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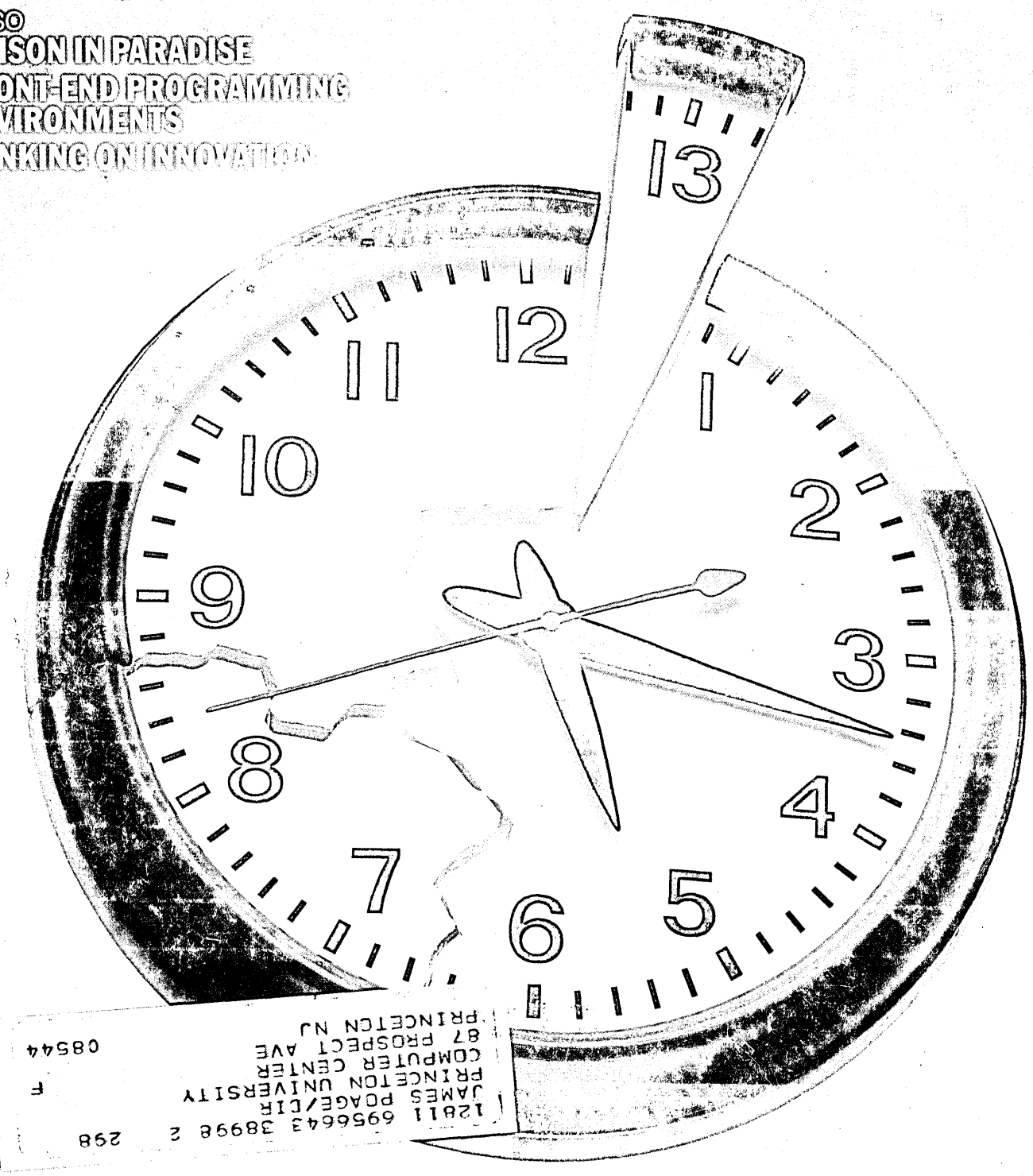

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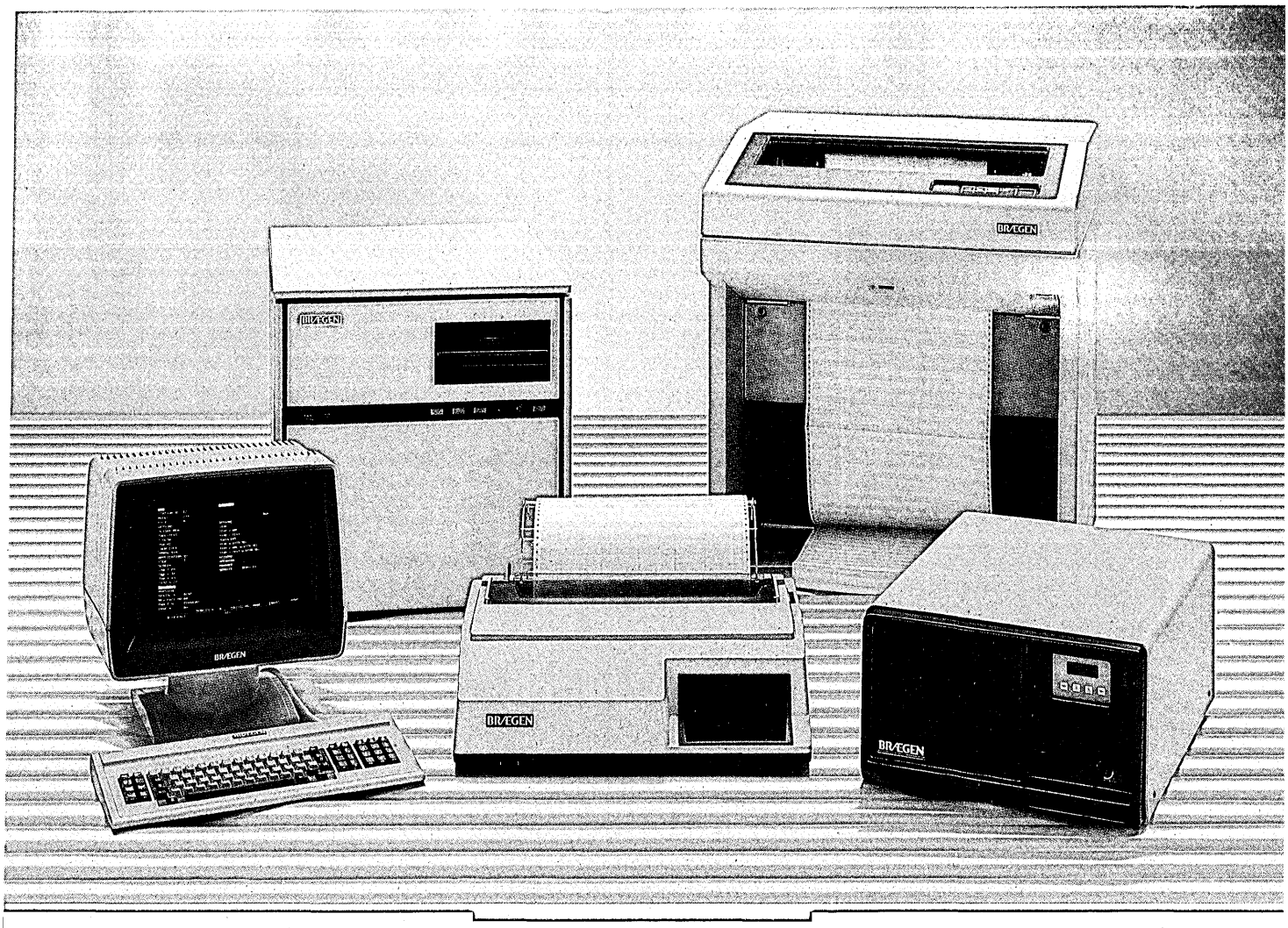

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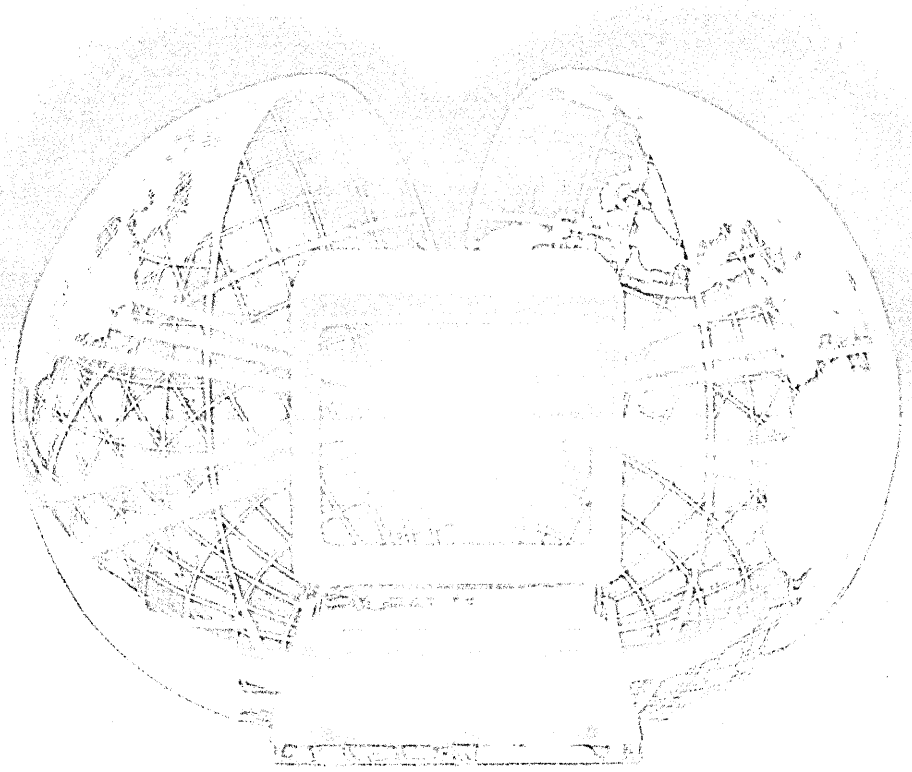

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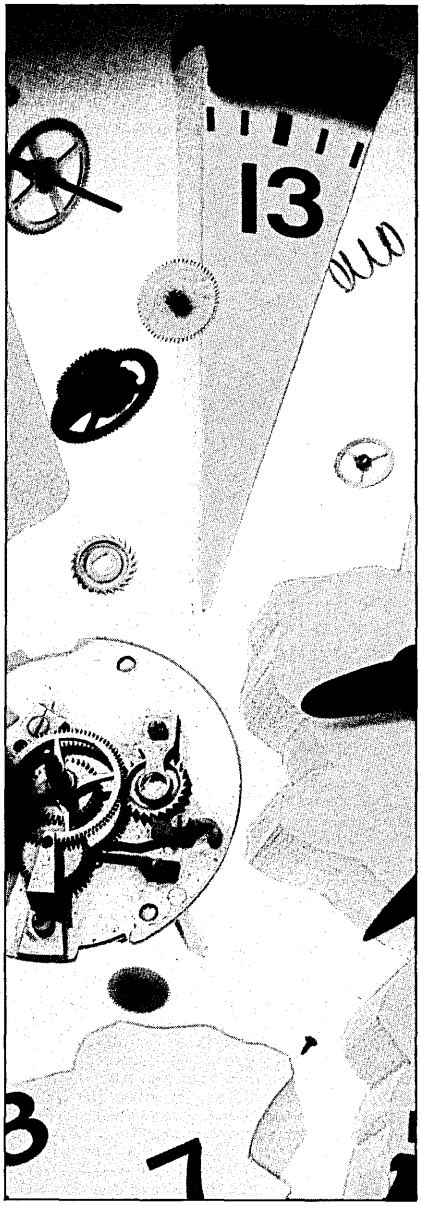

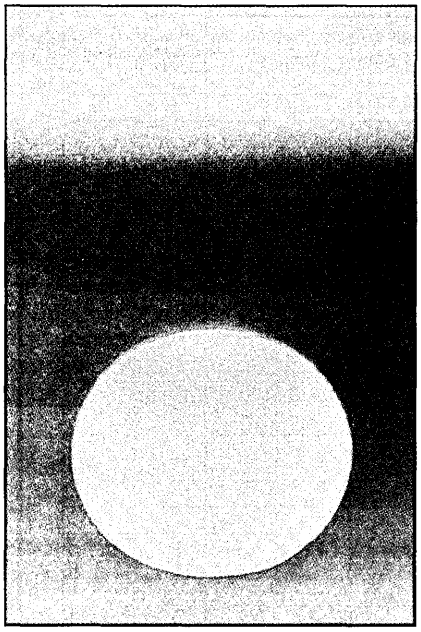

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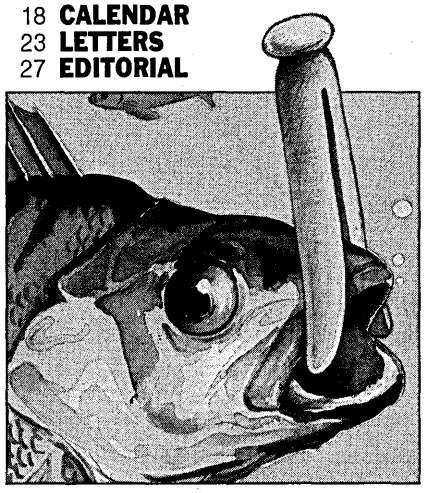

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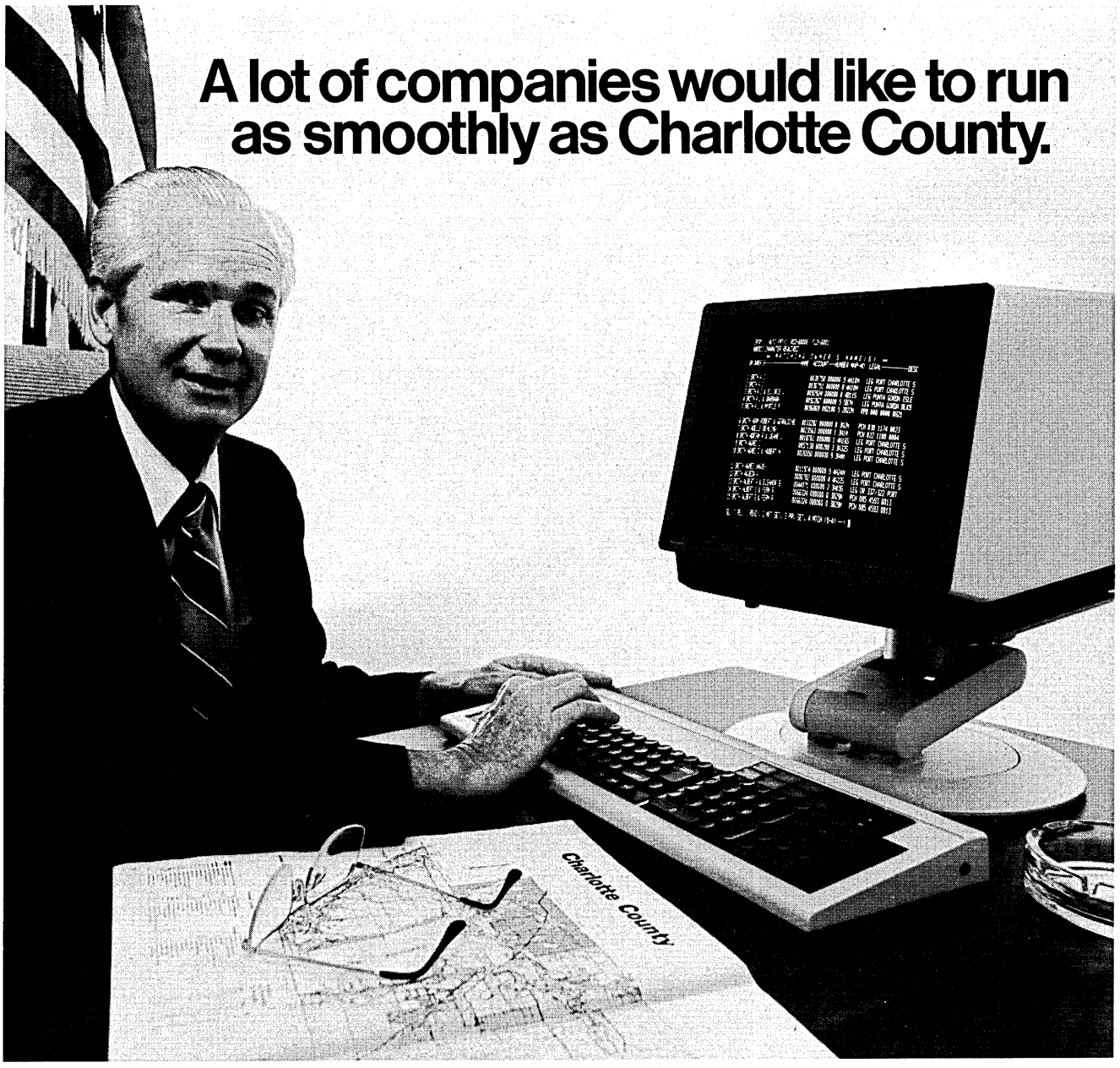
A lot of companies would like to run as smoothly as Charlotte County.



Charlotte County, Florida, is one of the fastest growing counties in America. And its government is one of the most efficient.

In fact, visitors have come from as far away as Europe to study Charlotte County's computer system. A Nixdorf computer system.

As Oliver Lowe, Charlotte County's Property Appraiser, and the driving force behind the implementation of the Nixdorf 600/55 computer system, puts it, "One of the primary obligations of any government agency, regardless of size, is the elimination of unnecessary expense and duplication of effort. With the Nixdorf system, we are able to meet the data and information processing needs of all county departments, and at the same time, make the information used by one organization available to any other department that might need it. We're comparable with private enterprise when it comes to efficient management."

The Nixdorf system handles the complete range of the county's administrative functions from property appraisal, tax collecting, license and registration renewals, payroll, and mosquito control to a number of law enforcement requirements.

Another reason for the selection of the Nixdorf system, according to Mr. Lowe, was its ease of use. The system is being run by people who had never operated a data processing system before. No computer specialists had to be hired. And that's a major factor in Charlotte County's ability to save hundreds of thousands of dollars.

For 32 years, Nixdorf has been providing solutions for the information processing needs of all kinds of businesses, as well as government agencies at the local, state and Federal level. And today, we're a successful international company with 16,000 people and over 110,000 computer systems installed around the world.

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Their Tandem on-line system has eliminated a mountain of paperwork. Where it used to take 12 minutes—or more—to find individual records by hand, all information is now instantly accessible to all collectors. And with no more time lost digging in file drawers, the average collector's phone time has increased from one hour to six highly productive hours per day.

With complete files instantly accessible, operator efficiency and productivity are increased by substantial margins.

Michigan Bell's ReCoup system provides many benefits. Since all transactions are recorded on-line as they occur, the comprehensive data base is complete at all times. Fewer accounts are referred to outside collection agencies and there is a vast improvement in reduced expenses and administrative control for these contracted services.

The ReCoup system also produces individual operator productivity reports which enable continuing, consistent and automatic employee evaluation. Attitudes and productivity have increased dramatically.

And because Tandem systems are totally modular, Michigan Bell can easily expand or modify their ReCoup system at any time. With no loss in hardware or software investment. And with no downtime.

To make sure that development went smoothly, Tandem's worldwide sales support, education, training, service and manufacturing organization were there to help, every step of the way.

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CIRCLE 23 ON READER CARD

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LOOKING BACK

COMPILING WE WILL GO . . .

August 1964: Digitek, a Los Angeles software firm, took on IBM when it announced its FORTRAN IV compiler for the 7040 (44) and 7090 (94). The company intended to lease the four-pass compiler directly to users. It was reported to be one fifth to one sixth the size of IBM's, and compiled, on the average, four times as fast as the 94's IBJOB FORTRAN version 9. The Digitek design really hummed on small programs (of approximately 200 statements), which the company felt constituted the bulk of FORTRAN jobs.

The company was formed in May 1961 by three former Hughes Aircraft employees (Jim Dunlap, Don Ryan, and Don Peckham), and began specializing in compilers in early '63. The company had already put out eight other compilers for various manufacturers.

Inspiration for the new compiler came from the May 8, 1964 Copyright Office decision to register computer programs, which promised to change the way the industry worked by forcing manufacturers to offer separate pricing of hardware and software.

CHANGE OF ATTITUDE

August 1974: Does the installation of terminals have a positive or negative effect on employees' motivation and morale? John W. Lawrie, John M. Ryan, and Alastair Carlyle researched the psychological changes that may occur as a result of such a project, and summarized the results in a DATAMATION article.

The authors conducted their study on behalf of a large midwestern bank that was considering installing terminals in all its branches. Along with the cost-benefit analyses to evaluate the economic impact of the terminals, the bank wanted a glimpse at the possible psychological consequences of this fundamental change in tellers' jobs.

Here's how the study was done: seven branches of the bank installed terminals on a pilot basis to test the hardware. Seven other branches were then tested to determine whether they had the same key operational and personnel variables, such as the branch manager's management style, types of banking business, and tellers' ages, length of service, sex, and salaries. The two groups did not differ significantly, nor did the other branches within the total network.

The behavioral indicators of poor teller morale were then identified as absenteeism, tardiness, and turnover. Attitudes were measured through use of a pretested questionnaire that was based on interviews with managers and tellers, and behavior was measured via centralized personnel records.

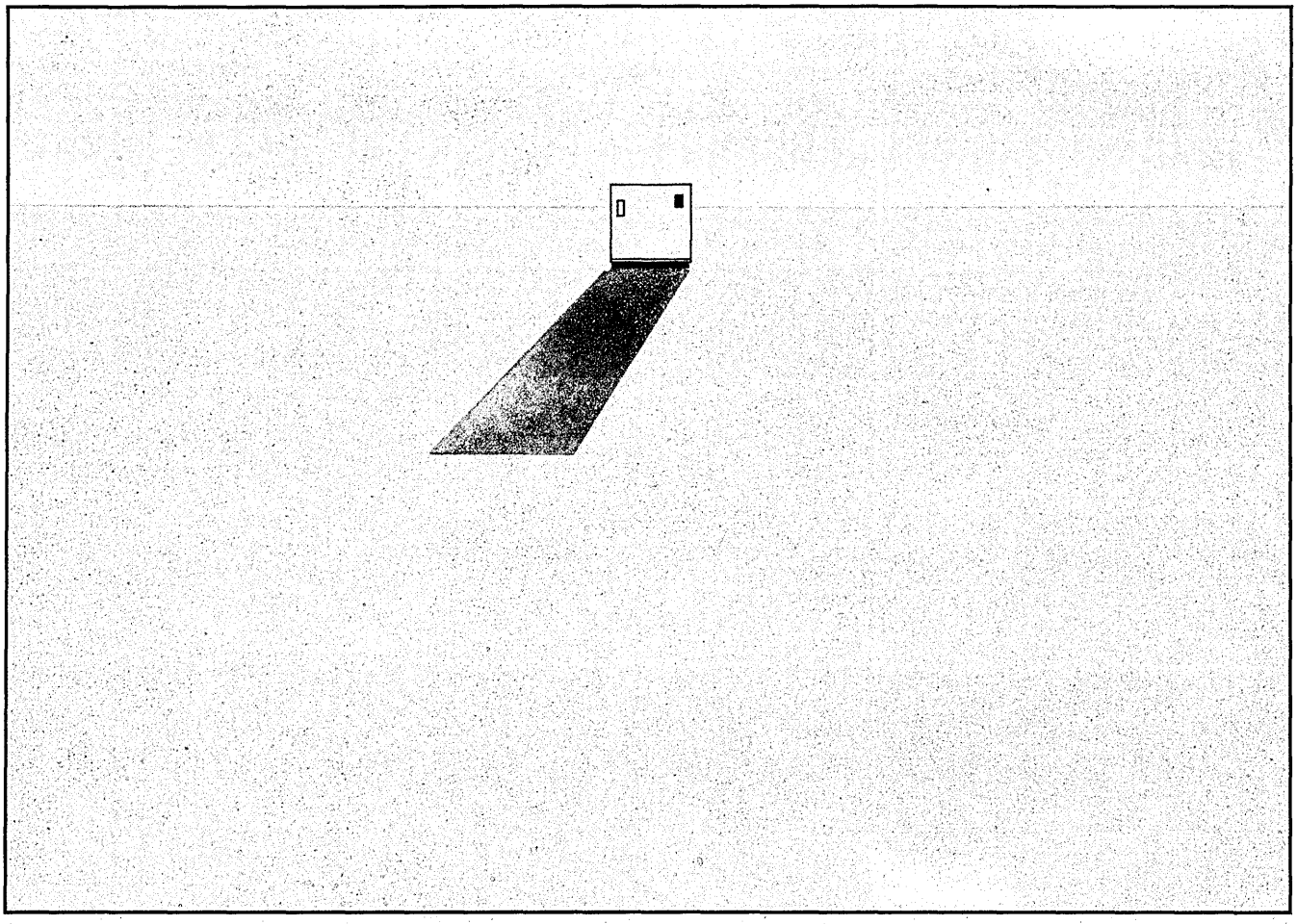
The authors uncovered an interesting pattern when they compared the terminal and nonterminal samples. Overall, there was no significant difference between the terminal group and the nonterminal group in their attitudes toward their jobs. When they looked at individual clusters of employees' feelings, however, the terminal group showed more positive attitudes than the nonterminal group. They felt more positive about coworkers and about their sense of personal responsibility.

As tellers' experience with terminals increased, a number of things were revealed. They experienced no major changes in their attitude toward work itself, their sense of personal development, or their responsibility for quality. Their feelings of accomplishment were slightly depressed, while feelings about coworkers became more positive, and they liked the increased amount of feedback available with a terminal (their degree of accuracy was now immediately known to them). Terminals seemed to have no effect one way or another on the tellers' tardiness, absenteeism, or turnover.

As a result of the survey, the authors recommended that bank management give a "tentative green light" to the project, with the provision that motivational impact be measured at each step of the conversion. It was their belief that no technological change could move forward without motivated personnel and that impact on personnel should be measured before a final decision is made.

—Lauren D'Attilo

No computer should be an island.



Standalone computers have clear limitations, but when they're linked to a data network they can give and receive information from many sources. That's why Boeing Computer Services offers you an independent, end-to-end, fully managed networking capability. And that's how you can take advantage of our expertise to connect your existing equipment and systems.

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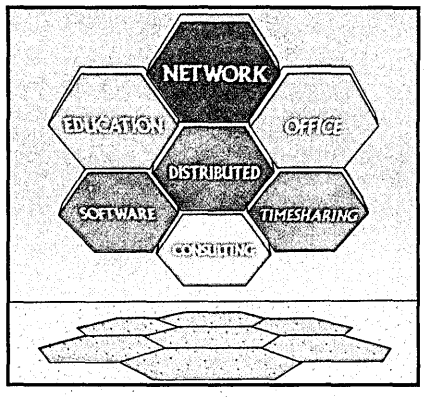

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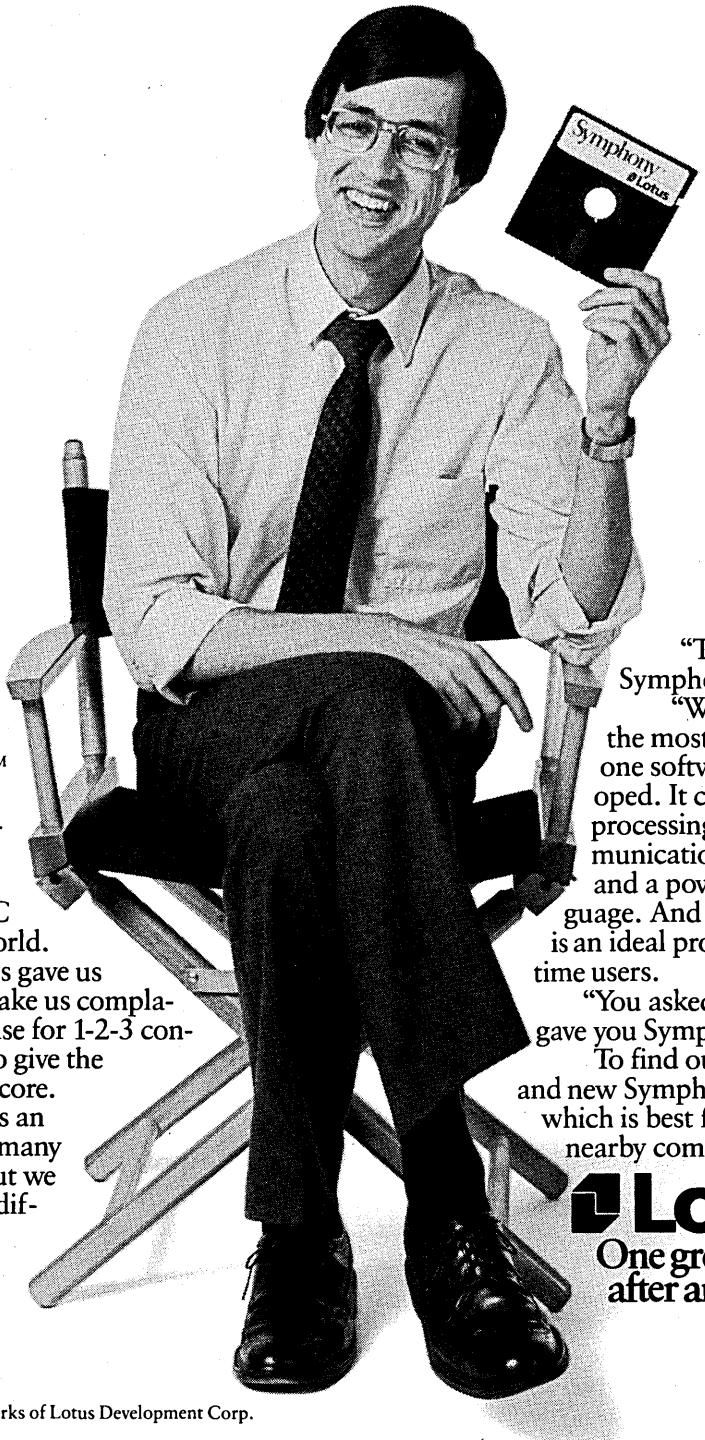
"You asked for an encore.

Brian Stains is the Symphony Program Manager at Lotus Development Corporation. He was previously involved with the creation of 1-2-3 software and is one of the original members of the company.

We gave you a Symphony."



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CIRCLE 27 ON READER CARD

LOOK AHEAD

BAD MARKS FOR 3B2/300	Boeing Computer Services, an arm of the Seattle-based aerospace company, is understood to be displeased with an order of 3B2/300 supermicros it received from AT&T. Several of the 32-bit Unix machines were delivered for evaluation recently, but BCS workers found them to be slow performers and in need of up to 50 nonspec changes. "This is a prototype, not a machine," said one BCS source. It was not clear, however, if BCS would return all the hardware or forge ahead.
IBM AND ITT TO JOIN ESPRIT	IBM and ITT will be the only non-European companies involved in the first full phase of the European Economic Community's $1.5 billion Esprit research program in computer and communications technology. Ignoring criticism from some members that this ought to be a Europe-only show, the EEC will announce in mid-September that the two U.S. companies are banding together with other European firms in the mainstream Esprit research projects. Altogether, 90 projects out of 441 proposals have been accepted, half funded by the EEC and half by industry. IBM tried to get involved once before in the pilot phase of the program but, as an EEC spokesman put it, "IBM's proposals simply weren't good enough."
REACHING OUT TO MAKE SOFTWARE	AT&T is fast expanding its list of European partners as it tries to make a splash in the international market. The latest agreement is with British videotex company Aregon, which will develop software for AT&T's videotex terminals and frame creation system. Both the North American NAPLPS and British Prestel protocols will be supported. The partners will also develop a system based on the pan-European CEPT standard, which is being used by IBM in West Germany's Bildschirmtext videotex system.
CATCHING UP WITH 3270	Even though North Star began volume shipments of its 16-bit, 12-user Dimension MS/DOS system in May, two months late, the San Leandro, Calif., vendor still plans to ship a 3270 emulation by October. It would make the Dimension appear to IBM mainframes like a 3274 controller with up to 12 logical units attached.
M&D TO ADD UTILITIES	McCormack & Dodge is set to unveil two new products at its annual user meeting this month in Washington. The Natick, Mass., firm will preview Passport, a report writer, and FYI, which is described as an on-line memo writer that lets

LOOK AHEAD

	users send electronic mail, update files, and incorporate messages into record-keeping activities. Both packages will interface with M&D's Millenium series of applications packages.
SDS, ONE MORE TIME	The third reincarnation wasn't the charm for Scientific Data Systems, but maybe the fourth will be. The SDS founded by Max Palevsky in 1961 disappeared in 1969 when Xerox bought him out for close to a billion dollars. The name was revived in 1975, right after Xerox folded the general purpose computer operation, when former SDSer Richard Duley picked up rights for $4 (September 1975, p. 102) and applied it to a short-lived leasing company. In 1979 another former SDSer, Jack Mitchell, dubbed his small business system startup SDS and obtained financial backing from Palevsky. SDS III failed to flourish and was sold off in pieces last year. The name, however, lives on, now retained by a major SDS investor, David Shamp of Washington, D.C., who named himself ceo. From what we hear, though, SDS IV hasn't done any kind of business yet.
IRS GOES PLASTIC	The Internal Revenue Service is looking hard at optical disk storage of tax forms. The IRS is thinking of electronically storing images of entire tax forms and then destroying the originals. It has reportedly received an OK from the Justice Dept. on the legal status of handling official, signed forms that way. One supplier close to the potential disk installation is FileNet, a Costa Mesa, Calif., company that sells Document-Image Processor, a disk-based office system. Meanwhile, the IRS is also toying with the idea of letting us pay our taxes by credit card.
RUMORS AND RAW RANDOM DATA	Work is under way at SofTech Microsystems to boost the memory capability of the so-called p-machine that underlies the firm's p-System portable operating environment. Current memory restrictions have limited the p-System's performance and, as a direct result, sales. . . .Intel's End-User Systems Operation is continuing work on off-loading mainframe dbms functions to microcomputers. The focus of some such work is on something called a "data filter.". . .Alpha Micro Systems of Irvine, Calif., is working on an attachment for MS/DOS machines into its 68000-based, multi-user computers. The company is also working out a software distribution scheme that would use spare bandwidth on video channels and is planning to come out with a videodisk backup device.

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Statistics, reports and plots happen magically with SPSS/PC+—the Statistical Package for IBM PC/XTs.

SPSS/PC is the most comprehensive statistical package for performing simple or complex tasks, regardless of data size. It maintains feature and language compatibility with mainframe SPSS, while optimizing for the PC environment.

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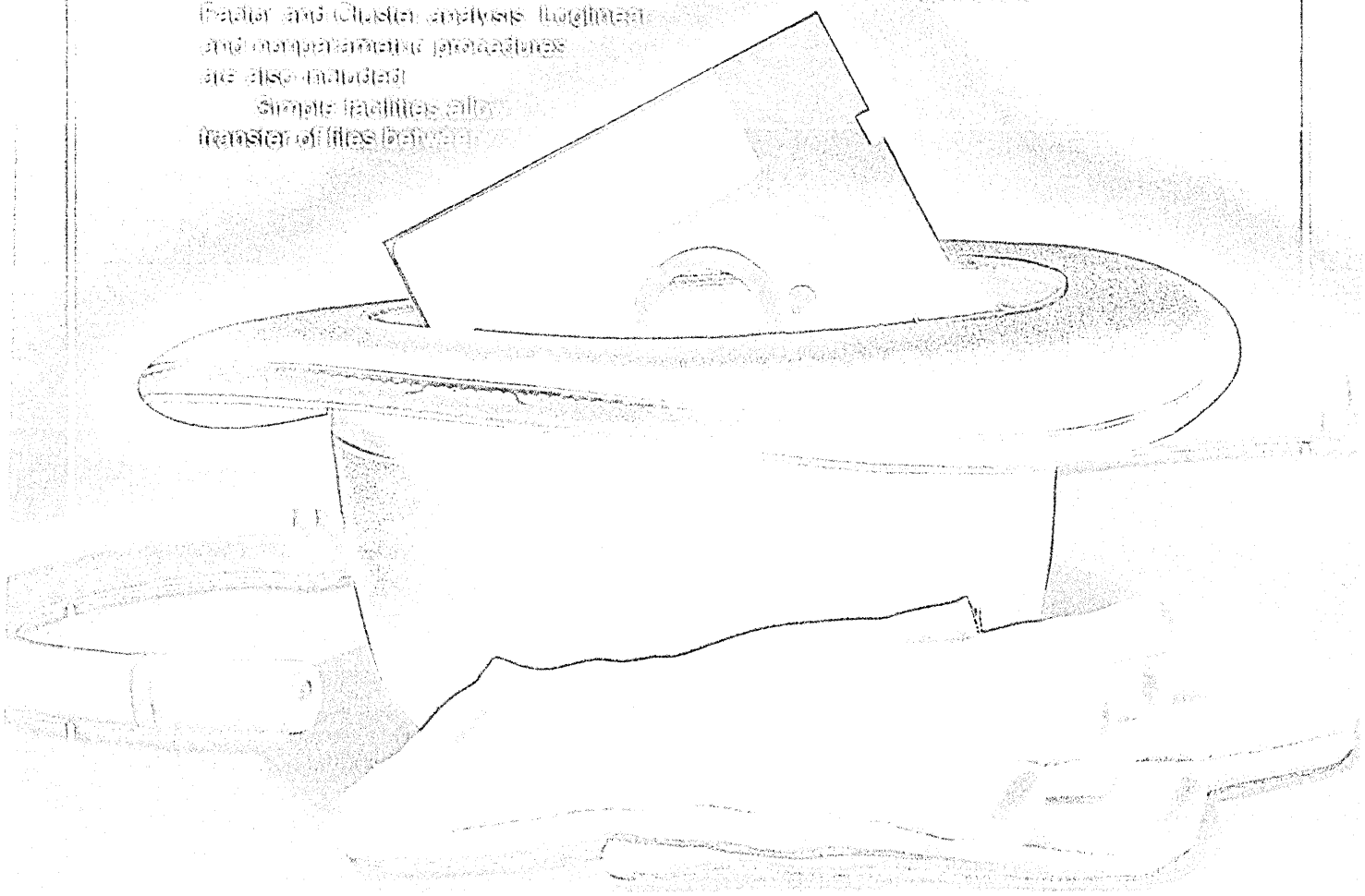

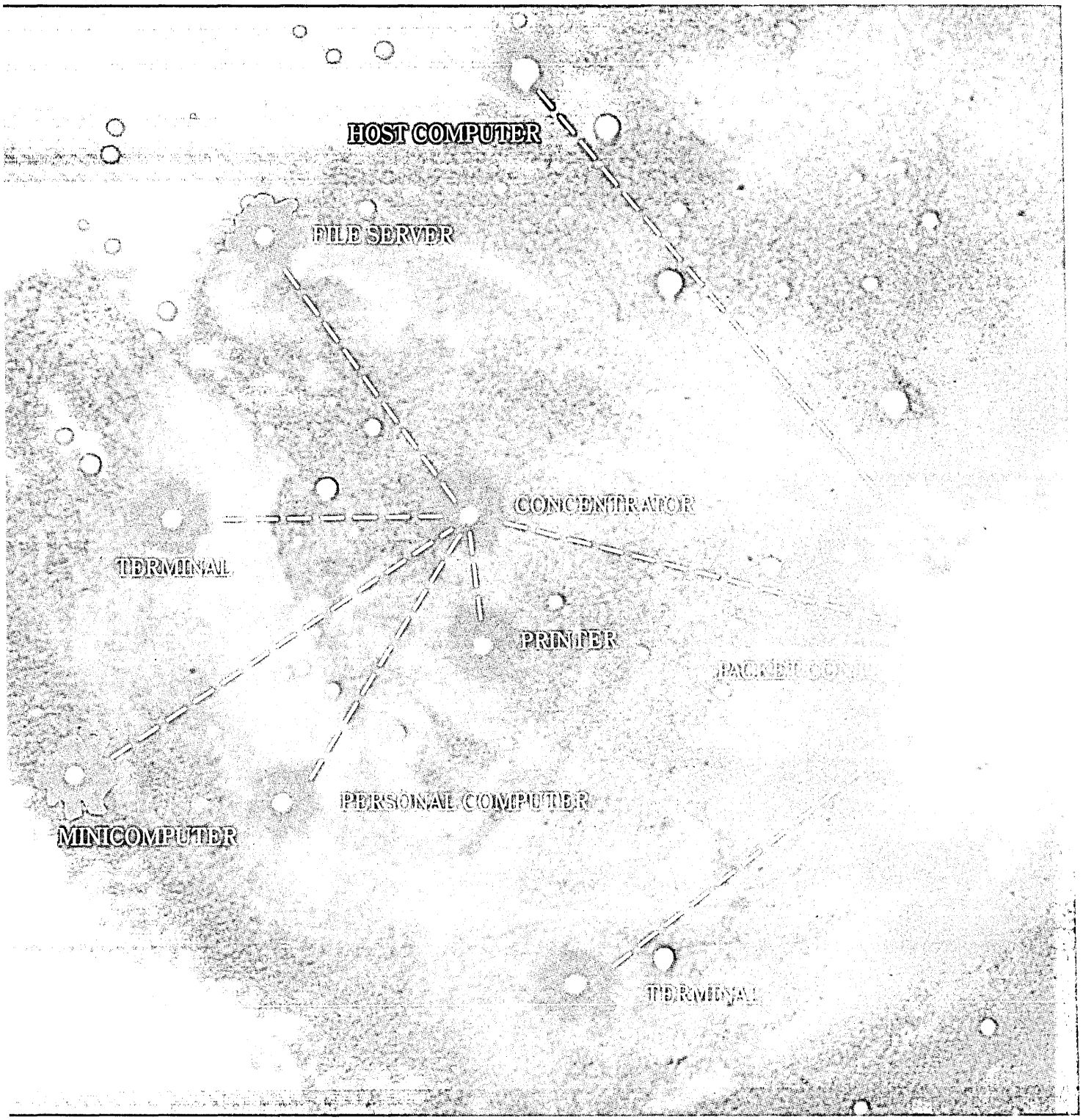

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The network brings together a star topology, a Packet Controller with a centralized transmission bus, and a collision-free network access protocol, making it truly unique in local networks. It not only performs with high stability in data flow conditions from low-load to near peak capacity, it also distributes access to as many as 1,900 individual users. ISN even provides centralized control and administration. And because all interfaces are housed in a central cabinet, security is high. Local and remote diagnostics make the system easy to maintain and administer.

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ISN is based on the communications and networking expertise drawn from AT&T Bell Laboratories, and AT&T Information Systems Laboratories for advanced research and development in new technologies. And on AT&T's stellar reputation for product reliability. What's more, this product is backed by AT&T Information Systems' professional, highly trained sales and service teams. They're committed to making [illegible] data network a reality with AT&T Information Systems Network, from design through installation.

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CALENDAR

SEPTEMBER

The IBM System User Show.
Sept. 3-5, London, England, contact: Peter Walker Associates, 32 Fitzroy Sq., London W1P 5HH England, or call (44) 01-388-9871.

The National Software Show (NSS).
Sept. 5-7, Anaheim, Calif., contact: Ginger Gaddy, Sales Manager, Raging Bear Productions Inc., 21 Tamal Vista Dr., Suite 175, Corte Madera, CA 94925, (415) 924-1194 or (800) 732-2300 outside California.

Electronic Imaging '84.
Sept. 11-13, Boston, Mass., contact: Electronic Imaging '84, Morgan-Grampian Expositions Group, 2 Park Ave., New York, NY 10016-5667, or call (212) 340-9780.

Midcon/84 and Mini/Micro Southwest-84.
Sept. 11-13, Dallas, Texas, contact: Nancy Hogan, Electronic Conventions Inc., 8110 Airport Blvd., Los Angeles, CA 90045, (213) 772-2965.

Eurographics '84.
Sept. 12-14, Copenhagen, Denmark, contact: Eurographics '84 secretariat, DIS Congress Service, Linde Alle 48, DK-2720 Vanlose, Denmark, tel. 45-1-712244.

Infodial Videotex '84.
Sept. 17-21, Paris, France, contact: Infodial-Videotex, 4 place de Valois, 75001 Paris, France, tel. (1) 261-52-42, telex 212597F.

Business Systems '84.
Sept. 17-22, Taipei, Taiwan, contact: American Institute in Taiwan, c/o CORDAG Associates Inc., 4405 East West Highway, Suite 401, Bethesda, MD 20814, or call (301) 652-6404.

Federal Computer Conference.
Sept. 18-20, Washington, D.C., contact: Federal Computer Conference, P.O. Box 368, Wayland, MA 01778, or call (800) 225-5926 or (617) 358-5181.

Fiber Optic Communications and Local Area Networks Exposition (FOC/LAN 84).
Sept. 19-21, Las Vegas, Nev., contact: Information Gatekeepers Inc., 138 Brighton Ave., Boston, MA 02134, or call (617) 787-1779.

SICOB
Sept. 19-28, Paris, France, contact: Sicob, 4-6 Place de Valois, 75001 Paris, France, tel. Paris 261-5242.

PCExpo.
Sept. 24-26, Anaheim, Calif., contact: PCExpo, 333 Sylvan Avenue, Englewood Cliffs, NJ 07632, or call (201) 569-8542.

Userfest/New York (formerly Applefest and PC '83).
Sept. 20-23, New York, N.Y., contact: Northeast Expositions, 822 Boylston St., Chestnut Hill, MA 02167, (617) 739-2000.

OCTOBER

INFO 84 (The 11th International Information Management Exposition & Conference).
Oct. 1-4, New York, N.Y., contact: Clapp & Poliak, 708 Third Ave., New York, NY 10017, (212) 661-8010, telex 12-6186.

14th International Symposium on Industrial Robots (ISIR).
Oct. 2-4, Göteborg, Sweden, contact: Svenska Massan Stiftelse, Box 5222, S-402 24 Göteborg, Sweden, tel. 46-31-20-00-00, telex 20600 Maessan S.

Infomatics '84 (The 16th Annual Conference and Exposition of the International Information Management Congress).
Oct. 2-4, Singapore, contact: Infomatics '84, P.O. Box 34404, Bethesda, MD 20817, (301) 983-0604, telex 904100 WSH.

ACM 1984 Annual Conference.
Oct. 8-10, San Francisco, Calif., contact: ACM, 11 W. 42nd St., New York, NY 10036, (212) 869-7440.

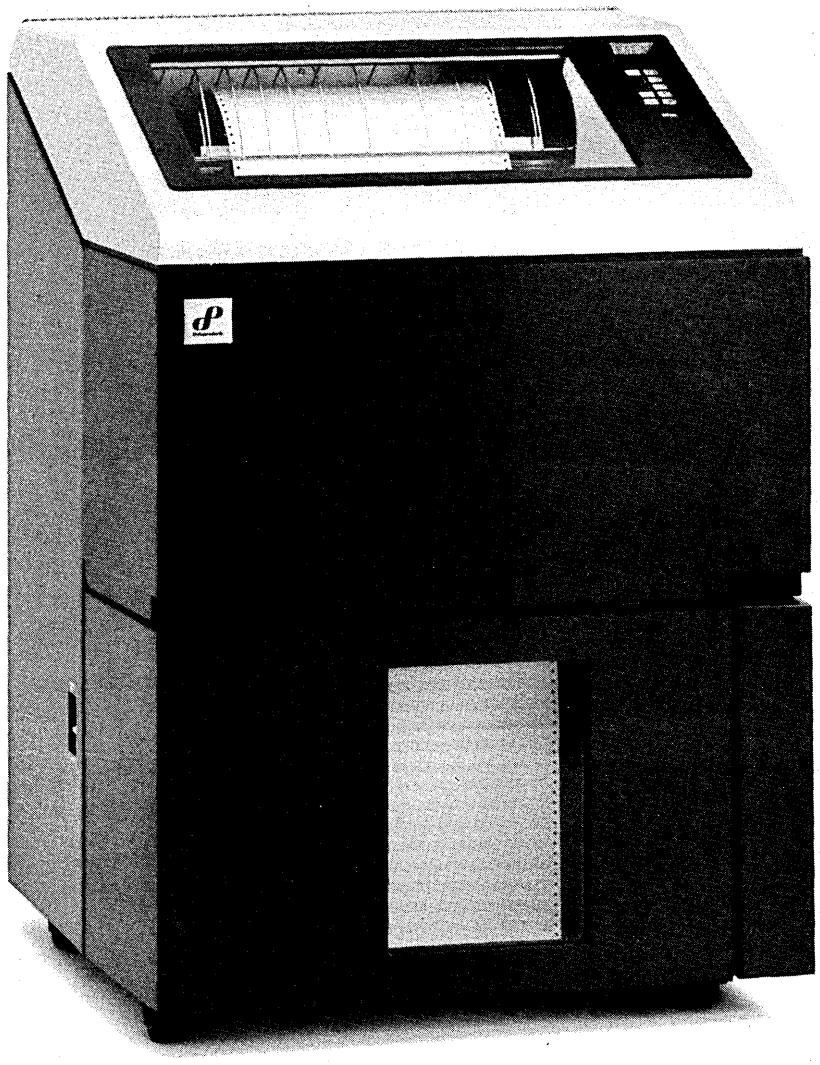
INTECH '84 (The Integrated Information Technology Conference and Exposition).
Oct. 8-11, Dallas, Texas, contact: Rosalind Boesch, Director of Public Relations, National Trade Productions Inc., 2111 Eisenhower Ave., Suite 400, Alexandria, VA 22314, (703) 683-8500.

Telcos & Videotex.
Oct. 10-12, San Diego, Calif., contact: Online Conferences Inc., Suite 1190, 2 Penn Plaza, New York, NY 10121, (212) 279-8890.

The 1984 Computer Expo & P.C. Faire.
Oct. 11-14, Sacramento, Calif., contact: The 1984 Computer Expo & P.C. Faire, P.O. Box 160288, Sacramento, CA 95816, (916) 924-9351.

TeleCon IV (The Fourth Anuual Teleconferencing Users Conference).
Oct. 15-17, Anaheim, Calif., contact: Mrs. Patty Portway, Conference Director, Applied Business Communications, 5 Crow Canyon Ct., Ste. 209, San Ramon, CA 94583, (415) 820-5563.

The West Coast Electronic Office & Expo Conference (EOE '84).
Oct. 16-18, San Jose, Calif., contact: Cartlidge & Assoc. Inc., 4030 Moorpark Ave., San Jose, CA 95117, (408) 554-6644.



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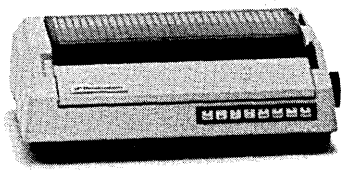

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Nobody puts ideas on paper so many ways.

If you're using your printer with a personal computer, you probably need one that can handle a variety of functions.

At the same time, the price should be in line with the computer itself. Low.

The pint-sized Dataproducts printer in the picture costs about as much as one good software package.

It prints spreadsheets, graphics and illustrations, labels, multi-part forms—even letters that look like they were typed.

But let's say you're running a big computer and it's hundred-page reports you need. Pronto. Or documents by the millions.

The printer on the right finishes a full computer printout page in less time than it takes to sneeze. At 2,000 lines a minute, it prints much faster than you can see. Three shifts a day. Year after year.

In between these two special-duty Dataproducts printers are whole families of other Dataproducts printers—daisywheel printers, non-impact printers, high-security printers for the government, and more.

In fact, we make more different kinds of computer printers than any other independent printer company in the world.

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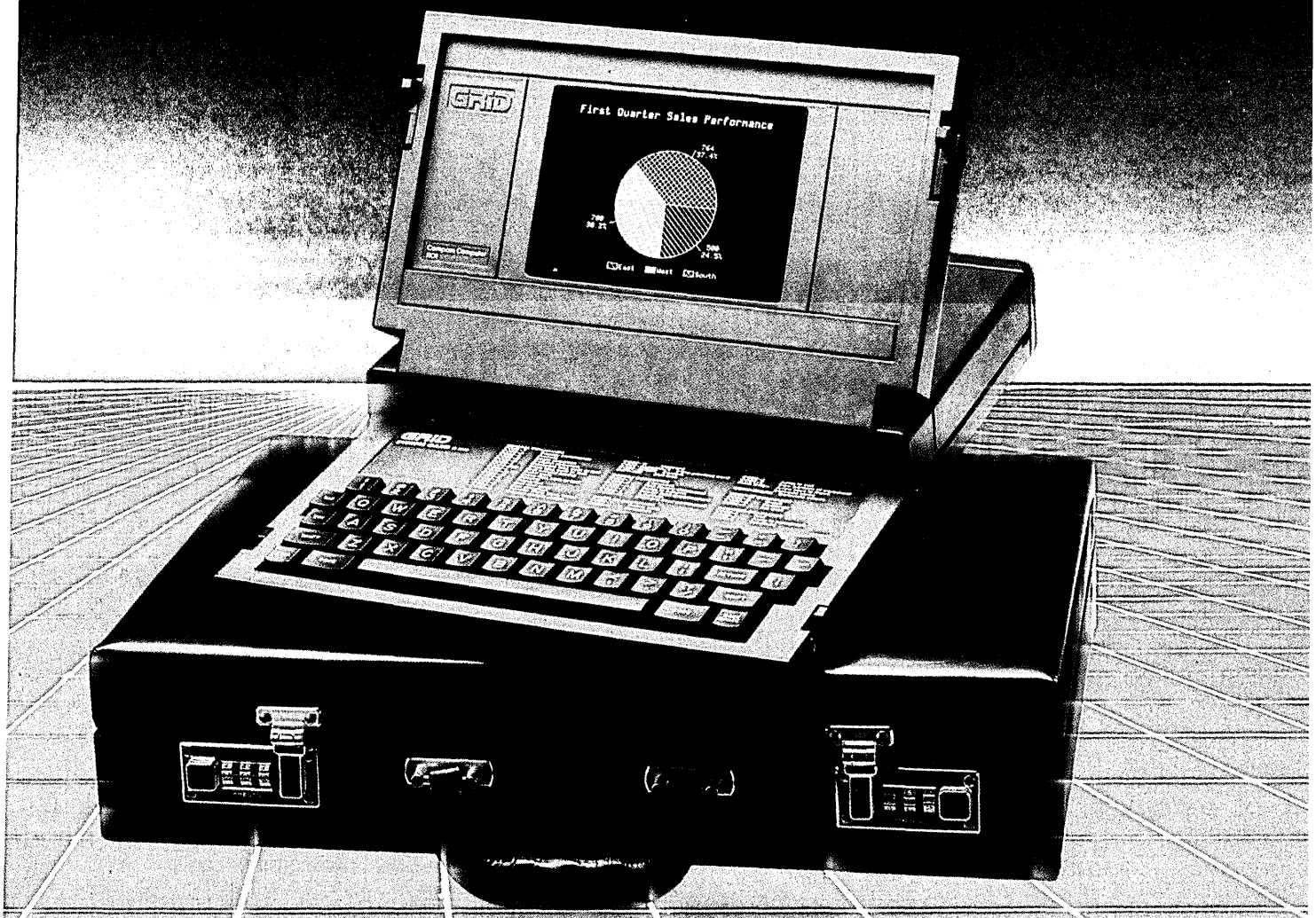
Dataproducts computer printers.

CIRCLE 29 ON READER CARD

All computer photographs are unretouched.

BRIGHTEST OF THE BUNCH.

A quick glance shows that GRiD's 25 line EL screen is brighter and easier to read than the 8 or 16 line LCD screens of other briefcase computers. But looks aren't everything.



GRiD COMPUTERS ARE SMARTER TOO.

For example, GRiD is more powerful with up to 1.4 million bytes of built-in memory for large files and spreadsheets. GRiD's internal modem communicates four times faster using ordinary phone lines. And GRiD Server networking keeps you in touch with your office from any location. GRiD features its own multitasking, easy-to-learn integrated software, plus popular IBM® PC programs like 1-2-3™ by Lotus.®

And for presentations, only GRiD's high resolution EL screen can be seen from any viewing angle.

Customers throughout the world have been relying on these proven capabilities for nearly two years. Best of all, GRiD briefcase computers start at only $3,450.

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CIRCLE 30 ON READER CARD

SYSTEM 2000® DBMS. WHEN YOU BOUGHT IT FIVE YEARS AGO, THEY THOUGHT YOU WERE SMART. TURNS OUT YOU WERE A GENIUS.

In the beginning, you bought your SYSTEM 2000 DBMS because it was the best anywhere.

You also figured Intel simply wouldn't be able to leave well enough alone.

You were right.

And, thanks to a continuing program of product enhancements, our DBMS keeps getting better and better.

While you keep looking smarter and smarter.

Now, in addition to all of our previous improvements, the SYSTEM 2000 DBMS also offers Relational Database Access (RDBA).

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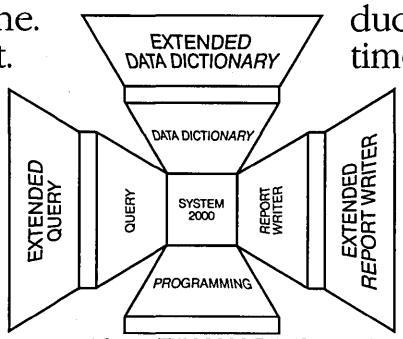
RDBA is an enhancement of our system's query and report languages which gives relational access to multiple databases. Which, in turn, enables users to greatly reduce programming time, perform database modeling and engage in "what if" analyses. Some very noteworthy user benefits in anybody's book.



The SYSTEM 2000 DBMS offers a powerful set of integrated functions. The result is the broadest and deepest functionality of any DBMS.

It all adds up to the broadest, deepest functionality of any DBMS anywhere.

The kind of functionality that allows virtually any pc to share data with virtually any mainframe. We call it the Data Pipeline™ system.

The ingenious SYSTEM 2000 DBMS.

Backed by a billion-dollar-plus, technologically-renowned company which continues to support each and every SYSTEM 2000 DBMS with complete training, documentation and hotline services.

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There's still time to go to the head of the class.

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CIRCLE 31 ON READER CARD

LETTERS

GREAT GRAPHICS

Congratulations to DATAMATION and artist Ponder Goembel for the most beautiful cover ever (June 1, Cover Art)! And, it has relatively subtle, yet to-the-point meaning—IBM blue-striped fish and floppy manta.

Perhaps DATAMATION will continue in efforts to improve the quality of art in magazines as "graphics" continues to be more than a buzzword in data processing.

PERRY PETERSEN
Chief Planner
SPCM Inc.
Oakland, California

NEVER UNDERESTIMATE USER BASE

The DATAMATION 100 survey presented in the June 1 issue was an informative, in-depth review of the major players in the dp industry. In its review of Martin Marietta Data Systems (p. 128), the survey reported on MMDS' merger with Mathematica Inc., saying, "[Mathematica Products Group's] RAMIS II is the industry's leading fourth generation language, with over 500 installations." Actually, there are over 1,200 installations of RAMIS II, in over 30 countries.

GLENN T. FRANTZ
Senior Marketing Specialist
Mathematica Products Group
Mathematica Inc.
Princeton, New Jersey

NEVER UNDERESTIMATE AT&T

I particularly enjoyed Rebecca Barna's comments in "Underwhelmed with Enthusiasm" (May 1, Editorial, p. 25).

For some time now I have been consulting to Jack Scanlon, head of AT&T Technology Systems, Computer Systems Division (AT&T Technologies Inc. Group) on many of the issues you touched on. I am particularly encouraged and impressed by your "Noble Inference" theory in response to AT&T's "Damned if you do, damned if you don't" predicament.

For some reason it has recently been considered great sport to criticize and underestimate AT&T's capabilities and determination in a number of areas. From my perspective, which may, in fact, be unique, I caution the detractors. Anyone concerned with his reputation as an industry seer would be advised to keep his predictions of mediocrity out of print.

Few companies in history have proved better equipped to generate, manufacture, sell, and manage both technology and service on a mass basis.

DENNIS JAY CAGAN
The David Jamison Carlyle Corp.
Culver City, California

MISSING LINKS INDEED!

Your June 15 issue carried a data communications news story, "Missing Links Emerge" (p. 78), and a feature article, "The Little Handshake Machines" (p. 102). Both these articles focused on protocol conversion for either 3270 bisync or 3270 SNA/SDLC. In the feature article, minor reference was made to specialty segments of the protocol conversion marketplace, such as Burroughs' Poll/Select.

