DATAMATION® 79
MARCH/3.00 U.S.A.

DATA COMMUNICATIONS

MODEM SURVEY, p.167

Also: Computing in China, a user looks at the IBM 8100, and what's wrong with dp operations jobs . . .

KENNEDY

SERIES 5300 DISK DRIVES

Series 5300 drives are fixed media, high performance units utilizing advanced Winchester disk technology.

Available in one, two, or three platter versions, the unformatted data capacity can be as high as 70M bytes—all in 7" of rack space.

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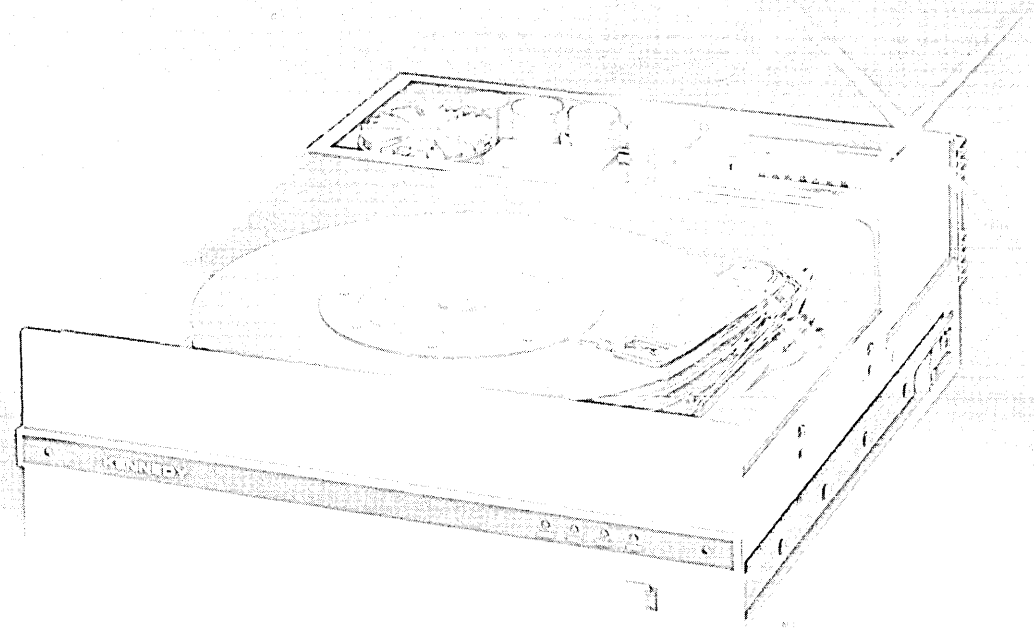
Maximum seek time is 70 msec, rotational speed, 3000 rpm, and data rate — 1.0 MB/sec.

The tightly sealed disk compartment allows Series 5300 drives to be used in environments unsuitable for conventional drives.

Other Series 5300 features include: NRZ-MFM data encode/decode circuits, daisy chaining of up to 4 drives, address mark detection, built-in power supply, small, easily replaced circuit cards and a standard interface.

Series 5300 is sophisticated in concept, yet like all Kennedy products, is simple in design for greater reliability, improved performance and lower cost.

KENNEDY Co.
540 W. WOODBURY RD., ALTADENA, CALIF. 91001
(213) 798-0953



Now appearing on your favorite networks: XL Distributed Processing Systems

Your Denver regional office needs up-to-the-minute reports from Los Angeles and Seattle ... the central parts depot in Atlanta must maintain current inventory based on information received from six supply centers ... Warehouses in Rochester and Raleigh need to access the data base in Atlanta, but don't need local processing ... Branch offices in Calgary, Phoenix and Toronto must process orders and transmit to regional managers ... headquarters in Minneapolis needs to communicate with all regional and branch offices ...

Presenting XL Distributed Processing Systems from Pertec Computer Corporation. A family of microprocessor-based computer systems — and an approach to distributed processing — that cuts through the buzzword maze to provide state-of-the-art hardware and software solutions.

High-power processing

The top-of-the-line XL40 handles up to 16 local and remote terminals. With up to 512K bytes of memory and disk storage expandable to 70 megabytes for local data bases, it can also interactively access your headquarters mainframe via 3270 inquiry mode or non-XL40 resident files. Put one in Denver, another in Atlanta.

Remote Access

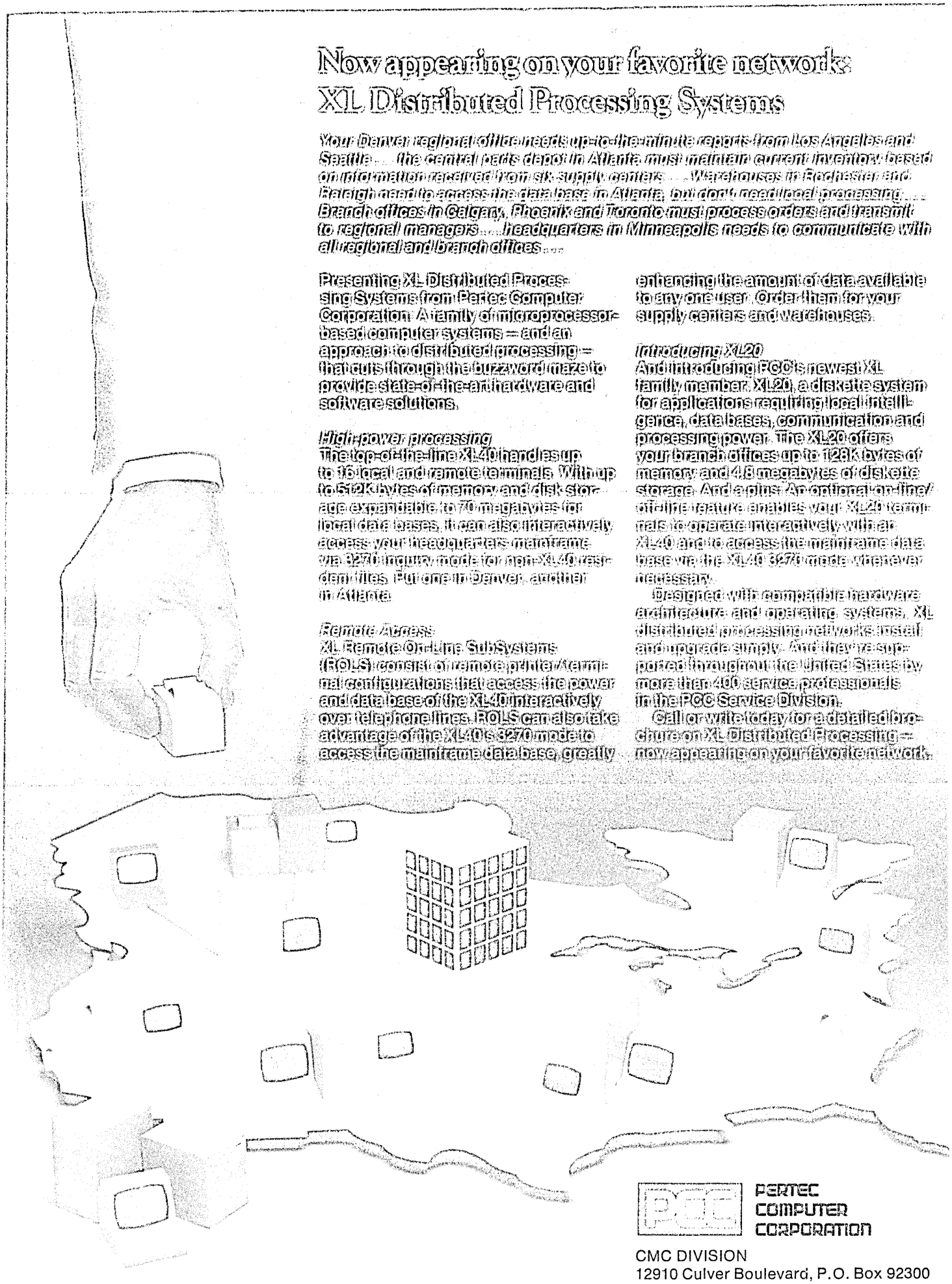
XL Remote On-Line SubSystems (ROLS) consist of remote printer/terminal configurations that access the power and data base of the XL40 interactively over telephone lines. ROLS can also take advantage of the XL40's 3270 mode to access the mainframe data base, greatly enhancing the amount of data available to any one user. Order them for your supply centers and warehouses.

Introducing XL20

And introducing PCC's newest XL family member, XL20, a diskette system for applications requiring local intelligence, data bases, communication and processing power. The XL20 offers your branch offices up to 128K bytes of memory and 4.8 megabytes of diskette storage. And a plus: An optional on-line/off-line feature enables your XL20 terminals to operate interactively with an XL40 and to access the mainframe data base via the XL40 3270 mode whenever necessary.

Designed with compatible hardware architecture and operating systems, XL distributed processing networks install and upgrade simply. And they're supported throughout the United States by more than 400 service professionals in the PCC Service Division.

Call or write today for a detailed brochure on XL Distributed Processing — now appearing on your favorite network.



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CIRCLE 4 ON READER CARD

GREAT PERFORMANCES BY MAESTRO™, HELD DAILY.

Which means programmers can hold great performances daily, too. Because Itel's Maestro, the first distributed programming solution, is "human engineered" to handle all tedious, time-consuming programming chores exactly the way a programmer would. So programmers are free to do what they do best—find new solutions to data processing problems. Maestro also offers programmers advanced techniques, like permanent audit trails, that other interactive systems can't provide.

But, allowing programmers to be more creative isn't all Maestro does. Combining the advantages of on-line programming with state-of-the-art distributed processing technology, Itel's Maestro takes all phases of program development—including problem definition, program planning, documentation and coding—off-line. Then Maestro moves on-line for compilation and testing. So your mainframe can spend more time on production.

In addition, Maestro supports software development in all current computer languages and functions independently from your CPU and operating system.

Maestro is the most advanced solution to program development and maintenance available. In saving you time, it allows you to be more responsive in providing useful information to your users. And because it eliminates repetitive programming tasks, it can help you attract and keep your best programmers. So, with Itel's Maestro, every phase of your DP operations can give a winning performance, daily.

For more information, call Itel Corporation, Software Marketing at (800) 227-8425. Within California: (415) 494-3338.

ITEL

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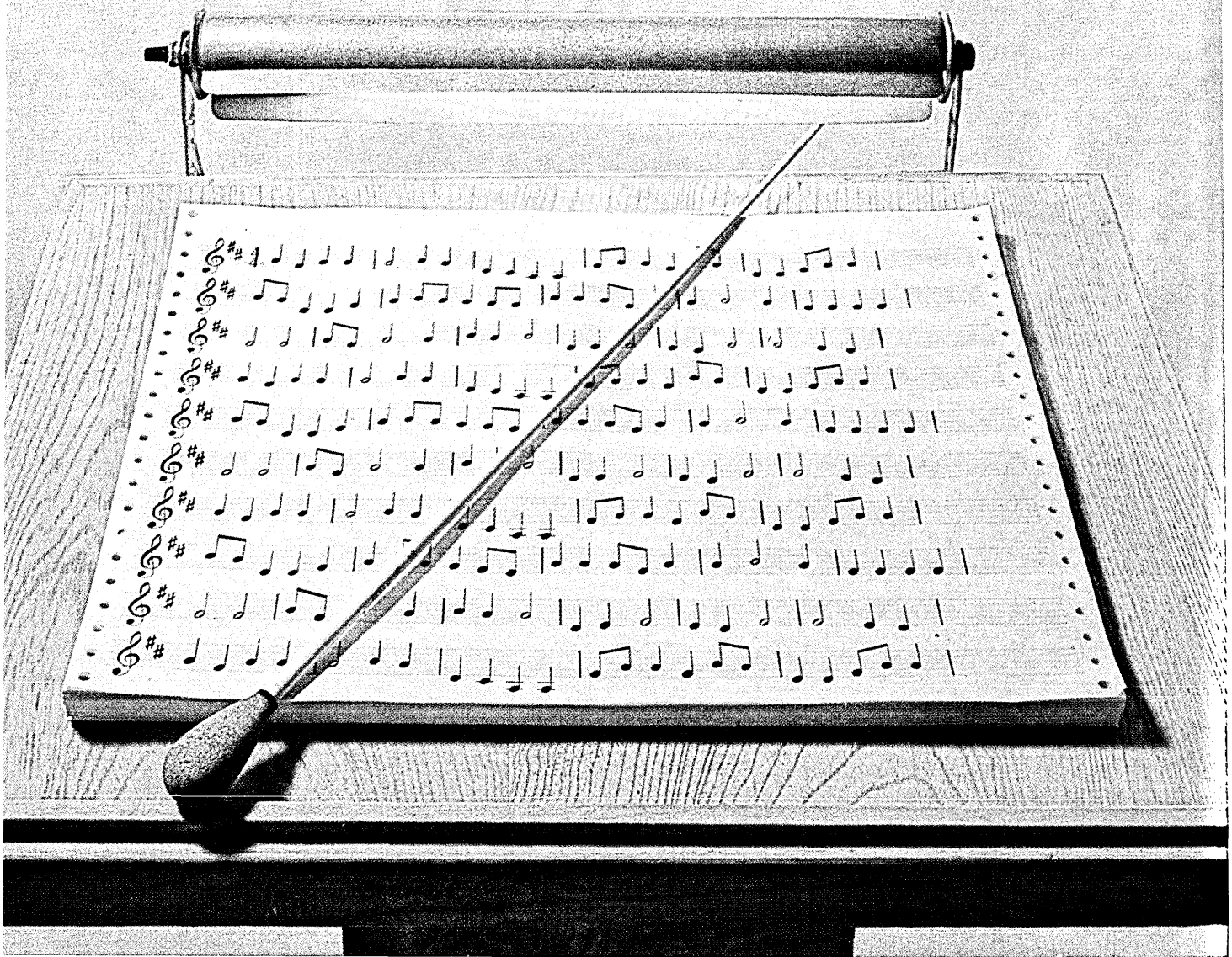

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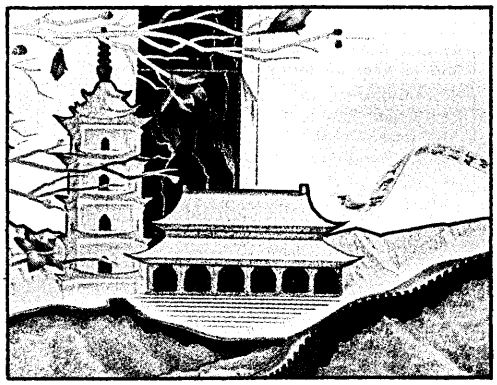

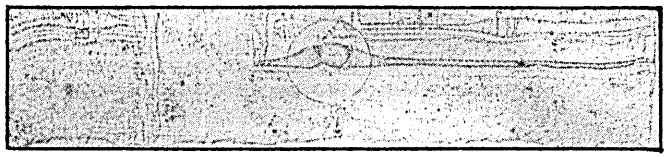
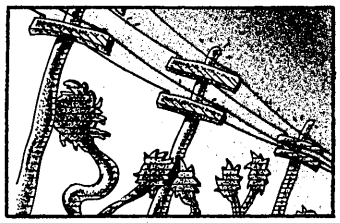
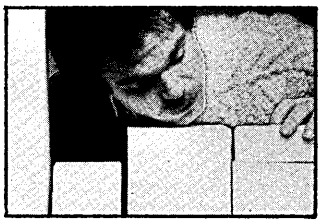

FEATURES

COVER
We take a serious look at a lot of the complex landscape of data communications. The painting is © 1979 by Jean Edelstein.

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SYSTEM 2000® MAKES EXCEPTIONALLY GOOD CENTS.

Today. Tomorrow. Data base management with SYSTEM 2000 makes it possible for you to do more without spending more. We call it centsible—so do our customers.

For example, Texas State Comptroller Bob Bullock's office is using SYSTEM 2000 to assist in recovering hundreds of thousands of dollars in delinquent taxes. (They very cleverly tied together their tax administration and statewide accounting systems with a SYSTEM 2000 data base.)

Some forward-thinking people at a leading manufacturer of nuclear pumps used SYSTEM 2000 to attack problems in inventory, purchasing, and quality control. As a result, they helped management increase the company's return on investment by increasing the turn on inventory. They solved in six weeks the purchasing problem that the company had been trying to solve with traditional methods for two years. They implemented a very thorough quality control program and a lot of other outstanding, cost-effective applications to make the company more efficient. More importantly, SYSTEM 2000 gave them the ability to expand these applications into their worldwide operations with only a very small increase in staff at the central site. And as for those central site staff members, their productivity—when compared to traditional methods—increased three to four fold! That's centsible.

There's still more. NASA is saving time and money in their space shuttle program by having SYSTEM 2000 handle tedious projects such as inventory control, problem reporting, documentation control, and other tasks which previously were labor intensive, cumbersome and inefficient.

Seven years ago, Ford Motor Company's Ford Parts and Service Division installed SYSTEM 2000 to track packaging specs and bill of materials information for over 200,000 different types of parts. (These parts are stored in the Ford Parts Redistribution Center which has over 3,000,000 sq. ft. of warehouse space and in 21 Ford Parts Distribution Centers which have 6,100,000 sq. ft. and are strategically located throughout the United States.) Imagine how incredibly costly and inefficient this would have been under the old paper file method!

These are just a few of our centsible customers. We'd like to tell you about the others and what SYSTEM 2000 can do for you. Just send in the coupon—we'll be right back with a penny for our thoughts.

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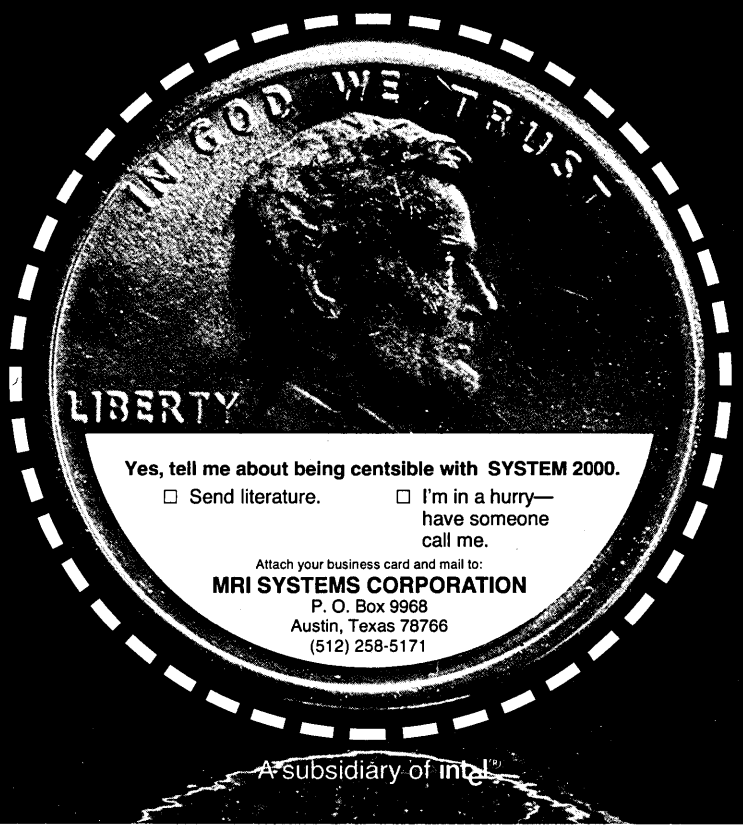

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CIRCLE 72 ON READER CARD

Clay, one of the most versatile of substances, can be as mundane as a brick, or as exciting as sculpture.

In much the same way, a Datapoint ARC™ system can be molded to fit the specific needs of a company.

Attached Processing: a unique architecture which combines the advantages of dispersed processing with the speed and capability of larger, conventional computers. The Attached Resource Computer™: a computer system that fits a business's shape, instead of fitting the business to the computer.

"Functionally" Dispersed Processing

ARC's versatility lies in its modular, building-block approach, comprised of an arbitrary number of small, powerful, yet inexpensive processors and peripherals, linked together by an Interprocessor Bus to form a "composite" computer of almost limitless capability.

Some of these small computers handle only data file management and retrieval, while others execute applications programs. Now many different business applications can have their own dedicated, autonomous processing power, while maintaining a common database for all users.

Have It Your Way

Processing power can be added or deleted as the work load requires. Peripherals and other resources can be shifted from place to place within the system without re-programming. Growth occurs in easy steps at incremental, predictable costs.

Just a Few of the Possibilities

Because of the inherent versatility of this architecture, a business can finally configure exactly the right amount and type of processing power. And use that power in the way that suits it best:

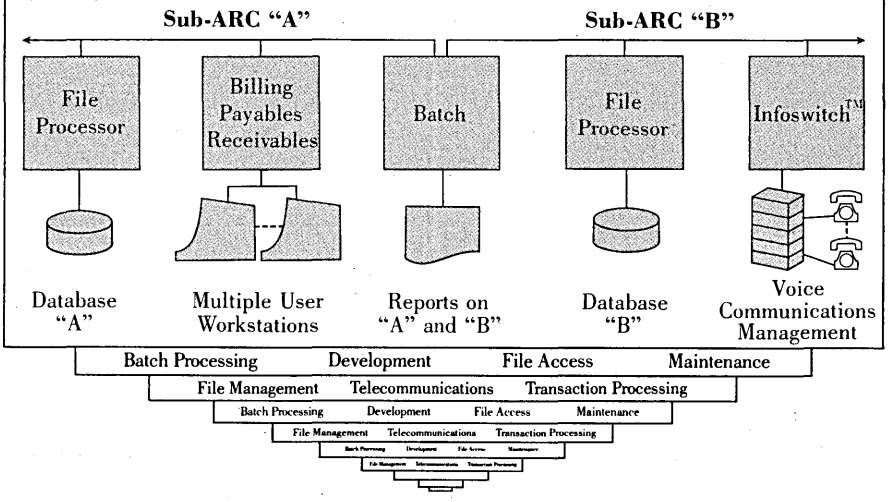
- Batch and Transaction: both types of processing can be run by different departments, on the same database. Companies can thus avoid the expense and complexity of two or more specialized computer systems with different databases.
- Multiple Languages: the ARC system supports all of the languages, utilities, and software packages that make up Datapoint's comprehensive software library. Languages like COBOL, RPG, and BASIC can be run alongside Datapoint's own DATABUS®/DATASHARE® family of business programming languages.
- Easy Growth: as new data processing demands arise, simply attach another applications or file processor to increase your throughput, without the usual software changes.
- Data Communications: when your ARC system needs to communicate with remote installations, count on Datapoint's experience. With our extensive library of communications packages, ARC systems can talk to mainframes, minis, or other Datapoint computer systems.
- Security: access to your company's confidential files in the common database can be limited by management, using any combination of hardware configurations and built-in security software for complete adaptability.
- Voice Communications: even a company's voice communications management needs can be handled through Datapoint's Infoswitch/ARC interface, enabling the same ARC system to help monitor and control business telephone costs.

Write for More Information

The versatility of a Datapoint ARC system can help you out-think your competition today, and in the years to come. A booklet describing the features and benefits of ARC in detail is available by writing: Marketing Communications Department (M62), Datapoint Corporation, 9725 Datapoint Drive, San Antonio, Texas 78284. Or simply call the Datapoint sales office nearest you.

ONE ARC™ SYSTEM!

ARC's versatility is seen in this multi-function office system. Two distinct "Sub-ARC" systems have their own secure databases. Data storage, batch, or transaction processors can be added in either subsystem. Only the batch printer (center) can access both databases.



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

DATAPOINT CORPORATION

The leader in dispersed data processing™

CIRCLE 84 ON READER CARD

TWENTY YEARS AGO/TEN YEARS AGO

LOOKING BACK

MARCH/APRIL, 1959

Minicomputers: Autonetics Div. of North American Aviation demonstrated its Recomp II at a Los Angeles meeting of the Digital Computer Assn. (DCA). The system is priced at $86,000 and will lease for $3,000/month. It features built-in floating point. A spokesmen said 11 Recomp II's "have been committed" but that no commercial deliveries had been announced.

Mainframers: General Electric's computer dept. said the first ERMA (the G-100) will be installed in May at the Bank of America. The prototype installation at Bank of America in San Jose has been effectively debugged, thus permitting first delivery of a fully operational system. ERMA accounts for the bulk of the computer dept.'s $50 million-plus backlog.

School system: Los Angeles City School System has leased a Burroughs Datatron 205 and thus has become the first school system in this country to adopt electronic data processing methods. The Board of Education had received bids from Remington Rand, IBM, and Burroughs.

Russia: A computer the Russians call "the most powerful in the world" is solving scientific problems at Kiev Univ. The computer, a differential analyzer, is described by a Russian writer as "incorporating 24 integrators and characterized by a high degree of automation in all of its units."

Universities: "The most important impact on university programs has been the education program of IBM," says Louis Fein, Palo Alto consultant, in a paper at the Western Joint Computer Conference. "IBM has 'presented' model 650s to more than 50 universities by now, under the condition that a couple of courses in data processing and numerical analysis be given."

MARCH, 1969

Justice vs. IBM: We hope that the people involved (in the antitrust case) understand the gravity of their individual and organizational responsibilities to the industry. And we'd like to humbly suggest that it is not simply a question of breaking up a monopoly, but of restructuring an industry which has known only the structure of IBM dominance.—From that month's editorial.

Computer on a chip: If this is the era of the minicomputer, is the bikini-computer next? With further advances in LSI semiconductor technology, the "computer on a chip" will eventually become a commercial reality. Unfortunately, there are no prospects for "peripheral equipment on a chip."—D.J. Theis and L.C. Hobbs.

RCA's Spectra 70/60: The step between the 360/50 and the 360/65 is a long one, and an expensive one, but many users who are outgrowing a 360/50 will find the Spectra 70/60 more than just a healthy step up.—Richard McLaughlin.

Acquisitions: A four-sentence news release from Scientific Data Systems was issued to notify the world that a "tentative agreement has been reached to combine the businesses of Xerox and SDS." In the four days prior to the announcement, SDS stock moved from about 85 to 100. Xerox was about 268 on the day the press release was issued.

Patent: David Ferguson, president of Programmatics, Inc., a Los Angeles software firm, has been awarded Patent No. 3422404 for an "Apparatus and Method for Decoding Operation Codes in Digital Computers." The patent covers both software and hardware embodiments of the package, but the company considers it basically a software patent. Application was made over two years ago. ✲

NEC Spinwriter. The fluent printer.

One printer. Many extra language features.

Users of word processing, computer output or terminal character printers expect fine print quality from their character printers.

But with NEC Spinwriter™ printers, you get even more. Our unique "thimble"—with up to 128 characters—gives you many extra features no other printer offers.

Like bi-lingual fonts, so you can print in any two languages at once. Or multi-lingual fonts—with up to five languages on the same print element: English, French, German, Spanish and Italian. Or technical/math thimbles with full alphanumerics, plus super- and subscripting and many arithmetic and scientific symbols.

Then add our unique 100-character-plus proportional space thimbles, numerous font styles in 10-, 12- and PS pitches, and our low-cost custom thimble design capabilities.

That's six extras so far. Seven: speed. Spinwriter printers use lightweight thimbles, so they print at a full 55 cps. Eight: durability. Our fiberglass-reinforced elements last up to 30 million impressions. And finally: quietness. Spinwriter thimbles are so much quieter than other character printers that you can hear the difference.

Now add those features to Spinwriter's acclaimed reliability, serviceability and ease of use, and see if you can find a reason for not including them in your systems.

And don't forget our Trimliner™ band printers. The ideal line printer for products that need 300-to-600 LPM output that you can always rely on.

For more information on Spinwriter and Trimliner printers, contact NEC, where better printers are made.

NEC

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CIRCLE 83 ON READER CARD

Our Automated Funds Transfer Systems can do your bank a world of good.

As a commercial bank, worldwide funds transfer is a vital part of your operation. Streamline this vital function, and you'll go a long way toward maximizing profits. Improving your competitive position. Attracting and holding new accounts, too. And that's precisely what the new Rockwell-Collins Automated Funds Transfer Systems are all about.

As the first fully integrated, upward-compatible family of advanced, computer-based systems, our AFTS interfaces all of the available funds transfer networks. Automates much of the internal handling. Cuts costs. Reduces delays. Gives you up-to-the-minute visibility.

AFTS works by integrating transaction processing with communications processing and message handling. Say good-bye to error-prone file reference. Interdepartmental hand carry. Manual record keeping. Say hello to automatic storage for incoming transactions. Automatic processing for fixed-format transactions. Automatic recording of processing events. Local data base of account information. Balance checking. Current position. Reformat to match wire type. And finally, automatic recording and reporting on work load distribution by priority.

Can one of the new Rockwell-Collins AFTS systems make your operation run more efficiently? You can bank on it. For details, contact your nearest representative listed below. Collins Communication Switching Systems Division, Dept. 420-200, Electronics Operations, Rockwell International, Dallas, Texas 75207. Phone: 214/996-2336.

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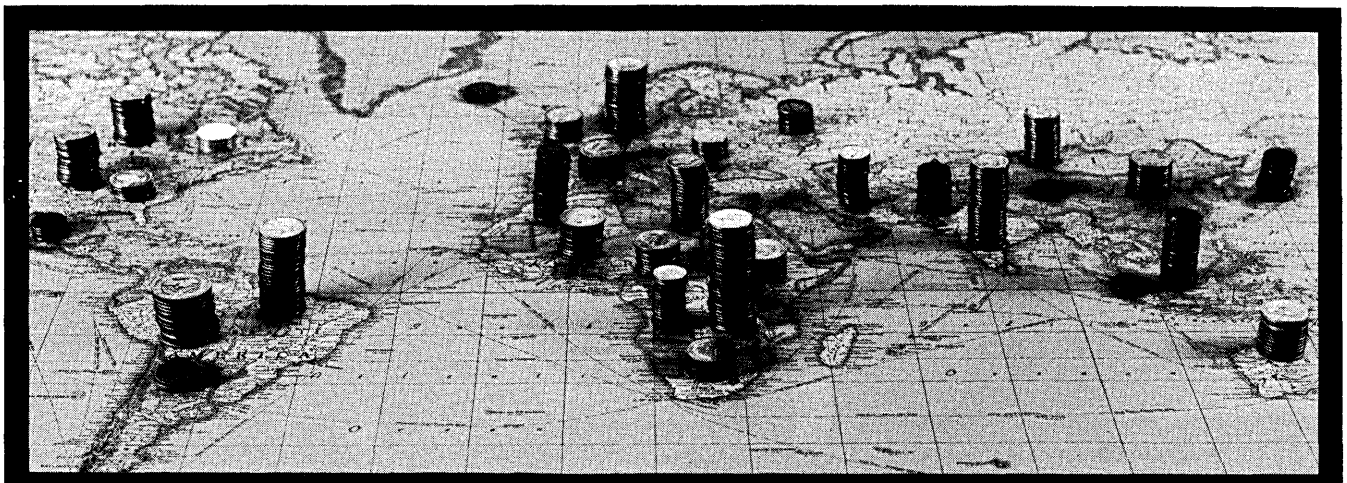

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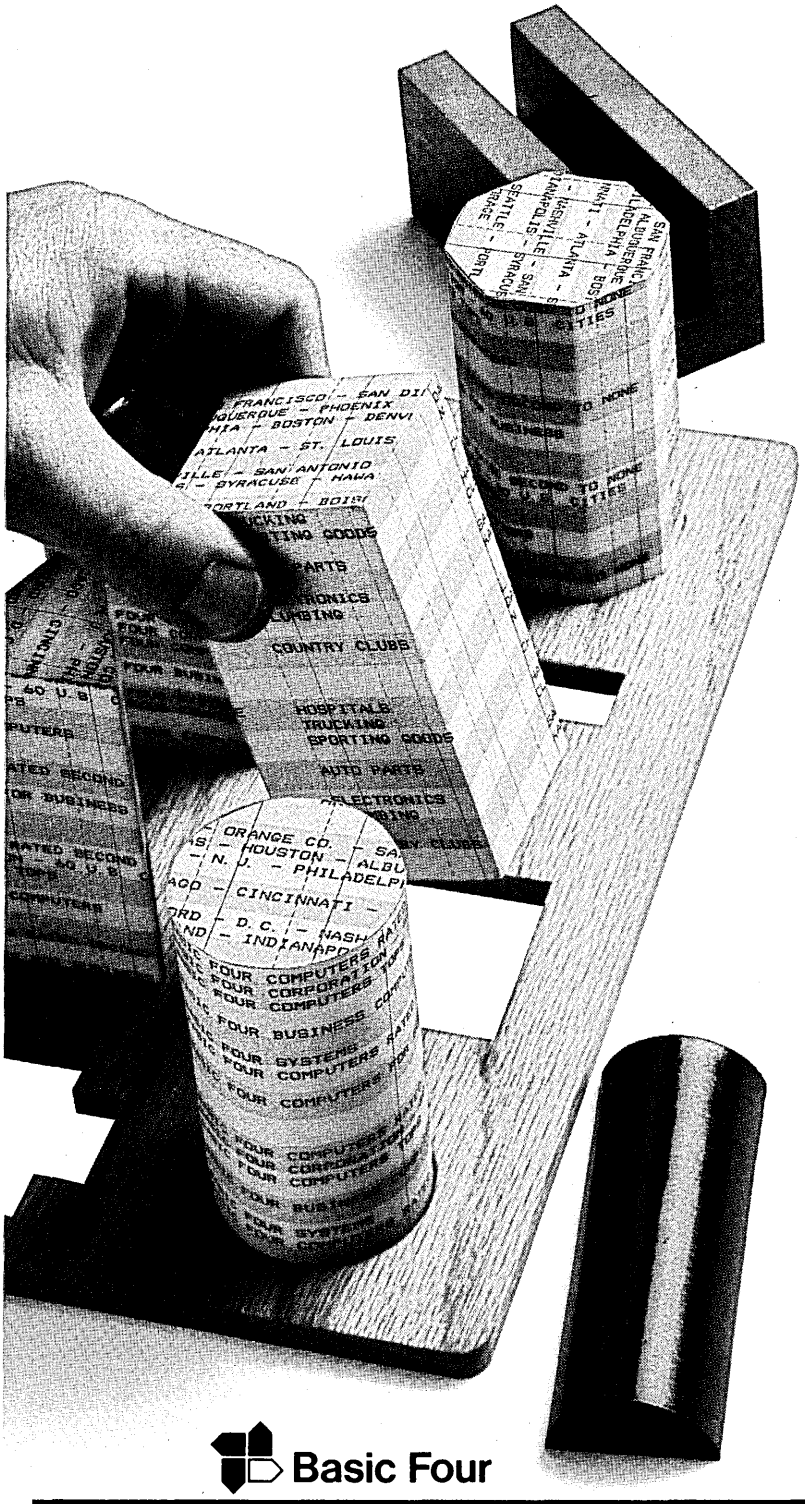
CIRCLE 206 ON READER CARD

It took Basic Four to fit distributed data processing to our business



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

Management approved. It makes sense to have tools where you do the work—as long as we could retain central control. We looked into it, and chose a network of Basic Four® computers.

Basic Four calls their network "Distributed Business Systems," because the emphasis is on business solutions, not just fancy hardware. And that's what our remote locations need.

Each one has the problems and volume of a small business. So the key factor is how well each computer in the network can handle such needs. And that's been Basic Four's specialty for over 7 years. They've put in more than 5000 systems for all kinds of businesses.

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

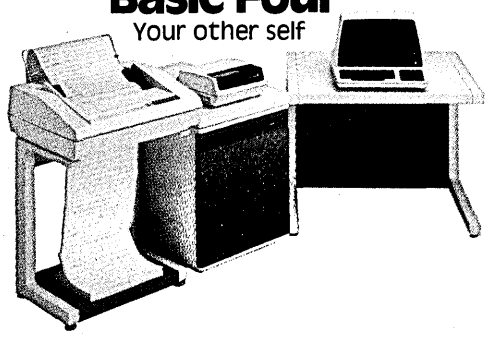
Naturally there's full communication between computers. For things like shared inventories. And easy reporting, to keep tight home office control.

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

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

Find out how Basic Four Distributed Business Systems can do the job for you. Call or write now.

Basic Four
Your other self



MAI

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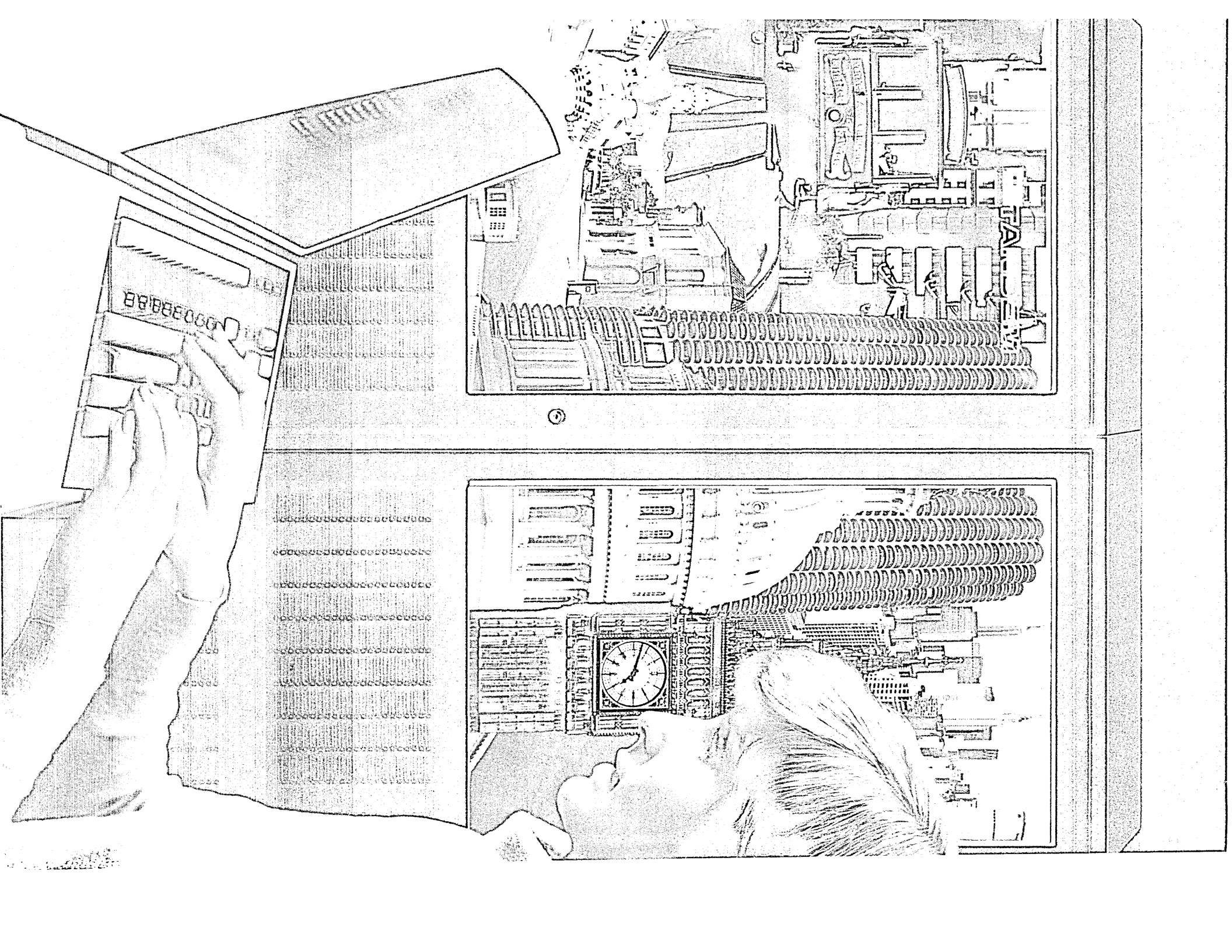


GUARDIAN/EXPAND
The Tandem NonStop™ Network Operating System

The differences are enormous. The system is entirely transparent.

It began with the Tandem NonStop System. First of its kind. The one multiple processor system in the world capable of continuous operation—even during the failure of a processor I/O channel, disc controller or disc. Without loss or duplication of any transaction, even those in process. And with maximum protection for the data base—at a level unprecedented in the industry. Plus phenomenal flexibility: expandable in low cost increments from a basic two processor system all the way to sixteen processors with the ability to support thousands of terminals per system. File capacity of up to four billion bytes per file, and no limit on the number of files. Extraordinary it is, all by itself, and now as many as 255 Tandem NonStop Systems can be economically interconnected in a powerful, complete and amazingly simplified network. Read on.

Announcing the 4000 processor network.

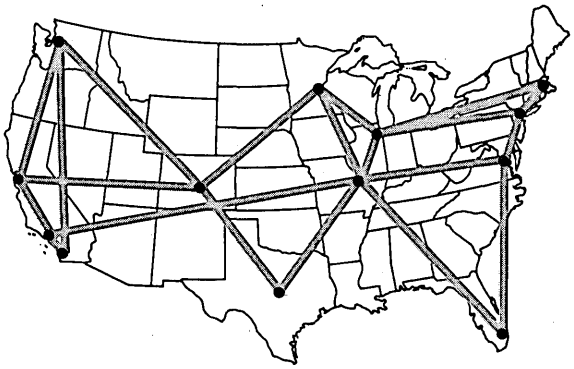
Here's how to tie together 4000 processors: Easy. Interconnected in the most beautifully simple way. Per the diagram. Point-to-point connections can be made between all centers of overlapping activities, but are not required. We can in fact tie the network together with a single continuous line. And there is no user involvement for pass-through. To get from "A" to "F," no user housekeeping penalties from "B," "C," "D," & "E." It looks exactly as if all messages were being transmitted only next door. And X25 protocol is available as well.

Introducing the distributed/ centralized data base.

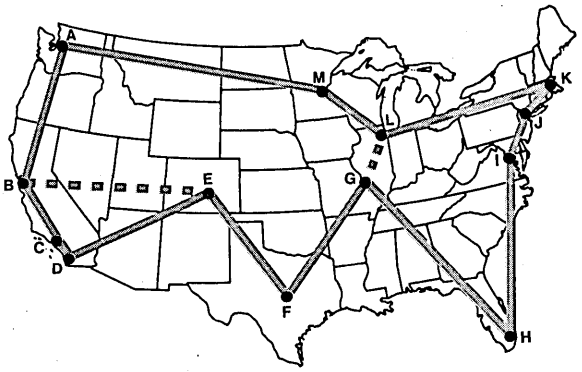
Totally transparent. With a split of geography completely invisible to the user. Not the separate interconnected data bases found in other networks but a unified data base completely and transparently accessible throughout the network. No user, and no application program, has or requires any awareness whatsoever as to the actual location of any segment of the data base in the Tandem network. With a Tandem NonStop Computer System, your data may be in Ypsilanti, but it looks for all the world like it's residing right in your own local system.

To get rid of a host of problems, get rid of the host.

Having a host system in a network is traditional. Unfortunately, it is also the traditional point of concentrated difficulties. For when the host goes down, so does the whole network. And even if the host is only suffering an intermittent difficulty, the integrity of the data base is up for grabs, not only in the host, but throughout the remote data bases as well. With Tandem's GUARDIAN/EXPAND Network, a local failure has no impact whatsoever on the rest of the



Conventional fixed network is difficult and expensive to expand and modify as needs grow. And they always do. Communication and utilization of data base records from twice removed nodes is prohibitively expensive in applications programming, so more lines are the only viable solution. And that is expensive, too.



Tandem pass-through packet switching enables "A" to communicate with "E" at no penalty in system overhead. And you can add direct lines, per "B" to "E" or "L" to "G" whenever traffic warrants without disrupting system performance or efficiency. Note that nodes can be of variable sizes, all using Tandem NonStop Systems as the common element. Efficient, powerful and extremely low cost.

system, and best-route switching automatically circumvents the trouble spot. If there is a failure in the communication link, the system will automatically go around it. The system and the network stay up and running, and best of all—the data is intact, its integrity assured.

A unique and unified operating system—free of geographic limits.

Whereas most network operating systems are created "on top" of prior operating systems, at significant penalty, Tandem's Guardian Operating System was created from day one for the multiple processor environment. It treats *all* resources within the system as files, both hardware and software, and accordingly achieves complete geographic independence, both for the user and for the user's programs. This is beautiful at any time, and it is a lifesaver when increased work loads call for an expanded system, more processors and peripherals, and perhaps a new configuration of resources. This is unique: no reprogramming is required, not even recompilation.

The long and the short of it—keeping costs down and performance up.

No one can do that like Tandem. For the differing needs at each node can be met by the expandable Tandem NonStop System in varying configurations. Single system programming works over the entire network and will continue to work regardless of growth and complexity of the system. And because this is after all a mini-based system, the costs are low to begin with and add-ons come in low-cost increments. Without one cent of penalty on the original investment.

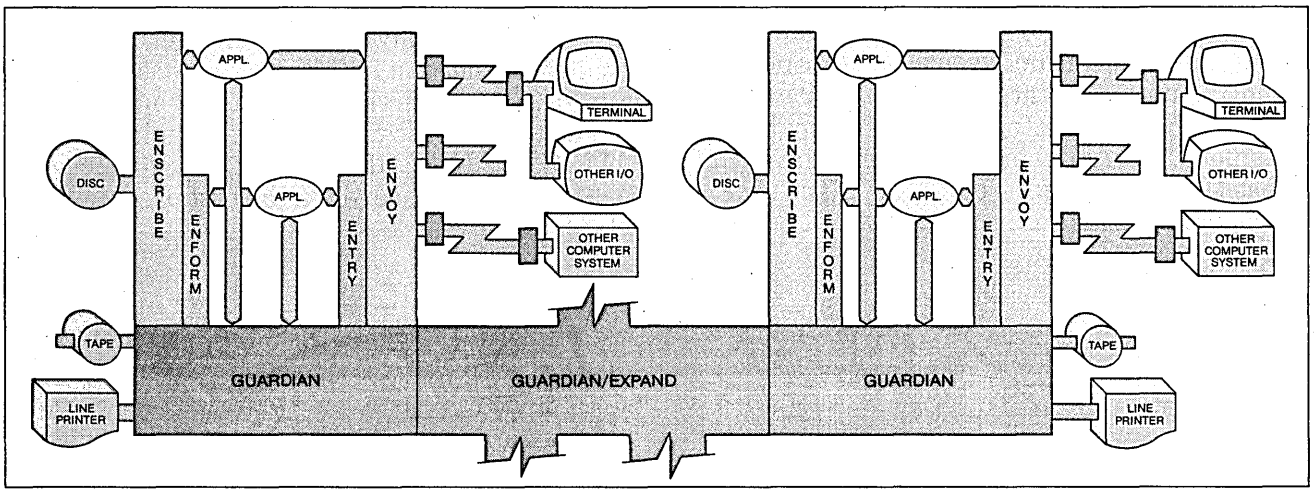
Comprehensive software—transparent and segmented.

Under the overall supervision of GUARDIAN/EXPAND, the Network Operating System, each individual system maintains its own Guardian Operating System plus all of the multiple processor and control communications systems and a host of applications languages including industry standard ANSI '78 FORTRAN and ANSI '74 COBOL. With T/TAL, EDITOR, SORT/MERGE, DEBUG, TGAL, ENFORM Query/Report Writer, and complete remote diagnostic capabilities, the software package of the Tandem NonStop Operating Network is truly impressive. Best of all, it never requires one iota of modification as systems, nodes and the entire network expand and are modified to suit changing requirements. And any Tandem GUARDIAN/EXPAND node can communicate with IBM or any other mainframe using industry standard protocols. We've made it possible and practical to go from any industry standard system to a low cost, comprehensive and flexible network without sacrificing your original installation.

If you're from Missouri, too.

Call or write for complete information about the Tandem NonStop Operating Network. We'll be happy to demonstrate both how and why this system will cost you less to begin with, less to expand, and less to operate than any other network on the market today. And most likely for years to come.

Tandem Computers, Inc.
19333 Vallco Parkway, Cupertino, CA 95014.
Toll Free 800-538-9360 or (408) 996-6000 in California.



Worldwide headquarters: Cupertino, California (408) 996-6000
U.S.A. Regional Offices: New York (212) 594-2320; Chicago (312) 397-5200;
Dallas (817) 640-8771; Branch offices throughout the U.S.A. and Europe.

TANDEM

LANDSLIDE

The results are already in for the Great Sorting Election of 1978!

(54% vote for Syncsort OS, only 36% for IBM 's "top" sort.)

Call (201) 568-9700.

Ask for a copy of the latest "sort census."

Ah, we can almost see and hear it now! It is Election Night, and there is Good Old Reliable Walter, sitting exactly where you'd expect him to be—at the anchor desk in Election Headquarters. Suddenly he fiddles with that thing he wears in his ear, listens intently and says:

"Ladies and Gentlemen, we now have a winner in that OS sort-program race that has aroused so much interest across the nation. We predict that SyncSort will be re-elected handily with an impressive 54% of the vote.

"Trailing badly is the handpicked candidate of the powerful IBM Machine—SM1-5740, Release 3. Despite the fact the other IBM entries—SM1-5734 and SMO23—threw their weight behind Release 3, IBM's top-of-the-ticket candidate garnered only 36% of the vote.

"Will this be the last hurrah for that silver-haired, florid-faced sort known in so many of the nation's club houses as 'ICEMAN 3?' To find out, we take you now to the losing candidate's headquarters in beautiful downtown Armonk..."

Sorry, Walter, but we've known about these results for weeks now. Because this year, as in 1977, we commissioned those redoubtable poll-takers, the International Data Corporation, to find out for us.

They conducted a telephone survey to find out who uses what sort. The results—together with those for last year—are shown below:

SORTS USED BY OS & OS/VS USERS IN THE UNITED STATES

Sort Name	July 1, 1977 No. of Systems	July 1, 1977 %	July 1, 1978 No. of Systems	July 1, 1978 %
SyncSort	1,333	43%	1,836	54%
SM1-5740 (IBM)	992	32	1,224	36
SM1-5734/SM023 (IBM)	651	21	204	6
Other	124	4	136	4
	3,100	100%	3,400	100%

If you'll call, we'll be glad to send you a copy of the full report. It contains some interesting information on how data processors migrate from those venerable old IBM graybeards —SM1-5734 and SMO23—to SM1-5740, Release 3 and, eventually, to SyncSort.

The reason is not hard to find. Data processors are becoming increasingly aware of inflated "sorting taxes"—overuse of CPU Time, Elapsed Time and the other valuable computer resources that go into sorting. Show them a sort that does more work for fewer resources, and they'll vote for it.

Quicker than you can say "Proposition 13."

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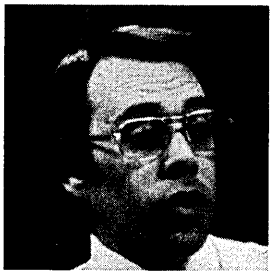
WHITLOW

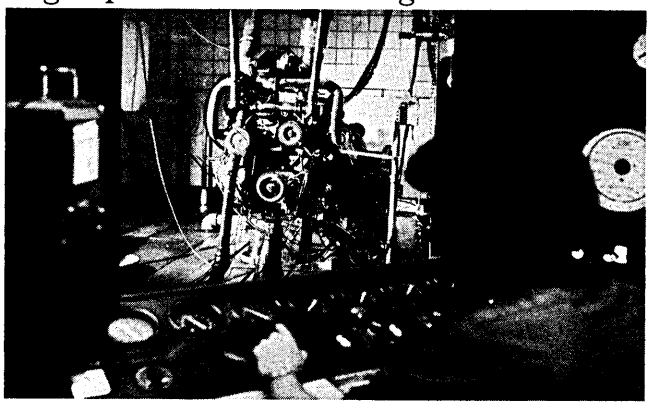
COMPUTER SYSTEMS Inc. 560 Sylvan Ave., Englewood Cliffs, N.J. 07632



"BEFORE WE COULD BUILD THE WORLD'S LARGEST INDUSTRIAL DATA ACQUISITION SYSTEM, WE NEEDED NETWORK AND SYSTEMS CAPABILITIES WE COULD DEPEND ON." "ONLY MODCOMP HAD THEM."

Jim Springer, Director of Data Systems,
AVCO Electronics, Huntsville, Ala.

Jim Springer is building what will be the largest industrial data acquisition system in the world. This system will be used for development and testing by one of the world's largest producers of diesel engines.



To implement the system, Jim chose MODCOMP's Classic® Computers, the MAX IV operating and communications system, and the MAXNET IV network extension.

"Network software capability is the key."

"The MAXNET IV network extension integrates all 120 computers in the system. This provides us with the performance characteristics of a stand-alone system, and the economic advantages of network resource sharing.

"In a real-time environment, that's essential."

"MODCOMP gives us the high speed and performance we need — at a cost we can afford."

"The MAX IV operating system is ideal for this type of real-time multi-programming. And with the Classic's extremely fast floating-point processor, we have more than enough speed.

"This is essentially the same system we specified for testing NASA's Space Shuttle. Ordinarily, that kind of superior quality and reliability would be out of reach for industry. But because of their experience with the NASA system, only MODCOMP could meet the assigned high performance levels at a cost industry can afford."

"MODCOMP's tougher on their equipment than we are."

"Our customer was concerned about equipment reliability in their plant. And with good reason. The temperature can get as high as 120 degrees. But we've seen the Classic perform in worse places. MODCOMP's 'hot room' test facility, for instance. That's 132 degrees."

"Obviously we have a lot of faith in MODCOMP."

"We're just in the first phase of this system. But we have to know that, say, 3 years from now, the hardware will be available and that the software can be implemented or interchanged as needed.

"We recommend MODCOMP because we have a lot of faith in them. In their company, their equipment and their service.

"We know they can deliver. It's as simple as that."

At MODCOMP, we specialize in building real time computer systems and the network software capability to make them work.

Easily. Reliably. Affordably. And with the kind of performance you'd expect to find in the world's largest industrial data acquisition system.

If that's what you're looking for from a computer system supplier, do what Jim Springer did. Call MODCOMP.

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LOOK AHEAD

HOW IBM MIGHT UPGRADE USERS

Some software specialists say the microcode module of the 4300 series, called ECPS (for Extended Control Program Support), may be IBM's leverage point to move users into the next hardware environment. Program products announced with the 4300 series rely upon a previously announced software package, the Advanced Function Product, that IBM says is required for warranted maintenance. It can be run on both the classic 360 and 370 models or on the new 4300 series. On the 4300s, however, this package and its "associated programs" are given a "fastpath" assist by the ECPS microcode.

Software people note, however, that IBM soon will withdraw its microcode source code from field distribution and they ask: what will happen if and when IBM announces a second release of the Advanced Function Product that requires ECPS microcode? Like a track switch thrown on a railroad, that would require an ECPS processor for all new releases of IBM software.

SLIPPING UNDER THE UMBRELLA

Independent software vendors forsee a huge expansion for their OS related products despite IBM's agressive split-fee pricing on software announced with the 4300 line. These vendors point particularly to programmer aids, program generation tools and general applications packages that they offer.

For instance, the OS version of the old DMS (Display Management System) was priced the same as the DOS version, $425 a month. Now, however, IBM has renamed the package "Development Management System" and while the DOS version is priced the same, including license and maintenance, the OS version has been hiked by 44%. Some independent software houses are talking about raising their prices for equivalent DMS-like OS packages to take advantage of the higher price umbrella.

A JOLT FOR SOME INDEPENDENTS

IBM's DMS/OS was the single higher priced item among software introductions with the 4300 series that generally featured tough competitive prices. For instance, ICCF-II (Intercomputer Control Facility), an apparently rewritten upgrade of ETSS-II (Entry Time-Sharing System) reflected an apparent 81% price cut. ETSS, which was priced at $325 a month for basic license and $85 more for a terminal control option, compares with the new ICCF-II at $60 a month (including the control option) and $20 for support -- or $80 for the whole thing. That's a better than five to one price reduction in cold cash, more if the new ICCF-II has increased functionality. All of this has jolted such software independents as ADR, Pansophic and NCI which market packages that compete against ETSS-II.

I/O PROCESSOR FOR A MICRO

Intel Corp. this month will announce the model 8089 I/O processor that could more than double the performance of

LOOK AHEAD

its 8086 microprocessor by relieving it of I/O functions. An Intel spokesman said the 8089 functions much like an IBM 360 series channel and its design reflects the thinking of mainframe designers moving into the semiconductor business. The 8089, which will sell for around $100, will be dedicated to doing logical manipulation, while the cpu "goes about doing what it's best at." Interrupt latency of the cpu is about 20 microseconds, while that of the 8089 is two microseconds. An advantage cited by Intel is that a systems house integrating the microprocessor and I/O processor could split a software team in half, assigning one half to the microprocessor and the other to the I/O device.

BIG ROLE FOR SUPERCOMPUTERS IN OIL

Supercomputers striking it rich in the oil industry? That's the prediction of one knowledgeable oil industry dp person who claims the industry's insatiable computation needs to maximize oil recovery efforts have spawned a parallel demand for super processor power. While today, most oil number crunching is for seismic analysis to uncover new oil reserves, there's also growing use of reservoir modeling to find ways to exploit existing reserves. These modeling techniques require massive simulations of multidimensional grids -- a perfect application fit, the source points out, for huge array computers such as the Cyber 203 and Cray-1.

MIXING MONEY AND GAS

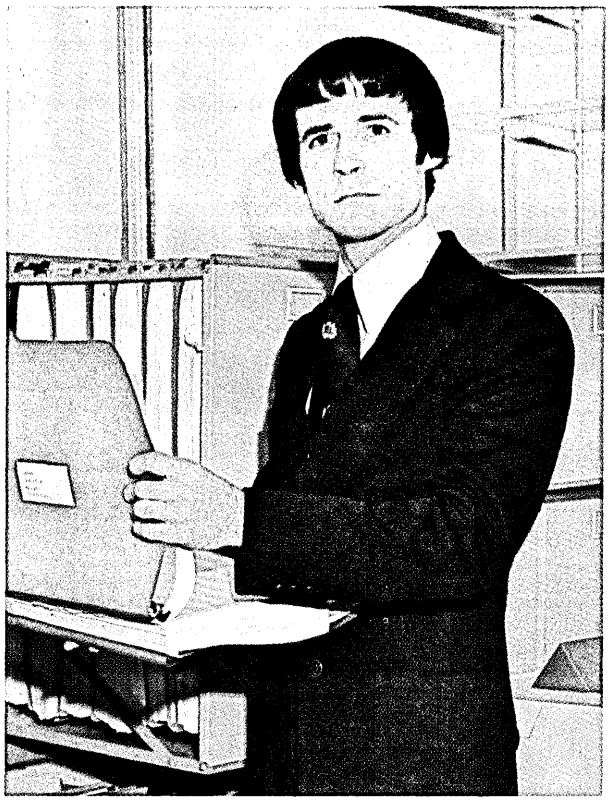
Among the bigger current concerns of commercial banks is the mixing of money and gas should gas rationing come to be. The government wants banks to be the dispensers of ration coupons and banks don't like that. But another mix of money and gas may be more appealing. City National Bank & Trust of Columbus, Ohio, has been building "auto-banks" -- minibranches combining an Automated Teller Machine (ATM) and space for a single live teller, to serve drive-in and walk-up customers at self service gas stations. The units can be installed for some $65,000 and can be built off-site and moved to the stations.

COAST TO COAST SWIFTLY?

Swift (Society for Worldwide Interbank Financial Telecommunication) was designed, as its name implies, as an international message switching system for financial institutions. But, are some U.S. banks using the network for domestic transmission -- east coast to west coast? Could be. A speaker at last month's American Bankers Assn. Telecommunications Conference who talked about Swift, was asked if his California bank used it for communications with the east coast. He declined to answer. "It's a sensitive subject." Another speaker at the same session noted that there's nothing in writing forbidding the practice, but it is generally accepted that domestic transmission is not what Swift is all about.

RUMORS AND RAW RANDOM DATA

IBM's unsuccessful model 5100 desk top computer, later replaced by the 5110, is being dropped by the company which will discontinue manufacturing by May 1.



"When we first looked at MARK IV, we weren't even interested in acquiring software — we were just doing an evaluation of data base management systems. MARK IV sounded so good that we had to take a closer look. Because of the capability and productivity improvements it offered, we decided to go with it immediately.

"We've had such tremendous success with the system that we have made it the standard programming language — the only Cobol work we do now is maintenance of existing systems.

"We're extremely happy with the way MARK IV works with our data base. We installed IMS with DL/1, and that afternoon we were processing off the data base with MARK IV.

"An important part of our success has been in getting MARK IV out to our users. For example, the Director of Budget uses the MARK IV On-Line Query Language for evaluations and projections. Our Registrar people do the same with the MARK IV batch facility. When the user can get his own report out quickly, it creates immense satisfaction and reduced costs for all of us.

"As far as the productivity of my own programmers, I've found that what takes a week-plus in Cobol takes only a day with MARK IV. We're going to use MARK IV to do all the batch work.

"When people ask me what I think of MARK IV. I tell them they can't afford **not** to look at it. I am a firm believer in the results and benefits of MARK IV. It's one of the best pieces of software I've ever used."

Get the facts about MARK IV. MARK IV is the most versatile and widely used software product in the world for application implementation, data management and information processing. Six powerful models (prices start at $12,000) are in daily use on IBM 360/370, Univac 70/90, Siemens 4004, Amdahl 470 and Itel Advanced System computers at over 1,300 installations in 44 countries. Programs in MARK IV require only about one-tenth the statements of Cobol, and users report 60 to 90% cost and time reductions on most MARK IV applications.

"MARK IV® is the best piece of software I've ever used!"

—Al Baker, Manager, Data Base Coordination and Administration Department, University of Georgia, Athens, Georgia

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Views expressed are those of Mr. Baker and not necessarily those of the University.

Meet the World Leader in Data Concentrators

Meet MICOM's Micro800 Data Concentrator, the statistical multiplexor which ended the TDM era. The Micro800 allows up to 16 terminals to share one telephone line more efficiently and more economically than ever before, and provides the added benefit of automatic error correction. And since it is virtually self-configuring, the Micro800 also offers *do-it-yourself installation* — no straps, jumpers, plug-boards or 'kluge' headers to mess with.

So if you have a time-share network and you think you can only afford error-controlled multiplexing to cities with more than 8 or 16 dial access ports, think again . . . and try our Auto-baud feature, you'll like it.

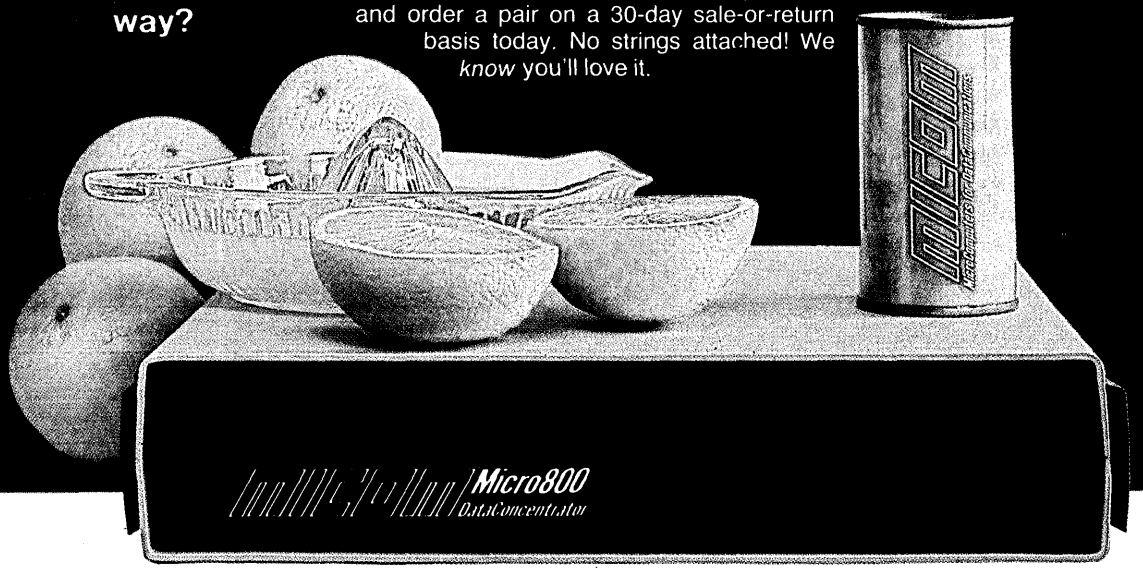
Or if you have a large private data communications network, and you can't afford to provide direct network access in your smaller locations, the Micro800 can provide economical error-controlled multiplexing into your network concentrators for as few as two terminals . . . and software demultiplexing in your network nodes may be awfully attractive.

In particular, if you have a minicomputer system with several terminals in one remote site, you are probably paying a fortune in communications costs, operating the terminals slower than you would like, and learning to live with the occasional phone line 'glitch' which drives your CRT's crazy. Why not talk with some of our Micro800 customers, supporting four 2400 bps CRT's on a single 2400 bps line, glitch-less! . . . and take advantage of our Hewlett-Packard, TermiNet® and DEC-writer® options.

The Micro800 requires absolutely no changes to the hardware and software you have installed today. Hundreds of Micro800's are already in service, and prices start as low as $1150 for a 2-channel unit. So why not call and order a pair on a 30-day sale-or-return basis today. No strings attached! We *know* you'll love it.

Still squeezing data through the old-fashioned way?

Concentrate. It's cheaper!



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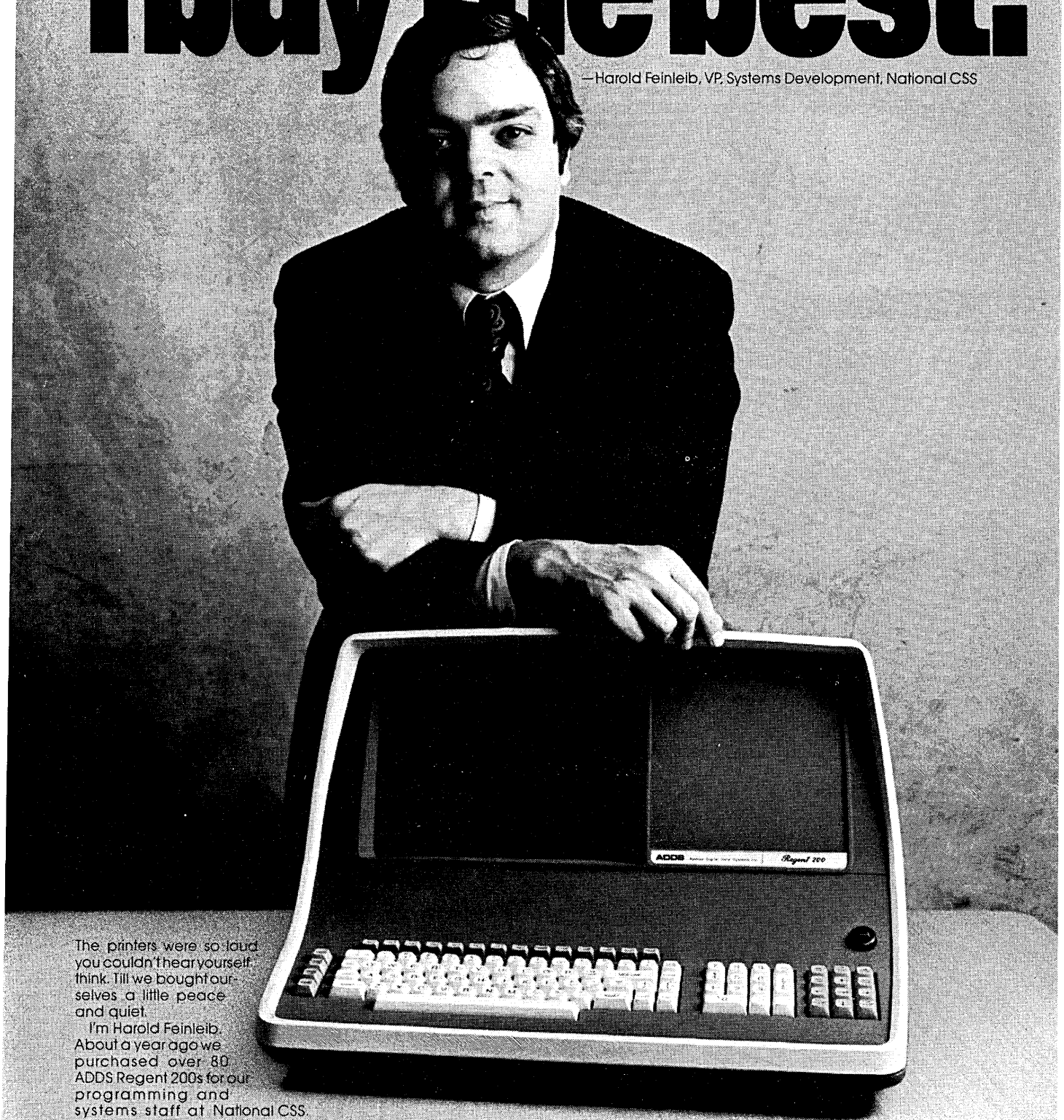
CIRCLE 205 ON READER CARD

"I buy the best."

—Harold Feinleib, VP, Systems Development, National CSS



The printers were so loud you couldn't hear yourself think. Till we bought ourselves a little peace and quiet.

I'm Harold Feinleib. About a year ago we purchased over 80 ADDS Regent 200s for our programming and systems staff at National CSS.

As a major remote computer services company, with over 120 programmers and analysts at our company headquarters, we needed a quality terminal that would meet our present requirements and keep up with our planned growth.

So we evaluated leading CRT terminals, and ADDS Regent 200 came out a winner. The Regent had the features, price and delivery we needed, and it looked great in our new offices.

We installed the Regents last June. And we've been smiling ever since.

ADDS Regent. They're quality we can rely on.

ADDS, Applied Digital Data Systems Inc., 100 Marcus Blvd., Hauppauge, N.Y. 11787 (516) 231-5400. CIRCLE 11 ON READER CARD

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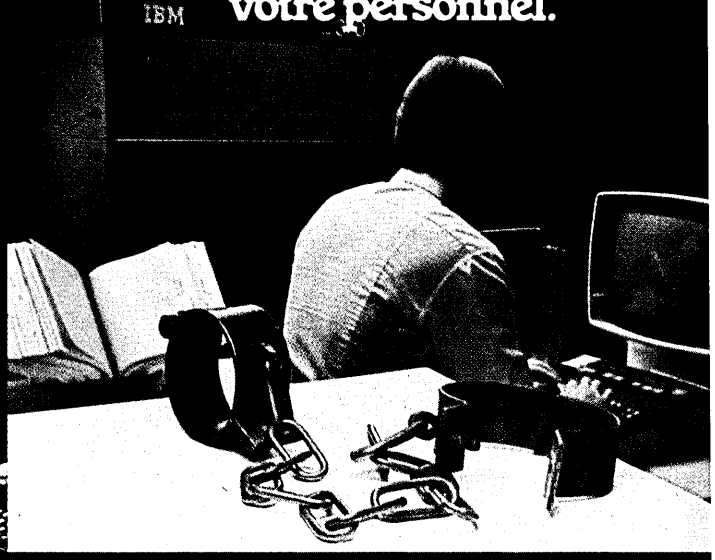


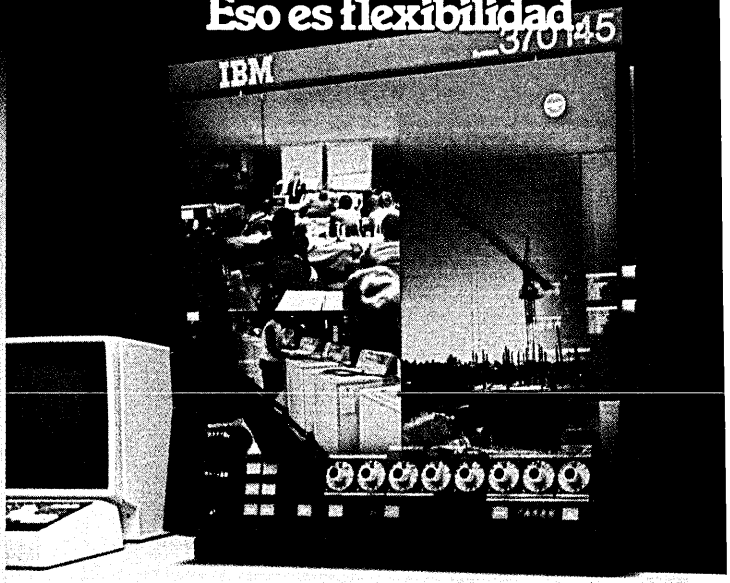
Nummer Eins in Durchlauf und Leistungsfähigkeit.

Il DBMS vincitore di premi.

IDMS har just gjort vad inget annat DBMS har gjort furut.

1976
1977
1978
datapro
HONOR
ROLL

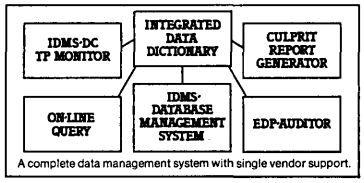
IDMS le permite poner el mundo real en su computadora Eso es flexibilidad.



Worldwide

Results today and protection for tomorrow.

Getting your database up fast and making it productive is our first concern. Making sure that you'll be able to grow and change as business conditions change is our second.



A complete data management system with single vendor support.

Many of the world's major industrial, financial and governmental organizations depend on Cullinane Corporation's Integrated Database Management System (IDMS) for efficient, cost-effective and *stable* management of their information resources.

IDMS is a technologically advanced system designed for ease-of-use, flexibility and continuing viability. It is CODASYL-compatible and fully integrated with a comprehensive family of proven Cullinane data management software products.

IDMS is the only database management system that has been named to the Datapro Honor Roll for three consecutive years.

IDMS is backed by a strong and responsive international network of service and support teams.

IDMS is backed by Cullinane Corporation's aggressive research and development program, by our commitment to keeping our users *ahead* of emerging data processing and data communications technology, and by our long-term financial stability.

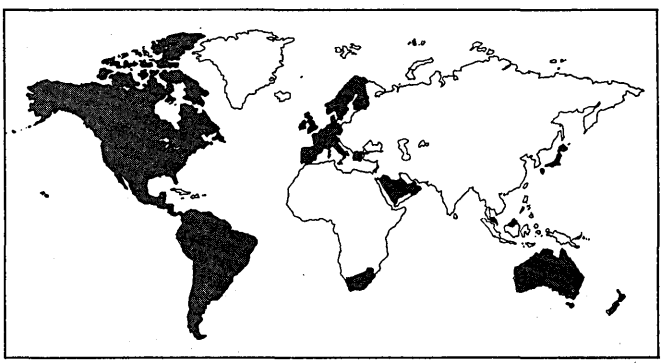
Integrated Software Systems from Cullinane:

IDMS is *the* state-of-the-art database management system for use in the IBM environment.
IDMS-DC, our teleprocessing monitor, is designed to streamline and simplify data access and programming in an on-line environment.
IDD (Integrated Data Dictionary) is an inclusive and up-to-date catalog of information on the location, definition and status of *all* data resources: database as well as conventional.
On-Line Query is an easy-to-use information retrieval tool for management and an effective monitoring facility for the data administrator.
INTERACT, Cullinane's interactive program development system, provides on-line editing, word processing and remote job processing capabilities.
CULPRIT is a fast, powerful and economical report generator designed for use by programmers and non-programmers alike.

Audit/Retrieval Software Systems from Cullinane:

EDP-AUDITOR is a set of comprehensive and independent auditing tools for use with IBM 360/370 and 303X computers.
EDP-AUDITOR/3 extends proven Cullinane audit capabilities to the System/3 environment.
CARS may be used to perform auditing tasks on any computer system which supports ANS COBOL.

Over 2000 installations at over 900 user sites worldwide.
For more information, write or call the Cullinane representative nearest you.



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ADV/ORGA (Schweiz) GMBH, Mainaustrasse 17, CH-8048, Zuerich, Switzerland, Mr. Klaus Ness, 1-320270

Finnsystems OY, Aleksi 15 A, 00100 Helsinki 10, Finland, Mr. Kalevi Kontinen, 90-13901

Raionell Programutveckling AB, Industrivagen 1, 19123 Sollentuna, Sweden, Mr. Lars Mild, 8-960500

M-Data, El. Venizelou 15, Kallithea, Athens, Greece, Mr. El. Michaelides, 9590-631

Praxis Calcolo, 32 Via Visconti Di Modrone, 20122 Milan, Italy, Dr. Enrico Albani, 799601

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ICL (S.A.) (Pty) Ltd., Post Office Box 7018, Johannesburg 2000, South Africa, Mr. Michael Wilson, 725-5200

In Asia
JMA Systems Corporation, Kyoritsu Building, 3-1-22 Shiba Koen, Minato-ku, Tokyo, Japan, Hirotaki Sogi, 434-6211

Zunonos Incorporated, No. 201 35-1 Okamoto 2-Chome, Setagaya-Ku, Tokyo 157, Japan, Dr. Hisayuki Handa, (03) 709-6133

MCS Private Ltd., Inchcape House, 450-452, Alexandra Road, Singapore, 5, Mr. Robert Leong, 623244

In Australia
INFOTROL Australia Pty. Ltd., 9 O'Connell Street, Sydney, NSW 2000, Australia, Mr. John R. Nixon, 233-5244

Cullinane Australia, Suite 4, 46-48 Colbee Court Phillip, A.C.T. 2606 Australia, Mr. Kim R. Newby, 062-812063

In South America
Cullinane do Brasil, Ltda., Rua Jeronimo De Lemos 162, Grajau, 20, 560, Rio De Janeiro RJ, Brazil, Mr. Teodoro Gimenez, 021-268-8799

Cullinane Mexicana, S.A., Filadelfia No. 119-301, Mexico 18, D.F., Mexico, Mr. Alejandro Ramos, 543-8554

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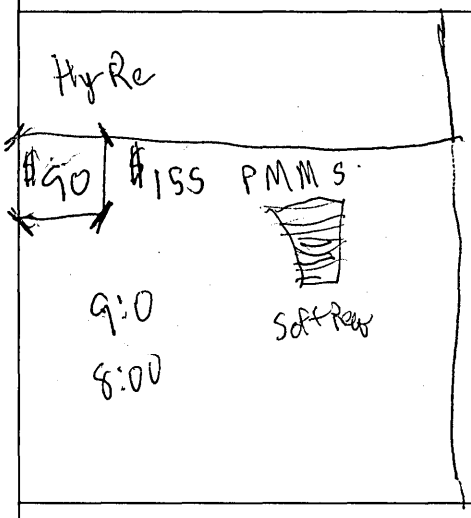
CALENDAR



MARCH

PSC-ACM Professional Development Seminar, March 31, Seattle.
Computer Communication Protocols: A Practical View will be the topic for a seminar sponsored by the Puget Sound Chapter of the ACM. Dr. John McQuillan will speak on fundamental choices in computer communication system design and protocol selection. A small registration fee (around $40) will include text, lunch, and refreshments. Student rates will be offered. Contact: John Sopka, PSC ACM-PDS, P.O. Box 16156, Seattle, WA 98116 (206) 655-2212.

APRIL

Salon des Composants, April 2-7, Paris.
International Electronic Components Exhibition. S.D.S.A., 20 rue Hamelin, 75116 Paris, France.

Specifications of Reliable Software, April 3-5, Cambridge.
Sponsored by the IEEE Computer Society Technical Committee on Software Engineering in cooperation with the ACM. Contact Douglas T. Ross, SofTech, Inc., 460 Totten Pond Rd., Waltham, MA 02154 (617) 890-6900.

COMMON Spring Conference, April 8-11, Philadelphia.
COMMON is an IBM user group. Contact David G. Lister, Administrative Director, COMMON-BI, 435 N. Michigan Ave., Suite 1717, Chicago, IL 60611 (312) 644-0828.

Interface '79, April 9-12, Chicago.
The theme will be New Directions in Data Communications and Distributed Data Processing. There will be 70 conference sessions. Registration fee is $95 for all four days, $60 for one day (including exhibits). Contact the Interface Group, 160 Speen St., Framingham, MA 01701 (800) 225-4620 (in Massachusetts call (617) 879-4502).

Hannover Fair, April 18-26, Hannover, Germany.
Contact Deutsche Messe u Ausstellungs AG, Messegelande, 3000 Hannover 82, Germany.

Electro/79 Show and Convention, April 24-26, New York.
Contact Electronic Conventions, Inc., 999 N. Sepulveda Blvd., El Segundo, CA 90245 (213) 772-2965.

MAY

Southwestern Computer Conference, May 1-3, Oklahoma City.
Contact E.Z. Million, OSU Technical Institute, 900 North Portland, Oklahoma City, OK 73107 (405) 947-4421, ext. 214.

COMPEC Europe '79, May 8-10, Brussels.
Contact Iliffe Promotions Ltd., Dorset House, Stamford St., London SEI 9LU, U.K.

1979 AEDS Convention, May 15-18, Detroit.
The Assn. for Educational Data Systems 17th annual convention. The theme is "Renaissance Man—the Key Component." Contact Arthur W. Daniels, Jr., Convention Coordinator, AEDS-'79, 31202 Dorchester, Madison Heights, MI 48071 (313) 585-7530.

Micro/Expo '79, May 15-17, Paris.
Contact Sybex-Europe, 313 rue Lecourbe, 75015 Paris, France.

JUNE

MUMPS Users' Group 8th Annual Conference, June 7-8, Atlanta.
Contact Judith Faulkner, Dept. of Psychiatry, Clinical Sciences Center, 600 Highland Ave., Madison, WI 53792 (608) 835-9223 or (608) 263-6160.

Teleinformatics 79, June 11-13, Paris.
The conference will focus on applications of distributed systems and networks of all kinds with the intention of setting the scene for the next decade. Contact A.F.C.E.T., 156 Blvd. Pereire, F, 75017 Paris, France.

IMMM, June 12-14, Geneva.
International Exhibition of Microcomputers, Minicomputers and Microprocessors. Contact ORGEXPO, Quai Ernest-Ansermet 18, CP 65, 1211 Geneva 4, Switzerland.

Fifth International Congress on Reprography, June 18-22, Prague.
Research, development and applications of copying, printing and micrographic technology will be addressed, with sessions covering the following areas: advances in photochemical processes; electrophotography; new principles of optical reproduction, including new sources of radiation; quality evaluation and control and measurement; reprography and dp systems; human factors in reprography; and problems of methodology and law including trends of international normalization. Contact Sekretariat 5. Mezinarodniho kongresu o reprografii, Dum techniky CVTS Praha, Gorkeho namesti 23, 112 82 Praha 1, Czechoslovak Socialist Republic.

EDP/USA, June 19-22, Milan.
Sponsored by the U.S. Dept. of Commerce's Office of International Marketing. The exhibition will feature computers, minicomputers, peripherals, software, personal/hobby computers and data communications equipment. Contact Marcia Griffin, Office of International Marketing (Room 1014), U.S. Department of Commerce, Washington, DC 20230 (202) 377-4975; or the U.S. International Marketing Center, Via Gattamelata, 5,

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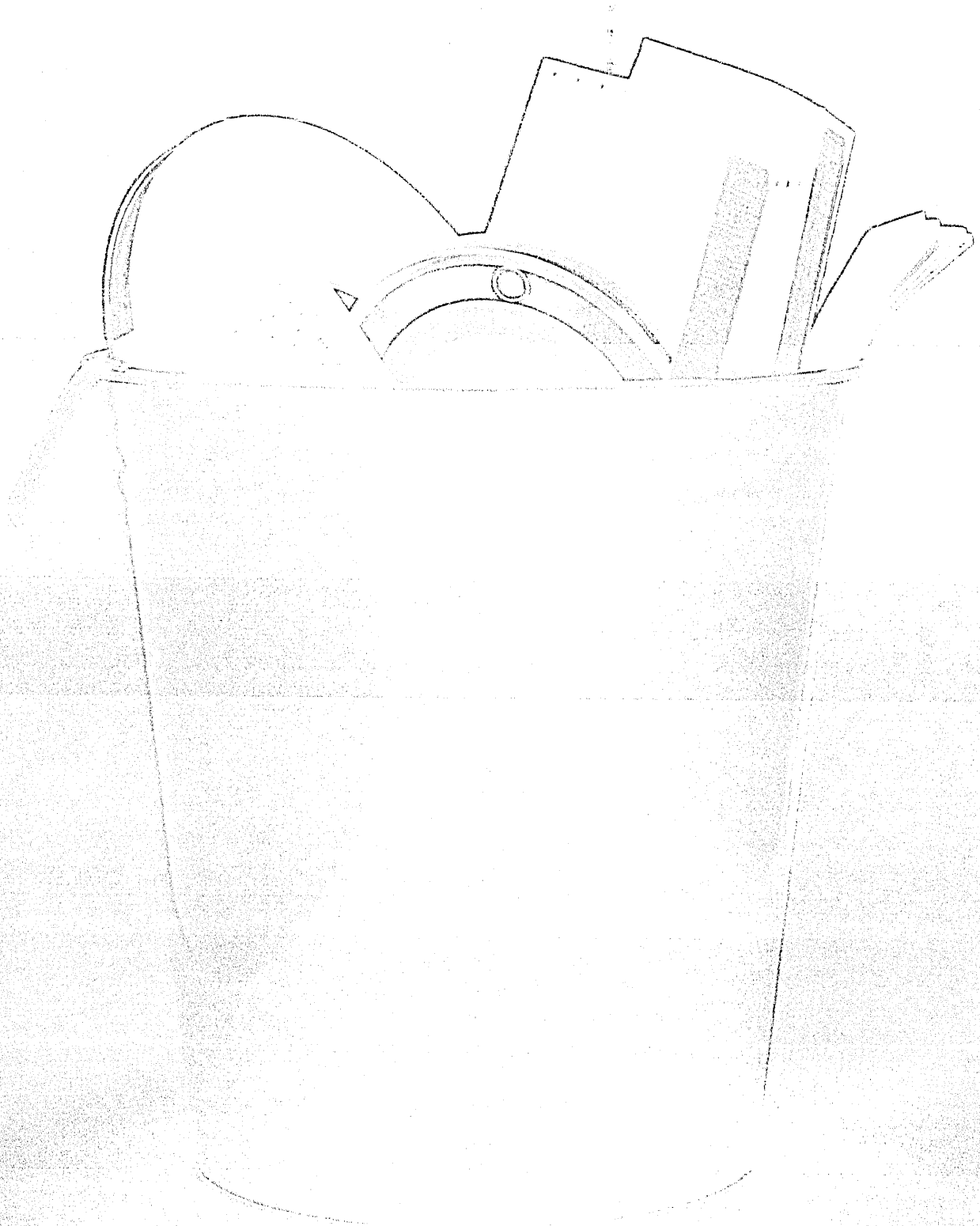
ITEL



20149 Milano, Italy.

1979 IEEE International Symposium on Information Theory, June 25-29, Grignano, Italy.
The Symposium is cosponsored by the Univ. of Trieste, Italy. Contact Professor Lee D. Davisson, Electrical Engineering Dept., Univ. of Maryland, College Park, MD 20742.

JULY

International Word Processing Exhibition & Conference, July 10-13, London.
Contact Business Equipment Trade Assn., 109 Kingsway, London WC2B 6PU, U.K.

Summer Computer Simulation Conference, July 16-18, Toronto.
Contact Dr. A.J. Schiewe, The Aerospace Corp., P.O. Box 92957, Los Angeles, CA 90009 (213) 648-6120.

AUGUST

Urban & Regional Information Systems Association Conference, August 19-24, San Diego.
Contact Lee P. Johnston, URISA Conference Program Chairman, 823 Monticello Drive, Escondido, CA 92025.

Fourth International Conference on Computers and the Humanities, August 20-23, Dartmouth College.
Immediately followed by the Conference on Data Bases in the Humanities and Social Sciences (August 24-25). Contact Prof. Joseph Raben, Queens College, Flushing, NY 11367 (212) 520-7407.

IJCAI-79, August 20-24, Tokyo.
The sixth International Joint Conference on Artificial Intelligence. Contact Professor Bruce Buchanan, Computer Science Dept., Stanford Univ., Stanford, CA 94305 (415) 497-4878.

1979 International Conference on Parallel Processing, August 21-24, Bellaire, Michigan.
Contact Anne Matthews, Dept. of Electrical & Computer Engineering, Wayne State Univ., Detroit, MI 48202 (313) 577-3864, 3920.

National Small Computer Show, August 23-26, New York.
Formerly the Personal & Business Small Computer Show. This will be the third annual event. Attendance last year was over 10,000. Contact the National Small Computer Show at 78 East 56th St., New York, NY 10022 (212) 753-4920.

SEPTEMBER

Engineering Software, September 4-6, Southampton, England.
An international conference and exhibition. Contact Dr. R. Adey, Engsoft, 6 Cranbury Place, Southampton SO2 OLG, England.

INFO/ASIA, September 5-8, Tokyo.
An exposition devoted to information management, computers, word processing, and advanced business equipment. Contact Clapp & Poliak, Inc., 245 Park Ave., New York, NY 10017; or contact Clapp & Poliak in Washington, Tokyo, London, or the Netherlands.

Fourth International Conference on Software Engineering, September 17-19, Munich.
Presented papers will cover (but are not limited to) data definition, data structuring, data flow and data bases; constructive techniques for the specification, development and maintenance of correct programs; programming process and product measurement, modeling and model interpretation; estimation, planning and life-cycle management; automated environments for software engineering; case studies of the effectiveness and consequences of software engineering practice; and the engineering of computer applications. Contact Dr. L. Stucki, Boeing Computer Services, P.O. Box 24346, Seattle, WA 98124 (206) 576-5118.

Medical Informatics Berlin '79, September 17-20, Berlin.
The conference and exhibition is intended to draw physicians, dp specialists, administrative experts, and public health policymakers as well as "the constantly increasing number of experts who are nowadays involved directly or indirectly with the medical applications of computers." Contact AMK Berlin, Postfach 191740, Messedamm 22, D-1000 Berlin 19, Germany.

SICOB '79, September 19-28, Paris.
An international office equipment exhibition. Contact Societe civile du salon des Industries et du Commerce du Bureau, 6 place de Valois, 75001 Paris, France.

TELECOM '79, September 20-26, Geneva.
Billed as the largest international telecommunications exhibition ever staged. All types of telecommunications equipment systems and services will be shown, including telephone transmission, switching, and station equipment; satellite communications equipment; data communications and related equipment; broadcast and studio equipment; microwave systems and equipment; various types of mobile radio; and a wide variety of radio and wireline communications equipment and systems. Contact John Sodolski at the Electronic Industries Association, 2001 Eye St. N.W., Washington, DC 20006 (202) 457-4981.

OCTOBER

Fifth International Conference on Very Large Data Bases, October 3-5, Rio de Janeiro.
Intended to identify and encourage research, development and applications of data base systems. This year's special focus will be applications of data bases in developing countries and mini- and microcomputer data base management systems. Contact Mr. R.J. Libero, IBM do Brasil, Caixa Postal, 1830-ZC-00, Rio de Janeiro-RJ-20.000, Brasil; or Professor Stanley Y.W. Su, Dept. of Computer and Information Sciences, Univ. of Florida, 512 Weil Hall, Gainesville, FL 32611.

CALLS

The IEEE Engineering Management Conference, to be held in Washington, D.C., October 1979, is seeking papers on all topics of interest to engineering managers, including behavioral research, business models, capital investment, career planning, communications, computer management, creativity, data management, decision making, information services, marketing, MIS, problem solving, product development, regulations, simulation, and technology assessment. A camera-ready *summary* no longer than four pages should be submitted by May 31 to Dr. Edward A. Wolff, 1021 Cresthaven Dr., Silver Spring, MD 20903 (301) 982-2496 (office) or (301) 439-1152 (home).

The IEEE Computer Society Technical Committee on Mathematical Foundations of Computing will hold their 20th annual symposium in San Juan, Puerto Rico, in late October. Prospective authors should send eight copies of a detailed abstract, no more than ten (typewritten) pages, by May 16 to Professor S. Rao Kosaraju, Dept. of Electrical Engineering, Johns Hopkins Univ., Baltimore, MD 21218. ✲

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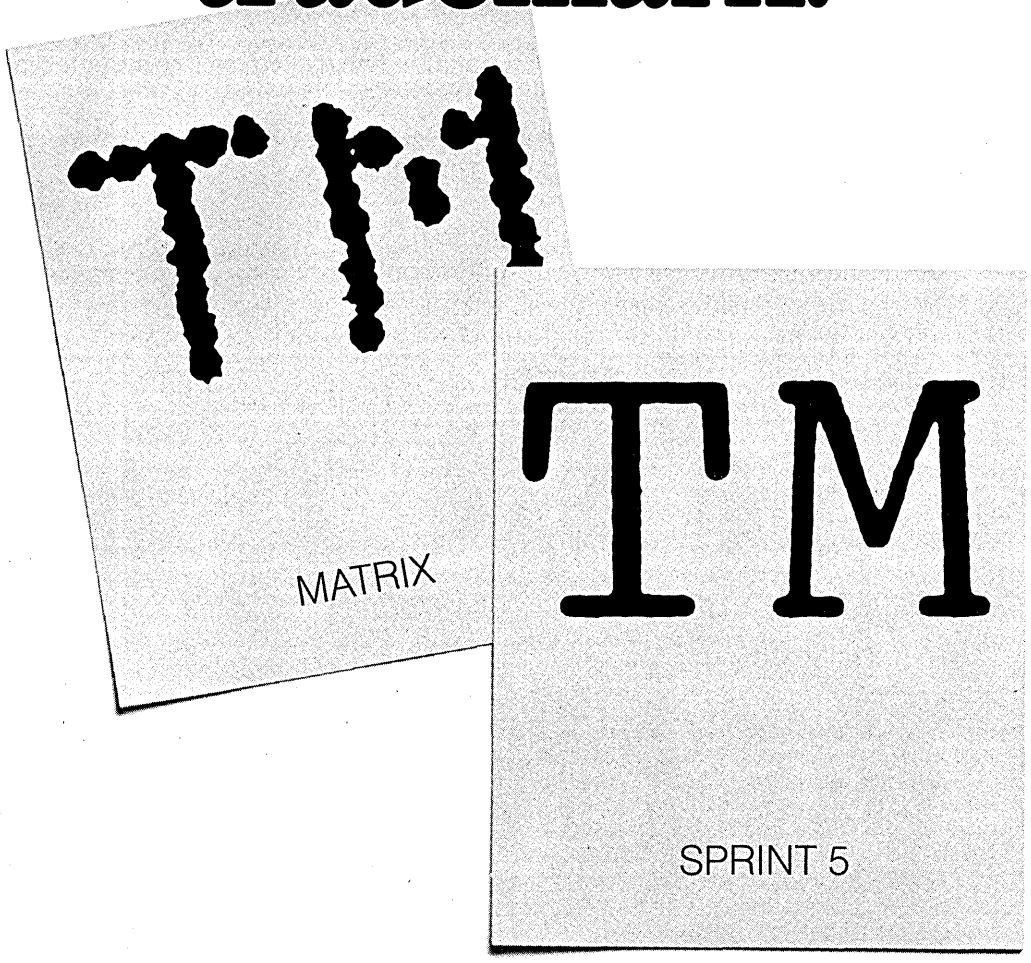

For all those times when you wish your computer could print letter quality, you need a Sprint 5 Daisywheel Terminal from Qume.

Its fully-formed characters are always clear, distinct, eminently readable. (Even after they've been enlarged 1000%.)

Perfect for executive reports, financial statements, and any other application where neatness counts.

But the Sprint 5 does more than give you outstanding print quality. Much more.

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When it comes to dots versus daisies, our advantages are easy to see.

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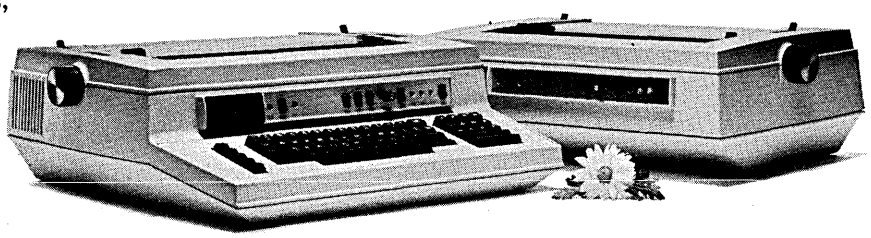

For more information, contact your nearest data terminal dealer or Qume, 2323 Industrial Parkway West, Hayward, California 94545.

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Our Wildest Card Yet

A programmable 16-line multiplexer that beats everything in its class*

PDP-11 users, we have another winner for you. This time it's DMAX/16™, our new programmable multiplexer for connecting your PDP-11 to 16 asynchronous serial communications lines. DMAX/16 makes the most of the 11's DMA capabilities to establish computer overhead at a level far below that of competitive units like the DJ11 and DZ11. It also offers software compatibility with the DH11 . . . in one-fourth the space!

Now, for the first time, you don't need an expansion box or special back planes. DMAX/16 consists of two hex boards which install easily into standard SPC slots and connect to the current loop or EIA/RS-232 panel by separate flat-ribbon cable. As many as 16 units can be placed on a single PDP-11 for a total of up to 256 lines. A DMUX/16™ option allows modem control for 16 channels.

DMAX/16 provides complete program control of the lines, each of which operates with several individually programmable parameters, such as character length and number of stop bits. Parity generation and detection are odd, even or none. The operating mode is half duplex or full duplex. Fifteen software programmable baud rates: 0 to 9600 baud — plus 19,200 baud – and an external baud rate. Breaks may be generated or detected on each line and the unit can echo received characters without software intervention.

Play the wild card now. You'll get top performance and a competitive price advantage of at least $1000 along with delivery from stock as usual. Write for details and find out why we consider ourselves the leader among manufacturers of DEC enhancements.

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1751 Langley Avenue, Irvine, California 92714.
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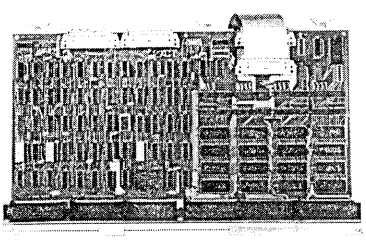

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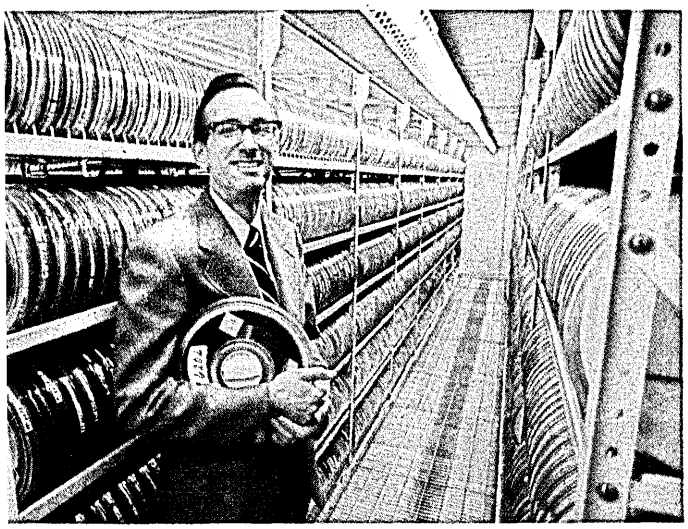
See ABLE products at Booth #115, Interface 79

VAX Program Capacity. Ask any user.

"VAX offered us almost three times the address space of our 370/168."

Bill Miller, Senior Systems Analyst
Chevron Geophysical Co., Houston, Texas



Chevron Geophysical is heavily engaged in seismic data processing involving matrix operations on large arrays.

As Senior Analyst Bill Miller states the problem: "Our IBM systems, running on TSS, give 24 bits of true address space—for a maximum program size of 16 megabytes. But only 10 to 12 megabytes of this can be used by the programmer—and our application had grown to the point that TSS was simply cramping us.

"With the VAX-11/780, we know we can have application programs that use a full 32 megabytes as we're configured now—and it could be more if we wanted."

But Chevron didn't buy their VAX without first benchmarking it against the far more expensive 168.

Miller comments: "We developed a number of benchmarks to test specific areas of performance. On the average, the VAX CPU appears to be about a third as fast as the 168, which is really quite impressive. And it's very possible that for certain applications, we may see a negligible loss of throughput over the 168, thanks to VAX's unique page clustering scheme."

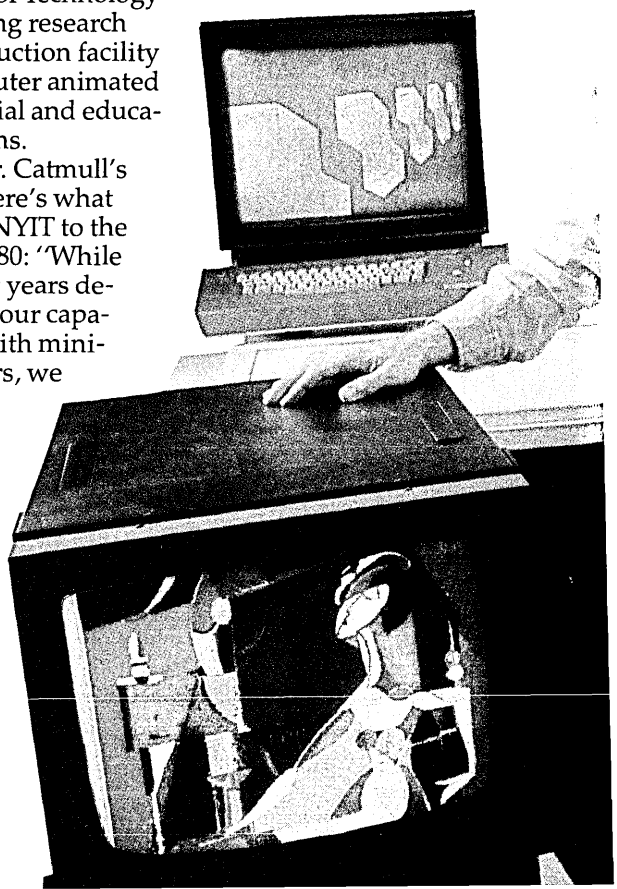
And as far as system performance to date, Miller reports: "The VAX/VMS operating system has been remarkably reliable. The people at Digital have done a phenomenal job."

"VAX's true 32-bit addressing puts its potential capacity so far out, we don't have to worry about it."

Dr. Edwin Catmull, Director,
Computer Graphics Lab
New York Institute of Technology,
Old Westbury, New York

The Computer Graphics Lab at New York Institute of Technology is a leading research and production facility for computer animated commercial and educational films.

In Dr. Catmull's words, here's what brought NYIT to the VAX-11/780: "While spending years developing our capabilities with minicomputers, we



"With a 22,000-point data base, we really needed VAX's huge memory capacity."

Peter Ackermans, Manager of Computer Systems Engineering
CAE, St. Laurent, Quebec, Canada

CAE Electronics Ltd., currently has thirteen VAX-11/780 systems under development for both flight simulation and supervisory power control.

Here again, VAX capacity was key. Systems Manager Peter Ackermans told us: "Our SCADA systems for the power market need to handle a 22,000-point data base. VAX's large memory capacity and the VAX/VMS virtual memory operating system made it a very attractive machine."

But speed was also important. "In flight simulators," Ackermans continues, "top FORTRAN performance is essential, and on that score, VAX measures up well. Our FORTRAN programmers have also been impressed with the machine's debug facility and file handling capabilities."

Digital's VAX-11/780, with its true 32-bit address space, has set a new standard for program capacity. This means that you can run large programs easily on VAX, with a potential for growth that's unmatched in the industry.

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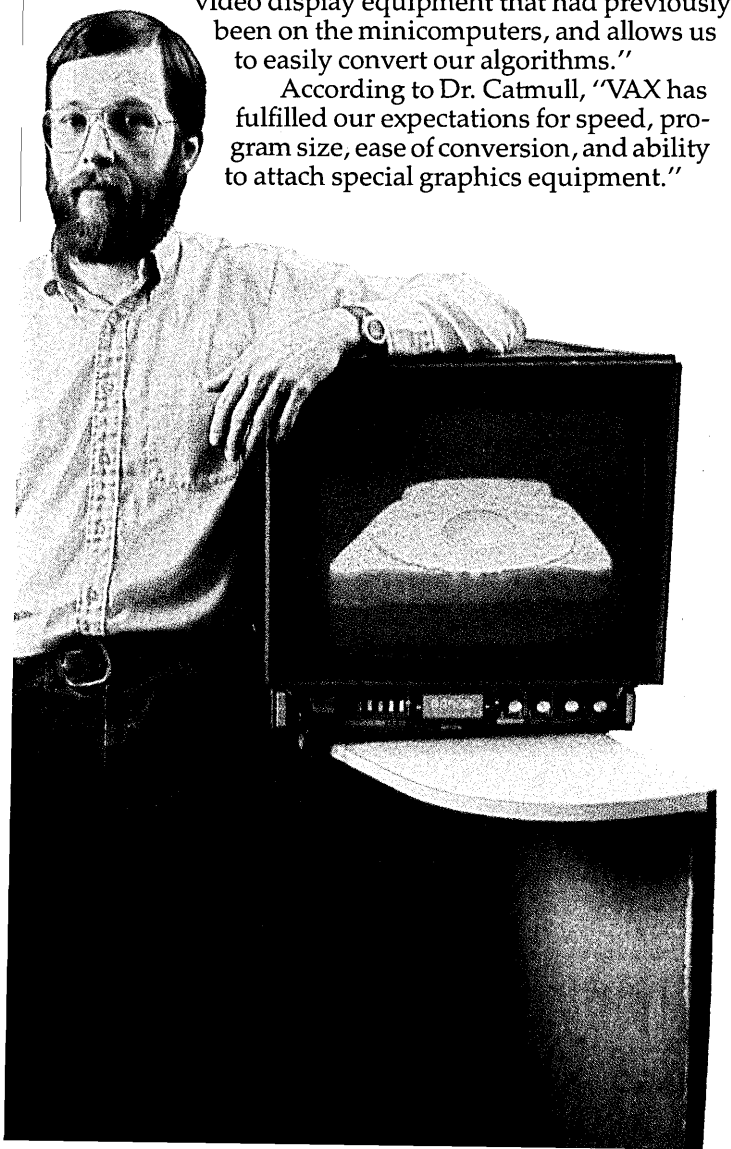
continually ran into the problem of small address space. Our work demands the large address space we can get with a 32-bit machine. We were dealing with extremely large, randomly accessed data bases, and memory mapping is not the answer."

Dr. Catmull continues, "The VAX UNIBUS lets us easily hook up a wide range of special video display equipment that had previously been on the minicomputers, and allows us to easily convert our algorithms."

According to Dr. Catmull, "VAX has fulfilled our expectations for speed, program size, ease of conversion, and ability to attach special graphics equipment."



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- Model 810 Data General Nova/ Eclipse Cartridge Disk Controller
- Model 211 DEC PDP-11 Storage Module Disk Controller
- Model 850 Data General Nova/ Eclipse Storage Module Disk Controller

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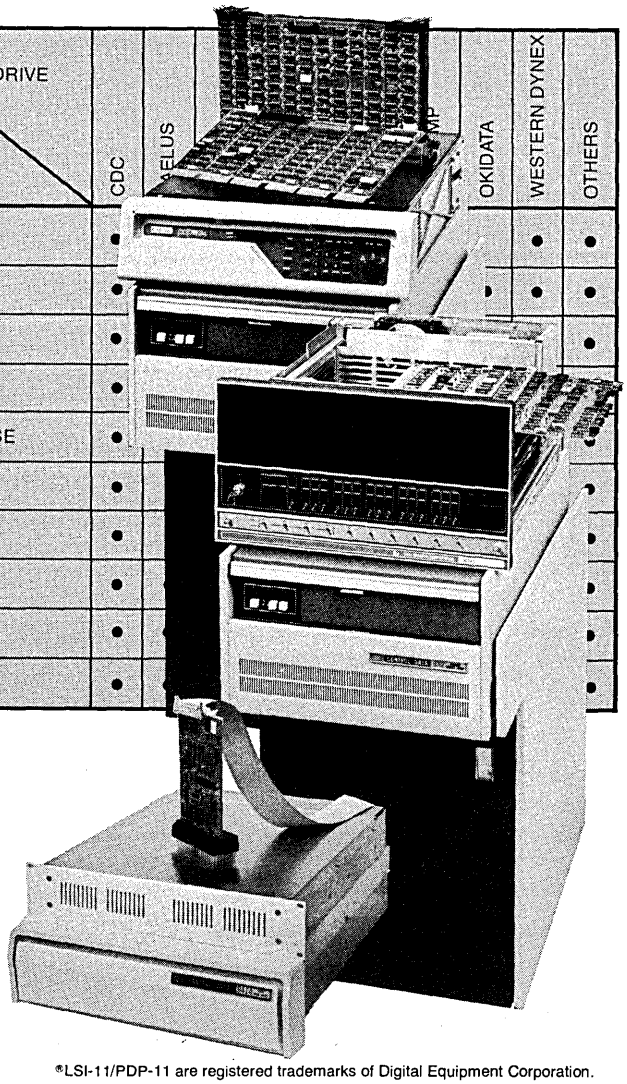

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The HP 3000 Ser

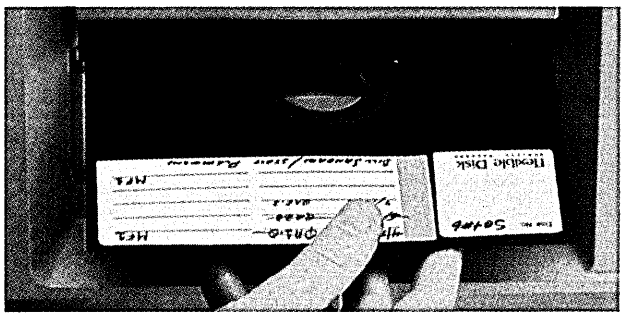
The evolution of HP's silicon-on-sapphire (SOS) technology let us pack a lot of capability into an incredibly small package. We put the CPU on three chips totaling one square inch instead of the 700 square inches of PC boards used by other HP 3000s. But, more importantly, the low power consumption and minimal heat of these ICs allowed us to put it all into an attractive desk that fits easily into office environments—and to cut costs at the same time!

Its good features run in the family.

The Series 33 gives you the speed and multiprogramming flexibility you've come to expect from the HP 3000 family. It can handle multiple users at the same time, working at terminals scattered throughout your company. And it retains both the powerful operating systems (MPE III) and IMAGE Data Base Management software that make the HP 3000 line so easy to work with.

So you can run the same programs on our larger Series III systems.

ies 33: Innovative.

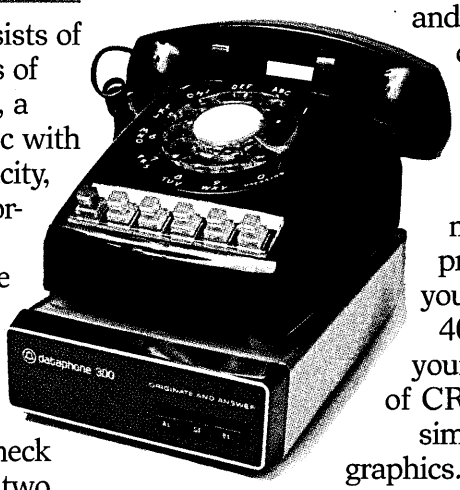


A system that's easy to expand.

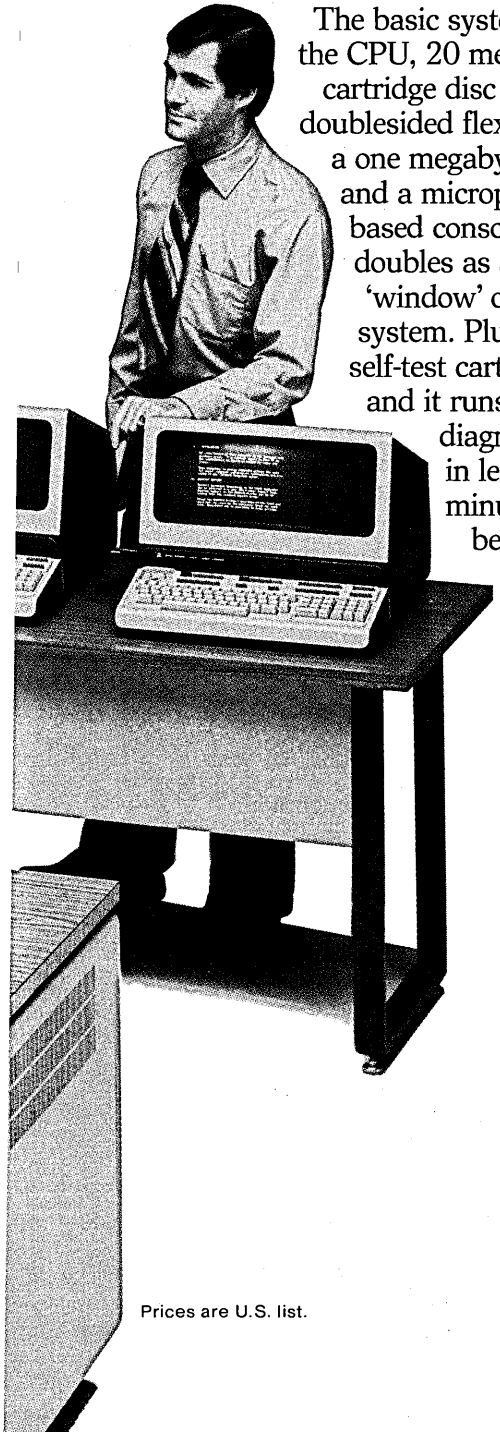
From the initial 256 kilobytes of 16K RAM main memory, you can expand easily and economically to one megabyte. Add discs up to 960 MB and as many as four mag tape drives. You can also use five languages—COBOL, RPG, BASIC, FORTRAN and SPL.

In addition to our SOS microprocessor-controlled printer or printing terminal, you can now connect our new 400 LPM line printer onto your system. And your choice of CRT terminals ranges from simple alphanumeric to smart graphics.

If you still find it hard to believe that we could put so much into so little (at a starting price of only $58,500), call your nearest HP office listed in the White Pages and ask for a hands-on demonstration. Or write for more information to Hewlett-Packard, Attn: Bob Bond, Dept. 435, 11000 Wolfe Road, Cupertino, CA 95014.



The basic system consists of the CPU, 20 megabytes of cartridge disc storage, a doublesided flexible disc with a one megabyte capacity, and a microprocessor-based console that doubles as a service 'window' on the system. Plug in a self-test cartridge and it runs a diagnostic check in less than two minutes. (It can even be run remotely via a modem.)



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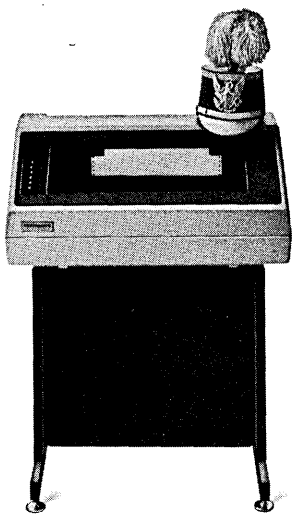
Centronics. The Band Leader.



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LETTERS

NONPROCEDURAL PROGRAMMING

As a dp manager who has developed and used a nonprocedural language since 1969, I wholeheartedly support McCracken's position in "The Changing Face of Application Programming."

My installation uses a powerful system which integrates data base management with nonprocedural capabilities controlled from both batch and on-line by a single command language. One hundred percent of our processing is now done by this system.

As an example of how these languages increase productivity and decrease maintenance, one of our major systems previously consisted of more than 200 programs in COBOL and assembly language. These contained over 125,000 lines of code and the system was totally batch. The current version takes 16,400 lines of nonprocedural code and is an on-line, transaction-processing-oriented system. Considering just the difference in the cost of coding, debugging, testing and maintaining 125,000 lines vs. 16,400 lines of code, one can understand why the time has come for the nonprocedural approach. Contrary to industry trends, my dp costs have gone down since 1974 while new applications and usage have gone up.

Along with decreased cost and increased productivity, our approach provides greater system availability to users. Many of our clerks and managers are trained to use the system for *ad hoc* demands. It creates a "user friendly" environment in which managers can get reports or inquiries with two or three statements using a dictionary of available data elements.

Moral: It works and the time is now!

WILLIAM L. BEARLEY
Director, Computing and
Information Systems
Citrus College
Azusa, California

In general, I would be the first to agree with Mr. McCracken's view on nonprocedural, high-level languages. However, Mr. McCracken in his example is not fair to COBOL. Using the COBOL Reporter Writer feature, the same processing functions can be performed with a fraction of the procedural statements in the COBOL program shown in the article. In other words, Mr. McCracken has chosen the worst case for comparison whereas Reporter Writer is closer to a nonprocedural method than regular COBOL.

Although the coming of nonprocedural software is in the near future, for the present, there are COBOL techniques that can alleviate some of the drawbacks of it being a one-statement-after-the-other language. I would hope that every dp department that is a COBOL shop would use Report Writer (for the appropriate applications) to take advantage of its what-we-want ability over regular COBOL's how-to-do approach.

DOHN P. ADDLEMAN
Sr. Systems Analyst
On-Line Systems Inc.
Silver Spring, Maryland

SERVICES SEEN AS SOLUTION

In his excellent article "The Automated Office: The Road to Disaster?" (November 15, p.154) Philip H. Dorn raises and partially responds to the problem of technological unemployment generated by the "automation changes that . . . represent a vast global problem." Little he says need be faulted; the spectre he raises of "a small minority of technologically oriented elitists against a vast majority of unskilled, nearly unemployable workers" clearly must be confronted by everyone concerned in any way with the consequences of the computer impact.

One unexplored avenue that may lead us from the pessimistic prediction (not his) of the end of the road for Western civilization as now understood is, however, implicit in his opening statement: "The craftsmen and cottage industries of the 18th century evolved to the now-familiar industrial society." By coalescing the industries and the craftsman, Mr. Dorn obscures the distinction between the new technologies and the workers who implemented them. Spinning machines and other wonders may have emerged from the craftsmen's cottages, but the hands that tended them were those which only recently had been wielding hoes and scythes. The Industrial Revolution was manned (and womaned and childed) by displaced agricultural workers whose jobs were being taken over, at the same time, by mechanized planters and reapers.

We have now reached the point in our agricultural efficiency where all the food we require to feed our population better than any other on earth or in history—with million of tons available for export—can be produced by a minuscule portion of the work force, about 5%. Automation has so thoroughly metamorphosed the agribusiness that on a recent car trip of several weeks from San Francisco to New York in August, I never happened to see a single farmer in his fields. The evidence of his machinery was everywhere: Brobdingnagian bales of hay and alfalfa, etched furrows to the horizon, infinite stands of wheat or corn—but in the slice of time that I occupied, no human was present to create those miracles.

What has been done for food production is presently being done, in some degree, for all our other necessities. The manufacturing processes are being increasingly automated: textiles, synthetics, automobiles, appliances. And the consequence is that workers who might have gone into those industries when they were labor-intensive have sought employment in administrative services that still require human hands and minds. In sales forces, in information services, in maintenance, they are finding the economic and psychological satisfactions that our culture has taught us to regard as essential. We might momentarily ask "If all our needs can be satisfied without most of us laboring for 35 to 40 hours a week, why can't we just cut down the workweek or the workday?" But it is unlikely that we will be able to deprogram our puritan heritage as rapidly as the technology will free us from our physical needs. We must, at least for now, accept the necessity for another shift in occupations to match the one that made the field hand into an assembly line hand.

Just as most of the jobs we hold today did not exist at the beginning of the Industrial Revolution, or even a generation ago, so there must be many more new occupations that will develop in the coming century. To start with, some existing professions have always been understaffed: teachers trying to instruct 35, 40, or even 50 individual students in a single classroom (or hundreds in a lecture hall); doctors and nurses trying to treat thousands of patients; legal and criminal justice professionals swamped by case loads, along with social workers and the whole new paraphernalia by which we try to keep the economic and social system from collapsing. If these were staffed by the office workers who will be surplussed when automation makes their positions redundant, we would not only be finding work for a new class of unemployed but also presumably contributing to the solution of some problems.

