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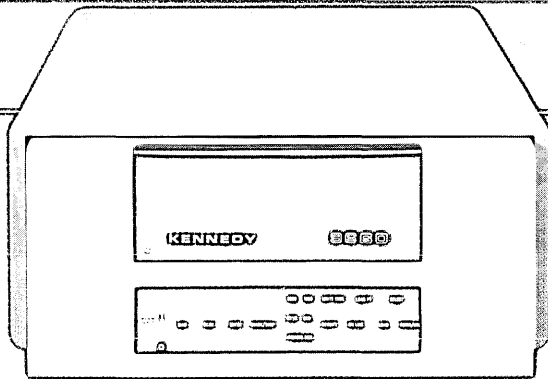
**MINI/MICRO
USERS SURVEY**
PLUS
**MACHINE POLITICS:
CAN COMPUTERS COUNT
THE VOTES?
HIGH NOON FOR CD-ROMS
HOW TO CHOOSE A 4GL**

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INFORMATION 88

What could possibly make the Kennedy 1/2" tape hybrid streamer even better? How about...

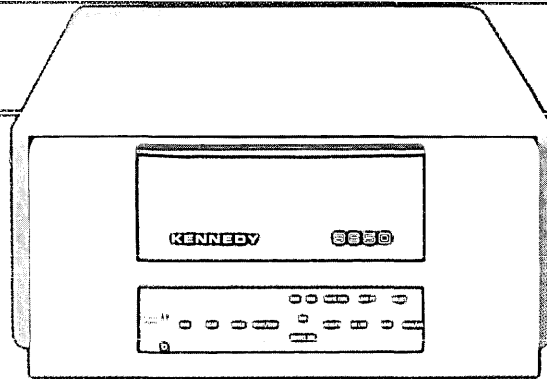
GCR



Model 9610/9660

Quad-density GCR 6250 BPI at 100/50 tps

- Inexpensive GCR storage with up to 270 Mb
- High speed streaming
- 50 tps true start/stop
- 800/1600/3200/6250 BPI
- .3" GCR IBC for maximum data capacity
- VLSI write/read logic
- Standard 8.75" height
- Front load
- Auto threading/loading
- Adaptive velocity control
- Automatic calibration of write current/read gains for each tape
- Automatic read gain control
- Rack mount or cabinet
- 50 MS reposition time in same direction at 100 tps
- 200 MS reposition time in opposite direction at 100 tps
- 12 MS ramp time at 100 tps



Model 9600/9650

Tri-density with 3200 BPI at 100/50 tps

- Low cost storage up to 110 Mb
- High speed streaming
- 50 tps true start/stop
- 800/1600/3200 BPI
- Interfaces: industry standard, SOSI
- Standard 8.75" height
- Front load
- Power up self diagnostics
- Service diagnostics
- Resident tester and exerciser
- Rack mount or cabinet
- 50 MS reposition time in same direction at 100 tps
- 200 MS reposition time in opposite direction at 100 tps
- 12 MS ramp time at 100 tps

Kennedy has long been in the forefront of computer tape peripherals, providing the highest quality 1/2" and 1/4" start/stop and streaming tape drives. That's one reason we can proudly state

Kennedy — twenty-four years of leadership.

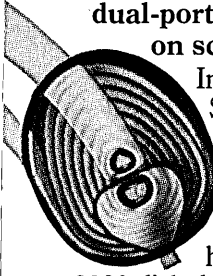
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We've Delivered On A Promise That's About To Deliver Much More.

StorageTek's 8380E disk drives: double capacity, dual-ported and delivered on schedule.



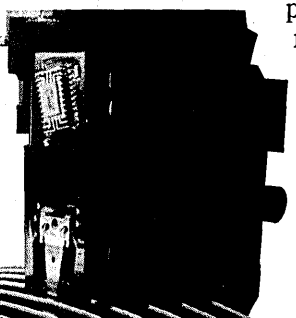
In April of 1985, the new StorageTek made its first public promise: a double capacity, field-upgradable extension of our highly successful 8380 disk drive.

A promise made is now a promise kept. StorageTek's 8380 customers are taking delivery of double capacity upgrades and drives on schedule... thus continuing to broaden StorageTek's base among the world's largest users of information technology.

But the fact that 8380Es are arriving is nothing compared to the performance that's arriving with them.

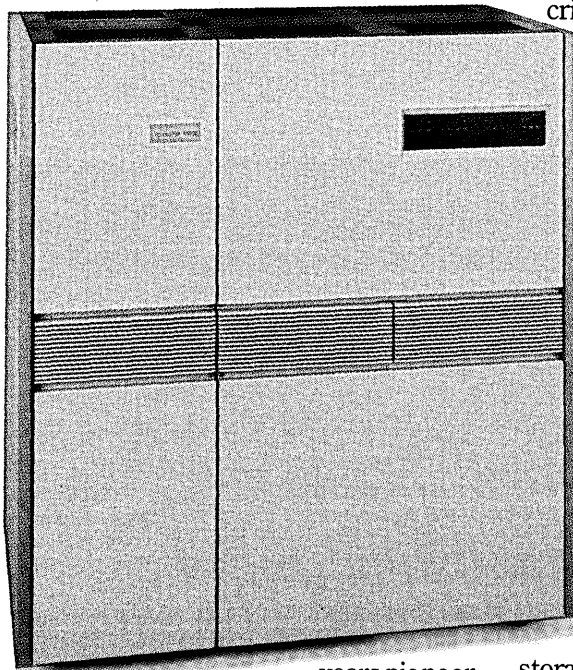
Double capacity without doubling floor space, power or aggravation.

Every StorageTek 8380 customer can now double capacity without moving into more floor space or moving out a single drive. 8380E upgrades are made on-site; on hard-



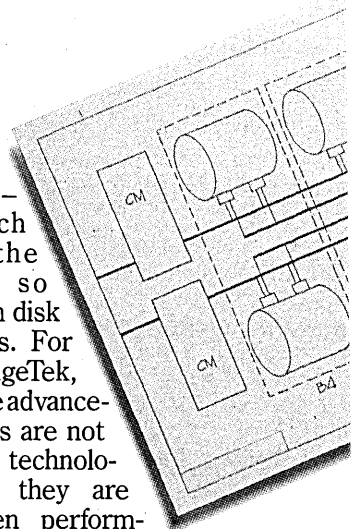
ware our customers already own.

For new and present customers alike, however, the foundations of 8380E capacity gains come from technologies StorageTek has spent



years pioneering and perfecting. These include dual porting (multiple data paths which allow users to lower response times and boost system utilization) and thin-film head design, dual actuators per spindle, distributed electronics, circuit redundancy and contin-

uous self-diagnostics—all of which increase the reliability so critical on disk drives. For StorageTek, these advancements are not new technologies; they are proven performance features that have been part of StorageTek's disk development for many years.



What others are still designing—we're delivering.

Superior performance; increased reliability; faster response times; measurable cost/efficiencies; improved system-wide resource utilization. All advantages you've come to expect from the

storage specialists at StorageTek; and all key chapters in the newest StorageTek success story.

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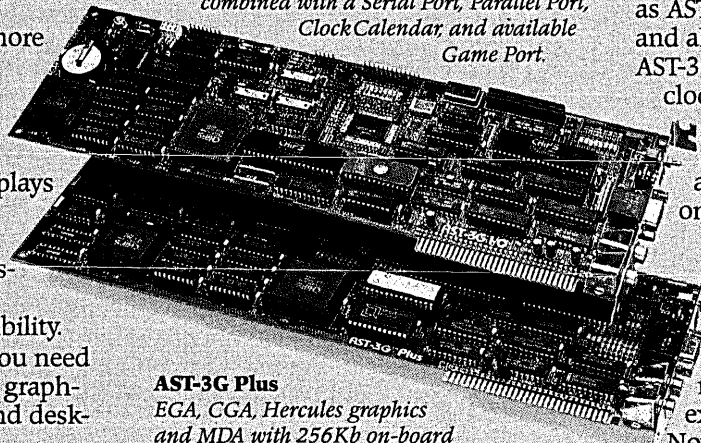
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with an optional parallel port.

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BEHIND THE NEWS

Serious questions have been raised over the trustworthiness of vote-counting computers and their vendors. John W. Verity explains that it boils down to "Machine Politics."

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MINIS, MICROS, AND MATURITY

John W. Verity

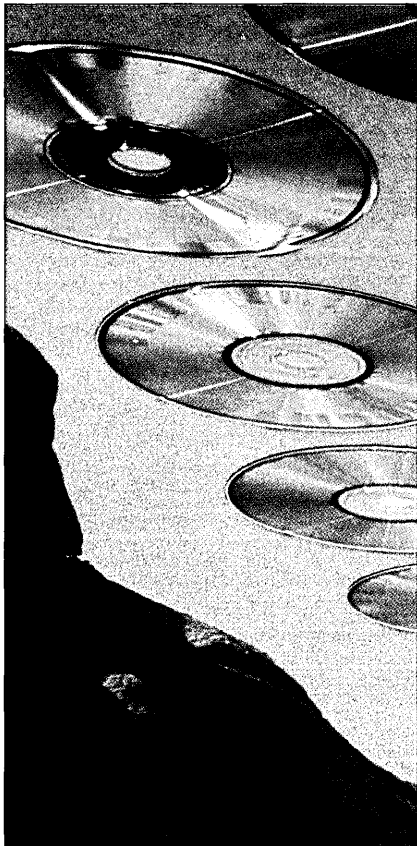
Growth of mini shipments this year is not projected to reach even 8%, according to the 1986-87 DATA-MATION/Cowen & Co. mini/micro computer survey. More within.

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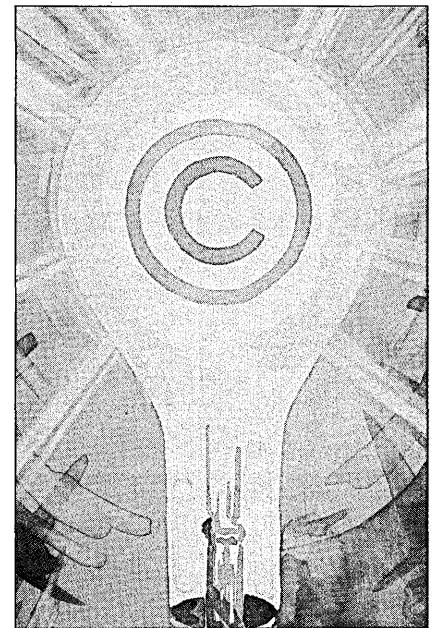
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Get Some Bright Ideas

How to save. Jog.
 Fix your car. Quit smoking.
 Choose life insurance. Get a patent.
 Select a home computer. Apply for credit.
 Remove mildew. Shape up. Buy a telephone.
 Write a resume. Reduce cholesterol.
 Discover parks. Avoid drug reactions.
 Buy surplus land. Control cockroaches.
 Make a job change. Choose a house.
 Pay for an education. Prevent sunburn.
 Select a mortgage. Get a con job.
 Choose a lawyer. Start a small business.
 Check for breast cancer. Buy an IRA.
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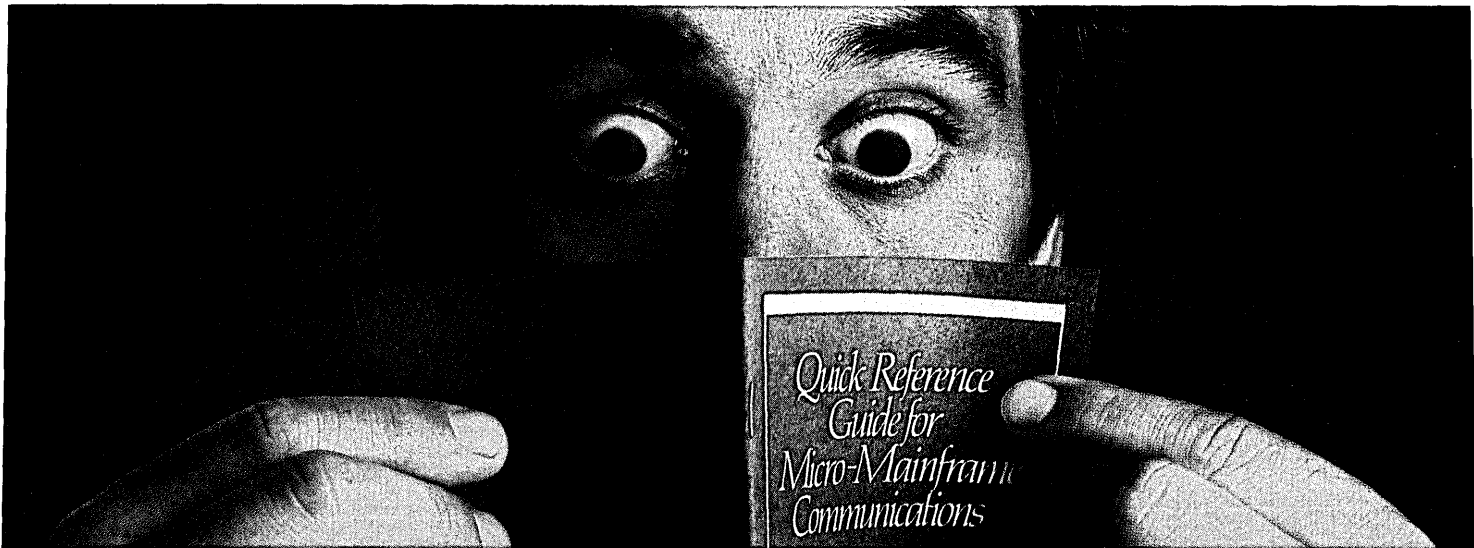
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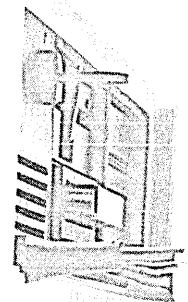
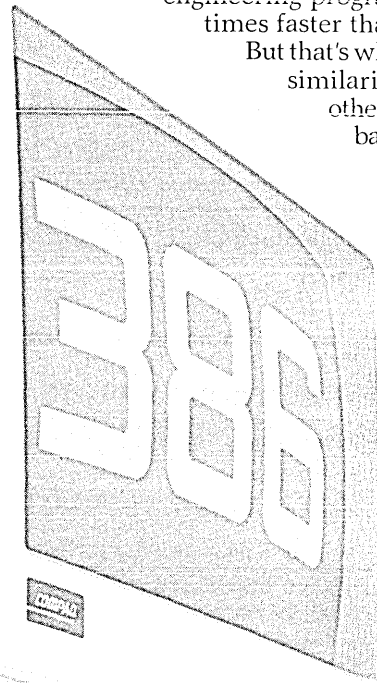
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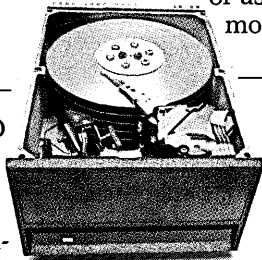
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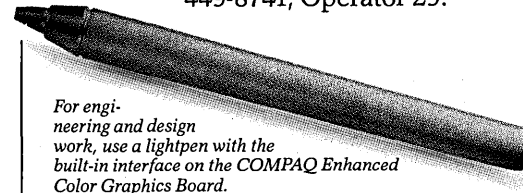
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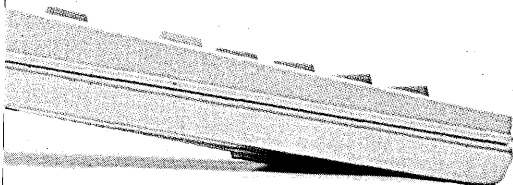
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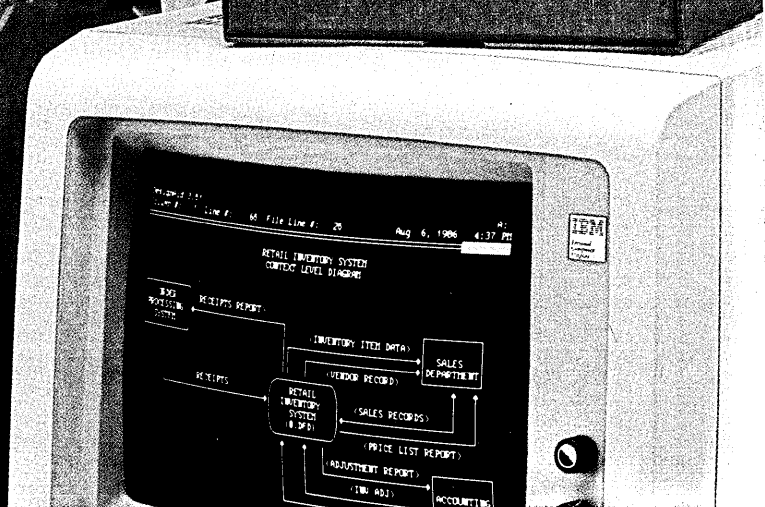
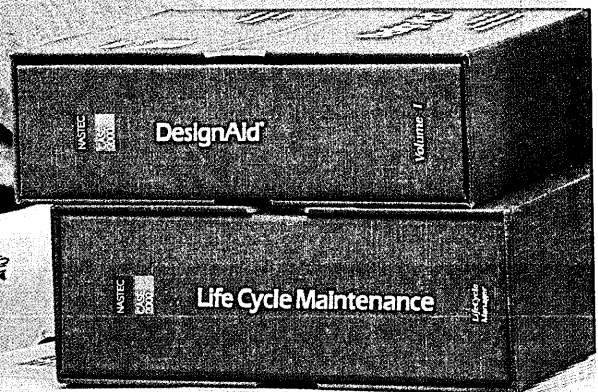


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LOOK AHEAD

USER SCUTTLEBUTT ON HONEYWELL

Honeywell remains hush-hush about its talks with Nippon Electric Corp. (NEC) and Groupe Bull concerning the formation of a new computer company, but its users claim to have heard the following: the new company would be based in the U.S., with Honeywell, NEC, and Bull investing \$1.5 billion, \$6 billion, and \$2 billion, respectively. The president of the joint venture would be William N. Wray, now executive vice president of Honeywell Information Systems. Among those most eager to see how the talks work out are the fiercely loyal, hardware-hungry users of the Multics operating system. They've just heard NEC has the latest copy of Multics quietly running at 30 or so MIPS on an S-1000 mainframe, a machine that Honeywell sells only to GCOS users as the DPS/90. If brought to market, such a combo would easily satisfy their needs for additional Multics horsepower. Meanwhile, word has it that Bull in France is being sued by some 200 companies over support for Multics by it and Honeywell.

MEMOREX ON THE BLOCK?

Word has it that Burroughs, in an effort to raise cash following its takeover of Sperry, is entertaining offers for its Memorex Corp. subsidiary in Santa Clara. Memorex officials won't say who the potential buyers are, but observers speculate that among them are Hitachi and Fujitsu, both already players in the compatible storage market. If a sale goes through, officials say, the plug-compatible disk, tape, and communications parts of the Memorex business would be sold as a package along with the company's distribution network.

UCCEL IN TALKS FOR ACF II

Talk about a big ticket item! Uccel Corp., Dallas, is said to be in negotiations to acquire Cambridge Systems's ACF II software program for a whopping \$65 million to \$70 million. That may be small change to some, but considering that ACF II made only a reported \$16 million, that's quite a load of simoleons.

REACHING THE END OF THE LINE

IBM is stopping further development of its relatively young protocol converter, the 3710. Users report that the device will be maintained but not enhanced. Slow sales, attributed to the product's kludgy software workings, are said to be the cause. Enhancement of the 3708, however, will continue.

AS IF DELAYS ON SPECTRUM WEREN'T ENOUGH

Several users at a recent Hewlett-Packard user group meeting reported a sporadic deadlock problem with two large HP 3000 minicomputers. According to one customer, the Series 70 "ceased like an engine without oil. We couldn't do a load or a dump. The only way to get the system up was to hit the off switch and turn it on again." He claims that the machine was not doing any-

LOOK AHEAD

HP READIES STARLAN PRODUCTS

thing unusually intensive when the problem occurred. Another user reports a similar problem with HP's Series 68. "All the disk drives stopped," he explains, "and the status lights came on and we couldn't get any response from the terminals. We put a tape drive online and that solved the problem." HP technical experts say they are unaware of the problem but will look into it.

Hewlett-Packard may announce products based on AT&T's StarLAN local network this month for delivery around February. HP has been active on the IEEE task force that recommended a standard based on StarLAN. However, the company reportedly is working on an implementation of IBM's token ring network, too. Also on the HP front, Access Technology Inc., South Natick, Mass., maker of the 20/20 spreadsheet program, has begun work on a version for HP's Spectrum line.

IBM-FORD CONTRACT NOW OVERDUE

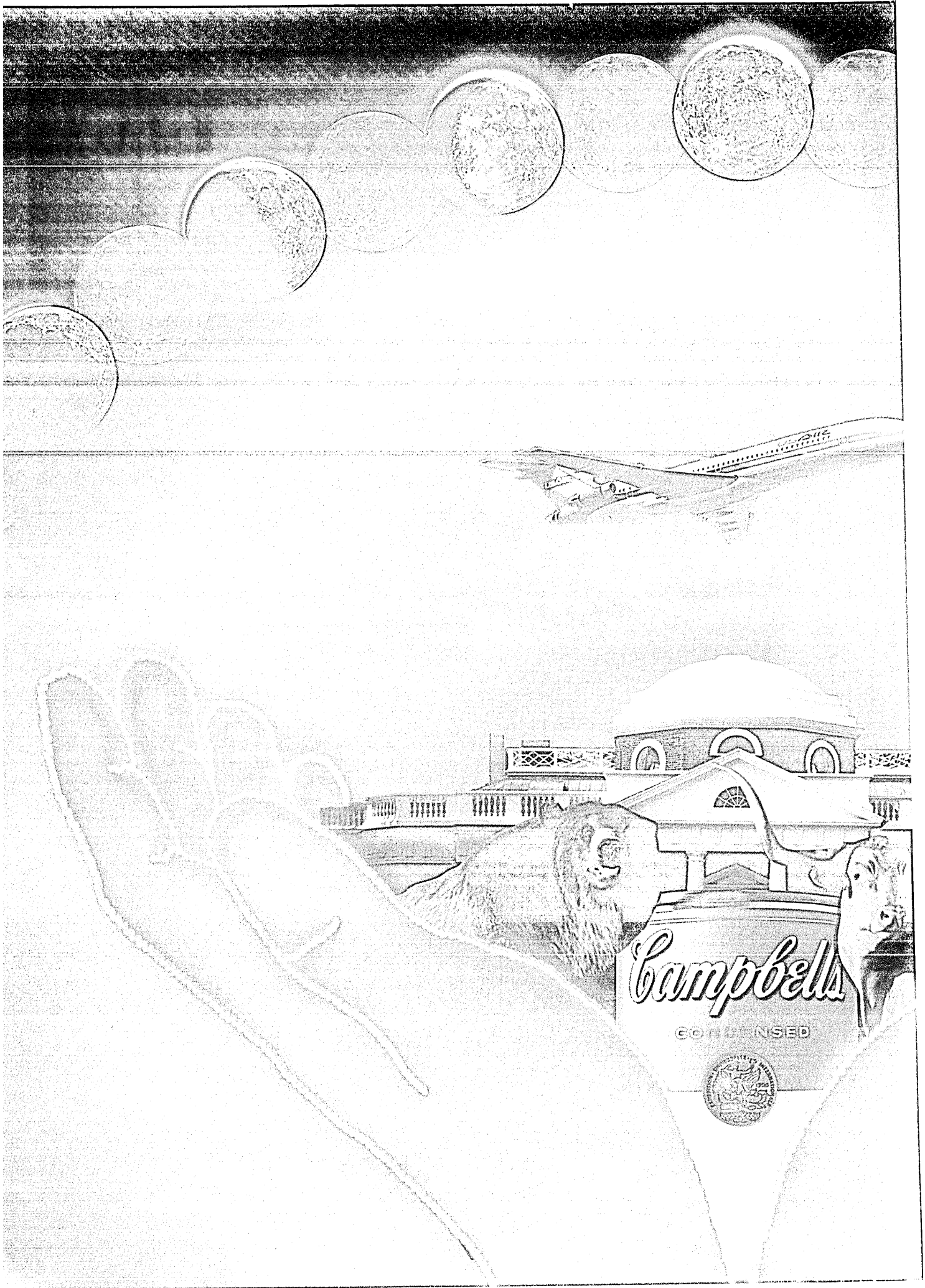
In July, when IBM said it had been selected preliminarily to be the exclusive provider of about \$300 million worth of office automation equipment to Ford Motor Co., the company said a contract would be ironed out within 30 days. Well, it's been 90 days, Ford and IBM are still talking, and they don't have a contract. Ford says the negotiations are going well, but the company now won't say when a contract will be signed. A key part of IBM's bid is understood to be its new 9370. Sources say IBM is proposing that Ford use the new box as a server, running VM/Entry and tied by Ethernet to PCs and terminals on one end and mainframes on the other. Ford's earlier selection of IBM reportedly was predicated on availability of the 9370, which IBM offered in place of Digital's MicroVAX II.

DIRECTION WITH NO MAP

The "islands of automation" in Telex Corp.'s ultra-modern 175,000-square-foot repair and production facility in Tulsa, Okla., will be networked together without the benefit of any of the factory floor protocols, like MAP, that are currently available. Instead, the 3270 terminal vendor will string its conveyor system, bidirectional transporter, and automated guided vehicles together through a protocol it developed in-house to run on two Tandem computers. The system will be operational early next year.

RUMORS AND RAW RANDOM DATA

Tandem Computers Inc. is working closely with General Motors and EDS on GM's Saturn project, insiders say. Tandem will possibly provide the computing power that will enable customers to order and finance an automobile from a showroom terminal and then have the car built to spec. . . . Ashton-Tate is readying RapidFile, a \$395 file-manager program for users of the dBASE family of database programs.





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LETTERS

MBAS AND MIS

Your editorial, "MBA Students Need More MIS" (Sept. 1, p. 19), and Michael Tyler's article, "MIS for MBAs, or Vice Versa?" (p. 46), are really on target in making it clear that good information systems are key to good business performance and are important elements in MBA education. I hope that DATAMATION will continue and expand its coverage of this important area.

The CISMER (Center for Information Systems Management, Education and Research) Research Group here at the University of Delaware believes that effective machine-based information systems must complement the other information systems in the organization and that MIS programs for MBA students need to address a variety of information systems-related organizational issues.

LOUISE H. JONES
Director, CISMER
University of Delaware
Newark, Delaware

I don't know why, since I almost never read editorials, but I read "MBA Students Need More MIS" in the Sept. 1 issue. My comment is to quote the inimitable Colonel Potter (of *M*A*S*H* fame) and say, "Horsehockey!"

Certainly, "there is solid agreement among professors on the need for such education." If I were a professor I would say the same, in the interests of saving my own job. Being an MBA (Northwestern, 1967) provides me with the experience and background to say that the two MIS courses (one undergraduate and one graduate) I took are more than adequate for a generalist degree. After all, the MBA graduate is specifically not required to have the detailed knowledge to solve the problem, but only to know whom to see in order to obtain the answer and to direct and guide the solution. If you want to add courses to assist MBA holders, make them courses in industrial psychology, dealing with people, communications, etc.

If you want a reasonable opinion,

talk to the people in the trenches, not the ones interested in preserving their jobs.

RICHARD F. DUFNER
Vice President, Finance
American Tape
Marysville, Michigan

I read Michael Tyler's article, "MIS for MBAs, or Vice Versa?" with great interest. I, myself, have an MS in MIS. I am a computer professional, not a "management type," and chose the MIS program in the business school for two reasons: I wasn't interested in an MBA, and I didn't feel the computer science department was very good at the time.

The MIS curriculum was thorough and rigorous. I took a range of business overview courses (economics, accounting, management, etc.) but the major thrust of the program was on using information systems (read: computers) to solve business problems. With such courses as database systems, decision support systems, operating systems, statistics, et al., and with a thesis topic that used a simulation language to model a business networking situation, I feel I got a well-rounded educational background on which to build my business experience.

MIS is not just for techies. It is a discipline which, if presented properly, can teach problem solving techniques that are applicable to a wide range of applications. Most CS students haven't the foggiest idea of how a business is run and most MBA students know little more than where the on/off button is on their terminals—MIS is the best of both worlds!

C.J. FALK MILOSEVICH
Computing Services Office
University of Illinois
Urbana-Champaign, Illinois

BOMB

Peter Krass's review of *The Computer Pioneers* (Source Data, Aug. 1, p. 73) contains several unfortunate errors in its account of the bombing of Coventry in November 1940. Colossus was not used for the decoding of the "Korn" messages

since Colossus was not built until 1943. The Korn messages were in the Luftwaffe version of the Enigma cipher and were decoded by the Bombe machines; Colossus was designed expressly for the purpose of attacking the Fish cipher, a more complex version of the basic Enigma. Although Winston Churchill, upon receipt of Enigma decodes on the evening of the raid, decided that the raid was probably destined for London (and insisted upon returning there along with his staff), Air Ministry staff opinion had been divided for several days over whether the forthcoming raid would be in the English Midlands (where Coventry is located) or in the South; consequently, defensive measures were thinly spread to cover both possibilities. The problem was further compounded by an error in measurement of the modulation frequencies of the German navigational beams which rendered the British jamming ineffective on the night in question. Several recent texts have provided overwhelming evidence that Winston Churchill took no direct part in the interpretation of the confused evidence available prior to the fateful raid on Coventry. Only in the sense that he was, in addition to being prime minister, minister of defense and thus responsible for the actions of the armed services can Winston Churchill be said to have "laid an egg."

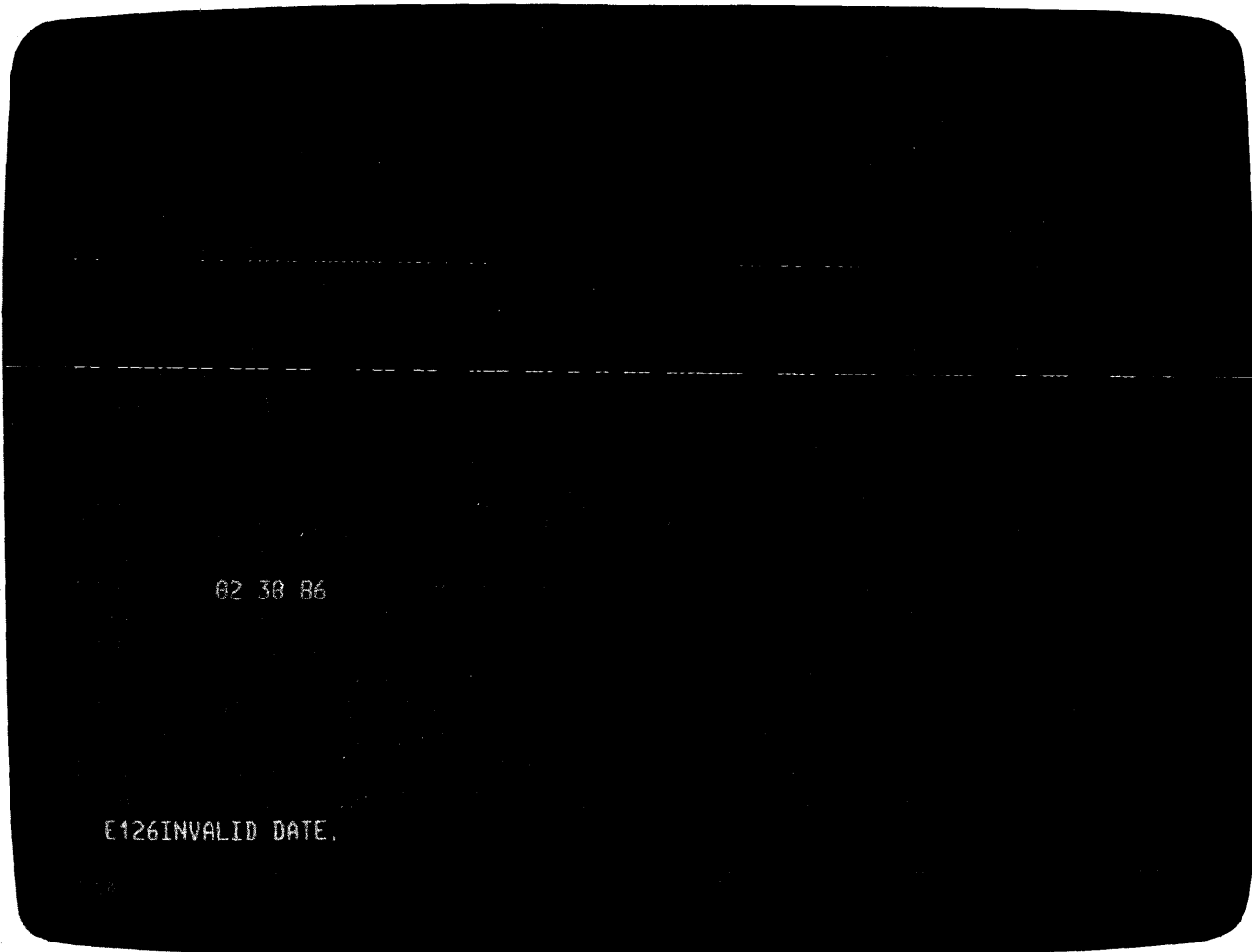
Incidentally, apart from using vacuum tubes, the capabilities of Colossus were remarkably similar to those of the first Altair microcomputers—including the reliability!

CHRIS WHETTON
Levittown, Pennsylvania

CORRECTION

In "Salary Survey: Small Change for Dp Pros," (Sept. 15, p. 72) a box illustrating inflation's affect on salaries since 1981 contained two wrong dates. In the chart titled "Inflation's Bite, the Five Years After 1981," the first column should be labeled "1981 Salary", the second, "1986 Salary."

See the data.



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EDITORIAL

TOUGHER COPYRIGHTS WILL BOOST INNOVATION

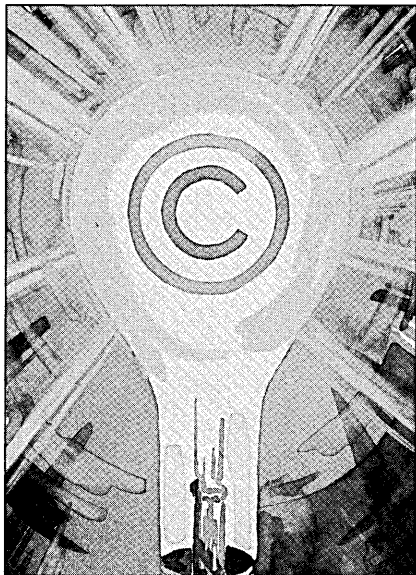


ILLUSTRATION BY DORIS ETTLINGER

U.S. District Court Judge William A. Ingram's recent microcode ruling granting copyright status to software embedded in a microchip (see "Bolt of Lightning," p. 41) has the manufacturing community applauding. Well it should. The U.S. information processing business has paid a heavy toll—some estimates are as high as \$20 billion over the past five years—for copyright rip-offs and software piracy.

The ruling creates an environment that rewards and safeguards intellectual equity and is certain to spur innovation among both clone makers and large manufacturers. For, as Irving Rappaport, associate general counsel of Apple, says, "The decision will demonstrate [to clone makers] that the secret to long-term success is innovation, not copying." That should have users applauding as well. After all, only through continuing innovation can the American computer industry hope to deliver on its promise of better and ultimately less expensive technology.

The fundamental need to compete and win a healthy share of the market will force more clone makers to increase research and development, resulting in better copies, and possibly—as demonstrated by the likes of Compaq and others—entirely new designs. It will come down to a matter of survival and simple economics. Clone makers know that while they may be able to survive, they will not prosper if they must pay IBM or Apple for the right to do business.

In fact, the higher the fees, the better. Expensive fees will push mere copycats to the economic brink and transform the clever ones into offering more than economy to the buyer: quality and invention.


There are those who argue, however, that licensing fees should be reduced on the theory that this will actually protect the larger manufacturers' turf in the future. This theory holds that by setting low fees, the leaders in microcomputer manufacturing can maintain a climate that is uncondusive to creative competition. Low fees mean more clone makers will be encouraged to enter the business, and since licensing is cheap, there is no need to invest in R&D to improve technology. The result: the status quo. In addition, it is argued, the low price would protect users' pocketbooks, which in the wake of the microcode ruling will have to absorb part of the license fee tab.

But the seeming attractiveness of low-priced license fees is deceptive. Taking this easy road would be a significant miscalculation of worldwide technical capabilities, the upshot of which would severely crimp computing technology in the United States. The danger of stagnated development on these shores while Japan Inc.'s army of engineers continues to pour resources into information processing is obvious.

In addition to charging steep prices for the right to copy, it is essential to enforce stiff penalties for those found violating the copyrights and intellectual property rights of others. While the U.S. computer industry has been chasing down these criminals in corporate clothes more vigorously than in the past, it could be more militant. And the courts, which have often unwittingly encouraged rip-offs by meting out toothless punishments to offenders, must follow Judge Ingram's lead and get tough.

Finally, the U.S. government must continue to put the pressure on foreign countries that permit copyright abuses to continue. The government's weapons are many, but most feared is its ability to deny tariff considerations to these nation violators.

Despite the inevitable turmoil Judge Ingram's decision will cause the industry, it will remove the disadvantage that burdens companies investing in originality only to have it plundered by others who can sell it cheaper (because they didn't have to pay for it) and place it squarely on the raiders. Making things hard for the imitators will propel the innovators. And users will ultimately reap the rewards. ©



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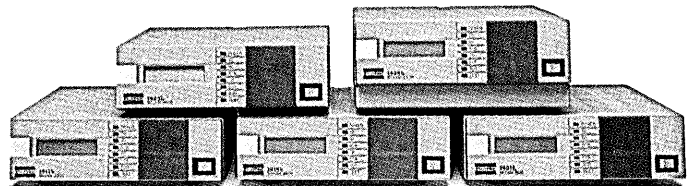


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NEWS IN PERSPECTIVE

DIVESTITURES

CLASH OF CULTURES

Martin Marietta ends its rocky relationship with RAMIS II, and On-Line must now pick up the mantle.

by Willie Schatz

RAMIS II, conceived and dedicated to the proposition that all fourth generation languages are not created equal, is about to have its second new address in three years. It's enough to give a product an insecurity complex.

Currently residing in Martin Marietta Data Systems' Information Technologies Division (ITD), Princeton, N.J., RAMIS II at press time was all but signed, sealed, and delivered to On-Line Software International Inc., Fort Lee, N.J. On-Line was also expected to purchase the Oxford Software piece of ITD. Terms were not disclosed, but sources put the figure at \$30 million to \$35 million. Martin Marietta paid \$30 million for Mathematica alone in 1983. Other interested parties were Pansophic Systems of Oak Brook, Ill., and, reportedly, UCCEL, Dallas.

Users, meanwhile, are beginning to express some of that insecurity.

"What lousy news. This is really a blow," says Larry Hall, vice president of the financial information management department at Security Pacific National Bank, Los Angeles. Hall's department has been using RAMIS for 10 years. "I hate to start over with new people," he says. "Every time there's a change in a software house, you always shudder a bit. Now it's back to square one."

With drums rolling and trumpets resounding, MMDS in 1983 had bought Princeton-based Mathematica, developer and purveyor of both RAMIS I and RAMIS II. It was the aerospace company's first outside venture into the computer business, and it seemed to be a match made in heaven. Mathematica, experiencing financial troubles, would take advantage of Martin Marietta's vaunted marketing strength and deep pockets. Martin Marietta would avail itself of Mathematica's renowned intellectual prowess and product development. MMDS in 1984 acquired Oxford Software, which markets the User Files Online (UFO) product. The third member of ITD, the Modular Application

System software, is not part of the deal. Nor is Hoskyns International, a wholly owned British MMDS subsidiary doing mostly systems software.

So, what happened?

"We set some plans for 1986 that were too aggressive on the revenue side," MMDS president Pat Zilvitas told DATAMATION. "We set the goals the same as 1985 and it turned out the industry wouldn't support that. We overestimated.

"That caused us trouble, because if you're not making your revenue goals, then your expenses are too high. RAMIS II had peaks and valleys, but it was not a good business year for Princeton."

Then why, oh why, does On-Line want to buy it?

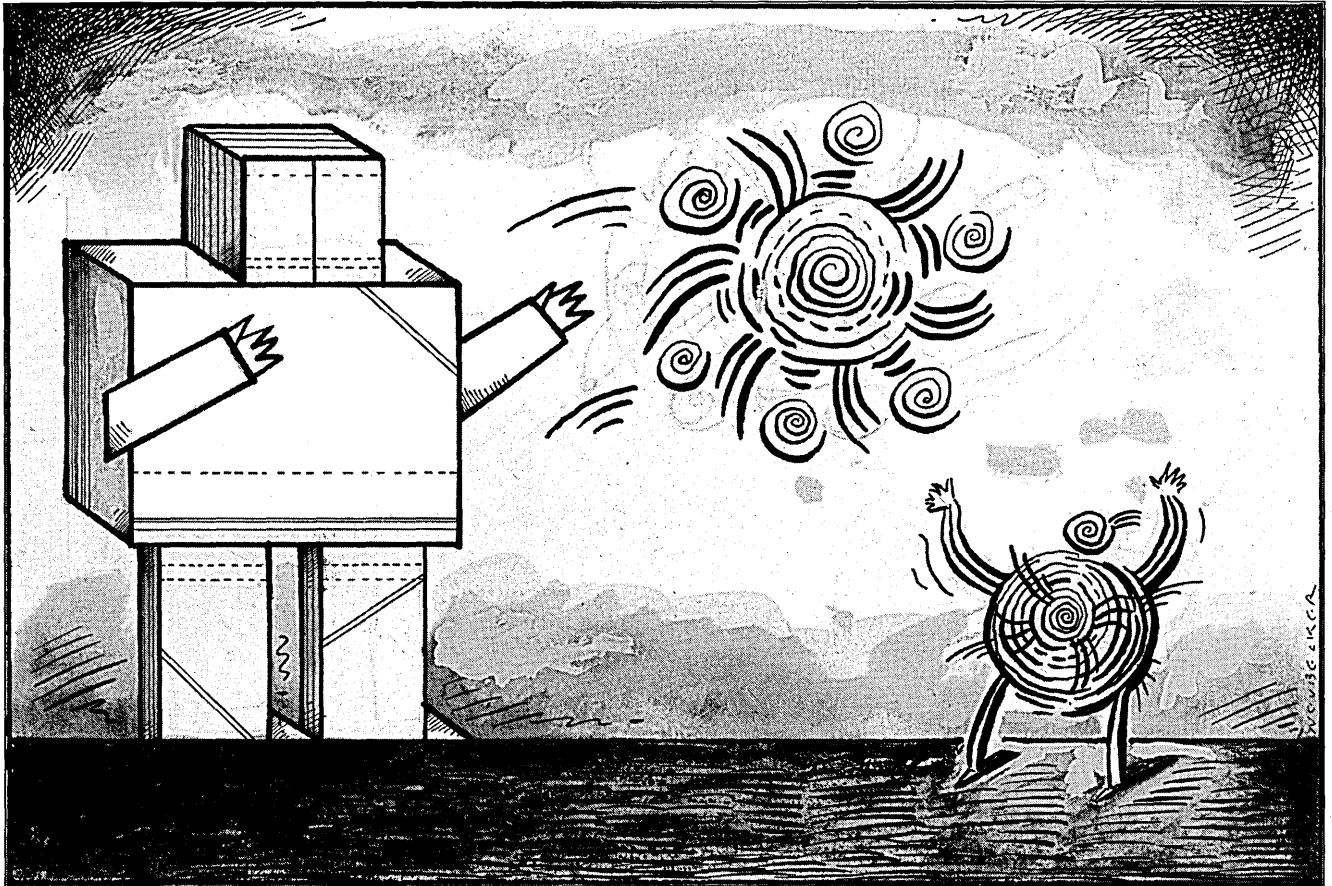
"It's a leading and successful product," says On-Line president Jack Berdy. "It adds a user base of 3,200 [1,200 RAMIS and 2,000 UFO] to our company. It doubles our size. We've got a totally telemarketing sales force. There is in the field and active. We get a direct sales force overnight, and we get instant access to the European market. Forty percent of their revenue comes from there. Only 5% of ours does.

"We know how to run a software company and how to do it profitably. If we didn't think we could run ITD as a profitable entity, we wouldn't be doing it."

Berdy knows whereof he speaks. On-Line, a developer of software designed to enhance the use of IBM's CICS and IMS, finished fiscal 1986, ended May 31, with record revenues and its sixth consecutive quarter with improvements in net income and earnings per share. Its only down year was 1984, when the entire industry went in the tank. Forget the instantaneous doubling in size. Never mind taking on the type of sales force it never had. Can On-Line really handle RAMIS II and UFO, both of which established markets where none existed and were then overtaken by competitors, and each of which has run some heavy red lines across the MMDS balance sheet?

"They have almost three times as many employees as I do and they generate about the same revenue," says On-Line executive vice president Edward Siegel. On-Line's 1986 revenues were \$36.4 million. MMDS doesn't break out numbers for its divisions, but company sources acknowledge that ITD contributed approximately 10% of MMDS's \$400 million in revenues.

"I run the same size business, and I do it better," Siegel contends. "MMDS hasn't run ITD very well. They coupled a bunch of businesses together and said, 'Go fly.' Then they looked at it two years later and said, 'Wow, it's not doing what we wanted it to.' Now they want to get rid



of it. They ran it into the ground.”

Harsh, but the truth always hurts. MMDS had had little but problems with RAMIS. The dissatisfaction crested in a minirevolution at last year’s users meeting (see “Can RAMIS II Deliver?” July 15, 1985, p. 32).

MMDS obviously got the message. It kept a full-scale revolution from erupting by delivering what it promised, even if some products were two years behind the original timetable. A user-company bulletin board went on-line in December. Concurrence, which allows several people to update and enter data to the same database simultaneously, also became available in December.

“We’ve probably held up some RAMIS growth because we had a customer base that we somewhat mistreated in promising some things we were late in delivering,” Zilvitas admits. “We gave them the aura of not listening in terms of product enhancements. We didn’t take their priorities into account—we imposed our own. We were not real swift in going out there and fixing a few liability problems with products they had installed.”

But the products would have been irrelevant without a new attitude by MMDS. So MMDS spent the last year making up for some very lost time.

“They’ve been killing us with kindness,” says Hall, who was one of the

more vocal dissenters at the 1985 user meeting. “We’ve had an excellent response from them about our problems. I thought from here on it was simply a matter of continuing to put their best foot forward.”

“They’ve done a super job doing the things people asked them to,” says Pat Engstrom, dp project officer in the information support center at Pittsburgh

“Every time there’s a change in a software house, you always shudder a bit. Now it’s really back to square one.”

National Bank and president of the Pittsburgh Users Group. “They’ve devoted a lot of time and effort to giving customers what they want. I have no complaints.”

Then who does? Martin Marietta Corp., 90% of whose business is related to aerospace, that’s who.

“To be successful in the packaged software business over the long haul requires repeated brilliance,” Zilvitas says. “Yesterday’s hit requires that repeated brilliance to maintain its level. That became a tremendous burden. We’re finding that the larger contracts that are executed over a long period of time are a lot healthier for us than one-time deals with packaged software.”

“Most of our executives have little

or no experience in businesses where your 60-days-out sales numbers aren’t 100% defined. The culture is such that when times are good they understand your software business. When things slow down, they really don’t know how to cope with the fact that the backlog, which used to be 60 days, is now 30 days. That’s not a big deal in the software business, but it’s very hard to understand when you don’t make that next 30-day revenue plan.”

So much for packaged software. It’s on to systems integration for MMDS, in which it has considerable federal government experience. It also has some, but not much, in the commercial market. Moving to that area will require a considerable shift in resources.

Not to worry. First and foremost, there are no short-term systems integration contracts. Once the original contract is signed, it becomes much easier to repeat the business. So say goodbye to repeated brilliance and perceived instability, and say hello to predictability and steadfastness.

“Part of MMDS’s strategic challenge is not only to build a business that’ll grow rapidly and contribute profits for the corporation,” Zilvitas says, “but to build a business that they’ll understand and be able to cope with the ups and downs of because they’re similar to the businesses they’ve had experience with.”

ILLUSTRATION BY ROBERT NEUBECKER

"Something that's driven off a backlog like systems integration is a lot easier for me to defend and for people to understand and participate in than something that's a fashion business like software. So from that standpoint maybe getting into the packaged software business was a mistake. We thought it was going to be a big business when we bought RAMIS and we still think it's going to be big business. But something that can be looked at as a retail business is absolutely the wrong business for our company."

Does that mean it's right for On-Line? Company executives apparently think so. They're convinced users have seen the RAMIS light. They believe the market will do likewise if the word's put out more forcefully than was done at MMDS.

According to the proposed acquisition agreement as outlined by Siegel and On-Line president Howard Sorgen, On-Line will acquire MMDS's assets, not its stock. On-Line can take its pick of which MMDS employees it wants. Siegel estimates that the final number will be "substantially less than double" On-Line's current total of 330 employees. On-Line can also choose which of MMDS's 14 domestic offices it wishes to keep open. It doesn't expect to operate more than six. On the product side, neither Siegel nor Sorgen will say at present how On-Line might evolve RAMIS technologically, but they concede that there had been a slowdown in the development of the product.

This, of course, has not been lost on the competition.

"It's usually not a good omen when a product trades hands twice in two years," says Vern Scheidler, manager of marketing support for Focus, the 4GL market leader and RAMIS's chief competitor, which is made by Information Builders, New York. "It's not as easy to make packaged software go as people think. There are some fairly delicate dynamics involved. When large corporations get in, they can't handle the entrepreneurial aspects.

"I'm really not that surprised. They're not selling much RAMIS that our field sales force can find. It's changed from a three-horse race [Focus, RAMIS, and NOMAD, owned by Dun and Bradstreet Computing Services, Wilton, Conn.] to a two-horse race [Focus and NOMAD]. RAMIS isn't a factor anymore because they haven't kept up with the technology. If we benefit from this, then that's all to the good. But I don't like to see a major product handed off like that. It doesn't look good for the industry."

Or for RAMIS? ©

News editor David R. Brousell assisted in the preparation of this story.

MIDRANGE COMPUTERS

THE CHILD BECOMES THE MAN

The S/38 picks up at the expense of the 4300 line, but how far will it go?

by Jeff Moad

Earlier this year, corporate MIS manager Charles McKellar was planning to upgrade the IBM 4341 Group 2 computer at machine tools manufacturer Brown and Sharp Inc., Kingstown, R.I. He considered the higher-performance 43XX alternatives. He looked at DEC. Then guess what he did? He bought a new IBM System/38 Model 400. That's right, a System/38.

Since August, when IBM started shipping new, upgraded S/38 models announced in June, the once nearly forgotten product line has enjoyed a modest rejuvenation, especially among users like McKellar who are looking for improved performance and broad software offerings but want to avoid the spiraling support and programming costs that go along with MVS-based systems. Many users seem to be taking IBM at its word when the company says it remains committed to the S/38 as a low-cost, midrange alternative. While the S/38 still is not posing a major new threat to its minicomputer competitors or to the 43XX, it's clear that the widespread reports of its demise were greatly exaggerated.

For Brown and Sharp, a Fortune 1000 manufacturer, the S/38 represented a way to boost processing power while keeping dp costs low. "Our goal was to keep data processing costs at or below 1.5% of our company's revenues," McKellar recalls. Brown and Sharp needed a more powerful processor on which to run its general business applications. "IBM was saying, 'You've got to go to MVS.' But that meant increasing our support staff of three to seven or eight. We couldn't do that and stay within our budget," says McKellar. "We wanted to stay with IBM, so we went with the System/38. Now we have one support person."

Like Brown and Sharp, the Specialty Papers division of Mead Corp. recently became a new S/38 user, trading in a DEC PDP-11/70 minicomputer that had run out of gas. According to Mead division information systems manager Buzz Sterner, the company decided against upgrading to a DEC VAX as a departmental

system because DEC lacked adequate payroll, general ledger, and costing software. Also, other divisions within Mead had already standardized on IBM mainframes, and the South Lee, Mass., division wanted to exchange data with them via 3270 SNA links and to use the same PROFS applications running on the corporate mainframe. "It had gotten to the aggravation point to have one division with a DEC system when everyone else was IBM."

Mead was well aware of the rumors months ago that IBM would drop the S/38 in favor of the S/36 or 4300 architecture. But when IBM upgraded the S/38 in June, Sterner jumped to recommend that the division buy an S/38 Model 400. "Initially, there was some concern about the System/38, particularly among our top-level executives," says Sterner. "But the IBM people in Rochester kept assuring us the product was here to stay. I figured IBM had put too much into the integrated database, layered architecture in the 38 to throw it all out the window."

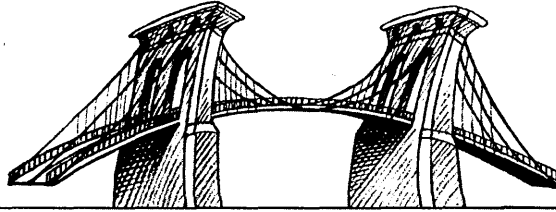
The new Model 400 that Mead and Brown and Sharp bought has 3.35 times the performance of the earlier generation's base Model 4 system. The new systems, all of which started shipping in August, go up to 4.9 times the performance of the Model 4. In addition, IBM began offering 3370-class disk storage devices and more main memory at lower prices. IBM also promised new S/38 operating system enhancements supporting improved S/36-S/38 data sharing and adding high-level language and better re-

"It had gotten to the aggravation point to have one division with a DEC system when everyone else was IBM."

covery facilities. IBM said the program products would be available some time in the fourth quarter, and many users were expecting them as early as the end of October. Similar hardware upgrades of the S/36 won't start shipping before the end of the year.

