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OCTOBER/3.00 U.S.A.

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

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

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

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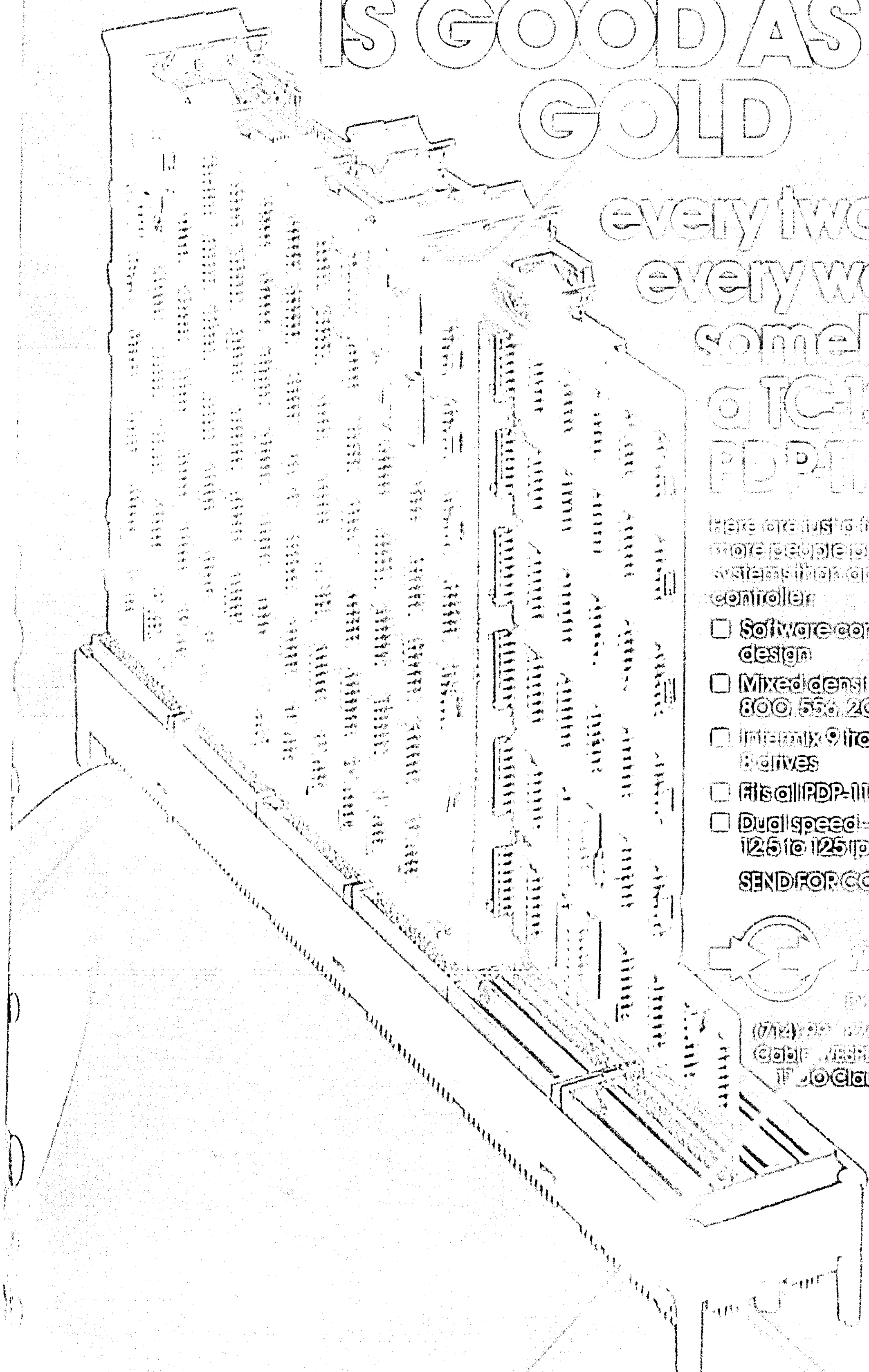
CIRCLE 1 ON READER CARD

OUR PDP-11* MAGTAPE CONTROLLER IS GOOD AS GOLD



every two hours of every working day somebody puts a TC-130 on a PDP-11 computer

Here are just a few of the reasons more people put TC-130's on their [illegible] systems than any other magtape controller:

- ☐ Software compatible—embedded design
- ☐ Mixed density—1600 bpi PE and 800, 556, 200 bpi NRZ
- ☐ Intermix 9 track and 7 track, up to 8 drives
- ☐ Fits all PDP-11 Series Computers
- ☐ Dual speed—[illegible]table, 12.5 to 125 ips

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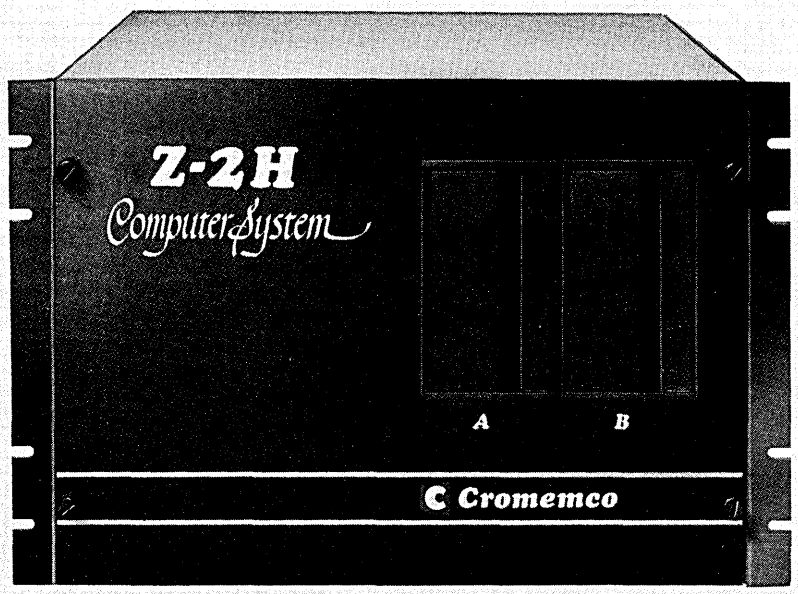
*Trade name of Digital Equipment Corp

CIRCLE 74 ON READER CARD



Low-cost hard disk computers are here

11 megabytes of hard disk and 64 kilobytes of fast RAM in a Z80A computer for under $10K. Two floppy drives, too. Naturally, it's from Cromemco.

It's a reality. In Cromemco's new Model Z-2H you get all of the above and even more. With Cromemco you get it all.

In this new Model Z-2H you get not only a large-storage Winchester hard disk drive but also two floppy disk drives. In the hard disk drive you get unprecedented storage capacity at this price—11 megabytes unformatted.

You get speed—both in the 4 MHz Z80A microprocessor and in the fast 64K RAM which has a chip access time of only 150 nanoseconds. You get speed in the computer minimum instruction execution time of 1 microsecond. You get speed in the hard disk transfer rate of 5.6 megabits/sec.

EXPANDABILITY

You get expandability, too. The high-speed RAM can be expanded to 512 kilobytes if you wish.

And the computer has a full 12-slot card cage you can use for additional RAM and interface cards.

BROADEST SOFTWARE SUPPORT

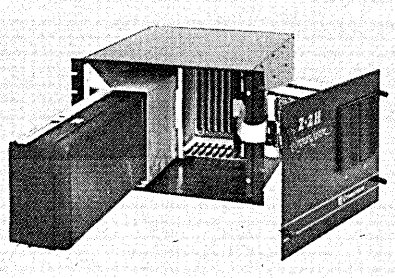
With the Z-2H you also get the broadest software support in the microcomputer field. Software Cromemco is known for. Software like this:

- **Extended BASIC**
- **FORTRAN IV**
- **RATFOR (RATional FORtran)**
- **COBOL**
- **Z80 Macro Assembler**
- **Word Processing System**
- **Data Base Management**

with more coming all the time.

SMALL, RUGGED, RELIABLE

With all its features the new Z-2H, including its hard disk drive, is still housed in just one small cabinet.



Hard disk drive at lower left can be interchanged just by sliding out and disconnecting plug. Seven free card slots are available. Z-2H includes printer interface card.

Included in that cabinet, too, is Cromemco ruggedness and reliability. Cromemco is time-proved. Our equipment is a survey winner for reliability. Of course, there's Cromemco's all-metal cabinet. Rugged, solid. And, there's the heavy-duty power supply (30A @ 8V, 15A @ +18 V, and 15A @ −18V) for circuitry you'll sooner or later want to plug into those free card slots.

CALL NOW

With its high performance and low price you KNOW this new Z-2H is going to be a smash. Look into it right now. Contact your Cromemco computer store and get our sales literature. Find out when you can see it. Many dealers will be showing the Z-2H soon—and you'll want to be there when they do.

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CIRCLE 71 ON READER CARD

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DATAMATION 79®

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130


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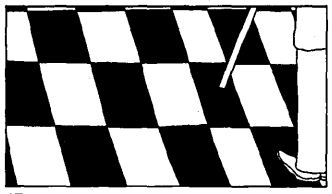
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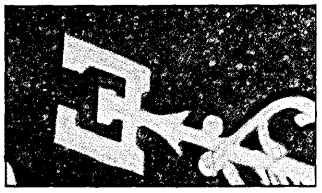
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FEATURES

COVER
The swinging doors swallow and disgorge computer industry employees faster and faster. And at each turn the paychecks get fatter and fatter. Photograph by Arthur Klonsky ©1979. Makeup by Joan Zandell.

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Art & Editorial Production
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CIRCULATION
666 Fifth Avenue, New York, NY 10019
Circulation Manager Suzanne A. Ryan
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Technical Publishing
a company of The Dun & Bradstreet Corporation

BPA Circulation audited by Business Publications Audit

ABP Member American Business Press, Inc.

DATAMATION (USPS 148-800) Magazine is issued monthly on or about the first day of every month, plus one special issue in mid-May. Published by Technical Publishing, a company of the Dun and Bradstreet Corporation, 1301 South Grove Ave., Barrington, Illinois 60010; James B. Tafel, Chairman; John K. Abely, President. Executive and Advertising offices, 35 Mason Street, Greenwich, CT 06830, (203) 661-5400. Editorial offices, 1801 S. La Cienega Blvd., Los Angeles, CA 90035. Published at Chicago, Ill. DATAMATION is circulated without charge by name and title to certain qualified individuals in the United States and Canada who are employed by companies involved with automatic information handling equipment. Available to others by subscription at the rate of $32 (U.S. and Possessions), $42 (Canadian). Reduced rate for qualified U.S. students: $16. Foreign subscriptions: £33.50. Additional charge for airmail: £30.00. Japan, Australia and New Zealand: £38.50 (air-shipped). Sole agent for all subscriptions outside the U.S.A. and Canada is J. B. Tratsart, Ltd. 154 A Greenford Road, Harrow, Middlesex HA1 3QT, England, (01)422-8293 or 422-2456. No subscription agency is authorized by us to solicit or take orders for subscriptions. Controlled circulation paid at Columbus, OH.

