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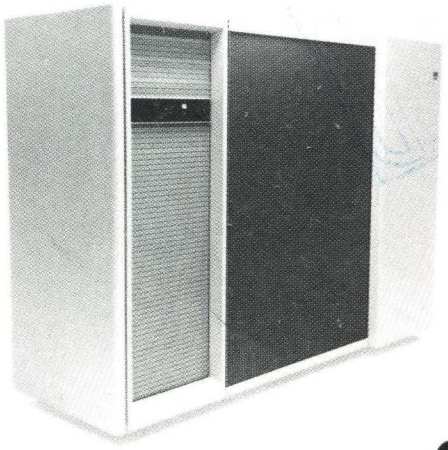

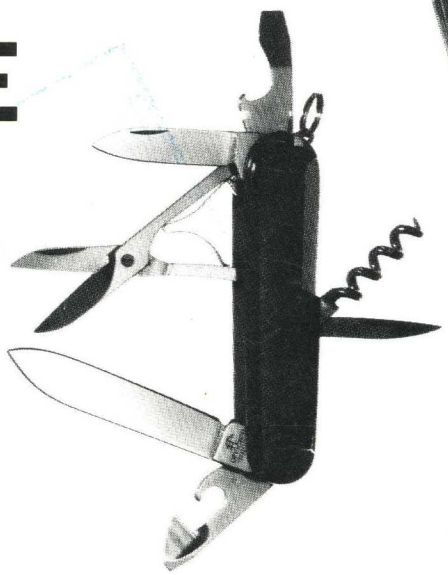

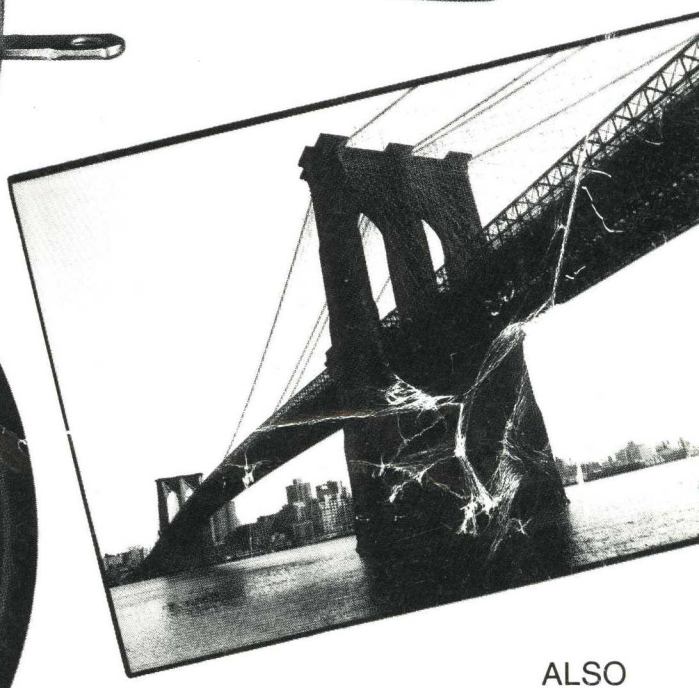

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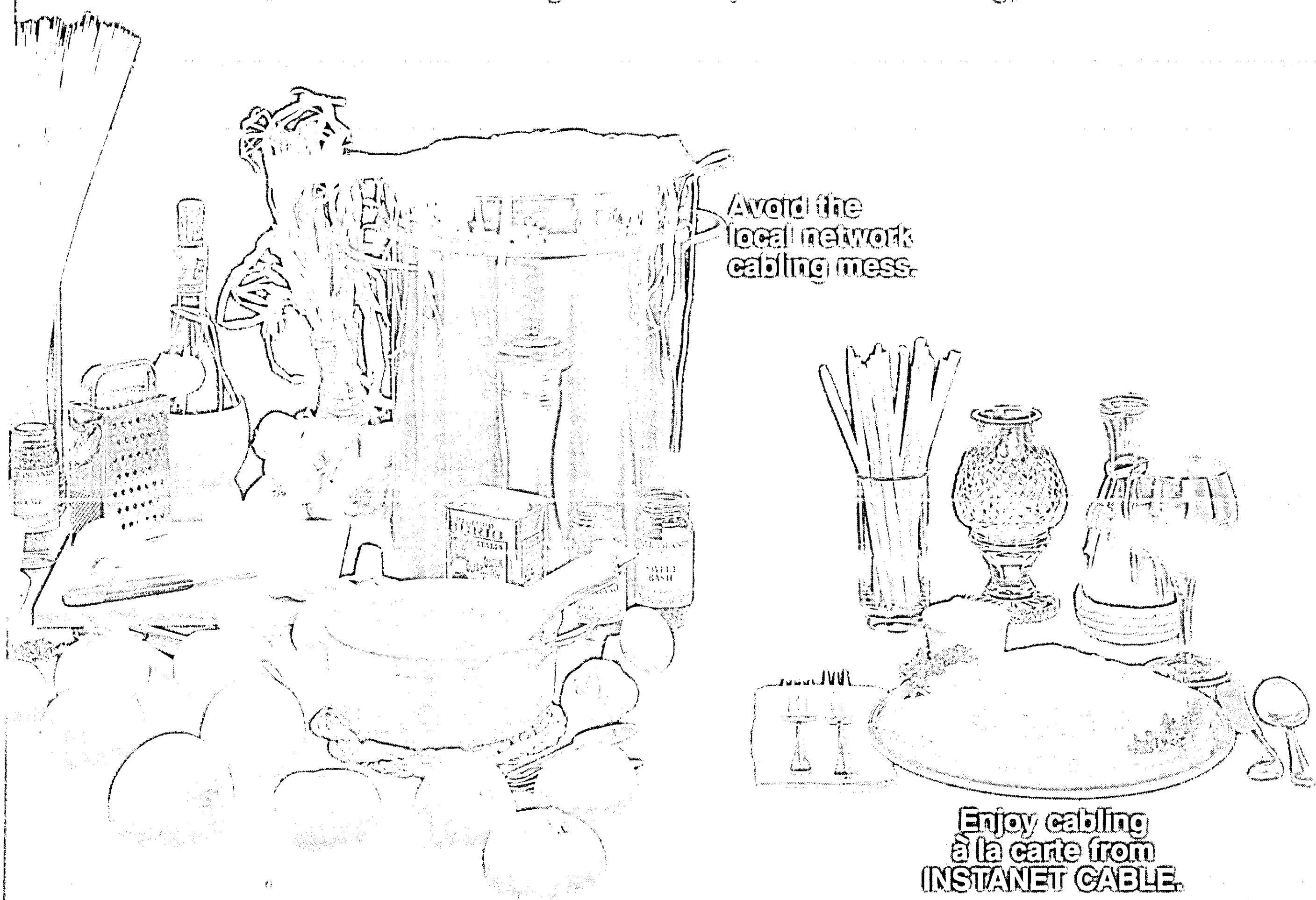

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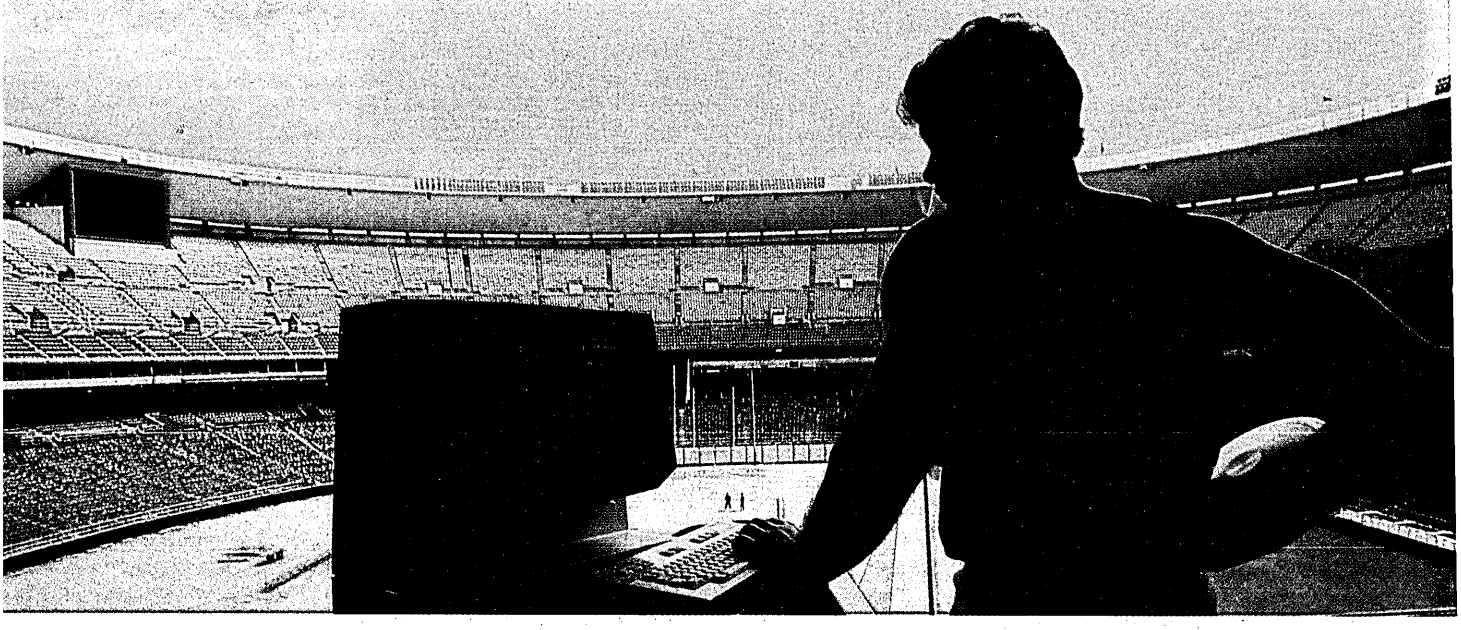
CIRCLE 4 ON READER CARD

Getting timely information to 50,000 people who need it is an event in itself.



Behind the action, pageantry and spectacle of the 1984 Olympic Games is one of the most extensive data communications systems ever built.

The Electronic Messaging System—12 computers, 1,700 terminals, 300 printers—was created for the 1984 Olympics by AT&T. And tied together with Infotron networking equipment.

The EMS is designed to replace the old system of hand-carried reports in the world's first multi-site Olympics. It does everything from displaying event results, to supplying athlete biographies for reporters, to providing schedules, qualifying information and personal messages to the participants themselves.

The system's true complexity lies in the numbers of people it serves: the 50,000 officials and reporters, coaches and athletes of the Olympic family. But the demands placed on it are very much like the demands all Infotron customers place on their networks.

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CIRCLE 5 ON READER CARD

DATAMATION®

MAY 15, 1984/$3.00 U.S.A.
VOLUME 30 NUMBER 7
This issue, 182,908 copies

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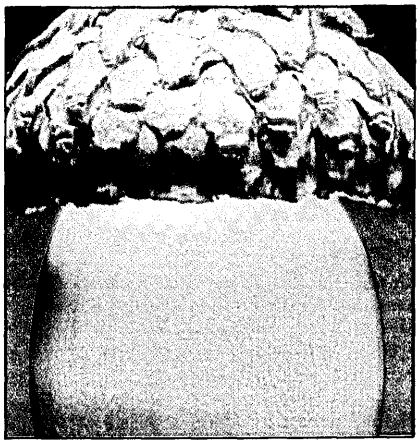

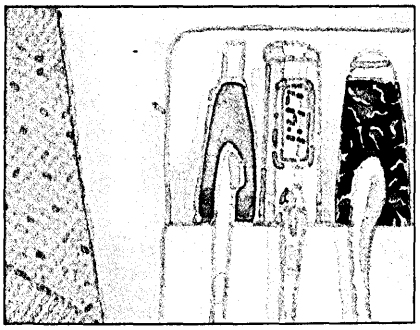

NEWS IN PERSPECTIVE

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OEM SUPPLEMENT 182-1

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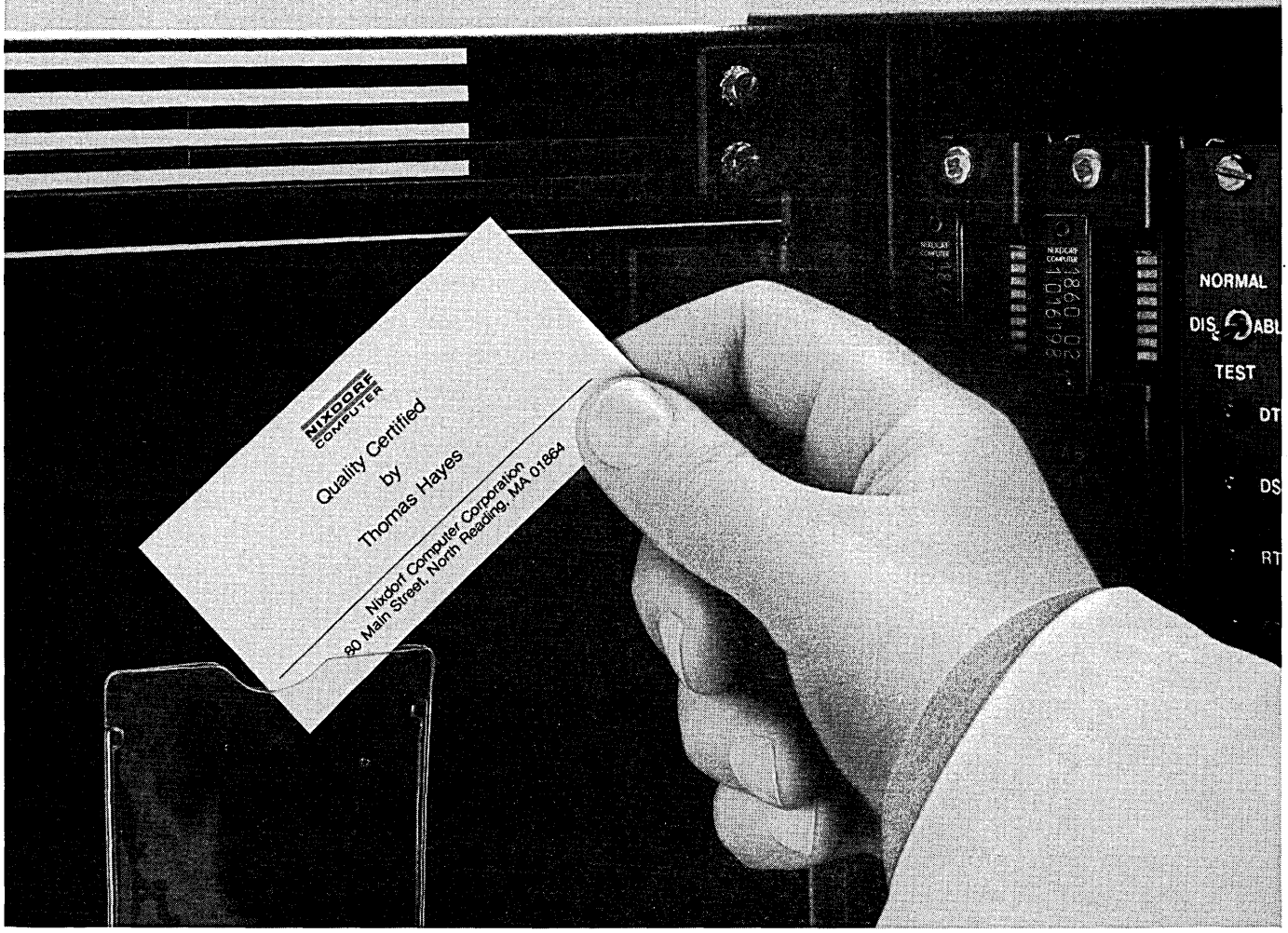

Every Nixdorf Computer system has to pass the most demanding tests in the industry. Then after that, it has to get past a very tough customer: a Nixdorf Manufacturing Quality Technician. And only when the system performs perfectly, will one of our Technicians put his or her personal card inside.

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You can put a system for as few as four users in one department. Use intermediate size systems in other areas. Or our largest computer that handles up to 400. If you have a lot of small offices, you can link up small systems. And tie them into our distributed mainframe at your regional headquarters. As well as your big IBM back at the main office.

As the whole family is fully compatible, you can change, rearrange, upgrade and add them at any-time — without any software conversion at all. Flexibility like this lets you fit the computers to your company. Not the other way around.

The HP 3000 is really several computers in one. It's a powerful data processing system with 466 off-the-shelf software packages from Accounting to Zoning. You'll find the HP 3000 just as helpful as an office system, too. And its programmer productivity tools have been designed to cut new applications development time as much as 80 percent.

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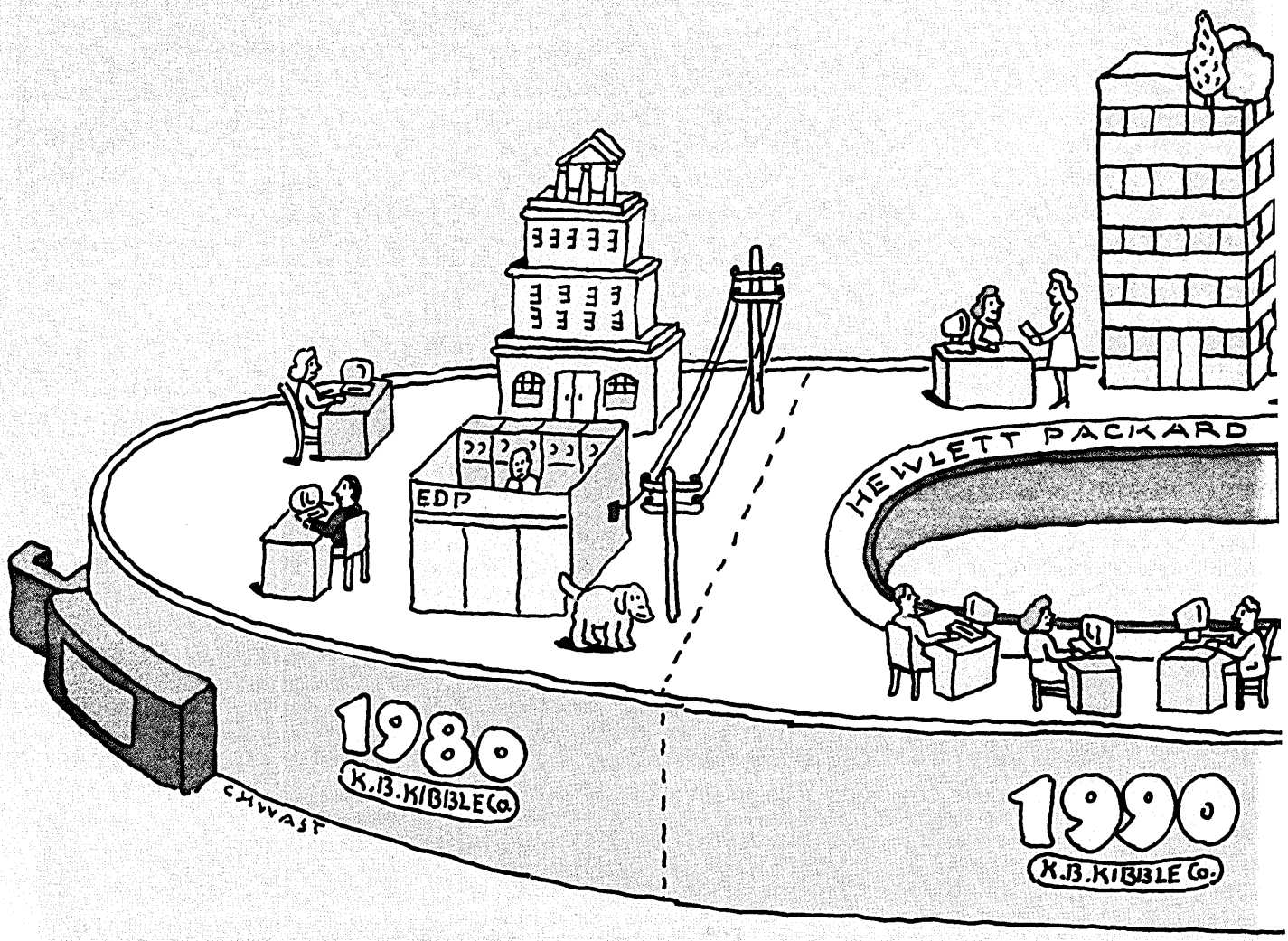

As you change, the HP 3000 computer

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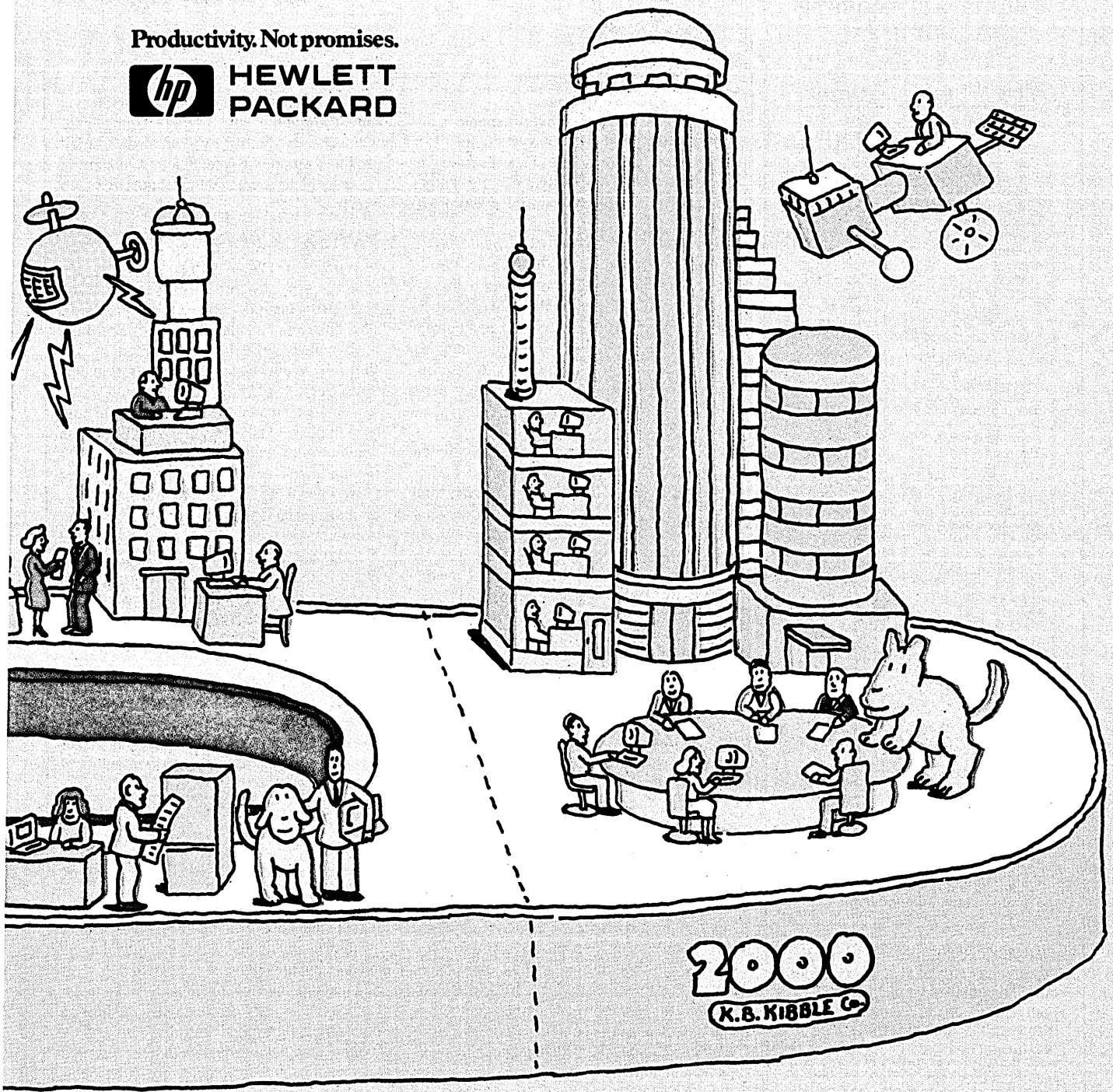

family changes right along with you.

CIRCLE 8 ON READER CARD

BD02324

LOOKING BACK

360 FEEDBACK

May 1964: After the previous month's announcement of the IBM's System/360, DATAMATION editor Bob Forest tried to separate fact from ballyhoo, and gather some of the industry's initial reactions to Big Blue's newest offspring.

One user (then using IBM's 7090, the most popular of its 7000 line), with a heavy machine language program investment, doubted his management would be willing to spend the necessary reprogramming bucks. Another user felt his company had enough '90 power to satisfy its requirements for the following four or five years. But then again, his company ordered some 360s anyway.

A commercial dper who ordered two 30s and a 40 (in addition to earlier orders for current IBM, Honeywell, and Burroughs gear) said he was "somewhat impressed" by the 360's I/O flexibility. He was going to use the 30s to replace a 1401/1460, thereby cutting his IBM rental expenditures by almost 50%. One maverick balked at his company's 360 orders saying that he couldn't imagine this being the best offer for the next 10 years.

Forest speculated that the outfit least likely to be hurt by IBM's announcement (on the surface, anyway) was GE, with its "400 compatibles" line. The problem, there, however, was that GE lacked a mass random access device.

RCA and NCR both had random access devices, and RCA was quick to point out that its 3488 had greater capacity than NCR's CRAM and more speed than IBM's announced counterpart. On the other hand, RCA and NCR lacked a complete, compatible family. Forest expected Honeywell might still be able to make some inroads into 1401 territory, although maybe at a slower pace, providing its Liberator lived up to its advance billing. Control Data had the beginnings of a family with some compatibility in the 3200-3400-3600 line, and was expected to come out with something under the 3200 within the year. It was expected that CDC's 6600 would have a year—or two at the most—of breathing room before IBM's first 70 was delivered.

The smaller competitors—SDS, Packard Bell, ASI, DEC, and others—seemed to be hit pretty hard by the 360, yet Forest thought their biggest trump card would be the ability to "marshall a small engineering crew to create a new system in six months to a year, without massive R&D overhead."

PAYCHECK POLL

May 1974: DATAMATION produced its first salary survey article from a base of 1,265 U.S. firms that cooperated in the yearly reconstruction of a salary database. The database was compiled and provided by the Philip H. Weber Salary Administration Services Section of A.S. Hansen Inc.

The survey was broken down into two main charts. The first listed jobs in conventional organizations that reported to the dp manager. The second chart listed those jobs in organizations reporting to other managers. Column headings were Nationwide Averages, Number in Survey, and Normal Salary Ranges vs. Installation Size Determined by Monthly Hardware Rental. Five salaries were reported for each position in the chart of nationwide averages.

The next part of the chart listed salaries by installation sizes. These were determined by monthly hardware rental: to $6000, $12,000, $25,000, $50,000, and over $50,000.

The nationwide average salary for dp managers in that year (in conventional organizations) was $477 a week. The low salary was $214 a week, and the high was $938 a week. Average for a systems programming manager was $382 a week, with a low of $231 and a high of $585. Applications programming managers drew a low salary of $169 a week, a high of $620 a week, and an average of $357 a week. A systems analysis manager received an average salary of $389 a week, with a low of $211 and a high of $643.

The salary survey was not broken down by geographic locations. This survey looked at a slice of the data that represented one level of pay. In other words, the numbers came from cities alike or nearly alike in their dp pay scales. These "similar" cities included Los Angeles, Chicago, Cleveland, Fort Worth, Miami, Phoenix, Tulsa, and Washington, D.C.

—Lauren D'Attilo

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CIRCLE 10 ON READER CARD

DM0584

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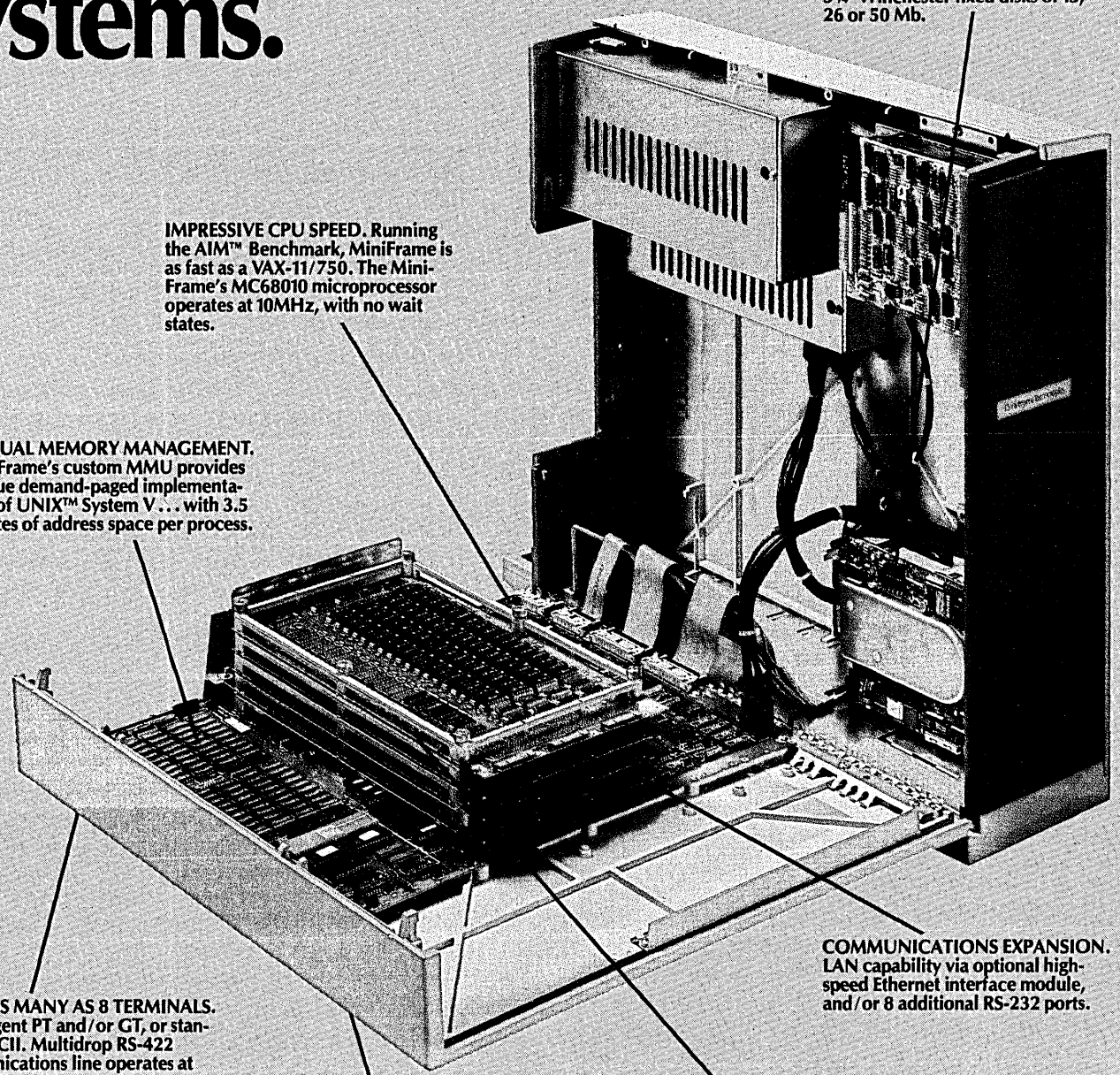

ONE TO EIGHT USERS. MiniFrame can be configured for up to 50 Megabytes of integral mass storage: 5¼" Winchester fixed disks of 13, 26 or 50 Mb.

IMPRESSIVE CPU SPEED. Running the AIM™ Benchmark, MiniFrame is as fast as a VAX-11/750. The MiniFrame's MC68010 microprocessor operates at 10MHz, with no wait states.

VIRTUAL MEMORY MANAGEMENT. MiniFrame's custom MMU provides unique demand-paged implementation of UNIX™ System V . . . with 3.5 Mbytes of address space per process.

RUNS AS MANY AS 8 TERMINALS. Convergent PT and/or GT, or standard ASCII. Multidrop RS-422 communications line operates at 307 Kbit/sec.

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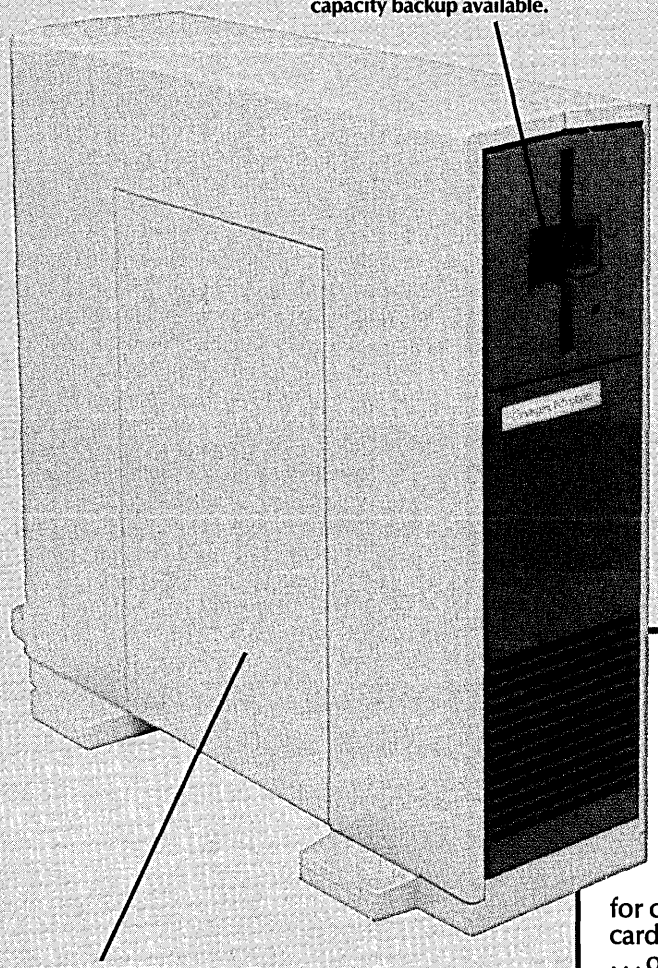
ECONOMICAL MEMORY EXPANSION. MiniFrame provides ½ Megabyte of RAM standard; up to three boards can be added for system expansion to 2 Mb.

FOR HIGH-SPEED PRINTERS, a Centronics-compatible parallel printer port is standard in the MiniFrame processor.

MiniFrame: another first from Convergent Technologies. Super-minicomputer power at PC prices.

OEMs can now meet the needs of small to medium-sized organizations for low-cost, high-performance systems capable of handling large UNIX-based applications.

The MiniFrame system—which effectively opens a whole new market for you—is unique not just for its price/performance advantages. It also provides complete flexibility in meeting requirements ranging from single-user "personal UNIX systems" to eight-terminal data-processing installations.



WE'VE CLOSED OUR CASE... now send for a complete information package. Write to Convergent Technologies, Data Systems Division, 3055 Patrick Henry Drive, Santa Clara, CA 95050. Phone: 408/980-0850. Telex: 176-825.

Convergent Technologies

Where great ideas come together

Convergent Technologies achieved this breakthrough by adapting the innovative hardware and software developed for its MegaFrame multiprocessor.

The result is a powerful, compact and expandable unit priced to give you the maximum opportunity of capitalizing on a rapidly growing UNIX market.

There are, of course, many other unique benefits of the MiniFrame system.

Convergent provides foundation software for office applications—including a powerful, Wang keystroke-compatible word processor, an advanced financial spreadsheet and complete electronic mail facility.

The Window Manager permits viewing and manipulating of up to four applications running simultaneously on Convergent's PT or GT terminal screens.

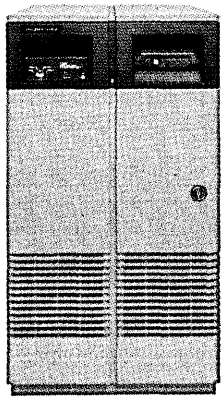
Major performance increases result from utilizing these terminals with the MiniFrame. At only slightly higher cost than standard "dumb tubes", our PT or GT terminals offer high-speed communications plus built-in processor with enough memory to execute key portions of the system code.

Programming languages include industry-standard High Level COBOL and BASIC, full FORTRAN-77, Pascal and C.

OEM prices for the MiniFrame start at less than $5,000; an eight-user MiniFrame can be configured for under $10,000. Prices like these make it an open-and-shut case for choosing the MiniFrame.

Graceful upgrade path to the MegaFrame.™

The MegaFrame, Convergent Technologies' revolutionary super-minicomputer system, utilizes multiple processors; has expansion potential to 128 users, 8 MIPS and gigabytes of disk storage. It enables OEMs to handle today's growing demand for computing services without discarding a single piece of hardware ... or being forced into expensive CPU upgrades.



Applications software can be transported—unchanged—from the MiniFrame to the MegaFrame whenever the workload requires it. The two systems are object-code compatible, allowing OEMs to provide a complete family of systems.

MegaFrame: proof that if anyone can build a UNIX system the way it should be built—it's Convergent Technologies.

CIRCLE 11 ON READER CARD

"IDMS/R represents a major advance in database technology."

Dave Litwack*

Because IDMS/R is the first relational DBMS designed for both the DP professional and the end user.

IDMS/R is not only a relational database management system, but a particularly powerful one. IDMS was made relational by removing all pointers and allowing the user to define data as tables and providing the traditional relational operators such as selects, projects and joins. The major benefit of a relational DBMS is the capacity to develop applications faster because the developer does not have to be concerned with the database design. IDMS/R provides this and much more.

For example, the Automatic System Facility (ASF) of IDMS/R is a major advance over fourth generation languages. The ASF is so comprehensive and easy to use that all a user need do, to develop an application, is define a relational record. The Automatic System Facility dynamically generates all necessary supporting structures including data definitions, screen formats, application processing logic, and documentation. So, the developer can witness the application being produced, literally, in seconds. This capability makes IDMS/R the perfect system for the end user.

Data processing professionals can use the ASF to help develop production applications. The ASF can be used to build a prototype that can be enhanced, using Cullinet's fourth generation language, ADS/OnLine, into a complex production application. But, when they build a complex high volume application using IDMS/R, DP professionals require outstanding performance. Typically, 5% of the data relationships (joins) in any application are accessed 95% of the time. With IDMS/R, they can simply change these relationships to predefined joins and benefit from a dramatic boost in performance. We call it Relational Fastpath. Relational Fastpath makes IDMS/R a unique DBMS and a perfect system for DP professionals' system development needs.

In addition, IDMS/R has the most sophisticated back-up and recovery capability of any DBMS, full integration with personal computers and is also integrated with Cullinet's complete line of financial and manufacturing applications.

In summary, IDMS/R was designed to satisfy the requirements of those who want to develop applications faster and those who have the responsibility of processing them.

For further information, attend a Cullinet Seminar. Mail the attached coupon or call Cullinet at 1-800-225-9930 (in Massachusetts, 617-329-7700) for a complete schedule.

**David Litwack is Cullinet's Vice President of Product Development. Mr. Litwack has contributed significantly to the many technical advances Cullinet has achieved in database software products, including IDMS/R. Mr. Litwack joined Cullinet in 1976. He is a Cum Laude graduate of Brandeis University and holds a Masters in Computer Science from Boston University.*

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CIRCLE 9 ON READER CARD

LOOK AHEAD

STILL WAITING ON VENUS	The company will acknowledge that it is at least one year late. Former employees say double that figure. Whichever view you take, everyone in the DEC world is still awaiting the company's new 5 MIPS Venus. Sources say we can now expect an October/November announcement ("certainly after Labor Day") of both Venus and the new single-board MicroVAX 2. Volume on both is expected for spring 1985. Also expect a slew of personal computer products from the Maynard giant, with the focus firmly on IBM compatibility. Included will be a new low-end Rainbow and local area network software linking all three of DEC's pcs to its All-in-One office automation solution and into Venus. Announcement is expected by year-end.
ADP GOES VIDEOTEX	Casting about for ways to shore up a sagging service bureau business, ADP begins testing a home banking videotex service this month in 20 market areas, covering 25 to 200 homes per area. Joining ADP will be 19 "participating" financial institutions, each paying $275,000 to $500,000 depending on the number of terminals in the test site, and 12 "observers," an ADP source says. Plans are to use AT&T's $900 Sceptre cordless videotex terminals and, later, pcs. Several pricing strategies will also be tested. The database, which includes funds transfer and automatic or manual bill paying applications, will reside on two VAX systems.
BIG BUCKS BACK SUPERMICROS	Edge Computer Corp., Minneapolis, completed the largest first round venture capital placement in Minnesota's history last month. The $11.1 million placement was larger than comparable backings for Control Data, Network Systems, Cray, CPT, or Lee Data, as well as the $10 million backing for Compaq, the record placement for a micro supplier. Money was raised among 12 venture firms, including Brentwood Associates and Interwest. Norwest Growth Fund, Minneapolis, led the venture. Plans are to build a supermicro that will implement the Motorola 68000 instruction set on a gate array chip set. Founders include former executives and engineers from IBM and CDC.
MEGATEK LAGS ON GRAPHICS	Megatek's new Merlin 9200 graphics system, slated for introduction this week, has been delayed about two weeks, company sources say. The system incorporates multiprocessors with a local hierarchical database for both graphic and textual data, local multitasking, and networking. It also uses an antialiasing technique called pixel

LOOK AHEAD

phasing, which deflects the electron beam by fractions of a pixel. The San Diego firm has applied for a patent on the technique, which it says gives the 9200 a virtual resolution of 3,072 x 2,304 pixels on a 19-inch monitor, with 4,096 colors.

M'SOFT YANKS MAC PROGRAM

A bug with potentially catastrophic consequences has forced Microsoft to recall all copies of its Multiplan spreadsheet program for the Apple Macintosh pc. The "save" command actually destroys files, we hear, but Microsoft says it has been corrected. All registered users will get a free update, and dealers who send Microsoft the defective software will soon get replacements. The recall is expected to take several weeks and severely delay the Bellevue, Wash., Mac Multiplan shipping schedule.

NCR PICKS UNIX FOR PC

NCR Corp. is quietly developing a Unix workstation based on the same proprietary 32-bit chip set that is used for the 9000 series mainframes. The machine, aimed at department level users in Fortune 1,000-type companies, is targeted for a fall introduction. It's unclear how the micro would affect NCR's Decision Mate workstations, which serve the same market and also run Unix, although only in emulation under the control of the host operating system.

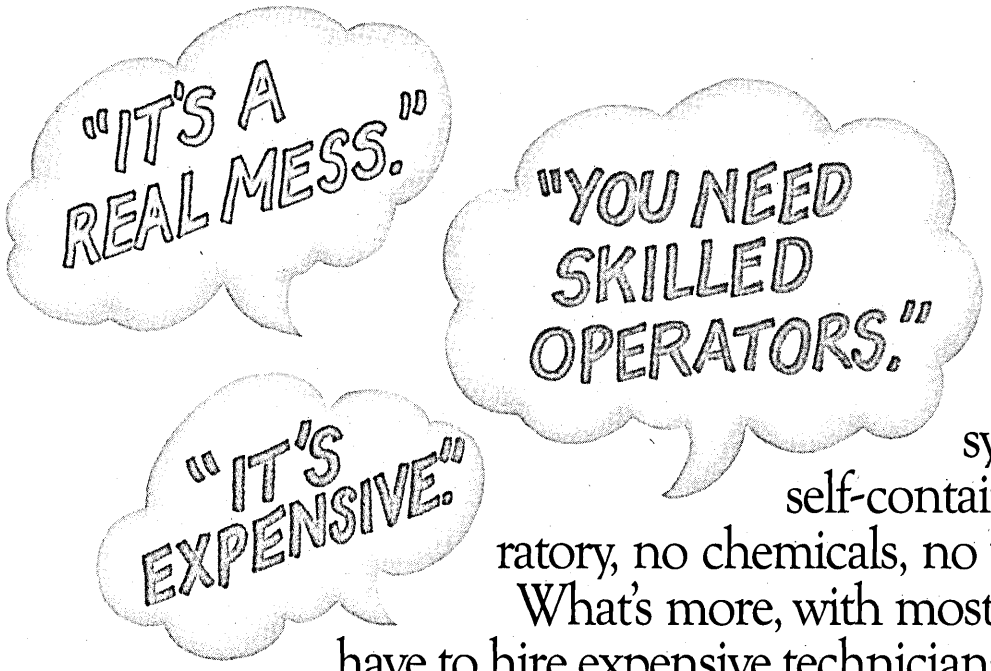
NEW GOALS AT PRIME

Prime Computer is looking to raise its oem business from virtually nothing now to as much as 10% of total sales four years hence, insiders claim. Look for Prime to grow the top end of its line and mount a large systems push in the government sector. Over the past year, the company's cost of sales soared from 42% to 47% of total revenues, in part because of a shift to low-end products with no simultaneous high-end push. The Natick firm's new 9950 "pipeline" cpu with high-speed ECL and on-board diagnostics processor is a first step to remedying this, and we've heard that a follow-on 10 MIPper will be on the way fairly soon.

RUMORS AND RAW RANDOM DATA

Printronix Inc. got a shot in the arm for its struggling microcomputer printer line when Tandy Corp. inked a contract to sell the Irvine, Calif., manufacturer's MVP line printer with the model 2000 micros....Look for a networked version of Open Access, the relational DBMS for micros from Software Products International, San Diego, at the NCC. It may also have a low-end version out by then....Masstor Systems Corp., Sunnyvale, Calif., has delayed introduction of Massnet until summer.

Forget all the you've ever in-house CO



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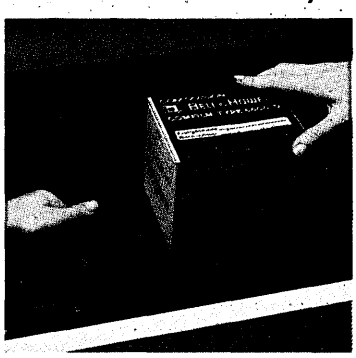

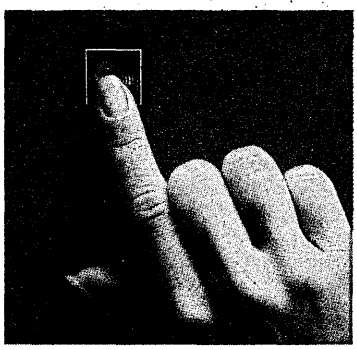

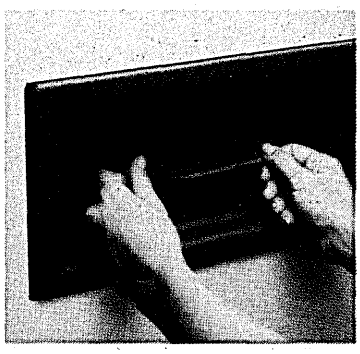

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CIRCLE 13 ON READER CARD

CALENDAR

MAY

Mini/Micro Northeast-84.
May 15-17, Boston, Mass., contact: Kent Keller, Electronic Conventions Inc., 8110 Airport Blvd., Los Angeles, CA 90045, (213) 772-2965.

The Fourth Jerusalem Conference on Information Technology (JCIT).
May 20-25, Jerusalem, Israel, contact: The Fourth Jerusalem Conference on Information Technology (JCIT), P.O. Box 29313, 61292 Tel Aviv, Israel.

BIT, USA.
May 22-26, Milan, Italy, contact: Carol Ross, Trade Promotion Officer, U.S. International Marketing Center, Via Gattamelata 5, 20149 Milan, Italy, telex 330208 or telephone (39) 2-4696-451.

MicroExpo '84.
May 22-26, Paris, France, contact: Dianne Brock, Show Coordinator–USA, Sybex, 2344 Sixth St., Berkeley, CA 94710, (415) 848-8233; or Gin Piau, Show Manager–Europe, Sybex, 4 Place Felix Eboue, 75583 Paris CEDEX 12, France, 1-347-3020.

Automach-Australia '84.
May 23-25, Sydney, Australia, contact: Society of Manufacturing Engineers, One SME Dr., P.O. Box 930, Dearborn, MI 48121; or A. Greco & Associates, 3/D "Tyrone" 80 Shirley Rd., Wollstonecraft 2065, NSW, Australia, (02) 439-4014.

Gulf Coast Computer & Office Show.
May 29-June 1, New Orleans, La., contact: James Whitsed, Gulf Coast Computer & Office Show, 119 Avant Garde Circle, Kenner, LA 70062, (504) 467-9949.

JUNE

Advanced Manufacturing Systems Exposition (AMS 84).
June 12-14, Chicago, Ill., contact: Clapp & Poliak, 708 Third Ave., New York, NY 10017, (800) 223-1956; in New York call (212) 661-8010.

Data 84/Toronto Computer Show.
June 12-14, Toronto, Ontario, contact: Lori Leivonen, 47 Lakeshore Rd. East, P.O. Box 190, Harbour Centre, Port Credit, Ontario L5G 4L7 Canada, (416) 271-1601.

INFO/SOFTWARE (Information Management Exposition & Conference for Software).
June 12-14, Chicago, Ill., contact: Clapp & Poliak, 708 Third Ave., New York, NY 10017, (800) 223-1956; in New York call (212) 661-8010.

PERCOM '84—Second International Exhibition & Conference on Business and Personal Computers.
June 19-22, Hong Kong, contact: Adsale Exhibition Services, 20/F., Tung Sun Commercial Centre, 194-200 Lockhart Rd., Wanchai, Hong Kong, telex 63109 ADSAP HX.

The First International Conference on Computers and Applications.
June 20-22, Beijing (Peking), China, contact: The Institute of Electrical and Electronics Engineers Inc., P.O. Box 639, Silver Spring, MD 20901, (301) 589-8142.

PCExpo.
June 26-28, New York, N.Y., contact: PCExpo, 333 Sylvan Ave., Englewood Cliffs, NJ 07632, (201) 569-8542.

Second World Conference on Transborder Data Flow Policies.
June 26-29, Rome, Italy, contact: IBI, Department of Policies, P.O. Box 10253, 00144 Rome, Italy.

JULY

MICROTRADE 84.
July 4-6, London, England, contact: Microscope, c/o Montbuild Ltd., 11 Manchester Square, London W1M 5AB England.

1984 National Computer Conference (NCC'84).
July 9-12, Las Vegas, Nev., contact: Registration Dept., AFIPS, 1899 Preston White Dr., Reston, VA 22091, (703) 620-8900.

SYNTOPICAN XII.
July 17-21, Chicago, Ill., contact: Association of Information Systems Professionals, 1015 North York Rd., Willow Grove, PA 19090, (215) 657-6300.

SIGGRAPH'84, The 11th Annual Conference on Computer Graphics and Interactive Techniques.
July 23-27, Minneapolis, Minn., contact: SIGGRAPH'84 Conference Office, 111 East Wacker Dr., Chicago, IL 60601, (312) 644-6610.

AUGUST

Great Southern Computer Show.
August 2-4, Charlotte, N.C., contact: Michael Chelette, Great Southern Computer Shows, P.O. Box 655, Jacksonville, FL 32201.

AAAI-84 (The National Conference on Artificial Intelligence).
Aug. 6-10, Austin, Texas, contact: Claudia C. Mazzetti, American Association for Artificial Intelligence, 445 Burgess Dr., Menlo Park, CA 94025, (415) 328-3123.

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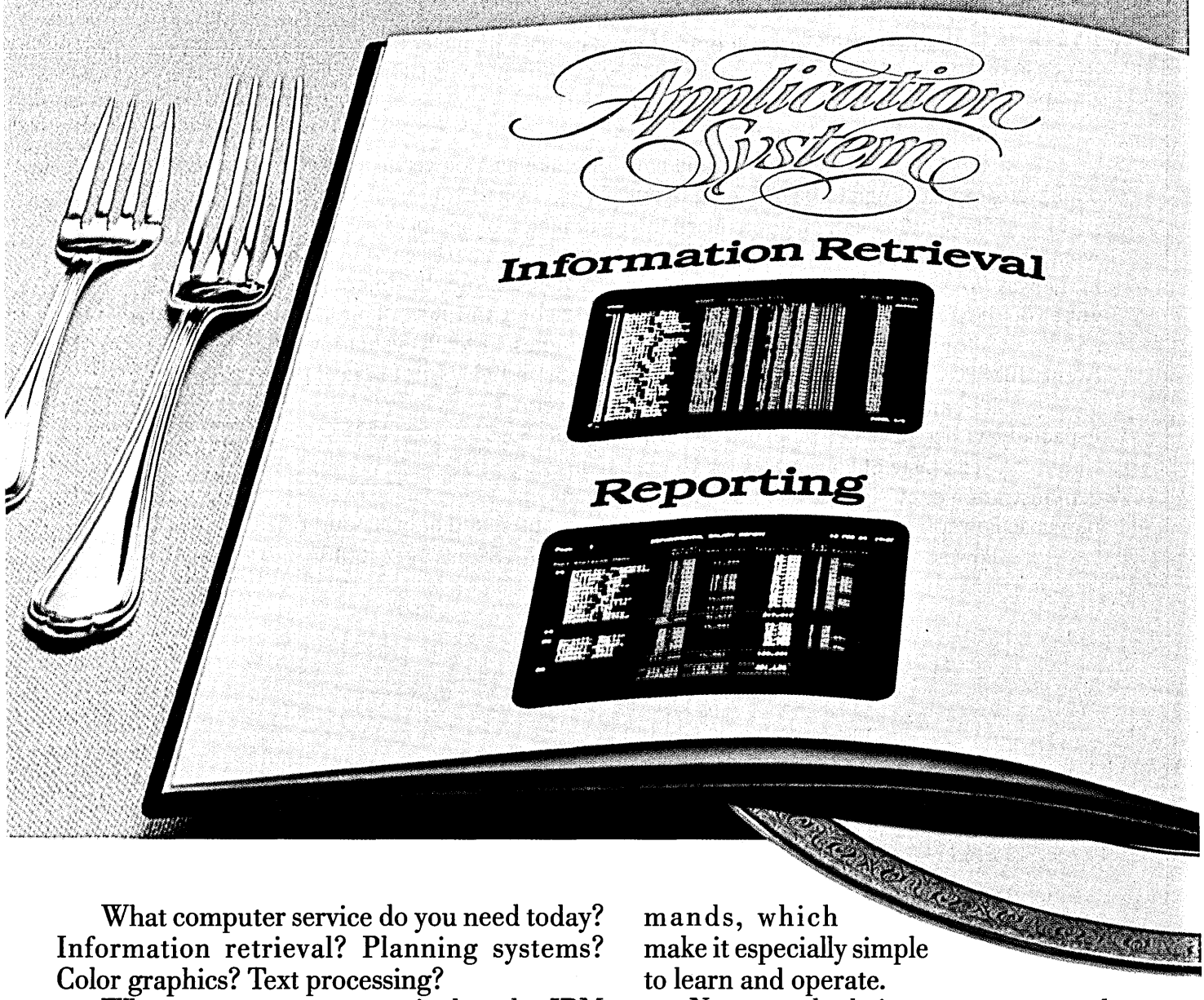
IBM computing



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LETTERS

ROLL OVER, SHAKESPEARE

seem[s] to me" your article, "Computer II, Part I" (January, p. 166). Leave it to writers of a computer magazine to abuse some of the most eloquent verse in English literature. Shakespeare and Bacon are probably looking down from heaven and frowning, "Lord, what fools these mortals be!"

Why don't you stick to something you know more about? Your prose isn't great, but your verse is worse.

VINNIE SENATORE PRATT
Totowa, New Jersey

HAMMER IT HOME

Regarding Dr. Michael Hammer's article, "The OA Mirage" (February, In Focus, p. 36), I simply cannot agree with the author's flip "bad news" that OA cannot be cost-justified, cannot be sold to senior management, and has no future. Certainly anyone familiar with office functions cannot advocate removing word processors and reinstalling typewriters in the belief that typewriters are cheaper and more productive. The problem with office automation is not the medium, but rather the management of it. If, in fact, the time saved by OA is consumed by an enormous increase in volume (typing, revising, communicating)—or by longer coffee breaks—and if this volume is not necessary, then management should reduce it.

My perception, however, is that the increased workload in the automated office (on the order of double per secretary) is necessary. Revisions to text generally result in better, clearer, and more understandable communication and enhance the professionalism of the office.

I wholeheartedly agree with Dr. Hammer that simply increasing the efficiency of administrative tasks does not necessarily translate into meaningful benefits for the firm. Company management controls the tasks and must insure that meaningful benefits are achieved. Also, it is recognized that the realm of office automation is larger than word processing, but the paperless society is still somewhere in the future. I challenge the author to toss out his terminal (word processing system) and write his articles on a continuing basis using a typewriter. If he can, then he is one of the very few writers who can do without OA. I, for one, rejoice at the improvements in day-to-day productivity achieved with word processing. How many times in the past were obvious typos or improper grammar not corrected in the eagerness to "get the work out" because it would take too long to retype? How many secretaries are there who were previously requested to stay for overtime, but no longer need to do so because their work has been made easier through word processing? Any objective examination of today's daily office tasks compared with a few years ago should result in the conclusion that word processing is useful, productive, has a future, and that costs can be justified.

W.K. HUTCHINSON
Rockwell International
Seal Beach, California

BITS AND BYTES REVISITED

I am writing to point out certain errors in the letter from Professor Henry C. Thacher Jr. (February, Letters, p. 30) entitled "Of Bits and Bytes."

1. I assume a typographical error in the factorization of 2.5×10^{14} into $2^{-2} \times 15^{15} \times 2^{15}$. The central factor in the last "phrase" should be 5 and not 15.

2. Professor Thacher is wrong in asserting that 5^{15} is a 35-bit integer. If he checks, I am sure he will agree with me that it is, in fact, a 34-bit integer, so that the product of 2.5×10^{21} requires only 68 bits and not 70 for exact precision.

3. If the resultant unavoidable error were as large as he says, we couldn't possibly use computers for tasks such as banking or sending rockets into space. Surely, since the *least* significant bits are the ones "lost," the magnitude of the error is 1 in 2^{25} or 10^{-8}.

4. Finally, I take issue with his statement that the limitations of nondecimal arithmetic are unavoidable. On the one hand, multiple precision routines can be written to handle numbers with greater accuracy than the chip manufacturer allowed for . Alternatively, software can be employed to detect when the machine is reaching the limits of its precision in numeric representation and to consistently round off to zero insignificant arithmetic (as opposed to logical) differences. Even a $30 Timex-Sinclair, powered by the Zilog Z80, can do the latter!

D.L. GIBBINS
Secretary/Treasurer
Timex Sinclair Users Group
Vancouver, British Columbia

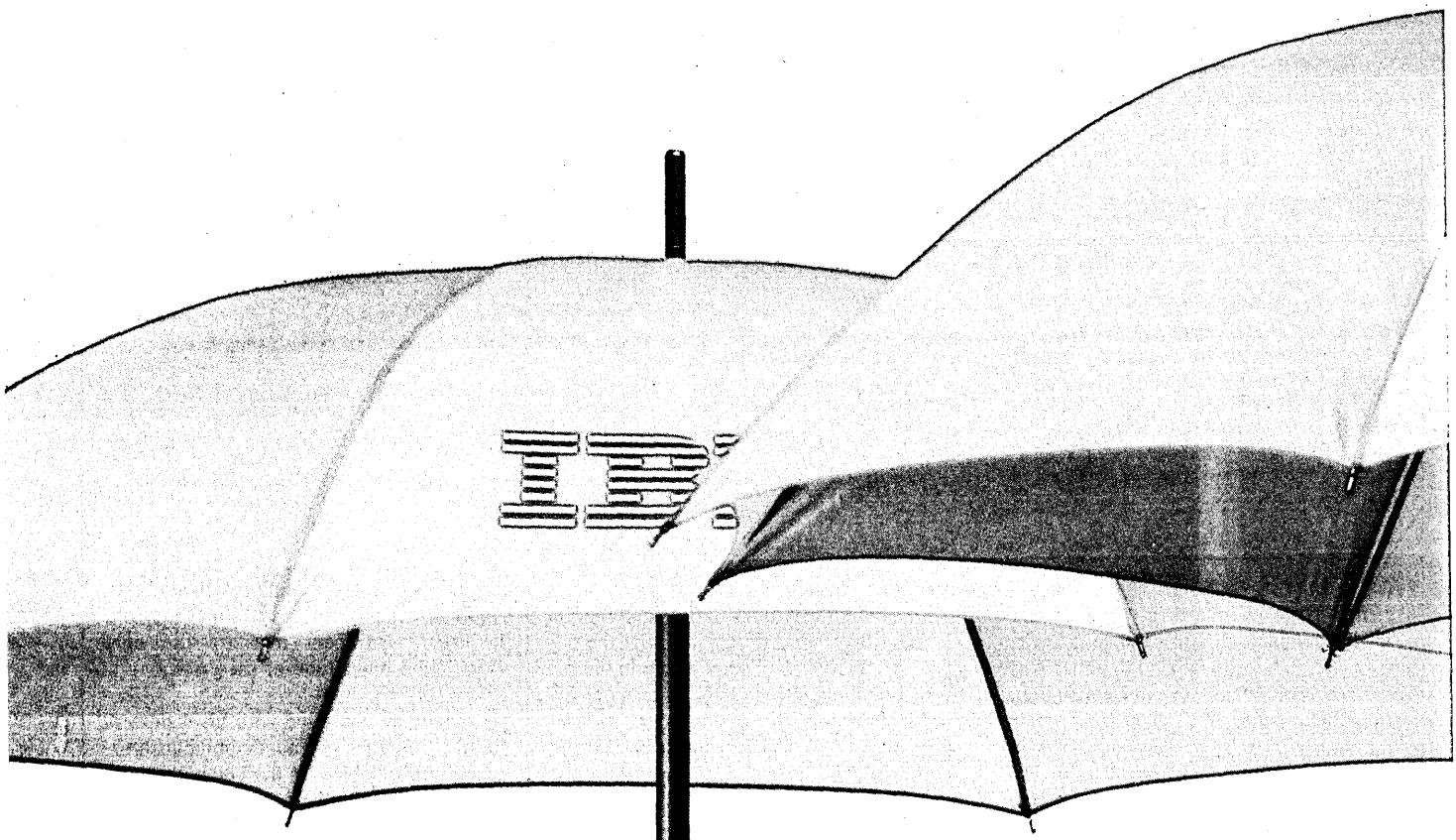
INORDINATE ORDNANCE

Your "Which Came First?" in the February issue (Looking Back, p. 8) was interesting, particularly because I grew up with it all and was introduced to ENIAC when I was at summer camp in 1948.

I would point out one error which, I might mention, I made several times myself while attending Purdue University during the same period. The correct spelling of the Army department located at Aberdeen, Md., is U.S. Army Ordnance Department (no "i" in Ordnance).

L.E. SMITH
Delco Electronics
Kokomo, Indiana

Your comments on DATAMATION are always welcome. We do reserve the right to edit the letters for either brevity or clarity. Letters should be addressed to Editor, DATAMATION, 875 Third Ave., New York, NY 10022.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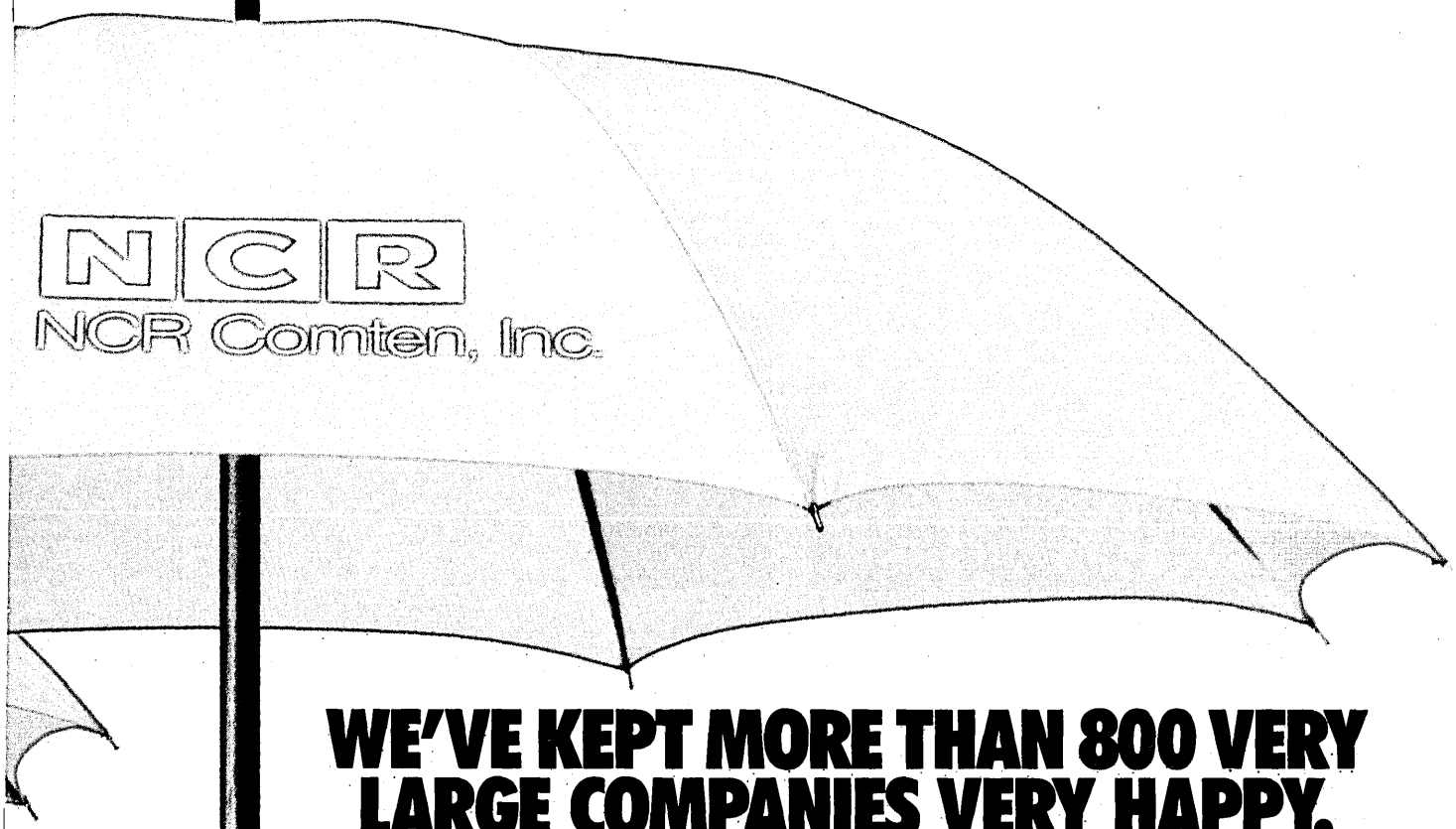

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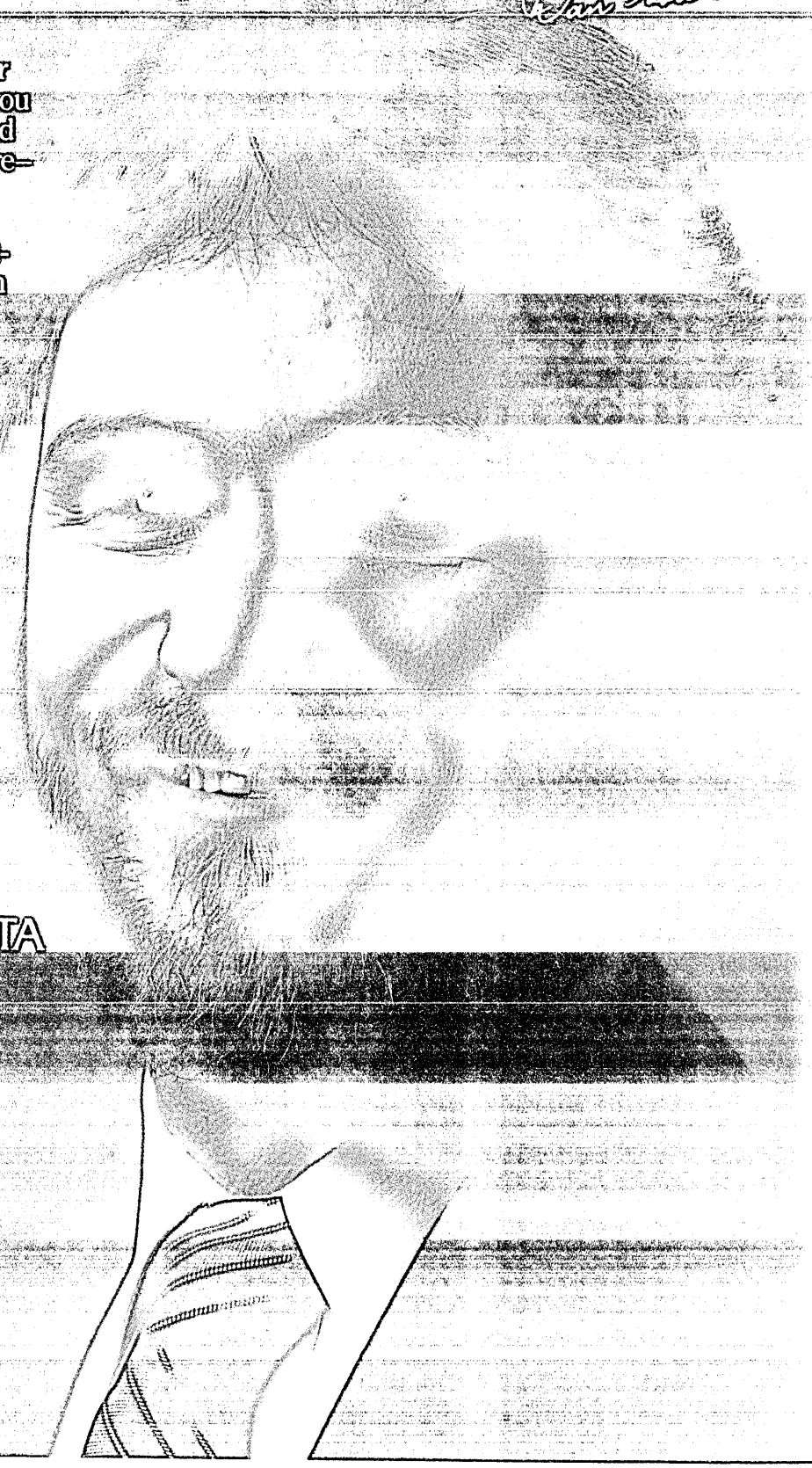

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CONTROL DATA

CIRCLE 18 ON READER CARD

Rebecca S. Barna, Editor

EDITORIAL

. . . AND THE VOICE OF THE TURTLE . . .

ILLUSTRATION BY DORIS ETTLINGER

The arrival of spring is marked by different events in various parts of the country. In the South, the magnolias and dogwoods explode into color. In Washington, the cherry blossoms appear, followed shortly by tourist hordes. In the New York area, it is time for the hockey playoffs. And somewhere, Pete Rose is limbering up his aging body for just one more campaign.

For us at DATAMATION, these past few springs have been marked by the appearance of the DATAMATION/Cowen & Co. annual survey of the computer industry. Once a single fat document, the results have now been cut in half. The computer/telecommunications answers appear with the first buds of spring; the mini/micro results show up just as the New England leaves begin to turn.

From our vantage point, we see results from literally dozens of industry surveys. Some make sense. Others don't seem to tally with what we have learned about this industry and the way user installations approach their plans for the next 12 to 18 months. This survey is based upon information provided by you, the DATAMATION reader, and is therefore a pretty fair cross-section of this industry. So, what you're seeing in news editor John Verity's story beginning on p. 88 reflects what you told us.

Twice each year, Cowen's partners gather up their friends in the financial community and interpret, for them, the results you are reading. To vary the program just a bit, Cowen's agenda planners include talks by senior executives of large and small vendors, as well as a panel discussion with real live MIS executives.

This year, one of the featured speakers was Carl J. Conti, president of IBM's Data Systems Division. This is the part of the IBM empire where the large systems are built. Although the popular press seems to believe Big Blue is concentrating 100% of its efforts on the PC family, IBM keeps reminding them of the very large percentage of revenue and profit still coming from big iron. When Conti talks, *everybody* listens—and carefully.

Now we all know IBM executives are famous for speaking at some length and saying little. It takes some parsing, digging, and extrapolating to grasp what is really being said. Conti's talk this spring was no exception to the rule. What follows is DATAMATION's interpretation.

First off, IBM's large-scale mainframe business was very good in 1983 and is following on plan during the first quarter of 1984.

Second, IBM has concluded the demand for MIPS by its customers is increasing at some 50% per year. This somewhat startling claim was instantly confirmed by one of the MIS managers present at the meeting.

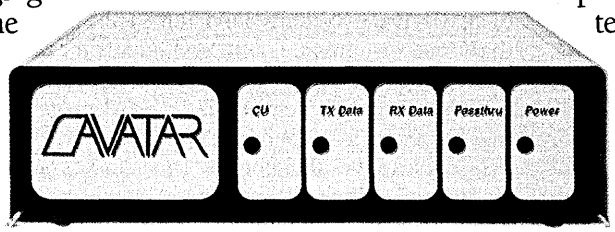
Third, and it should keep IBM's pcm competitors awake nights, Conti suggested IBM is gradually moving toward passing its manufacturing cost efficiencies back to the customer through price reductions. This perhaps explains the somewhat mysterious "X" announcement more clearly than any other pronouncement made by our industry pundits.

Finally, just to show IBM is not ignoring its competitors who have been thriving in the transaction processing area, Conti described the now generalized Airline Control Program (ACP) as a starting point for more serious efforts to recapture this market. The emphasis on TPF (its new name) was interesting since the transaction market is one of those areas where IBM to date has not been overwhelmingly powerful. Dpers running banking networks or on-line retail POS can expect to hear from their friendly IBM sales team fairly soon.

So, read our story and ponder these remarks. Don't forget, you are reading a composite of what you, the dp installation, told us.

For all of you who helped make this story possible, many thanks from DATAMATION and Cowen & Co. We'll talk to you again, next time concentrating on minis and micros, when the first hint of fall is in the air. ✱

Introdu
LinkTha



Today, you have to live in two different worlds. One belonging to IBM. The other to everyone else.

With that in mind, companies have come along with a variety of products that attempt to link the two together. But somewhere along the line, they all look a little dumb.

Enter the AVATAR PA1000™ Protocol Converter. It's the most intelligent way to bring personal computers, portable computers, or low-cost ASCII terminals into the IBM coaxial environment. For the first time, overburdened DP/MIS executives can look forward to truly smooth integration, minimal confusion, and fewer demands on their time. And users can get an affordable, easy-to-use way to tap the riches of their IBM mainframes.

So if you're looking for the best of both worlds, keep reading. And you'll see why the AVATAR PA1000 can out-think any product on the market.

First of all, the AVATAR PA1000 is an almost *universal* link. With no modification, it connects to virtually any personal or portable computer you have: IBM, Apple, DEC, TRS 80, Kaypro, COMPAQ, NCR, and others.

The AVATAR PA1000 also connects to the DEC VT100, IBM 3101, LSI ADM5, Televideo 910, ADDS Viewpoint or other compatible terminals.

The PA1000 connects coaxially to an IBM 3274/3276 cluster controller, so whatever personal computer or terminal you use will perform all the functions of an IBM 3278-2. The coaxial connection also means you won't be in for a future shock: ever-changing IBM protocols will be no problem.

	AVATAR PA1000 vs.	IRMALINE™
Easy to install	YES	YES
Q/A installation	YES	NO
English language commands	YES	NO
Help screens	YES	NO
Keyboard types	5	1
Remote dial-in/ security password	YES	YES
Dual host access	YES	NO
Local screen printout	YES	NO
3278 status line modes	3	1
Price	$995	$1395
Availability	Immediate	(?)

Two hosts are better than one. So in addition to the coax connection to IBM, the

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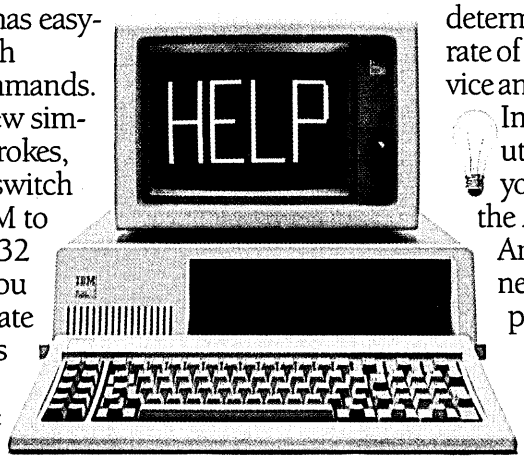
ging The tThinks.

AVATAR PA1000 gives you an *extra* RS232 port. That gives you access to other local or remote asynchronous host computers or local printers.

HELP! If you need it (and who doesn't) you have help screens to put you back on track. The PA1000 also has easy-to-use, English language commands.

With a few simple keystrokes, you can switch from your IBM to the extra RS232 port, giving you access to private data networks and public databases like Dow Jones. And when you switch back, the AVATAR PA1000 is smart enough to *remember* your IBM screen.



In a distributed terminal network, remote dial-in from personal computers or asynchronous devices is increasingly important. You can dial into your PA1000 at the nearest cluster controller, and reduce communications costs dramatically in the process.

Just by typing "1-2-3" (how much simpler can you get?), the PA1000 *automatically* determines the baud rate of the attached device and is ready to go.

In just five minutes (no kidding) you can install the AVATAR PA1000. And you don't need to be a computer operator.

The AVATAR PA1000 even gives you a file transfer option that lets you transfer information back and forth between your personal computer and an IBM mainframe.

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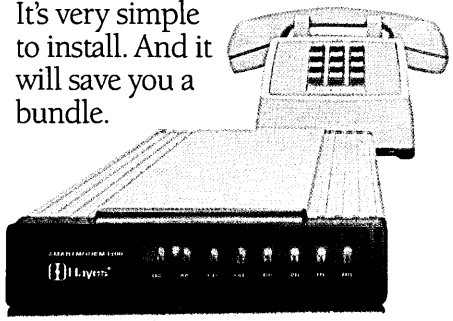

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CIRCLE 19 ON READER CARD

IN FOCUS

THE SEED OF EMPIRE

Twenty years ago, computing's mightiest oak first sprouted.

by Robert L. Patrick

The popular press loves to carry articles about two guys working in a garage and finding riches in the mad world of computing. Most readers are also familiar with Tracy Kidder's *The Soul of a New Machine* (1981, Little, Brown), which described the creation of a new computer. But there is a lesser known story that affected many more of us.

In the fall of 1961, one of the most successful companies in the world faced falling market forecasts for its current products and vigorous competition from its seven major competitors. Further, if the business were allowed to follow its usual pattern, multiple simultaneous development projects would be necessary and the investment for these would have strained the U.S. Treasury or broken the Common Market.

The IBM corporate culture, then as now, had a mechanism for collecting knowledgeable but ideologically opposed individuals in one room and keeping them there until a consensus emerged. These knock-down-and-drag-outs are known as task forces. In the latter half of 1961, Don Spaulding, then the head of group staff, recognized that business as usual would merely perpetuate IBM's problems. To create a new strategy, he promoted a task force, code named SPREAD.[1]

SPREAD's members and their current affiliations are listed in Fig. 1. Its technical membership consisted of representatives from each of the three major competing hardware development groups within IBM. In addition, there were members with marketing, application development, and system software experience.

For 60 days these 13 individuals lived and worked in the Sheraton New Englander motel, just outside Greenwich, Conn. Not only did they have the support of their parent organizations, they had first call on any other IBM resources they needed. On Dec. 28, 1961, they published a landmark report.[2] It addressed the concept of a family of compatible computers that would process both scientific and business applications equally well, the standards necessary for such a technical achievement, the pros and cons of this architectural approach, its marketing ramifications, the master schedules necessary for its timely introduction, the care needed to make sure IBM's revenues were not to be adversely affected, the support systems that must be in place before such a broad-based project could be successful, specific assignments for each of the major parts of the IBM development enterprise, and the framework of a project management plan to carry it all off.

The SPREAD report was truly outstanding. Not only did the team reach out boldly and propose an architectural step befitting the world's largest computer manufacturer, but it addressed all the facets that would be necessary to turn those architectural guidelines into reality.

In January 1962, the briefings started. Prior to the SPREAD report, IBM senior executives had heard and rejected a proposal for the development of a new series that was a partial approach to the global problem. Thus, when the SPREAD report was published, the stage was set for vigorous debate. After everyone had been heard, Vin Learson, then a vice president and group executive, kicked off the implementation effort when he asked a gathering of senior executives whether anyone else had a better plan, and hearing no answer, said, "Let's go do it!" Pet projects die hard, however, and it took until January 1964, two years later and barely three months prior to announcement, before the last of the competing development ventures was finally laid to rest.

On April 7, 1964, System/360 was announced, and so began the evolutionary process that still dominates most of the computing world.

On April 7, 1964, System/360 was announced, and so began the evolutionary process that still dominates most of the computing world. Before the announcement of 360, the life of a machine design was only four or five years. The 360 architecture, and its directly related progeny, has been in the field almost 20 years (the first Model 40s were delivered in April 1965), and shows every sign of being around several more years.

Many people in computing have difficulty remembering a world without jet airplanes and television. Some folks also take compatibility within families of computers for granted. Further, most of the larger machines you've worked with may have processed data, performed mathematics, and communcated to a terminal world in a natural fashion. Difficult as it is to believe, computers have not always handled the upper- and lower-case character sets made possible by the 8-bit byte.

Some of us who recently purchased

[1]The group's official name was Systems Programming Research and Development, but it was fondly referred to as Spaulding's Plan to Reorganize Each and All Divisions.

[2]"Final Report of SPREAD Task Group," as reproduced in the Annals of the History of Computing, Vol. 5, No. 1, Jan. 1983, by AFIPS Press.

PHOTOGRAPH BY TOGASHI

personal computers have rediscovered, much to our chagrin, the difficulties a minor hardware failure can cause in an unchecked computer, something the System/360 eliminated in the mainframe world. Today it is commonplace, even in our smallest computers, to have the operating system reside on a disk drive so the software can behave as an extension of the hardware without a severe performance penalty. While there were a few computers with disk-oriented operating systems prior to the 360, the 1964 announcements committed the largest computer corporation to just that course of action across a spectrum of machines. While we old-timers cuss 10- to 15-year-old production applications because they are so hard to maintain, we are blessed by the fact that they continue to run even when faced by constantly growing data volumes—a phenomenon attributable to the insight of the System/360 architects who provided us with computers that had virtually unlimited address space.

The production conversion effort was more formidable than anyone had imagined.

Even the 360 announcement was spectacular. Amid the invitation-only meetings, the color movies, and all the hoopla, IBM announced a family of six compatible processors, the biggest of which was 50 times faster than the smallest. And if that wasn't enough, it simultaneously announced 150 other products! The minds of the seven dwarfs[3] were boggled by what Snow White had just done to them.