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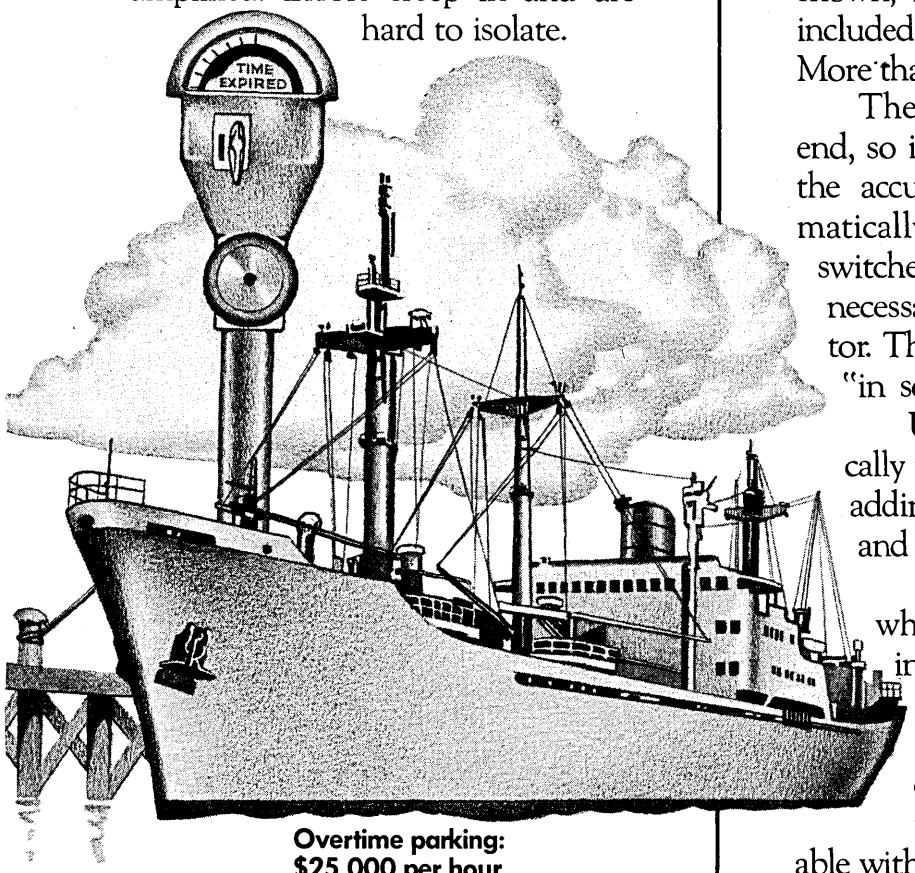

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Whole blocks of data are jeopardized. And retransmissions eat up valuable computer and line time.

Delays can have very expensive consequences. On the order of $1,000 per hour per circuit for time-sharing firms. Twenty-five times that for a company with a ship held in port by faulty documentation. Ulcers for a data processing manager transmitting month-end reports to the home office.

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Users often realize dramatically improved response times, adding capacity to their systems and improving efficiency.

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In addition, there will certainly be new professions developing. All the computer-related industries—design, manufacture, installation, maintenance, programming, data preparation, processing, education—have emerged only in the last decade or two. We have only just begun to recognize that the computer has potentials beyond numerical data processing; once its capacity for processing words, and all the information that words can contain, is widely recognized, there must be a revolutionary surge of applications in the whole spectrum of professions.

The potential therefore, is not hopeless, but rather hopeful. As we bring under control the sources of our physical requirements, we leave our minds freer to handle our psychological and spiritual needs. We may even learn to handle the social dislocations that have always accompanied rapid and violent changes in society's structure. A society that has finally learned from history need not repeat its earlier errors. When the mills and offices are run by a small group of technologists, we may finally have the labor force to provide all the services we still are crying out for.

JOSEPH RABEN
Editor, Computers and the Humanities
Professor of English
Queens College
Flushing, New York

Mr. Dorn replies: I always thought there were enough people in the teaching profession. Unfortunately, too many of them exist as administrators, program aides, and other nonteachers. And Secretary of HEW Califano has just told us we have too many doctors...

On a more serious basis, I am somewhat pessimistic about seeing masses of underutilized, undereducated, undermotivated people joining the professional or semiprofessional ranks. I would expect them to do for the named professions what they did for the social welfare system, namely swamp it in masses of paper, divert funds from the end users, and otherwise create an additional bureaucratic layer.

I do wish that somebody in the USA—in addition to Professor Raben—would pay attention to this problem. I continue to note the attention being paid in Europe and wonder if we here are not just pushing our heads deeper into the sand.

GET TO KNOW YOUR ROBOT

Marvin Grosswirth in your November 15 issue ("The Robots Are Coming!" p.147) uses my words to introduce his half-serious, half-playful warning that robots will make human beings obsolete. I do not share this view, and feel that I have been quoted out of context.

I believe humans can come to terms with advanced technology—including computers—by adopting two new attitudes: 1) recognize that each machine is in fact an *individual*; and 2) see that, for a human, a "good job" is one that is freely chosen, while machines work indifferently at any assignment.

Terms like "robot" invite sweeping generalizations. So do terms like "blue-collar worker," or "intellectual." But basically, humans encounter machines "one on one." The musician and his instrument, the trucker and his rig, and, yes, the computer operator and his "system," each function best as a team. It takes time for the human partner to get to know the unique capabilities and limitations of his machine colleague—just as it takes time to form a human friendship. But unless we make this effort we remain "strangers," naively trustful or irrationally hostile and suspicious.

Manual labor lost status in the Industrial Revolution since "even a machine" could do it. But the do-it-yourself movement in affluent societies shows that *any* job can acquire status when it is freely chosen rather than forced on someone. Far from replacing human workers, computers and other advanced machines could free humans to pursue work for its inherent challenge rather than in the hope of future rewards. Today we pay lip-service to this ideal. Tomorrow we may *live* it!

LANE JENNINGS
Research Director
World Future Society
Washington, D.C.

OFFICE EXPANSION

I would like to see the statistics John J. Connell used in his article "The Automated Office: The Challenge" (November 15, p. 162). He states "... since office salaries continue to rise with inflation, and since the demand for office-oriented services is increasing ..." and gives the impression that office workers are benefiting by that inflation. However, all of us are hurt by inflation, now over 9.5% per year. Few office workers that I know reaped more than 6% income increases last year. Management may well want to increase our productivity, but they should be aware that few workers can increase their efforts at a rate that will match inflationary pressures.

The alternative does indeed seem to be, rather, that Philip Dorn's dire predictions of widespread unemployment may well evolve. Technological, elite classes are already evidenced in Third World countries. If these countries are the laboratory for social experiments, then we would do well to heed Mr. Dorn, rather than duck our heads into the cheery, expanding market that Mr. Connell seems fixated on. The dp industry may benefit over the short range, but we all sink in the same ship.

DAVID KNAPP
Computer Sciences Corp.
Systems Division
Arlington, Virginia

Mr. Connell replies: The statistics you cite verify my statement about office salaries rising with inflation. Perhaps, as you indicate, they have not risen enough; but since office productivity has not risen at all, there is little justification for salary increase from a *management* point of view.

The problem is not with office workers, but with the office workload. We do not have a nation of office workers sitting on their hands. Office workers are hardworking, industrious, and constantly trying to improve. The problem, thus far virtually unrecognized, is that any improvement in office operations through better management or new technology is being offset by a constantly expanding workload.

The sources of this expansion are internal and external. The external source is the extraordinary demand for information imposed on business by regulatory agencies—information which seldom can be retrieved automatically from a computer file but rather must be dug out from a variety of locations. The internal source is of our own doing. Computer-based systems are providing managers with information they have never had before. As they become accustomed to the value of this information, their horizons broaden and they begin to ask for additional information which the system was not designed to provide. Once again, the office is called upon to dig it out manually until a new system can be designed.

The challenge facing us, as new technologies are developed for the office, is first to improve productivity sufficiently to counterbalance the increasing workload and then attempt to improve productivity even further so that office costs can be reduced and improvements made in the bottom line. It is a tremendous challenge and there is no guarantee of success. I have no doubt that the technology will be there; the question concerns our ability to manage it effectively.

I do not share Mr. Dorn's gloomy predictions for the future. I entered the computer field in 1955 and lived through the era of dire predictions of massive unemployment that computers were supposed to bring about. It

Photo courtesy of Universal Pictures.

CalComp's mini-peripheral service engineers won't turn into monsters when they have to work late.

A lot of DEC and Data General mini-peripheral suppliers handle every service call the same way: one problem—one engineer.

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Best of all, CalComp "Maintenance Alert System" service doesn't cost a penny extra. And it covers every DEC and DG-compatible peripheral we sell—up to 24 hours a day, 7 days a week—depending upon the maintenance contract.

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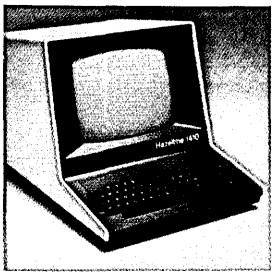

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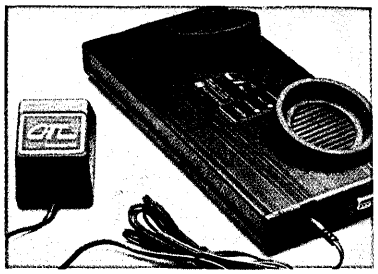
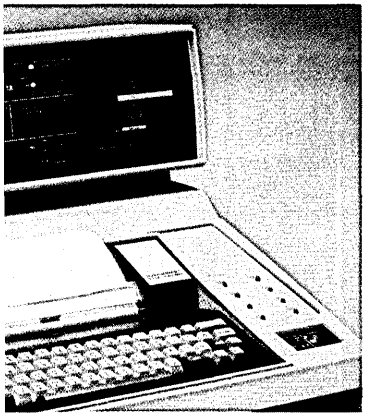
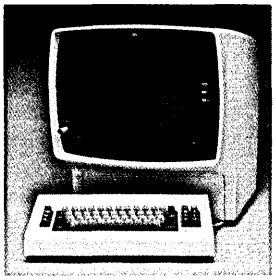


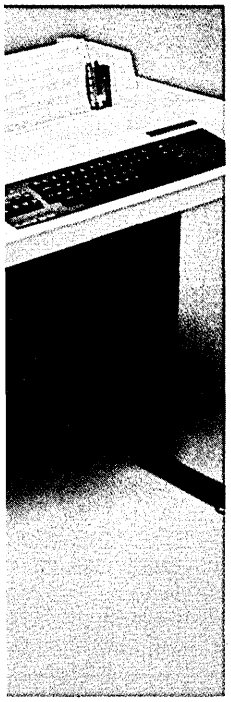
Lear-Siegler?

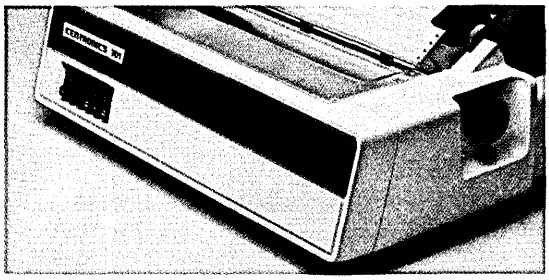




CRT's ?

Centronics?





TTY ?

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How can I reduce my costs ?

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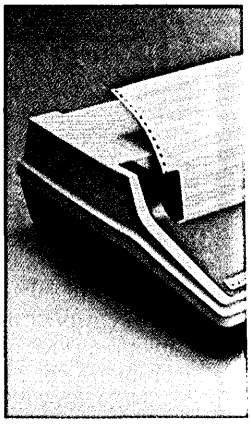
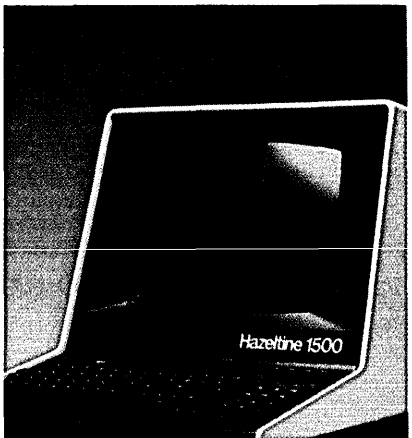
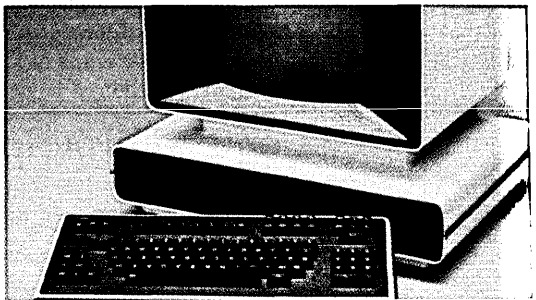


DEC ?



Texas Instruments ?



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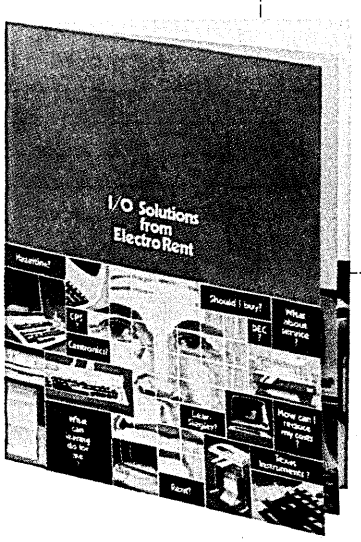

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never happened. Granted there were occasional dislocations, but, on balance, computers created far more jobs than they eliminated—better jobs, incidentally; better paying and more intellectually stimulating. Your own company is a good example.

The nature of the work force is changing. America used to be predominantly agricultural, later it became a predominantly blue-collar society and now we are changing to a white-collar society. In so doing, there is danger of creating groups of technological elitists. Dp people, with some exceptions, have become such a group. It is my contention, in the DATAMATION article and in my work with the Office Technology Research Group, that if technology is to come to the aid of the office worker, then such elitism must be abandoned. We must learn to humanize technology and to adapt office machinery to people rather than vice versa. My concern is that dp people, wrapped as they are in their technology, will fail to recognize this need and find themselves left behind as we move into the office of the future.

ARGUING AGAINST ASSEMBLER

I feel that R. Edward Mitchell's article, "Third Generation Myopia," (September, p. 233) does a disservice to the programming profession by advocating the increased use of assembly language coding (ALC). To state that some applications are better programmed in assembler is to state that there is no adequately suitable alternative since, obviously, assembler is a candidate for any application. The well developed tool box of macros which is so useful to the assembly programmer is the first step toward developing a higher level language for a specific application. Tool building is not limited to ALC but can be carried out for any language which supports a subroutine library and any programmer's efficiency can be improved by use of good tools. Writing good subroutines is probably easier than writing good macros, but macros are useful and it is unfortunate that more high level languages (HLL) do not have good macro facilities. This is no excuse, however, for not taking full advantage of capabilities which exist.

I acknowledge that assembler is more efficient than HLL code in terms of machine execution, sometimes by orders of magnitude, and this often justifies—even forces—the use of assembler, but let us admit the costs of gaining this efficiency. Assembler is machine oriented and when working in assembler the programmer is necessarily immersed in details of the machine. It requires a considerable amount of self-discipline to avoid the temptation to take advantage of the intimacy with the machine and resort to "tricky" coding. Assuming the programmer gets past this temptation, either because his management enforces standards which remove some of the temptation or because he knows better, the source text of an assembly program will be longer than a functionally equivalent HLL program. This means that the program probably takes longer to write, is more likely to contain errors, is harder to prove correct, and requires more and better documentation. The program will also take longer to debug because of the lack of assistance

TABLE TAMES TESTING

In reference to Lea Beitner's letter "Testing Methods Sought" (October, p. 42), our shop has developed a specialized form which has proved useful in testing. It is a modification of a standard decision table, and allows a programmer or analyst to list the input conditions which have been tested and the resulting outputs. Various input and output files, records, and fields can be designated on the form. Also, each test condition is linked directly to the transaction which represents those conditions.

Most users are not interested in specific test transactions, but they do want to verify that certain transaction conditions result in the proper outputs or actions. Thus there are several advantages to using this type of form. First, it communicates to the user, in a summarized fashion, those conditions which have been tested. If the user has questions or concerns about a specific set of conditions, the actual test transaction can be easily referenced. He then avoids wading through file dumps and utility compares, or being forced to accept the vague statement that "everything has been tested." Because of its structure, the form also helps to identify logical errors in the test plan, particularly when complex input conditions are involved. And finally, the form can go into the program documentation for future reference.

A copy of our form, filled in with a very simple example, is below. We hope this proves useful to Lea Beitner or any other readers who might be interested.

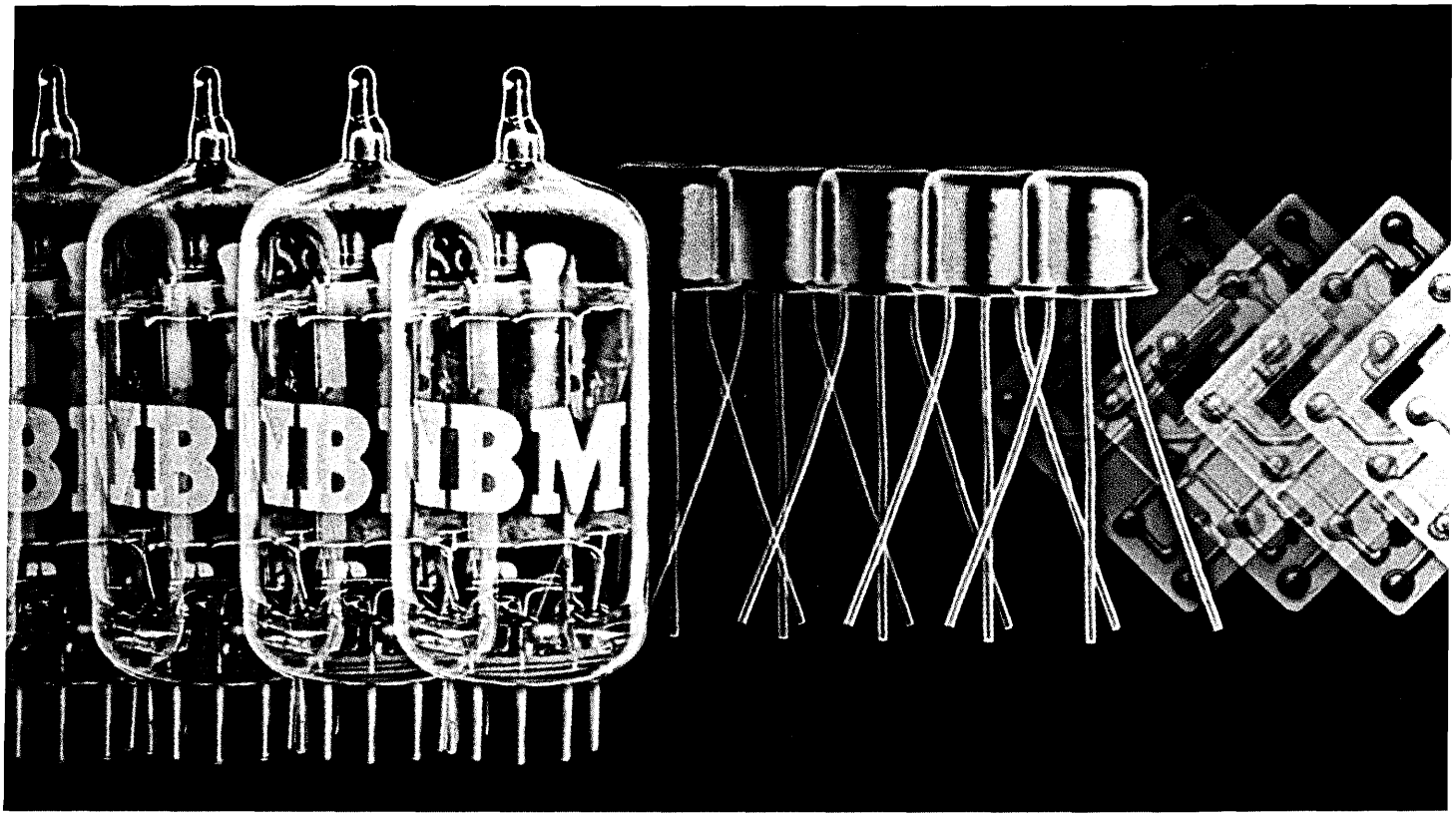
BARRY L. RANDALL
Michigan Department of Social
Bureau of Information Systems
Lansing, Michigan

SYSTEM: Payroll
PROGRAM: PA-01-00

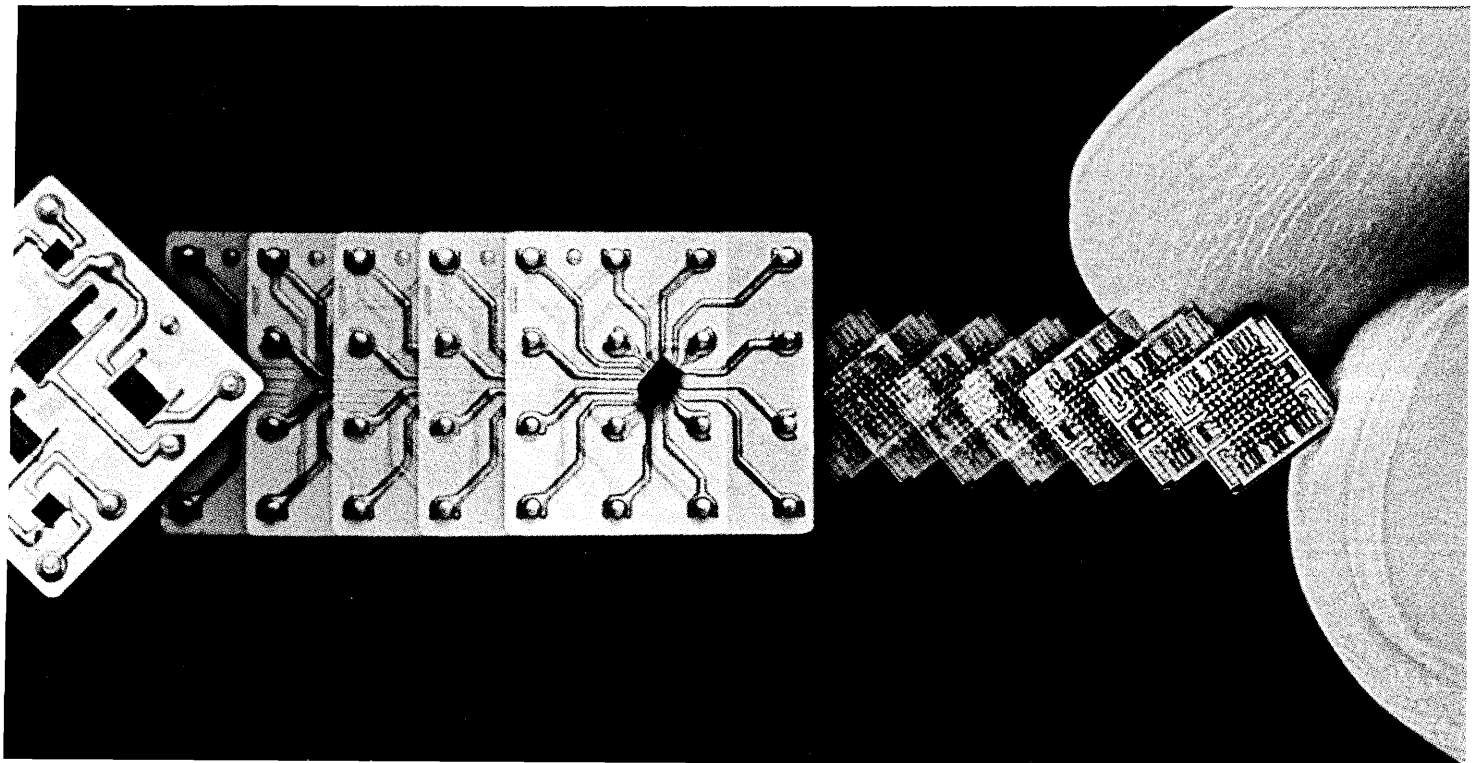
SSIS TEST DATA WORKSHEET

DATE: 8/10/78
AUTHOR: B.L. Randall

TABLE NAME:			DATA ITEMS/VALUES			
INPUT	FIELD	CONDITION	A	B	C	D
File #1	Billed Amount	Billed Amount=Zero	No	Yes	Yes	No
File #2	Error Code	Error Code=Zero	Yes	Yes	No	No
OUTPUT	FIELD	RESULT				
Report #1		Shows Billed Amount Paid	Yes	No	No	No
Report #2		Shows Transaction Errored	No	No	Yes	Yes
Report #2		Shows No Billing Submitted	No	Yes	Yes	No



From IBM, more technological advances.



We've put it all together ir

Over the past 27 years, IBM has made a steady series of major advances in computer technology, with a corresponding decrease in the cost of computing. Now astonishingly tiny silicon chips make possible a three- to four-fold increase in data processing capability at a dramatically lower cost than ever before.

IBM has put this new technology all together in two new computers from the Data Processing Division: the IBM 4331 and IBM 4341 Processors. Today's technological advance, called large scale integration, is used in both the memory and logic of the processors. Both processors – with a wide array of new and exciting peripheral equipment – can help make information more available through applications ranging from interactive computing, to data base and data communications, through distributed processing and large networks. Both can meet the needs of new customers as well as the most sophisticated, and both are compatible with System/370.

More power for less cost

If you could peer into the lilliputian world of large scale integration, you'd see the equivalent of a myriad of transistors and other components compressed into an extraordinarily dense interlacing of circuitry. A miniscule silicon chip measuring one-quarter of an inch square can store over 64,000 bits of information, while one measuring about three-sixteenths of an inch square can contain more than 700 logic circuits.

This use of large scale integration allows the new 4300 Processors to achieve new levels of memory, internal speed and price/performance. For example, the 4331 Processor, which costs less than a System/370 Model 115, has over twice the memory and can process information four times as fast. And the 4341 – for example, with 2 million characters of main storage – delivers a three-fold increase in internal performance over a System/370 Model 138 with one million characters of storage, yet the purchase price is lower.

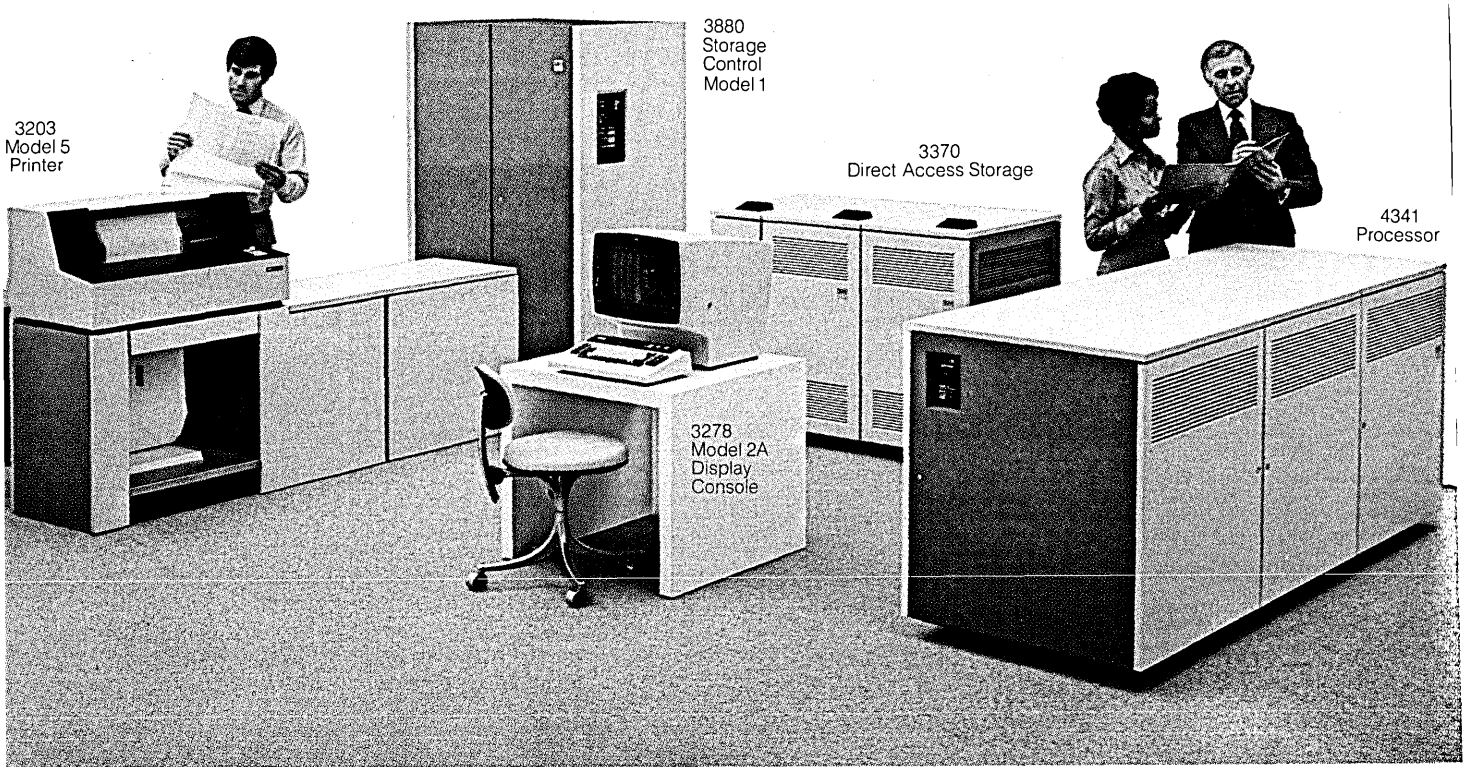
More opportunities to move ahead

The 4300 Processors, with new IBM disk storage products, as well as existing input/output and communications devices, drive down the cost threshold for justifying and implementing new data processing applications.

If your organization or department is considering a computer, the easy-to-install 4331 Processor can be an ideal standalone system, with memory capacity of up to one million characters.

For businesses with distributed processing plans, a full complement of communications programming and support can assure that the same versatile 4331 can be a powerful element in a growing company-wide network of distributed systems.

The larger 4341 Processor is especially attractive when your organization needs to increase existing performance or capacity, or extend distributed processing, data base, or problem-solving applications to subsidiaries or major departments. With up to four million characters of main memory, this processor offers ample



wo new processors...plus.

capabilities for advanced online applications and interactive problem solving.

Because both new processors are compatible with System/370, as well as System/360, you can select from the broad range of software in use today to extend the power of data processing into new areas quickly and economically.

More advantages, from installation to service

Because of greatly reduced requirements for power, space and air conditioning, both processors can be easily installed.

In the event of a processing interruption, both processors can analyze and diagnose the reason, and then display a reference to correction procedures for the IBM customer engineer. In other cases, an IBM customer engineer can use telephone lines to link the system with a team of IBM technical specialists in diagnostic centers who will provide additional support.

More new features and concepts

New disk storage products available with the 4300 Processors offer significant advances in high-performance online storage at markedly lower costs.

The 3310 Direct Access Storage Device provides convenient growth in 64.5-million-byte increments of storage for the new 4331 Processor. The 3370 Direct Access Storage Device provides 571-million-byte storage increments, improved seek time and data rate, and has a data recording density of more than twice that of the IBM 3350. It features a head manufactured via a semiconductor process. The 3370 attaches directly to the 4331, and to the 4341 using the IBM 3880 Storage Control. The 3880 offers lower user cost with added functions to enhance the availability of online data.

Also announced with the processors are three new printer models.

With the new processors, we're also introducing three new releases of IBM's Virtual Storage operating systems, new program products and productivity aids to help you get your new system up and running quickly and easily.

More support on every level

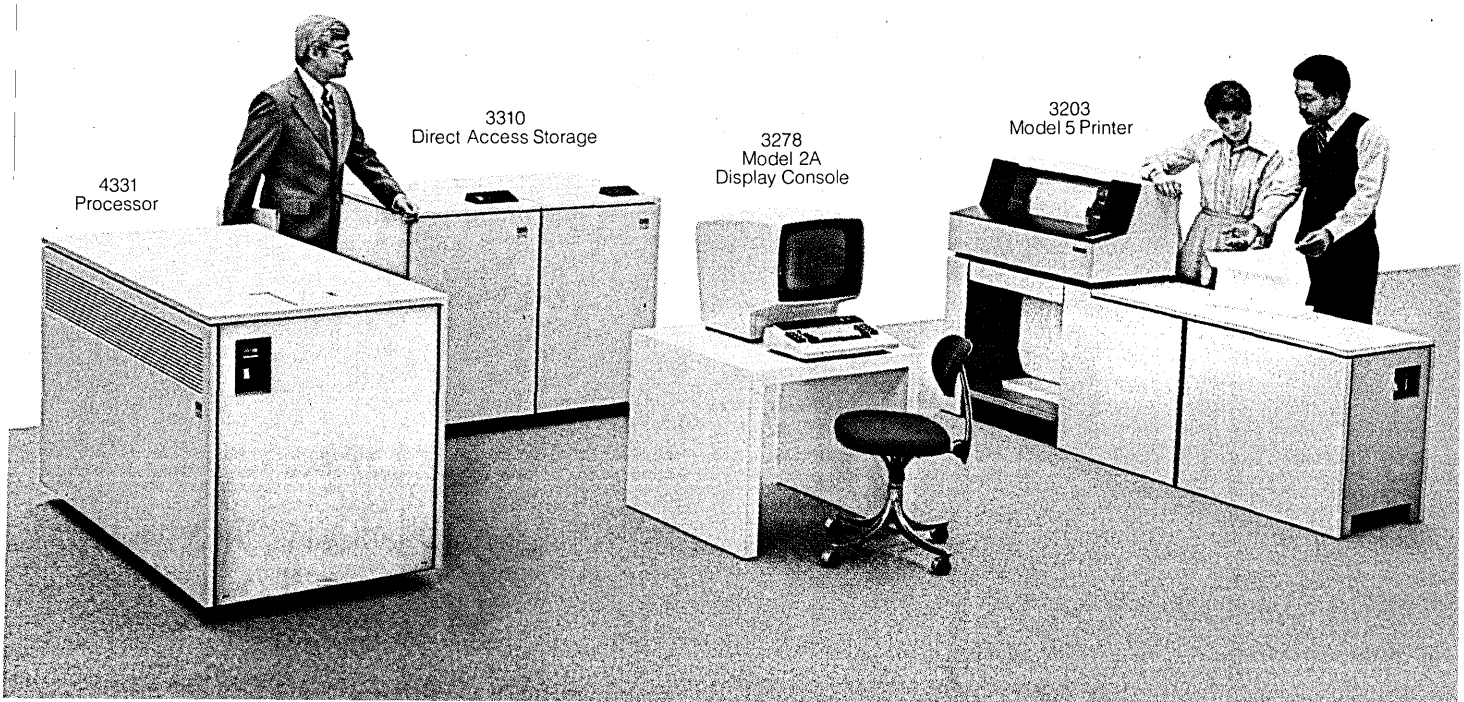
Technology is important – but equally important are the ways we help you put it to work. We do it with systems designed to deliver solutions today, yet with an eye on your future needs.

And behind the 4300 Processors is the skilled assistance in application development, installation support, training, education and the quality service that we offer – and you've come to expect from IBM.

If you'd like to learn more about how these new IBM 4300 Processors can help you in your organization, call your IBM Data Processing Division representative today. Or write: IBM Data Processing Division, Dept. 83F, 1133 Westchester Avenue, White Plains, N.Y. 10604.

The way we put it all together is what sets us apart.

IBM®
Data Processing Division



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Bruning know-how makes you a star in microfiche.

What could be more natural?

The same know-how that allowed us to perfect Bruning microfiche systems helped us perfect the film that makes them pay off in use.

Over the years, Bruning expertise has helped make microfiche the most versatile and reliable microform in the industry.

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For more information and a look at our latest films, call your local AM Sales Office. Or write AM Bruning, Dept. M, 1834 Walden Office Square, Schaumburg, Illinois 60196.

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AM Bruning
the Informationists.

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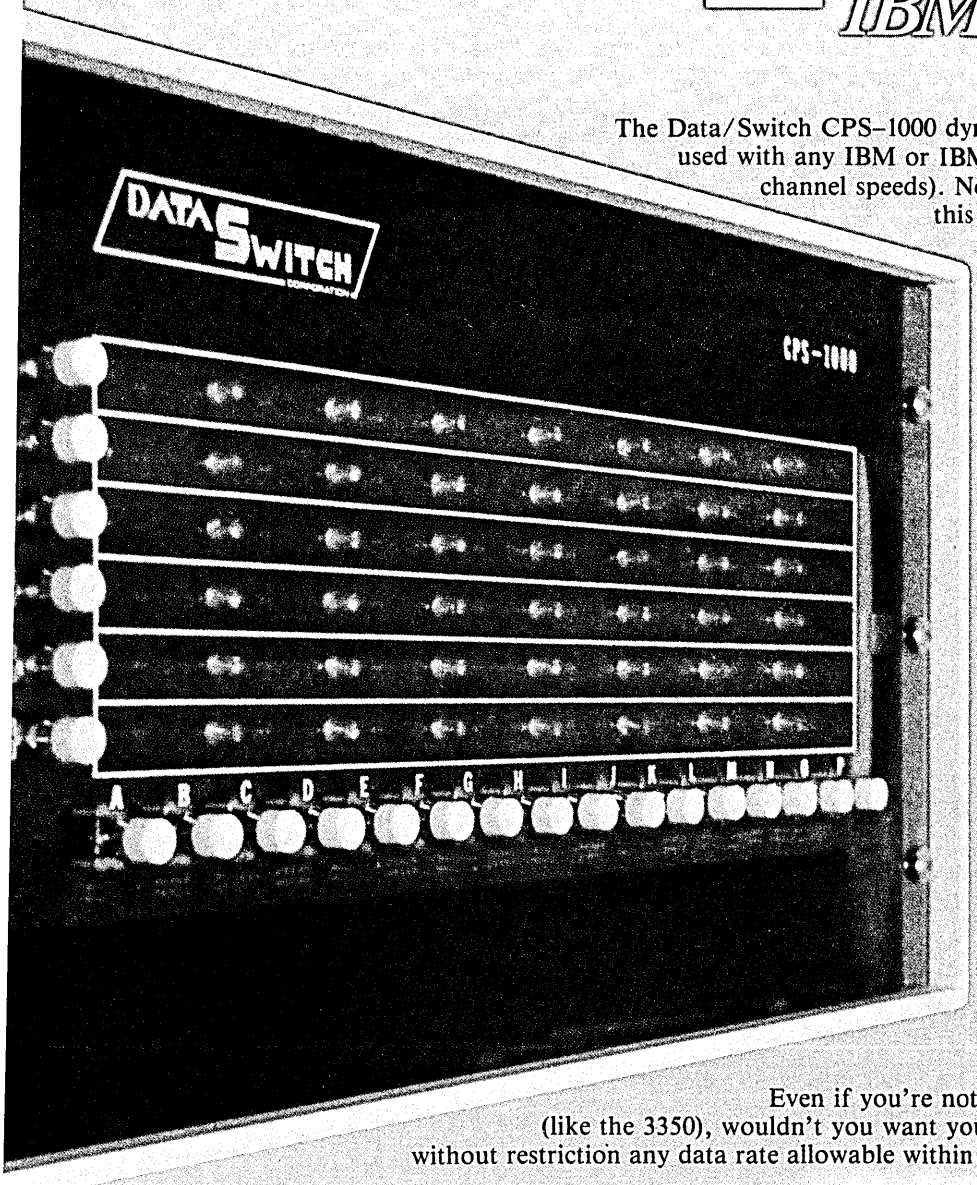

The Data/Switch CPS–1000 dynamically switches any 1/0 control unit used with any IBM or IBM compatible CPU (including 2305's at channel speeds). No one else, including IBM, can provide this unrestricted channel speed switching.

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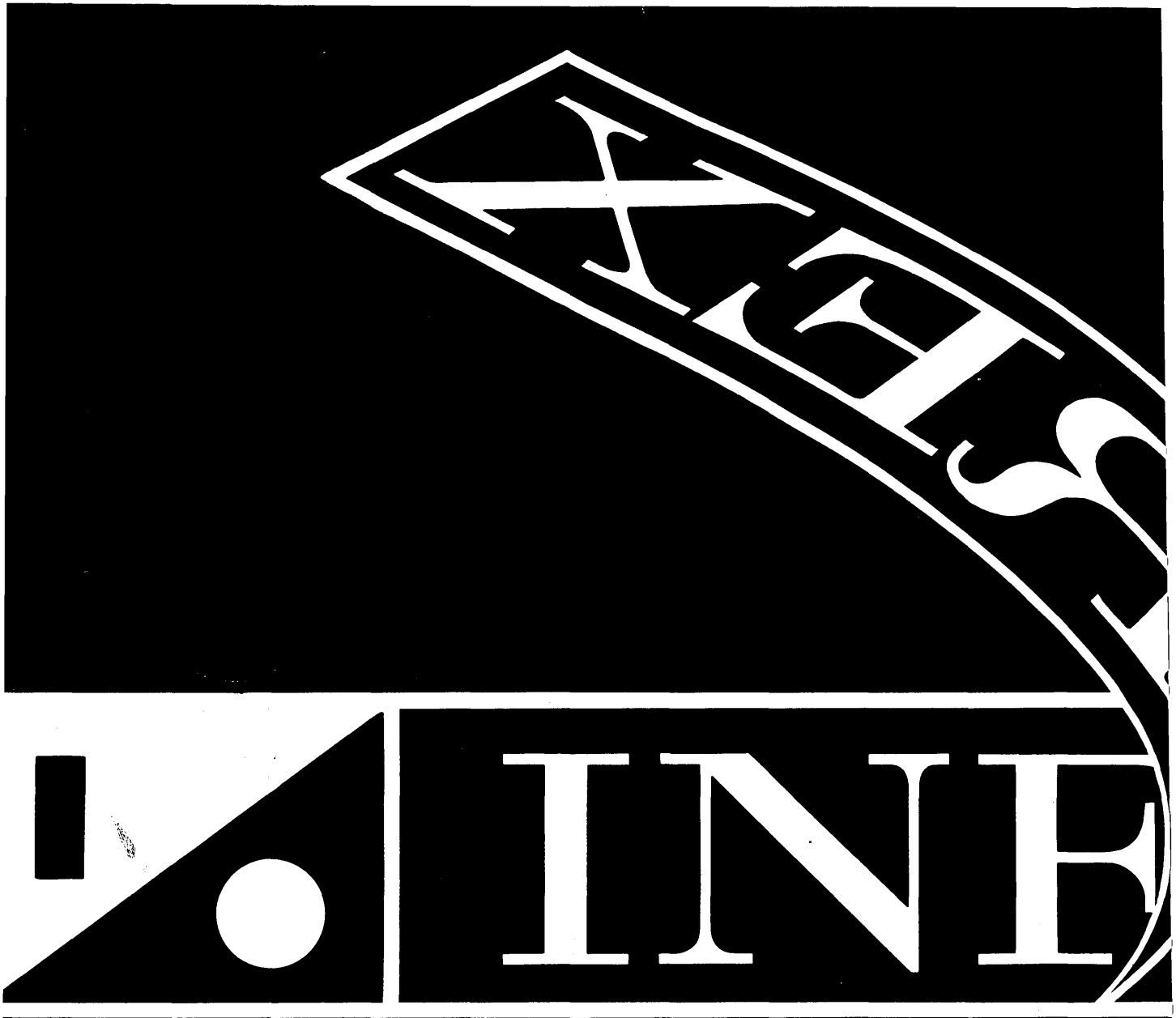
CIRCLE 32 ON READER CARD



There's something new in data entry. The System 3100 and the System 3200. Both are designed for centralized or decentralized high-speed key-to-disc data entry. Both offer operator simplicity without compromising power. Both systems support a full line of RJE and batch communications capabilities.

Both are designed for maximum price performance.

System 3100 – Designed for high productivity in a limited editing environment. Features 16 program levels, real-time balancing, and powerful foreground and background editing features.

System 3200 – Designed for installations where sophisticated editing is required – without sacrificing productivity. Features large disc capacity (up to 40 megabytes), heavy editing power, a COBOL compiler, and HASP multileaving communications.

YES

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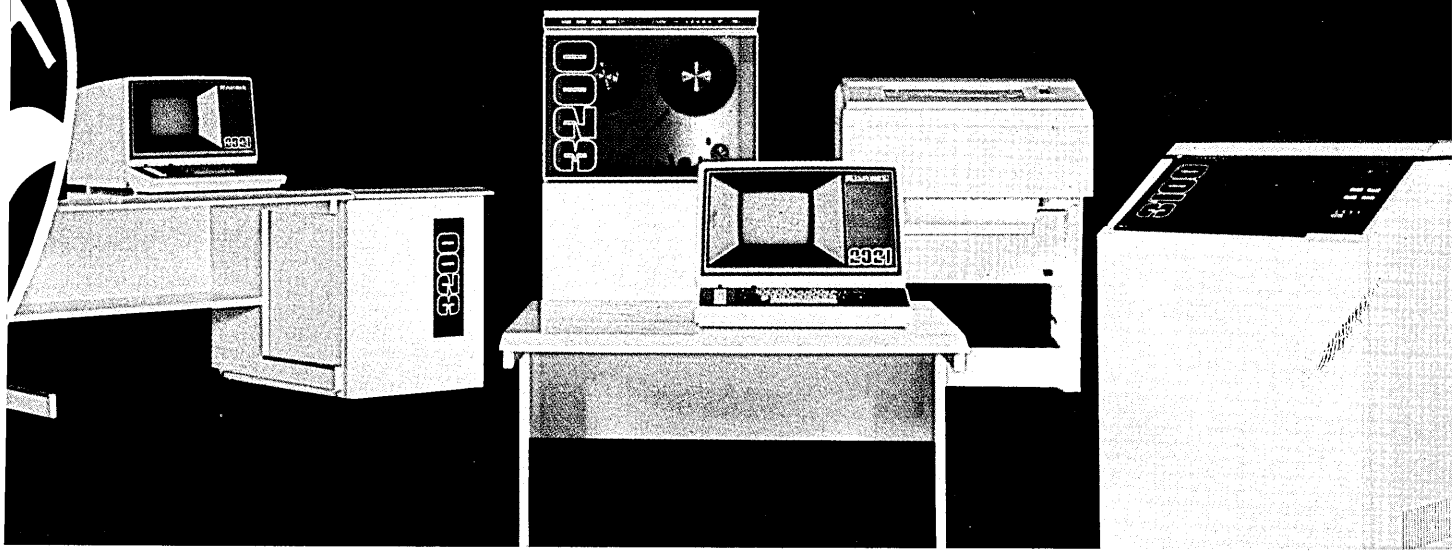

See us, booth 840, Interface '79 Chicago

CIRCLE 44 ON READER CARD

often provided by a HLL translator. Even if the program is the best possible, an assembly language program remains a machine dependent program, and as software costs continue to go up, it somehow seems to make less and less sense to produce software which will have to be rewritten should the current machine be replaced by one which is incompatible—no matter how unlikely that event might seem.

I agree that all programmers should have a working knowledge of ALC because it will make them better programmers and data processing management should not forbid the use of assembler. Both programmers and managers should look carefully at the reasons for using assembler and, if they occur too often, take steps to change the situation. Good subroutine libraries (including subroutines written in ALC) can extend the capabilities of high level languages and improve their usefulness even more than good macro libraries can for assembler.

As a programmer, I consider myself a problem solver and not a bit twiddler, and I resent having to grovel down to the machine's own level to get my job done. The continued reliance on assembler programming as a solution for the problems caused by poor compilers, inefficient algorithms, inappropriate data structures, conflicting program specifications, and inadequate machine capacity simply postpones the day when mainframe manufacturers are economically forced to provide efficient implementations of standard languages and programmers can advance beyond the current preoccupations with correctness (the mark of the student) and technique (the mark of the novice) to become true professionals.

JACK W. REEVES
Ford Aerospace
Communications Corporation
Houston, Texas

Mr. Mitchell replies: Mr. Reeves' experiences with high versus low-level programming languages contrast sharply with mine. The past decade of running my own business has taught me well which are the most cost-effective means for delivering software under contract and for maintaining software after delivery. I learned to judge each application on its merits and to select the methods and programming language on a case-by-case basis. The main point of my article is that for most computer installations, ALC is not even among the alternatives to be considered.

Based on my experience, ALC with a good library of macros is far and away the best choice for a large percentage of typical dp applications.

Computer programming is quite different from language programming. I think a professional programmer should be prepared to do either, depending on the task at hand. Since Mr. Reeves resents "having to grovel down" to the level of the computer, I presume he is unfamiliar or, at best, uncomfortable with computer programming. A person not competent in computer programming cannot be considered qualified to crticize the substance of my article.

The inordinately heavy and sometimes blind reliance on compiler languages in government and industry today is most often the result of ignorance and fear. The ignorance comes from so-called programmers who have no notion of how a computer works or of how to program one. The fear comes largely from unfortunate second-generation casualties who have now acceded to positions of power and decision-making authority. Enlightenment of such persons is a slow, painful process of education and example. Moreover, there is seldom any bottom-line profit in attempting it.

Therefore, at my company we are content with limiting the benefits of

From an elegantly simple print mechanism based on this unique leaf spring hammer and advanced matrix line printing technology . . . print quality and reliability no other impact printer can match . . . plus full plotting capability at no extra cost that band, drum or chain printers can't provide at any price.

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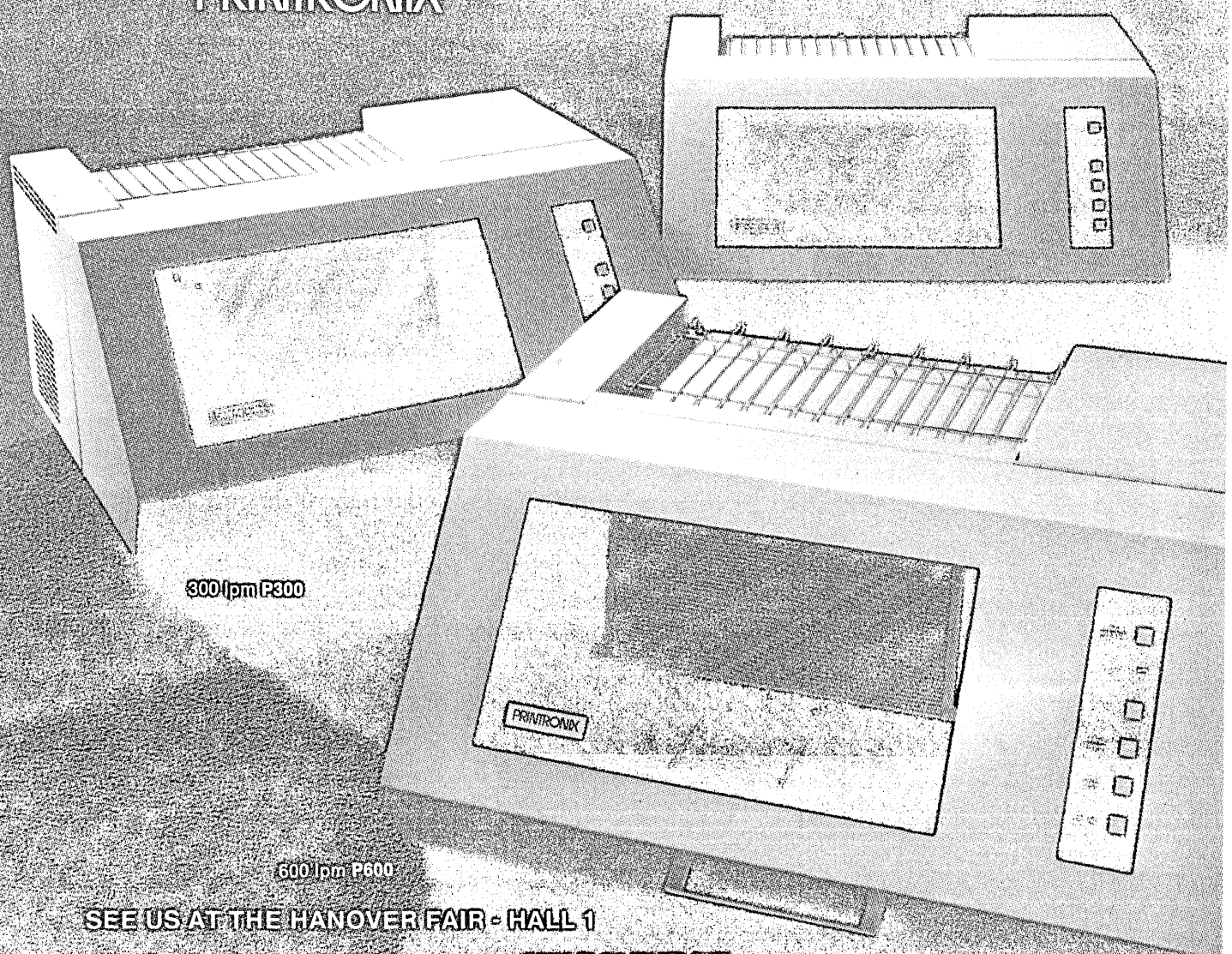
In 1975, Printronix introduced the first printer designed to fill the need for medium speed impact printing at practical prices. The unique concept and design of this matrix impact line printer brought unequalled print quality to impact printing. Its elegant simplicity, with up to 50% fewer parts than band, drum or chain printers, also established proportionately higher levels of reliability. Today, they are available in 150, 300 and 600 line-per-minute models priced about the same or less than medium speed band, drum or chain printers. They're warranted for one full year while 90 days is typical for others. And they all offer you one feature band, drum or chain printers can't: full graphics plotting capability. Get acquainted with our family. You might be captivated by their cost/performance and cost of ownership attributes. They're all up for adoption. Printronix, Inc., 17421 Derian Ave., P.O. Box 19559, Irvine, CA 92713. (714) 549-8272. TWX: (910) 595-2535.

PRINTRONIX

150 lpm P150



300 lpm P300

600 lpm P600

SEE US AT THE HANOVER FAIR - HALL 1

CIRCLE 27 ON READER CARD

The Bantam. The cocky new $599* CRT that just changed the pecking order.

User Need	Feature	P-E BANTAM	LSI ADM-3A	Hazel-tine 1400	Hazel-tine 1500	Adds Regent 100
Easy to read display	7 x 10 matrix for highly legible characters	Yes	No	No	Yes	No
	Black on white or white on black display	Yes	No	No	Yes	Yes
	Display set deep in hood to reduce glare	Yes	No	No	No	No
	Full 24 x 80 display	Yes	Yes	Yes	Yes	Yes
	Full upper and lower case	Yes	Option	No	Yes	Yes
	Non-glare screen	Option	Yes	No	Yes	Yes
High operator throughput, low operator fatigue	Tab stops/tab key	Yes	No	No	Yes	Yes
	Backspace key	Yes	No	No	Yes	Yes
	Repeat key	Yes	Yes	No	No	Yes
	Shiftlock key	Yes	No	No	No	No
	Separate print key	Yes	No	No	No	Yes
Convenient switching Local/on-line	Local—remote key	Yes	No	Option	Option	Yes
International Character sets	French/German/ Swedish/Danish/ British/Spanish	Option	Option	No	Option	Option
High speed numeric	Integrated numeric pad	Yes	Option	No	Yes	Yes
Convenient system interfacing	RS-232/CCITT-V24	Yes	Yes	Yes	Yes	Yes
	Current loop	Option	Yes	No	Yes	Yes
Simplified program debugging	Transparent mode and displayable control characters	Yes	No	No	No	No
Faster maintenance	Self-test	Yes	No	Yes	No	Yes
Minimum desk space	Small size	15Wx 19Dx 14H	15.5Wx 20.2Dx 13.5H	15.5Wx 20.5Dx 13.5H	15.5Wx 20.5Dx 13.5H	21Wx 23Dx 14.5H
Printer port	Printer port	Option	Yes	No	Yes	Option
Cost effectiveness	Qty. 100 OEM price	$599†	$740	Less than $550 in quantity 1000	$860	$895

*In quantities of 100.
†Qty. 1, End User Price $966.

Nobody ever offered you a tough, high quality, compact CRT like the BANTAM before. At $599 or any price. Designed for hectic office environments. And, human engineered to make an operator's life easier.

You get everything you need for cleaner input and faster throughput. An upper and lower case character set displayed on a sharp 7 x 10 dot matrix. A full 24-line by 80-character screen. A complete, sure-touch keyboard with shadow numeric pad.

You get complete tabbing. Full cursor addressing. Repeat, backspace and shiftlock keys. A transparent mode with displayable control characters to simplify host program debugging. And, a self-test mode for easy maintainability.

And, you get everything your operators need to make their jobs a joy. A hooded display that cuts glare. A wide bandwidth monitor for sharp images everywhere on the screen. Below-the-line character descenders to make reading easier.

A switchable white-on-black or black-on-white display, whichever your operator prefers. An easy-to-find cursor that frames the entire character position in a transparent, inverted video block.

Plus plenty of options you can't get with CRTs costing much more. Like our low-cost Pussycat page printer. A full range of foreign language character sets. We even have a model you can switch from ASCII to full overstrike APL.

But that's not all. The BANTAM's compact good looks fit any decor. It's handsome enough for executive row and rugged enough for the stockroom. Silent? The BANTAM's fan-free design makes it quieter than an electric typewriter. And, the BANTAM only weighs 28 pounds.

Only an industry leader like Perkin-Elmer could do it. We designed a powerful, custom LSI controller chip that makes the BANTAM the one and only high quality CRT in its class.

But see for yourself. Use the comparison chart. Learn why we're so proud to add this $599 CRT to the 250,000 peripherals that bear our good name.

And, remember our terminals come equipped with a No Hassle, 800 toll-free service phone number.

One call does it all. We give you service *where* you need it, when you need it. We're there. Not just "worldwide," but wherever you are.

For more information call or write Perkin-Elmer Terminals Division, Randolph Park West, Route 10 & Emery Avenue, Randolph, N.J. 07801 (201) 366-5550. Or contact any of our sales offices. Then watch the feathers fly.

The Bantam's available at all these places

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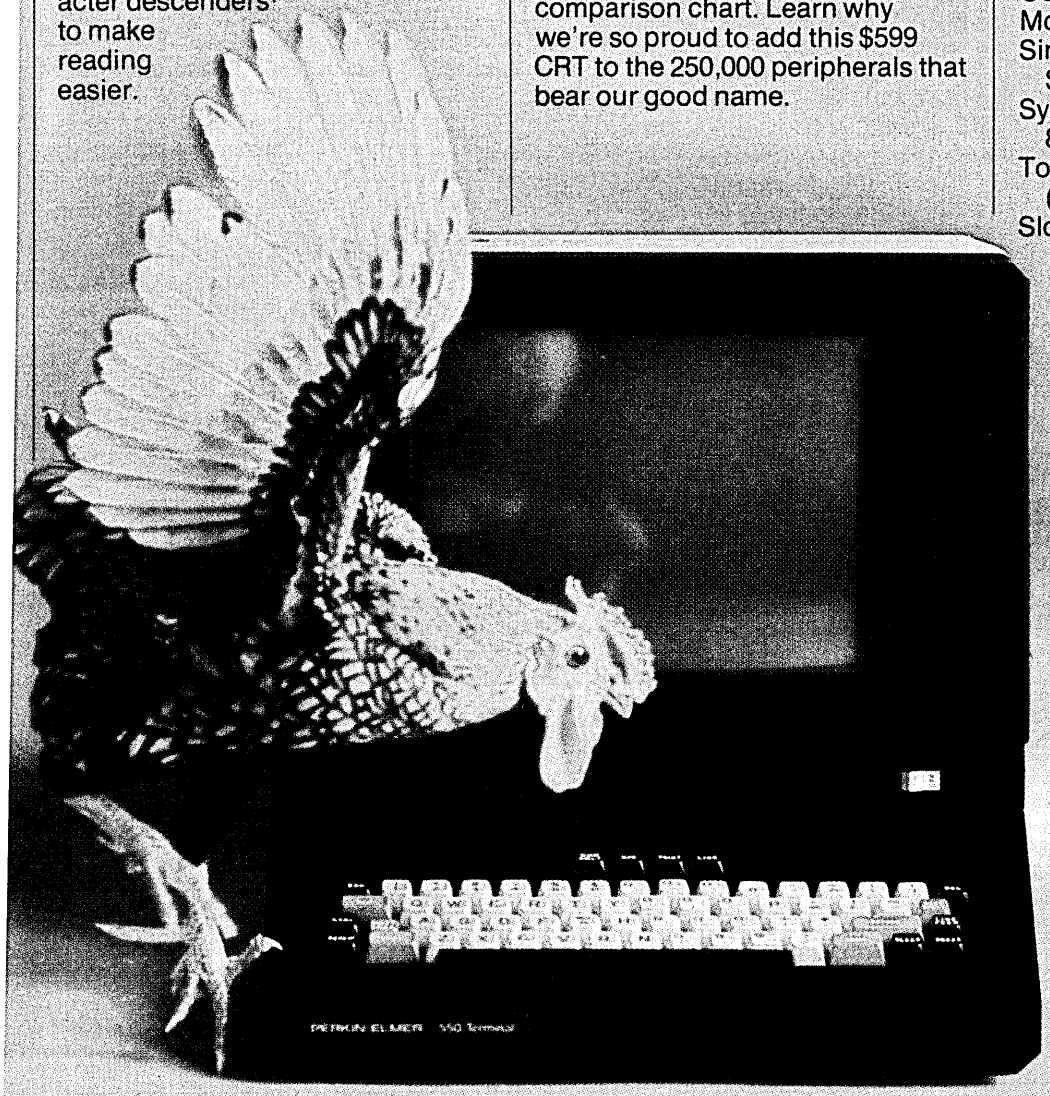


PERKIN-ELMER
Data Systems

CIRCLE 56 ON READER CARD

superior programming techniques to ourselves and to those of our customers who appreciate them.

VENDORS AND LANGUAGES

The discussion of assembler language use in the article "Third Generation Myopia" by R. Edward Mitchell, Jr. (September, p. 233) was like a breath of fresh air amid arguments from high level proponents who, in most cases, have little if any experience with low level languages.

I have seen far too many installations paying the extremely high price of bigger/faster machines and lower programmer productivity simply because someone has arbitrarily made the "high level language only" decision.

In many cases, representatives of the computer vendor are actually invited to participate in the language selection. Some problems with having computer vendor personnel participate in the choice, of course, are:

They usually has less real experience with the languages than the company's staff.

The vendor's personnel normally suggest the vendor's latest offerings in the area of hardware and software, regardless of the cost or complexity involved. They, of course, would be criticized by their superiors if they did not.

By suggesting languages and products that require massive amounts of computer resource, the vendor can be assured of a relatively rapid computer reorder or upgrade. If some find this logic hard to believe, consider that the average computer size for a medium size installation over a period of time as short as 10 years has gone from a 64K computer in 1967 to a megabyte computer in 1977.

I am glad there are still people like Mr. Mitchell who are willing to tell it like it is.

KENNETH R. LUNG
Manager of Technical Development
and Application Programming
Ben Franklin Division
City Products Corp.
Des Plaines, Illinois

A HOTEL SAVED IS A HOTEL EARNED

Looking Back (December, p. 8) says that the stately old Bellevue-Stratford Hotel no longer exists. The hotel, although closed, still stands. It is being refurbished and will open this year under the name and management of Fairmont. You were perhaps misled by thinking that the California tendency to smash down the old has spread to Philadelphia. It has not and we still hold to the Franklin tradition that, "What you save you have."

ERIC A. WEISS
Public Issues Consultant
Sun Company
Radnor, Pennsylvania

HEALTH HAZARD?

Crt terminals have been extensively used in the computer industry for tasks such as key-to-disk/tape and reservation systems for several years, and an increasing number of companies in other fields, including the one I work for, are making a substantial investment in these terminals. Recently, a few of my co-workers have begun to question the long term medical effects of spending several hours a day close to a crt. However, I am unaware of any technical literature dealing with this issue. I therefore would like to request that any of your readers who are aware of studies of the effects of crt radiation on users provide me with citations at the address below.

ALEXANDER MCKENZIE
50 Moulton Street
Cambridge, MA 02138

*

The C3 Series is the microcomputer family with the hardware features, high level software and application programs that serious users in business and industry demand from a computer system, no matter what its size.

Since its introduction in August, 1977, the C3 has become one of the most successful mircocomputer systems in small business, educational and industrial development applications. Thousands of C3's have been delivered and today hundreds of demonstrator units are set up at systems dealers around the country.

Now the C3 systems offer features which make their performance comparable with today's most powerful mini-based systems. Some of these features are:

Three processors today, more tomorrow.

The C3 Series is the only computer system with the three most popular processors— the 6502A, 68B00 and Z-80. This allows you to take maximum advantage of the Ohio Scientific software library and the tremendous number of programs offered by independent suppliers and publishers. And all C3's have provisions for the next generation of 16 bit micros via their 16 bit data BUS, 20 address bits, and unused processor select codes. This means you'll be able to plug a CPU expander card with two or more 16 bit micros right in to your existing C3 computer.

Systems Software for three processors.

Five DOS options including development, end user, and virtual data file single user systems, real time, time share, and networkable multi-user systems.

The three most popular computer languages including three types of BASIC plus FORTRAN and COBOL with more languages on the way. And, of course, complete assembler, editor, debugger and run time packages for each of the system's microprocessors.

Applications Software for Small Business Users.

Ready made factory supported small business software including Accounts Receivable, Payables, Cash Receipts, Disbursements, General Ledger, Balance Sheet, P & L Statements, Payroll, Personnel files, Inventory and Order Entry as stand alone packages or integrated systems. A complete word processor system with full editing and output formatting including justification, proportional spacing and hyphenation that can compete directly with dedicated word processor systems.

There are specialized applications packages for specific businesses, plus the vast general library of standard BASIC, FORTRAN and COBOL software.

OS-DMS, the new software star.

Ohio Scientific has developed a remarkable new Information Management system which provides end user intelligence far beyond what you would expect from even the most powerful minisystems. Basically, it allows end users to store any collection of information under a Data Base Manager and then instantly obtain information, lists, reports, statistical analysis and even answers to conventional "English" questions pertinent to information in the Data Base. OS-DMS allows many applications to be computerized without any programming!

The new "GT" option heralds the new era of sub-microsecond microcomputers.

Ohio Scientific now offers the 6502C microprocessor with 150 nanosecond main memory as the GT option on all C3 Series products. This system performs a memory to register ADD in 600 nanoseconds and a JUMP (65K byte range) in 900 nanoseconds. The system performs an average of 1.5 million instructions per second executing typical end user applications software (and that's a mix of 8, 16 and 24 bit instructions!).

Mini-system Expansion Ability.

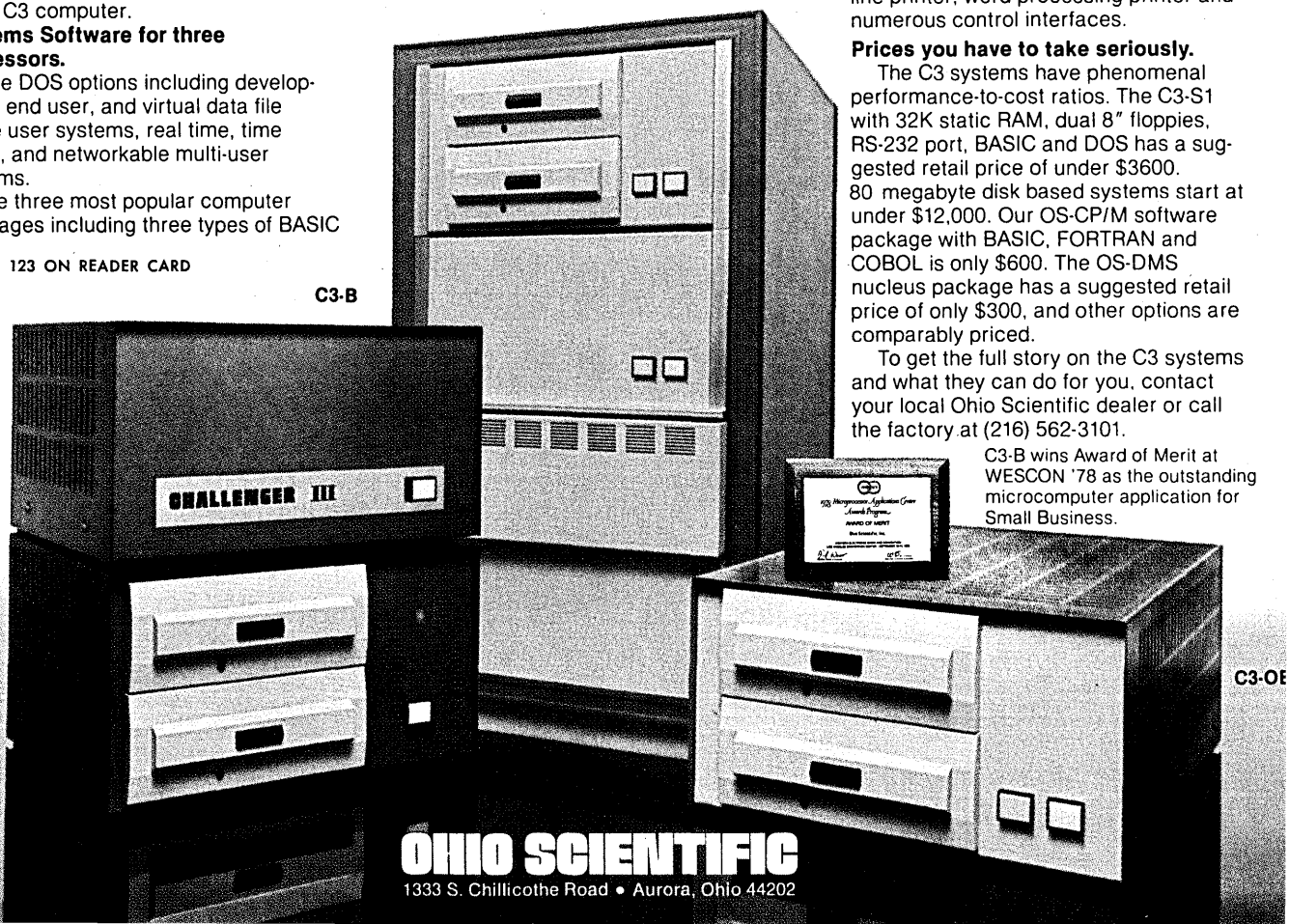
C3 systems offer the greatest expansion capability in the microcomputer industry, including a full line of over 40 expansion accessories. The maximum configuration is 768K bytes RAM, four 80 million byte Winchester hard disks, 16 communications ports, real time clock, line printer, word processing printer and numerous control interfaces.

Prices you have to take seriously.

The C3 systems have phenomenal performance-to-cost ratios. The C3-S1 with 32K static RAM, dual 8" floppies, RS-232 port, BASIC and DOS has a suggested retail price of under $3600. 80 megabyte disk based systems start at under $12,000. Our OS-CP/M software package with BASIC, FORTRAN and COBOL is only $600. The OS-DMS nucleus package has a suggested retail price of only $300, and other options are comparably priced.

To get the full story on the C3 systems and what they can do for you, contact your local Ohio Scientific dealer or call the factory at (216) 562-3101.

The C3 Series from Ohio Scientific.



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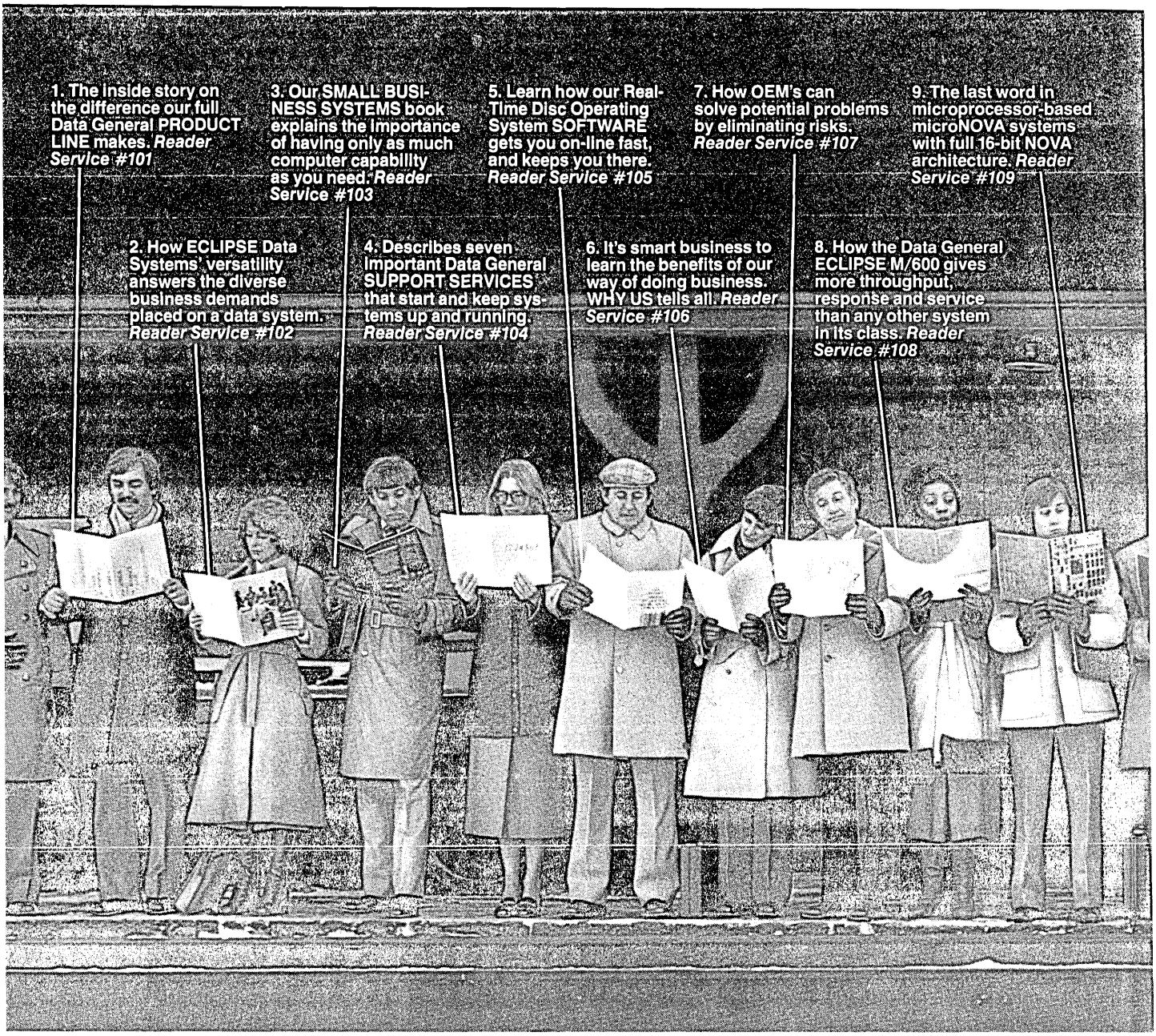

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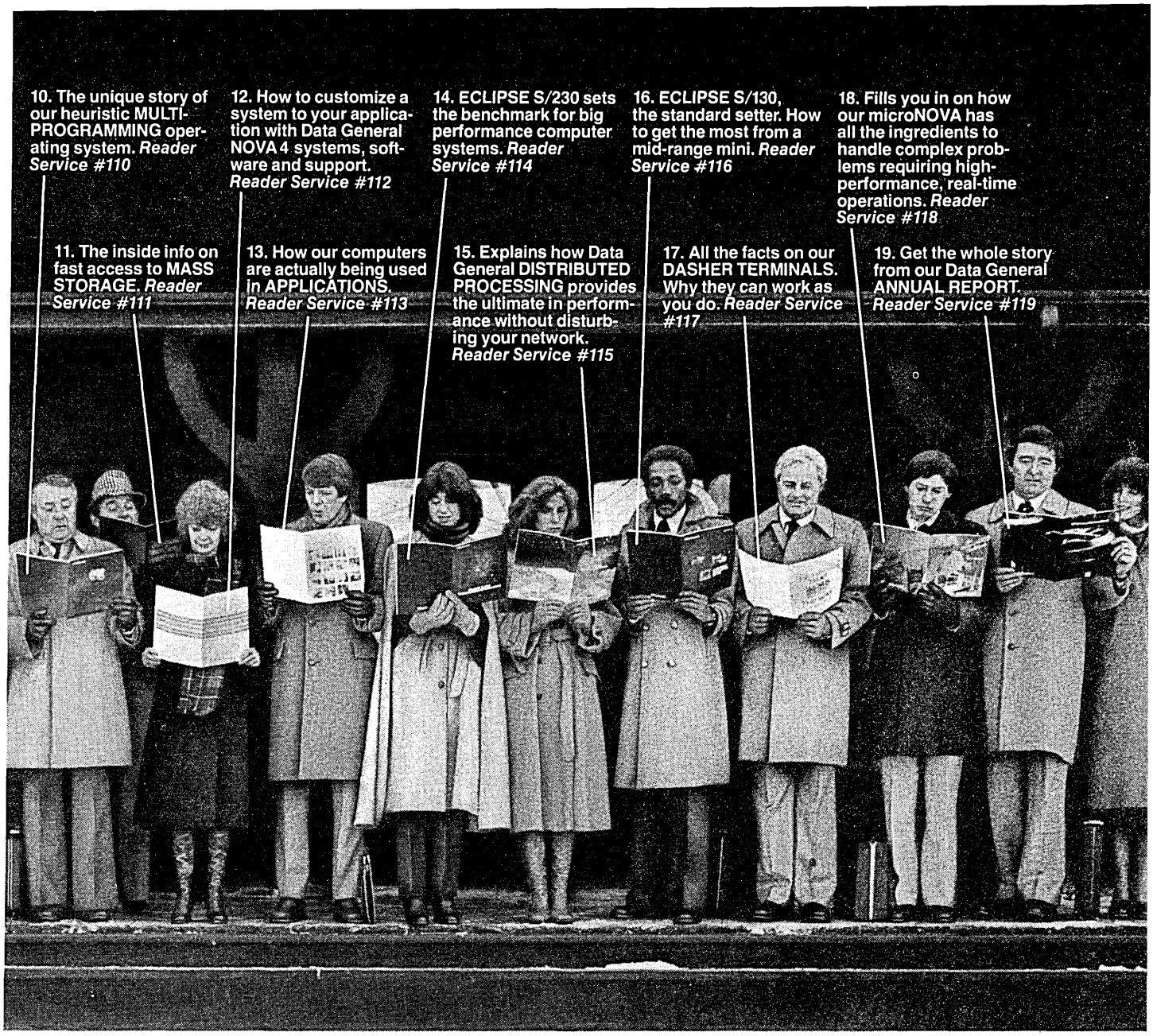

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In addition, the CM-9100 features:

- Expandable from 4 up to 32 input terminal ports plus up to 2 high speed output ports.
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The CM-9100 is an entry level unit fully compatible with DCC's high capacity (up to 480 ports) multimicroprocessor, the CP-9000. The 9000 series allows disciplined network development with uniform protocol and common software.

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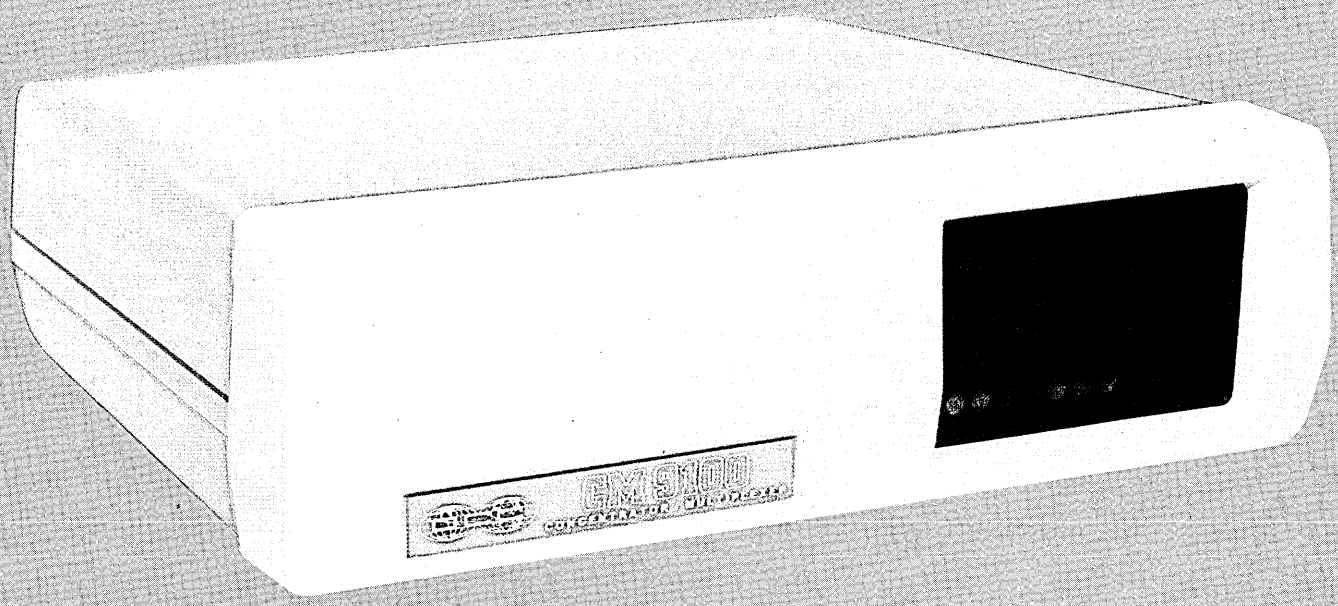
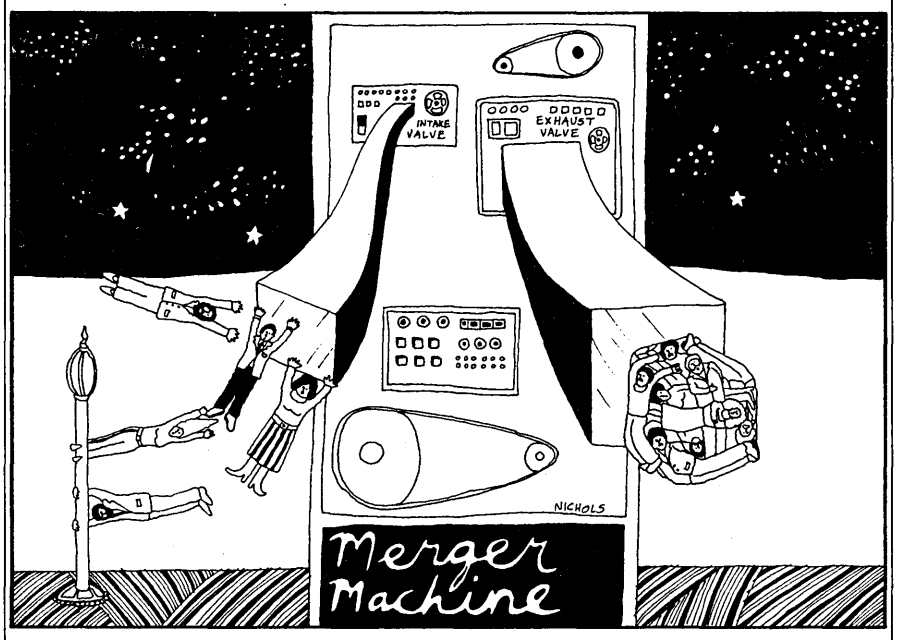


CIRCLE 145 ON READER CARD

JOHN L. KIRKLEY, EDITOR

EDITOR'S READOUT

THE COMING SHOWDOWN



Cock an ear to the corporate winds. Punctuating the boardroom chatter, the rustle of memos, and the telephone's ring is a predatory sound that is being heard with increasing frequency. It's a sort of gulp followed by a dignified executive belch. It's the sound of another merger or acquisition, perhaps hostile, perhaps friendly.

According to a recent Washington Post story, during 1978 there were 80 corporate mergers involving $100 million or more. That's twice the number in 1977 and six times the number in 1975. The total dollar value of all corporate mergers last year exceeded $34 billion, up more than $12 billion from the year before.

The government, in the form of the FCC, the Justice Dept. and Congress, fears this pooling of power will lead to increased antitrust and monopoly violations. They're preparing legislation to meet the challenge, but whether or not new laws can slow the accelerating merger pace is a matter for some conjecture.

John H. Shenefield, Assistant Attorney General for Antitrust, is quoted as saying, "We are looking at reversing the burden of proof in some cases . . . Should the merging companies, for example, have to show that their merger will have benefits in the marketplace?"

Reading that, we cheered a small cheer and wished him well. For this is precisely the point. Mergers and acquisitions are too often made for short term gain; their impact can be devastating to individuals, companies and, in the long run, to the industry itself.

For some time now we have been witnessing a merger stampede and the computer industry is no exception to this trend. As the pace accelerates, company after company—old familiar names—are suddenly osmosed into oblivion.

Over just the last year Shugart, Lexitron, Qume, Jacquard, Sycor, Data 100 and MRI, to name a few, have all proven to be tasty tidbits for larger, cash-rich corporations. The Xerox/WUI deal is now being consumated, Comten will soon be gone, and Microdata had a near miss. Who knows how many other companies in the $50 to $60 million range are being eyed at this moment for possible takeover? (That $50 million figures seems to be a crisis point—either the company moves through it to become a major independent force, or it falters and is lost.)

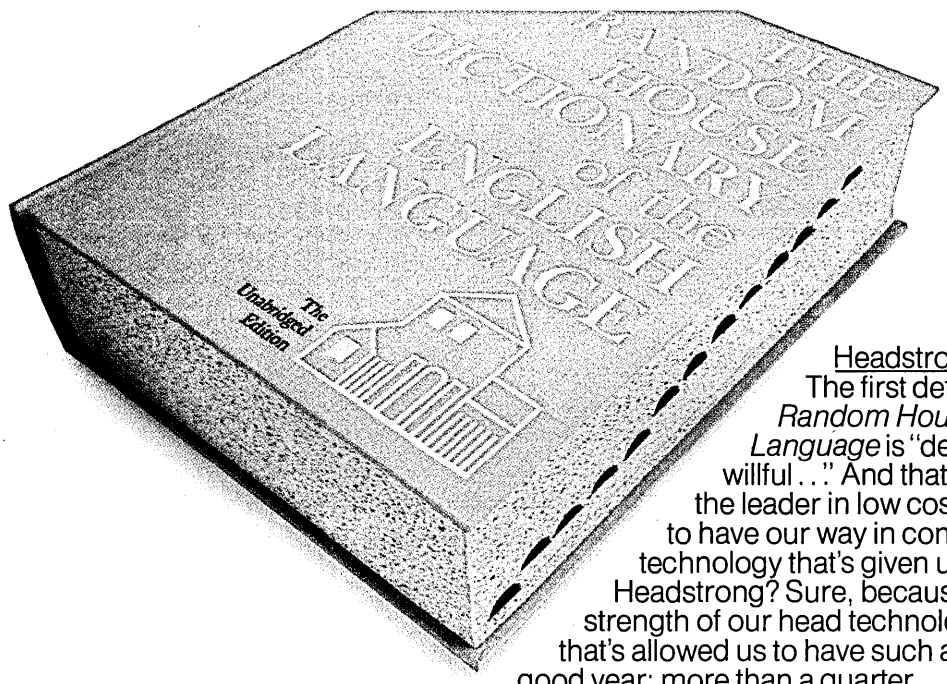
All the old reasons for this activity —expanding a market base, acquiring compatible product lines, etc.—are still valid but, quoting Shenefield again, more and more mergers are occurring "because of a stock market that has many companies valued unusually low, because of certain tax laws and benefits, because managers just like to manage bigger companies, and because a lot of companies have cash hoards . . ."

And the impact on the computer industry? Well, we have some very wealthy individuals who have become part of our industry folklore. And we have some highly under-utilized entrepreneurial minds—men who have made their bundle and split for Tahiti. On a positive note: some smaller companies which might otherwise have disappeared have been rescued in the nick of time by being acquired.

But there is a much more alarming and potentially debilitating consequence of this trend. Our industry is starting to congeal, to consolidate much too early. We need more innovation, more creativity, more entrepreneurial daredevils teetering on that dangerous high-wire between glory and disaster. We need the small companies and the talented, highly motivated few willing to gamble on an innovative idea.

But when the big company moves in, more often than not the entrepreneurial spirit—and often the entrepreneur—moves out. The accountant mentality pervades, return on investment governs all, and a steady 15% increase in annual revenues is much to be preferred to the more exciting but infinitely more hazardous go-for-broke attitude. The wheels of innovation slow to a lackluster but manageable pace, venture capital becomes even more scarce, and slowly a whole industry hardens into an oligopoly.

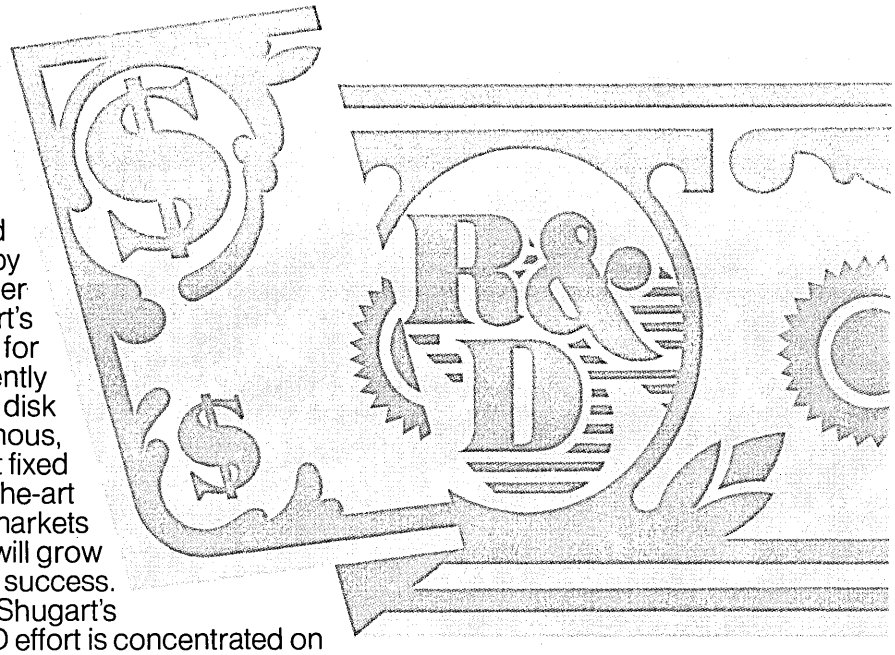
The computer industry, still vibrant, changeable, exciting, deserves better. ✲



Headstrong about leadership.
The first definition of headstrong in the *Random House Dictionary of the English Language* is "determined to have one's own way; willful . . ." And that's a fine explanation of why we're the leader in low cost disk storage. We're determined to have our way in controlling the read/write head technology that's given us our leadership position.
Headstrong? Sure, because it's the strength of our head technology that's allowed us to have such a good year: more than a quarter million floppy disk drives delivered. Proud of being headstrong? You bet. And proud of our heads-up OEM customers who specify Shugart products.

We headstrong of

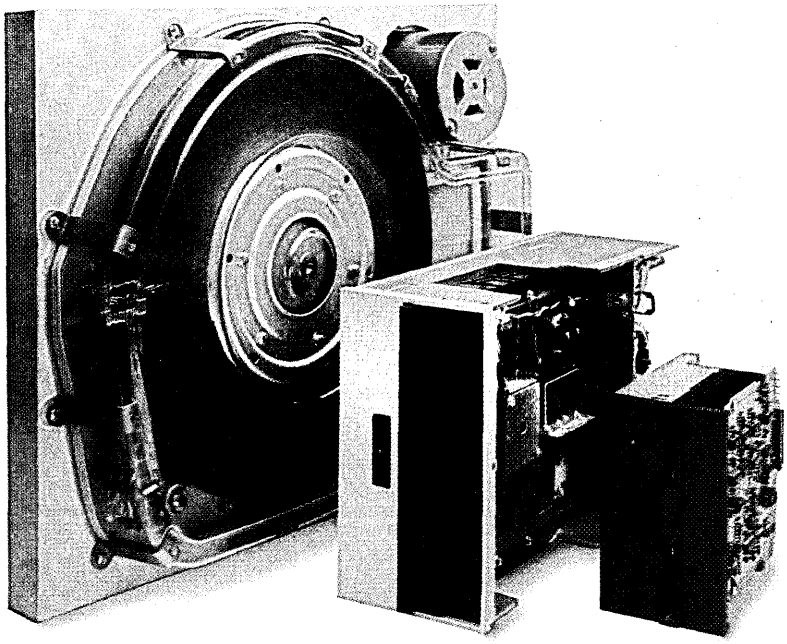
Headstrong about technology.
The only sure way to control quality is to control the key technology responsible for that quality. You can do that only if you have depth in your R&D and manufacturing capabilities. At Shugart, we've got the strength and resources to develop and produce all our read/write heads. We've been doing it since day one. That's why Shugart read/write head technology extends media life to over 3.5 million passes per track, and gives you a head life that exceeds 15,000 hours. And it's one of the big reasons why heads-up OEM's demand Shugart. Because they know we're headstrong about controlling our technology.



Headstrong about R&D. We invest significantly more Research and Development dollars in floppy disk technology than any other manufacturer in the business. Shugart's commitment to R&D is responsible for our introduction of the first independently developed IBM-compatible floppy disk drive; the first, and now famous, Minifloppy,™ and the first low cost fixed disk drive providing state-of-the-art Winchester technology. As your markets broaden, our product lines will grow to ensure your continued success. We're committed to it. Shugart's entire R&D effort is concentrated on innovating and improving low cost disk storage products. It's our only business That's why we're so headstrong about R&D.

're and proud it.

Headstrong about delivery. In our business, innovation isn't enough. You've got to deliver high quality products in high volume. We're headstrong about our commitment to high volume delivery of low cost, rotating memory products. We fulfill that commitment by implementing production techniques developed by one of the best R&D and manufacturing engineering teams in the industry. Automated systems featuring high-speed conveyor and turret assembly technology provide an unequalled manufacturing capability. And quality control at Shugart means testing 100% of the drives we manufacture. And these test procedures are tough—tougher, in fact, than any of the real applications where you'll be using our drives. Shugart Associates, Headquarters: 435 Oakmead Parkway, Sunnyvale, California 94086 (408) 733-0100; Europe Sales/Service: Paris (1) 686-00-85; Munich (089) 176006; Shugart products are also available from local Hamilton Avnet outlets.



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So now, for the first time, you can quickly get a permanent record in full color.

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Process industries, for example, can use the 6500 CGP for prints of process variables such as temperature, pressure, flow, valve settings and to record alarm conditions for analysis. It can help railroads keep track of their train routes. Graphics data processing centers can now print graphic data in color.

And when the 6500 CGP isn't working off a computer, it becomes a great way to make full-color copies from regular hard-copy originals. Or even 35mm slides.

So ask about the 6500 Color Graphics Printer.

It'll not only make your programs look better.

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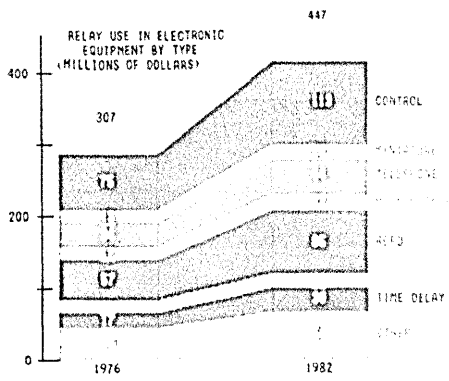
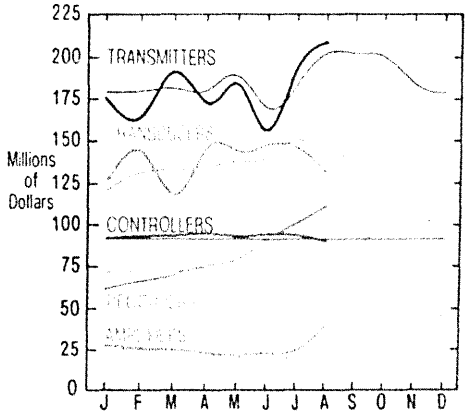
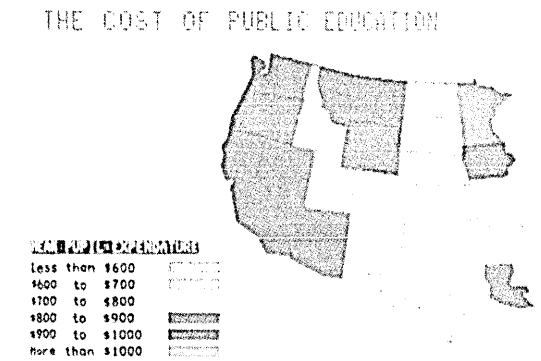
XEROX

CIRCLE 71 ON READER CARD

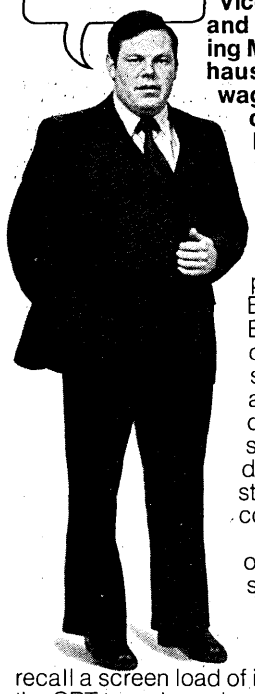






These prints were made on a 6500 CGP.

EDP professionals have a word for the new Wang VS computer.



Richard Berger, Vice President and Data Processing Manager, Bughaus, Inc., a Volkswagen service center network headquartered in Hartford, Conn.

"Because we had been using a computer—the Burroughs B1700—with card input sequential files and no video displays, we suffered long delays and storage constraints.

"Now, with our Wang VS system, storage is virtually unlimited, and we simply recall a screen load of information on the CRT to make a change in seconds—all of this without interrupting our normal flow of work.

"We've put everything in our business onto our VS system, including payroll, accounting, sales and wholesale and retail inventory control. And we did it in 90 days without changing languages and with only minor modifications in almost 90 COBOL programs."

"We are absolutely amazed at the throughput rate we've achieved with our Wang VS. On our very first job for one of the country's largest student insurance agencies, the VS arrived in Pittsburgh on December 23 and was completely installed and operational on-site on February 15, with 61 programs written, debugged and tested—all by only two people—and not a single line of code had been written until the machine came in the door.

"The VS really fulfills all of our requirements, particularly in areas where other systems are weak: cost/performance, language-availability, user-utility software.

"I think the real key for the DP manager is the utilities available with the VS, its speed and its interactive COBOL compiler. These three things combined make for a very powerful tool."

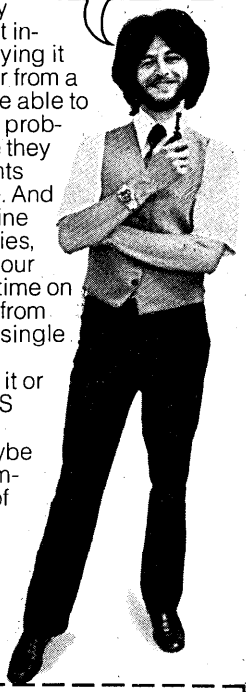
J.P. Scott, Data Processing Manager, Aptech Computer Systems, Inc., Pittsburgh, Pa.

Kenneth W. Cakebread, Manager of Data Processing, Trans-Air Forwarding and Brokerage, Inc., Inglewood, Calif.

"I had 30 days to convert about 220 programs from our old batch-oriented Honeywell 62 system to our new Wang VS system. Not only did I do it: Thanks to the programming power of the VS, I actually came up with more.

"Before we converted to the VS, the biggest problem we had in the accounts receivable area was misapplying cash. No more. Now, by capturing current information and keying it into the computer from a workstation, we're able to sort out potential problems long before they get to the accounts receivable stage. And with Wang's on-line editing capabilities, I'd say we've cut our average editing time on a per-item basis from 30 seconds to a single second.

"And believe it or not, while the VS gives us faster access and maybe triple the programming efficiency of our old system, it was only half the cost."



EDP professionals in more than 100 companies are singing the praises of the Wang VS. And for good reason.

The VS is a remarkably sophisticated, fully expandable virtual storage computer designed to provide maximum interaction in a mainframe environment.

The VS provides for distributed data processing, thus avoiding costly consumption of mainframe resources. It's fast, responsive, ease to use and can support up to 2.3 billion bytes of on-line storage. What's more the VS speaks EDP people's language: COBOL, BASIC, RPG II and ASSEMBLER.

We also think you'll appreciate how simple the VS is to operate. In fact, because of its level of sophistication, it can be operated by people with little or no computer-related training or experience.

One more thing: the entry level price of the VS is under $50,000. Which is perhaps the most remarkable thing of all about this computer.

For more information on the VS, return this coupon to Wang Laboratories, Lowell, MA 01851.

I'd like to know more about the Wang VS. Please send me a copy of your Executive Brochure.

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NEWS IN PERSPECTIVE

MINI PCM'S IN COURT

Plug-compatible manufacturers take action against DEC and Data General patents.

From various quarters around the computer industry, attempts are being made to break down the barriers that have held back something that might be called a plug-compatible minicomputer business. Just as there are a number of successful makers of IBM-compatible peripherals—and a larger number of hopeful IBM software-compatible mainframe manufacturers—so also there is a legion of manufacturers of peripheral equipment designed to be operated with the minicomputers of the likes of Digital Equipment Corp. and Data General Corp. And waiting in the wings are companies who want to clone minis that run DEC and DG software.

Makers of 370 software-compatible computers estimate that the world's inventory of IBM software has a value of some $200 billion. That's why even IBM must continue to design a new family of computers that run the old 370 programs. And while the value of DEC software is much smaller, perhaps $5 billion, and while DG's software may come to $2 billion, that's still a lot of programming that users are unwilling to convert. Thus the attraction of producing hardware that will run those old but reliable programs.

The latest to enter the DEC-compatible end-user peripherals market is Microcomputer Systems Corp. (MSC), a Sunnyvale, Calif., company that since 1974 has been selling disk controllers to oem's. MSC in January sued in federal court in San Francisco to have DEC patents relating to the Massbus declared invalid, unenforceable, and uninfringed by MSC. The latter, says MSC president James S. Toreson, "is the primary thrust of our action. We want to be declared a noninfringer so we can proceed."

What MSC announced in January, shortly after instituting its suit against DEC, were plug-compatible replacements for the DEC RP-04/05/06 disk drives for users of the System 10, 20, PDP-11/34 through 70, and VAX-11/780. Their compatibility with the DEC Massbus I/O controller, however, is what opens the peripherals maker to legal action by DEC. For, while DEC will license a company to attach to the Unibus, it will not do so with the Massbus.

"This business of someone patenting a bus and keeping people from plugging something onto it . . . I don't think anybody has ever been successful in doing that," says Toreson. And it is something the young company, which in its last fiscal year had sales of less than $6 million, is willing to challenge in court. DEC's motivation for wanting to keep companies like MSC out of that market, says Toreson, is obvious.

"There's a $200 million-a-year marketplace that they have a 100% ownership of today," he explains. "So they're going to do everything in their power to maintain control." He adds: "We think the world needs an alternative. We just don't believe in monopolies."

Industry observers do note that DEC has fiercely defended its Unibus and Massbus patents. In fact, one of them says, that's one thing that leads to an uncharacteristically aggressive response by a company most people do not consider terribly aggressive.

Toreson, who formerly was with Hewlett-Packard, is quick to note that HP has a patent on an instruments bus that has been adopted as an IEEE and U.S. standard. And HP freely licenses this patent for a once-only charge of $250. The so-called IEEE 488 standard has been adopted by many instruments makers, as well as manufacturers of peripherals that now can readily be interfaced to those instruments.

Of course, HP had an interest in promoting the development of a standard interface bus. It had its own design and stood to gain from the adoption of its own design, rather than that of someone else. So the company worked with the IEEE to determine whether it had the support of other companies, and then moved to get the official adoption.

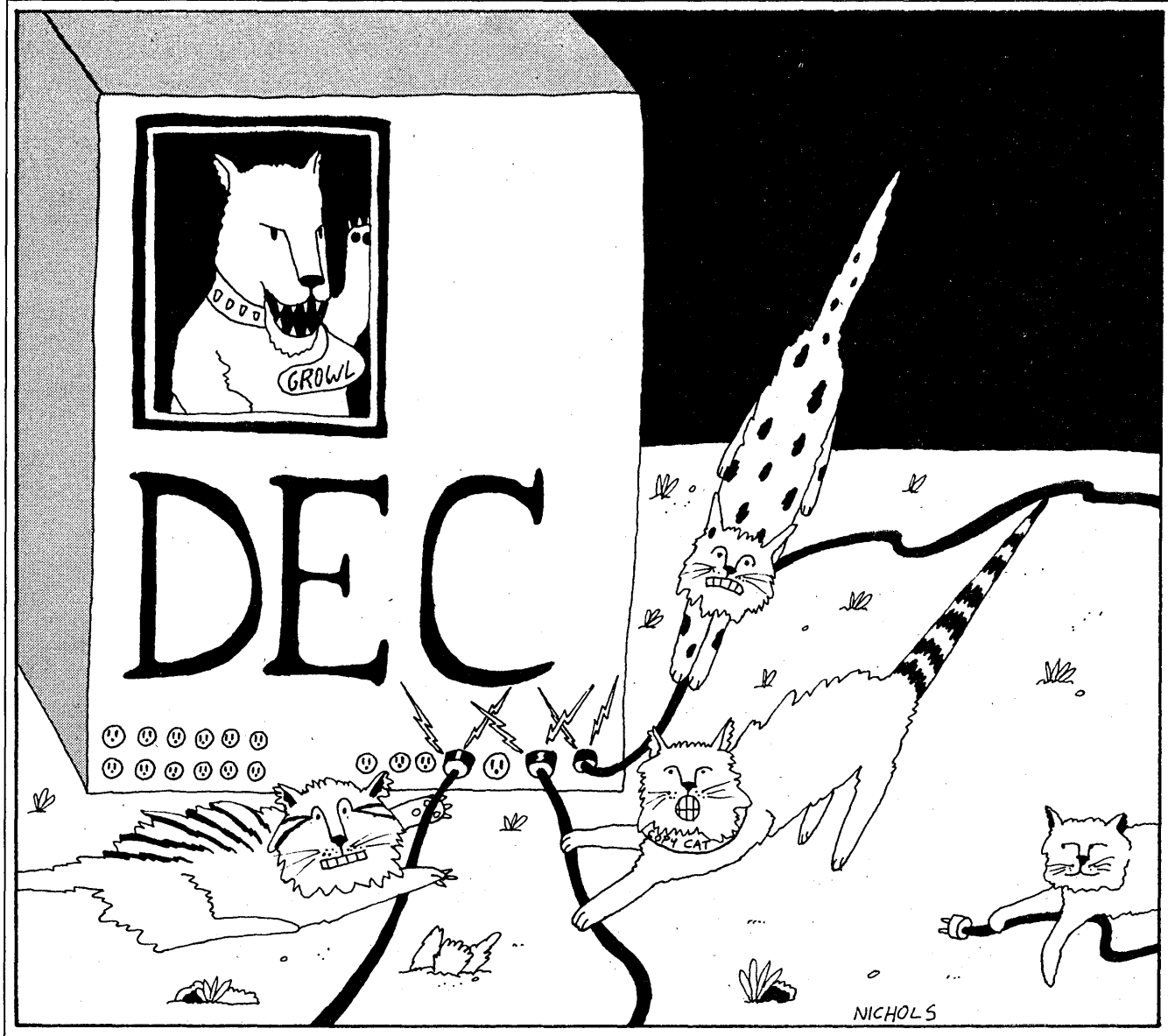
"That's one thing that leads to an uncharacteristically aggressive response by a company most people do not consider terribly aggressive."

But the company, which has a number of patents on its minicomputers, says it would "vigorously pursue our interests" if anyone without the benefit of a license were to try making a look-alike of the HP 3000 computers. Such a license, according to a spokesman, is available "for a reasonable fee."

If HP is thusly receptive to requests for such a license, which it has yet to receive, Digital Equipment Corp. is less so.

National Semiconductor Corp., in a separate suit, charges that its attempts to license some patents on the PDP-11 were turned down. National nonetheless intends to make and sell DEC-compatible minis, the company says. And, to be sure it isn't hassled by the Massachusetts company, National last September instituted its suit in federal court in San Francisco.

In addition to contending that it does not infringe any of those patents, National additionally charges DEC with "fraudulently and inequitably" procuring the patents on the PDP-11 and using



that patent position to "secure and maintain control of trade and commerce" in that segment of the minicomputer market. In thus challenging DEC's patents in its antitrust suit, National is taking a significant and different tack.

National says that in its Series 200 minis, which are software-compatible with the PDP-11, it does not infringe on those same DEC patents. The company purportedly tried to discuss a license with DEC, but was turned down. But, the suit alleges, DEC did license IBM and Western Electric, and that's discriminatory licensing.

"By inducing the technologically and financially best-equipped companies not to challenge the validity of DEC's PDP-11 patents," the suit states, "DEC has been left free to carry on its unlawful exclusionary practices against smaller firms seeking to compete in the manufacture and sale of equipment capable of utilizing the largest program base for minicomputers."

So the semiconductor manufacturer, preparing to make and market its PDP-11/34 look-alike, asks the court to rule that National is not infringing on DEC's patents, to say the patents are invalid, and to stop DEC from charging National or any of its customers that by running PDP-11 programs on non-PDP hardware they are in violation of the law.

"DEC did license IBM and Western Electric, and that's discriminatory licensing."

In its suit, National charges that DEC was not totally open and aboveboard when it filed its patent applications. The semiconductor manufacturer says DEC was too late in filing with the patent office, failing to point out that some of the designs had previously been revealed in such publications as the PDP-11 Handbook, and that some of the hardware had earlier been sold, "well before the patent applications were filed in March 1970."

To the casual observer, these lawsuits seem a bit confusing. (To the reporter lacking any legal training, they are very confusing.) One might question, for example, why there can be so many companies making peripherals that attach to someone else's minicomputers—without being sued. Why are some sued and some not? Calvert D. Crary of Bache Halsey Stuart Shields Inc., a lawyer who follows corporate cases, offers a simple explanation. He says maybe it's just that DEC and Data General can't know about every hardware vendor who's violating one or more of their patents or software licensing agreements. He uses the analogy of someone illegally making copies of movies. If it's a large pirating operation, the producing studio will bring suit to stop the practice. But if it's a backyard operation, it might go unnoticed by the movie company and never brought to trial.

And then there's a company like Pacific Cyber/Metrix Inc., which for the

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CIRCLE 16 ON READER CARD

last three years has been selling a board-level computer that is software-compatible with the DEC PDP-8. As such, the user of the so-called PCM-12 has access to an extensive software inventory developed by the large user community, as well as high-level languages. But this computer is not hardware-compatible with the original DEC machine. "We have our own bus, so we're not conflicting with DEC's bus structure, which is protected," explains PC/M's Ted Netoff. His machine does not use the Unibus or Massbus.

Of course, too, there is a large and growing community of companies that have licenses from DEC. In a letter dated July 1978 to Microcomputer Systems Corp.'s attorneys, DEC assistant patent counsel Paul E. Kudirka enumerates the peripheral equipment makers who at that time were licensed under the Unibus patent. They were Applied Micro Technology, Computer Extension Systems, Dataram, Digital Communications Assoc., Infotron, Miltope, 100 Plus Corp., Telcon Industries, Dynamic Sciences, Electronic Memories and Magnetics, Grumman Data Systems, Keronix, MNTL Logic Labs, Plessey Memories, and Zeta Research. Those additional companies said to be interested or already having indicated they will take a license were Xerox, Control Data, Perkin-Elmer, Wangco, and Floating Point Systems.

Of course there is a large and growing community of companies that have licenses from DEC.

Still, why do companies take the initiative and bring suit? Why don't they enter the marketplace with a product and see whether any legal action will be taken to stop them? This is explained by Grant S. "Skip" Bushee of the research firm, Dataquest. He says by suing first, National Semi achieved two things. It started the legal process, got it into motion as soon as possible, hopefully to get it settled sooner. Of course, it also avoided being enjoined later from making its Series 200 machines. And by taking the initiative, National also established venue in San Francisco, thereby getting a sort of home-court advantage.

But it looks like the litigation will be in the courts for a long time, and the question Bushee poses is whether National will be selling and delivering its Series 200 while the trial proceeds. If it does and if National loses, he says, National could lose not only all its profits from those sales but also be liable for whatever DEC claims it lost in the way of revenues, profits, and market share as a result of National sales of its 200s.

On the other hand, if National should wait for, say, two years for the resolution of the trial and if it should win, then it will have lost two years in getting its product to the market—and by then there may be no significant market anymore for PDP-11/34s.

No one at National Semiconductor or DEC would discuss the case.

"The big question is whether DEC and Data General are going to be able to keep these so-called emulators out of the market in the long run anyway," says Bache's Cal Crary. "I have my doubts about whether they will." He believes someone will tough it out and beat the patents and have them and the software licensing agreements thrown out. It would then open the floodgates to makers of look-alikes of DEC and Data General machines.

But Adolf "Sonny" Monosson of the American Computer Group Inc. can't get excited about it. "I don't think anyone is really interested," he says, even if National Semiconductor were to win. "Because by then the equipment is so obsolete that it's not going to be used."

—Edward K. Yasaki

GOVERNMENT AGENCIES

EVERYONE EYES THE WATCHDOG

U. S. General Accounting Office is the object of finger pointing as it embarks on a bold plan to get its dp act together.

It's not easy to be a watchdog when everybody else is watching you. That's the dilemma facing the U.S. General Accounting Office as it embarks on a bold new plan to get its dp act together.

Set up as an investigative arm of Congress to probe the federal bureaucracy, the GAO with its army of auditors has mounted countless attacks on waste and inefficiency at virtually every executive branch agency. But recently, the tables have been turned. And the finger pointing is now being aimed at GAO—specifically at its misbegotten internal dp operation.

For years, critics charge, GAO's administrative computer support setup has suffered from a lack of proper planning and management control. For years, they further contend, the agency has been wedded to questionable dp practices that it's officially faulted other agencies for following.

The "do as I say and not as I do" principle doesn't wash with these critics who claim the misguided watchdog has not adhered to federal information processing standards (FIPS) nor followed kosher procurement rules. There have been all too many no-no sole source buys of dp gear and services which should have been competitively bid, they argue. And they're not alone in their thinking.

Joining the growing group of GAO grippers, really actually spearheading the cause to get better computer policies in force at the agency, is Congressman Jack Brooks. As head of the powerful House Government Operations Committee, the Texas Democrat authored the well-known bill (PL 89-306 or Brooks Bill) which spells out the adp chain of command. Only the Postal Service and Congress are exempt from this binding statute which Brooks and his staff feel GAO has basically ignored in setting up its internal administrative support systems.

"We admittedly made some mistakes in administering our adp affairs in relation to the Brooks Bill and in relation to some of the procurements we wanted to make," concedes Dick Brown, GAO's director of general services and controller. "And we became very sensitive to that."

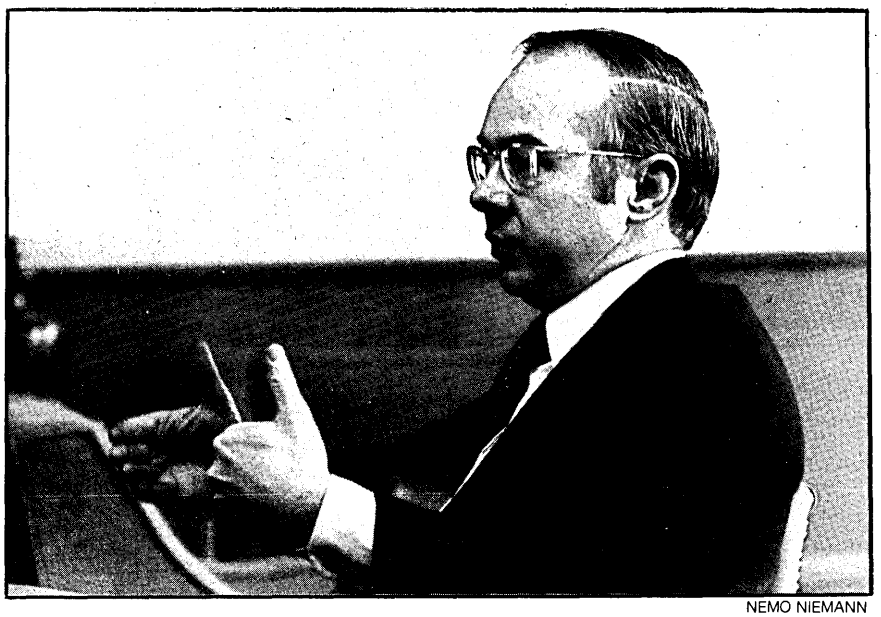
So sensitive that they decided to do something about the situation. "Prior to a year ago, we were not satisfied with the way we were going either," Brown admits. "We recognized we had problems and that we weren't doing the kinds of things we should be doing."

To get back on the right adp track, the agency set up an information policy committee to brainstorm a cohesive management information system strategy to handle both administrative and nonadministrative agency needs. In charge of approving GAO-wide information systems development and implementation, the five-member group reviews all current and proposed dp setups to make sure they conform with the agency's newfound information policy.

As part of this policymaking, the committee has come up with a long-range plan with projections for the next three to five years. Observers close to GAO, while commending the agency for finally getting around to recognizing the need for such planning, question whether a three-to-five-year timeframe is long range enough.

GAO points out this plan will be updated yearly but admits it may be overly optimistic on meeting current deadlines on some targets. The chief and most ambitious target currently goes by the name of AIRES, the Automated Information Resources System.

Touted by GAO'ers as their "showcase system," this integrated MIS setup will include three subsystems—an assignment management planning system (AMPS), a budget cost accounting system (BCAS), and a personnel resource management



NEMO NIEMANN

RICHARD BROWN—"We recognized we had problems and that we weren't doing the kinds of things we should be doing."

system (PRMS). Tying the whole operation together will be a data base management system.

Sources familiar with the auditing agency's administrative dp demands insist GAO should have had this type of setup years ago. And years ago, they further argue, GAO should have overhauled or thrown out its floundering programming, scheduling and reporting (PSR) system.

One of GAO's key administrative setups, the PSR system, which after many years of operation was totally discontinued last September, represented the agency's first stab at MIS development. And a good stab it wasn't, mainly because the first generation system never functioned as it should have. It never provided the timely management information reports so vital in controlling GAO's numerous projects.

Clerio Pin, GAO's assistant to the Comptroller General for Administration, readily concedes PSR's faults. After a task force review in 1977, he explains, it was decided the system "just wouldn't work. It was too slow and the information it provided was incomplete and milestones were missing."

So in 1977 the long overdue decision to scrap PSR was made. GAO watchers, critical of the system all along, wonder why it took the agency so long to reach that conclusion. And again they cite poor planning as the chief reason.

GAO's new plans, part of the AIRES project, have also spawned a rash of criticism and an unexpected procurement controversy. It all started when the agency awarded a contract last September to American Management Systems to modify an existing management data system (MDS) which was running off Computer Sciences Corp.'s Infonet timesharing network.

The original MDS setup was developed three years ago out of GAO's Atlanta office. This system, adopted in December 1977 by GAO headquarters as a temporary fill-in for PSR, also has its share of debunkers. Aware of the system's flaws, GAO, under its new game plan, wanted American Management Systems to reconfigure it as AMPS, one of the main modules in the AIRES operation. This development chore was slated to be completed this month.

GAO admits it may be overly optimistic on meeting current deadlines on some targets.