POSTMASTER: Form 3579 to be sent to Technical Publishing Company Circulation Office: 666 Fifth Avenue, New York, NY 10019. Publication Number: 148800. Single copy: $3.00 in U.S.A.

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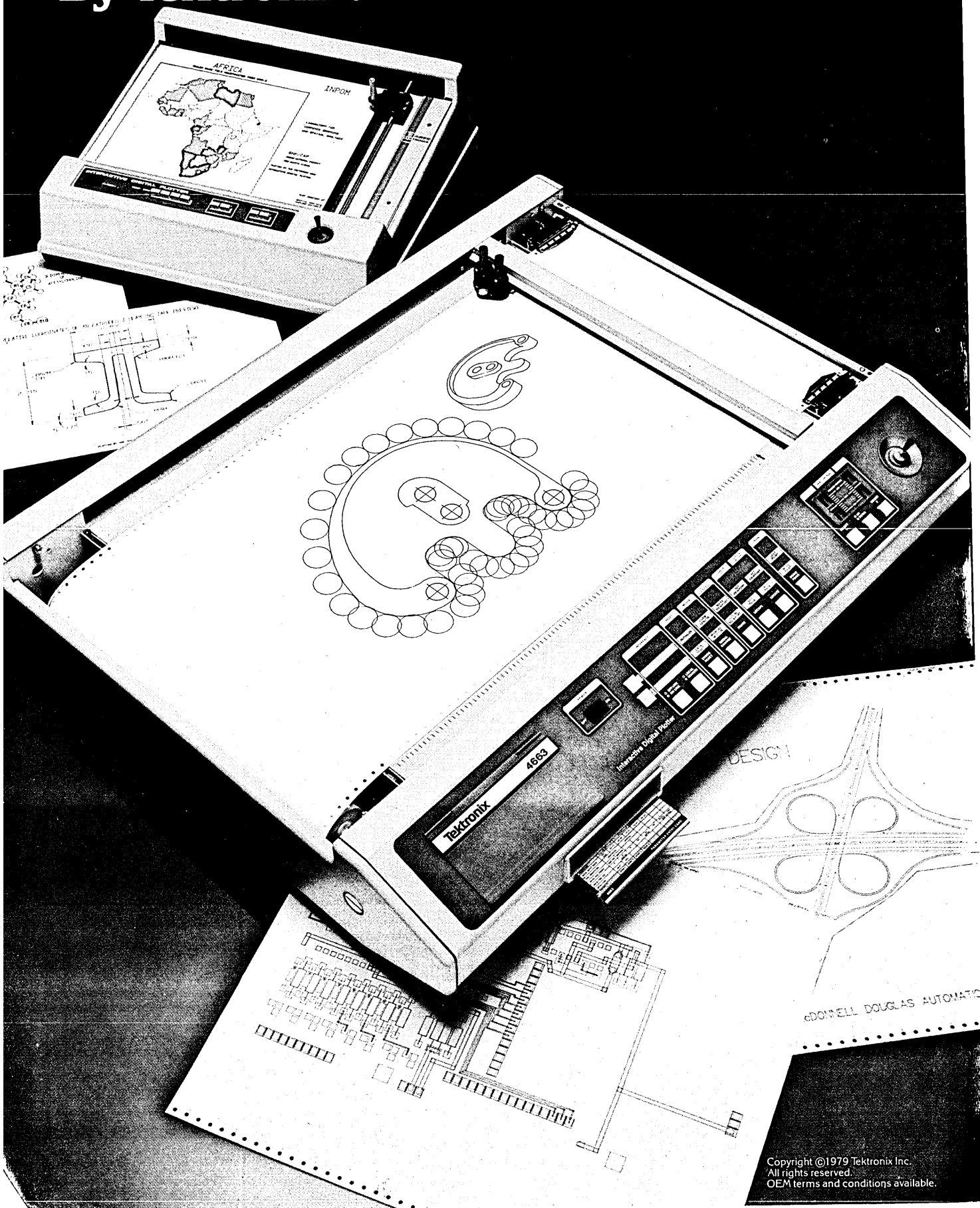

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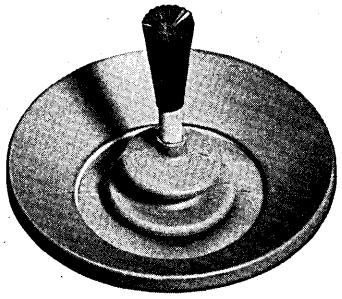
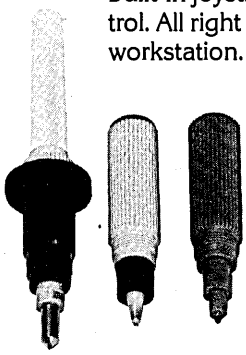
At Tektronix, we build plotters that pay for themselves.

Practicality is why Tektronix pioneered the smart small plotter. Why we led the move to more reliable, digital technology. We're proving that big plotter performance can take a small plotter price, with capabilities like those of our C-size (A2) 4663.

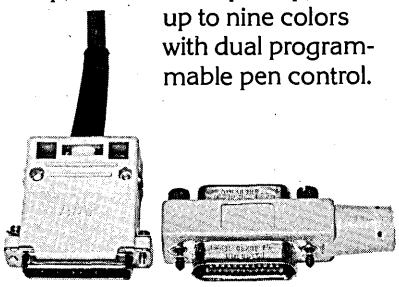
Economy. Instead of waiting in line for large plotter output, you can typically do two-thirds of your plotting on our 4663, with comparable quality. Faster turnaround. Tremendous cost savings.



Interactivity. Microprocessor intelligence not only makes the 4663 semi-independent, it lets you draw real curve forms. Rotate characters. Digitize with built-in joystick control. All right at your workstation.



Versatility. The 4663 plots on paper, film or Mylar® With felt tip, wet ink or ballpoint pens. In up to nine colors with dual programmable pen control.



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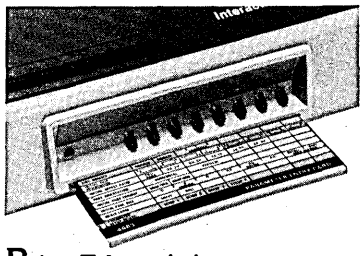
Simplicity. Our parameter entry card replaces rear panel straps and switches with a simple system for setting up to four sets of operating conditions right from the front panel, so one plotter can instantly accommodate four totally different jobs.



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TWENTY YEARS AGO/TEN YEARS AGO

LOOKING BACK

SEPTEMBER/OCTOBER 1959

Rumors of a new, solid-state computer out of IBM "called the 1401" were reported in this issue. The source of this piece of news thought the new machine would be "somewhere in the spectrum of the 7070 class"—erroneously, as it turned out. There also were rumors that a solid-state Univac III would be announced the following year. And people were anticipating Remington Rand's answer to IBM's powerful 7030. But it was thought the RemRand Larc would emerge "at half the cost but half as fast as Stretch."

At the MIT Lincoln Laboratory in Lexington, Mass., a high-speed magnetic film memory with a capacity of 32 ten-bit words was placed in operation. It was part of the TX-2 computer that, like the new memory, was developed under Air Force contract. The read-write cycle time was 0.8 microseconds. Each memory element was a circular spot of Permalloy film measuring 1.6 millimeters in diameter, centered 2.5 mm apart. "The spots are deposited by evaporation on a flat glass substrate," it was said, in 16 × 16 unit arrays.

Some interesting hardware from Japan, described by observers as "very representative" and "clever," was exhibited in Paris at the first International Conference on Information Processing. Among them was the HIPAC 101, which stood for the Hitachi Parametron Automatic Computer. Constructed of some 4,500 parametrons as logic elements, the scientific, fixed-point machine featured decimal to binary conversion and word lengths of 39 bits plus sign and 19 bits plus sign.

Nippon Electric was there with the NEAC 2201 computer, which had a 200-kilocycle clock pulse. No mention is made of main memory capacity, but it came with a 200-cps paper tape reader and an 8-cps punch.

OCTOBER 1969

A new mainframe received lengthy treatment in this issue, too. The IBM 360/195 had just been announced, and the writer noted that detractors referred to it as "just a 360/85 without the plumbing." The cpu had a cycle time of 54 nanoseconds, the core memory 756 nsec, and core was expandable to four megabytes. Purchase price ranged from $7 million to $12 million, rentals from $165K to $300K.

IBM vice president and chief scientist Dr. Emanuel R. Piore, speaking at an ACM conference in San Francisco, chided the nation's academic community for failing to provide intellectual leadership for the industry. "We need very badly a scientific base for our industry," he said. "We'll get into a lot of trouble—with operating systems, compilers, assemblers—we will not make much progress unless we have a much firmer intellectual base . . . unless we shift from being an industry to being a science."

Piore was right, of course, when he foresaw problems with software. Somewhat less accurate are predictions made by other industry pundits and recalled in a feature article by Fred Gruenberger. He tells of a film narration that in 1960 observed the use of 60 large-scale computers in the U.S. a decade earlier, a figure that apparently had grown to 3,500 by '60. "A decade hence," the narration continued, "there may be over 15,000 computers. Perhaps as many as 10 times the number of people involved today will be employed full time with the computers of the future."

Gruenberger couldn't resist the temptation to cite an early market survey by IBM, one that indicated a production run of some 50 for the new 650s. Indications are that IBM eventually shipped more than 1,000.

Getting back to the news department, RCA had just dedicated its new $12-million manufacturing facility in Marlboro, Mass. On that auspicious occasion, the company also announced its large time-sharing machine, the Spectra 70/61. It was said to have twice the speed of a 360/50 and lease for some $40K per month and up. Maximum core size was one megabyte, but each user had access to a virtual memory of two megabytes. ✲

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CIRCLE 83 ON READER CARD

Imagine what you could do

You've never seen anything like the HP 300. Its user-oriented environment gives you opportunities for program development that you wouldn't have believed possible on a computer this size. Or on one many times larger, for that matter.