Both articles ignored the recent heavy penetration of protocol conversion into two IBM market segments. PERLE GSD, Protocol Computers, Renex, and Wall Data are extremely active in both these market segments.

The first of these market segments is the 5251 protocol, which is supported by the IBM Systems 34, 36, and 38. These systems represent IBM's largest number of installed systems. Approximate figures for the number of U.S. installations are as follows: System 34, 65,000; System 36, 15,000; and System 38, 10,500. IBM has made major commitments in expanding the marketing of these systems.

The second IBM segment not discussed is the remote batch protocol. The bisync batch protocols, 3780/HASP, are serviced by suppliers, such as PCI, Local Data, Black Data, Sherwood Digital, and Innovative Electronics.

The SNA/SDLC batch protocol, 3770, is supported by PERLE GSD, KMW Systems, Wall Data, and PCI. In addition, PERLE GSD and Wall Data allow users connected through their 3270 SNA/SDLC protocol converters to switch their terminals or personal computers between the 3270 and the 3770 modes of operation.

The 3770 protocol is particularly useful for uploading files without the attendant delays in transferring files via the interactive 3270 protocol. In addition, the user can access either POWER or JES for remote job entry or reception of print files.

CHUCK BALSLY
President
PERLE GSD Ltd.
Chicago, Illinois

CALLING A THIEF A THIEF

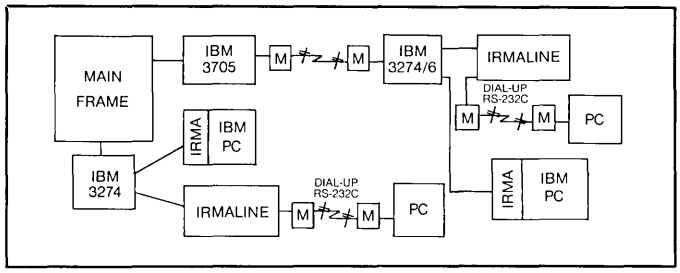
I have been reading reports on the problem of software piracy for some time, in DATAMATION (April 15, News in Perspective, p. 49) and elsewhere, and I think part of the problem is its name. What does "piracy" mean, or imply, these days? Something romantic and swashbuckling? Or perhaps something that teenage hackers do? Certainly, the word has acquired connotations that hardly describe the problem.

The word piracy fits the software industry's standards of finding cute names for things. Unfortunately, it is a euphemism—a nice word for a not-nice thing.

I doubt that the software industry can solve the piracy problem until we call it what it really is: *theft* and *copyright violation.* Using euphemisms can only disguise the problem and delay solutions. Calling a thief a thief will encourage people to look at the situation more clearly.

DAVID WOLFF
Framingham, Massachusetts

Here are two beautiful ways to get small computers on line with the mainframe quickly, easily and economically—yours from DCA, home of the industry's first coaxial cable links between small computers and IBM 3270 networks.



IRMA™ is the Decision Support Interface™ that gets IBM Personal Computers and IBM PC XTs into the 3270 mainstream via direct attachment to 3274 or 3276 controllers.

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IRMA™ and IRMALINE™. The DCA family connections that help small computers think big.

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IRMALINE™ does the same for remote IBM PCs, IBM PC XTs, Apple Lisas and DEC Rainbows, among others, with just a local phone call to a nearby 3270 controller.

Both can go to work literally minutes out of the box. Both provide mainframe data access, selection and storage, and data communication back to the mainframe.

Put first things first. Find out more about the DCA first family of 3270 micro/mainframe connections. For information, write DCA, 303 Technology Park, Norcross, Georgia 30092. Phone (404) 448-1400, TLX 261375 DCA ATL. Or call us toll-free (800) 241-IRMA.

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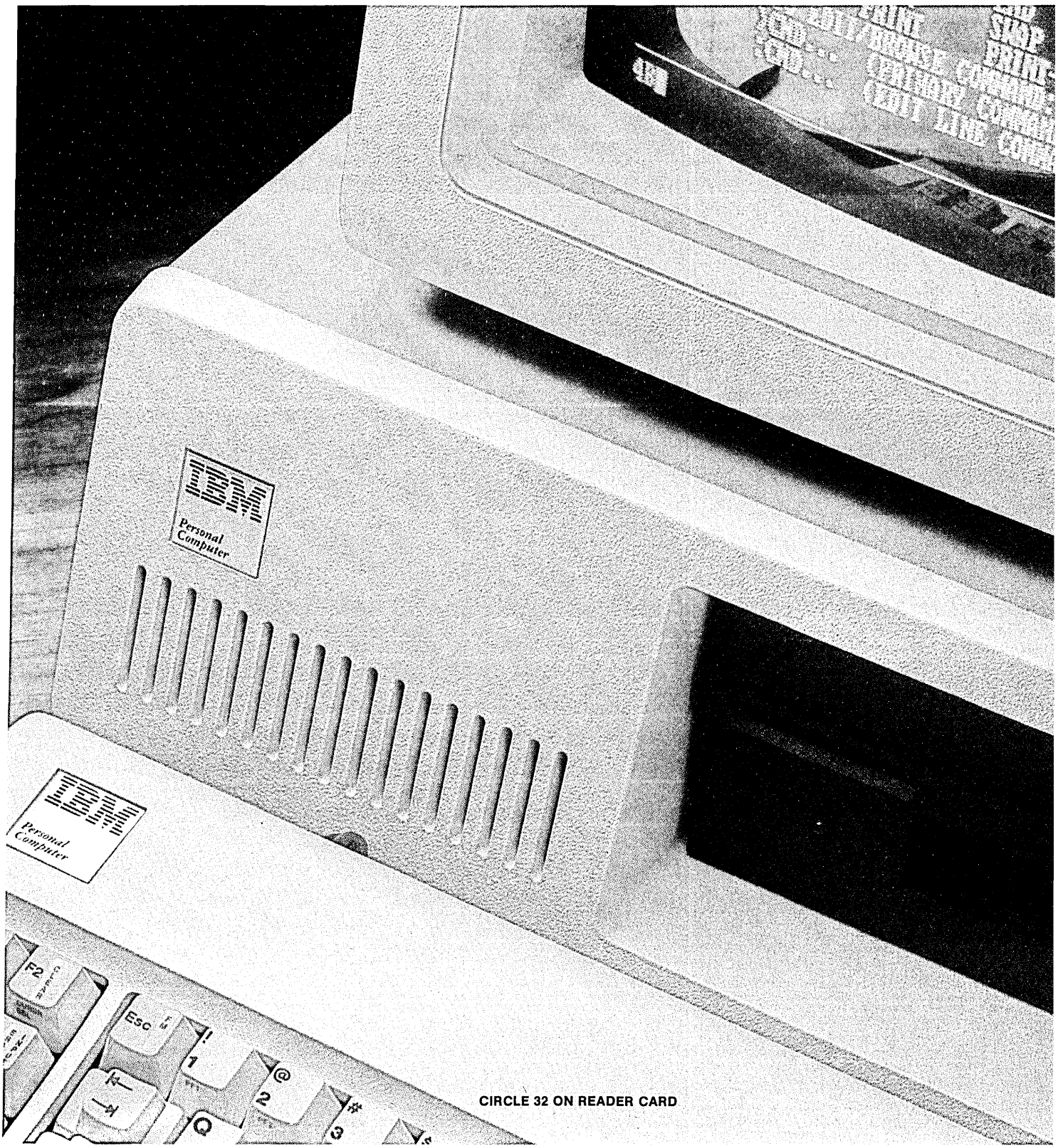
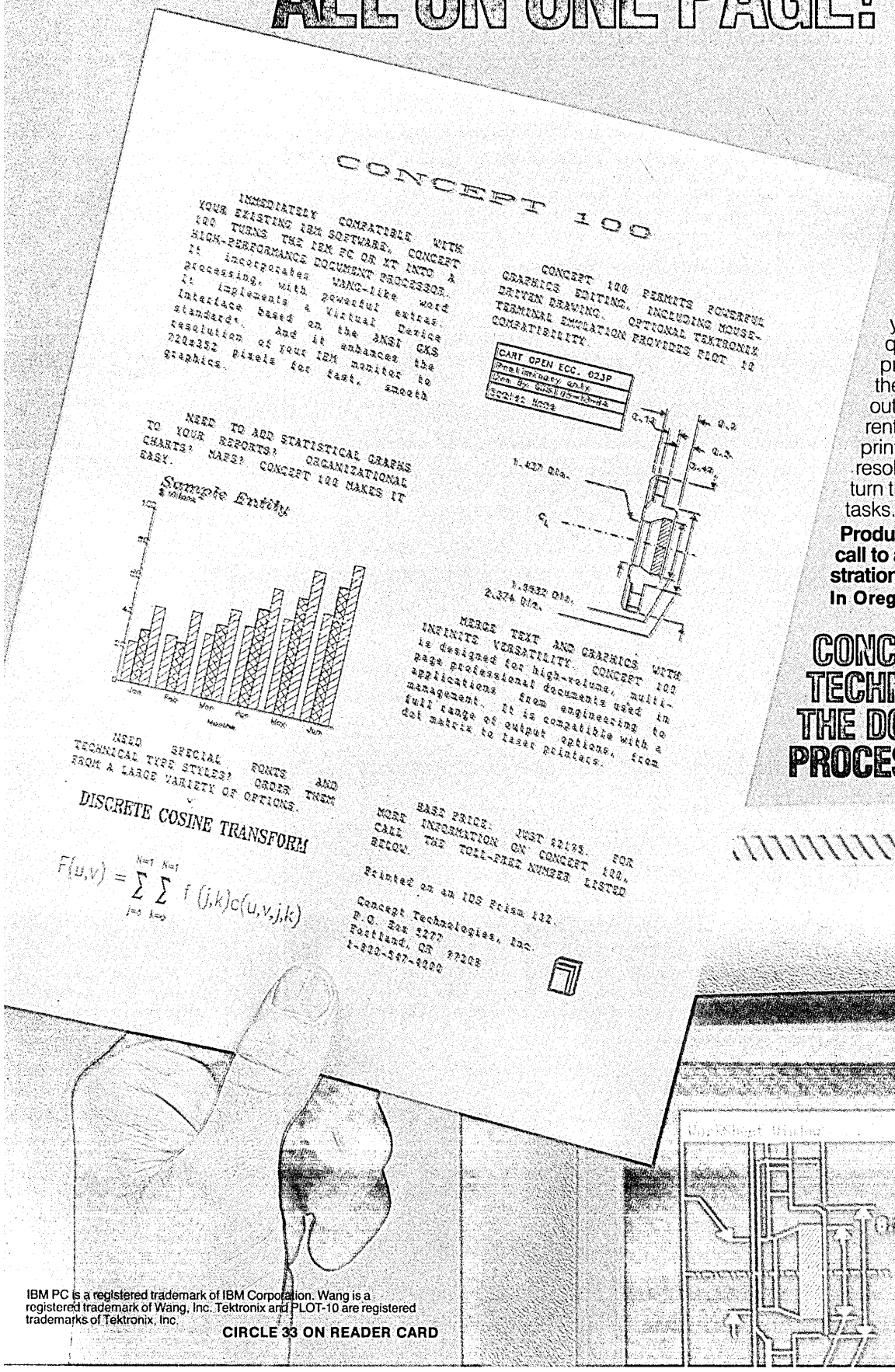


CIRCLE 32 ON READER CARD

IBM PC. WANG WP. TEKTRONIX PLOT 10. ANSI GKS. ALL ON ONE PAGE!



Here's documented proof that full-function word-and-graphics processing is practical at last.

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CONCEPT TECHNOLOGIES: THE DOCUMENT PROCESSORS

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CIRCLE 33 ON READER CARD

Rebecca S. Barna, Editor

EDITORIAL

THE CHIPS ARE DOWN

ILLUSTRATION BY DORIS ETTLINGER

Journalists have known for years that California is the storm bird of protest. Consider the Free Speech Movement in Berkeley, the nationwide ghetto riots that began in Watts, and the first demonstrations against the war in Vietnam that brought a regiment of reporters on a dead run to Oakland.

Of late, many Californians have turned their attention to Silicon Valley, where the semiconductor industry flourishes, and they do not much like what they see. The chip makers promised us light and clean industry, says a Greek chorus, but what they have given us is a legacy of tainted water and sick workers.

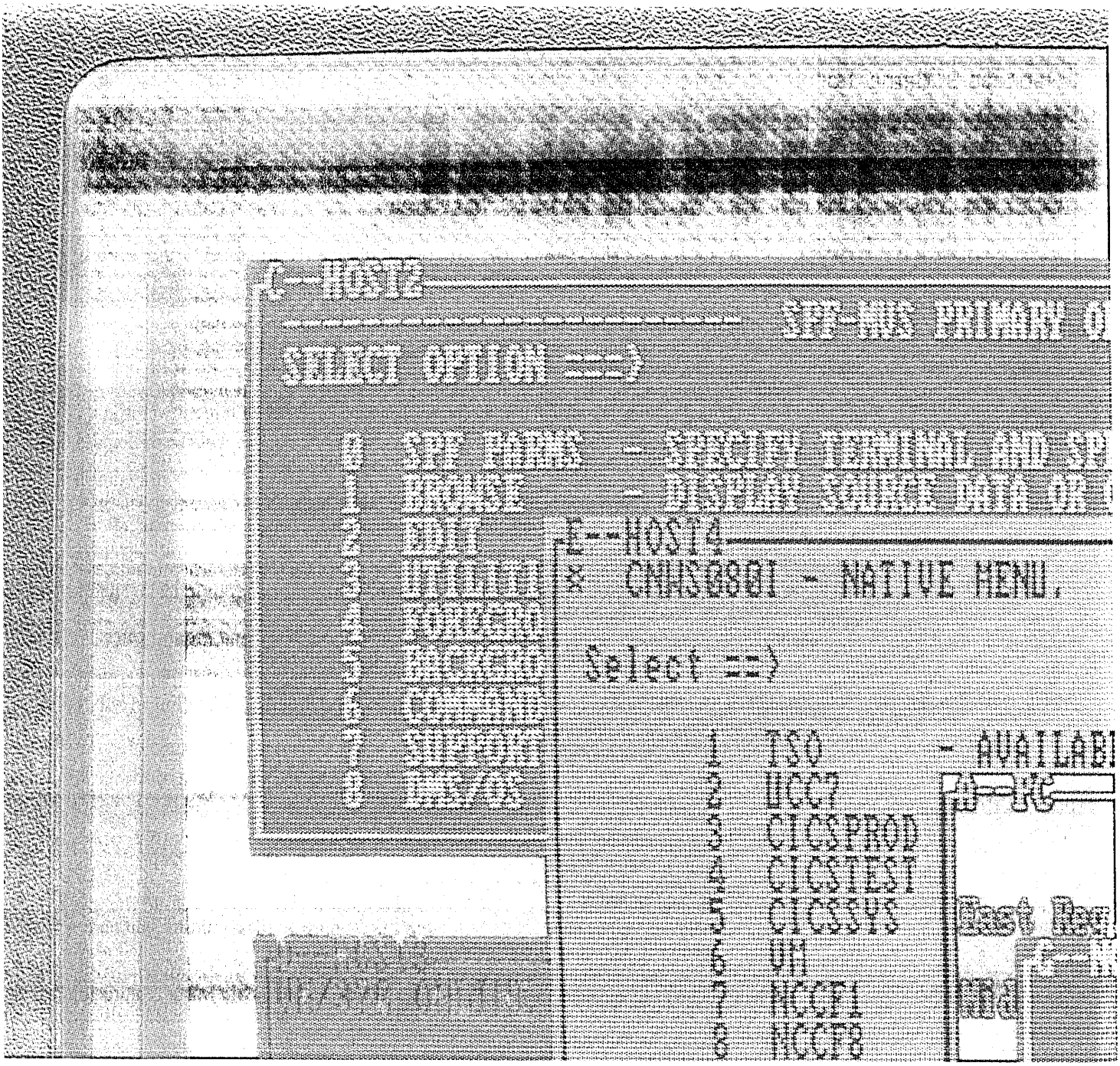
On balance, says Charles Howe, DATAMATION's San Francisco bureau manager, there are few villains in a toxic waste story that is drawing the attention of environmentalists and legislators in cities as diverse as Austin, Mexico City, Tokyo, and London. This much is clear. The chip makers need potentially dangerous chemicals to make their product, Howe explains in "Poison in Paradise," p. 30. Most of these chemicals were buried in underground tanks, as prescribed by law. Some of the tanks began to leak. The major vendors involved appear to have reported these leaks voluntarily. Subsequent investigation showed contamination of soil and groundwater. Publicity, lawsuits, and thus-far peaceful gatherings followed.

New and stiff legislation dealing with toxic chemical containers, say the chip makers, will make future spills unlikely. Perhaps. The industry has spent $50 million to date in Silicon Valley cleaning up the ground and the water, with no end of the spending in sight. Meanwhile, the semiconductor industry continues to move to new locations in towns across the world. Naturally, not a few environmentalists and labor activists promise to herald their coming with tales of Silicon Valley pollution.

Although a plea for federal help sounds like a throwback to the 1960s, that is what's immediately needed. The Environmental Protection Agency is years late in setting standards for the presence of these toxic substances in drinking water. Until they do, their feet should be held to the fire. All over, federal money must help in the cleanup—at least until it can be determined who spilled what and charges can be correctly apportioned. These tasks are clearly not going to be handled by California, whose governor recently cut some $5 million from funds earmarked for toxic waste monitoring.

The chip makers would do well to consider establishing a collective pot to fund long-term medical studies. Sooner or later, as defendants, many of them will be called upon in court to prove that the substances they inadvertently put in drinking water and exposed their workers to are not, as critics charge, genetic time bombs. Likewise, these vendors should be prepared to voluntarily institute California's new storage laws when they set up operations elsewhere, and then work closely with appropriate authorities from the moment they set up shop.

Finally, there is a matter of going public. Some vendors have remained silent in the face of lawsuits. Others have been more vocal. Collectively, the industry is going to have to make its case to the public, and here it might consider taking a page from Mobil Oil's books. For the questions being asked today in California are sure to be asked elsewhere in the world tomorrow, and in some places they may be asked with a vengeance. ◉



Introducing 3270 PC capability for

When IBM designed the 3270 PC, they thought of everything. Except what to do with all the PCs your company already owns.

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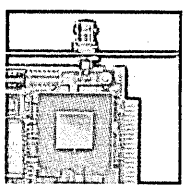

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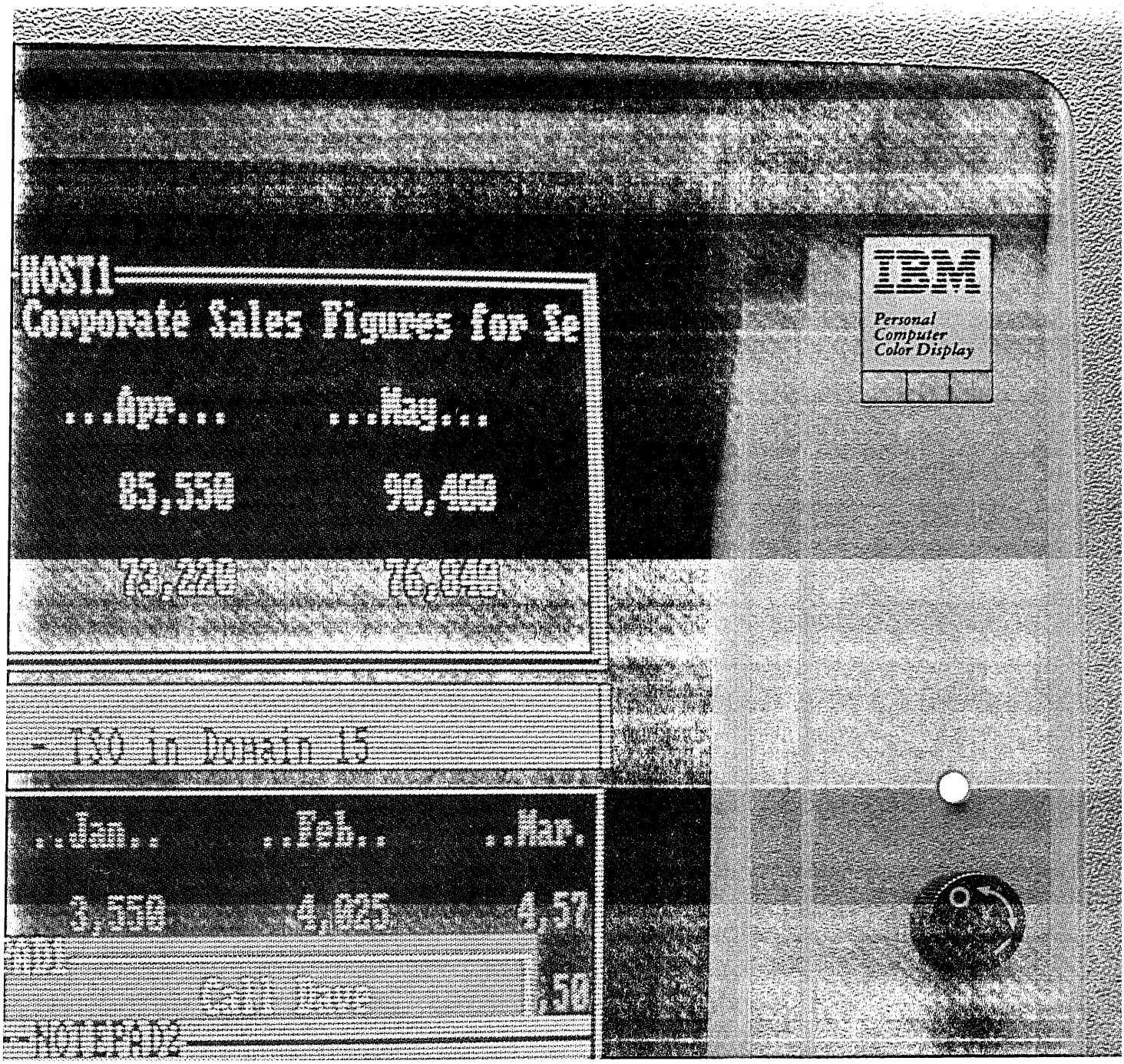

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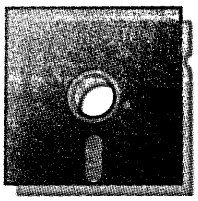

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IN FOCUS

POISON IN PARADISE

Californians charge that the semiconductor industry is contaminating Silicon Valley.

by Charles Howe

Progress, Icarus may have shouted shortly after he launched himself wearing a set of waxen wings, is not without its price. The automobile industry left the nation with a legacy of smog. The nuclear industry has yet to solve serious problems with radioactive wastes. Now a controversy that threatens to go international is festering in Silicon Valley, and it has to do with the toxic chemicals that are a by-product of the multibillion dollar semiconductor industry.

These chemicals are seeping into the public and private wells and surrounding underground pools of water that make up much of the water supply for the 1.3 million residents of Santa Clara County. Residents who have been drinking this water are going into court and charging that the chip makers have poisoned them. Moreover, lawyers representing hundreds of workers once employed in the semiconductor industry are alleging in workmen's compensation suits that their clients have been disabled by these chemicals.

Lines of battle are being formed as local and state officials, environmentalists, union activists—and even a handful of neo-Luddites—daily accuse the industry of misfeasance, malfeasance, and nonfeasance. To a journalist who grew up in this valley in the 1940s and ate of its fruit and drank of its sweet well water, the atmosphere is beginning to resemble that of a lynching bee out of a John Steinbeck novel.

To understand the problem is to understand the technology. Semiconductor chips begin as silicon crystals. These crystals are heated to temperatures of around 1,420°C, and dopants, including arsenic, phosphorus, and boron, are added to enhance electrical conductivity.

After the crystals are reduced to wafers, they are bathed in solutions containing sulfuric and nitric acids to remove grease. The chips undergo more heat treatment and are exposed to chemicals like hydrofluoric and hydrochloric acids and trichloroethylene, and toxic gases that include arsine, phosphine, and diborane. These substances form the transistors that will process electrical signals (see sidebar).

The seeds of the problem were sown more than two decades ago, as the apricot orchards and clapboard houses of the valley began to give way to the 1,600 semiconductor firms and their 150,000 employees who now do business there. Various city and county fire and safety regulations then in effect mandated that the chip makers bury the tanks containing volatile and otherwise hazardous materials. The vendors generally obliged, putting these tanks in areas sometimes only a few thousand feet from public and private wells. "In retrospect," laments Robert Ford of the State Water Quality Control Board, "it was the worst thing they could have done." Indeed, in time some of those mammoth storage tanks began to leak.

Most cities in Silicon Valley are served by public wells and by water that is piped in from sources still thought to be outside the area of contamination. There are also hundreds of valley families that have been drinking exclusively from private wells, some of them drilled even before Enrico Caruso fled San Francisco after he was shaken out of bed by the great earthquake of 1906.

"What you have to understand is that this valley is like a Swiss cheese, representing some 10,000 abandoned old wells," explains Ted Smith, a lawyer with an environmental group called the Silicon Valley Toxic Coalition. "The pollution problem, which has the potential for disaster, comes when these old wells act as an escalator for the industrial poisons," he continues. "These substances have seeped into the well shafts, dropped straight down, and the drinking water supply has become contaminated."

"In retrospect, ordering the industry to bury toxic chemicals was the worst thing they could have done."

Environmentalists say the water here has been tainted for 10 or more years. The first major leak documented occurred in late 1980 at IBM's south San Jose facility. State water engineers say that this leak and others apparently caused by IBM are yet to be contained.

To date the firm has spent some $20 million in its cleanup efforts, with most of the money going for drilling 332 monitoring and cleanup wells, at a rate of about $100 per foot, that are used to detect and then suck the poison out of the ground. Peter Johnson of the State Water Quality Control Board says that IBM's contamination has traveled underground more than two miles past its Cottle Road plant and is now moving northwest in a

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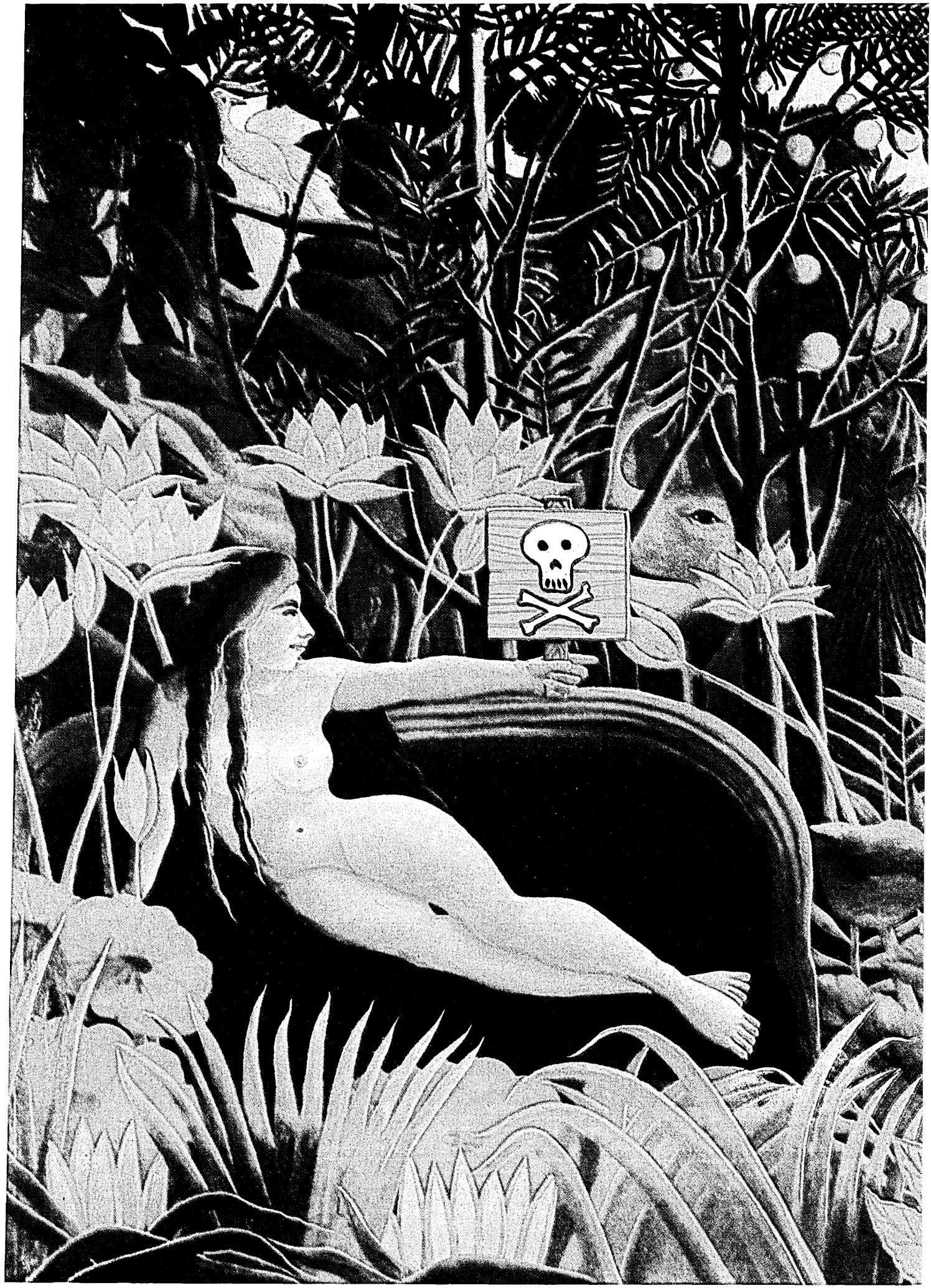

plume toward Coyote Creek at speeds of from five to 30 feet per day. IBM has not refuted the claim.

Another major spill occurred in 1982 after Fairchild Camera and Instruments reported that a storage tank, buried just 2,000 feet from a well owned by the Great Oaks Water Company in south San Jose, was leaking. State investigators found levels of a grease solvent called TCA about 13 times higher than its "action level," a status that could lead to a plant shutdown unless serious cleanup efforts commence.

To date, Fairchild has spent some $15 million trying to get the chemicals out of the water, according to state reports. More than 300 families that drank the water have filed suit against Fairchild, charging illnesses that include congenital heart defects in their children, childhood cancers, and thyroid, liver, and autoimmune disorders. Environmentalists say that Fairchild may have accidently released 58,000 gallons of hazardous solvents into groundwater between 1977 and 1981. A spokesman for Fairchild would neither confirm nor deny this figure. "You would have to read all the newspapers and look at all the figures they gave," she said. "You must understand that we have cleaned up the problem and we are now in litigation."

Other spills have been reported. Intel Corporation found one in Mountain View, and Hewlett-Packard found two leaks at its Palo Alto plants. By 1982 the state was concerned enough to order chip makers in the San Francisco Bay Area—which includes southern Alameda and the Livermore Valley, across the bay and east of the valley—to test for water contamination. Of the 79 companies that tested, 65 found toxic chemicals beneath their plants.

The state is financially hard-pressed to act as a water policeman for the nine regional districts that make up California. Nine overworked state inspectors monitor nine Bay Area counties including Silicon Valley, yet the governor is still contemplating cutting the agency's budget. "They must increase state resources to get on with the water cleanup," says Mike Belliveau, director of the hazardous materials program for the Citizens for a Better Environment group. "There are plans to add 112 new positions to the nine [state] regional water quality control boards, but the governor may cut them. In fact, last year he cut $1.8 million that was to have been spent on water quality control and toxic wastes."

Shortly after this conversation, Governor George Deukmejian cut some $3 million from a $39 million toxic waste program approved earlier by the legislature. Eliminated were $1.2 million to implement new state drinking water standards, $550,000 for a hazardous waste research laboratory, and $1 million for 64 new jobs for waste discharge and toxic inspections and enforcement.

Stung by a drumfire of criticism and lawsuits, the chip makers have been treading as gingerly as a toe dancer in a tack factory. On their attorneys' advice, they generally decline direct comment on the toxic spills and related alllegations on the grounds that they have been named as defendants in assorted lawsuits, and that a courtroom is the proper place to answer these charges.

Of the 79 companies that tested, 65 found toxic chemicals beneath their plants.

Speaking for the vendors are groups like the American Electronics Association (AEA), which represents 750 area chip makers. "We're learning as we go along," says Ralph Thompson, senior vice president. "We have acted with vigor," he says of the chip makers' self-policing efforts. "There have been some laggards, I'm sure, but we will be putting pressure on them" to clean up the estimated 120 toxic spills in Santa Clara County.

One firm flatly denies being responsible for pollution. Teledyne Semiconductor, of Mountain View, is being sued by several families for alleged negligence and carelessness. The company has been supplying uncontaminated water gratis to affected residents while stoutly denying any involvement in the problem.

"After the [state and county] investigations are completed and the sources of compounds have been identified, Teledyne will look to those sources for reimbursement," said Michael L. Canning, president of the firm, in a recent letter to Mountain View's city manager. "Teledyne has requested the voluntary cooperation of other companies in the area to fund this effort," continues Canning, and they are "not admitting any liability by this action."

Likewise, nearby Tandem Corp. appears to be sitting on a toxic bombshell. The firm recently discovered that the soil it resides on is contaminated by toxic chemicals, possibly deposited there by Four-Phase Systems, the former occupant. The cost for a cleanup is between $110,000 and $1.3 million. "Presumably,

FIVE TO FEAR

Five chemicals used by the semiconductor industry are being found in scores of public and private wells in Silicon Valley and elsewhere in the San Francisco Bay area. "There are probably dozens of [these chemicals] in all that show up in our tests, some in fairly high concentrations, some not," explains Lester Feldman, a section chief in the toxic cleanup division of the State Water Quality Control Board. "We really don't know what their effects are alone, and they could have effects in combination that no one can guess."

National drinking water standards for these substances are still on the drawing boards after six years of study. Existing standards are U.S. Environmental Protection Agency estimates, based on protecting semiconductor workers who encounter these substances during short-term, intense exposures.

• TCE—Trichloroethylene

Used to remove grease from chips until the late 1970s, and now being found in groundwater in volumes as high as 2,000 parts per million. EPA investigators say that it causes cancer in mice. At lengthy exposure in volumes of 75 parts per billion it probably causes liver damage and central nervous system disruption, including drowsiness.

• TCA-1,1,1—Trichloroethane

Used in place of TCE when alarming reports about that substance began surfacing. No cancer danger officially reported yet. Liver damage noted in long-term exposure to 140 parts per million in drinking water. The EPA would like to see standards set soon at less than one part per million, and eventually at 200 parts per billion.

• DCE—Dichloroethylene

Causes kidney cancer in mice. Suspected of causing damage to the human liver and central nervous system in long-term drinking of contaminated water where concentrations rise above 70 parts per billion. The EPA would like to have none of this substance appearing in potable water.

• Toluene

Another solvent under investigation as a cancer-causing agent. One study shows that 350 parts per billion in drinking water may cause a breakdown of red blood cells over a period of several months. Similar cases of blood damage have been reported when workers breathe toluene fumes.

• Xylene

A combination of three chemicals. Long-term effects are still under investigation. Amanda Hawes, a lawyer representing a worker in a chip plant who routinely used a rag soaked in xylene to clean machinery, claims that her client's central nervous system was severely damaged by this substance. "He is now a basket case," is how she puts it. The EPA would like to see xylene kept below 620 parts per billion in drinking water.

—C.H.

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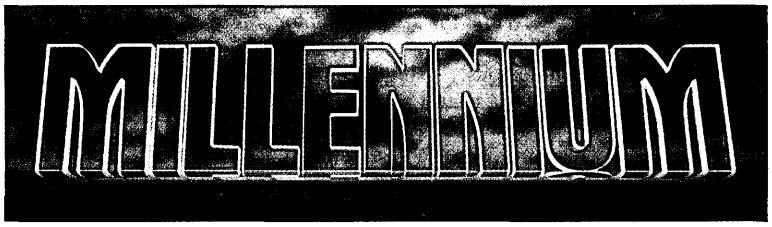

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Tandem could file a lawsuit against Four-Phase for recovery," says Steve Heikkela, a state water engineer. A Tandem source says that Four-Phase has agreed to pay for the cleanup.

Industry spokesmen say that stringent state laws passed last year will go far toward abating future toxic spills, while environmentalists like Smith and Belliveau claim that the chip makers, along with the oil industry, fought the passage of these laws tooth and nail. In any case,

Stung by a drumfire of criticism and lawsuits, the chip makers have been treading as gingerly as a toe dancer in a tack factory.

the laws call for more rigid monitoring of waste tanks.

Similarly, every city in Silicon Valley, save Los Altos, recently passed the Model Storage Ordinance. Basic provisions require secondary containment (double-walled tanks) for hazardous materials storage, strict leak monitoring and detection, public disclosure of what is stored where, mandatory reporting to local government of all leaks and spills, and "whistle-blower" protection for employees who elect to inform on their employers in toxic waste matters.

These new laws are going to cost the semiconductor industry a pretty penny. Steve Pedersen, environmental health manager at AEA, estimates that the industry has spent in excess of $50 million thus far in cleanup efforts.

"If you build a double-walled tank with a monitoring device between the walls, you are looking at roughly $20,000 per tank," says Pedersen. "Here, we are talking about a tank with a capacity of 5,000 or 6,000 gallons.

"For storage greater than that," continues Pedersen, "you have to go to a concrete vault set into the ground, with your tank set inside of the vault. These tanks cost in the area of $100,000 a piece and they hold around 12,000 gallons per tank. We are doing everything that we can to comply with the law, and we will continue to do so."

While the semiconductor industry deals with charges of water pollution, it is simultaneously being faced with accusations from health professionals, lawyers, and ex-workers who claim that making chips may in truth be as hazardous as felling trees, fighting fires, or even disarming bombs. Amanda Hawes, a compensation lawyer in San Jose, has filed more than 60 workmen's compensation cases against assorted semiconductor firms. She says "new ones are coming in at the rate of one per week."

An astute lawyer uses a subpoena duces tecum the way a gunfighter uses his pistol, and Hawes has forced some chipmakers to come up with what appear to be incriminating internal documents that belie their claims of being a safe and sane industry. Hawes has documents that indicate that Advanced Micro Devices (AMD) of Sunnyvale, for example, had 18 evacuations of its plant over an eight-month period. "It sent women in taxicabs to its own industrial clinic on one occasion. These women were complaining of itching and burning eyes, headaches, and chest pains after a chlorine leak," says Hawes. "I asked for the records on this incident and AMD said they did not remember the event. I repeated my request, they looked again and found the records."

Hawes says that about 75% of her clients are women who earn wages that start at around $4.50 an hour. What money they may eventually win in a compensation decision is not substantial—perhaps $100,000 for a lifetime total disability award, "though others who are hard-pressed financially settle for a [lower] lump sum and give up their rights to rehabilitation," she notes.

Not surprisingly, Hawes is not one of the industry's champions. She and others cite a recent state survey showing that 42 Silicon Valley firms collectively use 2 million gallons of acids and some 500,000 gallons of solvents annually. Additionally, the survey found that these 42 firms use 1.5 million cubic feet of toxic gases annually. "These companies are using incredibly dangerous things whose long-term effects simply are not known yet," says Hawes. "As regards assembly line and similar workers, what you have out there is a group of guinea pigs."

There are those who disagree. "It is probably one of the cleanest industries around," says Russell Umbrace, San Jose district supervisor for the California Division of Occupational Health and Safety. "They do use a lot of toxic gases and chemicals, but they also have state-of-the-art protective devices."

Still, accidents do happen. Last October, for example, about 100 production workers at National Semiconductor in San Jose fled their jobs when phosphine gas leaked into the manufacturing

The semiconductor industry is faced with accusations that making chips may be as hazardous as felling trees, fighting fires, or even disarming bombs.

area. And early this year, the firm ordered 500 workers off the job when an electrical transformer burst, spilling 100 gallons of oil containing PCBs, a suspected carcinogen.

In a death case against National Semiconductor that may be the first of its kind to be filed, Hawes charges that one of her clients was eventually killed by chemicals after working there for four years as a fabrication operator. Hawes says that Noemi Sanchez, who died at the age of 35, leaving a disabled husband and four children as survivors, developed systemic scleroderma as a result of exposure to toxic chemicals.

"Your primary responsibility around here, Fenwick, will be to save me should there be a fire."

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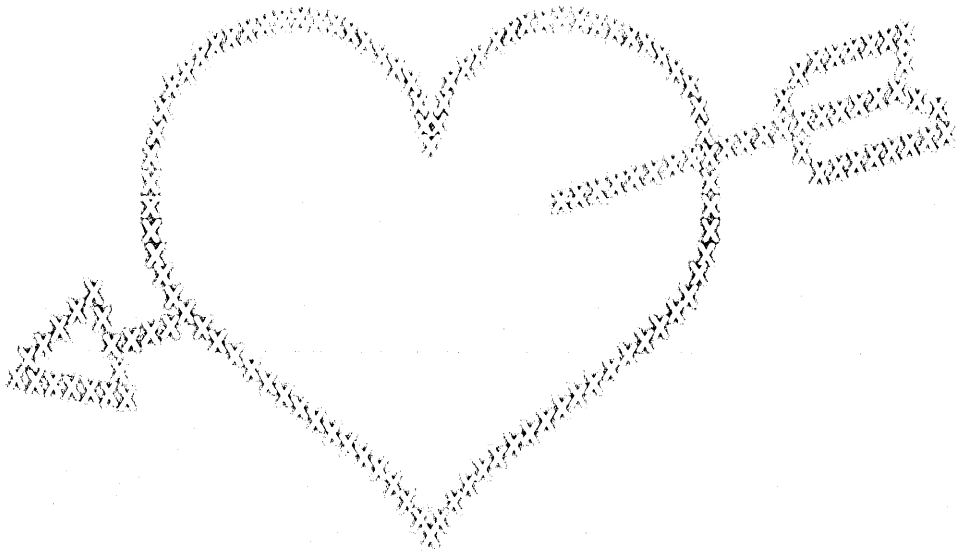

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IN FOCUS

Systemic scleroderma is a chronic disease characterized by vascular abnormalities of the skin and internal organs. In some cases it causes early death due to heart failure, kidney failure, or pulmonary complications. Most physicians regard it is as a disease of unknown origins, yet Hawes says her medical expert can prove that the death of Mrs. Sanchez was work related.

Conditions may be even worse than indicated by the lawsuits and occasional announcements that are made public. A physician who practices occupational medicine in Sunnyvale maintains that the semiconductor industry is not only unsafe but has tinkered with its own sickness and injury figures to present what he claims is a misleading and benign picture.

"In a 1980 survey, the California Department of Industrial Relations found that the [semiconductor] industry had 1.3 illnesses per 100 workers, compared with 0.4 per 100 workers for general manufacturing industries—more than three times as many." So writes Joseph LaDou MD in the May-June 1984 issue of *Technology Review*, the magazine of the Massachusetts Institute of Technology.

"Similarly," continues LaDou, "semiconductor companies have an alarming rate of occupational illnesses that result in lost work time; 18.6% of all cases that resulted in lost work time for semiconductor workers are occupational illnesses, versus 6.0% for all manufacturing workers from 1980 to 1982."

LaDou is among those who say that the industry is now calling illnesses injuries under a new reporting system. Around 1982, California health oficials noted a sharp drop in the number of illnesses reported in the semiconductor industry. "After the rate dropped, we were told anonymously that they [the chip makers] were using a different definition of illness," says Karen Jones of the California Division of Industrial Relations. Thus, a worker who briefly inhales a toxic gas is now reported as having sustained an injury, not an illness.

A physician maintains that the semiconductor industry tinkered with its own sickness and injury figures to present a misleading and benign picture.

In their defense, the industry says that sometimes exaggerated reports of health hazards have been offered by those who have their own axes to grind, especially persons who want to unionize an industry where labor zealots are as scarce as sardines off Monterey Bay.

Lawyer Hawes and environmentalist-activist Smith quickly agree that they would like nothing better than to see an organizer hawking unionization on every chip maker's doorstep. "In fact, the area is practically unorganized," says Smith. He cites a number of unsuccessful union efforts. "They even tried to organize Atari, but they got creamed."

Adds Hawes, "There is no big union ferment here, and it is too bad. I would like to see collective bargaining start before people get hurt, and not after." Like Smith, she is rather bleak about the unions doing anything. "I remember one guy who was briefly handing out [union] authorization cards in front of AMD," she recalls. "He just disappeared off the face of the earth the next day." Like all other organizers, Hawes says, the man simply gave up. ◉

Charles Howe, 51, is the recently appointed San Francisco bureau manager of DATAMATION. He was formerly news editor of *Data Communications* magazine and night city editor and military correspondent for the *San Francisco Chronicle*, where he was nominated for two Pulitzer prizes.

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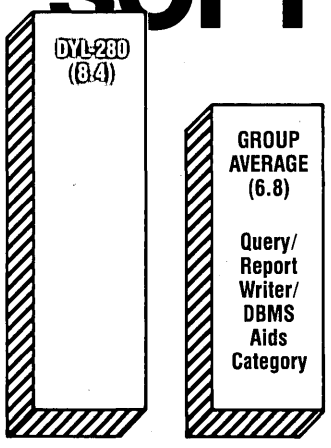

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NEWS IN PERSPECTIVE

SEMICONDUCTORS

AT&T LOSES INMOS

The U.S. telephone company lost its bid to buy the British semiconductor manufacturer.

by John Lamb

Since February, when AT&T made a $56 million bid for the U.K. chip maker Inmos, the U.S. telephone company had been the center of frantic negotiations on both sides of the Atlantic. Now, however, AT&T has been outbid by British electronics group Thorn-EMI PLC, whose $133 million play was enough to secure the British government's 75.6% holding in Inmos. AT&T was batting for its first semiconductor plant in Europe and until then the Thorn-EMI announcement was thought to be the leading bidder.

The cause of all the excitement was the British government's determination to rid itself of its interest in the semiconductor company. Inmos is one of the few chip makers in the world not already allied with a systems builder and is Britain's only presence in the mass market for chips. Inmos was set up by the previous Labour administration to secure a strategic interest for Britain in semiconductors, but the investment does not suit the present Conservative government's book. Prime Minister Thatcher has initiated a massive privatization of state interests, including Inmos.

Inmos was founded in 1979 by the present managing director, Iann Barron, and two Mostek refugees, Richard L. Petritz and Paul Schroeder. Schroeder has since left Inmos. The initial aim of the company was to establish itself in the competitive memory market before moving on to produce VLSI processors. In the early days Petritz predicted that Inmos would grow to the size of Texas Instruments by concentrating on a single advanced technology, the single-chip microcomputer.

Petritz and his partners argued well enough to convince the British government that Inmos not only had a good chance of success, but that success was best assured by a company with a strong U.S. presence. Much of the design work and all initial production of Inmos products has been undertaken at a Colorado Springs plant. Only more recently has a Welsh plant come on-stream. The Inmos product lineup includes 16K static RAMs, 64K dynamic RAMs, and an EEPROM chip. On the way are 256K dynamic memory chips and the jewel in Inmos's crown, the transputer, a high-performance 32-bit processor with on-board memory and interchip communications circuitry that has been designed with parallel processing system architectures in mind (see "British Fish for Chips," January, p. 78).

Until mid-July, AT&T seemed to be closest to deciding what would become of this technology. The company weighed in with its first bid after Inmos had rebuffed the British electronics combine GEC on grounds that GEC's terms were too low, but bounced back with a slightly improved offer of $70 million and renewed determination. This time AT&T dealt directly with Britain's industry minister, Norman Tebbit.

Up against AT&T were a number of British firms. Besides GEC and Thorn-EMI, which made an early $14 million bid for a small part of Inmos, was computer maker International Computers Ltd. (ICL), which sought a cooperative deal with AT&T. A third bidder showing its hand publicly was a consortium of investors, headed by merchant bank Hill Samuel and relying on the electronics know-how of Emerson Electric, St. Louis, Mo. AT&T's rivals apparently made little impression on the British government, however. The Thorn-EMI bid was for only part of the state investment, ICL was interested only in certain aspects of Inmos's technology, and the consortium proposed paying $42 million for 36% of Inmos to be followed by a public share offering in the autumn. This last offer would again have prevented the government from getting rid of all its holdings in Inmos.

AT&T was after manufacturing capacity and a foothold in the European chip market.

ICL wanted to get its hands on the Inmos transputer, designed at Inmos's Bristol, England, headquarters. The transputer is due for volume production next year. ICL was reported to have struck a deal with AT&T under which the telephone company would get Inmos's chip plants in Newport, South Wales, and Colorado Springs, while ICL would take on Inmos's 50-strong transputer design team.

At issue was the question of whether Inmos should be allowed to fall into the hands of a foreign, namely U.S., buyer or whether there was some way, perhaps via the ICL offer, to sell the company while retaining the technology in Britain. "The availability of leading-edge capability in silicon is something we have never had in Britain," said Barron shortly before the Thorn-EMI deal was closed.

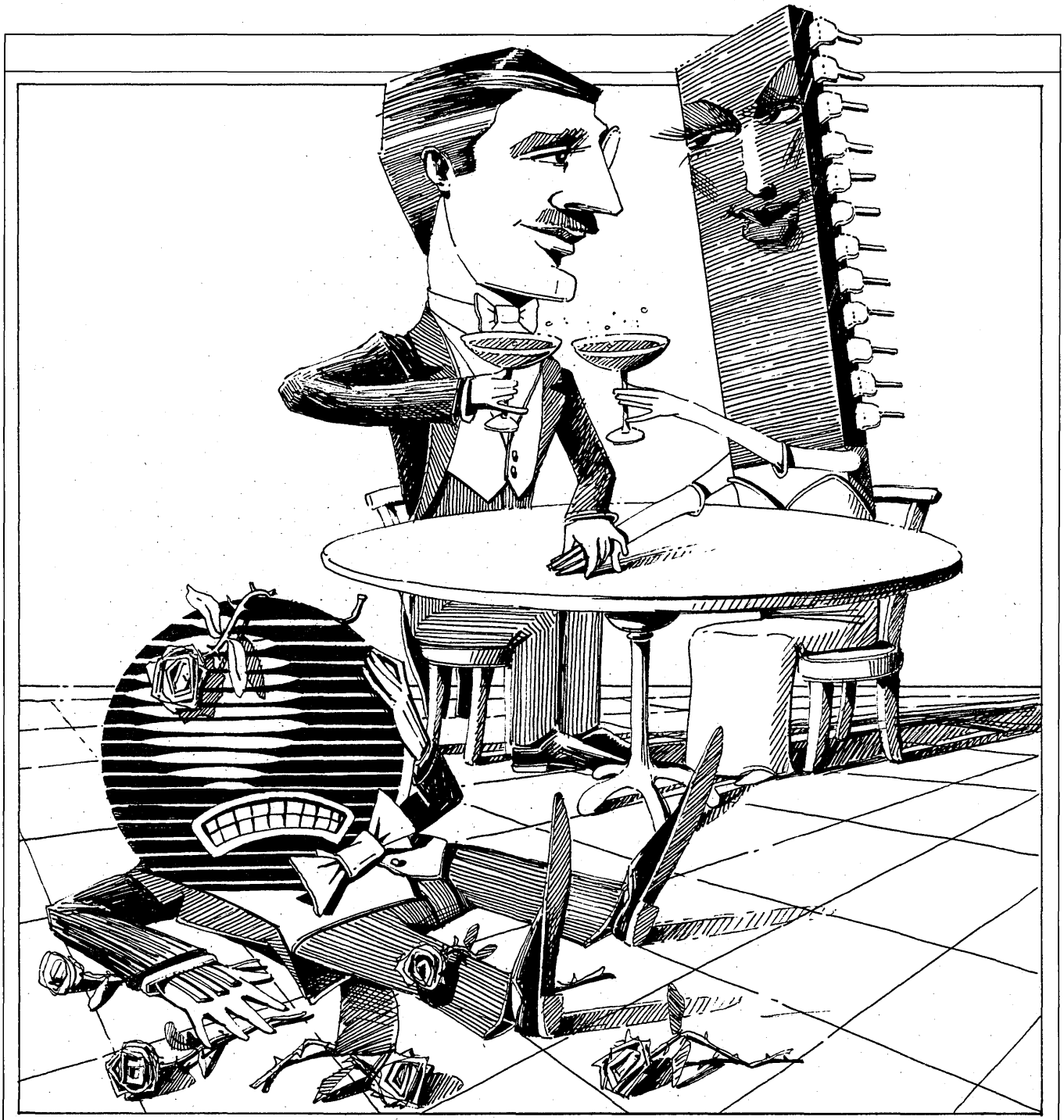

ILLUSTRATION BY JAMES R. JONES

"We are very concerned about the strategic implications of the semiconductor industry. In future there will be a greater ability for integration. . . . In that environment, local access to supplies of silicon becomes very important."

Set against this was the government's desire to recoup some, if not all, of the $144 million of taxpayers' money that has been spent on Inmos. During heated debates in the House of Commons, Tebbit refused to rule out a foreign buyer. "I shall not guarantee to exclude any prospective purchaser," the industry minister told opposition House members.

In any event, Tebbit got it both ways. The Thorn-EMI offer, which values Inmos at $175 million, gives taxpayers their money back and keeps Inmos's technology in Britain. In fact, Thorn-EMI appears to have got a bargain, according to some industry analysts who point out that a Korean effort to build a company similar to Inmos will carry a $350 million price tag.

Inmos's "transputer," which it hoped would be a big seller, particularly appealed to ICL.

Inmos critics say the company has so far failed to justify early hopes. Its products tend to be at the Rolls-Royce end of the market and the company has consequently failed to grab a large piece of the chip market. At the end of 1983 Inmos was only just beginning to trade profitably, but it showed a loss of $19 million for the year. Inmos directors now predict profits of $10 million on revenues of $140 million for 1984. The company also expects to be churning out 64K RAM chips at the rate of 3 million a month from its Newport plant by the end of this year.

Managing director Barron says his company is meeting sales targets but is misunderstood by financiers who do not realize what Inmos's business is all about. Barron did not help in the government's effort to find a buyer. Not only was he against a foreign buyer but, like most entrepreneurs, he has been fighting to keep as much control over the company as possible. Inmos is understood to have reject-

NEWS IN PERSPECTIVE

UNIX INVADES EUROPE

While its European silicon strategy is blocked for the time being, AT&T is moving quickly ahead in software. Last month the transportable Unix operating system was officially transported to Europe via a new company, Unix Europe Ltd. This has been set up jointly by AT&T and its European partner, Olivetti, to license, promote, and support Unix across the Continent.

So far the Unix outpost comprises one London office, 15 persons, and many high hopes. "There is around a one-year lag now between the U.S. and Europe with Unix," figures ex-DEC executive Vanni Pappi, the managing director of Unix Europe, "and we believe that the next 18 months is going to be critical here in terms of both the number of users and investment."

Since 1981 the number of European Unix users has risen from 200 to around 8,000 today, and they are not the early "software gurus with T-shirts and sneakers," as AT&T's Jack Scanlon describes them. In fact, there are now 105 commercial customers in Europe with Unix licenses, and around 90% of European users are in the commercial sector.

Pappi says that the new company will help to increase this base and will offer the latest version of the operating system at the same time as U.S. offerings. Licenses will be sold at one price with one contract for the whole of the Continent. Support will be provided directly and through local "accredited companies" in different countries, as will training. The company will also house the Unix applications software library, and it is offering worldwide marketing support to European software houses coming up with new Unix-based packages.

All this follows hot on the heels of the launch of the AT&T 3B line of Unix processors by Olivetti at this year's Hannover Fair in Germany, and now with both hardware and software available locally, the two partners are expecting the Eurobucks to come flooding in.

But watch AT&T closely. The Unix world tour is not over yet. Next stop is Japan.

—J.L.

ed several overtures on Barron's objections.

Reportedly, senior Inmos management and company workers vigorously resisted the joint AT&T/ICL proposal, claiming it would damage Inmos's ability to operate in a coordinated manner. But the company needed to settle the question of future financing quickly. Semiconductor manufacturing requires large capital investments. Development of the transputer, though a relatively low-cost endeavor, will require more than $10 million. Inmos also needs $39 million to build a test and assembly plant near the Newport plant to replace certain offshore assembly activities. Cash for these projects will not be forthcoming from this year's profits, but a Thorn-EMI spokesman said the parent was prepared to provide Inmos with up to $23 million a year in expansion funds.

With the Thorn-EMI deal, Barron not only stays in the driving seat, but has the option of selling his 4% stake in Inmos to his new masters for about $7.5 million. The 25% of Inmos not already bought by Thorn is owned by executives and staff and may be picked up by Thorn-EMI for another $39 million.

Thorn is keen to diversify from its consumer electronics and entertainment interests. The company recently failed to link up with British Aerospace, and that setback is thought to have prompted an improved offer for Inmos.

As of press time, AT&T said it had no plans to make a counterbid for Inmos and it was not clear how the U.S. giant would gain a foothold in the European chip market. AT&T is of course now part owner of Olivetti, the Italian office equipment maker, but that does not give it a chip-making presence on the Continent. The U.S. bidder was understood to be interested in additional manufacturing capacity for 256K RAM chips, which are expected to represent a large volume of overall chip shipments in the next few years. AT&T already makes such chips in U.S. plants.

For its part, Inmos said it would continue business as usual, planning to operate as a subsidiary of Thorn-EMI and retaining senior management as soon as the deal went through. ◉

MICROCOMPUTERS

UNIX TAKES IN GUESTS

A new software package enables CP/M and MS/DOS to run under Unix.

by Edith Myers

Peter G. Weiner was the first person to offer support for Unix in the commercial world (see "Personal Project in the Business World," November 1977, p. 188).

The operating system developed in AT&T's Bell Labs in the early '70s has come a long way since Weiner founded Interactive Systems Corp., Santa Monica, Calif., to make it a commercial product. Today, support is available from AT&T. Unix-based systems, which numbered under 100 in '77, currently are believed to be in the neighborhood of 100,000.

Now, to users of these systems, Weiner is offering the world of MS/DOS and CP/M and soon will offer the UCSD p-System. He calls the software that hosts these popular operating systems under Unix a "connector." It permits the other operating systems to run as Unix processes, enabling them to run their programs both alone and concurrent with Unix programs.

"We're discussing the connector with every relevant computer manufacturer," says Wensberg.

Weiner left Interactive Systems, creator of IBM's personal computing Unix product, PC/IX, last year because "it had become too big and I like to be in on the beginnings of things." He founded Uniform Software Systems Inc. to develop Unix business applications software for vertical markets. "We got interested in the connection problem on the side," says Weiner. "Because we ended up with an elegant solution, we decided to market it."

Uniform Software Systems has been a functioning company since last November. In February this year, Weiner announced the appointments of William M. Agee as chairman of the board and Peter C. Wensberg as president and chief executive officer. Weiner is chairman of the executive committee.

Agee was once chairman and chief executive officer of Bendix Corp. and president of Allied Corp. after Bendix and Allied merged. He and his wife, Mary Cunningham, now head up Semper Enterprises, a Massachusetts-based venture capital firm, which is a major investor in Uniform.

Wensberg was president of Atari-Tel, a division of Atari formed to bring a line of smart telephones to market. Before joining Atari, he spent 24 years with Polaroid, the last of them as executive vice president of the Industrial and Technical Products Group.

Agee, who says he will devote 20% of his time to Uniform, was keynote speaker at a Unix forum in San Francisco in early May. He talked of a $20 billion market for Unix-related products and services in the next five years and predicted the number of Unix-based systems will swell to a total of 800,000 by the end of 1985.