Now that timetable, as well as the timetable for the whole GAO long-range planning effort, has been dramatically thrown out of kilter by the sticky procurement problems that resulted from the agency's contract to American Management. The crux of the problem is that GAO went ahead and released a request for proposals (RFP) and the subsequent contract for the MDS system without getting the mandatory delegation of procurement authority (DPA) from the General Services Administration.

This injudicious move, clearly in violation of procurement law, raised the ire of the Brooks staff on Capitol Hill, and caused even more consternation on the part of Computer Sciences which also bid on the contract.

Objecting to the contract award on several grounds, the company filed a protest against GAO with the ultimate arbiter in such disputes, the GAO. And predictably, the agency refused to rule on the protest mainly because it didn't want to be placed in the conflicting roles of adjudicator and adversary.

So that left GSA holding the bag. Early last month, the procurement authority handed down one of its severest reprimands to GAO. Faulting the agency for taking actions "not consistent with the legal requirements for government acquisition of adp services," GSA told GAO it couldn't extend the American Management contract and advised the agency to begin immediately "a full and open recompetition" of the contract.

GAO's Brown estimates this new mandate from GSA could throw off the agency's long-range planning schedule by a year to 18 months. But it could also mean that all GAO's plans, including the AIRES project, could be scrapped. "There's a possibility," he confirms, "we could just scrub the whole thing. Everything is up in the air till we look at our options . . . "

The GSA decision on the AMS contract clearly was an unexpected blow to GAO officials. Earlier this year when the controversy hit its height they had staunchly maintained it was merely a tempest in a teapot stirred up by the Computer Sciences protest. They claimed to have gotten a "routine" verbal okay from GSA to proceed with what they believed was a fully competitive deal. And they further contended that an "exigency" situation forced them to go ahead.

While GSA questions the basis for such an exigency, top adp boss Pin defends it. "We decided as a matter of policy that we were not going to extend the sole source (Infonet) contract with CSC . . . We were going to get on a competitive footing and that's why we pushed forward. That's why," he insists, "it was an exigency."

GAO's Brown is considerably more cautious in defending the agency's moves. "It's obviously unwise to go ahead without written confirmation on these things," he admits, "because you get yourself into problems."

And these procurement-type problems, critics charge, result from the fact that GAO has never had the right management muscle. "It's the Band-Aid approach," quips one Congressional insider. "They've just been totally reactive. Whatever is pressuring them at a certain point is what they do."

Over the years, GAO has relied heavily on the processing power of several federal agencies to handle such administrative chores as payroll and personnel. Today, the agency continues to farm out some of its adp applications, believing as it has all along that it's following the intent of the Brooks Bill to exploit com-

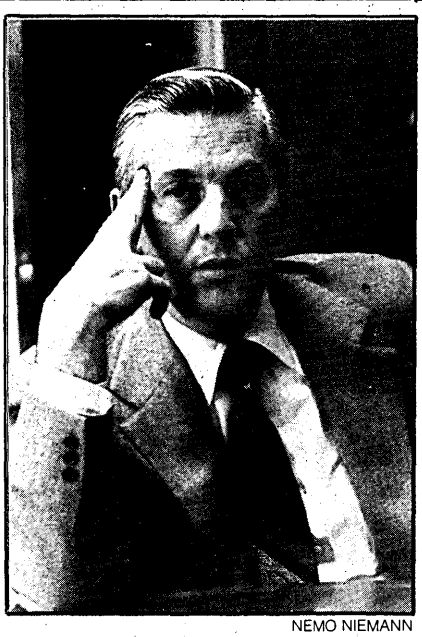
puter capacity inside the federal community first before going to an outside vendor.

GAO's adp budget has gone from $106,000 in FY 70 to $4.1 million for FY 80. The big boosts over these years, and especially more recently, come from services and not equipment buys. This continuing trend reflects a basic "philosophical change" in GAO's adp operation.

Instead of relying on an in-house staff as it had in the past, GAO a year and a half ago decided to go with outside contractors for its system design and development work. Vince De Santi, director of GAO's new office of information management, believes this new approach will be a boon to agency users. "The idea," he points out, "is to get adp skills and capability out into the (GAO) divisions and out into the infrastructure of the organization."

Pin sees this approach as being "decentralized with centralized control." Other systems specialists with first hand knowledge of the GAO adp scene worry that such a strategy merely keeps the agency in the same untenable management mold it's been in all these years.

GAO'ers, however, feel confident this methodology bolstered by outside contractors will work. So confident that they got rid of their 20-member programming staff last July in favor of bringing in contractor support on an as-needed basis.



NEMO NIEMANN

CLERIO PIN—Sees GAO approach as being "decentralized with centralized control."

Now, with all the woes from the AMS contract fresh on their minds, GAO'ers may have to rethink this strategy. Before the brouhaha, they'd settled on using contractors for AIRES, although they still were undecided on whether to go with an in-house setup, outside service support or even a combination strategy for the rest of their system schemes.

Too much reliance on contractor backup worries Brooks staffers, who feel that GAO has already awarded far too many of these deals. Brooks is also armed with plenty of other adp misconduct allegations against GAO with which he intends to hit the agency at a special hearing this year.

Blasting GAO for its "lack of a strong central adp structure," Brooks elaborated on several of his more specific charges against the agency in speeches he gave last year. In addition to finding fault with GAO's propensity for service contracting, he also called the agency on the carpet for its "predominance of sole source, noncompetitive adp acquisitions." But his bottom-line barb was aimed squarely at what many believe is the agency's persistent problem—"the lack of definition, analysis and planning of GAO's total adp and telecommunications needs."

GAO'ers counter this Congressional as-

sault by claiming they have their act together now with their long-range systems scheme and their policy committee which will pull it all together. As for sole sourcing, Pin contends GAO "hasn't done any procuring, sole source or otherwise, until last year."

Brown also confidently claims: "I don't know of any sole source procurements other than Infonet over the past five years." "Not true," protests one well informed Congressional source, who claims he can document several such deals.

GAO officials repeatedly argue that the agency's use of Infonet on a sole-source basis is at the root of their troubles with Brooks and his staff. They blame their usage of this system for all the gripes over sole sourcing, standards and services contracting.

One GAO follower on Capitol Hill dismisses this argument. The real concern, he declares, is not Infonet. "For example," he notes, "GAO could develop applications on Infonet that conform to standards." The agency also, he further contends, could have come up with applications outside Infonet that adhere to standards. To date, other sources confirm, most if not all of GAO's adp applications aren't in line with federal standards.

All of GAO's critics continue to stress the need for the agency to have a strong information resource manager to set policy and coordinate planning. They don't believe the committee approach, which has been tried before, will work at GAO. It's also felt that more adp requirements analysis work should be done and more use should be made of GAO's expert in-

Texas Congressman Jack Brooks blasted agency for a lack of a strong central adp structure.

house auditing staff. These people, the same who probe adp procurement and management practices at other agencies, could be put to good use on some of GAO's in-house system development projects, they maintain.

GAO had expected to turn over more details on AIRES and its long-range plan to Brooks in June. But right now the agency, stung by the disappointing AMS contract decision, isn't sure what its plans are going to be.

What it could do and what Congress fears it will do is shut down some of its adp operations. The GAO's Brown says such a scenario "is unlikely." Instead, he predicts the agency will probably go along with GSA's advice to recompete the AMS contract. And he's hoping that subsequent procurement will be completed by the end of September.

GAO also is hoping it can salvage some of the development work done under the disputed AMS contract. But more importantly, it hopes to salvage its long range systems plans—plans which it still feels will help shape up its adp act. Others are less optimistic.

"The only way out for them now," declares one veteran GAO watcher, "is for them to change management. All their troubles," he insists, "are self-inflicted wounds." **—Linda Flato Runyan**

SOFTWARE

WHAT IS SOFTWARE?

Attorneys and others disagree, depending upon their concerns.

"A rose by any other name would smell as sweet . . ."

So says Shakespeare. Lawyers involved with computing should only have such a simplistic attitude toward software. To them there's much in a name, a name they'd like to have clearly defined and in differing ways depending upon their concerns.

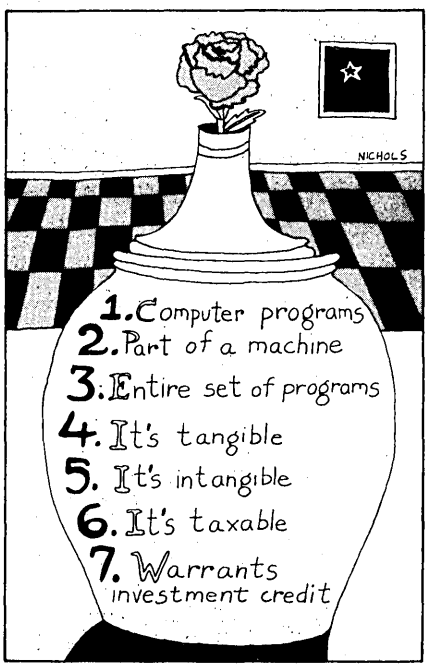
Stephen N. Hollman, general counsel for Optimum Systems Inc., Santa Clara, Calif., and a member of California's Sales Tax Action Group (STAG), is concerned with the imposition of sales taxes on sales of software. He blamed some of the software tax problems on a group of computer lawyers meeting in Los Angeles in January for their "loose use of software as a term."

"They (the taxing bodies) think they are taxing software. No, they are taxing computer programs. Computer programs are a subset of software."

Reed Lawlor, a Pasadena, Calif., attorney, in a paper prepared for the same meeting, the 1979 West Coast Conference of the Computer Law Assn., took a slightly different view. "We use the term software to refer to computer programs. We further distinguish between computer programs *per se*, that is listings of instructions on an eye-readable document and computer programs that are embodied in a physical device that can form part of a machine. This distinction must not be overlooked."

Lawlor's concern is the patentability of computer programs. He believes software is patentable.

Webster's definition is more broad than Hollman's or Lawlor's. "Software: the entire set of programs, procedures and related documentation associated with a system and especially a computer system, specifically computer programs."



Martin A. Goetz, senior vice president, Applied Data Research Inc., Princeton, N.J., in a presentation at the last National Computer Conference titled "The What Is Software Legal Snafu," listed the kinds of people asking the question, what is software?

Financial people, when analyzing a corporation's assets and liabilities.

State and federal tax authorities, when viewing new revenue sources.

The IRS, when considering the investment tax credits question.

The Copyright Office, when deciding whether software comes under their jurisdiction.

The Patent Office, when deciding whether the inventive concepts in a program constitute patentable subject matter.

Lawyers, when drawing up contracts.

Judges, when deciding cases involving ownership of software.

The State Dept., when licensing and exporting high technology products to Eastern Bloc countries.

The Justice Dept., in current IBM antitrust cases.

Goetz has his definition. "Software is a machine component of a computer system, similar to a computer circuit component or a terminal component, or a disk component. This software machine component can be in two forms—in source form (the source program) or in machine form (the object program)."

All laws, says Goetz, that apply to machines or to machine components should apply to software.

He takes the position that software is tangible and that software products should be subject to sales tax, as hardware products are.

And all while opponents of the imposition of sales tax on software sales are trying to establish the intangibility of software.

A puzzled attendee at the January Computer Law Assn. meeting wondered, after listening to those who would have software considered intangible for tax purposes and others who were arguing for its tangibility for patent reasons, if the association shouldn't come up with a uniform definition.

"We may not want uniformity," said Lawlor. "Everything may be uniformly bad."

An often cited case when the question of software's tangibility or intangibility comes up is that of Texas Instruments versus the U. S. government, now before the Fifth Circuit Court of Appeals. A TI subsidiary, Geophysical Service Inc., claimed an investment tax credit for seismic data tapes and films it produced for use in its speculative oil and gas exploration business.

The government took TI to court contending the credit shouldn't apply because "the costs represent investments in the speculative seismic data, not in the pieces of tape and film on which it is recorded, and that this information is indisputably intangible property, ineligible for the investment credit."

"All laws that apply to machines or to machine components should apply to software."

In its appeals brief, TI claims that the seismic data tapes and films "have intrinsic value because the seismic information contained thereon does not exist as property separate from the physical manifestation."

In a reply brief in the same action, the company contends "if the seismic data tapes and films were destroyed (the company) would retain nothing. In order to reproduce the seismic data tapes and films the entire productive process must be repeated."

The appellate court has yet to decide.

Those fighting the battle against imposition of sales tax on software probably would be best served by a government win, which would set a precedent for the intangibility of software.

California's STAG is optimistic, although conditionally so. It hopes the state's rule 1502, covering taxation of "Automatic Data Processing Services and Equipment," soon will be rewritten to its liking. A STAG committee has had five meetings with staff members from the state's Board of Equalization on "trying to do to 1502 what needs to be done."

Next step was to be presentation to the state board of suggested rewording of 1502. Then the board would have to give 30 days notice of a public hearing on the rewording.

A STAG spokesman said his group intends "to pack the room again" (as it did for a public hearing held last May which led to the committee meetings with the board staff). In the meantime, he said, assessments, many retroactive, have continued but "a lot are being sent back (from the board) to local offices for review."

"We can't legislate, we can't litigate, so we're chipping away," said Hollman at the Computer Law Assn. meeting. He said litigation was difficult because "nobody wants to be a test case." Legislative relief in California, he said, is difficult since the passage of Proposition 13, the property tax relief initiative which "has made the legislature unsympathetic to any special interest group seeking tax relief."

And as for the "chipping away," Hollman said the meetings between STAG and the Board of Equalization have at least resulted "in an informed consensus that inclusion of custom programs is probably ill-advised and that all of the services related to custom software consequently also would fall by the way."

He also said the meetings had modified the board's thinking that packaged programs had to be 100% modified before being put in the "custom" category is unrealistic and that 20% is a more realistic breakpoint.

Hollman took issue with the language used by the Commission on New Technological Uses of Copyrighted Works (CONTU) in its recommendation to Congress that copyright be expressly provided to computer programs. He called it (the language) "abominable." He didn't point to anything specific and neither the word tangible nor the word intangible appear in the CONTU recommendation. But the implications of the committee's report are that software has value and substance and he could have been referring to such sentences as: "In considering the 'quality of life' in this country, to fail to consider the positive contributions of computers and the programs with which they are used would indeed be a mistake."

Others who quarrel with the CONTU report, including Lawlor, worry about its preemption of trade secret protection. Miles Gilbourne, Irell & Manella, Los Angeles, said at the Computer Law Assn. meeting that the CONTU report states that, "The availability of copyright for computer programs does not, of course, affect the availability of trade secrecy protection." But, he noted, the report of CONTU's Software Subcommittee "appeared to be mildly in favor of construing the 1976 Copyright Act as preempting trade secret protection."

SUSAN H. NYCUM—A definition of nice people.

Roger S. Borovoy of Intel Corp., Santa Clara, Calif., wants copyright protection in any case and he wants it for chip topography. Intel sued the Copyright Office to force it to grant a registered copyright for its 8755 erasable program-

"The availability of copyright for computer programs does not, of course, affect the availability of trade secrecy protection."

mable read-only memory. The office "finally agreed to accept the chip with a pile of disclaimers."

But not all the definition concerns at the Computer Law Assn. meeting were with software. Susan H. Nycum, Chickering & Gregory, San Francisco, talked about security and was concerned with the nature of value. "What do we protect? What are we concerned about? I once asked an IBM lawyer what he most wanted to protect and he said, customer lists."

Nycum also talked about intentional violations of computer systems noting, in dealing with these, "you have to think like a criminal and out-think the perpetrator." And she had a definition of nice people: "Nice people are not quite as inventive as not so nice people."

—Edith Myers

COMMUNICATIONS

ABA ASKS FOR RULES

Bankers are unhappy with sudden reclassifications of networks resulting in big rate increases.

The American Bankers Assn. last month departed from its usual role of respondent to rule-making moves by federal agencies and petitioned the Federal Communications Commission asking for new rules.

The ABA would like, among other things, to have the FCC take the surprise out of substantial rate increases that have stemmed from sudden announcements of reclassifications of network tariffs from intrastate to interstate.

It all started with Citibank, said Stephen Ernst, vice president, Bank of America and chairman of the ABA's telecommunications subcommittee. Announcement of the petition was made at the subcommittee's annual Bank Telecommunications Workshop in Los Angeles.

The petition cites a reclassification under Tariff FCC 260 by AT&T of the New York-based Citicorp's Transaction Technology network of point-of-sale (POS) terminals and multiplex-circuits in New Jersey from state (intrastate) to federal (interstate) rates resulting in a 262% increase being imposed on an existing private line network.

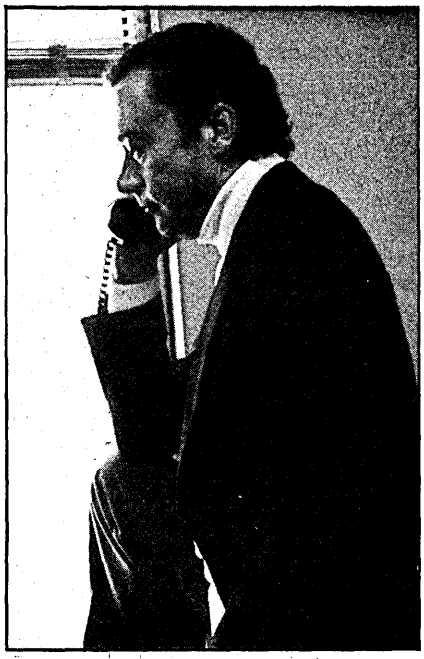
AT&T's grounds for the reclassification, said Si Rosen of Citibank, was "that they erred in the original classification in overlooking the fact that we had the ability to link to one interstate circuit. Ability was enough." Citibank has other, similar networks which have not been reclassified.

Citibank brought the problem to the attention of the telecommunications subcommittee although it intended to pursue the problem independently.

"We learned of similar problems," said Ernst. "Westinghouse incurred a 500% rate increase from a reclassification in Pennsylvania. In the State of Nebraska an intrastate police network was reclassified because it linked to the FBI in Washington."

What Citibank did independently was to file a brief in late 1977 in support of a Westinghouse complaint to the FCC. No action has been taken on the complaint to date.

William J. Bosies, Jr., Federal Administrative Counsel to the ABA, said he expects the FCC will open the suggested rule-making posed by the petition "to comment" but he doesn't expect definitive action "for at least a year."



WILLIAM McGOWAN—"Competition encourages introduction of new technology."

The three specific requests in the ABA petition asked:

1. When the percentage of an increase in charges exceeds the Consumer Price Index, for the same period since the last rate boost, the rate hike should be phased in over an 18-month or longer period.

2. When an increase in charges would result from a reclassification of service (from federal to state or state to federal jurisdiction) and basically the same service would continue to be provided, the increased charges would not be automatic and the carrier would be required to file for a new tariff.

"In the State of Nebraska an intrastate police network was reclassified because it was linked to the FBI in Washington."

3. When an increased charge is proposed, the carrier should clearly explain the change to their customers in terms that compare present bills with an estimate of what the higher charge would be for the same service.

"We make a commitment to configurations," said Rosen. "It's not possible to change because of unanticipated rate increases. Our planning is hampered."

Ernst of B of A said his bank has a different kind of concern. "In California, state rates are higher. Bank of America years ago ran a line from San Francisco to a correspondent bank in Reno which tied into the bank's whole state network, qualifying it as interstate. We called it (the link to Reno) the rusty switch." Ernst is concerned with consistency.

So is Bosies. "After the matter had been brought to our attention by Citibank, we wrote a letter to AT&T asking if this (the ability to connect to an interstate network qualifying a whole network for interstate tariffs) was a blanket policy. The answer was yes. But, it doesn't appear to us that it's being applied consistently and this is against the Communications Act (of 1934)."

The ABA petition told the FCC that "a compelling concern . . . is a sudden decline in the reliability of published rates and charges for communications channels our members have considered or must consider in planning such (as Electronic Funds Transfer) new banking and bank related applications."

"Sharp rate increases have been experienced as a result of unilateral service reclassifications by carriers. Other rate increases or service charges escalating private line costs go into effect through current Commission processes without practical prior notice to private line users."

Rosen said the situation as it stands, "is hampering our ability to take advantage of technological developments."

But telecommunications conference keynoter Russell L. Fenwick, senior vice president, Bank of America, more optimistically said, "It is a safe assumption that advances in technology will continue to press against the barriers of regulation. In the shorter term we will see bandwidth utilization improved by a factor of three or four. Longer term—maybe 10 to 15 years—we can speculate on exciting space construction projects that will follow the shuttle pioneering during the next year or two. And, as with electronic circuitry, generally we can expect telecommunications technology to continue to make periodic advances which typically yield twice the capacity at half the cost."

Fenwick worried about the commonality among people involved in the various aspects of bank telecommunications.

". . . we are in an era of word processing, time-sharing, and intelligent networks—with electronic mail and the office of tomorrow on the immediate horizon. And we have professionals not only in telecommunications and telecommunications engineering, but in teleprocessing control software, data base software, distributive processing, message switching, network planning and design, time-sharing control executives and others.

"And it doesn't require a great deal of imagination to take virtually any of the traditionally separate services or concepts, trace them forward to their ulti-

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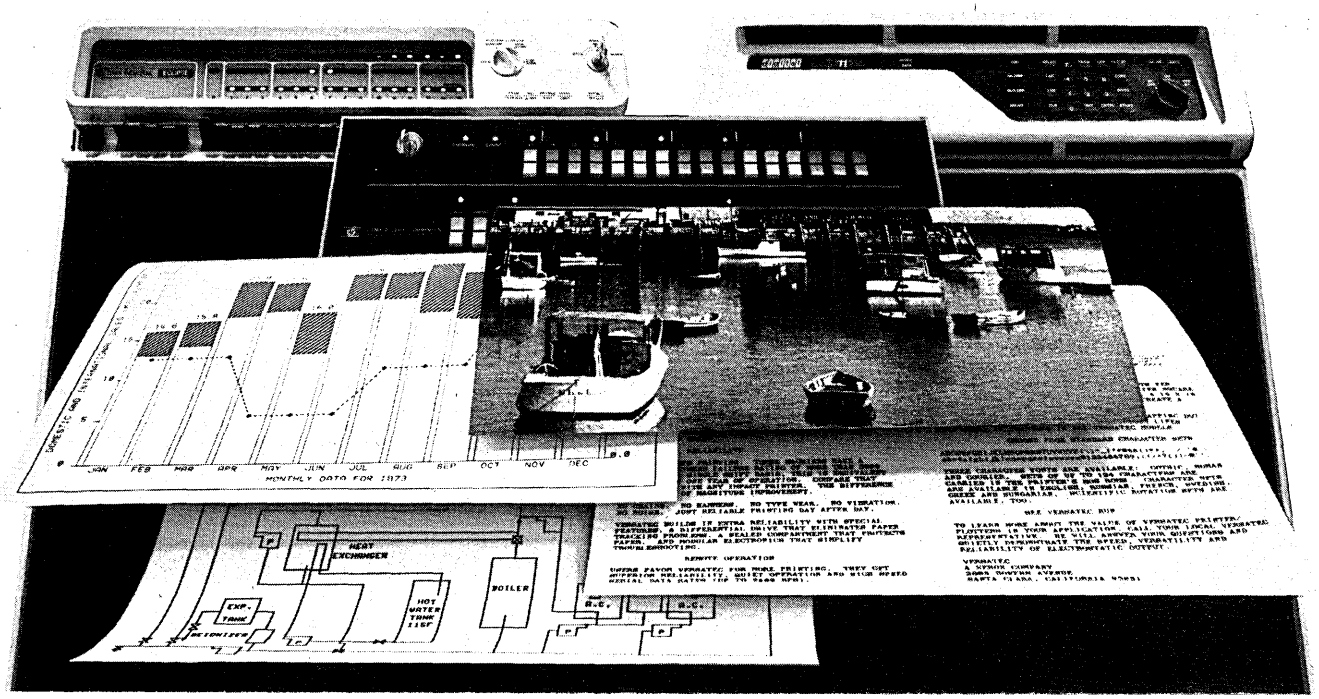

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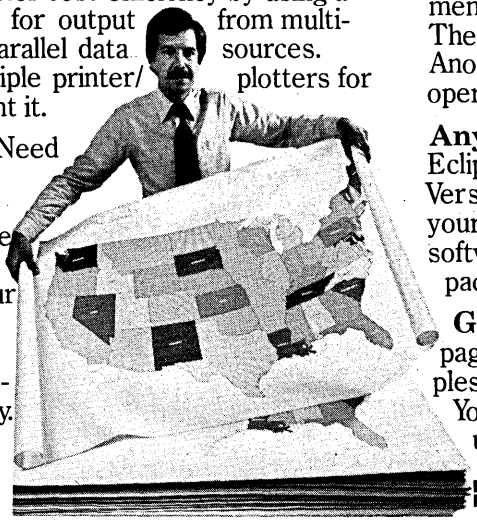

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CIRCLE 36 ON READER CARD

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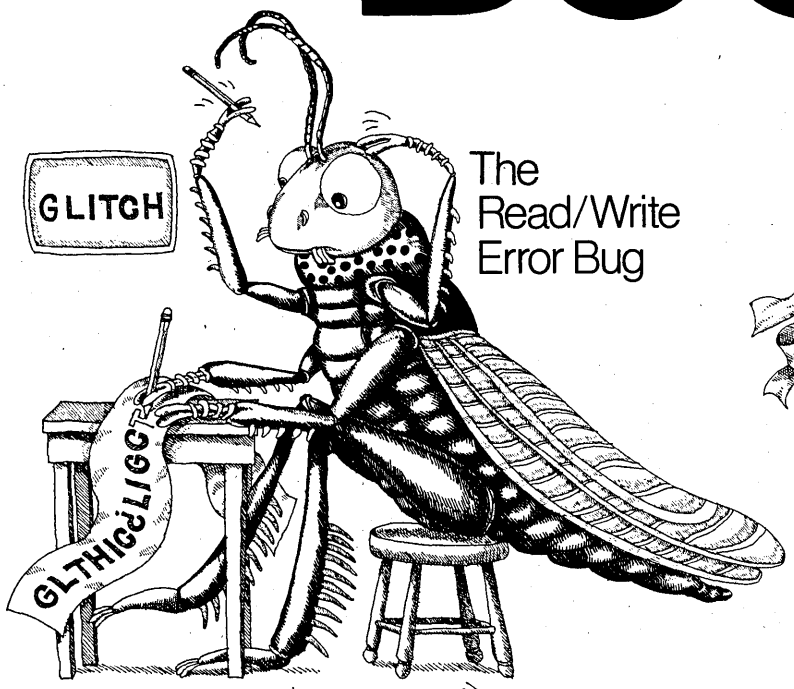
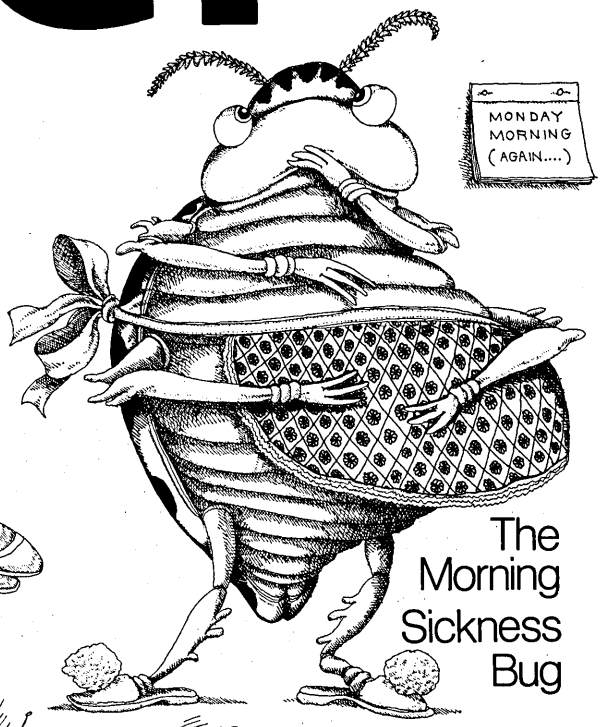
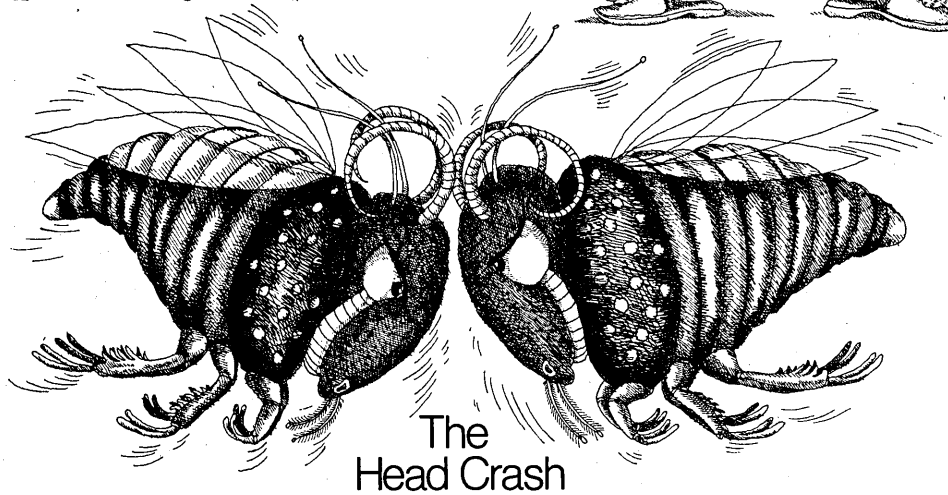


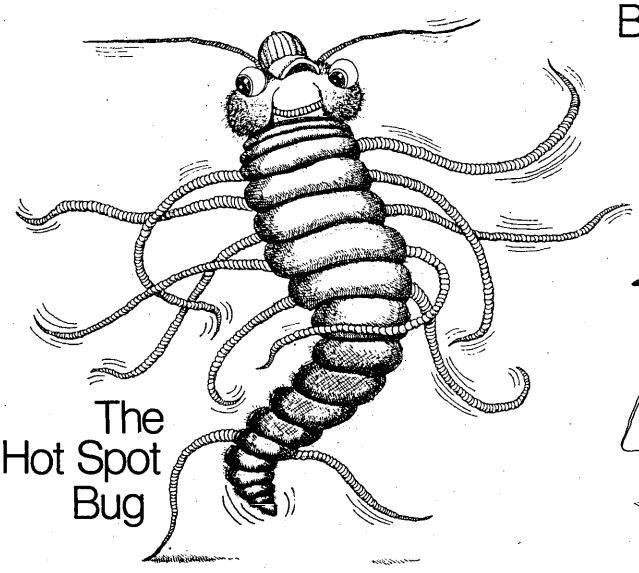
The Read/Write Error Bug



The Morning Sickness Bug



The Head Crash Bug



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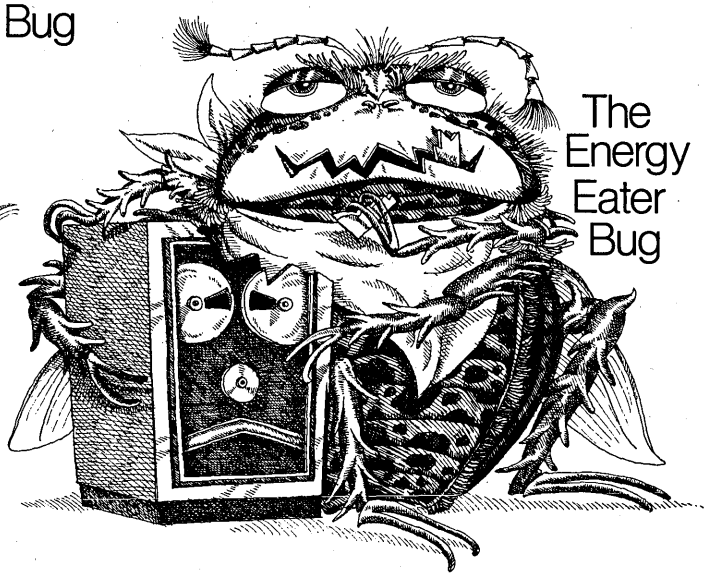

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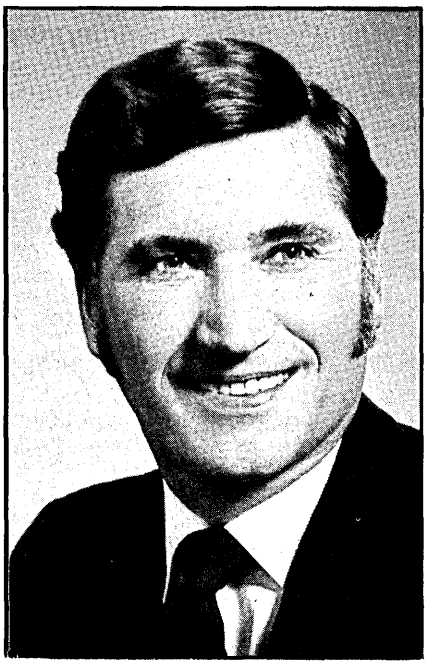
mate state of development, and find that they converge into one integrated entity—both in service capabilities and in facilities."

Fenwick offered an illustration. "Take a contemporary word processing machine, add a communications interface and it becomes an intelligent terminal. Connect it to record message switching and funds transfer facilities, give it access to time-sharing for advanced text editing, retrieval and interactive computation, connect it to both internal and customer teleprocessing networks and then merge this with digital voice, and superimpose the whole thing on an integrated intelligent global network. Now the question is not whether one grasps the concept (that is, the traditional but converging parallel paths), the question is how do you organize to effectively move forward to take advantage of some or part of these opportunities?"

Fenwick believes "telecommunications professionals should exploit the opportunity to master the banking business so that they become bankers specializing in telecommunications, not telecommunications people specializing in banking."



RUSSELL L. FENWICK—"Advances in technology will continue to press against the barriers of regulation."

Jean Blodgett, assistant vice president, Valley National Bank, Phoenix, wasn't as worried about distinctions as she was about scarcity. "If you're in need of good telecommunications people, you don't get much sleep. Getting good people means digging."

Fenwick suggested that companion professional skills in bank telecommunications should be brought together to be effective. "We remain convinced that decentralization, or worse, dispersion, of planning and management of telecommunications is not a sound solution. By their very nature, these activities need to be brought together—not sent in separate directions."

Herbert A. Schulke, Jr., vice president and director of telecommunications, corporate systems, The Chase Manhattan Bank, New York City, spoke out in favor of centralizing the telecommunications function, too, though he didn't see telecommunications and dp coming together.

He said he, at Chase, has responsibility for all telecommunications. He said his perception of other organizations, across industries, was that there now is a slight majority, 60/40, that favor splitting data and voice. He feels that is changing with the trend toward centralization. He said Chase's current telecommunications expenditures are 85% for voice and 15% for data but he feels by 1985 this will be 60% voice and 40% data "if the classical division of today continues. If we get digitized voice all will be mixed together, but

I don't see that happening by 1985."

As for the possibility of telecommunications and data processing coming together, Schulke believes "there is a slow awakening to the fact that telecommunications is a different breed of cat and requires a different management approach."

Schulke's prediction of the decline of the portion of the bank telecommunications dollar going to voice communications could be aided by realization of a proposed private telecommunications network for banks.

Blodgett of Valley National Bank of Phoenix, chairperson of the ABA Bank Network Task Force, told last month's conference that the first stage of an in-

"The situation, as it stands, is hampering our ability to take advantage of technological developments."

dustry study into the possibility of establishing the network will be completed this year.

"Last year," she said, "we estimated that banks spent almost a billion dollars a year on telephone expenses, almost $200 million just to telephone other banks, and that the overall expense is increasing at a rate in excess of 15% a year."

AT&T is cooperating with the ABA in the study, but Robert K. Potter, manager of financial industry marketing for AT&T, said his company, after the study, "may not be able, because of FCC rules, to supply the banking industry with an exclusive telephone network. Also, the company reserves the right not to offer the services to banks because the services required may not be compatible with the corporation's marketing thrust."

David O'Dwyer, AT&T's director, market management, commercial sector, was a Telecommunications Workshop luncheon speaker. He "mused" about the future. "People are on the wrong side of technology. People costs are going up; terminal costs are holding their own; transmission costs are going down a little; logic and mass storage costs are going down dramatically. In transmission versus processing, the processing content continues to increase."

He worried about the direction being taken in word processing. "From typewriter to word processor may increase secretarial productivity, but my productivity degrades . . . Why not eliminate the transcription process and use some communications storing and forwarding?" He told of his experience with meetings. "I return from a meeting to find a number of bug notes (telephone messages). I answer them all only to find my callers are all in meetings. I go on to my next meeting and they all call back . . . and so on. This is productivity loss and there is only one winner and I guess you know who that is." He suggested as a solution "automatic answering, a verbal memorandum, a voice store and forward system with a high processing content." But, he emphasized, "this is not a product announcement, just a philosophical observation."

Another AT&T speaker, John Segal, vice president, state regulatory matters, was more concerned with the present. He said AT&T accepts competition but feels more competition is bound to mean more regulation. He also feels AT&T, if it is to compete on equal terms, "should be allowed to write off investments faster than it now is."

Edward P. Larkin, Commissioner, New York Public Service Commission and Chairman, Committee on Communications, National Association of Regulatory Utility Commissioners, New York, disagreed. "The faster their depreciation, the higher your rates."

But Larkin was not exactly pro-competition. He believes it will lead to rates higher "than under the old monopoly

A JEWEL OF AN OFFER

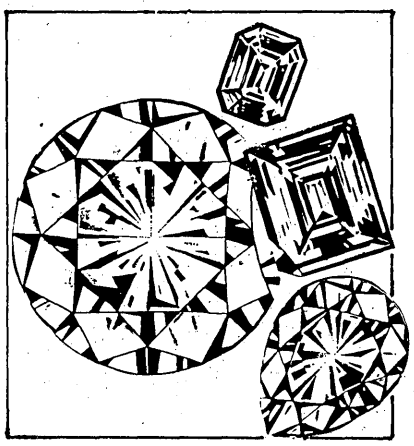
"Anyone here like some diamonds?"

Nicholas J. Ferrante, senior vice president, Security Pacific National Bank, wasn't serious when he made this remark at an American Bankers Assn. telecommunications conference last month in Los Angeles. He didn't really have diamonds for sale although he did offer "to do ring fittings at the back of the room."

Ferrante was talking about bank security precautions. He didn't tell his audience (he didn't have to) that the diamonds he meant were the $8.1 million of Soviet diamonds alleged to have been purchased by computer consultant Stanley Mark Rifkin (December, p. 9) with funds he is accused of having stolen from Security Pacific via the wire transfer room.

Rifkin's name wasn't mentioned although Ferrante referred to him. "It would have been cheaper to let him have more. The auditors are scurrying about with expensive suggestions. We've spent $1.5 million on our Woodland Hills (computer) Center, $500,000 on another center and more than $1 million on our Glendale Center. It's been suggested that we concentrate on our wire transfer room but we don't have one any more."

Rifkin is charged with stealing $10.2 million from Security Pacific using three key codes and the Fed Wire to



transfer bank money to an account of his own.

Ferrante's remarks were made on the same day that federal prosecutors announced they would not appeal a federal judge's ruling that blocked use of a reported confession and the diamonds as evidence in Rifkin's trial.

The government was ready to go ahead with the Feb. 15 trial, but it didn't. On the day after its announcement and Ferrante's talk, Rifkin was arrested again, this time for an alleged scheme to steal up to $50 million, again via wire transfer, from Union Bank of Los Angeles.

The new charges against Rifkin are conspiring to cause false entries to be made to a bank, interstate transportation of stolen property and failure to appear at scheduled court appearances.

Rifkin is alleged to have approached an undercover FBI agent posing as a business consultant who had once been a loan officer at Union Bank with a plan for obtaining funds via a wire transfer and disposing of them for bearer bonds.

Rifkin is reported to have met with the agent on Monday, Feb. 12, the same day on which the prosecution announced it would not fight the judge's ruling on inadmissible evidence and on which Security Pacific's Ferrante gave his talk in Los Angeles' Century Plaza Hotel.

An attendee at the conference who works in wire transfers at still another major California bank said "He's made us all a little nervous." But he didn't think Rifkin would serve time. He could be right. In late February, Rifkin's attorney was preparing to plead him guilty to two counts of wire fraud carrying a maximum 10 year sentence and to use his psychiatric condition as a plea in sentencing.

And as for the diamonds, the prosecutors still had them; customs officials wanted them and so did the bank.

There were no takers to Ferrante's offer. **—E.M.**

system partly because of redundancy and duplicative effort."

Definitely pro-competition was William McGowan, chairman of the board, MCI Telecommunications Corp. While agreeing with Larkin that we have "the best telephone system in the world," he said, "this is a mirror of gross national product of any country. Competition encourages introduction of new technology, response to specialized needs and adjustment to the data processing industry."

In an international banking section, Rui R. Lopes, vice president, telecommunications, Bank of America, agreed with both Larkin's and McGowan's assessments of our U. S. telephone system. "We're spoiled. In planning any international installation you better get your telecommunications man in there from day one." He also noted that political and social interests "pose tremendous telecommunications problems for multinational companies, especially for banks." He said a particular problem is the nonavailability of local leased lines.

Schulke of Chase made a similar point. "There is a trend toward limiting private network services in the overseas environment that is a severe operational restraint, particularly in data communications."

But all international problems are not regulatory. Nicholas J. Ferrante, senior vice president, Security Pacific National Bank, Los Angeles, talked of credit authorization problems. "Floor limits overseas are different." He told of a credit verification problem originating in Hong Kong. "We were losing $1,500 per day and there was a 30-day pipeline. We talked to corporate people and they suggested we talk to a Hong Kong bank. I said we didn't want to talk to bankers but to law enforcement people. It turned out they were the last people we should talk to. We were told there was one honest investigation firm in Hong Kong. I called them and when we got to money, I figured that it would be worth $4,000 to $5,000 to us to catch the guy but that this was a negotiating session so I offered $1,000. He reacted with astonishment. Oh no, I thought, one honest investigating company in Hong Kong and I've insulted them. Isn't that enough? I asked. Oh no, was the answer. For $1,000, we'll not only catch him, we'll kill him."

The perpetrator was caught but not killed. **—Edith Myers**

NETWORKS

NETWORKS FOR USERS

In the 1980s "genius" networks will adapt readily to changes in user requirements and eventually reach into the home.

Communications networks, more closely tailored to users' evolving needs, are on tap for the 1980s. These "intelligent and perhaps even genius networks," according to Booz, Allen & Hamilton's Jack Epstein, will "adapt readily to changes in user requirements." Using the latest technology, these "near future" nets, Epstein predicts, will invade a new breed of user organizations and will eventually reach into the home.

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at all levels" in their networks. As a result, he explains, these "physical communications nets will conform more closely to an organization's "logical" network or structure.

Epstein, a speaker at the Communications Network 79 Conference held in Washington in January, traced recent dp and data communications developments which impact this future network setup. One of the key developments is, of course, the networking concepts—mostly protocols and interfaces—created by the likes of IBM with its SNA offering and Digital Equipment with its DECnet architecture.

In time, Epstein believes these networking concepts will undergo implementation changes. "As technology progresses so will the ways in which these network concepts can be implemented physically."

The history of development in the data base area, Epstein continued, also provides a "useful lesson" for aspiring network designers and planners. And that lesson is flexibility.

By following established data base program interface standards, users have been able to "uncouple old data base hardware and software resources and couple in more advanced ones, without obsoleting the investment in applications programs. Now is the time to strive for the same degree of freedom in all kinds of communications networks."

Changes in packet switching in next five years will be more user-driven than in the previous 10, which have been primarily technology-driven.

Discussing the freedom and options open to packet switched network users, a panel of experts zeroed in on the future of these nets, including AT&T's Advanced Communications Service (ACS). Session chairman John McQuillan of Bolt, Beranek & Newman lead off with his prediction that changes in the packet switching arena during the next five years were going "to be considerably more user-driven than in the previous 10 years, which have been primarily technology-driven."

Continuing his packet prognostications, BB&N'er McQuillan said he foresees an ease-off in the development of packet switching technology. "I see very little basic development in packet switching technology in the next few years," he maintained, "but there will be more and more development of intelligence in the networks."

"The capabilities in the network," he explained, "are in the frontends which lead toward a transition (away) from extensive network software in host computers to a trend toward having network commands and capabilities at the user interface."

Speaking as a user, Ralph DeMent, DEC's data network planning manager, ticked off the advantages and disadvantages of the various packet switching strategies. Briefly reviewing each of the four, DeMent noted that DEC would be using all of them in its network game plan.

As described by DeMent, those packet alternatives included: the public net service provided by such firms as Telenet and Tymnet; the private nets recently being offered by these two companies and others; the "roll your own" private nets *á la* SNA and DECnet; and the private network bootstrap systems done in-house at considerable cost.

So where does ACS fit into DEC's overall packet switching scheme? DeMent acknowledged that the mini-maker would "experiment with it (ACS) if and when it ever comes." But he also admits to some reservations. "I'm concerned," he confessed, "that ACS will look like another DDS (Dataphone Digital Service) and it will never come."

However, DEC network planner DeMent also conceded the AT&T packet plan offered some "unique capabilities." Chief among them, he noted, were the service's embedded message and management and support systems. He also favorably cited the service's ability to provide a wideband usage-sensitive capability at 56 kilobits.

AT&T's ACS support troops could also prove advantageous. AT&T, DeMent predicted, will have "thousands of people running around the country willing to come knock on your door and help you use ACS."

DeMent's reference to Ma Bell's people power gets back to an earlier pragmatic point he made. All of the public packet switchers, he pointed out, have had capital-raising problems which have hampered them. AT&T has no such problems, but it, too, he speculated, may face the same money difficulties with ACS because of "its own priorities."

"The constraints today," DeMent declared, "are that public packet switching has limited terminal and computer support . . . . It's still basically a terminal networking offering."

Going on to describe the public packet switching scene today, DeMent claimed that these networks "have a lack of destiny as a group. They really don't know where they're going. . . . They are still floundering to find out. That makes it difficult," he insisted, "to sell a long-term solution."

One of the reasons for this lack of direction among the packet pushing pack may be the unresponsiveness of the dp industry. So far, "the suppliers of packet switching services have had limited success in motivating the computer industry (which is) motivated more by the needs of its users," DeMent maintained.

DeMent cautioned users to be aware of the changeable nature of the data communications and computer industries. "In the next five years," he vowed, "we'll see a need for data communications and computers in places we never dreamed of before. Therefore, maximize your alternatives. . . . Plan your strategy to be evolutionary, not revolutionary."

—Linda Flato Runyan

INTERNATIONAL

FRANCE'S THOMSON EYES U.S.

Huge electronics concern hopes to buy into minicomputer and peripheral companies as well as software and systems houses.

The French electronics conglomerate Thomson-CSF, is preparing to buy itself into the U.S. dp market.

American minicomputer and peripheral companies will be key targets for the $3 billion Paris-based concern, which is 51% owned by the Thomson-Brandt Group of France. But also sought will be software and systems houses, executives say.

Entry into the U.S. market has No. 1 priority in an international expansion plan for Thomson's Data Processing Group, which includes the leading European minicomputer maker, SEMS.

The dp group, established in 1976, was built around the creation of SEMS from the minicomputer interests of the French companies CII and Telemecanique. Since added have been software, service and peripheral concerns, as well as a military and aerospace systems arm, CIMSA.

Last year the group did some $350 million in sales with SEMS contributing the lion's share with $120 million. Exports accounted for about 30%. SEMS recently formed its first subsidiaries in Belgium and West Germany. According to the dp group and SEMS' chief, Francois Villepin, the company will launch a U.K. operation this year.

"But it seems logical that if you want to strengthen your position, it's in the U.S. market that you can do it more efficienty—rather than spreading your activities over various smaller markets," said Edouard Guigonis, Thomson-CSF

executive vice president.

"After all there is only one place in the world where you have 50% of the whole market." Guigonis is the man entrusted with the task of getting the dp group a good international profile. It is he who will have to buy and find partners in the U.S. "Unlike other countries, we don't want to form a general commercial subsidiary in the U.S. to sell the full range of Thomson products. The market is too vast, so we must specialize," Guigonis explained.

"If you want to strengthen your position, it's in the U.S. market that you can do it more efficiently."

By the end of 1978, SEMS had captured around 45% (by number) of the French minimarket, mostly specializing in industrial systems. But outside of France its hardware and limited peripheral range has the reputation of being overpriced. Guigonis freely admitted that the SEMS hardware was expensive. This he put down to high labor costs in France.

"If SEMS is prepared to reduce its prices we'd consider handling the hardware," said Peter Adams, managing director of the British software company SPL International. Adams is known to have the largest pool of specialists in industrial software throughout Europe—well over 100 professionals. Most of the mini hardware pushed around Europe into industrial automation and control applications tends to see his company at some stage.

Adams, who works mostly with Digital Equipment Corp. equipment, stressed the fierce competitiveness of the Americans in the small computer and peripheral area. "In order for SEMS to compete with the Americans, they must drop their prices. In order to drop prices you have to increase your volume. And in order to increase your volume, you need new markets," he said.

This leaves Guigonis little choice but to use Thomson's financial muscle to power his way into the U.S. and new markets. But why go at all?

The reason is an increasingly precarious home market for both minis and industrial applications due to the slow growth in the French economy, a sluggish demand and increased competition.

Societe Generale Deux (SG2), one of France's and Europe's biggest software companies, is anxious to exploit the benefits of cheap foreign hardware in industrial applications, sources reveal. The company is being urged to make its debut in the sector by several of its leading industrialist shareholders.

The SG2 president is understood to have approached Adams about a deal, but this hasn't been confirmed by the SPL chief. And now even SPL, which entered the industrial sector early, has been joined by other leading U.K. and international software concerns, such as Logica and Software Sciences, which anticipate rich pickings in Europe as the field is opened up.

In addition, the French government-sponsored CII-Honeywell Bull mainframe consortium has entered the French minicomputer market in a big way.

Thomson's response is not to hunt new markets only outside France. According to SEMS boss, Villepin, his company will make its long awaited debut in the small business computer area at the end of the year. In addition the firm's current Mitra and Solar ranges of minis are expected to be superseded by a new model in several configurations, sources say. The company did not comment on this, nor on whether the move would improve price/performance ratios.

Thomson will make its long awaited debut in the small business computer area at the end of the year.

Two other moves designed to increase the Thomson dp group's competitiveness also are expected this year, according to SEMS executives. First, the operating unit within the group, particularly the software and service companies, such as ECA Automation, CSIF, Amsware, and Titn, as well as the small Thomson peripheral and semiconductor divisions, will be drawn together in closer association to form a consortium. And second, the group's inroads into teleprocessing, communications and network software will be realized in a new architecture, SEMSnet. This follows the lead already given by Digital Equipment's DECnet, for example, and is in line with other current developments by Olivetti in Italy.

Guigonis talked of SEMSnet development initially as a communications and management tool for Thomson: "One reason for our dp group's entry two years ago was to fuse together and harmonize our diverging activities."

From its early base as a pure electronics company specializing mostly in military detection systems and radio and tv communications, Thomson-CSF has moved into the likes of telephone and PABX switching, data, space and satellite communications—all on an international scale.

"We had the currently fashionable dp/communications mix years ago with our air defense systems. Now we want to capitalize on this experience," said Guigonis.

The other linking elements in Thomson's diversification is its components business. But here, like the rest of France and Europe, the company's "strategic semiconductor developments" have been leapfrogged by advanced U.S. VLSI

technology.

"We were ready to put 16K chips on the market when the Americans jumped to 64K. At the lab stage we're well advanced at this level, but in the industrial sense we've had to go to Motorola to get our volumes," Guigonis explained.

Thomson's dp group already sells the Motorola 6800 micro under license in France. They have followed this recently with a five year joint agreement on VLSI successes. "We hope to be self-sufficient in a production sense after this period," the Thomson executive added.

All these measures have been augmented so far by deals with two U.S. peripheral companies, Pertec and CalComp, to bring total systems costs down.

"We know that if success in the U.S. and elsewhere is to be more than a dream, we must increase our capacity in software and look around for peripherals," said Guigonis.

"A couple of years ago we inherited CII minis. The first thing we had to do was to put our house in order and try to build from this element something that would make sense. And right now that's where we are. We have something that makes sense," he said. **—Ralph Emmett**

PICKING UP THE PIECES

U.S. computer and communications companies assess the damage to their balance sheets over lost business in Iran.

American computer and communications companies that have been doing business in Iran are now assessing the damage to their balance sheets in the wake of last month's political coup in which supporters of the Ayatollah Khomeini assumed power.

U.S. firms affected by the revolution that saw the Shah Mohammed Reza Pahlavi deposed and members of his regime imprisoned include Electronic Data Systems, Computer Science Corp. GTE, AT&T, CDC, Honeywell, Planning Research Corp., and Itel.

Under the Shah's rule, American concerns had aggressively pursued Iranian contracts, some of which ran into the hundreds of millions of dollars.

GTE, as an example, landed a $500 million order to install telephone switching equipment, while American Bell International, a wholly owned subsidiary of AT&T, received a $194 million contract to install a modern telecommunications facility in Iran.

Computer service firms had also made strong inroads into the Iranian market. EDS had reached agreement to establish and operate a national health insurance and social welfare data processing system while recruiting and training Iranian personnel in the data processing area. The project, which involved an EDS subsidiary and an EDS coventure with an educational foundation headed by the Shah, would have put an estimated additional $20 million in EDS coffers had the Shah stayed in power.

In addition, Computer Sciences was highly active in Iran, performing computer operation support services for the Iranian government until 1976 when its efforts were wound down. The company said these efforts are continuing at a "substantially reduced level" and that it still had personnel working in Iran, but wouldn't disclose the number. Similarly, Planning Research Corp., the Washington, D.C.-based firm that's added a host of dp services to its engineering and architectural capabilities, was involved in a $20 million four-year project building an Iranian naval port.

Mainframe and PCMM companies had become active in Iran, particularly after June 1977 when IBM closed down in sales

operations, retroactively canceling all pending orders. IBM's departure opened the door for firms like Itel, which had sold a number of AS systems in Iran and had one of its largest AS installations there. Control Data and Honeywell also vied actively for the Iranian mainframe business.

American firms began to feel the consequences of the deteriorating political situation by last fall, when the Iranians, traditionally slow payers, started not paying their bills at all. EDS, for example, had not been paid since October when in December it decided to bail out of the country altogether, canceling its contract and asserting that it would actively seek to collect the $5 million in arrears owed the firm by the Iranian government.

ABI also began pulling up stakes, first advising some 1,100 ABI dependents of the 900 American employees stationed in Iran to leave. Today, ABI, which was receiving as much as $60 million annually from its Iranian business, has terminated operations there, according to a story put out recently by Technology News of America.

Unwilling to write off its Iranian business totally, Control Data Corp. established Iranian operations headquarters in Brussels and opted to fly in its people on a short-term basis whenever possible. Recently, however, the firm admits its flights have come to a total standstill.

Honeywell meanwhile wound down its operations to the point where there were only 10 employees left in the country by Christmas, and Harris Corp. was reportedly forced to abandon a top secret defense project.

Despite this hasty, forced exodus from the country, the damage to American firms could have been much worse. Many concerns—Itel and ABI among them—got paid some or all of what was owed them before they ever agreed to do business with Iran. Other companies in turn were able to walk away from the country without leaving any major assets behind.

The real damage of the Iranian revolution, though, is that an enormous amount of projected future business may well be lost—business that has already been factored into future earnings projections. Moreover, as one financial analyst who follows many of the companies that were involved in Iran notes, orders from other Middle Eastern nations that appeared to be imminent are now at best questionable given the shaky political situation in the area as a whole. "A lot of companies have lost a number of good opportunities in the Mideast," he notes.

—Laton McCartney

WORD PROCESSING

MICROFILM IN FUTURE OFFICES

If we don't microfilm, the paperwork will become unmanageable in the office of the future.

Micrographics will have a key role in the office of the future. "Otherwise," says Thomas Wardlaw who manages records for Tosco Corp. of Los Angeles, "we could run out of forests" as the mountains of paperwork pile up.

Today's word processing product announcements all emphasize the production of more and more paper at faster rates, Wardlaw said last month at the spring symposium of the International Word Processing Assn. in Los Angeles. "At first we heard that 55 characters per second wasn't fast enough. Now we have the IBM ink-jet printer at 92cps and Wang's page printer going at the rate of 4500cps, or 18 pages per minute."

Microfilm cameras and microimage terminals will have to acquire native intelligence.

He said word processing today is very much like the earlier days of data processing when the emphasis was on getting information out at high speeds. Today's dp organizations now look at it as a business of managing information.

He suggested that word processing users begin to think of using micrographics (or microfilm) to curb paper usage as well as to organize information into a usable form in the office of the future.

The three-day conference drew some 70 exhibitors, including IBM Office Products Div. which introduced the model 6670 "information distributor," a copier and printer with communications capability. A spokesman said users can interrupt a printing job to make a copy and the 6670 will remember where to go back to printing. Wang Laboratories introduced a typesetter which it promoted as a step toward in-house printing, but soon will be offered as a peripheral to Wang small business systems.

Some speakers at the conference also compared word processing with data processing, likening word processing to dp 10 years ago. But that was contested by other speakers who talked of sophisticated microprocessors as well as sophisticated marketing know-how in a market where more and more buying decisions are being made by persons from the data processing departments.

Wardlaw's thoughts were reflected in a paper released recently to business magazines by Dennis R. Neary of Eastman Kodak Co., the huge producer of micrographics equipment. Neary, who is marketing coordinator for automated microimage retrieval in Kodak's business systems markets division, says microfilm plays a very prominent role in his thinking about the office of the future (see block diagram).

Neary thinks that the intelligent crt terminal with some sort of magnetic record storage will share the logic and derive its own from an even more intelligent

"Mr. Burrow has no time now, it'll all be explained in due course."

cpu. Today's ink-jet and daisywheel printers will be replaced by the multifunction electronic copiers of tomorrow. Neary thinks that all documents created on the word processing terminals will be transmitted to the cpu and result in two microimage files being created on a computer output microfilmer. (Today's COM units print at rates of up to 30,000 lines per minute.)

A microfiche that is updated and produced weekly for each user will provide a personal cumulative chronological file.

A microfiche that is updated and produced weekly for each user will provide a personal cumulative chronological file. A continuous role, containing every document created, will provide a master reference file. The cpu automatically will create and maintain a keyword index which can be referenced through printed reports or an on-line crt to assist in document retrieval.

The same goes for incoming mail, which will exist in two forms, paper and electronic. The electronic mail, in Neary's future office, will proceed along a circuitous route through the copier to the cpu and out the COM. Along the way, the electronic image will create excellent paper copies for the distribution and preindexed microimages for the respective personal files and master file.

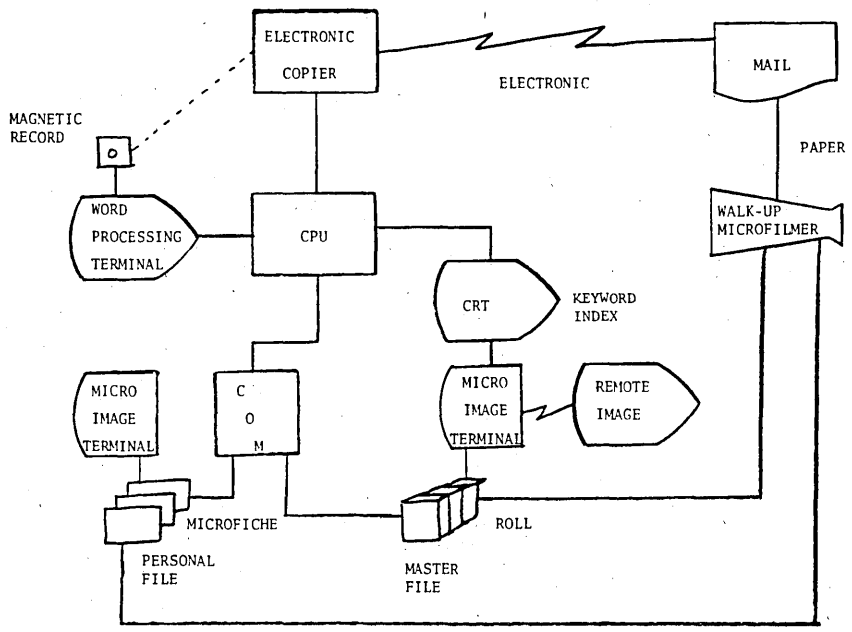
Incoming paper mail will be microfilmed either by a central micrographic department, or by the recipient on a walk up microfilmer. The output will be jackets or microfiche to supplement the personal file and rolls to add to the master file.

Every user will have an inexpensive desk-top microfiche reader. His entire file of documents will be arranged in chronological order with index by recipient, date and keyword. Incoming mail, both electronic and paper, also will be an easily referenced microfiche or microfilm jacket. He says the entire data base of all documents produced, plus all incoming mail, both paper and electronic, will reside in a microimage file. Retrieval will be assisted by a computer-generated index. The microimage also can be transmitted for remote reference.

Neary thinks that for his office of the future to become a reality, microfilm cameras and microimage terminals will have to acquire native intelligence. "The many things a camera operator must now remember to do should be relegated to the responsibility of a microprocessor."

If the microimage terminals are to consort with host computers, Neary says, "they must acquire enough intelligence to implement a majority of the retrieval tasks, relieving the host for more important efforts."

Actually, according to Wardlaw, some of this technology is already usable through communicating word processors, wherein a word processor could communicate with a cpu and have its output formatted, produced on tape at very high speeds and then microfilmed on a COM system.



EVERYTHING would be microfilmed in Kodak's concept of the office of the future.

NEWS IN PERSPECTIVE

SYSTEMS HOUSES

DEC DOMINATES

Oem's and systems houses shipped more than $2 billion in hardware last year.

Those "middlemen" of the computer industry, the mini/micro oem and systems houses, sold more than $2 billion worth of hardware last year, according to a directory just put out by the publishing division of Sentry Computer Services Inc., Hudson, Mass.

The directory shows that the systems houses and oem's together shipped an aggregate of 44,159 processors in 1978, including 9,888 minis, 32,822 micros and 2,449 small business computers.

According to the Sentry study, Digital Equipment Corp. dominated the mini supplier shipments with 40% of the market while Data General with 21% came in a distant second. None of the other mini suppliers generated more than 8%.

Among small business computer suppliers, Wang topped the list with 24.6%. Qantel with 15.9% and Microdata and Basic Four with more than 11% also were among the leading oem/system houses suppliers.

Intel and Motorola led the micro suppliers with 34.8% and 20.4% of that market respectively.

The directory also projected that some 200 new firms will be entering the systems house/oem field every year and pointed out that at least some of the concerns in this field are becoming almost as prosperous as many of the major companies that supply them.

Systems Applications Inc., for example, sells over $80 million a year in DEC and Interdata equipment as part of its instrumentation, data acquisition, and process control systems.

And Planning Research Corp. shipped about $180 million in DEC and Data General processors that serve as the heart of its turnkey systems sold to government and private industry. **–L. M.**

BENCHMARKS

NEW GAME PLAN: Computer Automation president David H. Methvin said he's developed a "game plan" to breathe new life into the company's Naked Mini division which once accounted for 70% of the company's sales and now is hovering at under 40%. Methvin has hired Paul Hachigian, formerly executive vice president at Commodore Co., Palo Alto, to head the operation and to straighten out manufacturing problems, material shortages and faulty memory parts that were said to have caused an $881,000 loss for the company in its quarter ended last Sept. 30, even though revenues were higher. Hachigian replaces George E. Dashiell, who becomes vice president of administration and staff services.

NEW BURROUGHS DIVISION: Burroughs Corp. has a new Office Automation Div. headed up by Dal Berry, former president of Graphic Sciences, a facsimile equipment manufacturer acquired by Burroughs in 1976. Graphic Sciences will be part of the division as will another subsidiary, Redactron, maker of standalone word processors. The division also will include business forms and supplies operations of the firm's Rochester-based Office Products Group. It is expected also to take in Context Corp., a privately held optical character recognition scanner manufacturer which Burroughs was negotiating to acquire last month.

PROTEST TO THE AIR FORCE: Systems Development Corp. said a $24.7 million Air Force contract to Control Data Corp. should be canceled because CDC at the time of the bidding didn't have the computers commercially available. The filing with the General Accounting Office says CDC's Cyber 203 supercomputers, basically upgrades to the Star computer, weren't announced formally until late January, yet the Air Force's bid called for them to be commercially available in 1978. Three Cyber 203's were involved in the contract and CDC bid two Cray-1 computers made by Cray Research. Cray Research also bid its computers but was disqualified because it could not meet software and hardware integration requirements. CDC actually announced its Cyber 203 publicly in late September at a seminar for computer and other trade publications in Minneapolis, but the formal announcement was delayed until late January in Washington.

EXXON IN SEMICONDUCTORS: Exxon Enterprises, a division of the huge oil company, announced the formation of Optical Information Systems as part of its Information Systems Group. The new company, with 70 employees and with plans to hire another 100 this year, manufactures and sells aluminum-gallium-arsenide laser components for which the company charges anywhere from $1,000 to $3,950 each. First customer is McDonnell Douglas Astronautics Co.

CLOUT OVERSEAS: CPT Corp., a Minneapolis word processing systems manufacturer, hopes to boost its overseas sales with an agreement with CII-Honeywell Bull to market the CPT model 8000 and 6000 desktop word-processing systems in France. CII-Honeywell Bull also may expand the marketing activity to Belgium and French-speaking African countries. CPT, which also has distributors in New Zealand, Saudi Arabia and Germany, does 20% of its sales overseas. CPT hopes to double its overseas sales with the French connection and with other arrangements in Mexico and South America.

WYLY OUT: Sam Wyly, who founded University Computing Corp. and built it into a major network services organization but ran into trouble in a hassle with Ma Bell over an all digital network, left the company last month. Wyly, 44, resigned as chairman, chief executive officer, and a director and was succeeded by

SAM WYLY

John Kason, the president. The resignation followed an investigation by the Securities and Exchange Commission into a letter Wyly wrote to an unidentified third party concerning the company's recapitalization plan. The company, now called Wyly Corp., sold off numerous assets while trying to set up its Data Transmission subsidiary, an all-digital network which eventually went into bankruptcy.

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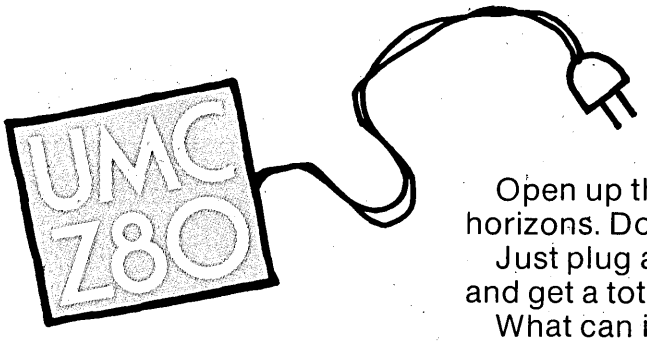

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NEWS IN PERSPECTIVE

MODCOMP OUSTER: Kenneth Harple left Modular Computer Systems, Inc. (Modcomp) as its president and chief executive officer last month and was succeeded by Alexander W. Giles, Jr., the company's chief financial officer. The

KENNETH HARPLE

Securities and Exchange Commission has been examining the company's financial statements for the years 1973 to 1976 and has asked for a restatement of some of the financial reports. This followed Modcomp's proposed public offering of 800,000 shares of common stock, which the firm later tabled. Harple's departure was reported to be tied to differences with Modcomp's board over the company's fiscal management which started after the company lost $4.1 million in 1976. Harple, who founded Modcomp in 1970, will remain with the company for a year as a consultant.

COMTEN ACQUISITION: At least six companies had been after Comten, Inc., the St. Paul company that did $38.3 million in the first nine months of its fiscal year, mostly in developing front-end minicomputers. Two companies, NCR and Amdahl Corp., were the more celebrated—NCR offering at first $125 million in cash and stock and Amdahl offering about $145 million in stock and later NCR matched that figure to become the apparent winner. Comten's president, Donald Herman, said autonomy for the company was a major consideration in the deal and NCR apparently planned to merge Comten into a subsidiary. Amdahl announced Feb. 1 that it was dropping out of the running, even though Amdahl's president, John C. Lewis, said the two companies would fit nicely together because many Amdahl computers use communications processors made by Comten. The deal still was undecided late in February.

OUT OF FLOPPIES: The Wangco division of Perkin-Elmer Corp., which now is called the Memory Products Div., is negotiating with a number of firms to sell its small disk operation in a move to get out of the floppy disk drive business. The company acquired the business, formerly Orbis Systems, Inc., in 1976. One reason for the company's decision to sell off the operation is a situation where prices are going down and features are up, notably in the 5¼-inch devices where all suppliers are having trouble developing reliable double-sided devices. A source close to the company said the Orbis operation was in a "growth stage and needs a lot of cash." The company's three largest customers were in the personal computer market: Cromemco, Inc., Heath Co. and Intelligent Systems Corp.

IBM SETTLEMENT: IBM turned over $750,000 to Levin Computer Corp., the computer leasing company, in return for Levin withdrawing a suit it filed against the giant computer company in 1972.

FLOATING POINT LAYOFFS: Floating Point Systems, Inc., Beaverton, Ore., cut 82 persons from its payroll of 691 because of a delay in orders for its array processors from General Electric Co. and Ohio Nuclear, Inc. Although no reasons were given for the delays, they affected persons in manufacturing, marketing and engineering, most of whom already have taken jobs in other electronic firms in the area. The company said Floating Point in the first quarter of this year will ship about $3 million worth of array processors to GE under an existing contract.

PERSONAL COMPUTERS: Who's ahead in the personal computer market? Dataquest, the Menlo Park marketing research firm, says Tandy Corp.'s Radio Shack subsidiary shipped about 100,000 of its TRS-80 personal computers, valued at $105 million. That gave the firm 50% of the volume and 21% of the value of all such shipments. The others: Commodore, 25,000 units; Apple, 20,000 units; IBM, 5,000 units; Hewlett-Packard, 4,000 units; Wang, 3,000 units; MITS/Pertec, 3,000 units; IMSAI, 5,000 units; and all others, 35,000 units. Dataquest, which said the figures were ball park ones, defined a personal computer as a "small, desktop computer intended to meet business, professional and home uses" and priced from $15,000 down to a few hundred dollars.*

IBM'S "E-SERIES"-- MORE TO COME?

Its price/performance advantage over 303X line leads to speculation of the H-Series by year-end.

by Bill Musgrave, Assistant Editor

"The King is dead. Long live the King." While IBM didn't preface its E-Series announcement with these words, it could have. At an analysts' briefing, an overly candid (and later chastened) IBMer said this year's shipments of the smaller 4331 processor should exceed the number of 370 Mod 115s installed worldwide. By industry estimates, that means more than 3,000 of the $65,000 entry-level 370-compatibles.

Of the eight processors bearing the 370 designation, only the models 138 and 148 are still being built, and these two are in "limited new production" to fulfill existing commitments. With a 4331 rated at roughly 90% the performance of a 138 at roughly 25% the price, and the 4341 rated at three times a 138's performance (about half again a 148) and priced at slightly under half the 148 price, it's likely the 138 and 148 machines will soon go out of production.

At first glance it appeared that the plug-compatible 370-makers were the ones with cause to don mourning attire. But first impressions aren't necessarily right. The 4300-series announcement should stimulate the market beyond its present growth rate and get small users on the growth path, says John Ferrick, director of product planning at Paradyne Corp., a manufacturer of communications gear for 370-type machines.

Said a marketing executive at a major mini maker, "You keep forgetting how small the pcm's are; they can always cherry pick."

Sweeping generalizations across the pcm spectrum can't be made, according to Sandy Garrett, an analyst with Paine Webber Mitchell Hutchins, Inc., who just finished a pcm study. The announcement should have no impact on Amdahl's 470 line, since those machines are targeted at the high end where IBM sells its 303X series. The others—such as Two Pi, Magnuson, National Semiconductor, and Itel—can manage, although some assumptions in their business plans may need changing. Where these, and other pcm's, will feel the impact of the E-Series is in their return on investment: the return will be smaller and take longer, according to Garrett. Those that haven't started customer shipments may find a rocky road ahead.

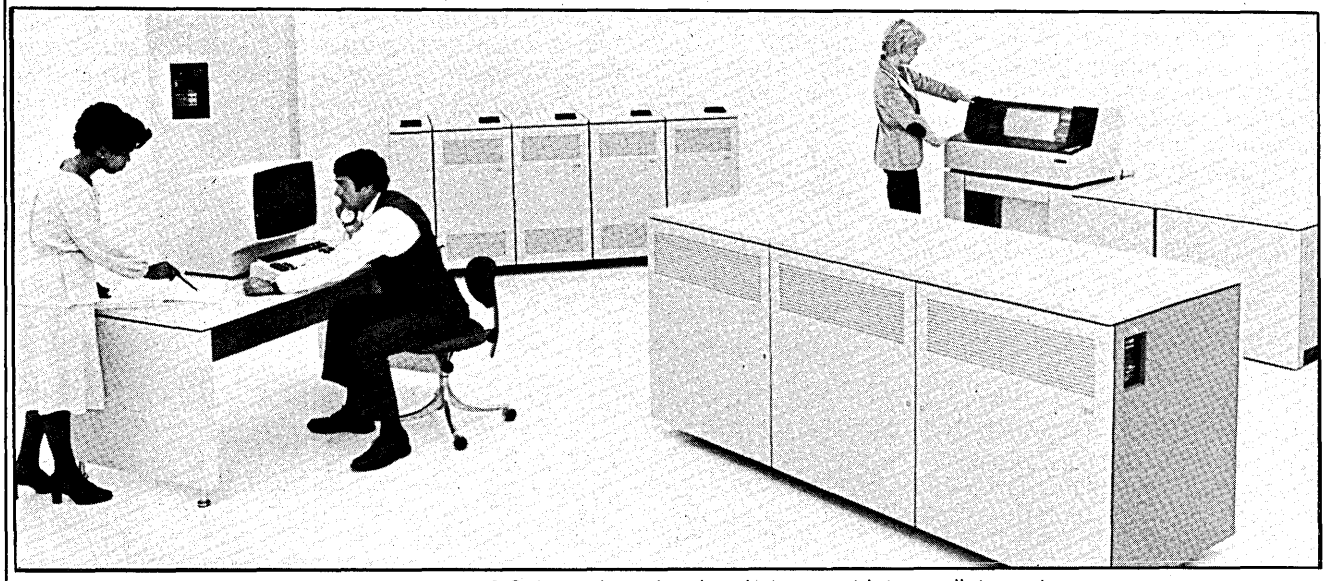
"We are satisfied with the announcement. We expected it and planned for it since May of last year," commented Joe Hitt, president of Magnuson. "We will have to make some adjustments in strategy and pricing, but we anticipated that." Hitt notes that his company's M80 offerings are aimed above the block-busting 4331. IBM's larger E, the 4341, carries a $245,000 price tag for a 2MB processor; a 138-class M80/3 goes for $205,000, a 148-level M80/4 was $495,000 at press time.

The 4800s create a new standard, says Jim Geers, marketing vp at Two Pi. But Two Pi doesn't consider itself a direct IBM competitor; the firm markets its processors to oem's, such as National CSS. Still, IBM did create the firm's market: customers with 370 software and 370-trained personnel.

National Semiconductor notes that this announcement is a lot more aggressive than most coming from IBM, particularly in respect to main memory priced at $15,000 per megabyte. The firm expected a two or threefold price/performance improvement with the E-Series, but "we got a lot more."

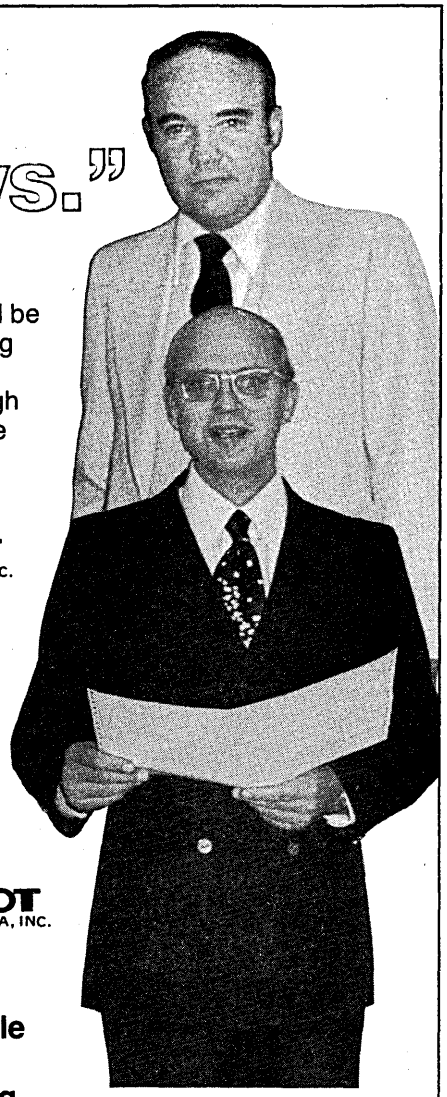
The E-Series has been grist for the rumor mill for so long one industry observer calls it "the most preannounced product in recent memory." Ironically, the one major market the E wasn't announced in was Japan. Last year salesmen in Japan reportedly pitched the then unannounced series to key accounts.

The rumors indicated E would comprise more than two machines. Aharon Orlansky, a vp at the New York brokerage firm of Oppenheimer & Co., notes a wide gap between the two announced processors. This lends credence to the



THE 4341 has an instruction execution rate 3.2 times that of a model 370/138 and has up to 4MB in main memory. It's aimed at current intermediate systems users.

"Up and running at Peugeot in sixty days."



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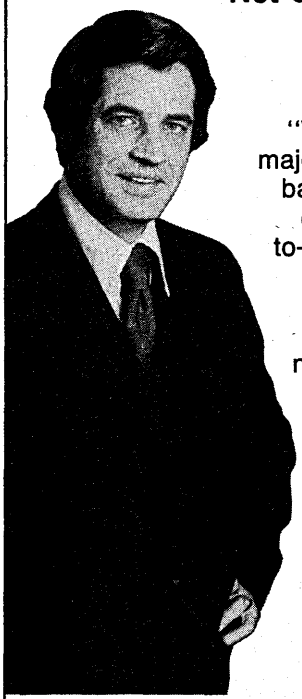

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CIRCLE 207 ON READER CARD

assertion of one dp manager that two more machines are coming, one between and one above the initial offerings.

This same manager indicated he would place an order for one or two 4341s before the first day order window closed on March 2. He currently runs a 138 and has a 3031 on order; the 3031 "will disappear real fast," if this manager is right in reading the tea leaves.

The manager of a large shop says the E announcement is "big," adding that IBM sent him the most announcement literature he's ever seen. He sees the new machines as having great impact on the 8100, TSO systems, and the 303X line. The 3033 will be superceded soon if Amdahl keeps the pressure on, according to this manager.

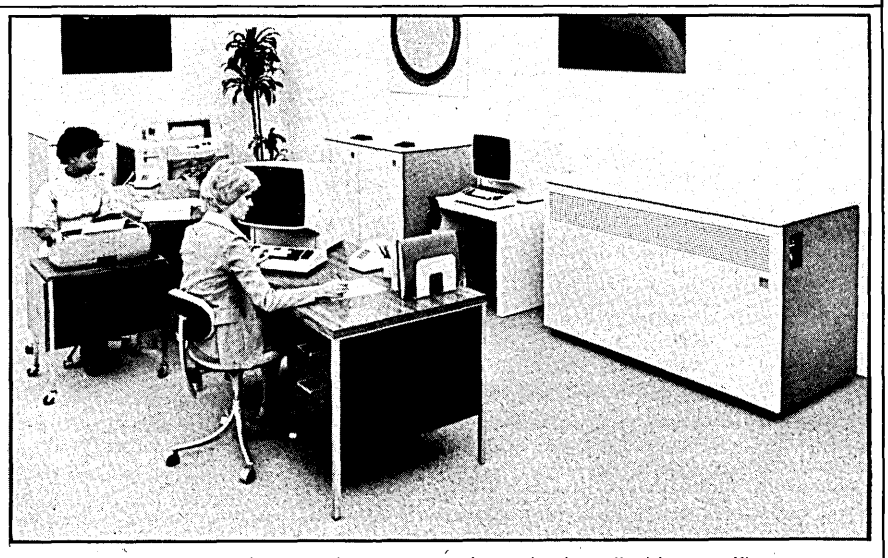
Orlansky notes this line strengthens IBM's position in the low-end 370 market where the pcm's have been making inroads. He sees it as a move to regain market share, and he expects the 4331 price/performance to extend up the line. Orlansky also feels the pcm's will have trouble with reduced profit margins.

In an apparent move to attract small customers and first-time users, IBM offers 24-month leases on the 4300 series. IBM is trying to accommodate users who don't like paying rental charges and don't care to be in lengthy leases, according to Frederic G. Withington of Arthur D. Little. Others have said IBM is moving away from its traditional preference for leases; Withington feels once customers build up some purchase credits they'll be likely to use them. With the 4300, IBM is letting purchase credits accrue to 60%. The new line clearly shows the future IBM walking away from its lease base and into competition with smaller companies, says Adolph (Sonny) Monosson, chairman of the board of American Used Computer Group. IBM has made itself a reasonable choice compared to the independents; makers of high-end minis should find themselves under fire, according to Monosson.

Delivery time will tell if the pcm's can pick up the fallout from the market stimulated by the 4300s, says Dale Kutnick, director of market research for the Yankee Group.

Unlike many IBM products, the 4300 has a relatively short lead time: 4331s are slated for second quarter deliveries, and the 4341 is due out by year-end. A current rumor in Europe asserts that the machines are "stacked in warehouses" near IBM's manufacturing facility close to Mainz, West Germany.

Kutnick notes that the microcoded machines have an instruction set extended to speed the 4300's operating system; he feels that some bells and whistles have been silenced to ensure operating system compatibility with 370s. One which he sees coming is single level virtual storage, as used in GSD's System/38 where all memory (primary and secondary) is treated as a single large address space. The pcm's will have to cope by developing corresponding microcode, a project Kutnick expects to take at least six months.



THE 4331 is aimed at the first-time user and can be installed in an office environment. It can be used with currently available IBM I/O and communications devices as well as with the new 3370 disk storage unit shown here.

The 3880 Storage Control Model 1, announced for use with the 4341 and the concurrently announced 3370 (571MB) disk and existing 3340/3344s, foreshadows the future as seen by Kutnick. "It's the size of a desk, but only two drawers are full," Kutnick explains. The unit's custom microprocessor has a large instruction set and internal switching speeds twice as fast as the logic in a 4300 cpu (1.5nsec versus 3nsec). The 3880 could very well evolve into a back-end data base management system. The 4300's apparent 30% to 40% price/performance curve advantage over the 303X leads Kutnick to predict the rumored H-Series announcement will come before year-end. ✲

THE 4300 AT A GLANCE

The smaller E-Series processor, the 4331, has roughly eight times the price/performance of a 370/115; the larger 4341 bests a 370/138 by a factor of six or more, according to IBM-supplied figures. These are hardware comparisons of user-state throughout for entry level processors with unequal amounts of main memory: a 1MB 4331 versus a 64 KB 115, and a 2MB 4341 versus a 1MB 138. Factoring in the added cost of software may reduce the 4331's advantage by as much as 25%, and that of the 4341 by 10% to 15%, according to estimates made by Oppenheimer vp Aharon Orlansky.

The two processors are built of logic chips containing as many as 704 circuits, customized to their intended function with a direct exposure electron beam manufacturing technique. Up to nine chips are included in each ceramic-carrier module that can provide as many as 23 layers of interconnections.

The processors use IBM's previously announced 18K-bit chip in their microcode control store. Each of the processors is offered in two memory sizes, 0.5MB and 1MB for the 4331, and 2MB and 4MB for the larger 4341; main memory uses the 64Kb chip announced with the 8100 and used in the System/38.

Each time this chip gets used it seems a new function is taken advantage of: the 4300 memory makes use of an on-chip eight-bit shift register as a buffer. To increase the effective speed of the relatively slow chips, the 4331 uses a four-byte data path, and the 4341 goes for eight bytes at a time. Memory cycle times are 900nsec for a four-byte read and 1300nsec for a four-byte write on the 4331; memory timing wasn't specified for the 4341. On the other hand, no processor cycle times are available for the 4331, while the 4341 is specified by IBM at 150nsec to 300nsec. Cache, 8 KB worth, is included in the 4341.

Three new operating system releases were announced with the 4300s: Disk Operating System/Virtual Storage Extended (DOS/VSE), VM/370 Release 6, and OS/VS1 Release 7. Extended Control Program Support (ECPS, microcoded assists) on the 4331 can speed DOS/VSE and VM/370; the 4341 has ECPS for all three operating systems. ✲

E-SERIES: PRICING, SUPPORT IMPORTANT ELEMENTS

IBM has moved a new, lean support organization into place.

by Vin McLellan

The pricing is flamboyant, the power impressive, the software and its pricing even exciting—but hindsight may highlight IBM's new service and support systems as the most important element in the 4300 announcement.

With the E-Series introductions, the 4331 and 4341, the Gray Mother took a systems approach to babysitting. Child custody went digital, hand-holding remote and telephonic. Support—perhaps IBM's most marketable product—has evolved to deal with a new generation of users. And quite profitably, thank you.

Just because Mother is treating you more like an adult doesn't mean she's going to let you forget the value of parental guidance.

IBM has moved a new, lean support organization into place, flexing all sorts of interesting muscle. And if the concepts are less than "revolutionary"—despite the spiels at the user briefings—it is generally acknowledged that it was done in a big way and with style.

The 4300s have a dedicated diagnostic processor within them that monitors the health of the hardware—marvelous and mysterious microcode included—and spits out an eight digit diagnosis of failures. System diagnostics of the sort heretofore seen only at the top of the line.

And for the software—not only on the 4300s, but the 8100, 303X, and the whole 370 line—the merely helpful SSC (software support center), introduced in October with the 8100, is now revealed as a multilevel facility with powerful resources. IBM's optimistic prediction is that two thirds of all customer software problems can be handled with a tool-free telephone call to the SSC, without the dispatch of a local PSR, an IBM programming support rep.

It it's not a hard-wired diagnostic unit like a 4300's Remote Support Facility—which a tending CE can put on line to his field support office to have a backup specialist remotely initiate diagnostic programs and, if necessary, channel microcode fixes where appropriate—the software support center has something of a parallel design and obviously similar goals.

IBM's American customers who are using DOS/VS, VS/1 and VM/370, soon will have an 800 number that will connect them to the Chicago-based SSC or its tandem backup in Tampa, Fla., where

The 3880 could very well evolve into a back-end data base management system.

SSC staff will help the user define the problem and query on line the Software Support Facility in Boulder, Colo., where IBM maintains its mammoth data base on software problems and fixes. If the problem can't be adequately defined or it can't be matched to a patch in an early pass at the data base, the customer, his description of the problem, and a crt profile of his facility are passed on to a secondary level of SSC specialists who work directly with the IBM "change teams," the groups responsible for a specific program evolution, at IBM programming centers across the country.

Since last February, more than 300 customers have been using the bi-level SSC approach as beta test sites, said an IBM executive spokesman, "and our experience in 14 user months only proved again what we've long known internally: most of the customers' problems have been experienced before by someone else." Only 5% of customer calls were traced to new problems, he added.

The beta tests already have about 5% of IBM's domestic customers tied into the center, said the company, and 1979 will see all DOS/VS, VS/1, and VM/370 customers phased on—4300 and 8100 installations as the new units go on line, and the rest of 370 users in a gradual assignment within each IBM region.

(MVS users will remain the principal operating system group not on the SSC bi-level system. IBM says it currently is engaged in studies to determine the appropriate way to support MVS users. One, perhaps the principal such test, underway since late 1978, allows MVS users to directly query the field engineering retained data base at the Boulder software support facility. An IBM spokesman refused to elaborate on that project.)

IBM also announced that beginning January 1980 it would charge separately for basic license fees and local on-site support for DOS/VSE; VS/1, release 7; and VM/370, release 6, and associated program products.

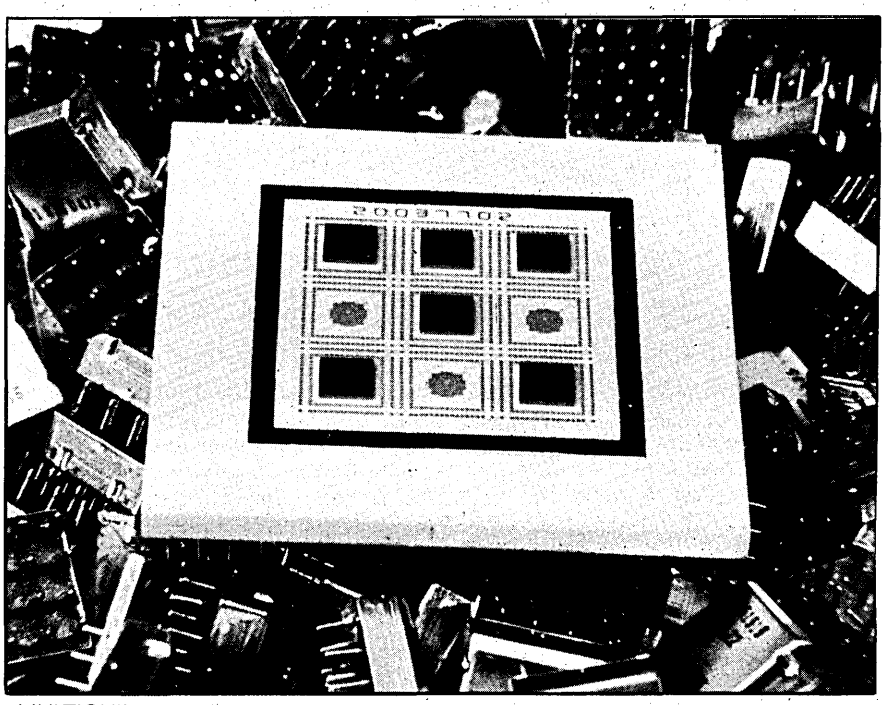
DOS/VS, release 34; VS/1, release 6; and VM/370, release 5, were declared "functionally stable" and will receive both local PSR support and central SSC support without charge until January 1981, after which conventional support will be discontinued and program assistance will be available only on an hourly basis.

The SSC telephone service will be available to all customers under the basic license charge, and an IBM spokesman stressed that local PSR assistance will remain readily available. Users of DOS/VSE; VS/1, release 7; and VM/370, release 5, will have a choice between paying separately a new lower basic license fee on program products and the new on-site local support fee (the two of which together about equal the current license fee for program products), or paying only the new license fee and bringing in PSR assistance on an hourly charge (currently $70/hr) as needed. Under the current license, for instance, users of COBOL DOS Library are charged $22 per month; after January 1980, the basic license fee will be reduced to $17 monthly and full on-site PSR support will cost an additional $5 monthly.

Current users of DOS/VIDEO/370 pay

HOW THE "E-SERIES" MESHES WITH IBM'S LOW END 370 LINE

Processor	Cpu cycle	Memory cycle	Channels	Price
S370/115	480	480	1	$129,500 (353KB)
125-2	480	320	1	$179,750 (512KB)
4331	na	900/1300 (4 Bytes)	3-6	$ 65,000 (512KB)
138	275-1485	715/935	3-4	$260,400 (1MB)
148	180-270	405/540	5	$518,750 (2MB)
4341	150-300	na	3-6	$245,000 (2MB)



MULTICHIP ceramic carrier for the 4300 processor holds up to nine large scale integration logic chips. The 50mm sq. module shown here contains six logic chips, each of which houses up to 704 circuits. (Earlier technology modules are in background.)

$224 monthly for the license; after January 1980, the basic license fee will be $155 monthly, and full on-site support—if the package deal is chosen instead of the hourly on call rate for systems engineering services—there would be a separate charge of $69 monthly.

IBM explains the separation of charges as "a way of allowing the customers to adjust the amount of local service he uses to his individual requirements," and tailor his charges accordingly. But a candid marketing executive told a 4300 presentation group that the company expects "99.9%" of all the users to opt for the full support package.

There is less hair splitting involved in a whole new class of 1980 support charges for operating systems: system control programs previously supported without charge. Users, said the IBM spokesman, will be billed not according to the OS or system control program used, nor even how many are used per system—instead, they will be billed by the size and nature of the processors upon which the operating systems are run (see chart).

An IBM spokesman explained the difference between the per product fees for program products and the per process fees for OS system control programs as merely a reflection of the cpu as the determining factor in PSR demand in OS program support.

Industry analysts wryly noted, however, the awkwardness such a pricing system would cause if IBM were ever ordered to support the new OS programs on plug-compatible mainframes.

For the fixed monthly charge, IBM customers can obtain local PSR assistance in problem source identification, problem fix and by-pass, APAR (software analysis reports requesting corrections) preparation, and ATS applications, explained a company spokesman. For routine PSR support, he added, the user must contract for a minimum of 12 months, and upon the beginning of priced support for the operating systems—DOS/VSE; VS/1, release 7; and VS/1, release 6—individual program products licensed to the processor being taxed may no longer be excluded from full local support. Local program support may, however, be redesignated from one IBM processor to another with one month's notice.

Local program support for new program products can be added as they are installed, and contract support can be canceled on a discontinued program product with one month's notice. Local OS program support can be discontinued if the processor is discontinued upon the payment of three months charge or 50% of the remaining contract, whichever is less.

IBM also offers what is essentially a volume discount on local support for multiunit installations which have a centralized approach to program development and maintenance.

Explaining that this centralization of the installation's program management allows the PSR to more efficiently provide local support, IBM offered an optional local support contract whereby the user pays for full coverage of a single designated cpu and for a lesser rate per processor (see chart) for other IBM processors approved for interchangeable software support.

Underlining much of the new software support offerings is IBM's new preventive service system. Users of DOS/VSE; VS/1, release 7, and VM/370, release 6—the 1979-shipped and the 1980-priced system control programs—will regularly receive a single program update tape from IBM which has been pretested against the integrated OS data base to insure that there are no conflicts between corrections and customized before shipment to the user's licensed system profile.

The frequency of preventive service tape distribution will depend upon software stability, of course, but the customized service feature allows a user to purposely skip one or two correction tapes and subsequently update his software with a single cumulative preventive service application.

Again, IBM is offering automation to replace the footsore PSR who has been applying program updates personally at his site. The changes save both IBM and the user costs and productivity, claimed an IBM spokesman, and to support the trend, IBM is offering new application vehicles to ease user entry into increased self-sufficiency. For DOS/VSE: the maintained system history program (MSHP) helps the customer apply preventive service and keeps track of what update tapes have been applied to the system. A similar facility, using the system modification program (SMP) is available for VS/1, and the program level change (PLC) offers the same capability to VM users. ✲

PRICING BREAKDOWN

Processor	Per processor charge for running licensed system control programs	Discounted rate for multiple processor installations (2nd and subsequent cpu's)
370/115	$140/mo	$84/mo
370/125	$175/mo	$105/mo
370/135	$250/mo	$150/mo
370/138	$285/mo	$171/mo
370/145	$325/mo	$195/mo
370/148	$435/mo	$261/mo
370/158	$540/mo	$324/mo
370/158AP/MP	$650/mo	$363/mo
370/168	$775/mo	$465/mo
370/168AP/MP	$945/mo	$567/mo
3031	$575/mo	$345/mo
3031AP	$650/mo	$390/mo
3032	$775/mo	$465/mo
3033	$1,045/mo	$627/mo
3033AP/MP	$1,210/mo	$726/mo
4331	$200/mo	$120/mo
4341	$570/mo	$342/mo

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CIRCLE 142 ON READER CARD

IBM Series/1

IBM has further expanded the range of modular hardware and software available in the highly versatile Series/1. These new features increase your ability to tailor the system you need today and extend that system for tomorrow's data processing requirements.

New Hardware

The 4952 Processor, the newest, lowest-cost member of the Series/1 processor family, utilizes new technologies to combine CPU, storage, address relocation translation function and a new clock/comparator on a single card. Storage is expandable to 128 KB with modules of 32 KB that are pluggable on the processor card.

A family of high performance, large capacity, full-function tape units has been added to the Series/1. The 4969 Magnetic Tape Subsystem comes in six models covering a range of speeds and formats.

The 5250 Information Display System stations (local only) can now be attached to the Series/1. The attachment feature provides for 4 ports and up to 8 stations per attachment.

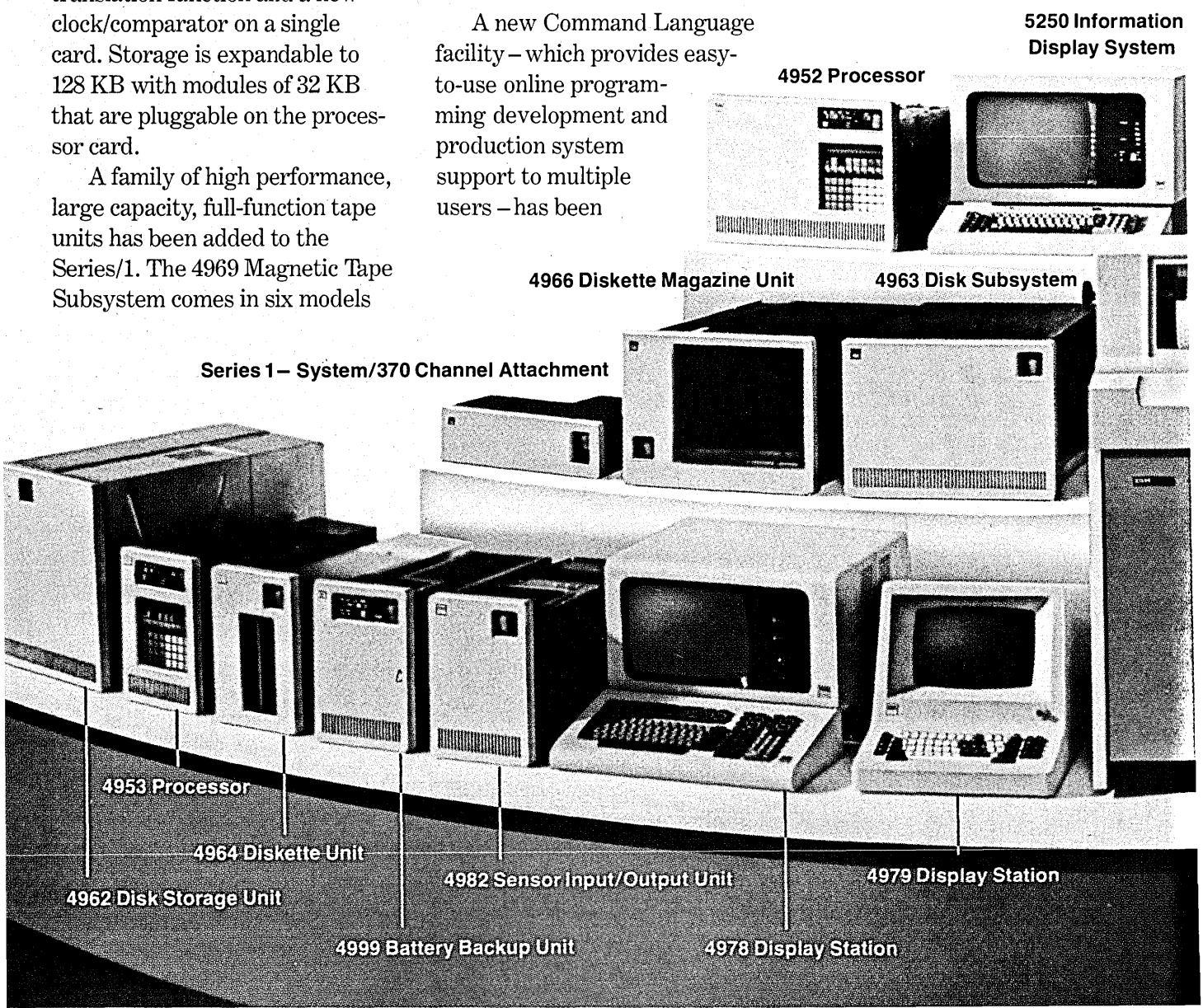
These new components have been added to a hardware menu that now includes 3 rack-mounted processors, matrix and line printers, standard and customized display stations and a wide variety of I/O devices.

New Software

A new Command Language facility – which provides easy-to-use online programming development and production system support to multiple users – has been added to the Realtime Programming System (Version 4).

Also newly available are an Indexed Access Method (IAM) program, which significantly enhances the data management capability of RPS, and a new version of the Program Preparation Subsystem, designed to increase customer program development productivity.

Series/1 also offers two additional operating systems. Event Driven Executive, which provides a powerful system for business and industrial users, has



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been expanded and is now warranted as an IBM licensed program. And the independent modules of Control Program Support let you tailor a supervisor to your specific needs.

The full line of Series/1 hardware is supported by a comprehensive menu of programming languages which includes Fortran IV, PL/I, Assembler and COBOL. Available, too, are a variety of Series/1 programming packages to meet such needs as energy management, intelligent data entry and interactive processing.

More Capacity and Flexibility

Series/1 is powerful enough to be used in a stand-alone capacity and flexible enough for distributed processing. It can be programmed for a wide scope of tasks, including general business accounting, administrative applications and industrial automation for machine and process control, as well as power management, communications applications and scientific and engineering functions.

IBM Service Support

Series/1 is backed by IBM's extensive service organization. Ongoing IBM maintenance is available at a fixed monthly charge.

To find out how Series/1 can contribute to the growth of your business, contact your IBM Series/1 marketing representative or write the IBM General Systems Division, P.O. Box 2068, Atlanta, Georgia 30301.

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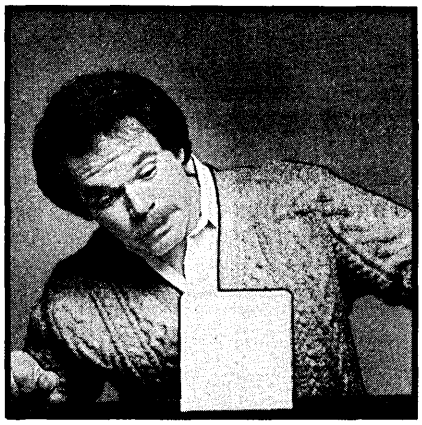
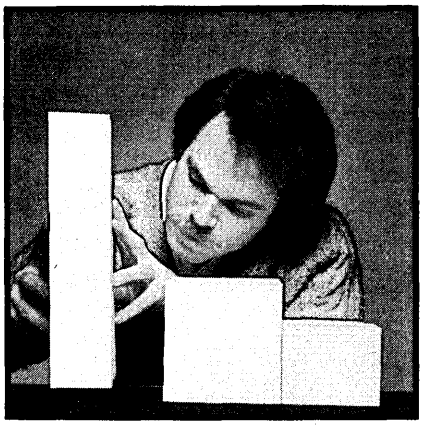
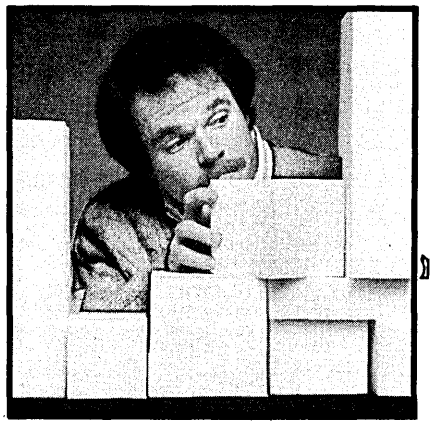
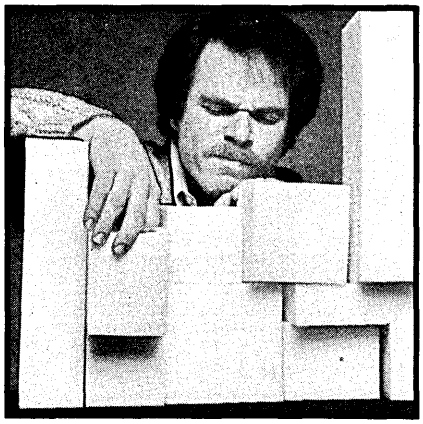
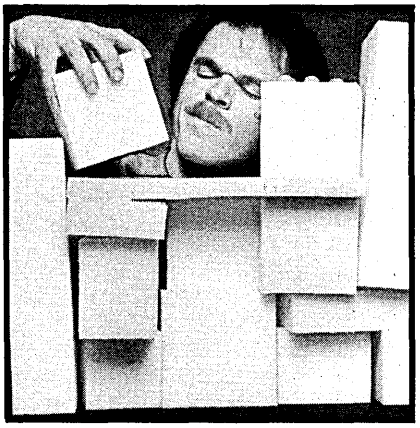
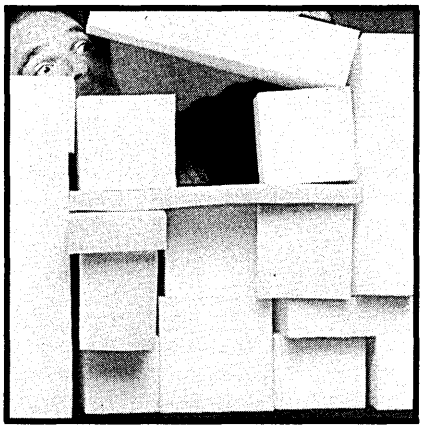


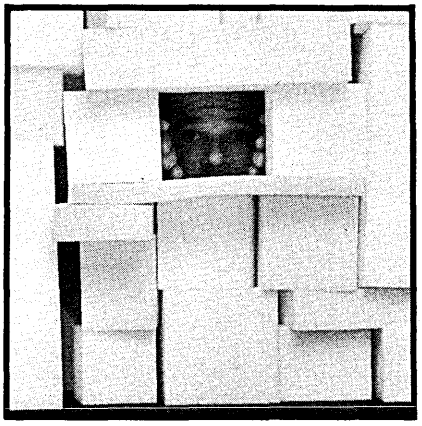




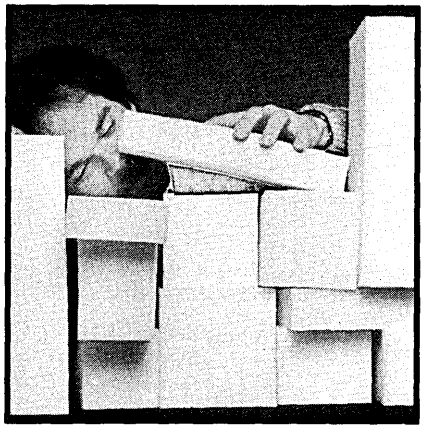


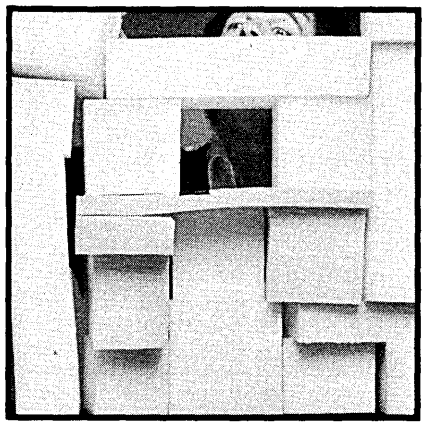






Some practical suggestions for getting a new data communications network on the air in a hurry when conditions are less than ideal — that is, normal.





THE QUICK AND DIRTY WAY TO IMPLEMENT DATACOM NETS

by Alan P. Rosenberg

The data processing manager on a first-time excursion into data communications is faced, as we have frequently been told, with numerous areas of questions and decisions. Many books and articles address these problems, often with detailed and deliberate approaches to find the "best" solution. Thus, the newly responsible data communications manager can find methods for designing minimal cost networks, for performing exhaustive analyses to select terminals and communications processors, for making the build-or-buy decision relative to software for controlling the development process, and for constructing a network management apparatus providing ease of operation, high reliability, and capacity for expansion. Armed with this wealth of information, and given adequate time for study, consultation, appropriate personnel and equipment resources, and proper specifications, there is seemingly no reason the dp manager shouldn't create a system that meets the needs of its users and the business needs of the organization.

Unfortunately, that rosy situation is as rare as hurricanes in Hertford, Hereford, and Hampshire. The more usual experience tends to include incomplete specifications, network characteristics based on current practice rather than optimal structure for cost or efficiency, and worst of all, there never seems to be enough time to do the job properly.

None of these realities comes as a surprise to a member of the profession; they simply reflect the conditions under which systems implementers generally function. The manager seeking to put a first time communications servicer on the air is usually under less than ideal conditions. For the first-time developor of a communications application, the usual complexities are exacerbated by unfamil-

iar equipment, by the differences in speed and resistance to error between data processing and data communications facilities, and by the arcane and often arbitrary rules and practices of the common carrier organizations.

When new systems are required in less time than is consistent with slow and craftsmanlike development, the cause is usually not, as might be assumed, bad planning. Rapidly changing economic climates, the explosive development of increasingly inexpensive microcomputer technology, expanding boundaries of business regulation by government, and the highly competitive nature of the market for data-communications-related services can combine to put the manager responsible for system development in the situation of having to provide less than fully defined services in less than adequate time. The size and complexity of the application is obviously a factor, but a development cycle of less than six months (from inspection to operation) will usually qualify as quick in the sense of being a tighter schedule than the developers think they need. Similarly, the point at which the system is on the air is subject to flexible definition: it may be acceptable to get a portion of the network, or a subset of the system functions, running rapidly, with the remainder phased in subsequently. For these reasons, then, the most important step for the manager at the outset is to identify the most important requirements and come up with well defined specifications for the new service. Key elements to include are:

Normal Schedule	Quick and Dirty
1. End-user satisfaction	1. Meeting immediate business needs
2. Meeting business needs	2. Reliability
3. Flexibility for change and growth	3. End-user satisfaction
4. Cost	4. Maintainability
5. Reliability	5. Cost
6. Ease of operation	6. Ease of operation
7. Maintainability	7. Flexibility for change and growth

Table 1. Design parameter priorities.

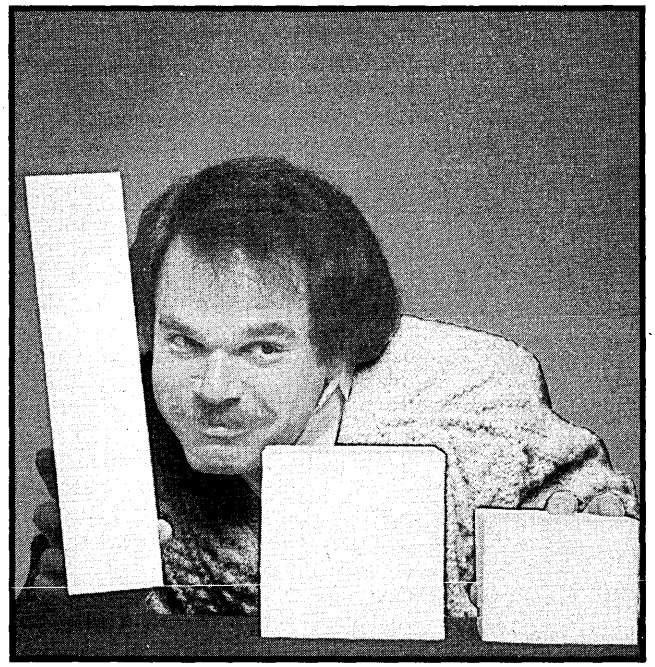
a functional description for each transaction type provided (transaction being used in the general sense to mean a message or unit of work); a description of all inputs, outputs, error processing, and file operations associated with each type of transactions; descriptions of the operational interfaces for system control, and a description of restart and recovery functions and procedures.

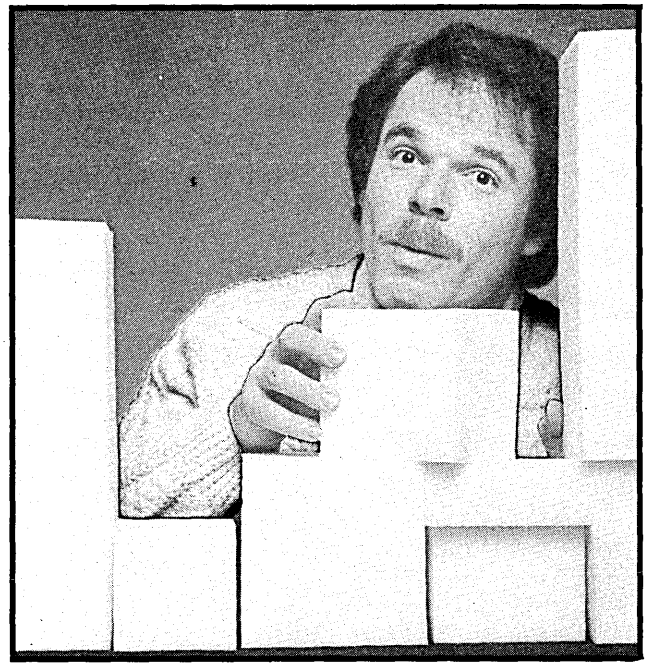
Nothing in this list is unusual or specific to a quick and dirty schedule. However, for a rapid implementation the goals of specification writing are to describe what is to be provided in sufficient detail to do the job, to make clear what is *not* being provided so as to eliminate subsequent confusion or dissatisfaction, and to provide a good basis for realistically estimating the cost of the system and the time needed to produce it.

The last two items are extremely important, because with tight deadlines it is necessary to develop project schedules by *backward estimation.* Working from the predefined end (cutover) date, the dates at which major implementation milestones must occur can be calculated; this method is also useful in determining the extent to which the job is feasible at all. However, this process is viable only if the system specifications are solid and complete *for the level of service to be provided.* For this reason, the use of specs to limit system scope is also essential.

USE WHAT'S THERE

A sensible approach toward defining a system for short-term delivery is to capitalize on existing technologies in hardware, software, and terminals. It is clearly simpler to adopt a standard communications processor, a standard telecommunications package, or widely supported terminals, than to try to build something from scratch. This approach also, however, carries the risk of the user becoming locked in to an inflexible system. This trade-off must be evaluated and made explicit early on, so that all parties understand both the near and





eventual consequences of embarking on a faster-than-ideal development schedule.

The pressures of time will also impact the design process. The usual parameters employed in developing a sound communications system design may not all be affordable in a tight schedule, and even the ones that are retained may affect the design process differently than under more normal conditions. Table 1 suggests the differences in the priority of these parameters between situations in which there is adequate time and those in which there is not. Once again, the development manager must make known the longer-range effects of rapid implementation. Because the system must meet specific business needs by a fixed end date, the considerations for good long-term design may have to be sacrificed.

Let's presume that all the problems and caveats have been made known and accepted. What can be done to shorten the development cycle? The first point of attack should be the network, with the following goals:

- Streamline the network to reduce equipment lead times, installation delays, and test time prior to cutover.
- Whenever possible, use standard terminals, controllers, and communications protocols to minimize software development and lessen the effect of the learning curve associated with unfamiliar devices.
- Seek methods to reduce the time needed to obtain common carrier facilities, such as the use of standard offerings or package deals for lines and terminals.
- Eliminate network nodes in locations with excessive lead-times for lines or other facilities compared to the majority of sites to be served.

Clearly, the intent is to cut over the leanest possible network consistent with the needs of the service for response time, throughput, and reliability. Standard terminals (such as tty-compatible printers, keyboards or IBM 3270-compatible crt's) will usually be supported by most communications processors and teleprocessing monitors. Choose the largest, most flexible terminal vendor consistent with the delivery schedule; often the most popular or most promoted device will not be the

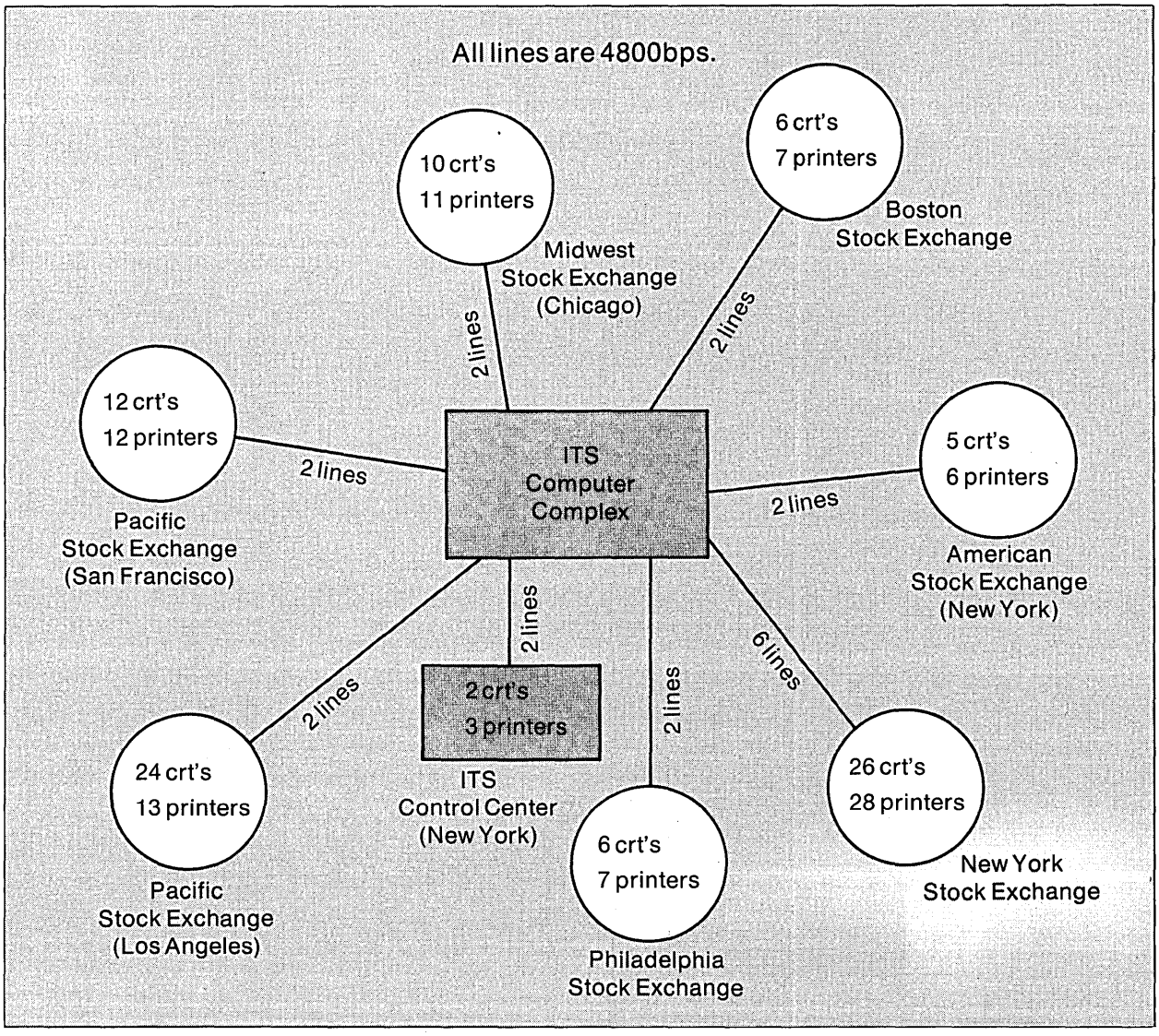


Fig. 1.

To minimize the system's birth trauma, order equipment and lines as soon as possible even if use charges are incurred before the system goes live.

most readily deliverable. Often the common carrier facilities (lines and especially modems) will be long lead items if ordered individually. On the other hand, an end-to-end arrangement (with the carrier supplying all equipment and facilities) may have a much more attractive availability, although usually at higher cost and less flexibility in the choice of options.

Ordering of equipment and lines should occur as soon as possible even if some months of use charges will be incurred before the service goes live. Those charges are well worth the confidence that comes from knowing that the network has been established and shaken out, and that its contribution to the birth trauma of the system can be minimized.