The performance boosts still leave the S/38's growth path limited, compared with that of DEC's VAX or the 43XX. But IBM used the upgrades to give departmental dp users a message: the S/38 lives. Or, as an IBM spokeswoman says, "IBM doesn't believe there is just one midrange solution. We will continue to offer the 3X and the low-end 370 architecture. That is the choice we are offering customers."

Figures compiled by market research firm Computer Intelligence of La Jolla, Calif., suggest some users are picking up on IBM's message. Computer Intelligence reported that, in the first six months of this year, the U.S. installed base of S/38s increased by 11% to about



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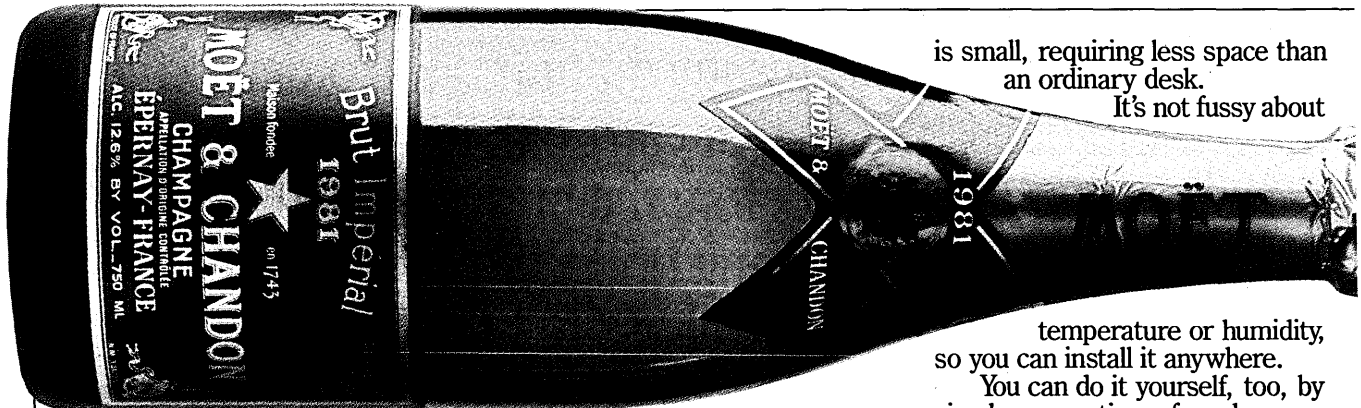
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Spery is proud to present the 2200/200—the very first Midframe computer.

It's small, inexpensive and easy to use, like a minicomputer. Yet it has all the power and functions of a mainframe.

Perhaps the best way to describe it is "the best of both worlds." And that's just why we thought it deserved a category of its own: the Midframe.

Suppose you are looking for a departmental or single-solution computer. A minicomputer would be your natural choice.

But let us tell you why the Midframe would be a better choice. Like a minicomputer, our Midframe

It's like a concert grand that fits in the space of an upright.



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It's like a family car with the power of a race car.

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powerful enough to serve as a host computer for most midsized companies.

In its most basic form, a single processor unit, the Midframe offers up to 6 Megawords (24 MB) of main storage, and more than a billion bytes of mass storage in the main cabinet.

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The Midframe offers enough capacity to support over 100 users

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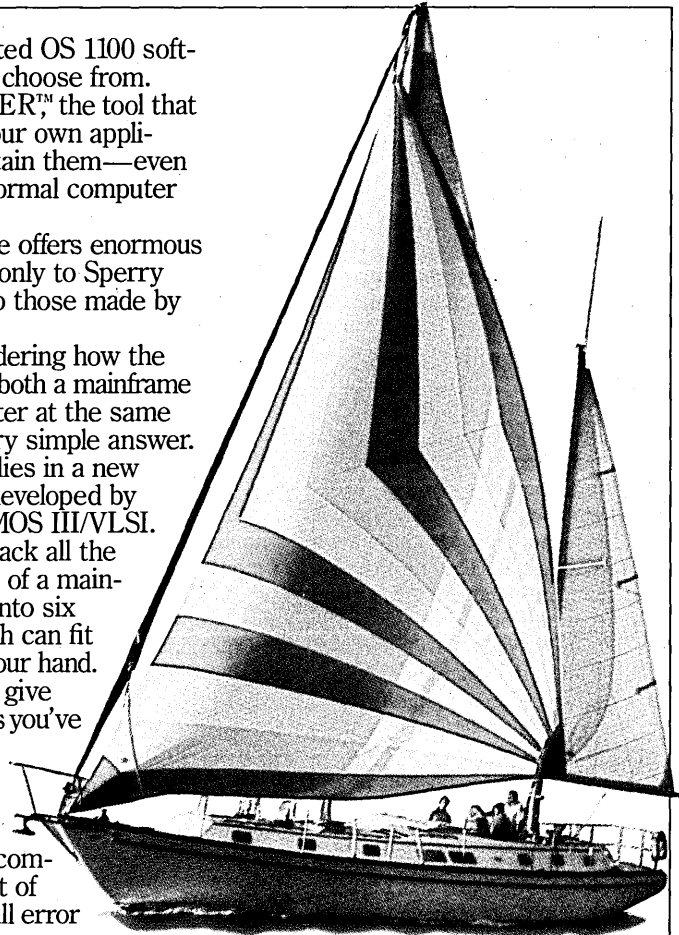
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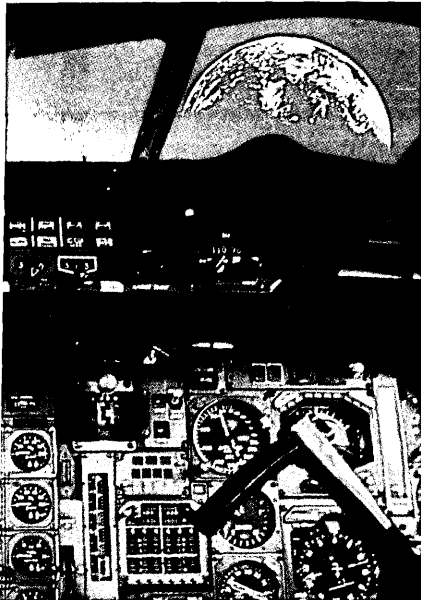


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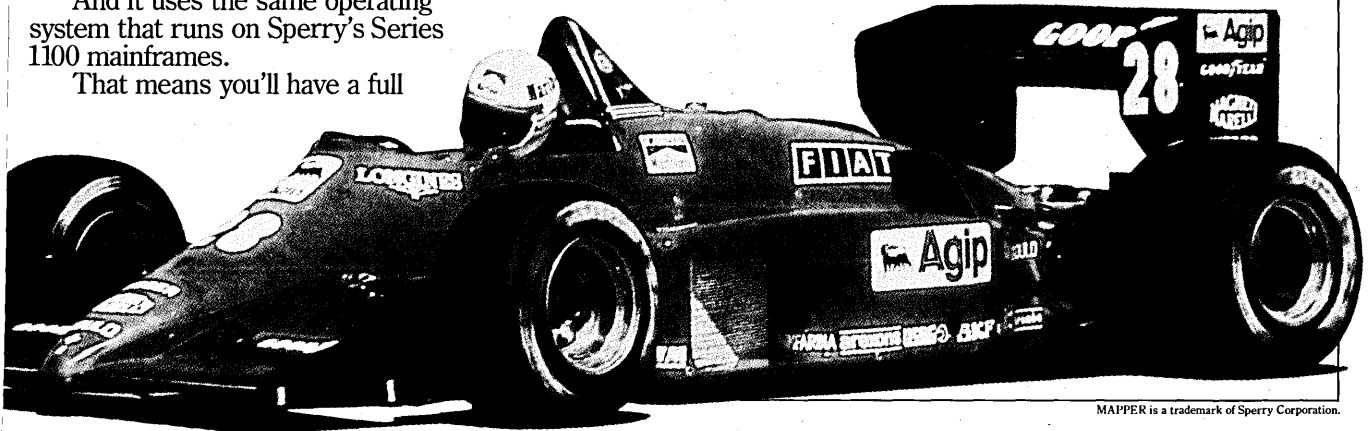


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running different applications at the same time. Just like a mainframe.

And it uses the same operating system that runs on Sperry's Series 1100 mainframes.

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NEWS IN PERSPECTIVE

10,000 systems.

IBM is not the only beneficiary of the S/38's modest rebirth. Applications software companies such as System Software Associates (SSA) of Chicago and Software International of Andover, Mass., report their S/38-related businesses are growing nicely. Sales of Software International's S/38 financial packages have increased about 50% over the last year, significantly above the company's overall 10% to 15% sales growth rate.

According to SSA technology vice president Larry Roches, the S/38's low support costs and recent performance improvements aren't the only factors making it attractive to some 43XX users. "IBM is creating a division within the 4300 product line," he says. "At the high end, IBM is anxious to migrate users to MVS/XA and the 3090. But the low-end 4300 users, who aren't ready for MVS/XA, haven't seen any major operating system improvements in a long time. They want new database technology. Right now IBM's not providing it. The improved S/38, with its built-in database at the microcode level is an alternative."

IBM's new 9370 system, although at a performance level that competes with the S/38, doesn't provide any significant new operating system or database solutions, says Roches. "It's a stopgap measure that we see providing off-line program development for the 4300. But it still doesn't provide any major operating system improvements."

While some S/38 users say they will take a look at the new low-end 4300 machine, others doubt in the end it will be as inexpensive to support as the S/38. According to Mead's Sterner, "It's a VM machine, and VM is no less manpower intensive to support than DOS or whatever else you have running on a 4300."

Of course, not everyone is convinced that the S/38 is attracting more interest or that IBM is more committed to it now than it seemed to be a year ago. A recent survey of large corporate users by Cambridge-based Forrester Research showed little improvement in the perception of either the S/38 or S/36 since the June announcements, according to research manager John McCarthy. The S/36 and S/38 were held in especially low esteem by users in search of a departmental system to act as a PC integration station. "The announcements made existing 36 and 38 users happy, but it didn't win many new customers," says McCarthy. "People still see those machines as based on an old 16-bit architecture."

Also suspicious of an S/38 rejuvenation is Cullinet Software Inc., which has bypassed the S/38 market with its embedded database in favor of the 4300 and DEC VAX markets. According to Cul-

linet product marketing director Bob Barr, "There's still a lot of uncertainty surrounding IBM's midrange strategy. In the long run it goes contrary to IBM's interests to have users switch from the 370 architecture to the S/38. Users making that switch may be making a mistake."

IBM, however, says users switching to the S/38 aren't making a mistake if what they are looking for is lower initial hardware costs and reduced support costs. "It all depends on the customer environment," an IBM spokeswoman says. "There may even be some shops where both a 3X system and a 4300 would be used. We don't feel that improved demand for the System/38 is coming at the expense of the 4300. Demand for the 4300 continues to be strong."

So far, most users who have completed the switch from a 4300 or some other system to one of the new S/38s seem satisfied. The Erie, Pa.,-based products division of GTE made its decision to switch from a 4341 to a System/38 about 18 months ago, well before this summer's S/38 enhancements were even rumored. "Sure, we were concerned about the 38's life expectancy," says GTE technical support manager Pete Swoger. "But we took a trip to Rochester and got promises that the system would continue to grow. The 370 is still at the center of IBM's strategy, but we're now satisfied that they're going to have to continue to be aware of and take care of 36 and 38 users." ©

CRIES AND WHISPERS

Most HP users are holding steady in the wake of Spectrum's latest delay, but there are some rumblings of discontent.

by Susan Kerr

Although many Hewlett-Packard users appear to be shrugging their shoulders at the latest six-month delay of HP's new top-of-the-line, RISC-based Spectrum minicomputer, the postponement may have crimped HP's attempts to woo much-needed new customers and has sent the company scrambling to hold on to the orders it had already signed for the new line.

Scheduled to ship this quarter, HP's Spectrum 930 minicomputer is being held back until mid-1987 for additional work on the operating system, with the primary job being to shrink pathlength or



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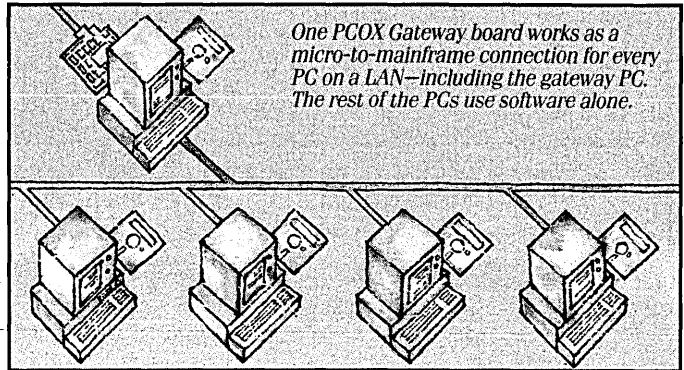
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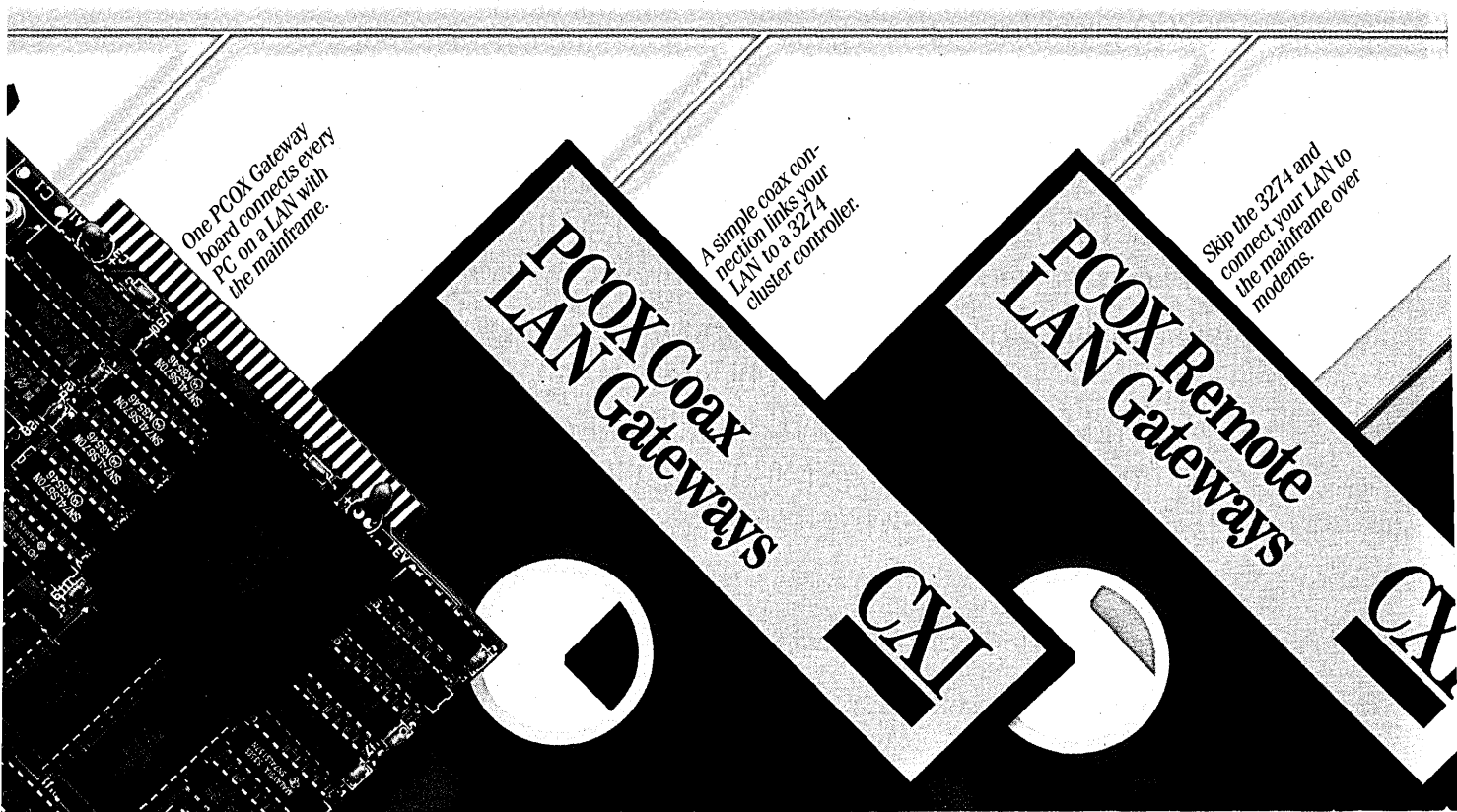
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Sep 18, Oct 30	IN Indianapolis	Oct 9, Nov 5, Dec 18	Aug 14, Sep 18,	NY Albany	Jul 23, Sep 11, Nov 20	Pittsburgh	Aug 7,	Dallas	Oct 14, Nov 18, Dec 11	El Paso	Dec 18
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New Haven	Aug 20,	Nov 13, Dec 10, Oct 29,	Nov 13, Dec 10, Oct 29,	NY Albany	Jul 23, Sep 11, Nov 20	Scranton	Oct 7				
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Nov 19	Nov 19	Nov 13, Dec 10, Oct 29,	Nov 13, Dec 10, Oct 29,	NY Albany	Jul 23, Sep 11, Nov 20	Scranton	Oct 7				

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NEWS IN PERSPECTIVE

the number of instructions required to obtain data. Yet, while HP officials are downplaying the complexity of the remaining work, it's becoming clear that the company's reputation rests on getting Spectrum out the door—and soon.

HP has often been credited with one of the most loyal user bases in the computer industry, and, for the most part, this feeling prevailed at the company's recent user group meeting in Detroit. But from those users who have reached the

HP is dealing with "concerned customers on a one-by-one basis to demonstrate to them that this is not a disaster."

limits of the current HP 16-bit 3000 minicomputer line, and have been patiently waiting throughout the five-year Spectrum development cycle for a solution, some rumblings of disenchantment are beginning to be heard.

One example is Lunn Poly Ltd., a London-based travel agency and current HP user. On July 15, HP proudly announced that Lunn Poly had signed the first contract in the U.K. for a 930 system. Two months later, after being faced with a delay it's not sure it can handle, Lunn Poly revised its contract with HP

and is evaluating other vendors.

Lunn Poly is not alone. Doug Spreng, general manager of HP's Computer Systems Division, acknowledges that "some" orders for the 930 have been "re-configured," but says that he's "not aware of any yet" that have been canceled. "I haven't found any cases where people have said, 'That's it, we're going elsewhere.' . . . It's hardly a fatal sort of thing," Spreng says. Still, HP is dealing with "concerned customers on a one-by-one basis to demonstrate to them that this is not a disaster."

What is troublesome, Spreng admits, is the effect the Spectrum delay is having on new business opportunities. HP has been perceived as being weak at the high end of the minicomputer market, and counts on Spectrum to be the cure. For example, the 930 will deliver twice the throughput and the second Spectrum release (the Series 950, to be based on NMOS VLSI technology) will deliver three times the system throughput of the previous high-end HP 3000 Series 68. Yet, while there are at present no benchmark tests, on a theoretical performance basis the 930 will be comparable to Digital Equipment Corp.'s 8600/8650 systems, according to Spreng.

Despite denials from HP officials,

leading market researchers estimate that HP has lost ground in the commercial minicomputer arena in recent years. Dataquest Inc. industry analyst Kimball Brown, based in San Jose, says that HP's position in the worldwide commercial business marketplace has slipped to 2% in 1985 from 3.1% in 1983. Likewise, Forrester Research Inc. president George Colony concludes that HP held between 15% and 17% of the U.S. minicomputer market in 1985, dropped to 13% to 15% in 1986, and next year will at best stay even or else drop to 10% if Spectrum isn't delivered by midyear.

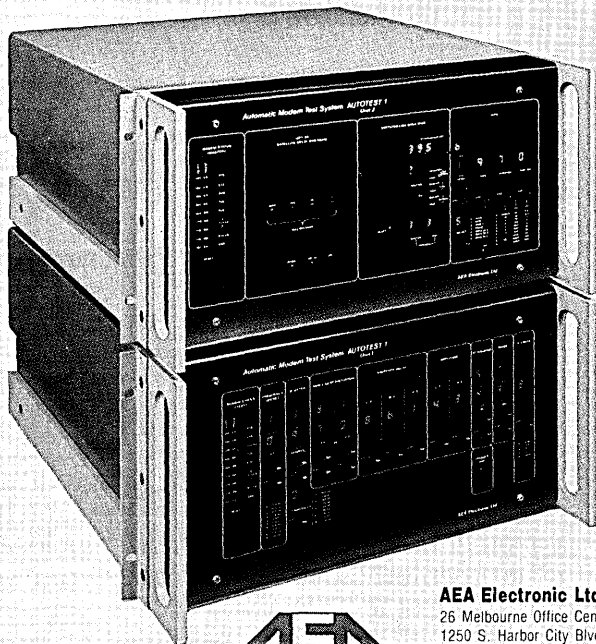
Analysts say that HP has primarily lost business to IBM, DEC, and Prime Computer, with DEC winning the award

"HP built up a lot of goodwill with its customers over the years. Right now they need it."

as most highly visible HP attacker. HP executives, however, shrug off the threat. "We pioneered commercial data processing," says Spreng. "They are coming into our business—business we understand extremely well."

That's all well and good, but for some users that may not be enough. "I have DEC and IBM knocking on my door

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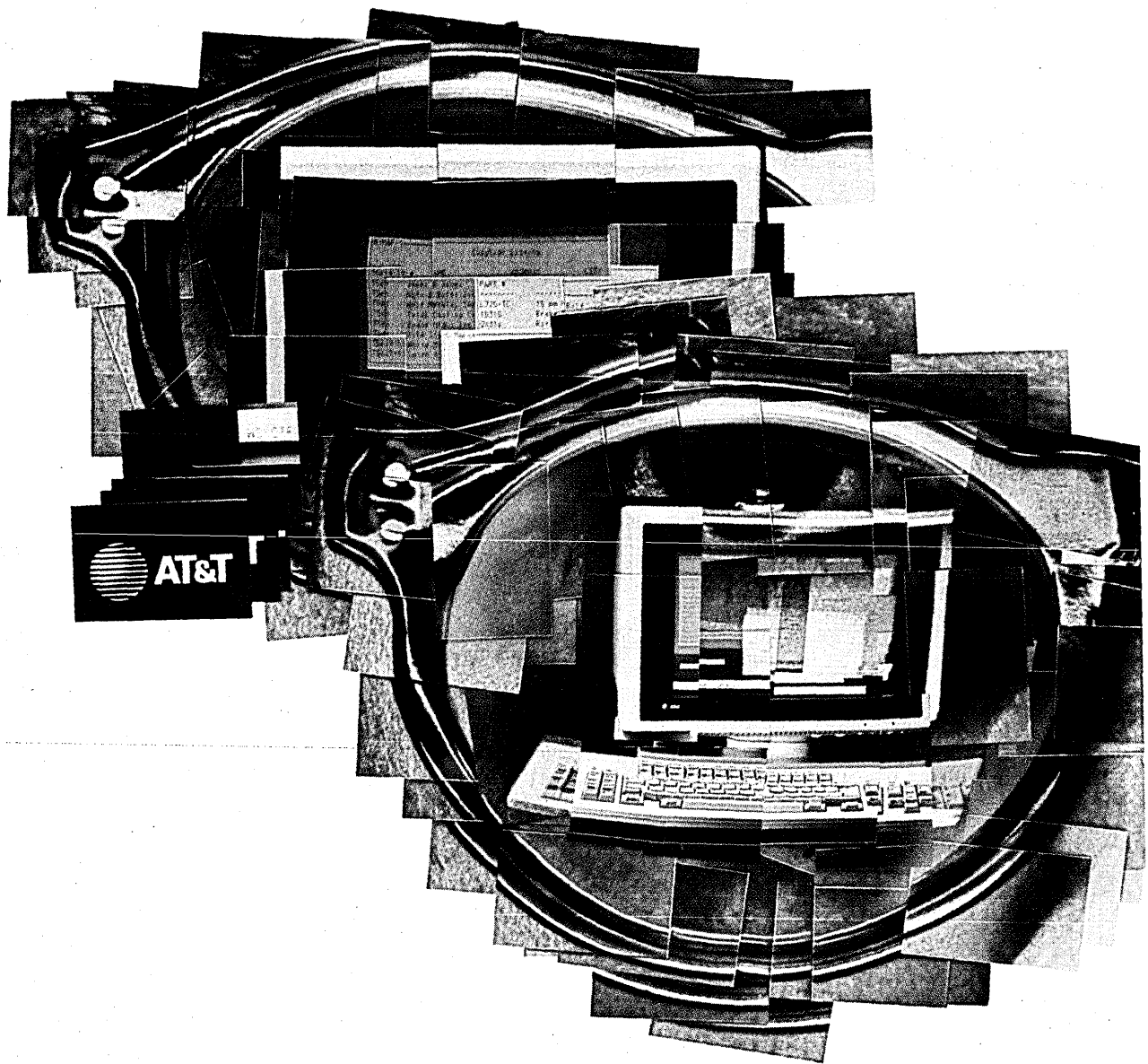


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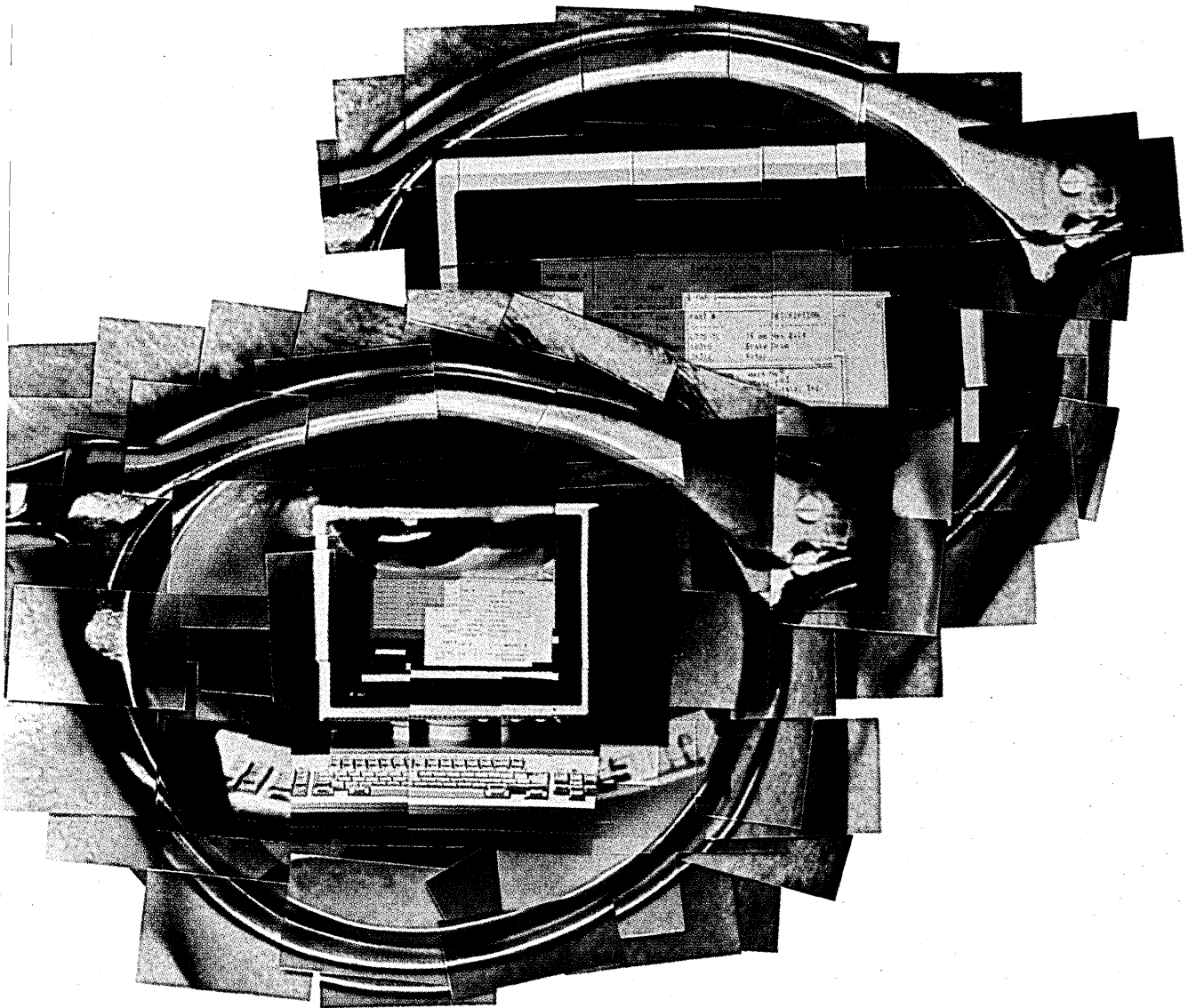
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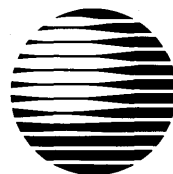
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NEWS IN PERSPECTIVE

every day," comments one HP customer. "HP built up a lot of goodwill with its customers over the years. Right now they need it. But the longer they go [without Spectrum] the more vulnerable they are."

HP depends on the decade-old HP 3000 minicomputer family for around 33% of its roughly \$6 billion in revenues, and the growth of the line is crucial to its future. Currently there are more than 26,000 installed HP 3000s that provide fertile ground for follow-on business. But until Spectrum is successfully proven at customer sites, it will be difficult for HP to increase its revenue base significantly. That can be done only by selling to a new crop of customers.

First, however, HP must make Spectrum a success with its present user base. To meet that objective, it has designed the 930 so that it runs software written for the old 3000 line.

Many originally thought that this software migration scheme would prove Spectrum's undoing. HP has managed to maintain software compatibility—but at a cost. In writing a new but compatible operating system, HP to date has found it

"My feeling is they're doing us a favor if it comes out and it's right."

can boost performance of the 930 only roughly 1.6 times that of the Series 68. That, says the company, is not enough.

"Unless we ship a machine significantly improved over the Series 70, it's better [just] to ship the model 70," HP executive vice president John Doyle told DATAMATION. The Series 70 is HP's current top-of-the-line minicomputer.

That decision was greeted with approval by many HP users. "My feeling is they're doing us a favor if it comes out and it's right. For us it's not a problem, since we won't need it for a year and a half. People are making too big a deal about it," remarks Terry Simpkins, MIS manager at Spectra Physics, Eugene, Ore.

But some customers do need the product now. Although HP says no major defections have taken place, the delay has given some users pause.

"I have two Series 68s," says one MIS manager, who, like many others, requests anonymity. "I'm fed up." While attending the user group meeting he took the opportunity to visit a forum held by rival supplier DEC. Asked if he would consider moving to DEC equipment, he replies, "I'm real interested."

Likewise, another MIS manager of a Fortune 500 company says that while he is reasonably content with his current HP systems, he questions whether people "want old systems running on new machines. . . . The whole delay is a good deal

WAITING IN THE WINGS

If Hewlett-Packard had the biggest contingent at its recent user group meeting, it's a good guess that second place was held by none other than Digital Equipment Corp.

DEC wasn't exactly attending the meeting. That point its officials want to make clear. Rather, Digital set up shop at a hotel suite directly across the street from Detroit's Cobo Hall—the site of the HP user group meeting—to advertise its VAX Systems Attract Program for HP Users.

Is DEC trying to take advantage of the delays HP is facing with Spectrum? Not exactly, say DEC attendees in a feeble attempt at delicacy. DEC has been planning this program since late last year, long before Spectrum was introduced, they explain.

"The VAX seemed like the logical upgrade to the HP 3000," says DEC marketing manager John McDonnell. "There's considerable overlap between the 3000 line and the VAX. We want to emphasize that to the commercial community. Some [HP users] are surprised we have COBOL compilers. They thought all we have is FORTRAN."

Still, DEC isn't going to win many awards for subtlety. Playing on HP's "What if . . ." advertising campaign, DEC handed out flyers and buttons asking "What if . . . you choose Digital?" If that wasn't clear enough, canvas bags and other literature boldly proclaimed how Digital has it "Now."

Traffic through the suite was heavy, with a good portion of the gawkers employed by HP. While few HP users questioned after receiving the pitch say they are seriously considering buying DEC in lieu of HP, they took the DEC appearance good-naturedly. "I think it's funny. They have a right" to show up, says John Churylo, MIS manager of Daniels & Associates Inc., Denver.

since it give us time to rethink" the company's computing strategy.

One possibility, he says, may be not to migrate to the 930 or 950 but just network upcoming 32-bit personal computers. He claims software written for HP minicomputers is beginning to be rewritten for smaller systems, which provides him with new options.

To date, an estimated two dozen customers and software suppliers have tested their software on the more than 400 preliminary 930 systems HP has in-house. The testing process begins with these companies running their software in compatibility mode. But for any noticeable performance gains, applications then must be recompiled, usually with optimized native mode compilers.

HP general manager Doug Spreng echoes that thought. "I think they [DEC] are wasting their time, but they have every right to be here. But I can't imagine it'd be practical" to convert from the 3000 to a VAX.

In a room full of various VAX systems, DEC hawked its migration tools for conversion from the 3000 to a VAX, including HP COBOL and FORTRAN converters and a scheme to convert HP's Image database to VAX/Ultra. While praising DEC for "a very well thought through program," Robertson, Colman & Stephens analyst Richard Edwards says many of the conversion programs have yet to be done and points out that most are supplied by third-party companies. Additionally, says HP's Spreng, "Just the cost of conversion for a Series 68 is \$50,000 and then there are no plug-compatible peripherals. You'd have to start from zero."

This is the first time DEC has actively camped out at another vendor's usergroup meeting. As to what results or level of sales DEC expects from its presence, it's too early to guess, says McDonnell. "We're not talking about physically moving HP out the door [at customer sites] and moving Digital systems in. Digital is interested in new growth opportunities," he adds.

When HP actually starts shipping Spectrum, HP "may well double our efforts" against DEC, notes HP Business Computing Sector marketing manager Bill Murphy. "Given that imitation is the best form of flattery," he laughs, "we're flattered that they copied our ad."

While HP might not be planning to set up shop at DECUS, DEC's user group meeting, it's not sitting still in the game of one-upmanship. Playing on DEC's Systems Attract Program name, Spreng quips, "We're calling it SAP. Our motto is, 'Don't be a SAP for DEC.'"

—S.K.

Those who've tested their software in the first stage—compatibility mode—report success. "Definitely, HP's claims regarding compatibility are absolutely true," says Donn Lewis, vice president of information resources at Allegheny Beverage Corp. "We've taken Series 68 software and run it without alteration on Spectrum successfully." Some have successfully executed programs in native mode, including Ask Computer Systems Inc., HP's largest 3000 reseller. Ask, Los Altos, Calif., has been running its Manman manufacturing software in "fully native mode for at least two months," says software development vice president Martin Browne. "We're very pleased with how migration took place."

Yet, while all the components may

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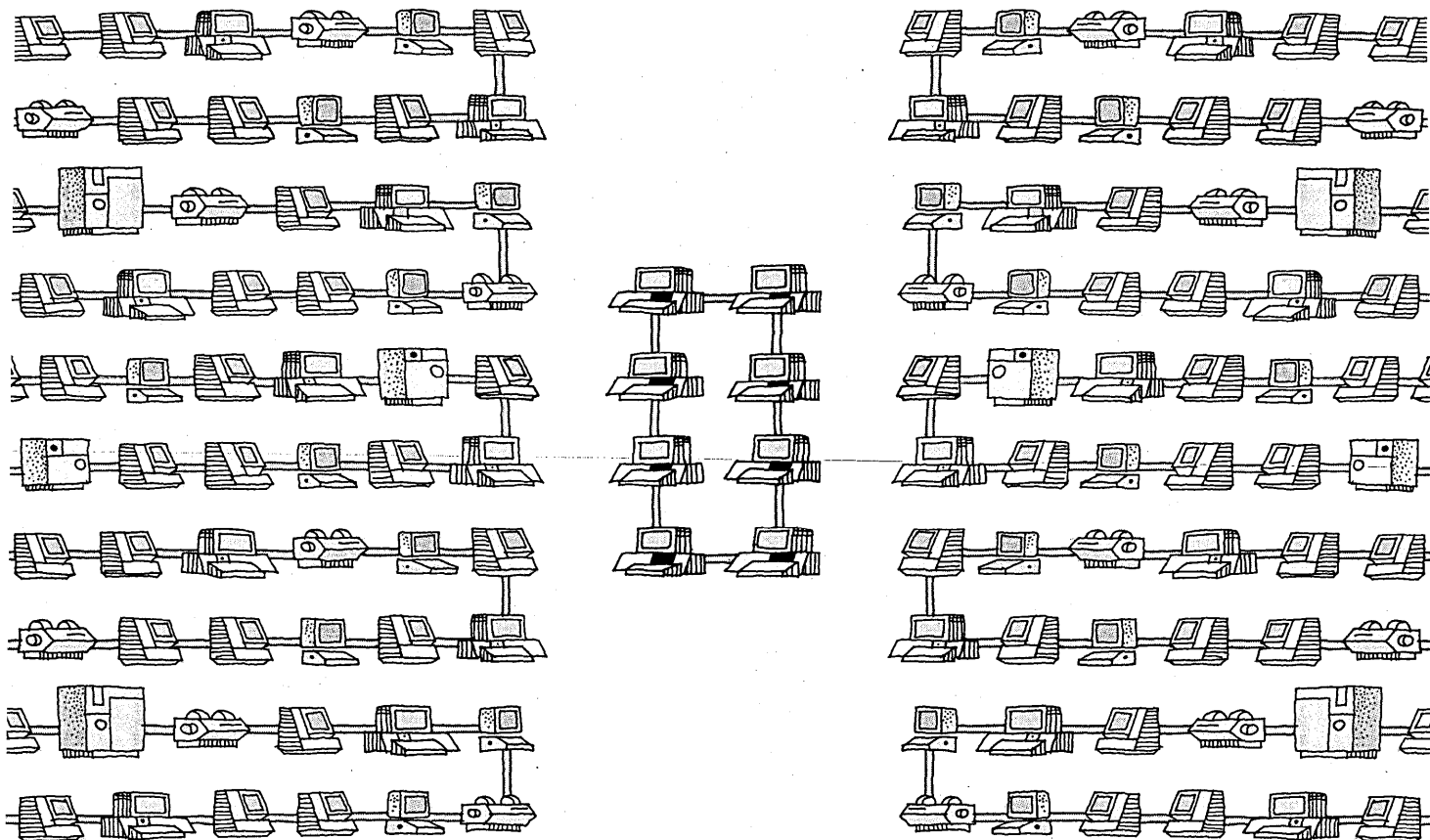
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NEWS IN PERSPECTIVE

be there, the raw performance is not.

Mitchell Kertzman, president of Computer Solutions Inc., a Burlington, Mass., firm that jointly markets manufacturing solutions with HP, says his software has run in compatibility mode on Spectrum. But "there's a lot that goes between working and being ready to ship. I believe the first push was compatibility—that's what HP focused on. To some extent the absolute performance of native mode suffered."

The real problem, according to Doyle, lies in the new operating system developed for the 900 series and its relationship with I/O functions. "The only question seems to be in the MPE operating system; in particular, as we integrate all the different modules together, we're finding that the I/O pathlength must be further refined," he says.

For example, according to one HP insider, one corrective measure will take place in the demand paged virtual memory scheme of the 930. Each virtual space is divided into fixed-size blocks. Those blocks will be doubled to 4KB from 2KB.

To maintain compatibility in the 3000 line, HP has had to upgrade its MPE operating system, which is based upon SPL. The new operating system, dubbed MPE XL, is written primarily in Pascal,

though it has borrowed 55 modules from MPE. That still leaves "several hundred thousand lines to be written," according to Spreng.

HP expects to place the 930 in beta sites in April. Meanwhile, the HP 9000 Model 840, a Unix-based computer for engineering and manufacturing applications, is already at beta sites and should ship on time in December. Although built around essentially the same RISC hardware as the 930, the 840 was easier to develop because Unix is newer and more portable than MPE, says Doyle.

Although MPE is getting the most publicity, there are several other concerns and question marks remaining with Spectrum. One is I/O bottlenecks.

"The area that worries me is I/O capability," says Mark Mojonner, data processing manager of Reliable Electric Utility Products, Chicago, a three-year HP user. In his application, "the amount of access to disk drives is very heavy. We've put in every option to deal with it and we still get bogged down in disk I/O." He says he's heard that I/O bottlenecks may still occur with the first release of the 930. Reliance Electric will wait and migrate to a 950.

To deal with potential bottlenecks on the more powerful systems, HP is de-

veloping a new fiber-optic I/O bus structure. The current 3000s and the initial version of the 930 utilize the slower HP-IB electrical link. But while fiber optics will "offer a lot more performance... be faster," says HP product manager Lee Courtney, HP-IB will allow customers to continue using many of the same HP peripheral devices they already have.

Another concern with the initial 930 release is networking. The first release will support only peer-to-peer or HP-to-HP networking. To access, for example, an X.25 network, a site will need a smaller system such as the HP Series 37 to act as a file server. HP is working on correcting that problem, insiders say.

"In the first release, HP will just bring out a very reliable product. With the second cut they'll address some of these deficiencies," says Lewis.

While HP's engineers are scrambling, so are its marketing employees. The arrival of the 930 should occur only a month or so before the new Series 950. The 4.5MIPS 930 is priced at \$225,000 while the 6.7MIPS 950 will be between \$300,000 and \$350,000. HP is now positioning the 950 rather than the 930 as the follow-on product to the current high-end Series 70. The 930 now is seen as the follow-up to the midsize 3000 models.

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NEWS IN PERSPECTIVE

"If we make it though the next three months [with the Series 70s], we'll make it through the rest of the year," says Reliance Electric's Mojonner. "If we survive that, we're probably not looking at a 930 but a 950. We don't want a little jump—we want a big jump."

After spending more than \$250 million to develop Spectrum, HP hopes a big jump is what it gets. Its officials brush aside comments that the first Spectrum minicomputer offerings are comparable to already established systems from other vendors. Without naming names, HP people say that these other suppliers have topped out on their current minicomputer architectures. Spectrum, they say, is new and scalable. Once—and if—the bugs are ironed out, the basic RISC architecture can be the basis for higher- and lower-performance systems than currently unveiled. They just hope people will wait them out.

Some definitely will. Kertzman of Computer Solutions is one of them. "I think Spectrum will be the VAX of the early 1990s," he says hopefully. "But there's a lot of pain involved to get there." ©

LEGAL AFFAIRS

BOLT OF LIGHTNING

A decision concerning copyright infringement may descend on clone makers like the plague.

by Tom McCusker

A court ruling this fall that semiconductor microcode is subject to copyright laws has been hailed as an important new weapon for IBM and Apple in the battle against some compatible microcomputer manufacturers.

The long-term result could be higher prices for hardware as these clone makers begin to pay expensive license fees to use the microcode, engage in costly court fights, or go out of business.

The ruling came in round one of a copyright infringement lawsuit brought by Intel Corp., Santa Clara, against NEC Electronics Inc., San Jose, U.S. subsidiary of the Japanese electronics company. U.S. District Judge William A. Ingram ruled in San Jose that software in any form—including software embedded in a microchip that interprets commands—is a form of expression that can be protected by a copyright.

The judge did not rule on whether NEC infringed on Intel's copyright for the microcode embedded in the Intel 8086 and 8088 microprocessors. That issue should be decided in round two of the suit sometime later this fall, when NEC explains to the court how it developed the microcode for its V20 and V30 chips.

The decision is being applauded by some micro vendors. "This decision will demonstrate [to clones] that the secret to long-term success is innovation, not copying," declares Irving Rappaport, associate general counsel of Apple. He says Apple knows of no clones that are not infringing on Apple patents or copyrights. "There is no such thing as a legitimate clone," Rappaport adds. Apple is currently embroiled in a patent infringement suit with Video Technology, a Hong Kong clone maker.

IBM does not say that all IBM PC clones infringe, but the company is diligent in warning or prosecuting those that do. J. Lyle McGuire, a spokesman for IBM on legal matters, says a majority of its complaints have been lodged against far eastern companies. He says IBM has taken legal action 24 times against companies that infringed its copyrights or patents—this despite the spirit of IBM's so-called Open Architecture policy, which encour-

ages connectivity of non-IBM products.

It is generally believed, for example, that IBM's basic input/output system (BIOS) was loosely written so that competitive machines would be able to use a comparable BIOS without infringing on the computer giant's copyrights. (An IBM-like BIOS is essential if application

Judge William A. Ingram ruled that software is a form of expression that can be protected by a copyright.

software written for PC/DOS is to be fully exploited on non-IBM machines.) When Phoenix Technologies Inc., Norwood, Mass., wrote its first commercial BIOS in May 1984, every major PC-compatible manufacturer was at its door.

Those were the days when IBM was trying to increase the size of the PC market. Now, as it changes strategy and seeks a larger market share, the rules may change. Big Blue may be slipping in a few hurdles for clone makers in the future.

For example, says software expert Brian Boyle of Novon Research Group, Menlo Park, Calif., programs written for IBM's windows environment, TopView, will execute only on IBM's original BIOS. More such products are on the way, in-

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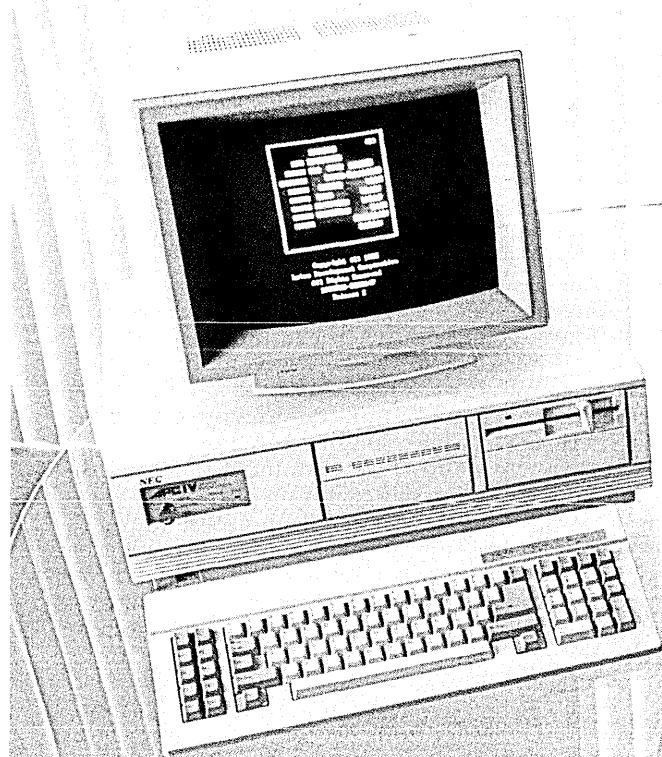
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NEWS IN PERSPECTIVE

cluding one before year's end in the graphics field. Boyle adds, "How are all these things being done? In microcode, which nobody now can touch."

A hint of just how far IBM intends to go to maximize its share of the market is offered by Robert Simko, executive director at International Technologies Group, Los Altos, Calif., a market research house. Simko predicts that IBM's future products will be built around the company's own 32-bit chip, not the Intel 80386. Under cooperative technology agreements between IBM and Intel, long a major IBM supplier, IBM has the right to modify the 80386 and to sell it as a proprietary product.

Simko thinks IBM would customize the 32-bit based computer to make it fit into SNA networks. Regardless of IBM's

"This decision will demonstrate [to clones] that the secret to long-term success is innovation, not copying."

eventual use, it would again have the effect of locking out—at least for a while—a lot of PC-compatible companies.

Meanwhile, Apple's Rappaport says the company soon will be registering all of that company's microcode with the copyright office. "We have programs called PALS [program array logic devices] and HALS [hardwired array logic devices] and all sorts of custom software embodied in microcode," he explains.

The ruling was generally considered a surprise. It should not have been, say those who have observed a national trend toward protecting intellectual property (see "Circling the Wagons," May 15, p. 42). "It should be a surprise only to the bad guys," Rappaport says.

"People who are infringing on copyrights generally do so because they believe the lower the level of utility [in this case in firmware], the less copyrightable it is," says Boyle of Novon. You can copyright the plans for a house, but you can't copyright the house, he adds.

"In this case, the old idea doesn't work because software is a way of accomplishing certain algorithms and that's what computers do—accomplish algorithms. The judge probably asked, 'Is this a utilitarian object or an expression?' He concluded that it was an expression."

NEC, if it can prove to the judge that it did not infringe on Intel's microcode copyright, will be able to continue to sell the V series in the U.S. It is unclear what effect the loss of the suit would have on the companies to which it now sells the V series. One such company is Epson America Inc., Torrance, Calif., whose Epson Equity line of IBM PC compatibles uses the V series. Epson refused to comment. ©

USED EQUIPMENT

SECOND-HAND ROSE

Small firms specializing in used computer equipment are making it big.

by Edith D. Myers

Greg Chartrand, a technical specialist with Fermi National Accelerator Center (Fermilab), Batavia, Ill., is delighted with several Micom Systems Inc. (Simi Valley, Calif.) data PBXs he's purchased over the past year. What's most delightful to him is that he saved 60% over what it would have cost to buy them new—his PBXs were purchased used from Century Computer Brokers, Culver City, Calif.

Like most managers in computers and data communications these days, Chartrand sought to keep costs down. He heard about Century from a colleague at Fermilab. Chartrand had once purchased some used terminals, but he was uneasy

about buying anything more.

"I was concerned. I didn't want to buy anything complex from anyone who didn't understand the equipment," Chartrand says. Century changed his mind. "They did understand it. There were some cosmetic problems, some chips and dents here and there, but they don't affect function and I plan to buy more."

The used computer equipment business has come a long way since Adolf F. (Sonny) Monosson, president of American Used Computer Corp., Boston, used to advertise his wares on a sandwich board on Atlantic City's boardwalk during Spring Joint Computer Conferences (see "On the Boardwalk," July 15, 1970, p. 72).

It became a \$1.6 billion business by 1978, with dealers handling predominantly used IBM equipment. Its voice at that time was the Computer Dealers Association (CDA), headquartered in Chicago. As some used computer dealers, like Comdisco Inc., Rosemont, Ill., became, for the most part, leasing companies, CDA was merged in 1981 with the Computer Lessors Association (CLA) to become the Computer Dealers & Lessors Association. CDLA is now a 305-member organization headquartered in Washington, D.C.

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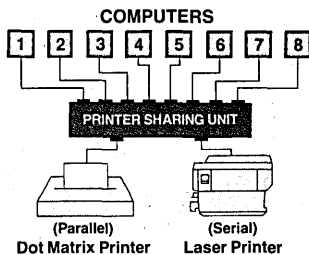
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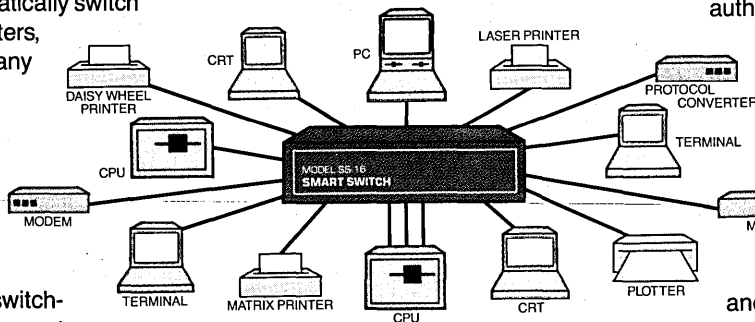


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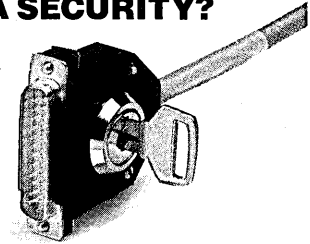
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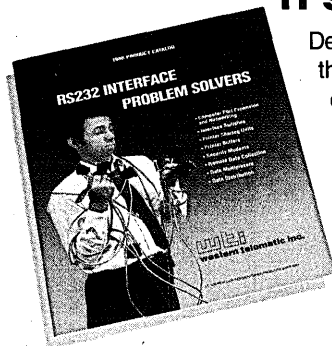
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NEWS IN PERSPECTIVE

Jim Benton, CDLA executive director, says the market was \$2.8 billion in 1985 and is projected to grow another 20% this year. He anticipates an attendance of 800 at an association conference this week in Colorado Springs.

The discount that customers can get for used equipment varies widely, depending on the type of equipment, its condition, market demand, and availability. None of the dealers interviewed by DATA-MATION wanted to venture a guess as to the average savings, but all agreed that there are some very good deals to be had.

Several large companies—Comdisco, CMI, Continental Information Systems, and DataServ, to name a few—dominate the used equipment market, but a number of young, small- to medium-sized companies have entered the scene and found it rife with opportunity.

One such company is Century—one-and-a-half years old with 25 employees and doing \$8 million a year in business. Although it might find itself with an occasional IBM terminal or PC in its constantly changing inventory, it deals primarily with non-IBM equipment. Century is unique in the used equipment field because it deals with data communications gear as well as modems and terminals.

Another young firm is Tectran, Cranston, R.I., also one and a half years old. Tectran began in Cambridge, Mass., as a one-man band: its president, Lorne Adrain. It moved to Cranston in the first quarter of this year and now has 10 employees. "I had worked for AT&T for five years and got interested in videotex and the whole notion of an information industry both there and while getting my MBA at Harvard Business School."

He views Tectran as an information service. The company doesn't buy or sell anything—it puts buyers and sellers in touch with each other. Sellers could be end users, dealers, or manufacturers

Jim Benton, CDLA executive director, says the market was \$2.8 billion in 1985 and is projected to grow another 20% this year.

phasing out a line or wanting to rid themselves of traded-in goods. Tectran charges companies from \$19.95 to \$600 to be listed for 90 days in both a hardcopy bulletin with a 60,000 circulation distributed every other week and a database that can be accessed either electronically, like a bulletin board, or by calling an operator.

