepts: MC & V.

THE COMPUTER STORE
820 Broadway,
Santa Monica (213) 451-0713
Equipment carried: Apple, Vector. Additional offerings: F, T, CS, MS.
Founded 6 years ago. Owner: Dick Heiser. Hours: Tues.-Fri. 10:00-8:00, Sat. 10:00-6:00. Accepts: MC & V.

COMPUTER WORLD
3808 Verdugo Ave.,
Burbank (213) 848-5521
Equipment carried: Apple, Hewlett-Pack-

THE CLEAR CHOICE



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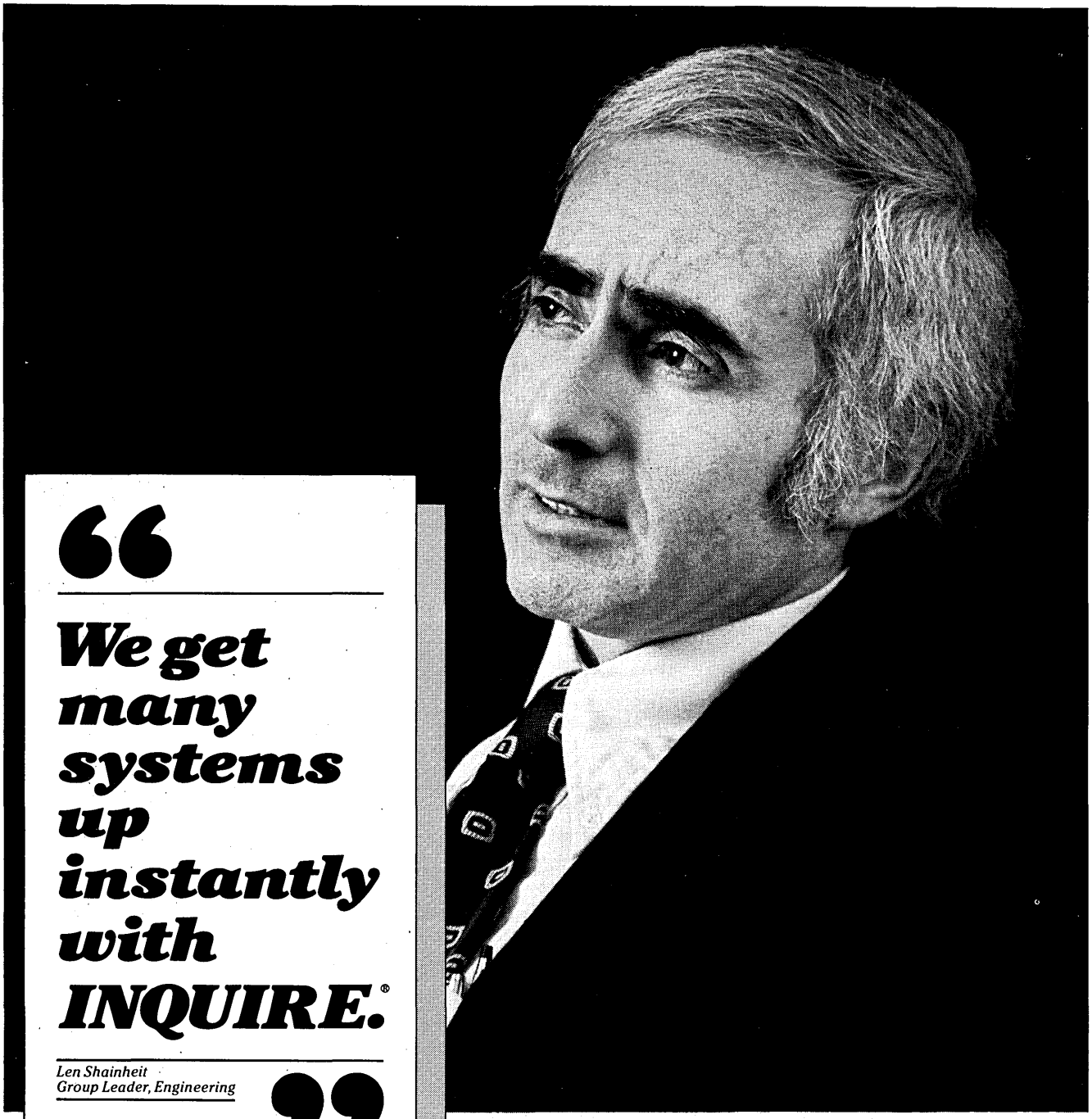

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Len Shainheit
Group Leader, Engineering

It's a real life situation when one of our engineers will walk into the information center and say, "I'm leaving on an airplane for Singapore this afternoon. I need some drawings and correspondence I think were done three years ago on such and such a project." He will board the airplane with his drawings and memos, thanks to INQUIRE. As the engineering division for a major oil company, we have over 50,000 valuable documents on microfilm. The contents of those documents and other information is kept on INQUIRE. We can do searching by keywords to find all documents pertinent to a given subject. Such access to past information saves us many man-years of labor and allows us to build on our past experience.

For producing computerized prototype systems, we generally turn to INQUIRE. The system permits computer professionals to rapidly build a database, write required reports, and through its macro language, make the system transparent to a user department. In the end, anyone can operate INQUIRE. Our personnel department uses an INQUIRE system heavily. In another database we keep track of all contract engineers and their skills. I have built a "business card and casual conversation database" for my boss, who travels a great deal and likes to collect business cards of people he meets around the world. When he plans a trip, he takes a printout of all past acquaintances in that part of the world. That database was a spare-time project.

INQUIRE allows us to bypass the "study" phase of a system. Working directly with the user, showing him results immediately, we achieve our finished system faster, Moreover, since the user has been involved at the outset, the situation of being presented with something completely unknown just disappears.

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CIRCLE 29 ON READER CARD

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ard, Industrial Micro, Vector. Additional offerings: F, T, CS, MS.
Founded 3 years ago. Owner: Renato Colantoni. Hours: Mon.-Fri. 10:00-6:00, Sat. 10:00-5:00. Accepts: MC & V.

COMPUTER WORLD
5848 N. Sepulveda,
Van Nuys (213) 786-7411

Equipment carried: Alpha, Apple, Cromemco, Microbyte, NEC. Additional offerings: F, T, CS, MS.
Founded 5 years ago. Owner: Richard Dickson. Hours: Mon., Fri., Sat. 10:00-6:00, Tues.-Thurs. 10:00-7:00, Sun. 12:00-5:00. Accepts: MC & V.

COMPUTIQUE
Equipment carried: Apple, Atari, Hewlett-Packard, Texas Instruments. Additional offerings: F, T, CS, MS.
Hours: Mon.-Sat. 10:00-6:00, Sun. 11:00-5:00. Accepts: MC & V.
11986 Wilshire Blvd., West Los Angeles, (213) 820-5761. Founded 6 years ago. Manager: Mark DeMenno.
16611 Hawthorne Blvd., Lawndale, (213) 370-5795. Founded 3 years ago. Manager: Reyn Taney.
260 S. Lake Ave., Pasadena, (213) 795-3007. Founded 3 years ago. Manager: Mike Cobery.
1080 E. Imperial Highway, Brea, (714) 990-6600. Founded 10 months ago. Manager: Baird Hill.
3211 S. Harbor Blvd., Santa Ana, (714) 549-7373. Founded 10 years ago. Manager: Carl Johnson.
18665 Ventura Blvd., Tarzana, (213) 705-7507. Founded 2 years ago. Manager: Rich Falcioni.
3285 Wilshire Blvd., Los Angeles, (213) 385-7777. Founded 8 months ago. Manager: Brad Matthews.

DIGITAL'S COMPUTER STORES
435 W. Seventh St.,
Los Angeles (213) 629-0121

Equipment carried: Digital. Additional offerings: F, T, CS, MS.
Manager: Jim Geer. Hours: Mon.-Fri. 9:00-5:00. Accepts: MC & V.

DIGITAL'S COMPUTER STORES
15436 Ventura Blvd.,
Sherman Oaks (213) 501-5256

Equipment carried: Digital. Additional offerings: F, T, CS, MS.
Manager: Peter Fogg. Hours: Mon.-Fri. 9:00-5:00. Accepts: MC & V.

GATEWAY COMPUTER CENTER
11470 South St.,
Cerritos (213) 865-4444

Equipment carried: Apple, Vector. Additional offerings: F, T, MS.
Founded 2 years ago. Owner: Ron Siegel. Hours: Mon.-Fri. 10:00-7:00, Sat. 10:00-5:00. Accepts: MC & V.

IBM BUSINESS COMPUTER CENTER
3550 Wilshire Blvd.,
Los Angeles (213) 736-4000

Equipment carried: IBM 5120.
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MICRO BUSINESS WORLD
16206 Hawthorne Blvd.,
Lawndale (213) 370-1577

Equipment carried: Altos, Apple, Atari, Commodore, Zenith. Additional offerings: F, T, MS.
Founded 4 years ago. Owner: Abi Ronen. Hours: Mon.-Sat. 10:00-6:00. Accepts: MC & V.
Other store: 20929 Ventura Blvd., Woodland Hills, (213) 704-6895. Same information as above.

OLYMPIC SALES
216 S. Oxford,
Los Angeles (213) 739-1100

Equipment carried: Apple, Atari, Hewlett-Packard, Texas Instruments. Additional offerings: T, MS.
Founded 25 years ago. Owner: Francis Razel. Hours: Mon.-Sat. 8:00-6:00, Sun. 12:00-5:00. Accepts: MC & V.
Other stores: 600 Sepulveda Blvd., El Segundo, (213) 615-0222. Hours: Mon.-Sat. 10:00-5:00.
1756 E. Colorado, Pasadena, (213) 577-1422. Hours: Mon.-Sat. 10:00-5:00.

PROFESSIONAL COMPUTER SYSTEM
3604 Foothill Blvd.,
La Crescentia (213) 248-2411

Equipment carried: Apple, Vector. Additional offerings: F, T, CS, MS.
Founded 2 years ago. Owner: Freny Berkenbile. Hours: Mon.-Fri. 9:00-6:00, Sat. 10:00-6:00. Accepts: MC & V.

RADIO SHACK COMPUTER CENTERS
Equipment carried: TRS-80. Additional offerings: T, MS.
Hours: Mon.-Fri. 9:00-6:00. Accepts: MC, V, & AE.
8371 Topanga Canyon, Canoga Park, (213) 347-9800. Manager: Steve Cullen.
236 N. Brand Blvd., Glendale, (213) 246-9310. Manager: Bill Westmiller.
2119 Bellflower Blvd., Long Beach, (213) 597-3377. Manager: Jeff Kweicien.
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RAINBOW COMPUTING
9719 Reseda Blvd.,
Northridge (213) 349-5560

Equipment carried: Apple, Atari, Digital. Additional offerings: T, MS.
Founded 5 years ago. Owner: Gene Sprouse. Hours: Tues.-Fri. 10:00-7:00, Sat. 10:00-5:00. Accepts: MC & V.

WESTWOOD COMPUTER SYSTEMS
2268 Westwood Blvd.,
Los Angeles (213) 475-0566

Equipment carried: Apple, NEC, North Star. Additional offerings: F, T, CS, MS.
Founded 4 years ago. Owner: Bill Shorter. Hours: Mon.-Fri. 10:00-6:00, Sat. 9:00-4:00. Accepts: MC & V.

NEW YORK AREA

ALTMAN DATA SYSTEMS
36 W. 44th St.,
New York (212) 575-0935

Equipment carried: Archives, Jacquard, Vector. Other offerings: F, T, CS, MS.
Founded 3 years ago. Owner: Jerome Altman. Hours: Mon.-Fri. 9:00-5:00. Accepts no credit cards.

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127 Madison Ave.,
New York (212) 679-4966

Equipment carried: Apple, Commodore, Personal Micro. Additional offerings: T, CS, MS.
Founded 12 years ago. Owner: Henry Weingarten. Hours: Mon.-Fri. 10:00-7:00, Sat. 10:00-6:00. Accepts: MC, V, & AE.

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519 Boston Post Rd.,
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Equipment carried: Altos, Apple, Atari, Commodore, Intertec. Additional offerings: F, T, CS, MS.
Founded 2 years ago. Owner: Richard Cooke. Hours: Mon.-Sat. 9:00-9:30, Sun. 1:00-6:00. Accepts: MC & V.

BC COMMUNICATIONS, INC.
207 Depot Rd.,
Huntington Station (516) 549-8833

Equipment carried: Apple, Archives, Commodore. Additional offerings: F, T, CS, MS.
Founded 6 years ago. Owner: Bill Cranz. Hours: Mon.-Thurs, Sat. 9:00-6:00, Fri. 9:00-9:00. Accepts: MC & V.

BERLINER COMPUTER CENTER
102 Jericho Turnpike,
New Hyde Park (516) 775-4700

Equipment carried: Altos, Apple, Ohio Scientific. Additional offerings: F, T, CS, MS.
Founded 15 years ago. Owner: Robert Berliner. Hours: Mon.-Wed., Fri., Sat. 9:00-6:00, Thurs. 9:00-8:00. Accepts: MC & V.
Other store: 668 Northern Blvd., Great Neck, (516) 466-2700.

BYTE SHOP EAST
130 E. 40th St.,
New York (212) 889-4200

Equipment carried: Apple, North Star, Zenith. Additional offerings: F, T, CS, MS.
Founded 4 years ago. Owner: Nick Barton. Hours: Tues.-Fri. 10:00-6:00, Sat. 10:00-5:00. Accepts no credit cards.

IN FOCUS

COMPUTER CENTER
31 E. 31st St.,
New York (212) 889-8130
Equipment carried: Atari, Cromemco, Hewlett-Packard. Additional offering: MS.
Founded 2 years ago. Owner: Robert Silverman. Hours: Mon.-Wed., Fri. 10:00-7:00, Thurs. 10:00-8:00, Sat. 10:00-6:00. Accepts: MC & V.
Other store: 480 Lexington Ave., NYC, (212) 687-5090.

COMPUTER CORNER
200 Hamilton Ave.,
White Plains (914) 949-3282
Equipment carried: Apple, Hewlett-Packard, Personal Micro. Additional offerings: F, T, CS, MS.
Founded 5 years ago. Owner: Harold Shair. Hours: Mon.-Wed., Fri., Sat. 10:00-6:00, Thurs. 10:00-9:00. Accepts: MC & V.

THE COMPUTER FACTORY
485 Lexington Ave.,
New York (212) 687-5000
Equipment carried: Apple, Atari, Commodore, Data General, Dynabyte, Intertec, Vector. Additional offerings: F, T, CS, MS.
Founded 3 years ago. Manager: Greg Pearlstone. Hours: Mon.-Fri. 10:00-6:00, Sat. 11:00-5:00. Accepts: MC, V, & AE.

COMPUTERLAND
79 Westbury Ave.,
Carle Place (516) 742-2262
Equipment carried: Apple, Atari, Commodore, Cromemco, Dynabyte, Texas Instruments, Vector. Additional offerings: F, T, CS, MS.
Founded 2 years ago. Owner: Elliott Greene. Hours: Mon.-Thurs. 10:00-6:00, Fri. 10:00-9:00, Sat. 10:00-5:00. Accepts: MC & V.

COMPUTERLAND
58 W. 44th St.,
New York (212) 840-3223
Equipment offered: Apple, Atari, Dynabyte, Vector. Additional offerings: T, CS, MS.
Founded 1 year ago. Owners: Joe Alfieri & James Egan. Hours: Mon.-Sat. 10:00-6:00. Accepts: MC, V, & AE.

COMPUTERLAND
600 N. Broadway,
White Plains (914) 328-0144
Equipment carried: Apple, Atari, Vector. Additional offerings: F, T, CS, MS.
Founded 1 year ago. Owners: Judy & Matt Fitzsimmons. Hours: Tues., Wed., Fri., Sat. 10:00-6:00, Thurs. 10:00-9:00. Accepts no credit cards.

COMPUTER MICROSYSTEMS
1311 Northern Blvd.,
Manhassett (516) 627-3640
Equipment carried: Apple, Commodore, North Star. Additional offerings: F, T, CS, MS.
Founded 5 years ago. Owner: A. Rozwadowski. Hours: Tues., Thurs. 10:00-8:00, Wed., Fri., Sat. 10:00-6:00. Accepts: MC & V.

THE COMPUTER STORE
40 E. 52nd St.,
New York (212) 832-2180
Equipment carried: Apple, Cromemco, Data General, Durango, Hewlett-Packard, Zenith. Additional offerings: F, T, MS.
Founded 8 months ago. Manager: Peter Kublikis. Hours: Mon.-Fri. 10:00-5:00. Accepts: MC & V.

CUSTOM COMPUTER SPECIALISTS
208 Roanoke Ave.,
Riverhead (516) 369-2199
Equipment carried: Apple, Commodore, Cromemco. Additional offerings: F, CS, MS.
Founded 3 years ago. Owner: Gregg Galdi. Hours: Mon.-Sat. 9:00-5:00. Accepts: MC & V.

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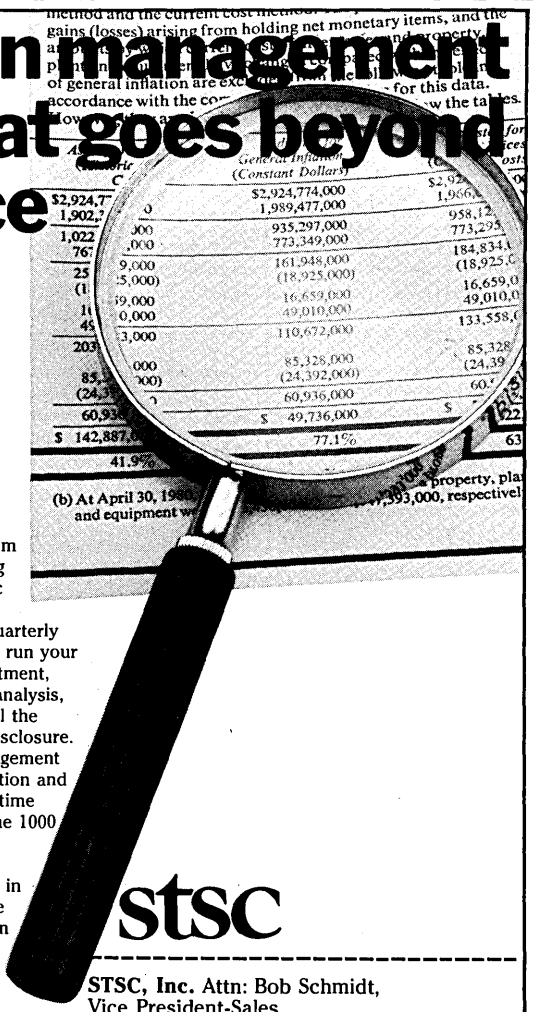

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IBM System/38

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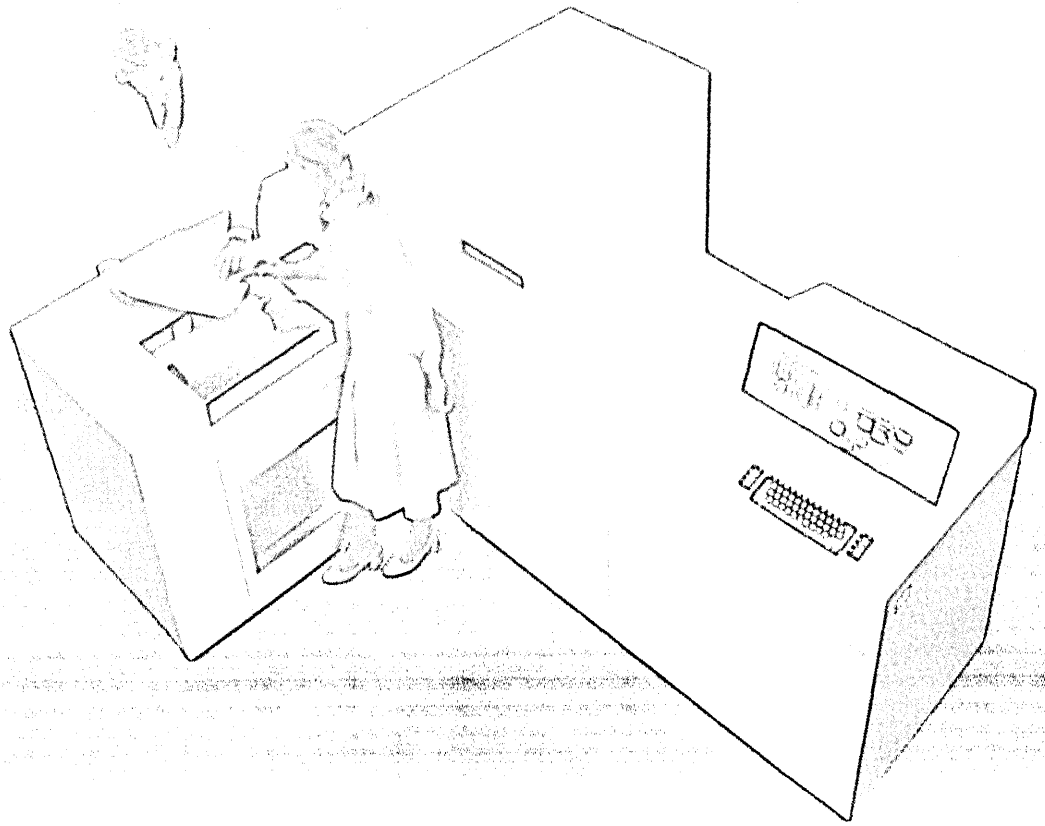

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Bently Nevada Corporation
Minden, Nevada

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General Systems Division

CIRCLE 32 ON READER CARD

Equipment carried: Apple, Dynabyte, Hewlett-Packard, Intertec, Osborne. Additional offerings: F, T, MS.
Founded 2½ years ago. Owner: W.D. Barton. Hours: Mon.-Fri. 8:30-5:30. Accepts: MC & V.

DIGITAL'S COMPUTER STORES
300 Garden City Plaza,
Garden City (516) 741-6484
Equipment carried: Digital. Additional offerings: F, T, CS, MS.
Manager: Jerry Jacobs. Hours: Mon.-Fri. 9:00-6:00. Accepts: MC & V.

DIGITAL'S COMPUTER STORES
55 E. 43rd St.,
New York (212) 599-0200
Equipment carried: Digital. Additional offerings: F, T, CS, MS.
Manager: Fred Carsentino. Hours: Mon.-Fri. 9:00-6:00. Accepts: MC & V.

FUTURE VISIONS COMPUTER STORE
70 Broad Hollow Rd.,
Melville (516) 423-7820
Equipment carried: Apple, Atari, Data General, Intertec, North Star, Texas Instruments. Additional offerings: F, T, CS, MS.
Founded 1 year ago. Owner: Michael A. DiSabello. Hours: Mon.-Wed. 10:00-6:00, Thurs., Fri. 10:00-8:00, Sat. 10:00-5:00. Accepts: MC & V.

IBM BUSINESS COMPUTER CENTER
2 Penn Plaza,
New York (212) 239-3631
Equipment carried: IBM 5120.
Call for appointment.
Accepts no credit cards.

MEIZNER BUSINESS MACHINES
4771 Boston Post Rd.,
Pelham (914) 738-6000
Equipment carried: Apple, Commodore. Additional offerings: F, T, CS, MS.
Founded 40 years ago. Owner: I. Meizner. Hours: Mon.-Fri. 9:00-5:00, Sat. by appointment. Accepts no credit cards.

POLK'S MODELCRAFT HOBBIES
314 Fifth Ave.,
New York (212) 279-9034
Equipment carried: Atari, Data General, Ohio Scientific. Additional offerings: F, MS.
Founded 4 years ago. Owner: Louis Polk. Hours: Mon.-Wed., Fri., Sat. 9:30-6:00, Thurs. 9:30-9:00. Accepts: MC, V, & AE.

RADIO SHACK COMPUTER ENTERS
Equipment carried: TRS-80. Additional offerings: T, MS.
Hours: Mon.-Sat. 9:00-6:00. Accepts: MC, V, & AE.
1751 Sunrise Highway, Bayshore, (516) 666-1800. Manager: George Hudson.
Richmond Island, Staten Island, (212) 698-3100. Manager: Ken Koswener.
97-77 Queens Blvd., Rego Park, (212) 897-5200. Manager: Doug Wyman.
242 North Ave., New Rochelle, (914) 636-0700. Manager: Dennis McGovern.

SILENT PARTNERS
2050 Center Ave.,
Fort Lee, N.J. (201) 947-9400
Equipment carried: Apple, Atari, Commodore, Osborne, Vector. Additional offerings: F, T, CS, MS.
Founded 1 year ago. Owner: Peter Schwartz. Hours: Mon.-Wed., Fri., Sat. 10:00-6:00, Thurs. 10:00-8:00. Accepts: MC, V, & AE.

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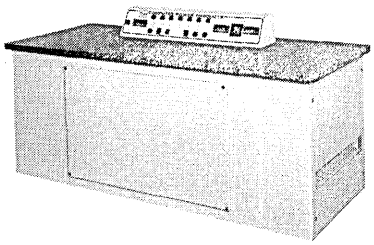

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PHILADELPHIA AREA

CALDWELL COMPUTER CORP.
6720 Rising Sun Ave.,
Philadelphia (215) 742-8900
Equipment carried: Apple, Atari, Commodore. Additional offerings: F, T, CS, MS. Founded 5 years ago. Owner: Sam Caldwell. Hours: Mon., Tues., Thurs. 10:00-5:30, Wed. 10:00-8:30, Sat. 10:00-4:30. Accepts: MC & V.

COMPUTERLAND
1650 Limekiln Pike,
Dresher (215) 542-8835
Equipment carried: Apple, Atari, Commodore, Cromemco, Texas Instruments, Vector. Additional offerings: F, T, CS, MS. Founded 1 year ago. Owner: George Willbanks. Hours: Tues.-Thurs., Sat. 10:00-6:00, Fri. 10:00-9:00. Accepts: MC & V.

COMPUTERLAND
81 E. Lancaster Ave.,
Paoli (215) 296-0210
Equipment carried: Apple, Commodore, Cromemco, North Star, Vector. Additional offerings: F, T, CS, MS.
Founded 2 years ago. Owner: William Liddle. Hours: Mon.-Thurs. 9:30-5:30, Fri. 9:30-8:00, Sat. 10:00-4:00. Accepts: MC & V.

THE COMPUTER SOURCE
546 Penn Ave.,
West Reading (215) 373-1264
Equipment carried: Apple, Atari. Additional offerings: F, T, CS, MS.
Founded 1 year ago. Owner: Interactive Information Systems. Hours: Tues., Wed., Fri. 12:00-6:00, Thurs. 12:00-9:00, Sat. 10:00-5:00. Accepts no credit cards.

THE COMPUTER STORE
1045 Lancaster Pike,
Bryn Mawr (215) 525-7712
Equipment carried: Apple, Data General, Vector. Additional offerings: F, T, CS, MS.
Founded 5 years ago. Owner: Richard Smith. Hours: Mon.-Fri. 10:00-6:00. Accepts: V.

DIGITAL'S COMPUTER STORES
1500 Market St., Central Square West,
Philadelphia (215) 568-3530
Equipment carried: Digital. Additional offerings: F, T, CS, MS.
Manager: B.J. Bomentra. Hours: Mon.-Fri. 9:00-5:00. Accepts: MC & V.

IBM BUSINESS COMPUTER CENTER
1700 Market St.,
Philadelphia (215) 943-6547
Equipment carried: IBM 5120.
Call for appointment.
Accepts no credit cards.

IBM PRODUCT CENTER
1414 Chestnut St.,
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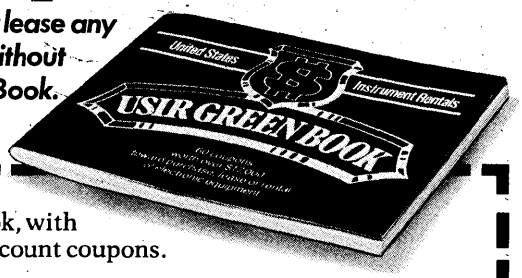

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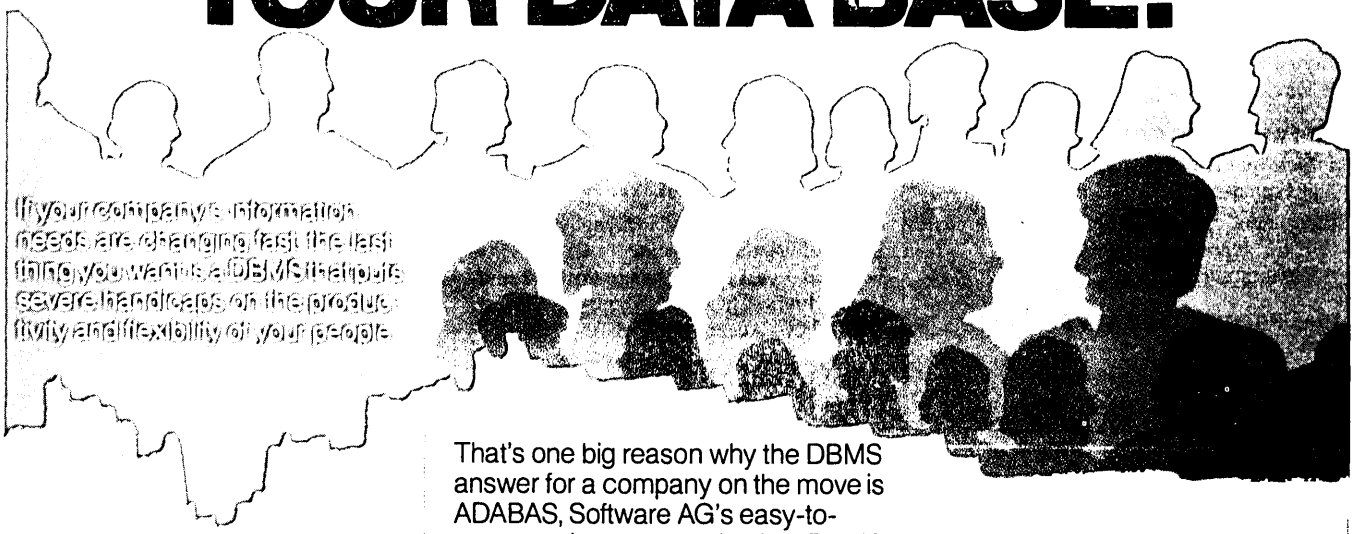

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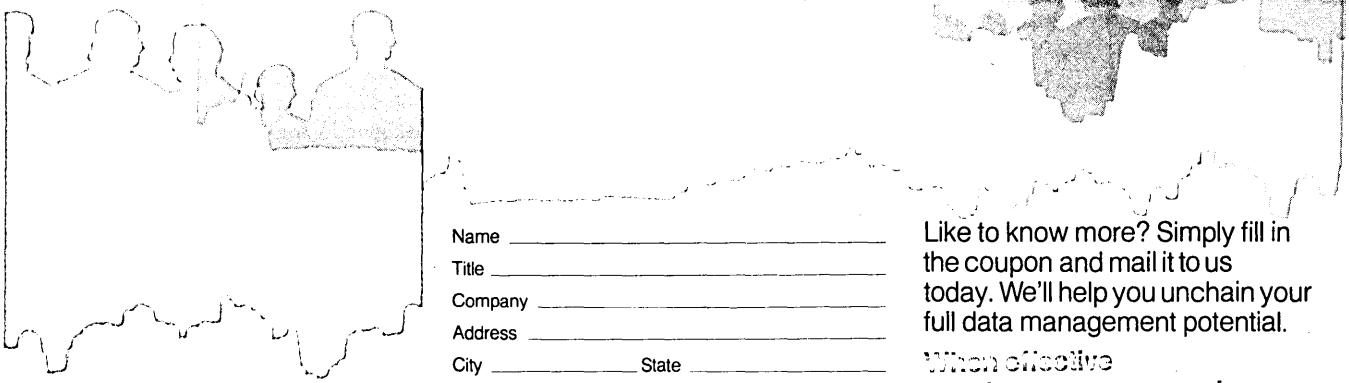

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6120 Franconia Rd.,
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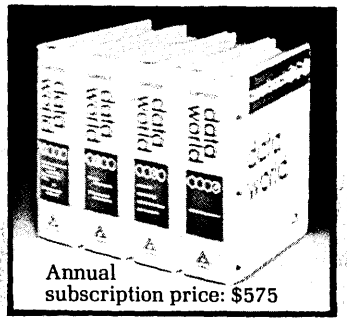

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CIRCLE 39 ON READER CARD

NEWS IN PERSPECTIVE

WAITING FOR THE B7900

Peripheral problems aside, Burroughs users remain loyal in their wait for a follow-on to the B7800.

More memory before more power is the cry from top-of-the-line Burroughs users, many of whom are chafing at the bit for a follow-on to the B7800.

"Not knowing enough about why the company has hung on to the 6-megabyte limit [to internal memory], I say they have not given large users the kind of attention they should have," complained a dp manager for one of the largest users of Burroughs equipment. The shop operates six B7000-series computers.

Another user in a shop that operates two B7800s put it more succinctly: "After the B7800, there is no place to go but to IBM." For most, though, the threat of moving off Burroughs and onto something else is really an idle threat because of staggering conversion costs.

Feelings of neglect are not as prevalent among users who have recently visited Detroit and talked with Burroughs. "We were concerned, but not now—not since we visited Burroughs," said Don Stunoff, vice president of corporate information services for The Quaker Oats Co. Now Stunoff says he feels "comfortable" with Burroughs' strategy.

What appears to be allaying fears is the B7900, which Burroughs hopes to unveil sometime during the first quarter of next year. Some sources had heard it would be wheeled out as early as this fall, but according to Burroughs it was the B3955, successor to the ill-fated B3950, that was slated for a fall presentation.

More important to the users than the date of the B7900 announcement is what will be inside the new box. For most, the solution to their computing problems is not a bigger, faster processor. It's more internal memory.

If Burroughs comes out with a faster processor and no improvement in memory, "it would be like having a small note pad on your desk when you are in the business of taking notes," quipped one manager. In short, it would make for a poor match and an inadequate answer to current problems.

If it takes an architectural change to increase the memory size, that too would cause problems. Users stress they are not "looking for any conversion, only an upgrade."

Tom Clark, with Burroughs World Inc. (better known as BWI, an independent organization that specifically services Burroughs users, offering them consulting services, a monthly newsletter and some sharp insight into Burroughs' operation), expects to see a bigger internal memory and a smaller overall box. As for the compatibility issue, based on Burroughs' history Clark doesn't believe the B7900 would offer software that's incompatible with any of the other B7000 series.

One of the most recent examples of Burroughs' attention to compatibility is the B6900. Jim Engel, computer center director for Waukesha County Technical Institute, Wis., recently upgraded from a B6700 to a B6900. It was a "load and go" situation, he said. "The conversion was incredibly simple." To date, Burroughs said it had delivered 85 B6900s; by the end of the year, Burroughs expects to have 130 units installed.

Lifting the veil a bit, Burroughs did say the B7900's directly addressable memory will be "substantially expanded" and, like the B6900, any internal changes will be transparent to users.

More important to users than the date of the B7900 announcement is what will be inside the new box.

In the meantime, one alternative to skirting around the 6-megabyte memory limit is to split the work load between two or more mainframes. There is a hidden cost in that route, however. More overhead time is required to manage the databases, said Quaker Oats' Stunoff.

For many, such as the dp department at Ford Motor Company's tractor operations, that is not a reasonable solution. The problem, said David Ashland, a supervisor in Ford tractor's dp department, is that there is not enough internal memory to support all their on-line users. But splitting the work load between two systems and supporting two databases is too expensive a solution.

What Ford tractor plans to do is link several B7800s using the Burroughs Network Architecture (BNA) so that the whole system will look like one big system. Burroughs refers to that configuration as its "loosely coupled configuration." A job could run on any computer in the network, and could share the work loads, tasks, and files, said Ashland. Another arrangement is called the "tightly coupled configuration," which would allow four cpus and four I/O processors to be linked together to produce 15 megabytes of memory, equal to 3 megabytes per individual processor plus 3 million bytes common to all processors.

While the B7900 announcement may quell the grumblings of many high-end users, weak software application support and exasperating experiences with cranky

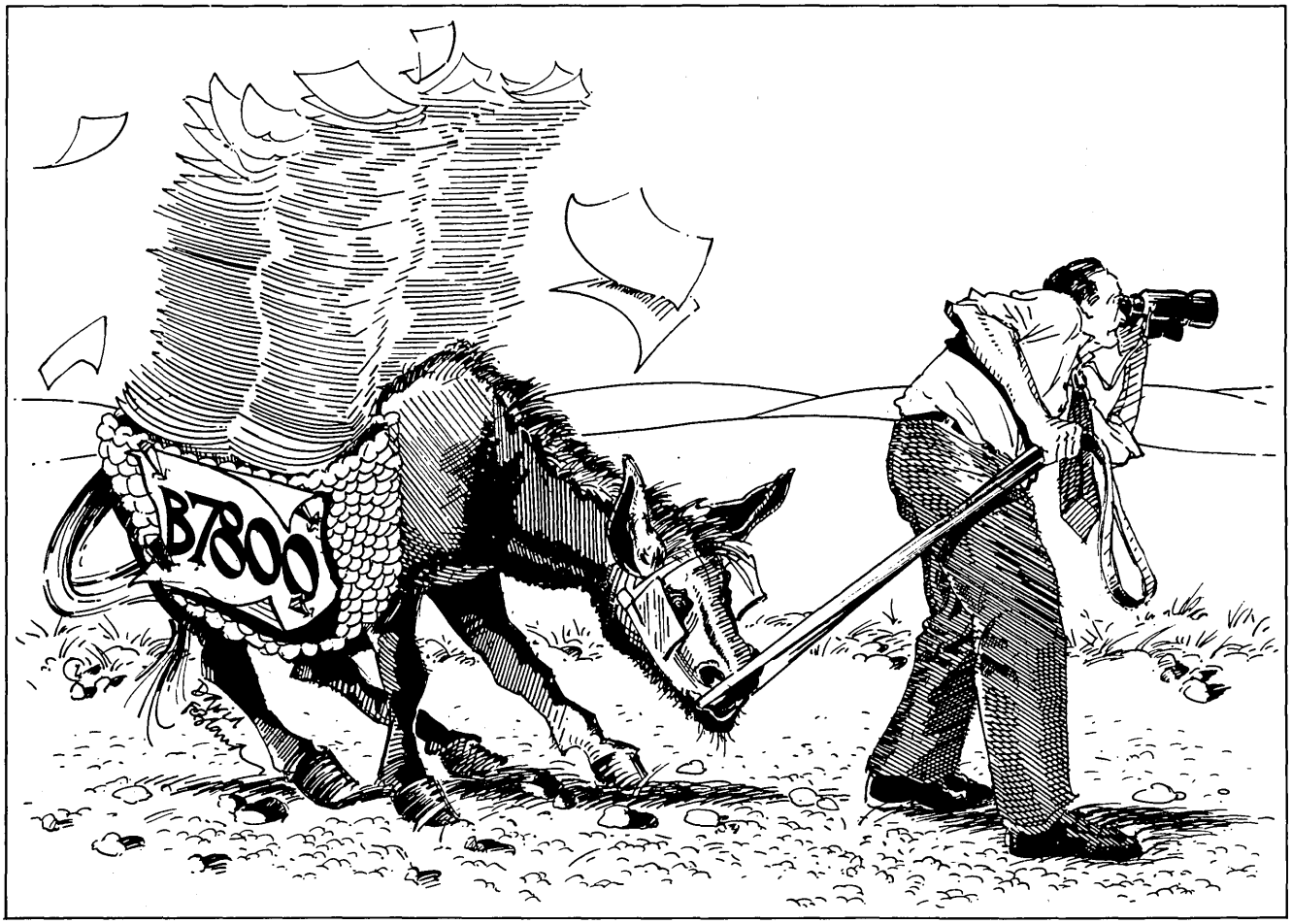

ILLUSTRATION BY DAVID FEBLANO

peripherals remain sore spots. Chipping at Burroughs' user base are mini and micro systems and their accompanying software packages and design attributes that make them especially suited to certain applications. Instances of migrating specific applications off Burroughs mainframes onto something else are turning up at several Burroughs sites. One example is Harris Trust and Savings Bank, Chicago.

With its dual B7700 and four B6800s, Harris Trust also ranks among the largest Burroughs users in the country. The company is switching from a B4800 cpu to an IBM 4341 for check processing and from B9137 and B9138 sorters to IBM 3890s, according to a source within Harris' dp department. The company is also moving certain dedicated trust applications onto Hewlett-Packard computers.

Jim Brill, manager of dp operations for St. Joseph's Hospital, Milwaukee, said his shop plans to move specific applications off its Burroughs mainframes onto minicomputers. (The hospital has two B6700s.) "I want to migrate several applications off the Burroughs mainframe onto something else but still have them linked to the mainframe." At present, Brill said, Burroughs, Honeywell, and Univac are studying that problem and have agreed to come back with proposals describing their solutions.

When queried about their overall opinion of Burroughs, specifically the "new Burroughs"—the Burroughs since Blumenthal—most users were optimistic. One of the changes most often mentioned was improved delivery times. "Honesty is the real improvement," explained Brill at St. Joseph's. "You can deal with time, just so they come through when they say they will come through."

Staging centers where various parts of an order—cables, peripherals, interfaces, processors—are collected and checked against purchase orders before shipping have helped to smooth out customer wrinkles. "I would say they must be doing a better job of staging equipment because there were very few problems in bringing up our order," said Bill Dierkes, vice president of MIS for Keebler Co., Elmhurst, Ill. Dierkes took delivery on two B6800s and several peripherals.

One alternative for skirting around the 6-megabyte memory limit of the B7800 is to split the work load between two or more mainframes.

Changes in quality assurance procedures have not gone unnoticed either. Burroughs has elevated QA, as well as the systems management function, to staff level so that manufacturing standards, policy, and procedures will emanate from a centralized authority. Before, the functions had been at the individual plant level. It was explained to one Burroughs user who had been waiting impatiently for a piece of hardware sent in to be remanufactured that "the old Burroughs ways were stopped. We are not doing things the way we used to." Parts are less likely to leave the plant untested and faulty these days, the user was assured.

A thorn that continues to aggravate users is peripherals. "Clearly one of the weakest points about Burroughs is the manufacturing of peripheral devices," said Quaker Oats' Stunoff. As a stopgap, Burroughs goes outside for many products oeming Control Data floppy disk drives and high speed printers, Xerox high speed nonimpact printers, and Storage Technology tape drives. If the Memorex acquisition goes through, many users are hopeful that Memorex's magnetic technology and people resources will help cure some of Burroughs' peripheral ills.

While some users label Burroughs' peripherals as among the worst in the industry, in the same breath many praise the company's operating system and mainframe reliability as among the best. Said David Frazer, vice president of data processing for Waukesha State Bank, Wis., "[Staying with Burroughs] is strictly an

economic consideration. Their operating system and their on-line software, which is my world, is the cheapest and easiest to operate software in the business. If I went to IBM and was doing the same amount of work, I would have to, at a minimum, double both operations and technical staffs, and pay more for the computers." He paused, then added, "You can put up with a lot of bumbling from people when you get a hunk of hardware that runs that easy." Frazer's shop has a B4708 and will soon be adding a B2930.

Nothing is better than a quick random survey to confirm hearsay, and Burroughs' reputation on mainframe reliability is attested to by users. Ashland at Ford tractor replied that his systems were up an average of 99.2% of the time, while Stunoff at Quaker Oats reported about 99.3%.

Peripheral problems aside, the bottom line for most users was summarized by a comment from Ashland: "How can you be unhappy when your system is up that much of the time?"

—Jan Johnson

STRATEGIES

STORAGE FOR THE MASSES

Masstor Systems plans to provide an entry-level storage device that will open up the advantages of mass storage to more users than ever before.

IBM's 3850 mass storage system, that honeycombed gadget that might have been invented by Rube Goldberg, never drew much attention from plug-compatible peripheral suppliers. Control Data tried its hand with a 3850 copy but sold only a handful. Fujitsu in Japan copied the 3850 but never brought it to the U.S. market. IBM itself has sold just over 600 systems since introducing the machine some eight years ago. Hindered by initial microcoding problems, users' unfamiliarity with the product, and a relatively high price tag—about $1 million a shot—the 3850 has not been a huge seller, despite growth in on-line storage demand running as high as 70% a year.

That may all change later this year when Masstor Systems Corp., a five-year-old Sunnyvale, Calif., firm which has kept fairly quiet so far, unveils a low-end answer to the 3850, an entry-level device that will open up the advantages of mass storage to a wider range of users than ever before. The firm will say little publicly about the new machine, which it has dubbed the M860, except that it has received attention from "several major mainframe manufacturers" as an oem product and that the device will "use the best features of what we already have."

What Masstor already has is the Fujitsu-built copy of the IBM 3850, which it markets as part of a so-called shared virtual storage system (SVSS), a combination of disk, tape, and cpu power which act together as an intelligent back-end to IBM, Control Data, Univac, and other mainframes. The new entry-level system, which will use video recording technology similar to that used in the 3850, will help Masstor crack the commercial user market and may smoke out what some industry observers say is a similar development going on behind closed IBM doors.

In any case, the system will help Masstor in its quest to capture a large share of the mass storage market in the way that arch-rival Storage Technology has done with disk and tape products. In fact, it is only after STC's recent introduction of its VSS intelligent back-end system that Masstor "opened the kimono" on its strategy after several years of quiet ground breaking and intelligence gathering in the large-scale user community.

The company's SVSS system, claimed to supersede the STC system in capability and price/performance, has so far been installed at only one unidentified commercial customer site and three government agencies. Like Amdahl, Cray, and other at-first unknowns, Masstor has initially aimed for government sales to establish credibility and make a name for itself.

Masstor's concept is one that has intrigued systems designers for years—that of an intelligent back-end system which controls storage in a hierarchical manner so that most-often-used data are most accessible to the cpu and less-used data are archived but still on-line on slower and cheaper-per-bit devices. Thus, the SVSS system combines the best of disk, half-inch tape, and 3850-type cartridge tape storage.

Masstor already has a Fujitsu-built copy of the IBM 3850, which it markets as part of a so-called shared virtual storage system.

During the past five years the firm has received financing from a number of investors, including West Coast venture capitalists, and has built a marketing team headed by several ex-Itel executives. They come to the firm with solid experience in competing with IBM in both the cpu and peripheral areas.

The privately held firm began marketing in late 1979 and, in conjunction with Sperry Univac, scored a coup against IBM and its 3850 in winning a large contract at Jet Propulsion Labs in Pasadena, Calif. Although Masstor was reluctant to discuss the win at the time, it points proudly to the JPL order as the first of its government contracts. Others have followed at Brookhaven National Labs on Long Island, N.Y., Sandia Labs in Albuquerque, and in Washington, where the Department of Agriculture is to install an M850 system this December.

ERIK SALBU claims that magnetic recording still seems to be the way to go, despite all the recent ballyhoo about optical storage.

Last spring the firm as subcontractor won a good piece of a $163 million order from the Air Force for Honeywell computers and related mass storage systems. Erik Salbu, president and chairman, says Masstor expects to book between $20 million and $25 million in orders this year and will achieve profitability late this year or early next year.

Salbu, an ex-Ampex employee who was in charge of that firm's aborted attempts to break into the mass storage arena with the video technology-based Terabit machine, estimates that the firm's potential market today is some 10,000 installations worldwide and that with the introduction of its entry-level system and continuing growth of the market, there will be some 15,000 installation in five years.

More conservatively, he suggests that there are about 1,500 sites that are mixed vendor shops using a combination of IBM, Univac, Control Data, and other manufacturers' computers worth $10 million or more. These mixed vendor shops, he says, offer the greatest potential for Masstor in that they have the incentive to share large data files between different cpus.

Essentially, Masstor's SVSS incorporates a high-speed local network, dubbed Massnet, to which the different cpus attach and communicate at channel speeds. This is managed by using Network Systems Corp.'s proprietary Hyperchannel product.

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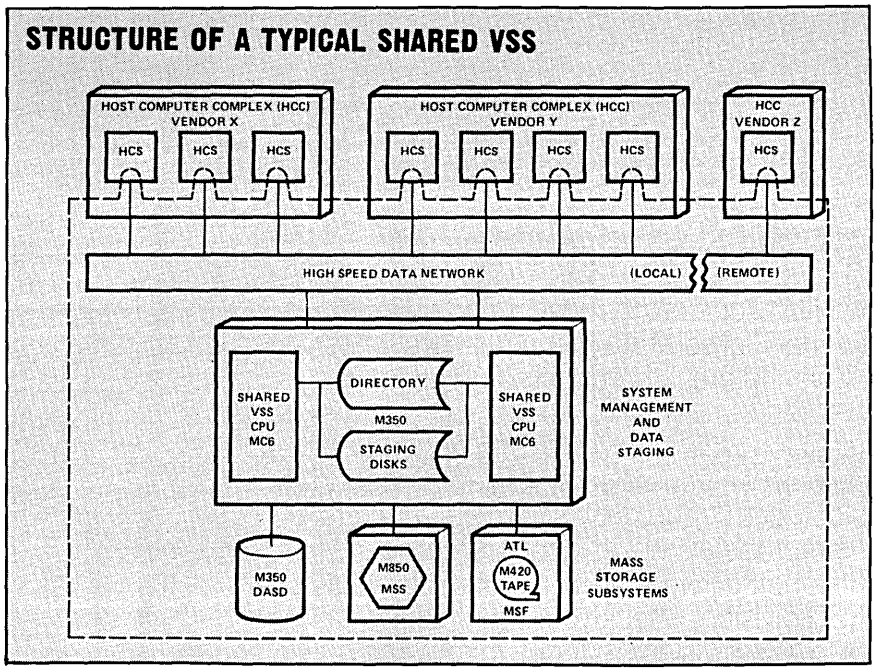


That network is in turn attached to a Fujitsu-built 370-compatible computer which interfaces the network "intelligently" to standard disk drives, the M850 mass storage system, and the former CalComp automatic tape library now marketed by Braegen.

Together, these storage devices are managed in a hierarchical staging system that Masstor claims provides users with several systems and economical benefits. Among these are reduced storage costs, reduced electrical usage and floor space requirements, reduced staff requirements, increased on-line storage capacities (up to 5 trillion bytes), and better system throughput.

Masstor's SVSS incorporates a high-speed local network, Massnet, to which different cpus attach and communicate at channel speeds.

Moreover, by using the MVS-driven Fujitsu cpu as a controller, storage devices are connected virtually to the host cpus and therefore if and when new storage technologies arrive they can be connected with little reprogramming, Masstor claims.

What new technologies does Salbu, generally acknowledged as a mass storage authority, see on the horizon? Not too many, he answers. Magnetic recording still seems to be the way to go, despite all the recent ballyhoo about optical storage.

"There's a lot more extendability in video recording than in disk," he notes, pointing out that the 3850 and his firm's M850 both use video technology to record data with a helical scan read/write head on wide (about 3 inches) magnetic tape. "There's no push on technology in the 3850. We can easily boost capacity by 10 times."

He compares that with the two to three times increase that can be expected from disk recording over the next five years. By then that technology will have reached its limit. "We have learned a lot from the 3850," Salbu muses.

That box, he notes, stores up to 472 billion bytes (using two A4 storage frames), and it is estimated that the 600 or so 3850s currently installed worldwide contain more data than are stored on all the 3350-type disk drives in use worldwide.

Masstor is certainly keeping its eye on optical recording as the best bet for industry use in the future, but when general usage will happen is still a matter for speculation, Salbu insists. "There is a high risk in assuming that the optical disk will be viable for general application," he says. "I'd give it a 50-50 chance right now. And it won't be a generalized solution—it will be for archiving only."

Masstor's director of research and development is Jerry Miller, who once headed engineering efforts on the Ampex Terabit machine. He has, Salbu notes, developed digital recording schemes that may be applicable to optical recording, a medium known for high error rates, and these schemes may be licensed to builders of optical recorders.

Salbu and cofounder Lynn Shirley, who serves as executive vice president in charge of long-term corporate product planning, have gathered a strong marketing force to help penetrate the plug-compatible market. Richard Lussier, executive vice president, comes from Itel, where he headed a worldwide marketing team. At Masstor, he is responsible for the equipment business segment, including R&D, manufacturing, sales, marketing, and technical support.

Also from Itel is John Bock, vice president of operations. Bock was most recently with National Advanced Systems, where he was in charge of strategic planning, and at Itel he had been vice president of development in the Data Products group.

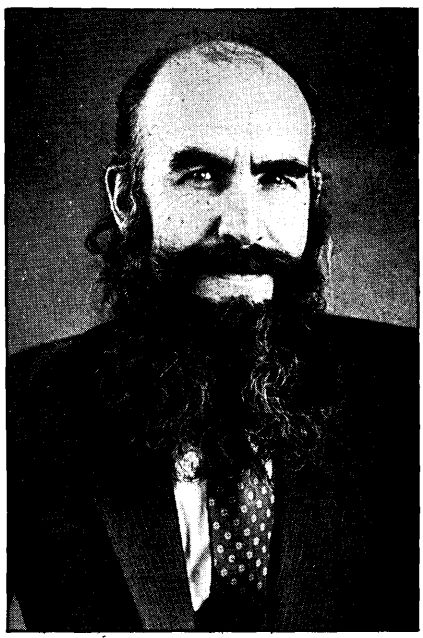
Thomas A. Rota, vice president of finance, joins Masstor from the Laser Systems division of Spectra-Physics Corp., and H. Robert Howie Jr., cofounder and vice president of Masstor, came from Ampex and the CIA.

Salbu says the firm has a "strong relationship" with Fujitsu but that it is limited to sharing technical information and does not include any equity position on Fujitsu's part.

Masstor is keeping its eye on optical recording as the best bet for industry use in the future.

Masstor appears to be counting on Storage Tech's recent VSS introduction to educate the market and give the concept of a back-end data management system credibility with users. However, it insists its product is a "superset" of STC's and claims it can deliver more performance per dollar. Both companies are attempting to cash in on the growing demand for on-line data storage, a growth which is estimated to be as high as 70% a year.

"A strong argument can be made," says Salbu, "that intelligent data storage systems are becoming the hub of systems and that processors are becoming the peripheral devices. Fifteen years ago the cpu represented 60% of a system's total cost. Today it represents just 40% or less, and



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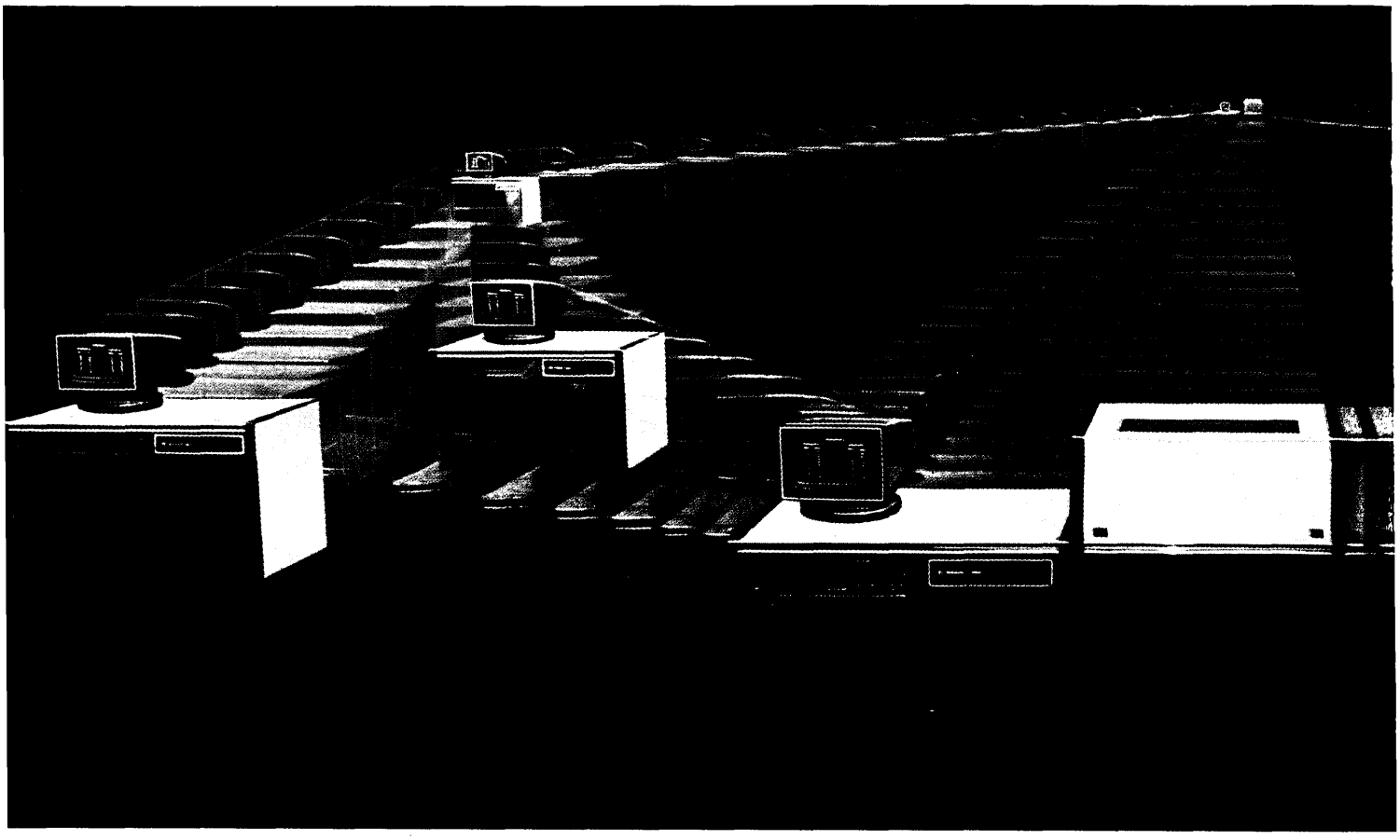

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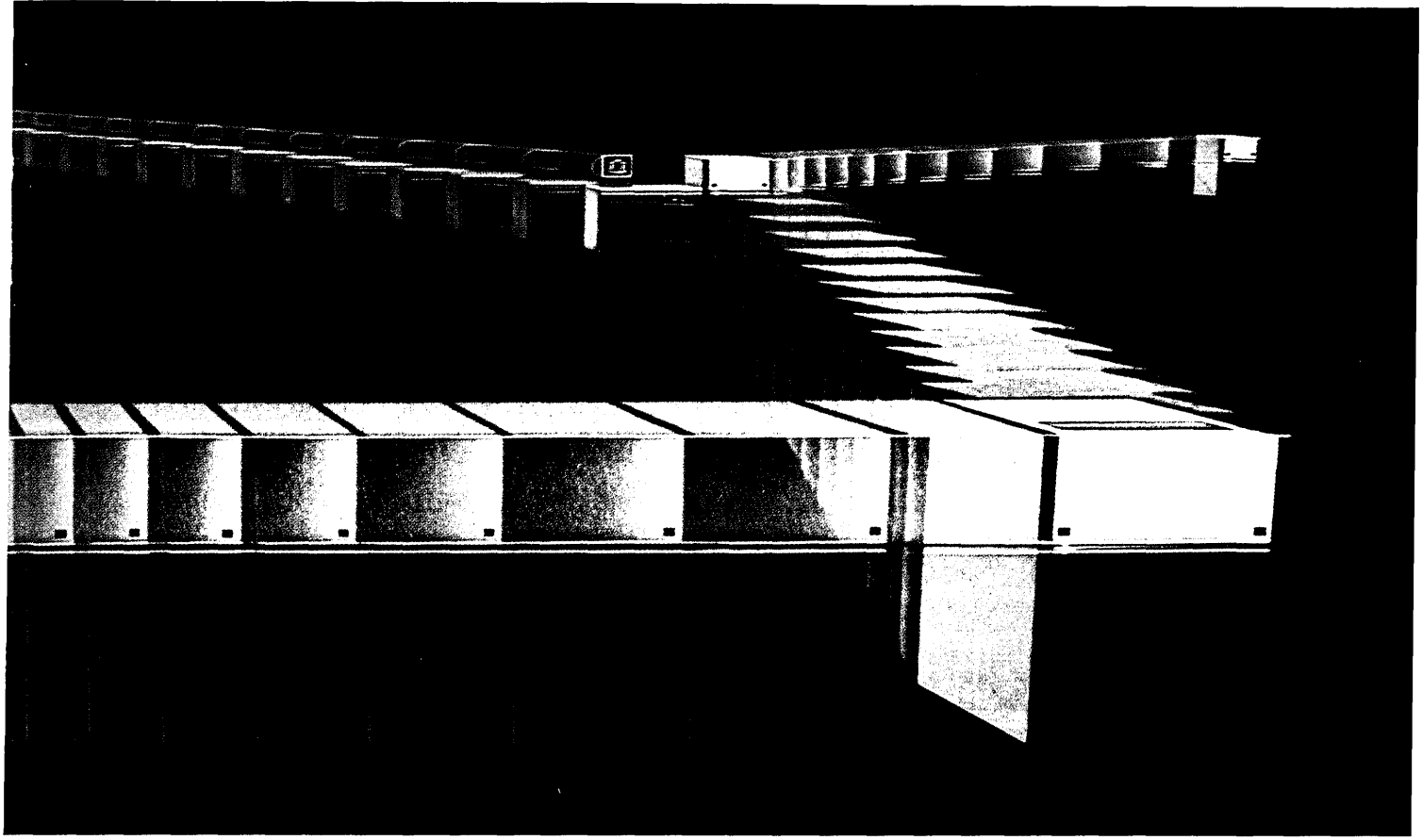

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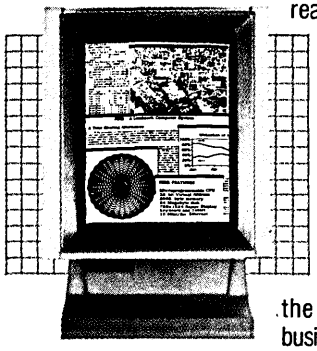

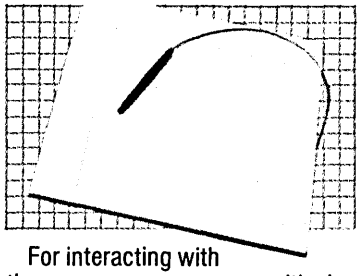

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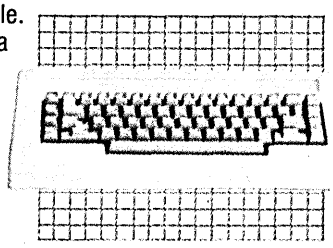

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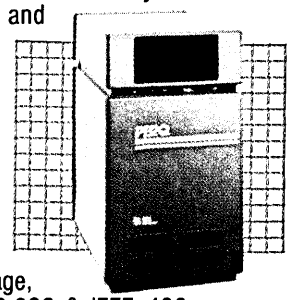

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RICHARD LUSSIER, formerly head of a worldwide marketing team at Itel, is responsible for Masstor's equipment business segment.

peripheral equipment accounts for at least 60% of the total cost."

Given that kind of growth, Masstor is projecting a 1985 market of $20 billion for large capacity on-line storage products. That size market is sure to draw the sights of some big competitors—not the least of which is IBM, which industry observers speculate may have some new mass storage products up its sleeve.

Perhaps Masstor's next product introduction will force the industry leader to show its hand.

—John W. Verity

SEMICONDUCTORS

CUSTOM IC CHIPS GAINING

The move to custom-made integrated circuits can cut manufacturing costs, and those savings can be passed on to the buyers.

Two custom-made integrated circuits have replaced from 15 to 20 of the off-the-shelf variety in several models of printers being made by Mannesmann Tally. In electronics, reducing the number of components in this way pays premiums in the form of higher reliability because there are fewer interconnections that can go wrong. But also it means fewer components to test, inventory, and stuff onto the printed circuit boards, and an easier time testing that board when the stuffing and soldering have been completed. But Tally has cut down on the number of IC chips in its printers, thus being able to get by with only one PC board instead of two. All around, the move to custom ICs has reduced Tally's manufacturing costs, and in the highly competitive printer business the Kent, Wash., company passes those savings on to the buyer.

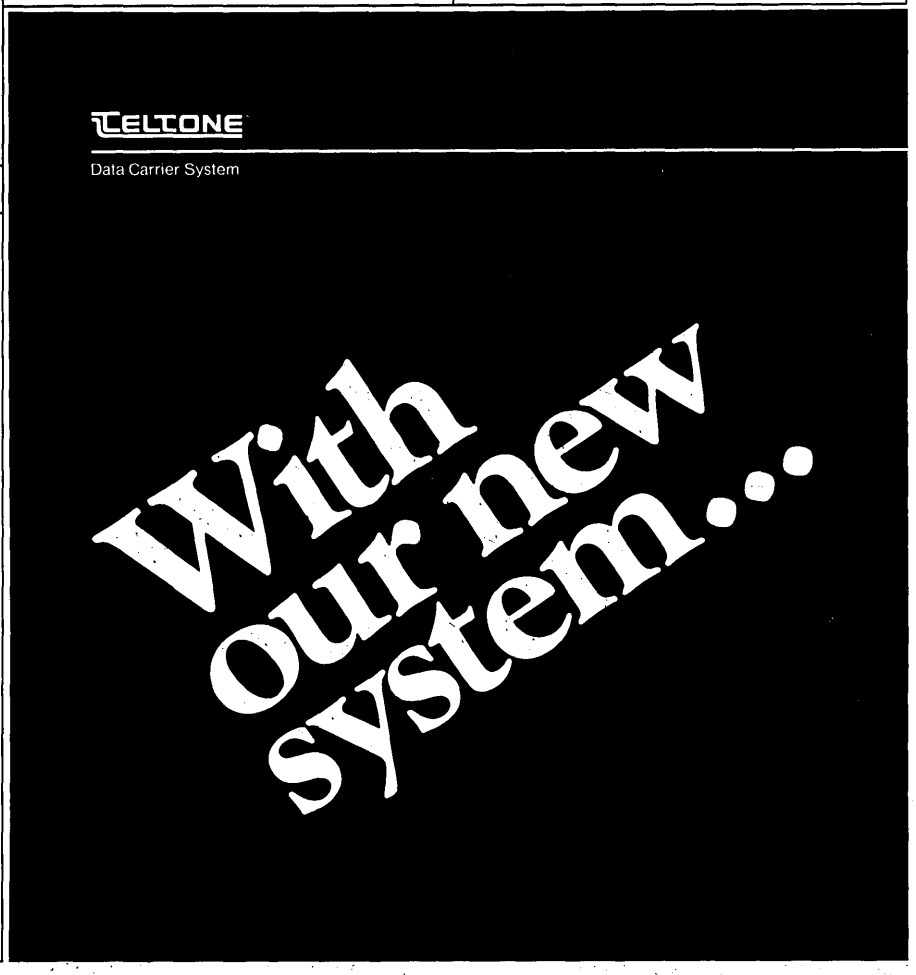
This ability of equipment makers to have custom ICs made is not a new phenomenon. Tally got into its custom program some three years ago. But it is a trend that has been building in the world of semiconductors. An increasing number of semiconductor service companies, devoted to helping oems like Tally get custom chips made, have been formed in recent years. The number of such service firms has increased by 63%, from 83 in 1978 to 132 in 1980, according to a recently published study. The consulting firm of Anderson/Bogert in Los Altos, Calif., calls it vertical disintegration, the formation of a number of small businesses that collectively perform the functions of a single integrated semiconductor company.

These include custom IC design houses, the number of which has not increased significantly; semicustom design firms that are involved in so-called gate arrays, which have grown from 13 companies to 23; maskmaking concerns that have not increased in number at all in the same period; wafer fabrication companies that have almost doubled in number from 16 to 29; and test companies, up to 22 from 10, according to Anderson/Bogert's study, "LSI Opportunities."

For many applications, designers not yet ready to commit to custom ICs are going to gate arrays, which are partially prefabricated circuits with predefined transistor locations. The user determines how these transistors are to be connected to perform the logic functions required by the application. As so often happens, IBM endorsed the use of gate arrays by filling its 4300 mainframes with them.

For many applications, designers not yet ready to commit to custom ICs are going to gate arrays.

The move to custom chips by an equipment maker is described by Robert B. Knipe, president of a custom design firm called Micro Innovators Inc., Santa Clara, Calif. He talks of a small company, which remains nameless, that has a product using gate arrays. The product was a success; they shipped a large number of them, learned a lot about their market with the product out there, and they see where they can make improvements in the product. Their next move is to custom chips.



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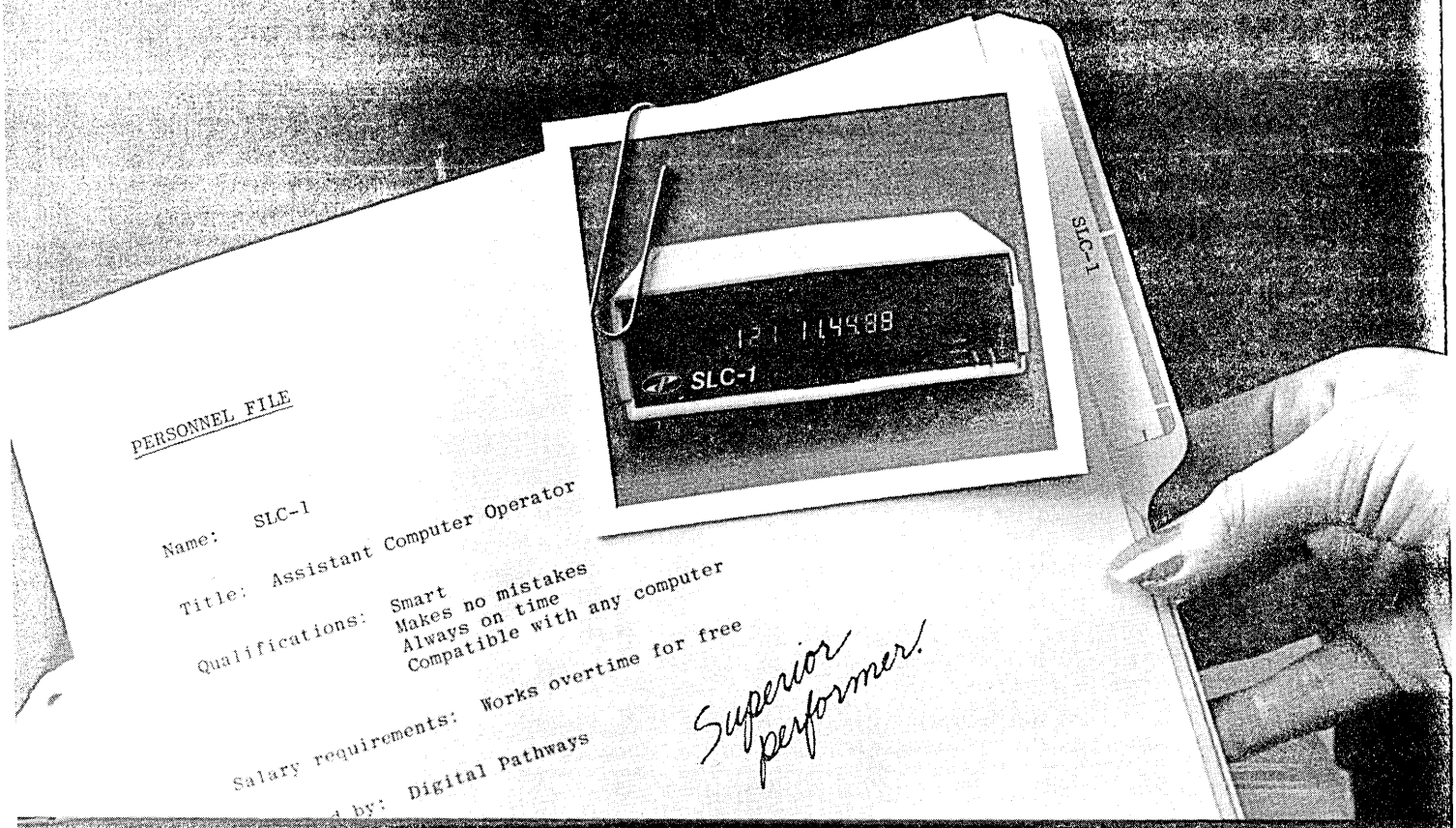

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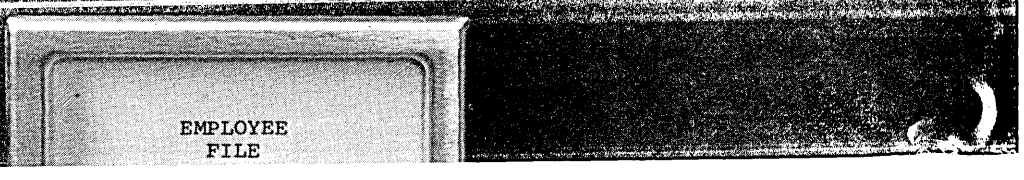


"What they need to do to really ramp up the volume," says Knipe, "is to get the cost out of the product, which means they need to get rid of the gate arrays and do a custom. So, while they had introduced the product with semicustom chips, they'll do an enhanced version of the product and at the same time integrate into a custom component." The manufacturing cost of the custom chips will be about a third less than the chips they replace. But the product will have enhanced features, in addition to producing the usual benefits of smaller component counts, more reliability, less assembly work, and the like.

In this case, there are two gate arrays in each box, and it would take one or two more to get the features they want to add—which would be replaced by one custom IC. So it's a ratio of one to three or four in the number of components, not a significant factor for all products but an important consideration for something that must be small or must consume little power. Of course,

The emergence of silicon foundries has begun to change the economic picture in favor of custom chips.

the company must invest in the design and development of its new chip. "Depending on the kind of component," says Knipe, "you see anywhere from three times to five times the cost" for a custom over a semicustom. "So you don't do it casually."

The five-year-old Micro Innovators has designed very simple chips with from 300 to 500 gates, but at the opposite end of the complexity scale has also designed a custom microcomputer, which conceivably could be 10 times faster than any existing standard product.

"A customer might come to us looking for a solution to a product and not know what logic architecture is best," says Knipe. "Or maybe he has some massive amounts of MSI [medium scale integration] and SSI [small scale integration] chips that he has used to make the product. We'll take a look at what he's done, or at the product plan itself, and determine what logic architecture is appropriate. And if it's a micro, we'll design a micro, which means you have to do the machine description, define the instruction set, design the IC, and write the software. So the custom IC is a big deal; it's expensive, not something you do lightly."

Because of the capabilities that can be built into a custom chip, it is typically used in a high-volume product or family of products. Knipe tells of a European computer maker that wants to integrate to custom chips while retaining software compatibility. He describes its effort as being very complex, perhaps pushing the state of the art "a little too much." But the company is willing to wait until the technology catches up with its requirements, for the new capability would shrink a very large box full of components to a desktop machine. And, Knipe adds, they are not deterred by the costs of integrating to two or three custom chips, even if the design and tooling functions come to a million dollars per chip.

So the industry has changed, and continues to change. More equipment makers are developing an in-house design capability, and many even have their own processing plants. Time was when the largest semiconductor companies and even some of the smaller wafer fabricators were not willing to engage in short production runs. But this attitude is changing, particularly with the formation in recent times of companies specifically looking to do the small-run jobs. These so-called silicon foundries are coming on-stream with millions of dollars of backing from venture capitalists.

At the design firm of Alphatron Inc., Cupertino, Calif., president Donald E.

IN THE CHIPS

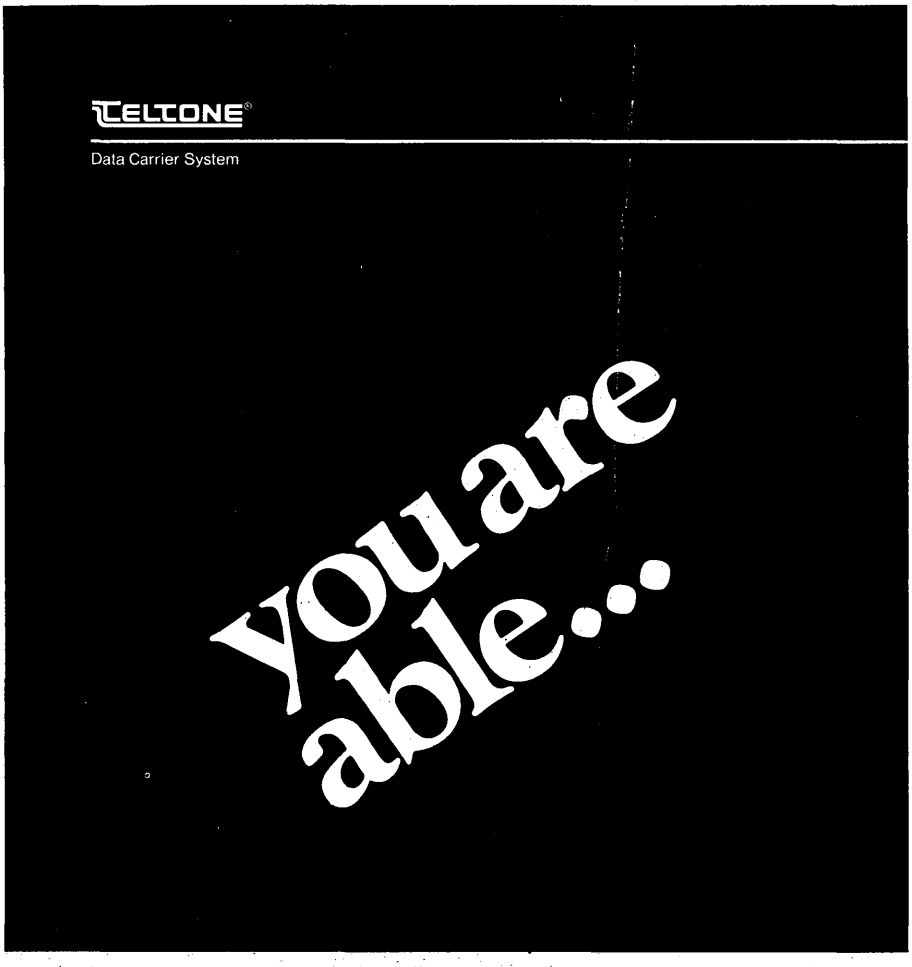
Silicon foundries and semiconductor service companies being positioned around them promise some new products at low prices not previously achievable. Now in the process of having a custom integrated circuit chip made is, for example, Atalla Technovations, a small company in Sunnyvale, Calif., in the field of personal identification and security. It markets to banks, savings and loans, and credit unions. Its requirement is for about 3,000 to 5,000 custom ICs per year, a quantity that a few years ago was just too small to interest the large semiconductor company. But the new capabilities for short production runs open new vistas for this company, which has a special need to put its functions on one chip.

On this custom hybrid chip, combining digital and analog functions on one substrate, the company is integrating a microprocessor, an EPROM, and support circuits, and then the whole thing will be covered with epoxy, making it difficult for anyone to get in there and intercept any of the secure information.

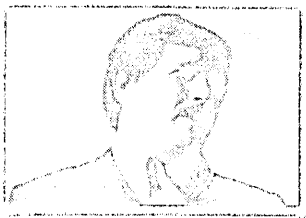
"We want the ability to have a piece of information come into that chip, the information processed, and compared with previously stored information to guarantee the validity of that message," says Atalla's director of engineering Alan Roberts. It will be up to the chip, then, to say whether the new information is valid.

If this were to occur on different chips on a printed circuit board, the information being transmitted from one chip to another could be intercepted and the secret compromised. But when it's all on one chip interception is much more difficult.

—E.K.Y.



And gambler goes for broke.
A corporate giant is ambushed.
A hot young company burns out.
Business as usual this month on ENTERPRISE.

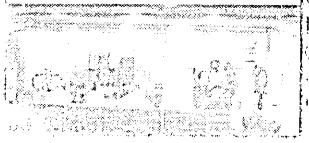


Will Bill Brodhax strike oil or strike out?

He's a wildcatter, a gambler who rolls the dice in the oil fields, drilling for the big pay-off. Tomorrow at sunup, he'll either be a very rich man or a very unhappy one.

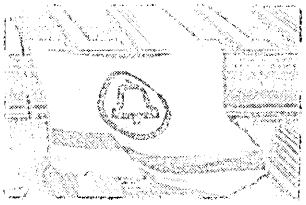
Is Japan ready for Colonel Sanders?

Kentucky Fried Chicken is opening a new outlet in Japan. What does it take for an American company to make it in the Japanese fast food business?



Can the world's largest company survive deregulation?

Corporate giant AT&T faces increasing legal ambushes on its bid to enter the communications business. But they're not taking it lying down.



Can Tom Gentry pull off a horsetrader's dream?

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Farina says his customers are requiring anywhere from 1,000 to 100,000 chips per year, but most are in the 5,000 to 10,000 per year range. At those quantities, the larger semiconductor companies usually don't want to get involved. "Most applications are in the region of a few thousand per year," Farina says, "particularly because as the complexity of the LSI goes higher and higher, the quantities of the chips go down and down."

He explains that semiconductor companies look for at least a half-million dollars of business from a customer, and thus are not likely to show a strong interest in the requirements of smaller companies. "They have a factory to support," he says, "and they want to see maybe 50 times the engineering development cost in total return for that engineer's work. So if it costs $100,000 for an engineer to design a circuit, or an engineer and some designers to design a chip, they might want to see $5 million worth of business resulting from that."

But in the last couple of years, the emergence of silicon foundries has begun to change the economic picture. These companies, with names like Comdial, Nitron, Supertex, Universal Semiconductor, and VLSI Technology, might undertake any quantity run, including one run of wafers. An engineering run will produce from five to 20 wafers, a productiuon run generally 20 wafers. The price will be from $100 to $200 per wafer, depending on the technology.

Making it simpler still, design companies like Alphatron and Micro Innovators like to take total responsibility for a job, from design to finished and tested chips. They will contract out for the maskmaking, the wafer fabrication, the testing and packaging, and sell the finished product to the customer.

Bob Knipe observes, too, that semiconductor companies haven't been willing to undertake small jobs that don't keep the factory busy. "But for us, someone says he foresees buying only 20,000 parts this year, maybe 50,000 the next, and then see the product taking off after that. That gives us, as a young company, the chance to grow right along with them, and so we'll take that kind of risk."

The design company thus becomes a bridge between the equipment maker and the semiconductor industry in helping transfer the LSI design technology to a systems company. "Then it's the design company's responsibility to guarantee the performance of those LSI chips," says Farina. It also takes responsibility for production yields and costs.

"I think that's the smart way to do it," says Mannesmann Tally's Bob McLaren. Otherwise, he explains, you must have people in-house who know their way around the semiconductor business and know about the hidden costs that may not have been explained to you. "There's a learning curve there," McLaren adds.

Richard C. Anderson of Anderson/Bogert, publishers of "LSI Opportunities," says, "Looking at the market as a whole, I think custom will tend to be bigger than semicustom."

—Edward K. Yasaki

WORD PROCESSING

ONE WORD LEADS TO ANOTHER

With the Racal-Telesystems 303 Protocol and Code Translator, otherwise incompatible word processing systems can transfer data.

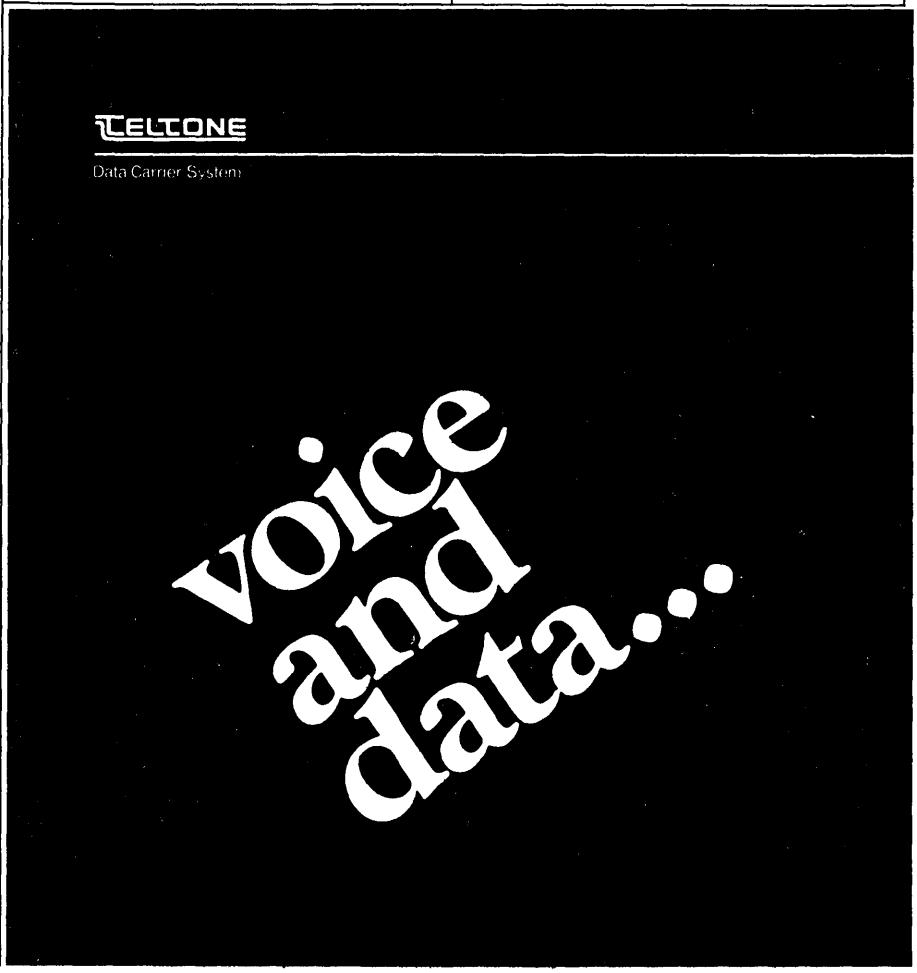
As word processing systems become more sophisticated, users are selecting them based on their ability to handle specific types of operations. In a large corporation, the legal department may prefer one word processor because of its adaptability to legal documents and the financial staff may install another system because it can handle certain types of reports. Still another word processing system will be used in office environments because of software for producing business letters and memos.

Typically, each using group selects the word processing system which is best suited to its application. After these diverse systems are operating in their basic standalone mode, management may decide that economies could be achieved if these systems were able to transmit data back and forth.