Once the network has been fixed, the selection of hardware and software for the communications processor must be made. In most quick-delivery situations, it is not feasible to consider building communications software from scratch; it will probably be sufficiently difficult to develop the required application programs within the time constraints. Therefore the choice is usually reduced to either an off-the-shelf hardware/software package, or a standard telecommunications monitor operating on a general purpose mainframe or minicomputer.

Several areas of examination are essential here. Is all software operational, or will customization be required? How well does the system support the selected terminal environment? Can the system take advantage of all terminal features? How easily is application software added to the basic system? Are high level language processors and other development tools available to expedite the production and debugging of applications? Are the file and data structure capabilities adequate for the functions and traffic volumes required? How well does the system interface with existing computers that must participate in the new service? How well does the system cope with component failure? To what extent must restart and recovery be provided by applications software? And what level of support is available from the supplier to ease the development process over rough spots and problems?

The manager should also examine the effects of each device on future capabilities. As mentioned before, although the goal is rapid cutover of a (necessarily limited) new service, it is important to quantify the extent to which the initial system (with appropriate upgrade) will ever be able to satisfy the long term need.

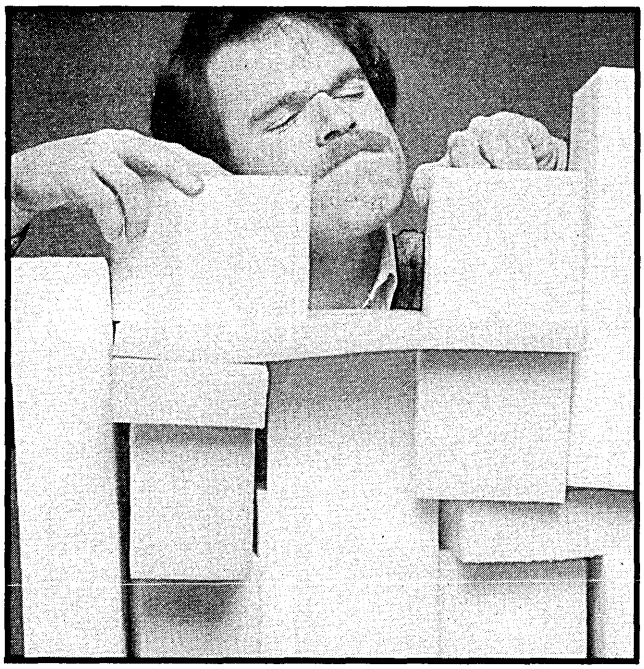
A CASE HISTORY

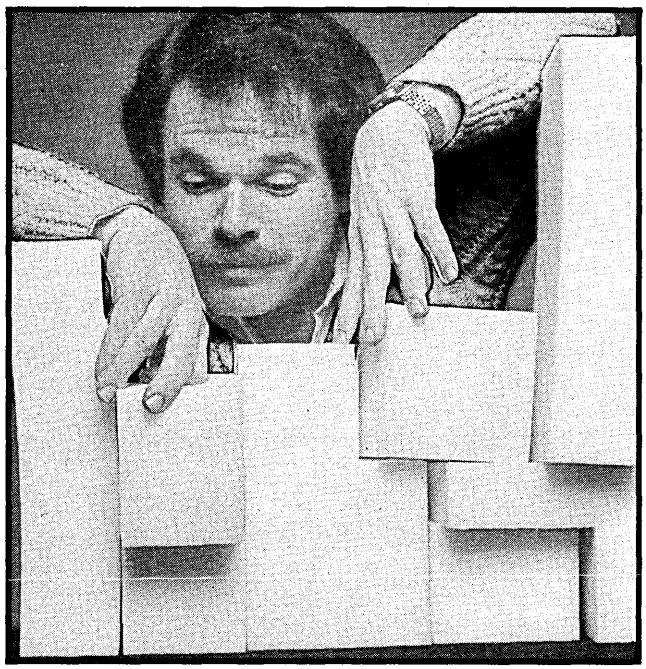
The development and installation of a communications system for the securities industry, the Intermarket Trading System (ITS) is an example of successfully getting on the air quickly.

In essence, ITS allows direct communication between brokers on the trading floors of physically remote stock exchanges for the purpose of buying and selling stock. The system consists of crt and printer terminals on the trading floors and a central message switching and data base management computer system located in New York City. The initial operation involved just two exchanges, New York and Philadelphia. At present, ITS links the six major stock exchanges in the United States (American, Boston, Midwest, New York, Pacific, and Philadelphia). Fig. 1 shows a schematic of the present ITS network and indicates the numbers of lines and terminals associated with each participant exchange. ITS is an expanding service, in many ways the first step toward the much discussed National Market System for securities trading.

Serious discussion of some form of inter exchange linkage was a major occupation of the financial community beginning around the middle of 1977. By the fall of that year, the New York and Pacific stock exchanges were planning for a pilot version of such a system (between New York and Los Angeles) to go live in April of 1978. At that point, development personnel from the Securities Industry Automation Corp. (SIAC), a subsidiary of the American and New York exchanges, began preparing draft specifications and studying prospective volumes, file requirements, recovery capabilities, and other aspects of the system design. It was agreed that ITS should use minicomputer equipment as its processor complex, rather than a mainframe or a special-purpose communication device. This choice was in recognition of the level of applications processing and data base management functions inherent in the service, and of the economic benefits of a minicomputer approach.

Once the concept of an intermarket linkage became generally known, the American and Philadelphia





exchanges expressed interest in joining—and in participating in the functional definitions of the service. Because of the new ground to be broken in establishing a first time ever direct interface between traders, and the large number of technical, procedural, business, and regulation issues to be identified and resolved, the end of 1977 approached with several major decision items at least partially unresolved: the choice of computer hardware, the choice of telecommunications software (including the build or buy question), and several key final details of the functional specifications for the service.

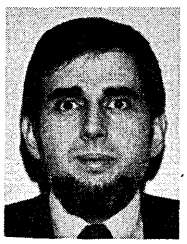
After an exhaustive (and occasionally exhausting) study, Tandem Computers, Inc., was chosen as the computer hardware vendor. Some of the reasons for this selection related directly to the live operation target date of April 1978: the Tandem operating system provided extensive recovery and restart features that would not have to be developed from scratch; the Tandem high-level programming language (TAL) seemed to offer a means for rapid application program development and checkout; the architecture of the hardware and operating system appeared to be geared for good throughput rates, and the multiprocessor design provided a capacity expansion path free from massive program rewrites.

To further capitalize on the hardware selection, it was decided to acquire an existing telecommunications monitor, ACI/NET (Applied Communications Inc., Omaha, Neb.), to act as intermediary between the standard Tandem operating system and the ITS application programs. The package had been in use in a large electronic funds transfer application in the Midwest, and provided many of the message processing, terminal services, and network generations and management functions required in ITS. The package was not ideal in every way, and required some modification to be used within the ITS functional architecture, but the alternative of creating a new communications monitor (on a computer that was also new to the development group) offered much less likelihood of completing the project in time.

Physical space for terminals is always at a premium on the various trading floors, and given a long lead time a specially built, very compact crt and printer combination might have been obtained or built on special order. That not being the case, both space and custom design for the application were sacrificed for equipment availability, and the network was designed around standard Dataspeed 40/4 crt's and printers from Teletype Corp. These devices are fully compatible with the IBM 3270 family, and were supported by the Tandem software and the telecommunications monitor. It was further determined that a complete (end-to-end) installation of lines, modems, and terminals by AT&T Long Lines would be the fastest way to get the network in place.

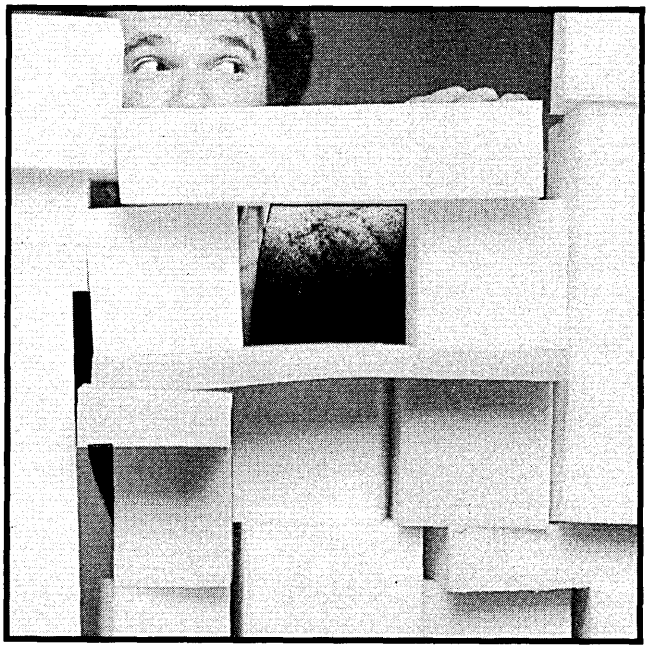
With excellent cooperation from all vendors and the participating exchanges, the development, systems assurance, and operations groups within SIAC were able to meet an extremely short delivery schedule; ITS went live on April 12, 1978. This first day had the heaviest trading volume recorded to that time on the New York Stock Exchange—63,000,000 shares. The system performed without problems, but initial operation involved just 11 stocks and two exchanges. The system has grown steadily and now handles more than 300 stocks among the six participating exchanges. And Murphy's Law has yet to be repealed. ✻

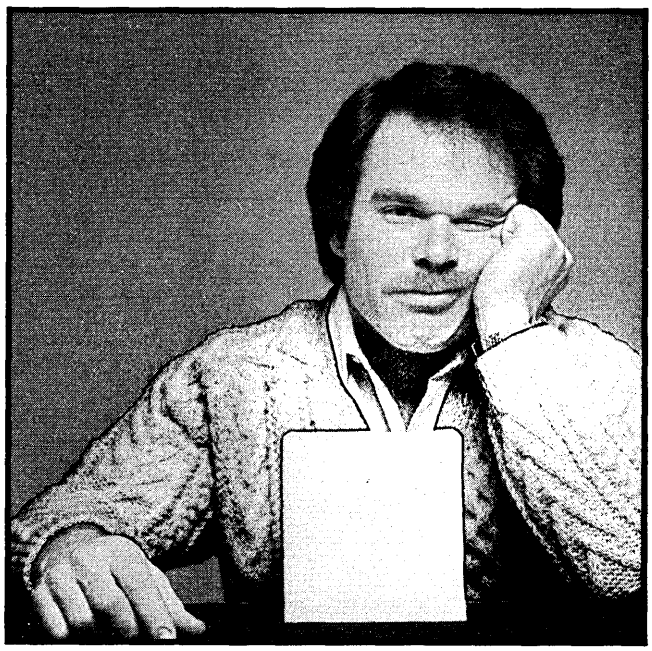
ALAN P. ROSENBERG

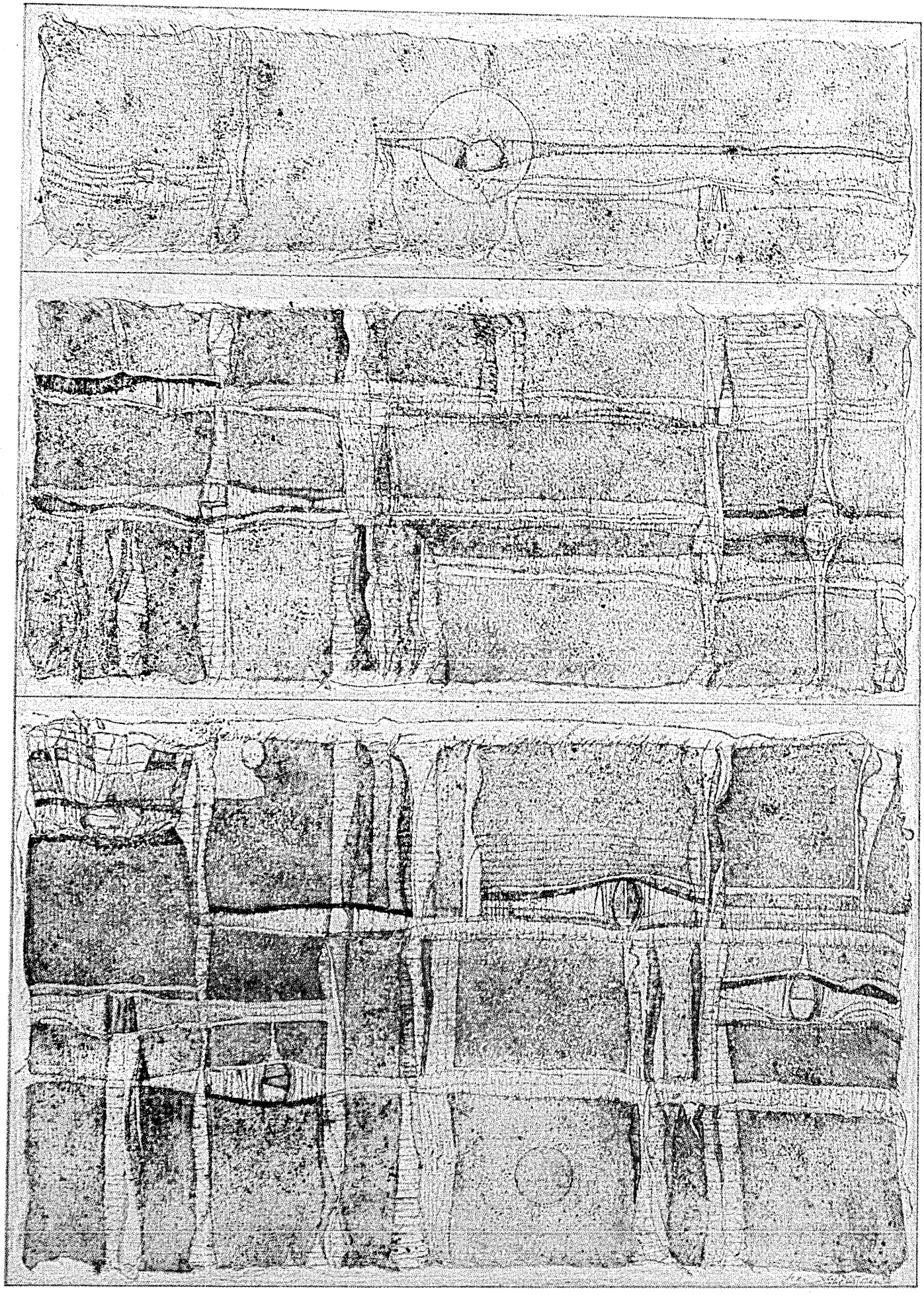


Mr. Rosenberg is implementation manager with SEI Computer Services, a systems consulting firm that provides design, development, and performance evaluation services for business and government organizations. Prior to joining SEI, Mr. Rosenberg was director of systems planning and development for the Securities Industry Automation Corp., where he participated in the development of the Intermarket Trading System and in advanced automation planning for the New York and American stock exchanges.

Mr. Rosenberg has held management and technical positions with several software and consulting firms, including Informatics and Computer Usage Co. His current assignment with SEI is in Washington, D.C.







Recovering from a poor start, DEC's networking architecture is evolving toward compatibility, with bridges to X.25, ACS, and other vendor's nets.

PUTTING DECNET INTO PERSPECTIVE

by Richard A. Loveland

Early computer networks were direct outgrowths of terminal networks, in which remote terminals, having no dp capability, were linked in a star configuration to a central mainframe. Communication in those early networks was based on several IBM application-oriented data transmission protocols. For example, using IBM's Binary Synchronous Communications (BSC or bisync) discipline, the 2780 and 3780 protocols were designed for remote batch and RJE transmission; and by 1974 or earlier the 3270 protocol became available for interactive terminal applications (mainly involving video display stations).

Thus, computer-to-computer communication was originally attained through the now-familiar and still widely used networking technique called terminal emulation. Special emulation software residing in one computer makes it look like a 2780/3780 or 3270 terminal to the other computer. The computers do not have to be IBM machines; these protocols have by now been applied in many networks that include little or no IBM hardware. The initial DEC-to-DEC computer transmission in the early 1970s, for instance, was through bisync transmission protocols.

But communication through terminal emulation is handicapped by the limitations of the protocols themselves. First, the protocols usually assume a master-slave (or host-satellite) relationship between the communicating computers. In exchanging data, the remote computer is a slave to the central mainframe just as if it were a terminal. Further, the bisync protocols emulated are limited to half-duplex data transmission.

Since the early '70s, there has been a widely recognized need for extending the communications capabilities of network systems beyond what the emulation techniques offer. We all realized that the value of the systems supported with extended capabilities would be vastly enhanced, but also that an underlying software structure, a network architecture, would be required.

It was a natural first step, therefore, for DEC to develop DDCMP (Digital Data Communications Message Protocol) as a data link protocol that would fulfill general system-to-system networking needs. DDCMP offered full-duplex data transmission, was character oriented to run on existing synchronous and asynchronous communications hardware, and supported both batch and interactive dp operations. At first limited to internal use primarily for message switching, the DDCMP specifications were offered to DEC's customers in 1973.

The application of DDCMP both inside and outside the company accelerated the communications needs that neither this nor any other existing protocol filled. For example, a network transmission protocol should permit both file transfer and program-to-program communication between systems in a network, multiplexed over a single transmission line. It was clear that network software should support communications with non-DEC makes of computers, too.

Further development of communications software at DEC had to begin with the definition of a network architecture that would meet current and future needs in DEC-to-DEC environments; but any implementation of the architecture had to include protocol emulators to provide necessary compatibility with non-DEC hardware. Above all perhaps, the network architecture would have to be evolutionary; without any change in its basic structure, it would have to be adaptable to whatever the future would bring in virtually every aspect of distributed processing and communications.

GOING INTO PHASE II

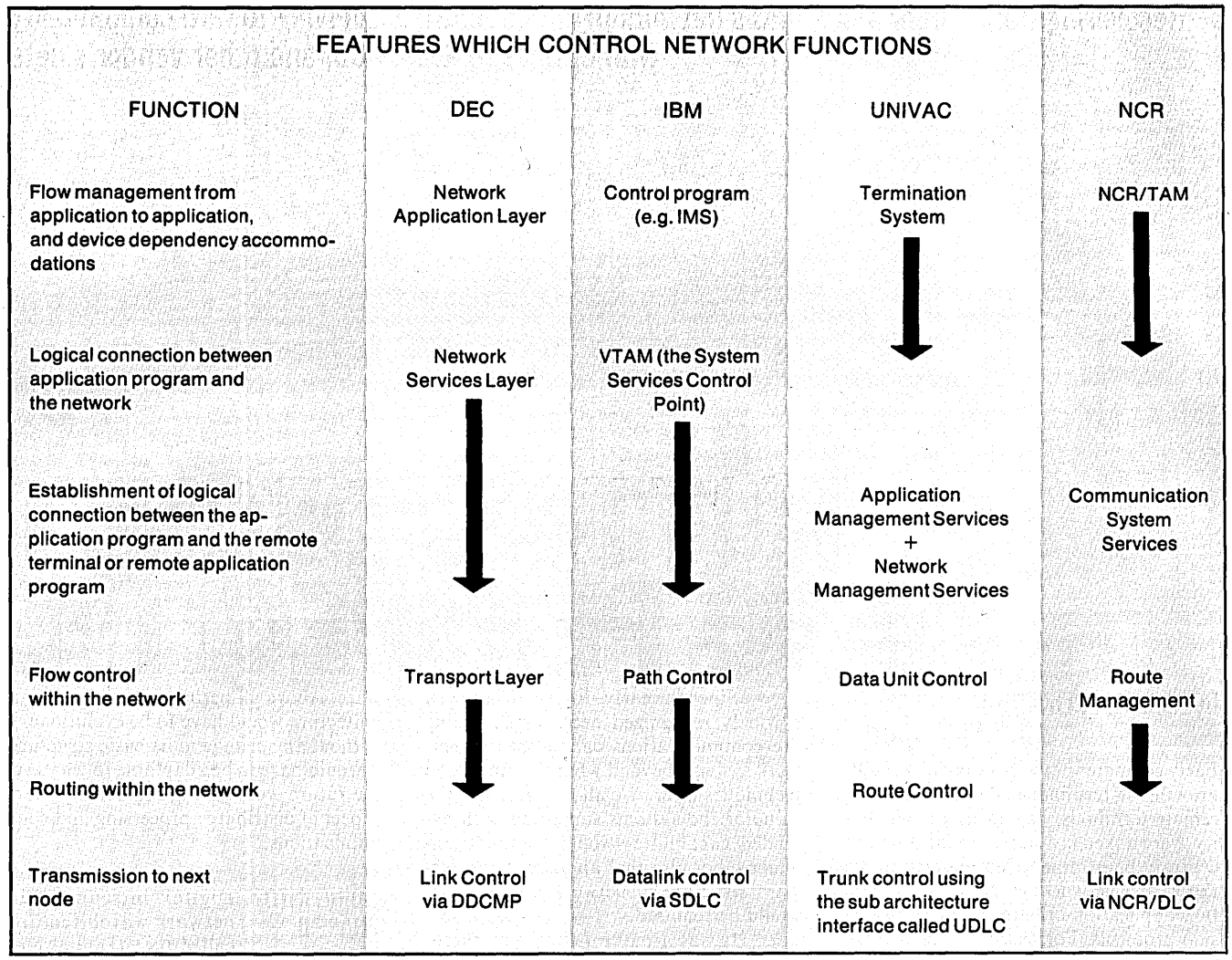
Digital introduced its network architecture, called DNA (Digital Network Architecture), in the spring of 1975. At the same time, the company announced its intention to develop DECnet, the set of software and hardware products that would implement the concepts of DNA across its major operating systems.

DNA consists of a model, a set of interfaces, and a set of protocols. The DNA model describes a structure that embraces the software modules which perform networking functions for each DEC operating system. The structure is layered, and each layer represents a particular set of network functions. Adjacent layers are related through distinctly defined interfaces, each of which is supported by network protocols that operate within those layers. Specific formats for messages are defined for the interfaces and protocols.

DNA establishes the framework for development of all DECnet products, and makes the software functions of lower layers transparent to the user of higher-layer functions.

DNA is designed to achieve the following specific goals:

System independence: permit a variety of DEC computers (16-bit, 32-bit, 36-bit) running a variety of DEC operating systems (real-time, time-sharing, transaction processing) to be linked in a DECnet-supported network.



Communications facilities: support any combination of half-duplex and full-duplex transmission, synchronous and asynchronous, multipoint and point-to-point, serial and parallel channels, satellites and leased lines.

Network functions: offer program-to-program communications, remote file access, remote system loading.

Cost effectiveness: accrue lower initial and operating costs than the majority of custom-developed networks.

User-defined network configuration: support hierarchical (host and satellites) or peer-coupled (computers of equal status) network, or be functionally organized according to user's needs.

Allow for growth: allow networks to grow in number of nodes (computers) and functions, and to be adapted to new software and hardware technologies. Components must be replaceable if better communications hardware becomes available or if a function is changed from software to hardware. This evolution of the network must be transparent to the user, except for functional changes at his location.

The scope and complexity of the undertaking has led to development of DECnet in phases, each phase expanding and adding to capabilities offered in the previous phase.

Phase I, announced in 1976, was limited mainly to real-time data acquisition and control, partly because research laboratories were already one of DEC's strongest markets and partly because these organizations were among the first to express the need to share dp tasks and computing resources. There were two operating system families, RSX and TOPS-10, involved in Phase I; they are based on PDP-11 and DECsystem-10, respectively.

By the end of 1977, Phase I DECnet packages totaling between 600 and 700 nodes had been installed by more than 150 organizations worldwide. During that time, a number of problems, typical of the implementation of a new technology, arose in the areas of protocols and implementation. The protocol problems, while they did not affect the current users directly, would eventually hamper the evolutionary capability of DECnet. Implementation problems, which affected about one out of 15 DECnet users, mainly concerned inadequate data transmission rates, excessive cpu utilization, and code bugs. We believe that both classes of problems have since been resolved in DECnet Phase II, and most of the original users are still operating their Phase I DECnet systems or have upgraded to Phase II.

Development of Phase II DECnet began in March 1977 and initial products were released to users in the spring of 1978. As of this writing, there are well over 1,000 nodes already in the field. In addition to eliminating Phase I protocol limitations, Phase II provides for general interconnectability among these Digital lines of computers: 16-bit (PDP-11), 36-bit (DECsystem-10 and DECsystem-20), and 32-bit (VAX-11/780).

Software compatibility similarly crosses architectural lines, from the RT-11 single-user real-time operating system to the VAX/VMS operating system for multi-user, event-driven time-sharing, batch, and real-time applications. The VAX/VMS operating system and communications software, in particular, are designed so that the network is totally transparent to the user; other DEC and non-DEC operating systems currently require an explicit call to access remote functions or files.

Digital products are currently available, as of the end of Phase II, to emulate these non-Digital protocols: IBM 2780 (bisync batch for file transfer), IBM 3270 (bisync interactive), HASP workstation, MUX200 for CDC interconnect, and UN1004 for Univac interconnect. Digital has ongoing projects to develop both an IBM SNA protocol emulator, and a network protocol interface based on CCITT's Recommendation X.25 (as described below).

Planning for DECnet Phase III products is now under way with the following goals set for DNA:

Upgrade Phase II operating systems: RSX series, RSTS/E, RT11, VAX/VMS, TOPS-20.

Maintain compatibility of Phase II and Phase III products. Phase III nodes can then be added to Phase II networks without affecting current operation, and networks can be gradually converted to full Phase III DECnet as the user requires.

Add new functions: auto-dial (automatic dialing under program control), multipoint mode (master/slave relationship), and routing (movement of messages by intermediate computers).

THE LAYERED LOOK

The layered organization of its structure, functional modules, and protocols is what lends the DNA architecture its flexibility and evolutionary nature. With the proper interfaces above and below, the modules in each layer can be modified or replaced by other modules that perform the same functions in a quite different way.

Here are the functions of the software modules in the six basic DNA layers (Fig. 1):

User Layer: includes all user-supplied functions. This is the highest layer in the DNA structure.

Network Application Layer: provides the network functions for the user layer. Modules in this layer include network remote file access modules, a remote file transfer utility, and a remote system loader module. The protocol used for remote file access and file transfer is the Data Access Protocol (DAP).

Network Services Layer: provides a location-independent communication mechanism for both the user layer and network application layer. Two network application modules may communicate with each other by means of the Network Services Layer, regardless of their locations in the network. The protocol used between network service modules is the Network Services Protocol (NSP).

Transport Layer: provides a routing mechanism for the Network Services Layer to send a data packet from any node to any other node in the network.

Data Link Layer: provides the Transport Layer with an error-free communication mechanism between adjacent nodes. The data link module implements the Digital Data Communications Message Protocol (DDCMP). Functions provided by this layer are independent of communication facility characteristics.

Physical Link Layer: provides the Data Link Layer with a physical transmission facility between adjacent nodes. Several modules may be specified for this layer (such as RS232C and CCITT), one for each type of transmission facility. This is the lowest layer in the DNA structure.

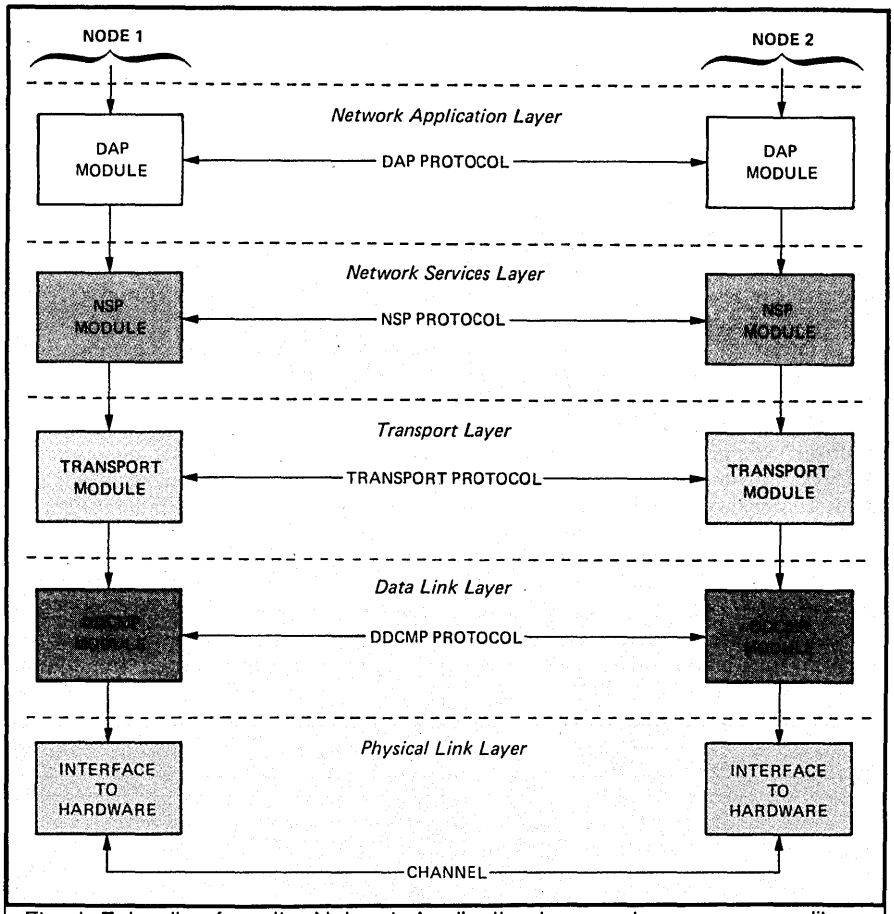


Fig. 1. Extending from the Network Application Layer, where a program like a telecommunications monitor would operate, to the Physical Link Layer, where standards like the EIA RS232C interface operate, DEC's networking architecture includes five levels of "modules" or service providers—six, if the user program level is considered.

Modules may use the services of other modules at lower levels, but not of modules at their own or higher levels. Communications with peer modules at different nodes is handled through protocols which are interpreted by, and intelligible to, only those peers.

Each DNA layer at a typical node includes one or more modules that will provide the desired network services at that node. Some networks will have identical modules in each layer of each node; others will contain nodes with special sets of modules. Each DNA module has an interface that is also defined by DNA, except for the user interface to the network application layer.

There are several structural rules: A module may use the services of a module in a lower layer but not those of modules in the same or higher layer. On the other hand, two modules in the same layer but residing in different nodes would cooperate to fulfill their network functions by exchanging the appropriate protocol messages.

A protocol is a set of guidelines governing communication between two cooperating modules that are in separate nodes but reside in the same DNA layer. A DNA layer processes only the protocol that is identified with that layer; it does not exchange service data or tasks with any other layer.

The protocol is simple in the physical link layer, usually defined by an electrical interface such as EIA RS232C or CCITT v.24. The protocols for modules residing in higher layers are more sophisticated. The DAP protocol for modules in the Network Application Layer, for example, includes the definition of message formats and rules for exchanging messages.

Protocols in DNA are enveloped. As the data passes down from the user layer to the data link layer, modules in each layer add some control information to the data received from the next higher module (see Fig. 2). The resulting packet is transferred across communications facilities.

The way data flows in a DECnet network is determined by a significant characteristic of the two lowest layers in DNA. That is, the modules that reside in the physical link and data link layers provide services only for moving data from a given node to an adjacent node.

This transmission in a DECnet network takes place in a packet-switching

Intermediate nodes concern themselves only with shuffling the packet off to the next station in the line.

mode, over virtual circuits between the source and destination nodes. The transmission path is not predetermined at the source node but is instead the sum of logical decisions made in the transport modules at intermediate nodes.

Based on whatever switching algorithm it contains, the transport module at each intermediate node (such as Node 2 in Fig. 2) selects—under the conditions that prevail at that instant—the particular adjacent node that constitutes the first link in the optimum path to the destination node. Like any packet-switching network, therefore, successive data packets that comprise a complete message may take entirely different paths between the source and destination nodes.

ONE MESSAGE, FOUR ENVELOPES

As each packet percolates down through the layers of protocol from user program level to physical interface level, several headers and one trailer field are added to it.

At the Network Application Layer, where a program like a telecommunications monitor would be operating, a two-field header is added, of which the following Data Message header is typical:

OPER	RECNUM

OPER a one-character field specifying the type of message being transmitted. In addition to the very common Data Message above, others would be configuration messages (identifying the kind of node sending the message), attributes messages (describing the type and format of a file), access messages, control messages, continue transfer messages, acknowledgements, access complete, and status messages.

RECNUM a field of from one to nine characters giving the record number or an equivalent counter, depending on the type of file.

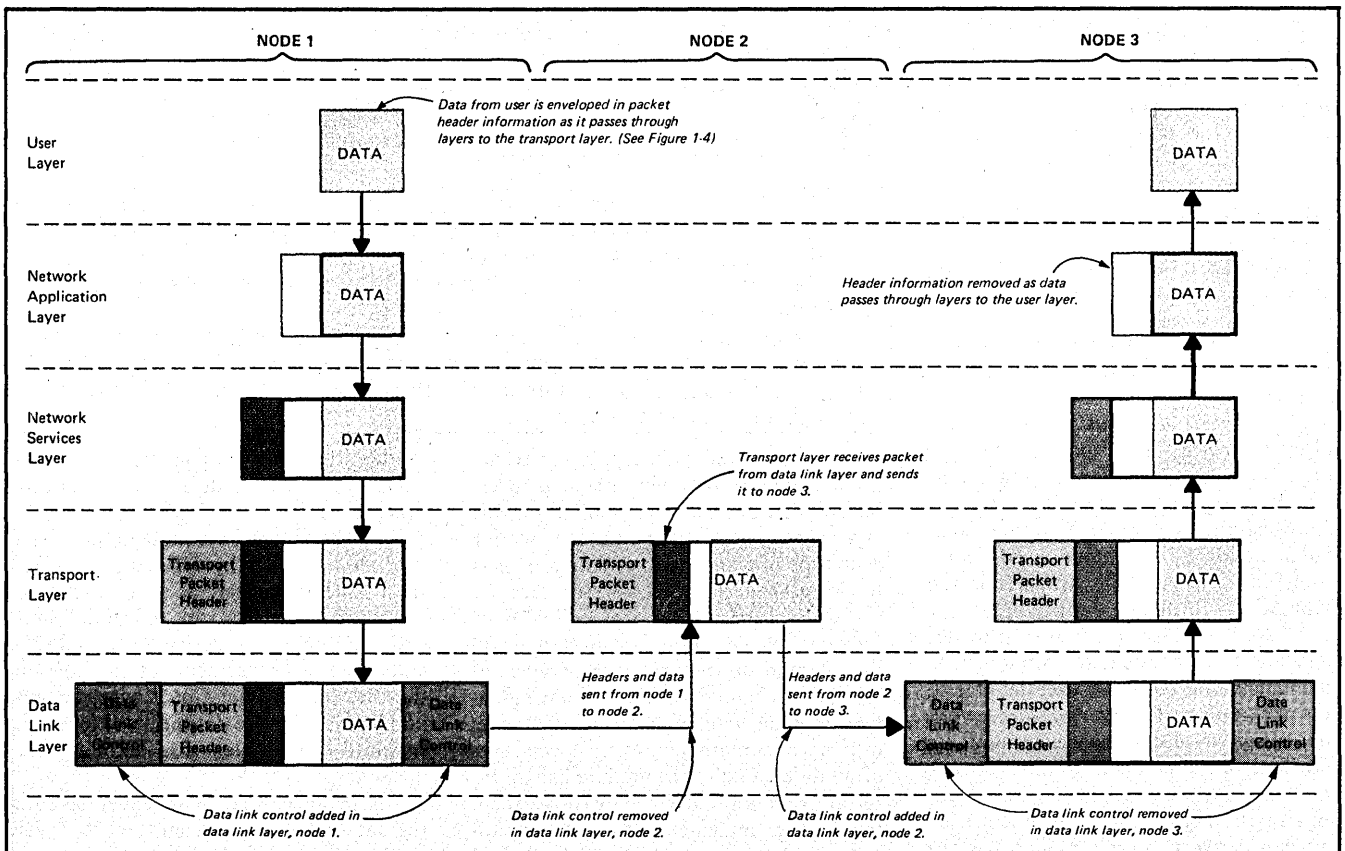


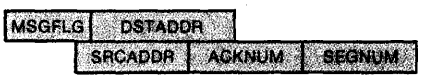
Fig. 2. Here is how a unit of data is transmitted from a user at one node (Node 1) to a user at another node (Node 3, which is not adjacent to Node 1). In the source node (the node in which the transmitting user resides), the user's data is enveloped by several layers of protocol data as it travels through a sequence of modules down into the transport module. The user's data and the protocol data (from the transport layer up) have now formed a packet that will remain unchanged as it makes its way through the network.

When the packet is given to the data link layer, it is further enveloped in data link protocol for transmission to an adjacent node. The node to which the packet will be directed (there may be several to choose from) is selected by the transport module.

In the selected adjacent node (in this case, Node 2), the data link module strips its control header off the packet and delivers the packet to the transport module. The transport module then selects the next adjacent node for the packet and gives the packet back to the data link module for addition of a new data link control header and transfer to the physical link module for transmission.

The process continues until the packet arrives at the destination node (Node 3), where all protocol data is removed from the packet as it travels up through a sequence of modules to the receiving user.

At the Network Services Layer, another communications header is added, of which the following Normal Data Segment header is typical:



MSGFLG a one-character message flag field giving the type of message. In addition to the Data Segment form shown, others would be interrupt messages, link service messages, acknowledgements, connect initiate, confirm connect initiate, disconnect initiate and confirmation, and control messages.

DSTADDR a two-character field specifying the logical address for the destination node.

SRCADDR a two-character field specifying the logical address for the source node.

ACKNUM an optional two-character field carrying the number of the last data segment received, plus an ACK or NAK acknowledgement for it.

SEGNUM a two-character message number.

At the Transport Layer, a third header is appended. Typical of these is the six-character Packet Route header:

RTFLG This one-character route flag field defines whether the message is an alarm message or some other type of header, and what's to be done with the message if for some reason it cannot be delivered.

DSTNODE a two-character field specifying the physical address for the destination node.

SRCNODE another two-character field for the source node address.

FORWARD a one-character field which counts the number of nodes passed in transit from source to destination. (This has several values, including serving as a warning flag if, say, the number of nodes passed is greater than the number of nodes in the network.)

In addition to the packet route header, others at this level include transmission control messages, transmission routing messages, transmission "hello and test" messages, initialization and ver-

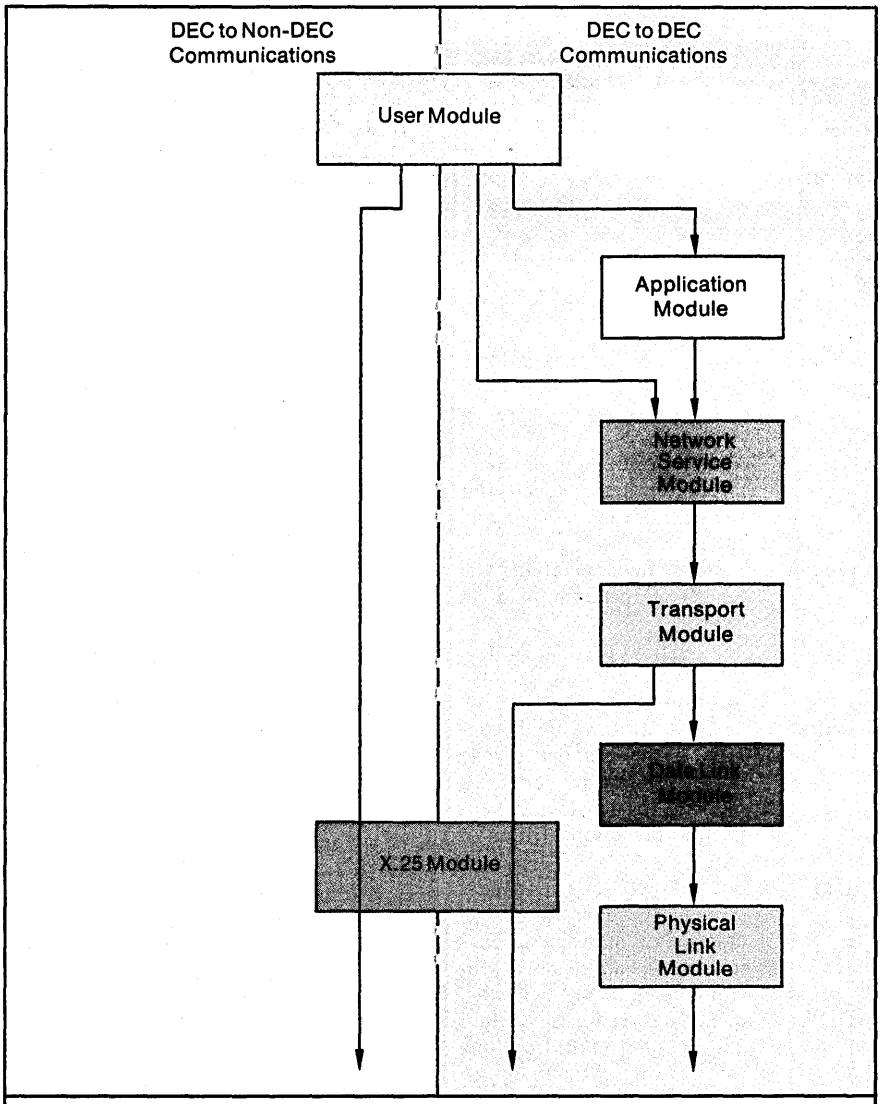


Fig. 3. It is helpful to think of the X.25 interface, which has functional layers very much like DEC's DNA, as a software module called an "X.25 module." The relationship of the DNA-layered structure and the X.25 module can then be diagrammed, as above, for data transmission between a DEC and a non-DEC computer (left) and two DEC computers (right).

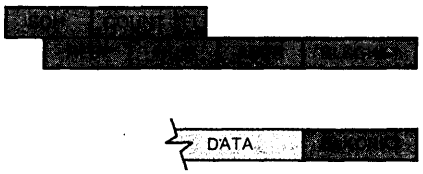
In DEC to DEC computer communication in an X.25 environment, the user data would travel to the transport module as in a DECnet network. (The data may go from the user module to either a network application module or the network service module, depending on whether a file access or program to program operation is involved.) The transport module gives the packet to the X.25 module, where the data link and physical transmission functions are performed.

In a DEC to non-DEC environment, on the other hand, the data packet would be transmitted directly from the user module to the X.25 module. X.25's HDLC protocol performs data link functions equivalent to DNA's DDCMP in providing a sequential, full-duplex data path between a piece of data terminal equipment (DTE) and data circuit-terminating equipment (DCE).

The X.25 module, like the physical link layer in Fig. 1, also establishes the hardware path between the DTE and DCE. However, the end to end communication functions provided by the DAP module in the network application layer, the NSP module in the network service layer, and the transport module in the transport layer cannot be provided by the X.25 module in a non-DEC environment. These functions must be done above the X.25 interface as defined by the packet-switching carrier or by the users themselves.

ification messages.

Finally, at the Data Link Layer, where the DDCMP protocol operates, another header and a trailer are added. The following sample, for a data message, is typical:



SOH — also ENQ or DLE, this is a one-character field specifying the start of the message, and the type of message.

COUNT — a 14-bit field specifying the length of the data field, in bytes.

FLAGS — a 2-bit field used to control link ownership and synchronization.

RESP — a one-character field containing the number of the last correctly received message for traffic in the opposite direction (modulo 256).

NUM — one character specifying the sequence number for a packet in a data message, or having other meanings in a control message.

ADDR — one character for the station address on a multidrop line, this is always 1 on a point to point line.

BLKCHK1 — a two-character CRC block check for the header.

BLKCHK2 — another two-character CRC check for the data.

Unlike the other headers, the header and trailer for the DDCMP protocol are used only between two adjacent nodes. Each receiving node in a chain strips off the existing header and trailer, and—except for the destination node—adds new ones before passing the packet along.

X.25, ACS, AND OTHERS

The continuing value of DNA as a foundation for network software development in general—and ongoing implementation of DECnet in particular—depends on its compatibility with present and future communications services. Its architecture should be such that an organization operating a DECnet-based computer network can interface whatever common carriers and communications media best meet its needs.

The communications services that should be considered include those currently available and new ones such as AT&T's DDS (Digital Dataphone Service) and DSDS (Digital Switch Dataphone Service). In addition, DNA should be capable of interfacing packet-switching networks such as Tymnet and Telenet as well as the potential AT&T ACS offering in the U.S., Datapac in Canada, Transpac in France, and other public packet networks being implemented worldwide. Moreover, whether the physical communications medium is a telephone line, satellite, or microwave link should be immaterial to the user application.

Recently DEC announced steps supporting and endorsing expanded network communications services currently available or projected. Among these was support for international standards. In late 1978, DEC Canada reported that it would implement the X.25 standard for interfacing DEC computers to the Trans-Canada Telephone System's Datapac network.

The advent of Recommendation X.25, a packet-level protocol standard proposed by CCITT (Consultative Committee International Telegraph and Telephony), offers the ability to link computers through any of the various public packet-switching networks, all of which are being implemented with X.25 interfaces. In addition to permitting a choice of packet-switching carriers, the utilization of X.25 within the DNA structure would give DEC users the ability to communicate with other computers linked to X.25 networks (Fig. 3). Also, the initial and operating cost of a network using an X.25-based packet-switching carrier may be significantly lower than that of other types.

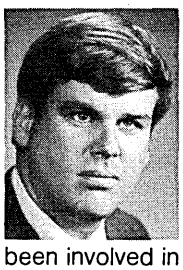
The architectural compatibility of DNA with the X.25 standard is especially important. In fact, knowing that we can integrate X.25 successfully into DNA is what makes us feel confident that we have developed a truly flexible network architecture, and that today's user programs interfacing at either the Network Services Layer or Network Application Layer can be left unchanged when adapting networks to include X.25.

The dp industry will benefit from adoption of public data network facilities with X.25 interfaces through achieving greater compatibility between systems at the message level rather than at the electrical interface level (RS232C), as is now done. Functions provided above the message level interface still will be provided primarily by vendors such as Digital. This, we believe, is the only way users will get necessary distributed data processing functions (such as file transfer, file access, remote loading, and transaction processing) across a vendor's range of products—at least until standards organizations such as ANSI and ISO provide definitions for protocols above the message level. A key role for these groups will be to provide protocol specifications, for functions such as file transfer, that can be implemented between one vendor's system and another's.

We see DNA evolving steadily toward other communications services, including digital transmission, satellite transmission, and public data networks such as ACS. In early January, DEC filed a brief with the FCC in Washington, D.C., urging a favorable ruling on AT&T's proposal to offer its Advanced Communications Service (ACS). DEC stated its belief that ACS is a communications service and not a data processing service; further, the proposed ACS is in the public interest because it will remove the artificial constraints currently imposed on computer users by equipment incompatibility and enable easy communication between computers made by different manufacturers.

When, one day, public data networks and very high level standard protocols are in place and operating, we will finally have divorced ourselves from our crude beginnings in terminal emulation. With the broadening acceptance of protocols like X.25, the provision of public networking services like ACS, and the development of evolutionary networking architectures like DNA, that day may not be far off. ✱

RICHARD A. LOVELAND



Mr. Loveland is software product manager in Digital's Distributed Systems Product Group. He joined Digital three years ago and has been involved in planning and implementing all phases of the DECnet program. Prior to joining DEC, he was a systems analyst manager at Univac, and had done systems design work for large terminal networks at RCA and Programming Sciences, Inc.

Distributed data processing gets center stage as show makes first appearance in a major metropolitan center.

CHICAGO HOSTS BIGGEST INTERFACE

by Tom McCusker

If you're going to distribute data processing functions, you've got to know of the telecommunications disciplines that are involved in the process.

That's the major topic that attendees at the seventh annual Data Communications Interface conference will be addressing next April 9-12 in Chicago's huge McCormick Place convention center. One session at the conference, Ddp Applications Progress, focuses on four applications that together account for "billions of dollars in annual datacomm/ddp expenditures," say sponsors of the conference.

Other sessions address: Ddp Perspectives; Hard Look at Software; New Directions in Network Services and Technology Update which explains how future technology developments, such as microprocessors and huge memory storage devices, will impact the plans of companies in distributed data processing.

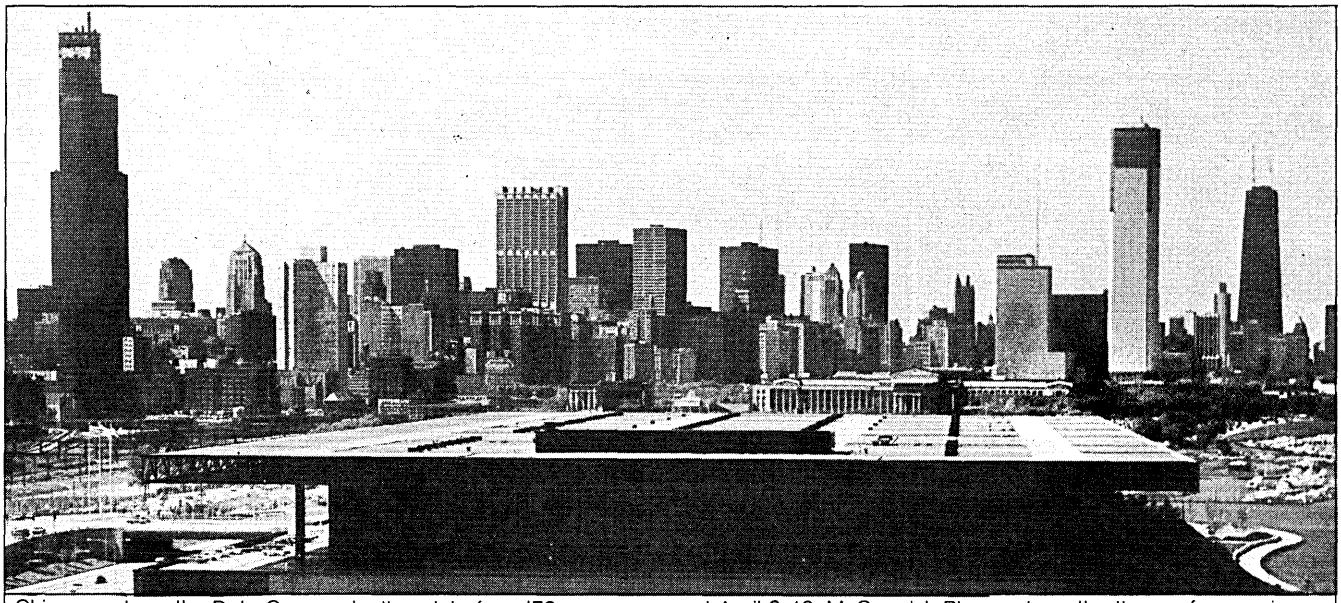
"Our conference is becoming the data communications and distributed data processing conference," said Sheldon G. Adelson, president of the Interface Group, which sponsors the show, now in its seventh year. Adelson said he's found that companies tend to turn over communications functions to the data processing professional because it's easier to teach a dp person telecommunications than to teach a telecommunications person about data processing. "So we're leaning toward the dp side in our conference and in the exhibiting companies that participate in the show," Adelson said.

Although IBM won't be displaying its 8100 series distributed data processing system, many of the 225 exhibitors Adelson expects to have signed up by next month, are involved in some form of distributed data processing. "Nearly all are selling data processing equipment that somehow relates to communications," he said.

Those 225 exhibiting companies are a considerable increase over the 180 companies that exhibited at the last Interface, held in Las Vegas in 1978. Adelson said Interface this year reserved 300,000 sq. ft. of exhibit space to accommodate some 800 booth spaces on the main floor of the McCormick Place convention center. (A plumbing and heating exhibit is being staged separately on the floor below.)

"We're rapidly becoming as large as the National Computer Conference (which last year had 396 exhibiting companies in 1,400 booth spaces) and if we were to locate ourselves in the traditional large population centers we'd get as many people," Adelson said referring to the 57,000 who turned out for NCC in Anaheim, Calif., last year.

But Adelson, whose previous conferences were in such places as Dallas, New Orleans, Miami, Atlanta and Las Vegas, says he prefers to hold Interface conferences in so-called "magnet" locations. That, he said, provides highly qualified attendees—people with enough clout in their companies to travel distances to get there. Chicago is the first large metropolitan area to host Interface. That's why the sponsors think the turnout may reach 13,000 to 15,000 because the city has the largest number of *Fortune* 1000 computer sites and the second largest collection of computer sites in the nation, even though it has a very small number of computer



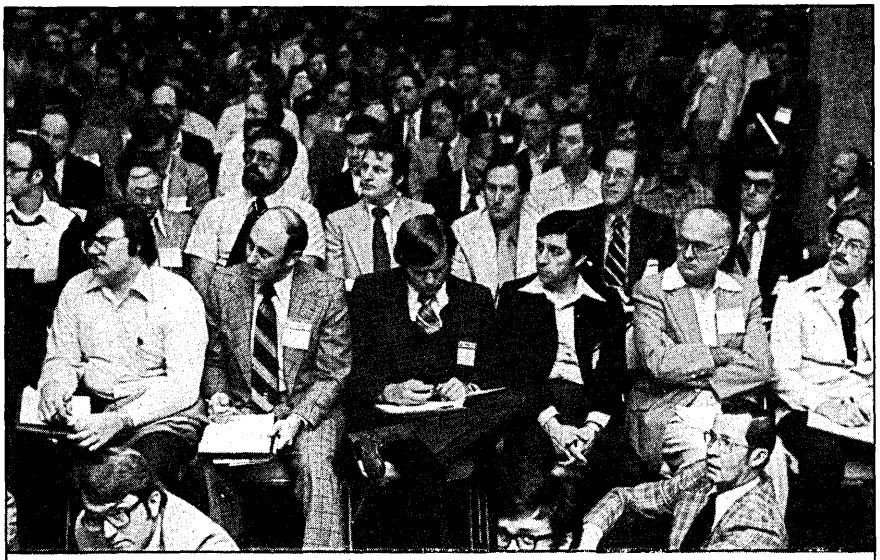
Chicago, where the Data Communications Interface '79 conference and show hopes to draw 13,000 to 15,000 persons next April 9-12. McCormick Place, where the the conference is held, is in foreground.

manufacturing companies.

Adelson, whose turnout at Las Vegas last year was about 9,000, expects a smaller turnout next year when the show and conference moves back to Miami. But then, he said, "Who knows, the way the industry is growing we could get 20,000 persons to travel to Miami."

He calls the smaller outlying locations "magnet" cities because he says the attendance reflects the computer population from around the nation. "There is 7.9% of the computer industry in New England and last year New Englanders represented 7.8% of our turnout." The number of persons who could profit by attending an Interface conference is anybody's guess, Adelson says. "It could go as high as 100,000 or as low as 50,000."

In any case, the estimated 13,000 to 15,000 expected at Chicago are offered an informative conference with most of the blue chip vendors in the exhibit. Although IBM's Data Processing Div. won't be showing its 8100, the IBM General Systems Div. will be there, probably hawking the Series/1 minicomputer and System 38. Other large computer manufacturers exhibiting include Control Data Corp., Hewlett-Packard Co., Honeywell, NCR Corp., and Sperry Univac.



Standing room only crowds flocked to Las Vegas last year for Data Communications Interface. This year's turnout in Chicago is expected to surpass last year's.

SCHOOL PLEASES CROWDS

A crowd pleaser at the conference is the annual DataComm School, which offers the basics of data communications during a six-hour session. The subjects include fundamentals of data communications, understanding communications processors and software, basic terminals and terminal systems, and networking and distributed data processing.

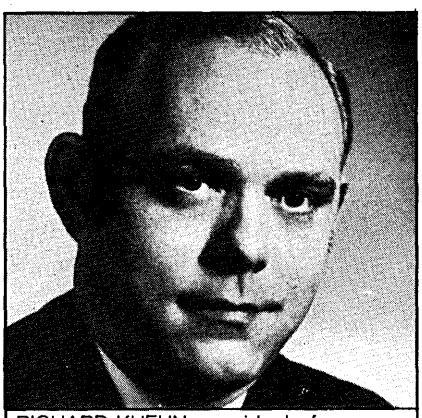
Networking and ddp will provide attendees with information on how they should use the old trade-offs between centralized and distributed processing or between a private and a shared transmission facility. It is aimed at persons seeking to tailor a network to their own special requirements. The trade-offs, the show sponsors say, are no less relevant today than they were several years ago, even though the range of possible solutions has broadened considerably.

Other subjects at the school: an explanation of how terminal categories such as intelligent and dumb are being eroded under the pressures of microelectronic chips; remote communications processors will be explained by examining the most common telecommunications access methods and the control programs they implement, and a nontechnical session will orient newcomers to the basic hardware and software building blocks of data communications.

Will the data communications manager be the one who'll control the movement of businesses into the so-called automated office? A market research company is quoted by the Interface sponsors as saying that by 1982, annual sales of automated office system elements will reach $15 billion and that most of these systems will be linked by communications. The data communications manager, the sponsors say, likely will be in control. Among the subjects to be addressed in this session are: "Message Communications: The Forms and Flow of Information"; "Electronic Mail: Current and Future Implementations"; "Telecommunications Tools for the Office," and "Facsimile Systems and Services."

An examination of the communications service companies also is scheduled. One session, on shared services, examines the new services offered by time-sharing firms such as information retrieval, economic models, physical simulations, cross-assembly and compilation. For many prospective users, the Interface sponsors say, time-sharing remains a viable alternative to a complex in-house system.

More alternatives also are being offered by the common carrier services in varying stages of use and development. The conference will provide attendees with "experts" to guide them through the many and complex offerings. Another subject to be discussed in the services session is Network Management Services, which Interface sponsors identify as an extension of the single vendor "turnkey" responsibility for an edp installation. Network management services simply extend this traditional concept into the arena of



RICHARD KUEHN, president of RAK Associates, Cleveland, has helped firms create their own communication departments.

RALPH G. BERGLUND, Berglund & Smith and DATAMATION consultant, a management and technical consultant in data communications.

RICHARD L. DEAL, president of Richard L. Deal & Associates, specializes in systems planning and design activities for clients.

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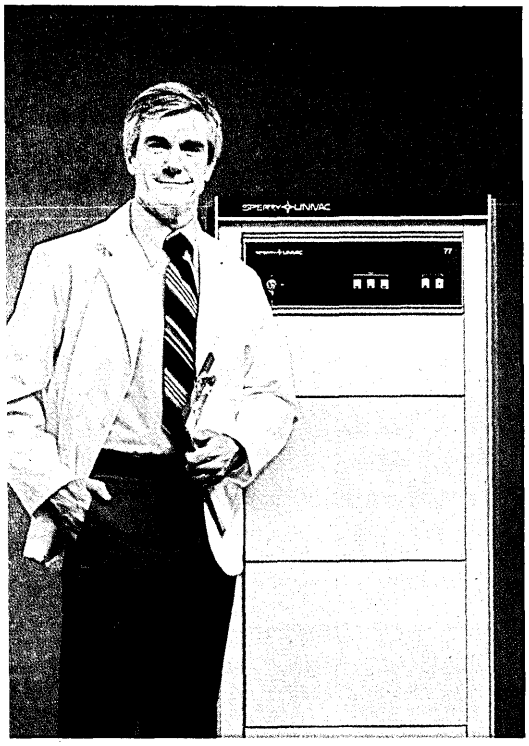

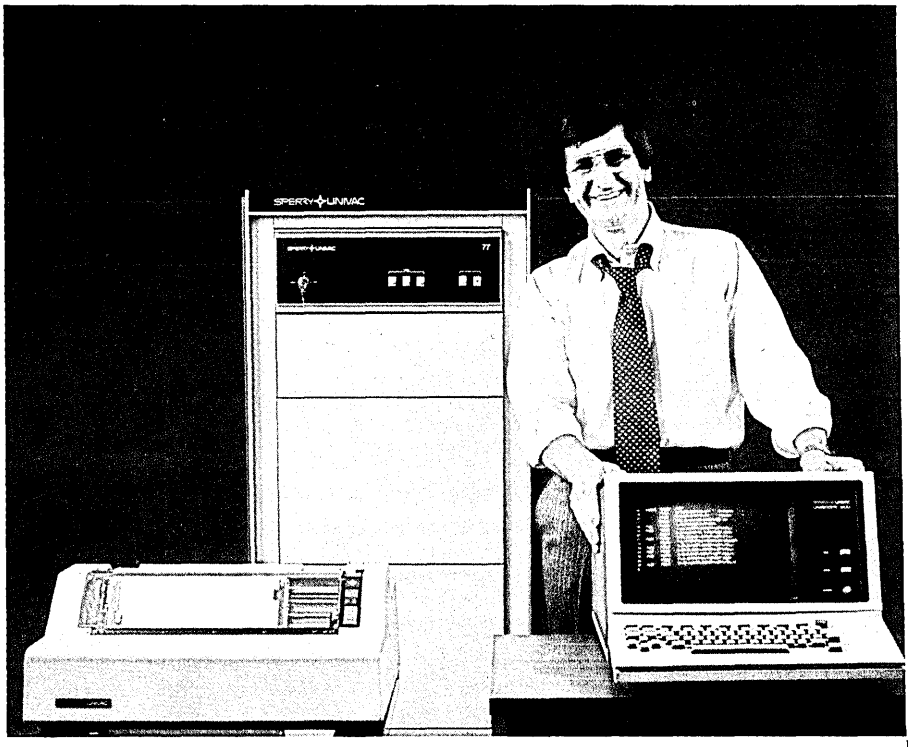

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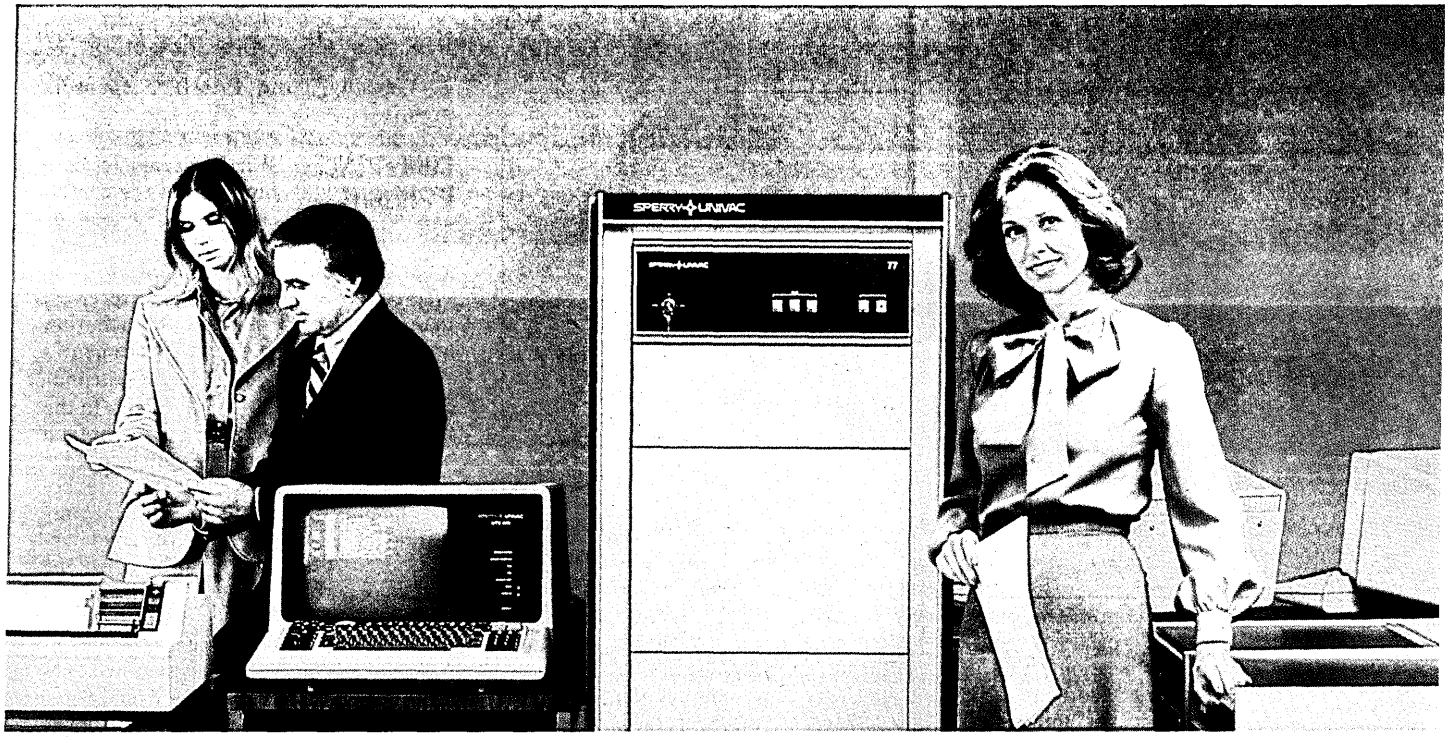

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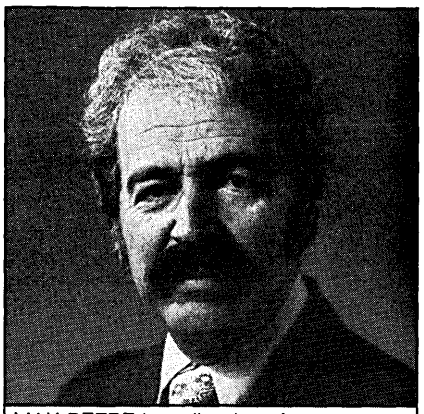


MAX BEERE is a director of telecommunications planning at TRW Electronics in Los Angeles.

DIXON R. DOLL, president of DMW Telecommunications Group, is expert in design, planning and implementation of advanced communications systems.

day-to-day communications operations.

A HARD LOOK AT SOFTWARE Another session takes a hard look at software as it relates to the implementation of complex distributed data processing systems that usually involve access to very large data bases. At stake, say the Interface organizers, is nothing less than the creation of an additional level of software in which the entire network is considered as "the system," integrating and evaluating numerous subsystems for optimal performance. A session on Network Operating Systems, for example, will provide for a discussion on general purpose network operating system tools now commercially available. Another session, on communications monitors, will examine the special tasks demanded of communications monitors, the way they handle these tasks, and the manner in which they interact with other higher and lower level control software.

Another aspect of the software session will be the data communications perspective concerning DBMS. File structures, query languages and data element dictionaries will be examined from the perspective of data communications managers. Software for evaluating and diagnosing performance also will be examined as attendees will be asked to consider whether bottlenecks in their systems result from being "I/O bound" or "compute bound." Is some combination of larger processor and more or faster lines required for greater performance, or could existing resources be reallocated to achieve the same level of enhanced performance, the speakers will ask.

Microcomputers, fiber optics and communications satellites will be discussed in a session called Technology Update, which the Interface sponsors say will be aimed at trying to prevent data communications professionals from suffering severe cases of "future shock." Participants in the session will try to give attendees "a penetrating look into the crystal ball."

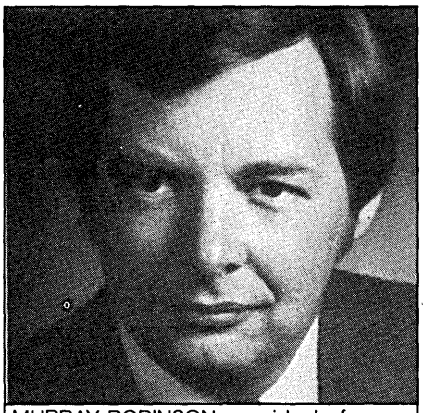
For instance, microprocessor technology is moving so rapidly that what was available yesterday often provides little indication of what's on tap for tomorrow. The same for fiber optics. Fiber optics cabling is playing an increasingly important role in data communications but before anyone jumps in, they should be apprised of current and near-future applications which this session promises to provide. A "blue sky" discussion on the next ten years in data communications, presented by consultants in the field, should "arm attendees with a modicum of Distant Early Warning," the Interface sponsors promise.

CONFERENCE HIGHLIGHT What appears to be a highlight of the conference is the session on ddp applications progress in which presentations will be offered on ddp in financial services, manufacturing, retailing, distribution and transportation, and in government.

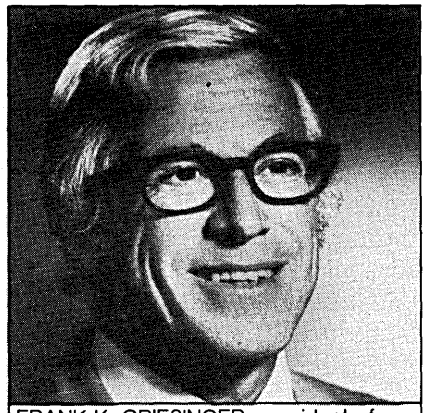
Experts will speak on the distributed computing concept as it applies to the financial community such as in branch banks, brokerage houses and insurance companies whose requirements are becoming more critical for real-time, transaction-oriented networks with remote access to large data bases. There will be discussions about what is transpiring in specific installations. Ddp in manufacturing will involve talks on the use of job entry terminals on the factory floor to executive-level data bases for the front office. The Interface organizers say their experts will discuss present technology in terms of very real case histories. The same thinking will hold in the discussion of distributed data processing in retailing and related businesses, where many thousands of discrete items must be tracked at all times through the long pipeline from numerous factory locations to regional warehouses.

Government agencies at all levels are moving into ddp networks as a way of bringing more services to more people with greater efficiency, according to the Interface planners. They promise guest experts who will discuss the "stormy but promising marriage" between the latest in data communications and government bureaucracies.

Registration fee for the four-day conference and exhibit is $95 ($60 for a single day). A lower rate ($60 for four days and $30 for one day) is being offered to companies who send three or more persons—it applies to the third or more attendees who register before the show opens. More details are available from Interface '79, 160 Speen St. Framingham, MA 01701, or by calling (800) 225-4620 (in Massachusetts (617) 879-4502). ✱



MURRAY ROBINSON, president of Murray H. Robinson & Associates, Ltd., Ottawa, provides telecommunications management and technical consulting.



FRANK K. GRIESINGER, president of Frank K. Griesinger & Associates, Inc., specializes in telecommunications cost control and service improvement.

ROBERT J. KAUFMAN, data communications manager with Damon Corp., Needham Heights, Mass.

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CHINA

AUGUST '79

The Chinese are at least a decade behind in computing, but vow to catch up by the end of 1999.

SNAPSHOTS OF COMPUTING IN CHINA

by Donald J. Reifer

China, vast, populous, ancient—the empire that built a 2,000 mile wall to keep foreigners out in the third century B.C. and has been partly or largely closed to outsiders ever since—is opening its gates and moving to join the modern world. A realm of 950 million people, China was 2,500 years old when Marco Polo revealed some of its secrets to the West; the nation's borders have been closed several times since then, and almost totally secured since its communist government came to power three decades ago.

Now, anxious to close the gap that separates it from its more industrialized neighbors, the country is inviting visitors —especially those who can help speed its learning—to see its industry and its level of technical development. With no advanced technologies to risk by full disclosure, the country's computer installations and factories are being opened for technical inspection. What that inspection shows is China must skip at least a generation of computer development to bring itself abreast of the rest of the world.

For a nation whose last well-known technical innovation was the development of gunpowder, this will be no little task; nor do the Chinese naively believe it will be. The goal of the People's Republic of China is technical equality by the beginning of the third millenium A.D., 21 years from now, and, from our recent observations, we'd say that goal will very likely be met.

What foreigners soon appreciate on visiting today's China is that the country is embarking upon a major industrialization program such as the West hasn't seen since the turn of the century. The Chinese recognize that there is a serious lack of computer power within the nation which will take many years to correct.

Although the Chinese have produced over 30 different models of computers, their installed base is approximately only 1,000 units, about half of which are used in military applications. Some of these units are powerful, but their effective utilization is hampered by limitations in communications and peripheral technology. The reliability of these machines is also adversely affected by poor packaging, inadequate quality control, and a lack of standardization.

These were some of the findings recently made by an IEEE delegation which visited 15 computer factories or installations during a three-week stay late last year. Other major findings were that the lack of adequate I/O and peripheral devices is considered to be China's number one problem. Specifically, the use of paper tape as the *primary* input medium, and the lack of large, fast disks are the first problems the Chinese feel must be dealt with in the near term.

On the other hand, the Chinese are not yet experiencing major software difficulties. But this situation will change as batch operating systems are replaced by virtual storage systems with teleprocessing options. The Chinese realize they will have a software problem and are already taking steps to cope with it, but in the end, production of large software systems might well be the challenge that determines whether Chinese goals are met by the year 2000.

Our delegation spent its time in the far, far east, the Pacific face of the country, as the western two-thirds are more agricultural (80% of the population lives in the countryside). Visits were arranged in Peking, Nanking, Shanghai, and Canton.

Our first technical visit was to Tsinghua Univ. in Peking, and the meeting set the pattern for what we were to experience through the rest of our trip. It began with our hosts briefly describing the history of their facility, then a tour, and ended with a question and answer session. The meetings tended to be formal, but the atomsphere was friendly and the people were open.

Tsinghua Univ. was built in 1911, and was small prior to the communists' rise to power in 1949. It is presently in a state of change. During the "Cultural Revolution," the Chinese educational system was practically destroyed. Examinations were abolished. "Elitist" subjects such as scientific research were stricken from the curriculum. Entrance to universities was governed by politics, not ability. Western-educated professors were criticized and sent to work in communes.

All this has changed over the last two years as Chairman Hua has attempted to revamp the educational system. University admission is again based on examination, and the curriculum has been broadened. The universities are being expanded and laboratories being built or rebuilt. The Chinese wish to train 800,000 engineers and scientists by 1985. A large number of new teachers are being trained, existing faculty members are having their skills updated, and the education level of students entering the universities from the middle schools is being improved.

We were told that the Chinese will be sending their best students to Canada, England, Germany, Japan, the United States, and also to other communist countries to study various technical disciplines. And the Chinese seemed always curious about which U.S. schools were best for computer science. Three typical "students" we met, who were scheduled to study at Stanford, were older than average American students (about 35) and more experienced (having spent about 10 years in their fields). Probably these early students will return to their native land to serve as teachers.

We were taken on a tour of the li-

brary at Tsinghua as well as the labs there. The library had a full complement of technical journals and magazines (including DATAMATION), although copies were either three-month-old originals or six-month-old reprints. The publications were from the U.S., the U.S.S.R., Japan, and both Germanys.

The first laboratory opened to us was the computing lab, where a DJS-130 computer generated a welcome on a crt. Input to the system was paper tape punched on an ancient looking typewriter-like device. The 130 is a 500,000 operations per second (500KOPS) computer with a Nova-like instruction set and memory capacity of 64K (16-bit) words. Access time is 2usec.

The DJS-130 was built at the university, in fact, and there are 15 of them in use there. The machine was reported to have beed designed by a cooperative team from seven different institutes and universities, and went into production in 1976 in Peking, Tientsin, Shanghai, and other cities simultaneously. In keeping with a national goal of self-sufficiency at the provincial level, each of the locations builds its machine independently from the same drawings. Languages available on it are ALGOL 60, BASIC, and FORTRAN IV.

SOLD BY SUNSHINE

Within the lab we also saw four other 130s connected to a new digitizer they were experimenting with. Still another was connected to a Bulgarian-made disk. The disk was in a clean room, and torn apart, apparently being inspected in great detail.

More surprising perhaps was the Cromemco System 3 sitting in one corner. It had 32K of RAM, four 8-inch disks, a Lear-Siegler crt, and a Centronics 779 printer. The system had a sticker on it saying "Sold by Sunshine Computer" (a Los Angeles computer store).

Other labs at Tsinghua were working on LSI masks and lasers. The mask generation was being done with red light, for a 1K NMOS RAM to be used in larger computers; but we saw no furnaces or production equipment. The laser lab was working on fiber optics (of low quality, with 20% loss over 1,000 meters), on holography (for storage of 20 images on one film), and on a three-color laser (red, green, and blue).

We visited the Computing Center of the Academy of Science in Peking soon afterwards. The center is a new one and has seven computers, the most interesting of which was the rather modern Model 013. The 013 has been operational for about two years. It's a 2MOPS 48-bit machine which employs small scale integration and ECL logic. Its achitecture is based on two accumulators, 16 index registers, and a pipeline processor which stages 13 instructions at a time (five of which are simply being queued and another five of which are in the lookahead unit).

The system has a set of 96 instructions and is intended for scientific workloads with floating-point operations. I/O is only through the channels, as there is no direct memory access. Three levels of memory are provided: 128K words of 1.5usec core with Hamming error correction; 140K words of 400nsec ROM for parts of the operating system; and 512 words of 300nsec thin film used as a cache (which isn't yet highly reliable).

The system's disks were of the 20-surface variety, with access times of 50msec, storage of 10MB/drive, and two drives per enclosure. Also attached were four 60 lpm line printers, eight tapes (the Chinese use 16-track, 20-bit/mm versions), four paper tape units (8-track), and two crt's. There are no graphics peripherals or telecommunications hookups.

Software capabilities include a FORTRAN IV, BCY (a Chinese variant of ALGOL 60), and a uniprocessing operating system.

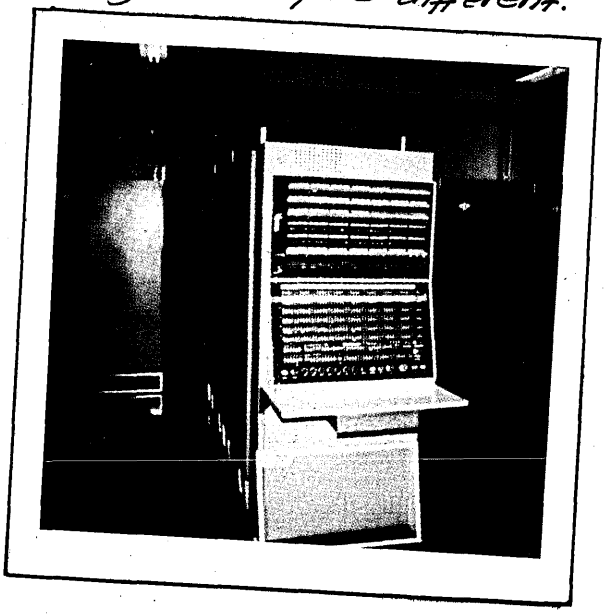
All in all, the 013 looks like a fairly late computer, but it hasn't yet been built in any numbers.

The Peking Wire Factory was the last site toured in that city. Originally opened in 1957 to produce automatic telephone exchange equipment, by 1958 it had already begun to ship vacuum tube computers copied after the Soviet BESM-2 and M3 machines. Second generation machines were produced in 1967, and third generation production began in 1976—all without the benefit of automatic wire wrap machines or other automation luxuries.

The factory began production of the DJS-154 last year, and is producing them at a rate of 60 per year. The 154 is described as general purpose, but its primary use is in process control. It has both analog and digital I/O, 16K to 32K 16-bit words, DMA plus two programmed channels, and a 4.8usec add time. Available software includes FORTRAN, BASIC, ALGOL 60, an assembler, and a real-time operating system.

Chinese tape drives look like ours but record on 16 tracks at 20 bits/millimeter.

Model 013 — one of China's most powerful home-growns. Resembles IBM 360 outside, but guts are quite different.



FIRST OF A NEW LINE The factory also began production of the DJS-220 this year, one of China's newest machines. Described as a 32-bit general purpose system, it is said to run at 150KOPS in floating-point mode, and to have two types of channels (one multiplexed and the other a patch switching channel for block transfers), plus double-precision. But its memory is core and is presently limited to 64K due to design problems. There are no disks and no software yet.

Both the 154 and 220 are microprogrammed, but no user-programmable microcode is included. Both use drum memory (fixed head, 20msec access, 1MB to 4MB) and large, two-layer circuit boards which look much like those once used in IBM's 709. Their mixture of old and new probably best typifies China's current technology. The newest of the pair, the 220, was said to have been designed in two years—by hand.

Three other models of the 200 Series have been designed, all of which share the microprogrammed set of 192 instructions, instruction sizes of 32 bits, and nominal word sizes of 64 bits. The other models are the DJS-210 (100KOPS, 16 bits, designed in Nanking), the DJS-240 (400KOPS, 64 bits, being designed in Peking), and the DJS-260 (1,000KOPS, 64 bits, design of which is just being started in Peking).

Operating system kernals for the 210 and 220 are the same, in spite of the difference in physical word sizes; for the 240 and 260, they are different, even from each other. Compilers and applications programs are supposed to run on all four models.

The Nanking Telecommunications Factory was as interesting for its use of computer products as for its production of them. Originally a facility for building telephones, its main product now is a 960-channel carrier communication system. The plant also produces small calculators, desk-top calculators, general purpose computers, real-time control computers, and peripherals—the most interesting of which was a black and white graphics display complete with light pen.

The CTJ-1 desk-top calculator looked like a Chinese version of a Tektronix calculator. Developed in 1970, the system is still being produced. According to our host there, the continuing demand for the old product is due to its high reliability. The unit has a 512 x 4-bit RAM, is programmable in up to 128 steps, and uses either paper tape or keyboard input.

Also in process in various labs there were a DJF-II-8 control system for the Peking subway, and a Model 702 computer which is used in a weather radar application. The latter machine is not a left-over from IBM's first generation, as its number suggests, but a 24-bit, 8K word machine built using small scale integration.

A GRAPHICS TERMINAL? The graphics terminal did seem a bit out of place, like a third-generation product in a second-generation world, but belied its origins under a closer inspection. It had some limited intelligence, being capable of performing trig and scientific functions, had 1,024 x 1,024 screen resolution, the light pen, and 4K to 8K words of memory—core memory. Most of its processing power came via the DJS-130 to which it was attached.

More crt's were seen at the Shanghai Radio Factory #13. These were Model XS-1's and had character generators instead of vector generators as the one in Nanking had. (Incidentally, the "Radio Factory" designation is common, and does not necessarily relate to the factory's product line. The Shanghai factory was constructed in 1966 specifically to manufacture computers. As far as we were able to determine, no radio has ever been built here).

This particular "radio" factory produces a wide range of dp products, which are available with an assortment of peripherals. Those in production include:

TQ-6: A large scale computer rated at 1,000KOPS.

TQ-16: A small TTL computer rated at 110KOPS, It uses 32K words of 48 bits, has a 2usec cycle time, and runs ALGOL 60. The one seen on the floor had attached to it a 3,600cps paper tape reader, a teletypewriter (10 lines/sec, 80 chars/line, non-ANSI), a drum (1Mbits, fixed-head), two 16-channel tapes, and an x-y plotter.

TQ-5A: Somewhat faster that the TQ-16, at a rated 160KOPS, these are apparently available with tape, paper tape, raster scan crt's, and drum printer (Model JY80). Their memory size is like that of the TQ-16, 32K x 48 bits.

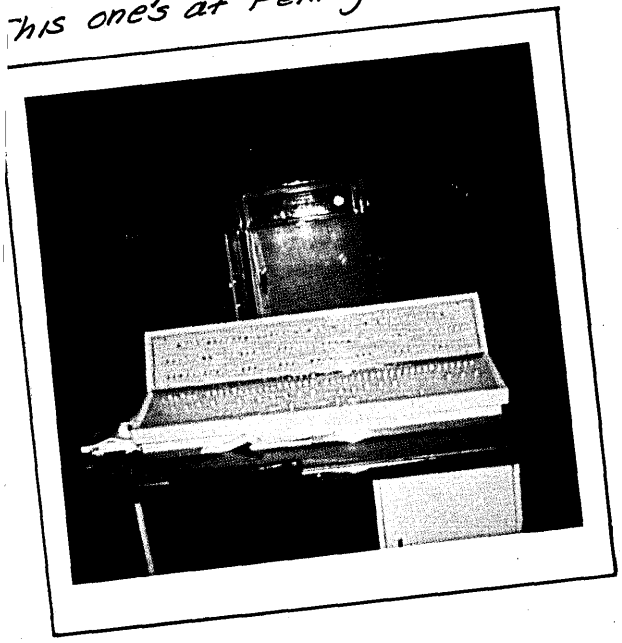
TQ-21: This is a desk-top calculator available with up to 4K of memory (10-digit words).

DJS-131: Like the 500KOPS 130 seen previously, but with DMA.

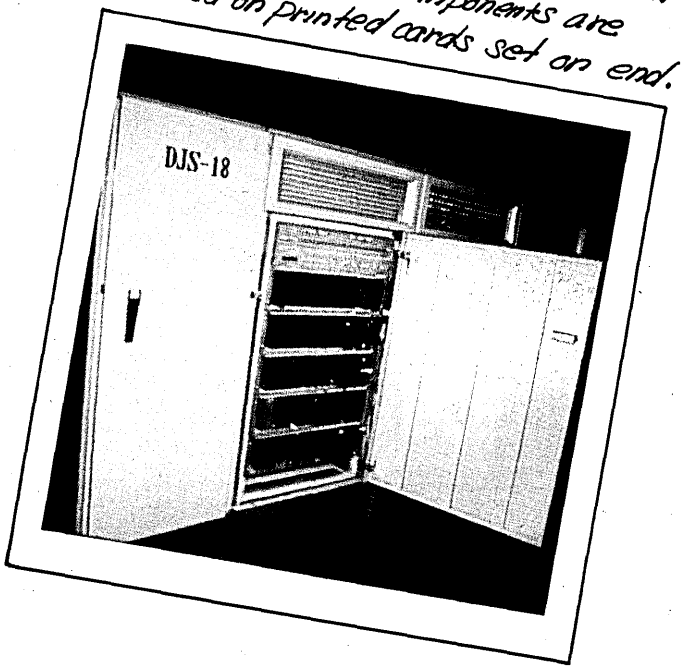
DJS-220: Part of the new 200 line, this model also is only in trial production.

All of these current models continue to use core for main memory, and the cores themselves are not unusual in any

DJS-18 looks like second generation machine done one generation later. This one's at Peking University.



Another view of the DJS-18. Small scale integrated components are stacked on printed cards set on end.



way, except perhaps in how they're strung. They are 0.8mm in diameter (0.55mm inside) and are wired into 3-wire, 3D planes by hand—without even the aid of magnifying glasses.

In fact, we were everywhere struck by how much of the production of the latest Chinese dp equipment is done by hand. The real-time control computers, for example, are not used to automate computer production. And seldom is that manual production done in clean rooms, even for integrated circuit manufacture, where yields of 1972-vintage devices are only in the 30% range. All in all, the production methods employed are about a generation behind those of the West. Another example of this is that the IC's weren't being tested until after packaging, at which point 50% were found to be faulty. The Chinese recognize the limitations of their current production methods and are taking steps to improve them.

Methods, facilities, and quality control procedures will all have to be improved before the Chinese are able to produce even medium scale integrated circuitry, and it is clear that they would prefer to skip directly to LSI, leapfrogging a generation in circuit technology as well as in computer geneology. Once the chips are available, improvements in packaging techniques and automation (wave soldering, automatic wire wrapping, etc.) will be required.

In parallel, they'd very much like to push ahead in memory development as well. They seem to be looking hard at semiconductor memory technologies, but no work in this area is evident, nor in bubbles or laser stores.

THE DJS-100 AND DJS-200 SERIES

Model	Speed	Word Size	Memory Size	Access Time	Status
DJS-120	200KOPS	16 bits	32K words	4.8usec	Produced since 1975
DJS-130	500KOPS	16 bits	64K words	2.0usec	Produced since 1975
DJS-131	500KOPS	16 bits	64K words	2.0usec	Produced since 1977
DJS-154	200KOPS	16 bits	32K words	4.8usec	Produced since 1977
DJS-210	100KOPS	16 bits	?	?	In development
DJS-220	200KOPS	32 bits	32K - 64K	?	In alpha test
DJS-240	400KOPS	64 bits	?	?	In development
DJS-260	1,000KOPS	64 bits	?	?	Being designed

The DJS-100 series, although now obsolescent, is still being produced. The line is microprogrammed and has direct memory access only in the 1977 versions. It uses an instruction set like that of the Data General Nova, and has a real-time executive plus ALGOL 60, BASIC, and FORTRAN IV. No disks or card peripherals are available.

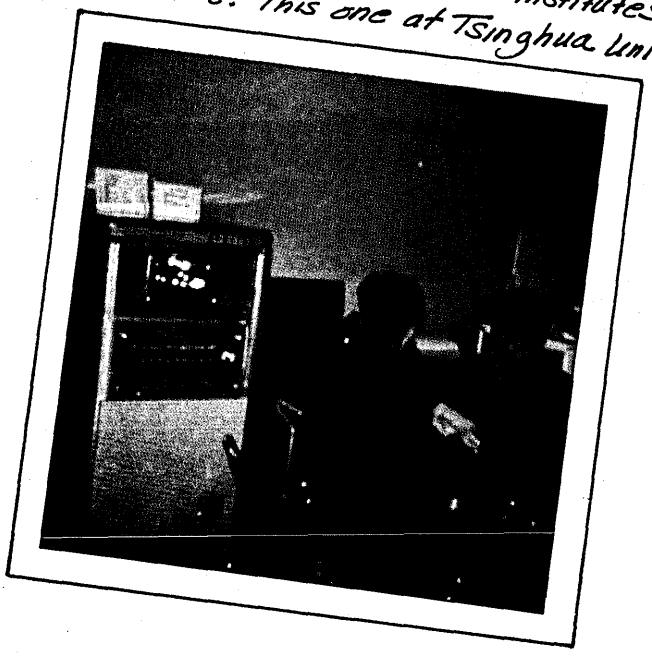
The DJS-200 has its own microprogrammed instruction set, which is not compatible with any other, including that of the DJS-100. Only batch operating systems are provided, and these are complemented with five compilers—adding COBOL and SPL to those on the 100 line.

No work on microprocessors is visible. Yet everywhere we visited we were asked, "How will microprocessors influence fourth generation computer architectures," or, "Can you build a supercomputer by interconnecting multiple microprocessors in a distributed network?" The Chinese consider that they might use micros to develop supercomputers, since that would not require a large work force of technically trained personnel or a new technology base; but they are beginning to understand the software complexity this would lead to.

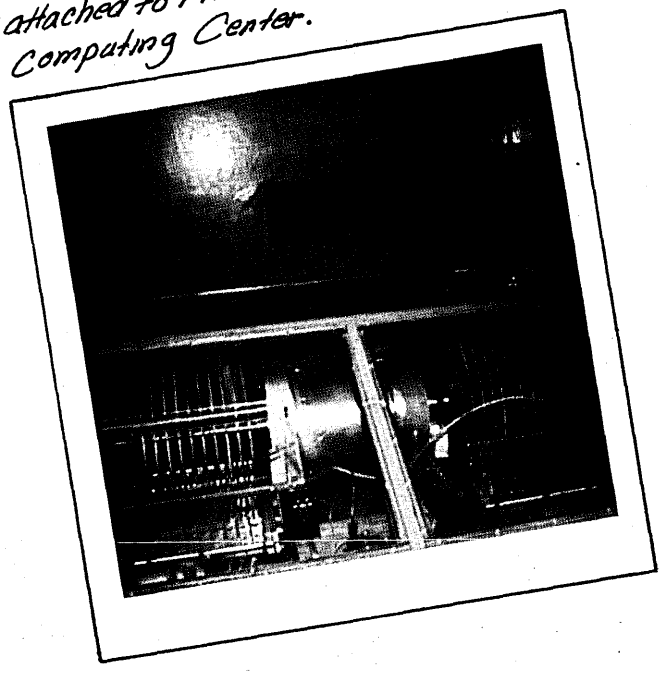
The Chinese have constructed several powerful computers of the TQ-6 and Model 013 series, but they have none which rival the large machines made in the West. Where they need more computer power, they go outside. For instance, one of the computers in use at Nanking Univ. was a French SETI PALLAS computer (28-bit word, 32K memory) tied to a British tape unit, French line printer, IBM terminal, and two Chinese paper tape readers. That PALLAS is now too small for the applications it processes, and the university is looking at buying an IBM 3032 to replace it.

Primary applications cited for large machines were in seismic research and weather prediction (thus far, large scale machines are not yet used in state planning). For these uses, too, the 3032

DJS-130 is Chinese mini independently built in 7 different institutes & univ's. This one at Tsinghua Univ.



Only mass storage system we saw in operation was this paired disk attached to Model 013 at Peking Computing Center.



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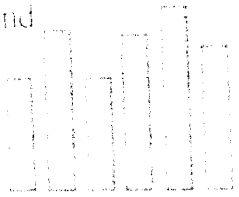

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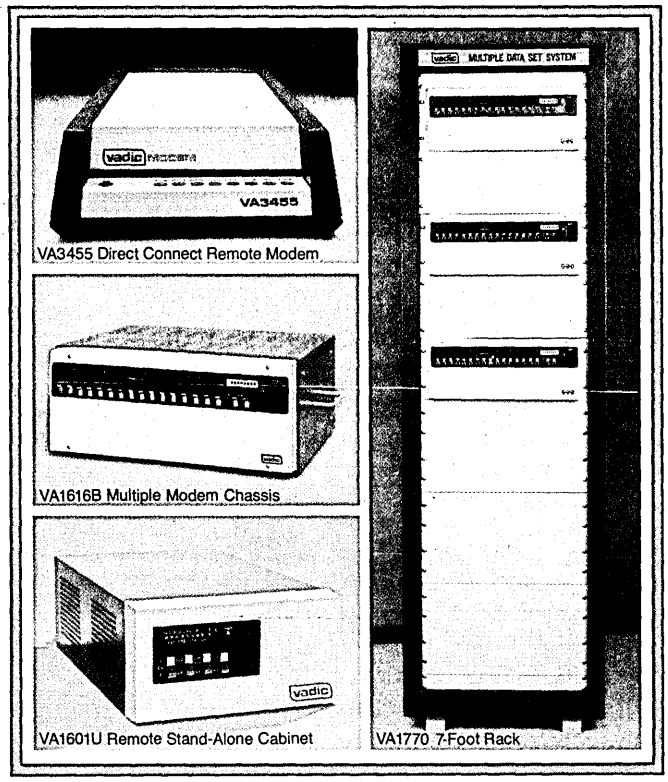

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CARDINAL DATES IN CHINESE COMPUTERS

1958	FIRST COMPUTER, BASED ON URAL-2
1962	FIRST NATIONALLY PRODUCED COMPUTER
1965	FIRST SOLID-STATE COMPUTER
1970	FIRST IC COMPUTER
1976	MOST POWERFUL COMPUTER (MODEL 013)
1976	DJS-100 (DJS-120, 130, 131, AND 154) SERIES
1977	FIRST MICROCOMPUTER (DJS-050)
1978	DJS-200 (DJS-210, 220, 240 AND 260) SERIES

was under consideration, and an IBM delegation was supposed to have visited China last November to discuss potential sales.

Some outside firms may be reluctant to sell small quantities of products to China until the country subscribes to international patent protection agreements. On the other hand, there is some evidence that the Chinese do not copy even as much as they should. For example, the new DJS-200 line has not been made IBM compatible, though that would open a wealth of software to them.

Still, the lack of adequate I/O is probably even more of a problem than the lack of large machines or the lack of software. We saw no card readers, and few crt's. Output devices were confined to line printers and plotters, and the printers were slow and noisy. There were no interactive program development stations, no teleprocessing hookups (which may be just as well, since the communications lines are not there to support them).

The primary mass storage device is the fixed-head drum. The only disk we saw in operation was the single 20-megabyte system at the computer center in Peking. The Bulgarian disk lying dismantled in the clean room at Tsinghua Univ. suggests they are trying to correct that situation, however, and that they are willing to copy what they choose to.

To make up for lost time, the Chinese will probably emulate Japan in order to take their giant step forward by the year 2000. The Japanese model will have to be greatly modified in the aspect of automation, however, because the Chinese expect to maintain full employment for their large population. Fortunately, the Chinese have one big advantage: oil and other natural resources.

We can expect the Chinese to organize their industry, like Japan's, in a way to minimize competition. They will then leverage their resources—including oil and buying power—to purchase the technology they need until they develop their own.

They will send their best people to our universities, enter into joint ventures with our high technology firms, encourage technically trained overseas Chinese to return home, and establish trade agreements with the West.

As part of this program, the CES, the Chinese equivalent of the IEEE and our host during our visit, has suggested the IEEE work with them on a cooperative plan to increase intersociety communication and to encourage leading technical people from different U.S. universities and industrial firms to come to China to live, work or teach. Three proposals were made: (1) Prominent computer industry personnel would come to China to lecture for several weeks (travel expenses paid by the lecturer, sight-seeing in China paid by CES; (2) professors and researchers would teach or work in China for several months (all expenses for the participant paid by CES; and (3) educated and experienced Chinese engineers would work in U.S. R&D environments for one to two years (all expenses for participant and family paid by CES).

However they must do it, the Chinese will make the tradeoffs and take the risks necessary to close the technical gap between them and the rest of the world by the year 2000. Progress will have to be made in all aspects of computing simultaneously. Yet we firmly believe that they will succeed. Don't underestimate the Chinese. ✲

DONALD J. REIFER

Mr. Reifer is a software management consultant in Torrance, Calif., and has done work for clients in government and industry. His last stop before becoming an independent was as a deputy program manager at TRW, where he looked into 1980's problems of supporting imbedded computers for the Air Force. Prior to that he worked at Aerospace Corp., where he managed software activities in support of the Space Shuttle.

He is listed in *Who's Who in the West*, and has been the recipient of a Hughes Aircraft Co. fellowship and the Tactical Air Command's Educational Achievement Award.

When in the country, he also conducts courses and workshops on software engineering for UCLA, Technology Service Corp., the ACM, and the IEEE.

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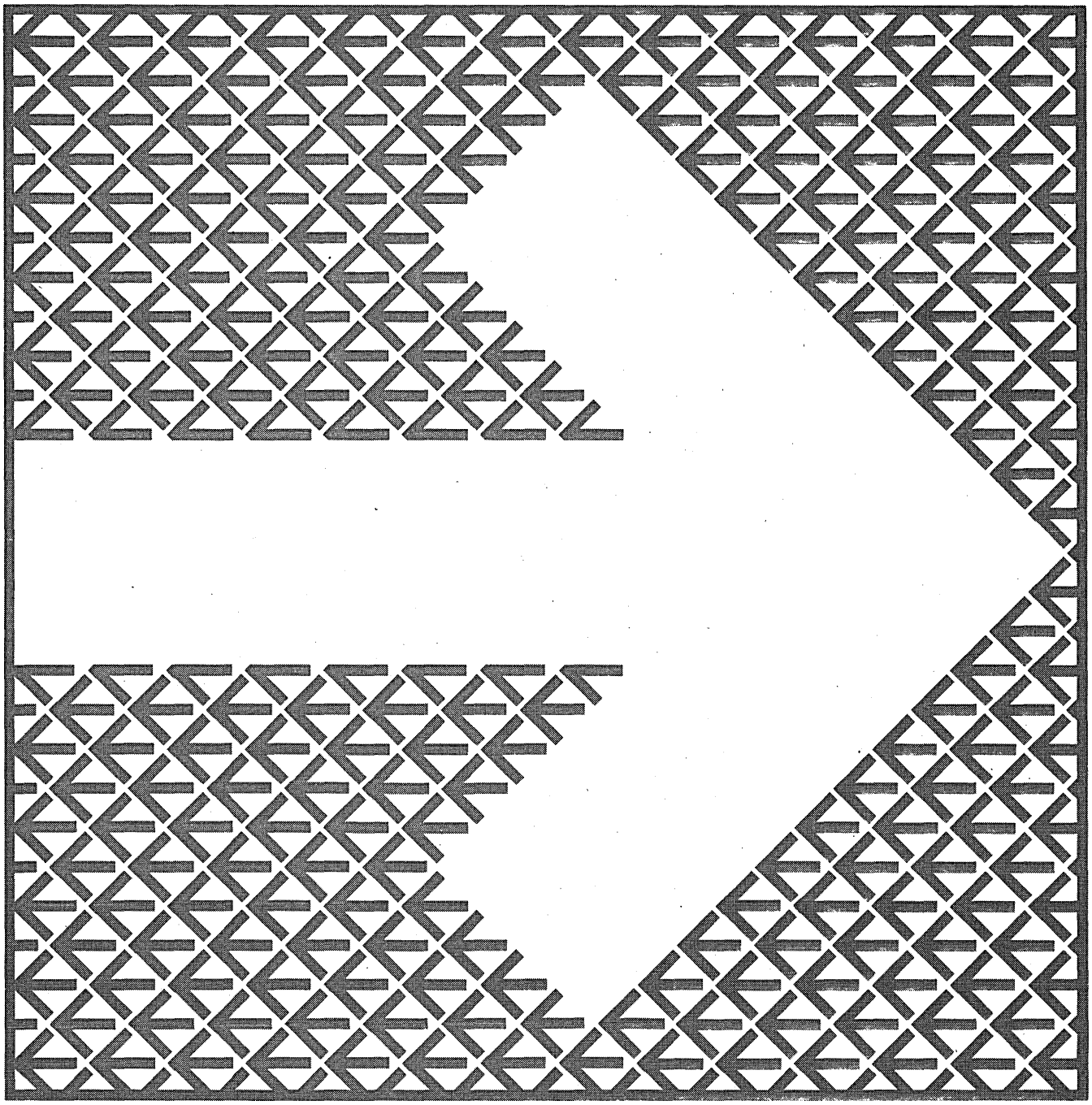
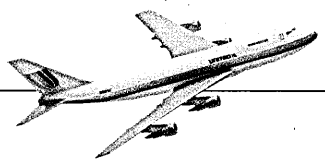


BECAUSE MANAGING DATA MEANS MANAGING CHANGE

Computer Corporation of America

Airline Terminal.



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XIII OLYMPIC WINTER GAMES LAKE PLACID 1980

If you would like more information on the Model 810 R/O impact printer, contact the TI sales office nearest you, or write Texas Instruments Incorporated, P.O. Box 1444, M/S 7784, Houston, Texas 77001, or phone (713) 937-2016.

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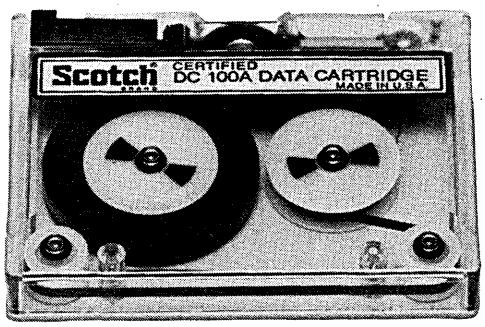

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CIRCLE 65 ON READER CARD

With its new general-purpose mini, IBM has both blessed the concept of ddp and entered this marketplace—with a vengeance.

IBM'S 8100: FIRST IMPRESSIONS

by Larry Woods

On October 3, 1978 IBM issued a press release announcing its version of a general-purpose minicomputer, the 8100. This computer can be used as a standalone machine or as a part of a larger network of machines in a distributed data processing (ddp) environment.

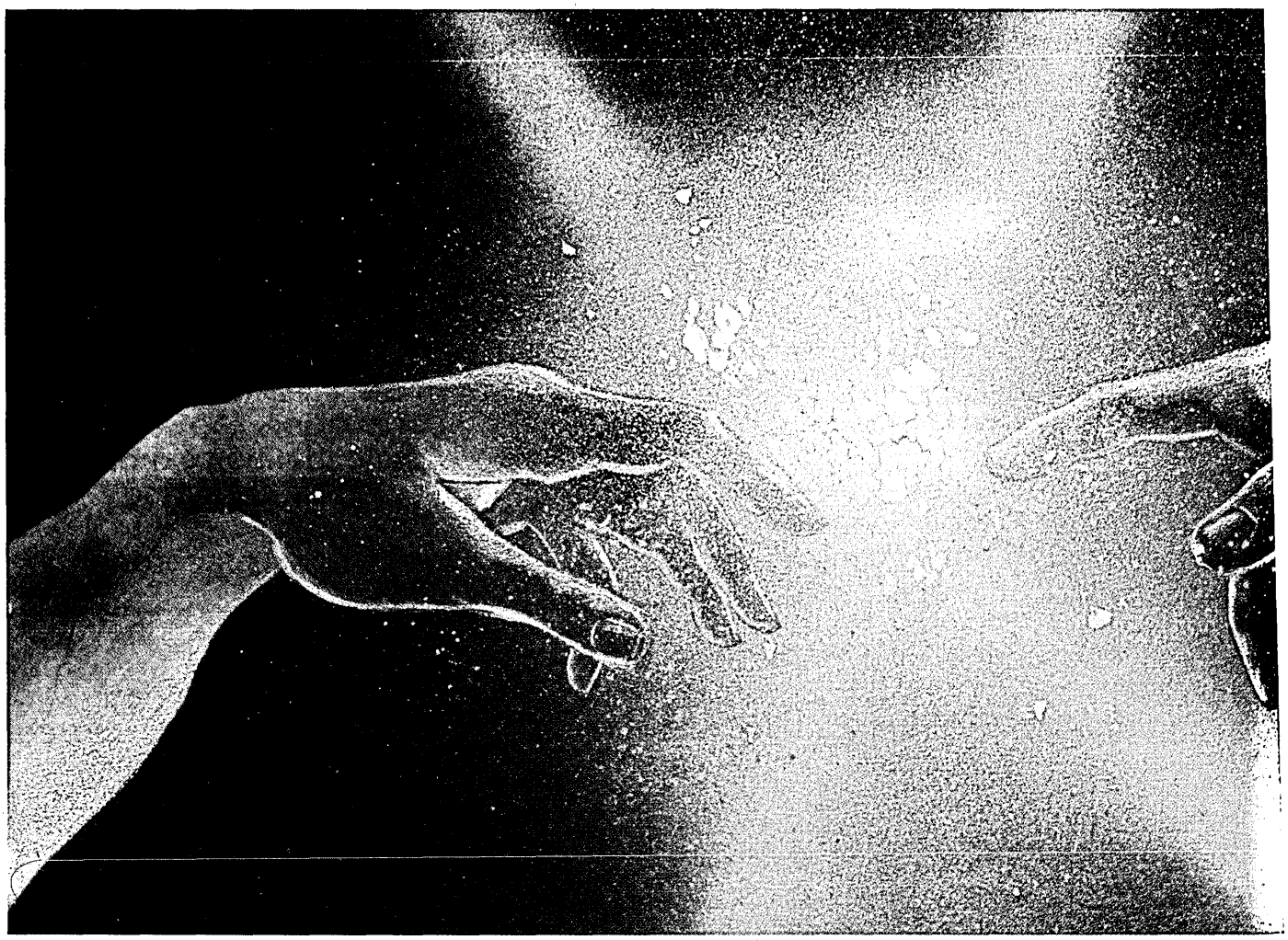
The significance of the announcement cannot be underestimated; it is possible computer historians will record October 3, 1978 as a turning point in the general direction of worldwide computer development. With the 8100 announcement, IBM legitimized the concept of ddp, and gave notice to the rest of the minicomputer industry that it is serious about entering this marketplace.

Any attempt to evaluate the technical aspects of the IBM 8100 at this point in time must be speculatory since only general information is available on the product. Actual equipment is confined to IBM development sites and, probably, user sites operating under nondisclosure agreements. Regardless of these obstacles, there is much to be learned from the information that does exist on this equipment. There is even more to be learned from the fact that this equipment *does* exist.

The 8100 announcement is not particularly important from the hardware viewpoint, as we will see later. What is significant is:

1. The 8100 is an IBM ddp product.
2. The 8100 is designed for online processing.
3. The 8100 comes with a reasonable set of software.
4. Complete 8100 systems will not be delivered until 1980.

The IBM 8100 series is a product of the Data Processing Div. (DPD) of IBM. This is the group that gave us the System/360, System/370, and the 303X line. This group should not be confused with IBM's

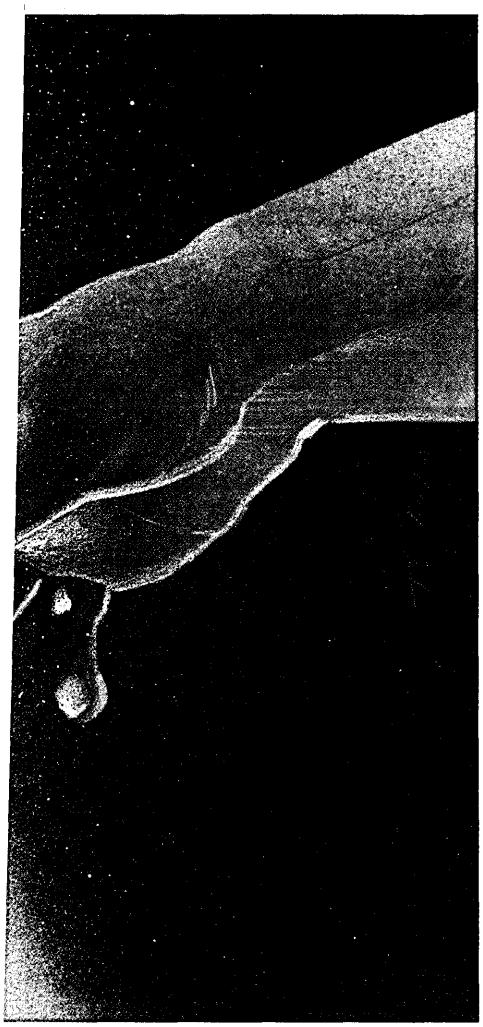


General Systems Div. (GSD). GSD is responsible for the Series/1, System/3, System/32, System/34, the 5110, and the new System/38.

Until the 8100 announcement, DPD general-purpose minicomputer activity had been confined to the creation of the IBM 3790. The 3790 was less than successful, and is disappearing with the introduction of the 8100 series (which can simulate 3790 functions through the DPCX operating system). In the past, DPD has been "the mainframe guys," and has not been too successful at selling minis.

Conversely, GSD has been the minicomputer marketeers. It has concentrated on selling small- to medium-sized business machines to the smaller commercial user. Its latest venture in the minicomputer market is centered around the Series/1. This computer was initially offered as basic iron, with very little software available. Software offerings for the Series/1 are increasing, primarily from outside vendors.

GSD and DPD each has its own sales and support staffs. In the past, the relationship between these two divisions has been one of tolerance. Now, with DPD's introduction of the 8100, there seems to be little reason for any relationship to continue between the divisions. We will see in our examination of the hardware of the 8100 that the initial offerings do not provide for the same potential as the Series/1, but we should expect those deficiencies to be remedied in the future. IBM DPD now has the potential for offering a complete line of computing equipment to its large customers—and new smaller customers as well.



HARDWARE: IT'S DESIGNED FOR ON-LINE

The hardware of the 8100 series is designed for on-line processing. Hardware task dispatching and 1024 registers (384 registers are 32-bit general purpose user registers) should provide for rapid context switching, which is essential for efficient on-line operations.

Although the general purpose user registers of the 8100 are 32 bits wide, the I/O channel path is only 16 bits wide. The memory path width is not defined, but one might assume that it is also 16 bits. If this is true, the IBM 8100 could be considered "traditional minicomputer" hardware.

Another interesting point about 8100 I/O implementation is that memory-to-I/O device (channel I/O) data transfer appears to use the cpu for its address translation. Channel I/O can then be expected to utilize most, if not all, of the cpu time during I/O operations. This is not what is normally defined as direct memory access (DMA), and should be considered to be a weakness in the 8100 system.

The cpu must be accessed during I/O operations because channel I/O is addressing *logical* memory addresses, as compared to *actual* memory addresses. This is necessitated because of a "unique" relocation technique used on the 8100 called dynamic address relocation.

Dynamic address relocation is an attempt to map logical, contiguous address spaces (logical memory) into physical memory (real memory) in order to maximize the utilization of real memory. This is accomplished through the use of a dynamic address translation mechanism.

IBM 8100 processor speed is not impressive and was not announced in a consistent manner. According to the 8100 introductory manual, the processor speed of the 8130 is 1,200nsec, yet various IBM press releases note an 8130 processor speed of 1,500nsec. There *is* agreement on the 800nsec processor speed of the 8140.

Hopefully, there will be future 81XX processors with more exciting speeds. The lack of processor speed could be compensated for with a good, efficient instruction set, which is not documented for the public at the present time. Also note that *if* the memory path is 16 bits, and *if* the 32-bit registers are used extensively in register-to-storage operations, then the processor speed will be only half as fast as specified in the literature.

The initial peripheral offerings for the 8100 vary widely in performance. The 8775 display terminal is an impressive display device—but it is *another* display device. Now IBM offers its customers the 327X and 8775 display products from DPD, and the 4978/4979 Series/1 displays from GSD. A customer cannot be expected to use all of these devices, and no single piece of IBM equipment supports them all. Again, another reason to consider an impending split between DPD and GSD—regardless of IBM statements to the contrary.

The fastest printer that can be attached to the 8100 is the IBM 3289 line printer model 3, which runs at 300 lpm with a 64-character set. This speed is inadequate for many RJE configurations, although it may be well matched with the 9600bps maximum transmission rate on a 8110-to-host data link.

Another interesting piece of equipment is the 2502 card reader which must connect to the 8110 *through* the IBM 3289 line printer! This tends to make RJE configurations rather clumsy, to say the least.

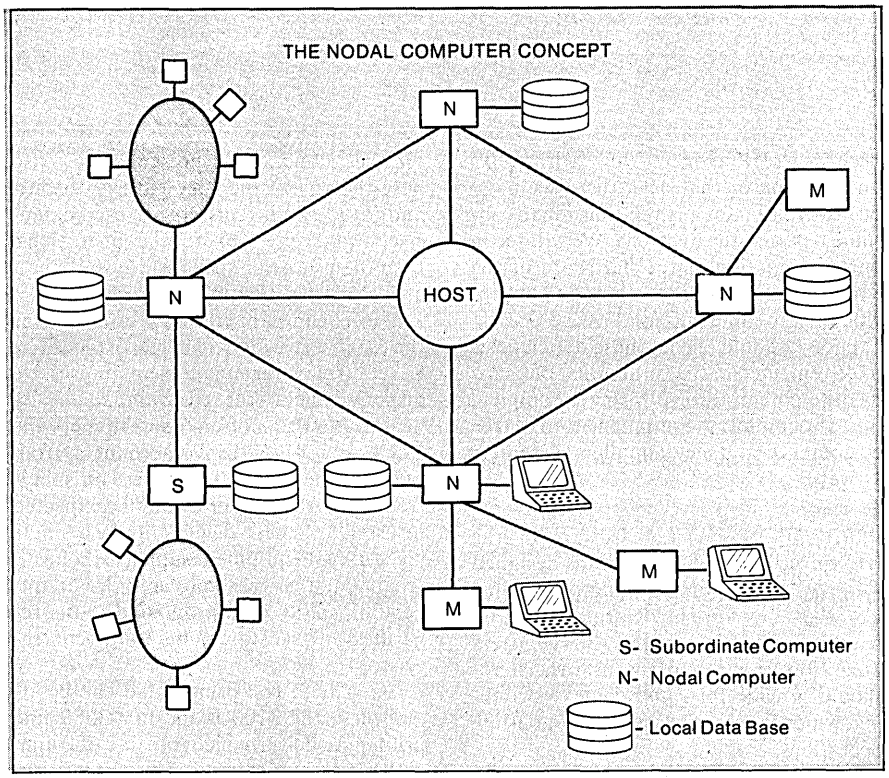
Local I/O peripheral interfacing is limited to the loop technology. Initial offerings on the 8100 fail to include the capability for connecting digital or analog sensor I/O to the processor. There are capabilities for connecting digital I/O through the digital input digital output (DI/DO) adapter on the 3641/3642 reporting terminal. This restriction does not allow the flexibility that is offered by other minicomputer manufacturers. It will still be necessary to use other vendors' equipment to interface into the sensor environment unless IBM offers the capability for interfacing this type of device into the 8100.

SOFTWARE: THE REAL STRENGTH

Software is the strength of the 8100 systems. Two operating systems (DPPX and DPCX), various resident software subsystems, and optional host support packages, are what is going to make the IBM 8100 a viable product.

The Distributed Processing Control Executive (DPCX) is an operating system which is offered to the existing IBM 3790 customer as a migration system. DPCX will allow the 3790 user to phase out of his 3790 and into the 8100 environment.

The Distributed Processing Programming Executive (DPPX) is the general-usage operating system for the IBM



8100. DPPX offers a higher degree of flexibility in system design than DPCX, and will require more user education in order to take advantage of that flexibility.

Two standard high-level language offerings (FORTRAN and COBOL) can be compiled on the 8100 under the DPPX operating system. Both compilers generate reentrant code. This feature allows for the creation of efficient on-line applications (a fact which has been ignored by DEC in their RSX offerings). Reentrant code allows multiple users to execute a single copy of application code. This makes much better use of memory and reduces or eliminates the necessity for paging code in and out of the processor (a feature which is not available on the DPPX operating system).

DPPX data access methods include an indexed access method (IAM) data set. This facility is utilized by DTMS, the Data Base and Transaction Management System, in order to provide what IBM calls "Data Base Management." This feature of DTMS provides for check-pointing of IAM transactions and subsequent backout, if necessary. Although the term "data base management" is used, it should not be confused with a data base management system (DBMS), such as IMS.

The absence of a true DBMX implementation on the IBM 8100 is considered to be a weakness by many potential users. Furthermore, existing IMS users prefer that a "mini-IMS" be made available on the 8100. Although there is obvious value in supporting a DBMS on the 8100, an eight-index indexed access method can provide the capability for designing reasonably complex data bases. IAM should also be relatively less complicated in its implementation which, in turn, will provide a more reliable 8100 installation. There is much to be said for simplicity.

The most disappointing aspect of the IBM 8100 announcement is the delivery schedule. Although the first deliveries of hardware are due this August, much of the software is not scheduled for availability until early 1980. This long delivery schedule will cause delays in previously planned minicomputer orders, as many large IBM customers evaluate the significance of the 8100 announcement. How long a customer might delay his decision will depend on two factors:

1. When the customer will be able to receive his 8100, and
2. The importance of the planned minicomputer application.

It is likely IBM is sitting on top of a large number of 8100 orders for nonexistent applications. Traditionally, large IBM customers have ordered equipment on announcement day in order to get their names into the production queue. This same procedure was followed with the 8100, but with a significant exception. When System/370 or the 303X was announced, many customers ordered *one* of the new machines. Reports are that many large IBM customers have ordered dozens of 8100s, and have no particular plans for them. Unless IBM finds some way of eliminating the "hedgers," its production schedule will be unrealistic, and may result in the serious customers receiving long delivery dates.

Customers who have critical minicomputer applications and who receive late delivery dates will be forced to turn to existing minicomputer products. This could be very good for the industry since some of these new customers may have only considered the use of minicomputers after seeing the IBM 8100 announcement. After all, how long do you wait for a $50,000 computer? The application could pay for itself by the time the 8100 is delivered.

There are a lot of closet believers in the philosophy of putting computing power and data where it is needed—in the hands of those who need it. There were those whose hearts quickened at the announcement of the IBM 3790, only to find that it really was not the answer. These same people rallied at the first presentations of the Series/1. This product, too, was quickly discounted because of its lack of software—and its other shortcomings (which were, in some cases, pointed out by their DPD salesman). Now, with the announcement of the 8100 from "the" IBM people—DPD—the MIS manager who liked minis all along can begin to plan for distributed data processing.

Previously noncommittal, the MIS manager is finding it harder to defend his totally centralized dp position as technology threatens his justification for total centralization. Now, he no longer has to fight the users from the door: he can offer the user the option of joining, or going out on his own.

The preceding points are, in essence, what is being promoted in the first IBM 8100 announcements. The 8100 system is a solution to the MIS dilemma: bigger, clumsier, less reliable, central computing installations which are being used for more and more on-line systems. Couple this with larger numbers of sophisticated users and a more rapidly changing competitive business environment, and we find an MIS manager who is feeling user pressure.