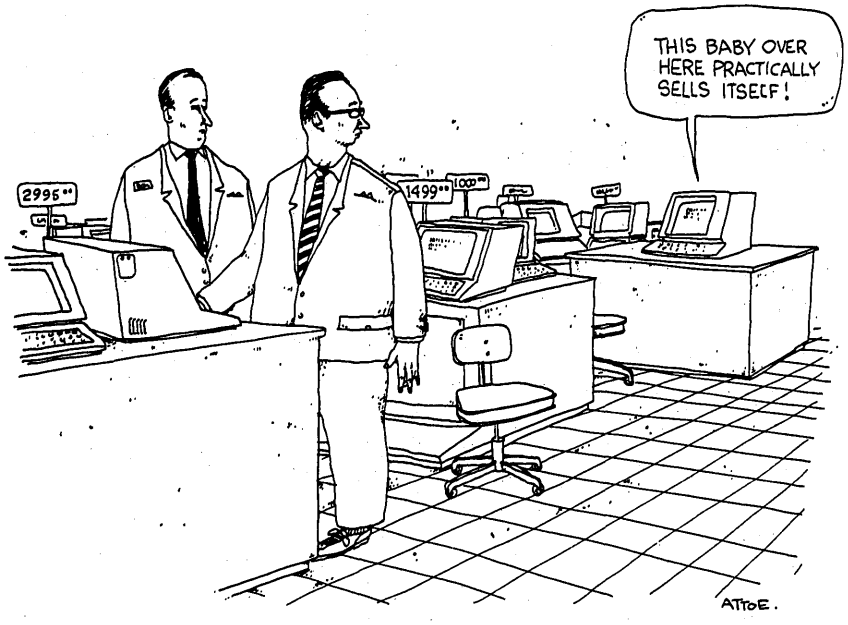
Between publication of the SPREAD report in December '61 and announcement of the 360 in April '64 lies another interesting story. The SPREAD report presented a concept; it provided principles but did not specify architectural details. The six processors were developed at three locations, one in England and two in the United States. In addition to the processor work, there were companion developments in disk files, tape drives, line printers, and crt terminals. If the number of devices, options, and features are counted, several hundred coordinated efforts were under way.

The leader of this massive effort was Bob Evans. The manager of processors was Fred Brooks. The architectural details were conceived, promoted, debated, published, defended, and maintained by an elite team of engineers and architects led by Gene Amdahl (see Fig. 1).

Each member of Amdahl's architectural team was an outstanding engineer in his own right, but they were dedicated like the monks of yore to promoting and maintaining the holy scripture: namely, the IBM System/360 Principles of Operation (Form A22-6821-0). This document was a triumph of computer engineering. It allowed six processors to be built simultaneously in various parts of the world and when they were installed in one machine room, a program prepared for one machine could run without change on any of the other machines, provided that configuration could supply the resources the program required (up and down compatibility).

The day before announcement, the U.S. patent application was filed on IBM's behalf by the individuals listed in Fig. 1.

[3]When DATAMATION coined the phrase in the '60s, the dwarfs were Burroughs, Control Data, General Electric, Honeywell, NCR, RCA, and Univac.



CARTOON BY STEVE ATTOE

FIG. 1

ORIGINAL SPREAD MEMBERSHIP AND THEIR CURRENT LOCATIONS

J. W. Haanstra—deceased
B. O. Evans—IBM, Armonk, N.Y.
J. D. Aron—retired
F. P. Brooks Jr.—University of North Carolina, Chapel Hill
J. W. Fairclough—IBM, Portsmouth, England
W. P. Heising—IBM, Kingston, N.Y.
H. Hellerman—Amdahl, Sunnyvale, Calif.
W. H. Johnson—retired
M. J. Kelly—whereabouts unknown
D. V. Newton—retired
B. G. Oldfield—retired
S. A. Rosen—whereabouts unknown
J. Svigals—IBM, Palo Alto, Calif.

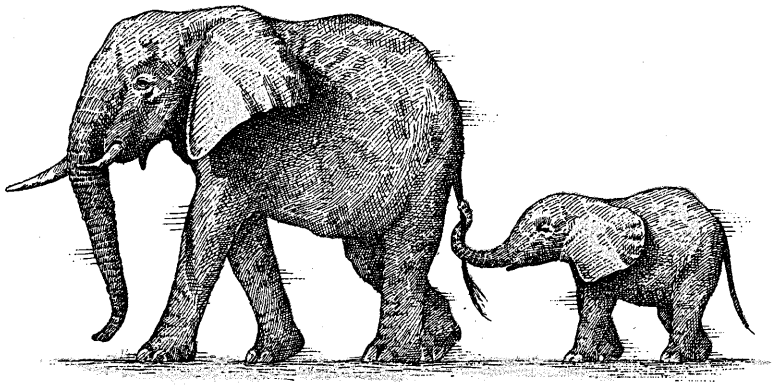
SYSTEM/360 ARCHITECTURE TEAM

Gene Amdahl
Bill Beausoleil
Gerry Blaauw
Fred Brooks
Peter Calingaert
Doug Calvert
Dick Case
Jack Greene
George Grover
Gordon Hedrick
Derek Henderson
Paul Herwitz
Jerry Ottoway
Andris Padegs
Tony Peacock
Bill Stevens
Carroll Thorne
Hugh Walsh
Bill Wright

SYSTEM/360 PATENT APPLICANTS

Gene M. Amdahl
Gerrit A. Blaauw
Elaine M. Boehm
Peter Calingaert
Richard J. Carnevale
Richard P. Case
Arthur F. Collins
Jack E. Greene
William P. Hanf
Jacob R. Johnson
Albert A. Magdall
Charles B. Perkins Jr.
John W. Rood
Bruce M. Updike
Anthony E. Villante
Helmut Webber

WHEN IT COMES TO LINKING PC's TO MAINFRAMES, ONE COMPANY IS A MILLENNIUM AHEAD.



You don't have to look hard to see why McCormack & Dodge has linked more PC's to more mainframes than any other business software vendor.

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CIRCLE 20 ON READER CARD

IN FOCUS

After a four-year period, its 131 claims were deemed unique and the patent number 3,400,371 was issued on Sept. 3, 1968. By that time, IBM had nine sizes of 360s in the field: Models 30, 40, 44, 50, 65, 67, 75, 91, and 95.

The System/360 was a mixed blessing to its early users. It was incompatible with the machines we already had installed, and a massive (mostly manual) effort was required to convert our old production codes to 360. The initial software lacked all the function that had been promised, and a good bit of it was up to a year late. In addition, when the software was delivered, it still had performance problems. I worked in one shop where we couldn't run a day's work in 24 hours.

But these birth pains were nothing compared with the magnitude of IBM's accomplishments. The System/360 was a clean design. Its checked architecture eliminated a whole class of hard-to-find errors the field had been forced to live with. The accompanying support software provided the installation manager with a Sysgen procedure that allowed him to automatically customize the system software to exploit his hardware configuration. When the production conversion effort appeared more formidable than anyone had imagined, IBM provided hardware emulators that allowed old programs to run using the new processor and its I/O configuration—an outstanding transition aid I'm sure we'll see again in the future. What's more, if your workload grew or shrank, you could drop in a different sized cpu without changing the I/O gear (this is now such a routine accomplishment that cpu changes are regularly done over a weekend).

The 360 hardware architecture has had only two major extensions in 20 years: hardware relocation and virtual memory. It is to IBM's credit that it stood steadfastly by the original architectural definition because it has brought lasting benefit to the company and its many customers.

While all of us familiar with the 360s and 370s have our private lists of deficiencies we wish were fixed, they pale in comparison to what IBM accomplished by stepping out boldly in the early '60s and providing us with a stable base of hardware and software that has already lasted 20 years. ✱

Bob Patrick is an independent computer specialist and longtime DATAMATION advisor. He has participated in the design of four processor projects, four operating systems, three database systems, and one compiler. As a consultant, he was a junior member of Gene Amdahl's S/360 architecture team in 1963 and '64, and worked on Fred Brooks' OS/360 software team in 1964 and '65.

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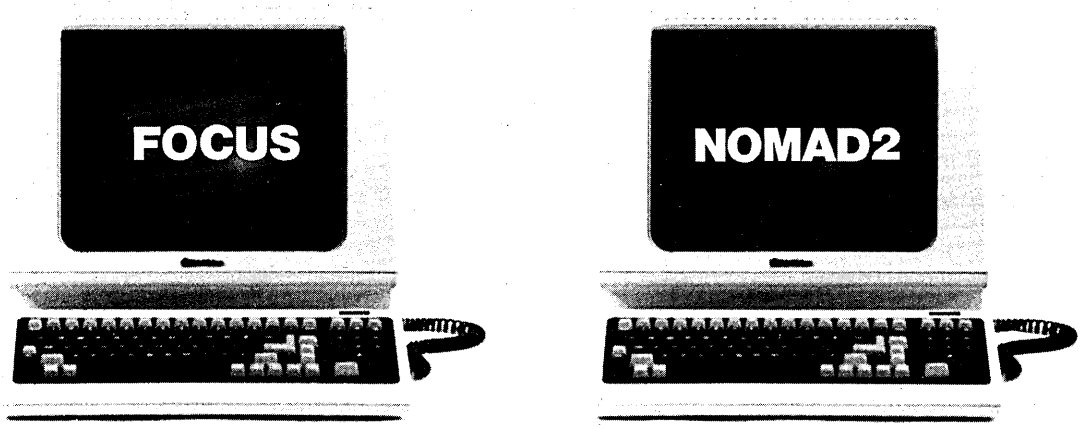

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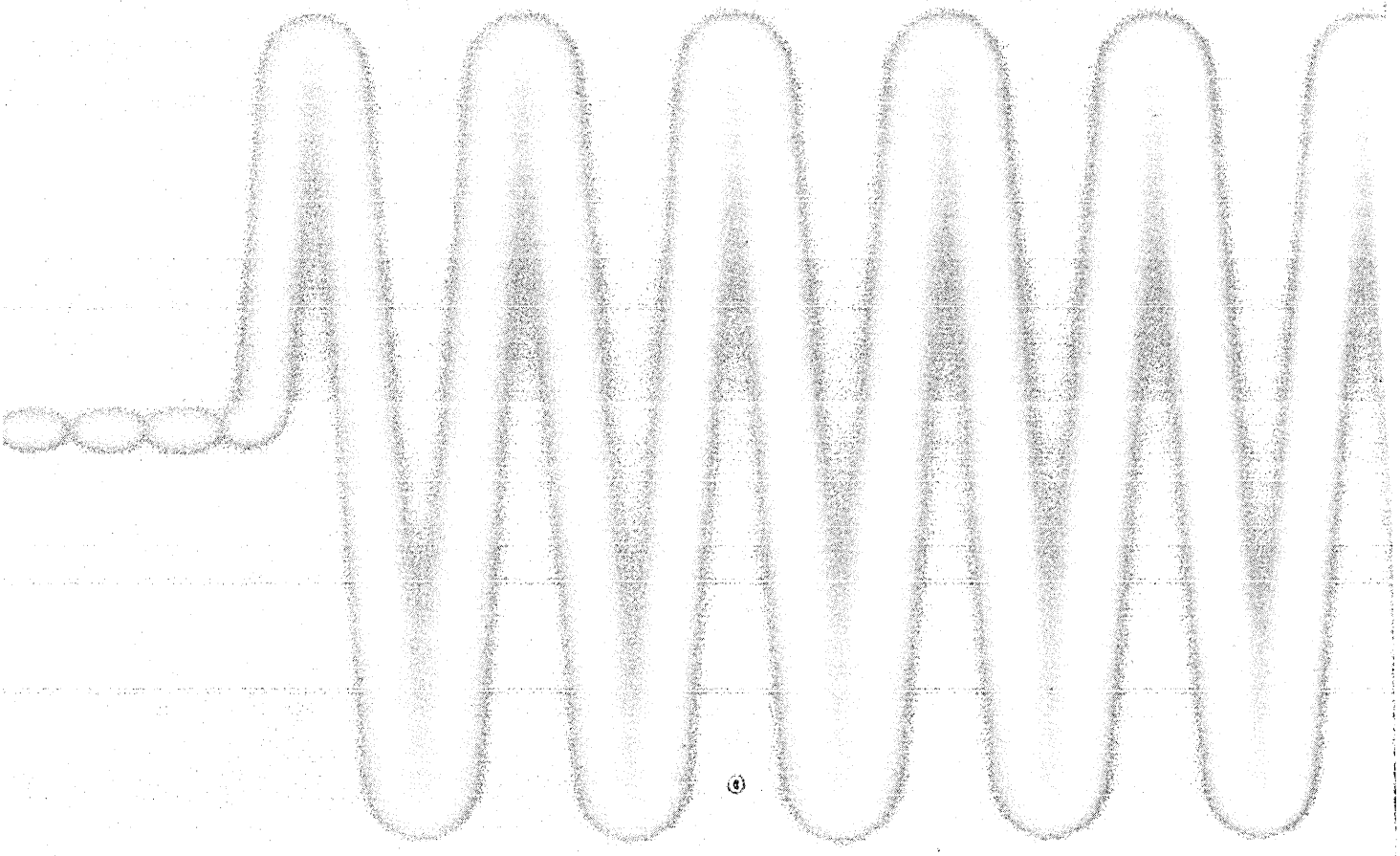
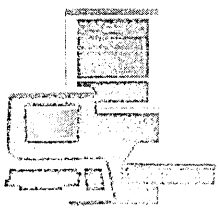
CIRCLE 22 ON READER CARD

THE AT&T FAMILY OF DATAPHONE





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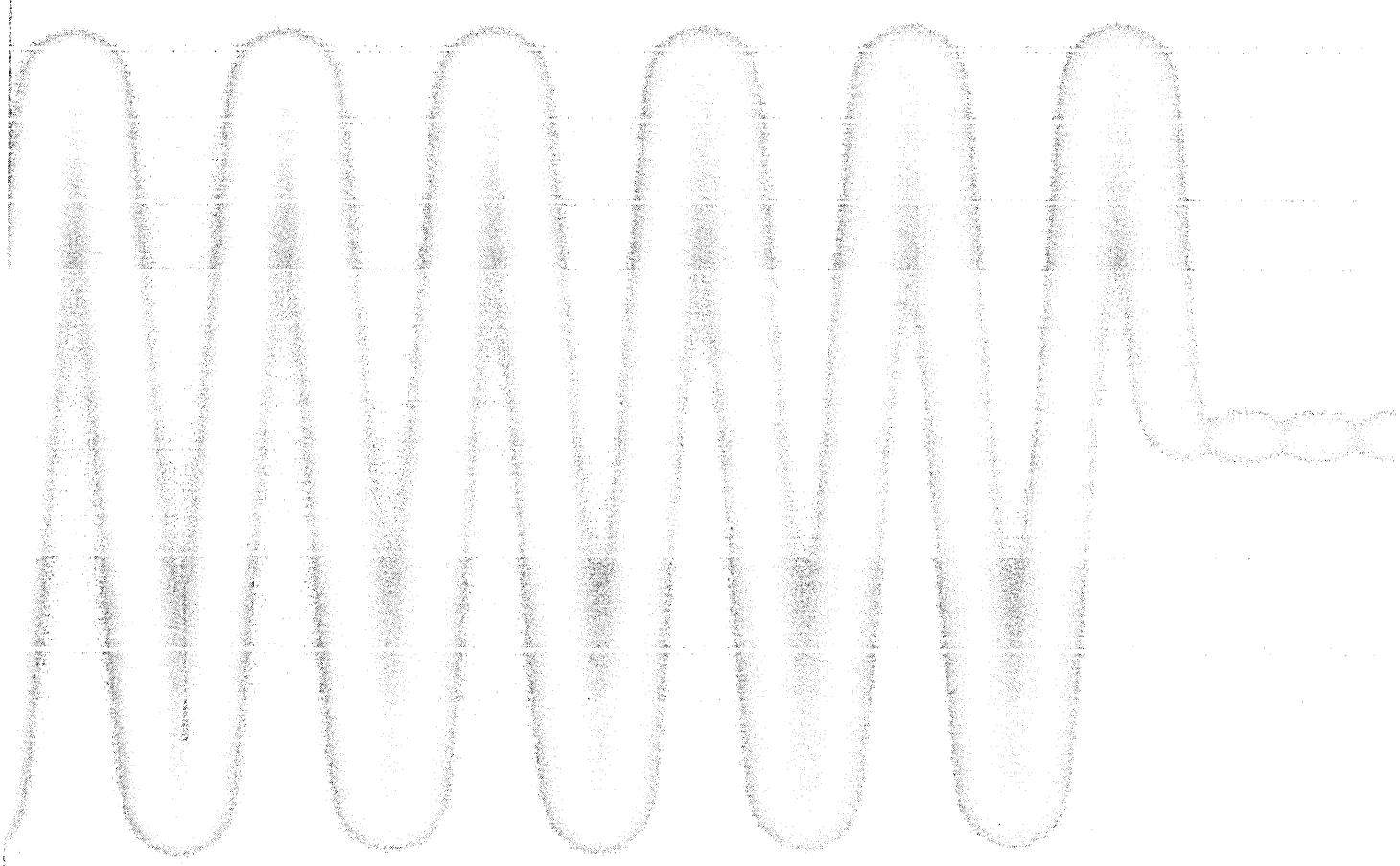

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CIRCLE 23 ON READER CARD

NEWS IN PERSPECTIVE

SOFTWARE

ADA FANS SAY NOW'S THE TIME

With the validation of more compilers, proponents of the DOD standard language look for a spread in its use.

by Edith Myers

The Ada programming language, like its namesake, Ada Augusta Byron, Countess of Lovelace, is different.

The countess, daughter of 19th-century British poet Lord Byron, was a mathematician in an age when women of her class leaned more toward social accomplishments that the intellectual. She has been called the world's first programmer for work she did in connection with Babbage's difference engine.

The difference of the programming language that bears her name is claimed as a point in their favor by both its proponents and its detractors. Detractors contend it would create a need for a massive retraining of programmers, which they consider unfeasible. Proponents, among the most enthusiastic in the industry, agree that retraining is needed, but contend that it's worth it for the benefits they feel Ada affords today's and tomorrow's needs.

Ada started as a gleam in the eyes of Department of Defense budget watchers (September, p. 114) and was born under its present name in 1979, as an official DOD standard language, the product of a CII Honeywell Bull (CII-HB) team that won a design competition.

On Jan. 1, this year, DOD began requiring use of Ada in "mission critical" applications and, on July 1, will require it on all programs going into full-scale development. The language is for real and is beginning to pop up in commercial as well as government applications.

Dr. Jean Ichbiah, who headed up the CII-HB Ada development team and who now has his own Ada compiler company, Alsys Microsoftware Inc., a French company with a subsidiary in Waltham, Mass., calls Ada, "not the ideal but the best. Ada is not for the uneducated. It is for the professional programmer to develop products for the uneducated user, which will allow him to remain uneducated."

'I don't think the commercial marketplace can afford to ignore it [Ada]," says Dr. Charles McKay, High Technology Laboratory, University of Houston, who is directing a NASA study on the use of Ada for future space station programming.

Ralph Crafts, vice president, Intellimac, Rockville, Md., which offers Motorola 68000-based, turnkey Ada development systems, feels "[Ada] is where the industry needs to be in terms of productivity and quality."

One factor slowing up the spread of Ada is the development of compilers, which the DOD puts through a rigorous "validation suite" consisting of 1,947 tests, referred to as "Ada breakers."

Ichbiah says the end of 1984 will see "many good compilers." McKay puts the number at 12 to 15. As of late April there were three packages commercially available with several others having been tested and their developers waiting for DOD evaluations.

The three packages that had been certificated were New York University, certificate number one; a Rolm (Santa Clara, Calif.) and Data General (Westboro, Mass.) joint venture was number two; and Gensoft, Pittsburgh, Pa., was number three. Gensoft was spun off from Western Digital Corp. (WD), Irvine, Calif., last September and still was the Systems Technology Center of Western Digital when its compiler was validated in July 1983.

Among those waiting for validation were their compilers from Softech, Waltham, Mass.; Intermetrics Inc., Cambridge, Mass.; Telesoft, San Diego, Calif.; Irvine Computer Sciences Corp., Irvine, Calif; Intel Corp., Aloha, Ore.; and Solutions Plus, Fort Collins, Colo.

The "validation suite" consists of 1,947 tests that have been called "Ada breakers."

David Fisher, president of Gensoft, says his firm's compiler is meeting with mixed success. "It was developed for Western Digital's Micro Engine, which is very small, only 128K bytes. The Ada language is intended for project development for very large systems. Our compiler is production quality, significantly better than any other validated, but the Western Digital machine is not the appropriate host."

For this reason, Fisher says, most of his sales to date have been in the less rigorous commercial sector and not for production development in aerospace and defense. Western Digital is no longer making the Micro Engine, but the Gensoft compiler also runs on the Delphi 700 from Digicomp Research, a small company in Ithaca, N.Y.

"This machine is still being manufactured and supported," says Fisher, "but it's still just 128K bytes of memory. What we're doing is taking our Western Digital compiler and rehosting it on other machines. We have a 16-bit interpretive version for VAX under VMS and will by the end

ILLUSTRATION BY DAVID FEBLAND

of this year have a 32-bit interpreter for VAX under VMS." He says the 16-bit version has one of the same limitations as the WD original, namely "no more than 400 source lines per separate compiled unit and that's inappropriate for large systems. The 32-bit version will overcome this limitation because it will go to 32-bit addresses, but neither will take full advantage of the language because they are interpretive, not native."

Gensoft, Fisher says, is working in conjunction with Tartan Laboratories, Pittsburgh, Pa., a spinout from a research project at Carnegie Mellon University, to develop its compiler for other machines on a native basis. "They have a superoptimizing code generator. We're using our Ada compiler as a front end and their optimizer as a back end. We should have a VAX VMS version of this by the third quarter of this year and expect at least two other joint products with them in the fourth quarter of this year and the first quarter of next year."

Digital Equipment Corp. itself is marketing an Ada compiler for VAX under both VMS and Unix, which was developed by Telesoft, and at press time was still unvalidated.

The Rolm/Data General compiler was certified in the spring of last year and runs on Data General's MV series of 32-bit computers and on Rolm's 32-bit Ada Work Centers. Under a cooperative marketing agreement between the two firms, Rolm is focusing on DOD business and Data General on the commercial marketplace. But, says Bruce Noel, formerly Rolm's Ada marketing manager and now working on a Rolm development project in Ada MIS applications for the armed forces, "We have seen a significant increase in commercial interest in our compilers. When we first brought it out the interest was 100% DOD and prime contractors. Now we're getting interest from a number of systems houses and from people involved in robotics." Rolm, he said, has delivered close to 50 compilers.

Tucker Taft, an Ada specialist with Intermetrics, which is waiting for DOD validation on several compilers, one for the government and the others for undisclosed

"There are still many people out there who like to buy their software from their computer manufacturer."

computer manufacturers, believes support of or in-house development of Ada compilers by computer manufacturers will be needed before Ada really takes off. "There still are many people out there who like to buy their software from their computer manufacturer," he claims.

Intermetrics began designing its first Ada compiler for the Air Force three and one-half years ago and other versions for manufacturers in the past year. It sells an interim Ada compiler, or what Taft calls "a boot compiler with Pascal for the 370s, but that doesn't handle the full language."

Tom Dent, acting president of Telesoft, believes, like Taft, that computer manufacturer support is important to the spread of Ada. He says, "I believe this is the year the manufacturers will get their capability in Ada." Dent also adds that his firm has contracts for compilers with seven computer manufacturers.

Telesoft was experiencing a somewhat unique validation process in late April in that it and the DOD were unsure as to whether one or several validations should be issued for its portable compiler, which can be used on a variety of machines. "Two of three parts [of the compiler] are machine independent," said Dent, "and the third part is dependent." The first compiler the company submitted for validation was for its own 68000-based processor under its own operating system, ROS, which Dent says is similar to the UCSD p-System. "It was quite portable from the beginning." Then, last April, it submitted the version for VAX VMS and Unix, which DEC is now selling.

Now Dent would like to see validation for a generic, 68000-based compiler. DOD in late April was testing both the two VAX versions and a 68000 Unix version run-

ning on Pixel, Callan Data, Wicat, Intellimac, Digicomp Data, and Sun Micro systems and on Burroughs' Megaframe.

"Hopefully," he said, "we'll get a generic validation. There are probably 60 manufacturers running 68000 processors and Unix." So far, Telesoft has delivered more than 450 Ada compilers, Dent claims.

Intel introduced an Ada compiler called Ada 432, Version 1.0, in mid-1982, and is shooting for validation of Version 2.3 (its fourth version) this fall. Mike McGowan, Intel's Ada product manager, said a little more than 100 units have been shipped.

Irvine Computer Sciences Corp. has delivered between 50 and 70 of its as yet unvalidated compilers which run on Z 8000 systems, 68000 systems, VAX (Unix and VMS), Gould/SEL computers, and Amdahl UTS. Greg Moulton, acting president, said the company is in the process of building cross-compilers for the 8086 and the 1750A military cpu. He is hoping for validation late this year.

"Ah, that's a government language. Why would I want to do that?"

Bob Ashford, president of Solutions Plus of Fort Collins, Colo., which in March introduced Ada compilers for the Hewlett-Packard 200 desktop computer family and last month was developing versions for the HP 500 and 1000 series, was expecting DOD validation by the end of April. He said he'd received $100,000 worth of orders for the 200 series version in the first month following its introduction. He said a version for the HP 3000 was "down the road."

Ichbiah's company, Alsys, has scheduled its first products, VAX-hosted Ada cross-compilers for 68000 and 8086-based systems, for release late this year with native compilers due to follow.

Ada proponents have to be called aficionados and Ichbiah is certainly one of them. McKay is another and so, he believes, are his students who have learned the language. "There is no bigger group of advocates than those good programmers who have learned to use it," he says.

Craft of Intellimac says, "Our programmers would fight if they were told they had to go to another language." He feels a strong point of Ada is the ease with which user requirements can be communicated to a programmer and then to code.

Ichbiah says the thing he considers to be the most important part of Ada is "the idea of software components that are reusable in different contexts."

Clarity is another oft-cited good point of Ada. "It is definitely clearer as far as code goes," says Crafts of Intellimac.

Rodger Smith, vice president, EVB Consulting Inc., a Rockville, Md., company involved in Ada training, likes reduced maintenance costs. "The use of Ada in a software development project can cut maintenance costs by 60% beginning immediately and, in the long run, can reduce them further."

Fisher of Gensoft likes this feature too. He believes one place where Ada should not be used is in business data processing. "It was never intended for that area." He thinks, however, that "Any applications that have significant maintenance costs, large systems for anything which have a long life, even business, are ripe for Ada."

McKay, of the University of Houston, says he believes Ada offers more benefits to the commercial world than to government. "So many companies are looking for the first time at automation. They're untainted by previous experience. They know what they want and they'll leave it up to the software houses. They have no ties to a mainframe, no ties to a language. They'll say this is what we want and we want the applications now. I predict that time after time the software houses that win out in this sort of situation will come from the Ada community."

McKay also feels Ada has potential in artificial intelligence applications. "There is a big need for distributed artificial intelligence." Crafts agrees. His company has been using Ada in translating technical documents from English to French.

Craft's company, Intellimac, in addition to offering turnkey Ada development systems, has been developing software in Ada for three years for commercial applications including payroll, inventory control, accounting, and parts control, and has installed some, "but we don't sell it actively. People tend to say, 'Ah, that's a government language. Why would I want to do that?' "

Money might provide the motivation. McKay says the DOD has compiled figures that indicate use of Ada since 1978 has reduced maintenance costs to the point where "maybe half of what would have been maintenance costs can go into new projects." He adds: "They're [DOD] the world's biggest customer."

There are those who say Ada is a more European language than an American language. To this, Ichbiah responds, "In the U.S., you've had good tools and poor languages. The tools are so good you survive the poor languages. In Europe, we have had poor tools and good languages. The languages are so good that we've survived the poor tools."

McKay's response: "In the U.S. we're reluctant to change. Europe has realized it can't compete with us in the manufacture of hardware so they've put their eggs in another basket, software. Europe has more new starts done in Ada than we do. They have a competitive edge but some enlightened companies in this country have been in [with Ada] since the beginning, companies like Westinghouse and General Electric."

It's generally agreed that there are few competent Ada programmers around and those that are can command good salaries. Training is more difficult than for other languages. Smith of EVB says, "A mistake with Ada often is to treat it as just a language. It's a methodology. We can teach a course in C in three days. It takes a minimum of 21 days to learn Ada."

Solutions Plus offers computer aided instruction packages with its Ada compilers. "A high-level language programmer can learn Ada typically in one month," says Solutions' Ashford.

McKay, at the University of Houston, says most of "the better" universities either have Ada built into their regular curriculum or are offering special topics courses at the graduate level to determine how to build it into the regular curriculum.

EVB's Smith says an Ada programmer should have a math background, computer science knowledge, and a knowledge of engineering, "but [without this background] that doesn't mean you can't do good quality work, three months down the road, in a restricted manner." He and others view Ada programmers not as programmers but as software engineers.

Ichbiah said Ada's design, "was not a scientific achievement, but an architectural achievement." A civil engineer by training, he notes that while building Ada, "we didn't do research. We looked at what had been developed and how we could best use it." *

RESEARCH

AMERICA ANSWERS BACK

It's taken two years, but the U.S. response to Japan's fifth generation computer effort is finally taking shape.

by Jan Johnson

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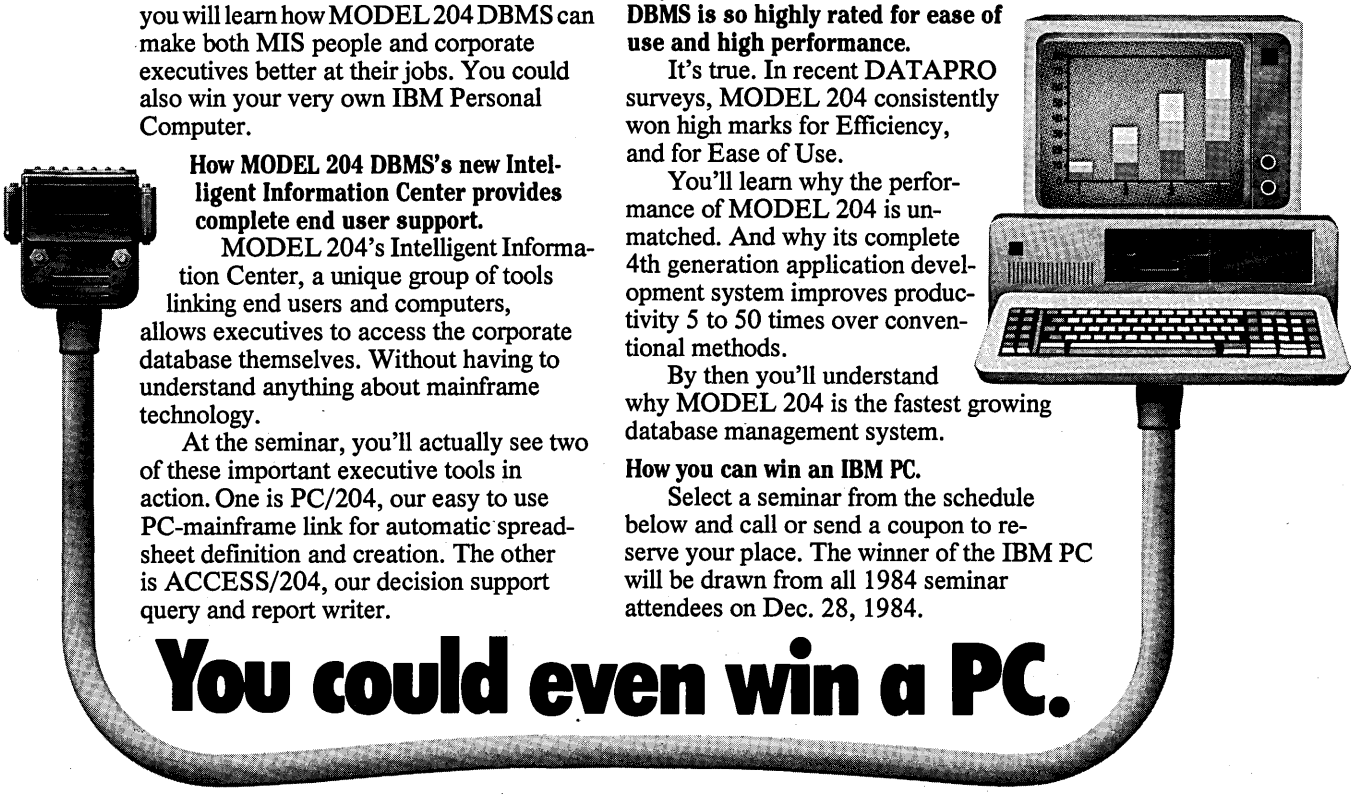

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Charlotte, NC	May 8	**June**		Rochester	June 28
Cincinnati	May 2	Albuquerque	June 14	Syracuse	June 27
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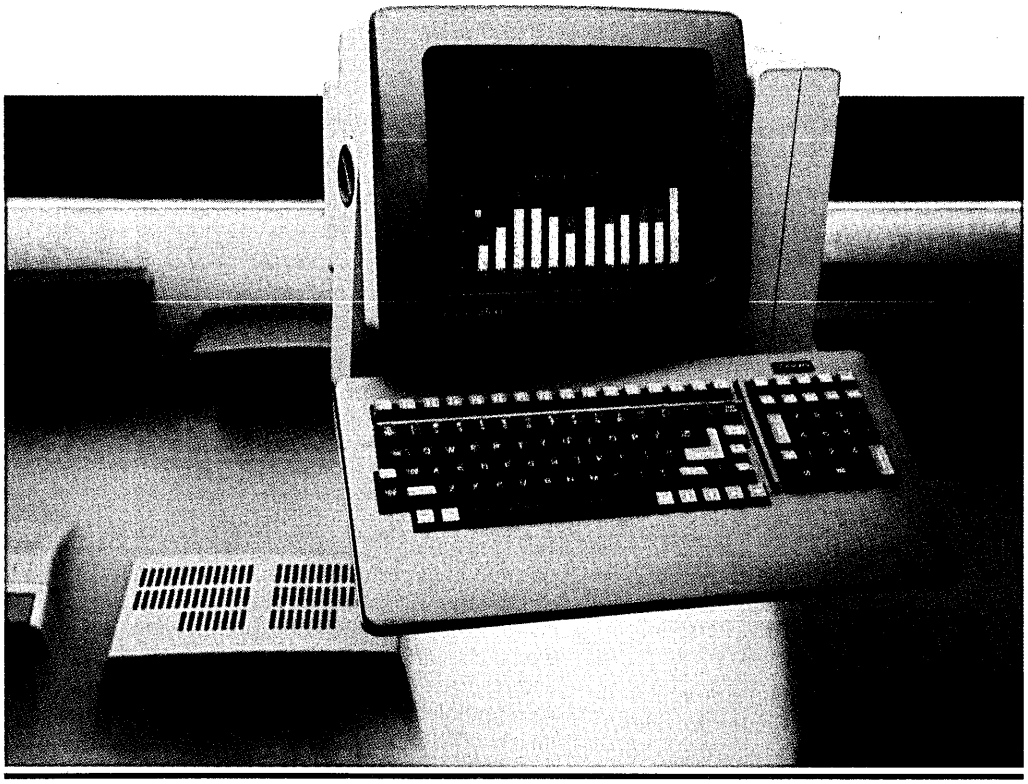

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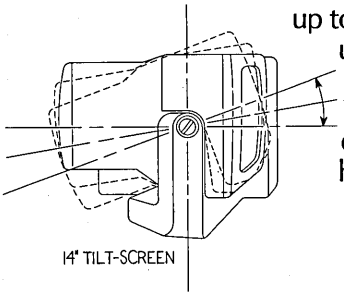

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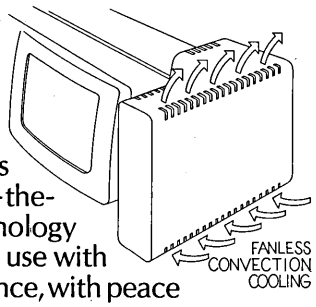

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CIRCLE 25 ON READER CARD

Computer Systems program with the formation of the Institute of New Generation Computer Technology (ICOT). That move struck at the heart of America's economic strength and national security.

The fifth generation challenge, more than all others, "scared the hell" out of U.S. business managers and those responsible for U.S. security, recalls one industry source. "The sleeping giant was awakened," says another.

The giant's response has been slow in coming and has taken many forms. Old antitrust laws created to protect a domestic marketplace are being challenged as a hindrance to competing in today's international marketplace. The long cherished "I'll do it myself" attitude of American businesses is being rethought as managers come to grips with scarce talent and huge long-term R&D investments. As a result, the most notable and potentially most effective action has come from industry.

In an unprecedented move, several computer industry competitors agreed to lay aside their proprietary shields and try to work together at the R&D level. The two pioneer organizations to watch are the Semiconductor Research Corp. (SRC), Research Triangle Park, N.C., which opened its doors in September 1982, and the Microelectronics and Computer Technology Corp. (MCC), Austin, Texas, which held its first board meeting in February 1983.

Of those two, MCC is the more daring. It represents a marked divergence from previous cooperative ventures, such as SRC's. SRC collects money from its 30 member companies, then redistributes it among select college and university research groups.

Buying into MCC is the cheap part; the real expense comes in supporting any of four research programs for at least three years.

In contrast, MCC is preparing to do its own research. "MCC's goal is to develop technology and tools that companies can use to develop their own products. There isn't much overlap," says Michael Maguire, senior vice president of Harris Corp., Melbourne, Fla., which is a member of both organizations. MCC's effort is "more an applied research effort than a basic one" and will be conducted in-house rather than through universities.

Last month MCC turned a critical corner. The basic outline for its seven research projects was in place, six of the seven research project directors were on board, and the dread antitrust clouds were beginning to clear as Congress moved closer to amending the old antitrust legislation. America was gearing up for its own fifth generation effort.

But for America, cooperation does not come easy. Imagine the monumental task of getting 10 disparate companies to agree on one corporate structure and seven long-term project directions. It is not surprising that it took MCC two years to groan and strain to life.

"It took a lot of talking to convince a number of people that the challenges we all face are great enough that we have to make some adjustments," recalls Gerry Ginneen, corporate vice president for science and technology, Honeywell, and an MCC board member. "Companies had to be willing to share technology in some areas where they felt they had invested a lot of money and attained some strength. That is why the formation of MCC took a while."

The outcome is a company wholly owned by its shareholders. It is not destined for the public market, assures Admiral Bobby Inman, MCC president and chief executive officer. Inman, who retired from the military in July 1982 after a long career with stops at almost every major intelligence organization in the U.S., including a

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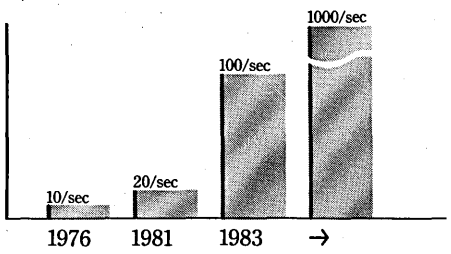

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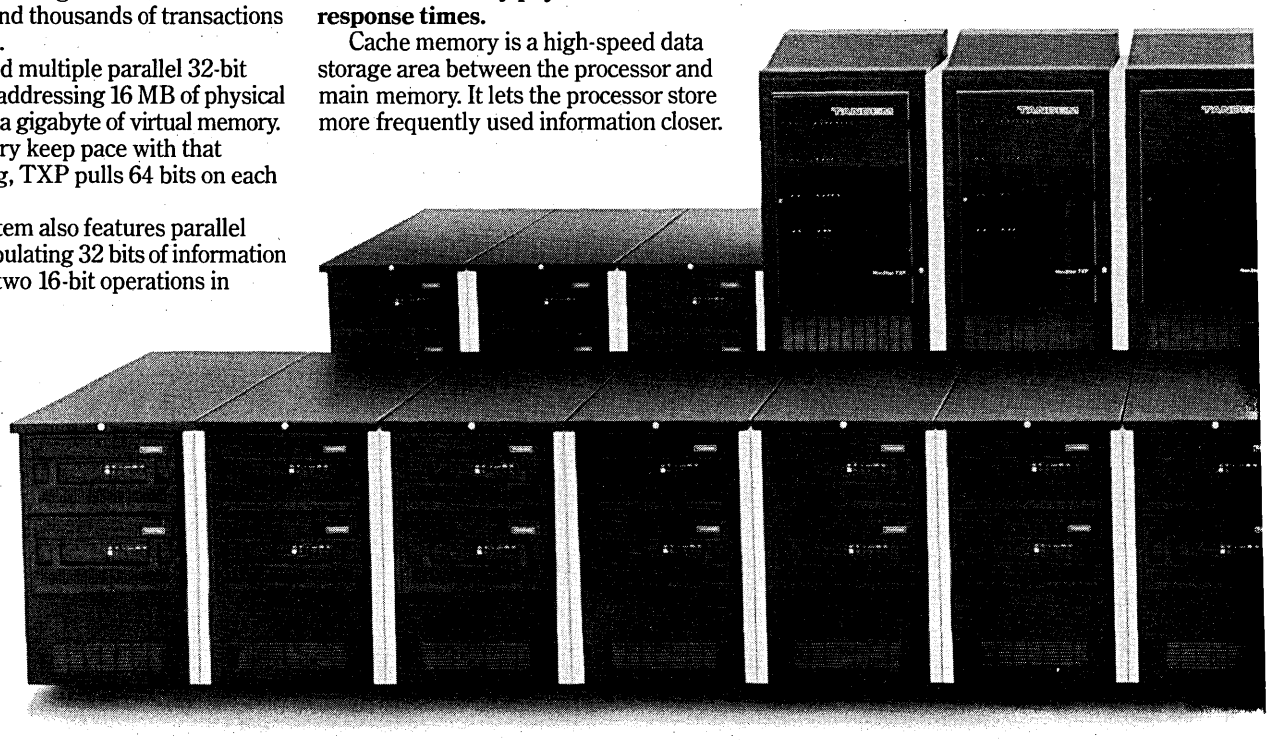

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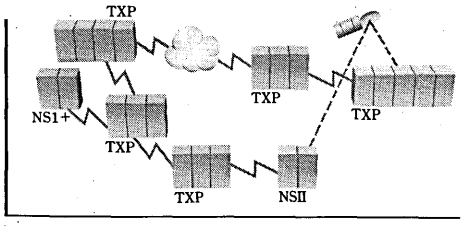

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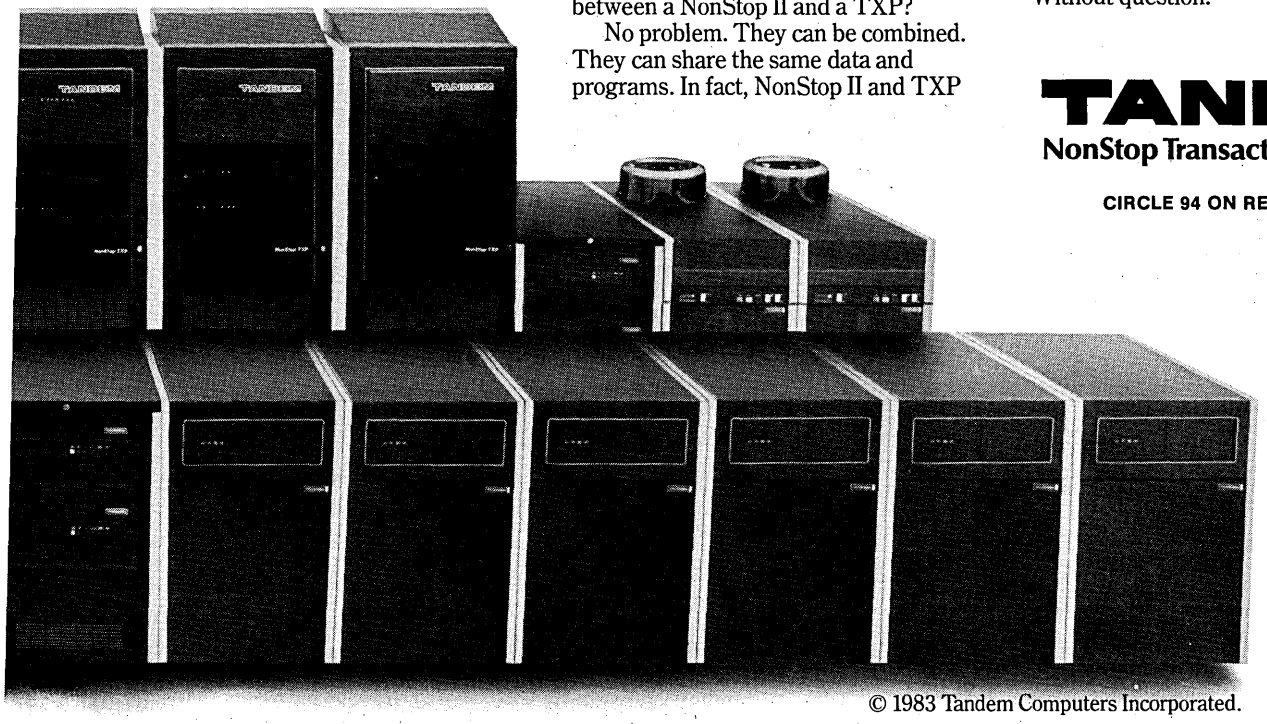

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CIRCLE 94 ON READER CARD

stint as head of the National Security Agency, accepted the MCC post in January 1983.

Each shareholder is limited to one share of stock, but that one share costs an extraordinary amount. It sold for $150,000 when the company was formed, and escalated toward the $250,000 mark as the company matured. Latecomers may pay as much as $500,000 per share, predicts Inman, assuming the company succeeds.

Buying into the company is only the beginning—the cheap part. The real expense comes at the program level. Each shareholder company must agree to support at least one of four research programs for a minimum of three years. A few shareholders have elected to support all four. Lumped together, the programs will have a funding profile somewhere between $50 million and $100 million per year, Inman estimates. "How much higher than $50 million depends on how many additional members join the program." Although Inman would not talk about specifics, the average investment per company per program appears to range between $1 million and $4 million per year.

The four programs address seven research areas: software technology, semiconductor packaging, VLSI computer aided design, parallel processing, database management, human interfaces, and artificial intelligence/knowledge-based systems. The last four projects make up the fourth program, called the advanced computer architecture program. It most closely corresponds to Japan's fifth generation effort.

In filling the position of chief scientist, Inman chose John Pinkston, a former deputy chief of research at the NSA with a background similar to Inman's.

The software technology program will focus on developing methods for guiding a user through problem definitions, says an MCC spokesman. "The goal is to increase the productivity of the entire development process by two orders of magnitude." One of the means for reaching that goal will be to develop "knowledge bases that contain domain-specific and general programming knowledge that can be used to transform high-level problem descriptions into efficient user-level languages," says the MCC spokesman.

A major focus of the packaging program is to develop automated methods for connecting chips with an excess of 400 pins to pc boards. In addition, says the MCC spokesman, researchers will investigate methods for reducing the number of interconnect levels on a chip and improving performance through the use of wafer scale integration, cryogenic packaging, or "novel materials."

In developing program directions, a fundamental rule of thumb was followed: "If it can be envisioned as a product, it ought not to go to MCC," Inman said. "We want to keep focused on the long term, where the industry needs breakthroughs for the next generation of products."

Equally as time-consuming as program definition has been the search for the right people. Heading the semiconductor packaging program is Barry Whalen, who comes to MCC with several years of experience in managing advanced semiconductor research projects. Most of those years were at TRW, where he served as general manager of the military electronic division and headed the VHSIC (very high speed integrated circuit) project.

Joining Whalen in the semiconductor packaging program is Harry Kroger, who was snapped up from Sperry Corp. when it closed its corporate research facility in Sudbury, Mass. Kroger has been involved in several areas of high-speed logic research, including work in Josephson junctions.

John Hanne, tapped to lead the VLSI computer aided design program, comes to MCC after many years with Texas Instruments. There he served as vice president of the data systems group, with specific experience in managing the advanced technology research group and the design automation effort. For a few days, Hanne was also

WHAT IS SRC?

The Semiconductor Research Corp., based in Research Triangle Park, N.C., "is dedicated to increasing the number of graduate students and improving the quality of graduate education as well as advancing research in the electronics field," explains Michael Maguire, senior vice president of Harris Corp. Harris is a member of both SRC and the Microelectronics and Computer Technology Corp. (MCC).

Currently, 30 SRC members are funding 53 projects at 35 U.S. universities with a $12 million budget. Project sizes range from $75,000 to a little over $1.25 million per year, say SRC sources. The three major categories of research are described as microstructure, design, and manufacturing sciences.

"One of our most important achievements to date is in manufacturing sciences," points out Robert Burger, SRC chief scientist and senior technical officer. "It was not a well-defined or a respectable subject in academic research. So we started doing missionary work among the universities to help them define approaches for participating in this new research area and to help them find people."

Stanford University, the University of Michigan, and the Microelectronics Center, a state funded consortium of North Carolina universities, number among the few sites that have organized research efforts in manufacturing sciences and are currently receiving SRC money in support of their projects.

SRC was born out of worry and concern among the members of the Semiconductor Industry Association. "As technology moved forward, companies came to the conclusion that they, by themselves, couldn't afford the costs of keeping up," explains Larry Sumney, SRC executive director. "In particular, they were finding it increasingly difficult to compete against vertically integrated competitors that could amortize the cost of a chip across sales of equipment, which put them in a position to sell the chip more cheaply."

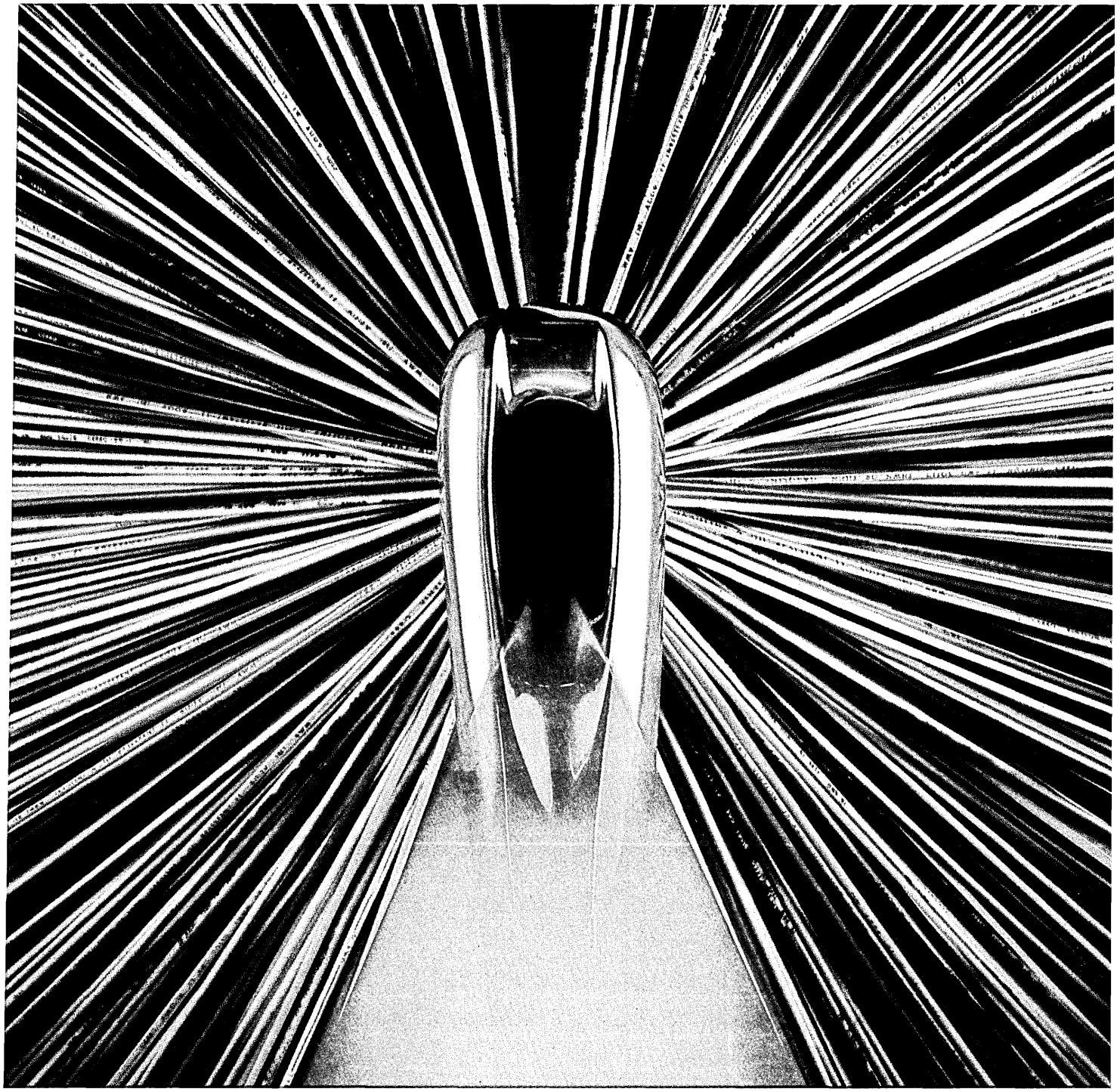
U.S. chip makers are also alarmed by Japan's increasingly shorter time span from the laboratory to the market. "The solid-state 1 megabit RAM is now out of R&D," reports Sumney. "The Japanese have been able to reduce their time from exiting R&D to production from two to three years down to one to two years. That 1 megabit RAM may be on the market in about a year."

As the industry moves closer to a system on chip, the problem becomes even more acute—design costs go up, time to market gets shorter, the product becomes increasingly unique, and fewer are produced. A prime example of rising cost for a limited-market chip is Intel's iAPX 432 chip set, a family of eight chips. It cost a whopping $40 million to design.

Several major chip consumers began to worry that the U.S. semiconductor industry would eventually disappear, says one SRC source. "When IBM projected its future requirements for integrated circuits, it realized it was indeed dependent on the merchant semiconductor industry," relates the SRC source. "The main objective of IBM's support of SRC is to insure that a U.S. semiconductor industry will be around." Other founding SRC members, in addition to IBM, are Advanced Micro Devices, Control Data, Digital Equipment, Honeywell, Intel, Monolithic Memories, National Semiconductor, and Silicon Systems.

To protect their future, chip makers decided to work together at the R&D level. They wanted to control redundancy and minimize fragmentation, explains Sumney. "If a company only has so much money for R&D, they can only do so many things above the threshold level," he reasons. "If they try to put their money everywhere, then nothing gets funded above the threshold level. If 15 companies are involved in the same area of research, why not pay one fifteenth? It doesn't make sense for a number of companies to spend their limited resources on the same research. Those are the problems that SRC is trying to address."

—J. J.



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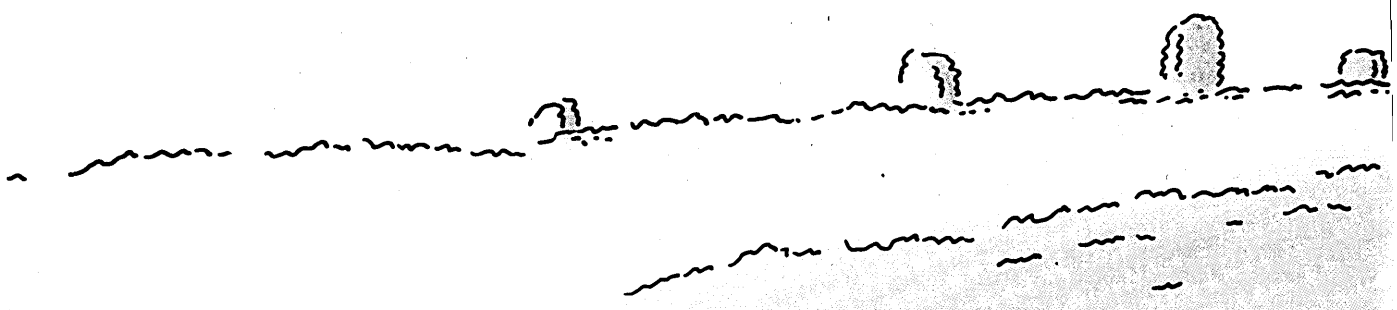

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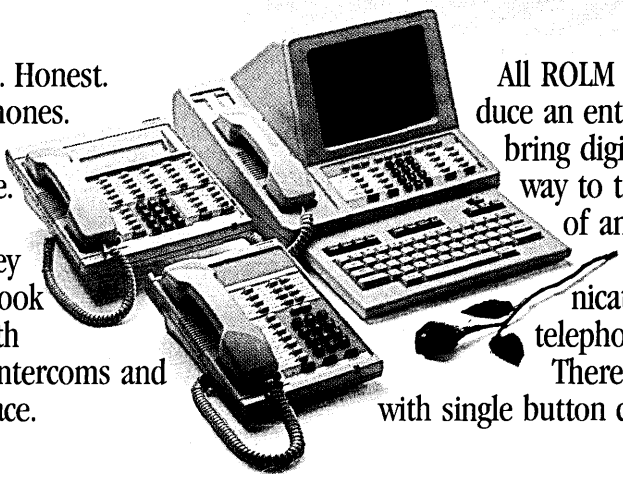

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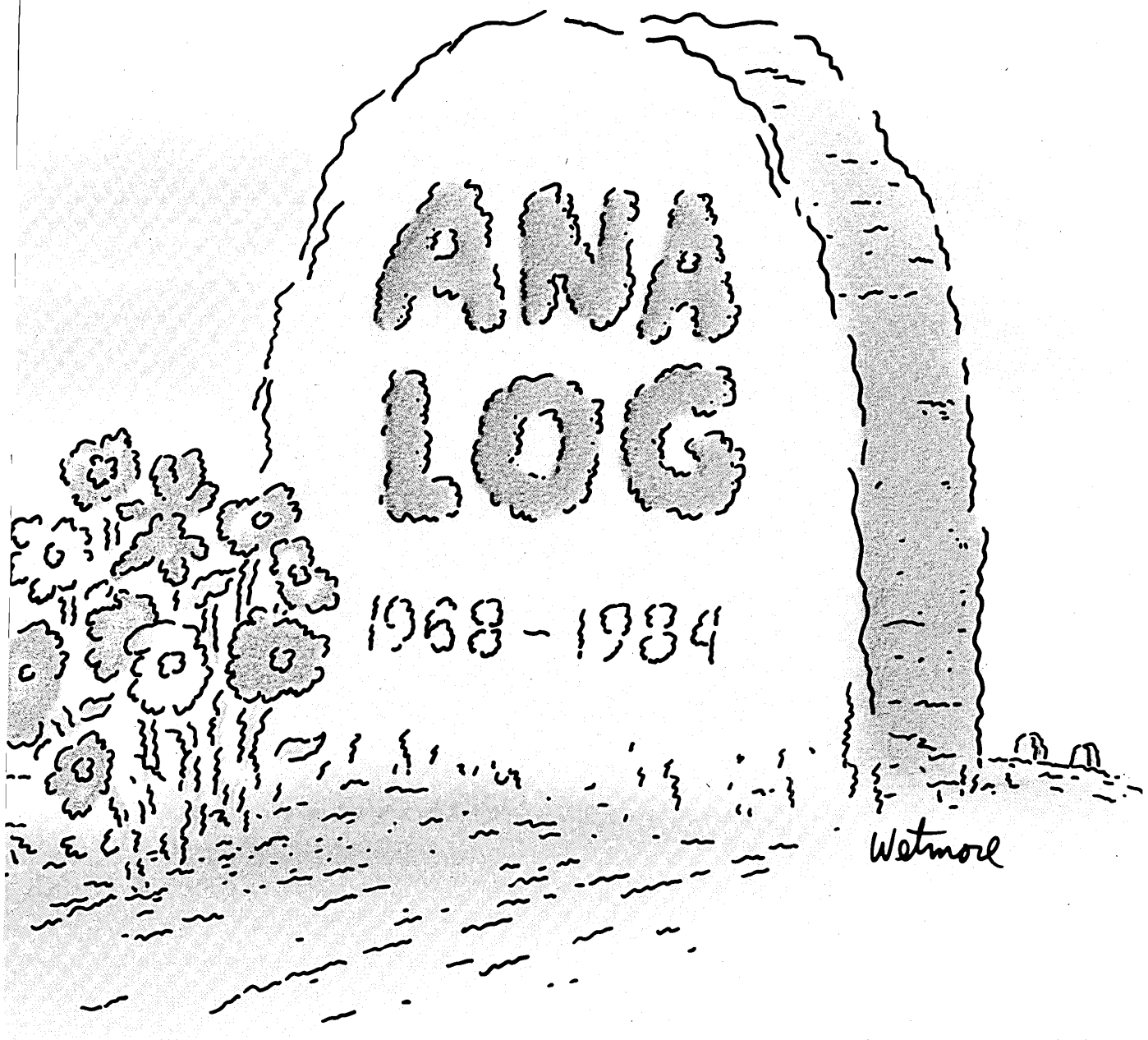

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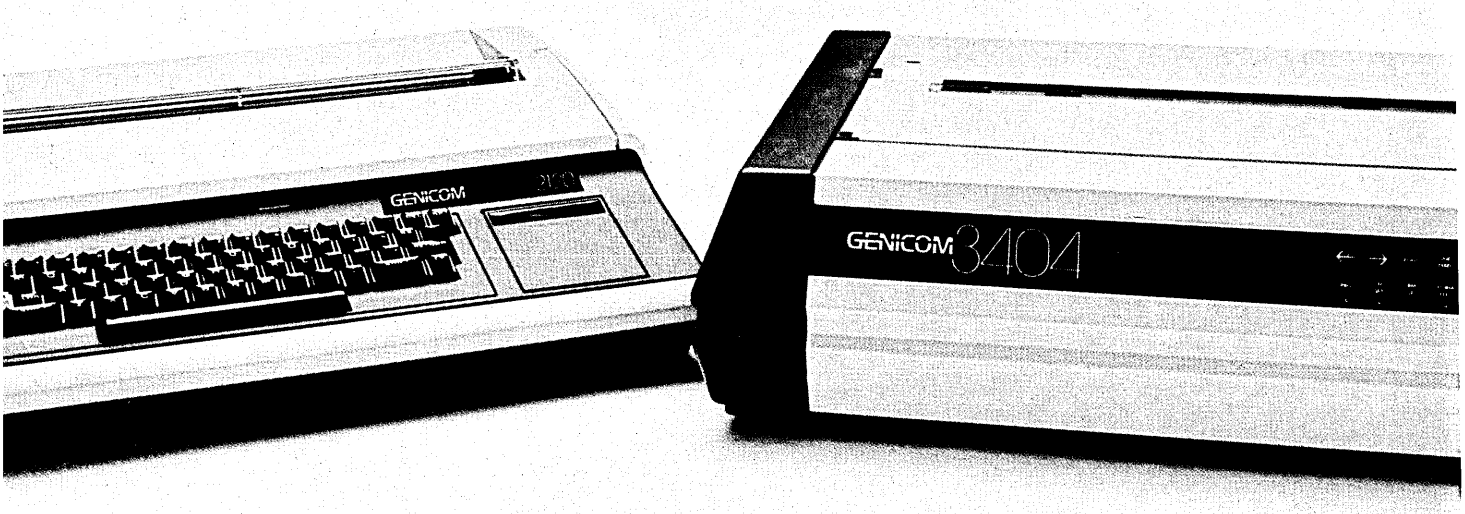

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vice president of engineering for Osborne Computer.

Managing the parallel processing project is Peter Patton, most recently head of the computer center at the University of Minnesota, the only such center in the country to own a Cray supercomputer. According to Patton's résumé, he has more than 20 years' experience in the design and application of high-performance, multiprocessor computer systems. Many of those years were spent with Sperry's defense division. Included in his long list of consulting jobs is a stint with the Department of Defense, where Patton served in an advisory capacity on the evaluation of the Safe Guard Anti-Ballistic Missile defense system. That system had a "highly parallel architecture," recalls Tom Gannon, technical director for Digital Equipment Corp.'s technology development program and a member of MCC's technical advisor board.

Eugene Lowenthal, a founder of Austin-based MRI (which was later acquired by Intel of Aloha, Ore.) and lead architect of the database management product System 2000, will head the database management project.

The incoming president of the American Association of Artificial Intelligence, Woodrow Bledsoe, accepted the reins of the AI/knowledge-based system project. He is on a leave of absence from the University of Texas, where he holds a chaired professorship in mathematics and computer sciences.

The only project manager to come from one of the shareholding companies is Ray Allard, who heads the human interface project. A vice president from Control Data, Allard has an extensive background in managing computer research activities and more recent experience in marketing large computer systems. His assistant is Bill Curtis, who comes to MCC from ITT and General Electric, where he worked on human factors problems.

Most shareholders say they are lured to MCC by the prospects of more bang for their R&D buck and the chance to be among the first to get at those results.

The only research position yet to be filled is manager of the software technology project. "We had that position filled," Inman explains, "but the selected individual was unable to get out of a contractual relationship with a foreign government."

Inamn's number two man, the senior vice president of plans and programs, is Pally Smidt, who comes to MCC from Sperry Corp, where he had been vice president of business strategy. "If something happens to me, Pally picks up," says Inman. As for the other key staff slots, the position of vice president of finance and administration was filled by a man from Control Data, and vice president of human resources went to a man from RCA.

In filling the plum position of chief scientist, Inman looked to his own background. He brought in John Pinkston, former deputy chief of research at the National Security Agency. That move created quite a stir among shareholder companies because no one had heard of Pinkston. "He's a very bright man with a BS in EE from Princeton and a master's and doctorate from MIT," says Inman. Because of his background, "he's therefore not known to many in industry or the academic world."

Coming to terms with compromise and cooperation is only part of the MCC challenge. Mustering the courage to brave the antitrust clouds adds yet another negative. All of the founders knew they were treading on the tentacles of antitrust laws when they joined to form MCC—Joseph Alioto, one of the nation's leading antitrust lawyers and former San Francisco mayor, made sure of that.

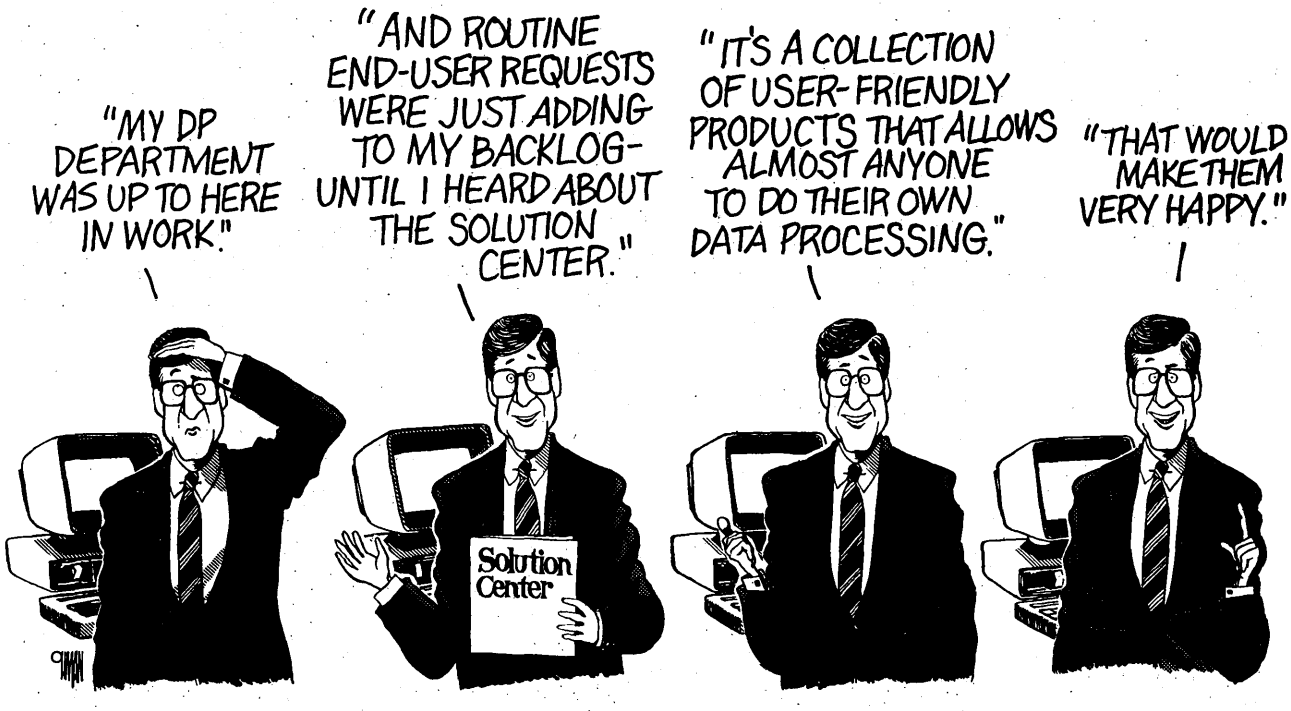
Alioto sent a letter to MCC sponsors challenging their intentions and reminding them their "conduct is an unequivocal combination in violation of the antitrust laws of the United States." Alioto's plainly stated threat of a lawsuit was taken seriously. The chance that he would find a willing client, eager to brave the legal system in hopes of winning huge damages, was more than some corporate lawyers were willing to risk.

Because of the antitrust threat, several companies backed out. Of the 18 computer and semiconductor company executives who attended the first exploratory meeting in February 1982, organized by Willian C. Norris, Control Data founder and chairman, only 10 went on to form the steering committee that led to MCC's creation.

The founding group was composed of Advance Micro Devices, Control Data, DEC, Harris, Honeywell, Motorola, NCR, National Semiconductor, RCA, and Sperry. Five other companies have since joined the founding group. Burroughs and Xerox were among the companies that dropped out, and have yet to reappear on the MCC roster.

MCC is still looking for additional shareholders. There is no limit to the number of companies that can participate in MCC, says Inman, but there are membership restrictions. Only one company has been turned down, and Inman would not reveal its name. "We had one applicant that was 53% foreign owned," he explains. "Basically, our bylaws require that a company must be 50% U.S. owned." Others decided

"How I increased with the flick of a



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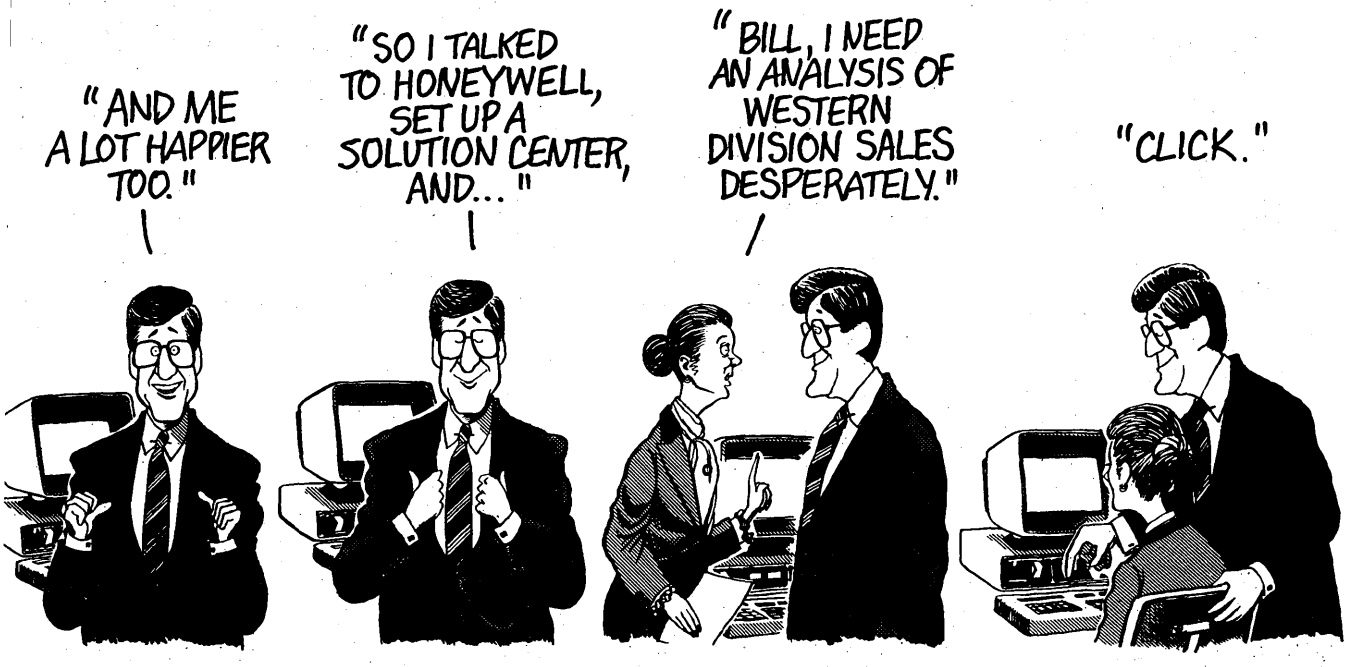

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it was too expensive or backed down because of antitrust concerns, Inman acknowledges.

Still other simply stayed away. IBM, for instance, reportedly declined involvement because of "misgivings" about its presence inciting litigation, reveals one board member.

To reduce the risk of government-instigated litigation, MCC has kept the Justice Department informed at every step. After reviewing MCC's bylaws, Justice declared it had no objections to the creation of MCC, but reserved the right to examine each program. Material concerning the four major programs was filed in April 1983. In addition, each individual member company has made major submissions to Justice. One board member quips, "We've kept a lot of lawyers prosperous."

In an offensive move, MCC is backing legislation in Congress that would shield certain research and development joint ventures from antitrust attacks. "Part of our legislature program is to modify the antitrust law as it relates to joint R&D ventures," explains George Scalise, MCC board member and senior vice president and chief administrative officer for Advanced Micro Devices, Sunnyvale, Calif. "We have legislation on the House side drafted and out of committee." A Senate version was expected out of committee in mid-April.

While there is a limit to the number of technical people one company can send, there is no limit to the number of professional assignees.

Although the Justice Department was promoting yet another version of the bill, Scalise believes that Justice and the House have "come to a meeting of the minds." The bill "doesn't do everything we hope to accomplish, but we believe it is a major step in the right direction," he acknowledges.

Among the key points slated for change is the elimination of the treble damages award in an antitrust suit and the addition of a clause providing for the payment of legal fees to the prevailing party. "What we want to do is limit the number of frivolous lawsuits," says Scalise.

MCC is also attempting to update business lawyers. In February, MCC submitted massive documentation to Justice on the issue of competing in an international marketplace. One board member estimates that MCC representatives have spent more than 100 hours in interviews with Justice Department lawyers and individual researchers. Why such a show of patience? It's essential to the MCC mission, the source muses. "We are helping to introduce a generation of lawyers to the idea of an international marketplace."

MCC'S ADMIRAL CHARTS COURSE

Admiral Bobby Ray Inman, U.S.N. (Ret.) believes there are still a few talented people out there who want to work on the leading edge of technology . . . himself included. Unlike many other retired admirals and generals who are content to draw retirement pay and sit on several corporate boards with little real responsibility, Inman has chosen to head Microelectronics and Computer Technology Corp. (MCC), a company devoted to advanced research.

As head of the National Security Agency, Inman managed a vast department that was involved in research and advanced uses of computers and other technologies to secure foreign communications for the national defense.

"MCC is not a research firm," Inman says. "We are not trying to recreate basic technology, but swiftly move through new technology and take it to the marketplace." What MCC does is determined by the 15 companies who hold stock in the firm. The admiral adds that the fruits of the research won't be realized for at least seven to 10 years.

Noticeably absent from the 10 charter members and the five subsequent members are IBM, AT&T, and Texas Instruments. Inman says the unwillingness on the part of these companies to become sponsors of MCC is "my security blanket" against further concern from the Justice Department. He adds that IBM declined to seek Justice Department clearance to explore MCC because it viewed the project as competition.

On his battle with the Justice Department to get clearance for this program, Inman says it was difficult to get the government's lawyers to look at MCC as not violating antitrust laws.

"America's antitrust laws of 1890 to 1910 shaped business attitudes in this country. It is feasible to put together a joining research program," Inman says, adding that there are bills pending in Congress that will make such ventures easier to form.

When asked what it is like to preside over 15 different corporations, Inman says, "It's a lot like dealing with NATO . . . different nations with different languages and cultures with common goals and interests."

He says that staffing is ahead of schedule with 110 people already on board and more than 225 expected by the end of 1984. In taking the job, Inman says that he had only two requirements: "To be chairman of the company and have absolute authority over personnel matters." He wanted the ability to bring in whoever he felt was best qualified to do the job, without interference from the board members.

Inman says it will take a lot more than research firms, think tanks, and joint ventures to bring America up to speed to compete through the end of the decade and into the next century. He says there should be an investment in education at the state and local level. "I do not want to create a generation of computer nerds, but students should obtain a level of competence to be effective in an automated environment."

—Robert J.Crutchfield

So what's the payback for all that risk and money? A long shot that some shareholders mention but few take seriously is the possibility of making money on license fees. At the end of each research program, participants have residual rights to the results. Three years after the close of a project, the technology can be licensed to outsiders.

"If something is a spectacular success," Inman suggests, "not only is there the prospect of a three-year lead time to the marketplace; if it is broadly licensed there is a good chance [project participants] could recover their sunk costs."

More to the point, most shareholders say they are lured to MCC by the prospects of more bang for their R&D buck and the chance to be among the first to get at those results. But how does a company bring those results back home? "That's one of the significant issues that lies before us," admits Gannon, the DEC technical director and representative on MCC's technical advisory board. Successful technology transfer is still very much an art and not a well understood process.

"Technology transfer is a problem even within a company," agrees William Hittinger, RCA executive vp and MCC board member. "It's more complex when dealing with an outside structure. Defining how it will take place is not easy to do."

Shareholder board meetings, technical advisory board meetings, seminars, and publications are all part of the formula. But at the heart of it, say several board members, are the technical liaison people and employees from shareholder companies who leave to work on a project team, then return to their respective companies.

Each shareholder company can have one liaison person involved in each of the projects it funds. That person shuttles back and forth between the two jobs, remaining on the payroll of the shareholder company. MCC reimburses that company for the liaison person's time. "The main mission of the technical liaisons," stresses DEC's Gannon, "is to maintain technical communications between the MCC program and interested organizations within their own company."

Shareholders also have the option of sending one or more assigned professionals to apply to project leaders for full-time positions. The position could last from three to five years. At the end of that time, the

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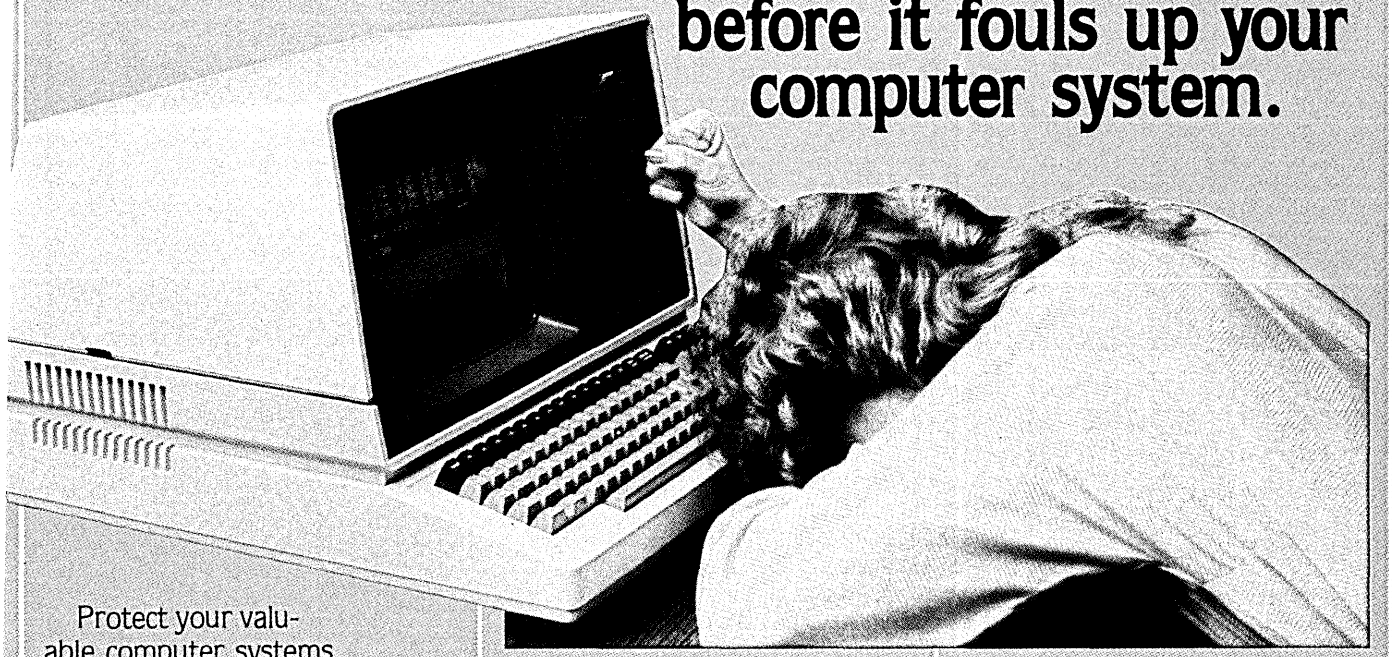

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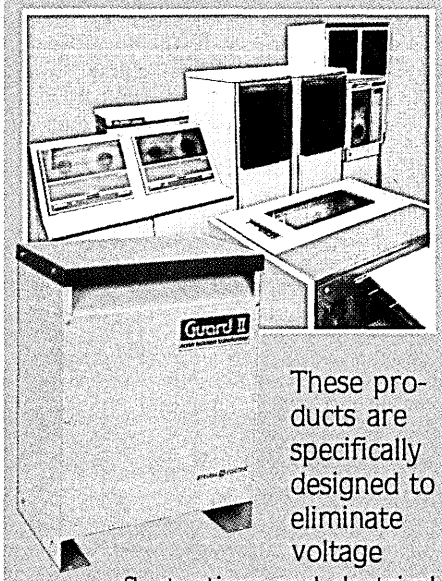

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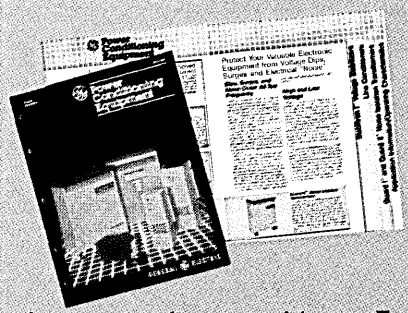

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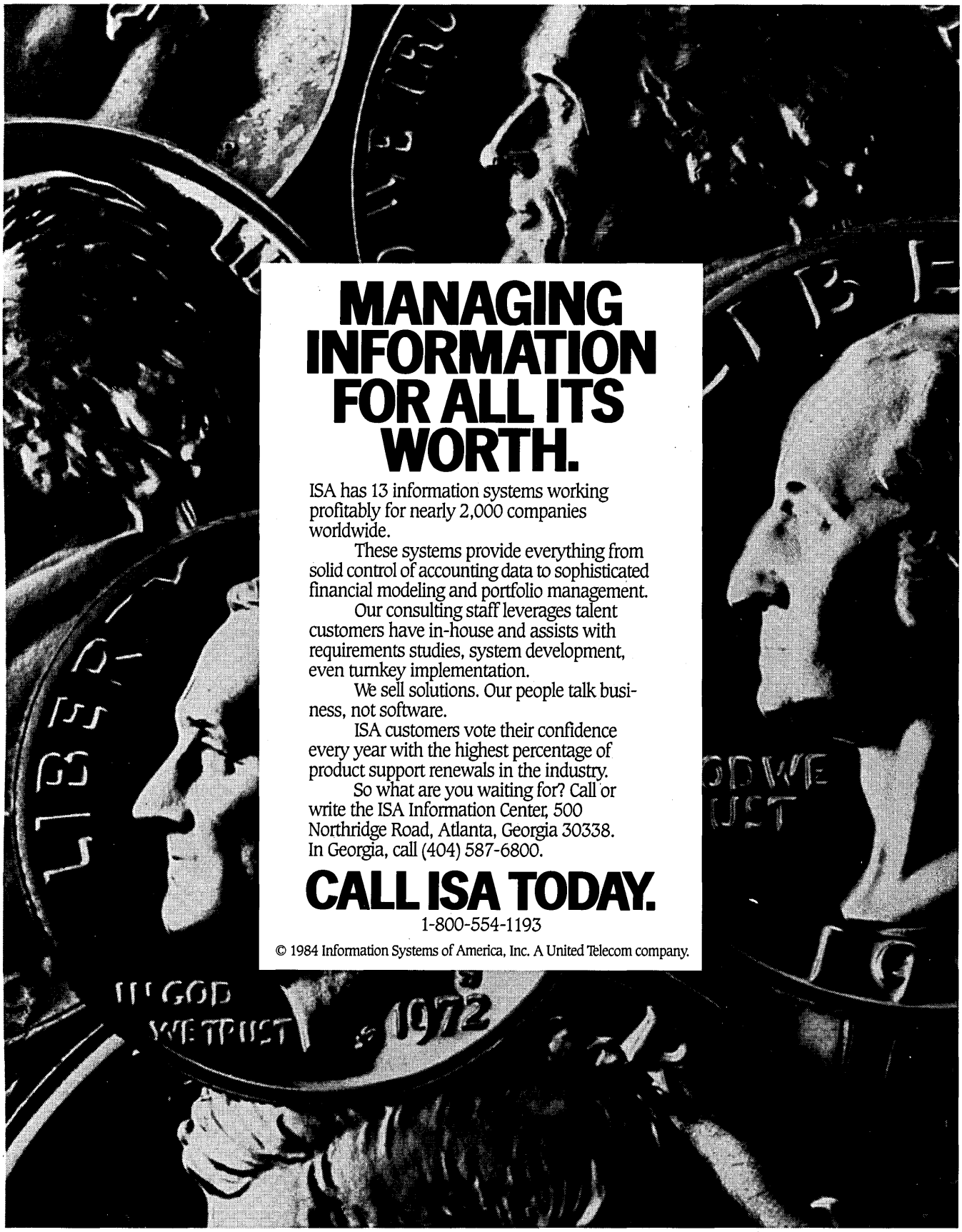

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While there is a limit to the number of technical liaison people one company can send, there is no limit to the number of professional assignees. "That depends on the quality of the candidate and the decision of the project director doing the hiring," explains Harris's Maguire. "MCC does not have to hire a shareholder's candidate."