At this point, the telecommunications staff is consulted and charged with the task of making the word processors talk to each other. After examining the communications capabilities of each system, the telecommunications manager often finds that these word processors, which work so well in their own environments, are completely incompatible when it comes to transferring data.

But all is not lost. There is a way for otherwise incompatible word processing systems to transfer data. The answer lies in a device called the 303 Protocol and Code Translator from Racal-Telesystems in Chicago.

Telesystems was started about six years ago as a media conversion bureau, explains Stuart Weiner, ceo and general manager. At that time it provided a service



CIRCLE 47 ON READER CARD

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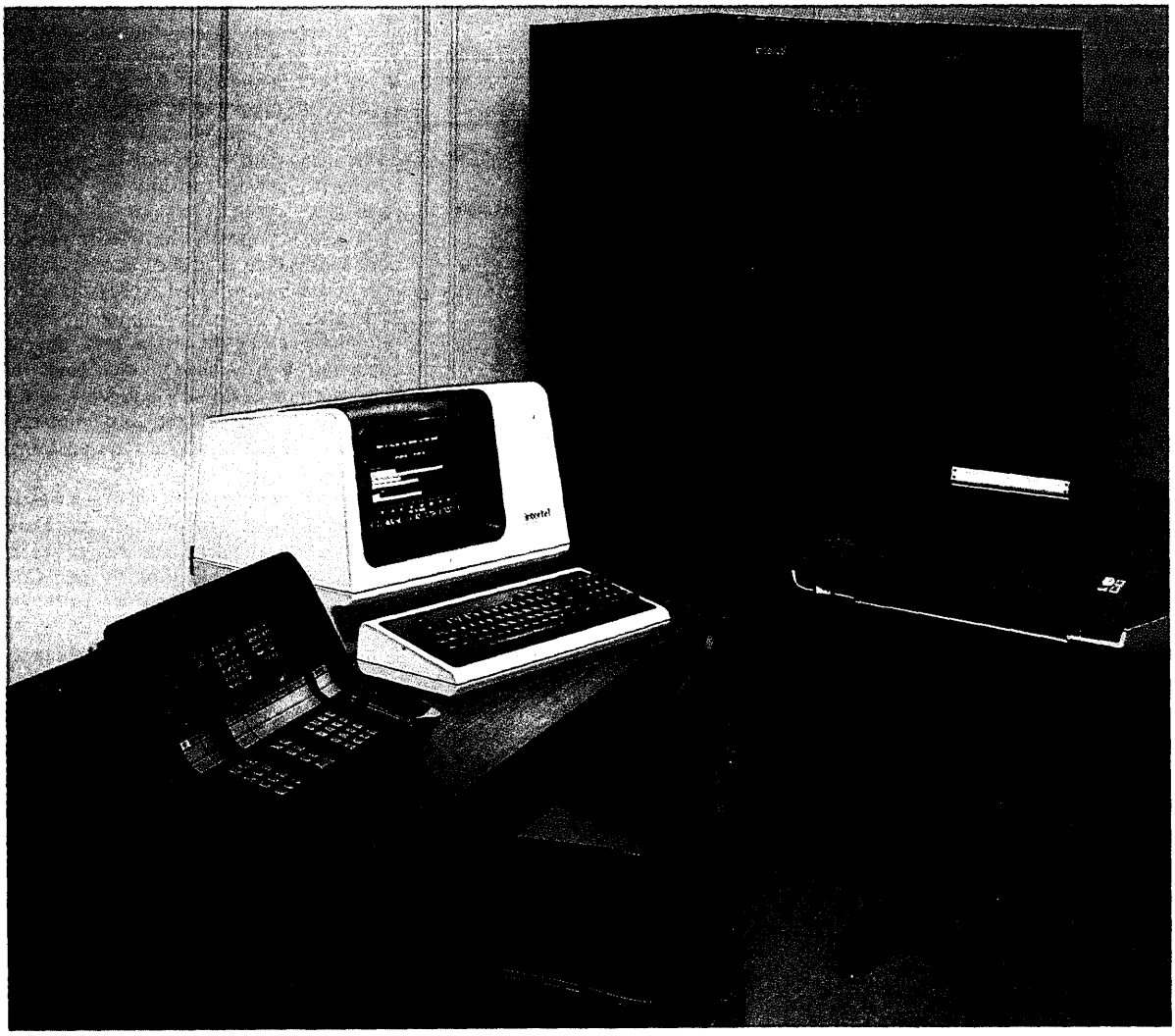

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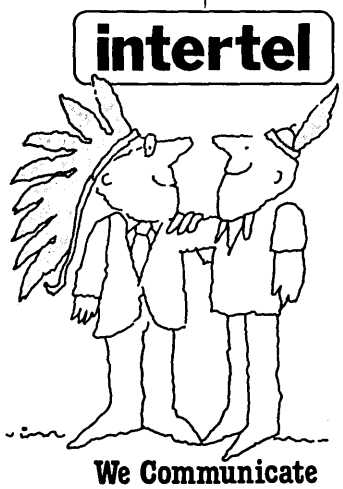


We Communicate

CIRCLE 49 ON READER CARD

for users who wanted to convert data from magnetic tape to floppy disk or a similar conversion.

In the course of developing its media conversion services, Telesystems programmers developed software that could be used to translate one data format to another. About two years ago, Weiner notes, this specialized software was adapted to a black box that could be installed at user sites to perform the translation operation in real time. In 1980, the company (then called Telesystems Network Inc.) attracted the attention of Racal-Milgo, and in July of last year the Florida modem vendor acquired the firm and changed its name to Racal-Telesystems.

At present, the 303 can handle data translation for 15 major types of word processing systems, and Weiner expects this number to grow to 20 by the end of the year. The translator uses a proprietary "internal code" which serves as a vehicle for translation between incompatible systems. The data from a sending system is first converted to the internal code and then to the format of the receiving word processor, Weiner states. Although the 303 can be used for systems operating at the same site, the translation works just as well when modems are included and the data is transmitted over dial-up phone facilities. And not so coincidentally, Weiner says the 303 works "very well" with Racal-Milgo modems.

The basic 303 is priced at $8,350, which includes two protocols selected by the customer. Additional protocols can be added at $500 each as a user acquires more word processing systems. In addition to providing compatibility between different word processing systems, the 303 can also translate data for transmission to mainframes and high-speed printers. Both asynchronous ASCII and synchronous EBCDIC protocols are supported for cpu compatibility. The 303 can also transmit data to the

The 303 presently can handle data translation for 15 major types of word processing systems.

IBM 6670 high speed printer, and support for the Xerox 5700 is coming "very shortly," Weiner confides.

Although it is primarily useful in converting data transmitted between word processors, the 303 translation capabilities are viewed by Telesystems as an alternative for such message services as Telex and facsimile. In fact, the 303 is being used by many of the company's 100 customers as a way to set up electronic mail systems using word processors at geographically dispersed sites.

Although there is little likelihood that word processing vendors will soon standardize their communications to accepted protocols used by the dp community, according to Weiner, the 303 is being considered as a box that could be built into the systems. He revealed that talks are now being held with several word processing and business system vendors to include the 303 translation capabilities inside their systems.

Telesystems is investigating the possibility of providing an interface to local data networks such as Ethernet.

The protocols implemented in the 303 are in firmware using EPROMs on circuit boards which can be modified in the field. In most cases, a single translator can handle up to nine formats which can be switch-selected by the user. While most word processors operate at 300 or 1200 bps, the 303 can handle transmission speeds up to 9600 bps, also on a switch-selectable basis.

While most of the protocols now supported relate to word processing systems, Weiner does not rule out other types of compatibility. "We're looking closely at the Xerox 820 and the new IBM personal computer," he says, adding that formats for Datapoint and Prime distributed systems might also be introduced in the future.

Beyond the translation features of the 303, Weiner says Telesystems is investigating the possibility of providing an interface to local data networks such as Ethernet. In any case, he adds, existing installed 303s will be provided with upgrade capabilities as a matter of policy.

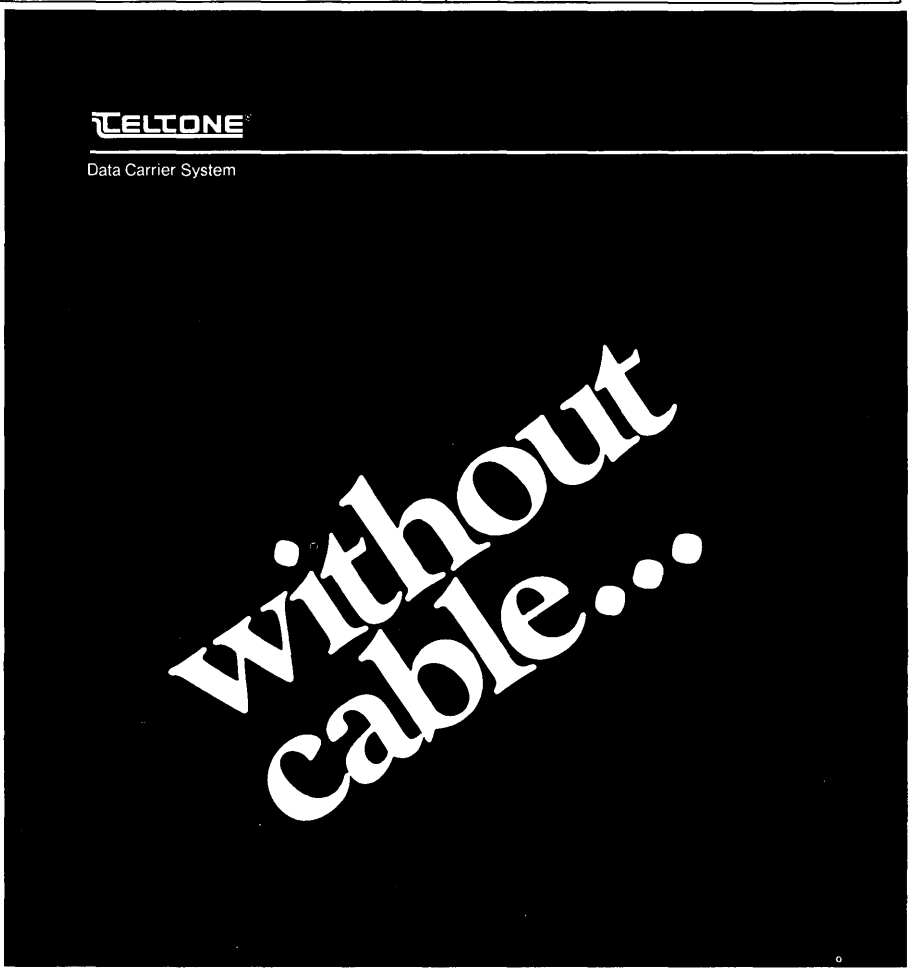
Some users of the 303 are sending their document data through a cpu to add a store-and-forward capability. This type of feature could be added to the translator along with auto answer and auto dial options. Whether such features would be part of the translator or included with associated modems still has to be determined, Weiner notes.

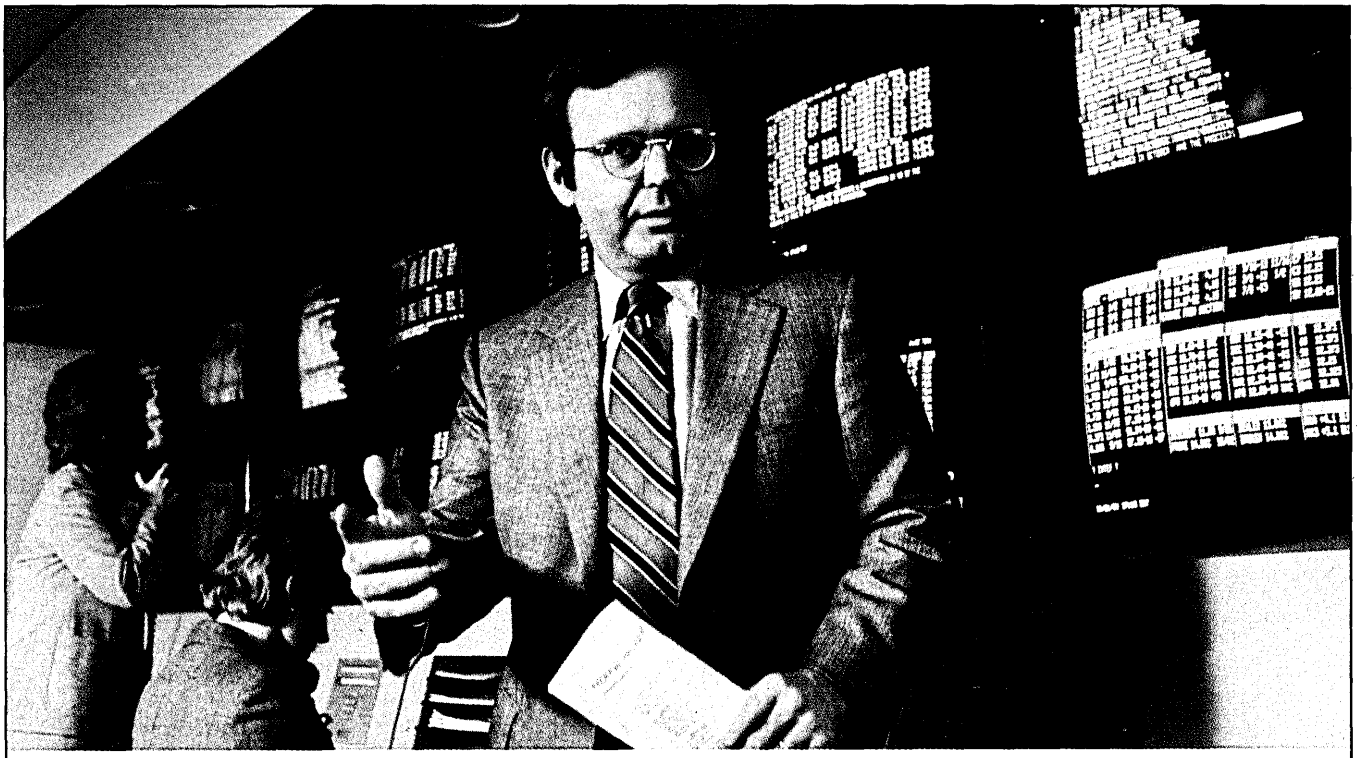
But for now most users are satisfied that their otherwise incompatible word processors can talk to each other. Among the leading types of users are law firms, insurance companies, hospitals, and banks. Many customers are in the country's top 1000 companies because these are apt to have a large variety of systems.

Telesystems sees the 303 translation capabilities as an alternative for such message services as Telex and fax.

The 303 is sold and maintained by the Racal-Milgo field force providing customers with national support for their systems. But reliability is good, Weiner claims, and most service calls are made to add new protocols.

—**Ronald A. Frank**





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CIRCLE 51 ON READER CARD

SUPERCOMPUTERS

COUNTING ON THE CDC 205

Control Data has delivered its first 205 supercomputer, but it's still too soon to tell how it stacks up against the Cray number crunchers.

Ever since Cray Research Inc. shipped its first supercomputer, the Cray 1, in 1976, the company has enjoyed a virtual monopoly in its niche of the market—a rare occurrence in the highly competitive computer industry. But the market for supercomputers is rapidly expanding, competition is picking up, and Cray is going through a lot of changes these days.

The most powerful competitor to step forward is Control Data Corp., brandishing its CDC 205, an historical competitor to the Cray machine that dates back to the days when Seymour Cray himself worked at Control Data. During the mid-'60s through the early '70s two projects were running simultaneously at Control Data. One was the ill-fated Star 100; that research led to the 203 and later the 205. The other was the CDC 8600 project under the direction of Cray, which led to a new company and the Cray 1.

"[The CDC 205] hasn't made as big an impact as we thought it might," said Cray Research president John Rollwagen. But that is not to say Cray is writing off its old competitor. To the contrary, Rollwagen views the 205 as competitive across the board. "That's the way we think of it; that's how we deal with it."

It is not yet clear whether the CDC 205 is gaining orders based on its price or its performance.

With only one 205 delivered, it's far too early for sweeping statements about each system's strengths and weaknesses, and who is going to outsell whom. Looking at Cray's upcoming production schedule is no tip-off either. Cray has more than enough orders to keep its production lines humming well into 1982. Although it should be noted that most of those decisions to buy were made before the 205 had matured from a "paper tiger" to a piece of hardware or, later, without benefit of a completed benchmark test from the 205. Several customers who ordered a Cray and not a 205 expressed concern about Control Data's dedication to the 205. With so many other products to support, slipped delivery dates on the 205, and missed benchmark tests, users have been speculating about CDC's commitment. "After all these years, you wonder why they don't have more software support for the 205," commented one customer at a site where Control Data had entered its name on the bid list but did not participate in the benchmark tests.

Another customer who recently bought a Cray indicated that CDC's delivery dates were a factor in their decision to go with Cray. Although Control Data would not comment on its production capability, a Minneapolis source said the company is producing one 205 per month. Plans are to kick production up to three every two months by the end of the year. Cray expects to produce 16 systems next year.

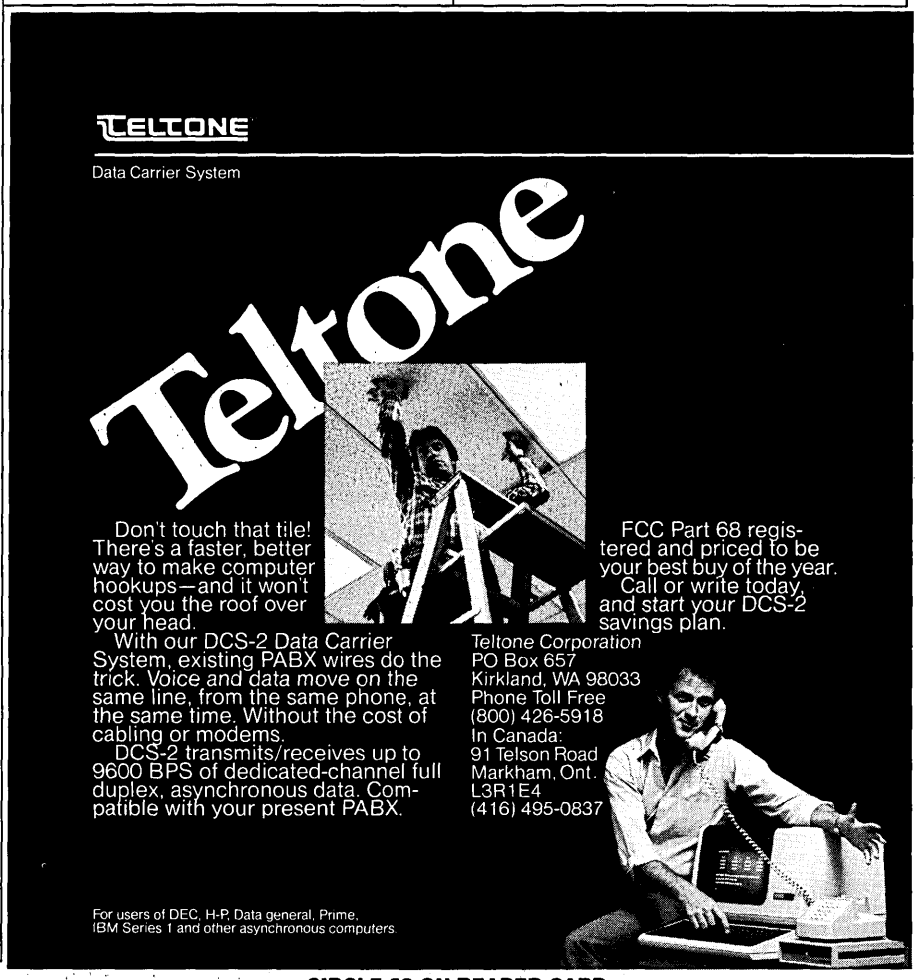
Control Data is winning orders, make no mistake about that. But it is not yet clear whether the 205 is winning on its price or its performance. It wouldn't be the first time a newcomer has sacrificed profits for market share. Among those who have ordered or indicated they plan to order a 206 are the U.K. Meteorological Office, Bracknell, England; the Geophysical Fluid Dynamics Laboratory, Princeton, N.J.; Standard Oil of Ohio, Cleveland; Bochum University, Bochum, Germany; Colorado State University, Ft. Collins; NASA-Goddard Space Flight Center, and another commercial sector customer who has not given CDC permission to release its name. Control Data refused to confirm three other orders that are rumored to be pending.

The only customer that has taken delivery on a 205 is the U.K. weather center in Bracknell. Delivery, although four months behind a February date discussed the first of this year, went "extremely well" and the machine itself is functioning "excellently," according to Paul Graystone,

A significant difference between the Cray machine and the CDC 205 is their scalar capabilities.

assistant director of the office. The contract, however, calls for the 205 to be linked to the office's IBM 360/195 and 370/158. That linkage has yet to be completed.

Said Graystone: "We are very pleased with performance and reliability—it can reach just about 400 MFLOPS [million floating point operations per second] for our particular sorts of problems. Development has gone very well indeed, apart from one thing. The actual [hardware and software] link to our existing IBM machines is not yet implemented. That, of course, is part of the contract." At present, the 205 is working with its own front-end, a Cyber 170, but that was always in the plan. From the first, said



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CIRCLE 53 ON READER CARD

Graystone, "it was known that development of the software link to the IBM mainframe would be problematic."

When Graystone was asked if the Cray were able to reach 400 MFLOPS, he said he'd "rather not answer that directly. It obviously wasn't the fastest machine we could get for the sort of problems we have to cover and for the sort of money we have to spend." It never became clear whether price weighed more than performance in the decision to go with CDC.

The latest Cray, the Cray-1 S with expanded buffer memory, sells in the range of $9 million to $17 million, while one 205 goes for between $7.5 million and $16.5 million. As for Cray's "top end," in the best possible situation, a theoretically proven situation, the Cray can do just over 200 million floating point operations per second. However, Cray answers questions about its speed by saying the machine runs between 50 and 150 MFLOPS when doing general scientific processing. The U.K. installation was not a general scientific situation; it was more a specific problem situation.

Howard Frazier, assistant director at the Geophysical Fluid Dynamics Laboratory in Princeton, N.J., said those vendors who bid on its contract had a fixed number of dollars to work with. The winner would be "the one who could provide the most production units."

Part of Cray's defense strategy includes spending 15% of annual sales on R&D.

Given a specific series of code to run and several benchmarks later, the 205 came out the winner. "They won the procurement because they guaranteed us more production units," Frazier said, then added, "and they were not unimaginative in the way they went about pricing the thing." Control Data bid two 205s front-ended by a Cyber 720 against a Cray-1 S with an expanded buffer memory and an Amdahl front-end. Frazier was reluctant to give a specific price estimate. The lab received its Cyber 720 this August; acceptance of the first 205 is slated for next June; the second is scheduled for August 1984.

Frazier noted that the kind of problems his lab runs are similar to those run at the U.K. Meteorological Office. He also acknowledged that the Cray was faster when doing scalar functions—problems that have to run sequentially, one calcuation after another, because the result from the first calculation is required in the next function. When it came to the type of vector problems his lab is doing, however, the 205 churned them out faster than the Cray. A vectorized problem is one that can be broken into elements, groups of numbers, that require the same manipulations and can be run simultaneously. Frazier also pointed out that the 205's vector capability had been "enhanced" over the 203's.

A significant difference between the Cray machine and the 205 is its scalar capabilities. Contracts have been lost and won because the scalar speed reduced the system's overall production ability. At present, because Cray is faster, several people indicated, that gives Cray an edge when doing general scientific processing or any kind of problem where there is a mix of scalar and vector problems. According to Peter Appleton-Jones, Cray vice president of marketing, his company's experience in the supernumber-crunching world has been that most problems are a mix of scalar and vector. Dan Turner, with the computer center at Exxon Production Research Co., Houston, which recently purchased a $17 million Cray-1 S/4400, agreed: "Everything is not a vector problem. There are a lot of decisions that have to be made in scalar-type situations."

Those who know the business of general scientific computing know how risky it is to try to predict who will "outperform" whom. It's almost a case by case chase, depending heavily on how users structure their problems and what their criteria are for measuring a computer's performance. "Everything is problem dependent; you have got to be careful in making generalizations," warned Frazier, who has experience with several superfast computers, including Texas Instruments' now defunct Advance Scientific Computer.

While Control Data may be the main competitor to Cray, it is not the only contender attracted by the growing number of customers who need big number crunchers. Others include Denelcor Corp.'s heterogeneous element processor, the ICL distributed array processor, Univac's Data West array processor, Floating Point Systems' AP190B and, inevitably, "the Japanese."

"The problem with multiprocessing array processors is arranging the problem so that all the computers are working at the same time," commented Rollwagen. He agreed that these computers lend themselves well to certain problems, such as tracking incoming missiles or doing image enhancement.

None of the contending computers have been shipped in "significant" numbers, reports an Auerbach Computer Technology report. However, the report singles out Floating Point as having been more "successful" than the others. "Some questions remain, however, as to whether array processors serve the same market as the Cray-1 S," the Auerbach report states.

As for the Japanese, Rollwagen has heard they have "specifically targeted" the supercomputer business with a machine that is to be 67 times more powerful than the Cray. That's good news and bad news for Cray, he added. "The good news is the Cray-1 is reinforced as the standard of the

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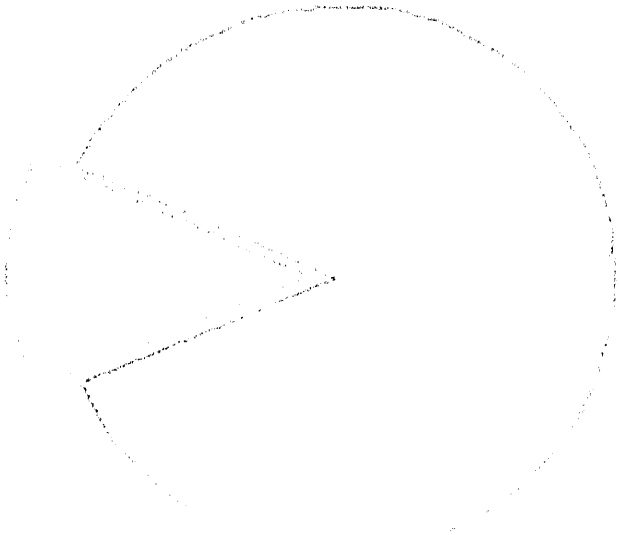
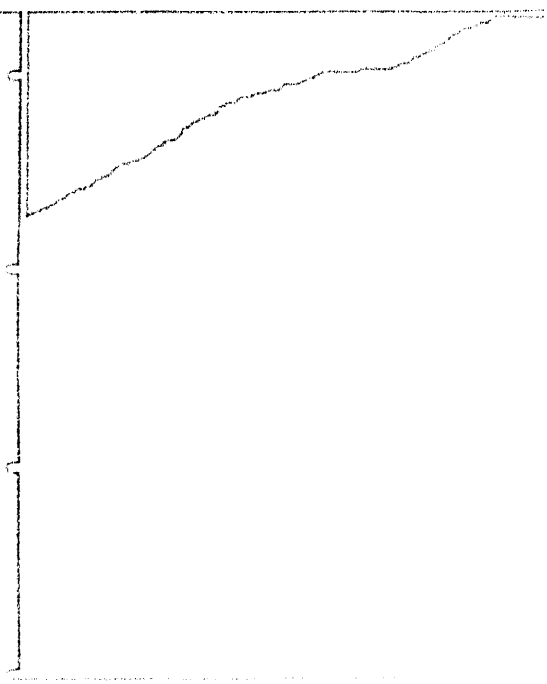
CIRCLE 54 ON READER CARD

SEPTEMBER SALES





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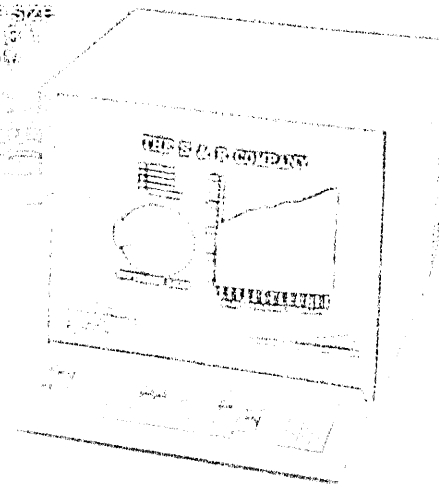

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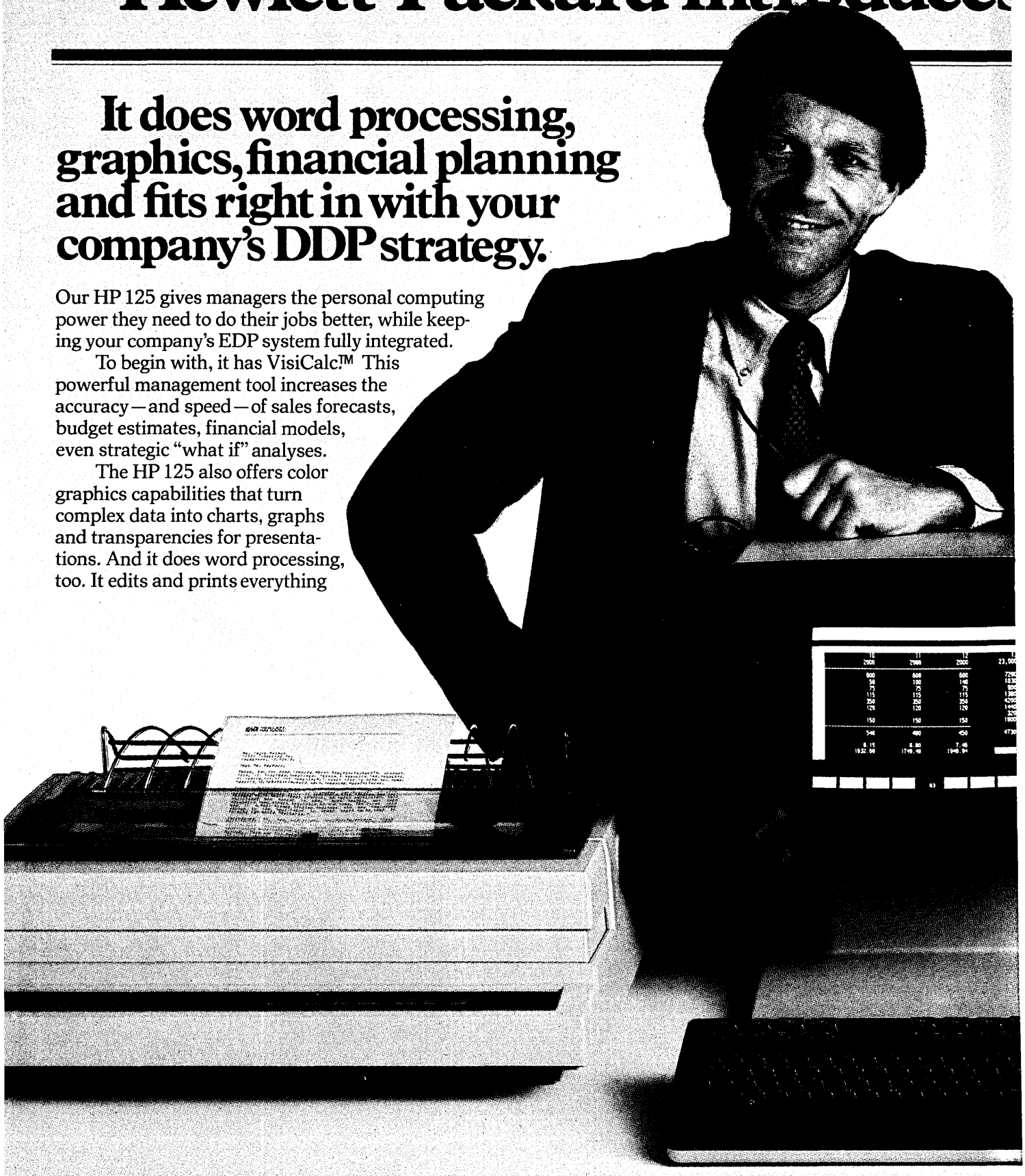

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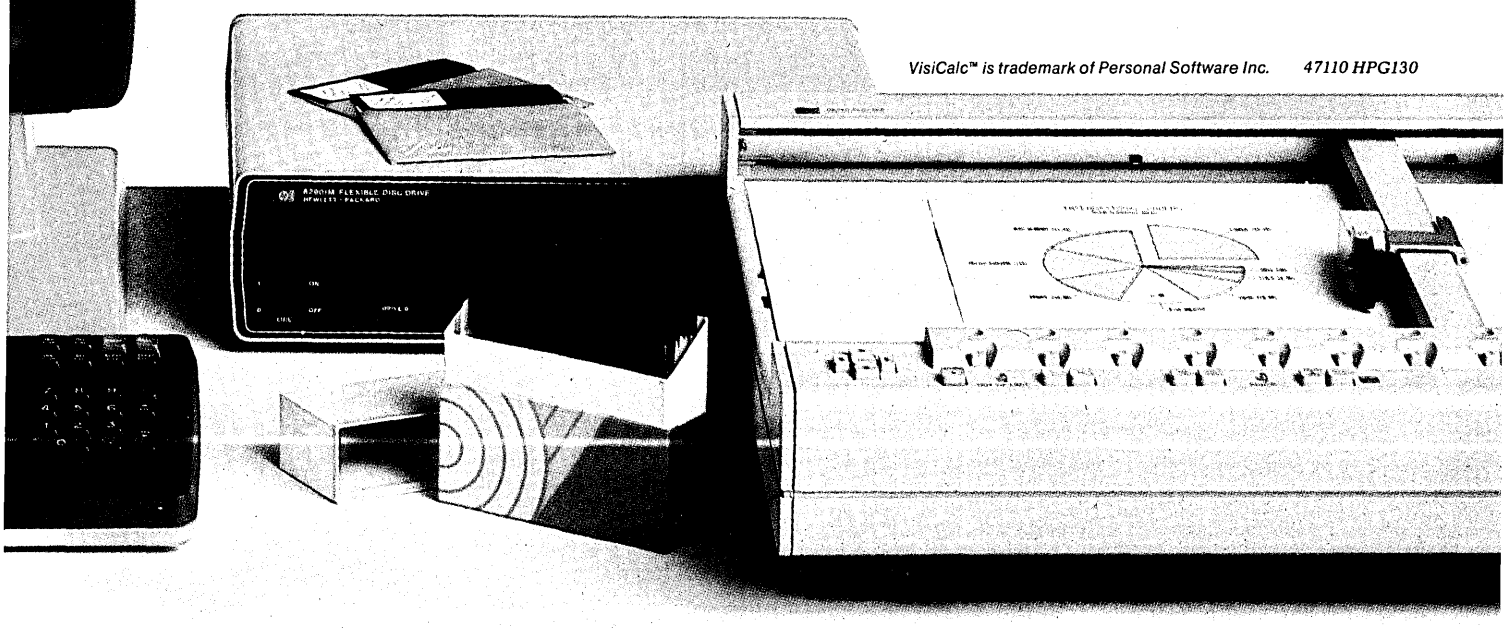

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industry. The bad news is they think they can do it. But in fact, and I don't want to tip them off or anything, 67 times may not be good enough. Our only defense is to stay ahead of them."

Part of Cray's defense strategy includes spending 15% of its annual sales revenues (1980 revenues were $60 million) on R&D for enhancements and new products. That's about $12,000 per employee. The big ace on hold, though, is the Cray-2, which is to be announced sometime between now and, possibly, 1984. "Development is well along," reveals New York market analyst Ulric Weil, with Morgan Stanley & Co. The decision to announce will depend, he thinks, on when Cray believes it needs the Cray-2. The "need" may come sooner than originally thought, say other observers, if the competition makes too many inroads into Cray's domain.

What's inside the Cray-2 is something everyone is speculating on. As the announcement date moves closer and Seymour Cray gets more excited, he has been heard to say the "2" may be 10 times faster than the "1." Cray corporate prefers to go on record with a more conservative number; it expects a four to five fold improvement in performance. Some of that gain will be realized through more compact chip designs.

At present, emitter coupled logic (ECL) chips with only two gates per chip constitute the workhorse inside the Cray-1. There are two competing technologies for that chip's replacement. One is a 16-gate ECL chip being developed by Seymour Cray and six coworkers at the Chippewa Falls, Wis., facility. The other is the application of very large scale integration (VLSI) technology. "[At the Cray research center] in Boulder they have two electron beam machines that can tailor chips on a wafer," said Rollwagen. "That would allow us to custom design our VLSI gates. That really is the leading edge of technology. It is being explored there with the idea of implementing the Cray-2 design with that capability." If the company goes with the E-beam approach, Rollwagen believes that would be a "major accomplishment. Engineers could work from Boolean arithmetic, which is the way we express logic in circuits, to a completed prototype in 10 days."

In comparison, the 205 is built with ECL technology, but its design calls for 168 gates per chip.

In addition to hardware changes taking place inside the Cray, some important changes are taking place outside the Cray in its marketing organization. Offering software applications and services has not been a Cray objective. It's been a hardware company catering to the biggest and the best; handholding was not its forte. That's all changing now, and the changes reflect Cray's changing customer base.

"As we broaden our base—we now figure 250 to 300 people as potential users, where before we were looking at between 80 and 100—many of those additional customers, probably all of our new ones, are commercial accounts that are not nearly as excited about the computer per se as they are about solving technical problems," explained Rollwagen.

Today, the company is actively seeking application packages that can be converted to run on the Cray, offering free computer time to assist the development process. Among those that have gone through this process are MSC/NASTRAN, a structural analysis program used especially by the transportation industry, and SASI/ANSYS, a large-scale general purpose program for three-dimensional, infinite element analysis.

"Again," said Rollwagen, "in these areas people don't care so much about computers; they care about engines, planes, building cars. So we see this market developing and we see it best served not by a Cray-2 over the intermediate term at least but by the Cray-1." Contrary to what several industry analysts thought, Cray had not planned to support and market the Cray-1 after the Cray-2 made its debut. That, too, has all changed now.

"This new group of users wants solid, reliable performance that can fit into existing systems and has a set of applications programs already available," Rollwagen said. "So we have committed this year to continue to support the Cray-1 probably all the way through the decade, but at least for the foreseeable future."

—Jan Johnson

PERIPHERALS

CII-HB HITS U.S. SHORES

After several years of quiet activity marketing disk drives in the U.S., the French computer firm has set up Cynthia Peripheral Corp., California marketing arm.

In the past it usually has been U.S. peripherals manufacturers that have brought their wares to foreign shores and, often enough, dominated local markets despite the best efforts of overseas suppliers. Now, however, French computer giant Compagnie Internationale d'Informatique-Honeywell Bull (Cii-HB) has taken aim on the U.S. peripherals market with an intent to boost sales of its disk drive line here.

A new marketing arm, Cynthia Pe-

ripheral Corp., has been set up in Palo Alto, Calif., under the leadership of Ivo Adam, formerly a director of sales at floppy disk leader Shugart Associates. Adam has been given the task of establishing Cii-HB's presence in North America after a not-so-successful single-handed attempt orchestrated from an office at Honeywell Information Systems' headquarters in Waltham, Mass.

"We've been given a big budget and our charter is to go get the market," says Adam, a bearded man whose Continental accent belies the fact of his birth in Egypt. "I'm in the process of hiring an aggressive sales and support team. We should have about 20 people on board by the end of '81."

While Adam declines to say exactly how much business the firm has been doing here in the U.S., he says he will attempt to double sales over the next year. The majority of that business will be in D-100 disk drives, a line of products which Cii-HB developed itself and which is hoped to be attractive to builders of small computer systems needing high-capacity storage in small boxes.

For the past several years Cii-HB's only large disk customer in the U.S. has been Datapoint, the San Antonio maker of small computers. Datapoint ordered an undisclosed number and value of drives about two years ago, after having selected the French supplier over a host of U.S. bidders. The order accounts for about 80% of the company's U.S. business, says Adam, who adds that "a few thousand" drives have been delivered to Datapoint so far.

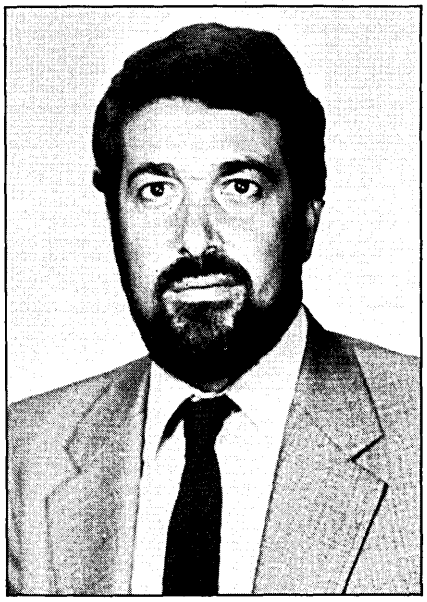
Headed by former Shugart Associates sales director Ivo Adam, Cynthia Peripheral will market an already proven line of disk drives.

"I think Datapoint will still be a big customer next year," Adam notes.

Cii-HB's desire for a strong push in the U.S. oem peripherals market is understandable. The U.S. market represents 70% to 80% of the worldwide oem peripherals market and is therefore a must for participation for any company wanting to maintain sales growth and technical expertise.

The Cynthia Peripheral operation is actually Cii-HB's second attempt at hitting the U.S. market in a big way. It tried in 1979 to buy System Industries, a West Coast disk subsystems supplier whose marketing force was seen as a good chance to avoid the difficulties of building a sales force from scratch. System Industries buys disk drives from various manufacturers, not including Cii-HB, packages them with controllers, and sells them to oems and systems houses using Digital Equipment and other minis.

Unfortunately for Cii-HB, the deal fell through when System Industries was unable to sell off its ink jet printing operation, Silonics, and Cii-HB was left to depend on a sole U.S. oem marketing employee, Jean-Paul Garodel.



IVO ADAM: "We've been given a big budget and our charter is to go get the market."

It was Garodel who secured the Datapoint order which, according to Adam, has gone a long way towards credibility to the company in its quest for more U.S. business. So far, however, that business has not yet turned up any large orders, at least none that rival Datapoint's.

Adam, however, plans to change that, relying heavily on the manufacturing and technical strengths of the French company. He notes that Cii-HB's Belfort plant, close to the West German border, employs some 2,000 persons building peripherals of all sorts. Cynthia, he says, will only sell disk drives at first. Printers may follow.

As for technical leadership, the D-100 line of drives is certainly a peculiar one compared to those offered by most U.S. and overseas manufacturers. Its most obvious difference is that it uses a 10.5-inch platter, unlike the 14-, 8-, and 5¼-inch disks employed in almost every other manufacturer's drives. Moreover, it uses thin-film head technology, which has so far appeared only in IBM's high-end disk drives and a few smaller Japanese models. And, to go along with the thin-film heads, plated disks rather than coated disks are used to boost recording densities.

The D-100 line, developed under the code name Cynthia, comes in three models: the 10-megabyte removable D-120 drive; the D-140, offering 10 megabytes each of fixed and removable capacity; and the D-160, offering 120 megabytes of fixed storage. Each drive is fully formatted and packaged for installation in small systems where size and weight are critical, Adam notes.

The low-end drives, he adds, use a single platter, a configuration that prompted the firm to adopt imbedded servo technology so that both surfaces of the platter could be dedicated to storing user data rather than devoting one to control read-write arm movement. This imbedded servo technology has been discussed for many years in technical literature but has seen little use in production disks because of the additional sophistication required in the surrounding electronics in the drive. He says the drives are able to record at densities of up to 500 tracks per inch and therefore store more data on a single platter than other manufacturers' products.

Moreover, the removable storage feature of the D-120 is expected to be attractive to oems here in the U.S. who want to provide a low-cost means of backing up mass storage. In fact, Adam claims, the 8-inch removable drives appearing on the market over the past few years have copied Cii-HB's design in coping with contamination of the recording surfaces and maintaining alignment of disk and head geometries.

The primary negative factor in Cii-HB's previous attempts to crack the U.S. market has been its distance from customers, a situation Adam hopes to solve with a U.S.-based support staff that can help customers integrate the disk drives into their systems. Some work will be done in France, he notes, but at least now U.S. users will be able to get some degree of local support and technical assistance.

The aggressive move into the U.S. market comes a year and a half after Francois Peleyras took over the French firm's oem, licensing, and joint venture efforts. He is said to have convinced top management that a push into the U.S. would benefit the corporation's overall oem marketing activities.

Peleyras says worldwide sales of the Cynthia disk line will total between $10 million and $12 million this calendar year. Sales targets for Cynthia Peripheral are between $25 million and $30 million for 1982, he says in his offices in France.

The French company's main success in the U.S. has been a large order secured several years ago from Datapoint.

Asked about the recent strengthening of the dollar, Peleyras rubs his hands with glee because the disk line in the U.S. is priced in dollars and not francs. "France needs dollar revenues," he says, adding that the government will be unlikely to interfere with anything which allows France to earn dollars from exports.

The Cynthia line is almost totally manufactured in France, and imported components represent only a small percent of the sales price. Countering suggestions that soaring European production costs will soon nullify the dollar exchange rate advan-

X.25

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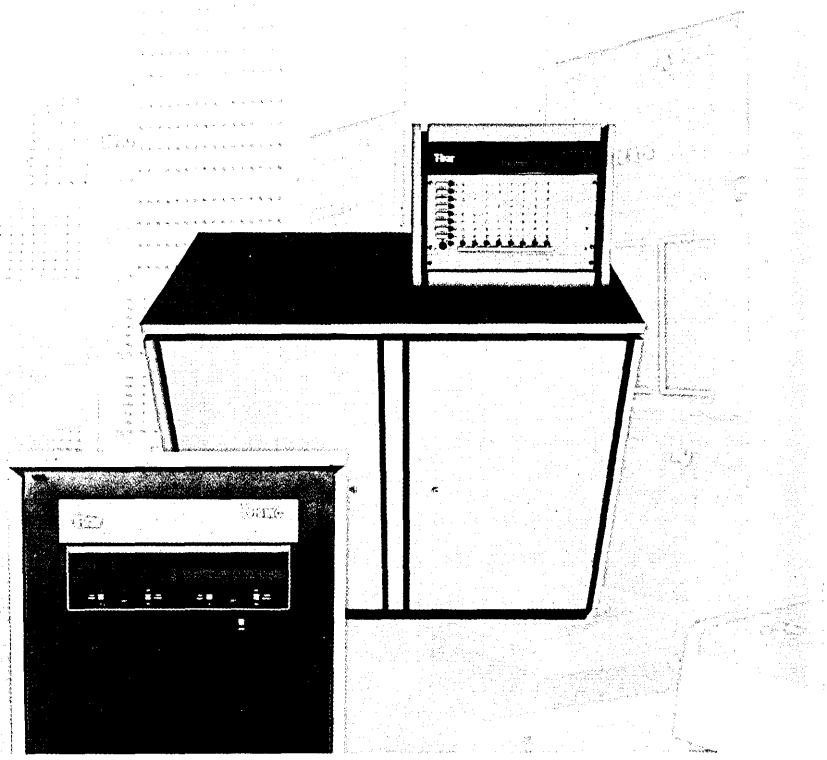

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CIRCLE 61 ON READER CARD

NEWS IN PERSPECTIVE

tage, Peleyras says that labor content is minimal. "In some disks, it is less than one man-hour [per disk]," he states.

Adam claims that Cii-HB has delivered some 10,000 Cynthia drives to date, far more than most competitors have delivered. That kind of field experience, he says, will go a long way towards assuaging customer fears of such "foreign" technology.

Adam's background includes working at a European distributor that handled Shugart floppy disk drives and then a stint at Hermes, the Swiss firm that also sold computer peripherals. Adam was hired by Shugart in 1975 to set up European marketing operations and was instrumental in boosting that firm's penetration of the market. In 1978 he moved to Shugart headquarters in California, where he was responsible for international sales and last year was named to head up domestic sales.

Among his plans for marketing the Cynthia disks to U.S. customers is an idea to put together DEC-compatible subsystems using Xylogics controllers. The subsystems would compete, he says, with DEC's RL01/02 products.

His primary aim, however, is to remain "flexible and responsive" to the U.S. market while relying on French production and backup. His mission is a clear-cut one, but he will face stiff competition from the likes of Control Data, Shugart and the host of suppliers who in recent years have flooded the market with 8-inch and 5¼-inch disk drives in attempts to supply the burgeoning small systems market.

—John W. Verity and Andrew Lloyd

COMMUNICATIONS

NETWORK USERS UNITE

Newly formed Network Users Association hopes to get vendors to unite for the purpose of setting network standards.

Large computer-network users, hoping to provide an impetus to the establishment of network standards, have formed the Network Users Association (NUA). At its first meeting in Seattle, Wash., last July, the group voiced its unanimous support of the IEEE 802 local networking standards effort, saying it looks for these standards "with the fewest possible options," and also of the National Bureau of Standards' network protocol standardization efforts.

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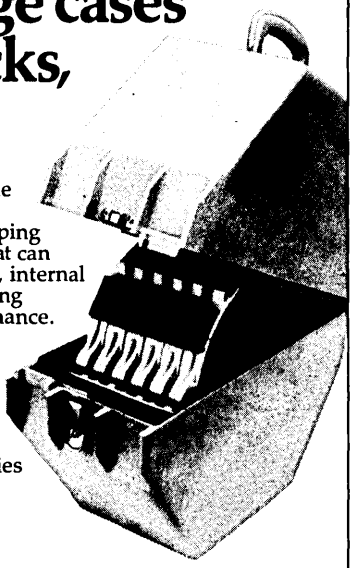

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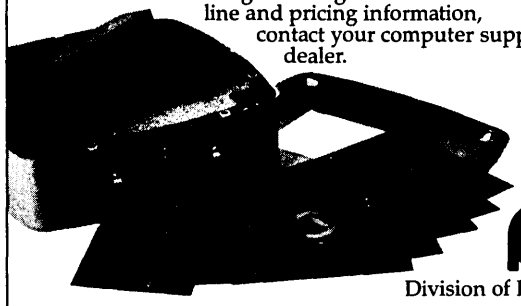

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August 28, 1981

NEWS IN PERSPECTIVE

If there is a direct correlation between the purchasing power of the association's member companies and its impact on the equipment vendors and standards-making communities, this group should prove very influential. The NUA, only some six months old, consisted in mid-August of 41 user members, along with 35 associate members from the world of equipment vendors. But the users are primarily very large corporations, such as Atlantic Richfield, Boeing Computer Services, Chase Manhattan Bank, Dow Chemical, Ford, GE, General Motors, and the like.

"The biggest problem that users are facing right now is the linking up of different manufacturers' mainframes," explains Sheldon R. Blauman, chairman of the NUA. Hardware that enables one to connect disparate devices exists, he adds, but once the hookups are made the various pieces of

Among equipment manufacturers, it's difficult to find a neutral party that's willing to develop a protocol compatible with all machines.

equipment might still not understand each other. "In line with that, we need the higher level procotol standards that are being developed within ISO [the International Standards Organization] and ANSI [the American National Standards Institute]." Lacking those standards, the user is left to his own devices. "And once you've done that, *your* system is the only one that understands that language."

Dow Chemical Co. in Midland, Mich., is heavily involved in local networking and is at the forefront of the broadband cable technology. And in local networking, with a need to get diverse devices to talk to each other, things like the IEEE 802 standard "are very important," says Dow's Marvin W. Rahm. They want to get things like executive terminals and word processing machines to be compatible. "We need some standards to have unlike devices [including computers] communicate," Rahm adds.

This need has already been identified at Dow, as at many other computer sites. "You usually end up solving the problem yourself by writing special software or designing hardware, and that's not the answer," Rahm says. Not only is it "extremely expensive," he continues, but you end up with a one-of-a-kind system that only the designer knows anything about. "And that's not a good solution."

"The entire effort to tie together different manufacturers' mainframes is potentially very costly, very difficult, and leads to a dead end unless there are standards," says Blauman of Boeing Computer Services. "So, as a user, I just don't see any other intelligent way to handle communications between different machines except through standards."

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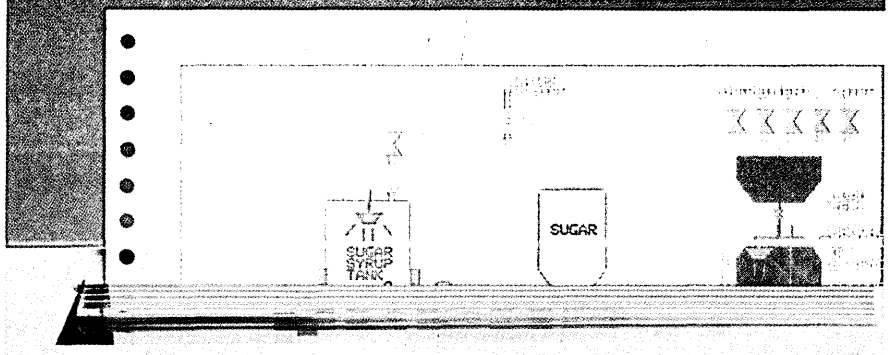

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Among equipment manufacturers, he adds, it's difficult to find a neutral party that's willing to develop a protocol compatible with all machines, one that is machine-independent. A protocol, like an operating system, is something that must be maintained and updated and expanded as needs arise. "That's why the protocols really can't come from a manufacturer or a vendor of software. They really must come from a standards organization." The NUA, he explains, will not be developing any standards. "All we want to do is encourage the process."

NUA will provide technical direction to the standards-making bodies.

Not all the members, however, are convinced that such an organization, although it represents a lot of purchasing dollars, can wield much power. "I think the vendors will have to be convinced that what [the NUA] is saying is in accordance with what [the users'] requirements are, and that the group, indeed, is going to act in a united fashion," says another member, Paul Emmerich of the Salt River Project in Phoenix, Ariz. He thinks the formation of the group is significant, but says we'll have to wait to see how effective it is. Emmerich looks forward to the NUA providing technical direction to the standards-making bodies and getting technically knowledgeable users on, for example, ANSI committees and subcommittees.

And that's what the young association has begun preparing to do. It has, for example, a technical committee on local networks; its chairman belongs to the IEEE 802 standards group developing the local networking protocol. The NUA also has a committee looking into higher level protocols, trying to get members to become active as individuals on ANSI standards committees. A third committee is looking into broadband nets, where the development of standards at this time might be premature. But the NUA, according to Blauman, wants to see some standards in the spectrum allocation—how this broadband frequency range is split up, determining what channels are for tv, for radio, and for data communications, for example. "About the best we could hope to do at this point is to encourage manufacturers to stay within those guidelines," says Blauman.

Along this line, the NUA has scheduled its second meeting for Feb. 9 to 11, 1982, at the Marriott Hotel in Denver, Colo. The theme for that meeting will be the vendors and their view of standards.

The theme for NUA's second meeting will be the vendors and their view of standards.

"One of my functions as chairman of this association," Blauman adds, "will be to attempt to get ANSI to make itself more amenable to user participation. As I see it right now, that would be the biggest contribution we could make at the moment." He says the NUA lacks the technical expertise to be able to tell ANSI to adopt, for example, the NBS transport protocol as a U.S. standard. But the association would be able to inform ANSI that its members like what they see in that protocol, if that were the case, and encourage ANSI in its standards-making efforts.

Formation of an independent group to foster the adoption of a standard is not new. Some time back the MUMPS user group got ANSI to adopt that language as a standard. But it's not certain that the NUA wants to go that far. "I don't think we have to force things," such as the adoption of a given standard, says Blauman. "I think there are a lot of friendly vendors out there that earnestly want to know what users want. They sell to us. They want to know what's going to sell the best."

Dow Chemical's Rahm agrees. He not only feels it's adequate to give guidance to standards-making organizations ("They

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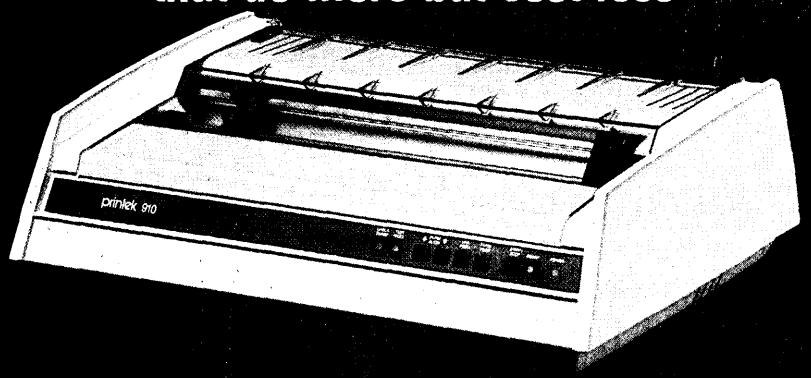

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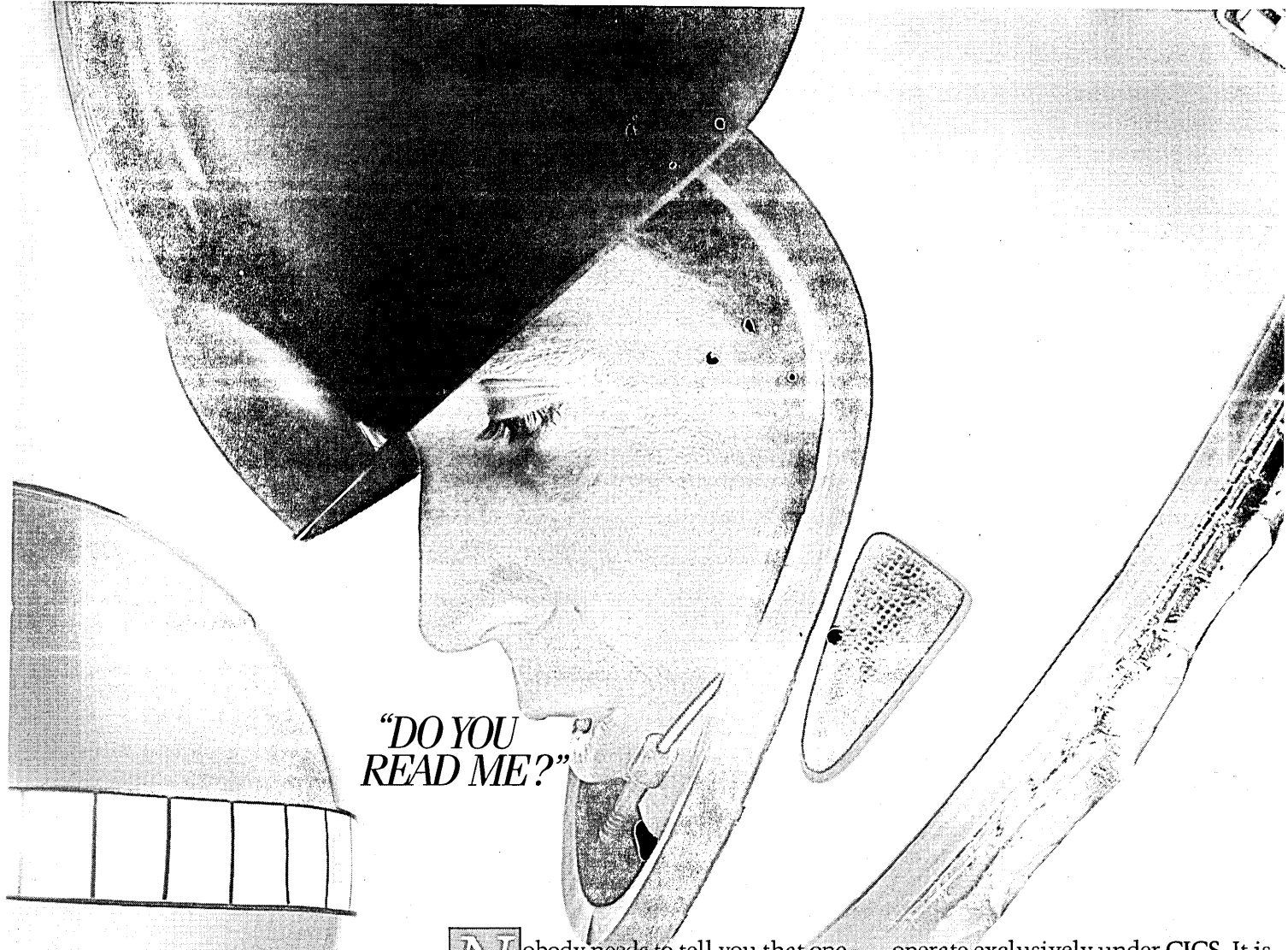

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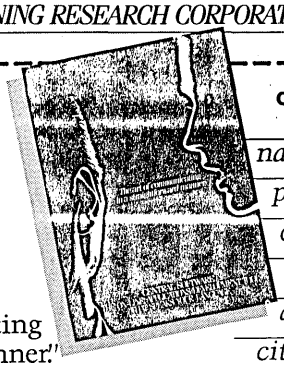

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need this kind of direction''), but also feels that the association, by describing users' needs for today and for the future, can be helpful to manufacturers of that equipment. By being vocal, he explains, ''you're doing a lot of the product research for the manufacturers.''

Blauman fends off arguments that standards tend to hold back technical development, arguing that standards are not only meant to be changed but have change processes, thus evolving as the technology changes. ''I don't think that developing a standard slows down the technical development process,'' he says. ''I think it lends order to it. It means that everybody is able to communicate among themselves while the systems are evolving.'' Having a diverse range of products to do the same thing is not necessarily progress in technology, he continues.

Referring to an editorial in DATAMATION (July, p. 25) on communications standards, or rather the absence of them, Blauman comments, ''As your editor said, it can be anarchy. And we really have to avoid that anarchistic situation.''

—Edward K. Yasaki

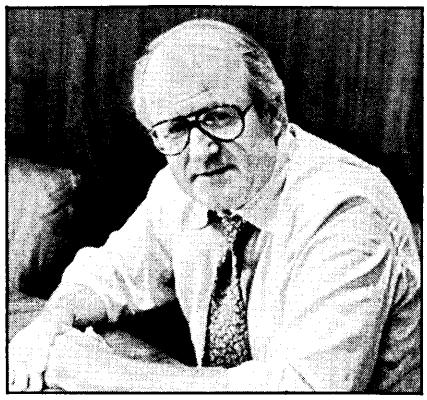
GETTING SET FOR BABY BELL

General DataComm Industries is one of many telecommunications companies that's preparing to do battle with Ma Bell's deregulated operation.

Many sectors of the telecommunications industry are trying to anticipate the impact of impending AT&T deregulated operations. Nowhere is this interest more intense than among the vendors that compete directly with the Bell System in the data communications equipment market.

One company that has been vying with AT&T for years is General DataComm Industries Inc., Danbury, Conn. Despite the power of Bell and other vendors, GDC (as it calls itself) has managed to chalk up increased revenues for 10 consecutive years, an enviable accomplishment in an industry marked by fast-paced changes and aggressive competition.

Much of the success of GDC can be attributed to Charles P. Johnson, who as chairman and president charts much of GDC's strategies. Even with impressive GDC gains in 1980, of 30% in sales to $41 million and 36% in income to $4 million, Johnson feels things could change for the worse if



CHARLES P. JOHNSON: "The problem is competing with a company that's both regulated and deregulated."

deregulation is not handled correctly.

''The problem is competing with a company that's both regulated and deregulated,'' Johnson explained. ''If you combine a regulated business which is guaranteed a profit with a deregulated business, then the parent will survive. The profits will be there while the deregulated [operation] puts everybody out of business.'' What worries Johnson and other independent vendors is that the new AT&T subsidiary will price its products artificially low, thus undercutting existing market levels.

Under the mantle of regulation, Johnson argues, there is a system of checks and balances that can be employed when Bell seems to step out of bounds. ''It's got flaws in it but it's better than nothing,'' he explained. ''Once you deregulate those types of activities, there's no place to go except the Justice Department. And you can't go to the Justice Department for damages until the damages have occurred. So the only way to prove [the loss] is to go out of business.''

But Johnson does more than warn about the evils of deregulation. He has positioned GDC in three separate market areas so that the impact of deregulation will be diffused on GDC's continued growth record.

First, GDC sells its equipment to telephone companies and other common carriers. This includes independent phone companies who may also find themselves competing with AT&T for the first time when the deregulated subsidiary goes into operation. Next, the company sells internationally either direct to users if allowed or through government-owned telecommunications agencies called PTTs. ''In some countries in Europe there are clubs, and you have to be a member of the club to sell the equipment. So what we do is license the member of the club that manufactures our technology,'' he said. While France and Germany have such clubs to divide up the business, he claimed, Britain is different and has more liberal interconnection policies.

The third market which Johnson

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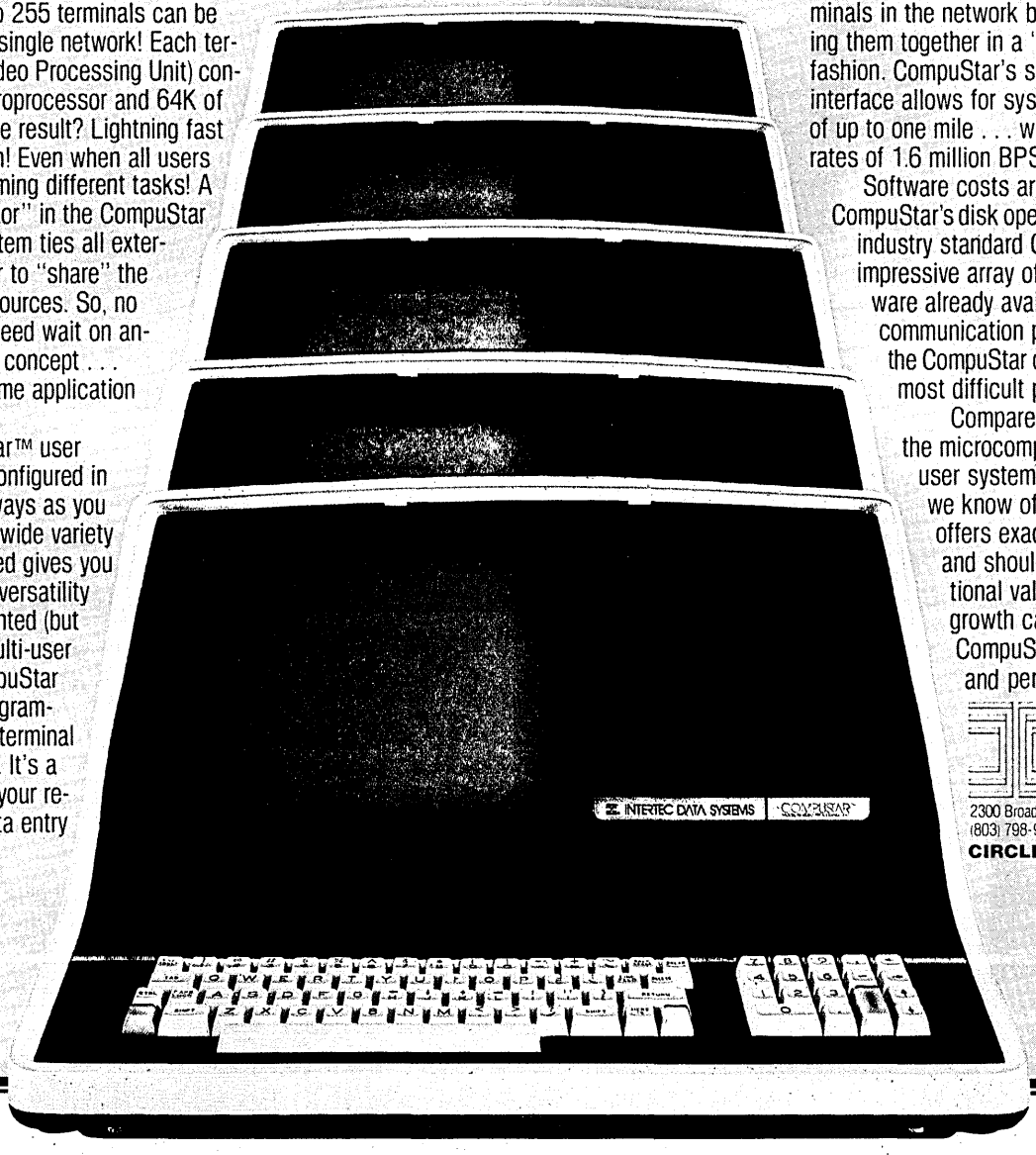

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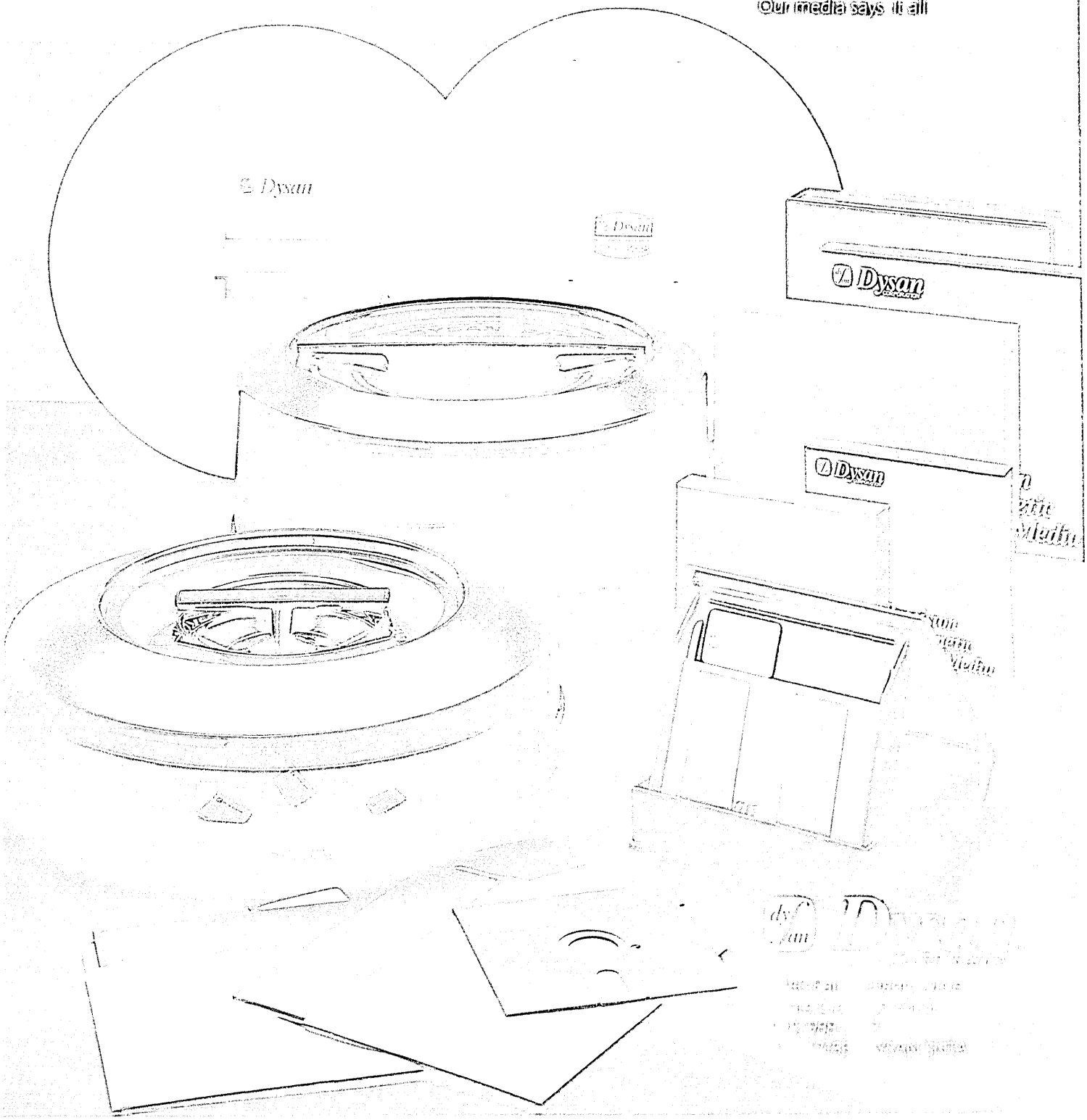

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classifies as "probably the most important" is the business user who can be either a large corporation with a nationwide network, or a company that shares the use of a switched network with other users.

Even with its regulatory uncertainties, Johnson called the U.S. the leader in usage of data communications technology "by at least two to three years" over Europe. Users on national networks generally are moving to higher data speeds since "the cost of the data set is such a small part of the cost of the system. The tendency is to get all the speed you can because your investment in the lines is much greater than your investment in the equipment connected to the line," he explained.

And most of the devices that can be connected to the line are made by GDC. In addition to modems, the company makes multiplexors, diagnostic systems, network control equipment, and even digital data sets that operate on Bell's all-digital DDS service.

Even though sales to common carrier customers have slowed this year, Johnson predicts that total sales for 1981 will show an increase. With revenues divided about evenly among the common carrier, international, and end-user markets, Johnson said GDC is currently "doing somewhere in the area of $65 million to $70 million a year," which works out to be "over 10%" of the total market. According to International Data Corp., a market research firm, the 1980 market for modems and multiplexors totaled just over $700 million.

Johnson has positioned GDC in three separate market areas to diffuse the impact of AT&T's deregulation on his company's growth.

GDC's largest modem segment is in the 1200 bps half-duplex area, where it commands 18% of the market and is second only to AT&T in total units shipped. The company is also big in 2400 bps modems, where it has 12% of the market and is overshadowed only by Racal-Milgo.

The independent telephone companies are slowing down in their modem purchases because they are not sure what will happen when Bell initiates its unregulated operation. They are "really the ones who are going to be hurt most by Baby Bell," he said. Since GDC actively sells to these companies, would Johnson consider some type of alliance with the independents to counter Bell in the marketplace?

"There's nothing wrong with that. Certainly it's desirable on our part," he revealed. But Johnson cautioned that a lot depends on whether the independents want to aggressively enter the data communications arena. "An alliance is only good if your partner wants to win."

—Ronald A. Frank

SOFTWARE

PORTABLE SOFTWARE FANOUT

Program at Texas Instruments is geared to increasing productivity of "indirect" personnel.

"Productivity is a byword at Texas Instruments," says Jim Bandy in describing the origins of a Texas Instruments program called PCIF, for Personal Computer Internal Fanout. Fanout, he explains, "is TI jargon for spreading something around, putting it out into the field." In the case of PCIF, it means fanning out personal computer capability.

Bandy directed the TI program for two years before leaving this midyear to join SofTech Microsystems, San Diego, as director of new business development. Now, technical aspects of the TI program are directed by Fritz Whittington and marketing aspects by Christine Kolberg.

PCIF got started at TI in 1977. "Management took a look at the costs of both direct [those employees actually adding value to a product in some way] and indirect [such as managers, accountants, etc.] employees as a percentage of net sales," Bandy said. "They found that for direct employees, costs as a percentage of sales were staying the same. In other words, they were under control. But the costs for indirect employees were continuing up inexorably as a percentage of sales. By 1985, 1987, and 1989, that could be a killer."

While TI had long used such productivity aids as automated assembly for the direct labor force, in 1977 no such aids had been applied to the indirect labor force.

"Fred Bucy [TI's president] began reading the brochures and marketing literature for the SR 59 [an advanced programmable calculator] and decided if it's that good for everyone else, 'by God, it should be good for us,' " Bandy recalled.

And so, PCIF. It began with an offer to all TI indirect personnel of a free SR 59 (actually centers they worked for were charged for the calculators but to the employees they were free) with the condition they take a two-day training course in its use.

A group of about 15 people was put in place, Bandy said, to build the training program, put out a monthly newsletter, conduct programming contests, and do productivity studies. "In spite of the overhead, payout took only two to three months." He

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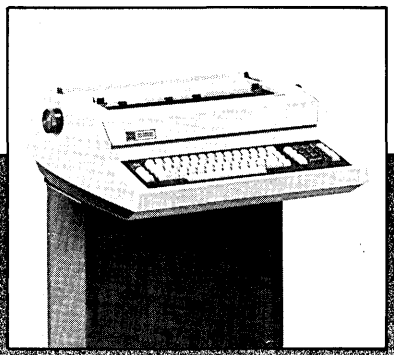

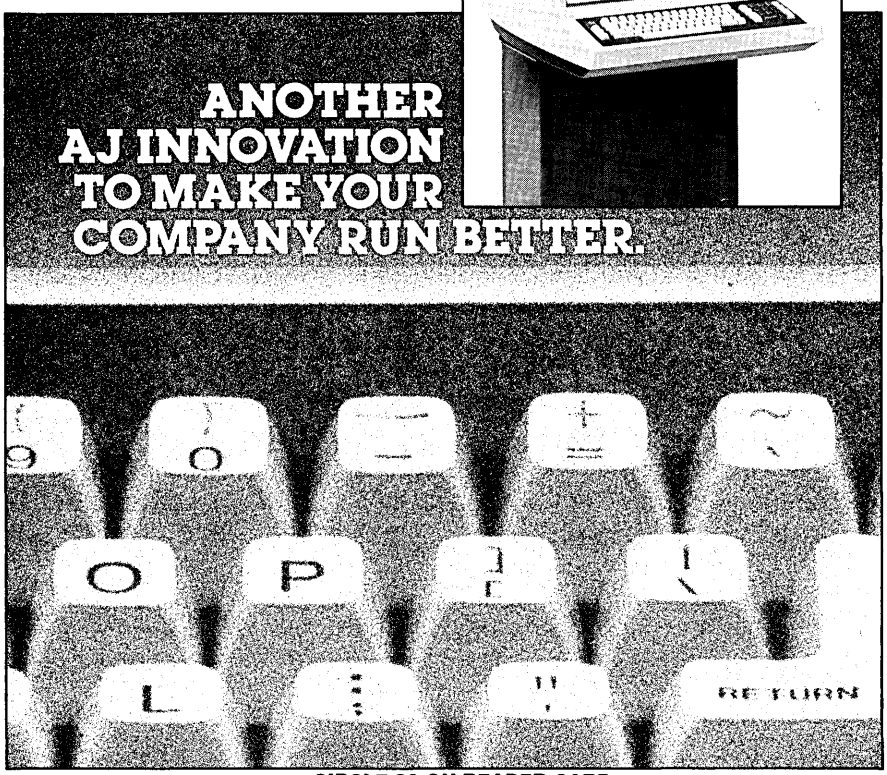

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NEWS IN PERSPECTIVE

said some 10,000 calculators were given out.

Then it began to wind down. The training portion was handed off to TI's internal learning centers. PCIF was transferred to George Helmeier, who had run the Pentagon's Advanced Research Projects Agency for three years before joining TI as the first vice president ever to be elected from outside the company.

"Shepherd [TI's chairman, Mark Shepherd Jr.] and Bucy were determined PCIF wouldn't die, that it really could have an impact," Bandy said. It was at this point he came into the picture. "They hunted me up. I had been a financial planning manager."

The program at that time was tied to a small business computer under development. "It was minicomputer-oriented," Bandy said. "When it became evident to me that the small business computer program was going to be canceled, I looked around and saw that closer at hand were all these things we were calling intelligent terminals that were really computers but without any software."

Bandy brought in the UCSD P system, the portable language system developed at

The training portion was handed off to TI's internal learning centers.

the University of California, San Diego, and licensed by SofTech Microsystems. "Using the P system I brought up compilers in Pascal, FORTRAN, COBOL and a high quality BASIC," he said. "Portability was important to us. We soon had our software running in 28 different hardware environments."

He recalls he had a "tough way to go in the beginning. The P system didn't have TI's official stamp of approval and there was one vp looking for my head on a platter, but I was backed all the way by Helmeier."

Today, PCIF's staff of eight people is mainly involved in the enhancement of P system-based software and the selling of it internally. "We can't give it away. We have to sell it," said Kolberg, "but it's had good response throughout the company." She said the Semiconductor Division is making the most use of the PCIF software. "I can't explain that. We are making inroads in other divisions."

She said the staff keeps "close tabs on all of our users and we've noted tremendous savings of time." Financial forecasting seems to be the most common use.

What the PCIF staff offers is a basic P system and some applications packages including word processing, a data entry program, a mathematical program called Free Form which Kolberg describes as "like a three-dimensional VisiCalc," and a communications package which enables users to access the TI network with their standalone

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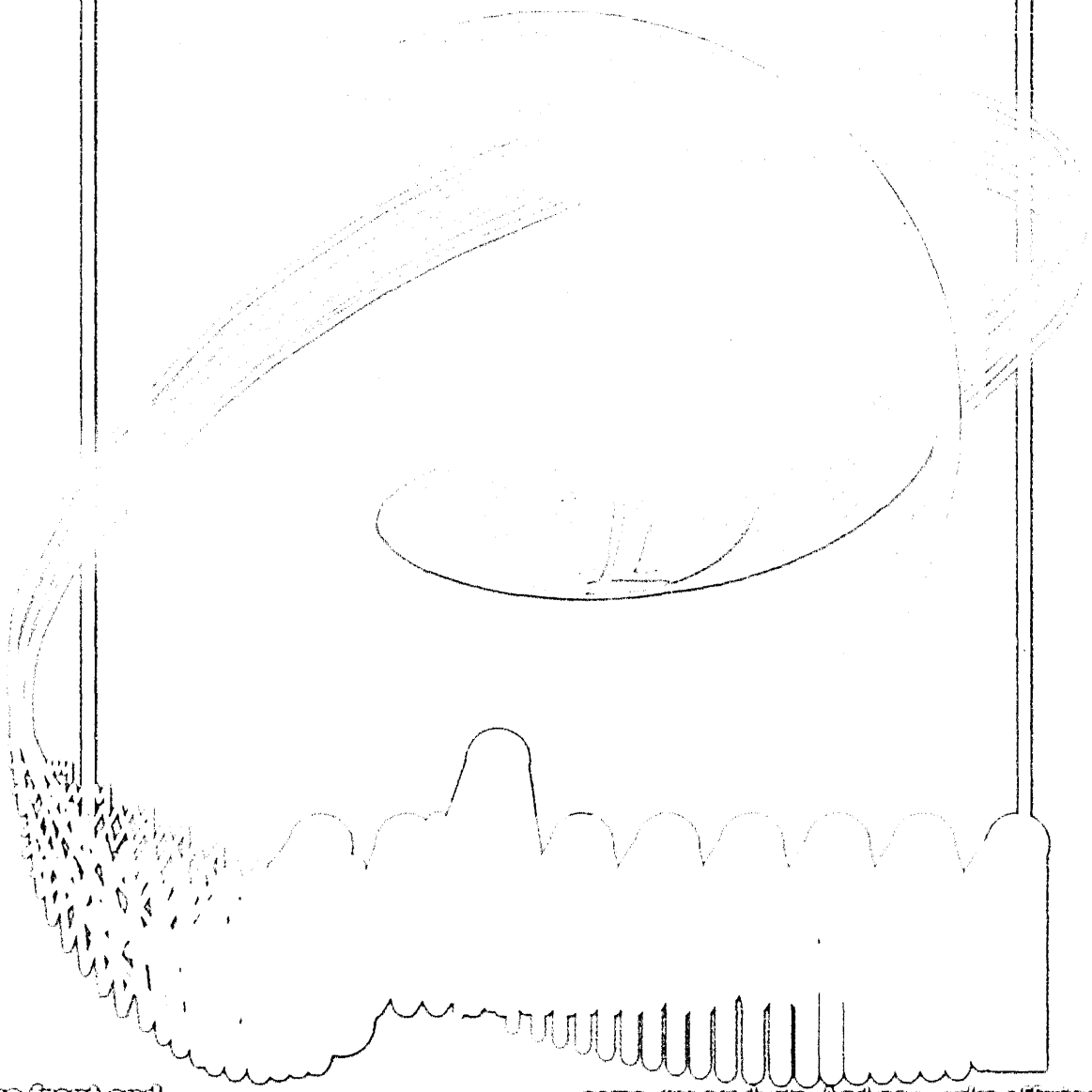

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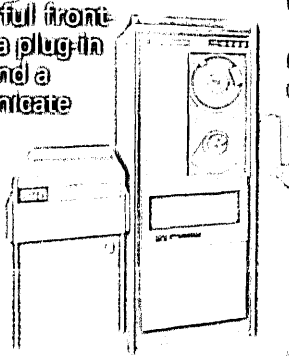

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systems acting as terminals.

Kolberg said the P system is ideal for program development "and we have some people doing that but not too many, proving to us that we have been choosing our applications programs correctly."

She said the P system is running on "the entire spectrum of TI's small computers," starting with the small 99/4 home computer up to the multi-user 990/12 running the X10 operating system.

She said the Consumer Products division had just begun delivering the P system with the 99/4 home computer. This is the first offering of the system outside TI.

A program using the 99/4 and the P system, similar to that undertaken with the SR 59 calculator back in '77, is being considered, Kolberg said, but no decision has been made.

As for Bandy, he became so hooked on the P system and the whole concept of software portability, he left TI for SofTech and has become almost evangelical. "Why should people have to write the same programs over and over again? I keep seeing grand predictions about the future size of the small computer market. These can only come true with truly portable software. You're going to see the IBMs, the Xeroxes and the DECs getting into this with both feet."

—Edith Myers

PERSONAL COMPUTERS

PERSONAL COMPUTER FROM IBM

The mainframer's long-awaited entry into the personal computing market aims for corporate as well as home users.

With uncharacteristic but resounding fanfare, IBM ended the summer's most popular guessing game for the industry by introducing its Personal Computer. Highly comparable to offerings from arch-contenders Apple and Radio Shack, the machine represents several new tacks for the leading computer manufacturer as it attempts to hitch its wagon to one of the fastest growing segments of the industry.

The computer, which is designed to appeal to home users as well as corporate professionals, ranges in price from $1,565 for a bare-bones configuration to $6,300 for the full-blown model. It will be sold through Sears and Computerland computer retail stores as well as directly to large corporate and educational users, IBM says, pointing out that it has set up a special national marketing team to handle such volume orders.

Donald Estridge, the articulate director of IBM's entry systems business who braved strobes and movie lights at the machine's Waldorf-Astoria introduction, declines to say how many personnel have been dedicated to the national marketing effort, but says it will be selling in volumes of 20 machines or more. Several weeks after the unveiling, he said response so far had been "very, very good," with orders being taken but no deliveries to be made before this month.