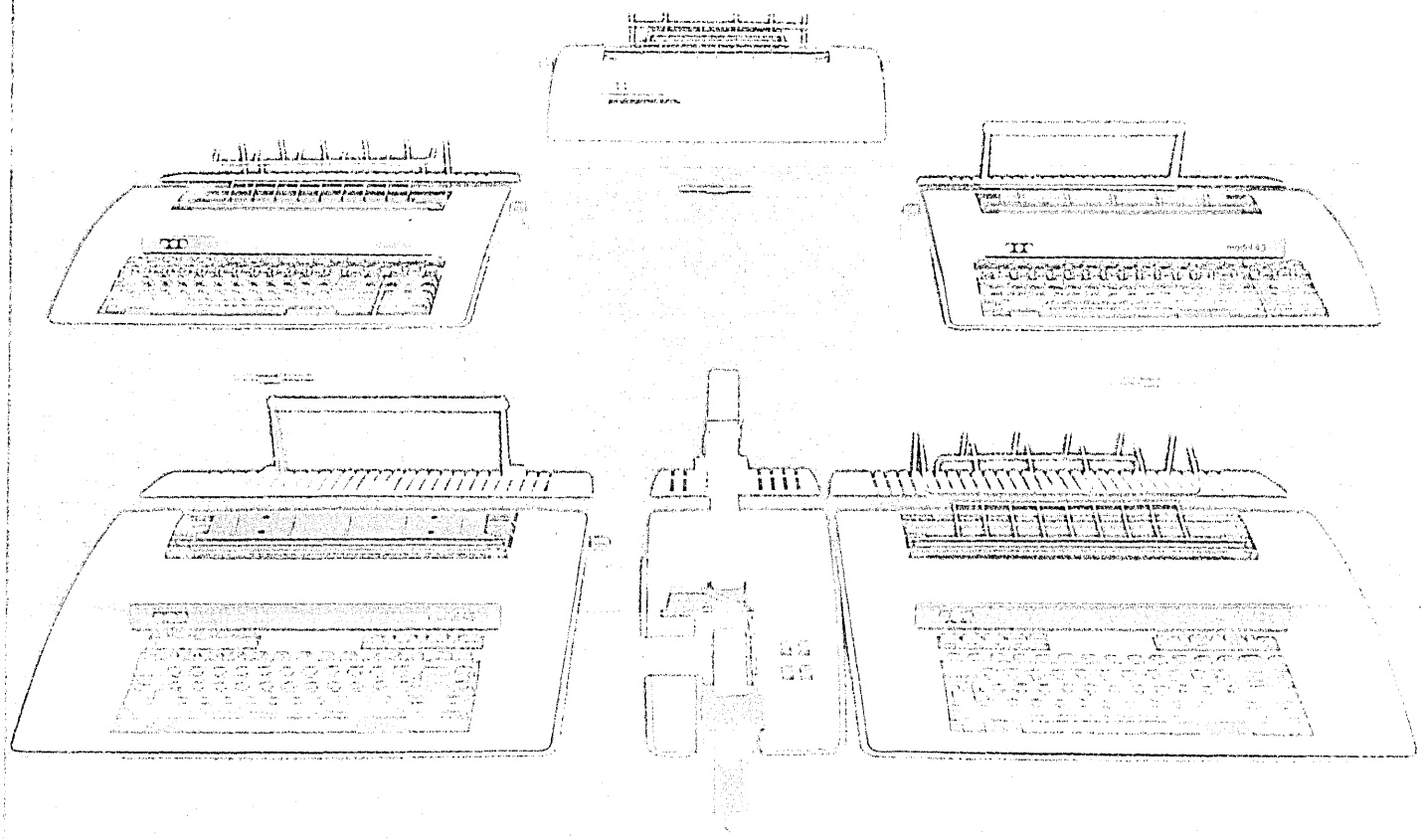
Users *are* complaining about poor response times at their terminals. Users *are* dissatisfied with central system reliability. Users *are* looking at alternative computing resources. Some are turning to time-sharing services while others are opting for their own computers. The pertinent question is, "Is the IBM 8100 the answer for these users?"

TRADITIONAL MARKETING CONCEPTS

The IBM 8100 is being marketed more as a traditional minicomputer; i.e., *you* bought it, now *you* make it work. IBM realizes (as do any other vendors who are selling small machines) it cannot justify furnishing mainframe level support for an 8100. At $25,000 to $90,000 per machine, large amounts of continuing service is not economically feasible for the vendor.

Traditionally, IBM has been an integral part of the computer planning of large IBM customer installations. It is the IBM systems engineer who has furnished much of this advice. This SE support has been the backbone of what the industry knows as "the IBM umbrella."

One of the October 3, 1978 IBM news releases stated, in part: "The system's programs may be entered simply by



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Model 43's come in a variety of configurations with either 80 column impact-printed or 132 column ink-jet printers. Some units are designed for use on the switched network, others for point-to-point private-line systems. (There's also a new generation of 5-level buffered teleprinters for Telex applications.)

The basic model 43 series operates on-line at 10 or 30 cps in either the half or full-duplex mode and prints multiple copies using the 96 character ASCII code set. A wide choice of interfaces, including EIA RS232C and IDC 20-60ma, are available for easy system integration.

With the automatic send-receive configuration, messages can be prepared off-line via the paper tape punch, edited, combined with a master tape, then sent at maximum transmission speed—automatically and unattended—when line rates are lowest.

Buffered 43's operate on-line at speeds ranging from 10 to 1920 cps and provide up to 2048/4096 characters of storage for sending, receiving and editing. These terminals send and receive automatically via the buffer while messages are simultaneously being prepared for future transmission. They also include full forms control, the automatic answer capability and answer back.

Just like its predecessor, the legendary model 33, our model 43 family is designed for extreme reliability. The reason is simple: simplicity. Our model 43's use only five major pluggable components (six, counting the paper tape module on the ASR), along with extensive use of LSI circuitry.

So when you think of our model 43 family, think of it as the beginning of a new legend.

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CIRCLE 42 ON READER CARD

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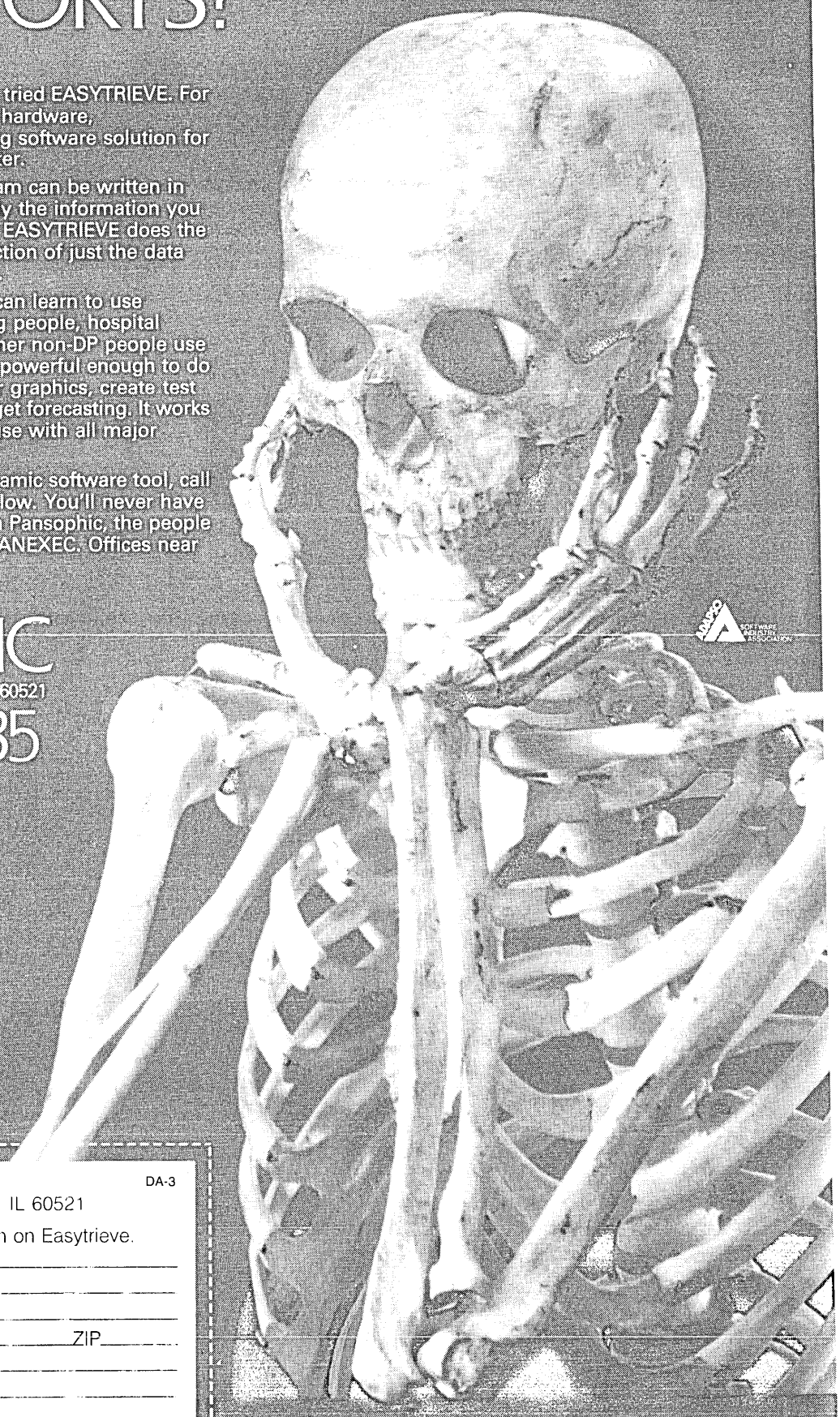

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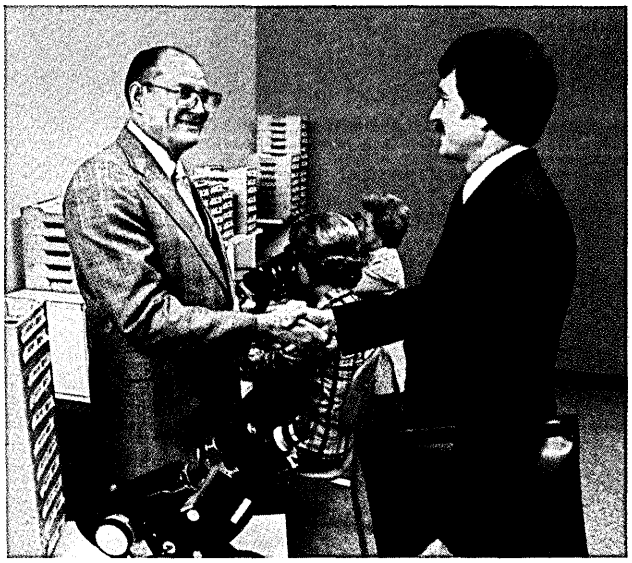
CIRCLE 149 ON READER CARD

"We switched to NCR," says Fred Brown of Rogers Enterprises.

BROWN:
Rogers Enterprises is an optical laboratory that fills almost 5000 eyeglass prescriptions a day. We have a complex computer program that guides us through the entire operation. From selection of the lenses out of inventory through the highly technical grinding process to billing of our customer. We have five years of development tied up in that program. And still we switched from another vendor to an NCR system.

NCR'S DUBOSE:
We could offer you the speed you had to have at a lower price than anyone else.



Fred L. Brown (left) is comptroller/administrator of Rogers Enterprises, Inc., of Beaumont, Texas. Ben DuBose is an NCR district manager.

BROWN:
Yes. And NCR has a full line with no gaps. As our volume increases, we can expand our system in reasonable increments. Even better, we can move to a larger system without obsoleting our software. Now with NCR, I will not have to go through another conversion under the pressure of our daily workload.

NCR'S DUBOSE:
That's NCR's Migration Path Engineering. Your software always runs on the next larger system.

BROWN:
VRX (Virtual Resource Executive) really makes our NCR V-8550 go. Our lab program is very large and is used heavily in the morning, but only occasionally in the afternoon. Because we have virtual memory, this program resides in main memory only when it is advantageous. Otherwise, that program would choke our operation.

NCR'S DUBOSE:
VRX allows you to run up to 35 jobs simultaneously. It dynamically allocates memory and other resources. It controls virtual memory swapping. It constantly monitors for memory thrashing and program loops. And adjusts the job mix to eliminate them automatically.

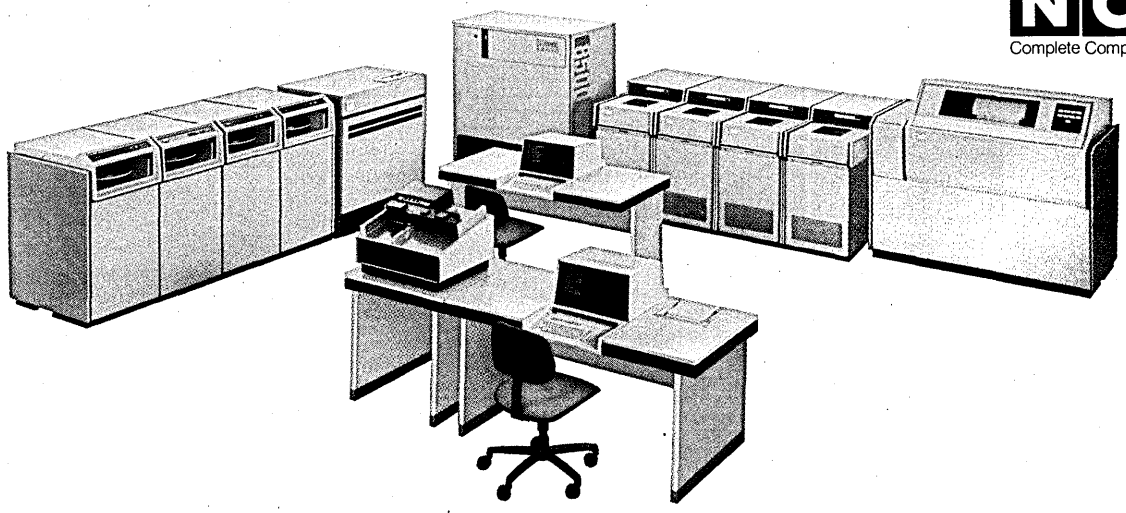
BROWN:
VRX also provides Online Program Development. Our EDP manager tells me OLPD has doubled our programmer productivity.

NCR'S DUBOSE:
System dependability has been important, too.

BROWN:
That's right. System operation is critical to our business. Before we switched to NCR, we talked to other NCR 8500 users and found they had all had excellent experience with this hardware. And with NCR service. We were particularly pleased that NCR had a service office right here in Beaumont.

In the NCR office nearest you, there is an NCR account manager like Ben DuBose who knows your industry and knows NCR systems, including VRX. To learn more about what an NCR system can do for you, phone him at your local NCR office. Or write to EDP Systems, NCR Corporation, Box 606, Dayton, Ohio 45401.

NCR
Complete Computer Systems



inserting an IBM Diskette about the size of a 45-rpm record into the processor."

At a recent IBM-sponsored class on the 8100, the section of the presentation entitled "8100 Problem Determination Tools" was introduced with a foil which stated:

PROBLEM DETERMINATION IS THE USER'S RESPONSIBILITY

Software installation and subsequent problem determination will be the responsibility of the customer.

In order to support the user in his debugging efforts, the DPPX operating system will provide a sizable number of diagnostic tools, including memory dumps, system traces and error logs (both software and hardware).

Hardware installation can also be done by the user. Again, an early IBM press release notes: "For example, portions of the new system can be installed by users—with a set of easy-to-follow directions—in much the same way as a basic household stereo system might be set up."

This feature is defined as Customer Set-Up (CSU) by IBM. It is available on the 8130/8140 processors and the 8101 storage and I/O unit. CSU is explained by IBM salespeople as meaning that the customer can uncrate his machine, roll it into place, release the disk unit (with a handy lever in the front of the unit), plug it in, and turn it on.

User installation is new even to the minicomputer industry. Most minicomputer manufacturers require their systems be installed by customer engineers; the CE's also execute the diagnostic tests. This installation procedure is followed so that the equipment is reliable enough to be able to allow the customer to "bring it up" on his own.

The marketing plan for the 8100 is to sell boxes, both hardware and software. The customer assembles his configuration(s) from the shopping list of offerings. If this does not seem like the IBM way, you are right.

With the introduction of the 8100, there is a dilemma for the IBM marketeer. What should the IBM salespeople attempt to sell to the customer: a new 303X, or a bunch of 8100s? Should the customer upgrade from a 3032 to a 3033, or should he distribute some of that processing? And where does GSD fit in with its Series/1, System/34, and the new System/38? It will no longer be possible for IBM to provide *the* answer for its customers. There are too many options—options which seem, at times, to contradict one another.

Planning will become more complicated for MIS management. Should the long-term plans for MIS growth include ddp, and, if so, how much? What should be the criteria used to determine whether or not distributed computers should be used in a particular application? How much of an application should reside in a distributed computer? All of these questions will need to be answered by those people who are planning the future of their company's MIS functions.

New responsibilities will also be put on MIS implementers. Systems analysts will have to understand the features of the IBM 8100 and how it fits into the larger 370 systems. The systems analyst has not had to concern himself with implementation configurations in the past. Now he may need to consider hardware and software options in addition to his regular analyst tasks.

Designers and programmers will need to be trained in the development of distributed computing systems. Many of the large system design techniques will have to be relearned so effective distributed systems can be implemented.

Career planning for ddp designer/programmers will have to be considered. It is a unique individual who can design and write code for a large cpu environment one day and produce good programs for a distributed computing system the next.

Operation staffing must be considered in any planned move into the 8100 environment. Personnel requirements must include network monitors and software support people.

In a large organization with many diverse, distributed computing applications, the manpower/hardware cost ratio will rise significantly. For example, the introduction of an 8100 application will increase personnel costs, regardless of the number of 8100s used. As new ddp applications are introduced, additional 8100s will be procured to be configured differently than previous units. Additional personnel would then need to be trained.

PLANNING FOR THE NON-MIS USER

IBM has not ignored the end-user in its 8100 announcements. The 8100 under the DPPX operating system is a standalone computer. It has the capabilities necessary to allow an 8100 user to develop complete data base-oriented systems without the use of a central computer.

For users who do not understand procedural computer languages, IBM has introduced an 8100-resident programming aid, the Development Management System (DMS). DMS is described as: "A sophisticated programming aid that uses English-language statements to lead *operators* through the creation of *new* system application programs. The system automatically translates the operator's instruction into COBOL, allowing persons without data processing backgrounds to create programs in COBOL." (italics mine)

We can expect to see this type of package being marketed directly to corporate end-users.

The nodal computer (see "Distributed Processing in Manufacturing," October 1977, p. 60) is a local computer which has the capability of supporting local applications and data bases, and provides a common interface for computers and terminals which are located locally. The nodal computer also provides the "gateway" for local computers and terminals to communicate with the host. The 8100 series can provide this capability, and will probably be marketed for this purpose.

The nodal computer concept will evolve in most organizations as follows:

Nodal—Phase I
- RJE
- Basic data collection
- Star connection to host

Nodal—Phase II
- RJE
- Basic data collection
- Data entry
- Local minicomputer message switch and minicomputer-host interface
- Peer-to-peer nodal connection
- Host interface

Nodal—Phase III
- RJE
- Basic data collection
- Data entry
- Local interactive data base
- Local mini message switch
- Node to subordinant computer interface
- Peer-to-peer nodal connection
- Interface
- Host interface

In the preceding evolutionary process, the nodal computer becomes the basis for transferring much of the computing work now being performed on the central host onto local processors. If accomplished in a planned manner, the resulting computing environment can give the user the services he requires.

How can this move to distributed processing be accomplished without the MIS department losing control over dp activities of the organization? MIS management must realize ddp is a reality, and that there are advantages to this style of data processing. A positive attitude will result in plans to use the new technologies where they are appropriate and effective. ✱

LARRY D. WOODS

Mr. Woods has designed real-time transaction-oriented operating systems for a $ multibillion U.S. corporation. He has done international consulting, specializing in distributed computing, and has been manager of distributed computing for Deere & Co. since 1975.

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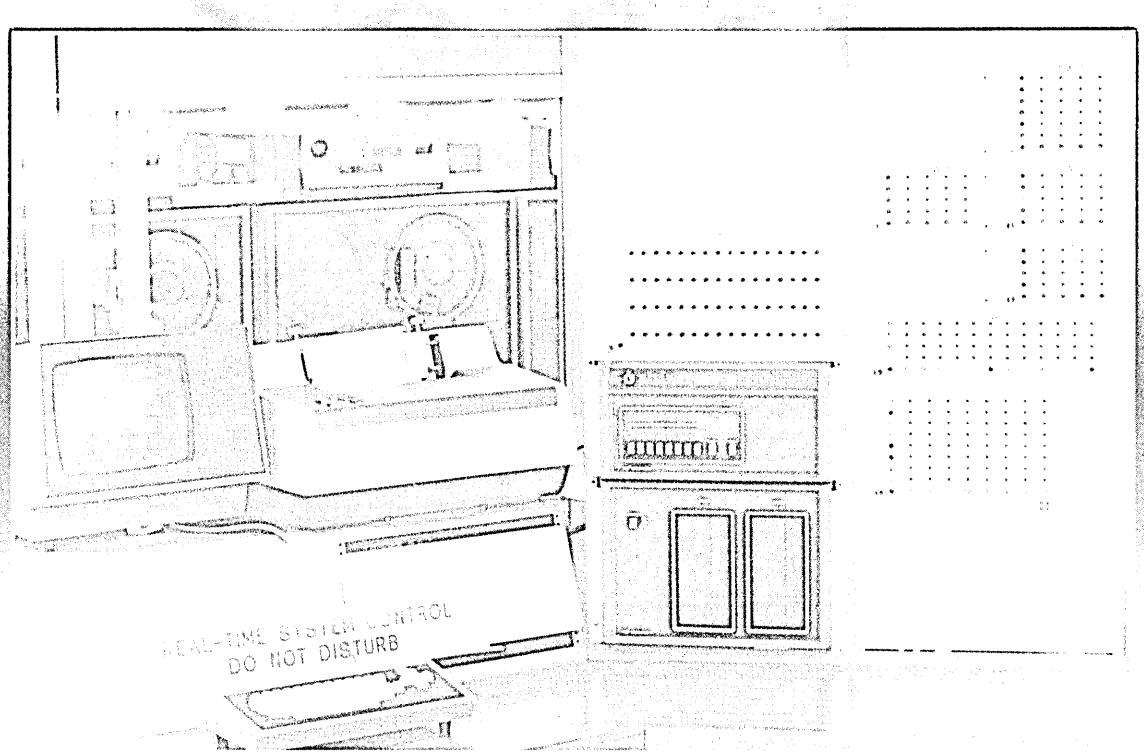

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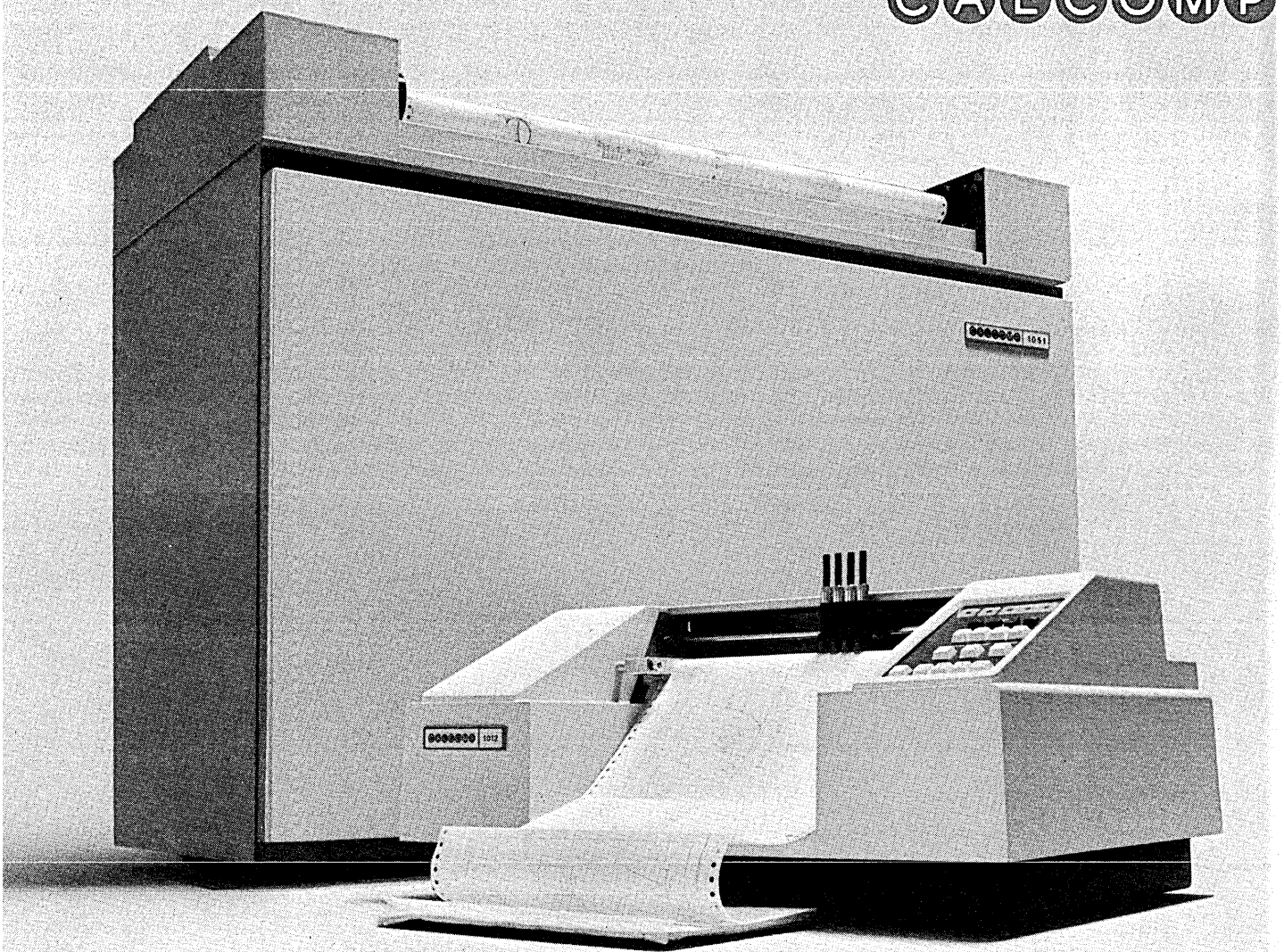
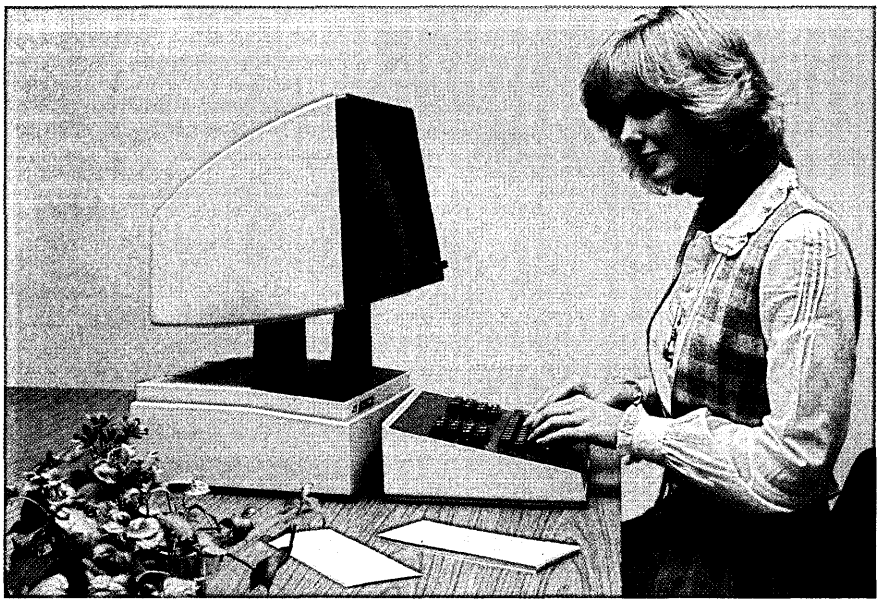
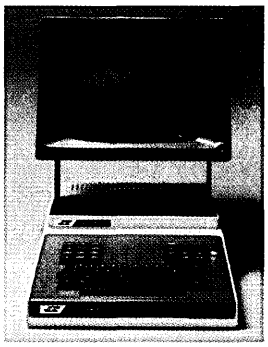


California Computer Products, Inc., 2411 W. La Palma Avenue, Anaheim, California 92801, Phone (714) 821-2011.

CIRCLE 22 ON READER CARD

New intelligent terminal concepts for advanced distributed data processing:





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The new Model 1001 Visual Display Unit marks a new milestone in intelligent terminal development. A uniquely capable work station . . . a powerful partner in large-cluster, interactive distributed data processing configurations.

The first of a new generation of intelligent terminal system hardware and software from INCOTERM, Model 1001 features advanced human factors design to promote higher speed operation, reduce fatigue and improve performance.

The 12″ alphanumeric display provides capacities of 2,000, 1920, or 960 characters; and has a tilt screen which allows operators to "tune out" glare. Seven glare-control techniques improve visual interface. The CRT can also be positioned to three vertical heights. High- and low-intensity characters and character-blink are provided.

The microprocessor-driven, detachable keyboard features n-key rollover, homing keys, and a keyboard tilt device to accommodate varying desk and table heights. A lock provides security at the input level; an optional "privileged mode" lock can be specified for supervisory access. The Model 1001 automatically turns itself off when not in use.

The entire unit — keyboard and screen — operates under software control of any of the INCOTERM Terminal Processing Units, which can be specified in the SPD 20 Family (core or MOS memory) or SPD 15 Family (microprocessor based). Either Family offers a series of intelligent terminal processing alternatives to meet small stand-alone needs or large-cluster interactive distributed data processing applications with powerful software to handle data entry and local transaction processing. In practically any telecommunications protocol. Why not learn more about INCOTERM . . . and the new Model 1001 Intelligent Terminal? Write or call today.

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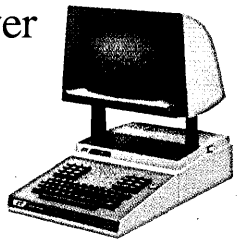

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PACX (Private Automatic Computer eXchange) is a sophisticated high speed data switching and port contention system designed to optimise the allocation and use of your resources.

PACX continuously scans all terminal channels. When a service request is received, the user is connected to an appropriate port in less than one second.

Plug-in port and terminal modules (some with integral short haul data sets) offer system expansion or reconfiguration without high cost or delay. As many as 510 terminals can contend for service from up to 254 ports.

Regardless of system loading, all channels remain completely transparent to speed, code and data format up to 9600 bps asynchronous or 19.2 Kbps synchronous. Ports on both local and remotely located computers can be assigned up to 64 different class designations, accessible on request from the terminal keyboard. Reallocation of resources, at any time, is achieved by reassigning port classes via the control panel. Complete system status is seen at a glance. Data suitable for statistical analysis is continuously generated. PACX puts control over data communications back where it belongs.

Shown here is Dual-PACX (up to 510 terminals and 254 ports). Standard PACX (up to 254 terminals and 126 ports). Mini-PACX (up to 48 terminals and 32 ports). Complete data is available upon request.

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Compared with other jobs in data processing, or with jobs in other fields, the people in operations consider themselves on the bottom of the totem pole.

SOMETHING'S VERY WRONG WITH DP OPERATIONS JOBS

by J. Daniel Couger and Robert A. Zawacki

Alaskan dp personnel have an unusual problem. They feel a keen sense of technical isolation in their great geographic distance from the major computer centers in the 48 contiguous states. Yet, as we learned in a professional society meeting in Anchorage last summer, their physical separation has precipitated some positive results. Because there are fewer local experts to rely on, the typical Alaskan systems analyst is forced to stretch himself to acquire new capabilities. In the view of Alaskan dp professionals, this situation produces motivational benefits which more than compensate for the physical separation.

We have a similar problem within the contiguous states, but with much less positive results. The computer operations department has physical barriers that separate its personnel from others in the company, including, often, security barriers. And apparently there are emotional barriers as well. Employees in this department feel that their jobs are substandard compared to jobs outside the security curtain. They perceive their jobs to be definitely deficient in those characteristics which relate to motivation and lead to increased productivity.

Our nationwide research leads us to conclude that operations has a stepchild status in the dp organization. It seems to require a catastrophe such as a flood or bombing to draw attention to operations. Yet few would argue that the success of a computer application depends less upon the people in data entry, data control, and computer operations than it does on system designers and programmers.

Jobs in that area of the dp organization have been sadly neglected. As a result, there now is an enormous potential for productivity improvement there. (In at least one experiment, productivity was raised nearly 40%.) Just as important, there is a real opportunity for making jobs more interesting and challenging for people in this essential area of our computing community.

The principal objective of our research project was to compare data processing employees' perceptions of their jobs with job perceptions of people in other occupations. We used the Job Diagnostic Survey (JDS) developed by J. Richard Hackman (Yale Univ.) and Greg R. Oldham (Univ. of Illinois). Through their survey, they developed a data base on 6,000 people in 500 different jobs. Our task was to extend that data base into data processing occupations.

In doing so, we soon found out that the lack of motivation in operations jobs is not restricted to just those people pushing buttons; it is true for their supervisors as well. Table 1 compares the results of the Hackman/Oldham survey and ours as they relate to five important job characteristics and to the motivating characteristics they lead to.

Skill variety (tasks that challenge the individual's skills and abilities), task identity (completing a "whole" and identifiable piece of work), and task significance lead to experiencing "meaningfulness" of the job, where the individual perceives his work as worthwhile or important by some system of values he accepts.

Task autonomy leads to a feeling of responsibility for outcomes of the job.

Finally, feedback concerning the effectiveness of the person's efforts must provide him with information, on some fairly regular basis, regarding whether or not the outcomes of his work are satisfactory.

Job Characteristics	Dp Operations Supervisors	Other Supervisors
Skill variety	3.90	5.37
Task identity	3.79	4.61
Task significance	5.24	5.62
Autonomy	3.80	5.22
Feedback from job	3.86	5.09
Internal Motivators		
Experienced meaningfulness	4.31	5.25
Experienced responsibility	3.80	5.58
Knowledge of results	3.85	4.89

Table 1. When jobs have the five characteristics listed, persons in those positions feel internally motivated. This leads to high work quality, low turnover and absenteeism. Dp operations supervsors rate their jobs much lower in those key characteristics than do supervisors in other fields, and thus are far less motivated by the jobs themselves. (Here, and elsewhere, the ratings are on a scale of 1 to 7.)

If these conditions exist, a person tends to feel good about himself when he performs well, and those good feelings motivate him to try to continue to do well. These are what are called "internal motivators," as opposed to "external" factors like incentive pay or compliments from the boss.

We found that supervisors of computer operations rate their jobs significantly lower than their counterparts in other occupations, in every category but one—task significance (which score is only "somewhat" lower). And they rate all those internal motivators—meaningfulness, responsibility, and knowledge of results— significantly lower than do their outside peers.

Table 2 provides the same kinds of information for nonsupervisory personnel in data entry, data control, and computer operations. Again, the numbers are all lower than those from personnel in other occupations.

Except for task significance and job meaningfulness, there are no appreciable differences in the ratings between computer operators, data entry personnel, and data control personnel, either. Computer operators do rate their jobs higher in those categories.

Not only are the operations ratings low compared to other jobs in other industries, they are low when evaluated within dp alone (see Table 3).

Further, in four out of five job factors and two of three motivational characteristics, these employees rate their jobs at or below the midpoint on a scale of 1 to 7. In short, these people believe their jobs are on the bottom of the totem pole.

Adding to the problem, dp operations personnel also rate their supervisors low in providing effective feedback. The ratings are:

Computer operators	3.91
Data entry personnel	3.93
Data control personnel	3.90

However, their counterparts in other occupations are only moderately more satisfied with supervisory feedback: white collar workers report in at 4.15 and blue collar workers at 3.97.

Further, the supervisors of dp operations are even more concerned with the lack of feedback from *their* managers. Their rating is significantly lower (3.85) than their counterparts in other occupations (4.37).

(There was a great deal of variance in the answers regarding feedback. Statisticians may wish to note that this was one of two areas in the survey where the standard deviation was high, averaging 1.16 for dp operations personnel. It is even higher for the H/O survey: 1.39.)

LACKING IN MOTIVATION

The Job Diagnostic Survey (JDS) provides a single summary index which indicates the "motivating potential" of a job. The index is called the motivating potential score (MPS) and is computed as:

(skill variety + task identity + task significance) ÷ 3 X (autonomy) X (feedback) = MPS.

Fig. 1 shows that each dp operations job has a motivating potential substantially below that of the occupations outside of data processing. The average score for the three dp jobs is, at worst, one-third that of the service industry jobs and, at best, barely over one-half that of the processing industry jobs.

The JDS also provides a measure of an individual's need for personal growth and development, called GNS (growth need strength). Fig. 2 compares the need for personal growth against the job's potential for motivation. The left side of that figure shows that the GNS of dp operations personnel is very slightly higher than that of the other occupations, for both supervisory and nonsupervisory personnel.

The right side of Fig. 2 summarizes MPS for nonsupervisors as well as for supervisors, for dp operations jobs com-

Job Characteristics	Computer operations	Data entry	Data control	Other white collar	Other blue collar
Skill variety	4.03	3.78	3.82	4.74	4.49
Task identity	4.08	4.01	3.98	4.76	4.60
Task significance	5.17	4.21	4.77	5.47	5.55
Autonomy	3.69	3.72	3.67	4.85	4.83
Feedback from job	3.66	3.42	3.64	4.88	4.76
Internal Motivators					
Experienced meaningfulness	4.42	4.00	4.19	5.10	5.14
Experienced responsibility	3.69	3.72	3.67	5.46	5.38
Knowledge of results	3.78	3.67	3.77	4.93	5.09

Table 2. Like their supervisors, dp operations personnel rate their jobs lower in characteristics relating to motivation than do persons in other fields. When an effort is made to improve these scores, productivity goes up. "White collar" employees here includes persons in sales and clerical work; "blue collar" includes persons in construction, metalworking, nonprofessional services, etc.

pared to other jobs.

Fig. 3 indicates a drastic imbalance between dp operations employees' needs and their jobs' potentials to fulfill those needs. Computer operations personnel have high growth need compared to workers in other occupations, yet are in jobs whose motivating potential is extremely low compared to others.

The need for social interaction on the job is not being met either, as shown by ratings on the right side of Fig. 3. The ratings of social satisfaction are surprisingly close for the three dp operations jobs, ranging from 3.73 in computer operations to 3.79 in data control. Likewise, the perceptions of social need are quite close, ranging from 5.51 in both data entry and data control to 5.69 in computer operations. Not only are social satisfaction ratings well below the midpoint of the scale, they are 33% below the level *desired* by personnel on these jobs.

The left side of Fig. 3 reveals a healthier situation. Although growth satisfaction ratings are an average of 14% below the level desired by dp operations employees, they are well above the midpoint of the scale. It seems reasonable to conclude that employees are satisfied with progress toward growth needs but are not satisfied with progress toward social need fulfillment.

The figures in Table 4 might appear to contradict data in earlier tables and figures. Operations personnel in the survey firms are *above* the midpoint in four of the five categories of satisfaction measurement. Only in social satisfaction, as discussed above, is there a problem.

Compared to workers studied by Hackman and Oldham, dp operations personnel in our survey firms show less satisfaction in two areas, security and social needs. On the other hand, dp operations people are more satisfied with pay. (Again the responses varied quite a bit and standard deviation is high for pay satisfaction: 1.20 for dp operations personnel, and 1.43 for other occupations.)

Computer operators indicate high satisfaction with their supervision (5.29) —significantly higher than data entry personnel do (4.60). The "general satisfaction" levels are comparable for dp workers and other workers, but that is not true for supervisors (see Table 5).

Satisfaction with management and general satisfaction levels are approximately the same for dp and non-dp supervisors. Dp operations supervisors have significantly less security satisfaction and social satisfaction. (As with nonsupervisory personnel, standard deviation was high for pay satisfaction, averaging 1.05 for dp supervisors and 1.27 for supervisors in the H/O survey.)

Job Characteristics	Analysts	Programmer/ analysts	Programmers
Skill variety	5.55	5.45	5.23
Task identity	5.37	5.29	5.00
Task significance	5.75	5.72	5.46
Autonomy	5.31	5.48	5.13
Feedback from job	5.20	5.05	5.10
Internal Motivators			
Experienced meaningfulness	5.56	5.49	5.23
Experienced responsibility	5.31	5.48	5.13
Knowledge of results	4.59	4.42	4.55

Table 3. In comparison to the jobs of operations personnel, those of analysts, programmer/analysts, and programmers are very high in motivating potential. They usually run more than a point higher, on a scale of 1 to 7.

Measuring satisfaction levels alone might lead one to expect high productivity in dp operations. However, as measures of job characteristics show, general satisfaction levels can be relatively independent of the job's motivating potential. The behavioral scientists have shown that general satisfaction and productivity are not necessarily related. There are cases of organizations with quite low productivity despite high general satisfaction levels.

Why are dp employee perceptions of general satisfaction so high when their ratings on core job dimensions are so low? Three possible reasons are:

1. A good career path exists in dp operations (plenty of latitude within each job category plus longitudinal growth possibilities to other functions within dp operations).

2. Greater than average promotional opportunities may be brought about by the accelerated growth of the dp department compared to other departments in the company.

3. Pay satisfaction is high enough to partially compensate for the lack of challenge in the job.

In other words, employees are not unhappy "biding their time" in present jobs—in anticipation of promotion to better jobs in a fast moving career field.

But imagine the productivity potential if jobs could be redesigned to increase the motivating potential of these jobs to a level comparable to the growth

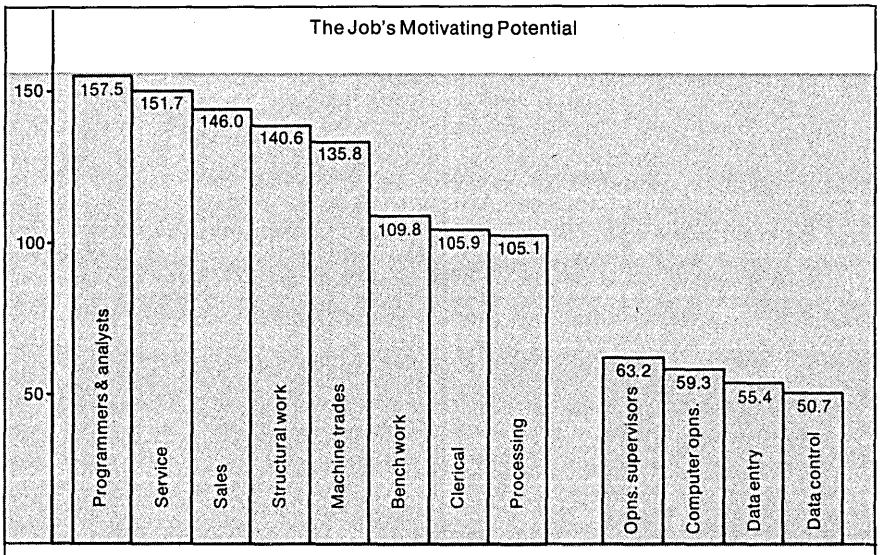

Fig. 1. The motivating potential for jobs in computer operations, as derived from employee ratings of job characteristics, is far below that of other occupations, especially that of data processing's "professional" occupations.

The occupations under "Service" include those in food or beverage preparation, lodging and related services, barbers, protective services, etc. "Structural work" covers jobs like carpentry, welding, painting, etc. "Machine trades" include metalworking, machinery repair, etc. "Bench work" covers fabrication, assembly, and repair of many kinds of products. "Processing" has to do with industries concerned with the flows of materials of some kind, such as ore refining, food processing, and petrochemical industries.

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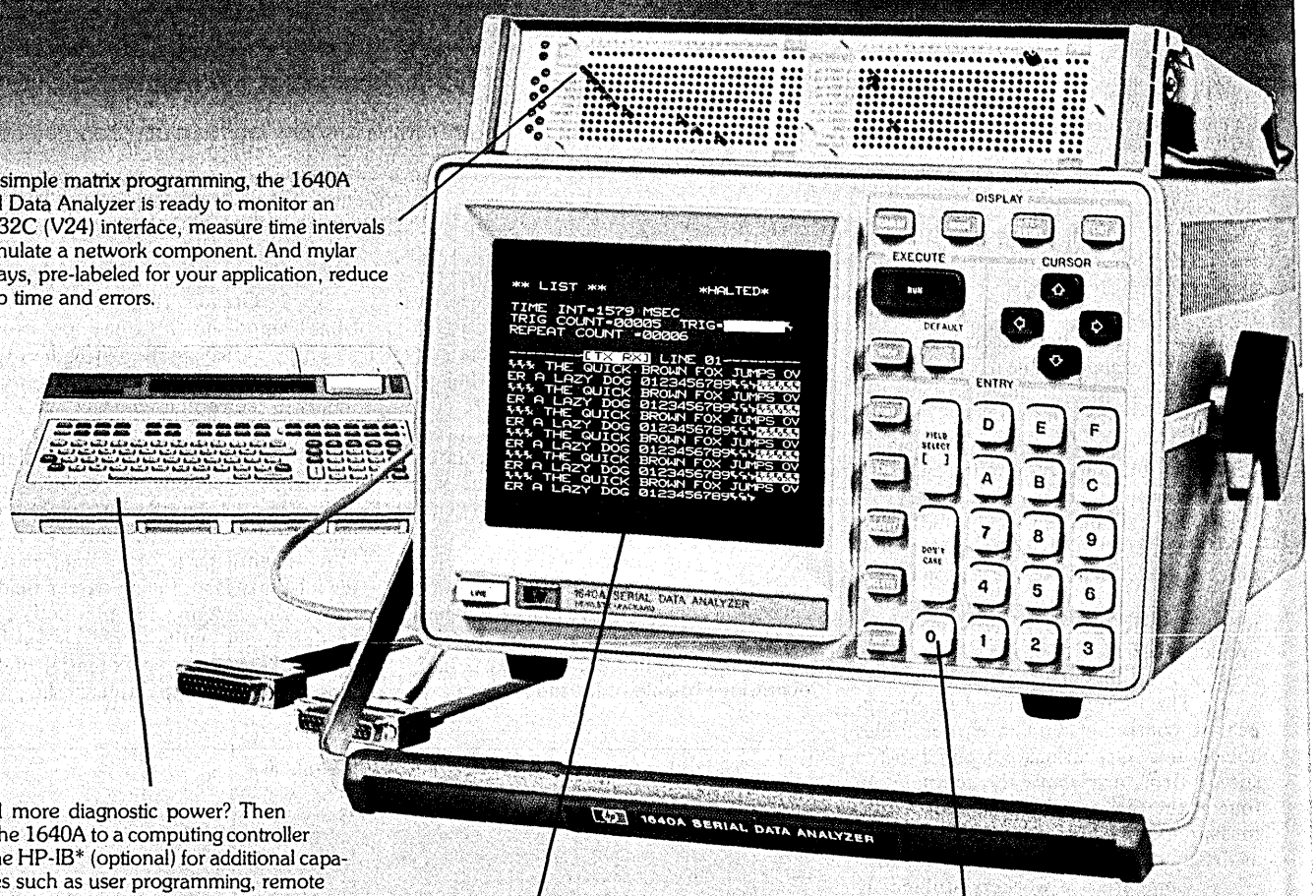

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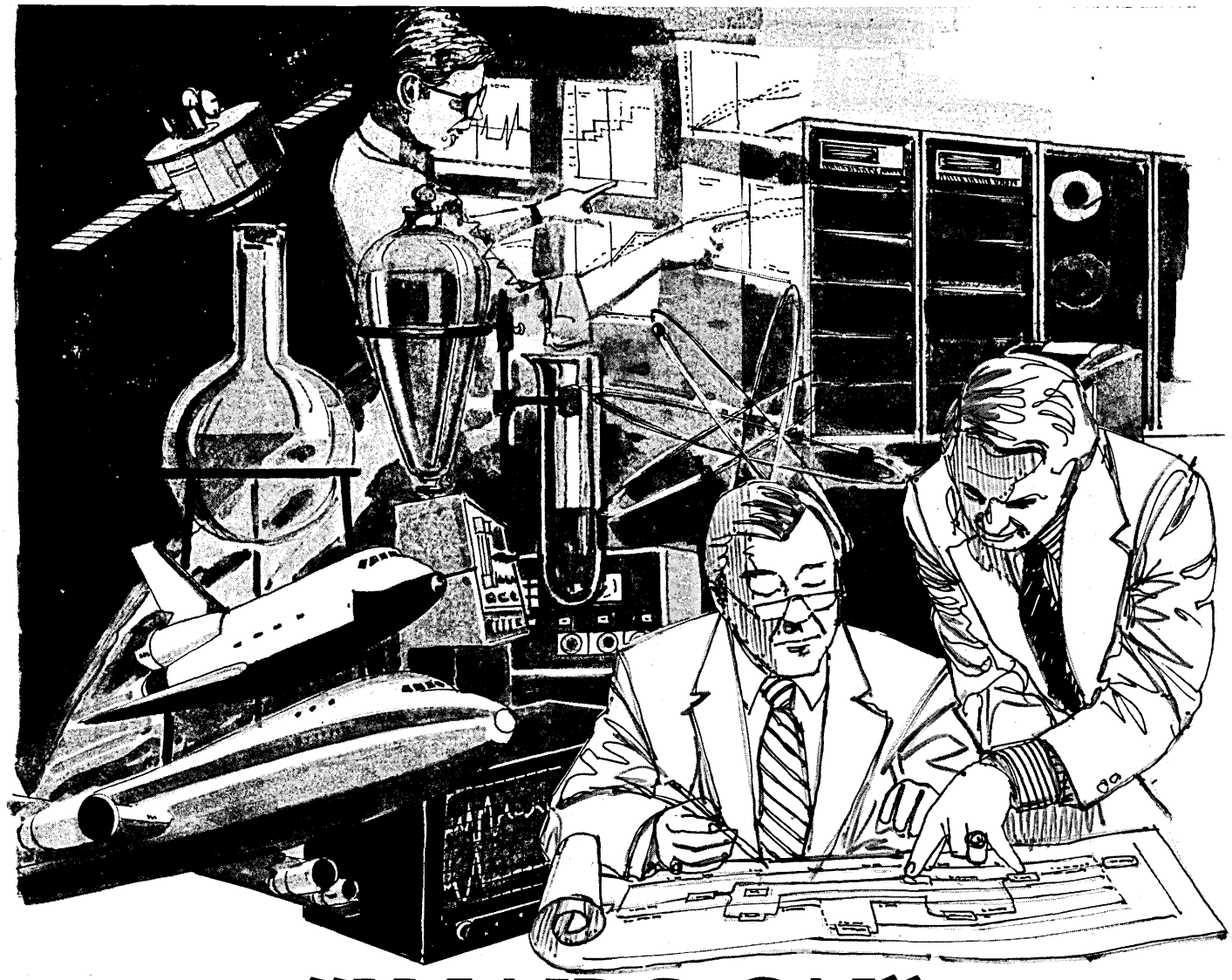

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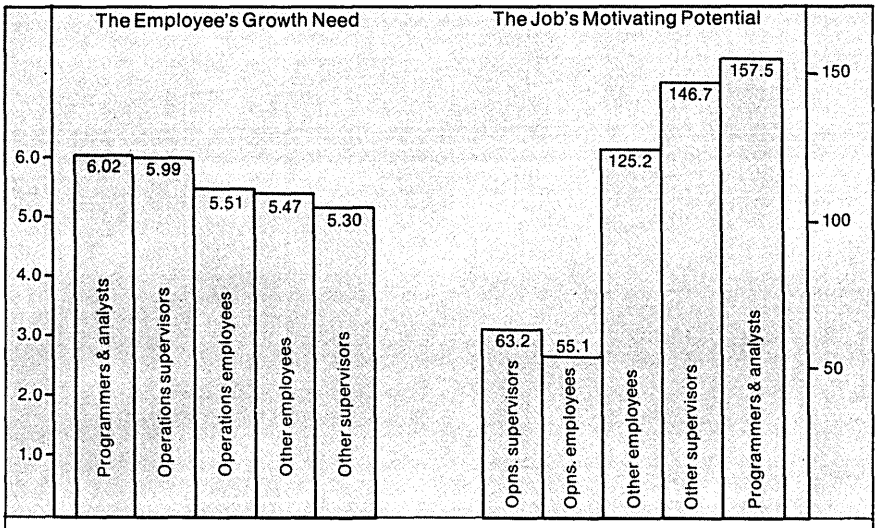

Fig. 2. A significant imbalance exists between the ability of the job (as presently constituted) to motivate dp operations personnel, as compared with their need for individual growth. Such imbalance does not exist for employees in other occupations, supervisors in other occupations, or dp "professionals."

needs of the job incumbents.

How does one evaluate the low ratings on core job dimensions by employees in our survey organizations? Why are they significantly below the ratings of employees in other occupations studied? Or, discounting other occupations, why are so many of the ratings made by dp operations personnel below the midpoint of the rating scale in the question?

One answer could be that our survey firms were not representative of the dp field, but we don't believe this is true.

We purposely sought to study average organizations. We wanted firms to be representative of the broad spectrum of the dp field, neither superior nor inferior to others. In this way we hoped to establish "norms" against which managers of other organizations could evaluate their jobs and employees.

We used an instrument (the JDS) whose reliability and validity had already been substantiated. Our own statistical analysis proved that our sample size was sufficient. But was our sample representative?

We sought to ensure representativeness by discussing our potential survey organizations with people outside those organizations, such as officers in local dp professional societies and managers of other dp departments in the city. We were forced to eliminate some organizations after interviews with their managers and employees. Careful comparison of the data, organization by organization, and of the standard deviations of the means of the combined data convinces us that our survey is statistically sound.

Thus, the question is, "What can we do to improve jobs in the dp operations area?" Can we at least raise the ratings on the core job dimensions to the midpoint of the scale—the "moderately acceptable" level as perceived by employees? A not unrealistic target is to raise ratings to the level of workers in other occupations.

CHANGING THE JOBS

To do this, management needs to consider the potential benefits of work redesign, which has been proven in other fields.

Richard Hackman wrote in a *Harvard Business Review* article ("Is Job Enrichment Just a Fad?" *HBR*, vol. 53, 1975, p. 138):

> Work redesign can help individuals regain that kick that comes from doing a job well and encourage them to care enough about their work to develop the competence to do it even better. These payoffs from work redesign will go well beyond simple job satisfaction. Cows grazing in a field may be satisfied, and organizations can keep employees just as satisfied by paying them well, keeping bosses off their backs, and arranging things so the days pass without undue stress or strain.
>
> This is not the kind of satisfaction at issue here. It is a satisfaction that develops only when an individual is stretching and growing as a human being and increasing his sense of competence and worth.

Two terms are often used by managers and authors when discussing work redesign; the first is "job enrichment" and the second is "job enlargement." Job enrichment refers to a planned change of job content to provide the worker with a greater variety of work that requires a higher level of knowledge or skill, generally providing an opportunity for personal growth and development. In a job enrichment program, a worker is encouraged to participate in the planning, organizing, and controlling of work as contrasted with the doing of work.

In a job enlargement program the worker is given a greater variety of work (such as job rotation) without increasing the need for a higher level of knowledge and skills. Job enlargement does not emphasize the autonomy or responsibility dimension of the work; it concentrates on the horizontal aspects of the job. For purposes of discussion here, both terms are included within the definition of work redesign.

A classic experiment with participation was undertaken at the Marion, Virginia plant of the Harwood Manufacturing Co. In the company's pajama factory, change was introduced in manufacturing procedures and the degree of involvement in the change effort by the workers was controlled. Two "full participation" groups were given an explanation of the change and then participated with management in implementing the change. A third group participated in the change effort on a limited basis and a fourth group was only given an explanation of the change effort.

The carefully designed experiment showed that productivity improvements after the change were directly related to the degree of participation. Further, as

Measures of satisfaction	Computer operators	Data entry personnel	Data control personnel	Other white collar	Other blue collar
General	4.70	4.62	4.49	4.60	4.80
Pay	5.44	5.19	5.33	4.19	4.40
Security	4.27	4.21	4.08	4.83	4.76
Social	3.77	3.74	3.79	5.33	5.40
Supervisors	5.29	4.60	4.97	4.95	4.79

Table 4. The general satisfaction of computer operations personnel is not significantly different from that of persons in other occupations. However, in only one aspect are they more satisfied with their jobs than other employees, that of pay, while they are a good deal less satisfied in a couple of other areas.

participation in the decision-making process increased, disruption and turnover from the change effort decreased.

In 1967, Texas Instruments started a work redesign program for 600 female assemblers of navigation equipment. The assemblers worked in small groups and each group was asked by management to help set production goals. The assemblers were given cost information, terms of the government contracts such as quality requirements, production schedules, and delivery schedules. At the end of one year, assembly time decreased from 138 to 32 hours. The company also reported a reduction in absenteeism, turnover, complaints, and trips to the medical center.

During the early 1970s, Travelers Insurance Co. decided to attempt to enrich the jobs of keypunch operators because the department was plagued by high error rates, high absenteeism, high turnover, and low morale. (This is one of the few reported work redesign efforts in a data processing function.)

The jobs were diagnosed by using the JDS. This diagnosis indicated that the keypunch workers perceived their jobs to be extremely low on all five core job dimensions. The job was changed to permit the workers to be responsible for their own accounts and to directly interface with their clients. Incorrect work was returned directly to the operator who had done it. Reports on productivity and error rates were provided on a weekly basis directly to concerned workers.

The job enrichment effort produced some amazing results: a 39.6% increase in productivity for the experimental group while the control group increased only 8.1%. The number of workers was reduced from 98 to 60 through attrition. The error rate decreased from 1.53% to 0.99%. Job satisfaction in the experimental group improved by 16.5%; in the control group it improved 0.5%. Absenteeism in the experimental group *de*creased by 24.1% while it *in*creased in the control group by 29%. The bottom line payoff was a hard saving of $64,305 during the experiment.

The Travelers and Texas Instruments examples are not as dated as their starting dates make them appear. Both companies have continued to use the job enrichment techniques. One sign of the acceptance of the techniques is that they now are carried on by persons who were not responsible for the original experiments. Another sign is that the techniques have been expanded to include personnel in other departments and other occupations. Although the TI program has not yet been extended into dp occupations, the Travelers program has been expanded to include systems analysis and programming jobs.

(For more examples, refer to "Research Round-up," an article by Rosenbach, Zawacki, and Morgan which appeared in the October 1977 issue of *The Personnel Administrator*, pages 51 - 61.)

ABOUT THE SURVEY

The Job Diagnostic Survey was conducted in 25 organizations, both in industry and government. The industries represented include: food processing, airlines, electronics, retailing, banking, insurance, and mail order sales. Their data processing organizations ranged in size from 25 to 150 employees and were located in all geographic regions of the United States.

The government organizations included operations at the city, state, and federal level. Their dp groups varied in size from 30 to 200 employees, and were located in 15 states.

More than 600 analysts and programmers were surveyed and their responses reported in DATAMATION (September, 1978, pp. 114-123, and November 1, 1978, pp. 96-102). Now, data for over 1,200 persons in other dp jobs are included in this feature.

The Job Diagnostic Survey (JDS), developed by J. Richard Hackman (Yale Univ.) and Greg R. Oldham (Univ. of Illinois), was used as the survey instrument, for two principal reasons:

1. The Hackman/Oldham instrument is conceptually sound. Its validity and reliability have been substantiated in studies of more than 6,000 subjects on more than 500 different jobs in more than 50 different organizations.

2. A major objective is to compare our results with prior studies of personnel in other professions. Our hypothesis on the difference between dp personnel and other personnel could be tested if we used the JDS.

Most JDS questions ask participants to record their response on a scale of 1 to 7, as in the example below.

The survey is individually and anonymously administered. It contains 53 questions concerning 21 variables and can be completed in 20 minutes. All survey results were analyzed with the computer packages for Analysis of Variance (ANOVA) and SPSS (Statistical Processing for the Social Sciences).

To what extent does your job involve doing a *"whole" and identifiable piece of work*? That is, is the job a complete piece of work that has an obvious beginning and end? Or is it only a small *part* of the overall piece of work, which is finished by other people or by automatic machines?

1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7

My job is only a tiny part of the overall piece of work; the results of my activities cannot be seen in the final product or service.	My job is a moderate-sized "chunk" of the over-all piece of work; my own contribution can be seen in the final outcome.	My job involves doing the whole piece of work, from start to finish; the results of my activities are easily seen in the final product or service.

Measures of satisfaction	Operations supervisors	Other supervisors
General	4.05	4.75
Pay	5.44	4.40
Security	4.23	5.12
Social	3.90	5.54
Managers	5.17	5.10

Table 5. Overall, dp operations supervisors are close to being as satisfied with their positions as are other supervisors. But, like their staffs, they are somewhat more satisfied with their pay, somewhat less satisfied with how their social and security needs are being met.

WHAT IT TAKES

For a decision to be effective, it not only must be a correct decision, it must be implemented properly. The persons assigned to implementation must be committed. Commitment can be enhanced when subordinates and/or team members participate—are actively involved—in the deci-

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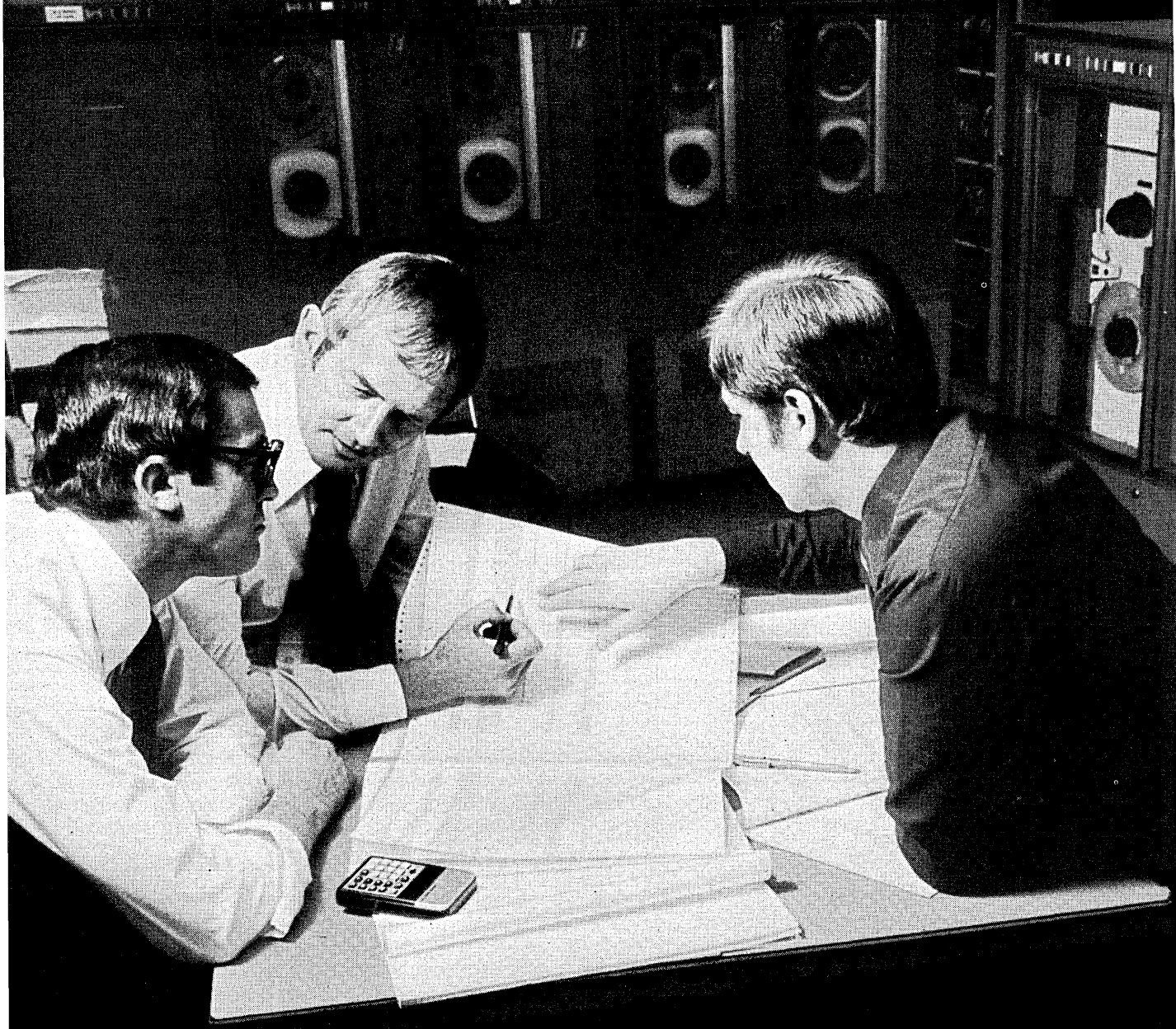

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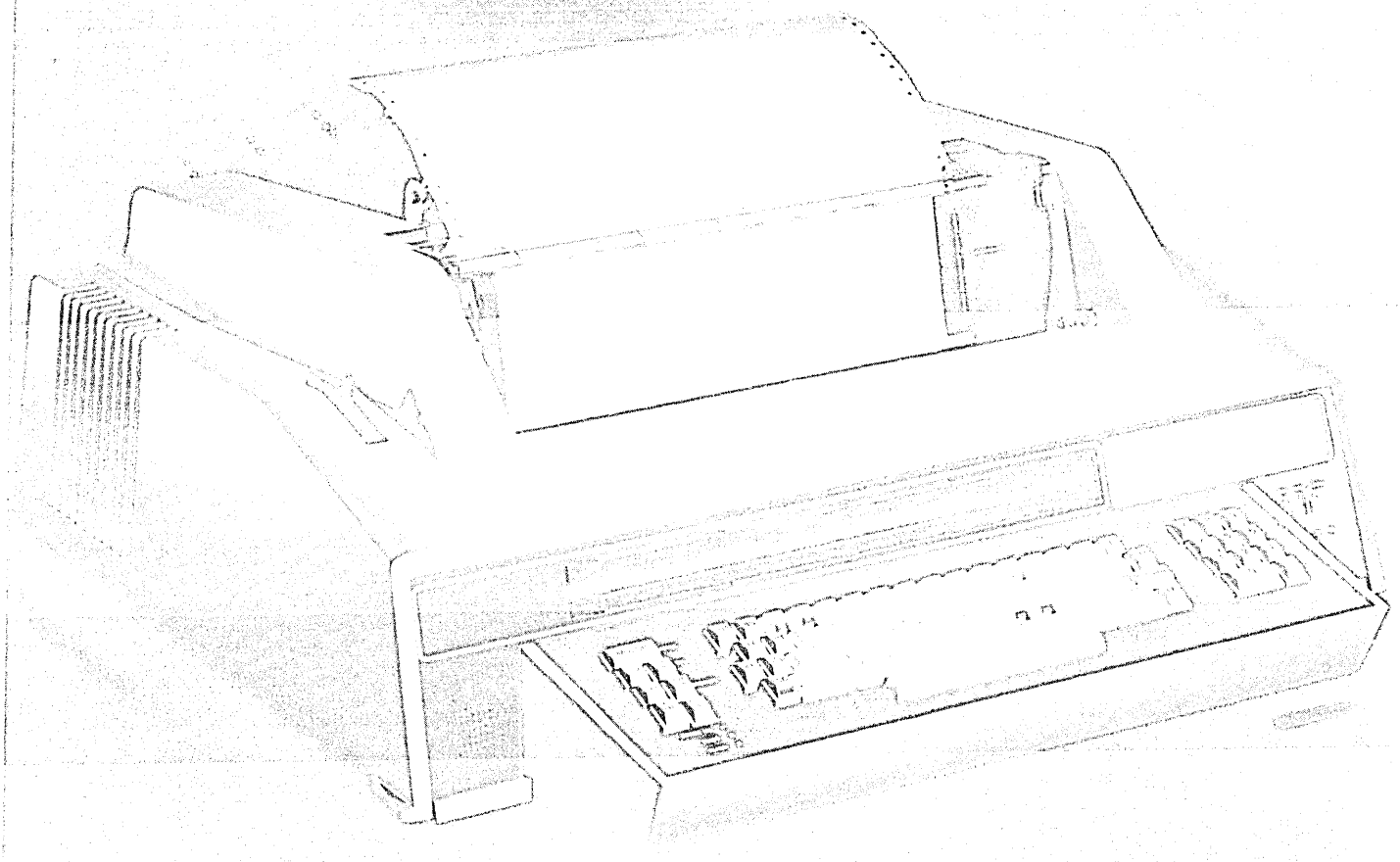

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And more — paper that can be loaded from front or rear, serviceability and self test features.

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The TermiNet 200
The Complete Matrix Printer

GENERAL ELECTRIC

CIRCLE 40 ON READER CARD

The rate of pay may partially compensate for the lack of challenge.

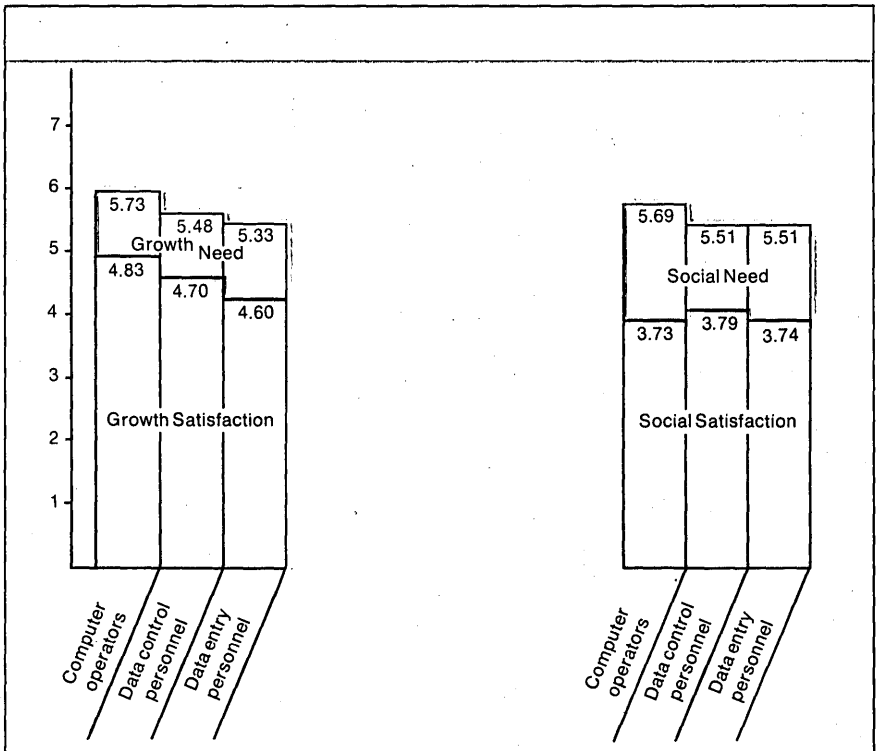

Fig. 3. Computer operations personnel are a good deal more satisfied with how their needs for individual growth are being met than they are with how their social needs are being met. Their relatively high level of satisfaction with their need for growth is somewhat surprising, in light of other data, and is probably best explained by the fact that they expect fairly rapid promotion from their current positions.

sion-making process. Further, the solicitation of participation by the manager must be sincere. The manager must believe that a good solution requires involvement of the people who implement the decision. Workers cannot be manipulated for very long. They soon see through a manipulative manager.

However, participation alone does not ensure successful results. The methods by which suggestions are solicited and processed, and by which feedback is given are the keys to success or failure in participative work redesign.

The procedure for work redesign is as follows:

1. Begin with a workshop for management, identifying the goals and procedures of the project. Explain the theories of motivation and feedback channels.

2. Conduct workshops for employees and first-line supervisors, by natural work group, discussing work motivation and characteristics of good jobs. Provide employees feedback on the job's profile as determined by the JDS.

3. Conduct two-hour brainstorming sessions with all employees to solicit proposals for improving jobs. (Keep group size less than 25 persons.)

4. Capture all suggestions on tape and transcribe them to a list distributed to all participants.

5. Use an evaluation committee (comprised of supervisors and non-supervisors) to screen, consolidate and determine the feasibility of suggested changes. If a proposal is rejected, record and disseminate the reasons.

6. Prioritize and schedule proposed work changes.

7. Follow up through formal audits; report results to all employees through a newsletter.

8. Repeat this process periodically (depending on the dynamic characteristics of the organization—typically, once every two years).

As shown by the Travelers Insurance example, work redesign can be just as beneficial for the dp field.

The current lack of challenge and the low motivating potential of jobs, as presently constituted, demand careful consideration of work redesign for both humanitarian and productivity reasons.*

J. DANIEL COUGER

Dr. Couger is a professor of computer and management science at the Univ. of Colorado's College of Business. Before joining the CU faculty in 1965, he spent 13 years in industry. He has more than 20 years experience in computing, having been one of the first to enter the field.

He has addressed more than 60 national and international professional society meetings, and has written 10 books and monographs and more than 50 articles concerning management uses of the computer. He has lectured in 46 countries on six continents and has served as a consultant to more than 30 organizations, including NCR, CDC, IBM, and Hewlett-Packard.

Last year he was selected as DPMA's U.S. Man of the Year in computer science. He is listed in "Who's Who in America."

ROBERT A. ZAWACKI

Dr. Zawacki is an associate professor of management and organizational behavior at the Univ. of Colorado, where he teaches personnel management and organization behavior courses. Before joining the CU faculty, for nine years he was on the faculty of the Air Force Academy, where he held a variety of positions such as director of the Academy Research Div., cadet professional counselor, chief of cadet personnel, and as a faculty member in the department of behavioral sciences.

His consulting experience has included organization development and personnel management programs for government agencies, hospitals, universities, high schools, and businesses.

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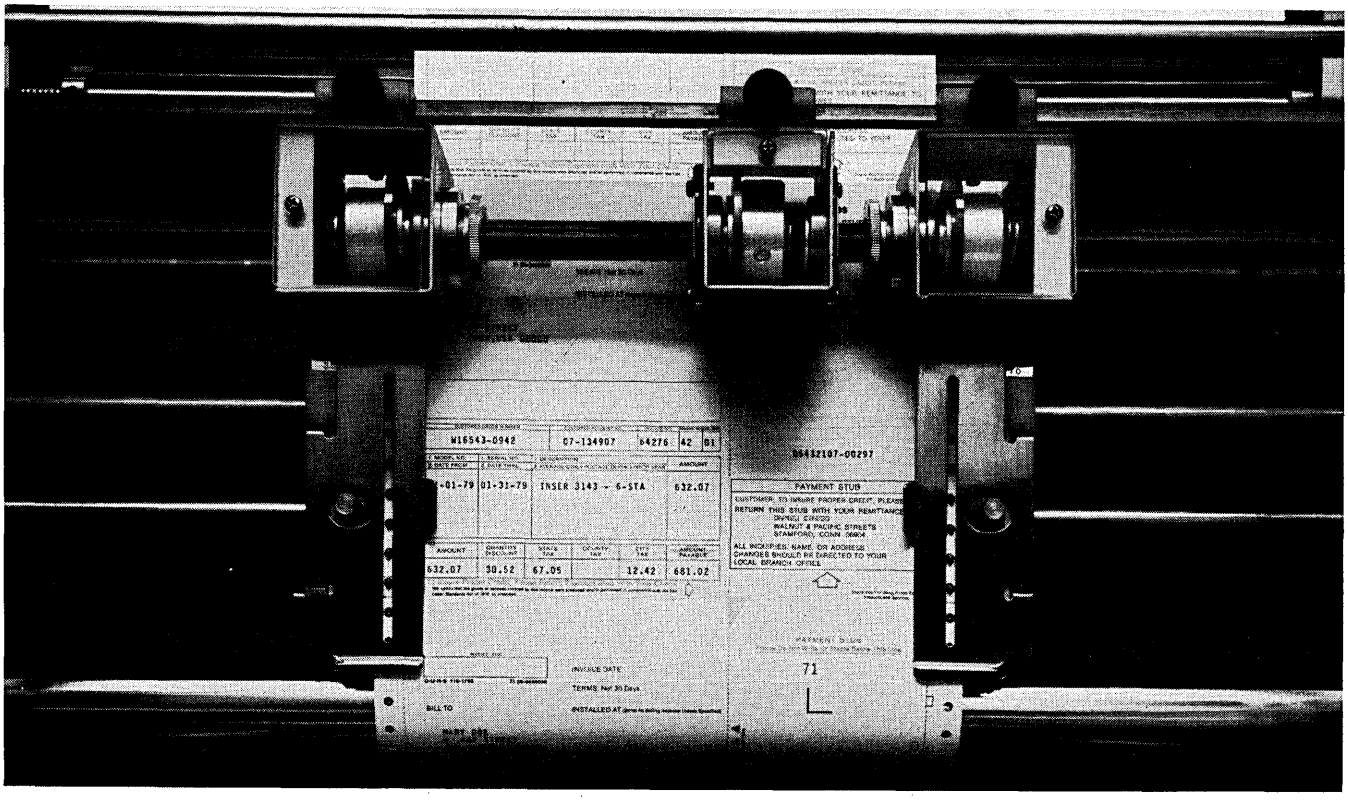
CIRCLE 46 ON READER CARD



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Minutes from now they'll be in the mail.

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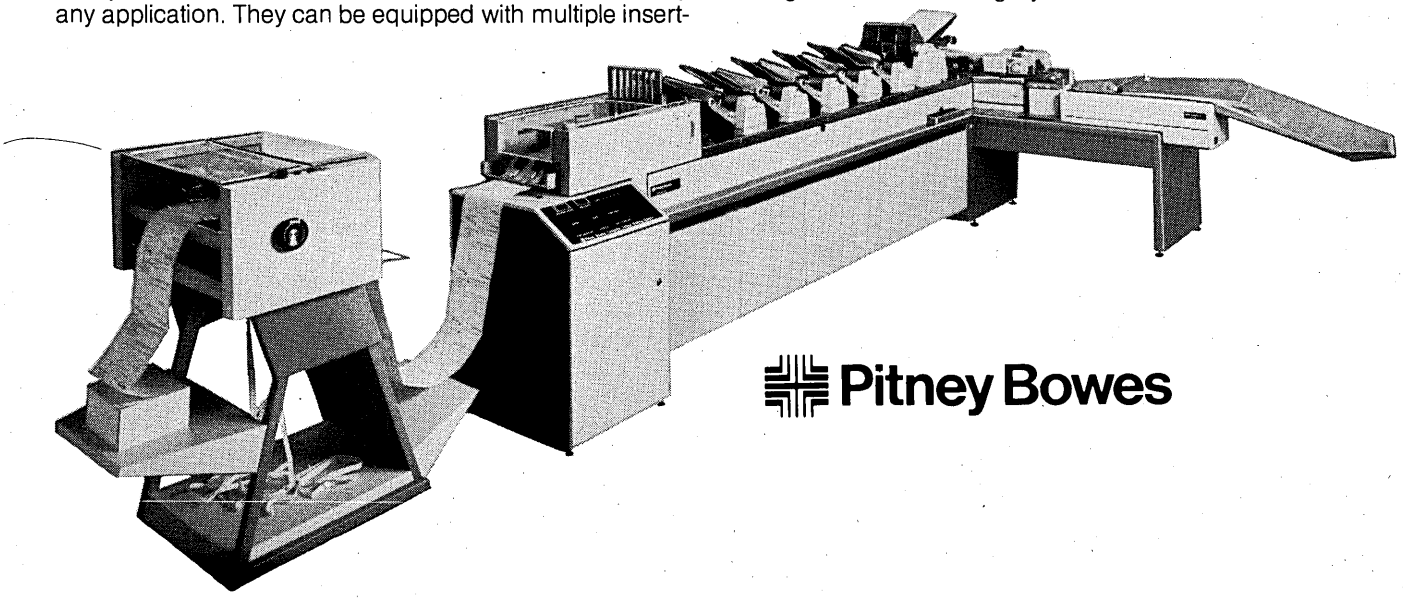

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CIRCLE 41 ON READER CARD

Accessing datacomm networks can be a matter of trial and error.

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CIRCLE 137 ON READER CARD

Build
last stalk
Know

With Graham's new Epoch 480 computer tape, you get all the reliability and durability of Epoch 4—plus much more.

When you couple Graham know-how with our no-compromise approach to quality, it's easy to see why Epoch 4 became the industry standard.

Now, with the introduction of new Epoch 480, we're creating an even higher standard in magnetic tape reliability and dependability.

Epoch 480 utilizes Epoch 4's binder system, but we've added Graham's "Magnum 80" particle—a significant improvement in oxide particle configuration.

Because the "Magnum 80" particle is larger, it has several important advantages over ordinary oxide particles. It makes possible more uniform particle dispersion. This helps greatly to reduce the usual particle clumps which would be worn away by the head—causing excessive head and tape wear, contamination and signal loss.

And like its famous predecessor, every reel of Epoch 480 is 100% certified error free.

Epoch 480. It's not our great Epoch 4. It's even greater.

When you buy from Graham, you deal direct with a Graham magnetic media specialist. We wouldn't have it any other way.

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CIRCLE 64 ON READER CARD

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NEW SERIES 2 INTELLIGENT TERMINALS. POWERFUL SYSTEMS IN EASY-TO-USE, COMPACT PACKAGES.

From the makers of famous KEY-EDIT key-to-disk data entry systems come powerful, intelligent terminals for local processing.

More computing power, when and where you need it, means you can declare your independence from complicated, pieced-together "do-it-yourself" configurations.

KEY-EDIT 22 single station and KEY-EDIT 24 dual station intelligent terminals are ideal for data entry, billing, order entry, message transmission, data collection and all the remote job applications you can dream up. And they'll do it at prices you may find hard to believe.

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KEY-EDIT 22 SINGLE WORKSTATION
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- Four floppy disk drives with 972K bytes of storage, two printers, dual CRT's and keyboards, and communications controllers

SOFTWARE THAT SETS A NEW STANDARD FOR INTELLIGENT TERMINALS

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A unique forms package called KEY-FORM, and KEY-EDIT Terminal Language (KTL) are designed specifically for source data entry and efficient stand-alone and interactive processing.

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A complete set of system support and program development utilities are provided in both the forms package and the terminal language.

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IBM 3780 communications emulator support is provided.

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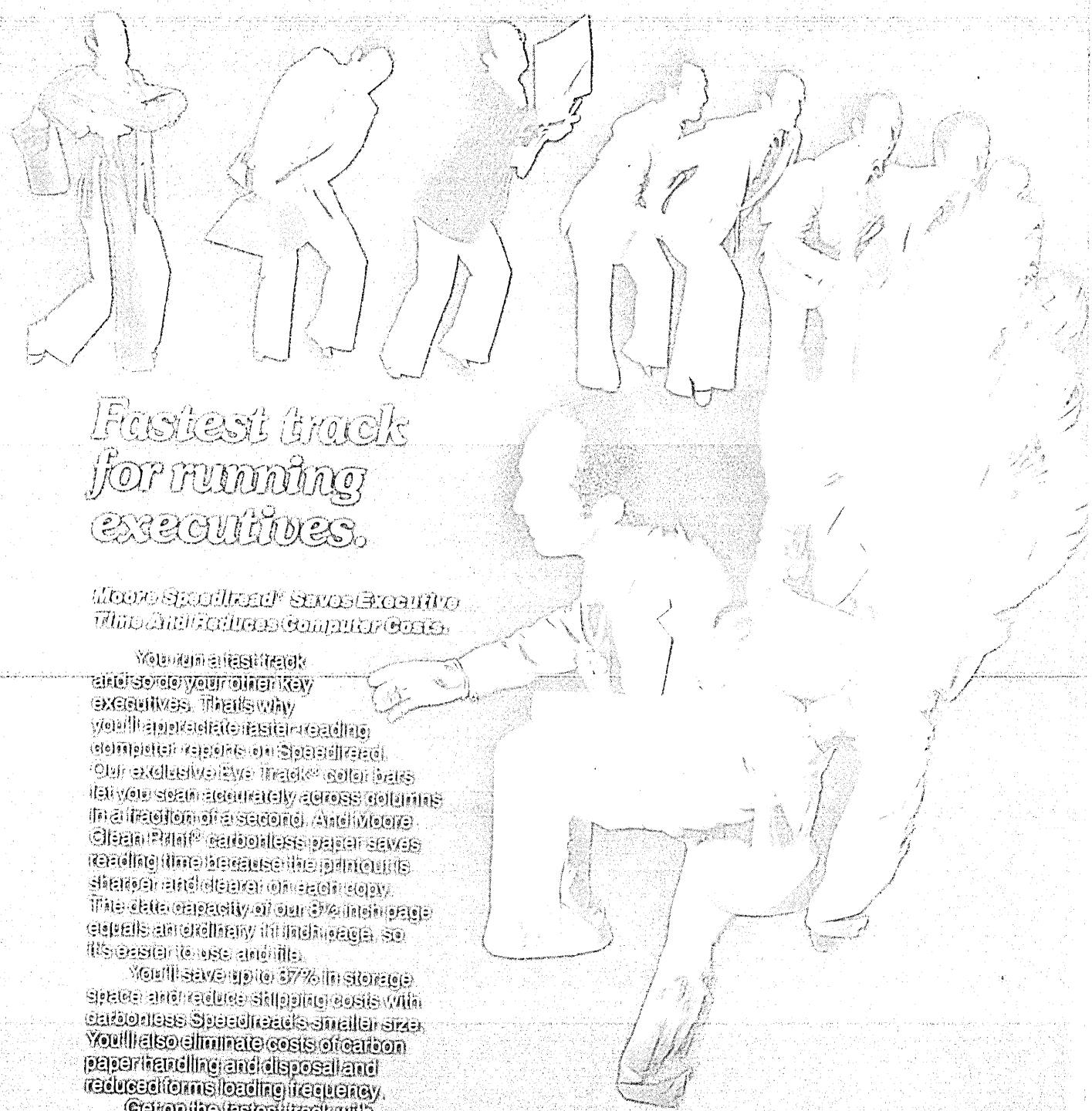

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CIRCLE 28 ON READER CARD

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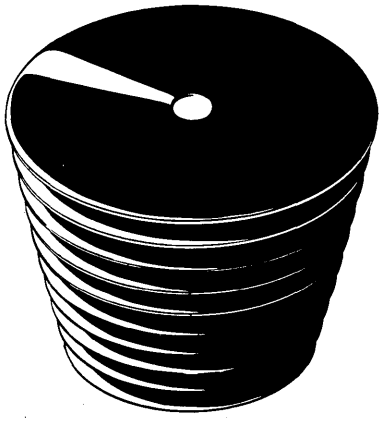
Five years ago, Tower Systems, Inc. pioneered the concept of a disk management system for DOS users. Today, DFAST is the most extensively used disk management system in the world. And for good reason. DFAST provides more features, offers greater versatility and is supported better than any other similar system. Over 400 DFAST users world-wide can attest to that.

DYNAMIC FILE ALLOCATION DFAST allocates file space from available area on a disk pack. The user is only required to specify the number of tracks for a file, not the starting relative track number.

***AUTOMATIC SECONDARY EXTENT GENERATION** When a disk output extent has been exhausted the system will automatically generate additional extents with no operator involvement or JCL modification.

***ALLOCATION BY LOGICAL RECORDS** Disk allocation may be requested by number of anticipated logical records. The system will calculate the correct allocation based upon the available DASD device types.



AUTOMATIC VOLUME RECOGNITION (AVR) The AVR feature of DFAST allows the system to automatically make logical unit assignments by the serial number in the EXTENT card. DFAST will make these assignments if the logical unit is unassigned or assigned to the wrong pack.

PUBLIC SPACE MANAGEMENT DFAST will allocate area within a user-defined pool of disk drives.

DEVICE INDEPENDENCE Programs may be run on any DASD device type without re-compiling.

***GENERIC DEVICE INDEPENDENCE** DFAST allows the generic device type to be changed at execute time. Disk files may be changed to tape or vice versa without re-compiling the problem program.

***PRIORITY FILE DISTRIBUTION** User may define the search priority for allocation. Avoids stacking all files on same drive. Provides up to three-fold increase in thruput.

FILE CONCATENATION DFAST allocates files as close together as possible, thus eliminating unwanted seek time between files on the same pack.

FILE PROTECTION DFAST allocates area from any available space on the disk, thereby making it unnecessary for operations to delete unexpired files.

***ALLOCATION ON TRACK BOUNDARY** Allocation of files is by track boundary resulting in more efficient DASD utilization.

FILE DELETION DFAST deletes files automatically, or a support program that will expire files by file name may be included in production job streams to delete files when they are no longer needed by the system.

PARTITION INDEPENDENT DFAST provides a facility for maintaining file uniqueness between partitions. This allows the same file name to be used by more than one partition at the same time on the same disk pack.

HARDWARE SOFTWARE COMPATIBILITY DFAST runs on any model 360 or 370 using the DOS. EDOS, DOS/MVT, or DOS/VS operating system and supports all disk drives (2311, 2314, 3330, 3340, 3344, 3350, 3330 MOD 11).

NO USER CORE NEEDED DFAST functions in the transient or SVA area and requires no changes to user programs or partition allocations.

RELEASE UNUSED FILE SPACE (SD FILES) When a sequential disk file is closed, only the amount of area used by the program is protected in the VTOC. The unused area is then available for use by other files. This feature allows the user to make more efficient use of his disk resources.

ENQUE/DEQUE OF DATASETS Files may be protected across partitions at execute time.

***REBLOCK FEATURE** Allows user to modify block size at execution time without re-compiling program.

***PASSWORD PROTECTION** Files may be password-protected to prevent unauthorized access.

NEW FEATURES

GENERATION DATA SETS provides capability to retain multiple versions of same file on disk pool.

AUTOMATIC FILE FRAGMENTATION eligible user may make files 'Best-Fit' — provides 'Checker-board' allocation for files.

EXTENDED ISAM SUPPORT. Full ISAM support for 3330-11 and 3350 devices without re-compiling problem programs:

Find out how economically you can unlock DOS. DFAST may be purchases or leased at a surprisingly low price. And for tape users, Tower Systems, Inc. offers TFAST — an extremely efficient tape management system.

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CIRCLE 136 ON READER CARD

Thinking Systems?

Think of the Possibilities – A Complete Computer for $1275!*

All You Do Is Add The Terminal, Printer, And Applications Software — And You've Got A Complete System!

The Horizon is a complete computer — Z80, 16K RAM, Disk and I/O — priced so that the only limit to application in your system is your imagination! And, the Horizon is packaged in a natural wood cover, adding sales appeal to your system! Think of the possibilities if you're designing a system for education, small business, process control, word processing, engineering, or whatever is on your mind.

Over 10,000 North Star Systems In Use!

We offer you the maturity and reliability to meet the needs of demanding, high-volume applications. Horizon performance and reliability are assured through the use of the proven Z80A microprocessor and industry standard 5¼" 180K byte disk drives. Our professional approach to design (for example, a memory parity option) has been proven in thousands of installations.

North Star Horizon Specifications:

CPU:	**4 mhz Z80A**
RAM:	**200ns (parity check optional)**
Bus:	**12 slot, S-100**
Disk:	**180K bytes per diskette**
Controller:	**Up to 4 drives (720K bytes), 250 KB transfer rate**
Cover:	**Natural Wood or Blue Metal, no charge**

Complete Software Support: DOS, BASIC, and MONITOR!

We provide you with the tools (system software) for writing the application programs that will make your system work! Our BASIC is a *full* extended disk BASIC! Hundreds of commercial software application packages have been developed using North Star BASIC. Additionally, a wide selection of application software for the Horizon is available from independent vendors.

Expand Your Horizon!

The Horizon can be expanded to 56K bytes or more of RAM, four disk drives (720K bytes), and three built-in I/O interfaces. Performance can be enhanced by the addition of the North Star hardware floating point board. Also, S-100 bus products from other manufacturers may be used to expand the Horizon.

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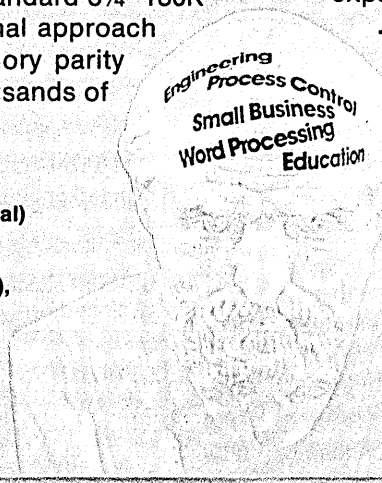
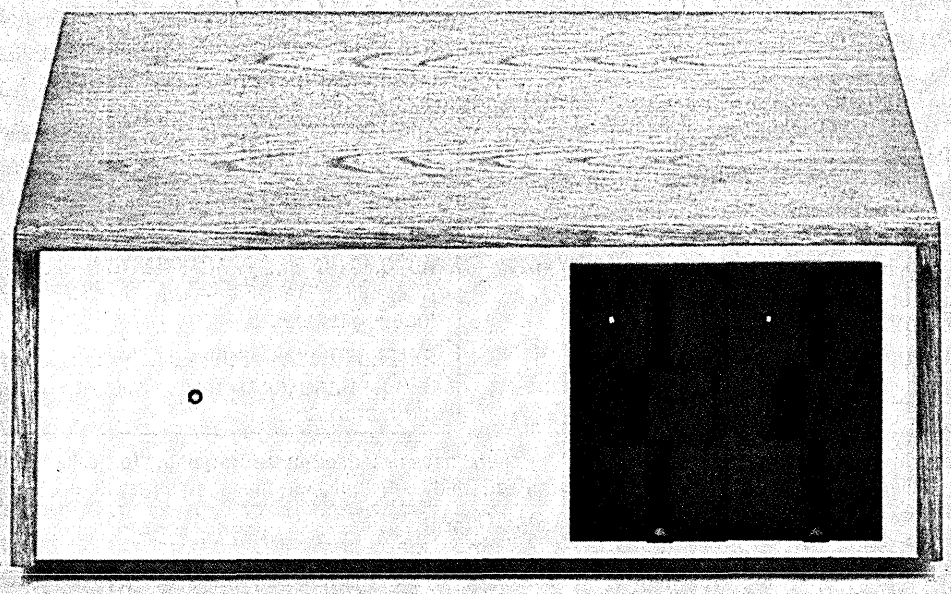
Think about North Star's memories, Z80A processor boards, floating point arithmetic boards, and disk drive systems. These are available for the OEM system designer. For complete information call Bernard Silverman at (415) 549-0858. North Star Computers, 2547 Ninth Street, Berkeley, California 94710.



NorthStar

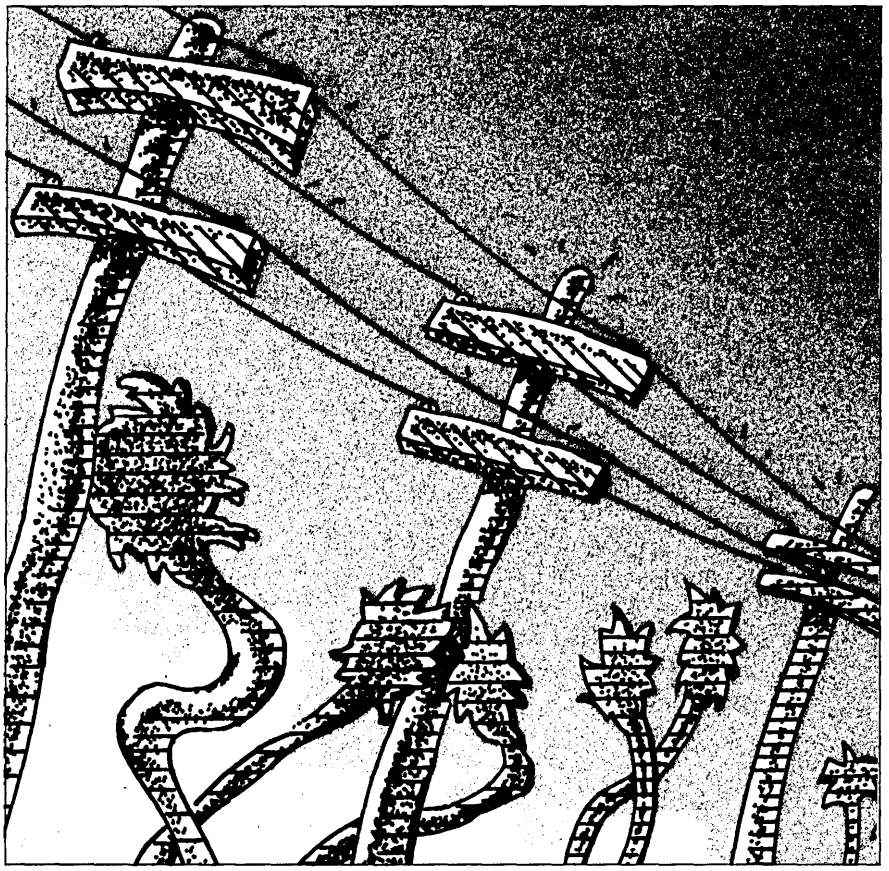


*In OEM quantities of 100 or more.

CIRCLE 49 ON READER CARD

With nearly 400 to chose from, there must be one to fill every need.

MODEM SURVEY



During the infancy of computer communications, which fell at about the beginning of hardware's third generation, the only commercially available modems were supplied by the common carriers. Then, as terminals like IBM's 1050 came into prominence as powerful extensions of the computer mainframe, the modem market began to expand and bloom with new products and new suppliers. What started as just a handful of vendors and models—most of which had some form of the Bell label—expanded to today's industry of more than 50 suppliers offering over 400 discrete models.

The impetus for such rapid growth can be accredited almost equally to the proliferation of terminals and to the slowness with which AT&T responded to users' needs. Now, with more than a million modems installed and more than 20% per year being added, Bell's share is pegged at about 60% and falling. The change has taken about ten years, and the rate of change doesn't seem to be slowing.

In 1968, for example, it seemed that one or two modem makers went out of business every week or so, only to be replaced by three or four new arrivals. Although 1978 did not see nearly as much turnover, it had its share of casualties and name changes. Prominent among these were Racal Electronic's addition of Vadic to its group of modem manufacturers (which already included Racal-Milgo), and Motorola's addition of Universal Data Systems to its team (which already included Codex Corp.).

Product lines changed rapidly, too, especially as microprocessor-based devices and FCC-certified devices were added to the fold. The newer models brought with them advances in fast-poll operation, diagnostics, quicker turnaround times, multiplexing, and automatic functions, among others.

All in all, it has been a very busy business, as the number and sophistication of modems in the following listings shows. With few minor exceptions, the data which follows was supplied or verified by the vendors during December and January, and so is as up to date as we can make it. Still, by the time these pages are printed, something new will have been added.

For ease of use, the listings have been grouped into categories by type of equipment and speed. The classifications are:

- Low-Speed Modems (to 600bps)
- Medium-Speed Modems (to 2400 bps)
- High-Speed Modems (to 9600bps)
- Wideband Modems (over 9600bps)
- Short-Haul Modems (limited distance devices)
- Modem Eliminators (substitutes for modems)
- Telephone Couplers
- Parallel Interface Modems

Several models cross group boundaries and consequently are repeated in each appropriate place.

THE TERMINOLOGY

Some of these classifications, and some of the characteristics important within classifications, may not be familiar to everyone, and thus some explanations are in order.

Compatibility: Many factors are involved in the question of whether one data set can communicate with another accurately, reliably, or at all. On the surface, a simple criterion seems to exist. Just as IBM sets the style for data processing standards, the Bell System pretty much sets the standards for data communications. Thus it would seem that two modems which are compatible with the same Bell modem should be compatible with one another. In fact, however, modem manufacturers tend to be very reluctant to guarantee compatibility with any models other than their own and perhaps Bell's. So it would be a mistake to read too much into the compatibility specifications without also requiring written assurances from the vendors.

Certification: One of the most controversial topics in today's modem arena is Bell's Data Access Arrangement (DAA). Prior to January 1, 1969, modems provided by independent suppliers were restricted to use on leased or privately-owned lines; the connection of a non-Bell modem to the public telephone network was forbidden by the telephone company. A customer who disregarded this "foreign attachment" ruling risked having his service terminated.

This policy was challenged by the Carter Electronics Corp., which brought an antitrust suit against the Bell System and GT&E. The suit resulted in an FCC ruling which allowed foreign attachments like independent modems to be connected to the dial-up network. But AT&T held out for the use of a DAA between the foreign attachment and the phone line, and charged from $2 to $8 per month for the device. This gave AT&T modems a competitive edge, among other things, and led to a great deal of unhappiness on the part of the independents, which in turn led to another FCC decision.

The final outcome was that independent vendors will be allowed to build their own versions of the DAA mechanism into their products, as long as their circuitry is certified by the FCC. Just to make things fair, AT&T is also required to have its products certified. All of this became effective as of June 1977, and the certified products have since begun to come onto the market.

Modulation: A modem's modulation technique is vital to the question of compatibility, among others. Essentially, modulation is the way information is encoded into the signal that is transmitted. The actual digital signal is not suitable for transmission over public phone systems, which is the whole reason for modems in the first place. Three properties of an analog signal can be exploited for carrying digital data: frequency, phase, and amplitude. Thus the techniques used for carrying data involve frequency modulation, phase modulation, and amplitude modulation. In practice, the techniques also involve encoding levels (two levels can be used to represent 0 and 1; four levels can represent the combinations 00, 01, 10, and 11; etc.).

The most frequently used kinds of modulation are FSK, AM, and PM.

FSK is short for Frequency Shift Keying, a two-level frequency modulation technique used almost universally for low speed operation. AM is amplitude modulation, of course, and is frequently used in specialized forms like QAM (Quadrature Amplitude Modulation, a four-level form). PCM is Pulse Code Modulation, in which the periodic nature of the signals is ignored, and the presence or duration of the signal is used for encoding.

Other, less common, forms of modulation include Duobinary (a GTE Lenkurt invention used only in its equipment), and baseband (where digital pulse trains are reshaped for transmission over analog lines, usually for sending over short distances only).

Line Conditioning: This refers to adjusting the properties of the communications line to prevent the signals from getting too far out of shape. Conditioning a line involves physically attaching electrical components to it, so it cannot be done on the switched network unless those components are built into the modem. For Bell System leased voice grade lines, C1, C2, C4, D1, and D2 conditioning is offered. Bell's Long Lines Division recently began offering B1 and B2 conditioning as well, both of which are usually employed only for short haul transmissions. In any case, if conditioning is required, line costs go up; to avoid this, many modems incorporate "equalization" circuitry that effectively accomplishes the same purpose by tuning the modems to the existing lines.

Synchronization: There are basically two ways for a modem to handle the transmission of data, in spurts or in a continuous stream. The former is called asynchronous; the latter synchronous. Asynchronous transmission is appropriate for data from sources like keyboards, but is not as efficient; and modems which transmit asynchronously generally can operate at any rate up to their maximum. Modems designed for synchronous operation run only at fixed speeds, although they may be able to operate at many rates within their overall range.

Turnaround Time: This affects throughput in important ways, and having a shorter turnaround can give a unit a competitive edge. For half-duplex circuits (one way at a time), turnaround measures the time required to reverse direction. For full-duplex operation, the analogy is *train time* or initialization time, the delay in establishing synchronization. For short-haul modems, it's the *clear to send* delay.

FEATURES

A number of features originating with the Bell System modems provide useful capabilties in a data communications environment. For example, sending acknowledgements of data received can be time-consuming in half-duplex operation, so a *reverse channel* is often provided. Sometimes called a secondary channel, this is a small slice of the communications link dedicated to traffic in the opposite direction from the main flow.

Also, in some networks, the coordination from end to end is done by operators who speak to each other over the same line that is used for data. This requires a feature referred to as *alternate voice/data* and also an *integral handset.*

For unattended operation, automatic answering (*auto-answer*) is required.

Equalization, which may be done manually or automatically, is for matching the modems to the phone line, compensating for differences between one line and another. The faster the transmission, the more important this is.

Multiplexing, in this context, refers not to the modem's ability to connect to a multiplexor, but to its ability to act *as* a multiplexor.

Diagnostics: One of the more valuable outgrowths of modem development is the inclusion of diagnostic capabilities within the modem. And one of the more common means for this is through *loop-back,* where a piece of transmitting equip-

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This feature and accompanying product listings have been condensed and adapted from material published in *Datapro 70,* a looseleaf information reference which provides reports on dp products and services. "All About Modems," the 53-page section on which the article is based, is available separately for $12 from Datapro Research Corp., 1805 Underwood Blvd., Delran, NJ 08075 (609) 764-0100.

ment can have its digital signal routed directly back to it through the modem interface (local digital loopback), or through the modem and back (local analog loopback), or to the opposite end of the communication line (remote analog loopback), or actually through the far end modem and back (remote digital loopback).

Related to this is the *self-test* facility, which incorporates a random pattern generator in the modem.

THE LESS COMMON FORMS

Short-Haul Modems are just what their name implies, devices for sending data over short distances. Actually the distances may be up to many miles. The point is that the devices generally assume that they will be connected to another device of the same type over a circuit that employs only wires (which is not true of all circuits in today's world). The main advantages of these devices is that they usually are less expensive than equivalent speed general purpose modems.

Modem Eliminators carry the concept of short-haul modems one step further. They are even simpler devices, and sometimes don't even bother to convert the signals they carry to analog form. Line driver is another name for some of them. Some modem eliminators are intended for very short distance use, as for a terminal on one floor of a building communicating with a mainframe somewhere else in the building. Others can communicate over longer distances, given a private line or other carefully tuned medium.

Telephone Couplers usually work acoustically but may also work inductively. Basically, they are mechanisms for drafting a regular telephone handset into service as a modem.

Parallel Interface Modems are specialized devices, most of which are fairly old, for communicating in parallel form over the phone network. Often used by banks, they make use of Touch-Tone phones or similar equipment.

GETTING MORE DATA

As mentioned, the vendors have provided the information presented on the following pages. For more information on any of the products listed, reader service numbers have been included with names and addresses in the vendor index on page 226.

THE LISTINGS

LOW-SPEED MODEMS (to 600bps)

ANDERSON JACOBSON L142 & L145
Bell 103F-compatible originate-only (L142) and answer-only (L145) types
Up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
2- or 4-wire with RS232C interface
L145 features auto-answer
Sold since 1970
$240 ($18/month) plus $35 installation

ANDERSON JACOBSON L150/12 SERIES
Originate/answer plug-in type compatible with IBM line adaptors
Up to 150bps or 600bps using FSK modulation
Asynchronous, half/full-duplex operation
2- or 4-wire with RS232C interface
Remote and local loopback diagnostics
Sold since 1972
$155 to $200 ($8.50 to $14.50/month)

ANDERSON JACOBSON DCM 151
Originate/answer type compatible with IBM 4634/35
Up to 150bps using FSK modulation
Asynchronous, half/full-duplex operation
2- or 4-wire with IBM interface (twisted pair or coax for up to 4 miles)
Sold since 1970
$100 ($10/month) plus $35 installation

ANDERSON JACOBSON L184/12
Bell 103F-compatible answer-only type, plug-in modems
Up to 450bps using FSK modulation
Asynchronous, half/full-duplex operation
2-wire with RS232C interface
Remote and local loopback diagnostics
Sold since 1973
$180 ($10.50/month)

ANDERSON JACOBSON MU290/12 SERIES
Bell 103A/E-compatible originate/answer type, plug-in modems
Up to 450bps using FSK modulation
Asynchronous, full-duplex operation
DAA with RS232C interface
Features auto-answer, remote and local loop
Sold since 1970
$200 to $250 ($10.50 to $13.50/month)

ANDERSON JACOBSON SERIES 332
Bell 103-compatible originate/answer type
Up to 450bps using FSK modulation
Asynchronous, half/full-duplex operation
2-wire with RS232 or 20ma interface
Features auto-answer and loopback
Sold since 1977
$495 to $795 ($32 to $42/mo) plus $50 inst.

ASTROCOM SERIES 1300
Bell 103/113-compatible originate-only/answer-only/originate-answer types
Certifed
Up to 300bps using FSK modulation
Asynchronous, full-duplex operation
2-wire with RS232B/C interface
Features auto-answer, diagnostic lights
4,000 sold since 1970
$145 to $415 ($12.50 to $18.50/month)

BELL DATA SET 103A
Originate/answer type compatible with 113
Certification not applied for
Up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
2-wire with RS232C interface
Provides alternate voice/data and handset with 804B
Features auto-answer and fixed equalization
No longer in production, but still available

BELL DATA SET 103J
Originate/answer type compatible with 113
Certification applied for
Up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
2-wire with RS232C interface
Features alternate voice/data, auto-answer, fixed equalization, remote and local loopback

BELL DATA SET 113A/B
103-compatible originate-only (113A) and answer-only (113B) types
Certification not applied for
Up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
2-wire with RS232C interface
Features alternate voice/data, integral handset, fixed equalization, auto-answer

BELL DATA SET 113C/D
103/108/113B/113D/212A-compatible originate-only (113C) and answer-only (113D) types
Certification applied for (113C)
Up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
2-wire with RS232C interface
Features alternate voice/data, fixed equalization, auto-answer (113D)

CARTERFONE TWX/DDD
Bell 101C-compatible originate/answer type
Certification applied for
Up to 440bps using FSK modulation
Asynchronous, half/full-duplex operation
2- or 4-wire with RS232C or 20ma interface
Features alternate voice/data, auto-answer, remote loopback diagnostics
2,500 sold since 1973
$465 to $670 ($26/month) plus $35-$70 inst.

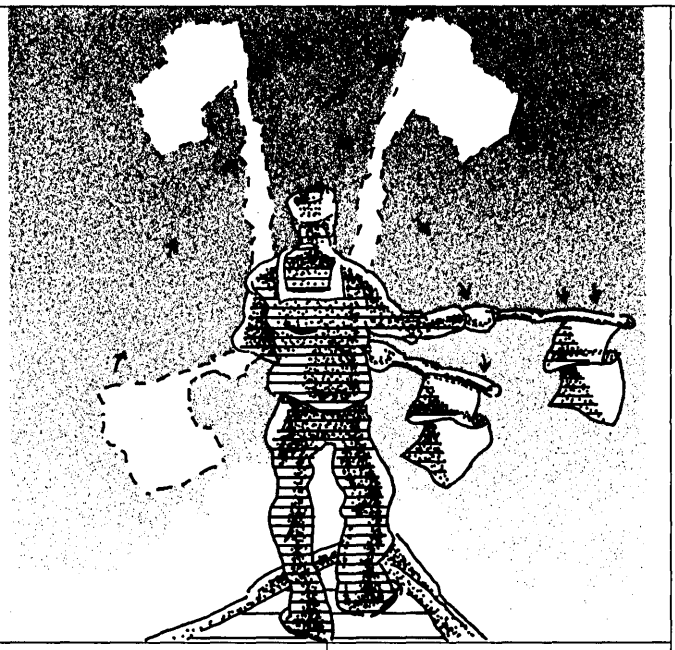
CODEX 103 TYPES
Bell 101/113-compatible originate-only/answer-only/originate-answer types
Certification not applied for
Up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
2-wire with RS232C or V.24 interface
Features auto-answer (some models), fixed equalization, local loopback diagnostics, rack-mount and card-only units available
Sold since 1976
$345 to $415 ($13 to $16/month)

COHERENT FSM-86A
Non-compatible originate-only or answer-only types
Certification not applied for
Up to 600bps using FSK modulation
Asynchronous, half/full-duplex operation
2- or 4-wire with RS232C or V.24 interface
Features reverse channel, alternate voice/data, local analog and digital loopback diagnostics, LED indicators
25 sold since December 1978
$450 to $550

COMDATA 302
Bell 103/113-compatible originate-only or answer-only types
Certified
Up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
2-wire with RS232C or 20ma interface
Features auto-answer, fixed equalization, indicators, local digital loopback diagnostics
Sales begin in 1979
$245 to $345

COMDATA 330 SERIES
Bell 103/113-compatible originate/answer type
Certified
Up to 300bps using FSK modulation
Asynchronous, full-duplex operation
2-wire or DAA with RS232C, CCITT, 20ma, or MIL 188B interfaces
Features auto-answer, local digital loopback diagnostics
Over 35,000 sold since 1971
$150 to $245 ($9 to $15/month)

DATA ACCESS SYSTEMS 68-01
Bell 103/113-compatible originate-only or answer-only types
Certified
Up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
2-wire with RS232C interface
Features alternate voice/data and auto-answer
50 sold since December 1978
$395 ($25/month) plus $35 installation



DATAPOINT 9401
Bell 103-compatible originate/answer type
Certification not applied for
Up to 300bps using FSK modulation
Asynchronous, full-duplex operation
2-wire or DAA with RS232C interface
Features auto-answer, manual equalization, local loopback diagnostics
Over 3,000 sold since 1970
$1,500 ($46/month) plus $15 installation

GENERAL DATACOMM 103A3
Bell 103/113-compatible originate/answer type
Certified
Up to 300bps using FSK modulation
Asynchronous, full-duplex operation
2-wire with RS232C interface
Features alternate voice/data, auto-answer, integral handset (opt.), local analog and remote digital loopback diagnostics
Sold since 1977
$425

GENERAL DATACOMM 113BR2
Bell 103/113-compatible answer-only type, rack-mount
Certified
Up to 300bps using FSK modulation
Asynchronous, full-duplex operation
2-wire with RS232C interface
Features auto-answer, local analog loopback diagnostics
Sold since 1977
$280

GENERAL DATACOMM 108 SERIES
Bell 108-compatible originate-only or answer-only types
Certification not required
Up to 300bps using FSK modulation
Asynchronous, full-duplex operation
2- or 4-wire with RS232C interface
Features local analog and digital loopback diagnostics
Sold since 1970
$300 to $400

LIVERMORE DATA SYSTEMS 403
Bell 103/113A-compatible originate/answer type
Up to 450bps using FSK modulation
Asynchronous, half/full-duplex operation
2- or 4-wire with RS232C interface
Features alternate voice/data and auto-answer
Sold since 1974
$190 to $250, installation free

LIVERMORE DATA SYSTEMS 76C
Bell 113A/B-compatible originate/answer type
Up to 450bps using FSK modulation
Asynchronous, half/full-duplex operation
2-wire or acoustic with RS232C or 20/60ma interface
Features alternate voice/data, auto-answer optional, local loopback diagnostics
Sold since 1977
$349, installation free

MULTI-TECH FM 300/310
Bell 103/113-compatible originate-only (FM 300) or originate/answer (FM 310) types
Up to 450bps using FSK modulation
Asynchronous, half/full-duplex operation
2-wire or acoustic with RS232B/C, or 20ma interface
Features optional auto-answer, FM 310 has local loopback diagnostics
7,000 sold since 1971
$210 to $390 ($22/month)

MULTI-TECH FM 320 SERIES
Bell 103/113B-compatible answer-only type
Certified
Up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
2-wire with RS232B/C interface
Features auto-answer, local digital and analog loopback diagnostics
Sold since 1976
$130 to $295

MULTI-TECH FM 360 SERIES
Bell 103/113-compatible originate/answer type
Certification applied for
Up to 300bps using FSK modulation
Asynchronous, full-duplex operation
2-wire with RS232B/C interface
Features auto-answer, local digital and analog loopback diagnostics, automatically switches between originate and auto-answer
Sold since 1977
$130 to $360

NOVATION 4643 SERIES
Bell 103/113-compatible originate-only/answer-only and originate/answer types
Models B, C and D certified for DDD, Models T and U for leased lines
Up to 300bps using FSK modulation
Asynchronous, full-duplex operation
2-wire with TTL interface
Features alternate voice/data (Models B, C and D), auto-answer (Models B and C), local digital and analog loopback diagnostics
$250 to $295

NOVATION 4102D, 4103B, 4113B
Bell 103/113-compatible originate-only/answer-only and originate/answer types.
Certified
Up to 300bps using FSK modulation
Asynchronous, full-duplex operation
2-wire with RS232C or 20ma interface
Alternate voice-data (some models), auto-answer (except 4102D), local analog and digital loopback diagnostics, LED display
$340 to $365

NOVATION 4102T, 4104T
Bell 103F/108-compatible originate-only (4102T) or answer-only (4104T) types
Certification not required
Up to 300bps using FSK modulation
Asynchronous, full-duplex operation
2-wire (leased) with RS232C or 20ma interface
Features local analog and digital loopback diagnostics, LED display

NOVATION 4503T, 4504T
Bell 103F/108-compatible origi-

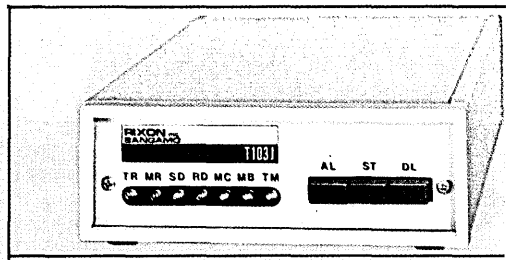
The RIXON Alternative

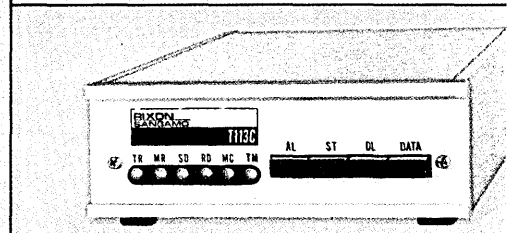
Complete Line of FCC Registered DDD Direct Connect Data Modems Designed to Save You Money the Moment You Plug Them In.

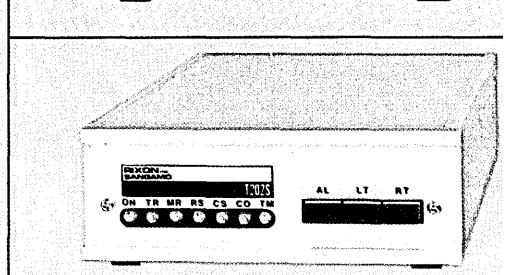
- DIRECT REPLACEMENT — Unplug your Bell 103J, 113C, 202S, 201C, 208B or 212A and plug in a Rixon T103J, T113C, T202S, T201C, T208B or T212A replacement. It's that easy.
- SAVE MONEY — Compare prices . . . the Rixon Alternative is lower!
- YOUR CHOICE — LEASE OR BUY — With Rixon, you can lease with a buy option or buy outright.
- OTHER Rixon ALTERNATIVES include . . . dial-up test center . . . exchange/repair program . . . service contract . . . the latest technology and built-in diagnostics.
- PEACE OF MIND — For more than two decades, Rixon has served data communications needs with quality products and service.

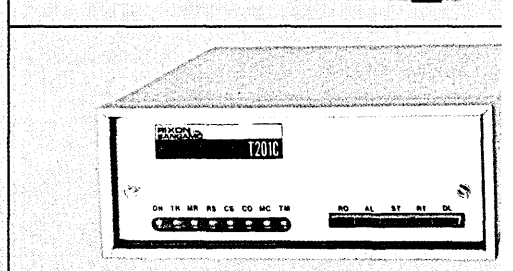
A satisfied customer is our first consideration.

SEND FOR THE RIXON ALTERNATIVE KIT . . . with details on our complete line of DDD data modems, a comparison chart on prices, details on our lease and service programs and more.









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5
8
10
Fred,
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the reports for
General Ledger
somehow they
got lost.
Tom
API530
API550
ACI625
PAY003
INV010
INV020
PAY004
B1
A2
C3

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The UCC-7 Automated Production Control System does everything a scheduling system does. And that's just for openers.

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UCC-7 eliminates many production control problems. It automates workflow, allows unheard of scheduling flexibility and alerts the proper operation point of any impending delays and their causes.

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Now, for the first time, you can centralize control for all work areas—Data Preparation, Scheduling, Operations and Distribution. Plus, you have one common source of information for all user requests. UCC-7 can tell you where the job is, when it will be produced and, if it's being held up, where and why it's being held up. So you can do something about it.