Although Harris, for instance, supports all four program areas, only half a dozen Harris employees are applying for MCC positions as assignees, Maguire says. Control Data and Sperry are the only other companies supporting all the programs, he adds.

The real measure of MCC's success will come at the end of each project. "Did those that put up the money end up making money in the marketplace as a result of MCC technology?" That is the measure by which Inman says he will judge.

If shareholders don't profit from their efforts, Inman suspects MCC may survive, "but more like a Battelle Labs" rather than a Bell Labs. The robust future of MCC hinges on the robust involvement of shareholder companies and everyone's ability to learn the fine art of technology transfer. ✱

COMMUNICATIONS

RUNNING OUT OF STEAM

Both users and vendors fear that the teleconferencing industry may simply disappear if codec standards are not established.

by Michael Tyler

Sometimes a better mousetrap isn't good enough—you have to market it and package it properly before the world will beat a path to your door.

That seems to be the lesson teleconferencing vendors are learning the hard way. The technology is certainly leading edge: as Jean Claude Delorme, president of Teleglobe Canada in Toronto, notes "Teleconferencing allows us to combine two-way television with telephone, telex, and facsimile to come as close as possible to all participants being together in the same room."

Nonetheless, the technology has gained only slow acceptance. "We have been unsuccessful in getting decision-makers to see the value of teleconferencing," says Anthony Zalenski, an executive with Isacomm in Atlanta. "The technology has been around 10 years and only 5% of the Fortune 500 companies have implemented it. In the next 12 months, that will rise to only 8%."

Don Gooding, director of telecommunications research for the Yankee Group in Boston, tags the market for full motion and slow scan video teleconferencing at a mere $75 million in 1984, and notes that "We've all been guilty of overoptimism, of thinking that if you build $500,000 rooms and charge $1,000 an hour, people will knock down your door. The telecom industry has not seen how teleconferencing fits in with the overall corporate communications network."

Several factors have kept teleconferencing out of many major installations. William Schmidt, general manager of the Overseas Telecommunications Commission in Sydney, lists several: "People are concerned about beaming corporate secrets up to satellites and then back down. People like to travel and don't want that taken away from them. People need to be at the same table, to communicate through handshakes and direct physical contact. On the vendor side, there has been no sustained effort to market the technology properly, and in the past it has been too expensive."

The fundamental problem underlying all of these concerns, however, is that the vendors and the potential (and actual) users often do not understand each other. Isacomm's Zalenski says, 'The focus has been on the technology, not on how the technology should be used. Unless we are successful in finding creative ways of developing applications, we deserve to grow at only 5% to 8% a year."

That misunderstanding is particularly vivid when the issue of standards arises. Currently, three manufacturers dominate the market for coder/decoders (codecs), the key devices in any teleconferencing setup. All three, Compression Labs Inc. (CLI) of San Jose, Calif.; NEC America Inc. of Sunnyvale, Calif.; and GEC-Jerrold Ltd., which is affiliated with British Telecom and whose U.S. offices are headquartered in Hatboro, Pa., use different proprietary coding algorithms, none of them compatible.

"We're running into a situation similar to the 8-track or cassette dispute," says Greg Paulsen, marketing manager of teleconferencing products for NEC. "All the standards have been around for a decade or more, and we're all sticking with what we have.'

Robert Kieper, manager of marketing planning at Compression Labs, agrees with his competitor. "Compatibility between all codecs will simply not happen in the near future because there are too many things against it. It's not just a matter of the coding scheme. The technology that went into the codec is phenomenally incredible. To ask us to stop developing that and to sell someone else's codec would make us a totally different company. We'd all be commodity vendors and every major person in CLI and NEC would leave to do something more interesting."

That bodes ill for users. Leslie Kaiser, who heads the seven city teleconference network set up by Atlantic Richfield Co., notes that her company would like to include participants from other cities in its videoconferences. "We need to talk to people in cities where we don't have enough employees to justify the cost of a room. We would love to trade time in our room in Houston for time in some other company's room in Atlanta or Chicago, but we use NEC and other companies use CLI or GEC." In particular, AT&T's Picturephone Meeting Service network of publicly available video conference rooms uses CLI codecs.

"Unless we are successful in finding creative ways of developing applications, we deserve to grow at only 5% to 8% a year."

"The user perspective is not the vendor perspective," CLI's Kieper responds. "Users connecting to each other is not the issue. The issue is that we have to protect ourselves and our growth rate. You must find a reason for us to want to provide compatibility or you don't have a leg to stand on. How is it in our interest? It's not."

Kaiser argues, "As a user, I feel that if I didn't use teleconferences, the vendors wouldn't be in business. If they were all compatible with one another they would sell a lot more to all of us users."

"They're telling us that because we made it possible to teleconference we need to make codecs standard and ruin our business," Kieper retorts. "I say, no way. We're in it to grow our business first.

"You can't do that with standardized codecs. If the airplane were standardized a few decades ago, either at the Ford Trimotor or at the DC-3 or at the 727, each of which was at the leading edge of its day, there would have been some immediate gain but the much greater airline business as we know it today would certainly never have developed.

"With each generation it becomes possible for more and more people to afford teleconferencing. I understand that users want to talk over what are now incompatible codecs, but is that worth freezing

the technology at current levels or should we keep our options open?"

There are clearly legitimate arguments on both sides, but the tenor of the debate has become more hostile as heavy users such as ARCO become more dependent on video conferences. That hostility may prove to be the undoing of both vendors and users. "We can't look at user-vendor relationships as antagonistic but, instead, as symbiotic," says Jay Borden, who runs Colgate-Palmolive's videoconference network. "We use it because you developed it, but you survive because we embrace your technology. We have to work from the same side or we'll never get anywhere."

Nonetheless, it is clearly the vendors who hold the cards. John Nuwer, director of teleconferencing services for Isacomm, which sells transmission services between private videoconference rooms, says, "I do not believe there will be any standards imposed for codecs, and if there are any I don't know that they'll mean anything. Just because they are prescribed doesn't mean you have to follow them."

And Paulsen of NEC says, "I don't see us being able to talk over incompatible codecs for some time. It won't happen."

Users, for their part, are begining to see that some concessions may be in order. Borden of Colgate-Palmolive comments, "I need to communicate. I need compatibility, and if I can't have that, can I have anything between complete compatibility and what we have now?"

Nuwer responds, "At best, we'll be able to develop gateways of some sort, which would be boxes that do nothing but convert from one standard to another."

John Thompson, deputy director general of British Telecom, argues that that setup is sufficient. "We're at a new stage of the industry. It's going to take years to have teleconferencing established, and there's no harm done in having some incompatibility for some time." Nonetheless, he adds, the major players should attempt to settle the coding issue as soon as possible. "We're just at the stage of doing point-to-point conferences now; even when we join five cities together, it is done as a sequence of point-to-point links. But multipoint conferences are the way of the future and we will have massive spaghetti in setting up conversions every time we want to have a conference."

The most frustrating aspect of the compatibility problem, says Nuwer of Isacomm, is that all three codec standards are similar. "The vendors aren't selling measurements or better technology than one another. They're showing purely what looks good."

NEC's Paulsen admits, "The codecs are all capable of the same things, and they all work. The user has to judge which has the better quality, which vendor has better experience. Both CLI and we use a combination of inter- and intraframe coding in our algorithms, but the combinations are different and proprietary." Because neither is clearly superior to the other, or the GEC-Jerrold codec, he says, neither vendor will capitulate to the other's standard where it might have if there had been clear technological advantages. Nor does it seem likely that any vendor can achieve—or hold—such an advantage.

Given that prospect, it seems clear that the future growth of teleconferencing depends on whether the user-vendor relationship becomes more cooperative. If vendors do compromise the proprietary natures of their codecs, they may be better able to market their products to users. Likewise, if users become more willing to accept some limitations on compatiblity, they will support vendors in overcoming some of the other weaknesses inherent in teleconferencing. Should the user-vendor relationship continue to deteriorate, however, Borden says that "the industry may go the way of quadraphonic stereos—they had great technology but no standards, and they went nowhere." ❋

VIDEOTEX A LA FRANCAIS

While pushing the technology at home, the French videotex industry is spearheading developments in the U.S.

by James Ethridge

Feb. 22 this year saw Honeywell Information Systems (HIS) place an order for 2,500 Minitel videotex terminals with the French company Telic Alcatel, part of the giant CGE group. At the same time, HIS signed a marketing agreement with the French software house Groupe Français d'Informatique (GFI) for its videotex monitor, Télésource, which HIS will supply and maintain.

Last month, some people may have been disappointed that J.C. Penney did not announce at Videotex '84 in Chicago that it planned to launch its FirstHand videotex system (developed with French technology) as a commercial service before the end of 1984. Since the nine-month trial run of FirstHand ended in February 1983, Penney has been exploring the possibilities of introducing a commercial version. But the company's director of videotex services, Stuart C. MacIntire, is anxious to scotch reports that a launch is planned for 1984: "You can forget the idea of our launching a commercial service in 1984. There could possibly be an announcement, but for a service starting in 1985 at the earliest."

Videotex systems may not exactly be up and running as a proven industry in the U.S., but considerable interest is being shown in the potential of both the corporate and residential markets. The French can take more than a little credit for that.

France is clearly ahead of the field with the world's largest and most rapidly expanding videotex network, Télétel, and its telecommunications administration (the Direction Générale des Télécommunications, or DGT) set up a marketing company early on called Intelmatique to export French videotex know-how. Intelmatique's managing director, Roy D. Bright, says it has concentrated on the U.S. as the world's biggest single market, though the French stake remains limited to the promotional activities of Honeywell and the FirstHand experiment. Elsewhere, videotex systems using French technology are operational in Italy, Brazil, Greece, and Kuwait.

FirstHand was a test service operated originally by First Bank of Minneapolis and aimed primarily at the local farming community. It went to 300 users, providing a wide range of data and services from 42 information providers. It ran from May 1982 to February 1983, at which point the project was taken over by J.C. Penney. The director of the project, Stuart MacIntire, moved with it, to continue the work of putting together a commercially viable videotex operation. MacIntire explains that since the trial ended, "we have been trying to determine whether videotex is a business or just fun and games."

For Honeywell, any involvement in a videotex system would be no more than an arm's length investment. It has confined itself so far to marketing a package of French hardware and software for internal, corporate use. HIS began in mid-1983 by setting up a videotex demonstration and support center at Schiller Park, near Chicago's O'Hare Airport, and its recent order for an initial shipment of Télétel terminals suggests it has succeeded in convincing a number of companies of the merits of the system.

In the words of Ed Kozner, a technical adviser at HIS, "Télétel is ideal for high volume information retrieval, from both internal sources and external databanks, since the package includes communications hardware and software."

Intelmatique's Roy Bright also stresses the system's particular advantages for businesses: "It is compatible with existing mainframe systems to give a cheap and flexible up-front solution for access to external databases as well as internal ones." It is only realistic for Télétel to be marketed specifically to the corporate sector in the

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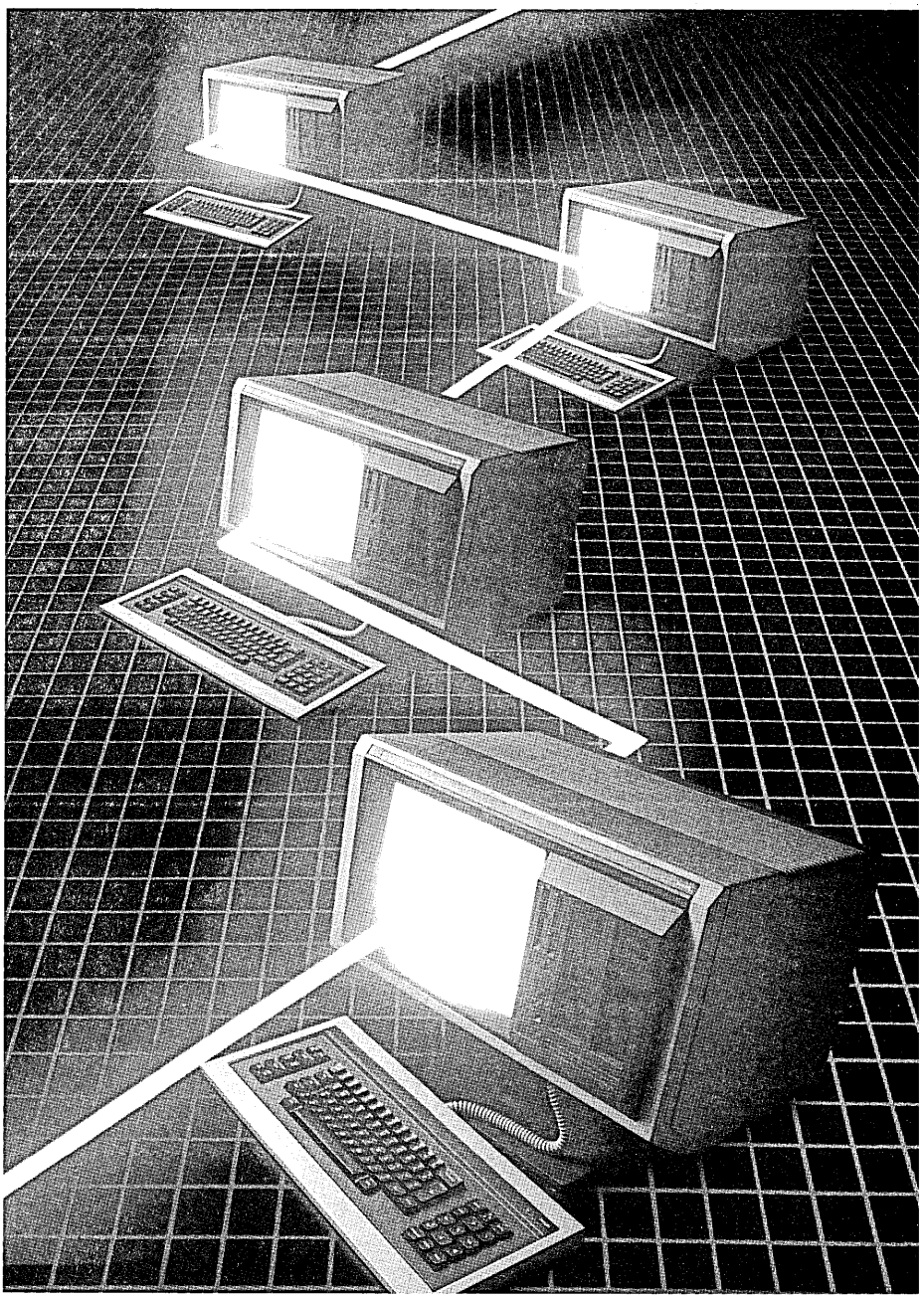

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U.S., since its limited graphics and color capability make it less suitable for a general videotex service aimed at private households. The advertisers that would largely finance such a service would naturally opt for the local display standard, NAPLPS (North American Presentation Level Protocol Syntax). This protocol subsumed the Telidon system developed in Canada and embodies high-quality alphageometric display technology, unlike Télétel, which uses the less sophisticated alphamosaic system.

A prime attraction of Télétel is the wealth and usefulness of its software, even though it suffers the drawback of being designed specifically for the Mintel. Honeywell's Kozner is certainly happy with the products of the Groupe Français d'Informatique. "GFI runs a videotex service for companies in France," he says. "It knows well what its business customers' needs are and its software fits very much what our customers want."

"We have been trying to determine whether videotex is a business or just fun and games."

He concedes it would be hard to adapt the software to the NAPLPS protocol, but points out that HIS hasn't needed to. In any case, adds Kozner, "GFI is planning to make its software adaptable to different protocol terminals, and we will probably see the results at the end of this year."

On its home ground, Télétel does not have to cope with a clash of protocols, of course, since it is a state monopoly. The French videotex network is rolling out region by region on the back of the well-publicized electronic telephone directory, which is hoped to render paper directories obsolete.

In those regions where the service is already available, subscribers have been given the choice between paper directories and free Minitel terminals. They are not allowed both, and Roy Bright says they are divided about 50-50 at present. The telephonic database will become operational at a national level in June, with some 22 million entries in all, giving users equipped with terminals direct on-line access to numbers throughout the country.

There are an estimated 175,000 terminals installed in France at the moment, of which about 25,000 are paid for by business users, and this figure is scheduled to rise to 1 million by year-end to 3 million in 1986. For comparison purposes, Roy Bright reckons there will be less than 250,000 terminals installed in the whole of the rest of the world at the end of 1984.

Only a massive investment of public funds has enabled France to take the lead in establishing the beginnings of a nationwide, all-purpose videotex system. In commercial terms, videotex is still not an economic proposition. As J.C. Penney's MacIntire says "The business of videotex just does not exist anywhere in the world right now."

While France's DGT is looking at ways of building in more intelligence to Minitel terminals to prevent microcomputers from cornering the market, MacIntire is concerned that existing terminals are too expensive, yet still have too limited a functional capability. "The terminals don't exist; it's partly cost, partly functionality, by which I mean more than the keyboard—I mean the functions within the terminal."

In order for the mass market for videotex to take off, manufacturers will have to come up with what MacIntire calls a "dumb, easy-to-use home appliance with some storage capacity." The consumer will also need to be able to buy it like any other household appliance. "Terminals will be sold like toasters and tv sets and will be as easy to use as a toaster," predicts MacIntire. He agrees, however, they will have to conform to the NAPLPS protocol to offer enough graphic and color capability to satisfy merchandisers. Advertisers account for 70% of the total revenue of Knight Ridder's Viewtron service in southern Florida, for instance. Yet Viewtron, which MacIntire describes as "the only major player in the business," has still to turn a profit and MacIntire wonders just how long it will remain in the red.

As a prerequisite for putting First-Hand into commercial operation, MacIntire has been talking to many banks over the past year. He feels that banking will play a key role in a consumer videotex service and that banks should participate in the ownership and operation of the system as well as act as service providers. Intelmatique's Bright agrees that a viable videotex service will have to offer more transactional services. That could have been a major shortcoming of Britain's pioneering Prestel system, which was launched amid a fanfare of self-congratulation and optimistic forecasts in the late '70s.

There are an estimated 175,000 videotex terminals installed in France and a full 3 million are expected by 1986.

But with the number of subscribers falling far short of expectations, British Telecom two years ago shut down 14 of the 16 computers that provided the system's plethora of information services at the outset.

Such cautionary fiascos are not lost on MacIntire. "Videotex systems involve a large amount of up-front investment for the systems operator. You don't push that button until you have a pretty good idea of what business you're in," he warns. *

MICROCOMPUTERS

THE PC MAKES FRIENDS

Easy-to-use relational database software is coming to the personal computer.

by R. Emmett Carlyle

Independent software suppliers are poised to introduce a broad range of advanced packages for the IBM PC that will make the machine significantly easier to use in handling large databases and interacting with remote mainframes.

While their approaches may differ, the independents are all seeking to extend the functionality of the PC and make it easier to use by analysts, financial and market researchers, and other professionals who need to manipulate local and mainframe-stored files. Among the techniques being applied are so-called natural language understanding systems and relational database management routines.

At one extreme, software vendors such as VisiCorp and Lotus Development have attempted to integrate off-the-shelf software such as spreadsheets, word processing packages, and mainframe access programs into integrated environments. These software products, which often use a windowing technique to display different files simultaneously on the PC screen, are designed to tie into the IBM IMS production database in a mainframe. This approach is considered by some observers to be at best a temporary solution to the micro–mainframe database sharing problem.

At the opposite extreme are a new batch of relational database systems designed to run on mainframes and PCs virtually unchanged. In other words, the same software will run on a wide range of processors, giving the user compatibility and usability advantages. One of the companies readying such a product is Oracle Corp., Menlo Park, Calif., which has offered database software to the IBM mainframe market.

Somewhere between these two approaches, and just completing field testing, is new database software from Cullinet, Westwood, Mass., which observers describe as "quasi-relational." Unlike Oracle, which has had the luxury of writing software in the high-level, portable Unix language C, Cullinet's bread-and-butter product, IDMS, like IBM's IMS which it challenges, was written in assembly or machine language. IDMS is neither portable nor rela-

tional. To make it easier to use in unpredictable and ad hoc query environments, Cullinet labored to produce a relational overlay, known as IDMS/R. (IBM attempted the same sort of thing with its IMS 2 project, dubbed Eagle, but failed to produce a product it believed would satisfy its customers—see August 1982, p. 40.)

Sensing the need for a personal computer connection, Cullinet went to Micro Database Systems, Indianapolis, and licensed its Knowledge Man relational query software for the PC for around $1 million, it is believed. Since then Cullinet has set about integrating IDMS/R and its PC software, but unlike Oracle, the same software does not run in both the desktop and mainframe.

Oracle and Qint have chosen radically different routes in the area of product distribution.

In addition to these so-called fourth generation adornments to the PC, a new company created by four former Control Data employees is preparing an English-like query package that runs on the IBM PC. Qint Database Corp., an overseas challenger that now has an office in Boston, devised a method for analyzing information flows using natural language. Gerard Nijssen's Tina (tools for information analysis) allows end users to go beyond the syntax of their information structure to form elementary sentences and objects and get at its meaning. The technique, which has since been adopted by the International Standards Organization (ISO)—where Nijssen was chairman of the database experts group—as the basis for conceptual models, is believed to be the inspiration for IBM's System R relational work on business "activity descriptions," says Qint cofounder and president Stefaan De Schrijver.

Tina, which was written in another portable language, Pascal, runs in 300K of main memory and allows users to create their own conceptual model of their business and their own database.

"How users implement the database is up to them. They can go with Oracle, Cullinet, or whatever. But we're betting they'll choose IBM's fourth generation relational DBMS, SQL/DS which currently is offered on the small 4300 mainframe," predicts De Schrijver.

With this in mind, Qint has also created, alongside Tina, what it claims to be the first relational DBMS software running on micros and the PC that is compatible with SQL/DS and IBM's Database 2. Qint may achieve this end by beating Oracle to the market by about one month, say insiders.

Though converging in this sense, Oracle and Qint have taken radically different routes to the thorny subject of product distribution. De Schrijver estimates that when fully configured (and requiring the full 640K capacity of a PC XT) his Qint/SQL plus Tina will sell for between $5,000 and $6,000. A mainframe version also has been developed for around $30,000. Query and update versions will be available for $1,000 and $1,350 respectively.

"These prices put Qint beyond the reach of retailers like Computerland," argues Oracle's Larry Ellison—and De Schrijver obviously agrees. "We decided at the beginning that we would sell our product through the large service bureaus and vendors, especially those in the office automation area that wish to mount a challenge to IBM," he says.

Because of the company's Danish and Belgian origins (De Schrijver, for example, is a former general manager of CDC Belgium), European users are early targets. The newcomer has been drawn into a tussle with Oracle, which also has a Dutch office, for the affections of Philips. The Dutch conglomerate is said by sources to be evaluating both packages for a new 32-bit IBM PC-compatible workstation it is planning to offer next year. Other names mentioned by insiders for a Qint-Oracle dogfight are ICL, Olivetti/AT&T, and the Japanese—particularly Fujitsu and Hitachi.

Ellison's Oracle, however, doesn't anticipate many head-to-heads with Qint. He intimates that the query and update versions of his software for the PC could sell for as little as $600 come June. "We're looking for high volume and market share early, by selling against packages such as Ashton-Tate's DB II. So we'll be concentrating on retail distribution and high-profile marketing."

According to Harold Feinleib at Non-Procedural Systems Inc., these exchanges are just the opening salvos. "The heavy fire will come next year when the 32-bit workstations arrive to host a new relational wave," he says. Feinleib's Westport, Conn., company is developing a fourth generation nonprocedural programming language for personal computing. The language will enable the programmer to state what data he wants to work on without having to instruct the system on how to get it.

Because fewer statements are required, SQL, for instance, has been clocked at five to 20 times faster than COBOL at IBM sites, and in addition doesn't require the technical virtuosity on the part of the programmer that the older language does. This is one reason why the Mountain View, Calif., research firm, Input, believes the number of programmers using nonprocedural languages will increase 680% during 1983-85, and use by nonprogrammers will increase 990%.

Feinleib claims that his company now has new relational software that goes far beyond the likes of Nomad and SQL. "But we need a workstation with a minimum of 1 megabyte of main memory to even think about running it." He predicts that his relational DBMS software in distributed, high-capacity workstations will make IMS "irrelevant" because most new applications will be mounted through end-user information centers and databases. "IMS will soon begin to settle into some low-growth backwater before petering out altogether in the 1990s," he concludes.

Ellison agrees, and says that IMS's "fate was sealed" when IBM failed to build a bridge from the database to the emerging relational world. "For the foreseeable future, IMS will settle into a pattern of bitty extensions, all of which will slow it down and make it less flexible than it already is."

IBM, for its part, seems to have switched its development focus to relational programs to prepare for the flood of demand for unstructured applications from its customers. In addition to the PC-to-SQL/DS link it has so far neglected to supply, its R Star relational network software for workstations running under the VM/370 operating system is expected next year.

Against a background of such developments it is only a matter of time before the central dp department's years of absolute and unquestioned control of the data resource draw to a close.

"Programmers and users won't settle for anything less than exploring their possibilities at their own pace, in their own place and time, and with their own machine," says Qint's De Schrijver.

IBM'S NEW SYS/36

The powerful office machine marks a strengthening of the role played by IBM's Rochester, Minn., development facility.

by R. Emmett Carlyle

They've been variously described by IBM colleagues in sister divisions as "elitist," "brilliant," "arrogant," and "innovative." These are the engineers at IBM's Rochester, Minn. facility, a group perceived as a "world within the world of IBM." Together they have forged a line of nonmainstream products, the Systems 34, 36, and 38, attempting to build programmerless database machines from scratch, rather than working from IBM's existing 370 architecture.

While other IBM divisions seem to be losing their separate identities, Rochester's is zealously guarded. Other divisions have either chosen, or been forced, to incorporate IBM's ubiquitous PC into their products. "Rather than bend to a generic solution at this time, Rochester has embarked on a mission to produce a more sophisticated and proprietary IBM alternative with the same Chaplinesque appeal as the PC," says one source.

Rochester made a significant move last spring when it unveiled its System 34-to-38 bridge, the System/36, which was greeted with a rapturous response from users. According to IBM's internal magazine, *Think*, the supermicro "attracted orders equivalent to its entire first year quota in less than two months." Sources believe that upwards of 10,000 System/36s were shipped in the latter part of last year, a figure on which IBM declined to comment.

Though these new machines are barely out the door, the irrepressible Rochester elite has quickly followed up with a "baby 36," whose base price $13,000 cpu is now nestled above the PC XT and desktop XT/370. While the new 5360 and 5362 processors are hardly desktops at present—they're about the size of a two-drawer filing cabinet, weigh around 150 pounds, and sit under the desk—sources believe that Rochester is so fired up that it will have a one-board System/36 ready for unveiling next year. After that, who knows?

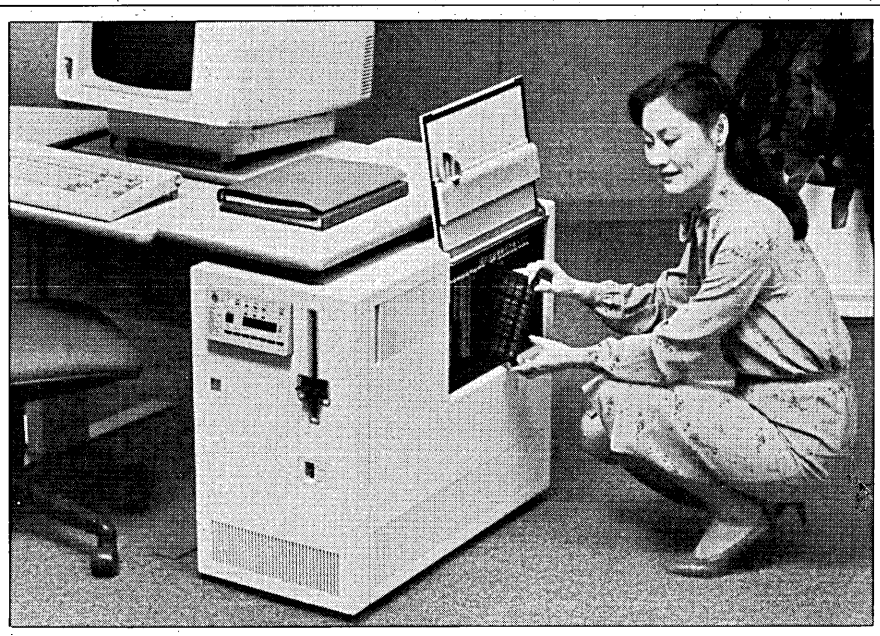
The new machines, which like their bigger brothers offer 24-bit addressing, are believed to use a 1,500-circuit chip produced at East Fishkill, N.Y., and Corbeil-

The Common show at Cincinnati turned into a "love-in with IBM" after the new 36's unveiling.

Essonenes, France, though IBM did not reveal hardware details at the April unveiling before an annual gathering of the Common small systems user group in Cincinnati. The 36 chip features the densest packaging of high-speed logic circuits on any IBM chip. The resulting manufacturing cost is so low that the cpu can be built for under $5,000, analysts say.

An IBM spokesman explained that the 536X models, selling at $23,510, will fit neatly into the gap between the $10,000 entry-level Datamaster configuration and the $34,000 starter configuration on the original System/36.

Unlike the Datamaster, which has a 128K main memory upper limit, the new 36 can grow to 512K and as much as 120MB of attendant disk storage. By comparison, the original System/36 now has a maximum capacity of 1 megabyte main memory and 800MB disk, following a doubling of its power in January.



USER DOES IT: IBM's new 5362 processor for the System/36 can be field upgraded by the user. Plug-in modules are used to add main memory, workstations, and communications, but an IBM service rep is still needed to add disk capacity, the company says.

"This doubling means that a user's source program can now travel from an entry-level, 30-megabyte system to 800 megabytes without any changes. This is the first time that IBM has offered such upward software compatibility and it's a very significant step," claims Brian Sullivan, marketing manager at RTC Systems Inc., located in Attleboro, Mass.

Sullivan and other independent software companies in the area expect new software and compilers from Rochester next year that will take that same user's source program up into the 8-megabyte main memory and 6-gigabyte disk capacity of the System/38. Following that are expected software packages that will help move such source programs into the 4300 and System/370 mainframe world, although it is not yet clear how IBM will merge the System/38 and 370 product lines, say observers.

Detractors of Rochester's go-it-alone method question the wisdom of a nongeneric approach. But according to Robert Fertig, president of Enterprise Information Systems, Greenwich, Conn., the new cpu could have tremendous appeal as an applications processor.

"There are currently 5,000 applications packages for the PC family, with the list growing at the rate of 500 a month. But what isn't generally known is that there are over 2,000 applications packages written for the System/34 that are available for the new 536X family," Fertig says.

Furthermore, the population of System 34, 36, and 38 computers could grow to 200,000 units by the end of 1984, according to observers. "IBM is swinging into volume this month with the 536Xs," says Tom Teresi, chairman of the System 34/36 group at Common, "and we hear talk that it will ship 800 of the systems in May alone, and several thousand by year-end."

Teresi and others who attended the Common show say the gathering had turned into a "love-in with IBM" once the new machines had been unveiled. "Last year at this time we were screaming at them for more capacity than the 34 offered, and the IBMers received very rough handling. Six weeks after last year's Common gathering, they replied by announcing the 36, and this year they got their timing just right," he says.

After the IBM demonstrations, users seemed particularly pleased about the 536X's modular design, Teresi notes. "It's like taking delivery of a video game," said one. "The user assembles it himself and the only thing that requires maintenance by IBM is the cpu board every time you add new disk drives." Another added that it was like buying a calculator—"very easy to use"—and added maintenance, which typically ranges from $60 to $120 a month, is about half what it was for the previous 36, which was one-third the price of a System/34.

According to RTC's Sullivan, the "unthinkable could happen by next fall because of this dramatic lowering of maintenance pricing for the users. "IBM could be selling the machine through retail stores, because when you give a customer control of setting up the system you not only reduce his implementation and training time, you also reduce the need for direct sales as well."

"Regardless of the price tag," Sullivan says, "you can allow for local or retail

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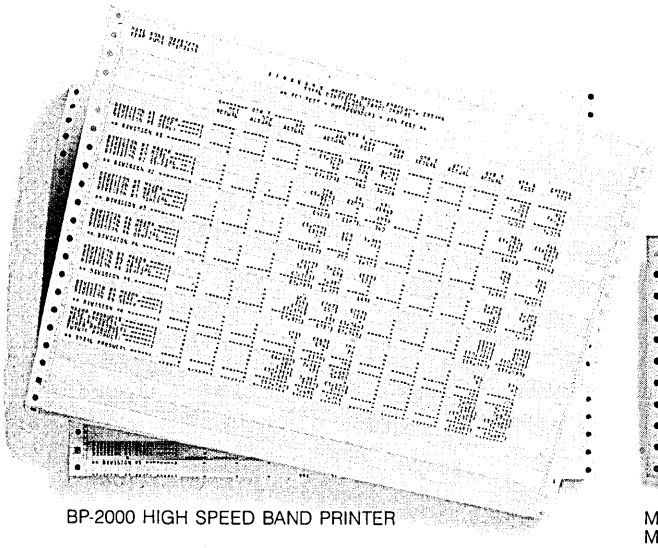

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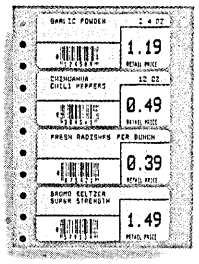

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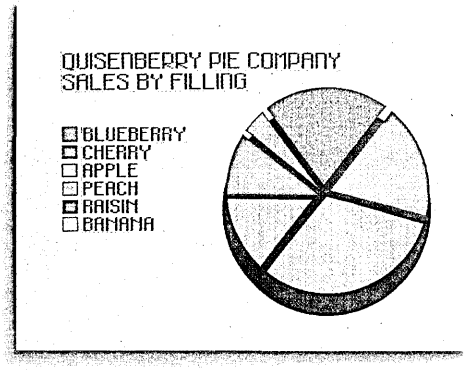

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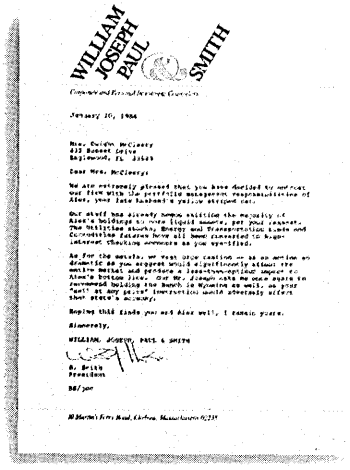

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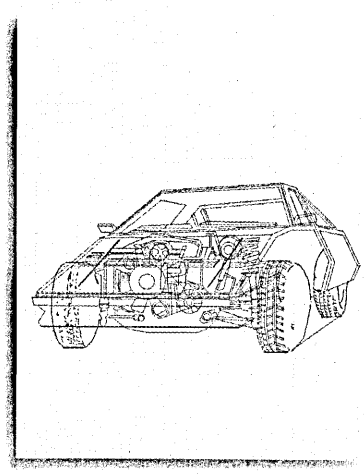

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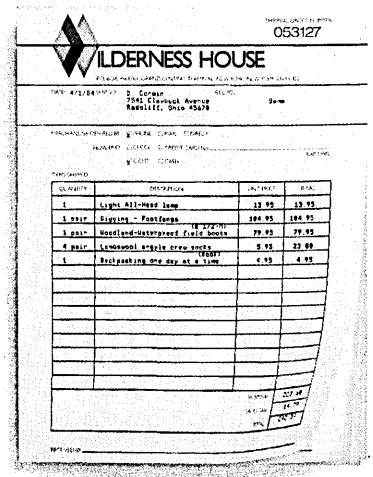

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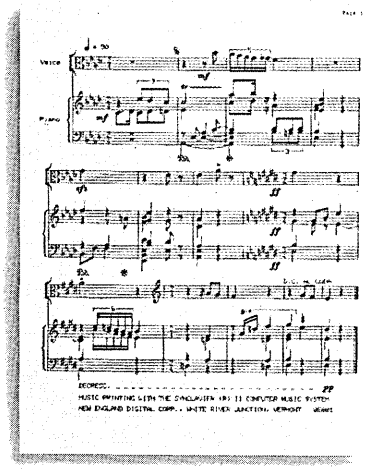

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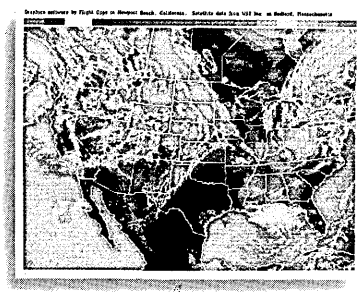
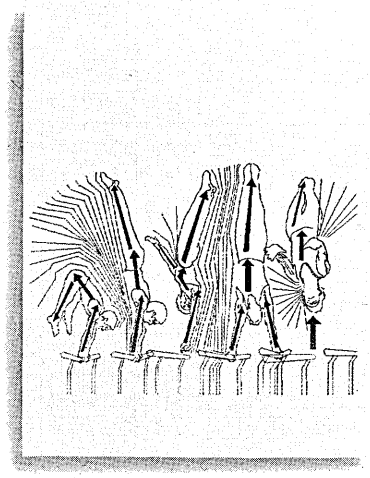


P-132 MATRIX PRINTER



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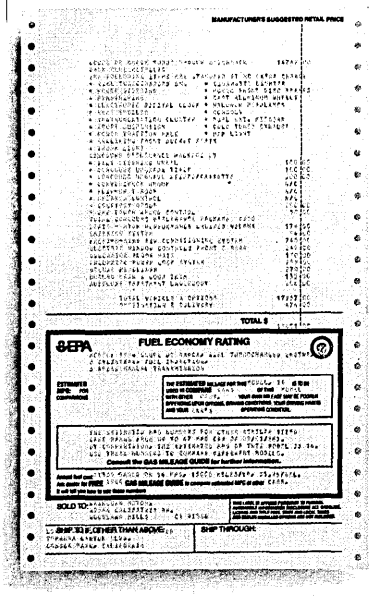
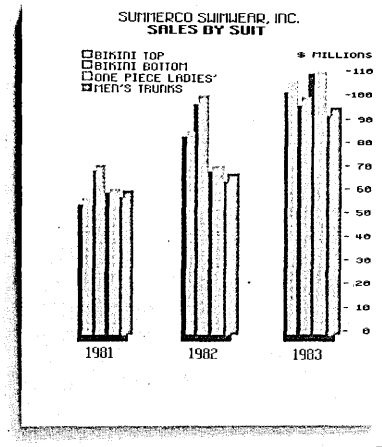


B-1000
MEDIUM SPEED BAND PRINTER



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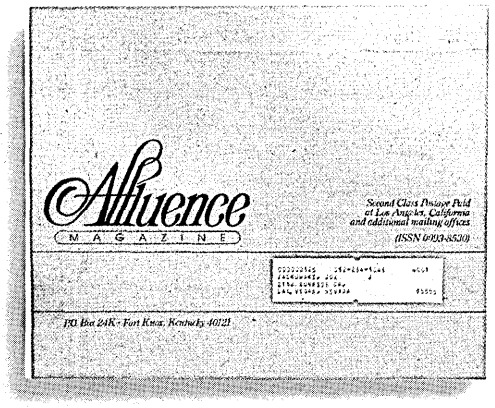
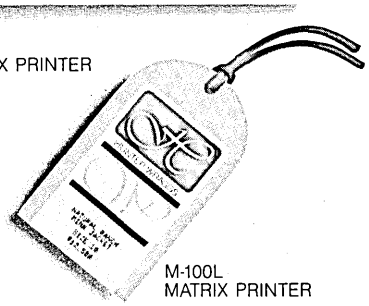
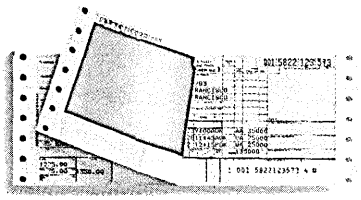


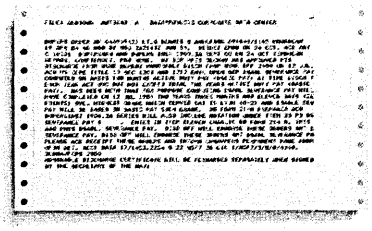
B-600 MEDIUM SPEED BAND PRINTER



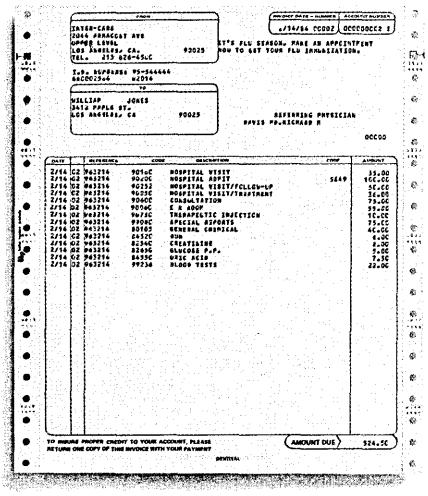
M-100L
MATRIX PRINTER



M-120 MATRIX PRINTER



MXT-1200 MILITARY PRINTER



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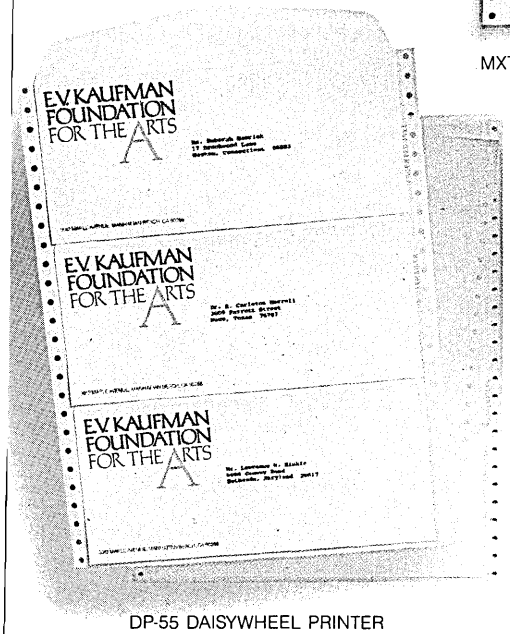
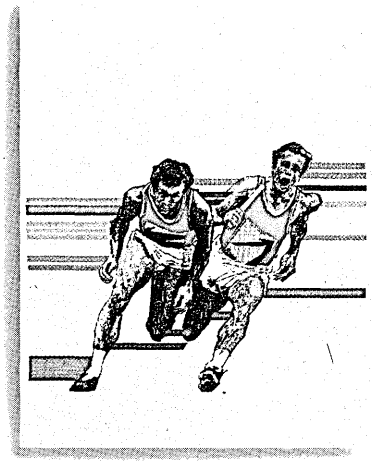
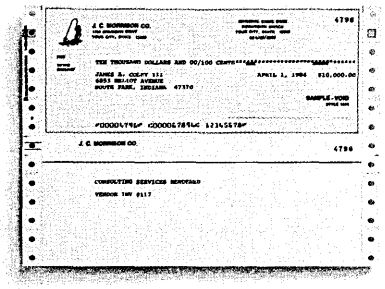


DP-55 DAISYWHEEL PRINTER



P-80 MATRIX PRINTER



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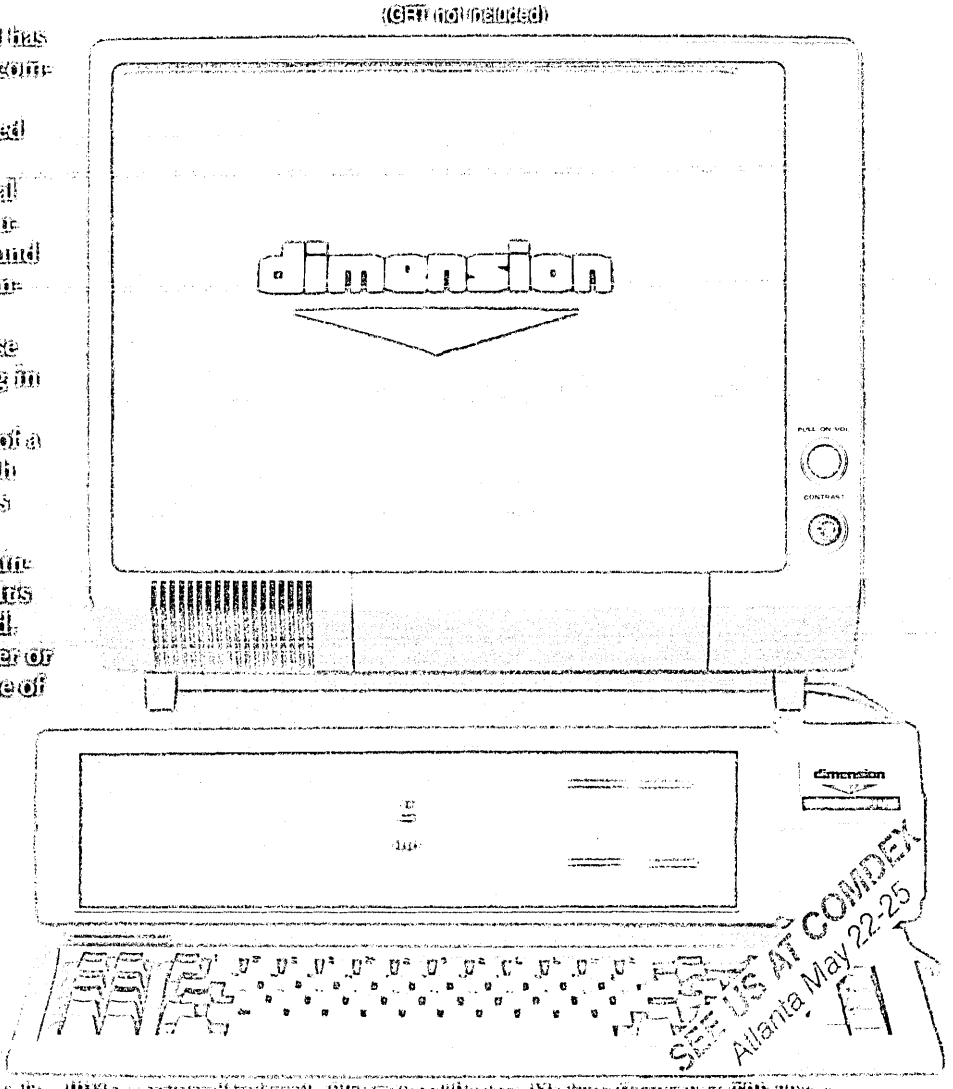

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distribution by nonprofessionals. All the customer has to do is sign the warranty card and call an 800 number if he needs help."

"IBM's whole strategy," Sullivan concludes, "is based on mass marketing and distribution on a nontechnical basis. It has to be if the company wants to compete with AT&T selling its stuff through phone stores."

But not all Common attendees were in a state of such euphoria. The starter system's 128K is not enough for real applications work, remarks George Colony at Forrester Research, Boston. "It'll probably be used as a PC file server in much the same way as the 5520. Its 30MB of disk should cater to 10 to 15 PCs," he estimates.

But by far the biggest complaint was from customers who recently bought low-end System/36s in the 30MB and 60MB class. "These people have really taken a bath," says Teresi, "because IBM is now offering the exact same machine for some 40% less."

In addition, the 536X comes with improved communications, including a 19.2 Kbps communications line straight into the box; thousands of dollars off the price of the Integrated Communications Function software; and $700 off the price of the SSP operating system, Chris Herron, president of Fusion Products, Mill Valley, Calif., says.

While conceding that Rochester has got the bit between its teeth in its attempt to show sister division Boca Raton (responsible for the PC) how to build computers, Teresi and Herron admit that it isn't IBM's style to obsolete a machine so quickly. Maureen Fleming, analyst at International Resource Development, Norwalk, Conn., says IBM's pricing and timing could have been determined by AT&T's late March entry into the computer business, and by its relations with IBM's archrival in the European office products arena, Olivetti.

Says Fleming, "Olivetti is pressing AT&T for its new 3B2 supermicro so it can get the jump on IBM in Europe, but the telecommunications giant is far from volume on its new computers, and can't satisfy its new partner.

"Now Olivetti has to sit back and watch IBM beat AT&T to market with a supermicro in the 3B2 class, while it wrings its hands in frustration. Once again, AT&T has been outmarketed by IBM," she adds. IBM earlier beat AT&T to market with a PC-Unix combination.

Despite a critical mass of 200,000 units by year's end and the tremendous pool of applications awaiting the new baby 36, IBM has a great deal of work to do before it can turn the machine into an office automation winner. In order for it to be a substitute for the 3B family, it will have to run Unix and offer file sharing with the PC. Rochester has so far offered only a bare bones link to the PC, which allows it to act as a "very expensive dumb terminal" to the 536X, one Common attendee put it. But, as Herron points out, this could soon be remedied by independents. He says his own company will offer query and file sharing software for the PC-536X link in June. A similar link between the PC and the System/38 is already available from Fusion.

Expected from Rochester is a new compiler to allow System/38 source programs to run on the 36 family, but because of its nongeneric stance, the Unix compilers and languages will have to come from elsewhere.

"The way the System/36 family is now evolving, there should soon be little reason for Fortune 2,000 companies and below to look for anything else for their business needs," says a hopeful Teresi.

For those on the outside, perhaps a little less buoyed by the Rochester spirit and resolve, there are still big questions. "Whether it wants to or not, Rochester will have to open its new creations to the portable standards that are emerging," says Colony. "Its petals will have to open before it can flower into the future engine of the office world." ✱

MAINFRAMES

HITTING A DEAD END

Users of the popular DECsystem line of mainframes are disgruntled with their vendor.

by Michael Tyler

Not many people are proud to own DECsystem-10 or 20 computers these days. A year after Digital Equipment Corp. said it would not build the Jupiter series of upgrades to the popular line of mainframes, many users still find themselves in a state of disarray and frustration over the lack of any way to expand their computing facilities without undertaking a major conversion effort. Some, it seems, consider owning a DECsystem a source of corporate embarrassment.

"We're in a very competitive business, and our having a DECsystem-10 puts us in a bad light," says the computer systems manager of a midwestern manufacturer, who asked not to be identified. "DEC chopped its head off and that left people like us high and dry."

User bitterness toward the giant computer maker apparently runs deep and has several causes, all related to what is perceived as DEC's fundamental lack of commitment to the mainframe series. "DEC was not able or willing to commit itself to ongoing, continuous mainframe environments," one user says. "They spent only $50 million on Jupiter, which disgusts me. How can you develop an upgrade with so little money? It seems to me that they never had a real corporate plan to do it, even though it was an official project."

A Colorado retail firm's systems manager says, "If you go back to their promises of the past few years, you'll see that they have since been clearly abandoned."

"They spent only $50 million on Jupiter, which disgusts me. How can you develop an upgrade with so little money?"

Harold Patzelt, general manager of information systems for Nalco Chemical in Chicago, says, "I had a private conversation about two years ago with DEC where they described Jupiter and at the time it seemed like a good way to go. The basic design was good, because it did a lot of things that would enable us to go ahead and expand our DEC-10 services to more users. Now we don't know where to move, and I'm ready to shoot somebody at DEC."

Such hostility is common throughout DEC's mainframe user base. The midwestern manufacturer's dp manager explains, "DEC totally misunderstood what a mainframe commitment means. You can find broken promises throughout their sales literature about how they would stick to their commitment, and dp managers who believed that now have their careers injured. Who would want to put on their résumé that they bought a DEC-10 in the last two or three years? I've heard of several dp managers who were fired because of the Jupiter cancellation."

As a result, dp managers have become less willing to accept at face value anything Digital says. Despite the company's assurances to the contrary, these users now distrust DEC's efforts to aid them in moving from DECsystem-10 and 20 processors to the mainstream VAX line, they say. "Sure, DEC says it will help, but I see no real activity there," Patzelt says. "I really believe it is beyond their capability to help. Moving applications from one mainframe to another is nuts, and you shouldn't be in the position of having to do it."

Digital has established a conversion clearinghouse at its Marlboro, Mass., Large Computer Group facility, notes Jerry Weiner, a systems engineer at Teradyne Corp. in Boston. "The clearinghouse is designed to allow users to contribute what they call integration aids, but which are really just conversion utilities, to help each

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other in moving from the 36-bit mainframes to the 32-bit superminis." Several users, including Weiner, note that the clearinghouse has not been of much help in the few months since it was established, however.

The number two computer maker's track record does not inspire confidence among users that the clearinghouse will provide much assistance in migrating from the DECsystem environment. "They have done similar things in the past," says a systems engineering manager at an East Coast timesharing company. "They're doing some things to help us integrate to the VAX line, but it's clear to me that they expect us to bear the brunt of the cost and effort of converting."

And even if users do successfully convert to the VAX line, they say, they still cannot rest easy. "It's rather clear at this point that the same thing could happen to the VAX line," the midwestern systems manager says. "They may simply say they will no longer support it. That's why we decided we would be better off with IBM." Indeed, Digital's long-awaited high-end VAX processor, the 11/785, had slipped behind schedule by the time it was announced April 3.

"It's rather clear at this point that the same thing could happen to the VAX line," says one user.

DEC did not respond to phone calls by press time.

With or without Digital's help, the conversion from the DECsystem environment to a VAX environment has many dp managers quaking. "It's a massive conversion from 36 bits to 32 bits," the timesharing manager says. "The DECsystem and the VAX are completely different, even if you're using the same languages. For us, it is particularly bad, because we've done some major modifications to the TOPS-10 software."

Other users note that once the conversion has to be made, it is just as difficult to move to a VAX as it is to a totally alien environment, such as an IBM system. "We looked at the available software for the kinds of administrative applications we have on the DEC-10, and there's really nothing on the VAX that is appropriate for the scale of our requirements," says Warren Fugate, assistant director of systems operations at the University of Pittsburgh. Rather than going with a VAX, therefore, Pitt will be converting and upgrading to a National Advanced Systems, Mountain View, Calif., AS 8050 running MVS, a procedure that Fugate believes will take two years.

The university has three DEC-10 machines, one for administrative use and the others for scientific research applications, Fugate notes. It is only the administrative machine that will be replaced with the NAS gear; the scientific machines will eventually be replaced by DEC VAX systems, he says, noting that much research software is available on VAX.

"It's going to be massive, but NAS will be helping with some services to get us started."

Similarly, Burns & McDonnell, in Kansas City, has decided to move from the DECsystem environment to a VM/CMS environment on IBM equipment. "We do feel that a conversion is required to avoid the dilemma of being stuck with a nonupgradable machine," says Alex J. Wilson, the firm's dp manager. "It's a multiyear conversion. In a four-year time frame, with maybe six more months until we can obtain a replacement system, we feel that it will be a very tight schedule to convert our major applications before the risk of being unable to service the DEC-10 becomes too great."

It is ironic that users are now so disgruntled with DEC over the DECsystem disbanding, for the family of machines and its TOPS operating system have long been highly regarded as superior timesharing machines. DEC's introduction of the systems—the DEC-10 series making its debut in 1971 followed by the downscaled DEC-20s in 1978—gave the company a strong competitor against IBM mainframes, particularly in the hotly contested educational market.

DECsystems have found wide use in universities and colleges, particularly in research applications. The machine's superiority in timesharing gave them appeal for physics and chemistry labs where many researchers needed to work with common files. The DECsystem line was also the main workhorse for much research in so-called artificial intelligence—much pioneering work in the LISP language was undertaken under TOPS-10.

Another class of users were timesharing services companies, which jumped at the DEC-2020 system at its introduction as a means of installing hardware at user sites, which could then be tied into the vendor's central network. Among the most successful with that scheme were Automatic Data Processing's Network Services division, Ann Arbor, Mich., and Rapidata, Fairlawn, N.J.

Some users say the need to convert is imminent even if they don't believe their DECsystems will be fully taxed in the next five to 10 years. "DEC says they will support the 10 and 20 for 10 years," Teradyne's Weiner says, "but I think that after about five years our machines will be beyond help."

Wilson of Burns & McDonnell questions DEC's commitment to servicing and maintaining the mainframe series over the next 10 years. "We feel that in three to five years we would have difficulty continuing the use of our system due to a lack of hardware support as the user community declines," he says.

Another user notes that DEC has already shown that its DECsystem users are not given priority and argues, "If you get down to one user in the city DEC isn't going to support it well no matter what they tell you. They won't stock the parts or keep up a staff very well."

The Colorado retailer adds, "It's inevitable that no matter what they say, in the long run the series will be less important to DEC and to software vendors than the VAX. We won't find any new software for the machine—and until now there's only been a poor variety to begin with."

Other users believe the day of reckoning, when the DEC mainframe finally expires either through unsupportable demand or through willful neglect by DEC, is not close at hand. The timesharing company says it has five to 10 years to decide how to move beyond the DECsystems it has installed, and is in no rush to convert despite the tremendous amount of custom code that will need to be moved. The Colorado retailer says, "We still have a functioning machine, and in the next few years we won't be changing what we're doing. But we won't be investing in the machine with new applications, either. We'll wait until we have a new machine."

Inland Steel reportedly will not switch until it finds a better timesharing system, and neither the Harvard Business School nor the Associated Press have any plans to expand or convert their systems within the next five years. (Chris Coles, assistant manager of data processing at AP, says that when the time does come to upgrade, however, DEC will not be involved. "I've had several problems with DEC over the past few years," he says, declining to specify what they were.)

"I think that taking that blasé attitude is being intellectually dishonest," says a midwestern manufacturer's dp manager.

"I think that taking the blasé attitude is being intellectually dishonest." the midwestern manufacturer says. "You have to pay the price of having a DECsystem at some point, even if it's hidden in upgrading to a more powerful incompatible system."

The question now facing users is twofold: when to pay, and whom to pay? Does one stick with DEC and convert to VAX at some point in the next five years or so, and if so, when, or does one switch to some other company? Patzelt notes that in its sales pitches IBM has already begun stressing its relatively new 4381 mainframe, which he says is roughly comparable in power to the DEC mainframes. As New York consultant Philip H. Dorn notes, "The door is open." ✲

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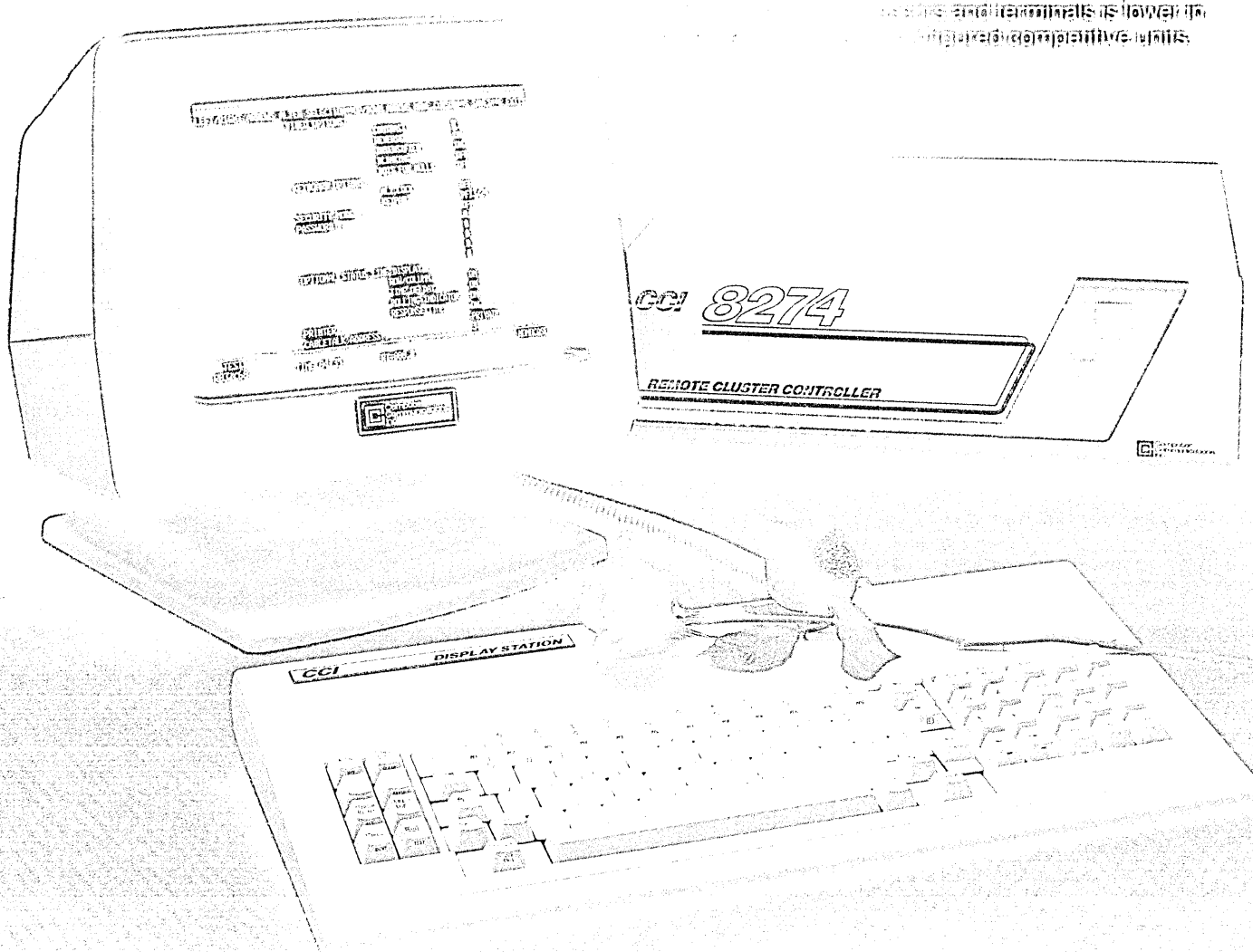

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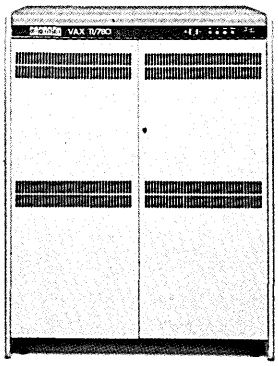

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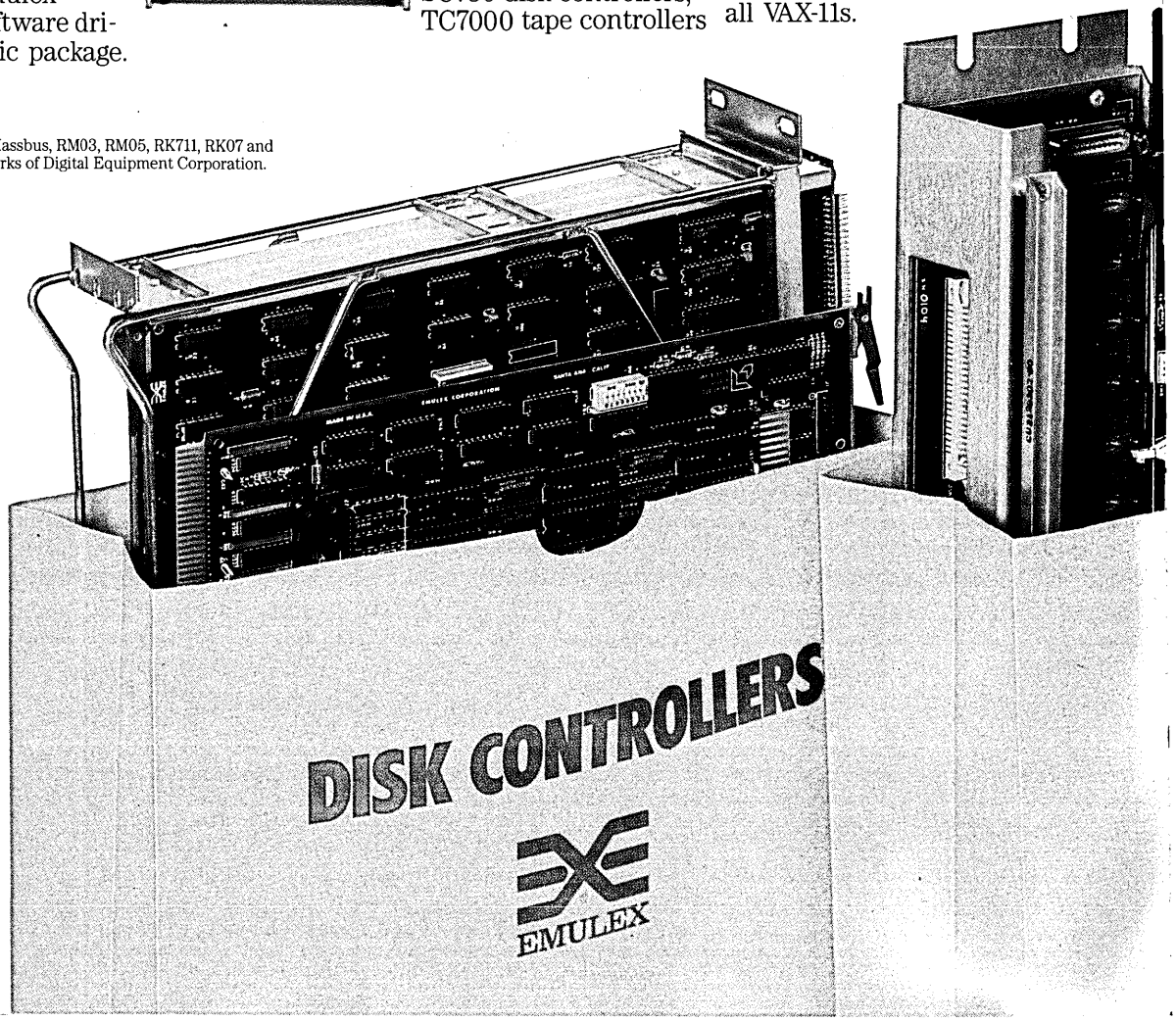

sers? Emulex, of course!

FOR THE VAX-11/750...

TC7000—A single-board, software transparent controller that interfaces directly to the internal CMI to support 1-4 STC or 1-8 Pertec formatted type drives. Emulates DEC's TM03/TU77 with tape speeds up to 125 ips at 1600/6250 bpi. Supports both "old" and "new" GCR 6250 kinds of drives.

FOR THE VAX-11/780...

TC7000—The same board, with the flip of a switch, fits in the V-Master/780 chassis to provide transparent emulation of DEC's TM03/TU77 through the SBI. Supports 1-4 STC or 1-8 Pertec formatted type drives at tape speeds up to 125 ips; 1600/6250 bpi. Both "old" and "new" GCR 6250 technology is supported.

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FOR UP TO 16 LINES—CS21 SERIES...

CS21/F—Emulates the asynchronous portion of the DMF-32 for use on VAX-11s. Is software transparent with VMS Version 3.0 and above. Handles 16 lines per controller.

Statcon 21—Statistical concentration through the combination of the proven CS21 multiplexer with special microprogramming and the CM22/EX local statistical port concentrator. Handles up to 16 remote lines per statistical concentrator, up to 32 lines per controller.

FOR 16 TO 128 LINES AND MORE—CS11/CS32 SERIES...

CS11/F—Emulates the asynchronous portion of the DMF-32 for use on VAX-11s. Is software and diagnostic transparent, and can handle 16, 32 or 48 lines per controller.

Statcon 11—Combines the proven CS11 multiplexer with special microprogramming and one or more CM22/EX local statistical port concentrators.

CS32/F—A single-board communications controller that's totally software transparent to DEC's new DMF-32. One CS32 can handle up to 128 lines per controller board.

Statcon 32—Combines the CS32 multiplexer with special microprogramming and the CM22/EX local statistical port concentrator. A single CS32 controller board handles an amazing 256 remote and local lines in this statistical concentration mode.

For more information on Emulex products for VAX, call toll-free: (800) 854-7112. In California: (714) 662-5600. Or write Emulex Corporation, 3545 Harbor Blvd., P.O. Box 6725, Costa Mesa, CA 92626.

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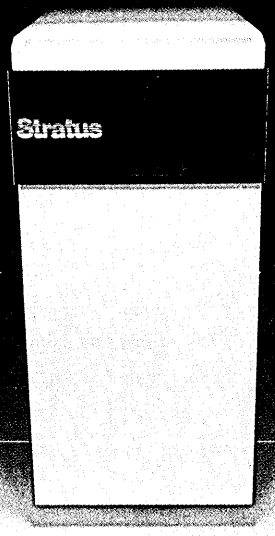
CIRCLE 45 ON READER CARD

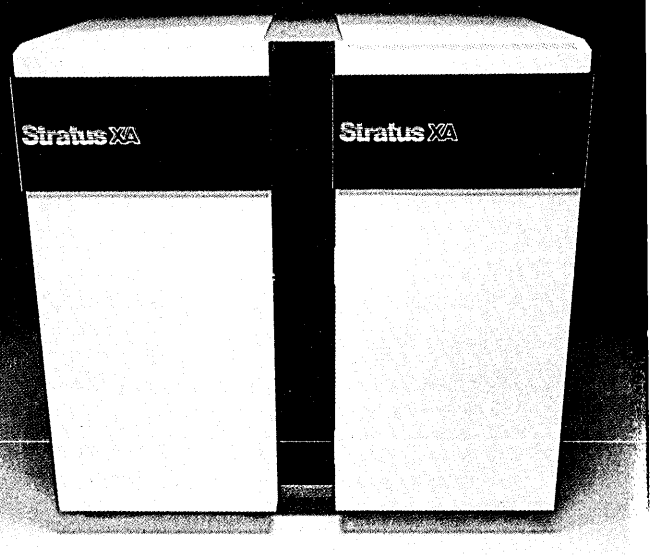
1982

STRATUS INTRODUCES THE WORLD'S FIRST HARDWARE-BASED FAULT-TOLERANT COMPUTERS.



1984

STRATUS INTRODUCES THE WORLD'S MOST POWERFUL FAULT-TOLERANT TRANSACTION PROCESSING COMPUTERS.



If You Need Transaction Processing, You Need to be Able to Count on it Every Second.

With the introduction of the new XA 400 and XA 600 Extended Architecture computers, Stratus can offer transaction processing power that goes beyond anything else available. This is great news in a world that is more dependent on transaction processing with each passing day. What makes it even better news (in a world where companies can lose thousands of dollars for every minute of downtime) is that it is *fault tolerant* transaction processing.

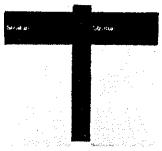
1982 is Compatible with 1984.

The original member of the Stratus/32 family, the FT 200, and the new XA 400 and XA 600 computers are completely program compatible. In addition, you can expand your Stratus/32 system by connecting together any combination of the three computers, creating a single system with up to 32 processors.

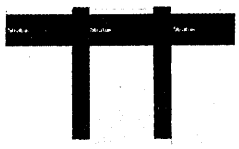
With the use of our StrataNET software, a network of over 65,000 processing modules can be joined together to provide a system that will work on thousands of transactions per second, with hardware based fault tolerant reliability.

Added Power, but No Added Effort for Programmers or Users.

One of the advantages of Stratus' hardware based approach to fault tolerance when it was introduced 2 years ago was that, unlike software based fault tolerant computers, it required no added attention from programmers or users. This is just as true now for the powerful new Stratus XA computers. Even the XA 400 with 4 parallel processors, and the XA 600 with 6 parallel processors, high speed cache memories, and additional hardware instructions require no more effort from developers and users than the original Stratus/32.



XA 400



XA 600

1984, and Beyond.

The writing is on the wall. Transaction processing in increasing volume will be the order of the day. Meanwhile, hardware based fault tolerance that can deliver continuous processing without loss of performance is already a necessity, rather than a luxury. No other computer is as prepared to prepare you for the demands of the times as is Stratus. For more detailed information, please contact your local Stratus sales office, or call Keith Johnson in Massachusetts at (617) 653-1466, or toll-free at 1-800-255-1515.

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CIRCLE 46 ON READER CARD

BENCHMARKS

JOINT VENTURE: Control Data Corp. and N.V. Philips extended their cooperative optical disk venture by forming a new venture, Optical Storage International (OSI). The venture is 49% owned by CDC and 51% owned by Philips, but CDC will manage it from a new Santa Clara, Calif., headquarters. The joint venture will use two development labs originally set up by the first CDC-Philips joint venture in 1982; the labs are in Colorado Springs and in Eindhoven, the Netherlands. OSI will lease manufacturing space in Santa Clara from Magnetic Peripherals Inc., another CDC subsidiary, for the production of the optical disk drives. The 12-inch glass-coated media for the drives will be manufactured at a Philips plant in Blackburn, England. While no product was announced, the venture is expected to introduce the drive later this year. It is expected to hold a billion bytes per side in a nonerasable format, with a density of 32,000 tracks per inch, and 32 sectors per track. Jim H. Caldwell, vice president of operations of OSI and former vp of peripheral products operations with CDC, would not say how much money has been sunk into the new venture, nor how much the disk drive or media would cost.

KILLS PROPOSAL: Japanese officials failed to meet a self-imposed March 27 deadline for submitting a controversial software copyright protection bill to the Diet, Japan's parliament. The bill, developed by the Japanese Ministry of International Trade and Industry (MITI), would have removed standard copyright protection from software and replaced it with a new system offering much less protection. Foreign software owners would have been compelled to license their programs to domestic computer makers under the bill. The proposal caused much angst among industry groups, with CBEMA and ADAPSO making vociferous written and verbal protests to the U.S. government. The concern reached Vice President Bush, who met with Japanese foreign minister Shimataro Abe in January to urge that Japan join the rest of the world in allowing computer software to be protected under copyright law. The U.S. pressure, combined with infighting between MITI and the Agency of Cultural Affairs, which proposed a less restrictive measure, prevented the bill from being introduced by the March 27 deadline. "It's conceivable that something could still happen," says CBEMA president Vico Henriques, "but it's not too likely." According to Maureen Smith, director of the Commerce Department's Japan desk, the latest a bill has ever been introduced into the first session of the Diet is May 5. If nothing is introduced by then, the same bill may be introduced when the Diet resumes in October. "We're just going to keep screaming and yelling," says Clyde Prestowitz, a Commerce attorney. "If we weren't effective, the bill would be law."

IMPORTS DOUBLE: The United States imported some $1.5 billion worth of computers, peripherals, and subassemblies from Japan in 1983, according to figures from the Commerce Department. That was twice as much as in 1982, and it was enough to turn a U.S. trade surplus into a $696 million deficit. Computer equipment imports tripled in 1983, to $819 million from $274 million, while computer subassemblies and parts imports grew 63.5%, to $708 million from $433 million. U.S. exports of the same equipment grew only 7.3% in 1983, to $828 million from $722 million. The Japanese import figures include sales of Japanese gear to U.S. oems and distributors, such as Amdahl Corp. and National Advanced Systems, as well as direct sales to U.S. customers. The figures cover the entire range from large-scale mainframes to personal and business microcomputers. U.S. firms exported $148 million in computer systems to Japan, up slightly from $137 million a year ago, and $387 million in subassemblies and parts, up $4 million from 1982. U.S. exports of single-case computers, including micros, grew 33% to $85 million from $63 million. The U.S. shipped $55 million in random access storage peripherals, up 14.5%, and $16 million in serial access storage devices, up 6.7%.

SEEKS PROTECTION: IBM has asked the U.S. Customs Service to monitor imported counterfeit copies of a dozen operating systems, 20 applications programs, and about 40 other products. The government agency has already approved IBM's request for special protection against illegal imports of the 12 operating systems and about 15 other products. IBM is the second computer maker, after Apple Computer, to register its copyrights with the Customs Service and ask for protection. Customs is usually compelled to accept a firm's request for protection if the firm's copyrights and supporting material are registered in Washington. IBM's first copyright registration with Customs was approved in November, and additional products were approved in the first two months of this year. The specific IBM products registered were not identified, but officials said they included the popular Personal Computer product line. Other products believed to be part of the protection request include instructional material and printed matter.

MILE-HIGH TECH: The 100-mile stretch between Boulder and Colorado Springs in the eastern foothills of the Rocky Mountains may be staking its claim to becoming a high-technology center. A study sponsored by the Central Bank of Denver and Arthur Andersen & Co. found that high-technology firms there are expecting an overall sales growth over the next three years of some 60% and an increase in employment of 50%. The study also found that most of the high-tech companies there are startups, created by former employees of the few established firms in the region. Storage Technology Corp., in Louisville midway between Boulder and Denver, and Hewlett-Packard in Fort Collins, farther south, are two such firms that have contributed to the startup fever. Some 62% of the companies responding to the study were formed after 1975; 28% were formed since 1980. Most of the startups are small, with 58% having fewer than 20 employees.

MULLS PURCHASE: Pacific Telesis is considering the purchase of Mercury, a privately held United Kingdom communications firm set up to compete with British Telecom. Pacific Telesis, one of the seven regional companies formed by the breakup of AT&T, applied to Judge Harold Greene for a waiver which would allow it to market products and services overseas. Greene ruled in the breakup case that the operating companies could not do so, and the Justice Department has filed several objections to the Pacific Telesis request. Pacific Telesis is thought to be interested in buying up to a third of Mercury, which is owned by Cable and Wireless (40%), BP (40%), and Barclays Merchant Bank (20%). Mercury has an exclusive license in the U.K. to compete with British Telecom, but it may not be commercially successful. Barclays has already said it wants to sell its share. If Pacific Telesis overcomes the U.S. obstacles to its purchase, it must still contend with the British licensing and regulatory framework, which may not want an American firm to hold a significant stake in the British Mercury.

SIGNS CORVUS: Honeywell has signed a $60 million oem contract with Corvus Systems Inc., San Jose, for microcomputer systems and local area networking equipment. The three-year deal calls for Corvus to design a micro system specifically for Honeywell, which design the Minneapolis mainframer will introduce sometime this spring. The agreement also covers Corvus's Omninet local area networking and disk drive products, which will be used in Honeywell's series 7900 bank branch automation systems. Honeywell said the Corvus equipment, based on the 68000 microprocessor running Unix, would be offered as an office system for engineers as well. Honeywell retains manufacturing rights to the workstation and would exercise those rights depending on demand for the workstation. The Corvus systems complement the Columbia Data Systems pcs that Honeywell already sells. ✲

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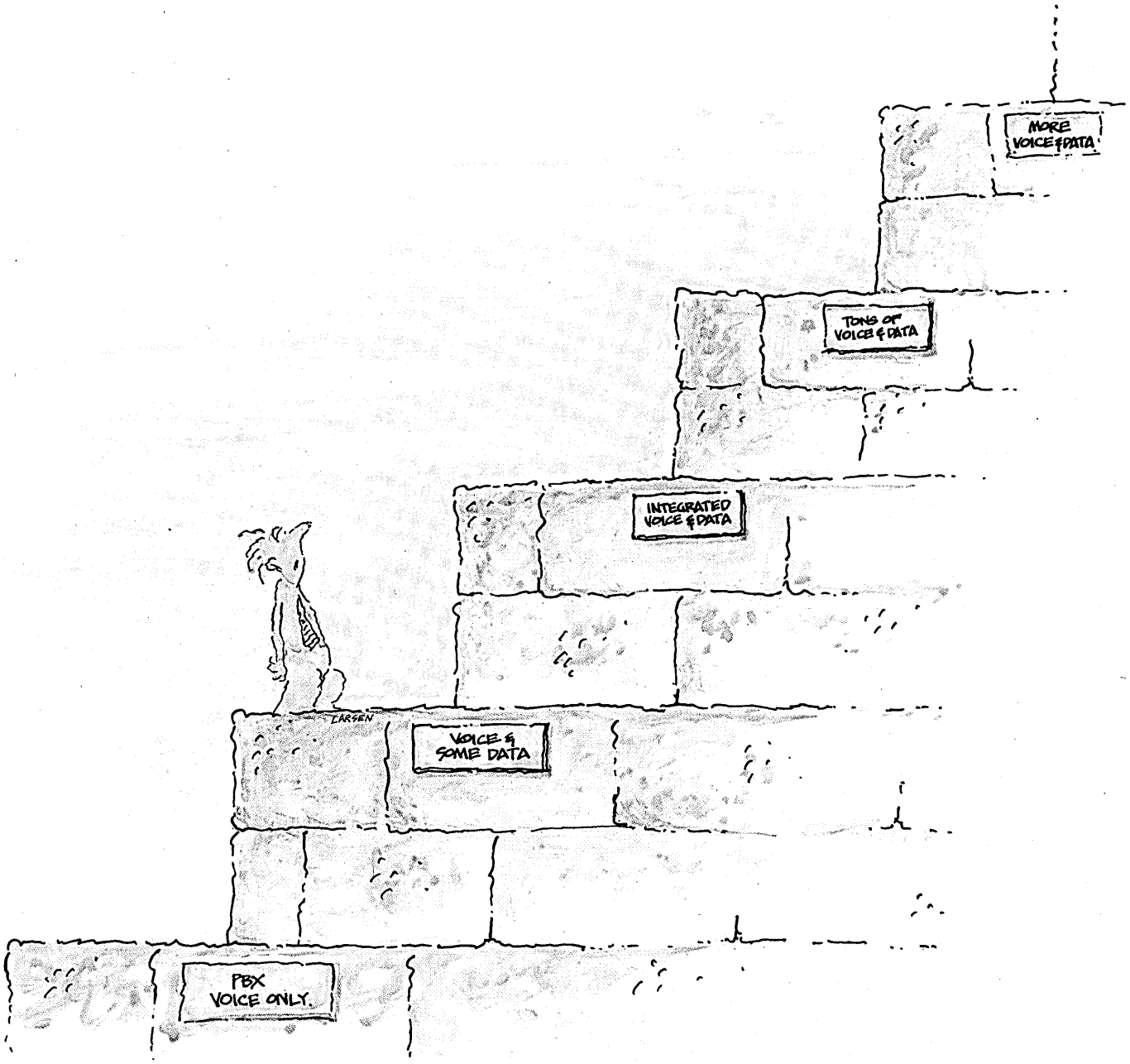

IBM and HP and DEC and Data General and the other movers and shakers to guarantee that we can take their new products and new systems in stride.