The listed equipment runs the gamut from microcomputers, peripherals, minicomputers, mainframes, and mainframe peripherals to telephone equipment and facsimile machines. Supply and demand, he says, "is a reflection of the market. Right now we're seeing a lot of

activity with IBM PC XTs, Altos machines, AT&T micros, a variety of Unix-based systems, MicroVAXs, and CAD/CAM equipment." He says he's beginning to see activity with IBM System/36s and 38s.

At the other end of the spectrum is 11-year-old East West Computing Inc., Los Altos, Calif. Its president, Bob Pearson, admits to being "kind of on the trailing edge." Pearson's firm specializes in IBM 3505 card readers and 3525 card punches.

Aside from the dominance of Big Blue in the market, there are other reasons for the prevalence of IBM in the used market. "IBM's attention to the aftermarket is very high," says CDLA's Benton. "They give good support."

Dealers echo this sentiment. Cameo Computer Corp., Torrance, Calif., sells IBM cpus from 34s, 36s, and 38s up to the 303X series. Steve Mack, Cameo's small systems manager, says the company has sold, "an occasional DEC and Data General machine," but adds, "No one is as good as IBM as far as support. IBM is conservative except for maintenance."

David Wolff, vice president, El Camino Resources, Sherman Oaks, Calif., which is among the top 10 used equipment dealers in the country and has a DEC division in Irvine, Calif., tends to

agree. "The contributions to earnings is lower," he says, "because there is more reconfiguration and parts swapping, more technical expertise involved. A VAX 8600 could have 60 variations whereas a 3081 is a 3081."

A few computer dealers, notably old-timers CMI of Bloomfield Hills, Mich., and Econocom, Memphis, have ventured into the telecommunications marketplace with used AT&T equipment, particularly PBXs, but most mainstream dealers prefer a one-vendor orientation. Wolff says his firm has considered PBXs, but it's "a tough industry," and the company has no plans in that direction.

There doesn't appear to be a consensus as to exactly where the used computer market is headed. There are those who see a shakeout and others who see the number of companies growing steadily. Wolff believes there will be "fewer players in the long run, not more." Mack of Cameo says the competition has increased dramatically in the last two years and will continue to increase in the future. "There are more people getting in than getting out."

Whatever wrinkles the future holds for the industry, there doesn't seem to be a place for sandwich boards any more. ©

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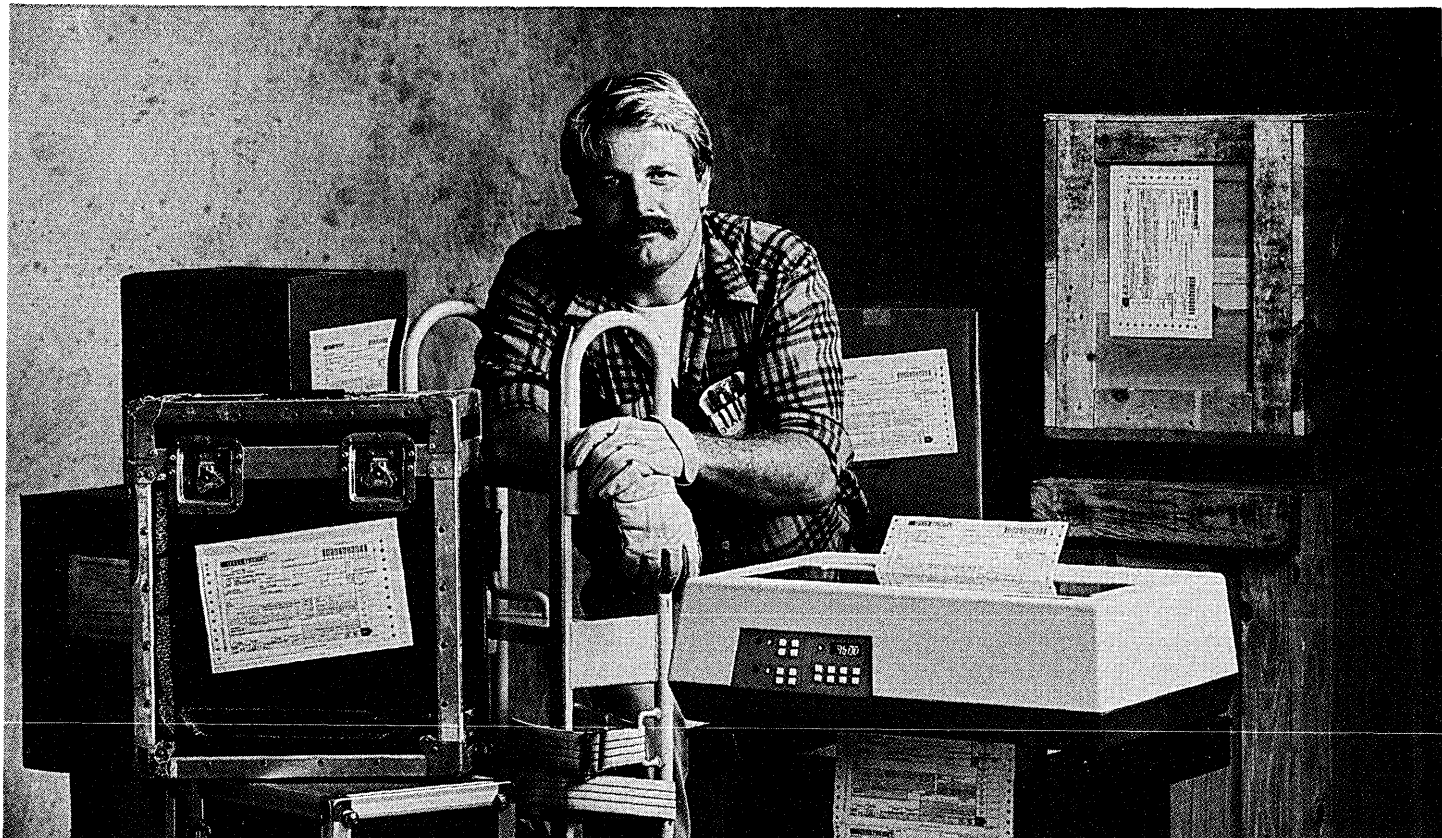
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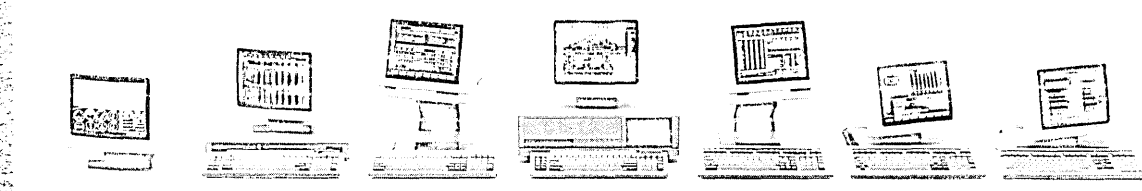
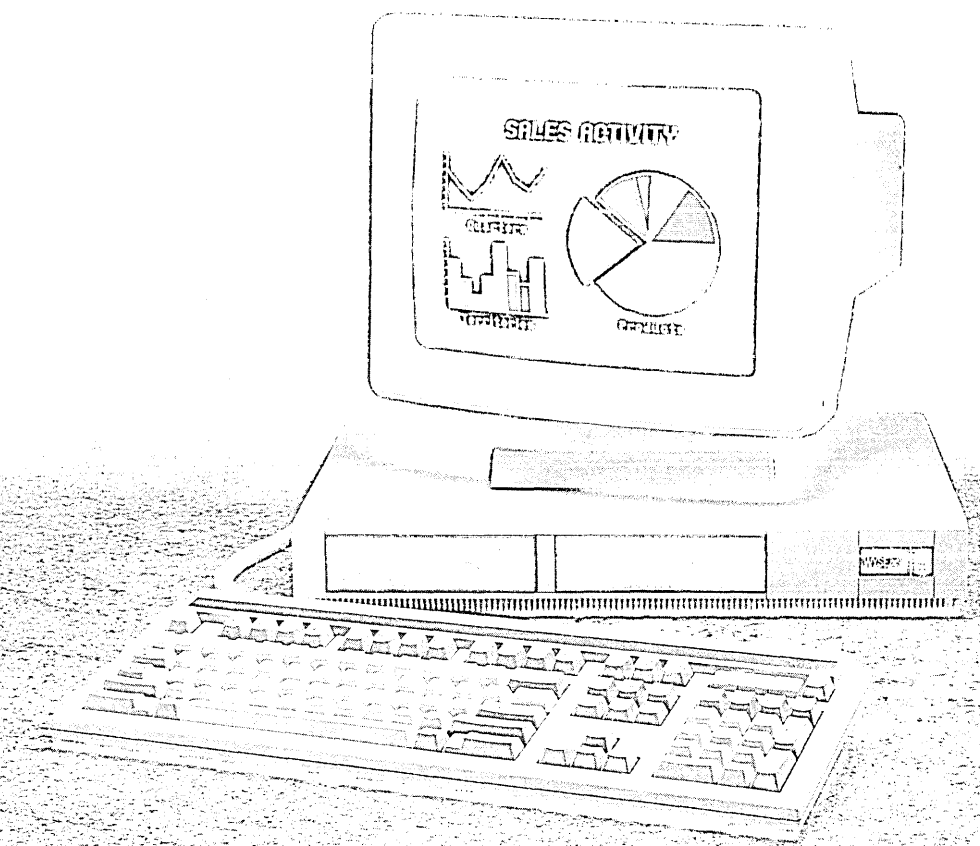
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NEWS IN PERSPECTIVE

MERGERS

SEPARATE BUT EQUAL

Sperry users express concern about the recently announced Burroughs-Sperry brand management strategy.

by Robert J. Crutchfield

The merged Burroughs-Sperry company may not yet have a new corporate name, but it does have a strategy, which, two months after the companies came together, is being revealed to users.

The strategy is basically a repeat of promises that Burroughs and Sperry made when they merged, with a new twist. At a recent meeting of Datametrics, a group specializing in education, software, and consulting services for users of the Sperry 1100 series, executives from the recently formed merger relations departments at both companies told dp/MIS executives that their systems would continue to be supported and enhanced.

According to John Wise, director of merger relations at Sperry, and Sharon Koshak, who holds the same title at Burroughs, the new company will treat each product line as a separate brand, much the same way General Motors does with its Chevrolet and Buick divisions and Procter & Gamble does with its personal care products.

Wise echoes Burroughs chief Michael Blumenthal's statements in the early days of the merger talks by referring to his "We're No. 2" slogan. As a "strong number two, we can develop a 'counter-punch strategy,'" Wise says. He likens the new company competing against IBM to such companies as Ford, Avis, or Pepsi competing against GM, Hertz, or Coca-Cola.

"We are not going to spend one dollar to converge product lines," Wise says, adding that the Sperry and Burroughs architectures will remain separate but equal.

Sperry is still trying to convince its customers that the merger will benefit the Sperry user base. According to the merger team, product planning, common hardware sourcing, and R&D budget dollars are areas where users will see immediate benefits. Wise says that while the two companies' architectures are different, the combined buying power of a \$10 billion company will lower manufactur-

ing costs, which he implied could be passed along to the user in the form of lower prices.

Initially, look for Memorex to offer tape drives and terminals to the Sperry user base. Sperry officials also indicate that the company may convert Sperry's Mapper program development tools and SperryLink office automation products to the Burroughs environment. There is already a version of Mapper in C being readied for release. Burroughs is also marketing the Sperry pc (oemed by Mitsubishi) to its users.

A task force of Burroughs and Sperry employees charged with studying the two product lines will make recommendations by the end of this year, according to Peter D. Bakalor, director of market development for Sperry's information systems division. The group looked at "commonalities in communication capabilities" of the two architectures, Bakalor says, but he does not elaborate.

Meanwhile, users remain skeptical of the positives put forth by Sperry. They continue to express concern, doubt, and confusion about the effect the merger will have on their equipment over time.

"I see a lot of negatives," says a data center manager at an airline, but, he added, "in the end, I think it will work."

Another user, who also requested anonymity, says, "When you support two architectures, someone has to lose. I am confident that the Sperry base will be supported but at some point I think the new company will move towards one architecture—they have to."

Other users are worried about where the R&D money will go. "When the companies combine their resources, they are not going to double the R&D budget," says a user. "Where is the money going to be spent—on a project for Sperry or a project for Burroughs? I don't see how it can be both."

Users also expressed concern for their Sperry support teams. "There is bound to be a lot of fallout with the merger. It hasn't started yet, but I see a lot of combining of personnel resources," a dp manager says.

Meanwhile, the company is trying hard to instill confidence in users. Sperry recently introduced a new family of mid-range mainframes and two new 32-bit Unix-based microprocessor systems (see Off-Line, p. 115). The introductions, Bakalor says, are proof that the company is committed to supporting its products.

Will these new products and long speeches quell users' fears? Sperry sure hopes so. "There are a lot of fence sitters out there," says a Sperry insider. "It is crucial for the company to instill confidence in its users who are unsure about remaining with the company." ©

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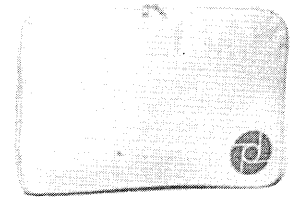
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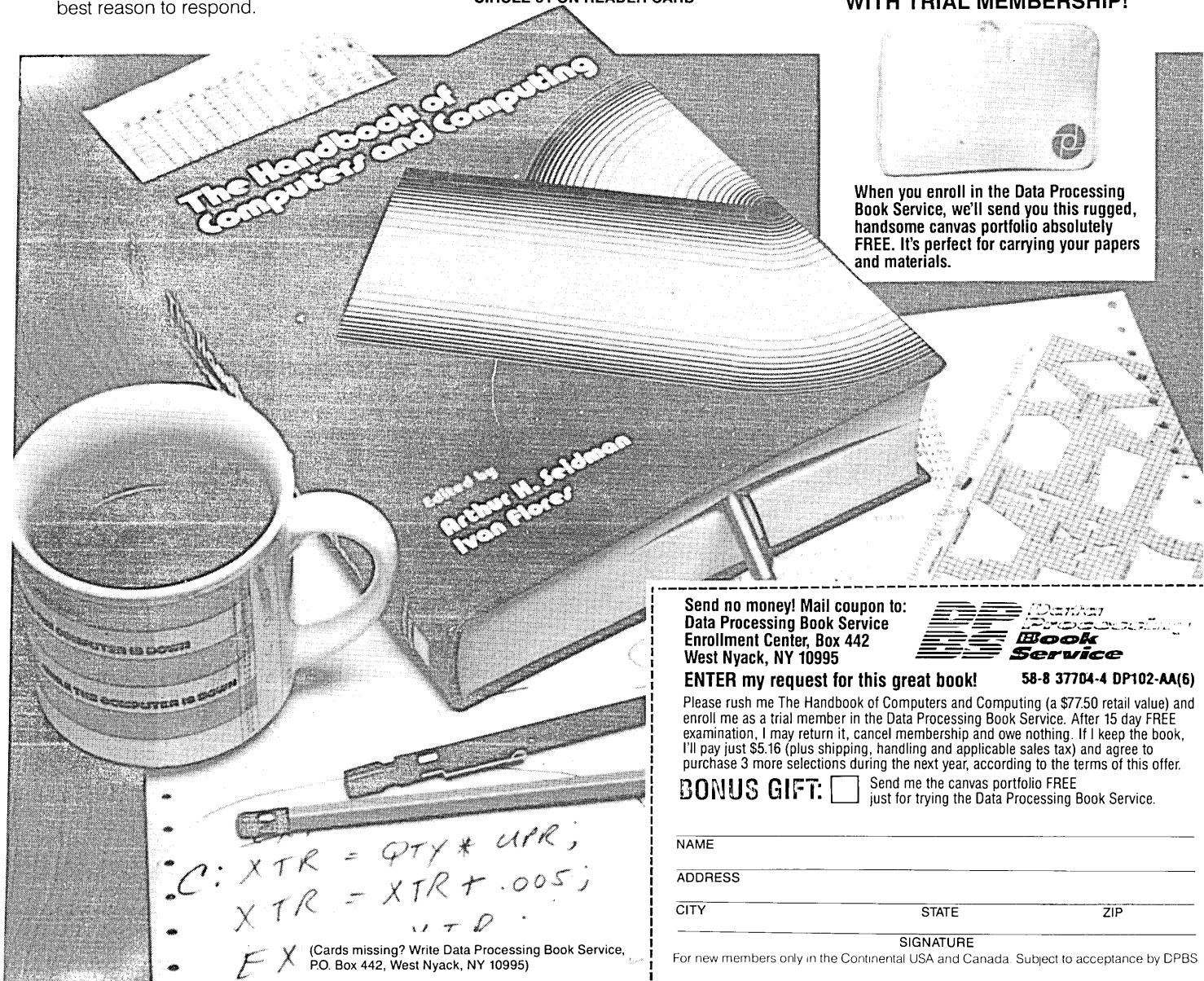
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BENCHMARKS

IBM STRIKES BACK: IBM, striving to defend itself from DEC, which has been enjoying great success at IBM accounts with its easily networked VAX, unveiled a new line of small 370 processors, the 9370s. The four machines will not be shipped in volume until late next year, but their low prices and promise of new technology should help IBM in certain major accounts where distributed 370 cpus are desired. IBM also says it will begin charging users sliding one-time fees for some 90 systems software packages, de-

pending on which cpu they run the software. It also unveiled the first of a series of so-called SolutionPacs, consisting of bundled software and support services for specific industry applications. Also, maintenance charges for certain networked IBM machines were cut by 16%.

GOODBYE, HONEYWELL? Honeywell Corp. is in negotiations with NEC Corp. of Japan and Groupe Bull S.A. of France to restructure its Information Systems division. Honeywell says it intends

to hold talks with the two firms regarding the "combination of HIS with Bull and NEC." Sources indicate that the company will, along with Bull and NEC, form a new U.S. subsidiary of Honeywell to take over HIS's functions. Honeywell will retain its federal systems division, sources say. All three companies have declined to comment further.

DRI FORMS SUBIDIARY: Micro-computer software maker Digital Research Inc. has formed a subsidiary to develop software for tying differing machines together with industry standard interfaces. Interconnexions Inc. is headed by former DRI senior engineering vice president John Hiles, who says it will develop software that allows microcomputers, minicomputers, and mainframes to work together. Interfaces used will include MAP, PC-Net, SNA, TOP, TCP-IP, X.400, and X.25. The subsidiary will develop products for oem distribution and will do some contract development work.

SEI'S NEW DIRECTION: Officials at Carnegie-Mellon University (CMU), Pittsburgh, have tapped one of the original visionaries of the Software Engineering Institute (SEI) to become the institute's new director. Larry E. Druffel, 48, who had helped charter SEI two years ago while serving as a technical manager in the Pentagon, replaces John Manley, who resigned last July in a "philosophical" dispute with CMU officials (see "Question of Balance," Sept. 1, p. 24). Manley had been pushing to establish private-sector ties for SEI, a government-funded software R&D center administered by CMU (see "SEI: The Software Battleground," Sept. 15, p. 109). Druffel, most recently a vice president at Ada Developer Rational in Mountain View, Calif., avowed that the goal for SEI under his leadership "is not to create new companies. Our goal is the transition of technology to practical uses in support of the Department of Defense."

ADR'S GOETZ SHIFTED: Martin A. Goetz, a founder and president of Applied Data Research Inc., Princeton, N.J., has left that job to become senior vice president and chief technology officer, a new position. Replacing him as president and chief operating officer of ADR, which was acquired early this year by Ameritech, is Dennis F. Strigl, former president of Ameritech Mobile Communications. Goetz, 56, a well-known software industry pioneer who, in 1968, was awarded the first U.S. patent on software, requested the job change, ADR says. ADR also named William T. Clifford, formerly vice president of planning and services, to the new post of executive vice president. ©

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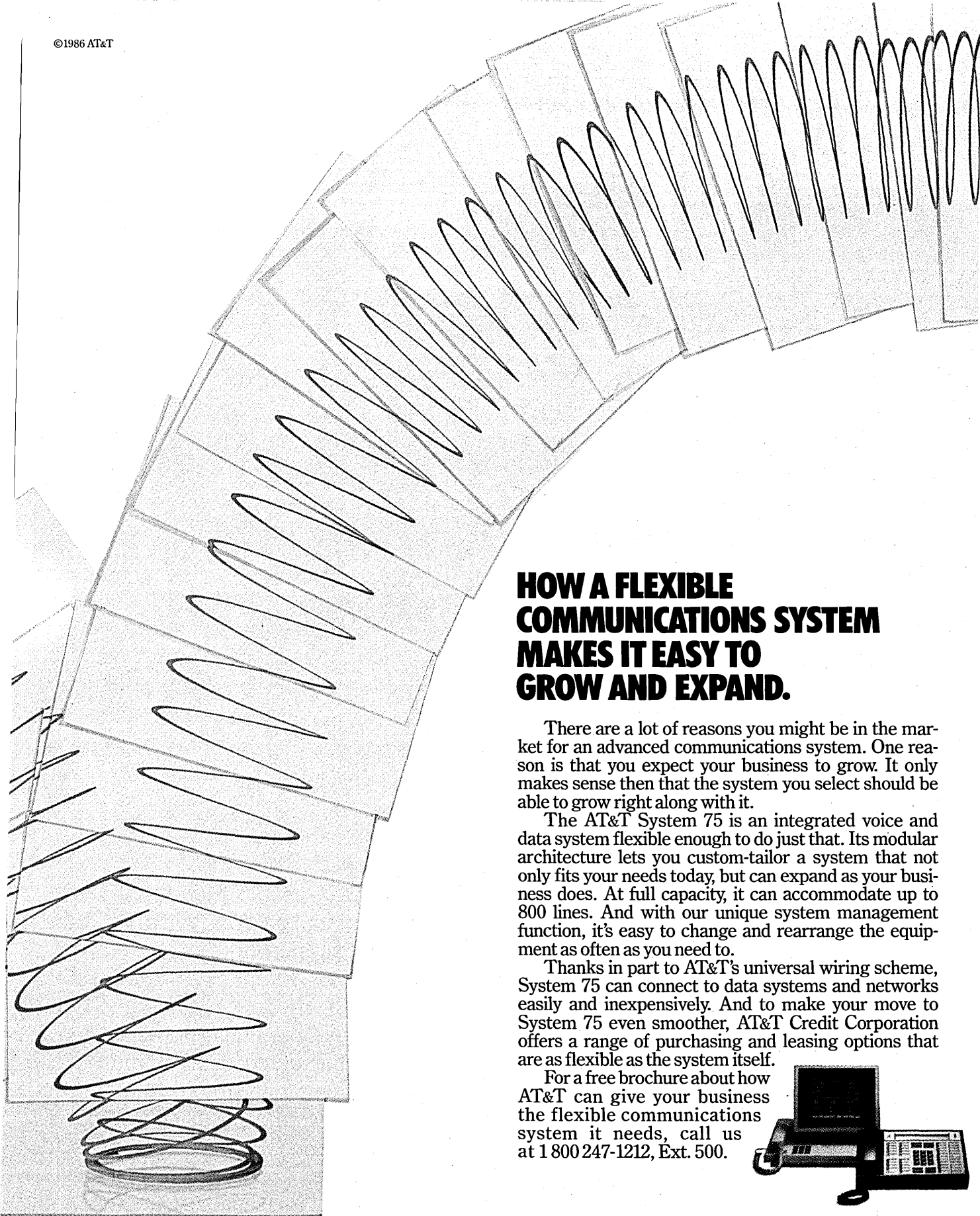
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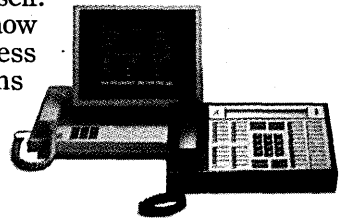
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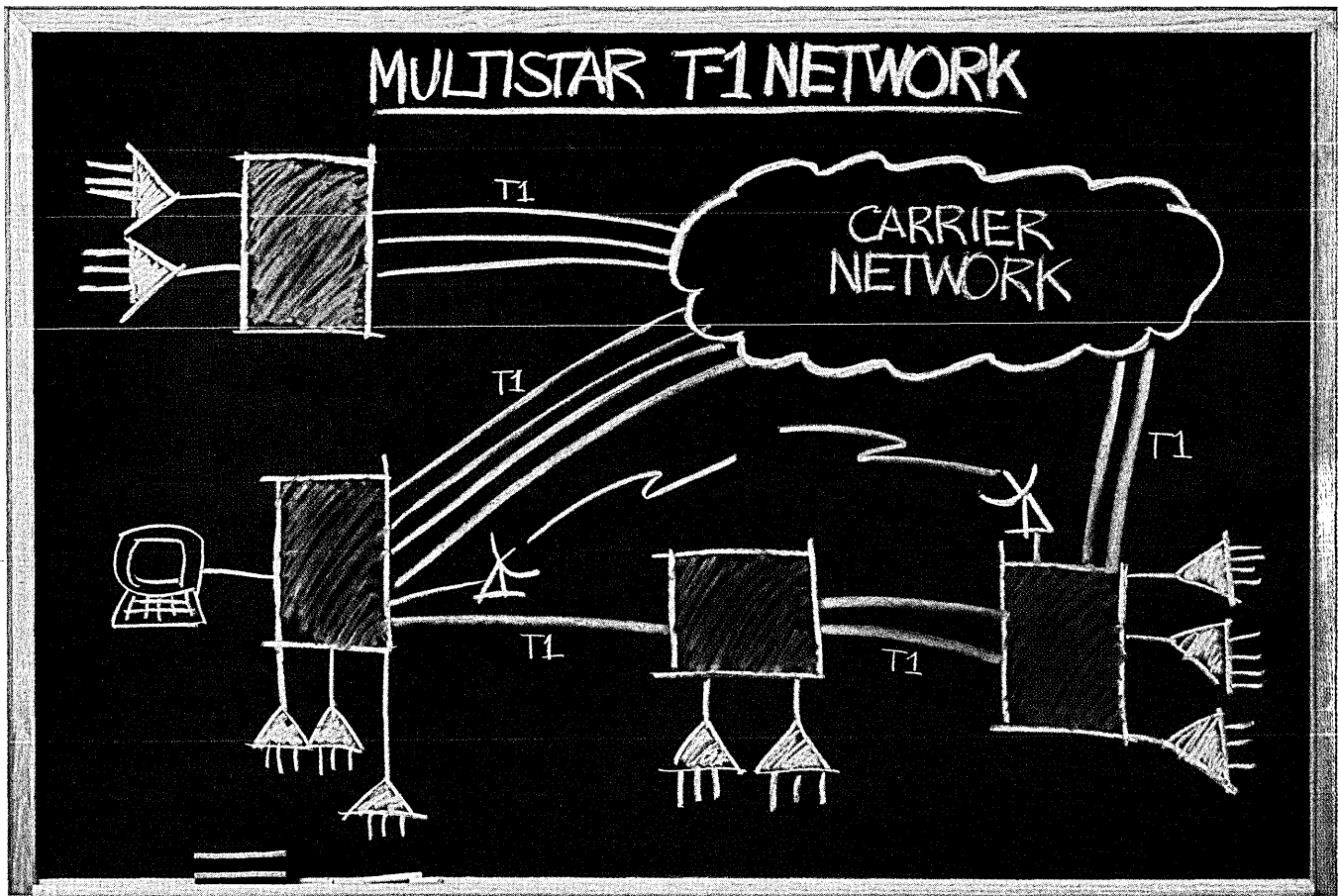
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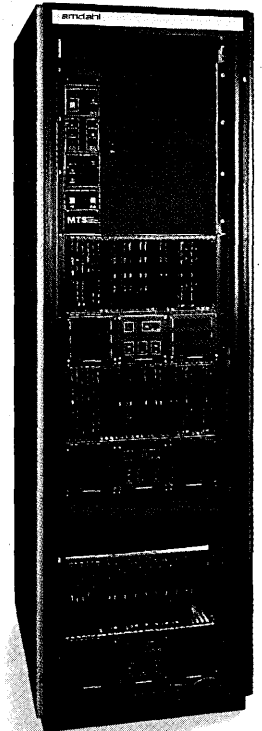
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Charges of vote fraud and sloppy technology cloud the role of computers in electoral politics.

by John W. Verity

It's time to vote again, but look out—your vote may not get counted at all next week. Worse, someone else's may get counted twice. Or 10 times. Who knows? The computer isn't telling, that's for sure.

Chances are that sometime after you step out from behind the curtain, your ballot will be counted by a computer. If so, it is likely to be processed by a machine whose accuracy and logical integrity have been severely questioned by computer experts and whose vendor has been accused several times of helping to throw elections to candidates who would otherwise have lost.

An estimated 60% of American voters cast their ballots in 1984 with the help of a computer. Leading the market for computer-based vote-tallying systems and services is a company that in the past six years has been sued four times on charges of fraud. Although the vendor has never been convicted of any wrongdoing, disturbing questions concerning technical sloppiness, suspiciously complicated programs, and outdated technology remain unanswered.

The latest and apparently best documented incident of such alleged vote fraud occurred in Texas. Last year, A. Starke Taylor, Dallas's incumbent mayor, won reelection against three challengers and avoided a runoff by just 472 votes. (A runoff is required in Dallas elections if the leading candidate receives less than half the votes cast.) After 18 months of examining election records and interviewing numerous workers involved in the vote, Terry Elkins, campaign manager for unsuccessful challenger Max Goldblatt, gathered enough evidence of potential vote fraud—30 separate discrepancies—that the Texas attorney general began investigating the election. The investigation may have national implications: more than one third of the votes cast in the U.S. in 1984 are said to have been processed by the company whose machines are at the center of the Dallas controversy.

"On their face," Elkins told the *New York Times*, the election documents "indicate there was fraud." Meanwhile, the newspaper reported, Texas state election authorities are investigating the need for additional security measures in this month's elections. Mayor Taylor has not been implicated.

At first glance, the job of counting votes seems perfectly suited to the computer; it's a classic dp application involving the repetition of a simple task, adding up the number of marks or holes found on a stack of voting cards. In fact, vote tallying turns out to be a rather tough computing problem, mainly because the hardware and software doing it must be mass produced and yet be able to handle the myriad individual ballot formats of the nation's thousands of voting precincts. Each precinct has its unique set of candidates and issues to be voted on, a set that varies not only in number but in complexity of interlocking requirements—for example, if you are a registered Democrat, vote for three candidates in column A but only two in column B, and so forth. Add in the necessity for effective security against fraud and the need for complex vote-tallying software becomes obvious—but just how complex?

As DATAMATION readers know, the best software can be quite complex in its logical function without being overly complex in its structure. That's what structured programming methods are all about, even if they've never fully lived up to their promise. As readers will also recognize, code that is easy to read (i.e., structurally elegant and sound) is generally the easiest for others—those who have never seen it before—to understand.

At first glance, the job of counting votes seems perfectly suited to the computer. In fact, it turns out to be a rather tough computing problem.

Code that has no structure—that relies heavily on mysterious GO TOS and whose flowchart resembles a plate of spaghetti—is usually unfathomable to the outsider and, one can surmise, difficult for even the original author to understand and maintain.

This is where Computer Election Systems of Berkeley, Calif., enters the picture. Founded in the 1960s by former IBM employees, CES has since become a division of Business Records Corp., Dallas, and its name has been changed to BRC Election Services. It is the company whose machines have most frequently been criticized by specialists and whose officers have been accused in court of helping put in the fix. CES's machine, critics claim, relies on a heap of spaghetti code that is so messy and so complex that it might easily contain hidden mechanisms for being quietly reprogrammed "on the fly" (see "Suing CES").

In other words, challengers say, a certain pattern of holes in an otherwise innocuous looking vote card, one that looks to the outsider like all the others in



BEHIND THE NEWS

SUING CES

Richard Clay Bodine, a Democrat who lost his 1983 bid for election to Indiana's Third Congressional District, joined seven other losing candidates that year to sue members of the Elkhart County Election Board and Computer Election Systems (CES), Berkeley, Calif. Bodine and his fellow plaintiffs charged that the counting of votes in the election was "false and fraudulent," according to their lawyer, David Stutsman. CES, which supplied the systems used to tally the votes, has since changed its name to BRC Election Services.

To plead their case, the plaintiffs hired a computer consultant to examine in detail as much of the CES system as she was able to. In her report, Deloris J. Davisson, president of Emerald Software & Consulting Inc., South Bend, Ind., and the chairman of nearby Ancilla Domini College's computer science department, identified a series of potential vulnerabilities and areas where the CES system did not meet professional dp standards.

For instance, the NCR Century mainframe used by CES to count votes was found to be programmed in such a way as to use nonstandard translations of standard 80-column Hollerith punch cards. "We have no way of knowing for certain how the NCR [software] actually handles the assignment of characters," Davisson stated. Without an opportunity to scientifically test the system, she added, there was no way of determining how certain "extraneous or 'funny punches'" were handled. The NCR machine was programmed in a 1971 NCR version of COBOL, for which no manual could be found.

Davisson went on to state that the program "does not halt or give any error messages if, in fact, there are more votes recorded than there are registered voters.

"The whole process is further complicated by the source code," the consultant stated, "which is so convoluted, unstructured, and undocumented as to make following the logic anything but clear and straightforward."

Another peculiarity she identified

was the CES program's use of certain areas of main memory over and over, through repeated program overlays, which "serves to obfuscate what is going on in the program The mind finds it extremely difficult to keep track of all the possibilities. The REDEFINES [a COBOL term] memory overlay is unnecessary with today's larger computer memory and very hard to audit. It does cloud the logic and makes it much easier to manipulate the incoming data."

She also found that the program's WORKING-STORAGE memory allocation held incoming data and control card information along with the tables that store the actual vote counters: "The nondocumentary names of these memory locations, being continually redefined, make intermediate contents of the storage areas incomprehensible. It's a shell game!"

Davisson said she also discovered that the program might easily use the same counters for different electoral races, which made auditing the system extremely difficult. In addition, the program relied on the ALTER verb, which "can change the execution of the program ON THE FLY, or while it is executing. The use of the ALTER verb is highly unstructured and adds to the cloudiness of the source code. It creates convoluted logic Further, the undocumented 'maintenance' of the CES programs prevents any consultant from knowing what the program actually did at any given time" (emphasis in original).

She went on to describe a CALL to an exterior subroutine for which no source code was available. "On one copy of the source code the CALL was commented out," she stated. "However, we have no way of knowing if there was a subroutine, how it was used, why it was used, or why it was commented out.

"Where you see one cockroach, you know there are hundreds you do not see," Davisson concluded, referring to the CES program's logic.

Of particular concern to Davisson was the CES system's "frequent use of pro-

gram switches which can be used to alter the program while it is executing." She quoted another consultant who had examined the program: ". . . it would be easy to sabotage the computer in this system (CES). . . . *The switches are there for the switching.*" Console hardware switches, too, were of major concern, for they could enable source code, control cards, and ballots to be changed quietly and without a trace "during the election tally.

"Election officials, who are not knowledgeable of computer operations, and who are not operating the election processing, may be entirely unaware of operator intervention to *bypass* either individual ballots or whole precincts," Davisson noted in her written report.

Finally, she expressed concern about the system's security, auditing, documentation, and testing. Maintenance of the program, she contended, was undocumented.

"This program, in its execution, does not follow basic accounting procedures of counting and reporting on all input data, valid and invalid. There is no way the operator or user can track what is happening to the data, especially ballots which the program decides are invalid for one reason or another. Coupled with the problem of translation tables and non-standard codes, the program can obscure the way it processes any ballot."

The original Elkhart County suit, which charged that the candidates' civil rights had been violated, was dismissed as a result of a summary judgment and an appeal was denied at the circuit court level. Lawyer Stutsman says Davisson's technical criticisms, as well as several other similar analyses prepared by those suing CES, have gone unanswered in any formal way. "We have no counter opinions or official written evidence which contests or disputes our expert's report. CES's general response has been that the ballots themselves are an audit trail, which we consider to be a fallacious argument," he states.

—J.W.V.

a stack, might quietly reprogram the CES machine and alter its final tabulations with nary a sign to election watchers. This change in logic might be triggered by accident, but, more disturbing to election specialists, it might also be initiated as part of an illegal scheme to fix a close election. In many cases, only a few ballots would have to be altered to change an election's outcome.

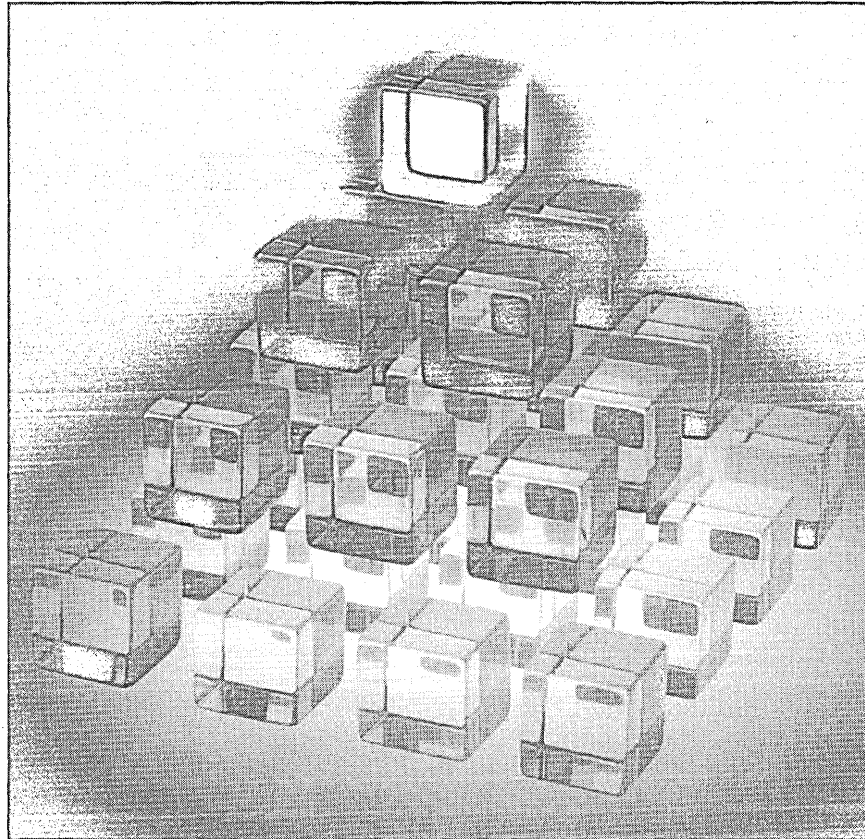
BRC, once an independent company, was recently purchased by Cronus Industries, a Dallas-based firm understood to control several other companies that supply vote-counting equipment.

At press time, BRC had not responded to repeated telephone calls placed to its Berkeley and Dallas offices. Last year, John H. Kemp, then the company's president, denied to the *New York Times* that BRC was involved in fraudulent schemes, but he conceded that all computers could be tampered with. "It is totally economically infeasible to have a fraud-proof system," he told *Times* reporter David Burnham. BRC's current president is Richard H. McKay.

Suits have been filed against CES by losing candidates in Indiana, West Virginia, Maryland, and Florida, charging

the company and local election officials with miscounting votes. Several of the suits are on appeal, but none of the plaintiffs has won a case yet. CES has denied all wrongdoing.

The vulnerability to fraud of computer-based vote tallying is a recent discovery, although the Texas case seems to represent the first time state officials have begun an investigation into alleged improprieties. DATAMATION's coverage of the subject goes back as far as May 1965. In May 1970, the magazine published "Cheating the Vote-Count Systems," in which authors James Farmer, Colby



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BEHIND THE NEWS

YES, VIRGINIA, THERE IS AN ANSWER

Maybe, just maybe, the fault lies not in the machines, but in the humans.

"As the election software company's client, you have to take control of the situation," says Audrey Piatt, director of operations of the Virginia State Board of Elections. "You have to be very knowledgeable about every aspect of the situation. You have to establish your own managerial control. You can't let them slough you off."

They haven't, at least not in Virginia. Since 1982, when the state started voting with electronic counting devices, using punch cards and Computer Election Systems (CES) software, election officials have found one—count it, one—bug in the system. That was in a jurisdiction using for the first time a ballot for a multiseat office, and that type of election is so complicated most voters don't even look at the choices, much less punch one.

When voters do punch holes beside their favorite person or issue, they can be pretty damn sure the powers that be will get it right. Virginia voters drop their ballots into enclosed ballot boxes, which stay put during the election.

After the election is over, then, and only then, the ballots are counted. They are tallied on the spot, in the precinct, not in some remote central counting room that is neither seen nor heard by the general public.

"In a centralized counting system, the computer operator is the person controlling the election," contends Eva Waskell, a writer from Reston, Va., who was among the first people to bring this problem to national attention. "Who are these people? Who's paying them? We know more about Steve Wozniak's life than we do about people writing and running programs controlling our most fundamental right. Someone has to check out these companies and their codes."

They've gotten the message in Virginia. Each precinct's counter system is required to be tested by the elections board before every election. A special test

deck, devised by the board of elections and CES, is used to check the counting program seven to 10 days before the election. The tape from that test is then locked away for posterity.

"Almost all the articles about counting problems have been written from the perspective of a large, central counting system," Piatt says. "I think that's due more to a lack of proper administrative control in the computer room than the counting program itself. If you want to make sure that works, devise a test program and work out the bugs."

"If we ever did use a central counting procedure—and the Virginia legislature is a long way from allowing the transportation of uncounted ballots—you can bet there would be a very stringent test to check it before the election."

Sometimes that's irrelevant, immaterial, and inadmissible. A 1980 evaluation of CES's Votomatic System in Pennsylvania said the system "is based on seriously outmoded computer technology"; it was "a security nightmare, open to tampering in a multitude of ways"; that "tampering with the tabulating element is not only easy, but virtually encouraged"; and "the tampering that could be performed by an imaginative and determined individual is only hinted at." The examiner, Michael Shamos of the University of Pittsburgh, recommended that the state deny the system certification. So did another of the three examiners. Still, the secretary of state certified the system.

"I think state election boards really want elections fair and free of taint," Shamos says. "But they're being buffeted by state and local governments and election systems salespeople. They're not persuaded by the farfetched writings of a few technologists. Punch cards result in disenfranchisement," he says. "They were obsolete 10 years ago. The CES system is riddled with scandal potential. It's in spite of the technology that they sell it."

Sell it they do, though Shamos is hardly out there by his lonesome. A re-

port by the California attorney general underscores many of the same concerns.

The study notes that the Votomatic's counting program, the EL-80, was written in 1971. It's actually not a single program but a family of programs that can be customized to different computers and different jurisdictions—and the problems are all in the family.

"The CES EL-80 program has been strongly criticized both for its structure and its lack of tamperproof audit trails," says last May's report by Robert Granucci, deputy attorney general of the criminal division. "The style has been described as 'spaghetti code.' The instructions have no logical sequence."

"Experts who have studied the EL-80 program conclude that it is possible to alter its functioning without leaving any record. This defect is more ominous than the spaghetti code, but it may be attributable to the state of programming art at the time the EL-80 was written. . . . By today's standards, the lack of a reliable audit trail in a program performing any sensitive function is unacceptable."

The attorney general is encouraging the secretary of state to adopt the National Bureau of Standards' software standards, which were released in draft form at a recent meeting of the Federal Election Commission's National Clearinghouse on Election Administration. Those standards contain requirements that the software be structured and written in a high-level language, provide an audit feature, and run without alteration until the program is completed.

"There was considerable bitterness from the vendors about doing programming in high-level language," says Robert Naegle, a consultant for the California secretary of state who for 20 years has been evaluating vote-tabulating equipment. Naegle's other consulting business is done through Granite Creek Technologies, Laselva Beach, Calif. Naegle defines a high-level language as anything but assembler.

Springer, and Michael J. Strumwasser, all of Systems Research Inc., described several ways in which fraud could be perpetrated in vote-tallying computers.

Farmer, Springer, and Strumwasser identified three vulnerable elements in the mainframe-based systems of the time, namely the supervisor, or operating system, the object deck, and the vote-counting program itself. Each, they showed, could be modified in ways that would be undetected by the unaware system operator. "Many techniques of computer vote fraud require the access of only one person and, at most, an operator and a programmer."

They concluded, "The faith of the general public in computer operations, frighteningly demonstrated by the reaction of one election official to our findings ('If IBM is acceptable to billion-dollar banks, it's acceptable to me.') must not be shared by those who know better. Computers may be foolproof, but the men who program and operate them are only human, and subject to human weaknesses."

An accompanying article by DATAMATION advisor Robert L. Patrick and associate editor Aubrey Dahl heavily criticized Los Angeles County's vote-counting operations. "We regretfully report that our votes are being counted by

a set of programs with several pathological weaknesses," they reported, after interpreting a technical analysis of how the county actually employed its IBM-supplied, 360-based Votomatic system.

Just the year before, IBM had declared its intention to leave the vote-counting market by 1974, ostensibly because it had decided its marketing effort could be better spent elsewhere. It had licensed several small firms to support the Votomatic systems already in use.

Perhaps as a result of the negative publicity it received when first using computers to count votes, Los Angeles Coun-

"You're dealing with Z80 types here," Naegle explains. "The vendors also complained about the difficulty and the cost impact of providing a real-time audit trail for precinct counters. I don't think either of those are valid."

Those standards will be voluntary, not mandatory. They can be adopted by the states as they see fit.

"The states need something, and they know it," Naegle contends, "but in all the time I've been doing this, there's been nothing wrong with the hardware or the software. Even where there is something wrong with the software, it could have been fixed. But people are too dumb to do it. I think the complaints have more to do with perception than reality. There isn't a conspiracy, but a lot of people are dropping the ball." If so, CES seems to be recovering all the fumbles.

"CES is getting bigger," says an observer who requested anonymity. "They're not unstoppable, but nobody's interested in stopping them. It's very dangerous to have computer vote counting in the hands of one company, especially when there are no federal, state, or local laws regulating the ownership of that company. What's to prevent the Mafia from running an election? How do you stop CES? By requiring massive scrutiny of companies selling computer voting software and hardware." Or by remembering that machines and programs are, after all, as fallible as their creators.

"Elections don't happen every week," Piatt says. "You've got to realize that these companies are going to be understaffed and spread too thin, so you have to take control."

"The technology exists to capture results of voting instantly," says a source who asked not to be named. "If you can do it for a lottery, you can do it for elections. But there we're only talking votes. In a lottery we're talking cash."

Did someone say something about a constitutional right?

—Willie Schatz

ty made great efforts in subsequent years to tighten security and fix administrative glitches. As a result, it is now considered by specialists in the field to be a model user of computers in this area.

As the use of computers in voting spread during the 1970s, so, apparently, did awareness of the potential for fraud and other problems. A series of widely publicized voting snafus occurred in various cities, and they were blamed, at least initially, on computer-related problems ranging from ill-prepared voting officials operating newly installed machines they did not understand to excess chad and moisture in decks of punch cards. Conse-

quently, numerous calls were heard in Washington and elsewhere for guidelines to help local election boards run smooth voting operations and prevent the public from losing faith in the election process.

In 1975, the National Bureau of Standards' Institute for Computer Sciences and Technology, prompted by the General Accounting Office, issued a 130-page report on "Effective Use of Computing Technology in Vote Tallying." By 1978, when a slightly revised version of the report was released, only about 10% of American voters, most of them in western states, were using punch cards to cast their ballots. The idea, however, was catching on throughout the country.

The Bureau of Standards in its report identified many potential problem areas, ranging from technical issues such as the accuracy and security of computer systems to administrative concerns such as the management of the entire election process. It recommended that further research be done and that uniform guidelines be developed to help voting districts throughout the nation use computers properly and effectively for tallying votes. Key to the report's recommendations was extensive training of election administrators in both basic computer technology and related security issues.

"Technology and the management of technology are inextricably linked," the report concluded. "The effective use of technology requires management control; and the effective management of technology requires the utilization of appropriate technological expertise." Almost 10 years later, the bureau still receives requests for the report. Even though computing technology has changed a great deal, the report remains the best overview of security and fraud-prevention issues available.

What has changed since then? Roy G. Saltman, a bureau computer scientist who led the project that produced the 1978 report, notes that new computing technologies have created new problems in electronic vote counting. "The appearance of microcomputers means that there is a greater likelihood of individual computers used where before there was only a central vote-processing system," Saltman says. That change has both positive and negative effects.

On the one hand, individual computers located in each precinct or polling place means depending less on timesharing and avoiding the security risks of telecommunications. "Security could be said to be improved," Saltman says. On the other hand, he notes, special-purpose voting computers may not be programmed in high-level languages, which means it would be harder to evaluate them for logical correctness. Microprocessors are of-

ten programmed with firmware that is unavailable to outsiders to check for accuracy or logical function.

"You could impose design criteria on high-level code, but that's insufficient when you really need performance," he states. He points out that New York City is contemplating replacing its current electromechanical voting machines with functionally equivalent, computer-based machines that would be operated through pushbuttons, not high-level programming. In that case, he states, "structured programming issues would be mute."

(New York voting officials could not be reached for comment. It is understood, however, that the city is investigating electronic replacements for its current machinery.)

"The technology has changed, but much of the [1978] report is still valid," Saltman adds. "The primary problems still concern control over election resources—ballots, computers, and their software—and the security of all aspects of the vote-tallying process. You must look at election processing from a systems point of view."

Saltman says he is well aware of the national attention that has been focused recently on computers and voting, and, at the suggestion of other government agencies, he is currently attempting to secure funding to update the 1978 report.

Meanwhile, the National Clearinghouse on Election Administration, a division of the Federal Election Commission, is soon to release a set of guidelines that will be available for state and local election officials to apply voluntarily to their computer operations. The guidelines, produced by a panel of election spe-

"Computers may be foolproof, but the men who program and operate them are human, and subject to human weaknesses."

cialists and vendors, will cover hardware, software, and management issues, according to Penelope Bonsall, director of the clearinghouse. Two key elements of the recommendations are the testability and the auditability of systems.

"Most problems election districts have with computers occur in the first year of their use," Bonsall notes. "These are simply administrative problems that stem from the installation of a new technology that people are just not used to. But there have been problems with all vote-counting technologies, from paper ballots to pure electronics."