Weiner and Tony Barton, inven-

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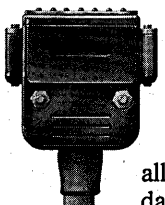

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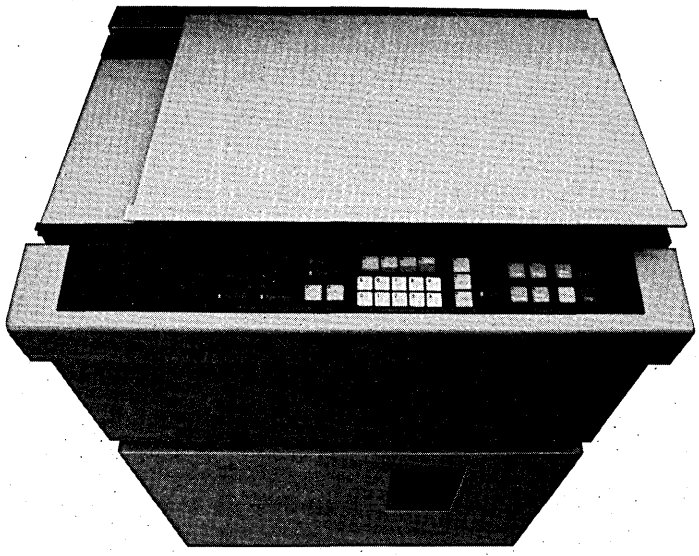
tor and designer of the "connector," demonstrated it at the market forum. "Since then our phones have been ringing off the hook," comments Wensberg. And, he adds, "We're discussing it [the connector] with every relevant computer manufacturer."

Weiner expects the connector to work also with IBM's expected Unix lookalike.

Barton said the software can work with virtually any form of Unix, including Xenix from Microsoft. Should IBM, as has been rumored, develop its own Unix-like operating system from scratch, he thinks they'll be able to work with that as well.

While the connector is already working with MS/DOS and CP/M, its ability to work with the p-System was still a gleam in Weiner's eye in late May. "I got the idea coming back from New York on a plane," he said. "There's a lot of generality in what we've done." ◉



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CIRCLE 7 ON READER CARD

FROM ONE TO ANOTHER

One company's solution to its own pc diskette problems has become a product.

by Edith Myers

Pacifica Technology is a small San Diego research firm doing work in areas such as shock physics, fluid mechanics, and structural dynamics.

"We work with machines in the Cray and Cyber class," said Jerry Kent, president, "but they are not our own." Like most computer workers, Pacifica researchers were quick to buy their own personal computers as they became available.

"Everyone was bringing one to work to use in ongoing projects. The problem was everyone had something different. You couldn't get data from one guy's Kaypro to someone else's IBM."

Being problem-solvers, the Pacifica researchers saw the incompatibility as an attackable problem and came up with a solution they have been using internally for about a year.

It's called the DISCON (for disk conversion) system and is essentially a small cpu with disk drives that can read, write, and convert more than 165 disk formats for both 5¼- and 8-inch disks.

Pacifica's first DISCON system included an 8-bit cpu that could format disks using both CP/M and PC/DOS or MS/DOS but couldn't read the PC/DOS formats. A 16-bit cpu was to be added late last month to create this capability.

In addition to using the system itself and reformatting the disks that people in the San Diego area bring to them, Pacifica has been selling systems, largely to software publishers. Now it wants to move into big companies that Kent feels need a solution to incompatibility between micros.

"At first we didn't realize that by solving our own internal problem we had solved a problem shared by corporations, government agencies, and other software users around the world," he said.

The company doesn't have a formal sales structure for the systems but it is taking direct orders. The complete system with the 8-bit cpu, including a terminal, four disk drives, software, and a board called the DISCON BRAIN, is available for $6,995. The system without the terminal for hookup to a user's ASCII ter-

minal is $5,995. Also available is the DISCON BRAIN board by itself with software for $2,495. With Pacifica-supplied cables this can be plugged into any ASCII terminal using disk drives that meet standard DISCON specifications.

Two-way conversion of data between IBM and DEC diskettes and PC/DOS or CP/M formats can be performed using optical software that reads and writes IBM Basic Data Exchange diskettes and/or DEC RT-11 diskettes.

The bundled asynchronous communications software that will send or receive files to the mainframe or another micro is included with the system. An optional HASP emulator provides synchronous communications to mainframes. ◉

SERVICES

UP FROM THE ASHES

Itel is still in business, pushing hard into remote computing services.

by Charles L. Howe

A soupçon bloodied, but decidedly unbowed, Itel Corp. is launching a nationwide campaign to sell timesharing services. The San Francisco-based leasing leviathan's last involvement in mainframes, of course, ended after 32 months of Chapter 11 bankruptcy proceedings that left it mainly concerned with the mundane railcar and container leasing business.

This time around, says an Itel spokesman, the firm will "absolutely not" get burned by selling or leasing IBM-compatible mainframes, as it did when its troubles started some five years ago (see "The New Computer Company," November 1979, p. 54). Instead, the company will offer timesharing services on its 3083E and NAS 7000 mainframes. And with experience often being the best teacher, one of these services will be advice on bankruptcy to firms whose books are showing more red than black.

For Itel, the timesharing offerings are part of a long road back to solvency. During the 1979-1980 period, the company lost $505 million. In the final settlement of claims late last year following the implosion of its leasing business, more than $800 million out of a total of $2 billion were dropped, leaving a sour taste in the mouths of many shareholders.

Its offices were once decorated with some of the finest art and tapestries in Northern California. The new Itel looks little like its former self. In 1978, for example, it received 70% of its $661 million in revenues from mainframe leasing. Last year its total revenues were $173.3 million, gleaned from its railcar and seagoing refrigerated container businesses.

The key to Itel's timesharing offerings—which have been going on quietly for the past two years, but which the firm is now touting in newspaper advertisements—is a nationwide data communications network already in place that it uses for moving data on its information rail and sea cargo container businesses.

"We have a lot of dedicated tele-

The key to Itel's timesharing services is a nationwide network installed for its shipping services.

phone lines around the country that are not being fully utilized" is how Ben Ballard, Itel's director of information services, explains it, "so we are selling excess

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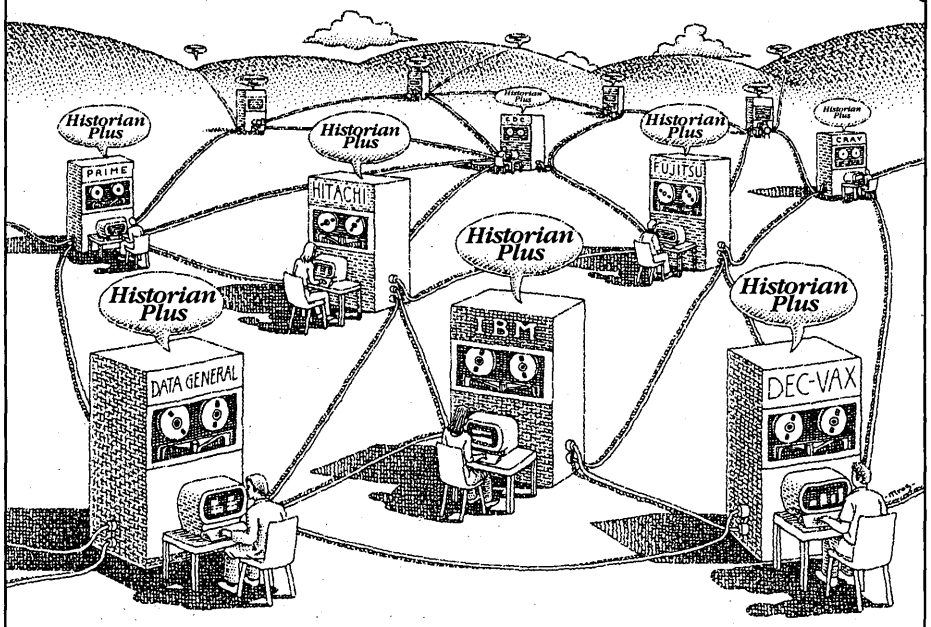

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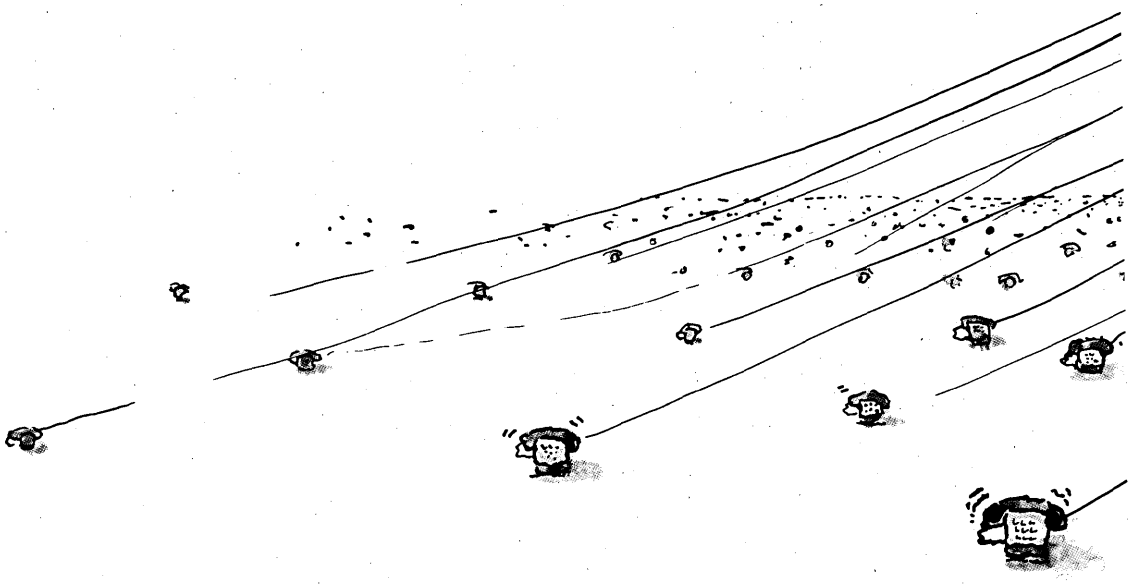

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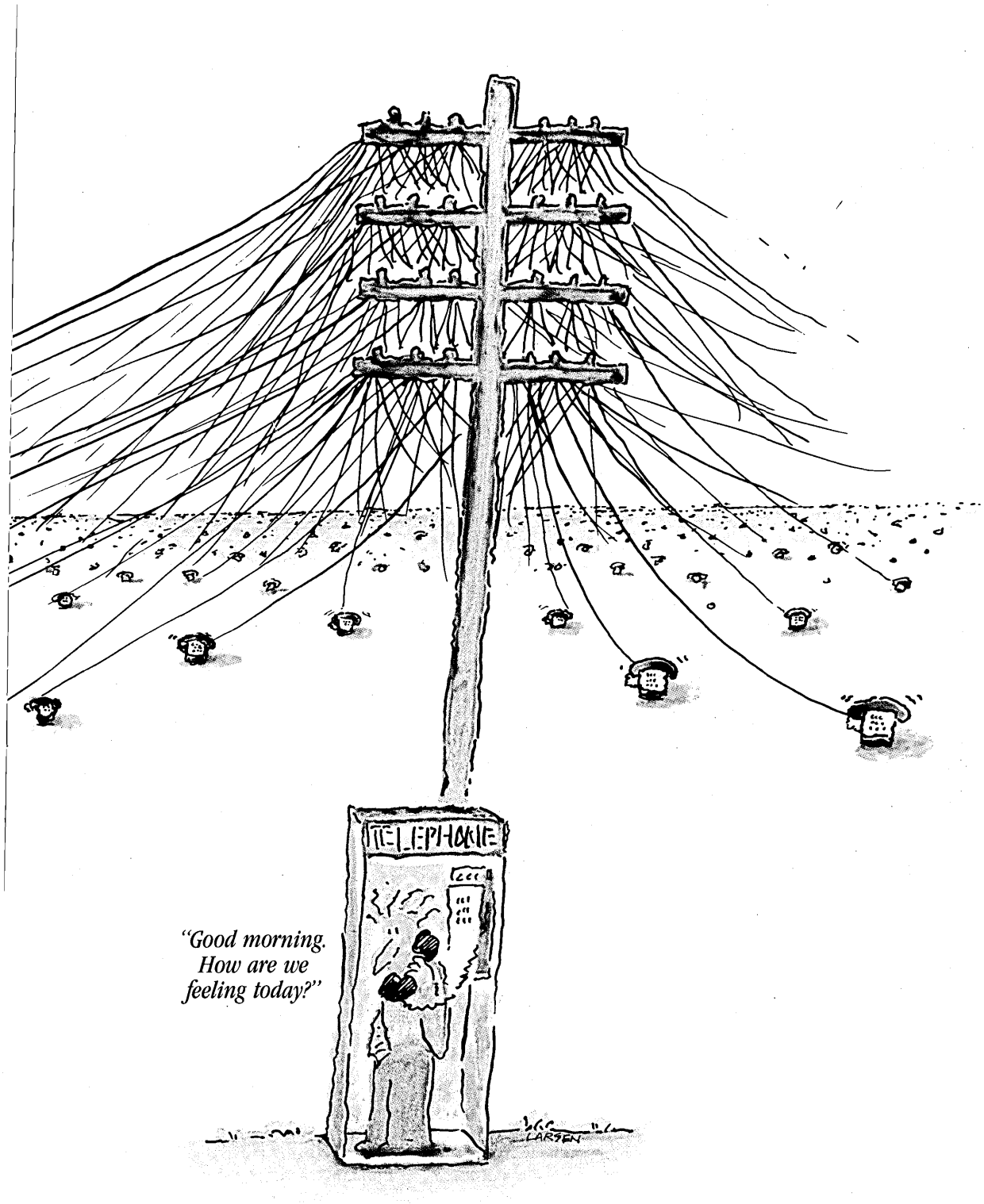

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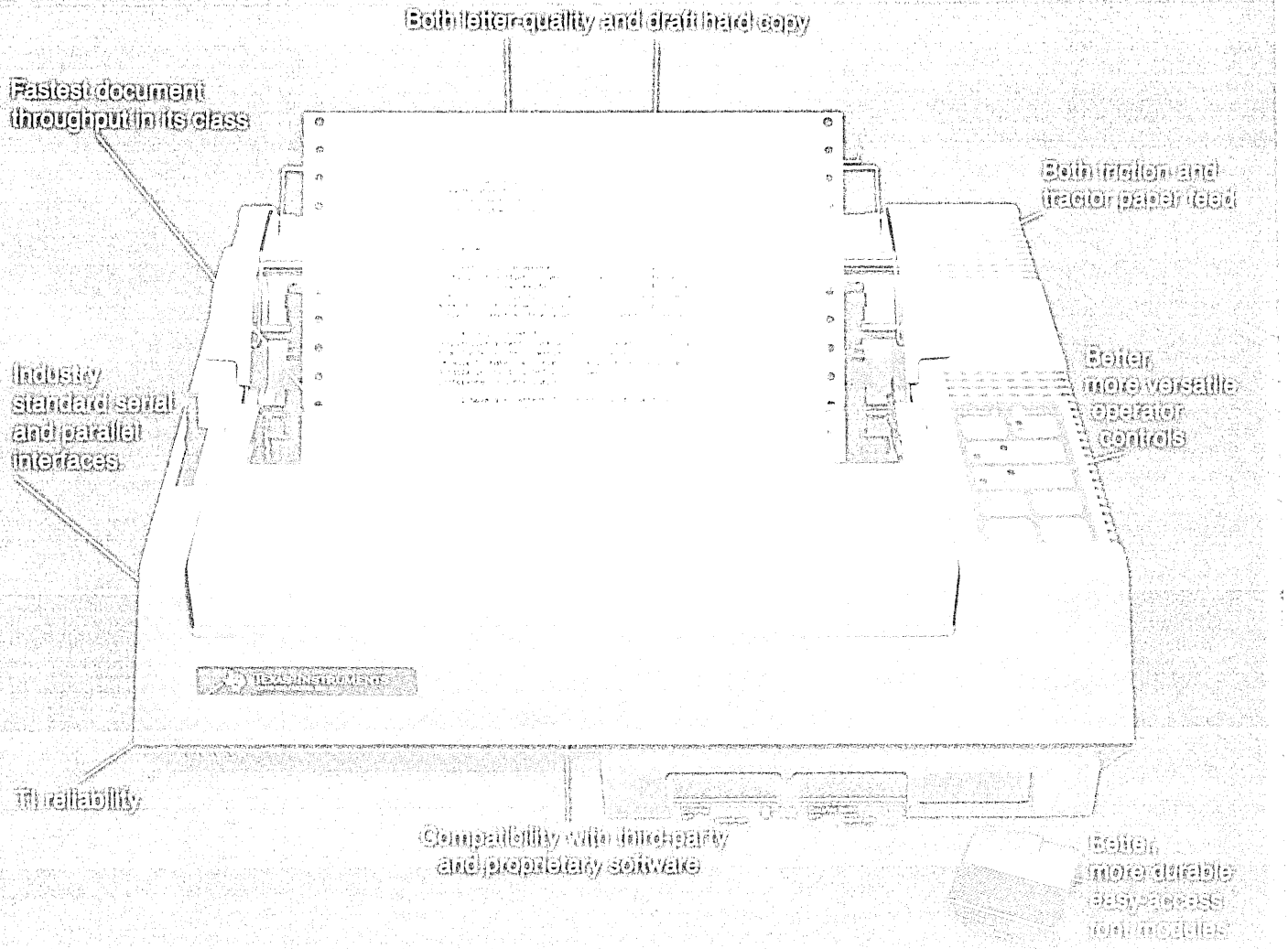

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capacity on them. In fact, we have at least 12 nodes in the network in major seaport cities in the United States."

Customers with a terminal and a modem can patch into IBANK, an Itel offering, "which is a software support service that handles the administrative aspects of Chapter 11 proceedings," says Ballard. "This service does not replace a legal advisor," he adds. "It is just a massive record-keeping service. After all, you don't go to school to learn how to go bankrupt. People are in shock and our IBANK service makes them feel a lot more comfortable."

Itel's second service offers data processing as well as distributed processing. Local users can walk into Itel's Embarcadero Center office and use the firm's terminals. Those who wish to patch into its network can do the same chores remotely. Itel has some 50 ddp users including Activision Inc., the Mountain View, Calif., games software firm, and Cambridge Systems Group, the nearby Sunnyvale software developers. These firms are using Itel's remote services for tasks that include general ledger, accounts receivable, and electronic mail.

Itel is not counting on these services to provide heavy revenues. "We expect to take in $10 million over the next five years," speculates Ballard.

Hard on the heels of Ballard's announcement came news that the firm plans to swap debt securities with some of its debt holders with the thought of improving the company's cash flow and thus hastening its profitability. In this connection the firm will offer a new kind of debt security, including warrants to purchase common stock, to the holders of $110 million of its 10% notes and $150 million of its 14% notes. ◉

MAINFRAMES

CRYSTAL-BALLING THE S/38

IBM's database-oriented machine is in for some changes.

by R. Emmett Carlyle

IBM's one genuinely eccentric product, the System/38, is losing its unique character. Someone once said of the machine and its unusually sharp break with the 370 mainstream architecture that "if engineers ran IBM, this is what their product would look like." That may have been true of the 38's first two years ('80 and '81) when, heir to no particular tradition, the product just articulated the aspirations (and egos) of its engineers. The 38 emerging today, however, is much more a testament to those who really run IBM—the marketeers.

Although ostensibly working on an upgrade for IBM's venerable System/3 and 34, engineers at IBM's Rochester, Minn., facility (many of whom had worked on IBM's ambitious though aborted virtual machine architecture, Future System, in the early '70s) came up with an innovative database architecture and near-programmerless machine. This all happened before IBM reorganized and rationalized its marketing groups in late 1981—"a move that veiled an internal rationalization of its products as well," says Rick Martin, former IBM executive and head of Auragen Systems, Fort Lee, N.J. The 38 emerging today, stripped of its proud isolation and bunched in with IBM's complete product line, has turned into a purely market-driven vehicle: a chameleon reflecting all the colors of its 370 stablemates.

A necessary step? "Yes," says

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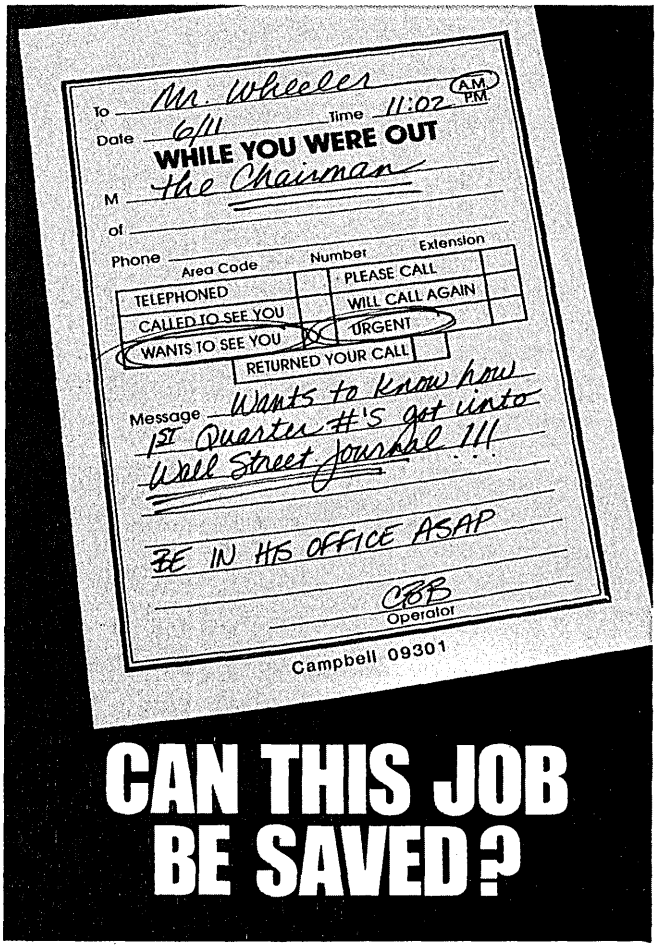

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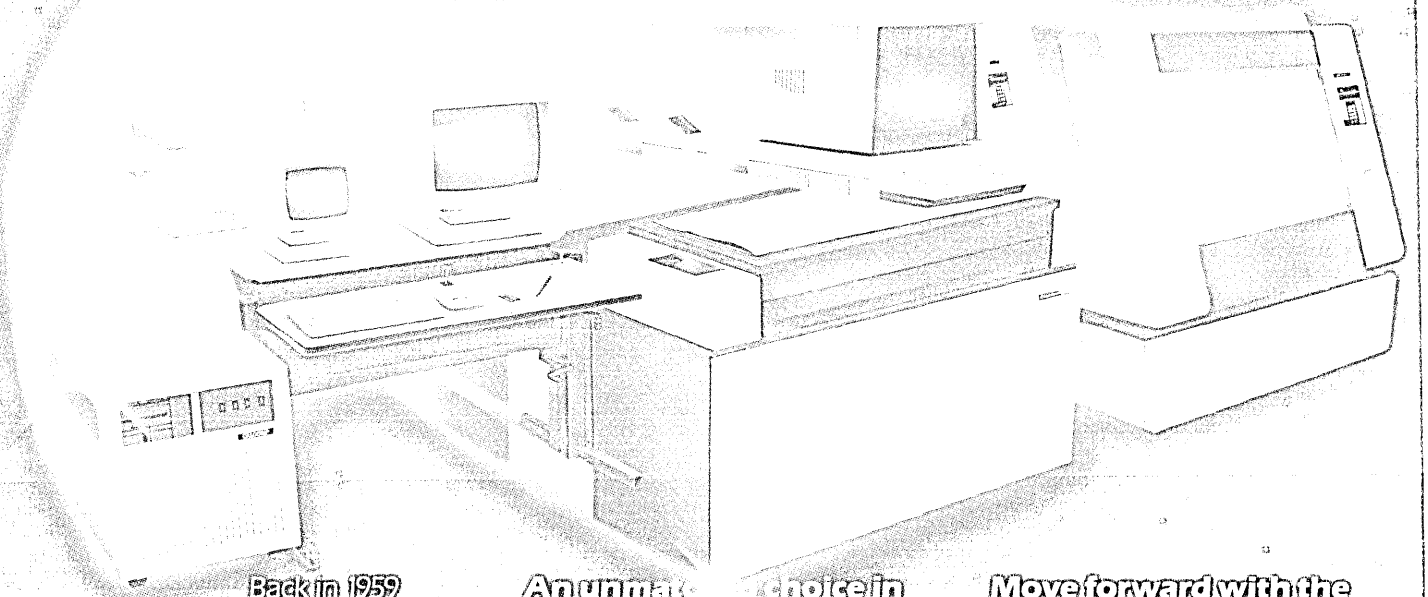

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THE MOMENTUM IS GROWING

CIRCLE 40 ON READER CARD

George Colony, president of Forrester Research, Cambridge, Mass., "for the truth is that the product mirrors both the inspiration and free hand the engineers had, as well as their indulgences. Both are reflected in the 38's high manufacturing cost." The economics of the 38 place it firmly outside IBM ceo John Opel's low-cost producer scenario, Colony believes, "hence the product isn't a vital part of IBM's unfolding office automation strategy, unlike its Rochester companion, the System/36, which has perhaps the lowest manufacturing cost of any midrange IBM system."

As a result, Colony and other experts now believe that Rochester must search for new customers for its System/38 among large accounts and data centers. "The only way for them is up and up," says Dale Kutnick, research director of the Yankee Group, Boston.

In line with this trend, Kutnick expects a new System/38 to emerge by the fall. Unlike the model 8, which merely doubled the memory of its predecessor, the model 7, the upcoming System/38 is expected to offer more cpu power as well as a jump in memory. Other sources close to Rochester say that its engineers are also working at more rarefied levels on a 12- to 15-MIPS System/38, packing 10 times the power and functionality of current models.

Kutnick expects IBM marketeers to try to disguise this upward trend of the machine by simultaneously cutting its price. "By year's end, a $100,000 model 5 could cost as little as $75,000, and maybe $50,000 by 1986, but it still will look expensive to the new, first-time users exposed to micros and the miniaturization of the rest of the industry."

Another potential problem for the 38, currently postured as a low-end or first-time user machine, is the lack of the Unix operating system. "For IBM, the office means competing with AT&T, and the 38's lack of a generic Unix doesn't equip the machine for that task," says Bob Djurdjevic, editor of the Phoenix-based *Annex Computer Report.* Sources close to Rochester explain that the difficulty is injecting Unix into the kernel of the 38's bundled software. One way around the problem is to lure outsiders into doing it. "IBM's own approach is through the agency of its new national distribution division (NDD), which was recently set up to draw oems for a number of nonstrategic machines, including the 38, by offering heavy discounts of up to 35%," one source explains (see "IBM's New NDD," January, p. 59).

"The truth is the product mirrors both the inspiration and the free hand the engineers had."

One net result of this forced move upward is that the System/38 could drop some of its existing customers. First to jump ship could be the giant New York-based chemical concern, W.R. Grace, which could be preparing to dump its 34s and 38s over the next 18 months in favor of upcoming "downsized" 4300s and Unix software running under IBM's VM/370 operating system, sources reveal. Grace's systems specialists were unavailable for comment at press time.

For the past two years, the aging 4300 family has provided IBM marketing with an opportunity to boost System/38 revenues by selling the machine as a cost-effective alternative remote processor to the 4300 in some network applications. Many 4331/41 customers have repeatedly complained about the hidden costs that can more than double the price of their systems. The 38, in contrast, has the appeal of being a bundled system with the cost of the database and attendant software built in, and much lower charges for operation and maintenance.

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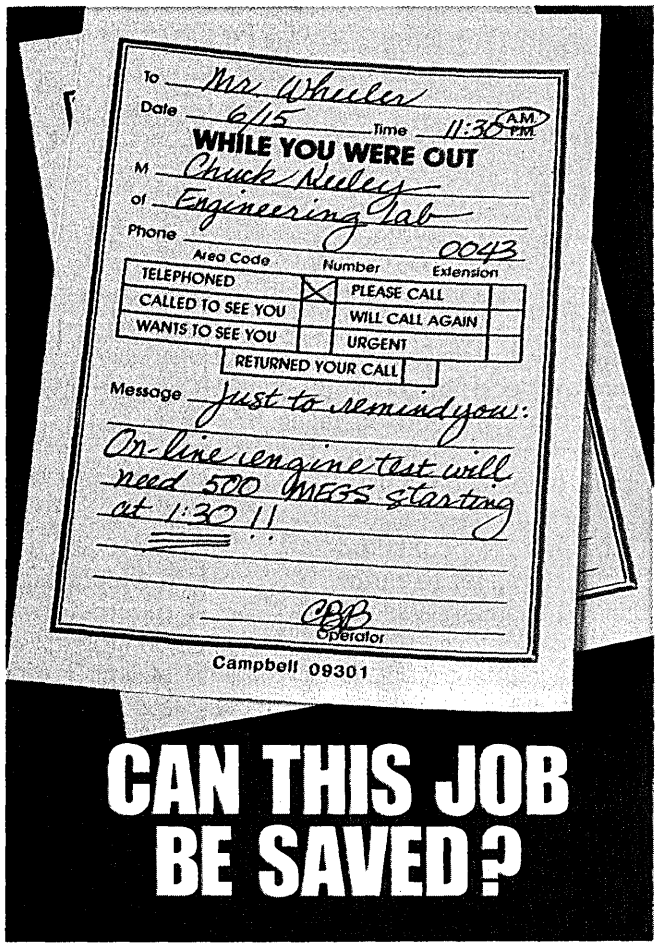

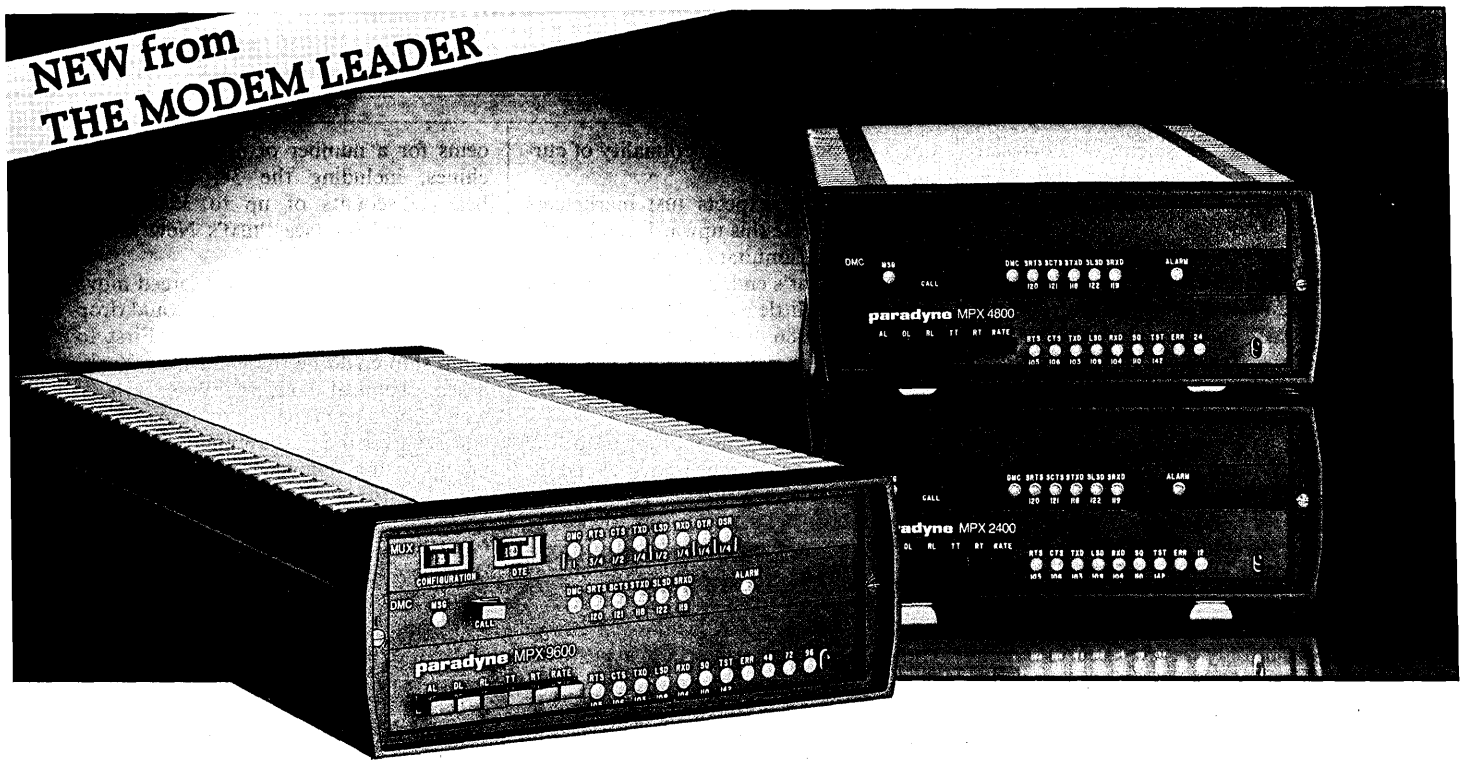

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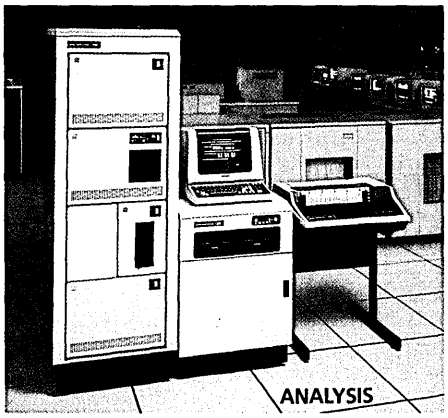

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CIRCLE 41 ON READER CARD

munications links and 3270 support for the 38 has made it a legitimate contender for the 4300's distributed machine crown. Powerful users such as GM, Bechtel, and Shearing Plough have embraced the 38 to build increasingly worldwide networks. Behind the scenes, however, the economics of distributed processing have changed. IBM's Böblingen Division in West Germany has been charged with the mission of "downsizing" the 4300 to produce an effective engine for VM/370 and Unix software. Sources believe that IBM has been preselling one such machine, the "4305," with postive results at the Grace installation. The scenario IBM salesmen have woven around the 4305 and new VM/Unix software (which was set for January announcement and then mysteriously canceled at the last minute) seemingly has no place for the 38, and suggests that even the hugely successful System/36 is just an "interim solution."

A number of non-370 solutions have emerged as departmental DBMS and cluster controllers for the office: the new 8100s, the System/36, and the upcoming Intel 286-based multi-user PC, for example. All the while though, central dp has eagerly awaited a low-cost VM/370 that would perform the same functions, controlling clusters of PCs and 3270s. The 4305, featuring a proprietary IBM 32-bit processor and its 1,500-gate VLSI logic chip, is apparently Böblingen's answer at about $40,000. Due to the difficulty of building supervisory tasks for multi-users in a complex VM operating system environment onto miniaturized hardware, the machine is not expected to be shipped until late next year, sources warn.

While there seems to be no way that the 38 can compete at the 4305 class, experts point out that the RPG-based Sys-

IBM is understood to be quietly pitching a new 4300, the 4305, to selected accounts.

tem/36 can at least be offered as a substitute, as well as an upgrade path to the 38. According to Kutnick, however, it will be just as easy for System/36 users to upgrade to the new 4300 machines.

"Both the 36 and the 4300 have an SQL-like query facility," he says, referring to System R's data definition and data manipulation language. He added that no software or compilers for 36 to 38 migration were yet on the horizon to provide a bridge for the 38 to the departmental database machines. "My guess is that System/36, 8100, and Intel 286 PC users will be offered upgrades to a new 4300 running IBM's XA operating system in two years." He notes that the 36's lease-to-purchase ratio heavily favored an outright buy, and that the machine was only a short-term, interim solution.

In this scenario, there seems little else for the System/38 and 370 families to do but remain incompatible—IBM has privately told customers that there's not enough money in the world to establish a program of JCL conversion between the two lines—a common base of functionality is being created at a level above the operating system. GM, for example, has strong-armed IBM into providing the high-level language PL/1 on the 38, thus establishing a new path for migration to the 370 world. In addition, sources reveal that Rochester has created a common disk protocol that allows that System/38 to support the new disk storage units on 370 mainframes and convert files from System/38 disk format to 370 disk formats. On the upcoming Trout family of mainframes, built from a federation of processors, the converted System/38 files would reside on the mainframes file management processor, sources explain.

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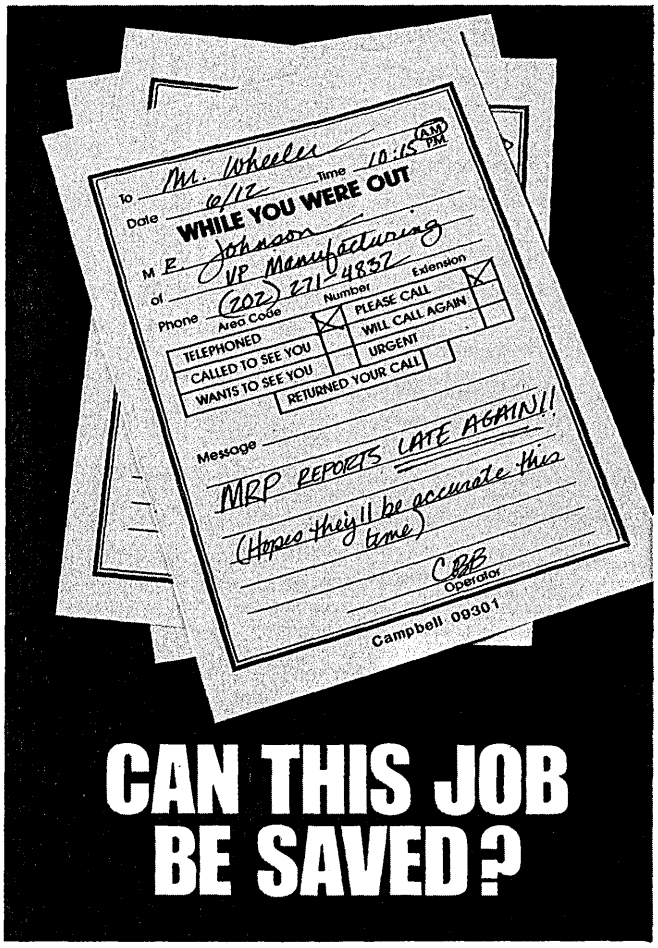

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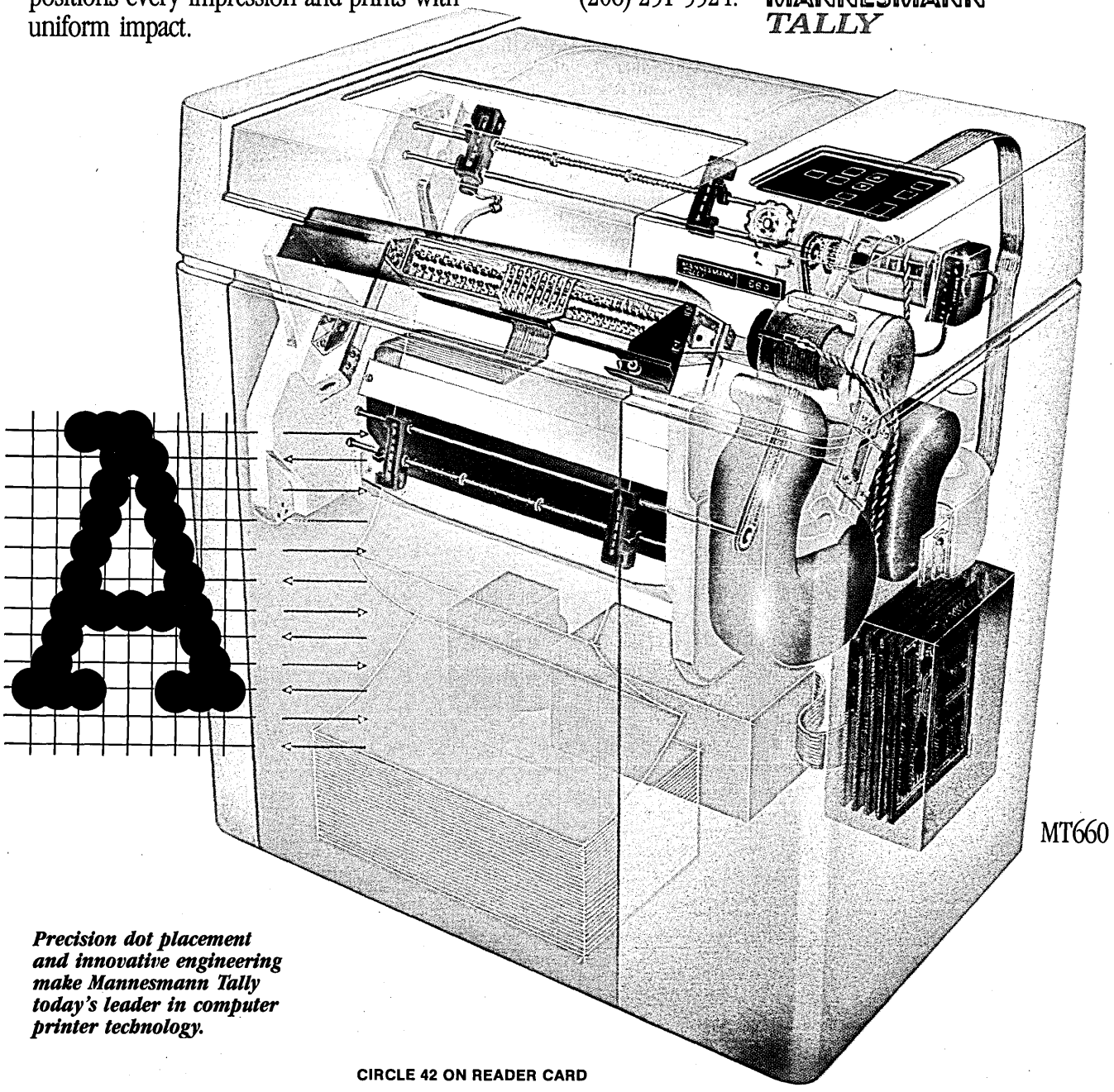

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IBM processors begins to emerge. It is also a world where the 38 is increasingly subsumed into the 370. It is perhaps a little sad that in the process the 38's multihued techology should come to reflect only one color: marketing blue. ◉

PRIVACY

KEEPING PIRATES AT BAY

Old-timers are bringing an old technology to bear on new software protection problems.

by Edith Myers

Mention of a startup in the computer industry these days conjures up visions of a couple of students working in their dormitory or garage on a new, micro-based machine.

Such a vision would be way off base for Codercard Inc., Costa Mesa, Calif., founded in July 1983 to attack what founders saw as companion problems: unauthorized network access and software piracy.

For one thing, the founders are long past their student days. They are Robert W. Herman, 61, president, treasurer, and director; Dr. E. Richard Reins, 57, chairman of the board; and Marvin Perlman, 58, director and vice president.

Their technology isn't new either. It's based on work in pattern generation done since the early '50s.

The problems the three see themselves addressing, however, are new in the sense that their present magnitude is a direct result of the proliferation of personal computers. "It all started five years ago," recalls Herman. "Dick Reins stopped by my office. He'd just gotten a pc and was going to develop some programs. We talked about how easy it would be for anyone to copy them and he left depressed."

Reins at that time was the senior civilian at the Navy's Fleet Numerical Weather Central, Monterey, Calif., where he was director of engineering and technical advisor to the commanding officer. He and Herman had worked together earlier at another Navy facility at China Lake, Calif.

Herman, the entrepreneur of the three Codercard founders, had left the Navy's employ to found Decision Controls in 1957, a company which spawned many of Orange County's computer firms and which was sold to Varian Associates in 1967 to become Varian Data Machines. Herman sold another startup in the early '70s to Genisco and it became what is now Genisco Computers. Most recently he has been executive vice president of New World Computer Inc., a Costa Mesa, Calif., disk drive manufacturer.

"I owed Dick a favor," says Herman, who adds that he began pondering the piracy problem following his conversation with Reins. "At about that time, kids were getting into their schools' computers and I decided that was an easier problem. I thought about work I'd done in pattern generation back in the early '50s and about a technique called feedback shift register. It used nonlinear techniques."

He recalled that work on such techniques had been done at California Institute of Technology's Jet Propulsion Laboratory. He went to JPL and met Perlman, a member of the technical staff there. Perlman had developed a nonlinear pattern generator at JPL for which he got a release from JPL. "They're nondeterministic," explains Herman, describing the JPL techniques. "Given the pattern, you can't determine the generator."

With Reins, Herman and Perlman formed what Herman calls "a little R&D partnership. Marvin would work out the generator and Dick would work on the architecture for the system. Dick went back to Monterey and I didn't hear from him for many months. Then he called and said, 'Hey, I've got this thing worked out.' I'd practically forgotten about it. He brought down a little model and it was pretty grim, just a printed circuit card and a connector."

But it worked. Herman got funding from a friend for the partnership, which set about to refine the system. Last Feb. 7 the company, which has a license from the partnership, made a $3.5 million public stock offering, which closed March 1. Its basic product is the Codercard, which initially will be sold for remote terminal access applications and later for piracy prevention.

The card itself is a tiny circuit board contained in a housing the size of a credit card and approximately ⅛-inch thick. It is designed to be inserted into a receptacle connected to an RS232 port.

Pricing for the card itself has been set at $69.50, according to the company. The receptacle, depending on configuration, ranges from under $100 to as much as $800.

In the network access application, a Codercard network terminal must be attached to the network. A user logs on in the usual way and inserts his Codercard into his terminal. Herman hopes that someday every terminal "will have that slot built right into the keyboard." The slot is now housed in the outboard receptacle.

The access computer or terminal sends the Codercard ID number to the Codercard network terminal, which in turn comes up with two numbers, one of which is sent to the Codercard requesting access. Only the correct Codercard will be able to compute an answering number that matches the second number produced by the network terminal. For each access request a totally different pair of question/answer numbers will be generated, even for the same Codercard.

The access system currently is being evaluated at the University of California Los Alamos National Laboratory. "We have some of our original kludges down there," says Herman. "They found some problems for us." Last month, engineering prototypes were scheduled for installation at Los Alamos.

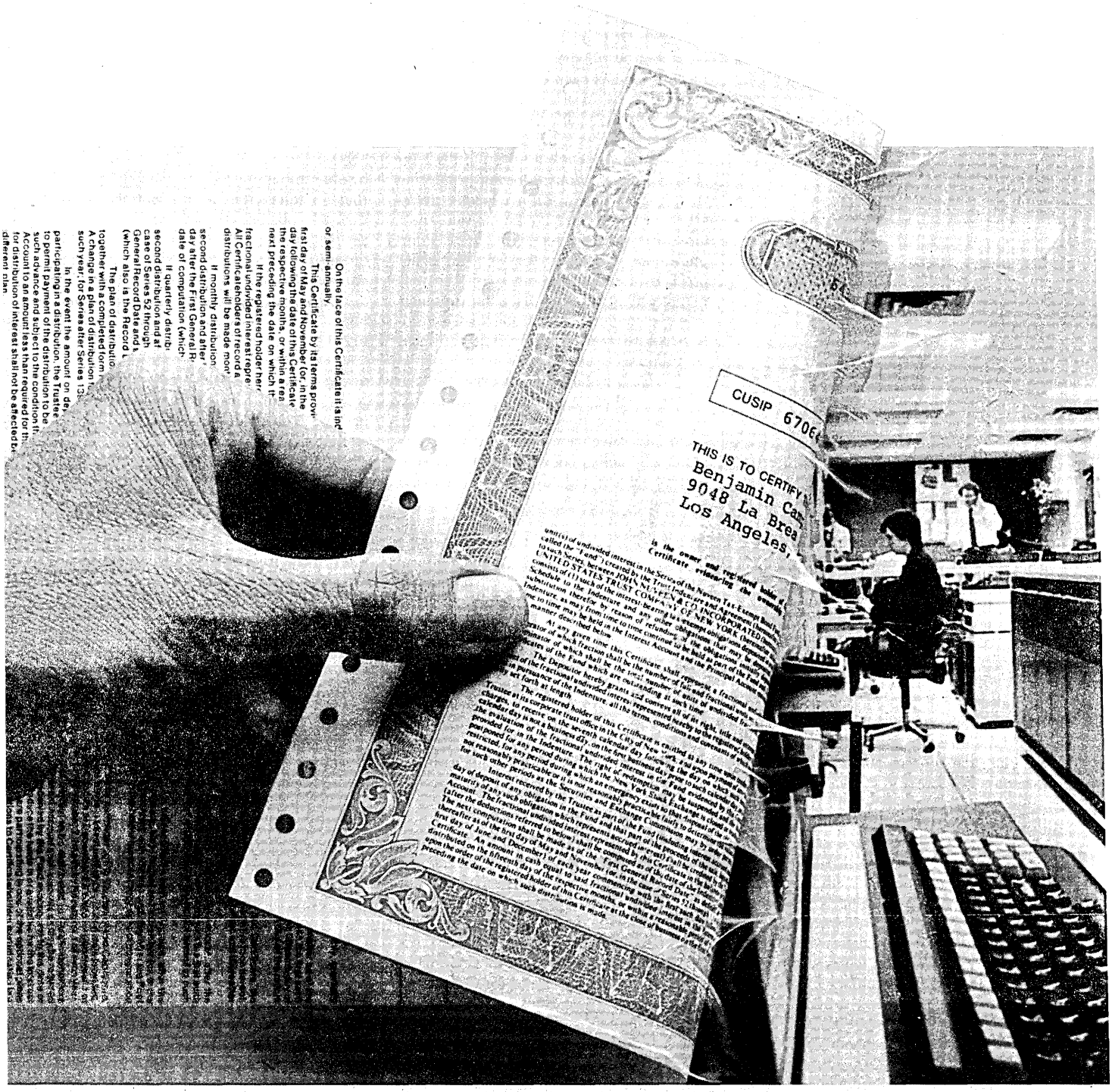
For the piracy prevention application, the Codercard is plugged into a user's computer. Its microcomputer will compute critical steps in a program. Only a serial numbered Codercard, from which the program is coded, will be able to do this. Consequently, the user can make as many copies as desired and even change computers, but no one will be able to run the program without the original Codercard for which the parameters were computed.

The software designer decides on the amount of protection desired, Herman explains. He chooses points in his program at which a computer would be requested to call on the Codercard to compute a sequence of steps.

"It was pretty grim, just a tiny printed circuit board." But it worked.

Programs will be encoded for the Codercard by serial number so that a user will need only one on which all his programs are encoded. The company plans to produce two types of Codercards, gold and silver. The silver cards will be unique in that only one card will ever be issued with a particular serial number. Gold cards would have serial numbers beginning with a letter that would indicate to the software producer that multiple copies of that Codercard serial number are or can be issued. Programs for such cards could be sold at a premium since multiple users would be presumed. Gold cards would allow for multi-user situations such as in large organizations or computer clubs where a legitimate form of software sharing could be practiced.

Herman says he likes to visualize Codercard use as "personalizing" the software for the user. ◉



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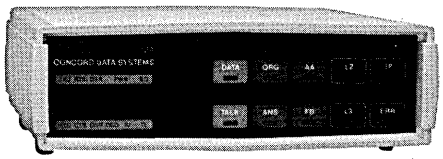

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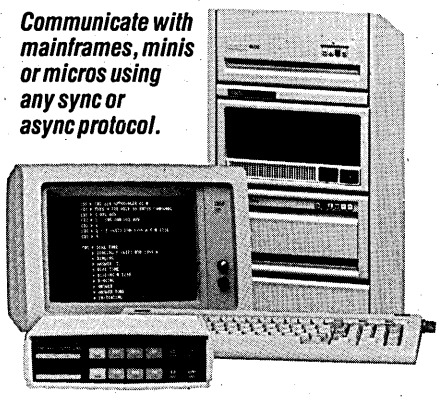

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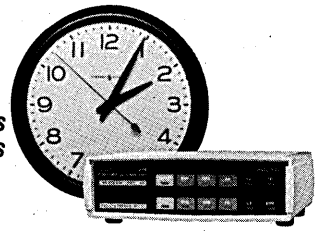

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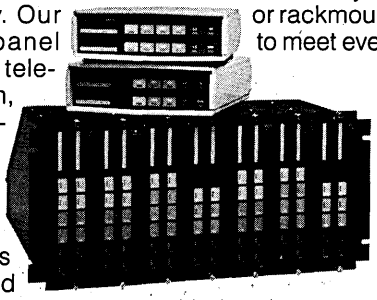

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CIRCLE 44 ON READER CARD

ROBOTICS

NOW IT'S PERSONAL ROBOTS

The industry is in its infancy, but one observer believes the first steps have been taken.

by Edith Myers

As computers move out of computer rooms into offices, schools, and homes, will robots follow?

Jean-Michael Gabet, president of Cosma International, a San Francisco-based consulting firm, thinks so. For since we have a personal computer industry, we also have a personal robot industry, an infant industry in Gabet's estimation.

It's an industry that has already held its first national conference, the International Personal Robot Congress, in April in Albuquerque. It attracted half a dozen personal robot makers and some 500 robot enthusiasts.

Gabet, a speaker at the congress, says of the robots exhibited, "It's hard to imagine any of those doing well in the market." He describes them as "showpieces that couldn't do anything useful."

He believes, however, that the congress served to present those companies already making personal robots, as well as the half dozen more he believes have something on the drawing board, the technological hurdles they must overcome, and the importance of addressing market needs.

"When you think of a human being, you realize the rest of the body works on behalf of the hand."

He says most of the people in the personal robot field do not have an industrial robot computer background. "They've come from a kind of hobby subculture and they've focused on their products. Now they have to face the question of how to make money with the products. It doesn't do much good to say it does nothing but we had fun designing it."

One robot at the conference tried to do something—it tried to pick a flower. "It never managed to do it," says Gabet. "It was a pitiful sight."

The robot in question was the RB5X "intelligent" robot, produced and marketed by RB Robot Corp., Golden, Colo. RB president Joseph H. Bosworth was the initiator of the Albuquerque congress.

The RB5X has been on the market since September 1982 and is aimed at the home, school, and business markets. In late April, RB filed for reorganization under Chapter 11 in U.S. Bankruptcy Court in the district of Colorado. "They're all in trouble," says Gabet of the fledgling personal robot firms.

The Colorado company said the Chapter 11 filing was necessary because of "usually high" development stage debts incurred in the design, manufacturing, and marketing of the RB5X, which it describes as the world's first fully programmable mobile personal robot.

Gabet does have hopes for the market he has followed closely for the last year and a half. "The market is there. If something useful is produced, every home in the U.S. will have one." While the technology exists to support a personal robot industry, "there is a need for high-level integration of various technologies." This, he feels, is yet to be achieved.

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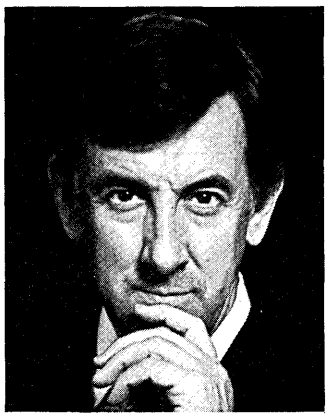

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"The industry really is trying to find its way. The first steps have been taken. The intermediate steps come next." Gabet believes one common "design mistake" has been the linking of robots to external computers. "There are enough electronics around so that what is done in a computer outside can be done inside a robot."

Another mistake is treating the arm as an add-on to a robot, he says. The arm "should be the centerpiece. When you think of a human being, you realize the rest of the body works on behalf of the hand."

Gabet doesn't see industrial robotics companies taking an interest in personal robots. "They're a totally different group of people." He believes some technology from industrial robotics can be leveraged into personal robots, but "most of it tends to be overkill and to be pretty expensive."

Gabet puts robots into three categories: personal robots priced under $5,000; robots priced from $5,000 to $50,000 and used for activities like surveillance and tasks in hostile environments, though he predicts a paucity of applications there; and the industrial robots—factory tools used, for instance, in welding cars.

"The appliances will do everything a typical housewife does."

A factory robot, he says, "is designed to implement a limited set of tasks and to do them well and with a high degree of accuracy. A personal robot will do a lot of things in a more approximate fashion."

Gabet believes there are two difficult technologies that must be conquered before a truly useful personal robot can be developed. One is giving a robot a set of coordinates to allow it to determine where it is spatially. "To get from here to there, you have to know where you are, which way you're facing."

The second is giving a robot the ability to recognize things such as patterns and objects. "There are computer systems that can do this but it involves multiprocessing architecture, parallel architecture. It'll be a while before the techniques can be cost-effectively applied to personal robots."

When successful personal robots do finally arrive, Gabet believes they'll fall into two categories, at least for home use. "They'll be either appliances or entertainment units. The entertainment units will do things like talk or play cards. The appliances will do everything a typical housewife does, like set the table, vacuum, and fetch the paper."

No comment. ◉

OFFICE AUTOMATION

FINGERS DO THE WORK

A new office system uses touch-screen icons to give executives easy-to-use functions.

by Edith Myers

Purveyors of office automation systems are finally starting to realize that the MIS director can't be left out of the loop.

For Santa Barbara Development Laboratories (SBDL), which last month began field installations in San Francisco and Santa Barbara, Calif., of a micro-based office system (Hardware Spotlight, August 1983, p. 219), the MIS director is a prime target, even though the system was clearly developed with top executives and their executive secretaries in mind.

The MIS director has "hunted in every direction to find something more suitable for his top executives to use," says SBDL's vice president of marketing and sales, Reginald O. Parker.

Contact Office Automation Centers, Century City, Calif., formed in early 1982 to develop an international sales network to address the office automation needs of doctors and lawyers, has a separate department to serve consultants and corporate MIS departments.

SBDL's executive system has been plodding its way to market since 1982. At NCC last year a prototype of its system was shown for the first time to prospective buyers, oems, and the press. Since then, the system, which combines an iconographic touch screen and keyboard input, has been refined. One of the refinements, says vice president of development Mike Cheiky, was to make the icons "look less cartoony."

Icons are small pictorial representations of files, system services, and other resources that are pointed to or touched by various means to control a system's operation. The use of icons was pioneered by Xerox Corp. in its Alto and Star workstations and brought to the mass microcomputer market by Apple Computer in its Lisa and Macintosh machines. Icons are thought to save time in directing a computer's operation as well as making it easier for personnel with less training to use systems.

In 1983, the company showed a prototype at a condo in Newport Beach, Calif., a short drive from NCC in Anaheim. This year the "refined" engineering prototype was shown in another condo in Las Vegas. And right after NCC, field installations were begun. How long the testing would last was uncertain. "It's a sophisticated system," says Cheiky . "It's more like a mini or mainframe beta test than a micro."

Cheiky founded SBDL in 1982 when he bought rights to a product he was then developing for M/A-Com. Prior to that, he and his wife Charity had founded Ohio Scientific, an early maker of microcomputer gear. They sold that company to M/A-Com in 1980 when it was a $20 million company. M/A-Com set Cheiky up as a consultant with a Santa Barbara research and development facility. There, he began development of what is today SBDL's product. When M/A-Com cut funding for his facility Cheiky purchased the rights to the system.

A basic SBDL system has two consoles, one for the executive and one for the secretary. Both have keyboards, but it is presumed the executive's will get only limited use. The secretary's console has two screens, one for displaying a main menu of icons with the submenus obtainable by touching an icon on the main menu, and one for doing standard word processing. Each module also has a telephone handset. Multiples of the two-console systems will be available on a single system. Parker says a typical system starts at $15,000 per user. He adds, "The more users, the lower the price."

Although the emphasis from the end user's point of view is on simplicity, internally the system itself is far from that. "It meets the real-time demands of an array processor," says Parker. "There is no partitioning." The machine uses an Intel 80186-based system and each user gets 112K of RAM and an 8085 voice processor. There is a dedicated I/O processor for each function.

The office system's development was first begun at M/A-Com, which had bought Ohio Scientific from Cheiky.

If a user presses the icon for file cabinet, he or she can leaf through pages in a given file at speeds far faster than fingers doing their own walking possibly can. In addition to filing, main menu offerings include telephone and directory, electronic mail, graphics and slide capabilities, word processing using voice-on-disk technology, electronic calculator and spreadsheet, and executive calender. Teleconferencing is to come, probably in the fourth quarter of this year.