With its advanced display and editing capabilities, you can easily dedicate the HP 300 to a wide range of specific departmental jobs. Order entry, for instance. Customer files. Personnel records. Any job, in fact, that requires constant updating of information and easy access to a variety of data—all by people with little or no computer experience.

What's more, the HP 300 starts at only $36,500. So let your imagination go. Then come in and see for yourself the start of something big in small business computers. For a hands-on demonstration, just call your nearest HP office listed in the White Pages and ask about the HP 300 seminar scheduled for your area. Or for more information write Hewlett-Packard, Attn: Bob Kadarauch, Dept. 456, 11000 Wolfe Road, Cupertino, CA 95014.

Integrated Display System
Focused, single point control provides a highly interactive, environment that's easy on the user as well as the programmer.

Display
The screen can be split into eight asynchronously controlled "windows" to view various aspects of your applications. And you can attach each area to a complete data file to scroll horizontally up to 160 columns, and vertically for the entire length of the file.

Operating System
The virtual memory operating system supports RPG-II and enhanced BASIC languages with powerful multiprogramming and multitasking capabilities. And now you can fine tune your BASIC programs with SL/300, an advanced, high-level systems programming language.

Program Development
A special language subsystem manages all aspects of your programming environment—just a keystroke, for example, and the system automatically does compilation, binding, and linking. You can easily convert IBM 32/34 programs to run on the HP 300, and for additional applications development, the economical HP 300 Satellite Workstation is available, with full display and editing functions.

Memory
You can expand 256K bytes of error-correcting main memory to one megabyte for large data sets and big programs. And with the addition of separate disc units, the system can accommodate up to 490 megabytes of on-line disc storage.

Processor
HP's proprietary silicon-on-sapphire technology put the CPU logic onto six CMOS chips for greater speed and reliability, and lower power requirements.

Attention Facility
By simply depressing an ATTENTION key, you can put the entire system on hold while you satisfy an immediate request. And when you're ready, the computer picks up exactly where you left off.

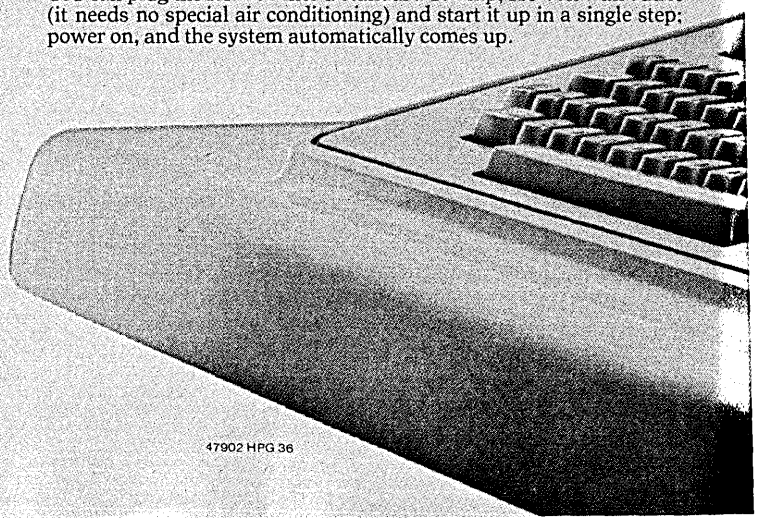
Remote Terminals
The HP 300 can support up to 16 terminals, by direct connection or via a modem.

Soft Keys
Eight special function soft keys right on the console can be dynamically labeled to guide the user (without any computer experience) step-by-step through any job.

Power
You can plug the HP 300 into a standard 10 amp, 115-volt wall outlet (it needs no special air conditioning) and start it up in a single step: power on, and the system automatically comes up.

HEWLETT hp PACKARD

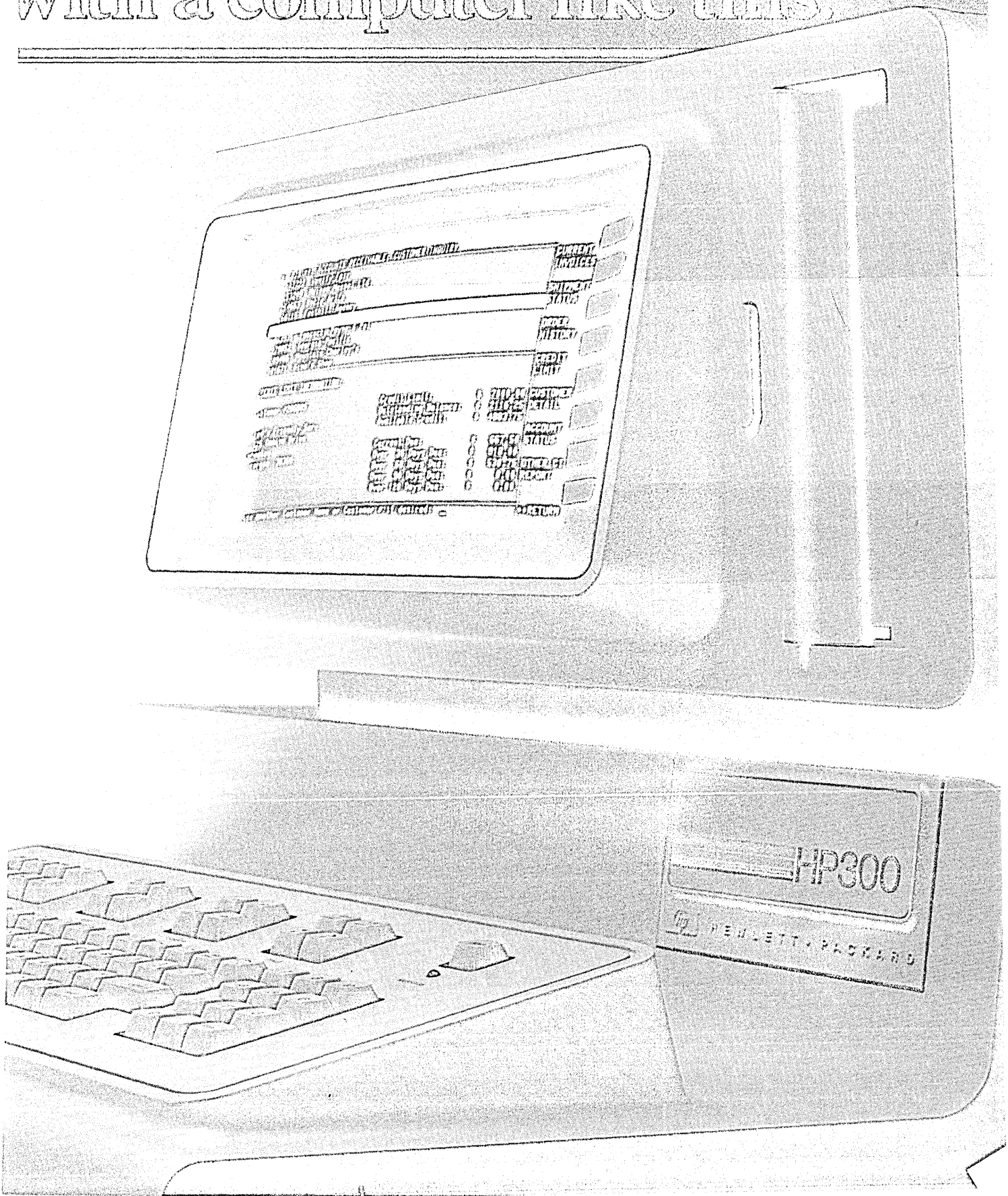
CIRCLE 37 ON READER CARD



Price is U.S. list.

47902 HPG 36

with a computer like this?

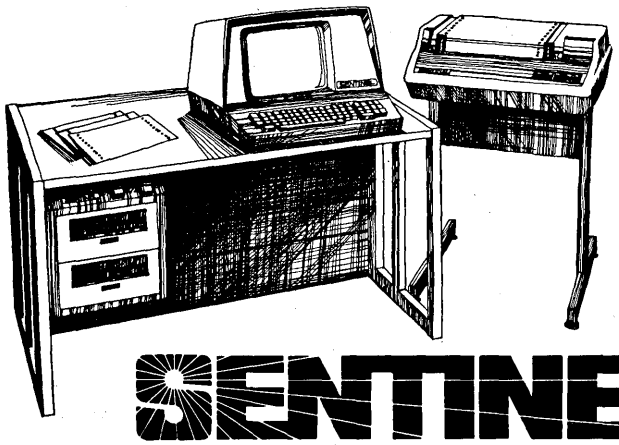


WHEN WE SAY WE'LL BEAT THE PANTS OFF THE COMPETITION...

We'll beat their pants off!

Sentinel is the "not-just-another-computer" computer company.

When it comes to the very latest in microprocessor based technology, Sentinel leads the way! Sentinel offers you four computers, from a diskette drive model that delivers 1.6 megabytes, up to four disk drive Winchesters with a total cabability of 120 megabytes and accommodating as many as 17 CRT's and 17 printers. Main memory storage can be up to one million characters, and Sentinel's Data Base Operating System provides the complete facility to implement interactive integrated information systems. In short, Sentinel offers you upgradability that is virtually unsurpassed!



Sentinel incorporates 16 bit microprocessor technology into each Sentinel computer to provide more power and remarkable computing speed. And the Sentinel system features a substantial reduction in the physical space required to deliver such dynamic computing power!

We're so confident in the capability, flexibility and pure "saleability" of the Sentinel system that when we say we'll beat the pants off the competition . . . we'll beat their pants off! That's why Sentinel *is* the "not-just-another-computer" computer company.

A limited number of territories are still available for qualified distributors. Inquiries are invited. Contact or call: Mr. Jack Peters, National Sales, or Mr. Leland Cole, International Sales, for more information.