She also notes that suits have been filed against suppliers other than CES/BRC, but for one reason or another those suits have been far less publicized. ©



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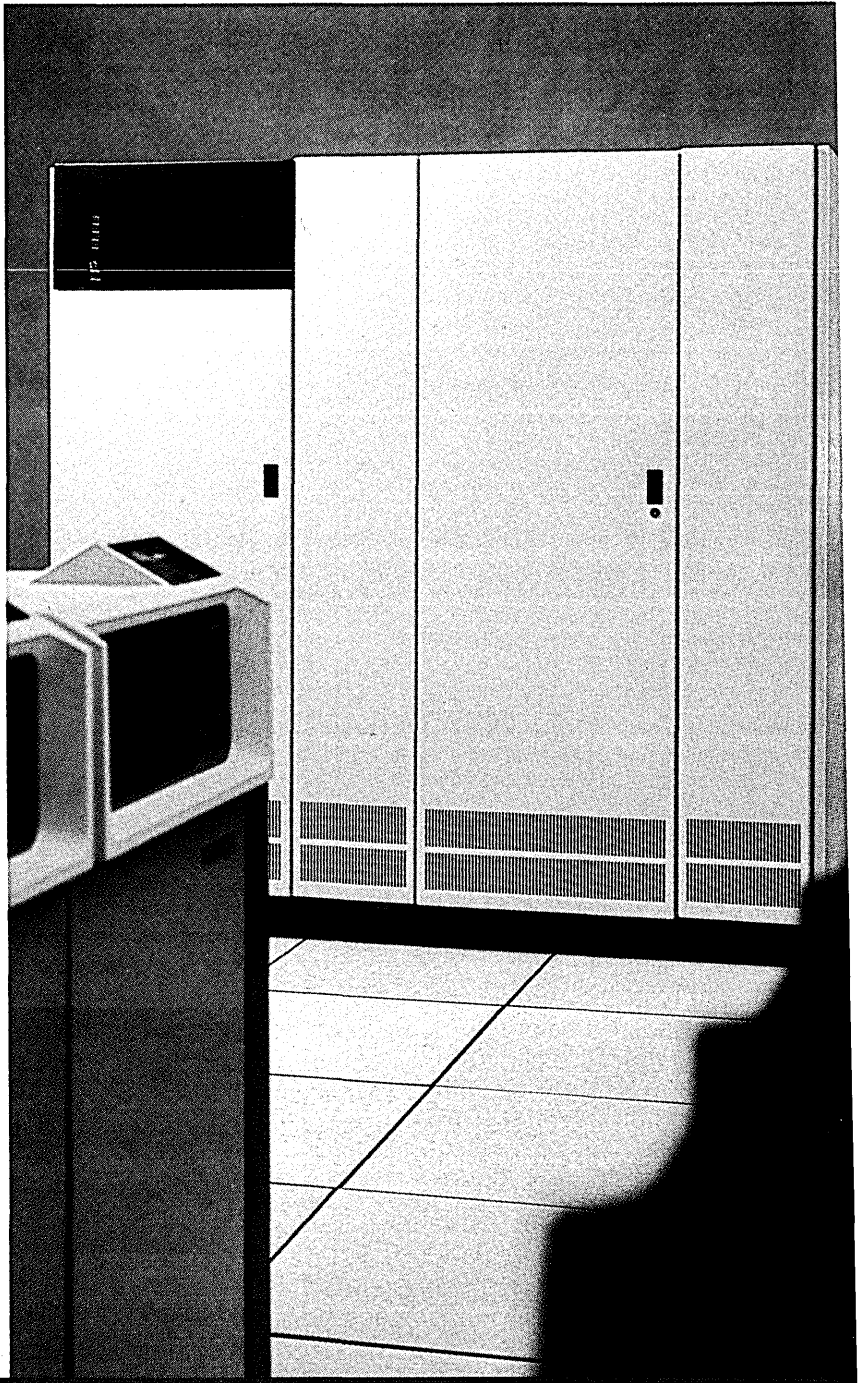
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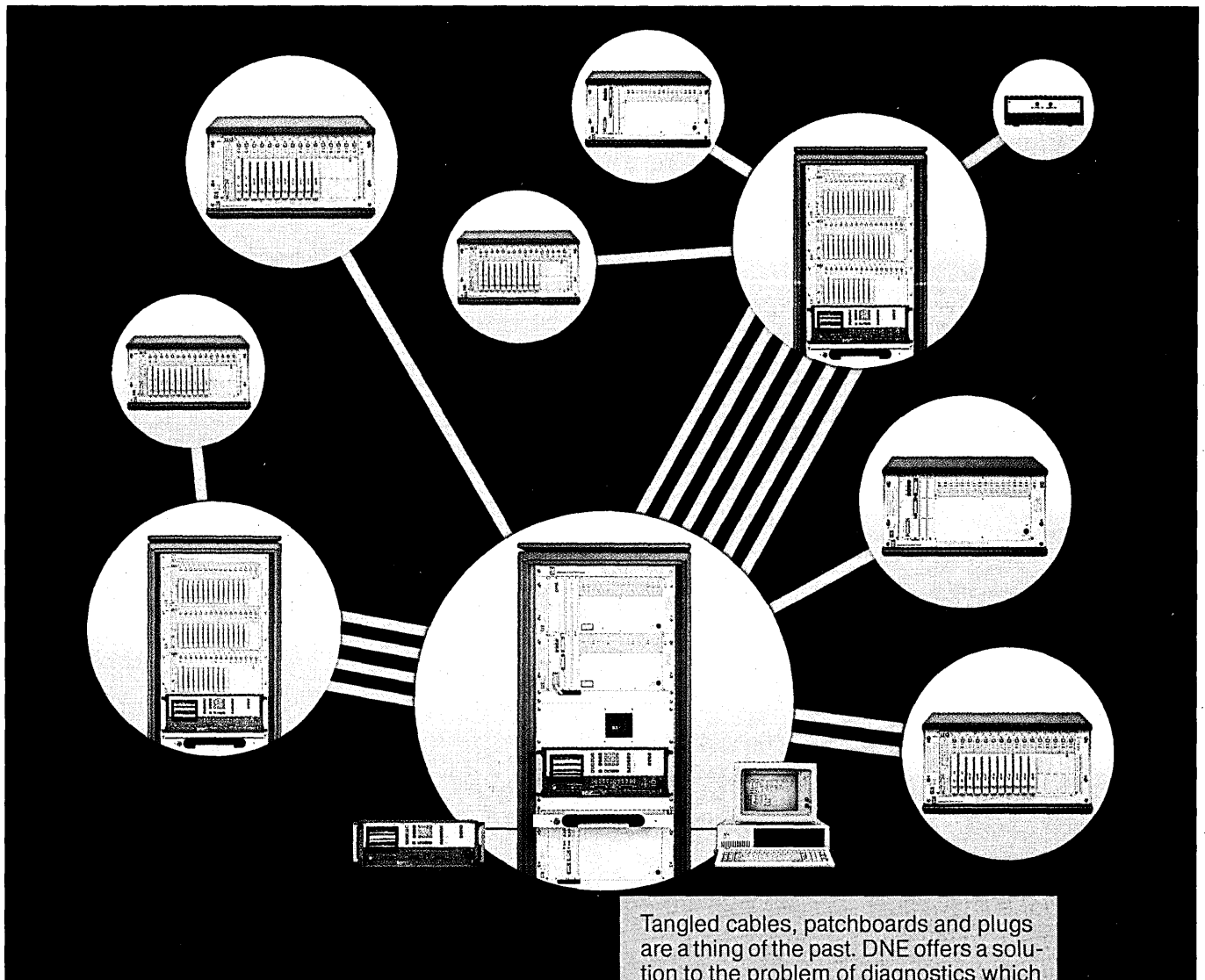
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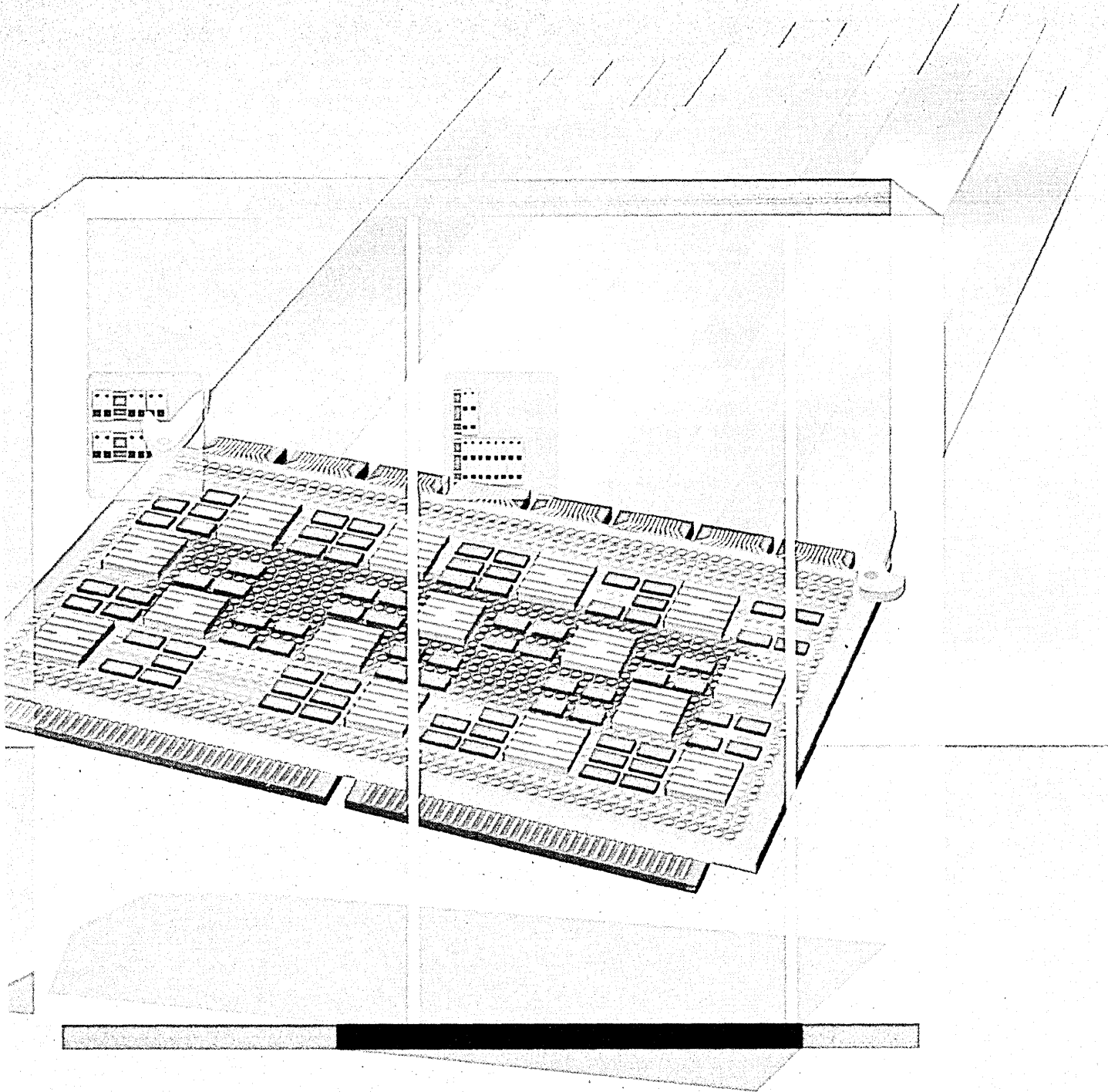
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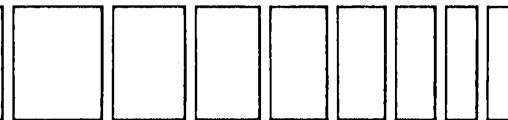
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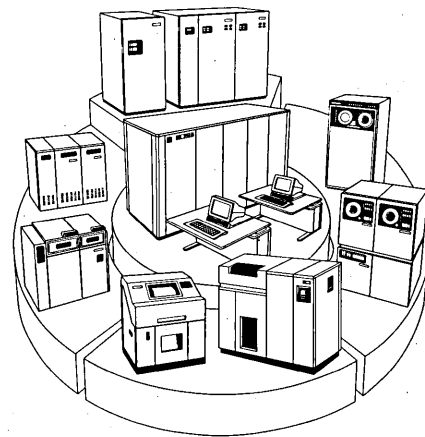
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Network security could make the difference between being safe and being sorry.

GUARDING THE NETWORK

by Nick Anning

A few months ago, the City of London's fraud squad was called into the offices of a major international company in the heart of England's financial square mile. Its task was to investigate an attempted \$8.5 million theft that involved false data entries on the company's electronic funds transfer network.

Lax password security at the London office of New York investment bank Prudential-Bache Securities had allowed an unauthorized Eurobond transfer to be set up. On the Pru-Bache system, only one password, known to several employees, was enough to set the bond transfer in motion. Normally, funds transfer systems require transaction authorization to come from a separate source using a different password.

By the time Pru-Bache's parallel accounting procedures had thrown up the \$8.5 million shortfall in the company books, the securities had already been transferred via Eurobond clearinghouses in Brussels and Luxembourg to an account at the Lombard-Odier Bank in Geneva. Pru-Bache was saved from becoming the victim of one of the U.K.'s biggest computer network frauds only by the mandatory seven-day period before bonds can be cashed. A Swiss court granted an injunction that blocked the payment and thwarted moves to get cash across the counter.

As the levels of computer crime continue to rise around the world, that type of networked fraud is becoming a favorite among computer criminals. Yet the popular press, and quite probably much of the public it serves, still believes that most computer fraud is the result of twitchy-fingered hackers poring over a pc keyboard in the dead of night in some seedy suburban basement.

Not so, counters Clive Blatchford, security strategy manager at U.K. computer company ICL. Blatchford believes that the single greatest threat of computer fraud comes from people with inside knowledge

of systems and networks. "We've built these huge, powerful machines," says Blatchford, "and we're in awe of them. We've created a special group to service them, interpret them, and attend to their every need. That group includes systems engineers, programmers, and maintenance personnel. The 'vestal virgins,' I call them. I don't want to cast doubts on the great majority of honest professionals, but it's worth remembering that by no means every vestal in the temples of Ancient Greece would qualify as a virgin."

Insider fraud is not the only worrying problem for a company dependent on networked computers. Deliberate network sabotage can cause considerable headaches too, and also is often the work of people with inside knowledge of a system.

That sabotage can take many forms, but there are basically two main categories. First, there's the danger of physical attack on parts of the network, as when political activists cut cables of the Japanese railway net last year. Second, there's the problem of hidden sabotage, where the network is destroyed from within the system. That's what recently brought a West German research network to its knees during an operators' strike at the Technical University of Berlin.

When the strike began, the network was switched to function automatically, but within a short time it was paralyzed. One node had received the apparently innocent instruction to perform a simple counting operation, but soon, other nodes on the network began to follow suit. Before long, the entire network was occupied by this one simple operation and the whole thing had to be shut down.

GROWING NUMBER OF TRICKS

That method of tying a network into knots is well known to the criminal computer fraternity and is called the "computer virus" because the infection spreads throughout the system. The virus is only one of the growing num-

ber of techniques being used by the world's computer criminals to interfere with networks and systems (see "Tricks of the Trade").

Those problems of fraud and sabotage are affecting a rapidly growing number of network-based computer users. National and international banks, stock exchanges, commodity traders, oil and aircraft corporations—all put their faith in data networks. Without trusted networks, credit card agencies, travel and entertainment booking systems, car rental companies, and cash dispenser terminals would all cease to function. Security and reliability have become top priorities for these large users on everything from the humble LAN to giant transcontinental and global transaction processing systems.

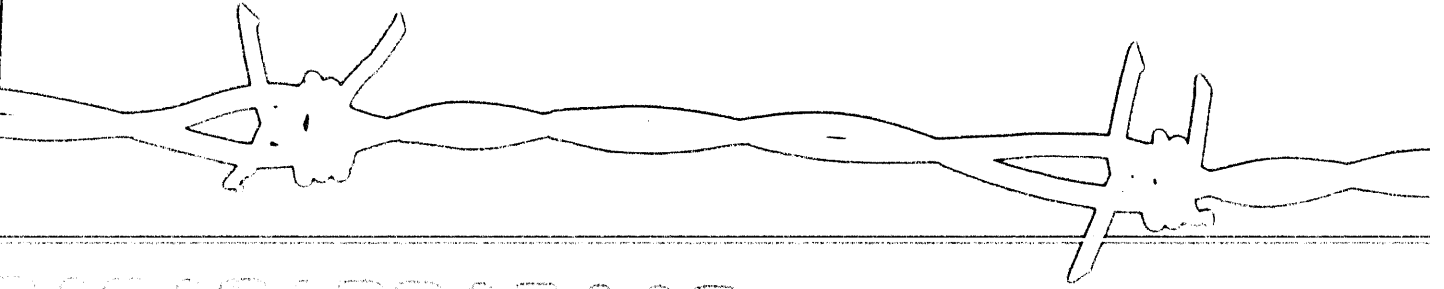
As British computer security analyst Donald Davies points out, most of the commercial networks now in operation were built up without much thought to sophisticated security procedures. These were, as he puts it, "patched on later, and that's the situation we have to live with."

Davies has some apocalyptic views on the way in which such technical compromises in data and network security can affect a company. "There are major manufacturing corporations that exchange information of the utmost confidentiality on lines across the Atlantic," he explains. "They have to be protected not only against their own competitors but also against discovery by other countries.

"The economic effects of this could be considerable. Large companies, corporations, and subsidiaries of large corporations, could disappear from the map. They couldn't survive if some of their important commercial secrets were lost."

Such a corporate crisis could also have broader consequences, he adds. "There are lots of ways in which this could affect the world's economies. The worst kind of breach of security in large-scale banking could, if not destroy the economy of the West, upset it for a long time."

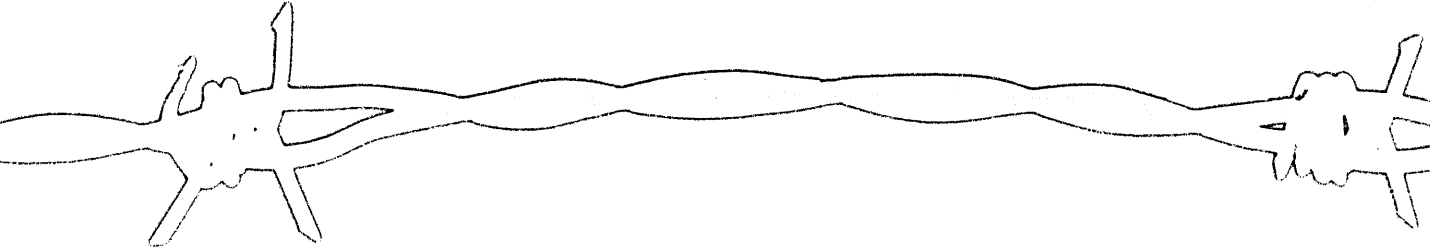
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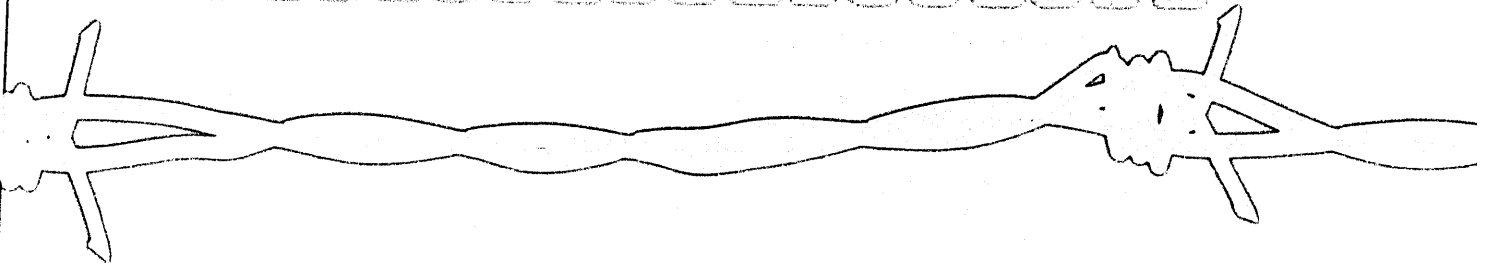
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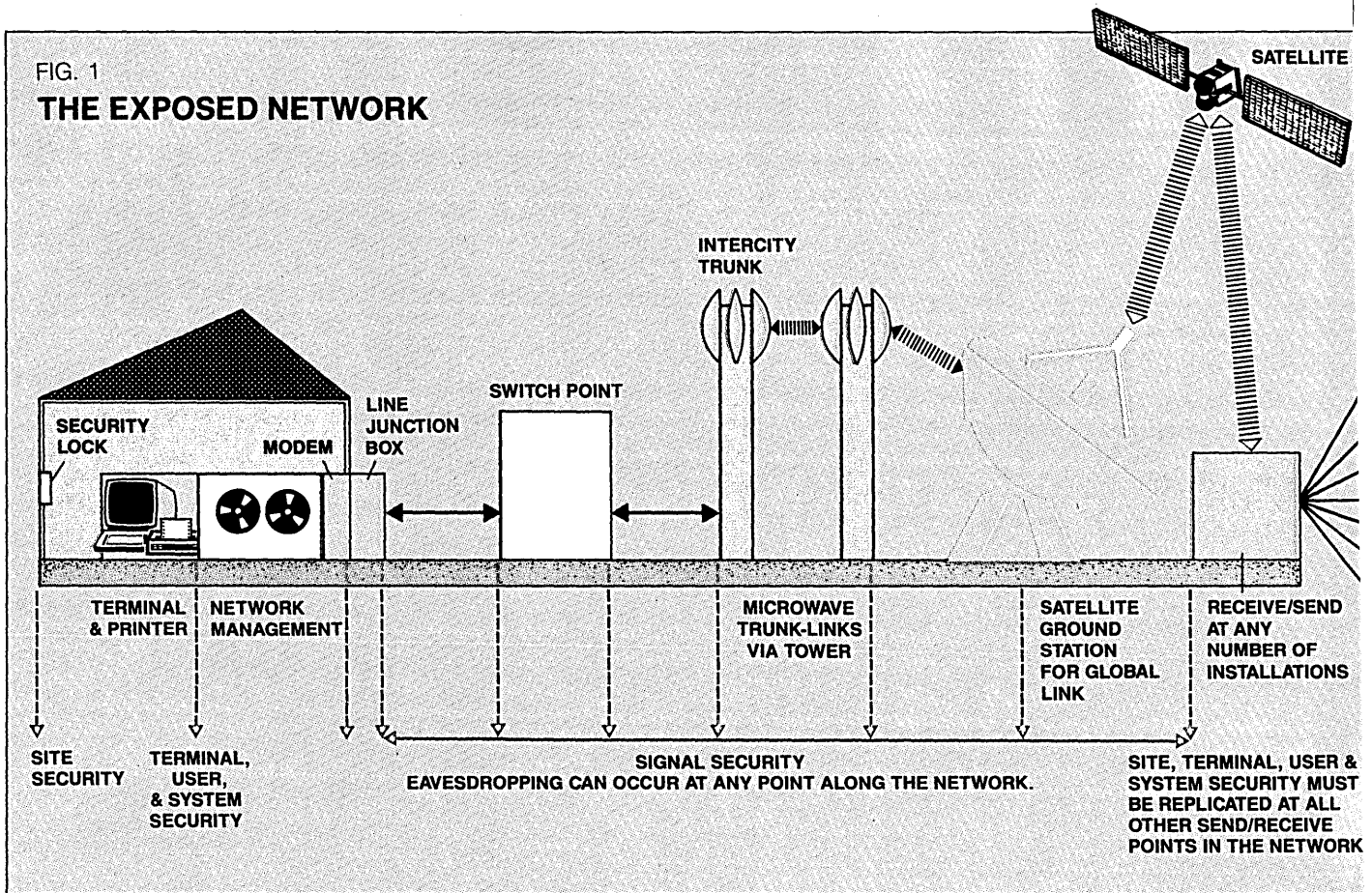
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FIG. 1

THE EXPOSED NETWORK



According to some U.S. observers, complacency among the networking fraternity about frauds and system failures makes the situation even more dangerous. A panel at Georgetown University of U.S. experts discussing crisis management in a networked society concluded that "the vast majority of network disruptions that have occurred in the U.S. have been sufficiently local in impact, brief in duration, and minor in cost that our society has become conditioned to the frequency of inconvenient failures and, as a result, inured to the growing risk of catastrophic failure."

But the task of changing peoples' attitudes about the vulnerability of networked systems is not an easy one. One of the major problems here is working out just how much network interference, particularly computer fraud, actually takes place. The situation is complicated by two things, the number of uncheckable stories floating around the industry (see "The Folklore of Network Crimes") and the reluctance of real computer crime victims to speak out. Companies that have suffered a ripoff do not relish publicity, usually citing the risk of copycat attempts and the potential loss of client confidence. Often the police are the last to hear what has taken place.

Calculating the total amounts of money lost through computer fraud is even more difficult than persuading companies to talk about individual cases. That's a point picked up by Kathleen Lucey, senior consultant at the Paris office of the Stan-

ford Research Institute. "The trouble with any computer crime figures," she says, "is that nobody really keeps track, so they have to be treated very cautiously."

SPECIAL FRAUD SQUAD

Some figures have nevertheless come to light. The U.K.'s Audit Commission has worked out that during 1984 a total of just over \$1.5 million was lost by U.K. companies through computer fraud. The situation has become so serious that the British police at New Scotland Yard have recently set up a special Computer Fraud Squad, which is now investigating some 25 cases.

In France, computer security consultant J.M. Lamère estimates that the country lost around \$150 million over the same period through computer crime. In West Germany, meanwhile, the number of reported cases doubled to over 70 between 1977 and 1983. In Japan, where there were 59 major computer crimes reported during 1985, more specific figures relating only to networked automatic teller machines (ATMs) show the number of ATM cases rocketed to 472 in 1982 from 64 in 1977.

In the U.S., meaningful figures are equally rare, although the National Center for Computer Crime Data in Los Angeles has tried to make some sense of what's available. Without putting a value on the amount of U.S. computer crime in 1985, center director Jay Bloombecker has been able to work out who's at risk. "The pri-

mary victims of such crimes," he says, "are the commercial companies, followed by the banks, and then the telecom carriers."

So what can these victims do to protect themselves? A lot, it seems, if they only take the trouble. "Computer security," explains consultant Davies, "has polarized into two very different subjects. There is the rather esoteric area of operating systems security and multilevel secure systems. The other is the very general question of running a computer center—ensuring physical controls against fire and flood, making sure it's safe against intruders and that operators do their jobs and don't dive in and destroy the system if they're sacked."

In Davies's view, it is artificial to divide communications and network security from computer security. "In the area of access control they all come together," he argues. Davies's own specialty is in the field of data security within networks, and this involves various aspects of encryption. But he stresses that security must start from simple safeguards like access controls. "You've got to know, or have a good idea about, who is sitting at the other end of the line," he points out. "That involves both a communications network, the terminal itself very often, and the computer. They're all collaborating."

While the way they collaborate may be different for different networks, there are some general security rules that can be applied at the most vulnerable points (see

The convergence of voice and data will give rise to new security problems.

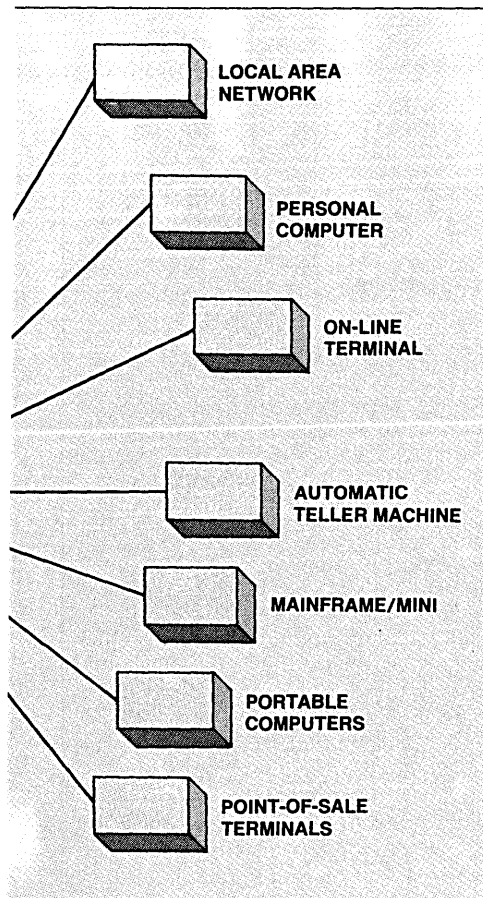


Fig. 1). Here are some examples:

- **Site security.** Physical protection against fire, flood, and break-ins; security locks on all access points; identity checking to authorize access to installations; secure handling and storage of software and sensitive data; security locks on line junction boxes.
- **Terminal security.** Machine locks on terminals, user passwords; tamperproof modems; protective cages to block signal radiation from terminals.
- **User security.** Authenticated users should have personal identification numbers or similar passwords; security routines to prevent careless use or loss of passwords; encryption keys used in signal validation or sender identification.
- **System security** (where terminals dial up mainframe databanks). Authorization filtered by smart modems, network management systems, or system operating software; signal validation and security grading for file access and data input.
- **Signal security.** Encryption with secure handling of code keys; use of fiber optics to reduce access points for passive/active taps; built-in error checking to reduce error propagation on high-speed links; special care taken with vulnerable satellite and microwave signals.

Security rules cover most aspects of network vulnerability, although they are not exhaustive. More detailed recommendations can be found in a growing number of official reports from around the world such as the U.S. Department of Defense's

1983 report, "Trusted Computer Systems Evaluation Criteria." Subsequent draft updates of this document have concentrated specifically on problems of network security. The report suggests various grades of secure systems from Class D systems, which have minimal protection, to Class A systems, which are described as verified designs. Some U.S. observers would like to see these gradings being used more regularly in the commercial world. "If such ratings can be made practical and specific enough to be placed in requests for all critical systems," suggests Lance Hoffman, professor of computer science at George Washington University, Washington, D.C., "the effective result could be a significant enhancement in the overall resiliency of computer and communications systems."

The U.K.'s National Computer Center in Manchester has also been working on the problem. Its latest report, titled "Audit Control of Computer Networks," is to be adopted by the U.K. Department of Trade and Industry before the end of 1986. In a preface, the authors of the National Computer Center report state that their aim is to increase general awareness of the need for security in wide area networks by examining threats to network security and recommending ways to protect them. The range of topics covered includes physical

security, logical access controls, availability, resilience, data encryption, and hacking.

Peter Olson, a senior consultant at the National Computer Center and coauthor of the report, is concerned not just with present problems, but also those that will arise in the near future. "The convergence of voice with data, text, and fax traffic," Olson argues, "could well give rise to different security problems at the data and information level. Voice security is new to the data processing world and to commercial organizations. But with ISDNs [Integrated Services Digital Networks], there won't necessarily be point-to-point links—messages will take the most effective route from A to B. They'll be multiplexed into channels, mixed down in packets, and fired off into networks. PTTs must already have in mind systems for network management, traffic analysis, and network diagnostics."

This theme is taken up by Ken Wong, manager of the security and privacy division at BIS Applied Systems and an authority on computer security. "British Telecom has already had problems with Prestel," Wong points out, referring to the well-publicized case in which hackers tapped in to the Duke of Edinburgh's videotex mailbox. "There are inevitably going to be network security concerns when ISDN comes on stream, and when a whole series

TRICKS OF THE TRADE

There are numerous techniques used by computer criminals and network saboteurs to defraud, infiltrate, or disrupt a system. Here are some of their favorites.

- **The computer virus.** A small program that exploits existing features in the network management system to produce an automatic follow-on effect across the network. For example, one node in a network can be asked to store messages and continually pass them on to neighboring nodes for storage and forwarding. Within a relatively short period, the network's capacity becomes hopelessly clogged and ceases to function.
- **The salami.** A software patch that slices a small amount of money from many repeated transactions so that no one notices anything missing.
- **Superzapping or easypatch.** Bypassing applications or operating controls to alter systems software without leaving a record.
- **The Trojan horse.** An addition to an existing program that contains routines to collect, modify, or destroy data.
- **Logic bombs.** Pieces of software designed to clog up a system or destroy data. These are hidden in the system and

become operative only under a certain set of conditions. They can be left by disgruntled ex-employees to crash a system from a remote terminal at a later date.

- **Asynchronous attack.** Changing the sequence of certain operating instructions to gain financial advantage in electronic funds transfer. For example, altering the system so that all credits are posted to accounts before the debits. For a brief period, the account gains interest on an inflated amount. This interest is then put into a secret account.
- **Masquerading.** Assuming the identity of a user, or in some cases a coded terminal, to carry out unauthorized transactions.
- **Piggybacking.** Intercepting signals to a terminal and modifying them before they are passed on to their intended recipient.
- **Scavenging.** Collecting sensitive data left behind after a transaction has been completed.
- **Data massage.** The misuse of corporate data held on file to run simulations or models. For example, privileged information on sales, taxation, or payroll records that is then used illicitly to produce a revealing corporate model.

—N.A.

Some large companies couldn't survive if their commercial secrets were being lost along a network.

THE FOLKLORE OF NETWORK CRIMES

Computer fraud and network sabotage stories are a stock-in-trade with security consultants. Many of those tales are apocryphal, most are uncheckable, and a few have entered into computer industry folklore. But whether they happened or not, they do highlight some of the possibilities of network crime.

Take the well-known tale of the operator on a check-clearing bank network who instructed the system to round off, by half a cent, all the millions of daily transactions at the bank. The money was then put into a secret account, but it soon mounted up to such a large sum that the fraudster became embarrassed, and, as in all good fairy tales, the villain came clean and confessed to his employers.

Not all fraud involves spectacular sums. One busy day in a small branch of a British bank, a request arrived for the transfer of 200,000 French francs to a bank in the south of France. An employee entrusted with the transfer asked his superior for the proper authentication that was required, but his superior was busy and simply called his authentication code number across the office for the employee to key in himself. The transfer was duly entered in the SWIFT network en route to France, but the currency sign had been

accidentally changed. The result was that 200,000 pounds *sterling* was paid into the recipient's account; this translated to 10 times the original amount. Scarcely able to believe his luck, the customer withdrew the money and spent it.

When the bank's investigators traced back the transfer, the recipient refused to return the money. It took a court ruling before he agreed to pay back what he owed over a 10-year period.

Some cases involve cash sums several orders of magnitude greater. Two years ago, Chase Manhattan's London branch received a telex purporting to come from the director-general of the National Bank of Colombia. It requested the transfer of \$13.6 million to a bank in Switzerland. The payment was sent via SWIFT to New York, where Morgan Guaranty forwarded it to Switzerland. Once there, the money was rerouted to the Bank of Panama, from which it was withdrawn.

The original authorization turned out to be fraudulent. At first it was thought that the operation had been masterminded by M-19, the revolutionary Colombian opposition group. Later, suspicion fell on PTT workers and bank staff in Bogota. It is even suggested that some

of the parties involved in Colombia were subsequently murdered to prevent any further details of the fraud from emerging.

But perhaps the most serious instance of attempted fraud, which could have had catastrophic economic and political repercussions, was thwarted just in time by U.S. authorities.

An American software designer was approached by representatives of organized crime to whom he was related by marriage, and was asked to help set up an alternative to the SWIFT international banking network. This would be offered to all the Arab states that had boycotted SWIFT over Israeli participation. The project was to be backed by the designer's contacts, and he would be handsomely rewarded. One essential condition was included in the deal: he was to build a trapdoor in the management software that would allow the racketeers to access the new network at will.

He had already started negotiations with General Electric's timesharing giant, GEISCO, when the FBI began tapping his phone. Soon after, he was arrested, tried, convicted, and jailed. His coconspirators were not.

—N.A.

of electronic services can be piped through to domestic tv sets."

Last year, the management advisory group Input, based in Mountain View, Calif., produced an in-depth report on telecommunications security that covered the risks associated with running data networks. Input's document also tackled the important aspect of cost—after all, there is little point in management being acutely aware of the need for security if it is then reluctant to commit cash to providing it. And the more sophisticated the system, the higher the cost of making it secure.

The European Commission is now preparing to draw on this fast-growing body of expert knowledge on computer security. The EC has set up a year-long project involving French researchers, the National Software Center in Dublin, Denmark's Elektronikcentralen, and the U.K.'s National Computer Center. The goal is to draw up guidelines, standards, and recommendations on risk analysis, operational efficiency, and the latest technology available for network security.

The work of this group is to be supplemented by another EC-sponsored study headed by U.K. consultant Coopers & Lybrand. It hopes to raise around \$600,000

from the EC and industry to look into the best methods for securing data and programs and maintaining interference-free networks.

Watching the development of these research projects closely is Henry Beker at U.K. electronics multinational Racal. Beker is a visiting professor of mathematics at London University's Royal Holloway College and he's also head of Racal Guardata, a newly established security systems company. Racal Guardata was set up with the express purpose of offering a complete service to large users of data networks, from the initial design stage through installation to maintenance. "At present," says Beker, "data integrity and data security aren't generally thought of as important. We're in the business of selling integrity and security. Apart from a few systems that handle transactions of a high financial value, things are in a very immature state. Few people really do protect their data."

Beker explains that Racal Guardata's approach to security is to focus on four key areas: access control and user verification, protection of messages or transactions from corruption or unauthorized modification, message authentication and privacy, and protection from insiders.

Clive Blatchford, meanwhile, is convinced that a totally fresh approach to security is now called for. "Security mechanisms cannot just be add-ons," he suggests. "They must be an integral part of the whole system. We need to go back to fundamental architecture principles. We should now be able to build in security, not just at the applications levels, where the insiders still have access, but at the node and network levels, too."

Of course you can't protect against everything, as one West German consultant points out: "Just as there is no such thing as an unbreakable code, so there is no such thing as a totally secure network. Flaws appear, faults turn up—you can't anticipate every single thing, but you'd better have it all covered!"

You can see his point. When one U.S. financial network developed a fault recently, a major New York bank ran up a \$12 billion deficit with the Federal Reserve Bank in just three hours. With those kinds of sums at stake, it's better to be safe than sorry. ©

Nick Anning, an investigative journalist specializing in the computer and communications industries, is based in London.

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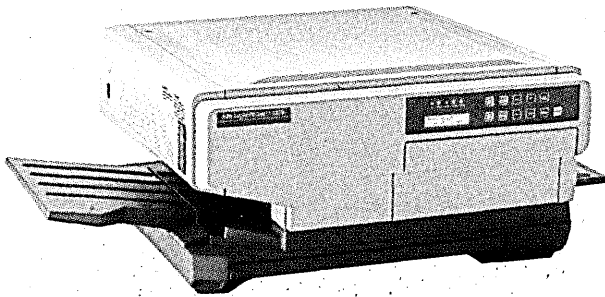
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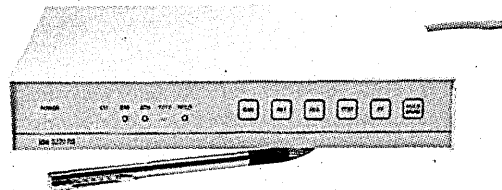
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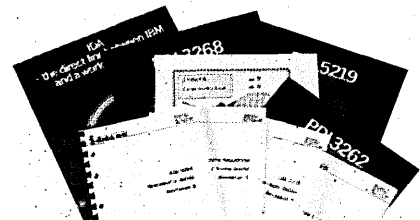
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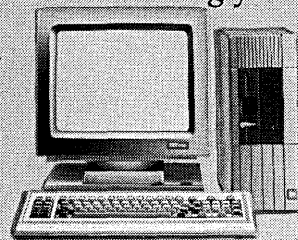
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System security in Japan is more a matter of honor than fact.

JAPAN'S INSECURITY COMPLEX

by Bob Poe

"Water and security are free," runs an old and curious saying in Japan, still often quoted by Japanese executives. It illustrates a widespread attitude among Japanese companies that exasperates security-conscious dp managers. The foundation of trust upon which Japanese business relationships are based means that "managers think it's absurd to have to pay for security," says Azuma Koiwai, a former IBM Japan employee, now director of Computer Engineering and Consulting (CEC) in Tokyo.

To some extent that attitude is understandable. The most spectacular case of malicious network damage in Japan resulted from physical attack rather than illegal access. That was in October last year when radicals at numerous points around Tokyo simultaneously cut communications cables belonging to Japan National Railways. The sabotage virtually paralyzed the urban train system for a day.

Physical damage was also the cause of another major incident the previous year. In November of 1984, a fire destroyed the main underground cables of an on-line ATM network, knocking out the entire system over a busy weekend. Apart from these two examples, system crashes due to software bugs, or mechanical and electrical failures are by far the Japanese dp manager's most common security problem.

In comparison, illegal access is regarded as an almost insignificant problem. "Many companies think just guarding the computer room is security enough," says Katsuhiko Suzuki, information systems control manager at Mobil Oil Japan. Even when computer crimes such as embezzlement do occur, they are often treated as personnel rather than security problems. "The managers in the [victimized] companies always blame it on an isolated character flaw in the individual," says CEC's Koiwai. "They never think their security system was at fault."

Mobil's Suzuki, who takes security seriously and last year was appointed president of the Japanese chapter of the EDP Au-

ditors Association (EDPAA), agrees with Koiwai. "Employers believe that since they checked their employees' backgrounds before they hired them and have lifetime employment contracts, they'll always be safe," he observes.

Most Japanese executives echo the belief that computer crime by employees is highly unlikely. "Japan has very good people," says Manabu Ikeda, securities information manager at Yamaichi Securities in Tokyo. "Company and family unity are very strong. If a person committed such a crime, he would be excluded from society."

Koji Okamoto, general manager of Toshiba's Information Network Systems division and also an advisor to the government's Ministry of International Trade and Industry (MITI), views this sense of unity from a broader perspective. "The most important point is that we are all Japanese," he says. "There are no whites, no blacks, no Chinese." While Okamoto is at a loss to explain exactly how this racial homogeneity results in trustworthiness, he and many others in Japan clearly believe that it does.

Such attitudes may represent a dangerous blind spot among Japanese managers. Last year, 59 computer crimes were reported to the National Police Agency, says Shinju Tezuka, the agency's technology specialist. This may not seem like many at first, but, Tezuka admits, "We have no idea how many were not reported."

INCREASE IN CRIMES EXPECTED

This year, the number of crimes is expected to rise, forcing the Japanese legal system to work out new ways of dealing with the problem. For example, Japan has no law against the theft of data. When three men were brought before the courts in September this year, accused of stealing valuable data from a vehicle company by copying magnetic tapes, they had to be convicted only for the theft of the physical tapes. The result was a two-year, suspended jail sentence.

According to most experts, this failure to accept the possibility of interference has left Japanese networks poorly protected. "I would guess that less than 10% of

Japanese firms have any file protection software like IBM's RACF [Resource Access Control Facility]," says Mobil's Suzuki.

Even those using such software aren't necessarily safe. "Most companies protect only 10% of their data, because it takes a lot of work to update all the protection rules using RACF," says Koiwai. "They don't want to spend the money to hire more computer staff."

For non-IBM users, the situation may be even worse. Fujitsu has a software security package that it says is equivalent to early versions of the IBM RACF product. This, however, has not been updated along similar lines, possibly because of the widespread anxiety in Japan over software disputes with IBM. Third-party software is not the solution either. According to Koiwai, whose firm imports the ACF2 file protection software for IBM mainframes from SKK Inc., Rosemont, Ill., this U.S. product cannot be used on supposedly IBM-compatible machines like those from Fujitsu and Hitachi.

Things are beginning to change, though, and a number of moves within Japan over recent months have made data security an issue almost as important as physical protection from accidental and criminal damage. MITI, which established a Computer System Security Committee in 1976 and published its first guidelines on security in 1977, has recently caught on to the problem. In January of this year, it took a close look at data integrity and published a new set of guidelines covering the auditing of data in dp systems. MITI also added dp auditing as the fourth category in its annual skill tests for dp workers. Previously, MITI ran only three certification tests of skill for programmers and system engineers. The new test, which started in October this year, is for dp auditors. MITI expects around 8,000 dp workers in middle and senior levels of management to take the test before the end of 1986.

Both the new MITI guidelines and the new test are partly a reaction to the enthusiastic response of local companies to the new EDPAA chapter. After only a year, the EDPAA has around 200 members in To-



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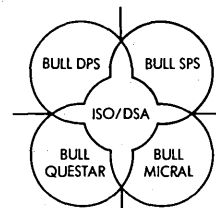
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HACKING IT IN JAPAN

Hacking hasn't been much of a problem in Japan. The first major case, in fact, happened only last March, when someone guessed a password for the country's Venus-P international packet switching system and used it to access databases in the U.S. This relative quiet on the hacking front compared with other computer-wise countries might be due to some inherent honesty in the Japanese character. Or it might be because the Japanese don't know how to hack—not yet, anyway.

If it's a lack of ability, then things will change in the next few years. Until recently, there have been few opportunities for budding Japanese hackers to polish their skills, but in the past year or so those opportunities have proliferated.

Software house ASCII Corp., until recently Microsoft's Japanese distributor, started things off on May 1, 1985, with its ASCII Network for computer hobbyists. The network—three Unix VAXs serving 64 phone lines—now offers bulletin boards, electronic mail, games, conversation programs, and conference services to more than 20,000 registered members. Surprisingly, the average user is a busi-

nessman in his thirties who wants to learn more about computers, though the most enthusiastic contributors to the bulletin boards are teenage boys.

ASCII Corp. takes a tolerant attitude toward members who try to do things they shouldn't. "We have two types of hackers," says Hidenori Miyazaki, the system administrator. "The beginners are proud to think of themselves as hackers. They just do things like posting dirty words on the bulletin boards. But we know who they are because they've logged in, so we just send them a message telling them to stop it."

The other type is more skilled; it includes such people as engineers. Often they have access to a Unix system manager's manual, and try different commands to see what they'll do. "If they're in an area where security is not tight, they may be able to read some files they normally couldn't," says Miyazaki. "When they reach a certain stage, we might send them a message." But the message probably isn't a reprimand.

"Usually, we praise them for their skill, and try to find out how they got into

that area. It's a good way for us to find bugs in our system. And if they're very good, we try to hire them."

So far, no one has gotten in deep enough to gain system manager's privileges, for example, or to crash the system. If someone did, though, it wouldn't matter that much. "We don't keep any important information in the VAXs," says ASCII Corp. executive vice president Ken Tsukamoto. "If the system crashes, we can have it back up in half an hour or so."

Other companies have followed ASCII Corp.'s lead and set up their own networks, most notably Nippon Electric with its PC-VAN. These playgrounds are likely to be where the budding Japanese hackers learn their trade. Unlike other countries, Japan has few nationwide networks, although a number of projects are under way to set up research nets across the country. To date, "few of the systems are linked together," says Microsoft Japan president Susumu Furukawa. "Japan has nothing to compare with the universities' UUCP network and the ARPA defense network in the U.S."

—B.P.

kyo, with another 40 or so in Osaka. The association has held its own Certified Information System Auditor (CISA) test for two years, first in English and now in Japanese, and over 200 people have passed so far.

The Ministry of Posts and Telecommunications (MPT) has also gotten into the security act. Its main concern, according to Kouji Omura, deputy director of the telecommunications system division, is the proliferation of common carriers since the deregulation of the Japanese telecommunications market. The 237-page booklet it published in July was developed in consultation with NTT, the formerly state-protected telecommunications monopoly. It covers some 165 points, including both physical and logical security, which the ministry hopes the new common carriers will implement.

The latest entry into the security arena is Japan's Home Affairs Ministry. Earlier this year, it conducted a survey on computers used by 762 regional and local governments in Japan and found their security generally inadequate. Guidelines covering 224 items were published in August, but once again they emphasized physical rather than logical access control, along with the usual subjects like power supplies, separate storage of backup data, and building construction techniques.

POLICE SECURITY GUIDANCE

Possibly the most useful booklet, however, was put out this spring by the National Police Agency. Titled, "Information Security for the Future Network Society," it is the only official publication in Japan concentrating on pro-

tection against criminal misuse. It includes the results of a survey sent to all the companies on the Tokyo Stock Exchange, and puts forth guidelines for network protection, covering both physical and logical access control quite thoroughly.

Among the most significant of the survey's findings was that 61% of the companies said they did not educate employees at all about proper computer security practices, 28% educated irregularly, and only 6% had a system for periodic training. Tezuka considers this a major weakness. "Education is the most important factor," he says, "since inside people can do the most damage."

The evidence suggests they have been doing just that. Tadahiro Uezono, marketing manager of security products for financial systems at IBM Japan, compared a sample of Japanese computer crimes with a similar sample from the U.S. He found that whereas 47% of the U.S. crimes were committed by employees of the company, the figure for Japan was 59%.

But internal security isn't the only worry in Japan. The days when computers can be completely shielded from outside access are drawing to a close. "There has been more use of dial-up lines since deregulation began," says Mobil's Suzuki, "and more firms are using links with other companies." Services for individuals using personal computers are also increasing. Besides the Japanese networks for pc hobbyists, which are mainly playgrounds for budding hackers (see "Hacking It in Japan"), major financial institutions are promoting the networking trend as well. Home banking systems are being developed, and

Yamaichi Securities, for example, has just started a Home Trade service so that customers can buy and sell securities via their personal computers.

Alongside the growth of national networks in Japan has come the growth of international networks and these cause their own security problems for the Japanese. "In the future, our financial institutions must tighten security because networks are becoming international," says Yuzo Asaka, general manager of Yamaichi Securities' systems planning department. He cites the company's worldwide financial information service for institutional investors as an area that must be closely watched to prevent foreigners from getting into the system.

Of course it works the other way too. Shinichi Hirabayashi is a former Toshiba employee, now president of Japan Communication Corp., a small computer consulting firm. He warns that Japan could become a popular access point for hackers around the world if it doesn't tighten up its controls. "If a U.S. company makes a secure system but its Japanese branch is insecure, then U.S. data can be lost," he says. The worry is especially acute for companies making products with defense applications, and even the National Police Agency admits in a recent report that "it is extremely difficult to arrest [spies]" in Japan, whether they are politically or industrially motivated. ©

Bob Poe is a Tokyo-based writer who works for *Japan Economic Journal*, *High-Technology Magazine*, and *Economic Materials Report*.



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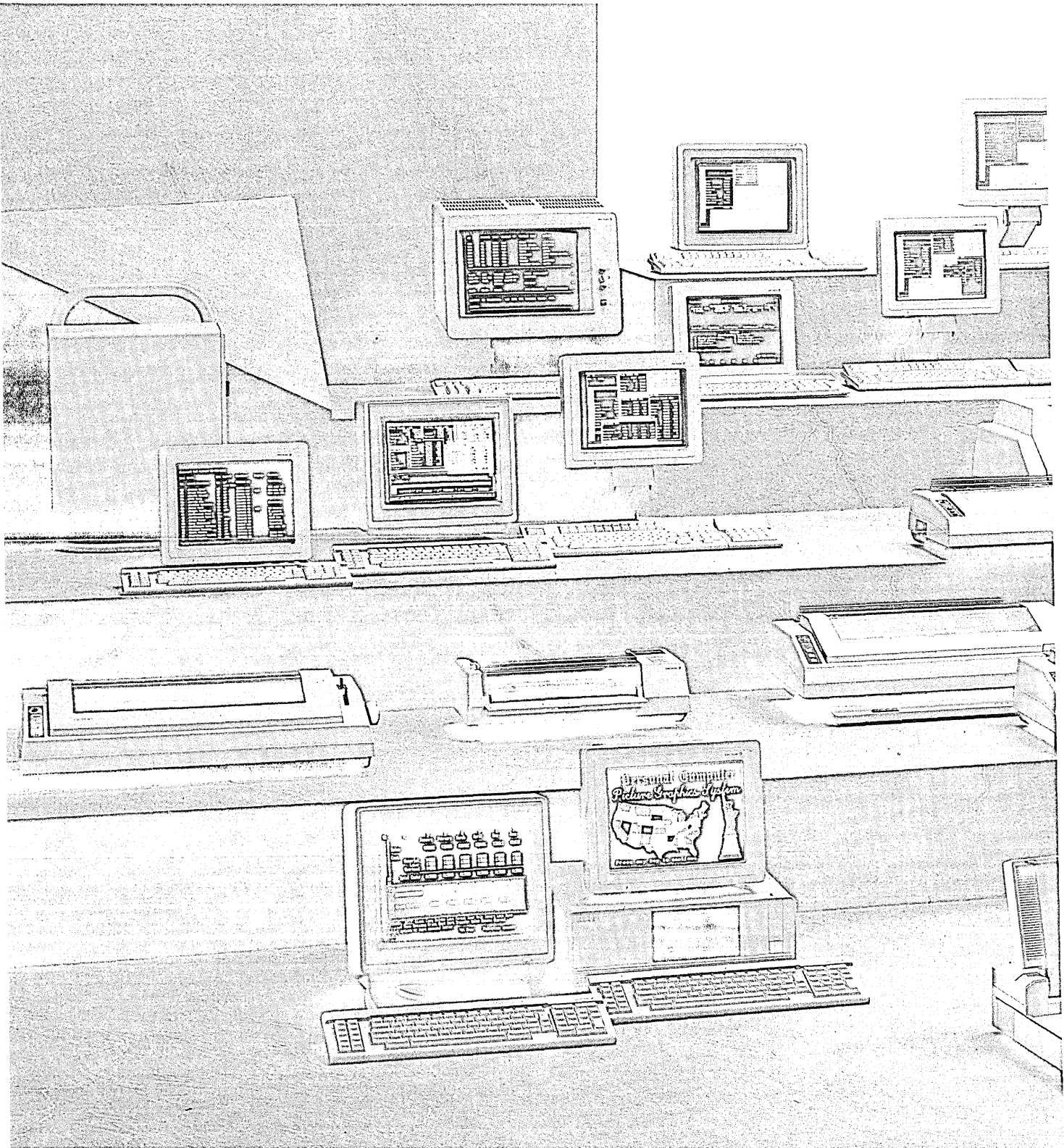
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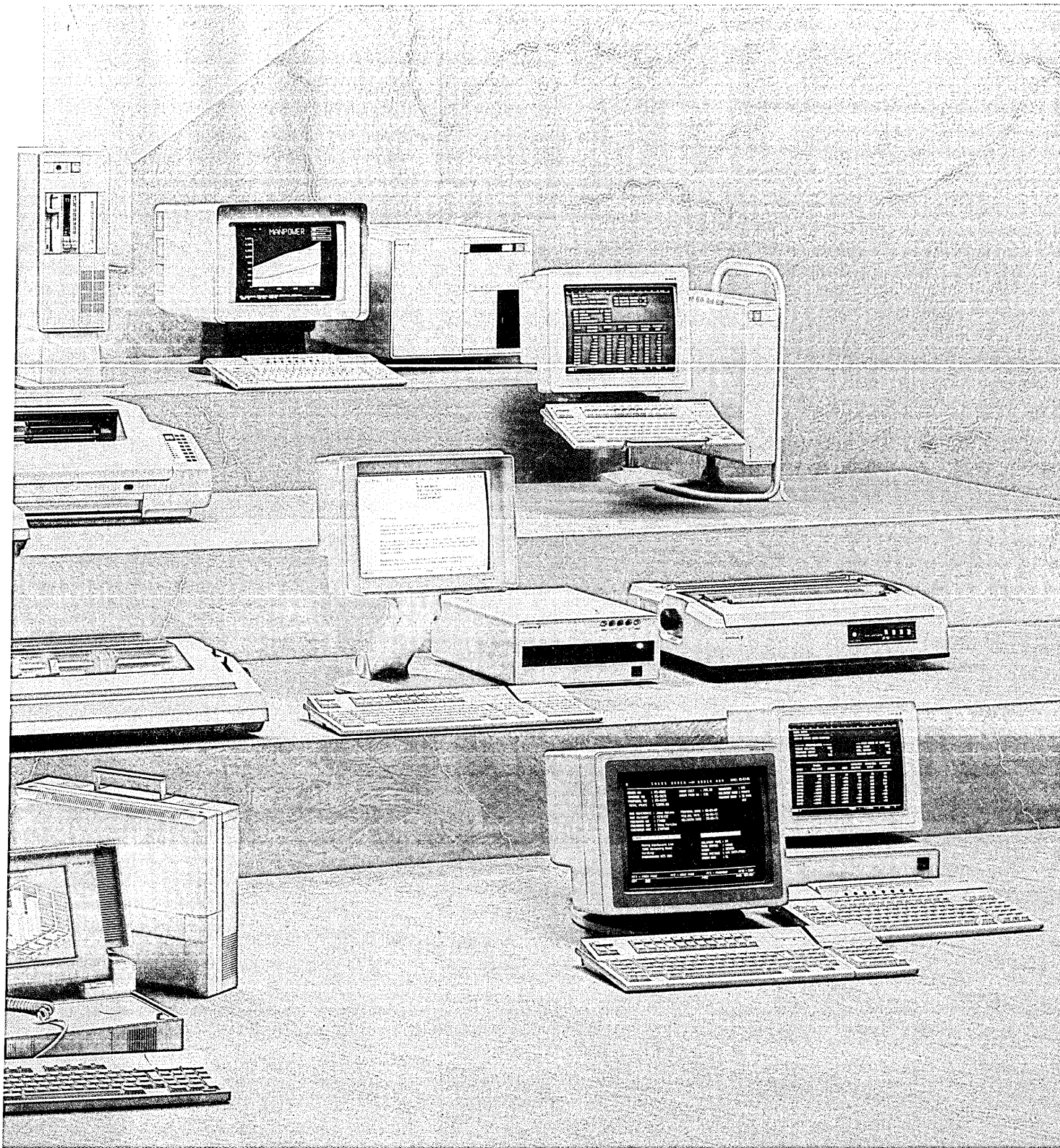
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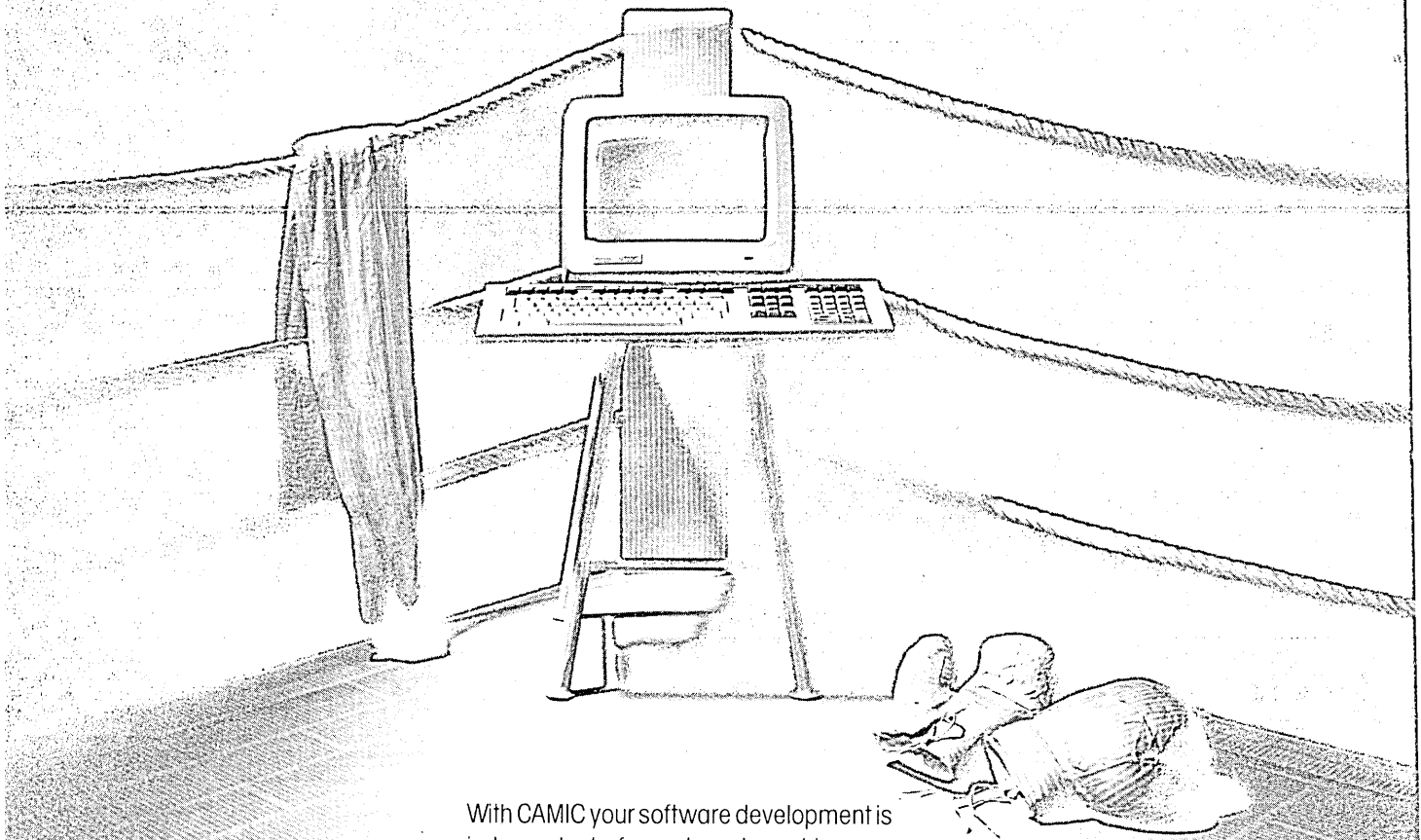
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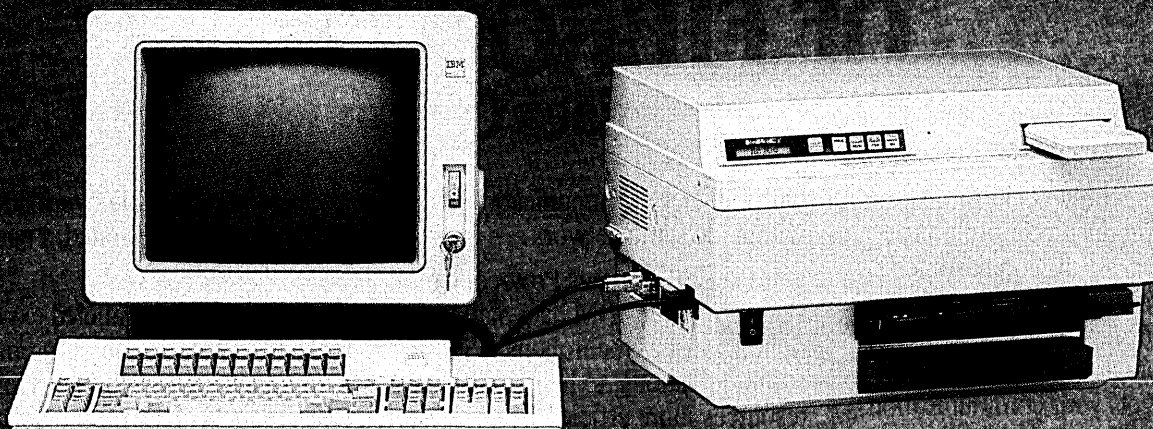
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**When the world's banks move money, SWIFT
secures the route.**

BANKING ON A SAFETY NET

by James Etheridge

Moving money among the world's banks has always been a tricky task. Today, with over 800,000 messages passing through a global banking network every 24 hours, that task has grown even bigger and the tricks more technical. The Society for Worldwide Interbank Financial Telecommunications (SWIFT), claims to have all the tricks it needs to make that system impenetrable.