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nate-only (4503T) or answer-only (4504T) types, rack-mount
Certification not required
Up to 300bps using FSK modulation
Asynchronous, full-duplex operation
2-wire (leased) with RS232C or 20ma interface
Features local analog and digital loopback diagnostics, LED display

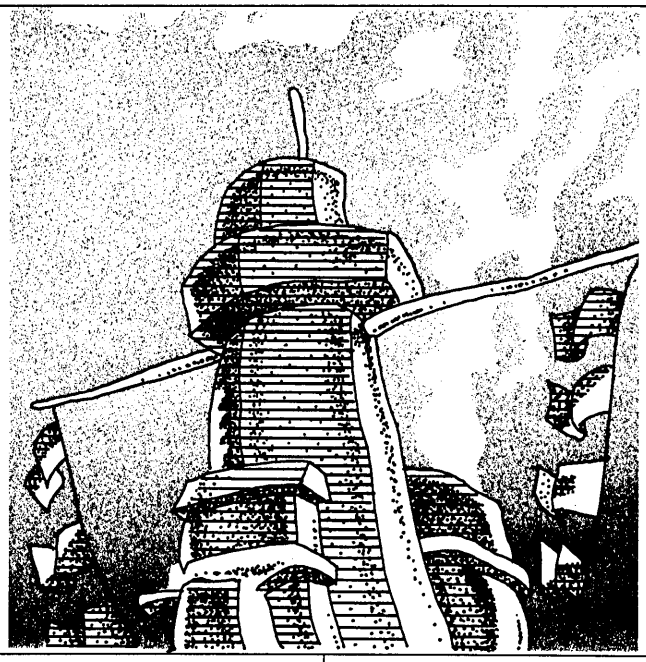
NOVATION 4513B
Bell 103/113-compatible answer-only type, rack-mount
Certification not applied for
Up to 300bps using FSK modulation
Asynchronous, full-duplex operation
2-wire (DDD) with RS232C or 20ma interface
Features auto-answer, local analog and digital loopback diagnostics, LED display
$315

OMNITEC 701R
Bell 103/113-compatible originate-only type
Certification not applied for
Up to 450bps (600bps opt.) using FSK modulation
Asynchronous, full-duplex operation
Acoustic or 2-wire with RS232C or 20ma interface
Features local analog and digital loopback diagnostics
28,000 sold since 1963
$341, installation free

OMNITEC 703A/B
Bell 103/113-compatible originate-only/answer-only/originate-answer types
Certification not applied for
300bps (600bps opt.) using FSK modulation
Asynchronous, full-duplex operation
Acoustic or 2-wire with RS232C or 20ma interface
Features auto-answer, local analog and digital loopback diagnostics
Over 5,000 sold since 1963
$541 to $690, installation free

OMNITEC 4500, 4700, & 4900
Bell 101-C-compatible originate/answer type
Certification not required
Up to 300bps using FSK modulation (Model 4500 110bps)
Asynchronous, half-duplex operation
2-wire with RS232C or 20ma interface
Features auto-answer, local loopback diagnostics
Models 4500 & 4700 designed for mounting in Teletype unit, Model 4900 for use with all teleprinter terminals
1,500 sold since 1974
$560 to $760

OMNITEC 4911
Bell 101/103/113/212-compatible originate/answer type
Up to 300bps using FSK modulation
Asynchronous half/full-duplex operation
2-wire with RS232C interface
Features reverse channel, auto-answer
1,000 sold since 1977
$838 ($75/month) plus $75 installation



OMNITEC 9113B
Bell 103/113-compatible originate/answer type
Certified
Up to 450bps using FSK modulation
Asynchronous, half/full-duplex operation
2-wire with RS232C or 20ma interface
Features LED display diagnostics
700 sold since 1976
$454, installation free

PENRIL 300 SERIES
Bell 103/113-compatible originate/answer type
Certification applied for
Up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
2-wire with RS232C interface
Features alternate voice/data (opt.), auto-answer, fixed equalization, remote and local loopback diagnostics
5,000 sold since 1970
$200 to $250 ($10 to $25/month) plus $75 inst

PRENTICE P-103/P-113
Bell 103/113-compatible originate-only/answer-only/originate-answer types
Certification not applied for
Up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
2-wire with RS232C or 20ma interface
Features remote and local loopback diagnostics
Sold since 1970

PRENTICE P-113C/D/J
Bell 113C/D/J-compatible answer-only (P-113D), originate-only (P-113C) or originate/answer (P-113J) types
Certification applied for
Up to 300bps using FSK modulation
Asynchronous, full-duplex operation
2-wire with RS232C interface
Features alternate voice-data option and standard auto-answer (P-113C and P-113J), local analog and digital loopback diagnostics
400 sold since 1978

PULSECOM 4080 SERIES
Bell 108-compatible originate/answer type
Up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
2-wire with RS232C, 20/60ma interface
Features alternate voice/data (4086 only), auto-answer, fixed equalization, local loopback (remote optional) diagnostics
1,500 sold since 1971
$225 to $300

RACAL-VADIC LDA, LLA & SLA
IBM-compatible originate/answer type
134.5bps or 600bps (SLA and LDA), 600bps or 1200bps (LLA) using FSK modulation
Asynchronous, half-duplex operation
2- or 4-wire with RS232C interface
Features local analog and digital loopback diagnostics
9,500 sold since 1970
$200

RACAL-VADIC VA 21
Non-compatible originate/answer type
Up to 300bps using FSK modulation
Asynchronous, full-duplex operation
2-wire with V.24 or V.28 interface
Features local analog and digital loopback diagnostics
3,000 sold since 1971
$600

RACAL-VADIC VA 300 SERIES
Bell 103/113-compatible originate/answer type
Certified
Up to 300bps using FSK modulation
Asynchronous, full-duplex operation
2-wire with RS232C interface
Features auto-answer, local analog and digital loopback diagnostics
75,000 sold since 1969
$215 (card version) and up

RACAL-VADIC VA 355 SERIES
Bell 103/113-compatible originate/answer type
Certified
300bps using FSK modulation
Asynchronous, full-duplex operation
2-wire with RS232 interface
Features fixed equalization, local analog and digital loopback diagnostics
Sold since 1978
$375

RFL 5220/5105
Bell 101/103/113-compatible originate-only or answer-only types
Certification not applied for
Up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
2- or 4-wire or acoustic with RS232C or 20ma interface
Features auto-answer option, remote and local loopback diagnostics
$275(5220), $130(5105)

RIXON T103J
Bell 103/113-compatible originate/answer type
Certified, designed for DDD
Up to 300bps using FSK modulation
Asynchronous, full-duplex operation
2-wire line
Features alternate voice/data, fixed equalization, remote and local loopback diagnostics, LED displays
Sold since 1978
$550

RIXON 108D/E
Bell 103F-compatible originate-only or answer-only types
Certification not required
Up to 300bps using FSK modulation
Asynchronous, full-duplex operation
2- or 4-wire (leased) with RS232C in-

"At Lockheed-Georgia, we've found that color improves the flow of management information."

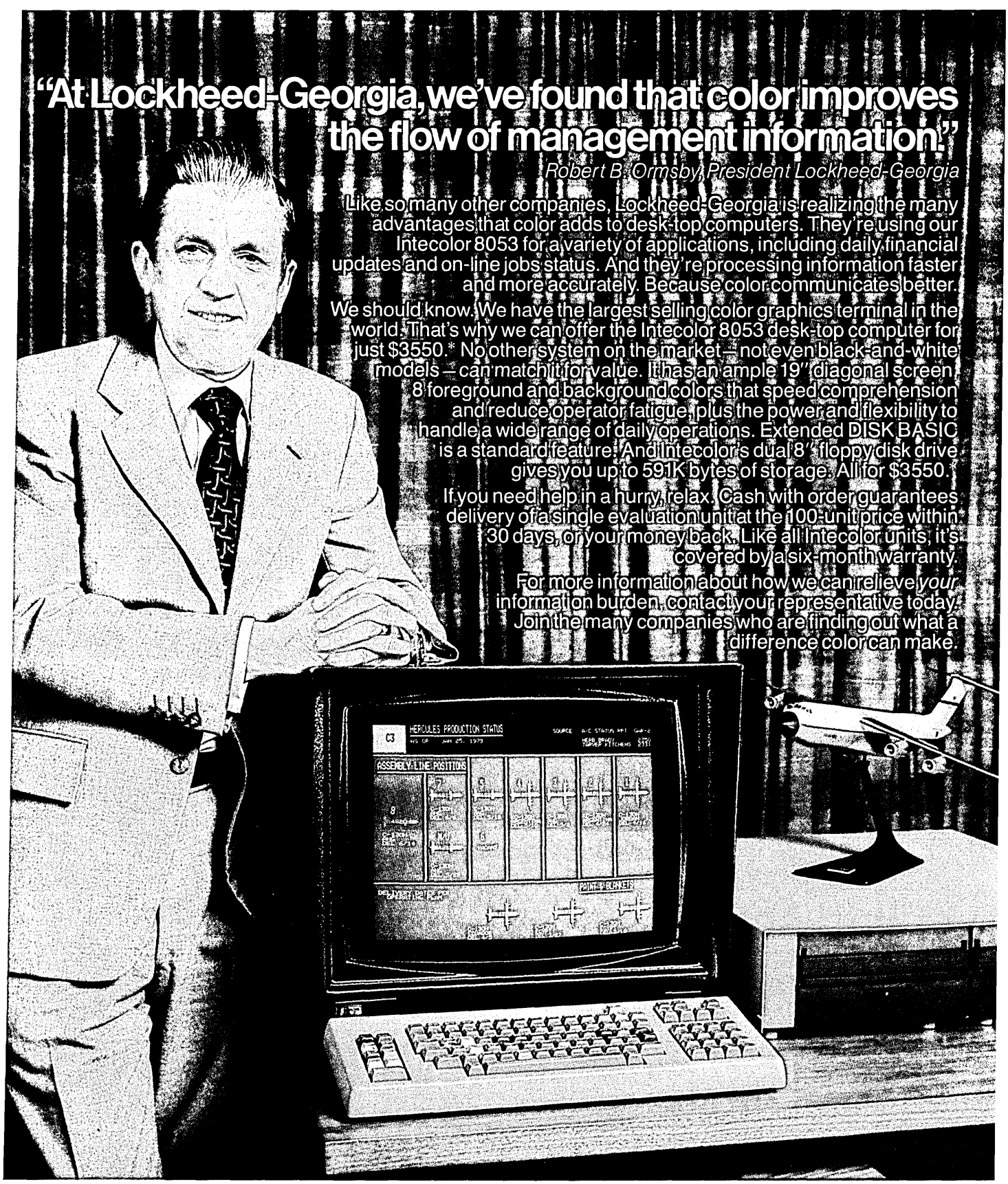
Robert B. Ormsby, President Lockheed-Georgia

Like so many other companies, Lockheed-Georgia is realizing the many advantages that color adds to desk-top computers. They're using our Intecolor 8053 for a variety of applications, including daily financial updates and on-line jobs status. And they're processing information faster and more accurately. Because color communicates better.

We should know. We have the largest selling color graphics terminal in the world. That's why we can offer the Intecolor 8053 desk-top computer for just $3550.* No other system on the market – not even black-and-white models – can match it for value. It has an ample 19" diagonal screen, 8 foreground and background colors that speed comprehension and reduce operator fatigue, plus the power and flexibility to handle a wide range of daily operations. Extended DISK BASIC is a standard feature. And Intecolor's dual 8" floppy disk drive gives you up to 591K bytes of storage. All for $3550.

If you need help in a hurry, relax. Cash with order guarantees delivery of a single evaluation unit at the 100-unit price within 30 days, or your money back. Like all Intecolor units, it's covered by a six-month warranty.

For more information about how we can relieve *your* information burden, contact your representative today. Join the many companies who are finding out what a difference color can make.



Unretouched photo of screen

*100 unit price: USA domestic $5075 single unit price

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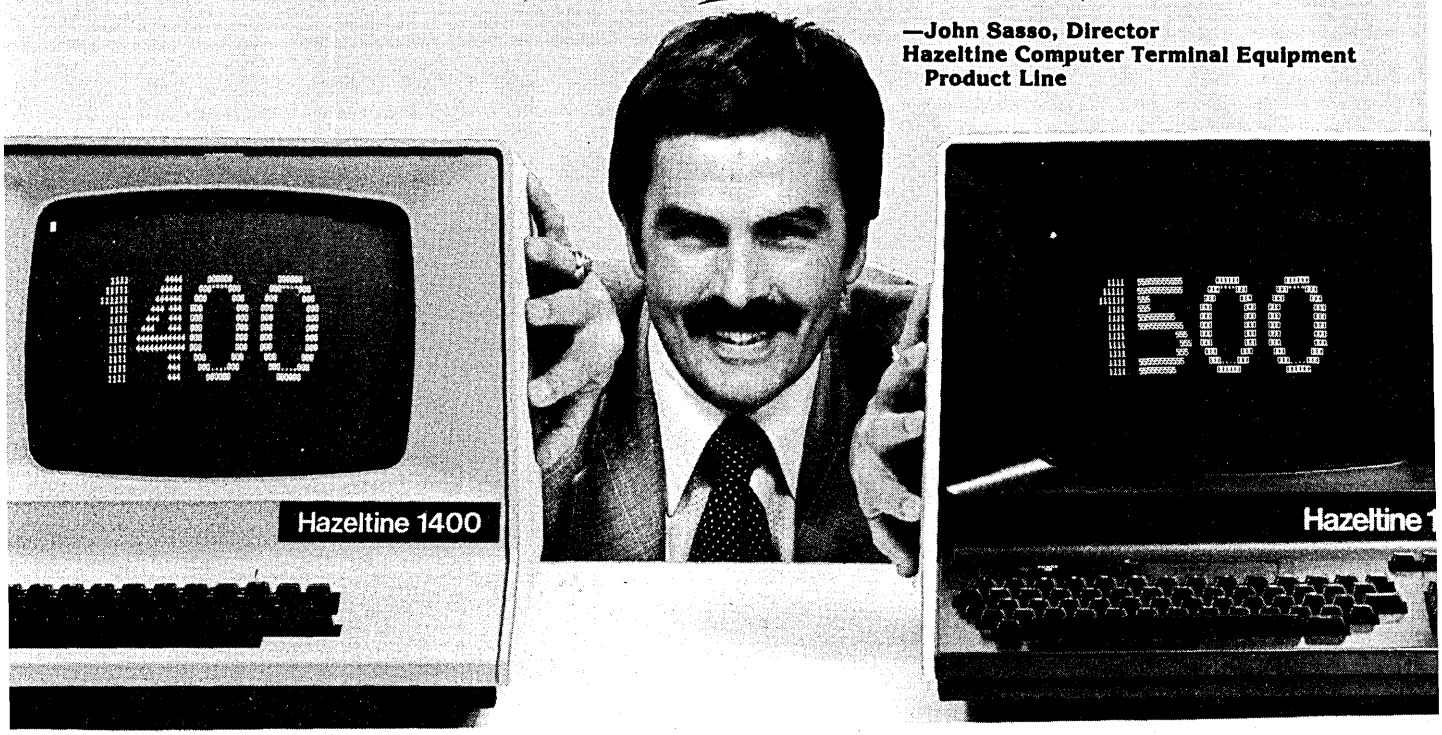
For sales and service in other countries contact ISC headquarters in Norcross, GA., U.S.A.

Intelligent Systems Corp. ☐ 5965 Peachtree Corners East ☐ Norcross, GA 30071 ☐ Telephone 404-449-5961 ☐ TWX 810-766-1581

CIRCLE 35 ON READER CARD

We've got another new terminal and it fits right here...



—John Sasso, Director
Hazeltine Computer Terminal Equipment Product Line

Announcing Hazeltine 1410.

All Hazeltine 1400 and Hazeltine 1410 Terminals delivered in the United States after January 1, 1979 are covered by Hazeltine's new Two Year Warranty. Copies of the terms of that Warranty are available upon request.

It's the right terminal, with the right features, at the right price...built and backed by the right company, Hazeltine.

With its Payload of Performance and handsome profile, one look will tell you why this newest entry is worthy of the Hazeltine name.

A low-priced video terminal with all the features needed for data inquiry and data entry applications, the Hazeltine 1410 has a separate numeric key pad to make numeric entry faster, easier and error-free.

Its total design, from baseplate up, is for efficiency in operation and maximum operator comfort!

Phone any Hazeltine sales office for further information or the name of your nearby Hazeltine distributor.

Hazeltine

Hazeltine Corporation—A World Leader in Information Electronics for More than a Half Century.

Computer Terminal Equipment, Greenlawn, New York, U.S.A. 11740 (516) 549-8800 Telex 96-1435

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

CIRCLE 8 ON READER CARD

terface
Features alternate voice/data, auto-answer, fixed equalization, local and remote loopback diagnostics, self-test, LED indicators
Sold since 1978
$320

RIXON T113C/D
Bell 103/113-B compatible originate-only (T113C) and answer-only (T113D) types
Certification applied for
Up to 300bps using FSK modulation
Asynchronous, full-duplex operation
2-wire with RS232C interface
Features alternate voice/data, fixed equalization, remote test diagnostics

SONEX 2103
Bell 103/113-compatible originate/answer type, desk unit or PC card
Certification not applied for
Up to 300bps using FSK modulation
Asynchronous, full-duplex operation
2- or 4-wire with RS232C, 20ma, or logic interface
Features auto-answer, fixed equalization, diagnostic indicators and busy out
2,500 sold since 1970
$185

SONEX 2113 AUTOSET
Bell 113-compatible originate/answer type
Certification not applied for
Up to 300bps (600 opt.) using FSK mod
Asynchronous, full-duplex operation
2- or 4-wire with RS232C, 20ma, or logic interface
Features fixed equalization; multichannel unit with up to 12 channels
2,000 sold since 1970
$125

SYNTECH TT-103
Bell 103/113-compatible originate/answer type
Certified
Up to 300bps using FSK modulation
Asynchronous, full-duplex operation
2-wire with RS232C or TTL interface
Features alternate voice/data, auto-answer, remote loopback diagnostics
Over 5,000 sold since 1969
$375 ($19/month), installation free

TELE-DYNAMICS 7103-LC
Bell 103/113-compatible originate/answer type
Certification not applied for
Up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
2-wire with RS232C, 20ma, TTL, or CCITT interface
Features alternate voice/data (via Bell 804A), integral handset (on 804A), auto-answer, remote and local loopback diagnostics
300 sold since 1975
$292 ($15/month), installation free

TELE-DYNAMICS 7113-LC-4
Bell 113A/B-compatible originate-only or answer-only types
Certification not applied for
Up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
2-wire with RS232C, 20ma, CCITT or TTL interface
Features auto-answer (some models), local analog and digital loopback diagnostics
550 sold since 1975
$210 ($14/month), installation free

TIMEPLEX 103
Bell 103/113-compatible originate/answer type
Certification not applied for
Up to 300bps using FSK modulation
Asynchronous, full-duplex operation
2- or 4-wire with RS232C interface
Features auto-answer, remote and local loopback diagnostics
5,000 sold since 1975
$199 to $349

TIMEPLEX R103
Bell 103/113-compatible originate/answer type
Certified
Up to 300bps using FSK modulation
Asynchronous, full-duplex operation
2-wire with RS232C or MIL 188C interface
Features auto-answer, remote and local loopback diagnostics
$249 to $399, plus $50 to $100 installation

TUCK 1500 SERIES
Bell 103/113-compatible originate-only/answer-only/originate-answer types
Certification not applied for
Up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
2- or 4-wire with RS232C, 20ma, or MIL 188C interface
Features auto-answer, remote loopback diagnostics
$199 to $349

UNIVERSAL 103/113
Bell 103/113-compatible
Certification not applied for
Up to 300bps using FSK modulation
Asynchronous, full-duplex operation
2-wire with RS232C or V.24 interface
Features auto-answer (some models), local analog and digital loopback diagnostics
Sold since 1973

UNIVERSAL 103J/113D
Bell 103/113-compatible originate/answer type
Certified
Up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
2-wire with RS232C or V.24 interface
Features auto-answer, fixed equalization, local analog and digital loopback diagnostics
$325 to $495

U.S. ROBOTICS 320
Bell 103/113-compatible answer-only type
Certified
Up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
2-wire with RS232C or 20ma interface
Features auto-answer
Sold since 1978
$299

U.S. ROBOTICS 330
Bell 103/113-compatible originate/answer type
Certified
Up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
2-wire with RS232C or 20ma interface
Features auto-answer
Sold since 1978
$324

VEN-TEL MD 103/113
Bell 103/113-compatible originate/answer type
Certification not applied for
Up to 300bps using FSK modulation
Asynchronous, full-duplex operation
2-wire with RS232C or V.24 interface
Features auto-answer (MD 113), local loopback diagnostics
4,400 sold since 1975
$220(103), $200(113)

MEDIUM-SPEED MODEMS (to 2400bps)

ANDERSON JACOBSON MU 1291/12
Bell 202C/D-compatible originate/answer type
Up to 1200bps using FSK modulation
No line conditioning required
Asynchronous, simplex/half-duplex operation
Turnaround time same as Bell 202C/D
DAA, 2- or 4-wire with RS232C interface
Features reverse channel, auto-answer, manual equalization, remote and local loopback diagnostics
Sold since 1974
$350 ($19.50/month)

ANDERSON JACOBSON AJ 1255
Non-compatible originate-auto-answer type
Certified
Up to 1200bps using QAM modulation
No line conditioning required
Async/synchronous, full-duplex operation
2-wire DDD with RS232C interface
Features optional alternate voice/data and integral handset, standard auto-answer, fixed equalization, remote and local loopback diagnostics
300 sold since September 1978
$895 ($50/month) plus $50 installation
(Prices include handset)

ASTROCOM SERIES 120
Bell 202-compatible originate/answer type
Not certified
Up to 1200bps or up to 1800bps using FSK modulation
Requires C2 conditioning for 1800bps
Asynchronous, simplex/half-duplex operation
Turnaround time 35msec
2- or 4-wire with RS232B/C interface
Features reverse channel, auto-answer, fixed equalization, indicator lamps
1,000 sold since 1970
$245 to $500 ($12.50 to $22/month)

ASTROCOM 140
Originate/answer type
Not certified
150bps or 1200bps using FSK modulation
No line conditioning required
Asynchronous, half/full-duplex operation
Turnaround time 25msec
2-wire with RS232B/C interface
Features reverse channel, auto-answer, signal status indicator
1,000 sold since 1975
$430 ($25 to $50/month)

BELL DATA SET 201A
Originate/answer type
Certification not applied for
2000bps using 4-phase PM modulation
No line conditioning required
Synchronous, half/full-duplex operation
2- or 4-wire with RS232C or contact closure interface
Features alternate voice/data and integral handset (with 804), auto-answer, fixed equalization
No longer in production, but still available
$75/month (DDD) or $55/month (private line)

BELL DATA SET 201B
201B/C-compatible originate/answer type
Certification not required
2400bps using 4-phase PM modula-

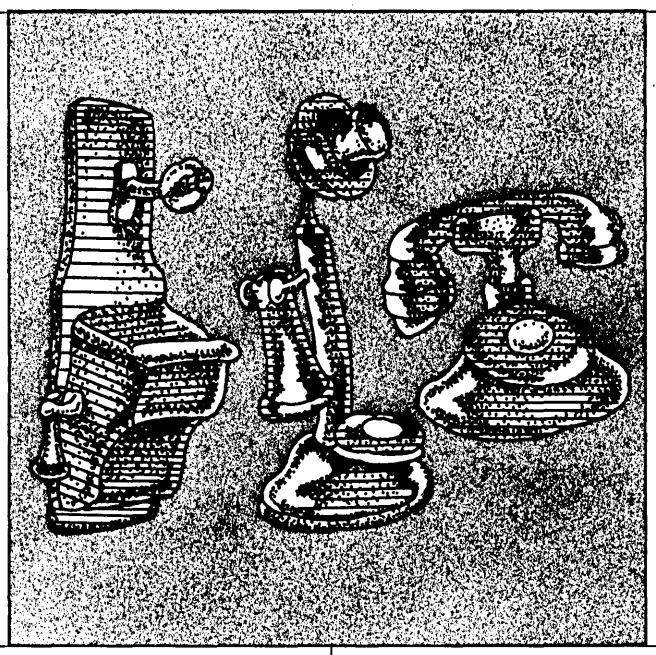
tion
C2 line conditioning required
Synchronous, half/full-duplex operation
2- or 4-wire with RS232C or contact closure interface
Features alternate voice/data and integral handset (with 804), auto-answer, fixed equalization
No longer in production, but still available

BELL DATAPHONE 2400 DATA SET 201C
201B/C-compatible originate/answer type
Certification applied for
2400bps using 4-phase PM modulation
No line conditioning required
Synchronous, half/full-duplex operation
2- or 4-wire with RS232C interface
Features auto-answer, fixed equalization, remote and local diagnostics
Older versions not available

BELL DATA SET 202C
Originate/answer type
Certification not applied for
Up to 1200bps (switched) or 1800bps (private) using FSK modulation
Requires C1 conditioning for 1400bps, C2 for 1800bps
Asynchronous, half/full-duplex operation
2- or 4-wire with RS232C interface
Features reverse channel (opt.), alternate voice/data, integral handset, auto-answer, fixed equalization, loopback, self-test
No longer in production, but still available

BELL DATA SET 202D
Originate/answer type
Certification not required
Up to 1800bps using FSK modulation
Requires C1 conditioning for 1400bps, C2 for 1800bps
Asynchronous, half/full-duplex operation
2- or 4-wire with RS232C or contact closure interface
Features reverse channel option, alternate voice/data and integral handset (with 804A), auto-answer, fixed equalization
No longer in production, but still available

BELL DATA SET 202E
Originate/answer type
Certification not applied for
Up to 1800bps using FSK modulation
Requires C1 conditioning for 1400bps, C2 for 1800bps
Asynchronous, half-duplex operation
2-wire with RS232C interface
Features reverse channel option, alternate voice/data, integral handset, auto-answer, fixed equalization
No longer in production, but still available



BELL DATA SET 202R
Originate/answer type
Certification not applied for
Up to 1800bps using FSK modulation
Requires C1 conditioning for 1400bps, C2 for 1800bps
Asynchronous, half/full-duplex operation
2- or 4-wire with RS232C interface
Features alternate voice/data, fixed equalization
No longer in production, but still available

BELL DATAPHONE 300/1200 DATA SET 212A
101/103/113-compatible originate/answer type
Certification applied for
Up to 300bps (asynch) using FSK modulation or 1200bps (synch) using PSK modulation
No line conditioning required
Asynch/synchronous, half/full-duplex operation
2-wire with RS232C interface
Features alternate voice/data, auto-answer, fixed equalization, remote and local loopback diagnostics

BELL DATAPHONE1200 DATA SET 202S
Originate/answer type, for use on DDD as an LSI replacement for the 202C
Certification not applied for
Up to 1200bps using FSK modulation
No line conditioning required
Asynchronous, half-duplex operation
2-wire with RS232C interface
Features reverse channel option, alternate voice/data, auto-answer, fixed equalization, remote and local loopback diagnostics, self-test

BELL DATAPHONE 1800 DATA SET 202T
Originate/answer type, an LSI replacement for the 202C
Certification not required
Up to 1800bps using FSK modulation
C2 conditioning required for 1800bps
Asynchronous, half/full-duplex operation
2- or 4-wire with RS232C interface
Features reverse channel and alternate voice/data options, fixed equalization, remote and local loopback diagnostics, self-test

BURROUGHS TA 1201
Bell 202-compatible manual originate or answer type
Certification not applied for
Up to 1800bps using FSK modulation
Requires C2 conditioning for 1800bps
Asynchronous, half/full-duplex operation
2- or 4-wire with RS232C or V.24 interface
Features fixed equalization, local and remote loopback diagnostics
Sold since 1977
$625 ($24/month) plus $50 installation

BURROUGHS TA 1203
Bell 202-compatible automatic originate or answer type
Certification not applied for
Up to 1800bps using FSK modulation
Required C2 conditioning for 1800bps
Asynchronous, half/full-duplex operation
2- or 4-wire with RS232C or V.24 interface
Features auto-answer, fixed equalization, local and remote loopback diagnostics
Sold since 1977
$850 ($26/month) plus $50 installation

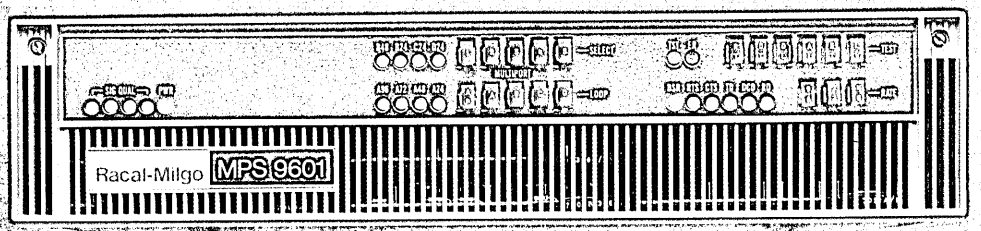
BURROUGHS TA 1801
Bell 202-compatible manual originate or answer type
Certification not applied for
Up to 1800bps using FSK modulation
No line conditioning required
Asynchronous, half/full-duplex operation
2- or 4-wire with RS232C or V.24 interface
Features fixed equalization, local and remote loopback diagnostics
Sold since 1977
$890 ($27/month) plus $50 installation

BURROUGHS TA 1802/TA 1804
Bell 202-compatible manual originate or answer type
Certification not applied for
Up to 1800bps using FSK modulation
No line conditioning required
Asynchronous, half/full-duplex operation
2- or 4-wire with RS232C or V.24 interface
Features fixed equalization, local and remote loopback diagnostics
Sold since 1977
$990 ($36/month) plus $50 installation

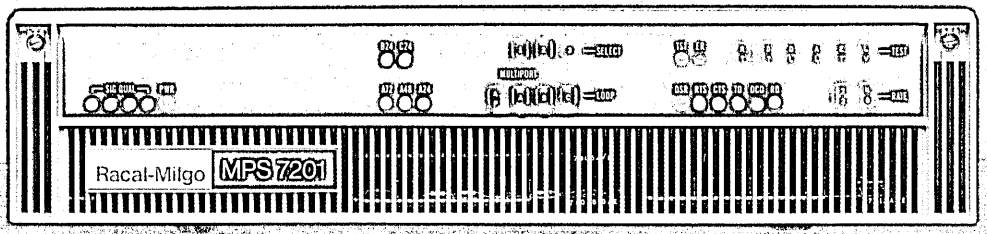
BURROUGHS TA 2401
Bell 201-compatible manual originate or answer type
Certification not applied for
1200bps or 2400bps using PSK modulation
No line conditioning required
Synchronous, half/full-duplex operation
2- or 4-wire with RS232C or V.24 interface
Features fixed equalization, local and remote loopback diagnostics
Sold since 1976
$1,250 ($57/month) plus $50 installation

BURROUGHS TA 2403
Bell 201-compatible automatic originate and answer type
Certification not applied for
1200bps or 2400bps using PSK modulation
No line conditioning required
Synchronous, half/full-duplex operation
2- or 4-wire with RS232C or V.24 interface
Features auto-answer, fixed equalization, local and remote loopback diagnostics
Sold since 1976
$1,450 ($72/month) plus $50 installation

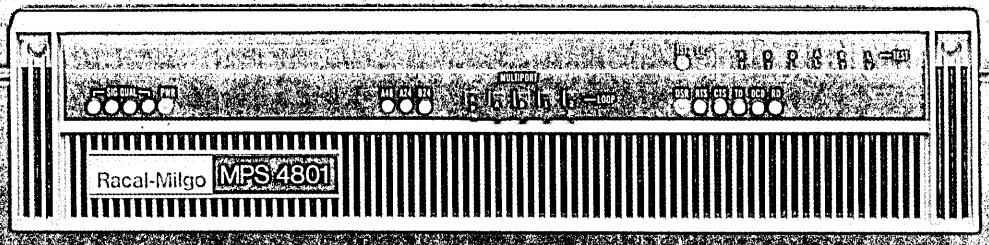
Racal-Milgo's new modems make sure you get every millisecond's worth from your data channels.



The MPS 9601 series includes 6 models of synchronous modems that deliver full 9600 bit-per-second data transmission in both point-to-point and multipoint networks. The modems offer unique cost saving advantages such as FASTRAN™ ultra-fast 30 millisecond response time and DYNAPORT™ automatic channel allocation as well as multiport operation and modem sharing. Models are available with CCITT/V.29 modulation.



The MPS 7201 modem series provides synchronous 7200 bps data communication over unconditioned lines in point-to-point or multipoint networks. Four models offer a selection of high efficiency features that include up to three independent ports, FASTRAN ultra-fast response time, diagnostics and DYNAPORT automatic channel allocation.



The MPS 4801 series offers optimum 4800 bps data communication over unconditioned lines in point-to-point or multipoint networks. Modems in this series are available with either a single 4800 bps data port, or with two 2400 bps ports. Cost-saving options, including DYNAPORT and FASTRAN, are available in this series.

The exceptional advantages offered in this new series of microprocessor-based modems are fully described in our 12-page brochure. We'll gladly rush you a copy.

Racal-Milgo™

BOOTH No. 740
INTERFACE '79

RACAL
The Electronics Group

Racal-Milgo Information Systems, Inc.
8600 N.W. 41st Street, Miami, Florida 33166 Telephone (305) 592-8600 TWX: 810-848-6588
In Europe: Racal-Milgo Limited, Reading, Berks, England

member of IDCMA

CIRCLE 208 ON READER CARD

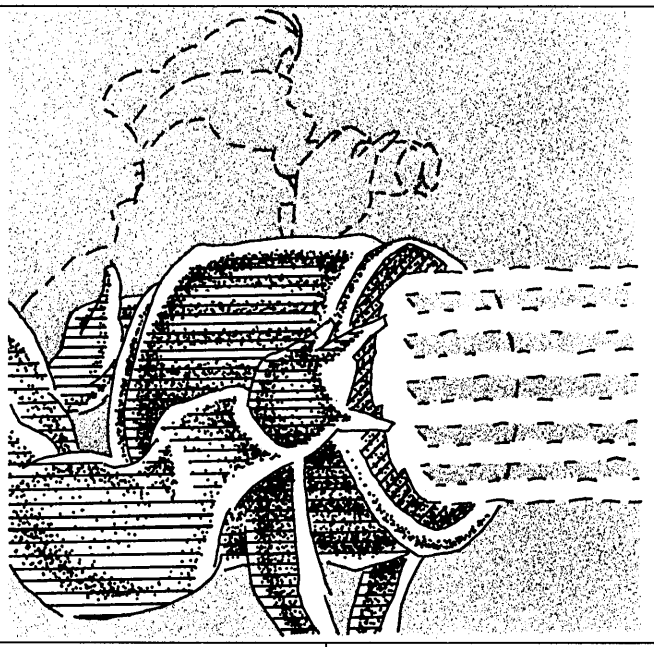
CODEX 202 TYPES
Bell 202-compatible originate and answer types
Certification not applied for
Up to 1200bps using FSK modulation
No line conditioning required
Asynchronous, half/full-duplex operation
2- or 4-wire with RS232C or V.24 interface
Features auto-answer (some models), fixed equalization, local and remote loopback diagnostics
Sold since 1976
$465 to $495 ($20/month)

CODEX 1200 FD
Manual originate and auto-answer type
Certification not applied for
1200bps using PSK modulation
No line conditioning required
Async/synchronous, full-duplex operation
2-wire with RS232C or V.24 interface
Features auto-answer, fixed equalization, local and remote loopback diagnostics
Sold since 1977
$900 ($45/month)

CODEX 201 TYPES
Bell 201B/C-compatible manual originate and auto-answer type
Certification not applied for
2400bps using PSK modulation
No line conditioning required
Synchronous, half/full-duplex operation
Turnaround time 8.5msec
2- or 4-wire with RS232C or V.24 interface
Features auto-answer on some models, fixed equalization, local and remote loopback diagnostics
Sold since 1976
$1,175 to $1,275 ($55 to $60/month)

CODEX LSI 24/24
Manual originate and auto-answer type
Certification applied for
2400bps using QAM modulation
No line conditioning required
Async/synchronous, full-duplex operation
2-wire with RS232C or V.24 interface
Features alternate voice/data, integral handset optional, auto-answer, automatic equalization, local loopback and self-test diagnostics
Sold beginning in April 1979
$4,760 ($110/month) plus $152 installation

COHERENT DAM-4
Originate/answer type
Certified
Up to 1200bps using FSK modulation
No line conditioning required
Asynchronous, half/full-duplex operation
2- or 4-wire with CCITT interface



Features reverse channel up to 75bps, alternate voice/data, local and remote loopback diagnostics
1,500 sold since 1971
$500

COHERENT DAM-5D
Bell 202C-compatible originate/answer type
Up to 1800bps using FSK modulation
No line conditioning required
Asynchronous, simplex/half/full-duplex operation
Turnaround time 8.5, 65, 200msec
2- or 4-wire with RS232C, CCITT, or MIL 188B interface
Features reverse channel, alternate voice/data, local loopback diagnostics, LED indicators
800 sold since 1971
$350 to $385

COHERENT DAM-8
Originate/answer type
Certification not applied for
Up to 1200bps using FSK modulation
No line conditioning required
Sync/asynchronous, half/full-duplex operation
Turnaround time 200msec
2- or 4-wire with V.24 or V.27 interface
Features optional reverse channel, alternate voice/data, integral handset and auto-answer, manual equalization, local loopback and LED diagnostics
100 sold since 1977
$800

COMDATA T212A
Bell 212A-compatible originate/answer type
Certified
1200bps/300bps using PSK or FSK modulation
No line conditioning required
Sync/asynchronous half/full-duplex operation
2-wire with RS232C interface
Features auto-answer, local and remote loopback diagnostics
Sold since June 1978
$750

COMDATA 7201
Bell 201B/C-compatible originate/answer type
Certified
2400bps using DPSK modulation
No line conditioning required
Synchronous, half/full-duplex operation
Turnaround time 15msec to 265msec
2- or 4-wire with RS232C interface
Features optional alternate voice/data and auto-answer, manual equalization, local digital loopback diagnostics
Sold since 1969
$895

COMDATA 232
Bell 202-compatible originate/answer type, PC card
Certification not applied for
Up to 1800bps using FSK modulation
No line conditioning required
Asynchronous, full-duplex operation
Turnaround time 15msec to 265msec
2- or 4-wire with RS232C interface
Features optional reverse channel, alternate voice/data and auto-answer, manual equalization, local loopback diagnostics
Sold since 1977
$205 to $225

DATAPOINT 9402
Bell 202-compatible originate/answer type
1200bps to 1800bps using FSK modulation
Requires C2 conditioning for 1800bps
Asynchronous, half/full-duplex operation
2- or 4-wire with Datapoint I/O interface
Features reverse channel, auto-answer, manual equalization, local loopback diagnostics
Over 2,000 sold since 1970
$1,500 ($46/month) plus $15 installation

DATAPOINT 9408/9409
Originate/answer type
Certification not applied for
1200bps/150bps (or reverse) using FSK modulation
Asynchronous, full-duplex operation
2-wire with RS232C interface
Features reverse channel, auto-answer, manual equalization, remote loopback diagnostics
Sold since 1976
$790 ($20/mo for 36 mos) plus $15 inst.

DEVELCON DS 202D
Originate/answer type
Certification not required
Up to 1800bps using FSK modulation
No line conditioning required
Asynchronous, half/full-duplex operation
Turnaround time strap selectable
2- or 4-wire with RS232C interface
Features reverse channel, fixed compromise equalization, local analog and digital loopback diagnostics
Sold since 1976
$395

GENERAL DATACOMM 201C
Bell 201A/B/C-compatible originate/answer type
Certified
1200bps to 2400bps using DPSK modulation
No line conditioning required
Synchronous, half/full-duplex operation
Turnaround time 7.1msec
2- or 4-wire with RS232C or V.24 interface
Features optional alternate voice/data, integral handset and auto-answer, manual equalization, local analog and digital loopback diagnostics, remote test
Sold since 1977
$1,377

GENERAL DATACOMM 201-7(R)
Bell 201B/C-compatible, also available for rack mounting
Certification not required
2400bps using DPSK modulation
No line conditioning required
Synchronous, half/full-duplex operation
Turnaround time 7.1msec
4-wire (leased) with RS232C interface
Features manual equalization, local analog and digital loopback diag-

Solving data comm problems doesn't have to be expensive.

Until now, identifying data comm problems has been reserved for the specialists.

Introducing...the trim, 11-lb 832 Data Comm Tester from Tektronix. It helps identify and solve most data comm problems the first time without calling the specialist.

Take this new 832 Data Comm Tester to the field and use it in either the passive monitor or active simulation modes. In the monitor mode, capture data and control line status to identify problems.

Once you've identified the problem, the 832 allows you to stimulate the suspected equipment off-line to troubleshoot or verify performance without the use of expensive CPU time. "The quick brown fox..." and six other messages are stored in the 832. Or, tailor the stimulus pattern to your own needs with a user-definable PROM or a front panel entry.

The 832 is also easy to operate and learn. Since it doesn't require extensive data comm knowledge to operate, service people require less training time.

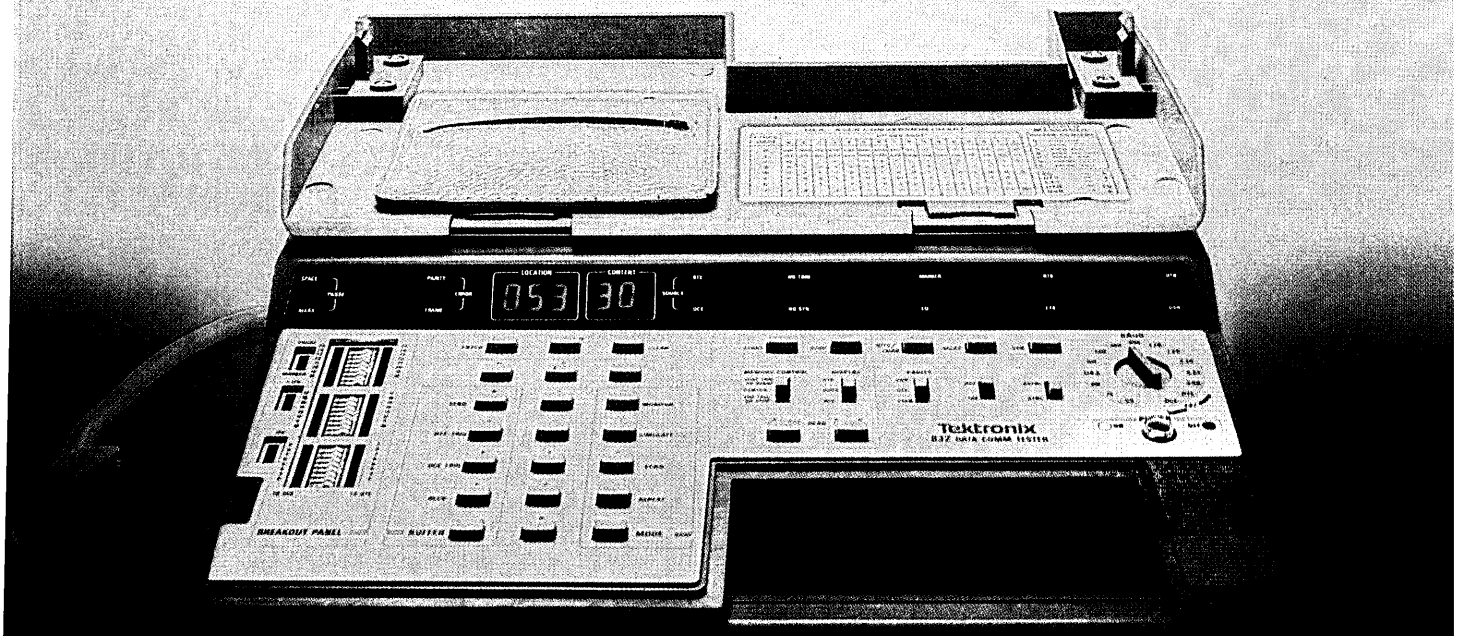
For under $2000, it costs only a fraction as much as the equipment you've had to buy in the past to perform similar functions.

For more information about the 832 Data Comm Tester, call your nearest Tektronix office or call our automatic answering service toll free on 1-800-547-1512. Oregon residents call collect on 644-9051.

For availability outside the U.S., please contact the nearest Tektronix Field Office, Distributor or Representative.

Tektronix®
COMMITTED TO EXCELLENCE

CIRCLE 86 ON READER CARD



THE 832 DATA COMM TESTER

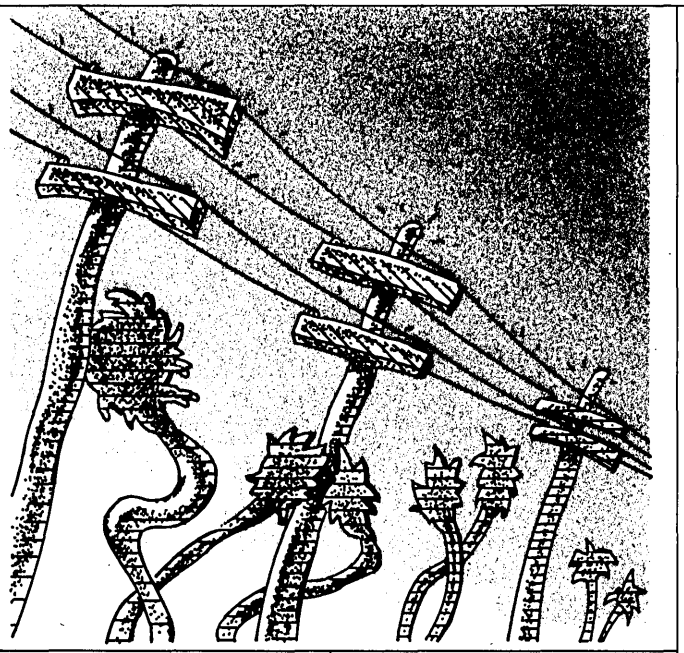
nostics
Sold since 1972
$750 to $875

GENERAL DATACOMM 202S
Bell 202S-compatible originate/answer type
Certification applied for
1200bps using FSK modulation
No line conditioning required
Asynchronous, half-duplex operation.
Turnaround time 8.5msec
2-wire with RS232C interface
Features optional reverse channel and alternate voice/data, auto-answer standard, fixed equalization, local analog and digital loopback diagnostics
Sold since 1978
$565

GENERAL DATACOMM 202T
Bell 202D/T-compatible originate/answer type
Certification not required
1200bps or 1800bps using FSK modulation
Requires C2 conditioning for 1800bps
Asynchronous, half/full-duplex operation
Turnaround time 8.5msec
2- or 4-wire (leased) with RS232C interface
Features optional reverse channel and alternate voice/data, manual equalization, local analog and digital loopback diagnostics, remote test
Sold since 1972
$480

GENERAL DATACOMM 202S/T
Bell 202-compatible originate/answer type
Certified
1200bps or 1800bps using FSK modulation
No line conditioning required
Asynchronous, half-duplex operation
Turnaround time 8.5msec
2-wire (DDD or leased) with RS232C interface
Features optional reverse channel and alternate voice/data, auto-answer standard, fixed equalization, local analog and digital loopback diagnostics, remote test
Sold since 1977
$565

GENERAL DATACOMM 202-9D(R)
Bell 202D/T-compatible type
Certification not required
1200bps or 1800bps using FSK modulation
No line conditioning required
Asynchronous, half/full-duplex operation
Turnaround time 8.5msec
2- or 4-wire (leased) with RS232C interface
Features manual equalization, local analog and digital loopback diagnostics
Sold since 1975
$380 to $485



GENERAL DATACOMM 212A
Bell 212A-compatible originate/answer type
Certified
1200bps using PSK modulation, up to 300bps using FSK modulation
No line conditioning required
Sync/asynchronous, full-duplex operation
2-wire (DDD) with RS232C interface
Features alternate voice/data option, auto-answer, fixed equalization, local analog and digital loopback diagnostics, self-test, remote test
Sold since 1978
$850

GENERAL DATACOMM 2400 ES
Originate/answer type
Certification not required
1200bps or 2400bps using DPSK modulation
No line conditioning required
Synchronous, half/full-duplex operation
Turnaround time 12msec
2-wire (switched) or 4-wire (leased) with V.24, V.26 or V.28 interface
Features optional reverse channel and integral handset, standard alternate voice/data and auto-answer, automatic equalization, local analog and digital loopback diagnostics, self-test
Sold since 1977

GTE LENKURT 26C
Originate/answer type
Up to 1800bps or up to 2400bps using Duobinary FM modulation
C1 or C2 conditioning required on some models
Async/synchronous, simplex/half/full-duplex operation
2- or 4-wire with RS232C or MIL188 interface
Features optional reverse channel and alternate voice/data, manual equalization, remote and local loopback diagnostics
Sold since 1965
$1,700 to $2,200

GTE LENKURT 261A
Originate/answer type
Certification not applied for
2400bps using Duobinary FM modulation
No line conditioning required
Synchronous, half/full-duplex operation
2- or 4-wire with RS232C or RS334 interface
Features optional reverse channel and alternate voice/data, manual equalization, back-to-back and loopback diagnostics
Sold since 1974
$825

IBM 3872
Originate/answer type
1200bps or 2400bps using DPSK modulation
Line conditioning typically unnecessary
Synchronous, half/full-duplex operation
2- or 4-wire with RS232C interface
Features optional alternate voice/data and auto-answer, manual or automatic equalization, line and self-test diagnostics
Sold since 1972
$2,575 ($94/month)

INTERTEL MCS 1200
Bell 202C/D-compatible originate/answer type
Up to 1800bps using FSK modulation
Requires C2 conditioning for 1800bps
Asynchronous, half/full-duplex operation
Turnaround time 8.5msec
4-wire with RS232C or V.24 interface
Features optional 150bps reverse channel, alternate voice/data, integral handset and auto-answer, fixed equalization, local analog and digital loopback diagnostics
Sold since 1973
$960 ($30/month), plus $100 installation

INTERTEL MCS 2400
Bell 201B-compatible originate/answer type
2400bps using PM, 4-phase modulation
No line conditioning required
Synchronous, half/full-duplex operation
Turnaround time 8.5msec
2- or 4-wire with RS232C or V.24 interface
Features optional 150bps reverse channel, alternate voice/data, integral handset and auto-answer, fixed equalization, local analog and digital loopback diagnostics
Sold since 1973
$1,750 ($48/month), plus $110 installation

LIVERMORE DATA SYSTEMS 412
Bell 202S/T-compatible originate/answer type
1200bps using FSK modulation
No line conditioning required
Asynchronous, simplex/half/full-duplex operation
2- or 4-wire with RS232C, CCITT, or MIL 188B interface
Features optional reverse channel and auto-answer, remote loopback diagnostics
Sold since 1971
$414

LIVERMORE DATA SYSTEMS 424
Bell 201B/C-compatible originate/answer type
2400bps using PM, 4-phase modulation
No line conditioning required
Synchronous, simplex/half/full-duplex operation
2- or 4-wire with RS232C, CCITT, or MIL 188B interface
Features optional reverse channel and auto-answer, automatic equalization, remote loopback diagnostics
Sold since 1971
$620

MULTI-TECH 212
Bell 212A-compatible originate/answer type
Certification applied for
Up to 300bps or 1200bps using 4-phase PM (sync.) or FSK (async.) modulation
No line conditioning required
Async/synchronous full-duplex operation
2-wire with RS232C interface
Features auto-answer, local digital and analog loopback diagnostics, self-test
Sold since 1978
$600 to $850

MULTI-TECH FM 1200/1210
Bell 202-compatible originate/answer type
Certification applied for
Up to 1200bps using FSK modulation

Who needs an INTERVIEW® [illegible]

[illegible]

And the list includes hundreds of companies and government agencies worldwide, both large and small.

Why? Because downtime is too costly [illegible] possible, the INTERVIEW [illegible] [illegible] potential problems [illegible] [illegible] not just [illegible]

The heart of the INTERVIEW [illegible] System is the INTERVIEW [illegible] [illegible] It connects to the digital interface RS-232, V.24, Bell 208, V.35 and others. [illegible] [illegible] [illegible]

[illegible]

[illegible] programs [illegible] line or several [illegible] at once.

But don't worry too much about programming [illegible]

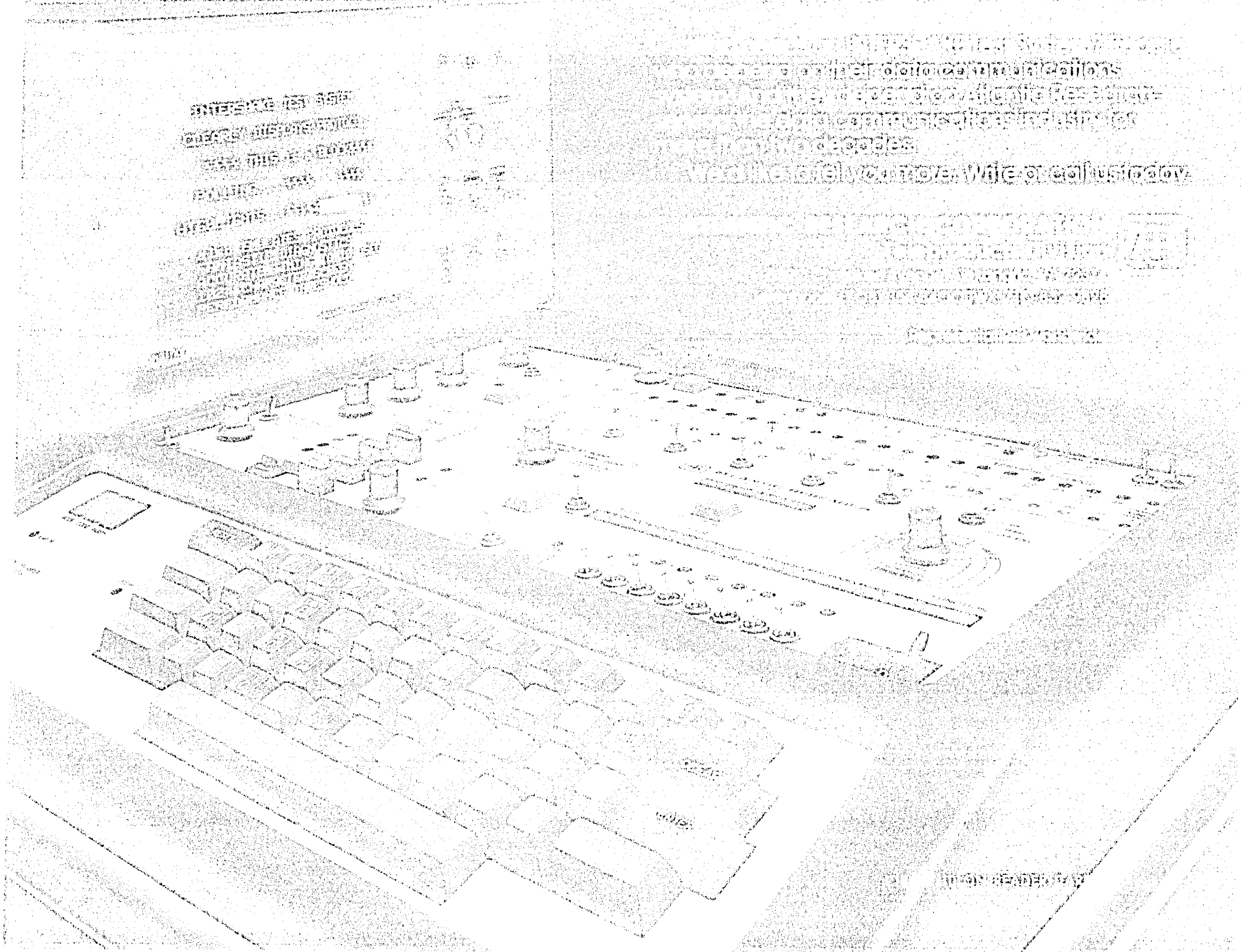
[illegible]

[illegible] RS-232 [illegible]

[illegible]

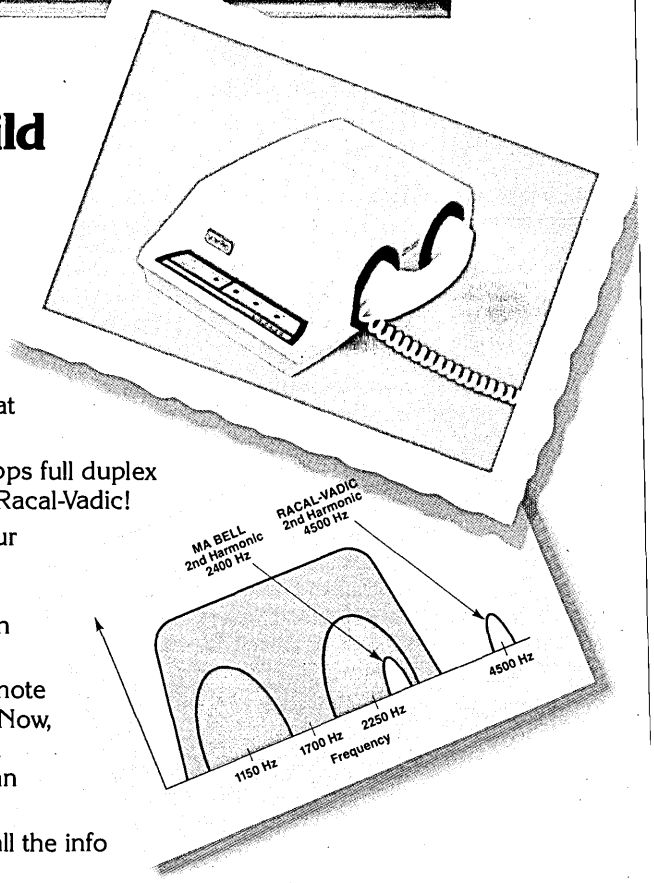
[illegible] data communications [illegible]

[illegible]



Dear Ma:

How come Racal-Vadic can build a 1200 bps full duplex acoustic coupled modem and you can't?



When Racal-Vadic invented the VA3400 way back in 1973, they purposely chose to transmit data in the originate mode at 2250 Hz and receive data at 1150 Hz. They were really thinking ahead, Ma, because these frequencies place 2nd harmonic distortion (created by non-linearity in the telephone microphone) at 4500 Hz — well away from the coupler's received signal.

This wise choice of frequencies has made possible a 1200 bps full duplex acoustic coupler—the VA3434, which is now in full production at Racal-Vadic!

Why in the world, Ma, did you reverse the frequencies in your 212A? By transmitting at 1200 Hz and receiving at 2400 Hz, the 2nd harmonic of your transmitted signal falls right in the middle of the received signal, making the design of an acoustic coupled 212A an engineer's nightmare.

So Racal-Vadic has done it again, Ma. The real winners are remote terminal users who no longer have to settle for 300 bps operation. Now, merely by replacing their present coupler with the VA3434, they can operate at 1200 bps full duplex, while retaining the portability that an acoustic coupler provides.

Suggest that you phone or write Racal-Vadic today, Ma, for all the info on the VA3434 1200 bps full duplex acoustic coupler.

Your independent thinking son,

Alexander Graham Jr.

PS: Racal-Vadic has shipped over 175,000 modems to date.

Racal-Vadic the new name for **vadic**

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RACAL *The Electronics Group*

CIRCLE 64 ON READER CARD

No line conditioning required
Asynchronous, half/full-duplex operation
2- or 4-wire with RS232C interface
Features optional auto-answer, manual equalization, remote and local loopback diagnostics
Sold since 1974
$225 to $460

NOVATION 202
Bell 202-compatible originate/answer type
DDD models certified
Up to 1200bps or 1800bps using FSK modulation
Requires C2 conditioning at 1800bps
Asynchronous, half/full-duplex operation
Turnaround time adjustable
2- or 4-wire with RS232C or TTL interface
Features optional reverse channel, alternate voice/data and auto-answer, fixed equalization, local loopback diagnostics, LED display
Sold since 1971
$350 to $595

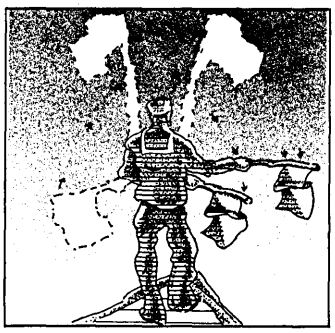
OMNITEC 1200
Bell 202C-compatible originate/answer type
Certification applied for
1200bps using FSK modulation
No line conditioning required
Asynchronous, half-duplex operation
DAA or 4-wire with RS232 interface
Features reverse channel, auto-answer, local analog and digital loopback diagnostics
100 sold since 1974
$975, installation free

OMNITEC MODEL 9202B
Bell 202D/T-compatible originate/answer type
Certification not required
1200bps using FSK modulation
No line conditioning required
Asynchronous, half/full-duplex operation
2- or 4-wire (leased) with RS232 interface
Features reverse channel, analog loopback diagnostics
800 sold since 1977
$545

PARADYNE LSI-24
Bell 201C-compatible
Certification not required
1200bps or 2400bps using DPSK modulation
No line conditioning required
Synchronous, half/full-duplex operation
Turnaround time 7msec
4-wire (leased) with RS232C or V.24 interface
Alternate voice/data (opt.), automatic equalization, local analog and digital loopback diagnostics, remote (opt.)
Sold since 1978
$1,200 ($35/month), plus $150 installation

PENRIL 1200/5 & 1200/150
Bell 202C/D-compatible originate/answer type
Certification not applied for
Up to 1200bps using FSK modulation
No line conditioning required
Asynchronous, half/full-duplex operation
2-wire with RS232C or V.24 interface
Features 5bps or 150bps reverse channel, optional alternate voice/data, auto-answer, fixed equalization, local loopback diagnostics
1,000 sold since 1970
$300 to $400 ($15 to $20/mo) plus $75 inst.

PENRIL 2400 DCM
Certification applied for
1200bps or 2400bps using V.26 modulation
No line conditioning required
Synchronous, half/full-duplex operation
4-wire (leased) with RS232C or V.24 interface
Features 110bps reverse channel (opt.), alternate voice/data (opt.), fixed equalization, local analog and digital loopback diagnostics, self-test
300 sold since May 1978
$100 installation



PENRIL 1200DM/1800 DED
Bell 202D-compatible originate/answer type
Certification applied for
Up to 1800bps using FSK modulation
Requires C2 conditioning for 1800bps
Asynchronous, half/full-duplex operation
Turnaround time 200/8.5msec
2- or 4-wire with RS232B/C or CCITT interface
Features optional auto-answer, fixed equalization, remote and local loopback diagnostics
4,000 sold since 1970
$320 ($12/month) plus $75 installation

PENRIL 2400 LSI SERIES
Bell 201B/C-compatible originate/answer type
Certification applied for
1200bps or 2400bps using 4-phase PM (CCITT) modulation
No line conditioning required
Synchronous, half/full-duplex operation
Turnaround time 150/8.5msec
2- or 4-wire with RS232B/C or V.24 interface
Features auto-answer, automatic equalization, remote and local loopback diagnostics, self-test
Sold since 1977
$800 ($40/month) plus $75 installation

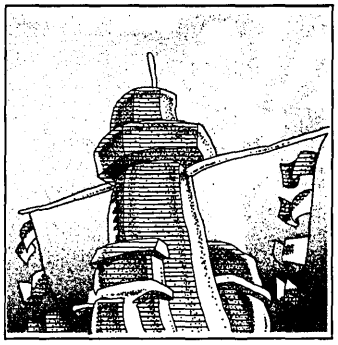
PRENTICE P-202
Bell 202-compatible originate/answer plug-in type
Certification not applied for
Up to 1200bps using FSK modulation
No line conditioning required
Asynchronous, half/full-duplex operation
2- or 4-wire with RS232C or 20ma interface
Features reverse channel, auto-answer, remote and local loopback diagnostics
Sold since 1972

PRENTICE P-202S
Bell 202S-compatible originate/answer type
Certified
Up to 1200bps using FSK modulation
No line conditioning required
Asynchronous, half-duplex operation
2-wire with RS232C interface
Features optional reverse channel and alternate voice/data, standard auto-answer, analog loopback diagnostics, LED indicators
Sold since November 1978

PRENTICE P-202T
Bell 202T-compatible
Certified
Up to 1800bps using FSK modulation
No line conditioning required
Asynchronous, half/full-duplex operation
2- or 4-wire with RS232C interface
Features optional reverse channel, analog and digital loopback diagnostics, self-test
1,000 sold since July 1978

PRENTICE P-1200 PLUS
Originate/answer type
1200bps using FSK modulation
No line conditioning required
Asynchronous, full-duplex operation
2-wire with RS232C interface
Features optional alternate voice/data, standard auto-answer, LED indicators
800 sold beginning in 1979

RACAL-MILGO 24 LSI MARK II
Bell 201B/C-compatible originate/answer type
Certified
2400bps using FSK modulation
No line conditioning required
Synchronous, half/full-duplex operation
Turnaround time 8.33, 66, 133msec
2- or 4-wire with RS232C, V.24, or MIL 188C interface
Features optional 150bps reverse channel, optional alternate voice/data and integral handset, auto-answer standard, compromise equalization, local analog and digital loopback diagnostics, self-test
Sold since 1977
$1,250 to $1,450 ($40 to $50/mo), plus $85 installation



RACAL-VADIC VA 23
Originate/answer type
Certification not required
Up to 1200bps using FSK (V.23 compatible) modulation
No line conditioning required
Async/synchronous, half/full-duplex operation
Turnaround time 8.5, 65, 230msec
2-wire with V.24 interface
Features optional reverse channel, alternate voice/data and integral handset, auto-answer standard, compromise equalization, remote and local loopback diagnostics
7,000 sold since 1972
$325

RACAL-VADIC VA 1200
Bell 202-compatible originate/answer type
Certified
Up to 1800bps using FSK modulation
Requires C2 conditioning at 1800bps
Asynchronous, half-duplex operation
2- or 4-wire with RS232B/C interface
Features reverse channel option, auto-answer, remote and local loopback diagnostics
55,000 sold since 1969
$285

RACAL-VADIC VA 2400
Bell 201B/C-compatible originate/answer type
Certified
2400bps using DPSK modulation
Line conditioning not required
Synchronous, half-duplex operation
Turnaround time 8.1, 150msec
2- or 4-wire with RS232C interface
Features optional alternate voice/data and integral handset, auto-answer standard, compromise equalization, remote and local loopback diagnostics
7,500 sold since 1975
$550

RACAL-VADIC VA 3400 SERIES
Originate/answer type
Certified
Up to 1200bps
No line conditioning required
Async/synchronous, full-duplex operation
2- or 4-wire or acoustic with RS232C interface
Features optional alternate voice/data and integral handset, auto-answer standard, compromise equalization, remote and local loopback diagnostics
30,000 sold since 1973
$740

RACAL-VADIC MODEL 3467
Bell 212A-compatible answer-only type
Certified
Up to 300bps or 1200bps using DPSK (sync) or FSK (async) modulation
No line conditioning required
Async/synchronous, full-duplex operation
Turnaround time 230msec
2-wire with RS232C interface
Features auto-answer, manual equalization, local analog and digital loopback, self-test, remote loopback control diagnostics
350 sold since June 1978
$750

RFL 32DT/32DR
Originate/answer type
Certification not applied for
Up to 1200bps using FSK modulation
Requires C1 conditioning
Asynchronous, full-duplex operation
2-wire with RS232C interface
Features optional 120bps reverse channel and auto-answer, compromise equalization, remote loopback diagnostics
$940 to $1,160 ($60 to $70/month)

RFL 6385
Bell 202C-compatible originate-only type
Certification not applied for
Up to 1800bps using FSK modulation
No line conditioning required
Asynchronous, half/full-duplex operation
Turnaround time 10msec
2- or 4-wire with RS232C interface
$235

RIXON-SANGAMO T201C
Bell 202B/C-compatible originate/answer type
Certified
2400bps using 4-phase PM modulation
No line conditioning required
Synchronous, half/full-duplex operation
Turnaround time 7msec
2- or 4-wire with RS232C interface
Features alternate voice/data, auto-answer, manual equalization, local analog and digital loopback diagnostics, self-test

RIXON-SANGAMO T202S
Bell 202S-compatible originate/answer type
Certified
Up to 1200bps using FSK modulation
No line conditioning required
Asynchronous, half-duplex operation
Turnaround time 7msec
2-wire with RS232C interface
Features reverse channel option, alternate voice/data, auto-answer, fixed equalization, local analog and digital loopback diagnostics, self-test

RIXON-SANGAMO T202T
Bell 202T-compatible originate/answer type
Certification not required
Up to 1800bps using FSK modulation
Requires C2 conditioning for 1800bps
Asynchronous, half/full-duplex operation
Turnaround time 8msec
2- or 4-wire with RS232C interface
Features reverse channel option, manual equalization, local analog and digital loopback diagnostics, self-test

RIXON-SANGAMO T212A
Bell 103/113/212A-compatible originate/answer type
Certified
Up to 300bps or 1200bps using PSK (sync) or FSK (async) modulation)
No line conditioning required
Async/synchronous, full-duplex operation
2-wire with RS232C interface
Features alternate voice/data, auto-answer, fixed equalization, local analog and digital loopback diagnostics, self-test

RIXON-SANGAMO DS2401
Bell 201B/C-compatible originate/answer type
Certification not required
1200bps or 2400bps using 4-phase PM modulation
No line conditioning required
Synchronous, half/full-duplex operation
2- or 4-wire with RS232C interface
Features manual equalization, local analog and digital loopback diagnostics, self-test

ROCKWELL-COLLINS R24
Bell 201B/C-compatible
Certification not applied for
1200bps or 2400bps using DPSK modulation
No line conditioning required
Synchronous, half/full-duplex operation
2- or 4-wire with logic interface
Features optional reverse channel and auto-answer, compromise equalization
Sold since January 1979

ROCKWELL-COLLINS TE-1200
Bell 202D-compatible originate/answer type
Certification not required
Up to 1800bps using FSK modulation
No line conditioning required
Asynchronous, half/full-duplex operation
2- or 4-wire with RS232C interface
Features optional reverse channel and auto-answer, local loopback diagnostics, integral test
1,000 sold since 1973
$440 to $520

SONEX 2202 AUTOSET
Bell 202-compatible originate/answer multichannel type
Up to 1800bps using FSK modulation
Requires C1 conditioning for 1800bps
Asynchronous, half/full-duplex operation
Turnaround time 150msec
2- or 4-wire with RS232C interface
Features reverse channel, auto-answer, automatic equalization, remote and local loopback diagnostics
Sold since 1972
$325

Software is 80% of costs & going up

RAMIS II®
stretches your software budget

In 1965, system development costs were fairly evenly divided between software and hardware. Today many sources indicate that 80% of the cost is software. And the trend is continuing.

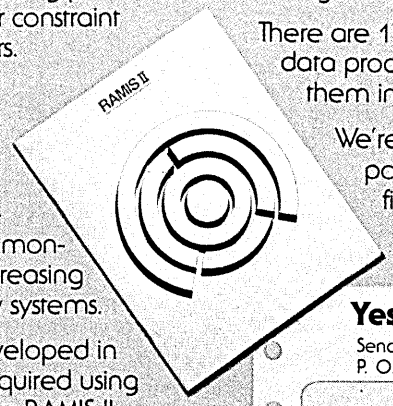
Why? Because software technologies are not keeping up with hardware in improving productivity. Software is now the major constraint restricting effective use of computers.

How can you get more from your software dollar?

RAMIS II.

RAMIS II improves software productivity by decreasing the amount of money spent on maintenance. And increasing the amount left for productive new systems.

With RAMIS II, new systems are developed in no more than one-fifth the time required using conventional means. That's because RAMIS II is both a data base management system and a complete English-like nonprocedural language.



With RAMIS II, you just say what you want. You don't have to tell the computer how to produce it.

A simple request gives you information from anywhere in the data base. And, you don't have to make costly application changes every time you change the data base.

There are 175 ways RAMIS II can improve your data processing. We'd like to tell you about them in our free RAMIS II factbook.

We're Mathematica, a technical consulting, policy research, and computer software firm involved in the improvement of decision-making techniques.

Yes! I'd like the free RAMIS II Factbook.

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P. O. Box 2392, Princeton, New Jersey 08540 /800-257-9576

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The brains behind RAMIS II

CIRCLE 48 ON READER CARD

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Harry -

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Be sure to stop by booth #855 when you're at Interface.

I hear they have a new high performance system that'll outclass anything on the market.

Get info back to me ASAP

JR

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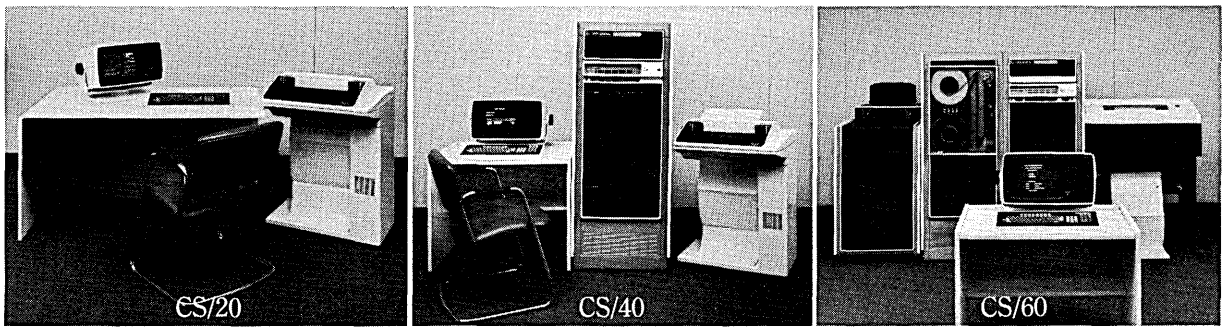
NO SINGLE BUSINESS COMPUTER HAS ALL THE ANSWERS.



NOW, WHAT'S YOUR PROBLEM.

One of Data General's family of new small business computers can answer your problems. They're designed to quickly and easily process your billings, accounts payable, accounts receivable, sales analysis, purchase analysis, inventory control and payroll with management information on demand.

We began with the introduction of CS/40, a mid-range business system which accommodates up to nine operators. Now it's joined by the CS/20, an entry level, stand-alone system and the CS/60, a higher capacity business system with up to seventeen clustered or dispersed terminals.

They're simple to operate and fully capable of expanding right along with your company. They all use the same Interactive COBOL software, so your investment in software is protected. And, if you need help with your applications, there is a group of experienced Business System Suppliers to assist you.

For more details on how to solve your business problems, fill out the coupon and we'll introduce you to the family.

My immediate problem is that I need more information about Data General's CS Family. Send the brochure.

I'm an: ☐ End User ☐ Business System Supplier ☐ I'm too busy to wait for brochures; have someone contact me.

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Title

Company

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Address

City

State Zip

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Data General

We make computers that make sense.

Data General Corporation, Westboro, MA 01581, (617) 366-8911, Data General (Canada) Ltd., Ontario. Data General Europe, 61 rue de Courcelles, Paris, France, 766.51.78. Data General Australia, (03) 89-0633. Data General Ltda., Sao Paulo, Brazil, 543-0138. Data General Middle East, Athens, Greece, 952-0557.

SYNTECH TT-201
Bell 201-compatible originate/answer type
Certified
2000bps or 2400bps using 4-phase PM modulation
No line conditioning required
Synchronous, half/full-duplex operation
Turnaround time 150/7.5msec
2- or 4-wire with RS232C or TTL interface
Features alternate voice/data, auto-answer, fixed equalization, remote and local loopback diagnostics (opt.)
Over 10,000 sold since 1970
$1,095 ($55/month), installation free

SYNTECH TT-202
Bell 202-compatible originate/answer type
Certified
Up to 1800bps using FSK modulation
No line conditioning required
Async/synchronous, half/full-duplex operation
Turnaround time 8.5, 60, 200msec
2- or 4-wire with RS232C or TTL interface
Features reverse channel option, alternate voice/data, auto-answer, fixed equalization, remote and local loopback diagnostics
Over 10,000 sold since 1969
$500 ($25/month), installation free

SYNTECH ESP-201/SDP-201
Bell 201-compatible originate/answer type
Certified
2000bps or 2400bps using 4-phase PM modulation
No line conditioning required
Synchronous, half/full-duplex operation
Turnaround time 7.5, 25, 150msec
2- or 4-wire with RS232C interface
Features alternate voice/data, auto-answer, fixed equalization, remote and local loopback diagnostics, self-test
Over 2,000 sold since 1975
$1,350, installation free

TELE-DYNAMICS 7201C
Bell 201-compatible originate/answer type
Certified
2400bps using 4-phase PM modulation
No line conditioning required
Synchronous, half/full-duplex operation
Turnaround time 7.5msec
2- or 4-wire with RS232C or CCITT interface
Features alternate voice/data option, auto-answer, fixed equalization, remote and local loopback diagnostics
500 sold since April 1978
$765 ($33/month) plus $100 installation

TELE-DYNAMICS 7202S/T
Bell 202-compatible originate/answer type
Certified
Up to 1800bps using FSK modulation
No line conditioning required
Asynchronous, half/full-duplex operation
Turnaround time 8.5msec
2- or 4-wire with RS232C or CCITT interface
Features optional reverse channel and alternate voice/data, auto-answer standard, fixed equalization, remote and local loopback diagnostics, self-test
100 sold since November 1978
$440 ($21/month) plus $100 installation

TIMEPLEX 202
Bell 202-compatible originate/answer type, desk unit, desk-top, or rack-mounted PC board
Certification not applied for
Up to 2000bps using FSK modulation
Requires C2 conditioning at 2000bps
Async/synchronous, simplex/half/full-duplex operation
Turnaround time 8, 30, 60, 180msec
2- or 4-wire with RS232C, CCITT, or MIL 188C interface
Features 5bps reverse channel (opt.), auto-answer, compromise equalization, remote and local loopback diagnostics
5,000 sold since 1973
$199 to $399

TUCK 1600 SERIES
Bell 202-compatible originate/answer type, rack-mount or PC card
Certification not applied for
Up to 1200bps using FSK modulation
No line conditioning required
Asynchronous, half/full-duplex operation
2- or 4-wire with RS232C or TTL logic interface
Features reverse channel (5bps), alternate voice/data option, auto-answer, fixed equalization, local loopback diagnostics, lamp display
$105 up

TUCK 1652
Bell 202T-compatible
Certification not required
Up to 1200bps using FSK modulation
No line conditioning required
Asynchronous, full-duplex operation
Turnaround time 5msec to 60msec
4-wire with RS232C interface
Features local analog and digital loopback diagnostics, lamp display
Sold since 1978
$275

UNIVERSAL 12/12 CBS
Certification not applied for
Up to 1200bps using PSK modulation
No line conditioning required
Sync/asynchronous, full-duplex operation
2-wire with RS232C or V.24 interface
Features local and remote loopback diagnostics
Sold since 1975

UNIVERSAL 201A/B/C CBS
Bell 201-compatible
Certification not applied for
Up to 2400bps using PSK modulation
No line conditioning required
Synchronous, half/full-duplex operation
Turnaround time 8.5msec
2- or 4-wire with RS232C or V.24 interface
Features auto-answer (except 201B), five LED diagnostic indicators
Sold since 1975

UNIVERSAL RM-16
Bell 103/113/201/202-compatible originate/answer type, rack-mounted PC boards
Certification not applied for
Up to 2400bps using FSK and PSK modulation
No line conditioning required
Async/synchronous, half/full-duplex operation
2- or 4-wire with RS232C interface
Features reverse channel, auto-answer, remote and local loopback diagnostics
Sold since 1972

VEN-TEL MD 202
Bell 202-compatible originate/answer type
Certified
Up to 1800bps using FSK modulation
Requires C2 conditioning
Asynchronous, half/full-duplex operation
2- or 4-wire or acoustic with RS232C or 20ma interface
Features reverse channel option, auto-answer, remote and local loopback diagnostics
Sold since 1978
$425 ($22.75/month)

VEN-TEL MD 212A
Bell 212A-compatible originate/answer type
Certified
Up to 300bps or 1200bps using PSK (sync) or FSK (async) modulation
No line conditioning required
Async/synchronous, full-duplex operation
2-wire or acoustic with RS232C or 20ma interface
Features optional integral handset, standard auto-answer, remote and local loopback diagnostics
Sold since 1978
$750 ($39.50/month), installation free

UNIVERSAL 201C
Bell 201B/C-compatible originate/answer type
Certified
2400bps using PSK modulation
No line conditioning required
Synchronous, half/full-duplex operation
Turnaround time 8.5, 25, 150msec
2- or 4-wire with RS232C or V.24 interface
Features auto-answer (except B), LED display
Sold beginning in 1979
$325 to $495

UNIVERSAL 202C CBS
Bell 202C-compatible originate/answer type
Certification not applied for
Up to 1200bps using FSK modulation
No line conditioning required
Asynchronous, half/full-duplex operation
2- or 4-wire with RS232B/C interface
Features 5bps or 150bps reverse channel (opt.), auto-answer, remote and local loopback diagnostics
Sold since 1972
$465

UNIVERSAL 202D/M
Bell 202D-compatible originate/answer (202D) type
Certification not applied for
Up to 1800bps using FSK modulation
Requires C2 conditioning for 1800bps
Asynchronous, half/full-duplex operation
2- or 4-wire with RS232C interface
Features remote and local loopback diagnostics
Sold since 1972
$445(202D), $675(202M)

UNIVERSAL 202S
Bell 202C-compatible originate/answer type, stand-alone or rack-mounted
Certified
Up to 1200bps using FSK modulation
No line conditioning required
Asynchronous, half/full-duplex operation
2- or 4-wire with RS232C interface
Features 5bps or 150bps reverse channel (opt.), auto-answer, local analog and digital loopback diagnostics
Sold since 1978
$510

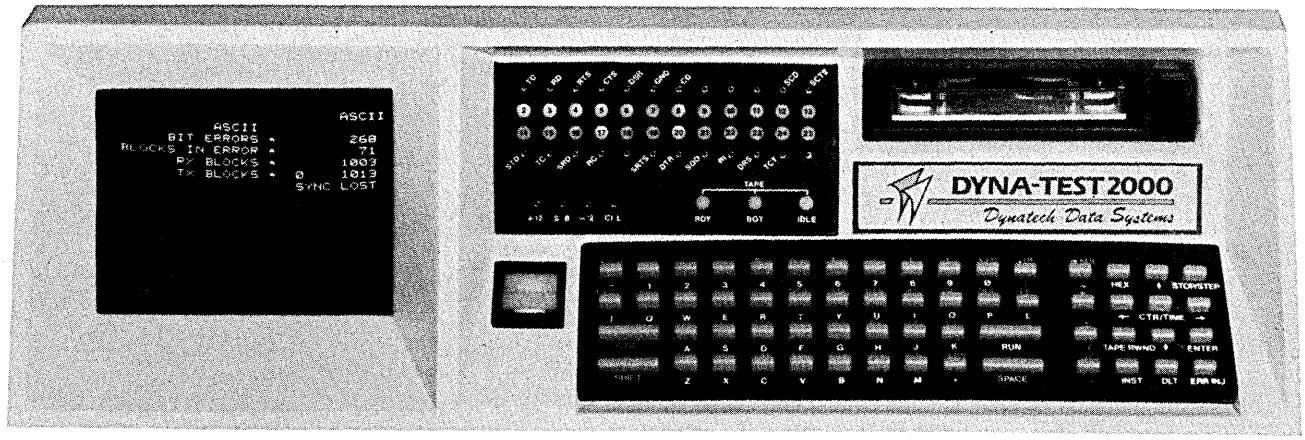
UNIVERSAL 202SS
Originate/answer type
Certification not applied for
1200bps using FSK modulation
No line conditioning required
Synchronous, half/full-duplex operation
2- or 4-wire with RS232C interface
Features remote and local loopback diagnostics
Sold since 1972
$560

45 DAY DELIVERY

DYNA-TEST 2000

Total digital diagnostics in one package—512 character CRT, 200K character tape, 4K character data memory, non-volatile program memory, full function keyboard and complete tri-state LED interface status display.

WE'VE PUT IT ALL TOGETHER.



TRUE EMULATION—half or full duplex; asynchronous, synchronous, and SDLC; polling and responding under full control of user entered macro programs (speeds up to 19.2K bps).

TEST AND MEASURE—bit, block, and character error rates; parity, CRC, and LRC; time delays; and distortion analysis.

MONITOR, CONTROL—and store information from RS-232/V-24 or MIL-188 interface leads.

OPERATIONAL EASE—fully programmable with user oriented instruction set. Selectable ASCII, EBCDIC or Hex display formats. Other languages optional.

PORTABLE OR RACKMOUNT—compact and lightweight.

DYNA-TEST 2000. IT'S ALL IN ONE PACKAGE!

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94566 Rungis, Cedex, France
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INTERFACE '79
BOOTH 1025

TECH CONTROL

CIRCLE 74 ON READER CARD

HIGH-SPEED MODEMS (to 9600bps)

AVANTI 3002
Originate or answer type
3600bps or 4800bps using PSK modulation
No line conditioning required
Sync/asynchronous, half/full-duplex operation
Turnaround/train time 30msec
2- or 4-wire with RS232C or V.24 interface
Features manual equalization, local and remote loopback diagnostics, multiplexing
Sold since 1977
$1,350 plus $100 installation

BELL DATAPHONE 4800 DATA SET 208A
Originate/answer type
4800bps using 8-phase PM modulation
No line conditioning required
Synchronous, half/full-duplex operation
Turnaround time 50, 150msec
4-wire with RS232C interface
Features alternate voice/data option, automatic equalization, remote and local loopback diagnostics, self-test
Sold since 1972
$135/month plus $163 installation

BELL DATAPHONE 4800 DATA SET 208B
Originate/answer type
4800bps using 8-phase PM modulation
No line conditioning required
Synchronous, half-duplex operation
Turnaround time 7.5, 50msec
2-wire with RS232C interface
Features alternate voice/data, auto-answer, automatic equalization, remote and local loopback diagnostics, self-test
Sold since 1973
$135/month plus $163 installation

BELL DATAPHONE 9600 DATA SET 209A
Originate/answer type
9600bps using QAM modulation
Requires D1 conditioning
Synchronous, half/full-duplex operation
4-wire with RS232C interface
Features alternate voice/data, automatic equalization, remote and local loopback diagnostics, self-test
Sold since 1974
$249/month plus $216 installation

BURROUGHS TA 4801
Manual originate/answer type
2400bps or 4800bps using QAM modulation
No line conditioning required
Synchronous, half/full-duplex operation
2- or 4-wire with RS232C or V.24 interface
Features automatic equalization, local and remote loopback diagnostics
Sold since 1977
$3,708 ($129/month) plus $50 installation

CODEX 4800 MP (MULTI-POINT)
Originate/answer type
4800bps using PSK 8-phase modulation
Requires C1 conditioning
Synchronous, full-duplex operation
Turnaround/train time 20msec/50msec
4-wire with RS232C or V.24 interface
Features optional reverse channel and alternate voice/data, automatic equalization, local and remote loopback diagnostics
Over 1,000 sold since 1972
$4,500 ($95/month) plus $152 installation

CODEX 4800 I
Originate/answer type
4800bps using PSK 8-phase (V.27) modulation
Requires M102 conditioning
Synchronous, half/full-duplex operation
Turnaround/train time 50msec
4-wire with V.24 or RS232C interface
Features optional reverse channel and alternate voice/data, automatic equalization, remote and local loopback diagnostics, multiplexing
Over 1,000 sold since 1973
$4,500 ($95/month) plus $152 installation

CODEX 4800 C
Originate/answer type
3200bps or 4800bps using QAM modulation
No line conditioning required
Synchronous, simplex/half/full-duplex operation
Turnaround/train time 140msec
4-wire with RS232C, V.24, or MIL 188C interface
Features optional reverse channel (150bps) and alternate voice/data, automatic equalization, local and remote loopback diagnostics, multiplexing
Over 4,000 sold since 1971
$4,500 ($95/month) plus $152 installation

CODEX 7200 C
Originate/answer type
4800bps or 7200bps using QAM modulation
Requires C2 conditioning
Synchronous, half/full-duplex operation
Turnaround time 275msec

4-wire with RS232C, V.24, or MIL 188C interface
Features optional alternate voice/data, automatic equalization, local and remote loopback diagnostics, multiplexing
Over 1,000 sold since 1971
$6,850 ($150/month) plus $152 installation

CODEX 9600 C
Originate/answer type
4800bps or 9600bps using QAM modulation
Requires C2 conditioning
Synchronous, half/full-duplex operation
Turnaround/train time 275msec
4-wire with RS232C, V.25, or MIL 188C interface
Features optional alternate voice/data, automatic equalization, local and remote loopback diagnostics, multiplexing
Over 5,000 sold since 1971
$8,900 ($185/month) plus $152 installation

CODEX LSI 4800
Originate/answer type
2400bps or 4800bps using QAM modulation
No line conditioning required
Synchronous, half/full-duplex operation
Turnaround/train time 75msec
4-wire with RS232C, V.24, or MIL 188C interface
Features 150bps reverse channel (opt.) and alternate voice/data, automatic equalization, local and remote loopback diagnostics, multiplexing, DDD restoral, circuit quality monitoring
Over 5,000 sold since 1976
$4,325 ($95/month) plus $152 installation

CODEX LSI 7200
Originate/answer type
4800bps or 7200bps using QAM modulation
Requires C2 conditioning
Synchronous, half/full-duplex operation
Turnaround/train time 100msec
4-wire with RS232C, V.24, or MIL 188C interface
Features reverse channel (opt.) and alternate voice/data, automatic equalization, local and remote loopback diagnostics, mutiplexing, DDD restoral, circuit quality monitoring
500 sold since 1976
$6,500 ($150/month) plus $152 installation

CODEX LSI 9600
Originate/answer type
4800bps or 9600bps using QAM modulation
Requires C2 conditioning
Synchronous, half/full-duplex operation
Turnaround/train time 100msec
4-wire with RS232C, V.24, or MIL 188C interface
Features optional reverse channel and alternate voice/data, automatic equalization, local and remote loopback diagnostics, multiplexing, DDD restoral, circuit quality monitoring
Over 500 sold since 1976
$8,500 ($185/month) plus $152 installation

CODEX LSI 48I
Originate/answer type
2400bps or 4800bps using 8-phase DPSK (V.27) modulation
Requires M102 conditioning
Synchronous, half/full-duplex operation
Turnaround/train time 47.5msec
4-wire with RS232C, or V.27 interface
Features 150bps reverse channel (opt.) and alternate voice/data, automatic equalization, local and remote loopback diagnostics, multiplexing
Over 1,000 sold since 1976
$4,325 ($95/month) plus $152 installation

CODEX LSI 48FP
Originate/answer type
2400bps or 4800bps using QAM modulation
Requires C1 conditioning
Synchronous, half/full-duplex operation
Turnaround/train time 9msec
4-wire with RS232C, V.24, or MIL 188C interface
Features 150bps reverse channel (opt.) and alternate voice/data, automatic equalization, local and remote loopback diagnostics
Over 5,000 sold since 1976
$4,500 ($105/month) plus $152 installation

CODEX LSI 72FP
Originate/answer type
4800bps or 7200bps using QAM modulation
Requires C2 conditioning
Synchronous, half/full-duplex operation
Turnaround/train time 9msec
4-wire with RS232C, V.24, or MIL 188C interface
Features reverse channel (opt.) and alternate voice/data, automatic equalization, local and remote loopback diagnostics
300 sold since 1976
$6,725 ($160/month) plus $152 installation

CODEX LSI 96FP
Originate/answer type
4800bps to 9600bps using QAM modulation

From the graphics leader

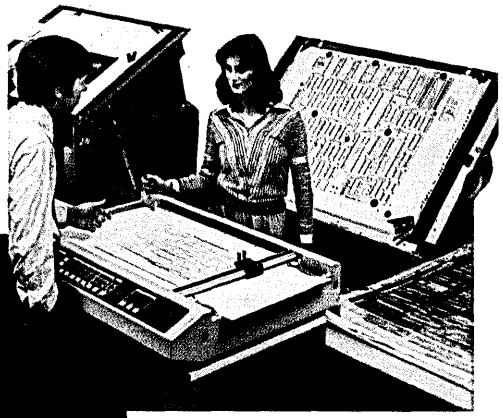
Tektronix 4663: Big plotter capability meets C-size convenience.

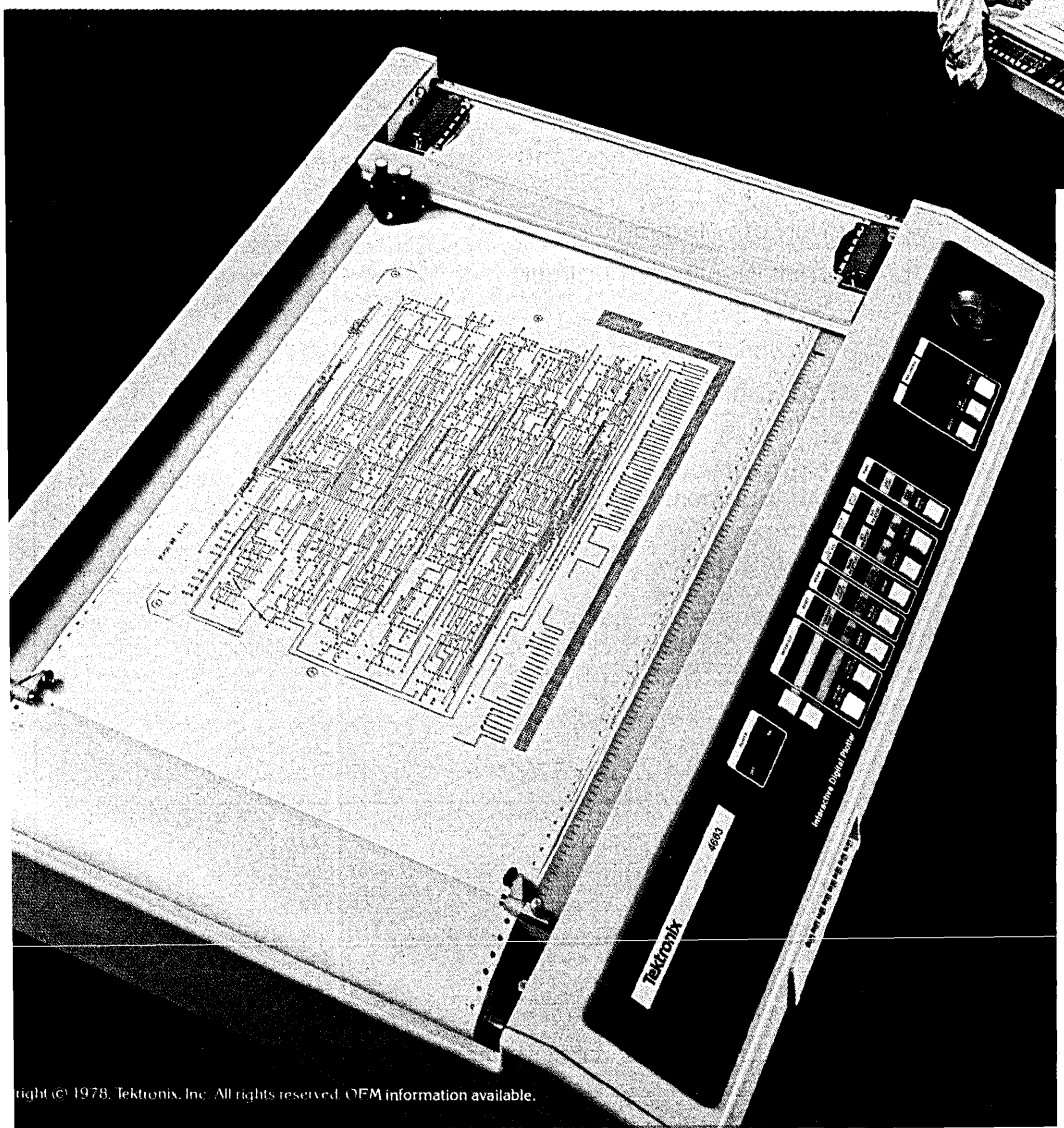
Introducing large plotter capabilities in a C-size plotter package.

The 4663 is a smart digital plotter built on one intelligent observation: much of the work that comes off large, slow flatbed and drum plotters occupies no more than a 432mm x 559mm (17" x 22") area. So we built a C-size unit with big plotter performance and convenience all its own.

Operation is easy. Output camera-ready. Standard and optional capabilities include dual programmable pen control. Digitizing. Circular interpolation. Down-loadable character sets. Programmable media advance. Macro symbol generation. A variety of interfaces, including RS-232 and GPIB. And a unique user parameter entry card that instantly enters your preferred operating characteristics, including interface, baud rate, pen speed, media size and type.

Tektronix pioneered smart small plotters. We're bringing new high standards of human engineering to plotter technology, while providing the assurance of easy PLOT 10 software and worldwide service support. For more information





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CIRCLE 61 ON READER CARD

BEEHIVE'S MICRO Bee 1S designed for emulation plus!

Have you ever wished you could change terminal vendors without losing your investment in software? Well, the new socketed Micro Bee 1S can do exactly what you want. This terminal is perfect for the person who knows his application and needs, and can specify what he wants to do.

The basic terminal configuration comes with: 3K of RAM, plus sockets available for an additional 3K of RAM population for a total of 6K; six sockets for ROM (total 12K), all of which are depopulated; and a socketed/populated auxiliary port, character generator, and line drawing generator. The Micro Bee 1S offers full communications capabilities with a standard RS232C/current loop main port in addition to the bidirectional serial auxiliary port. The empty RAM/ROM sockets allow for the expansion capabilities of the terminal to meet a wide variety of customized product applications.

Beehive offers emulators for the DEC VT52™, Microdata Prism™, Data General Dasher™, ADDS Regent 100™ and Beehive's own Micro Bee 1A™ . . . for starters.

Plus . . . if the emulator you want is not available you can custom generate your own software for your specific applications! The Micro Bee 1S can be compared to any terminal, because it can emulate any terminal you desire.

Whether you want to buy a standard package from Beehive or develop your own highly specialized application software, why not give us a call today to learn more about this new and versatile product? *It's just what you've been looking for!*

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or contact our sales office nearest you.

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EUROPE: Amsterdam, The Netherlands Phone 020-451522

BEEHIVE INTERNATIONAL

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EUROPE: Schiphol Airport • Building 70 Schiphol East • Amsterdam, The Netherlands
Phone 020-451522 • Telex 15284

CIRCLE 21 ON READER CARD

Requires C2 conditioning
Synchronous, half/full-duplex operation
Turnaround/train time 9msec
4-wire with RS232C, V.24, or MIL 188C interface
Features reverse channel (opt.) and alternate voice/data, automatic equalization, local and remote loopback diagnostics
400 sold since 1976
$8,750 ($200/month) plus $152 installation

CODEX LSI 96/V29
Originate/answer type
9600bps using QAM modulation
Requires M102 or C2 conditioning
Synchronous, half/full-duplex operation
Turnaround/train time 253msec
4-wire with RS232C or V.24 interface
Features optional reverse channel and alternate voice/data, automatic equalization, remote and local loopback diagnostics, multiplexing
Over 5,000 sold since 1976
$9,350 ($205/mo) plus $125 installation

COMDATA 7208A/B
Bell 208B-compatible originate/answer type
4800bps using differential encoding, 8-phase modulation
No line conditioning required
Synchronous, half-duplex operation
2-wire with RS232C interface
Features reverse channel (opt.), automatic equalization, remote and local loopback diagnostics, self-test
Sold since 1978
$3,150/$2,750

GENERAL DATACOMM 208 B/A
Bell 208A/B-compatible originate/answer type
Certified 4800bps using DPSK modulation
No line conditioning required
Synchronous, half/full-duplex operation
Turnaround/train time 50msec-150msec
2- or 4-wire with RS232C interface
Features optional alternate voice/data and integral handset, auto-answer standard, automatic equalization, local loopback diagnostics, end to end test
Sold since 1977
$3,600/$3,275

GENERAL DATACOMM 208-9A
Bell 208A-compatible
4800bps using DPSK modulation
No line conditioning required
Synchronous, full-duplex operation
Turnaround/train time 25, 50, 150msec
4-wire (leased) with RS232C interface
Features automatic equalization, local analog and digital loopback diagnostics, self-test
Sold since 1978
$2,975

GENERAL DATACOMM MP-208 B/A
Bell 208A/B-compatible originate/answer type
4800bps using DPSK modulation
No line conditioning required
Synchronous, half/full-duplex operation
Turnaround/train time 50msec
2- or 4-wire leased or 2-wire DDD with RS232C interface
Features alternate voice/data, integral handset option, auto-answer, automatic equalization, local analog and digital loopback diagnostics, self-test
Sold since 1977

GENERAL DATACOMM MP-4801/EL/ES
Originate/answer type
2400bps or 4800bps using DPSK modulation
No line conditioning required
Synchronous, full-duplex operation
Turnaround/train time 25/50/265msec
2- or 4-wire (DDD, leased) with CCITT or V.24 interface
Features 150bps reverse channel (opt.), alternate voice/data option, auto-answer, automatic equalization, local analog and digital loopback diagnostics, self-test
Sold since 1977

GENERAL DATACOMM 9601
4800bps to 9600bps using PAM/VSB modulation
D1 conditioning recommended
Synchronous, full-duplex operation
Turnaround time less than 3sec
4-wire (leased) with RS232C or V.24 interface
Features alternate voice/data option, auto-answer option, automatic equalization, local loopback diagnostics
Sold since 1976
$6,545 plus $215 installatin (first unit)

GTE LENKURT 262A/208A
Bell 208A-compatible originate/answer type
4800bps using 8-phase DPSK modulation
No line conditioning required
Synchronous, half/full-duplex operation
2- or 4-wire (leased) with RS232C or V.24 interface
Features optional reverse channel and alternate voice/data, automatic equalization, back to back and loopback diagnostics
Sold since 1975
$3,500

GTE LENKURT 262B/208B
Bell 208B-compatible originate/an-

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Interface '79
McCormick Place,
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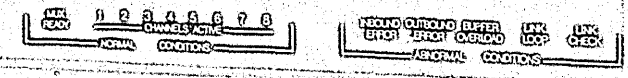
Super Smart Super Cheap

Supermux 480

Infotron Systems



A Statistical Multiplexer for Only $1500

A four channel statistical multiplexer for only $1500, an eight channel unit for only $2500. Super prices with super performance—error-free data, double or better the throughput, down-line loading and built-in diagnostics.

Super smart Supermux 480's replace up to eight transmission lines with just one. Bandwidth is assigned dynamically without wasting any on idle terminals—double or better the throughput of dumb TDM's.

Transmission errors are eliminated too! Data is buffered, checked and, if necessary, retransmitted, all completely transparent to existing terminals and software. With Supermux, not a bit of data is lost, even with outages lasting ten seconds or more on a fully loaded 9600 bps line.

Microprocessor-controlled Supermux 480's mix dial-up and dedicated asynchronous inputs at speeds up to 9600 bps. Super features—built-in diagnostics, system status reporting, as well as reconfiguration of remote, unattended units—all standard.

Super Smart . . . Super Cheap . . . Supermux 480.

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Cherry Hill Industrial Center, Cherry Hill, NJ 08003
800-257-8352 609-424-9400

In Europe: Infotron Systems Ltd.
Systems House, Poundbury Road
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Infotron Systems

First in Performance and Reliability

CIRCLE 35 ON READER CARD

swer type
4800bps using 8-phase DPSK modulation
No line conditioning required
Synchronous, half-duplex operation
2-wire (DDD) with RS232C or V.24 interface
Features auto-answer, automatic equalization, remote and local loopback diagnostics
Sold since 1975
$3,750

IBM 3874
Originate/answer type
2400bps or 4800bps using CPSK modulation
Requires C1 conditioning
Synchronous, half/full-duplex operation, point to point or multipoint
2- or 4-wire with RS232C interface
Features optional alternate voice/data and auto-answer, automatic equalization, line and self-test diagnostics
Sold since 1975
$3,570 ($170/month or $145/month)

IBM 3875
Originate/answer type
3600bps or 7200bps using combined PM/AM modulation
Requires C2 conditioning
Synchronous, half/full-duplex operation, point to point or multipoint
4-wire with RS232C interface
Features optional alternate voice/data and auto-answer, manual equalization, line and self-test diagnostics
Sold since 1972
$7,275 ($269/month)

INFOTRON SYSTEMS DL 9600
Originate/answer type
4800bps or 9600bps using PAM, VSB modulation
Requires D1 conditioning
Synchronous, full-duplex operation
Train time 2.8sec
4-wire with RS232C or V.24 interface
Features optional alternate voice/data, automatic equalization, local and remote loopback diagnostics, self-test
Sold since 1978
$5,500 plus $200 installation

INTERTEL MCS4800
Originate/answer type
Up to 4800bps using QAM modulation
No line conditioning required
Synchronous, half/full-duplex operation
Turnaround/train time 50msec
2- or 4-wire with RS232C or V.24 interface
Features 150bps reverse channel (opt.), alternate voice/data, integral handset and auto-answer; provides automatic equalization, remote and local loopback diagnostics, multiplexing, signal quality indicator
Sold since 1974
$4,400 ($106/month) plus $135 installation

INTERTEL MCS 9600
Originate/answer type
Up to 9600bps using QAM modulation
No line conditioning required
Synchronous, half/full-duplex operation
Turnaround/train time 225msec
2- or 4-wire with RS232C or V.24 interface
Features 150bps reverse channel (opt.), alternate voice/data, integral handset and auto-answer, automatic equalization, remote and local loopback diagnostics, multiplexing, signal quality indicator
Sold since 1974
$8,700 ($195/month) plus $200 installation

LIVERMORE DATA SYSTEMS 440/48
Originate/answer type
2400bps or 4800bps using PAM modulation
No line conditioning required
Async/synchronous, full-duplex operation
2- or 4-wire with RS232C or V.24 interface
Features optional reverse channel, alternate voice/data, integral handset and auto-answer, automatic equalization, remote and local loopback diagnostics, multiplexing
Sold since 1974
$1,995

PARADYNE BISYNC-48/M-48
IBM BSC-compatible (Bisynch-48) originate/answer type
4800bps using 4-level PAM, VSB modulation
No line conditioning required
Synchronous, half/full-duplex operation
Train time 7.0msec
2- or 4-wire with RS232C or MIL 188C interface
Features optional alternate voice/data and auto-answer, automatic equalization, remote and local loopback diagnostics, multiplexing
2,500 sold since 1971
B-48: $4,600 ($120/month) plus $100 installation
M-48: $3,000 ($110/month) plus $100 installation

PARADYNE LSI-48
Originate/answer type
4800bps using 2-level PAM, VSB modulation
No line conditioning required
Synchronous, full-duplex operation
Train time 2.8sec
4-wire with RS232C or MIL 188C interface
Features optional alternate voice/

Static-free information.

Kraco Enterprises, Inc. is one of the country's largest manufacturers and distributors of automobile radios, CB radios, and accessories. To help service its thousands of customers worldwide, Kraco has installed a Series 21 distributed processing system from Mohawk Data Sciences. This compact, easy-to-use system not only handles order entry, billing, inventory control, and payroll at Kraco headquarters, but communicates as well with the mainframes of its distant customers.

"Static-free" information—information that is meaningful and up to date—information that allows managers to make sound decisions. That's what Kraco gets—and you can too.

With the MDS Series 21 family, you also get a broad range of capability that fits every need. For data entry and local processing, there's the System 21/20. For transaction processing, consider the System 21/40. And for more sophisticated applications requiring multiprogramming, the advanced System 21/50 is ideal.

Learn more. Get your FREE copy of colorful 12-page booklet on distributed data processing. It's easy to read ... easy to understand. Call toll-free (800) 223-0100. (In New York State, call (315) 797-7445.) Or fill out and mail coupon.

Please send me free copy of "Distributed Data Processing—A Rational Approach."

Name _____ Title _____

Company _____

No. & Street _____

City, State & Zip _____

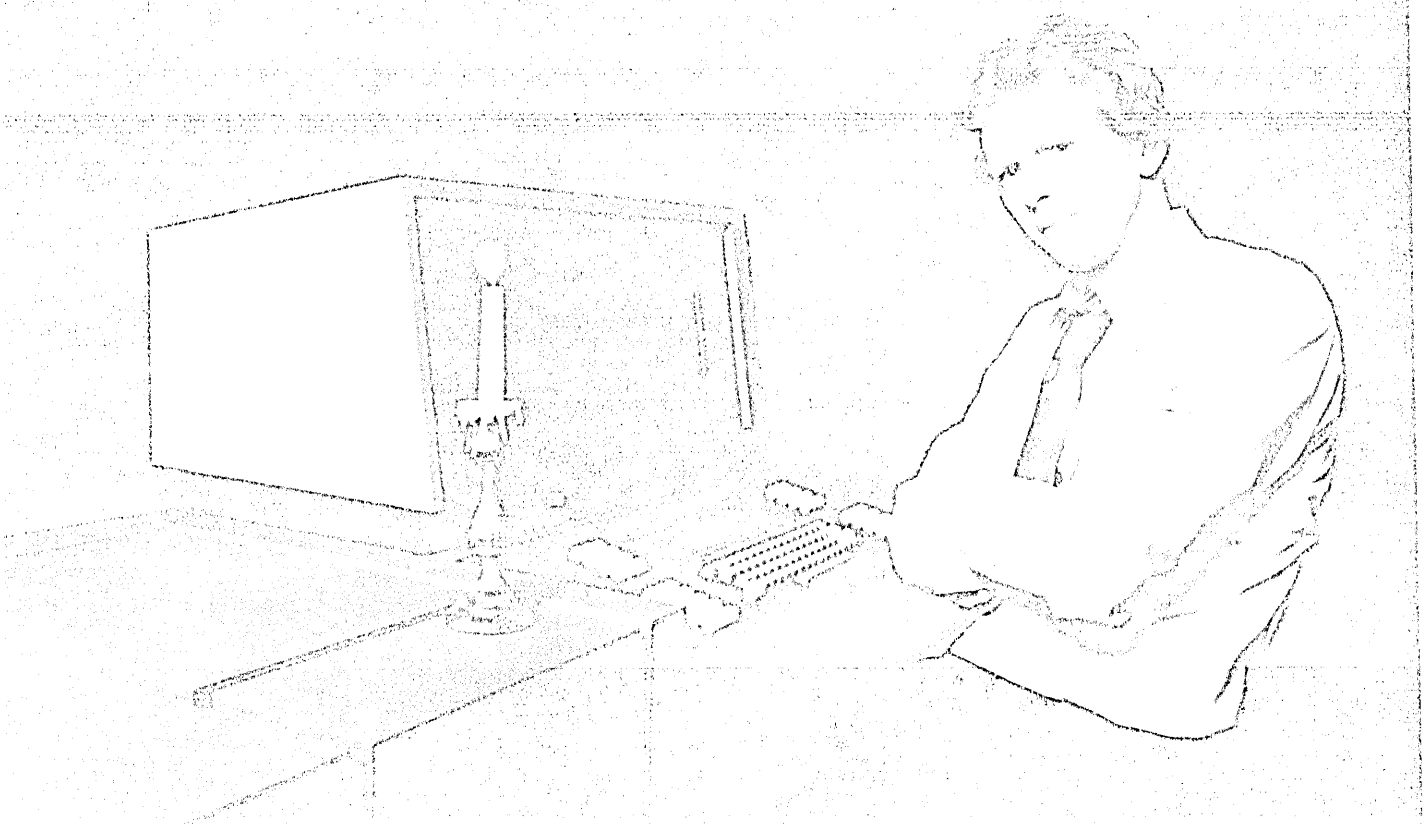
DM 379

MDS

1599 Littleton Road, Parsippany, New Jersey 07054 • (201) 540-9080
Series 21 is a trademark of Mohawk Data Sciences

Visit MDS exhibit
INTERFACE '79

Mohawk Data Sciences



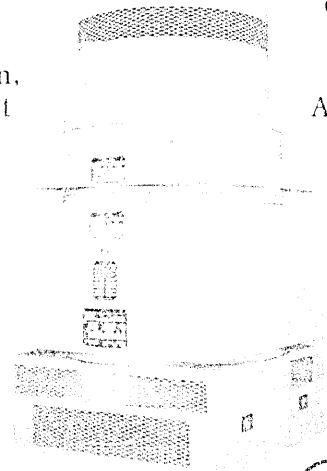
How do you explain a brownout to a computer?

The same way you explain the other unpredictable line anomalies found in today's commercial power. You don't.

There is an answer, however, to this rapidly growing problem.

A Kato motor-generator set. It delivers a constant supply of clean, accurate power so you can ride out sudden voltage fluctuations that often shut down systems needlessly. In fact, you can continue operations indefinitely, despite voltage reductions of 20% or more.

And because an M-G set is the only method that provides total load isolation, you're fully protected against harmful spikes that result in costly, often untraceable computing errors.



Kato Engineered M-G sets do the job with energy saving efficiency and low maintenance requirements.

They're rugged, too. Our conservatively designed units withstand severe overloads that would destroy a solid-state device in seconds.

Ask us about the cost-advantages of using a Kato motor-generator set in your operation. We'll draw on our 50 years of experience in meeting your power conversion needs. Call Kato Engineering Company, Mankato, Minnesota 56001. (507) 625-4011.

KATO Engineering COMPANY

CIRCLE 202 ON READER CARD

data and auto-answer, automatic equalization, remote and local loopback diagnostics
Sold since 1975
$3,000 ($90/month) plus $200 installation

PARADYNE LSI-72
Originate/answer type
4800bps or 7200bps using 3-level PAM, VSB modulation
No line conditioning required
Synchronous, full-duplex operation
Train time 2.8sec
4-wire with RS232C or MIL 188C interface
Features optional alternate voice/data and auto-answer, automatic equalization, remote and local loopback diagnostics
Sold since 1975
$4,000 ($130/month) plus $200 installation

PARADYNE M-96/LSI-96
Originate/answer type, self-contained unit or PC board
4800bps to 9600bps using 4-level PAM, VSB modulation
No line conditioning required
Synchronous, full-duplex operation
Train time 2.8sec
4-wire with RS232C or MIL 188C interface
Features optional alternate voice/data and auto-answer, automatic equalization, remote and local loopback diagnostics, multiplexing
8,000 sold since 1974
M-96: $6,500 ($165/month) plus $200 installation
LSI-96: $4,500 ($135/month) plus $200 installation

PARADYNE MP-48
Originate/answer type
4800bps using 8-phase DPSK modulation
No line conditioning required
Synchronous, half/full-duplex operation, point to point or multipoint
Turnaround/train time 35msec/25msec
2- or 4-wire with RS232C or V.24 interface
Features optional reverse channel, alternate voice/data and auto-answer, automatic equalization
Sold since 1976
$3,000 ($85/month) plus $200 installation

PENRIL 48/MULTI
Originate/answer type
4800bps using 8-phase DPSK modulation
No line conditioning required
Synchronous, half/full-duplex operation
Turnaround time 8.5msec
2- or 4-wire with RS232C interface
Features optional alternate voice/data and integral handset, manual equalization, remote and local loopback diagnostics, self-test
2,000 sold since 1971
$2,800 ($85/month)

PENRIL 9600/DM
4800bps to 9600bps using PAM, VSB modulation
Requires C1/C2 conditioning
Synchronous, half/full-duplex operation
Turnaround time 2.38sec
4-wire with RS232C or V.24 interface
Features optional alternate voice/data and auto-answer, automatic equalization, local and remote loopback diagnostics, multiport/multiplexing
Sold since May 1978

RACAL-MILGO MPS 48
4800bps using 8-phase DPSK modulation
No line conditioning required
Synchronous, half/full-duplex operation
Turnaround/train time 20, 26, 65, 125msec/26msec
4-wire with RS232C, V.24, or MIL 188C interface
Features 150bps reverse channel, alternate voice/data option, automatic equalization, local analog and digital loopback diagnostics, self-test, remote loopback (opt.), multiplexing (opt.)
Sold since 1976
$4,300 ($95/month) plus $170 installation

RACAL-MILGO MPS 48 (DIAL)
4800bps using 8-phase DPSK modulation
No line conditioning required
Synchronous, half-duplex operation
Turnaround/train time 26, 65, 125msec/26msec
2-wire with RS232C, V.24, or MIL 188C interface
Features alternate voice/data, integral handset (opt.), auto-answer, automatic equalization, local analog and digital loopback diagnostics, self-test
Sold since 1976
$4,695 ($115/month) plus $170 installation

RACAL-MILGO 4801
4800bps using 4-phase DPSK modulation
No line conditioning required
Synchronous, half/full-duplex operation
Train time 30msec
4-wire with RS232C, V.24, or MIL 188C interface
Features optional alternate voice/data and integral handset, automatic equalization, local analog and digital loopback, diagnostics, self-test, remote loopback, multiplexing (opt.) and modem sharing
Sold since 1978
$4,850 ($120/month) plus $170 installation

RACAL-MILGO MPS 7201
4800bps or 7200bps using 8-phase

optimized DPSK modulation
No line conditioning required
Synchronous, half/full-duplex operation
Train time 30msec
4-wire with RS232C, V.24, or MIL 188C interface
Features optional alternate voice/data and integral handset, automatic equalization, multiplexing (opt.)
Sold since 1978
$6,675 ($160/month) plus $205 installation

RACAL-MILGO MPS 9601/9629
4800bps to 9600bps using DPSK and QAM modulation (8-phase, two amplitude levels, optimized)
No line conditioning required
Synchronous, half/full-duplex operation
Train time 30/253msec
4-wire with RS232C, V.24, or MIL 188C interface
Features optional alternate voice/data and integral handset, automatic equalization, multiplexing (opt.)
Sold since 1978
9601: $8,250 ($179/month) plus $230 installation
9629: $8,750 ($188/month) plus $230 installation

RIXON 208 A/B
Bell 208A/B-compatible originate/answer type
4800bps using 8-phase PM modulation
No line conditioning required
Synchronous, half/full-duplex operation
Turnaround time 50/150msec
2- or 4-wire with RS232C interface
Features alternate voice/data, autoanswer, automatic adaptive equalization, remote and local loopback diagnostics, self-test
Sold since 1978

SYNTECH S 208
Bell 208/201C-compatible originate/answer type
2400bps or 4800bps using 4/8-phase PM modulation
No line conditioning required
Synchronous, half-duplex operation
Turnaround time 150/50msec; train time 50msec
2-wire with RS232C interface
Features alternate voice/data, autoanswer, automatic equalization, remote and local loopback diagnostics LED display
Over 400 sold since May 1978
$3,350 ($120/month), installation free

TELE-DYNAMICS 7208A
Bell 208A-compatible originate/answer type
4800bps using 8-phase PM modulation
No line conditioning required
Synchronous, half/full-duplex operation
Turnaround/train time 48msec
4-wire with RS232C or CCITT interface
Features automatic equalization, remote and local loopback diagnostics, self-test
1,100 sold since 1975
$2,750 ($99/month) plus $100 installation

TELE-DYNAMICS 7208B
Bell 208B-compatible orginate/answer type
4800bps using 8-phase PM modulation
No line conditioning required
Synchronous, half-duplex operation
Turnaround/train time 50, 150msec/48msec
2-wire with RS232C interface
Features alternate voice/data, autoanswer, automatic equalization, remote and local loopback diagnostics
800 sold since 1975
$3,100 ($112/month) plus $150 installation

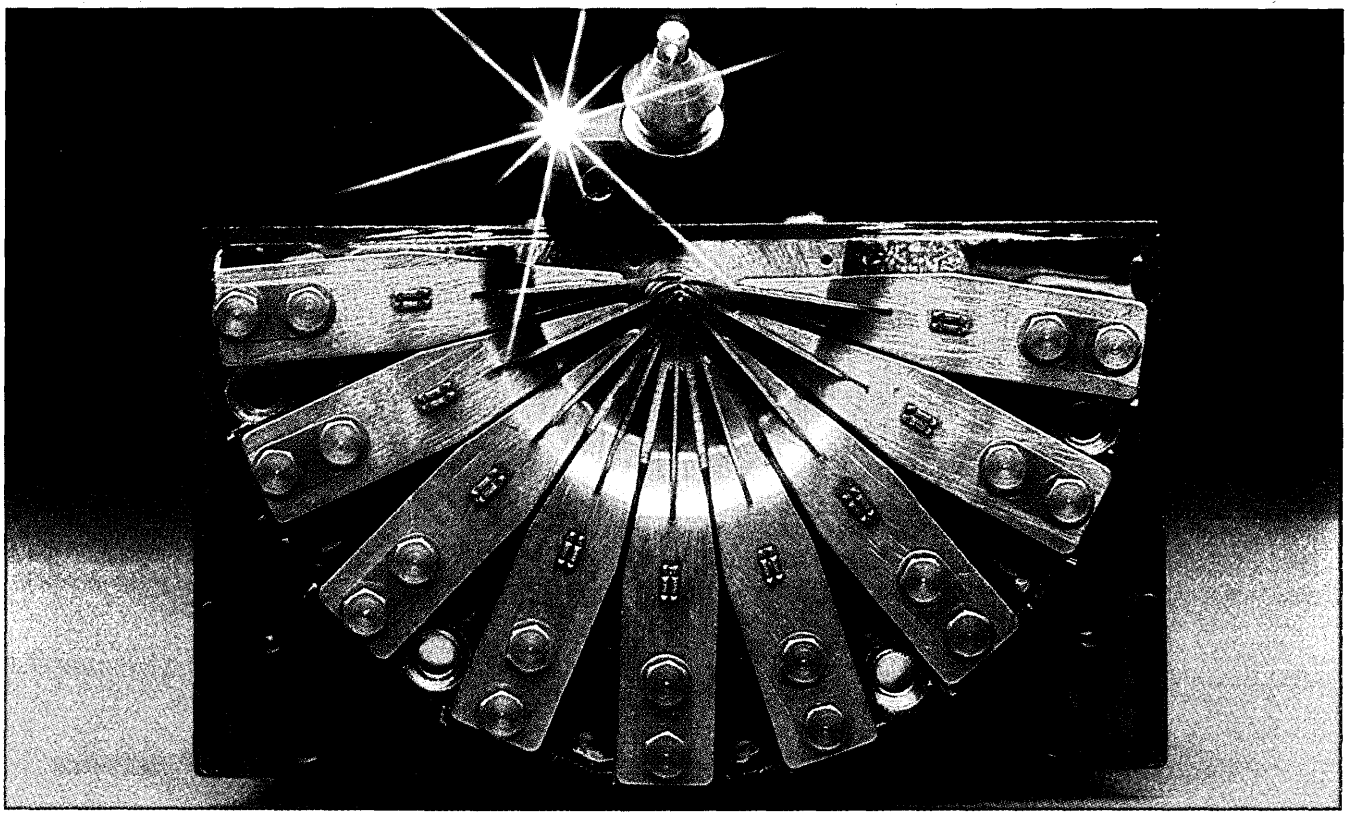
TELE-DYNAMICS 7296
Originate/answer type
4800bps or 9600bps using VSB modulation
No line conditioning required
Synchronous, full-duplex operation
Train time 2.8sec
4-wire with RS232C interface
Features automatic equalization, line loopback and digital loopback diagnostics
Sold since 1978
$4,900 ($190/month) plus $150 installation

TRAN M437-2
Originate/answer type
9600bps
Synchronous, full-duplex operation
4-wire line
Features automatic equalization
Sold since 1978

UNIVERSAL 208A
Bell 208A/compatible
4800bps using 8-phase PM modulation
No line conditioning required
Synchronous, half/full-duplex operation
Turnaround time 50,150msec
4-wire with RS232C interface
Features alternate voice/data option, automatic equalization, remote and local loopback diagnostics, self-test
Sold beginning in 1979
$2,625

UNIVERSAL 208B
Bell 208B-compatible originate/answer type
4800bps using 8-phase PM modulation
No line conditioning required
Synchronous, half-duplex operation

LET'S PUT OUR HEADS TOGETHER.