In addition to the game of Adventure, which Estridge said has been thoroughly exercised by his Boca Raton, Fla., staff, IBM has decked out the machine with an array of packaged applications programs that are expected to make it attractive to the corporate user.

Among these are the popular VisiCalc spreadsheet package from Personal Software, accounting packages from Management Science America's Peachtree Software operation, and Information Unlimited's EasyWriter word processing system. Although IBM wouldn't say, more independently developed packages are certain to be offered for the computer as well as packages

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developed by users and IBM's own employees. IBM said it would help publish such packages on a royalty basis, but it was not clear how much marketing or support services the company would provide.

One of the more interesting capabilities of the personal computer is 3270 terminal emulation. Estridge noted that the code for that application has not been fully developed, but that it would certainly provide a powerful capability for corporate users. Databases, timesharing, and small-scale distributed processing applications could then be handled by the machine in conjunction with 370 and compatible computers.

Industry observers also speculated that the machine, with its communications facilities, could be used as an intelligent terminal for future computing services offerings the company may make (September, p. 46). IBM has been placing many small communicating devices in the field in recent years, ranging from electronic typewriters to the Displaywriter word processor to small computers such as the recently introduced Datamaster.

Conceivably, some observers say, all such devices could be connected into local office networks and attached ultimately to large host computers that would manage big databases, distribute software and data, and even connect into public data networks. The personal computer also may find a use in home information systems, just as other machines have proved useful in videotex and similar systems.

While the personal computer field hardly needed legitimizing by IBM's entry, the firm's introduction is expected to expand the market for most of the leading companies in the arena and may eventually pressure some smaller competitors to seek refuge of some sort. For now, however, IBM may help educate the world in ways that Apple and Radio Shack could not because of its established reputation in office equipment. It is expected to benefit from that "in" with office managers more than Xerox will in trying to market its new model 820 personal computer. IBM's name is close to synonymous with the word computer and as such will probably hold more weight with conservative and skeptical firms first looking at personal computing.

The company builds little of the hardware itself, importing printers from Japan and crt monitors from Taiwan, and buying floppy disks here in the States.

When asked what applications the machine will find in the corporate environment, Estridge said the best examples could be found at IBM itself, where the system had been used for several months before its introduction. There, he said, such applications as budgeting, cost estimating, sales forecasting, revenue planning, and word processing have been popular uses. In addition, the machine's graphics capabilities have been used to prepare foils for overhead projection. Estridge himself said he uses the machine to store phone numbers and keep his business calendar in order.

"There's nothing dramatically new" in the applications expected from corporate users, he said, adding that with computers on their desks "people can be more productive and feel they are contributing more because they can get at information faster."

Volume discounts will help sell the new machine to large users and secondary educational institutions. The discounts range up to 15% off the standard purchase price for orders of more than 150 machines, according to Estridge. There will also be a separate educational discount schedule to help move the machine into universities and high schools.

In technical terms, the computer seems to establish de facto standards in the areas of operating systems and microprocessor hardware. The OS chosen by IBM is the CP/M-86 package developed by CP/M-developer Digital Research. CP/M has been

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very popular with the personal computer community, having been chosen by many vendors, including Xerox with its latest model 820 machine. IBM's choosing it will probably seal its fate as a standard, according to observers.

The firm's choice of the 16-bit Intel 8088 microprocessor may prove even more significant, signaling a trend at IBM to adopt outside technology and opening the new machine up to plug-compatible attacks from independents. Already Intel has licensed the processor chip to Fujitsu, the Japanese giant that is expected to compete directly against the IBM system. Also, the 8088 is used in IBM's Displaywriter, a machine which sources say will soon be upgraded with further data processing capabilities. Third party software developers, some of whom are known to be working on such packages as COBOL compilers for the Displaywriter, will thus be given an even wider market for their 8088-compatible products. How much support IBM will give to oems and software houses working with the personal machine is not immediately clear, but it may go the way it has with the Series/1 mini, entering into joint marketing arrangements and licensing outside packages.

The hardware is largely non-IBM. The matrix printer is made by the Japanese firm Epson, and the crt monitor by an unidentified Taiwanese company, IBM said.

KIDS' PLAY: IBM's new Personal Computer can be used at home or at the office. Children can explore music with the system and its built-in speaker, or it can be used for planning family budgets, analyzing stocks, or playing video games.

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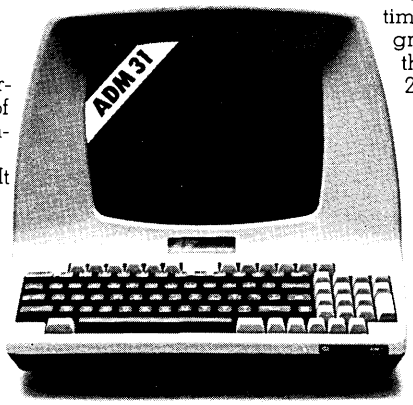

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The 5¼-inch floppies are built by an unidentified firm thought to be Tandon Corp.

Observers generally applauded IBM for its entry into the personal computing market, particularly when comparing the overall introduction to what seemed to be ill-planned systems in the 5100 series from General Systems Division (that machine went through three iterations before being renamed the Datamaster System/23 this past summer), and a rather bare entry into minicomputers with the original Series/1. They agreed that the new system compares very well with Apple and Radio Shack offerings in technical features and software.

One seemingly missing element is a large disk. The firm's current smallest drive is the Picollo 8-inch unit offered with the Series/1 and System/38, but which is seen as too large physically for a desktop computer. However, sources close to the personal computer operation in Florida say a new 8-inch, 14-megabyte disk is due soon from IBM, and it will be a welcome addition to the personal machine, the Datamaster, and perhaps even the Displaywriter, all of which now depend on floppy disks. The personal computer can attach a standard cassette drive, but that is expected to appeal only to hobbyists and home users.

IBM said it will provide much internal information about the machine, including necessary specs for hardware and software interfaces. This will help the independent peripherals and software industries to make a go of complementing the machine with many products IBM won't provide.

—John W. Verity

GOVERNMENT

CBEMA WINS WAR WITH DOL

In the first round, CBEMA has managed to get the Labor Department to exempt maintenance and repair of commercial dp equipment from the Service Contract Act.

On paper, the two-year war between the Computer and Business Equipment Manufacturers Association (CBEMA) and the Department of Labor is history. DOL recently proposed regulations which would exempt from the Service Contract Act maintenance and repair of commercial dp equipment. CBEMA claimed a victory.

In reality, only the first shot has been fired. The heavy shelling is about to begin.

"We are going to ask the Secretary [of Labor, Raymond Donovan] not to grant the exemptions in the final regulations," promises economist John Zalusky of the AFL-CIO, which has mounted late but potentially effective opposition to the computer industry. "If he does grant them, we'll go to court.

"We're not even prepared to bargain because we can take it right to court. If we do, we will challenge the authority and ability of the Secretary to grant exemptions at all, then question specific matters. Some of these exemptions are so broad as to be absurd."

The Service Contract Act was enacted in 1965 to protect against "wage busting" of workers on federal contracts of which the principal purpose is to provide services using service employees.

"Wage busting" is the practice of lowering employee wages and fringe benefits by either incumbent or successor contractors in an effort to become low bidders on government contracts. The act provides that service workers must receive wages and fringe benefits equal to those being paid workers performing similar tasks in their localities.

The regulations proposed on Aug.

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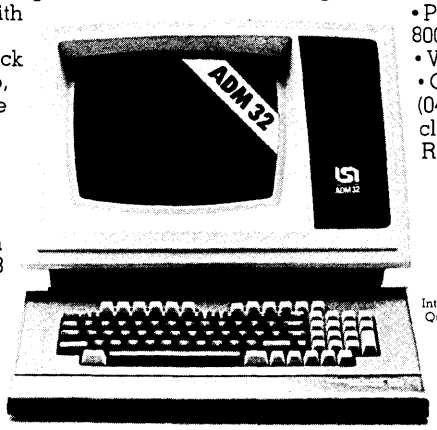

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14 would provide the following exemption: contract requirements for the maintenance or repair of automated data processing equipment, including office automation systems, procured pursuant to the Brooks Act; contract requirements for the maintenance and repair of scientific and medical apparatus or equipment which has automated data processing or other high technology as an essential element; and contract requirements for the maintenance and repair of office/business machines where such maintenance and repair is performed by the manufacturer or supplier of the equipment.

"It's my understanding that organized labor considers this a significant threat," CBEMA president Vico Henriques says. "I'm sure they will wait until the regulations are adopted, then go to court and ask for an injunction. We feel pretty good about what we've accomplished, but we see this continuing for some time as far as the regulations themselves are concerned.

The Service Contract Act was passed to protect against "wage busting" of workers on federal contracts.

"We can write rhetoric like anyone else. But if you give them numbers it's much easier to establish your position. So we're going to put together well-reasoned verbiage and hard data that hopefully will be irrefutable before the comment period expires Oct. 13. We want to show that the Secretary is absolutely right in his determination."

Until the August proposed regs, Henriques and his clients had been insisting the Secretary was totally wrong. The Service Contract Act originally protected only blue collar workers. In 1972 DOL began issuing wage determinations that included white collar employees. Several contractors protested this action, and two U.S. District Courts held that Congress had never intended the act to apply to white collar workers. The legislators then changed colors in 1976, when they extended the act to cover white collar workers.

The computer industry's problems began on June 5, 1979, when DOL notified the General Services Administration (GSA) that the maintenance and repair services specifications of all federal contracts for the purchase or rental of supplies or equipment were subject to the act. GSA and other federal contracting agencies previously had not considered these contracts to be subject to the act. Neither had the industry.

Both GSA and the Office of Federal Procurement Policy disagreed with DOL's interpretation of the act, but DOL had the Attorney General on its side. So the industry retaliated. It slammed the government in the checkbook.

Hewlett-Packard ceased all business with the government. Honeywell and IBM did so selectively, and DEC threatened to do so, although it obtained enough specific exemptions so that it never cut off the feds.

"If the act had applied, it would have affected the way the industry does business with everybody, not just the government," Henriques explains. "The industry pays its service engineering personnel on a merit pay system that ranges from $15,000 to $30,000. Applying the act would have meant paying an entry-level person at least 20% more."

CBEMA and friends found support from Rep. Jack Brooks (D-Tex.), chairman of the House Government Operations Committee and usually an implacable foe. He requested an investigation by the General Accounting Office, which contacted 18 corporations to determine if the threat was as dire as the industry claimed.

"Without an exemption, Labor's decision to enforce the act would adversely affect operations in the adp, office equipment, and other scientific and high-technology industries," GAO wrote in September 1980. "The most serious concerns presented by the corporations GAO contacted were that Labor's decision would eventually increase the administrative burdens and operating costs of each corporation and hinder employee productivity and morale by disrupting merit pay systems and staff assignment practices."

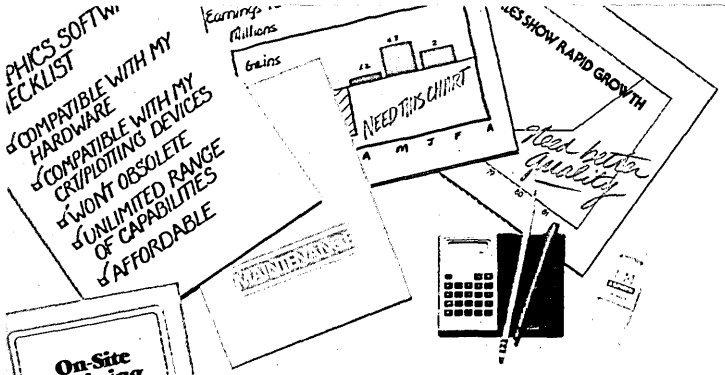
GAO raised the proverbial red flag, saying national security could be harmed if the companies continued to shun government contracts. It recommended Congress amend the act to make clear it excludes coverage for adp and other high-technology product-support services.

Labor remained unyielding. It had issued in November 1979 an interim wage determination which provided that the current wages paid to service technicians were adopted as prevailing, temporarily allowing the industry breathing space. Shortly thereafter it selected $5.24 per hour as the proposed entry-level rate. That sum was well below what the industry was paying, but it was never implemented because Labor, under CBEMA pressure, decided to study the matter further.

"The most significant aspect of this affair is the climate it created," HP's Bill Schmick says. "The only agency which wanted to apply the act was Labor. All the others were violently opposed to it. It shows how one department of the government can play havoc with the others. Labor made it a very costly exercise.

"We decided right away to stop doing business with the government. It's 13% of our overall revenue, but we were not going to jeopardize our commercial customers for some stupid regulations. It didn't come easy. But in the long run it was a good investment. We'd do it again."

They won't have to. Neither will other CBEMA members. From out of the



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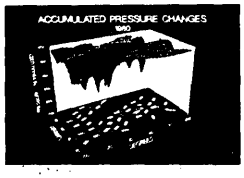

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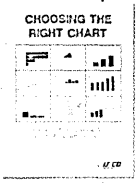

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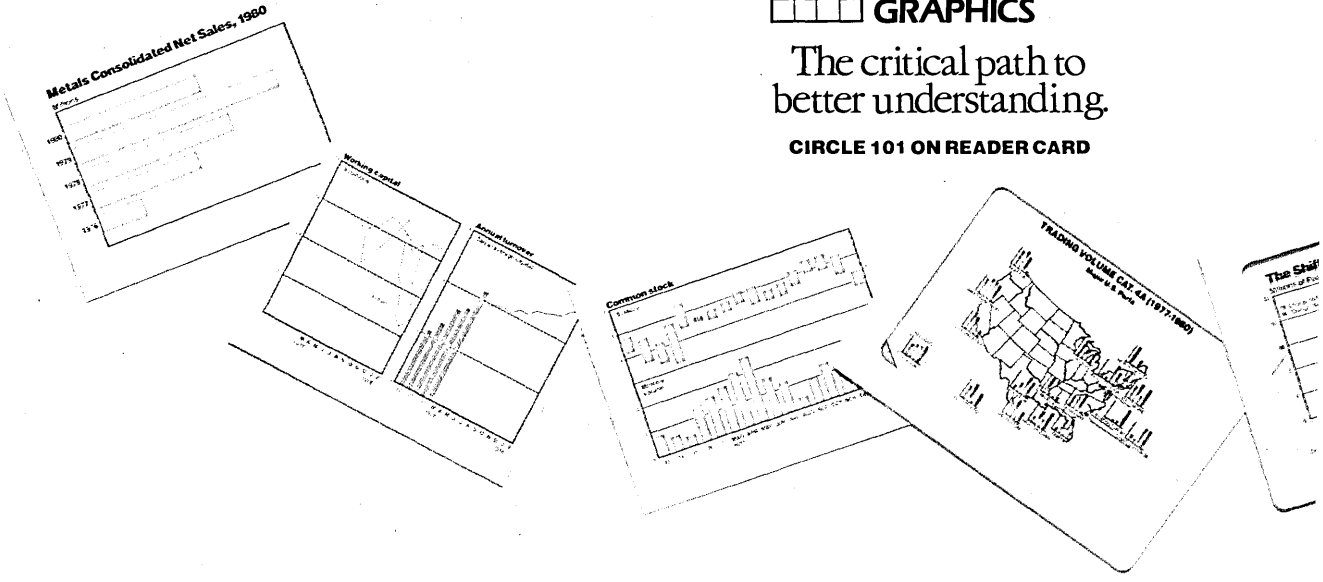

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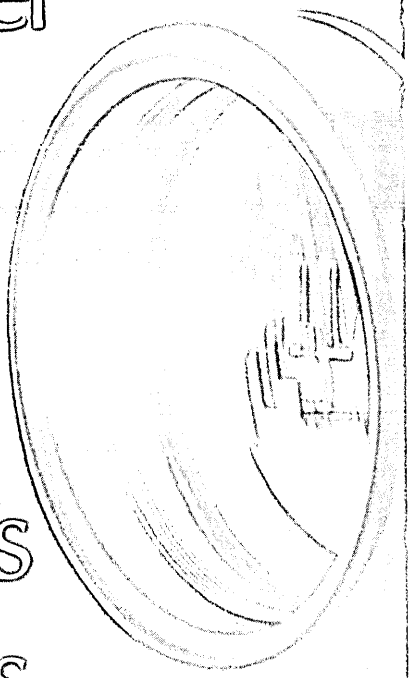

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Convenient Ticket Company

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"We've been able to grow our business incredibly rapidly without having to reprogram, reconfigure or relink our system. Efficiency is up and costs are slashed. We're booking more seats than ever with a fraction of the overhead. But most of all, with 67 outlets in the Greater Detroit Metropolitan area and the lion's share of theatrical offerings in our area, we needed a system with incredible reliability and flexibility. The Tandem NonStop System has enabled us to grow as we need to, in locations and scope of service.

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ARAMCO SERVICES COMPANY

CIRCLE 103 ON READER CARD

NEWS IN PERSPECTIVE

West has ridden Ronald Reagan, savior.

Just prior to the effective date of the Carter Administration's regulations, Reagan Administration officials put them on hold, pending the standard "thorough review."

"The previous Administration really stonewalled us," Henriques complains.

"We started fresh on the legal analysis," explains attorney Diana Berkeley of the DOL Solicitor's Office. "We did an in-

GAO raised the proverbial red flag, saying national security could be harmed if the dp companies continued to decline government business.

ternal review on which we got assistance from OMB [Office of Management and Budget]. And we got very useful input from industry, which demonstrated the need for the exemption."

The industry had previously offered input but received no output. But in five months CBEMA accomplished what it could not in the preceding two years, offering another textbook example of Washington's modus operandi—it's not what you know, but who.

In an about-face from its position under Carter, DOL admitted the error of its ways. The agency concedes in print that service engineer employees are "relatively highly paid" pursuant to the merit pay system; that maintenance and repair of equipment furnished to the government is a minor proportion of total business done by the industry; and that the employees perform federal work as part of their overall duties of servicing equipment in commercial establishments. Nor did DOL ignore the dire threat to the future of the republic.

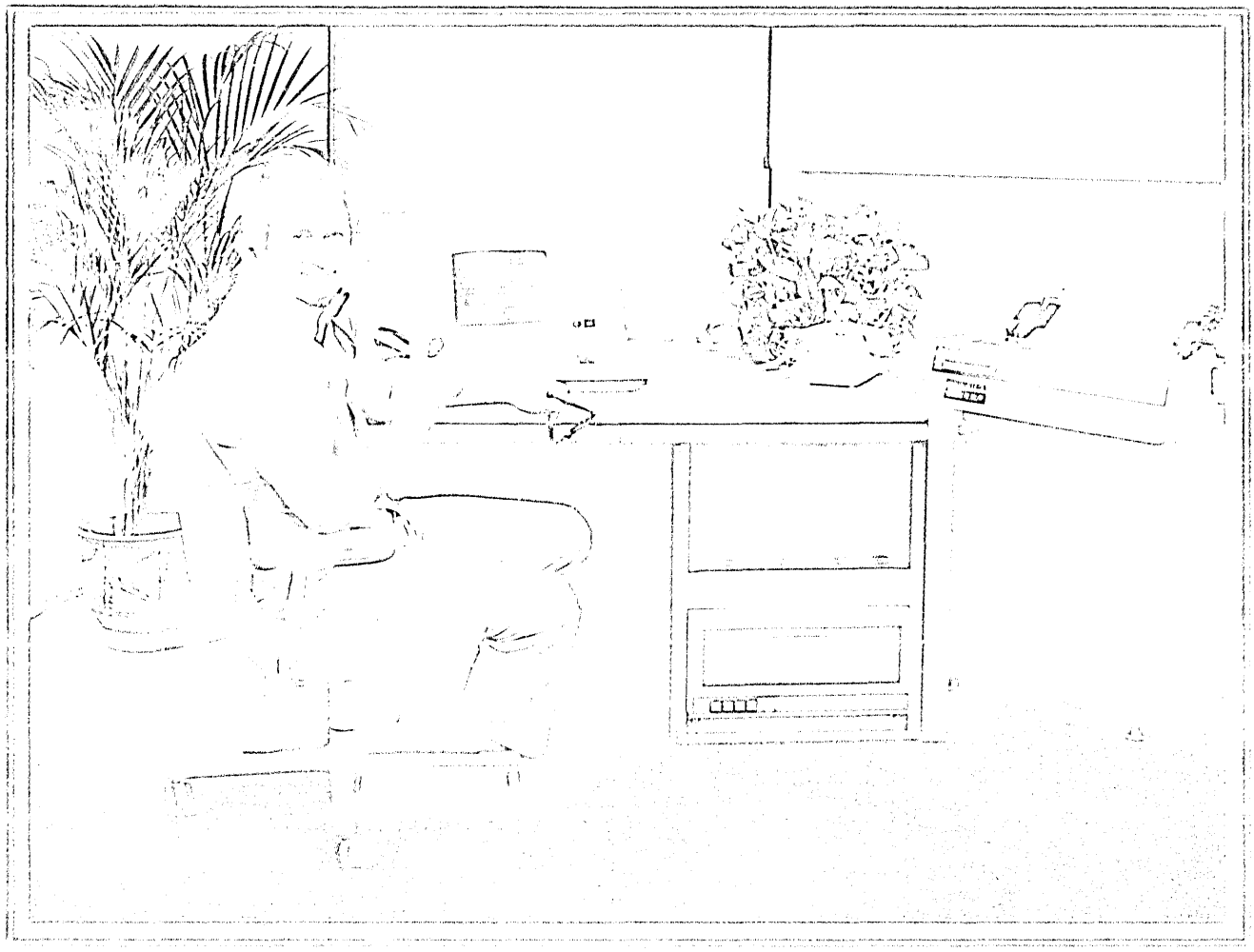
"In the absence of this exemption, there is likely to be a serious adverse impact on the operations of the government, such as the potential curtailment of crucial programs and services, many of which are critical to national defense and security, as a result of certain segments of the industry ceasing to do business with the government," the proposed regulation states.

"It has been determined, pursuant to the Secretary's authority," DOL continues, "that it is necessary and proper in the public interest and to avoid the serious impairment of government business to provide such exemption from all the provisions of the Service Contract Act. The proposed revisions will result in substantial cost savings of at least $240 million annually for both contractors and the government while still assuring protection of local wage rates and practices."

Not all members of the public agree the proposed action is in their interest.

"This has been a sickening, frantic scramble by the industry," Zalusky complains. "They've held the government hos-

CIRCLE 104 ON READER CARD



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tage. It's a rather dastardly trick to pull and a complete disservice to the workers who should be covered by the act. There are certain implications associated with their behavior that need to be investigated.

"I'm convinced the major objection for the industry is that the government will look at its books for the first time. They're trying to keep Brooks' committee and GSA from discovering what really goes on in the industry."

The industry, naturally, could not be more pleased. Regulations rarely change once they are proposed, and DOL's Berkeley indicates it will require "a pretty persuasive legal argument" to convince her agency it's mistaken.

"The government was trying to put us in an impossible situation," an attorney for a major company says. "There's no way their pay system would have worked. We've proven ours does. In the real world, no matter what the government thinks, no one keeps records of where people work or what machines they repair for how long.

"It took us a while to wake up to this one. It wasn't something that's easily reversed. When we started out four years ago, only the most optimistic people thought we could get the exemption."

Only those same ones believe they're exempt from further struggle.

—Willie Schatz

SMALL BUSINESS SYSTEMS

DIFFERENT FROM THE REST

Alpha Micro has hung a 16-bit cpu on an S-100 bus, and it doesn't support CP/M.

In the small systems world, Alpha Micro is something of a maverick.

The Irvine, Calif., firm, founded in 1977, started its marketing via computer stores. But Bob Hitchcock, president, is firm in his statements that his is not a hobbyist system.

Like IBM's latest offering, Alpha Micro's small business system is based on 16-bit cpus, but Hitchcock doesn't see the IBM personal computer as a competitor. "They're not looking at our marketplace. They're looking at the Apples and the Tandys."

Alpha Micro does compete with IBM though. The company competes with any and all offerings of multi-user systems. One of its distributors, Big Sky Data, Billings, Mont., has been beating out IBM (Series/1 and System 34), Burroughs (B90), and NCR (8500) in providing systems for county governments.

"Three counties that received bids from Big Sky Data judged the hardware price/performance as excellent and determined that Big Sky Data offered them the best cost per point ratio," said Jim Rizza, dp systems coordinator for the Local Government Services Div. of Montana's Department of Community Affairs (DCA).

Rizza is author of a rating system for computers available for use by Montana's county and city governments, and his department works with local governments that are soliciting vendor proposals for computer systems installations. Alpha Micro has provided systems for six Montana counties and last month was anticipating a contract from a seventh.

"In 1975, Montana initiated a program requiring its local governments to employ accounting and reporting systems which met generally accepted accounting principles," Rizza said. "The Budgetary Accounting and Reporting System (BARS) was developed in response to this. BARS can be used manually and on automated and semiautomated systems. Since we didn't have the resources to develop automated systems ourselves, we provided assistance

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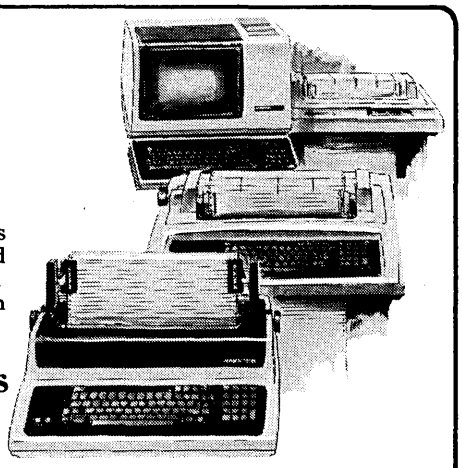

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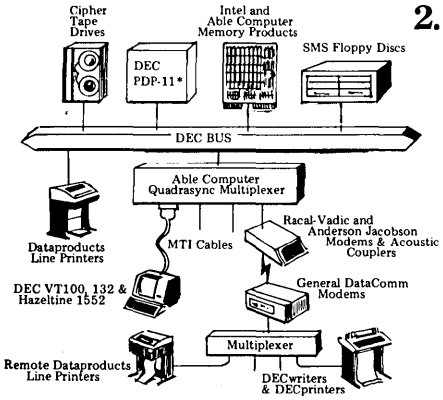

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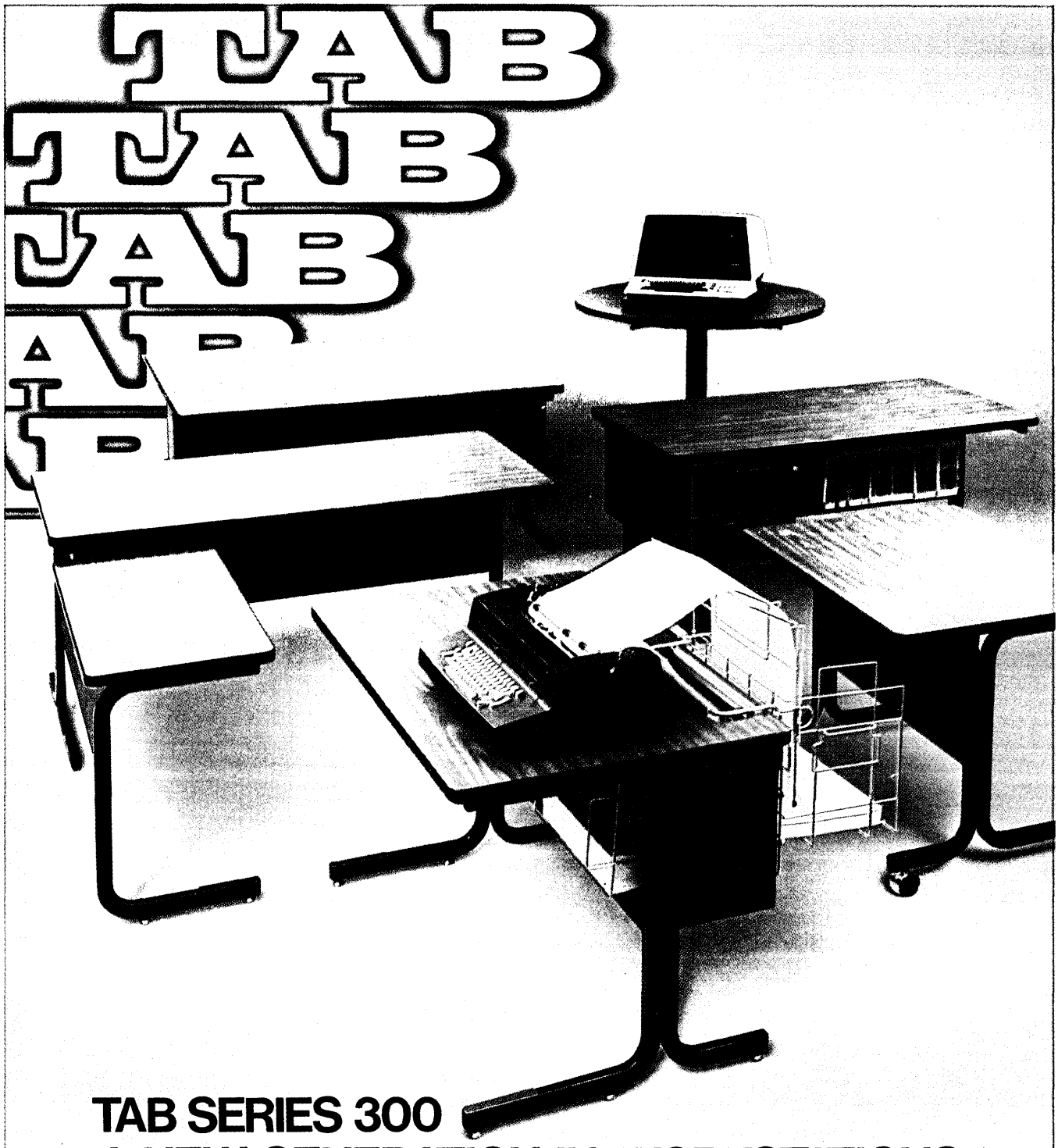

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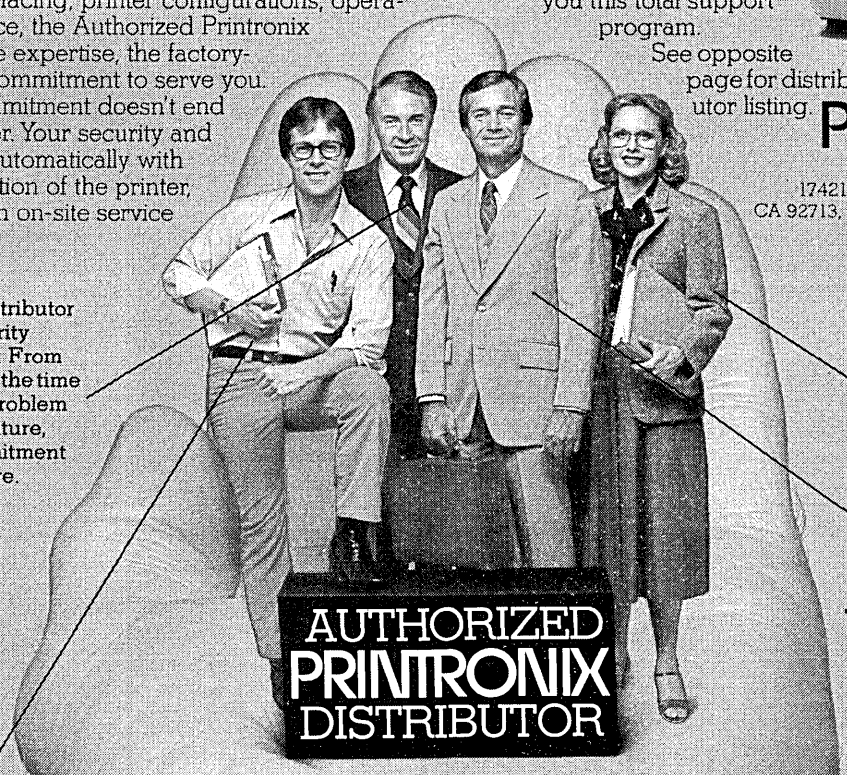

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CIRCLE 107 ON READER CARD

Following are Distributor headquarters and their telephone numbers. Forty-two offices exist around the U.S., Canada and Puerto Rico to serve your printer needs. For the office nearest you, check with your distributor.

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(416) 245-4848
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BFA CORPORATION
(505) 292-1212
New Mexico

COMPUTEC SYSTEMS CORP. (809) 781-7880
Puerto Rico

DENCO DATA EQUIPMENT CO.
(215) 542-9876
Delaware, Eastern Pennsylvania, Southern New Jersey

DYTEC/CENTRAL
(312) 394-3380
Northern Illinois, Indiana, Iowa, Wisconsin

DYTEC/NORTH
(612) 645-5816
Minnesota, North Dakota, South Dakota, Western Wisconsin

DYTEC/SOUTH
(314) 569-2990
Southern Illinois, Kansas, Missouri, Nebraska

G&S COMPUTERS
(907) 276-4268
Alaska

GENTRY ASSOCIATES, INC.
(305) 859-7450
Alabama, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee

GROUP III ELECTRONICS
(213) 973-7844
California, Nevada

LOWRY & ASSOCIATES, INC. (313) 227-7067
Kentucky, Michigan, Ohio, Western Pennsylvania, West Virginia

MESA, INC.
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NACO ELECTRONICS CORP. (315) 699-2651
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OEM SPECIALTIES
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Arizona

PACIFIC NORTHWEST ELECTRONICS
(206) 454-0150
Oregon, Washington

PAR ASSOCIATES
(303) 371-4140
Colorado, Idaho, Montana, Utah, Wyoming

S&S ELECTRONICS, INC.
(617) 458-4100
Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont

LOGON, INC.
(201) 646-9222
Northern New Jersey, Metropolitan New York City, Long Island

USDATA ASSOCIATES, INC.
(214) 661-9633
Arkansas, Oklahoma, Texas

PRINTRONIX
CIRCLE 107 ON READER CARD

NEWS IN PERSPECTIVE

ROBERT B. HITCHCOCK is firm in his statements that Alpha Micro's products are not for the hobbyist.

to local governments wishing to address the private sector for bids. The counties evaluated these bids using specifications developed by DCA."

The need for an automated BARS system brought Dick Johnson, president of Big Sky Data, in contact with DCA.

"By developing the software for a specific application such as BARS, we have found that we can compete very well with the large computer manufacturers," Johnson said. "The state is only a small portion of these companies' markets, and the computer manufacturers have either been unwilling to modify standard software packages or unable to find third party packages to conform to such detailed requirements. However, we are flexible enough to work with Montana's local governments and have customized our systems to meet their needs."

And Big Sky hopes to move beyond Montana's borders. "Our next targets are Wyoming and Washington," said Johnson. "We think our software could be used by local governments in any state."

Big Sky is one of some 170 dealers selling Alpha Micro systems in the U.S. Each dealer is an independent business which establishes its own selling prices. Prices to the end user of Alpha Micro systems generally range from $15,000 to $45,000. The exact price of a system depends upon a number of factors including the model purchased, the peripherals selected, and the dealer services and applications software provided.

Alpha Micro's dealers are also responsible for service and maintenance. In an effort to assist its dealers, the company has developed a maintenance network called AlphaSERV, which provides third party maintenance services to end users and dealers. AlphaSERV currently consists of nine independent maintenance organizations which provide service to 20 metropolitan areas, principally in the western U.S. The company is attempting to expand this geographical coverage.

Alpha Micro's 16-bit system is definitely more expensive than its 8-bit cousins, but it shares the same S-100 bus with most of them. The S-100 was originally intended to be used with 8-bit processors. All memory boards available for the bus are limited to 8-bit words as the logical addressable element.

In order to use the available 8-bit memory boards, the Alpha Micro systems have to split up read and write transfers from the 16-bit microprocessor into two half-word movements.

When Alpha Micro started business with a paid-in capital of $1,000, it was selling only bare bones boards based on Western Digital's WD 16, a 16-bit microprocessor to which it has exclusive systems rights.

Unusually, its operating system AMOS, a multi-user, multitasking timesharing operating system, came before the computer—at least in the mind of its developer, Richard C. Wilcox, a cofounder of Alpha Micro and now chairman of the board. "Dick's operating system approach has been in existence since 1970," said Hitchcock.

Alpha Micro moved from boards and computer stores to complete systems and systems houses in 1979. Currently there are three different models in its product line: AM-1010/1011, a floppy disk based system with up to 480 bytes of memory which can support up to 24 terminals, printers and magnetic tape drives as well as hard disk storage; the AM 1030/1031, with a base configuration containing a 10 Mbyte hard disk drive and which can have up to 1024K memory and can support additional hard disk storage as well as up to 24 terminals, printers, and magnetic tape drives; and the AM 1050/1051, with a base configuration including a 90 Mbyte hard disk drive and with the same upper limit capabilities as the 1030/1031 models.

All of the systems provide data communications capabilities and support three programming languages as well as word processing in a multi-user, multitasking, timesharing environment.

Alpha Micro systems have been called the programmer's small business computers. They are most easily used by persons from a background of large computer installations where concepts of user priority, background jobs, and multiple peripheral devices are familiar. But, for a first time user with a little patience, it is a product line which takes the user from a floppy disk-based system with 64K memory up to a hard disk driven system with up to 1024K.

For the investor, the company this month is going public with a 900,000 share offering.

—Edith Myers

BENCHMARKS

BIG BUCKS: The computer industry has made a lot of money for many people over the years, that's for sure. But Ross Perot was by no means the last of the computer millionaires, as shown by a *Venture* magazine list of entrepreneurs whose stock was worth $10 million or more when they took their firms public during the last year. Leading the *Venture* list of 30 people in the computer field is Steven P. Jobs, vice chairman and founder of Apple Computer, who was worth a cool $166 million with the 7.5 million shares he held at the firm's much-publicized offering last December. Apple helped six others make it over the $10 million mark as well. Other computer millionaires on the *Venture* top 100 list include W.M. Wells III, president of Intertec Data Systems ($45.19 million); William Norred, chief of Micom Systems ($36.72 million); C. Norman Dion, chief of Dysan Corp. ($31.09 million); John N. Maguire, chief of Software AG ($29.08 million); John M. Imlay, chairman of Management Science America ($28.30 million); Sirjang Lal Tandon, chief of Tandon Corp. ($25.92 million); and Stephen J. Ippolito, president of IPL Systems ($16.76 million).

JUSTICE: In the end, the report prepared by the Defense Department for AT&T and then used in the phone company's defense against the Justice Department's antitrust suit won't be worth the reams of paper on which it was printed.

"The people at Justice had a good laugh at the predicament that caused," a well-placed source said. "They couldn't believe it." With good reason. DOD had accidentally, coincidentally, or purposely neglected to inform Justice about the report. The paper concluded that the breakup sought by Justice would severely harm the national defense communications system. AT&T was the only nongovernmental party to receive a copy of the report, which was forwarded to a cabinet-level group and has provided much of the foundation for the Reagan Administration's opposition to the suit. A high AT&T official then asked John Whealan, general counsel of the Defense Communications Agency, if the report could be used as evidence. Justice did not receive a copy until seven days after AT&T.

"These acts amount to direct cooperation with a defendant in a lawsuit in which the government is the plaintiff, on the very subject of the lawsuit, and they are not within the bounds of propriety," Judge Greene wrote.

BUBBLE BURSTS: National Semiconductor has left the bubble memory market, the third big semi maker to drop out this year. The earlier two were Texas Instruments and Rockwell. That leaves in the U.S. only Intel and Motorola, which had been second sourcing the National Semi parts. Of course, the Japanese may come into the U.S. market, but the latest exit of a U.S. manufacturer would seem to give the once promising technology a severe blow. Industry observers say that advances in disk technology have made mechanical devices continually more cost-effective than bubbles on a price-per-bit basis, leaving only ruggedized applications as a potential niche for the semiconductor technology. National said that it had generated revenues of only about $1 million from bubble technology, and because its overall financial condition is under stress it made a business decision to drop out of the market. Motorola moved quickly to take up the slack and assured customers that it is in the market to stay.

SECOND COMING: Lawrence Goshorn and a group of other former General Automation executives have formed a company to build and market robotics devices. International Robomation/Intelligence introduced a robot arm priced at $9,800 in single quantities, with evaluation units set for delivery in early 1982. Goshorn, who was ousted from GA a couple of years ago after several disappointing fiscal quarters, is chairman and president of the firm. Joining him are former GA vice presidents Erwin L. Allen, Walter F. Burke, and Walfrid Mildner.

SELLS DIVISION: Memorex Corp. sold off its Business Systems Division to Computer Leasing, Inc., Anaheim, Calif., for an undisclosed amount. BSD had been showing losses in recent months, as has been Memorex as a whole. The division, which used to be a separate company until acquired by Memorex in 1977, supplied the IBM System/3 marketplace with disk drives, printers, terminals and controllers. Memorex said the division's 135 employees will stay on with the new owners, and Computer Leasing will continue to service the division's customer base of 1,300 throughout the U.S.

MICRO MARRIAGE: Compiler Systems, Inc., Sierra Madre, Calif., which claims its CBASIC is the most widely used micro language for business in the CP/M market, has been merged into Digital Research, Pacific Grove, Calif. CP/M, developed by Digital Research, is the most widely available operating system for micros. Gordon Eubanks, Compiler Systems president, will head up a new Digital Research Language division as a vice president of the Northern California firm. Under a reorganization coincident with the merger, Digital Resource will operate three divisions—language, operating systems, and research and development.

AT HOME: If a forecast from International Resource Development, Inc., Norwalk, Conn., holds, U.S. families will be paying an average of $78 per month for such home videotex services as video games, teleshopping, bank-at-home, and electronic mail by the end of this decade. Even if only 10% of U.S. households decide to subscribe to these services, their total spending will exceed $9 billion, IRD says. And the research firm expects AT&T to be a major participant in the provision of these services "although new telecommunications legislation probably will restrict the ability of the phone company to actually own the information databases."

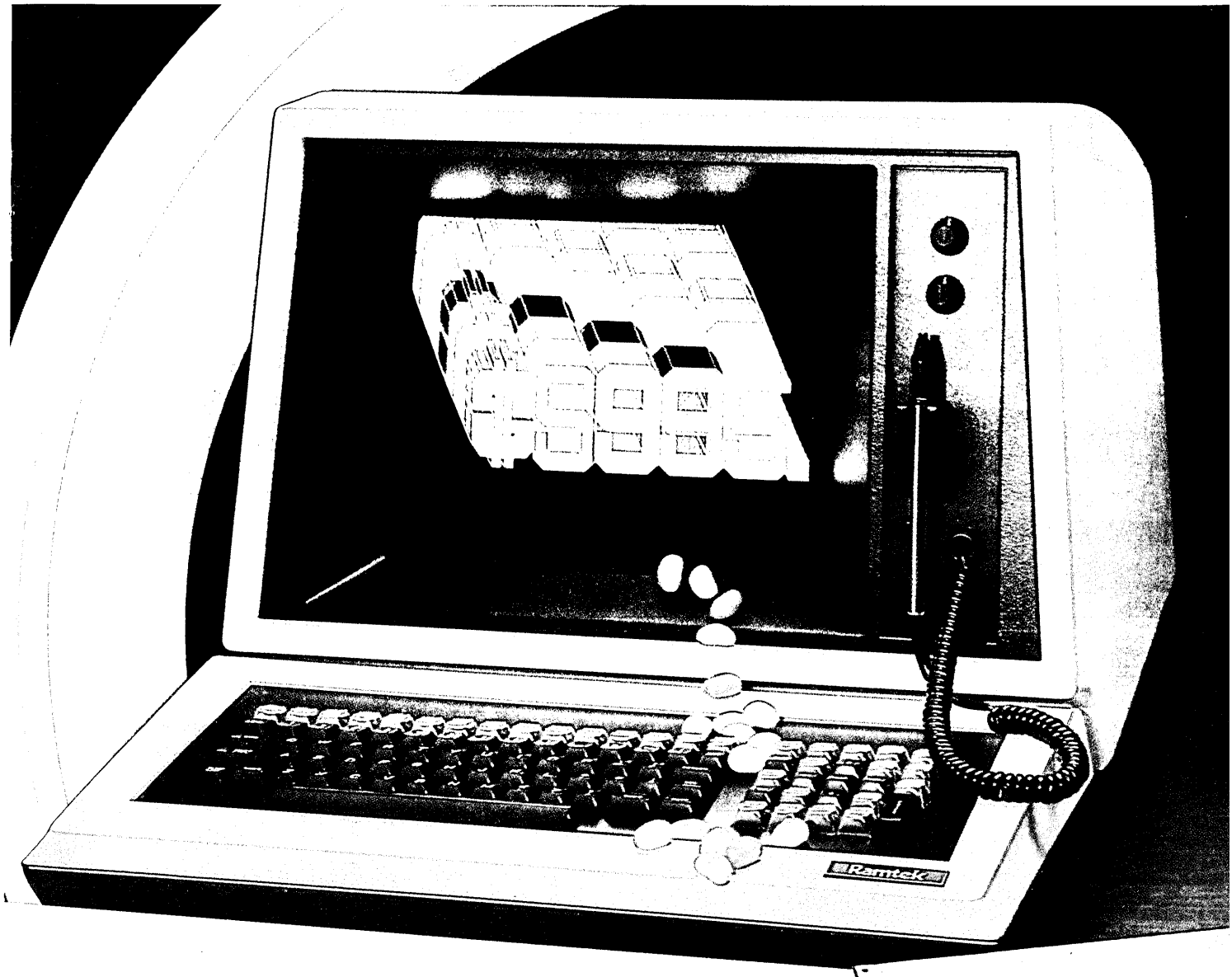
COLLEAGUE DIES: Longtime industry observer, pundit, and writer James Peacock died of cancer-related complications in Provincetown, Mass., on Aug. 23. He was 44, and leaves a surviving brother, John.

Peacock was a 15-year veteran of International Data Corp., most recently occupying the posts of senior vice president of IDC and director of its EDP Industry Report, also known as the "Gray Sheet." He joined IDC in 1966 as managing editor of the Gray Sheet. Peacock rose to corporate vice president in 1977 after the launch of IDC's first executive conference on distributed processing; in 1979 he was promoted to senior vice president.

Before joining IDC Peacock held editorial positions at McGraw Hill, writing for *American Machinist* and *Business Week*. He was made Boston bureau manager for *Business Week* in 1966.

Services were held Sept. 1 at Boston's Old West Church. Contributions may be sent to the American Cancer Society.

PIONEER DIES: Richard E. Merwin, 58, president of the Computer Society of the Institute of Electrical and Electronics Engineers (IEEE), died Aug. 28 of complications following open-heart surgery. He was considered one of the pioneers of digital computing. Born in East Palestine, Ohio, Merwin began his career at the Moore School of Engineering, working on the Eniac computer. Later, at Los Alamos Scientific Laboratory, he organized the engineering team for Maniac, another early computer. At IBM, which he joined in 1951, Merwin helped develop the 702 and 705 computers and was engineering manager for the Stretch program. After earning an MSEE from Syracuse University in 1960 and a PhD from the University of Pennsylvania in 1965, Merwin joined the Army Ballistic Missile Defense Program Office and served as deputy director for data processing until 1977. He then joined George Washington University, where he served as a research professor until his death. He is survived by his wife Sally Ann, a daughter, and two sons. A memorial fund in his name has been established by the IEEE to support research and education in computer sciences.



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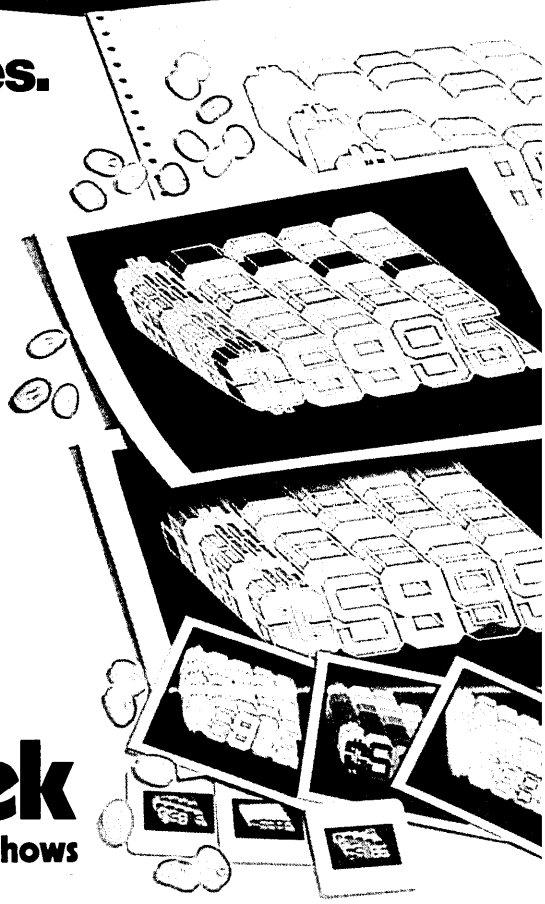

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CIRCLE 109 ON READER CARD

Flashy graphics are as common as Sears commercials, and about as interesting. A few computer artists are trying to do more.

ART? OR NOT ART?

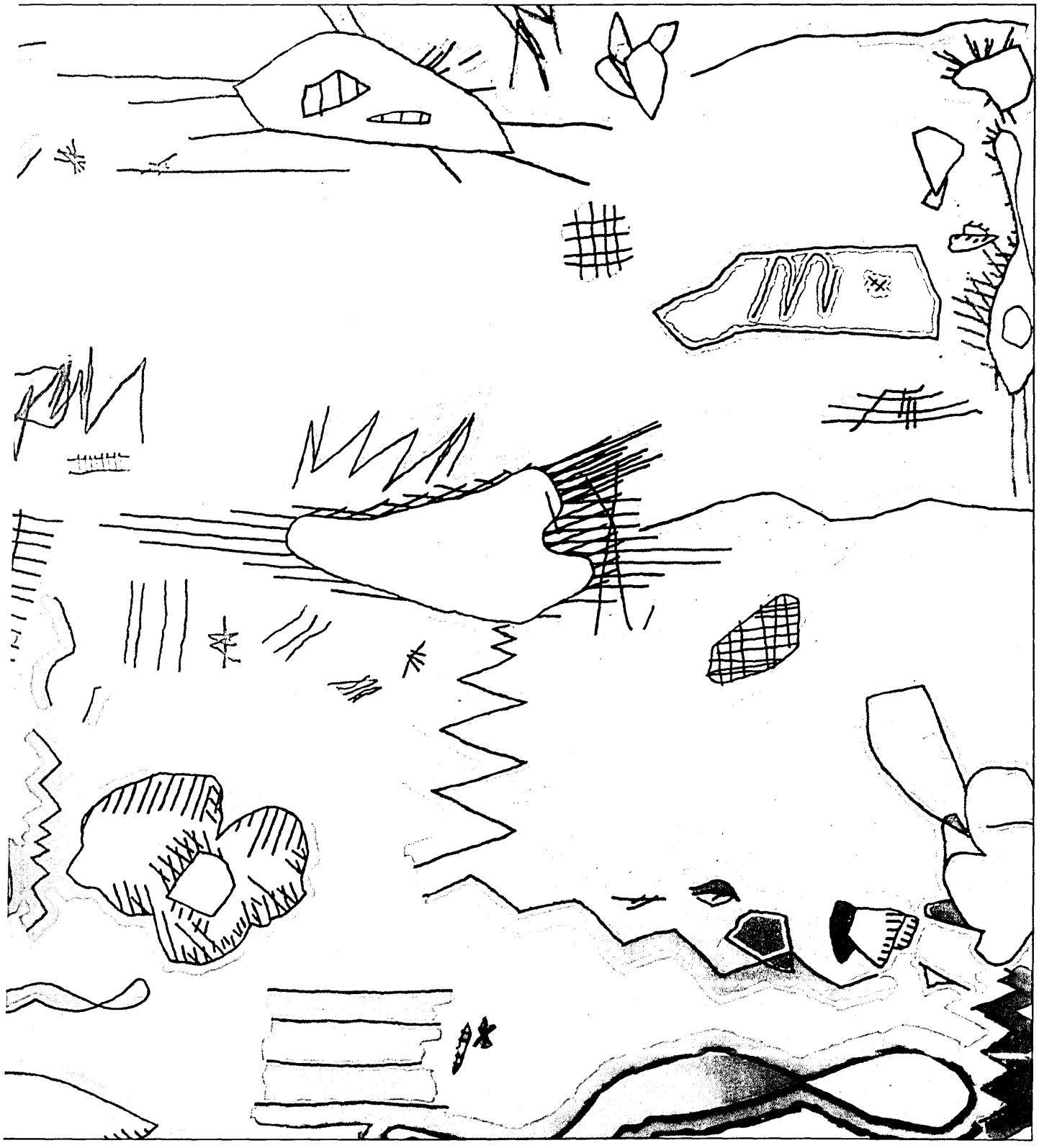
by Ken Sofer

There are these machines, see, and one of them is on fire, but they tell me it's a work of art, see, and then this guy tells me himself *to put it out, see, and the crowd yells 'No! No!'*

—Calvin Tomkins, quoting a fireman on duty at Jean Tinguely's "Homage to New York."

In J. Lee Thompson's 1964 film *What a Way to Go!*, one of Shirley MacLaine's seven consecutive husbands (Paul Newman) is a particularly inventive bohemian artist responsible for the creation of a Rube Goldberg-style painting machine. With brushes mounted on fantastically geared and hinged steel-rod appendages, this contraption turns out apparently successful abstract paintings, which earn the artist widespread acclaim. With an art-hungry public clamoring for more, Newman is forced to build more and increasingly complex machines. Soon he is conducting a studio full of brush-tipped, crane-like arms flaying madly against yards of canvas. Finally, in a fit of aesthetic frenzy, the mechanical artists turn on their master and destroy him.

Thompson's ill-fated painter was a comedic cliche. A mere five years earlier, though, this vision of the artist as eccentric inventor would have been inconceivable; the stereotypical brother-of-the-brush would have been hiding from the mechanized world, repulsed by anything smacking of the scien-



Harold Cohen, "Mousewars in Winter," 1980. From "Four Seasonal Narratives," Digital Museum, Marlborough, Mass. Artist projects hardcopy on wall, then applies acrylic paint.

PHOTOGRAPH BY STEVE COOPER

In place of an object, conceptual artists offered the examination of ideas.

tific. What had happened in those five years to make Thompson's artist recognizable, and therefore funny?

The late 1950s and early '60s saw a number of European and American artists making a violent break with accepted standards and practices.

A group of Parisian artists calling themselves "nouveaux réalistes" were achieving notoriety with art works which made highly original—and sometimes bizarre—use of industrial products and forms. César was creating sculptures from the block-like remains of crushed cars. A sculptor named Arman was building glass cases and filling them with tools, spoons, and other samples of industrial output. Niki de Saint-Phalle was offering her audience .22 caliber rifles and inviting them to shoot at paint-filled bags concealed in plaster-covered collages.

In the United States, composer John Cage was organizing "happenings"—multi-media performances of music, painting, poetry, film, and photography. And the Swiss-born Jean Tinguely, perhaps the real-life model for Thompson's bohemian handyman, was constructing kinetic, machinelike sculptures of welded scrap. Employing asynchronous gears that made their performances always unpredictable, these machines drew pictures, threw balls, sprayed water, blew up balloons, gyrated, bounced, and performed other ostensibly useless functions.

Tinguely's most famous and perhaps most influential piece was performed at the Museum of Modern Art in New York in 1960. Entitled "Homage to New York," it was a machine whose function was to destroy itself. In "Art and Destruction: Thoughts Following a Suicide in a Garden" (March 1960), *New York Times* art critic John Canaday described the 23 foot long by 27 foot high sculpture:

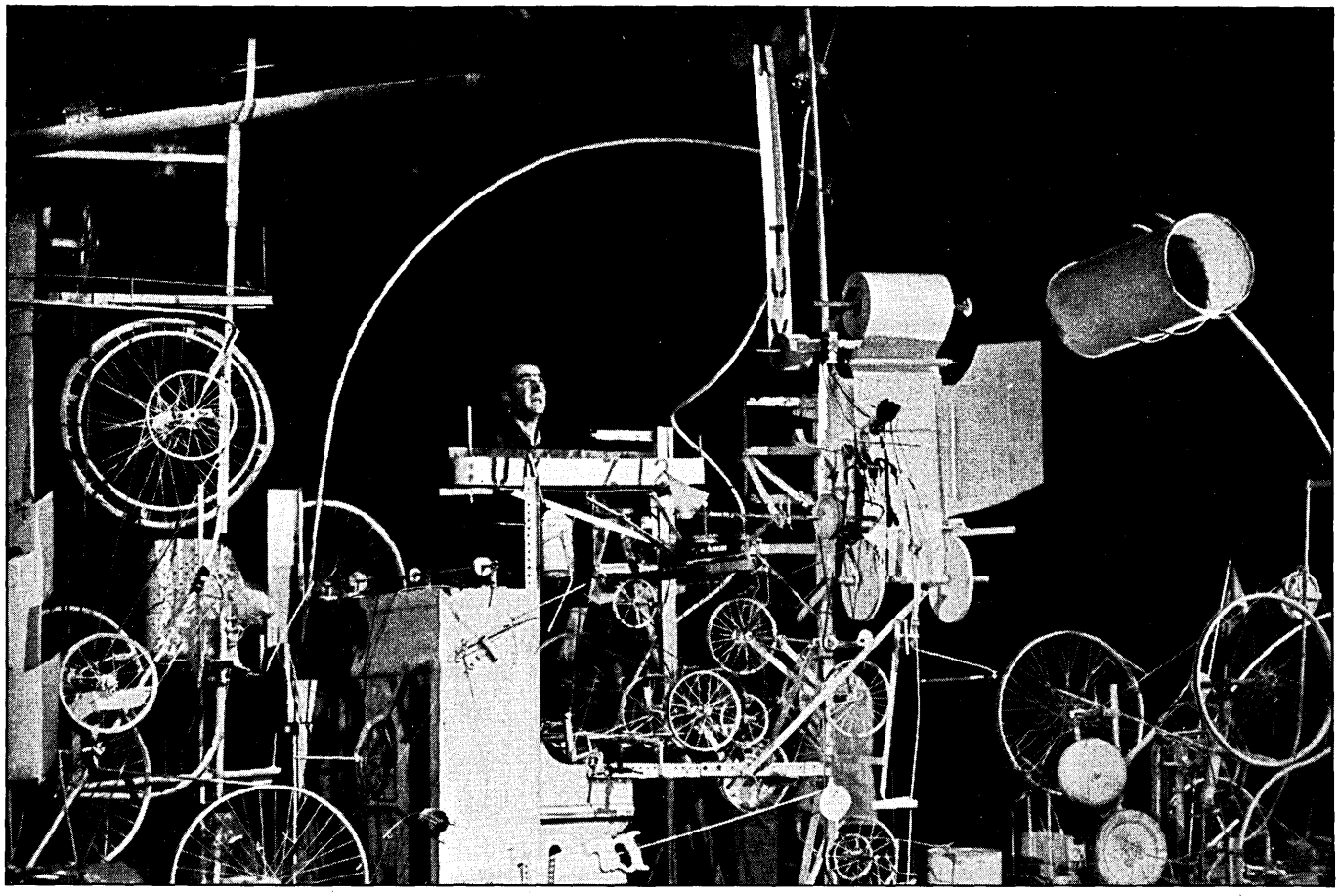
". . . an object of perverse attraction if not of classical beauty, a super-gadget constructed of such elements as 80 bicycle, tricycle, and wagon wheels, an already moribund player piano, a battered toy wagon, an enameled bathtub, a meteorological trial balloon, many glass bottles, and other material picked up in junkyards . . . It was designed to beat, burn, hammer, and saw itself to death."

Time magazine was not impressed; its reviewer called "Homage" an "unbeautiful joke with no punch line." The newsweekly did, however, bring an elaborate description of the evening and a photograph of Tinguely and machine into over 2.5 million American homes.

> *Artists are offered new media, new colors, new forms of lighting; the modern world moves in and takes over, even in painting. It forces things to change naturally, normally.*
>
> —Marcel Duchamp 1967

By the mid '60s this spirit of experimentation and invention had become nothing less than a cultural imperative. How could a traditional painting or sculpture hope to shock, excite, stimulate, or even draw a glance from an audience weaned on neon billboards, movies, radio, and tv? Large, colorful, sometimes kinetic images—plentiful, cheap, disposable—were now part of daily experience, made to be ingested in an instant while the viewer whizzed by on the freeway or flipped through a glossy magazine. The demands of high-speed experience rapidly transferred to art-viewing, where studies showed the typical museum-goer spending an average of 1.6 seconds before a work. If McLuhan was right in calling the medium the massage, the massage of the day was a beam of electrons flooding a phosphorescent screen—certainly not a stroke of paint across canvas.

This fact did not go unnoticed by art-



PHOTOGRAPH BY DAVID GAHR

Tinguely's "Homage to New York," 1960, was designed to make music, create and erase "action" paintings, and destroy itself.

Nam June Paik, the "George Washington of video art," with video artist Shigako. By 1967 Paik owned 23 television sets, nine of them color.

PHOTOGRAPH BY ERIC KROLL

ists such as Korean-born Nam June Paik. Often called the "George Washington of video art," Paik was among the first to recognize that the economy, speed, and efficiency of electronically transferred images would become increasingly important to art-making. In 1962 he sold everything he had and bought 13 tv sets (by 1967 the number had increased to 23—nine of them color). He based performance pieces on arrangements of these sets and the controlled distortion of their images.

On Oct. 4, 1965 Paik bought the first Sony videotape recorder and monitor to enter the United States, and began a series of collaborations with cellist Charlotte Moorman, incorporating video, live performance, and music in unique juxtapositions. For one piece, "T.V. Bra" (1969), Moorman played the cello with small tv monitors covering her breasts. The monitors were hooked up to respond to the sounds she produced on the instrument. In another collaboration, "T.V. Cello" (1971), monitors of various sizes were arranged to form the cello itself, which Moorman "played" during the performance.

In these pieces Paik and Moorman forced their audience into new relationships with the ubiquitous television. Moorman was not watching tv and was not *on* tv. Tv was in fact on her, becoming part of her clothing, or an extension of her body. The monitors and the musician formed a kinetic sculpture—a system part biological, part electrical. Work such as this, which emphasized active relationships rather than static handcrafted objects, led the way to art/technology explorations that would eventually bring about the very dematerialization of the art object itself.

> *At the high speeds of electric communication, purely visual means of apprehending the world are no longer possible: they are just too slow to be relevant or effective.*
> —Marshall McLuhan 1967

At the end of the 1960s three major art museums mounted exhibitions sporting curious titles: "Cybernetic Serendipity" (1968) at the Institute of Contemporary Art in London; "Information" (1970) at the Museum of Modern Art in New York; and "Software" (1970) at the Jewish Museum in New York. Sounding more like conventions for computer manufacturers, they were nevertheless art shows, focusing on the cultural impact of modern technology. The exhibitions dealt with machines, most notably computers, and their place in something called conceptual art, a form directly related to information processing.

By this time, science not only offered new methods of producing and transmitting sounds and images, but a whole new way of looking at information and communication in general. Conceptual artists were attracted to these new modes of thought, and in particular to cybernetics, with its focus on the process by which information is generated, transmitted, and assimilated. They began to apply a systems approach to art. In their view, the exploration and rapid transfer of information was of central interest, and the art object itself had become a kind of tomb for the creative spirit—a bit of congealed culture to carry to the gallery, living room, or museum. According to these artists, the handcrafted object served the dealer, collector, and curator rather than the artist, art, or the public.

In place of an object, conceptual artists offered the examination of ideas. This could include the study and documentation of biological systems, or explorations into the political, social, and economic systems surrounding the making and marketing of art. The works took an astounding range of forms—from excavations of tons of earth to simple written statements—and could employ audio or video tapes, diagrams, site photographs (of where an event could take place or an object might be built), copying machines, radio transmitters, or computers. These means were chosen not for their aesthetic value, but for their ability to act as vehicles for the transmission of information.

Conceptual/video artist Dan Graham's entry in the "Information" show, for example, was a sheet of paper on which he had listed some distances (see box p. 122). For the "Software" show, the Architecture Machine Group from MIT, headed by Nicholas Negroponte, created a fascinating computer piece called "Seek." It consisted of a five- by eight-foot platform on which were placed 500 two-inch metallic cubes. A block-piling mechanism, activated by a space-allocation program, arranged the cubes to produce a small geometric city into which a colony of 40 gerbils was set loose. As the gerbils knocked over cubes, the computer rearranged them. When a cube was slightly displaced, "Seek" merely returned it to its original position. If a cube's location was significantly changed, the program read the displacement as the gerbils' intention, and the cube was fitted neatly into its new site.

It would be a mistake to view "Seek" merely as a sculpture consisting of an attractive (albeit changing) arrangement of cubes. The piece was a system of interaction between the animate and inanimate—a system that Jack Burnham, organizer of the show, likened to the art-making process itself.

The remarkable versatility of the computer, and the ability of Negroponte to see beyond the traditionally established limits of "sculpture" made possible an innovative piece of limitless, unpredictable variation. Given precedent-setting examples such as this, and the astounding development of computer hardware and software during the last decade, it would seem that museums and galleries would be filled with computer art by now. Yet this is clearly not the case. In fact,

Why does it seem that artists have relegated the computer to the role of an expensive electronic paintbrush?

Negroponte opened a recent essay by stating that "Rarely have two disciplines joined forces to seemingly bring out the worst in each other as have computers and art. While the intentions may be good," he continued, "the results are predominantly bad art and petty programming." What went wrong?

The visual arts entered the computer age about 25 years ago through the simple line-drawing capacity of plotters and cathode ray tubes. Although scarcity and high cost kept them beyond the reach of most artists during the 1950s and '60s, these early machines became the basis for the booming computer graphics field, where technological advances have since offered artists a full array of hues and shades, enormous control over line and area, and the ability to enhance, vary, and move images.

Of course, not all of these great achievements were made for the sake of art. The use of computer graphics in such diverse fields as medicine, cartography, industrial design, education, and business management has been well documented. Most of the more "artistic" applications have been made by commercial art firms in hopes of saving labor, time, and costs, and finding new high-tech looks for their clients' advertisements. Animation is a particularly successful example of this. Here the computer has proven both a generator of stunning visuals and a great labor-saving device.

Artists have also turned to these graphic systems to produce "fine art," but the results have generally been awful, consisting mainly of grids, repetitious patterns, kaleidoscope and snowflake images, patchwork quilts, or worst of all, mechanical representations of humanoid forms. They are often accompanied by titles employing pseudoscientific jargon followed by a number: "Combinatorial Cybernetic Still-Life #5000."

Where are the offspring of the more innovative art/technology fusions featured in "Cybernetic Serendipity", "Information", and "Software"? Why does it seem that artists have relegated the computer to the role of an expensive electronic paintbrush?

The answers are complex. For one thing, the art/technology shows received anything but universal critical acclaim. They were extremely costly to mount (approximately $125,000 for "Software"), required engineers to set up and operate, and after all that, many pieces never worked properly. According to Grace Glueck of the *New York Times*, " 'Temporarily out of order' was the operative phrase . . . at 'Software' . . .". "Software," and especially Negroponte's "Seek," were the objects of a poignant attack by Thomas Hess, then editor of *Art News*.

Furthermore, as one might expect, the idea of uncollectable art never went over well with dealers, collectors, and museum curators. Conceptual artists, who claimed that the elimination of the art object also obviated the art critic, didn't make many friends in that field either. And not having anything to sell is a hard way to make a living.

Conceptual art has in fact mustered enough interest to survive. Video art has gained in popularity, and has become increasingly sophisticated both technically and aesthetically. But what of the computer? Has its use for fine art production been hopelessly subsumed by flashy blips and grids?

> *We have all let anthropologists, philosophers, historians, connoisseurs, and mercenaries, and everybody else tell us what art is or what it should be. But I think we ought to very simply let it be what the artist says it is. And what the artist says it is, you can see by his work. I would like to leave it just like that.*
>
> —David Smith c.1952

Visitors entering the San Francisco Museum of Modern Art during the summer of 1979 were greeted with a disarming sight. A tremendous sheet of paper lay on the floor, on top of which rode a small metallic contraption vaguely resembling a toy truck. Linked by a long tail of black wire to a DEC PDP-11/45 computer, this tiny vehicle meandered over its clean white landscape, producing the most remarkable drawings.

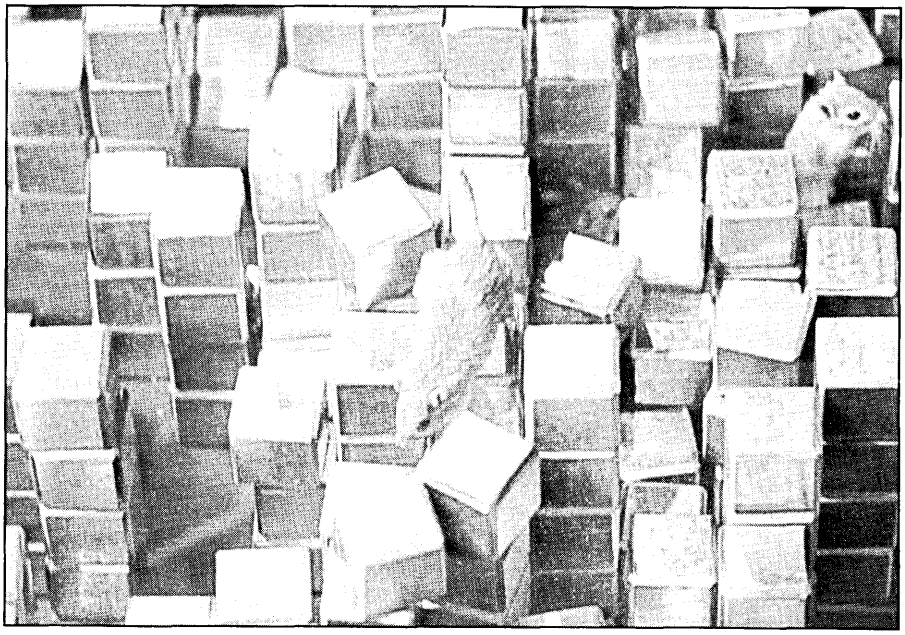
This small truck (actually called the "turtle") was developed by California artist Harold Cohen. Cohen, originally a painter, began working with computers 12 years ago from a desire to explore the process by which humans read symbols and images. At the Artificial Intelligence Lab at Stanford University, he developed AARON, a program that simulates drawings done by the human hand.

With the aid of the turtle, AARON draws asymmetrical shapes and calligraphic scribbles with a remarkably expressionistic

MARCH 31, 1966

1,000,000,000,000,000,000,000,000.00000000 miles to edge of known universe
100,000,000,000,000,000,000.00000000 miles to edge of galaxy (Milky Way)
3,573,000,000.00000000 miles to edge of solar system (Pluto)
205.00000000 miles to Washington, D.C.
2.85000000 miles to Times Square, New York City
.38600000 miles to Union Square subway stop
.11820000 miles to corner 14th St. and First Av.
.00367000 miles to front door, Apt. 1D, 153 First Av.
.00021600 miles to typewriter paper page
.00000700 miles to lens of glasses
.00000098 miles to cornea from retinal wall

—Dan Graham



Nicholas Negroponte's "Seek," 1970, prompted Thomas Hess's complaint that "the big point in art and technology manifestations . . . has been that none of the technology works."

PHOTOGRAPH BY MIT ARCH. MACHINE GROUP

line. Discrete, fully and partially enclosed images engage in unexpected relationships: here attached by overlapping lines, here floating alone in space, some touching, some almost but not quite. There are large complex images complete with elaborate interior structures juxtaposed with tiny empty circles and jagged boxes. Crosshatched shadows provide contrast and give some images a volumetric appearance. All forms and lines float in an undefined, limitless space—there is no gravity, and massive objects hover weightlessly above slight marks—yet the entire work has a completely resolved look.

Cohen has written that AARON can "knock off a pretty good drawing," and in fact, "in the course of an evening produce the equivalent of a two-year one-man show." However, Cohen's major interest in AARON's drawings lies in what they tell him about the way humans understand images.

Drawings are made up of various marks. Images are marks that appear to "stand" for something, or to express intention. It is commonly believed that human response to symbols is based upon a reading of the image-maker's message (e.g., this mark means "sun," these lines represent "tree," etc.). AARON is an image-maker with no knowledge of the world, and hence no message. Cohen has found, however, that people inevitably respond to AARON's drawings as if they were made by a person. They see references to the real world, such as landscapes inhabited by creatures, and they read meanings and intentions into the work. Yet the program merely consists of simple rules for drawing; it is not capable of making intentional references to the world. It recognizes a filled space and an empty space, curved and straight lines, outside and inside, closed and open shapes, repetition, etc.

These "simple rules" are contained in a program written in C, under the UNIX operating system. The program consists of over 300 "productions," or subroutines, arranged in a hierarchical structure. The levels are mapping, planning, lines, sectors, curves, lookahead, movement control, avoidance, and, atop the hierarchy, artwork. To draw a single line, AARON may call upon 20 to 30 productions on at least three levels of the structure. Artwork is responsible for the organization of the drawing as a whole.

The program does not carry out preplanned drawings by Cohen. Rather, it randomly selects a combination of productions and uses them to create a unique and unpredictable drawing. Cohen says that the drawings are of a "highly evocative kind" but are not "meaningful." Because they may nevertheless be perceived as possessing meaning, he has come to believe that the message content of symbols is largely dependent on the viewer's preconceptions. Cohen has called this phenomenon the "paradox of insistent meaningfulness," and he says that it determines the way images (and by extension, art in general and the artist) function in society.

Cohen's interest is not limited to the response provoked by the drawings alone. He also wants to confront his audience with the process. Therefore, a typical show (of which he has had a number, both in the U.S. and in Europe) consists of several carefully arrayed parts: computer, turtle, Tektronix graphics terminal, hardcopy terminal, works in progress, full-color computer-inspired mural, finished drawings, and—a rare attraction at any museum show—the artist himself.

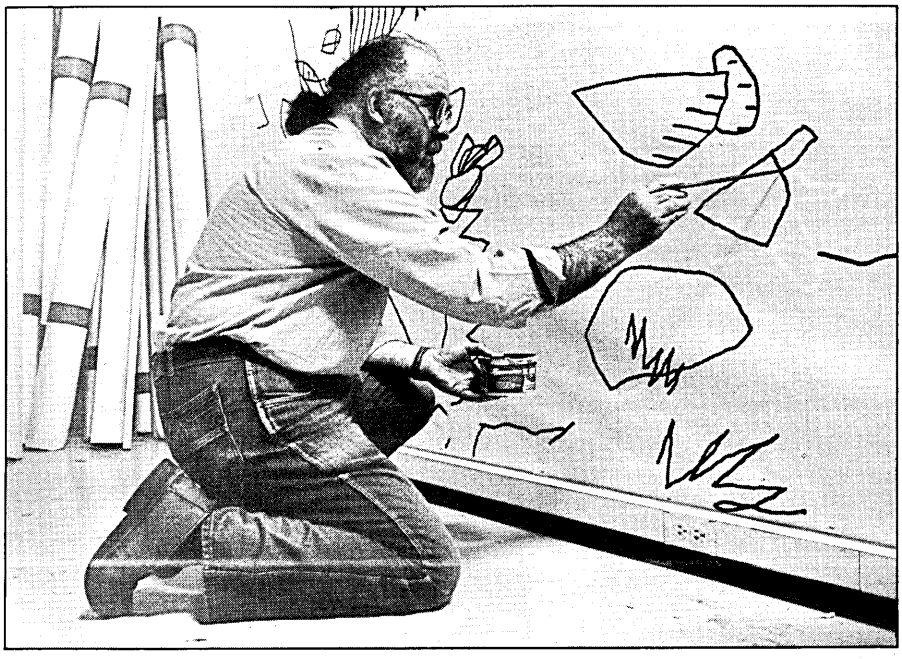
Cohen does not like to categorize his work. He rejects the term "computer art" mainly because he dislikes most of what is produced under that name. "I don't really know too much about what the world at large thinks about computers and art," he says. "If they think what I think, they probably don't care to look." When asked whether he thinks of his work mainly as drawing, painting, sculpture, or conceptual, he replies that he is not interested in those distinctions either. He is not even concerned with whether or not it is labeled "art."

"I find myself at my exhibition," says Cohen, "talking to some obviously enthusiastic and interested person for an hour about all kinds of things having to do with the program, art, life, philosophy—God only knows what—and at the end of an hour, the person will say rather timidly; 'Well, it's absolutely marvelous, but is it art?' The answer I finally figured out was 'Well, why do you care? What difference does it make? You've just had a hell of a good time, you've seen more than you could possibly have seen looking at every picture in the museum for 15 seconds at a time; why do you care whether it's called 'art'?"

Whether or not one calls it art, one will find Cohen's work in a number of prestigious art museums in the near future. He is currently planning shows with the Institute of Contemporary Art in Boston, the Brooklyn Museum in New York, the Tate Gallery in London, and the National Gallery of Wales. Cohen wants to entitle these shows, "Bringing Down the High Cost of Art." Their main feature will be a series of drawing machines. The audience will be able to buy, very cheaply, a sheet of paper upon which a machine will create drawings according to the visitor's specifications (and, of course, sign them). "Instead of going to the museum to see things that only very rich people can have," Cohen explains, "the visitor takes home an original, unique work of art for which he's paid $5."

So although the cost of mounting the show may be high, the museum will be able to give out perhaps 1,000 such drawings, thereby subsidizing the public—a function that Cohen finds completely appropriate.

Cohen is currently at work on an enhancement of his original program. Whereas AARON approaches each new work as if it has never drawn before, the new program will build on past experience. It will draw images and then modify them according to stored criteria for distribution, complexity, and other parameters. The modified images will be stored on disk, to be called up and used during subsequent runs.



PHOTOGRAPH BY BECKY COHEN

Harold Cohen at work on a tile mural for the Computer Science Department at Stanford University in California.

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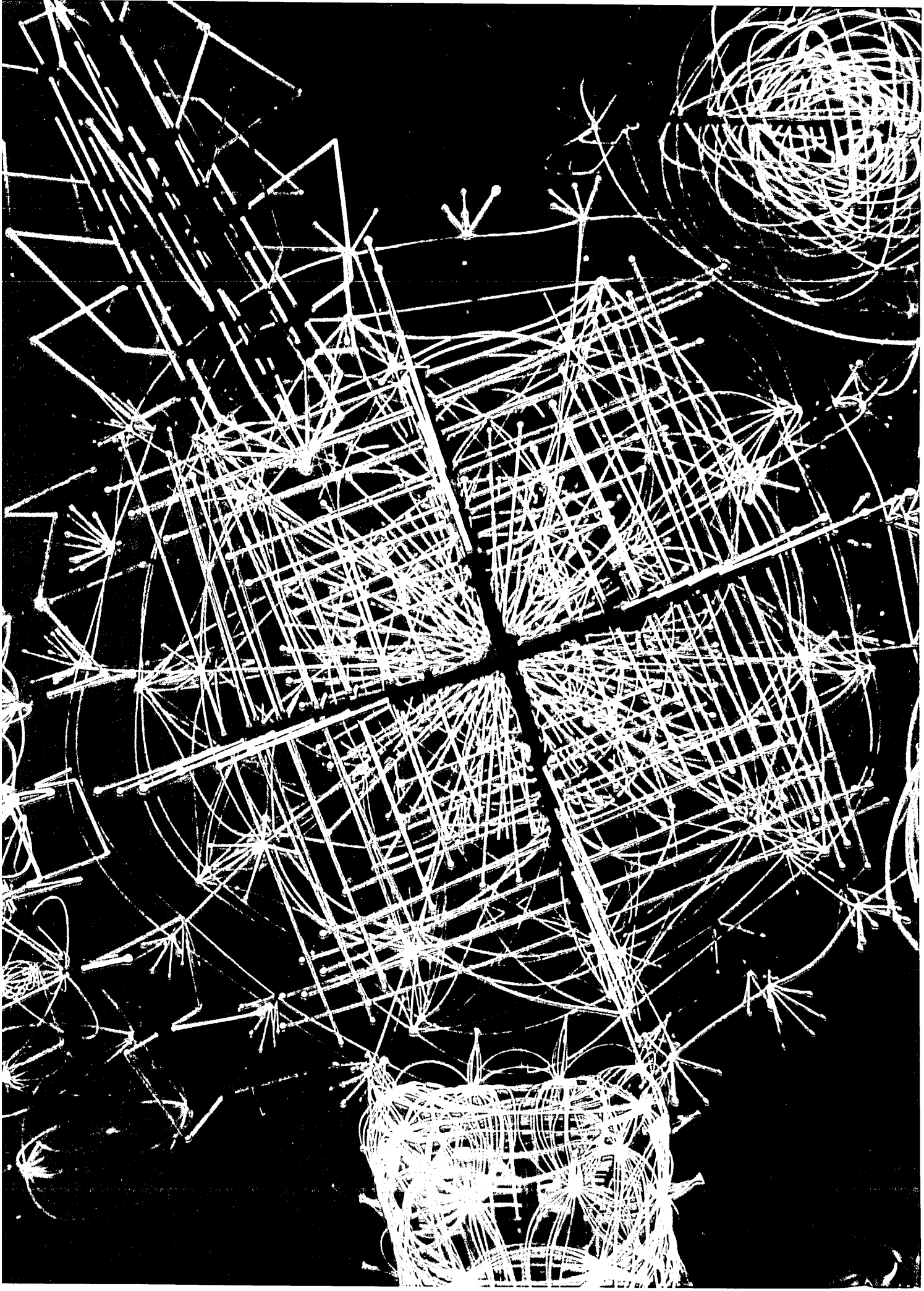


Computers will continue to alter our culture, and in particular our notions of how art can be made and viewed.

The program will thus develop a supply of images in a manner analagous to the way in which a human artist builds his vocabulary. AARON is rule-oriented, with its unpredictability based on random selection of productions; the new program's unpredictability will be of a more "human" kind, because it will increase its store of images each time it is run and it will modify those images each time it fits them into a drawing. Cohen is reluctant to be too specific about how the drawings will look, but he does say that the program should shed some light on a question that is basic to artificial intelligence studies: "What do you mean when you say that a computer is behaving creatively?"

Another California artist, Milton Komisar, takes a very different approach to the computer. Komisar's romance with technology began as a search for more vital ways of expressing his concerns as a painter. Trying to structure light, color, and movement on the two-dimensional painted surface became increasingly unsatisfying in a world brimming with electronic possibilities, so by the late '60s Komisar had given up painting in favor of three-dimensional environments incorporating electronic components. Then in 1974 he met computer scientist Michael H. O'Malley at the University of California at Berkeley and began a collaboration that has, according to Allan Temko of the San Francisco *Chronicle*, produced " . . . the Bay Area's most innovative sculpture of the past five or six years."

Komisar's most recent sculpture, "Nisus," is a dramatic example of this collaboration. "Nisus," 23 ft. wide by 14 ft. high, is an assemblage of hollow plastic pipe, solid polystyrene rods, and 600 twelve-volt bulbs. A recent installation at the Walnut Creek Civic Arts Gallery in California had "Nisus" rotating 13 feet above the gallery floor, emitting a carefully orchestrated, computer controlled light show, complete with electronic sound accompaniment.

The axial structure of "Nisus" is a pyramid of black plastic plumbing, about which weaves a jungle of thin plastic rods bent into shape by heat and tension. The powerful geometry of the pyramid determines the placement of a multitude of satellites, which Komisar calls "babies." A SOL microcomputer with 48K of RAM pilots the swirling, pulsating, and undulating white and colored lights which surge through the clear plastic structure. It also controls electronically generated sounds (which Komisar humbly avoids calling "music") corresponding to the emotional effect he wants to establish at each state. At times, the quantity and variety of color brings to mind the stained-glass windows at Chartres. Then "Nisus" suddenly bursts into pure white light, which quickly melts into various other combinations. "Nisus" color comes from the remarkably simple technique of painting the tips of each plastic rod with a marking pen. When illuminated the rod becomes infused with the color. If a different color and light source is placed at each tip, the colors blend in varying degrees along the rod's length.

A typical 50 minute "Nisus" performance calls for some 1,000 predefined light patterns to be produced in sequence under control of a Forth program. Komisar stores each pattern in memory as an array of binary bits, each of which corresponds to the on-off state of a group of five bulbs. This enables him to control 600 bulbs with a 120-bit output port. To add complexity and rhythm to the sequences, he blends each pattern into the preceding one so that patterns of light and dark bulbs superimpose and interact with each other in a way that could be described in computer terms as a multitasked process. The effects are much more complicated than could be achieved with a simple "player piano" approach. The sound effects are generated by General Instruments chips. Again, predefined sound patterns are stored as binary arrays and are sequenced in conjunction with the light patterns

Interestingly enough, the word that comes up most frequently in a conversation with Komisar is not "computer" but "Cézanne." Although the computer has become indispensable to his work, his inspiration comes from the overlapping planes of color which dominate the later paintings of the Post-impressionist. For Komisar, electronics is the perfect medium for exploring and expanding upon Cézanne's concepts. He explains:

"Cézanne brought the whole idea of experiencing air, space, and movement in nature up to its apex, by seeing it in terms of colored light . . . Until you get into a real electronic medium that can really go out into space with movement, you don't have the resolution of this idea." Komisar is currently negotiating with Apple Computer to sponsor a nationwide tour of "Nisus". He recently began a residency at the Center for Advanced Visual Studies at MIT where artists and engineers collaborate on art/technology explorations including the use of computers, light, holograms, gases, and video.

> *From Marx to Spengler, from Tolstoy to Tocqueville, not a single prophet of the recent past predicted the greatest problem of today: parking.*
>
> —Nam June Paik, 1969

Cohen and Komisar share a reluctance to make predictions about the relationship between art and computers. The reason is plain. Predictions are bound to be wrong, given the vast array of social, economic, political, and technical variables waiting to thwart them. It is obvious that computers will continue to alter our culture, and in particular our notions of how art can be made and viewed. What is not so obvious is the form the resulting art will take.

At the height of the industrial revolution, English artists were so aesthetically offended by the machine and its products that they turned to the distant past for inspiration. The resulting movements were the Pre-Raphaelite Brotherhood, whose adherents adopted 15th century painting styles, and the Victorian High Renaissance, whose followers turned to Greece and 16th century Italy for inspiration. Victorians would have had trouble imagining that by the turn of the century, the dreaded machine would be the favorite subject of a new generation of avant-garde painters and sculptors. The idea that the machine itself might someday be regarded as art would have struck them as nonsense.