SENTINEL

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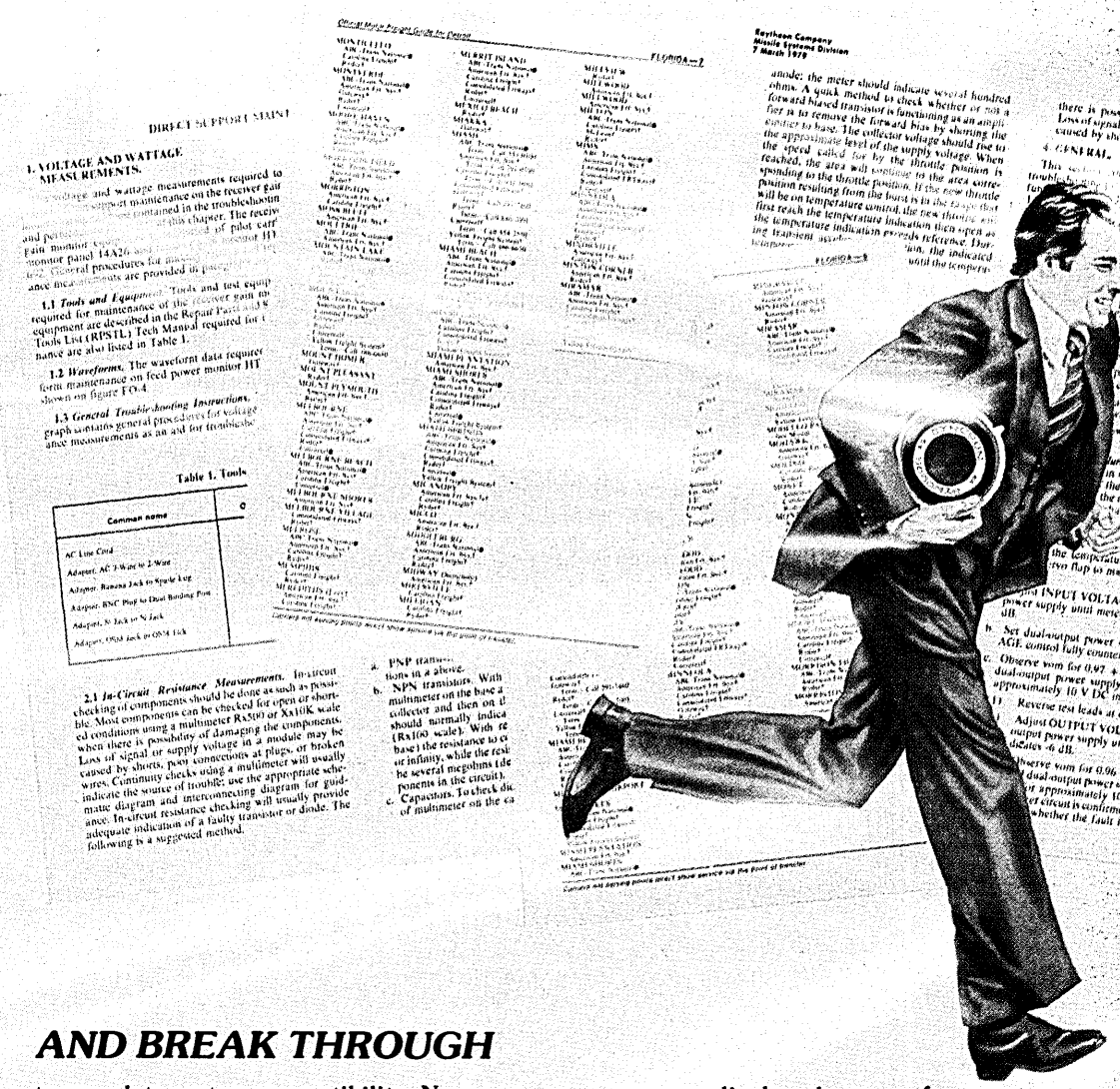

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to complete system compatibility. Now our APS-5/COMP Phototypesetting System can talk to your Word Processing System in a language they both understand.

If you're still producing reports, manuals, proposals, legal documents and a small mountain of other technical matter in standard typewriter quality, we have good news for you. You can now TYPESET those documents on the most Intelligent Phototypesetting System in existence—the APS-5/COMP from Autologic. The high-speed Phototypesetting System that has, at last, overcome the language barrier.

APS-5/COMP CAN TALK TO ANYONE—DACONICS, WANG, JACQUARD, ATS/ATMS, and a multitude of others. In fact, whatever language *your* front end system speaks, our APS-5/COMP System understands. APS-5/COMP's program is written with your system in mind. That means no special coding, no need to imbed commands into your text, and no special operator training. Simply enter your data into the APS-5/COMP System via mag tape. No translation or data restructuring is required. Make your composition selections from the "menu" displayed on one of our system terminals and then put the system to work. You'll be generating camera-ready copy at up to 8,000 characters per second, *fully composed and paginated*. The power of APS-5/COMP provides total composition flexibility while eliminating any restrictive language hang-ups.

CONSIDER THE INCREASED IMPACT that typeset documents will have, both internally and on your ever-important customers.

CONSIDER THE SAVINGS in paper, handling and storage realized by the reduced size of typeset documents compared to your current bulkier, less impressive typewritten documents. A savings that could possibly reach thousands of pages per year.

YOUR WORD PROCESSING SYSTEM and our APS-5/COMP Phototypesetting System. A perfect match. Let's get them speaking to each other. But before they can talk, we have to talk—about exactly the right system for you. So give us a call.

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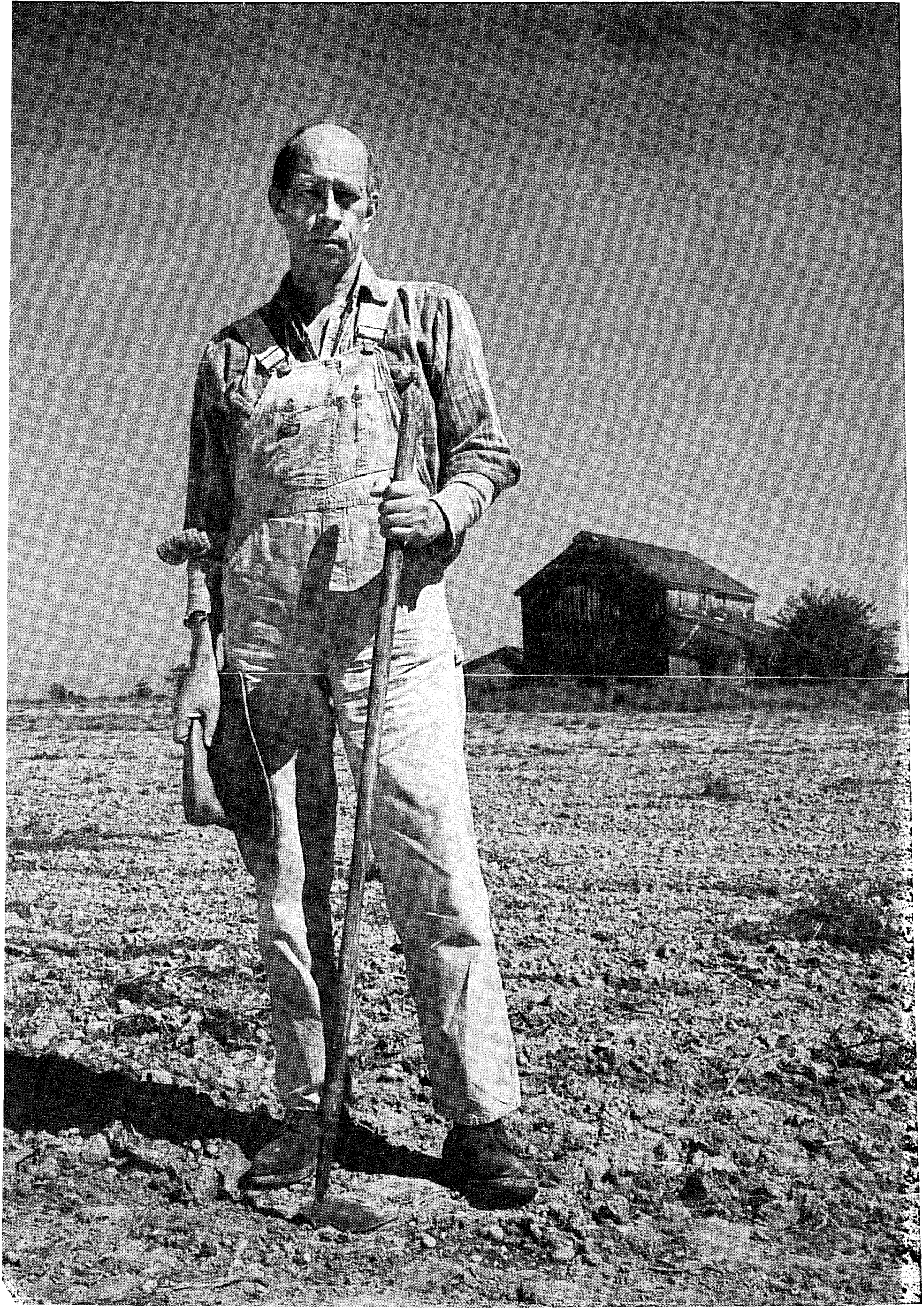

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The American work ethic has always assumed that if you worked hard, your efforts would be rewarded.

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Information Management isn't a way of sidestepping hard work. It's a way of making it more productive.

For example, there's no virtue in having to spend hours typing, retyping and re-retyping documents. So we make electronic typing systems that let you type, revise and retrieve information in a lot less time. Which gives you a lot more time to create and perfect it.

To make information easier to work with, we make a full range of copiers, duplicators and computer printers. Ones that not only reproduce, but can reduce, collate or even print in color.

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BTI, 870 W. Maude Ave., Sunnyvale, CA 94086. Sales Offices: Piscataway, NJ (201) 457-0600; Cherry Hill, NJ (609) 662-1122; Braintree, MA (617) 843-4700; Minneapolis, MN (612) 854-1122; St. Louis, MO (314) 878-8110; Dallas, TX (214) 630-2431; Sunnyvale, CA (408) 733-1122; Anaheim, CA (714) 533-7161.

LOOK AHEAD

IBM STARTS SHOWING ITS 256K CHIP

IBM scientists showed photographs of 256K CCD chips and discussed high density memory production strategy at an invitation-only IEEE workshop on solid state circuits in Oregon last month. "It's still experimental," said one participant, "but they're much further along on it than I thought they'd be. They seemed very serious about it."

"The design is very similar to the TI design in terms of loops, but the manufacturing process seems identical to the Fairchild process," noted another workshop attendee. "My impression was they were using an implanted barrier type structure, rather than TI's implanted well approach. They seemed to be basically using Fairchild's approach, but stressed their techniques for saving and using good partials from damaged chips. It's the only thing they believe makes very large CCD memory a viable technology."

The 256K chip displayed was on a 34 millimeter chip, which was claimed as double the density possible with RAM on the same chip. Reportedly, the big CCD chip used an eight-phase clocking system, 16 4K parallel series blocks, and IBM's controversial 8.5 volt power supply. IBMers from Fishkill, N.Y., claim that 8.5 was the optimum power supply because it maximizes the ratio between the store charge -- which determines the state of the memory cell -- and the charge collected by an alpha particle.