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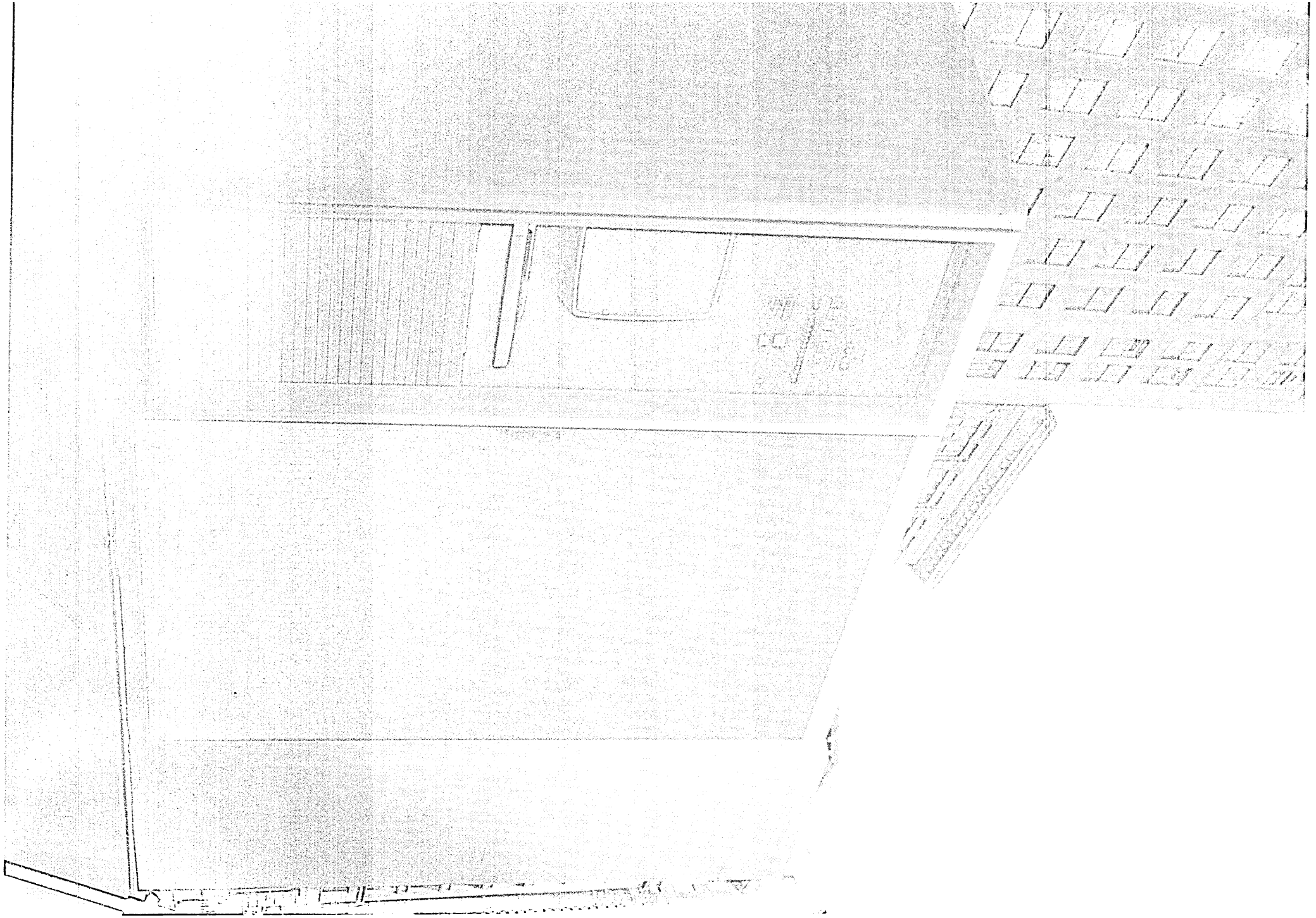


The big machines continue to grow as they are called upon to service data-hungry personal computers.

SURVEYING THE MAINFRAME LANDSCAPE

by John W. Verity

The personal computer, particularly as sold by IBM, continues to gain importance in the mainframe data processing world, accounting for a growing amount of revenues for manufacturers and forming the basis for many user-oriented applications. While IBM enjoys increasing acceptance of its PC as a de facto standard in the corporate sector, its mainframe competitors are finding mixed success in trying to penetrate the all-important, high-growth pc/office systems markets.

According to the 1984/85 computer market survey, researched for the 12th year by Cowen & Co. in conjunction with DATAMATION, the IBM PC will capture three quarters of respondents' planned personal computer purchases during 1984, up from a commanding three fifths of last year's unit purchases. Apple's share of respondent unit purchases will shrink to 6.7% from last year's 18.5%, according to the survey results.

The survey comprises responses from 4,993 U.S. and Canadian user sites received prior to Feb. 29, 1984. Increased observation of telecommunications, personal computing, and software trends were made in this year's survey. In addition to a penetrating look at IBM mainframe sites, the survey detailed spending and procurement trends at Sperry, Burroughs, NCR, and Honeywell shops.

Some major conclusions can be drawn from this year's survey results:

- IBM has found great success with its System/36 midrange machine, the Personal Computer, and increasingly so with its new 4361 and 4381 systems.
- Plug-compatible manufacturers (pcms), both in the cpu and peripherals markets, offer little threat to IBM, despite gains they have made in the 3380-class disk arena.
- In general, large-scale system users are showing the biggest appetite for additional computing capacity, a good portion of which

is being fueled by demands placed on mainframes by the growing pc population.

- Applications software is generally the weakest point for non-IBM mainframe suppliers, according to users.
- IBM is garnering an increasing share of distributed processing and office systems installations, even at sites that are using non-IBM mainframes.
- High-end Sperry users are apparently convinced the manufacturer will finally be able to deliver its long-promised but delayed 1100/90 mainframe.
- A warm reception for NCR's 9000 series of machines is expected, but demand for the Convergent Technologies-built NCR Worksaver may be on the wane.
- Pent-up capacity demands among Burroughs users look strong, boding well for the company's order rates into 1985.

FIG. 1

NON-IBM USERS NEED MORE INDUSTRY APPLICATIONS SOFTWARE

Query: Which category of service needs the most attention by your vendor?

	MOST FREQUENTLY CITED CATEGORY			
Industry served	**Honeywell**	**Sperry**	**Burroughs**	**NCR**
Manufacturing	Applic. software	Applic. software	Applic. software	Applic. software
Wholesale/Retail	Applic. software	Applic. software	Maintenance	Applic. software
Financial Instit.	Applic. software	Applic. software	Applic. software	Applic. software
Service Bureaus	Sales personnel	Applic. software	Maintenance	Systems engineering support
Education	Applic. software	Applic. software	Applic. software	Applic. software
State/Local Govt.	Applic. software	Applic. software	Applic. software	Applic. software
Federal Govt.	Applic. software	Operating systems software	Systems engineering support	No mention

Among IBM mainframe users, the industry leader is enjoying continued strong demand for its products, particularly among large-scale users who are nearing capacity on their 308X mainframes, according to the survey. While the results of the survey were tabulated before IBM's March mid-life kicker to the 308X series, the 308XX machines, the survey shows a strong outlook for the 3084 segment. Following last September's introduction of the 4361 and 4381 cpus, respondent demand appears strong for those machines. Indeed, the 4381 is perceived as siphoning away orders from users who would previously have ordered 3083 computers.

Despite the aging of the 308X product life cycle—a follow-on line of mainframes code named Sierra or Trout is expected to be unveiled by early next year— the vast majority of 308X machines are being booked as purchases. In terms of dollar value of 308X installations planned for the following 24 months, users said they would purchase 44%, lease 8% from IBM Credit Corp., lease 33% from third-party lessors, and lease 11% from IBM on a long-term basis. That leaves only 2% renting machines from IBM. IBM Credit Corp's portion of that overall 308X activity is up from 3% in last year's survey, but still substantially below that of third parties.

As for 4300s, on a similar dollar value, 24-month basis, 45% of the machines will be purchased, 9% leased from IBM Credit, 31% leased from third parties, 10% leased from IBM for two years, and 2% rented from IBM. (About 3% of the 4300 machines will be purchased on the used computer market.)

Last year saw a substantial shift from lease to purchase, particularly in the IBM installed peripherals arena, where, for instance, only 17% of survey sites were renting or leasing disk drives directly from IBM, compared to the previous year's comparable figure of 47%. Similar shifts were seen in add-on memory—to 12% from 31% leasing or renting from the parent corporation—and in terminals, where last year's figure of 53% dropped to only 17%.

Disk drives and terminals were seen as showing the strongest procurement activity among respondents, with almost 40% of respondents planning to acquire products this year in each category. Comparable figures for tape drive and add-on memory hovered in the 12% range.

The presence of plug-compatible manufacturers' gear at IBM installations is seen as fading, particularly in the add-on memory area where only 15% of medium to large sites indicated pcm products installed. The comparable 1981 survey showed add-on memory at 42% of the survey sites.

In the disk business, IBM is clearly dominating all activity, despite an uptick in pcm shipments after delays in getting 3380-type thin-film drives to market in volume. Survey respondents indicated that about 63% of their outlays for 3380 disk would go to IBM; Storage Technology captured 10%, Memorex 4%, and Control Data only 1%.

IBM LEADS IN TAPE DRIVE BIZ

The tape drive business, too, shows IBM in command, although the survey was conducted too early to gain any knowledge of how users would react to the new IBM 3480 tape cartridge drives introduced in March. IBM was seen as shipping 46% of the total tape drives to be ordered by respondents in the 1984-85 period, followed by a strong Storage Tech with 40%, Memorex with 4%, and Telex with 2%. Storage Tech's share of the tape drive market was seen as particularly high among high-end users (3033/308X) where it had a 56% share of the add-on market, compared to IBM's 36% share.

In add-on memory, IBM's pricing pressure has given it an 82% share, compared to 4% for Amdahl, 2% each for National Semiconductor and Storage Technology, and 1% for Control Data. Intel, which has held a 10% share in the 1980 mainframe survey, has apparently been squeezed out of the picture altogether.

In the terminals add-on market, respondents said that 60% of their acquisitions would be for IBM products, 8% from Telex, 6% each for Raytheon and ITT Courier, 2% for Memorex, and 18% other for unspecified. When asked if they expected to need additional system capacity by year-end 1984, respondents showed a slight increase in need compared to last year's survey. For instance, 26% said they would need to upgrade to larger cpus, 8% said they would need to install additional cpus, and 27% said they would have to add main memory or peripherals. Comparable figures from last year's survey were 25%, 7%, and 27%, respectively.

Among high-end users, however, even more demand for additional capacity is expected. Among 3081 and 3084 sites, 23% expect to need additional cpus and 36% to need to upgrade installed machines. The stage appears set for IBM's introduction of a new line of higher-performance mainframes.

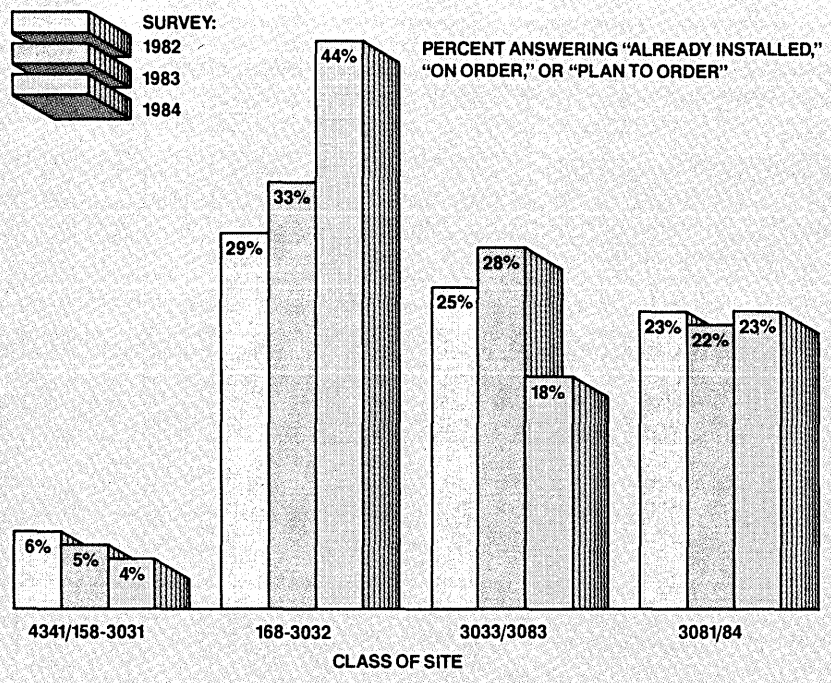
As seen in successive surveys over the past five years, the installation activity in 308X class machines appears to have crested and (in dollar terms) is being taken over by 4300s, particularly the 4361 and 4381. Looking ahead 24 months, respondents said they would spend 69% of their dollars on 308X machines, and 30% on 4300s. Last year's comparable figures showed 77% of the dollars going to 308X systems and 18% going to 4300s.

Meanwhile, the PC is expected by respondents to capture 21% of the dollars spent on dp systems compared to 79% on IBM mainframes. Last year those numbers were 7%

FIG. 2

PCM PROSPECTS

Query: What consideration has your organization given PCM cpus (e.g., Amdahl, NAS) as an alternative to your IBM cpu(s)?

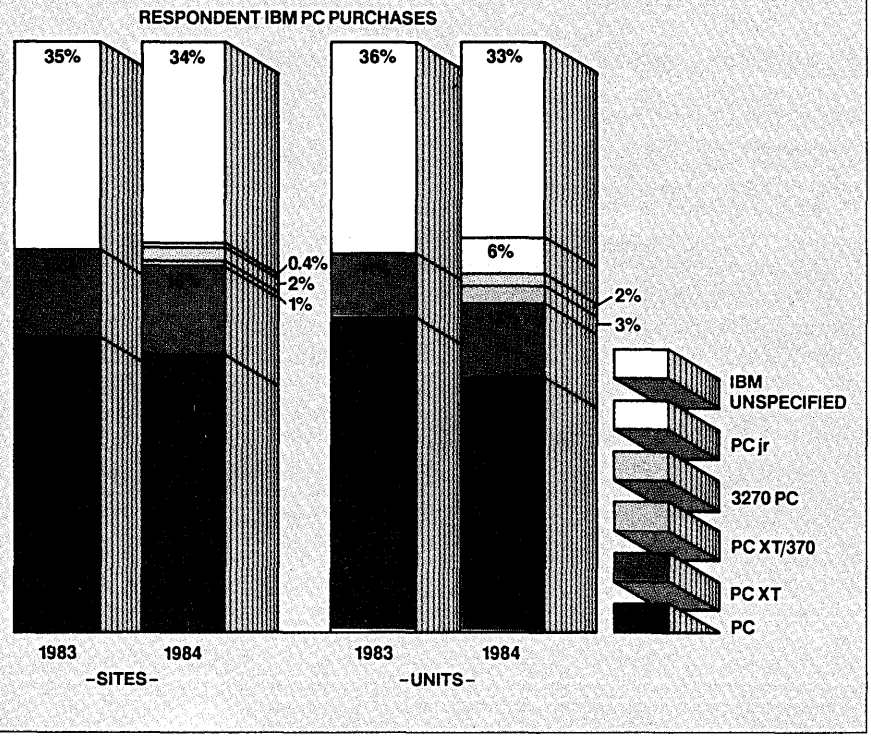


Note: Negligible impact in 4300 segment of IBM line

FIG. 3

IBM'S ORIGINAL PC VS. OTHER IBM MICROS

Query: How many personal computers were purchased by your organization during 1983 and how many are planned for 1984?



CHARTS BY PAUL GOODFRIEND

and 93%, respectively.

Personal computer purchases are coming most strongly from users in manufacturing and education SIC sectors, followed by government and business services. Standardization at the corporate level is found most evident in larger organizations; 70% of organizations with revenues of over $250 million a year have standardized on one or two pc suppliers, compared to the overall survey portion of 61%.

At the current rate of growth, therefore, the PC could easily catch up with mainframe shipment values in a few years. In fact, as a fraction of the annual incremental revenue growth experienced by the corporation, the PC is already close to matching the mainframe product line. On the other hand, pcs are seen as fueling mainframe demand because of the increasingly popular micro-mainframe links users are installing.

IBM's already imposing share of pc shipments to survey respondents is expected to rise even further in the coming year. The company accounted for 62.8% of all installed machines at the end of 1983 and was expected by users to account for 75% by the end of 1984. Comparable figures for Apple Computer, the next leading vendor in the corporate marketplace, are 18.5% last year and only 6.7% this year. Tandy's share was seen as dropping from 2.5% last year to only 0.5% this year, while Compaq, Wang, and HP showed slightly more significant standings.

Among the IBM PCs being acquired by survey respondents, the original model still accounts for the largest fraction of shipments, at least 43%. Following it are the XT model, with 13% of planned 1984 acquisitions, PCjr, with 6%, and the XT/370 with 3%. Fully a third of the IBM PCs mentioned by respondents were left unspecified.

Standardization on one or two brands of personal computer was more evident than ever, with 61% of the responding sites having made such a commitment. Survey results showed that the larger the organization the more likely standardization has become. Of those corporations standardizing, the IBM PC family was by far the most common choice, accounting for 72% of the mentions. Apple came next with 9%, followed by Digital Equipment with 3% and Tandy with 2%.

DDP CONTINUES TO EXPAND

Distributed processing, a concept more than a decade old, continues to expand among survey respondents. Looking ahead 24 months, almost two fifths of the respondents said they would have distributed processing systems installed, up significantly from the one quarter of sites currently involved. IBM's share of that business was seen as increasingly strong, ris-

ing to 83% of the expected shipments during 1984/85. Interestingly, Datapoint, once a leader in the business, was not mentioned for future installations. It has apparently suffered greatly at the hands of an aggressive IBM.

IBM, too, is gaining a strong share of the office automation business, being mentioned as the main OA supplier by just over half the sites planning to build mainframe-based OA systems. Use of the company's PROFS and DISOSS office systems, each of which runs on mainframe computers, was also found to be growing significantly among survey respondents.

In connecting office machines together, the local area network was found to be the leading choice over PBX systems, although only by a slight margin. Rolm's share of planned PBX installations was found to have taken a good-sized jump among IBM sites, apparently reflecting user confidence in the Rolm-IBM partnership which was disclosed since last year's mainframe survey. Of the PBXs to be installed at IBM sites, about one half are expected to come from Rolm, compared to 28% from AT&T and 10% from Northern Telecom. Last year's survey showed Rolm with only a 29% share of installed PBXs.

Usage of IBM's SNA continues to grow, penetrating almost a third of the IBM sites surveyed and expected to hit another 11% in the following two years. SNA was found to be particularly popular at large organizations.

Similarly, database management software finds its widest use among large sites while smaller sites (370/135-4341 range) show the largest growth rate for DBMS usage. The three winners in the DBMS marketplace appear to be Cullinet, Applied Data Research, and IBM, the latter selling its SQL relational package with significant success. IBM's IMS, however, is still the single most used DBMS package among IBM respondents.

As has been seen in previous surveys, a rising percentage of the total data processing budget—some 11.3% in this year's survey—goes for outside software packages. IBM was found to be capturing about 65% of those software expenditures, a figure showing little change from previous years.

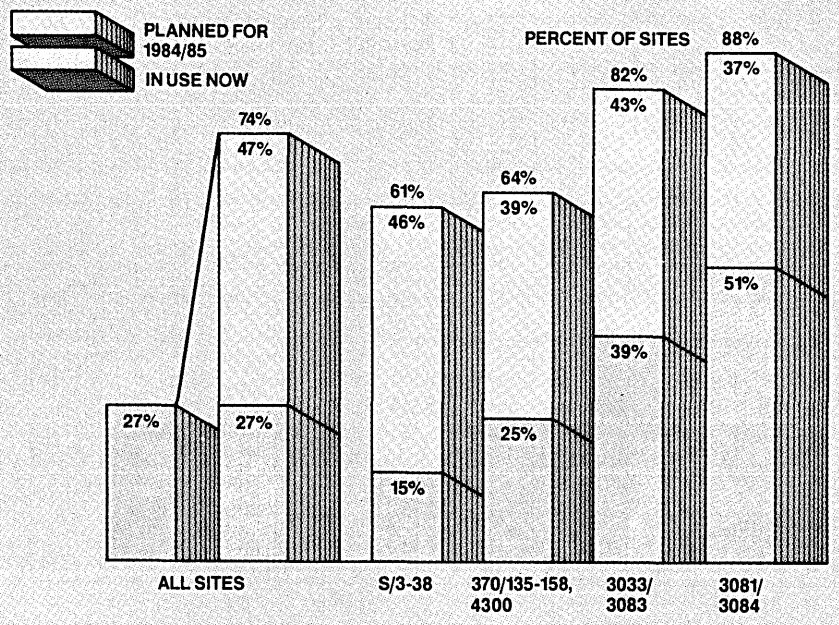
Conversion to the industry leader's MVS/XA operating system, which was first shipped in late March 1983, as a major extension to the decade-old MVS, is continuing strongly. While only 7% of responding MVS sites said they already use the software, a third said they would install it in 1984 or 1985. As expected, larger machine sites were more eager to install MVS/XA.

Turning to non-IBM sites, the appearance of high-end machines from such vendors as Honeywell and Sperry has apparently dampened, at least in the short term, growing

FIG. 4

MICRO-MAINFRAME LINKS

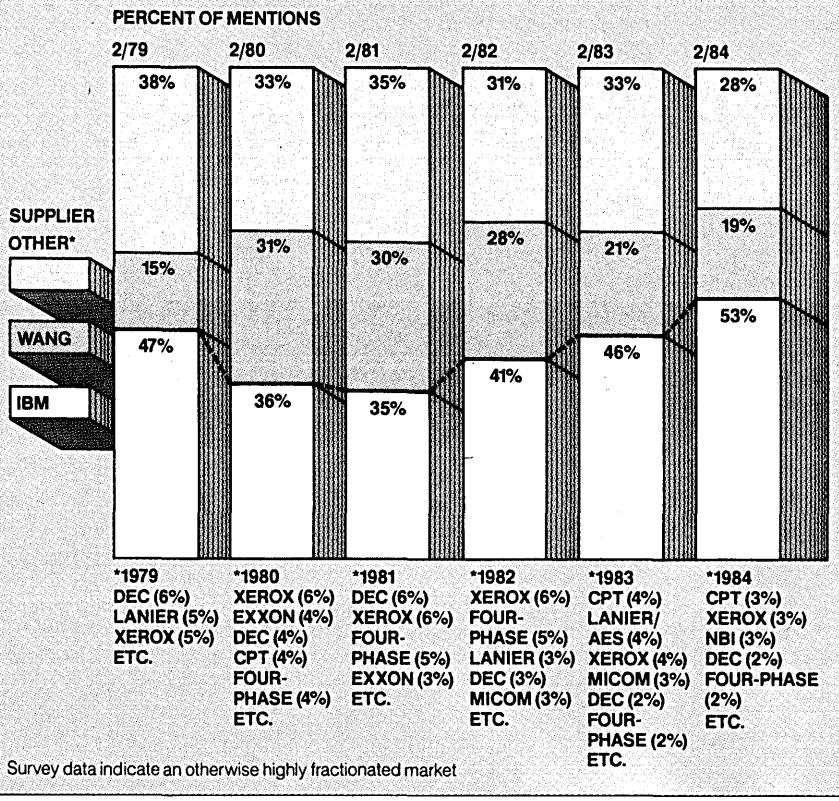
Query: What if any plans do you have for interconnecting personal computers with your mainframe system(s)?



*66% compound user base expansion

FIG. 5

WP/OFFICE SYSTEMS PROCUREMENTS



Survey data indicate an otherwise highly fractionated market

Compatibility

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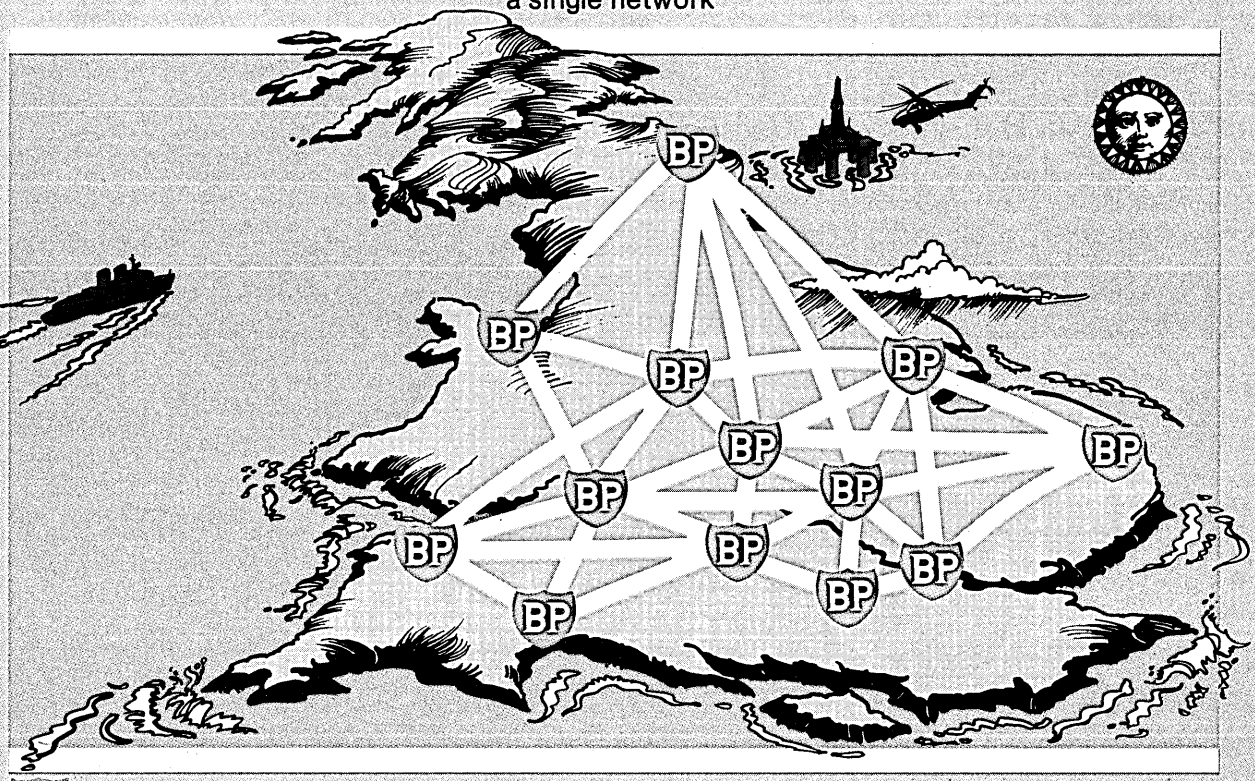

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user dissatisfaction. At Burroughs, for instance, only 16% of large systems users said they were seriously considering making a vendor switch, compared to 19% last year. At Sperry, the figures were 12% this year, down from 19% last year. At Honeywell, however, 30% of the users said they may switch, up from 24% last year.

Of those seriously considering making the switch, over half said they were looking to "the IBM world" for the future. In fact, 63% of those large system sites considering a switch picked IBM or an IBM pcm as a likely future supplier, followed by 16% citing DEC.

The lack of trained applications programmers for non-IBM mainframes was the most often cited reason in considering a switch to another vendor—in the case of large Sperry users, 56% complained of that lack.

However, survey data showed still relatively modest amounts of actual vendor switching activity by users. Competitive displacements seem to take place primarily in older, heavily purchased lines of small-scale equipment, although some switching has begun to take place in larger systems where IBM is seen as taking business from all vendors.

Burroughs users showed a continued warming to their supplier, a trend which has been noted in the annual survey for three years running now. The biggest shift was seen among distribution and government users while those in the educational market showed a negative shift in their sentiment toward the Detroit mainframer. Apparently, Burroughs efforts in concentrating on specific lines of businesses is paying off, but users expressed dissatisfaction with the comany's field force activities.

BURROUGHS USERS BUYING

As with IBM, Burroughs is experiencing a major shift to purchasing of its equipment. Among currently installed and planned installations, only 16% and 14% of the system value in dollars respectively are leased—the rest is purchased directly from Burroughs, leased from a third party, or installed under a five to seven year lease from Burroughs.

The largely dormant B6000 user base has apparently been sparked by the recently unveiled A9 machine from Burroughs. Nearly half the ordered A9s indicated by respondents are replacing B6800s and another fourth are being used to upgrade B1900 installations. Few B6900 users are moving to the new A9. Strong deliveries of the B4900 and B7900 are foreseen among respondents to the survey, but it is clear that further product introductions will have to be made to stimulate order rates in 1985.

Burroughs users also indicated that

FIG. 6

PABXS, LANS, OR BOTH?

Query: Which, PABX or LAN, is likely to be emphasized for your future local site data communications?

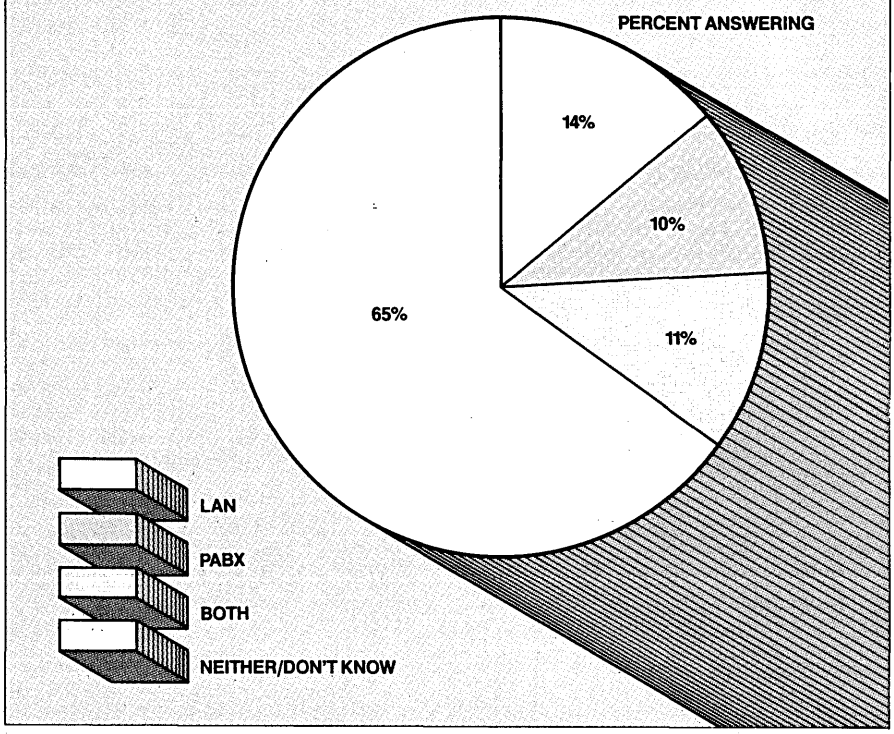
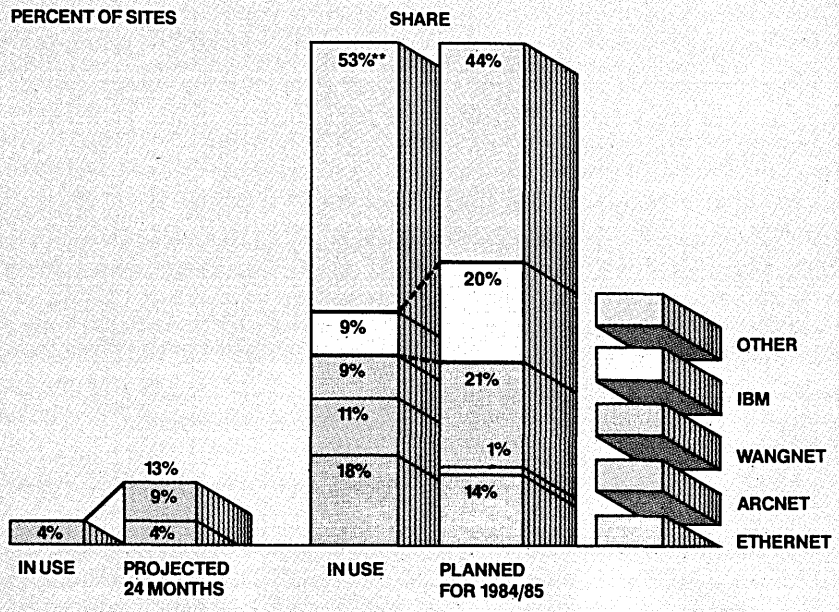


FIG. 7

LOCAL AREA NETWORK MARKET STILL FRACTIONATED

Query: If your organization has installed or plans to install a local area network (LAN), who is the supplier?



*80% compound user base expansion
**Includes Sytek (6%), Corvus (5%, 3% 1984/85), 3 COM (4%), Nestor (4%), Ungermann-Bass (3%, 4% 1984/85)

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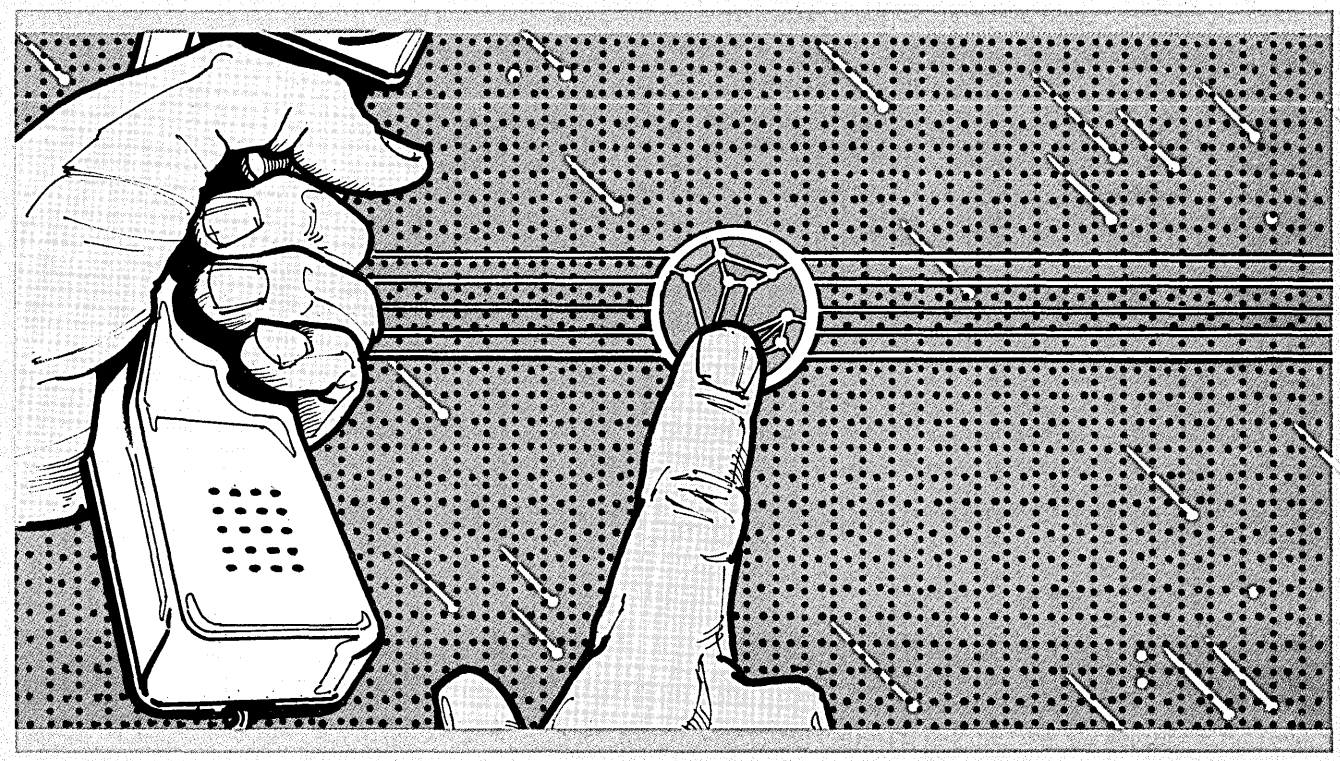

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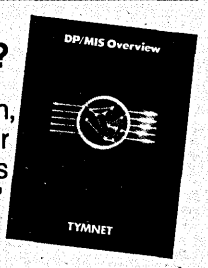

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they are buying the company's B20 workstation, a 16-bit machine manufactured by Convergent Technologies, but little interest has been expressed in the company's in-house developed Ofis 1 office automation systems. The strongest interest in the B20, which can be used as a standalone device or attached to a mainframe as a workstation, comes from B48/4900 and B7000 class users.

Add-on peripheral plans among Burroughs users appeared subdued for the second time in a row, a situation that may result from the relatively high rate of total system shipments in the recent past.

Honeywell Information Systems, which has shown weakness in previous years in delivering large-scale mainframe systems and which recently opted to sell such machines made by NEC in Japan, still has much work to do to satisfy its users' needs. Indeed, the threat of defections away from its user base remains a serious problem. Among large-scale users, 31% said their attitude towards Honeywell became less favorable during the past year, while of those using old, Level 62 equipment, which is effectively dead-ended, 45% said their attitude was less favorable. The most negative feelings were expressed by government customers.

Applications software is the most sensitive issue with Honeywell users, who decidedly rate the company's efforts as inferior to IBM and the industry as a whole. A good portion of the user base, however,—68% of the Level 66 and DPS 8 users, in fact—said they were planning to make the conversion to the new GCOS 8 virtual memory operating system, a conversion that is far from trivial. This faith in the system seems to bode well for future orders of DPS 88 machines.

Planned installations of mainframes was found to be rebounding among all Honeywell users, which means the company will bring in a certain amount of high-margin business, but that activity is still not ebullient. Add-on peripherals business for the coming year was up only a little, with Honeywell losing a significant amount of business to plug-compatible terminal suppliers.

Users are still making much use of the Level 6/DPS 6 minicomputer line as an adjunct to their mainframe installations. Almost half the large systems users said they already have used or will install the small machines. Like Burroughs, however, the company's efforts in the office automation field are finding small acceptance—only 13% of large users said they have installed or will install the firm's office systems.

After a rush of new orders in the second half of 1983, NCR appears to be on its way to a very healthy 1984. In fact, it looks as if the company will have to concentrate on producing and installing equipment rather

FIG. 8

DBMS ON IBM MAINFRAMES

Query: If you are using a DBMS software package on your IBM mainframe(s), which one?

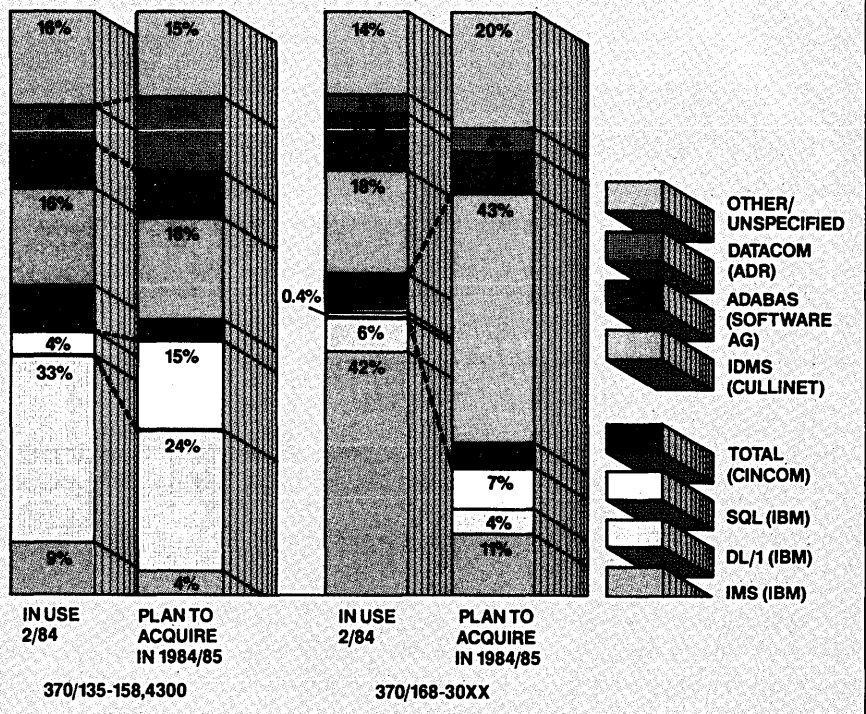
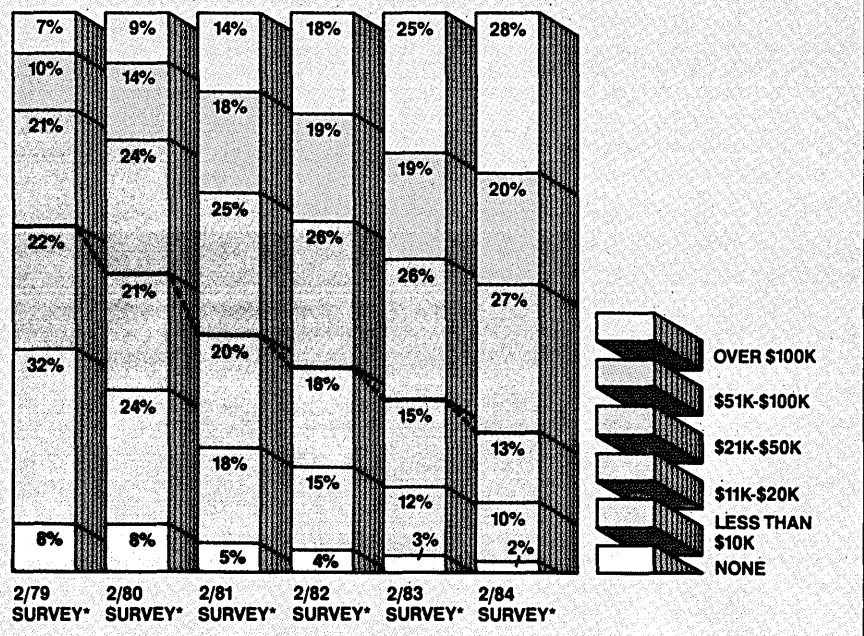


FIG. 9

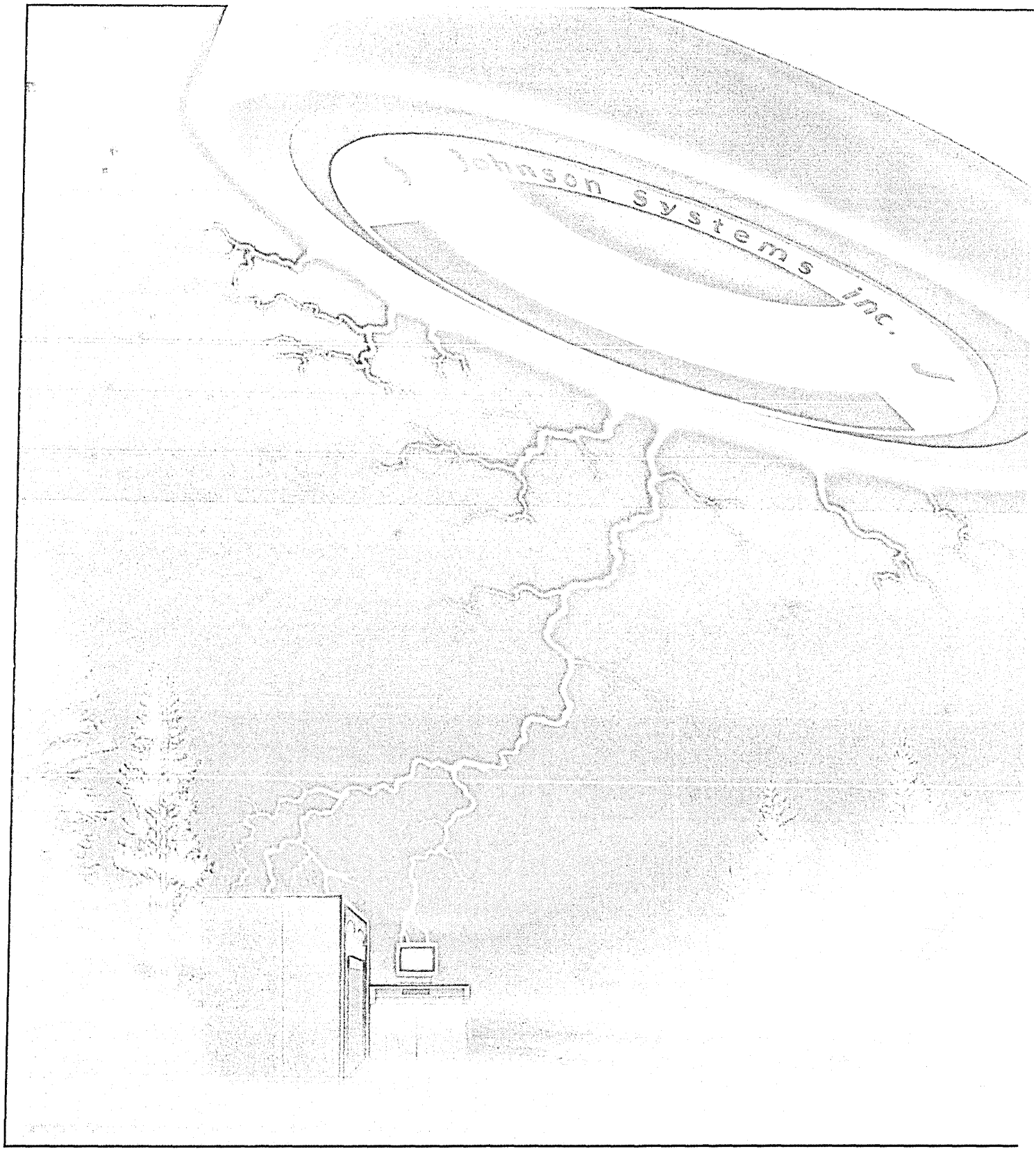
OUTLAYS FOR PACKAGED SOFTWARE

Query: Approximately how much of your organization's annual dp budget currently goes for unbundled software from IBM and other outside software packages?



*Excludes System/3, 32 and 34, which had not been included in 77/78 survey sample.

IBM capturing 65% of respondents expenditures (66% in 1983 survey, 67% in 1982)



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Planned installations of mainframes was found to be rebounding among Honeywell users.

than on seeking out orders. Of particular interest on the rapid takeoff of the new 9000 series of 32-bit machines, which are based on proprietary chips that the company is building for itself and selling on the merchant market. As of the time of this year's survey, fully 8% of the dollar value of the NCR-installed mainframe base was represented by 9000 series machines, which were to be 48% of planned installations.

The strengthening of the economy and the wide range of new products introduced by NCR last year have prompted a burst of installation activity among users. In terms of dollars, users said they would install in 1984/85 equipment worth 24% of their currently installed base. That figure is substantially up from the 11-12% range recorded in previous years. Moreover, the company seems to have begun a reversal of the user base erosion it experienced in previous years.

On the negative side, the firm's Worksaver product line, based on Convergent Technologies hardware, is not faring well among NCR mainframe users. A growing share of those users (some 20% in this year's survey) said they have considered the hardware but have no interest in using it, while a shrinking portion said they are planning to evaluate it. Only 7% said they will install the Worksaver systems. On the other hand, among those NCR users who have standardized on one or two personal computer vendors (a total of 44%), 42% have chosen NCR's Decision Mate systems, compared to 36% choosing IBM.

Sperry, whose high-end customers have been forced to wait while the company works out manufacturing problems in its long-promised 1100/90 machine, is serving a user base whose appetite for additional system capacity took a strong upturn in this year's survey. Looking ahead to 1985, 18% of all Sperry respondents said they would need to upgrade to a larger cpu (up from 12% last year) and 9% (up from 6%) said they would have to install additional cpus. Among large users, the comparable figures were 16% (9% in last year's survey) and 10% (level with last year). Undoubtedly, the resolution of the 1100/90 situation has encouraged users to assess their capacity needs more favorably. A particularly strong need for additional capacity in 1985 was recorded among 1100/60 users, many of whom have had their machines installed for five years or so and who will be installing 1100/70 machines.

The company's Sperrylink office automation system is apparently moving well into the user base, with 16% of all Sperry respondents saying they will install the system and another 23% planning to evaluate it. Among 1100/60 sites, 32% of the respondents said they would install Sperrylink.

Applications software is the most often cited negative aspect of Sperry's offerings when compared to those from IBM. Fully 60% of the users said they found Sperry's applications software inferior to the industry leader's; last year's figure was 53% in that category. While high-end users showed a distinct shift to a more positive attitude in general toward Sperry, those using the dead-ended 90 series machine expressed a new level of disgruntlement. *

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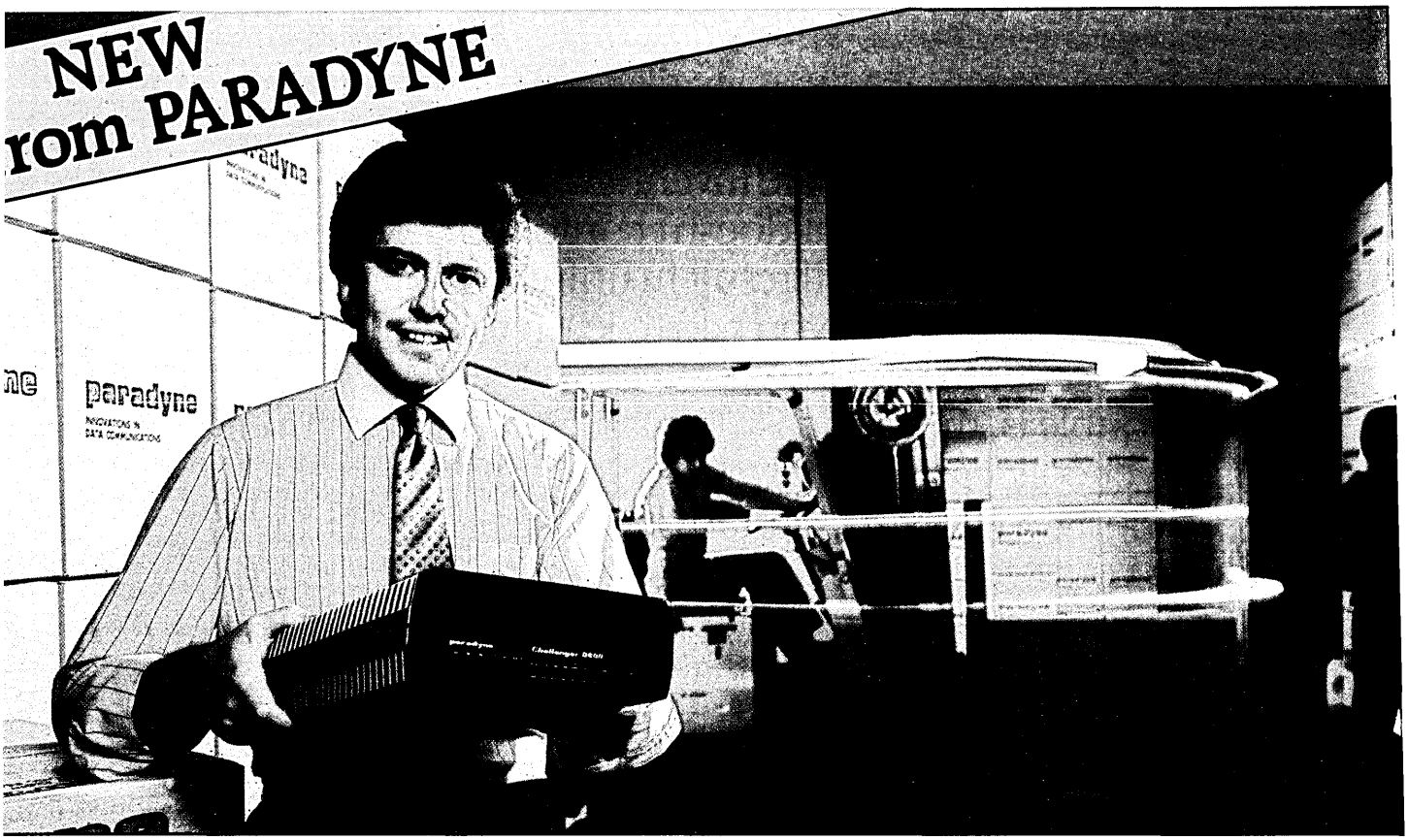

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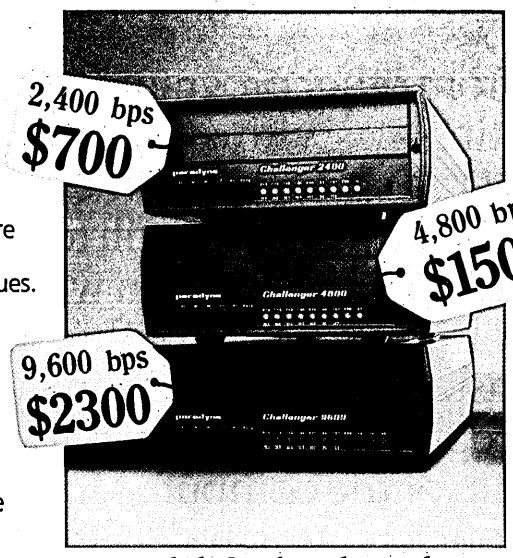

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IBM Credit Corp. is redrawing the computer leasing picture, but some things will never change.

LESSORS ON LEASING

by Hesh Wiener

In a short three years, IBM Credit Corp. has invigorated the $4.5 billion computer-leasing industry as its parent company has moved aggressively to lock into emerging markets while keeping a strong hold on traditional ones.

IBM formed its leasing subsidiary in 1981 and has witnessed the unit's growth to a whopping $1.7 billion in assets last year. Fueling that dramatic growth has been the industry leader's massive shift from monthly rental to purchase and term-leasing strategies. No user can now ignore the leasing option when procuring computer equipment. Whether considering a lease from IBM Credit or from an independent lessor, however, it is only the well-informed user who will be able to make the most of such creative financing.

Fortunately for the user, the financial structure of IBM's leases differs little from many of those that have been offered for years by independent lessors. Typically, IBM's leases run for three to five years with terms and conditions that are simple by industry standards. IBM's rates are, in most cases, not the lowest available, but the relationship IBM has developed with users is a very good one, and IBM Credit, already one of the biggest factors in computer leasing, appears to be headed for a position of market leadership (see box).

One key difference between IBM and the independents will prevent it from overwhelming third parties: IBM and its Credit Corp. are in the business of selling and leasing IBM's current line; the independent leasing companies buy, sell, and lease older as well as new equipment.

"A good third-party lessor can act as an advisor to the user and provide alternatives unavailable from IBM," says Ken Pontikes, head of Comdisco Inc., Rosemont, Ill., the largest of the independent lessor–dealer companies. "Maybe you need the latest gear," Pontikes states. "You can talk to IBM, IBM Credit, or third parties. But most shops use a mix of current- and last-generation technology to get the most out of their budgets. They're not all XA, they're not all 3380 disk-oriented. These users will find that third parties are not predisposed to one or another solution. And at their best, they will try to discuss and review the costs and benefits of various alternatives within the framework of the user's needs.

"Sometimes, a third party can even help forecast what today's equipment choices might be worth in the future, when it comes time to sell and replace the equipment being considered for lease or purchase," he says.

IBM's switch in marketing philosophy—from rental and sale to sale and long lease—has encouraged many users to consider long leases even if in the past they had acquired equipment by a mix of outright purchase and short-term rentals.

"When the leasing business began," says Ed Cherney, president of lessor CMI, "it was perceived to be geared to a user who could not afford to buy a computer. Today, many of the strongest companies, who can afford to pay cash, have decided to adopt a lease program. They do this because of the way they are structured from a budget standpoint and because they wish to tie computer costs to performance over time.

"In addition, there are many companies that use a mixture of purchase and lease, of new and used equipment, to satisfy their requirements. And these days, lessees range in size from the very small to the giants of industry." CMI, with headquarters in Troy, Mich., is part of the Torchmark insurance and finance conglomerate.

This growing interest in leasing appears to be helping independent lessors as well as IBM. Jim Benton, executive director of the Computer Dealers and Lessors Association, believes his members account for 95% of all leases written by independents. "Our members are generally healthy," he emphasizes. "When we formed the association by merging the Computer Dealers Association and Computer Lessors Association in 1981, we had 140 members. Now we've got 225. Our members' revenues from leasing are $4

ICC AT A GLANCE

Established in 1981, IBM Credit Corp. now has a staff of over 100. Its annual report for 1983 reveals that the Old Greenwich, Conn., subsidiary of IBM closed the year with assets of $1.7 billion. Income was $163 million, producing net earnings of $42 million.

During 1983, IBM Credit bought $849 million of equipment that will be put on installment payments. In addition, the company wrote equipment leases with a value of $334 million. When arranging leases in which the investment tax credits (ITC) are passed to the lessor, IBM Credit has formed partnerships with other companies to make the most of the tax breaks associated with ownership of capital equipment. These partners include Metropolitan Life, Merrill Lynch, and General Mills. In conjunction with its partners, IBM Credit's businesses acquired $188 million in gear from IBM over and above the machinery leased solely by IBM Credit.

The latest idea to come from IBM Credit is a credit card for individuals that can be used to charge products at IBM's retail stores. The card may in the future be accepted by IBM's authorized dealers, too. Like a bank charge card, this instrument provides revolving credit to the holder. IBM Credit expects the card to be used for the purchase of personal computers, typewriters, computer add-ons, and software.

IBM Credit's leases for nongovernment users come in three forms. First is an ICC-to-lessee lease with terms of three, four, or five years; there are stipulated buy-outs available to the user at anniversaries of the lease signing and at the termination of the lease. Next is an ICC-to-lessor lease, under which title to the equipment is sold by IBM Credit to a partnership in which it participates. These, too, run three, four, or five years, and there is no way for the user to buy out. At the end of this type of lease, the user may purchase equipment for fair market value. Last is a lease that really amounts to full-payout financing with a very small buy-out option at the end of the term. —H.W.

The possibility of disagreements can be substantially reduced if potential points of friction are avoided at the outset.

billion to $4.5 billion, and they grossed about $2.5 billion trading in used gear. We're looking for growth of 33% this year.

"While our organization was formed to serve the independents, IBM Credit is becoming closer to us these days. It's joining our organization's electronic trading wire, CDLA Net, although it has not yet joined our trade association," Benton notes.

The shift by users to financing and away from outright purchase is forcing many user organizations to get a hasty education in leasing. While the concepts of leasing are not hard to understand, lessors and lessees often must renegotiate their agreements during the term of the lease. This is largely because both parties must adapt to conditions unanticipated at the time a lease is first signed.

IT SEEMS SIMPLE ENOUGH

A computer lease is an exchange. The user gets a piece of equipment for a specified period, typically two to six years, and in return agrees to pay the lessor, typically on a monthly basis and in regular amounts, during the term of the lease. If properly constituted, the lease yields benefits to both lessor and lessee.

In reality, however, leases do not always work out the way they were planned. Dissatisfaction rarely stems from deliberate efforts by either lessor or lessee to take advantage of the other party. Rather, a common source of difficulty is the inability of either party to foresee the future accurately. Leases involve lengthy commitments to technology, interest rates and business relationships, conditions that may change during the course of the lease, leading to problems for the user or the lessor.

While nearly all problems encountered during the course of a lease can be settled by negotiation—there is very little litigation involving computer leases—the possibility of disagreements can be substantially reduced if potential points of friction are avoided at the outset. It is important that everyone affected by a lease understand how the transaction works.

But that knowledge alone is not enough. Users should be wary of commitments to equipment that may exceed the machinery's useful life in their operations. Lessors should remember that their relationship with a customer is likely to last longer than that with any individual at the user site. And both sides should take into consideration the heady mix of technological change and competition that will determine the future value of installed equipment.

IBM Credit's entrance into the leasing arena has signaled a general trend toward simpler leasing arrangements than in the past. While a small portion of large, sophisticated dp shops still customize their leases with many of the finer points allowed by tax and leasing laws, the majority of computer leases follow fairly standard lines. Compared with those fancy leases that tend to approach the frontiers of understanding, the standard lease is an order of magnitude thinner in terms of paper alone.

Ironically, as the typical user's lease contract becomes simpler, the financing methods used may become more intricate. Independent leasing companies, forced to compete with IBM's relatively low cost of funds, have had to develop new means of securing inexpensive capital. While the user is almost always insulated from the consequences of an unforeseen change in the tax status of a lessor's funding sources, such insulation derives from the lease contract itself and involves matters best left to attorneys. Despite new wrinkles that occasionally come up in writing leases, the basic transaction is not very complicated and has remained essentially the same over the years.

So, too, have the problems users are likely to encounter.

While many of the leasing difficulties a user can get into are familiar to larger, more experienced companies, certain errors are made again and again. This, according to leasing company executives, is because data processing managers often get locked into leases that are too long in duration. If faster processors, larger disks, or different terminals are needed before the lease comes to term, one must return to the lessor and try to work out a new and mutually satisfactory arrangement.

Solving this first problem may lead the user into others, however. For instance, users may find their budgets shattered by the cost of paying the substantial penalties usually levied by lessors for early termination. The penalty fee is usually the difference between the present value of all remaining lease payments and the revenue the displaced machine will generate at its next home. Because hardware often loses an unexpectedly large portion of its initial market value during the term of a lease, termination penalties can be very stiff. The cost in such a case may bear no relation to the utility of equipment at the user's site; it is set by conditions in the used-equipment market. Although these costs can be deferred or buried (but never eliminated), such budget-juggling techniques are fraught with danger.

BEWARE LONG-TERM LEASES

Leasing company executives universally warn the user against signing leases that are too long. Users should first examine their own procurement histories and future computing plans to develop an equipment strategy. Then they should look at the costs of carrying out that strategy. With this two-stage approach, users may avoid getting involved in leases that they will eventually be forced to exit with penalty. Early terminations are often very expensive for the user, and lessors don't like to see their customers hurt.

George Heilborn, president of IPS Computer Marketing Corp. in Paramus, N.J., advises users to exercise caution in estimating the length of time they commit to keeping computers under a lease.

"There's a big danger in the rate of technological change," Heilborn cautions. "Users must be realistic and not sign seven-year commitments when they will only want a machine for five years, not sign for five-year terms when they will outgrow their systems in three or four years."

The temptation of a longer lease, of course, is the lower monthly lease rate. But leases are iron-clad, legally binding commitments, whether from IBM Credit or third-party lessors. While both IBM and the independents are generally willing to talk about ways to unlock a user from an overly long lease, there is usually no way for the user to get out from under that lease inexpensively.

When it comes to early terminations,

POPULARITY OF LEASES

During 1983, Computer Intelligence Corp., a market research firm in La Jolla, Calif., polled thousands of users to determine the popularity of third-party leases. Some of the results follow. Note that early IBM 4341s were offered on a two-year lease at very good terms, thus reducing the popularity of third-party leases in this sample.

PERCENTAGE OF SELECTED SYSTEMS ON THIRD-PARTY LEASE

SYSTEM	THIRD-PARTY LEASE (IN %)
IBM 4341-1	19
IBM 4341-10	31
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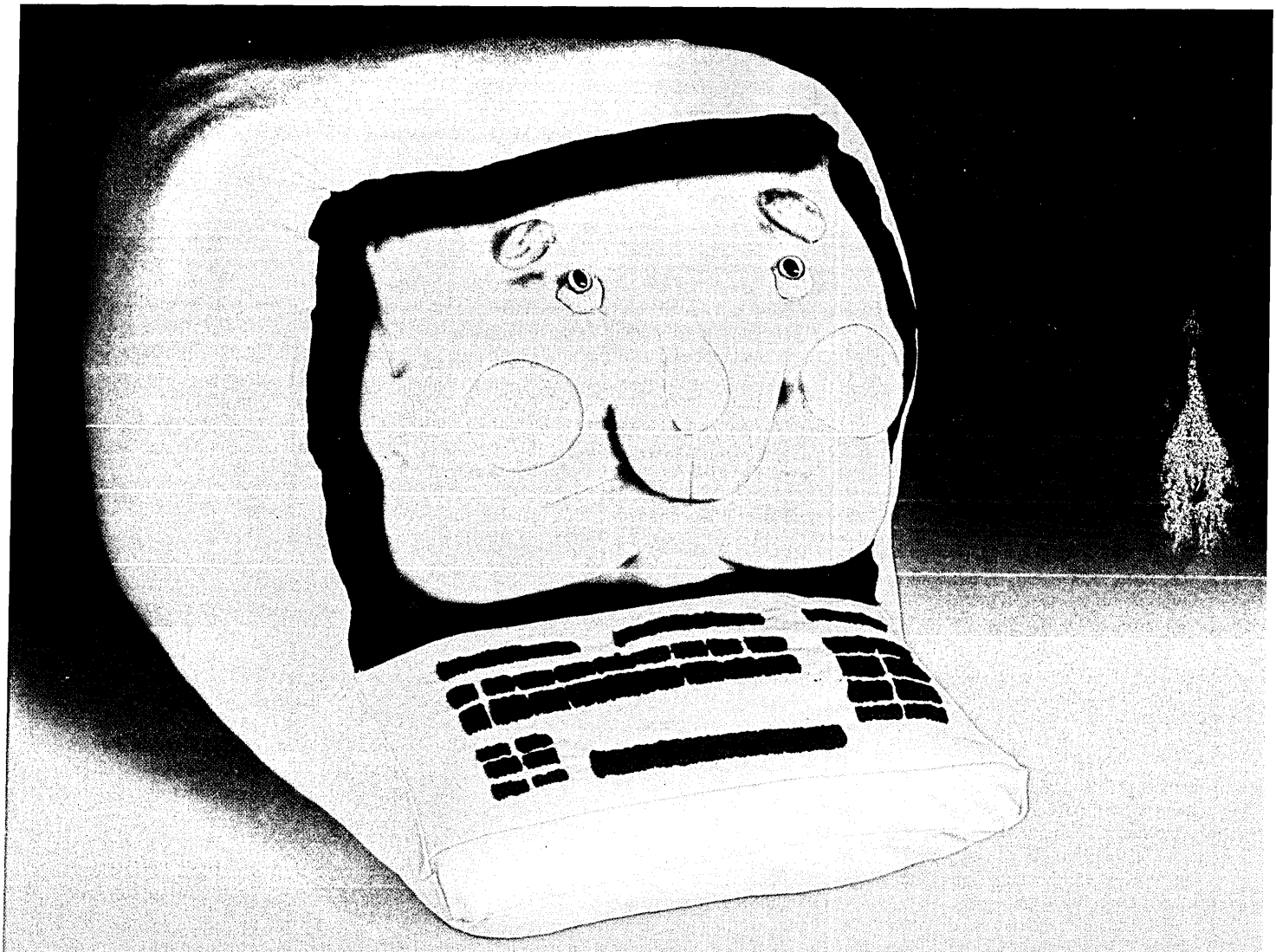

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CIRCLE 55 ON READER CARD

Created by Dayner/Hall, Inc., Winter Park, Florida

The independent lessor is acutely aware that equipment is identical, regardless of the source of finance.

IBM Credit, for the moment, seems to be at a disadvantage. The problem stems from IBM's limited ability to remarket machinery returned by a user that needs an unforeseen early upgrade. While IBM Credit does have a director of remarketing, so far it has no remarketing sales force and must work through third parties. One must suppose that any third party would work harder (and pay more) to help one of its own customers unload unwanted equipment than it would on behalf of a competitor's client, whether or not that competitor is IBM. IBM's handicap could be passed to the user in the form of higher costs or a flat refusal to talk about a termination prohibited in the lease contract.

While leasing companies, like banks writing mortgages on homes, will work with a user who has an unwanted commitment with someone else, there may be advantages for users who stay with their leasing companies when they need upgrades. The independent lessor is acutely aware that the equipment is identical regardless of the source of finance; the difference between lessors is service. Naturally, if a user feels ill-served by a lessor, he will go elsewhere. Few users will sign any lease without checking out the terms offered by competition.

The independents say that they can do a better job helping a user cope with an excessively long lease—and with other common leasing problems—than IBM Credit can. But they all point out that it's better to avoid such commitments in the first place.

"It is very unusual for the lease on a user's first piece of equipment to go the full term," says Ed Cherney, head of CMI. "The user must understand that the signing of a lease is the beginning of a relationship with a leasing company."

Cherney draws an analogy between the user company's computer installation and a family's house. The family seldom pays off the full mortgage, particularly when the family is growing. Instead, the family will purchase a new house that meets its new requirements. "That's when the old mortgage may be liquidated, but it is also possible the old mortgage will hang around until the earlier house can be sold," the CMI executive notes.

PROBLEMS BEGET NEW PROBLEMS

In ending a lease early, a user may be able to spread the cost of a termination penalty over the period of his next lease. In the leasing trade, this is known as rolling the old deal forward. While this may enable a user to live within his budget constraints, it is a practice that causes new problems as it solves old ones.

"It's bad business practice to toll the takeout into the lease on the next machine," advises Tom Martin, who heads Computer Financial Inc., Hackensack, N.J. "The user should take the hit when a machine comes out. Rolling old debt forward is a way of hiding from management an unfortunate decision made in the past. Now I want to point out that user companies sometimes have cash-flow problems that force them to roll takeouts forward. But in setting up a forward roll, they should confront all the issues frankly. Otherwise, at some future date, users will be paying huge amounts for equipment that is no longer in use within their company."

There are two alternatives to rolling debt forward: independent financing of the obligation and lump sum payment. (A very large company can sometimes move an older machine to another department, thus sidestepping the issue of early termination.)

Independent financing calls for the user to continue servicing the original debt even though the equipment has been removed in a transaction that is not tied to a new lease. The debt service may be on the original schedule or on a revised schedule. If the old equipment has been subleased after removal, the sublease payments will generally be kept separate from the termination payments. This enables the transactions to be handled independently in the event of some serious problem, such as the failure of a sublessee to perform.

A lump sum payment can shock the user's budget, but it discharges any debt on an old system once and for all. That done, budgeting can be geared to the equipment actually in place. If old equipment has been subleased, the user may seek to sell that sublease obligation at a discount to a financial institution such as a bank; the user will then get a lump sum payment as income that can offset a portion of his own lump-sum termination payment.

The user may not wish to become entangled in the subleasing of equipment that is no longer needed. In that case, he must work out a termination agreement with the lessor that completely specifies user obligations at lease termination and discharges any other responsibilities he accepted when signing the original lease.

Users sometimes ask lessors to specify in their initial lease renewal or upgrade options that lock in a future price. Both these options should be undertaken only with some forethought. In most cases renewal options are actually unnecessary, while upgrade options may put the lessor in an awkward position without really giving the lessee any great advantage.

When a user signs a lease, he may desire to fix his renewal costs so that he can present a long-term plan to management. The rental price under a renewal or extension may be much less than that of the initial leasing period, but by the time of renewal, the leased equipment may be obtainable for even less from the used-equipment market. A user wishing to renew will thus pay too much. The remedy is simple, say leasing executives.

"The user should ask for extensions at 'fair market value' if he needs a way to extend his lease," suggests Tom Martin. "A user asking for a fixed renewal rate will almost always pay more than fair value. The

CDLA AT WORK

Most but not all computer lessors are members of the Computer Dealers and Lessors Association. From offices in Washington's Georgetown district, the organization coordinates the activities of its members and oversees an electronic trading wire, the CDLA Net.

CDLA helps set up arbitration of disputes between members and their clients. If a user has a problem with a member company, CDLA's executive director, Jim Benton, will try to work with both lessor and lessee in the interest of the association and industry as a whole. Lessors not in CDLA may be as worthy as any in the association but either may not have been around long enough to qualify for membership or do not think the organization can be of help to them. IBM Credit Corp., for instance, is not a CDLA member, although it will be linking its remarketing staff to CDLA Net.

Whether or not a leasing firm is in CDLA, the ethical code of the industry association is a good guide of what to expect from a lessor. Anything less should be unacceptable. Any violation of the code can get a member drummed out of CDLA.

According to the CDLA code, lessors pledge to act with integrity, keep the user's affairs in confidence, and generally act in a way that is in the interest of the industry. Members also must stick to oral and written commitments, conclude transactions in a timely fashion, and tell users of any significant constraints that might affect the transaction. When dealing with a CDLA member (or with any lessor, for that matter), the user should under no circumstances permit his organization to suffer as a result of misconduct on the part of a lessor.

A list of CDLA members and an information packet that is useful to the user unfamiliar with leasing may be obtained from James F. Benton at CDLA, 1212 Potomac Street NW, Washington, DC 20007.

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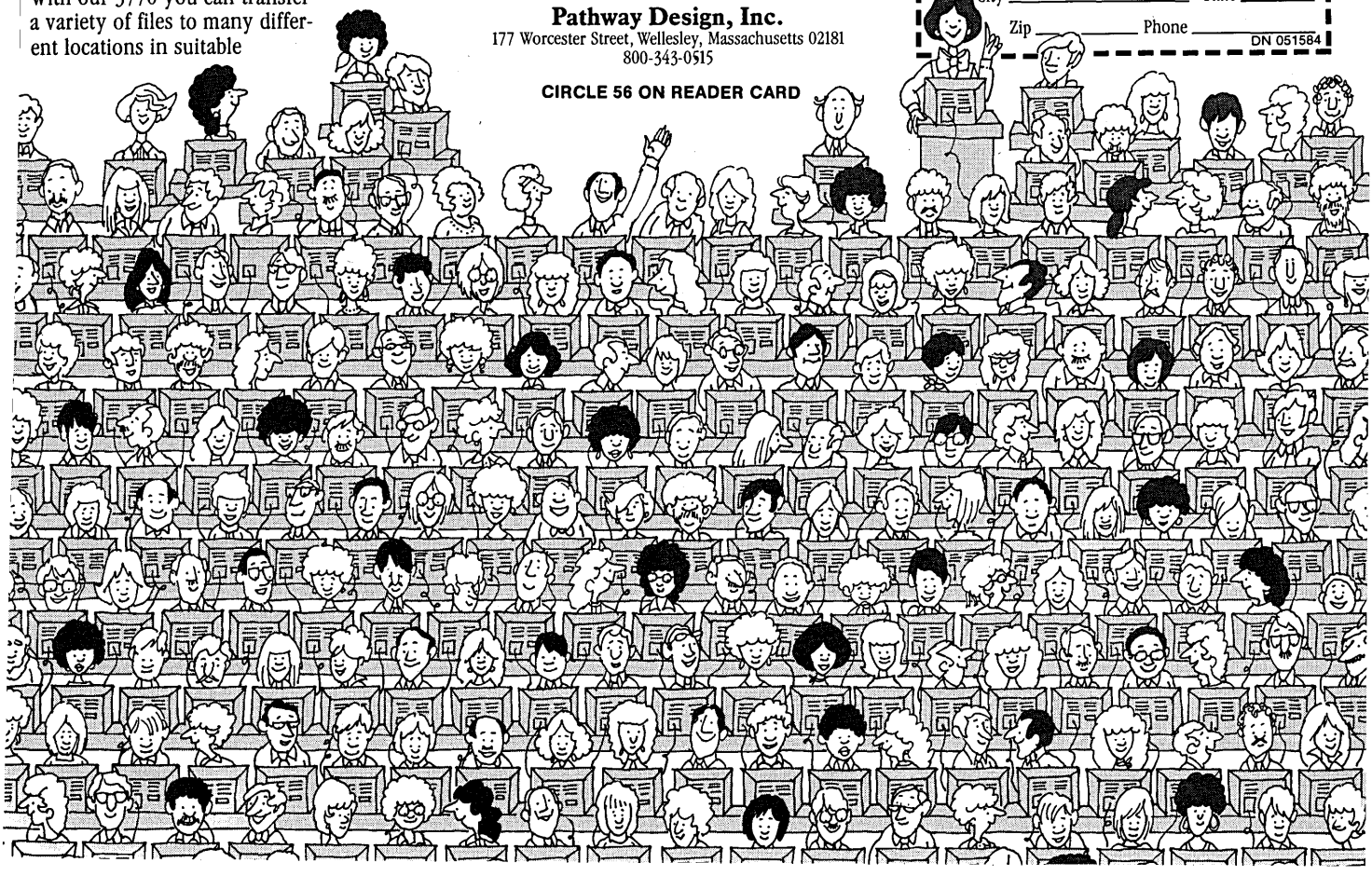


The user may not wish to become entangled in the subleasing of equipment that is no longer needed.

only exception I can remember was the 3350 disk." That piece of IBM gear, however, grew in value because of an anomalistic problem in IBM's manufacturing schedule.

SELECTING A LESSOR AND LEASE

Having developed a sound planning philosophy, the user must then select a lessor and a leasing arrangement. Generally, bids from several companies are requested, and an investigation of these is undertaken.

On new IBM equipment (and on some installed IBM gear) the user will almost certainly ask IBM Credit to bid. The IBM sales rep will encourage this, for IBM now pays commissions to its National Marketing Division reps for selling leases. In the National Accounts Division, the branch manager will get a bonus (and the sales rep points toward quota) when a user signs for financing with IBM Credit. The days when the IBM rep could advise the user impartially about financing are gone. Third-party lessors can help at this point. "The user can view them as soundingboards," explains Ken Pontikes. The user may reflect on his own company's past history in leasing, or ask the lessor about the history of other machines in the same class. While history is hardly an absolute guide in computing, there may be lessons there for the present negotiation.

When all bids are in, there will be differences in lease rates and contract terms, and the user should be especially wary of bids that are far below the others. "If a lessor is more than 15% below the pack, watch out," says Jeff Klein of dealer-lessor KCI, Englewood, N.J. In the past, such low-ball bids have sometimes signaled extremely poor judgment on the part of a lessor or a deal that can never be completed.

It may be difficult to normalize the bids, but there are several things every user should do when selecting a source of financing. "First, make sure the leasing company you deal with has an established reputation and the resources to fulfill its obligations," says Jim Benton of CDLA.

A user will always come out ahead "if he understands the leasing company he's dealing with," says Ed Cherney of CMI.

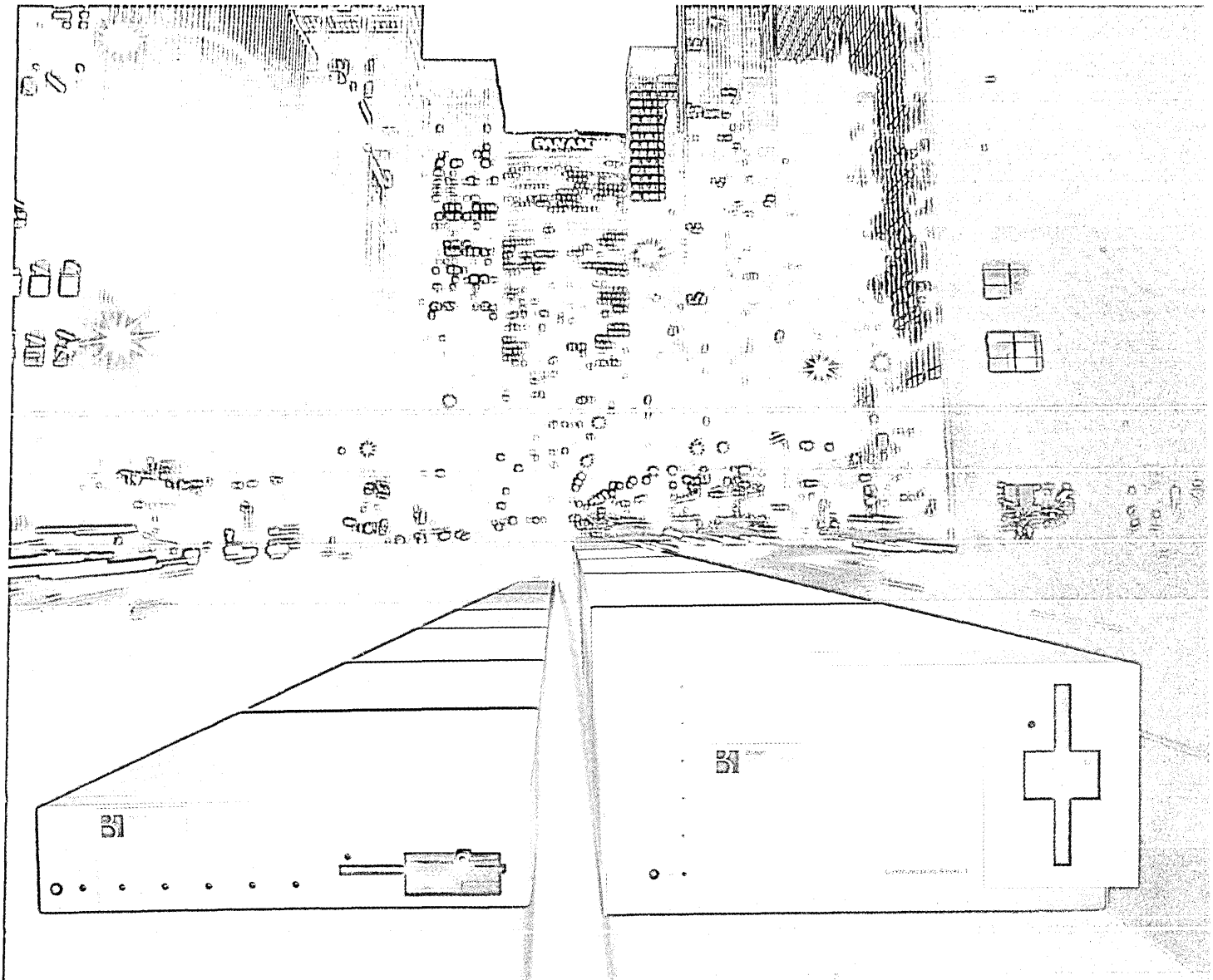
"Size is no indication of integrity," advises Tom Martin of Computer Financial, but "character and references are."