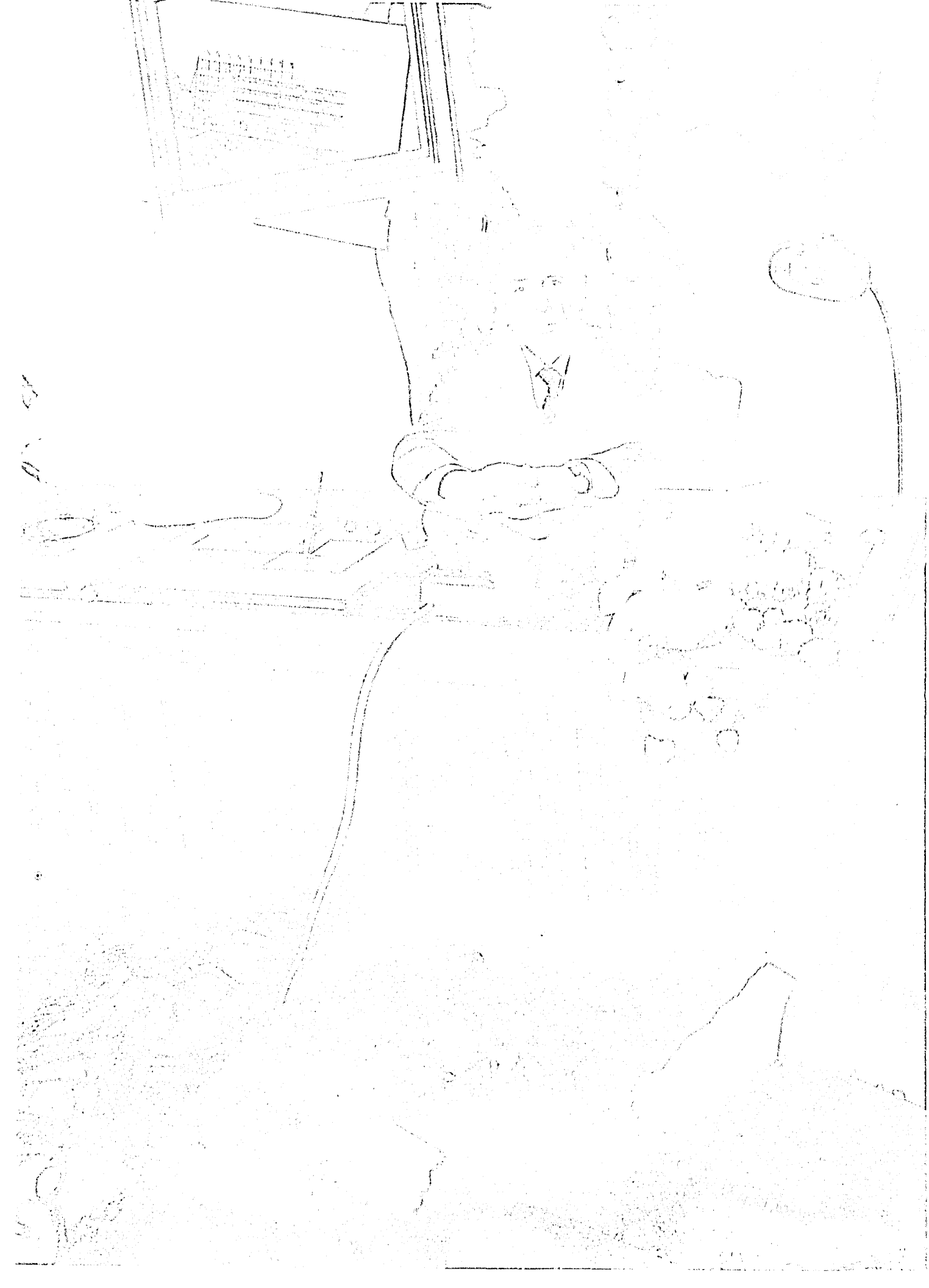
We are probably not much better prepared to predict what art will be like if the computer becomes as common as the television. Jacques Ellul has speculated that in the next century, knowledge will be fed by machine directly into the nervous system, bypassing consciousness. That possibility seems remote, but artificial intelligence researchers are already altering our ideas about consciousness and creativity. It is not surprising that Harold Cohen, like other pioneers, finds that he needs a new vocabulary to discuss his work. Our aesthetic lexicon is likely to change considerably over the next few decades.

In the short run, however, it is possible to apply some existing criteria to determine what is and what is not worthy of attention. To wit: the most successful "computer artists" are those few who do more than merely replace the paintbrush with the electronic pen. These artists use the computer as a means of significantly advancing artistic concerns—a process that often requires conceptual and aesthetic breaks with practices that may have taken a lifetime to develop. Many artists are unwilling (or perhaps unable) to take this leap. In the right hands, though, the computer has proven a remarkably flexible and effective medium for artistic explorations. For Harold Cohen it is a small mechanical turtle providing new insights into image processing. For Milton Komisar it is an electronic road to Cézanne. The work is highly interesting, engaging, and provocative. Can we call it art? Well, "What difference does it make?"

PHOTOGRAPH BY PETER BROWN

Milton Komisar's "Nisus." Although the computer is essential to the sculpture, the inspiration comes from Cézanne.

Ken Sofer, an artist who paints and exhibits in Manhattan, has also published a book, *Two Years on the Public Palette*.



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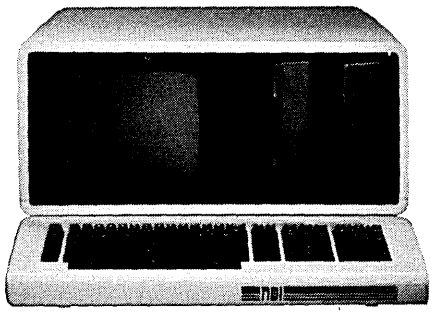

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NBI WORD PROCESSORS.

CIRCLE 112 ON READER CARD

If-then-else is not yet as familiar to musicians as allegro ma non troppo, but that may change.

GIVE TCHAIKOVSKY THE NEWS

by Leopold Froehlich

"Is it the composer's fault that man has only 10 fingers?
—Charles Ives

A bespectacled gentleman wearing a short-sleeved white shirt sits at a table poking a keyboard terminal. While speakers behind him whirl out electronic sound, the green light of the cathode tube reflects off his glasses. An audience of about 100 stares dumbly at the man by the keyboard, who continues to gaze raptly into his machine. The piece ends with an abrupt glissando and a comic moment of misplaced tumidity, and the listeners begin their tentative applause.

After the concert a dozen people linger around the stage discussing software and technique. Computer music, or more properly computer-aided music, elicits such response from its listeners. Many are wary of the results—the music—but most are enthralled by the technique.

There have been many grandiose and naive claims made about computer music over the past two decades. Some people predicted that music would cease to be; others foresaw an era of musical change as great as when diaphony supplanted monophony in 10th century Holland. Such sweeping changes, however, have yet to occur, and much of computer music today remains delimited by technical descriptivism. What has often been created is music that is neither outrageous enough to merit condemnation nor good enough to stir interest.

Lars-Gunnar Bodin of the Electronic Music Studio in Stockholm writes: "Music was probably the first art form in which the computer was used for serious and continuous work." The work began with the pioneering efforts of Max V. Mathews and Lejaren Hiller in the 1950s; those researchers profited from the fact that music was created electronically decades before the arrival of the first analog computer.

The "classical" electronic music studio of the 1950s relied on tape splicing and manual control of recordings for sound manipulation. This was followed by compositional efforts with a general-purpose computer using Hollerith cards for digital-to-analog conversion. Computation times were so long that a sound might not be heard for hours.

In the 1960s, with the introduction of the keyboard-input voltage-controlled synthesizers of Robert Moog and Donald Buchla, new high-speed DACs, and Bell Labs' programs for sound generation, the composer could begin to construct sounds of extraordinary complexity. Further advances allowed for computer-direct control of sound parameters, a greater reliance on memory, and faster computation times.

But during the 1950s technique and style were central concerns of the artist. The effect and place of chance in art was a popular subject during this period. Aleatory music, or random composition, was defended for ontological reasons, despite its dynamic simplicity and often wearying texture. The earliest attempts at musical programming were not much more than compositional games. Nothing new there: Mozart composed his *Musikalische Wuerfelspiel* (K.294d) by selecting a scale from a roll of dice and constructing a harmony from it.

Efforts in the 1950s were not much advanced from that crapshoot. Sometime around 1951, Harry Olson and Herbert Belar built a composing machine that consisted of two number generators spewing out random integers. These numbers were applied to a score according to various probabilistic functions, and would usually end up performed with traditional instruments.

In 1956 M. Klein and D. Bolitho of Datatron came up with a device dubbed "Push Button Bertha," which synthetically generated some 4,000 pop tunes (after analyzing common features of 100 then-favorite songs along with "some of Mozart's remarks on melodic design"). In 1955, by way of a similar process, Belar synthesized tunes in the style of Stephen Foster. These works accomplished some insights into probability distributions and learning and information theory, but because of their derivative nature were pretty much an aesthetic dead-end.

ILLIAC COMPOSES SUITE

In 1957 Lejaren Hiller and Leonard Isaacson wrote a program at the University of Illinois for the generation of random numbers, which were then screened for acceptance according to probabilities in force. The program, eventually known as "ILLIAC Suite for String Quartet," provided for a "try again" routine permitting the computer to rewrite unacceptable passages. The process began with polychromatic, dissonant music and subjected it to a process of selection; the human composers were the final arbiters. "ILLIAC Suite" did not please a great many people. Critical response was negative, and performers shunned performances, perhaps construing the piece to be somehow unfair to musicians (the American Federation of Musicians' contracts still prohibit the use of "surrogate" instruments). The ILLIAC computer was regarded as a composing machine that could evolve its own style. For Claude Shannon or Norbert Wiener this would represent a monumental achievement indeed, but the ILLIAC lacked variety in timbre and ultimately fell short of the mark. The work remains influential, though, as an intrepid move in the development of computer music.

The polymathic Iannis Xenakis applied compositional algorithms such as stochastic processes (based on behavior of random variables), Markov chains, and Poisson distributions for the creation of his music. Xenakis' 1961 work "ST/10-1, 080262" used an IBM 7090 computer to determine the compositional order. Xenakis' architectural training allowed him an empathy for found music in a style reminiscent of Pierre Schaeffer's musique concrète (see box p. 132).

In the '50s and early '60s the computer was regarded as a plausible composing machine (with given data). More recently, the computer has been used as a memory capable of producing desired sound in exact sequence. Work today is based not so much on composition as on the analysis and synthesis of sound via computer. The man most responsible for this development is Max V. Mathews of Bell Labs in Murray Hill, N.J. Math-

ILLUSTRATION BY BERNARD BONHOMME

Bonhomme

"No sound becomes old more quickly than a new sound."

PRELUDES

Musicians have been tinkering with electricity since at least 1897, when the Canadian Thaddeus Cahill demonstrated his sounding stave, an electric device for the control of timbre. While the orchestras of his day were concerned with Berlioz or Rossini, Cahill was applying for a franchise to lay wires in the streets of New York for the purpose of distributing music electrically.

By 1906, when Cahill demonstrated his 200 ton telharmonium—which generated sounds by rotating toothed wheels in an electromagnetic field—composers had begun a search for an alternative to the classical tradition of tonal thought. In 1907 composer Ferruccio Busoni cited Cahill's work as a hope for a future of "abstract sound, unhampered technique, and unlimited tonal material." Arnold Schoenberg's further break with diatonic harmonies in 1908 made any combination of pitches permissible. Composers began to explore timbral relations and tonal qualities.

In 1917 Edgar Varèse wrote:

"Music, which should be alive and vibrating, needs new means of expression and science alone can infuse it with youthful sap. . . . I dream of instruments obedient to thought—and which, supported by a flowering of undreamed-of timbres, will lend themselves to any combination I choose to impose and will submit to the exigencies of my inner rhythm."

Technological advances in the period around the First World War granted musicians the opportunity to move in this direction. The Italian Futurist Luigi Russolo (who referred to the traditional concert hall as a "hospital for anemic sound") produced his *intonarumori* in 1913. These were elaborate and bulky noisemaking mechanisms, which Russolo operated on stage in Paris and London. Russolo was intrigued with the rhythmic quality of machine sounds, and defiantly described his work as "noise music." Not surprisingly, noise music was never widely appreciated, but Russolo does prefigure much of later 20th century music.

American inventor Lee DeForest perfected the first oscillator (a source of periodic changes in voltage for the production of pitch and timbre) in 1915. New instruments, such as Leon Theremin's etherophone (1923), Maurice Martenot's ondes martenot (1928) and Friedrich Trautwein's trautonium (1928), were introduced in quick succession. In 1929 A. Givelet and E.E. Coupleux devised a musical synthesizer that used four oscillators controlled by a punched paper roll. Laurens Hammond produced the first electronic organ in 1929, which allowed the performer to control timbre, pitch, and volume.

Edison's and Berliner's invention of the phonograph in 1878, along with Valdemar Poulsen's invention of the wire recorder in 1898, had made possible the storage of electronic sound; in 1935 the invention of the first tape recorder, the magnetophone, enabled the composer to move beyond rudimentary sound manipulation. It became possible to vary speed during playback, to play sound backwards, to alternate between sounds by splicing or montaging, or to augment sound further by overdubbing. The plasticity of sound had been extended. "Everything which was limited," writes music historian Paul Griffiths, "became unlimited; everything which was imponderable could then be subjected to precise measurement."

The serial techniques of Schoenberg, as furthered by his students Alban Berg and Anton von Webern, had a direct effect on the shape of modern composition. The serial principle assured a coherency to atonal music by applying a 12-note series to a piece. This series—known as a tone row—is then maintained in strict order throughout the composition. A new objective musical language could thus be achieved. At first, serial techniques were applied only to pitch. Later, serial control was extended to rhythm, dynamics, texture, and register, which resulted in an often rarefied atmosphere of disjunct melodies. This total serial technique was considered in keeping with the tenets of technological advance, scientific thought, and modernity.

In 1948 Pierre Schaeffer, in collaboration with Pierre Henry at Radiodiffusion et Télévision Francaise in Paris, introduced tape-recorded sound objects freed from association to the natural world. By altering and rearranging natural or manmade sounds stored on magnetic tape, Schaeffer composed what he defined as musique concrète.

The commercial availability of the tape recorder around 1950 furthered efforts toward dealing with found noises and pure sound. By 1953 the field of electronic music was flourishing. Karlheinz Stockhausen, with Herbert Eimert and Werner Meyer-Eppler, had established the Elektronische Musik studio in Cologne, where they used sounds made by sine wave generators for manipulation by tape recorder. Their work, along with the efforts of Vladimir Ussachevsky and Otto Luening at Columbia University in the 1950s, typified the music that emerged from the so-called classical electronic music studio.

Such early efforts were hindered by the rudimentary technology of the analog synthesizer, and constrained by the manual difficulties presented by tape splicing. Modulators and waveform generators had a certain acoustic sameness, which allowed for no harmonics but only a single frequency of even dynamics. Harry Olson's and Herbert Belar's invention of the RCA Mark I synthesizer in 1954 offered the first variety in timbre and shape that permitted the composer to explore new sounds. With this, the stage was set for the introduction of the computer into the world of music.

—L.F.

ews has been called the father of computer music and a man as important to the development of music as the inventor of the pianoforte. It was Mathews who in 1957 first used the DAC to translate binary voltage fluctuations into sounds.

Mathews' accomplishments are legion. While finding the act of playing a violin attendant with obstacles, he saw in the computer a performance instrument capable of "breaking the shackles of mechanical virtuosity." Mathews sought to make the computer accessible to composers and performers without imposing his "tastes and ideas about instruments on musicans."

His Music IV and Music V programs were of great significance to computer music because they let musicians work with the computer without being overwhelmed by technical concerns. Mathews' GROOVE program, developed with F.R. Moore, allowed for "edited improvisation" between machine and performer, thus freeing computer music from the barren rigidity of unchanging performance.

Mathews' more current endeavors include the completion of further musical programs as well as the invention of the intelligent instrument (like the sequential drum, sequential piano, and sequential violin). These instruments permit interaction between score, instrument, and performer in a manner hitherto impossible. Mathews was dissatisfied with conventional instruments because "one had the freedom to play wrong notes when one didn't want that freedom. Intelligent instruments take away that freedom to play wrong notes."

Mathews is also responsible for what has been called the greatest conceptual advance in computer music, unit generators. These are distinct subprograms that stimulate electronic signal-generating devices—instruments, you might say—which the composer can use as sonic building blocks. An executive source of voltage control makes possible the generation of sounds in real time; by pushing a button, the composer can create sounds

SCIENCE/SCOPE

A device that directly converts electrical input signals into output images could be used for optical data processing and the projection of very bright TV pictures on a large screen. The device, a CCD liquid-crystal light valve, uses a charge-coupled device array and a metal oxide semiconductor readout structure to transfer signal charges to a liquid-crystal layer. The readout source can be common white light or a laser in the spectral range from near ultraviolet to infrared. Hughes has demonstrated a fully operational 64x64-element device.

A fiber-optic communications system may lead to an anti-armor missile whose many advantages include firing without being exposed to enemy counterfire and locking on a target after launch. The concept calls for a missile with an imaging seeker to relay signals to the gunner over a glass thread that pays out as the missile flies. The gunner would select and acquire a target which he sees on a TV screen. The system would be low in cost because much of the data processing is done at the launcher, not the missile. It also would be reliable because the missile is immune to countermeasures and is controlled over the entire flight. Hughes and principal subcontractor ITT Electro-Optical Products Division are developing the Integrated Fiber-Optic Communications Link for the U.S. Army.

A new window material for infrared sensors to see through has shown to be highly resistant to damage from nuclear radiation. The material, produced using a reactive atmosphere process recently developed for oxide material, is a glassy silica called fused cristobalite. In tests at Hughes the material suffered no damage when exposed to gamma radiation of 1 million rads. Conventional fused silica, though known to be one of the materials least affected by radiation, is heavily discolored by doses even 100 times smaller. Fused cristobalite has slightly different physical characteristics from other fused silicas, such as a higher melting point, but it maintains the same high optical quality.

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A millimeter-wave radar has demonstrated its ability to track targets and guide missiles accurately through smoke and rain. The radar, under study because it has more resolution than conventional radar and can penetrate adverse weather better than infrared, was used to guide TOW (Tube-launched, Optically tracked, Wire-guided) missiles to stationary targets. In three of the successful launches, the target was obscured by heavy smoke and aerosols. In one of those, visibility was further deteriorated by rain. The demonstration was conducted by Hughes for the U.S. Army and the Defense Advanced Research Projects Agency.

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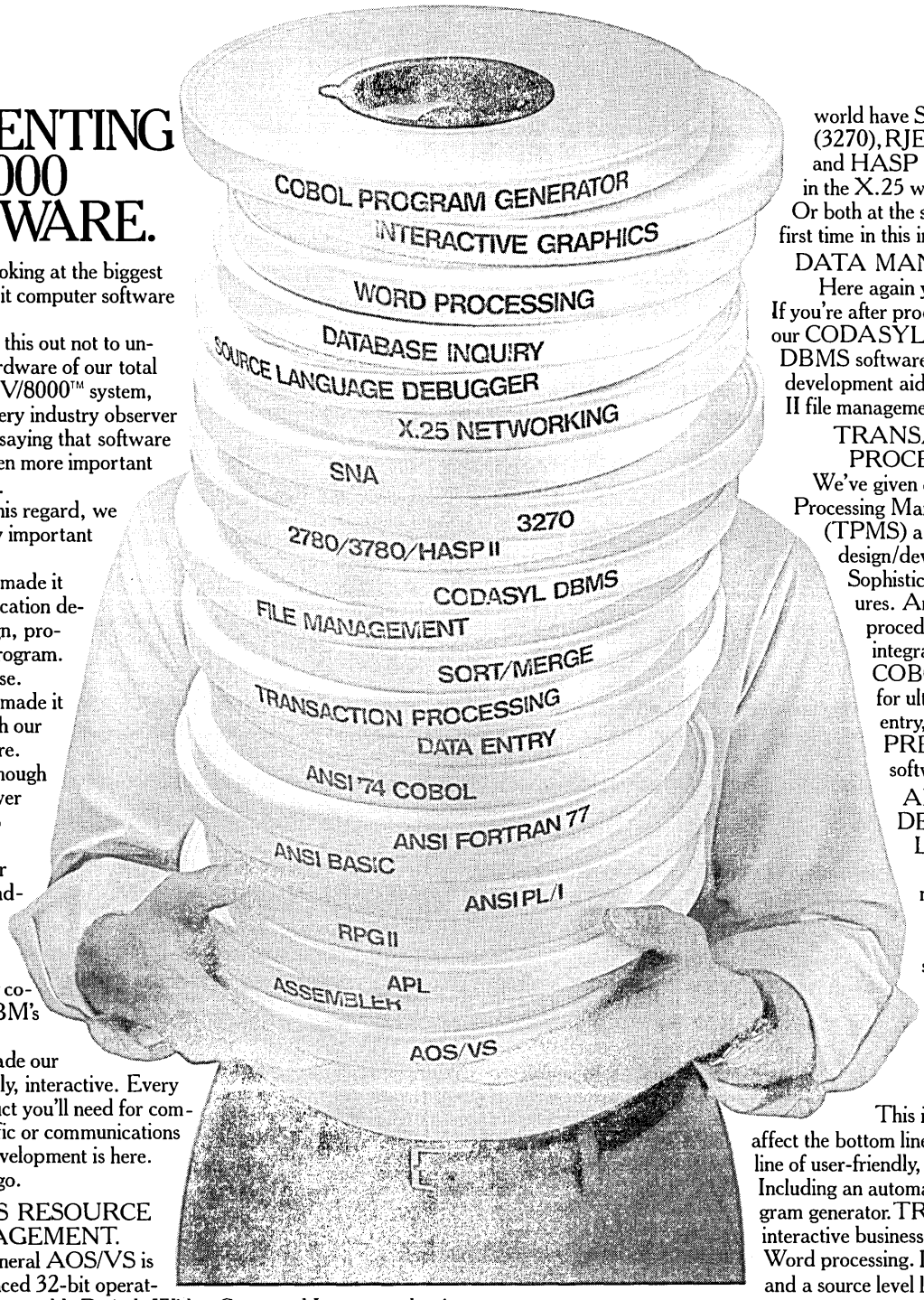

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CIRCLE 113 ON READER CARD

Push Button Bertha, in 1956, generated some 4,000 pop tunes.

of astounding complexity.

Mathews is modest about his work as a composer, and has even described certain of his pieces as "musically nauseating." Certainly his compositional efforts are overshadowed by his achievements as instrument builder and musical analyst. But his engineer's ability to hear sounds in an objective fashion has not betrayed his essential love of music. His importance to computer music is not likely to be surpassed by any of his contemporaries.

BOULEZ FOUNDS IRCAM

At Paris' Institut de Recherche et de Coordination Acoustique/Musique (IRCAM), director Pierre Boulez, who until 1977 was musical director of the New York Philharmonic, works on a digital sound synthesizer developed by H.G. Alles of Bell Labs. Having once renounced electronic music, Boulez has gone on to found IRCAM, and now plans to unveil a computer-aided composition at Donaueschingen this month.

Some modern composers have worked in the spirit of Edgar Varèse, who, while expressing interest in new musical resources, insisted that they enhance expression as well as technique. By using advances made in sound analysis and synthesis by Xavier Rodet and Gerald Bennett, these composers have managed exemplary compositions: John Chowning at Stanford, Conrad Cummings at Oberlin, Charles Dodge at Brooklyn College, Paul Lansky at Princeton, Roger Reynolds at San Diego, and Jean Claude Risset at IRCAM, to name a few.

But a lot of computer music has been a parade of complexity for its own sake. Lars-Gunnar Bodin has written: "In spite of great efforts in time and money, relatively little of artistic significance has been produced in computer music." In some cases, compositions have been downright tedious. Ezra Pound pointed out that "170 pages of mathematics are of less value than a little curiosity and a willingness to listen to the sound that actually proceeds from an instrument." Nevertheless, many computer composers, perhaps finding music to be minatory, have sought refuge in their calculations.

One is reminded of Charles Babbage's hatred of street music, particularly that of organ grinders, and the ends to which his neighbors went to annoy him with tin whistles, kitchen pots, and "worn-out or damaged wind instruments." Babbage proposed a sort of steam-driven musical calculator with which, one supposes, he would have supplanted his tormentors. Judging from his journals, Babbage envisioned a music that was mechanized and controllable, and consequently less of a nuisance. Certain computer programmers cum composers seem to have followed his lead.

Much of the music that grew out of Mathews' early undertakings was overly concerned with timbre—the shape of a sound. The computer work of J.K. Randall, Barry Vercoe, Godfrey Winham, or G.M. Koenig seems beguiled with the psycho-acoustics of sound, much to the detriment of the compositions, which are often little more than successions of glossy timbres.

In dealing with taped sound objects, Pierre Schaeffer found that if a sound is to be considered music, it cannot be recognizable to the listener—that is, it cannot be an evocative symbolic representation of natural sound. By Schaeffer's definition a mimetic tape is not music but literature, a kind of drama of sound effects. A fair portion of computer music is literature in this sense: gong noises evoke the cathedral, bird sounds suggest the aviary, the catlike howlings of a modulator recall the back alley, and the faked viola sounds almost like a real one. The listener identifies these sounds. Beyond that there is commonly not much more.

A lot of this music has also been hardwired into its epoch: by paying too much attention to the novelty of the sound and not enough to the sound itself, the composer has stamped a date on his composition. "No sound," said the composer Milton Babbitt, "becomes old more quickly than a *new* sound." Sound cannot progress by a change in the field of action from instruments to electronics because, as composer Paul Lansky notes, "C Major itself is a neutral quality." There is an aesthetic decrepitude to this process of ceaseless technical change, a frenzied epidemic of ever-novel sound with each new wave washing away previous fixations. Music can change both conceptually and technically, but it does not necessarily progress.

INTUITIVE ELEMENTS LACKING

Gamelan gong music from Bali, like the music of Mahler, has a certain intuitive structure to it that computer music has chiefly lacked. The acoustician Hermann Helmholtz has written of this mysterious something:

"There arises in our mind a feeling that the work of art is the product of a design which far exceeds anything we can conceive at the moment, and which hence partakes of the illimitable."

This sense of the illimitable, present in Balinese and Viennese music but absent from computer music, has intrigued artificial intelligence researchers, who have moved music closer to psychology and engineering.

In working with the computer for the generation of music, one finds that nothing is indicated, i.e., left to the performer, as in the instruction "adagio." Instead, everything must be realized by the composer. To understand music, one must investigate the mental processes through which it comes into existence. "You have to make a little composer," Marvin Minsky is quoted in the *New York Times*. "That means your attention is drawn not so much to the rules of the surface [of music], but to the rules of how the perceptual process proceeds, or how the composer decides what to do next." Music is a mental process assembled from cooperating procedures that pursues a goal-determined course of action. It can be perceived procedurally and not analytically. If the mental process involved in comprehending a sound for musical purposes could be objectified, an intelligent machine might truly compose music.

It is this interest—not bound to musical objects but concerned with their making—that has become of seminal concern to certain computer-composers. Otto Laske, a proponent of a procedural theory of music, has written: "Music is in existence only when it is being made or remade." This realization has offered a different approach for music composition by computer.

"In 1967," says composer Charles Dodge in his studio in Flatbush, "there were probably no great works of computer music. I think today there are." As a result of work at Stanford's Center for Computer Research in Music and Acoustics (CCRMA), Bell Labs, and IRCAM, composers have been given a new vocabulary of sound in the last decade. It has only recently become possible to assemble a wide range of compositional and sound-synthesis techniques for the purpose of making music.

"I may be one of the first composers in the history of music for whom the speed of sound is something that I must figure on as I write my music," says Paul Lansky in his office at Princeton. Lansky is a composer who has become more sensitive to the complexity of human performance. Lansky's "Six Fantasies on a Poem by Thomas Campion" (1978-79) is an elegant treatment of classical quantitative verse, where the composer has observed spoken cadence from a musical perspective. The sound of the human speaker's voice is transformed into a musical response. Using linear predictive coding for speech synthesis on an IBM 360/90 and 3033, Lansky alters and modifies the sound of a female voice reading Campion's "Rosecheekt Lawra." The result is at once ethereal and concrete.

"Composers in the past," says Lansky, "were more like playwrights. They wrote the plays and the plays were performed. Now composers are more like sculptors. We have to create strings of numbers to represent sound."

Lansky is currently working with Kenneth Stieglitz on a series of pentatonic folk song syntheses using synthetic violins

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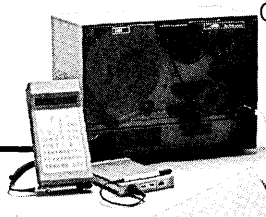

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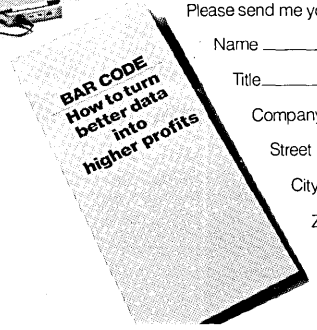

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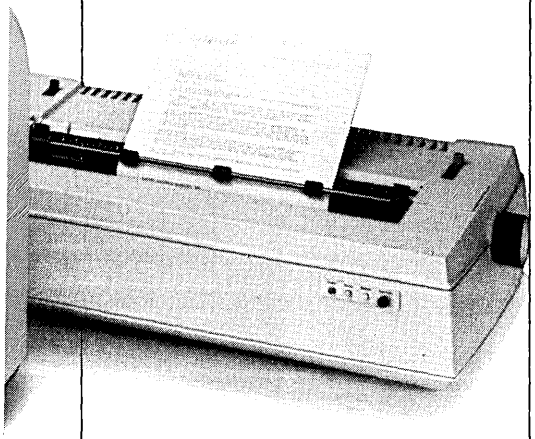

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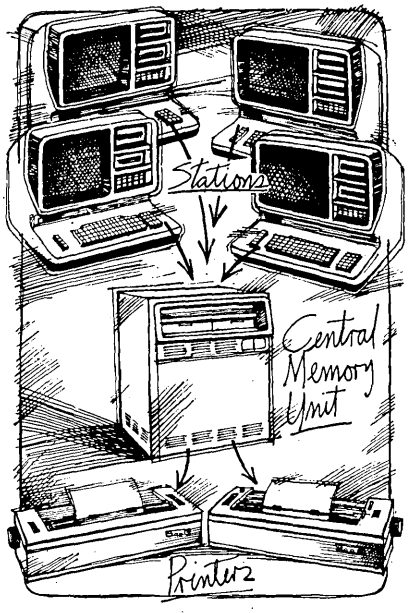

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"In 1967 there were probably no great works of computer music. Today there are."

and cellos. He is also studying the synthesis of choirs and orchestras ("There's a C chord here that sounds just like the Philharmonic," he says of a taped synthesis).

Taking the timbre and phrase inflection of the violin and adding his own pitch and rhythm, Lansky functions as a skilled interpreter of acoustic sound. "In 1976," he says, "I would have imagined that this was not an appropriate thing to do on a computer, since it's the kind of thing you can easily get people to play." But now Lansky is concerned with spatial acoustics—hence the awareness of the speed of sound—as well as intonation, pitch-bending, and transforming the sound of violins to that of the cello or double bass.

"You can listen to some sound," Lansky adds, "and have the computer give it to you to play with. I'm working with the difference between what is perceived as a complex electronic sound and what somebody perceives as a simple human sound. In reality, the complexities are reversed in many cases." Computer music, for Lansky, has no specific characteristic. It is of little interest as a thing in itself. Computer capabilities offer the liberation, not of music, but of the composer.

Charles Dodge has also used signal processing and speech synthesis in his compositons. His "In Celebration" (1975) is a remarkable piece using a system designed by Joseph Olive at Bell Labs. His "Speech Songs" (1973) consists of a catarrhal voice reading lyrics by Mark Strand. By altering the natural resonance, pitch, contour, and speed of the voice, Dodge realizes the great richness of sound-synthesis technique and uses it in an aesthetically convincing fashion. The synthetic voice is capable of sounds no human voice can make. The effect is alternately humorous, frightening, and giddy. "The field is opening up in a lot of fascinating ways," says Dodge, "offering an entirely new set of tools for the composer."

Dodge's "Cascando" (1978) for three characters—Voice, Music and Opener—is taken from Samuel Beckett's radio drama. It is an unusually expressive piece in which the composer has established the rules the computer will use to produce sounds. Using linear predictive coding to disassemble, alter, and reconstruct the sound of a human voice, "Cascando" is a work that merges the opposite processes of intuition and analysis.

CARTOON BY HENRY MARTIN

CARUSO SINGS AGAIN

Dodge has also completed some amazing work with a recording of Enrico Caruso singing "Vesti la giubba," a recording that was originally influential in popularizing the gramophone. Caruso made this recording by singing into an acoustic horn connected to a stylus. In the process, the horn transmitted certain frequencies with special emphasis while attenuating others. This caused the grainy tone of gramophone recording. Thomas Stockham of the University of Utah determined the acoustic characteristics of the type of horn Caruso used and digitally constructed a filter with the inverse frequency response. This resulted in a more lifelike recording. Subsequent work by Neal Miller removed most of the remaining scratchiness from Stockham's modification, but also filtered out the accompaniment.

Working with this tape of an isolated Caruso, then altering it in assorted ways, Dodge composed a work for live piano and recorded Caruso. The voice of Caruso, strangely disembodied and mutated, is manipulated by the composer to strong effect. The singer meanders through the song, losing track, breaking into sobs, hurrying to catch up. Dodge has called this piece his way of "putting Caruso to rest." It is a fine example of the multeity of perspectives that a composer may bring to any acoustical information.

Works that use voice analysis and synthesis can be strikingly eerie. As Conrad Cummings has written of his "Beast Songs," which uses voice synthesis and live voice: "The more lifelike the synthesized voice, the more powerfully one feels its slightly abstracted, cool quality." To hear a disembodied computer-synthesized voice enunciating human emotion is to better understand the intricacy of musical expression itself.

The most rewarding work in computer music has probably only begun. Other composers have taken other paths. John Chowning's "Stria" is based on mathematical Fibonacci series. Jean Claude Risset's "Songe" is an example of how sound images can be manipulated to fascinating effect. Laurie Spiegel's dronelike work is in its stark quality reminiscent of Erik Satie's *musique d'ameublement* (furniture music).

Although the aesthetically satisfying work may never drown out the epigonal efforts of lesser composers, it does seem possible that computers will someday force a reevaluation of music. "There's a whole uncharted universe of sound that we are just beginning to get in touch with," says Charles Dodge, "one that has a profound effect upon those who hear it." ✻

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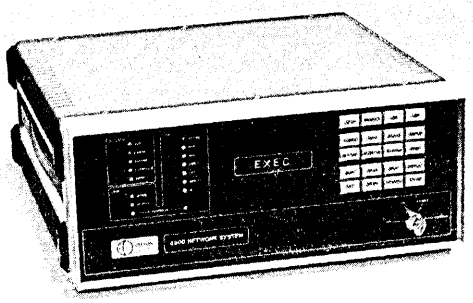

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The technology of IBM's operating systems has been called totally wrong for the '80s and '90s. A panel of experts discusses modernization methods.

RENOVATING DINOSAURS

In January 1981, DATAMATION editor John Kirkley discussed the computer industry's "longest goodbye." IBM's operating systems, he wrote, have been with us for nearly two decades, and in that time have swollen to monstrous, unmanageable proportions. Kirkley argued that the industry has to face up to the task of replacing the systems; as a first step, he said, DATAMATION would convene a panel of experts and have them chew mightily on the issue. The session has taken place. Larry Welke was the moderator, and the other participants were Jay Michlin, Edward Miller, Jr., and Marvin Silverman.

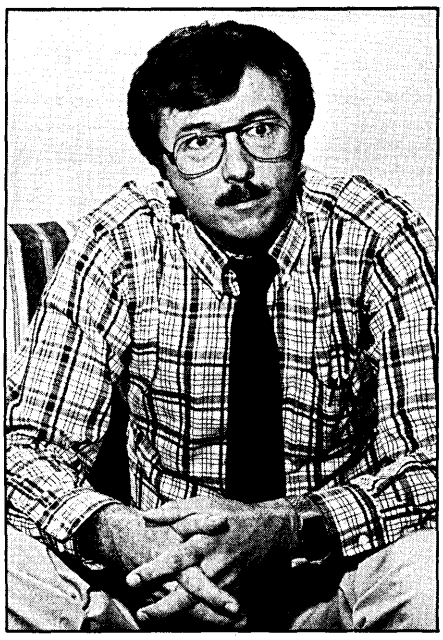
Larry Welke is president of International Computer Programs, Inc. (ICP), Indianapolis, Ind., the company he founded in 1966. ICP provides an information service to the public on the software product and service marketplace via publications and seminars. Before founding ICP, Welke spent seven years with IBM as a systems analyst and as a dp salesman, and a year and a half with GE doing product control. He had also worked for several banks, both here and abroad, in various dp capacities. Welke received his business degree from Marquette University.

Jay Michlin is an engineering associate, office automation, at Exxon Research and Engineering Co., Florham Park, N.J. Prior to joining Exxon in 1975, he worked for Bell Labs, handling systems programming and computer performance assignments. From '68 to '72, Michlin was employed by Western Electric to do hardware and software integration for an antimissile system. Michlin received his MS in electrical engineering from the Stevens Institute of Technology, and his BA in electrical engineering from CCNY.

Edward Miller, Jr. is president, technical director, and founder of Software Research Associates, an advanced software technology consulting and development firm in San Francisco, Calif. His current activities involve application of software engineering principles to major software development and quality assurance projects. Dr. Miller was previously director of the software technology division at Science Applications, Inc., San Francisco, and before that, director, Program Validation Project with the General Re-

Larry Welke

Jay Michlin



Edward Miller, Jr.

Marvin Silverman

MICHLIN: "If we're going to make progress, one of the things we need to do is inject some of the outside world into IBM."

search Corp., Santa Barbara. He received a BSEE from Iowa State University, an MS in applied mathematics, and a PhD from the University of Maryland, where he was an instructor from 1965 to 1968.

Marvin Silverman, director of data center operations for Blue Cross and Blue Shield of Greater New York, Inc., is responsible for the company's data processing line operations. Before he came to BC/BS, Silverman was manager of computer technology for Consolidated Edison Co. of New York, Inc., where he was responsible for the software and hardware planning and implementation for Con Ed's two IBM data centers. Silverman began his career as a systems programmer with IBM and subsequently served with various service bureaus during the late '60s in the development and support of timesharing systems software.

Welke: Many people in the industry complain that the successor operating systems to OS and DOS are behemoths, bloated monsters that have gotten out of control. Consequently, we sit back and conclude that they need to be replaced, that there's got to be a better way. I'd like to get everybody's opinion on that particular premise. Is it valid?

Miller: Okay, first off, let's consider how OS got to be the way it is. I'll give you my picture of that history.

Until the early '60s operating systems weren't needed because the computers were scheduled to do particular tasks. It was when multiprogramming, or serial multiprogramming and batch jobs came along that you had to take this expensive piece of hardware and divide its use up more efficiently.

When they brought out the IBM 360 with multiprogramming in a true sense—swapping and timesharing and all that—they had to have an operating system. What they came up with was something very close to the hardware. All the hardware changes that occurred from '65 until perhaps the late '70s were reflected in the upward compatibility of OS. Whatever happened, IBM had to preserve upward compatibility; your programs, your systems, your applications had to run on tomorrow's machine, even though they had been developed on yesterday's machine and were running on today's machine. This resulted in layer upon layer of hardware technology being reflected back into the operating system. From the performance point of view, this gave you an enormous capability for managing that hardware.

Michlin: The real problem is that these operating systems are out of control. We have to replace them because the technology is totally wrong for the '80s and '90s, for the things people will need to do. But we can't replace them because we must have $50 billion to $100 billion invested in them.

Miller: I think it's more money than that, because it's maybe 10 years of the software work product of the OS environment. Actually it's a huge capital investment.

Welke: I really wonder if that is significant. There was a huge investment in the old Bessemer steel furnaces and nobody uses those anymore, either.

Miller: Yes, but the only thing that replaced those old-style furnaces was a significant cost-competitive alternative.

Welke: Will that not be the driver in this case?

Michlin: Computing somehow isn't like a steel furnace, which is the capital stuff that makes our business. It's more like typewriters or telephones. The service is essential, but it's not considered intrinsic to the business.

Miller: From the public's point of view, the investment in software is considered to be trivial, or is not even considered at all.

Welke: It certainly isn't on anybody's books.

Miller: Well, there are some reasons why you don't want to carry it on your books. If it's on your books it becomes a capital item, and you may have to pay an inventory tax on it.

Michlin: People are beginning to look into that one even as we sit here.

Miller: Anyway, I think that the point about the behemoths is exactly correct. Those huge animals' efficiency as organisms was so low that when there was a minor dip in the food supply, they perished. I think that what will happen with OS is that one day someone will replace it.

Silverman: I'll take a different tack. I'm not sure the operating systems are out of control. I look at the MVS operating system, and then I go back to my systems programming days and remember how I felt about operating systems from a technical viewpoint. I look at it today and I see that from 1967 to 1981 it's gotten a lot better. It doesn't "crap out," as we used to say. It stays up. My basic feeling is that it's not so much out of control as it is a manifestation of the architecture it runs on. It basically comes down to Von Neumann computers, multiprocessors, whatever you want to call them.

Welke: You're saying, then, that by definition an operating system is a monster, but it need not be out of control.

Silverman: Right.

Michlin: I think there's another side to it. The MVS in your shop and mine is sitting there, chomping out the work, making things happen. But if your shop is anything like mine, in the next few years you'll see all kinds of new requirements in data processing. I have to do some of this and some of that, and convert to a nine-digit zip code, and make changes every time the tax laws change, and so on. I have to develop applications. And because of the nature of MVS, I need a whole army to do it and an army to maintain it. The purpose of an operating system is to make the hardware invisible to the user.

Welke: Well, what about the idea of using firmware, hard wiring? What's your response to that?

Michlin: Something you wouldn't print. If I'm a manufacturer, if I'm IBM, I care a lot. It affects my economies and it affects my ability to lock people into my equipment. And maybe if I'm a dp operations supervisor, I care.

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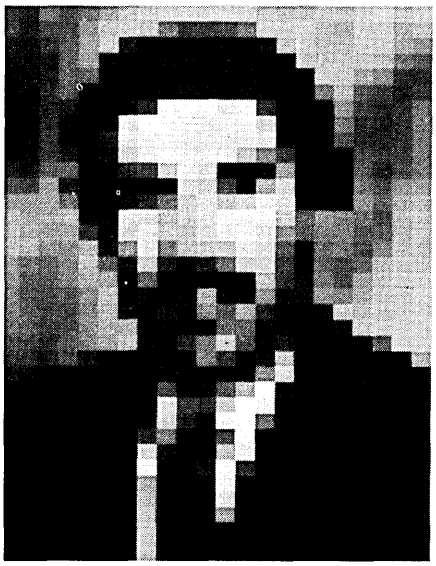

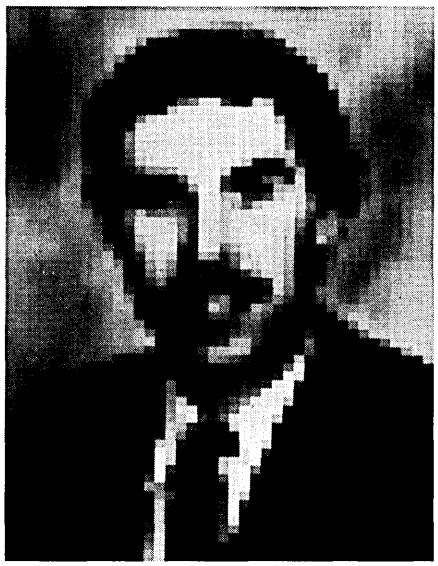

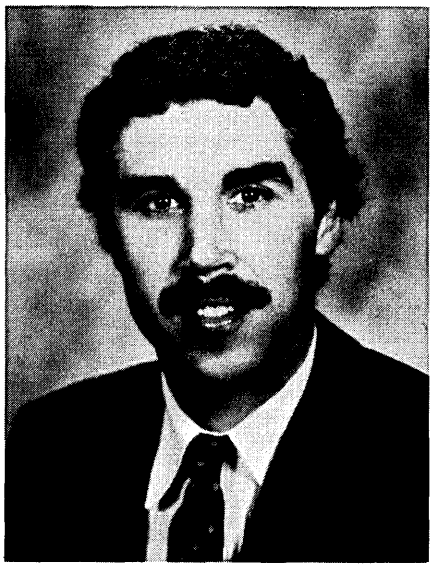

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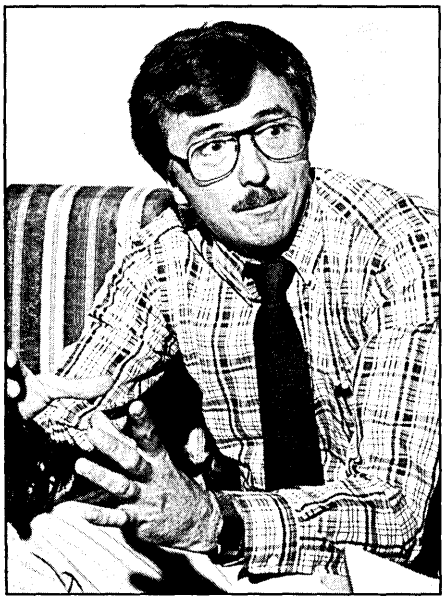
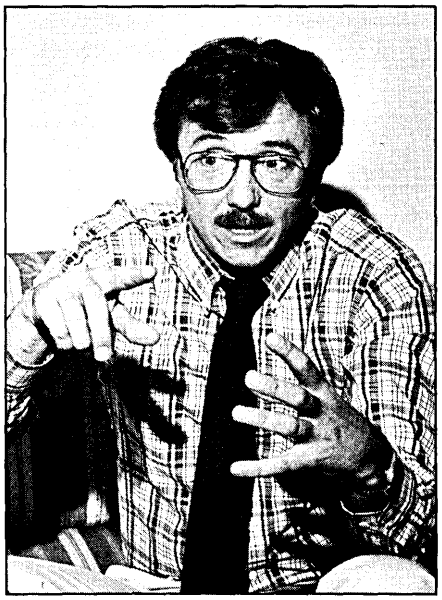
MILLER: "If all of OS were put in microcode, you'd still have all of OS. It would run faster, so you'd make mistakes a bit quicker."





But what if I'm a user? I say something and then the machine responds, and I don't care if it's in firmware, or in hardware, or in software. If it's done right, I won't even know.

Microcode is one of those magic incantations that the vendors love to talk about. They say something is going to be great, because it's going to be in microcode. Somebody needs to challenge that and say, "Okay, then what?"

Miller: Microcode is an implementation technique, not a piece of magic. If you took all of OS and put it in microcode, you'd still have all of OS. It would run faster, so you'd make the mistakes a little bit quicker. Let me change the subject a bit. If you were a big IBM user, what about the reliability of that system? How many deficiencies are there? How many things do you have to program around? What's the repair rate on those things?

Silverman: That's a tough question to answer. Let's look at the track record. The reliability and availability statistics for mainframe systems are better than they were 10 years ago. It has a lot to do with the hardware, certainly, which has gotten progressively better, from error-correction and checking to peripheral storage capability. But you're running more on the systems at any given time, and the reliability of the software component has increased phenomenally.

Michlin: Availability is a funny kind of thing. It can lull you into a false sense of security.

Welke: What do you mean when you say availability?

Michlin: The time that the operating system is running. The time between crashes and the time between whenever MVS says it's back up. Our statistics say MVS is up over 98% of the time. But it's different for the guy at the terminal. The thing goes down and he's disgusted. So he has a cup of coffee and comes back in a minute or two, and it's still down. If I'm lucky, he loses only a half hour. If I didn't get lucky, he loses half a day. Availability, when you publish it as measured at the door of the computer room, is a very funny thing, but that seems to be how we do it.

Miller: Because it's a better number than the one that you were referring to for the end user. Hardware could be 98% or 100% available and you still couldn't get anything useful out of it.

Siverman: Okay, but there are many components of availability; network availability, for example. What you're measuring from an operating standpoint is a variable set of components of availability. From the user's standpoint, the bottom line perception is perhaps transaction turnaround or response time. If the phone jumps off the desk every day with complaints from users, well, that's no good. No matter how good we say availability is, it's only as good as the user says it is. The real users are outside of the data processing division in any company. And those users are receiving hardcopy reports every morning, out of a batch run. I think you're going to find that if you measure a level of satisfaction over the last three or four years, you'll see an upward trend of people being happy. That's my estimate. Where that's not the case, you find levels of dissatisfaction with all aspects of availability . . . particularly the highly visible on-line environment.

MVS runs and runs well. But I don't think you're really talking about MVS when you're talking about operating systems. You have to include software like IMS. Since 1969 there has been an insatiable demand in IBM's user community for this product, and it had to patch its way through to provide service. IBM has managed over the past 10 years to go from MVT to virtual storage to MVS and DOS/VSE. They dug the hole deeper, and for every two steps forward, I think they took one backward.

The hardware architecture is going to be the driving force. I think something has to happen to get us away from the way we process instructions on any computer, whether we employ microcode or back-end database processors. I don't care what the system is. If it's a multiprocessor or a uniprocessor, we are still taking a set of instruction streams and processing it without any real improvement in throughput.

Michlin: If operating systems hide the hardware, then why do I care about the hardware?

Miller: There are two kinds of operating system interfaces. There's the interface that looks at the workload and says, "Well, I have these resources and this kind of storage, so I'll allocate it this way."

And then there's the other user/hardware interface. That's the one with the long link list, the long compile procedures; that's the one that gets in everybody's way because it moves this hardware information, columns, cylinders, lengths of records, and all of that junk over into the user's side. It ought to be hidden. I think you've got to get rid of those things that are simply too complex to deal with.

Welke: I'm trying to figure out what's driving change. We're saying that an operating system by definition is big; it is a monster, but it's not necessarily out of control. Just by definition, it has to be as complex as it is. Some of the complexity is because it is an outgrowth of what was a bad planning job back on OS, but that was the first time anybody had ever undertaken doing programming on that large a scale. No one had ever tried to create anything as big as OS.

Part of it is also dependent on the hardware design and architecture, and on the fact that the world is changing. In 1972 you had a few terminals, and you were on batch and everybody got their listings in the morning. Now we have 75 people and 26 terminals, and before we add another person, we'll add another terminal.

Miller: Two factors determine the direction of operating systems, and both have to do with economics. Now, you can essentially put an entire 370 on four chip sets. What has happened is that the cost of buying additional hardware has gone down amazingly, and nowadays it costs very little to get an extremely large computing capacity. There are thousands of examples of what you can get in the way of hardware for astonishingly small

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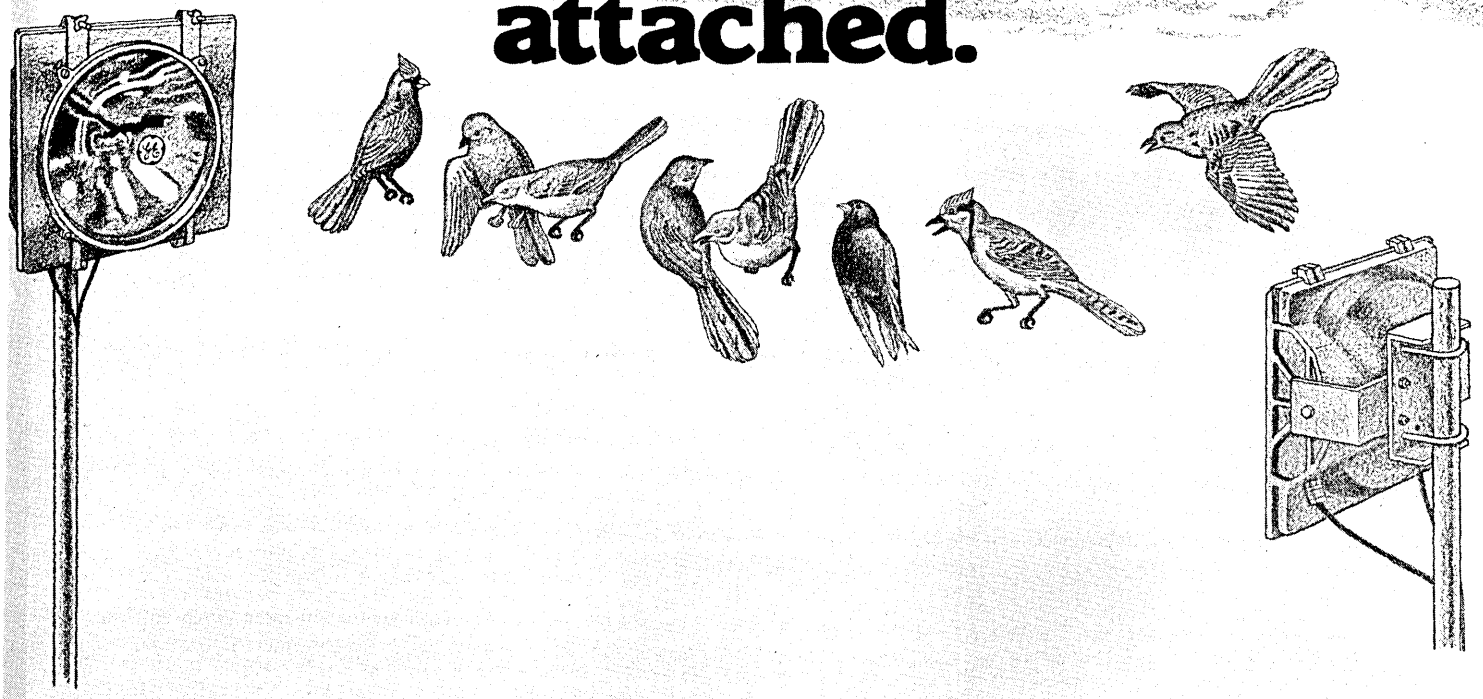

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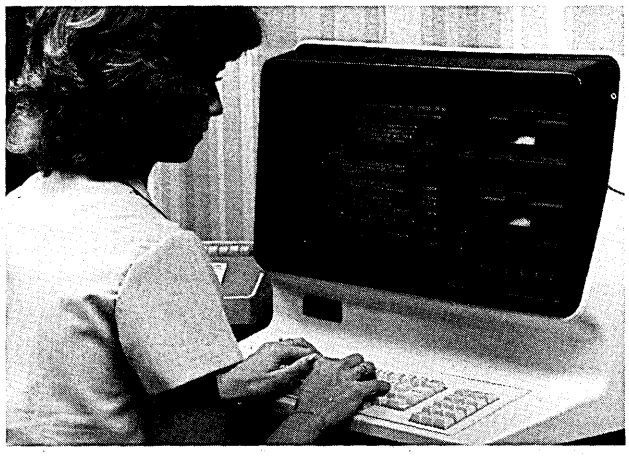

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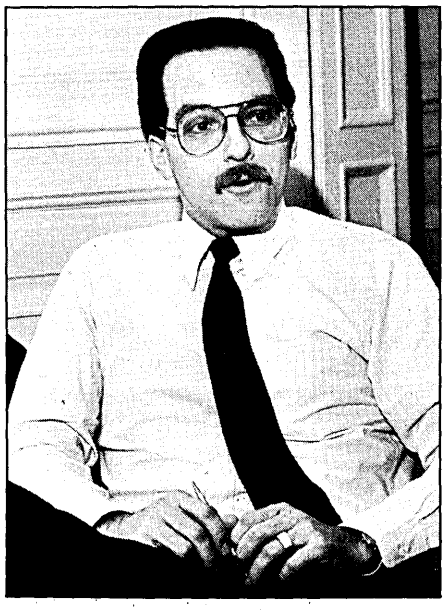
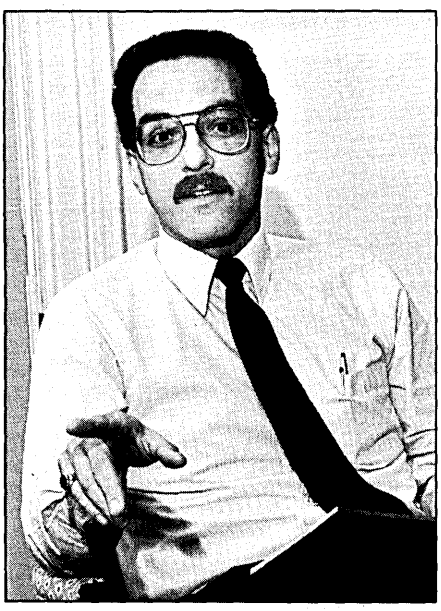
CIRCLE 121 ON READER CARD

SILVERMAN: "If, as IBM users, we voted in the vast majority to say 'change it,' I'm not sure that IBM wouldn't jump at the chance."





amounts of money. So where's all the money going? Well, the money is going into the people time, the cost of programmers. The cost of people is going up and the cost of hardware is going down, and you can no longer afford to assign a programmer to decode this huge and complicated construction of details about hardware, when you can replace the entire thing with a subroutine call. Ten years ago hardware was 90% of the cost and people were 10% of the cost. You used to have a million dollars worth of equipment. Nowadays you put the hardware in your briefcase and take it with you.

Welke: What do you look for as a way out, then?

Miller: Well, the way out is pretty obvious. What'll happen is that the operating systems that are simple enough to be learned rapidly and that have a high degree of transportability will simply take over: the AOSs, the UNIXs, on machines like the MV/8000 or the VAX UMSs.

Michlin: An analogy to this is the auto business. In 1973, suddenly gas was hard to come by, but the auto business said everybody demands large cars, that's the way we're going to continue to do it. Then the next gas problem happened and the consumers voted for small cars with their pocketbooks. In data processing, we have an opportunity now to manage it and do it right from our point of view. If not, it's going to happen anyway, exactly as in the auto business.

Silverman: But the change won't happen unless IBM's bottom line is affected in some way. IBM is a marketing organization, and marketing implies not only sales but also service. And if you look back over IBM's history in the last 20 years, you see that IBM is going to react to the marketplace. I think that they've already made some of the changes and we're seeing this in the operating system itself. There was a time, back in MVT days, when you would make wholesale changes to the operating system. How many shops can afford to do that today?

Miller: People should customize an operating system.

Silverman: That's right. You don't do it anymore. It's now giving you the things that you used to have to make changes to get. They've done it in JES. They still allow you to modify JES, but they've made more enhancements—taken more from the user community, from SHARE and GUIDE, and incorporated them into the operating system—more than we ever imagined. And that says to me that it's not out of control.

Michlin: Let's think about 10 years ago. The big machine was a 65 or an 85 or something like that. We were struggling with region sizes and all that. PL/1 was a hot topic. And it's now 1981, and the computing business isn't anything like it was in 1971. In 1990, it isn't going to be anything like it is now. Do we manage the change?

Welke: What is it going to be like, and how do we get from here to there vis-à-vis the operating system? Because we started out the conversation saying it is big and it is a terrible thing, a burden on our backs, but that's how it is, guys, you can't get out from under it.

Michlin: I have two scenarios. One is the optimistic one that I wish would happen, and the other is the one I think will happen. The one I wish would happen is that IBM and users could somehow, antitrust notwithstanding, work together in recognition of the fact that we have a mutual problem. We're each trying to support the other, really, and we should be able to work together to evolve toward the way things ought to be. That's the way I wish it would happen.

Welke: Why is that not possible?

Michlin: I think because there are so many people and so many vested interests and so many divergent ideas. Now, the way I think it will happen is that we in the data processing business will lose control. We're going to lose control to the first- and second-level managers who have the budget authority to buy their own machines. We're going to lose control to people who can spend $12,000 to $16,000 or even $100,000, and they're going to vote with their pocketbooks and their feet. You see it in your organizations now, people doing that with minis. And it's unfair, because the mini people and the Xerox people don't have to support all the people who were their customers before and rely on OS 360 applications. It's unfair, but it's going to happen that way, and one day we're going to discover that our large MVS systems are running our on-line insurance systems and our batch jobs that produce lots of paper and don't do much else. Nothing else is going to be going on there.

Miller: I've got a different scenario. I see the whole dp industry splintering. I think I agree pretty much with people voting with their pocketbooks. If the cost per user station gets below about $3,000, then everybody will want one. Once you have that, then no one will want to do the kinds of work that they're talking about. And you'll still have central computers that will maybe run these big database applications, but with different implementations. There's a new back-end database machine on the market for $250K that is a kind of hardware implementation of IMS. It's got to be better than a general-purpose computer running IMS.

I see an enormous increase in distributed computing, local smart terminals, smart terminals with satellites, satellites that talk to other places, and the ability to modify interfaces. The thing that's astonishing about any of these minicomputing operating environments is that every one of them is designed to work with virtually any terminal at all. This really customizes that operating system's interaction to you, the user, in terms of the available keys on your particular type of terminal. You essentially have a standard operating system that can adapt to anything. It can be distributed and splintered off, so that the major applications are dedicated functions, and they talk to each other. Now, the hardware is simpler, and an operating system for that hardware becomes simpler. And all these things which currently have to be programmed in long DL/1 sequences become single, primitive calls.

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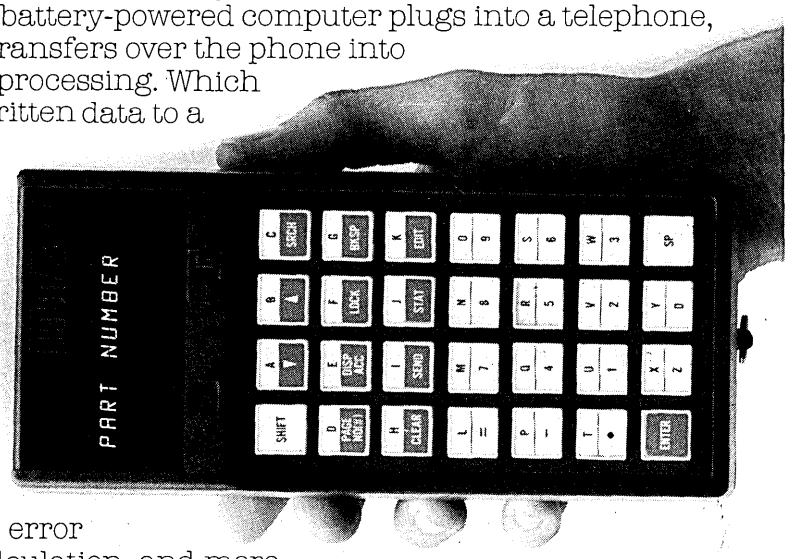

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WELKE: "Why is upward compatibility important? Did we set ourselves a trap by insisting on it?"

Michlin: But you could do that with software or hardware. Hardware may make it cheaper, but you could do it.

Welke: Are you in effect saying that we're going to make things easier by changing the hardware?

Miller: Somebody's going to come along and say, "Well, there's this kind of market for this kind of box. We're going to change the operating system, and we'll sell this many copies of this back-end database machine and make us a nice profit."

Michlin: I don't know if that's going to precipitate change. This box will be fully compatible, which means that the interface with the programs that people use is going to be the same old stuff.

Silverman: Explain that.

Michlin: DL/1, whether hardware, software, or firmware, is still DL/1.

Miller: I think you can improve the DL/1 software.

Welke: But you're not changing the delivery vehicle. You're going to change the program.

Miller: Oh, I think you change the whole way you look at the DL/1 objective. DL/1 is a language that helps you describe requests from a database, and there are much better data languages being implemented. The only fly in the ointment is the conversion from the old database to the new database, but that's really not that difficult. You write those programs once.

Michlin: We're using a thing called NOMAD, which is a proprietary product, and very easily relational.

Miller: I think it's fair to emphasize that the relational database is considerably more natural to human thinking than any of the information structures like DL/1 or the other, similar computer languages.

Silverman: Okay, human beings can get used to anything, as long as it's productive. I think we can accept any level of complexity, and we witness that with the jargon we're throwing around right now. We've accepted it, assimilated it. We love the complexity of the operating system. We love jargon. We love technical terms. We're not used to relating to business terms, and I don't say that's bad.

Michlin: It seems to me that we have buried things in a lot of jargon, and it bespeaks a lack of understanding or a lack of concept.

Silverman: There has to be a certain amount of that.

Miller: Well, I think there's a progression. An operating system 15 years ago had to be complex because we really didn't know what it had to do, what the bottlenecks and the problems were going to be. Then the next level came along; maybe it was MULTICS, which was able to generalize and therefore simplify some things, like the idea of the file. And then the Bell Labs people came along and further generalized some things from MULTICS, and came up with something called UNIX. Each time the jargon becomes different, each individual word addresses a higher and more sophisticated general concept.

Welke: Okay, let me question the validity of that concept: Why is upward compatibility important? Did we set ourselves a trap by insisting on it?

Michlin: Upward compatibility was an unbelievably terrific thing when it came along. That's what the 360 was all about, and it made computing what it is today. The 360 is a terrific design. But if everything is forever upwardly compatible, when does it wear out? The software doesn't depreciate, so we will keep it bandaged and patched and running.

Welke: Who invented upward compatibility, and whom did it benefit?

Silverman: It benefited us.

Michlin: It benefited all the manufacturers, not just IBM, but all the manufacturers.

Miller: The manufacturers still support upward compatibility because it locks you in. If you own a Data General and you get locked into Data General FORTRAN, you will have great difficulty converting from that particular form of FORTRAN to somebody else's version. It's a marketing action on the part of the manufacturers. It sells hardware.

Silverman: But if you change the definition of upward compatibility, and your vendor announces a new operating system and a new architecture, your first questions are going to be, "What is that going to do to my programs? Do I have to convert?" Everybody needs to do conversion at some point. If the vendor tells you that the new architecture is going to buy you new economies of scale and give you a better operating environment, you'll be willing. And IBM did just that, with the System 38. The 38 is a radical departure from System 32. IBM may be a behemoth; they move slowly, they don't react quickly to change, but they're looking 10 or 15 years down the pike. IBM is the one company I see, at least in the high technology field, that is thinking in those terms. They're entering into minicomputers and personal computers. It's slow, but when you're that size, you cannot be the first guy in to lay out the $250 million and wait for the market to come about, because you've got a capital-intensive business. You know there's a risk involved, and that's a business decision.

Welke: We now have a problem of an outdated software architecture that is too costly to change. Can this be because as management people we've done a lousy job on cost control and accounting for data processing over the years? If we had depreciated the investment to begin with, we would have had dollars available for the replacement.

Miller: That's a management problem, and you articulated it very well. But we did not foresee that kind of thing. We did not believe the cost studies that were done in the early '70s because our preconceived notions told us that the biggest cost item was hardware. Now, a decade later, there have been some more studies, and things are turning out a little differently than people had expected. The number you hear quoted a lot as the

SILVERMAN: "Something has to happen to get us away from the way we process instructions on any computer, whether we employ microcode or back-end database processors."

predominant cost in software is the 75% to 85% of the time spent making small changes to complex programs. I don't think management yet makes its software engineering decisions based on good data about where the money goes.

Silverman: Dp management doesn't, but corporate management had better do it, because they're being judged ultimately by Wall Street and the stockholders.

Michlin: There's another reason why we have to eliminate or reduce complexity. What's happening is that corporate management, not dp management, is taking a hand in it. Computers are becoming part of the mass culture. Management is learning about these things, and they're not going to let us manage a huge dp budget without their input. And how can we communicate with them when we have to talk in terms of block sizes and record formats?

Silverman: I question whether corporate management is really viewing dp as a complex organization, or as just not contributing effectively to the bottom line. What they see is if a request is made for a change to an existing application or for a new system design, dp might say it'll take a year and a half. If it's a priority item, maybe you get the development process down to six months. It's shorter certainly in an on-line environment, and it's shorter still when data processing tosses it to the user to develop through on-line interactive query facilities such as NOMAD or RAMIS. That's what people see. I don't think they see complexity. They see lack of responsiveness from an organization that bills itself as having a technological leading edge.

Miller: You said an application could take 18 months, or maybe six months if you try hard. I want to ask you, in an application like that, do you visualize reusing anything?

Silverman: From the user's standpoint? I doubt it. If a systems analyst is working on it, I would hope so.

Miller: But what percentage of old software might you expect to be reused in any application similar to one that you've done in the past? Programmers don't like to reuse things. They want to recreate them.

Michlin: That's a management problem.

Miller: It is a conceptual problem and a management problem. Most people view software as something you do rather than something you own or can employ or exploit. And the popular conception in management now is that software cannot be capitalized. That's probably the main reason why it isn't, though there's also the problem of paying taxes on it.

If you look at the reusability of software, however, you find that in practice very few modules are ever reused. An operating system may be a little different, but on the applications level the software is very rarely repeated; it's always redone. That's why it costs so much. It doesn't have to be that way, though. The reason UNIX is not that way is because it ties together every verb in the operating system with the common concept of a file, and it's possible to "pipeline" two verbs together and have the intermediate file be invisible. You can't do anything as elegant as that in OS. OS has complexity without elegance.

Michlin: We've been talking about UNIX. I don't think that any of us is saying that UNIX is the answer; I think there are better answers. It's just a fairly well-known example to point to. We did a study in SHARE on large system requirements for application development, specifically on how we are going to migrate MVS and VM in the '80s. We did some studies, and we discovered that if you want to get anything done and still live with the supply of programmers and within the budgetary and maintenance constraints, you've got to change the operating system, the user interface to the operating system, and the underlying concepts. There's no other way. And we figured conservatively that might be worth 35% of your present application development budget. But if you try another way, more Band-Aids, VSAM and VTAM and IMS on top of each other, it isn't going to work. It is going to die under its own weight.

Miller: It seems to me that there are at least three kinds of interplays. There's the development interplay, where you develop an application and examine its properties by trying it out. There's research, which is where you're fishing around trying to figure out how to do something—a weapons construction project or something. And then there's the production-oriented operating system, where you're trying to do a canned process and get some results in a fixed amount of time. For example, you have to run the payroll, and the checks have to be ready tomorrow afternoon.

So from the development point of view, you get into the issue of timesharing. The user wants quick response, simplicity, and the capability of complex activity without any overhead. From the user's point of view and in the development environment, response time has always been, and will probably continue to be, the most critical factor.

Now the research environment is a little bit different; what you want there is an operating system that has as many different kinds of things on it as possible. Production is the area where I think there may continue to be a need for OS in the next decade. That's probably the only place where it'll be used: where you're doing the checks overnight, or doing the check reconciliation statements.

Silverman: I thought all the other things you mentioned were production, too.

Miller: They're production, but they're not interacting with a person. They're interacting only with a file, and you're not concerned with the response time on a transaction-by-transaction basis, as much as you are concerned with whether the work gets done on time. You could overlay any number of these production-like tasks, and they can all intermix and take advantage of their states to keep switching back and forth.

Welke: Are you saying, then, that one of the ways out is to have at least two and maybe three separate operating systems?

Miller: Yes, you may have to have several different kinds.

Silverman: Doesn't that automatically imply a level of complexity in deciphering what that research person had to do—allocate the resources, load the files, develop the link? By your example of those three needs, what do we want from an operating system? All three, require complex software. One manifestation of the complexity problem that we have now is where the control cards to the link editor and the JCL statements of the job are too long to do a simple task. If, as IBM users, we voted in the vast majority to say "change it," I'm not sure that IBM wouldn't jump at the chance.

Michlin: You're right. You know, it's really not fair to sit up here smugly and say it's IBM's fault, because it ain't. Pogo said it: "We have met the enemy and he is us."

Miller: I also point out that the complexity of an operating system that provides the user with a simple conceptual interface can be very large. I don't think that anyone claimed MULTICS or UNIX or AOS or VAX/MVS is a simple operating system; as programs, they are inordinately complex. They require very simple behavior on the part of the user; to achieve that you need a great deal of complexity.

Michlin: You do a little in TSO and a little in VTAM, a little in IMS, a little in batch, and so on. Every time you change one line of code in the structured programs, you've impacted all the others, and you have to have a series of committee meetings and a resolution procedure to do it. It makes the change very difficult. The thing that's missing is an underlying philosophy, an underlying set of concepts.

Miller: But there is an underlying set of concepts for an MVS. It's the hardware primitives from 15 years ago.

Michlin: And with MVS, IBM very conscientiously tried to get away from the hardware a little bit, but the architecture pulls them back.

Welke: Jay, what do you want out of an operating system?

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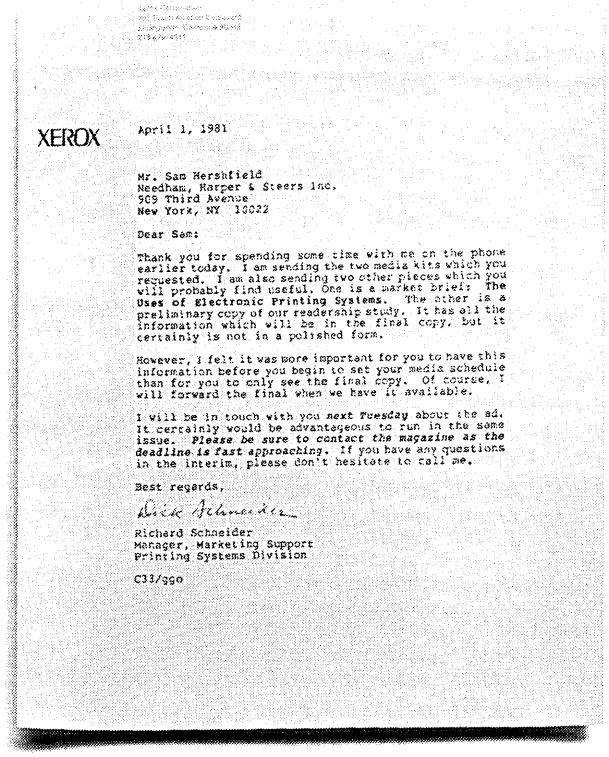

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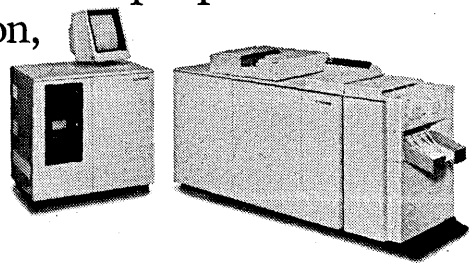

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CIRCLE 130 ON READER CARD

MICHLIN: "If you want to live within the budgetary and maintenance constraints, you've got to change the OS, the user interface, and the underlying concepts."

Michlin: One kind of OS should leave me alone and do my production batch, so that I don't have to know about it. The other kind of operating system is not an operating system or a computer; it's an environment, something that knows about me.

Miller: Custom tailoring is extremely "in" in the modern operating systems.

Michlin: I'm thinking of the computer as a piece of my office or home environment, just like my telephone or my desk. I think it really has to become that way. I need the computer to be as matched to my needs as the telephone is. You don't have to take training courses or read manuals to dial a phone.

Silverman: I need availability of data, whether batch or on-line. I truly must be able to get at anything I want. I want data to be available in a form that I can compute on, do something with, get an answer out of, and process.

Michlin: IBM really has decided they've got to go for ease of use, and they're working at it mightily. They're running into the complexity and the fragmentation that makes every change so hard. I really believe that they can't do it without our help.

Welke: To what extent do you think IBM should let the user community know what it's doing?

Miller: It's really kind of hard to complain about IBM's failure to disclose. They probably provide more technical information than anyone else.

Welke: But you don't know where they're going with operating systems in 1981.

Miller: In terms of their plans, yes, it would be nice to know at that level. You can deduce it if you read the so-called technical disclosure bulletins (TDBs).

Welke: Where are they going?

Miller: I think if you study the current TDBs, you find that they're going in all directions because they don't know themselves.

Michlin: That's the key. I'm sure there could be a mechanism for us to work within their organization.

Welke: Then to what extent is it incumbent upon the user community to let IBM know what we want?

Miller: Well, I think the user community is already doing that. Look at the growing popularity of UNIX.

Silverman: The GUIDE and SHARE user groups are important vehicles of communication. The most recent example I can think of is the new COBOL standards.

Michlin: GUIDE and SHARE may be an opportunity, but there is a problem in that when you get together twice a year or four times a year, you have a tendency to work on the tactical issues and ignore the strategic issues.

Welke: You're saying that there is no vehicle to form a strategic liaison between the user community and IBM?

Michlin: Yes, and I'm also saying that in our own enterprises I don't think we address the strategic importance of data processing as much as we address the day-to-day problems.

Silverman: An early systems networking project at SHARE in the '70s influenced a lot of networking policies and software that came out of IBM, so it is a vehicle.

Michlin: IBM listens, probably more than most other vendors. But the problem is, do we know what to say to them? Can we talk to them strategically? And if we can, can they talk within their own organization in terms of the strategy that needs change? We have to recognize the problem, individually and through user groups, and give IBM the opportunity to work with us.

Miller: But IBM has got to move in the direction of least impact to its cash flow, and that's always going to be in conflict with the adoption of the new technologies. Historically, IBM has decided in favor of preserving the cash flow and avoiding the incorporation of technological advance until the last moment.

Michlin: You're right, but they're no different from any of us. We all resist change. But if we manage this thing, and IBM can work with us on the new systems and start bringing them into its product line, maybe by 1990 they'll still be selling each year $12 billion worth of 370 equipment, but $14 billion worth of whatever the new thing is. There's no problem there. If we can all work on it together and think about it strategically, it's going to be in everybody's interest. If we're going to make progress, one of the things we need to do is inject some of the outside world into IBM.

I don't believe there's a grand design for solving the operating system problem. But we have to start thinking strategically for our own benefit. If enough of that happens, then we're going to start talking about it in user groups. And then we're going to start talking about it with IBM.

Silverman: I think it has to be brought out in the trade press, because those publications are read by everyone in the industry, including IBM. I think that's where it's going to start. I don't think it's going to be in the marketplace, because then we're going to be dependent on the user groups to make the change.

Welke: One other thing, let's keep the government out of this problem. Let's not legislate what anybody in the industry can do or must do relative to the problem.

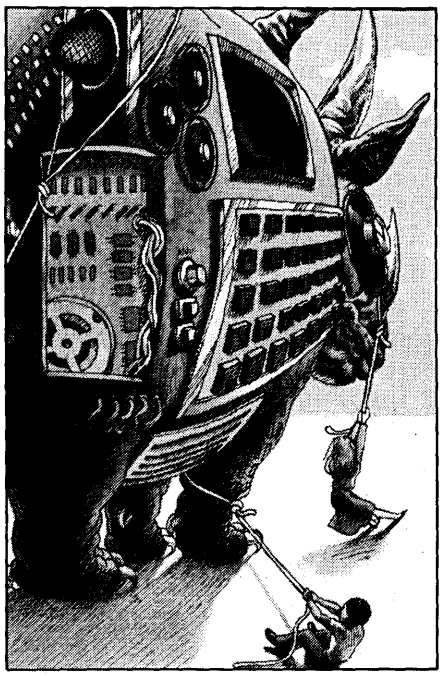
Silverman: In looking back over 12 years of litigation, I would say that the antitrust trials against both IBM and AT&T probably caused half of our current problems.

Michlin: I agree with you. Any time the government imposes a solution, it's guaranteed to make things worse.

Welke: I think the question is, what can be done? And I think that if you can state a problem, you can solve it. The problem is to determine how complex an operating system should be and what it should cost. How is software really done? What does it really cost? What are the real implications? And how should we plan to change the way things are done in the future? That's stating the problem with software. The problem of operating systems is really part of the problem of software engineering.

And then you have the problem of applications. What applications do we need? What hardware? If you can just state the problem of hardware selection, I think that'll do about 90% of the job.

Miller: Let's state that a little more concisely. It appears that operating systems are too complex to be effectively and efficiently usable by today's programmers. That's the problem, and it implies a question: How did we get to the point where systems are dictating what we should do, rather than doing what we ask them to do? Stating the problem is really asking that question. I think the readership of DATAMATION will collectively be able to take at least some of the right steps. ✻



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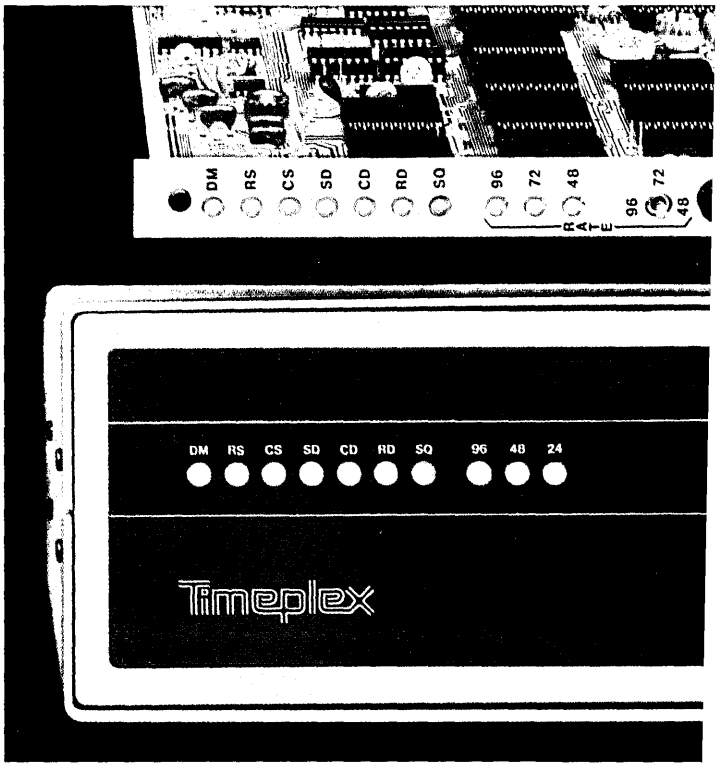

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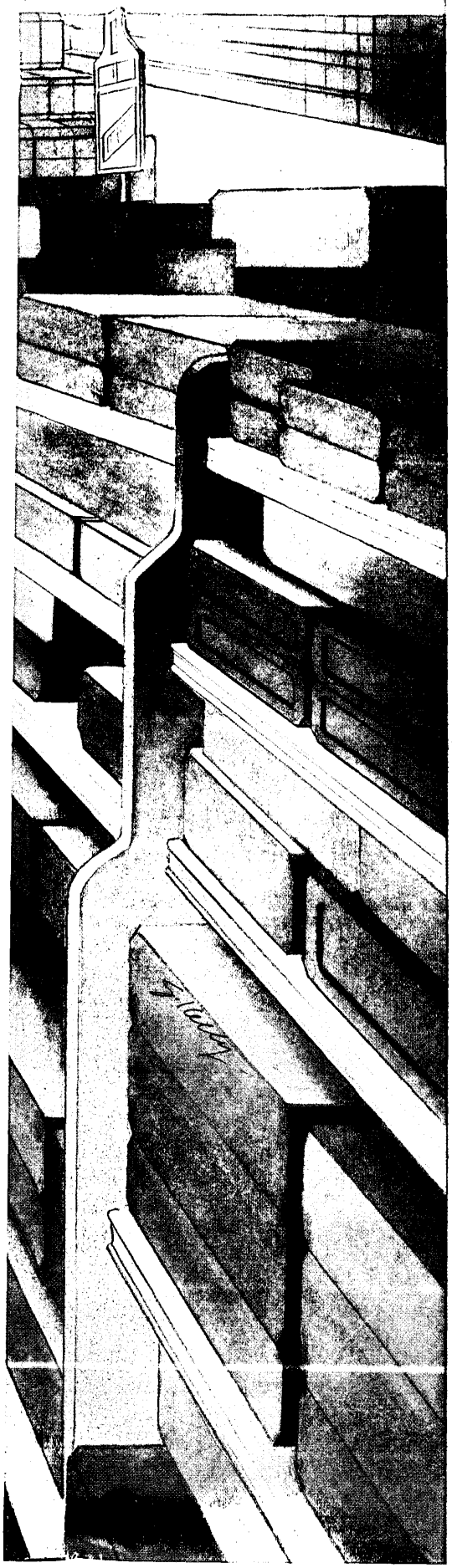
More than 500 models offered by 70 vendors are identified.



MODEM SURVEY

by Data Decisions

The modem industry continues to expand. DATAMATION'S last modem survey, in March 1979, listed some 50 vendors offering over 400 products. This time around, Data Decisions has identified 70 vendors who deliver over 500 models to the oem and end-user markets. Why the plethora of players and products? For several reasons:

- The shift toward distributed data processing and the increased interest in other applications requiring data communications—such as transaction processing, credit authorization, and electronic mail—have created a huge demand for modems and related datacom equipment.
- Users can save money by dealing with independent modem vendors instead of leasing Bell System products.
- Independent vendors like Racal Milgo and Codex have flourished by offering innovations that increase modem performance and capabilities.

The modem industry is divided into several segments that focus on specific application areas. These include Bell System compatible modems, low-speed modems for TWX and Telex networks and for timesharing applications, high-speed modems for dedicated facilities, limited distance (short haul) modems for private facilities, and acoustic couplers for portable applications. Some vendors target just one or two specific application areas, while others focus on the broad market spectrum.

According to the Yankee Group, the current base of installed modems is estimated at just over 3 million units valued at $580 million. Over 600,000 modems valued at $300 million were shipped in 1980. AT&T's share of the total number of shipments was estimated at 45%, but its share of the dollar volume was estimated to be about 60%, or about $180 million. The Yankee Group's projections for 1985 show a decline in the installed base to 2.25 million units valued at $1.6 billion, triple the value of 1980's base. Overall shipments for 1985 are expected to be about 1 million units, valued at $450 million. AT&T is expected to retain its 45% share of the number of shipped units, but the estimated $245 million value of its 1985 shipments represents a decline to 55% of the total dollar volume.

The anticipated decline in the installed base suggests a strong migration to digital transmission such as Bell's DDS over the five-year period; the expected threefold increase in the value of the installed base by 1985 indicates a heavy concentration of sophisticated, high-speed modems.