STANDARDS FOR WORD PROCESSING

There may finally be a faint ray of hope on the horizon for users that want to set up communication links between multivendor word processing equipment and with cpu's. The veritable jungle that now exists in word processing communications has drawn the attention of a new ANSI study group dealing with communications requirements for text communications.

Known was Working Group 4 (WG4), the standards efforts on word processing is part of X 4A12 which covers text communications. While ANSI X3, dealing with computers and information processing, is familiar to dpers, X4 covering the office machine sector is not as well known. Specifically, WG4 will develop standards "which will enable communicating word processors, produced by different manufacturers, to communicate with each other, and with computers which handle text."

Three levels of work have been defined. First, WG4 will develop a page image format for basic communications. The second level will include unique codes and characters used in word processing. The third and most important level includes networking considerations for circuit-switched and packet-switched nets to be compatible with existing ISO and CCITT standards. User and vendor inputs to this effort are being solicited. Details are available from the X4 secretary at CBEMA, 1828 L St., NW, Suite 1200, Washington, D.C. 20036.

LOOK AHEAD

LEXAR TO MARKET WP SYSTEMS

The Lexar word processing terminals that have been used experimentally in the microcomputer based management workstations at Citibank's Project Paradise (September, 1978, p. 104) are now being marketed. First product demonstrations of the machines, which are manufactured by Lexar Corp. in Los Angeles, have been to other divisions of Citibank. Additionally, market demos reportedly are being arranged out of the brand new Lexar office in Citicorp's New York headquarters.

Citibank, which funded the Lexar product, had hoped to find a way to market the terminals themselves, but ran into legal restraints. And now, Lexar is gearing up for the marketing effort itself. It has even split off a new company, Lexar Business Communications, to be located in Woodland Hills, Calif. Volume production of the terminals are planned for next year.

INDICTMENT IN LOS ANGELES; TRIAL IN NEW YORK

David T. Herr, vice president of business development for Bowne Information Systems, New York City, did not come to trial Aug. 28 in Los Angeles on charges he illegally accessed computers belonging to Proprietary Computer Systems, Inc., Los Angeles (September, p.101). Indeed he won't be coming to trial in Los Angeles at all. Over objections from the Los Angeles U.S. Attorney's office, Judge David W. Williams granted a motion by defense attorney Patrick Wall to transfer the case to New York City. A November trial date is expected.

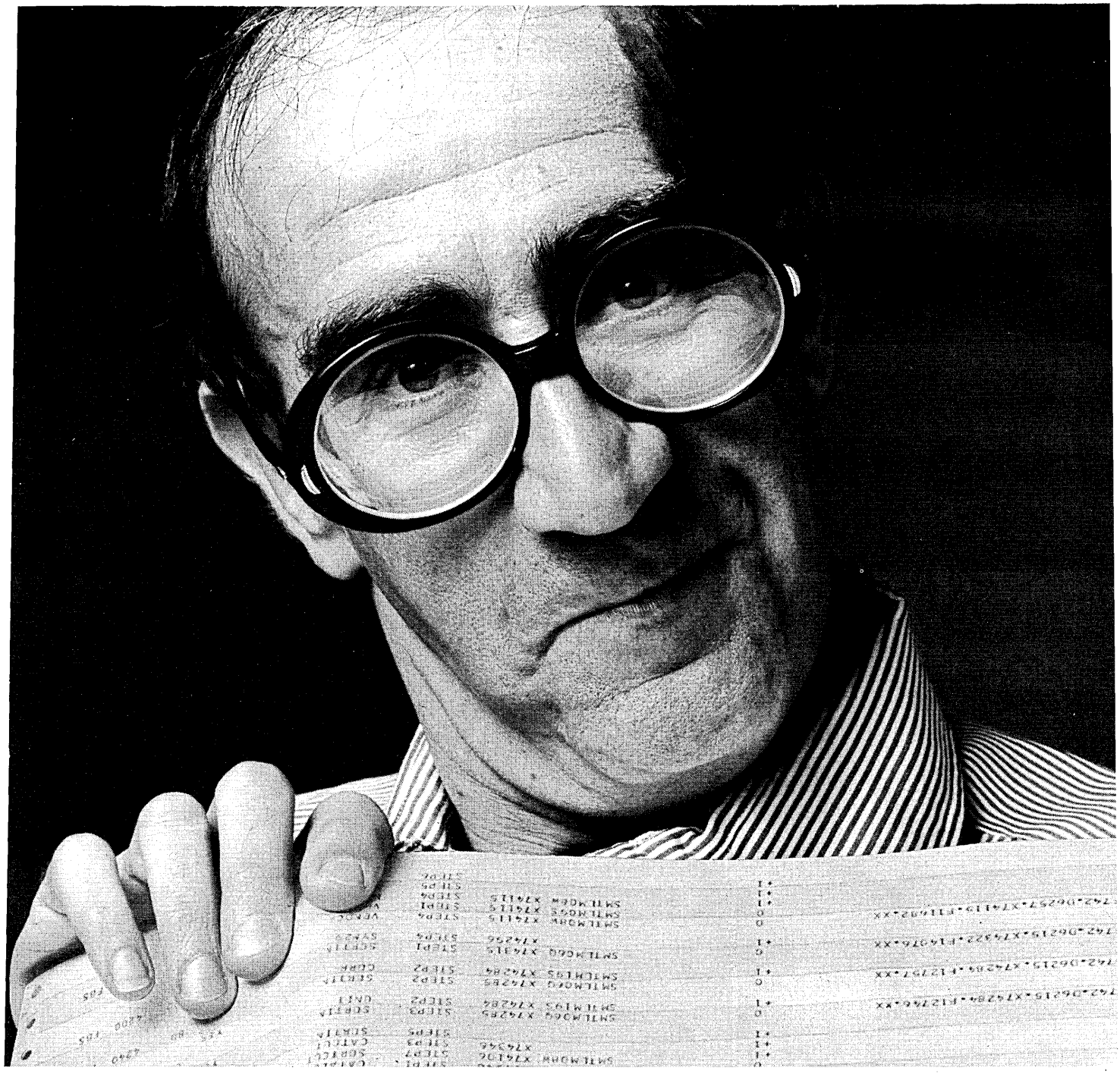
Herr was indicted in early July by a federal grand jury in Los Angeles and charged with accessing PCS computers between December 1978 and June 1979. He entered a not guilty plea to the charges in a Los Angeles federal court later the same month.

NOT WITHOUT EXPERIENCE

The Liebert Corp., Columbus, O., which early this year became the fourth company in the U.S. supplying flexible computer power distribution systems (p. 59), had some familiarity with the field before announcement of its initial product late last January. Some 35 of the Ohio air conditioning firm's representatives had been handling systems of the other three companies in the business: Data Processing Power and Computer Power Systems of Los Angeles, and Emergency Power Engineering Inc., Costa Mesa, Calif. (Nov. 1, 1978, p.61). "We educated their reps," said Warren Caves, marketing manager of Emergency Power Engineering which lost the most reps as a result of Liebert's entry. Second biggest loser was Data Processing Power which lost nine. Computer Power Systems lost "a few."

Liebert's system is said to most resemble that of Emergency Power Engineering which in the past had jointly exhibited with Liebert in trade shows. "They were very familiar with our product," said Caves. "They visited our plant." The Costa Mesa company has taken Liebert to court on "several matters" but Caves would say only that the legal situation "is in limbo now but other matters are coming to light which probably will lead to more legal action."

(Continued on page 51)



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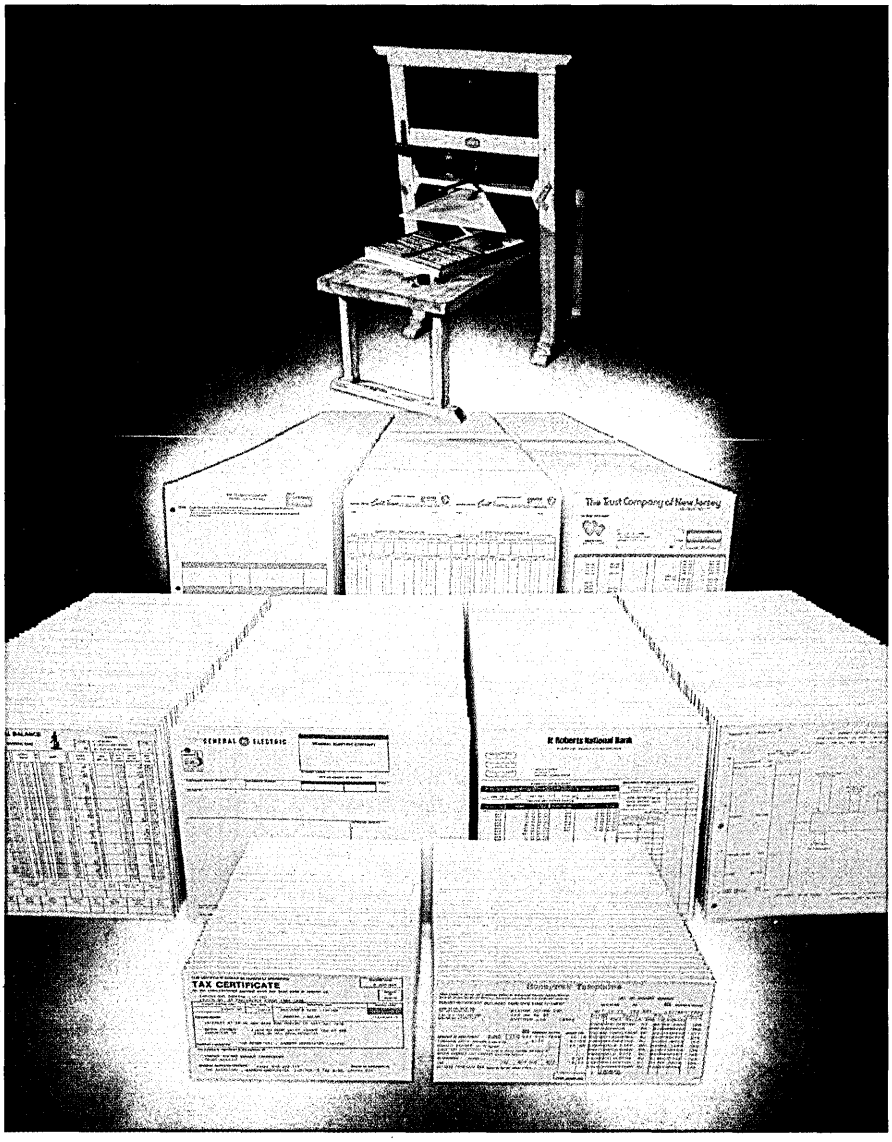
CIRCLE 25 ON READER CARD

PRINTING PROGRESS.