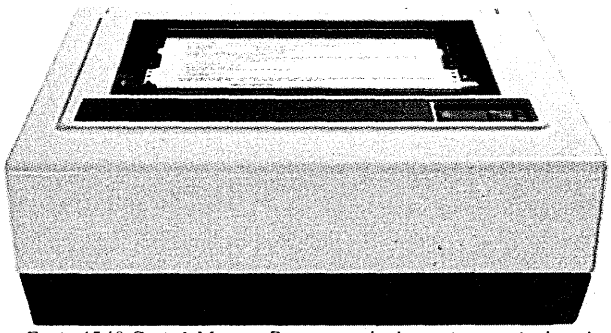
The Facit 4540 Serial Matrix Printer has already made a name for itself with its standard 250 characters a second – all crisp, fullbodied and perfect throughout the 500 million character service life of the printhead. Versatility comes from the rare 9×9 dot matrix, and the Facit 4540 offers a genuine 100% duty cycle and entire elimination of adjustment and lubrication.

The whole secret is in the unique printhead and its microprocessor controlled impact printing mechanism.

Integration of mechanics and electronics has made Facit peripheral data products world famous.

Facit 4540 extends this tradition.

So let's put our heads together. To make your systems more efficient, more competitive and more in demand.



Facit 4540 Serial Matrix Printer with the unique printhead.

FACIT DATA PRODUCTS

FACIT-ADDO INC., 66 FIELD POINT RD, GREENWICH, CONN. 06830. (203) 622-9150. TELEX 96-5998.

CIRCLE 143 ON READER CARD

ATHANA
MAGNETIC MEDIA

"CRITERIA"

The superior manufacturing methods utilized in the production of the various types and models of ATHANA magnetic media products are second to none.

A series of demanding standards is applied by the ATHANA engineering and production team to each facet of our manufacturing cycle. This strict adherence to the principles of excellence results in products that establish ATHANA as the standard of comparison.

FACT: No other manufacturer in the magnetic media industry presently meets the rigid **CRITERIA** for purity of process and production methods required in the manufacture of each and every ATHANA product.

ATHANA products are represented in various export markets as well as the domestic end-user market by professional distributor organizations.

Domestic OEM's and the U.S. Government are serviced on a factory direct basis.

In short — we sell to the industries most demanding consumers. We must, therefore, be totally committed to product excellence.

The **only** way ATHANA can continue to grow and receive business is to set the **CRITERIA** by which product excellence is measured. We welcome your comments, inquiry and evaluation.

ATHANA

Post Office Box 3696 □ Torrance, CA 90510
(213) 775-3741 □ Telex 69-1502

CIRCLE 199 ON READER CARD

Turnaround time 7.5, 50msec
2-wire with RS232C interface
Features alternate voice-data, auto-answer, automatic equalization, remote and local loopback diagnostics, self-test
Sold beginning in 1979
$2,975

WIDEBAND MODEMS

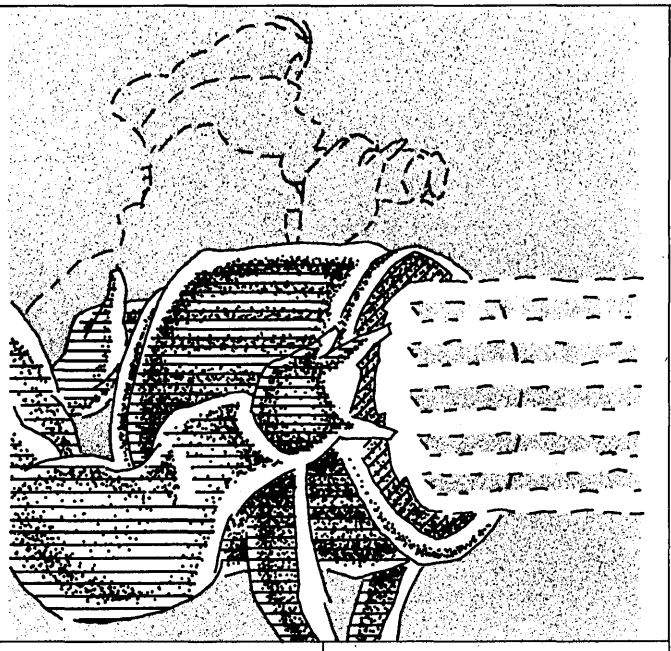
BELL 300 SERIES
The 303B, 303C, and 303D Data Sets operate synchronously at 19,200bps, 50,000bps, and 230,400bps, respectively, on Series 5000 and 8000 communication channels. The Data Sets are part of a wideband service terminal and are not available separately.

CODEX CT6
Originate/answer type, combines two voice-grade lines
Up to 19,200bps using QAM modulation
Requires C2 conditioning
Full-duplex operation
RS232C or Bell 303 interface
Features optional alternate voice/data, automatic equalization, remote and local loopback diagnostics
Sold since 1973
$24,000 ($580/month) plus $152 installation

CODEX
8300 GBM (GROUP BAND)
Bell wideband-compatible originate/answer type
Up to 64,000bps using 4-phase PSK modulation
Full-duplex operation
4-wire with V.35 interface, V.35 to Bell 303 interface adapter optional
Features optional alternate voice/data, fixed equalization, remote and local loopback diagnostics
Sold since 1974
$6,450 ($215/month) plus $152 installation

GTE LENKURT 26C 40.8
Bell wideband-compatible originate/answer type
Switchable 20,400bps/40,800bps
Simplex/half/full-duplex operation
4-wire with current switching interface
Features manual equalization, VF loopback diagnostics
Sold since 1967
$1,750 to $2,000

PARADYNE LSD 19,200
Interfaces with Paradyne modems to provide 19,200bps operation over two unconditioned voice-grade lines
Full-duplex operation
Turnaround time 2.5msec



RS232C or V.24 interface
Features optional alternate voice/data and auto-answer, automatic equalization, remote and local loopback diagnostics
Sold since 1976
$5,150 ($235/month) plus $100 installation

PARADYNE SIM-38
Microprocessor-based with integral LSI modems, takes wideband input and reverse multiplexes to multiple outputs
24,000/28,800/38,400bps using PAM VSB modulation
No line conditioning required
Full-duplex operation
Turnaround time 2.5msec
Multiple 4-wire voice grades with RS232C or V.24 interface
Features automatic equalization, remote and local loopback diagnostics
Sold beginning in 1979
$25,000 ($713/month) plus $300 installation

PARADYNE SIM-56
Microprocessor-based with integral LSI modems, reverse multiplexes wideband input to multiple outputs
48,000/56,000/57,600bps using PAM VSB modulation
No line conditioning required
Full-duplex operation
Turnaround time 2.5msec
Multiple 4-wire voice grades with RS232C or V.24 interface
Features automatic equalization, remote and local loopback diagnostics
Sold beginning in 1979
$31,600 ($970/month) plus $400 installation

RACAL-MILGO (ICC)
LINEPLEXER II
Multiplexes two voice-band modems over two voice-band lines at rates up to 19,200bps
Requires D1 or C2 conditioning
Full-duplex operation
4-wire (two) with RS232C, CCITT, or MIL 188C interface
Features remote and local loopback diagnostics
Sold since 1974
$5,250 ($170/month)

SHORT-HAUL MODEMS

ASTROCOM SC200
2400bps to 19,200bps using PM modulation
Synchronous, simplex/half/full-duplex
Turnaround time 20msec
2- or 4-wire RS232C interface for transmission up to 3.5 miles
Features remote loopback and self-test diagnostics
4,000 sold since 1969
$495 ($40/month)

ASTROCOM SC400
10Kbps to 125Kbps using PM modulation
Synchronous, simplex/half/full-duplex
Turnaround time 1msec
2- or 4-wire RS232C interface for transmission up to 3 miles
500 sold since 1969
$1,495 ($85/month)

ASTROCOM MOS/2
Bell 43401-compatible
2400bps to 19,200bps using PM (2-phase)
Synchronous, half/full-duplex operation
Turnaround time 20msec
2- or 4-wire RS232C interface for transmission up to 20 miles
Features remote and local loopback diagnostics
1,000 sold since 1977
$695 ($40/month)

ASTROCOM SH96A
Up to 9600bps using FSK modulation
Asynchronous, half/full-duplex, point to point or multipoint operation
Turnaround time 20msec
2- or 4-wire RS232C interface for transmission up to 3 miles
Features status lights for diagnostics
Sold since August 1978
$295 ($30/month)

AVANTI 2100
Bell 43401-compatible rack-mount type
2400bps to 19,200bps using DPSK
Synchronous, simplex/half/full-duplex
Turnaround time 0-16msec
2- or 4-wire with RS232C, V.24, V.35, or MIL 188C interface for transmission up to 20 miles
Features remote and local loopback, and bit error indicator for diagnostics
Sold since 1977
$775

AVANTI 2100S
Bell 43401-compatible rack-mount type
19,200bps to 230,400bps using DPSK
Synchronous, simplex/half/full-duplex
Turnaround time 0-16msec
2- or 4-wire with RS232C, RS442, V.24, V.35, RS423, MIL 188, or AT&T 300 interface for transmission up to 3.5 miles
Features manual equalization, remote and local loopback, plus bit error indicator for diagnostics
Sold since 1977
$970 and up

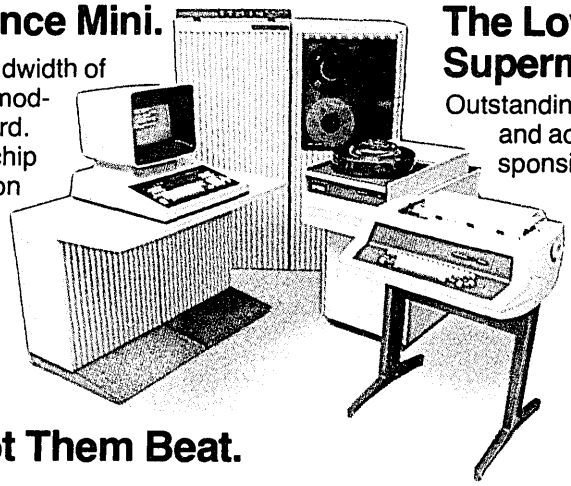
AVANTI 2300
Up to 3Mbps using encoded bipolar
Synchronous, simplex, half/full-duplex
Turnaround time 0msec
2- or 4-wire with RS422, RS423, V.35, or MIL 188 interface for transmission up to 1.25 miles at 1.5Mbps
Features manual equalization, alarms, 100% redundancy, remote and local loopback for diagnostics
Sold since 1977
$1,750 and up

BELL LADS
2400bps to 19,200bps using PM (2-phase)
Synchronous, half/full-duplex operation
Turnaround time 8msec
2- or 4-wire with RS232C or MIL 188 interface for transmission up to 6 miles (2 miles at 19,200bps)
Features fixed equalization, remote and local loopback for diagnostics

INTRODUCING THE PERKIN-ELMER 3220

The Highest Performance Mini.

Full 32-bit architecture. DMA bandwidth of 3MBytes. MOS memory in 256KB modules with error correction as standard. Memory error logging down to the chip level, if you want. Memory expansion to 4MBytes. Cache memory, 128 32-bit registers, number-crunching features no 16-bit mini can match. And, all for less than a PDP-11/60.



The Lowest Cost Supermini.

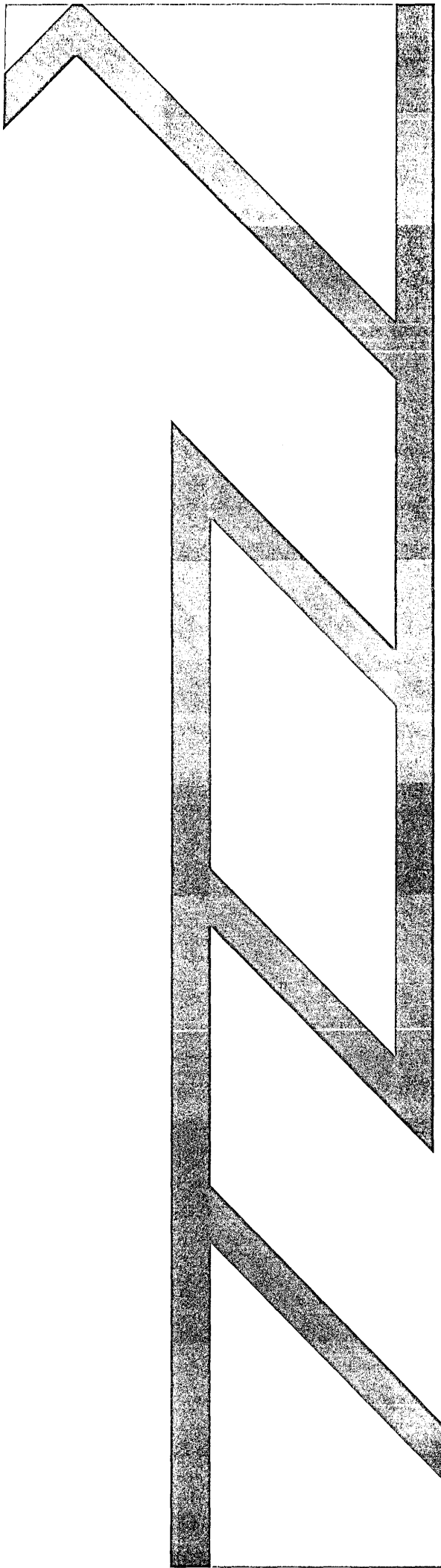
Outstanding run-time speed and accuracy. Fast, responsive program development. Easy, cost-effective program conversion. Check the comparison chart.

Either Way, We've Got Them Beat.

	DEC 11/34	DEC 11/60	P-E 3220	SEL 32/57	PRIME 550
Architecture	16-bit	16-bit	32-bit	32-bit	32-bit
DMA Bandwidth	2MB	6MB	8MB	26MB	2.5MB
Maximum Memory	256KB	256KB	4MB	1.87MB	2MB
Number of Registers	8	16	128	8	128
Direct Addressing	56KB	56KB	4MB	.5MB	32MB (virtual)
Writable Control Store	No	Yes (opt.)	Yes (opt.)	Yes (opt.)	No
Shared Memory Support	No	No	Yes (opt.)	Yes (opt.)	No
Pricing – Processor 256KB, PF/AR, Systems Console, Chassis and Cabinet	$29,700	$41,900	$33,500	$41,600	$70,000
256KB Expansion Memory	N/A	N/A	$10,000	$12,500	$15,000

	Optimizer Technology	Average Compile Time	Whetstone Benchmark	Matrix Inversion Program	Binary Search	Price *
3220 FORTRAN VII	Global	2000 LPM	2.25 Sec.†	3300 Sec.†	39 Sec.†	$ 88,600
VAX FORTRAN IV Plus	Block	1300 LPM	.85 Sec.	3700 Sec.	109 Sec.	$167,200

Both 3220 and VAX configured with: 512KB, Floating Point, 10MB Disk, Dual Density Tape, OS, FORTRAN.
Without cache memory option.



Dynamic 32-Bit Software.

Perkin-Elmer 32-bit software is the best you can get. Tuned and proven where it counts. In the field. And not just for months. For years.

Powerful software like our FORTRAN VII the only globally optimizing 32-bit FORTRAN compiler available on a supermini. It chops through tough, time-critical jobs with ease. And, it's targeted to ANSI FORTRAN 77 and IBM FORTRAN H compatibility to reduce conversion costs.

A flexible operating system for event-driven, real-time applications. Program development with up to 32 on-line, interactive terminals. The industry's most advanced transaction processing monitor, supporting commercial applications with up to 64 terminals, using COBOL and SORT/MERGE II.

Shareable software that allows our OS/32 MTM to make multi-terminal, multi-task program development a snap. And, increases memory efficiency as well.

From The People Who Invented The 32-Bit Supermini.

We introduced the first 32-bit supermini five years ago. Today, we have over 2,000 successful 32-bit installations worldwide. The Model 3220 is the first member of our new Series 3200 family, with more to come. Advanced systems and software that will keep Perkin-Elmer the undisputed leader in 32-bit performance and price.

Find out how we've got them beat any way you look at it.
Call or write for a demonstration today.
Perkin-Elmer, 2 Crescent Place, Oceanport, NJ 07757. (800) 631-2154. Or, in New Jersey (201) 229-6800.

PERKIN-ELMER

CIRCLE 144 ON READER CARD

CODEX 8200 LDSU
Originate/answer type
2400bps to 19,200bps using PM (2-phase)
Synchronous, half/full-duplex operation
Turnaround time 8msec
2- or 4-wire with RS232C or MIL 188B interface for transmission up to 23 miles
Features fixed equalization, remote and local loopback for diagnostics
Over 5,000 sold since 1974
$995 ($45/month) plus $152 installation

DATA-CONTROL MC 4800A
Bell 43401-compatible
Up to 19,200bps (asynchronous) or 2400bps to 19,200bps (synchronous) using delay modulation
Half/full-duplex operation
Turnaround time 144 bit times
2- or 4-wire RS232C interface for transmission up to 20 miles
Features manual equalization, analog and digital local loopback for diagnostics
100 sold since 1978
$650

DATA-CONTROL SR-100
Bell 43401-compatible up to 2400bps
Up to 19,200bps using baseband modulation
Asynchronous, simplex/half/full-duplex
Turnaround time 10msec
2- or 4-wire with RS232C or 20ma interface for transmission up to 9.6 miles
EIA loopback for diagnostics
450 sold since 1974
$280

DATA-CONTROL SR-140
Rack-mount type
Up to 19,200bps using baseband modulation
Asynchronous, simplex/half/full-duplex
Turnaround time 10msec
2- or 4-wire RS232C interface for transmission up to 9.6 miles
50 sold since 1976
$440

DESIGNED ENCLOSURES ADT-1/1R
Bell 43401-compatible
Up to 9600bps using baseband modulation
Asynchronous, half/full-duplex operation, suitable for multipoint
Turnaround time 8, 40msec
2- or 4-wire RS232C interface for transmission up to 20 miles
Features local and remote loopback for diagnostics
Over 3,000 standalones (ADT-1) sold since 1976
Over 1,500 rack-mounts (ADT-1R) sold since 1977

DESIGNED ENCLOSURES SDT-1
Bell 43401-compatible
Up to 2400bps (asynch) or 2400bps to 19,200bps (synch) using baseband modulation
Half/full-duplex operation
Turnaround time 8, 40msec
4-wire RS232C interface for transmission up to 15 miles
Features local and remote loopback, plus test generator for diagnostics
300 sold since 1978

DEVELCON DS 512
Bell 43401-compatible
Up to 9600bps using baseband modulation
Asynchronous, half/full-duplex operation
2- or 4-wire RS232C interface for transmission up to 6.7 miles at 9600bps
Features fixed equalization, digital loopback for diagnostics
3,000 sold since 1973
$275

DEVELCON DS 513
Up to 19,200bps using baseband modulation
Asynchronous, full-duplex operation
2- or 4-wire RS232C interface for transmission up to 5 miles at 19,200bps
Features manual equalization, digital loopback for diagnostics
2,000 sold since 1974
$325

DEVELCON DS 548
1200bps to 19,200bps using delay modulation
Synchronous, full-duplex operation
4-wire RS232C interface for transmission up to 13.5 miles at 19,200bps
Features reverse channel, manual equalization, digital loopback for diagnostics
2,000 sold since 1975
$685

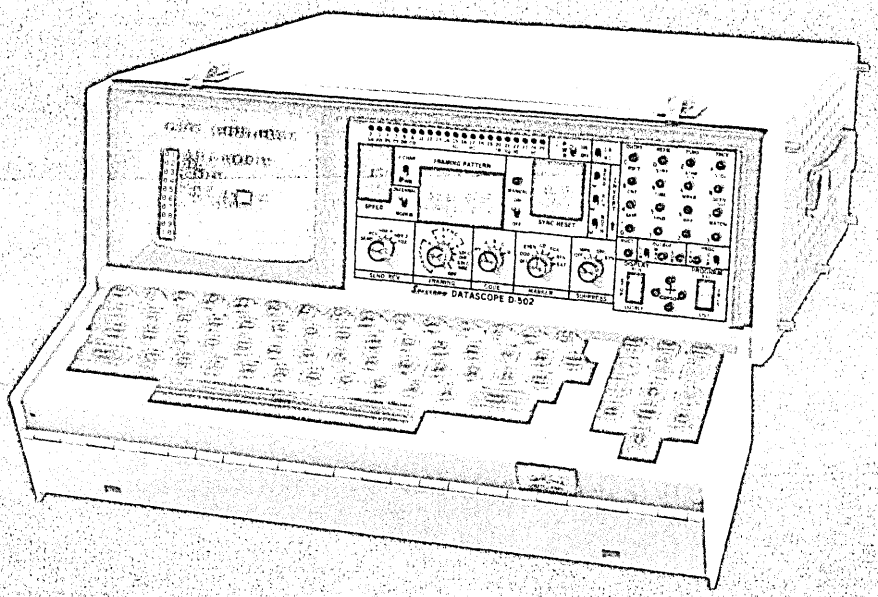
DEVELCON DS 558
100Kbps using delay modulation
Synchronous, full-duplex operation
4-wire with RS232C or Bell 303 interface for transmission up to 3 miles
Features reverse channel, manual equalization, digital loopback for diagnostics
200 sold since 1978
$775

DYNATECH LDM-1
Up to 19,200bps using modified FM modulation
Asynchronous/synchronous, full-duplex
Turnaround time 8.5, 50msec
4-wire with RS232C or V.24 interface for transmission up to 10 miles
Features local loopback and LED display for diagnostics

Put your network to the test.

Solve your data communications problems with the Spectron D-502B DATASCOPE

Three capabilities in one instrument
- ☐ It's a data monitor
- ☐ It's a powerful data analyzer
- ☐ It's a truly interactive data simulator and tester



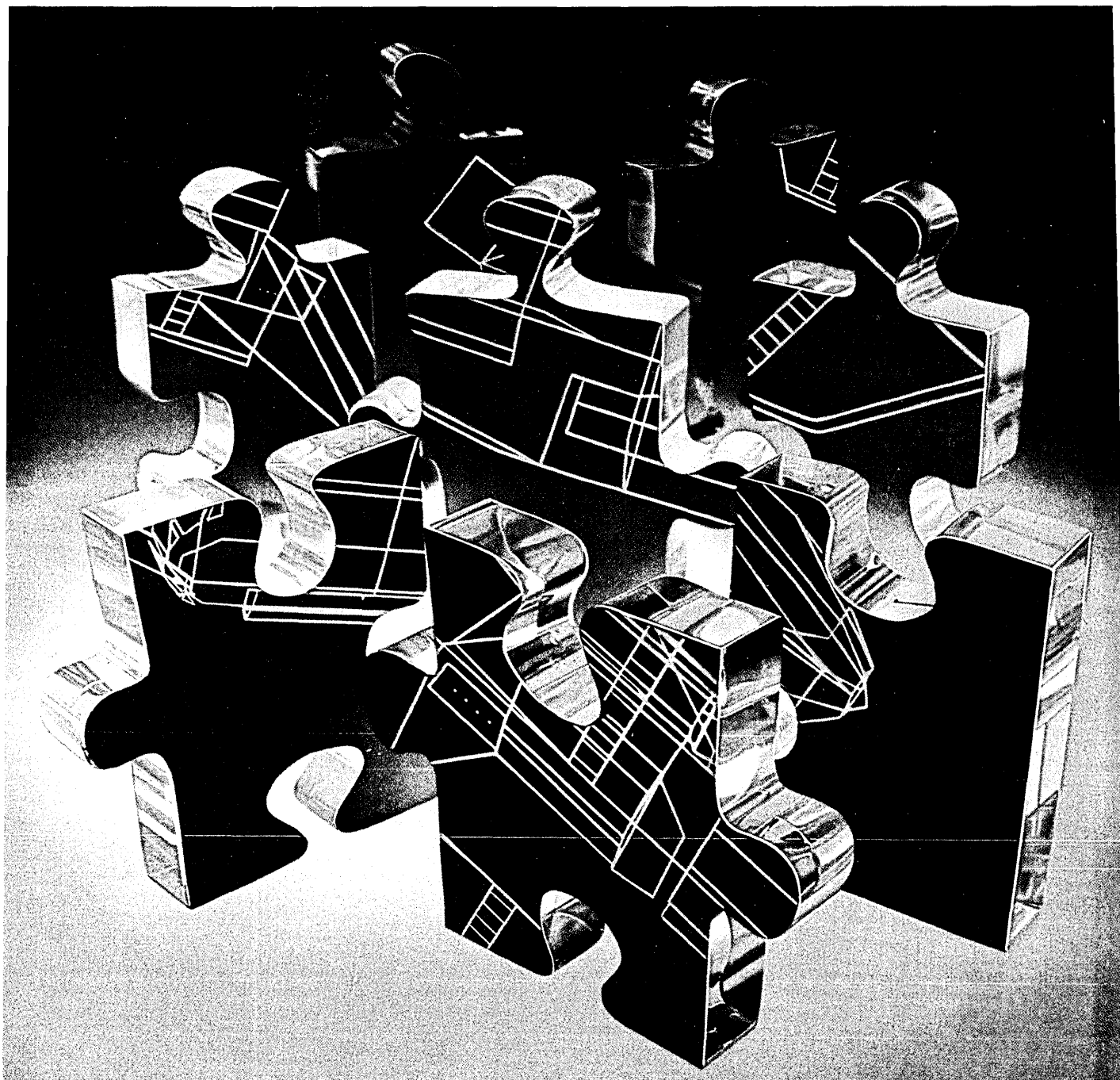
SEE US AT INTERFACE '79 BOOTH 325

Now you can have all three capabilities in one instrument — without sacrificing performance, making operation too sophisticated, or adding unduly to cost. ☐ A decade of experience in building the industry's most widely acclaimed data monitors has enabled us to develop an instrument which is both simple to use and universal in its application. ☐ As a monitor, it will help you isolate software, hardware, and communications problems, quickly and easily. ☐ As a data analyzer, it will make important measurements of line utilization, response times, block error rates — and many more — with equal facility. ☐ As a data simulator and tester, it will allow you to test new software without tying up communication facilities, test and debug new lines, modems and terminals off-line without risking adverse effects to the on-line network, or test your lines dynamically, varying response times, data rates, etc. to determine the most economical and reliable way to optimize network performance. ☐ Best of all, this capability is available in an instrument which can be used as easily by operating and field service personnel as by programmers and engineers. Without need for the highly trained equipment specialists, you get full value from a Spectron D-502B DATASCOPE.

SPECTRON CORPORATION

344 New Albany Road
Moorestown, NJ 08057
(609) 234-5700
TWX: 710-897-1359 / Telex: 83-1488

CIRCLE 48 ON READER CARD



WHY PUZZLE OVER PIECES?

See the whole picture on Sanders' Graphic 7

Sanders' Graphic 7 provides the whole picture by drawing bright, crisp vectors and symbols so rapidly that you see all the data you want. Benchmark tests with actual time measurements have proven Graphic 7 to be the refreshed cost/performance leader. This performance spells results for your application.

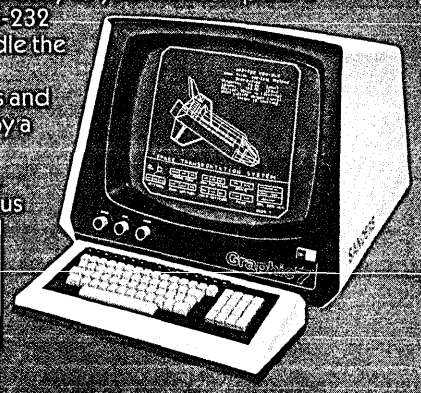
Convenience? Chances are the Graphic 7 will interface directly to your minicomputer's parallel DMA channel or connect to your mainframe via an RS-232 time-share link. The Graphic 7 dual microprocessors will handle the graphics and let your computer do its job more efficiently.

At Sanders we build graphic displays to tough standards and we support them. The reliability of a solid product backed by a solid organization helps keep your job on track.

To make sure you get the whole picture of performance, convenience, and reliability, call us at (603) 885-5280 and let us arrange a demonstration of the Graphic 7.

Sanders Associates, Inc., Information Products Division, Daniel Webster Highway South, Nashua, NH 03061. (603) 885-5280, TWX: 710-228-1894

SA
SANDERS ASSOCIATES, INC.



CIRCLE 53 ON READER CARD

350 sold since 1977
$299

GANDALF LDS 101
Originate/answer type
9600bps
Asynchronous, half/full-duplex operation
Turnaround time 1msec
4-wire with RS232C or V.24 interface for transmission up to 10 miles
1,000 sold since 1974
$400

GANDALF LDS 120
Bell 43401-compatible
Up to 9600bps using polar return to zero modulation
Asynchronous, half/full-duplex operation, suitable for multipoint
Turnaround time 10msec
2- or 4-wire with RS232C or V.24 interface for transmission up to 5.5 miles
Features manual equalization, local loopback for diagnostics
Over 15,000 sold since 1970
$300 ($400 for rack-mount LDS 121)

GANDALF LDS 140
Western Union 41004 and Bell 43401-compatible originate/answer type
Up to 9600bps using binary non-return to zero modulation
Synchronous, full-duplex operation
4-wire with RS232C, V.24, or 20ma interface for transmission up to 10 miles
Features manual equalization, local loopback
500 sold since 1977
$450

GANDALF LDS 250
9600bps to 100,000bps using PM modulation
Synchronous, half/full-duplex operation, suitable for multipoint
Turnaround time 10msec
4-wire with RS232C or V.24 interface (Bell 300 or V.35 opt.) for transmission up to 3.5 miles
Features manual equalization, local loopback
Over 700 sold since 1974
$784

GANDALF LDS 309/3309
Bell 43401-compatible (3309)
1800bps to 19,200bps using PM modulation
Synchronous, half/full-duplex operation, suitable for multipoint
Turnaround time 8, 50msec
4-wire with RS232C or V.24 interface for transmission up to 13 miles
Features manual equalization, remote and local loopback for diagnostics
Over 10,000 sold since 1974
$685 ($560 for Model 3309 rack-mount)

GANDALF LDS 319
Bell 43401 single-speed compatible
2400bps to 9600bps using PM modulation
Asynchronous, half/full-duplex operation
Turnaround time 8, 50msec
4-wire with RS232C or V.24 interface for transmission up to 8.5 miles
Features manual equalization, remote digital loopback for diagnostics
Sold since 1978
$785

GANDALF LDS 329
Bell 43401-compatible
2400bps to 9600bps using PM modulation
Synchronous, half/full-duplex operation
4-wire with RS232C or V.24 interface for transmission up to 8 miles
Equalization not required
Features local analog and digital loopback
Sold since 1979
$450

GANDALF LDM 404B/3404B
4800bps using QAM (single-sideband) modulation
Synchronous, full-duplex operation (dual-channel 2400bps opt.)
Turnaround time 35msec
4-wire with RS232C or V.24 interface for transmission up to 50 miles
Features manual equalization, remote and local loopback for diagnostics
1,000 sold since 1977
$1,200 ($995 for 3404B rack-mount)

GANDALF LDM 414
4800bps using QAM modulation
Asynchronous, full-duplex operation (dual-channel 2400bps opt.)
Turnaround time 35msec
4-wire with RS232C or V.24 interface for transmission up to 50 miles
Features manual equalization, local analog and remote digital loopback
Sold since 1978
$1,200

GENERAL DATACOMM LDM-1
1200bps to 19,200bps using delay modulation
Asynchronous/synchronous, half/full-duplex
Turnaround time 7.5msec
2- or 4-wire RS232C interface for transmission up to 22 miles at 1200bps
Features remote and local loopback, LED displays, self-test for diagnostics
Sold since 1978
$830

GTE 263A SERIES
2400bps to 56,000bps using bipolar modulation
Synchronous, full-duplex operation
4-wire V.35 interface for transmission up to 8 miles
Features fixed equalization, remote and local loopback for diagnostics

Sold since 1977
$850

IBM LINE ADAPTORS
Originate/answer type
134.5bps or 600bps using FSK modulation
Asynchronous, half/full-duplex operation
2- or 4-wire with IBM interface for transmission up to 8.25 miles (cable-connected)
Features fixed equalization
$432 to $865 ($10 to $21/month)

PARADYNE SRM-192
Originate/answer type
Up to 19,200bps using delay modulation
Synchronous, half/full-duplex operation
Turnaround time 8.5msec
2- or 4-wire RS232C interface for transmission up to 19 miles
Features remote and local loopback for diagnostics
150 sold since 1977
$900 ($25/month) plus $75 installation

PENRIL PSH HI-SPEED
Originate/answer type
19,200bps to 1Mbps using PM modulation
Synchronous, half/full-duplex operation
2- or 4-wire Bell 301/303 interface for transmission up to 8 miles
Features manual equalization, remote and local loopback for diagnostics
100 sold since 1975

PENRIL PSH 96A
Originate/answer type
19,200bps
Asynchronous, half/full-duplex operation
Turnaround time 8.5msec
2- or 4-wire with RS232C or V.24 interface for transmission up to 35 miles
Features manual equalization, remote and local loopback for diagnostics
500 sold since 1975

PENRIL PSH SERIES
Originate/answer type
2400bps to 9600bps using encoded FSK modulation
Synchronous, half/full-duplex operation
Turnaround time 8.5msec
2- or 4-wire with RS232C or V.24 interface for transmission up to 35 miles
Features manual equalization, remote and local loopback for diagnostics
450 sold since 1975

PRENTICE LRA-1
Originate/answer type
600bps to 19,200bps using PM (2-phase) modulation
Synchronous, full-duplex operation
2- or 4-wire with RS232C or Bell 303 interface
Features automatic equalization, remote and local loopback for diagnostics
Sold since 1972

PRENTICE ALD
Bell 43401-compatible
9600bps using polar non-return to zero modulation
Asynchronous, half/full-duplex operation
2- or 4-wire RS232C interface for transmission up to 14 miles
Features fixed equalization, local loopback for diagnostics
10,000 sold since 1977

PRENTICE SYNCH LINE DRIVER
Bell 43401-compatible
1200bps to 28,800bps using delay modulation
Synchronous, half/full-duplex operation
Turnaround time 3, 10, 45msec
2- or 4-wire with RS232C or Bell 303 interface for transmission up to 20 miles
Features automatic equalization, remote and local loopback for diagnostics
3,000 sold since 1976

RACAL-MILGO COM-LINK III
1200bps to 19,200bps using delay modulation
Synchronous, half/full-duplex operation, multipoint or point to point
Turnaround time 8.8, 17msec
4-wire with RS232C, V.24 or MIL 188 interface for transmission up to 25 miles
Features manual equalization, remote and local loopback, plus self-test
Sold since 1978
$975 ($39/month) or $875 ($34/month) for rack-mount

SYNTECH LDM-192
Originate/answer type
Up to 19,200bps using FSK modulation
Synchronous/asynchronous, half/full-duplex operation
Turnaround time 5msec
2- or 4-wire RS232C interface for transmission up to 3 miles
Features manual equalization, remote and local loopback for diagnostics
Sold since 1975
$795 ($50/month), free installation

SYNTECH LDM-7296
Originate/answer type
Up to 9600bps using FSK modulation
Synchronous/asynchronous, half/full-duplex
Turnaround time 5msec
2- or 4-wire RS232C interface for transmission up to 5 miles

OUR FIBEROPTIC MODEM. IT BEATS ORDINARY MODEMS COMING AND GOING.

There's really no contest. Ordinary modems just can't match our fiberoptic data link's throughput over the long haul. Duplex. Asynchronous. RS-232-C data transmission. Transmits 0-20 KBPS up to 3,000 feet (1 kilometer).

And, when you use our fiberoptic modem, you get rid of electrical and electromagnetic interference. No more sparking or crosstalk. Complete data traffic security.

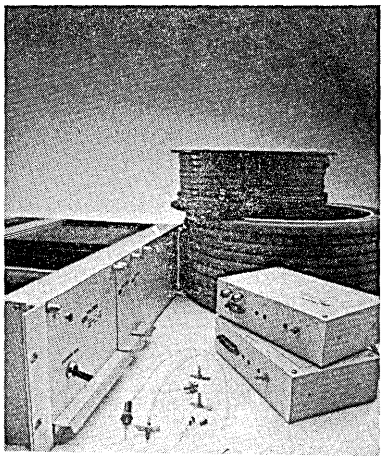
Buy our fiberoptic modem by itself. Plug it into any RS-232-C computer or terminal. It's ready to go.

Buy our data link with Valtec's super-flexible, crush-resistant, lightweight, fiber-optic cables. Installation is a snap.

Or, buy a complete optical communications system. Ready-to-use systems tailored to your needs. Costing substantially less than electrical communications systems.

Add our new fiberoptic TTL interface. It transmits 10 MBPS up to 3,000 feet (1 kilometer). And then, you'll understand why Valtec is Number One in optical data communications.

Send for our free brochure today. Call (617) 835-6082 or write, Valtec Corporation, Communication Fiberoptics Division, 99 Hartwell Street, West Boylston, MA 01583.



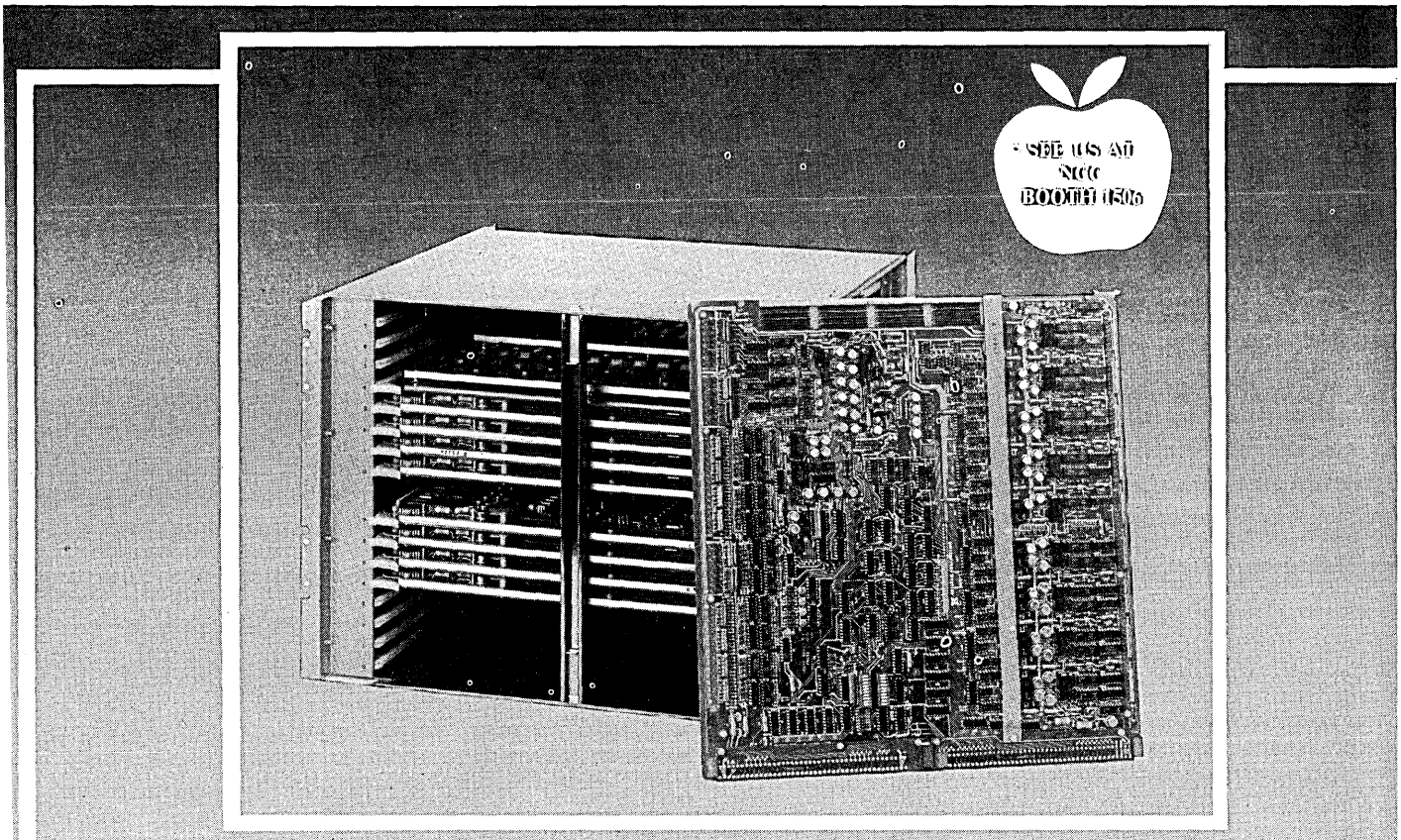
EVERYTHING YOU NEED IN OPTICAL COMMUNICATIONS. AND THEN SOME.

Data. Voice. Analog. If you want to move signals further and faster, Valtec has the answer. Field-proven optical components. Integrated communications systems. A decade of product innovation and dedication to optical communications.

VALTEC

Visit us at Interface '79 – Booth #1128.

CIRCLE 126 ON READER CARD



NOBODY SELLS MORE INTERDATA-COMPATIBLE MEMORY THAN DATARAM...EXCEPT INTERDATA

NOBODY OFFERS A WIDER RANGE OF INTERDATA MEMORY PRODUCTS THAN DATARAM...EXCEPT INTERDATA.

Interdata 32KB and 64KB Core Memory Modules

Dataram offers 32KB and 64KB core memory modules for main memory expansion which can be used with Interdata's Model 50, Model 70, 6/16, 7/16, 8/16, 7/32, and 8/32 minicomputers. Dataram's 32KB and 64KB memory modules are strappable for 750 nsec or 1000 nsec speed, parity or non-parity operation, at no additional cost.

512KB 7/32 Chassis

Dataram-manufactured 7/32 chassis with eight 64KB Memory Modules provides 512KB memory expansion for your 7/32 minicomputer. The Memory Bank Interface board is also available from Dataram.

Interdata Bulk Core Disk Emulator

And now, Dataram's BULK CORE is available for Interdata users who want to go beyond the normal addressing boundaries of the host minicomputer. BULK CORE does it at much higher speeds and is all-electronic, and that means no moving parts. And a 15¾" BULK CORE system offers 2.0 megabytes of peripheral storage.

NOBODY SELLS INTERDATA-COMPATIBLE MEMORY FOR LESS THAN DATARAM ...NOT EVEN INTERDATA.

DATARAM CORPORATION

PRINCETON-HIGHTSTOWN ROAD CRANBURY, NEW JERSEY 08512
TEL:609-799-0071 TWX:510-685-2542

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CIRCLE 55 ON READER CARD

Features alternate voice/data, manual equalization, remote and local loopback for diagnostics
Over 8,000 sold since 1975
$690 ($48/month), free installation

TELE-DYNAMICS 7300
Bell 43401-compatible originate/answer type
1800bps to 19,200bps
Synchronous/asynchronous, half/full-duplex
2- or 4-wire RS232C interface for transmission up to 15 miles
Features manual equalization, remote and local loopback plus command loopback
Sold since 1975
$695 ($40/month) plus $100 installation

TRAN DIRECTRAN 611
Originate/answer type, emulates Bell 103, 113, and 202
Up to 9600bps using baseband modulation
Asynchronous, half/full-duplex operation
Turnaround time up to 10msec
4-wire RS232C interface for transmission up to 22 miles
Features remote and local loopback for diagnostics
Over 4,500 sold since 1972
$350 ($29/month) plus $30 installation

TRAN DIRECTRAN 631
Originate/answer plug-in type, emulates Bell 103, 113, and 202
Up to 9600bps using baseband modulation
Asynchronous, half/full-duplex operation
Turnaround time 1.5, 10msec
4-wire RS232C interface for transmission up to 22 miles
Features remote and local loopback for diagnostics
Over 750 sold since 1973
$550 ($43/month) plus $40 installation

TRAN CONNECTRAN 650
Up to 9600bps using baseband modulation
Asynchronous, half/full-duplex operation
4-wire RS232C or V.24 interface for transmission up to 1,250 feet
Over 300 sold since 1973
$350 ($28/month) plus $30 installation

TRAN INTERTRAN 911 & 931 SERIES
1200bps to 19,200bps using PCM modulation
Synchronous, half/full-duplex operation
Turnaround time up to 250msec
4-wire RS232C interface for transmission up to 15 miles
Features remote and local loopback for diagnostics
Over 4,400 sold since 1973
931 Series are plug-ins: $750 ($62/

When it comes to mainframes, there's safety in numbers.

Especially IBM's.

Take your 370, for example. Proven performance and reliability. On-the-spot service whenever there's a problem. It's obviously the safe buy.

But when it comes to IBM-compatible I/O sets, the numbers add up to a better source. And an outstanding new alternative.

The CalComp 4800 I/O set.

Instead of a matching nameplate, our new controller/card reader/line printer combination delivers a lot more of what really counts. Like performance. Reliability. Service. And price.

For starters, our new 4800 I/O set's controller is microprocessor-based. So it's actually smaller, more trouble-free and can easily support two line printers.

Our set's card reader features the patented Basic Transport Mechanism (BTM) that's proven itself one of the most reliable 1,000 card-per-minute designs on the market today.

Our line printer is special, too. Field-proven in over 10,000 worldwide installations, its innovative ChainTrain design quietly delivers up to 1,200 lines-per-minute of crisper, cleaner type using a 48-character set. You'll even get up to six readable copies from your multiple forms work. And if space is a problem, you'll love the 4800's compact size.

We haven't forgotten service, either. That's why we maintain over 50 company-operated field service offices. Which means you can always count on first-rate engineers and factory-direct parts.

Just like IBM.

Except, of course, when it comes to price. And that's where we can, at the very least, make your dollars work twice as hard.

So call Van R. Ramich at (714) 821-2011. Or write to us at the address below.

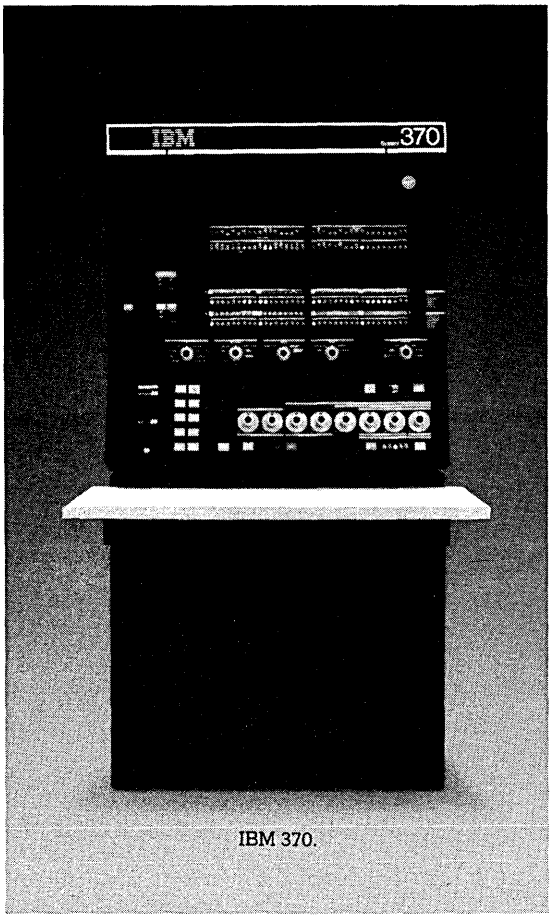
We'll show you that the sanest way to run your 303X/360/370 is without all those expensive IBM attachments.

CALCOMP

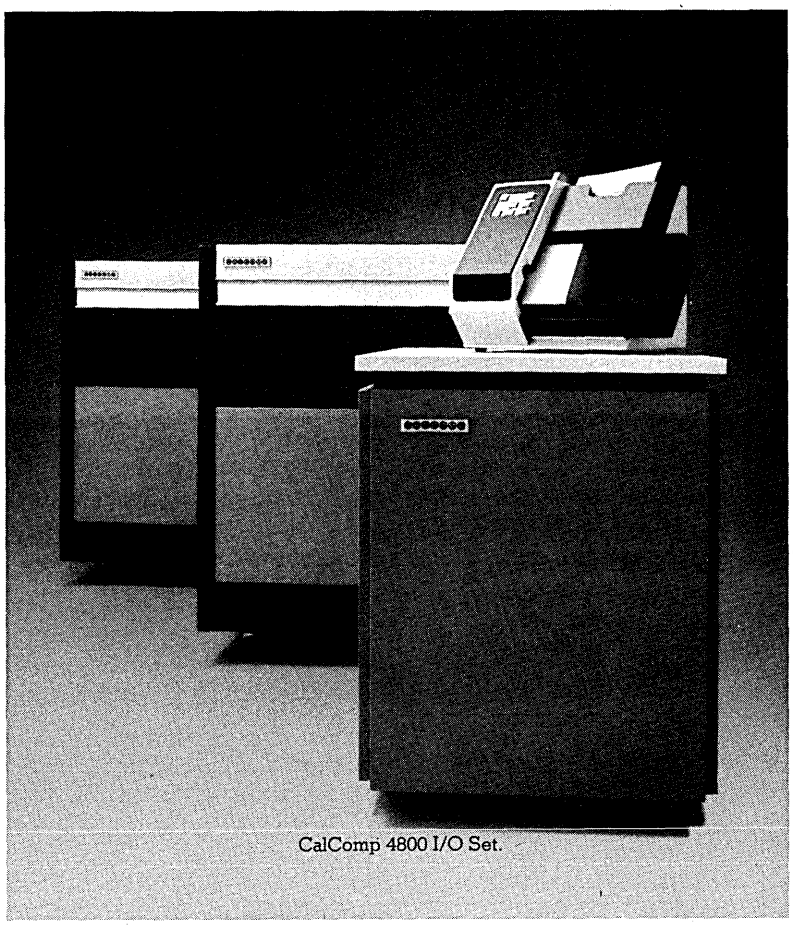
California Computer Products, Inc.

Data Processing Products & Services Division
3320 East La Palma Avenue, Anaheim,
California 92806 Telephone: (714) 821-2011
TWX: 910-591-1154

SAFE. AND SANE.



IBM 370.



CalComp 4800 I/O Set.

CIRCLE 167 ON READER CARD

month) plus $75 installation
911 Series are self-contained: $875 ($70/month) plus $75 installation

TRAN INTERTRAN 916 & 936 SERIES
19,200bps to 250,000bps using PCM modulation
Synchronous, half/full-duplex operation
Turnaround time up to 250msec
4-wire Bell 303 interface for transmission up to 9 miles
Features remote and local loopback for diagnostics
Over 1,000 sold since 1973
936 Series are plug-ins: $1,500 ($112/month) plus $100 installation
916 Series are self-contained: $1,800 ($135/month) plus $75 installation

TRAN INTERTRAN 918 & 938 SERIES
48Kbps to 64Kbps using PCM modulation
Synchronous, half/full-duplex operation
Turnaround time up to 250msec
4-wire V.35 interface for transmission up to 5 miles
Features remote and local loopback for diagnostics
Over 400 sold since 1975
938 Series are plug-ins: $1,400 ($107/month) plus $75 installation
918 Series are self-contained: $1,700 ($130/month) plus $100 installation

TUCK 1652
Originate/answer type
Up to 1200bps using FSK modulation
Asynchronous, half/full-duplex operation
Turnaround time 5-60msec
4-wire RS232C interface
Features fixed equalization, local loopback and indicator lights
$275

TUCK 2120
Up to 19,200bps using PSK modulation
Synchronous, half/full-duplex operation
Turnaround time 10msec
2- or 4-wire RS232C interface for transmission up to 10 miles
Features fixed equalization, local loopback for diagnostics
Sold since 1977
$425

TUCK 2130
Up to 2400bps using FSK modulation
Asynchronous, half/full-duplex operation
2- or 4-wire with RS232C or 20ma interface.
Sold since 1977

MODEM ELIMINATORS (local)

ASTROCOM MODEM EMULATOR
2400bps to 9600bps
Asynchronous/synchronous, half/full-duplex
Clear to send delay 20msec
EIA cable with RS232C interface for transmission up to 200 feet
Features status lights for diagnostics
Sold since 1977
$295 ($30/month)

AVANTI MODEL 300
Up to 19,200bps
Synchronous/asynchronous, half/full-duplex
Clear to send delay 8, 17msec
EIA cable with RS232C or V.24 interface for transmission up to 500 feet
1,325 sold since 1977
$360

DATA-CONTROL 1A-250
Up to 19,200bps using baseband modulation
Synchronous, full-duplex operation
Clear to send delay selectable (usually 10msec)
4-wire RS232C interface for transmission up to 100 feet
Over 35 sold since 1976
$300

DESIGNED ENCLOSURES LDD-1
2400bps to 19,200bps, user-selectable
Asynchronous/synchronous, half/full-duplex
Clear to send delay 8, 40msec
EIA cable with RS232C interface for transmission up to 500 feet (5,000 opt.)
Features remote and local loopback, plus LED indicators for diagnostics
300 sold since 1976
$450

DYNATECH ME-1
1800bps to 19,200bps
Synchronous, half/full-duplex operation
Clear to send delay 8.5, 50msec
EIA cable with RS232C or V.24 interface for transmission up to 100 feet
Features digital loopback and LED's for diagnostics
200 sold since 1977
$330

SPECTRON MER
Up to 19,200bps
Asynchronous/synchronous, full-duplex
EIA cable with RS232C interface for transmission up to 200 feet
Features reverse channel (opt.)
Sold since 1977
$345

SPECTRON ME-81/81FS
Up to 19,200bps (selectable with 81FS)
Asynchronous/synchronous, full-duplex
Clear to send delay 10, 50msec
EIA cable with RS232C interface for transmission up to 50 feet
Sold since 1975
$240 (plus $20 for speeds over 9600bps); $330 for the 81FS

SPECTRON ME-8B/8BFS
Up to 56,000bps (selectable with 8BFS)
Synchronous, full-duplex operation
Clear to send delay 40msec
Bell 300 Series cable with 301 or 303 interface for transmission up to 50 feet (V.35 interface opt.)
Sold since 1975
$450 ($630 for 8BFS)

SPECTRON MIR 4/6
Up to 19,200bps
Asynchronous/synchronous, full-duplex
RS232C for transmission up to 100 feet
Features opt. reverse channel (MIR 6)
300 sold since 1975
Over $300

SYNTECH ME-2
19,200bps
Asynchronous/synchronous, full-duplex
RS232C for transmission up to 100 feet
Features modem simulation, LED indicators for diagnostics
7,100 sold since 1977
$500

MODEM ELIMINATORS (short-haul)

BO-SHERREL M-1
Rack-mount type
Up to 9600bps using baseband modulation
Asynchronous, half/full-duplex operation
4-wire RS232C or V.24 interface for transmission up to 10 miles
1,500 sold since 1977
$149

BO-SHERREL M-2
2400bps to 9600bps using biphase modulation
Synchronous, half/full-duplex operation
4-wire with RS232C or V.24 interface for transmission up to 4 miles
150 sold since 1976

DATA CONTROL SR-200
Bell 43401-compatible at 2400bps
1800bps to 19,200bps using baseband modulation
Synchronous, half/full-duplex operation
Clear to send delay adjustable (usually 10msec)
2- or 4- wire RS232C interface for transmission up to 15.9 miles
200 sold since 1974
$480

GANDALF LDS 100C
19,200bps using baseband modulation
Asynchronous, half/full-duplex operation
Clear to send delay 1msec
4-wire with RS232C or V.24 interface for transmission up to 10 miles
4,000 sold since 1974
$225

MICOM 410D/S
Up to 9600bps using baseband modulation
Asynchronous, full-duplex operation
2- or 4-wire with RS232C or V.24 interface for transmission up to 12 miles
(2 miles at 9600bps)
Features local loopback for diagnostics
2,500 sold (all models) since 1977
$150 ($185 for S model, which simulates Bell 103 handshaking)

VEN-TEL ALD
9600bps
Asynchronous, half/full-duplex
RS232C or 20 ma interface for transmission up to 20 miles
Features local and remote loopback for diagnostics
675 sold since 1975

VERSITRON NODEM
Up to 19,200bps
Asynchronous/synchronous, full-duplex
Clear to send delay selectable to 150msec
4-wire RS232C interface for transmission up to 10,000 feet at 19,200bps
Features remote and local loopback for diagnostics
Sold since 1976
$460

TELEPHONE COUPLERS

ANDERSON JACOBSON A 242
Bell 103A-compatible originate-only type
Up to 450bps using FSK modulation
Asynchronous, half/full-duplex operation
Acoustic, with RS232C or 20ma interface
Over 20,000 sold since 1970
$325 ($24/month) plus $35 installation

ANDERSON JACOBSON AD 342
Bell 103A-compatible originate/answer type
Up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
Acoustic or 2-wire with RS232C or 20ma interface
Over 1,000 sold since 1968
$398 ($28/month) plus $35 installation

ANDERSON JACOBSON ADAC 1200
Bell 202C-compatible
Up to 1200bps using FSK modulation
Asynchronous, simplex/half-duplex operation
Turnaround time same as Bell 202C/D
Acoustic or 2-wire with RS232C interface
Sold since 1969
$595 ($40/month) plus $50 installation

ANDERSON JACOBSON AJ 1234
Originate/answer type compatible with AJ1255 or any Racal-Vadic Model 3400
Up to 300, 600 or 1200bps using QAM modulation
Async/synchronous, full-duplex operation
Acoustic or manual DAA with RS232C interface
300 sold since September 1978
$895 ($50/month) plus $50 installation

ANDERSON JACOBSON AJ 1245
Bell 103/202-compatible originate-only type, switch-selectable between 103 and 202 modes
Up to 450bps or 1200 bps using FSK modulation
Asynchronous, half/full-duplex operation
Acoustic with RS232 interface
Features reverse channel, automatic/manual equalization
Sold since February 1978
$795 ($48/month) plus $50 installation

ASTROCOM 1100
Bell 103/113-compatible originate-only type
Up to 300bps using FSK modulation
Asynchronous, simplex/half/full-duplex operation
Acoustic or 2-wire with RS232B/C or 20ma interface
Features diagnostic indicators
2,000 sold since 1972
$198 ($18/month)

ASTROCOM 1100A
Bell 103/113-compatible originate/answer type
Up to 300 bps using FSK modulation
Asynchronous, half/full-duplex operation
Acoustic or 2-wire with RS232C or 20ma interface
Features diagnostic indicators
500 sold
$265 ($25/month)

COMDATA 150 SERIES
Up to 300 bps using FSK modulation
Asynchronous, full-duplex operation
2-wire or acoustic with RS232 or CCITT interface
Features carrier indicator
Over 25,000 sold since 1972
$125 to $195

COMDATA 150A2-14C
Teletype 43-compatible
110 bps or 300 bps using FSK modulation
Asynchronous, half/full-duplex operation
Acoustic with RS232 interface
Sold since 1978
$147

COMDATA 302 SERIES
Bell 103/113-compatible originate/answer type
Up to 300bps using FSK modulation
Asynchronous, full-duplex operation
2- or 4-wire or acoustic with RS232, CCITT, or MIL 188C interface
Features auto-answer (some models), local loopback diagnostics
Sold since 1968
$245 to $345

COMDATA 302C2-13
Bell 103/114-compatible originate-only type
Up to 300bps using FSK modulation
Asynchronous, full-duplex operation
Acoustic with RS232C, CCITT, or MIL 188B interface
Provides data interface for audio cassette recorder, enabling data storage on ordinary cassettes
Over 500 sold since 1976
$425

DATA ACCESS 76 SERIES
Bell 103-compatible originate/answer type
Up to 300bps using FSK modulation
Asynchronous, full-duplex operation
Acoustic with RS232C or 20ma interface
Features optional auto-answer
Over 500 sold
$300 ($15/month), installation free

DATAPOINT 3400
Bell 103-compatible originate-only type
Up to 300bps using FSK modulation
Asynchronous, full-duplex operation
Acoustic with RS232C interface
Features local loopback diagnostics
Sold since 1969
$350 ($16/month) plus $20 installation

DATEC 32
Bell 103/113-compatible originate/answer type

HOW TO GET A COMPUTER THAT ALREADY KNOWS YOUR BUSINESS.

The trouble with most computer systems is that it can take months to adapt them to your specific business needs.

Not so with the NCSS 3200 computing system.

When you buy a 3200, you get software that's been performance-proven by businesses just like yours—application level software geared to your industry and ready to go.

Unlike other systems, NCSS software has been developed, tested, and refined through over 5 million hours of on-line use by over 10,000 customers.

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Wilton, Connecticut 06897
(800) 243-6119
In Connecticut: (800) 882-5575

NCSS 3200

WE SOLVE YOUR INFORMATION PROBLEMS ONCE AND FOR ALL.

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DYNAGRAPHIC™

Refreshed, Interactive Graphics

More Intelligent Than a 4014

At $14,750, the DYNAGRAPHIC™ Model 3205 Terminal is literally more intelligent than investing in a 4014*. With it you can plug into your PLOT-10* application immediately. When you're ready, move up to true interaction with our Dynagraphic software.

Dynagraphics really offers you more.

You'll generate and interact with sophisticated vector graphics using simple FORTRAN subroutine calls. Structured pictures and a refreshed display mean selective erasure and picture manipulation WITHOUT the annoying flash. Reduced Host I/O is made possible because our terminal processor does part of the work — including light pen or joystick interaction.

Check us out before you spend more money on storage tube graphics (or low-resolution raster graphics). Write IMLAC Corporation, 150 A Street, Needham, Massachusetts 02194 or call **(617) 449-4600.**

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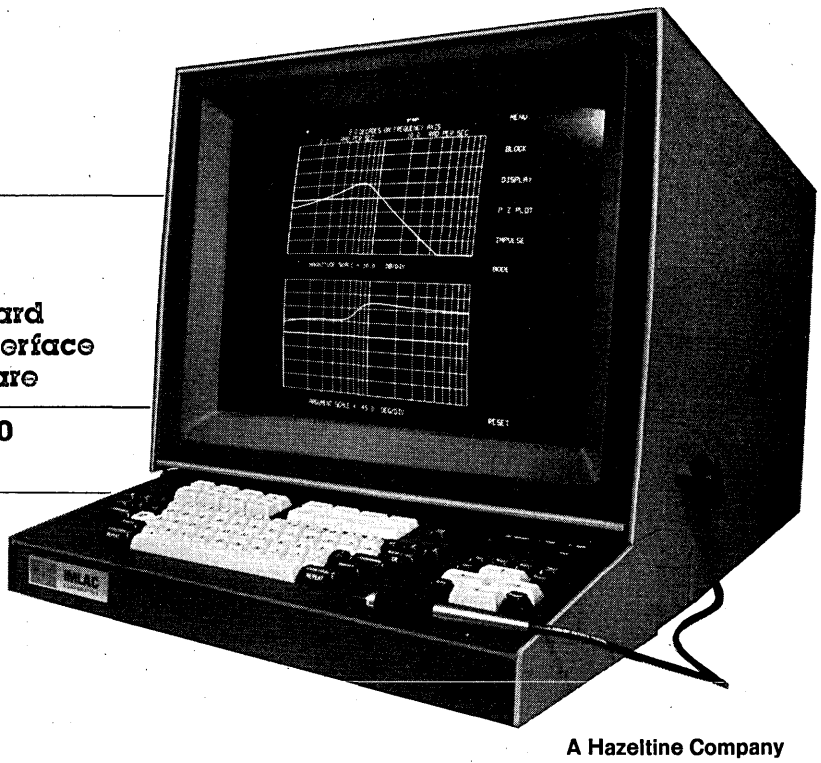
BRIGHT DISPLAY —
30-to-1 Contrast Ratio

$14,750 —
16K Semiconductor Memory and Processor
19" CRT, Flexible 92-Key Keyboard
Light Pen or Joystick, RS 232 Interface
Built-in Terminal Support Software

EMULATOR for Tektronix 4014/4010 Optional

DYNAGRAPHIC HOST GRAPHICS SOFTWARE — $750 (FORTRAN Subroutine Library)



US Prices only
*Tektronix 4014, 4010 and PLOT-10 are trademarks of Tektronix, Inc.

A Hazeltine Company

CIRCLE 120 ON READER CARD

Up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
Acoustic with RS232 interface
Sold since 1978
$395

DIGICOM SERIES 312
Originate/answer type, interchangeable PC boards
Up to 300bps or 1200bps using FSK modulation
Asynchronous, half/full-duplex operation
Acoustic with RS232C interface
Features 5bps reverse channel (opt.), diagnostic LED indicator
Sold since 1977

LIVERMORE DATA SYSTEMS 76B
Bell 103/113A-compatible originate-only type
Up to 450 bps using FSK modulation
Asynchronous, half/full-duplex operation
Acoustic with RS232B/C interface
Features alternate voice-data
Over 4,000 sold since 1975
$300

LIVERMORE DATA SYSTEMS 76C
Bell 113A/B-compatible orginate/answer type
Up to 450bps using FSK modulation
Asynchronous, half/full-duplex operation
Acoustic or 2-wire with RS232 or 20/60ma interface
Features alternate voice/data, optional auto-answer, local loopback diagnostics
Sold since 1977
$374

M & R ENTERPRISES
Bell 103-compatible originate-only type
Up to 300bps
Asynchronous, half/full-duplex operation
Acoustic with RS232C interface
Sold since 1977
$129 (kit) or $225 (assembled)

MULTI-TECH FM 30 SERIES
Bell 103/113A-compatible originate-only type
Up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
Acoustic with TTL or 20ma interface
Over 10,000 sold since 1976
$190 to $270 ($20/month)

MULTI-TECH FM 300/310
Bell 103/113A-compatible originate-only (FM 300) or originate/answer (FM 310) types
Up to 450bps using FSK modulation
Asynchronous, half/full-duplex operation
Acoustic or 2-wire with RS232B/C or 20ma interface
Features optional auto-answer, local loopback diagnostics (FM 310)
Over 6,000 sold since 1971
$210 to $390 ($22/month)

NOVATION 4133/4136/4143
Bell 103/113-compatible originate-only type
Up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
Acoustic with TTL interface, all units derive power from terminal
Features local analog and digital loopback diagnostics
$185 to $275 plus $35 installation

NOVATION 4102/4103/CAT
Bell 103/113-compatible originate/answer type (4102 originate-only)
Up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
Acoustic with RS232C or 20ma interface
Features local loopback diagnostics, 4102 and 4103 have LED display
$275 to $245 ($25 to $30/mo) plus $35 inst.

OMNITEC 103/202
Bell 103/202-compatible originate-only type
Up to 300/1200bps (switchable) using FSK modulation
Asynchronous, half/full-duplex operation
Acoustic with RS232C interface
Features reverse channel
125 sold since 1976
$1,698, installation free

OMNITEC SERIES 700
Bell 103-compatible originate-only/answer-only or originate/answer types
Up to 300/450/600bps using FSK modulation
Asynchronous, simplex/half/full-duplex operation
Acoustic or 2-wire with RS232C or 20ma interface
Features auto-answer (703 A and B only) remote and local loopback diagnostics
Over 30,000 sold since 1963
$341 to $690, installation free

OMNITEC 702B
Bell 103-compatible originate/answer type
300bps (600bps opt.) using FSK modulation
Asynchronous, half/full-duplex operation
Acoustic with RS232C or 20ma interface
Sold since 1977

OMNITEC MODEL 710/736/743
Bell 103-compatible originate-only type
450bps using FSK modulation
Asynchronous, half/full-duplex operation
Acoustic with RS232C interface

5,000 sold since June 1978
$178.25-$189.75

OMNITEC MODEL 716
Bell 103/compatible originate-only type
600bps using FSK modulation
Asynchronous, half/full-duplex operation
Acoustic with RS232C interface
100 sold since June 1978
$293.25

OMNITEC MODEL 1200A/B
Bell 202C/S-compatible originate/answer type
1200bps using FSK modulation
Asynchronous, half-duplex operation
Acoustic or 2-wire with RS232C interface
Features reverse channel, alternate voice/data optional (on 1200B), remote and local loopback diagnostics (on 102A)
Sold since 1974
$975 ($98/month), installation free

RFL 5220/5105
Bell 101/103/113-compatible originate-only or answer-only types
Up to 300bps using FSK modulation
Asynchronous, half/full-duplex operation
Acoustic or 2- or 4-wire with RS232C or 20ma interface
Features optional auto-answer, remote and local loopback diagnostics
$130 (5105), $275 (5220)

TELE-DYNAMICS 7102A/D
Bell 103/113-compatible originate/answer type
Up to 300bps using FSK modulation
Asynchronous, full-duplex operation
Acoustic or 2-wire with RS232C, CCITT, Teletype or TTL interface
Features remote and local loopback diagnostics
400 sold since 1974
$292 ($12/month), installation free

TUCK 1500 SERIES
Bell 103/113-compatible originate-only/answer-only/originate-answer types
Up to 300bps using FSK modulation
Asynchronous, simplex/half/full-duplex operation
Acoustic or 2- or 4-wire with RS232C or 20ma interface
Features auto-answer, remote loopback diagnostics
$122 to $395

VEN-TEL AC 103
Bell 103/113-compatible originate/answer type
Up to 300bps using FSK modulation
Asynchronous, full-duplex operation
Acoustic and 2-wire with RS232, CCITT, or current loop interface
6,000 sold since 1974
$265

VEN-TEL MD 1212
Originate/answer type
1200bps using FSK modulation
Asynchronous, full-duplex operation
Acoustic with RS232, current loop, or CCITT interface
Features remote loopback diagnostics and indicators
300 sold since 1976
$530

VEN-TEL MD 202
Bell 202-compatible originate/answer type
1800bps using FSK modulation
Asynchronous, half/full-duplex operation
Acoustic line
Features reverse channel option, auto-answer, remote and local loopback diagnostics
Sold since 1978
$425 ($22.75/month), installation free

VEN-TEL MD 212A
Bell 212A-compatible originate/answer type
Up to 300bps or 1200bps using FSK or PSM modulation
Asynchronous, half/full-duplex operation
Acoustic
Features integral handset option, auto-answer, remote and local loopback diagnostics
Sold since 1978
$750 ($39.50/month), installation free

U.S. ROBOTICS USR-310
Bell 103/113-compatible originate-only type
300bps using FSK modulation
Asynchronous, half/full-duplex operation
Acoustic with RS232C interface
Sold since 1977
$149

PARALLEL INTERFACE MODEMS

BELL TOUCH-TONE RECEIVER DATA SET 407A
401-compatible answer-only type for DIVA systems
Up to 10cps using FSK modulation
Asynchronous, simplex operation
2-wire with voltage or contact closure interface
Features alternate voice/data, auto-answer, fixed equalization, remote and local test diagnostics

BELL TOUCH-TONE RECEIVER DATA SET 407B
401-compatible answer-only type

WHY WAIT UNTIL 80X?

TYMNET HAS THE ADVANCED FEATURES PROJECTED FOR BELL'S ACS RIGHT NOW.

When Bell speaks, the world listens. Certainly the Bell System's plans for an ACS (Advanced Communications Service) have captured the attention of the entire computing/communications world. And we're glad they got your attention. Nearly every feature of the proposed ACS makes sense to us. But what makes no sense at all is the thought of anyone waiting until sometime in the 1980s to take advantage of such a service.

There's no need to wait... the features that make sense in ACS are already here, today... in TYMNET, the nation's largest packet communications network providing public service nationwide. TYMNET gives you advanced data and message services today in some 150 locations with nothing more than a local call. ACS proposes only 100 locations several years from now.

Check these features available today... in TYMNET, not a proposed service of the next decade:

Ability to resolve protocol differences—TYMNET's Advanced Communications Technology allows users to fully interconnect terminals, computers, and entire networks with totally different protocols.

Automatic code conversion protocol translation, and speed matching for terminals.

Full terminal independence—you can connect virtually any data terminal into TYMNET (Right now, more than 100 different terminal models are being used with our network.)

Extensive computer interface capability—more than 50 computer models from 15 manufacturers are now interfaced to TYMNET.

Ability for a terminal to access multiple data bases a standard feature of TYMNET since 1971.

Local call access to TYMNET from over 150 cities.

Ready integration with other carriers—TYMNET now interconnects with all international record carriers and Canada's DATAPAC, and can interface with emerging foreign national data networks.

Integrated data communications and message switching—our OnTyme store-and-forward message switching (Electronic Mail) service has been up and running on TYMNET for more than a year.

Full protection against unauthorized access to the network and to specific computers as well.

Centralized network management—real time status information on network nodes, lines, and host computers is monitored continually at our Network Control Center.

These TYMNET features, and then some, are in TYMNET today, the only public packet network built on more than six years of successful experience and service. TYMNET is the present common carrier network offering the advanced communications capability needed by anyone wishing to make efficient, economic linkage for computer/terminal systems.

For more information on the communications capability of the 1980s, but available right now in TYMNET, contact the Tymnet, Inc. office nearest you or Tymnet, Inc., Corporate Marketing, 20665 Valley Green Drive, Cupertino, Ca. 95014, 408/446-7000.

TYMNET®

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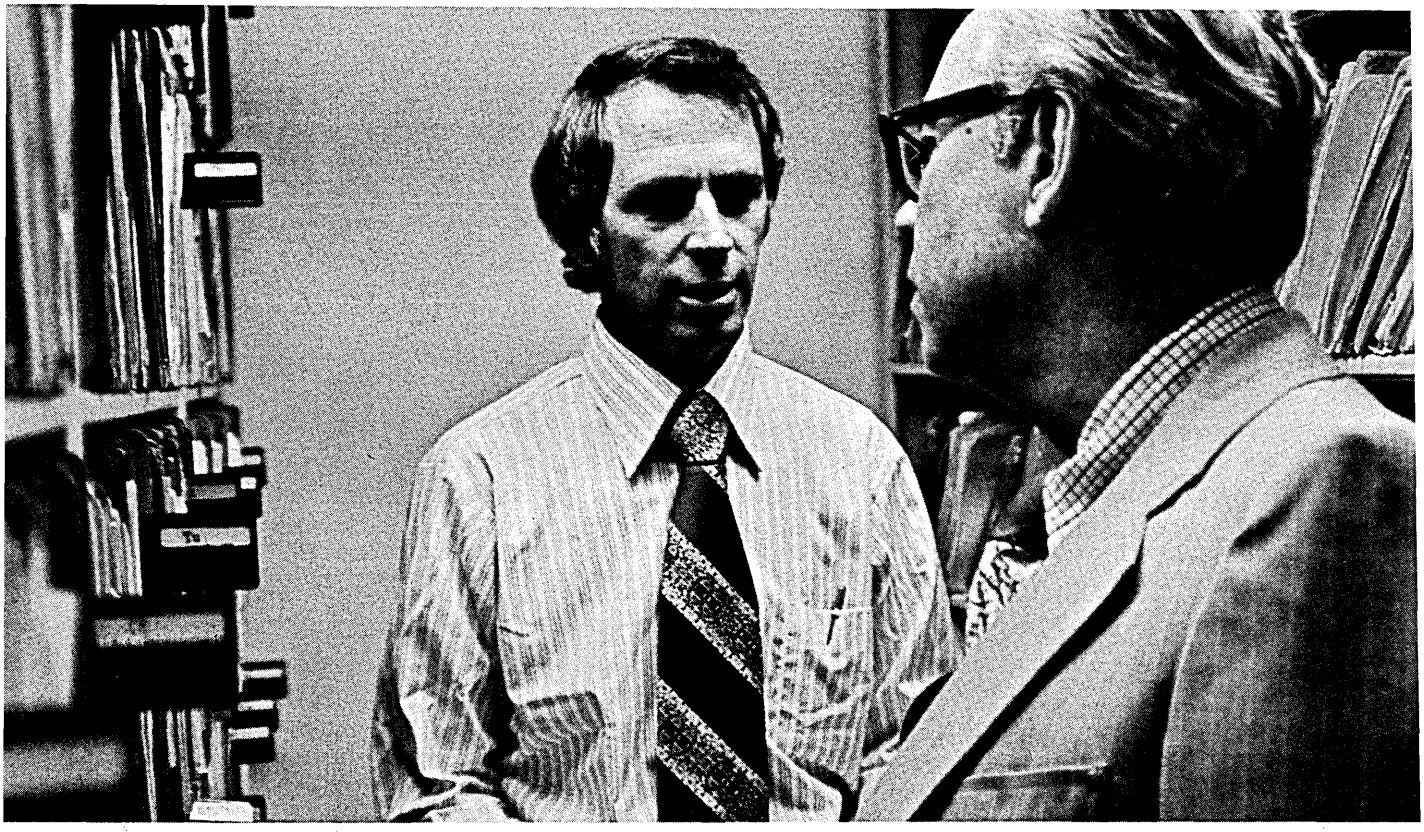
CIRCLE 147 ON READER CARD



William G. Garrett
Assistant VP-data processing.

B. David Hinkle
Senior VP-human resources.

Crawford & Company couldn't wait until 1980 for a payroll/personnel system.

InSci delivered in 1978.

In early 1978, fast-growing Crawford & Company set up a human resources division. The Atlanta-based insurance adjusting firm needed a payroll/personnel system on its System/370 computer —fast. Senior VP-human resources Dave Hinkle turned to DP first.

"I said it would take at least two years to develop a combined system in-house," claims assistant VP-data processing Bill Garrett. "Crawford & Company couldn't wait that long. So Dave and I turned to InSci—and had a system in seven months. Believe me, that was fast.

"The system is excellent. Before we had separate files for payroll, insurance, retirement and what few personnel records were kept. Now we have one complete employee data base, one interface between payroll and personnel. And the data is readily available—without any systems or programming involvement."

Adds Dave Hinkle, "It has great value for the company. For one thing, our growth is somewhat based on mobility. We have 770 offices. If we need to find the right person for a new adjuster-in-charge location in Terre Haute, we can access complete records, right down to years of experience, courses taken and rooms of furniture to be moved."

"It was a team effort," says Garrett. "InSci worked with us every step of the way. I definitely feel it was the right decision for Crawford & Company."

Choosing InSci can be the right decision for you, too. For many reasons. We have 50 of the Fortune 100 as clients. And human resources is our only business.

Information Science Incorporated
95 Chestnut Ridge Road
Montvale, New Jersey 07645
201-391-1600 or toll-free 800-631-1650.

InSci

Innovators in people management

for Transaction Telephone
Up to 10cps using FSK modulation
Asynchronous, simplex operation
2-wire with voltage or contact closure interface
Features alternate voice/data, auto-answer, fixed equalization, remote and local test diagnostics

BELL TOUCH-TONE RECEIVER DATA SET 407C
401-compatible answer-only type
110/150/300bps using FSK modulation
Asynchronous, half-duplex operation
2-wire with RS232C or contact closure interface
Features alternate voice/data, auto-answer, remote and local test diagnostics

CARTERFONE 403/407
Bell 403/407-compatible answer-only plug-in type
Up to 10cps using multitone FSK modulation
Asynchronous, receive-only operation
2-wire with 2-out-of-8 parallel, BCM, or ASCII interface
Features optional alternate voice/data and integral handset, standard auto-answer, busy out
1,500 sold since 1971
$495 ($22/month)

GENERAL DATACOMM 402 SERIES
Bell 402D-compatible originate-only type
600bps (75cps) using FSK modulation
Asynchronous, transmit-only operation
2- or 4-wire with contact closure interface
Features optional reverse channel
Sold since 1970
$485 to $540

SONEX 2401 AUTOTONE
Bell 401J-compatible answer-only type
Up to 20cps using Touch-Tone modulation
Asynchronous, half-duplex operation
2-wire with contact closure interface
Features alternate voice/data, auto-answer, automatic equalization, diagnostic indicators
500 sold since 1972
$600

SONEX 2403 AUTOTONE
Bell 403D/E/407B-compatible answer-only or originate-only types
Up to 12cps using Touch-Tone modulation
Asynchronous, half-duplex operation
2-wire with RS232C, contact closure, or logic interface
Features alternate voice/data, auto-answer, automatic equalization, diagnostic indicators
Over 2,000 sold since 1972
$550 to $600

SONEX 2404
Answer-only type, Touch-Tone receiver on PC board for PBX or PABX applications
Up to 12cps using Touch-Tone modulation
Asynchronous, half-duplex operation
2-wire with user-specified interface
Features alternate voice/data, automatic equalization
Sold since 1974
$250

SONEX TYPE 21
Answer-only type, Touch-Tone receiver on PC board
Up to 12cps using Touch-Tone modulation
Asynchronous, half-duplex operation
2-wire with TTL interface
Features alternate voice/data, automatic equalization
1,500 sold since 1971
$125

TUCK 1810, 1880, 1881
Bell 4013/401A/401H-compatible originate-only/answer-only/originate-answer types
20cps using AM (3-tone sets) modulation
Full-duplex operation
2-wire with contact closure interface
Features optional alternate voice/data and integral handset, auto-answer (on 1810 and 1881), front panel LED diagnostics
Sold since 1976
$675/$225/$325

TUCK 1820
Bell 407-compatible auto-answer or originate-only types
10cps using Touch-Tone (2-tone sets) modulation
Asynchronous, full-duplex operation
2-wire with RS232C interface
Features reverse channel, optional alternative voice/data and integral handset, auto-answer, front panel LED diagnostics
Sold since 1972
$485

TUCK 1830
Bell 403-compatible auto-answer or originate-only types
10cps using AM (2-tone sets) modulation
Asynchronous, full-duplex operation
2-wire with RS232C (BCM) interface
Features reverse channel, optional alternate voice/data and integral handset, auto-answer, front panel LED diagnostics
Sold since 1972
$585

MODEM VENDOR INDEX

For additional information or clarifications regarding the products included in this survey, please contact the vendors directly, either by circling the appropriate number on the reader service card bound into this issue, or by using the addresses and phone numbers below.

Anderson Jacobson, Inc.
521 Charcot Avenue
San Jose, CA 95131
(408) 263-8520
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Astrocom Corp.
120 W. Plato Blvd.
St. Paul, MN 55107
(612) 227-8651
CIRCLE 471 ON READER CARD

Avanti Communications Corp.
Box 205, Broadway Station
Newport, RI 02840
(401)849-4660
CIRCLE 472 ON READER CARD

Bell System
Contact local Bell office.
CIRCLE 473 ON READER CARD

Bo-Sherrel Co.
36443 Shelly Court
Newark, CA 94560
(415)792-0354
CIRCLE 474 ON READER CARD

Burroughs Corp.
Burroughs Place
Detroit, MI 48232
(313)972-7000
CIRCLE 475 ON READER CARD

Carterfone Communications Corp.
1111 W. Mockingbird Lane
Dallas, TX 75247
(214)630-9700
CIRCLE 476 ON READER CARD

Codex Corp.
(Subs. of Motorola, Inc.)
15 Riverdale Ave.
Newton, MA 02195
(617)969-0600
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Coherent Communications Systems Corp.
85D Hoffman Lane
Central Islip, NY 11722
(516)582-4044
CIRCLE 478 ON READER CARD

ComData Corp.
8115 Monticello
Skokie, IL 60076
(312)677-3900
CIRCLE 479 ON READER CARD

Data Access Systems, Inc.
100 Route 46
Mountain Lakes, NJ 07046
(201)335-3322
CIRCLE 480 ON READER CARD

Data-Control Systems, Inc.
Box 860
Commerce Drive
Danbury, CT 06810
(203)743-9241
CIRCLE 481 ON READER CARD

Datapoint Corp.
9725 Datapoint Drive
San Antonio, TX 78284
(512)690-7000
CIRCLE 482 ON READER CARD

Designed Enclosures, Inc.
563 Citracado Parkway
Escondido, CA 92025
(714)743-8344
CIRCLE 483 ON READER CARD

Develcon Electronics, Inc.
423 N. Main Street
Doylestown, PA 18901
(215)348-1900
CIRCLE 484 ON READER CARD

Digicom Data Products, Inc.
1440 Koll Circle, Suite 108
San Jose, CA 95112
(408)279-8711
CIRCLE 485 ON READER CARD

Dynatech Data Systems
7644 Dynatech Court
Springfield, VA 22151
(703)569-9000
CIRCLE 486 ON READER CARD

Gandalf Data Inc.
1019 South Noel
Wheeling, IL 60090
(312)541-6060
CIRCLE 519 ON READER CARD
(Affl. of Gandalf Data Communications, Ltd.
15 Grenfell Crescent,
Ottawa, Ontario, Canada
K2G 0G3 (613)225-0565)
CIRCLE 487 ON READER CARD

General DataComm Industries, Inc.
One Kennedy Ave.
Danbury, CT 06810
(203)797-0711
CIRCLE 488 ON READER CARD

GTE Lenkurt, Inc.
1105 County Road
San Carlos, CA 94070
(415)595-3000
CIRCLE 489 ON READER CARD

Infotron Systems Corp.
Cherry Hill Industrial Center
Cherry Hill, NJ 08003
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CIRCLE 490 ON READER CARD

International Business Machines Corp.
Data Processing Div.
1133 Westchester Ave.
White Plains, NY 10604
(914)696-1900
CIRCLE 491 ON READER CARD

Intertel, Inc.
6 Vine Brook Park
Burlington, MA 01803
(617)273-0950
CIRCLE 492 ON READER CARD

Livermore Data Systems, Inc.
2050 Research Drive
Livermore, CA 94550
(415)447-2252
CIRCLE 493 ON READER CARD

Micom Systems, Inc.
9551 Irondale Ave.
Chatsworth, CA 91311
(213)882-6890
CIRCLE 494 ON READER CARD

M & R Enterprises
285 Sobrante, Suite E
Sunnyvale, CA 94086
(408)738-3772
CIRCLE 495 ON READER CARD

Multi-Tech Systems, Inc.
80 Second Ave. S.E.
New Brighton, MN 55112
(612)331-5000
CIRCLE 496 ON READER CARD

Novation
18664 Oxnard Street
Tarzana, CA 91356
(213)996-5060
CIRCLE 497 ON READER CARD

Omnitec Data Corp.
2405 South 20th Street
Phoenix, AZ 85034
(602)258-8244
CIRCLE 498 ON READER CARD

Paradyne Corp.
8550 Ulmerton Road
Largo, FL 33540
(813)536-4771
CIRCLE 499 ON READER CARD

Penril Corp.
Data Communications Div.
5520 Randolph Road
Rockville, MD 20852
(301)881-8151
CIRCLE 500 ON READER CARD

Prentice Electronics Corp.
795 San Antonio Road
Palo Alto, CA 94303
(415)494-7225
CIRCLE 501 ON READER CARD

Pulse Communications, Inc.
(Div. of Harvey Hubbell, Inc.)
5714 Columbia Pike
Falls Church, VA 22041
(703)820-8000
CIRCLE 502 ON READER CARD

Racal-Milgo, Inc.
(Formerly ICC)
8600 N.W. 41st Street
Miami, FL 33166
(305)592-7654
CIRCLE 503 ON READER CARD

Racal-Vadic, Inc.
222 Caspian Drive
Sunnyvale, CA 94086
(408)744-0810
CIRCLE 504 ON READER CARD

RFL Industries, Inc.
Communications Div.
Powerville Road
Boonton, NJ 07005
(201)334-3100
CIRCLE 505 ON READER CARD

Rixon, Inc.
(Subs. of Sangamo Electric Co.)
2120 Industrial Parkway
Silver Spring, MD 20904
(301)622-2121
CIRCLE 506 ON READER CARD

Rockwell/Collins
Electronic Devices Div.
3310 Miraloma Ave.
Box 3669
Anaheim, CA 92803
(714)833-4600
CIRCLE 507 ON READER CARD

Sonex, Inc.
Data Communications Products
2337 Philmont Ave.
Huntingdon Valley, PA 19006
(215)947-6100
CIRCLE 508 ON READER CARD

Spectron Corp.
344 New Albany Road
Moorestown, NJ 08057
(609)234-5700
CIRCLE 509 ON READER CARD

Syntech Corp.
11810 Parklawn Drive
Rockville, MD 20852
(301)770-0550
CIRCLE 510 ON READER CARD

Tele-Dynamics
525 Virginia Drive
Fort Washington, PA 19034
(215)643-3900
CIRCLE 511 ON READER CARD

Timeplex, Inc.
100 Commerce Way
Hackensack, NJ 07601
(201)646-1155
CIRCLE 512 ON READER CARD

TRAN Telecommunications Corp.
2500 Walnut Ave.
Marina del Rey, CA 90291
(213)822-3202
CIRCLE 513 ON READER CARD

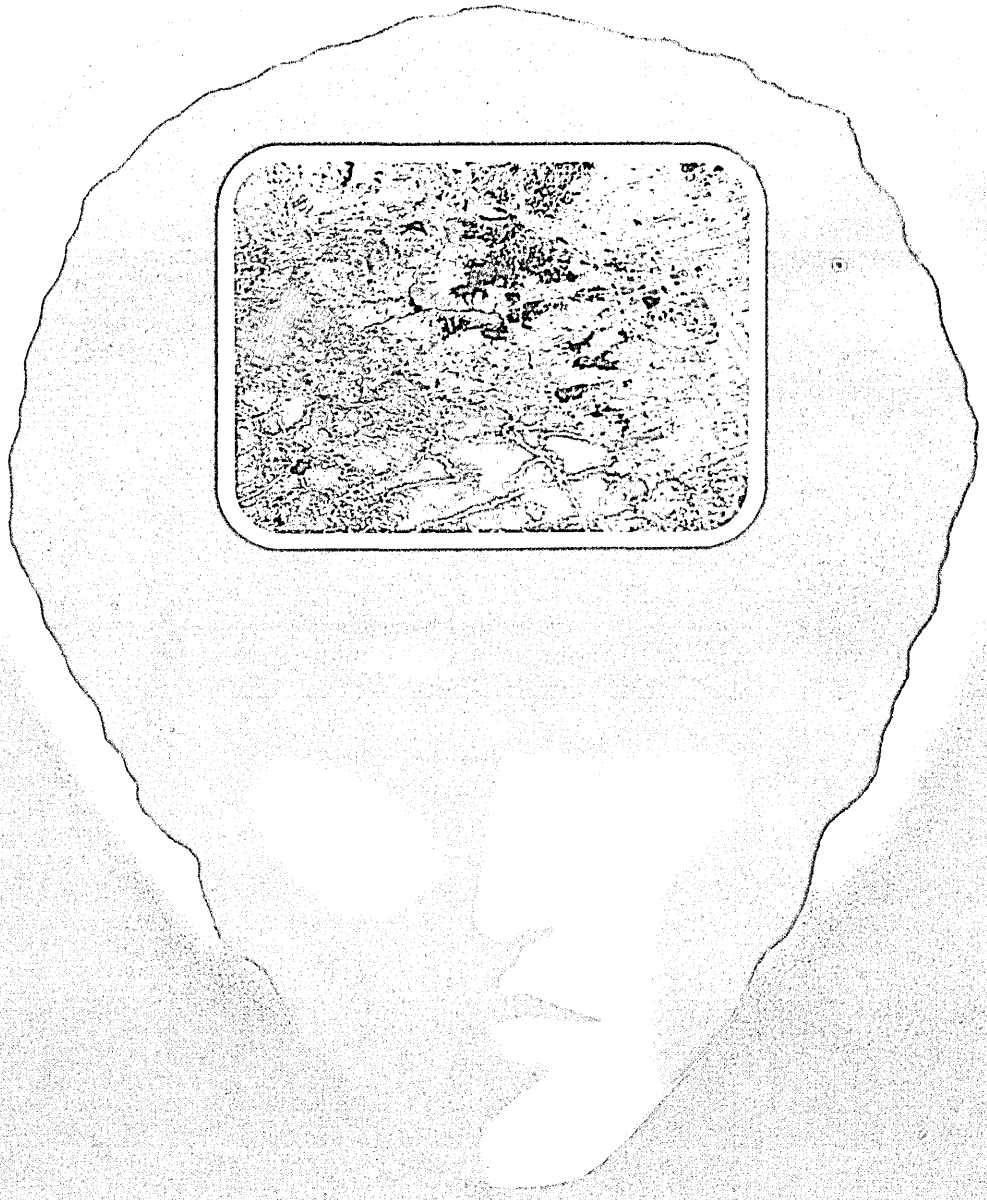
Tuck Electronics
4409 Carlisle Pike
Camp Hill, PA 17011
(717)761-4354
CIRCLE 514 ON READER CARD

Universal Data Systems
(Subs. of Motorola, Inc.)
4900 Bradford Drive
Huntsville, AL 35805
(205)837-8100
CIRCLE 515 ON READER CARD

U. S. Robotics, Inc.
1035 W. Lake Street
Chicago, IL 60607
(312)733-0497
CIRCLE 516 ON READER CARD

Ven-Tel
2360 Walsh Ave.
Santa Clara, CA 95050
(408)984-2727
CIRCLE 517 ON READER CARD

Versitron, Inc.
6310 Chillum Place N.W.
Washington, DC 20011
(202)882-8464
CIRCLE 518 ON READER CARD



An intelligent solution to image and graphic display problems

Higher performance + lower price = optimum systems by Aydin Controls

THE NEW AYDIN CONTROLS Model 5216 Display Computer is the intelligent solution to your graphics and image processing display requirements. Why be locked into the limited capability "packaged terminal" approach now prevalent in the industry? The Model 5216 consists of a family of functional hardware and software modules from which you may configure a display system for stand-alone operation or for integration into your system. Simply select those modules which are consistent with your application. The Model 5216 provides multi-processing capability and multiple buss architecture for separate input/output, display processing, and display refresh functions to enhance system performance and flexibility. Whether you need a low-end alpha/graphic color terminal or a sophisticated multi-image, high resolution image processing display system (or anything in between), the Model 5216 display family is your answer.

SALIENT FEATURES

○ High-performance multi-processor buss architecture ○ Pixel or graphic DMA block mode data transfer (800 nano-seconds per 16-bit pixel) ○ Multiple pixels per word ○ Wide selection of display formats including 512 x 512 x 64, 1024 x 1024 x 16, and up to 1024 x 512 x 16 bits per pixel at 60 Hz refresh rate ○ Video processing through look-up table RAM at bit rates to over 40mHz ○ Built-in vector and circle generation ○ Four sizes of alpha characters ○ High speed hardware math ○ Both parallel and serial peripheral interfaces available ○ User programmable.

STANDARD HARDWARE MODULES

○ Processor Module (16-bit) ○ Processor Expansion Memory (up to 1 megabyte of PROM or RAM) ○ Memory Buss Controller (sync and control) ○ CPU I/O Module (DMA to host) ○ Video Modules (several types available) ○ Memory Modules (display formats from 256 x 256 to 1024 x 1024 x 16) ○ Mass Storage Controllers (floppy disk and magnetic tape) ○ Zoom Controller (2X, 4X, 8X and 16X) ○ Hardware Math Modules (including vector/circle) ○ Alphanumeric Channel Module (80 x 48 format, 256 unique symbols, 8 colors).

STANDARD SOFTWARE MODULES

○ AYDOS Operating Systems ○ Software Support Modules ○ AYGRAPH 2D or 3D Graphics Modules ○ AYGRAPH Image Processing Modules ○ Emulation Modules.

Configure your system from the Model 5216 family of Hardware and Software Modules and prove to yourself the cost/performance advantages of AYDIN CONTROLS for your application.

AYDIN CONTROLS

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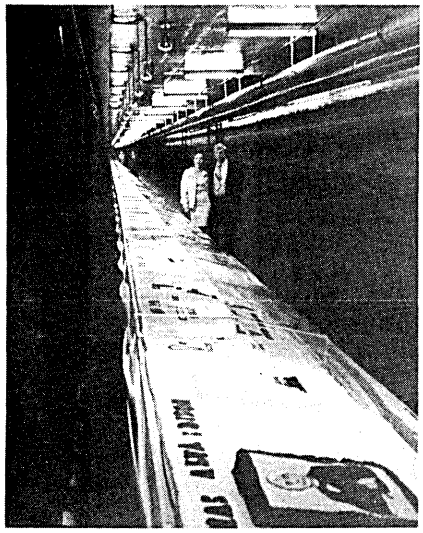
One source for all your CRT display requirements

CIRCLE 19 ON READER CARD

HARDWARE

OFF-LINE

It took an engineer, a graphics terminal, a food services director and his wife three months to plan and produce this birthday cake to celebrate General Electric's 100th anniversary. At a yard a year, the 300-foot cake reportedly has earned its place in the Guinness Book of World Records. Decorations

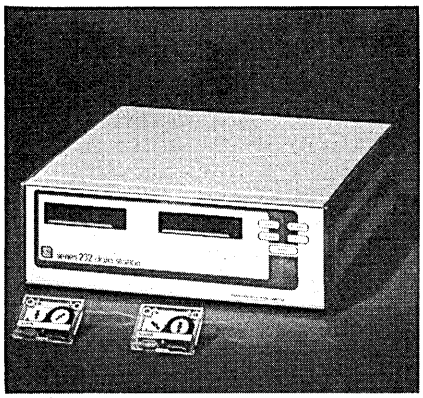


on the cake painted the history of GE. Designed in 50 six-foot panels, the decorative icing included portraits of Edison and Steinmetz, as well as nuclear submarines, light bulbs, jets, and offshore oil wells. At an open house more than 65,000 people saw the cake, after which 13,000 GE employees got down the the serious work at hand: eating it.

A report prepared by Strategic Business Services (once SBS Publishing) looks at the future of retail computer stores and paints a rosy picture. Revenues are projected to grow at an average annual rate of 40%, making the market worth $945-million in 1983. At the same time, stores are expected to proliferate at 20% annually; about 2,000 should be open in 1980.

SMART CARTRIDGE TAPE

Designed to sit between a terminal (smart or otherwise) and a communications line, the Series 232 Data Station can provide or augment the terminal's processing capabilities. The auxiliary storage/retrieval device includes a 16-bit microprocessor, as much as 16KB of ROM, from 2KB to 64KB of read/write memory, and one or two 3M DCD-1 data cartridge transports. The unit's native processing capability allows users to build data bases off-line for subsequent transmission to a host cpu. The Series 232 can be programmed in BASIC (we hear FORTRAN also is available), or users can get canned programs for text editing and word processing. Plotter software to emulate Houston Instrument's PTC-5 command protocol also is available. Off-line, users can create, delete, list, and edit files on tape; files also can be packed to the front of the tape cartridge to reduce search and access time. On-line, the unit can record, transmit, and echo (to the terminal) characters being sent downline to the host. The Series 232 talks to the outside world through RS232 ports, at switch-selectable data rates ranging from 110bps to 9600bps. A single-transport Se-

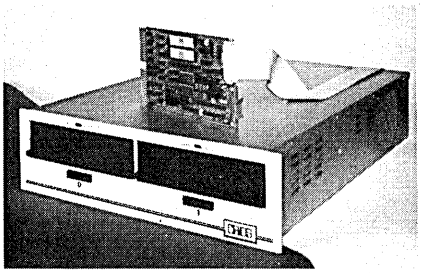


ries 232, with 3KB of ROM and 2KB of user memory sells for $2,495. A second tape transport adds $500 to the price tag. Word processing software goes for $750; the plotter code is $350. DIGITAL DATACOM, INC., Irvine, Calif.

FOR DATA CIRCLE 434 ON READER CARD

FLOPPY DISK SYSTEM

Compatible with DEC's RX02, this vendor's FD-211 double density, dual floppy disk system packs all controller logic on a single card that plugs into the backplane of an LSI-11 or LSI-11/2. The controller includes a bootstrap loader, IBM 3740 formatter, and interface electronics. Data is transferred per sector via DMA. The FD-211 uses Shugart SA800 drives which oper-



ate in both single and double density modes. The FD-211 sells for $3,250. CHARLES RIVER DATA SYSTEMS, INC., Natick, Mass.

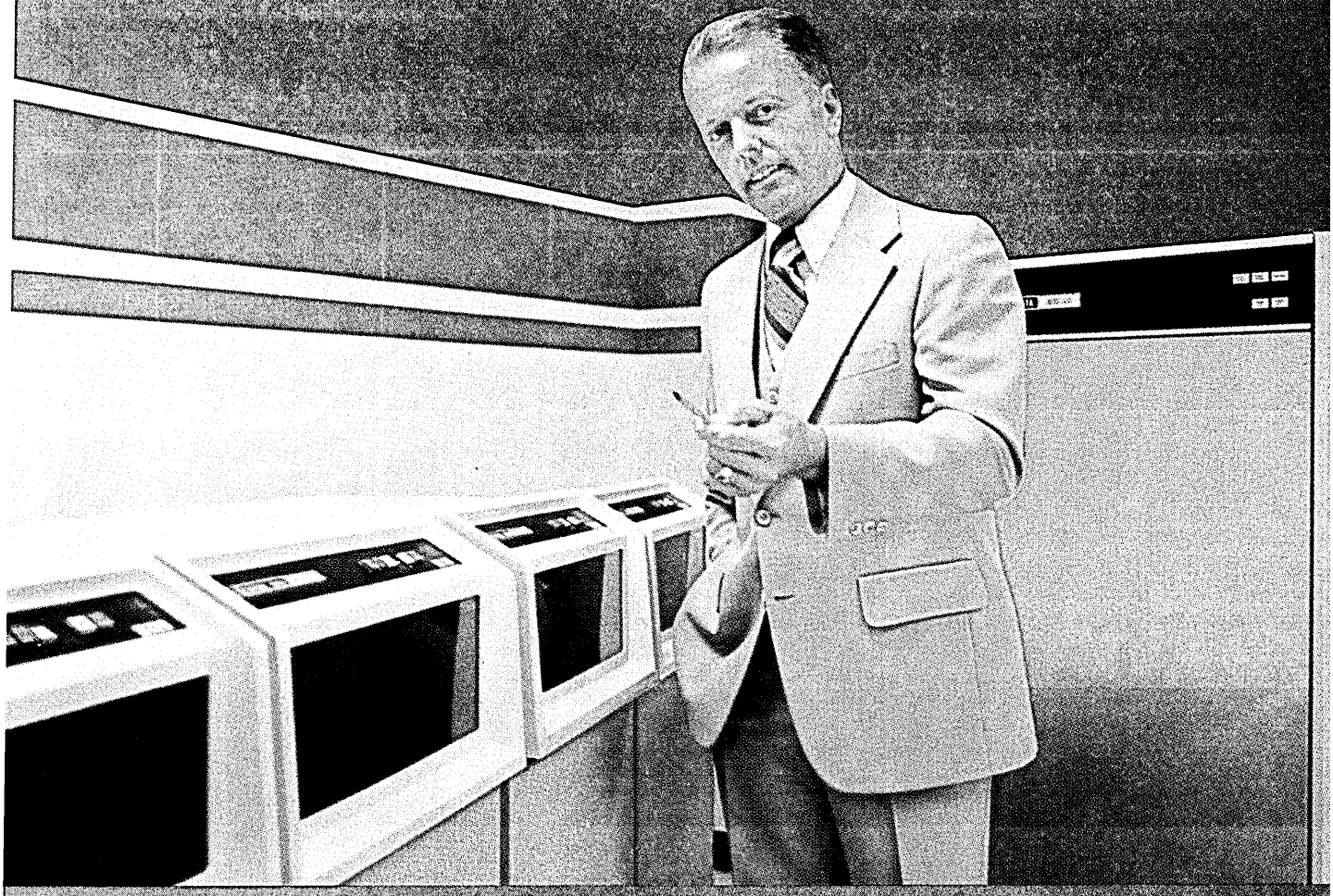
FOR DATA CIRCLE 435 ON READER CARD

SUPER COMPUTER

Control Data recently made public the details of its largest number-cruncher to date, the Cyber 203. Based on the Star 100, the 203 uses LSI emitter coupled logic (ECL) chips that allow the vendor to build the system's scalar processor on only 16 boards (those 16 boards are said to pack the wallop of a 6400). But the 64-bit machine really gains speed from its vector processor, which is said to be able to process as many as 65,000 calculations with a single instruction; the machine is said to execute up to 100-million floating point operations per second. Vectorization requires sophisticated language processors, and the Cyber 203's FORTRAN compiler, originally developed for the Star, exploits the machine's architecture by recognizing

code suitable for vectorization. With a supercomputer such as this, a front-end is needed; in this case it's a Cyber 170. Pricing on a Cyber 203 system ranges from $5.8 million to $11.7 million. At the low-

"Our 33502, with 635 megabyte capacity, is the better business decision."



Jim Cron, General Sales Manager, Peripheral Systems Marketing

"Our 33502 has twice the capacity of an IBM 3350. So you can save dollars and floor space. And the improved technology behind our new 33502 data module offers other advantages.

"Better performance, for example. Track-to-track access time is faster than the 3330/3350 technology can offer. Average access time is faster too—19 milliseconds per 317.5 Mbyte logical volume. And you get more optional fixed head storage—1.72 Mbytes instead of only 1.14 Mbytes.

"Another technological innovation is our dynamic dual access. It gives you up to 25% greater throughput over a comparable switch configuration. And if you have a multiple CPU installation, we can offer you both string switch and dual access to provide four data paths to each spindle.

"And when you choose Control Data's 33502, you needn't worry about conversion or compatibility problems. It is totally compatible with all IBM 3330/3350 disks and controllers. Our Storage Controller lets you intermix 100MB, 200MB, 317.5MB, 400MB, 635MB—even Mass Storage all on the same unit.

"Besides technical considerations, there are many other reasons that make the 33502 a better business decision. Control Data's reputation is for reliability, service support and broad product experience. And there are more reasons. For the full story contact your local representative, or call 612/553-4158."

CONTROL DATA CORPORATION

More than a computer company

CIRCLE 73 ON READER CARD

end price, you'll get the 203 with 500,000 words of memory. For a total system, including peripherals, Cyber 170 front end, and software, figure on spending $8 million and up. Deliveries are quoted at 12 months to 18 months. Existing Star 100s (of which four have been built) can be upgraded; a Star in the vendor's Cybernet service bureau operation is slated for upgrade this year. CONTROL DATA CORP., Minneapolis, Minn.

FOR DATA CIRCLE 436 ON READER CARD

DATA ENTRY

This established vendor of data entry systems has expanded the lower end of its product line to address new market segments. The System 3100 is directed at users needing high volume productivity and batch editing, as well as first-time users. The system doesn't interrupt an operator as bad data is keyed. Instead it waits until the operator is done, and then validates the entire batch of input records. The system can reduce keystroking by substituting data from tables for shorter keyed codes. It can also validate entries through table lookup, and balance entries on a record, document, or batch basis. Capable of supporting up to 16 entry stations, the System 3100 is built around a 40KB processor, with 2.5MB of disk, and a 12½ips or 45ips tape transport. A 3100 with eight workstations and a 12½ips tape unit sells for $49,240; it leases for $731 (plus maintenance) per month on a 42-month contract. System 3200 is a big brother to the 3100; it can run programs written for the 3100 and it's said operators will not need retraining. The system has full arithmetic capabilities, can move and edit data conditionally, and it supports a COBOL compiler. These functions can be used as data are being entered, or as background activity. A System 3200 including a 64KB processor, 10MB of disk, 45ips tape, 600 lpm printer, communications interface, eight terminals (16 are the maximum), sells for $89,630. It can be leased for $1,554 (plus maintenance) per month on a 42-month contract. INFOREX, Burlington, Mass.

FOR DATA CIRCLE 437 ON READER CARD

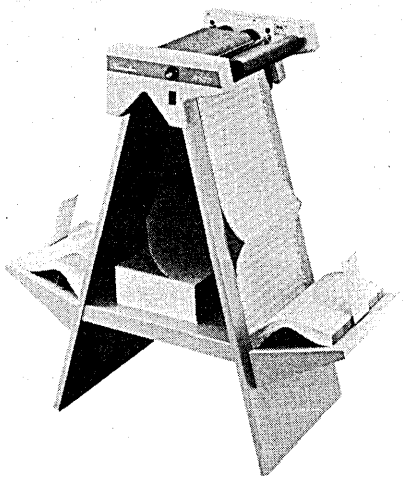
PATCHING SYSTEM

The DPS-4 Data Patch status/alarm and fallback switch system monitors and allows switching of RS232 communications lines. The system will allow users to switch to backup equipment in the event of primary equipment failure. It also lets the user patch in spare equipment, and provides access for system diagnostics and service restoration. The system comes in three basic configurations. The DPS-4-1 provides a status display, patching, and A/B fallback switching. The DPS-4-2 adds an alarm function (both an indicator LED and an audible signal) to the functions of the DPS-4-1. The DPS-4-11 provides basic patching and fallback switching. A 16-channel DPS-4-11 sells for $3,954. ATLANTIC RESEARCH CORP., Alexandria, Va.

FOR DATA CIRCLE 438 ON READER CARD

DECOLLATOR

Capable of separating forms at up to 450 feet per minute, the Model 6325 A-Frame Decollator handles two-part forms up to 15-inches wide. The unit will accept up to a full box of forms ranging from 13-pound



to 140-pound bond. Forms come out stacked, and the carbon paper winds up on a take-up spool. The 6325 sells for $649. THE SWINGLINE CO., Long Island City, N.Y.

FOR DATA CIRCLE 439 ON READER CARD

GRAPHICS

An IBM Series/1 interface and dynamic graphics module increase the capabilities of this vendor's model 7000 vector refresh graphics system. The parallel interface to Series/1 is contained on a single printed circuit board that fits in the mini's chassis; the interface sells for $3,000. The vendor says it is investigating the conversion of its graphics support software to the Series/1. A hardware clipping, rotation, scaling, and translation (HCRST) module provides two-dimensional rotation independent of a host processor. Pictures can be rotated about an arbitrary origin or moved to new origins. The module also lets a user examine portions of an image, and to reduce or enlarge a picture. The HCRST model sells for $6,000. MEGATEK CORP., San Diego, Calif.

FOR DATA CIRCLE 440 ON READER CARD

MINICOMPUTER

The newest member of the Series/1 family, the 4952 processor, packs cpu, clock comparator, storage address translation function, and up to 128KB (the machine's maximum) of memory on a single card. With an average instruction time of 9.4usec, it can't exactly be called fast, but as a friend of ours said, "Put it in a word processing system, or use it to control the environment in a building, and nobody will know the difference." Deliveries begin in May, and the basic processor, with 32KB, sells for $4,600. Additional memo-

ry, in 32KB chunks, sells for $450 (that's $14,400 per MB, even less than DPD's $18,000/MB price that astounded many when the 8100 was announced last fall). Announced with the 4952 were four disks added to the 4963 family: model 23A, a 23MB primary disk ($9,980), model 23B, a 23MB expansion disk ($8,280), and the 29MB models 29A (primary, $9,260) and 29B (expansion, $7,560). The 23MB versions both have 131KB of fixed head ca-

HARDWARE SPOTLIGHT

SPEECH SYNTHESIS

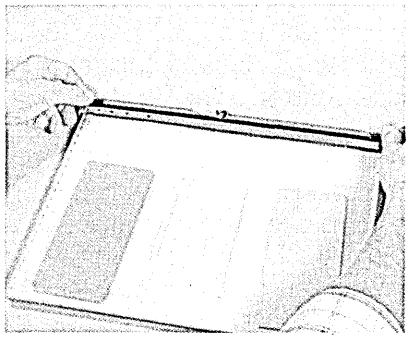
From all indications, Radio Shack's TRS-80 personal computer is a mighty popular machine. That's why this vendor chose the TRS-80 as the target of its first non-S-100 bus speech synthesizer. Known as the Computalker CT-1T, the unit consists of a chassis and power supply, audio amplifier, the firm's existing (S-100 bus) CT-1 synthesizer, and interfacing for the TRS-80. The target TRS-80 must have Level II BASIC and 16KB of memory (32KB is recommended). The synthesizer is controlled by nine acoustic-phonetic parameters sent over the TRS-80's bus; two operating modes—direct parameter control and phonetic—are possible. Each unit comes with software, on minidiskette or cassette, and a hardware users manual. Software includes CTEDIT, a parameter data editor, several parameter data files, and a synthesize-by-rule program. The complete package sells for $595; for $225, existing CT-1 can be converted for use with the TRS-80. COMPUTALKER CONSULTANTS, Santa Monica, Calif.

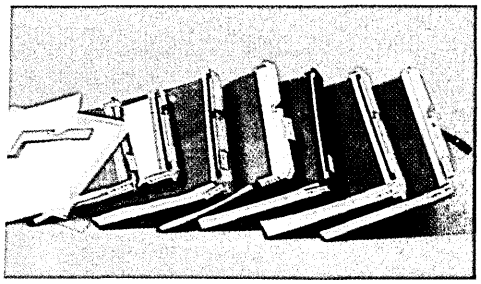
FOR DATA CIRCLE 443 ON READER CARD

how DOCU-MATE™ and the structured filing concept improve systems and programming productivity

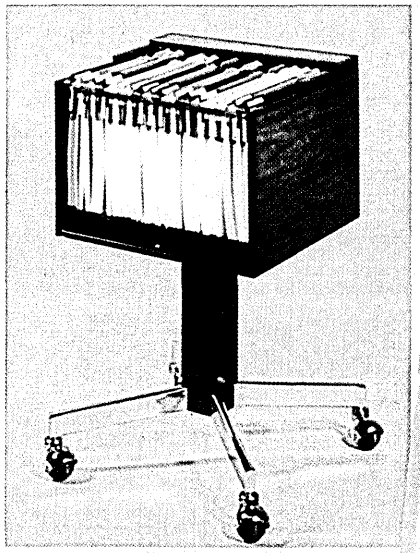
A thorough and complete data processing documentation library is like motherhood and the flag. Everyone is in favor of it. The real problem lies in organizing it and making it work. That's where our DOCU-MATE System comes in. Starting with the problems, we designed solutions in the form of products that make it easy to file and access virtually every size and shape of documentation . . . to intermix different sizes and shapes in the same filing equipment . . . to move documentation from filing to reference mode and vice-versa while keeping it in the same filing device . . . and to structure workable standards for managing and controlling all documentation.

The heart of the DOCU-MATE System is the hanging cartridge. It provides center hook lateral filing or end hook drop filing . . . snaps open or closed with the flick of a finger . . . and has highly visible end and top labeling areas.





Along with other DOCU-MATE filing devices, cartridges fit compatibly into a wide variety of filing and referencing equipment that allows almost unlimited flexibility in the planning of central documentation libraries and development support libraries, and individual work stations.



The DOCU-MATE System is the key you are looking for to make your documentation library system work. It will help you to improve project control, increase systems and programming productivity, improve interdepartmental communications and reduce the cost of maintaining your documentation system. In less than two years since its introduction, it is now in use by over 3,000 companies in the U.S.

Wright LINE

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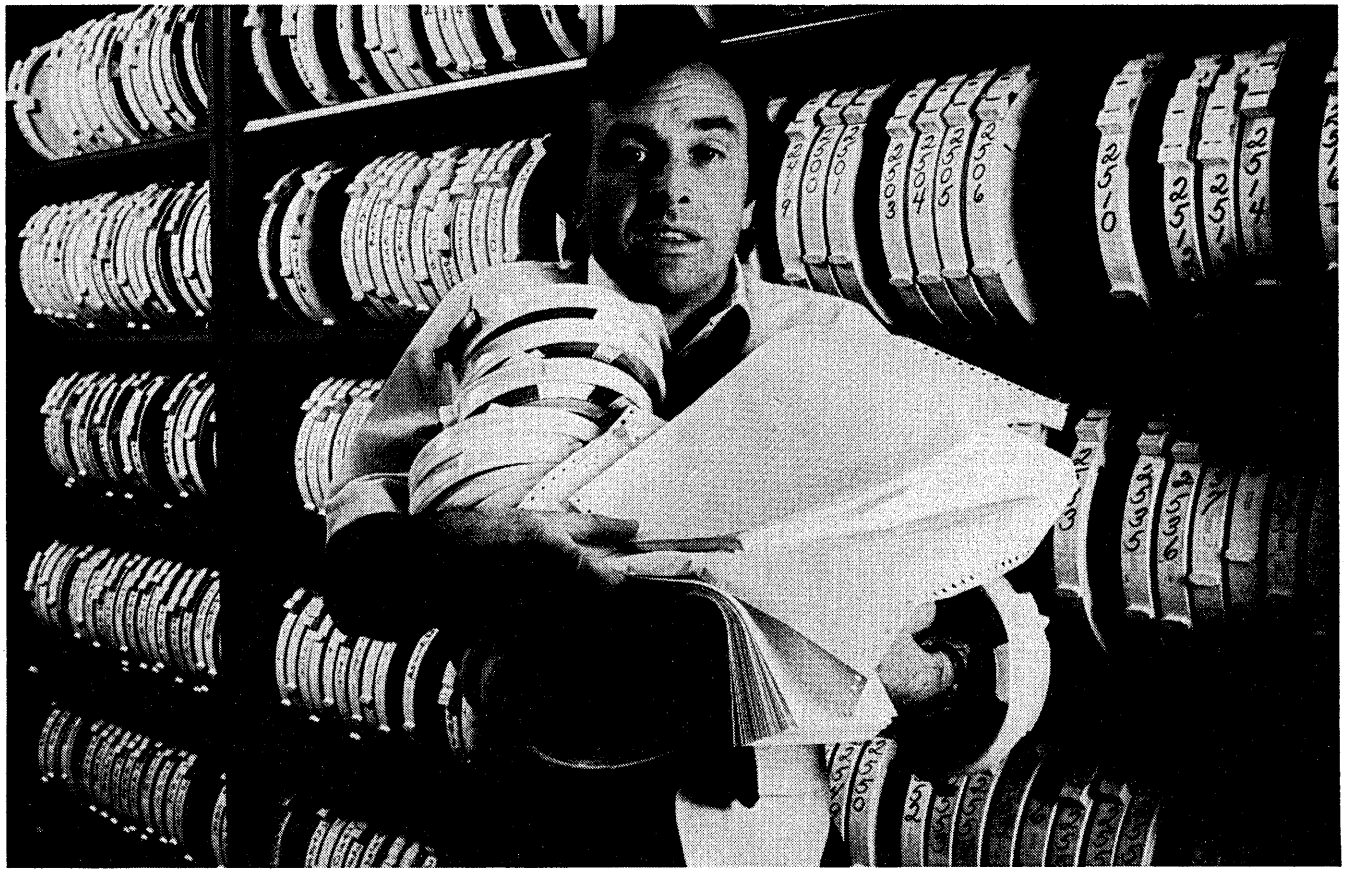
CIRCLE 108 ON READER CARD

Library a shambles?