Modems fall into several different categories, which differ in operating parameters and performance according to the applications for which they're intended. These categories include long and short haul modems, acoustical couplers, modem eliminators (line drivers), and modems designed for communications over a fiber optic or coaxial cable. Long haul modems can be further categorized by communications facility and by transmission speed (data rate).

Long haul modems for voiceband communications are available for use on the public switched (DDD) network, while others are designed strictly for dedicated use on a leased telephone line (referred to by the Bell System as a Type 3002 voice channel), and still others are available for both switched and dedicated applications. Speed categories are low (to 600 bps), medium (1200 to 2400 bps), high (3600 to 16Kbps) and wideband (19.2 K bps and above). Line conditioning, a service provided by the telephone company to improve the electrical characteristics of leased voiceband lines, is normally required for modems operating at higher transmission rates. Conditioning improves the frequency response and signal-to-noise ratio of a line to provide error-free performance at high speeds without signal degradation. The telephone company offers five standard conditioning levels from minimum to maximum: C1, C2, C4, D1, and D2. Conditioning is not available for the DDD network.

Short haul modems, also referred to as limited distance modems, are designed for

The current base of installed modems is estimated at just over 3 million units valued at $580 million.

use over privately owned facilities installed on user premises or over private telephone company lines. The transmission medium is typically a twisted pair cable referred to as a metallic circuit. Transmission distance is limited by the transmission speed and conductor diameter and is typically six to 10 miles, although some short haul modems are available for distances up to 30 miles at low to medium transmission speeds. Short haul modems are typically less expensive than long haul modems.

Acoustic couplers are modems that acoustically connect data terminal equipment to the DDD network. The acoustic connection is implemented via a conventional telephone handset, which is cradled in the coupler's acoustic transmitter and receiver transducers. Acoustic couplers are useful for portable applications, and are typically priced below conventional modems. However, acoustic couplers are inherently limited to transmission speeds no greater than 1200 bps; most couplers do not exceed 450 bps.

Modem eliminators are low-priced substitutes for conventional modems, and are used to extend the cable distance between two data terminal equipment devices (such as a crt terminal and a minicomputer) beyond the 50-foot limitation imposed by the EIA RS-232C interface. One modem eliminator substitutes for two modems. Line driver and null modem are synonyms for this direct current device.

Many modem vendors produce modems with transmission parameters identical to one or more Bell System modems. These vendors price their modems at a substantial margin below the equivalent Bell System models and guarantee their modems to be end-to-end compatible with the Bell modems. However, modems from different vendors that claim Bell compatibility may not be compatible with one another because of slight variations in their electrical parameters.

Prior to June 1977 when FCC Docket 19528 Part 68 became effective, all modems designed by independent vendors for attachment to the public telephone network required a line coupling device called a Data Access Arrangement (DAA). The DAA, available from the Bell System for $2 to $8 per month, is a network protection device that limits the modem output power and protects the network from hazardous voltages. It also performs signaling functions for network control. The FCC decision allows independent vendors to incorporate the DAA circuitry into their products, which then must be certified by the FCC and given a registration number. Certified modems connect directly into the DDD network.

OPERATING FEATURES

The *transmission mode* defines the direction that data is transmitted over a communications link as simplex, half-duplex, or full-duplex. Simplex is one-way transmission between two points. Half-duplex is two-way transmission between two points, but in only one direction at a time. Full-duplex is two-way simultaneous transmission between two points. Full-duplex transmission requires a four-wire communications path for modems that do not employ frequency shift keying (FSK) modulation. Those that do can operate in the full-duplex mode over a two-wire path such as the DDD network.

Synchronization: The data transmission technique may be either asynchronous or synchronous. Asynchronous transmission, also called start-stop transmission, frames each transmitted character with a start bit and one or two stop bits. The interval between

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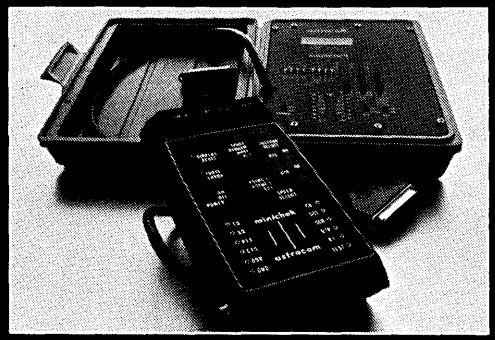

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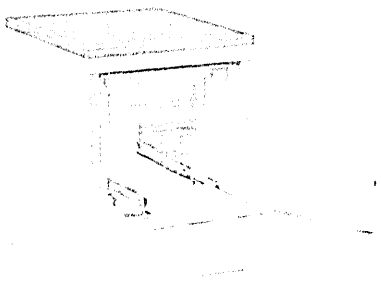

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CIRCLE 133 ON READER CARD

Many modems offer special features at no extra cost or as options.

successive characters can vary in time without affecting the transmission, but the interval between successive bits within a character is identical. Synchronization between transmitting and receiving devices is achieved on a character-by-character basis by each character's start and stop bits, which define the beginning and end of data. Asynchronous transmission is least expensive to implement, and is mainly used for low-speed, low-volume transmission.

Synchronous transmission is a continuous bit stream. Start and stop bits are not used, and the interval between successive bits within a character and successive characters is identical. Synchronization between transmitting and receiving devices is achieved through synchronization characters or bits at the beginning of each transmission. Synchronous transmission is more expensive to implement, but is more effective for communication efficiency, especially for high-volume transmission.

The *modulation* technique is the method a modem uses to alter its carrier signal with respect to the data signal received from the data terminal equipment. The altered carrier signal contains the data, which are extracted from the carrier by the receiving modem in a process called demodulation. The carrier can be altered (modulated) by varying one of three signal parameters: amplitude, frequency, or phase. Complex modulation techniques alter combinations of these signal parameters.

The modem industry uses several different modulation techniques to satisfy different applications. Some are simple, such as FSK (frequency shift keying), which changes the frequency of the carrier to one of two set frequencies for a "one" or "zero" data bit. FSK modulation is mainly used for low- to medium-speed transmission up to 1800 bps. Some modulation techniques are complex, such as QAM (quadrating amplitude modulation), which is used for high-speed synchronous transmission to 9600 bps. Modems at each end of a data link must use the identical modulation technique to be compatible.

Modems that employ FSK modulation use one pair of frequencies (mark and space tones) to transmit data over a communications link, and receive data from the remote modem via a different pair of frequencies.

The call originating modem is assigned one pair of frequencies and the call answering modem is assigned a different pair to implement full-duplex communications over a two-wire link such as the DDD network. Telephone couplers are specified according to *calling mode*: answer only, originate only, or selectable originate/answer.

Equalization neutralizes a line's undesirable electrical characteristics, which distort the data signal, increasing error rates and degrading performance. Equalization and line conditioning are extremely important to optimize modem performance, especially at data rates above 2400 bps. Both act to minimize signal distortion, such as envelope delay and amplitude attenuation. Equalizers are essential because line conditioning does not totally neutralize distortion; it assures that distortion is reduced to specific limits identified in the specifications for each type of line conditioning. Modems that operate on the DDD network at higher speeds especially require equalization because conditioning is neither available nor possible for switched lines; line length varies for each connection, resulting in different electrical characteristics. The industry provides four basic forms of equalization: fixed, manually adjustable, automatic, and adaptive. Fixed equalization, called compromise or statistical equalization, is designed to neutralize a specific set of electrical parameters and is based on the fact that about 90% of all unconditioned voiceband lines exhibit similar electrical characteristics.

Manual equalization provides manually adjustable controls on the modem that are set according to a visual indication of the results such as a null meter or indicator lights. Automatic equalization initiates and performs equalization automatically, but does not define the type of equalization. It is useful for modems that operate over the DDD network.

Automatic adaptive equalization, also useful for switched line operation, combines automatic and adaptive equalization methods. It is used on most high-speed modems because it provides the best performance. The time required to equalize a line is called training time and can range from as little as 25 milliseconds to as much as 150 milliseconds; data transmission cannot proceed until equalization is completed.

Electrical interface is the connection between data terminal equipment (DTE) and data circuit equipment (DCE), i.e., the modem. The interface passes digital data and control signals between the devices, but can differ electrically depending on the application. Modems are available with the following electrical interfaces: EIA Standard RS-232C, EIA Standard RS-449, CCITT Recommendation V.24, MIL STD 188C, and current loop. The most common electrical interface used throughout the industry is the EIA RS-232C. The interface supports transmission rates to 20 Kbps at distances to 50 feet between DTE and DCE. The EIA RS-449 is an improved interface standard designed to meet current and future requirements; however, it has not yet received wide industry acceptance. RS-449 supports data rates to 2 Mbps at distances to 200 feet between DTE and DCE.

The CCITT Recommendation V.24 is an international interface specification established by the Consultative Committee on International Telegraphy and Telephony. The specification is closely compatible with the EIA Standard RS-232C. The MIL STD 188C is a U.S. military electrical interface for military equipment. A current loop interface employs telegraph technology. Data is transferred in the form of current pulses at rates to 150 bps.

Two signaling standards exist: neutral (unipolar), where signaling is performed by switching DC current on and off, and polar (bipolar), where signals are produced by positive or negative DC current pulses. Signal current standards are 20, 40, or 60 milliamperes. Current transmission was used primarily for message communications via teleprinters before the inception of data communications.

FEATURES AND OPTIONS

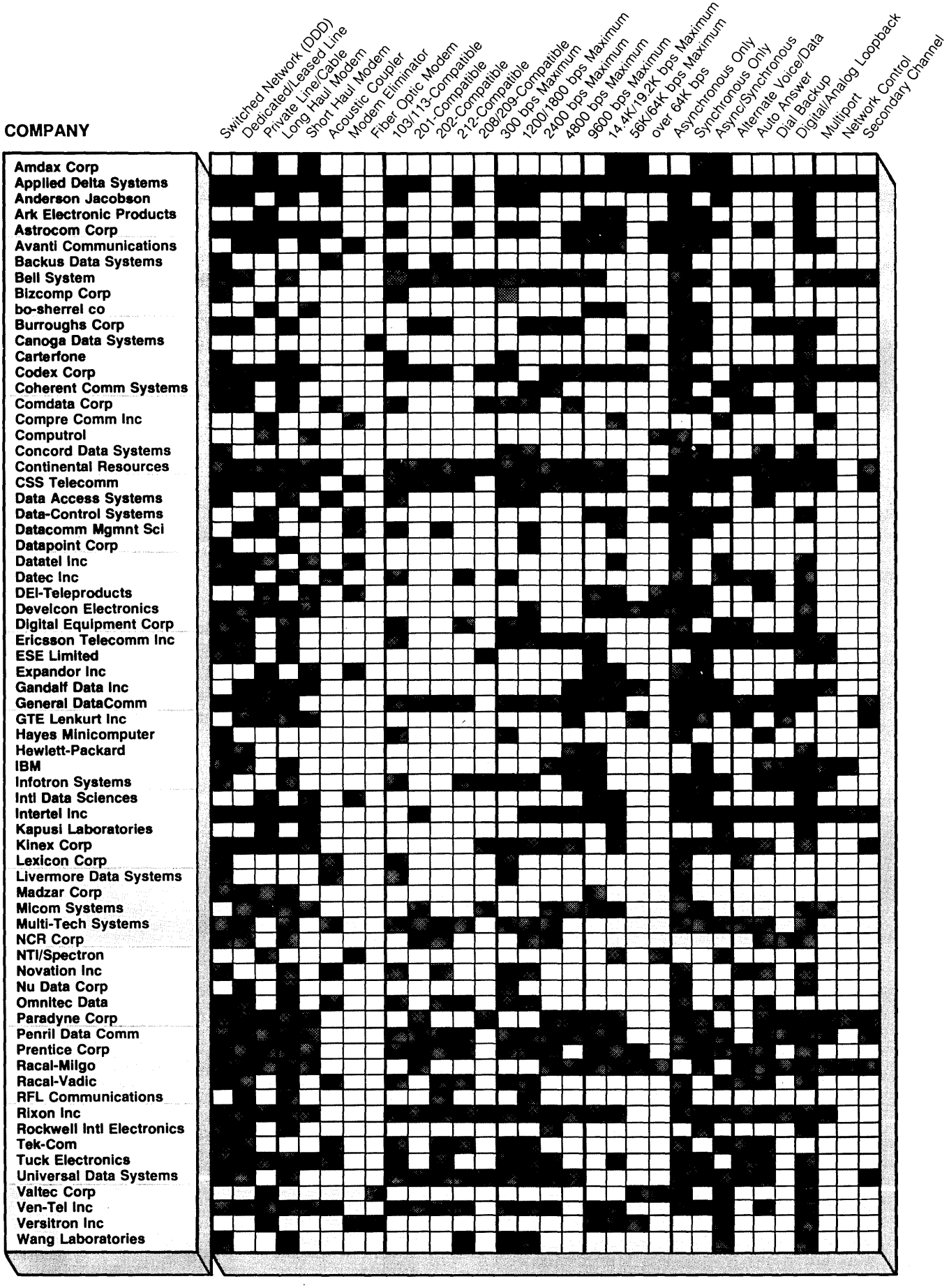
Many modems are equipped with special features that may be included in the standard unit at no extra cost or are available as options. Most of these features are available throughout the industry and offer the user additional useful capabilities. The more common features are multiport operation, alternate voice/data, reverse channel, secondary channel, auto call interface, auto answer, dial backup, hot spare modem switching, and diagnostic functions.

The listings on the following pages include characteristics and pricing for each of the modem models marketed by the independent vendors as well as for Bell System modems. Use the listings to select the modems that best satisfy your needs, then inquire about vendor leasing terms (if any), service support, and quantity discounts. Most small vendors (and some larger ones) offer factory service only, which means you should have a spare modem to replace the faulty one. Factory service usually takes 10 to 15 days. Most large vendors offer maintenance contracts for on-site maintenance, either through a third party service organization or their own. Some vendors provide maintenance assistance over the phone or on-line diagnostic testing via their own diagnostic center.

The modem outline chart that precedes the listings is a quick reference guide to vendors whose product parameters match specific user requirements. The parameters are transmission facility, modem type, Bell System modem compatibility, transmission speed and technique (async/sync), and special features.

This modem survey is based on a report by David H. Axner, senior editor analyst, in Data Decisions' *Computer Systems*, a looseleaf reference service covering computer hardware and software. A trial review is available from Data Decisions, 20 Brace Rd., Cherry Hill, NJ 08034, (800) 257-7732.

MODEM OUTLINE



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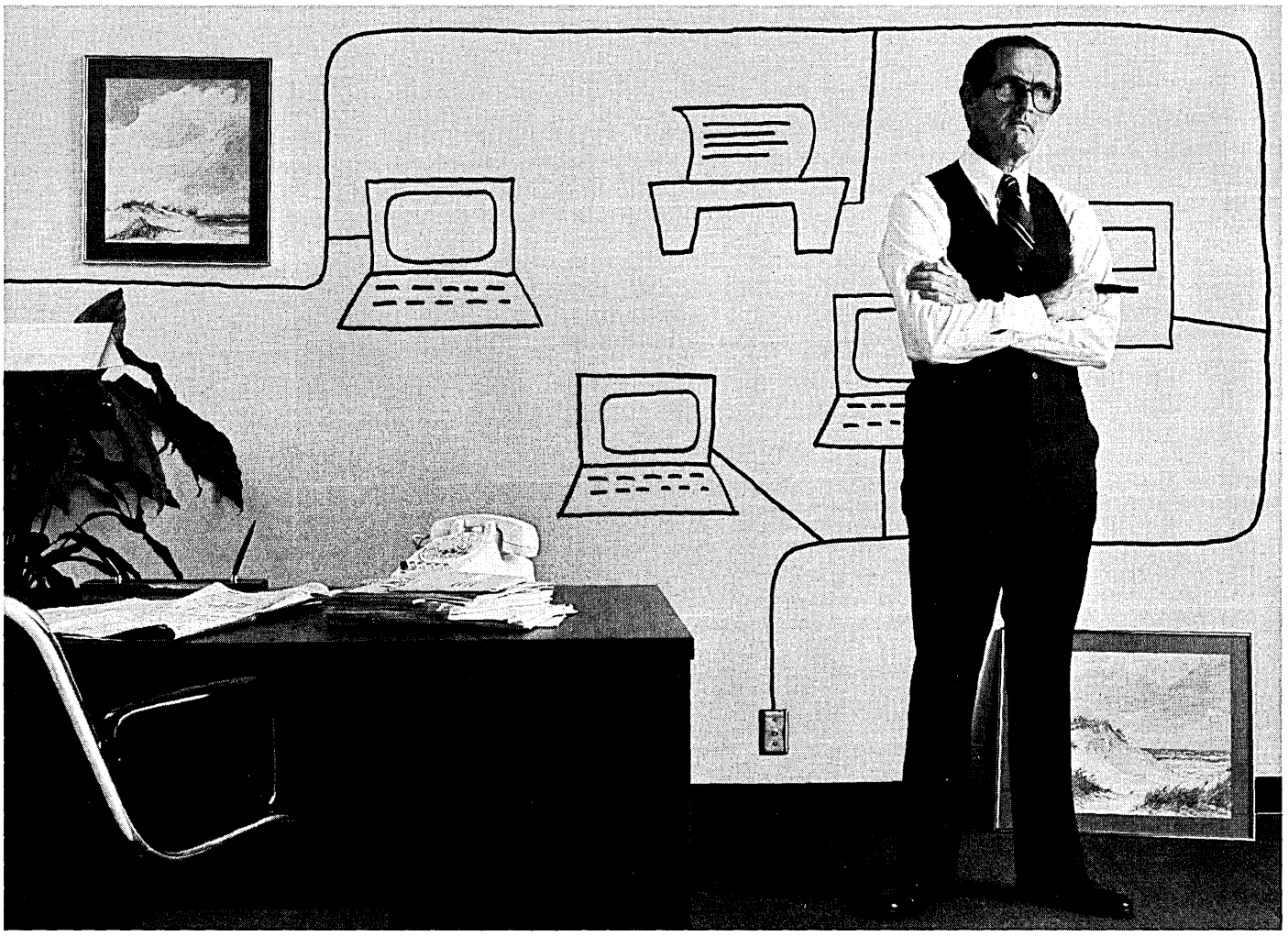

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Datapoint's Integrated Electronic Office™ offers data processing, word processing, electronic message service, and management of voice and data communications, all in one. All the basic business functions can be truly integrated at multifunction workstations to help your people become more productive.

The Integrated Electronic Office is based on our ARC™ local network. Datapoint introduced the concept of local networking more than three years ago. Now, more business is processed on ARC coaxial networks than all others combined.

In an ARC network, workstations, processors, printers, and files can be linked together so that all resources are available to all users. But ARC goes well beyond conventional cable networks. No matter where a file is physically located, the information on it — both words and data — may be accessed as a common compatible information base. And this information may be organized to match a company's structure, with security controls at all levels.

Start where you choose. Grow with your needs. With ARC you can add processing power, workstations, storage, and peripherals without constant reprogramming. And no matter how large your Integrated Electronic Office grows, you'll get responsive performance at every workstation.

We're ready to help you get your office of the future off the drawing boards and into operation. For more information, send for our new brochure, "The Integrated Electronic Office." Write: Datapoint Corporation, Corporate Communications T-41 DM, 9725 Datapoint Drive, San Antonio, TX 78284. Or call (512) 699-7059.

DATAPOINT

CIRCLE 134 ON READER CARD

AMDAX CORPORATION

160 Wilbur Place
Bohemia, NY 11716
(516) 567-7887

MODEL DAX 746

Point-to-point or multipoint operation over a two-way broadband coaxial cable up to 50 miles; simplex, half- or full-duplex; asynchronous or synchronous at selectable data rates up to 19.2K bps; standalone—$950 prch.

MODEL DAX 1140

Point-to-point or multipoint operation over a two-way broadband coaxial cable up to 50 miles; simplex, half- or full-duplex; synchronous at selectable data rates of 50K/56K bps; standalone—$1,800 prch.

ANDERSON JACOBSON, INC.

521 Charcot Avenue
San Jose, CA 95131
(408) 263-8520

MODEL A242A ACOUSTIC COUPLER

DDD network via acoustic coupling; half- or full-duplex; asynchronous at data rates up to 450 bps; standalone—$295 prch.

AJ243 ACOUSTIC COUPLER

DDD network via acoustic coupling; full-duplex; asynchronous at data rates up to 450 bps; standalone—$250 prch only.

MODEL AJ245 DIRECT CONNECT MODEM

DDD network via direct connection; full-duplex; asynchronous at data rates up to 450 bps; standalone—$245 prch only.

MODEL AJ247 ACOUSTIC COUPLER/MODEM

DDD network via direct connection or acoustic coupling; full-duplex; asynchronous at data rates up to 450 bps; standalone—$295 prch.

MODEL AJ347 ACOUSTIC COUPLER/MODEM

DDD network via acoustic coupling or direct connection; half- or full-duplex; asynchronous at data rates up to 450 bps; standalone—$365 prch.

MODEL AJ1234 ACOUSTIC COUPLER/MODEM

DDD network via DAA or acoustic coupling; point-to-point operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with Anderson Jacobson modems AJ1255, AJ1256, AJ1257; also compatible with Racal-Vadic modem VA3400; full-duplex; asynchronous at data rates up to 300 and 1200 bps or 150 and 600 bps; standalone—$795 prch.

MODEL AJ1235 ACOUSTIC COUPLER/MODEM

DDD network via acoustic coupling or direct connection; point-to-point operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with Bell System modems 103 and 113; compatible with Racal-Vadic 3400 series modems and AJ1255, AJ1256, and AJ1257; half- or full-duplex; asynchronous at selectable data rates of 150/450/600 bps; standalone—$895 prch.

MODEL AJ1245 ACOUSTIC COUPLER/MODEM

DDD network via DAA or acoustic coupling; compatible with Bell System modems 103, 113, and 202; half- or full-duplex; asynchronous at data rates up to 450 or 1200 bps; standalone—$695 prch.

MODEL AJ1256 DIRECT CONNECT MODEM

DDD network via direct connection; point-to-point operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with Anderson Jacobson modems AJ1234, AJ1255, and AJ1257; also compatible with Racal-Vadic modem VA3400; full-duplex; asynchronous at data rates up to 1200 bps; standalone—$775 prch.

MODEL AJ1259 TRIPLE MODEM

DDD network via direct connection; point-to-point operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with Bell System modems 103, 113, and 212A; compatible with Racal-Vadic modem VA3400; half- or full-duplex; asynchronous at data rates up to 300/1200 bps; synchronous at 1200 bps; standalone—$920 prch.

ARK ELECTRONIC PRODUCTS INC.

3250 West Hibiscus
Melbourne, FL 32901
(305) 724-5260

LIMITED DISTANCE MODEM MODEL 1B

Point-to-point operation over a 2- or 4-wire metallic circuit up to 17 miles using AWG; simplex, half- or full-duplex; synchronous at selectable data rates up to 19.2K bps; standalone—$685 prch.

LIMITED DISTANCE MODEM MODEL 4

Point-to-point or multipoint operation over a 2- or 4-wire metallic circuit up to 6 miles; simplex, half- or full-duplex; asynchronous at data rates up to 9600 bps; standalone—$295 prch.

LIMITED DISTANCE MODEM MODEL 5

Point-to-point operation over a 2- or 4-wire metallic circuit up to 6 miles; compatible with ARK modem Model 4; simplex, half- or full-duplex; asynchronous at data rates up to 9600 bps; standalone—$395 prch.

ASTROCOM CORPORATION

120 West Plato Boulevard
St. Paul, MN 55107
(612) 227-8651

LIMITED DISTANCE MODEM MODEL MOS-2

Point-to-point operation over a metallic circuit up to 15 miles; compatible with AT&T Tech Ref Pub 43401; half- or full-duplex; synchronous at selectable data rates up to 19.2K bps; standalone—$695 prch.

LIMITED DISTANCE MODEM MODEL SC205

Point-to-point operation over a 2- or 4-wire metallic circuit up to 3 miles; half- or full-duplex; synchronous at selectable data rates up to 14.4K bps; standalone—$495 prch.

LIMITED DISTANCE MODEM MODEL SC210

Point-to-point operation over a 2-or 4-wire metallic circuit up to 3 miles; half- or full-duplex; synchronous at selectable data rates up to 3600 bps; standalone—$495 prch.

LIMITED DISTANCE MODEM MODEL SC219

Two- or four-wire metallic circuit up to 3 miles; half- or full-duplex; synchronous at selectable data rates up to 19.2K bps; standalone—$495 prch.

LIMITED DISTANCE MODEM MODEL SH48A

Point-to-point or multipoint operation over a metallic circuit up to 7 miles using AWG; compatible with AT&T Tech Ref Pub 43401; half- or full-duplex; asynchronous at data rates up to 4800 bps; standalone—$295 prch.

LIMITED DISTANCE MODEM MODEL SH96A

Point-to-point or multipoint operation over a 2- or 4-wire metallic circuit up to 3 miles using AWG; compatible with AT&T Tech Ref Pub 43401; half- or full-duplex; asynchronous at selectable data rates up to 9600 bps; standalone—$295 prch.

MODEM MODEL 140-0

DDD network via DAA; full-duplex; point-to-point operation over an unconditioned 4-wire dedicated Type 3002 voice channel or metallic circuit up to 5 miles; asynchronous at data rates up to 150/1200 bps—pricing available on request only.

MODEM MODEL 140-A

DDD network via DAA; point-to-point operation over an unconditioned 4-wire dedicated Type 3002 voice channel or metallic circuit up to 5 miles; full-duplex; asynchronous at data rates up to 150/1200 bps—pricing available on request only.

MODEM MODEL 212

DDD network via direct connection; point-to-point operation over a 2-wire dedicated Type 3002 voice channel or metallic circuit up to 5 miles; half- or full-duplex; asynchronous at data rates up to 300/1200 bps; synchronous at 1200 bps; standalone—$795 prch.

LIMITED DISTANCE MODEM 400 SERIES

Point-to-point operation over a 2- or 4-wire metallic circuit up to 5 miles; half- or full-duplex; synchronous at selectable data rates of 10K to 125K bps; standalone—$1,495 prch.

ACOUSTIC COUPLER MODEL 1100-0

DDD network via DAA or acoustic coupling; point-to-point operation over an unconditioned 2-wire dedicated Type 3002 voice channel; compatible with Bell System modems 103 and 113; half- or full-duplex; asynchronous at data rates up to 300 bps; standalone—$198 prch.

ACOUSTIC COUPLER MODEL 1100-A

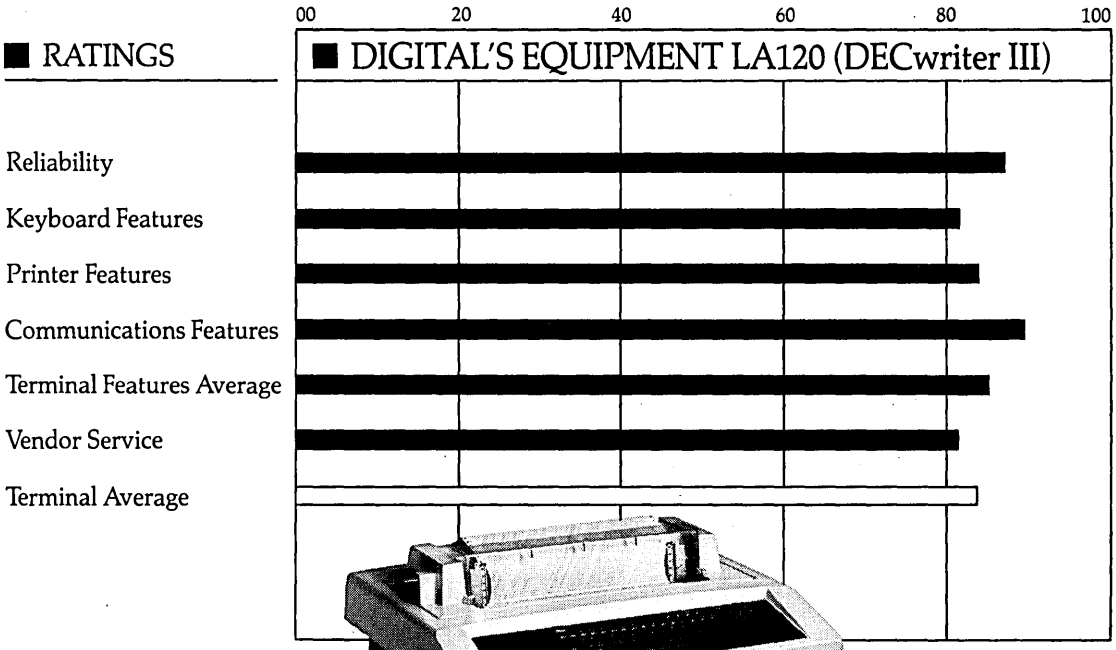
DDD network via DAA or acoustic coupling; point-to-point operation over an unconditioned 2-wire dedicated Type 3002 voice channel; compatible with Bell System modems 103 and 113; half- or full-duplex; asynchronous at data rates up to 300 bps; standalone—$265 prch.

MODEM MODEL 1300-0

DDD network via DAA; compatible with Bell System modems 103 and 113; half- or full-duplex; asynchronous at data rates up to 300 bps; standalone—$250 prch.

MODEM MODEL 1300-A

DECwriter III users are happier.



The DECwriter III™ was rated the best teleprinter to use by the people who use it.*

It was rated particularly high in ease-of-use categories and in reliability.

We point this out not only to call attention to our high-throughput, 1200-baud DECwriter III, but also to mention Digital's long-standing commitment to products that work well for people.

You see, we believe people work better when they're given tools that work better.

To buy a DECwriter III, contact your local terminals dealer. For the name of the one nearest you, call (800) 225-9378 (outside the Continental U.S. and in Massachusetts call (617) 467-7068) between 8:30am and 5:00pm Eastern time, or contact your local Digital sales representative.

Digital Equipment Corporation, Terminals Product Group, MR2-2/M67, One Iron Way, Marlboro, MA 01752. Tel. (617) 467-7068. In Europe: 12 Av. des Morgines, CH-1213 Petit-Lancy/Geneva. In Canada: Digital Equipment of Canada, Ltd.

*According to Data Decisions, Inc. For a copy of the survey entitled "Interactive Terminal Ratings," write to Data Decisions, Inc., 20 Brace Road, Cherry Hill, New Jersey 08034.

digital

We change the way people work.

CIRCLE 135 ON READER CARD

DDD network via DAA; point-to-point operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel or metallic circuit up to 20 miles; compatible with Bell System modems 103 and 113; half- or full-duplex; asynchronous at data rates up to 300 bps; standalone—$165 prch.

MODEM MODEL 1300-D

DDD network via direct connection; point-to-point operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel or metallic circuit up to 20 miles; compatible with Bell System modems 103 and 113; half- or full-duplex; asynchronous at data rates up to 300 bps; standalone—$245 prch.

AVANTI COMMUNICATIONS CORPORATION

Aquidneck Industrial Park
Newport, RI 02840
(401) 849-4660

LIMITED DISTANCE MODEM MODEL 600

Point-to-point operation over a 2- or 4-wire metallic circuit up to 8 miles using AWG; half- or full-duplex; asynchronous at data rates up to 9600 bps; standalone—$350 prch.

MEDIUM DISTANCE MODEM MODEL 3002

Point-to-point or multipoint operation over an unconditioned 4-wire dedicated Type 3002 voice channel or metallic circuit up to 50 miles; half- or full-duplex; asynchronous (optional) or synchronous at selectable data rates of 3600 or 4800 bps; standalone—$1,395 prch.

HIGH SPEED MODEMS MODELS 2300H and 2300M

Point-to-point operation over a 4-wire metallic circuit up to 6,000 feet using AWG; simplex, half- or full-duplex; synchronous at selectable data rates up to 6.31M bps for Model 2300H and up to 460.8K bps for Model 2300M; standalone—Model 2300M, $1,450 prch; Model 2300H—$1,750 prch.

MODEM ELIMINATOR MODEL 300

Point-to-point operation over a cable between business machines located up to 400 feet apart; half- or full-duplex; synchronous at selectable data rates up to 19.2K bps; standalone—$360 prch.

LOCAL AREA DATA DISTRIBUTOR 1900

Point-to-point or multipoint operation over a 4-wire metallic circuit up to 8 miles using AWG; compatible with AT&T Tech Ref Pub 43401; half- or full-duplex; synchronous at selectable data rates up to 19.2K bps; standalone—$745 prch.

LOCAL AREA DATA DISTRIBUTOR 2200

Point-to-point or multipoint operation over a 2- or 4-wire metallic circuit up to 9 miles using AWG; compatible with AT&T Tech Ref Pub 43401; half- or full-duplex; asynchronous (optional) or synchronous at up to 19.2K bps; standalone—$795 prch.

BACKUS DATA SYSTEMS, INC.

1440 Koll Circle
San Jose, CA 95112
(408) 279-8711

MODEL AC-312

DDD network via acoustic coupling; compatible with Bell System modem 103 or 202; asynchronous; half- or full-duplex at data rates up to 300 bps; half-duplex at data rates up to 1200 bps; standalone—300 bps originate-only, $245 prch; 300 bps originate/answer—$295 prch.

BELL SYSTEM

Distributed by local Bell System offices.

DATA SET 103JR

DDD network via direct connection; compatible with Bell System 103, 113, 153, and 212 modems; full-duplex; asynchronous at data rates up to 300 bps; standalone—$28 mo. rental; $130 installation.

DATA SETS 108F/G

Point-to-point over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; 103F is compatible with Bell System modems 108A/E/G/J and 103F; 103G is compatible with Bell System modems 108B/C/D/F/H and 103F; full-duplex; asynchronous at data rates up to 300 bps; standalone—$28 mo. rental; $90 installation.

DATA SET 113AR

DDD network via direct connection; compatible with Bell System modems 113B/D, 103, 153, and 212; full-duplex; asynchronous at data rates up to 300 bps; standalone—$20 mo. rental; $85 installation.

DATA SET 113CR

DDD network via direct connection; compatible with Bell System modems 103, 113B/D, 153, and 212; full-duplex; asynchronous at data rates up to 300 bps; standalone—$25 mo. rental; $90 installation.

DATA SET 113DR

DDD network; compatible with Bell System modems 103, 113A/C, 153, and 212; full-duplex; asynchronous at data rates up to 300 bps; standalone—$25 mo. rental; $90 installation.

DATA SET 202SR DATAPHONE 1200

DDD network via direct connection; half-duplex; asynchronous at data rates up to 1200 bps; standalone—$40 mo. rental; $110 installation.

DATA SET 202T DATAPHONE 1800

Point-to-point or multipoint operation over an unconditioned or conditioned 2- or 4-wire dedicated Type 3002 voice channel; simplex, half- or full-duplex; asynchronous at data rates up to 1800 bps; standalone—$40 mo. rental; $110 installation.

DATA SET 201C DATAPHONE 2400

Point-to-point operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with Bell System modems 201B/C/D, 251A, and 2024; half- or full-duplex; synchronous at 2400 bps; standalone—$65 mo. rental; $125 installation.

DATA SET 201CR DATAPHONE 2400

DDD network via direct connection; compatible with Bell System modems 201/B/C/D, 251A, and 2024; half-duplex; synchronous at 2400 bps; standalone—$60 mo. rental; $110 installation.

DATA SET 212AR DATAPHONE 300/1200

DDD network via direct connection; compatible with Bell System modems 103, 113, 153, and 212AR; full-duplex; asynchronous up to 300 bps; synchronous at 1200 bps; standalone—$40 mo. rental; $100 installation.

DATA SET 208BR DATAPHONE 4800

DDD network via direct connection; compatible with Bell System modem 2048B; half-duplex; synchronous at 4800 bps; standalone—$125 mo. rental; $220 installation.

DATA SET 208A DATAPHONE 4800

Point-to-point or multipoint operation over a 2- or 4-wire dedicated Type 3002 voice channel; half- or full-duplex; synchronous at 4800 bps; standalone—$135 mo. rental; $150 installation.

DATA SET 209A DATAPHONE 9600

Point-to-point operation over a conditioned 4-wire dedicated Type 3002 voice channel; half- or full-duplex; synchronous at 9600 bps—$250 mo. rental; $410 installation.

DATAPHONE II DATA SET 2024A

Point-to-point or multipoint operation over an unconditioned 4-wire dedicated Type 3002 voice channel; compatible with Bell System modems 201B/C/D and 251A; full-duplex; synchronous at 2400 bps; standalone—$95 mo. rental; $150 installation.

DATAPHONE II DATA SET 2048A

Point-to-point or multipoint operation over an unconditioned 4-wire dedicated Type 3002 voice channel; full-duplex; synchronous at 4800 bps; standalone—$135 mo. rental; $200 installation.

DATAPHONE II DATA SET 2048C

Point-to-point or multipoint operation over an unconditioned 4-wire dedicated Type 3002 voice channel; full-duplex; synchronous at 4800 bps; standalone—$135 mo. rental; $200 installation.

DATAPHONE II DATA SET 2096A

Point-to-point or multipoint operation over a conditioned 4-wire dedicated Type 3002 voice channel; full-duplex; synchronous at 9600 bps; standalone—$210 mo. rental; $250 installation.

LOCAL AREA DATA SET (LADS)

Point-to-point operation over a metallic circuit up to 6 miles; full-duplex; synchronous at up to 19.2K bps—$40 mo. rental; $130 installation.

BIZCOMP CORPORATION

P.O. Box 7498
Menlo Park, CA 94025
(415) 966-1545

1022 INTELLIGENT MODEM

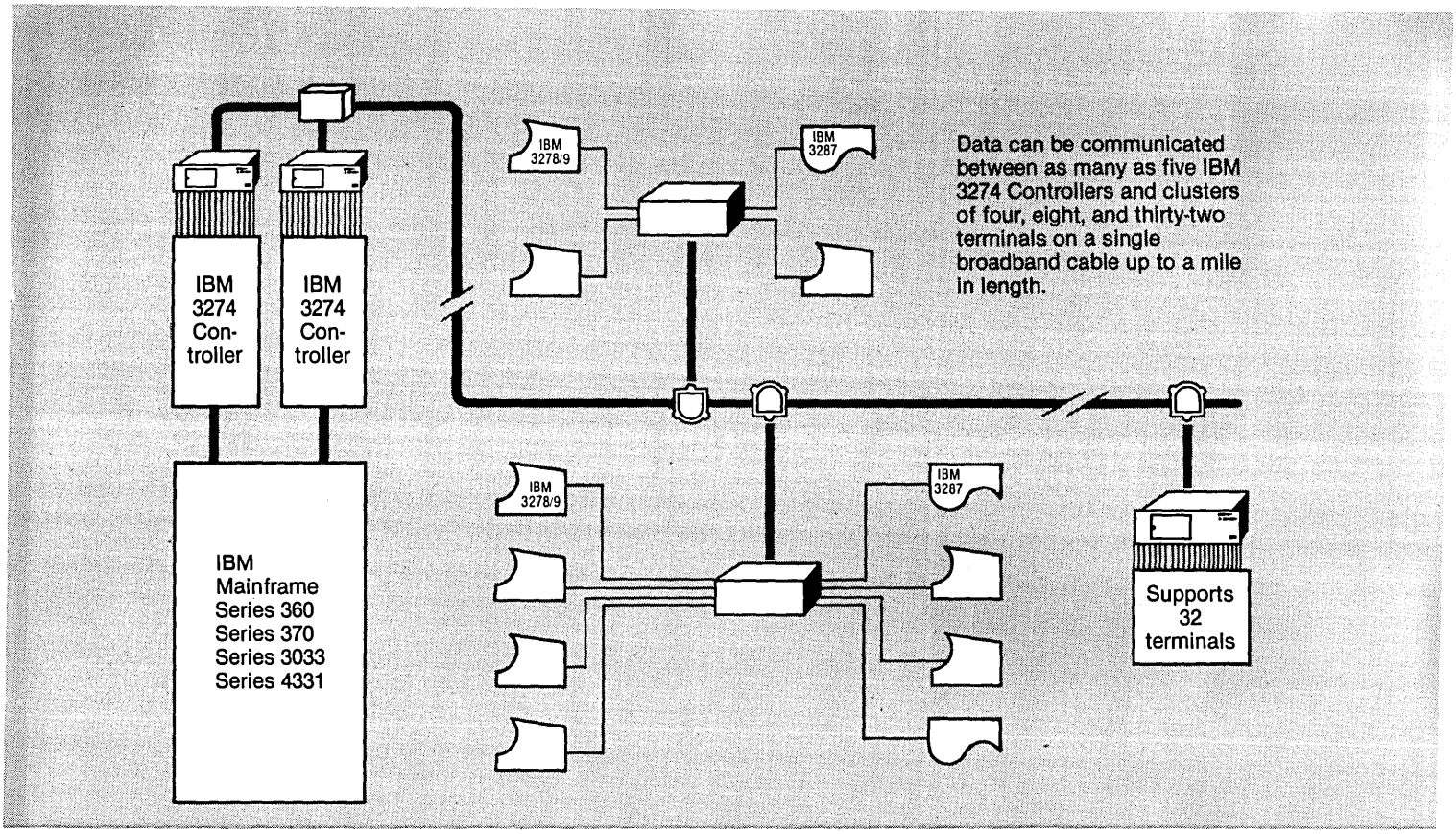
DDD network via direct connection; compatible with Bell System modem 103 and Bizcomp 1030 Series modems; half-duplex; asynchronous at program-selectable data rates of up to 300 bps; standalone—$595 prch.

1030 INTELLIGENT MODEM

DDD network via direct connection; compatible with Bell System modem 103 and Bizcomp 1022 and 1031 modems; half-duplex; asynchronous at automatically selectable data rates of up to 300 bps; standalone—$395 prch.

1031 INTELLIGENT MODEM

DDD network via direct connection; compatible with Bell System modem 103 and Biz-

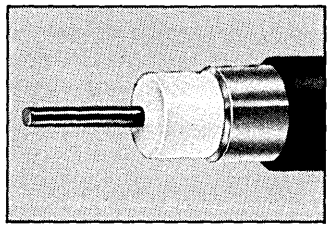


Our new single-cable VIDEODATA® network is a money-saving way to connect your IBM mainframe to scores of remote terminals.

Using individual baseband cables between your "locally attached" IBM 3274 Controller and remote terminals or printers can be a very expensive way to transmit data. Not only is the initial installation costly, but you can also run up big labor bills when it comes time to add or move terminals. You also have the inevitable difficulties of adding more home runs to a snakepit of both functioning and abandoned cables.

The new 3M Model 6732 "IBM attach" multiplexer from Interactive Systems/3M offers a practical, cost-effective way to keep installation, rewiring, and maintenance problems to a minimum. It even does away with error-inducing crosstalk and electronic noise.

The Model 6732 is a rack-mountable, 7½"-high box that connects directly to the 3274 Controller's ports with 32 local cables. Data from all 32 ports is modulated at an assigned radio frequency and carried to and from the terminal via a single shielded, self-contained broadband coaxial cable. The distance between the Controller and its farthest terminal can be up to a mile, with the total multi-leg VIDEODATA network incorporating many miles of cable. The network is fully transparent to IBM and plug-compatible terminals.



Thousands of digital, audio, and video signals can travel simultaneously in both directions within this low-cost, fully shielded ½" coaxial cable.

Remote terminals are connected to the trunk broadband cable with 4-, 8-, or 32-port modems built by Interactive Systems/3M. Up to five separate IBM 3274 Controllers can presently be used in the network; each operates within its own 6-MHz channel. All peripherals send or receive data at the standard IBM channel speed of 2.3 Mb/s.

Because the Interactive Systems/3M VIDEODATA network used with the 6732 Multiplexer is a *broadband* local area network, thousands of other computers, terminals, office machines and even video or audio devices can be hooked up to the main cable without creating interference. Thus a dedicated IBM data network can serve as the basis for a future multi-purpose communications system.

Interactive Systems/3M has been engineering and installing VIDEODATA networks for factories, office buildings, university campuses, and government/military applications since 1972. To find out how this proven concept can improve the efficiency of your IBM 3270 system, mail the coupon. Better yet, call (313) 973-1500 today.

Mail to: Interactive Systems/3M
3980 Varsity Drive
Ann Arbor, MI 48104
Attention: Marketing Dept.
D-10

- ☐ Send more information on your new Model 6732 "IBM Attach" multiplexer.
- ☐ Send more information about 3M's VIDEODATA network, modems and multiplexers.
- ☐ Please have an Interactive Systems/3M representative call me for an appointment.

Name _____

Title _____

Phone ( ) _____

Address _____

City _____

State _____ Zip _____

3M Hears You...

3M

CIRCLE 136 ON READER CARD

comp 1022 and 1030 modems; half-duplex; asynchronous at selectable data rates of up to 300 bps; standalone—$495 prch.

1084 INTELLIGENT VERSAMODEM

DDD network via direct connection; compatible with Bell System modem 103; half-duplex; asynchronous at selectable data rates of up to 300 bps; standalone—$299 prch.

BO-SHERREL COMPANY

6101 Jarvis Avenue
Newark, CA 94505
(415) 792-0354

M-1 LIMITED DISTANCE MODEM

Point-to-point operation over a 2- or 4-wire metallic circuit up to 10 miles; full-duplex; asynchronous at data rates up to 9600 bps; standalone—$165 prch.

M-3 ASYNCHRONOUS LINE DRIVER

Four-wire metallic circuit up to 10 miles; compatible with bo-sherrel M-1 Short Haul Modem; half- or full-duplex; asynchronous at data rates up to 9600 bps; standalone—$99 prch.

M-4 LIMITED DISTANCE MODEM

Point-to-point or multipoint operation over a 2- or 4-wire metallic circuit up to 6 miles; simplex, half- or full-duplex; synchronous at selectable data rates of up to 19.2K bps; standalone—$440 prch.

BURROUGHS CORPORATION

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

MODEM MODEL TA 1201

DDD network via DAA; point-to-point operation over an unconditioned or conditioned 2- or 4-wire voice channel; compatible with Bell System modem 202 and Burroughs TA 700, TA 1200, and TA 1800 modems; half- or full-duplex; asynchronous at data rates up to 600 (optional)/1200/1800 bps; standalone—$170 prch.

MODEM MODEL TA 1203

DDD network via DAA; point-to-point operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with Bell System modem 202 and Burroughs TA 700, TA 1200, and TA 1800 modems; simplex or half-duplex; asynchronous at data rates up to 600(optional)/1200 bps; standalone—$963 prch.

MODEM MODEL TA 1801

DDD network via DAA; point-to-point operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with Bell System modem 202 and Burroughs modems TA 700/TA 1200 Series, and TA 1800 Series; half- or full-duplex; asynchronous at data rates up to 600 (optional)/1200/1800 bps; standalone—$1,012 prch.

MODEM MODEL TA 1802

DDD network via DAA; point-to-point operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; half- or full-duplex; asynchronous at data rates up to 1200/1800 bps; standalone—$1,122 prch.

MODEM MODEL TA 2401

DDD network via DAA; point-to-point or multipoint operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with Bell System modem 201B/C and Burroughs TA 734-24, and other TA 2400 Series modems; half- or full-duplex; synchronous at selectable data rates of 1200/2400 bps; standalone—$1,375 prch.

MODEM MODEL TA 2403

DDD network via DAA; compatible with Bell System modem 201B/C and Burroughs modems TA 734-24, and TA 2401; simplex or half-duplex; synchronous at selectable data rates of 1200/2400 bps; standalone—$1,595.

MODEM MODEL TA 2404

DDD network via DAA; point-to-point operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with Bell System modem 201B/C and Burroughs modems TA 734-24 and TA 2401; simplex, half- or full-duplex; synchronous at selectable data rates of 1200/2400 bps; standalone—$1,815 prch.

MODEM MODEL TA 2405

DDD network via DAA; point-to-point operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with Bell System modem 201B/C and Burroughs modems TA 734-24, and TA 2401; simplex, half- or full-duplex; synchronous at selectable data rates of 1200/2400 bps; standalone—$2,035 prch.

MODEM MODEL TA 4801

DDD network via DAA; point-to-point or multipoint operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; simplex, half- or full-duplex; synchronous at 4800 bps; standalone—$4,079 prch.

CANOGA DATA SYSTEMS

6740 Eton Avenue
Canoga Park, CA 91303
(213) 888-2003

FIBER OPTIC DIGITAL DATA LINK MODEM CRS-100

Point-to-point operation over a fiber optics cable up to 1 kilometer; simplex or full-duplex; asynchronous at data rates up to 56K bps; standalone—$625 prch.

FIBER OPTIC DIGITAL DATA LINK MODEM CSY-100

Point-to-point operation over a fiber optics cable up to 1 kilometer; simplex or full-duplex; synchronous at selectable data rates of up to 57.6K bps; standalone—$750 prch.

CARTERFONE COMMUNICATIONS CORPORATION

1111 West Mockingbird Lane
Dallas, TX 75247
(214) 630-9700

MODEL 3000

DDD or TWX network via direct connection; point-to-point operation over a 2-wire dedicated Type 3002 voice channel; compatible with Bell System modems 101C and 103; half- or full-duplex; asynchronous at selectable data rates of 110/150/300 bps; standalone—$678 prch.

CODEX CORPORATION

A Subsidiary of Motorola Inc.
20 Cabot Boulevard
Mansfield, MA 02048
(617) 364-2000

CS 4800 DATA MODEM NETWORK CONTROL SERIES

Point-to-point or multipoint operation over an unconditioned or conditioned 4-wire dedicated Type 3002 voice channel; half- or full-duplex; synchronous at selectable data rates of 2400/4800 bps; standalone or rackmount—$4,675 prch.

CS 9600 DATA MODEM NETWORK CONTROL SERIES

Point-to-point or multipoint operation over an unconditioned or conditioned 4-wire dedicated Type 3002 voice channel; half- or full-duplex; synchronous at selectable data rates of 2400/4800/7200/9600 bps; standalone or rackmount—$7,975 prch.

CS 48FP DATA MODEM FAST-POLL NETWORK CONTROL SERIES

Point-to-point or multipoint operation over an unconditioned or conditioned 4-wire dedicated Type 3002 voice channel; half- or full-duplex; synchronous at selectable data rates of 2400/4800 bps; standalone or rackmount—$4,175 prch.

CS 96FP DATA MODEM FAST-POLL NETWORK CONTROL SERIES

Point-to-point or multipoint operation over an unconditioned or conditioned 4-wire dedicated Type 3002 voice channel; half- or full-duplex; synchronous at selectable data rates of 4800/7200/9600 bps; standalone or rackmount—$7,475 prch.

SP14.4 DATA MODEM

Point-to-point or multipoint operation over a conditioned 4-wire dedicated Type 3002 voice channel; compatible with Codex Distributed Network Control System; full-duplex; synchronous at selectable data rates of 9600/12K/14.4K bps; standalone or rackmount—$9,950 prch.

LSI 4800 DATA MODEM POINT-TO-POINT SERIES

Point-to-point operation over an unconditioned 4-wire dedicated Type 3002 voice channel; compatible with Codex LSI and C Series modems; compatible with Codex Distributed Network Control System; full-duplex; synchronous at selectable data rates of 2400/4800 bps; standalone or rackmount—$3,500 prch.

LSI 7200 DATA MODEM POINT-TO-POINT SERIES

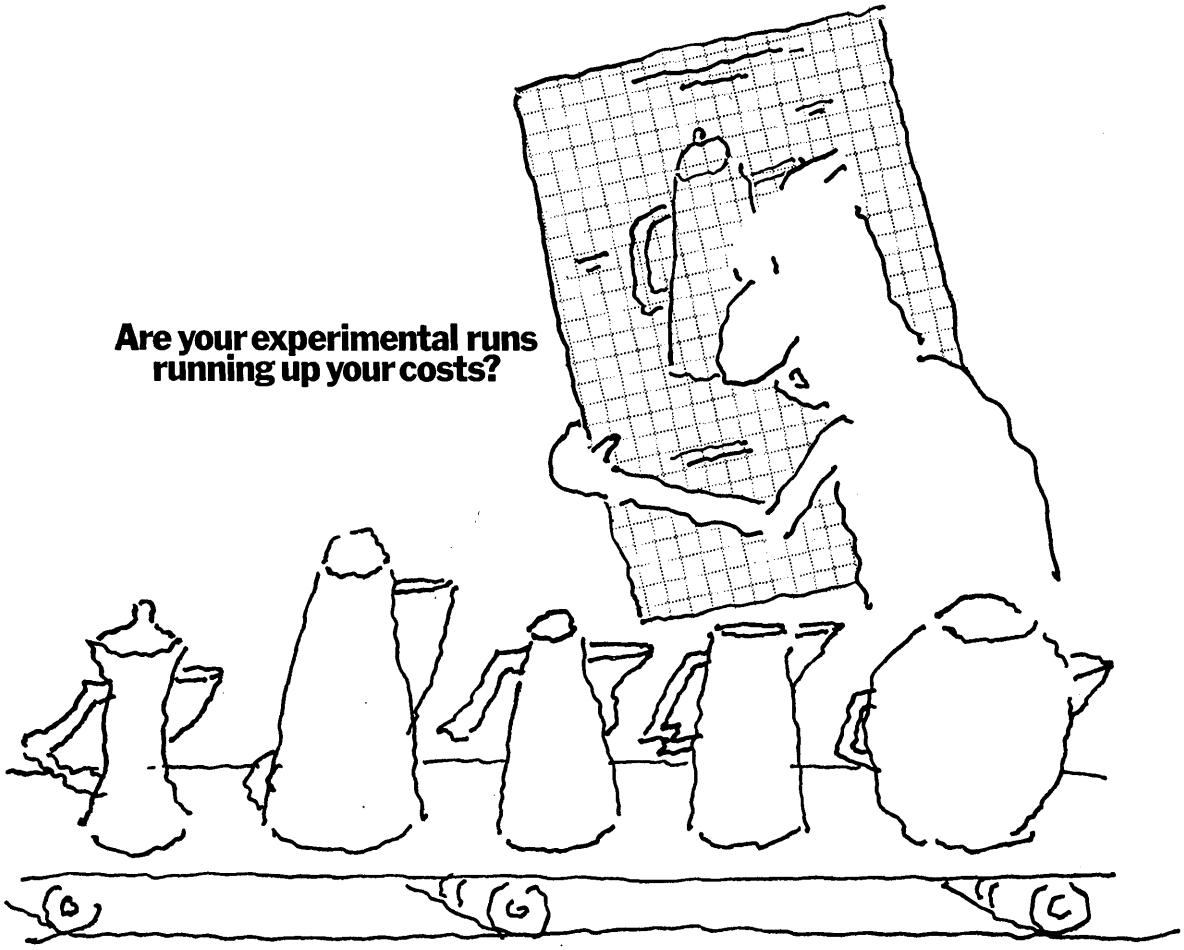
Point-to-point operation over an unconditioned or conditioned 4-wire dedicated Type 3002 voice channel; compatible with Codex LSI and C Series modems; compatible with Codex Distributed Network Control System; full-duplex; synchronous at selectable data rates of 4800/7200 bps; standalone or rackmount—$6,500 prch.

LSI 9600 DATA MODEM POINT-TO-POINT SERIES

Point-to-point operation over an unconditioned or conditioned 4-wire dedicated Type 3002 voice channel; compatible with Codex LSI and C Series Modems; compatible with Codex Distributed Network Control System; full-duplex; synchronous at selectable data rates of 4800/7200/9600 bps; standalone or rackmount—$6,800 prch.

LSI 48FP DATA MODEM MULTIPOINT FAST-POLL SERIES

Are your experimental runs running up your costs?



Optimizing a production line is a trial and error process. Unfortunately, trial and error takes time and costs money.

But now we have found a way to cut down on the number of experimental runs.

It's a new software package—PCAP, the Process Characterization and Analysis Package—developed by Western Electric for its own use.

PCAP has already proved itself in dozens of Western Electric production lines and is written to be portable so that it can be used on various computers.

PCAP does statistical analysis and projections. From either production data or experimental data, PCAP analyzes the variables and indicates how to run a production line. It can help bring production closer to optimization with much less experimentation.

PCAP is available under license from Western Electric. If you can use PCAP "as is," without maintenance or support, just send in the coupon below to find out how to make PCAP work for you.

Or write to Bell System Software, P.O. Box 25000, Greensboro, North Carolina 27420. Or call (919) 697-2942. Telex 5109251176.

To: Bell System Software DM-3
P.O. Box 25000, Greensboro, N.C. 27420

Please send me more information about Bell System software packages.

☐ **PCAP** ☐ **Other Bell System software packages.**

Name_____

Title_____ Company_____

Address_____

City_____ State_____ Zip_____

Telephone_____ Hardware_____

CIRCLE 140 ON READER CARD

Point-to-point or multipoint operation over an unconditioned or conditioned 4-wire dedicated Type 3002 voice channel; compatible with Codex LSI and C Series modems; compatible with Codex DNCS and MNCS network control systems; full-duplex; synchronous at selectable data rates of 2400/4800 bps; standalone or rackmount—$3,500 prch.

LSI 72FP DATA MODEM MULTIPOINT FAST-POLL SERIES

Point-to-point or multipoint operation over an unconditioned or conditioned 4-wire dedicated Type 3002 voice channel; compatible with Codex LSI and C Series modems; compatible with Codex DNCS and MNCS network control systems; full-duplex; synchronous at selectable data rates of 4800/7200 bps; standalone or rackmount—$6,500 prch.

LSI 96FP DATA MODEM MULTIPOINT FAST-POLL SERIES

Point-to-point or multipoint operation over an unconditioned or conditioned 4-wire dedicated Type 3002 voice channel; compatible with Codex LSI and C Series modems; compatible with Codex DNCS and MNCS network control systems; full-duplex; synchronous at selectable data rates of 4800/7200/9600 bps; standalone or rackmount—$6,800 prch.

LSI 481 DATA MODEM

Point-to-point or multipoint operation over an unconditioned 4-wire dedicated Type 3002 voice channel; optional compatible with CCITT V.27 bis; compatible with Codex LSI and C Series modems; full-duplex; synchronous at selectable data rates of 2400/4800 bps; standalone or rackmount—$3,500 prch.

LSI 48/V.27 BIS/TER DATA MODEM

DDD network via direct connection; point-to-point or multipoint operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with CCITT V.27 bis/ter; half- or full-duplex; synchronous at selectable data rates of 2400/4800 bps; standalone or rackmount—$3,500 prch.

LSI 96/V.29 DATA MODEM

Point-to-point or multipoint operation over an unconditioned or conditioned 4-wire dedicated Type 3002 voice channel; compatible with CCITT V.29; compatible with Codex LSI and C Series modems; full-duplex; synchronous at selectable data rates of up to 9600 bps; standalone or rackmount—$6,800 prch.

LSI 24/24 DATA MODEM

DDD network via direct connection; point-to-point operation over an unconditioned 2-wire dedicated Type 3002 voice channel; full-duplex; asynchronous (optional) or synchronous at selectable data rates of up to 3200 bps; standalone or rackmount—$2,650 prch.

MX 2400 DATA MODEM

DDD network via direct connection; point-to-point or multipoint operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with Bell System modems 201 B/C and CCITT V.26/V.26 bis; half- or full-duplex; asynchronous (optional) or synchronous at selectable data rates of 1200/2400 bps; standalone or rackmount—$1,425 to $1,600 prch.

5103 DATA MODEM

DDD network via direct connection or via DAA; point-to-point operation over an unconditioned 2-wire dedicated Type 3002 voice channel; compatible with Bell System modems 103J and 113; full-duplex; asynchronous at data rates up to 300 bps; standalone—$595 prch.

5113 DATA MODEM

DDD network via direct connection or via DAA; point-to-point operation over an unconditioned 2-wire dedicated Type 3002 voice channel; compatible with Bell System modems 103J and 113; full-duplex; asynchronous at data rates up to 300 bps; standalone—$475 prch.

5201 DATA MODEM

DDD network via direct connection; or via DAA; point-to-point or multipoint operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with Bell System modems 201C; compatible with Codex MX 2400 modem; half- or full-duplex; synchronous at 2400 bps; standalone—$1,210 prch.

5202 DATA MODEM

DDD network via direct connection; or via DAA; point-to-point or multipoint operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with Bell System modem 202 series; half- or full-duplex; asynchronous at data rates up to 1200 bps; standalone—$670 prch.

5208R DATA MODEM

DDD network via direct connection; point-to-point or multipoint operation over an unconditioned or conditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with Bell System modems 208A and 208B; half- or full-duplex; synchronous at 4800 bps; standalone—$2,450 prch.

8200 LOCAL DISTRIBUTION SERVICE UNIT

Point-to-point or multipoint operation over a 2- or 4-wire metallic circuit up to 23 miles using AWG; data rates up to 19.2K bps; compatible with AT&T Tech Ref Pub 43401; simplex, half- or full-duplex; synchronous at selectable data rates of up to 19.2K bps; standalone—$995 prch.

8300 GROUP BAND MODEM

Point-to-point operation over a wideband (groupband) channel; compatible with CCITT Recommendation V.35; full-duplex; synchronous at selectable data rates of up to 64K bps; standalone—$6,450 prch.

COHERENT COMMUNICATIONS SYSTEMS CORPORATION

60 Commerce Drive
Hauppauge, NY 11788
(516) 231-1550

MODEM MODEL DAM-4

DDD network via DAA; point-to-point operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; half- or full-duplex; asynchronous at data rates up to 600 or 1200 bps; standalone—$516 to $772 prch.

MODEM MODEL DAM-50

DDD network via DAA; point-to-point operation over an unconditioned or conditioned 4-wire dedicated Type 3002 voice channel; compatible with Bell System modems 103 and 113; simplex, half- or full-duplex; asynchronous at data rates of up to 1800 bps; standalone—$400 to $500 prch.

MODEM MODEL DAM-8

DDD network via DAA; point-to-point operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; half- or full-duplex; asynchronous up to or synchronous at data rates of 600 or 1200 bps; standalone—$1,100 to $1,800 prch.

MODEM MODEL SPMT-9A

Simultaneous voice, message, and data transmission over a point-to-point unconditioned or conditioned 4-wire dedicated Type 3002 voice channel; half- or full-duplex; asynchronous up to 1200 bps; synchronous at selectable data rates of 1200/2400 bps; optional 75 bps asynchronous tty channel; standalone—$6,900 prch.

COMDATA CORPORATION

8115 Monticello
Skokie, IL 60076
(312) 677-3900

MODEL 150A2-12B

DDD network via direct connection; compatible with Bell System modems 103 and 113; half- or full-duplex; asynchronous at data rates up to 300 bps; standalone—$127 prch.

MODEM MODEL 208A/B

DDD network via direct connection; point-to-point or multipoint operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with Bell System modem 208A/B; half- or full-duplex; synchronous at 4800 bps; standalone—$2,950 prch.

MODEM MODEL T212A

DDD network via direct connection; compatible with Bell System modem 103/113; half- or full-duplex; asynchronous up to 300 bps; synchronous at selectable data rates of 1200 bps; standalone—$837 prch.

MODEL 302A2-13

DDD network via acoustic coupling; compatible with Bell System modems 103 and 113; half- or full-duplex; asynchronous at data rates up to 300 bps; standalone—$177 prch.

MODEL 302A-33

DDD network via acoustic coupling; compatible with Bell System modems 103 and 113; half- or full-duplex; asynchronous at data rates up to 300 bps; standalone—$227 prch.

MODEL 302B2-13

DDD network via DAA or acoustic coupling; compatible with Bell System modems 103 and 113; half- or full-duplex; asynchronous at data rates up to 300 bps; standalone—$197 prch.

MODEL 302B2-33

DDD network via DAA or acoustic coupling; half- or full-duplex; asynchronous at data rates up to 300 bps; standalone—$247 prch.

MODEL 330E2-42L

DDD network via direct connection; compatible with Bell System modem 113B; half- or full-duplex; asynchronous at data rates up to 300 bps; standalone—$394 prch.

MODEL 332E2-42L

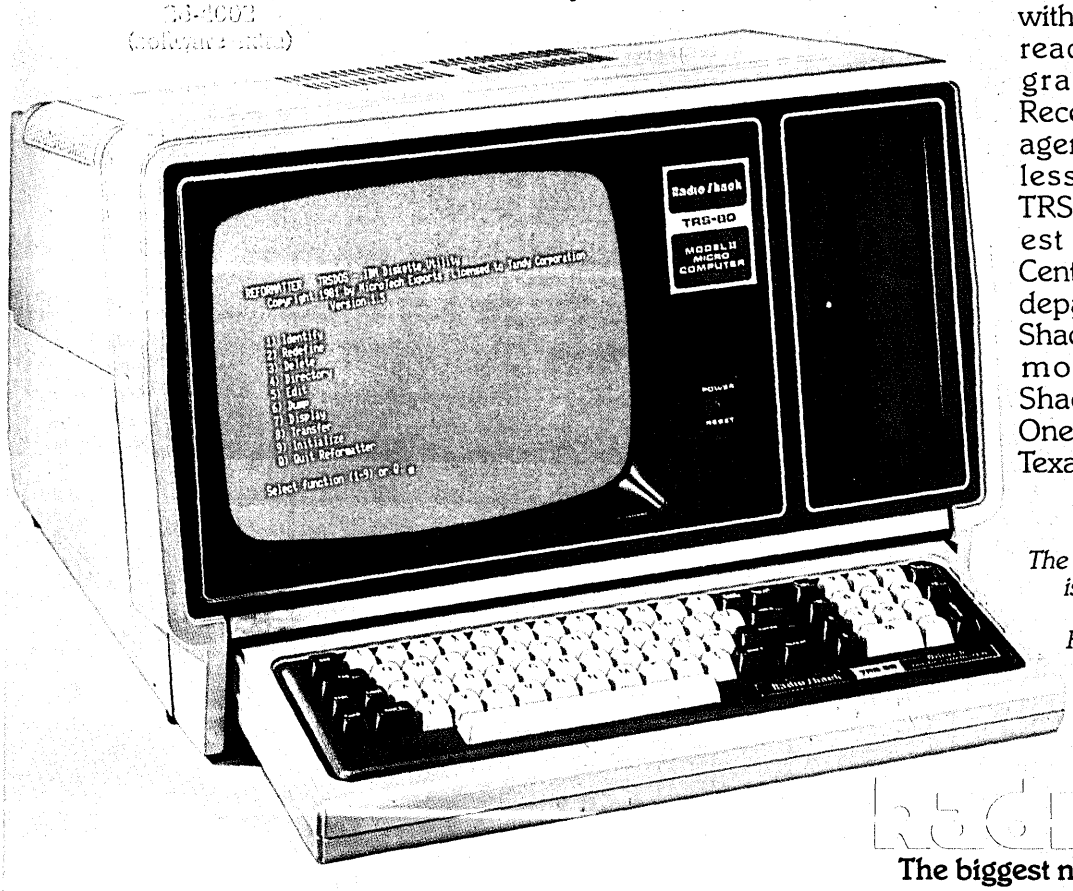
DDD network via direct connection; half- or full-duplex; asynchronous at data rates up to 1200 bps; standalone—$434 prch.

MODEL 332F2-22L

Point-to-point or multipoint operation over a

Now the Radio Shack TRS-80® Model II Microcomputer Can Communicate With IBM® Mainframes. (And our talk is cheaper!)

That's right, a TRS-80 *microcomputer* from Radio Shack. With the software capability to access large mainframes *and* serve as a complete stand-alone system within your department. That's not only practical, it's extremely cost effective! With our ReformaTTer™ program (only $249†) and an additional disk drive, you can transfer files between the Model II's disk operating system and standard IBM diskettes. It organizes data to conform to the 3741 single-density IBM format and performs an EBCDIC/ASCII character conversion — automatically. Our Binary Synchronous Communications 3270 program (only $995†) emulates an IBM 3270/3271/3275/3277 display station, and is fully interactive with IBM remote programs. So your low-cost Model II can communicate with IBM Systems 360/370 and 30 Series central processing units, as well as any BSC-3270 non-IBM device. The TRS-80 Model II can also function as a Remote Job Entry (RJE) terminal — our Binary Synchronous Communications 3780 program ($995†) provides communications with IBM System 360/370, 30-Series, 2780/3780 terminals, DEC® PDP-11, VAX-11 and other BSC-equipped devices. And because Model II is a complete computer system, you can use it for other functions — without tying up your company's mainframe. That means you can use it with our ANSI-74 COBOL Development System. Or with any of our complete line of ready-to-use business programs — from Accounts Receivable to Inventory Management. Why pay more for less functionality? See the TRS-80 Model II at your nearest Radio Shack Computer Center or expanded computer department of selected Radio Shack stores today. Or write for more information: Radio Shack, Dept. 82-A-139, 1300 One Tandy Center, Fort Worth, Texas 76102.



The TRS-80 Model II Microcomputer is complete with 4 MHz CPU, 12" Monitor, 76-Key Keyboard, 8" Floppy Disk Drive, Parallel Printer Port and Two RS-232C Ports

Radio Shack

The biggest name in little computers™

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Retail prices may vary at individual stores and dealers. Special order may be required. †Requires installation at an authorized Radio Shack repair center. *IBM is a trademark of International Business Machines Corporation. *DEC is a trademark of Digital Equipment Corporation. ™Microtech Exports. TRS-80 specifications subject to change without notice.

CIRCLE 138 ON READER CARD

If you were Sherlock Holmes, we'd be your Dr. Watson.

The unfailingly dependable Dr. Watson.

Loyal, trusty, he always managed to be there when Holmes really needed him.

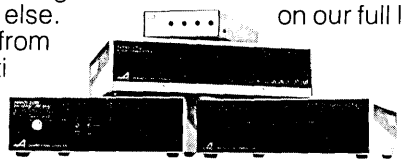
Which, when you think about it, is precisely the kind of reliability you need from the company who sells you your communications equipment.

And so at Avanti, we try to act more like a partner than a supplier. Which means always being there when you need us. Anticipating the kind of products you'll have to have. And delivering the kind of service you can't get anyplace else.

Whether you're transmitting data from desk to desk, or from city to city, Avanti has the equipment to make it work.

Plus the experience to help you choose the most cost-effective solution. From our full line of synchronous and asynchronous medium distance modems, line drivers, interface converters, modem sharing units, modem eliminators and more.

You don't have to be a super sleuth to detect which local data distribution company has the most to offer. It's elementary. Just write to Avanti for the facts on our full line.



Avanti Communications Corp., Aquidneck Industrial Park
Newport, RI 02840, Tel: (401) 849-4660, TWX: (710) 387-6543

CIRCLE 139 ON READER CARD

We're always here when you need us.

2- or 4-wire dedicated Type 3002 voice channel; compatible with Bell System modems 103 and 113; half- or full-duplex; asynchronous at data rates up to 1200 bps; standalone—$359 prch.

350F3-72 LINE DRIVER

Two or 4-wire metallic circuit up to three miles using AWG; full-duplex; asynchronous at data rates up to 19.2K bps; standalone—$137 prch.

MODEL 370E2-12 PHONEM

DDD network via direct connection; via DAA or acoustic coupling; half- or full-duplex; asynchronous at data rates up to 300 bps; standalone—$337 prch.

COMPRE COMM, INC.

51 East Chester Street
Champaign, IL 61820
(217) 352-2477

MODEM ELIMINATOR ME-2

Point-to-point operation over a cable between business machines located up to 100 feet apart; full-duplex; asynchronous or synchronous at selectable data rates of up to 19.2K bps; standalone—$400 prch.

COMPUTROL

15 Ethan Allen Highway
Ridgefield, CT 06877
(203) 544-9371

MODEM MODEL 30-0078

Point-to-point or multipoint operation over a coaxial cable up to 50,000 feet; half- or full-duplex; asynchronous at data rates up to 2M bps; standalone—$235 prch.

MODEM MODEL 30-0080

Point-to-point or multipoint operation over a coaxial cable up to 27,000 feet; half- or full-duplex; asynchronous at data rates up to 3.0M bps; or synchronous at data rates up to 1.544M bps; standalone—$360 prch.

CONCORD DATA SYSTEMS, INC.

430 Marrett Road
Lexington, MA 02173
(617) 863-1472

V.21 SERIES

DDD network via DAA; full-duplex; asynchronous at data rates up to 300 bps; standalone—$250 prch.

V.22 SERIES

DDD network via DAA; point-to-point operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; full-duplex; asynchronous or synchronous at data rates up to 600/1200 bps; auto answer; standalone—$965 prch.

V.23 SERIES

DDD network via DAA; point-to-point operation over a 2-wire dedicated Type 3002 voice channel; asynchronous at data rates up to 1200 bps; standalone—$290 prch.

DATA ACCESS SYSTEMS, INC.

100 Route 46
Mountain Lakes, NJ 07046
(201) 335-3322

DASI 68-01

DDD network via direct connection; point-to-point operation over an unconditioned 2-wire dedicated Type 3002 voice channel; half- or full-duplex; asynchronous at selectable data rates of 300/600 bps; standalone—$300 prch.

DATA-CONTROL SYSTEMS

P.O. Box 860, Commerce Drive
Danbury, CT 06810
(203) 743-9241

MODEL RAM-11 WIRELESS MODEM

Multipoint in-house data distribution via an AC power line; full-duplex; asynchronous at data rates up to 9600 bps; standalone—$795.

MODEL RAM-22 WIRELESS MODEM

Multipoint in-house data distribution via an AC power line; full-duplex; synchronous at selectable data rates of up to 9600 bps; standalone—$895 prch.

MODEL CCM 100 COAXIAL CABLE MODEM

Multipoint operation over a coaxial cable up to five miles; data rates up to 9600 bps; full-duplex; asynchronous at data rates up to 9600 bps; standalone—$695 prch.

MODEL CCM 200 COAXIAL CABLE MODEM

Multipoint operation over a coaxial cable up to five miles; data rates up to 9600 bps; full-duplex; synchronous at selectable data rates of up to 9600 bps; standalone—$795 prch.

MODEL SR 102 ASYNCHRONOUS LIMITED DISTANCE MODEM

Point-to-point or multipoint operation over a 2- or 4-wire dedicated Type 3002 voice channel or metallic circuit up to 16 miles using AWG; compatible with AT&T Tech Ref Pub 43401; simplex, half- or full-duplex; asynchronous at data rates of up to 1.0M bps; standalone—$260 per 1 to 3 units prch.

MODEL LM 192A LIMITED DISTANCE MODEM

Point-to-point operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel or metallic circuit up to 20 miles using AWG; compatible with AT&T Tech Ref Pub 43401; half- or full-duplex; asynchronous or synchronous at selectable data rates of up to 19.2K bps; standalone—$795 prch.

MODEL SR 202 SYNCHRONOUS LIMITED DISTANCE MODEM

Point-to-point or multipoint operation over a 2- or 4-wire metallic circuit up to 16 miles using AWG; compatible with AT&T Tech Ref Pub 43401; simplex, half- or full-duplex; synchronous at selectable data rates of up to 19.2K bps; standalone—$360 prch.

MODEL 1A-250 MODEM ELIMINATOR

Point-to-point operation over a cable between business machines located up to 100 feet apart; full-duplex; asynchronous and synchronous up to 19.2K; standalone—$350.

MODEL 1A-252 MODEM ELIMINATOR

Point-to-point operation over a cable between business machines located up to 100 feet apart; full-duplex; asynchronous and synchronous up to 19.2K; standalone—$395.

DATACOM MANAGEMENT SCIENCES, INC.

181 Main Street
Norwalk, CT 06851
(203) 838-7183

MODEM ELIMINATOR MODEL ME-31

Point-to-point operation over a cable between business machines located up to 100 feet apart; full-duplex; synchronous at selectable data rates of up to 19.2K bps; standalone—$315 prch.

MODEM ELIMINATOR MODEL ME-31A/B

Point-to-point operation over a cable between business machines located up to 100 feet apart; full-duplex; synchronous at selectable data rates of up to 19.2K; standalone—$750.

UNIVERSAL MODEM UM-EIA FOR DATAPAK SYSTEM

Point-to-point operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel or telegraph loop; compatible with Bell System modems 103F and 202B; half- or full-duplex; asynchronous at data rates up to 1200 bps; synchronous option at rates up to 1200 bps; standalone—$640 prch.

DATAPOINT CORPORATION

9725 Datapoint Drive
San Antonio, TX 78284
(512) 699-7000

MODEL 9478 MODEM

DDD network via direct connection; point-to-point operation over a 2-wire dedicated Type 3002 voice channel; full-duplex; asynchronous at data rates up to 150 bps (receive), 1200 bps (transmit); standalone—$995 prch.

MODEL 9479 MODEM

DDD network via direct connection; point-to-point operation over an unconditioned 2-wire dedicated Type 3002 voice channel; full-duplex; asynchronous at data rates up to 150 bps (transmit), 1200 bps (receive); standalone—$995 prch.

DATATEL, INC.

2005 Greentree Road
Cherry Hill, NJ 08003
(609) 424-4451

MODEM ELIMINATOR DCP 2000

Point-to-point operation over a cable between business machines located up to 100 feet apart; half- or full-duplex; asynchronous or synchronous at selectable data rates of up to 19.2K bps; standalone—$300 to $400 prch.

LIMITED DISTANCE MODEM MODEL DCP 3000

DDD network via DAA; point-to-point operation over a 2- or 4-wire dedicated Type 3002 voice channel or metallic circuit up to 30 miles using AWG; compatible with AT&T Tech Ref Pub 43401; half- or full-duplex; asynchronous at data rates up to 19.2K bps; standalone—$190 to $250 prch.

LIMITED DISTANCE MODEM MODEL DCP 3020

DDD network; point-to-point or multipoint operation over a 2- or 4-wire dedicated Type 3002 voice channel metallic circuit up to 30 miles using AWG; compatible with AT&T Tech Ref Pub 43401; half- or full-duplex; asynchronous at data rates up to 19.2K bps; standalone—$190 to $250 prch.

DATEC INC.

300 East Main Street
Carrboro, NC 27510
(919) 929-2135

30 ACOUSTIC COUPLER MODEM
DDD network via acoustic coupling; compatible with Bell System modems 103 and 113; half- or full-duplex; asynchronous at data rates up to 300 bps; standalone—$225 prch.

32 ACOUSTIC COUPLER MODEM
DDD network via acoustic coupling; compatible with Bell System modems 103 and 113; half- or full-duplex; asynchronous at data rates up to 300 bps; standalone—$250 prch.

MODEL 33 MODEM
DDD network via DAA point-to-point operation over an unconditioned 2-wire dedicated Type 3002 voice channel; compatible with Bell System modems 103 and 113; half- or full-duplex; asynchronous at data rates up to 300 bps—prices available on request.

MODEL 212 MODEM
DDD network via direct connection; point-to-point operation over an unconditioned 2-wire dedicated Type 3002 voice channel; compatible with Bell System modems 103,113, and 212A; half- or full-duplex; asynchronous at data rates up to 300 bps; synchronous at 1200 bps; standalone—$795 prch.

DEI-TELEPRODUCTS
2128 Vineyard Avenue
Escondido, CA 92025
(714) 743-8344

MODEL ADT-2 ASYNCHRONOUS DATA TRANSCEIVER LINE DRIVER
Point-to-point or multipoint operation over a 4-wire metallic circuit up to 20 miles using AWG; compatible with AT&T Tech Ref Pub 43401; compatible with DEI SDT-2 modem; half- or full-duplex; asynchronous at data rates up to 9600 bps; standalone—$225 prch.

MODEL SDT-2 SYNCHRONOUS DATA TRANSCEIVER LINE DRIVER
Point-to-point or multipoint operation over a 4-wire metallic circuit up to 17 miles using AWG; compatible with AT&T Tech Ref Pub 43401; compatible with DEI modem ADT-2; half- or full-duplex; synchronous at selectable data rates of up to 19.2K bps; standalone—$445 prch.

MODEL LDP-1 MODEM ELIMINATOR
Point-to-point operation over a cable between business machines located up to 350 feet apart; half- or full-duplex; synchronous at data rates of 2400 to 1.0M bps; standalone—$450 prch.

MODEL LDD-II MODEM ELIMINATOR
Point-to-point operation over a cable between business machines located up to 350 feet apart; half- or full-duplex; synchronous at selectable data rates of up to 19.2K bps; standalone—$350 prch.

DEVELCON ELECTRONICS INC.
423 North Main Street
Doylestown, PA 18901
(215) 348-1900

DS 202D ASYNCHRONOUS MODEM
DDD network via DAA; point-to-point operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; half- or full-duplex; asynchronous at data rates of up to 1200 bps on DDD and 1800 on dedicated line; standalone—$545 prch.

MODEL DS 512 LIMITED DISTANCE MODEM
Point-to-point operation over a 2- or 4-wire metallic circuit up to 50 miles using AWG; compatible with AT&T Tech Ref Pub 43401; simplex, half- or full-duplex; asynchronous at data rates of up to 9600 bps; standalone—$295 prch.

MODEL DS 513 LIMITED DISTANCE MODEM
Point-to-point or multipoint operation over a 2- or 4-wire metallic circuit up to 50 miles using AWG; simplex, half- or full-duplex; asynchronous at data rates of up to 19.2K bps; standalone—$330 prch.

MODEL DS 541 MODEM ELIMINATOR
Point-to-point operation over a cable between business machines located up to 100 feet apart; half- or full-duplex; synchronous at selectable data rates of up to 19.2K bps; standalone—$445 prch.

DS 548 LIMITED DISTANCE MODEM
Point-to-point operation over a 2- or 4-wire metallic circuit up to 60.5 miles using AWG; compatible with AT&T Tech Ref Pub 43401; half- or full-duplex; synchronous at selectable data rates of up to 19.2K bps; standalone—$770 prch.

MODEL DS 558 HIGH-SPEED LIMITED DISTANCE MODEM
Point-to-point operation over a metallic circuit up to 2.5 miles using AWG; full-duplex; synchronous at selectable data rates of 19.2K to 100K bps; 56K bps standard; standalone—$770 prch (with RS-232C interface); $1,100 prch (with WE 303 interface); $895 prch (with V-35 interface).

DIGICOM: See BACKUS DATA SYSTEMS.

DIGITAL EQUIPMENT CORPORATION
129 Parker Street
Maynard, MA 01754
(617) 897-5111

MODEL DF02 MODEM
DDD network via direct connection; point-to-point operation over an unconditioned 2-wire dedicated Type 3002 voice channel; compatible with Bell System modem 103J; full-duplex; asynchronous at data rates of up to 300 bps; standalone—$450 prch.

MODEL DF03 MODEM
DDD network via direct connection; compatible with Bell System modems 103J and 212A; full-duplex; asynchronous at data rates of up to 300 bps; synchronous at 1200 bps; standalone—$950 prch.

ERICSSON TELECOMMUNICATIONS, INC.
100 Crossways Park West
Woodbury, NY 11797
(516) 361-1111

ZAT 12/96 BASEBAND MODEM
Point-to-point operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; half- or full-duplex; synchronous at selectable data rates of up to 9600 bps; standalone—$200 prch.

ZAT 300 MODEM
DDD network via DAA; point-to-point operation over an unconditioned 2-wire dedicated Type 3002 voice channel; compatible with Bell System modems 103 and 202; compatible with CCITT V.21; half- or full-duplex; asynchronous at data rates of up to 300 bps; standalone—$300 prch.

ZAT 1200-5 LSI MODEM
DDD network via direct connection; point-to-point operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with CCITT V.23; half- or full-duplex; asynchronous at data rates of up to 1200 bps; synchronous at selectable data rates of 600/1200 bps; standalone—$500 prch.

ZAT 2400-5 LSI MODEM
DDD network via direct connection; point-to-point operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with CCITT V.26/V.26 bis modems; half- or full-duplex; synchronous at selectable data rates of 1200/2400 bps; standalone—$750 prch.

ZAT 4800-5 MICROPROCESSOR MODEM
DDD network via direct connection; point-to-point operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with CCITT V.27 bis/V.27 ter; half- or full-duplex; synchronous at selectable data rates of 2400/4800 bps; standalone—$950 prch.

ZAT 9600 LSI/MICROPROCESSOR MODEM
Point-to-point or multipoint operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with CCITT V.29; half- or full-duplex; synchronous at 9600 bps; standalone—$1,000 prch.

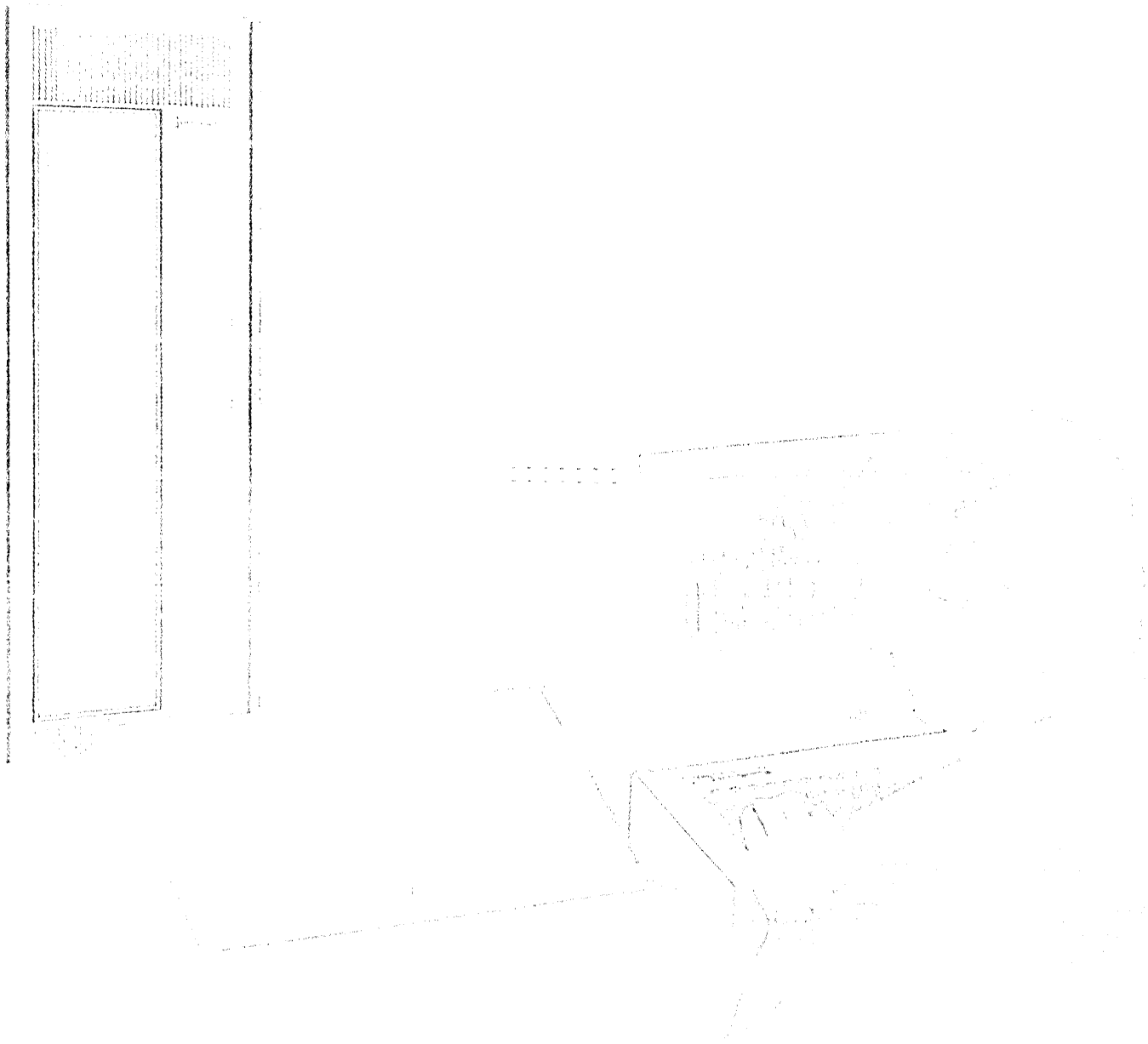
ESE LIMITED
1780 Albion Road
Rexdale, Ontario
Canada M9V 1C1
(416) 749-2271

MODEL 96SP-V.29
DDD network via direct connection; point-to-point operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with CCITT V.29; half- or full-duplex; synchronous at selectable data rates of up to 9600 bps—prices available on request.