If you thought the Page Printing System was revolutionary, wait till you see its successor.

It's called PPS II, for Page Processing System, and it does everything the PPS did and more.

It still prints as many as 600 original pages per minute – still punches, perforates, collates and addresses the finished copies. You can still design your own forms, still choose different sizes and colors, still operate with a variety of host processors.

More options.

Now PPS II offers even more. You can print online without tying up expensive CPU cycles. Or off-line. Or both. You can electronically print forms and data at the same time. Select your own print speed according to your throughput needs. Design your own character sets and store them on disk for instant use. Stack your output in job sequence and/or user-designed sequence, such as departmental order.

More capacity.

PPS II is based on the proven technology of the Page Printing System. A system that has cost-effectively replaced anywhere from 1 to 6 impact printers for users in a wide variety of industries.

And PPS II is growth-oriented. You can add disk storage or stackers. Increase printing speeds. Design new characters or forms as your applications change.

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Best of all, PPS II is cost-effective. Its speed, quality, and flexibility all combine to help you control the mounting costs of hardware, personnel, forms and inventory. In fact, our customers have even reduced their paper costs.

For more information, write: Honeywell (MS 487), 200 Smith Street, Waltham, Massachusetts 02154.

Honeywell

CIRCLE 69 ON READER CARD

Our new display terminal has a great supporting cast.

The AJ 510 display terminal with AJ 460 Micro Diskette System, AJ 832/RO receive-only printer, and AJ 1234 acoustic data coupler/modem.

The AJ 510, the most versatile CRT terminal in its class, excels at interactive timesharing and a lot of other jobs. And with the addition of these supporting AJ products, you can greatly expand your application flexibility.

Start with the AJ 510

As a stand-alone device, the AJ 510 is ideal for jobs such as data entry, text editing, order entry, and graphics. It includes such features as ASCII, Graphics, and optional APL character sets; a bright 15-inch screen; 16 video enhancements; editing capability; a format mode with protected fields; and communications rates up to 9600 bps.

Now add data storage

For convenient, low-cost data storage and retrieval, the AJ 460 Micro Diskette System offers you local data manipulation and high-speed on-line communications. Combined with the AJ 510, the AJ 460 helps you reduce telephone charges and computer connect time, while further increasing application flexibility.

And top quality printing

Connect an AJ 832/RO receive-only printer and you get letter-quality hard copy output. Features include selectable data rates up to 45 cps, dual pitch selection, vertical forms control, and more—even interchangeable "daisy" wheel printing elements so you can customize the type face to the application. Now you have a system that's ideal for form letters, contracts, and camera-ready art of all kinds.

And communications

Finally, from the wide range of AJ couplers and modems, select the one that best fits your application. The AJ 1234 coupler/modem, for example, lets you take advantage of full duplex 1200 bps communications over dial-up or two-wire leased lines.

The final act

We not only build all this equipment, we also lease, sell, and service it. We'll take care of it throughout its lifetime. Which makes life easier for you.

So whether you need a stand-alone terminal or one with a strong supporting cast, AJ has the answer. Get in touch with the AJ regional office nearest you: San Jose (408) 946-2900; Chicago (312) 671-7155; Hackensack (201) 488-2525. Or write Anderson Jacobson, Inc., 521 Charcot Avenue, San Jose, California 95131.

Also available through AJ subsidiaries in Ottawa, Ontario; Paris, France; Shepperton, Middlesex, U.K.; and distributors throughout Europe.

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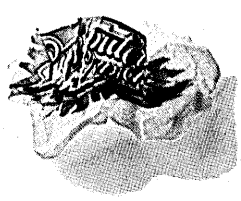

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CIRCLE 47 ON READER CARD

CALENDAR

OCTOBER

INFO 79, October 15-18, New York.
The Sixth International Information Management Exposition & Conference. Attendance may reach 20,000. Exhibitors such as IBM, Basic Four, Xerox, Datapoint, NCR, Hewlett-Packard, Wang, and Vydec have reportedly increased the size of their booths by an average 44% in comparison with last year's show. Contact Clapp & Poliak, Inc., 245 Park Ave., New York, NY 10017 (212) 687-7730.

Fifteenth Meeting of the Computer Performance Evaluation Users Group, October 15-19, San Diego.
Sponsored by the National Bureau of Standards. Papers, tutorials and case studies will be presented on, among others, the following topics: installation performance; workload forecasting; network performance; fraud; security and CPE; measuring user satisfaction; workload modeling; benchmarking; remote terminal emulation; performance prediction techniques; and CPE in auditing. Contact Judith G. Abilock, The MITRE Corp., Metrek Div., 1820 Dolley Madison Blvd., McLean, VA 22102 (703)827-7072.

Computer in Aerospace II, October 22-24, Los Angeles.
Contact Richard R. Erkeneff, McDonnell Douglas Astronautics Co., 5301 Bolsa Ave., Huntington Beach, CA 92644 (714) 896-4975.

Ninth Annual Conference of the Association of Computer Programmers and Analysts, October 22-24, Washington, D.C.
ACPA will be sponsoring a software showcase. For more information contact Ken Burroughs, 1500 N. Beauregard St., Alexandria, VA 22311 (703) 820-3310.

Government-Industry Data Exchange Program (GIDEP), October 23-24, Orlando, Florida.
Annual conference and workshop, to be held at the Harley Hotel, Orlando. For more information call Dennis Starling, DatagraphiX, Inc. (714) 291-9960, X1266.

ACM Annual Conference, October 29-31, Detroit.
The theme is "Advances of the 70s—Challenges of the 80s." Contact Mayford L. Roark, Ford Motor Co., The American Road, Room 895 WHQ, Dearborn, MI 48121 (313) 323-1690.

NOVEMBER

Interface West, October 30-November 1, Anaheim.
Conference sessions are planned on small computers and office automation systems, word processing, distributed dp, and data communications hardware, software and services. Contact The Interface Group, 160 Speen St., Framingham, MA 01701 (800) 225-4620; in Massachusetts, (617) 879-4502.

Seventh National Conference of the North American Datamanager User Group, October 30-November 2, San Francisco.
For further information contact Secretary of NADUG, 21 Worthen Rd., Lexington, MA 02173 (617) 861-6130.

International Symposium on Computer-Assisted Cartography, November 4-8, Reston, Va.
Leading cartographers, geographers, and other experts from the academic and federal sectors will be chairing sessions and presenting papers. For further information please contact James A. Smith, Conference Management Branch, NCHS, Room 2-12, Center Building, 3700 East West Highway, Hyattsville, MD 20782 (301) 436-7122.

COMPSAC 79, November 5-8, Chicago.
The Third International Conference on Computer Software and Applications, sponsored by the IEEE. The first day is devoted to tutorials. Papers are being considered in the areas of software development methodology; software management; data base management systems; data communication and computer networking; transaction and information management systems; computers and biomedicine; business office automation; design automation; application-oriented languages; reliability, maintainability and security; software testing and tools, mini/micro software, distributed system performance, human engineering of software systems, legal implications of dp technology and others. Contact the general chairman, Dr. William Smith, Executive Director, Toll Electronic Switching and Operator Services Div., Bell Laboratories, Naperville, IL 60540 (312) 690-2389.

Federal Computer Conference, November 6-8, Washington, D.C.
Over 6,000 people attended last year. Contact the Federal Computer Conference, P.O. Box 368, Wayland, MA 01778 (617) 358-5181.

Midwest Small Business and Computer Expo, November 9-11, Chicago.
An array of small business computers for office and home will be the focus for this Expo. For further information contact Louise Garcia, 1453 Rio Rancho Dr. S.E., Rio Grande, NM 87124 (505) 897-1971.

1979 Midwest Consumer and Small Business Computex Expo, November 9-11, Chicago.
Will feature small computer systems used in business and home; software, hardware and peripherals for existing equipment featured. For further information contact Louise Garcia, Expo Dynamics, at telephone (505) 897-1971.

Canadian Computer Show, November 13-15, Toronto.
Last year's attendance was 15,159. This year's show will celebrate the 10th anniversary of the Canadian Computer Show. Contact Reg Leckie, Show Manager, Canadian Computer Show, 36 Butterick Rd., Toronto, Canada M8W 3Z8 (416) 252-7791, or Bill Robertson at (416)444-0321.

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Each BMT terminal system is driven by its own microprocessor, a tiny, but powerful, programmable computer with its own memory.

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It eliminates the need for separate communications controllers. And it allows the terminals to be programmed for alternate functions.

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And remember, when you buy a Burroughs system, you get more than just equipment. You get the bonus of dealing with a total capability company with 90 years experience. And the security of knowing the whole Burroughs organization is behind you.