"Ask the lessor how he plans to handle the transaction," suggests George Heilborn of IPS. "Then the user can understand if he will have problems with extensions, upgrades, or early terminations if something unforeseen develops."

These lessors agree that there are trade-offs in every transaction. If the user has a clear understanding of what is given up and what is received in return with each change in lease term, payment schedule, or renewal option, the lease that best fits his present and projected requirements will be gained.

Lessors, the user should remember, are financiers as well as computer dealers. In other words, all that's not impossible is negotiable. *

Hesh Wiener is president of Technology News of America Co. Inc. in New York City, and a contributing editor of DATAMATION. Among his company's publications is *Computer and Communications Buyer*, a monthly report on the acquisition and financing of mainframes and related equipment.



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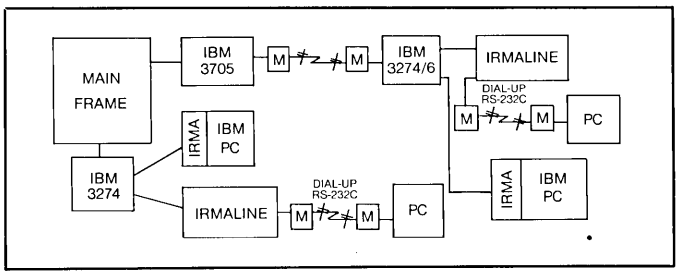

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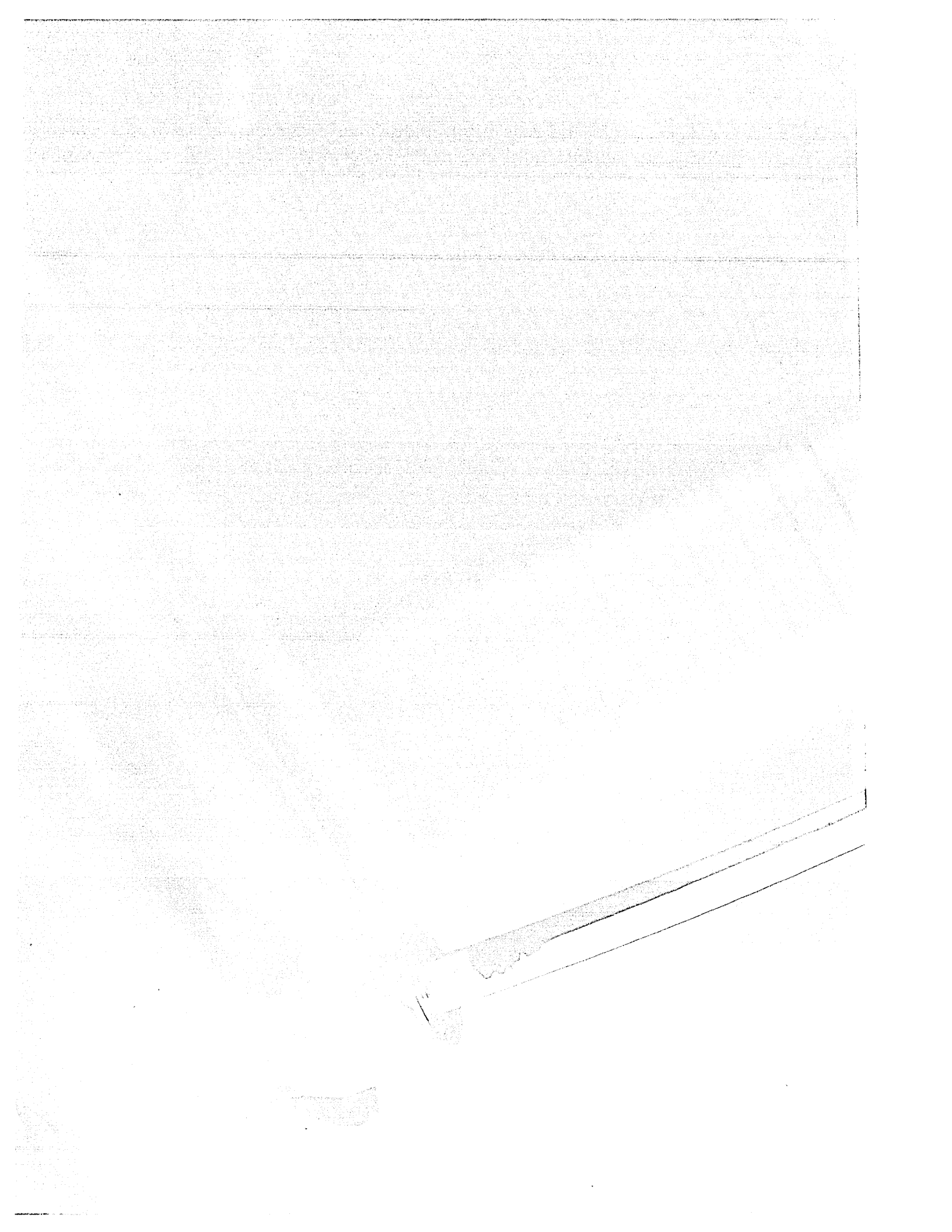

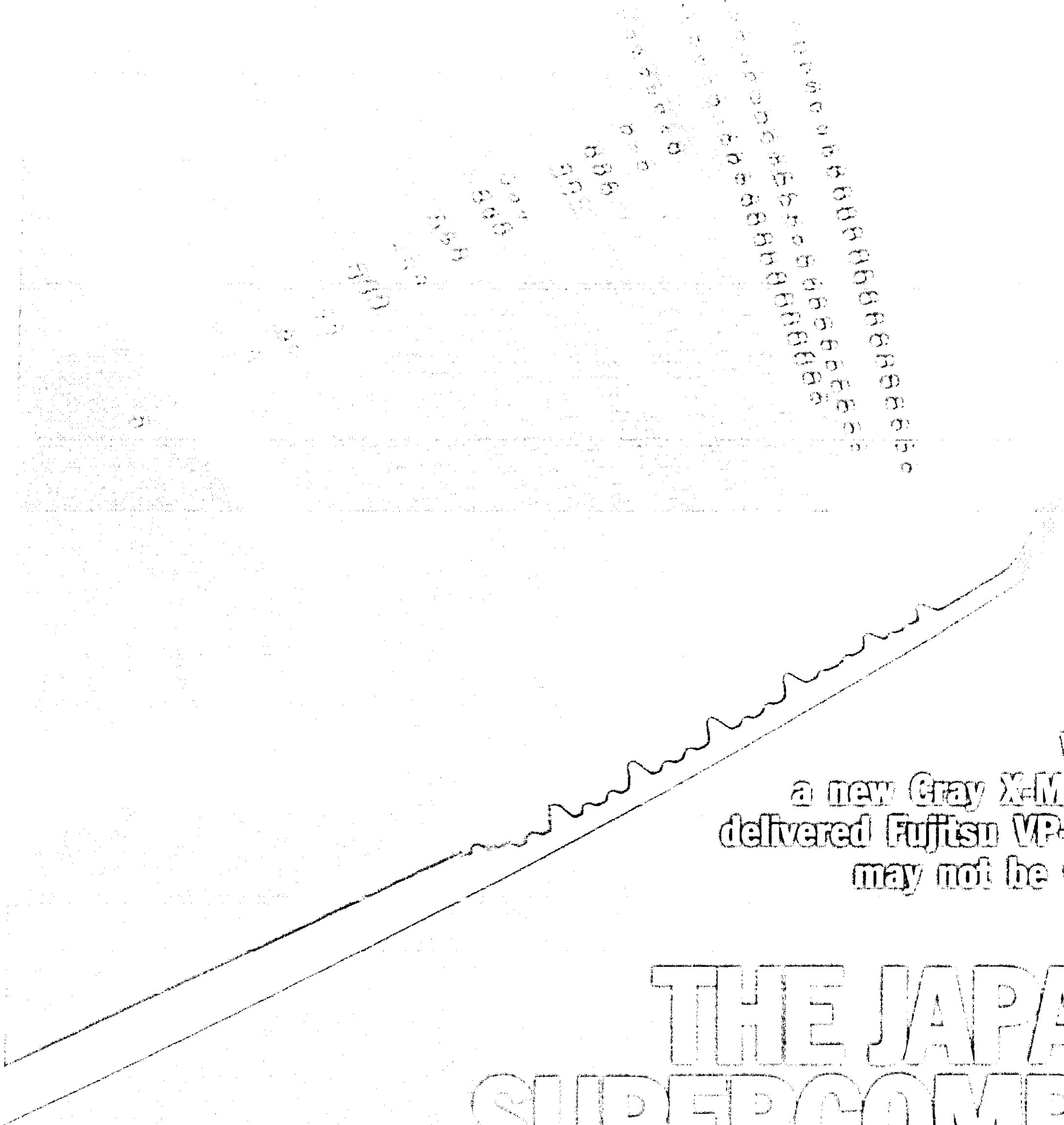

We benchmarked a new Cray X-MP against a just-delivered Fujitsu VP-200. The results may not be what you expect.

THE JAPANESE SUPERCOMPUTER CHALLENGE

by Raul Mendez and Steve Orszag

The Japanese have just delivered their first supercomputers. To see what's up with these new machines, we recently benchmarked the newest generation of American and Japanese supercomputers, the Cray X-MP and the Fujitsu VP-200. While the Japanese have made significant progress and may give U.S. manufacturers stiff competition in the future, our tests reveal that they have not yet overtaken American vendors; the race to build bigger and faster supercomputers is just beginning.

Supercomputers appear to be a key ingredient in Japan's plan for its future industrial development. By the 1990s, it is likely that much industrial design, control, research, and development will be done by computers. Computers will cut both the cost and time of putting ideas from research laboratories into practice. And supercomputers—the largest and fastest computers available at any given time—should play an increasingly important role.

Fujitsu's R&D investment is nearly 10 times that of Cray, but only one tenth of IBM's.

Aircraft design already relies extensively on the use of supercomputers. The Boeing 767 and the Airbus 310's wings were designed using numerical wind tunnels "built" in supercomputers. Future generations of supercomputers will be able to calculate the airflow around the entire airplane, reducing the cost and the time needed to design new aircraft. Automobile designers now routinely use supercomputers to calculate combustion inside engines or the effects of head-on collisions. For some time, weather forecasters have relied on supercomputers to predict the dynamics of the atmosphere, a massive number-crunching problem. For an oil company, information that obviates the drilling of even a single dry well can recover the cost of a multimillion dollar machine. Supercomputers play key roles in nuclear reactor safety analysis, cryptography, and in image processing.

One of the largest supercomputers, a Cray X-MP, installed at Digital Productions Inc. in Los Angeles, makes computer generated movies and tv advertisements.

This already wide range of applications can continue to grow in the future; supercomputers can be the mainstay of industrial development.

But the key to this rich future for supercomputers is their continued development into easy-to-use computer systems. If supercomputers are accessible and usable only to a programming elite, they will not have the widespread impact forecast above. It is the combined hardware/software capability, rather than brute force hardware power alone, that will determine the utility of future supercomputers. Indeed, it may be estimated that nearly 90% of the costs of supercomputing are related to software costs.

The U.S. has traditionally held a significant lead over other nations in supercomputer technology and use. More than 50% of the worldwide market, now mainly shared by Control Data Corp. (CDC) and Cray Research, is in the U.S. This market was about $260 million last year and is expected to grow by about 30% per year; it may hit $800 million by 1987. About 35% of the current supercomputer purchases are made by the U.S. government, but this share is expected to decrease as more industries and nations are swept up into large-scale computing.

Significant competition for the U.S. manufacturers is only now appearing. Two Japanese manufacturers, Fujitsu and Hitachi, have announced their entry into the market with IBM-compatible supercomputers, and four of the new Japanese machines (three Fujitsu VP-100s and one Hitachi S-810 Model 20) have been installed this year in Japan. It is noteworthy that three of the four are at universities, Fujitsu's at Kyoto University and the Nagoya Plasma Physics Institute and an Hitachi at the University of Tokyo. Only very recently has the supercomputer famine in American universities begun to receive attention from Congress, the National Science Foundation (NSF), the Department of Energy, and from other government agencies.

Both the Fujitsu and Hitachi machines have IBM-compatible operating systems, so they may provide significant competition at the high end of the IBM mainframe line. It is possible that the new Japanese machines will be more competition for IBM than for Cray or CDC, who already have their devoted supercomputer customers. Compatibility with future generations of IBM mainframes, however, is not assured.

CRAY HAS DOMINATED MARKET

Since 1976, Cray has dominated the market, now holding about a two-thirds market share. Cray offers both single-processor Cray-1 models, with peak computational rates of roughly 160 million floating point operations per second, (MFLOPS), and the newly introduced two-processor Cray X-MP, with a peak rate of about 420 MFLOPS. Cray has delivered about 70 machines, and 17 X-MPs are expected to be shipped this year. Three of these machines have been sold in Japan, the last being an XMP sold to the Japanese telephone company during President Reagan's visit to Japan last fall. Only one Cray-1 is located in a U.S. university, at the University of Minnesota.

Cray has had an annual R&D investment rate of about 20% and a return on equity of about 20%. It plans to invest nearly $100 million over the next three years to develop its entry, the Cray-3, in the race to build the next generation of supercomputers, the so-called Class VII machines. They Cray-3 is expected to be an eight-processor machine based on gallium arsenide technology. Architecturally, it should be a follow-on to the four-processor, 4nsec clock, 1,000 MFLOPS Cray-2 machine due to be installed first at NASA's Ames Research Center outside San Francisco in late 1984.

CDC is currently marketing the Cyber 205; it has sold about 15 to date. Three Cyber 205s will be on university campuses by summer—at Colorado State, Purdue, and the University of Georgia. Since CDC does not release financial data on its supercomputer division, it is difficult to estimate its R&D investment in supercomputers and its return on equity.

CDC's Class VII efforts will center on the 10 GFLOPS, eight-cpu, GF-10 machine to be built by ETA Systems, St. Paul, Minn., a spin-off company started by CDC in 1983. The GF-10 is scheduled to be available by 1986, and CDC will provide about half its nearly $100 million development cost. Supercomputers have traditionally sold for about $10 million. With the rapid advance of technology, however, the time may be right for the introduction of machines costing between $500,000 and $1 million. Imagine a machine costing little more than DEC's VAX supermini, but with performance characteristics similar to those of the Cray-1 and Cyber 205. If such machines become feasible, they will open up a much larger market for supercomputers.

While Fujitsu has delivered three VP-100 machines, it has yet to deliver its top-of-the-line VP-200 machine, one of which is running at the Fujitsu factory in Numazu, south of Tokyo.

In 1983, Fujitsu, Japan's largest computer manufacturer, had sales of about $4 billion, nearly 2% of the world market. About 15% of its sales were made outside Japan. Fujitsu's R&D investment was about 9% of sales, which is nearly 10 times that spent by Cray but only one tenth of what IBM laid out. It is not known what fraction of Fujitsu's R&D money was spent on supercomputer research, but it should be noted that whatever Fujitsu invested was supplemented by considerable government support delivered through MITI, Japan's Ministry of International Trade and Industry. Fujitsu also has the great asset of its strength in semiconductor manufacture and design. It is currently studying gallium arsenide high-electron-mobility transistors (HEMT), which may be a critical component in the next generation of supercomputers.

To make major inroads into the international supercomputer market, Fujitsu is using local manufacturers to distribute and service its machines; in England, ICL may serve as distributor; in Germany, Siemens; in the U.S., Amdahl. (It has recently been learned that Fujitsu has increased its holdings in Amdahl to about 50%.)

Hitachi is currently the world's leading producer of 64K DRAM semiconductor memories, with over 70% of the market. Hitachi also has pioneered in 256K DRAM memories. Hitachi's position in this market allows it to achieve very favorable cost-performance ratios in the production of its S-810 Model 10 and 20 supercomputers. While Hitachi ranks only fourth among Japanese computer manufacturers, it has competed intensely with Fujitsu in the mainframe market and in the race to be first among Japan's supercomputer manufacturers. Both these companies use the M-series architecture, which was developed jointly by them from 1970 through 1974 in one of MITI's most successful computer projects. Hitachi is Japan's largest manufacturer of electrical and electronic products with $16 billion in 1983 sales. About 5% was

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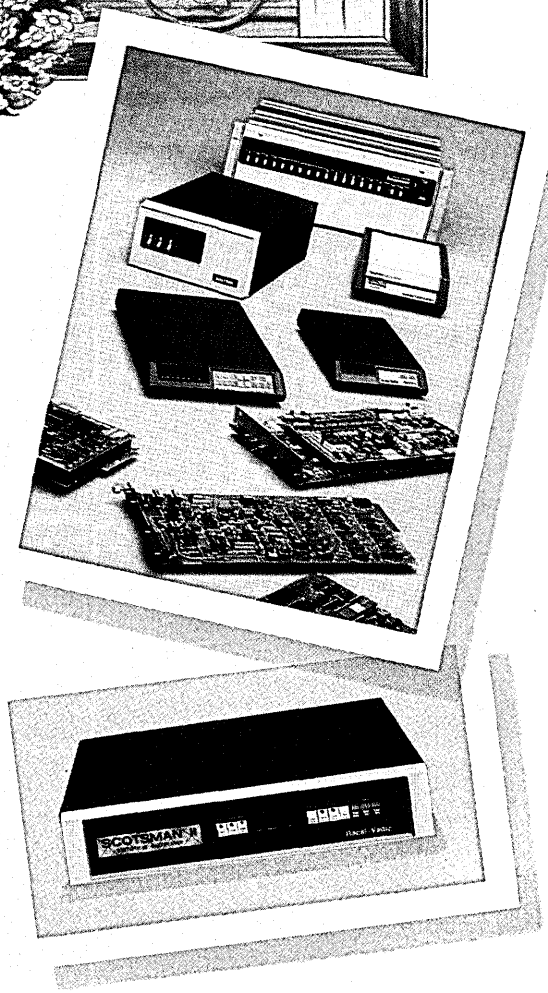

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U.S. hardware manufacturers must give much more consideration to software than they do now.

spent on R&D, but the fraction spent on supercomputer development is not released. Hitachi's reputation has suffered, as well as its balance sheet, as a result of IBM's successful espionage suit, settled for about $300 million in addition to a fee of $2 million to $4 million per month for the use of IBM software. This suit forced the development of a new operating system for Hitachi's sole delivered supercomputer.

NEC TO INTRODUCE SX-1 SOON

NEC plans the introduction of the SX-1 and SX-2 supercomputers within a year. The performance of the SX-2 is aimed at that of the Cray-2 although its machine clock cycle is 6nsec versus 4nsec for the Cray-2. NEC machines use the in-house ACOS operating system.

One major question mark in future Japanese supercomputer developments concerns IBM's plans. In the second week of February, IBM announced the immediate replacement of the one-year-old 3080 mainframe series by the new 308X series. This new series of computers offers significant improvements in throughput performance. But by putting part of the operating system in microcode, IBM may undermine its plug-compatible competitors. The introduction of the X series is apparently a strategic ploy in IBM's defense against its Japanese competitors, but Hitachi and Fujitsu may be able to offer significant improvements in speed and cost-effectiveness compared to the new IBM offerings. On the other hand, it has been rumored for some time that IBM will introduce an array processor that will perform at high MFLOP speeds.

It is very difficult to make detailed comparisons of such complex systems as supercomputers. While it is easy to describe hardware features of various machines, it is another matter to derive conclusions about how hardware performs on real problems.

Our benchmarks were run on the Fujitsu VP-200 at Numazu in November 1983, and on the Cray X-MP at NASA/Ames and at Cray's facility in Mendota Heights, Wisc., from December 1983 to February 1984. The memory capacity of the X-MP is currently 32MB or 4 million 64-bit words; that of the production VP-200 is expandable to 256MB or 32 million 64-bit words. The VP-200 presently running at Numazu, however, has 64MB. Its memory has been upgraded from 16K RAMs to the 64K RAM specified in the machine design. The memory disparity between the VP-200 and the X-MP is mitigated by the availability of a solid-state disk (SSD) for the X-MP; the SSD is available with up to 256MB, but its use does require data-handling I/O processing techniques that can be tricky to program properly. For brute force speed, the SSD is a satisfactory answer to the problem of limited fast memory on the X-MP—the SSD gives I/O speeds nearly 100 times faster than conventional rotating magnetic disks. A single, large, fast memory, however, (like that on a fully configured VP-200) is much more user friendly than hierarchical memory like that provided by an SSD. Also, code written for a single, large memory machine should be much more easily transportable from machine to machine.

The VP-200 is air-cooled, while the X-MP is cooled by a Freon-based liquid coolant requiring a 25-ton compressor. The VP-200's main memory is based on MOS semiconductors that run cooler (allowing air cooling) but slower, access time 55nsec, than the bipolar 16Kb, 38nsec of memory used in the X-MP.

Both the X-MP and VP-200 are vector-oriented pipeline computers: they achieve their great speeds when operating on vectors. A vector is an array of numbers, e.g., A(I) [I = 1,2,...,N]. A conventional, or scalar, computer computes the results of the sum A(I) + B(I)[I = 1,2,...,N] serially: first A(1) and B(1) are loaded into registers, then A(1) + B(1) is computed, then A(1) + B(1) is stored, then A(2) and (B(2) are loaded, then A(2) + B(2) is computed, then stored, then A(3) and B(3) are loaded, etc. On the other hand, a vector machine computes the results A(I) + B(I)[I = 1,2,...,N] as if the computer were a computational assembly line. Typically, one result is obtained per clock period, so that the above vector sum requires just (N + S) machine clock periods to complete, where S is the so-called startup time of the vector assembly line (pipeline).

The machine clock time of X-MP is 9.5nsec, in contrast to the 15nsec clock of the VP-200 for scalar operations and 7.5nsec for vector operations. It is noteworthy that the X-MP and VP-200 appear to have similar scalar capabilities, despite their different clock cycles. (This could be attributed to the concurrency between the operations of the vector and scalar unit in the VP-200; the X-MP shares its floating point pipelines between its vector and scalar components.) In each clock period, each of the two processors of the X-MP can produce one result of an add, one of a multiply; in each clock period of the VP-200, each of its add and multiply pipelines can produce two results.

A MAJOR ADVANTAGE OF X-MP

The startup time on the X-MP is on the order of six to 10 clocks, while that on the VP-200 is about 10 to 30 clocks. This is a major advantage of the X-MP—it means the vector pipeline of the X-MP can work effectively on vectors as short as roughly 10 elements, while the VP-200 requires vectors longer than roughly 30 to operate efficiently. The story is not that simple, however. The eight vector registers of each of the X-MP's processors have a total capacity of only 512 words. The vector registers on the VP-200 have a capacity of 8K 64-bit words and can be dynamically reconfigured so there are between eight and 256 registers. Analysis of many applications codes shows that the limited number of registers on the Cray is a severe liability, one presumably avoided by the Fujitsu design. (We have not yet been able to analyze machine code produced by the Fujitsu compiler, so this last point deserves much further study.)

It may be noteworthy that the X-MP uses 16-gate-per-chip semiconductors while the VP-200 is designed using either 400- or 1300-gate-per-chip devices. The higher level of integration used in the VP-200 is a result of Fujitsu's in-house expertise in semiconductor manufacture. Indeed, Cray has begun to invest in the manufacture of gallium arsenide chips in order to lessen its dependence on outside, especially Japanese, suppliers. Although the ETA System's GF-10 will use 20,000 gates per chip, it is not clear that gallium arsenide technology can deliver this level of integration by 1986.

Another noteworthy difference between the VP-200 and the X-MP concerns their FORTRAN compilers. The compiler on the X-MP runs at a rate of about 5,000 lines per second on the vector processor.

The compiler for the VP-200 does not run on the vector processor itself, but rather on the front-end processor. Unless a powerful front end is used for the VP-200, this may produce a significant bottleneck in throughput for the VP-200 system. We consider front-end compilation, as presently run, to be a significant disadvantage of the VP-200.

On the other hand, the FORTRAN compiler for the VP-200 generates efficient vector code from many FORTRAN constructs that give the Cray compiler difficulty, including arithmetic IF statements and other kinds of DO loops. (It has, however, been announced that the next version of the CFT compiler will be able to vectorize DO loops with IF statements.) In fact, this may prove to be a significant advantage of the VP-200 over the X-MP. Our conclusion from this is that U.S. hardware manufacturers must give much more consideration to software than they do now.

We ran several benchmark fluid dynamics codes on the VP-200 at Numazu and on X-MPs at NASA/Ames and Mendota Heights. These benchmark codes were originally written for the Cray-1 and later modified for the Cyber-205. They were optimized for performance on the Cray-1 by writing essential internal loops in assembly language. For example, assembly

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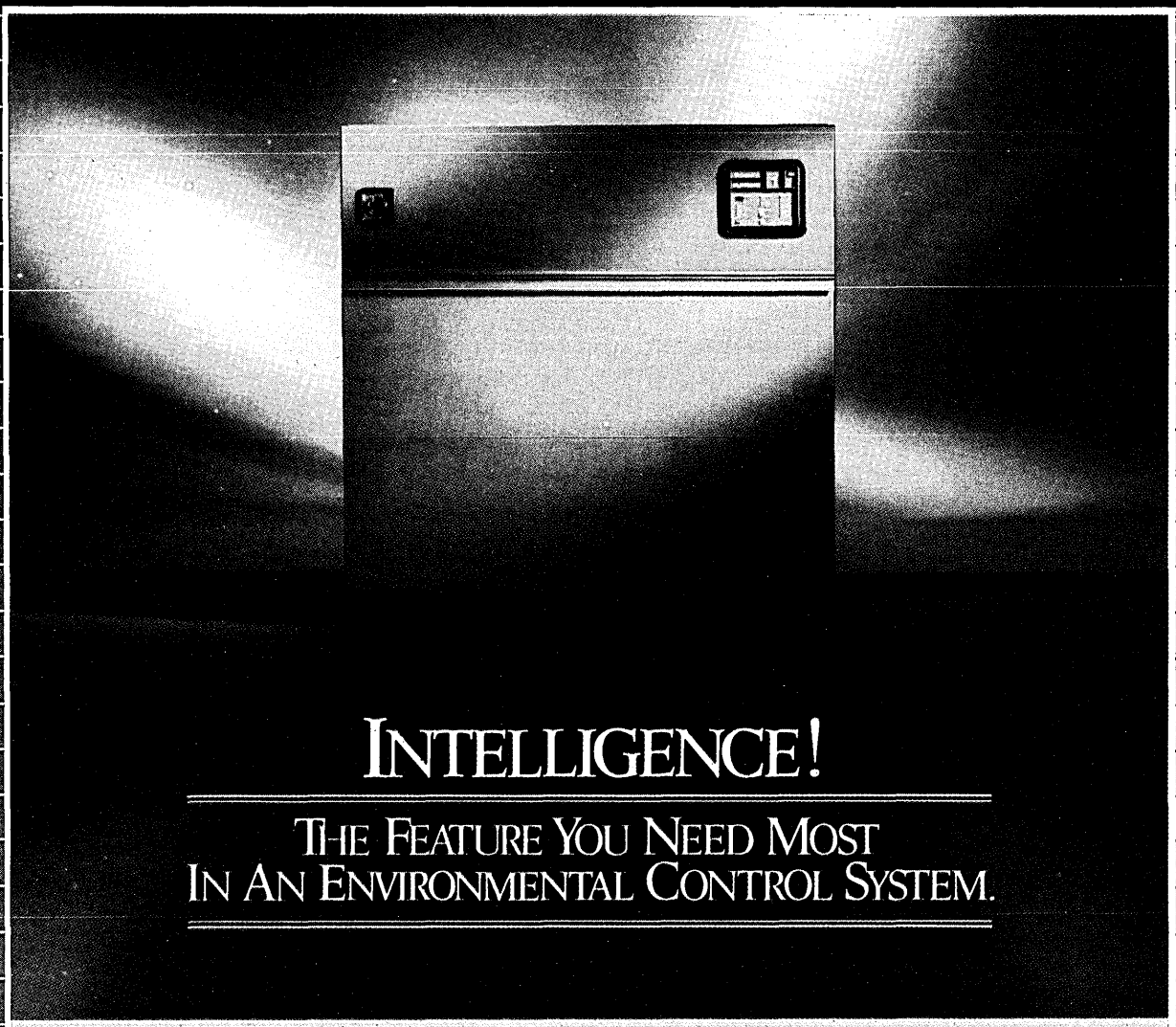

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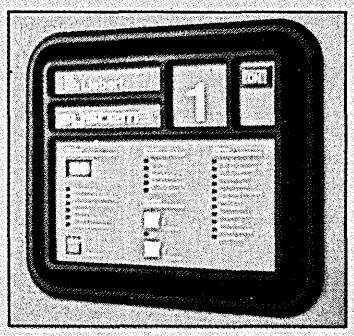

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A major question mark in future Japanese supercomputer developments concerns IBM's plans.

language routines were used for fast Fourier transformation, and for matrix or vector multiplication. The codes were also optimized for performance on the Cyber 205, using FORTRAN-callable assembly language statements. One of the programs, 2DMHD, a two-dimensional magnetohydrodynamic turbulence program, had typical vector lengths of 256. Another, SHEAR3, a three-dimensional thermal convection program, had vector lengths between 32 and 1,032 in one run and between 16 and 256 in another.

For the runs on the VP-200 and the X-MP, we used standard FORTRAN versions of these programs with all assembly language constructs removed.

The timing runs show that the VP-200 is an efficient processor, especially if long vectors are involved. For 2DMHD, the VP-200 ran at about 115 MFLOPS, nearly three times faster than the optimized assembly language Cray-1 code and nearly 1½ times faster than on a two-pipe Cyber 205. The X-MP speed on this code was about 40% slower than that of the VP-200, using only one of the two X-MP's processors (the two-processor NLCTSS operating system is not yet available). For runs with shorter vector lengths, the speed of the VP-200 slowed down. With vector lengths of 16, SHEAR3 ran on the VP-200 just a little slower than the assembly code on the Cray-1, while the optimal FORTRAN X-MP code on one processor ran about 10% faster than the VP-200. The VP-200 seems to perform best on computations with long vectors, a property it shares with the Cyber 205. As mentioned earlier in this article, the pipelines of the VP-200 become efficient only if vector lengths longer than about 30 are used, while those on the Cray machines are efficient for vector lengths larger than 6 to 10.

The 14 Livermore Loops have been used since 1974 to benchmark the performance of computers. The performance of the Cray computers on these benchmarks has steadily improved with time, as Cray has gradually improved the vectorizing power of its CFT compiler. The most recent, experimental version of the CFT compiler used in one processor of the X-MP ran at an average rate of 73 MFLOPS. The VP-200 and S-810 supercomputers have been clocked on these loops at average rates of 134 MFLOPS and 124 MFLOPS respectively.

These comparisons suggest that the new Japanese machines may be real competition for U.S. supercomputers. The development of the Hitachi and Fujitsu machines has been aided by information and technology transfer from the American manufacturers, specifically, in architecture of vector machines, and in compiler generation. The real test of the Japanese manufacturers will come in the next generation supercomputers; they will be required to innovate and introduce new systems without the benefit of their U.S. competitors' earlier ideas. This international competition is likely to speed the introduction of new, more powerful supercomputers leading to further scientific, engineering, and industrial progress. The next 10 years should surely see exciting new developments in supercomputing and therefore exciting new applications and ideas for using computers. ✱

Raul Mendez is a professor in the mathematics department at the Naval Postgraduate School, Monterey, Calif. Steve Orszag is a professor in the mathematics department at the Massachusetts Institute of Technology.

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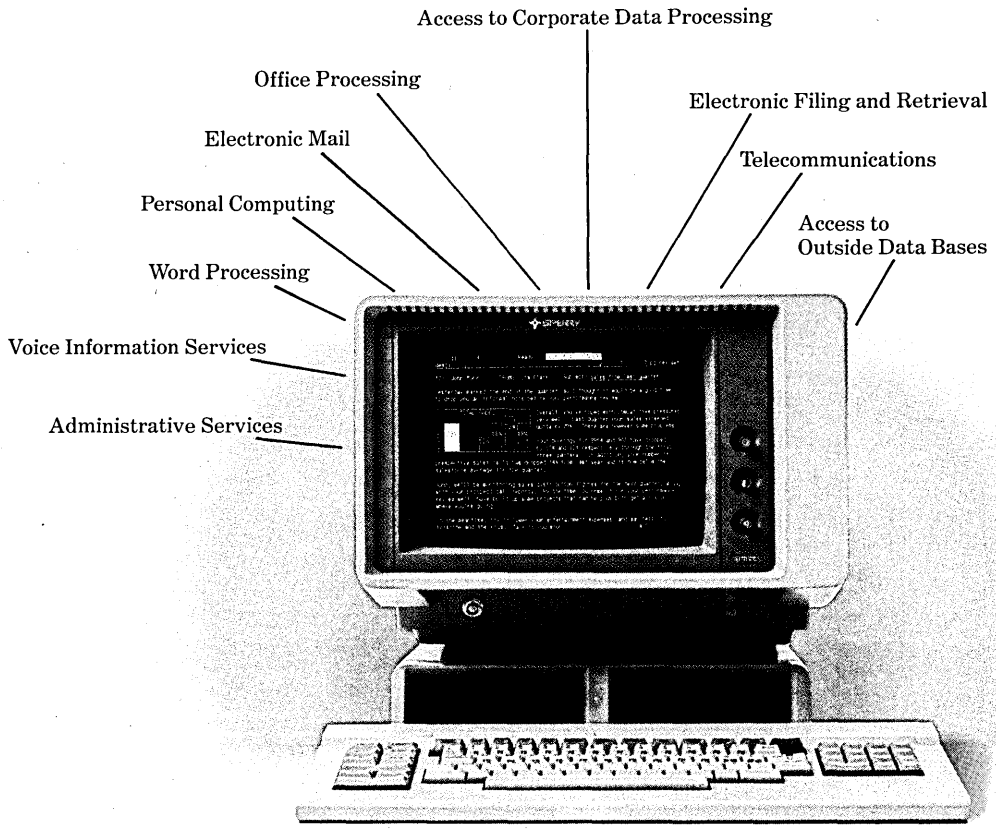

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They may have begun as freebooters, but now they're going legit.

THE ASIAN MICRO PIRATES

by Daniel Burstein

ILLUSTRATION BY CRIS SPOLLEN

As readers of James Clavell epics like *Tai-Pan* and *Noble House* know, many powerful companies in Southeast Asia had their origins in the nefarious deeds of pirates and smugglers back in the early days of the China trade. Amassing treasure chests full of gold from the sale of their opium cargoes, nineteenth-century seafaring rogues founded banks and trading companies whose skyscrapers loom over the Hong Kong waterfront today.

A late twentieth-century replay of this old story may be taking place among the pirates of the microcomputer trade. While they don't use grappling hooks to board unsuspecting ships, today's Asian computer pirates have been known to inspire as much fear in Silicon Valley as if they had hoisted the skull and crossbones. What's more, like their freebooting predecessors, today's micro pirates are using their ill-gotten gains to lay the financial and technical groundwork for legitimate businesses of the future.

The most visible evidence of computer piracy is to be found at the "Golden Shopping Centre" on the Kowloon side of Hong Kong, where scores of small shops dot a brightly lit arcade piled high with fake Apples, TRS-80s, and even fake IBM PCs. Most of these machines are manufactured in Taiwan, where, until recently at any rate, international patents and copyrights were largely meaningless. Hong Kong, traditionally a free port, does not regulate the flow of electronic goods in or out of its teeming wharves. Under Hong Kong law, as long as a computer's logo or trademark doesn't infringe on an accepted international one, the product can be legally sold even if its inner workings might be a violation of American copyright law. Thus, the Golden Shopping Centre and a number of smaller arcades lie at the heart of the pirate distribution system.

"Most of the fake Apples and such come from Taiwan," observes Charles Chapman, an officer of Hong Kong's Trade Development Council. "Some companies tried to make them here, but they just

A reputation as a center for ripped-off computer goods is not likely to help Taiwan.

couldn't compete with Taiwan's efficiency in turning them out. But they do sell a lot of them here. Hong Kong is a very big market for fake Apples."

Describing a Golden Shopping Centre shopping spree, James Tunnell, a former Osborne employee, told a congressional subcommittee that a customer there can "dictate his own computer or electronic system package and, within an hour, a teenager will put down the screwdriver and a custom-built North Star Advantage, Osborne, or IBM can be toted out the door." Adds a Hong Kong-based expert on the Asian computer industry, "Things are getting tighter over in the Golden Shopping Centre. There have been crackdowns and threats of action by American authorities. An American walking in there is likely to be suspect these days. But if you know your dealer well, you can still get an IBM PC assembled for $600."

Freed from manufacturer-imposed constraints and with a wide assortment of cheap Asian-manufactured peripherals and pirated software at their disposal, the shopkeepers of the Golden Shopping Centre can indeed quickly assemble customized packages to suit the particular needs of a buyer. A program like VisiCalc, complete with photocopied manuals, sells for as little as 20 American dollars.

"Hong Kong became famous for digital watches and calculators," says a Golden Shopping Centre merchant who agreed to talk but not to have his name mentioned. "Why should assembling computers be any more difficult? High school students here are very good at figuring out how to interchange circuit boards and components to get the right mix."

Unlike other widely faked products in Southeast Asia (Cartier watches) for example, or Louis Vuitton luggage), computer copies are rarely labeled as the real thing. Most of the customers are local people who simply can't afford the genuine item, and are happy to settle for an illegal knockoff for less than half price. Many of the knockoffs have their own Chinese names, while others come in plain vanilla exteriors. Buyers who want to impress their friends can get a fake Apple or IBM logo for a dollar or two.

HARD-HIT APPLE IS FIGHTING

Hardest hit by piracy, Apple has been the manufacturer doing the most about it. In part, Apple's inexperience allowed the problem to arise in the first place. When the company first geared up massive production of the Apple II, it failed to register key parts of its designs in Taiwan, thus allowing Taiwanese manufacturers to take advantage of then-existing laws that made it possible to legally replicate proprietary designs that hadn't been specifically registered in Taiwan. Moreover, when fake Apples began floating around the Pacific Rim three years ago, Apple was slow to press legal action, thus enabling a wide gray market to unfold.

But as the fake-Apple business began to be estimated in the tens of thousands of units, and as some of those units began showing up in Western Europe and North America, Apple pulled out the stops and initiated numerous legal actions. Apple spokeswoman Barbara Krause states, "We intend to pursue aggressive legal action. We take these matters very seriously and we will use whatever methods we have to stop copyright infringement." Since 1982, Apple has brought more than 50 lawsuits in 16 countries charging that copyrights on its operating system are being violated.

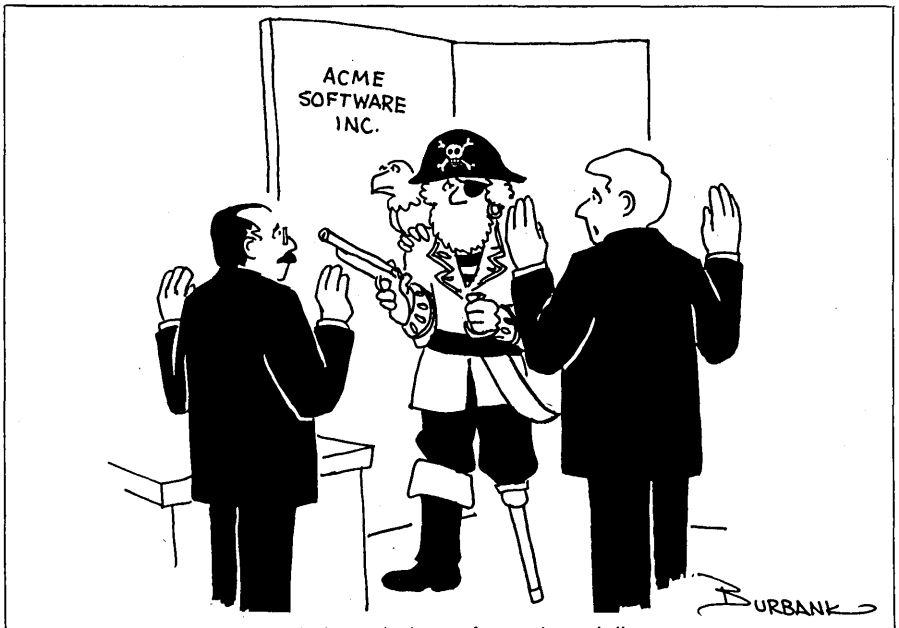
Working with the U.S. Customs authorities, Apple arranged to have 400 fake machines seized last December in California. In February, a federal grand jury in Philadelphia indicted six individuals and five different companies on charges of criminal conspiracy and smuggling of counterfeit Apples—the first time criminal, rather than civil, charges have been brought in a computer piracy case of this type.

Internationally, Apple has had a mixed record of success. In the Netherlands, a court awarded Apple a $300,000 settlement in a case involving a Dutch trading company that imported Taiwan-built Apple fakes. In Australia, however, a court rejected Apple's claims of copyright infringements by the Taiwan-made "Wombat" (a computer so similar to an Apple that its instruction manual is actually the Apple II manual) on the grounds that computer programs are not literary works and can't be protected by existing copyright law.

The most important legal battle over computer piracy is going on in Taiwan itself. Though content to tolerate the counterfeit industry in the early days when it helped create jobs and expand the island's technological base, the Taiwan government is now much more concerned with attracting investment from major U.S. and European high-tech manufacturers. A reputation as a center for ripped-off computer goods is not likely to help that cause, so Taiwanese authorities have begun to issue edicts against Apple counterfeiters to show their good will to the international technology community.

In January, for example, six Taiwan computer company executives were sentenced by the Taipei courts to eight-month prison terms for copying Apple software—the first time prison sentences were actually handed down in a case involving computer counterfeiting. Moreover, according to reports received from Taiwan by the *Asian Computer Monthly*, Taiwan's government is now planning to outlaw "domestic and overseas sales of Apple II copies—whether outright fakes or the more ambiguous 'Apple compatible' machines."

The publication reported that Taiwan's Minister of Economic Affairs, William Y.T. Chao, had visited the Apple factory in Cupertino, Calif., in 1983 and had drawn up a plan afterwards to effectively shut down Taiwan's Apple-imitation industry.



"At least he's up front about it."

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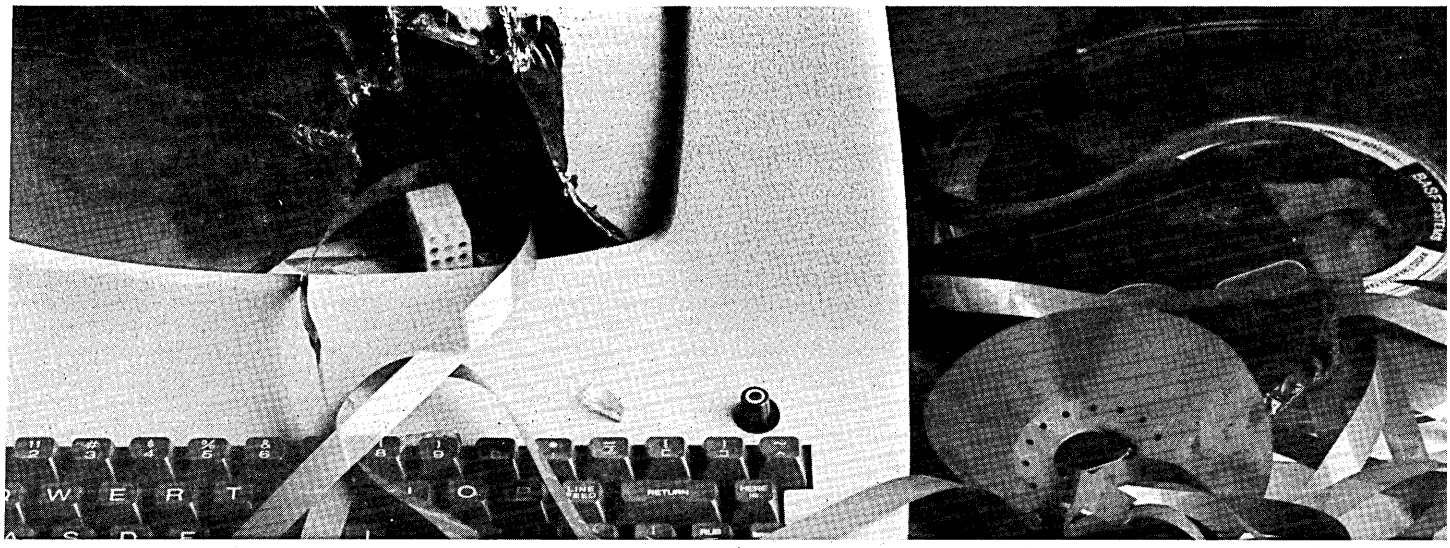

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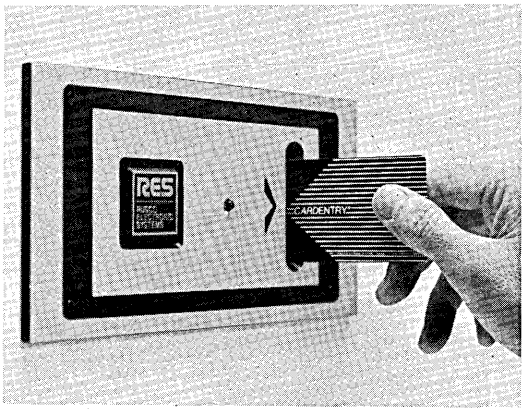

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"The fakes have been an unmitigated good thing for the industry."

Whether such action is ever taken specifically against Apple copiers—and indeed, whether the above-mentioned Taiwanese executives ever serve a day in jail—remains to be seen. But Taiwan is doing its best to give the appearance of restricting the free hand counterfeiters formerly had.

Taiwan's actions may not benefit Apple much, however. They come at a time when most of the pirates have turned to other products, because Apple is no longer the rage it once was. The company's Asian market share has fallen dramatically and today's up-and-coming pirates set their sights on IBM.

COPYING IBM IS HARDER

Counterfeiting IBM products, however, will be a much more difficult task. IBM has registered its copyrights and patents in Taiwan, and is closely policing infringements. It has taken full-page ads in important Southeast Asian newspapers, warning that it will prosecute pirates. IBM officials use conventions and trade shows to reiterate the company's positions on piracy. At the offices of the Taiwan government agency charged with enhancing the domestic computer industry, IBM representatives have held meetings to ensure that illegal systems are avoided, and that licenses are negotiated for those wanting to incorporate proprietary designs.

Outright piracy may have actually peaked in Southeast Asia. Having built up significant cash flow through their sales of counterfeit machines, and having trained a sufficiently large technical force to assemble them, many of the pirates are now ready to go legitimate. Multitech, today one of Taiwan's biggest computer manufacturers, reportedly made millions in the fake Apple business, but is today producing a line of IBM-compatible equipment no less legal than IBM-compatibles made in the U.S. Mycomp and Mitec, two other Taiwan companies identified at one time or another as sources of pirated goods, have also entered the IBM-compatible market with their own designs, and several more are on the way.

Looking at the broader implications of Asian computer piracy, Euan Barty, the editor of *Asian Computer Monthly*, takes a controversial position that would not be much appreciated in Cupertino or Armonk. "The fakes have been an unmitigated good thing for the industry," he says. "No one was really harmed. The buyers knew they were buying fakes, so there is no issue of consumer fraud. Most of them couldn't have afforded the real things, so they weren't taking market share away from anyone—just expanding the total size of the market."

Barty believes that the pirates helped create and indigenous microcomputer industry that will now go on to bigger, better, and more legitimate things. Piracy, he says, has generated "entrepreneurs, a trained technical work force, and distribution systems." In the long run, Barty argues, the burgeoning microcomputer industry in Southeast Asia will help the major international manufacturers by providing improved low-cost production facilities and by expanding the user base and thus the market for IBMs, Macintoshes, and other state-of-the-art American computers.

The teenager who today assembles phony Apples in a back room at the Golden Shopping Centre may someday manage an IBM plant in Hong Kong. ✱

Daniel Burstein is a New York-based free-lance writer who frequently reports on business and technology in Asia.

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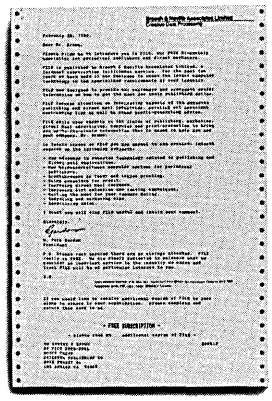

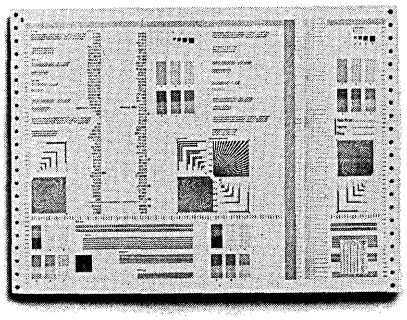

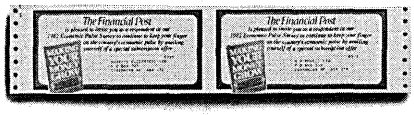

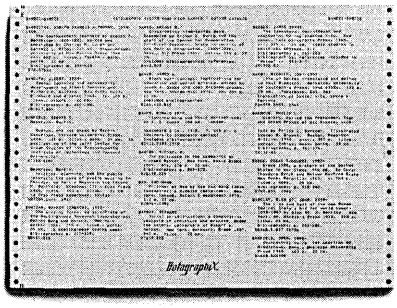

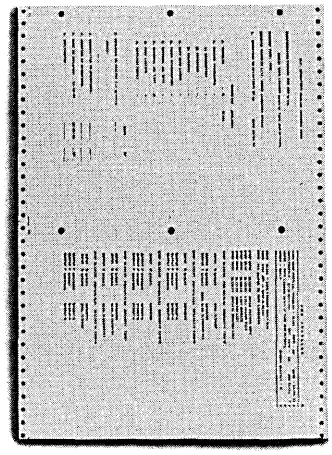

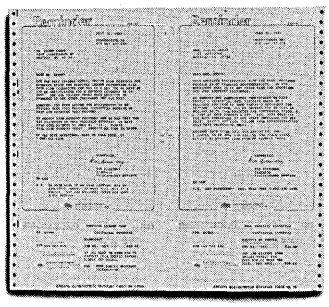

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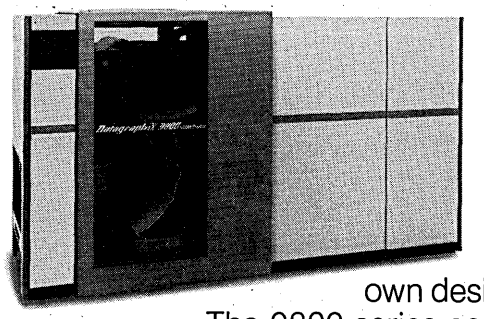
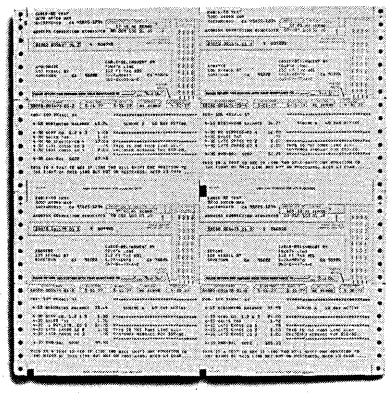
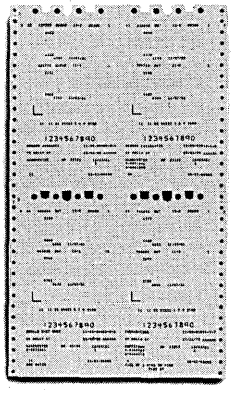


The 9800 series comes in a variety of on-line, off-line, or on-line/off-line configurations compatible with a broad selection of CPUs. Off-line models offer user-oriented menu-driven software, hard copy log, 6250 BPI tape drives with ping-ponging capability and more. On-line models offer full IBM 3800 compatibility, in addition to the advantages of DatagraphiX's advanced engineering.





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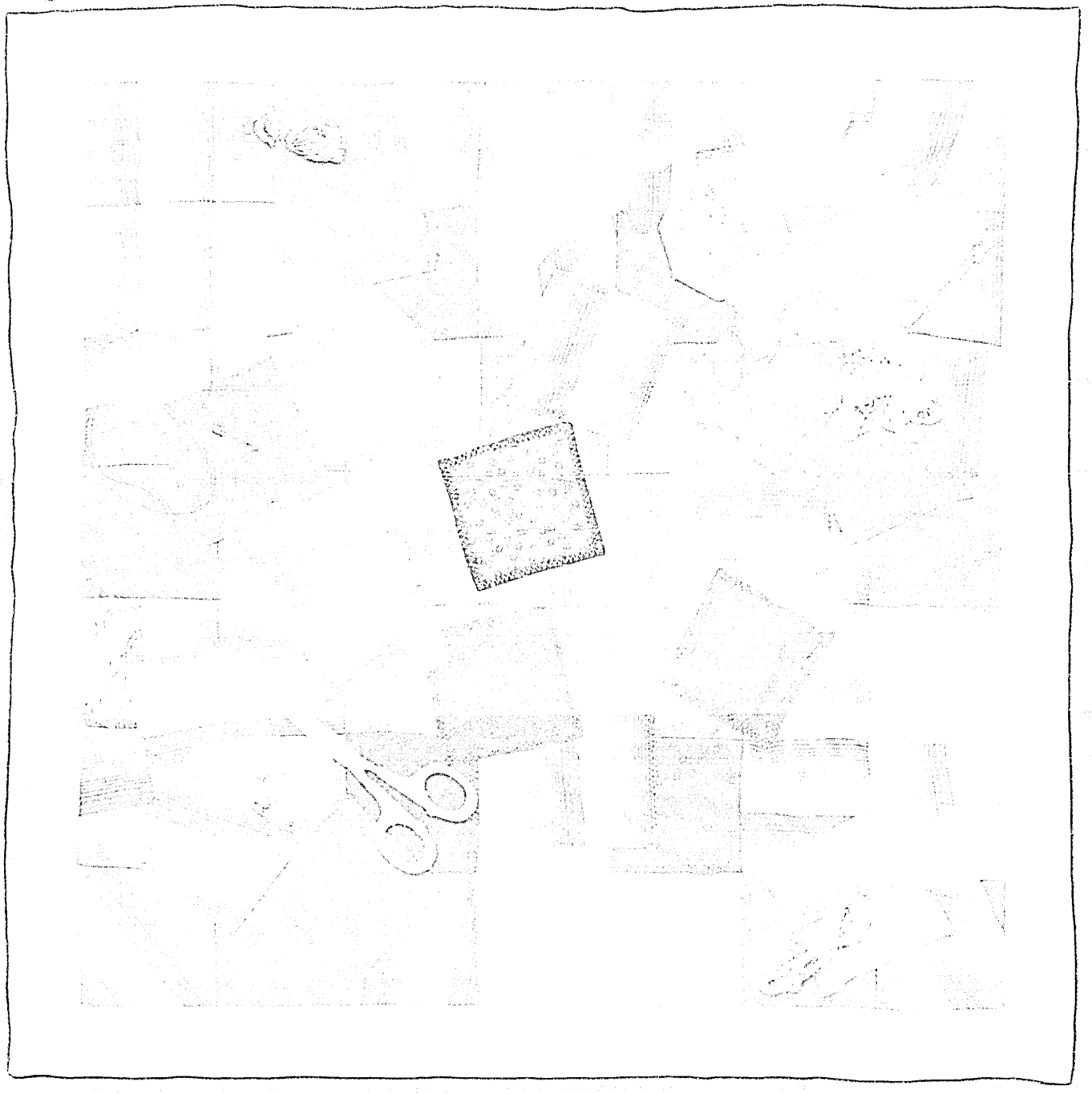
After much patchwork, production code can become a maintenance nightmare. Here's one way to sleep easier.

MENDING CRAZY QUILT SYSTEMS

by Gary L. Richardson, Charles W. Butler, and Earl D. Hodil

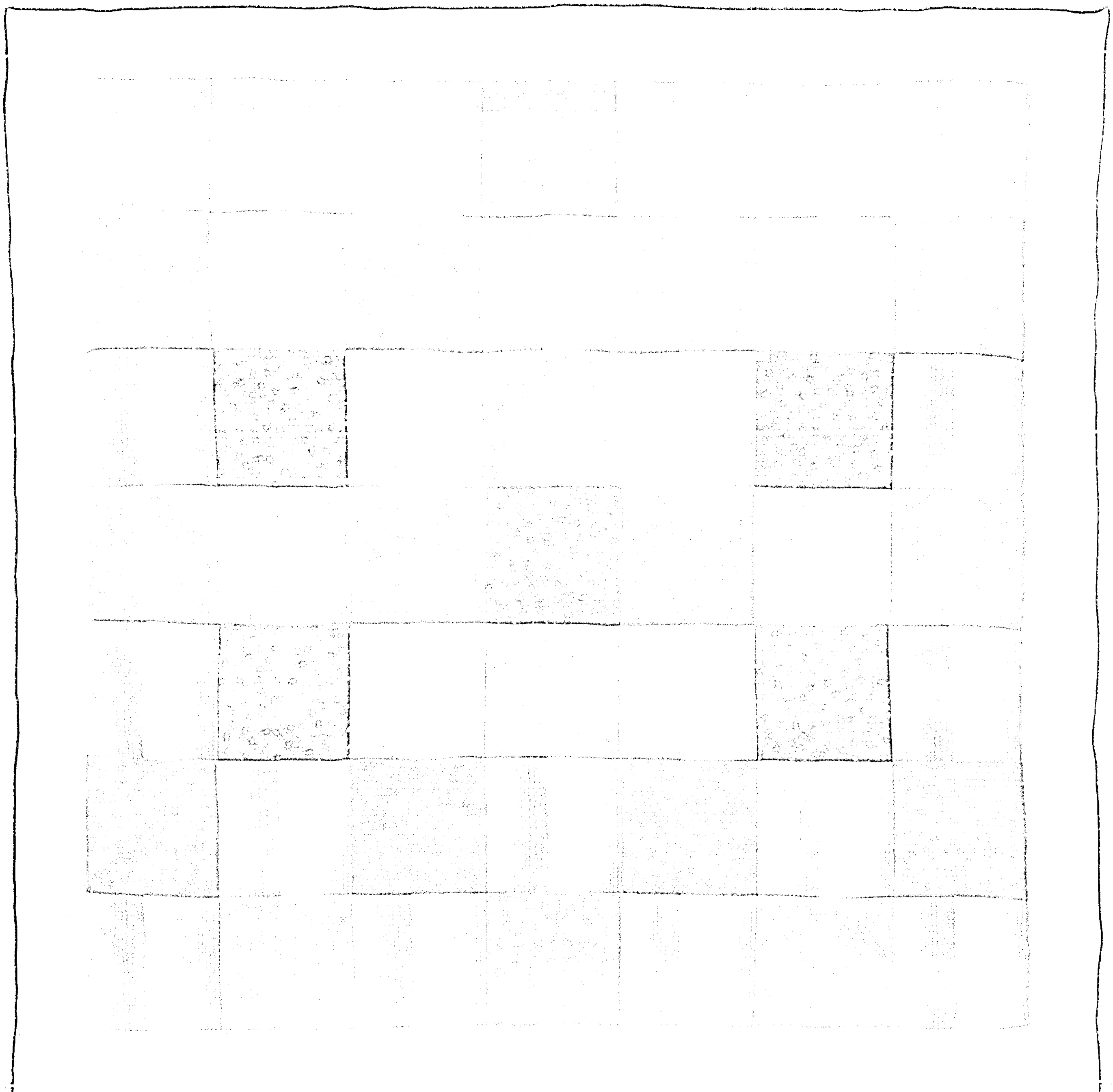
As data processing has grown through the '60s and '70s, the volume of implemented software has become enormous. The development expense for software applications is now highly visible to management. Most companies have struggled with the cost of new applications as well as the maintenance of existing production software. Despite the rapid introduction of new technology, there is no panacea to the cost dilemma. In fact, highly publicized fourth generation languages



such as NOMAD and RAMIS present many unanswered questions when long-run operational performance and system integration are evaluated. Even with the advantages of new technology, dp management still has a significant amount of traditional production code, most of which is poorly written and inadequately documented. The current state of production code is not surprising when a firm's dynamic operation and the laborious nature of manually producing quality code are taken into account.

Without knowing of an optimal solution to the cost problem, it is the authors' contention that software maintenance be recognized as asset management. Historically, expense reduction was achieved by eliminating or reducing an expense item. Reduction, as a concept, is contradictory to software maintenance. Code is rarely reduced. Software maintenance should facilitate the growth of new features and logical functions. In contrast, asset management implies careful planning, organizing, and controlling to yield the greatest return. Firms have been investing heavily in their software over the years and the software's asset value is typically between $5 and $50 per line of code. (Data collected by L. H. Hermann, manager of technology and development, for 44 projects at Shell Oil from 1979 to 1983 revealed a cost range from $4.41 to $32.50 per line. Shell's numbers are believed to be lower than industry norms because of successful implementation of structured methodologies. Other studies have computed unit cost as high as $100 per line.) Effective use of maintenance resources requires skilled application of human resources, maintenance tools, and new methodologies. Only through organized management of production code can the maintenance dollar be stretched.

The need for effective mainte-



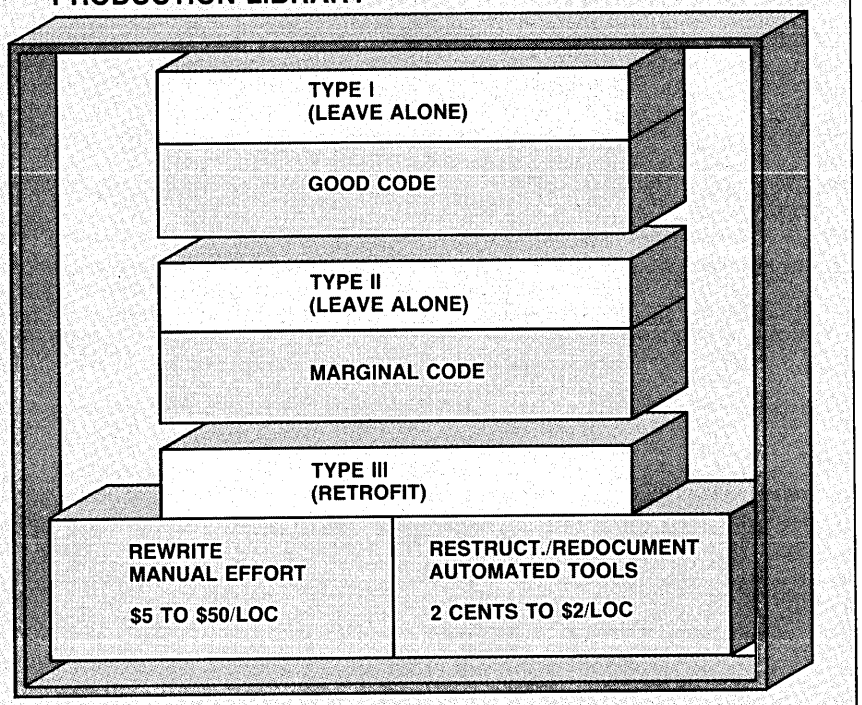
nance management is even more obvious in light of current industry trends. Software maintenance tools are proliferating, and structured code, clear mechanical format, and schematics of architectural definition are increasingly being accepted as useful maintenance aids. Recent studies indicate, somewhat conclusively, that structured programming can have a beneficial effect on maintenance costs.

With this growth, one point is increasingly clear. Methodologies and tools alone will not correct all the problems embedded in existing production code. Indeed, these technologies can become costly and ineffectual if they are used in an unmanaged approach. Our challenge here is to describe a rational way of managing the software asset and improving the performance of the maintenance dollar.

Proper allocation of maintenance resources, including the growing set of software tools, requires three activities: operational controls, code evaluation, and purification. First, operational controls are required to manage the programming environment. By storing production code in a controlled location, operational components can be identified and studied. Then a formal evaluation procedure is needed to properly identify problem code units. Based upon evaluative techniques, resource allocations can be prioritized to yield the greatest return on maintenance activity. Finally, the prioritized code units are purified, improving their future performance and lowering future maintenance costs. Benefits derived from the maintenance dollar can be improved only through the integration of all three activities.

FIG. 1

DECISION SCHEMATIC FOR PRODUCTION CODE



ISOLATE CODE FIRST

Surprisingly, many organizations cannot physically isolate or statistically quantify their production code, much less quantitatively describe the quality of code units. This situation must be resolved before the subsequent steps outlined below can begin. Three integrated administrative systems can aid in this process.

1. Library management is best accomplished through an automated control package that insures all production source code modules reside in approved libraries and that production load modules exist for only these source modules. While there are many reasons for installing such a system, its purpose here is to bind the execution errors associated with a load module's execution to the source code that is responsible for them.

2. System Profile. Professional staffs will better understand the importance of production code by studying the system profile. The profile is a text-oriented system, summarizing basic system metrics such as age, language, total lines of code, user evaluations of the current system, and future enhancement plans at the aggregate level.

3. Release Concept. Software changes are a recurring fact of life, so the installation of changes should be completed in an orderly fashion. The release concept categorizes changes as enhancements, modifications, and fixes. The level of resource allocation for software maintenance is determined by the degree of change that's required. By managing software through the release concept, code units are rewritten according to the degree of functional change. Appropriate quality assurance standards are established for each change category. Also, testing strategies (such as parallel or regression testing) and installation of changes are administered through a standard library architecture. Accountability and synchronization of change activity must be integrated into library management procedures.

With the establishment of these administrative systems, a framework is built within which the target code population can be identified. Once an administrative foundation is completed, the code evaluation and purification phases can be implemented.

To evaluate the quality of production code, phase two centers on the answers to four questions:

1. Which programs abend most frequently?

2. Which programs, though they may run perfectly, are so poorly written that they cannot be easily changed?

3. Which programs or systems are poorly documented?

4. Which programs are frequently subject to function changes initiated by user request?

These questions are significant since two of the essential activities associated with software maintenance are correcting program errors and implementing user-requested changes to software. Even though many firms recognize the need to answer these questions, most large dp shops find the task arduous.

In an assessment of the operational quality of production code, code units are divided into three broad categories:

- Good code–low abort frequency;
- Bad code–high abort frequency;
- Marginal code–borderline abort frequency.

Successful stratification of code quality uses a tracking system that traps all production jobs and records completion status (e.g., good completion, space abort, JCL error, bad completion code). Detailed execution information should come down at least to the load module level before code quality is evaluated.

There are both philosophical and technological issues to consider in establishing code quality. Philosophically, there should be an inverse relationship between well written code and abort frequency. In contrast, an argument can be made that abort history is not dependent entirely on code structure. The authors believe that the subject

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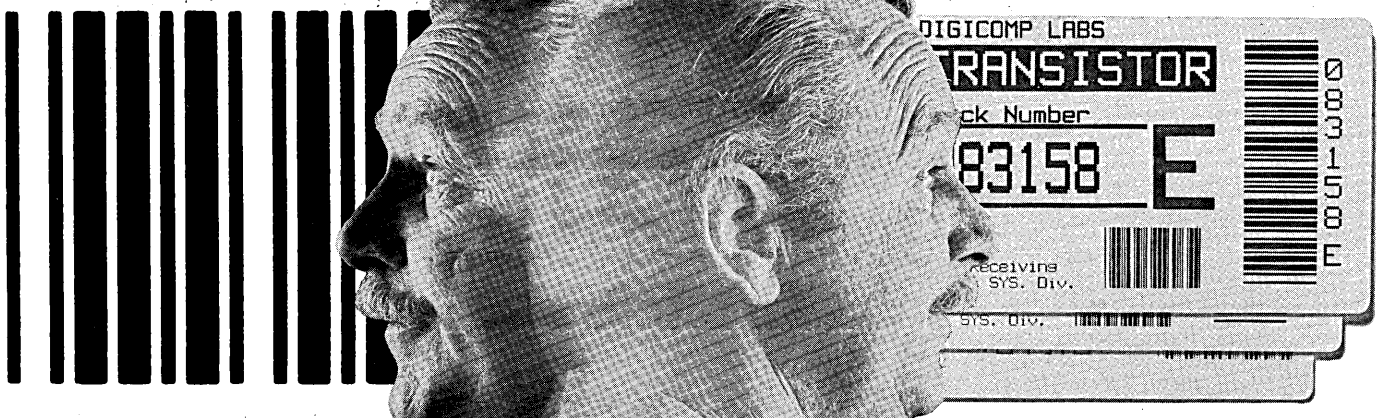

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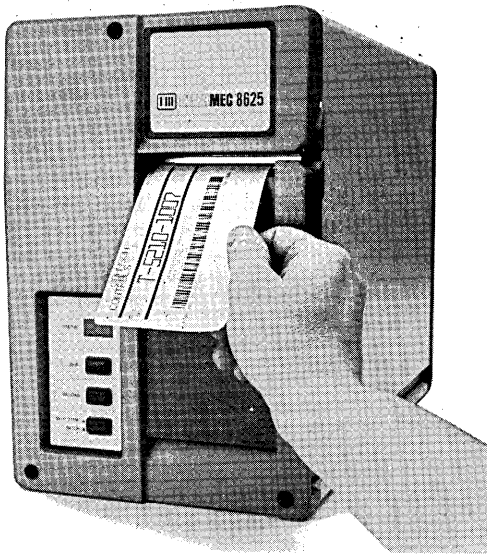

Superstructure creates a "score card" that identifies unacceptable program flaws.

of good vs. bad code is multidimensional, involving both mechanical and operational factors. As an example, code modifications can be complex owing to the absence of a coherent design architecture, yet abort statistics indicate a stable system because of the use of highly skilled operations personnel. The maintenance function involves both aspects of operation and enhancement, so judging code as good must involve more than one view. A second philosophical issue surrounds the idea of documentation value. In any examination of the millenia of existing production code that has no supporting documentation, there is some doubt as to whether it is worthwhile to be concerned about such things. In attempting to rationalize this behavior, the obvious conclusion is that the cost of documentation production outweighs its value. We believe an automated approach to producing documentation improves both software accuracy and cost effectiveness.

STAGES OF CODE REVIEW

There are also technical problems associated with code classification. First, code complexity needs to be evaluated. Although many people have defined quantitative measures of code complexity, once again there is no broad agreement as to when a code unit is overly complex. Indeed, productive code often requires complexity. Sometimes it is rationally added to the code architecture for execution efficiency or other operational reasons. In any case, high-complexity index values should serve as flags to review an existing code unit and help decide whether simplification is feasible. A second aspect of the technical problem is architecture of the code unit itself. This is usually manifested by unstructured or large modules. Within this realm one might attempt to review the unit's style, language, structure, size, and existing documentation to supply a qualitative grade. The final aspect of code review involves judging whether the code should be a candidate for modification based on strategic objectives. For example, if an old batch system is being replaced in less than one year by a new online system, deferring that code from any extra support makes sense. Alternatively, an old system with no upgrade planned would be a candidate. Any one of these technical problems complicates the evaluation process.

Current operational problems must be quantified through formalized abort history statistics for effective allocation of maintenance resources. In addition, a grading scheme at the code unit level is needed to identify repairable modules for which resources can be profitably allocated. It is quite feasible to use automated tools to do much of the scanning work for items such as size (lines of code), complexity, adherence to code standards, and other related functions. With the summary of automated statistics, it is possible to select high priority targets for closer manual examination. From this aggregation of data, code units can be selected, ranked, and given special consideration for rework. Someday this process will be highly automated, but, to date, it still involves a large degree of subjective judgment.

Having outlined an analytical process designed to identify systems and code units (i.e., programs) that are candidates for rework, we must now turn to managing the defined subset of problem code. Fig. 1 is a schematic of the process described above. Rewrite action is applied to those code units that require manual re-architecture of the system to resolve the indicated problem. In this case, new program functionality is required, or the basic database design approach is flawed. The release concept provides the administrative framework through which the code is reworked. Obviously, code should be placed in this category only as a last resort because of the inherent costs and time needed

FIG. 2

SAMPLE SYSTEM PROFILE ENTRY

APPLICATION PROFILE
DATE: MM/DD/YY

Application Name:

User Department:

Accountable Departmental Unit:

Overview:
A brief description of the application's function and objective.

I. ATTRIBUTES	
A. LANGUAGE USED (LINES OF CODE)	
1. PL/I	260,000
2. COBOL	-
3. FORTRAN	-
4. APL (FAMILY)	-
5. RAMIS	-
6. MARK IV	-
7. OTHER	225,000
8. TOTAL	485,000
B. DATABASE ARCHITECTURE	
1. IMS SEGMENTS	13,000,000
2. PHYSICAL FILES	100
3. ON-LINE STORAGE (MEGABYTES)	20,000
4. TAPE VOLUMES CREATED/MONTH	17
C. SYSTEM AGE	
1. ORIGINAL IMPLEMENTATION	1978
2. AVERAGE PROGRAM AGE	5
D. SOURCE LIBRARY STATISTICS	
1. PANVALET MEMBERS	1,200
2. OTHER MEMBERS (TSO, ETC.)	477
3. AVERAGE PROGRAM SIZE (EST.)	289
E. OPERATIONAL STATISTICS	
1. JOBS (INCLUDES UTILS./RSTRT.)	750
2. LOAD MODULES	200
3. AVERAGE JOB ABORTS/MONTH	100
4. HARDWARE ENVIRONMENT	IBM, DATAPOINT
F. PERSONNEL STATISTICS	
1. SYSTEM SUPPORT	24
2. OTHER SUPPORT	2
3. TOTAL SUPPORT	26
4. AVERAGE YEARS, EXPERIENCE	2.5

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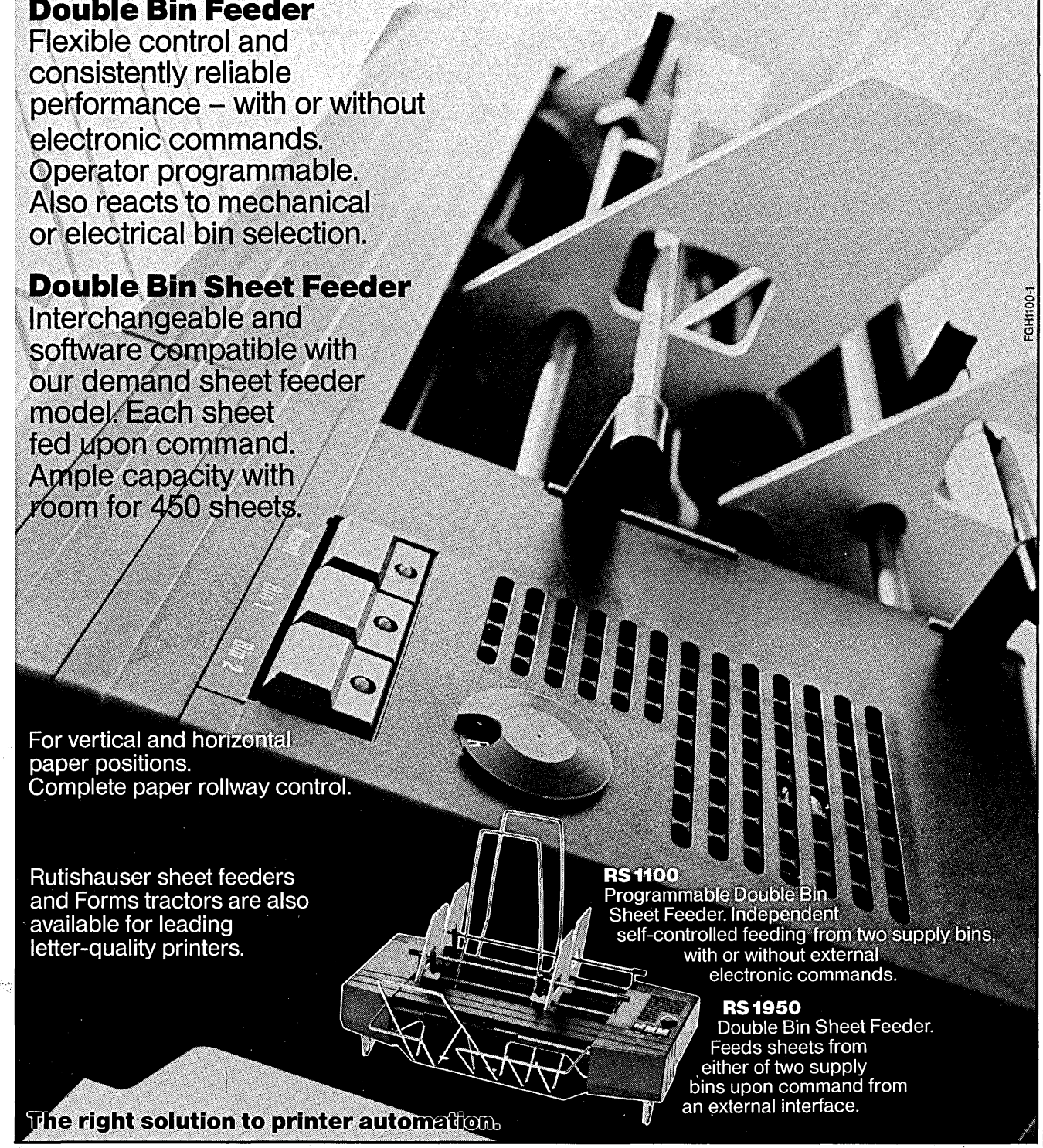

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CAN YOU FIND THE SEVEN IBMs IN THIS PICTURE?

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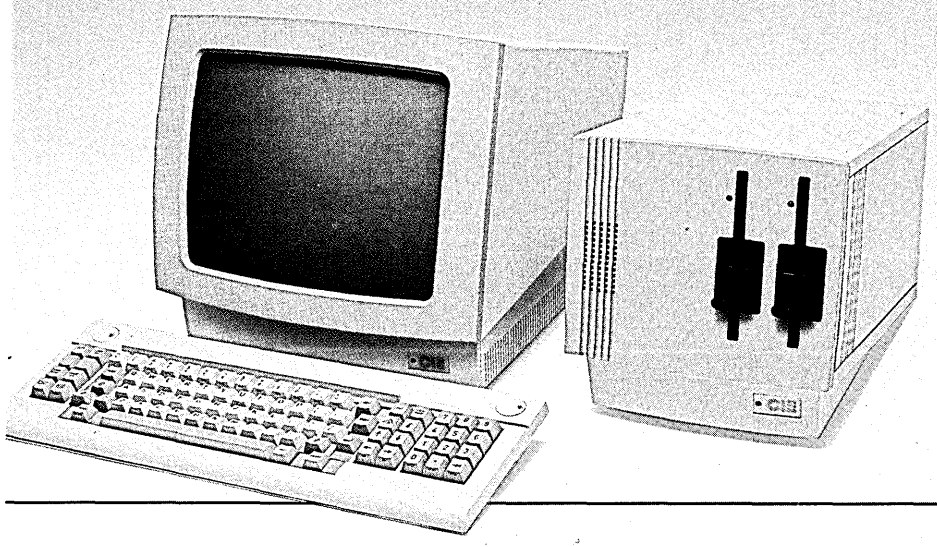

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A small allocation of resources can produce dramatic results for properly chosen code units.

to accomplish the task.

The second form of code repair is automated redocumentation, which is defined as using a software aid to produce documentation for existing production code directly from the code syntax itself. While these same tools have significant functions in new code development, redocumentation tools are most useful to the maintenance programmer who is trying to draw understanding from a block of unyielding (and usually undocumented) source code. These tools may be categorized as follows:

- Dynamic analyzers: Compilers and interpreters with interactive debugging facilities.
- Static analyzers: Automated software aids producing logic schematics. Updated documentation is produced during the normal program change cycle.
- Restructure/recording tools: Software that rebuilds existing code to eliminate bad code, and substitutes quality structured code.

Dynamic analyzers have long been accepted as part of the maintenance programmer's workbench. Usually, the dynamic analyzer is used in conjunction with test data during an interactive session. Features commonly associated with dynamic analyzers are: fast syntax checking, one-step compile and run, program path tracing, execution suspension and restart, and variable dump and modification.

The disadvantage with this method of analysis is that it only considers the paths traveled by the selected test data. Dynamic analysis is, therefore, analysis by trial and error. It is best suited for the investigation of a particular test case, or limited set of test cases, but not for gaining an "all path" understanding of a program.

BENEFITS OF STATIC ANALYZERS

Static analyzers are newcomers to the maintenance environment. To be sure, flowcharting programs have been in existence for some time. Yet the flowcharting program merely provides a rehashed version of program logic in graphic form. A picture of overall program logic is built into the output of a typical static analyzer. Moreover, such analysis can provide useful information regarding program style and complexity.

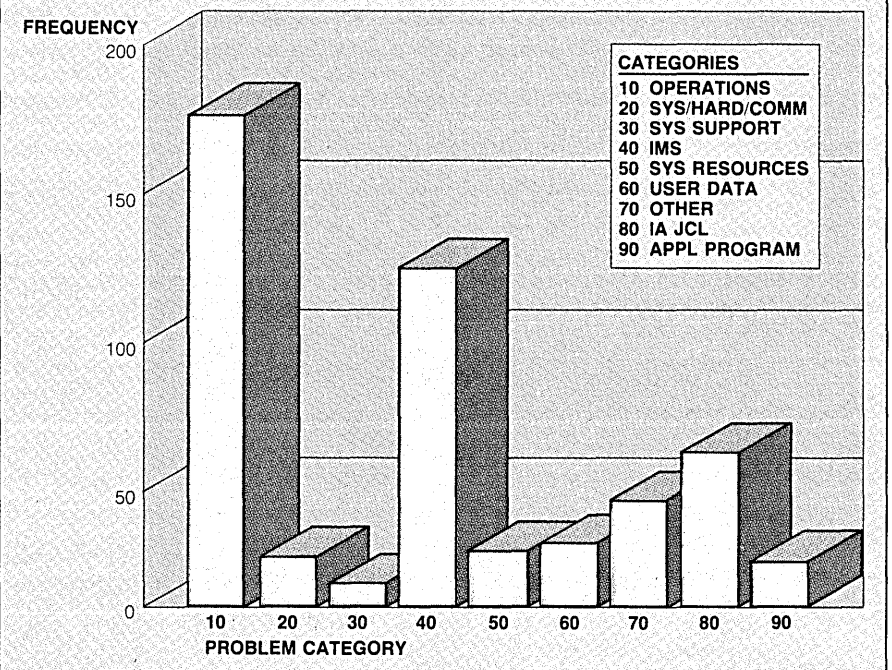
The third possible activity that may be performed on targeted code units involves the use of restructuring and recoding tools. These tools combine the intelligence of the static analyzer with the ability to generate code. Given unstructured code (i.e., code with uncontrolled branching), the recoding tool rewrites that code in a structured format. Collectively, this family of tools is our strategy for addressing the maintenance legacy.