SBDL has added a touch overlay for the spreadsheet offering. "We don't think the executive will want to learn to use a spreadsheet," said Parker. The overlay is

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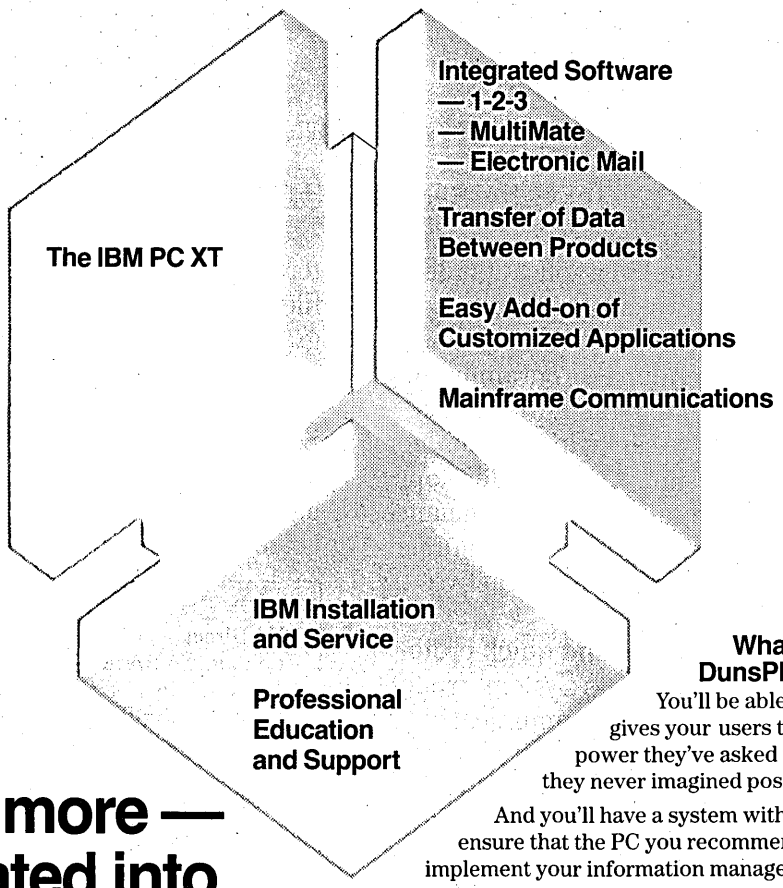

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CIRCLE 45 ON READER CARD

a kind of simplified spreadsheet that SNDL calls "Touch What If," and it can be manipulated by touching the screen.

Another overlay, of which Parker is most proud, is a mainframe touch overlay by which users can call up data from a company's mainframe or from any outside computer to which they have access. For demo purposes, SBDL was showing a touch overlay for the Dow Jones Retrieval service through which users could get stock prices by touching a keyboard-like display of letters using the proper stock symbol.

Security in the system is quite graphic. If an icon is pushed for a service or file that is protected, a large padlock shows up on the screen and a password must be entered before the user can go any farther.

Cheiky said SBDK would move into "pilot marketing" this month in San Francisco and Washington, D.C.

Parker said sales efforts would be "multitiered—first data processing, next data communications, and finally office automation."

Richard Azera, chairman of the board of Contact, feels corporate information professionals can be placed in the same category as other professionals in that "they all have too much to do." Contact's general office automation department will be selling systems in the $10,000 to $25,000 range and providing consulting, training, and service. The organization has one center in Beverly Hills, Calif., which it emphasizes is a sales center but not a retail store. "People won't be coming in here off the street," said Azera. He doesn't expect corporate MIS directors to come in either, but "we'll interface with them at the second phase of the sale."

Contact's hopes are to establish a number of company-owned centers and to set up franchise operations internationally. ◉

BENCHMARKS

BASIC FOUR BIDDER: Bennett LeBow, a New Jersey investor, proposed buying Basic Four Information Systems from Management Assistance Inc. for $30 million in cash and $75 million in securities. LeBow leads a group of investors who, he said, would keep existing Basic Four management in place and infuse additional capital. At the same time, he said, they would cut the unit's operating losses by reducing overhead and corporate structure. Basic Four had an operating loss of $10.2 million in the fiscal year ending Sept. 30, 1983, while the parent MAI reported a $1 million profit. For the second quarter of 1984, ending March 31, MAI reported a $1.7 million loss, but did not report results of its Tustin, Calif., subsidiary. LeBow said that the acquisition, which includes the operating obligations of Basic Four and other related liabilities, would be completed by early August. Separately, MAI said that it had received offers for its Sorbus unit, which services computer systems. It said the offers were rejected as inadequate.

AXED: Two microcomputer makers struggling to keep afloat cut several top managers, and a printer maker laid off a third of its production work force. Eagle Computer, which emerged from the fiery death of its founder a year ago as one of the top IBM PC-compatible manufacturers, removed five senior level executives at the same time that three of its five board members resigned. The five executives were product planning vice president Ron Petersen, engineering vice president Hal Simeroth, finance vice president William Glynn, senior marketing vice president Gary Kappenman, and director of strategic planning Al Heivein. Kappenman, Glynn, and Robert Loary resigned from the board of directors.

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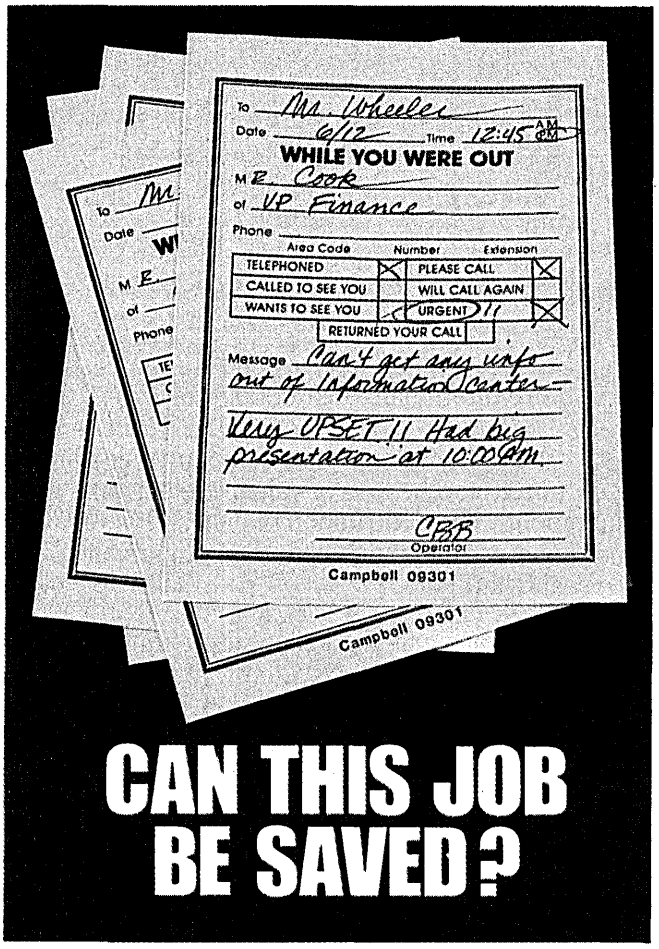

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Kappenman is the brother of Eagle chairman Charles Kappenman, and Loary is a general partner of Lawrence WPG Partners, one of Eagle's leading venture backers. The actions were taken to stave off a Chapter 11 bankruptcy filing, which has been threatened by Eagle's creditors. Eagle's problems stem in large part from an IBM suit claiming Eagle infringed on trade secrets in building the BIOS of its pc line. For the quarter ending March 31, the Los Gatos, Calif., firm reported a loss of $9.8 million on revenues of $10 million. Separately, two cofounders of Fortune Systems resigned. Sales vice president David Van Den Berg and planning vice president Homer Dunn will not be replaced, Fortune said, and lower-level sales and planning managers will report directly to senior vice president Robert Ruebel. Fortune has lost money in each of the past four quarters. The Redwood City, Calif., micro maker recently laid off 5% of its 600 person work force in an attempt to cut expenses. Finally, Diablo Systems Inc. laid off 284 hourly production workers, or 36.5% of its production workers, because of increased competition from foreign printer makers. The Xerox subsidiary, based in Fremont, Calif., now has about 500 production employees and 820 salaried nonproduction workers. The layoff follows a cut of 150 workers two years ago, and a recent switch to a four-day workweek on production of Diablo's fully formed character printers. The printers have fared poorly in the competition with laser and ink jet printers for a niche in the microcomputer peripherals marketplace.

HALTS WORKSLATE: Convergent Technologies halted production of its Workslate lap-sized spreadsheet microcomputer. The unit was announced to acclaim a year ago, but sales were lagging far behind expectations, company officials said. Workslate production employees were diverted to other areas of the Santa Clara, Calif., company. Convergent currently has some 6,000 completed Workslates in inventory, and will not resume production until a substantial part of that is sold off. The firm may decide to take a pretax writeoff of about $50 million to close down the operation, sources said.

AT&T'S PC: AT&T Information Systems finally threw its hat into the personal computer ring with an IBM-compatible unit made by Ing. C. Olivetti & Co., the Italian office equipment maker that is 25% owned by New York-based AT&T Corp. The unit, dubbed the model 6300, costs from $2,745 to $4,920, about 5% less than comparable IBM models. The product provides what appears to be the first head-to-head battle between the two industry giants. "We welcome electronic *High Noon,*" AT&T Information Systems president Charles Marshall said. The machine can be tied via a high-speed network to AT&T IS's more powerful 3B line of supermicros and minicomputers, which was announced last spring. The 6300 will be carried by ComputerLand, Sears Business System Centers, Microage, Compushop, and other micro retailers, but initially it will not be sold through AT&T's own Phone Center Stores. Analysts say that about 60,000 machines could be manufactured this year, but the company would not comment on production plans. The 6300 does not run the Unix operating system, sold by AT&T Bell Labs for the past 15 years, although AT&T IS officials said that one or two additional desktop micros will be introduced this year and may run Unix. Those machines are being developed jointly with Convergent Technologies, the Santa Clara, Calif., manufacturer.

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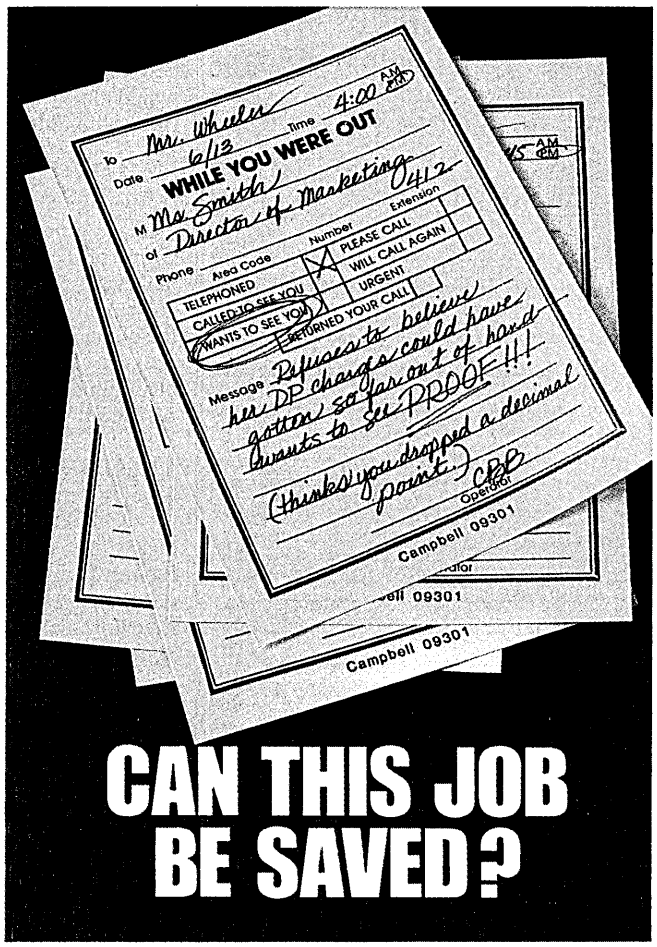

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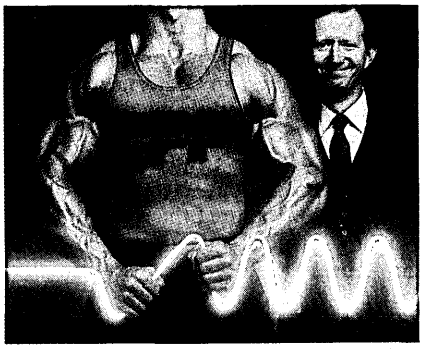

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NEWS IN PERSPECTIVE

inated mail) did (at least in the eyes of its numerous critics), however, may live long after it was pronounced dead by the Postal Service's Board of Governors. The board, which has been feuding with the Postal Service about Ecom almost since the electronic mail operation's inception in January 1982, directed the Postal Service to file a request for termination of Ecom with the Postal Rate Commission (PRC) by July 6. The Postal Service was also told to dump all its Ecom equipment either through sale or by lease. These directives were only the beginning of what could be a lengthy burial ceremony. The 950 current users of Ecom, mostly direct mail advertisers, may try to keep the service alive by delaying the PRC's action. The users would thus prolong the benefits they receive from what critics and supporters alike concede are Ecom's ridiculously low rates. Ecom charges 26 cents for the first page and five cents for the second. That's about a dollar short of what a congressional committee estimates are the service's real costs. There's also the issue of how and when the Postal Service is going to get rid of the equipment, which Ecom critics contend is so awful no one wants it. Nevertheless, there are several possible private sector Ecom heirs, but all say there would have to be significant changes in the service before they'd buy it. The Postal Service may be tempted to offer a potential buyer specialized access to its delivery capabilities, but that would almost certainly mean a lawsuit by those who didn't get the access.

R&D CRITICISMS: Bucking the currently popular theory that less government is good government, Congress's Office of Technology Assessment (OTA) makes a strong case for more federal involvement in research and development. Responding to a request from Rep. John LaFalce (D-N.Y.), his party's leading industrial policy advocate, OTA says that an Advanced Technology Foundation (ATF), as provided for in H.R. 4361 (see "Agreeing to Disagree," April 1, p. 58) could be a major step in deepening and broadening the technological foundations for U.S. industry. OTA notes that many studies over the last few years, both within and without the government, have established the need for such a network. That need remains unmet. To those who believe that military and space projects will eventually trickle down to the civilian sector, OTA says such spin-offs tend to be long term and indirect. While spin-offs sometimes lead to major classes of commercial products or processes, "serendipitous results can neither be planned nor guaranteed." OTA's analysis indicates a strong need for a more active federal role in facilitating the generation and diffusion of technical knowledge to business and industry. This would be accomplished by institutional innovation aimed at "greasing the wheels" for commercial technologies and setting up a flexible and adaptive network with ample room for local control and initiatives. Regarding LaFalce's "civilian DARPA" (Defense Advanced Research Projects Agency) proposal, OTA says that while DARPA holds useful lessons for civilian technology development, a federal agency for developing advanced commercial technologies would run severe risks of misjudging market needs.

BUYS MORE MDS: Asher Edelman, the investor who recently won control of Management Assistance Corp., upped his stake in Mohawk Data Sciences, another New York-area firm in shaky financial footing. Edelman filed a statement with the Securities and Exchange Commission saying that he and related companies now hold 8.8% of the Parsippany, N.J., maker of distributed processing systems. His group's stake had been 6.3%. Edelman met with MDS chairman Ralph O'Brien and proposed several restructuring steps. Those include dismembering the company and selling the parts individually to private investors, spinning out some units as public firms, or leveraged buy outs of all or parts of the company. Edelman said that he would fight to gain seats on the company's board of directors at its annual meeting this month if his proposals were rejected. Mohawk has struggled through the past two years, losing $52.9 million in fiscal 1984, which ended April 30, on revenues of $402.5 million. The loss was due to a fourth quarter deficit of $59.7 million. Earlier this year, Edelman won four of 10 seats of MAI's board, after waging a proxy fight for ownership of the New York company.

BUYS STC UNIT: Storage Technology Corp. has agreed to sell its Microtechnology division to Plessey Co. for an undisclosed amount of cash. The unit currently supplies linear and digital circuits for several StorageTek operations, and was to have been the primary source of CMOS circuits for the firm's aborted mainframe computer system. Under the terms of the agreement, Plessey will operate the unit in its current facility, adjacent to StorageTek's corporate headquarters in Louisville, Colo. "We felt it would be more efficient for an experienced semiconductor company like Plessey to direct the operation of Microtechnology," said StorageTek chairman Jesse I. Aweida. The unit currently has manufacturing facilities for 2- and 3-micron CMOS products, along with analog bipolar circuits. The facilities include mask making, assembly, and text capabilities.

NEWS IN PERSPECTIVE

REJECTS BID: International Computers Ltd. rejected an offer of $516.1 million from Standard Telephones & Cables PLC. STC's surprise offer was regarded as too low by the British mainframer. STC then said that it would mail its offer document to ICL shareholders anyway, and that it might raise its bid. The firm, which is 35% owned by ITT Corp., has already bought 9.8% of the firm on the open market. Should the purchase ultimately be accepted, the two firms would merge and be renamed STC International Computers Ltd., according to STC chairman Sir Kenneth Corfield. The new company would have annual sales of $2.64 billion and some 5,000 employees, Sir Kenneth said, making it Britain's largest domestically owned electronics company. STC's initial purchases of ICL stock created concerns in Parliament that England's largest computer company would fall into foreign hands, but Sir Kenneth and Prime Minister Margaret Thatcher asserted that STC is still a British firm. Thatcher, while supporting the proposed merger, told Parliament that the government would still investigate any antitrust implications of the deal.

STORE CLOSINGS: Control Data Corp. is getting out of the retail computer business. Some 60 of its 125 Business Centers, operated by the firm's Commercial Credit subsidiary, had been closed down by early summer when the Minneapolis giant said that all of them would be phased out, most by the end of the year. CDC also said that it will either close or sell its chain of software retail outlets, called Software Only. Finally, the firm said it will shut three of its four domestic timesharing facilities as an economy move. The Cybernet timesharing centers, in Houston, Arden Hills, Minn., and Sunnyvale, Calif., will all be closed by mid-1985, the firm said, at which point all Cybernet services will operate out of the Rockville, Md., facility. Overseas, the Cybernet center in Brussels will continue to operate. All told, the three Cybernet closings will eliminate about 100 jobs, the firm said. The Cyber 205 supercomputers will be reassigned within the firm, perhaps for use in design work, according to the company.

REALIGNS: In a single stroke, Hewlett-Packard completely realigned its product lines, marketing teams, and the divisional executives who run them. Dean O. Morton, who had headed HP's medical and analytical products segment, was named chief operating officer. Paul Ely Jr., the executive vice president who had run all of HP's computer operations for nearly a decade, was reassigned to replace Morton, and John L. Doyle, who had been vice president of research and development, replaced Ely in the computer segment. William Terry, who had been executive vice president of HP's instrument divisions, was named the head of HP's third major segment, the newly created Measurement, Design and Manufacturing Systems sector. Concurrently, all of the engineering hardware divisions were stripped from the computer segment of the company, which now concentrates strictly on the HP 150, 250, and 3000 commercial computer systems. The reassigned product lines, the HP 9000 32-bit desktop computer, and the HP 1000 technical minicomputer, are now part of Terry's segment. A fourth major segment, Marketing and International, was created to handle all marketing and field sales for the rest of the company. That segment is now headed by Richard C. Alberding, former international senior vice president.

TELECONFERENCING TWIST: A joint venture between an insurance company and a teleconferencing vendor has resulted in a system called Inforum. The product was jointly developed by The Travelers Companies of Hartford, Conn., and American Video Teleconferencing Corp. of Oceanside, N.Y. It integrates computer-based information processing and videoconferencing, operating on an IBM SNA data network. To an IBM mainframe, the teleconferencing session emulates a 3270 terminal. The system transmits in the 9,600 to 19,200bps range that typically exists in the user's data processing network, according to AVTC. It uses the SNA network and host application program as the distribution vehicle for photographic and computer-generated images. The teleconference facilities use standard audio, video, and communication equipment, and an IBM Personal Computer in conjunction with a proprietary communications controller, room controller, and personal computer software. The communications controller physically connects the video, IBM PC, and room controller to the data network, using host bridging software. The entire videoconferencing session is controlled from a flat-panel display on the conference table. From there, the moderator can switch from still video to data generated by the PC by touching the menu-driven screen. The computer controls the lighting functions and activates the appropriate equipment. It also sets up multipoint calls, distributes information exchange presentations, selects and transmits camera images, displays presentation frames, adds and drops locations, and ends the conference session. The Travelers developed the software package for the PC. Called Decision Images, it enables the user to produce any combination of text, graphs, spreadsheet, and user-created drawings within a single visual frame that can be used in-house or during a teleconference. This software will be sold with the system as well as separately. So far, Inforum is installed in three specially designed conference rooms at The Travelers' headquarters in Hartford, Conn., and offices in Norcross, Ga., and Orlando, Fla. American Video Teleconferencing Corp. will market Inforum along with The Travelers. Neil Lewis, president of AVTC, said the system would give teleconferencing a "shot in the arm" because of the lower transmission costs associated with still video as opposed to full motion video. Lewis added, however, that full motion video is also possible with Inforum. The equipment (less room construction) will sell for approximately $150,000 per conference facility. ◉

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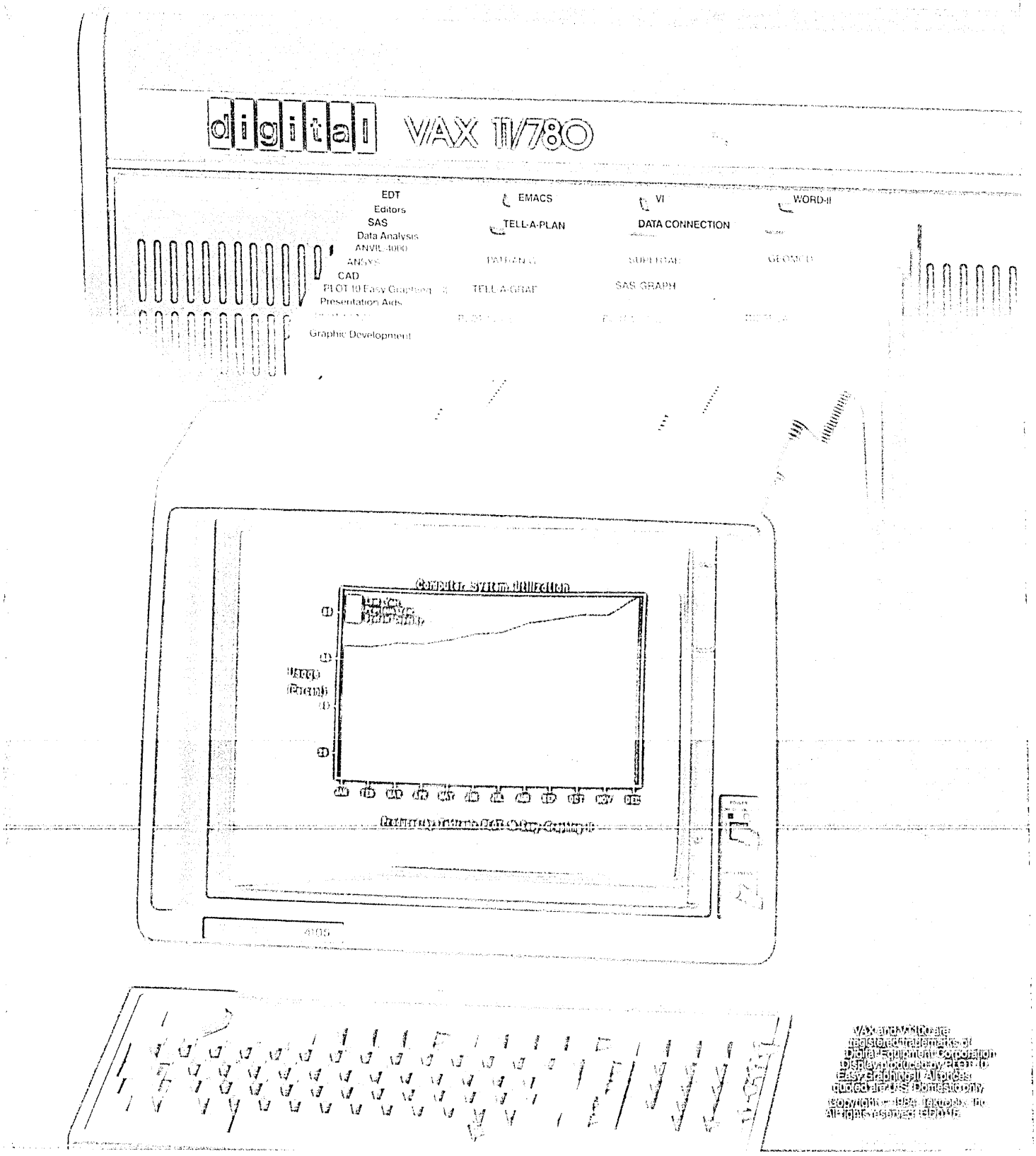

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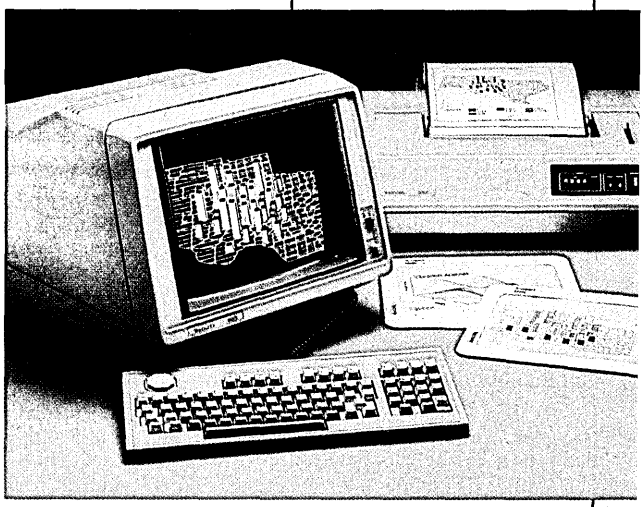

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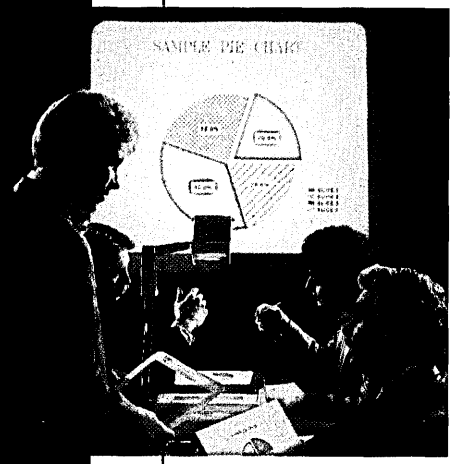

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CIRCLE 47 ON READER CARD

The programmer's tool kit is growing larger, but innovative management and end-user involvement are important, too.

IN SEARCH OF PRODUCTIVITY

by Howard Bromberg

Just what is productivity? Is it merely output in relation to input? In strict technical terms, productivity refers to measures of output and input that are based primarily on physical units—units of product in relation to an input factor such as labor hours, for example.

But productivity is in the eye of the beholder, and different disciplines have different ways of measuring it. Engineers compare output to worker-hour input or machine-hour input; they attempt to gauge how changes in production methods affect output. Economists measure the ability of a production system to deliver goods and services for consumption.

Business managers characteristically compare the input-output relationships of similar departments or businesses. Thus, we have computer departments of major corporations measuring the productivity of their personnel by number of output COBOL lines produced per day. Such a measure is valid if you're comparing people with similar jobs—applications programmers, for example. Each area of specialization, however, would appear to require its own distinct measure of productivity; it makes no sense to compare the output of an analyst to that of a systems programmer.

Measures of productivity must be tailored to the problem and production system at hand. The output of a single programming group, for example, is of interest to a manager who wants to assess the effect of a change (i.e., a new piece of equipment, a new set of operation guides, new working hours) in the way that programming group operates. By contrast, the vice president of finance is interested in a different form of output measure—usually one that requires some calculation of output change in the form of an index number.

There is no universally valid measure of input. For the last 100 years, labor has been a useful thing to measure because it's such a large part of the cost of most products.

Alvin Toffler comments on the popular notion that Japan is more productive than the U.S. in his book, *Previews and Premises* (William Morrow & Co., New York, 1983). He says, "The first problem is the definition of productivity. It is one of the spongiest, and one of the most treacherous of economic concepts. It was designed for a world of material production, when you could count how many workers and how many hours it took to turn out how many skirts or copper bars. As we have moved toward what I've been calling a Third Wave economy, more and more of our output consists of information, services, experiences. More and more the consumers' own actions affect the efficiency of the producer. In addition, we have begun to appreciate that economic 'productivity' is frequently more an artifact of accounting and of permissible externalizations than of anything else. So I have tremendous problems with the very term 'productivity'."

In order for us to understand how to increase productivity, we in the computer industry must synthesize information from such seemingly disparate fields as psychology and economics. Because productivity is tied so closely to labor, it's necessary to look at the worker within a broad context. It isn't enough to consider technical factors alone: social, political, and economic forces are also at work.

If there is a productivity problem in the information industry, it is not one of decline. People are not productive one day and unproductive the next. Something else has happened. Two areas of change are of interest here: the increase in workload per employee, and the increase in the complexity of the jobs to be performed.

The work load for MIS departments has increased dramatically in recent years, and the volume of work per employee is now so high that the existing production technology is unable to produce an acceptable level of output. In maintenance alone, programmers may now have responsibility for hundreds of programs. Similarly, development personnel are now expected to create dozens of systems in order to satisfy user groups. Under these circumstances, it's difficult to be productive. This backlog of work is symptomatic of our society's radical shift toward an information economy. It is a product of fear as much as it is of need—fear of being left behind. The problem is especially acute in corporations that lack a cogent information policy.

WORKERS SPEED UP IN TIME

It's not hard to see why an increase in complexity causes productivity problems, but these problems should abate somewhat as organizations get their people up to speed in the new technologies. Once a development team has become proficient with a new tool or language, uses the new it, the more its productivity increases.

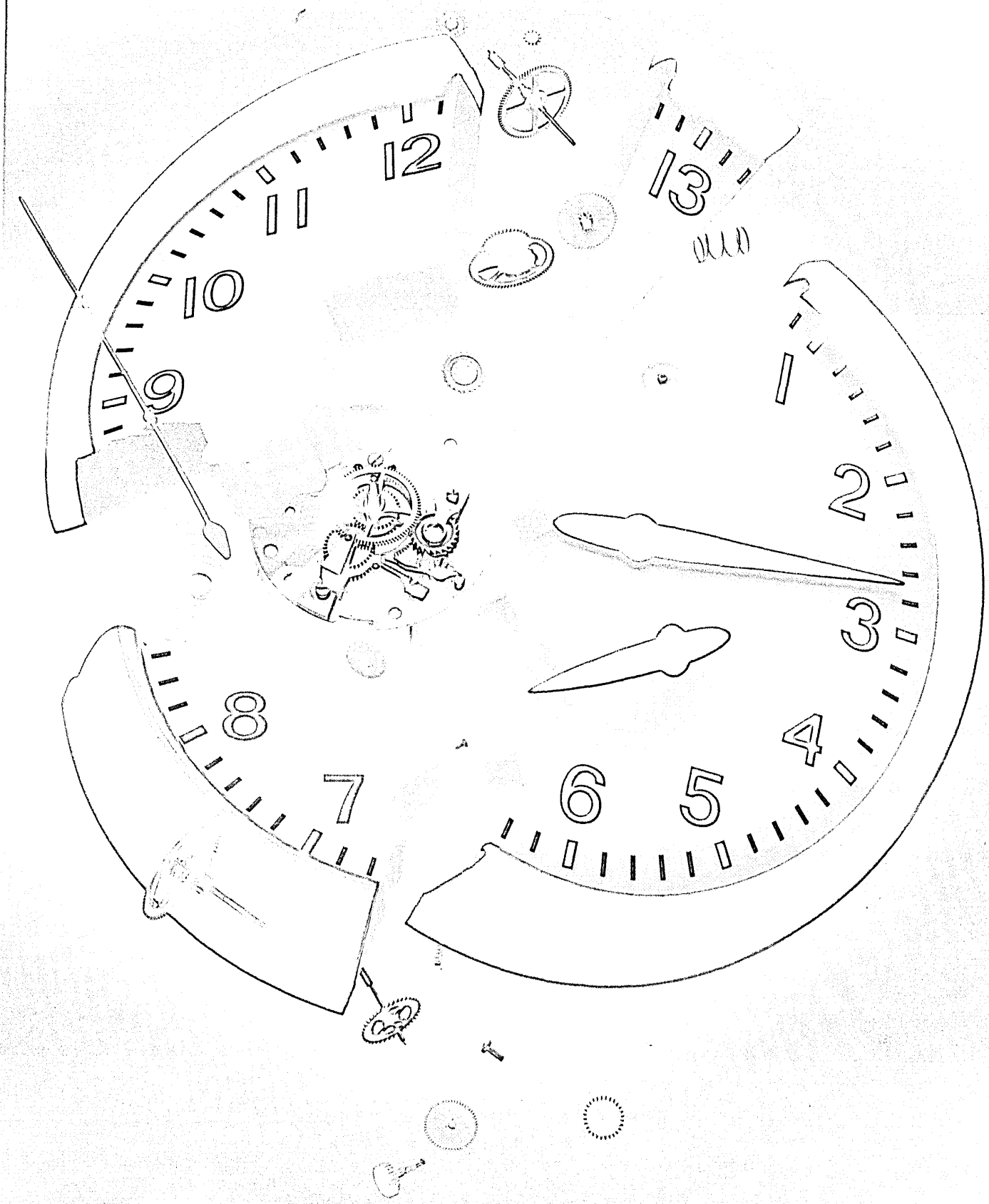
The automation of MIS functions is a valid approach to increasing productivity. MIS's main labor-intensive activities can be listed as follows: system design; development and testing; documentation; and maintenance, which is tied to all of the others.

There are a number of methodologies that attempt to improve the system design process. They help designers collect and verify information, and organize that information into preestablished structures. There are also techniques for making programming development more efficient, usually by changing the organization of the development team or the programming methods themselves.

Most of the productivity aids, however, are tools for improving development and testing. These include code editors and code optimizers, as well as applications generators and program generators. The generators are greatly appreciated because manual coding is such a time-consuming and error-prone activity. Generators can also solve the portability problem by producing code that is transferable among a number of different machines.

Most generators include report-writing capabilities, screen generation tech-

ILLUSTRATION BY KATHY JEFFERS; PHOTOGRAPH BY WALTER WICK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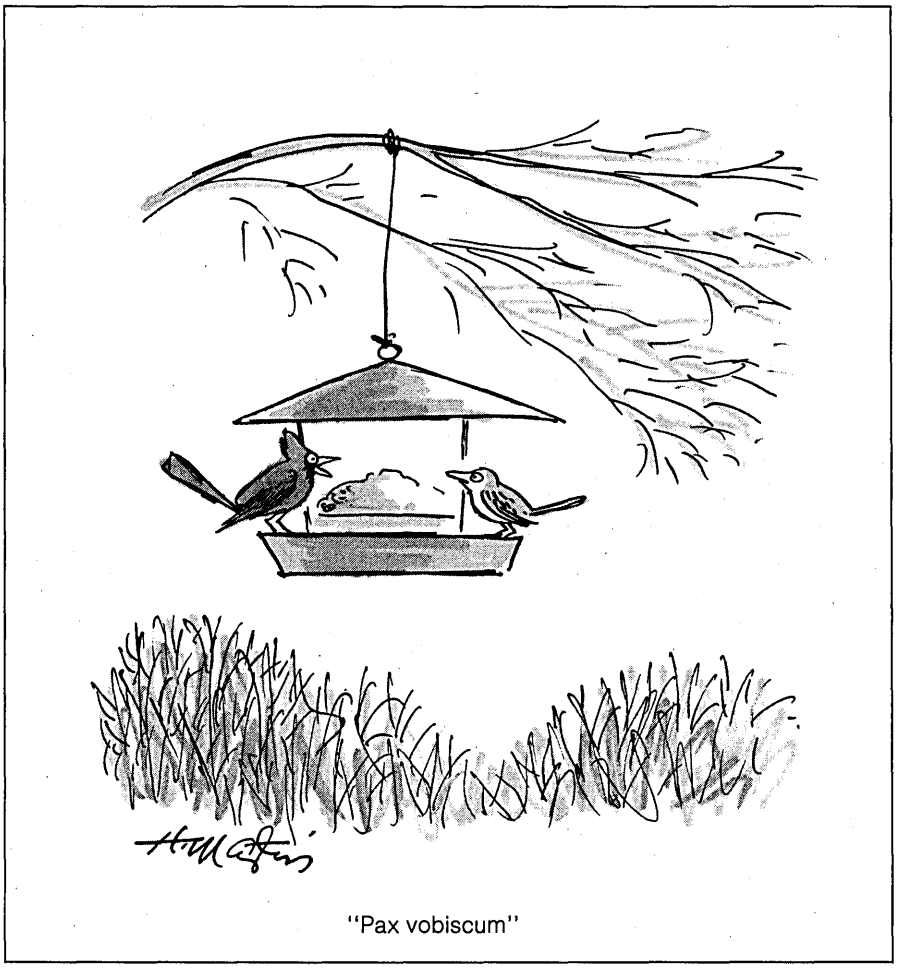
The choice of a productivity aid is not as important as the decision to choose.

niques, structured programming, and self-documenting code. Other tools in this genre are development compilers that enable the programmers to prototype, and complete front-end programming environments that include compilers, debugging tools, and communications links.

One attractive concept that has been discussed for some time is the establishment of a library of standard functions and reusable code. The problem has been the high overhead cost of maintaining the library until the concept is established and repetitive use of the code occurs. Perhaps this will change when more software becomes available on a chip.

Finally, there are testing aids such as static and dynamic program analyzers that give programmers a picture of exactly what is happening with respect to their source code or in the actual execution of the code with data. Another aid is a testbed model used in a quality control environment for defect identification. Such a model is created along with the application, and it trades development time against maintenance cost. In addition, systems can be written to accommodate step-level debugging, and tools exist to provide on-line, source-level debugging.

In the area of documentation aids, the most widely known and used are the graphic products such as logic and flowcharters. Other aids include program organizers and analyzers. All of the documentation aids address the problem of keeping the documentation from getting out of sync with what is being run in production. Combining a maintenance effort with a documentation effort accomplishes this goal in a single step. Providing adequate documentation has always been the goal; elegant documentation has always been considered a waste of resources. Perhaps automating this function will change our ideas. Skeleton outlines can be created to represent common functions and common documents. Standard programs, like those produced by generators, will simplify the documentation, as will the use of graphics and icons within systems. Certainly, user documentation will be improved by these facilities as well as by on-line help capabilities and program tutorials.



"Pax vobiscum"

CARTOON BY HENRY MARTIN

UPKEEP IS MAJOR CONCERN

Maintenance is an area of tremendous concern. It has been estimated that as much as 80% of the MIS resource is applied to this function, so any attempts at improving productivity must of necessity address maintenance problems. Because maintenance includes the functions of design, development, testing, and documentation, all the tools used in these areas are appropriate for maintenance. For example, regenerating a module or program with a program generator produces consistent code and creates the appropriate level of documentation. The testing procedures and tools used initially can be reused. If the maintenance process is not automated, all production suffers.

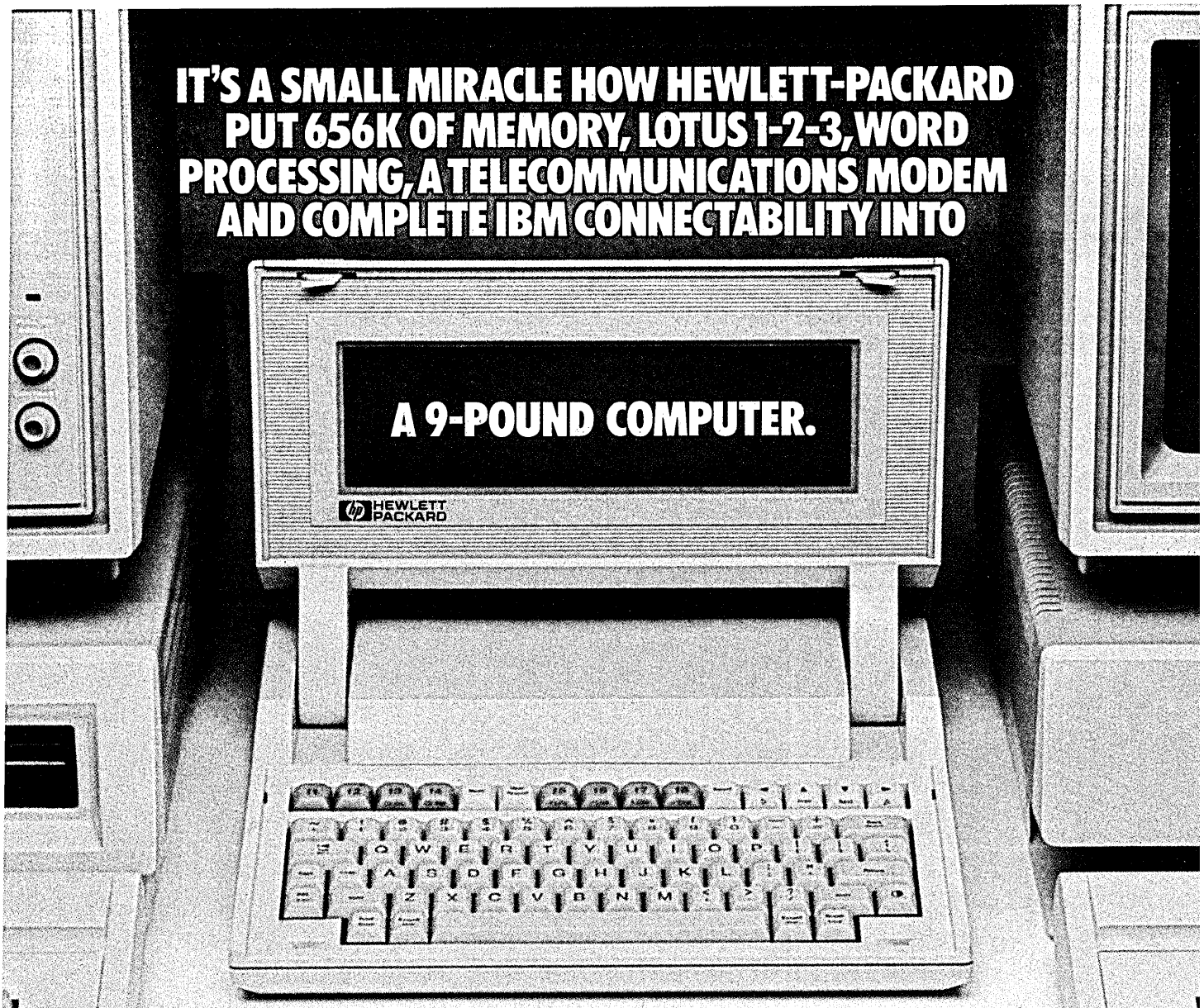
The choice of a particular productivity aid is not as important as the decision to choose. The computer industry understands how to automate manual processes, and by turning its attention inward it can improve its own productivity. With the high cost of labor and the falling price of hardware, productivity tools are becoming a necessity. Certainly they will help us produce faster; whether they will also help us produce better remains to be seen.

Fortunately, there's another kind of tool that seems likely to help us in that regard. For 30 years we have been sending programmers and analysts to communicate with accountants, doctors, lawyers, and Indian chiefs to the mutual dissatisfaction of all parties. Now, however, the right way has found us: the personal computer in the hands of the very people who understand the problem.

With personal computers and programmer productivity aids in use, the productivity of both users and MIS personnel will surely increase. It's worth noting, however, that increasing a worker's productivity is not merely a matter of providing the individual with a better hammer, a faster computer, or an automated methodology. You also have to be willing to improve other aspects of the job. People who participate in decision-making, whose jobs are enlarged and enriched, and who can choose from options like flextime, work at home, and nontraditional fringe benefits are likely to be more productive, and our industry is enlightened enough to put these practices to work. ◉

Howard Bromberg is an independent consultant in the San Francisco Bay Area and a longtime member of the DATAMATION Advisory Board. He provides product planning, business development, and marketing services to emerging and established firms in the computer industry.

IT'S A SMALL MIRACLE HOW HEWLETT-PACKARD PUT 656K OF MEMORY, LOTUS 1-2-3, WORD PROCESSING, A TELECOMMUNICATIONS MODEM AND COMPLETE IBM CONNECTABILITY INTO



THE PORTABLE.

For years business people had to choose between the power of a desktop computer and the limited capabilities of the first portables. That problem was solved when Hewlett-Packard introduced The Portable.

The Portable is designed with more total memory than most leading desktop personal computers...656K in fact. That includes 272K of user memory. So, The Portable's built-in business software can work with enormous amounts of data.

1-2-3™ from Lotus,™ America's most popular spreadsheet, file management and business graphics program, is permanently built into The Portable. So is Hewlett-Packard's word processing program, MemoMaker. Just press the key and you're ready to work.

The Portable even has a built-in modem and easy-to-use telecommunications software to send or receive data using a standard telephone jack.

If you use a Hewlett-Packard Touchscreen PC, IBM® PC, XT or an IBM compatible you'll be glad to know that your desktop and The Portable can talk to each other with the simple addition of the Hewlett-Packard Portable-Desktop Link.

The Portable's rechargeable battery gives you 16 hours of continuous usage on every charge.

Finally, you can work comfortably on a full size keyboard and an easy-to-read 16-line by 80-column screen. And it all folds shut to turn The Portable into a simple nine-pound box.

The Portable. A small miracle...perhaps. But then consider where it came from.

See The Portable and the entire family of personal computers, software and peripherals at your authorized Hewlett-Packard dealer. Call (800) FOR-HPPC for the dealer nearest you.

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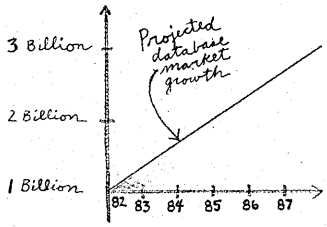
YOUR SEARCH FOR THE BEST ENGINEERED DATABASE TERMINAL ENDS HERE. DIGITAL'S CORRESPONDENT.

As more and more businesses rely on the immediate access to data bases for their success and growth, we are witnessing a veritable explosion in the database market. The Spring 1984 issue of the Directory of Online Databases, compiled by CUADRA Associates, reports the addition of over 2,000 new database listings between 1979 and 1983. The list of databases spans the range from ABI/INFORM for use by business executives to the ZOOLOGICAL RECORD that provides worldwide coverage of zoological literature. According to Link Data Resources, what was a 1 billion dollar industry in 1982 is projected to triple in size by 1987.



The increased demands by business for databases have placed an ever increasing demand on the terminals that access that information.

These terminals must be fast. They must be reliable. They must be flexible. And they must deliver high-quality results.

Digital's DECwriter Correspondent™ teleprinter has been so comprehensively engineered that it more than satisfies all these exacting requirements.

FASTER DATABASE SEARCHES MEAN MORE SEARCHES FOR YOUR MONEY.

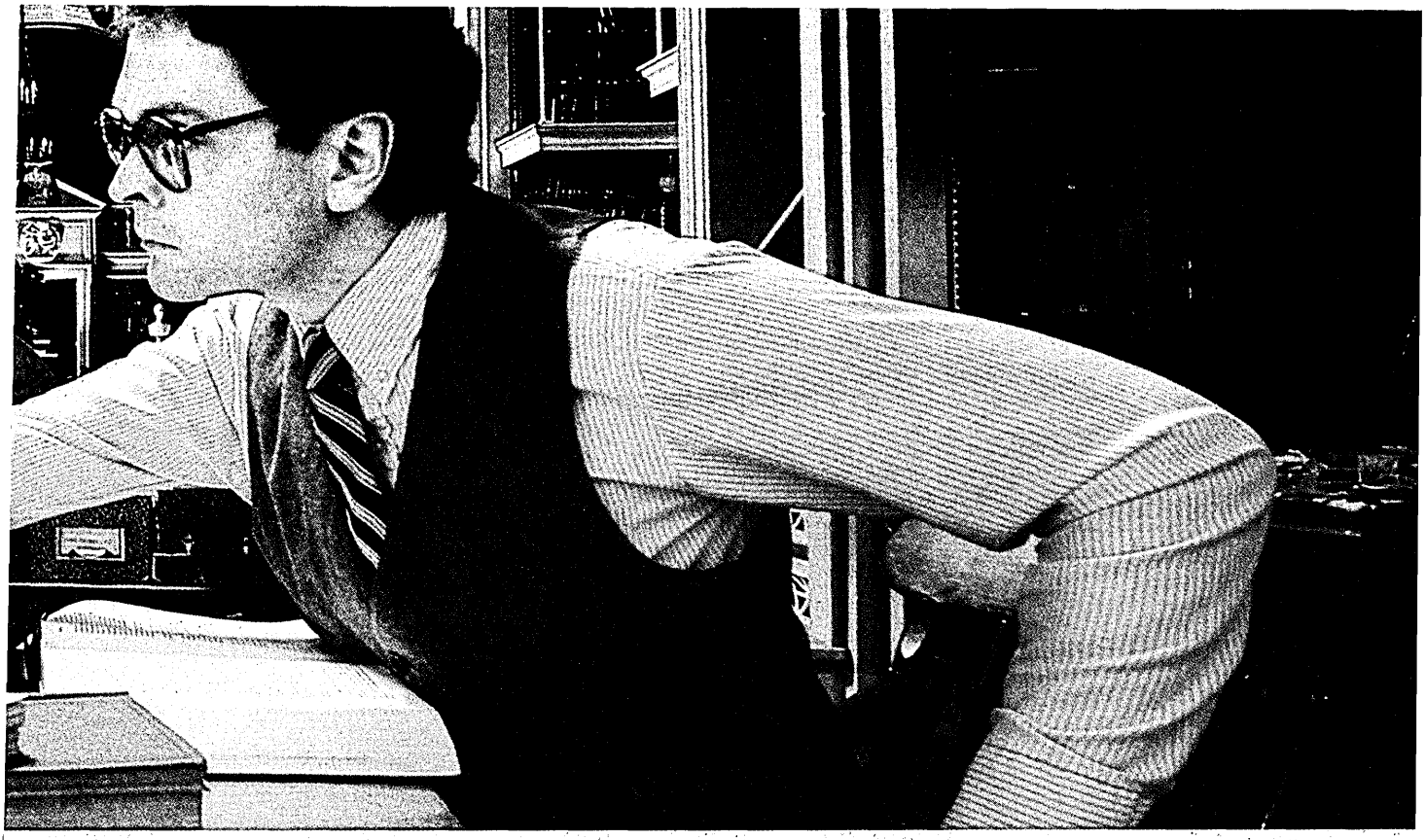
If your business requires an occasional database search, and even more if you're a frequent user, cost can become a very important factor. Simple arithmetic tells you the faster you access the data, the more money you save. Put another way, with greater speed you can perform more data searches for the same amount of money.

Digital's Correspondent teleprinter features a bidirectional printhead which prints out a rapid-fire 150 characters per second for true 1200 baud performance. That's a full four times faster than what you can expect from any other portable teleprinter. All that speed means that you can save up to 75% on your dial-up phone line charges. And can save up to 75% on computer connect time as well.

THE QUALITY OF THE ENGINEERING DETERMINES THE QUALITY OF THE PERFORMANCE.

Because your data is meant to be read, shared and perhaps stored for later reference, it must be, above all else, legible.

The Correspondent tele-



printer has been engineered with exactly that in mind.

Its 9-wire printhead produces an extremely crisp, readable output that does not put a strain on your eyes. Original printouts are so clearly legible that you can run them on the copier machine with exceptional results. It prints true descenders, so a "y" will never be mistaken for a "v" or a "j" for an "i." If some of your information needs to be highlighted, you can receive correspondence quality bold print at 80 characters per second.

And it prints on plain paper, for increased legibility at a reduced cost.

PRINT THE DATA YOU WANT IN THE FORMAT YOU WANT IT.

The Correspondent teleprinter offers you a printout versatility that does not lock you into any predetermined format.

You can set margins at the top, bottom, left and right, and choose from 132 horizontal and 168 vertical tabs to customize a printout for your specific requirements. Paragraphs of information can appear in column form. Or vice versa. You can also select 8 different character sizes, and print up to a remarkable 132 columns per line.

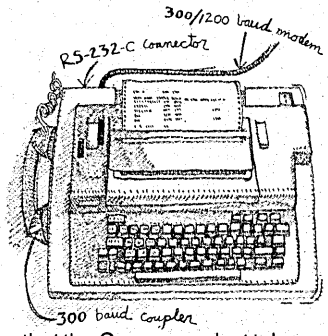
And the Correspondent teleprinter's command of the printed word doesn't stop there. There are 10 different national character sets built into it, as well as APL.

One other format is particularly helpful for presenting complex information in an easily understandable way. The Correspondent teleprinter prints bit map graphics for a high-impact visual presentation of charts, graphs and formulas.

CONDUCT DATABASE SEARCHES AT WORK, WHEREVER THAT MAY BE.

The Correspondent teleprinter's flexibility of formats is matched by its flexibility of communications options. A built-in 300/1200 baud modem lets you dial directly through the keyboard. With the modem, you can store 125 characters of your most frequently used phone numbers and dial them by simply hitting a single key. A built-in acoustic coupler can accommodate almost any phone, so you can access a database whether you're at home or on the road. And when you are on the road, you'll find the Correspondent teleprinter easy to take along. It's such a compact package that it takes up just about the same amount of space as an average typewriter and weighs under 20 lbs. Finally, there's an EIA RS232-C serial port that lets you connect directly with a host computer.

With such high-performance standards for speed, print quality and versatility of formats and communication, it is little wonder



that the Correspondent teleprinter is held in high esteem by experts in the data search field. Jeff Pemberton, editor of ON-LINE, states, "I have been doing on-line searches since 1969, and the DECwriter Correspondent is certainly at the top of the list of the print terminals I have tried."

BEST ENGINEERED MEANS ENGINEERED TO A PLAN.

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A look at six systems that could help make programmers more productive.

FRONT-END PROGRAMMING ENVIRONMENTS

by Nicholas Zvegintzov

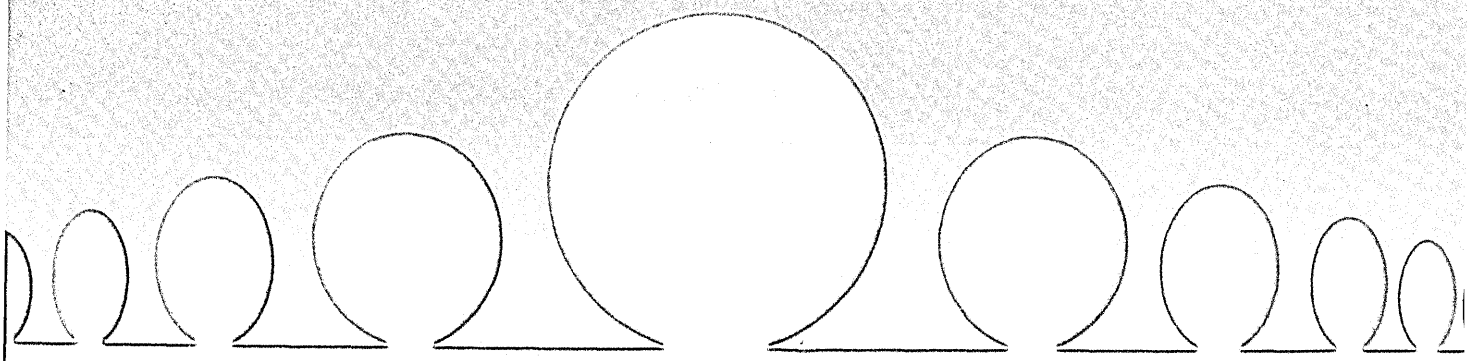
A programmer/analyst who creates, enhances, upgrades, tunes, tests, or corrects a computer-based application system is performing a highly technical task. The function being supported, the hardware on which the system runs, the algorithms used, and the flow of information are all complex. Anyone who thinks this task will melt away under the magical sunshine of user-friendly languages also believes that the procurement of Mickey Mouse telephones will solve telecommunications problems.

Unfortunately, having said this about the technical challenge of the programmer's task, we are forced to add that too many programmer/analysts approach their task in a Mickey Mouse fashion. Most programming shops are undercapitalized; most programmers are poorly trained, and know little of the literature or theory of computer science. Their methods are manual—paging through listings, scrolling through screens, hunting and pecking like barefoot scouts through the application forest. They are reminiscent of the ragtag militia, mustering in with hand-me-down hunting muskets, that came under the command of George Washington. Though valiant, the militia had to be hammered into an army, with standard equipment and drill, by Baron von Steuben.

The systems surveyed in this article—front-end programming environments—fall somewhere between equipment and drill. We defined these systems to the vendors as "a combination of hardware and software that supports the programmer and is connected to the mainframe." Using this definition we found six systems, all of which sell for approximately $10,000 to $15,000 per programmer workstation. They are identified in Fig. 1. In this figure, the systems are listed in alphabetical order, and all but one are identified by the vendor's name. The exception is Maestro, which is the marketing name for a system designed by Softlab GmbH in Munich, which was implemented on hardware from, and is marketed by, Four-Phase Systems, a subsidiary of Motorola Inc.

The purpose of a front-end programming environment is to offload some of the programmer's tasks from the mainframe and enable the programmer to perform them better, cheaper, or quicker. It is important, therefore, to know what a programmer's tasks are. As Harald Wieler, designer of Maestro, told us, "If an intelligent terminal is going to learn your job, you have to be able to teach your terminal what your job is."

Fig. 2 depicts the programming environment as two rows of tasks on



the right, and a column of technologies on the left.

The top row on the right illustrates the contents of an application system. SOURCE CODE represents texts in a variety of specialized languages—COBOL, JCL, ISPF, fourth generation languages—which express the functioning of the application system; these texts, taken together, define what the system does. They are translated into executable form by utility programs such as compilers, interpreters, linkers, and loaders. EXECUTION represents these translated texts in action. DATA represents the material on which the system acts—the input and output data recognized by the user, and the files and databases in the system's memory.

The second row on the right illustrates two areas of programming activity that are not explicitly visible in application system functioning, but support it. DESIGN DOCUMENTATION represents the backup material—manuals, specifications, indexes, etc.—that the programmer creates or consults in order to understand the implemented application system. PROJECT CONTROL represents the control required for a team to work together on a complex system, or for an individual to complete a linked sequence of tasks.

FIG. 1

FRONT-END PROGRAMMING ENVIRONMENTS

IDENTIFIER	VENDOR	SYSTEM
Canaan	Canaan Computer Corp. 39 Lindeman Drive Trumbull, CT 06611 (203) 372-8100	Canaan Departmental Mainframe Series 5000
Formation	Formation Inc. 823 East Gate Drive Mount Laurel, NJ 08054 (609) 234-5020	Formation 4000 Information System
Maestro	Motorola Four-Phase Systems 10700 North De Anza Blvd. Cupertino, CA 95014 (408) 255-0900	Maestro
Nastec	Nastec Corporation 24681 Northwestern Highway Southfield, MI 48075 (313) 353-3300	Nastec CASE 2000
SOLOsystems	SOLOsystems Inc. 3025 Orchard Parkway San Jose, CA 95134-2091 (408) 945-1700	1116 SOLOstation
Wang	Wang Laboratories Inc. One Industrial Ave. Lowell, MA 01851 (617) 459-5000	Wang VS Systems

PERCEIVE, MONITOR, CONTROL

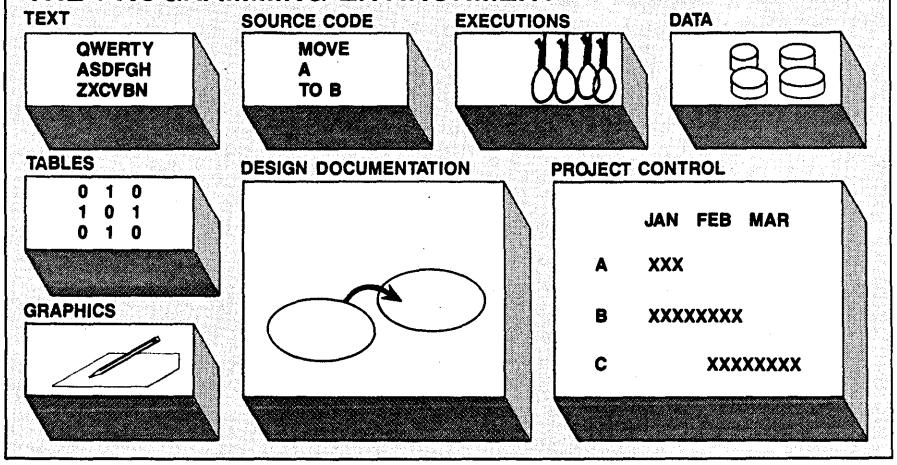
The activities in the two rows extend over space and across different hardware—from a mainframe in the machine room, for example, to a controller, to a cable, and into a terminal in the user's office; they respond in cycles ranging from instant response to end-of-year processing; and they extend in time over years as successive versions are created by incremental modification. The challenge of programming is to perceive, monitor, and control this extended system in a series of specialized symbolic views. Programming is a symbol processing task.