MODEL 96SP-209A
DDD network via direct connection; point-to-point operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with Bell System modem 209A; half- or full-duplex; synchronous at selectable data rates of 2400 bps (ESE DDD mode) or 9600 bps (209A mode)—prices on request.

MODEL 96SP-V.29/209A
DDD network via direct connection; point-to-point operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with Bell System modem 209A; compatible with CCITT V.29 modem; half- or full-duplex; synchronous at selectable data rates of up to 9600 bps—prices on request.

EXPANDOR INC.
International Sales/Leasing Company
400 Sainte Claire Plaza
Pittsburgh, PA 15241
(412) 746-2910



Attention, Multibus™ users...

Only the CD100M now supports CP/M and CP/M86 in the perfect desktop package.

Hear this, LSI-11 users...

Only the CD100L emulates a VT103, an RL02 and an RX02 in a single desktop package.

And both now include a 10 megabyte Winchester!

CD100M — THE TOTAL OEM SOLUTION

To give your Multibus microcomputer system increased file storage, the Callan™ CD100M Integrated Work Station now includes a high performance 10 Mbyte 5¼-inch micro Winchester disk drive complete with full DMA and fully automatic and transparent burst error correction. A one Mbyte unformatted floppy provides file entry and back-up. With its integral 6 slot Multibus compatible card cage, intelligent video terminal, and Winchester/Floppy disk system, the CD100M is the *only* single desktop package available to OEM and volume end-users who wish to configure a modular microcomputer system using any Multibus compatible card set. It's the perfect solution, significantly reducing product costs and development time.

CP/M AND CP/M86 CONFIGURATIONS

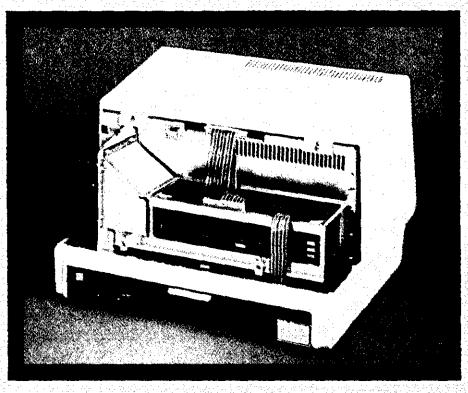
If you prefer the popular CP/M operating system, Callan can provide the CD100M with either 8-bit or 16-bit micros. A Z80 with 64K RAM and CP/M, or an 8086 with 128K RAM with error correction and CP/M86 are both available as the complete solution for CP/M compatible software. And both systems include 10 Mbyte Winchester performance.

If you're using Multibus cards in your system you must see the Callan™ CD100M Integrated Work Station.

CP/M and CP/M86 are trademarks of Digital Research. Multibus and 8086 are trademarks of Intel Corp. Z80 is trademark of Zilog.

CD100L — COMPLETE DEC COMPATIBILITY

For the OEM or end-user configuring an LSI-11 system, only the Callan™ CD100L Integrated Work Station can emulate a 10 Mbyte RL02 Winchester disk, a 0.5 Mbyte RX02 floppy, and a VT103 Terminal in a *single* desktop unit. Software presently running on RT-11, RSX-11 or other LSI-11 operating systems can now run on the CD100L, reducing hardware costs by as much as 30%. For users who prefer a more complete solution, the CD100L can also be ordered complete with LSI-11/2 or LSI-11/23 and RT-11.



Built-in card cage holds 6 Multibus or 7 quad/14 dual height LSI-11 cards.

MORE FOR LESS

No other solution compares for performance, features and price. The VT100/VT52 compatible terminal offers 6 video attributes, true split screen with separate scrolling regions standard. The LSI-11 Q-bus compatible card cage provides 7 quad or 14 dual height slots to house even the largest configurations. A Winchester controller is available to directly emulate the 10 Mbyte RL02. RX02 emulation is available either in a 1 Mbyte dual floppy configuration or as 0.5 Mbyte back-up for the Winchester.

If you're tired of multiple package or multiple vendor solutions, you must see the CD100L.

DEC, LSI-11, VT103, RL02, RX02, RT-11, RSX-11, VT100/VT52, LSI-11/2, LSI-11/23 are trademarks of Digital Equipment Corp.

Callan is trademark of Callan Data Systems.

Callan™

DATA SYSTEMS

2637 Townsgate Road
Westlake Village, CA 91361
Telephone: (805) 497-6837

CIRCLE 137 ON READER CARD

- 1024 x 1024 MEMORY DOT RESOLUTION
- 1024 x 768 VIEWABLE DOT RESOLUTION
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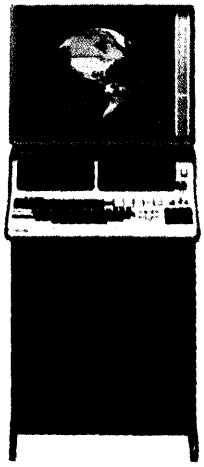
- TWO SERIAL INPUT-OUTPUT PORTS
- MC 68000 16 BIT PROCESSOR
- 128 K BYTES DYNAMIC RAM
- HIGH RESOLUTION BIT MAP
- 151-KEY KEYBOARD
- 24 FUNCTION KEYS
- 32 K BYTES EPROM
- 8 BEZEL KEYS
- 19" CRT

$14,995.00



THE MOST SIGNIFICANT PRICE/ PERFORMANCE BREAKTHROUGH IN COLOR GRAPHICS HISTORY

Chromatics proudly announces the availability of its revolutionary MC68000 driven CGC7900-1 color graphics computer with 1024 x 768 viewable resolution at the unprecedented price of $14,995.

The CGC7900 is the equivalent of a full-blown minicomputer with the latest in color graphics capability. A 10 megabyte hard disk and dual double-density 512K byte flexible disk drive can also be added to create large local data bases or to load programs. The CGC7900 is assembled as an integrated system and utilizes DOS or the IDRIS general purpose operating system designed especially for the MC68000 CPU. PASCAL and C Compilers are supported.

At last, price is no longer an issue when choosing between medium and high resolution graphics. Now Chromatics offers you much more resolution, power, speed and versatility with the CGC7900-1 for only $14,995.

Chromatics

Chromatics, Inc./2558 Mountain Industrial Boulevard/Tucker, GA 30084
Telephone: 404/493-7000/TWX: 810/766-8099. For additional product information call toll free 1-800-241-9467.

CIRCLE 141 ON READER CARD

BREAKTHROUGH

BLACK BOX MODEL SME-1 MODEM ELIMINATOR
Point-to-point operation over a cable between business machines located up to 100 feet apart; full-duplex; synchronous at selectable data rates of up to 19.2K bps; standalone—$295 prch.

BLACK BOX MODEL SME-3 MODEM ELIMINATOR
Point-to-point operation over a cable between business machines located up to 100 feet apart; full-duplex; synchronous at selectable data rates of up to 19.2K bps; standalone—$335 prch.

BLACK BOX MODEL SHM HUB ASYNCHRONOUS SHORT HAUL MODEM
Multipoint operation over a 2- or 4-wire metallic circuit up to 10 miles; simplex or full-duplex; asynchronous at data rates of up to 9600 bps; standalone—$495 prch.

BLACK BOX MODEL SHM ASYNCHRONOUS SHORT HAUL MODEM
Point-to-point operation over a 2- or 4-wire metallic circuit up to 10 miles; simplex or full-duplex; asynchronous at data rates of up to 9600 bps; standalone—$165 prch.

GANDALF DATA INC.

1019 South Noel Avenue
Wheeling, IL 60090
(312) 541-6060

SM9600 SUPER MODEM
Point-to-point operation over an unconditioned or conditioned 4-wire dedicated Type 3002 voice channel; compatible with AT&T Tech Ref Pub 41004; full-duplex; synchronous at 9600 bps; standalone—$3,400 prch.

LDS 100C AND LDS 100BR
Point-to-point or multipoint operation over a 4-wire metallic circuit up to 10 miles using AWG; half- or full-duplex asynchronous at data rates up to 19.2K bps; standalone—LDS 100C, $225 prch; LDS 100BR, $260 prch.

LDS 120 AND LDS 120BR (STANDALONE) AND RM 3120 (RACKMOUNT)
Point-to-point or multipoint operation over a 2- or 4-wire metallic circuit up to 5.5 miles using AWG; compatible with AT&T Tech Ref Pub 43401; compatible with Gandalf modems RM 3120 and LDS 121; half- or full-duplex; asynchronous at data rates up to 9600 bps; standalone—LDS 120, $300 prch; LDS 102BR, $350 prch.

LDS 121
Point-to-point or multipoint operation over a 2- or 4-wire metallic circuit up to 5.5 miles using AWG; compatible with AT&T Tech Ref Pub 43401; compatible with Gandalf modem LDS 120; half- or full-duplex; asynchronous at data rates up to 9600 bps; rackmount—$440 prch.

LDS 140 (STANDALONE) AND RM 3140 (RACKMOUNT)
Point-to-point operation over a 2- or 4-wire metallic circuit up to 25 miles using AWG; compatible with AT&T Tech Ref Pub 43401 and 41004; simplex; half- or full-duplex; asynchronous at data rates up to 9600 bps; standalone—$440 prch.

LDS 250/3-CI, LDS 250/3-V.35, AND LDS 250/3-RS
Point-to-point or multipoint operation over a 4-wire metallic circuit up six miles using AWG; half- or full-duplex; synchronous at selectable data rates up to 50K bps; standalone—LDS 250/3-CI, $886 prch; LDS 250/3-V.35 and LDS 250/3-RS, $786 prch.

LDS 309/H (STANDALONE) AND RM 3309/H (RACKMOUNT)
Point-to-point or multipoint operation over a 4-wire metallic circuit up to 17 miles using AWG; compatible with AT&T Tech Ref Pub 43401; half- or full-duplex; synchronous at selectable data rates up to 19.2K bps; standalone—$685 prch.

LDS 309/L (STANDALONE) AND RM 3309/L (RACKMOUNT)
Point-to-point or multipoint operation over a 4-wire metallic circuit up to 17 miles using AWG; compatible with AT&T Tech Ref Pub 43401; half- or full-duplex; synchronous at selectable data rates up to 9600 bps; standalone—$635 prch.

LDS 319/H (STANDALONE) AND RM 3319/H (RACKMOUNT)
Point-to-point or multipoint operation over a 4-wire metallic circuit up to 17 miles using AWG; compatible with AT&T Tech Ref Pub 43401; half- or full-duplex; asynchronous or synchronous at selectable data rates up to 19.2K bps; standalone—$785 prch.

LDS 329 (STANDALONE) AND RM 3329 (RACKMOUNT)
Point-to-point operation over a 4-wire metallic circuit up to eight miles using AWG; compatible with AT&T Tech Ref Pub 43401; compatible with Gandalf modems LDS 309 and RM 3309; half- or full-duplex; synchronous at selectable data rates of 2400/4800/9600 bps; standalone—$450 prch.

LDM 404B AND LDM 404B/SC (STANDALONE) AND RM 3404B (RACKMOUNT)
Point-to-point operation over an unconditioned or conditioned 4-wire dedicated Type 3002 voice channel; compatible with AT&T Tech Ref Pub 41004; full-duplex; synchronous at data rates up to 4800 bps; standalone—LDM 404B, $1,200 prch; LDM 404B/SC, $1,300 prch.

LDM 414 (STANDALONE) AND RM 3414 (RACKMOUNT)
Point-to-point operation over an unconditioned or conditioned 4-wire dedicated Type 3002 voice channel; compatible with AT&T Tech Ref Pub 41004; full-duplex; asynchronous at data rates up to 4800 bps; standalone—LDM 414, $1,300 prch; LDM 414/SC, $1,500 prch.

GENERAL DATACOMM INDUSTRIES, INC.

One Kennedy Avenue
Danbury, CT 06810
(203) 797-0711

MODEL 103A3 MODEM
DDD network via direct connection; compatible with Bell System modems 103 A/E/E/H/J and 113A/B/C/D; full-duplex; asynchronous at data rates up to 300 bps; standalone—$395 prch.

MODEL 103J MODEM
DDD network via direct connection; compatible with Bell System modems 103 and 113; full-duplex; asynchronous at data rates up to 300 bps; standalone—pricing available on request.

MODEL GDC 103J-L MODEM
DDD network via direct connection; compatible with Bell System modems 103, 113, and 212A; full-duplex; asynchronous at data rates up to 300 bps; standalone—$199 prch.

MODEL 108-3 MODEM
Point-to-point operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with Bell System modems 103F and 108; half- or full-duplex; asynchronous at data rates up to 300 bps; standalone—$315 prch.

MODEL 113BR2 MODEM
DDD network via direct connection; compatible with Bell System modems 113A/B/C/D; full-duplex; asynchronous at data rates up to 300 bps; standalone—$265 prch.

MODEL 113C MODEM
DDD network via direct connection; compatible with Bell System modems 103 and 113; full-duplex; asynchronous at data rates up to 300 bps; standalone—pricing available on request.

MODEL 113D MODEM
Point-to-point operation over an unconditioned 2-wire dedicated Type 3002 voice channel; compatible with Bell System modem 113; full-duplex; asynchronous at data rates up to 300 bps; standalone—pricing available on request.

MODEL 201C MODEM
DDD network via direct connection; compatible with Bell System modems 201A/B/C; compatible with General DataComm modem 201C-M; half-duplex; synchronous at selectable data rates of up to 2400 bps; standalone—$1,345 prch.

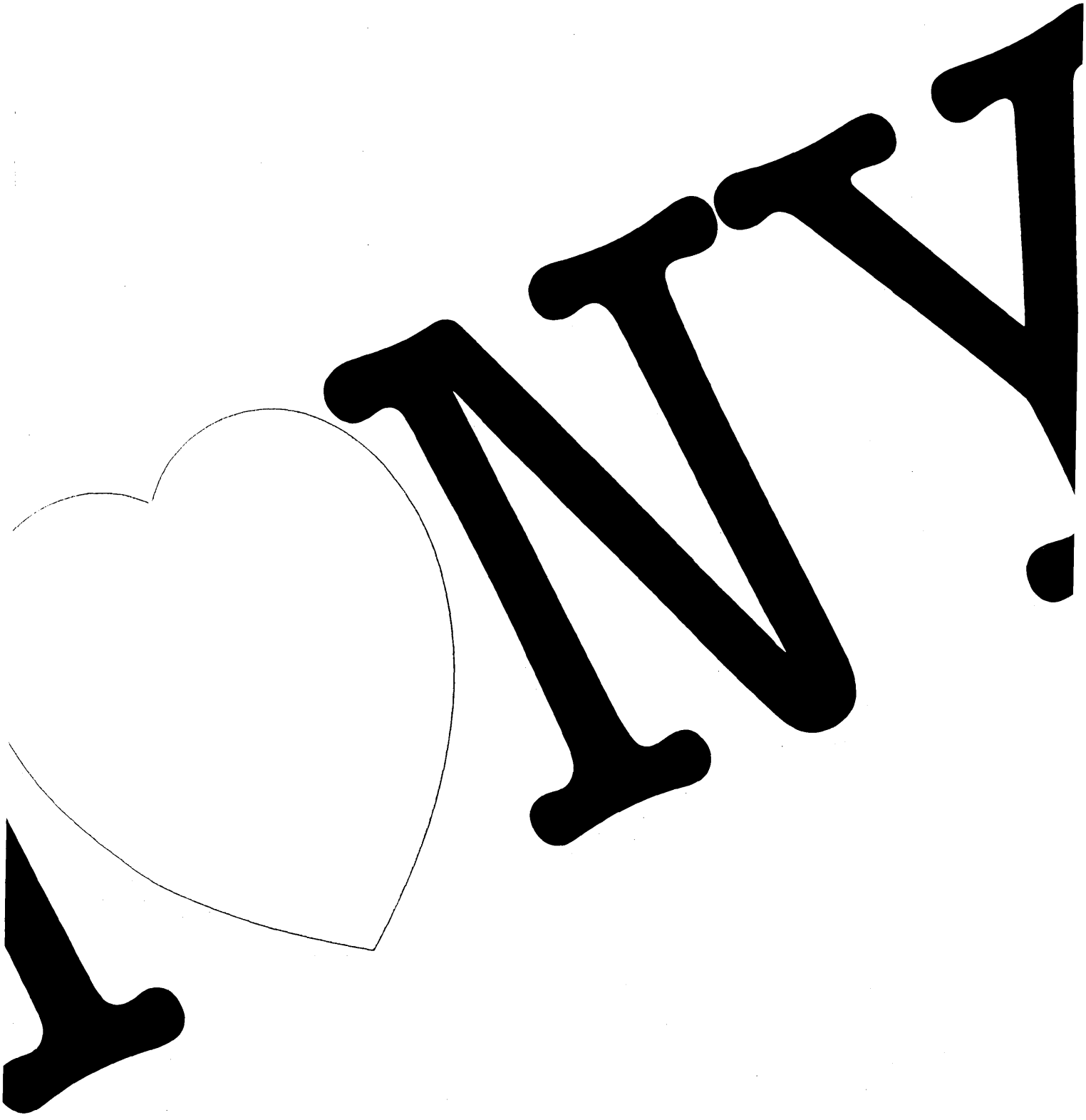
MODEL 201C-M MODEM
DDD network via direct connection; point-to-point operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with Bell System modem 201B/C; half- or full-duplex; synchronous at 2400 bps; standalone—$825 prch.

MODEL 201-7 (R) MODEM
Point-to-point operation over an unconditioned 4-wire dedicated Type 3002 voice channel; compatible with Bell System modem 201B/C; half- or full-duplex; synchronous at 2400 bps; standalone—$695 prch.

MODEL 202S TYPE 21 MODEM
DDD network via direct connection; compatible with Bell System modems 202S/C/E; simplex or half-duplex; asynchronous at data rates up to 1200 bps; standalone—pricing available on request.

MODEL 202S/T MODEM
DDD network via direct connection; point-to-point operation over an unconditioned or conditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with Bell System modem 202S/T; half- or full-duplex; asynchronous at data rates up to 1200 bps (DDD) or 1800 bps (dedicated); standalone—$615 prch.

MODEL 202T MODEM
Point-to-point operation over an uncondi-



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Computrend, Inc.,22 A Street, Burlington, MA 01803. Nationwide call 800-225-5378 for the Computrend sales representative nearest you. In Massachusetts, call 617-272-8372.

CIRCLE 142 ON READER CARD

tioned or conditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with Bell System modem 202T; half- or full-duplex; asynchronous at data rates up to 1200/1800 bps; standalone—$541 prch.

MODEL 202-9D/-9DR MODEM

DDD network via DAA; point-to-point operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with Bell System modem 202C/D; half- or full-duplex; asynchronous at data rates up to 1200 bps (DDD) or 1800 bps (dedicated line); standalone—$395 prch.

MODEL 212A MODEM

DDD network via direct connection; point-to-point operation over an unconditioned 2-wire dedicated Type 3002 voice channel; compatible with Bell System modem 212A; full-duplex; asynchronous or synchronous at data rates up to 300 or 1200 bps; standalone—$810 prch.

MODEL 2400 ASM MODEM

Point-to-point or multipoint operation over an unconditioned 4-wire dedicated Type 3002 voice channel; compatible with Bell System modems 201B/C and CCITT V.26 (Type B); full-duplex; asynchronous at data rates up to 300/600/1200/1800/2400 bps; synchronous at 2400 bps; standalone—$795 prch.

MODEL 9600 MODEM

Point-to-point operation over an unconditioned or conditioned 4-wire dedicated Type 3002 voice channel; full-duplex; synchronous at selectable data rates of 4800/7200/9600 bps; standalone—$3,570 prch.

MODEL 4802E (D) MODEM

DDD network; point-to-point or multipoint operation over a 2- or 4-wire dedicated Type 3002 voice channel; compatible with CCITT V.27 bis/ter; half- or full-duplex; synchronous at selectable data rates of 2400/4800 bps; standalone—$3,250 prch.

MP208B/A FAST POLL MODEM

DDD network via direct connection; point-to-point operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with Bell System modem 208A/B; half- or full-duplex; synchronous at 4800 bps; standalone—$2,400 prch.

MP208-9A FAST POLL MODEM

Point-to-point or multipoint operation over an unconditioned 4-wire dedicated Type 3002 voice channel; compatible with Bell System modem 208A; full-duplex; synchronous at 4800 bps; standalone—$2,795 prch.

MODEL LDM-1 LIMITED DISTANCE MODEM

Point-to-point 2- or 4-wire metallic circuit up to 15 miles using AWG; half- or full-duplex; synchronous at selectable data rates up to 19.2K bps; standalone—$830 prch.

GSU-1 SYNCHRONOUS LOCAL DATA DISTRIBUTION MODEM

Point-to-point 4-wire metallic circuit up to 15 miles using AWG; full-duplex; synchronous at selectable data rates of 2400/4800/9600 bps; standalone—$695 prch.

GTE LENKURT INC.

1105 County Road
San Carlos, CA 94070
(415) 595-3000

263A WIRE LINE MODEM

Point-to-point operation over a 2- or 4-wire metallic circuit up to 24 miles; compatible with AT&T Tech Ref Pub 43401; simplex, half- or full-duplex; synchronous at selectable data rates up to 56K bps; standalone—$3,711.

HAYES MICROCOMPUTER PRODUCTS, INC.

5825 Peachtree Corners East
Norcross, GA 30092
(404) 449-8791

SMARTMODEM

DDD network via direct connection; or via acoustic coupling; compatible with Bell System modem 103; half- or full-duplex; asynchronous at data rates up to 300 bps; standalone—$279 prch.

MICROMODEM II

DDD network via direct connection; compatible with Bell System modem 103; half- or full-duplex; asynchronous at selectable data rates of 110/300 bps; standalone—$379 prch.

MICROMODEM 100

DDD network via direct connection; compatible with Bell System modem 103; half- or full-duplex; asynchronous at selectable data rates of 110/300 bps; standalone—$339 prch.

HEWLETT-PACKARD COMPANY

1501 Page Mill Road
Palo Alto, CA 94305
(415) 856-1501

MODEL 37210T 4800 BPS MODEM

DDD network via optional DAA; point-to-point or multipoint operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with CCITT V.27 bis; half- or full-duplex; synchronous at selectable data rates of 2400/4800 bps; standalone—$4,350 prch.

MODEL 37220T 9600 BPS MODEM

Point-to-point operation over a 4-wire dedicated Type 3002 voice channel; full-duplex; synchronous at selectable data rates of 4800/9600 bps; standalone—$6,150 prch.

IBM/DATA PROCESSING DIVISION

1133 Westchester Avenue
White Plains, NY 10604
(914) 696-1900

3863 MODEL 1

Point-to-point or multipoint operation over an unconditioned 4-wire dedicated Type 3002 voice channel; full-duplex; synchronous at 1200/2400 bps; standalone—$2,465 prch.

3863 MODEL 2

DDD network via direct connection; half-duplex; synchronous at 1200/2400 bps; standalone—$2,695 prch.

3864 MODEL 1

Point-to-point or multipoint operation over a 4-wire dedicated Type 3002 voice channel; full-duplex; synchronous at 2400/4800 bps; standalone—$4,045 prch.

3864 MODEL 2

DDD network via direct connection; half-duplex; synchronous at selectable 2400/4800 bps; standalone—$4,275 prch.

3865 MODELS 1 AND 2

Point-to-point (Model 1) or multipoint (Model 2) operation over an unconditioned or conditioned 4-wire dedicated Type 3002 voice channel; half- or full-duplex; synchronous at selectable data rates of 4800/9600 bps; standalone—$6,130 prch.

INFOTRON SYSTEMS

Cherry Hill Industrial Center
Cherry Hill, NJ 08003
(609) 424-9400

DL 113B

DDD network via direct connection; compatible with Bell System modems 103A and 113A/B; full-duplex; asynchronous at data rates up to 300 bps; standalone—prices available on request; rackmount—$265 prch.

DL 212B

DDD network via direct connection; compatible with Bell System modems 103, 113B, and 212; full-duplex; asynchronous at data rates up to 300 bps; synchronous at 1200 bps; rackmount; $750 prch.

DL 4800

Point-to-point or multipoint operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with Bell System modem 208A; half- or full-duplex; synchronous at data rates up to 4800 bps; standalone or rackmount—$3,600 prch.

DL 96/V.29 BANDSPLITTING MODEM

Point-to-point or multipoint operation over an unconditioned 4-wire dedicated Type 3002 voice channel; compatible with Bell System modems 208A and 201C at lower speeds; compatible with INFOTRON modem Model DL 68/9600 and CCITT V.29; full-duplex; synchronous at 4800/7200/9600 bps; standalone—$4,500 prch.

DL 68/9600

Point-to-point or multipoint operation over a conditioned 4-wire dedicated Type 3002 voice channel; full-duplex; synchronous at selectable data rates of 4800/9600 bps; standalone—$5,500 prch.

INTERNATIONAL DATA SCIENCES

7 Wellington Road
Lincoln, RI 02865
(401) 333-6200

MODELS 6000L and 6000H LIMITED DISTANCE MODEMS

Point-to-point or multipoint operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel metallic circuit up to 23 miles using AWG; compatible with AT&T Tech Ref Pub 41004 and 43401; synchronous at selectable data rates of 2400/4800/9600 bps (Model 6000L) or 4800/9600/19.2K bps (Model 6000H); Model 6000L/H standalone—$750 prch; Model 6000L rackmount—$590 prch; Model 6000H rackmount—$640 prch.

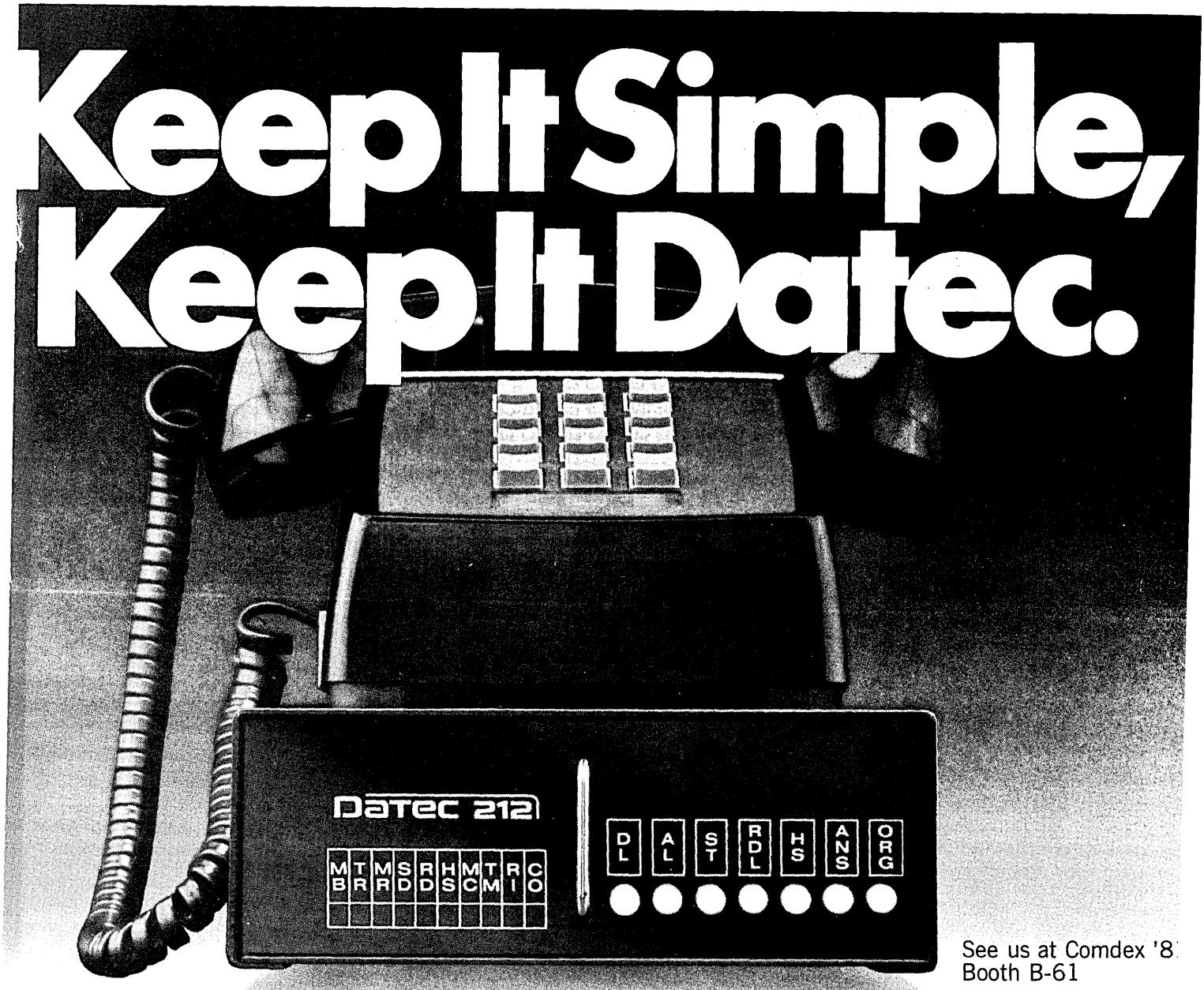
MODEL 6100 MODEM ELIMINATOR

Point-to-point operation over a cable between business machines located up to 100 feet apart; half- or full-duplex; asynchronous or synchronous at external clock data rate; standalone—$710 prch.

MODEL 6110 MODEM ELIMINATOR

Point-to-point operation over a cable between business machines located up to 100 feet apart; half- or full-duplex; synchronous at ex-

Keep It Simple, Keep It Datec.



See us at Comdex '8
Booth B-61

Datec's 300/1200 bps modem is the simple answer to your end-users' needs — whether they're installing a new system or upgrading an existing one. It's a simple, reliable, versatile modem that'll give you — and your customer — convenience and confidence. Here's why:

Simple Installation The Datec 212 connects to *any type* phone—both dial network and 2-wire leased line systems — by simply plugging it in to a standard connection.

Simple Operation Saves time, reduces line charges because only Datec has manual and automatic operation in both the answer and originate modes.

Simple Testing Easy to use front panel switches control seven simple diagnostic tests which let the user isolate any problem in seconds instead of hours.

Efficient Operation Programmed or permissive transmission, full or half duplex operation at all speeds — just two more exclusive Datec innovations.

Reliable Communications Datec has Carrier-On and Ring Indicator LED's. The modem operator can confirm connection *before* starting data transmission, saving valuable time and money. Datec's exclusive built-in "A" control helps prevent interruptions on key system telephones by lighting the line button. Built-in telephone line equalizer gives the Datec 212 one of the highest receiver sensitivities in the industry.

Datec®

DATEC, INC. 300 E. Main St. Carrboro NC 27510 (919) 929•2135

CIRCLE 143 ON READER CARD

ternal clock data rate; standalone—$370 prch.

MODEL 6200 LIMITED DISTANCE MODEM

Point-to-point or multipoint operation over a 2- or 4-wire metallic circuit up to 20 miles using AWG; asynchronous at data rates up to 19.2K bps; standalone—$250 prch.

MODEL 6210 LIMITED DISTANCE MODEM

Point-to-point or multipoint operation over a 2- or 4-wire metallic circuit up to 18 miles using AWG; compatible with AT&T Tech Ref Pub 43401; half- or full-duplex; asynchronous at data rates up to 9600 bps; standalone—$330 prch.

INTERTEL, INC.

Six Shattuck Road
Andover, MA 01810
(617) 681-0600

MCS1200 MODEM

Point-to-point or multipoint operation over an unconditioned or conditioned 4-wire dedicated Type 3002 voice channel; compatible with Intertel modem NCM 1200 and Intertel EMS-ONE and NCS 4000 network control systems; half- or full-duplex; asynchronous or synchronous at selectable data rates of 1200/1800 bps; standalone—$860 prch.

MCS2400 MODEM

Point-to-point or multipoint operation over an unconditioned 4-wire dedicated Type 3002 voice channel; compatible with Intertel modem NCM2400 and Intertel EMS-ONE and NCS4000 network control systems; half- or full-duplex; synchronous at 2400 bps; standalone—$1,375 prch.

MCS4800 MODEM

Point-to-point or multipoint operation over an unconditioned 4-wire dedicated Type 3002 voice channel; compatible with Intertel NCM4800 and Intertel EMS-ONE and NCS4000 network control systems; half- or full-duplex; synchronous at 4800 bps; standalone—$3,375 prch.

MCS9600 MODEM

Point-to-point or multipoint operation over an unconditioned 4-wire dedicated Type 3002 voice channel; compatible with Intertel EMS-ONE and NCS4000 network control systems; half- or full-duplex; synchronous at selectable data rates of 4800/7200/9600 bps; standalone—$6,600 prch.

NCM1200 MODEM

Point-to-point or multipoint operation over an unconditioned 4-wire dedicated Type 3002 voice channel; compatible with Intertel modem MCS1200 and CCITT V.23 mode-2; compatible with Intertel EMS-ONE and NCS4000 network control systems; full-duplex; asynchronous or synchronous at 1200 bps; standalone—$860 prch.

NCM2400 MODEM

Point-to-point or multipoint operation over an unconditioned 4-wire dedicated Type 3002 voice channel; compatible with Bell System modem 201; compatible with Intertel modem MCS2400 also CCITT V.26 alternative B and V.26 bis; compatible with Intertel EMS-ONE and NCS4000 network control systems; half- or full-duplex; synchronous at 1200/2400 bps; standalone—$1,375 prch.

NCM4800 MODEM

Point-to-point or multipoint operation over an unconditioned 4-wire dedicated Type 3002 voice channel; compatible with Intertel modem MCS 4800 or optionally with CCITT V.27 bis; compatible with Intertel EMS-ONE and NCS4000 network control systems; half- or full-duplex; synchronous at selectable data rates of 2400/4800 bps; standalone—$3,375 prch.

M1200 MODEM

DDD network via direct connection; point-to-point or multipoint operation over an unconditioned 4-wire dedicated Type 3002 voice channel; compatible with Bell System modems 202C/D/E/F/S/T; half- or full-duplex; asynchronous at 1200 bps; standalone—$695 prch.

M2400 MODEM

DDD network via direct connection; point-to-point or multipoint operation over an unconditioned 4-wire dedicated Type 3002 voice channel; compatible with Bell System modem 201B/C; half- or full-duplex; synchronous at 2400 bps; standalone—$1,050 prch.

DLM1200 DIAGNOSTIC LOOP MODEM

Point-to-point operation over an unconditioned 4-wire dedicated Type 3002 voice channel; compatible with IBM 3603 modem; designed for use in IBM 3600 Finance Communication System; simplex; synchronous 1200 bps; standalone—$1,990 prch.

DLM2400 DIAGNOSTIC LOOP MODEM

Point-to-point operation over an unconditioned 4-wire dedicated Type 3002 voice channel; designed for use in IBM 3600 Finance Communication System; compatible with IBM 3603 modem; simplex; synchronous 2400 bps; standalone—$2,465 prch.

M1236IBM 3600 LOOP MODEM

Operation over an unconditioned 4-wire dedicated Type 3002 voice channel; compatible with IBM 3603 modem; designed for use in IBM 3600 Finance Communication System; full-duplex; asynchronous at data rates up to 1200 bps; standalone—$840 prch.

M1524 ALTERNATE VOICE/DATA MODEM

DDD network via direct connection; compatible with Intertel modem 2415; full-duplex; synchronous reception at 2400 bps; asynchronous transmission at 150 bps; standalone—$1,225/1 to 50 units.

M2415 ALTERNATE VOICE/DATA MODEM

DDD network via direct connection; compatible with Bell System modem 201B/C; compatible with Intertel modem M1524; full-duplex; synchronous transmission at 2400 bps; asynchronous reception at 150 bps; standalone—$800 prch.

SLD1920 SYNCHRONOUS LINE DRIVER

Point-to-point or multipoint operation over a 4-wire metallic circuit up to 20 miles using AWG; compatible with AT&T Tech Ref Pub 43401; full-duplex; synchronous at selectable data rates of 2400/4800/9600/19.2K bps; asynchronous up to 2400 bps; standalone—$895 prch.

CM2020 DIRECT CONNECT CARD MODEM

DDD network via direct connection; compatible with Bell System modem 202S; half-duplex; asynchronous at data rates up to 1200 bps; PC board—$270/1 to 50 units.

KAPUSI LABORATORIES

2121 South El Camino Real
San Mateo, CA 94403
(415) 573-5475

DT19.2L DATA TRANSCEIVER

Point-to-point or multipoint operation over a 4-wire metallic circuit up to 40 miles using AWG; compatible with AT&T Tech Ref Pub 43401; half- or full-duplex; asynchronous at data rates up to 19.2K bps; synchronous at selectable data rates of 2400/4800/9600/19.2K bps; standalone—$1,190 prch.

DT19.2S DATA TRANSCEIVER

Point-to-point or multipoint operation over a 4-wire metallic circuit up to 19 miles using AWG; compatible with AT&T Tech Ref Pub 43401; half- or full-duplex; asynchronous at data rates up to 19.2K bps; synchronous at selectable data rates of 2400/4800/9600/19.2K bps; standalone—$790 prch.

KINEX CORPORATION/A SUBSIDIARY OF NOKIA CORP., HELSINKI, FINLAND

6793 Cross Bayou Drive
Largo, FL 33543
(813) 541-6404

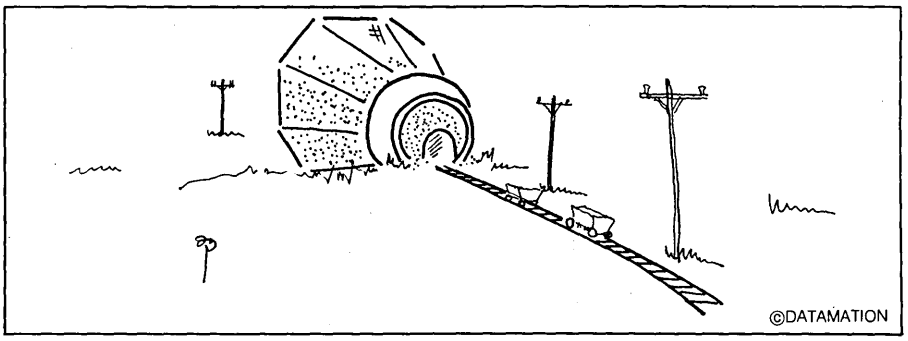
MODEL 300/21 MODEM

DDD network via DAA; point-to-point operation over a 2-wire dedicated Type 3002 voice channel; full-duplex; asynchronous at data rates up to 300 bps; standalone—$635 prch.

MODEL 1200/24 MODEM

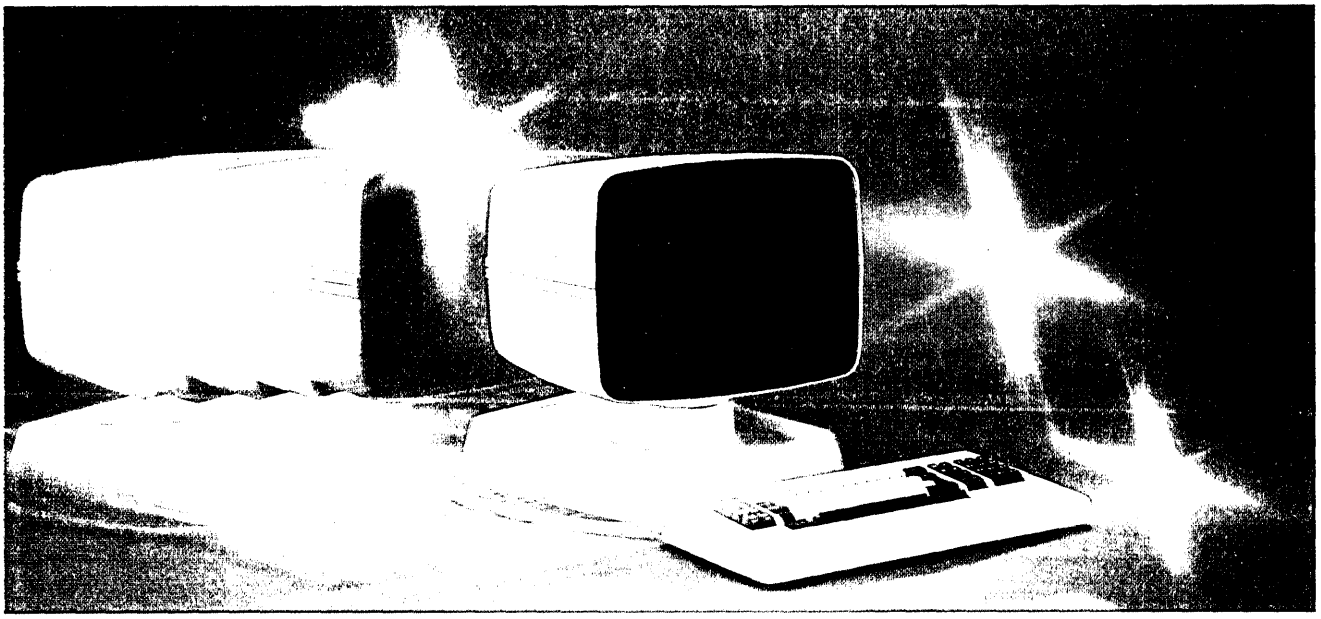
DDD network via DAA; point-to-point or multipoint operation over 2- or 4-wire dedicated Type 3002 voice channel; simplex, half- or full-duplex; asynchronous or synchronous at 600/1200 bps; standalone—$715 prch.

MODEL 2400/26 MODEM



CARTOON BY TENGO

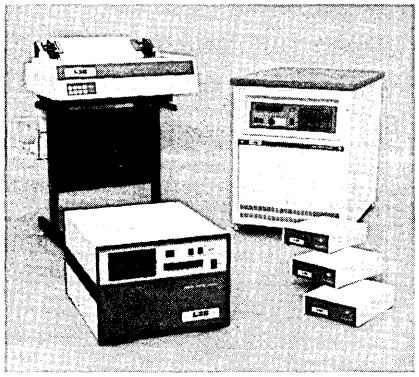
Lee Data's NEW All-In-One Display System is ~~a better~~ the best choice for your 3270 requirements.



You get economy with Lee Data's Coax Eliminator™ and unsurpassed character clarity with our new high resolution All-In-One display. And you get the choice of BSC or SNA communications in either remote or local cluster systems.

DISPLAY ADVANTAGES

☐ Four 3278 compatible screen sizes in a single All-In-One display: 24, 32 and 43 lines by 80 columns and 27 by 132.
☐ Two special screen sizes—43 lines by 132 columns and 66 lines by 132 columns (a full printer page)—available for special applications.
☐ Unsurpassed character clarity with no flicker achieved with a screen refresh rate of 60 times per second, twice that of similar displays.
☐ Non-glare, fingerprint resistant screen rotates (180° horizontally) and tilts (25° vertically).
☐ Detached and lightweight keyboard with 9′ extendable coil cable—available in five standard and many special styles.
☐ Display is lightweight, only 31 lbs.
☐ Display is also compact, with a base footprint of only 14″ x 16.″



The Lee Data Interactive Display System also includes: Model 310 Remote Controller, Model 320 Local Controller, Matrix Printer and the exclusive Coax Eliminator, Models C/8, T/1 and T/8.

LEE DATA CORPORATION

10206 Crosstown Circle
Minneapolis, MN 55344
612/932-0300

SYSTEM ADVANTAGES

☐ A full range of controllers emulate IBM 3274 local and remote systems using either BSC or SNA communications.
☐ Multiple microprocessor design provides a system that easily meets the performance demands of a 32 station cluster.
☐ Select from a line of printers including printers compatible with the IBM 3287.
☐ Save coaxial cable costs with the Coax Eliminator™ that supports up to eight displays or printers on one coaxial cable or twisted wire circuit.
☐ Advanced system software offers · easy system configuration · access to multiple station addresses for individual stations · system and station statistics collection · dynamic on-screen communications line trace.
☐ Experienced and responsive service personnel in over 70 U.S. locations.

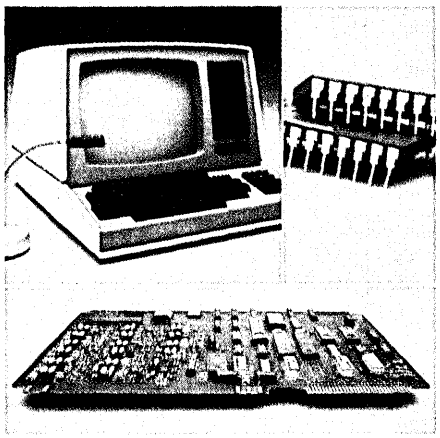
Call our system specialists toll free and ask about our 30-day delivery:
800-328-3998

CIRCLE 145 ON READER CARD

It's easy to add the competitive power of Voice Recognition to your product line. The cost is low and the return on the investment is very attractive. Whether you are an OEM or an end user, Interstate has a Voice Recognition product to suit your needs; terminals and boards for system integration and chips to create your own sub-systems.

Terminals. Interstate standalone Voice Recognition terminals perform voice controlled data and word processing with a vocabulary up to 100 words and 99%+ accuracy. You unpack them, power them, and immediately begin talking to your system. You can develop and execute resident application software using voice data input without going through expensive, time consuming integration.

Boards. Interstate Voice Recognition Q-Bus,™ Multibus,™ and Lear Siegler Dumb Terminal® compatible boards are capable of recognizing up to 100 words or short phrases in any language. They perform all training, updating, word recognition and communication for your selected vocabulary. Accuracy is 99%+.



And if you need voice response we also offer a Multibus board with a 1500 word vocabulary.

Chips. Three separate chip products from Interstate provide Voice Recognition capabilities with 100, 25, and 8 word vocabularies and accuracies up to 99%+ for your commercial, industrial and consumer applications.

Discover the world of voice. Data entry via direct human to computer communication makes voice recognition ideal for a broad range of application areas *including office and factory automation, word processing, small business data processing, computer-aided design, building security and many more.* Whatever your application, the benefits of voice are virtually unlimited.

Talk to the experts. We listen just as well as our computers. Tell us your voice recognition needs. We've got the terminals, the boards, and the chips to meet them. And we've got them now.

Write to: Manager, Marketing, Voice Recognition Products, Interstate Electronics Corporation, 1001 East Ball Road, P.O. Box 3117, Anaheim, California 92803.

(714) 635-7210
or call toll free
(800) 854-6979.

INTERSTATE ELECTRONICS CORPORATION

CIRCLE 146 ON READER CARD

Call to attend our nationwide voice seminars.

Q-Bus is a trademark of Digital Equipment Corporation. Multibus is a trademark of Intel Corporation. Dumb Terminal® is a trademark of Lear Siegler, Inc.

VOICE RECOGNITION BY INTERSTATE

DDD network via DAA; point-to-point or multipoint operation over 2- or 4-wire dedicated Type 3002 voice channel; simplex, half- or full-duplex; synchronous at selectable data rates of 1200/2400 bps; standalone—$795 prch.

MODEL 4800/208A B MODEM

DDD network via direct connection; point-to-point or multipoint operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with Bell System modem 208A/B; simplex, half- or full-duplex; synchronous at 4800 bps; standalone—$2,750 prch.

MODEL 4800/27 MODEM

DDD network via direct connection; point-to-point or multipoint operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; simplex, half- or full-duplex; synchronous at selectable data rates of 2400/4800 bps; standalone—$2,750 prch.

MODEL SAB-2X4 LIMITED DISTANCE MODEM

Point-to-point or multipoint operation over a 2- or 4-wire metallic circuit up to 25 kilometers; half- or full-duplex, asynchronous or synchronous at selectable data rates of up to 19.2K bps; standalone—$630 prch.

MODEL SAB-IV LIMITED DISTANCE MODEM

Point-to-point operation over a 4-wire metallic circuit up to 25 kilometers; asynchronous or synchronous at selectable data rates of up to 19.2K bps; standalone—$430 prch.

LEXICON CORPORATION

8355 Executive Center Drive
Miami, FL 33166
(305) 592-4404

LEX-11 ACOUSTIC MODEM

DDD network via acoustic coupling; compatible with Bell System modem 103A; half- or full-duplex; asynchronous at data rates up to 300 bps; standalone—$175 prch.

LEX-12 MODEM

DDD network via direct connection; compatible with Bell System modem 103A; full-duplex; asynchronous at 300 bps; standalone—$195 prch.

LIVERMORE DATA SYSTEMS, INC.

2050 Research Drive
Livermore, CA 94550
(415) 447-2252

STAR ACOUSTIC MODEM

DDD network via acoustic coupling; compatible with Bell System modems 103 and 113; compatible with CCITT V.21 and IEEE 488; half- or full-duplex; asynchronous at data rates up to 300 bps; standalone—$199 to $379 prch depending on interface.

MADZAR CORPORATION

37490 Glenmore Drive
Fremont, CA 94536
(415) 794-7400

Z9600 MODEM

DDD network via DAA; operation over a 2- or 4-wire metallic circuit up to 10 miles using AWG; simplex, half- or full-duplex; asynchronous at data rates up to 9600 bps; standalone—$167 prch.

MICOM SYSTEMS, INC.

9551 Irondale Avenue
Chatsworth, CA 91311
(213) 882-6890

MICRO 4000 MODELS 400 (STANDALONE) AND 4400 (RACKMOUNT) ASYNCHRONOUS LINE DRIVERS

Point-to-point operation over a 2- or 4-wire metallic circuit up to 30 miles using AWG; full-duplex; asynchronous at data rates up to 19.2K bps; standalone—$190 prch; rackmount—$120 prch.

MICRO 400 MODELS 401 (STANDALONE) AND 4401 (RACKMOUNT) ASYNCHRONOUS LOCAL DATASETS

Point-to-point operation over a 4-wire metallic circuit up to 25 miles using AWG; compatible with AT&T Tech Ref Pub 43401; full-duplex; asynchronous at data rates up to 19.2K bps; standalone—$230 prch; rackmount—$160 prch.

MICRO 400 MODELS 402 (STANDALONE) AND 4402S (RACKMOUNT) ASYNCHRONOUS LINE DRIVER/LOCAL DATASET

Point-to-point operation over a 2- or 4-wire metallic circuit up to 30 miles using AWG; full-duplex; asynchronous at data rates up to 19.2K bps; standalone—$270 prch.

MICRO 400 MODELS 420 (STANDALONE) AND 4420 (RACKMOUNT) SYNCHRONOUS LINE DRIVERS

Point-to-point operation over a 4-wire metallic circuit up to 30 miles using AWG; full-duplex; synchronous at selectable data rates of up to 19.2K bps; standalone—$290 prch.

MICRO 4000 MODEMS 4024 AND 4024/ASYNC

Point-to-point or multipoint operation over an unconditioned 4-wire dedicated Type 3002 voice channel; compatible with Bell System modems 201 and CCITT V.26; half- or full-duplex; asynchronous (Model 4024/ASYNC only) or synchronous at 2400 bps; Model 4024 standalone or rackmount—$720 prch; Model 4024/ASYNC standalone or rackmount—$750 prch.

MICRO 4000 MODEL 4048 SYNCHRONOUS MODEM

Point-to-point or multipoint operation over an unconditioned 4-wire dedicated Type 3002 voice channel; compatible with Bell System modem 208A; half- or full-duplex; synchronous at 4800 bps; standalone or rackmount—$3,200 prch.

MICRO 4000 MODEL 4096 SYNCHRONOUS MODEM

Point-to-point operation over an unconditioned 4-wire dedicated Type 3002 voice channel; compatible with CCITT V.29; full-duplex; synchronous at 9600 bps; standalone or rackmount—$4,700 prch.

MICRO 4000 MODEL 4748 SYNCHRONOUS MULTIPORT MODEM

Point-to-point or multipoint operation over an unconditioned 4-wire dedicated Type 3002 voice channel; compatible with Bell System modem 208A; half- or full-duplex; synchronous at 4800 bps; standalone or rackmount—$3,850 prch.

MICRO 4000 MODEL 4796 SYNCHRONOUS MULTIPORT MODEM

Point-to-point operation over an unconditioned 4-wire dedicated Type 3002 voice channel; compatible with CCITT V.29; full-duplex; synchronous at 9600 bps; standalone or rackmount—$5,250 prch.

MICRO 5000 MODEL 5596/24 ASYNCHRONOUS INTELLIGENT MODEM

Point-to-point operation over an unconditioned 4-wire dedicated Type 3002 voice channel; compatible with Bell System modem 201 and CCITT V.26; full-duplex; asynchronous at 2400 bps; standalone or rackmount—$1,500 prch.

MICRO 5000 MODEL 5596/48 ASYNCHRONOUS INTELLIGENT MODEM

Point-to-point operation over an unconditioned 4-wire dedicated Type 3002 voice channel; compatible with Bell System modem 208A; full-duplex; asynchronous at 4800 bps; standalone or rackmount—$4,000 prch.

MICRO 5000 MODEL 5596/96 ASYNCHRONOUS INTELLIGENT MODEM

Point-to-point operation over an unconditioned 4-wire dedicated Type 3002 voice channel; full-duplex; asynchronous at 9600 bps; standalone or rackmount—$5,500 prch.

MULTI-TECH SYSTEMS, INC.

82 Second Avenue, S.E.
New Brighton, MN 55112
(612) 631-3550

FM30

DDD network via acoustic coupling; compatible with Bell System modems 103 and 113; half- or full-duplex; asynchronous at data rates up to 300 bps; standalone—$225 prch.

FM31

DDD network via acoustic coupling; compatible with Bell System modems 103 and 113; half- or full-duplex; asychronous at data rates up to 300 bps; standalone—$265 prch.

MT 103J

DDD network via direct connection; compatible with Bell System modems 103 and 113; full-duplex; asynchronous at data rates up to 300 bps; standalone—$295 prch.

MT 113D

DDD network via direct connection; compatible with Bell System modems 103 and 113; full-duplex; asynchronous at data rates up to 300 bps; standalone—$275 prch.

MT 201C

DDD network via direct connection; point-to-point operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with Bell System modem 201C; half- or full-duplex; synchronous at 2400 bps; standalone—$795 prch.

MT 202T

Point-to-point or multipoint operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with Bell System modems 202D and 202T; half- or full-duplex; asynchronous at data rates up to 1200

bps; standalone—$345 prch.

MT 202S

DDD network via direct connection; compatible with Bell System modem 202S/C; half-duplex; asynchronous at data rates up to 1200 bps; standalone—$435 prch.

MT 212A

DDD network via direct connection; point-to-point operation over an unconditioned 2-wire dedicated Type 3002 voice channel; compatible with Bell System modem 212A; full-duplex; asynchronous up to 300 bps; synchronous at 1200 bps; standalone—$850 prch.

MT 212D

DDD network via direct connection; point-to-point operation over an unconditioned 2-wire dedicated Type 3002 voice channel; compatible with Bell System modem 212A; full-duplex; asynchronous or synchronous at data rates up to 1200 bps; standalone—$695 prch.

NCR CORPORATION

1700 Patterson Blvd., Bldg. 26
Dayton, OH 45479
(513) 445-5000

7120 ASYNCHRONOUS MODEM

DDD network via DAA; point-to-point operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with Bell System modems 202/C/S/T; compatible with most NCR asynchronous modems; half- or full-duplex; asynchronous at data rates up to 1200/1800 bps; standalone—$755 prch.

7121 SYNCHRONOUS MODEM

DDD network via direct connection; point-to-point operation over an unconditioned 4-wire dedicated Type 3002 voice channel; compatible with Bell System modem 201C; compatible with NCR 2400 bps modems; half- or full-duplex; synchronous at 2400 bps; standalone—$1,315 prch.

NORTHERN TELECOM/SPECTRON DIVISION

Albany Road
P. O. Box 620
Moorestown, NJ 08057
(609) 234-5700

MER-810 MODEM ELIMINATOR REPEATER

Point-to-point operation over a cable between business machines located up to 100 feet apart; half- or full-duplex; asynchronous or synchronous at data rates of 50K to 19.2K bps; standalone—$360 prch.

ME-358 V.35 MODEM ELIMINATOR

Point-to-point operation over a cable between business machines located up to 100 feet apart; half- or full-duplex; asynchronous or synchronous at 16 selectable data rates from 18K bps to 460.8K bps; standalone—$515.

NOVATION

18664 Oxnard Street
Tarzana, CA 91356
(213) 996-5060

CAT

DDD network via acoustic coupling; compatible with Bell System modem 103; half- or full-duplex; asynchronous at data rates up to 300 bps; standalone—$189 prch.

D-CAT

DDD network via direct connection; compatible with Bell System 100 Series modems; half- or full-duplex; asynchronous at data rates up to 300 bps; standalone—$199 prch.

AUTO-CAT

DDD network via direct connection; compatible with Bell System 100 Series modems; compatible with Novation CAT and D-CAT modems; half- or full-duplex; asynchronous at data rates up to 300 bps; standalone—$249 prch.

APPLE-CAT II

DDD network via direct connection; compatible with Bell System modems 100 and 202; half- or full-duplex; asynchronous at data rates up to 1200 bps; PC board—$389 prch.

4200 SERIES

DDD network via direct connection; point-to-point operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with Bell System modems 202C/D/E/R/S/T; simplex; half- or full-duplex; asynchronous at data rates up to 1200 bps; standalone—$375 prch, dedicated line only; $569 prch, DDD or dedicated line.

NU DATA CORPORATION

32 Fairview Avenue
Little Silver, NJ 07739
(201) 842-5757

MODELS 108D/S AND 108E/S STATION DATASETS

Point-to-point or multipoint operation over a 2-wire dedicated Type 3002 voice channel; compatible with Bell System modem 108; half- or full-duplex; asynchronous at data rates up to 300 bps; standalone—$280 prch.

MODELS 108D/P AND 108E/P CENTRAL OFFICE DATASETS

Point-to-point or multipoint operation over a 2-wire dedicated Type 3002 voice channel; compatible with Bell System modem 108; half- or full-duplex; asynchronous at data rates up to 300 bps; standalone—$255 prch.

OMNITEC DATA

2405 South 20th Street
Phoenix, AZ 85034
(602) 258-8244

710 AND 772

DDD network via acoustic coupling; compatible with Bell System modems 103 and 113; half- or full-duplex; asynchronous at data rates up to 450/600 (optional) bps; standalone—$195 prch.

9202 B (STANDALONE) AND 9202R (RACKMOUNT)

DDD network via direct connection; point-to-point operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with Bell System modems 202C/CR/D/S/T; half- or full-duplex; asynchronous at data rates up to 1200 bps; standalone—$545 prch.

9113B (STANDALONE) AND 9113R (RACKMOUNT)

DDD network via direct connection; point-to-point operation over an unconditioned 2-wire dedicated Type 3002 voice channel; compatible with Bell System modems 103A/F, and 113B; half- or full-duplex; asynchronous at data rates up to 300/600 (optional) bps; standalone—$388 prch.

912A (STANDALONE) AND 9212RD (RACKMOUNT)

DDD network via direct connection; compatible with Bell System modems 212, 103, and 113; full-duplex; asynchronous at data rates up to 300 bps; synchronous at 1200 bps; standalone—$787 prch.

4000 SERIES TWX/DDD MODEMS

TWX network via FCC certified direct connection or TAA (all models); DDD network via FCC certified direct connection or DAA (all models except Model 4500); compatible with Bell System modems 101C, 103A, and 113B; half- or full-duplex; asynchronous at selectable data rates of 110/300 bps; standalone—$862 to $952 prch, depending on model.

PARADYNE CORPORATION

8550 Ulmerton Road
Largo, FL 33541
(813) 530-2000

MP 4800

DDD network via optional direct connection; point-to-point or multipoint operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; half- or full-duplex; synchronous at selectable data rates of 2400/4800 bps; standalone—$3,000 prch.

MP 4800/208B

DDD network via direct connection; compatible with Bell System modem 208B; half-duplex; synchronous at 4800 bps; standalone—$3,400 prch.

MP 9600

Point-to-point operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; half- or full-duplex; synchronous at selectable data rates of 4800/7200/9600 bps; standalone—$6,500 prch.

MP 9600RP

Point-to-point or multipoint operation over an unconditioned 4-wire dedicated Type 3002 voice channel; full-duplex; synchronous at selectable data rates of 4800/7200/9600 bps; standalone—$6,800 prch.

MP 14400

Point-to-point operation over a conditioned 4-wire dedicated Type 3002 voice channel; half- or full-duplex; synchronous at selectable data rates of 9600/12.0K/14.4K bps; standalone—$14,400 prch.

MP 16000

Point-to-point operation over a conditioned 4-wire dedicated Type 3002 voice channel; half- or full-duplex; synchronous at 9600/12.0K/14.4K/16.0K bps; standalone—$16,000 prch.

LSI 2400

Point-to-point or multipoint operation over an unconditioned 4-wire dedicated Type 3002 voice channel; compatible with Bell System modem 201C; simplex, half- or full-duplex; synchronous at selectable data rates of 1200/2400 bps; standalone—$1,200 prch.

LSI 2400LP

Point-to-point operation over a 2- or 4-wire dedicated Type 3002 voice channel; designed for IBM 3600 loop networks; simplex or full-duplex; synchronous at selectable data rates of 1200/2400 bps; standalone—$1,400 prch.

370÷311=IV

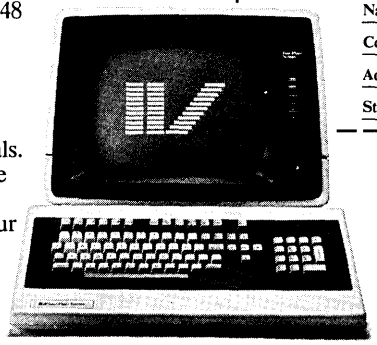
Announcing the new math for OEMs

IBM 370 software goes right into our System 311 hardware. That equation gives you four big advantages.

I. Total IBM compatibility. Both the 311 and 312 use the 370 instruction set and run DOS/VS, DOS/VSE, OS/VS1 and VM/370 System Control Programs. That equation conserves your investment in hardware, software and staff training.

II. Better profit margins. The System 311 and its big brother, the 312, are available to you at savings of up to 50% of the comparable IBM 370/138, 4331-2 and 370/148 mainframes. That kind of math is easy to understand.

III. A complete integrated system – not a PCM. The 311 and 312 have integrated controllers, so you don't have to use expensive IBM peripherals. Four-Phase ships the systems with disc and tape drives, communication devices, printers, card readers and a console CRT. All that adds to your profit margin.



IV. Nationwide support. You can support users yourself, or take advantage of a Four-Phase service contract. We have over 1000 service personnel in more than 130 locations across North America.

If you like the way the new math adds up, call us at 1-800-528-6050 extension 1599 (in Arizona call 1-800-352-0458 extension 1599) and ask for our brochure on the Systems 311 and 312. Or complete the coupon below.

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Name _____ Title _____

Company _____

Address _____ City _____

State _____ Zip _____ Phone _____

Four-Phase Systems
The Distributed Processing Company
10700 North De Anza Blvd., Cupertino, CA 95014.

See us at INFO '81 Booth # 2201

CIRCLE 147 ON READER CARD

LSI 2400A
Point-to-point or multipoint operation over an unconditioned 4-wire dedicated Type 3002 voice channel; half- or full-duplex; asynchronous at 1200/2400 bps; standalone—$1,300.
LSI 2400C
DDD network via direct connection; compatible with Bell System modem 201C; half- or full-duplex; asynchronous at data rates up to 1200/2400 bps; standalone—$1,300 prch.
LSI 48
Point-to-point operation over an unconditioned 4-wire dedicated Type 3002 voice channel; full-duplex; synchronous at 4800 bps; standalone—$3,000 prch.
LSI 96
Point-to-point operation over an unconditioned 4-wire dedicated Type 3002 voice channel; full-duplex; synchronous at selectable data rates of 4800/7200/9600 bps; standalone—$4,500 prch.
M-96
Point-to-point operation over an unconditioned 4-wire dedicated Type 3002 voice channel; full-duplex; synchronous at selectable data rates of 4800/7200/9600 bps; standalone—$6,500 prch.
T-96
Point-to-point operation over an unconditioned 4-wire dedicated Type 3002 voice channel; compatible with CCITT V.29 modem; full-duplex; synchronous at selectable data rates of 4800/7200/9600 bps; standalone—$2,740 prch only.
SRM-192A SHORT RANGE MODEM
Point-to-point operation over a metallic circuit up to 19 miles using AWG; compatible with AT&T Tech Ref Pub 43401; half- or full-duplex; synchronous at selectable data rates of up to 19.2K bps; standalone—$900 prch.

PENRIL DATA COMMUNICATIONS DIVISION

5520 Randolph Road
Rockville, MD 20852
(301) 881-8151

24/48/72/96 SHORT HAUL MODEM
Point-to-point or multipoint operation over a 2- or 4-wire metallic circuit up to 40 miles using AWG; compatible with AT&T Tech Ref Pub 43401; half- or full-duplex; synchronous at selectable data rates up to 19.2K bps; standalone—$525 prch.
96A SHORT HAUL MODEM
Point-to-point operation over a 2- or 4-wire metallic circuit up to 35 miles using AWG; half- or full-duplex; asynchronous at data rates up to 9600 bps; standalone—$250 prch.
300/1200 DATA MODEM
DDD network via direct connection; point-to-point operation over a 2-wire dedicated Type 3002 voice channel; compatible with Bell System 100 Series and 212A modems; compatible with CCITT V.22; full-duplex; asynchronous up to 300 bps; synchronous at 1200 bps; standalone—$850 prch.
1800 DED DATA MODEM
DDD network via DAA; point-to-point operation over an unconditioned or conditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with Bell System modems 202D and 202R; half- or full-duplex; asynchronous at data rates up to 1800 bps; standalone—$375 prch.
2400 LSI
DDD network via DAA; point-to-point or multipoint operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with Bell System modems 201B and 201C; half- or full-duplex; synchronous at selectable data rates of 1200/2400 bps; standalone—$795 prch.
4800 DCM
Point-to-point or multipoint operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with CCITT V.27 bis/ter; half- or full-duplex; synchronous at selectable data rates of 2400/4800 bps; standalone—$2,400 prch basic.
9629 LSI
DDD network via DAA; point-to-point or multipoint operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with Penril 4800 DCM modem; compatible with CCITT V.29 and V.27 bis/ter; half- or full-duplex; synchronous at selectable data rates of 2400/4800/7200/9600 bps; standalone—$6,050 prch.

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P103/P113 MODEM SERIES
DDD network via direct connection; compatible with Bell System modems 113A/B/C/D and 103J; half- or full-duplex; asynchronous at data rates up to 300 bps; price range reflects calling mode (originate-only, answer-only, and originate and auto answer); standalone—$385 to $470 prch.
P201C MODEM
DDD network via direct connection; point-to-point operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with Bell System modem 201B/C; half- or full-duplex; synchronous at 2400 bps; standalone—$950 prch.
P212A AND P212C
DDD network via direct connection; compatible with Bell System modems 212 and 103; full-duplex; asynchronous at data rates up to 300 bps; synchronous at 1200 bps; standalone—$865 prch, P212A; $915 prch, P212C.
P202S MODEM
DDD network via direct connection; compatible with Bell System modems 202C/D/E/S; simplex or half-duplex; asynchronous at data rates up to 1200 bps; standalone—$455 prch.
P202T MODEM
Point-to-point or multipoint operation over a conditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with Bell System modem 202T; simplex, half- or full-duplex; asynchronous at data rates up to 1800 bps; standalone—$440 prch.
ASYNCHRONOUS LIMITED DISTANCE MODEM (ALD)
Point-to-point operation over a 2- or 4-wire metallic circuit up to 21 miles using AWG; compatible with AT&T Tech Ref Pub 43401; simplex, half- or full-duplex; asynchronous at data rates up to 9600 bps; standalone—$280.
SYNCHRONOUS LIMITED DISTANCE MODEM (SLD-MKII)
Point-to-point or multipoint operation over a 2- or 4-wire metallic circuit up to 19 miles using AWG; compatible with AT&T Tech Ref Pub 43401; half- or full-duplex; synchronous at standard selectable data rates of up to 19.2K bps; price differences reflect standard and optional data rates; standalone—$490 or $950 prch.

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CMS 12
Point-to-point or multipoint operation over an unconditioned 4-wire dedicated Type 3002 voice channel; half- or full-duplex; asynchronous at data rates up to 1200 bps; synchronous at 1200 bps (optional); standalone—$1,900 prch.
CMS 24
Point-to-point or multipoint operation over an unconditioned 4-wire dedicated Type 3002 voice channel; half- or full-duplex; synchronous at 2400 bps; standalone—$2,200 prch.
CMS 48
Point-to-point or multipoint operation over an unconditioned 4-wire dedicated Type 3002 voice channel; half- or full-duplex; synchronous at 4800 bps; standalone—$4,400 prch.
CMS 4801
Point-to-point or multipoint operation over an unconditioned 4-wire dedicated Type 3002 voice channel; half- or full-duplex; synchronous at 4800 bps; standalone—$4,800 prch.
CMS 7201
Point-to-point or multipoint operation over an unconditioned 4-wire dedicated Type 3002 voice channel; half- or full-duplex; synchronous at selectable data rates of 2400/4800/7200 bps; standalone—$6,500 prch.
CMS 9601
Point-to-point or multipoint operation over an unconditioned or conditioned 4-wire dedicated Type 3002 voice channel; compatible with CCITT V.29; half- or full-duplex; synchronous at selectable data rates of 4800/7200/9600 bps; standalone—$7,500 prch.
24 LSI MARK II
Point-to-point or multipoint operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with Bell System modem 201B/C; compatible with Racal-Milgo modems 2200/24 and 24 LSI; half- or full-duplex; synchronous at 2400 bps; standalone—$1,450 prch.
MPS-48
Point-to-point or multipoint operation over an unconditioned 4-wire dedicated Type 3002 voice channel; half- or full-duplex; synchronous at 4800 bps; standalone—$3,600 prch.
MPS-48 DIAL
DDD network via DAA; half-duplex; synchronous at 4800 bps; standalone—$3,745 prch.
MPS-4801
Point-to-point or multipoint operation over an unconditioned 4-wire dedicated Type 3002 voice channel; half- or full-duplex; synchronous at 4800 bps; standalone—$4,000 prch.

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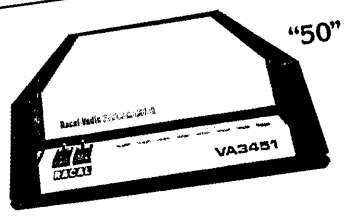
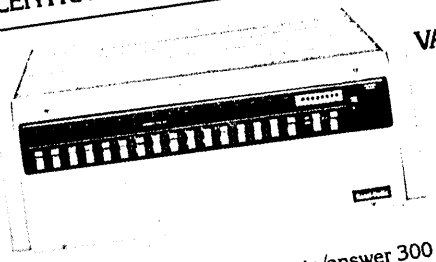
PACKAGING	MODEMS FOR THE REMOTE TERMINAL USER	MODEMS FOR THE CENTRAL COMPUTER SITE
Near Right: Low profile, low cost, low heat "50" series. Includes displays, diagnostics and voice/data switch. Far Right: VA1616 Multiple Data Set. 16 channel chassis houses up to 16 intermixed modems and automatic dialers in 7-inch high chassis. Includes displays, diagnostics and redundant power supplies.	 "50" Series	 VA1616
300 bps Full Duplex Bell 103/113 Compatible	**VA103** — World's first voice/data phone with modem circuitry built inside standard rotary or tone telephone. Direct connect.	**VA315** — Direct connect auto originate/answer 300 bps FDX modem. Operates with Racal-Vadic VA811 Singleline/Multiline Automatic Calling Unit. **Replaces** Bell 103A/E/J and 113A/B/C/D.
	VA355 — Direct connect originate/answer 300 bps FDX modem. Switched network and 2-wire leased line in single package. **Replaces** Bell 103A2/F/J, 108, 113A/B/C.	**VA317** — Direct connect answer only 300 bps FDX switched network/2-wire leased line modem. **Replaces** Bell 113B/D.
1200 bps Half Duplex Bell 202 Compatible	**VA1250/55** — Direct connect switched network 1200 bps half duplex modem (with or without reverse channel). **Replaces** Bell 202C/E/S. Leased line models available to replace Bell 202D/T.	**VA1230/40** — 2/4-wire leased line 1200 bps half duplex (with or without reverse channel). **Replaces** Bell 202D/T. VA1230 is 1800 bps version.
		VA1244/45 — Direct connect switched network 1200 bps half duplex (with or without reverse channel). Operates with Racal-Vadic VA811 Singleline/Multiline Automatic Calling Unit. **Replaces** Bell 202C/S.
1200 bps Full Duplex Bell 212A/103 and Racal-Vadic VA3400 Compatible	**VA3413/12** — Full duplex dual acoustic coupler (VA3413). Operates at 1200 and 0-300 bps. Bell 103/113 and Racal-Vadic VA3400 compatible. VA3412 operates at 1200 bps FDX (VA3400) mode.	**VA3467** — Direct connect switched network answer only triple modem. 1200 and 0-300 bps FDX operation. (VA3400, Bell 212A and 103 modes.)
	VA3450 — Direct connect switched network originate/answer triple modem. 1200 and 0-300 bps FDX operation (VA3400, Bell 212A and 103 modes). 2-wire leased line model available.	**VA3480** — Direct connect auto originate/answer triple modem. 1200 and 0-300 bps FDX. (VA3400, Bell 212A and 103 modes.) Operates with VA811 Singleline/Multiline Automatic Calling Unit. **Replaces** Bell 103A/E/J, 113A/B/C/D and 212A.
2400 bps Half Duplex Bell 201 Compatible	**VA2450** — Direct connect switched network 2400 bps half duplex modem (with or without 75/150 bps auxiliary channel). **Replaces** Bell 201B/C. 2/4-wire leased line models available.	**VA2440/45** — Direct connect switched network 2400 bps half duplex (with or without 75/150 bps auxiliary channel). **Replaces** Bell 201B/C. Operates with VA811 Singleline/Multiline Automatic Calling Unit. 2/4-wire leased line models available.

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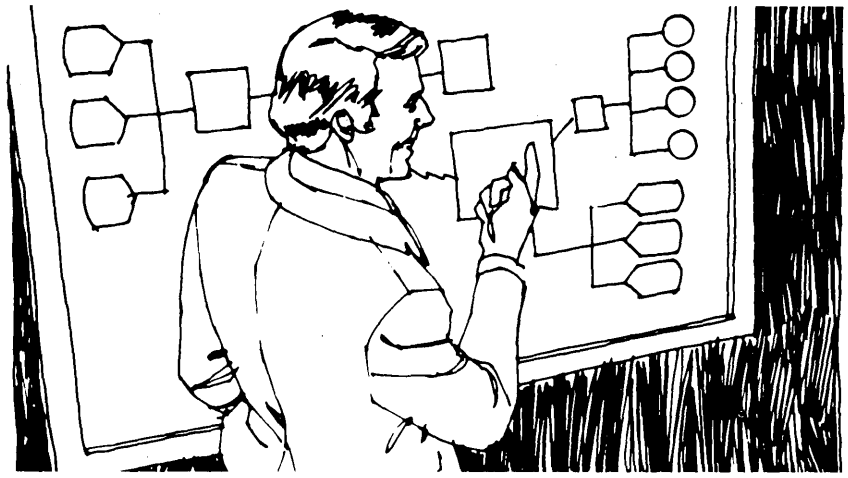

Do you really know if you're in the one best position? Are others getting better exposure? Are you being paid what you're worth? Where will you fit in your present company's plans a year from now? What about in three years? Will you continue to grow or have you peaked out?

In today's dynamic computer field it's almost impossible to stay abreast of what others are doing and whether you are keeping pace. The Source Edp Computer Career Conference has been conceived to help computer professionals analyze and evaluate the current job market and find out where they stand. Key information systems executives from leading organizations in your area and across the nation will be available at the Conference to explain their long-range plans—and where you might fit in. These firms represent a broad cross section of computer user, consulting and service organizations. They are diverse in industry, location, size and types of positions currently available. Each has something special to offer that might better utilize and broaden your skills and potential. Compensation levels are outstanding.

The Computer Career Conference is an easy way for you to investigate a wide variety of career paths rapidly while maintaining complete confidence. Over 15,000 specific positions currently exist with the Conference participants. A brief summary of these openings follows.

Applications Programming
The widest choice of alternatives represented in the Conference is provided to those professionals who have one to two years or more of applications programming background. Conference participants will provide direct exposure and training in a variety of languages (COBOL, PL/1, BAL, RPG, BASIC, etc.), operating systems (OS/MVS, DOS/VS, VM, etc.), and data base and data communications (IMS, CICS, TOTAL, IDMS, ADABAS, System 2000, ENVIRON 1, etc.). In almost all cases, assignments will be projects or teams developing new and leading edge computer techniques. Significant opportunities exist for those with solid programming backgrounds to move into systems development, software, EDP auditing, or systems evaluation. In addition, professionals with exposure or interest in minicomputers will find a broad variety available at the Conference. All positions offer challenging job assignments providing the opportunity to accelerate career growth. Starting salaries range from $18-$37,000.

Systems Development, Consulting and Project Management
A broad variety of openings exist within Conference organizations for persons with systems development background ranging from Junior Analyst to Senior Project Manager. While any industry exposure is acceptable, a background in manufacturing, finance, and/or distribution information systems will provide the broadest choice. College degrees are preferred, but not required. Ability to interface at all user levels and good oral and written communications skills are mandatory. A number of the Conference organizations offer current Applications Programmer Analysts the opportunity of moving directly into systems design projects. Those more senior are sought for Project Manager openings. Due to their ambitious MIS expansion plans, several organizations provide formal management training and development programs. State-of-the-art communications and data base oriented information systems are being planned by many of the participants. In addition, exceptional opportunities are available for those desiring to move into line management. Several small to intermediate firms are now making their first thrust into computerized systems implementation. In addition, nationally respected management consulting firms will be represented for those interested in a variety of assignments and high visibility. Starting salaries range from $25-$54,000.

A special invitation to computer professionals with one to five years of experience.

If you are a computer professional with one to five years of experience, the Computer Career Conference offers you a most unique opportunity. Now is the most crucial period in your career. At this point in time, you have an almost unlimited number of career options from which to choose. Unfortunately, this also means you have more opportunities to make an error in selecting your one best career path. A wrong move now could close forever the option that would have yielded you the greatest long-term potential. By attending the Conference, you'll gain invaluable career planning knowledge in a matter of days that might otherwise take you years to learn.

Systems Programming and Software Development
The challenges provided by Conference participants in software are both broad and unique. Those with at least one to two years of OS, DOS, DOS/VS, VS, or VM systems programming experience will be able to gain direct exposure to some or all of the following: OS, VS, MVS, JES3, CICS, IMS, TSO, DL/1, BTAM, TCAM, VTAM, OCR, duplex lines, modems, programmable line concentrators, switches, CRT's, IBM up to 370/168's, 4341-2's and 3033's, and a variety of non-IBM systems including minicomputers. Assignments range from development and modification to maintenance and support of advanced data base and data communications software. Many larger firms offer the combination of formal training and day-to-day association with some of the top technical professionals in the country, providing an ideal environment for professional development and exposure. Some smaller organizations provide an opportunity to join newly formed software support groups. Opportunities also exist for senior software men and women capable of supervising other professionals. A variety of positions are available in the design and/or development of a wide array of new systems software with both established computer manufacturers as well as ground floor opportunities with the new venture hardware companies. Several Conference participants offer software entry level positions for Applications Programmers strong in OS/BAL. Starting salaries range from $24-$52,000.

Marketing and Marketing Support
Those professionals with a background or interest in computer marketing or marketing support will find significant opportunity at the Conference at both the individual contributor and management levels. Unique alternatives exist across a broad front including mainframes, minicomputers, terminal systems, time-sharing, facilities management, proprietary software packages, OEM's, consulting, etc. Those firms selected for the Conference have demonstrated a prior record of success and strong financial stability. Several are just now entering new markets providing exceptional growth potential. Compensation for those in direct marketing at quota ranges from $30,000 to $75,000. In support, salaries range from $22-$38,000.

Mini and Microcomputers
The mini and microcomputer market is exploding. There exist substantial demands for professionals having experience in applications programming, software development, systems programming, and management. A background in Assembly language, COBOL, Basic Plus, RPG II, FORTRAN or PASCAL in business applications, systems programming, or software development (real-time operating systems, compilers, communications, or data base) is preferred. Starting salaries range from $23-$45,000.

The Computer Career Conference will be in a city near you soon. There is no charge for your enrollment or participation. Call today for complete details.

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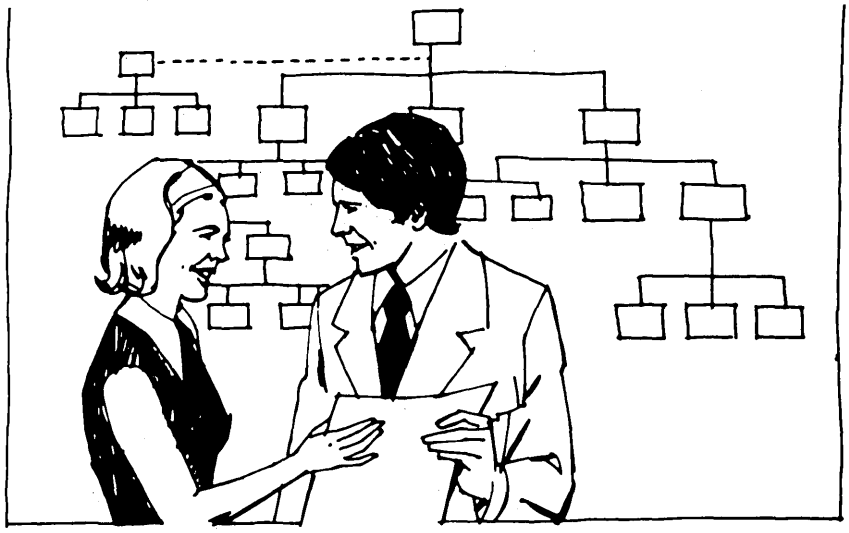

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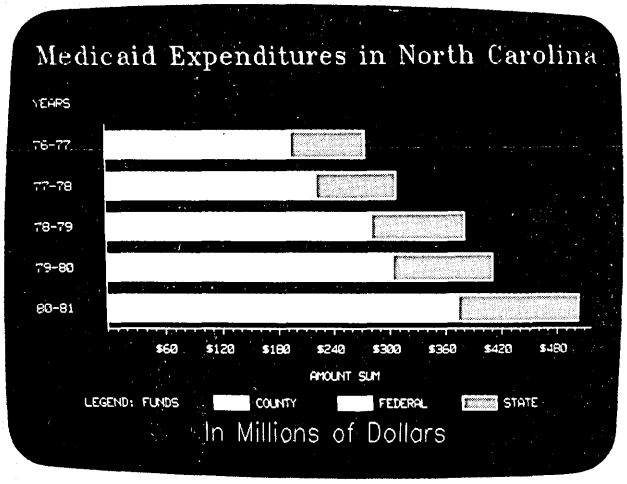

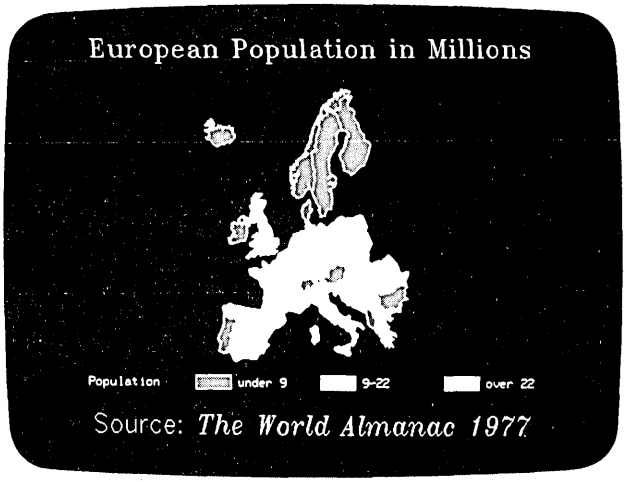

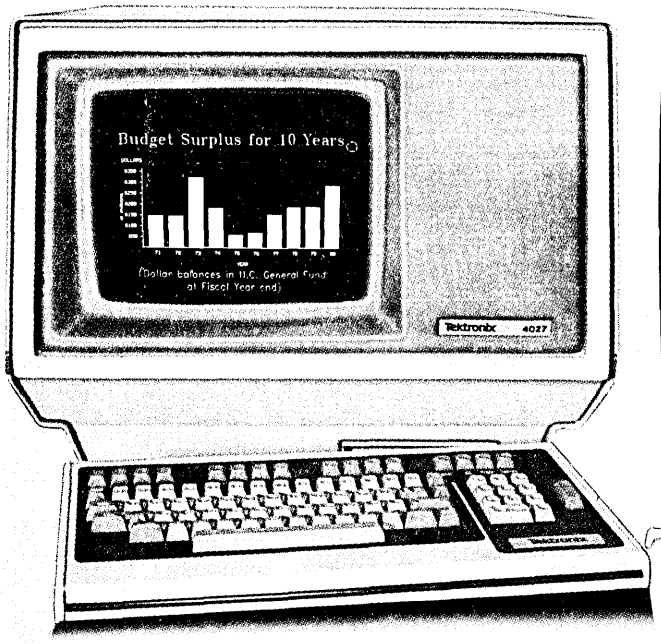

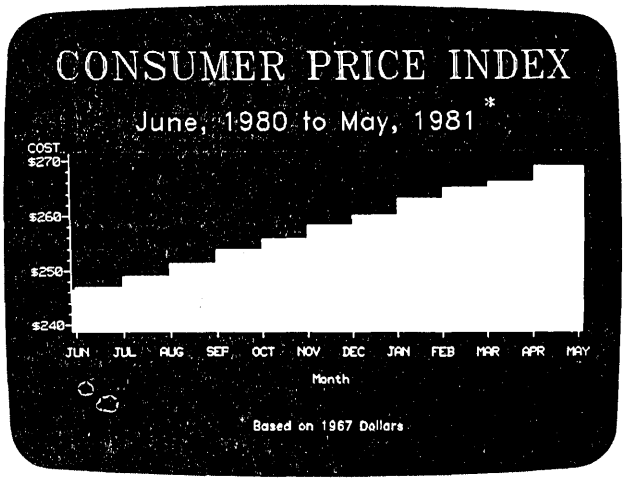

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MPS-7201
Point-to-point or multipoint operation over an unconditioned 4-wire dedicated Type 3002 voice channel; half- or full-duplex; synchronous at selectable data rates of 4800/7200 bps; standalone—$5,700 prch.