There is reason for accepting automated redocumentation as the preferred alternative for code repairs, especially in light of the resource economics involved in code repair decisions. Type I and II code, identified in Fig. 1, represents the production code that should be left alone. For this segment of the code population, human resources can generally be allocated at the rate of one maintenance programmer per 40–70 thousand lines of source code (independent of the language). This includes resource allocation for a small amount of enhancement in addition to normal daily operational requirements. Obviously, such a numerical guideline needs to be validated locally before it is extensively used.

FIG. 3

SUMMARIZED SYSTEM PERFORMANCE

INSTALLED APPLICATIONS ABENDS FOR "YOUR SYSTEM NAME"
MONTH: NOVEMBER



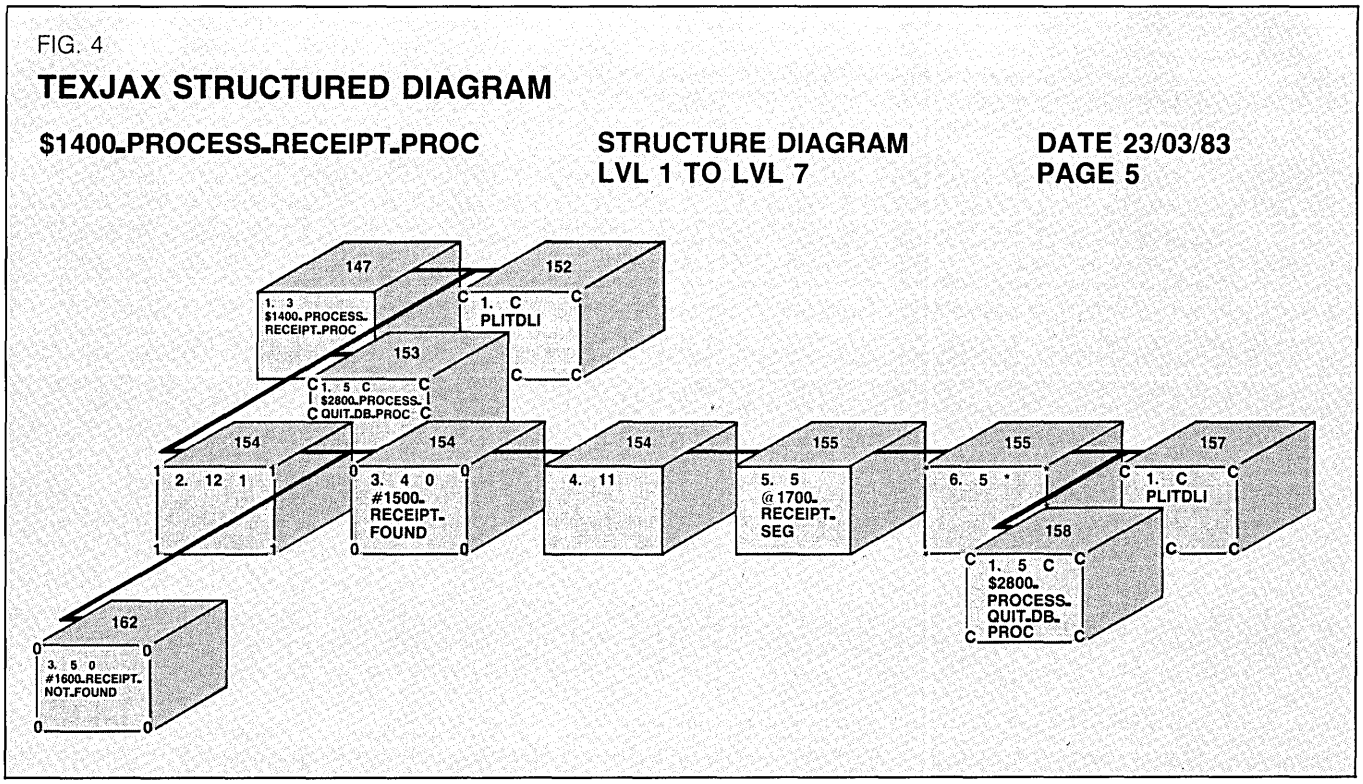
Determining an appropriate level of resource allocation is toughest in the Type III subset. In many dp organizations, the proportion of aggregate resources dedicated to the maintenance function can range from 30% to 90%. The proper number is up to management, and it is closely tied to a general maintenance philosophy. We suggest at least 10% of the maintenance allocation be dedicated to Type III activities. A larger portion should be allocated if the production library has been neglected. Given the fact that manual rewrite costs from $5 to $50 per line of code, automated documentation is a particularly desirable alternative since it can typically be performed for 20 cents to $2 per line. This represents a cost ratio of 5 to 1! In stable database situations, the redocumentation strategy is often quite viable and cost-effective. A small allocation of resources can produce dramatic results for properly chosen code units. Even more dramatic improvements can be made through the rewrite process. But, as we said earlier, the allocation of resources is high, and the benefit often occurs much later after an extended development cycle (e.g., one or more years).

Up to this point, we have identified and examined important elements of software maintenance. We have also discussed the operational and economic rationale for using them. To demonstrate the utility of this approach, let us turn to a case study drawn from the authors' experience.

Texaco Inc., as is typical of many firms with large dp operations, recently faced the problem of rising maintenance costs. There were a number of diverse applications, each with its own maintenance staff and procedures. Also, like many other dp organizations, Texaco's had invested a considerable amount of money and manpower in the use of new design technologies and tools. These efforts notwithstanding, dp management intuitively felt that the level of effort expended on

FIG. 4

TEXJAX STRUCTURED DIAGRAM



maintenance was still too high. To quantify the actual amount of maintenance effort, the various functional applications were manually inventoried. This inventory showed that approximately half of the professional programming staff worked on maintenance activities. The situation was deemed unacceptable because of the increasing backlog of new applications, enhancements to existing systems, and the desire to hold costs down. Early recommendations to reduce this effort called for various discrete strategies to attack unique problems. Despite the relative "cheapness" of each alternative, the integration of all activities yielded the best cost-benefit estimations. Hence, selective implementation of particular tools was chosen as the preferred strategy.

First, manual methods were used to identify the relevant applications. Two points became apparent as this process was carried out: manual code reviews were too time-consuming, and manual records of abends were difficult to organize.

CONTROL SYSTEM CREATED

It was decided that expanded use of automated tools would help address these problems. An automated library management system was required to better control source and load libraries across multiple sites. After an exhaustive search of the outside software market for an integrated tool to meet these requirements, it was decided that a custom library management system, LIBMAN, would be created. LIBMAN is a control system that uses the services of several existing software tools (SPF, VTAM, PANVALET, ACF2, etc.) to provide control over both the repair and enhancement of programs. Administrative objectives include:

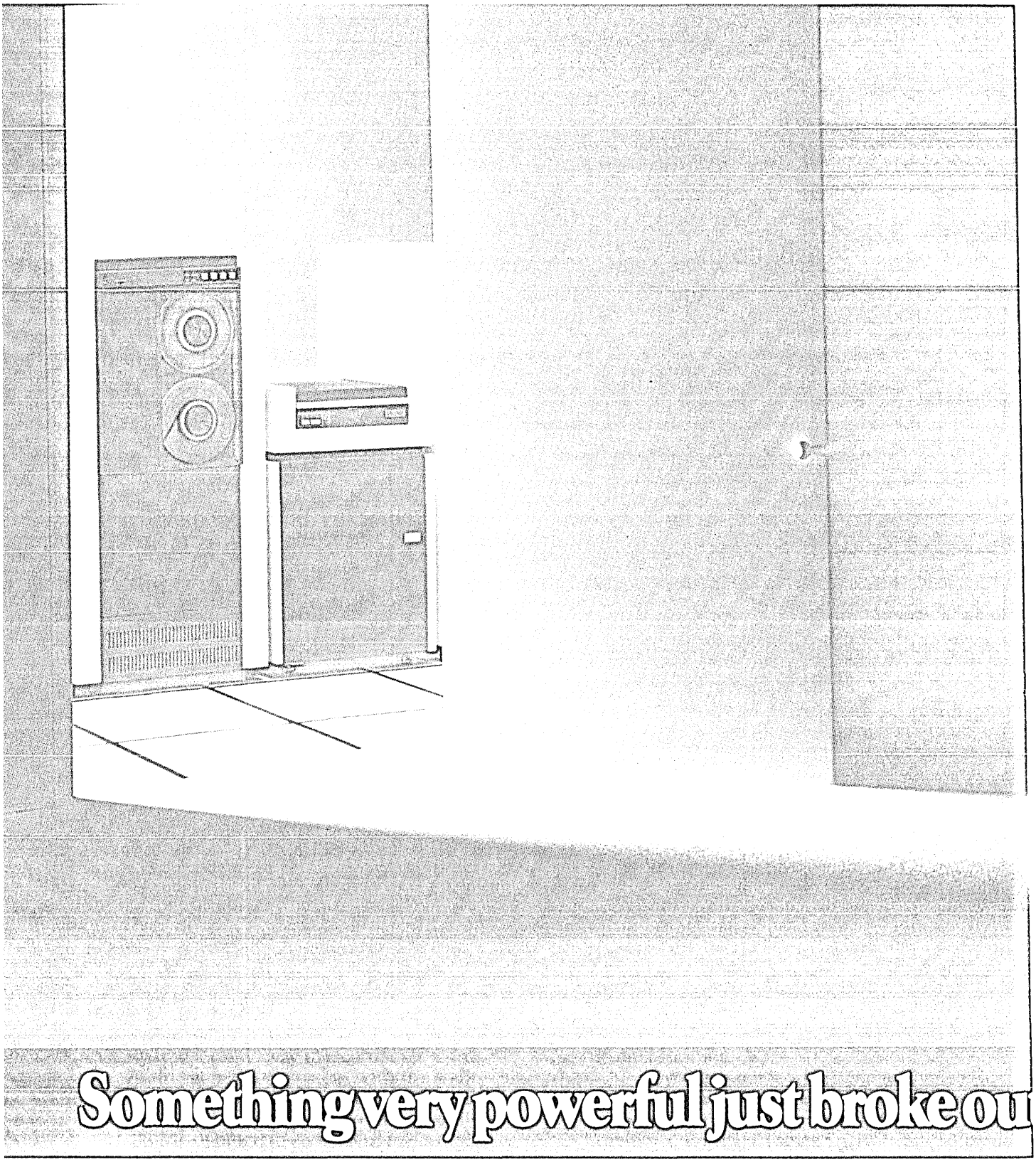
1. Storage of production components in a standard library.
2. Assurance that production applications are executed from a standard library.
3. Assurance of existing source code for all production load modules.
4. Restricted access and resulting change responsibility for production software members.

LIBMAN successfully isolated production components including source code, load module, and JCL. It also provided for physical implementation of the release concept through the establishment of separate libraries that were used during rewrite activities. Now, the code could be statistically quantified.

For each application captured in the production libraries, a system profile was completed. Greater understanding of operational complexity was gained by establishing the metrics of the system. A sample profile is illustrated in Fig. 2. Note the detail of the system metrics, particularly the measurements of source code, data components, and operational statistics.

Next, in Phase II, the code evaluation activity was implemented to determine code quality. An operational logging system was used for the actual identification of problem programs. MVS Integrated Control System (MICS) gathered information from diverse sources such as SMF (system monitoring facility), TSO/MON, and IMS/LOG. This information was then collected on an SAS database from which reports on code unit performance were derived. In this phase, a two-stage approach was used to categorize code quality. First, a detailed record was created for system aborts. Each job produced important abend information; this data was then sorted, aggregated, and periodically summarized to produce an abort frequency distribution as shown in Fig. 3. At this level, the abort data is allocated into nine unique categories based on an examination of the abort circumstances. These results were then used in the determination of code quality (good, bad, or marginal).

In Phase III, several tools were applied to programs targeted for redocumentation. Whenever possible, the redocumentation strategy was chosen because of its relative low cost. First, for the COBOL systems, an outside product—Scan/370, by Group Operations Inc., Washington, D.C.—was selected. Scan/370 produces various diagnostics, one of which is a report that traces all the logic paths of a given program. In addition, this program provides a source listing that contains embedded path data,



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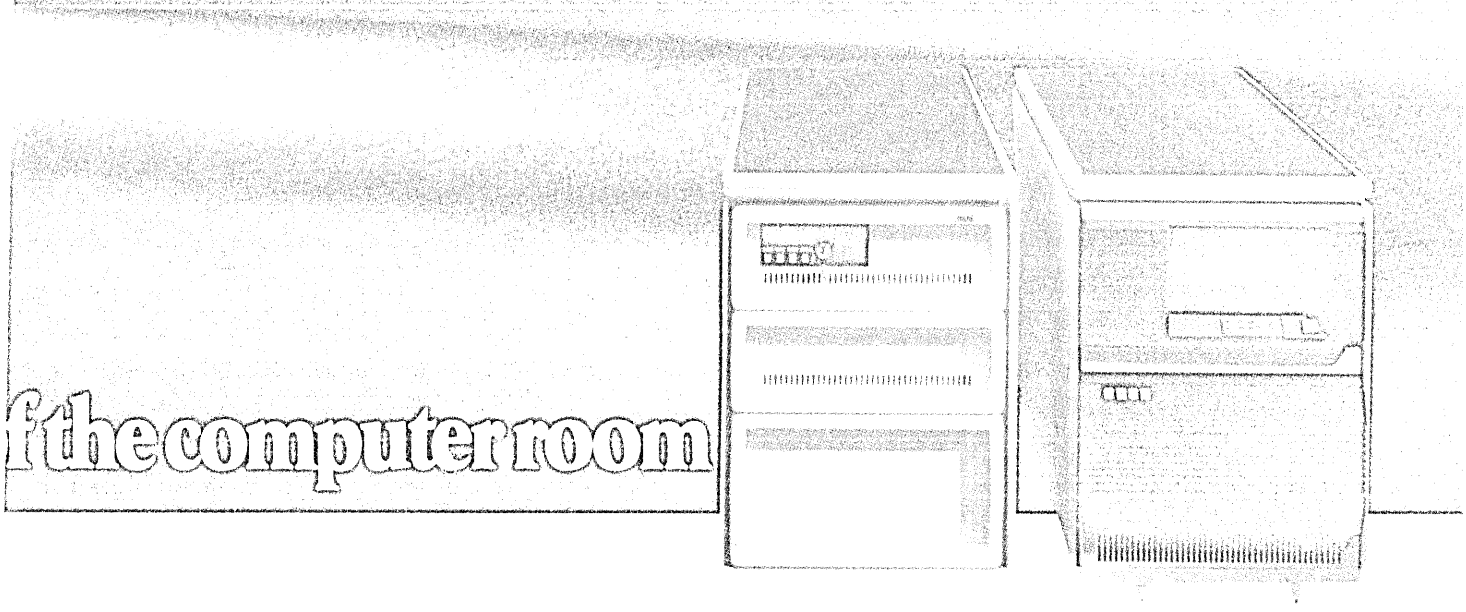

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CIRCLE 73 ON READER CARD

Within the software tools marketplace, more innovation is anticipated.

complete with identification of "dead" code.

Later in this phase, a restructuring/recoding tool that restructures COBOL source programs became available. This program, SUPERSTRUCTURE, written by Morino Associates, Inc., Vienna, Va., creates a "score card" that identifies unacceptable program flaws such as interparagraph GOTO statements, runaway paths, and fall-through execution of paragraphs.

Having created this score card and identified the paths of a program, SUPERSTRUCTURE proceeded to rewrite program paths into a structured program. The resulting source code contained essentially none of the flaws of the original source program.

IN-HOUSE SYSTEM DEVELOPED

While Scan/370 and SUPERSTRUCTURE were used to address COBOL applications, most of the company's developmental programming was produced in PL/1. Though the language itself contains elements that may encourage better programming style, a number of older systems have been found to abend with regularity and are difficult to modify. Significant review was done to find analyzers and documenters that fit a PL/1 development environment. Unfortunately, no vendor-supplied tool was found to be compatible with the current methodologies, so an in-house tool was developed. The tool, TEXJAX, conducts static analysis of program paths. In addition to the usual analysis performed by this kind of tool, TEXJAX produces three additional measures: complexity measures, Jackson design methodology-style program structure charts, and schematic design logic linked back to source code. Fig.4 illustrates examples of the measurements discussed above. The output is a program structure turned on its side. In the example, the function $1400_PROCESS_RECEIPT is superordinate to PLITDLI and $2800 PROCESS_DB_PROC. Jackson notation is included to represent sequence, condition, and repetition. Repetition is designated in function 6.5 by the ☆ in the box. Both of the functions, #1500_RECEIPT_FOUND and #1600_RECEIPT_NOT_FOUND, are conditional as indicated by 0 within the box. Morover, each logical function is directly linked to source code through a statement reference number and a procedure name. In the source code, the PL/1 procedure @1700_RECEIPT_SEG begins at statement number 155. The documentation value of TEXJAX is increased by tying design (logical schematics) to actual code. More important, it can be generated automatically with each new change to the system, thereby resulting in updated system documentation.

The fourth documentation tool, common to both COBOL and PL/1 applications, is a system redocumentation tool linked to JCL. This tool, DOCU/TEXT_200, from Diversified Software Systems Inc., San Jose, Calif., has been targeted on a few test applications, and initial results indicate it could be used on all of the JCL libraries. This is in marked contrast to the way other tools are used, but in this case it seemed feasible. Our evaluation is that such system level tools cause one of two events to occur: either the automated tools must be changed to fit prevailing customs, or prevailing customs must be changed to fit the automated tool. Since the system formats were so widely used, the purchased version of DOCU/TEXT_200 does not provide all system documentation requirements. Accordingly, work is proceeding on a JCL scanning tool that will use DOCU/TEXT_200 as a nucleus. Its output will be used to duplicate and replace the current manual-run books used by the operational group.

There are many disjointed software tools on the market today and more are emerging daily. Various combinations of these tools will fit unique organizations. What we've done here is outline an approach to categorize production code units and assimilate general types of tools that collectively aid in the maintenance function. The most important conclusion from our experience is that these tools cannot simply be purchased or built and then used indiscriminately. Rather, it takes an administrative activity to quantitatively decide which code units should receive incremental resource allocation. Then, management has to support these efforts with rational levels of resources designed to "purify" production libraries. Consistent application of resources in conjunction with automated redocumentation will result in improved existing systems. For this strategy to be successfully implemented, high-level management support must be gained so the process can occur in an orderly manner.

Within the software tools marketplace, more innovation in the area of automatic recoding/restructuring is anticipated. It seems very likely that artificial intelligence (expert systems) may lead the way. One possible way to implement such a scheme would be to create an expert system that was well versed in one of the popular design methodologies; give it access to the path information provided by static analysis tools; then restructure code accordingly. Once this can be sucessfully done, the entire family of redocumentation tools will become more coherent.

Whatever the case may be, it is a safe bet that tools will continue to play an increasingly visible role in the maintenance of software systems, and, as such, will require continued management to keep them cost-effective. ✱

This article was adapted from a paper, "Redocumentation: Addressing the Maintenance Legacy," that Richardson will deliver (session 150 in the Maintenance track) at the National Computer Conference. July 9-12, in Las Vegas.

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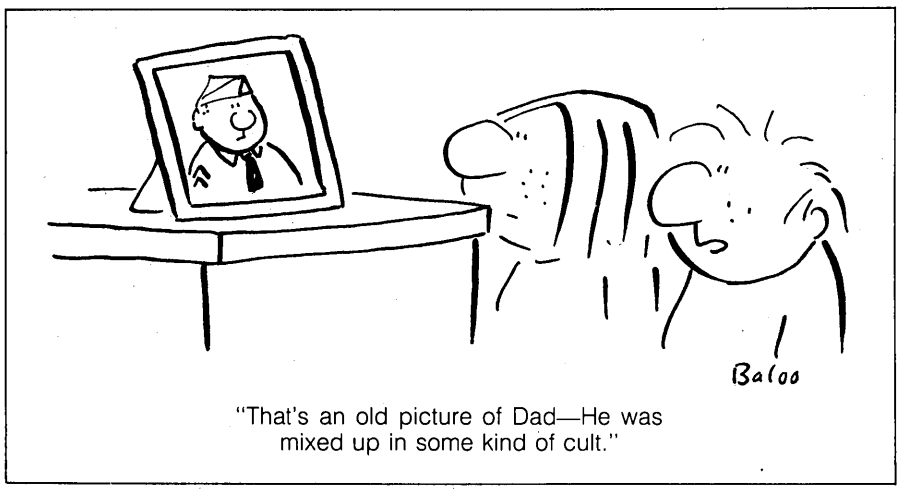

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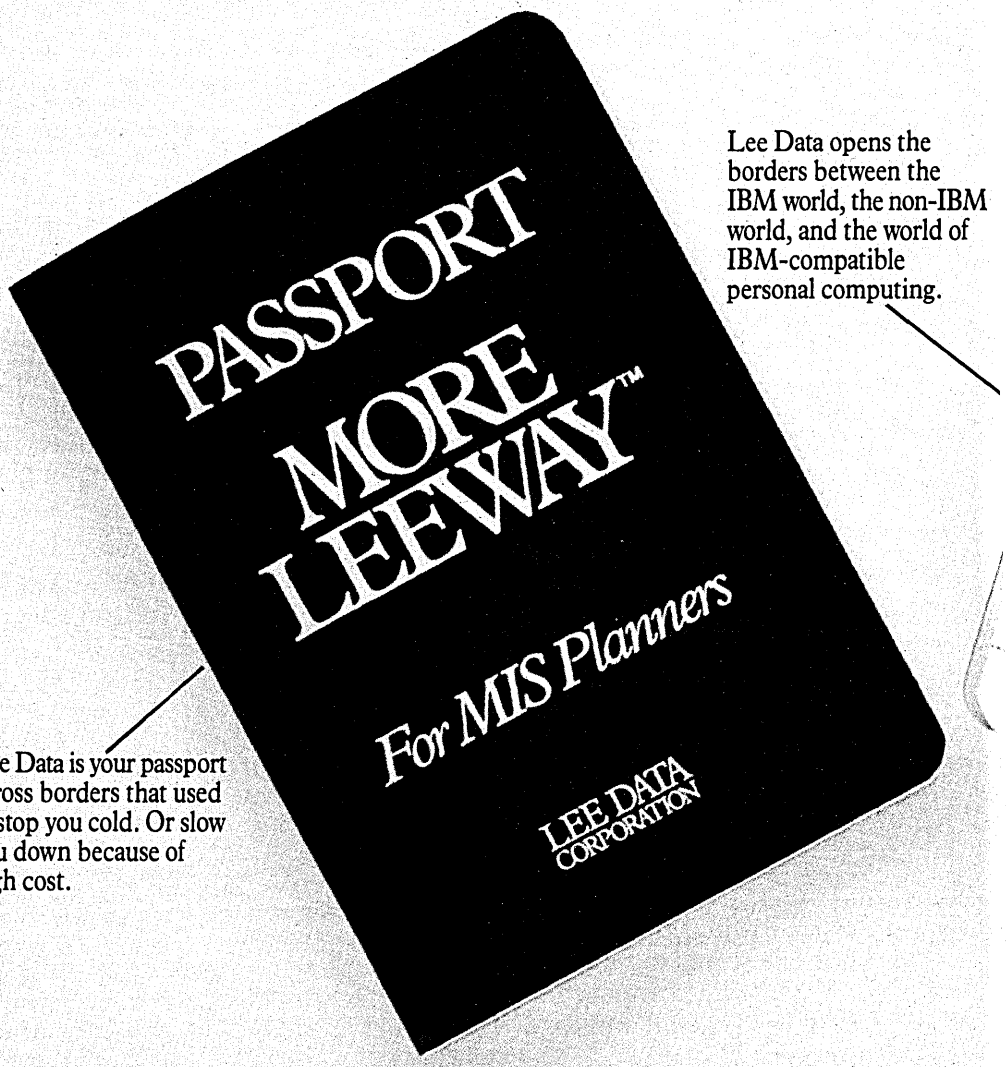

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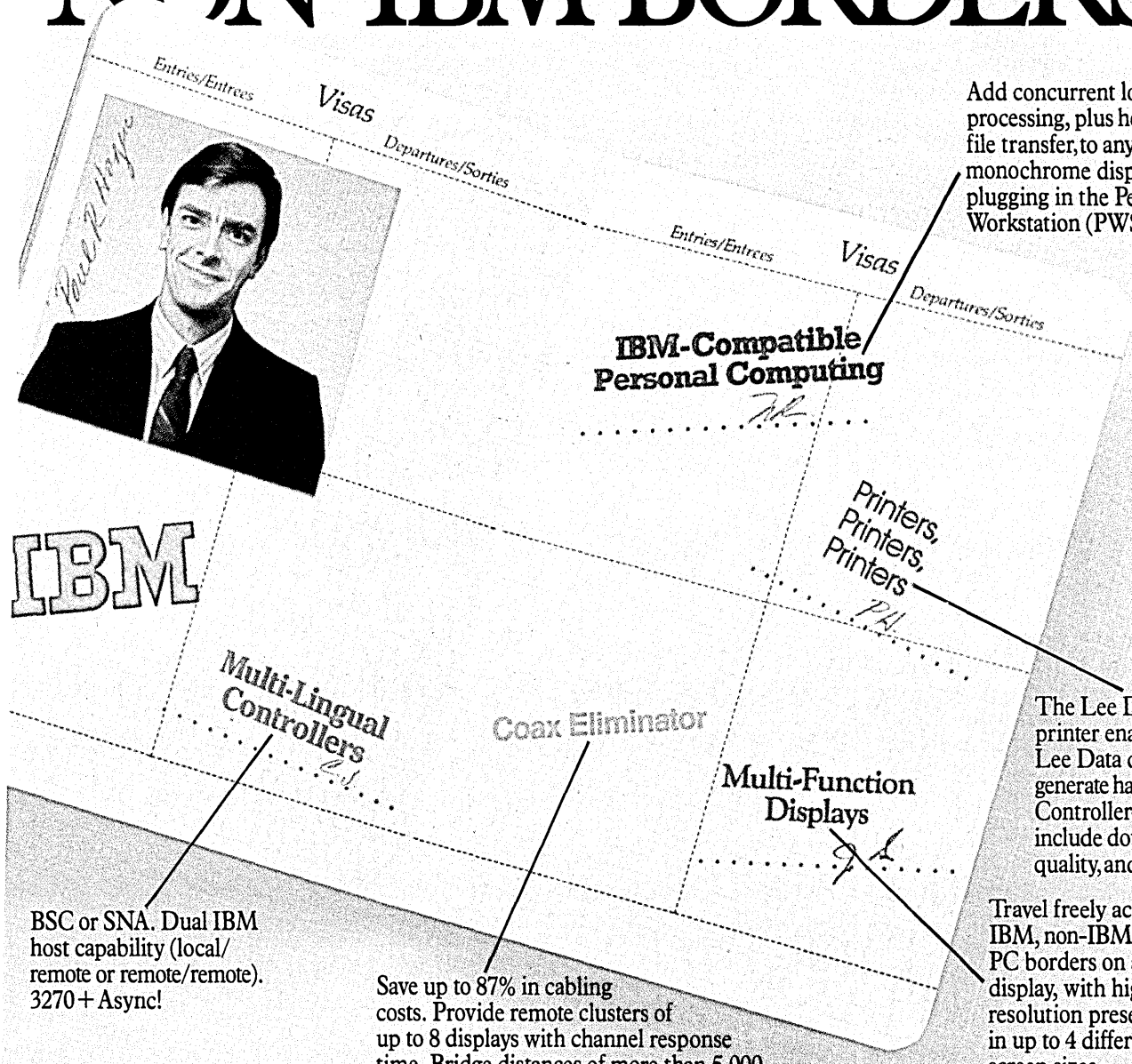

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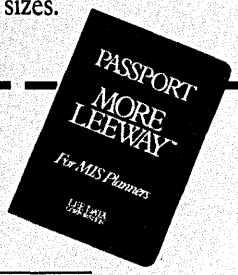

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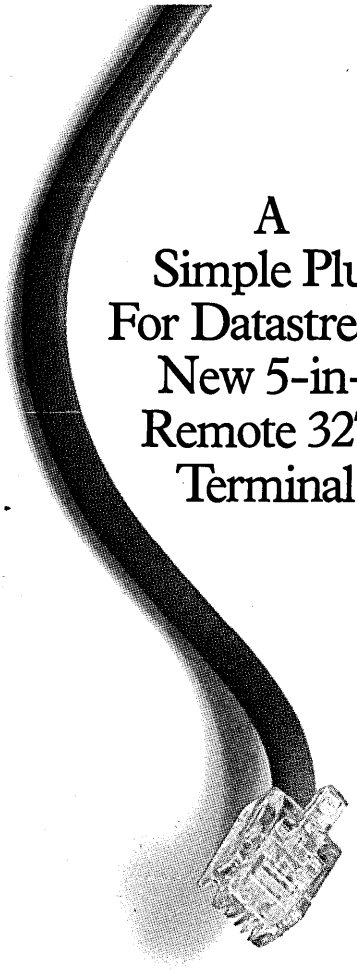

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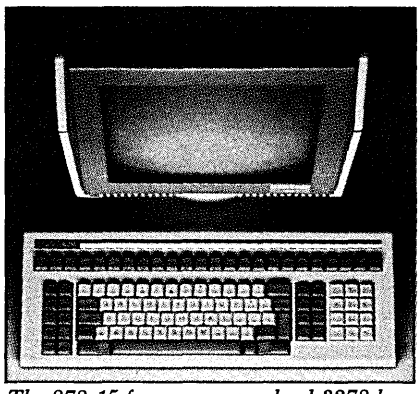

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CIRCLE 98 ON READER CARD

Well-written, strategically distributed documentation unlocks the door to successful software development.

COMMUNICATIONS IS THE KEY

by Melinda Thedens

Software development projects tend to cost too much and take too long. Often, they don't even meet users' needs. Why does this happen again and again, when experienced people are on the job? Because expertise alone does not bring a project through development; people need information to do their jobs. How, when, and in what form project members get their information can make the difference between success and failure.

On most projects there are plenty of meetings and people talking to one another. But team members don't always communicate their intentions clearly, or to enough people; they forget details as the project proceeds and the documentation, if it exists, is difficult to find. Newly acquired ideas, plans, and facts may seem too obvious to worry about sharing them with others or writing them down for later reference.

Managing the information flow is a full-time job on a large project and as with anything else, the work gets done only if it's someone's priority. There must be an organized documentation scheme from the feasibility study to the testing and installation phase, and someone who makes sure the scheme works.

As each person working on the project makes a contribution—whether by specifying requirements, designing the system, or writing code—that person has information to communicate to other project team members. If anyone "writes something down" in a haphazard way, without any intention of updating it later, it may take more time to decipher those notes than they're worth.

On the other hand, if team members spend half their time documenting, everyone will be unhappy and the work will go too slowly. It's possible to invest too much time in documentation. System documentation does not have to be edited, typeset, and distributed in hardcopy to everyone. It does have to be done along with the work it describes, reviewed and understood, updated, and indexed for easy retrieval.

Each person on the team must know what information is required of him or her. Recording this information is part of a team member's work, and no task is complete until the information has been reviewed and understood by someone else. This means that each team member must write, or that writing specialists will do the documenting concurrently with design and programming. However it is done, the information must be available to the rest of the team. This is best accomplished when:

- It is one person's priority to coordinate the information;
- People are not forced to write more than they are comfortable writing;
- The process of recording information is simple and fast;
- Everyone understands what they are responsible for communicating;
- Everyone understands how to contribute and find information;
- People are not inundated with information they don't need.

The time spent writing is not expendable overhead. Documentation is part of the job, and if it is done correctly, it saves time in the long run. In many cases the work done for one project can be used for another, thereby saving time and manpower.

Each stage of the development cycle produces information for those that follow. If each is well planned and thoroughly documented, the next phase can begin before the previous one ends. It isn't enough to simply have the documents; a project library (on-line or otherwise), organized for quick retrieval, brings people and information together. In addition to the major documents at each stage of development, the library should contain a project notebook, in which the meetings' minutes are recorded, and a log of any changes made; memos to clarify issues or terminology; and an index to available information.

SUPPORT DOCUMENTS NEEDED

The following is a more detailed look at the type of documentation the library should contain to support the various stages of the system's life cycle. Each development stage, in italics, is shown above its corresponding documentation.

Problem definition.

- Software justification. Management is appraised of the needs and costs of software development; this document explains the problems, opportunities, and goals.

Data collection and analysis.

- Functional requirements. Examine and refine the problems and opportunities statement (e.g., "let's design an inventory system"), study existing procedures, formulate system objectives, conceive potential solutions, analyze costs and benefits. Outlines the user's requirements and criteria for a solution.
- Acquisition plan. How the capability will be achieved (e.g., outside contract, in-house implementation) and what resources are required (manpower, equipment, estimated time needed, etc.); analysis of organization to determine such things as whether it can do the job, if it can make a profit, and if enough manpower is available.

Preliminary design.

- Functional specification (software requirements document). High-level basic design of the entire system, describing, in user terms, what the system must accomplish to satisfy objectives and constraints stated in the functional requirements document. The functional specification contains a system overview and subsystem design requirements; it also identifies and describes system functions (database structures, file access techniques, and dataflow).
- Software design definition. A translation of the requirements in the functional spec into a conceptual design of the program. It deter-

A project library, organized for quick retrieval, brings people and information together.

mines the scope of the work, refines the original cost and schedule estimates, formulates the design base at the highest levels of abstraction, and initiates team selection, work planning, and coordination activities, but it is not a detailed work plan.

•Agreement with requester. Describes, in detail from the user's point of view, what functions will be provided, and estimates when they will be completed.

Design details.

• Software specification document. Basic system design is expanded and refined to produce detailed specs for all program modules and data structures. The spec is precise, explicit, and sufficiently detailed to support the implementation or programming stage. All computer logic is completely specified in preparation for coding. The database is designed for file records and logical element organization.

This document becomes the basis for later program maintenance and enhancements. It has two parts: the program design spec and the software test spec. The former includes decision tables, descriptions of data structures, descriptions of interfaces between modules, and descriptions of interfaces between users and programming. The latter describes functions to be tested for quality assurance and how that test will be conducted.

Implementation details.

• Update to software spec (system document). At this stage, the software spec becomes the systems documentation. It keeps track of changes and additions to the detailed design and of how the design is implemented, including routines developed, libraries used, audit trail of changes to code, globals and flags used, interfaces (how data and control are passed between modules and to users), and programming conventions. It also records design meeting activities and project progress. Update the document as the code changes; keep user document writers and trainers informed when design decisions are made. The user documents must be ready when enhancements to the code are complete.

Operation information.

• User guides and courses. With the software spec and functional spec as guides, this documentation should be developed while the code is being written. It should cover operation tasks and user procedures.

Quality assurance of system and documentation.

• Software test report. Quality assurance people test the documentation while testing the rest of the system. Do the procedures in the manuals work? Does the system meet requirements stated in the functional spec? This includes the results of all development tests and acceptance tests.

PROJECT SIZE A FACTOR

Suppose a development team decides to maintain control of its project through an organized documentation scheme. It will have three major problems to consider when designing this scheme. How to handle these issues will depend on the size of the project and the people on the project team. The decisions to be made, however, are basically the same for every project.

1. Making sure information is clear. Meaning is obscured by missing information, ambiguous terms or sentences, or verbose writing. The way to clarify information in writing is to decide on the key terms and their meanings; require each person to identify who or what is performing each action; ask team members to draw pictures and have them put information in tables and lists; provide forms for them to fill in, so that no one struggles to compose paragraphs when a list will do—besides, forms create natural headings; have the information coordinator write documents from the information provided, or have this person ask for clarification of ambiguous prose before accepting it into the project file.

Finally, you must encourage good description techniques. As author Harry Katzan said in *Systems Design and Documentation* (New York, Van Nostrand Reinhold Co., 1976): "The way to describe an automobile is first by thinking about what it is for, about its function, and note the list of items that make up its structure. If you think about its function (what it is for) you won't describe it by talking about its four wheels, its engine, size, and so on. You will think of it as a means of transporting a few people from one place to another at a certain cost."

2. Making information available and keeping it up to date. Things to consider are:

• Standards for documentation. To find information that has been written, there must be some system for recording it. Is it in a central file? Is it consistent enough that someone else can maintain it?

• A plan for how team members can obtain and update information. How is it to be distributed? How is it to be stored? How is each version to be dated, so that everyone knows whether it is the most recent? How is the rest of the team to know when a design decision has been modified?

• Timely documentation. To prevent inconsistencies in the code or an unannounced change in an important data element that affects other modules, everyone on the team must know what the rest of the group is doing while it's happening. How will this be done?

• Distribution lists. Who needs to know? "Screening" information or forgetting to pass it along can result in difficulties that won't show up until the project is nearly completed.

3. Keeping the work down to a minimum and making it part of the job. Think of documentation as two basic activities: recording the information and organizing it. If you appoint one person to organize information, the other team members are responsible for organizing their information and communicating it to that one person. If recording the information is too burdensome, consider using automated tools for that part of the job. They make it easier to keep documents up to date and retrievable. They also decrease the team's dependence on each individual's communication skills. Unfortunately, they do not organize the information in the project library.

The more organized you are, the less work you must do to maintain a system; system documentation must be designed and written as efficiently as the code. Just as a good programmer wouldn't dream of using 2K of memory when 1K will do, a good writer is concise. Just as a good designer knows that modules and routines are easier to maintain than a huge section of main code, a good writer divides the information into small chunks. No one wants to maintain something that is poorly designed, and unmaintained system documentation is often worse than no documentation at all.

KEEP SYSTEM UPDATED

In each document, most of the information builds on earlier documents, the same way that each stage of the project life cycle builds on earlier stages. Each document, or piece of a document, is written to be read by someone else, and therefore it should be read, and approved, before it becomes part of the project file. If each piece of information is added to the general pool as it is completed, documentation is not such a chore.

A software project involves many people with very different tasks to perform. Some are system users; others are designers or programmers; still others test or write about the system. Often, these people don't think of themselves as a team, or realize that they need to communicate information. It is up to the project manager to make sure everyone has a relatively painless way to do so; left on their own, team members will perform their jobs well, but no one else will know about it. ✱

Melinda Thedens is supervisor of software communications for Atex Inc. She participates in the design process by maintaining documentation for some of the company's software products.

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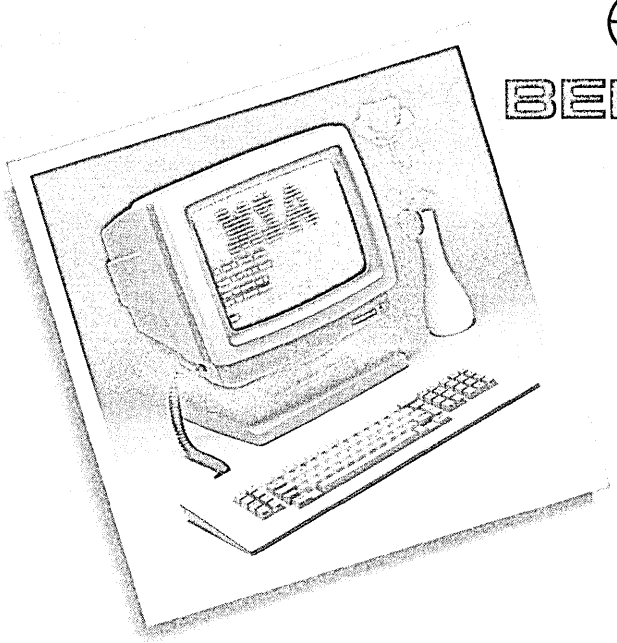

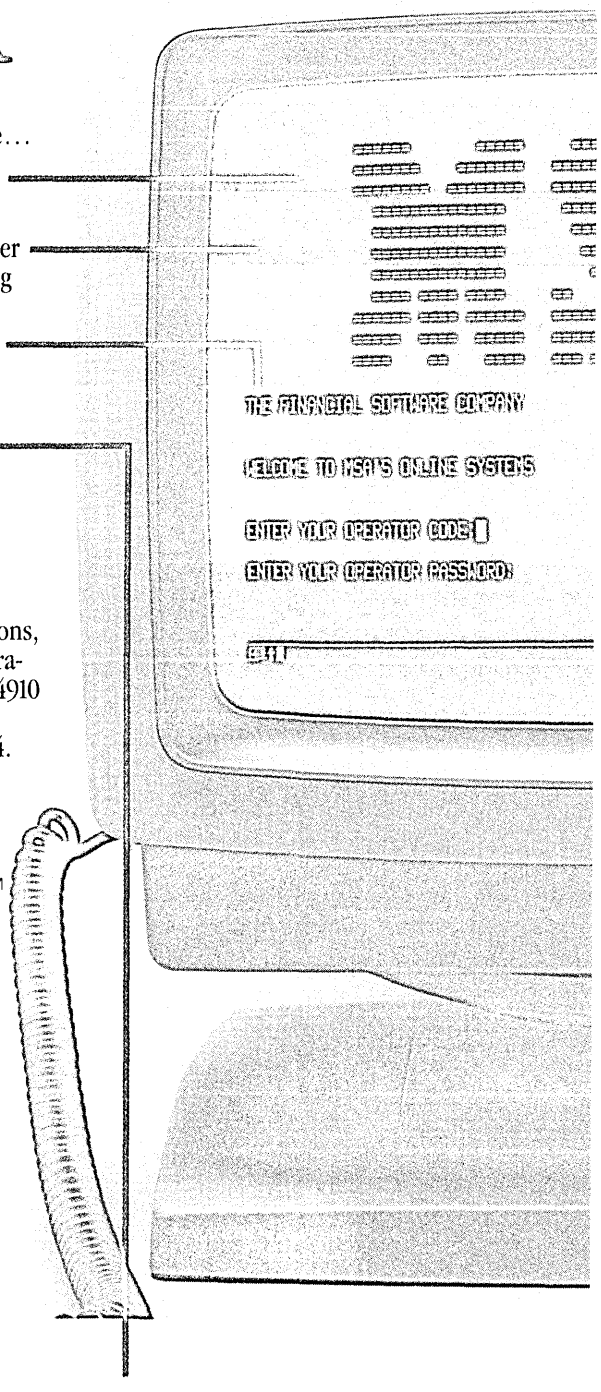

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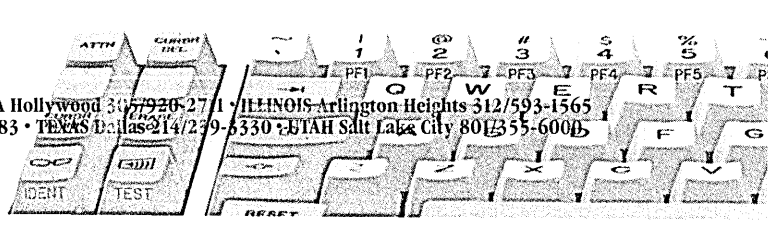

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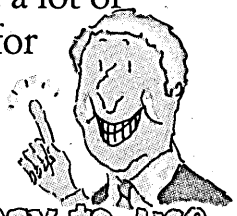

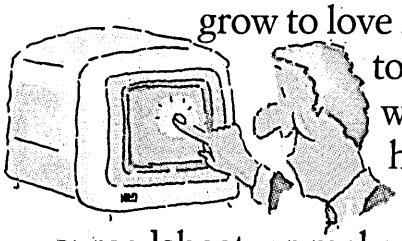

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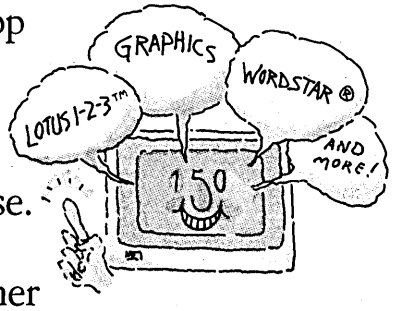

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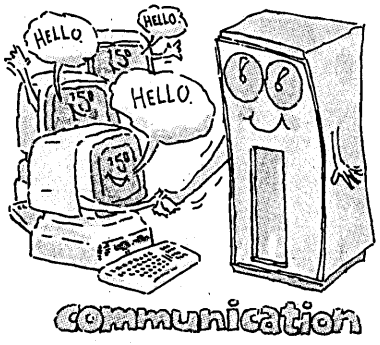

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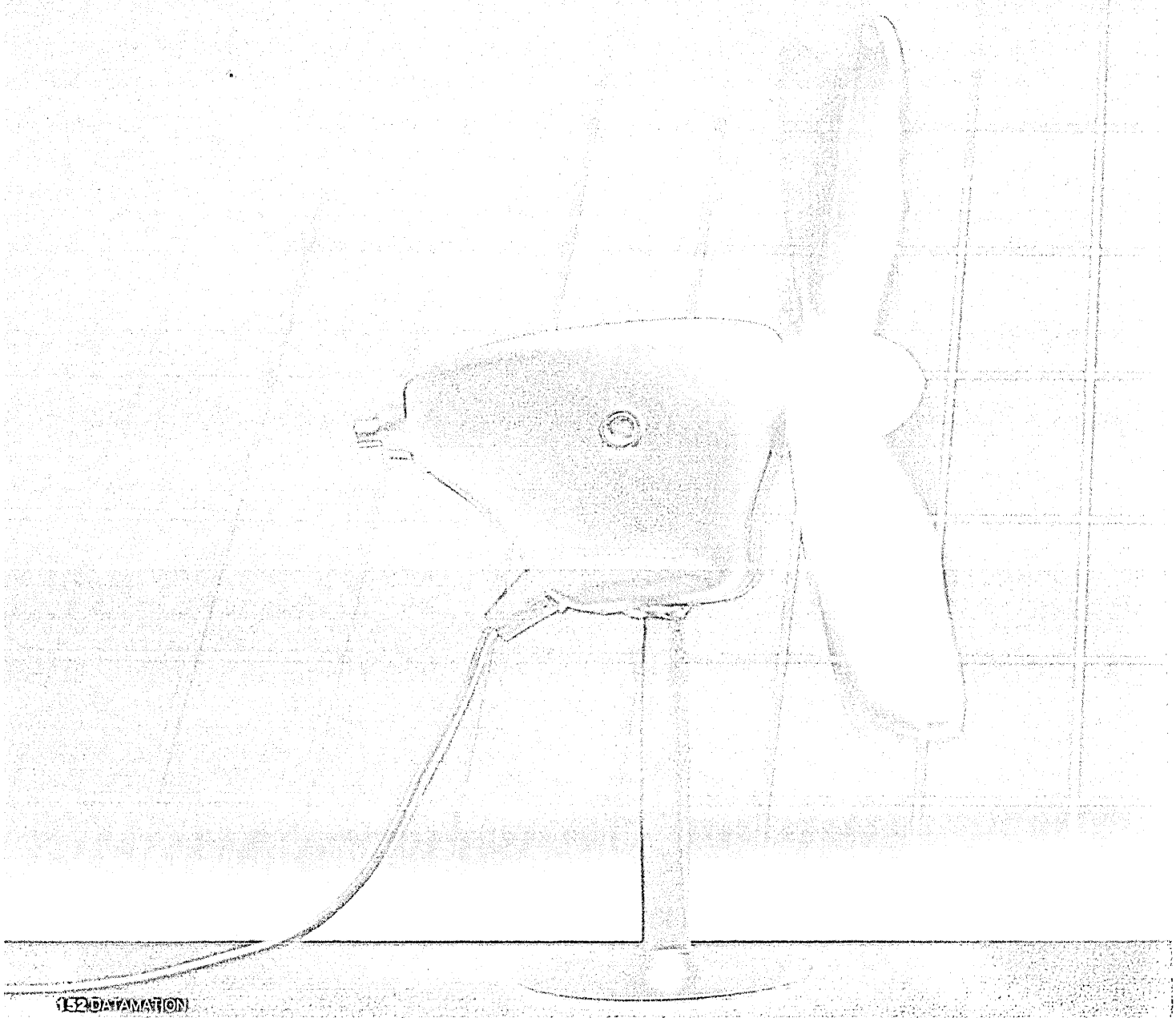
A Texas oil firm has created a technique for rapid and cost-effective systems development.

SUPERIOR PROTOTYPES

by T.R. Young

Computing has suffered from two chronic problems: first, it has always been virtually impossible to obtain a complete description of the users' information needs, and second, new systems consistently take too long to build. Although many formal procedures have been created to control these problems, most users remain dissatisfied with dp's performance. Usually, neither party recognizes that prototyping can resolve its predicament.

The difference between proto-



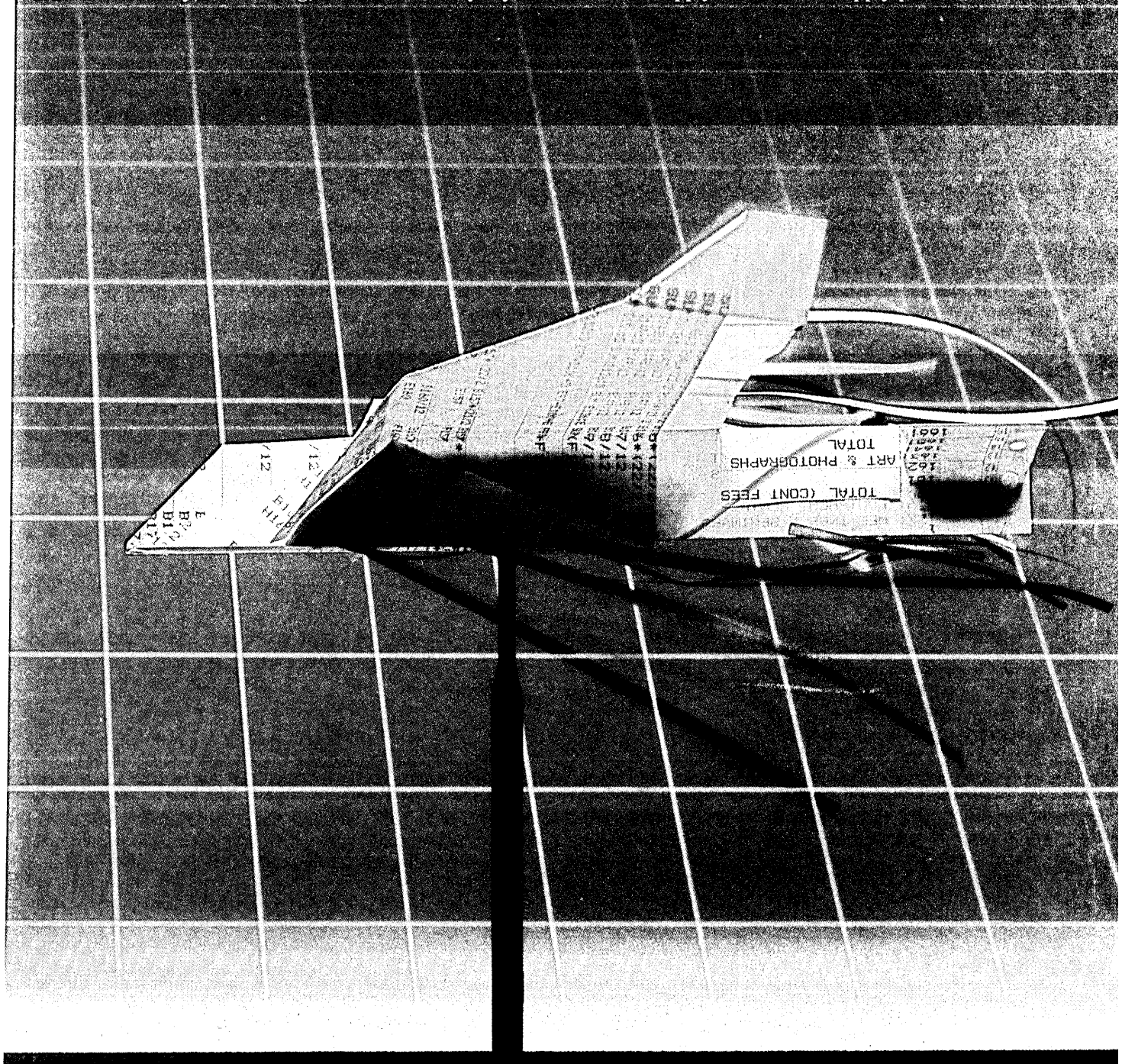
typing and the early years of "cowboy programming" is discipline. Prototyping does extend freedom to system designers that can be abused, as it was in early systems work; but this technique also retains a tight discipline in selective use of the recycle privilege (repeating certain procedures). Recycle occurs a limited number of times and worthwhile design improvement is expected each time.

The Superior Oil Company, Houston, Texas, has completed two substantial prototyping projects in its materials department, resulting in increased efficiency, cost-saving, and large numbers of happy users.

Companies exploring for oil and gas need a lot of "tubular goods," i.e., steel casing and oil tubing. The casing keeps the well bore clear during drilling, and the tubing conducts the crude oil from the producing formation when the well is completed. An 18,000-foot well requires about $7 million worth of tubular goods. Nationwide inventory levels recently reached 4 million tons of these products, worth up to $7 billion. This large amount of excess stock is directly related to the drop in drilling activity caused by hydrocarbon oversupply and OPEC price moves. The same kind of overstocking can occur within a single oil company, caused by the same factors.

All high-valued inventories require management to prevent excessive capital tie-up. In this particular case, inventory management is complicated by fluctuations in both drilling demand and steel availability. Procurement lead times of nine months to a year are common in tight supply periods; yet lead times have dropped to zero almost overnight when drilling activity slackens. In short steel supply periods, orders are

PHOTOGRAPH BY ROBERTO BROSAN



Effective control was not possible with the existing materials availability reporting system.

placed far in advance. In long supply periods, tubulars are bought on the spot market.

If information-limited purchasing occurs, either unnecessary levels of capital are tied up, or the material needed is out of stock. Both conditions are costly.

The purchasing and inventory control of tubular goods is managed by Superior Oil's materials department. In response to the dynamics of oil pricing and consequent drilling activity, materials management decided to create improved information systems, capable of faster response and broader scope. The first effort centered on purchasing.

The work was viewed as a user-directed prototype system—a "first" in the company—so the project was approached with appropriate prudence. The design team searched for the most useful services the system could deliver to the materials department. After considering eight or nine possibilities, the on-line preparation of purchase orders was finally selected as the primary system objective.

The materials automated purchasing system (MAPS) was built in two parts, basic reporting and purchase order writing. The concept accepted for prototype construction included the following building method:

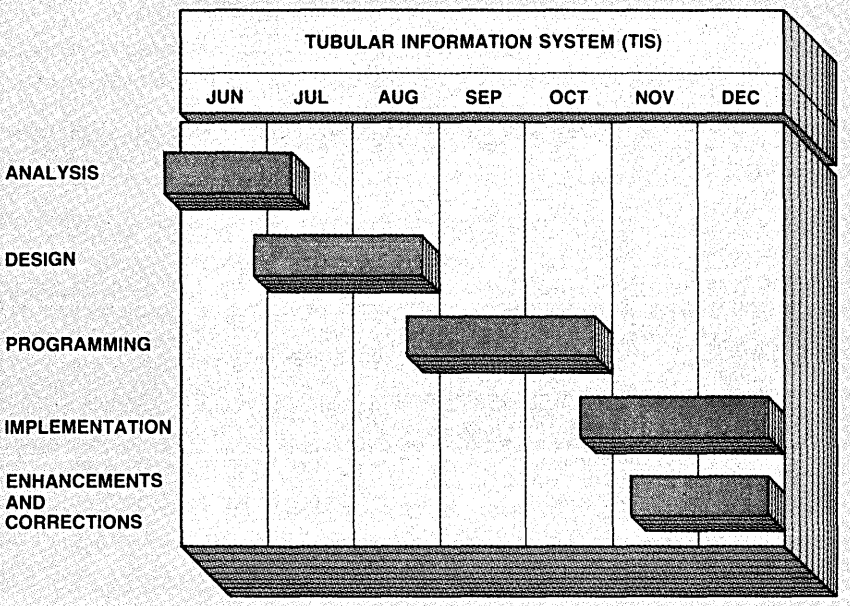
- Analysis.
- Basic reports: design; program; implement, and repeat procedures from design if necessary.
- Generate purchase orders: review; redefine; implement, and repeat procedures from review if necessary.
- Production system.

Conventional systems development practitioners view such recycling as bad practice on the assumption that the user's needs can be determined accurately and comprehensively prior to design. Yet the iterative design process appeals to many different organizations. The key factors are a self-discipline that insures the iterative cycle is used only when justified, and the availability of fast-working software support tools that are transparent to the user.

MAPS users were shown how to handle ADRS (A Departmental Reporting System), a software facility, as a principal file and report tool. Afterwards, the materials department people worked their way through the complete external design of the system—screens, screen functions, and reports. The users' working requirements were specified precisely the way they wished to see them. The prototype was developed over a period of 12 to 16 weeks during the last two quarters of 1981 with labor expenditures of seven man-months each from the materials department and MIS for training and technical support. The system has been generating purchase orders since March 1982.

FIG. 1

PROJECT DEVELOPMENT TIMETABLE



The project created a working purchasing system, delivering management control information at material commitment time; efficiently produced expediting reports; and auto-generated hard copy purchase orders. This was implemented on a nationwide network of terminals with central and remote inquiry capability.

MATERIALS CONTROL PROJECT

After the success of the purchasing projects the materials department was encouraged to proceed with a second prototyping project, addressing the materials control function.

Past materials control practice at Superior had been based on the output of a "tubular availability report" (TAR), a batch system reporting on the physically available stock. This system had plenty of limitations. Specifically, there was no inquiry capability; updates were delayed because it was a batch system; verbal (and, therefore, unreliable) input was used; transaction analysis was unavailable; there were no controls or audit trails; and the master files' integrity was compromised. In other words, effective control was not possible with the existing TAR system. This was unsatisfactory to Martin Stetzer, materials director, and he discussed the problem with Walter Coultas, the MIS manager. Coultas agreed to support development of an on-line tubular information system using prototyping methods.

The decision was made to use the old TAR system as an operating prototype and then go to a new, grass roots, on-line system. Target characteristics were those that the TAR system lacked, along with some other enhancements.

The Tubular Information System (TIS) was to be built with software suitable for prototyping that would permit rapid development and early system availability to materials people. Development began in May 1982 and the system was operational by January 1983. "It went like a train!" says Stetzer.

The design process started with a half-day team effort to create an overall materials system plan tying MAPS and TIS together. The team consisted of two staffers from MIS and one from the materials department.

The plan contained block diagram indications of the intended relations among inventory, purchase orders, fixed assets, vendor master files, logistics, general ledger, accounts payable, and stock ledger.

The plan, in dataflow form, allowed the design team to draw boundaries around the existing MAPS prototype and the projected TIS, thereby identifying all interfaces with related systems.

The design concept called for construction of a production system to handle the functions for managing tubular materials. The system would be on-line, constructed by the MIS professional staff in close cooperation with the user's organization. The principal

CHARTS BY PAUL GOODFRIEND

base software used would be Natural, a high-level language that greatly facilitates access to ADABAS. The language offers extremely high productivity in the hands of professional programmers. A user contact was dedicated full-time during the system definition and implementation stages. The materials department was particularly motivated—and rightly so—as they regarded the development as "their" project.

To get started, materials management asked the drilling engineers for nine-month tubular requirement forecasts. Proper tracking of tubular inventory requires both the engineers' forecast and materials' knowledge of market conditions to permit the best possible scheduling of purchases, stocking, and deliveries. One MIS team member then built a number of screens to handle keyboard data input and file inquiry. Users were called in to evaluate the screens and to resolve differences of opinion among themselves. As the users worked with the screens, they realized that certain necessary features had not been included in the initial screen designs. In the course of a day, the entire first draft set of screens was reviewed. The following day, the user group returned and found that a fully revised set of screens had been constructed by the MIS programmers using Natural. The revised versions incorporated the new requirements identified during the previous session.

These screens eventually evolved into the final operational screens. A later version of Natural reduced screen setup and modify time at Superior to its current level of 15 to 20 minutes per screen.

The evolution of screen designs moved quickly along until a set of screens had been developed that satisfied user requirements. The screens' convenience in use, vocabulary, and format were also satisfactory. None of the users had ever experienced such immediate response from computer support. The reaction was highly favorable and the materials control users began to warm to the idea of building "their own" system.

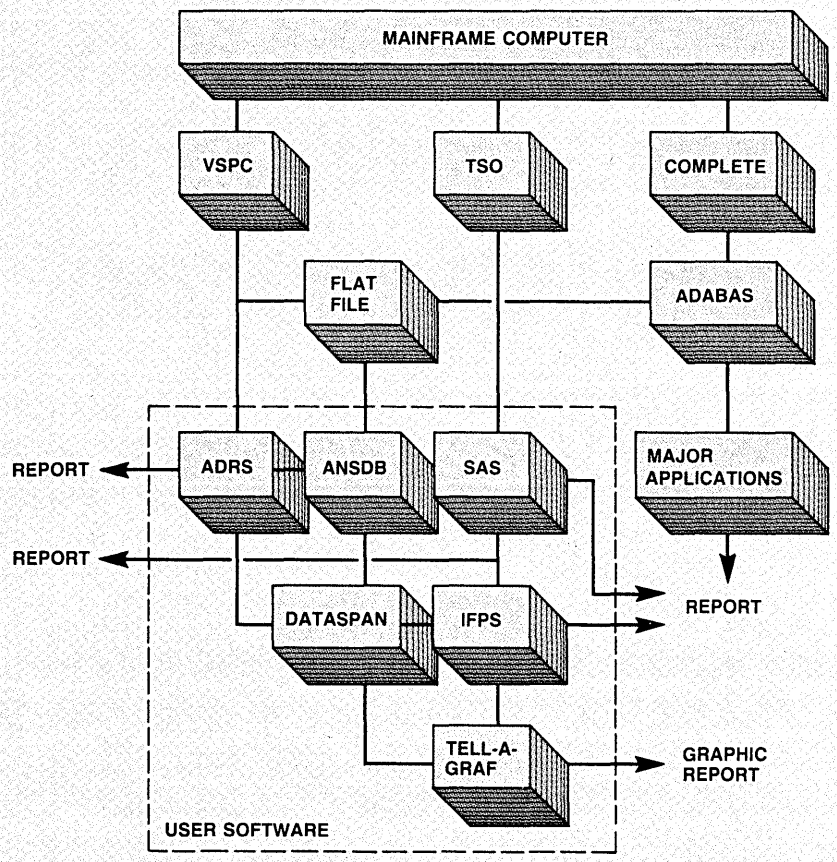
In approaching the project, the MIS staff decided to furnish Answer/DB a query language and report formatter, for batch queries to the tubular goods database outside the on-line system. The database would be constructed under ADABAS operating with Natural as a programming language, and complete as the teleprocessing monitor. These software facilities were professional programming tools and required suitable interface facilities for users. The development process would follow the conventional system development cycle except that the time scale would be greatly compressed because productivity-leveraged software was used and the users had been heavily involved during system requirements development.

The development process includes three stages. The first stage is initiated by the statement of management objectives, covering system boundaries and capabilities. User participation is high during this stage as the specifications for the system are worked out and prototype screens and reports are developed. Because user involvement is intense, users feel a personal identification with the system being created. As a result, their acceptance of the system is well formed by the end of this stage.

The second stage begins with a re-

FIG. 2

SOFTWARE TOOLS USED BY SUPERIOR OIL



VSPC = VIRTUAL STORAGE PERSONAL COMPUTING
SAS = STATISTICAL ANALYSIS SYSTEM
IFPS = INTERACTIVE FINANCIAL PLANNING SYSTEM

This chart shows the principal software used for both prototype and production systems building. The resources within the user software area are the tools users employ for data retrieval and the creation of analyses, reports, and graphics. Dataspan plays a key role in making the set of tools work because it links the retrieval ability of Answer/DB and the other resources. Before Dataspan, users doing financial modeling with IFPS had to key in data for model runs—this method is both time-consuming and error prone. Dataspan, originally written by an IBM support programmer, has served very well in integrating the family of user-friendly resources. On-line TIS structured user inquiries are supported by Complete and Natural software. Ad hoc inquiries written by users in Answer/DB are batch submitted and returned in as little as one hour and no later than overnight.

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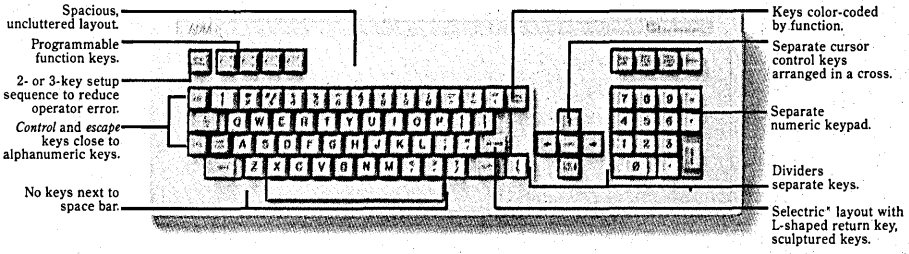

Low-profile, tapered, DIN-standard keyboards with Selectric layout feature logical key groupings and adjustable tilt for comfort and efficiency. ADM 11 shown above.

	ADM 11 Conversational	**ADM 12** Editing	**ADM 24E** Host Programmable
Programmable Function Keys	4 (Shiftable to 8)	16 (Shiftable to 32)	16 (Shiftable to 32)
Non-Volatile Function Keys	Optional	Standard	Standard
Function Key Legends on 25th Line	From Host	From Host	Standard Non-Volatile
No. of Pages of Display Memory	1	2	4
Display Memory Configurations (Plus 25th Message/Status Line)	24 Lines by 80 Characters	(2) 24 x 80 or (1) 48 x 80 or (1) 24 x 158	User Definable up to 96 x 80
Scrolling	Standard Scrolling	Smooth, Jump or Horizontal Scrolling Split Screen	Smooth or Jump Scroll Split Screen
Transmission Mode	Conversation Mode	Conversation or Block Mode	Conversation or Block Mode
Editing	Limited	Full Editing & Protected Fields	Full Editing & Protected Fields
Visual Attributes: Reduced Intensity, Blink, Blank and Reverse Video. Underline also on ADM 12 and ADM 24E	3 Embedded 1 Non-Embedded	4 Embedded, 1 Non-Embedded or All Non-Embedded, plus Full Screen Reverse Video	5 Embedded, 1 Non-Embedded or All Non-Embedded, plus Full Screen Reverse Video and Highlight
OEM Flexibility	Modifiable Set-Up Characteristics	Modifiable Set-Up Characteristics & Personality	Modifiable Set-Up Characteristics. Add to Program in ROM or Down-Line Load in RAM (56K ROM or RAM. Up to 22K Display Available) Room for additional Logic Boards.
Terminal Compatibility	ADM 3A, ADM 5. ADDS Viewpoint & Regent 25, Hazeltine 1400, 1420 & 1500, also available.	ADM 3A, ADM 5, ADM 31, ADM 32	ADM 3A, ADM 5, ADM 31, ADM, 32, ADM 42

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"The production system contributed directly to inventory reduction of $100 million. And there's more to go."

view and approval of completed work by user management. This stage primarily concerns the supporting MIS organization constructing the system. User participation drops back to a consulting capacity. As the external specifications of the system are well defined and stable, the programming work proceeds smoothly and rapidly. The products of this stage are the system design, equipment selection, and completed programming. Preliminary documentation is produced.

The final stage begins with a management review and commitment to system implementation in field operation. At this point the system is ready to go live and a team is formed for implementation. User involvement accelerates as operational testing of the prototype occurs in parallel with the old system. When testing is completed, the new system is installed at all field locations. At the end of field implementation, work begins on Mod II, the inevitable next phase in development that occurs as new needs are discovered through use of the system.

With the new system in place at Superior, data integrity became even more important. At the planning level, materials field management was made responsible for the accurate input of forecast rig, well, and spud date (the day drilling would begin) information. These data covered all future drilling activities that would require physical support by tubular goods controlled in the new on-line TIS.

At the second level down, material control assigns material to specific wells, originates purchase orders, makes interdivisional transfers, and reports surplus. Responsibility for this input was given to materials field operations.

A third level executes transactions, checks material description accuracy, and makes reconciliations. The implementation team shared these responsibilities with other materials people not on the original team.

EARLY SYSTEM PROBLEMS

Early system difficulties included inadvertent assignment of completion tubing to wells 100 to 200 days before the material was needed. The field people were allocating, hence reserving, completion tubing on the day the well was spudded. This practice tied up large quantities of tubing for three to six months, thereby inflating the company's working capital. The problem was simply that the spud date was the single available time reference. The solution was to add a separate "date of use" data element to the system.

These and other difficulties were found by management monitoring system information. Materials management, however, was cautious when questioning subordinates concerning operations, because every transaction is visible in an on-line system. Errors are easily detected and embarrassment is counterproductive to system acceptance in the field.

With a moderate number of problems discovered and solved, TIS went on-line in January, seven months following project start.

In recounting his experience with prototype systems, materials director Stetzer recalled an earlier project with another company in which two years of conventional system development had failed to produce an inventory system. Dropping back to prototype methods under time pressure, his group had been able to create the desired system in six months. That experience marked his conversion to rapid development prototyping.

To review the tubular information system project, Fig. 1 shows how system development evolved. The professional MIS systems staff provided 15½ man-months of development labor to build the system. Additionally, the materials staff contributed six man-months for requirement definition, and user services (MIS) furnished another six man-months for training and other user support. Total labor invested amounted to about 27½ man-months, expended over seven calendar months.

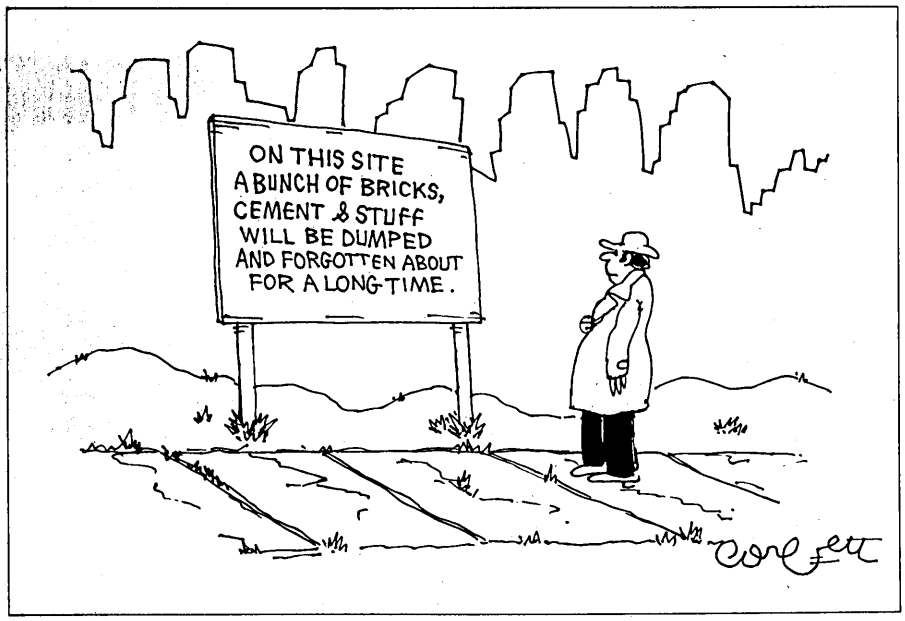
Management evaluation of the project indicates that the seven calendar month expenditure would have been approximately 20 months under conventional development practices. The relatively short time between inception of the design work and system availability has been very important to materials management. Since its implementation, the system has ensured the best possible use of tubular goods at a time when cost reduction pressure on the oil industry has become critical.

Stetzer reports that "the TIS production system contributed directly to inventory reduction of $100 million from February 1982 to December 1983. And there's more to go." In addition, recognizing which pieces in stock are on consignment with vendors has helped release this capital.

The system is also capable of handling nontubular stock. As a result, more capital reductions will be achieved by improved control over other classes of high valued material.

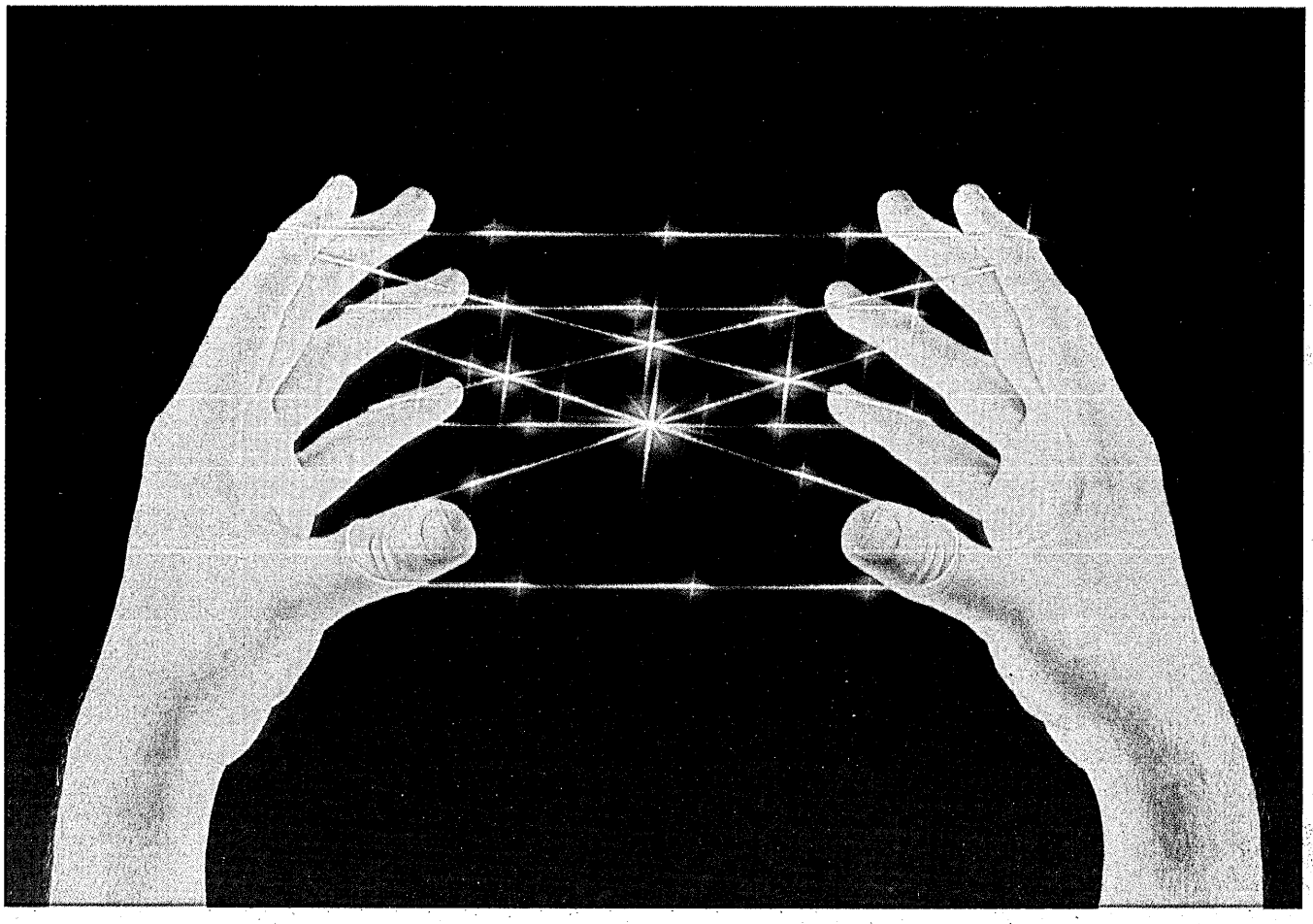
Further savings are shown by the fact that purchasing a proprietary system would have cost more than twice the price of in-house development. Candidate proprietary systems were foreign to Superior's business practice because they addressed manufacturing activity and were difficult to adapt to the oil drilling environment. Stetzer was again well satisfied with the decision to use in-house prototype methods for system development.

Prototyping offers an alternative to the rigid, formalized system development protocols that have appeared in recent years. Users are happy because the systems are truly theirs in every respect. Moreover, the systems are ready for use much more quickly. Although the iterative freedom could be wasteful, when well managed it can offer substantial economy at the business problem level. ✱



CARTOON BY JACK CORBETT

T. R. Young, a free-lance writer based in Houston, Texas, writes on business and technical subjects.



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COMPANY _____

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Protocols currently used (including lookalikes)

☐ IBM 3270 ☐ SDLC

☐ Burroughs Poll/Select

☐ X.25 ☐ Other _____

Number of remote locations _____

Geographic Scope

☐ National ☐ Regional ☐ Local

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CIRCLE 80 ON READER CARD

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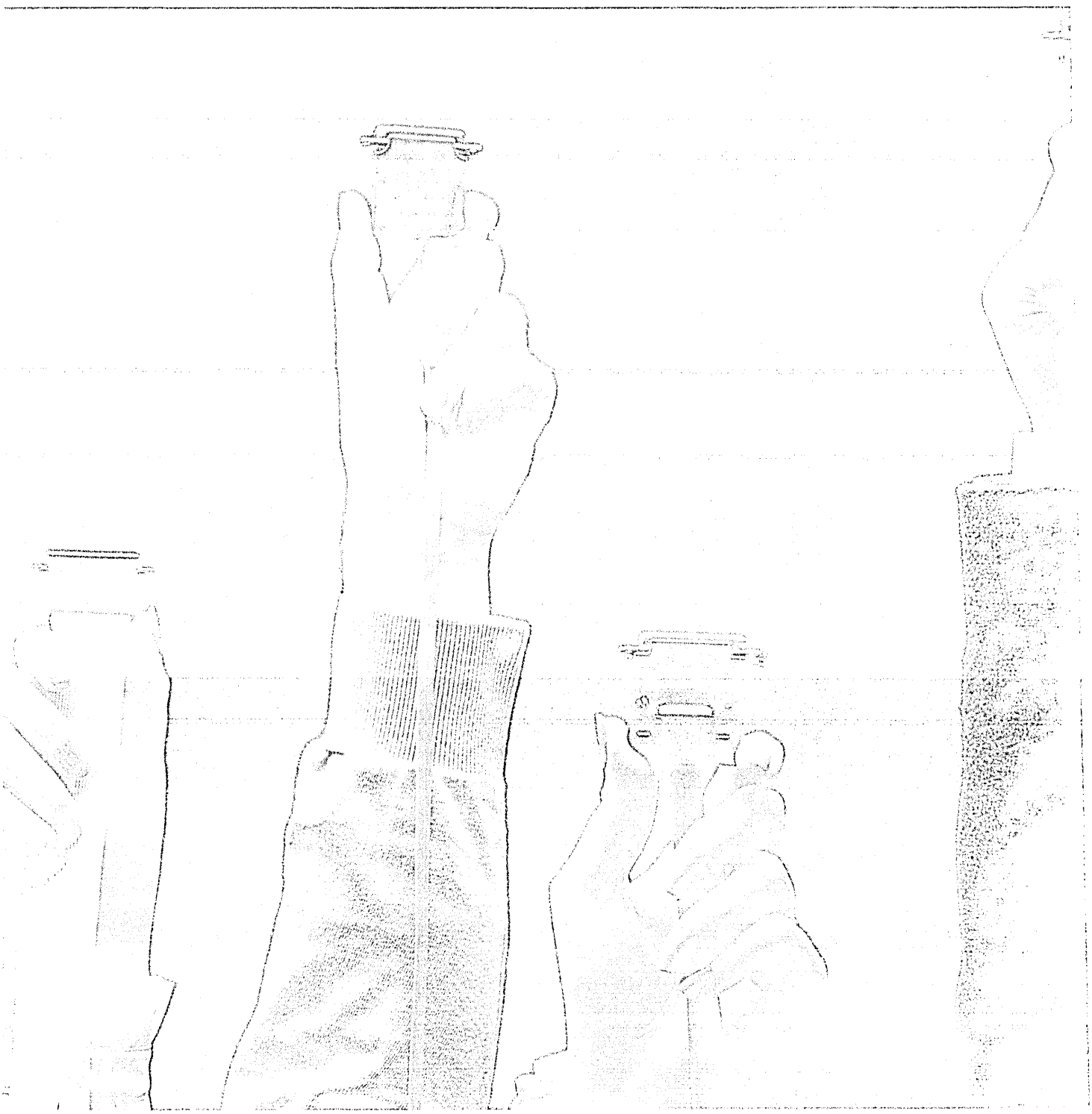

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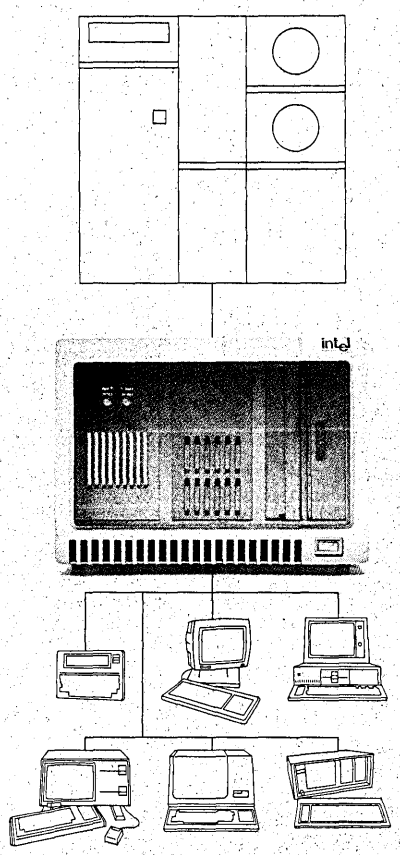

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***According to the Gartner Group, who took the time to figure out all the hidden costs, each direct pc-to-mainframe connection costs approximately $22,000. Each. *Xenix and Multiplan are trademarks of Microsoft Corporation. © 1984 Intel Corporation.*

CIRCLE 81 ON READER CARD

What system development teams can learn from Shelley and Thoreau.

PROGRAMS AS ESSAYS

by Ben Ross Schneider Jr.