In the left column are the three symbol processing technologies commonly used by human beings—TEXT, TABLES, and GRAPHICS. In modern computing, text is supported by word processing and text formatting, and by newer editorial functions like spelling checking; tables are supported by report generators, screen painters, spreadsheets, and so on; and graphics are supported by icons, shape generators, mice, color overlays, etc. These facilities are the keyboard with which the programmer explores and manipulates the mechanism represented by an application system.

The structures and functions represented in Fig. 2 are logical, not physical. They are often implemented on a single machine so that all the outsider sees is a programmer connected to a mainframe (Fig. 3). This deceptively simple interface often baffles the novice, and sometimes leads the nontechnical onlooker to believe that the programmer is promoting an artificial complexity.

FIG. 2

THE PROGRAMMING ENVIRONMENT



The monolithic programming environment can be split between different machines—the mainframe as operational back end, and the programming environment as front end—if two conditions are met: first, a subset of structures and functions that are relatively independent of the rest can be found, and, second, this subgroup can be made to communicate with the rest when necessary. We shall see when we examine the systems currently available that various splits are feasible; but even when feasible, are they desirable?

The arguments for splitting off a front-end programming environment are

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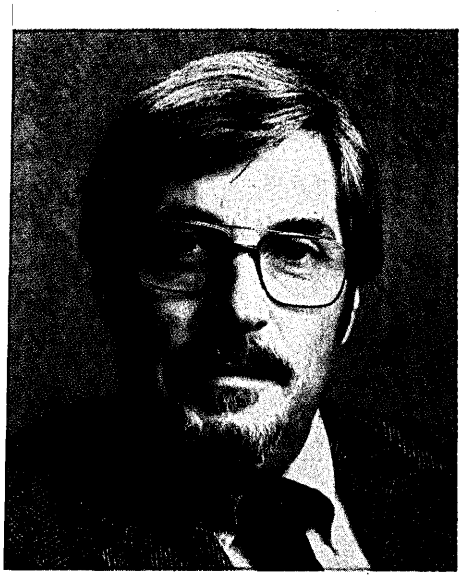

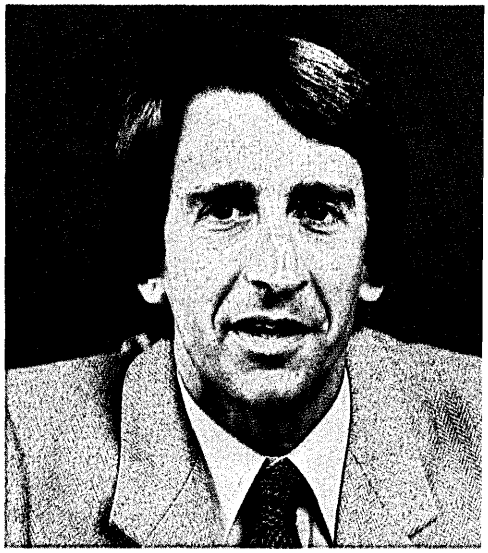

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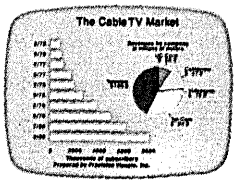
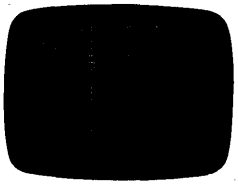
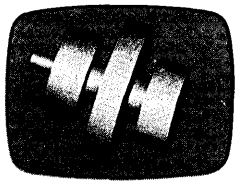


Enhanced Contouring

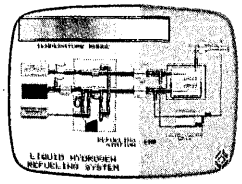
VLSI Design



Solids Modeling



Process Control



*UNIX is a trademark of BELL Laboratories, Inc.

threefold: efficiency, specialty of function, and occupational status.

The argument from the standpoint of efficiency is that in a monolithic shared system, different categories of uses inevitably interfere with one another, just as the gentleman of leisure ambling to the Off Track Betting windows in New York's Grand Central Terminal can be seriously impeded by streams of commuters attempting to access trains. Similarly, the random access between programmers and systems and among the programmers themselves can be delayed by the mainstream of user transactions in the host system. The front-end environment can streamline programmer interactions.

The argument from the specialty of function viewpoint is that front-end environments offer unique features, either of software or hardware, that are not available on the mainframe. Several of the systems surveyed offer, for instance, high-resolution graphics hardware and specialized use of those graphics for programmer-oriented design documentation.

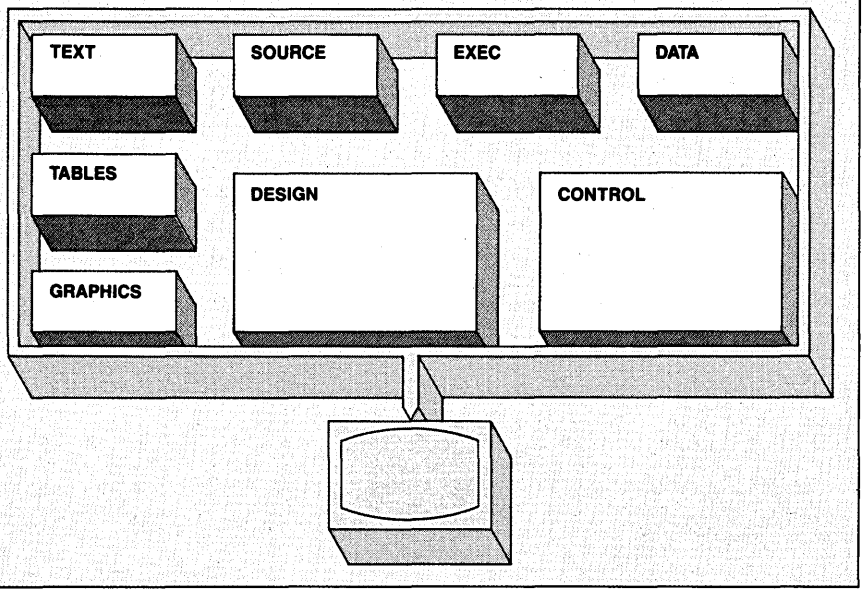
The argument from the occupational status standpoint is that a front-end programming environment can be used, like the standard drill and equipment that Baron von Steuben brought to the Continental Army, to boost morale and professionalism. The environment can be a means of introducing new techniques, or it can be conferred as a distinction that builds team spirit.

A DOORWAY THAT MAY CLOSE

Assuming that the front-end programming environment is feasible and desirable, could it be a trap? Might the purchaser invest in an environment that uses a doorway to the mainframe that the mainframe vendor subsequently closes? Or, since IBM is the mainframe vendor that stands to lose when work is offloaded, can rival vendors find a doorway that IBM cannot close? The answer to such problems lies in avoiding, as far as possible, novel protocols and interchange standards and sticking with older models of intercommunication. The older the model, the more devices there are attached and the less likely the protocol is to be changed. As the communications consultant of one vendor told us, "Our strategy is to make sure that IBM cannot shoot us without shooting itself in the foot." The trick is to make the mainframe think it is communicating, not with a sophisticated front-end computer, but with one of a small number of common dumb devices. The key question to ask is "What does the mainframe think the other system is?"

FIG. 3

THE PROGRAMMING ENVIRONMENT ON A SINGLE MACHINE



Linkage to an IBM mainframe can be accomplished in several ways. In approximate historical order, these are:

- The mainframe thinks the other system is a remote job entry (RJE) station—a card reader (80 character images incoming), a card punch (80 character images outgoing), or a line printer (132 character images outgoing). The other system need not be any of these devices; it is just a sender and receiver of unit records.
- The mainframe thinks the other system is a tape drive. In fact, it probably *is* a tape drive, with the tapes being hand carried to the other system.
- The mainframe thinks the other system is a single terminal, sending and receiving screen images.
- The mainframe thinks the other system is a terminal controller. The mainframe sends and receives screen images with added addresses that associate the images with one of several terminals.
- The mainframe thinks the other system is a direct access storage device—a disk drive.
- The mainframe thinks the other system is another computer.

Of these options, the last two are unfavorable. The disk drive interface gives IBM too much leeway for changes in coding, and, as for interfacing computers, it is not clear that even IBM knows how it intends to do that. The first four options, however, are stable and are used by the front-end environments. A common configuration is that the front-end environment is linked as both an RJE station and as a terminal controller. This gives the front-end programmers the capability to run their terminals directly on the mainframe system, to capture terminal images or to transmit stored images, and to use the RJE link to exchange files. The tape drive option is used by the Canaan and Formation products, which are source-code-compatible with the IBM mainframe.

The use of these traditional linkages limits the type of information the mainframe will exchange. Basically, the RJE and terminal controller interfaces will move only sequential text files or screen images. Referring back to Fig. 2, EXECUTION is performed by object modules and load modules, the output of IBM compilers. DATA usually takes the form of indexed or hierarchical files. To move either of these categories of information across an RJE or a terminal interface requires ingenuity and computer time at both ends of the link. Thus, however desirable it might be to offload the interactive execution and testing of programs, it is not feasible on most front-end programming environments.

With these definitions in place, it is easy to summarize the capabilities of the six products in Fig. 1.

Canaan and Formation are SCMs—software-compatible mainframes. They are not PCMs—plug-compatible mainframes—since no part of them (cpu, memory, disk drives, tape drives) can be replaced with the corresponding part of an IBM mainframe, but the whole system executes the same source code, including memory, disk, and tape accesses, as an IBM system with the corresponding peripherals. The actual limits of this compatibility vary between the two systems. Canaan is delivered with a proprietary OSKER operating system that is said to provide "the same CMS application program interface as the CMS portion of IBM's CM/370 operating system." Formation is said to run any of the IBM public domain operating systems and some versions of its licensed operating systems. In

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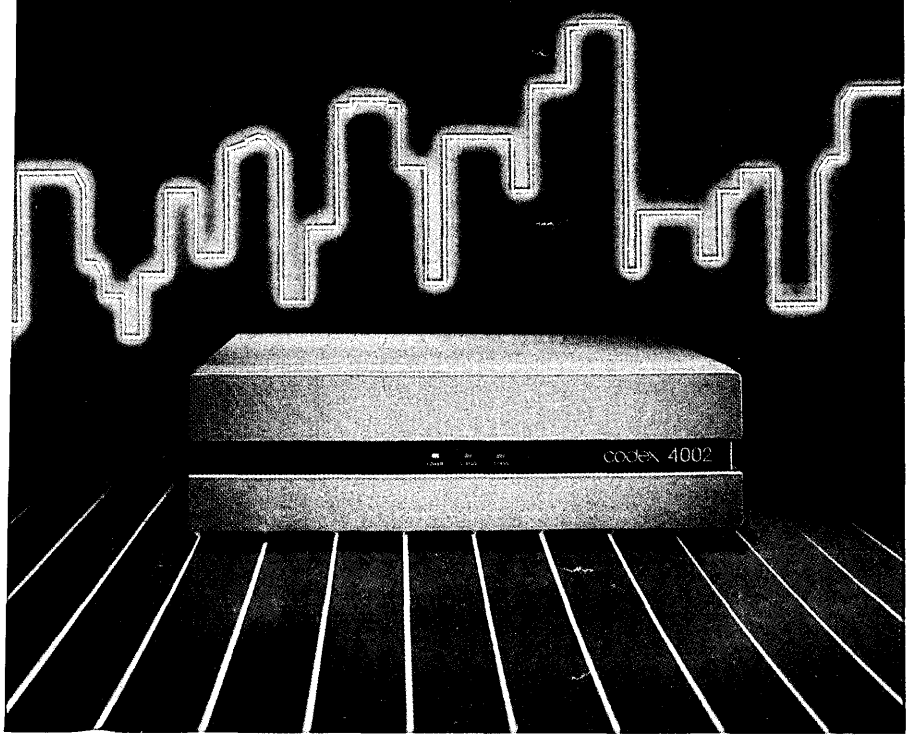

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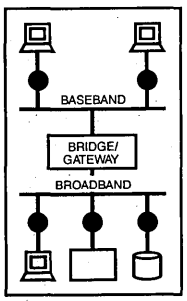

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As for interfacing computers, it is not clear that even IBM knows how it intends to do that.

any case, both systems run a wide range of IBM source languages, compilers, and object modules without change.

MOST VERSATILE IN THEORY

Thus, both systems are candidates for offloading the entire programming environment of Fig. 2, including the execution and testing of complex programs and files. Both systems support tape drives; the mainframe can dump operating systems, programs, and data to tape and the front-end system can load them, and vice versa. The two systems also support the RJE and the terminal controller interfaces. In principle, they are the most versatile systems in the group; in practice, however, the tape linkage is unsuited to interactive use. These systems have therefore been used up to now as offline development environments rather than front ends.

The histories of both companies are interesting. Bob Bernard, cofounder of Canaan, was also a founder of National CSS (now D&B Computing Services), which pioneered commercial timesharing on IBM mainframes; Canaan answers the question "What does a timesharing pioneer do in the era of distributed computing?" Formation was founded by engineers from the now defunct RCA computer line; they first made RCA replacement parts, then other custom computer components, and finally the Formation 4000. Formation answers the question "What does a custom hardware house make when it becomes its own customer?"

Neither Canaan nor Formation are big sellers yet—they report installed bases of 15 and 60, respectively. They even have a defunct competitor—Spartacus Computers Inc.'s K102 software-compatible machine—which was dropped in May 1984, along with the company's founder, George C. McQuilken, in a dispute with the company's venture financiers. They also have a chilling, though mostly intangible, competitor in IBM's PC XT/370, announced in October 1983, for shipping in the second quarter of 1984, with reported capabilities comparable to Canaan's.

This article was written in the last week of June 1984, at which time IBM had released only minimal information. Customers favored with previews have reported impressive capabilities for this desktop mainframe, but no straightforward solution for downloading. There are obvious motives for IBM to hold back on the downloading. They would like to make a competitive end run around desktop mainframes that might come from Canaan or Formation or similar companies; if they make the downloading between giant and tiny mainframes too easy and too ubiquitous, however, they throw open the doors to such competition.

FIG. 4

THE MAESTRO ENVIRONMENT

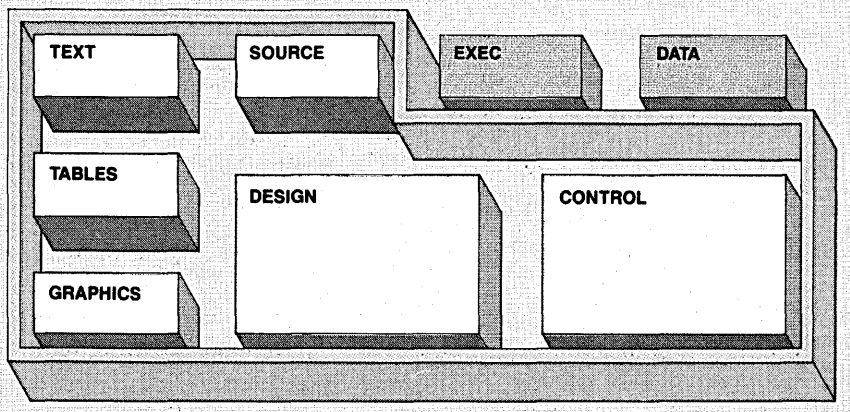
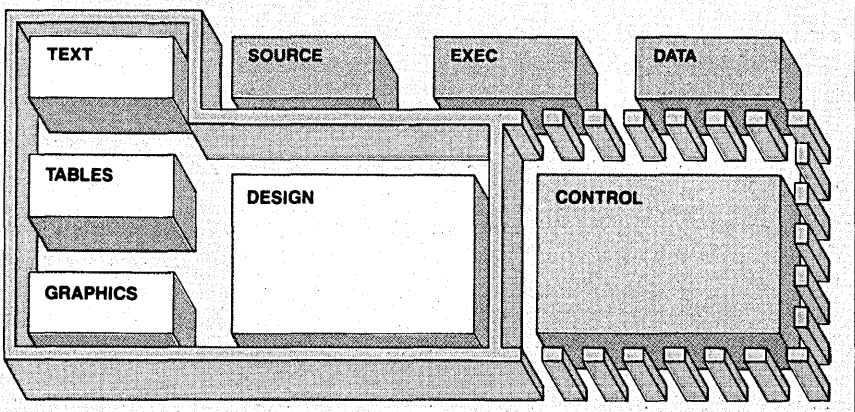


FIG. 5

THE NASTEC ENVIRONMENT



The other four environments are not software-compatible with the IBM mainframe; their strength, therefore, lies not in preempting mainframe functions, but in complementing them.

Maestro is the godfather of all the front-end programming environments and is based on a deliberate inquiry into the needs of programmers. In 1974 the West German Ministry of Research and Development made a small grant to a struggling Munich software and consulting firm, Softlab GmbH, for a feasibility study and market research report on the concept of a front-end software development environment. The report came to three important conclusions that influenced the design of Maestro: the target clients already have large development mainframes, they already have large application systems, and, in the words of Softlab general manager Klaus Neugebauer, "The key to automating software production lies in recognizing that what a software developer does, hour after hour, is mostly read, write, and modify bits of text."

MAESTRO WAS THE RESULT

The resulting system, Maestro, was designed by Harald Wieler, born in Peekskill, N.Y., of German immigrant parents. He got into computing "by devious paths" after a pilgrimage to Munich to study electronic music; the devious paths led him to spend 10 years as a systems programmer at Siemens, and then to become chief consultant at Softlab. Maestro is a multiple-user envi-

FIG. 6

THE SOLOSYSTEMS ENVIRONMENT

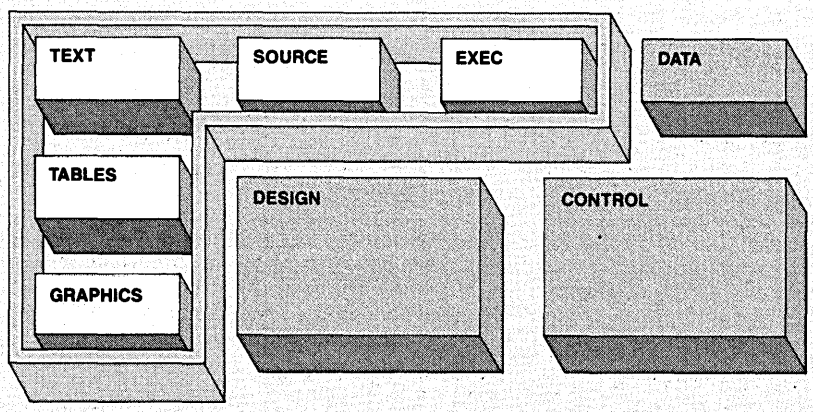
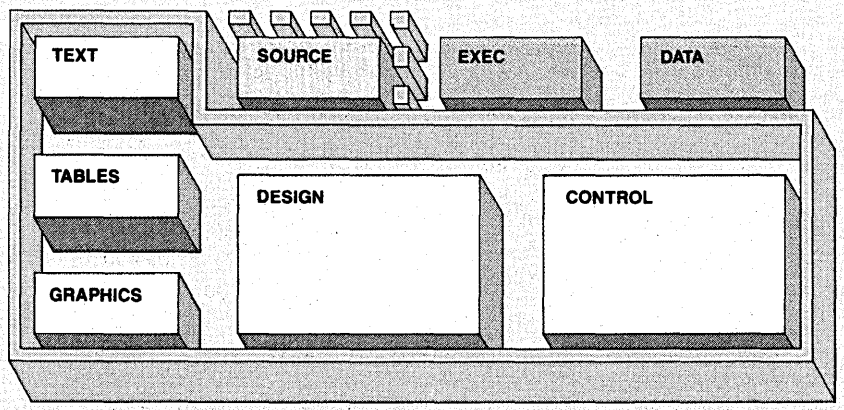


FIG. 7

THE WANG ENVIRONMENT



ronment programmed on Four-Phase equipment (now Motorola Four-Phase) to take advantage of its high-speed, high-resolution graphics.

Maestro is strong in the DESIGN DOCUMENTATION and PROJECT CONTROL areas. The programmer can create designs in a structured design language, and can then either visualize them with such tools as Chapin charts or structured diagrams, or can use them to generate syntactically correct source code in COBOL, FORTRAN, or other languages. Maestro thus carves out the territory pictured in Fig. 4.

Maestro is not a system for the slouch. It appeals to the von Steuben ideal of discipline and professionalism, and it responds to the programmer's ideal that the system be superior to the implementation. When asked what languages Maestro supports, Wieler challengingly replied, "What languages does your telephone support?" It can be tailored to support many computer languages (COBOL, FORTRAN, PL/1, etc.) and to serve mainframes of many brands and nationalities ("IBM, ICL, Honeywell Bull. . ." in the brochure's tactful list). It is marketed in the U.S. by Motorola Four-Phase and supported technically by Softlab Systems Inc., Softlab's subsidiary in San Francisco. It has a strong user community, particularly in the West, including Boeing Computer Services, Bank of America, and the Air Force Accounting and Finance Center in Denver. The West German government, pleased by the outcome of its initial grant, has funded Softlab for an in-depth study of programmer needs for the 1980s and beyond. The next system, the Nastec CASE 2000, is the product of a venture capital startup in Southfield, Mich. It is a single-programmer environment implemented on top of the Convergent Technologies workstation. CASE is an acronym for Computer Aided Software Engineering, and the main thrust of Nastec is to support the DESIGN activity (see Fig. 5). Nastec's argument is that the various life-cycle support systems (such as those marketed by Yourdon Inc. or Ken Orr & Associates Inc.) have not lived up to their promise because they were cumbersome paperwork processes, lacked an automated delivery system, and were seen by analysts and programmers as burdens rather than resources.

The Nastec strategy is to offer software tools that take the burden off of drawing, modifying, verifying, and displaying the types of structure charts prescribed by these methodologies. Nastec spokespeople are just as tactful about rival methodologies as Maestro's are about rival languages and nationalities. We were told that "Nastec is not tied to any one methodology." Nevertheless, each methodology has its specific formats, and the formats that we were shown were data-flow diagrams and structure diagrams from the Yourdon methodology, and Warnier-Orr diagrams from the Orr methodology.

The 1116 SOLOstation, the product of startup SOLOsystems Inc., is, as its name implies, a single-user, self-contained workstation. The SOLOstation is not a copycat of any other front-end programming environment; it carves out an entirely different subset of functions—the EXECUTION area (see Fig. 6).

SLANTED TOWARD COBOL

Though not compatible in its machine language or its operating system with the mainframe, it is specialized toward the analysis and interactive execution of IBM OS/VS COBOL. It provides an editor specialized toward COBOL; static analysis tools such as a cross-referencer, a diagrammer, and a source code comparator; and dynamic analysis tools, such as an interactive executor and a profiler or path coverage analyzer. At present the SOLOstation handles only separately compilable modules, rather than modules linked with multiple CALL statements. It also does not simulate mainframe data structures. Thus, it is the programmer's responsibility to supplement CALLs or I/O statements with stubs.

The final vendor, Wang Laboratories Inc., is by far the largest and best established on our list. Number eight in dp revenue and number two in office systems revenue in the 1984 DATAMATION 100 sur-

Maestro responds to the programmer's ideal that the system be superior to the implementation.

vey, with a wide range of compatible systems in the VS product line and more than 10,000 units shipped, Wang is a major presence in all branches of dp. It entered front-end programming environments more by a circumstantial association of strengths than by deliberate policy.

The Wang VS systems are pervasive as word processing clusters. The same systems will also run dp, complete with SOURCE, EXECUTION, and DATA. Wang also pioneered the mainframe linkages discussed earlier. In certain shops, the programmers were connected to the mainframe on their own network of terminals, while their clerical support groups were connected to Wangs. Mainframe programming groups were attracted to the Wangs because of quick response and low load, and perhaps because the DOCUMENTATION and CONTROL materials were already being entered through the Wangs. They used the mainframe linkage to bring mainframe source code back to the Wang, and then found the Wang library control utilities a convenient storage medium. Thus, though the Wang operating systems, data structures, and languages were not particularly compatible with IBM's, the Wang system became a convenient home base for the IBM programmers, and therefore became by default a front-end programming workstation (see Fig. 7). In acknowledging the power of this process, and echoing the Maestro designers' concept that programming is largely the mastery of texts, Aaron Zornes, product marketing manager for Wang VS systems software, remarked, "As we often say at Wang, data processing is a subset of office automation."

Front-end programming environments are a lively and heterogeneous group, arbitrarily defined here as existing between programming environments that have no linkage to the mainframe (such as the recently announced Excelerator design station marketed by Index Technology Corp., Cambridge, Mass.) and environments that run wholly on the mainframe (such as the forthcoming software support environment from startup Software Renovation Technology, Sunnyvale, Calif.). The locus of technology may shift back and forth between mainframe and desktop workstation, but the important concept for the programmer and the programmer's manager is the process, and the idea behind the process.

Programming environments are an area of rising competition. They are not so gaudily marketed as nonprogrammer environments (i.e., spreadsheets on personal computers) but, if we are right about the underlying technical nature of the dp task, they should have more staying power. Nastec's and SOLOsystems' differing ideas about where to mechanize the program life cycle, and Maestro's and Wang's about where to mechanize the programmer's own symbol processing capabilities, are signposts for transforming programmers from a weekend militia into a workday army. ◉

In writing this piece, Nicholas Zvegintzov, a New York City-based consultant and the editor of *Software Maintenance News*, attempted to interpose his brain as a front end between the vendors and the reader.

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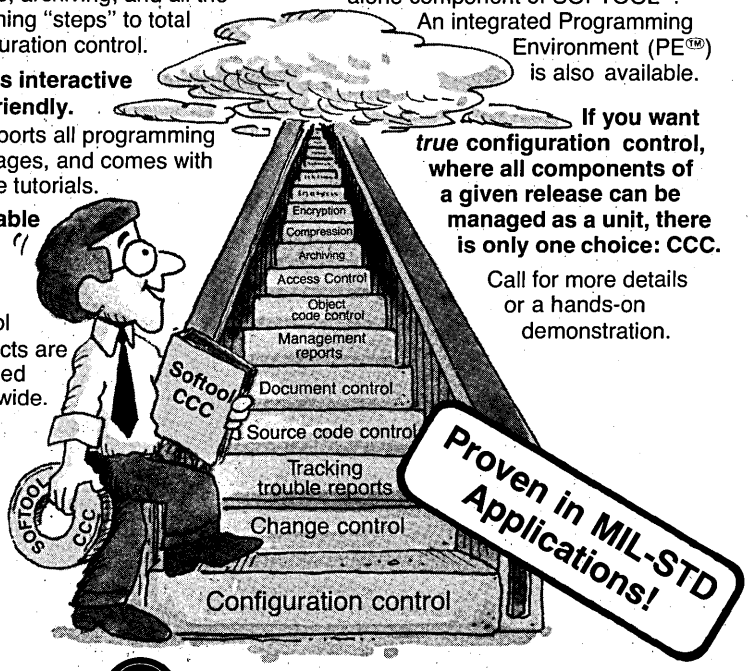

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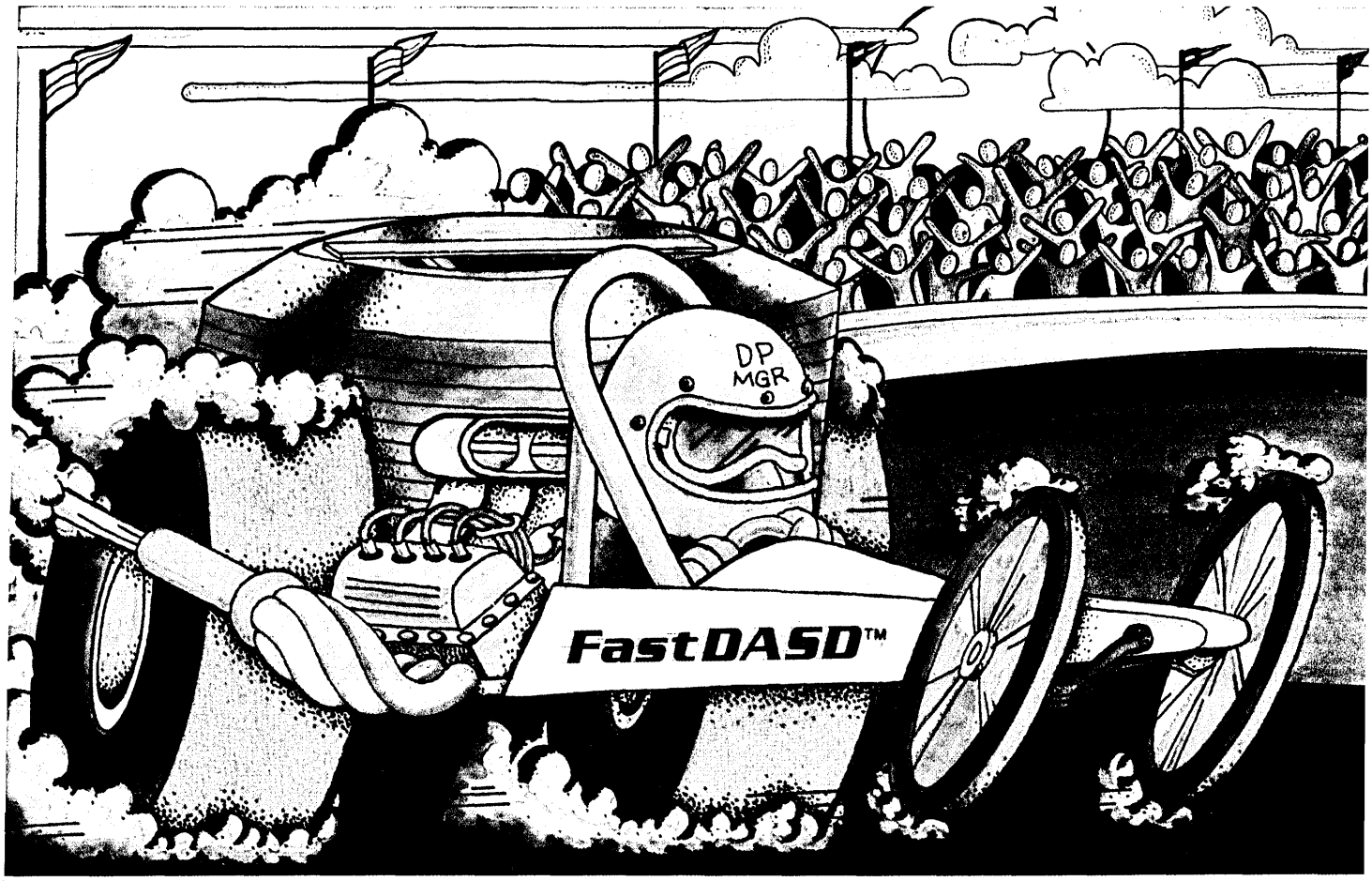

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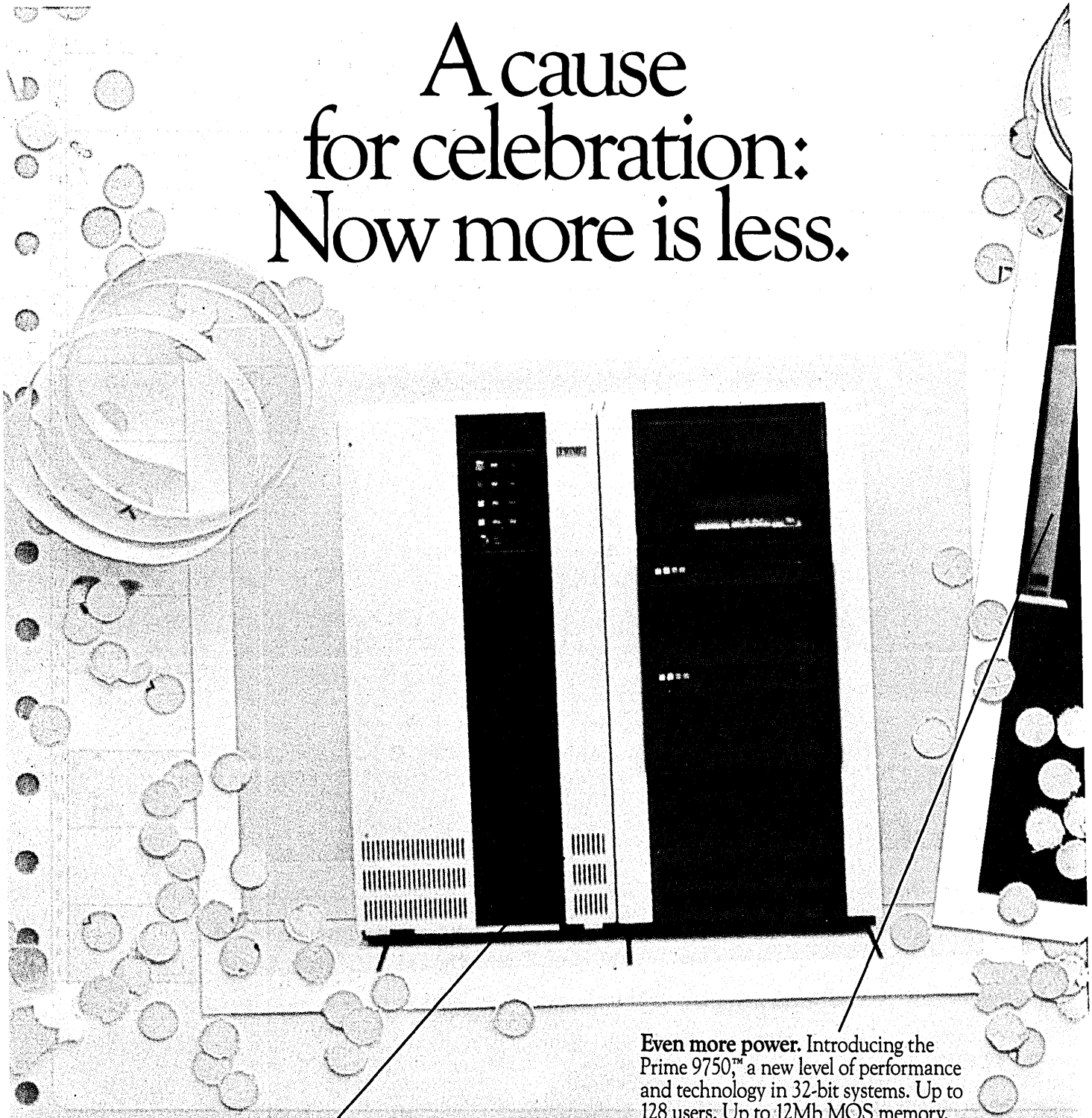

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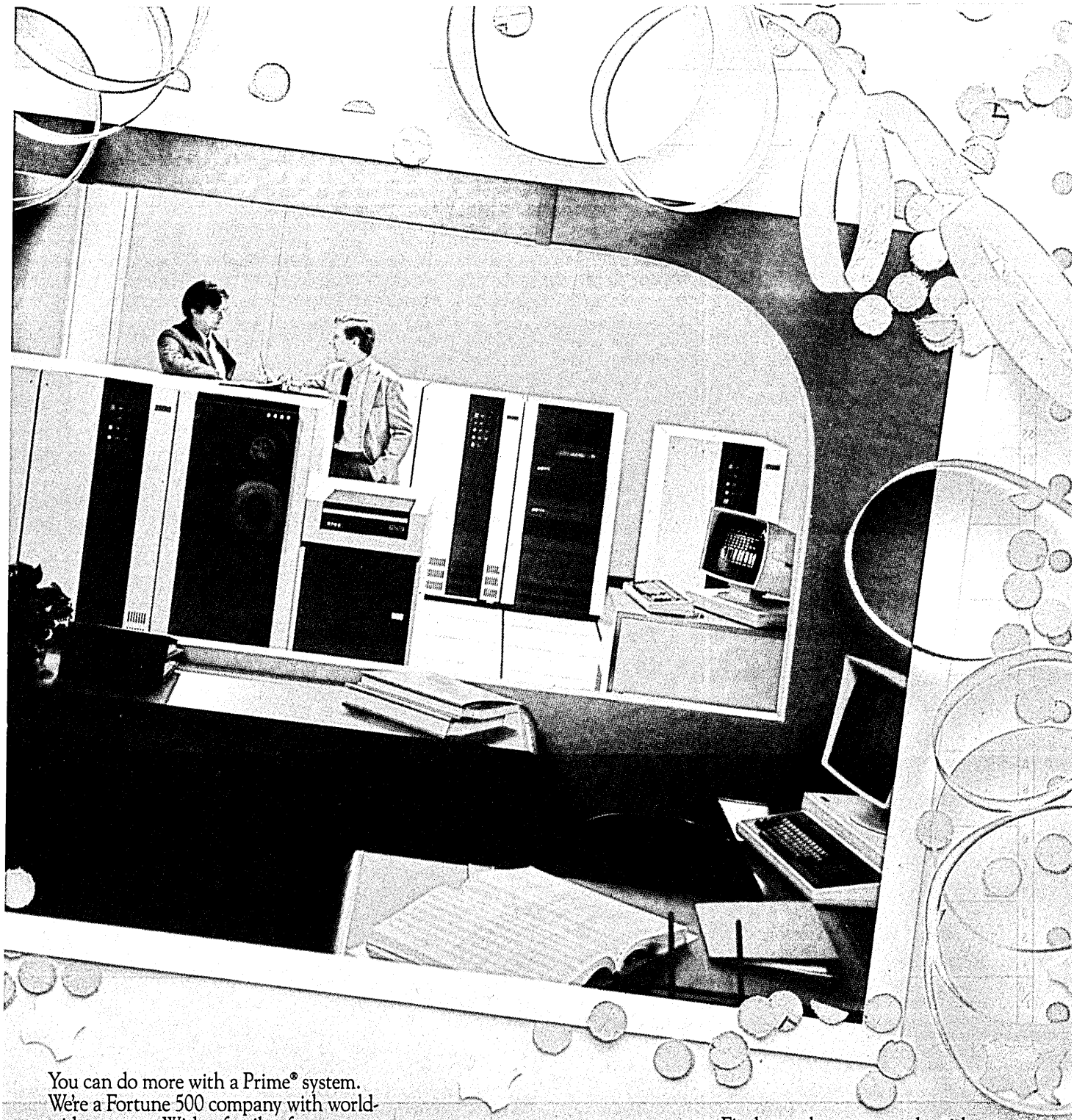

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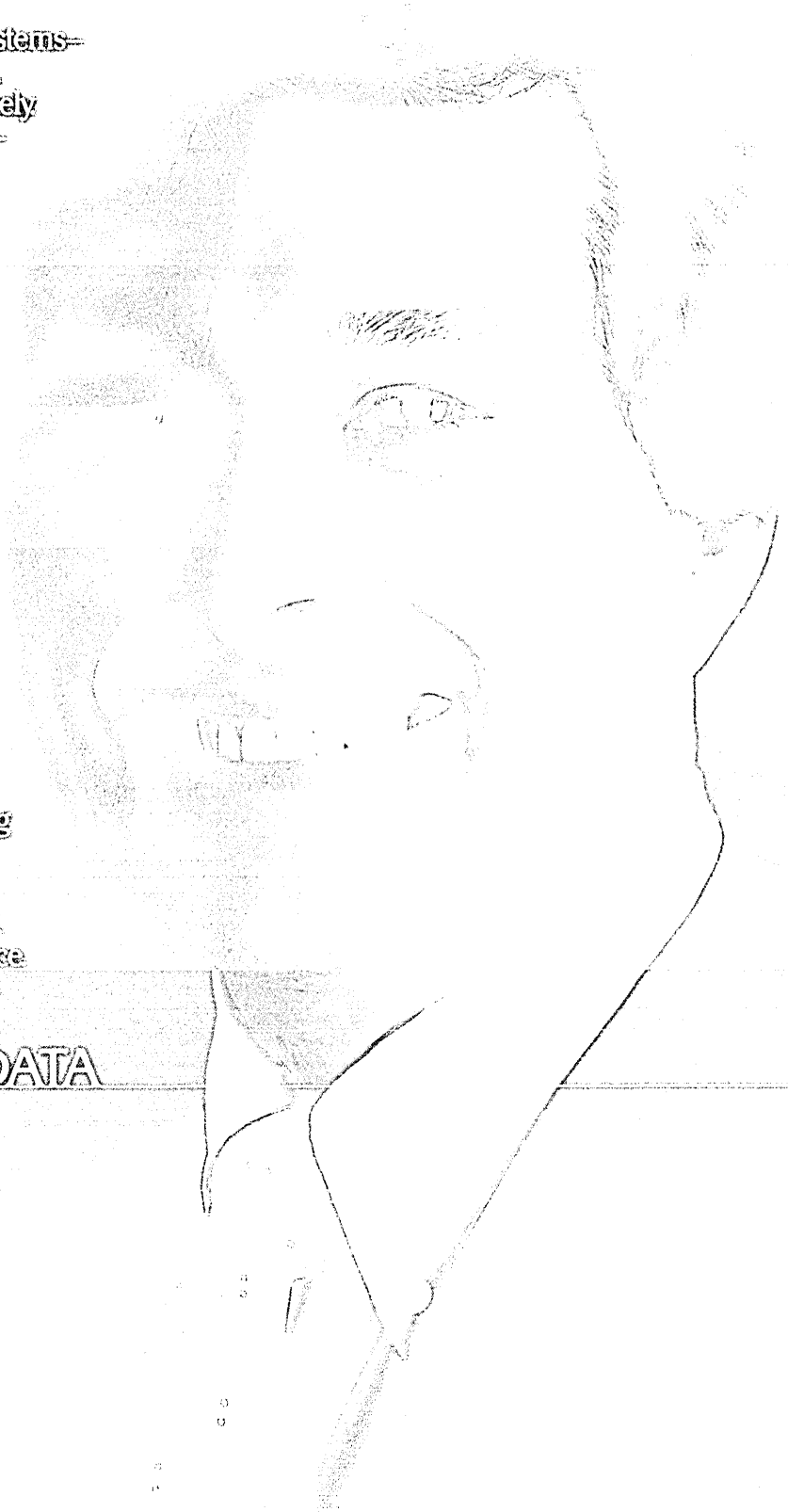

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This technique, coupled with relational database management systems, will play a major role in future applications development.

RAPID PROTOTYPING

by John Connell and Linda Brice

By the late 1980s, rapid prototyping of computer applications may become the most popular system development technique. The formal method of building software systems using structured analysis and design tools such as lengthy system analysis documents, structure charts, and pseudocode is under attack by users who deplore the thought of having their task join the dp department's backlog.

Those same users have knowledge of system development without system planning from experience on their own micros. New rapid prototyping techniques do not require as much programming expertise as traditional methods, enabling even frustrated users to develop applications themselves. The recent wave of distributed processing may be followed by a new wave of distributed development.

In the late '70s and early '80s, prototyping experiments included the introduction of a prototype at the end of the design phase, which was constructed to validate the systems' specifications. Another approach was the development of specialized prototyping languages used to create pilot systems for testing the feasibility of a new proposal. Most of these approaches represented additional steps in the development process and, typically, a 10% add-on to total development time. Some produced software that was intended to be thrown away when the production version was implemented.

A new approach to rapid prototyping is evolving that does not require add-on development time or throw-away software. Using this approach, prototyping is the first activity that occurs in a development project. It continues through all phases of the system life cycle, even after a refined version of the prototype software has been implemented. Production prototyping has been made possible by the recent development of new tools. Future natural languages, expert systems, and knowledge-based systems will provide users with miraculous development powers through verbal conversations with computers and other exciting techniques. Today's state-of-the-art tools use relational database management techniques for implementing rapid prototyping.

Relational database management systems (RDMS) provide tools that allow prototypes to be expanded into production systems. Key features of such tools are the ability to rapidly modify data storage structures on-line, the ability to create and run the prototype using menus and screen forms that minimize programming effort, and a resulting prototype that is efficient enough to be used as a first phase production system.

A true relational database management system allows storage structures to be modified quickly without regard to record management (chains, pointers, keys, and indexes) or database structure (repeating groups and parent-child relationships); there is no danger of losing stored data. Recent developments in RDMS have provided commercially available packages that offer the necessary flexibility and efficiency to run production systems. In addition, some of these products have a forms interface that allows the applications to be developed using screens and menus rather than written procedures. Use of these tools allows the developer to present forms to the user for critique. The same or similar screens and menus can become the production system without development of job control language.

The control flow graph for a typical application developed in this way is shown in Fig. 1. The application illustrated here represents a resource control system (RCS) that involves programmer hours reported against projects in progress in a dp shop.

PURPOSES OF THE SYSTEM

The purposes of the system are to provide project control and communications to customers and management. The users of the system include management, programmer/analyst staff, and dp shop customers. Menu selection begins with the obvious choices of data input and reporting. Each level of the menu hierarchy includes an on-line help facility and a return to the next highest level.

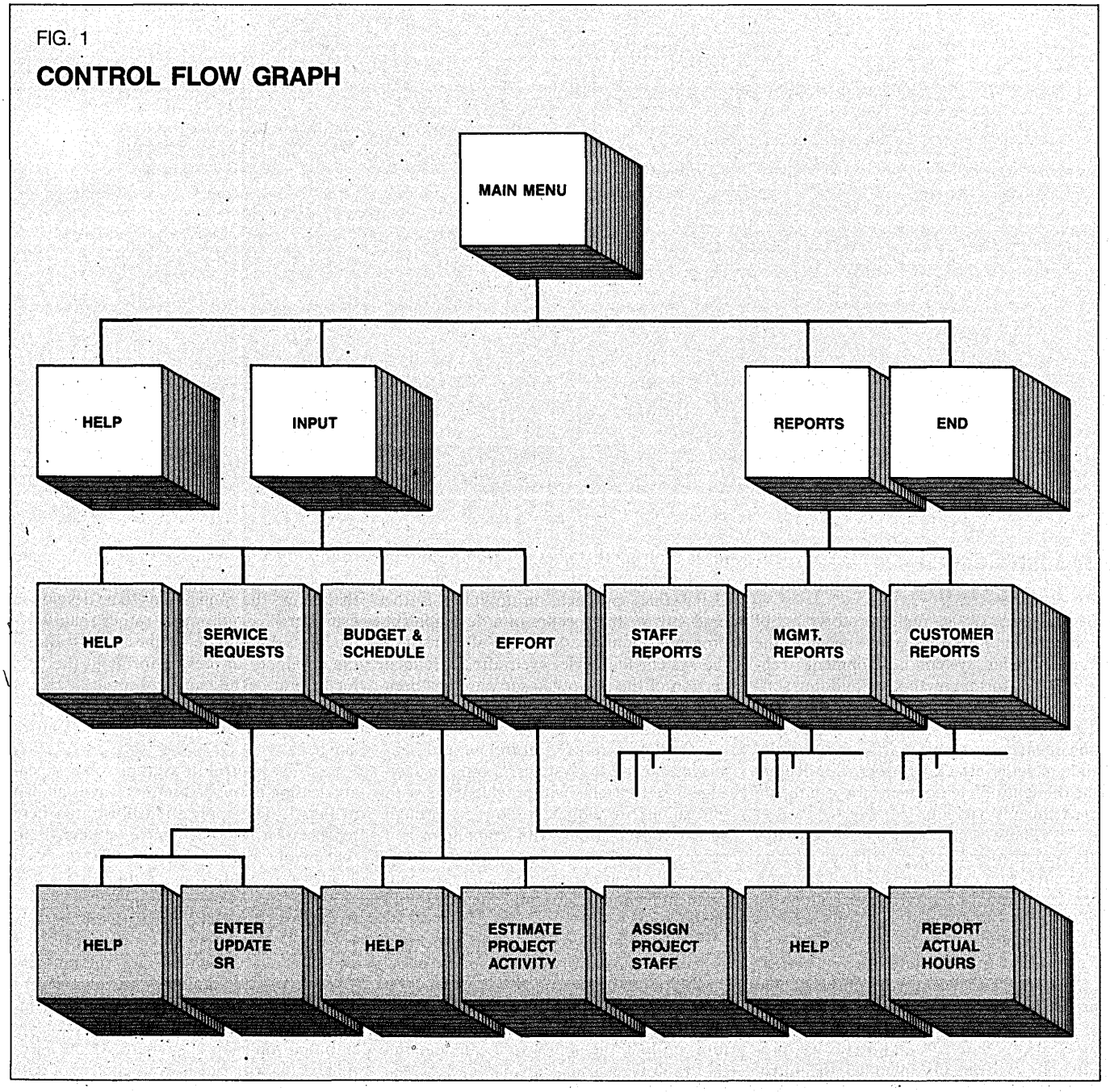
Data entry processes include a screen for customers to enter a request for service (SR), another for management to enter budget and schedule for the service request, and a third for project personnel to report actual effort expended on a project. The information gathered through data entry is then reported down the reports branch of the menu.

As with all levels of the hierarchy, report selections will grow as system users

To be effective, rapid prototyping begins in the analysis phase of a development project.

FIG. 1

CONTROL FLOW GRAPH



refine their requirements. Some desirable reports include one listing time expended on project activities by staff members, a second listing status of service requests by customer, and a management report on scheduled project activities. Because screen-oriented editors are easy to use, developers are more likely to accommodate user requests for specification changes at any point in the development process. In a rapid prototyping environment, specifications are not frozen toward the end of a development project in order to meet a politically desirable deadline. In terms of continual change and refinement, prototyping never really stops.

System developers are motivated to satisfy user requirements, but traditional development methods are often at odds with this desire. The techniques of rapid prototyping are based on the fact that the complete set of essential system requirements will not be discovered until the user has a chance to experiment with a working model of the system. The rapid prototype will accommodate new requirements easily, regardless of when they are discovered.

To be really effective, rapid prototyping begins in the analysis phase of a development project, beginning with a first draft prototype based on preliminary user interviews and very brief, high-level functional analysis. Detailed processing specifications are intentionally left incomplete until the user has had several chances to view the working prototype and request changes. A rapid prototype is iterated and ultimately used to derive a detailed design—the reverse of the traditional devel-

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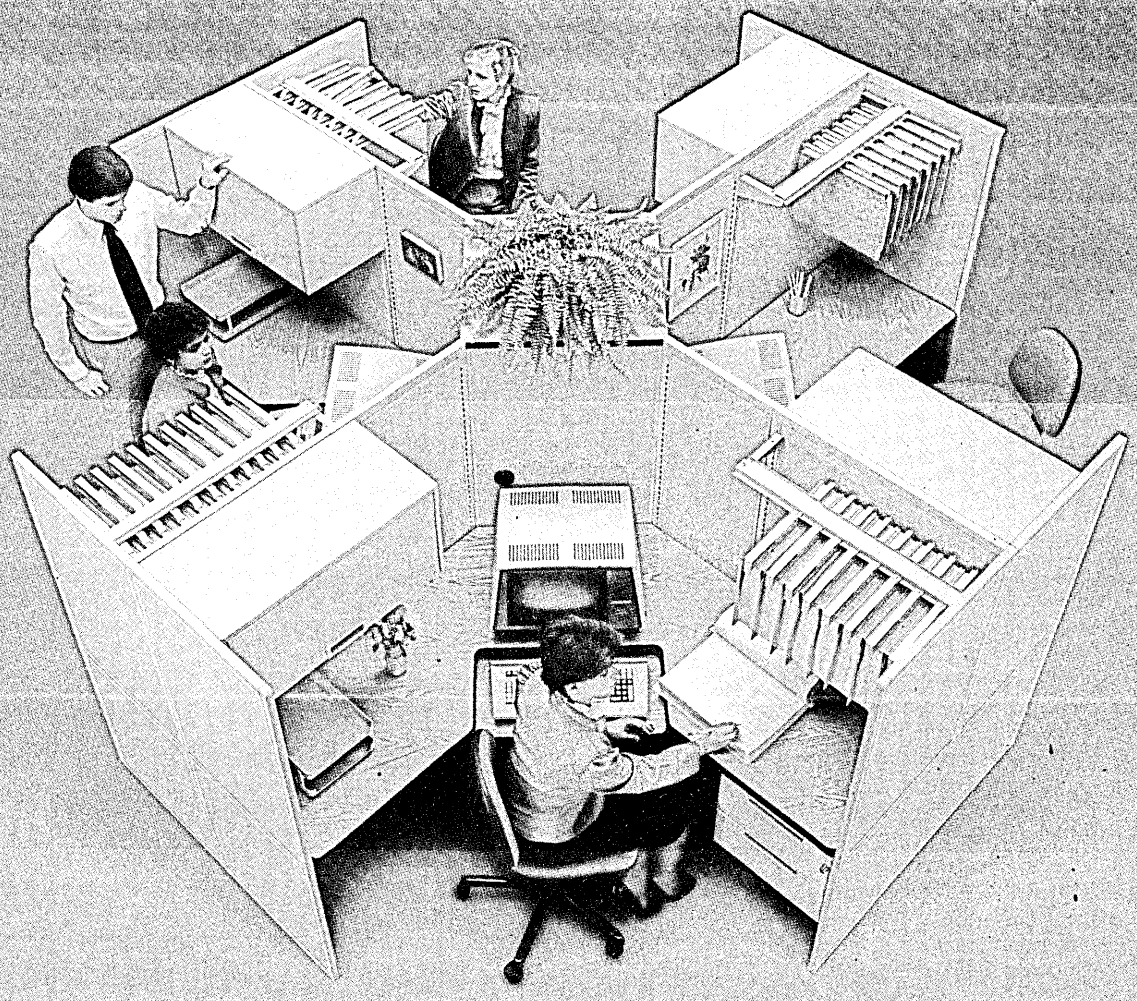

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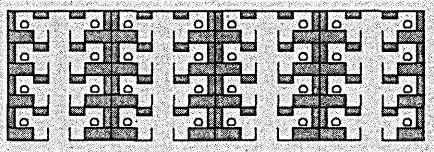

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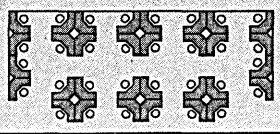

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opment process. Because the user is exposed to a functioning system early in the development process, changes in requirements are quickly identified. Early changes mean modification to high-level design instead of to detailed specifications, and therefore represent potential savings in development labor.

Can the new techniques of rapid prototyping be used within the traditional life-cycle approach, development methodologies? Certainly, with some appropriate modifications to traditional methods. First, forget about hardcopy screen and report formats in the early phases. These are good for final documentation and user guides, but a working prototype is more useful during analysis and design. Next, forget about the requirement to have design specifications complete, approved, and frozen before development begins. Final specifications can be derived from a user-approved prototype. Suggested in place of the traditional life-cycle methodology is the rapid prototyping process (see Fig. 2), described below.

Rapid analysis. Based on preliminary user interviews, an intentionally incomplete paper model should be drawn up to aid the developer in determining database design and functional modules for the prototype. The important elements of such a model are:

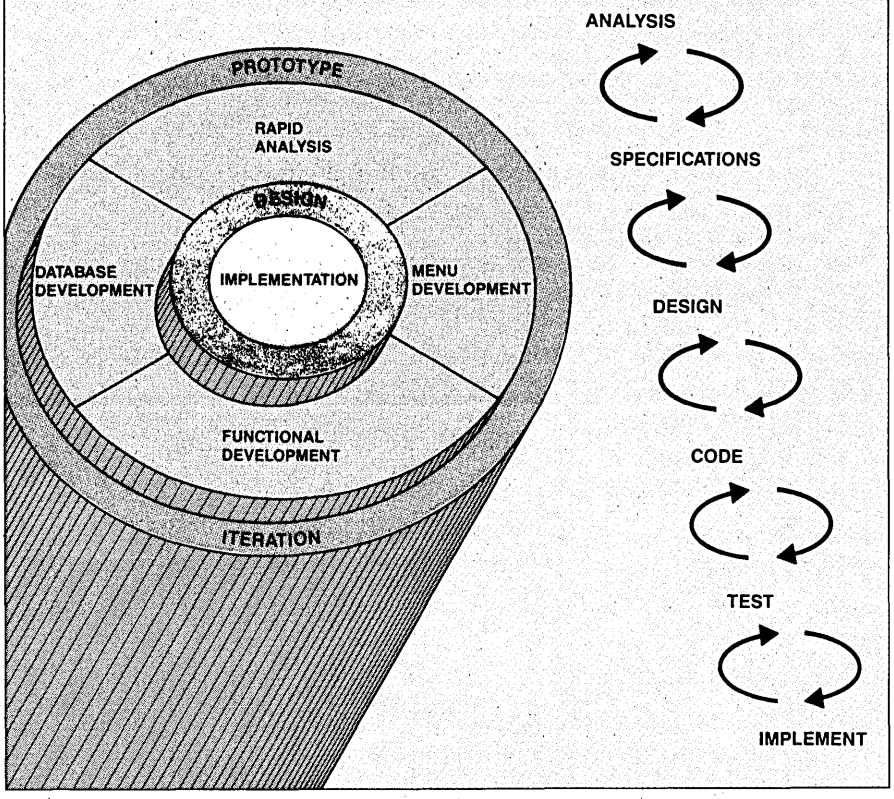
- The system context, showing where the system will obtain data and deliver information. Fig. 3A illustrates a context diagram for a typical paper model.
- The essential functions the system must perform to deliver required information using data provided in the system context. Such functions typically include capturing incoming data, storing some of it in the database while passing the rest directly to other functions, performing data transformations, and reporting requested information in a user-acceptable format. Fig. 3B shows an essential functions diagram.
- The database design derived from the essential function diagram. Fig. 3C illustrates an entity relationship diagram that aids database design.

MODELS HELP DEVELOPER

The models in Fig. 3 are intentionally left incomplete for a rapid prototype. The purpose of such a paper model is to help the developer conceptualize elements like tables, attributes, screens, and menus that need to be included in the prototype, not to specify in detail how each of those elements will function. Normally, the control flow graph shown in Fig. 1 would be developed here as an extension of the paper model.

FIG. 2

THE RAPID PROTOTYPING PROCESS MODEL VS. THE TRADITIONAL WATERFALL MODEL



Database development. Next, the paper representation of the database can be used to create a database structure on-line. Using a relational database management system, the developer need not be concerned with the possibility of the schema requiring changes as new requirements are discovered during prototyping. Data elements and data tables can be added or deleted on the fly with little effort and no loss of stored data. The developer can fearlessly develop a best-guess database and load live data into it from automated files for use in prototyping.

Menu development. This step involves developing a set of menus that invoke the various functions shown on the paper model. There will always be a main menu allowing users to branch to other menus such as data entry, analysis, reports, and graphs. The submenu, reports, will then list a choice of reports the user can produce. The calling sequence of these menu screens will be hierarchical with control always returning to the previously called menu (see Fig. 1).

The appropriate level of menu nesting depends on the size and complexity of the application. There are, of course, practical limits to nesting. These limits will be discovered during rapid prototyping when the user becomes impatient with having to step through too many menus. When this happens, the application can be split into two or more applications, instead of attempting to make one application be an "anything box."