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CIRCLE 32 ON READER CARD

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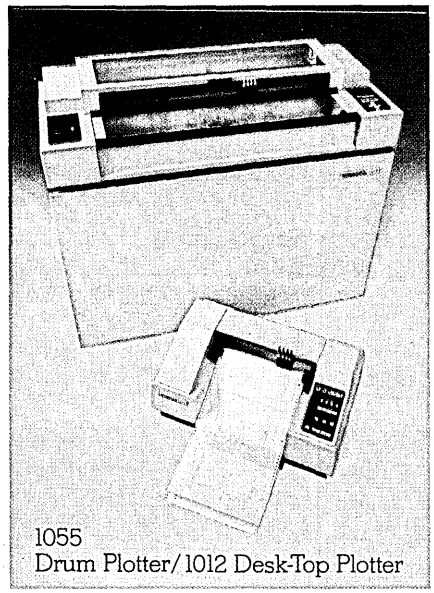
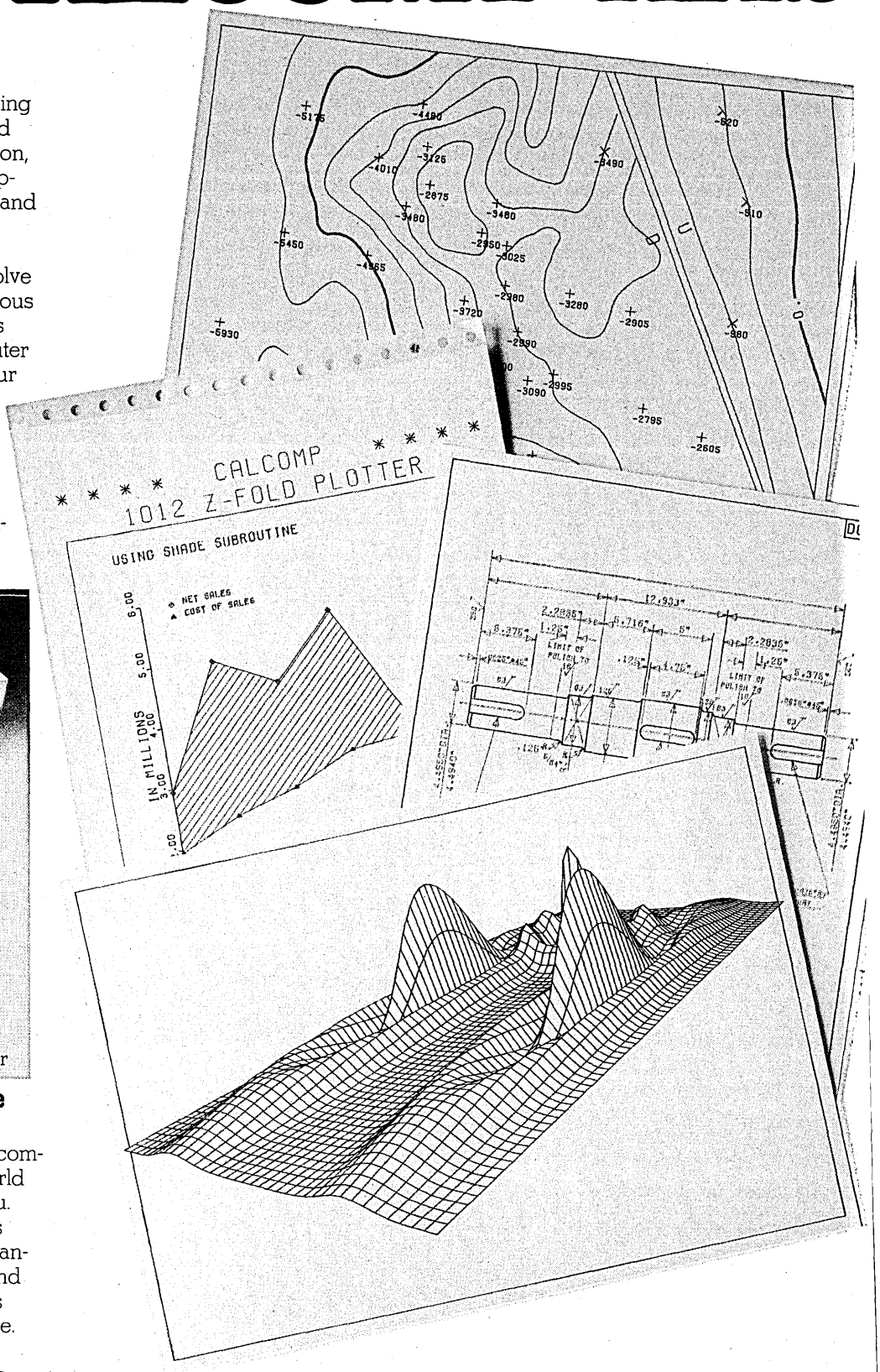


1055
Drum Plotter/1012 Desk-Top Plotter



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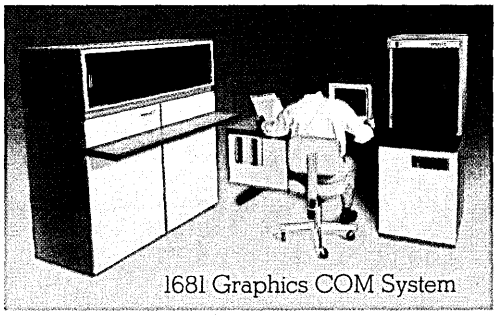
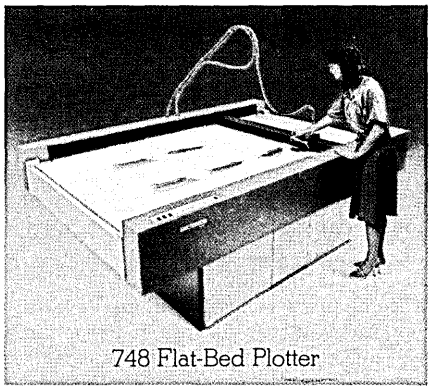

1681 Graphics COM System

At CalComp, part of the right answer is the right people.

At CalComp, hardware's a multiple choice question. Nobody offers a broader choice of answers.

Take our compact 1012 desk-top plotter, for example. You get crisp, clean 8½" x 11" or 11" x 17" size plots


748 Flat-Bed Plotter

at an impressive 10 inches-per-second. Four-pen versatility, and the convenience of Z-fold paper.

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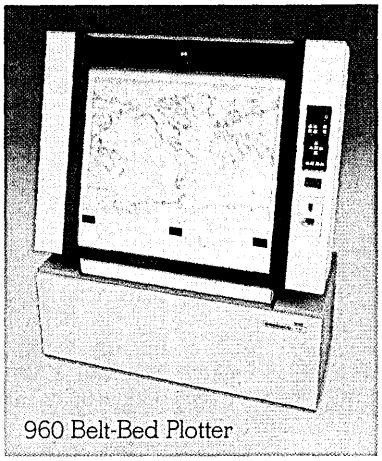
960 Belt-Bed Plotter

At CalComp, COM systems are an important part of the big picture.

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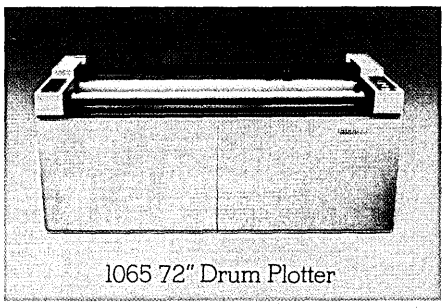
So contact CalComp today. And get the best possible answer to your specific graphics need.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CALENDAR

American Bankers Assn. Western Regional Workshop, November 14-16, San Francisco.
Contact the Meetings Coordinator, Operations & Automation Div., American Bankers Assn., 1120 Connecticut Ave., N.W., Washington, DC 20036 or call William Moroney at (202) 467-4332.

The Third Western Educational Computing Conference, November 15-16, San Francisco.
Sponsored by the California Educational Computing Consortium (CECC). For further information contact Ron Langley, Director, Computer Center, California State Univ., Long Beach, 1250 Bellflower Blvd., Long Beach, CA 90840 (213) 498-5459.

INTELEC 79, November 27-29, Washington, D.C.
The International Telecommunications Energy Conference is sponsored by the IEEE Communications Society. Contact R. H. Jones, Publicity, 1979 INTELEC Committee, ITT North Electric Company, Power Systems Div., P.O. Box 688, Galion, OH 44833 (419) 468-8100.

DECEMBER

Winter Simulation Conference, December 3-5, San Diego.
Cosponsoring WSC 79 are the National Bureau of Standards and six leading organizations sharing an interest in computer simulation. For further information contact Stan Lichtenstein, National Bureau of Standards, Washington, DC 20234 (301) 921-3181.

TDCC Forum and Exhibit Plan, December 4-5, Washington, D.C.
The theme will feature the state of the art of planning for electronic data interchange for applications in transportation. For further information contact TDCC Coordinating Committee, 1101 17th St., Washington, DC 20036 (202) 293-5514.

American Institute of Industrial Engineers (AIIE), December 10-12, San Francisco.
Distributed Data Processing, Data Communications and Networks, and Minicomputers are the subjects to be presented by AIIE. For further information contact Linda Fasulo, Computer and Information Systems Div., P.O. Box 3727, San Monica, CA 90403 (213) 450-0500.

JANUARY

Sixth Semi-Annual ATE Seminar/Exhibit, January 7-10, Pasadena.
The seminar/exhibit will feature a comprehensive technical program of workshops, technical papers, and courses that will span the four days of the conference, in tandem with the three-day exhibit. For further information contact Karen Knope, ATE Seminar/Exhibit and Test Instrument Conference, 1050 Commonwealth Ave., Boston, MA 02215 (617) 232-5470.

Communication Networks '80, January 28-30, Washington, D.C.
Communication Networks '80 is the national business communication conference and exposition. For further information contact William Leitch, Conference Company, 60 Austin St., Newton, MA 02160 (617) 964-4550.

WINCON 80, January 29-31, Los Angeles.
Officials predict more than 500 scientists and engineers from government, military, and industry will attend to probe new technology and developments in electronics and aerospace. For more information contact Richard L. Harmon (714) 557-4700.

MARCH

Conference on Application Development Systems, March 9-11, Santa Clara.
For further information contact Mitch Zolliker, IBM Research, San Jose, CA 95121 (408) 256-7582.

Fifth West Coast Computer Faire, March 14-16, San Francisco.
The Computer Faire Conferences and Exposition will focus on inexpensive computing power for home, business, and industry. For further information contact Computer Faire, 333 Swett Rd., Woodside, CA 94062 (415) 851-7075.

APRIL

Tenth Conference on Computer Audit, Control, and Security, April 28-May 2, San Francisco.
Jointly sponsored by IIA and ATC. For further information contact John Sheehan, Manager of Public Relations, The Institute of Internal Auditors, Inc., 249 Maitland Ave., Altomonte Springs, FL 32701 (305) 830-7600.

MAY

The Seventh International Symposium on Computer Architecture, May 6-8, La Baule, France.
For further information contact Jacques Andre, Campus de Beaulieu, Avenue du General leclerc, 35042-Rennes, Cedex, France (99) 36 48 15.

CALLS

Papers are being solicited for the 1980 Summer Computer Simulation Conference, which will be held in Seattle in July. The theme will be the future of computer simulation. Three- to five-page summaries are due Dec. 1. Contact David R. S. McColl, 1980 SCSC General Chairman, Manager Military Spacecraft, Boeing Aerospace Co., P.O. Box 3999, MS 84-16, Seattle, WA 98124 (206) 773-1543.