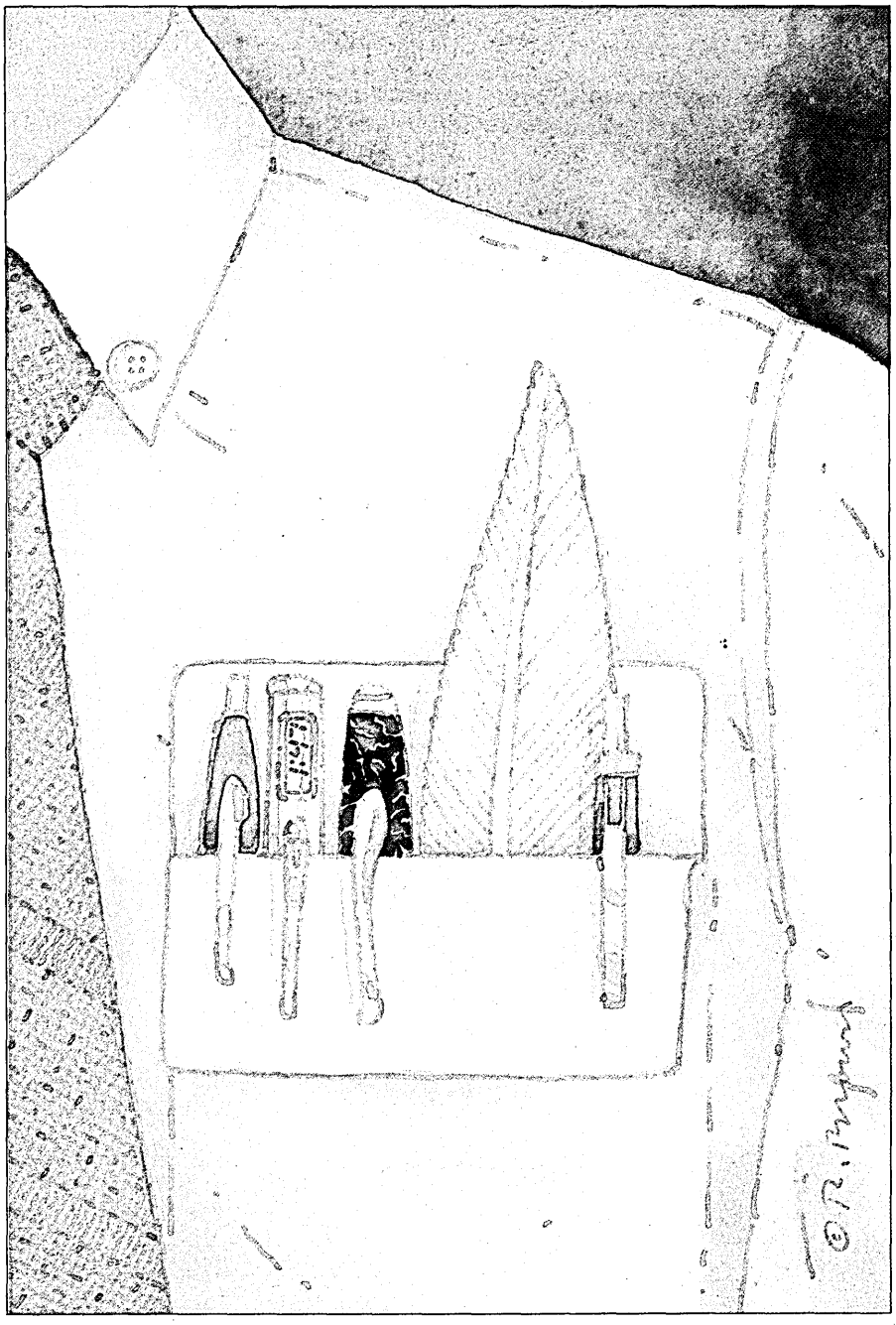


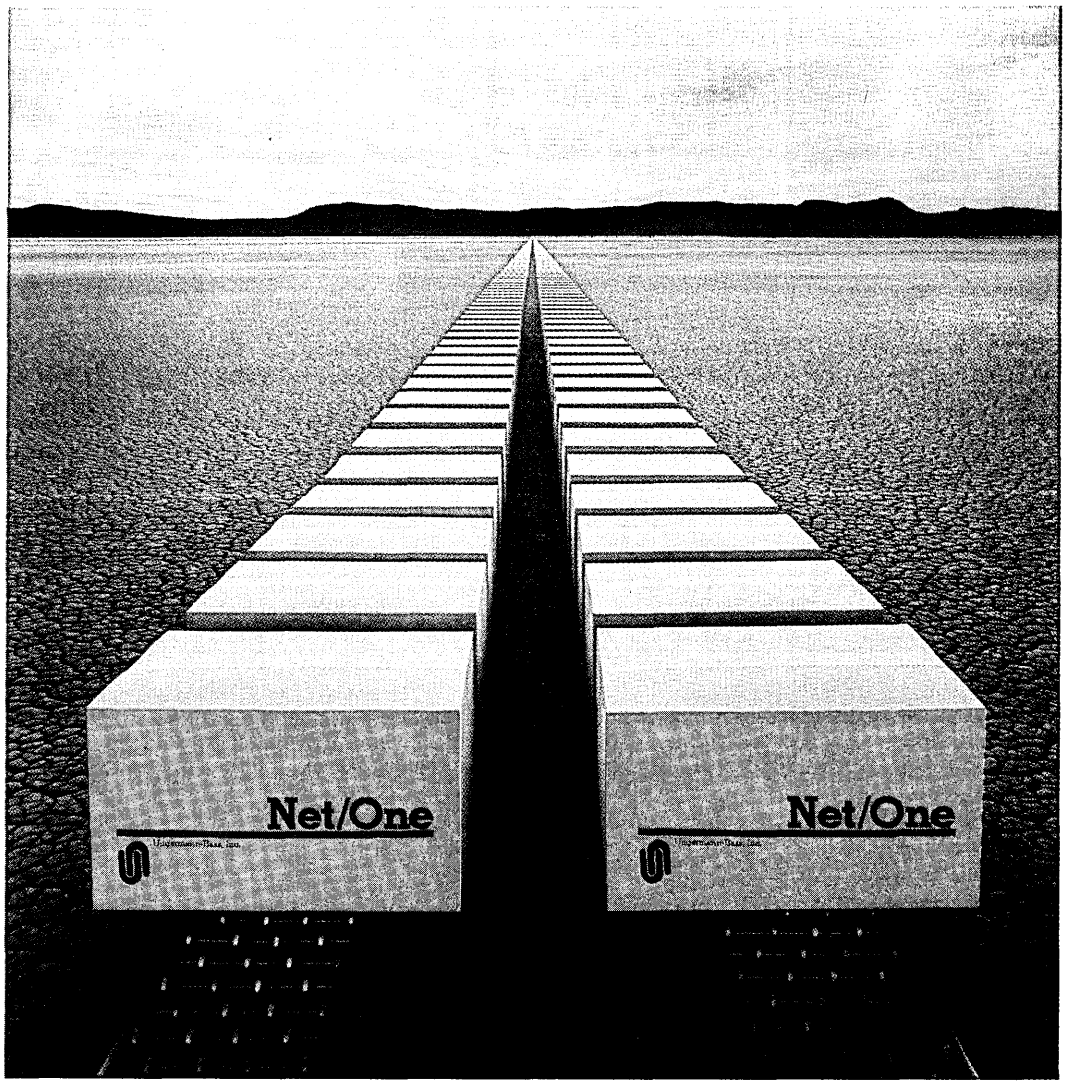
ILLUSTRATION BY RICHARD BROWN

When I consider the field of computing, two phenomena astonish me: that programmers aren't the best of writers, and that computer science has had to discover what the whole human race has known about the relative merits of chaos and order since God created the world in six days. I should have thought the discipline of programming would have made computer professionals the most polished group of writers in the country. But not only does the precision of programming fail to rub off on them, they have actually had to *invent* "structured programming" and *discover* the top-down approach, secrets quite obvious to writers—at least since Homer. I can't imagine how programmers went about their business before they, like Molière's Bourgeois Gentilhomme, suddenly discovered that they spoke prose.

There has been a failure of communication between writers and programmers, and this essay is an attempt to start a conversation.

Last fall I finally wrote a program. Although I have been computing since 1965 and have conducted three fairly horrendous computer projects, I have shied away from programming on the theory that it isn't a practical pursuit for a fellow who can't figure out in his head what day of the week it will be 10 days from now. But last fall, having some time on my hands and having been unable for some years to find a decent text formatter for my Centronics 737 printer (which, because its characters came in nine different widths, required special treatment), I decided to build my own formatter out of Microsoft BASIC. Progressing at a rate of about five good lines per day and 20 bad ones, in two months I produced a passable formatter, and proved two things to my own satisfaction: 1. I am indeed not cut out to be a programmer; 2. programming does indeed have close affinities to writing.

In the first place, the laws of programming seem to apply quite handily to writing as well. For bad writing is very like a program that doesn't work! its GOTOs get



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The computer does not forgive incoherence, but it does forgive lack of structure.

lost, its GOSUBS overlap, its IFs have no THENs, its constants vary, its variables interlock. Consider, for example, the manual for a prominent text editor that I now have before me. It was shipped in 1981, and it may have improved considerably since then, but it will do for an example of bad writing.

Its GOTOs get lost. An early section of this manual sends us to Appendix A for instructions on customizing the editor. Appendix A informs us that "the enclosed 'Example Keyboard Layout' and the next section 'Running SETUP' give recommended values for every question" asked by the setup routine. "Enclosed" in what? The word suggests something loose, and there *was* a sort of handout in the package. There indeed we find, stapled in the middle of 10 other afterthoughts, a page called "Example Keyboard Layout." But we also find two other keyboard layouts that our GOTO never mentioned. And what about the "next section"? It isn't next to the sample keyboard layout, as strongly suggested; perhaps it's next to the original section. Sure enough, four pages further on, something approximately eligible does occur but not exactly what we expected, because it's called "Running SETUP or SETCRT." A good writer gives better addresses to other parts of his essay than this manual does, but he strives to avoid GOTOs altogether by collecting all the material on one subject in one place.

Its GOSUBs overlap. In this manual "Running SETUP" is a sort of subroutine whose purpose is to show us how to answer setup questions. But a considerable amount of discussion on this point has already occurred in a previous section, called "Getting Started," and there is a good deal more about it among the handouts. As a result, some of the advice is repeated several times and some of it doesn't agree. If the manual were a program, it would be inefficient in the first place, and unworkable in the second.

MANUALS DON'T COMMENT

Its IFs have no THENs. On the first sheet of our handouts we are told to be sure that our package contains "Notes on Software License Agreement," "Software License Agreement," "Example Keyboard Layout," "Example Customization," "Software Update Option," and several other sheets. If this were a program, the author would have to tell us what to do if we don't find everything (proceed no farther?) and what to do if we do (sign license agreement and proceed with setup?); but it's a manual, and there's no further comment.

Its constants vary. Names change without warning. "Software Support Option" changes to "Software Update Option," "Auto Read/Write" changes to "Auto-Buffering," "text register" changes to "text save," "naming" a file switches to "opening" a file, and "eloquent" means "elegant." If this were a program it would soon fail to find a previously defined value and crash, just as most readers of this documentation do.

Its variables interlock. Categories aren't mutually exclusive. The system is said to have two modes, "Command Mode" and "Visual Mode," but both modes have commands. Nor does "Control Functions" gracefully divide into "Cursor Movement" and "Visual Functions," not only because apples don't divide into apples and oranges but also because in this case both categories have visual manifestations. The basis for comparison shifts in the very act of comparing, like that of the man who asked, "Do you walk to work or carry your lunch?" A programmer who defined his variables this sloppily would find them at variance in fatal dimensions. A reader is simply mystified.

Bad writing persists even in the unforgiving world of computers, I suppose, because we have come to depend on the human mind's marvelous power to make sense of a crazy, mixed-up world, which, not surprisingly, contains lots of crazy, mixed-up documentation. "Well, you know what I mean," the documentor says lazily. Programmers are friendly natives at heart. Perhaps if they thought of themselves as programming the user—which is exactly what they are doing—their writing would become friendly in deed as well as intent.

So much for the ways in which programming skills might help the writer. Let us now consider the ways in which writing skills might help the programmer. The computer does not forgive incoherence, but it does forgive lack of structure. The computer doesn't care about structure as long as the data paths are clear, but structure does make programs comprehensible to human beings who may need to know how they work. Into this category fall not just future programmers—enhancers, updaters, and debuggers—but also and especially the writer of the program himself, who adds more and more features and gets more and more confused.

Structure is the arrangement of parts; first of all, it involves recognizing the parts into which the material naturally divides, and second, it involves arranging these parts into a logical order that derives from the nature of the parts. Both writer and programmer have the problem of presenting a system of parts that is logically a tree but that must take the form of a list, and both use GOSUBs (and GOTOs) that patch the branches of the tree into the list. As they do so, they follow—or ought to follow—a few simple rules that maintain clarity.

Never digress. You know that your parts are in order when they march relentlessly forward to their final goal, glancing back occasionally (because of the tree), but never going back. The first principle of structure is to lay down at the beginning those definitions, facts, and assumptions that the rest of the work will take as given. We begin a program by setting parameters, those variables that remain constant during a given run. A storyteller that gets the cart before the horse can patch in a horse as an aside—"Oh, I forgot to tell you"—but that dulls the point of the story. When a programmer patches in a given as an afterthought, he spoils the structure of his program, increasing its obscurity.

DEFINE TO AVOID REPEATING

One thing at a time. The second principle of structure is to define the parts so that you never have to cover the same topic twice. A certain amount of redundancy may be delightful in "Goldilocks and the Three Bears," but in expository prose or software it is a great bore, a waste of time, and a source of confusion. Our manual has three sections entitled "Getting Started," and all of them tell us something about keyboard layout; how much easier it would be for us if all the material were in one place! For the programmer, one thing at a time means defining subroutines so that they do not overlap.

There must be a perceivable reason for the order of parts. In an essay, we might move from familiar ground to the undiscovered country of the conclusion. In building my text formatter I discovered that I moved from setting parameters to a central branching point, after which I listed the subroutines according to the frequency with which they were used and the order in which they were used: first to last and general to particular.

The program starts by establishing margins, paragraph indentation, page length, and character widths; then it proceeds to measure out a string until it reaches the decision point—the string is long enough to be filled and printed, or a code embedded in the text requires special treatment. Next come the routines for chopping, filling, and printing lines that impinge on the right-hand margin; then the routines for lines that don't. These are followed by the paging routine, and finally the finishing-up routine. Because I had a systematic filing system, I knew where to find every routine, and because that system had something to do with dataflow, it helped me comprehend its operation.

My experience has been that in the search for structure, whether I am programming or writing, I discover things about my subject that I wouldn't otherwise have known. I discover, very simply, that I can't

Writing is an activity of the imagination; perhaps we have underestimated the degree to which this is also true of programming.

get from A to C without inventing B. That is why I would agree with those who say that structured programming increases programming efficiency.

I found that close line-by-line commentary also helped my comprehension. I'd get to a point where I'd added so many complexities I couldn't follow the program anymore, or to a point where my failure to understand *why* a routine happened to work caught up with me. Stopping to write in comments often got me out of the woods.

Use commentary to explain branches. A writer makes a big fuss about transitions, waving showy flags like "However," "Moreover," and "It follows" whenever he branches to a new part of his argument. I found it helpful in programming to mark every branch to a subroutine with words that highlighted why I branched and what subroutine I went to. I also decorated the subroutine itself, not only with an explanation of what it did, but what called it and what job it RETURNed to do. Rows of asterisks and other artistic devices also help, but commentary is the best way I know of to impose the actual tree structure on a listed presentation.

USE VERBS FOR MORE PRECISION

Put an imperative verb in every comment. A writer seeks as much precision as his topic allows. I found that a good way to increase the precision of my comments was to make sure that they always contained a verb, logically an imperative verb, because program statements are imperative. Don't say "output," say "print the line"; don't say "line length," say "calculate line length"; don't say "indent flag," say "set indent flag."

Modern American writing suffers in general from lack of verbs. We habitually compose sentences that consist mainly of strings of nouns, adjectives, and participles loosely connected by the verb "to be," our least dramatic verb. We say, "A main feature of X is its visual mode editing," instead of "X uses a crt screen to display changes in text as fast as the user makes them." I have added the verbs "use," "display," and "make," as well as some previously unstated subjects and objects that the verbs forced me to consider.

The avoidance of verbs in American speech and writing stems partly, I suppose, from laziness and partly from a wish to sound scientific. Scientific prose (quite hypocritically, I think) abhors the pronoun I. Many young people are prepared for college these days by being told never to use I in an essay. Avoiding I forces a writer to use passive verbs ("to be" plus past participle). The scientist says, "The telescope was pointed at Vega," instead of " I (We? They? My assistant?) pointed the telescope at Vega." Discourse in which nobody does anything sounds professional to us, and unfortunately it is. But when you avoid active verbs you avoid subjects and objects as well, and meaning and precision suffer. A line of programming code always acts; its commentary deserves an active verb.

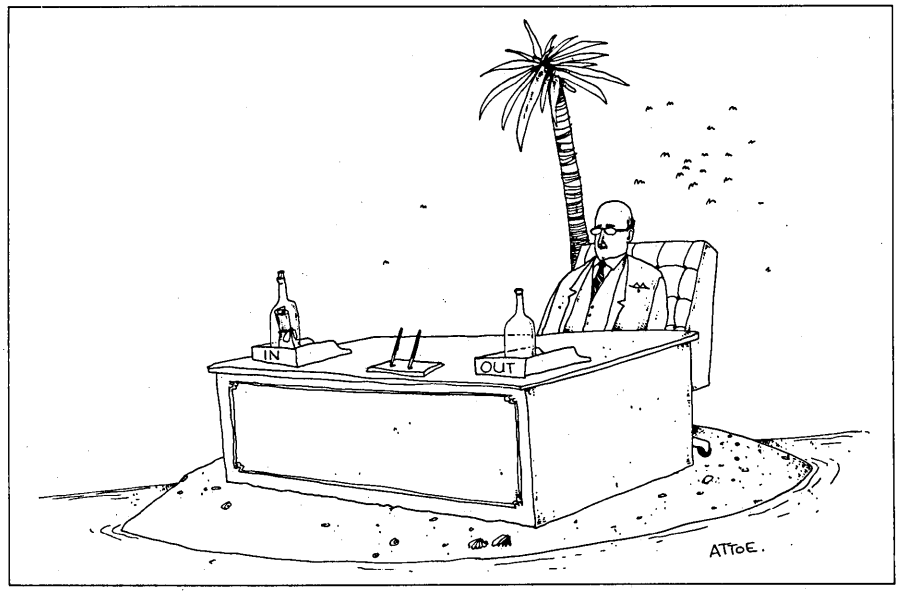
Imagine the user. Writing is an activity of the imagination, and perhaps we have underestimated the degree to which this is also true of programming. Writing software appears at first glance to be an activity of reason, but when the programmer considers his "user interface" his imagination encounters a challenge. Too often we pick up documentation that on one page explains how to mount a floppy disk and on another expects the user to be able to count in hex. Or supposes that he can handle words like "iteration macro," but not "backup." What we have here is a failure to imagine the user's whereabouts. If we know our user, the task of reaching him reduces to choosing, from all the options open to us, the ones that suit him best. We have options both in the features we use and in the language that explains them, in design and in presentation.

No amount of good documentation will make a bad program good, because a good product begins with its basic design. If the software itself cannot serve the user's needs or match his capacities, documentation can do no more than show him the devious route by which he can reach his goals despite the dismaying complexity of the software. Thus dozens of handbooks surface when an essentially unfriendly piece of software happens to become the common default. The automotive industry, because it can imagine specific users, can design a car for a family, a sports buff, a commuter, a camper. But the computer industry has not progressed this far. A typical word processor today (to speak of what I know best) seems to be a helter-skelter assemblage of whatever features all the rest have plus a few bells and whistles of its own. If the designers of word processors really wanted to provide friendly systems, they would begin by scaling down to essentials.

"Simplify, simplify, simplify," said Thoreau. Get rid of the nonessential. The writer of a magazine article decides to avoid a section on whether or not Hitler died in his bunker, by simply assuming that he did. Why open that can of worms for a nonspecialist audience, as long as the consensus of specialists supports the assumption? Similarly, automobile manufacturers don't put a tachometer and a stick shift on a family car: families don't drive with that kind of precision. Nor does a family word processor need commands to set left margin, right margin, and standard indentation; let Mom, Dad, or Sonny state the width of his or her stationery—in inches—and let the word processor calculate good-looking values for the rest. The purpose of machines is to save labor, not increase it.

HOW TO KNOW THE USER

We are now finally facing the question of how to know this all-important user. Market research alone doesn't seem to do the trick. Back in 1975, market research couldn't have told anyone that personal computers were the world's greatest need. IBM, with its massive research and development spending, was sound asleep. If market research had asked the man on the street back then whether he wanted a computer, he would have said, "What for?" But Steve Jobs guessed that if



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If market research had asked the man on the street in 1975 if he wanted a computer, he would have said, "What for?"

he himself could afford a computer, anyone could, and he further guessed that anyone would find a use for it. He imagined the market. In his *Defence of Poetry* Shelley wrote, "A man, to be greatly good, must imagine intensely and comprehensively; he must put himself in the place of another and of many others; the pains and pleasures of his species must become his own."

It is not enough to want to be friendly; one must first know how, and imagination is the way. I do not equate imagination with inborn talent, genius, IQ, or romantic notions of "creativity." I think the imagination can be set in action by the will and that it can be trained. Shelley thought it could be trained with poetry, which "strengthens the imagination in the same way that exercise strengthens a limb." Let's say that a person who hungers and thirsts after knowledge develops, in due course, a strong imagination.

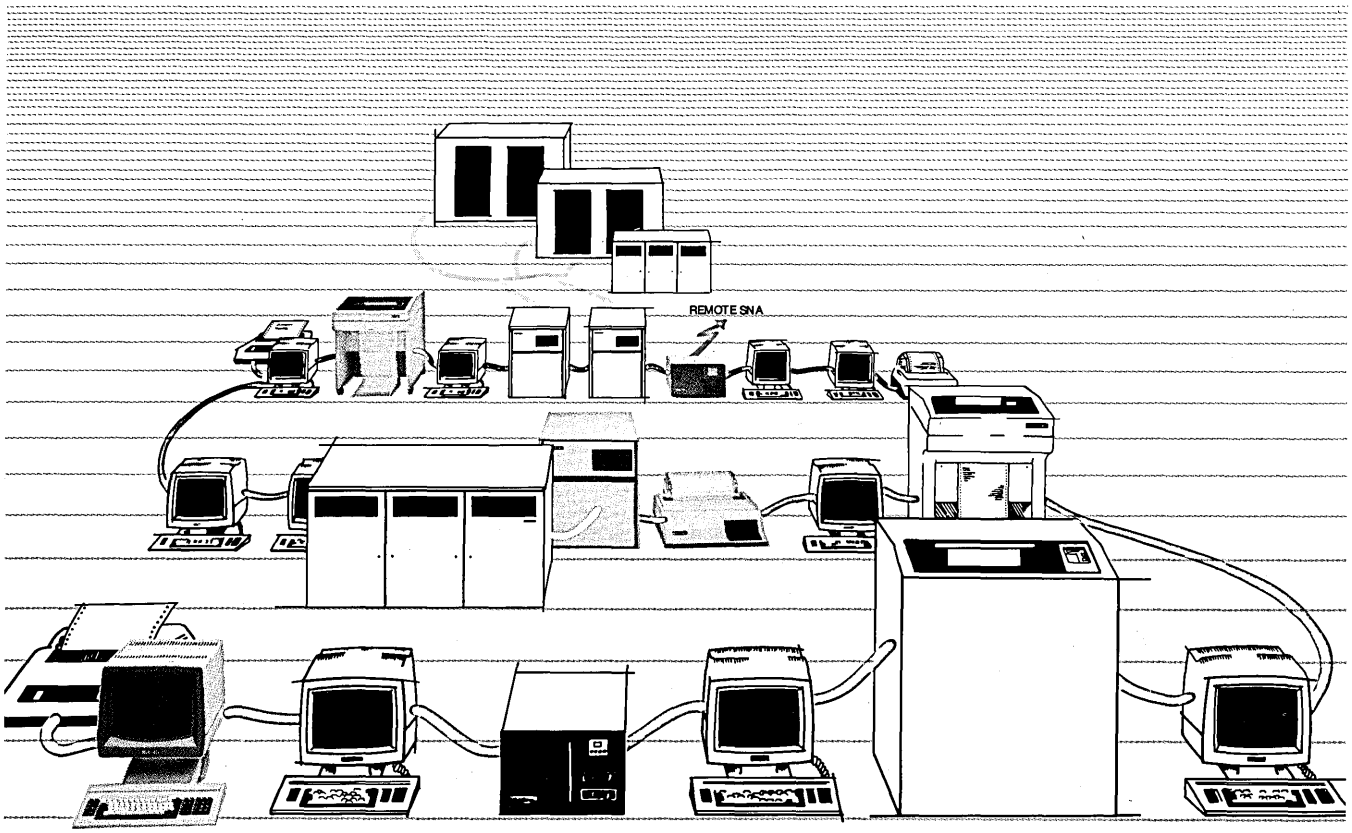
Few writers start to build on such flimsy foundations as programmers have been wont to use. We have perceived programming as a field sufficient unto itself, like mathematics, and we have sent programmers out into the dense jungle of whatever trade, profession, or business feels the need of automation, without any preparation for the perils they will assuredly encounter. While we wouldn't dream of appointing a programmer vice president for market research, we have had no qualms about assigning him the task of automating market research. On the face of it, his chances of success are about equal to those of a schoolboy asked to explain the causes of the Civil War.

If we really believed in top-down design we would give ultimate responsibility for automating market research to the vice president of marketing himself: his rank proves that he knows the territory; he knows what's essential; let him justify his salary. VisiCalc was the solution of a problem that conventional programming couldn't even define, let alone solve; it was not a programmer, but a student at Harvard Business School who imagined that program.

If Shelley is right about knowing the territory, programming should disappear as an isolated discipline, and take its place as an adjunct to the studies of any educated man or woman, like math, English composition, and foreign languages. Programming should never be anyone's primary course of study—or career.

Friendliness is not jocularity and stick figures: it is inherent clarity based on simplicity; it determines the essential through a sympathy with the user's needs that is established by an imaginative grasp of the territory he inhabits; it begins with clear design and ends with clear documentation. ✱

Ben Schneider, an English professor at Lawrence University in Wisconsin, began using computers in 1965. In his first project he used an IBM 1620 to analyze the repertories of more than 200 actors on the London stage from 1660-1730. In the '70s he computerized an 11-volume reference work called *The London Stage, 1660-1800.* These projects resulted in two books, *The Ethos of Restoration Comedy* (Illinois Press) and *Travels in Computerland* (Addison-Wesley), in addition to the 939-page *Index* (Southern Illinois Press). This fall Macmillan will publish his latest book, *My Personal Computer and Other Family Crises.*



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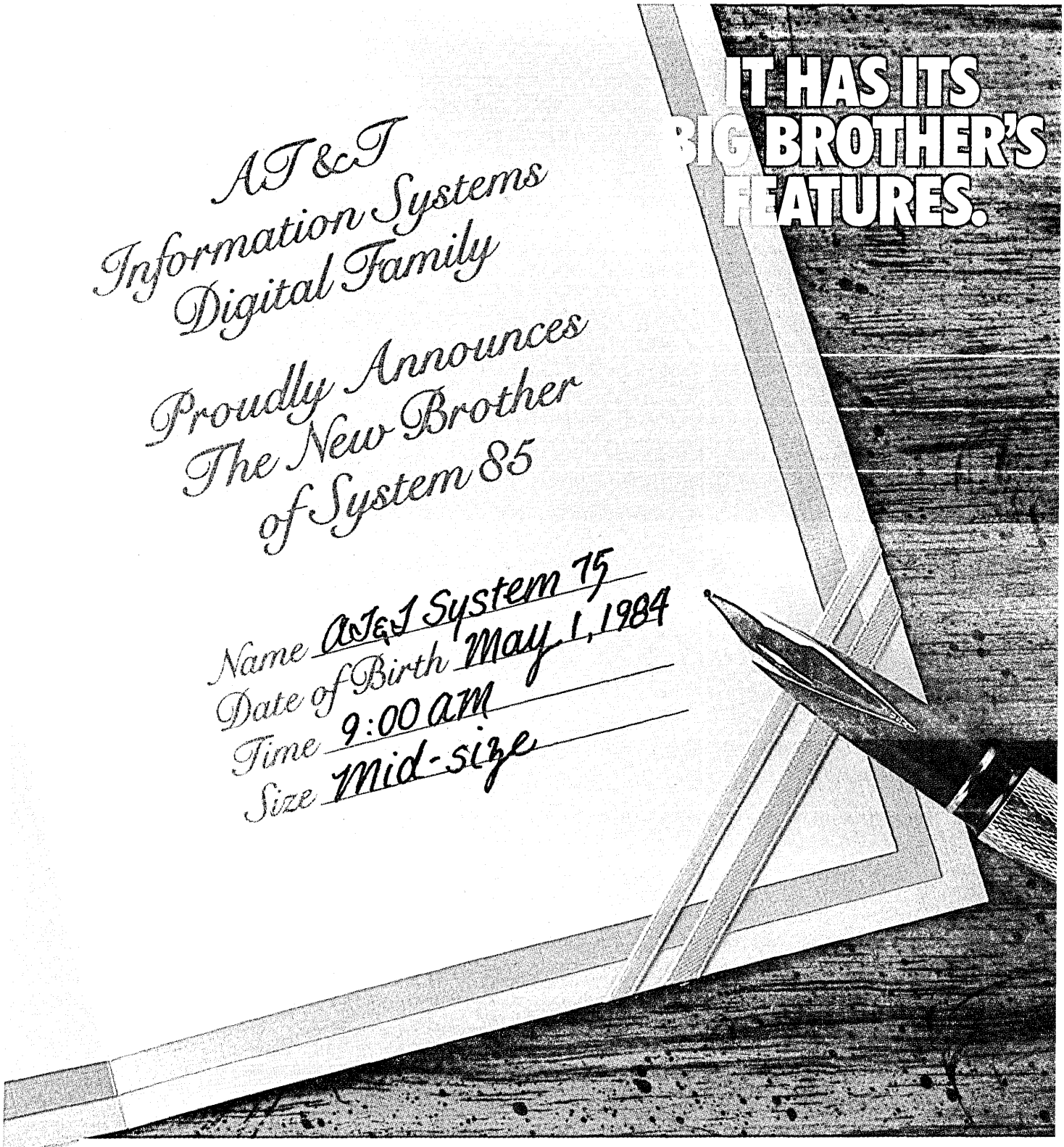

voice and data, to outside locations. It has many configurations that can link switches within a building, across the street, or across the country.

Office Management—includes an integrated leave word calling system and a company-wide directory that can streamline everyday office procedures into one system and increase productivity.

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CIRCLE 88 ON READER CARD

Algebraic data processing techniques can enable applications programmers to work with units of data larger than a single computer word.

AVOIDING THE VON NEUMANN BOTTLENECK

by T. H. Merrett

In the days of the ENIAC (begun in 1943) and the EDVAC (1944), both random access memory and secondary storage were very small. In the ENIAC, RAM was about 20 words. The EDVAC improved on its predecessor, not only by offering secondary storage of 1,000 words in mercury delay lines, but also by storing its programs as if they were data. This latter advance is attributed by many to John von Neumann. Digital computers since then have been largely "von Neumann machines."

A third of a century later, John Backus described (in the August 1978 *Communications of the ACM*) something called the "von Neumann bottleneck." This is the limitation created by the fact that, in a von Neumann machine, data are transmitted from store to processor in units of only one word. In that third of a century, we have gone from primary memories of tens of bytes and secondary memories of thousands, to capacities of megabytes and gigabytes, respectively. In database and information systems, we transfer tens of thousands of bytes from secondary to primary storage at once. It is no longer profitable to think in terms of individual words.

Let us examine the von Neumann bottleneck in the context of a fairly complex commercial information system, the manufacturing costing system outlined in Fig. 1. This system uses salary and routing data to calculate labor costs (LABCOST), fixed asset depreciations to find equipment costs (EQUIPCOST), and combines these with raw materials prices to obtain BASIC COSTS. To calculate the FINAL COSTS of making a complex assembly, the basic costs of assembly and raw materials must be multiplied by the number of times each component appears in the finished product. This information is shown in the bill of materials (BOM) when it has been processed to reveal all the constituent subassemblies.

Price data are then combined with the calculated final costs to permit profit analysis. The system first finds the profit for each finished product (PART PROFIT), then, with data on the orders received, analyzes them both by customer (CUSTANAL) and by salesman (SALESANAL).

This system is presented in Fig. 1 in a highly modular way that avoids the von Neumann bottleneck. Each calculation is performed by a program that operates on one or more files to produce a new file. Instead of individual words, the units of data processing are now files. The system is built from relatively few modules, and its outline is easy to understand.

There are further advantages that can be seen when a little more detail is given. As an example, let us look at the calculation of EQUIPCOST from ROUTING and FIXED ASSETS (shaded subsystem in Fig. 1). Fig. 2 shows this from the von Neumann point of view, with program loops containing record-by-record processing of the files by selecting and combining the relevant fields of each record. To follow the computation at this level of detail, we need sample input files (Fig. 3) and an output file (Fig. 4). With these we can see, for instance, that assembling a car requires 24 hours (out of a 40-hour week) on the Gluset machine, and that this machine has a depreciation of (EQCOST − SALVAGE)/LIFE, or ($10,000 − $1,000)/300 = $30 per week. So, the equipment cost of making a car is $30 × 24/40 = $18.

The processing outlined in Fig. 2 extracts the relevant fields of each record of the ROUTING file and matches it with the corresponding (on EQUIP) record from FIXED ASSETS. (Fig. 2 does not explicitly show the depreciation or equipment cost calculations, or the final extraction of the ASSEMBLY and EQUIP$ fields to form EQUIPCOST.)

In a sense, Fig. 2 is just an expansion at the von Neumann level of a detail of Fig. 1, and as such, it retains the modularity and relative simplicity of Fig. 1. However, Fig. 1 results from a particular higher-level approach, and there is a sense in which the detail of Fig. 2 is unnecessary and distracting. The next step in the high-level approach advocated here is to seek a small set of precisely defined operators at the files level instead of at the level of individual computer words. These operators should include the processing shown in Fig. 2, but should be defined at a level that does not presuppose that the underlying computer is a von Neumann machine. Thus, the programmer who builds the information system must think at the level of operations on files rather than on computer words.

An important requirement of the operators we are looking for is that they be closed, in the sense that the file resulting from the operation can, in turn, be used as input to a further operation. This property enables us to build an extended system, as in Fig. 1, from simple component operators. The output files are always compatible with the input files. In the cases of ROUTING, FIXED ASSETS, and EQUIPCOST, we can see, without going into unnecessary detail or precise specifications, that the files have the same simple forms. This similarity results from having designed the manufacturing costing system with operational closure in mind.

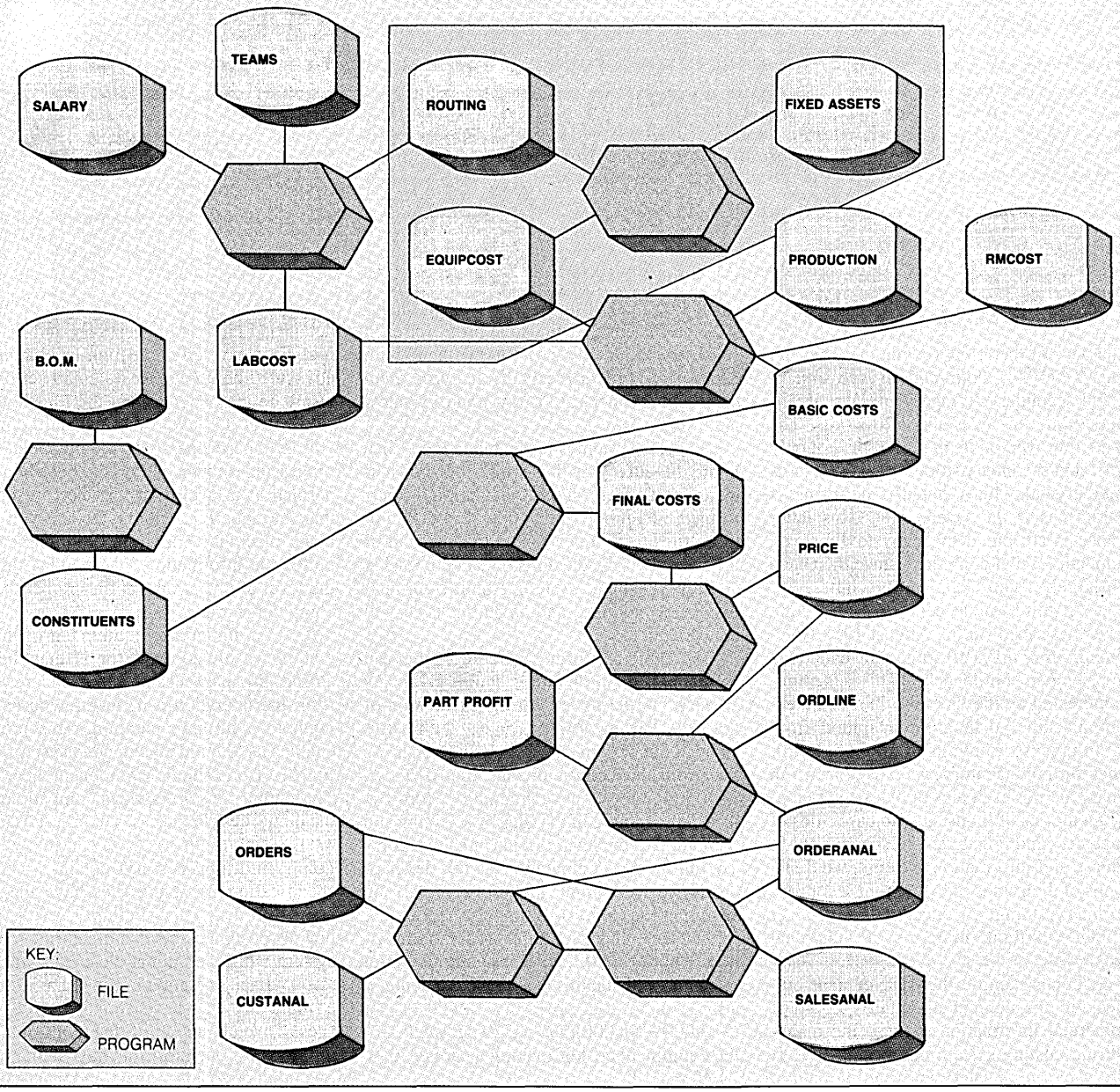
Each operation in Fig. 1 has as output a single file. They have from one to four input files. To keep our set of operators small, we will look for operators that have either one or two input operands—unary and binary operators, respectively. This is rather like arithmetic, in which $+, -, \times, \div$ are binary operators and log and exp are unary. By combining two binary operators, we can make an operation with three inputs, just as the expression $a + b \times c$ has three operands.

In fact our whole enterprise here, motivated by the inadequacy of the von Neumann model of computation for information systems, is to create primitive operations for data processing in the same fashion that arithmetic gives the primitive operations for numerical computation. We hope for an infor-

We hope for an information systems programming language that operates on files as FORTRAN does on numbers.

FIG. 1

FLOWCHART OF A MANUFACTURING COSTING SYSTEM



CHARTS BY CYNTHIA STODDARD

mation systems programming language that operates on files in the same way that FORTRAN, say, works on numbers.

When we look at the detail in Fig. 2, we see two very basic file operations: an extraction of relevant fields, and a merge on matching records. The sorts are supplementary to the merge operation, and so are not counted separately. The extraction is unary, the merge binary. If we take these to be two of the set of operators we are seeking, Fig. 2 can be represented in the manner shown in Fig. 5. (The merge is followed in Fig. 5 by a second extraction, which picks out the relevant fields ASSEMBLY and EQUIP$ and, incidentally, computes the values for EQUIP$ using the appropriate formulas.)

TWO STANDARD OPERATORS

What claim have extraction and merge to being important members of a set of standard operators? Fig. 6 shows that the entire manufacturing costing system can be written using only these two operators, with the occasional appearance of two others. The question of what is a suitable set of high-level operators for a wide range of information systems must be answered by empirical study of different information systems. Part of the Aldat project at McGill University has been to undertake just such a study. We have examined commercial, library, geographic, and text information systems requirements and can report considerable success in reducing these requirements to a set of three very general oper-

FIG. 2

DETAIL OF MANUFACTURING COSTING: EQUIPMENT COST

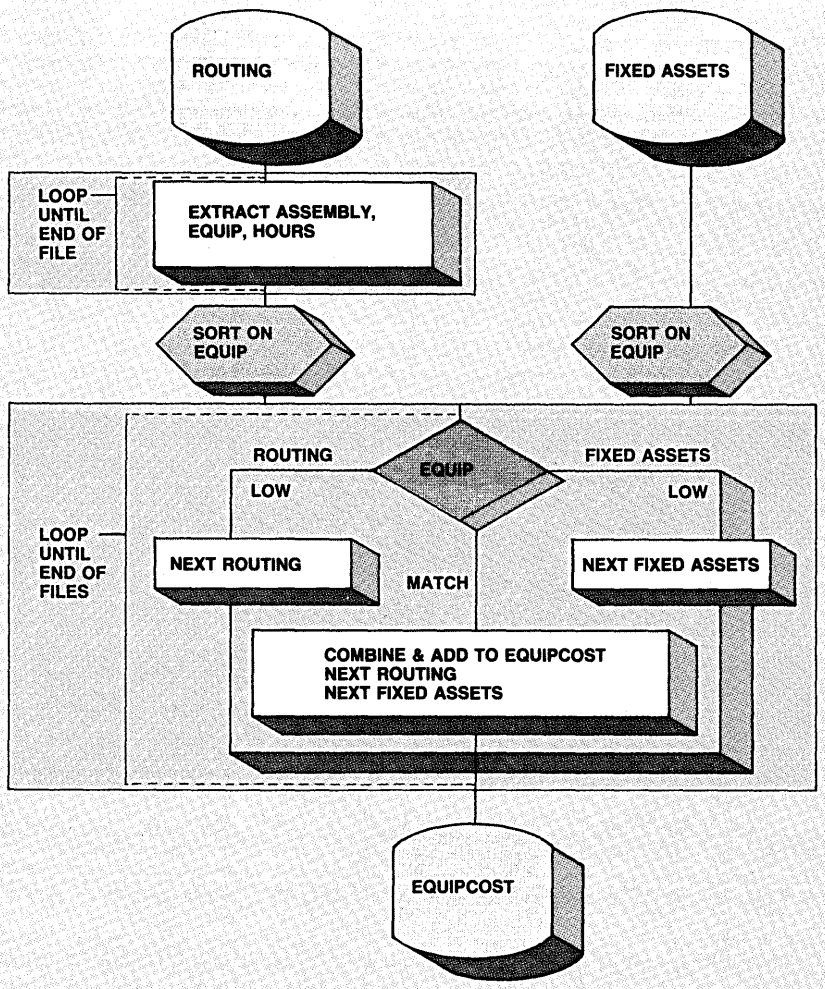


FIG. 3

INPUT TO THE EQUIPMENT COST CALCULATION

ROUTING

(TEAM	ASSEMBLY	EQUIP	HOURS)
A	Car	Gluset	24
A	Caboose	Gluset	8
PT	Base	Wheel Jig	16
T	Toy Train	String Stapler	24
AP	Body	Gluset	8
P	Locomotive	Wheel Jig	16

FIXED ASSETS

(EQUIP	EQCOST	SALVAGE	LIFE)
Gluset	10,000	1,000	300
Wheel Jig	20,000	2,000	500
String Stapler	10,000	400	200

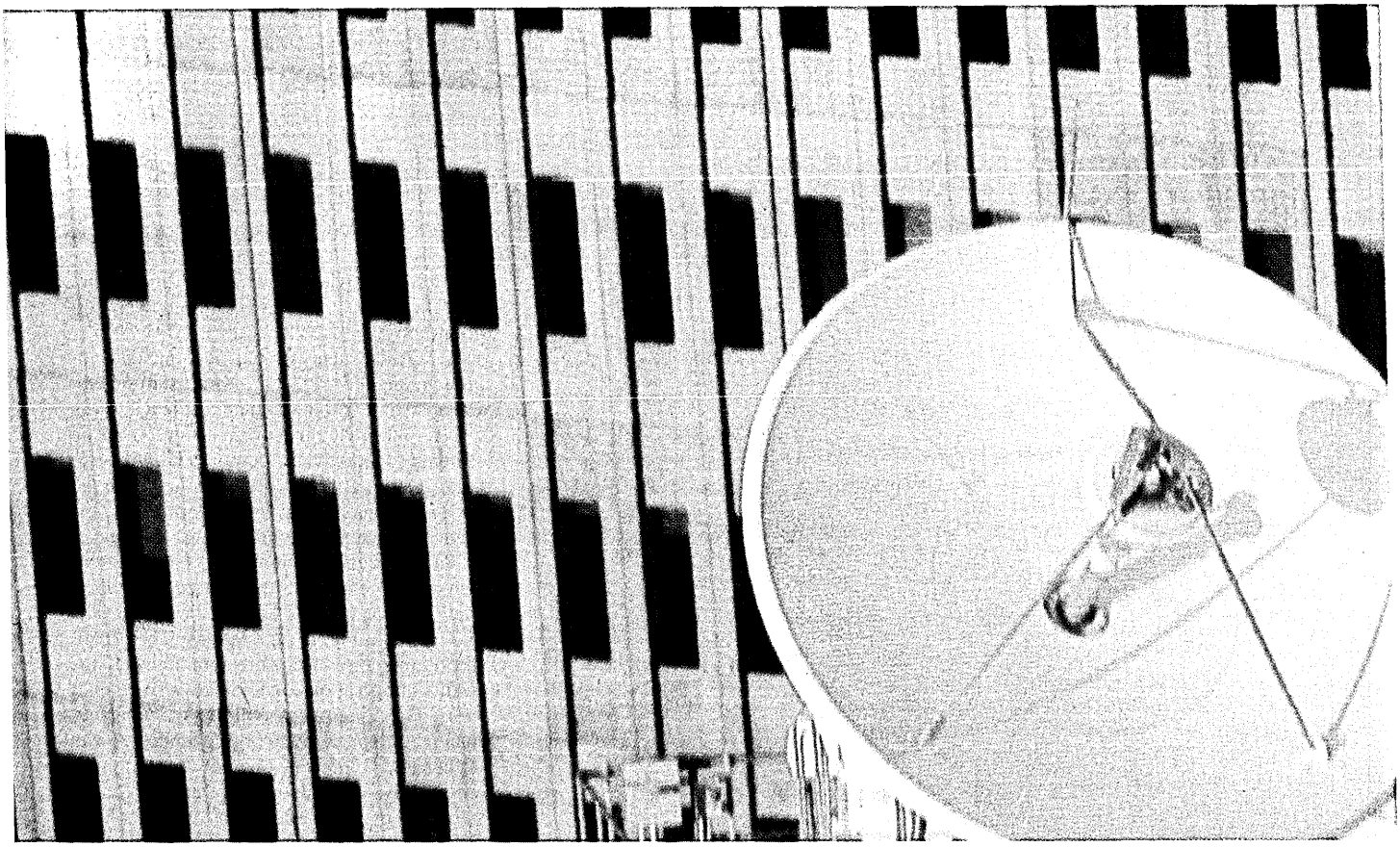
ators together with a mechanism for arithmetic calculations, such as finding the depreciation above.

Aldat stands for the algebraic data approach, and the project has resulted in several variants of a database management system called MRDS, running on machines from an Amdahl to an Apple; a commercially distributed database/library system called MINISIS; and two implemented versions of the information system programming language, Aldat. The basis of the project is the relational model of data, and the relational algebra. The files ROUTING, FIXED ASSETS, EQUIPCOST, and others in Fig. 6 are relations. The principle of operational closure requires that the results of operations on relations also be relations. The principle of avoiding the von Neumann bottleneck by working entirely with higher-level objects—namely relations—simply says that relations are atomic for the purposes of data processing, and that their internal structure is not of concern to the programmer. These two principles form the basis of an algebraic approach, and the Aldat project has sought to exploit and extend the formalism of the relational algebra.

The theme of our extensions to the relational algebra has been "utility controlled by generality." We have not invented a new operator unless a practical need for it has arisen, and we have not permitted any operator that does not fit into a general conceptual framework. We insist on generality for the sake of fundamental user friendliness. A single conceptual framework avoids ad-hoc operators, special cases, and the general difficulty in understanding and using the relational algebra. The result is three families of related operators and an integrated mechanism for doing arithmetic.

The first is a family of unary operators that includes the extraction operation used in the equipment cost calculation. This extraction is called projection in the relational algebra and serves to extract certain fields of the relation, such as the columns ASSEMBLY, EQUIP, and HOURS from the relation ROUTING in Fig. 3. The complementary operation is called selection. It extracts records—selecting, for example, all rows of ROUTING for which EQUIP = Gluset. The family that includes projection and selection permits extraction of arbitrary combinations of rows and columns and adds the facility of quantifying the extraction, as in a request for all items of equipment used for at least two assemblies (answer from ROUTING: EQUIP = Gluset, Wheel Jig).

The other two families are those of binary operators. The first includes both merges used in Fig. 6. The merge of Fig. 2 finds records having common values in both relations of the specified attributes: in rela-



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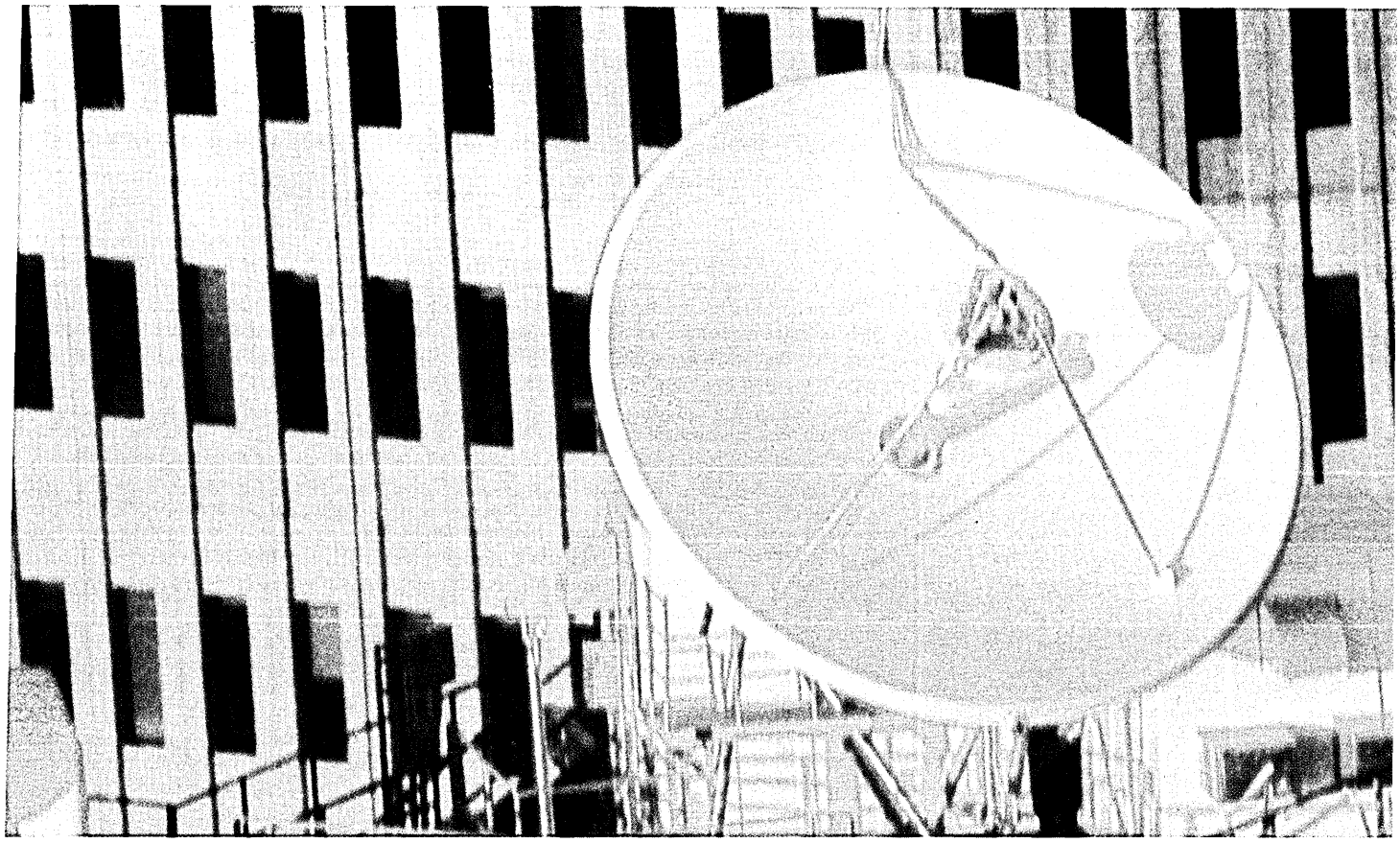

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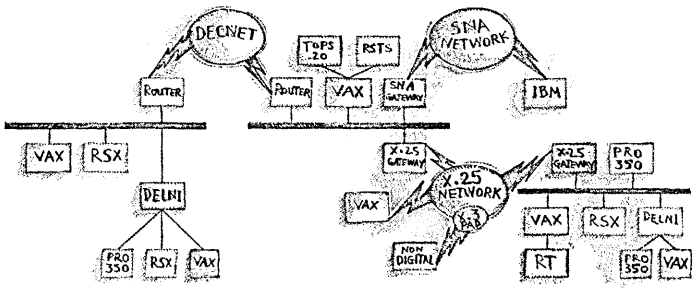

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The three families of relational operators provide more power for data manipulation than any other body of operators discovered.

tional terminology, it is the natural join. The other merge in Fig. 6 is the *outer join*, which incorporates records from both relations whether they match or not. Both of these merges belong to a family of relational joins that result in a relation built from the two operand relations according to whether or not they match on specified attributes.

COMPARE SETS OF VALUES

The second family of binary operators is not illustrated in the manufacturing costing example. It is used to compare sets of values of specified attributes on two relations. For instance, to find what equipment from ROUTING is used to make both assemblies from the set [Car, Caboose], we would use one of these joins (the one called relational division) on ROUTING and the set [Car, Caboose]; we'd find that Gluset was the only equipment used. Another operator in this family (called natural composition) can be applied to ROUTING and the set [Toy Train, Locomotive] to find the equipment used to make either one of these assemblies, or [String Stapler, Wheel Jig].

These are brief descriptions of the three families of relational operators in the relational algebra. They provide more power for data manipulation than any other body of operators discovered; yet they form only three closely integrated families of operators, each easy to understand and define in terms of the other members of its family.

Arithmetic operations may seem easy to add into this framework—just define a few operators like + and × and some functions like AVG, MAX, SUM for scanning down the column of values of an attribute. But this method is inflexible and ad hoc; it is more rewarding to integrate arithmetic more closely into the relational framework. We again do this with an algebraic approach—this time an algebra of attributes, which allows us to operate on attributes to create new attributes. There are two main classes of attribute operations, a horizontal class and a vertical class. The horizontal class is illustrated by the calculation of depreciation in the equipment cost calculation above. The vertical class performs totals, subtotals, and other more subtle computations on the column of values of an attribute. Each class results in a new attribute, whose values can be actualized in a relation by naming the attribute in a relational operation, such as projection. This actualiza-

FIG. 4

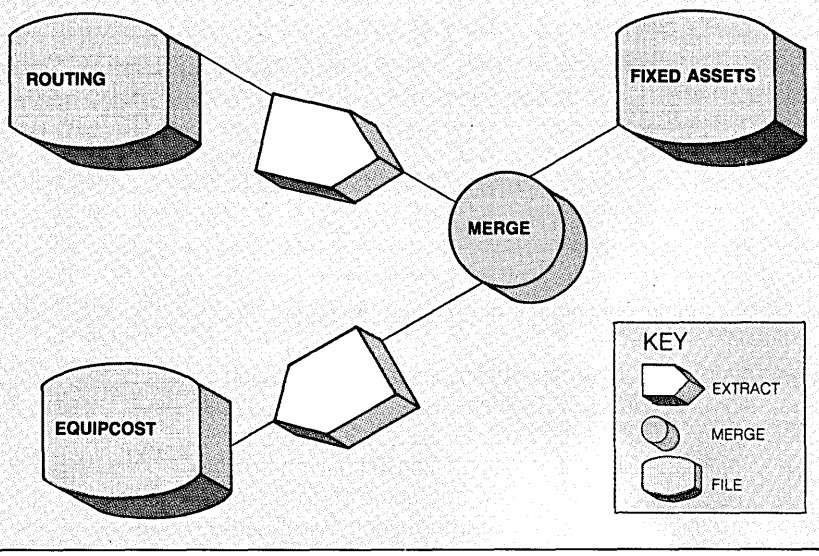
OUTPUT OF EQUIPMENT COST CALCULATION

EQUIPCOST

(ASSEMBLY	EQUIP $)
Car	18
Caboose	6
Base	18
Body	6
Locomotive	18
Toy Train	48

FIG. 5

EQUIPMENT COST CALCULATED USING STANDARD OPERATORS



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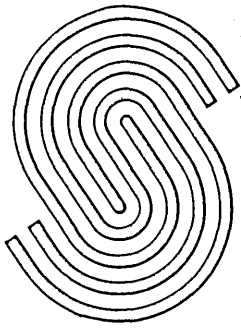

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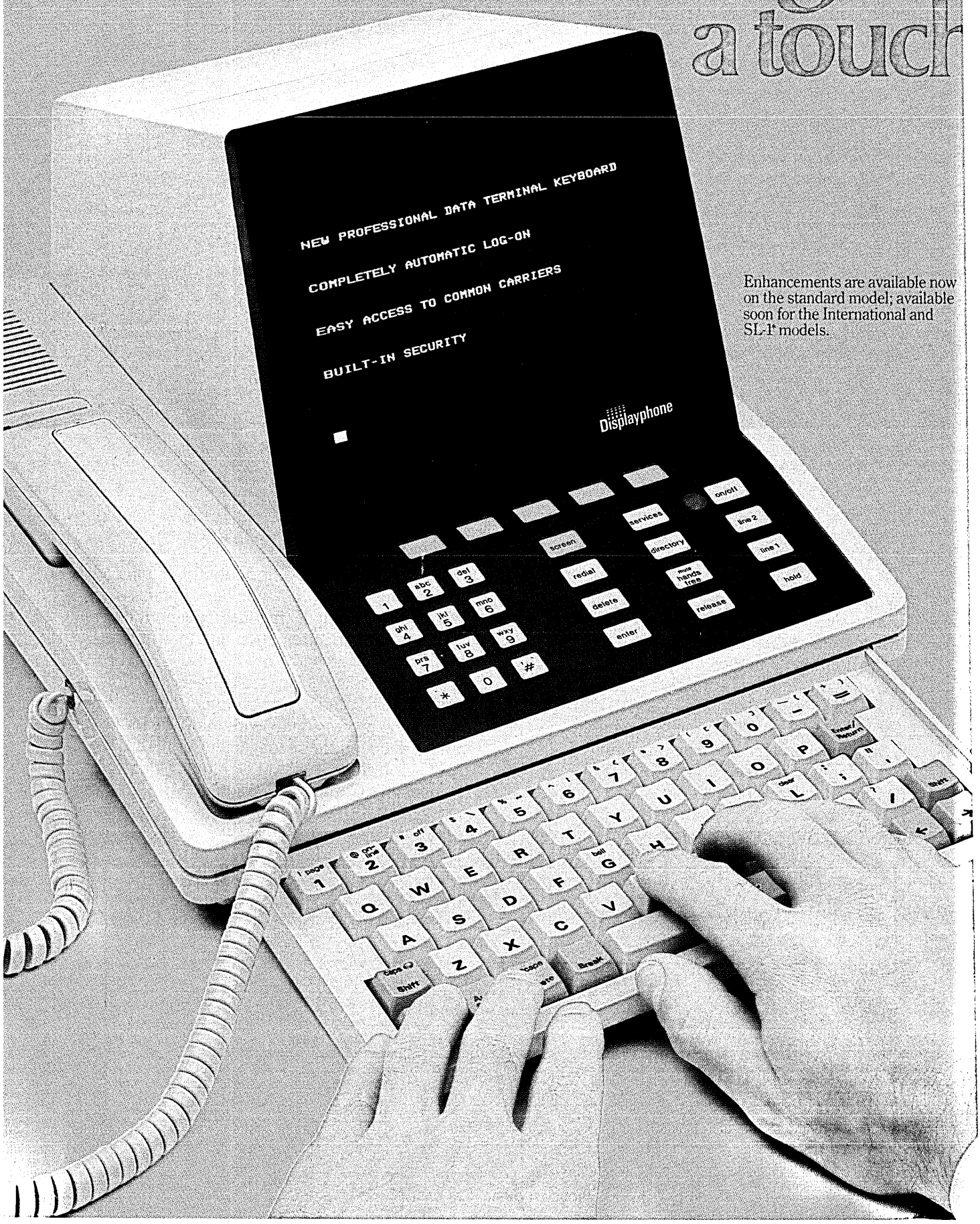

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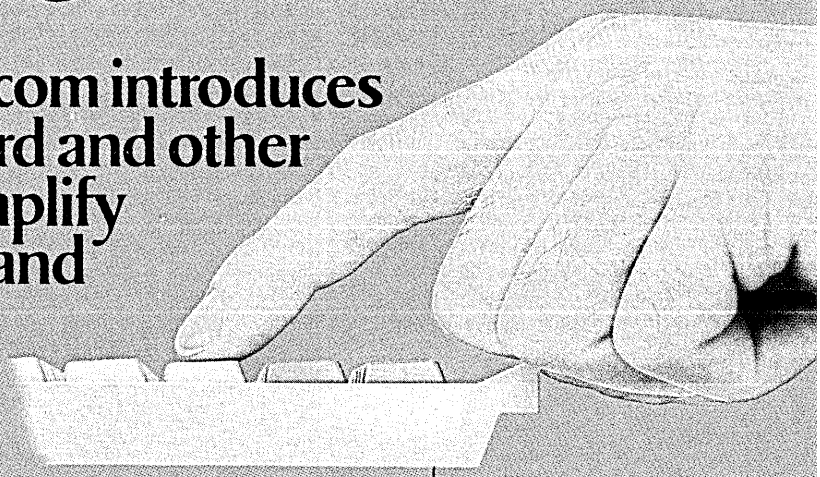

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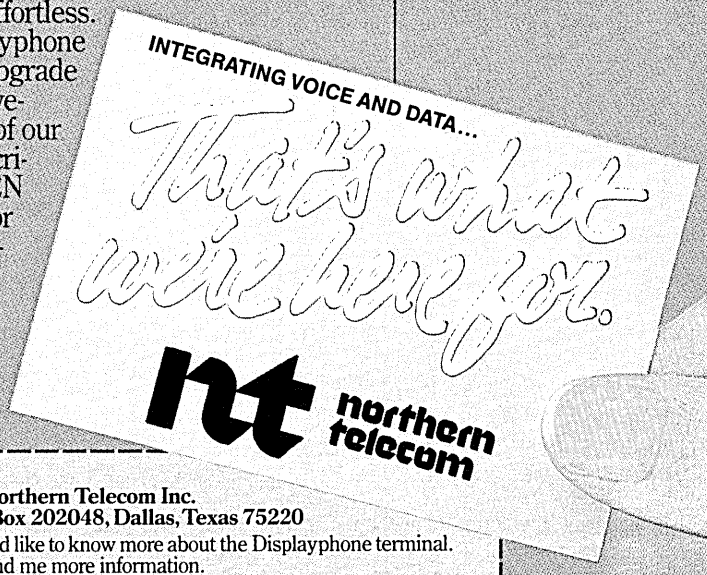

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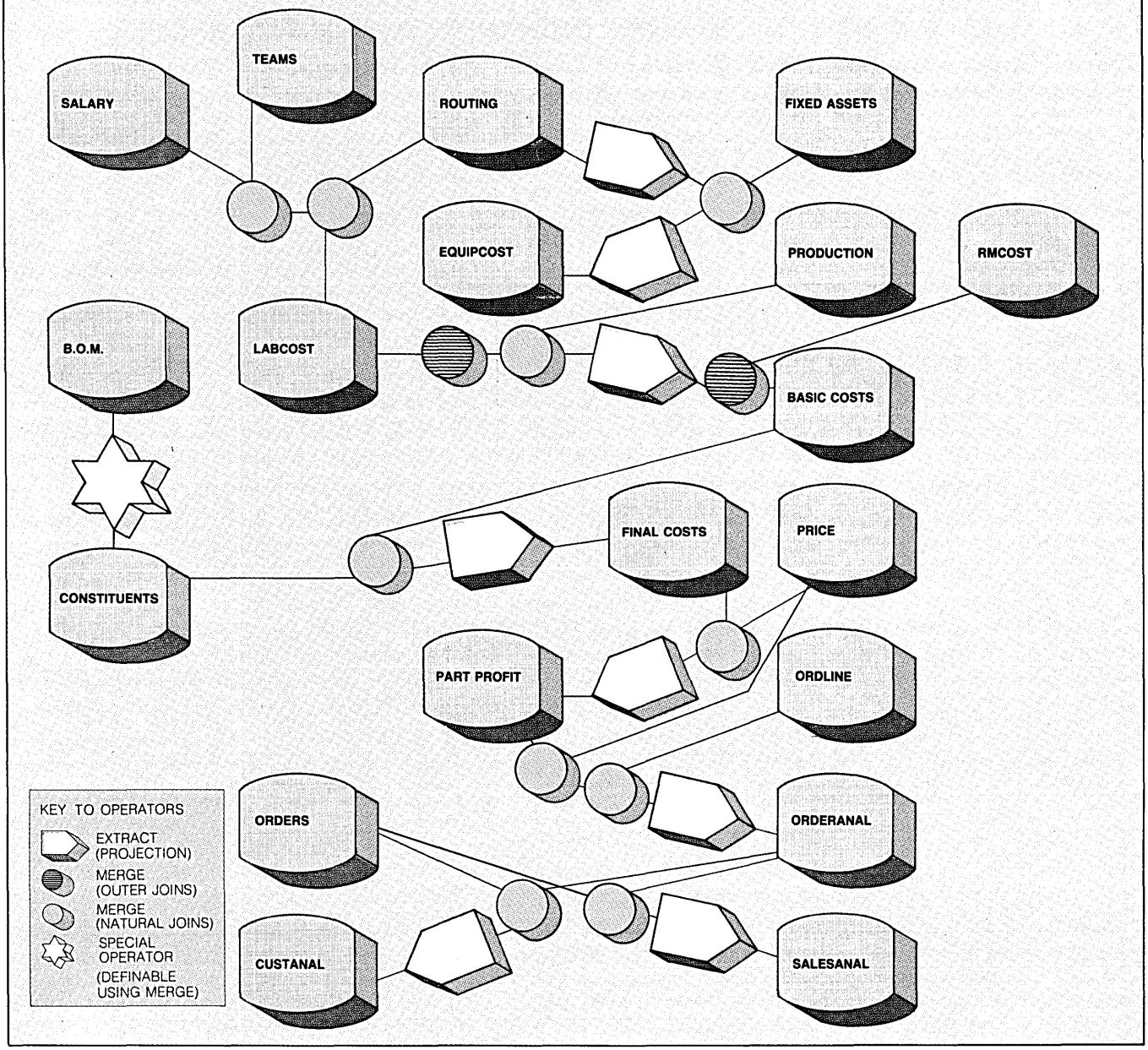
Atomicity helps us avoid the von Neumann bottleneck in our thinking.

FIG. 6

MANUFACTURING COSTING USING STANDARD OPERATORS



tion is the only interaction between the relational algebra and the algebra of attributes, so attributes can be manipulated freely and independently of their participation in relations.

The three families of relational operations and the two classes of operations on attributes provide a great deal of flexibility, and empirical research finds that they are sufficient for a wide variety of information systems implementations. At the same time, they satisfy the algebraic principles of closure and atomicity. Closure requires the results of an operation on relations to be a relation, so that an elaborate system of relational operations can be built. Atomicity saves us from looking at the internal structure—the individual records—of the relations, thereby avoiding the von Neumann bottleneck in our thinking and, in principle, in the implementation of the operators. Algebraic data processing techniques can save information systems programmers from having to work with only one computer word at a time, freeing them to deal with more appropriate units of data. ✲

Dr. T.H. Merrett is associate professor in the School of Computer Science at McGill University in Montreal. He has researched the implementation of the relational algebra and the application of database techniques to information systems since 1975, and has published a book on this work (*Relational Information Systems*, Reston, 1983). Before joining McGill University, he worked for IBM (U.K.) Ltd.

HARDWARE

OFF-LINE

Municipalities can rarely be accused of being on the leading edge of computer technology -- especially in California, where cities are still feeling the effects of the Proposition 13 tax-cutting legislation and the deficits that followed the tax revolt. But the city of San Francisco is an exception. The police department there has plunked down $1.6 million for an advanced computer system that makes it possible to clarify, match, and trace the origins of fingerprints or even partial prints left at the scene of a crime. In order for the SFPD to acquire this sophisticated equipment, some old-fashioned grass roots politicking had to take place. A citizens' group called the Crime Lab Fund began gathering support and contributions for the fingerprint system, and forced a citywide referendum to win approval of the system. The Automated Fingerprint Identification System consists of optical recognition equipment, high-speed processors, disk drives, NEC Advanced Personal Computers, and NEC Spinwriter printers. The system is able to check fingerprints at the rate of 650 per second. It already has a database of some 500,000 prints that is enlarged daily. Fingerprints can be searched, graphed, plotted, clarified, enlarged, scanned, and then electronically matched against the database. The police department says it is happy with the initial results of the system, which is already credited with helping to solve or bring about arrests in 76 burglaries, two rapes, five robberies, and 10 homicides. With a little luck, "Hill Street Blues" will have a similar system soon.

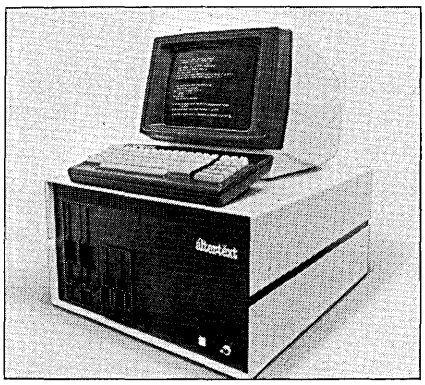
AT&T has thrown its hat into the general purpose computing ring with a line of machines ranging from a desktop multi-user supermicro to a supermini, all based on the 32-bit WE 32000 microprocessor and the Unix operating system. The line can handle from one to 100 users, and includes some noteworthy features. The line's Unix finally includes some real-time capability in a fault-tolerant environment, and it offers compatibility with the ubiquitous IBM Personal Computer. The company also brought out two networking products and gave its blessing to Ethernet.

In presenting the product line, AT&T Technologies ceo James Olson didn't really say anything earthshaking -- but then, the 3B series can hardly be called a surprise. Olson confirmed that the entire line, except for the supermicro, has been in production use in what is certainly a demanding environment: the nation's telecommunications system. Nor were there any surprises concerning what was not announced: no comments were forthcoming about the widely rumored personal computer at the low end or the less likely possibility of mainframe processors. It seems unlikely that AT&T would want to lock horns with IBM in IBM's two strongest areas so soon after the divestiture; better to wait until the current line is installed in several locations and firmly established in the marketplace. Moreover, even with its current enhancements, Unix System V is less than an ideal mainframe operating system -- especially as more users turn their mainframes into timesharing boxes.

Whether or not any of the prospective products ever becomes reality, Olson insists AT&T is in the market to stay, with plans to introduce products in communications, networking, and computer integration. Expect these products to match industry standards, such as the IBM PC interface. Didn't RCA, GE, and Xerox say the same things 15 years ago?

PROTOCOL CONVERTER

The Altertext Communicator is a screen-based protocol converter that can read and write floppy disks used on personal computers. It permits direct exchange of text, codes, and commands between previously incompatible word processors, typesetting equipment, and computers. The unit translates all codes and format commands so that information can be retrieved on equipment from numerous manufacturers. According to the vendor, virtually any combination of incompatible computer-based devices can communicate simultaneously through the device.

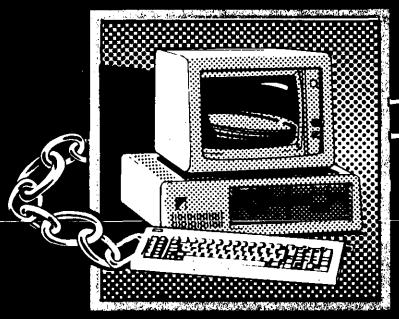


In addition to its communications capabilities, the unit is equipped with a CP/M operating system so it can also be used as a standalone desktop personal computer. The system consists of a Z80 microprocessor with 64KB of RAM, a 9-inch crt with 24 lines of 80 characters, a detachable keyboard, a proprietary communications program built around the company's A code, one 5¼-inch 420KB floppy disk drive, four parallel ports, and three RS232 serial ports.

It receives data via communications using a modem, or directly from another computer-based device via connector cables. Both asynchronous and bisynchronous interfaces can be used with the device. Information can be transmitted at different speeds ranging from 300 to 19,600 bits per second. The complete system costs $12,000. ALTERTEXT INC., Boston, Mass.

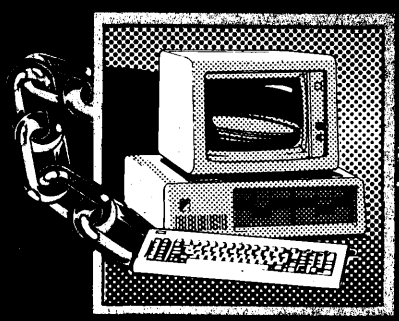
FOR DATA CIRCLE 302 ON READER CARD

Does your MICRO-TO-MAINFRAME LINK look like this?



hundreds of companies have installed TEMPUS-LINK because it provides:

- ☐ **simple** file transfers such as PC/DOS* Copy
- ☐ **better performance** than batch communications
- ☐ **executive friendly** for all PC/DOS applications
- ☐ **independence** from the communications devices
- ☐ **distributed processing** from PC/DOS applications
- ☐ **continuity** by adhering to PC/DOS standards



- ☐ TEMPUS-LINK micro operates under PC/DOS (or MS/DOS**) on IBM-PC* and many other compatibles.
- ☐ TEMPUS-LINK mainframe operates in CICS*, IMS*, TSO*, CMS* under DOS/VSE*, OS/VS1*, MVS*, VM*.
- ☐ TEMPUS-LINK supports major communication devices in 3270 and Asynch modes.

For information contact:

MICRO TEMPUS INC.
440 Dorchester Blvd. West, Suite 300
Montreal, Quebec H2Z 1V7

Phone: 514-397-9512
Telex: 055-61829
U.S.: (800) 361-4983

MICRO TEMPUS INC.

*Trademarks of International Business Machines Corp.
**Trademark of Microsoft Corporation

CIRCLE 91 ON READER CARD

HARDWARE

TELEPHONE TRANSACTION PROCESSOR

This telephone transaction processor is designed for manufacturers, distributors, and college registrars. The VCT Series 2000 handles transactions via Touch-Tone phone using a digitized human voice stored on a disk. The system also confirms each order or transaction by number and description

The system is software and hardware complete. The Order-Matic software is designed specifically for order processing tasks within the distribution and supplier industries.

The VCT Series 2000 is designed to be interfaced to the company's host computer. The vendor will write the software to accomplish this. It can be run on-line or in batch mode. The vendor says the system is completely selfinstructional. The computer's voice guides callers through the process with step-by-step instructions on how to enter an order using Touch-Tone buttons.

With the basic system, up to four hours of inventory descriptions and customer names can be stored. The unit can process eight phone lines simultaneously, and the two-line system can handle 120 call minutes per hour. The voice prompts and messages can be custom-made for individuals. The unit can also do electronic mail. The two-line VCT Series 2000 costs $27,325, and increases in cost by $7,400 for each additional two lines up to eight. VCT CORP., Washington, D.C.

FOR DATA CIRCLE 303 ON READER CARD

PRINTERS

The 1770 color ink jet printer and the 1730-336 character printer are intended for use with personal computers, microcomputers, and other business computer systems.

The 20cps 1770 printer features switch selectable unidirectional and bidirectional printing. The printer can integrate text and graphics on cut sheet or roll paper in seven colors. The 1730-336 prints at 40cps and includes the PC Graphics 12 printwheel and associated electronics for printing the characters that the IBM PC can display. In addition, the 1730-336 is compatible with the standard line of Xerox 1730 character printers. Users can select more than 200 Diablo and Xerox printwheels in 10, 12, and 15 pitch type.

With the 1730-336, metal printwheels can be used where letter-quality printing is required, while plastic printwheels can be used for high-speed printing. The 1770 color printer has 120 dots-per-inch resolution, a 96-character ASCII set and an additional set of 64 mosaic graphics characters for graphic representations. It also has bit-mapped printing capability. The 1770 is packaged with a Centronics parallel cable. The single unit purchase price for the 1770 color printer is $1,250. The 1730-336 costs $2,600. Volume discounts are available for both printers. XEROX CORP., El Segundo, Calif.

FOR DATA CIRCLE 304 ON READER CARD

KEYBOARDS FOR HANDICAPPED

This vendor offers replacement keyboards for handicapped people who have difficulty with a regular one. Individuals not having the use of two hands can fully operate the IBM PC or Apple II with these corresponding keyboards. This is possible with the employment of alternate action switches on the shift, control, and alternate keys Alternate action key switches overcome the obstacle of having to depress one of these keys and another key simultaneously. The keyboards feature low-profile design, microprocessor electronics, solid state capacitive switches, and familiar key location. The vendor says the mouse, special keyboards, and voice recognition input devices will help handicapped users eliminate computer operation barriers. KEY TRONIC CORP., Spokane, Wash.

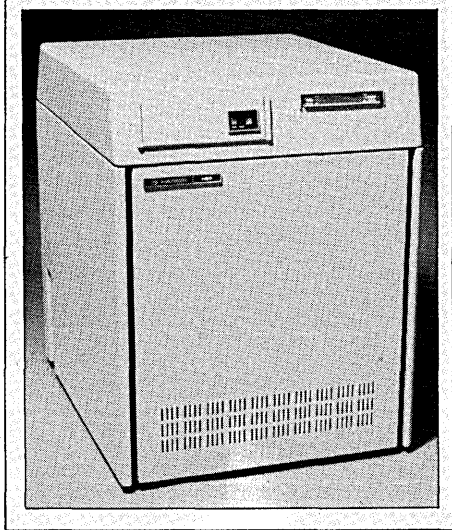
FOR DATA CIRCLE 305 ON READER CARD

HARDWARE SPOTLIGHT

LOW-END SUPER-MINICOMPUTER

The Harris 60 superminicomputer is a low-end unit with nearly 1 MIPS performance. It is targeted for business, engineering, and scientific uses. It is software-compatible with other Harris systems, and its multi-user applications include distributed processing, office automation and decision support, multiple CAD/CAM workstations, scientific/engineering R&D, and real-time processing.

The Harris 60 can support up to 32 users concurrently. Its communications capabilities include industry standard remote job entry protocols. The unit can support local and wide area network protocols, providing users with file transfer and virtual terminal access between systems. X.25 networking is available for cpu-to-cpu communications, and the system is supported by the VOS operating system.



The unit is housed in a 30 by 19 by 30½-inch cabinet. It delivers up to .85 MIPS performance in single precision and .81 MIPS in double precision, measured by the Whetstone benchmark. The unit uses VLSI/LSI circuits and has 256K RAM memory circuits. A floating point processor is optional.

The unit uses standard 110 power, and requires no special electrical hookup. The basic system includes a two-board cpu, communications controller (expandable to 16 lines), one 80MB, 8-inch Winchester disk drive, one 23MB ¼-inch cartridge tape drive, an operator communications terminal as a systems console, and the VOS operating system.

The main memory of the unit is expandable to 12MB. Each integrated subsystem module includes a memory controller and 6MB of memory. Separate peripheral expansion cabinets allow more disk and tape storage. Prices for the basic Harris 60 super minicomputer start at $69,500. HARRIS CORP., Computer Systems Division, Fort Lauderdale, Fla.

FOR DATA CIRCLE 300 ON READER CARD

NETWORK ANALYZER

The HP 3577A network analyzer is designed for bench use or automatic testing. Measurements can be made over the analyzer's 100db dynamic range with up to 0.02db and 0.2 degree dynamic accuracy. In the 1Hz resolution bandwidth, low-level measurements can be made with -130dbm sensitivity. The display marker shows points of interest to 0.001 dB, 0.005 degree, and 0.001 Hz resolution.

The unit provides a three-input receiver, graphics display, and synthesized source. The companion HP 35677A or HP 35677B S-parameter test set can be used with the HP 3577A to make reflection measurements such as return loss, reflection coefficient, and impedance in 50 or 75 ohm systems. These test sets also allow simultaneous display of both transmission and reflection parameters.

An autoscale puts the measurement on the screen with a full-scale display; output can also be sent directly to a graphics plotter (without a computer intermediary) for hardcopy documentation. User-defined vector math is provided in order to present the results in the form needed; the unit supports multiple display formats with electronics graticules for accurate displays in rectangular, polar, or Smith-chart coordinates.

The unit is compatible with the vendor's HP-IB interface bus. The HP 3577A is tagged at $23,500. The HP 35677A (50 ohm) and HP 35677B (75 ohm) S-parameter

HARDWARE

test sets are $3,500 apiece. HEWLETT-PACKARD CO., Palo Alto, Calif.

FOR DATA CIRCLE 323 ON READER CARD

PROGRAMMABLE TERMINAL

The UTS 60 is a programmable terminal with color graphics capabilities. It can also function as a personal computer using the CP/M-68K operating system. The standard version comes with eight colors, and another eight colors can be added on an optional basis.

The graphics capabilities can be used either on-line with an 1100 series host or in a standalone capacity using a business graphics package. Other graphics are provided as part of the Mapper applications development system.

The system uses an MC68000 central processor and a Z80 as a secondary processor to control the peripherals and the video section of the system. The unit is also equipped with 128KB of memory and can be expanded to a maximum of 2MB.

Software includes an edit processor, a file transfer utility, business graphics, UTS COBOL, and a character set utility. A tty utility and communications utility are also available when the unit is operated a sa personal computer.

Peripherals for the UTS 60 include a diskette subsystem, a correspondence-quality printer, matrix character printer, and a mass storage subsystem. The terminal costs $5,610. SPERRY COMPUTER SYSTEMS, Blue Bell, Pa.

FOR DATA CIRCLE 316 ON READER CARD

COAX INTERFACE

This coax interface adds PC-to-mainframe windows to IBM Personal Computers and their lookalikes. The unit lets IBM PCs function as IBM 3270 PCs.

IBM PCs with the Attachmate-3270 can operate as a maximum of four 3278 terminals when connected to mainframes. Seven different sessions, including the four mainframe sessions and a PC program, can be in separate screen windows. Mainframe access security is controlled with a lock and key.

The unit also lets PCs connect via coaxial cable to all 3274 and 3276 control units, and use in-place BSC and SNA networks. PCs can share 3270 family printers, and files can be transferred and data shared with a host mainframe and with other PCs. The unit also lets PCs become 3287 printers and access data to print, process, send, or save. No PC memory is used and 256 KB is optionally included on the board. The standard Attachmate-3270 costs $910. ATTACHMATE CORP., Bellevue, Wash.