SWIFT's satisfaction with the security of its world banking network is borne out by its record. In more than nine years of message carrying, it claims that there has been no attempt to penetrate the network. The only minor blots on its record have been a few delays in delivering messages due to technical mishaps.

The organization's success is reflected in its regular 20% annual growth in the volume of traffic, and the constant addition of new members. Based in Brussels, Belgium, SWIFT is effectively a cooperative owned by the banks that are its customers. At last count, there were 1,326 member banks in 61 countries, with 2,054 branches connected to the network. Users pay an average of 40 cents a message, enabling SWIFT to make a modest profit on its \$100 million-plus turnover and to finance its own development. Some 20% of its revenues are derived from SWIFT Terminal Services (STS), a separate subsidiary that supplies software and terminal interfaces to users.

The group was initially established in 1973 with a charter to develop a totally secure international network. That applied not only to the switching installations, but also to access procedures and data. The network facilities are protected by the usual kinds of looping, backup systems, and physical checks, while access control and data protection are guaranteed by password and encryption methods pioneered by SWIFT.

Along with these safeguards, SWIFT's customers demanded nonstop availability of the service. Jacques Cerveau, general manager of SWIFT, explains, "Our bankers wanted fully redundant systems

from day one. If one center was prevented from operating, for whatever reason, the other center could take over total operation of the network without undue trouble."

There are two operating centers, one in the U.S. and the other in the Netherlands. They are linked to regional processors in every country covered by the network. Interconnection between operating centers and regional processors and from regional processors to user terminals is made over lines leased from national or commercial carriers. All lines are duplicated to safeguard against breakdowns. SWIFT insists on two separate cables going through different access points into each country. There is complete hardware backup both at the operating centers, which are manned, and at the regional processing sites, which are unmanned and located in secret installations within buildings belonging to PTTs or financial institutions.

The dependence on lines provided by PTTs and commercial carriers is a cause for concern at SWIFT. "Our main problem is the poor quality of the international system," observes Cerveau. Since deregulation in the U.S., he adds, chaos has reigned and the service has deteriorated. To give it additional backup and greater control, SWIFT has installed its own satellite earth station in the U.S., although Cerveau points out, "The problem is not undersea cables, it's the last 20 miles."

NETWORK PUT TO THE TEST

Acts of both God and man have put the SWIFT network to the test in recent years, none more so than the Mexican earthquake in September 1985. The organization was fortunate insofar as its regional processor, located in a local PTT building, emerged unscathed from the tremor, but all communications with the U.S. were cut. It took SWIFT days to set up an alternative route, using a satellite link from Mexico to Spain and then cables to the European operating center.

Another part of the system was temporarily put out of action earlier this year when high winds caused a Soviet cargo ship moored in a Dutch port to drag its

anchor, severing a cable that carried both of SWIFT's lines into the country, even though PTTs are supposed to provide two separate links. It took several hours for normal service to be resumed.

Harry Steele, SWIFT's chief inspector, is in charge of a department that is responsible for security at all levels within SWIFT. He considers such isolated incidents as just one—and not the most important—of the hazards that a network has to be designed to overcome. "The biggest risk from my point of view is the capacity of the network," says Steele. SWIFT was originally designed to handle 300,000 messages a day—it has now been expanded to a capacity of 930,000. Further expansion of the existing network was considered impractical, so the installation of a replacement system was decided upon.

Known as SWIFT II, the new network is based on a different architecture, with virtually unlimited scope for growth and with support for additional value-added services. It was initially scheduled to start up in June 1986 but has been pushed back until the end of 1987. The delay is chiefly due to the late delivery of software from Burroughs, the main contractor.

When the transfer to the new network is complete, SWIFT will have invested some \$30 million in new software. Another \$40 million will be spent on additional hardware over a three-year period.

Yet, SWIFT II will only involve minor improvements in security because the existing array of procedures has proved satisfactory.

Access to SWIFT is controlled by what Steele describes as a unique log-in system. It requires each bank to use a different password for each message transmission session, and there may be several sessions every day. The password consists of eight digits and corresponds to a separate input sequence number. Passwords are sent to banks in two parts, on carbonized paper. The top sheet must be torn off before the numbers can be read. If the person responsible in the bank thinks that the document has been interfered with, he or she can refuse to use it and can fall back on a contin-

INTERNATIONAL

Some banks even pin up the password lists on notice boards.

gency set of numbers.

The system is designed to cut off any terminal automatically if three unsuccessful attempts are made to access the network. The same log-in procedure will be retained under SWIFT II, except that there will be a second stage for gaining access to particular services. Steele concedes that sending out paper lists of password numbers by mail is less than ideal, but experiments with alternative methods have not yet produced a better procedure.

INSURANCE AGAINST TAMPERING

After it is established that the person at the bank's terminal is authorized to be there, the next step in the security chain is to ensure that the message sent into SWIFT is not modified by anyone before transmission. For this, the message carries an authenticator in its trailer. The authenticator is the product of an algorithm supplied by SWIFT, combined with two keys agreed on bilaterally by the sending and receiving banks. It is applied to every character in the message.

The receiving bank can then verify

that the message delivered is the one that the sending bank officially approved for dispatch. Any tampering with the message between authentication and transmission at the sending bank would produce the wrong result when the receiving bank tries to unlock the code.

The algorithm was developed by SWIFT and will be used in the extended SWIFT II network. A second authentication algorithm will be added, giving an additional guarantee that the message sent is the one received. "This is a less sophisticated algorithm designed to protect against accident, not against fraud," explains Cerveau.

The third level of protection concerns the data alone, which are encrypted by the SWIFT system. SWIFT was one of the first civil organizations to use encryption, but it didn't develop its own algorithm. That was acquired under license from a Swiss firm and it will continue to be utilized under SWIFT II. At the time SWIFT began, IBM's Data Encryption Standard (DES) was in its infancy, but despite the campaign to make DES an international standard, it

has never appealed to SWIFT. "We've refused public algorithms; why let the world have a crack at you? We prefer proprietary algorithms examined and checked by outside experts," says Steele. SWIFT is not against standards in general, though; one of its main tasks has been to establish standard message formats, and these have since been adopted by ISO.

Under SWIFT II, a second level of encryption is being introduced to provide total secrecy for messages transmitted. It will allow only the banks to retrieve messages in encrypted form, preventing national authorities from being able to require SWIFT to divulge their content. SWIFT will still be able to store and retrieve the full history of messages it carries in case of any dispute over delivery.

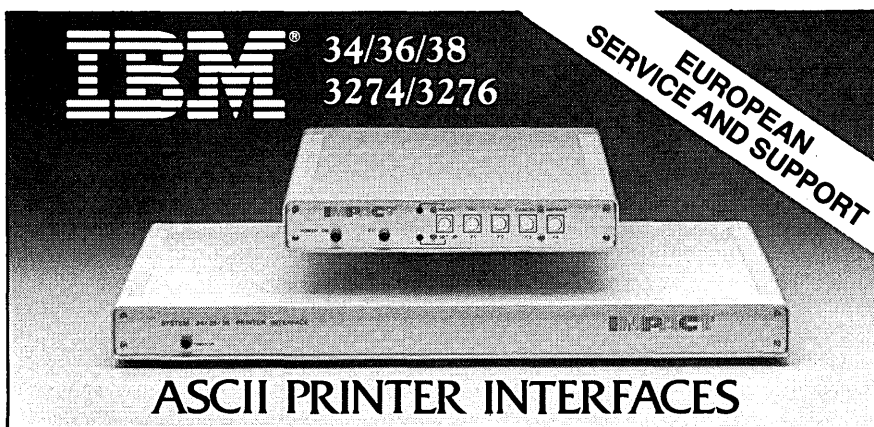
SWIFT cannot require messages sent by banks to be encrypted before they enter its network at a regional processor, but it does encourage users to use encryption. Its product sales division, STS, markets a device called SWIFT Terminal Encryption (STEN). SWIFT itself keeps a constant stream of garbled data flowing through its system, so that any interference would show up immediately.

The lines between the banks and SWIFT's regional processors, however, are only the second weakest link in the security chain, Steele says. The weakest link is comprised of the banks themselves. "None of SWIFT's security procedures can prevent internal fraud," says Steele.

Roger Anderson, director of SWIFT's bank support division, is more specific: "The main risk is collusion between two banks' employees. Many banks are not sufficiently security conscious as regards controlling access to SWIFT." He concedes, though, that at the end of the day banks have to make their own assessment of risk vs. investment.

Computer fraud at banks is a growth industry, and insurers have seen the consequences of that trend in the number and size of the claims. Sources close to Lloyds of London report that premiums for bankers' blanket bond insurance, which covers employee fraud, computer fraud, and errors and omissions, went up by 300% this year. SWIFT's premiums have risen much less dramatically.

"We haven't claimed a single Belgian franc on our insurance policy," asserts Steele. The only penalties incurred by SWIFT have been payments in cases where it has failed to deliver a message on time. This deprives the banks and their customers of interest. That has happened on three occasions in the past five years, according to Steele. ©



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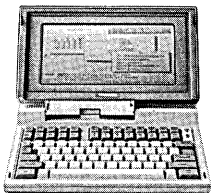
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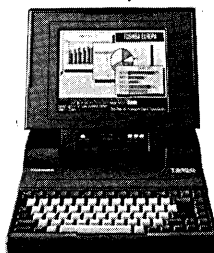
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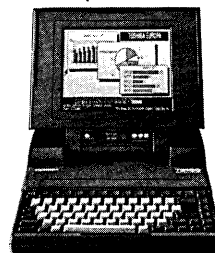
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3. The new T 3100 features a 80286 microprocessor, which enables it to operate at four times



the speed of conventional desktop computers. The T 3100 is as compact as the T 2100, incorporating a plasma display, a hard disk

drive and a main memory with a storage capacity of up to 2.6 megabyte. The T 3100 is compatible with the IBM AT and is mains operated.

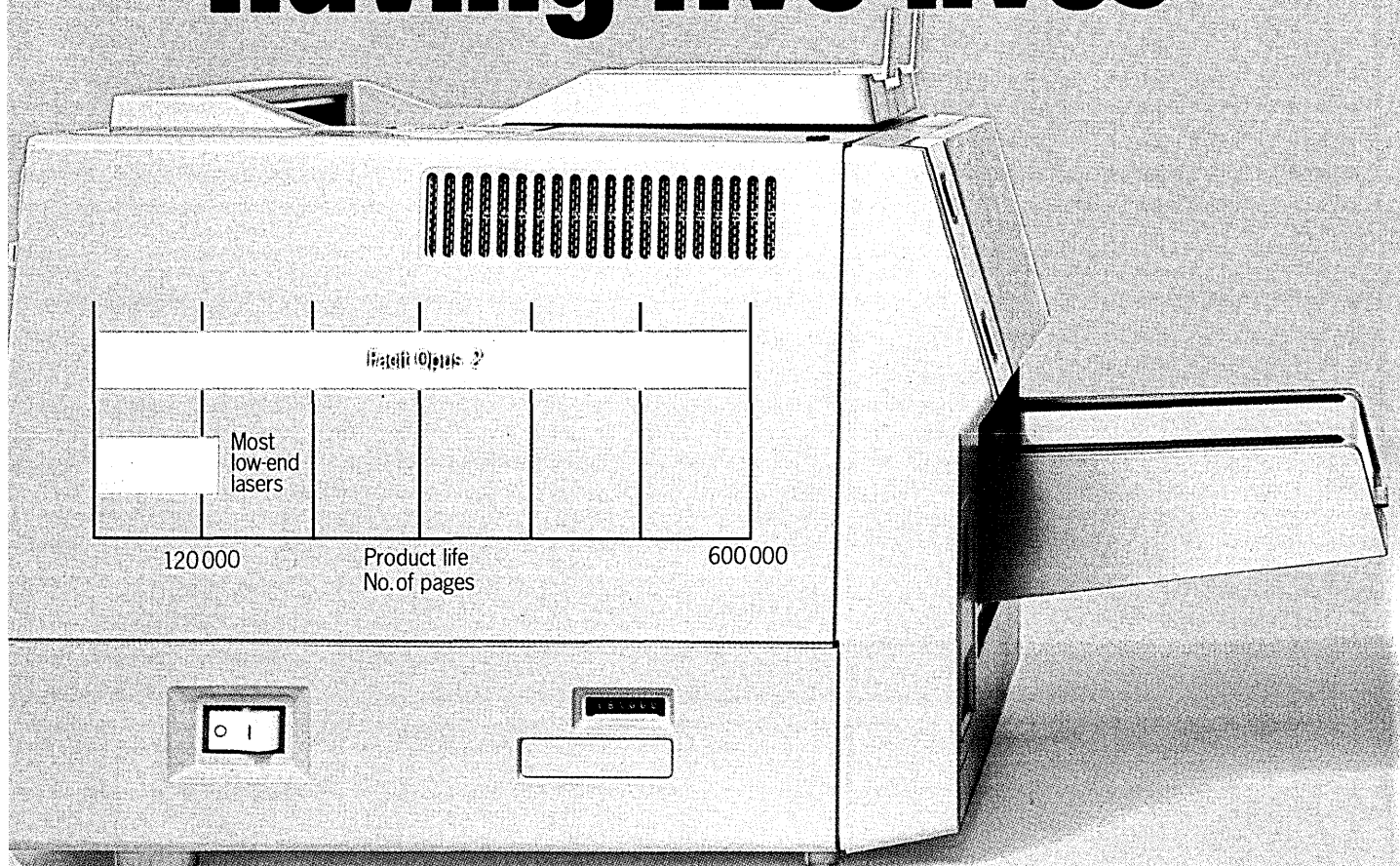
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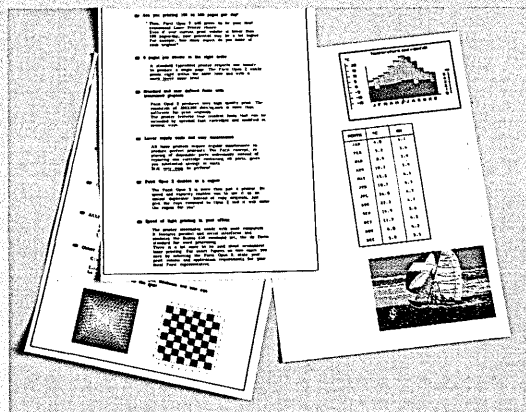
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DATAMATION's annual mini/micro survey finds sales flat, growth down, the outlook indifferent.



MINIS, MICROS, AND MATURITY

by John W. Verity

These are slow times for the well-matured minicomputer industry. Growth of shipments during the year ending June 1987 is not projected to reach even 8%, according to the 1986-87 DATAMATION/Cowen & Co. Institutional Services mini/micro computer survey. This is down significantly from the 13%-plus growth forecast in last year's tabulation.

Meanwhile, the corporate personal computer market promises to be only slightly more robust, with projected shipment growth dropping to the 10% to 20% range from last year's 24%. Such sluggishness, attributable largely to the market's increasing saturation, contrasts sharply with the 117% rate recorded just three years ago.

All in all, the market for small computers has seen far better days. At many times, it has had much more to look forward to than it does this year. Changes in circuit technology, namely the widespread adoption of VLSI chips, have shortened delivery lead times for many key products and thus reduced the need for systems houses and oems to place massive orders as a means of maintaining future inventories. For this and other reasons, there seems little likelihood of a major cyclical resurgence in minicomputer growth as was seen in 1984.

Nevertheless, the rather dismal outlook for small computers is not without its bright spots. Workstations, those relatively high-powered, single-user machines that sell for \$7,500 and

up, are selling particularly well—and taking significant business away from traditional minicomputers. Office systems in general are selling above average, too. Digital Equipment Corp., in particular, is winning new market share from IBM and other vendors in both sectors and evidently is enjoying above-average user loyalty. On the other hand, despite much public criticism of the product, IBM's System/36 is enjoying respectable demand. IBM still dominates the organizational market for personal computers, even though it's suffering increasing competitive inroads by the PC clones.

Some other survey findings follow:

- Despite the introduction of new circuit technologies and systems architectures that provide great improvements in price/performance, raw performance itself is not yet an important enough factor to lure most users away from their current minicomputer vendors.
- Compaq, the Houston supplier of transportable IBM-compatible computers, has bumped Apple as the number two pc supplier to the corporate market.
- Santa Clara-based Intel appears to be enjoying a near tripling of orders for its microprocessor chips, taking over from Motorola as the leading microprocessor supplier in this survey.
- IBM's token ring looks as if it will double its share of local networks installed by respondents as of June of next year.
- Growth in the use of Lisp, a language popular in so-called artificial intelligence applications, has tapered off compared with last year.
- Data processing hardware budgets will continue to grow at a lesser rate—only 8.6% a year, compared with the 11.8% measured in 1982—over the next few years.
- For the next generation of machines, personal computer users say they are interested most in additional processing speed and better communications capabilities.

THE BOOM TIMES ARE OVER

Although growth in personal computer shipments is still well ahead of that for minicomputers, the boom times are over and show no signs of returning. Asked to look ahead and compare their pc spending for the year ending June 1988 with that for the current year (ending June 1987), the survey's respondents were not particularly optimistic. Only 35% of them, down from a high of 54% in the 1983 survey, expected their pc spending to be higher in that future year. About a quarter of them said spending would be lower.

As in previous years, the survey measured users' spending for small com-

FIG. 1

TOP DOZEN MINICOMPUTER SYSTEMS 1986-87

A. Based on number of respondents acquiring systems (7/86-12/87)

MANUFACTURER	SYSTEM	NUMBER OF SITES ACQUIRING	AVERAGE UNITS PER SITE
DEC	MicroVAX-2	287	2.7
IBM	System/36	197	3.7
DEC	VAX, unspecified	114	2.2
DEC	VAX 8200	74	1.3
IBM	System/38	70	1.2
DEC	VAX 8600	44	1.3
DEC	VAX 8500	42	1.4
Hewlett-Packard	3000, unspecified	39	2.2
IBM	Series 1	33	7.4
DEC	PDP-11/73	31	2.7
DEC	VAX-11/780	31	1.4
DEC	VAX-11/750	30	1.3

B. Based on number of units being acquired (7/86-12/87)

MANUFACTURER	SYSTEM	NUMBER OF UNITS BEING ACQUIRED	EST. VALUE (\$ MILLIONS)
IBM	RT PC	1,209*	\$12.9
DEC	MicroVAX-2	787	36.5
IBM	System/36	721	36.6
Burroughs	B25	537	2.8
Honeywell	DPS 6, unspecified	386	8.0
Texas Instruments	Business System, unsp.	385	8.5
NCR	Tower XP	301	6.9
DEC	VAX, unspecified	256	55.0
Wang	VS 6	252	5.6
IBM	Series 1	245	12.0
Sun	Sun-3, unspecified	167	3.4
NCR	Tower, unspecified	107	4.0

*Includes a 1,000-unit purchase by a single respondent organization (a university prominent in computer-related research and education).

FIG. 2

ONLY MODEST SPREAD IN USAGE OF UNIX DURING LATEST 12 MONTHS

Query: What if any plans do you have for the use of Unix (Ultronix, Xenix, etc.) as your primary or secondary operating system?

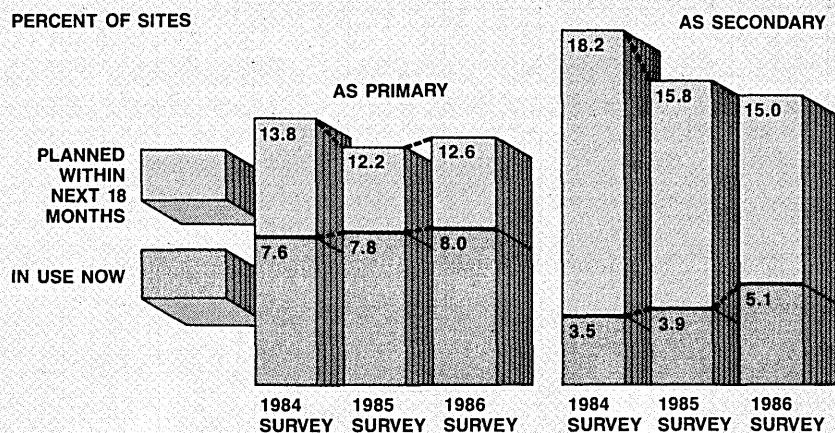
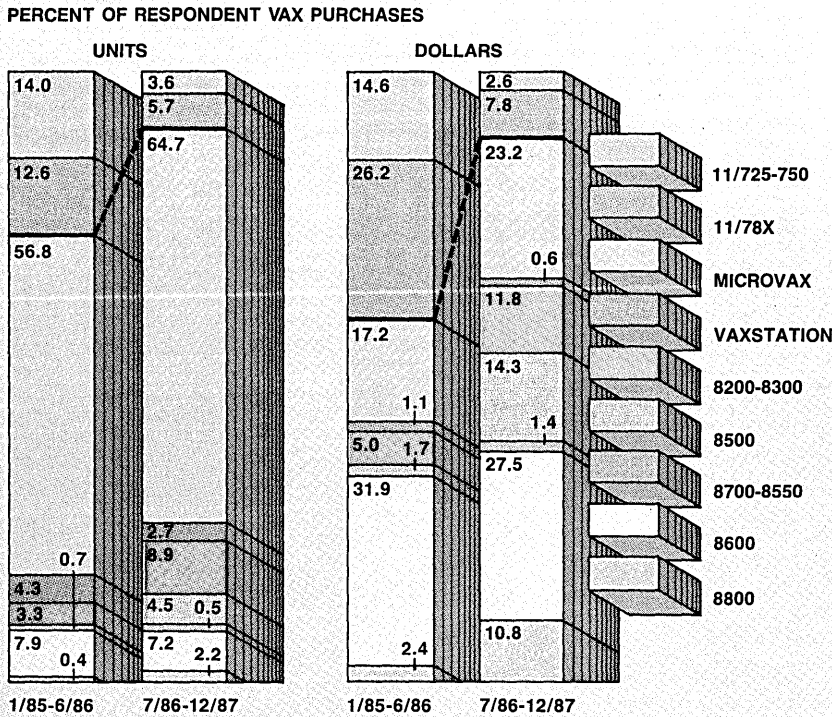


FIG. 3

ORIGINAL VAXs LESS IMPORTANT TO DEC



computers during the previous and forthcoming 18-month periods (see "Survey Method"), and tallied their responses to questions about a wide range of specific economic and technical topics. One of these topics is the all-important issue of pricing, which can be quite volatile in this end of the computer market.

End users this year reported a slight increase—12.4% vs. the 11.6% recorded last year—in the price concessions (above and beyond normal quantity discounts) they received from their minicomputer vendors. Oems and systems houses reported average concessions of 19.5%, up from 18% last year.

Some of the largest concessions were reported by those respondents that purchased machines from Apollo and Sun Microsystems, two of the leading workstation vendors. Vendors were reported to discount workstations an average of 16.4% off list prices, compared with only 10.7% in the less competitive small business systems arena.

On the whole, list prices in all systems categories were found to be falling. The average minicomputer system price for the 18 months before July 1986 was \$83,800, but during the following 18 months, the price was expected to be only \$71,200. The average workstation price will fall to \$18,500 from \$28,000.

Looking ahead 18 months, the survey found that 81% of oem/systems house sites, up from 77% last year, indicated that their current minicomputer inventories were "about right." Only 7% of those sites, down from 12% a year earlier, described their inventories as "too high." This is seen as a sign of confidence among these sites that, if business should pick up, needed hardware can be procured quickly and in sufficient quantities. In other words, the minicomputer business as a whole has lost some of its cyclical nature.

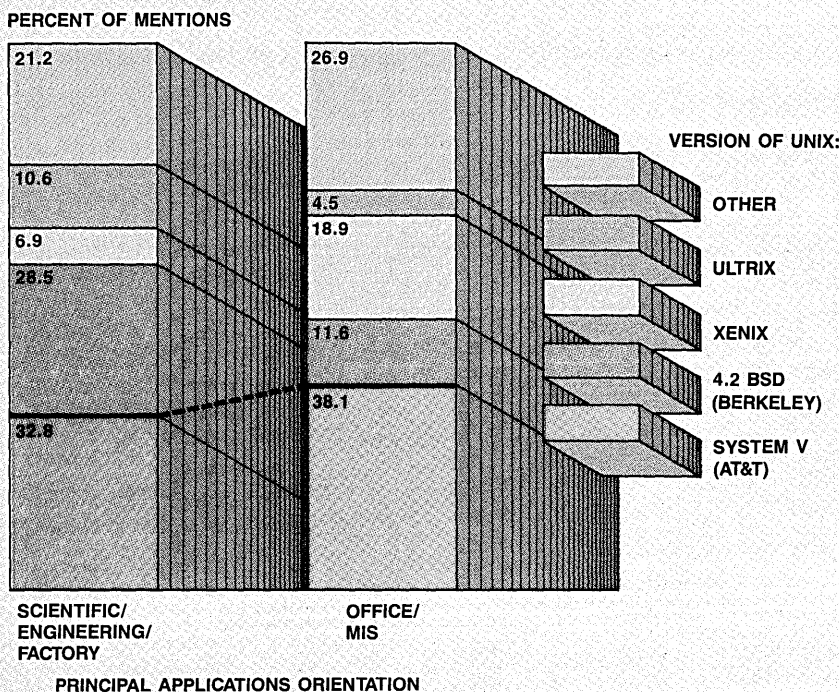
Fig. 1 shows a ranking of the machines that survey respondents said they intend to purchase during the year and a half ending Dec. 31, 1987. Notably, two VLSI-based machines, DEC's MicroVAX-2 and IBM's System/36, show up as two of the most popular machines for the near term.

In terms of the dollars they plan to spend for minicomputers, respondents indicated they would increase substantially their purchases of DEC gear. In the previous 18 months, they spent 36.5% of their money with DEC, but in the following period they planned to spend 40.9%. IBM's share, by contrast, was seen falling to 18.1% from 19.3%. This seems to indicate that DEC is gaining market share from the industry leader. Hewlett-Packard's spending was

FIG. 4

SYSTEM V MOST WIDELY USED VERSION OF UNIX IN LABS AND OFFICES

Query: If already using Unix or planning to, which version?



projected to hold around 6%, but that may not take place, given the company's post-survey disclosure of technical problems with the new 32-bit Spectrum line.

DEC's share of minis planned for use in scientific, engineering, and factory applications was projected to rise slightly to 52.3% from 51.6%; IBM's share of total dollars in that category is expected to fall to 7.8% from 8.4%. In the highly competitive workstation market, DEC stands to receive 31.7% of the total respondent dollars, compared with 39% previously, while Mountain View, Calif.-based Sun's share goes to 14.7% from 11.4%. (Apollo's share was recorded as falling to 7.5% after the survey from 10.1% before, but it should be noted that the survey ignores the international market, where the Chelmsford, Mass., company is understood to be a relatively strong player.) Finally, DEC seems to be the big winner in office minicomputers, where it competes with the All-in-One software package. There, DEC stands to see its share of spending rise to 35.3% from 27.7%; IBM in that category will see its share fall, to 17.9% from 24.3%; Wang's share will go to 9.0% from 8.0%.

STRONG DEMAND FOR VAX

DEC, the leading mini vendor, is enjoying strong demand for its VAX line, particularly relatively new models such as the 8650 and MicroVAX. Pre-1984 VAX models, namely the 11/XXX series, will account for only 10.4% of the dollars respondents said they would spend for VAX hardware in the following 18 months (see Fig. 2); that is far less than the 41% those machines contributed during the previous like period. The model 8800's dollar contribution will rise to 10.8% from only 2.4% earlier. But it is the MicroVAX-2 that is doing best: in both scientific and commercial applications categories it is the model of choice for more than half of those using VAX systems (including both end user sites and oem/systems houses).

Data General sites plan to spend 42% of their upcoming dollars on MV/20000 systems, 28% on MV/10000s, and 4.2% on MV/8000s. These figures compare with the previous 18 months' respective figures of 8%, 43%, and 21.5%.

Prime sites are primarily using the company's model 9950/9955, which stands to garner 55.4% of the dollars to be spent in the following 18 months, down slightly from 60% in the previous like period. Shipments of the model 2350/2450 are also strong, accounting for 52% of the Prime Series 50 units to be ordered by respondents and 24.6% of the dollars (up from 5.2% and 5.1%, respectively).

FIG. 5

CONVEX AND ALLIANT LEAD STILL YOUNG MULTI/PARALLEL PROCESSING MARKET SEGMENT

Query: If you have an interest in multi- or parallel-processing systems, which, if any such systems, actually are being considered?

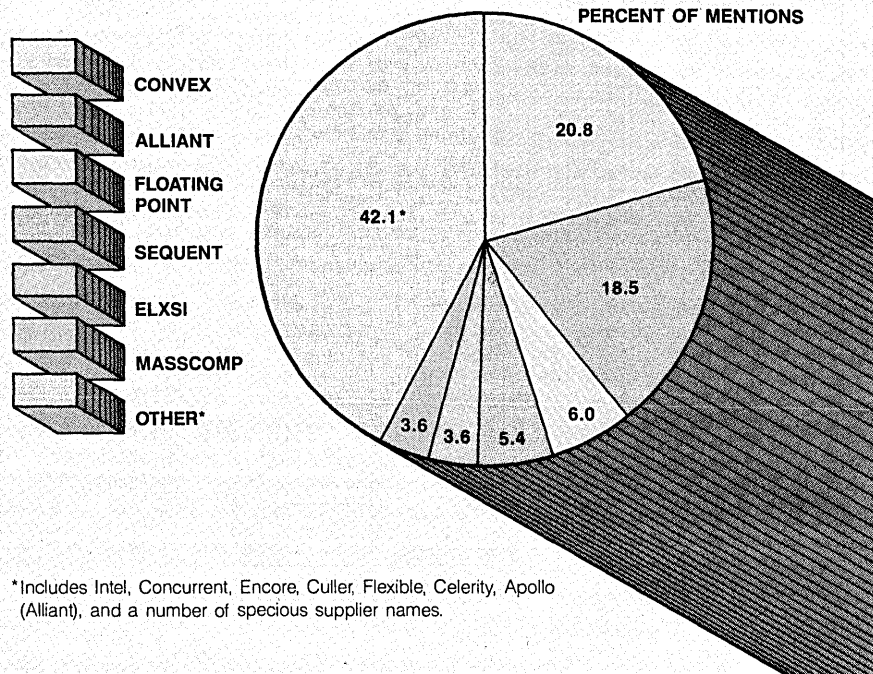
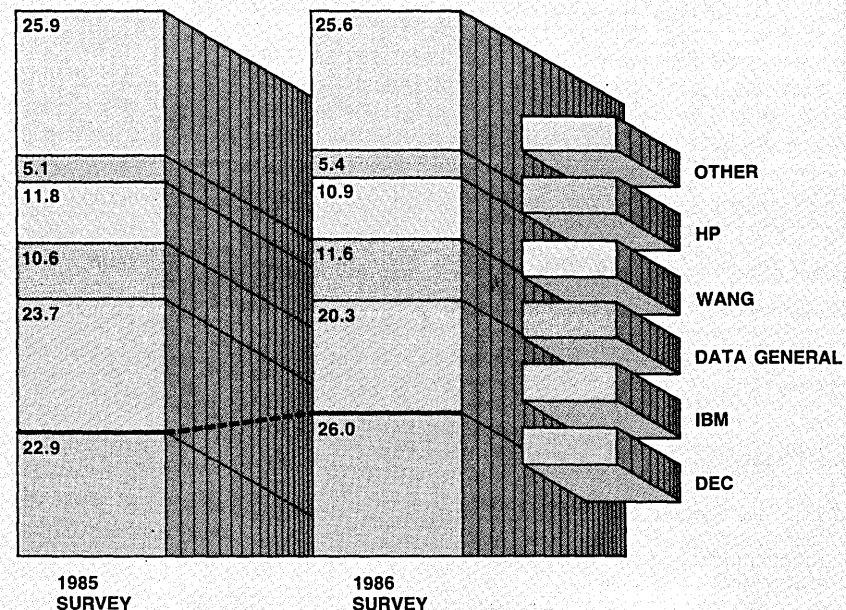


FIG. 6

DEC SHARE OF INTEGRATED OFFICE SYSTEMS MARKET UP DURING PAST 12 MONTHS

Query: If your organization has an integrated office system already in use or planned, whose?

PERCENT OF MENTIONS (ALREADY IN USE OR PLANNED)



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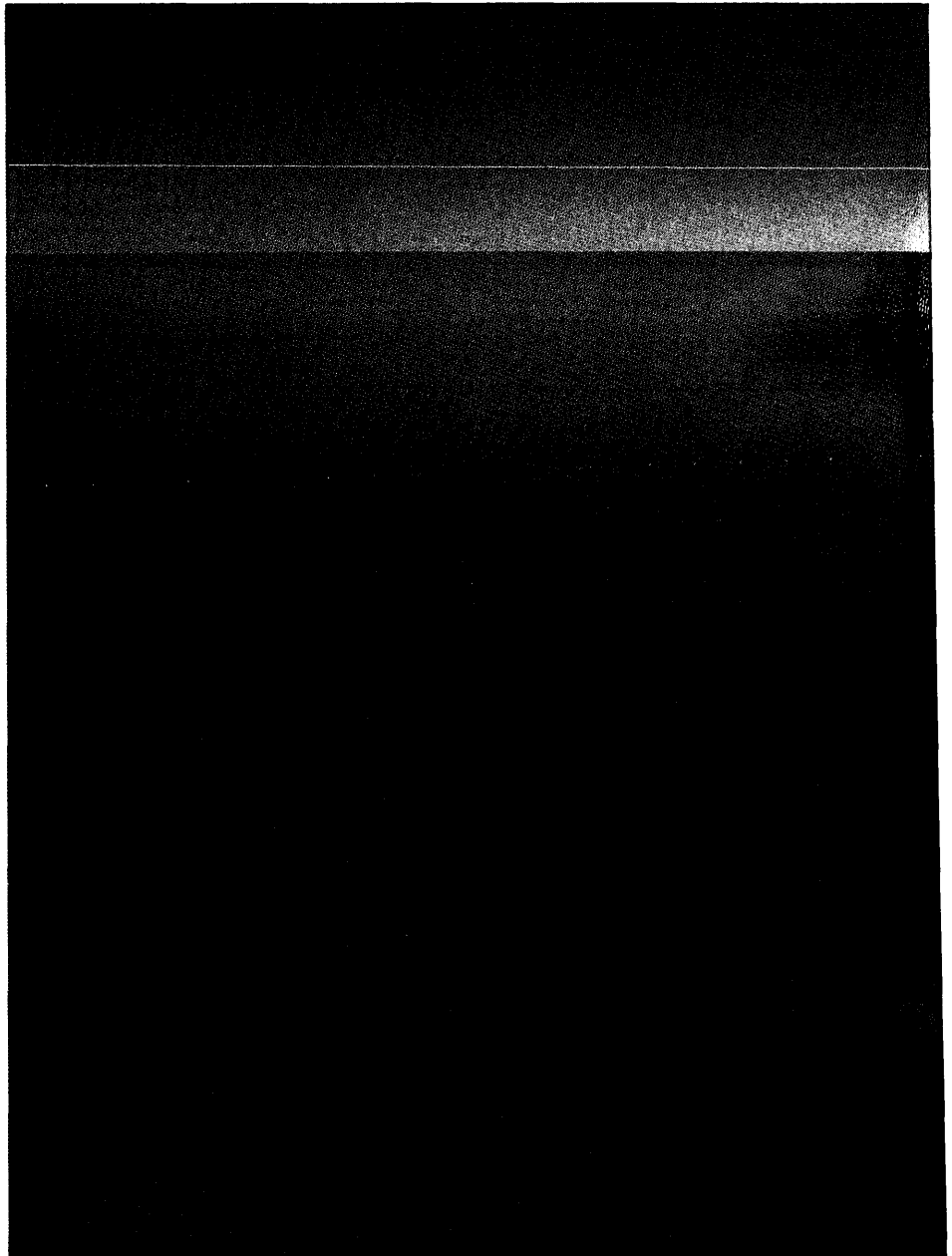
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Hewlett-Packard's shipments through the end of next year appear to be heavily dependent on its 16-bit model 3000 systems, which as a family are over a decade old. The survey, taken several months before the firm's problems with the 32-bit Spectrum line were disclosed, showed users planning to spend 72% of their HP dollars on model 3000s, down from 78% for the previous 18 months. Spectrum was expected to account for 10.6% of their spending with HP and 5% of the HP units shipped.

Once again, the survey looked into the desire among users for fault tolerant systems and discovered a slight uptick. Asked if they would like their mini vendors to offer such capability, 40.5% said yes, but only for no extra charge; 14.8% said yes, even if it cost extra; and 3.6% said they already had such capability installed. These figures compare to last year's respective tallies of 36%, 15%, and 3.1%.

The two biggest names in fault tolerant computing are Tandem Computers, Cupertino, Calif., and relative newcomer Stratus Computer, Marlboro, Mass. Despite aggressive marketing and a contract to supply IBM with its machines, Stratus's share of the respondents' planned spending for fault tolerant systems is expected to stay put at around 13% this year. Not a single Stratus-built IBM System/88 showed up among the machines cited by survey participants. Tandem's own aggressive product cycle is evidently helping it maintain market share.

ITS OWN BEST CUSTOMER

AT&T is still its own best computer customer, but it has made substantial inroads with others. With particular strength in timesharing and with customers in the manufacturing, education, and government sectors, 45% of the company's 3B machines will be shipped to non-AT&T sites, according to the survey. This contrasts with a figure of only 24% during the preceding 18 months. Meanwhile, DEC's share of future AT&T survey site purchases of minis will remain substantial, accounting for 5% of all such units.

Dear to AT&T's heart and central to its marketing strategy, but not exactly catching on like wildfire, is the Unix operating system. Its use appears to be rising among the survey population, but at an extremely modest rate. All told, only 8% of the survey's respondents designated Unix (or a derivative thereof, such as Ultrix or Xenix) their primary operating systems; another 4.6% said they planned to install such an operating system during the next 18 months (see Fig. 3). Even among AT&T sites, demand for personal computers using

FIG. 7

PRICE GAINS IMPORTANCE AS PC BUSINESS ACQUIRES COMMODITY ORIENTATION

Query: What are the three most important criteria in your selection of a pc supplier?

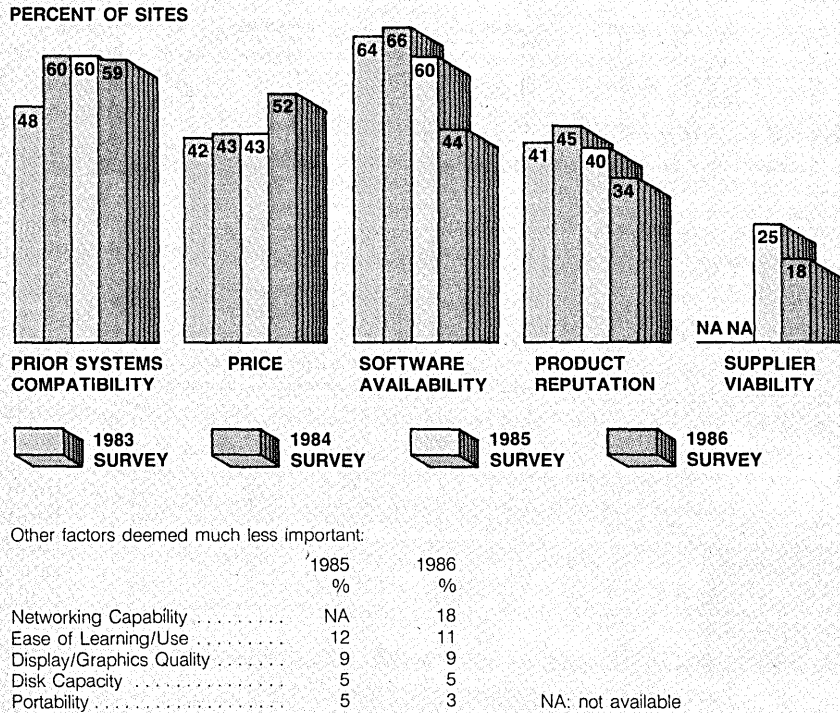
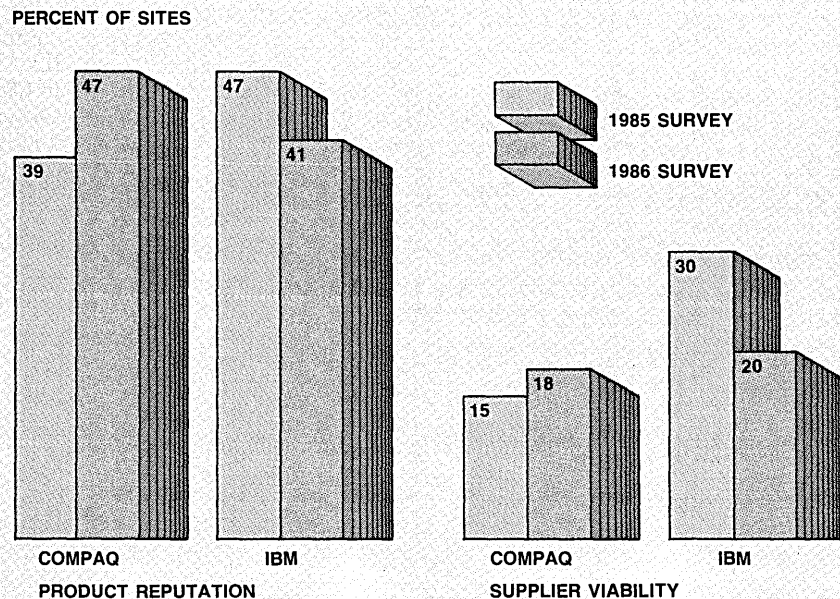


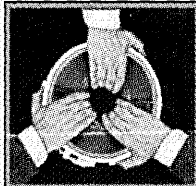
FIG. 8

ON LATEST SURVEY, COMPAQ RATED AHEAD OF IBM ON PRODUCT REPUTATION

Query: What are the most important criteria in your selection of a pc supplier?



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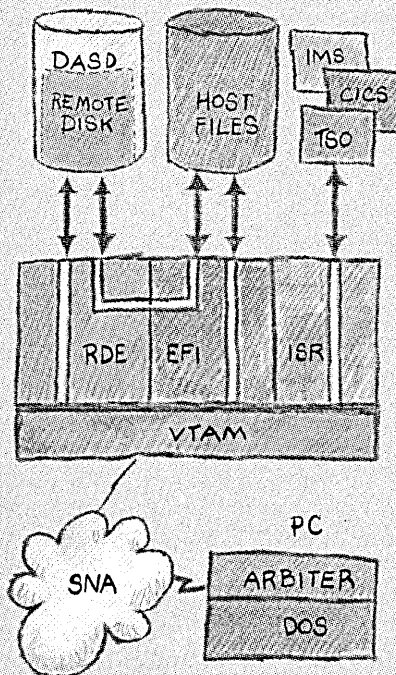
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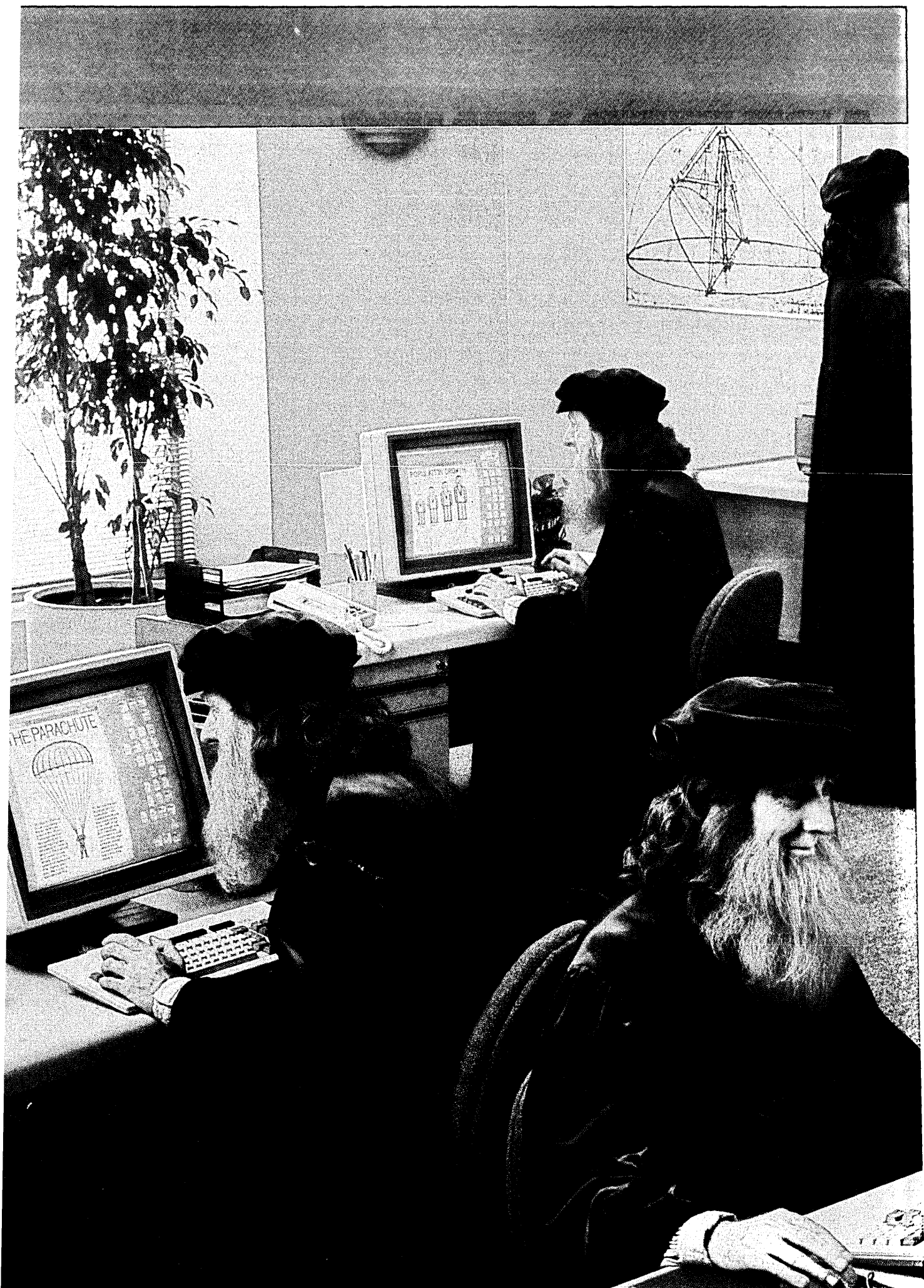
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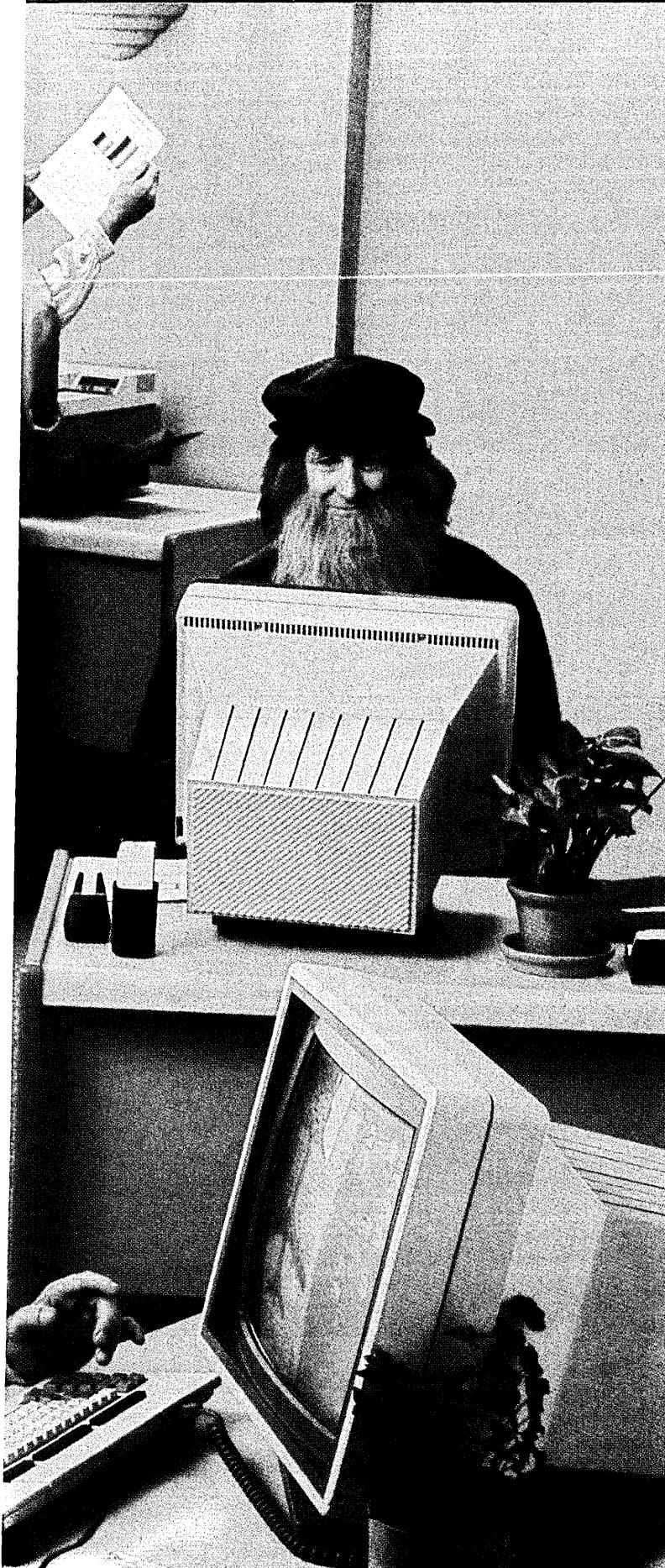
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MS/DOS far outranks that for Unix-based machines—95% to 5%. As seen in last year's survey, only a quarter of all survey respondents called multi-user (e.g., Unix) capability "very desirable" for pcs.