Function development. Again, the paper model can be reviewed to determine what functional modules must be developed. In the early stages, there is usually a one-for-one relationship between each essential function and a module in the prototype. These modules will be invoked at run time from the appropriate menu and should be aggregated by type of function, such as data entry, reports, and so forth. As mentioned above, some new relational database management systems have screen-oriented development tools so these functions can be developed using screen editing techniques rather than by writing pro-

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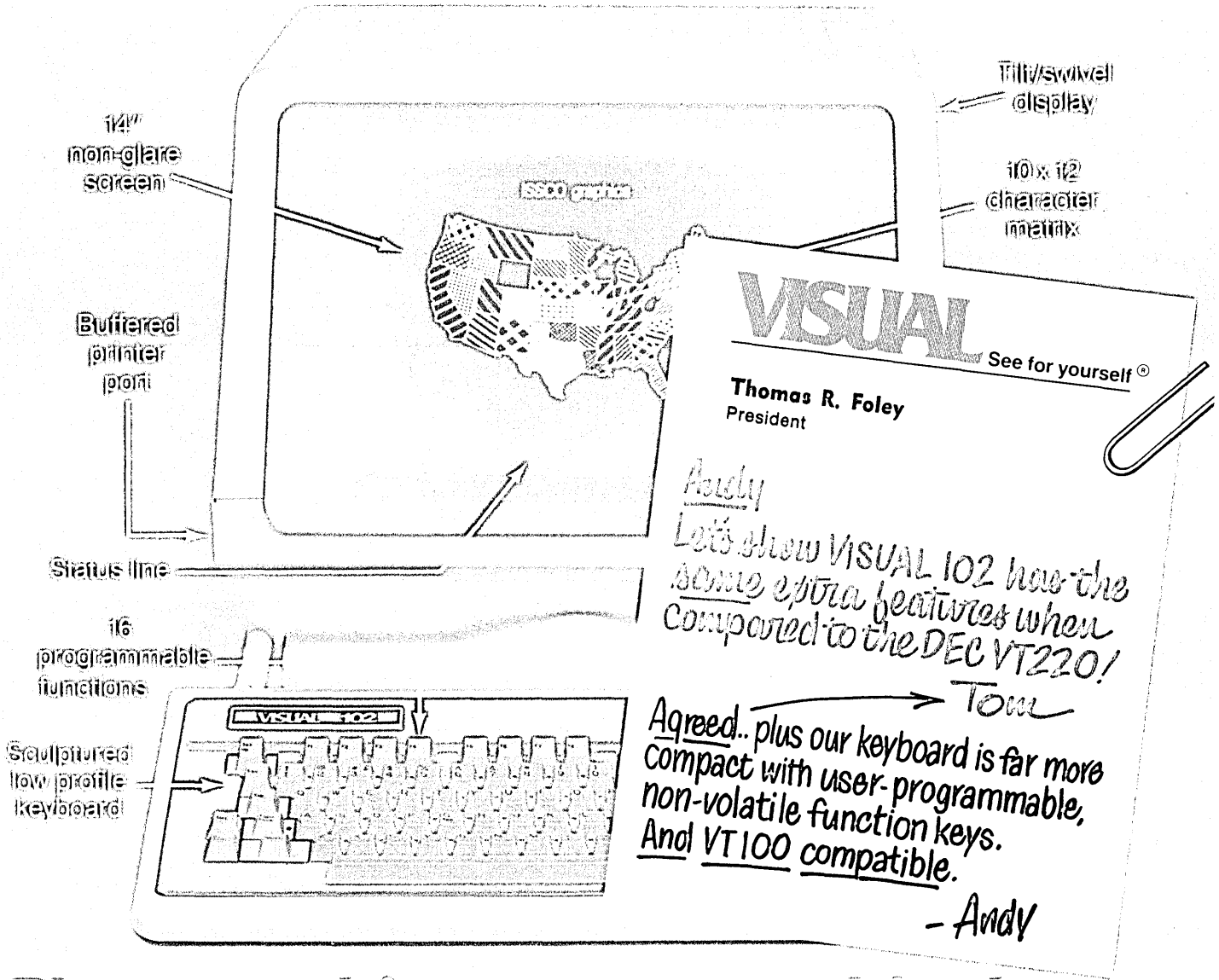

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grams. When these tools are used, development proceeds rapidly and the prototype presented to the user will perform with familiar data, thus helping to define requirements.

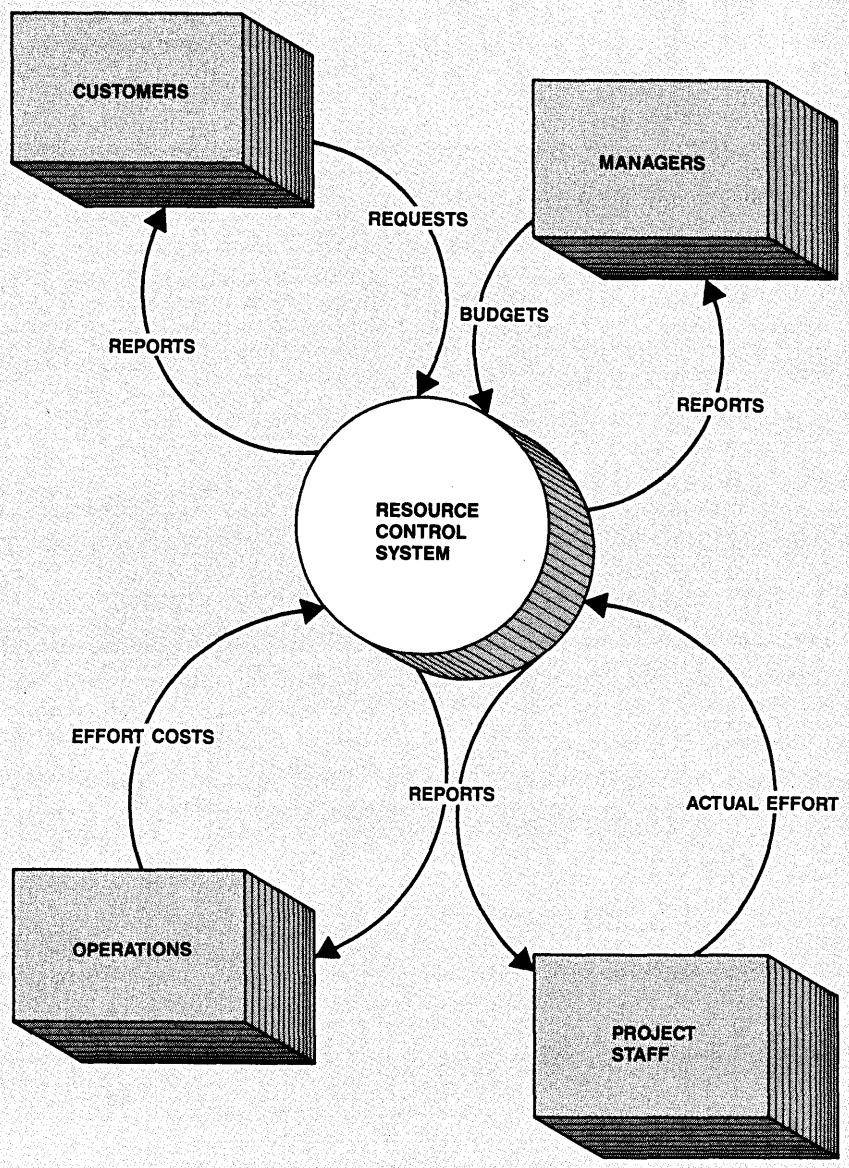
Prototype iteration. When a partially specified working model (the rapid prototype) is functioning satisfactorily, it is time to demonstrate the system to the user. It will not necessarily function as the user had hoped or anticipated. Experience has shown this to be true with both rapid prototypes and traditionally developed production systems. The difference is that little effort was invested in the rapid prototype, and it can be easily modified to adjust to new requirements discovered during this early stage.

As a word of caution, some education and guidance may be required when dealing with users who are not familiar with rapid prototyping. A project plan defining rapid prototyping and detailing production system implementation is a good communication tool. During early prototype demonstrations it is important to emphasize that the user is not viewing a production system, but only a preliminary suggestion of how that system might look. It is a good idea to agree on a review and approval schedule with the user from the beginning of the project.

Design, coding, and testing. Development has proceeded at a brisk pace through all the aforementioned steps. The prototype has been expanded and modified to accommodate newly discovered requirements. The user has approved the current version. No detailed design was prepared before this development. It is now time to complete the detailed specifications, which will be useful to those in charge of maintaining the production system. If done carefully, the final specifications will be correct because they'll be derived from the functioning, user-approved prototype. Elaborate testing is unnecessary at this point because the user has been experimenting with the prototype, using real data, from the beginning of the project.

FIG. 3A

THE CONTEXT DIAGRAM



This represents the first step of the high-level functional analysis used to create a paper system. One process (the circle) represents the whole system. The terminators (boxes) represent data sources outside the system. Although this functional analysis is presented here following the Control Flow Graph of Fig. 1, it is actually performed first, lending knowledge of how the menu hierarchy should be developed. The context diagram is based on needs specified by the user during preliminary interviews.

USES FOR THE CHECKLIST

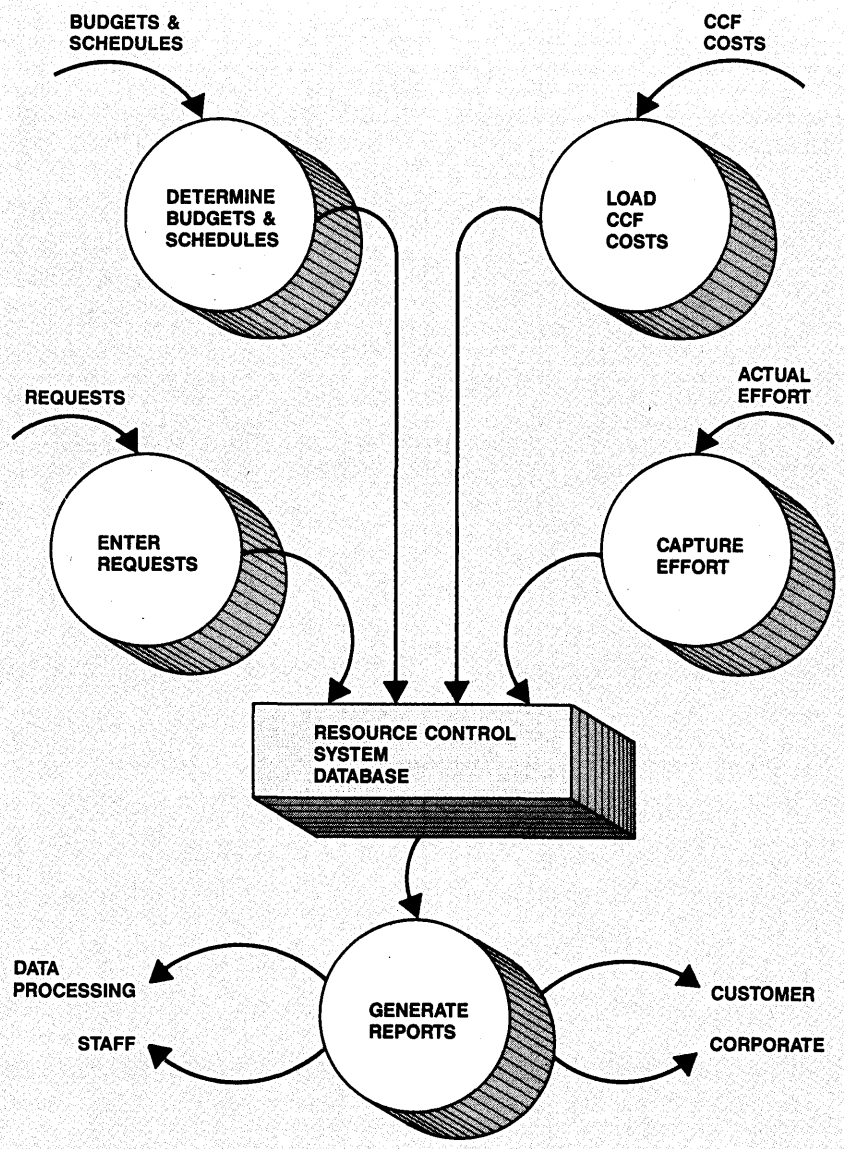
Implementation. The implementation checklist should ascertain that the latest version of the prototype has been approved by the user, that detailed specifications are complete, and that all documentation has been approved by an appropriate review process. The prototype goes into production. Does prototyping stop here? No, a flexible, readily modifiable system is in place so perfective and adaptive maintenance requirements can be performed using the same prototyping techniques used during development.

Training for rapid prototyping. Programmers, who are trained to solve information management problems by writing systems composed of program modules, are often uneasy with the transition to rapid prototyping concepts. Unfortunately, there is little training available to help introduce this new way of thinking about system development. The companies that develop the tools for rapid prototyping, i.e., relational database management systems, have courseware specific to the use of their tools. Other companies have courseware relating to system development methodologies. The concepts of rapid prototyping as presented here are not currently taught.

Perhaps a third-party approach is needed. Instructors could teach rapid prototyping using specific relational database

FIG. 3B

THE ESSENTIAL FUNCTIONS DIAGRAM



Here, the whole system is broken down into several processes. The data flow from the Context Diagram is repeated but terminators are not. Inside the expanded system process, a data store is now shown—the RCS database. Each function maps to a menu selection as indicated in Fig. 1. As more functions are added to the system to meet new user requirements, more menu entries are added.

management systems and methodologies, tailored to each customer's development environment. Such instructors would need in-depth experience in developing rapid prototypes for actual applications. How should a course be structured to teach these techniques effectively? A hands-on workshop designed to demonstrate the development of a rapid prototype, on-line, is best. This workshop would incorporate a class exercise based on a typical rapid prototyping application.

If rapid prototyping is really a better way to develop new applications and does not require the use of programming techniques, what is preventing users from developing their own applications? Very little. Sometimes they are cut off from the development nodes of dp-controlled computers. Many users are unaware that the new techniques are available. Others would simply rather pay dp to do the job for them. But now a new breed of sophisticated, computer-literate users are coming into the picture. They are comfortable with computers, having been exposed to them in the form of video arcade games, computer aided instruction, and perhaps even a personal computer in the home.

These new users typically have cost-justified, requested, and obtained personal computer workstations for their offices. Although relational database management systems exist for personal computers, they are not very practical because of performance problems related to memory requirements. The day is rapidly approaching, however, when that problem will be solved. Users will have the freedom and capability to develop their own distributed applications. The centralized dp shop will become less important and may assume a whole new corporate role, perhaps in the area of consulting.

NEED FOR FRIENDLY INTERFACE

Some applications using RDMS have in fact been developed by sophisticated users on distributed processors. Many more users would participate if not for the held-over computerese concepts incorporated into the development techniques of these systems. Query and update procedures often require knowledge of specialized syntax and Boolean logic for correctly forming commands. Incorrect syntax or logic often produces results that appear to be correct but are not. Before the great mass of users jumps on the rapid prototyping bandwagon, friendlier user interfaces must be developed.

Recent developments in artificial intelligence are an encouraging sign that extremely friendly development systems are on the way. There is also some effort directed toward embedding relational database management systems inside intelligent user interfaces. Some of these systems will be plagued by the same or increased levels of performance problems as experienced with current relational database management systems. This too shall pass. The next step may be an intelligent system that will structure its own database, design input and output formats, and make its own modifications based on feedback from the user. Critical applications for such a system might be in aircraft and spacecraft design, and in executive offices where requirements change in real time and it is not feasible to wait for a new system to be designed and programmed.

There is a possibility that some applications may not be amenable to rapid

prototyping techniques. It is necessary to analyze the candidate application initially to determine potential size of database, number of probable concurrent users, performance requirements, and user preference for interface characteristics. A very large relational database will produce longer response times than a moderately sized one. Many users, competing for database access, will have to wait longer for response than a small number of users. If both database size and number of users are large and performance requirements are stringent, then an RDMS may not be the best implementation vehicle for the application. A final consideration is that some users simply do not like menu-driven applications. One brokerage house stated that they did not feel such an interface would be appropriate for their application.

Discussion of brand-name software has been avoided in this article for three reasons. First, the current rate of change in new relational database systems technology is such that any attempt at a comprehensive review of available software would probably be obsolete by the time of publication. Second, many vendors claim to have relational database management systems, but they actually have relational interfaces to older types of database management systems. Third, the specific product used is not as important as the correct use of rapid prototyping techniques.

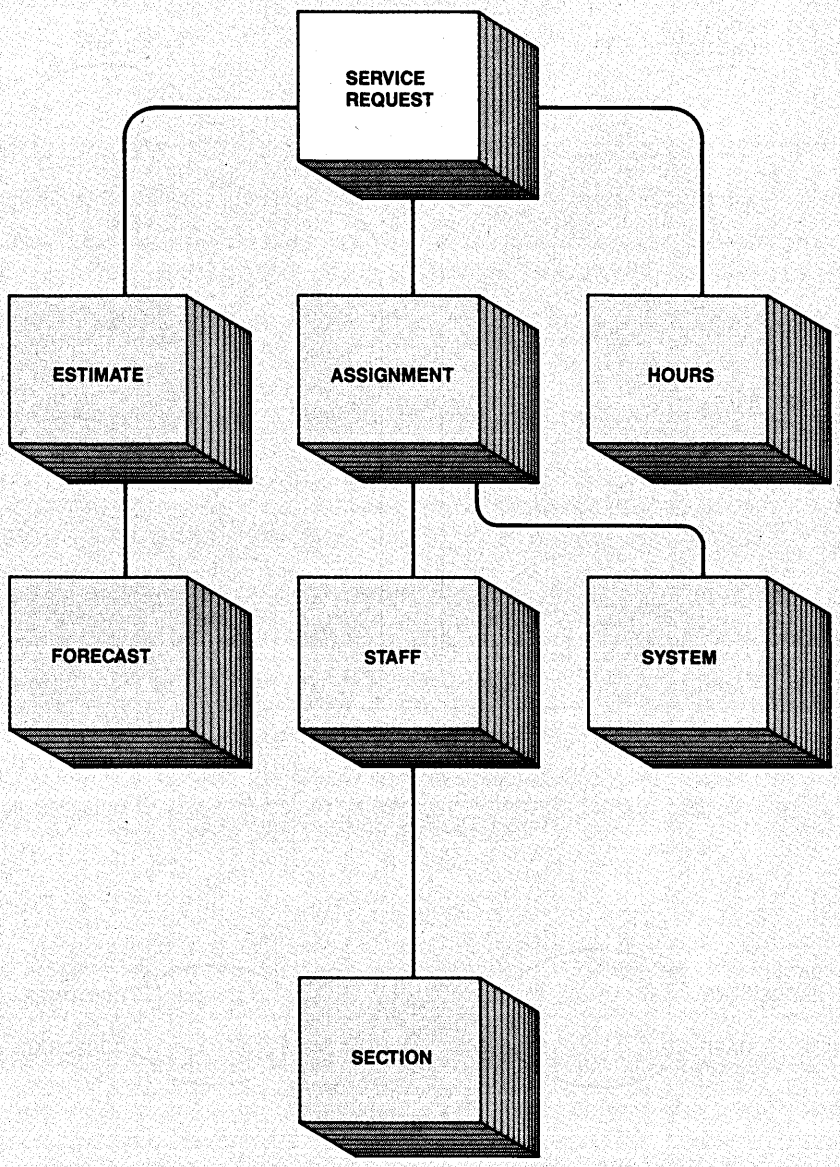
A true RDMS allows prototyping to be accomplished as described in this article. It is important that new data elements can be added and old ones deleted without concern over data paths.

One should be able to combine or join data from different tables in the database without reference to predefined key elements in each table. A database management system that uses the concepts of repeating groups or parent-child relationships is inflexible compared with relational systems.

Good rapid prototyping tools are based on providing a development environment where what you see is what you get. This implies the use of screen-oriented tools where formatting can be accomplished with a screen editor and function can be specified through menu selection. Products that require development through written programs or by dialog with a long series of questions must be avoided. Systems that require implementation through complex interfaces with developer-written job control language must also be avoided. Complex job control language is a holdover from old batch-oriented systems and not suitable for modern interactive environments.

FIG. 3C

THE ENTITY RELATIONSHIP DIAGRAM



This model shows relationships among aggregations of data elements or entities. In the RCS application, we know that service requests are assigned to the project staff members, and that they forecast, estimate, and report on actual effort. The paper model provides understanding of which data elements belong in common groups and how those groups are related. It contributes to proper normalization of data and reduces the table restructuring effort during implementation.

Review the manual—not just the sales brochure—for the product under consideration. How are retrievals and updates accomplished? Is the command language easy to master? Are the results of commands easy to predict? How close to English is the syntax? While waiting for the ideal system, it is worthwhile to consider the vast differences in friendliness among currently available products. ◉

John L. Connell and Linda Brice have been developing rapid prototypes of computer applications in relational database environments for over two years. They have used these techniques in more than two dozen projects. Brice is a staff member at the Los Alamos National Laboratory, Los Alamos, N. Mex., and Connell is a staff engineer with Martin Marietta Denver Aerospace in Denver.

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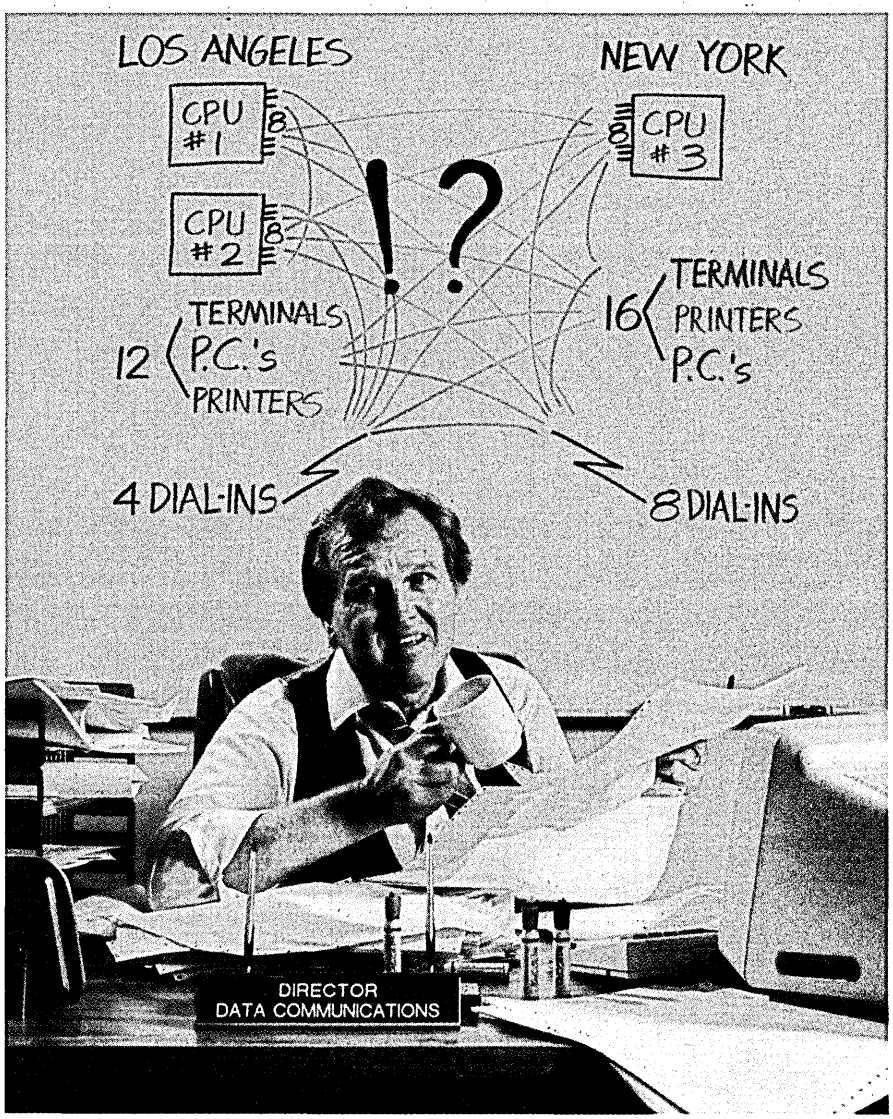

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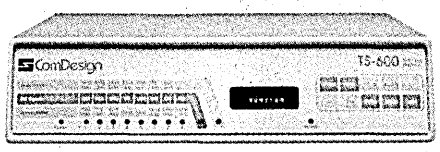

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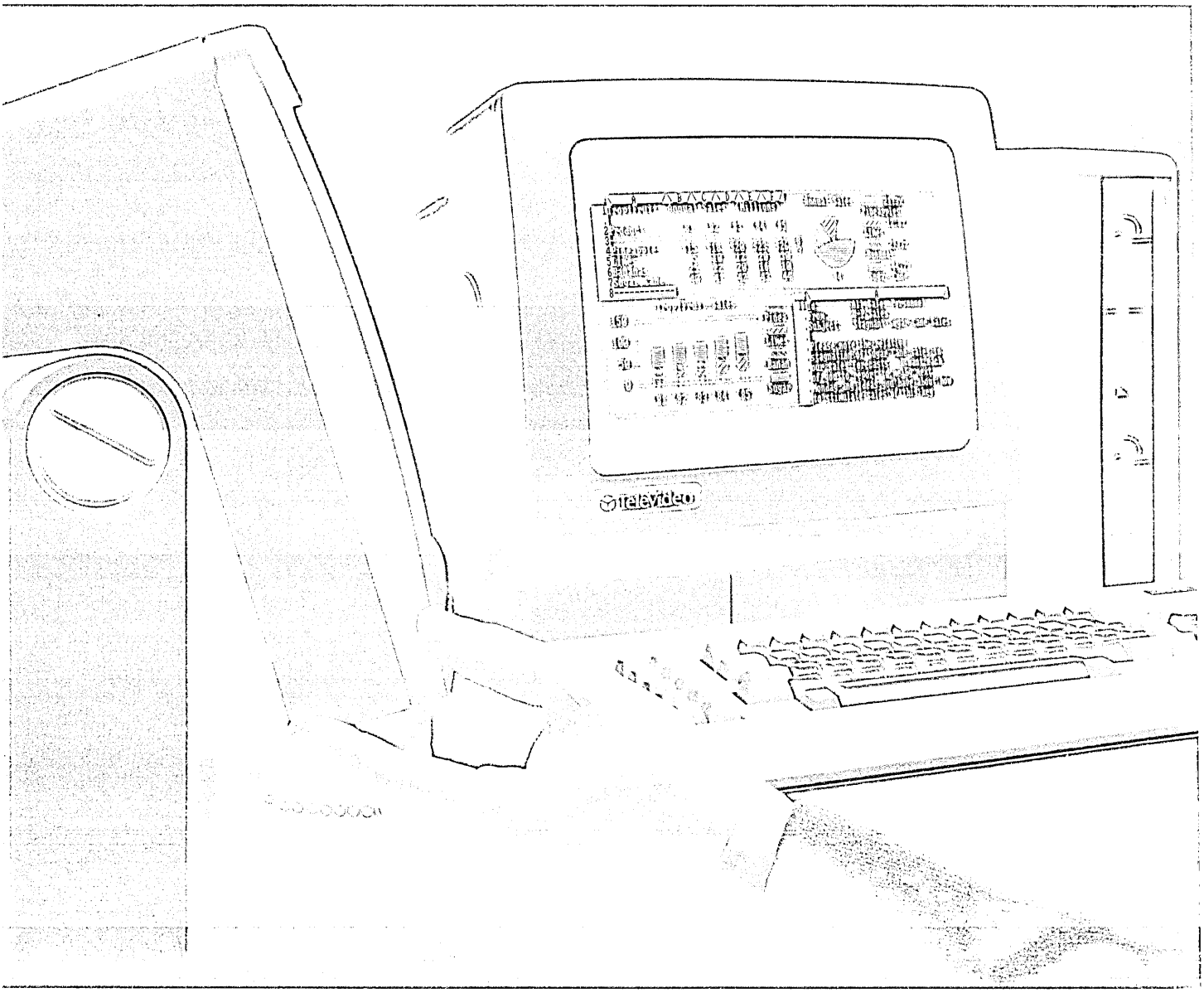

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Printer Port	YES	OPTIONAL	YES	OPTIONAL
Communications Port	YES	OPTIONAL	YES	YES
MS™-DOS/BASIC	YES	OPTIONAL	YES	OPTIONAL
System Expansion Slot	YES	YES	YES	YES
RGB and Video Port	YES	OPTIONAL	YES	OPTIONAL

PC compatibles. for the best software.

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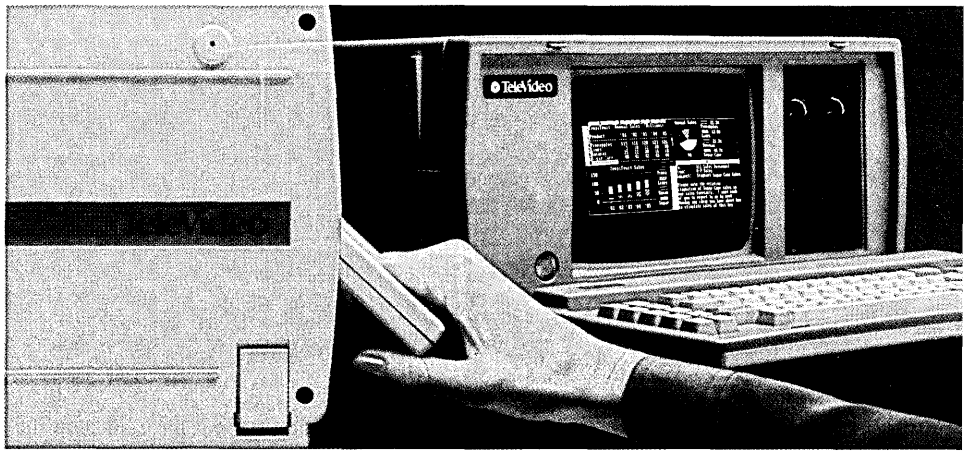

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Quiet Operation	YES (NO FAN)	NO
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Communications Port	YES	OPTIONAL
Printer Port	YES	OPTIONAL
MS™-DOS 2.11	YES	OPTIONAL

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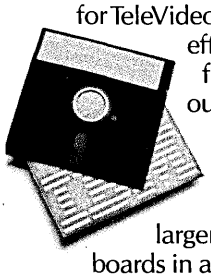

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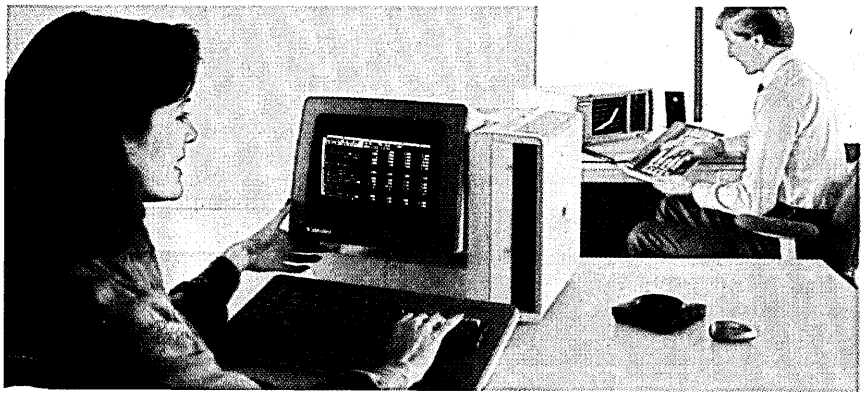

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CIRCLE 55 ON READER CARD

Improved software development productivity is possible, but you've got to fish for it in the right places.

LOOKING FOR THE RIGHT POND

by Frank Druding

For five years we had mounted a massive and sustained attack to improve software quality and productivity.

The principal thrust was to deal with software development for embedded, on-line, real-time computer systems. An effective, modern, coordinated set of software methods, standards, and procedures had been put in place and software people were trained extensively in their use. Top-down, structured methodology was used along with a host of planning, scheduling, and resource allocation management tools. A large investment was made in the Programmer Workbench (PWB) approach, along with numerous supporting tools and features.

Substantial investment had been made in office facilities so that all programmers and analysts had quiet, private workspaces with good storage facilities for books, computer listings, and other necessary items. Many offices had PWB terminals, and all were wired to accept a terminal when the need arose. We had many challenging software contracts, were located in a highly desirable area, had a competitive pay scale and outstanding fringe benefits, and actively recruited both new college graduates and highly experienced software personnel. We waited for the good times to begin.

An informal evaluation was undertaken to measure the progress achieved as a result of these great investments in time and expense. Certain improvements were obvious. There was more consistency in cost estimating and performance. Most projects tracked very well and finished very close to planned schedule and cost. The quality of delivered software was extremely good and documentation was so complete that it was almost overdone.

Still, there were some clouds on the horizon. Competitors often bid substantially lower prices for software development. In those cases where they won the competition, more often than not they significantly overran cost and schedule to a point far beyond our original "noncompetitive" bid. Where did the fault lie? Was it with the procurement system or the customer? Did our competitors lack skill and integrity or were we at fault?

Another type of problem recurred whenever a substantial amount of software subcontracting took place. The subcontractors did not follow similar standards and disciplines and often had not made equivalent investments in methods, tools, and training. There were also times when the quality level and late delivery of some subcontractor software packages caused schedule slippage and cost overruns for the entire project. Could anything be done about this?

When a software project got into serious trouble (where cost and schedule performance exceeded the original plan by 20% or more), the fundamental problem was always the same. There was a very broad and loose underlying contractual specification, often coupled with myriad changes, and no real agreement between the customer and contractor on the technical baseline (the complete technical description of what's going to be built). Every major design document was done two or three times and each subsequent design document related poorly to its predecessor due to the ever-changing technical baseline. There was nothing inherent in the new software development system or philosophy that could effectively prevent this from happening.

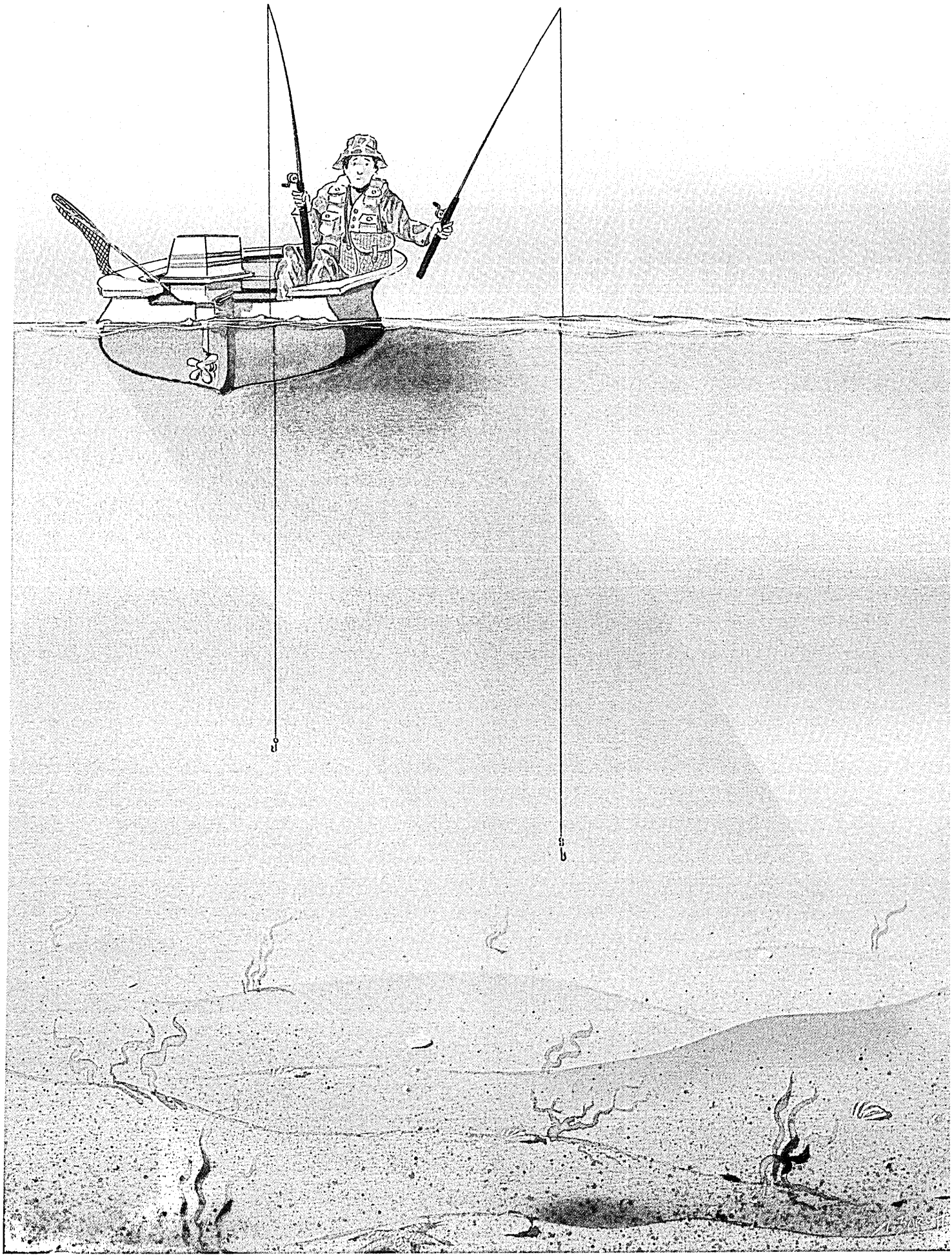
The problems that still existed were therefore the classic program management problems that people have grappled with for years. They arose in relationships with competitors, subcontractors, and customers—all of which were not fully controlled by the new software development methods and tools. It was disturbing that these problems still existed, but certainly not new or unexpected. It is not surprising that healthy software development can occur only in a healthy contractual environment.

NO REAL PROGRESS MADE

The real surprise came when a preliminary look at productivity implied that no real progress had been made. When the average costs per source code instruction for 1978 and 1979 software projects were brought forward and adjusted for the economics of inflation (mostly in the form of increased software salaries), the resulting cost per source code instruction was slightly less than the actual costs in 1983. Why? Had all of our new methods and tools failed us? Had anything changed?

Certainly some things were different. The average system was now bigger and more complex, almost always with a multiple computer architecture interrelated through a complex network. Documentation and record-keeping demands were much greater. Design level work in Program Design Language (PDL) far exceeded the kind of detail thought necessary in 1978-'79. Unique devices were now attached to the computers, and they required special software and careful timing analysis. The burden placed on the system by the man-machine interface had greatly increased. Each computer often performed so many interleaved functions that timing and baseline analysis became a very large and difficult task, frequently leading to modified software architecture and substantial software redesign and programming. With multiple jobs in a single computer, the in-

ILLUSTRATION BY ANDREA BARUFFI



Quality and consistency had been achieved, but at the expense of productivity.

ternal housekeeping function rapidly expanded, thereby lowering effective computational throughput, and requiring further redesign and reprogramming.

On the other hand, software quality (as measured by the type and number of detected discrepancies during final integration) had greatly improved. The estimated and actual number of source code instructions were regularly very close to each other. There was far better schedule and cost control, and all projects had more stability and consistency. The quality of documentation was so high that it was probably excessive. Quality and consistency had been achieved, even in this far more complex environment, but it was achieved at the expense of productivity.

During the same time period, computer hardware had increased an order of magnitude in capability and was reduced substantially in price. The 256K semiconductor memory on a single chip was becoming a standard product. The new family of microprocessors had the equivalent computing power of the VAX 11/750 at less than one tenth the price. Somehow software development had to use the leverage of hardware technology to solve its own productivity problem. Where and how should we apply it? What parts of the software development process will give us the greatest productivity yield for the investment required? Are there natural limits set by the current state of our knowledge and technology? These issues needed to be explored from the beginning to the end of the entire process.

To explore ways of improving software development productivity, it would be helpful to establish and roughly characterize the sequence of events from contract initiation to the operational software system. An item that is the end product of one category and the starting point for the next will be listed under both headings.

System engineering
- Basic contract
- System requirements
- Top-level architecture
- Requirement allocation
- Hardware-software interface specification
- Software system requirements

Software engineering
- Hardware-software interface specification
- Software system requirements
- Top-level software system architecture
- Software requirements allocation
- Software-software interfaces
- Preliminary design for each computer program configuration item (CPCI)

Software development
- Hardware-software interfaces
- Software-software interfaces
- Preliminary CPCI design
- Software subsystem (CPCI) architecture
- Detailed software design
- Coding (module and unit testing)
- Integration and testing (CPCI level)

System acceptance
- Integration and testing (system level)
- Discrepancy correction

System operation
- Routine maintenance
- Routine modifications

WHERE AND HOW OF IMPROVING

Remember, the problem is where and how can major productivity improvements be realized in the development cycle of new software systems for embedded, on-line, real-time computers.

Integration and testing, although a large part of the total cost, is not a very promising area for productivity improvement. It is near the end of the development cycle and consequently has little flexibility and very little multiplier effect. It is procedure, data entry, running time, and "observer" (the independent party who provides certification that the procedure meets all specifications) time intensive. Clever simulators, automatic test sequencing and recording, and even partial automatic test plan generation would not cause large savings in this part of the development cycle.

Next, there is a strong temptation to think that improving the ease of coding would improve productivity dramatically. Modern compilers gave us a three to six multiplication factor in going from source code to machine instructions. Suppose we could go to machine instructions directly from a design language like PDL, all on the computer. That entire process now represents only 15% or less of the cost of producing the kind of software we are concerned with, and a good portion of that is occupied by module and unit testing. It appears we would be very lucky indeed to realize an overall improvement in productivity of 10% or more in this area. The technology to go to machine instructions directly from a design language is still a long way off. Such a large R&D investment for the potential productivity yield does not seem cost-effective.

The real hope, if there is any, must lie in the areas of architecture and design. We need a finer focus to explore this vast region, however; we need constraints and restrictions to make the problem finite, conceivable, and solvable. Perhaps we can gain some insight into the problem by asking:

What makes software development hard?

1. Incomplete or inaccurate software requirements,
2. Incomplete or inaccurate interface definition,
3. Trying to fit too much in a given memory space,
4. Trying to do too much computing in too little processing time,
5. Trying to do too many things simultaneously inside a single computer,
6. Internal conflict for resources,
7. Queuing,
8. Too many types and/or numbers of interfaces with outside hardware,
9. Error detection and correction,
10. Documentation.

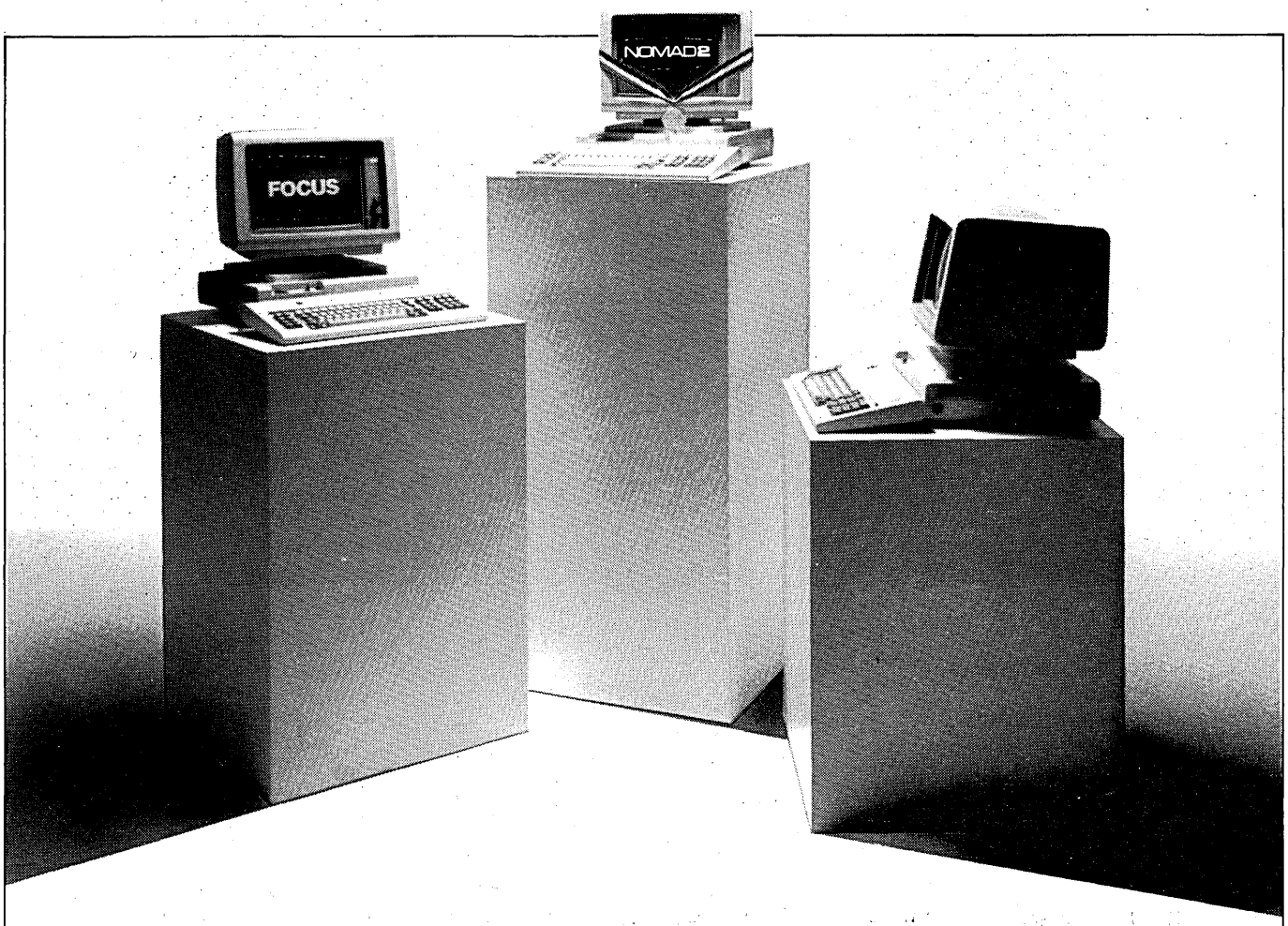
In looking at the list, items 1 and 2 are classic program management and system engineering problems. They are processes and disciplines that are not intrinsic parts of either hardware or software development. They are, however, basic keys to success for both.

Items 3 through 7 belong in the realm of software system architecture and are all facets of the same problem. New microprocessor technology and the associated economics have made these items amenable to solution. It is now far less expensive to purchase more memory and computing capacity than to build software that timeshares or spaceshares limited resources. A series of software packages that operates in a given number of time slots on a complex commutated basis is bound to be expensive to develop and will surely have severe design problems. All of the interrupted processes, intermediate storage, stoppage of external (or disk) data transfers, and the total range of internal traffic control is extremely inefficient. As the number of sharing software programs increases, and the commutated time slots thereby decrease, the bulk of computing capacity is spent on internal housekeeping.

NO USEFUL COMPUTING PERFORMED

Pushed to the limit, all computer resources are dedicated to housekeeping and no useful computing throughput is performed. The ability to properly analyze the timing baseline in such a system is pure fiction. If the external environment is asynchronous and widely variable, which is the norm for embedded computers, then true timing baseline analysis is either superficial or so expensive and time-consuming that it is not affordable. The so-called interrupt driven system can be cited as the extreme example of the inability to design a software system with planned and controlled resource utilization.

Another phrase that is used when



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CIRCLE 56 ON READER CARD

Another phrase used when we have no idea how to match asynchoronous demand to available resources is "priority assignment."

we have no idea how to match asynchronous demand to available resources is "priority assignment." "Queuing" occurs when we want everything in the priority system to be processed eventually, but haven't got the compute power to do it in true real time.

Look at the software complexities created by the shared resource concept of architecture: segmented software, an elaborate internal housekeeping software system, a commutating system consistent with all external demands, elaborate timing baseline analysis, a priority handling system, an interrupt handling system, and a sophisticated handler for queuing. All of these expensive, complex software packages must be designed and built for the specific environment that contains the embedded computer system. Consider for a moment the time and cost to do all of the above, and realize that not one piece of it does any useful, actual processing of system data. It only manipulates the software and resources that do the data processing.

Today's technology and its associated economics permit a new architecture: true distributed computing. It is possible to separate independent functions into separate computers and memories. It is possible to provide enough time and memory space to handle all functions without interrupt and elaborate queuing systems; to avoid a complex timing baseline analysis because everything is being processed in real time without resource conflict; and to always fully respond to an asynchronous system demand because the capacity exists to do everything that is necessary at the same time. The increased hardware costs would be insignificant alongside the reduced software complexity and cost and the greatly improved system performance.

It is presently claimed by at least one semiconductor manufacturer that a microprocessor with the system level performance of a VAX 11/750 is available for under $10,000. It therefore follows that if 150 lines of source code are required to adapt an existing software package to a shared computer architecture environment, it might be less expensive to let it run on a standalone basis in a dedicated microprocessor. Here then is an important area to explore for productivity improvement.

Item 8, interface devices, can be a source of major difficulty for the software system. If an attempt is made to put too many external interfaces on a single computer, we get back to the set of timing, shared resource, commutating, priority, interrupt, and queuing problems already discussed. The computer then becomes primarily a decommutator and buffer store, and little or no useful system data processing is actually done. This situation, as in the preceeding discussion, is amenable to an architectural solution that trades microprocessor hardware for software complexity and system performance.

ANOTHER AREA FOR IMPROVING

There is another interface area where productivity improvement is possible—it has to do with standardization. There are relatively few external devices that directly interface to the computer proper. Can we standardize these interfaces to a reasonable number? Perhaps. Consider things like RS232, SNA, X.25, Ethernet, and HASP. By definition, we can make a set of interfaces that are the only ones to be used by system engineering in defining the hardware-software interface (which would also help solve item 2). It would then be possible to build "standard cell" software for each of these interfaces that was reusable, and relatively independent of the actual data content and format. This approach would have a very favorable impact on integration and testing because the hardware-software interface has long been one of the major problem areas in integration.

It is obvious why item 9, error detection and correction, is a problem in shared architectures. When a failure occurs among many things being processed in a single computer, on a shared basis, it is difficult to detect which one (or more) of these elements has failed, if the failure is in the housekeeping system, the hardware-software interface, or a combination of all of the above. Again, it is the architectural complexity that makes error detection complex. A distributed architecture with simple internal functions and simple hardware-software interfaces becomes a problem much easier to handle.

Imagine how much simpler testing and integration could be if software and computer error isolation were straightforward.

Finally, item 10, documentation, is a massive, costly, and time-consuming element of software development. It is presently overdone and is used mostly to convince semiskilled project managers and customers that the software is going together properly and addressing all the system requirements. Because the traditional shared architecture approach is so complex and variable, elaborate documentation is now necessary. Just think of all the problems in describing the internal timesharing systems; the complex interfaces that result; the priority, interrupt, and queuing systems; the timing baseline for a wide variety of system environments; the error detection schemes; and so on. No wonder documentation is so contentious an item and no one ever knows where to stop.

Imagine how different documentation would be for a distributed architecture where functions were separable; there were no sharing or timing baseline problems; interfaces were simple and standard; there was no resource conflict; errors and their causes were readily detectable and isolated; and there was no concern about the ability to respond to any asynchronous system state. The only documentation needed would be an architectural equivalent to a hardware logic flow diagram—a series of separable, top-down, structured CPCI descriptions, and a simple, standardized interface description document. How much could we save toward improved productivity? Probably a substantial amount.

Although the list of things that make software hard has already been discussed, there is yet another major productivity issue. If a compiler can give us a factor of five expansion from source code to machine language, and we could get another factor of five expansion in going automatically from a design language to a compiler source code (which is probably not feasible in the near future), then imagine the benefit in productivity we could achieve if we could say "compute satellite orbit" and all necessary software and documentation were quickly available to us. This is, of course, the realm of reusable, transportable, or archived software. A better name might be "standard cell" software, because it clearly draws the parallel to the standard cell chip design process for VLSI. In fact, it becomes a very nebulous distinction whether it is a standard cell software package operating in a microprocessor, or a standard cell hardware chip that performs the required function. Certain government and industry moves are taking place that make this a technically plausible area to explore.

PRESSURE FOR ADA STANDARD

One major factor is the DOD pressure to make Ada the standard design and standard source code language. Combine that with a general acceptance of top-down structured software methodology and we have a giant step toward standard cell software. In the shared-resource architecture of the past, it was often difficult to insert a standard cell software package unless it was custom-built to handle the segmentation, priority, interrupt, and queuing schemes peculiar to that specific environment. In a structured, distributed architecture system, with no re-

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How much simpler testing and integration could be if software and computer error isolation were straightforward.

source conflicts, it becomes far more feasible to construct and insert standard cell software. The opportunity for productivity improvement is tremendous. There are many standard computing processes, interface handlers (per the earlier hardware-software standardized interface discussions), network protocols, graphics, etc., that are amenable to being packaged. There is an intuitive feeling that this must be the greatest long-term hope for major software productivity improvement.

At this point, a few comments are in order about software requirements, specifications, and the technical baseline. All too often the customer is tempted to specify design along with requirements. It is not uncommon to have a computer or computer type, or a given number of CPCI's specified, frequently with descriptions of what each CPCI will contain. Other common items specified are the percentage of compute capacity to be used, addressable memory, or data-bus capacity.

All of these and similar design-oriented specifications must be avoided if possible. They are usually based on shared-resource architectures and concepts and could preclude an active search for a more cost-effective distributed architecture and design. Customers, in an attempt to be specific about design, can inadvertently hamper substantially improved productivity.

Efforts to improve software productivity are necessarily founded on a firm and clear technical baseline. Nothing else in software management is so universally agreed upon and so seldom realized. The opposing forces are formidable. Customers want to leave their options open and are learning and changing as designs progress. The software technical people are trying to avoid being prematurely committed to a particular structure and design. The hardware designers, like the customers, want to leave all options (especially interface detailing) open as long as possible. The system engineers cannot unilaterally force agreement on a detailed design because of all the reluctant players involved. Is early establishment of the program technical baseline an achievable goal? Is it important to improving software productivity? The answer to both questions is unequivocally yes.

Because there are so many natural forces opposed to early establishment of a technical baseline, there is an inherent need to make it a contractual item, binding to both parties. It is not enough that a contractor prepares and submits an adequate description of the proposed technical baseline; timely closure is also contractually required in the form of customer review and formal approval. Peoples' attitudes must change—a baseline is not a fixed, immovable object but simply a set point from which all change is to be reckoned in an orderly and precise manner. Customers should concentrate their efforts on the man-machine interface because it is fundamental to their requirements and style of operation. They should also concentrate on required interfaces with other existing or concurrently procured systems, since only they have the ability and the responsibility to specify these items.

FOCUS ON QUALITY, PRECISION

Contractors must concentrate on the quality and precision of internal system interfaces since these are fundamentally their responsibility. A survey ("How Software Projects Are Really Managed," January 1979, p. 118) taken five years ago among AIAA members performing on projects that had a significant amount of software indicated the greatest gain in performance improvement could be achieved by early mutual agreement of the developer and customer on the technical baseline. This is still true today.

In spite of all of the above possibilities, the real world has a habit of limiting success in productivity improvement over a given period of time. New problems arise as an intrinsic part of our solutions to old problems. There is no free lunch. The suggestions set forth on where to look for significant improvement in software productivity are aimed at achieving four goals:

- Distributed architectures,
- Elimination of resource conflict,
- Standardized interfaces between hardware and software,
- Standard cell software.

Solutions for the classic management and human problems involved in establishing and stabilizing contracts, system requirements, and technical baselines are beyond the scope of this discussion. Those issues will only be resolved by education, training, and hopefully, evolution. There is certainly hope, however, for major improvement in software development productivity, and some of the places to search for it are clear. ◉

Frank Druding is currently assistant to the general manager at Ford Aerospace's Western Development Laboratories, Palo Alto, Calif. He also served as director of special programs and director of software engineering with the same organization. He was an early pioneer in the ground control complex for the Discoverer series of satellites.