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TLMS is the Tape Library Management System from Capex. Use it, and you'll know location, contents and disposition of every tape volume in your library. TLMS assures security, inventory management and cost reductions at hundreds of IBM OS sites. In use since 1968, this dependable program product prevents accidental destruction of data sets or storing of obsolete data, and cuts new tape expenditures. It assures positive ID of every tape, accommodates off-site storage, simplifies tape maintenance. Call us at (602) 264-7241. We'll help you bring your library under control . . . with TLMS.

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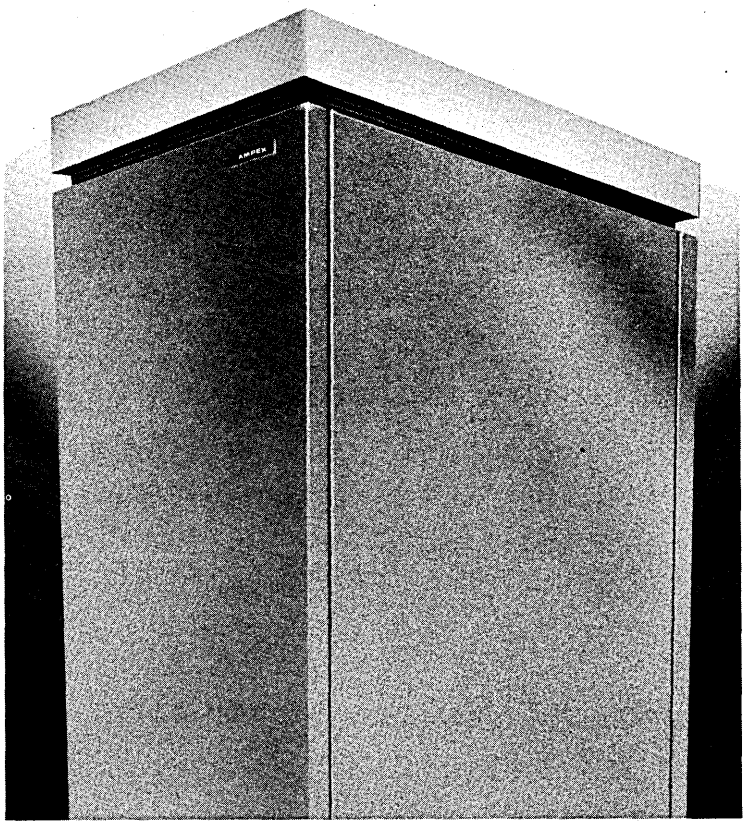
SUPER MEMORY FOR A SUPER MAINFRAME



Money is the main reason you'll look into this Ampex add-on memory for the IBM 3031/32/33 mainframe. And performance is the reason you'll buy it. The ARM-303X from Ampex costs a lot less than IBM's own memory expansion, and it'll take any of the big three computers all the way to 16 million bytes of memory.

The whole works are in a single cabinet that hinges right to the IBM frame housing processor storage. Get rid of a door and get as much memory as you need, in one-meg increments for the 3031 and 3032, and in two-meg increments for the 3033.

ARM-303X memory is both hardware and software transparent to the 303X system, is precisely timed to the mainframe operation, and is totally self-contained. Forced cooling uses your computer room ambient air, so there's no extra plumbing to worry about.

AMPEX TAKES YOUR IBM 303X ALL THE WAY TO 16 MEGABYTES.

1/3 LESS

Ampex diagnostics are another plus with the ARM-303X. The CE display panel (plus Ampex diagnostics) pins down errors to the single memory chip at fault. And you'll have the secure feeling that comes from knowing that Ampex Customer Support will assume total responsibility for installation and maintenance support.

Dommie Johnson has the details, along with all the numbers you need to prove that Ampex add-on memory is the best way to get more work from your IBM-3031/2/3, and still save about a third the money you'd spend otherwise. Call him at 213/640-0150, or write to Dommie at Ampex Memory Products Division, 200 N. Nash Street, El Segundo, CA 90245.

AMPEX MAKES IT EASY.

CIRCLE 67 ON READER CARD

pacity. IBM also gave warranted status to the Event Driven Executive (EDX) and announced a FORTRAN IV compiler for use with the EDX Basic Supervisor and Emulator. FORTRAN licenses for $14 per month, and the EDX Basic Supervisor and Emulator is $16 per month. INTERNATIONAL BUSINESS MACHINES CORP., General Systems Div., Atlanta, Ga.

FOR DATA CIRCLE 441 ON READER CARD

MAGNETIC TAPE

Epoch 480 is this vendor's latest computer tape. The tape's oxide coating, using the vendor's "Magnum 80 Particles," is said to virtually eliminate oxide growths that cause surface irregularities. The vendor also says the new tape's binding system is 50% more durable than Epoch 4's, its predecessor. The tape is certified for densities of up to 6,250bpi, and it carries a 20-year guarantee. A 2,400-foot reel will sell for between $16 and $18, depending on quantity and shipping charges. GRAHAM MAGNETICS., Fort Worth, Texas.

FOR DATA CIRCLE 442 ON READER CARD

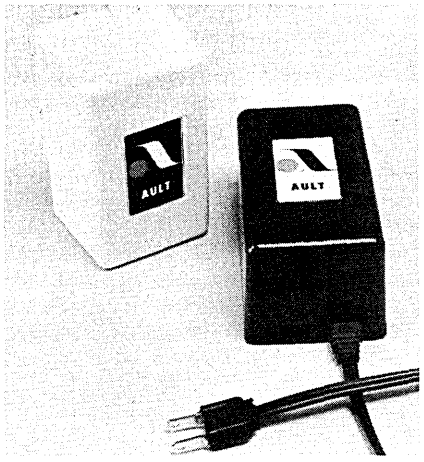
EDITING TERMINAL

The 1730 remote editing terminal is intended primarily for newspapers, but it also may find use in large organizations that prepare enough documentation, manuals, and newsletters to justify the acquisition of a composition system. The terminal provides two-way communications between a central copy processing system and remote offices originating editorial, classified, and display advertising. Without connection to a central 2500 composition system, the 1730 has editing features that allow users to move copy blocks, delete characters, words, lines, sentences, or paragraphs, insert characters or text, and create effects using inverse video, underlining, and strikethrough. Working with the central controller, the 1730 lets the user fit copy, hyphenate, justify, and access a central editorial data base. Classified ad-takers can enter or alter ads while the system automatically checks the advertiser's credit. Display ads also can be input from a remote office via the 1730. The 1730 sells for $6,990; 2500 systems start in the $250,000 neighborhood. HARRIS CORP., Composition Systems Div., Melbourne, Fla.

FOR DATA CIRCLE 444 ON READER CARD

POWER SUPPLIES

Designed for use with microprocessors, small computer systems, terminals, modems, and peripherals, this vendor's line of external power supplies are packed either to plug directly into a wall outlet, or as desktop units with six-foot cords. The UL-listed units are said to allow a designer



to build smaller products and avoid problems of heat buildup and RF interference. The units are offered with a variety of power ratings, including ± 12VDC at 0.1 amps ($13.95) and 5VDC at 1.5 amps ($21.95). Other models are available for 220volt and 50Hz power mains. AULT, INC., Minneapolis, Minn.

FOR DATA CIRCLE 445 ON READER CARD

DATA CAPTURE TERMINALS

Intended for use primarly in manufacturing companies, these three on-line terminals are meant to capture industrial infor-

Smarts™ is like having another secretary.

Our Smarts terminal control unit can handle your branch office's growing message volume. And at less cost than hiring an additional secretary.

It adds intelligence to general-purpose communication terminals, providing them with such additional capability as concurrency, text editing, file management and access to multiple networks, including TWX®.

Concurrent operations.

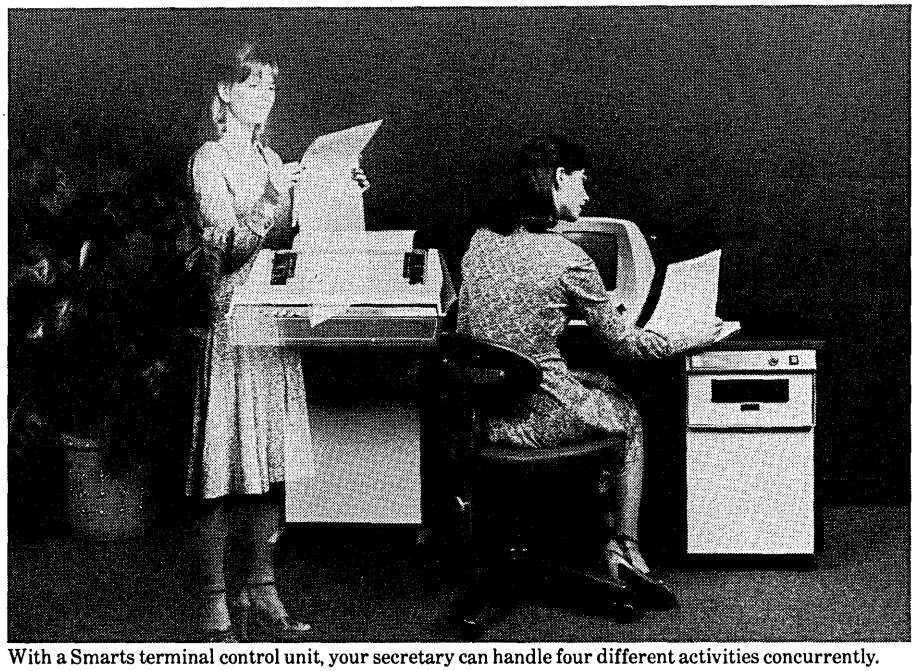
Here's how four different activities can be handled concurrently: Your secretary can enter a message via a CRT terminal while its associated printer prints out messages received in the last poll. At the same time, your headquarters computer can poll the controller for sales orders, while your office receives a TWX message.

This is just one example of how the ability to perform concurrent operations can increase your office's productivity.

Electronic mail.

The Smarts unit has two communication ports. One for 202 coded line control. The other for alternate line use—103 and TWX access. And Binary Sync is also available.

And, as part of Western Union's Electronic Mail™ services, you can send Mailgram® messages, domestic Telegrams and International Telegrams right from your secretary's work station.



With a Smarts terminal control unit, your secretary can handle four different activities concurrently.

Easy to operate.

With the Smarts controller, your secretary can call up standard message header formats and even entire paragraphs quickly.

A secretary will find that corrections can be made easily with the control unit. Additions, deletions and changes in message composition can all be made with a minimum of time and effort.

Messages can be entered into the Smarts controller either in free-form or by relying on operator prompting.

It also is equipped with floppy disk storage, able to store up to 270,000 characters in up to 60 files. Each file can be called up conveniently by name. And messages can be segregated for multiple transmission or local printing.

For more information, or for a copy of our free product catalog, call Bob Roth toll free at 800-631-7050. (In New Jersey, 201-529-1170.) Or write: Western Union Data Services, 70 McKee Drive, Mahwah, N.J. 07430.

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So if you are looking to add capability around your mainframe, look harder at the following Telex systems:

- OUR 3420-COMPATIBLE TAPE SUBSYSTEMS, with self-diagnostics and error correction features that give maximum reliability in densities from 800 to 6250 BPI. And 12 years of Telex know-how in every tape subsystem.
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- OUR FULL LINE OF 360/370/303X ADD-ON MEMORIES, with technology that matches IBM's, but with reliability features unmatched in the industry. Eleven models to choose from.
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- OUR 3270-COMPATIBLE TERMINALS. With more than 40,000 installed, Telex is a leading supplier of 3270-type displays, printers and controllers.
- OUR NEW ENHANCED 3270 FUNCTIONS. Now 3270 users can add local format storage, store and forward, edit, local printing and batch printing features easily within their network.
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CIRCLE 166 ON READER CARD

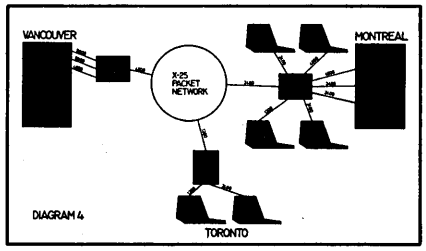
mation at its origin. The 3075A, a desktop unit for finance, stock control, order processing, and the like, has user-definable prompting lights and a 26-key alphanumeric keyboard. Using a shift key, an operator can switch between alphanumerics and user-defined operations. A printer is

optional. Model 3076A is a wall-mounted version of the 3075A. It can be fitted with a multifunction card reader. One of its applications would be to capture work-in-progress data on a machine shop floor. The 3077A is a wall-mounted time reporting terminal that can be fitted with a badge reader or card reader. Its applications include controlling access to restricted areas and employee time reporting. All three units have RS232 interfaces and an integral data link. Users can link the terminals to their computer through multipoint, point-to-point, multidrop connections. The data link allows multidrop configurations along a line as long as 5 miles. Single unit prices for the basic terminals are: $2,090, $2,475, and $2,530 for the 3075A, 3076A, and 3077A respectively. Optional alphanumeric keyboards, displays, printers, and readers range from $110 to $715. Oem and quantity discounts are offered. HEWLETT-PACKARD CO., Palo Alto, Calif.

FOR DATA CIRCLE 446 ON READER CARD

X.25 COMMUNICATIONS

The MPAC 5000 communications processor provides an interface to X.25 packet switched networks. It can support up to 16 asynchronous or synchronous terminals and two HDLC access lines. Asynchronous terminals may run at speeds of up to 9600bps; synchronous terminals can go to 56,000bps. HDLC access lines can run from 1,200bps to 56,000bps. Installation of the MPAC 5000 is said to entail no modification to a user's hardware, operating system or applications software. Options



include data compression/expansion, which uses three or four characters to represent a stream of up to 255 identical characters, and data encryption/decryption support conforming to the Data Encryption Standard (DES). A basic unit with four asynchronous/synchronous ports and two HDLC access lines sells for $3,500; a 16-port unit is $5,400. These prices are in U.S. dollars. MEMOTEC SERVICES CORP., Montreal, Quebec, Canada.

FOR DATA CIRCLE 447 ON READER CARD

PORT CONCENTRATOR

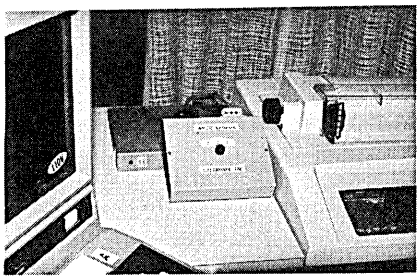
This vendor's Micro200 Port Concentrator, intended for use with the vendor's previously announced Micro800 Data Concentrator (see November 1977, p. 198), will let minicomputer users dedicate one computer port to communicating with as many as 16 channels of remote data. Intended to save communications line costs, as well as computer ports, the Micro200 accommodates either synchro-

nous or asynchronous data. Some user programming will be required to support the Micro200. In single unit quantities, the Micro200 sells for $1,000. MICOM SYSTEMS, INC., Chatsworth, Calif.

FOR DATA CIRCLE 453 ON READER CARD

RS232 SWITCH

The RS232-X3 switching unit allows a user to connect his terminal or printer to three switch-selectable driving devices. Or the user can turn it around and connect three peripheral devices to one RS232 port on a



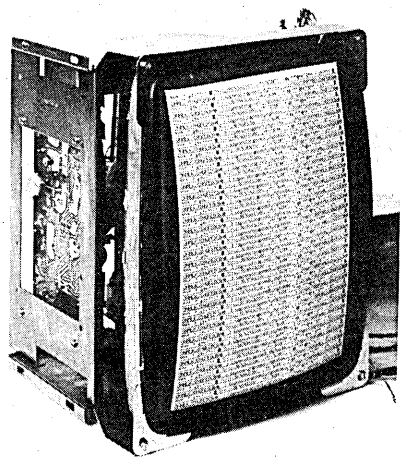
computer. Available as kits or fully assembled switches, the RS232-X3 carries prices ranging from $47.95 to $78.95. GILTRONIX, Palo Alto, Calif.

FOR DATA CIRCLE 448 ON READER CARD

CRT MONITOR

For those people building a word processing or graphics system from the ground up, the VR-800 high-density, high-resolution crt monitor may be a desirable component. The noninterlaced crt displays 800 visible scan lines and refreshes at 60Hz. It can display 66 lines of 7 × 9-dot matrix characters on its 15-inch diagonal screen. In quantities of 1,000, the VR-800 sells for $375; samples are available. MONITERM CORP., Long Lake, Minn.

FOR DATA CIRCLE 451 ON READER CARD



DISK CONTROLLERS

A family of three microprogrammed disk controllers for the PDP-11 provide emulation of all of DEC's large disk subsystems. The SC11/A mimics RP11, RP02, and RP03 subsystems; the SC11/B covers the RH11, RM02, RP04, RP05, and RP06, while the SC11/C emulates RK611, RK06, and RK07 subsystems. Providing performance characteristics identical to the DEC controllers they emulate, the SC11 controllers also have automatic self-test and subsystem diagnostics in firmware. It is said special functions often can be added for specific user requirements. Packaged on two printed circuit boards that plug into the PDP-11's bus, the bipolar controllers include 2KB of RAM providing a three-sector buffer. Error conditions and operating mode are displayed by onboard LED's. The controllers sell for $3,900 apiece in lots of 50. EMULEX, Irvine, Calif.

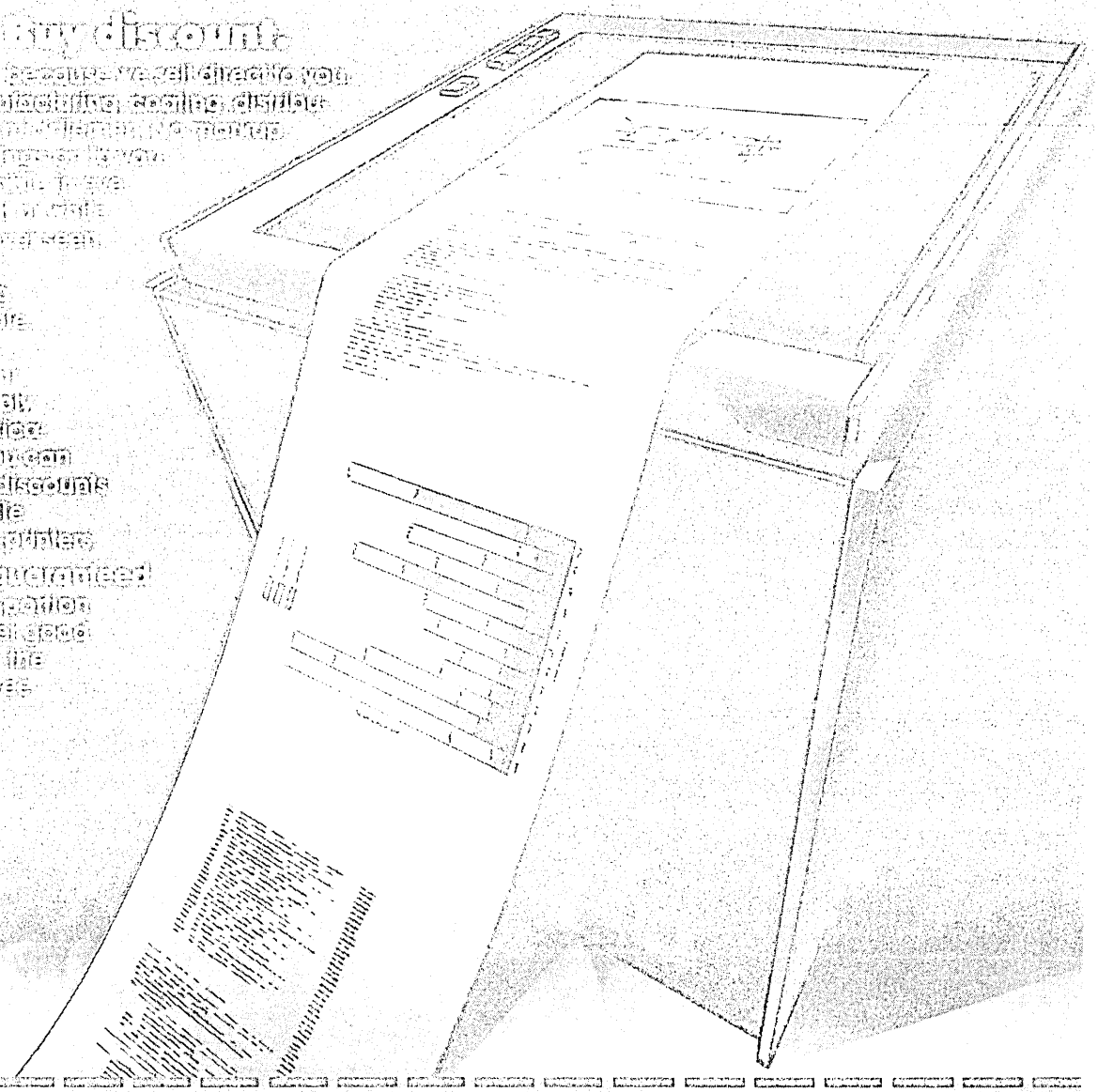
FOR DATA CIRCLE 454 ON READER CARD

MICROCOMPUTER MODEM

The MM-103 is a low-speed, S-100 bus compatible modem with FCC certification for direct connection to the switched-telephone network. It operates at up to 300bps for long-distance use, and 600bps over local telephone systems. The MM-103 can automatically answer or originate calls; it includes a dialer. The MM-103 sells for $319.95 assembled (kits are not offered). POTOMAC MICRO-MAGIC, INC., Alexandria, Va.

FOR DATA CIRCLE 449 ON READER CARD ✱

VARIAN PAPER
VARIAN PRICES



Please order:

☐ Rolls ___ ☐ Fanfolds ___ Paper Number ___

To fit: ☐ Varian ☐ Versatec
☐ Texas Ins. ☐ Rapicom
☐ (Other) _____

Annual usage _____ rolls.

☐ Please have salesman call me.

Name _____
Phone _____
Firm _____
Address _____
City _____
State _____ Zip _____

GRAPHIC CONTROLS
COATED PRODUCTS DIVISION

Mail to Coated Products Division
Graphic Controls Corporation
P.O. Box 1309, Buffalo, New York 14240

CIRCLE 31 ON READER CARD

Think Ontel

It's Intelligent

Toren/Gaynor

Buying intelligent terminals?
Then you should be thinking about Ontel! It's the intelligent thing to do.

First of all, we know that extensive software is vital to our OEM users and new Ontel software is continually being introduced. Because of this our users are able to reduce their development costs in a multitude of application areas.

High level languages, forms generation, word processing, text editing and complete utilities and diagnostics, all running under Ontel's disk or diskette operating systems, complete the comprehensive set of sophisticated software packages now available for the OEM market.

Our hardware is truly outstanding. The OP-1 user programmable intelligent terminal series has been carefully planned and engineered as a complete systems family able to fulfill and complement your design specifications. All OP-1 terminals have been designed to make possible on-site feature enhancements. A full range of peripheral controllers is available providing communications, mass storage and printer interfaces. Master processors, coupled with secondary processors, provide unique distributed computing capabilities.

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Edward J. Heinze
Vice President Domestic Sales

Ontel Corporation
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(516) 364-2121

CIRCLE 105 ON READER CARD

Our new line of 80-column, dot-matrix line printers – the Anadex DP-8000 Series – combines high performance and operating convenience with a price that's causing OEM's to take a closer look.

Looking for Performance?

All models feature a precision engineered, continuous duty printer mechanism that can print the complete 96 ASCII character set, bi-directionally, at 64 LPM actual throughput. And three lines of internal FIFO buffer storage (optionally, 2K character FIFO buffer for CRT dump, etc.) allow faster external system operation.

A 9 x 7 character font provides virtually half-dot resolution for superior print quality.

For flexible interfacing, the DP-8000 is available with three standard interfaces: EIA-RS232C, with selectable BAUD rates up to 9600 BAUD, Current Loop, or Parallel Bit, Serial Character.

Precise positioning of single or multiple-part paper is ensured by sprocket-feed paper advance, user-programmable Top of Form Control, and up to 8 Vertical Tabs.

Looking for Convenience?

For operating ease, the DP-8000 Series accepts paper through the rear or bottom of the unit, provides programmable Skip Over Perforation control, and Out of Paper indication and signal.

Looking for Low Cost?

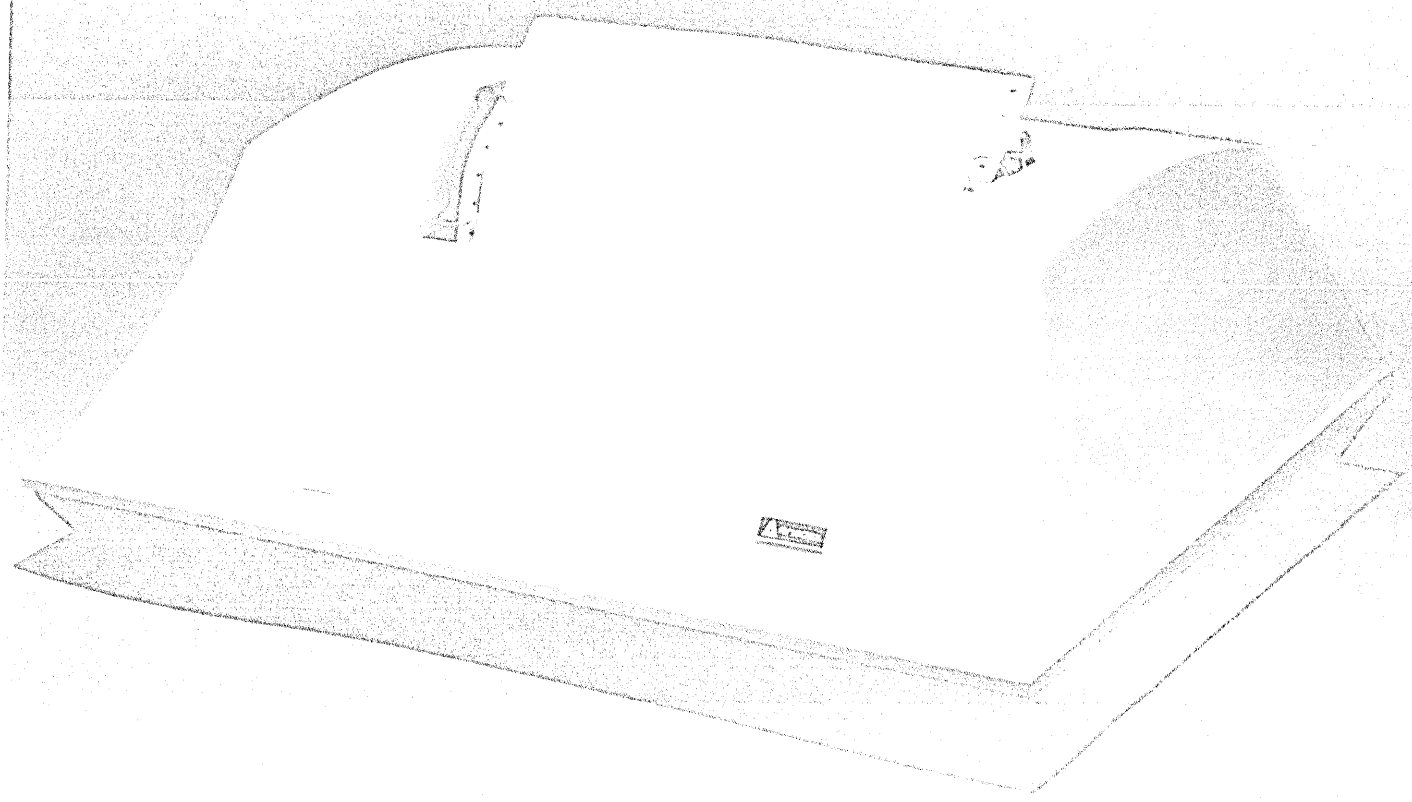
The best news is the price. A complete DP-8000, including case, is priced under $600 in OEM quantities.

Printer Price/Performance never looked better.

Once you've examined the specifications and seen the printer in operation, we think you'll agree, "Printer Price/Performance never looked better."

For complete details, contact: DP-8000 Marketing Dept., Anadex, Inc., 9825 DeSoto Ave., Chatsworth, CA 91311. Phone (213) 998-8010. TWX 910-494-2761.

Anadex



CIRCLE 200 ON READER CARD

SOFTWARE AND SERVICES

UPDATES

What's in a name? In the case of a product listed in December's software package ratings, it was confusion. The statistical program SPSS/C from Carleton College in Minnesota, was identified as being for Xerox Sigma computers. Instead it's for DEC PDP-11s.

The Sigma SPSS actually comes from Carleton Univ. in Ottawa. Information on it is available from Kathy Reasbeck (613)231-6770.

Meanwhile, the Carleton College operation has since become a division of SPSS, Inc. and changed the name of its product to just plain SPSS. Information on PDP-11 versions is available from Bonnie Labosky (507)645-9357.

The National Criminal Justice Reference Service (NCJRS), an arm of LEAA, has installed a computerized system to produce two publications. Software known as SAMANTHA (System for the Automated MANagement of Text from a Hierarchical Arrangement) will be used by NCJRS to produce the Selective Notification of Information (SNI) and the Document Retrieval Index (DRI). SNI, a set of biweekly announcements, describes recently released documents pertaining to criminal justice; DRI classifies documents in the NCJRS clearinghouse on a semiannual basis.

San Diego's Digital Scientific Corp., makers of the Meta 4/5000 small scale scientific computer, is beefing up its communications capabilities. New software, slated for release this month, will let the machines take on the personalities of a number of terminals: CDC UT200, IBM 2780, 3741, and 3780s. The minimaker wants to move into networks hosted by 360s, 370s, System/7s, System/32s, and Univac 1108s.

PROGRAMMING AID

The List Handling Facility (LHF) provides a programmer with the means to manipulate tables of data in main memory. The operating system independent package occupies less than 2KB on 360s and 370s, and its functions can be invoked by applications written in any language supporting the standard CALL facility. LHF includes add, delete, and update functions for manipulating records within the table. An ARRANGE function sorts the data in a specified order, in place. Retrieval functions include FIND (retrieve by key), GENERIC (retrieve by partial key), FINDLOW and FINDHIGH (get the record with the lowest or highest key value), FINDNEXT, FINDLAST (get the previous record), FINDREAL (retrieve the nth record in the table), and FINDSKIP (return the record n positions in front of or be- hind a given key position). Records may be up to 4KB in length, and keys can be as long as 256 bytes; LHF can access more than one table if need be. LHF leases for $300 for one year, $750 for three, and $1,200 in perpetuity. Maintenance after the first year is $50 per year. JEFF WAGNER, Fort Washington, Penn.

FOR DATA CIRCLE 420 ON READER CARD

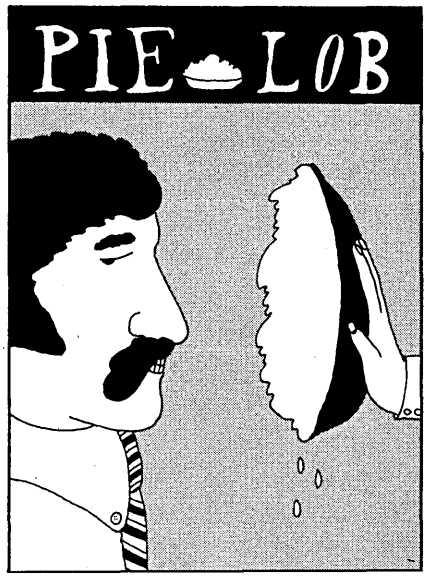
MODELING AND SIMULATION

Dynamo, modeling and simulation system developed at MIT's Sloane Business School 20 years ago, now runs on DEC's low-end members of the PDP-11 family. Mini-Dynamo, as it is known, runs under RT-11 on PDP-11V03, MINC, and LSI-11 systems having at least 24K words of memory. In the early days at MIT, Jay Forrester (recently of *Limits to Growth* fame) used Dynamo for industrial dynamics simulations; this vendor sees availability on microcomputers as a way to bring the package into classrooms, small businesses, engineering groups, and other environments that can't support expensive hardware. Distributed on 8-inch diskettes, Mini-Dynamo carries a price of $2,500; educational institutions can get it for $1,000. PUGH-ROBERTS ASSOCIATES, INC., Cambridge, Mass.

FOR DATA CIRCLE 422 ON READER CARD

FUN AND GAMES

Here's a source for inexpensive games to play with your personal computer. For those owning an Exidy Sorcerer, there's a game tape containing the ubiquitous LEM (lunar lander) and five other games. In Nuclear Reaction, two alternately bombard an atom with protons and electrons, eagerly awaiting the time when it reaches critical mass. Pie Lob is a good, old-fashioned custard pie fight. The three other games on the cassette are Bounce, Checkers (novice level), and Dodgem. Dodgem also appears on a tape for Ohio Scientif-



ic's Superboard II and Challenger IP. The tape also includes Tank Attack, Free-for-all (pitting an airplane, a submarine, and a destroyer against each other), and Hidden Maze. Both tapes come with instructions. Either sells for $7.95 (plus 75¢ postage). Dealer discounts are offered. CREATIVE COMPUTING SOFTWARE, Morristown, N.J.

FOR DATA CIRCLE 421 ON READER CARD

TIMESHARING LANGUAGE

This vendor has brought up its Datashare Business Timesharing System on its small-scale 1800 processor. The system allows up to four concurrent users to run the same or different programs. Each program can use up to 32KB of virtual memory and can access random, sequential, or ISAM files. Files conform to the vendor's standardized structure and can be used by programs written in other languages. A data entry and validation package, DSGEN, can be used to create data entry applications. Under Datashare, 1800 processors can participate in the vendor's At-

asi/inquiry

The IMS DB/DC QUERY LANGUAGE

USED BY MORE IMS INSTALLATIONS THAN ANY COMPETING PRODUCT

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

MAJOR HIGHLIGHTS

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

Additional features and functions include:

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

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

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tached Resource Computer (ARC) systems; in this mode, the 1800's diskettes aren't used (the system accesses files maintained by another processor within the ARC system). Existing 1800 installations can get Datashare for the cost of media; a bundled, four-user 1800 Datashare system sells for $18,750. DATAPOINT CORP., San Antonio, Texas.

FOR DATA CIRCLE 423 ON READER CARD

CICS DEVELOPMENT TOOL

CICS/MM is said to simplify development of on-line programs and to help produce programs that are easier to maintain. The package allows nonprogramming users to participate in system development by providing the means to develop display formats (for both input and output) interactively. CICS/MM reportedly eliminates the message mapping and editing parts of on-line programs. Input data are preedited before the data are passed to the applications program. An "echo test" capability allows checking out new formats and editing rules as soon as they are entered. The package produces printed descriptions of all new data formats and corresponding source code for use in PL/1, COBOL, or assembler applications programs. Display formatting, input editing, and error processing are performed in the package's reentrant 36KB nucleus, removing the need for the application program to do so. This also cuts the demand for dynamic areas and system services. CICS/MM carries a purchase price of $14,000; one-, two-, and three-year plans carry monthly charges of $510, $450, and $390, respectively. A variety of discount plans are offered to educational institutions and multiple installations. TURNKEY SYSTEMS INC., Norwalk, Conn.

FOR DATA CIRCLE 425 ON READER CARD

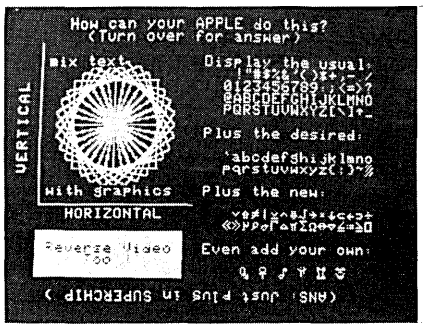
BUSINESS APPLICATIONS

Intended for commercial oem's selling systems based on Datasystems 308 and 310, the Digital Integrated Business System (DIBS) comprises five modules: accounts payable, accounts receivable, payroll, invoicing and inventory control, and general ledger. The vendor expects oem's to use DIBS as the basis of comprehensive systems. Oem's will be able to enhance, modify, and customize their systems with DIBS. The package includes management guides, system documentation, operating procedures, and other relevant information. DIBS goes for $10,000 per cpu; individual modules are $2,500. DIGITAL EQUIPMENT CORP., Maynard, Mass.

FOR DATA CIRCLE 426 ON READER CARD

TEXT PROCESSING

A combination of firmware and software for the popular Apple personal computer provides enhanced text processing and display capabilities. The Superchip, which plugs into the Apple without modification, provides the microcomputer with the full upper/lower case character set and 31 special characters not in the ASCII set. The chip is said to be compatible with existing Apple software, including Integer BASIC and Applesoft. Special character edit software, supplied on cassette, lets



the user define new characters. The software allows definition of entire character sets, such as foreign alphabets, musical notation, and game pieces. The Superchip sells for $99.95 and the character edit cassette goes for $24.95, plus shipping. ECLECTIC CORP., Dallas, Texas.

FOR DATA CIRCLE 427 ON READER CARD

BRAILLE OUTPUT

The Braille Utilities Field Developed Program can output an EBCDIC file in braille on specially equipped line printers. Running on a 370 under DOS/VS, OS/VS, or VM/370, the FDP can produce braille output on printers equipped with either brailling brackets or the braille feature. Brailling brackets, standard on 3203 printers and optional on 1403s, are supports that hold a resilient paper-backing strip, allowing braille embossing on standard, single-part paper. The braille feature, for 1403s and 3203s, consists of a braille embossing cartridge and a 10 line per inch line-spacing unit. The feature produces high-quality braille on 50- to 80-weight stock. The software attempts to save paper and printing time by deleting blank records and trailing blank record segments. It can be used by vision-impaired programmers; many IBM publications, available on print tapes, can be converted into braille using the FDP. The package carries a $130 per month license fee, which is waived after 12 months. INTERNATIONAL BUSINESS MACHINES CORP., White Plains, N.Y.

FOR DATA CIRCLE 429 ON READER CARD

LSI-11 OPERATING SYSTEM

Primarily for users wishing to develop applications for larger PDP-11s running RSX-11M, LSX-11M provides an RSX-11M environment on the less expensive LSI-11 processor. LSX-11M supports up to 28K words of memory, and all the peripherals supported by RSX-11M. RSX-11M executive functions and file operations not available under RSX-11S are provided by LSX-11M. Software developed under RSX-11M on larger processors will run on the LSI-11 under LSX-11M and, conversely, programs developed under LSX-11M will run on larger processors under RSX-11M. Programs can be written in Macro-11 or, optionally, FORTRAN IV. LSX-11M lists at $2,330, which includes media and documentation; the operating system is unsupported. PLESSEY PERIPHERAL SYSTEMS, Irvine, Calif.

FOR DATA CIRCLE 428 ON READER CARD

MICROPROCESSOR LANGUAGES

The software development package for this vendor's 16-bit 8086 microprocessor includes a high-level language, PL/M-86, an assembler, conversion aids, and loaders. Written specifically for the 8086, PL/M-86 is a block-structured language capable of supporting the key hardware features of the microprocessor; it is said programs written in PL/M-80 (for the earlier 8080 and 8085) generally will compile on the 8086 without change. The assembler, ASM86, is said to perform extensive type checking. Context-dependent translation

SOFTWARE SPOTLIGHT

BANKING DEMOGRAPHICS

The Mark/Tract System can help the marketing departments of banks and financial institutions analyze their performance and plan for potential market development. The system sorts a bank individual account data, classifying each by standard metropolitan statistical areas (SMSA), city, community, census tract, block, and date. Once sorted, data can be analyzed on a household basis, according to such factors as home value, length of residency, and other socioeconomic indicators. The package provides a market overview, including distribution of accounts and household activities, accounts and services used by each household and, given banking industry data, a variety of comparisons between a customer's branch performance versus those of competitors. The system allows a bank to set goals and monitor performance. Offered as a service on the vendor's Amdahl mainframe, the Mark/Tract System has a $1,000 up-front charge, and additional charges based on the number of accounts processed. It's estimated that the bill for an institution with 30,000 to 50,000 accounts would be between $3,000 and $4,500 (more if the bank's account files required substantial massaging). DATA MARKETING, INC., Santa Clara, Calif.

FOR DATA CIRCLE 424 ON READER CARD

REPORT 4 — CASH RECEIPTS REPORT BY ADMINSTRATOR — JANUARY 15,1979

ADMIN	CACC#	CUSTOMER NAME	INV. #	CHECK-REF	TRANSDATE	CASHAMNT	DISCAMNT	ACCT. RECVBLE	A/R #
3	6089	Tri-State Computer Corp.	22528	2375	09 DEC 77	3630.00	0.00	3630.00	1420
3	6089	Tri-State Computer Corp.	22529	2375	09 DEC 77	1086.50	0.00	1086.50	1420
3	6089	Tri-State Computer Corp.	22530	2375	09 DEC 77	1139.50	0.00	1139.50	1420
	***					5856.00	0.00	5856.00	
3	6094	Tri-State Computer Services	25765	145	09 DEC 77	3490.23	0.00	3490.23	1420
3	6094	Tri-State Computer Services	25765	145	09 DEC 77	0.00	33.77	33.77	1420
3	6094	Tri-State Computer Services	22531	145	09 DEC 77	125.35	0.00	125.35	1420
3	6094	Tri-State Computer Services	28342	4432	20 DEC 77	3490.23	0.00	3490.23	1420
3	6094	Tri-State Computer Services	28342	4432	20 DEC 77	0.00	33.77	33.77	1420
	***					7103.81	67.54	7173.35	
3	6108	State Electric Company	24107	771700	28 NOV 77	608.60	0.00	608.60	1420
3	6108	State Electric Company	257674	771700	28 NOV 77	1161.35	0.00	1161.35	1430

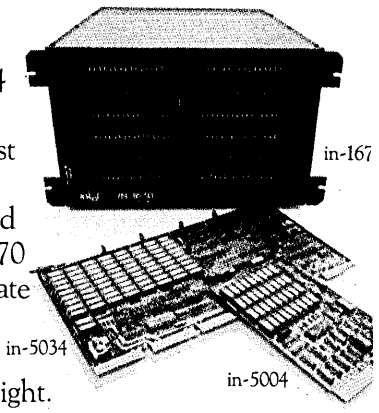
Introducing in-5004, Intel's new add-in memory for LSI-11, LSI-11/2 and PDP®11/03 computers. It's the two-wide board for system designers who demand the same performance, flexibility and economy from their memory as they do from their CPU. Best of all, we're delivering in-5004 now.

Intel memory systems give you the uncompromising quality and reliability you'd expect from the world's largest manufacturer of MOS memory. Like all our systems, in-5004 is thoroughly tested at both component and board levels and is backed by a full one year warranty.

Intel's in-5004 means flexible design, too. It's available in 8K, 16K, 24K and 32K x 16 bit versions, so you can match it to a full range of applications. To ensure compatibility with your present system, the starting address is switch selectable from 0-32K in 4K increments. And since you can set the upper address limit at 28K, 30K, 31K or 32K, available memory space is maximized. Use in-5004 with standard on-board refresh or select external refresh.

We designed in-5004 for future flexibility, too. To make upgrades easy, addressability is expandable to 128K. For designs requiring byte parity, in-5004 is available in an optional 18 bit configuration.

Intel ships more DEC memory than any independent. Now in-5004 is in local dealer stock, priced to keep system cost low. Our in-5034 for PDP-11/04 and 11/34 and our in-1670 for PDP-11/70 are available for immediate delivery, too. To order, phone your local Intel representative, listed at right. Or, for more information, call us at (408) 734-8102 or write Intel Corporation, 1302 N. Mathilda Avenue, Sunnyvale, CA 94086.



intel® delivers.

Intel delivers the new LSI-11 memory for engineers who just won't compromise.

CIRCLE 34 ON READER CARD

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Intel Representatives

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ARIZONA
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Phoenix
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BFA Corp*
Scottsdale
(602) 994-5400

CALIFORNIA
MAC-1*
Berkeley
(415) 843-7625

MAC-1*
Cupertino
(408) 257-9880

MAC-1*
Fountain Valley
(714) 839-3341

Earle Assoc.
San Diego
(714) 278-5441

Intel Co.
Santa Ana
(714) 835-9642

Intel Corp.
Sherman Oaks
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Intel Corp.
Sunnyvale
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MAC-1*
Woodland Hills
(213) 347-5900

COLORADO
Intel Corp.
Denver
(303) 758-8086

Mountaintek
Evergreen
(303) 674-5255

CONNECTICUT
Intel Corp.
Danbury
(203) 792-8366

FLORIDA
Pen-Tech Assoc*
Deerfield Beach
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Intel Corp.
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GEORGIA
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Oakbrook
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INDIANA
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Indianapolis
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IOWA
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Glen White Assoc.
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Intel Corp.
Timonium
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SOFTWARE AND SERVICES

allows the same mnemonic to map onto different machine instructions, depending on the data types of the operands. The new assembler is not directly compatible with 8080/8085 assembler, so a conversion program, CONV86, is provided to help move source programs from the 8-bit micros to the 16-bitter. The software development package, known as MDS-311, runs on Intellec 800 or Series II Microcomputer Development Systems, and carries a price tag of $3,400. The price includes manuals and one year of updates. INTEL CORP., Santa Clara, Calif.

FOR DATA CIRCLE 430 ON READER CARD

STATISTICS

IDA, the Interactive Data Analysis system, allows PDP-11 users to maintain data bases of statistical information and perform analyses of the data. Although an IDA data base theoretically is limited by available disk space, execution times dictate that data bases be smaller than a few thousand subjects or records, with a few hundred data items per record. Users can define their own data names; a query facility allows users to search the data base to locate records satisfying logical or arithmetic relationships between data items. IDA can calculate means, standard deviations and ranges, and it can perform linear regressions. Users can interface their own specialized FORTRAN applications programs to IDA. Output data can be displayed as lists, tables, graphs, or histograms. Support is included for Tektronix 4000-series graphics terminals, as well as dumb terminals. Capable of running under RT-11, RSX-11M, RSX-11D, and IAS, IDA can be used on anything from a 28Kword PDP-11/03 up to an 11/70 system. The package has a price of $2,500 (Canadian) and discounts are offered to nonprofit institutions. MC GILL UNIV., Biomedical Engineering Unit, Faculty of Medicine, Montreal, Quebec, Canada.

FOR DATA CIRCLE 431 ON READER CARD

COBOL DEBUGGER

For use with the Roscoe on-line development system, COBOL/ADE provides a debugging environment for COBOL programming. The system has three parts. During the specification phase, the programmer prepares debugging specifications. Then the program is run in batch under the execution phase. Finally, the debugger's output is given to the programmer during the analysis phase. The system can trace logic at the verb level and it provides dynamic analysis of nested PERFORM logic, including unresolved exits. Users can set specific, categorical, or conditional breakpoints. COBOL/ADE also gives program run statistics, including a paragraph-by-paragraph execution count, and cpu time elapsed between selected events. COBOL/ADE carries a permanent license fee of $5,000, or it can be licensed for $275 per month. APPLIED DATA RESEARCH, INC., Princeton, N.J.

FOR DATA CIRCLE 432 ON READER CARD

JOB ACCOUNTING SYSTEM

This IBM systems software vendor has acquired the JASPER job accounting system from Datachron Corp., adding enhancements, and renamed the product CA—JASPER+. The job acounting system for DOS and DOS/VS installations supports POWER/VS and a range of other existing accounting facilities. The package includes Wizard, a report generator that allows users to define their own daily and summary reports. Embedded CICS support allows CA-JASPER+ to process CICS accounting data generated by IBM's Performance Analyzer II facility. The package also captures computer utilization statistics not provided by POWER/VS. A full costing system, covering daily and historical data, provides both batch and CICS billing, summary charging, and cost allocation. CA-JASPER+ carries a purchase price of $6,000. COMPUTER ASSOCIATES, New York, N.Y.

FOR DATA CIRCLE 433 ON READER CARD

PROGRAM DEVELOPMENT TOOL

Based on WYLBUR, Interact (once known as Mentext) is an interactive system for program development and word processing. The package's developers were acquired by this firm late last year, and the package's name was changed so as not to imply that the package is only a text editor. Interact provides full-screen editing with split screen capabilities, so programmers can use part of the screen to display a program's output, while editing the source code on the remainder of the screen. Remote job submission, retrieval, and job control are possible under Interact. An interpretive programming language, said to resemble BASIC, allows users to write editing procedures. Users can write procedures to generate JCL prior to job submission. Program generation can be simplified using Interact's programming language; for instance, a user can write a procedure to quickly generate IDENTIFICATION, ENVIRONMENT, and DATA divisions. Included with Interact are a number of EXEC files, for such functions as letter generation and mailing list maintenance. Interact is said to run on any 360 or 370 running OS; a DOS version is in the works. The package supports 3270, 2741, and Teletype-compatible terminals. A license to use Interact goes for $25,000. CULLINANE CORP., Wellesley, Mass.

FOR DATA CIRCLE 319 ON READER CARD

COLOR GRAPHICS EDITOR

Pedit, for Intelligent Systems Corp.'s Intecolor graphics terminals, provides capa-

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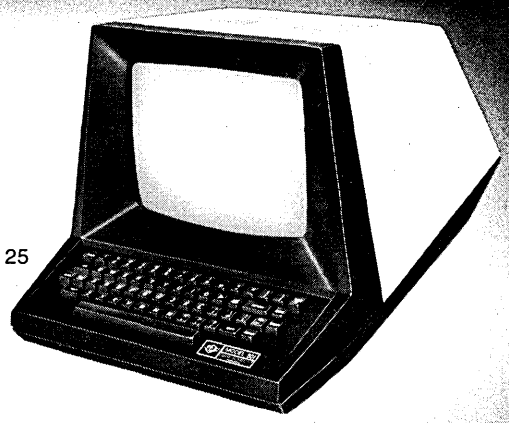

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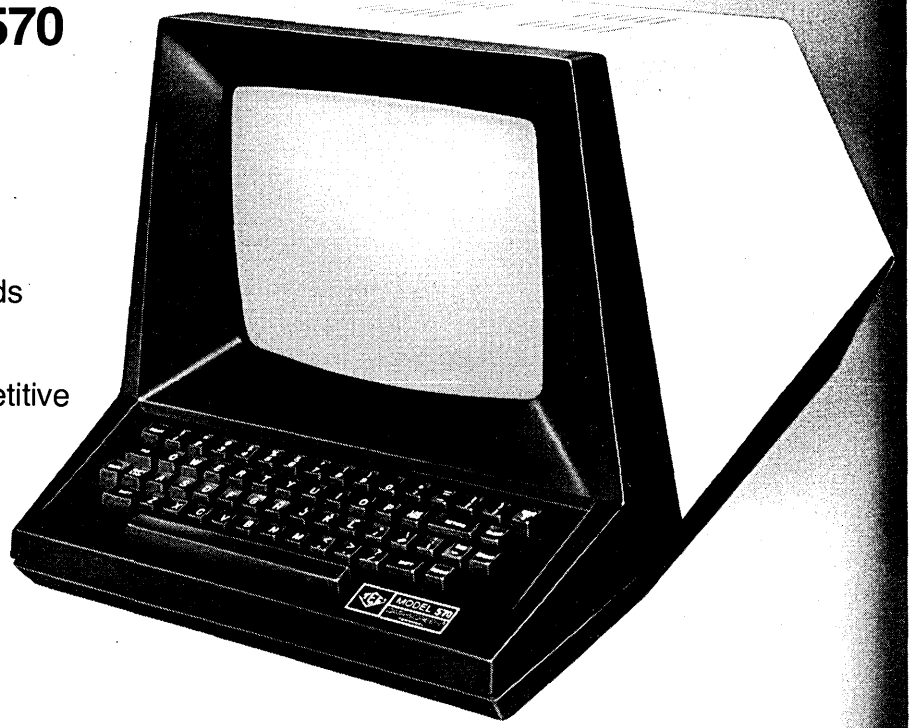

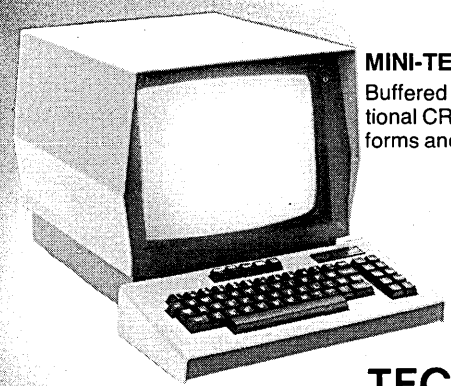

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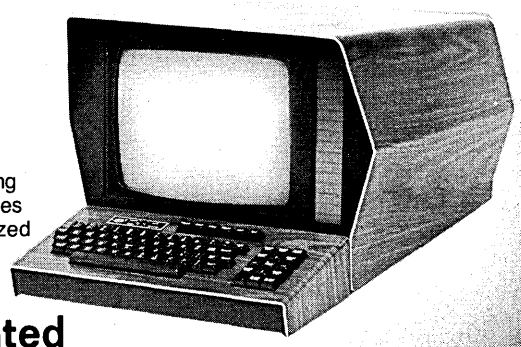

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CIRCLE 124 ON READER CARD

SOFTWARE AND SERVICES

bilities for creating and editing color graphic displays. Pedit relies heavily on the smart terminal's function keys, so users don't need programming experience. Users can draw lines or rectangles, entering the coordinates of endpoints or vetices via cursor position, light pen, or keyboard input of X and Y coordinates. Pedit can generate a "rubber band" line with one endpoint fixed and the other endpoint defined by the movable cursor; move the cursor and the line follows. Perhaps the most attractive of Pedit's capabilities is its symbol definition and recall function. As many as 100 symbols, consisting of any graphics or alphanumeric data ranging in size from one character position to a full screen, may be defined and later recalled by the user or host computer. One potential application cited by the vendor is defining a set of symbols to depict process control systems. Pedit is supplied in EPROM for $750. USDATA ENGINEERING, INC., Dallas, Texas.

FOR DATA CIRCLE 328 ON READER CARD

JOB SHOP CONTROL

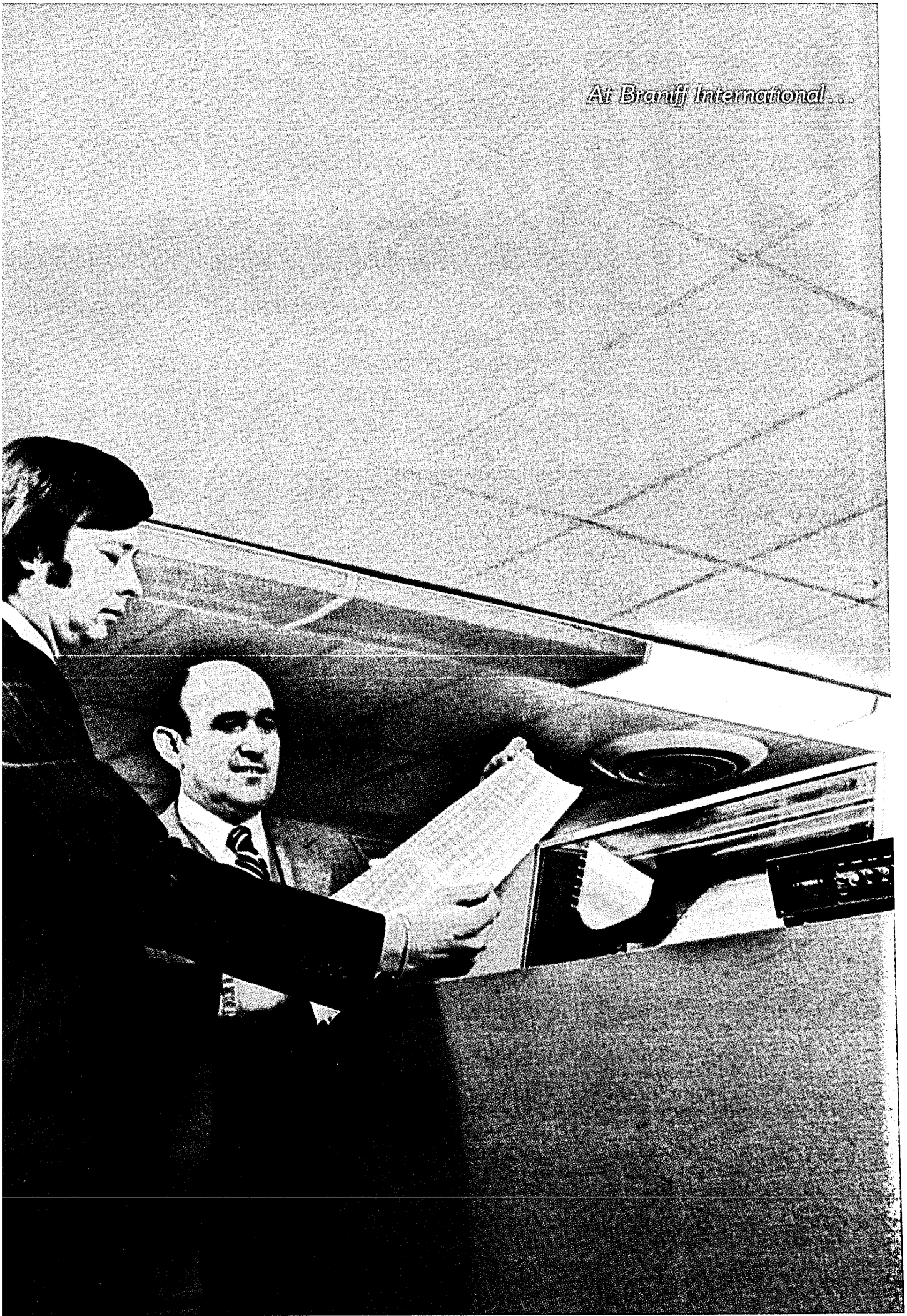
Designed for manufacturing and printing firms, the Job Shop Control System (JSCS) runs on this vendor's BC/7 small business systems having at least 48KB of main memory and 3MB of diskette storage. The package handles and processes data from the level of detailed employee productivity up to the general ledger level. The various modules of the system include job costing, labor efficiency, production control, purchasing (integrated with job costing), raw material inventory control, integrated payroll, sales analysis, accounts payable, accounts receivable, and general ledger. A small system without accounting goes for a license fee of $5,500, which includes 50 hours of installation support. A full-blown package and 100 hours of installation carries a license fee of $8,500. The package was developed by the DCD Corp. of Minneapolis. SPERRY UNIVAC, Blue Bell, Penn.

FOR DATA CIRCLE 326 ON READER CARD

DOCUMENTATION GENERATOR

Docgen can help users of Datapoint equipment generate documentation and specifications. A system of Datashare programs, Docgen acts as a front end to Datapoint's MSCRIBE and DSCRIBE word processing utilities. The system enforces documentation standards by leading the user through prompting to generate five documentation sections: overview narrative, equipment configuration, system and program flow diagrams, program user's guide, and file/record definitions. Additionally, Docgen automatically prepares an index of the document. Docgen is distributed in object form on diskette or cassette tape for $1,750. EFAX CORP., Elmhurst, Ill.

FOR DATA CIRCLE 327 ON READER CARD ✲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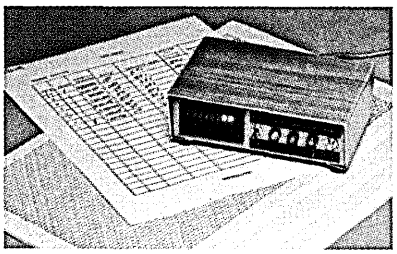
"He attached a device called a line counter that electronically counts each line of print. Then we ran both the IBM ribbon and my regular ribbon to exhaustion. And we found that the IBM ribbon printed 50% more lines.

"Of course, the IBM ribbon costs more — 25% more, to be exact. But with 50% longer life, it's worth it. I'm getting over 20% more lines for every ribbon dollar and my yearly savings are significant.

"As my rep told me beforehand, results may not always be that dramatic. But I'd sure recommend that any ribbon user give the test a try. It only takes a few hours, and the results could pay off in savings for years to come."

Most tests show savings

In another test, a manufacturing company compared IBM high-speed wide ribbons to another brand on their 1403 printer. Their results: the IBM ribbon gave over 40% more print life, at only a 20% higher price. That's 17% more lines for every ribbon dollar.



The same long-life fabrics and ink formulations used to manufacture high-speed wide ribbons are used in IBM narrow ribbons, providing similar long ribbon life for your other printers.

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This kind of ribbon performance must be built in at every manufacturing step. Ink ingredients, for example, are milled for at least five hours to reduce all solids to less than 5 microns. Abrasive content is held to low levels, to protect your valuable printers. Ink content of each ribbon is controlled by *both* weight and reflectance testing.

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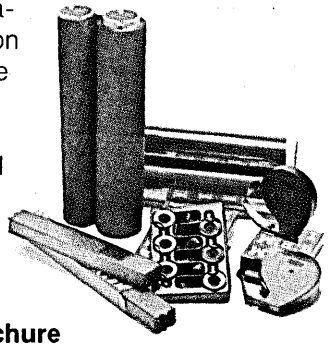

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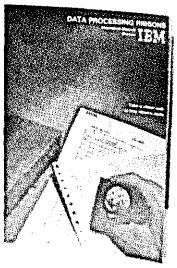

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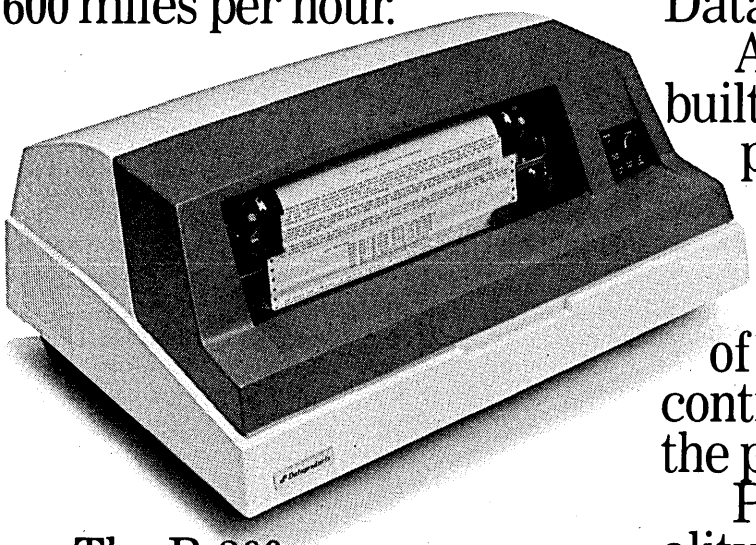

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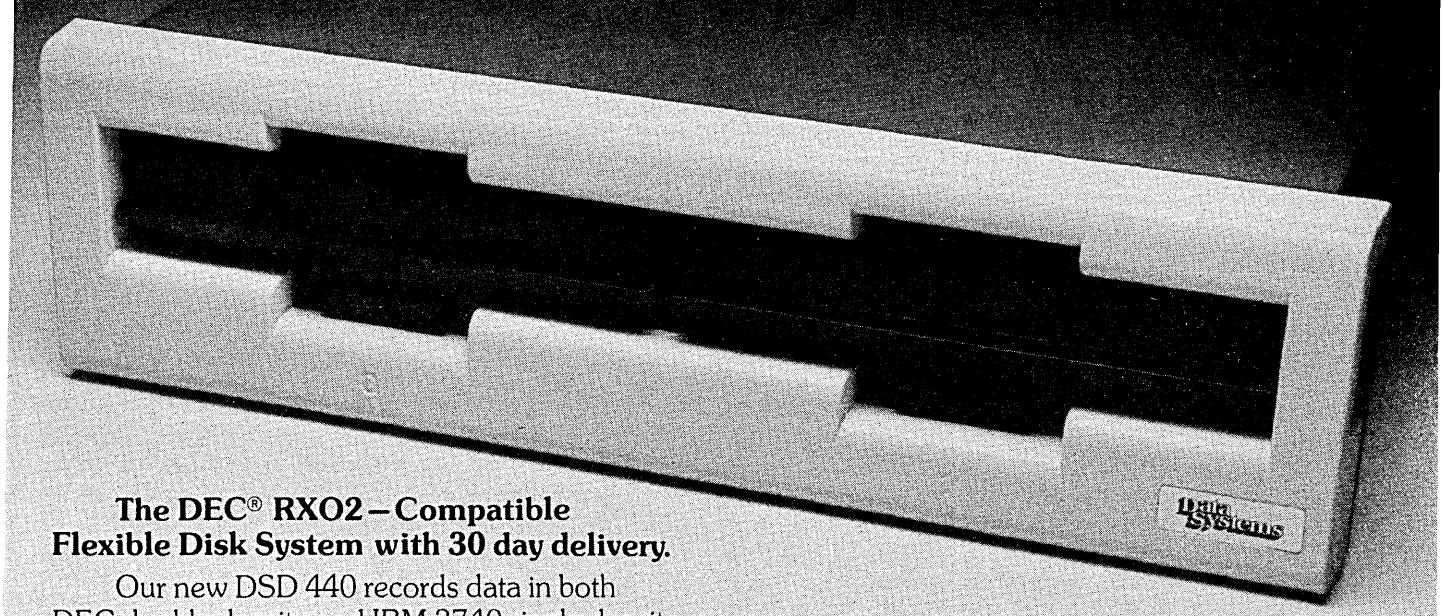

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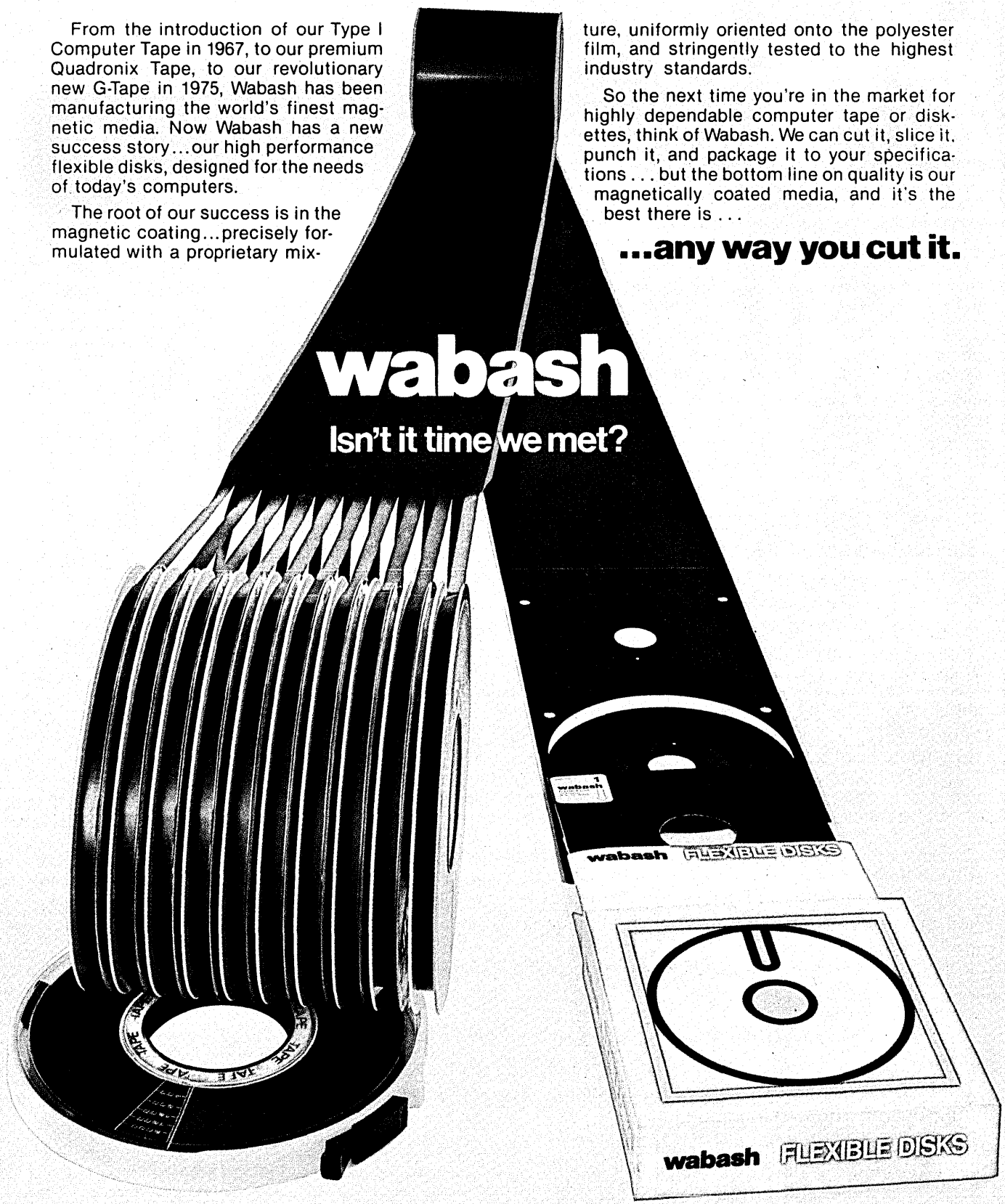

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CIRCLE 131 ON READER CARD

PERSONAL COMPUTING

A PIECE OF THE ACTION

by George Miller

Since the birth of personal computing, self-employment opportunities in the computer industry have mushroomed. As the new subindustry keeps unfolding, the growing need for products and services will support thousands of self-sustaining enterprises which once were viable only as sidelines or part-time vocations. Three growth areas are immediately identifiable: the market for do-it-yourself products for hobbyists; the market for turnkey systems for businesses grossing less than $500,000 annually; and the vast, untapped and as yet unknown market for home computers.

Not only is the business evolving toward wholly new sets of customers, it is also demanding wholly new kinds of products. Most application systems installed to date have been custom designed. The increased number of installations of such tailored products alone would constitute a respectable growth for the industry. But the vast new markets for packaged, plug-in systems for small business and domestic use will break the field wide open.

Many computer professionals will find opportunities for self-fulfillment—in expressing their creativity, growing professionally, and staying on top of technological developments—which their primary employment does not well provide for. There's another side of the coin, too. Not only does personal computing offer great promise for entrepreneurs; it can never realize its full potential without them.

Here are some of the most obvious opportunities:

Software: The development of personal computer markets will be controlled by the availability of off-the-shelf software that can be plugged in and used immediately with no installation, debugging, or support problems. Software will have to be taken for granted in the same way as any successful consumer product. There will be no place for user/vendor installation bouts as in the old days.

The software author can develop his product and either self-publish it or go through an established software publisher. The self-publishing route requires marketing and business skills which many programmers don't have. Often self-publishers take the marketing aspect too lightly and feel that their product should sell itself at the slightest exposure. The microcomputer software publisher is a new breed who works much the same as a book publisher. The author submits his work to the publisher for review and if the product is marketable, suitable for clean-up, minor alteration and documentation, a royalty contract can be arranged. The publisher can be anyone from a one-man bedroom shop running "SOFTWARE WANTED — 50% ROYALTY" ads, to a more established house paying smaller royalty percentages but with the marketing expertise to sell more programs. The capabilities and track record of the publisher should be investigated before giving up all rights to a product. The shoestring publisher who pays high royalty rates may only sell a handful of copies because of his limited marketing budget and limited ability to produce a high quality product in quantity. The larger, better financed publisher may pay only half of that 50%, yet might move ten, twenty, or fifty times as many copies.

Software publishing will offer excellent opportunities for small entrepreneurs with the financial and marketing resources to compete with the many large scale software publishers coming on the scene. Direct response marketing via trade magazine advertising and direct mail pieces are always open to any publisher with money. But certain channels such as rack merchandising of cassettes through retail computer stores and retail book stores could become locked up to all but the most reputable publishing houses. So direct response marketing for the little guy with a brilliant product idea may be his route to salvation.

With more complex and costly products, buyers will typically want a demonstration before making commitments, making the direct response approach impractical. But with simple low-cost products, pictures of sample outputs, input formats, and work flows laid out on an attractive mailing piece can be enough to start money-filled envelopes coming the publisher's way. And with moneyback guarantees or free 30-day trials, prospective buyers can feel very comfortable about buying through the mail.

The software author going through a publisher today will get more attention from the publisher than he will in the future when the market becomes saturated. So the time for an author to entrench himself with a publisher is now, because publishers in the future will be more likely to work with proven authors. In the book publishing world, thousands of manuscripts are mailed to publishing houses by aspiring writers hoping to connect with another "Jaws." The bulk of these is rejected. Here is where the smaller software publisher of the future may be able to carve a niche—by taking on the rejects. In book publishing, most rejects aren't necessarily substandard; they simply don't fit in with the publisher's present scheme of things or have enough potential market for the big volume publisher. It's likely that as personal computing software becomes a mass volume industry, similar publishing patterns will emerge.

Computer stores: The $100,000 front money, about minimum to properly start up a computer store or dealership today, may will be out of reach for the small entrepreneur. But since stores are the most common proven line of business related to personal computing, they deserve a few words. The number of stores nationwide is now beyond 500 and over the next few years may soar into the thousands. These outlets can be started either by dealer discount arrangements or by a franchise. A franchise requires an initial franchise fee and usually a royalty based on revenue. The franchisor in turn gives startup and operations training, a product inventory, advertising support, selling aids, and continuous assistance to make the operation successful. If the franchisor comes through with everything he promises, the arrangement can be lucrative for both sides. But if he merely rips off the franchisee for the initial fee and then lets him flounder, it can be a nightmare.

Whether a franchise is good or not depends largely on the expertise offered that the prospective franchisee doesn't already have. If he's a seasoned computer pro with good business skills and a financial pipeline, he might do as well on his

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own and save the franchise fee and royalties. If he's a technician with no business acumen, or a noncomputer type simply looking for a good business opportunity, then the franchise route may be wise.

Though the prepackaged hardware/software system may be a reality in the future, the successful computer store of today has to fill all the gaps between what software is available and what is needed. When the day comes that everything can be handed over the counter, the larger retail establishments, with their economies of scale, will make it difficult for the little guy in a storefront to compete. Where he can compete is with custom-designed systems. Hopefully, for the sake of the small dealer, there will always be some market for the more personalized, sophisticated systems.

Computer retailing consultants: The established, well-staffed retail computer store may not need third-party customer consultants, but some stores are staffed by people who know little more about selling and servicing than passing a do-it-yourself kit over the counter to a hobbyist and those stores will look for outside help. The consultant can help greatly by filling the gap between the raw hardware and what the customer wants out of it. The consultant takes responsibility for the software, implementation, operation and customer training of the system. It isn't a business that will make him rich on hourly or per diem pay rates, and he may eventually burn himself out doing it single-handedly, but it's a way for him to get started in the small systems business and develop some expertise and credentials for his own systems house later.

Peripherals: When the personal computer user starts attaching peripherals, his hardware costs multiply. An $895 processor with a printer, keyboard, and decent-sized floppies all of a sudden prices out at $8,895. Opportunities for developing low-cost peripherals abound. Broad interfacing capability should be a primary design consideration, so that no one ends up holding a lemon if any one manufacturer goes out of business. If I were going into hardware or software development today, I'd attack the TRS-80 and not even worry about anything else. It's not the only market, but you can be sure that Radio Shack isn't going out of business and they're creating a massive market for third-party hardware/software developers.

Systems houses: Some industry authorities feel that the future of the microcomputer-oriented systems house is doomed because of the eventual availability of totally packaged hardware and software. But for today's needs and today's problems, nothing is needed more than third-party systems design and implementation specialists to fill the gap between what is available and what is

needed. The complete hardware/software package to handle most user needs will remain a dream for another few years.

The personal computer, because of its low cost, makes the one-person basement-style systems house a viable enterprise. Minicomputer-based systems houses require more financing, larger staffs and facilities, and more credentials in the markets they're dealing with; for a few thousand dollars, the personal computer-related systems house can be off and running with the first system ready to demo or deliver.

Computer services (picking up the scraps): Small volume accounts, unattractive to larger service bureaus, can be serviced profitably by the low-overhead, garage-based personal computer shop. In some cases the smaller operation may even be able to compete with larger service bureaus by offering more timely service. When the customer isn't paying for high overhead, it's possible to throw in other services and still be price competitive.

Mail order computer services, such as general accounting for small businesses, home budgeting and financial reporting, can all be done profitably with a low-cost personal computer. With mail order products and services, marketing is always the largest single expense—sometimes 50% to 60% of the selling price. This makes it critical to keep all other costs in line in order to squeeze out a profit. With the low-cost personal computer, the chances to do this are much greater than with large equipment.

Data base services: The demand for specialized information in the business world is growing so rapidly that little service companies that build, maintain, and sell access to specialized data bases are cropping up nationwide. As more communications capability is developed for the personal computer, little data base suppliers could start popping up like weeds. The Information Industry Association, 4720 Montgomery Lane, Suite 904, Bethesda, MD 20014, is involved in the continuing progress and study of data base services.

Equipment maintenance: Most personal computer dealers have marginal field service capability, creating excellent opportunities for third-party field service engineers. A person with some hardware servicing experience can easily set himself up to handle service calls for local computer stores. The probability of earning a lucrative full-time income today may still be small in many localities, but where personal computer users can live with 24-hour turnaround to fix a broken device, it is quite feasible to moonlight.

Computer laundromats: This can be a sideline business for dealers, systems houses, or service bureaus. A part of a facility can be partitioned off and stocked with personal computers for local customers' use on an hourly basis. Software can be supplied from a library of standard applications. Paper and other supplies, and an array of custom programming and consulting services can also be offered. It's a good way to go for the customer who can't quite justify his own system. When he is ready, he can buy a system from the dealer just like the one he's been using.

Publishing: The potential number of personal computing enthusiasts far surpasses that of the few hundred thousand computer professionals. New books, reports, newsletters, directories, manuals, magazines, and training materials covering specialized areas of interest within this massive industry are launched daily. Some come from large publishing houses and others from small publishers with an intimate knowledge in a specialized area. Newsletters for users of specific hardware such as the TRS-80 or Apple, buy/sell exchange newsletters for the masses of personal computing fanatics who are craving to communicate with each other, directories of stores, clubs and personal computing users, programming manuals, and how-to-do-it cassette courses are just a small sample of the unlimited publishing opportunities available within the personal computing field.

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RULES FOR SUCCESS

All of the businesses described in the accompanying article make sense, but not everyone can succeed at all of them. The first rule to go by is *Capitalize on your background.* You'll be less dependent on others to develop and run your business. When the chips are down and you can't afford to pay employees for their services, you're one step closer to boarding up the doors if you can't do it all yourself. Delegate responsibilities to others if you can, but rest secure in the knowledge that you can always revert to a one-person operation if you must. The computer salesman who tries to be a systems consultant or the top-speed programmer who fails at marketing his own software products are just two examples of the thousands of misfit situations that have caused so many little computer companies to hit the skids in past years.

Don't be overwhelmed by the computer industry. You don't need a piece of everything. Specialize. The more unique your niche, the harder it will be for others to compete with you. If possible, put something personal into your product or service that no other competitor has. And whatever you do, do it well.

Try to build vehicles. The consultant, contract programmer, or other freelancer with a flow of jobs at $50 an hour is in great shape. But get sick, lazy or old and the troubles begin. Vehicles are things that work for you when you aren't able to, such as patents and copyrights. You own and control these vehicles and do not need to be personally involved with every dollar of revenue they generate. In personal computing it could be a software product, component part, peripheral device, or complete system—something with which to expand your business as far as the vehicle can run, not merely as far as you can run.

Be sure there's a viable market for your product and not just the product concept. One missing competitive feature can put you out of business. Do your market research before the kick-off.

Don't assume that your idea is already in use. Here is where most potentially great product or service ideas die—at the action stage. Brilliant people come up with great ideas and then sit on them. Marketable software programs lie around in drawers collecting dust, yet mediocre programs become big money-makers for the action people.

Keep overhead to a minimum. Pour whatever you've got into R & D, marketing, and other expenses directly connected to revenue production. Also build a file of reliable freelancers instead of being in too much of a hurry to load up your payroll. For the eventual privilege of sitting in the cart, you must be the horse in the beginning stages of your business.

Build pipelines for capital. As a sideline project to your business, get into your banking community. Start obtaining small loans for say $1,000, and pay them off quickly, building your reputation as a good risk for larger loans later.

Develop a marketing consciousness. Many functions are needed to make your business succeed, but in today's media-bombarded world, marketing becomes more and more the single most important ingredient of success.

Specialized mailing lists: The personal computing field keeps segmenting itself into specialized user groups, with a number of different vendor and product interests. The person who can accumulate a few thousand specialized names—such as small business owners who've shown a serious interest in buying computers, users of specific hardware or software applications, clubs and stores—and determine who is trying to reach these markets, can develop a steady business by renting out his lists. These lists can be run on the list vendor's own personal computer or at a local service bureau for roughly $5 per thousand, and be rented out for $30 to $60 per thousand.

Taking a small startup business beyond the hand-to-mouth stage requires a combination of skills and a massive effort; but if the personal computing industry is ever to develop to its full potential, it will be because of the growing force of entrepreneurs who are willing to do whatever it takes to make things happen. The club membership of wealthy and successful innovators of this industry remains open to those who are willing to pay the price. ✱

GEORGE MILLER

Mr. Miller spent 12 years in dp marketing and management prior to forming Datasearch Inc., an industry research/publishing company, in 1977. He is the editor/publisher of *Computer Opportunities*, a monthly newsletter for entrepreneurs, "EDP Marketing Update" looseleaf service, and has authored several career guides.

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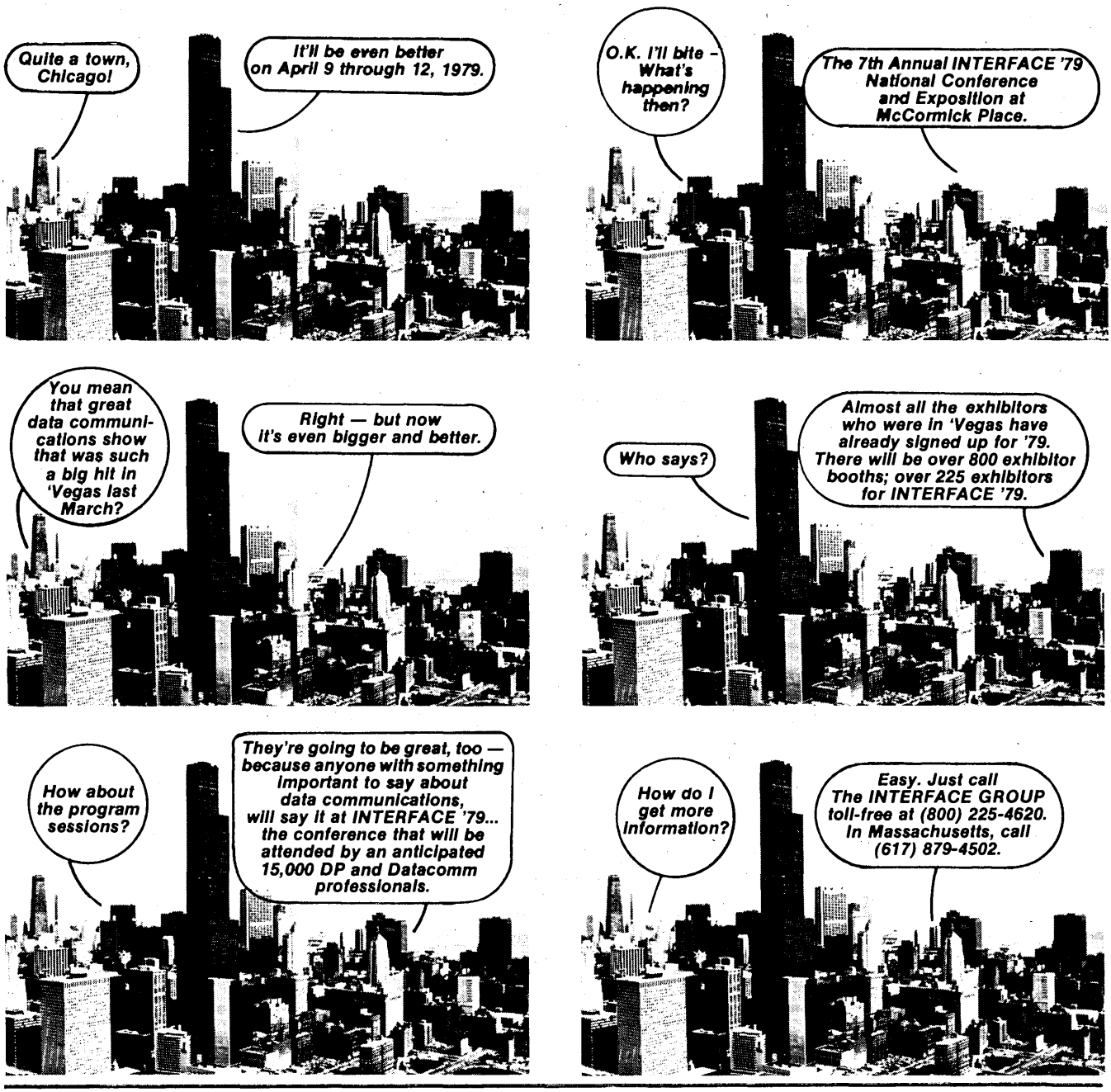

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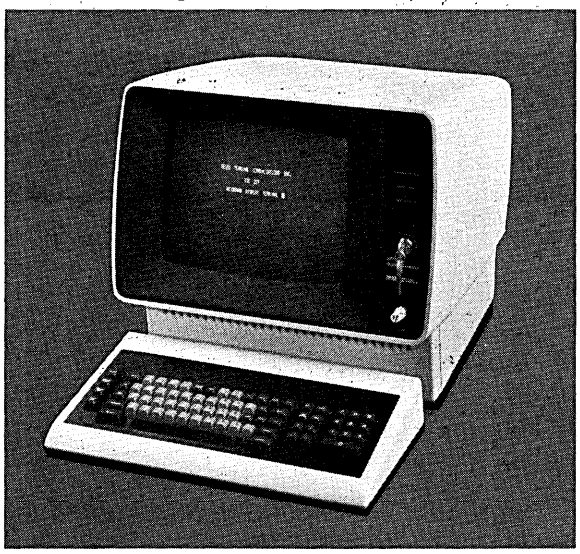

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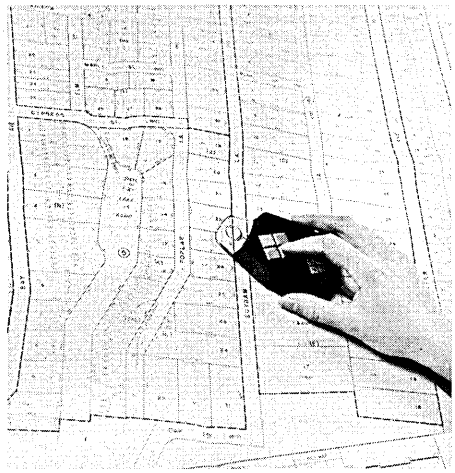

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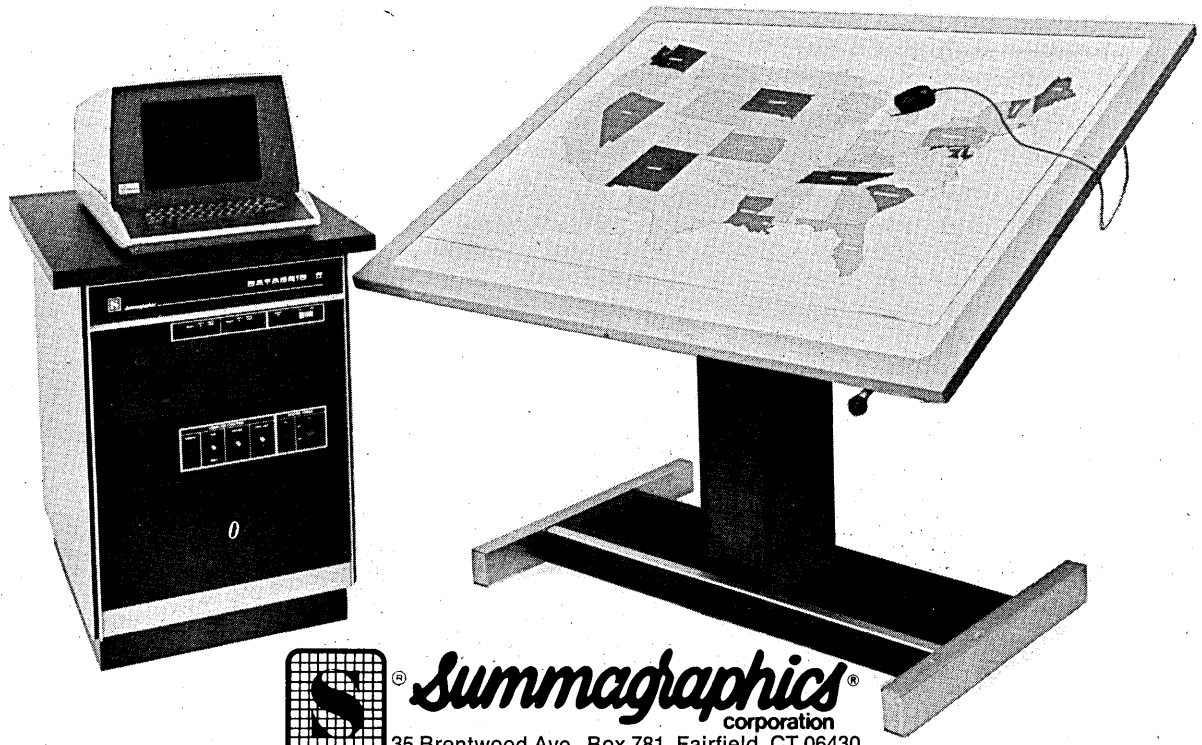

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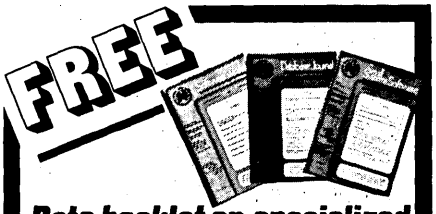

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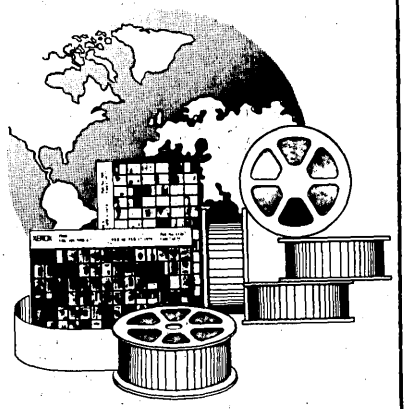

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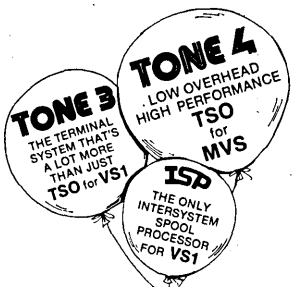

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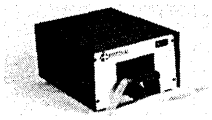

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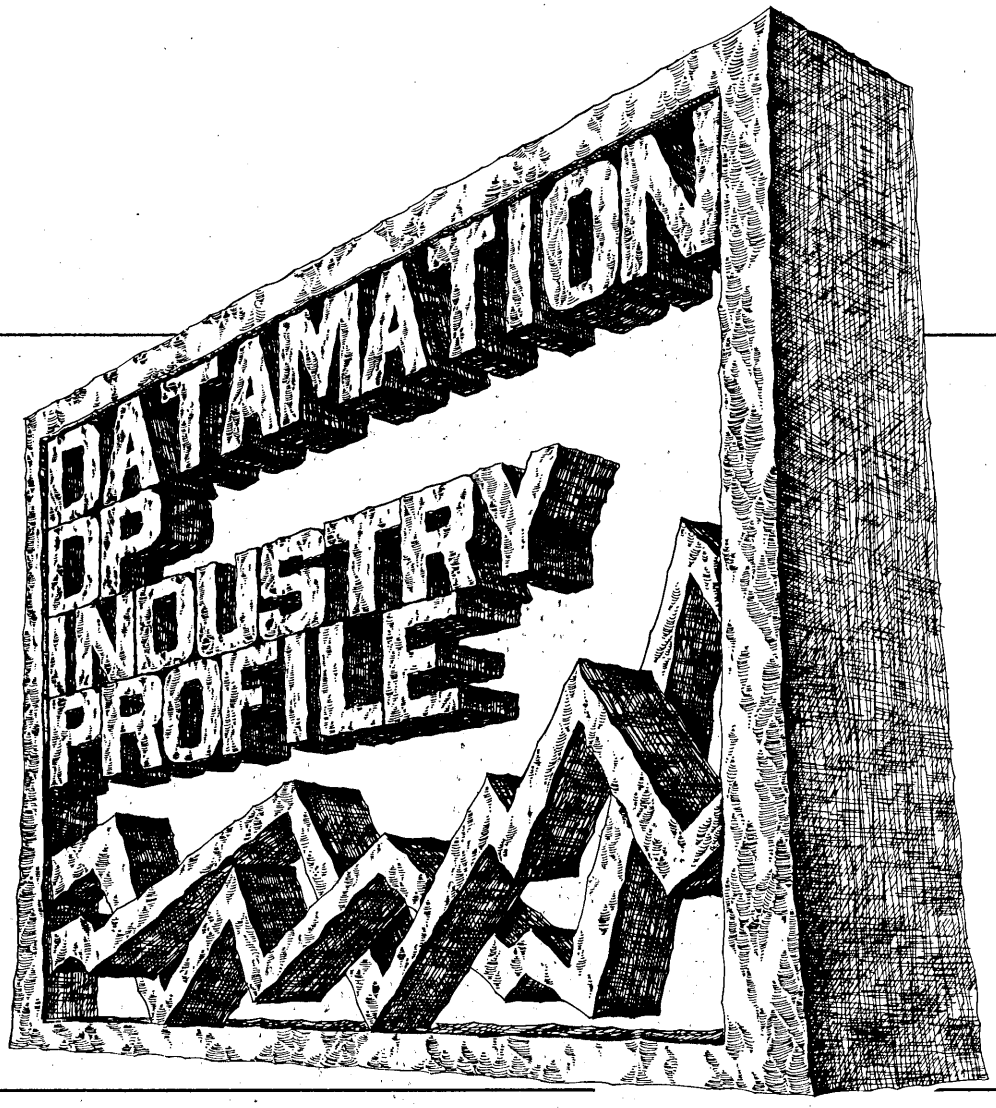

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SOURCE DATA

BOOKS

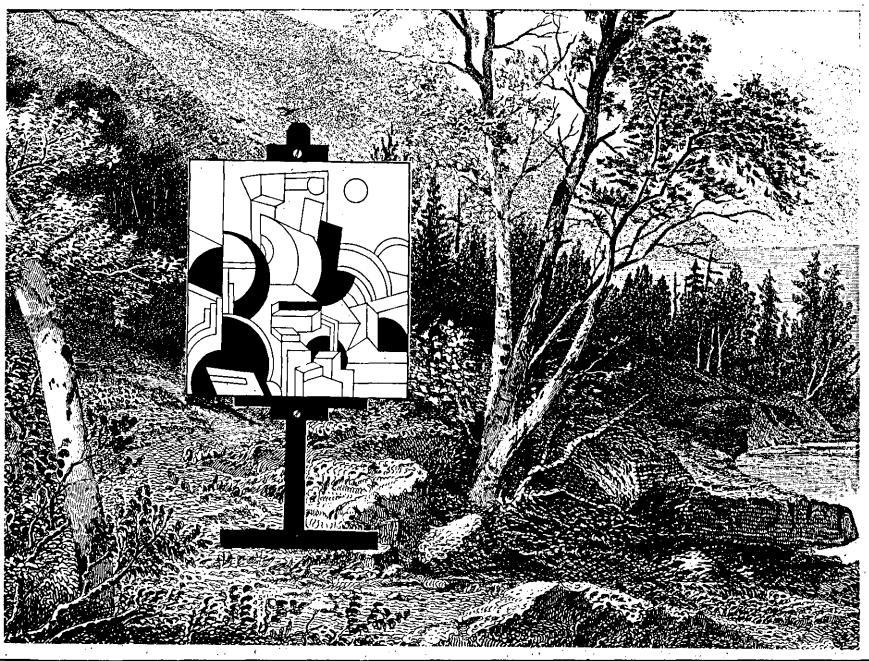
STRUCTURED ANALYSIS AND SYSTEM SPECIFICATION
by Tom De Marco

A few years ago, Ed Yourdon and Larry Constantine authored a book entitled *Structured Design.* Much of the book dealt with concepts previously published by Stevens, Myers and Constantine. Since then, the concepts of structured design have been refined and extended to address issues in the problem definition phase. This extension of the methodology is called structured analysis. This brings us to the subject of this book which is, simply, how to model a problem in a methodical way (structure it) and refine it in such a way as to ease the transition to a quality design.

De Marco has created the most succinct and highly palatable discussion of the notation and concepts associated with structured analysis (and design) seen by this reviewer. It is an easily read description of this methodology, its basics, and its subtle nuances. It provides information of value to both the novice and the expert. The discussion is from a how-to perspective. Practical problems with the notation and the methods are addressed together with practical, workable solutions. The author does not imply that this or that is the only or best way, but that each has some imperfection. This is not a parochial treatment of the subject. References to other works and authors appear throughout.

Perhaps the most remarkable characteristic of this work is the fact that it is believable. The author comes across as one who has used these techniques, tools, and methods; one who knows where they always work and where they can be made to work. He describes how to perform various analysis tasks and demonstrates key points with well-chosen examples.

Systems analysis is not a well-defined activity. Its goals, procedures, and conduct vary as widely as its application. Some authors have presented systems analysis as a disjointed collection of tools and techniques. Others have treated it as a deterministic process. In this text, a third approach is taken. The author describes the general flow of the systems analysis process, some exceptions to this flow, and how specific tools, such as the data dictionary, fit into the overall plan. The pros and cons of each of the tools and techniques are discussed revealing a remarkable insight into their practical value. The full spectrum of analysis activity is described from the initial surveys through the incorporation of the analysis results into the design. This latter subject is treated briefly since software design is not the primary topic.



"... how to model a problem in a methodical way (structure it) and refine it in such a way as to ease the transition to a quality design."

This book is organized into six sections. The first provides an overview of the structured analysis approach, its tools, and its concepts. The remaining sections expand on these topics (i.e., decomposition, data dictionary construction, process specification, system modelling, transition into design) and demonstrate their use. The book ends with a novel and insightful discussion of estimating that is typical of the rest of the book. Some tips, based on experience, are provided as guidelines. For example, one guideline relates the fact that by direct observation the author found that persons responsible for a project consistently give the least accurate estimates. He recommends averaging estimates obtained from those conversant with the project (other than the one responsible for it).

The book would be of most interest to systems analysts and software designers. Many software designers would find the techniques presented useful in validating the analysis that they or others have performed. The book is easy to read and understand and employs well chosen examples which demonstrate the use of the methodology in a variety of applications, potential problems, and solutions. This text would be especially useful to those utilizing the structured design methodology but its suitability is not limited to this design approach.

Good (useful) technical books may be hard to find but good books about good tools are even rarer. This work fills the bill on both counts. Yourdon, Inc. (1978, 368 pp., $25, softcover).

—Laurence Peters

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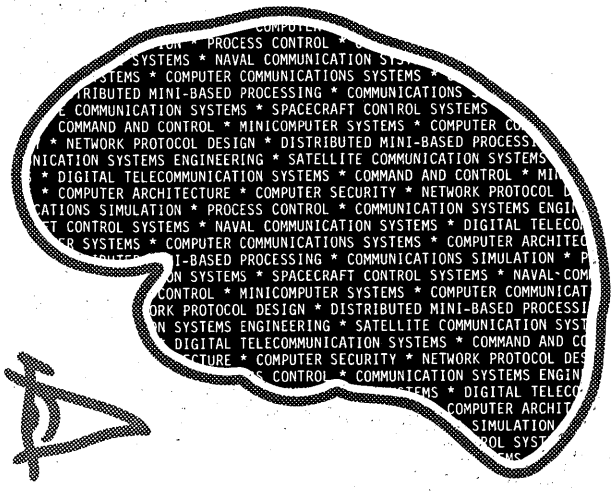

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DATA AND REALITY
by William Kent

The data base phenomenon continues to spread. Today, even the smallest computer systems are not complete, perhaps marketable is a better term, without a data base package. A (mercifully) anonymous cynic once commented: ". . . we have succeeded in making it nearly impossible to go disk to print; what have we gained?"

We have all become enraptured by the notion that on demand we can access literally millions of pieces of data. While we are likely to believe that this is information, in fact it is only the raw material which has yet to be milled. Rarely do we stop to consider that the mill, the human mind, has built-in filtering and discrimination circuits that select the needed from the trivial, clarify the ambiguities and bridge the gaps between discrete points.

Kent has produced a rather remarkable and highly readable short work. The basic thesis that runs through the book is an old one although rarely used in the information processing world: "It isn't the act that is important but rather the way that people perceive that act." Kent puts it another way: ". . . we are not modelling reality, but the way information about reality is processed, *by people*." (My emphasis.)

One's view of reality must, necessarily, be very personal and highly biased by cultural traits. While there is a strata of common reality (if there were none the society would have long since collapsed), there can be no absolute or objective reality. Technologists, however, have insisted on forcing names and addresses, characteristics and relationships, into monolithic information systems. It works only in limited and highly specific situations. As generality increases, the attempts to obtain and relate pieces of data often fall apart under the demands of multiple views of reality.

Kent has a specially interesting discussion of ambiguities in section 5.0. He and others are uneasy about the difficulties in differentiating the attributes of an object from the relationships between objects. Yet there is a very real problem lurking here for anybody who would create an information processing system.

Is this book a philosophy text? Yes and no. Kent does pass us through discussions of entities, domains, relationships and records, all well-known dp terms and concepts (although the arguments over the meaning of each still continue). But the most important things he has to say are philosophical and go right to the heart of the key concepts that must be understood if a system is to be "successful" (whatever that may mean!).

A simple notion but a fundamental one in all systems is the meaning of nouns. But Kent's handling of Sapir's concept of nouns suggests that the deep cultural bias surrounding language is far more critical than most people understand. The contrast between the Hopi, Aztec and Eskimo notions of "cold" and "snow" are fascinating and revealing. We've been coming at information systems from technology. Perhaps it is time to sit back and reconsider our starting point. Linguistics might well be a better take-off point.

This is a serious book but not a heavy one. Kent writes easily and without hiding behind the semantics of the data base specialists. The ideas are presented in a straightforward manner with no attempt to preach. He admits on occasion to being puzzled at some of the contradictions inherent in information processing systems. Perhaps it is an admission of this nature that makes this book so unusual in this reviewer's opinion. Too often texts on data processing subjects represent themselves and their ideas as *the* single path to righteousness. On the contrary, Kent seems genuinely uneasy and almost quizzical when looking at some of the concepts bandied about. One has a feeling that this is a writer who takes his subject quite seriously but refuses to take himself seriously.

That's not a bad attitude in a profession increasingly overloaded with pretentiousness and self-aggrandizement.

Finally, a word about the physical production of this book. It is surprisingly difficult to read text that has been prepared using a computer system that lacks a word hyphenation routine. Annoying and distracting gaps appear at seemingly random intervals between words. A flat, lackluster sameness seems to be a secondary effect; it would give sleepless nights to a professional book designer. One wonders if this publisher will ever come to grips with modern computerized phototypesetters. The final product is displeasing to the eye and represents a considerable disservice to the author. North Holland Publishing Co., Amsterdam and New York (1978, 203 pp. $26.75).

—Philip H. Dorn

REPORTS AND REFERENCES

DATAMATION SUBJECT INDEX

Tired of endlessly flipping through pages or phoning harried editors long distance for references to vital but elusive DATAMATION stories? We thought so. The answer is the 1978 DATAMATION Subject Index, for which there is no charge. Contact 1801 S. La Cienega Blvd., Los Angeles, CA 90035 (213) 559-5111.

TYPO CREATES HAVOC

Our December Source Data mentioned the availability of a 272-page report entitled *Arab Computer Markets* which reports on the strictly import computer market in 20 Arab countries. A zero was left off of the price of this study in our mention, causing many requests for a one dollar report when the volume should have been offered at an introductory price of one *thousand* dollars. The supplier tells us that he is losing his shirt on postage sending back the influx of one dollar checks.

The report, which includes a direct mailing list of major existing and potential computer end users for unlimited promotional use and outlines directions of computer trade, market shares by exporting country and suppliers, dp restrictions and plans for development, and other acquisition influences, is available for $1,500 from 21st Century Research, The Stonehenge, 8200 Kennedy Blvd. East, North Bergen, NJ 07047 (201) 868-0881. Our apologies for the confusion.

VENDOR LITERATURE

FLEXIBLE DISK DRIVES

Two spec sheets describe this vendor's double-head flexible disk drives for oem's. One sheet describes the 8-inch FD650 with a picture, text, and specs covering media, physical dimensions, environmental considerations, performance, recording parameters, and power requirements. The other spec sheet describes the 5¼-inch FD200 and FD250 drives in the same format as the FD650 description. PERTEC COMPUTER CORP., Pertec Div., Chatsworth, Calif.

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ANTISTATIC CARPETING

A four-page, color flier illustrates this vendor's line of antistatic carpeting for use in computer rooms and other areas housing sensitive electronic equipment. A full-page discussion covers static, floor covering performance, the vendor's proprietary Compu-Carpet, and the company. A table of specifications details the construction and performance factors of each of the vendor's three series of carpet. Color selections also are provided. UNITED TECHNICAL PRODUCTS, INC., Westwood, Mass.

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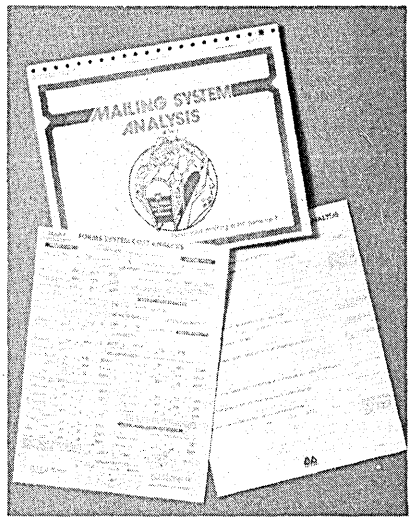
MAILING SYSTEMS

This well known business forms company has produced a booklet containing a step-by-step guide to help analyze mailing sys-

VENDOR LITERATURE



tems costs. The booklet includes 27 suggested methods for reducing costs. MOORE BUSINESS FORMS, INC., Glenview, Ill.

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WIRELESS DATA COMMUNICATIONS

Short-range, low-speed data transceivers are described in an illustrated flier. It's explained how the vendor's XD300 Optical Data Link transmits and receives data over a line-of-sight infrared beam. Various applications are illustrated in the four-page brochure, and diagrams show system operation and physical characteristics. A spec sheet is included, as are the vendor's warranty and repair policies. AMREX CORP., Redmond, Wash.

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PRINTERS

The IPS 7000 series of dot matrix printers are described in an eight-page brochure. The printers' microcomputer control unit is discussed, then the brochure goes on to cover the various members of the family which gain their personalities through plug-in PROM's. A keyboard send/receive model also is described. The brochure closes with a brief overview of the vendor, and a table of system specifications. DATAROYAL, INC., Nashua, N.H.

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MILITARY MEMORY

Military computer memory products and systems are described in this vendor's four-page, illustrated brochure. The vendor comments on its design, quality control, manufacturing, and liaison and technical support, then it goes on to describe its standard military memory systems, cores and custom stacks, and special memory systems. The vendor also lists a number of major military systems and programs using its memory products. FABRI-TEK, INC., Minneapolis, Minn.

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SATELLITE COMMUNICATIONS

A four-age brochure entitled "The Time-Space Barrier Broken!" describes this satellite communications company's Satellite Delay Compensation Unit (SCDU). After explaining the problem (it takes about half-a-second for a radio signal to reach the satellite and return to Earth), the brochure explains how the SCDU provides data-block acknowledgement to terminal devices. A timing diagram illustrates bisynch data flow via satellite link, and another diagram graphs throughput efficiency for satellite links (with and without SCDU) and terrestrial circuits. The brochure concludes with a spec sheet and a listing of the vendor's marketing offices. AMERICAN SATELLITE CORP., Germantown, Md.

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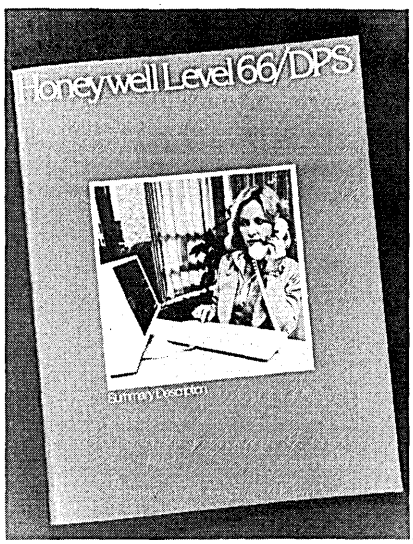
DISTRIBUTED PROCESSING

If a "summary description" takes 62 pages either the author is being very thorough or the topic is fairly extensive. This vendor's booklet on its approach to distributed processing seems to be a thorough treatment of a large topic. In the booklet's first section, The Distributed Systems Environment, readers will find a discussion of the benefits of distributed systems, their elements and structures, and vendor-specific descriptions of hard-



ware, compatibility features, applications systems, and languages. A second section addresses system software, including data management, utility programs, network communication, and diagnostic and system protection features. Applications software available from the vendor for manufacturing, banking, management science, financial management, health care, and education are described in the third section. Hardware for the central system is covered; subheadings include expansion capabilities, central processors, system control units, I/O multiplexors, and integrated network processor. A discussion of peripherals, such as consoles, secondary storage, and the vendor's page printing system, completes the summary. The booklet also features block diagrams of system configurations, tables of specifications, and photographic illustrations. HONEYWELL INFORMATION SYSTEMS INC., Phoenix, Ariz.

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TURNKEY SYSTEMS

This vendor, which has provided computer services to the wholesale distribution industry for a decade, offers an eight-page, illustrated brochure describing its "First Family" line of turnkey systems. The brochure discusses the distributor's need for information and how the firm has responded to that need. The pieces of hardware that make up the product line, also known as the Datafile System V family, are described in their various configurations. Software, from the operating system through applications packages, also are covered. Features of the applications software—billing and accounts receivable, sales reporting, inventory control and management, and more—are listed for each package. NLT COMPUTER SERVICES CORP., Blue Bell, Penn.

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PERIODICALS

NEW HISTORY JOURNAL

Articles are now being solicited for the new quarterly periodical *Annals of the History of Computing*, which AFIPS will begin publishing July 1979. Formal articles are invited from "individuals who participated in, or witnessed, the events and decisions which have shaped the present computing environment." Short anecdotes or personal recollections are being sought, as are descriptions of current historical projects, annotated bibliographies, and the like.

AFIPS is considering historical items from at least 15 years ago, and including in their focus not only events but factors that contributed to the development of the field, such as the influence of societal factors, and significant successes and failures in the industry.

Prospective authors are asked to send five copies of their contributions, accompanied by a brief biographical sketch (approximately 50 words), and an abstract of approximately 100 words, to Bernard A. Galler, editor-in-chief, *Annuals of the History of Computing*, Univ. of Michigan, College of Literature, Science and the Arts, 2522 LSA Bldg., Ann Arbor, MI 48109.

Charter subscriptions are being accepted at $20 yearly for non-AFIPS members, $15 for members, and $40 for institutions. Microfilm or microfiche copies are available at the same rates. To subscribe contact AFIPS Press, 210 Summit Ave., Montvale, NJ 07645 (201) 391-9810.

ADAPSO UPDATE

ADAPSO (the Association of Data Processing Service Organizations, Inc.) now publishes a newsletter about the computer services industry for the financial and business community. *Update*, the 8-page quarterly newsletter, features a market commentary by Robert O'Connor of Fourteen Research Corp., revenue and earnings reports on publicly held computer services firms, and short features and commentaries by computer analysts (the financial kind).

The upcoming issue (Vol. 1, Issue 4) will contain an article by Peter Cunningham, president of Input, forecasting the development of the computer services industry in 1979. There will also be a synopsis of the annual ADAPSO meeting and management conference held in Orlando, Fla.

The newsletter is not limited to ADAPSO members, and is intended to serve as a vehicle for discussion among industry leaders. There is no subscription fee. UPDATE, ADAPSO, 1925 N. Lynn St., Rosslyn, VA 22209 (703) 522-5055 ✲

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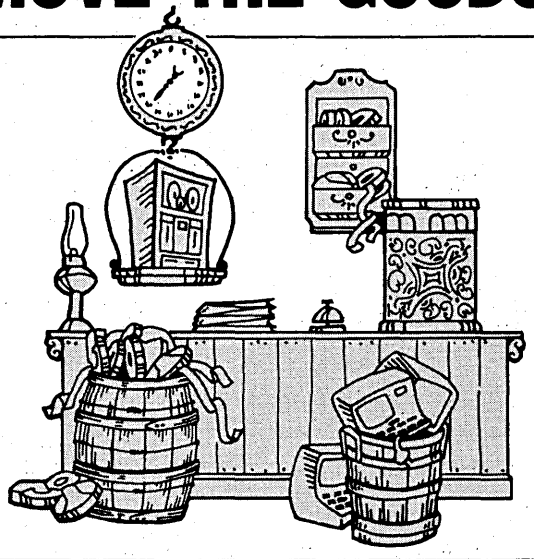

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Hughes is one of two AMRAAM finalists selected by the Joint System Program Office at Eglin Air Force Base to participate in the validation phase of the Advanced Medium-Range Air-to-Air Missile program. The Hughes design provides track-while-scan, multi-shot, and launch-and-leave capabilities, even against severe electronic countermeasures. AMRAAM will replace the AIM-7 Sparrow, now in use with the U.S. Air Force and U.S. Navy. It will outperform Sparrow yet be half the size and weight, and cost less. AMRAAM will be used with the F-14, F-15, F-16, and F/A-18 aircraft. The validation phase is expected to last 33 months, at which time the winning design will be carried into full-scale engineering development.

Hughes Missile Systems Group has many openings for engineers in every phase of missile production -- from design through manufacturing -- for its facilities in Canoga Park, California, and Tucson, Arizona. For immediate consideration, send resume to: August Chiary, Engineering Employment, Hughes Aircraft Company, Canoga Park, CA 91304. Or call (213) 883-2400, Ext. 2424.

Vast amounts of data gathered by the Pioneer Venus mission in just 90 minutes last December, though still being analyzed, have given scientists a dramatic glimpse of Earth's nearest planetary neighbor. Teams of investigators already are using their discoveries to refine their theories on the evolution of the solar system and on the forces that drive Earth's weather.

The mission consisted of two spacecraft designed and built by Hughes for NASA's Ames Research Center. One, the Multiprobe, sent four probes to the surface, one of which survived for more than 67 minutes before succumbing to the searing environment. The other, the Orbiter, continues to provide pictures and other data as it circles Venus every 24 hours.

Many of the Pioneer Venus findings confirmed scientists' predictions. The planet's intense surface temperature (850°F) and atmospheric pressure (91 times that of Earth's) seem certainly to be due to a formidable greenhouse effect caused by thick cloud layers trapping solar energy. Various instruments revealed that Venus has global weather patterns. Cloud temperatures are warmer at the equator and colder at the poles. There is even a whirlpool-like vortex in the polar clouds that provides down-motion of the atmosphere.

There were, however, surprises. Probe instruments detected several hundred times more primordial argon and neon gases than Earth has. They also found the smog-like atmosphere is free of particles from an altitude of 19 miles to the surface. Two night probes saw an unexpected glow, perhaps due to "chemical fires" caused by reactions of sulfur compounds in extreme heat near the surface.

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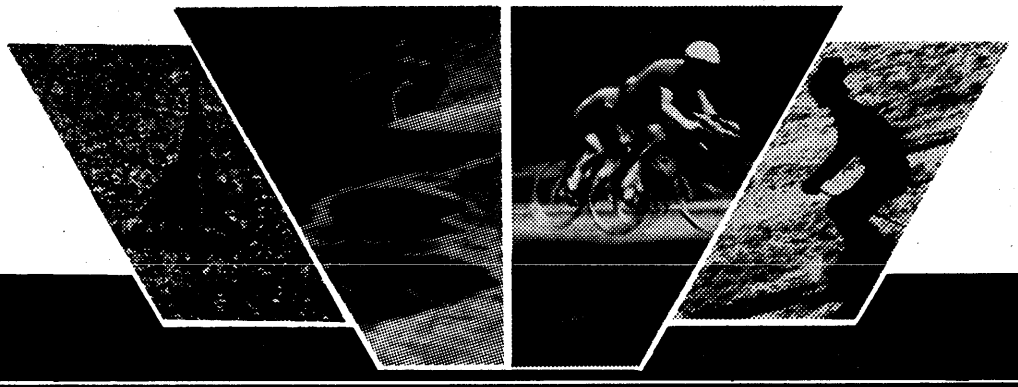

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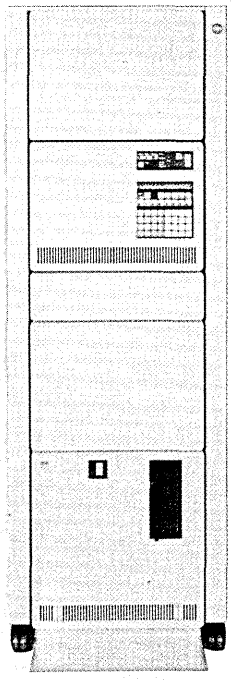

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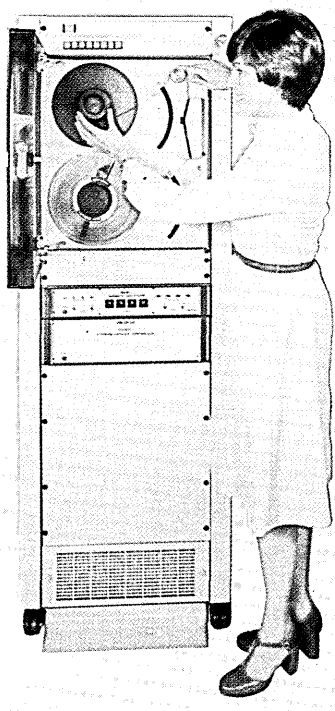

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