Doubts remain about the appeal of the AT&T-developed operating system, which still finds its greatest use among scientific and factory computing sites: 13% of them said it was their primary choice. In a list of 12 criteria used to select a mini vendor (e.g., cpu performance, price, compatibility with prior system), Unix was judged least important by both scientific and commercial users. Finally, it was found that while AT&T's System V version is still the most widely used Unix version (36.4% in use now), it is Microsoft's Xenix (rising from 14.5% in use now to 19.2% planned for the next 18 months) that is proliferating fastest (see Fig. 4). This holds true for both scientific and commercial computing.

Besides Unix, the survey paid particular attention to the recently emerging market for parallel and multiprocessing minicomputers, which are designed to provide extremely high computational rates. A dozen or so companies have entered this field in recent months, many funded by great amounts of venture capital, but judging by this survey they will have a tough time fighting over a still limited market. Even among scientific sites, which would seem to have the most need for extra computing horsepower, 22% said their applications would warrant these new machines, but just 10% of all survey sites said so. The most desirous of these high-performance machines are the petroleum/natural gas, military, and transportation equipment industries. Not surprisingly, the most likely applications areas for such machines are in artificial intelligence and scientific and engineering computation. Only 4% of IBM minicomputer sites (compared with 35.7% of Sun sites) expressed interest in the machines. Convex Computer, it was found, showed the most appeal so far with respondents, garnering 21% of the mentions; it was followed by Alliant, Floating Point Systems, Sequent, Elxsi, and Masscomp, in that order (see Fig. 5).

As has been seen in previous surveys, personal computers and workstations are becoming the machines of choice for many applications that used to be performed on traditional minicomputers. Among scientific sites, workstations are favored by 38% of the respondents (up from 32% in last year's survey) compared with 48% for minicomputers (down from 51%). In office applications, personal computers are being emphasized by 59% of the respondents (up from 52% last year), while

FIG. 9

SURVEY SHOWS COMPAQ IN NUMBER TWO POSITION IN SHARE OF PLANNED PC PURCHASES

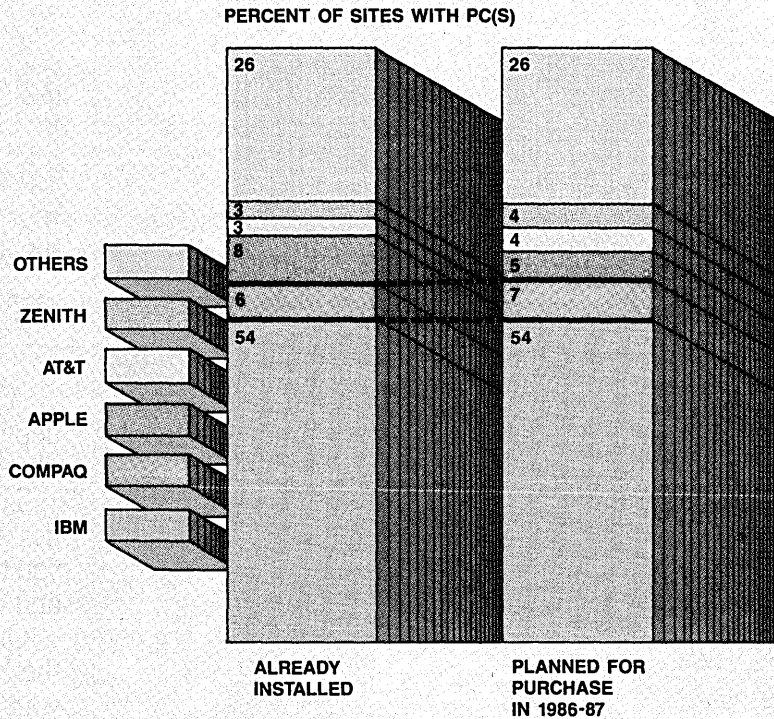
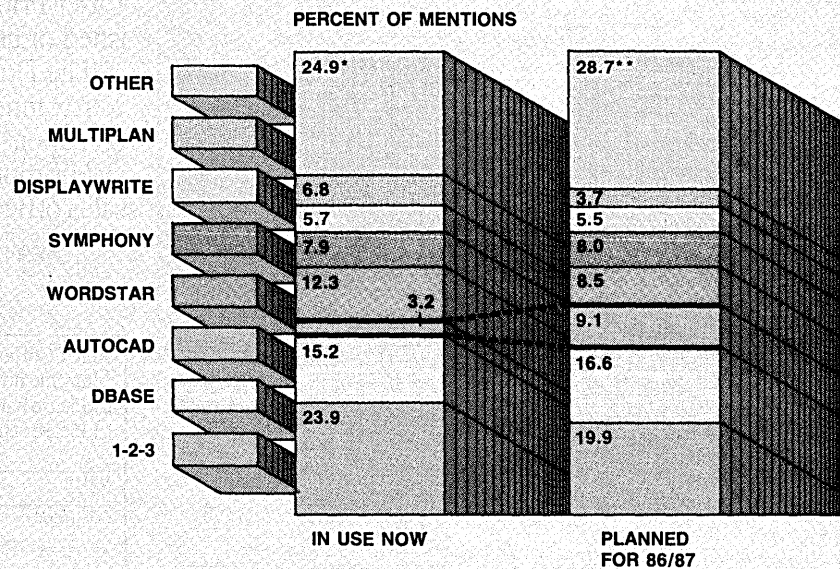


FIG. 10

AUTOCAD PC SOFTWARE USAGE RISES SHARPLY

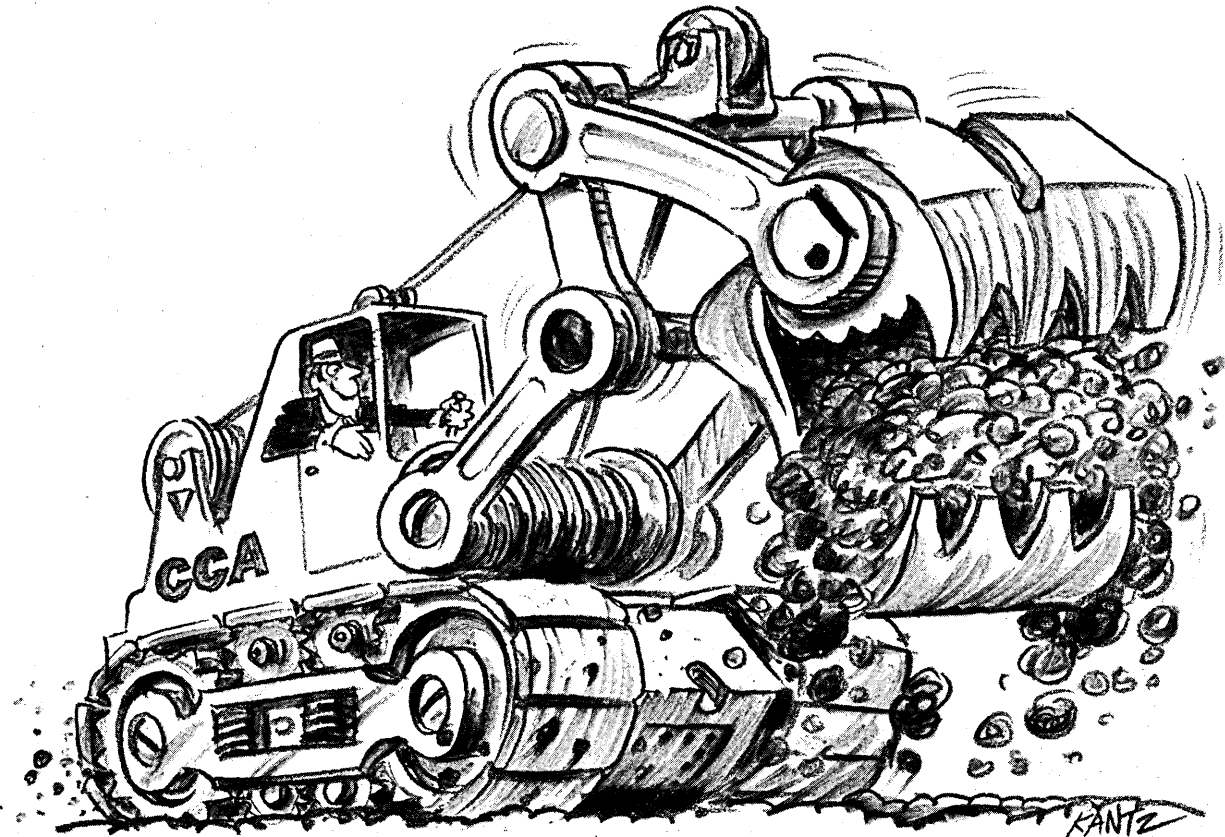
Query: Which pc applications software package does your organization principally use now and which are planned for use (initially or additionally) in 1986-87?



*Includes Wordperfect 2.4%, Multimate 2.2%, Framework 1.9%, Microsoft Word 1.3%, Topview 1.1%

**Included Wordperfect 3.1%, Topview 2.3%, Multimate 2.1%, Framework 1.9%, RBase 1.4%, Microsoft Word 1.2%

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minis dropped to 40% from 44% last year.

The traditional minicomputer is still finding widespread use in integrated office systems such as DEC's All-in-One and Data General's CEO (see Fig. 6). The departmental mini was chosen by 55% of those planning to implement an integrated office system, followed by 22% for mainframe host-based systems, 15% for networked pcs, and 8.7% for standalone pcs. Among IBM sites, the mainframe is still the chosen vehicle (at 33%, compared with 31% for minis) for such office systems. Additionally, it was found that the mini vendors are selling the lion's share (upwards of 75%) of their integrated office systems to their respective installed bases; Data General seems to have made the greatest penetration of its base. But DEC's share of the installed and pending integrated office market is now 26%, topping IBM at 20.3%, Data General (11.6%), Wang (10.9%), and HP (5.4%). DG's and Wang's share of this market is expected to shrink in coming months as IBM and DEC gain ground.

ONGOING SUCCESS FOR INTEL

Turning to the micro-computer and personal computer arenas, the survey revealed ongoing success by the Intel microprocessor family (8088, 8086, etc.) and by IBM-compatible personal computers. Intel, chosen by 57.3% of the sites buying microprocessors during the next 18 months, beat Motorola (24.9%) in the microprocessor sweeps. Intel's projected shipments to those sites during that period were expected to be close to triple those seen in the previous like period. The company's 8088 part is still a big seller (17.5% of Intel's total units to be shipped); the 80286 will garner 6.0% of coming shipments, while the 80186 captures 7.3%.

Motorola is by no means out of the race, however. It is enjoying strong demand for its 68020 component, which is used in Apple's Macintosh and a variety of workstation products. The part will make up 33% of the units shipped to survey respondents in the coming 18 months, up from 16.7% for the previous like period.

Year-to-year growth in the personal computer user base has once again slowed, according to the survey. The rate hit 15% this year, down from 31% in last year's survey and the 85% recorded in 1982 when the IBM PC was shipping in great initial volumes. Breaking down this rate by supplier, the survey found that the IBM PC base will grow by only 10% this year while Apple's will grow by 8%. The banking, education, and government sectors were among the most saturated with pcs of various kinds: upwards of 90% have them installed.

SURVEY METHOD

This year's 1986-87 DATAMATION/Cowen & Co. mini/micro computer survey began July 7, 1986, when over 61,000 questionnaires were mailed to DATAMATION subscribers who had previously indicated that they purchased small computers of one kind or another. In addition, approximately 5,000 questionnaires were sent to readers who had not indicated any prior usage of such machines.

Replies, collected through Aug. 21, yielded some 6,900 qualified, unduplicated responses from users across the country. The staff of Cowen & Co., a Boston brokerage house, tallied results, analyzed data, and presented its findings to institutional investor clients on Sept. 28.

IBM's share of first-time pc users dropped this year to 46% from 63% last year, as the many clones gained market share. The clones have benefited from a shift in priorities by users when it comes to choosing pcs—price is significantly more important a factor than it was a year ago, second to compatibility with a prior system, but for the first time ahead of the availability of software (see Fig. 7). Product reputation and supplier viability, two of IBM's long suits, dropped in importance, too. Gaining the most from this shift has been Compaq, the leading clone maker, which users rated better than IBM in the product reputation category—47% of answering Compaq sites, compared with only 41% for IBM, ranked product reputation as the most important criterion for choosing a pc vendor (see Fig. 8).

The pc software market shows few signs of fueling new pc growth. While packaged applications software for personal computers was once again rated better than that available for minicomputers—helping the smaller machines gain in usage for new applications—no dramatic new generic class of applications (e.g., spreadsheet or word processing) has yet emerged to do what VisiCalc once did. The fastest-growing pc application is database management, which accounted for 13.1% of respondents' total elapsed time at their machines (compared with only 5.6% last year); spreadsheet usage fell to 31% from 33%, while word processing continued to rise. Only a small uptick, to 5.1 hours from 4.9 hours, was seen in daily pc usage.

The two most widely used software packages were once again Lotus 1-2-3 and WordStar, with 32% and 10.3% of mentions, respectively, followed by dBase at 10.1%. As for those packages planned for use in the following 18 months, AutoCAD, a computer aided design package sold by Autodesk, Sausalito, Calif., showed particularly strong growth—to 9.1% of mentions from 3.2% in use now.

The survey resulted in some findings about how money is spent for pcs. Spending for packaged software, as op-

The survey defined minicomputers as including cpus such as the Digital Equipment Corp. PDP-11, VAX, and 4300, mini-based small business systems, user-programmable terminals, data entry systems, office systems, and workstations. The latter are single- or multi-user desktop systems, generally priced above \$7,500 each; typical examples are products from Apollo and Sun Microsystems and the IBM RT PC. Personal computers are single-user systems priced below \$7,500, including the Apple Macintosh, IBM PC, and Compaq. Finally, the survey asked about users' purchases of unbundled microprocessor chips, typically used by oems in building some larger machine.

posed to hardware, still accounts for about a fifth of the dollars respondents lay out for pc systems. Independent stores continue to be the primary channel of distribution for the majority of sites, but in terms of total units shipped, the manufacturers themselves have most of the business.

IBM STILL DOMINATES PC SCENE

IBM's domination of the pc scene remains unchecked, although the company seems to have suffered here and there from the clones and other vendors. For instance, the survey found for the first time that IBM's share of the number of sites with installed pcs has dropped. Where last year IBM was cited as the primary supplier at 56.3% of the responding sites, this year it was cited by 53.9%—the "other" category, which includes clone makers such as Compaq (5.9%) and AT&T (2.6%), grew to 32.2% from 25.5% last year. IBM's share of the sites planning to purchase pcs is expected to fall to 54%, from 62% last year. Apple's share of such sites remains at 5%, leaving Compaq, with 7% of the sites, as number two behind IBM (see Fig. 9).

While at the time of the survey many sites were expecting their mini and pc vendors to come out with new personal computer gear, there seemed little sign of a strong wave of replacement activity in the pc market. More speed and better networking capabilities topped the list of most wanted improvements, but not overwhelmingly. Even if such features were available, only a fifth of the responding sites said they would be "very likely" to replace their current machines. Add to that the expectation of further decline in the growth of dp hardware budgets for the next few years (8.6% increase per year now, compared with 9.3% expected in last year's tally), and there seems little likelihood of a major resurgence in pc shipments anytime soon. ©

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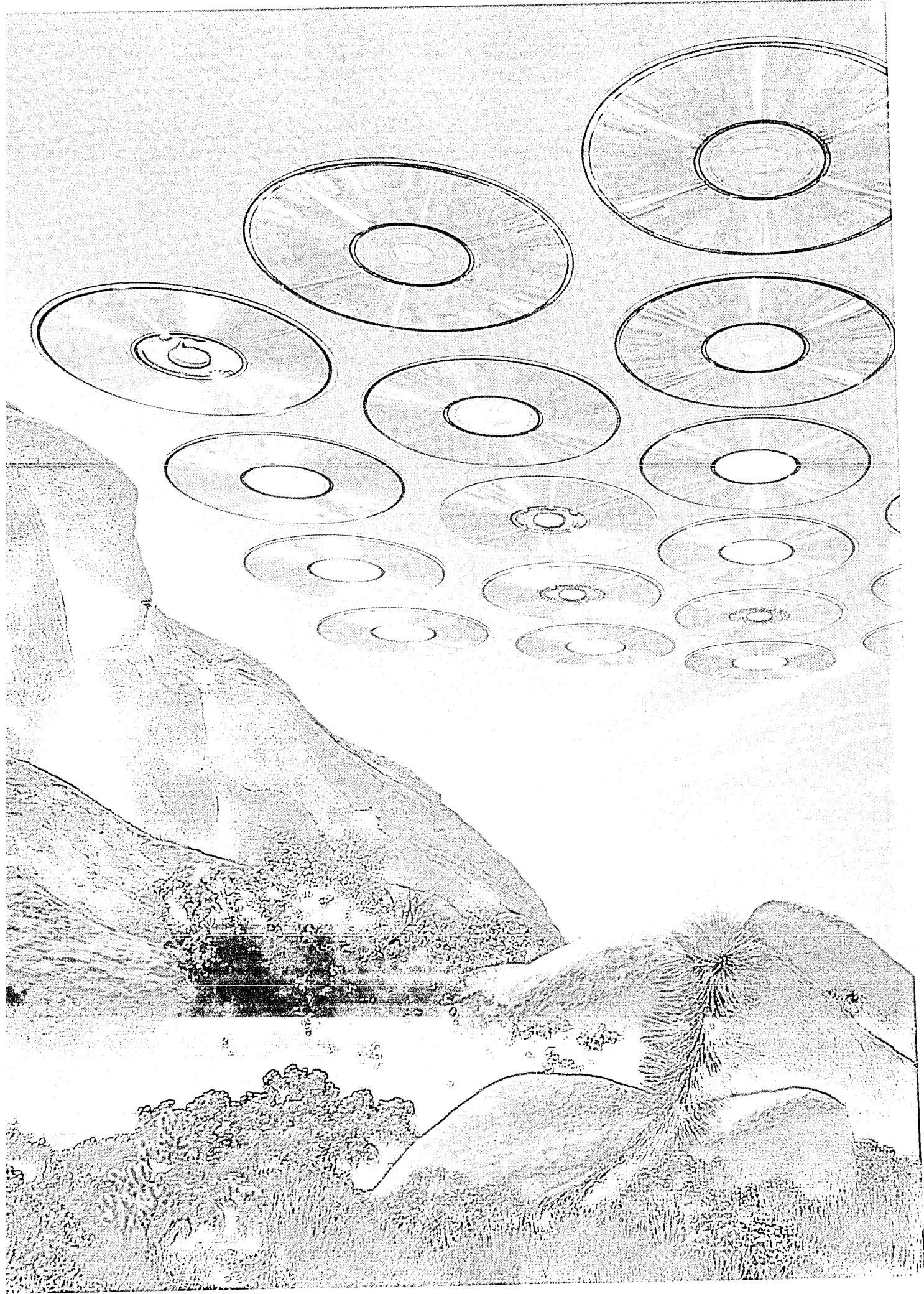
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Are there swarms of silvery plastic platters hovering on the horizon? Backers of CD-ROM technology prepare to enter a decisive phase.

HIGH NOON FOR CD-ROM

by Barbara K. Sehr

Usually, when Apple, IBM, Sony, or Matsushita get together at high noon in the marketplace, they wind up shooting each other in the foot. Late last year, however, these Hatfields and McCoys of the electronic world and at least nine other companies joined hands at the Lake Tahoe gambling resort of Stateline, Nev., in the High Sierra mountains to begin work on a document that could guarantee the success of the most dramatic technology since the personal computer.

The document is a proposed standard for formatting data stored on CD-ROMs (compact disk read-only memory). A draft version of the document, known as the High Sierra standard, was submitted last July to a subcommittee of the American National Standards Institute (ANSI); official ANSI adoption is currently expected by the fall of 1987.

Widespread use of the standard, officially or not, would enable software publishers and providers of data services to distribute their products on uniform compact disks. These optical storage disks, in turn, would be readable by CD-ROM players connected to any number of different computers, from micros to mainframes. Users of personal computers are expected to benefit most from this small-sized technology. CD-ROM is a phenomenal storage medium that can store up to 550MB of data, the equivalent of 1,200 floppy disks or 150,000 printed pages.

Finding a common encoding format was probably the most important issue in assuring both users and sellers that CD-ROM will be more than a laboratory success. In-

PHOTOGRAPH BY STEVE COOPER

CD-ROM may provide a new market for database providers.

deed, some computer industry observers say they see swarms of the 120mm (4.72-inch) silvery plastic platters on the horizon. Even usually conservative market experts believe that the technology could, in the decades ahead, unleash a meteor shower of new applications. Computer manufacturers hope the CD-ROM will do as much for their industry as the IBM PC did.

Meanwhile, skeptics, particularly in the publishing industry, recall the galactic failures of videotex, Selectavision and other promising "gee whizz" technologies that never got off the ground. Despite growing evidence to the contrary, these skeptics are waiting to see if CD-ROM, like Halley's comet, will become an overplayed media event that is more flash than substance.

For MIS managers, however, a primary concern will be the impact of CD-ROM on their use of on-line databases. CD-ROM enables users to browse through a massive database, currently available only on-line, without the pressure of perfecting search routines to reduce hourly costs. A question remains, however, just which kinds of databases will remain on-line and which ones will be adapted for distribution on CD-ROM disks. There is also a concern that CD-ROM's average access time of approximately one second might impair and frustrate users who are used to the quicker retrieval rates of magnetic media.

CD-ROM uses the same metal-coated, clear plastic platters that are now used for digital audio recordings. As with audio CDs, the digital information is burned onto the CD-ROM platter by a laser. In fact, a CD-ROM player is nothing more than an audio compact disk player with an added layer of error correction. Under microscopic examination, the disk resembles a continuous spiral comprised of small circular indentations, or pits, molded onto one side. The playing surface is coated with a thin film of aluminum, which reflects the scanning laser beam of a CD-ROM player, and a second protective layer of clear resin. A single disk has 2 billion pits, each measuring 0.12 micrometers deep and 0.6 micrometers wide. The platter has a density of 16,000 tracks per inch, hundreds of times the density of a 96tpi floppy—greater even than the typical 300tpi Winchester disk.

PLAYERS FOR PCS, STEREOs

CD-ROM is likely to benefit from the commercial success that has been achieved by audio disks and players. Audio compact disk recordings, introduced widely just two years ago, now represent 10% of all audio titles in production. A few enterprising electronics companies are already introducing gadgets

to update existing compact disk audio players into CD-ROM players. These fledgling firms are also coming out with devices that will allow the same compact disk players to serve both the stereo and the pc.

CD-ROM was pushed into the forefront by the combined efforts of Sony in Japan and Philips in Holland. Both electronics giants quickly recognized that all players in the digital audio market had to agree on a single standard for laser-scanning technology, mastering (which involves the conversion of raw data into the pits of the optical disk), and disk replication. This drive for uniformity is behind the High Sierra effort, which will standardize the file structures used in CD-ROMs, enabling them to be processed in any operating system environment.

File structures determine how data and disk directories are arranged on a CD-ROM disk. The requirements of the various mainframe, minicomputer, and microcomputer environments vary. As a result, manufacturers of first generation CD-ROM players have had to make up individual file format standards for the most common environments: MS/DOS for micros, VAX for minis, and VMS for mainframes.

Among the companies represented at the original September 1985 meeting in Nevada were LaserData (Cambridge, Mass.), Xebec Corp. (San Jose, Calif.), TMS Inc. (Stillwater, Okla.), all of which manufacture optical disk players. Also in attendance were computer hardware and software firms like Microsoft (Redmond, Wash.), 3M (St. Paul), Apple, Digital Equipment Corp., Hitachi, and Philips. In April 1986, IBM joined in the High Sierra discussions.

John Einberger, a systems technology manager at Reference Technology Inc. (Boulder, Colo.), organized the talks. He says the draft of the High Sierra standard that was submitted last July to the National Information Standards Organization, an ANSI subcommittee, has so far met no serious opposition, so he feels confident that things are on track for final ANSI adoption by next fall.

Meanwhile, vendors of CD-ROM technology continue to forge ahead (see Fig. 1). Nearly a dozen hardware manufacturers are already delivering CD-ROM players that interface with everything from huge mainframes to small desktop systems. So far, software has been limited to a few large databases that were formerly delivered on-line, but the High Sierra standard may change all that. "The momentum is definitely on," says Einberger. "The players represented in this standard have enough market share to assure its success."

Just how big is that market? The entire optical storage market, which also includes conventional laser disks, is currently estimated at approximately \$200 million. The New York research firm Frost & Sullivan predicts that, with the advent of CD-ROM technology, the market for optical storage products will skyrocket to between \$2.5 billion and \$4.5 billion by 1990.

The usually conservative "Disk-Trend Report" in Mountain View, Calif., calls CD-ROM a "valuable technology" that by itself is expected to amount to a \$108 million market by 1988. That translates into 350,000 players. Presently, the players range in price from \$500 to \$2,600.

Robert Gaskin, a memory industry analyst at Dataquest Inc., a San Jose, Calif., market research firm, believes that 1986 will see an acceleration in CD-ROM shipments compared to 1985. Dataquest has not yet released official market projections on CD-ROM, however.

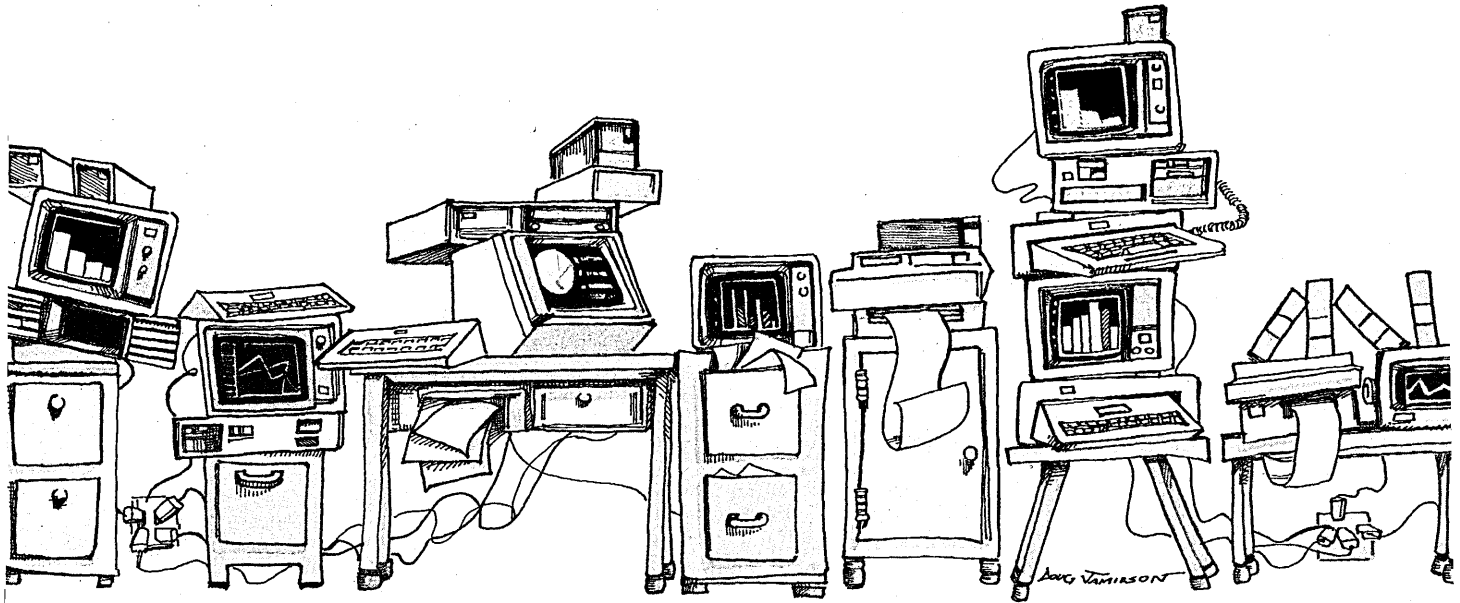
PLAYERS MUST DROP IN PRICE

Many industry watchers agree that for really widespread distribution, CD-ROM players must drop in price before they can become a part of every pc comparable to today's floppy disk drives. Mass production would eventually bring CD-ROM hardware to these levels. Mass production, of course, can not develop without a mass market. The introduction of compact disk-interactive (CD-I) by Sony and Philips could potentially push down prices for CD-ROM players, because CD-I machines, like audio CD players, share many parts with CD-ROM players.

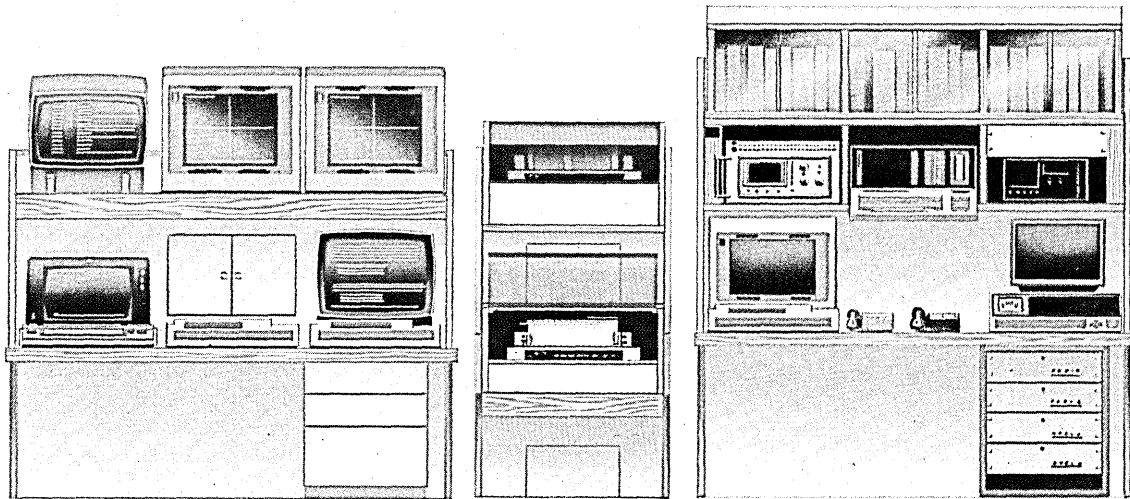
The hardware world is also playing its typical wait-and-see game to determine what course IBM will take on this technology. The growth of CD-ROM players would be greatly increased if IBM were to enter the market with either its own or a purchased product, says Robert Katzive, of "Disk-Trend Report." IBM's participation in the High Sierra negotiations is an indication that Big Blue has some interest in the technology. However, Dataquest's Gaskin believes that even a late entry by IBM will not overshadow the dominant role in both hardware and media played by Philips.

"Considering design concepts, mergers, manufacturing, standards activity, and capital equipment development, Philips is consolidating its position as the leading force in the CD-ROM marketplace," maintains Gaskin.

Microsoft, developer of the MS/DOS and PC/DOS software that has become a microcomputer standard, is positioning itself as another early leader in the CD-ROM field. Microsoft has created an internal



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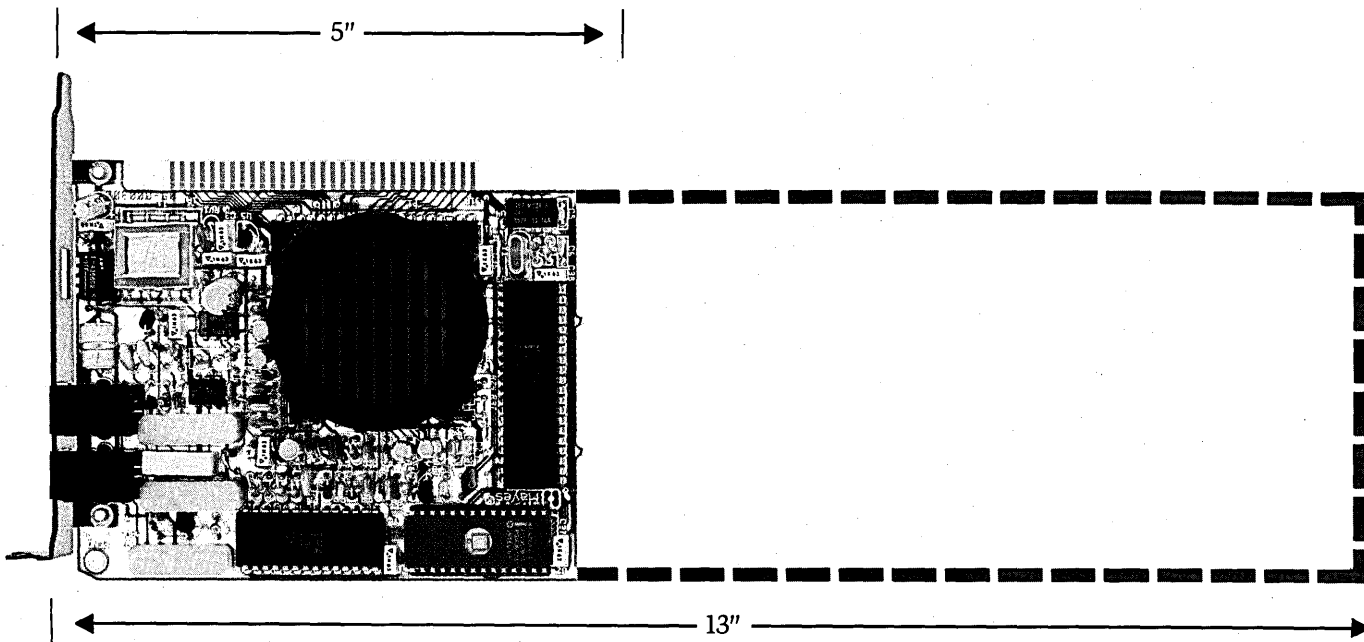
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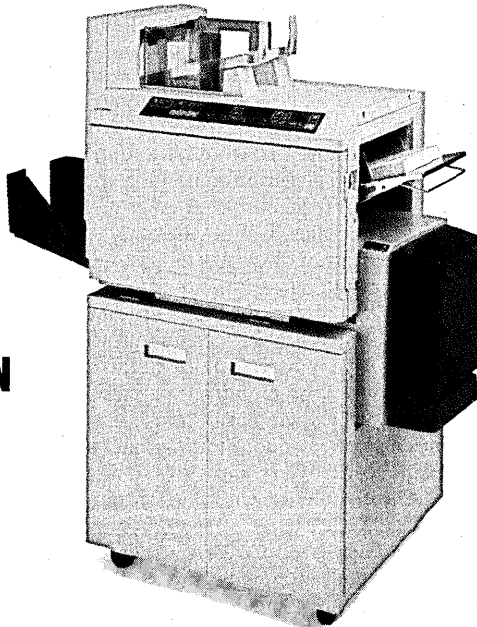
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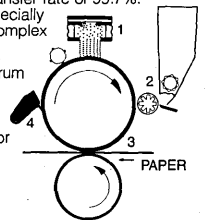
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LASER DISKS: FOR THOSE WHO CAN'T WAIT

The lights are burning late at the research laboratories of Electronic Data Systems, the computer services arm of the giant General Motors Corp. The atmosphere inside the labs suggests Disneyland, Christmas morning, and the staging of a *Star Wars* epic all rolled into one. Researchers have been handed a new tool that they believe is destined to shape a limitless future for GM and other large corporations.

"We are stretching technology and imagination here," gushes Michael Allie, an account manager at EDS in suburban Detroit. "It's something we're all very excited about."

EDS's new tool will not boost the horsepower, improve gasoline mileage, or even advance any of the technology of GM cars. What it will do, however, is improve the marketing of automobiles in ways that were never before possible. "We're going to bring C-P-C (the Chevrolet, Pontiac and Canadian divisions of GM) closer to the customer than ever before."

The marketing tool is an interactive video disk system manufactured and developed by Visage Inc. of Natick, Mass. The system is made up of an IBM-compatible pc, a 12-inch laser disk player, a video monitor, a laser disk controller with graphics overlay and data decoding, and one or more I/O devices.

The 12-inch laser disk, which provides much more storage than a standard 4.72-inch CD-ROM, is an established, ma-

ture product that has developed from the less-than-successful consumer video disk technology of the late 1970s.

An interactive video disk system allows the user to interrupt a presentation recorded on a video disk to review information, answer questions, or go back to a specific frame. A standard laser disk can store up to 54,000 still frames and billions of bits of data, meaning a single disk can contain a variety of applications. Interactive video disk systems are already used for electronic catalogs, training employees, and visual maintenance manuals.

Before the advent of microcomputer-based systems like Visage's, interactive video disk systems required a high-powered—and high-priced—interface with a mini-based graphics system. As a result, interactive video disk players usually could be cost-justified only for high-volume training or income-generating applications such as coin-operated video games. Previous applications of high-cost interactive video disk systems also include electronic tourist information centers and shopping mall directories.

EDS's prototype interactive video for auto sales—which, Allie says, was put together in one month—is now being tested in a suburban Detroit shopping center. EDS has also developed a unique in-house employee newsletter system that uses interactive video disk technology. About 20 Visage V-Station 2000s, a laser disk system based on an IBM PC-compatible micro

from Televideo Systems Inc. (Sunnyvale, Calif.), are scattered around the Chevrolet, Pontiac, and GM of Canada offices in Warren, Mich.

The setup brings company information to about 5,000 GM employees. Employees can touch the screen of the various monitors to get news capsules on company events. Workers may also vote in an opinion poll on company issues, results of which are combined and displayed on the system a week later.

Affordable micros have also put advanced applications within reach of users with smaller budgets than GM's. Visage recently signed a value-added reseller agreement with Gould Inc.'s Programmable Control Division in Andover, Mass. Under the pact, Gould will sell training packages it has developed with the Visage system, along with turnkey systems, to customers who use its factory automation products. The training programs are aimed at smaller companies that are not able to maintain their own internal training departments.

Visage was founded in May 1983 by Philip V.W. Dodds and Leo Keightley. Dodds, an electrical engineer and musician, had previously distinguished himself as the organist who communicated with extraterrestrials—he played the memorable five-note phrase that figured prominently in the movie *Close Encounters of the Third Kind*.

—B.A.S.

business group specifically "to focus on this opportunity," according to founder and chairman William H. Gates. Last March, Microsoft sponsored a CD-ROM conference in Seattle that drew over 1,000 participants, who were charged \$980 apiece. At the four-day meeting, which one observer called "the Woodstock of CD-ROM," manufacturers and users saw a demonstration of Microsoft's Multi-Media Encyclopedia, which gave them a glimpse of some of the new technology's potential.

The encyclopedia demonstrated how the enormous storage capacity of CD-ROMs makes possible applications that marry sight and sound. Manufacturers and users listened and watched in awe as the sounds of music and cannon fire were mixed with color graphics portraying the story of America's Civil War. On the enlarged image of the IBM AT monitor, the push of a mouse on a highlighted word brought forth cross-references to subjects like Gettysburg, Robert E. Lee, and Abraham Lincoln. Each of these was accompanied by its own sound. Instead of picking up a volume of an encyclopedia and reading bland text with sparse illustrations and then following up on cross-references, the reader is instantly beamed into the center of a subject. Among other things, the encyclopedia can whistle "Dixie."

But even as the last strains of the demonstration faded, some members of the audience remained cautious. "It's still too early to go head over heels about this," warns T. Richard Halberstadt, a design specialist for the management systems division at Procter & Gamble in Cincinnati. Halberstadt says he is looking at "any and all" possible applications of CD-ROM for the huge soap conglomerate, including using CD-ROM players as an alternative to on-line data services.

"It's straight economics," points out Halberstadt. "It would be foolish to spend \$10,000 a year on something you can get for 10% of the cost."

Economics is not the only roadblock in the way of CD-ROM's passage into the fast-growth lane. While the attendees at the Seattle conference watched the Microsoft multimedia show on a projection screen, everyday users would see the image on an ordinary pc monitor, not exactly an eye-opening experience. "Desktop machines make very poor viewing machines," explains Robert Carr, director of the Forefront Development Center at Ashton-Tate, Torrance, Calif.

"There are times when one word is worth a thousand pictures," asserts Philippe Kahn, president of pc software company Borland International Corp., in

Scotts Valley, Calif. But Kahn notes that for some people, illustrations can be distracting. For others, reading text on a computer screen can be equally distracting.

Stan Cornyn, president of the Record Group, a division of Warner Communications in Burbank, Calif., the first company contracted to produce software for a new consumer version of CD-ROM players, agrees. He says that watching a multimedia presentation on a pc "conjures up an image of packing the family into the car, going to the neighborhood theater, and reading *Gone with the Wind* on a screen."

FAILURE OF VIDEOTEX

Nothing has more effectively proved the disadvantage of reading text on a terminal than the late, great videotex experiment. The noble challenge of bringing the printed newspaper page to the electronic screen proved a multimillion dollar fiasco for its major boosters, Times Mirror and Knight-Ridder. These companies learned that it is not enough to simply convert the printed page to the instantly updated electronic screen.

Once engineers have figured out how to make reading text on a pc screen bearable, they must then find ways to make the experience less of a challenge to non-engineers. When small Winchester disks

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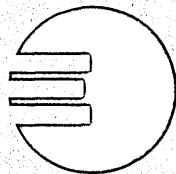
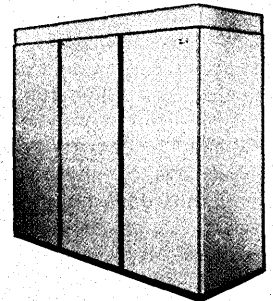
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CIRCLE 47 ON READER CARD

dramatically increased the storage capacity of the desktop computer from hundreds of kilobytes to megabytes, operating system developers had to create new directory structures. Applications developers had to fit their applications to these directory structures, which organized the information on a disk. Still, thousands of inexperienced hard-disk users remain willfully ignorant of confusing commands such as a PATH, TREE, and SUBDIRECTORY. With the advent of CD-ROM, a new level of organization will be required in order to direct the user to specific data on a disk. "CD-ROM interfaces must allow their users to move freely and quickly through information, always aware of context and style," explains Ashton-Tate's Carr, who had experience in user interfaces when he developed Framework.

If the CD-ROM user interface succeeds in making information access less challenging than today's generation of on-line databases, CD-ROM may create a new market for database providers, which in some cases may require considerable expertise from customers. In addition, the very nature of CD-ROM as an optical medium makes it a natural storage device for large subscription databases. Unlike the less dense magnetic media, this early generation of optical media can be encoded only once and is not erasable. While that may be a drawback for many applications, it is a great benefit for databases that require less frequent updates, such as industrial credit ratings, legal code revisions, and even the Yellow Pages. Most of these services are now available on-line at a premium cost.

CD-ROM could make its biggest advance into the area of huge databases that is now the exclusive property of a growing number of on-line services. Instead of paying several hundred dollars of connect time, users could pay a one-time cost to purchase an entire database and use it at leisure—with no meter running—on a CD-ROM player. The amount of information on a single disk—which can be mailed in a standard manila envelope—would take a 1,200-baud modem more than a week of 24-hour days to deliver.

That does not necessarily mean, however, that on-line services will suffer as a result, says Rick Meyer, product manager for the advanced technology group at Dialog Information Services Inc. (Palo Alto, Calif.), the world's largest provider of on-line databases. Meyer says CD-ROM will complement on-line services much as in-house libraries complement specialized reference libraries.

Jane Brown, director of business development for BRS Information Technol-

FIG. 1
MAJOR PLAYERS IN EMERGING CD-ROM MARKET

COMPANY	LOCATION	PRODUCT
HARDWARE		
Sony Corp.	Tokyo	Media, Player CD-ROM, CD-I
Philips International B.V.	Apeldoorn, The Netherlands	Media, Player CD-ROM, CD-I
Reference Technology Inc.	Boulder, Colo.	Player
LaserData	Cambridge, Mass.	Player
TMS Inc.	Stillwater, Okla.	Player
3M Corp.	St. Paul	Media, Disk Replication
Digital Equipment Corp.	Maynard, Mass.	Player
Adaptive Data Systems Inc.	Pomona, Calif.	Player
Xebec Corp.	San Jose	Player
SOFTWARE		
Microsoft Corp.	Redmond, Wash.	
Borland International	Scotts Valley, Calif.	
AIRS Inc.	College Park, Md.	
Batelle Software Products	Columbus, Ohio	
OPTICAL PUBLISHERS		
Arthur Andersen & Co.	Chicago	
Dialog Information Services Inc.	Palo Alto	
Grolier Electronic Publishing	New York	
Library of Congress	Washington, D.C.	
Mead Data Central	Dayton, Ohio	
The Record Group	Burbank, Calif.	

ogies, New York, also doesn't see CD-ROM technology hurting the on-line services industry. "We were told at one time that microfiche would one day threaten our on-line business," she recalled. "Microfiche hasn't hurt our industry, and neither will CD-ROM."

DATABASES OUT SOON ON CD-ROM

On-line services such as Dialog, BRS, Dun & Bradstreet, and Dow Jones have begun taking steps to make some of their own databases available on CD-ROM. "Dialog is likely to be among the first providers of CD-ROM databases," Meyer contends. D&B has already put together a prototype of its annual "Million Dollar Directory" on CD-ROM, according to Richard Schwarz of Dun's marketing service. No decision has been made on whether or not the directory will become a delivered product, Schwarz says.

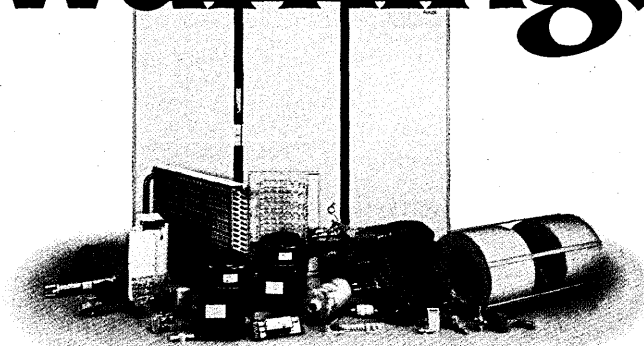
In addition to complementing on-line services, there are some dramatic possibilities for CD-ROM players in the corporate environment. CD-ROM disks

make otherwise ungainly databases convenient. A lawyer could, for example, instantly have access to legal precedents on a screen while preparing a brief. A designer could have a huge repository of icons that could be inserted into a drawing. The possibilities appear limitless.

Nonetheless, software publishers seem to be approaching the CD-ROM market with caution so far. Part of the problem for publishers waiting to deliver their product on CD-ROM is that no royalty structures or pricing calculations have been established. The situation recalls the early days of vcrs, when the movie and television industries were rocked by strikes and disputes between various crafts people and broadcast and studio management. Everyone wanted a piece of the enriched royalty pie that the vcr market would bring in. The same is likely to happen in the CD-ROM industry as publishers discover new outlets for their various works.

In the first days of videocassette sales, most tapes sold at prices that hovered near the \$100 mark. As a result, most vid-

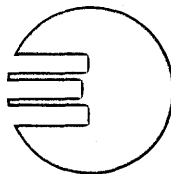
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CIRCLE 48 ON READER CARD

CD-ROM could make its biggest advance into the area of huge databases now the property of on-line services.

ecassettes were rented, rather than sold, establishing an entirely new retail industry. More recently, the tapes have dropped in price to between \$20 and \$30, as manufacturers seek to encourage sales rather than rentals. The same pattern is likely to occur with CD-ROM products. There are also large differences in considerations between pub-

lishers aiming at the mass consumer market and those going for the business market. "It is generally accepted that the must-know business information market is not price sensitive," says Dialog's Meyer.

Publishers will have to figure out just what a fair royalty is. That will, for the most part, determine what the price of their

CD-ROM products will be. The actual costs of producing CD-ROM wares are likely to fall well below the cost of publishing books. Media costs currently range between \$2 to \$5 per disk and will probably be reduced further with high-volume production. The cost of duplicating the disks is likely to drop to the same level as this generation's floppy disk. A new European replication process now in development will bring down the cost of disk duplication to about 25 cents each, according to Edward Rothchild of Rothchild Consultants in San Francisco.

Any new technology also fuels new concerns about copyright protections. As CD-ROM emerges, it is a far more secure technology for software distribution than floppy disks, since duplication of CD-ROM disks requires much more technical ability and costly hardware. That security, however, is also likely to pose a challenge for the thousands of technical gurus who will eventually find a way to duplicate the disks. The sheer volume of information available on a CD-ROM disk is likely to make pirating more profitable than ever before.

The huge capacity of CD-ROM disks raises another security issue. "Today, if a disgruntled, fired employee were to leave with a box of floppy disks holding sensitive data, it might be upsetting," says Ashton-Tate's Carr. "If that same employee walked out with just one CD-ROM disk holding sensitive data, it could be catastrophic."

The High Sierra effort inspires hope that the industry will be able to settle secondary standards issues quickly. Already, the Association of American Publishers, for instance, has settled on Standard Generalized Markup Language that will enable any electronic manuscript to be stored as a searchable database and processed on any computer. And despite the many challenges facing the technology, CD-ROM has some powerful supporters among vendors, some of whom are expressing hope, even positive passion, that CD-ROM will soon become the white knight that saves the personal computer industry. "The combination of CD-ROM with a microcomputer creates a medium that potentially is more interactive than any previous consumer product," predicts Microsoft's Gates.

Still, the habits of users can be difficult to change. As Stuart Flexner, editorial director at Random House, observed at the Seattle conference, "Despite the presence of all of the high technology here and the people who developed it, I still see a lot of yellow note pads in the audience." ©

Barbara K. Sehr is a consultant and freelance writer based in Seattle.

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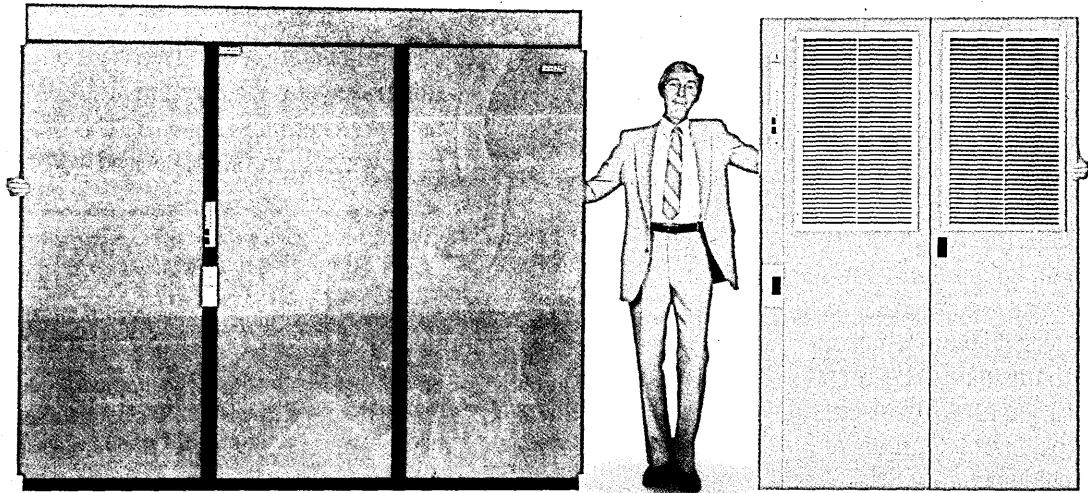
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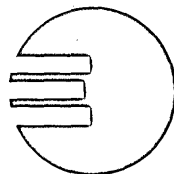
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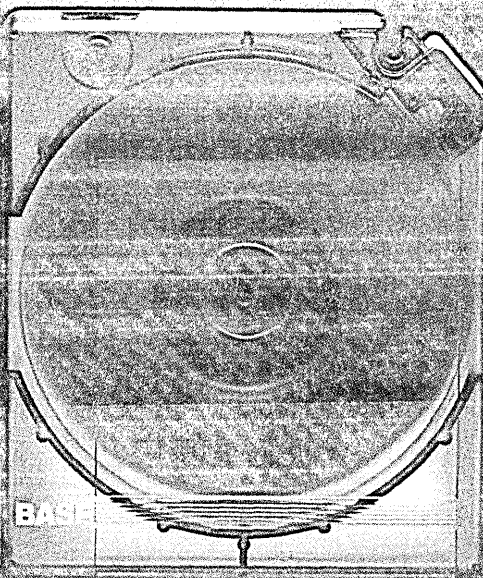
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Performance measurement systems provide a variety of views of a company's communications operation.