FOR DATA CIRCLE 315 ON READER CARD

HOME CENTER MICRO

This turnkey business computer system is designed for the building material and home center industries. The Champ is a 16-bit multi-user, multitasking microcomputer, which has a standard configuration of a cpu with 128KB of RAM, a 30MB hard disk drive, a 64 lpm bidirectional printer, and two model 4200 terminals.

The basic system can accommodate up to six terminals. The system can be upgraded to 256KB to handle up to 15 terminals. A 300 lpm band printer and cash drawer modules are also available.

Champ is designed to be operated by users without previous dp experience. Two software packages area available for the system.

Lumber-Data and Distribu-Data can assist the user with billing, inventory, purchasing, accounts receivable, accounts payable, general ledger and sales analysis. Another feature of the software is its ability to do unit conversions and measure lumber in 28 units of measurement.

The video display is an 80-column by 24-line 12-inch green phosphor display screen. The Champ is priced at $35,000. STORAGE TECHNOLOGY CORP./ULTIMACC BUSINESS SYSTEMS GROUP, Waldwick, N.J.

FOR DATA CIRCLE 314 ON READER CARD

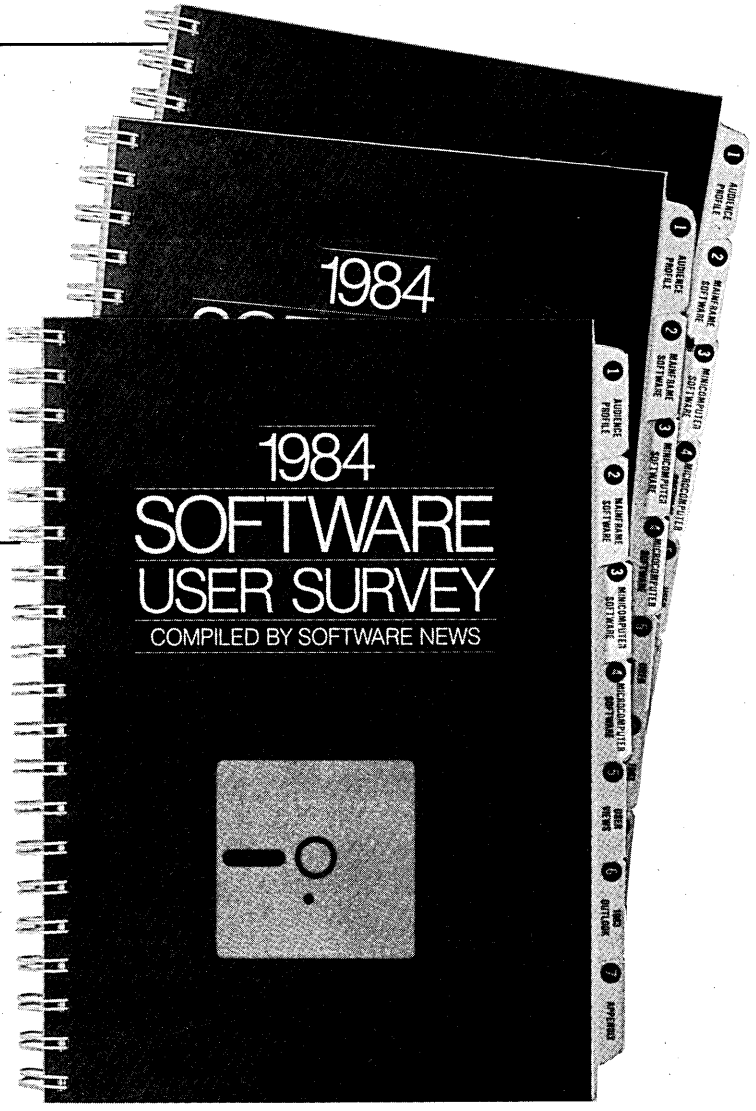
—Robert J. Crutchfield

CIRCLE 93 ON READER CARD

SECOND ANNUAL

Software User Survey Forecasts Prosperity and Problems for Major Vendors

Be prepared for some eye-openers in 1984's software market...order your personal copy of the Software User Survey today



The results are now in from the second annual Software User Survey conducted by Software News. Over 2000 major national accounts participated.

Virtually every sector of the U.S. economy was polled...banks, insurance firms, manufacturers, distributors, medical and legal groups, educational institutions, systems

iouses, process industries, :tc. The respondents iden- ified the software)ackages they are now ısing and what they plan o buy in 1984. The main- rames, minis and micro- :omputers currently in use ınd those planned for pur- :hase in 1984 are also dentified.

The 200-page report of :he survey results ranks :he leading software vendors by their relative market shares. The expected increases in 1984 software expenditures are analyzed separately for mainframes, minis and micros. Twenty-seven specific categories of applications and systems software were studied to identify the fastest growing segments. Examine the Table of Contents for more details.

Partial Table of Contents

System Accounting in VM

Who Has Their Hands in Your Information Center?

Just six months ago, you told your executive committee that the proposed computer system for your Information Center would meet the corporation's needs for two years. Now it seems the system will be saturated in the next two months. Your chief executive wants to know why.

Your staff is able to identify individual users, but cannot track each user's resource consumption. You cannot identify where the overrun is.

System accounting in a VM interactive environment inherently demands a different approach than you may expect. VM just doesn't provide the raw accounting data offered by other systems. Still, you need to account for system and resource usage in your VM Information Center.

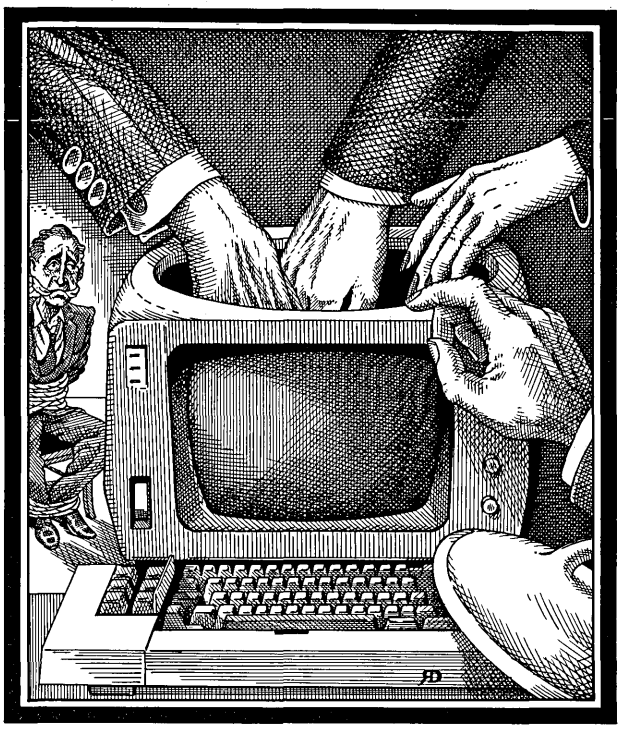
PERSPECTIVE

Many MIS and DP executives began their careers in the MVS environment, and consequently view system software product evaluations from an MVS perspective. A *VM based* Information Center though, simply does not fit into the MVS world. That is not to say that VM is inherently better; it's just very different.

HISTORY

MVS has been a strategic product for IBM since at least the early 1970s. This strategic "label" caused IBM to devote substantial development resources, over a long period, to enhancing MVS and all of its component parts. The success of this long term effort shows today. MVS is a robust, full featured, reliable, and stable *batch* operating environment. But as an interactive support environment, it is seriously deficient in terms of productivity and end-user friendliness.

This deficiency created the need for VM. The explosive growth in the number of VM sites is largely due to VM's clear superiority over MVS as an interactive decision support environment. As the Information Center and Development Center concepts grew in popularity, IBM labeled VM as a "highly strategic" product and began to devote extensive development resources to enhancing the product. IBM's VM



development team is moving aggressively to close the enhancement gap between MVS and VM.

SYSTEM ACCOUNTING

A good example of the difference in relative sophistication of features between MVS and VM internals is in system accounting.

MVS allows you to collect over 200 different types of records from the Systems Management Facility (SMF) and the Resource Management Facility (RMF). Independent software vendors have created products that allow this SMF and RMF data to be summarized and reported in a myriad of useful ways. The key to this success is that MVS itself offers native realtime collection and management of these records in the SYS1.MAN data sets.

VM in contrast produces only six basic accounting records. Many more are required before system accounting in VM will reach the level of sophistication enjoyed by MVS. No software vendor can build a VM accounting product as complete and strong as the existing MVS products because the raw data just isn't available in VM. Many enhancements to MVS accounting came as a result of pressure from IBM user groups. These groups are placing similar pressure now on IBM to enhance VM accounting. VM *will* evolve substantially, but you need resource accounting now.

YOUR ACCOUNTING NEEDS

What is important to the MIS or DP manager in an interactive decision support environment? The accounting demands of MVS and VM system accounting are externally similar, but with significant internal differences. The needs are the same, but the implementations are different.

Let's look at your needs from an overall management perspective. First, if you are running an Information Center under VM, you don't have the control over resource consumption that you would under MVS, nor do you have the predictability of the timing of resource demand. Other departments can consume huge portions of your resources without notice, and worse, without accountability.

Next, you may be forced to fund large software purchases for another department with no way to recoup the cost or even determine whether the acquired software product is being used.

Similar problems exist in project accounting. You must be able to track expenditures to budget and enforce budget controls by project.

To be accurate in a VM environment, this data must be collected realtime. Batch accounting is sufficient for a batch environment, but for pure interactive work, only realtime accounting is timely enough.

Of course you also require the ability to do the traditional system accounting functions of invoicing, management reporting, auditing, and security enforcement.

WHAT IS YOUR SOLUTION?

The senior developers at VM Software Inc. have the experience to force an accounting system to meet these needs through extensive modifications to VM internals; but this would be a serious mistake. IBM is moving so aggressively to enhance VM that there is no way to ensure that internal modifications to VM made by an independent software vendor today will operate on the next VM release. This is an assurance you must have before you acquire any software package. An effective VM accounting system *must* work within the existing framework of the VM environment, yet allow for future VM growth.

We at VM Software Inc. have developed six products that work together to help you run your VM Information Center more efficiently. VMACCOUNT meets the resource accounting needs discussed above. Perhaps more importantly, VMACCOUNT is specifically designed to grow in sophistication as IBM enhances VM to collect and report more detailed data on system usage. VMSI, as the leading vendor of VM system software products, understands the intricacies of VM and the needs of VM Information Centers. VMACCOUNT is designed to meet these needs, now and in the future.

VM Software Inc.
2070 Chain Bridge Rd.
Suite 355
Vienna, Virginia 22180
(703) 821-6886

SOFTWARE AND SERVICES

UPDATES

At a recent microcomputer seminar, one of the speakers noted that each of the larger software houses had produced only one product that was highly successful in the marketplace, and he mused whether any of these companies could duplicate its initial success with an equally profitable follow-up product. So far, no micro applications software vendor has been able to accomplish that feat, and this summer the industry will see whether two big companies can pull it off. Ashton-Tate, which has been unable to match the success of its dBASE II package with later products such as Friday! and Bottom Line Strategist, will start selling Framework. Lotus Development Corp., publisher of last year's top-selling 1-2-3, begins rolling out Symphony next month. Both firms will offer current users of their products incentives for buying the new software. Lotus has already said it will offer the 240,000 users of its 1-2-3 the chance to buy Symphony for $200 with a trade-in. Ashton-Tate says it will offer the 200,000 dBASE II users a similar deal. Symphony and Framework each costs about $700 without any trade-in. Both vendors plan aggressive advertising campaigns to coincide with initial shipments, and plan to go after the corporate market as well as the retail environment.

Even as Lotus begins shipping Symphony on the IBM PC, it is revising its manufacturing plan for 1-2-3. The earlier product is currently available on 10 micros (plus those that are fully IBM compatible) pretty much chosen on the basis of their market share. But market share isn't everything, Lotus has decided, since it is discontinuing the 1-2-3 version for the Victor 9000 computer. Although its market share is respectable, the machine's maker, Victor Technologies Inc. of Scotts Valley, Calif., is in the midst of bankruptcy proceedings. Lotus vice president of sales and marketing Jim Manzi said that Victor's financial problems led Lotus to quit making 1-2-3 for the 9000. Lotus will, however, support all 9000 users who have already purchased 1-2-3. Lotus separately announced that it will offer 1-2-3 for the Tandy TRS-80 model 2000 micro on the assumption that Tandy's 1,000 computer centers and 8,000 Radio Shack outlets can move the product well.

Although Lotus sells primarily through corporate channels, its acknowledgement of Computerland and Radio Shack reflect the software industry's perception that retail outlets are still doing well. Future Computing, the Dallas-based market research firm, predicts that the number of computer specialty retail stores will double by the end of 1988. The firm says that there are about 3,200 such retailers today, up from 2,500 a year ago. Future Computing found substantial growth in company-owned and franchised chains during the second half of 1983.

Data General prides itself on being an office automation company with strong emphasis on software, and its recent debut of the CFO financial package was indeed impressive. Still, one wonders whether company management believes that line. The news conference announcing CFO, like the CEO debut two years ago, did not have any of the flamboyant frills for which DG is known, nor did it feature company president Edson de Castro, as past hardware announcements have. Indeed, one DG insider says that de Castro is "strictly a hardware man. He's not that interested in software." Too bad, since CEO and CFO deserve more interest.

ARTIFICIAL INTELLIGENCE

Expert-Ease is a software product that enables the user to construct systems without any knowledge of programming. After inputting data about a given subject, the user can consult the computer for an opinion about the subject. The program can serve organizations large or small, including businesses, schools, and government agencies. Other potential users include people who work extensively with information, such as lawyers, brokers, writers, and salespeople. The program is an aid in decision-making.

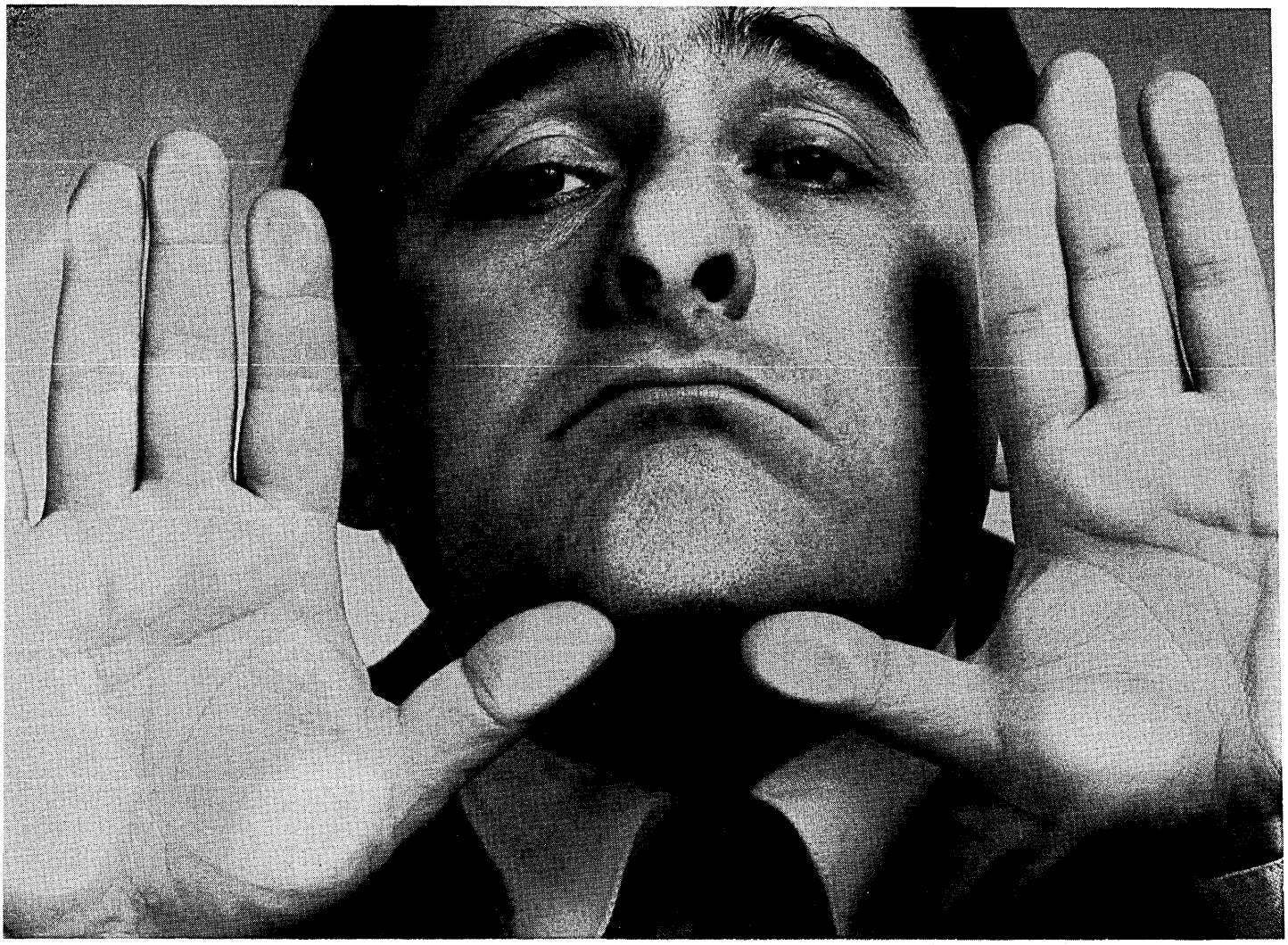
Designed in spreadsheet format, this package collects data by guiding the user through a series of simple prompts. The program can answer questions based on the information fed previously into the computer. The system's central concept is to define things by listing their characteristics.

According to the vendor, this software does more than regurgitate facts that someone has stored. It spots patterns among facts and forms logical conclusions. Its powers of logic enable the package to zero in on the answer to a user's question. In effect, the program can eliminate illogical or irrelevant possibilities among its selection of answers. Expert-Ease operates on the IBM PC and PC compatibles. The software is based on artificial intelligence research done at the University of Edinburgh. SOFTWARE INTERNATIONAL LTD., San Francisco, Calif.

FOR DATA CIRCLE 328 ON READER CARD

ASYNCHRONOUS OUTDIAL SERVICE

This asynchronous outdial service can be used with a host computer, terminal, or personal computer to send information to an unattended terminal or printer. The host initiates a call that travels across the Tymnet data communications network to a dedicated outdial port on a Tymnet node near the receiving terminal. A 300bps or 1200bps auto dial modem at the port dials the telephone number provided by the host to an auto answer modem at the remote



Finally, an information management system that will never leave you out in the cold.

Your System 34/36 is filled with all sorts of information you'd love to get your hands on. It's all there, so near, yet so far. The problem is you just can't get at a lot of the information without a special program. So unless you're an expert yourself, you've got to wait in line until the pros get around to your problem. And even if you are an expert, you'll be out in the cold until you finish the long, tedious task of writing a new program.

But it doesn't have to be that way. Now there's ExecuTrieve—a complete information management system for the System 34/36 computer that makes everyone feel like an insider. Because in order to take advantage of ExecuTrieve's sophisticated capabilities, the only programming language you need to know is plain, simple English.

ExecuTrieve gives you the ability to locate, display and print exactly the information you want—exactly the way you want it—without getting bogged down in complicated routines. With ExecuTrieve you can create customized reports, select and sort data, perform mathematical calculations, even print charts and graphs—all without knowing a single programming language or needing technical assistance. And ExecuTrieve works with your existing files as they are, so you don't have to restructure or overhaul your present system.

What makes ExecuTrieve so easy to work with is On-Line Software's unique Content Address Method. This powerful new technology makes it possible to find and retrieve information stored in your system, based only on the *content* of the records you need. You simply ask for the data you want—using plain English commands—and ExecuTrieve finds and displays it for you, regardless of whether the information is stored in one file or several, or whether the files were created by ExecuTrieve or by another software system.

You can even extend ExecuTrieve's power and capabilities to your company's PCs with ExecuTrieve's DB/LINK. With it, you'll be able to access data from your System 34/36, and you can also take advantage of OMNIMICRO, a whole package of helpful micro software.

So try ExecuTrieve, and see how easy it can be to get the information you want, when you want it, the way you want it. Now there's no reason for anyone to feel left out anymore.

ExecuTrieve™ for System 34/36 from

ON-LINE SOFTWARE INTERNATIONAL

Fort Lee Executive Park
Two Executive Drive
Fort Lee, NJ 07024
(201) 592-0009
Toll free (800) 526-0272

Contact us for information about our OEM distributor plan

A product utilizing the new Content Address Method™ technology from On-Line Software International.

CIRCLE 96 ON READER CARD

terminal site.

The primary advantage to the outdial service is to allow users to save long distance charges and to defer transmission until late hours, when the originating host, telephone system, and network are least heavily used, and rates are at their lowest. Because the system can be coded to operate independently, company personnel need not be present at the remote sites.

Outdial service will be available in high- and medium-density population areas. With the addition of this service, Tymnet can be used for such applications as printing reports at remote sites, downloading files, or transmitting bills of lading. Financial institutions can program systems to transfer information nightly, and supermarkets can update inventory daily without manual intervention.

It can be useful to service industries dispatching calls from centralized offices to the closest service branches. In high-density areas the service costs $100 per month plus $125 per port. In medium-density areas the port charge is the same, but the service charge is $150 per month. In both areas there is a one-time installation fee of $500. TYMNET INC., San Jose, Calif.

FOR DATA CIRCLE 329 ON READER CARD

WORD PROCESSING

Symphony is a professional word processing system. The screen display and format controls are patterned after those in professional, dedicated word processors. Users can preview documents as they will appear when printed. Other functions include a forms-oriented database, communications, spreadsheet, and business graphics.

The functions of this package can be combined: for example, combining the spreadsheet with the word processor to create a document with embedded tables that change as the spreadsheet changes; adding the database to implement full mail merge capabilities; or using the window management system to display different sections of a document of the screen at the same time or multiple documents simultaneously.

The word processor includes justification, automatic word wrap, insert, delete, erase, copy, move, and search and replace. The screen displays lines and character numbers at all times to indicate the position of the cursor. Format lines can be added to the text to allow automatic indenting of subsections, and the creation of single-spaced paragraphs in double-spaced text.

Printing options include single-, double-, or triple-spaced lines, underlined or boldface characters, subscript, superscript, and headers and footers with automatic page numbers and dates. Symphony costs $700. LOTUS DEVELOPMENT CORP., Cambridge, Mass.

FOR DATA CIRCLE 330 ON READER CARD

CAD/CAE/CAM SOFTWARE

Unigraphics II is an interactive graphics software package for 32-bit processors. It is designed to run on several industry standard minicomputers. The vendor says it is a powerful, flexible, easy to use tool for design and manufacturing engineers, draftsmen, and detailers. It can be used in many phases of product development, including engineering design and analysis, drafting, and generation of numerical control data for manufacturing.

The software has an associative database that permits the user to establish and manipulate links among various pieces of information in ways that help automate design, drafting, and manufacturing. Among the funtions automated by Unigraphics II are the dimensioning of drawings and the development of programs to machine-complex product geometrics.

The software provides tutorial menus to guide the occasional user of the system through the CAD/CAE/CAM process. It also permits frequent users to capture a sequence of menus and speed up the process. The macro capability allows the user to repeat a series of operations at the touch of a key.

The end product of a design developed on this package is a complete and accurate three-dimensional model of the part with all descriptive data stored in the database. Unigraphics II costs $40,000 for small systems and $60,000 for large systems. MCDONNELL DOUGLAS CORP., St. Louis, Mo.

FOR DATA CIRCLE 331 ON READER CARD

FILE TRANSFER

The FileNet series are mainframe-resident software packages that are designed to facilitate the transfer of entire data files between an IBM mainframe and a network of IBM PCs. Complete mainframe files can be downloaded to a PC via a 3270 network and outputted in PC/DOS formats. Conversely, PC-generated data can be uploaded to the mainframe for storage of centralized processing. Data sent to the mainframe can also be made available to other PCs on the network.

To work, the products require an IBM PC or XT equipped with either of Forte's emulation boards. These supply the requisite coaxial network interface, allowing the PC to emulate an IBM 3278 or 3279 terminal when linked to an IBM mainframe.

FileNet programs reside on the mainframe as communications utility software. The PC can access the mainframe and operate in CICS, MSV/TXO, or VM/CMS environments—controlling the downloading and uploading of selected data files within these operating environments.

Security can be maintained by password access, and controlled by an organization's MIS department. Once intitiated, file transfer may proceed unattended for various functions, including overnight report distribution. Both text and binary data transfers are supported. FileNet products

SOFTWARE SPOTLIGHT

UNIVERSAL FILE TRANSFER PACKAGE

A dictionary-driven software transfer program, iLink lets users upload, download, and crossload data files from many IBM PC database or spreadsheet applications to many of the IBM mainframe information center products.

According to the vendor, every PC applications program for data management, graphics and financial analysis which uses data in DIF or CSV file formats is compatible with the product. iLink takes DIF or CSV files and transforms them into mainframe exchange files which the company calls its Information Interchange Format (IIF). It also transforms mainframe data files into DIF or CSV formats for use in the PC.

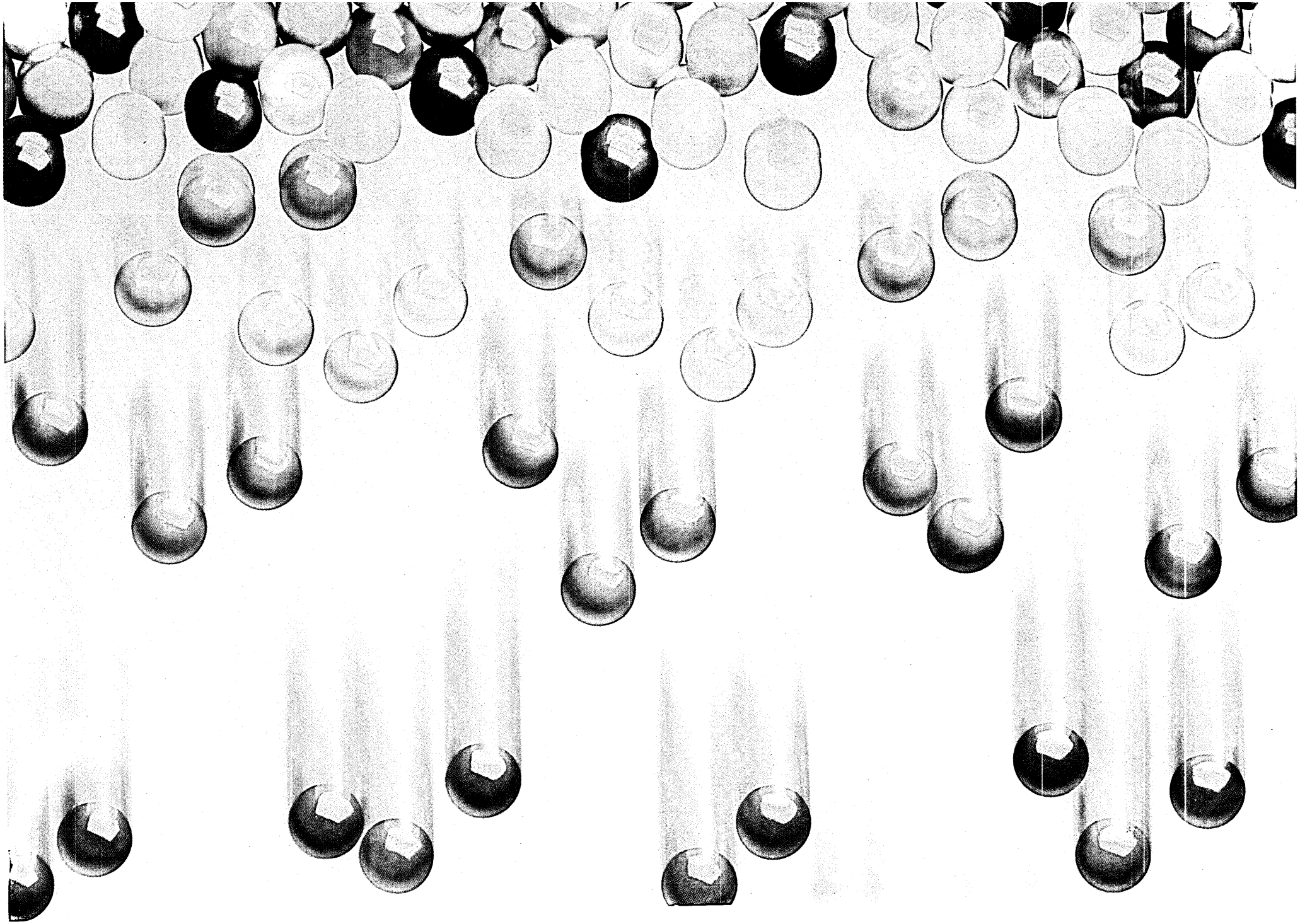
Also, the vendor says that any product, package, or language that runs under VM/CMS and can access CMS files can work with the IIF. Product links to SAS, RAMIS, FOCUS, ADRS, and APLDI are available in the iLink package. In addition to uploading PC files to the mainframe and downloading segments of the mainframe database to the PC, it also crossloads data between different mainframe and PC database products.

The procedures for each file transfer are English language prompted and transparent to the user. No intermediary programming skills are necessary. The only additional component required to operate Infolink is a communications package with file transfer capabilities.

The software's dictionary allows users to tailor interchange files to a specific worksheet or database environment into which the data file will be transferred. The dictionary, containing field information for the receiving applications program, can be modified to match alternative applications programs. It also has an instruction file which offers an electronic notepad, partial source file extraction, record ID creation, and row/column transportation for each transfer procedure. It can automatically generate a default response from previously created instructions.

It can run on a PC, PC XT, or PC compatibles with PC/DOS or MS/DOS and at least 96K of memory. Mainframe hardware includes the IBM 370, 43XX, 30XX, or any mainframe running under VM/CMS. iLink costs $12,500. Additional PC diskettes are $4,000 for 10. INFOCENTER SOFTWARE, New Paltz, N.Y.

FOR DATA CIRCLE 325 ON READER CARD



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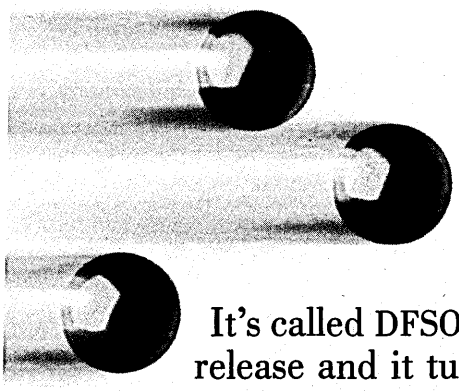

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The gains were significant under almost all test conditions, regardless of the character of the work or the system configuration. And IBM benefits from this performance daily in its own operations.

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Powerful DFSORT functions let the application programmer specify several commonly needed actions without writing exit programs. For example, the programmer can define criteria for including or omitting records to be sorted or merged, which improves performance since only relevant records are processed.

Similarly, the programmer can include or omit data elements within records, before or after sorting. In some applications this can significantly improve the time and cost of the sort.

And there's a new summing function that provides the totals of designated fields.

DFSORT works in the OS environment. It is compatible with IBM's Extended Architecture (XA), and XA systems can invoke it from above the 16-megabyte line.

For facts on the faster sort, call your local IBM representative. Or call IBM toll free at 1 800 IBM-2468, Ext. 82; ask for the Software and Education Department. Or return the coupon.

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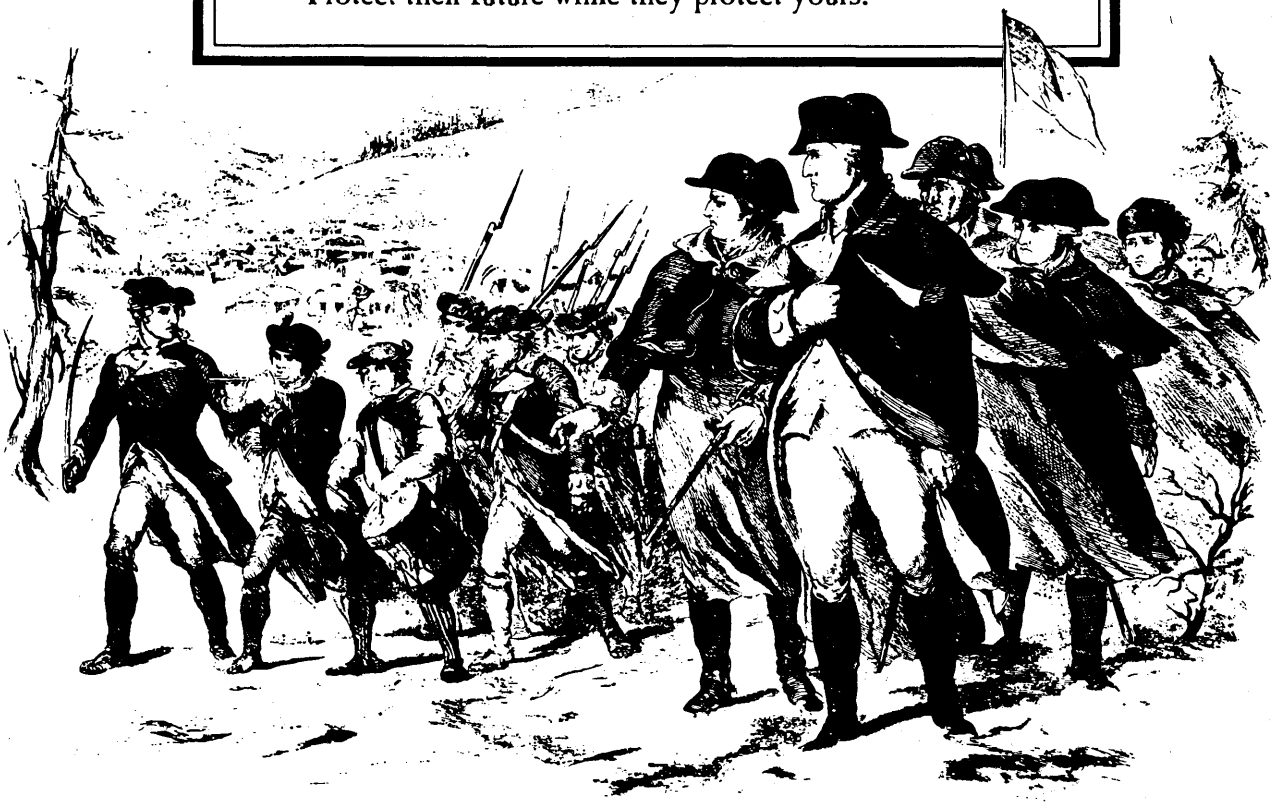

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are available on a site license basis. CICS FileNet costs $15,000. TSO FileNet and CMS FileNet sell for $1,000. FORTE DATA SYSTEMS INC., Santa Clara, Calif.

FOR DATA CIRCLE 332 ON READER CARD

REPORT MONITOR

The Data Center Distribution System (DCDS) was developed for medium to large IBM mainframe installations running under MVS. The on-line software package enables the data center to exercise better control over the format, length, routing, and distribution of all reports. DCDS makes use of database technology and can track reports from start of report job to hardcopy delivery. The database enables the package to generate detailed, on-line forecasts of report production and availability.

The vendor says this package can reduce the number of printed reports users receive, and create a better way to distribute and produce reports throughout large user organizations.

DCDS sends reports to the JES queue to await their turn to print after a table search of the database. The reports are broken up into individual versions for all recipients based upon the customizing parameters found in the database. These parameters include paper, printer ID, and delivery location.

DCDS prints only the parts of a report the recipient asks for. The vendor says several side effects of the system add to the streamlining of the entire report production cycle. For example, printers will no longer be tied up unnecessarily, producing volumes of printout that need not be printed. It will also save paper. The Data Center Distribution System (DCDS) costs $40,000. VALUE COMPUTING, Cherry Hill, N.J.

FOR DATA CIRCLE 333 ON READER CARD

SORT CAPABILITY

Sort-on-Line (SOL) provides an on-line sorting capability in the IDMS/DC environment. With SOL, IDMS application designers and end users can obtain information from databases in various sequences, different from the way the data was originally stored. This on-line sorting capability works equally well for scratch, queue, and table records.

Using the software system, the overhead time and costs normally associated with batch sorting are eliminated, according to the vendor. The software enables end users to specify the sort sequence desired at the moment, with no need for preliminary definition by a programmer. It also provides for program definition of sorting fields and the order of sorting. The software operates with COBOL, PL/1, and ADS on-line programs.

The IDMS application designer has a useful tool with this on-line sorting system, the vendor says, adding that it is not necessary to interrupt the processing cycle to sort. The SOL capability may be used to expedite continued processsing after sorting. It also works with record and page formats and can be incorporated into the host program. SOL costs $10,000. JCA SOFTWARE INC., Irvine, Calif.

FOR DATA CIRCLE 334 ON READER CARD

BUSINESS DATABASE

This database details ownership information for 5,000 public companies in the United States. Disclosure/Spectrum Ownership gives bankers, portfolio managers, and investment analysts a source of information for details of institutional holdings, 5% ownership details, insider ownership data, and ownership summaries. It enables analysts to construct portfolios of the holdings.

This database is compiled from sources such as Standard & Poors and Dun & Bradstreet. Data are available for detailed financial statistics, business directories, corporate families and affiliations, company executives, business news, and products. DIALOG INFORMATION SERVICES INC., Palo Alto, Calif.

FOR DATA CIRCLE 336 ON READER CARD

—Robert J. Crutchfield

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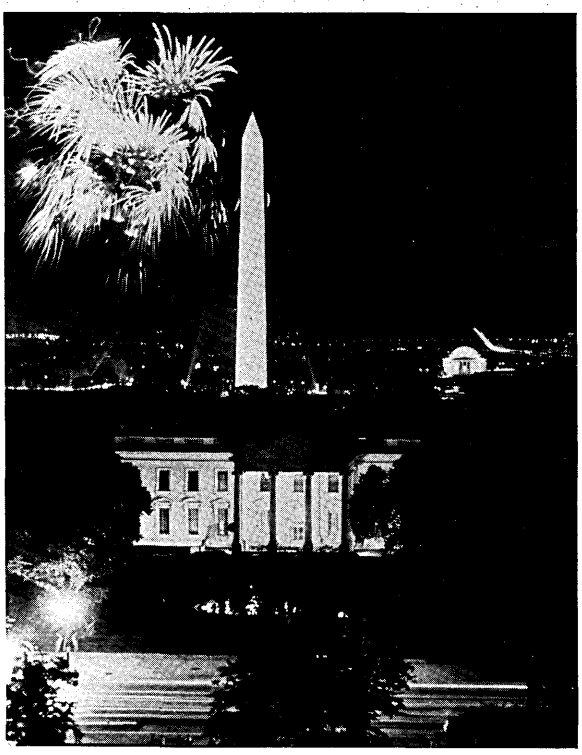
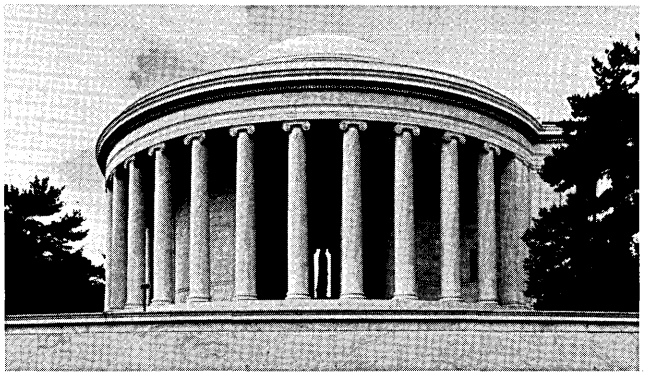


THE BUSINESS

This year's expanded program is built around hard-working, half-day, shirt-sleeve workshop sessions which focus on security topics important to users of IBM and IBM-compatible systems. Special attention is being paid this year to the security problems generated by the widespread use of personal computers. Optional full-day seminars will be conducted before and after the two-day Workshop program. In addition, Special Interest Sessions encourage you to share problems and solutions with fellow practitioners. The entire program is aimed at putting you in touch with the information...and the people... you need to know to do your job effectively.



THE PLEASURE...

A well-thought-out 1½ day program of sightseeing and private tours has been arranged for your spouse (or other members of your family). For workshop participants we have a special treat! On Monday evening, July 16, you can enjoy a special "Champagne at Twilight" tour of Washington's famous landmarks. You'll travel along some of the city's most beautiful avenues viewing the magnificently lit monuments. Each of these programs is available at a very modest extra cost.

WORKSHOPS

You will have the opportunity to attend 4 of the 20 half-day workshops being offered—2 on Monday, July 16th, and 2 more on Tuesday, July 17th. Here's a sampling of Workshop topics:

- **Security Awareness—From Executive Orientation to Technical Training**
- **Introduction to Microcomputer Security**
- **Developing a "Master Plan" for Microcomputer Security**
- **Security and Control Considerations for Networking Microcomputers**
- **"How We're Controlling Our Micros"—a Case History**
- **Auditing Microcomputers**
- **User Experiences with ACF2**
- **User Experiences with RACF**
- **User Experiences with TOP SECRET**
- **A Framework for Evaluating Operating Systems Security**
- **Securing the MVS Environment**
- **Product Solutions to Dial-up and Other Security Problems**
- **Security and Control of CICS**
- **IMS Security**
- **A Disaster Recovery Planning Methodology**
- **A Strategy for Securing Distributed Processing Networks**
- **Security in a Large-Scale, Multi-Application IBM Environment**
- **On-Line Security—Concerns and Solutions**

SPECIAL INTEREST SESSIONS

These unstructured group sessions on Monday evening, provide a valuable opportunity for participants to meet colleagues with mutual interests and to discuss common problems and solutions. Among the sessions already scheduled are meetings for RACF users, Amdahl users, ACF2 users, and Top Secret users.

OPTIONAL 1-DAY SEMINARS

These full-day seminars offer another opportunity for in-depth learning about significant topics in computer security.

Sunday, July 15th:

Establishing a Computer Security Program—*Gerald I. Isaacson, Computer Security Institute*

Wednesday, July 18th:

Implementing a Total, Layered Computer Security Program—*George E. Caldwell, Bell Atlantic*

Microcomputer Security—*Gerald I. Isaacson, Computer Security Institute*

Disaster Recovery Planning—*Robert P. Campbell, Advanced Information Management, Inc.*

Data Communications Security—*William C. Grayson, TRW, Inc.*

COMPUTER SECURITY INSTITUTE

Computer Security Institute, established in 1974, is a membership organization devoted to helping its 3,000 members safeguard their information resources. Members receive the *Computer Security Newsletter, Computer Security Quarterly,* and a hot line service. The Institute sponsors the Annual Computer Security Conference and the National Computer Security Exhibition, CSI also publishes the *Computer Security Journal, Computer Security Handbook,* and the *Computer Security Manual.* A full program of regional seminars is conducted throughout the United States and Canada. In-house training courses are also available.

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CIRCLE 102 ON READER CARD

ON THE JOB

A BYTE TO EAT

Employees of Goodyear in Akron, Ohio, got a taste of computer technology during a lunchtime computer literacy program offered by the company. Goodyear set up its "Brown Bag" Innovation Series to give employees a chance to learn more about such things as the tire industry, the economy, the state of Ohio, national policy, world events, and new technology.

When the company began the 12-week program on computers, attendance went wild. The series, which was offered twice a week on a first-come basis, drew 700 clerical and secretarial personnel, engineers, supervisors, managers, and directors. A third day was added so everyone could get in on the classes.

Goodyear slated the program on computers to coincide with a couple of major systems projects. The program was conceived by people in the company's Computer Education, Corporate Innovation, and Technical Computing Facility. Goodyear wanted its employees to understand that computers would help them in their jobs, rather than replace them. It figured the program would assist employees through the first stages of system installation, and at the same time, bring everybody to the same basic level of understanding.

Goodyear worked with Deltak Inc., Naperville, Ill., which planned the program, utilizing its Video Journals, 30-minute videotapes that come with a short text for review and reference.

The program addressed three main topics: "What is a Computer?"; "Why Industry Is Embracing Technology?"; and "How Technology Directly Affects User Departments." A Goodyear expert on each topic supplemented the Video Journal with a question and answer session after each tape. An overview of the corporate computer center was given by the corporate dp

manager, and the dp training specialist and the manager of Goodyear's Technical Computer Facility also described their departments. Attendees were given a Goodyear notebook, with a master glossary of terms and summaries from the Deltak courses, at the end of the program.

The series was so successful that four satellite training locations were established in Akron, and the company has made plans to extend the program to three of Goodyear's subsidiaries and two industrial plants outside of Akron.

STAYING ON TOP

Keeping abreast of new developments and techniques has always been a priority for people in engineering fields. Northeastern University, a private school in Boston with an enrollment of 70,000, has developed a continuing education program that should help professionals in the Route 128 area do just that. The program offers high-tech companies a variety of specialized, on-site consulting services, education and training courses, and media-based services.

Customers can get assistance in introducing new products, expanding into new markets, teaching employees new technologies, and developing a variety of operations skills.

Some classes are held at the school's Dedham campus; other sites are the Boston, Burlington, Chelmsford, Marlboro, Westwood, Lexington, and Framingham campuses. Programs are also conducted at client companies, and are available in videotaped format (in conjunction with the Association for Media-Based Continuing Education for Engineers and the Boston-based Instructional Television Fixed Services). Teleconferencing and live broadcast instruction also allow companies to take full advantage of the program's resources at their own convenience.

Northeastern's program has been around since 1963. It was developed on the premise that "the best teaching/learning environment is one in which a free exchange of new knowledge occurs among participants who have a body of expertise to share."

There are four major topic areas: computer science and engineering, with courses in microcomputers, AI, computer automation, software engineering and programming languages; semiconductor science and microelectronics, featuring courses on solid state principles, VLSI design, and integrated circuit fabrication; communications and systems engineering, with courses in communcations theory, telecommunications systems technology, and telecommunications administration; and technical management, offering courses in new product development, software project management, and material requirements planning.

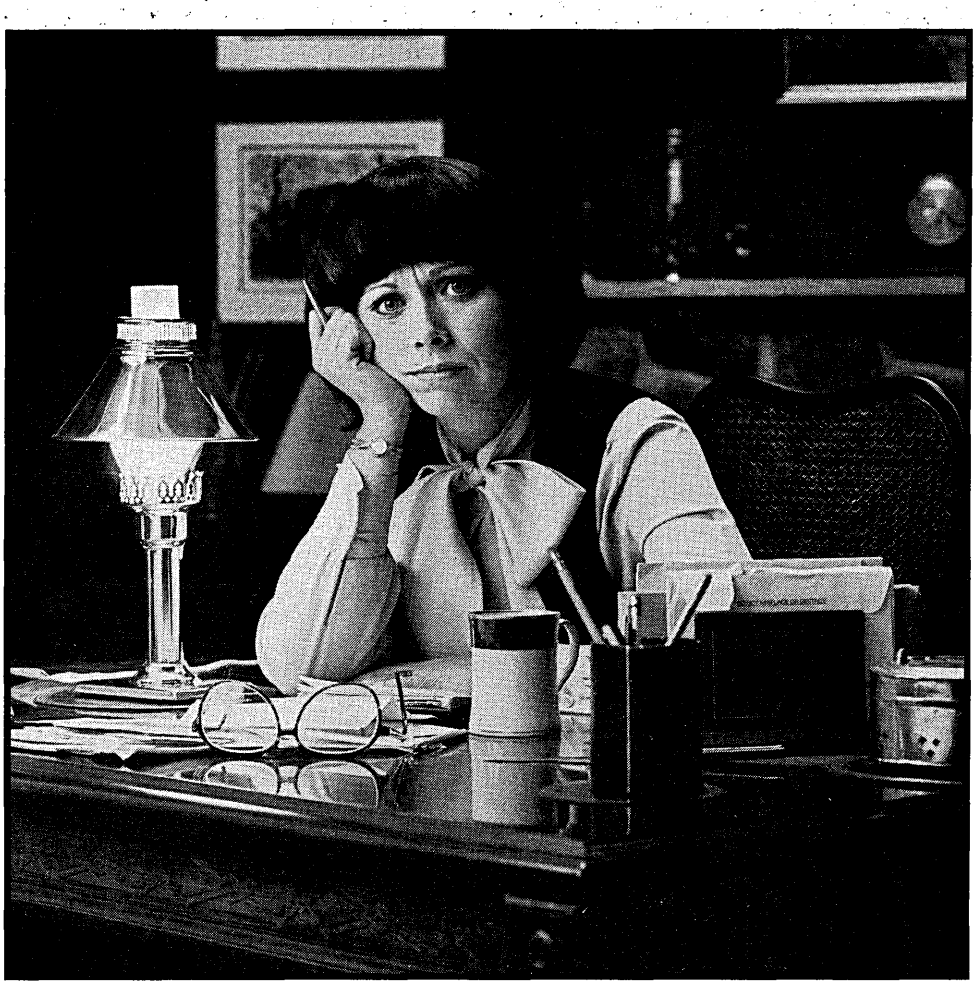
Engineers, analysts, scientists, and programmers comprise 63% of the participants in the program. Draftsmen, technicians, and engineering assistants constitute 18%, managers and department heads 15%, and corporate management 3%.

Originally, most participants had master's and doctoral degrees; these days, 47% of the students have only a bachelor's degree and 30% have earned a master's.

The faculty is made up of representatives of some of New England's leading high-tech companies, including Digital Equipment Corp., Wang, Polaroid, Analog Devices, GTE, Honeywell, Prime, and Gen-Rad. Some younger companies such as Laser Analytics, Spartacus Computers, and Telesis are also represented.

Courses cost $395 for an 11-week session, including all materials. For more information on Northeastern's State-of-the-Art Engineering Program, contact Catherine Ziegler, Northeastern University Center for Continuing Education, State-of-the-Art Engineering Program, 370 Common St., Dedham, MA 02026, (617) 237-1829.

—Lauren D'Attilo



"At the rate I was going, in ten years I'd have about $2000 saved."

I have a pretty good job. I've never been out of work. I've received regular promotions. The only thing I've never been able to do is save money.

One day I overheard my secretary talking about how much she'd saved buying U.S. Savings Bonds through the Payroll Savings Plan. I was astounded.

Then I looked at my bankbook. I figured out how much my average yearly savings had been since I'd been working. And I almost cried. At the rate I was going, in ten years I'd have about $2000 saved.

Oh, some years I'd save three or four hundred (nine hundred one year), but it didn't last long. Something would always come up and I'd take it out and spend it. I always figured one of these days I'd bear down and build up a nest egg.

Since nothing else seemed to work, I decided to give the Payroll Savings Plan a try. I *should* be able to save as much as my secretary. If it worked for her it should work for me.

It turned out to be very easy. They take a little out of each paycheck toward Bonds, so *that's* a portion of your pay you're not tempted to spend. Not only is it easy but it's safe. The Bonds are piling up and so is the interest. And, by the way, the interest is guaranteed.

I never thought much about Bonds before but it's hard to find a better return on such a small, initial outlay.

When I get enough saved I may look into other things. But as for right now, it's the best, easiest way I know of to save. Actually, it's the *only* way that works for me.

I started late, but better late than never.

Take stock in America.

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If you still believe in me, save me.

For nearly a hundred years, the Statue of Liberty has been America's most powerful symbol of freedom and hope. Today the corrosive action of almost a century of weather and salt air has eaten away at the iron framework; etched holes in the copper exterior.

On Ellis Island, where the ancestors of nearly half of all Americans first stepped onto American soil, the Immigration Center is now a hollow ruin.

Inspiring plans have been developed to restore the Statue and to create on Ellis Island a permanent museum celebrating the ethnic diversity of this country of immigrants. But unless restoration is begun now, these two landmarks in our nation's heritage could be closed at the very time America is celebrating their hundredth anniversaries. The 230 million dollars needed to carry out the work is needed now.

All of the money must come from private donations; the federal government is not raising the funds. This is consistent with the Statue's origins. The French people paid for its creation themselves. And America's businesses spearheaded the public contributions that were needed for its construction and for the pedestal.

The torch of liberty is everyone's to cherish. Could we hold up our heads as Americans if we allowed the time to come when she can no longer hold up hers?

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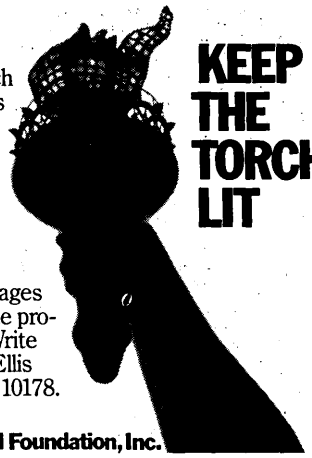
You are invited to learn more about the advantages of corporate sponsorship during the nationwide promotions surrounding the restoration project. Write on your letterhead to: The Statue of Liberty-Ellis Island Foundation, Inc., 101 Park Ave, N.Y., N.Y. 10178.



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An exchange of readers' ideas and experiences. Your contributions are invited.

READERS' FORUM

TELECOM LITERACY

In the past few years, many managers and end users have taken courses, received briefings, or studied on their own to become computer literate. Faced with the opportunities provided by smaller and less expensive computers these people have had to make decisions on issues they could no longer defer or delegate. Technological developments will soon force them to make another set of decisions, this time in telecommunications. Again, they will need to learn new concepts.

Before 1980 most firms relied on local telephone companies to take care of virtually all their voice and a good part of their data communications needs. Advances in technology and the AT&T divestiture ended those days forever. Managers will find their telecommunications costs—local and long distance, voice and data—rising quickly. They will also discover a much wider choice of equipment and services.

For those of us who work with information systems, this comes as no surprise. We have watched the marriage of computers and communications take place over the past several years. But for most managers and end users, these are new developments. Many are now in the same position they found themselves in about 10 years ago with data processing—they need to learn new terms and ideas very quickly.

What should managers and end users know or be able to do to make these new decisions? Three things. First, communications-literate persons should be able to take part in discussions on the subject (as it applies to their organizations) without their minds going numb or eyes glazing over. This is no easy task. Telecommunications has traditionally been the province of engineers and attorneys, two groups notorious for their jargon.

Second, these people should have enough background knowledge of the field to organize and evaluate the barrage of future regulatory and technological changes. Training or education can provide only part of this skill; people uncomfortable with instability will have a tough time in the world of telecommunications no matter what knowledge base they have.

Finally, persons literate in communications will be able to understand the work needed to plan, organize, and control this function in an organization. As a result, they (managers or end users) will know what standards to set and what level of service to expect from internal communications experts and outside vendors.

We need to refine these general goals into specific objectives so the participants know what they can do after the course that they could not do before. Training in telecommunications literacy should enable participants to do eight major things:

- Define basic terms for equipment and service, e.g., handset, keyset, PBX, Centrex, local loop, central office, LATA, CPE.
- Identify the roles and functions of local Bell companies, regional holding companies, long distance services, and equipment manufacturers.
- Discuss, in general, concepts used in the economics of telecommunications, such as switched and private line service, flat rate and usage-sensitive pricing, regulated and deregulated services, and the roles of the FCC and state regulatory boards.
- Compare AT&T vs. alternative long distance services, discuss various long distance discount plans (e.g., WATS).

Define fundamentals of datacom, e.g., digital vs. analog transmission, modems, multiplexing, codes, line speeds, protocols.

- Identify new and advanced communications services, including paging, electronic mail, voice mail, cellular radio, teleconferencing, local area networks, public data networks, satellite services.
- For international customers, identify the functions of PTTs in foreign countries, international record carriers, and INTELSAT.
- Discuss steps needed and major issues involved in communications planning, requirements definition, organizing the communications function, controlling costs, and ensuring maintenance and security.

Achieving literacy in telecommunications will be more difficult than it was in data processing. The material does not lend itself to hands-on methods, and will probably need more briefings or discussions that, in the wrong hands, can be deadly boring. Nonetheless, later parts of the course can use case studies or other group projects where participants learn by applying the ideas and concepts presented earlier. Case studies may not have the pizzazz of hands-on computer graphics demonstrations, but they can promote carryover to the participants' work, which of course is the first goal of training.

Participants should expect to spend at least five days in this kind of training. If it sounds like a lot of time, consider the implications of having managers and end users who are unable to take part in discussions on the subject, cope with rapid changes, or appreciate the need for better communications management. A one-day briefing in communications may be adequate to define some of the terms, but do not be misled into thinking that a briefing prepares anyone for making the big decisions. In this case, a little bit of knowledge can be a dangerous and costly thing.

—Alan Kotok
Arlington, Virginia

QUALITY IS REALLY A PANE

"Horace, this testing project of yours isn't working!"

Horace Heuristic winced. He had been MIS manager at the Potent Toy Manufacturing Co. for nearly 10 years; Aloysius Access had been manufacturing systems manager all that time, but Horace had never gotten used to Aloysius' blunt manner.

He kept his cool. "Look, Aloysius," he said, "don't you agree that it's better for us to find the errors before our users do? Besides, by carefully recording and analyzing the reasons for the errors, we feed information back into the development process that helps us make improvements." Horace was proud of the "ongoing quality control" project he had established, and he wasn't going to let Aloysius discourage him.

"You're missing the point," replied Aloysius. "Testing at the end is simply too late! The problems are already there; we can find some of them, but it's essentially impossible to find them all." He leaned over Horace's desk and picked up a book. "Right here, in this very book you gave us all to read, Glenford Myers implies the problem:

"The probability of the existence of more errors in a section of a program is proportional to the number of errors already found in that section" (from *The Art of Software Testing*, John Wiley & Sons, New York, 1979).

"What's worse," continued Aloysius, "are the problems we build into the programs when we try to fix the errors. By then we're almost always under great time pressures, and the corrections often create as many mistakes as they fix. And whatever logical program structure we might have had is compromised."

"I'm not going to argue that with you," replied Horace. "But you haven't suggested any alternatives; I still feel strongly that we should find our own mistakes."

Aloysius took a deep breath. He sensed an opening, and rushed ahead. "As you know, Horace, product assurance is one of the functional areas I've been covering. Those guys used to be second-class citizens; the manufacturing managers viewed them as policemen, as inspection barriers to get around to meet shipment targets. Well, all that is changing. The whole toy industry is learning from Japanese methods, one of the major lessons is that we must do things right the first time; to do anything else, is both expensive and nonproductive. Furthermore, if you don't do it right the first time, you are lowering quality."

Horace was annoyed with Aloysius, but he knew that a lot was going on in the company under the hushed tone of quality. He hated to admit it, but maybe Aloysius had a point.

"I really don't understand what you're saying, Aloysius," Horace finally replied. "Perhaps you can help me learn more."

Aloysius now wore a full smile. "Here are three books you should read, Horace, and I suggest you read them in this order: *Zen and the Art of Motorcycle Maintenance* [Robert M. Pirsig, William Morrow & Co., New York, 1974], *Japanese Manufacturing Techniques* [Richard J. Schonberger, The Free Press, New York, 1982], and *Characteristics of Software Quality* [B.W. Boehm, J.R. Brown, H. Kaspar, M. Lipow, G.J. MacLeod, and M.J. Merritt, North-Holland, New York, 1978]." It was quite a pile; Horace was a fast reader, but this was ridiculous.

The following Tuesday, all the MIS managers gathered for their weekly staff meeting. Portia Partition, finance and administration systems manager, sat down next to Bartholomew Byte, of marketing systems fame, and remarked, "Horace is late . . . strange, he's a stickler for starting meetings on time."

Mortimer Micro, manager of the newly established information center, explained, "Horace got an electronic watch for his birthday, and the battery died yesterday."

Horace arrived a few minutes later. He was carrying the three books Aloysius had given him plus the department's very thick standards manual. "I apologize for being late," he said, as he placed the stack on the table. "I'm going to start carrying a portable sundial. If you don't mind, I'm going to dispense with the usual status reports for today; we'll schedule a meeting tomorrow to catch up on those. This morning, I want to introduce you to the topic of quality.

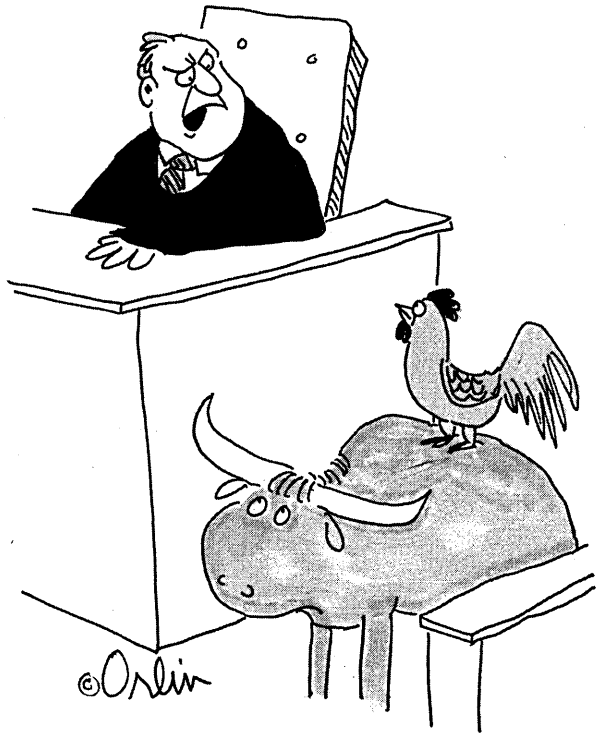
"Aloysius suggested I read these three books, starting with Pirsig's." Horace held it up. "I was, frankly, turned off by its title, but it says early on that it is neither about Zen nor much about motorcycle maintenance. It's about one man's search for a meaning of the concept of quality; its real value is that it encourages all readers to search for definitions of their own.

"Let me share with you," he continued, "some of the insights I've gained." He turned to the flipchart and wrote:

1. Quality is an all-encompassing characteristic; all other attributes can be viewed from the standpoint of quality.
2. Quality and "caring" are the external and internal aspects of the same thing.
3. There is a long-range "classic" quality and a short-range "romantic" quality.

"I guess I understand the point about caring," said Portia. "If someone cares about something, she will obviously do the best job she can."

"That doesn't seem like a big deal to me," retorted Bartholomew. "We're always trying to get people to care about their work—only we call it motivation. It's in every management course we're ever taken."



May I remind the witnesses that this court has a low tolerance for fabrication."

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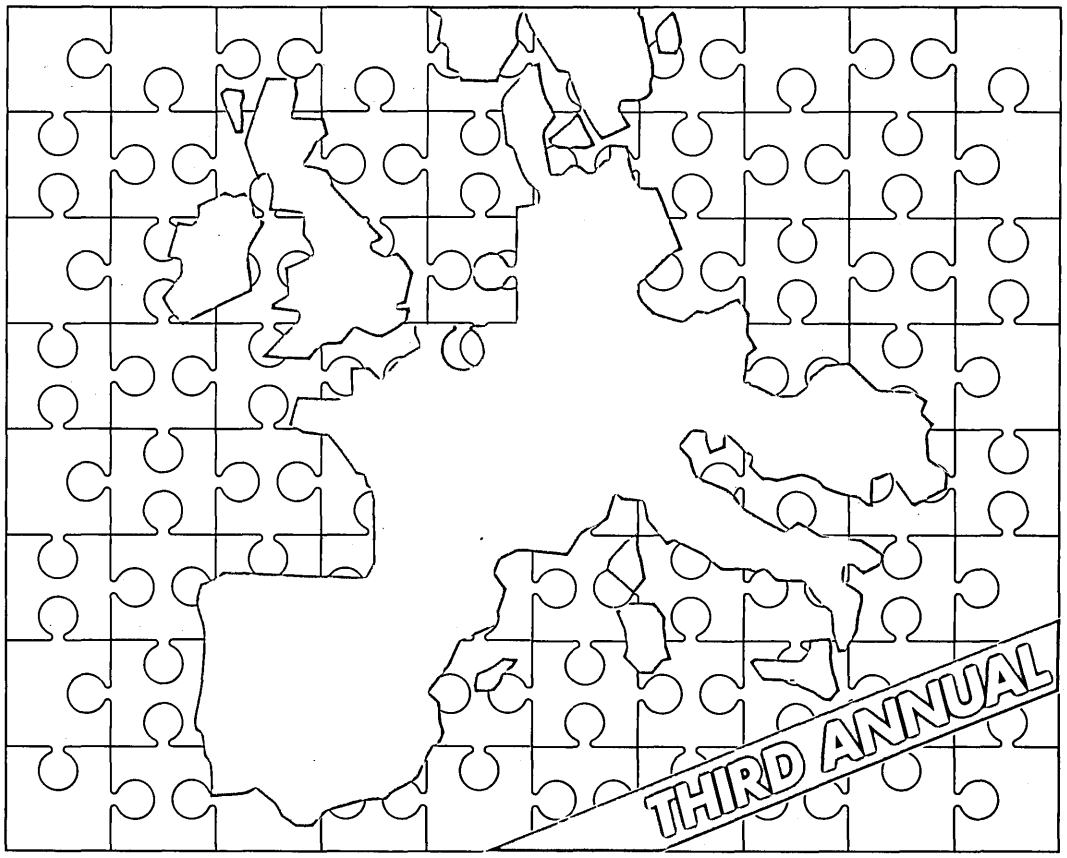

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Mortimer chimed in, "I really don't understand your first point, Horace. Clearly some things in a system are more important than others; since we don't have the resources to do everything well, it seems that we should focus on a few and do them well."

"How do you choose?" Aloysius had been sitting quietly, but now felt the need to respond to Mortimer's comment. "Moreover, in a project, how do you communicate those choices to the others on the team?"

"I just know." answered Mortimer. "I guess it comes from my experience and training. You're right, though, about the communication; it's hard to transmit my standards to others, especially when I respect their need to be creative."

"In his book," Horace said, "Pirsig describes a creative writing class; that really hit home because I think creative writing has a lot in common with programming. The teacher was trying to teach the students rules of grammar, good composition, and so on, but the best he could get was technically correct, dull writing.

"So he approached the task from the viewpoint of quality. He showed the class a variety of papers and asked them to rank their relative quality without trying to define the term. Sure enough, everybody, including the teacher, ranked the papers similarly. He still couldn't define quality, but he had proved to the students that it was real. Then he asked them to write anonymous papers, and they ranked those. Again, the rankings were consistent. Next, the teacher asked the class to write other papers; the students had realized they knew what quality was and that they could increase it with better tools. So they now went to the teacher for help in improving their grammar, syntax, or whatever, not as ends unto themselves but as a means to the end of quality."

"The notion of short- and long-term quality is also important," added Aloysius. "A person's standards will change over time primarily as a result of education and experience. Those improved standards, coupled with caring, help people to do increasingly better work."

"Let me now move closer to the world we know," said Horace. "Schonberger's book describes how Japanese companies use the concept of Total Quality Control. I'll write the basic principles on the flipchart." After he taped the page with the Pirsig lessons on it to the wall, he wrote:

1. Process control
2. Easy-to-see quality
3. Insistence on compliance
4. Line stop
5. Correcting one's errors
6. 100% check
7. Project-by-project improvement

"Let's take those from the top," began Bartholomew. "I understand process control. In a manufacturing operation you always want as tight control over the process as you can get. In most divisions here we have process specifications for the production workers to follow; in some automated areas, a computer system monitors the process."

"What about in programming?" mused Portia. "In programming, we hardly control the process at all. We have some project checkpoints and some walkthroughs, but at best we look for compliance with the customer specification. That's only one aspect of quality."

Aloysius was positively beaming; he could see another convert emerging from her chrysalis. "Points one and two are closely related," he said. "In manufacturing we devised statistical tools like control charts so people know right away if a process is drifting, and they can take corrective action. We have no analogous tools or concepts in programming. Further, without the good measures implied by point two, it's hard to accomplish point three."

"Of course," Bartholomew shouted. "And if we don't insist on compliance, because we don't know what to measure, the programmers think we don't care, and if we don't care, they won't care. And quality will go down!"

"I think he's got it," giggled Portia, "but in programming we do meet some of those principles. For example, we've always encouraged people to take responsibility for their own work. Isn't that analogous to line stop and correcting one's own errors?"

"I'll buy the correcting one's own errors," answered Horace, "but we don't often let programmers stop their line. Usually, we insist they adhere to an already tight schedule, even if there's a major glitch in the process, like one of the team members leaving or finding a major inconsistency between two modules."

"I really do see," said Bartholomew. "If we insist that a project be completed on time in spite of a process failure, we're really telling our programmers they don't have control over their own work. They can rationalize lower quality by blaming it on someone else; we allow them to care less."

"The last two points are also related to measures," continued Aloysius. "Without consistent measures, we obviously can't do 100% inspections, or ask for project-to-project improvement. We really don't even know what we mean by an improved system; we must define improved before we can go further."

Mortimer still looked glum. "I know I'm the new kid on the block," he said, "but I still don't see where all this is going. It's no great revelation that software quality is hard to measure."

"You're right," answered Horace. "But now that we've established a conceptual base, perhaps we can move to the third book." Horace taped the second flipchart sheet onto the wall, picked up the third book, and said, "Barry Boehm and his colleagues defined potential attributes for software quality. They devised a whole taxonomy for these attributes, but let me just give you some examples." He wrote on his flipchart pad:

1. Modifiability
   a. Augmentability
   b. Self-containedness
   c. Structuredness
2. Intelligibility
   a. Conceptual integrity
   b. Conciseness
   c. Consistency
   d. Legibility
   e. Simplicity
3. Usability
   a. Power and scope
   b. Robustness
   c. Support costs
4. Reliability
   a. Accuracy
   b. Availability
   c. Consistency

"Those are nice words," said Bartholomew, "but I'm not sure what they accomplish. Some of those terms are as hard to define as the word quality."

"Well," answered Mortimer, "I have a suggestion about how to use the list of attributes."

He walked to the flipchart, taped the third sheet on the wall, and began drawing a flowchart. "You've all seen this type of chart before," Mortimer said. "We use it constantly in various management classes. It points out the need for setting expectations very early in any process. After the design is built, we should measure results against the expectations and take corrective action if there are variances . . . or give positive feedback when appropriate."

"Are you suggesting we define our expectations in terms of those attributes?" asked Bartholomew.

"I think so," replied Mortimer, "although I sure don't know what to say about some of those. How do we know if a program is augmentable, or consistent, or robust? I agree they're all attributes of a quality program, but I can't define them."

"It's tough," Horace replied, "but I think we could ask some of our better technical people to write specific guidelines that, from the very beginning of the project, would be definitions of the

READERS' FORUM

attributes deemed important for the project."

"That's good," commented Bartholomew. "Then, as the project progressed, we could update those guidelines with what we learned, and those updated guidelines would be used for subsequent projects, till finally, our work would improve, just as Schonberger says it should."

"Exactly," agreed Horace. "Furthermore, we don't have to try to achieve all these attributes; we can select the important ones for a given project and even set priorities. It's not going to be easy," he sighed, "but I think we've come a long way this morning." Horace started thumbing through the fourth book, the department standards, and said, "I suggest we add a few steps to our life-cycle standards." He taped Mortimer's flowchart to the wall and wrote on the pad:

1. Very early in each development effort, state that all of us, especially the managers, are fully committed to the concept that quality is of paramount importance and we expect quality to be achieved.
2. When we write specifications for the system, select the quality attributes we feel are appropriate for this system. Give them a priority sequence to resolve any conflicts that might arise later.
3. Define each attribute as it pertains to that system; the definition becomes part of the specification. For attributes that have not been defined before, it might be appropriate for some specialists to write a technical standard to be followed.
4. Inspect the programs for compliance with those attributes every time we examine a program, for example, in walkthroughs or when a supervisor is reading a programmer's code. Use checklists or other tools to record variances and provide feedback.
5. Remember that quality pertains to the entire project, not just the code, i.e., documentation and training are also subject to quality expectations.
6. Note areas for improvement and tighten the standards (improve quality) for the next project.

"I really like those," said Bartholomew, "and, because I'm getting hungry, let me provide what I hope will be a closing observation. These rules will work for two important reasons:

1. Focusing management attention on specific quality issues tells systems designers that these issues are important. The designers will then take the care needed to increase these attributes in their systems, thus leading to an increase in what we have predefined as our quality expectations.
2. The process of choosing and defining the attributes that are appropriate for a given system generates the construction and implementation of improved technical standards and of measures for those standards. This, in turn, enables us to make continuing improvements in each succeeding project."

"I guess," concluded Mortimer, "I'm beginning to appreciate what we've accomplished here." He pointed at the first chart on the wall. "We started this morning by talking about quality as a point of view for all aspects of the systems process. Once through that looking glass, we were forced to tackle all sorts of real problems in systems design; it all comes from looking at things through a window of quality."

"You could say," smirked Aloysius, "that quality is really a pane."

The managers dashed from the room, groaning as they went, leaving Horace to remove the taped sheets from the wall. Panes like that he thought to himself (referring to both quality and Aloysius), we can always use.

—Joseph L. Podolsky
Palo Alto, Calif.

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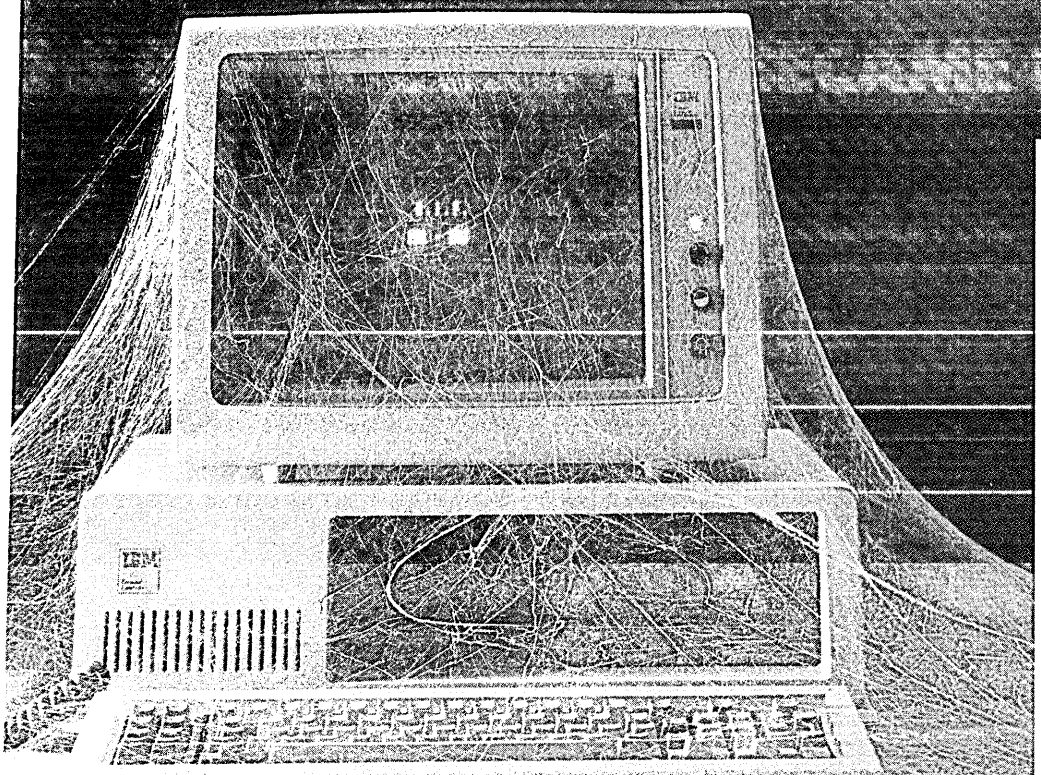

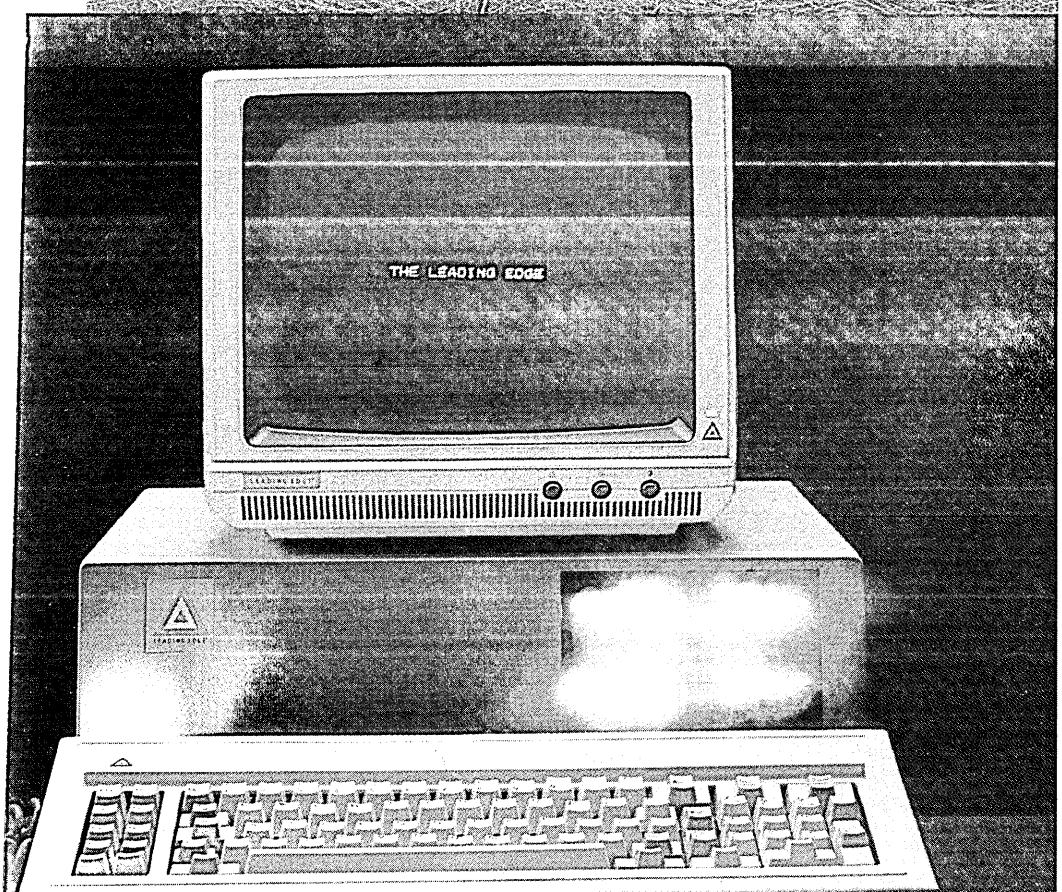

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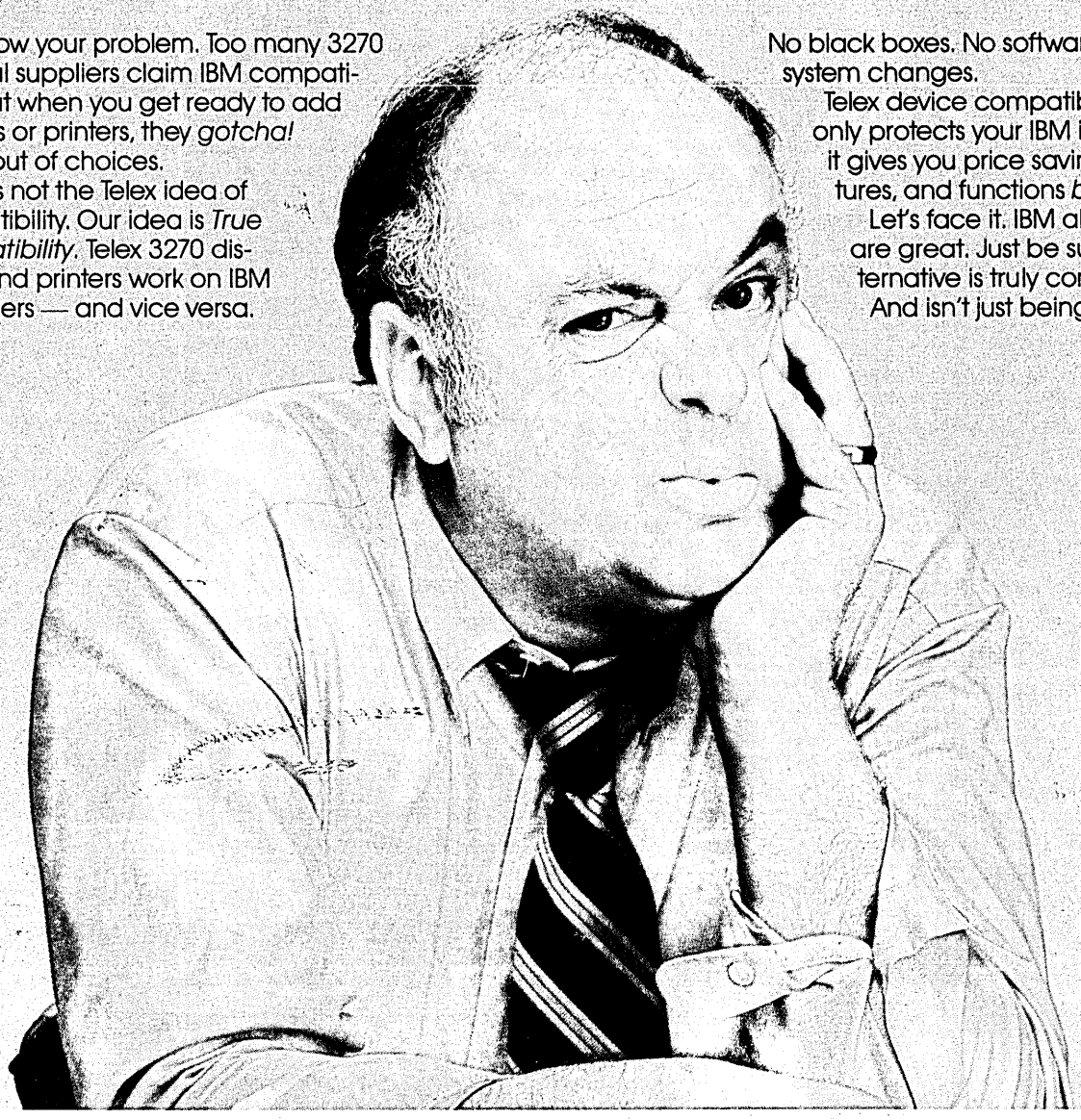

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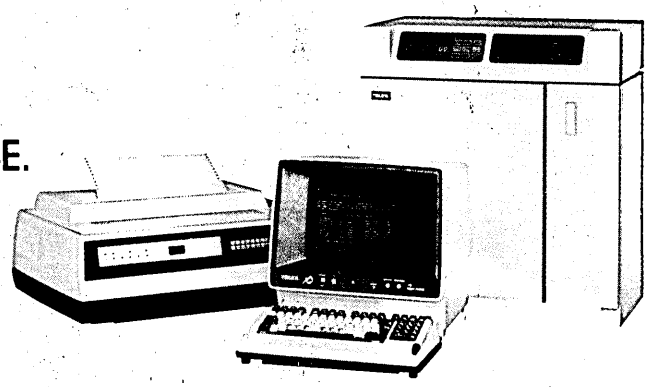

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