MPS-9601
Point-to-point or multipoint operation over an unconditioned or conditioned 4-wire dedicated Type 3002 voice channel; half- or full-duplex; synchronous at selectable data rates of 4800/7200/9600 bps; standalone—$6,700.

MPS-9601/449
Point-to-point or multipoint operation over a 4-wire dedicated Type 3002 voice channel; half- or full-duplex; synchronous at selectable data rates of 4800/7200/9600 bps; standalone—$7,000 prch.

MODEM 56K GROUP BAND MODEM
Point-to-point operation over a 2-wire wideband channel; full-duplex; synchronous at 56K bps; standalone—$8,000 prch.

MODEM 112K GROUP BAND MODEM
Point-to-point operation over a wideband channel; full-duplex; synchronous at 112K bps—prices available on request.

COM-LINK III
Point-to-point or multipoint operation over a 4-wire metallic circuit up to 25 miles using AWG; compatible with AT&T Tech Ref Pub 43401; full-duplex; synchronous at selectable data rates of up to 19.2K bps; standalone—$920 prch.

COM-LINK IIIS
Point-to-point or multipoint operation over a 4-wire metallic circuit up to 18 miles using AWG; compatible with AT&T Tech Ref Pub 43401; full-duplex; synchronous at selectable data rates of up to 19.2K bps; standalone—$1,520 prch.

RACAL-VADIC

222 Caspian Drive
Sunnyvale, CA 94086
(408) 744-0810

VA103 MODEMPHONE
DDD network via direct connection; compatible with Bell System modems 103 and 113; half- or full-duplex; asynchronous at data rates up to 300 bps; standalone—$250 to $380 prch.

VA317
DDD network via direct connection; point-to-point or multipoint operation over a 2-wire dedicated Type 3002 voice channel; compatible with Bell System modems 103 and 113B/D; full-duplex; asynchronous at data rates up to 300 bps; standalone—$250 prch.

VA355
DDD network via direct connection; point-to-point or multipoint operation over an unconditioned 2-wire dedicated Type 3002 voice channel; compatible with Bell System modems 103A2/F/J, 108, and 113A/B/C; half- or full-duplex; asynchronous at data rates up to 300 bps; standalone—$375 prch.

VA1250 SERIES LEASED LINE MODEMS
Point-to-point operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with Bell System modems 202D/R/T; half- or full-duplex; asynchronous up to 1200 or 1800 bps; price range reflects 1200/1800 bps rate and 2-/4-wire operation over four models—$425 to $535 prch.

VA3413 DUAL ACOUSTIC COUPLER
DDD network via acoustic coupling; compatible with Bell System modems 103 and 113; compatible with Racal-Vadic modem VA3400; full-duplex; asynchronous up to 300 bps; synchronous at 1200 bps; standalone—$895 prch.

VA3450 SERIES TRIPLE MODEMS
DDD network via direct connection; point-to-point operation over an unconditioned 2-wire dedicated Type 3002 voice channel; compatible with Bell System modems 103A/F/J, 113A/B/C/D, and 212A; compatible with Racal-Vadic VA3400 modems; full-duplex; asynchronous at data rates up to 300 bps or 1200 bps; synchronous at 1200 bps; standalone—$775 to $900 prch.

VA3467 SERIES TRIPLE FULL-DUPLEX MODEM
DDD network via direct connection; compatible with Bell System modems 103 and/or 212A; compatible with Racal-Vadic modem VA3400; full-duplex; asynchronous at data rates up to 300 bps or 1200 bps; synchronous at 1200 bps; standalone—$650 to $800 prch.

VA3480 SERIES TRIPLE MODEMS
DDD network via direct connection; compatible with Bell System modems 103A/E/J, 113A/B/C/D, and 212A; compatible with Racal-Vadic modem VA3400; full-duplex; asynchronous at data rates up to 300 bps or 1200 bps; synchronous at 1200 bps; rackmount—$645 to $950 prch.

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SERIES 6385
Point-to-point operation over an unconditioned or conditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with Bell System modem 202D; half- or full-duplex; asynchronous at selectable data rates of 1200/1800 bps; standalone—$429 prch.

MODEL 6860 SPEECH/DATA PROCESSOR
Point-to-point operation over a conditioned 4-wire dedicated Type 3002 voice channel; full-duplex; asynchronous at 1200 bps; standalone—$3,000 prch.

RIXON, INC./A SUBSIDIARY OF SANGAMO WESTON

2120 Industrial Parkway
Silver Spring, MD 20904
(301) 622-2121

T103J
DDD network via direct connection; compatible with Bell System modems 103 and 113 and 801A/C Automatic Calling Units; full-duplex; asynchronous at data rates up to 300 bps; standalone—$580 prch.

T108
Point-to-point operation over a 2- or 4-wire dedicated Type 3002 voice channel; compatible with Bell System 100 Series modems and Rixon T103F2 modem; half- or full-duplex; asynchronous at data rates up to 300 bps; standalone—$350 prch.

T113C
DDD network via direct connection; compatible with Bell System modems 103 and 113; full-duplex; asynchronous at data rates up to 300 bps; standalone—$415 prch.

T212A
DDD network via direct connection; compatible with Bell System modems 103, 113, and 212 and 801 Automatic Calling Units; full-duplex; asynchronous at data rates up to 300 bps; synchronous at 1200 bps; standalone—$890 prch.

TA201C
DDD network via direct connection; operation over a 2- or 4-wire dedicated Type 3002 voice channel; compatible with Bell System modems 201B/C and 801 Automatic Calling Units and Rixon T201C modems; half- or full-duplex; synchronous at 2400 bps; standalone—$990 prch.

T202S
DDD network via direct connection; compatible with Bell System modems 202 and 801 Automatic Calling Units; half-duplex; asynchronous at data rates up to 1200 bps; standalone—$580 prch.

T202T
Point-to-point or multipoint operation over an unconditioned or conditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with Bell System 202 Series modems and 829 Auxiliary Sets; half- or full-duplex; asynchronous at 1200/1800 bps; standalone—$480 prch.

T208A/B
DDD network via direct connection; point-to-point operation over an unconditioned 4-wire dedicated Type 3002 voice channel; compatible with Bell System modem 208A/B and Rixon modems T208A and T208B; half- or full-duplex; synchronous at 4800 bps; standalone—$2,985 prch.

R209A
Point-to-point operation over a conditioned 4-wire dedicated Type 3002 voice channel; compatible with Bell System modem 209A; half- or full-duplex; synchronous at 9600 bps; standalone—$6,770 prch.

LDM710 LIMITED DISTANCE MODEM
Point-to-point or multipoint operation over a 2- or 4-wire metallic circuit up to 24.5 miles using AWG; compatible with AT&T Tech Ref Pub 43401; half- or full-duplex; asynchronous at data rates up to 9600 bps; standalone—$295 prch.

LDM720 LIMITED DISTANCE MODEM
Point-to-point or multipoint operation over a 2- or 4-wire metallic circuit up to 20 miles using AWG; compatible with AT&T Tech Ref Pub 43401; half- or full-duplex; synchronous at selectable data rates of up to 19.2K bps; standalone—$495 prch.

ROCKWELL INTERNATIONAL CORPORATION

P. O. Box 3669, RC48
Anaheim, CA 92803
(714) 632-5535

MODEL R24 INTEGRAL MODEM
DDD network via direct connection; operation

over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with Bell System modem 201B/C and CCITT V.26; simplex, half- or full-duplex; synchronous at selectable data rates of 1200/2400 bps; PC Board—$395 prch.

TEK-COM, INC.

2142 Paragon Drive
San Jose, CA 95131
(408) 263-7400

TC2122A

DDD network via direct connection; compatible with Bell System modem 212A and Tek-Com 8000 Series buffers modems; full-duplex; asynchronous at data rates up to 300 bps; synchronous at 1200 bps; standalone—$849 to $995 prch.

TC3001 ACOUSTIC COUPLER/ MODEM

DDD network via DAA or acoustic coupling; compatible with Bell System modem 103; half- or full-duplex; asynchronous at data rates up to 300 bps; standalone—$249 prch.

TC3002 ACOUSTIC COUPLER/ MODEM

DDD network via DAA or acoustic coupling; compatible with Bell System modem 103; half- or full-duplex; asynchronous at data rates up to 300 bps; standalone—$265 prch.

TC3006 ACOUSTIC COUPLER

DDD network via acoustic coupling; compatible with Bell System modems 103F/113A; half- or full-duplex; asynchronous at 300 bps; standalone—$195 prch.

TC3012 ACOUSTIC COUPLER TTL

DDD network via acoustic coupling; compatible with Bell System modem 103/113; compatible with Teletype 43; half- or full-duplex; asynchronous at data rates up to 300 bps; standalone—$195 prch.

TC4007 DIAL MODEM

DDD network via direct connection; compatible with Bell System modems 113B and 103A2; half- or full-duplex; asynchronous at 300 bps; standalone—$365 to $495 prch.

TC5001 LEASE LINE MODEM

Point-to-point or multipoint operation over an unconditioned or conditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with Bell System modems 202/C/D/E/R/T; half- or full-duplex; asynchronous at data rates up to 1200/1800 (optional) bps; standalone—$385 prch.

TUCK ELECTRONICS

3645 Industrial Park Road
Camp Hill, PA 17011
(717) 761-4354

MODELS 1510 AND 1520

DDD network via direct connection; compatible with Bell System modems 103 and 113; full-duplex; asynchronous at 300 bps; standalone—Model 1510, $395 prch; Model 1520, $257.50 prch.

MODEL 1530

DDD network via direct connection; compatible with Bell System modems 103A and 113B; full-duplex; asynchronous at data rates up to 300 bps; standalone—$297.50 prch.

MODELS 1540, 1541, AND 1542

DDD network via direct connection; point-to-point operation over a 2-wire dedicated Type 3002 voice channel; compatible with Bell System modems 103A/E and 113B; half- or full-duplex; asynchronous at data rates up to 300 bps; standalone—Model 1540, $242 prch; Model 1541, $288 prch; PC board—Model 1542, $168 prch.

MODELS 1610 AND 1611 DATASETS

DDD network via direct connection; compatible with Bell System modems 202C/D/R/S/T; half- or full-duplex; asynchronous at data rates up to 1200 bps; standalone—$375 prch.

1600 SERIES ACOUSTIC AND DEDICATED MODEMS

Model 1651: DDD network via acoustic coupling; Models 1630, 1636, 1640, 1650, 1651, 1652, and 1653: point-to-point operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with Bell System modems 202C/D/R/S/T; half- or full-duplex; asynchronous at data rates up to 1200 bps (all models) or 1800 bps (Models 1631 and 1652); standalone models—Model 1650, $242.50 prch; Model 1652, $285 prch; Model 1653, $275 prch; Model 1651, pricing available on request; rackmount models—Model 1630, $232.50 prch; Model 1631, $275 prch.

MODEL 2010 SYNCHRONOUS MODEM

DDD network via direct connection; point-to-point operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with Bell System modems 201A/B/C; compatible with CCITT V.27 bis/ter; half- or full-duplex; synchronous at selectable data rates of 1200/2400 bps; standalone—$1,200 prch.

2120 SERIES SHORT HAUL MODEMS

Point-to-point operation over a 2- or 4-wire metallic circuit up to 9 miles; half- or full-duplex; synchronous at data rates up to 9600/19.2K bps; standalone—pricing available on request; rackmount—$350 to $425 prch.

U.S. ROBOTICS, INC.

National Sales/Leasing Company
203 North Wabash
Chicago, IL 60601
(312) 346-5651

U.S. ROBOTICS PHONE LINK

DDD network via acoustic coupling; compatible with Bell System modems 103 and 113; half- or full-duplex; asynchronous at data rates up to 300 bps; standalone—$179 prch.

USR-330D/330A

DDD network via direct connection; compatible with Bell System modems 103 and 113; half- or full-duplex; asynchronous at data rates up to 300 bps; standalone—$339 to $399 prch.

UNIVERSAL DATA SYSTEMS

5000 Bradford Drive
Huntsville, AL 35805
(205) 837-8100

103LP

DDD network via direct connection; compatible with Bell System modems 103 and 113; full-duplex; asynchronous at data rates up to 300 bps; standalone—$195 prch.

103JLP

DDD network via direct connection; compatible with Bell System modems 103 and 113; full-duplex; asynchronous at data rates up to 300 bps; standalone—$245 prch.

103-1 AND 103-2

DDD network via DAA; full-duplex; asynchronous at 300 bps; standalone—$295 prch.

103J AND 113D

DDD network via direct connection; full-duplex; asynchronous at 300 bps; standalone—Model 113D, $375; Model 103J, $450 prch.

212A

DDD network via direct connection; compatible with Bell System modems 103, 113, or 212A; full-duplex; asynchronous at data rates up to 300 bps; synchronous at 1200 bps; standalone—$900 prch.

201B AND 201C

DDD network via direct connection; point-to-point operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; half- or full-duplex; synchronous at 2400 bps; standalone—Model 201B, $845 prch; Model 201C, $915 prch.

202LP

DDD network via direct connection; compatible with Bell System modems 202 series; half-duplex; asynchronous at data rates up to 1200 bps; standalone—$295 prch.

202S

DDD network via direct connection; point-to-point operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; half- or full-duplex; asynchronous at data rates up to 1200 bps; standalone—$515 prch.

202D AND 202T

Point-to-point operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with Bell System modem 202 series; half- or full-duplex; asynchronous at data rates up to 1800 bps; standalone—Model 202D, $425 prch; Model 202T, $445 prch.

12.12

DDD network via DAA; point-to-point operation over an unconditioned 2-wire dedicated Type 3002 voice channel; full-duplex; asynchronous at data rates up to 1200 bps; synchronous at 1200 bps; standalone—$600 prch.

208 A/B

DDD network via direct connection; operation over an unconditioned or conditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with Bell System modems 208A or 208B; half- or full-duplex; synchronous at 4800 bps; standalone—$2,450 prch.

VALTEC CORPORATION

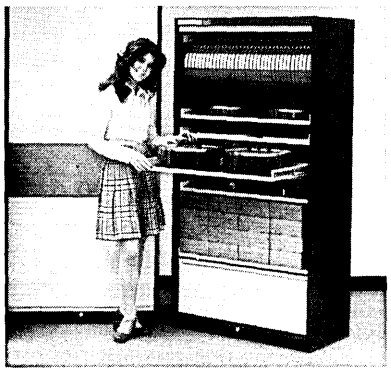
99 Hartwell Street
West Boylston, MA 01583
(617) 835-6082

RSK-D1

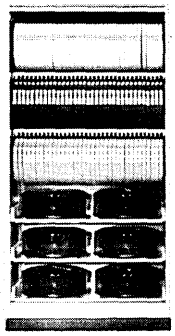
Point-to-point operation over a fiber optics cable up to 3,300 feet or one kilometer; 10,000 feet optional; full-duplex; asynchronous at data rates up to 100K bps; standalone—$625 prch.

SRSK-D1

Point-to-point operation over a fiber optics cable up to 3,300 feet or one kilometer; 10,000 feet optional; full-duplex; synchro-

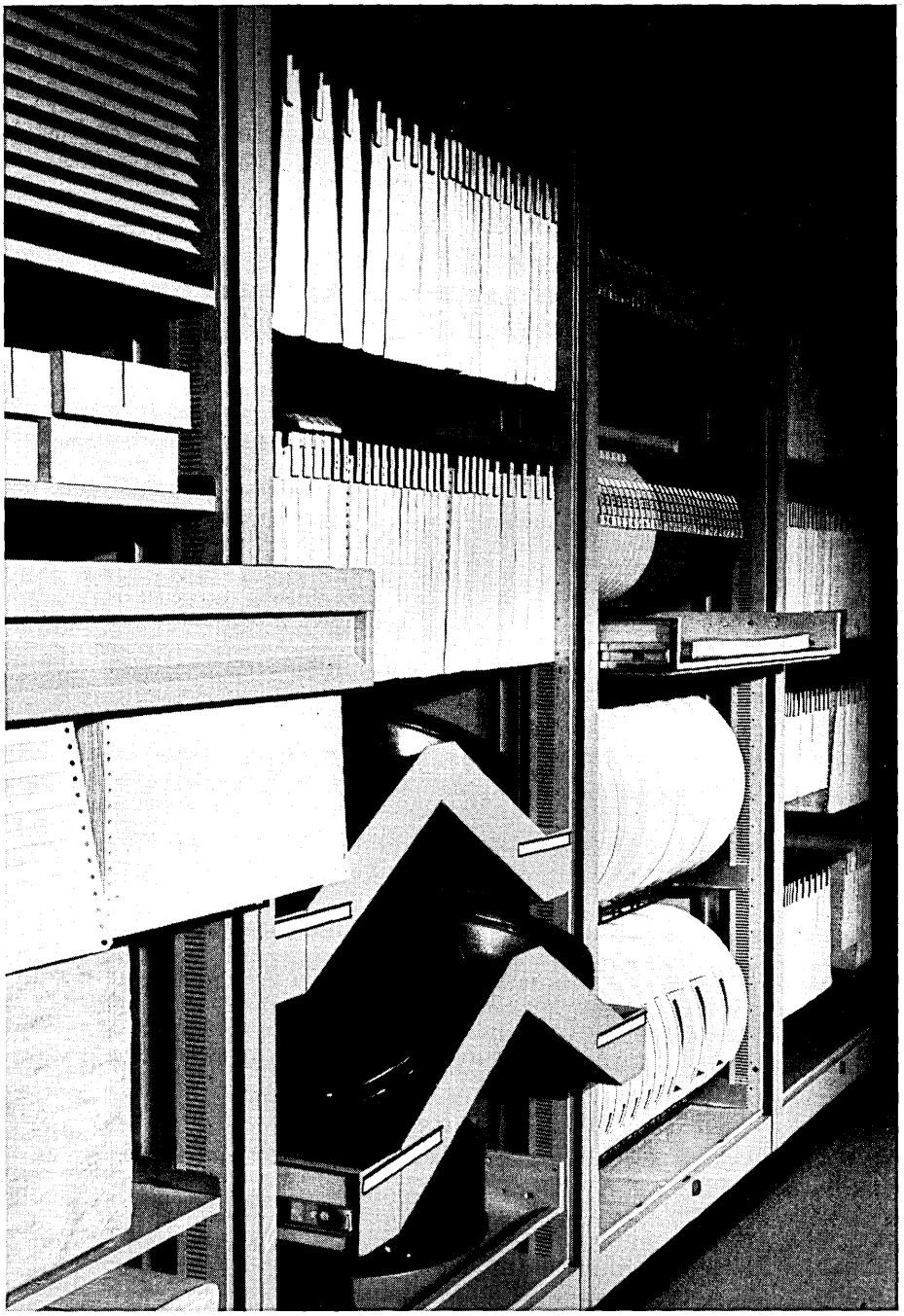


1972 Bought first Optimedia cabinets to file remaining punch cards, 1316 disc packs and reels of 1600 BPI tape.



1975 Media changed to include 3336 packs in addition to tape. Cabinets reconfigured, new cabinets added.

1978 New system required 3348 disks but no tape. Manuals and run books added. Cabinets again adapted to needs.



1981 Optimedia usage has grown to include a wide variety of computer room media, systems and programming documentation and printout reports in all departments of the company. As media has changed, the Optimedia cabinets have been reconfigured to meet each new filing need.

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Because you don't know how your filing requirements may change in years ahead.

The days of single-purpose, soon-to-be-obsolete cabinets for D.P. records, documents and reports were struck a blow in 1972. That's the year Optimedia was introduced to computer rooms. Now these cabinets have become industry standards wherever D.P. media is filed. It's the filing cabinet with 99 lives. Find out why, circle the readers' service number or write today for our free brochure. Wright Line Inc., 160 Gold Star Boulevard, Worcester, Massachusetts 01606.

Wright LINE

a unit of Barry Wright

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nous at 16 selectable data rates of up to 252K bps; standalone—$725 prch.

TTK-D1

Point-to-point operation over a fiber optics cable up to 3,300 feet or one kilometer; 10,000 feet optional; full-duplex; asynchronous or synchronous at data rates of 10K to 10M bps; standalone—$595 prch.

VEN-TEL, INC.

2390 Walsh Avenue
Santa Clara, CA 95051
(408) 727-5721

AC103 ACOUSTIC COUPLER/ MODEM

DDD network via DAA or acoustic coupling; compatible with Bell System modems 103 and 113 series; half- or full-duplex; asychronous at data rates up to 300 bps; standalone—Model AC103-1, $245 prch; Model AC103-3, $270 prch.

MD103/113

DDD network via direct connection; point-to-point operation over a 2-wire dedicated Type 3002 voice channel; compatible with Bell System modems 103 and 113 series; half- or full-duplex; asynchronous at data rates up to 300 bps; standalone—$230 to $395 prch.

MD201

DDD network via direct connection; point-to-point or multipoint operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with Bell System modems 201A/B/C; half- or full-duplex; synchronous at 2400 bps; standalone—$675 prch.

MD202

DDD network via direct connection; point-to-point or multipoint operation over an unconditioned 2- or 4-wire dedicated Type 3002 voice channel; compatible with Bell System modem 202S/T; half- or full-duplex; asynchronous at data rates up to 1200/1800 bps; standalone—$350 to $380 prch.

MD212

DDD network via direct connection; compatible with Bell System modems 212A, 103, and 113 series; full-duplex; asynchronous at data rates up to 300 bps; synchronous at 1200 bps; standalone—$850 to $995 prch.

MD212-PLUS

DDD network via direct connection; compatible with Bell System modems 103, 113, and 212A; full-duplex; asynchronous at data rates up to 300 bps; synchronous at 1200 bps; standalone—$995 prch.

ALD ASYNCHRONOUS LINE DRIVER

Point-to-point or multipoint operation over a 2- or 4-wire metallic circuit up to 20 miles using AWG; compatible with AT&T Tech Ref Pub 43401; half-duplex; asynchronous at data rates up to 9600 bps; standalone—$275 to $320 prch.

SLD SYNCHRONOUS LINE DRIVER

Point-to-point or multipoint operation over a 4-wire metallic circuit up to 20 miles using AWG; compatible with AT&T Tech Ref Pub 43401; half- or full-duplex; synchronous at data rates up to 19.2K bps; standalone—$450 prch.

VERSITRON, INC.

6310 Chillum Place, N.W.
Washington, DC 20011
(202) 882-8464

NODEM MODEM ELIMINATOR

Point-to-point operation over a 4-wire cable between business machines located up to three miles apart; full-duplex; asynchronous or synchronous at selectable data rates of 2400/4800/9600/19.2K bps; standalone—$500 prch.

VERSITRON FOM-3 FIBER OPTIC MODEM

Point-to-point operation over a fiber optics cable up to 3,300 feet or one kilometer; asynchronous at data rates up to 9600 bps; synchronous at 56K bps; standalone—$880 prch.

WANG LABORATORIES, INC.

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

WA3451

DDD network via direct connection; compatible with Bell System modems 212A, 103J, and Racal-Vadic modem 3400; half- or full-duplex; asynchronous at data rates up to 300 bps; synchronous at 1200 bps; standalone—$1,050 prch. ✻

PARTIAL CALENDAR

SEMINAR	LOCATION	DATE
INTRODUCTION TO DATA COMMUNICATIONS	Chicago	Oct 14-16
	Boston	Oct 21-23
	Detroit	Oct 21-23
	New York	Nov 4-6
	Los Angeles	Nov 4-6
	Washington	Nov 18-20
	San Francisco	Dec 2-4
	Atlanta	Dec 2-4
	Dallas	Dec 2-4
	Denver	Dec 7-9
DATA COMMUNICATIONS NETWORK COMPONENTS	San Francisco	Oct 14-16
	Washington	Nov 16-18
NETWORK DESIGN I	Washington	Oct 21-23
	San Francisco	Nov 4-6
NETWORK MANAGEMENT	New York	Oct 21-23
	San Francisco	Nov 4-6
	Chicago	Dec 16-18
CORPORATE NETWORK ARCHITECTURES	San Francisco	Oct 28-30
	Washington	Nov 4-6
BUSINESS TELECOMM. I	New York	Oct 6-8
	Boston	Nov 2-4
	San Francisco	Nov 16-18
	Chicago	Dec 2-4
INTRODUCTION TO INTERNATIONAL TELECOMM.	New York	Oct 7-9
	Los Angeles	Dec 9-11
SYSTEMS NETWORK ARCHITECTURE	New York	Oct 14-16
	San Francisco	Nov 4-6
	Boston	Nov 18-20
	Chicago	Dec 9-11
LOCAL AREA NETWORKS	Chicago	Oct 14-16
	New York	Nov 18-20
	San Francisco	Dec 16-18
COMMUNICATION TECHNOLOGY TRENDS 1-DAY BRIEFING	Chicago	Oct 23
	Washington	Oct 30
	New York	Nov 20
	San Francisco	Dec 11
COMMUNICATION TECHNOLOGY TRENDS 2-DAY COURSE	Washington	Oct 28-29
	San Francisco	Dec 9-10

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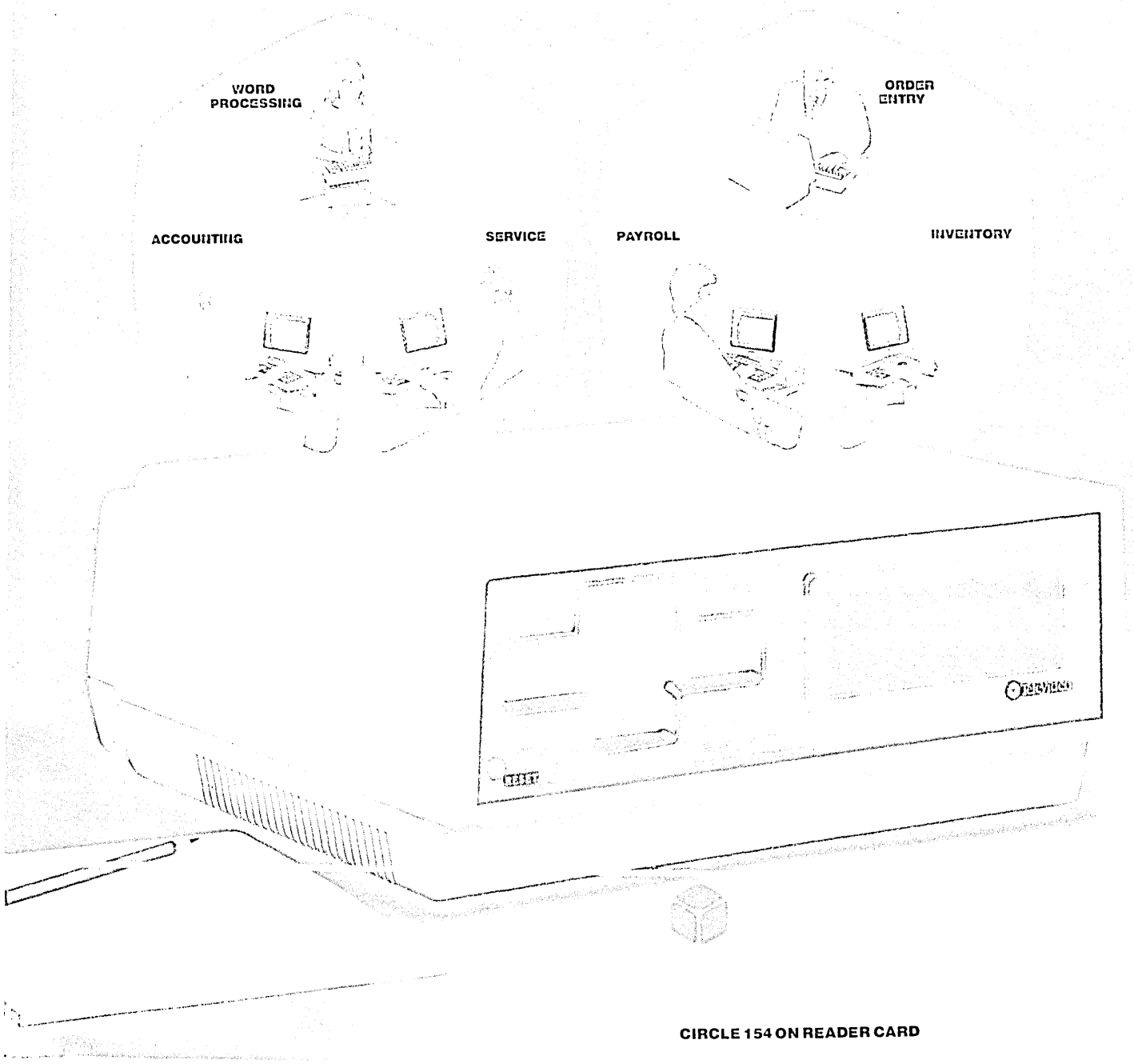

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☐ Please send me the complete MDBS III manual set including manuals for MDBS III, RTL, QRS, and DMU plus tutorial materials. Check for $75.00 enclosed. (Indiana residents please add $3.00 for Indiana tax.)

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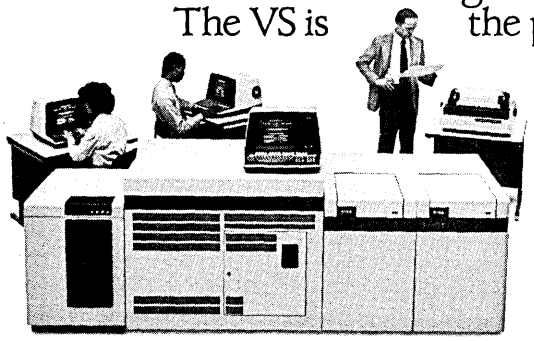

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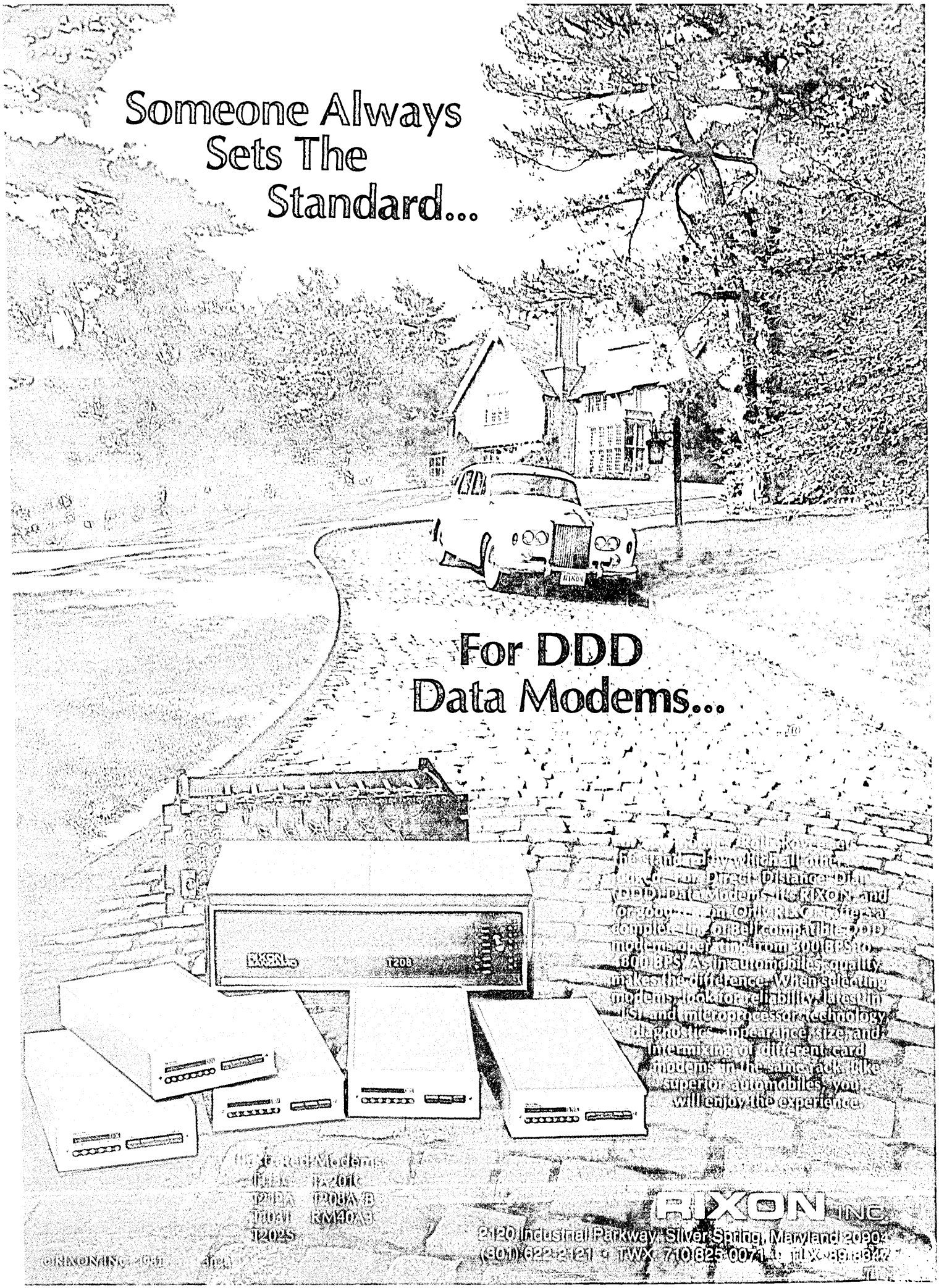
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HARDWARE

OFF-LINE

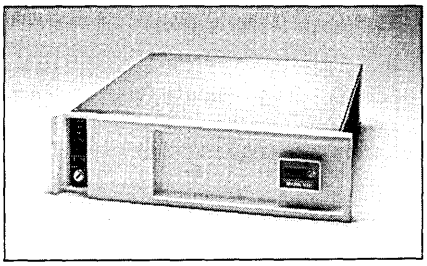
Control Data Corp. reports the first customer acceptance of its most powerful supercomputer, the Cyber 205. The United Kingdom Meteorlogical Office took delivery of the first Cyber 205 shipped; CDC reports that seven more of the 8100 MIPS processors have been ordered. Three early Cyber 200-series machines, 203s, have been installed, one in CDC's Cybernet computer services operation and two in U.S. government facilities.

Does IBM's recently announced System/23 Datamaster suffer from the 90% syndrome? A friend of ours took delivery within a week of receiving credit approval, but the accompanying documentation -- volumes of it to be sure -- did not include two volumes covering the Datamaster's implementation of BASIC. A quick call to IBM resulted in a variant of one of American business' most famous sayings: "The books are in the mail."

Strategic Inc., formerly known as Strategic Business Services, has issued a report predicting an annual average growth rate of 115%, compounded, for the voice output market over the next four years. The report, entitled Voice Input/Output: Markets, Technologies & Applications, says the market will grow from $23 million in 1981 to $95 million in 1985. Speech recognition systems will trail behind output devices, although they too will experience rapid growth. Strategic's figures show growth at an 82% rate, from $15 million this year to $150 million in 1985. Strategic Inc. is located in Palo Alto, Calif.

MINICOMPUTER & TURNKEY SYSTEM

Point 4 Data Corp. announced its promised new top-of-the-line processor, the Mark VIII, and a turnkey system with software for project management and control using PERT and CPM (Critical Path Method, not the microcomputer operating system).



While the Mark VII cycles at 400nsec, just as its nearest neighbor in the family, the Mark V, the VII is said to run at up to twice the earlier machine's speed, due to the addition of new microcoded instructions. Borrowing from the philosophy behind the original Nova, upon which architecture the Point 4 processors are based, the new instructions are used by the IRIS operating system; processors not having the extra instructions trap the operations and execute them as native-mode subroutines (much like an early Nova without hardware multiply and divide). Revision 8 of IRIS is due by year's end, and a disk cache with up to 2MB of buffering is in the works. With the cache and an extended translation microinstruction, paging and swapping time should be cut, and a virtual memory operating system may be in the offing. A Point 4 Mark VIII with a full complement of 128KB of main memory sells for $10,700; oem discounts are offered on the machines, with deliveries scheduled to begin in mid-November.

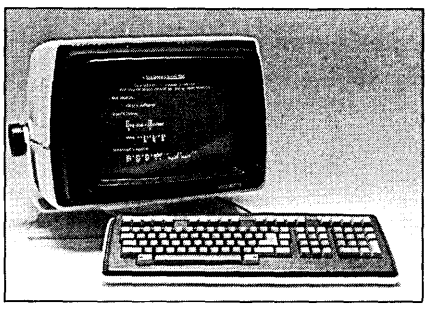
FOR DATA CIRCLE 301 ON READER CARD

For project management, Point 4 has taken its Readinet project control software (written in Business BASIC) and bundled it in two basic configurations, one based on the Mark III processor, the other on the Mark V. The bundled system, called 4Site, comes in two models, the 4Site 300 (Mark III) and the 4Site 500 (Mark V). The 300 supports up to three concurrent users, and sports 64KB of main memory, a four-port mux, 200 lpm printer, and a minimum of 16KB of disk. Base price for a minimal 4Site 300 system is $28,500. The larger 4Site 500 supports up to 16 users, up to 128KB of memory, and a 300 lpm printer. Configured with an eight-line mux and four crt terminals, the 500 lists at $65,500. POINT 4 DATA CORP., Irvine, Calif.

FOR DATA CIRCLE 302 IN READER CARD

COLOR TERMINAL

Data General joined the ranks of color alphanumeric display terminal manufacturers with the introduction of its Dasher D280C eight-color crt terminal. Designed for applications where color can dramatically highlight text, the D280C contains 128 upper and lower case ASCII characters, plus storage for an additional 128 user-designed symbols. These user-definable characters can be used for limited graphics, such as building line and bar graphs. As some other manufactur-

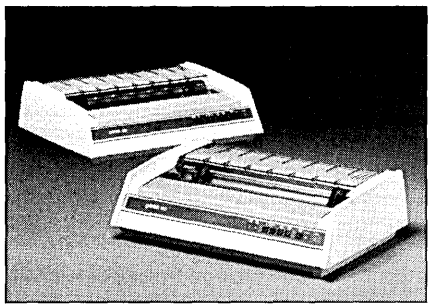


ers have done, DG has included seven alphanumeric character sets in its new terminal for international use; the keyboard is configured in the user's language. The alphabets are American, British, Danish/Norwegian, French, German, Spanish, and Swedish/Finnish. Additionally, each keyboard has a 14-key numeric pad, 12-key screen management keypad, 15 program function keys, and five operator function keys. The D280C's display measures 13 inches diagonally, and has a format of 24 lines of 80 characters. Compatible with Dasher D100 and D200 displays in single-color mode, the D280C can communicate at seven standard speeds ranging up to 9600bps. The unit can link to a computer via a 20mA current loop or RS232 interface. The terminal lists for $3,750 ($3,500 for the display, and $250 for the keyboard). The terminal is available 120 days from DG's Special Systems Group. DATA GENERAL CORP., Westboro, Mass.

FOR DATA CIRCLE 303 ON READER CARD

PRINTERS

Printek is a new printer company in Benton Harbor, Mich. Started by a pair of Heath/Zenith Data Systems alumni and three veterans of NEC, Teradyne, and Telecommunications Systems, Printek's first products are a pair of dot matrix impact printers—the 900 series printer line. The initial two models, the 910 and 920, share many features and common parts, and differ only in rated print speeds: the 910 runs to 170cps, while the 920 runs to 340 cps. The upper and lower case ASCII printers feature true descenders, underlining, super- and subscripting, and raster-scan, dot-addressable graphics with 144 point per inch resolution (horizontal and vertical). The tractor-fed printers can handle paper widths ranging from 2½ inches to 16 inches, and forms lengths to 24 inches; the paper path allows loading from the front, rear, or bottom. Both printers support eight character sizes—10, 12, 13.3, and 16.7 pitch, in single or double width; four line spacings are selectable: 6, 8, 12, or 16 lines per inch. There is also provision for down-line loading a custom designed character set. RS232 intefacing is standard, with six selectable data rates ranging from 300bps to 9600bps; a 1,972 character buffer protects against lost data at higher data rates. Options include modem control and parallel interfacing. The printer series has been designed for worldwide use, with a power supply that accepts line power at standard voltage levels from 110 volts to 240 volts, 50Hz or 60Hz, and compliance with FCC Class B, UL, VDE, and CSA safety standards. The 910 lists at $1,695, and the 920 is $2,345. Quantity discounts are offered. PRINTEK, INC., Benton Harbor, Mich.



FOR DATA CIRCLE 304 ON READER CARD

GRAPHICS

Calcomp, probably best known for its pen and ink plotters, has broadened its graphics line with the addition of three raster scan refreshed graphics displays and a 36-inch wide electrostatic printer/plotter.

Manufactured by CalComp's parent company, Sanders Associates, the Vistagraphic 3000 family of interactive color graphics displays comes in three basic models. The three models are totally program-compatible with the extant Vistagraphic 1000 series of stroke displays, due to the use of identical display processors. The first in the new line, the 3100, uses a display processor with 32KB of memory, a graphic control processor with its control program in firmware, and a full ASCII keyboard with 32 function keys. Next up is the 3200, with larger memory (64KB) and two-dimensional capabilities provided by 2-D coordinate converters. For 3-D applications, the 3300 has a memory of 128KB and 3-D coordinate converters.

All three models have double-buffered image memories and 19-inch display screens. Four screen resolutions are available—512 × 512, 640 × 480, 1024 × 768, and 1024 × 1024—with either four or eight bits per pixel.

The two highest resolutions come interlaced, while the other two can be had interlaced or noninterlaced. The standard format is 640 × 480 interlaced, with four bits per pixel. A programmable color look-up table is standard, allowing 16 colors (four bits per pixel) or 256 colors (eight bits per pixel). Prices start at $33,000.

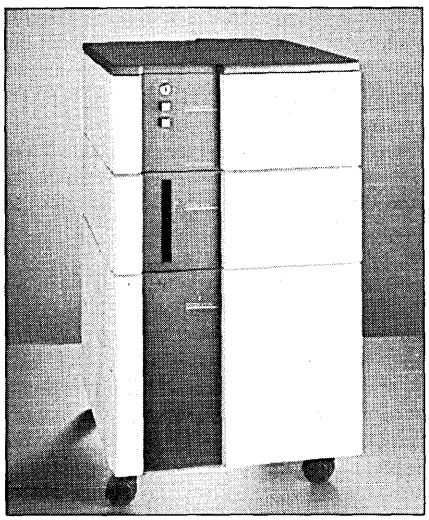
FOR DATA CIRCLE 305 ON READER CARD

The Model 5500 electrostatic printer/plotter is a 200 dot per inch, 36-inch wide unit that can plot at up to 1.62ips and print at up to 777 1pm. It is both the widest and first electrostatic unit developed by CalComp; CalComp's other electrostatic plotters were

HARDWARE SPOTLIGHT

MULTI-USER MICRO

Zilog has taken Bell Lab's UNIX operating system, added extra system utilities and application development tools, and implemented the extended operating system, known as ZEUS on a Z8000-based 16-bit microcomputer. ZEUS provides the operating environment on Zilog's new System 8000 multiuser microcomputer system. Because the UNIX kernel remains intact, applications developed for the seventh edition of UNIX are said to be transportable to the System 8000 if they are written in C, COBOL, or Pascal. ZEUS additions include system utilities for file management, communication, reporting status, system accounting, and interpreting commands. The system can be more easily tailored to its users because the command interpreter is selectable on a per-user basis. Initial communications capabilities allow asynchronous communications with other systems running UNIX or ZEUS. Development tools include language processors for C, PLZ/SYS, and PLZ/ASM (an assembler); optional languages include Pascal and COBOL compilers. A screen-oriented text editor, which works with virtually any cursor-addressable crt, also has been included in ZEUS.



To host the new software, Zilog introduced its System 8000, built around 6MHz segmented Z8001A 16-bit microprocessor. The cpu card also has three on-board Memory Management Units (Z8010As) that support segmented and nonsegmented processes. Main memory size ranges from 256KB to 1.5MB, in 256KB increments. Initially, users will have to make do with 128KB address spaces, divided equally between data and code; future releases of ZEUS are planned to increase the user address space to 8MB. The system bus has been designed with additional lines for the future inclusion of 32-bit micros. There are also 8-bit micros (Z80s, of course) on the bus; these are used as intelligent I/O controllers for disks, cartridge tape, and terminals. An eight-user System 8000, with 24MB of Winchester disk, cartridge tape, two intelligent controllers, and all ZEUS software goes by the name of the Model 20, and sells for $29,950. Model 30, with 512KB of memory, and a pair of 24MB disks, sells for $37,950, inclusive of software. Expansion kits to add eight more users at a time sell for $6,950. Deliveries are to begin this month. ZILOG, INC., Cupertino, Calif.

FOR DATA CIRCLE 300 ON READER CARD

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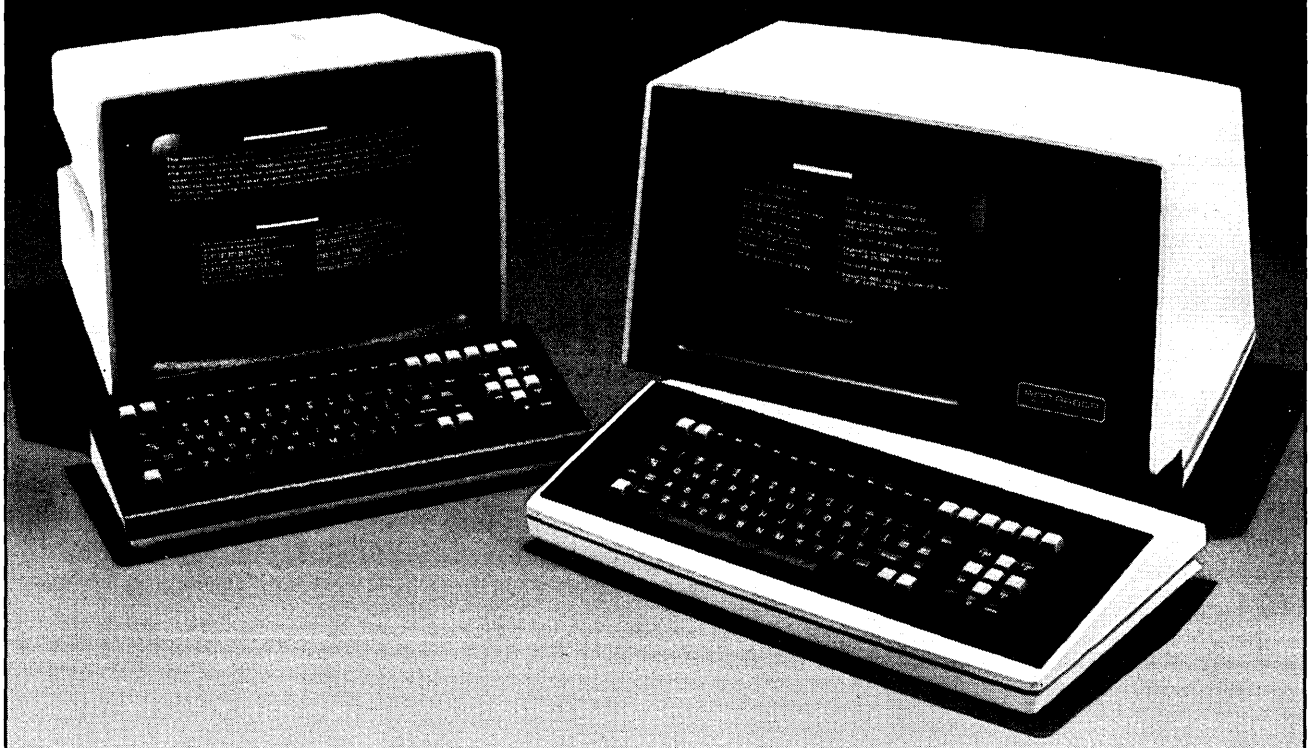

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CIRCLE 158 ON READER CARD

acquired from Gould. The plotter has a base price of $40,000.

Interfaces are available for Tektronix 4000 series of DVST graphics terminals, and minicomputers from DEC, Data General, and Hewlett-Packard. The 5500 also can be used with CalComp's 951 or 953 vector-to-raster controllers, so it can plot directly from CalComp format vector tapes or on-line. CALIFORNIA COMPUTER PRODUCTS, INC., Anaheim, Calif.

FOR DATA CIRCLE 306 ON READER CARD

COMMUNICATIONS

Computer Automation expanded its communications capabilities with the introduction of a dual bisync (BSC) option for the company's SyFA systems equipped with Model II processors. The $4,000 microprocessor-based controller allows 3780 RJE or HASP batch data entry to run concurrently with 3270 emulation; previously, only one mode of operation was allowed on a system at any given time. SyFA Dual BSC works with a SyFA Network Processor equipped with 128KB of memory and running the SyCLOPS (SyFA Concurrent Operating System). A typical configuration could consist of three crts performing 3270 interactive inquiries over the same link, and a fourth crt controlling 3780 or HASP batch transmissions over a second link. Synchronous modems are required, and the communications links can run to 4800bps. The 3270 communications emulator needs a leased line, while the batch communications line may be either leased or dial-up. COMPUTER AUTOMATION, INC, Commercial Systems Div., Irvine, Calif.

FOR DATA CIRCLE 307 ON READER CARD

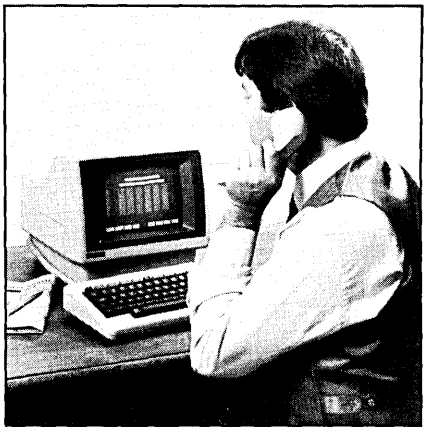
TERMINALS

HP released its least expensive graphics terminal and an inexpensive "office display terminal" for use by managers and other office personnel.

The HP2623A graphics terminal has a 512 × 390 point screen resolution, and separate graphics and alphanumeric memories. An optional integrated thermal graphics printer can be used to create hard copies of an image on the screen. Local intelligence supports the addition of annotation on graphics and user-defined area shading. The 2623A is supported by HP's DSG/3000 business-oriented graphics software, Graphics/1000-II technically-oriented software, and third-party packages including Tektronix's PLOT 10. The HP2623A sells for $3,750; the integrated thermal printer brings the terminal's price up to $4,960. A line drawing character set, and six national language keyboard options are priced at $105 apiece.

FOR DATA CIRCLE 308 ON READER CARD

The nine-inch HP2382A is a small block-mode terminal with a 24 line × 80



column display format. The detached keyboard has eight screen-labeled softkeys, each capable of generating a message of up to 80 characters. Software compatible with HP's 2622A and 2640B terminals, the 2382A can operate in block, line, or character modes using full-duplex asynchronous communications over an RS232 interface. The basic 2382A sells for $1,700; options include a line drawing character set and six national keyboards, each priced at $80. HEWLETT-PACKARD CO., Palo Alto, Calif.

FOR DATA CIRCLE 309 ON READER CARD

WORD PROCESSING

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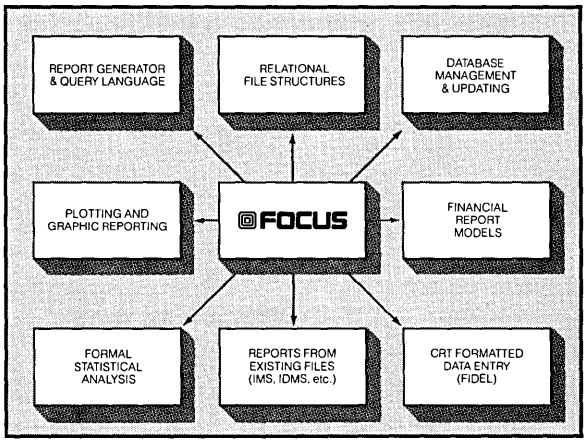

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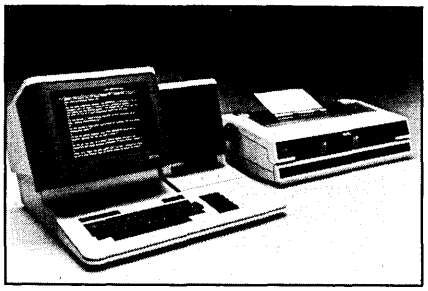
CIRCLE 160 ON READER CARD

alone Omniwriter and the Royal Shared System—of word processing gear, developed by Omnidata, another TA subsidiary. Omniwriters also can be participants in a Shared System.

The Omniwriter, as one might guess from its name, is targeted at the same market as IBM's Displaywriter. Designed as a three-piece modular system consisting of a 24 line × 80 character display, diskette drives, and keyboard, the Omniwriter has three levels of increasing software support: Word-Pack, Text-Pack, and Info-Pack. As the software level increases, Royal adds necessary memory (from 96KB to 192KB) and an appropriate keyboard. Priced at $7,800, including software, the Word-Pack configuration provides simple text entry, editing, storage, and print functions. Hardware includes 96KB of working memory, a single diskette drive (120 pages per diskette), a simplified keyboard, and a 17cps daisywheel printer. The software supports background printing, a merge function for form letters, block moves, underlining, centering, pagination, justification, global search and replace, column functions, and proportional spacing at 10-, 12- or 15-pitch. Text-Pack makes use of the standard Royal 7000 keyboard and 128KB of memory, and extends Word-Pack functions to include document assembly, sorting, selective retrieval and print-merge, and in-text math functions; it is priced at $8,500. The $12,000 Info-Pack configuration has an Info-Pack keyboard, 160KB of memory, dual diskettes, and a 45cps daisywheel printer. Info-Pack unleashes the Omniwriter's TI-9900 cpu, allowing the user to develop programs in assembler, COBOL, Pascal, FORTRAN, and BASIC. Users can have the results of processing automatically stored at the proper place within a text document.

For its shared system, Royal initially offers a choice of two cluster controllers



and two shared system terminals; any of Royal's existing word processors, including the Omniwriter, can be linked into a shared system. The 500-Series Cluster Controller contains either 32MB of disk (model 505), or 96MB (model 508), and handles the resource sharing of terminals, printers, and disk. Using twisted pairs, up to 12 terminals can be connected to a Model 505 or up to 16 to a Model 508; 14 or 18 printers, respectively, are supported by the controllers. The controllers sell for $21,500 (505), and $25,000 (508). The 100 Series Shared Terminals include the local intelligence and software for text editing and processing. The Model 100 includes a 24 line by 80 column display, detached keyboard, and a printer controller capable of interfacing to a 45cps daisywheel printer; it sells for $6,200. For $9,000, the Model 102 adds a pair of local diskette drives to the Model 100. ROYAL BUSINESS MACHINES, INC., Hartford, Conn.

FOR DATA CIRCLE 312 ON READER CARD

GRAPHICS CONTROLLER

Raster Technologies' Model One graphics controller can be used either as an interactive or output-only device, sitting between a computer and a color monitor. The graphics controller offers two standard resolutions—512 by 512 pixels, and 1024 by 1024 pixels—with the lower resolution for imaging, and the higher resolution for full screen line drawing. Model One's display memory can be expanded to 768KB, yielding 24 bits per pixel in 512 by 512 imaging mode, or six bits per pixel in 1024 by 1024 line drawing mode. Drawing modes are software selectable. Model One uses a 16-bit Z8000 processor and a high-speed vector processor that handles line generation instructions. Options include DMA to the image memory

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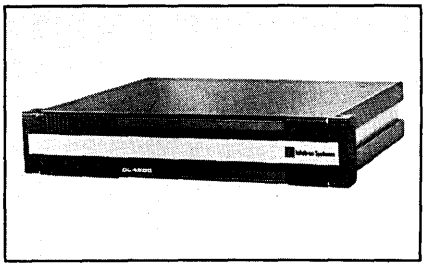
CIRCLE 163 ON READER CARD

(at up to 3.75 MBps), and an additional memory plane for overlaying alphanumeric information on the display. Hardware pan and zoom (1X, 2X, 4X, and 8X) are standard, and interactive input devices—including digitizers and joysticks—can be supported by the Model One. The controller responds to commands issued by FORTRAN programs running on the host. To aid debugging, there's a command stream translator that displays commands as they are sent from the host to the controller, and an "instant replay" feature for diagnosing erroneous command sequences. The basic Model One, packaged as a table-top controller, sells for $10,800. It can be shipped with the user's choice of monitors and graphics peripherals, and quantity oem discounts are available. RASTER TECHNOLOGIES, INC., Troy, N.Y.

FOR DATA CIRCLE 311 ON READER CARD

MODEM

Infotron Systems' latest modem, the DL 4800, is a microprocessor-based 4800bps unit for synchronous multidrop polled and point-to-point applications. The unit operates in full-duplex over four-wire and half-duplex on two-wire Type 3002 unconditioned lines; it is compatible with Bell's 208. Self-testing is standard, and remote unattended units can be put through tests including analog and digital loopback. A

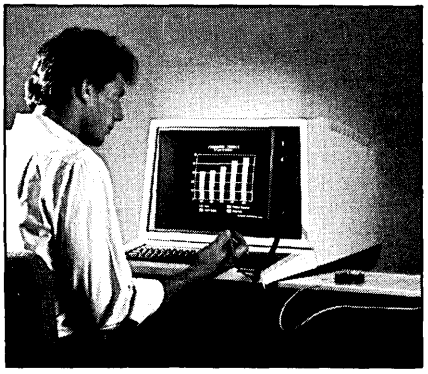


standalone DL 4800 sells for $3,600, while a DL 4800 integrated into an Infotron Supermux sells for $3,200. INFOTRON SYSTEMS CORP., Cherry Hill, N.J.

FOR DATA CIRCLE 319 ON READER CARD

COLOR GRAPHICS

Until the end of this year, Ramtek will be selling its RM-6211 desktop raster scan color graphics terminal at an introductory price of $5,995. Featuring pixel-addressable graphics, the RM-6211 has a 13-inch monitor and offers two resolutions: 640 × 480 pixels at a 30Hz refresh rate (interlaced), and 640 by 512 pixels at 60Hz. The terminal has RS232 interfacing for communications with a host, and BNC connectors for daisy-chaining slave display monitors. Four video refresh memory planes are standard, allowing display of up to 16 colors (selected from a palette of 64), or eight colors plus either an alphanumeric overlay or a blink function. Ramtek's Colorgraphic Programming Language provides the 6211 user with a set of English language commands for getting started in color graphics, or adding color to existing graphic applications. The Ramtek terminal



is compatible with DEC's VT-100, and a number of software packages, including Tektronix Plot 10, and ISSCO's DISSPLA and TELL-A-GRAF, to mention a few. The terminal has a parallel output port that can drive Centronics (and compatible) devices, including Ramtek's 4100 color printer. Digitizers, light pens, and additional memory are available as options. RAMTEK CORP., Santa Clara, Calif.

FOR DATA CIRCLE 315 ON READER CARD

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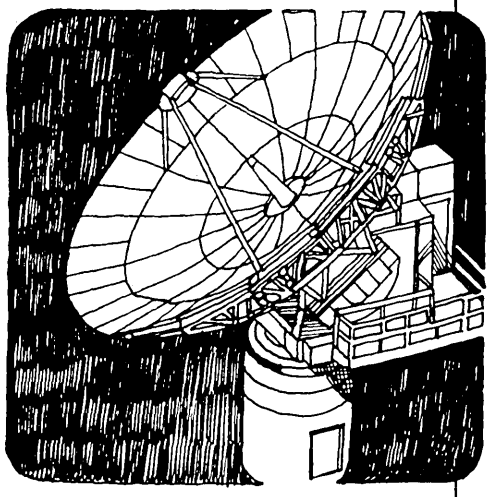

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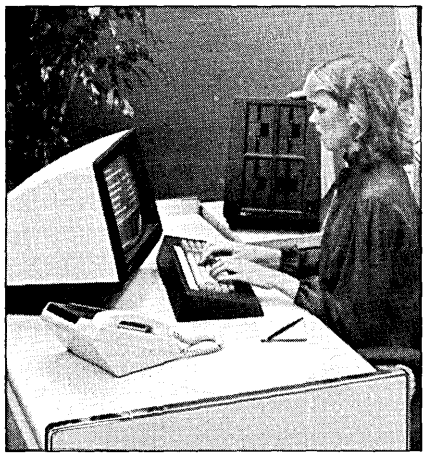

tems; witness IBM, Xerox, Data General, Digital Equipment, Hewlett-Packard, etc. Now, Northern Telecom's Electronic Office Systems has brought forth its Model 503, a microprocessor-based desktop system combining data processing, word processing, and communications functions in a system starting at $6,490. The basic 503 comprises a microcomputer with 64KB of memory, a 15-inch, 2,000 character display screen, detachable keyboard with numeric pad, and dual minidiskettes (each with 800KB capacity). An additional pair of floppy drives and either a Sprinter or Striker printer can be added. For word processing, the 503 can run Omniword ($750); for dp, applications may be written in BASIC, COBOL (screen interactive and background batch), or TAL 2000, a proprietary data entry language. Model 503 can operate at up to 9600bps in a communications environment using asynchronous, bisync, or SDLC protocols. Additionally, it can be a part of an Omnilink local network, communicating with other Northern Telecom processors via co-ax cable. NORTHERN TELECOM INC., Electronic Office Systems, Minneapolis, Minn.

FOR DATA CIRCLE 313 ON READER CARD

GRAPHICS

Megatek has come up with another hardware option—a 3-D surface processor—to increase the capabilities of its Whizzard 7200 family of sophisticated computer graphics systems. The 3-D surface processor can be added easily to the Graphics Engine of any 7200: the 7210 stroke refresh system, the 7250 raster refresh system, or the 7290 dual-output stroke and raster refresh systems. Once installed, the option allows users to fill any part of a line drawing, thus creating solid, textured, or patterned surfaces. The 3-D surface processor can work with both monochrome and color displays, allowing the user to specify a polygon (of up to 670 sides), fill density, and any of the Whizzard's standard line styles to be combined with fill lines. Once an object has been filled with color, its outline may be redrawn in a different color. The bit-slice, pipelined 3-D surface processor even handles holes in a surface; as the object is rotated, graphics behind a hole become visible. The 3-D surface processor can be used with or without the optional hardware module for clip, rotate, scale, and translate functions (HCRST). The surface processor is slated for first deliveries in December; its price is roughly $5,000. MEGATEK CORP., San Diego, Calif.

FOR DATA CIRCLE 314 ON READER CARD

5¼ INCH WINCHESTER DISK CONTROLLER

Xebec has designed a controller for Seagate Technology (and compatible) 5¼-inch Winchester disks. Dubbed the S1410, the controller provides a host interface compatible with Shugart Associates' SA 1400 and Data Technology Corp.'s DTC 510 controllers, allowing use of host adaptors from either of the two competitors to provide an interface to computers using Q-bus, Multibus, S-100, and Apple bus specifications.

Key features of the S1410 stressed by Xebec include small size (one pcb measuring 5¾ in. by 8 in.), low parts count (fewer than 60 ics), low power consumption, and a very low single-unit price of $295. XEBEC CORP., Sunnyvale, Calif.

FOR DATA CIRCLE 310 ON READER CARD

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	DESCRIPTION	PURCHASE PRICE	PER MONTH 12 MOS.	24 MOS.	36 MOS.
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	LA34 DECwriter IV	995	95	53	36
	LA34 DECwriter IV Forms Ctrl.	1,095	105	58	40
	LA120 DECwriter III KSR	2,295	220	122	83
	LA120 DECwriter III RO	2,095	200	112	75
	VT100 CRT DECscope	1,695	162	90	61
	VT132 CRT DECscope	1,995	190	106	72
TEXAS INSTRUMENTS	TI745 Portable Terminal	1,595	153	85	58
	TI765 Bubble Memory Terminal	2,595	249	138	93
	TI Insight 10 Terminal	945	90	53	34
	TI785 Portable KSR, 120 CPS	2,395	230	128	86
	TI787 Portable KSR, 120 CPS	2,845	273	152	102
	TI810 RO Printer	1,695	162	90	61
	TI820 KSR Printer	2,195	211	117	80
DATAMEDIA	DT80/1 CRT Terminal	1,695	162	90	61
	DT80/3 CRT Terminal	1,295	125	70	48
	DT80/5L APL 15" CRT	2,295	220	122	83
LEAR SIEGLER	ADM3A CRT Terminal	650	62	36	25
	ADM31CRT Terminal	1,095	105	58	40
	ADM42 CRT Terminal	2,195	211	117	80
HAZELTINE	1420 CRT Terminal	945	91	51	34
	1500 CRT Terminal	1,095	105	58	40
	1552 CRT Terminal	1,295	125	70	48
TELEVIDEO	920 CRT Terminal	895	86	48	32
	950 CRT Terminal	1,075	103	57	39
NEC SPINWRITER	Letter Quality, 7715 RO	2,895	278	154	104
	Letter Quality, 7725 KSR	3,295	316	175	119
GENERAL ELECTRIC	2030 KSR Printer 30 CPS	1,195	115	67	43
	2120 KSR Printer 120 CPS	2,195	211	117	80
CENTRONICS	730 Desk Top Printer	715	69	39	26
	737 W/P Desk Top Printer	895	86	48	32

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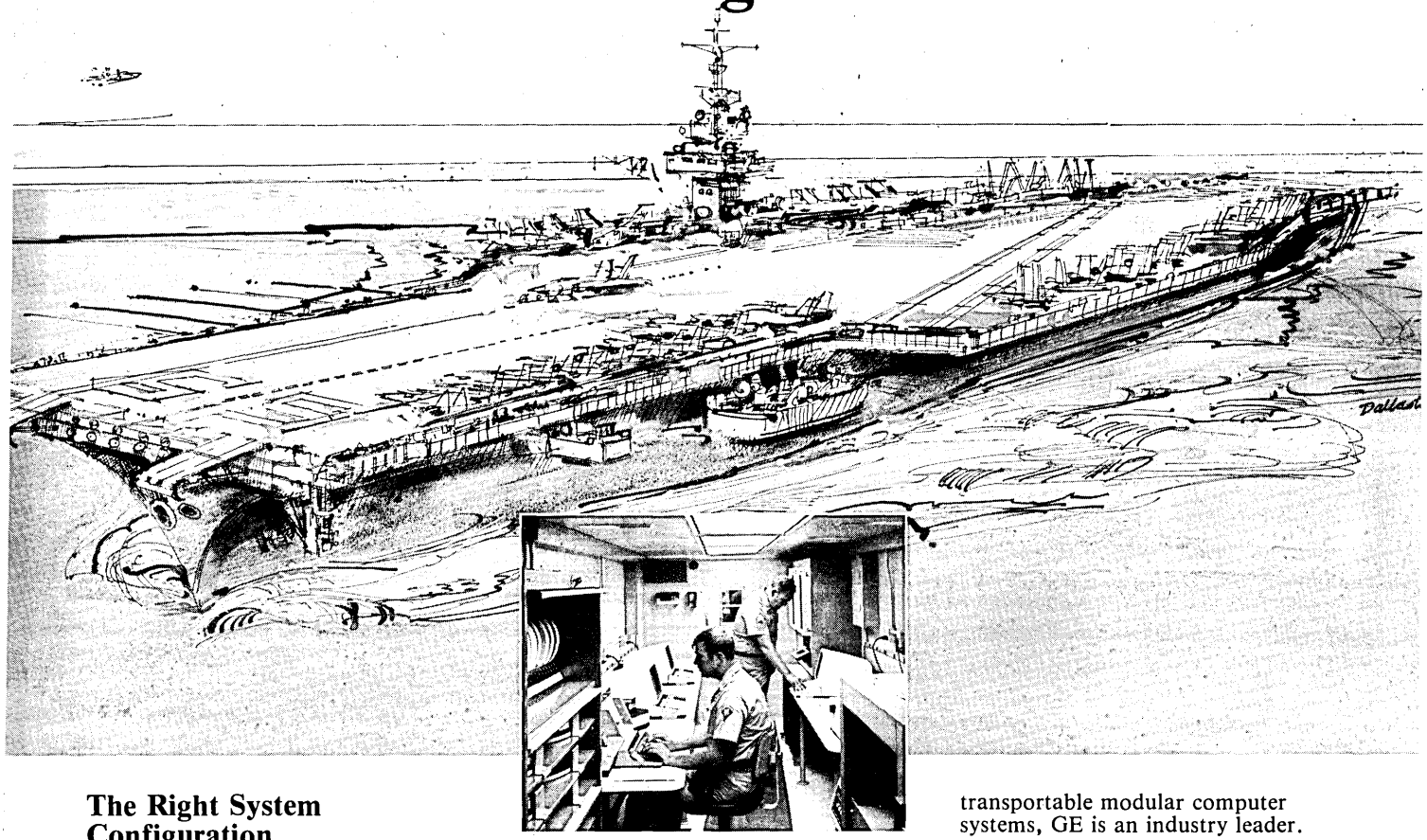

The Right System Configuration

General Electric data systems specialists are proven systems integrators. We offer solutions to system and mission requirements with complete objectivity in hardware and software. Our system designs are based on a complete evaluation of current, commercially available ADPE and are backed by performance tests using GE developed simulation tools, benchmark demonstrations, and environmental testing.

The Right Life Cycle Cost Concept

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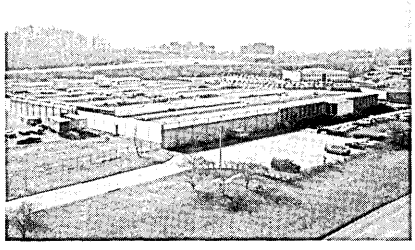

Our 122,000 square-foot facility in Valley Forge, PA, is dedicated to the design, engineering, manufacturing, and testing of integrated mobile data systems for the military. Automated design tools are used extensively for system engineering, including state-of-the-art Computer-Aided Design techniques employing dynamic simulation, emulation, and real-time monitoring.

Our record includes DAS3, a multi-year program for low-cost, mobile logistical computer systems for the Army, and PERSCO, a self-propelled data management system for the Air Force. We recently completed a demanding benchmark effort in design integration, operation, and test of a modular system for SNAP.

The GE approach provides total life cycle coverage from system design and manufacturing, through training and documentation, and on to total Integrated Logistics Support.

The Right Attitude

GE program managers are committed to national defense objectives. They are backed by a general management involvement that calls for high visibility and meticulous monitoring of all program milestones.

For the right solution to the tactical data systems challenge, choose the right company for the right reasons.

Space Systems Division, Valley Forge, PA

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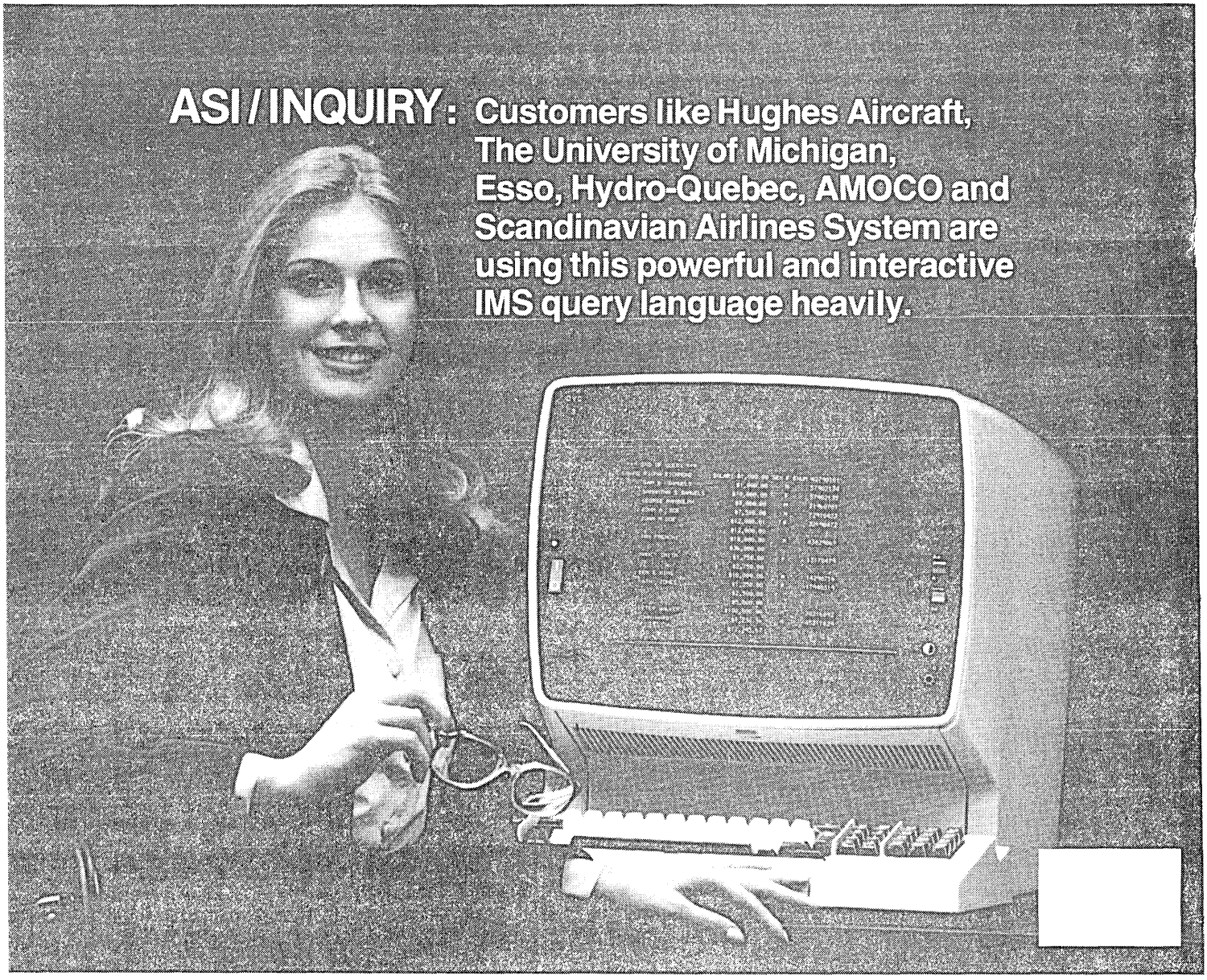

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SOFTWARE AND SERVICES

UPDATES

"To err is human, but to really foul things up requires a computer." That adage, with 20 or so years of dust on it, also applies to word processing. In their wise attempts not to alienate office workers, many vendors make it a point of never mentioning that word processors are but dedicated computers; many users have never heard the word GIGO. But "Garbage In, Garbage Out" applies to wp as well as dp, as evidenced by IBM's response to an RFP for a real estate system. The closing two boiler plate paragraphs read: "GENERAL DOCUMENTATION/MARKETING PUBLICATIONS: IBM 5250 introduction manual, GA09-1625 and IBM 5250 information display system (ideographic language implementation)...

"Several of these Chinese keyboards, display screens and printers attached to the System/34 for your newspaper management system, will automate the editorial operation, increase the productivity of your staff, and tremendously facilitate text editing."

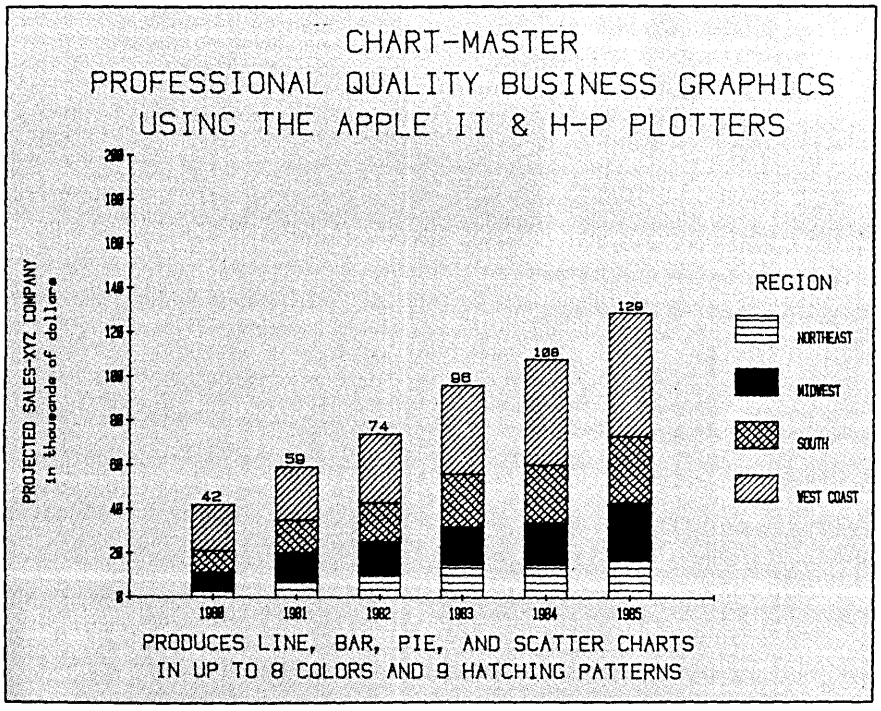
Sounds like just what every landlord needs: the ability to identify tenants by their laundry marks.

Digital Research, the Pacific Grove, Calif., software company responsible for the CP/M family of microcomputer operating systems, has received funding from four venture capital firms, led by T.A. Associates of Boston. The other three investors are San Francisco's Hambrecht & Quist Group, Page Mill Partners of Palo Alto, and Venrock Associates in New York. The four have taken a minority interest in the company for an undisclosed investment, according to founder, president, and majority stockholder Dr. Gary Kildall.

GRAPHICS

Chart-Master is a program for driving Hewlett-Packard plotters from Apple computers, either the II or the III. Depending on your HP plotter, you can get business graphics in as many as eight colors when using Chart-Master. The menu-driven package lets the user create, edit, store, and plot bar graphs, line and pie charts, and scatter diagrams. Text pages, signs, and abstract graphics also can be created, and the program can generate plots from data prepared by VisiCalc. Chart-Master reportedly requires little user training. User-selectable options include hatching and line types, linear regression and curve fitting, and output on paper or acetate for overhead transparencies. Chart-Master lists at $375. DECISION RESOURCES, Weston, Conn.

FOR DATA CIRCLE 326 ON READER CARD



MICRO OPERATING SYSTEM

Digital Research, the company responsible for the CP/M family microcomputer operating systems, has extended its offerings with the introduction of MP/M II, a multi-user system for the 8080 family of microprocessors. A minimal system capable of running MP/M II consists of an 8080, 8085, or Z80 microcomputer with 48KB of RAM, a clock timer interrupt, a disk subsystem, and a terminal. Up to 400KB of RAM, 16 terminals, 16 disks (each as large as 512 MB), and 16 printers. In a 400KB environment, 16KB is required for the operating system nucleus, leaving 384KB that can be switched in 48KB banks among eight users. The new operating system features enhanced file handling capabilities, and utilities—RMAC, a macroassembler; LINK-80, a linker with overlay capabilities; and LIB, for program library

SOFTWARE SPOTLIGHT

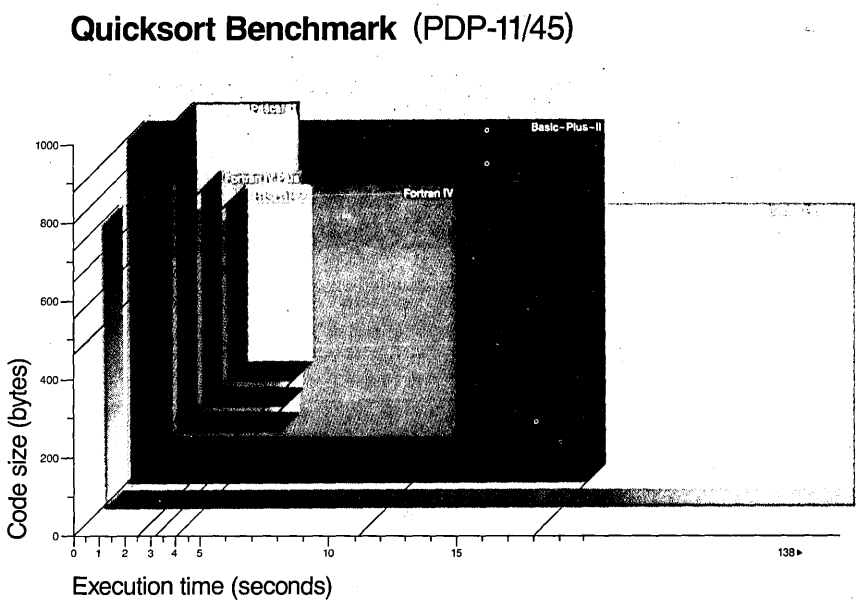
PASCAL COMPILER

Oregon Software, previously known as OMSI, has released Pascal-2, an optimizing compiler that runs on DEC's 11 range, from LSI-11 to VAX-11/780 (in compatibility mode). Capable of running under any of DEC's operating systems for the PDP-11 (and S&H Computing's TSX-Plus), the compiler reportedly generates object code 30% to 40% more compact and twice as fast as that produced by the firm's original Pascal compiler; the existing single-pass compiler, now called Pascal-1, will continue to be marketed.

The five-pass Pascal-2 compiler conforms closely to the ISO draft standard for Pascal (ISO dp7185.1). Conformant array parameters are not included, making the compiler ISO Level 0 conformant. All of standard Pascal is supported, reports Oregon Software, including set types of up to 256 elements, nonlocal GOTO statements, packed data structures, and procedure and function parameters. A number of extensions have been provided under the headings of programmer convenience, I/O flexibility, and low-level operations. For convenience, there are "external" procedures (either Pascal-1 or 2), "nonPascal" external procedures using DEC's standard calling sequence, an "include" compiler directive for combining source files, and an "otherwise" clause in "case" statements. I/O can handle random access files, and additional parameters in "reset" and "rewrite" operations. Low-level extensions include the ability to specify an "origin" for variables as well as logical operations on integer data types. A compiler switch allows the user to disable the extensions, compiling only ISO standard Pascal statements. In the first two passes, the compiler performs error detection, including type checking in conformance with ISO specs, and other checks that find many uninitialized variables before run time. Errors cause the final three passes to be skipped; Oregon Software says the compiler doesn't have the nasty habit of rippling errors (letting a single error produce multiple diagnostics). Runtime checking, which can be disabled to increase execution speed, catches array indexing errors, bad pointers, missing labels in "case" statements, and many I/O and arithmetic errors.

Oregon Software includes several useful tools with the compiler. Foremost among these are the debugger and profiler. The debugger gives the programmer interactive control over execution, supplying information in a high-level Pascal context, i.e., it knows all standard and programmer-defined identifiers, constants, types and variables. The profiler monitors program execution, and reports the number of times each line executed and the percentage of the execution count by program block. Additionally, there are utility programs for cross referencing variables and procedures, formatters for source listings, a library of string functions written in Pascal, and a set of assembler routines for interfacing Pascal-2 to assembler programs. A single processor binary license costs $3,450; a number of multiple cpu licenses, and instructional not-for-profit, and source licenses also are offered. OREGON SOFTWARE, Portland, Ore.

FOR DATA CIRCLE 325 ON READER CARD



management—that previously were priced separately. While files under the new operating system are said to be fully compatible with those created under CP/M, they can be much larger (up to 32MB). Password protection, file and record locking, and dual date stamps (creation and most recent access) are supported by the file management part of MP/M II. The system also supports CP/Net, allowing interconnection of multiple micros into a resource sharing network. Digital Research says that 15 companies to date have announced the intention of providing language support for BASIC, Pascal, COBOL, FORTH, FORTRAN, C and others. MP/M II is distributed on an IBM single-density, standard format diskette for $450; oem discounts are offered. DIGITAL RESEARCH, Pacific Grove, Calif.

FOR DATA CIRCLE 327 ON READER CARD

PATTERN RECOGNITION

The On-Line Pattern Analysis and Recognition System, OLPARS, is a graphics-oriented interactive pattern recognition system for DEC PDP-11s and VAX systems. Pattern Analysis & Recognition Corp., authors of the package, says it plans to have versions for all DEC operating systems, with RSX and VMS leading off. The program requires a Tektronix (or compatible) display, some form of graphic input capability, and a processor with the full floating point instruction set; a user partition of 32K words is needed. A joystick is deemed useful.