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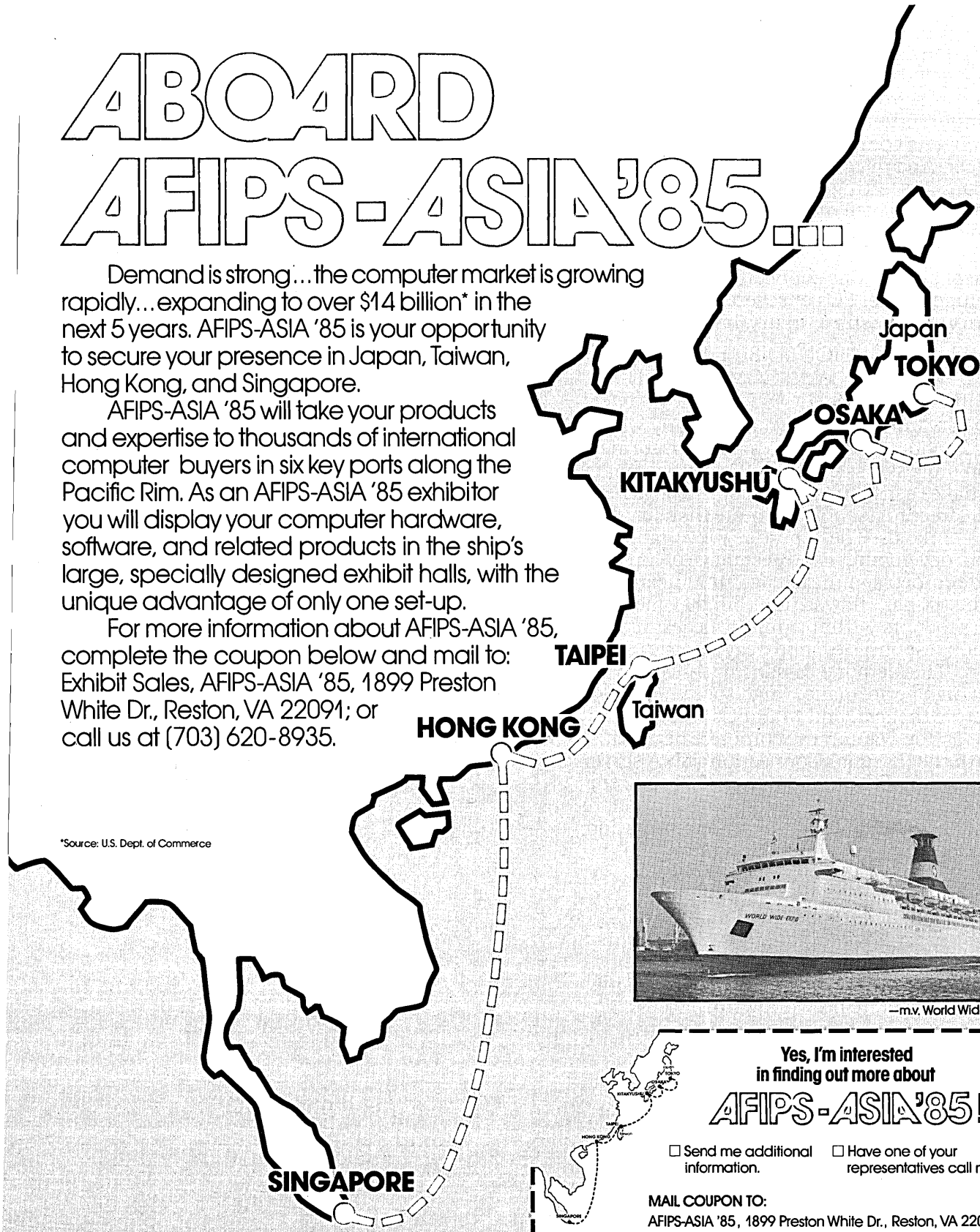

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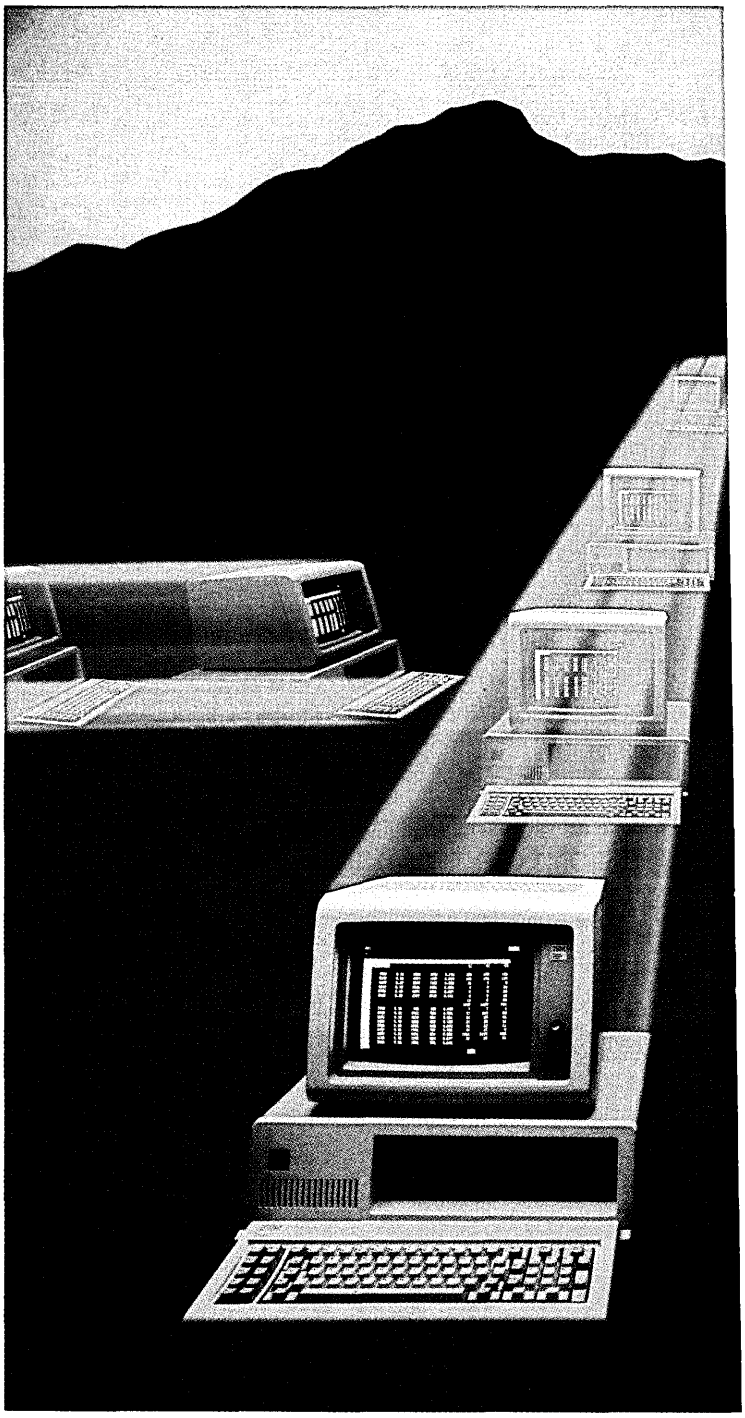

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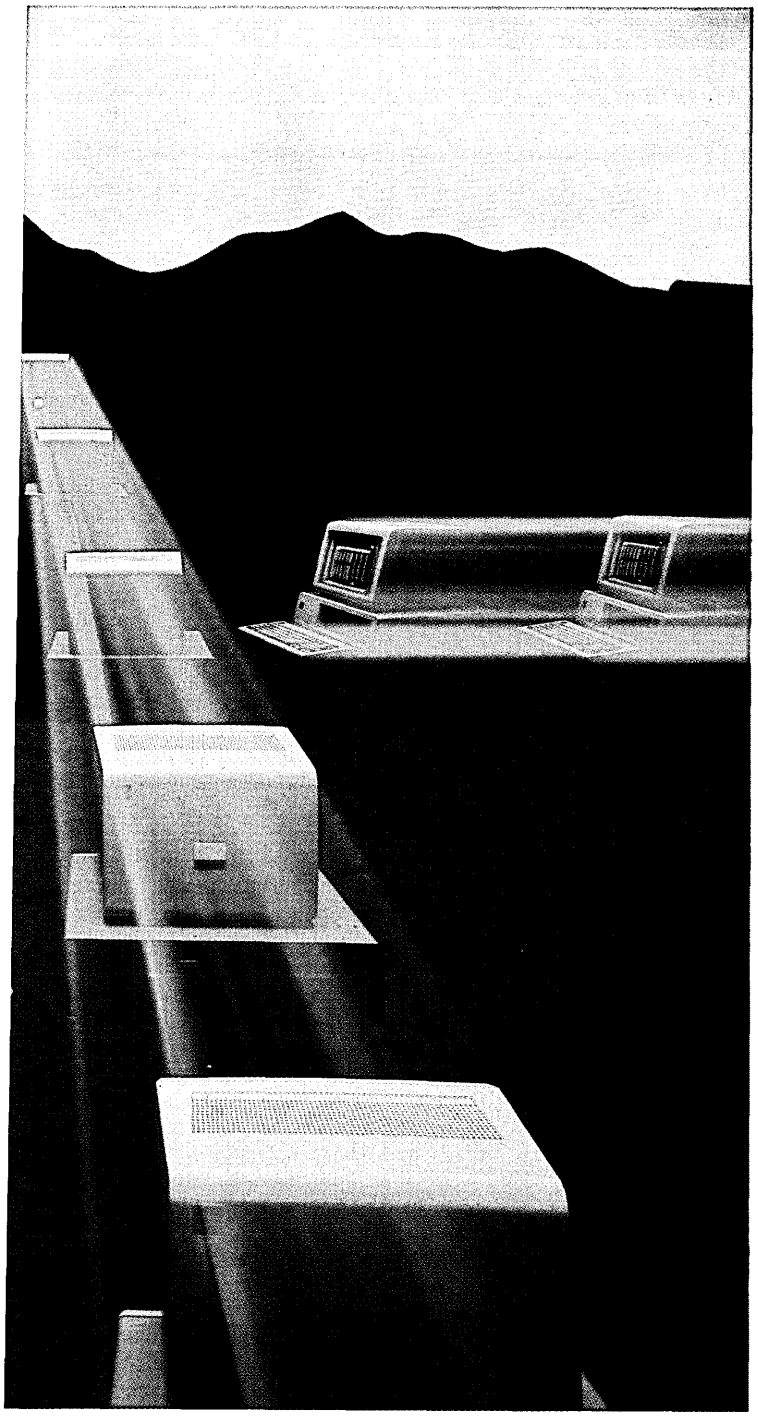

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CIRCLE 58 ON READER CARD

Bank of America found that staying ahead of the competition required the best possible systems development tools.

BANKING ON INNOVATION

by Gary Lansman

Large financial institutions recognize that a profitable future depends on innovative application of automation to meet their customers' needs. At Bank of America, president Sam Armacost states flatly that "we are an information processing company." As banking deregulation progresses, the trend of introducing more and more technology driven financial products to meet expanding market needs is expected to accelerate.

Recently, there has been a rash of high-tech banking products, which, unlike past products whose technology was "hidden," are touted for their technology. In fact, the technology is the product's selling point. Home banking with personal computers, nationwide automated teller machines (ATMs), and debit cards with real-time account access are examples of such retail customer product innovations. Corporate customers can also enjoy the benefits of these innovations in micro-based cash management systems that are available to corporate controllers, telecommunications systems like SWIFT (the Society for Worldwide Information and Funds Transfer, built by a consortium of banks about 10 years ago), which send corporate payments worldwide in seconds, or networks that tie together foreign exchange dealers on all continents to serve capital market foreign exchange needs.

Meeting the need for innovative systems-based banking products is the name of the game for major financial institutions. But how will these new systems be designed and built? What tools will be used? Who will use them? Can the tried-and-true techniques of the past be expected to meet the growing demands for technological innovation?

This article addresses the issue of which tools to use in building these systems. The word "tool" is used in its broadest sense. It includes all languages, techniques, and processes used in developing systems. Thus, COBOL, data flow diagrams, and strategic systems planning are all examples of systems development tools. Just as the quality of a modern jet plane is dependent on the quality of the tools used to build it, the quality of an innovative systems-based product is dependent on the quality of the systems development tools.

As the data processing industry has grown, so has the number of tools. In the 1960s, when dp was mostly batch processing on mainframes, tools usually consisted of a hodgepodge of internally developed functions like transfering files, editing files, and monitoring computer resource utilization.

Later, in the 1970s and early 1980s, the spectrum of software tools expanded to project-estimating tools like Estimacs (Management and Computer Services Inc.), system life cycle methodologies like Method/One (Arthur Anderson Co.), data dictionaries like Datamanager (MSP Inc.), and nonprocedural languages such as Nomad II (D&B Computing Services). For data dictionaries alone, there are approximately 39 competitors.

Experts suggest the rest of this decade will see an accelerated growth in the introduction of systems development tools. What's needed now are tools that can be integrated across all phases of the systems life cycle. A good example is an integrated project estimating/tracking system. Such a tool would be used to produce project plans, monitor progress, perform cost accounting, and maintain project history. Firms providing tools that address systems development on a broad basis will be favored by the marketplace.

A THREE-PART PROCESS

To help Bank of America manage the tools employed in systems development, we built a process that has three fundamental components: a System Development Tools Portfolio, a Systems Development Productivity Measurement Technique, and a Strategy for Change. The process has proved effective in assessing systems development organizations ranging from large centralized dp divisions to small distributed dp units. It is also effective for evaluating and improving the tools used to build systems for micros, minis, and mainframes. In short, the process is versatile, and organizations benefit from its use.

The System Development Tools Portfolio (SDTP) (Fig. 1) is a comprehensive model of systems development techniques and processes used by Bank of America. Tools in the portfolio are partitioned into three levels: strategic level tools, management level tools, and operational level tools. This partitioning, based on R.N. Anthony's classic business organizational model (from his book, *Planning and Control Systems: A Framework for Analysis,* Harvard University Press, 1981), is particularly appropriate since an important motive for employing the SDTP is the promotion of the management of systems development activities like any other business activity.

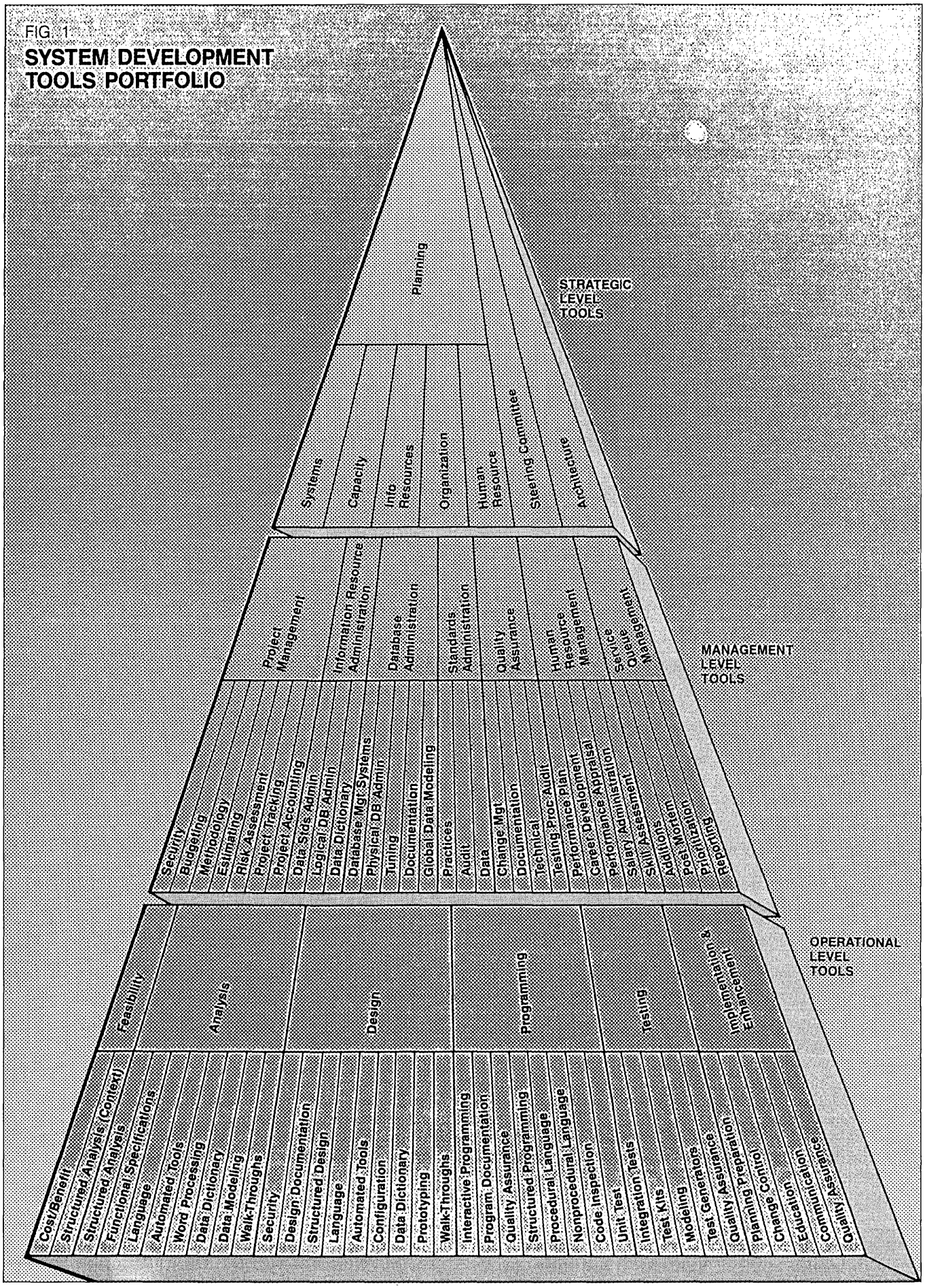
Strategic level tools are used to plan for systems development. They tend to be long term in focus, address issues on a broad scale, and consolidate many detailed variables such as human, financial, and technological resources. These tools are used to set the organization's systems development direction. Strategic systems planning, human resource planning, and steering committees are examples of tools found at this level.

Management level tools help managers aim their resources in the direction established through use of strategic level tools. Typical management tools noted are project tracking/techniques, performance review procedures, and service queue prioritization.

At the operational level, we find the tools used by those involved most closely in constructing a system. During each phase of a typical systems life cycle, several tools are available to the dp professional. Historically, tool development at this level has received the most attention. Structured walk-throughs, structured design, and CO-

FIG. 1

SYSTEM DEVELOPMENT TOOLS PORTFOLIO



Interview questions, based on responses, are specifically tailored to the unit being studied.

BOL are examples of systems development tools found here.

Although the noted tools are generic and therefore would be expected to remain fairly stable over time, the SDTP can be modified, as can any portfolio. In fact, significant differences would be expected for organizations in different stages of dp growth. In Fig. 1, there is a bias toward information resource management tools in the management level tools. This reflects the importance Bank of America assigns to managing data as a corporate resource.

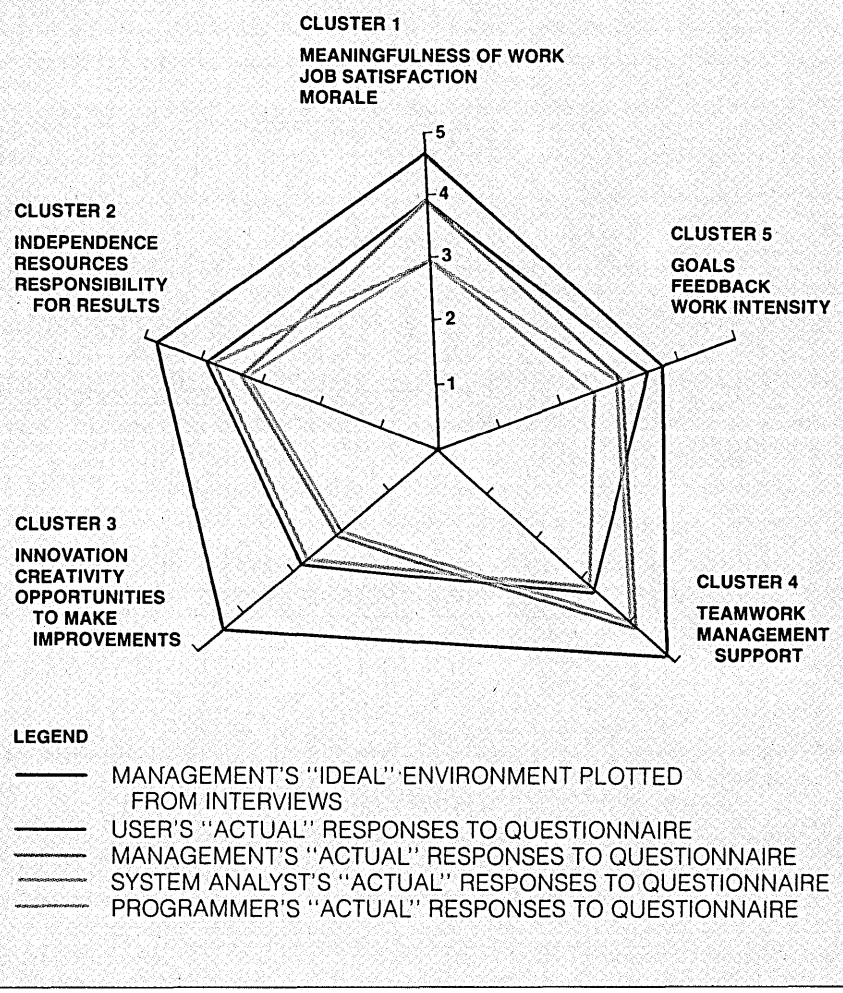
At Bank of America, the SDTP is used to assess a unit's systems development capability. To do this, we administer questionnaires, conduct interviews, and analyze documentation. From these three activities, we can determine what tools a unit has. We can also determine the tools a unit ought to have to improve its systems development productivity.

To assess an organization's SDTP, we require participation from four broad categories of systems development staff. Staff are categorized as programmers, systems analysts, users, and managers. They all have different but complementary objectives in the systems development process. Therefore, our questionnaires and interviews address the unique objectives of each group.

Data from questionnaires administered at the beginning of a study serve several purposes. First, a preliminary assessment for the organization is derived. From this background information, early assessments can be made on staff skills mix, organizational investment in training, etc. The information, which permits a judgment on the appropriateness and adequacy of training, plays a key role in devising the unit's productivity improvement program, described in more detail below. Second, interview questions, based on responses, are specifically tailored to the unit being studied. For example, questionnaire responses may indicate there are concerns over the adequacy of user participation in systems development. In this case, interview questions would be constructed to further probe user participation in each phase of development. Third, the completed questionnaires provide data to construct the unit's System Development Productivity Map.

FIG. 2

GENERIC SYSTEMS DEVELOPMENT PRODUCTIVITY MAP



MEASURING SYSTEMS' OUTPUT

This perceptual mapping technique is used to measure and graphically depict an organization's systems development productivity. It was developed by Dr. Michael Packer, a productivity researcher, to measure productivity of white collar knowledge workers. Using this technique (illustrated in *Technology Review*, February/March), systems development productivity is divided into categories called clusters. For each cluster, several related questions are asked in the questionnaire. The respondent's answers reflect his point of view and his perceptions of the organization's systems development environment. For every question, a choice of answers is provided and each answer carries an associated weight or value. Based on the weighting scheme, a mean value can then be calculated for each cluster. The resulting cluster values (or measurements) are calculated for the four categories of systems development staff mentioned earlier. By graphically displaying these cluster values, a map can then be drafted with each cluster serving as one axis on the map. The resulting map serves as a valuable representation of an organization's systems development productivity.

In Fig. 2, productivity has been divided into five clusters. They represent five key dimensions of general systems development activities. Cluster 1 addresses the meaningfulness of work activities. Questions for this cluster ask the individual to indicate the degree of satisfaction derived from his job. Cluster 2 deals with the individual's perception of how easy or difficult it is to get things done. Cluster 3 probes the level of innovation in the work environment. Cluster 4 addresses the amount of teamwork and management support in the organization. Cluster 5 deals with goal orientation. For example: are goals explicit? Is there timely and effective feedback on pro-

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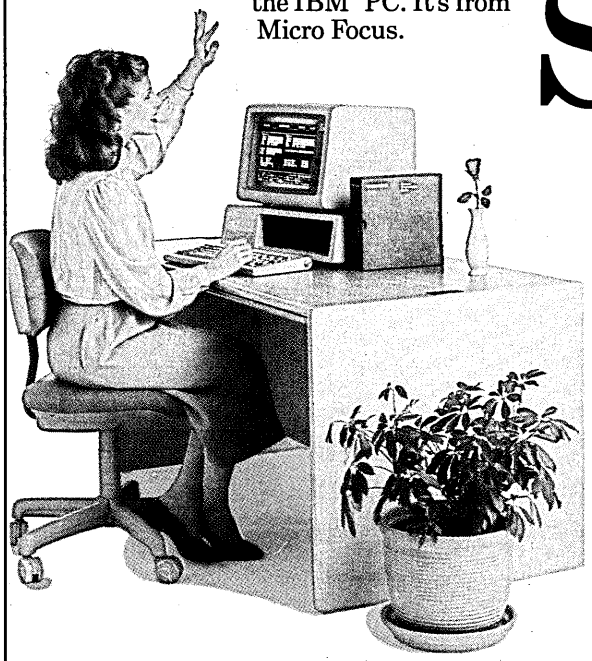

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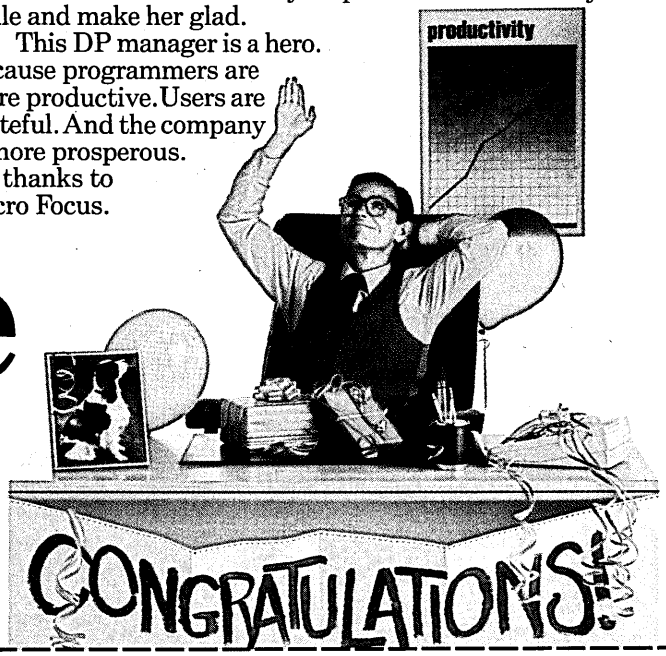

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CIRCLE 59 ON READER CARD

The issue becomes one of how to implement the productivity improvement program's recommendations.

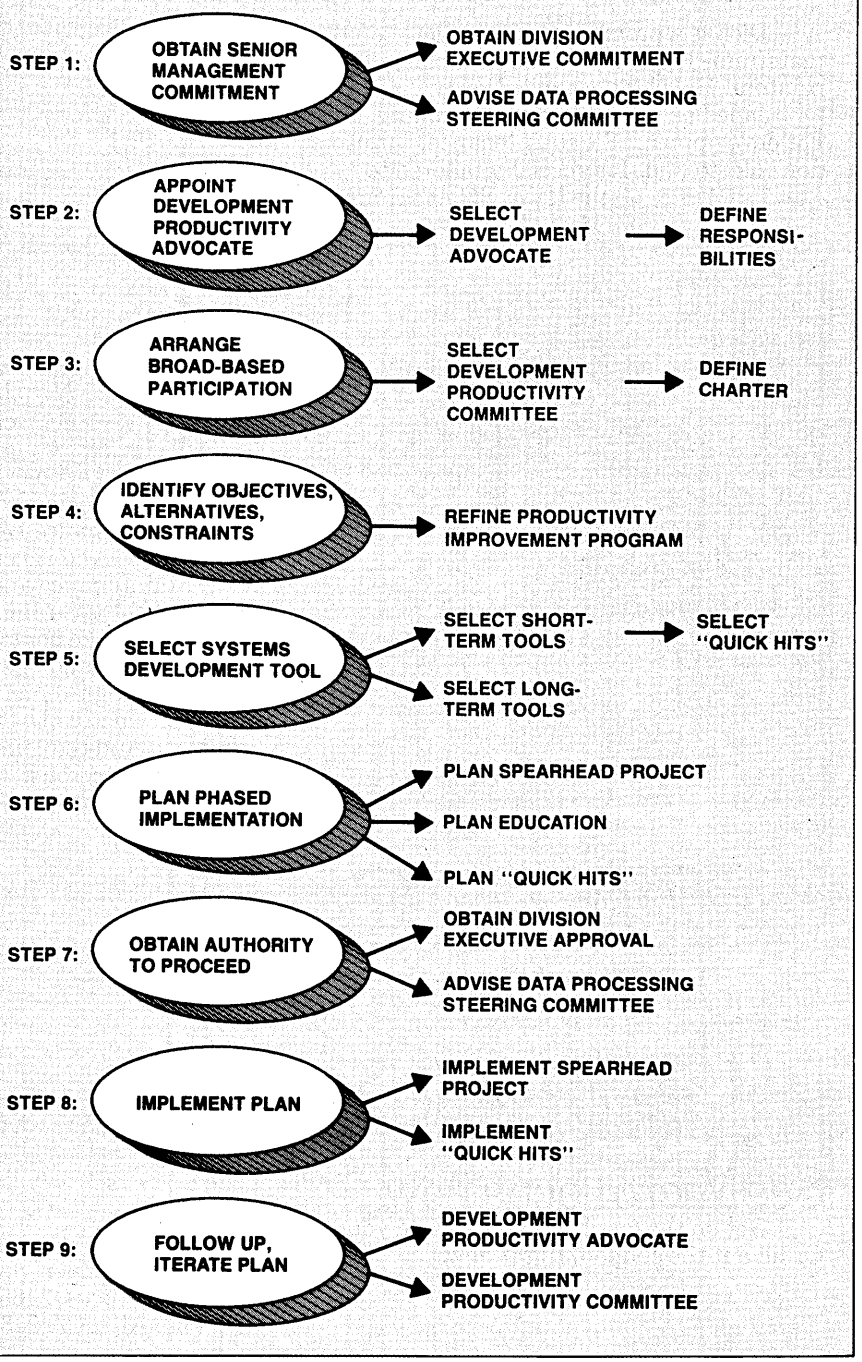
gress toward goals?

This figure shows several superimposed maps. One is labeled as the ideal map. This map is determined by asking managers to sketch their ideal systems development environment—the environment they would construct to meet their objectives if they were given free reign to do so. The other maps are the "actuals." As mentioned above, there is no actual Systems Development Productivity Map (SDPM) for each subgroup. The benefit of the SDPM stems from its usefulness for analysis. For example, comparing the ideal map to the organization's systems strategy allows an assessment to be made regarding management's understanding of the environment that is required to support strategic objectives. By comparing actual maps with the ideal map, interesting discrepancies and alignments can be observed. Discrepancies typically point to organizational weaknesses, and conversely, where close alignment is observed, organizational strengths are reflected. SDPMs indicate differences in productivity of the four subgroups. Where significant discrepancies are observed, the map provides valuable direction for investigating ways of bringing the subgroups into alignment.

The SDPM provides an excellent means of taking a picture of productivity before and after implementing a productivity improvement program. By comparing the differences between the two maps, the benefit from an organization's investment in change can be measured. For instance, improvement in the requirements phase of the systems development life cycle might be reflected in closer alignment between the subgroups, particularly systems analysts and users. Another indication of improving productivity would be an actual shift of the organization closer to the ideal map.

FIG. 3

EXPANDED CONTEXT PLAN



HOW TO IMPLEMENT CHANGES

We can make two important observations based on analysis of an organization's System Development Tools Portfolio and measurements using System Development Productivity Maps: an assessment of the organization's strengths and weaknesses; and the development of the organization's systems development productivity improvement program.

Now the issue becomes one of how to implement the productivity improvement program's recommendations.

For this, Gloria Bronsema and Peter Keen's hypothesis (from their paper "Education And Implementation in MIS," the Sloan School of Management, MIT, 1982), that education is crucial to effectively introduce change, plays a fundamental role. Used in this context, education is more than training. It brings staff together to deal with issues that are not clear-cut, so the benefit of many views and opinions can be synthesized to expedite learning. By building a team, users, managers, and technicians find their commitment to projects growing and being mutually reinforced. Everyone involved in the systems development experience is able to work closely together and leverage off one another's growing systems development strengths. Effective change requires education based on teamwork.

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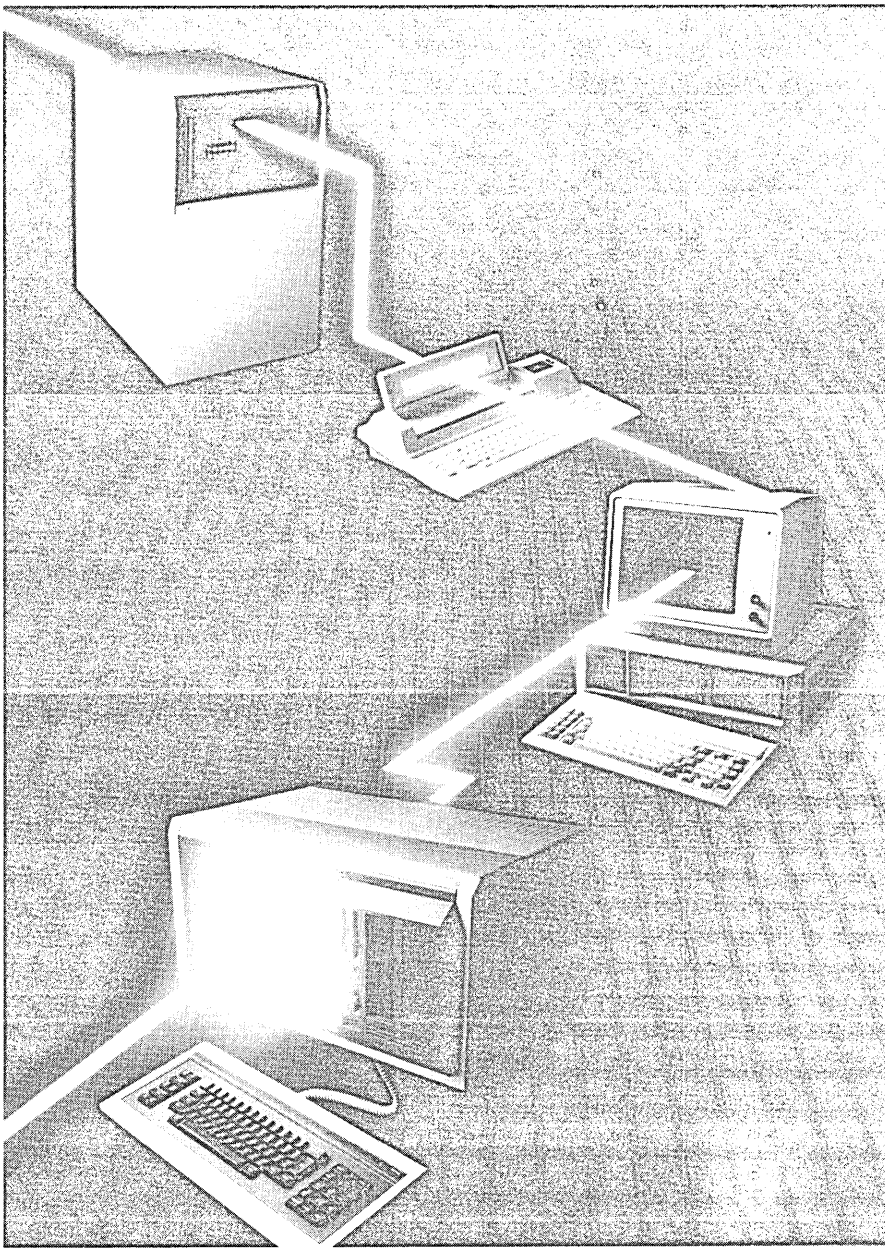

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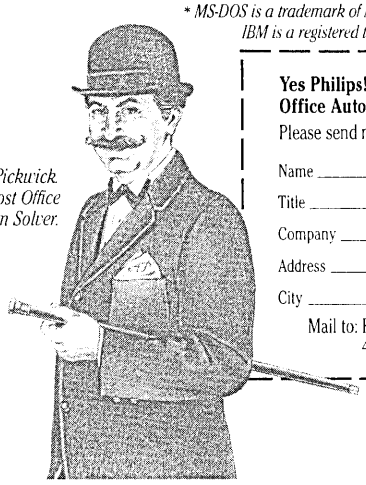

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CIRCLE 60 ON READER CARD

Changes in the way systems are developed will affect not only technicians, but users and managers as well.

When introducing change of any significance, too often the corporate culture is viewed as an invisible, unchangeable, insurmountable hurdle that stands in the way of efficient systems development. Edgar Schien wrote in *Industrial Management Review* (Spring 1961) that he saw change progressing through three states: unfreezing, enlightenment, and refreezing. But, how do you unfreeze a corporate culture? In addition to the partial answer provided by the Bronsema and Keen hypothesis, management commitment is an absolute requirement. Managers get the productivity they deserve. Therefore, obtaining and retaining management commitment requires active attention. Education again serves this purpose by involving managers with the process of change. In our past studies, managers have seen the payback from investing in productivity improvement, and this has reinforced their commitment to make changes that boost productivity.

In *Software Engineering Economics* (Prentice-Hall, 1981), Barry Boehm suggests that implementation of systems development productivity improvement programs is generally consistent. For that reason, the following Context Plan, based on Boehm's general plan, is used to guide the change process. The plan can be tailored to include specific recommendations (such as project risk assessment), as well as recommendations requiring more definition (such as selection of a systems development life cycle methodology). Since many decisions typically still need to be made after productivity studies have been completed (e.g., selection of spearhead project), additional tailoring of the plan is required. The Context Plan does, however, provide a starting point.

The Context Plan has nine steps:

1. Obtain senior management commitment.
2. Appoint development productivity advocate.
3. Arrange for broad-based participation.
4. Identify objectives, alternatives, constraints.
5. Select systems development tool.
6. Prepare phased implementation.
7. Obtain authority to proceed.
8. Implement plan.
9. Follow up, iterate plan.

This constitutes the macro version of the Context Plan, but each of these steps breaks down into more detail, as shown in Fig. 3.

Step 1: *Obtain senior management commitment.* Boehm makes the point: "If managers do not genuinely want improved software productivity, the organization will not get improved software productivity."

CHANGES AFFECT EVERYONE

As discussed, changes in the way systems are developed will affect not only technicians, but users and managers as well. It is therefore essential that senior management commitment is visible to all affected. One key means of reinforcing that commitment is obtaining the support of senior managers to periodically review productivity in systems development. If a data processing steering committee exists, then it can serve as an important forum for periodic review.

Step 2: *Establish a Development Productivity Advocate.* This step follows a basic management tenet: If you want something done, make somebody responsible for it. The individual selected as development productivity advocate must be experienced in systems development, know the organization, and be motivated toward improving productivity. This persons' responsibilities include:

- maintaining awareness of external system development productivity tools and techniques,
- identifying potential systems development productivity tools and techniques,
- evaluating systems development productivity proposals,
- promoting the need for systems development productivity tools.

Step 3: *Arrange broad-based participation.* The anticipated changes will affect many in the organization, not just the technicians. By having managers and users participate in the planning phase, two advantages are achieved: their enthusiasm and support are stimulated, rather than their resistance—since they participated in building the plan, they have engendered commitment to carry it out; and a more accurate assessment of the environment is obtained, which is important in establishing the criteria for selection of systems development productivity tools.

In large organizations, the creation of a development productivity committee is recommended. Its members should include: executives, operations managers, the head of the systems development organization, the development productivity advocate, and key individuals from units planning significant systems development projects. To get broad-based participation, the committee can be structured as either a subcommittee of the dp steering committee or as a new working group. Having consultants participate during the committee's early stages can provide valuable guidance in getting organized.

The development productivity committee's charter is to:

- Evaluate systems development productivity proposals. Most proposals would be submitted by the development productivity advocate, but might originate from committee members themselves or from others in the organization. The fundamental responsibility of each member is to add his or her perspective on how proposals would affect the organization's productivity in systems development.
- Support the development productivity advocate, who will need broad-based support to investigate and instigate changes that might affect many units. The committee can be very helpful in mustering such support.
- Promote the need for systems development productivity tools.

Step 4: *Identify objectives, alternatives, constraints.* Objectives for the productivity improvement program are important. Michael Packer states: "An organization's productivity cannot always be measured simply in terms of widgets per labor-hour. Analysts must account for subjective factors ranging from managerial effectiveness to customer satisfaction." Obviously, productivity objectives for systems development will include reduced costs, quicker implementation, and less manpower. Other less quantifiable objectives must also be included, such as system quality, user control, and system flexibility.

For many classes of systems development tools, different alternatives are available. To evaluate these alternatives, consulting assistance may be required to evaluate the tools that are most suitable to an organization.

INCLUDE CHECKS IN CRITERIA

Every organization faces constraints, including financial, legal, and hardware considerations, and local availability of tool support. These need to be included in the criteria for selection of new systems development tools.

Step 5: *Select systems development tool.* The priority of new tools to be implemented must be decided. Typically, tools to be implemented first are selected on the basis of significant payoff, or because they are a prerequisite for a tool offering significant payoff. How much change and how quickly it can be implemented are dependent on an organization's ability to absorb change. There are limits. Management will face choices between tools that are easy to implement (e.g., project risk assessment, walk-throughs, structured programming) and more complex tools that promise greater payoff (e.g., a systems development life

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CIRCLE 61 ON READER CARD

Many productivity measurements are subjective and qualitative rather than quantitative.

cycle methododgy, structured design, and organizational changes).

Why not do a little of both? Implementing an easy-to-use tool such as a project risk assessment procedure requires very little effort for such a potentially significant payback. Unquestionably, the implementation of a change such as the selection and installation of a systems development life cycle methodology must be carefully planned, and significant effort must be expanded to ensure its success.

In addition to realizing payback from "quick hits," this implementation sends important signals to the corporate culture. It announces and reinforces commitment to change in order to increase the organization's productivity. It helps establish the context for further significant change, and stimulate the education process in its broadest sense (as discussed earlier), and in a low-risk manner.

Step 6: *Plan phased implementation.* Education requires planning. Who is education planned for? What are the topics? When will participants be scheduled for education? What follow-on educational activities are needed? Initially, education should begin within the development productivity committee. At the conclusion of each committee session, the next educational agenda should be agreed upon. In setting the agenda, a top-down approach has been successful in initiating spin-off teams to pursue specific systems development productivity objectives.

A key planning activity is selection of a spearhead project to learn a complex new systems development tool and introduce its use into the organization. Ideally, the spearhead project would be modest in size and would start from scratch. If a project fulfilling these criteria cannot be found, then a project being built in phases might be considered.

Since spearhead projects are used to introduce significant changes into an organization, it is important to keep the size of the projects modest to facilitate successful change implementation.

Step 7: *Obtain authority to proceed.* Once the plan has been developed, the next task is to obtain the approvals needed to implement it. Especially since users as well as technicians will receive training, periodic assessment and review by the organization's senior management (e.g., steering committee) is beneficial to maintain awareness of the tools being introduced.

Step 8: *Implement plan.* Implementation of the plan will raise an important management issue. Frustrations may arise as the organization progresses through learning curves associated with using new tools. Sometimes, as pressure mounts, systems developers take short cuts to quicker system installation. Management should therefore anticipate proposals or tendencies to return to "the way things were done before." It is at these moments when management's commitment to change must be clearly demonstrated and understood by all participants in system development.

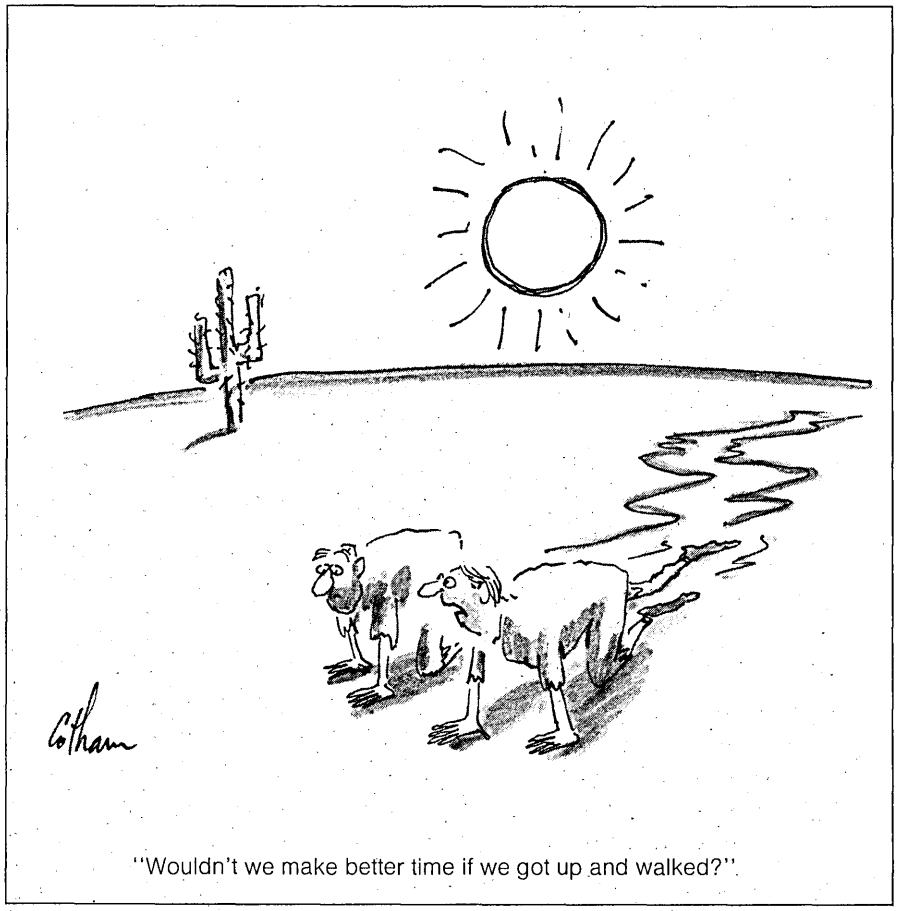
HOW WELL ARE TOOLS ABSORBED?

During implementation, the development productivity advocate and the development productivity committee are responsible for monitoring how well new tools are being absorbed. Many productivity measurements are subjective and qualitative rather than quantitative. Productivity increases, resulting from tools used during early phases of a system's life cycle, often aren't realized until later phases. For example, improvements in the requirements phase of systems development are reflected in the maintenance phase by a reduced number of enhancement requests. As the development productivity committee and the organization become more educated in systems development productivity, the methods used to introduce new tools and measure their impact can be expected to become more productive.

Step 9: *Follow up and iterate.* After completion of initial spearhead projects and the subsequent tool "rollout" into the organization, the development productivity committee as well as the development productivity advocate will have gained valuable experience in promoting change. A significant amount of education will have occurred.

From this point onward, the focus for the organization on ways and means to improve productivity is established. New technology and customer demand will continue to boost the delivery of new systems and development tools. The development productivity committee's challenge will be to act as the leading edge in introducing emerging tools into the organization's System Development Tools Portfolio. ◉

Gary Lansman is technical products manager with the Bank of America, San Francisco. He has worked in dp for 15 years, both here and in Europe, diligently pursuing ways to improve productivity in systems development.



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CIRCLE 62 ON READER CARD

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PC-DOS 2.0
Version: 1.0
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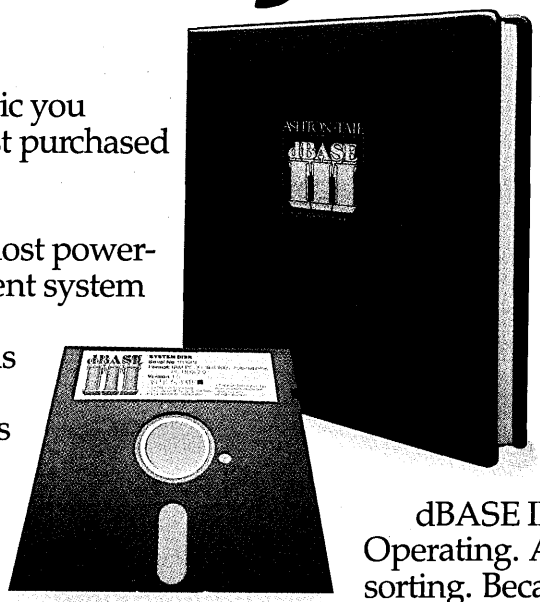

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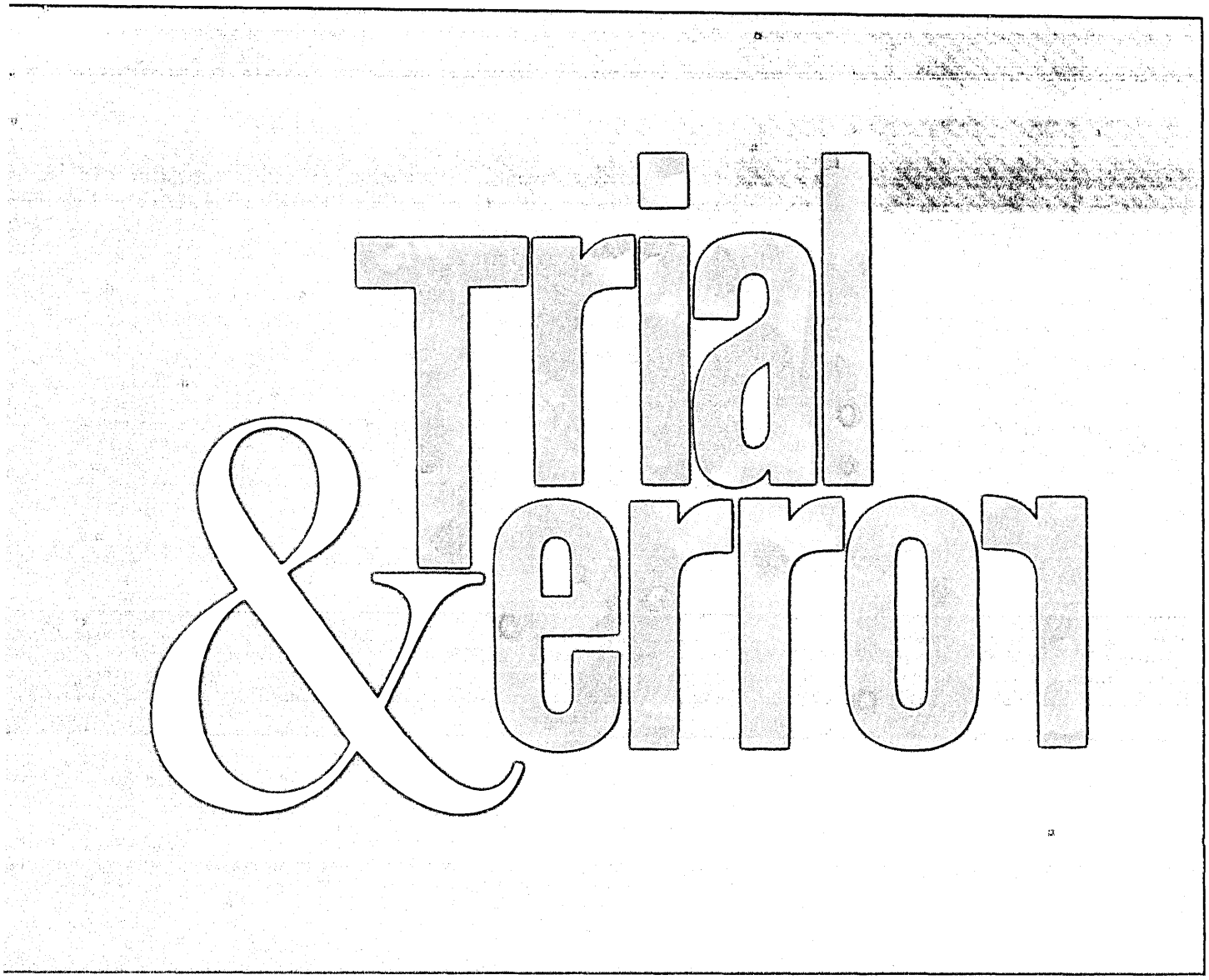

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CIRCLE 36 ON READER CARD

HARDWARE

OFF-LINE

When American industry went from having a casual affair with the Japanese style of management to being totally obsessed by it, the rationale was that the Japanese style resulted in greater productivity. So many vendors -- especially the microcomputer hardware vendors -- came out with new products specifically designed, they said, to increase productivity. Riding the crest of this wave of productivity enhancing tools, as they are often pompously called, is the lap computer. Several vendors produce them, but the most common is the Radio Shack TRS 80 model 100. The computers actually range rather little in size, price, or performance: they all are smaller than a three-ring binder, cost slightly less than $1,000, and run comparable 16-bit programs on a tiny liquid crystal screen. If you need to process sensitive information or intelligence, there are models that are magnesium encased and meet the Defense Department "Tempest" security requirements for processing classified data. For busy executives on the run and not privy to sensitive data, there are less secure models that enable users to do word processing and spreadsheets.

Manufacturers of these miniature micros tout how much work can be accomplished away from the office, at home or on the road. The vendors say that these devices will make employees more productive, and keep them in touch with the home office while on the road. And if the busy executive's time permits, it may even be possible to do some projections or reports. Since the devices are a kind of novelty, users still get funny looks when they whip one of these devices out of a briefcase and endeavor to be more productive, and that does help strengthen the image of enhanced productivity.

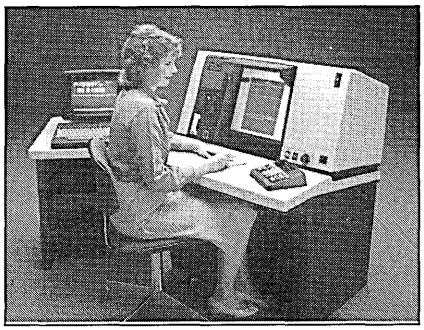
The vendors' ads clearly intend to reinforce this image. They typically show pictures of happy executives working on spreadsheets and memos while traveling on planes and commuter trains. Never mind that they are not yet sanctioned for use by the the commercial airlines, although one large vendor of these devices currently is negotiating with the major trunk carriers. And if the ad people had ever ridden a commuter train in the crowded Northeast corridor, they would have realized that the busy exec would certainly not have an empty seat to spread out her material while tapping away at the lap-size device, and might not have any seat at all. If these machines are called lap computers, how do you use them when you're standing in the aisles with no seat at all? Moreover, our exec would not likely be smiling -- not even in the bar car. As for people who drive to work or while on the job, how many times have you seen a someone VisiCalcing at a red light? Alas, lap-size computers don't enhance everyone's productivity.

Ironically, the issue of productivity has been around for a long time in other forms. From the 1940s well into the early 1960s, one group of industrial psychologists believed that if a defined task couldn't be accomplished in an eight hour day, either the worker was given too much to do, or the task had had to be redefined. It's a good thing the added factor of lap-size computers wasn't considered, since that calls into question whether the workday is indeed only eight hours long. It will be interesting to see just how much more productive the worker will be using lap-size computers -- and in the meantime expect the lap-size computer vendors to continue to stake their claims of enhancing productivity.

MICROGRAPHICS SYSTEMS

Broadening its line of electronic imaging systems, this vendor has come out with an "intelligent" microfilmer, a related retrieval terminal, and a pair of turnkey micrographics systems. The Reliant microfilmer is claimed to process 700 documents a minute, storing images on 16mm film along with code marks for later retrieval.

The IMT-250 terminal handles the Reliant's coded film rolls, retrieving any of more than 10,000 document images on a roll in "a matter of seconds." The two



products have been bundled with an Applied Digital Data Systems (ADDS) Mentor computer to make the KAR-4400 and 2200 multi-user information systems. Each combines standard dbms functions with micrographics. The 4400 is designed for users handling 3,000 to 7,000 documents a day, while the 2200 is for those handling as few as 500 a day.

The Reliant microfilmer, slated for first delivery in the fall, is priced at $19,000 and the IMT-250, available immediately, lists for $15,500. The model 4400 system, available in August, starts at about $76,000, depending on which options are ordered. Pricing for the 2200 has not yet been established. It is to be delivered in late fall. EASTMAN KODAK CO., Rochester, N.Y.

FOR DATA CIRCLE 301 ON READER CARD

TERMINAL SERVERS

This network terminal switch enables users to connect multiple computer termi-

nals to VAXclusters and other systems on an Ethernet local area network. Also available is a complimentary software package that enables users to dedicate their PDP-11 computer systems to terminal server functions. Both products provide users with the means to connect multiple terminals in configurations independent of specific processing units (hosts/nodes).

The local area transport (LAT) protocol enables both the network terminal switch, the terminal server, and PDP-11 computer-based systems to operate with a VAXcluster or other VAX/VMS systems in an Ethernet environment. This software product allows a properly configured Unibus-based PDP-11 to be used as a terminal server. The software can be downline-loaded from a host node or bootstrapped from disk or tape.

In addition to load balancing, these terminal server products provide users with layers of security, including the ability to lock terminals at the logic level from unauthorized use via passwords. This locking feature is independent of the hosts that a user is logged into. The terminal server enables the hosts in a LAN to dedicate more cpu cycles to user applications.

The terminal server can support up to 32 terminals. The 32-line version is priced at $20,000 and the 16-line version costs $14,000 for the hardware and $500 for the software. The LAT-11 license is priced at $3,000. DIGITAL EQUIPMENT CORP., Maynard, Mass.

FOR DATA CIRCLE 302 ON READER CARD

MINI APPLICATIONS

The Personal Mini offers IBM PC/XT users the ability to move up from a single-user environment to a true multi-user environment with the capability to run minicomputer applications. It consists of the PM/16 desktop computer that serves as the host system, the InfoShare operating system, and up to 16 workstations (either IBM PCs, PC-compatibles, or the vendor's PM Workstation) connected to the PM/16.

The computer operates in a distributed processing architecture similar to a network of personal computers. In such an environment, each workstation uses its own processor to run applications and shares the hardware and software resources of the host PM/16 for multiuser applications.

This product is aimed at departments in corporations that need to share the same information, small businesses whose data processing requirements are expanding, professional offices, and educational institutions.

The PM/16 utilizes the 80186 chip and runs all 16-bit applications and functions as an intelligent disk input/output processor. A Z80A acts as an intelligent I/O processor for high-speed synchronous data via eight RS422 serial ports to each workstation. It has 256KB of RAM that is expandable to 512KB. Mass storage is provided by a 46MB Winchester disk drive, and capacity can be increased to 92MB using external drives.

The system can support one serial and one parallel printer. The operating system lets users run PC/DOS software. The system is designed from a hardware and software standpoint to support future LAN developments including Microsoft's MS/NET and IBM's token ring networking architectures. The Personal Mini PM/16 desktop computer with an InfoShare operating system sells for $9,000. PM workstations cost $2,000 each. A plug-in card for adding new workstations retails for $100. TELEVIDEO SYTEMS INC., Sunnyvale, Calif.

FOR DATA CIRCLE 303 ON READER CARD

LETTER QUALITY PRINTER

This vendor is offering a letter quality printer that prints at 18 cps, which averages out to 200 words per minute. The printer measures 20½ inches wide, 6 inches high, and 14 inches deep.

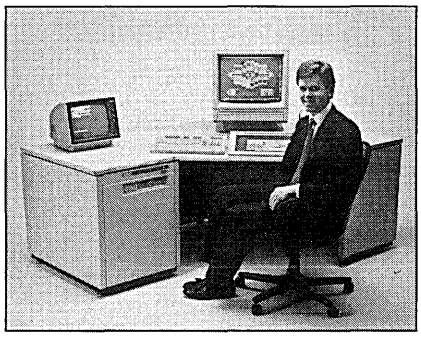
It has a drop-in daisywheel print wheel and a snap-in cartridge ribbon, which is available in office supply stores. The printer has a 2KB buffer expandable to 8KB, or four typewritten pages. Character sets are standard and include several foreign languages.

The unit has a Centronix-type interface and features three pitch ranges plus proportional spacing. A snap-on tractor feed is optionally available. The printer sells for $600. KAYPRO CORP., Solana Beach, Calif.

FOR DATA CIRCLE 304 ON READER CARD

CAD SYSTEM

Artech is a computer aided design and drafting system for architects and engineers. It is based on the Hewlett-Packard 32-bit computer, and puts three-dimensional CADD within the reach of small A/E firms. The system can be connected in a network. It displays two- and three-di-



screen, and enables users to enter operational commands via a graphics tablet. The tablet contains more than 300 directly accessible instructions. The unit can be upgraded with a graphics processor.

The placement of fixtures, including walls, doors, and windows can be accomplished by using symbols or patterns stored in the computer's library. It integrates various design components, including heating, ventilating, and air conditioning. The system electronically layers sheets in color, and each layer can be shown separately or in combination.

A relational database, Arbase, is also available. It helps users monitor projects by providing information on costs, scheduling, and equipment/supply inventory. The Artech design station costs $27,000. A fully configured system, including all hardware and software, is priced at $59,000. The system also includes a complete workstation, dual disk drive, a D-size plotter, and Arplan, a two-dimensional design and drafting program. SKOK SYSTEMS INC., Cambridge, Mass.

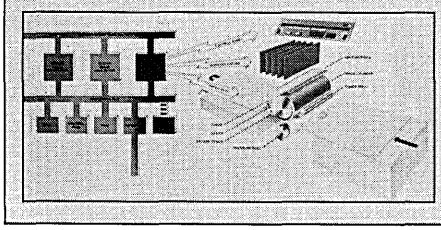
FOR DATA CIRCLE 305 ON READER CARD

—Robert J. Crutchfield

HARDWARE SPOTLIGHT

ION PRINTER

The Series 6000 is a nonimpact page printer that is claimed to offer significant price and reliability advantages over traditional laser printers. It is claimed the machine can produce up to 60 pages a minute, forming page images electrostatically on a dialectric aluminum drum with a patented ion generator. Toner particles that stick to the charged areas on the drum are cold-pressed onto the paper as the drum rotates against a pressure roller.



This method is said to be more reliable than the hot pressing used in laser printers because fewer parts are required and less toner is wasted. The product's printing resolution is 240 by 240 pixels per inch, enabling letter-quality output.

The vendor, a joint venture between Dennison Manufacturing Co. and the Canada Development Corp., is selling the printer to oems with IBM 3211 and Dataproducts interfaces. End-user pricing is expected to be in the $60,000 range. Shipments are slated to begin in September. DELPHAX SYSTEMS, Mississauga, Ontario, Canada.

FOR DATA CIRCLE 300 ON READER CARD

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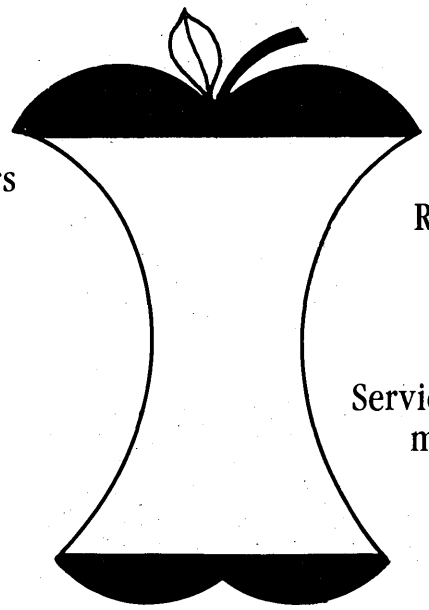

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Now, thanks to The Systems Center, you can get your micros and mainframes communicating in a SNA environment over which you have complete control. And best of all, you'll use fewer resources and save money.

Welcome to a historic micro to mainframe solution. Welcome to the SNA Gateway. The first... the complete... the full SNA interface... the OMNINET-based, disk/printer sharing LAN... the 3270 emulating... the 'beyond 3270' intelligent workstation. The SNA Gateway.