WINDOWS ON THE NETWORK

by Bill Musgrave

Standalone network performance measurement systems provide a window into network operation. On a day-to-day basis, they act as early warning systems, alerting operations personnel when certain conditions, such as a response time exceeding predetermined thresholds or the complete failure of network components, occur. The systems also aid operators in pinpointing trouble spots.

Over the long term, data that are collected by these systems and saved in databases can help planners add capacity as network usage increases. They can also save money by reassigning infrequently used devices and by identifying places on the net where several lines can be consolidated into one.

More than half a dozen companies currently offer network performance systems. Some, like Racal-Milgo, Fort Lauderdale, Fla., got into the business as a sideline to their main market interest. Racal-Milgo entered the performance measurement market with a product that was originally developed as an option to its modem management systems. Other vendors, like Emcom of Plano, Texas, and Tesdata Systems of Herndon, Va., have made it their business to specialize in network performance measurement.

Other players in the performance measurement market include modem maker Infinet in North Andover, Mass., Avant-Garde Computing in Mt. Laurel, N.J., Data Switch in Shelton, Conn., and Dynatech Data Systems in Springfield, Va. Infinet, which oems gear from Tesdata, adds the hooks that tie these wares into a system with its modem management tools. Avant-Garde Computing provides complementary products for managing networks, while Data Switch and Dynatech Data Systems complement their measurement products with matrix switches for reconfiguring net-

works and restoring service.

These standalone network performance measurement systems monitor digital data streams. To do that they must know the protocol on each line, which allows them to observe devices and control units by recognizing addresses. All systems toe the IBM line and some support the protocols of Burroughs, Honeywell, Sperry, ICL, and other major manufacturers. More and more vendors are also adding X.25 support.

Some systems can distinguish among the types of messages traversing the network. Most can tell CICS from TSO and either of these from whatever else may be on the net. Some can also differentiate between messages based on any user-selected field. Using this capability on an airline reservation network, for example, you can track transmissions to each airline.

Performance measurement can help users get a handle on just how efficient their networks really are. Infinet product manager Jim Durham explains that as protocols have become more sophisticated, their overhead has increased and they've become less efficient in moving data. "You start using faster modems and you find that you're not really getting the throughput that you expected. The lack of throughput results in users not getting the response times they need." Network users also need to determine how efficiently they're passing data, rather than how efficiently they're passing data plus control characters, Durham points out.

ESTABLISH RESPONSE TIMES

Once this performance information is known, network operators can establish standards for response times—standards that they can guarantee to their customers. Durham says that typically network managers may tell customers "95% of the time your response will be less than five seconds and 100% of

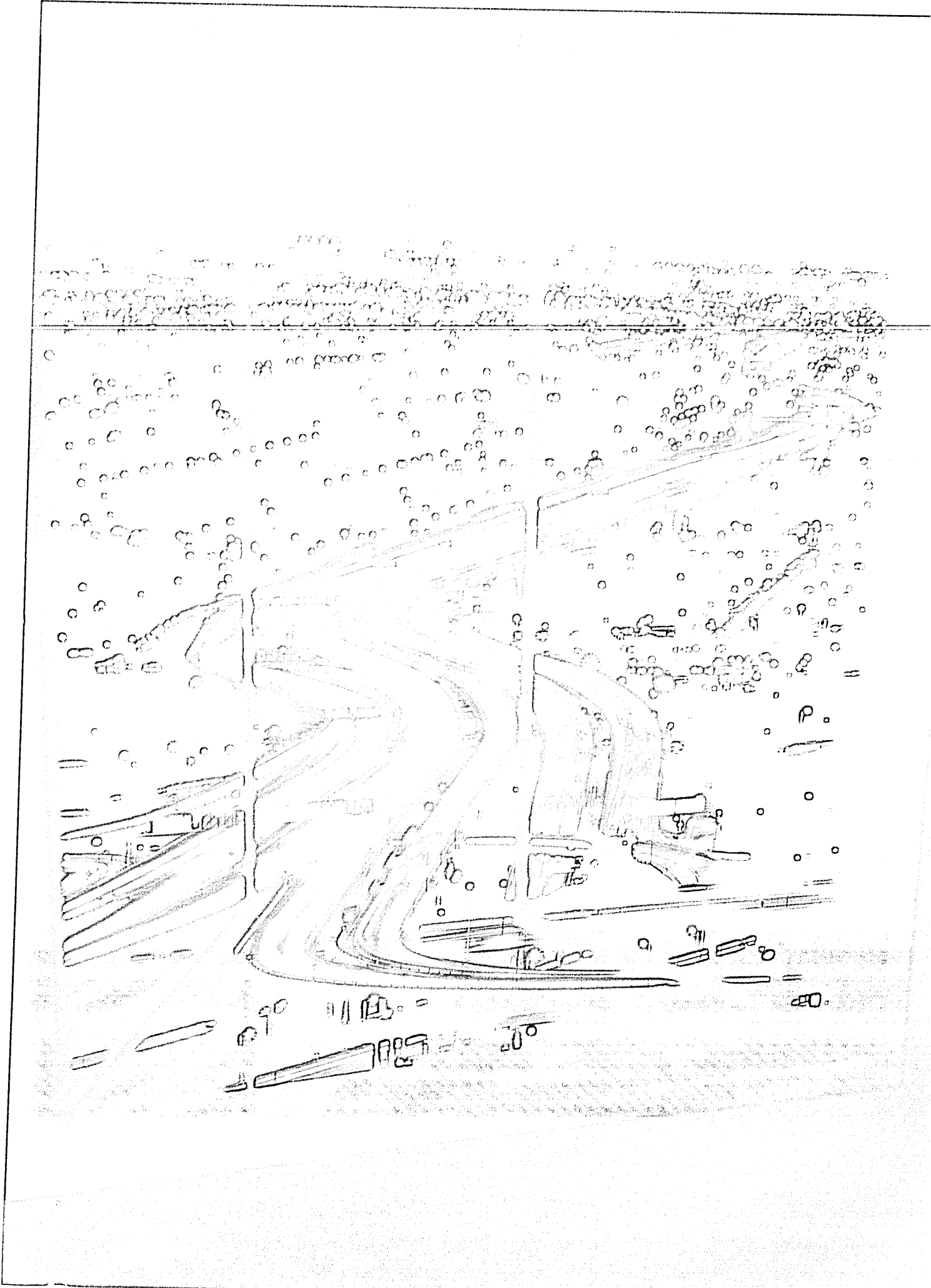
the time it will be less than 10 seconds." Often there's a penalty—either in the form of reduced charges or free time—for poor service, he notes.

This service-level monitoring is becoming an increasingly popular application of performance measurement systems. In fact it's among the most common, according to Tom Flanagan, manager of marketing services at Dynatech. A typical service-level contract, he explains, might stipulate that the network provide 98% availability with five-second response times at least 95% of the time. The figures obviously vary according to the type of network and applications. Once the contracts are established, network users and operators can document service and see how they're doing.

These monitoring chores can prove tricky, however. Michael Fitzpatrick, executive vice president of Data Switch, says that service-level tracking requires complete response time information on all transactions. Systems that average their totals can mislead. For instance, based on averages, a two-second response time followed by an eight-second response would satisfy a service-level agreement that calls for a five-second response time. It's unlikely, however, that it would satisfy the user who waited eight seconds.

While performance measurement systems can determine the various components of response time, including host delay, they are blind to the internal operations of the host and front-end processors. Vendors, aware that considerations such as queuing and buffer utilization can slow the host and affect network performance, see software packages that report on hosts and front ends as complementary to their performance measurement products. They point out that host-based software can't "see" past the front end into the network, and that front ends sacrifice memory and cycles if they're used to track networks.

PHOTOGRAPH BY TOGASHI



Heading off trouble before it hits the user is one of the major goals of network performance measurement.

Also, a front end or host can only deal with the lines it supports, while independent, standalone systems can easily cover many cpus and front ends.

"We feel that a system such as our Net/Alert, which is transparent to the network, is superior because it can't possibly affect anything that's happening," claims David Hunter, director of communications at Avant-Garde. "It can't bring the network down or anything like that. And because it's a standalone system, it's not consuming any host or front-end processor resources."

WHERE BLAME BELONGS

There is another advantage to independence. It allows the blame to be put where the blame belongs when something goes wrong. "It's amazing!" exclaims Data Switch's Fitzpatrick. "You have a problem, yet none of the vendors ever believe it's their problem. The terminal's running fine, the control unit doesn't have a problem, the line's working terrifically, and the communications controller is okay, but there is still a problem. Yet nobody wants to take responsibility."

Fitzpatrick feels it's up to the user to find out where the fault lies. "It's really the user's job to control vendor finger pointing," he says. "For that, you've got to have the equipment to ascertain who's at fault."

Putting in a plug for his product, he adds, "Rapid fault detection and isolation is a key goal of our Intellinet system."

In real time, systems like Intellinet measure such things as response times, errors and retransmissions, and polling activity. The systems can raise alarms whenever measures exceed user-specified thresholds. When most exceptions are detected, alarms indicate two levels of urgency. For instance, a first-stage alert may be triggered when a response time exceeds five seconds, while a second-stage alarm may be set off when a response time exceeds eight seconds.

To avoid constant alarms, a condition can be qualified. For example, an alarm would only be raised if in a predetermined period of time the response time becomes greater than five seconds for, say, 100 transactions. A few bad response times, however, may only indicate a transient line problem. With two-level alarms, the operations staff can learn of trouble before irate users begin making phone calls. In turn, many problems can be fixed before they ever affect users.

Because performance measurement only "sees" the network as digital data, it may not be able to tell the difference be-

tween, say, a faulty terminal, a haywire control unit, or a bad phone line. Systems such as Racal-Milgo's Span and Infinet's PMS can work with their respective modem diagnostic systems to correlate the analog line with its digital traffic.

"Our database combines modem-based statistics with PMS data. You can derive the fact that the retransmissions are being caused by the phone line as opposed to the terminal, the modem, or the cpu," claims Infinet's Durham.

Eugene L. Furtman, vice president of network engineering at Tesdata, sees value in several approaches. "If I had to run a network," he says, "I'd pick from three technologies—modem diagnostics, standalone performance measurement, and host-based software. No one vendor," he adds, "has it all."

Performance measurement system suppliers also try to serve more than the day-to-day needs of network users. Over the long term, the trend analysis provided by their various products can identify circuits heading for saturation. They can also zero in on underutilized lines and devices.

Data captured on a day-to-day basis are generally piped over to another system, either to a mainframe or, as is increasingly the case, to a microcomputer. Mainframe analysis often uses SAS for statistical analysis with graphic output, while micros process the data with spreadsheets and graphics packages.

In addition to diagnosing short-term problems and allowing long-range planning, performance measurement tools can also be applied over an intermediate period to fine-tune the network. "You can catch problems such as bad scheduling of a host application or you might notice polling delays," explains Tesdata's Furtman.

Furtman went on to describe how one user did an interim fix that improved network response times. "When one of our customers installed MasterSmart and started measuring the network, they noticed after a day or two that they were getting a 20-second average response time. Looking into the problem, they found that it was a polling delay. They were able to reconfigure and retune their front end to bring their average response time down to six seconds. It was done in a very short period of time, but it wasn't an immediate operator kind of thing or a long-range network planning thing. Over a period of several weeks, it was measure, tune, measure, tune, measure, tune; that was the fix."

In a similar case cited by Flanagan of Dynatech, a network user found out that detected delays weren't caused by any malfunction of the control units, but by strap-

ping on the modems. "This was something that the customer wasn't aware of until he started using Prism," recalls Flanagan. "The user community wasn't complaining yet, but as loading increased it would start impacting the performance of the network. This gave the customer the ability to head off trouble."

Heading off trouble before it hits the user is one of the major goals of network performance measurement. Users, who should be grateful, sometimes worry when worry isn't warranted. User perceptions about the network may not be borne out by fact.

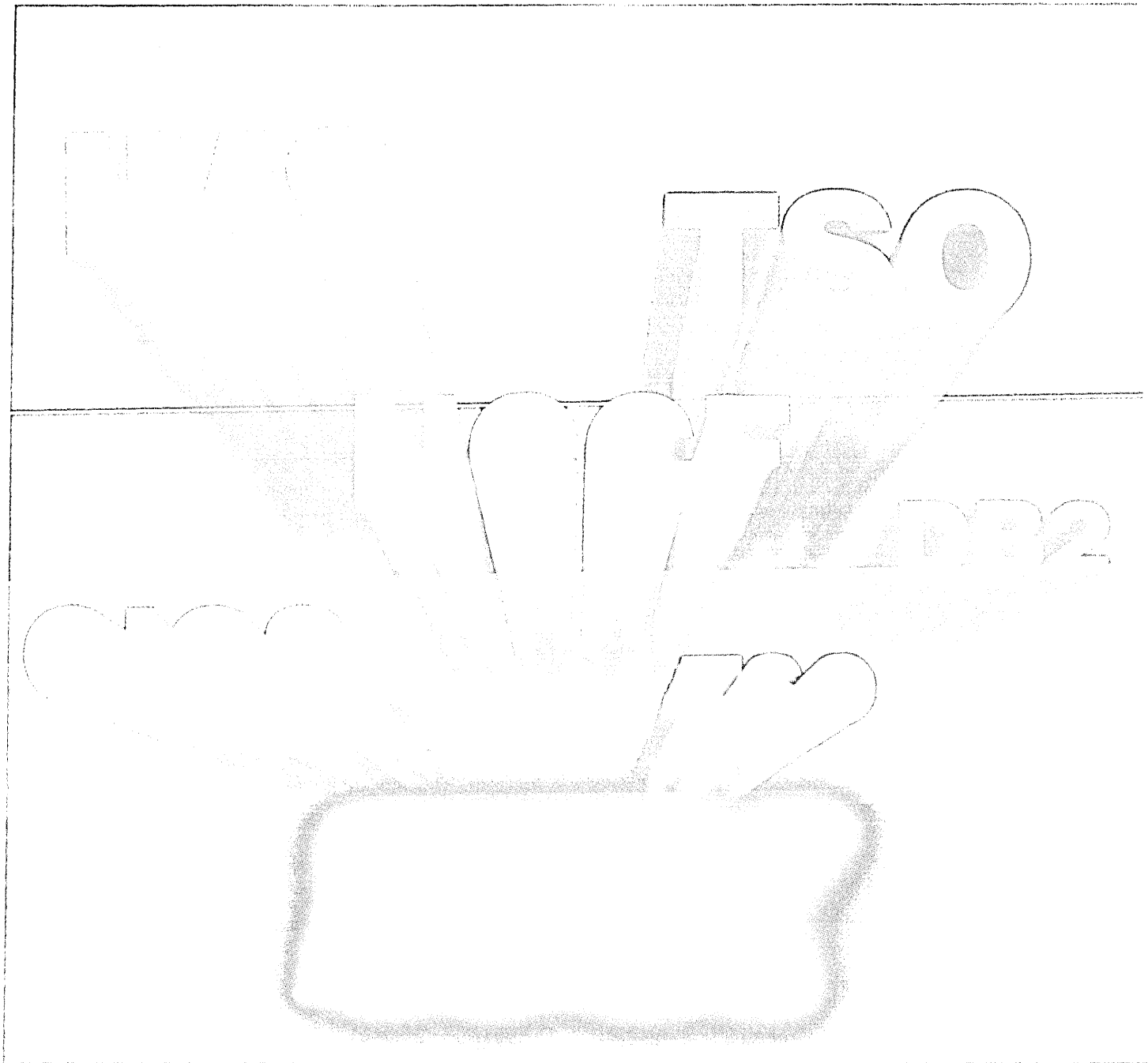
The real barometer of what's wrong or right on the net is the performance monitor that can track response time to a fraction of a second. And, as Avant-Garde's Hunter notes, response-time monitoring will frequently show that things aren't as bad as the users think. Likewise, adds Hunter, if you ask users how often they use their terminals, they'll say "all the time," while the performance monitor indicates that it's usually much less than they claim. This type of tracking enables network planners to reallocate terminals, saving money on hardware.

SAME GENERAL APPROACH

All performance measurement systems share the same general approach: they use microprocessor-based line-monitoring cards to passively tap into the network at the digital interface between the modem or the data service unit and the front-end processor or computer port. In turn, the line monitors report back to a freestanding network measurement computer that supports the user interface, which is generally a color workstation augmented by printers and plotters. Since line-monitoring cards are mounted in chassis and use RS232 links for reporting, they can be located remotely for monitoring distant systems or front-end processors that operate as concentrators.

Observed data also are logged to a database; some systems interpose an intermediary computer between the line cards and the machine that supports the user interface. While all performance measurement systems have a similar distributed architecture, they differ when it comes to the line-monitoring cards and systems software. In some systems, the line cards send back raw measures that are processed by a computer. In others, the line cards summarize and average the observations they make.

One system that does most of its processing in the line monitors is Emcom's NCS70. This enables the system to use an



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Today, most suppliers ballpark their systems at around \$1,000 a line.

IBM PC with a light pen as the user interface into a network that can measure and report on as many as 4,096 lines, according to Emcom executive vp George Macintyre. "You could just about run the system with a simple terminal," claims Macintyre. "Our line cards even generate the displays for the lines they monitor and the PC brings everything together."

Over the last few years, Macintyre has watched the performance measurement market grow and prices drop. Several years ago, a standalone system, he says, cost about \$2,000 per line monitored. Today, most suppliers ballpark their systems at around \$1,000 a line. Prices obviously vary according to network configuration.

Some users monitor all of their lines, while others check only those lines that are critical. Complete monitoring is the rule for companies in such industries as finance and airlines. According to Tesdata's Furtman, a typical installation monitors roughly 100 lines, although the network itself may actually be much larger. Other vendors estimate that users generally monitor 10% to 20% of their net. Still oth-

ers say they see interest in 16-line to 32-line systems.

Users may choose to support their network without buying a system to cover every line. Dynatech's Flanagan offers one such solution: "If you use performance measurement in conjunction with a matrix switch, you can move line monitors around. The system doesn't have to sit on all lines all the time."

Monitoring cards can move from line to line, either on a regular schedule or in response to problems. When reassigning monitor cards, it's important to be able to download the protocol for the new line, a capability offered by Dynatech and Data Switch. Both companies also build matrix switches. Meanwhile, Avant-Garde was beta testing its download capability in September and Tesdata expects to offer it this month.

All the performance measurement tools discussed provide a color window into the network, but the views through that window afford different perspectives. Each one gets out there to the devices; it's just a matter of how they relate the parts back to

the whole of the network. Some systems that are line oriented, for example, may send the user to a network diagram to determine where, in the scheme of things, an event occurred. Most vendors use "traffic light" colors—green for normal, yellow for a first-level alert, and red for outright failure or a second-level alert.

Even more detail is provided by Data Switch's Intellinet, which furnishes a comprehensive breakdown of the network. The system uses six colors, allowing differentiation between functional problems such as failed lines or equipment and performance problems. It also enables operators to view the organization's overall communications environment from the perspective of individual networks, hosts, front ends, line groups, lines, control units, and devices such as terminals. Users can step down through this tree structure to the level of detail they need. ©

A former associate editor with DATAMATION, Bill Musgrave is a California-based free-lance writer specializing in computers and communications.

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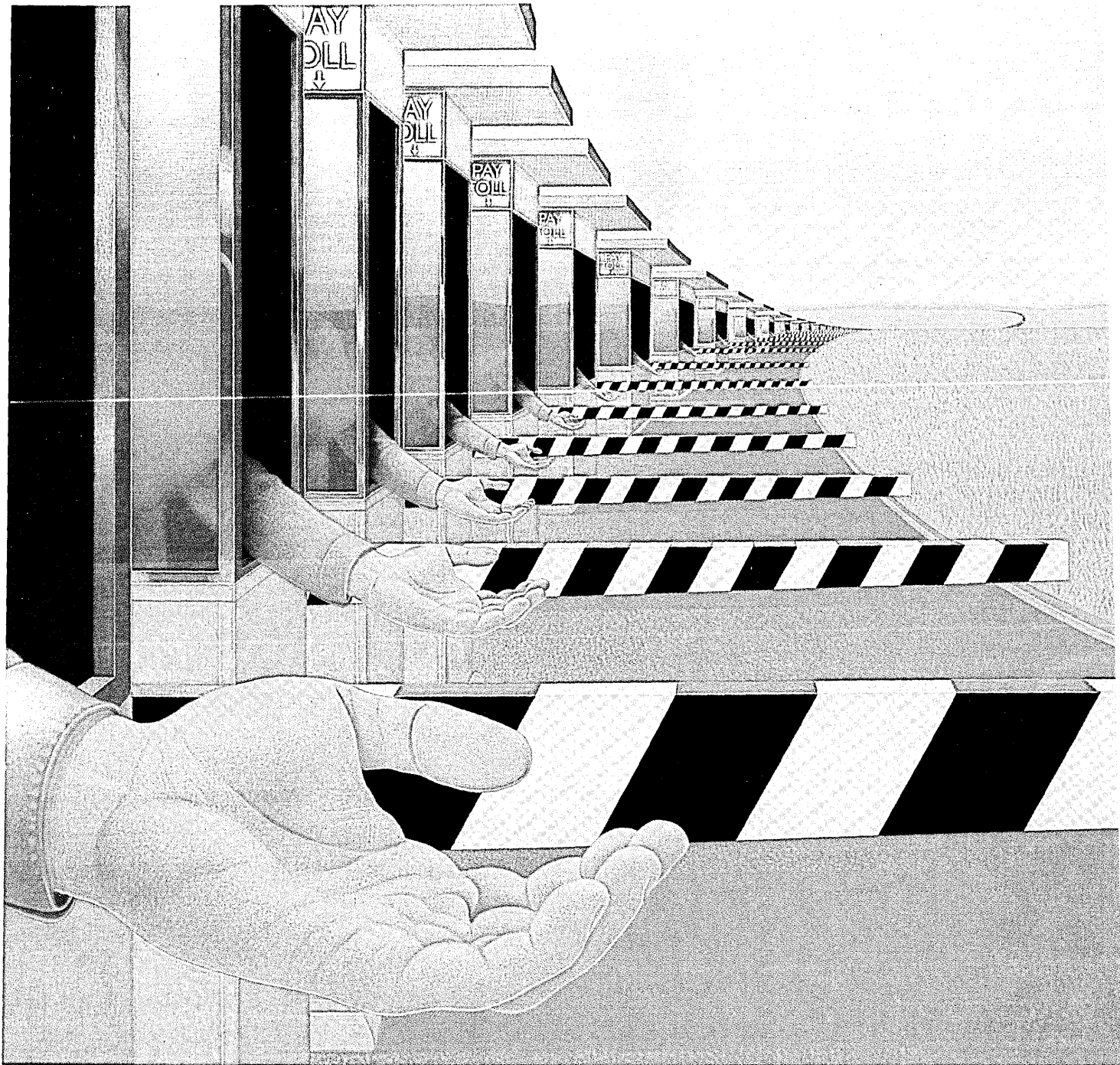
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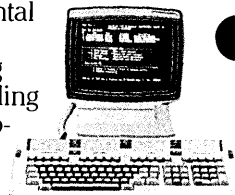
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If you're in the market for a 4GL, you'd better be in the mood to answer 10 basic questions.

SHOPPING FOR A FOURTH GENERATION LANGUAGE

by George Schussel

Fourth generation languages are like a good set of tools—when you need them they come in handy. Today's 4GL software provides significantly different solutions for improving productivity compared with third generation COBOL and FORTRAN. The semantic and syntactical differences among 4GLs are also far greater than the differences between FORTRAN and COBOL. And although 4GLs are similar in some ways—most interface to one or more database management systems, provide query facilities and report writers, and support screen painting and some kind of procedural language—proprietary versions vary greatly in the types of applications and environments they are best suited for.

Some 4GLs, such as Natural from Software AG (Reston, Va.), Mantis from Cincom (Cincinnati), and ADS/O from Cullinet (Westwood, Mass.), are designed for the professional programmer who builds complex systems. Others, such as Focus from Information Builders (New York), Ramis II from Martin Marietta Data Systems (Greenbelt, Md.), and Nomad2 from D&B Computing Services (Wilton, Conn.), are geared more to the information center user. Still other 4GL products, such as Pacbase from CGI Systems (Pearl River, N.Y.), Telon from Pansophic Systems (Oak Brook, Ill.), and APS from Sage Systems (Rockville, Md.), generate COBOL and database calls. While these COBOL systems generators are also aimed at the professional programmer, they are usually complete life-cycle management tools with modules for project planning and control, librarian functions, and documentation.

There are 10 basic questions buyers should examine in evaluating whether a particular 4GL product is meant for their dp environments and applications. The first

question is, *do you like the syntax?* Actually, a broad range of syntax is available for the different 4GLs. Some products like Focus, Natural, and Mantis, which are very language-oriented, have instructions that are written in code or English language-like statements. Support for both procedural and nonprocedural constructs also exists. People who have experience in programming will be very comfortable with language-based formats.

In contrast, other systems do much of their work through function generation. Ideal from Applied Data Research (Princeton, N.J.), Application Factory from Cortex Corp. (Wellesley, Mass.), Ally from Foundation Systems (American Fork, Utah), and ADS/O tend to fall into this category. Much of their functionality comes through interactive sessions and dialogs that are menu driven. These sessions are normally used to specify report formats, screens, and data definitions. In addition, menu driven front ends have recently been added to some language-oriented products, such as Focus and Ramis II.

Potential 4GL purchasers should then ask themselves the second question, *how procedural is the language?* If the language is procedural, as is the case with assembler or third generation languages like COBOL and FORTRAN, then the user, through constructs such as IF THEN ELSE, GO TO, and DO, tells the computer exactly how to take each step. If, on the other hand, the language is nonprocedural, then the user tells the computer *what* to do, not *how* to do it. Typical programming in a nonprocedural language supports various constructs such as the following: SELECT DATA FROM FILE, PRINT REPORT, and ORDER BY EMPLOYEE NUMBER.

While procedural languages are needed to build sophisticated, corporate dp systems, they can interfere with productivi-

ty in decision support and information center applications. Languages like Focus are therefore more effective in nonprocedural applications, while languages like Ideal and Natural, which have procedural features, offer enough detail control to solve almost any problem that can be handled by COBOL.

RUN-TIME VERSION NEEDED?

Next, 4GL buyers should ask, *is a run-time version of the system required?* The best-known 4GLs are proprietary languages like Focus, Natural, Mantis, ADS/O, and Sperry's Mapper, which combine some interpretive and some compiled features. All of these languages require a run-time version of the vendor's software.

This is a fine solution if you are using a particular brand of hardware for both building and running your applications. But what if you want to build in one environment and migrate to another or even several other environments? In this case, you need to look at 4GL environments that do not require run-time modules. Since most COBOL systems generation technologies—such as Gamma by Tarkenton Software (Atlanta), Transform/IMS from Transform Logic Corp. (Scottsdale, Ariz.), and Pacbase—generate structured COBOL code and native DBMS calls, they do not require the vendor's system at run time.

Before deciding on any 4GL, you have to determine who the user is going to be. So, question number four is, *who is the targeted user?* Some 4GLs are designed for people with a programming background. These products generally have more procedurally oriented languages. They also usually have performance features like multithreading capability, which allows transaction processing applications to be built that support up to several hundred simultaneous terminal users.

Most IBM software systems do not support the active dictionary concept.

Other 4GLs offer a friendlier interface that is easier for nontechnical types to master. These high-productivity, less procedural products are frequently used in information retrieval applications.

After the user is identified, you should ask, *what kinds of programmer support tools are provided and are they highly interactive?* Some 4GL products allow interpretive execution and debugging upon completion of each line of code or at the completion of each step of function generation. Others require you to complete programming tasks and then go into separate modules for execution. When an error is found in the execution module, the task must be terminated while the development module is brought back up and changes made. While IBM's CSP offers debugging trace facilities, it also requires the developer to change modules.

The sixth question you should explore is, *how diverse are the applications that can be coded?* Some 4GLs such as Natural and Ideal can be used for a broad range of applications. Almost any application that can be written in COBOL can be

written in these languages—small or large databases, small or large numbers of transactions, batch or on-line systems, and logic that runs the gamut from very procedural to not so procedural.

Other 4GLs, like ADS/O, can be used for a slightly narrower range of applications. The building of batch logic, for instance, requires a separate system. And still other easy-to-use 4GLs, such as Focus, Ramis II, and Nomad2, provide more suitable performance for building departmental, as opposed to corporate, computing systems.

The next question that crops up in evaluating 4GLs is, *what support is there for an active dictionary?* An active integrated data dictionary/directory significantly enhances control of a fourth generation software environment. The active dictionary is a software component that stores data definitions, edits, and serves as the integrating/control unit for the entire software environment. Generally, the software technologies aimed at the professional programmer level provide active dictionary products.

Cullinet, Cincom, Applied Data Research, and Software AG are some of the

companies that strongly support the active dictionary concept. IBM software systems do not support this active dictionary feature. Neither DB2 nor CSP, for example, support an active dictionary. Most 4GLs that are tailored to the information center support a passive dictionary. These products require the programmer to take procedural steps to invoke the dictionary.

WHICH SUPPORT SYSTEM?

That brings us to question number eight—*is your 4GL a language or a life-cycle support system?*

Of course, 4GLs provide languages and facilities to build applications. A number of 4GL wares have even been enhanced to support such tasks as system and database design, table management, librarian functions, project management, and technical and user documentation.

Generally, the more support the system provides, the more suitable it is for adoption as a complete technology by the dp department. If, however, your dp shop already has adequate systems development support and only needs to get certain types of programs operational more quickly, then a full documentation and life-cycle support environment may simply provide too much extra baggage and unnecessary overhead.

You should also ask the related question, *how much education and investment are needed?* It normally takes more education and investment to make a complete life-cycle support system productive than it does to get products with less functionality up to snuff. For example, Pacbase, which provides a great deal of support for development, requires a major initial commitment. Mantis, on the other hand, can be installed and used quickly.

Finally, 4GL system shoppers should ask, *what type of integration is supported?* Usually 4GL products are either tightly coupled to a single DBMS or loosely linked with several of these systems. Ideal and ADS/O are examples of 4GLs that are tightly coupled to one DBMS. Both languages are designed for operation with their own proprietary data dictionary and DBMS engine. Used in this format, these languages are perfectly suitable for various updating and retrieval processing applications. Loosely coupled languages like Focus and Nomad2, which offer interfaces to a number of DBMS packages from different vendors, sometimes only support retrieval for reporting and querying. ©

George Schussel is president of Digital Consulting Associates Inc., an Andover, Mass., consulting firm that specializes in DBMS and 4GL systems.

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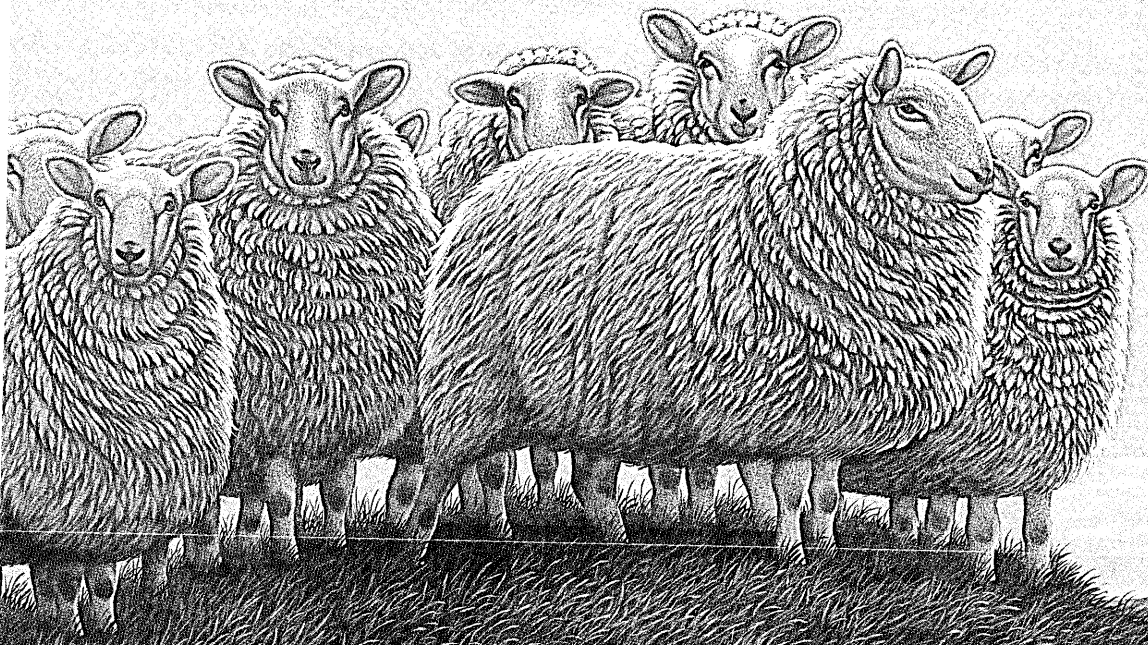
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Prospective DBMS purchasers need to understand the concept of data independence if they want to know what they're being sold.

DATA INDEPENDENCE AND THE RELATIONAL DBMS

by Stephen Ferg

The issue of data independence is frequently overlooked amid the hype and controversy of today's relational database management system (DBMS) market. Nevertheless, support for data independence is arguably the most important feature of a relational DBMS. Although a DBMS should not be selected solely on the basis of its ability to support data independence, it is clear that prospective DBMS purchasers need to understand the concept of data independence in order to evaluate its importance in their own environment. Support for data independence belongs among today's DBMS selection criteria as much as more traditional criteria such as price, availability of application generators, and transaction processing rate.

In a June 1970 *Communications of the ACM* article entitled "A Relational Model of Data for Large Shared Data Banks," E.F. Codd first defined the relational data model: "The most important motivation for the research work that resulted in the relational model was the objective of providing a sharp and clear boundary between the logical and physical aspects of database management. . . . We call this the *data independence objective*."

What is data independence and why did Codd attach so much importance to it when he was developing the relational model?

A historian of ideas will tell you that the best way to come to grips with an idea-complex is to view the complex as an intellectual response to a problem. If you can identify the seminal problem, it will act as a spotlight, pointing directly to the central idea in the complex. Let us then approach the concept of a relational DBMS as an intellectual historian would, by asking this question: what problem or problems confronted Codd when he developed the relational model?

The problem, as Codd described it, was that in typical DBMSs, "the model of data with which users interact . . . is cluttered with representational properties." Codd recognized that an application program that sees and uses information about the way data elements are physically represented in the database becomes *dependent* on that internal representation. If for any reason it becomes necessary to change the way that the data are physically represented, an application program that accesses the data will no longer be able to function correctly, if at all. In order for such a program to continue to work, it must be modified or rewritten, often at a substantial cost.

Codd's response was to envision a DBMS that would free all database applications from such dependencies.

The key to understanding his conception lies in a distinction between the format in which database data are presented to a user, the data's *presentation format*, and the format in which they are stored in the database, their *storage format*.

DBMS THAT PROVIDES INTERFACE

The storage format of the data includes all of the internal physical representations of the data and the data access mechanisms: the physical order and clustering of the records in the database, the hashing algorithms, the existence and names of pointer chains and indexes, and the hierarchical order of tree-structured databases. Codd's achievement was to envision a DBMS that would make the presentation format of the data independent of its storage format in the database. Such a DBMS would provide an interface to the database that concealed all information about access mechanisms (such as pointer chains and indexes) from terminal users and application programs. Even the physical sort-order of the stored data would be hidden; if an application needed its data to be presented in a specific

order, it would explicitly specify that requirement in its data-retrieval request to the DBMS. (This is the function of the ORDER BY clause in SQL.)

For brevity's sake, I shall refer to such a DBMS as a $PF \neq SF$ DBMS, where PF stands for the presentation format of the data, SF stands for the storage format of the data, and the not-equal sign (suggesting the possibility of differences between the presentation format and the storage format) stands for "is independent of."

A $PF \neq SF$ DBMS may be defined as a DBMS that provides a database interface in which the presentation format for the data is independent of, and may differ from, its storage format.

If we try to imagine a $PF \neq SF$ DBMS, the following question naturally arises: if the data's presentation format doesn't necessarily resemble their storage format, what *does* the presentation format look like? Codd's conclusion was that the best format for presenting data in a $PF \neq SF$ DBMS was a *relational, or tabular, format*. In his seminal 1970 article he wrote: "The relational view (or model) of data . . . provides a means of describing data with its natural structure only—that is, without superimposing any additional structure for machine representation purposes. Accordingly, it provides a basis for a high-level data language which will yield maximal independence between programs on the one hand and matching representations and organization of data on the other."

Having adopted the relational model for the presentation format of the $PF \neq SF$ DBMS, Codd was then faced with the problem of representing relationships between relations (that is, between tables): how can relationships *between* tables be represented *in* tables? The relationship between a department and all of its employees, for instance, might be represented in a nonrelational DBMS by a pointer chain linking employee records to a department record.

Proponents of the relational model had to contend with the problem of recovering relationship-based information from a relational database.

But in a PF≠SF DBMS such pointer chains (if they exist) are invisible to the user. In a PF≠SF DBMS, in order for the relationship between departments and employees to be visible to the user, the relationship must somehow be inherently represented in the data. This problem is what motivates the notion of a *foreign key*. The DEPT-NUM, stored as a foreign key in the EMPLOYEE table, provides a mechanism for recording the relationship between employees and departments.

Once he had discovered a means of representing relationships in a tabular format, Codd had to develop a technique that would allow a user to extract database data based on those relationships. In a network DBMS the user navigates the relationships between database segments by following pointer chains, but pointer chains are not visible in a PF≠SF DBMS. The problem, then, is, how can a user "navigate" through the tables of a relational database? This problem is what motivates the concepts of relational operations such as SELECT and JOIN. Especially important, of course, is the JOIN operation: it is the ability to JOIN a foreign key in one table to the primary key in another table that enables a user to recover relationship-based information from a relational database. It is a JOIN based on the DEPT-NUM of the DEPARTMENT table and the DEPT-NUM of the EMPLOYEE table, for instance, that enables a user to recover the name of an employee's department manager, or the names of all of the employees in a given manager's department.

In response to these and similar problems, the entire complex of relational concepts (relation, primary key, foreign key, JOIN, SELECT, etc.) has grown up around the central concept of data independence. Over time this collection of ideas has become quite large: concepts of primary

key and foreign key have led naturally to concepts of referential integrity and integrity constraints, the concept of physical data independence was extended to logical data independence and distribution independence, and so on. Because almost all of these ideas are extensions of the basic notion of a relation, it is important to emphasize that despite the expression "relational DBMS," the concept of a relation is *not* the central element in the notion of a relational DBMS. All of these "relational concepts"—including that of a relation itself—derive their importance from their connection to the notion of a PF≠SF DBMS: a DBMS in which the presentation format of the data is independent of its storage format.

Because data independence is so central to the entire concept of a relational DBMS, I would like to suggest that the best definition of a relational DBMS is this:

A relational DBMS is a PF≠SF DBMS that provides an application interface whose data-presentation format is based on the relational model.

Or, we may choose to put the matter more simply this way:

A relational DBMS is a DBMS that provides application data independence via a relational interface to the database.

What does this definition mean for buyers and sellers in today's market? First, let's consider the plight of vendors of today's nonrelational DBMSs. Their customers are demanding the productivity and ease of use provided by relational database interfaces, but the body of developed applications that utilize the existing nonrelational interfaces is too large to be rewritten. What should the vendors do? The wisest course for them is to meet their customers' needs by adding relational interfaces to their products while still retaining the existing nonrelational interfaces. In short, the

best thing that can happen to a nonrelational DBMS is for it to be "reborn" as a relational DBMS.

Let us imagine XDBMS, a hypothetical nonrelational DBMS that has been modified by the addition of a new relational interface. By retaining the old, nonrelational interface, XDBMS's vendor plans to allow existing applications to continue to function undisturbed. XDBMS's new relational interface will give current users the fourth generation query language facility they are demanding.

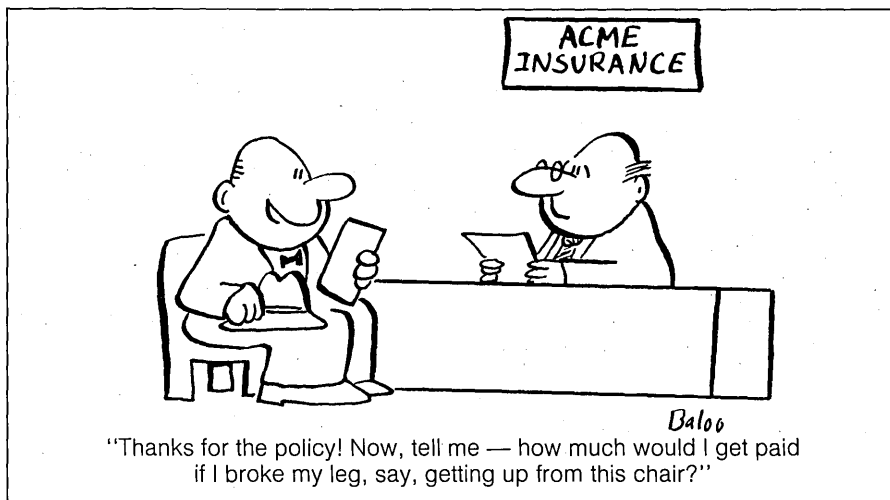
Note that the addition of a relational interface to XDBMS has not automatically moved XDBMS's current users into a relational—that is to say, data independent—environment. The existing data-dependent applications continue to operate through the old nonrelational interface. If the storage format of one of the XDBMS databases needs to be modified, many of those application programs will require maintenance. To the current users of XDBMS, then, the addition of a relational interface to XDBMS means only the gain of a nice query language facility that enables them to look at their data in tabular format.

A new purchaser of XDBMS is in an entirely different position. Starting from scratch, a new user has the option (which an established user does not) of simply not using the older nonrelational interface. By using only XDBMS's relational interface, he or she may begin life in a completely relational environment, develop all applications in a relational environment, and reap all of the benefits of data independence.

Unfortunately, the kind of modifications made to XDBMS are far from trivial. Grafting a fully functional relational capability onto an existing nonrelational DBMS is both difficult and expensive. A more feasible (although still formidable) alternative involves adding a semirelational interface that allows users to see their data presented in a tabular format, and that provides retrieval-only access via an SQL-like query language. Many vendors of nonrelational DBMSs have added, or are planning to add, such semirelational interfaces to their products. Once these additions are complete, these DBMSs will almost certainly be marketed as "relational" systems.

CRITICISM FROM CODD HIMSELF

The established users of such systems will find the new features most welcome. They will have query-language capabilities that they never had before; productivity will increase. The vendors, having responded to their customers' requests (and retained their business) will also be happy.



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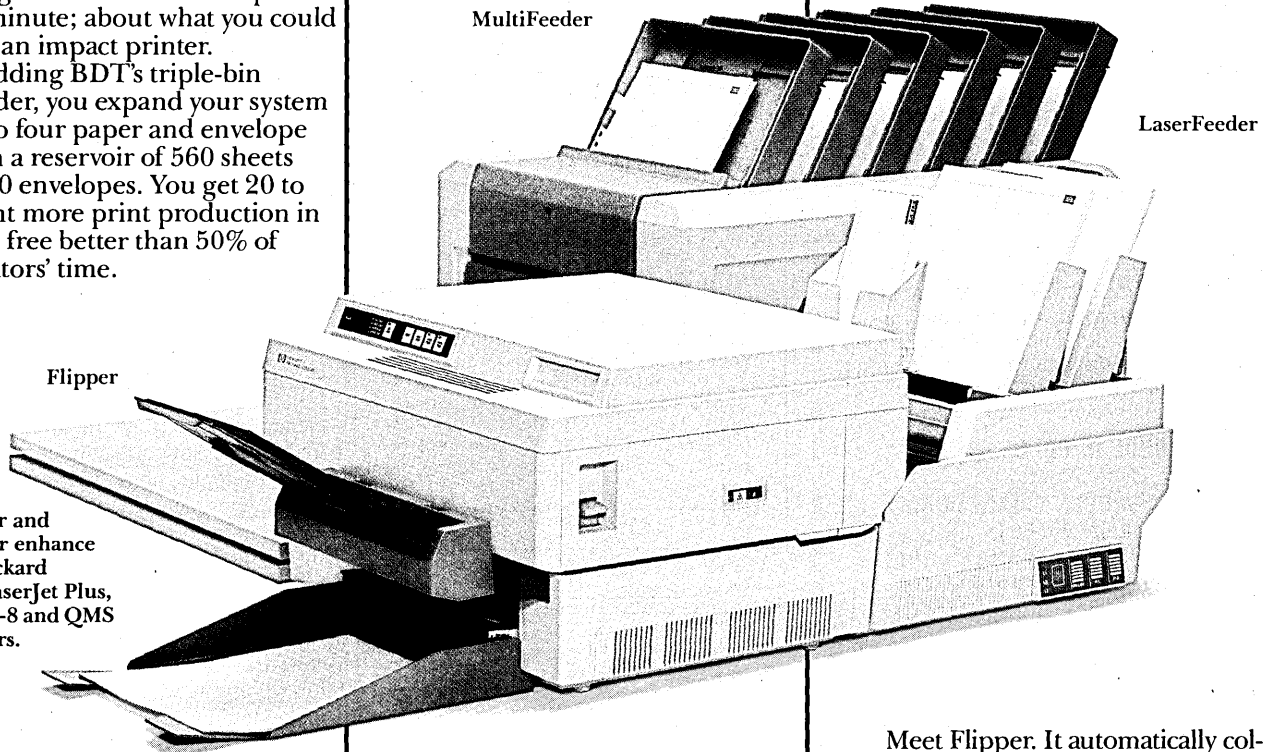
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CIRCLE 57 ON READER CARD

Just because a DBMS is marketed as "relational" doesn't mean it will support a fully functional data-independent environment.

This delightful scene has its flaws, however; one of its harshest critics has been Codd himself, who has attacked various "born again" systems' claims to being relational, on the grounds of both performance and functionality. Specifically, Codd's criticism of these systems centers on two basic objections.

The first is that although such systems may provide a relational interface, they often cannot meet users' performance requirements when accessing the database via the relational interface. Casting diplomatic circumlocution to the winds, Codd has accused the "born again" vendors of failing to invest the time and manpower

needed to optimize their relational interfaces, and of then propagating a "performance myth" about relational systems to cover up their failure. He bluntly notes that a vendor's manual that advises users to revert to the system's nonrelational capabilities "to achieve acceptable performance" is a de facto admission of this type of failure. "Compatibility with programs written in the past on nonrelational database systems," he asserts, is the only valid reason for reverting to a "born again" system's nonrelational interface.

Codd's second objection is that such systems often do not provide all the functionality needed to support a standalone relational environment. Such functionality includes support for database insert, update, and delete at the relational (multiple record at a time) level. The requirement for this functionality is so essential to data independence that Codd refers to it as Rule Zero: the "system must be able to manage databases entirely through its relational capabilities. This rule must hold whether or not the system supports any nonrelational capabilities of managing data."

The important point here is that the effect of both of these shortcomings is the same: at some point the user is forced to abandon the system's relational interface and fall back to its nonrelational interface. In using the nonrelational interface, the user's database applications almost inevitably become data dependent. The ultimate deficiency in both cases, then, is the system's inability to support a practical data-independent applications environment.

This deficiency may not represent any significant loss to an established user of the DBMS, who probably would find it prohibitively expensive to attempt to migrate to a data-independent environment anyway. It may, however, represent a significant drawback to a new user of the system, for whom (as we saw in the XDBMS example) a data-independent environment is still a live option.

The best advice for DBMS shoppers who understand data independence may be caveat emptor. A marketing description of a DBMS as "relational" should not be interpreted as a claim by the vendor that the system will support a fully functional data-independent environment. ©

Stephen Ferg is a computer applications analyst with the Federal Reserve Board in Washington, D.C.

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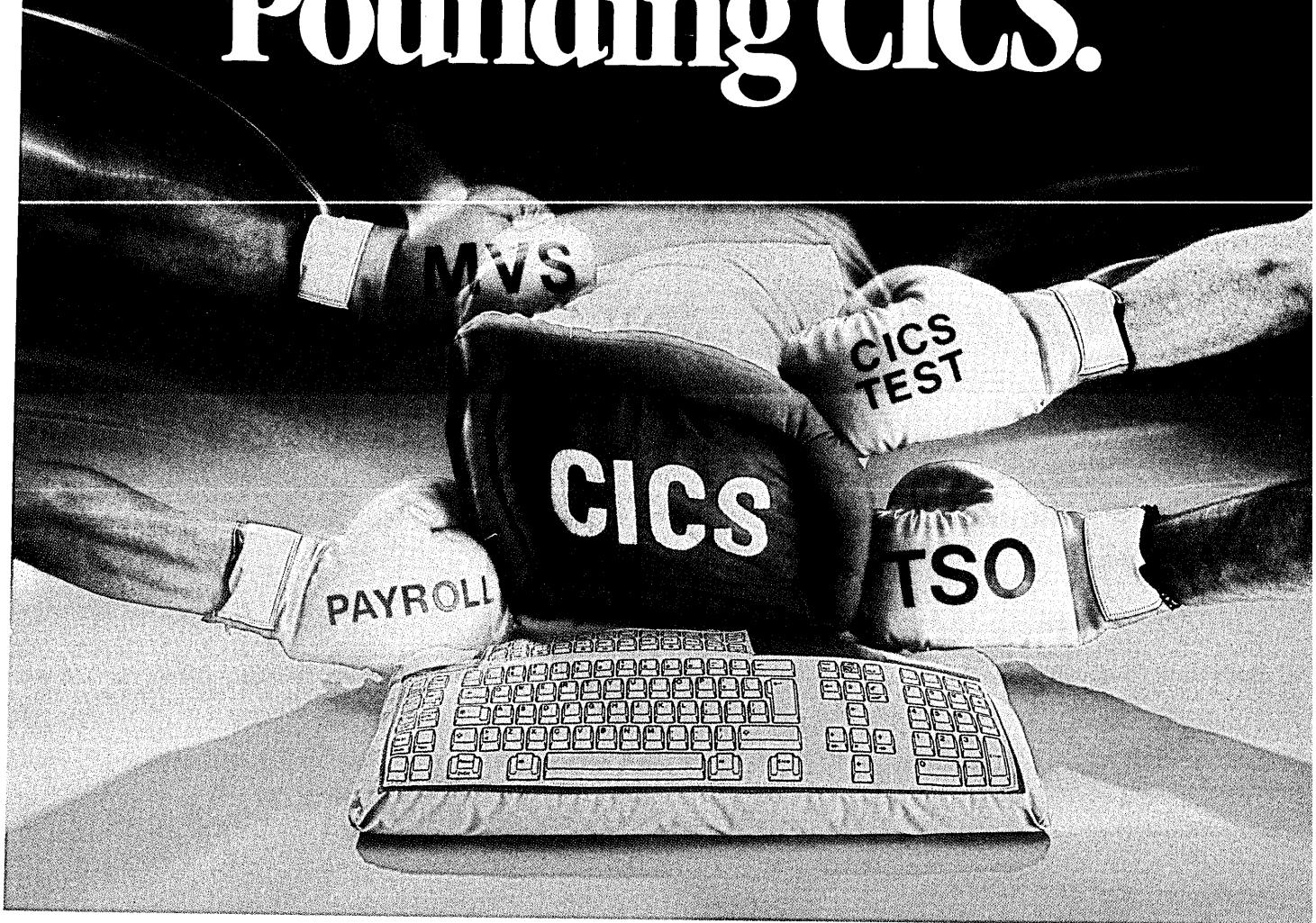
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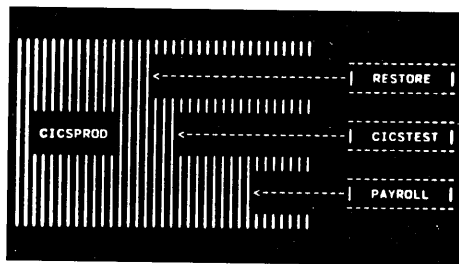
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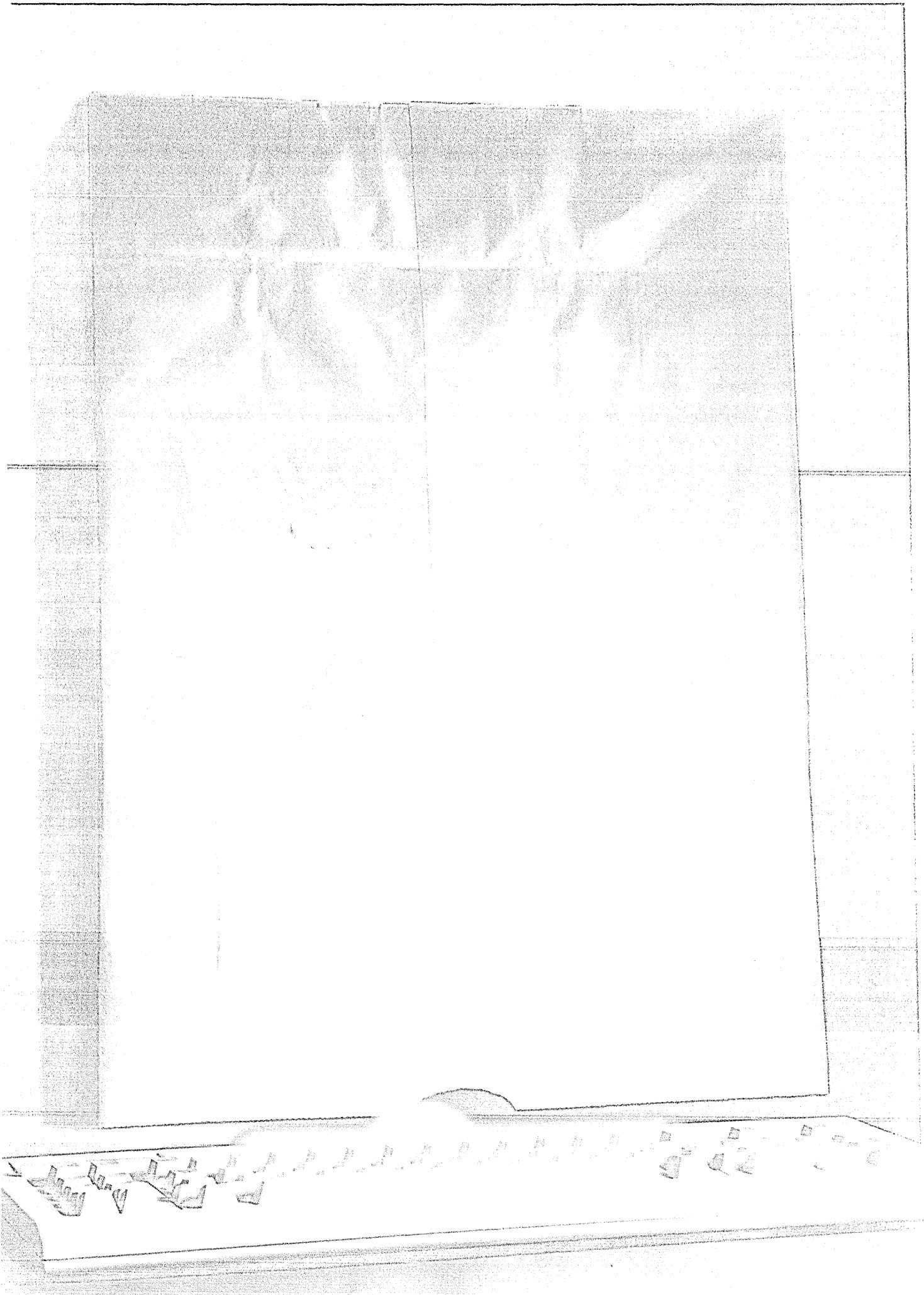
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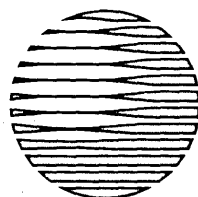
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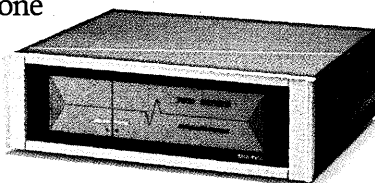
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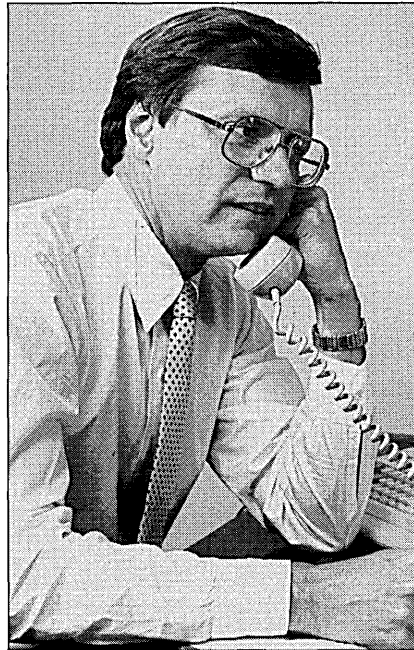
MAN OF TWO FACES

When meeting a man named John B. Landry III, one might expect to be greeted by a pillar of the establishment: dignified, conservative, a little stuffy, perhaps. But no, even the briefest exposure to the boyish charm and self-deprecating humor of the former McCormack & Dodge executive vice president quickly dispels any such notion. The old French form of his name—Laundry—is as much a target for his wit as any other subject. “My ancestors used to mess about in other people’s dirty linen,” he says. The slightly lopsided grin can be a real icebreaker.