OLPARS can be used for a number of applications. The vendor, a DOD contractor, sees many uses in the military and defense fields. Nonmilitary applications include spectral analysis, medical applications (classifying cells in tissue samples, etc.), radar, communciations, magnetic and seismic signal processing, and nondestructive testing. OLPARS works with graphic data supplied in vector format. OLPARS goes for $20,000. PATTERN ANALYSIS & RECOGNITION CORP., Rome, N.Y.

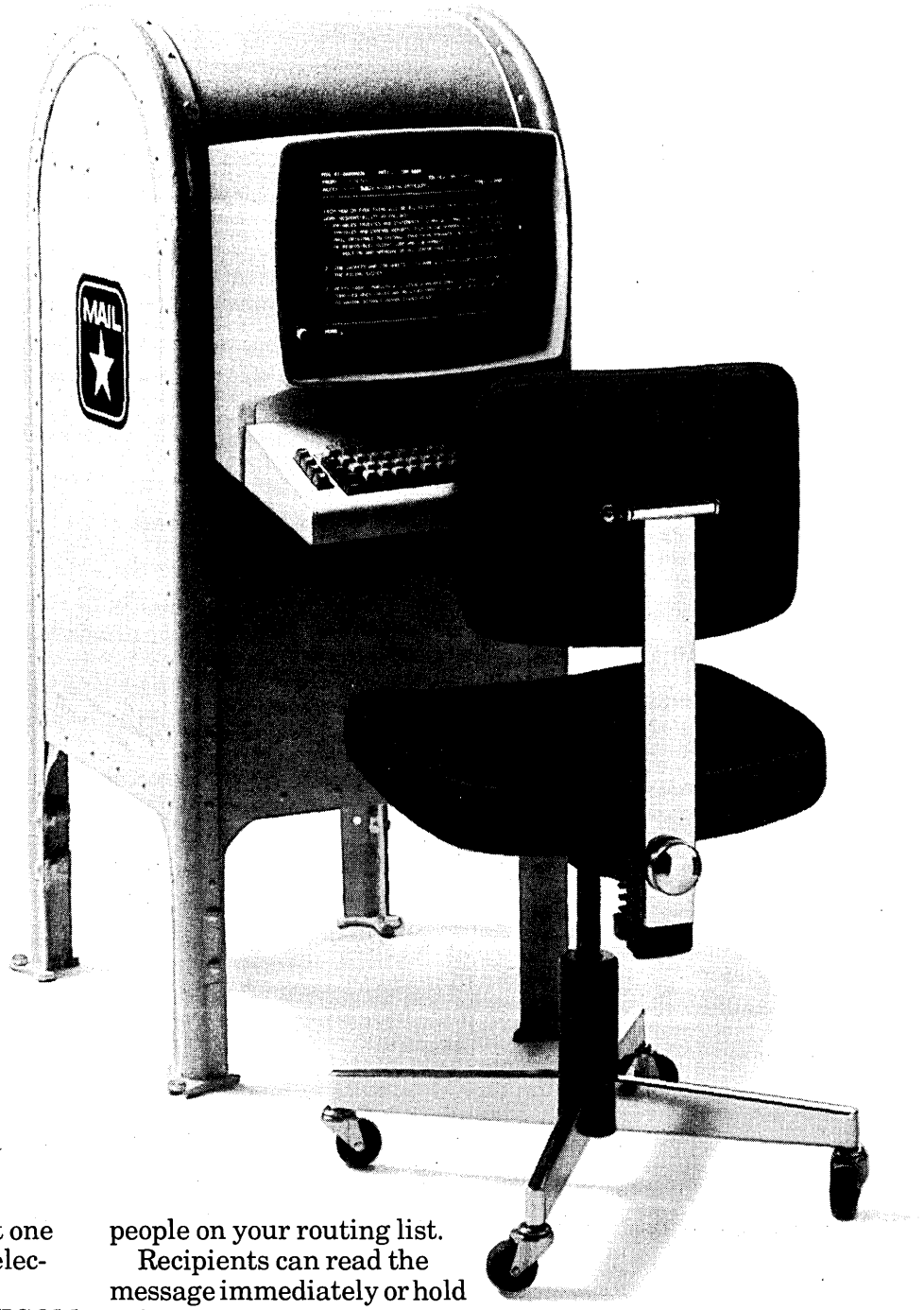
FOR DATA CIRCLE 331 ON READER CARD

OPERATING SYSTEM ENHANCEMENT

For mainframe users running under MVS or VS1, the Program Management Optimizer (PMO) maintains the system's most active LINKLIST directory entries in main memory, in addition to automatically monitoring program loading activity. Software Module Marketing, the vendors of PMO, says the package can result in "dramatic" performance increases when compared to the static operating system BLDL list. Testing has shown that in most instances, a PMO-managed list of 100 entries yields a hit ration in excess of 80%. That means 80% of your LINKLIST requests can be satisfied from information in main memory, saving a time-consuming library search.

PMO installs with no system modifications and no changes to the IPL sequence. I/O time, EXCP counts, and contention between processors are said to be immediate benefits of PMO. The package also provides statistics on library usage and performance,

How to turn your CICS network into a mail carrier.



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CIRCLE 175 ON READER CARD

as well as identifying frequently used reentrant programs. The MVS version of PMO should be available now, with the VS1 version following shortly. Both are priced at $4,000 for the first cpu and $2,000 for each additional processor. SOFTWARE MODULE MARKETING, INC., Sacramento, Calif.

FOR DATA CIRCLE 329 ON READER CARD

COMMUNICATIONS

A transaction processing package and support for SNA networking are the latest communications products Texas Instruments has released for its DS990 computer family (models 4 through 30) running the Distributed Network Operating System (DNOS). DNOS Transaction Processing (DXP) and the Distributed Network Communications System (DNCS) are complementary packages; DXP provides a more efficient interface for transaction processing applications, while DNCS allows DS990 systems to participate in networks under IBM's Systems Network Architecture. Both products have been validated within TI's worldwide network of mixed systems (TI and IBM equipment).

DXP reportedly makes efficient use of system resources, allocating only those required to serve a pending transaction, and returning the resources when the transaction terminates. The transaction processing monitor sits between DNOS and the user's application program; it provides terminals I/O, HELP message, file I/O, and security—independent of the application. The applications programmer need only be concerned with program logic and file I/O, instead of assuming the responsibility of controlling terminal I/O and providing HELP messages and security controls. DXP relies on DNOS TIFORM for the terminal interface. TIFORM handles screen formatting independent of the application program. DXP allows the programmer to supply HELP messages. When the user needs an explanation, depressing the HELP key calls up the appropriate explanation then returns the user to the point of departure from the screen. For data integrity, DXP maintains a transaction log. Within DXP the basic unit of information is called a message—a collection of data entered at a terminal. Transaction programs are idle until the arrival of a message. Then DXP allocates the resources required by the transaction, responds with any output message, and returns the allocated resources idling the transaction program until another message arrives. DXP licenses for $6,000 to $6,800, depending on the media specified by the customer.

FOR DATA CIRCLE 332 ON READER CARD

Developed to meet internal networking requirements, DNCS lets DS990 systems participate in networks under IBM's SNA. The package provides communications support between DS990s and IBM mainframes by emulating IBM 3274 or 3276 Physical Unit (PU) Type 2 cluster controllers. DNCS lets DS990 display terminals emulate 3278 display stations. TI says host application can exploit the DS990's processing capabilities. DNCS requires TI's Four Channel Communications Controllers (FCCC, $3,900) as microprocessor-based front ends; up to eight FCCCS, supporting as many as 32 terminals in toto, can be controlled by DNCS. DNCS also provides emulation of 3271 Model 12 terminals, giving SNA PU Type 1 support to users. Depending on the media specified, DNCS licenses go for $5,500 to $7,100. TEXAS INSTRUMENTS INC., Dallas, Texas.

FOR DATA CIRCLE 333 ON READER CARD

STATISTICS

A new release of the BMDP statistical package offers complete compatibility with the VMS 2.0 operating system for DEC's 32-bit VAX line; additionally, eight new programs have been added to the library for a total of 44. The new routines include Box-Jenkins Analysis, Spectral Analysis, Boolean Factor Analysis, Cox Survival Analysis, General Analysis of Variance, and Linear Preference Scores. The entire BMDP library has been enhanced for interactive users, primarily in the I/O domain, and for the first time, one of the programs—Box-Jenkins—is fully conversational. BMDP for the VAX is li-

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SYSTEM TECHNICIANS-FIELD:** Require high school and/or technical or Jr. College diploma/certificate plus 10 years experience in maintenance of computer system. Experience with INTEL 8084 and/or Data General ECLIPSE C350 and SCADA system is preferable. Responsibilities will involve the maintenance of computer hardware of SCADA system for pipeline, electrical distribution, production and terminal facilities plus the maintenance of RTU's.

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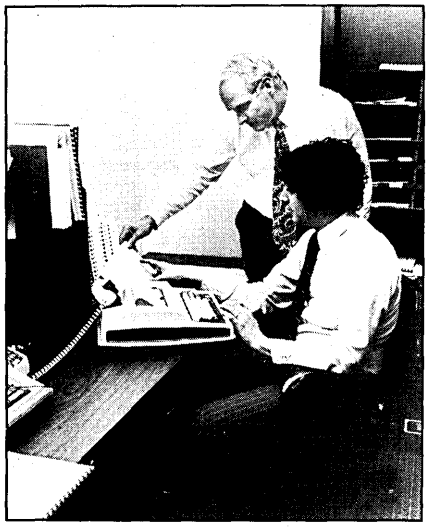
censed on an annual basis, with three-tier pricing. Commercial users pay $2,000 per year, nonprofit and governmental users are charged $1,500, and educational institutions can get the package for $1,000 per year. MANAGEMENT SCIENCE ASSOCIATES, INC., Pittsburgh, Pa.

FOR DATA CIRCLE 328 ON READER CARD

MUX SERVICE

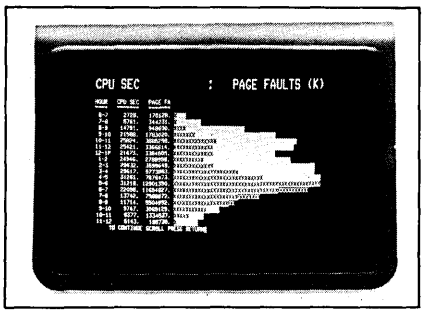
Timeplex has introduced a remote diagnostic service for users of its Series II Microplexors. The service allows Timeplex technicians to access failed Microplexors via telephone lines, using a 103-type modem and the supervisory port on the mux (the port is a $300 option). When a user experiences problems, he can call for service, allow Timeplex access into his network through the supervisory port, and have the problem fixed or diagnosed (to the board or component level, depending on the severity of the fault). The technician's telephone link allows the same diagnostic capabilities available to a repairman on site. He can fix the problem (if possible) or inform the local service rep of the cause, reducing repair time. As an incentive to new customers, Timeplex is offering one-year service contracts at half price for those beginning by Nov. 15. TIMEPLEX, INC., Rochelle Park, N.J.



FOR DATA CIRCLE 330 ON READER CARD

VAX CHARGEBACK

The Processing Accounting and Chargeback System (PACS) for VAX computers has undergone enhancements and now is at release Version 3.0. Primary areas of enhancement are the user interface and the addition of internal changes that will provide the hooks for future planned products. PACS now has its own editor for entering and modifying its operating parameters. The table-driven chargeback system allows users to specify billing rates for standard system resources (cpu time, I/O, etc.) with the ability to specify different rates for each resource based on the time of day. Nonstandard resources, including software and custom hardware, also can be defined along with billing rates, allowing an installation to charge for each resource used. The system also can track a user's budget allowance, warning when charges approach the user's limit, and optionally logging off anyone going over the budget. PACS 3.0 also includes PACSGRAPH, which displays 12 different resource utilization profiles over time on a DEC VT100 terminal. PACS also can generate bills and, upon request, show a user his charges incurred to date. The PACS package carries a perpetual license fee of $3,900, including documentation, source code, and a year's maintenance. SIGNAL TECHNOLOGY, INC., Santa Barbara, Calif.



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- DEC PDP 11 23 34 44 45 70 VAX 11 780 RSX 11MK RSTS E VAX VMS MACRO 11, BASIC 2, FORTRAN ASSEMBLY LANGUAGE
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SOFTWARE AND SERVICES

MVS SECURITY

Top secret, the first software product to result from the merger of CGA Software Products Group and Allen Services Corp., is designed to protect data and programs in the IBM MVS operating system environment. Using the standard MVS security interface, the package is said to be independent of changes to the operating system and to support IBM or independent products that use the same interface. Seven levels of authorized access are provided for jobs, data sets and tape/DASD volumes. Auditing and maintenance facilities are provided to facilitate the package's use, according to the firm.

The software has been field-tested and is to be available this fall for a monthly rental of $700 per cpu, with multiple cpu discounts available. CGA said the package enables a security administrator to control usage of specific system resources according to a password scheme which incorporates user profiles. Access can be authorized for selected intervals, for specified days, and for hours during a day. CGA SOFTWARE PRODUCTS GROUP, INC., Vandalia, Ohio.

FOR DATA CIRCLE 335 ON READER CARD

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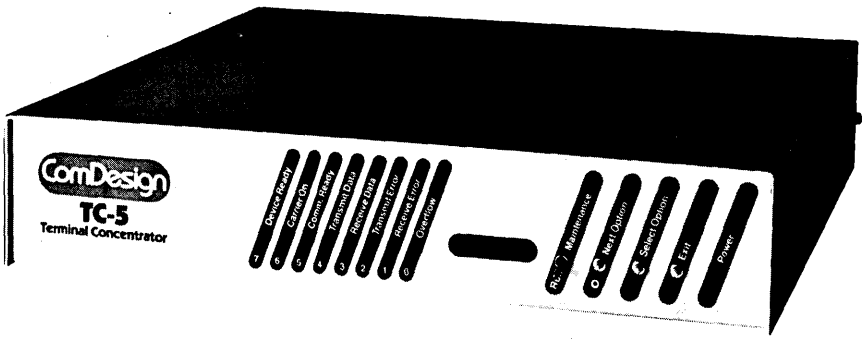

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CIRCLE 190 ON READER CARD

TRS-80 BASIC COMPILER

A BASIC language compiler for the TRS-80 model 1 and model 3 computers provides a program development environment with more speed and arithmetic accuracy than the computer's ROM-based interpreters. BASIC programs are compiled into a pseudo-code by a module designated RSBASIC, but users can develop and debug programs in an "immediate" mode prior to compilation. BEDIT is an editor for RSBASIC source programs and RUNBASIC executes compiled programs. The compiler's features include sequential, random and single-key ISAM file access, direct calls to machine language programs, and program chaining with common variable storage. Numerical accuracy is said to be 14 significant digits for real numbers. Compiler BASIC has been available for the company's model 2 TRS-80 computers for some time. The new version requires a 48Kbyte, dual-disk machine and is priced at $149 at various retail outlets. TANDY CORP., Radio Shack Division, Fort Worth, Texas.

FOR DATA CIRCLE 336 ON READER CARD

SNA FOR HONEYWELL

A new set of data network software packages for the manufacturer's line of DPS 6 and Level 6 small computers enables the machines to attach into IBM System Network Architecture (SNA) networks. Operating under the GCOS 6 executive, the programs make the Honeywell computers appear to IBM host machines as standard IBM controllers and devices with no additional programming at host or satellite site. The company said, however, that it will continue to develop its own DSA (distributed systems architecture) as its mainstream networking plan for the 1980s. The new facilities include SNA remote job entry 3270-emulation and a prerequisite transport package that handles most low-level SNA protocols. Demonstrations are scheduled for this month; first deliveries won't be until the second quarter of '82. The transport facility is priced at $270 per year, the 3270 package at $210 a year, and RJE at $315. HONEYWELL INFORMATION SYSTEMS Waltham, Mass.

FOR DATA CIRCLE 337 ON READER CARD

TEXT EDITING

Fastext is a full screen text processing system for DEC's LSI-11, PDP-11, and VAX-11 family; currently RSX-11, RT-11, and S&H Computer Systems' TSX-Plus operating systems are supported, with plans calling for VAX/VMS and RSTS in the near future. The Fastext package provides an extensive search and replace facility that uses UNIX-like regular expression notation; all or part of the matched text can be inserted into the replacement string. Justification, tab stops, cut and paste, and a word-wrap function are standard. Multiple rulers, defining tab stops and margins, can be stored and recalled without disturbing text already on the

screen. The package comes with Fastmerge, a document assembly utility. Single site licenses go for $750 for RT-11 and TSX-Plus installations and $950 for RSX-11M (and RSTS when released). GLENN A. BARBER & ASSOCIATES, INC., Glendale, Calif.
FOR DATA CIRCLE 338 ON READER CARD

FILE UTILITY

Filecomp is an assembly language file comparison program for mainframe shops running under either OS or DOS. The program prepares well-formatted reports and concise diagnostic aid messages. Dataware, vendors of the package, says that Filecomp can be used in virtually every case when two files must be compared. Comparison parameters allow for sign differences in display or packed decimal fields; field options let the user specify key fields for alignment after missing records. Users also can specify fields to be omitted from the comparison. Other options allow variable record limits, the specification of file types and record sizes, and matching spaces to zeros. Reporting options let the user select character or hex format, as well as full or partial record printing. Dataware, which specializes in software for automatically converting code from one system to another, offers Filecomp on two plans. A one-year lease can be had for $1,200. A perpetual license is $5,000. DATAWARE, INC., Buffalo, N.Y.
FOR DATA CIRCLE 339 ON READER CARD

VM/CMS ADJUNCT

VM/CMS users can have one physical terminal function as up to nine virtual terminals with Computer Associates' VTERM systems software product. CA-VTERM allows users to depress a PF key to toggle from one virtual terminal to another. With VTERM, users can simultaneously be connected to several virtual terminals, each of which can be logged onto a different ID. The package can be used with the latest VM/SP or VM/370 systems. The package is offered on a three-year lease for $2,500; other lease plans are available. COMPUTER ASSOCIATES INTERNATIONAL, INC., Jericho, N.Y.
FOR DATA CIRCLE 340 ON READER CARD

DISKETTE CONVERSION

Reformatter allows CP/M-based personal computers to read, write, and alter diskettes written in DEC's RT-11 format. Running on a micro with at least two diskette drives, Reformatter provides a means for bidirectional file transfers between your machine and an LSI-11 or PDP-11. Reformatter can list the DEC diskette directory and display unused diskette space. Users can alter the DEC diskette's directory, changing any field such as the file's creation date and protection status. A "squeeze" function available from Reformatter allows packing a fragmented RT-11 diskette into a continuous data area. Reformatter sells for $195. The vendor, Micro Tech Exports, also offers a CP/M to (and from) the IBM version of Reformatter, complete with user-controlled character code conversion capabilities. MICROTECH EXPORTS, INC., Palo Alto, Calif.
FOR DATA CIRCLE 341 ON READER CARD

CICS SECURITY

With release 3.1 of its Secure/CICS package, Boole & Babbage has brought its on-line software security product into the DOS/VS and DOS/VSE operating environments. Secure/CICS now offers file and program protection to CICS users, as well as previously available protection on the operator, terminal, and transaction levels. Files defined in CICS' File Control Table can carry various access protection levels: READ, UPDATE, DELETE, ADD, and BROWSE. Programs named in the Program Processing Table can be protected against access and execution. Any of the protection levels can be defined by operator, terminal, and transaction. For the DOS environment, Secure/CICS carries a purchase price of $7,500, including one year's maintenance. For the MVS environment, the package sells for $18,800. BOOLE & BABBAGE, INC., Sunnyvale, Calif.
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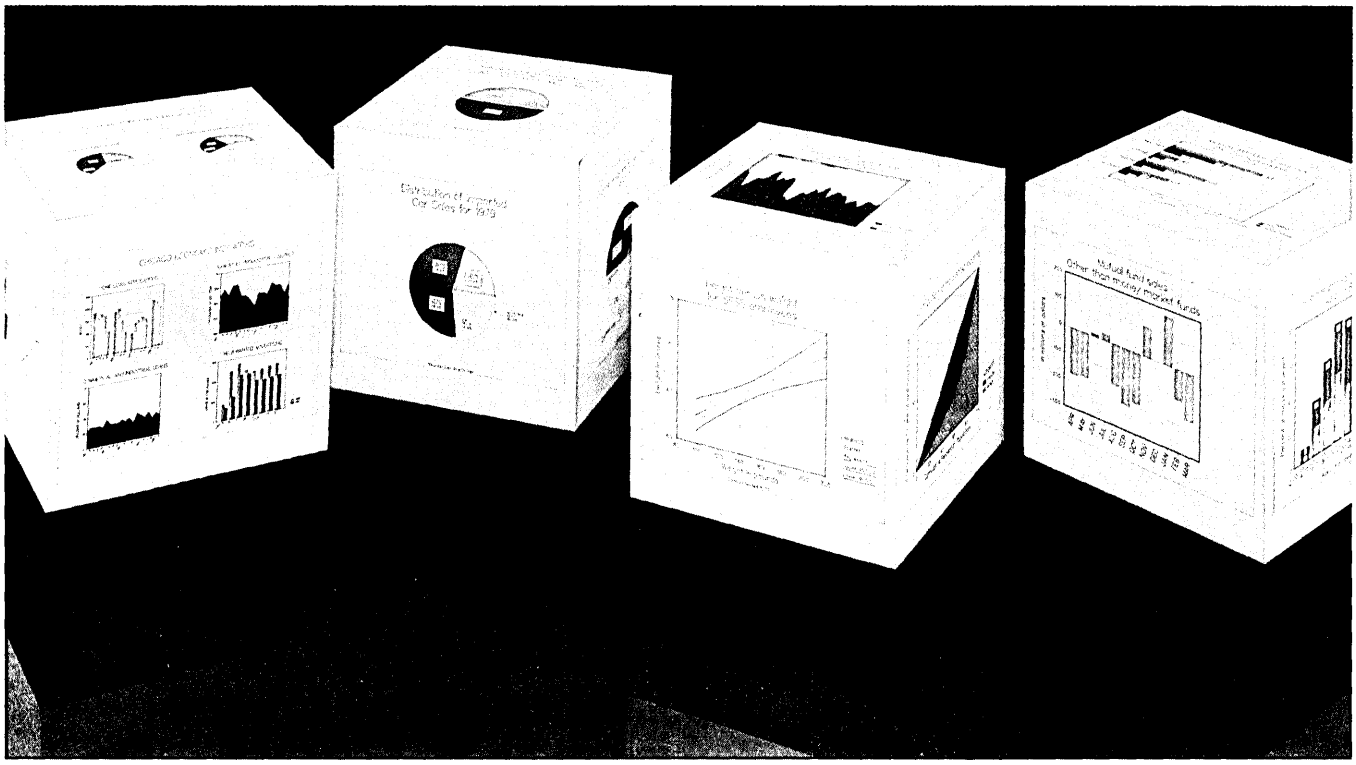

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CIRCLE 184 ON READER CARD

SOURCE DATA

BOOKS

THE SOUL OF A NEW MACHINE by Tracy Kidder

Finally somebody's done it. This computer industry we all love and cherish has been galloping along now for 30 years, mesmerizing us with visions of wired societies, offices of the future, and artificial intelligence. It has helped send man to the moon, criminals to court, and bombs to Bikini. It's given us the Cray-1 and the TRS-80, not to mention the digital cigarette lighter. It's spewed out more jargon than the Pentagon, and along the way it's made lots of money for lots of people. What this industry hasn't done, however, is give us a good book.

Sure, there've been some good textbooks here and there, several acclaimed studies of where the industry is going and even some excellent self-criticism (e.g., Weizenbaum's *Computer Power and Human Reason*). But for all the excitement computers have generated in recent years, there hasn't yet been a Melville around to jump on board, get his hands dirty, and write about what he sees. Nor has there been a Tom Wolfe to find out what the right stuff of computing really is. For that matter, there's been no Robert Pirsig to explore Zen and the art of computer maintenance. But all that's changed with the publication of Tracy Kidder's *The Soul of a New Machine*.

Kidder's book is by no means a product of the computer industry. Kidder is a regular contributor to *The Atlantic*, a magazine that probably doesn't know a bit from a byte, but he did venture into a remote corner of the industry and come back with a real story. His book is a pleasure to read because it is that of a true writer. It has been crafted with a critical eye, unabashed curiosity, and, best of all, literary skill. No programmed text here—this is a real book.

It is real in several senses of the word. It is first of all about real people working on a real computer for a real company. No names have been changed and only a few sources are left unidentified. It is also a real narrative, with plot, character development, and denouement. And it is a real work of art in that it tries, mostly successfully, to capture that almost mystical relationship between the engineer and his machine. Kidder's triumph is that he has made such an engaging tale of what would seem at first glance a very boring story indeed: a bunch of engineers sitting around in a basement designing computers.

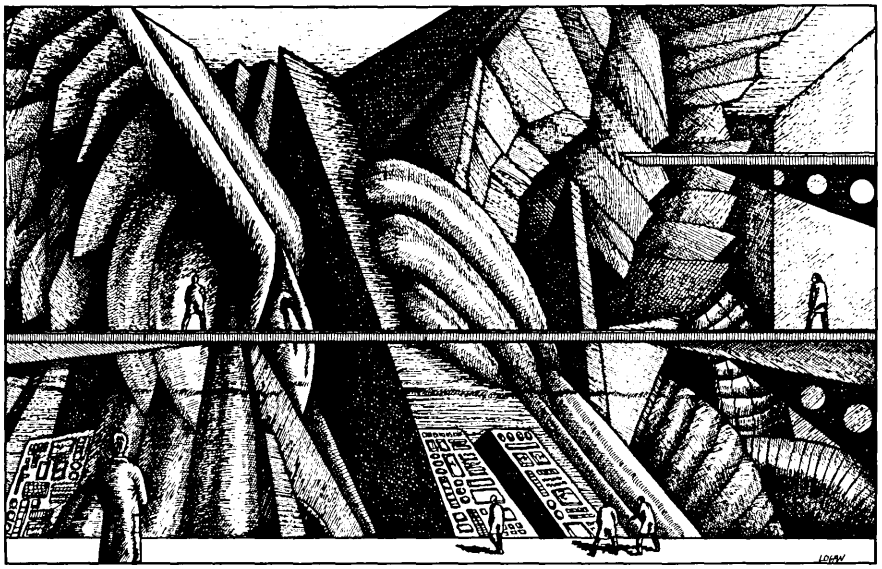

ILLUSTRATION BY RON LOGAN

The Soul is at the very least a were-there account of the conception, gestation, and birth of Data General's 32-bit minicomputer, which was built under the code name Eagle and is now marketed as the MV/8000. The machine, we learn in a vividly detailed chapter entitled "The Wars," was not exactly the apple of Data General president Edson de Castro's eye. It was late in getting started after Digital Equipment's well-received VAX; it was forced to compete for corporate resources with another 32-bit project already under way at Data General; it was ordered to be software-compatible with the firm's 16-bit line; and de Castro, in a seemingly arbitrary decision, had ruled out the obvious design solution, mode bit architecture. These constraints seemed at first to mean that Eagle would end up being nothing more than a dreaded kludge.

That might well have been Eagle's fate except for what appear to Kidder and, I expect, to most readers, to be the extraordinary skills of one Tom West, the enigmatic leader of the Eagle project. West is a moody, gifted man who is the central character of Kidder's story. He is a character most novelists would be pleased to have created: he talks of having jumped out of his jeep in the Mozambique outback and shouting "Massachusetts, Massachusetts" several times in the belief that someday children there would be given that strange epithet as a name. He is seen as remote by his staff, and yet they remember him for throwing all-day pig roast picnics. His office is austere, with only a few papers in sight, and yet he is totally in control of designing a machine more complex than anything done before at Data General.

It is West and his group of handpicked engineers that get Eagle off the ground and to the market. Getting there, however, is not easy. The corporate re-

straints, personality conflicts, and West's mysterious character create a high-pressure atmosphere in the basement of Building 14A/B where the Microkids write microcode and the Hardy Boys build hardware. It is an atmosphere of all-night sessions in front of the logic analyzer, looking for a missing NAND gate, and hours upon hours of unpaid overtime. Few complaints are voiced, although at one point an engineer, weary of counting nanoseconds, threatens to run away to a commune in Vermont where he "will deal with no unit of time shorter than a season."

Kidder serves up this race-against-the-clock story with some of the most lucid explanations of computer hardware and software I've ever seen. His descriptions are not just asides for the techweenies in the audience but are integral to the much bigger story of a team of brilliant men working on a machine so complex that no one of them can comprehend it all. He explains instruction processors, cache buffers, mode bits, and memory segmentation with such ease that even lay readers get a true feel for the soul of a new machine.

For all the New Journalism Kidder uses to tell his story, we should perhaps thank him most for what he leaves out. He doesn't try to amaze us with the much abused facts and figures of computers. There are no long strings of "000s," no Believe-It-Or-Not descriptions of the unimaginably incredible, and not even that many exclamation points. The closest he comes to such hyperbolic inventories is toward the end of the book, with this tongue-in-cheek passage:

"Now it was done. The Eclipse Group and the many others who had worked on the machine—including, especially, Software and Diagnostics—had created 4,096 lines of microcode, which fit into a volume eight inches thick; diagnostic programs amounting to thousands of lines of code; over 200,000 lines of system software; several hundred pages of flowcharts; about 240 pages of schematics; hundreds and hundreds of engineering changes from the debugging; 20 hours of videotape to describe the machine; and now a couple of functioning computers in blue-and-white cases, plus orders for many more on the way."

Kidder cleverly weaves into his narrative the knowing comments of his subjects, many of whom have been around the industry for years. We attend a National Computer Conference with them, show up for the public launching of Eagle, down a few beers at various bars, and even get a glimpse of the engineers' home lives. We see the men, and a few women, play practical jokes on each other, playing Adventure on their office machines, and we learn how each found his way into the Data General fold. If they have anything in common, it's that they take delight in the computer as a challenging game. "What you want to do," says one, "is look at the wheels of the machine and if you like them, have fun."

Kidder himself is also visible in the story, stepping in to explain the technical and sharing with us his thoughts about what he sees day by day. His presence is sometimes an intrusion, but often serves to anchor in concrete terms what could have been vague, abstract ideas.

This book is a great read. I cannot recommend it enough to anyone interested at all in the computer industry, engineering, or computing in general. It will surely rank as one of the best books written about computing, and it is certainly one of the best pieces of nonfiction to arrive in a long time. Let's hope Tracy Kidder won't retire on the basis of this success. Little, Brown & Co., Boston (1981, 293pp., $13.95).

—John W. Verity

VIDEOTEX: The New Television-Telephone Information Services by Roger Woolfe

The trouble with writing a book about videotex is that by the time the author is finished, the book is dated, and by the time the book is published, some of the material is so old as to make the anguished author appear ridiculous. Having stated this, I feel better about saying that Roger Woolfe's *VIDEOTEX: The New Television-Telephone Information Services* escaped these difficulties only by avoiding time-sensitive issues.

Mr. Woolfe is a consultant with Butler Cox & Partners Limited of London, and he has written extensively about videotex. The book was originally published in England by Heyden and has much relevance for that country.

Videotex is a generic term for interactive services delivered to personal computers or adapted television sets in the home or office. The introduction states that the book is supposed to be understood by a lay person, and the editor should have considered this in the opening chapters. The explanation is all there, because Woolfe knows the subject inside and out. He is hindered, however, by an editor who must also know the field but doesn't realize that terms must be explained up front, a few at a time, for only then can the subject be discussed in depth.

Woolfe has some interesting insights into the growth of telecommunications, but some of these thoughts are predicated on circumstances prevalent in the U.K. Countries that do not have government-run systems, for example, will have to plan differently. Also, systems that will not serve an entire country will not face the same problems that plagued Prestel in its infancy.

Still, the book offers a lot as an historical piece, as well as much that is controversial. Woolfe states that "the residential marketplace will develop slowly" and that "at first, the main application in both the residential and the business marketplace will be information retrieval." Studies recently done by Communications Studies & Planning Ltd. state just the opposite. CS&P says that transactional services will be the key to introducing a viable system to consumers. Woolfe is most probably right when he states that "conceivably both videotex and personal computers will develop independently from the tv, whose prime role will continue to be entertainment," and that ". . .there will be a noticeable convergence between videotex terminals and personal computers."

The most valuable information in the book is contained in Chapter 7, where charts list information providers' experiences with database structures and page design.

A costs and revenues section is also included, but once again, this is a British-centered approach and may not work for other countries. Also, the section is hypothetical—based on assumptions concerning service centers, number of users, and expected accesses. It's good to see someone take a chance and give us a basis for looking at revenues down the road, but the reader must realize that until a system is well beyond the experimental stage, there is no way to predict the perfect numbers for user access times, ports, and subscriber charges.

Each system will grow by virtue of the creative talent employed by that system. If there are no subscribers, there will be no system. If the databases are unattractive, uninteresting, or unappealing to users, the system will fail. But if the perfect match between user and database can be reached, and transmission speed and efficiency are assured, systems will grow, each according to its own plan.

Woolfe gives us a basic introduction to videotex, with careful and intelligent observations and conclusions. If we could all see what he or any other author has to say about videotex, then maybe active issues could be debated and discussed. As it is, Woolfe has left the reader with a prelude, a good one—and it is time to observe the scene with the curtain open. Heyden & Son, Inc., Philadelphia (1980, 184pp., $18).

—Darby Miller

REPORTS & REFERENCES

STANDARDS MANUAL

Gunter & Associates, Inc., is offering a programming and documentation standards manual geared specifically toward IBM System/3, 32, and 34 users. The manual consists of three major sections: documentation standards, RPG II programming standards, utility programs and procedures and "fill-in forms" which can be reproduced for on-site use. The manual is priced at $35, and can be

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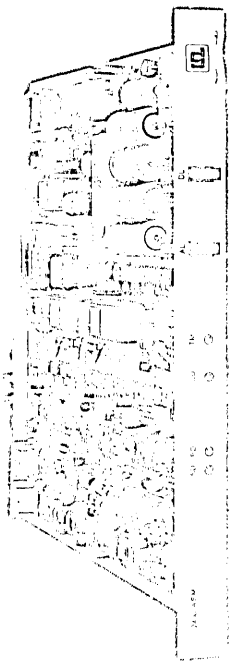

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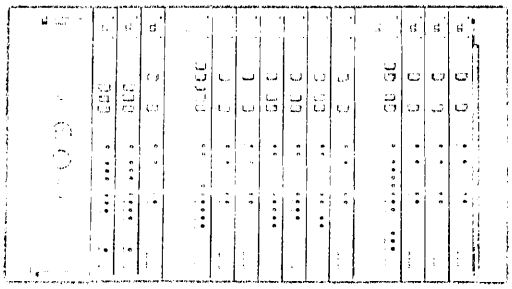

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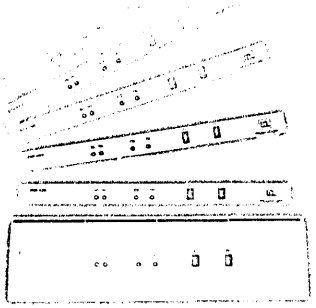

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ARE YOUR CHARTS EFFECTIVE?

If not, a 39-page booklet by Integrated Software Systems Corp. might have the information you need to produce more effective charts. Entitled "Choosing the Right Chart," the booklet is divided into two chapters. Chapter one focuses on actual chart construction and design, pointing out many common errors made in computer graphics. The second chapter is devoted to proper chart usage, e.g., when to use pie, curve, step, bar, or map charts. As a simple set of guidelines, the booklet is useful. Cost: $8.50. Contact ISSCO, 4186 Sorrento Valley Blvd., San Diego, CA 92121, (714) 452-0170.

SEMINARS

THE DATAMATION 36

The DATAMATION Institute for Information Management and Technology released its fall schedule of one- and two-day seminars, to be conducted in 11 U.S. cities and in London, England. The seminars include sessions on database management, dp project management, business graphics, data communications, office automation, "Selecting Your First Computer," and the CAD/CAM revolution. The schedule began in September and will run through April of '82. For more information, contact Karen Smolens, DATAMATION Institute Seminar Coordination Office, 850 Boylston St., Chestnut Hill, MA 02167, (617) 738-5020.

THE HISTORY OF MAGNETIC RECORDING

Billed as the first conference on the history of magnetic recording technology is a two-day meeting at the University of Santa Clara, about an hour's drive south of San Francisco. The event, on Oct. 22 and 23, is cosponsored by the university, Memorex Corp., and the Babbage Institute for the History of Information Processing. Guest speakers from abroad are included in the program, the proceedings of which are expected to be published as a reference source for historians. Proceeds of the conference go to the nonprofit Charles Babbage Foundation. For more information: Gordon Smith of Memorex at (408) 987-1000.

UPDATING THE OFFICE

Advanced Office Concepts has announced a traveling three-day seminar on strategic planning for office automation. The seminars will take place in Washington, D.C.; Los Angeles, Calif.; Chicago, Ill.; and New York City, and will be geared toward the needs of office administrators, management information specialists, information systems analysts and educators. Topics to be examined are the benefits of office automation, technologies' affects on OA products, planning for the transition, priorities for applications, the planning and management of pilot installations, and effective system measurement and evaluation. Case studies, based on the experiences of Advanced Office Concepts' consultants, will also be on the seminar agendas. For more information, contact Dee Einhorn, Advanced Office Concepts, One Bala-Cynwyd Plaza, Bala-Cynwyd, PA 19004, (215) 667-5993.

HOW TO MANAGE

A four-day course is being offered in Washington, D.C., Boston, and Los Angeles by Integrated Computer Systems. Entitled "Software Project Management," the course is "a methodology for avoiding common pitfalls of cost/schedule overruns and unreliable, unmaintainable software." Discussions will include determining system requirements and objectives, estimating project costs and time, scheduling, increasing productivity, ensuring adequate testing, and improving documentation of both hardware and software. Contact Ruth Dordick, Integrated Computer Systems, 3304 Pico Blvd., P.O. Box 5339, Santa Monica, CA 90405, (213) 450-2060.

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WORDS

With office automation technology proceeding at a gallop, the International Information/Word Processing Association's journal *Words* is well worth its $15 subscription price. The magazine contains articles on the latest OA developments as well as such current controversial issues as the safety of VDTs (video display terminals). There are departments on managing stress, combining word and data processing, management methods, new equipment, and even a Q-and A column called the "In-House Consultant." *Words* is published every two months; send subscription requests to Dorothy Logan, *Words* Circulation, IWP, 1015 North York Rd., Willow Grove, PA 19090.

TRANSNATIONAL DATA REPORT

TDR is published every two months by North-Holland Publishing Co., in association with the Transnational Data Reporting Service in Washington, D.C. The magazine concentrates on transborder data flow, its ensuing legal complications, and privacy issues. Making full use of its worldwide editorial staff, *TDR* covers the globe—for example, "PTT Review Set Up in the Netherlands," "Data Flow: The U.S. Takes on Europe," "Chile to Install Public Data Network," and "Italy Begins Privacy Protection Work"—an international mix from a late summer issue of *TDR*. A year's subscription goes for $172.75; contact Elsevier/North-Holland, Inc., 52 Vanderbilt Ave., New York, NY 10017. Outside the U.S. and Canada, contact the publisher at P.O. Box 211, 1000 AE Amsterdam, The Netherlands.

VENDOR LITERATURE

DBMS SIMPLICITY

This 10-page booklet begins by describing the traditional methods of DBMS development and continues through DBMS developments in the '80s. Modern development then leads us to a discussion of the vendor's product, DATACOM/DB. APPLIED DATA RESEARCH, INC., Princeton, N.J.

FOR DATA CIRCLE 350 ON READER CARD

THE ILLUSTRATED BUSINESS SYSTEM

A 34-page summary describes this vendor's interactive business system, "designed for the distribution industry." As a summary (the vendor's word), the booklet is quite detailed, and well illustrated with numerous charts, graphs, photos, and sample menus of application programs. There are seven chapters outlining the system's features. HONEYWELL, INC., Waltham, Mass.

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DECDIRECT

Digital Equipment Corp.'s Accessories and Supplies Group is offering a direct sales catalog containing descriptions and prices for that group's entire line. The book also supplies readers with part numbers to assist in mail or telephone orders. DIGITAL EQUIPMENT CORP., Nashua, N.H.

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SOFTWARE TOOLS

"Software Tools for Network Design & Management" is a 32-page publication that describes the network planning process and shows how software tools can assist the process. The booklet examines the structure and design of analytic programs and discusses acquisition considerations from the user's point of view. NETWORK ANALYSIS CORP., Great Neck, N.Y.

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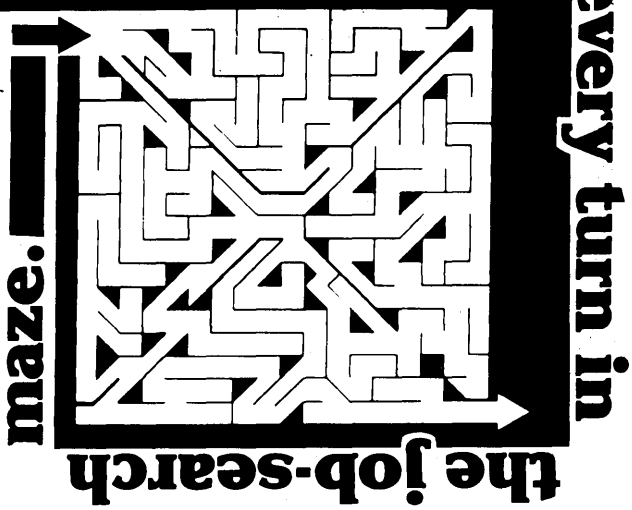

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ADVERTISERS' INDEX

SOFTWARE & SERVICES

Amcor Computer Corp. 234
American Used Software Co. 233
Arkay Computer, Inc. 234

CGA/Allen 232
CGA/Allen 233
CGA/Allen 234

Dataware, Inc. 232
Dataware, Inc. 233
Dataware, Inc. 234
D/B Services 234
Duquesne Systems, Inc. 232
Duquesne Systems, Inc. 233

EEC Systems 232
Electronic Interface Associates, Inc. 232
ESCOM 234

Federated Consultants, Inc. 234

Plycom Services, Inc. 234

S-Cubed Business Systems 233

Viking Software Services, Inc. 233

PERSONAL COMPUTING

Micro Management Systems, Inc. ... 235
Pan American Electronics, Inc. 235

BUY, SELL, LEASE

Elston-Richards Storage 235
General Electric Instrument Rental . 235
Nice Corporation 235
C.D. Smith & Associates, Inc. 235
Thomas Business Systems, Inc. 235
Unitronix Corporation 235

JOB MARKETPLACE

Los Alamos National Laboratory 236
Los Alamos National Laboratory 236
RSVP Services 236
Wilkinson & Associates, Inc. 236

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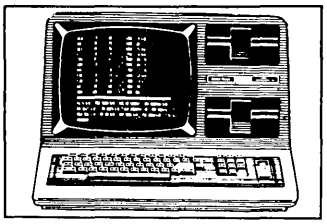

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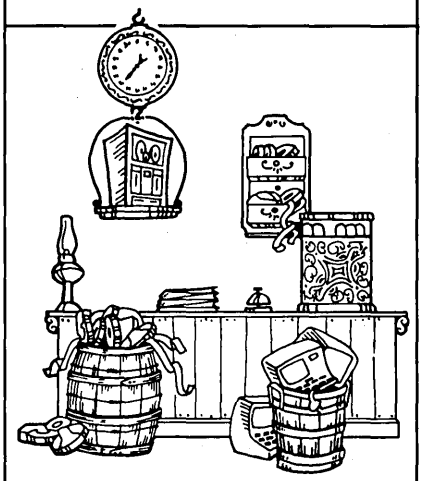

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Aramco Services Co. 108
Astrocom 160
AT&T 60, 61
AT&T (Long Lines) 244
Auerbach Publishing 53
Authorized Terminal Distributors 248
Avanti Communications 174

Bechtel 231
Bryant Bureau 220
BTI Computer Systems 12
Burroughs 26, 27
Business Week 146

Calcomp 207
Callan Data Systems 171
Chromatics 179
Citibank 2
Codex 109
Comdesign 222,223
Computer Associates 97
Computer Corporation of America 47
Computer Power Products 46
Computrend 181
Control Data Institute 48
Cullinane 147

DASD 238
Data General 86, 87
Data General 134, 135
Datagraphix 141
Datamation Institute 124, 229
Datapoint 164, 165
Data Switch 245, 247
Dataware 104
Datec, Inc. 183
Digital Communications Associates 81
Digital Equipment Corporation 167
Digital Pathways 64
Dun & Bradstreet Corporation 66
Dysan Corporation 94, 95

Eastman Kodak 31
Electrohome 39
Execucom 221

Ford Aerospace 211
Four Phase Systems 189
Fox Morris 237
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General DataComm 227
General Electric 149
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Grado Software 210

Halcyon 142
Hambrecht & Quist 84
Harris Corporation 33
Hewlett Packard/Corvallis 43
Hewlett Packard 76, 77
Honeywell Info Systems 16, 17
Hughes Aircraft 133
Human Designed Systems 8

IBM/System 38 ..... 44, 45
IDA Ireland 78, 79
Infodata Systems, Inc. 40
Informatics 15, 240
Information Builders 206
Infotron 177
Intel 5, 10, 11
Intelligent Systems 74, 75
Intermec, Inc. 137
Intertec 91
Intertel 68
Interstate Electronics 186
Intertec Data Systems 91
ISSCO 105
C. Itoh 19

AM Jacquard 1

Kennedy Co. ..... Cover 2
Robert Kleven 218

Lanier Business Products 138, 139
Lear Siegler 100, 101, 102, 103
Lee Data 185
Link Communications, Inc. 210

Martin Marietta Corp. 239
MCAUTO 218
McCormack & Dodge 57, 72, 73
McDonnell Douglas 219
Memorex 9
Micom ..... Cover 3
Micro Data Base Systems, Inc. 200
Mitre Corporation 85
Moreno Associates, Inc. 151
Motorola 237
MSI 152
MTI 110

National Computer Board 243
NBI 128, 129
NCR 228, 240
Network Systems 35
Numetrix 208

Oasis Oil 219
On Line Software International 217
Opcode, Inc. 90

Perkin Elmer 70
Philips Information Systems 49
Planning Research Corp. 89
Plessey Peripheral Systems 98
PRC of America 83
Prime Computer 22
Printacolor 85
Printek 88
Printronix 112, 113

Racal Vadic 191
Radio Shack 173
Ramtek 115
Rixon 202
Rusco Electronics 246

SAS Institute 194
S&H Computer Systems 145
Software AG 51
The Software Authority 59
Software Results 208
Source EDP 192,193
Southern Computer Services 220
SPSS 224
STSC 42
Syncom 83
Systems Technology Forum 198

T Bar 82
Tab Products 111
Tandem Computers 106, 107
Tektronix 6, 7
Teletype ..... Cover 4
Televideo 199
Telex 209
Teltone 63, 65, 67, 69, 71
Texas Instruments 125
Three M 36, 37, 169
Three Rivers Computer Corp. 62
Timeplex 157
Trans Net 212

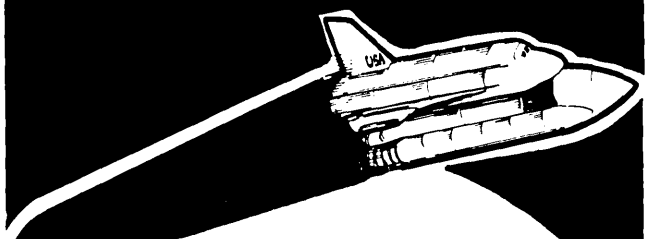
University Computing Corp. 92, 93
University of Petroleum & Minerals 212
U.S. Instrument Rentals 50

Versacomp 4
Victor 161
Visual Technology 99

Wallach Associates, Inc. 230
Wang Labs, Inc. 201
Western Electric 178
Wright Line 197

Xerox (XPSD) 155

DP OPPORTUNITIES



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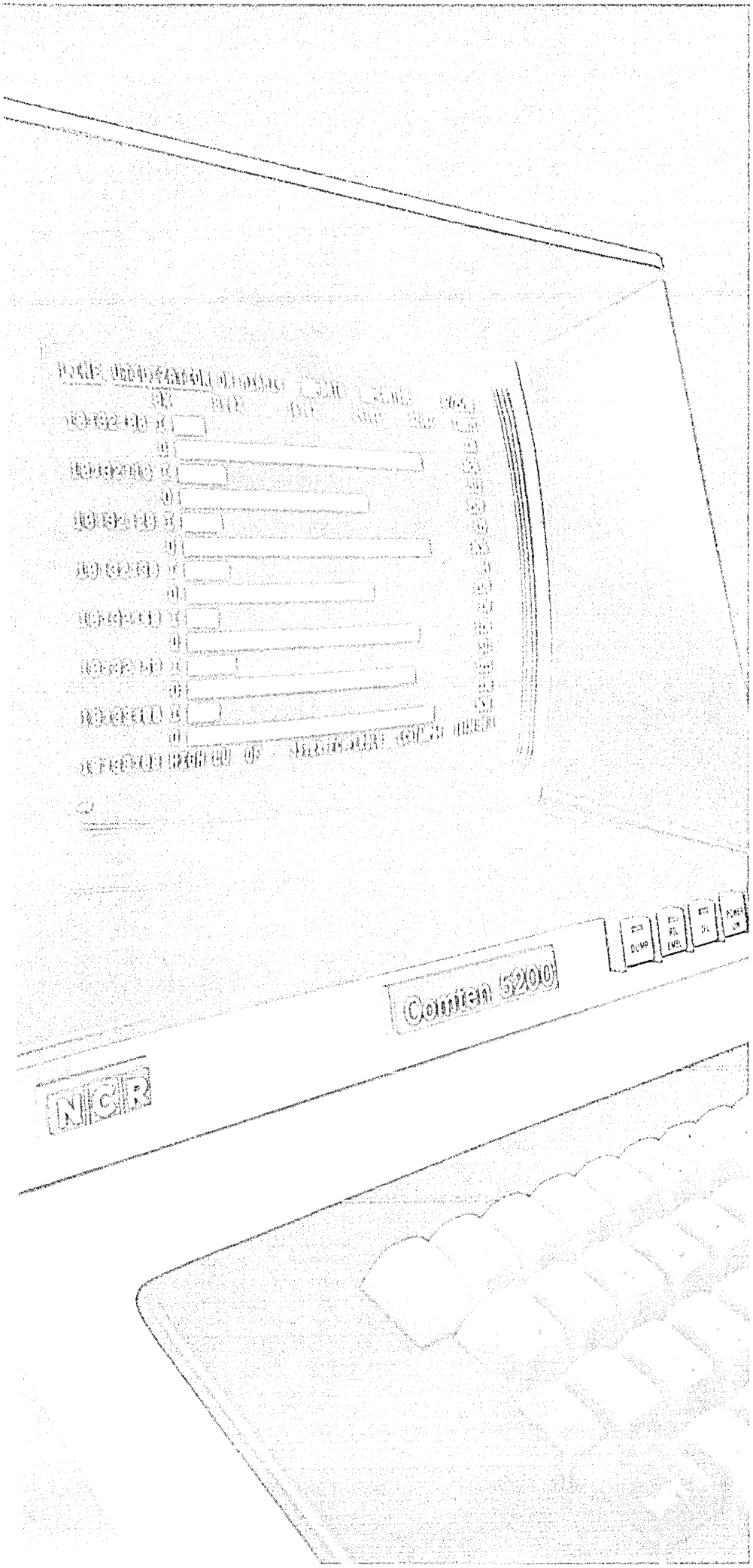

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CIRCLE 307 ON READER CARD

An exchange of readers' ideas and experiences. Your contributions are invited.

READERS' FORUM

HELP WANTED

Many buyers of data communications equipment, myself included, have been guilty of giving salesmen a hard time—letting them cool their heels in the outer office, not returning their calls, and so on. Now the time has come for us buyers to eat crow and ask the salesman, and the organization behind him, for some help.

What I want is simple: some performance measurement tools for things like response time and traffic density measurement. Go buy a stopwatch? Well, I did, but . . . The system programmers claimed the front-ends were to blame for slow response times. I, of course, replied that the delays were in the operating system and in disk queues. The result was my expulsion from the system programmers' coffee pool. War was declared.

As a move toward a cease-fire, we purchased a response time analyzer. The literature promised that it could separate host processing time from network time. After excitedly connecting it up to a troublesome line, though, we discovered that front-end time was included as part of host processing time. Thus, the network was defined as ending at the line side of the front-end. Hostilities were resumed, and I had to start going to a local cafe for coffee. I'll probably have to keep going there until I get a response time analyzer that can connect into the channel between front-end and host. In this way I might be able to get the components of response time broken out into network, front-end, and host.

Actually, the response time analyzer did help for a while, because it allowed sending response time analyses in three decimal places to the terminal users. Those three decimal places kept them bullied at first. Finally, though, they began to ask questions about why they had some 30-second responses when my analysis said their average over a full day was 5.123 seconds. I'm sure glad those users don't know what a standard deviation is.

Anyhow, issues began to come up about delays for the system available light to go out, queue lengths on the lines during long message transmissions, and what happens between hitting the enter key and return of a display. The users keep offering me coffee, but it seems unwise to drink it. Life would be a lot more tranquil if I could just find out what happens after an operator hits a transmit key—how long the screen waits for a poll, network time, front-end time, and host processing time.

It might be difficult to imagine things getting worse, but they did—several times. The first case was when we put in the concentrator at Mule Shoe, Texas. Now, this concentrator has a highly desirable feature intended to cut down on trunk usage. The concentrator performs polling of the terminals connected to it. The front-end ACK's poll lists from the host. In this manner all polling traffic is taken off the trunks. Messages to and from the terminal are passed between the concentrator and front-end in a manner similar to store and forward.

We tried the response time analyzer at the central site. It wouldn't work because it didn't recognize concentrated data. Next, we tried the response time analyzer at the Mule Shoe end. The analyzer thought that the network ended at the concentrator. As a result, the host processing time included the delays of storage at the concentrator on the way in and storage time in the front-end on the way back, plus the network time in between. It made the network time look mighty good in the published three decimal place figures, but didn't do much to promote good relations with the system programmers responsible for host processing time.

A solution looked rather obvious, so an analyst was assigned the task of sorting it all out. It was determined that three monitors were needed. The first would "T" into the channel between the host and front-end, the second would monitor line signals at the front-end, and the third would connect into the cable between a terminal and a controller. One of the three would serve as a coordinator and an output device.

Here's how the system would operate: an operator would initialize the system and enter into a control console the poll address of the terminal to be monitored. This step helps all three devices to monitor the same terminal. When a transmit key is hit, the remote monitor stores the time. The middle monitor records the time of input to the front-end, and the channel monitor catches the time of passage into the host. On the way back, each device captures the time of passage of the reply to the terminal. Next, the two monitors transmit the time-of-day times for each passage to the remote monitor. The remote monitor then computes delta time for each step, and prints it out. In this way, each significant step is of a known duration.

The project was abandoned because we could never figure out a way to synchronize the three clocks. If some manufacturer would overcome this small detail, I feel it would be a highly marketable product.

Shortly after the concentrator was in, the bosses decided to acquire 25 communicating word processing systems. These are used like electronic mail, and send messages among offices in many cities. In addition, they have an RJE (Remote Job Entry) capability, and can access the central computer's database. When given the task of designing the communications, I whipped out my math tables and determined it would take 325 leased lines to connect them all together. Next, I discovered that each word processor did not have 25-line interface ports, but two. Therefore, connecting all of them together by leased lines was out. Dial lines were in.

Some three months later I was called to the boss's office. Since I was expecting a decoration, it was disconcerting to be shown a long distance telephone bill that looked like the national debt. He threatened to take it out of my pay. He didn't offer me coffee.

The answer was circuit switching and multiplexing. The RJE line and the terminal-to-terminal line for each device were multiplexed into a nearby hub. The hubs, in turn, were statistically

multiplexed into a circuit switch at the central site. In this manner, a terminal needed only to enter a four-character code on the keyboard to be connected to any other terminal in the system. The switch also served as a port contender for the 25 RJE lines connected to the switch, contending for 10 cpu ports for RJE. It was slick.

When the company acquired 15 digital FAX units, they dropped right in on the circuit switch system. The FAX terminals were connected to the hubs, and then into the switch. In most cases, they were added to the word processing multiplexors, so very few leased lines had to be added. Since the FAX units didn't have keyboards, small keypads were tied into the line between the FAX and modem. When a circuit is desired to any other FAX, the operator enters a four-digit destination code. If my boss was impressed, he didn't tell me.

When broadband Telpak service ended, we converted to Bell's Digital Data Service (DDS) between the hubs and the central site. The tail circuits into the hubs had to remain as analog, because DDS is not available in more remote locations. The conversion to DDS caused some changes. First, we gave up our modem control system. (The manufacturer presumptuously calls it a "Network Control System.") It doesn't work with DDS. Further, it doesn't work with short-haul modems, and we use a lot of them into the hubs. If you manufacturers stick with devices for analog circuits and continue to ignore short-hauls, you may wind up thinking you are holding the bag on a snipe hunt.

Oh, yes. Our analog test equipment in the network control center is now gathering dust. We can't use it with DDS.

We ended up with a commonly used technique for network balancing: we adjust the load on lines based on the decibel level of user screams. It would be nice if we could measure response time and traffic loads on the terminal-to-terminal links, but so far the best device we have come up with is another stopwatch.

It was an exciting day when the 10 minicomputers were delivered. The company decided they needed these to control production levels at the plant sites. Why should minis be exciting? Because they communicated in X.25, and this heralded a new day in the company's networking. This addition was solved easily. All it took was money. An X.25 packet switching processor was installed next to the circuit switch. The terminals were multiplexed into the hubs, and from there to the central site via the statistical multiplexors. However, instead of going into the circuit switch, the X.25 links were demuxed into the packet switch. This would have allowed the network control center to analyze for problems if we had had a packet problem analyzer.

I still felt confident even after the company controller and my boss parked themselves unexpectedly in my office. I had job security. The network was so complex they could never find a replacement for me. I was asked, "Explain how users are charged for network time." "Well, they are billed based on computer time and connect time." "And how many of the company's total terminals use terminal-to-terminal sessions only?" "Ahhh, 50%." The next question was not a surprise. "What provisions have you made for billing the word processors, FAX, and minis for network usage?" The boss explained the system he'd devised for taking the money out of my pay.

Let's be serious for one paragraph. Networks are undergoing radical changes: analog circuits are being replaced by digital, circuit and packet switching systems are being added to previously nonswitched networks, and master/slave protocols are giving way to peer communications. The traditional methods of measuring network performance are no longer usable; yet the new, more complicated networks need even more control and measurement. The operators of these networks would love to buy products to help with performance measurement on advanced communication techniques.

If any of you salesmen would like to buy me a cup of coffee, I would appreciate it.

—Joe M. Wiley
Chattanooga, Tennessee

BABBAGE – THE LANGUAGE OF THE FUTURE

There are few things in this business that are more fun than designing a new computer language, and the very latest is Ada—the Department of Defense's new supertoy. Ada, as you know, has been designed to replace outmoded and obsolete languages such as COBOL and FORTRAN.

The problem is that this cycle takes 20 to 30 years and doesn't start until we're really convinced present languages are no good. We can short-circuit this process by starting on Ada's replacement right now. Then, by the time we decide Ada is obsolete, its replacement will be ready.

The new generation of language designers has taken to naming its brainchildren after real people rather than resorting to the usual acronyms. Pascal is named after the first person to build a calculating machine and Ada is named after the first computer programmer. As our namesake, we chose Charles Babbage, who died in poverty while trying to finish building the first computer. The new language is thus named after the first systems designer to go over budget and behind schedule.

Babbage is based on language elements that were discovered after the design of Ada was completed. For instance, C.A.R. Hoare, in his 1980 ACM Turing Award lecture, told of two ways of constructing a software design: "One way is to make it so simple that there are obviously no deficiencies and the other way is to make it so complicated that there are no obvious deficiencies." The designers of Babbage have chosen a third alternative—a language that has only obvious deficiencies. Babbage programs are so unreliable that maintenance can begin before system integration is completed. This guarantees a steady increase in the dp job marketplace.

Like Pascal, Ada uses "strong typing" to avoid errors caused by mixing data types. The designers of Babbage advocate "good typing" to avoid errors caused by misspelling the words in your program. Later versions of Babbage will also allow "touch typing," which will fill a long-felt need.

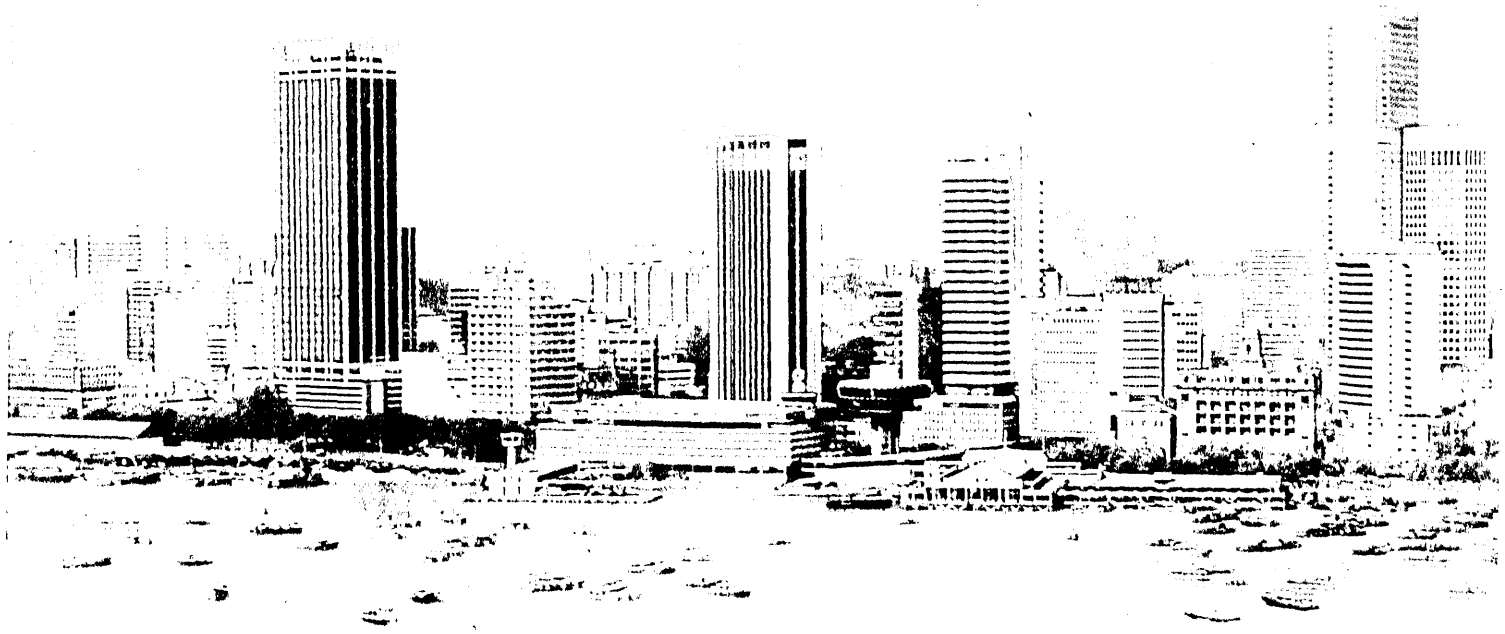
A hotly contested issue among language designers is the method for passing parameters to subfunctions. Some advocate "call by name," others prefer "call by value." Babbage uses a new method—"call by telephone." This is especially effective for long-distance parameter passing.

Ada stresses the concept of software portability. Babbage encourages hardware portability. After all, what good is a computer if you can't take it with you?

It's a good sign if your language is sponsored by the government. COBOL had government backing, and Ada is being funded by the Department of Defense. After much negotiation, the Department of Sanitation has agreed to sponsor Babbage.

No subsets of Ada are allowed. Babbage is just the opposite. None of Babbage is defined except its extensibility—each user must define his own version. To end the debate of large languages versus small, Babbage allows each user to make the language any size he wants. Babbage is the ideal language for the "me" generation. The examples that follow will give some idea of what Babbage looks like.

Structured languages banned GOTOs and multiway conditional branches by replacing them with the simpler IF-THEN-ELSE structure. Babbage has a number of new conditional statements that act like termites in the structure of your program:
WHAT IF—Used in simulation languages. Branches before evaluating test conditions.



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CIRCLE 209 ON READER CARD

READERS' FORUM

OR ELSE—Conditional threat, as in: "Add these two numbers OR ELSE!"

WHY NOT?—Executes the code that follows in a devil-may-care fashion.

WHO ELSE?—Used for polling during I/O operations.

ELSEWHERE—This is where your program really is when you think it's here.

GOING GOING GONE—For writing unstructured programs. Takes a random branch to another part of your program. Does the work of 10 GOTOs.

For years, programming languages have used "FOR," "DO UNTIL," "DO WHILE," etc. to mean "LOOP." Continuing with this trend, Babbage offers the following loop statements:

DON'T DO WHILE NOT—This loop is not executed if the test condition is not false (or if it's Friday afternoon).

DIDN'T DO—The loop executes once and hides all traces.

CAN'T DO—The loop is pooped.

WON'T DO—The cpu halts because it doesn't like the code inside the loop. Execution can be resumed by typing "May I" at the console.

MIGHT DO—Depends on how the cpu is feeling. Executed if the cpu is "up," not executed if the cpu is "down" or if its feelings have been hurt.

DO UNTO OTHERS—Used to write the main loop for timesharing systems so that they will antagonize the users in a uniform manner.

DO-WAH—Used to write timing loops for computer-generated music (Rag Timing).

Every self-respecting structured language has a case statement to implement multiway branching. ALGOL offers an indexed case statement and Pascal has a labeled case statement. Not much of a choice. Babbage offers a variety of case statements:

The JUST-IN-CASE Statement—For handling afterthoughts and fudge factors. Allows you to multiply by zero to correct for accidentally dividing by zero.

The BRIEF CASE Statement—To encourage portable software.

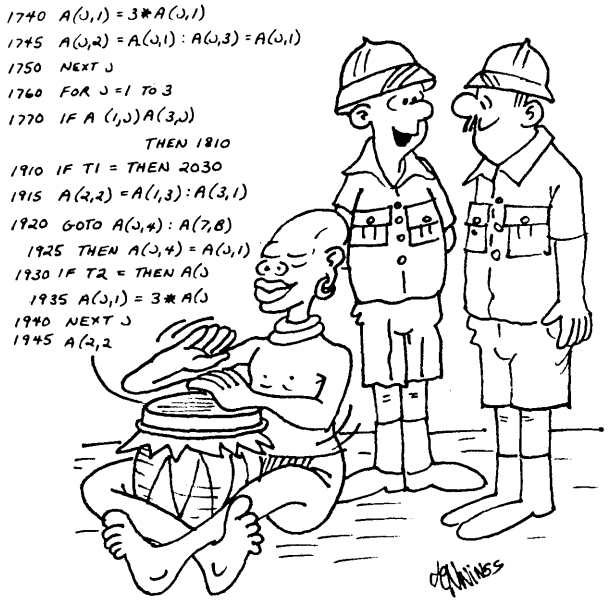
The OPEN-AND-SHUT CASE Statement—No proof of correctness is necessary with this one.

The IN-ANY-CASE Statement—This one always works.

The HOPELESS CASE Statement—This one never works.

The BASKET CASE Statement—A really hopeless case.

The Babbage Language Design Group is continuously eval-

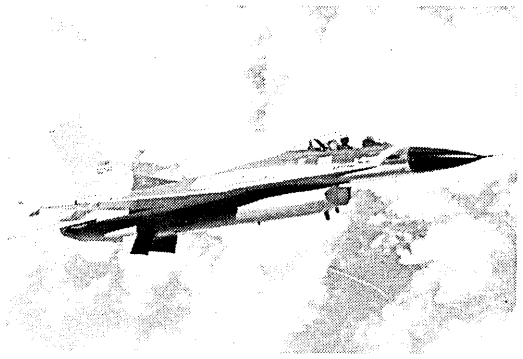


"They claim that they can actually send simple messages with drumbeats."

CARTOON BY DALE JENNINGS

©DATAMATION

AT GENERAL DYNAMICS...



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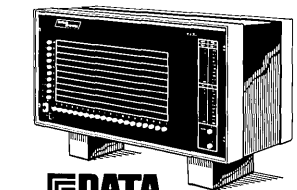

DATA SWITCH

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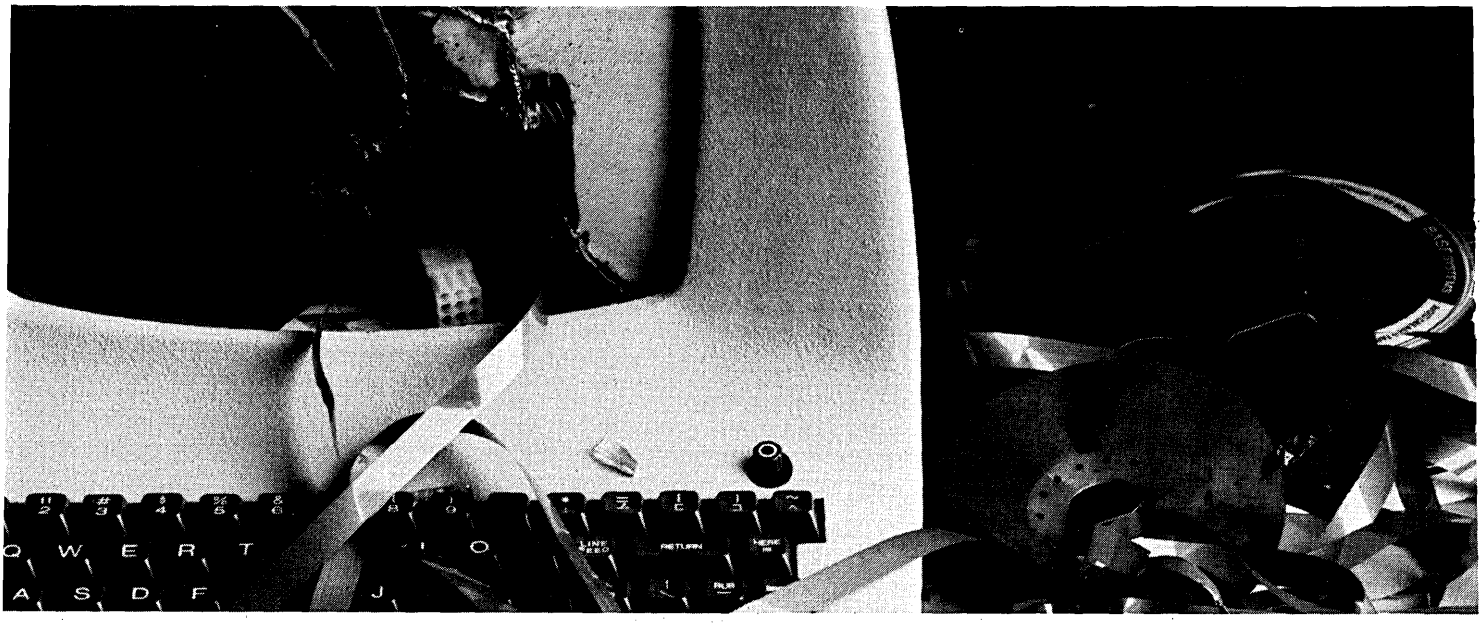

"Oh no! Somebody got into the computer room last night."

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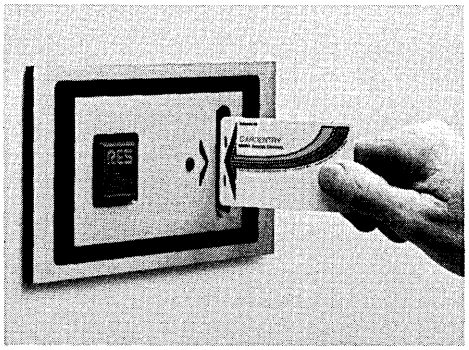

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CIRCLE 213 ON READER CARD

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uating new features that will keep its users from reaching any level of effectiveness. For instance, Babbage's designers are now considering the ALMOST EQUALS SIGN, used for comparing two floating point numbers. This new feature "takes the worry out of being close."

No language, no matter how bad, can stand on its own. We need a really state-of-the-art operating system to support Babbage. After trying several commercial systems, we decided to write a "virtual" operating system. Everybody has a virtual memory operating system so we decided to try something a little different. Our new operating system is called the Virtual Time Operating System (VTOS). While virtual memory systems make the computer's memory the virtual resource, VTOS does the same thing with cpu processing time.

The result is that the computer can run an unlimited number of jobs at the same time. Like the virtual memory system, which actually keeps part of the memory on disk, VTOS has to play tricks to achieve its goals. Although all of your jobs seem to be running right now, some of them are actually running next week.

As you can see, Babbage is still in its infancy. The Babbage Language Design Group is seeking suggestions for this powerful new language and as the sole member of this group (all applications for membership will be accepted), I call on the data processing community for help in making this dream a reality.

—Tony Karp
Jamaica, New York

THE KINGDOMS WITHIN

Business publications often point to the weaknesses of the technical manager. The problem a technical manager poses to business, however, is only a minor one because technical managers don't last long. Technical managers leave because they cannot cope in a business environment—they stay and become political managers.

Political managers are the real threat, but they are difficult to identify because there is no such thing as a 100% pure political manager. Every political manager must have some business sense, and all business managers must have political awareness to survive.

When we look for the characteristics of a political manager, a clearly defined profile develops.

1. *Politics*
   - Highly developed debating skills
   - Strives for power
   - Uses subordinates in political situations
   - Takes credit for group or individual innovation
   - Recognizes accomplishments by group
   - Eliminates or controls support groups
2. *Personnel management*
   - Controls all delegated work
   - Evaluates on reputation and subjectivity
   - Promotions based on performance, time, visibility, and allegiance
   - Makes upward pressure by creating top heavy organizations
3. *Planning*
   - Avoids measurable planning
4. *Controls*
   - Avoids controls
5. *Economic measurements*
   - Builds defense by blaming others

Let us examine the creation and progression of a typical political manager in a programming environment.

Joe graduated from a good university with a degree in computer science, and then worked for a number of programming contractors prior to being hired by a large programming firm. His first assignment in his new job was to design and code a complex

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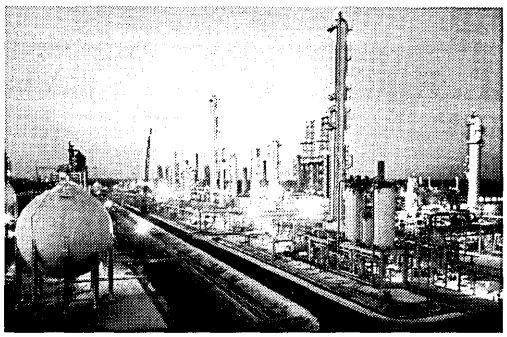

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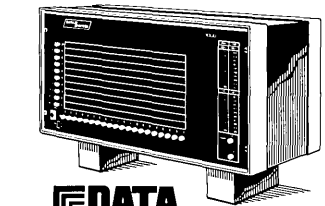

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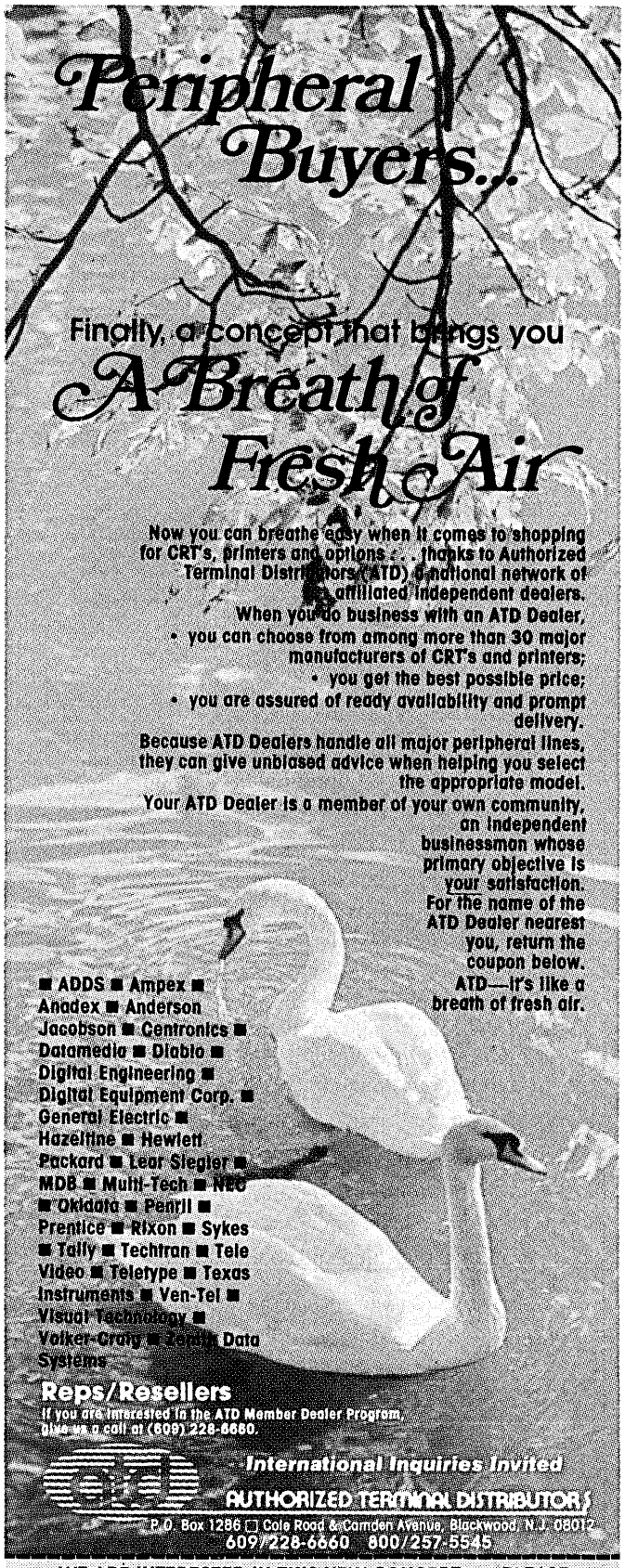

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database system. He was an outstanding programmer, and after three years became the recognized expert on databases. He also became the project leader on two other major applications. Joe's manager had a winner. Joe handled all the technical aspects of the business, while the manager handled all the financial, project control, and personnel work. Joe and his manager were highly respected by the company executives.

It didn't surprise anyone when Joe, with his manager's assistance, was named manager of a newly formed development group. Joe received a good deal of management cooperation in his new job and was permitted to choose the people he wanted. Since he was an outstanding programmer, he selected the best available team for the assigned project. It just happened that the group was 75% senior professionals. Joe did not realize that salary affected costs.

As a "technical" manager, Joe directed all of the design and implementation of his project. When problems were encountered, he worked around the clock discovering the source and coding solutions. The system was completed and installed ahead of schedule. The customer made a personal visit to the director of development to applaud Joe's work. Joe became a successful technical manager.

His second project did not go as well. The customer constantly added new requirements that were accepted because they would improve the system and Joe wanted to do a good job. The project started to slip the schedule, but no one noticed.

One month before the product ship, Joe realized he was in trouble. When he informed his manager (who wasn't doing *his* job), the cover-up began.

Needless to say, Joe and his manager were able to contain the situation by shifting expenses, adding more people, and working with the customer. The product overran the estimate by 30%, it was two months late for installation, and it required more than the normal number of post-installation fixes, but Joe made it through the ordeal. What's more, he learned a lot from the experience, everything, in fact, except how to manage a business. Joe became a "political" manager. He had learned how to build a defense and shift expenses.

He would never again rely on planning groups. From that point on, Joe insisted on planning and staffing his own projects. He would also incorporate many contingencies in his plans. His survival became his primary goal.

As a political manager Joe excelled. He was very expensive, but he always finished ahead of schedule. He had much more spare time than ever before, so he began to make "contacts." He got the opportunity to place one of his "loyal" senior analysts on the directors staff. His job became even better.

Joe was promoted to manager of projects and immediately interviewed the project managers assigned to him. Joe had his first surprise. Two of the managers were business managers and their presentations were completely foreign to him. Luckily, the other two had backgrounds similar to Joe's, and a good deal of time was spent discussing mutual acquaintances. After a short period of time, it became evident that the two business managers had to be replaced. Joe had no trouble finding two qualified "technical" managers.

Joe and his four political managers became a dedicated entity. Joe was the leader and everyone under him supported his goals. He was no longer concerned with survival, he would now begin to grow and expand his influence.

Joe and his staff make impressive presentations. His track histories, shown with color slides, expertly prove the capabilities of his groups. The only thing missing in Joe's presentations is his expense-to-revenue position. Joe's departments lose money, morale is slipping because the work load is too low, and the programmers are talking about forming a group to promote opportunity. *The moral*: political regimes do not exist for the good of the company. Top management must learn to recognize them and dispute them.

—J. Harris
Saratoga, California

DEC, Data General, HP communications costs are down, again

Phone line rates are up, and if you're supporting multiple remote terminals on your minicomputer—DEC, Data General, HP or any other—chances are you're paying a fortune in communications costs and still not running the terminals as fast as you'd like. And to add insult to injury, you have to put up with the occasional phone line "glitch" which drives your CRT's crazy.

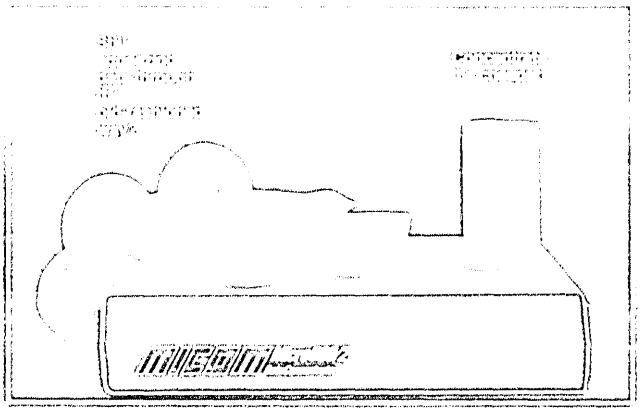
What you really need is a smart little box that will provide error control for your terminals and allow several of them to share one telephone line.

What you need is MICOM.

MICOM's Micro800/2 Data Concentrator represents a major new breakthrough in low-cost data concentration (sometimes called "statistical multiplexing"). Allows up to 16 terminals to share a single phone line. Typically (but *even supporting only a single CRT and a printer, and the error control comes free.* It requires absolutely no changes to existing hardware and software, and typical prices are only $1050 for a 2-channel unit, $1400 for a 4-channel version. (Even single-channel versions are available to provide error-free data communications for lone terminal installations.)

Although the Micro800/2 is brand new, more than 25,000 of the original Micro800's are already in service, installed by their users as painlessly as plugging in a terminal. And with some of those customers supporting four 2400 bps CRTs on a single 2400 bps line, it's no wonder so many have been installed.

Call or send today for our free, 12-page booklet describing the Micro800/2 and its applications.



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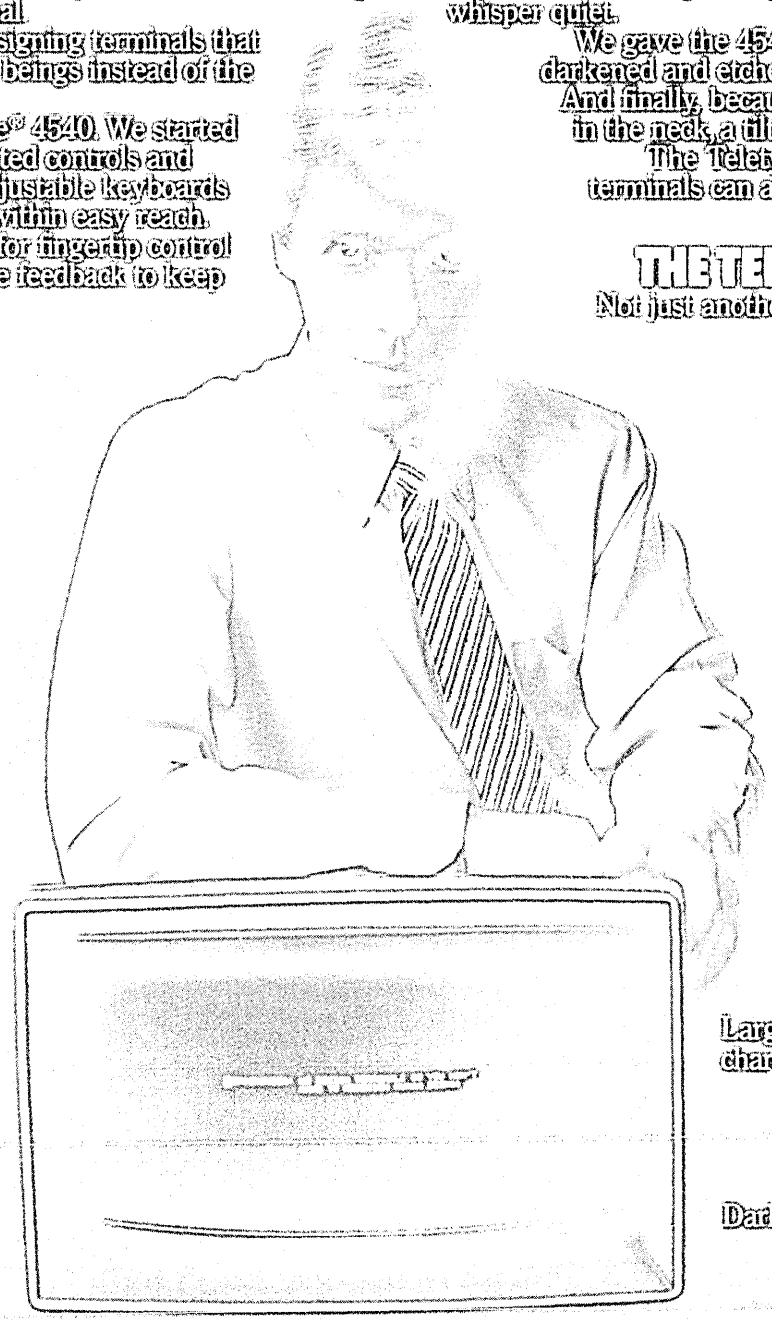

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