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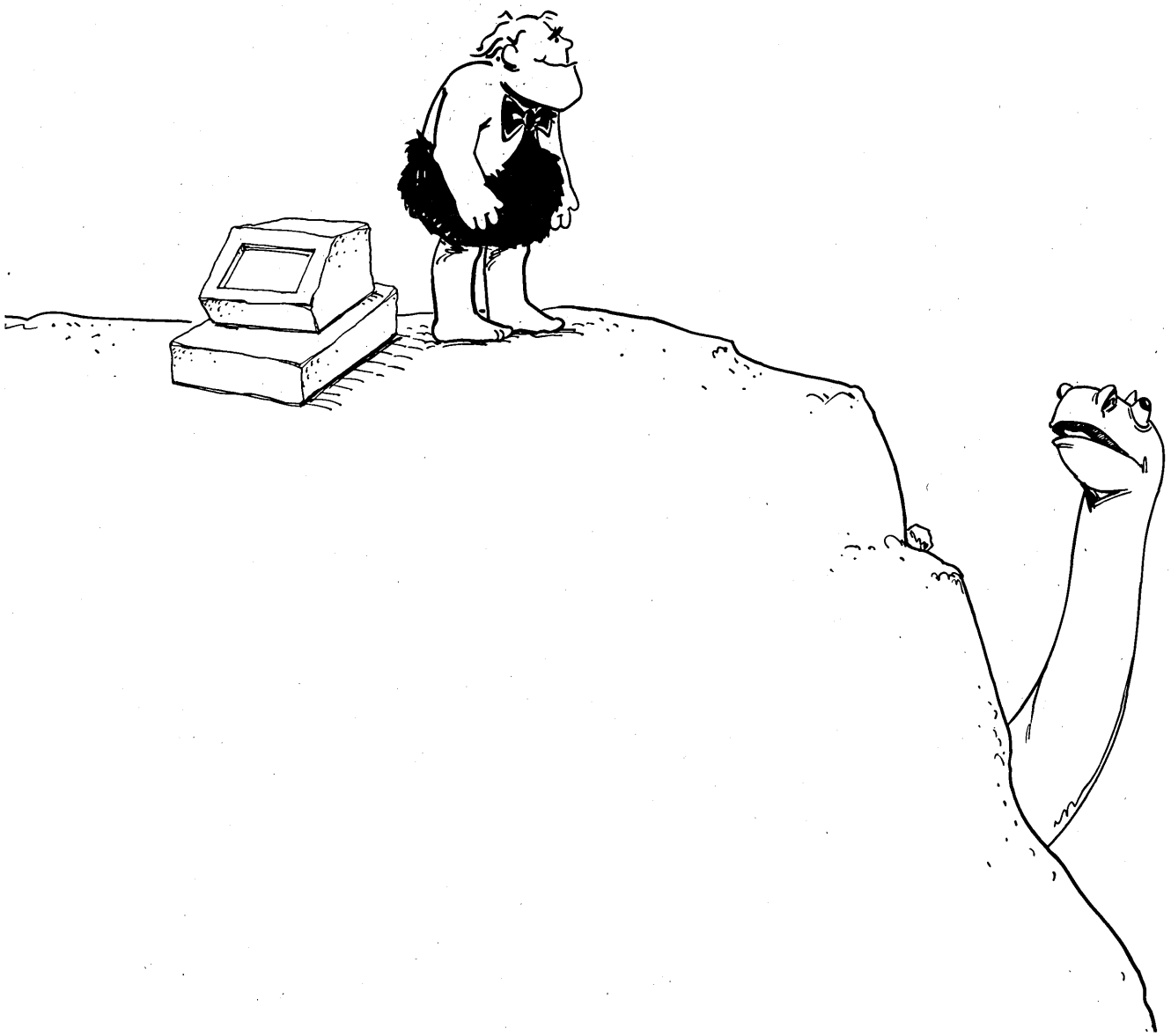

The SNA Gateway connects your micros to your mainframe through an OMNINET LAN, the most widely used and cost effective network available. This is the only full SNA Gateway which attaches micros to mainframes via a local area network.

SNA Gateway hardware is a stand-alone 4.5" x 15" x 17" dual processor. The Systems Center's SNA software resides in the SNA Gateway hardware and in each micro workstation.

What the SNA Gateway delivers is the highest order of micro to mainframe connection, including program to program communications. And it works with no required changes to the host environment or applications. You even get a complete network diagnostic and trace capability.

The SNA Gateway, when used with The Systems Center's Network Data Mover products, also allows the unattended, automatic distribution of different file types like text, graphics, programs and mail bags. In fact, a combination of the SNA Gateway and NDM gives you the most powerful set of network management tools available.

So keep your present systems from going the way of the dinosaur. Start satisfying your micro users while maintaining complete control.

For more information, call The Systems Center at (800) 345-0611 outside California, and (415) 345-0611 if you're calling from inside California.

Or write 2988 Campus Drive, Suite 325, San Mateo, CA 94403.

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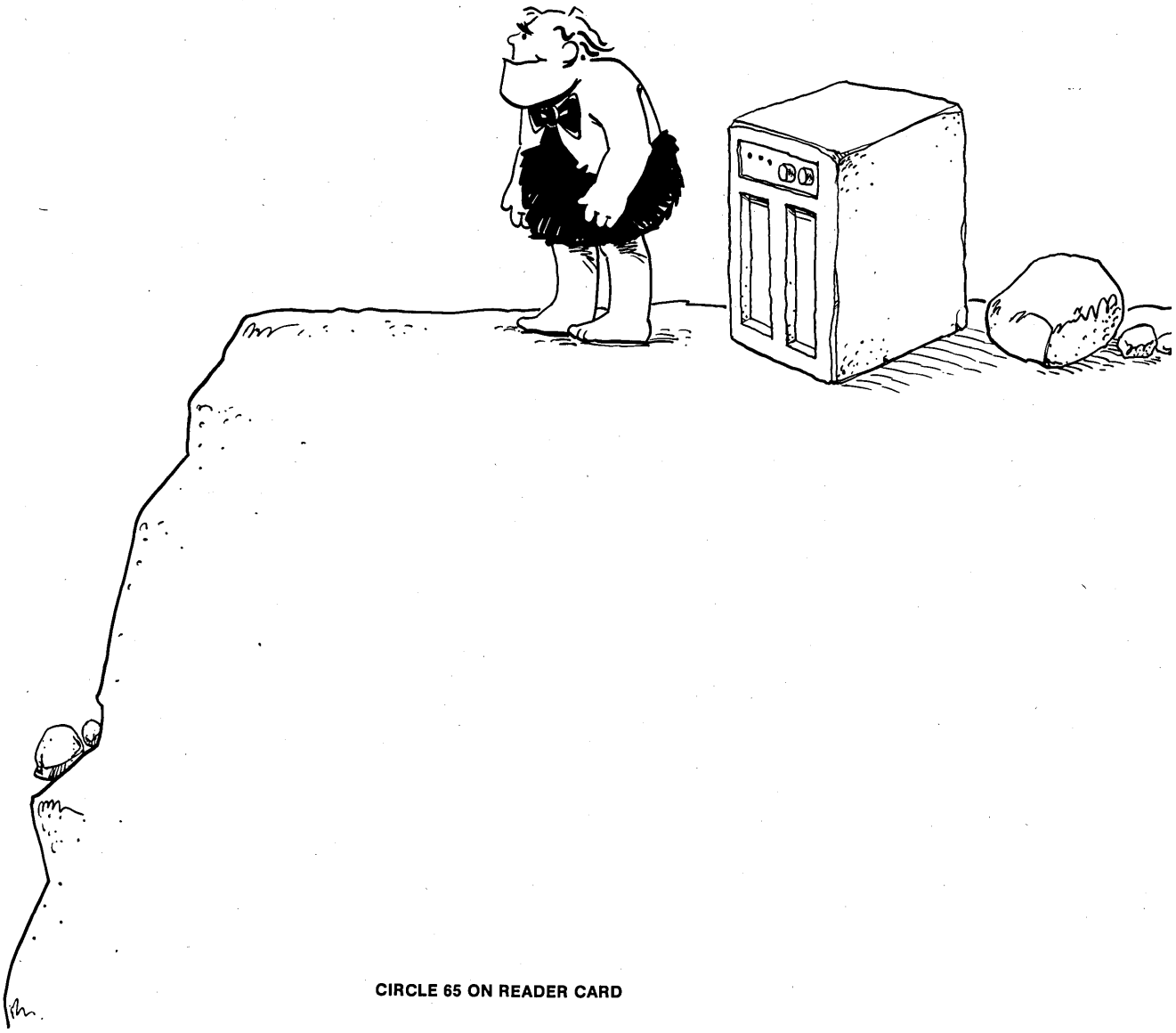

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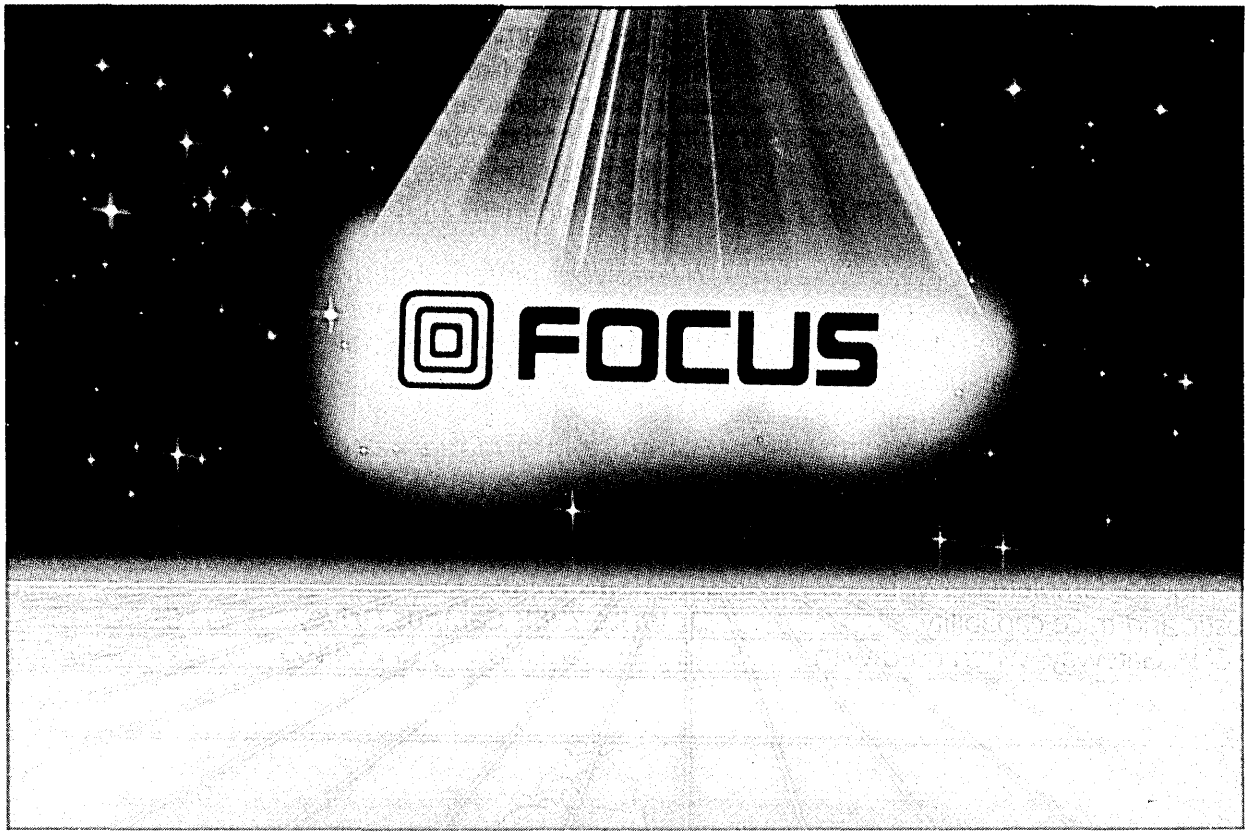

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CIRCLE 66 ON READER CARD

SOFTWARE AND SERVICES

UPDATES

Micro software vendors, faced with an enormous potential market and possessing no experience in reaching it, have adopted many of the distribution techniques of other industries, some with more success than others.

Most recently, some vendors have begun shipping software to distributors and retailers on consignment just as they might ship second-hand furniture. The driving force in that direction is Softra Inc., a small distributorship based in San Diego.

The Softra system combines electronic distribution with a consignment-style inventory. At press time, 15 major vendors, including Peachtree and Sorcim/IUS, had endorsed the distribution scheme, which goes like this:

The vendor ships one master disk of its software to Softra, as well as a full stock of documentation and little diskette holders. Softra then uses a proprietary disk reproduction system to encode the system disk of each package onto a high-density floppy diskette with extensive encryption and formatting instructions. Softra leases one of these systems to each retailer for $100 per month, and sends along one copy of each modified program so that the retailer can manufacture the user's copy from the master in the retail store. The retailer duplicates the software onto a standard diskette, gives the buyer the documentation and the disk holder, and concludes the sale.

The key to the process is that the retailer pays 20% of the wholesale cost on receipt of the documentation, and the remainder only after the software is sold. Softra's San Diego computer polls each retailer's machine nightly to tablulate customer names and addresses, and to bill the retailer for packages sold that day. The system has an impressive array of security procedures to ensure that the retailer does not make unauthorized copies or in some other way defraud the user, the distributor, or the vendor.

The system is currently operational only on the West Coast, but it has the makings of a successful venture. It's unclear whether retailers will take the plunge or whether they will balk at the added red tape and security; it's also unclear whether corporate users will find the Softra technique more appealing than other retail channels. Without support from those two camps, the technique cannot succeed.

The word "integrated" is not necessarily synonomous with the word "easy." While the vendors of integrated software packages have succeeded in bringing together various modules into a cohesive package with uniform formats and protocols, they have not yet made them easy. Still, software vendors often confuse the two words when marketing their products. Whether a spreadsheet is integrated with a word processing package or stands alone, it still must have procedures for setting up information and using the package. Realizing this, some template publishers are preparing to sell packages that act as software overlays to new integrated packages such as AshtonTate's Framework and Lotus's Symphony.

Robert Lazlo, an executive at DSS Development in Bloomfield, Conn., makers of OptionWare (a set of support applications to work within the 1-2-3 environment), says users can expect to see more support software for their integrated packages, because the user will not embrace the packages until the procedures for setting up tasks are simplified. And as the software gets more powerful, it becomes increasingly important to improve and simplify that user interface.

HUMAN RESOURCES

Genesys is a fully integrated human resources management for IBM mainframes or plug compatibles in both OS and DOS environments. The software package includes IMS/database and All-Screen, a management tool for on-line system design, as well as benefits, personnel, and payroll accounting modules.

Each human resource application is accessible on-line. Users can develop integrated employee record files for benefits, personnel, and payroll. This feature is designed to reduce data redundancy and error from duplicate entries. According to the vendor, the segmented structure of the database permits the software to custom generate a user's system with virtually unlimited flexibility and storage space.

The software also offers instantaneous benefit calculations, such as one which allows a benefits manager to perform retirement calculations for an employee. The vendor updates the system with information from government agencies such as the Occupational Safety and Health Administration (OSHA).

Features for generating a report or calculating a projected benefit are English language prompted and transparent to users. The product has pc integration, telecommunications capability, and Multi-Lock, a security system that allows the systems administrator to establish access rights for each employee.

The IMS/Database (DL/1) system supports CICS and IMS/DC. The source language is COBOL. The complete Genesys human resource package costs $300,000. Individual modules range in price from $50,000 to $110,000. GENESYS SOFTWARE SYSTEMS INC., Lawrence, Mass.

FOR DATA CIRCLE 327 ON READER CARD

PROPRIETARY SOFTWARE

The Sybercache Statistical Product (SSP) is this vendor's proprietary software package designed for use with its 8890 Sybercache Intelligent Disk Controller. The program is designed to help OS/VS users

monitor the performance and status of disk subsystems controlled by the 8890.

The software helps alleviate the bottlenecks in the DASD subsystems. Using microcode intelligence, the unit collects performance statistics about its own operation, which are then available through use of the SSP software. The vendor is also offering other proprietary software. The SSP has a one-time charge of $1,000. STORAGE TECHNOLOGY CORP., Louisville, Colo.

FOR DATA CIRCLE 328 ON READER CARD

MICRO-TO-MAINFRAME LINK

Foctalk is a standalone micro-to-mainframe link that enables users of floppy disk or hard disk systems to specify, access, and transfer data from any mainframe or database, provided it is accessible through the Focus report writer residing on the mainframe. Foctalk is specifically designed to enable users to access mainframe data without having to develop applications to do so. It also opens up the mainframe to users with floppy-based systems.

The software allows files to be created on the pc for transfer to the mainframe as well as the building of Focus report requests on the pc for execution on the mainframe. Executed reports can be received at the micro in either Focus ASCII, DIF, or Lotus PRN formats.

This product's functions use the vendor's Talk technology—a fourth generation nonprocedural database system. This technology allows even novice users to become productive by positioning the cursor to answer questions which automatically appear in windows on the screen.

The software features Link, a communications facility that provides for a bidirectional transfer between the micro and mainframe Focus in asynchronous or bisynchronous 3278/79 mode via IRMA board. TableTalk, which has windows, is the report creation component of the vendor's Talk technology. FileTalk is the file creation component of the software, and TED is the vendor's full screen editor for the micro.

Foctalk requires an IBM PC or PC-compatible with 256KB of RAM, one disk drive, PC/DOS 2.0 or higher, and mainframe Focus report writer. It is also available for Wang and Texas Instruments microcomputers. Prices for Foctalk range from $270 to $450 depending on quantity. Mainframe Focus report writer costs $43,000 for a one-time license or $1,200 a month. INFORMATION BUILDERS INC., New York City.

FOR DATA CIRCLE 326 ON READER CARD

DATABASE TRAINING COURSE

Introduction to Database Concepts is a self-paced course that provides an overview of the organization, operations, and concepts of database management. The course, which consists of three videotapes accompanied by a study guide, is designed for dp management, systems analysts, designers, programmers, and computer operations personnel.

In institutions of higher learning, administrators and instructors can use the course as a useful supplement to existing courses in database systems, as well as a source of examples to help students draw clearer connections between theory and application.

The course begins with an overview of the historical development of databases and covers topics involving the relational database, hierarchial database, and database management. The modular program is designed so users can check their understanding of the material presented on the videotape through the use of stop tape excercises and quizzes. The three videotape course costs $1,500. SPERRY COMPUTER SYSTEMS, Princeton, N.J.

FOR DATA CIRCLE 329 ON READER CARD

STRUCTURED ANALYSIS

This set of automated sturctured analysis tools provides front-end system and software requirements definition through graphic editing, error checking, error correcting, and data output techniques. The tools bring design automation to areas of structured analysis that have previously required manual diagram generation, the vendor says.

This software covers four areas: graphics diagram editing, internal consistency checking, error correcting, and formatting the analysis for output. It is used to describe a software system in terms of its data flow, and employs graphic diagrams and a simple set of symbols to identify processes that modify data and the data flow between those processes. It also uses "mini specifications," which are structured in English descriptions of processes, and a data dictionary which defines data in all processes and mini specs used in the analysis.

The structured analysis tools run on both the Tektronix 8560 Microcomputer Development System and the DEC VAX. The set is priced at $9,500. TEKTRONIX INC., Beaverton, Ore.

FOR DATA CIRCLE 330 ON READER CARD

SCIENTIFIC SOFTWARE

Asyst is an integrated software package for scientists, engineers, and mathematicians. The software is designed to run on the IBM PC XT or a compatible product. According to the vendor, this product offers users three of the most widely used scientific functions—data acquisition, analysis, and graphics—in a single integrated package. It has three integrated modules so users can acquire, manipulate, analyze, graphically display, and print hardcopy of data produced by scientific instruments and experiments.

It operates under MS/DOS and utilizes the Intel 8087 math coprocessor. There is an on-line help system. The software is command driven as opposed to menu driven. Also, operations can be condensed into a single name or word, and function and control keys can be programmed to execute any word or command in a single keystroke. The list price for the three-module package is $1,700. MACMILLAN SOFTWARE CO., New York.

FOR DATA CIRCLE 331 ON READER CARD

--by Robert J. Crutchfield

DECISION SUPPORT SYSTEM

The Organizational Planning Technique (OPT/) is part of a series of minicomputer-based educational and planning programs designed to help executives strategically manage the information resources within their organization. Information systems managers can use OPT/ to effectively manage their company's information resources to meet the organization's business objectives.

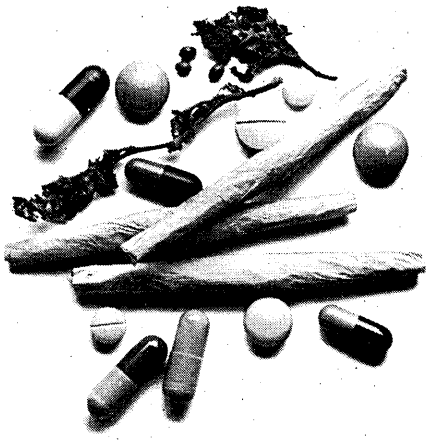
The software consists of several modules that enable managers and analysts to model various "what-if" scenarios about information systems resources and determine the impact on services provided to the organization. The product addresses the relationships between workload volume, the capacity of existing or upgraded computer systems, and the response time to the user. The results are compared against service goals. Such relationships are examined as the user steps through the case studies.

The product includes menu-driven software packages, documentation, tutorials, case studies, live instruction, and direct line support. When fully introduced, it will include 12 modules that will allow managers to conduct technical and financial analyses in order to integrate an information systems model with a company's business module.

OPT/ runs as a template over Lotus 1-2-3 and requires 640KB of usable memory on the IBM PC, PC XT, or PC-compatible computers. The PC should be outfitted with two floppy disk drives or a compatible hard disk and run under DOS 2.0. OPT/ Sensitivity Analysis is priced at $2,000. BOOLE & BABBAGE INC., Institute for Information Management, Sunnyvale, Calif.

FOR DATA CIRCLE 325 ON READER CARD

Get involved with drugs before your children do.



Sooner or later, someone's going to offer to turn your children on.

It could be their best friends.

And chances are, you won't be anywhere in sight.

So what can you do?

Obviously, the time to talk to your children about drugs is before they have to make a decision on their own.

Which means you have to learn something about drugs.

Learn the dangers. And learn to recognize the signs of drug use. Listlessness in your child. Sudden drop in school grades. Temper flare-ups and staying out late a lot.

Learn about peer pressure on a twelve-year-old. Then show them you understand how important their friends are to them. But also tell them that real friends won't insist they do drugs.

Check your own personal habits. You can't tell a child about the dangers of drugs with booze on your breath.

But it's through love and understanding that you can be the most effective. Threatening to tear their arms off just won't work.

You can get a lot more ideas from the booklet, "Parents: What You Can Do About Drug Abuse." Write: Get Involved, P.O. Box 1706, Rockville, Maryland 20850.

Remember, it doesn't always happen to someone else's kids.

After all, there are over 35 million drug users in America.

And they're all someone's children.

Ad Council A public service of this publication and the National Institute on Drug Abuse.

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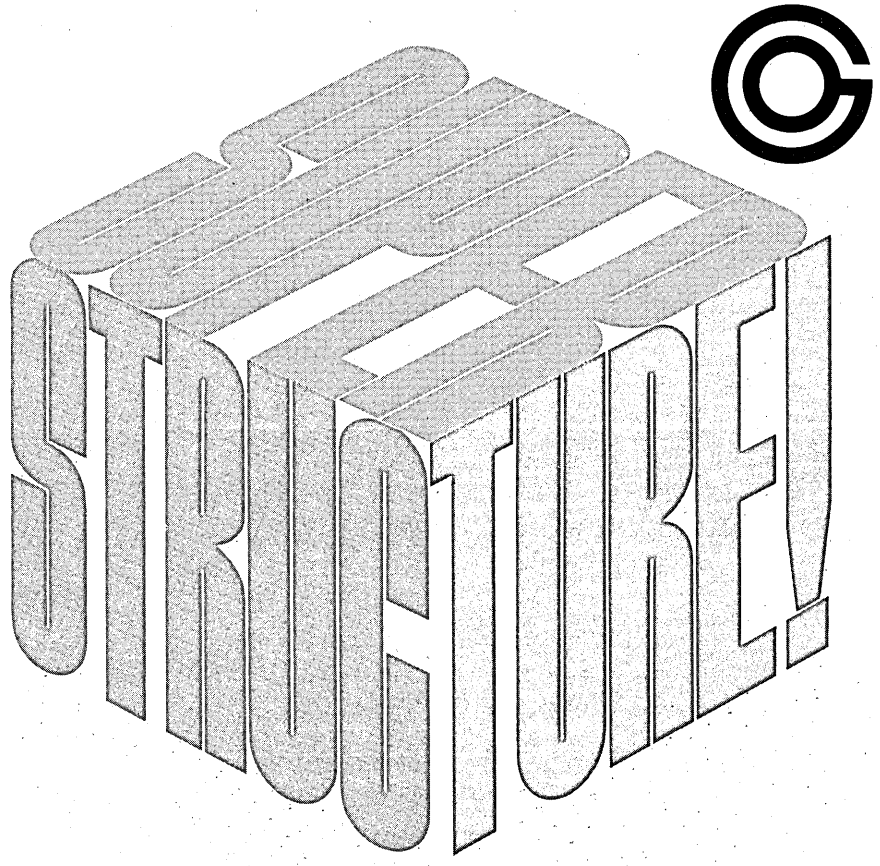
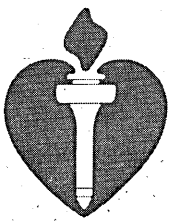


Put your money where your Heart is.



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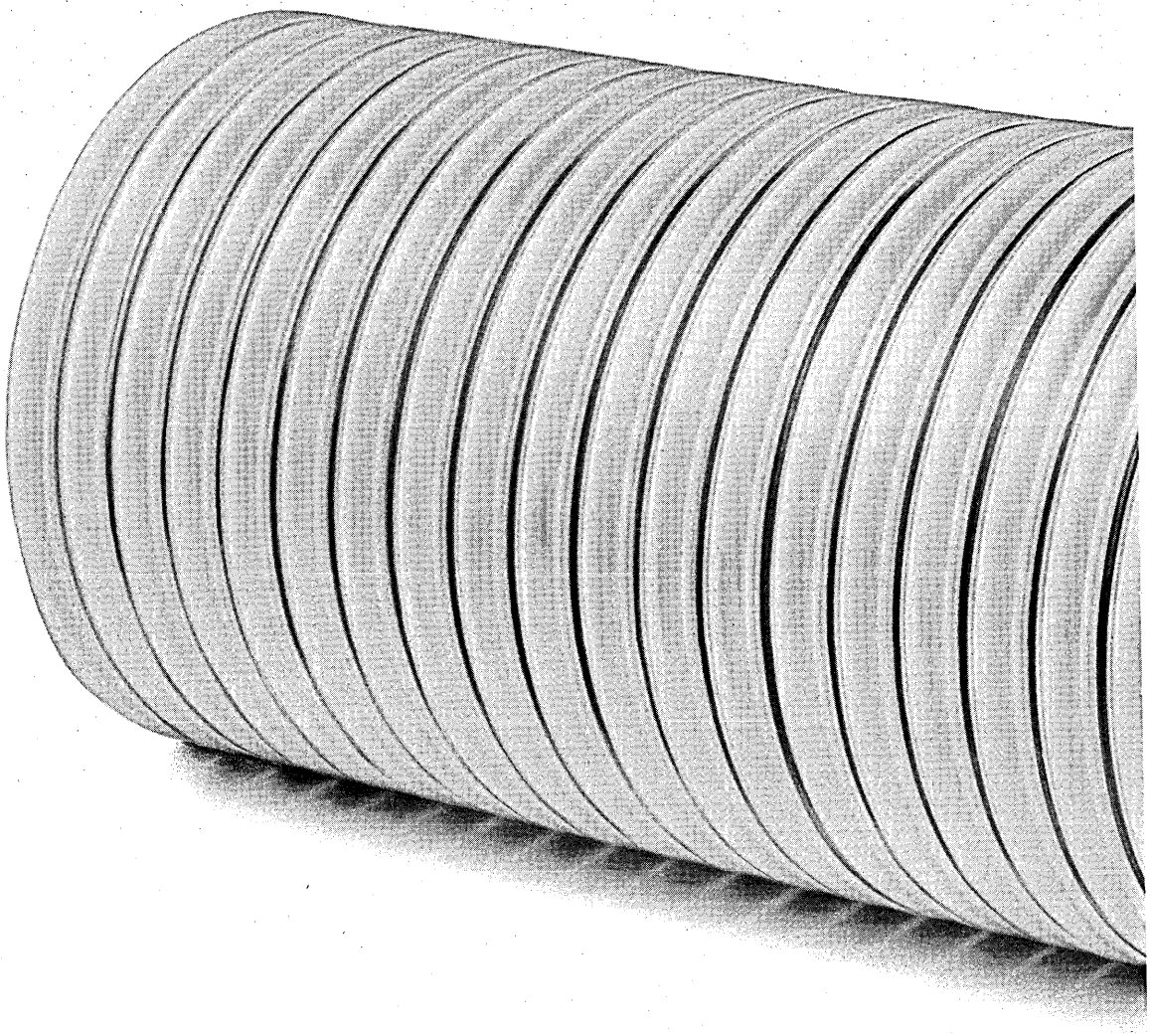


Most computer tapes are a pain.

Because they're abrasive.

They're rough on tape drive read/write heads. Pass after pass, they wear them down.

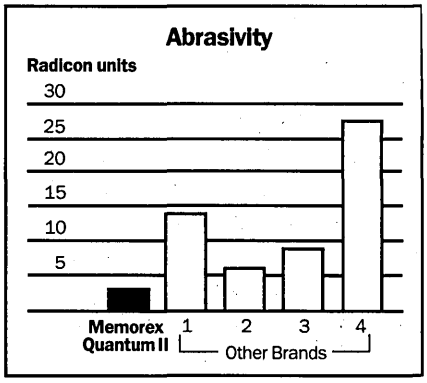
And tough on you because of the problems that result from worn heads. Like erratic signal levels. Dropouts. And, worst of all, data loss.

How do you relieve these head aches? By making sure they don't happen in the first place.

By specifying Memorex.®

Our computer tape is the least abrasive available. Because we take the pains to make it right. Our proprietary "thin coating" oxide formulation is so carefully pre-mixed, dispersed and surfaced that it's uniform to ten-millionths of an inch. So there's little to bump your head.

Our thin coating also makes possible the highest output at high recording densities. So your data is safe, even in extreme situations.



Radicon Test measurements above are obtained by running different computer tapes over an irradiated tape drive head. The higher the count of irradiated particles rubbed onto the tape, the more abrasive the tape.

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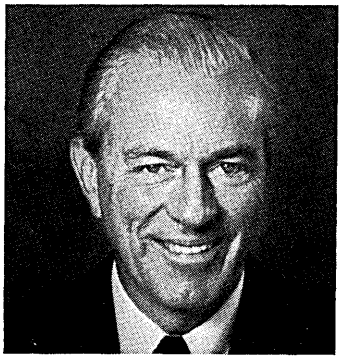

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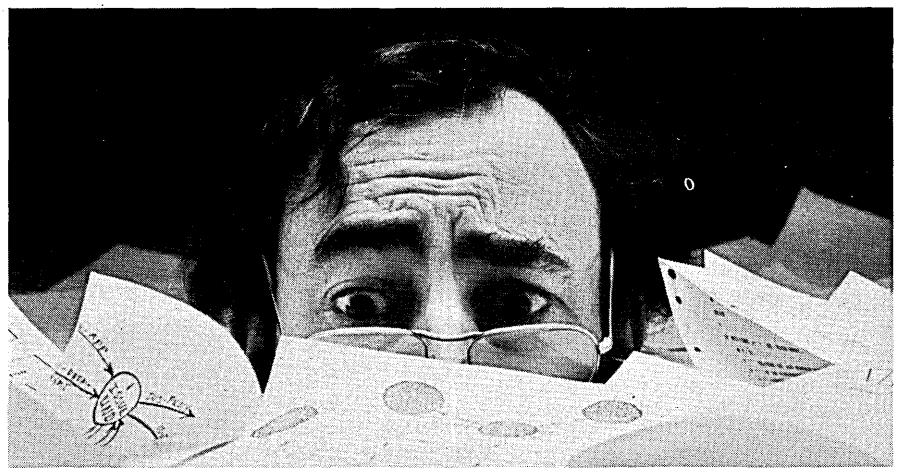

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ON THE JOB

QUE SERA, SERA

The world is changing, and so is the job market. The information age, like the industrial age before it, is creating new jobs while rendering others obsolete.

There is much argument over exactly what kind of impact new technologies will have on current unemployment levels. Now Anthony Warren, chief executive of PA Consulting Services (a technology and management consulting firm based in Princeton, N.J.), has issued a release disputing a recent congressional study that predicts higher unemployment due to factory automation. Warren argues that the congressional report "paints too depressing a picture and takes little account of the potential growth of employment in brand-new industries."

The 471-page document released by the U.S. Office of Technology Assessment (OTA), on May 10th, 1984, states that plant automation in the U.S. will lead to higher unemployment in the Northeast and Midwest as people shift from "manual to mental work." It also says that even though automation would probably improve actual physical working conditions, it could bring "negative effects such as decreasing employees' degree of autonomy and creativity."

Warren feels that this study, like most others predicting the future, takes little account of the potential growth of employment. For example, he says, "the introduction of automatic telephones removed most operators from the system. The result, however, was far more employment opportunities in manufacturing, servicing, and marketing. And even four years ago, who could have predicted the number of jobs created by the explosion of the personal computer business and related fields?"

Warren also says that this growth

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LECTURER OPENINGS

The Computer Science Program has several openings for lecturer positions involving teaching of programming languages and the participation in a number of projects among which are the computer-aided instruction and the computer graphics projects. The positions are open for the academic year 1985-86, starting September 1, 1985.

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Candidates are expected to have Master's Degree in data processing, computer science program, or an equivalent degree in a related field, with a working knowledge and/or experience of Cobol, Pasca, 370 Assembler Language, Fortran, PL/1, data base organization, operating system, or similar areas.

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Language of instruction is English.

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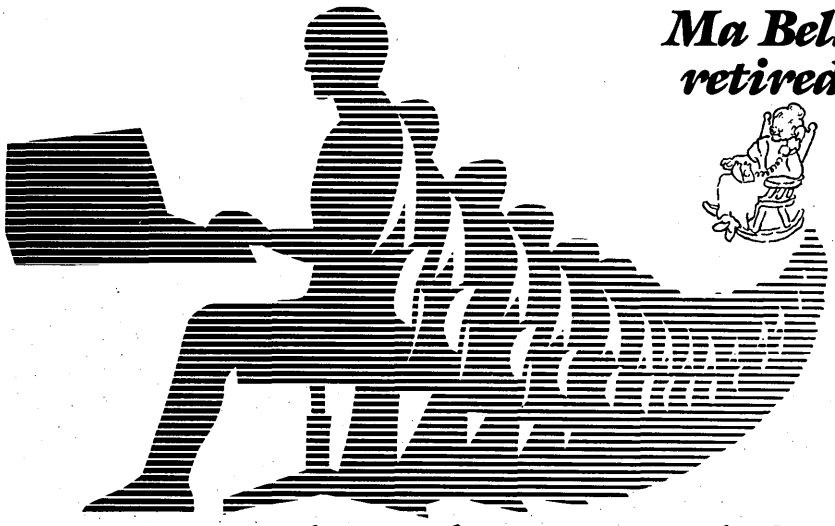

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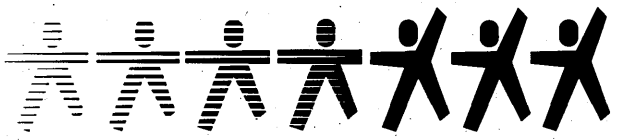

There's a whole new breed at Pacific Bell

will only be obtainable if senior managers are trained in the deployment of the new tools. His complaint is that "the OTA report does not address this key issue. There is no point in training technicians if we do not train our business leaders. Over the next 15 years, our economy will be driven by its manufacturing strength. We must ensure that corporate strategy includes manufacturing strategy as a central element."

Meanwhile, the people at Kelly Services have also offered some job market forecasts for the next 11 years, and have come up with some interesting numbers.

For instance, they say that total employment of 101.5 million in 1982 will soar to 127.1 million by 1995. That means a 25% increase in the work force (white collar workers now make up about half of the current total).The Kelly report says computer and communications technologies will provide new jobs in fields like robotics and knowledge engineering, while reducing the need for other jobs such as stenographers, postal service clerks, and data entry operators.

The need for certain workers will increase dramatically in this period, they say. For instance, Computer specialists are expected to increase to 943,000 in 1995 from 521,000 in 1982 (a growth of 81%). The number of secretaries will increase 29%, to 3.2. million in 1995 from 2.4 million in 1982.

Their jobs are changing as well. Currently 58% of all secretaries spend at least half their time using word processing equipment. In the nation's 1,300 largest companies, as many as 80% of all secretaries have access to and use wp equipment. In fact, the report claims that 98% of these companies use electronic equipment ranging from electronic (memory) typewriters to desktop computer terminals and communications networks. The most important reason companies gave for buying automated equipment is "improving worker productivity."

Kelly's study says that between now and 1986, U.S. businesses are going to spend about $1 trillion on information processing equipment and personnel to run and maintain such systems.

RECRUITMENT AID

If you have a job to fill, you might be interested in getting a copy of Deutsch, Shea & Evans's 10th annual *Recruitment Manual*, which lists information on more than 800 individual print media that are available for recruiting purposes.

The 1984-1985 guide includes the names of 250 daily newspapers, 250 specialized trade and professional journals in fields ranging from accounting and bioscience to robotics and training, as well as 24 Canadian newspapers. Most of the items include circulation, frequency of publication, and advertising costs.

There are listings of the 92 special career issues or supplements scheduled by U.S. newspapers through May 1985. Many of these are devoted to specialized career areas such as engineering, edp, medicine, and business. There is also a list of 100 campus publications that may be valuable to recruiters, and 40 national periodicals that reach minority groups and women in various professional and business categories. There are 33 professional and trade journals that utilize direct mail response cards.

Another list of 32 professional human resource publications may not be strictly for recruiting purposes, but is relevant to the information needs of personnel and human resource executives.

The Recruitment Manual is available for $25 from Deutsch, Shea & Evans Inc., Publications Dept., 49 East 53rd St., New York, NY 10022 (212) 688-0500.

—Lauren D'Attilo

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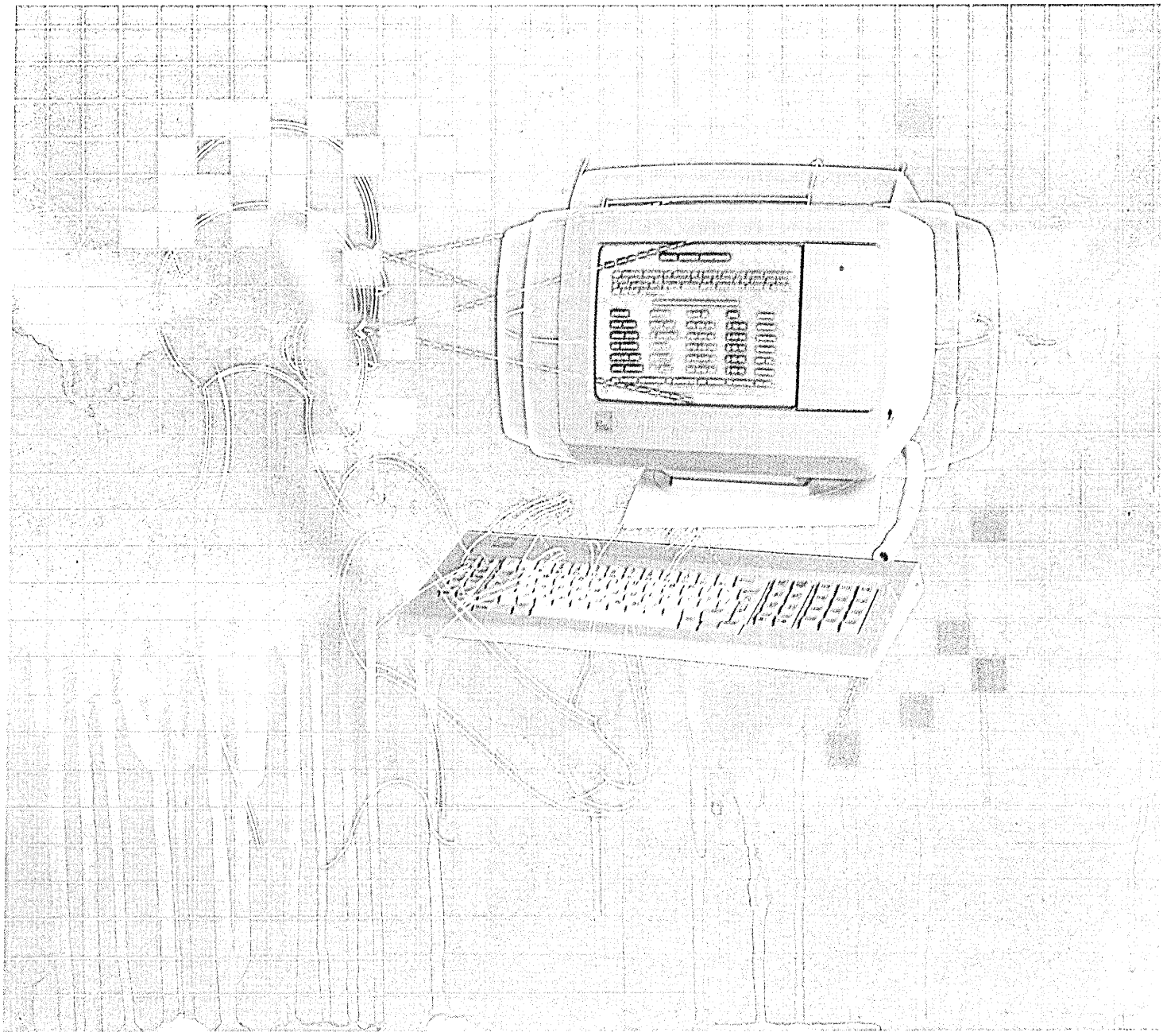

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CIRCLE 68 ON READER CARD

You are cordially invited to attend the Eleventh Annual

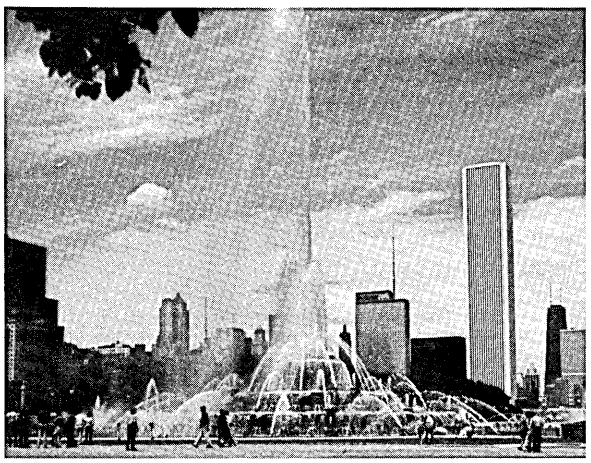
Computer Security Conference

GENERAL SESSIONS
Nine expert speakers will address a wide range of today's vital security issues. Whatever aspect of computer security you're involved with day-to-day, these sessions will broaden your professional perspective and help you do your job more effectively. This year's guest speakers include Judge William H. Webster, director of the FBI.

WORKSHOPS
60 workshops will be offered over the three-day Conference. Participants can attend 6 of these 1¼-hour sessions, led by experienced practitioners, that cover the entire spectrum of computer security concerns. You'll find something useful no matter what your area of interest or level of experience.

GRADUATE PROGRAM
This special 2-day program is designed to meet the needs of the advanced computer security professional with at least 4 years experience. There is no extra charge for this program, but space is limited.

EXHIBITION
Don't miss this opportunity to attend the National Computer Security Exhibition, the only one of its kind devoted solely to computer security. You'll see the latest in security products and services.



PERSONAL NETWORKING
The value of this Conference is much more than the formal program; it's also an unparalleled chance to meet professional colleagues, to share your headaches and experiences with people who really understand what you're up against. It's a once-a-year opportunity to significantly expand your network of contacts, enabling you to exchange ideas when you return to the job. Using a variety of mechanisms throughout the Conference, CSI makes this interaction happen.

Here's What Attendees Said About Last Year's

FINANCIAL

"**Still the premier computer security conference! An interesting and diverse program, well-organized and a great opportunity for information.**" David Puttock, Data Security Planner, Bank of Montreal

"**The best forum for exchanging security problems and solutions—presents 'state-of-the-art' & related topics in a concise fashion!**" Christine Jermyn, EDP Security Analyst, Mutual of New York

"**I was concerned that the conference could become repetitive over the years. But CSI listens to its members as is evident with the Graduate Program. Another great job!!!**" Frank A. Sydor, Security Analyst, First National Bank

"**I've been active in arranging security educational seminars at the regional and international level and you, your staff, and all the people that participated should be congratulated for one of the finest jobs I've seen.**" Daniel T. Cumberledge, V.P., Lincoln First Bank,

"**Overall, high quality. Useful in all aspects.**" David E. Farquhar, V.P., Nat'l Bank & Trust Co. of Norwich

"**Excellent; it really is a good opportunity for getting up-to-date on the data security field.**" Naftali Fasten, Asst. V.P., Republic Nat'l Bank of N.Y.

"**Very good conference. Great opportunity to exchange ideas with others in the field. Management of the conference was excellent.**" Dixie Alexander, Management Support Assistant, Bank of Virginia

"**Excellent!! I picked up a great deal of information & ideas that will be very useful in my field (disaster contingency planning). I also liked the luncheon seating by job title, industry, & special interest.**" James McClelland, Computer Operations & Facilities Manager, Suburban Bank

"**Overall, the conference was very good. I could see CSI had put a tremendous effort into it and CSI deserves credit.**" Chung Yau, EDP Auditor, Long Island Trust

"**An excellent forum for frank interaction on security/control issues (past, present, & future).**" E.H. Perley, Manager, Royal Insurance Canada

"**Excellent program presented by professionals in a no-nonsense program schedule. Lunches were good.**" Joseph F. Heissler, Dir. of Operations, Country Mutual Insurance Co.

"'**Job well done' CSI.**" John Cusick, EDP Auditor, First Nat'l Cincinnati Corp.

"**Well managed, informative, & enjoyable.**" Joseph B. Mihalyi, Systems Analyst, New Jersey Blue Cross

"**Of all the computer security conferences I have attended, this one is a must for computer security personnel.**" Joselyn Mascarenhas, Data Security Off., First & Merchants National Bank

MANUFACTURING

"**Excellent—one of a kind—seems to have something new every year.**" D.R. Lamberth, Security Specialist, Gulf Oil Corporation

"**Terrific—this is my third conference and, amazingly, it gets better every year.**" Ray Evans, Security Analyst, R.J. Reynolds Industries, Inc.

"**A very excellent conference that was extremely well planned; the best I ever attended. The Graduate Program is an excellent program to view several topics with experienced security managers.**" John O. Tosatto, Supv., Database Security, PPG Industries

"**High quality and content of sessions and workshops presented in a practical and usable manner. Thank you for another cost-effective and beneficial conference.**" Ezra W. Brooks, Security Coord., Burlington Industries

"**An excellent forum to learn from a cross-section of security practitioners. The exhibition was a great idea to expose us to many products available.**" Steve Cullen, Sr. EDP Auditor, U.S. Tobacco Co.

"**The conference was invaluable in my selection of security software.**" Paul Frazer, Mgr, Technical Support, Kennametal Incorporated

"**Best organized conference I ever have attended.**" Donald W. Horner, V.P. Systems, Colwell Systems

"**In a year of severe cost restraints, worth every penny!**" Ansgar Mantel, Manager, EDP Audit, Domtar,

"**The conference provides a wide variety of information for each of the professions involved in computer security: specialists, auditors, and DP personnel.**" John Noe, Contingency Recovery Coordinator, Armco

"**Very good conference. A well organized learning experience. Well worth the trip.**" Michael Adams, Supv. EDP Audit, Royal Canadian Mint

"**Very educational, eye-opener. Wish that I had the opportunity to attend a conference like this before starting my duty as an EDP security officer.**" Norman Dang, EDP Security Officer, Texas Instruments

"**Very good conference. All of the sessions I attended were very worthwhile. I'm looking forward to next year's conference in Chicago.**" Mary E. Kiley, Mgr., Security Services, Northern Telecom

"**The conference was very enlightening & an eye-opener. Picked up a lot of good pointers and ideas. Liked the personal schedule.**" Walter R. Mazuryk, Security Admin., Sterling Drug Inc.

"**Excellent—as usual.**" Rolf Moulton, Sohio

"**A very well managed conference which offered me the opportunity to tailor a program to my needs and security concerns.**" John Yandrisovitz, Auditor, Bethlehem Steel Corp.

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Chicago

and Exhibition

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A Hospitality Hour, "Time to Unwind" evening entertainment, plus luncheon every day, frequent coffee breaks, a streamlined registration process, a specially prepared Workbook, and your own individualized schedule for the entire Conference.

And finally, optional (at extra cost) programs to maximize your experience...

ONE-DAY SEMINARS (Open to non-Conferees)
You have the chance to attend one or two of the seven optional, full-day seminars offered in addition to the Conference sessions. Choose from two offered on Sunday and five on Thursday.

SPOUSES' PROGRAM
This optional 1½-day series of sight-seeing tours and seminars is offered to Conferees' spouses (and other family members) at CSI's cost.

ECONOMY
CSI has worked hard to keep your costs down. Hotel rates are quite low for the excellent Hyatt Regency accommodations, and bargain air travel is available to Conferees.

ABOUT COMPUTER SECURITY INSTITUTE
CSI, established in 1974, is the first full-service membership organization devoted solely to helping its more than 3,000 members safeguard their EDP resources and information assets. Services include a bimonthly newsletter *Computer Security*, the forthcoming *Computer Security Quarterly*, a "Hotline" telephone referral service, and reduced rates for conferences, seminars, and publications. CSI sponsors the Annual Computer Security Conference and Exhibition (generally referred to as the "Computer Security Event of the Year") and the Annual IBM Users Computer Security Workshop. CSI publishes the semiannual *Computer Security Journal*, the 500+ page *Computer Security Handbook*, the *Computer Security Manual*, and periodic special reports. The training arm offers both standardized and customized in-house training courses as well as a full program of regional public seminars throughout the U.S. and Canada. For information, use the Reader Service Number below, or call or write:

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"A multitude of ideas and suggestions for both the experienced and inexperienced computer security practitioner." James T. Spence, Sr. Staff Member, AT&T Technologies

"The exhibition and personal interchange have been very valuable for learning about the latest products for handling our security needs." George W. Siegmann III, Supervisor, Lockheed Missiles & Space Co.

"This is the prime source of information for companies to develop and benchmark their security systems. A great place to meet and converse with other security professionals." Frank P. Behm, E.I. Dupont Co.

"Opportunities for an interchange of ideas are fantastic. Most speakers were excellent." James S. McKinney, Sr. Systems Engineer, Brown & Williamson Tobacco

"This was the best organized and most helpful conference I've ever attended." Bill Miller, Mgr., Standards & Professional Development, Mitchell Energy & Development

GOVERNMENT

"Conference is the best single source of information on computer security on both the conceptual and technical levels. All this expertise in one place is an enormous resource for the data security community." Robert Sayre, Security Spec., Social Security Administration

"Superb conference, totally pertinent subjects by the best in the business." Leo G. Miller, Computer Security Officer, U.S. Air Force

"An outstanding event. The topics covered were timely, informative, and well presented. A definite contribution to the world of ADP security." Jerry Kushner, Network Security Officer, U.S. Army

"This was a very good conference in all aspects, especially the Graduate Program. Many good connections were made and the Exhibitions were like being in a candy store. Very well run as usual and quite enjoyable. Just too short." Richard Brinkley, Prog. Analyst, Bureau of Public Debt

"As always, a super job. There exists no better forum for the exchange of information on computer security." Robert S. Hansel, Capt. USMC, DoD Computer Institute

"I've attended many data processing conferences. This was my first Computer Security Conference—and the best of all!" Robert P. Bell, EDP Security Officer, Naval Supply Systems Command

"Highly professional and well-managed conference. It is truly the EDP security event of the year. A wealth of information." Mary Anne Todd, Systems Analyst, Naval Supply Systems Command SSSG-N

"Of great interest. The best place to interchange about security topics." Michel Dubois, Systems Analyst, Government of Quebec

"I felt the conference was motivating and inspirational. The handouts will be quite useful in enhancing our ADP security program." Robert N. Learn, Head Applications Programmer, Naval Surface Weapons Center

"Well done—tightly run—solid subject matter." George Mayerchak, Program Analyst, Veterans Administration

"I find the annual 'plugging in' with my fellow practitioners very stimulating. Will try to bring a team next year. I'm proud to be a member of the organization." Mae C. Morris, ADP Security Officer, Navy Finance Center

"As usual you did an excellent job in putting this program together. It still is the only single source for a security administrator to get all the security tools." Horst Rahden, Corporate Security Officer, U.S. Railroad Retirement Board

SERVICE

"Absolutely the best 'meeting of methods and minds' for all concerned with security." Susan Fletcher, Coord Sys Mgt, Union Gas Limited

"Attending for the 7th straight year, I'm still impressed with the high standards and quality this conference achieves." F. Wayne Barnett, Corporate MIS Security, Sonat Inc.

"Conference was very well organized. Impressed especially with workbook, the individual schedules, and the providing of handouts at the workshops." David D. Israel, Chief Staff Auditor, Washington Gas Light

"I was extremely impressed by the caliber of general speakers and workshop speakers. Overall organization of conference is superb." William Gieske, Bell Laboratories

"The value of this conference to those attending who took full advantage of the various seminars and exhibit materials is simply unmeasurable! The conference program for the 'Graduates' was excellent in content and was most relevant to today's security issues." Gerald L. Huerta, Security Consultant, Martin Marietta Data Systems

"Well structured to provide 'something for everybody' involved in computer security." Daniel D. Cottrell, Manager-Security, AT&T Communications

"Excellent, well-managed conference—keep up the good work." C.M. Elliott, Dir., Quality Assurance & Security, Martin Marietta Data Systems

"Enjoyed the conference very much. Felt the material presented was insightful in addressing the concerns of today's security practitioner." Steve Foley, Sr. EDP Auditor, Days Inn of America

"Overall very informative for auditors, security officers, and everyone connected with EDP security." James S. Sigmon, Jr., Computer Security Analyst, Aramco

"Excellent—Best technical conference I have attended." Kenneth C. Kendrick, Dir., Internal Audit, Informatics General Corp.

"Stimulating—I accumulated 16 action items in the first two days; well worth the cost of the conference." Gerald W. Grindler, Mgr., EDP Security, Southwestern Bell

"The information I get from this conference is invaluable to me as a data security administrator. That is why I have kept coming back year after year for ten years." Melvin Swanson, Data Security Admin., Borden Incorporated

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WE'RE FIGHTING FOR YOUR LIFE

An exchange of readers' ideas and experiences. Your contributions are invited.

READERS' FORUM

WHY HAVE INFO SYSTEMS FAILED?

"That darn user has no idea what information he wants, and he keeps changing his mind about what he said."

"Those data processing people take forever to do anything, speak in their own language, and think they know my business better than I do."

If these and other similar complaints sound familiar, it's because they reflect the sentiments of the majority of computer and business people. Recent studies show that most dp organizations still develop systems and applications without soliciting user advice—they only check with them after the system is complete. Indeed, the user's supposedly larger role in the system development process has either been relegated to the back burner or is nonexistent.

Is there any question, then, why users by the tens and hundreds of thousands are rushing to buy personal computers? Surely there are many legitimate and valid uses for pcs in a corporate environment; but not when they are bought for the wrong reason (to get around dp!), or will be misused and, in the long run, create a chaotic, potentially dangerous scenario. This is especially true when considering the value, benefit, and essentially crucial nature of having corporatewide data where everyone in the organization talks about the same information in the same way. In other words, where something means the same thing to everyone! For example, what do you mean when you say "product cost," or "full sales value," or "head count"?

A company's data are a critically important resource and can't be allowed to be fragmented, hoarded, stolen, or uncontrolled. Yet that often happens when frustrated users buy pcs (as "oscilloscopes," "calculators," "AV equipment," or whatever else shows up on the purchase order) because they can't have their informational requirements satisfied by dp. Recently, there have been numerous attempts by the dp community to provide Band-Aid solutions like information centers, fourth generation languages, prototyping, and decision support systems.

All of these are attempts to let the users "do their own thing," and in many cases they provide very valuable assistance. Unfortunately, as with most panaceas, they are oversold, overpromoted, and stand a good chance of only increasing the user's frustration. For instance, if an organization's databases have not been properly built to have sharable, consistent data, fourth generation languages or information centers won't help users retrieve the exact data they want. The problem is compounded if the data come from different places and if they have different names or meanings wherever they appear. These are some of the reasons why it may really take data processing so long to produce what appears to the user to be a simple request. Similarly, prototyping, decision support systems, and so on are all good tools, but must be used in the proper context and with the right planning and databases in place.

The basic truth is consistently overlooked. You must understand your business before you can either automate it or develop information system support for it; you must know what you do and how you do it before you can improve or change it. Once this understanding is developed and communicated, the users and technicians can work together and make effective use of these new and powerful techniques.

Why does this situation exist? If we temporarily put aside the professional disdain many dp folk have for the "less than sophisticated and unimaginative user," there are some clearly identifiable reasons why this disastrous communications gap exists. If we go back to the dark ages of punch cards and the first generation business computers—UNIVAC I, IBM 650 and 705, etc.—the first programmers and system analysts actually were the users, or at least came from the using functions. Most companies, at that time, took people from functional areas, such as manufacturing, accounting, and sales, and taught them programming and system design. Thus, the first systems, applications, and programs were written by users who understood their own business area. Generally, the systems developed were not very exotic since they primarily automated the repetitive, clerical activities and other similar tasks of the business functions.

This situation remained essentially static for a number of years until, slowly but surely, the retrained users became computer and data processing professionals and were no longer accountants, purchasing agents, and manufacturing/material analysts. Indeed, because of the rapid growth in data processing and the lack of qualified people, these ex-users were now forced to deal with many areas outside of their original expertise.

Rapid progress in technology spawned such new and wondrous things as operating systems, terminals and on-line systems, higher-level languages (COBOL, FORTRAN, PL/1), databases and database management systems, and so forth. This onslaught of technology swung the pendulum completely away from the original starting point of the "user turned programmer."

The new, predominant mode for bringing people into an information system organization, (aside from the rampant pirating of experienced people from the other companies) became the hiring of new or recent college graduates. The nation's colleges and universities had now developed computer-oriented curricula and were beginning to produce computer science graduates. While the curricula, in general, produced people that were aca-

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READERS' FORUM

demically oriented, they did have a very solid, basic computing foundation.

This combination of technically oriented people and the overabundance of new technologies has led to our current state of superspecialization. We now have systems programmers who work mostly with operating systems, computer science experts who work with compilers, database administators who work primarily with databases, and so on. Most of the other graduates (nonspecialists) have become generalists—systems analysts or programmer analysts, depending on what titles their respective companies adapt. These technically oriented people have become the dp experts whose jobs are to help users manipulate their information systems to meet their business requirements.

For the most part, these dp people have had no training in what business is, what is involved, or how to find out what that is. What's even worse, in many cases they haven't cared.

During the past 10 to 15 years, technicians have generally taken the position that they were the experts and it was the user's responsibility to tell them what the requirements were. What's more, the user should express those needs in terms the dp expert could understand! Only then would a systems design be created that would hopefully meet what the technician thought the user wanted. In many cases, the dp people decided—on their own—to "improve" the way the system worked.

Of course, much of this was done incorrectly, poorly, irresponsibly, and many times with acrimonious results. Logically, then, dp organizations are not well respected by the users, and vice versa. So we now see users buying personal computers, pushing for information centers, and so on, to try and get around dp to get the information they need.

While we are sympathetic to the reasons for this dichotomy, the situation must change. The only way this crucial communication barrier will be smashed once and for all is to have the users and dp people truly work together in defining and understanding what the business is, what it does, how it does it, and what data it needs.

There are now methodologies and technologies, which have been developed at great expense over a long period of time, that make dramatic strides in solving these problems. They are not inexpensive. They require a change in the way dp people do things, an organizational/corporate commitment to a new way of doing things (e.g., do it right the first time), and the recognition, by most companies, that they had better start now or be left behind in this highly competitive business world of ours. Only then will computing systems, with their benefits of productivity, reliability, and accuracy, be properly supportive of the corporation. If this evolution begins now, during the coming years the two groups will merge to become businesspeople with an excellent knowledge of their business and how computers and information systems can support their business goals and objectives.

—Herb Jacobsohn
Burlington, Massachusetts

ORATORIO

The campaign's grotesque
And needs to be muter
When they promise a desk
Under every computer.

—Edmund Conti
Summit, New Jersey

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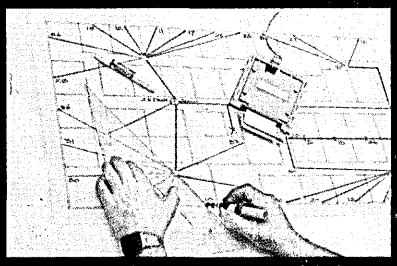

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