Colleagues at Distribution Management Systems (DMS), where Landry is chairman and ceo, say that the B in his name stands for Bhagwan—a joking reference, says one, to his role as guru “as well as teacher and guide. You can always trust his instincts about business or people.”

Landry’s growing reputation as an industry prophet is balanced by his mastery of technical minutiae. And he has led a charmed professional life.

While at McCormack & Dodge, he authored G/L Plus, the world’s top-selling general ledger system in the mainframe market. He also was principal architect of the company’s innovative applications development architecture, Millennium. Today, he is a prophet of the fifth generation and is busily embedding ex-



LANDRY OF DISTRIBUTION MANAGEMENT SYSTEMS: “I prefer to build on the past, not destroy it.”

pert systems technology into the traditional fabric of commercial dp.

“Being Bhagwan’s all right,” says Landry, “but I guess I’d really prefer the B to stand for builder, since that’s what I like to do most—build software systems.”

Landrys I and II (now both deceased) would have preferred the B to stand for banker. “They both were bankers, and I suppose they were hoping I’d become a chip off the old block,” he says. “I tried it for a while, but found it stifling,” he says of his years in the financial department of a Boston bank.

The career change came in the

early 1970s, when Landry met his first group of software salesmen. “We had an immediate rapport. They were crazy and a little flaky—a breath of fresh air.” This new society sparked a latent desire in him to build application programs. After a sales pitch from Jim McCormack, he told McCormack & Dodge’s former chairman that he could write better software for users like himself. McCormack told him to try writing one for M&D.

Landry joined the young company as its sixth employee in 1974, and the rest, as they say, is history. His technical leadership was instrumental in catapulting M&D from a \$7 million company to \$100 million today.

Landry is a fascinating study in contrasts. His mind is equally at ease in worldly issues or technical detail, in art or science, in people or ideas. The play of opposites is apparent in his working life as well, particularly in its blending of caution and apparent risk. “As a kid, I was drawn to investment and speculation. I played the stock market and took chances, but I always had a system,” he says. His unusual combination of instinct and logic paid off. “I made a bundle in high school, paid my way through college, traveled through Europe, and bought a Corvette.”

Then, in the late 1960s, the bottom fell out of his world. “I got out of college with the world of investment at my feet, but no one would employ me. I had a 1A draft status for Vietnam.”

An early marriage collapsed (he has since remarried and has two children). His college degree got him jobs washing dishes and working in the warehouse at Child World, a toy manufacturer. “Suddenly, I was a bum,” he says. To minimize the risk of being sent into com-

PEOPLE

bat, he signed up for an 18-month stint in the National Guard, "a humbling experience when you're a cocky bastard." By a fluke, his draft physical notice and his acceptance into the National Guard arrived on the same day. "I had opened the draft physical notice first," he says.

Later, when Landry joined M&D, the play of opposites surfaced once again. "I was leaving a solid career at the bank—a way of life really—for nothing but big dreams. I asked for equity in M&D. They gave me 10%, but for a long time it was 10% of nothing!"

He says that when he told his father "about this weird new business I was getting into—how you could take a tape and two books and charge \$100,000 for it—his main concern was, 'Is it legal?'"

Dun & Bradstreet's subsequent acquisition of M&D made Landry a wealthy man, and last year he was ready for another gamble. "While at M&D, I'd spotted three major shifts in technology: SQL, LU 6.2, and expert systems. But I knew it would be hard for M&D, with its large base of customers, to react quickly to such changes. So I decided it was time to get out."

Landry, after a typically intense research period, decided to focus on expert systems, and began shopping around

for a platform or infrastructure from which to launch his ideas. He decided to resurrect an existing company that had fallen on hard times rather than create a new one from scratch. He had three criteria for his choice: first, it must be an applications software company; second, it must be in a fast-growing market niche that, third, had no meaningful penetration by large software companies.

DMS, Lexington, Mass., in its 37% growth market of distribution and warehouse management systems, fit the bill perfectly. DMS was created 10 years ago as a custom shop. It grew too quickly and contracted more rapidly still. After another chief executive attempted a turnaround and failed, Landry took the helm last summer. A number of key M&D personnel, including 17 from the R&D area, have since joined Landry, and there are continuing rumors of legal action by M&D to stem the tide. M&D won't comment. Landry merely shrugs, "Who knows?"

"DMS has always had good products, but it was waiting for people to break down the doors to buy them. Now, with real marketing and selling, we've got more leads than we know what to do with," he laughs. DMS managed \$5 million in sales last year, and will do \$10 million this year, according to its new ceo.

"The best thing is the deep sense of satisfaction you get from watching a company turn around."

Though Landry is a confirmed individualist and a self-made man, he is not a rebel against established thought. "I prefer to build on the past, not destroy it." This is the key to his belief that rules-based programming and other fifth generation techniques should be grafted onto the traditional fabric of computing.

With his streak of sentiment and caution, it's unlikely that Landry, 39 years old this month, will emulate his boyhood heroes, the robber barons and financiers who made millions but died unlamented. "I guess I was motivated by money as a kid, but that's changed," he says, remembering the first piece of software he ever wrote. "It was just a little certificate of deposit system—just a simple thing in BASIC, but God, the high I got out of that, just knowing that people found it useful."

It may be a safe bet that Landry will get wealthier still from his software architectures, but he believes that the play of opposites, like fortune's wheel, will continue to mold his life. As he has learned, "You're always just one spin away from being a bum."

—Ralph Emmett Carlyle

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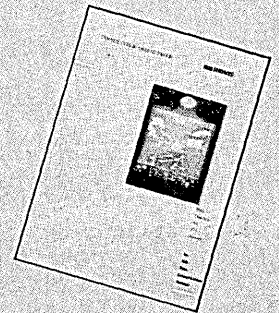
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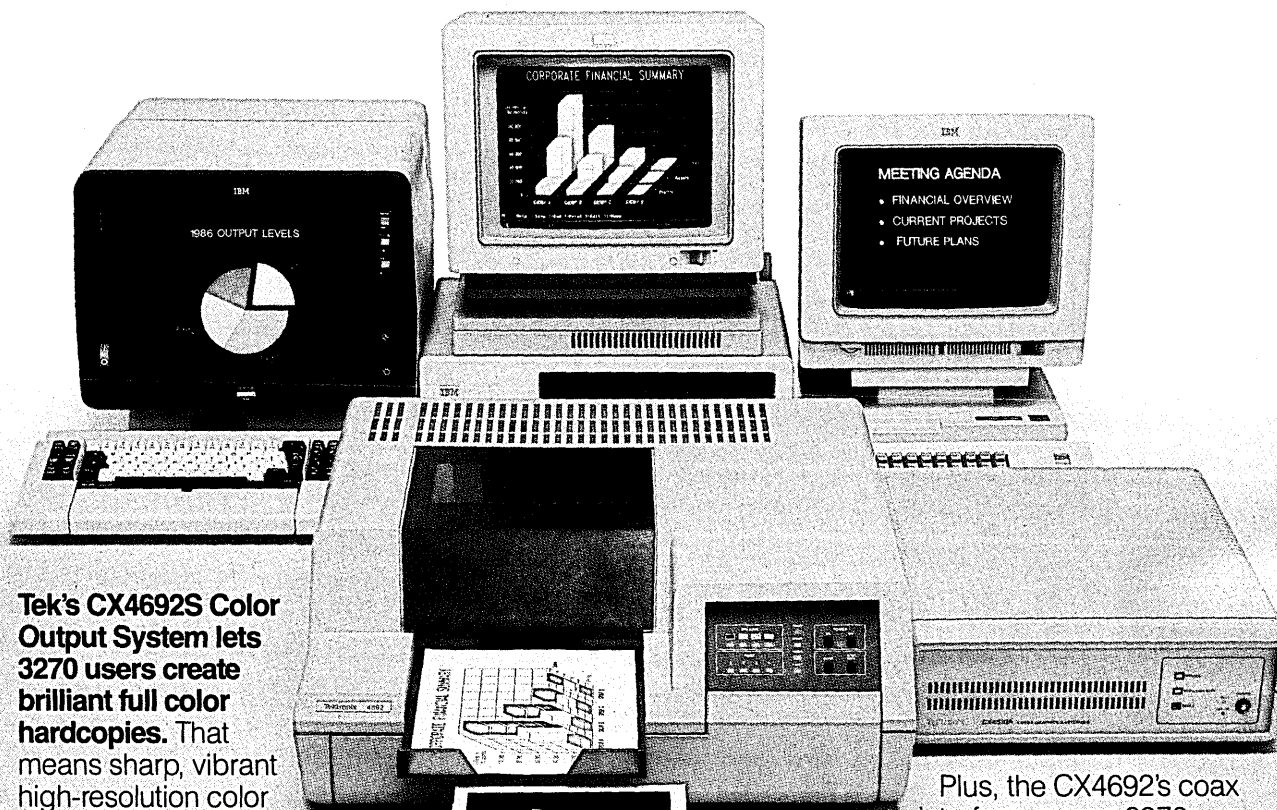
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OFF-LINE

Earlier this year, when Burroughs Corp. announced it was merging with Sperry Corp., many users, particularly on the Sperry side, expressed concern that some product lines would be phased out or not fully supported. Both companies said they would continue to support existing products and introduce new products in the future.

Now Sperry has introduced a new midrange mainframe, which it says is the first in a family of integrated computers, two new Unix-based 32-bit microprocessors, and several software products. Although it's still too early to judge how the merger will affect both firms' product lines, the Sperry announcements seem designed to convince its users that they have nothing to fear.

Sperry is calling its 2200/200 a "midframe,"-- a system with the functions of a mainframe and the price and size of a supermini. Aimed at departmental computing and small businesses, the 2200/200, which went by the code name Swift prior to its announcement, has a performance range of 1.2MIPS to 4.4MIPS, depending on the number of processors.

The system is compatible with Sperry's 1100 series, although it employs a different chip technology, developed in-house. A one-processor system provides up to 24MB of main storage and holds up to eight integrated 140MB disk drives.

The system supports Sperry's Distributed Communications Processor/15 (DCP/15), a connectivity software program that is a repackaged version of the

DCP/10, already available for other Sperry mainframes. The DCP/15 offers twice the main memory and communication ports as the earlier DCP/10, Sperry says.

The system will be at beta test sites this month; Sperry says it has about 30 machines running internally. Manufactured at the company's facility in Roseville, Minn., the 2200/200 will be available for volume shipments in February. A one-processor system is \$198,000.

Sperry also introduced two high-performance 32-bit Unix-based systems, the Series 5000 Model 30 and Series 7000 Model 30. Both are functionally compatible with Sperry's other Unix family systems. They can function as standalone or as departmental computers and they support SNA, X.25, Ethernet, and other industry standard data communications protocols.

The Series 5000/30 has 2MB to 8MB of main memory and can support from one to eight users. It ranges in price from \$14,900 to \$18,310. The Series 7000/30, a 5MIPS system, supports from 30 to 100 users. A minimal configuration is priced at \$136,000.

Sperry says that in the coming months it will announce applications software packages for the 2200/200 series. Some of these will be repackaged 1100 series software.

Within 18 months the company says it will introduce the next member of the 2200 family, offering twice the performance of the current machine. In addition, Sperry says the introduction of intermediate machines is likely.

THREE NEW MICROS

Digital Equipment Corp., Sperry Corp., and IBM all recently introduced new 80286-based micros.

DEC's VAXmate networked micro is designed to support work group, departmental, and organizational computing, providing MS/DOS-based personal computing and access to VAX-based services and resources. It comes with DECnet/ThinWire Ethernet LAN support on a network that can include VAX and MicroVAX computers, other VAXmates, DEC Rainbows, IBM PC ATs and XTs running DECnet software, and, through DECnet/SNA Gateway software, IBM mainframes. VAXmate is PC AT compatible, has a built-in 5¼-inch disk drive, a keyboard that supports DEC and IBM keying functions, and a mouse. System software includes MS/DOS V3.1 and the MS-Windows applications interface, Microsoft Network client software, and DEC VT220 and VT240 terminal emulators. DEC and IBM graphics are supported. Other features are 1MB of memory



and an Intel 80286 chip running at 8MHz. Options include an expansion box with a 20MB, half-height hard disk, hard disk controller with two option slots, integral 2MB RAM, internal 300- to 2,400-baud modem, and a math coprocessor. VAXmate is available now and is priced at \$4,045. The software license is \$250. DEC is planning to introduce in 1987 network integration kits for Rainbows and IBM PCs that will provide users with ThinWire

HARDWARE

Ethernet support. DEC also announced the immediate availability of two software products: PC All-in-1, priced at \$81,160 for the MicroVAX II hardware, software, and services to support 30 pcs; and VAX/VMS for MS/DOS, available in three configurations, priced at \$650 to \$19,000. DIGITAL EQUIPMENT CORP., Maynard, Mass.

FOR DATA CIRCLE 301 ON READER CARD

The PC/microIT, or PC/uIT from Sperry, is a single-user system. It has a footprint of 15 by 15 inches, and uses 16-bit open architecture and MS/DOS. It can be configured as a multi-user system for up to five users under Xenix System V. A basic version, with no disk drives, and an expanded version, with a 20MB fixed disk drive, are available. Standard user memory is 512KB, which can be increased to 1.5MB. A 1.2MB diskette drive or 360KB diskette drive plus a nonremovable 20MB fixed disk drive are available, as is a 20MB on-card hard disk drive. Both versions include configuration switches and Centronics parallel interface and RS232C serial port.

In the expanded, multi-user environment, options include multiterminal adapter card with four additional RS232 ports and Xenix Release V. Available now, the basic version is priced at \$2,345 and the expanded version is \$3,590. SPERRY CORP., Blue Bell, Pa.

FOR DATA CIRCLE 302 ON READER CARD

IBM says its new 16/24-Personal Computer XT Model 286 operates up to three times faster than earlier models of the XT. It comes standard with 640KB of memory, and various memory expansion

options allow up to 12.6MB of memory. Standard features include a half-high, 1.2MB, 5¼-inch, double-sided diskette drive; 20MB fixed disk drive; serial/parallel adapter card; IBM enhanced PC keyboard; and eight I/O or expansion slots. The XT Model 286 is priced at \$3,995 and is available now. IBM CORP., Rye Brook, N.Y.

FOR DATA CIRCLE 303 ON READER CARD

REAL-TIME PC INTERFACE

IBM has come out with an 80186-based real-time interface coprocessor for its industrial and personal computers. The device, which is microcoded, provides a real-time, multitasking environment for supporting industrial applications. It can be programmed to support a wide variety of protocols and, through a series of interchangeable plug-in boards, accommodates a variety of physical interfaces.

The coprocessor is designed to support programmable controllers from Allen-Bradley, Gould Modicon, TI, and GE. Two direct memory access ports operate at up to 64Kbps, and up to five programmable hardware timers may be accessed.

The board can accommodate up to a megabyte of RAM. It is designed for use in the IBM 5531, 7531, 7532, 5160, and 5170 computers. Various software utilities are available, too. The coprocessor carries a price of \$1,295 with 128KB of on-board RAM. Interface boards run from \$130 to \$245 each. IBM CORP., Information Systems Group, White Plains, N.Y.

FOR DATA CIRCLE 308 ON READER CARD

SMALL-SIZED SUBSYSTEMS

The 400 Series Backup tape subsystems for IBM PC XT, AT, and compatibles have been introduced by Irwin Magnetics. The company claims the systems, measuring 2 inches wide by 7¼ inches deep, are 80% smaller than competitive brands.

The 400 series employs the vendor's Servo head position and EC/Tape error correction features. Servo head positioning allows the products to find the appropriate data track electronically. The vendor claims that EC/Tape error correction ensures data recovery even from damaged tape. The series uses 3M DC1000 and DC2000 tape minicartridges. The system allows higher-capacity drives to read tapes created on lower-capacity



drives. The software for the series is menu driven and gives users the option of copying an entire hard disk or only selected files.

The 400 Series consists of four models. The 410 and 420 are 10MB and 20MB models, respectively, for the IBM PC XT and compatibles; they support data transfer at 250,000bps. The 425 and 445 are 20MB and 40MB models, respectively, for the IBM PC AT and compatibles, and support 500,000bps data transfer. The 410 and 420 will operate with ATs but at the lower bps rate. Prices range from \$799 for the 410 to \$950 for the 420 and 425, and \$1,095 for the 40MB 445. IRWIN MAGNETICS, Ann Arbor, Mich.

FOR DATA CIRCLE 309 ON READER CARD

LASER PRINTER

The SmartWriter 80+ is an eight-page-a-minute laser printer with 2.5MB of RAM and 816KB of download font and print buffer memory. It can print an entire page of graphics at 300 by 300dpi, and features IBM PC screen dump graphics capabilities. The printer has 19 resident fonts and three resident print emulations—Epson FX-80, Qume Sprint II, and Diablo 630—and a dual parallel and serial interface. It's available now and is priced at \$4,595. QMS Inc., Mobile, Ala.

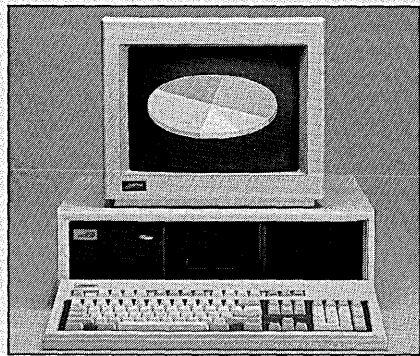
FOR DATA CIRCLE 310 ON READER CARD

—Theresa Barry

HARDWARE SPOTLIGHT

80386-BASED PC

Compaq Computer Corp. unveiled its 80386-based micro, the Deskpro 386. The microcomputer operates at 4MIPS when running 32-bit code and at 2MIPS when running at 16 bits, Compaq claims. The machine's 16MHz, 32-bit chip is fully compatible with hardware and software designed for 80286-based micros. Compaq has also broken the 640KB RAM barrier by offering up to 14MB of RAM through the Compaq Expanded Memory Manager



for applications that support the Lotus/Intel/Microsoft Expanded Memory Specification.

Initially, the Deskpro 386 will run under MS/DOS 3.1; Compaq says future versions of MS/DOS will be supported. In conjunction with the announcement, Microsoft Corp. announced that the Xenix V/386 operating system will be available during the first half of 1987. Other software vendors, including Lotus and Ashton-Tate, say they intend to write software that will fully utilize the 80386 chip.

The Deskpro 386 is available in the Model 40 and 130. Both come standard with 1MB RAM, a real-time clock, and six expansion slots. The Model 40 has a 40MB hard disk and sells for \$6,500. The Model 130 comes with a 130MB hard disk and sells for \$8,800.

Options for the 386 include memory expansion, color graphics, a 80287 coprocessor, and a 40MB tape drive. COMPAQ COMPUTER CORP., Houston.

FOR DATA CIRCLE 300 ON READER CARD

Now 4381 owners can discover what thousands of savvy IBM users already know about EMC memory.

OK, admit it. You're probably a little hesitant about installing EMC's new main storage upgrade for your IBM® 4381 system.

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CIRCLE 54 ON READER CARD



South Seas Shipping Company

November 20, 1986

Ms. Cathy Lyons
Import Officer
Botanical Research Ltd.
55 Wewak Road
Moresby, Papua, New Guinea

Re: Palm Fruit Research

Dear Ms. Lyons:

This letter confirms the agreement we reached at our meeting last week in San Francisco. Botanical Research, Ltd. will recommend the optimal conditions for shipping palm fruit and palm oil.

Most important issues for consideration are: temperature during shipping and length of time between shipping and landing.

These conditions should be completed by June 1, 1987.

South Seas Shipping Company
Corporate Organizational Chart

PRESIDENT
Trevor Cardinal

PETISON

INVESTOR'S UPDATE

SOUTH SEAS SHIPPING COMPANY NEWSLETTER

SHIPPING GOES WILD IN THE SOUTH PACIFIC

BY SUZANNE FAHRAND
DIRECTOR OF SALES

South Seas is causing a shipping world-wide stir. Not only every other shipping company, but South Seas has managed to maintain its growth despite the strong dollar and lower-than-expected freight rates. For the first quarter ending on March 31, South Seas turned in a record \$20 million profit on sales of \$117.1 million.

President Trevor Cardinal cited several reasons for this record-breaking quarter. First of all, by expanding operations into specialized, price insensitive commodities like palm oil and rum, South Seas has been relatively unaffected by the strong dollar and unfavorable exchange rates.

Second, South Seas is now reaping the benefits of long-term relationships it has developed with port authorities throughout the South Pacific. These relationships have let South Seas keep its rates competitive, yet profitable, during recent freight rate wars.

Finally, Mr. Cardinal said South Seas had money left over from funds it set aside last year for costs associated with the building and launching of new container ships.

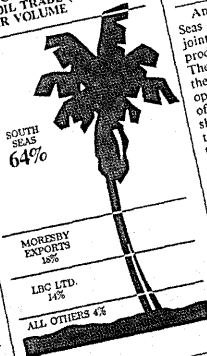
Outlook for Sales

Spectacular sales for the first quarter will set the pace for what industry analysts expect will be a record year for South Seas. "South Seas will be the industry leader by 1990," says Michael Wong, a vice-president at Donovan, Kroll & Co. "Their growth strategy is sound and their balance sheet continues to be the financial muscle to continue to grow even during the current slump in the shipping industry."

Competitive Factors

One of the primary factors in South Seas success has been the company's ability to identify new market opportunities and then to establish the dominant position in that market. The palm oil trade is a prime example of this successful strategy. Since entering the market in 1977, South Seas has become the key player in the specialty shipping market.

SHARE OF PALM OIL TRADE (1985) DOLLAR VOLUME



However, LBC Ltd. is expected to become a more aggressive player. The Singapore concern had concentrated its efforts on short-haul container freight in the Indian Ocean. Last year, LBC purchased the ailing Barton Lines. This move more than doubled LBC's tanker capacity. Several of these new-sized tankers have been refitted for the palm oil trade and are expected to enter service by mid-1986. So far, the LBC has been unsuccessful in winning any of South Seas customers. In the future, the increased competition can be expected to depress both prices and margins, but for the short-term, South Seas contracts with most of the palm oil industries largest producers should insulate it.

Joint Ventures Considered

Another growth strategy South Seas is exploring is to establish joint ventures with several of the producers of these commodities. These ventures would be similar to the Transpac/South Seas tea venture, in that South Seas is the shipping capabilities offer its shipping capabilities to the company is holding on to its share of the venture. At this time, the company is holding on to its share of the venture. At this time, the company is holding on to its share of the venture.

One company expected to be interested in a joint venture with South Seas is MountainView. MountainView has seen its products grow in the Japanese market. In response to this demand, MountainView has begun to strengthen its

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CIRCLE 65 ON READER CARD

PG602DMX

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SOFTWARE AND SERVICES

UPDATES

The London Stock Exchange will be computerized under a new set of regulations that take effect Oct. 27 (see "A New London Tradition," May 1, p. 38). On that day, dubbed the Big Bang, the exchange is doing away with fixed commissions. Brokers will be able to trade stock in any company 24 hours a day by means of an electronically linked system similar to the ones already in place in the New York and NASDAQ exchanges. The effect will be a more competitive and faster-paced exchange.

While stockbrokers the world over are preparing for this new round-the-clock system, CMQ Communications Inc., a Toronto-based vendor of on-line quotation services, is providing services that will help make the transition less painful and keep brokers on top of business.

CMQ, which entered the U.S. market in April, recently introduced two new products that complement its existing software products. KeyMaster is a keyboard for CMQ's Multiport workstation, which provides access to CMQ's AutoQuote, an on-line service offering access to over 55,000 exchange-traded stocks, bonds, commodities, options, and futures.

KeyMaster resembles an ordinary keyboard, but it allows brokers in the trading room to control and view up to four screens of data from four different databases simultaneously. Unlike typical systems, CMQ claims, it utilizes digital signals rather than video switching.

CMQ says that digital signals are "significantly less expensive and more compact."

Presently in the works at CMQ is the development of a video switch that can access non-digital information sources.

The Telerate Shared Addressing (TSA) system from CMQ is geared toward financial institutions with a large number of Telerate users. (Telerate is a widely used on-line international money market information database.) Up to eight users can obtain Telerate information simultaneously with TSA.

A variety of configurations providing different degrees of access to Telerate are available. The Telerate information is delivered via CMQ's Multiport controller and terminals, which can still access live quotation data and other communication services independently. "Active" shared addressing allows a user to request any Telerate page his or her firm has subscribed to and share it with other monitors, and "passive" shared addressing allows users to receive only the page that has been selected by the active keyboard controlling it.

CMQ's manager of U.S. operations, Albert J. Thompson, says AutoQuote will provide the first continuous real-time feed from the London Stock Exchange, covering the leading listed 1,700 securities as well as over 500 leading international securities traded in London.

KeyMaster with AutoQuote and Telerate, including equipment, data, and maintenance, is priced at \$1,854 per month, and there is a one-time installation fee of \$2,500 for both AutoQuote and Telerate.

FOR VMS ENVIRONMENT

Elxsi recently introduced six products that give DEC VAX users a migration to the Elxsi System 6400. Called the EMS Environment, the products include EMS/ECL, an implementation of the Digital Command Language (DCL) Interpreter; EMS/ERT, which provides some of the VMS System Services and Run-time Library functions; an interactive text editor for VMS that offers complete EDT compatibility; a new release of Elxsi's FORTRAN compiler for EMS; and a new release of EDMS, the database management package compatible with Ingres 3.0, now available for EMS. Elxsi's proprietary operating system, EM-BOS, is the foundation of the EMS Environment. System 6400 also offers Unix System V and Unix BSD 4.2. Elxsi is planning to support CommUnity, an implementation of DECnet Phase IV, by the first quarter of 1987, enabling the System 6400 to communicate with VAX hosts running VMS 4.0 or later. A package price of \$20,000 is being offered for EMS/ECL command interpreter and the EMS/ERT utilities product. Purchased separately, they are each \$12,500. The text editor is \$2,000. CommUnity will be \$15,000. ELXSI, San Jose.

FOR DATA CIRCLE 326 ON READER CARD

OPEN SYSTEM DBMS

Oracle Corp.'s SQL*Star is an open system distributed relational database management system and is comprised of three products: Distributed Oracle, SQL*Net, and SQL*Connect. It's modeled on IBM's R-Star research work.

The open system architecture of SQL*Star allows for the distribution of databases among Oracle and non-Oracle DBMSs situated on multiple dissimilar systems. Distributed Oracle provides multi-site query processing and distributed directory services. SQL*Net provides interfaces to a variety of communications networks and allows distributed processing between applications and the databases that are accessed. SQL*Connect provides a gateway facility to allow non-

SOFTWARE AND SERVICES

Oracle DBMSs to participate in SQL*Star distributed DBMS networks.

Oracle's database, IBM's DB2, and SQL/DS are now supported, and Oracle plans to support VSAM and IMS in 1987. The networks presently supported are the DECnet interface, asynchronous protocol, and 3270 coax connections, such as IRMA. Oracle is planning TCP/IP and SNA 6.2 APPC connections, and support for the MAP protocol. By year-end, Oracle plans to have available the SQL*Net Communications Toolkit, allowing custom creation of protocol interfaces between SQL*Net and any other network, and in '87, the SQL*Connect Gateway Toolkit, allowing for the development of custom interfaces to non-Oracle data sources. The prices for each component vary considerably depending on the system used. ORACLE, Belmont, Calif.

FOR DATA CIRCLE 327 ON READER CARD

PC-CICS FOR IBM PC

Micro Focus has released the PC-CICS package, which emulates the CICS mainframe transaction processing monitor on the IBM PC. In conjunction with Micro Focus's vs COBOL Workbench, PC-CICS allows mainframe users access to PCs for developing and testing CICS applications. It also allows selected applications to migrate onto the PCs for single-user operation. The program is used with Version 1.2 of vs COBOL Workbench to support the compilation and execution of CICS command-level programs, and supports BMS and VSAM KSDS commands on an IBM PC, XT, AT, or compatible. A screen development system allows for development of BMS map sets and maps for use with PC-CICS; corresponding BMS macros can be generated for uploading to the mainframe. A facility for the association of transaction IDs to programs is provided, as is a facility to define and generate VSAM KSDS databases and file handlers. PC-CICS allows users to define multiple directories for use by the system facilities.

PC-CICS is available now for \$1,500; a run-time version is \$100. MICRO FOCUS, Palo Alto.

FOR DATA CIRCLE 328 ON READER CARD

THREE PUBLISHING PACKAGES

Bestinfo has released an updated version of its successful WYSIWYG publishing software for IBM PCs. Some new features of Superpage II include an increase in text handling from 30KB to 16MB; the ability to handle ASCII text files; global formatting; automatic rule and box attributes, font attributes, and small caps; unlimited kern pairs; unlimited fonts per page; justification speeds of 2,000cps to 3,000cps; unlimited columns and column groups per page; output spooling; and RAM-resident program modules. Graphics can be imported from leading scanners and software packages. Superpage II requires an IBM AT or XT with 640K RAM, hard disk, and Hercules graphics card. A permanent license is \$7,000; upgrades from Superpage are free. BESTINFO, Springfield, Pa.

FOR DATA CIRCLE 329 ON READER CARD

Xerox Corp. has unveiled its first desktop publishing product to run on industry standard pcs. The Ventura Publisher Edition in the Xerox Desktop Publishing Series, developed by Ventura Software Inc., allows pc users to merge text and graphics to create documents. It runs on the Xerox 6065 pc and IBM XT, AT, and compatibles and supports popular laser printers as well as phototypeset-

ters. The package provides a WYSIWYG interface, a mouse, and drop-down menus. The software automatically reformats the altered text at speeds up to 20,000cps. Style sheets determine the layout of a page. These are preprogrammable document formats that allow users not familiar with typesetting techniques to choose layout, typefaces, and other characteristics with the mouse. The program can also change the size or cropping of scanned images. The price is \$895 and it's available now. XEROX CORP., El Segundo, Calif.

FOR DATA CIRCLE 330 ON READER CARD

LetraPage is the first desktop publishing offering from Letraset, best known as a manufacturer of typefaces and graphic design materials. It runs on the Macintosh and is a result of collaboration with Boston Software Publishers Inc. LetraPage incorporates features of MacPublisher II (from Boston Software), plus additional unique features, including a tool box for editing text and creating graphics directly on a page layout, automatic hyphenation and line and depth justification, and a library of 137 kerned letter pairs. A range of issue and page layout options is provided.

LetraPage supports the 512K Macintosh and Macintosh Plus computers, Apple's LaserWriter, LaserWriter Plus, Imagewriter, and Imagewriter II printers, PostScript-compatible printers, and the Allied Linotronic phototypesetter. LetraPage is \$495 and is available now through Letraset and selected Apple dealers. LETRASET USA, Paramus, N.J.

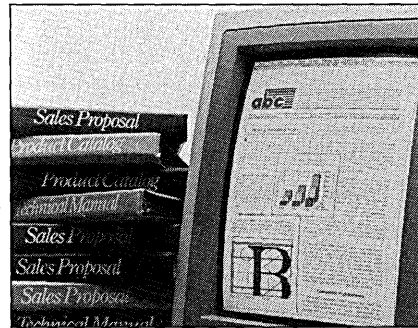
FOR DATA CIRCLE 331 ON READER CARD

INVESTMENT MANAGEMENT

StreetSense is a micro-based investment management service from Citicorp Investment Bank that combines market information with direct, electronic order entry. The service provides access to quotes and trades from the New York Stock Exchange, the American Stock Exchange, the NASDAQ OTC markets, and all domestic and regional stock exchanges. Plans are already under way to provide quotes from foreign stock exchanges. The system is targeted for small- to medium-sized brokers, portfolio and pension fund managers, and investment advisors so that they can track stocks, access information, and plan strategies. Features include windowing and the ability to set "alerts" to notify users of changes in the market. The software runs on an IBM PC or compatible with 512KB of memory. A 1,200bps modem is required to access the service. StreetSense is available for \$475 per month and includes unlimited quotes. CITICORP INVESTMENT BANK, New York.

FOR DATA CIRCLE 332 ON READER CARD

—Theresa Barry



SOFTWARE SPOTLIGHT

PROJECT MANAGEMENT

ISSCO has introduced Tellaplan Professional and Tellaplan Expert, two packages that combine project management functions with graphics for visual reporting.

Tellaplan Professional features include gantt chart reporting with start-to-end and end-to-start planning; planning in hours, days, weeks, and months; human resource and arbitrary units; milestones and benchmarks; and dependency designation. It can handle up to 2,000 tasks.

Tellaplan Expert includes all features of Tellaplan Professional and adds

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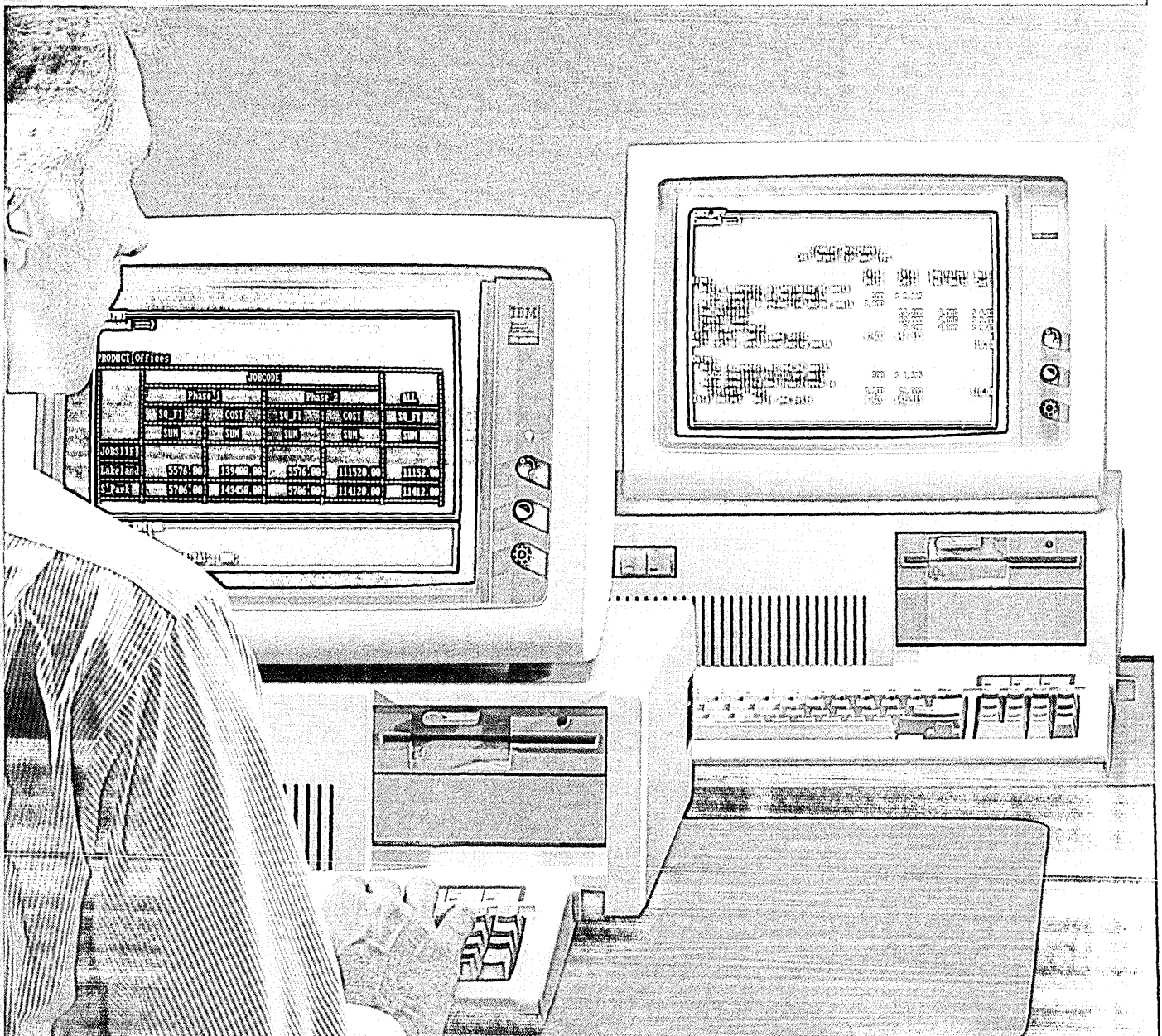
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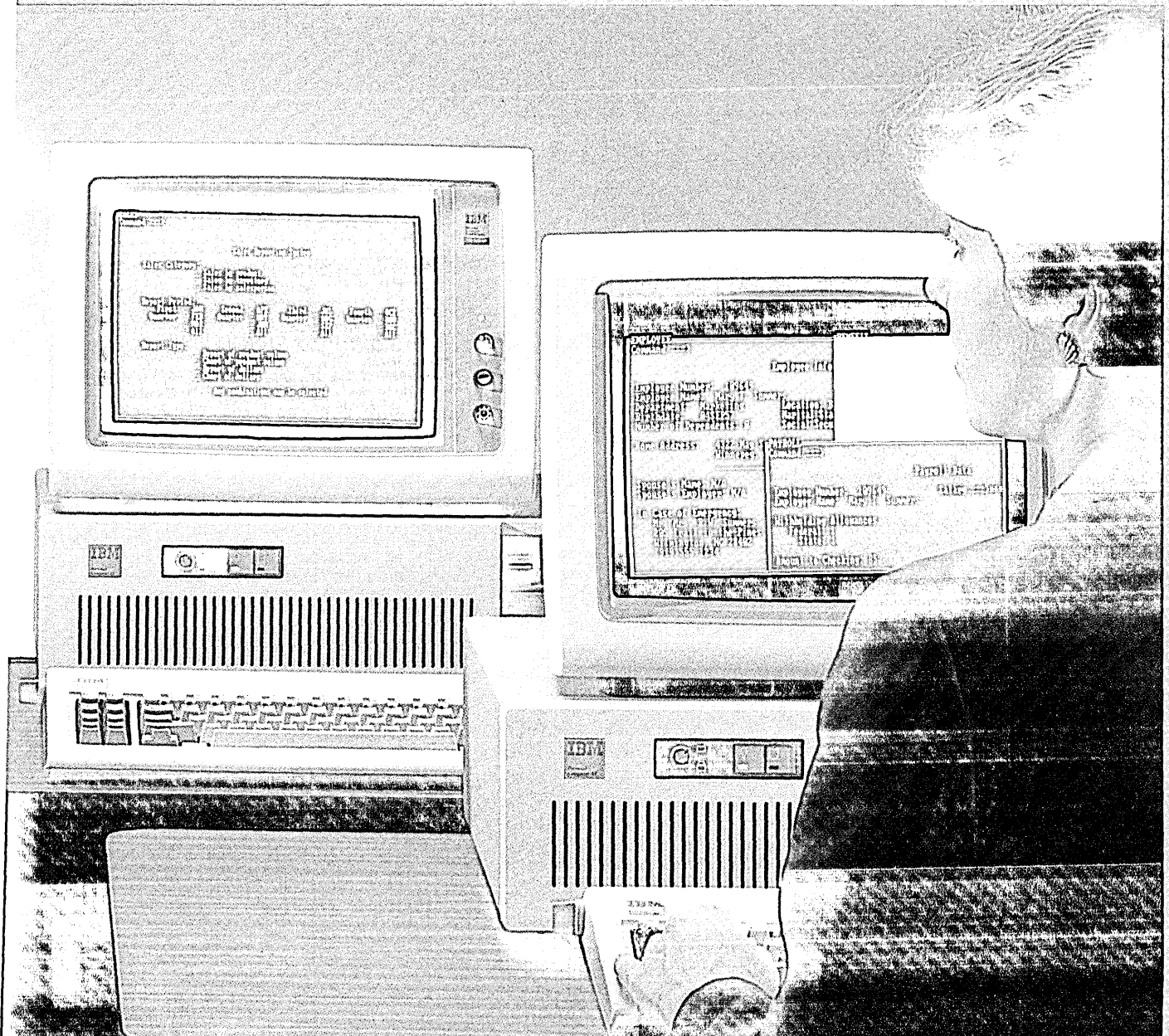
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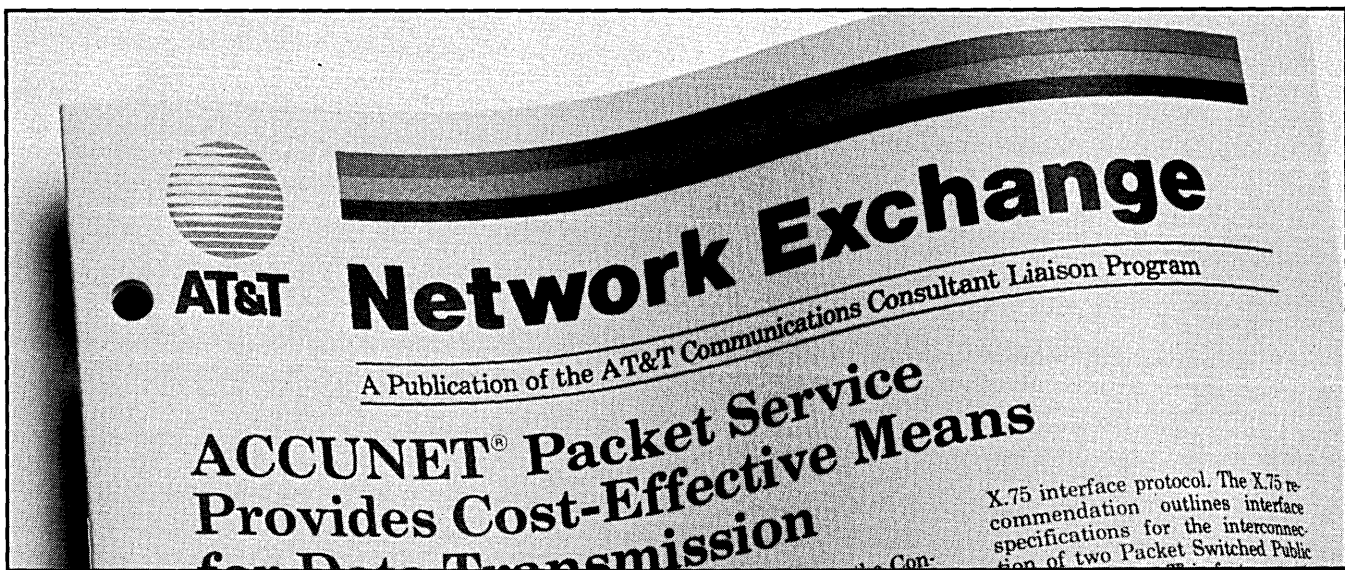
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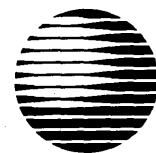
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READERS' FORUM

explain everything to everybody so they won't get the idea that you're some kind of idiot.

```
BUG      param1 : [enumeration of "compile," "run time,"
                "comment"]
        return : [random discontinuity]
```

Debugging. What a chore! What would you give for a tool that would let you avoid the tedium of debugging? A dream, you say? Wrong! It's here: BUG is just the command you need! Don't be fooled by other so-called miracle techniques that claim to keep out as many bugs as possible. *You* know that programs *always* have bugs, *no matter what*. Here is the amazing secret of debugging your programs: *put them in yourself!* Then when it comes time to debug, you already know where they are! Call BUG to insert a compilation bug, a run-time bug, or even a bug in your comments. (Many others to choose from soon!) When you reach the test stage of your project, just go through the code and throw out all those calls to BUG. Then watch your code work fearlessly! Easy? You bet! Using BUG lets you get bugs out—*fast!*

```
ENCRYPT MESSAGE  param1 : [meaningful error message]
                return : [encrypted error message]
```

No longer must you labor long hours to come up with those computer-style error messages like "E10211" and "A-33519" that are always de rigueur for any high-tech system. Let RICH style your error messages for you. Just give ENCRYPT MESSAGE a concise, enlightening description of the error condition, and RICH will produce a version for the user. The resulting message is encrypted so craftily that any sentient being will be completely gripped by listless despair upon viewing it. Future enhancements to ENCRYPT MESSAGE will produce an Error Message Translation Table for the programmer, suitable for extracting ransom, or for throwing under the stuff in your desk drawer.

```
END PROGRAM    param1: [program of RICH commands]
                (no return)
```

Now that you've done the hard part—coming up with this great idea and implementing it via an elegant algorithm—you don't want to be bothered by endless, gritty details. Let RICH take that reentrant 1986-2006 calendar program that accepts options for octal and hex, and finish off the drudge work. RICH will run system integration and user acceptance tests (no problem, since you've already tried it a few times and it ran like a champ, right?), comment the code, document the design, whip off a few snazzy lines of advertising copy, market it, generate copies, and distribute your little dream of a tool to a grateful world. RICH's END PROGRAM will even automatically handle any crank phone calls from pointy-heads who thought it was supposed to run under DOS. All this for no extra charge, and END PROGRAM even guarantees that you will absolutely not be bothered with any return whatsoever.

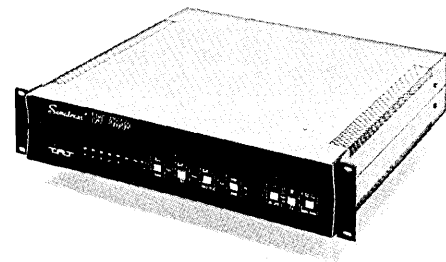
A final word: with RICH, stuffy old reference manuals are a thing of the past! Further information on RICH may be found in a selection of finely crafted Reference Glossies, beautifully bound and illustrated, suitable for prominent display on your coffee table or in your library. Those of you with the proper equipment may prefer the entertaining and instructional RICH Music Video, available soon in fine stores everywhere. Coming soon: "RICH, The Movie."

—Richard McCabe
 Arlington, Virginia

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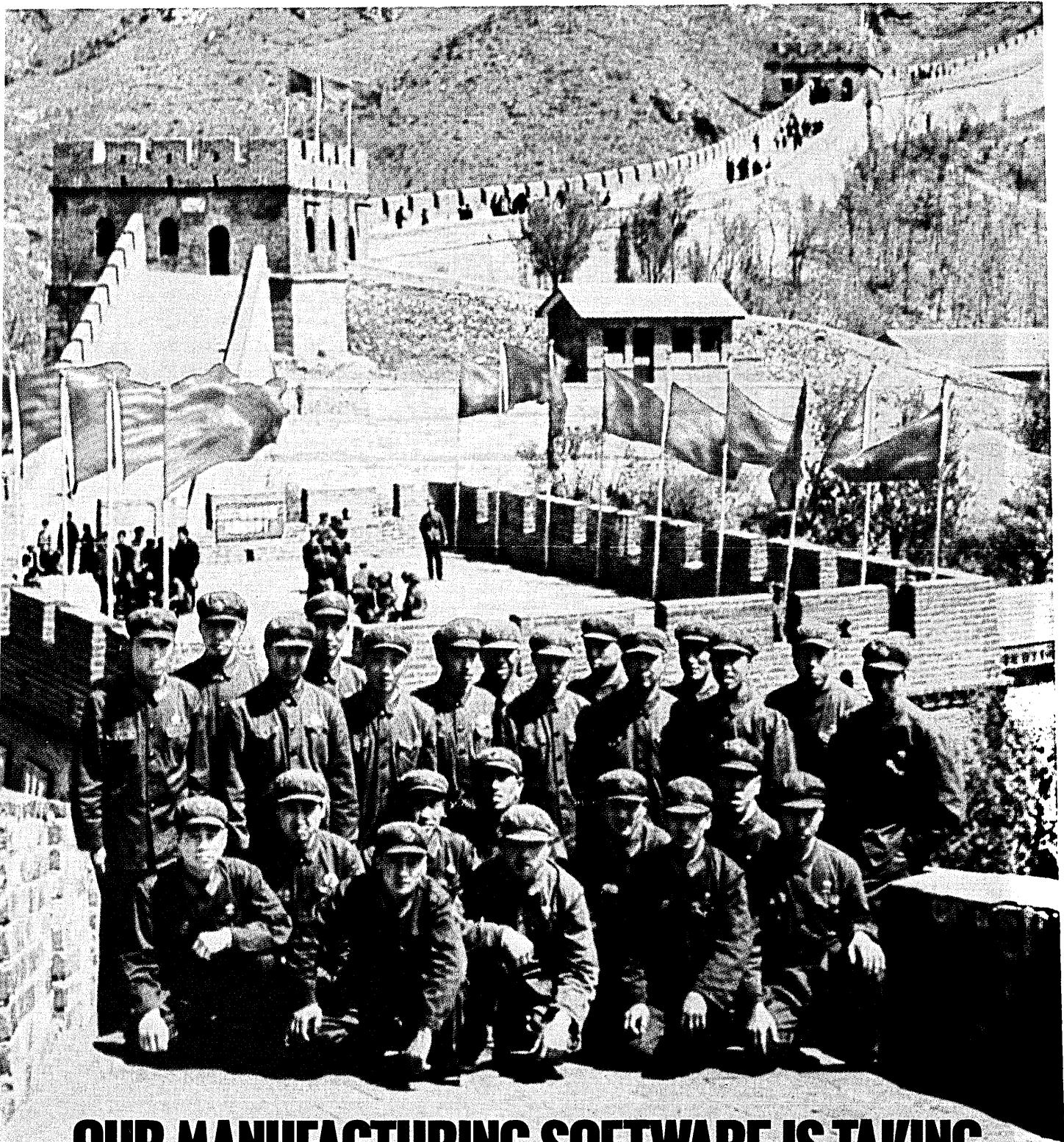
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