Papers are being solicited for the 1980 Joint Automatic Control Conference, August 13-15, New York. Theme areas emphasized will be the frontiers in theory, application, and implementation of automation and control. The conference will cover all aspects of automation in the areas of: multivariable frequency domain control design, robust controls; the role of control in power networks; control for energy efficiency; large flexible aerospace structures; the automated factory including flexible manufacturing; distributed microcomputer systems; and digital control of automobile and turbofan engines. Two types of papers are being solicited: a) regular papers describing work in some detail; and b) short papers which present recent, perhaps preliminary, results. Authors should submit at least seven copies of regular papers and seven copies of a 700-word abstract for short papers marked "1980 JACC" by Dec. 1 to Dr. J. L. Shearer, 213 Mechanical Engineering Building, Penn State Univ., University Park, PA 16802 (814) 865-6377. Authors will be notified of selection by April 1. ✲

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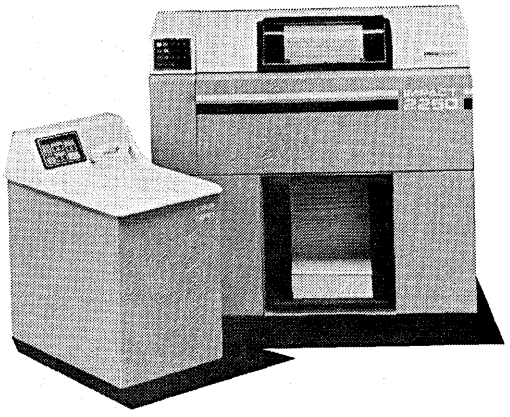

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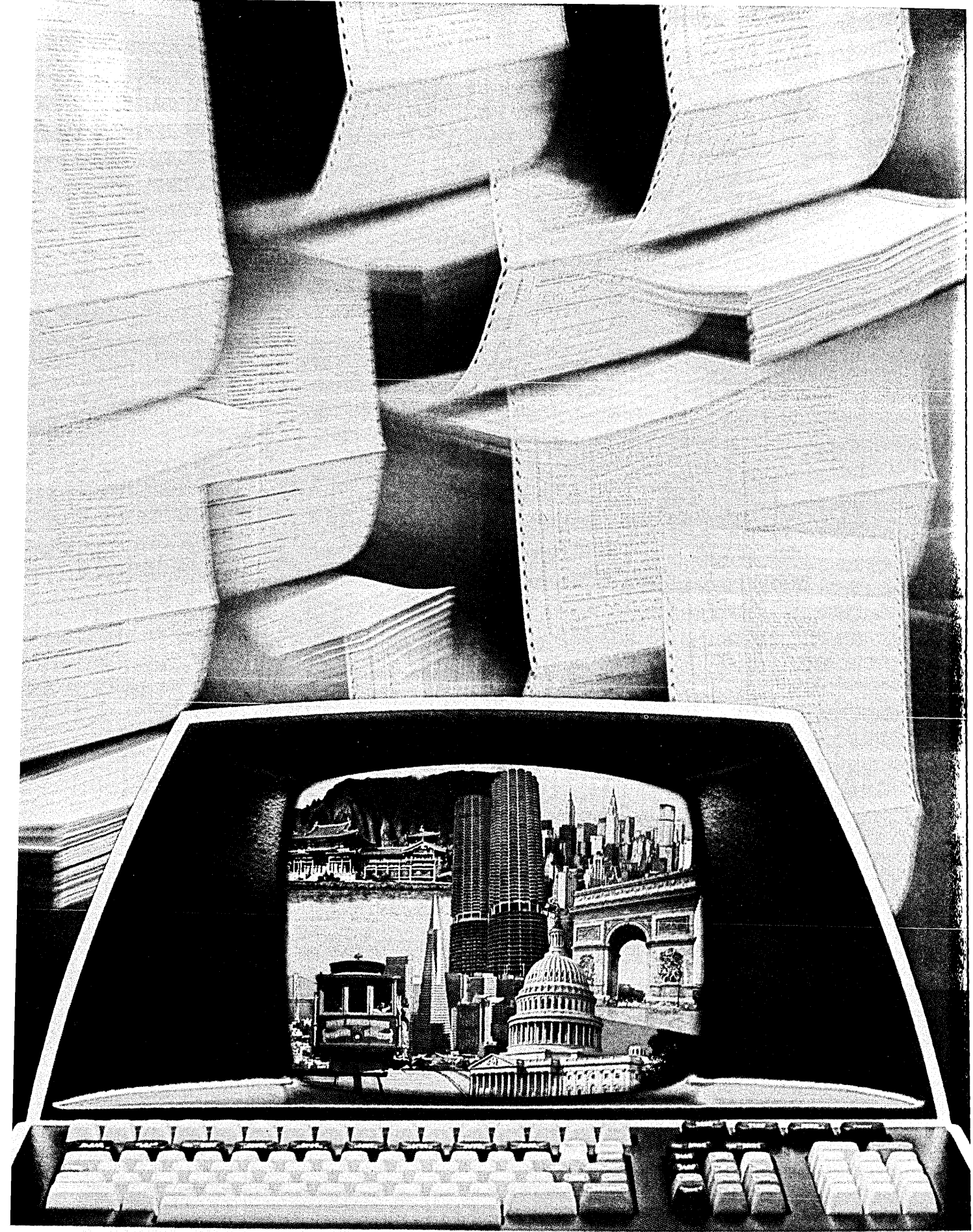

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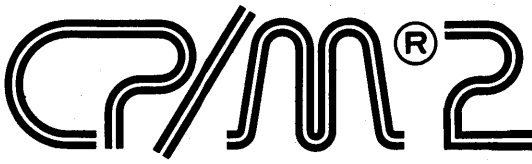

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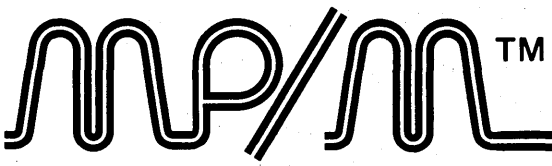

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Like CP/M, MP/M is especially built to adapt to most 8080 or Z80 microcomputers, with an 8086 version on the way. You can operate your I/O devices either interrupt-driven or polled, and you can even write your own system processes which are combined with MP/M through a simple system generation. It's an exciting new product from the most experienced systems software supplier in the microcomputer industry. Contact us for details, or ask your dealer about MP/M availability for your computer system.

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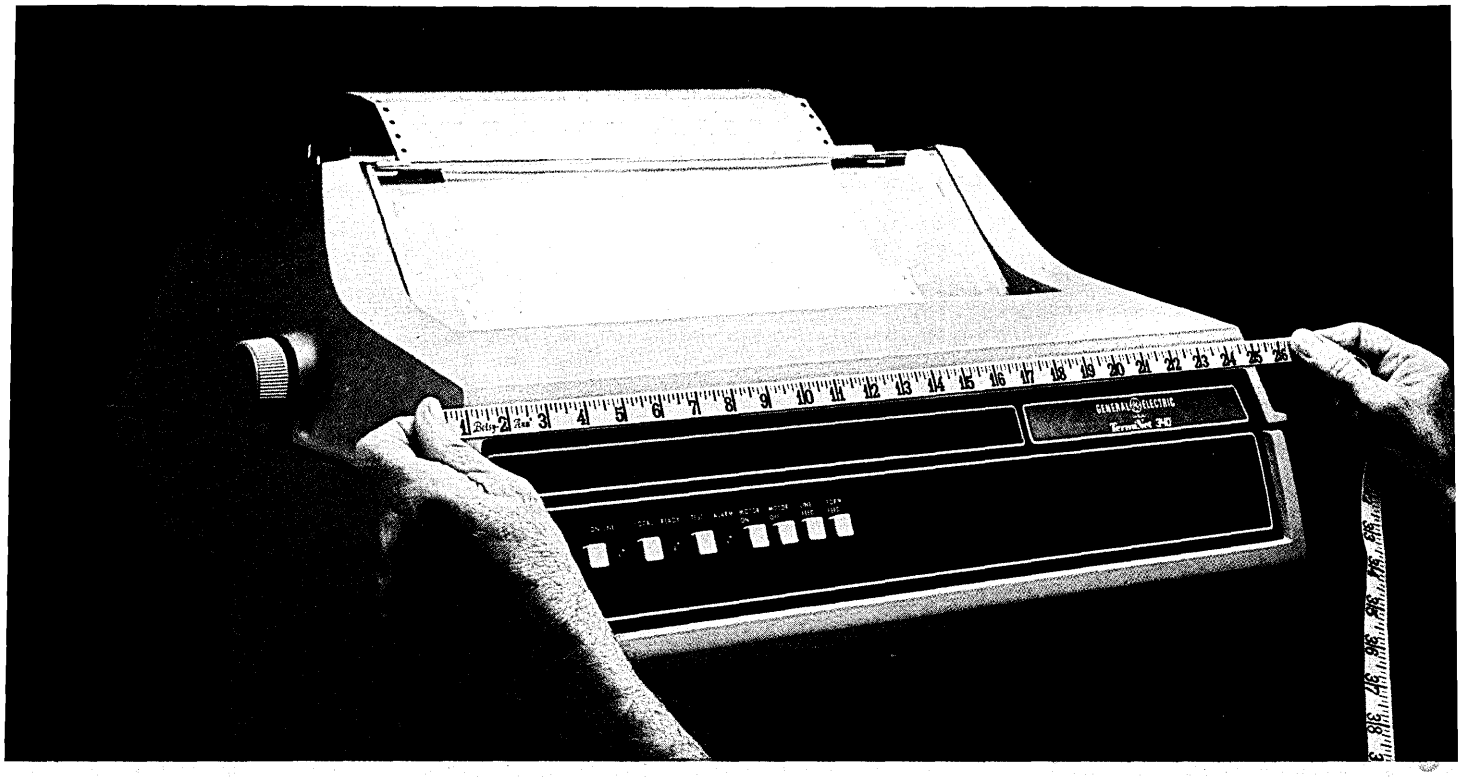

Solid engineering and 340 lpm speed make the TermiNet 340 a more rugged, productive line printer.

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A true 100% duty cycle printer

Unlike ordinary line printers, the TermiNet 340 can take the punishment of the broadest range of operating environments—from front office to factory floor—without complaining. The key reason? A tough, ruggedly engineered design. As a result, it keeps on performing under tough-use conditions when other line printers would sputter and break down.

Engineered to stay on the job.

From top to bottom, the compact TermiNet 340 line printer is engineered with long-life components designed to keep the printer on-line. And businesses on schedule.

One reason: extra-thick, heavy-duty, environment-resistant materials chosen for the base and housing. Together, they provide this rugged printer with the impact strength, dimensional stability and resistance to adverse environments needed to keep working.

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The fact is, TermiNet 340 line printers are such productive workers, they require very little attention and very little maintenance once they're up and running. Should service be needed, you can count on getting these printers back on-line in a hurry. That's because of convenient self-test features that make troubleshooting easy and fast. And because of a responsive nationwide service network that keeps downtime to a minimum and operating costs low.

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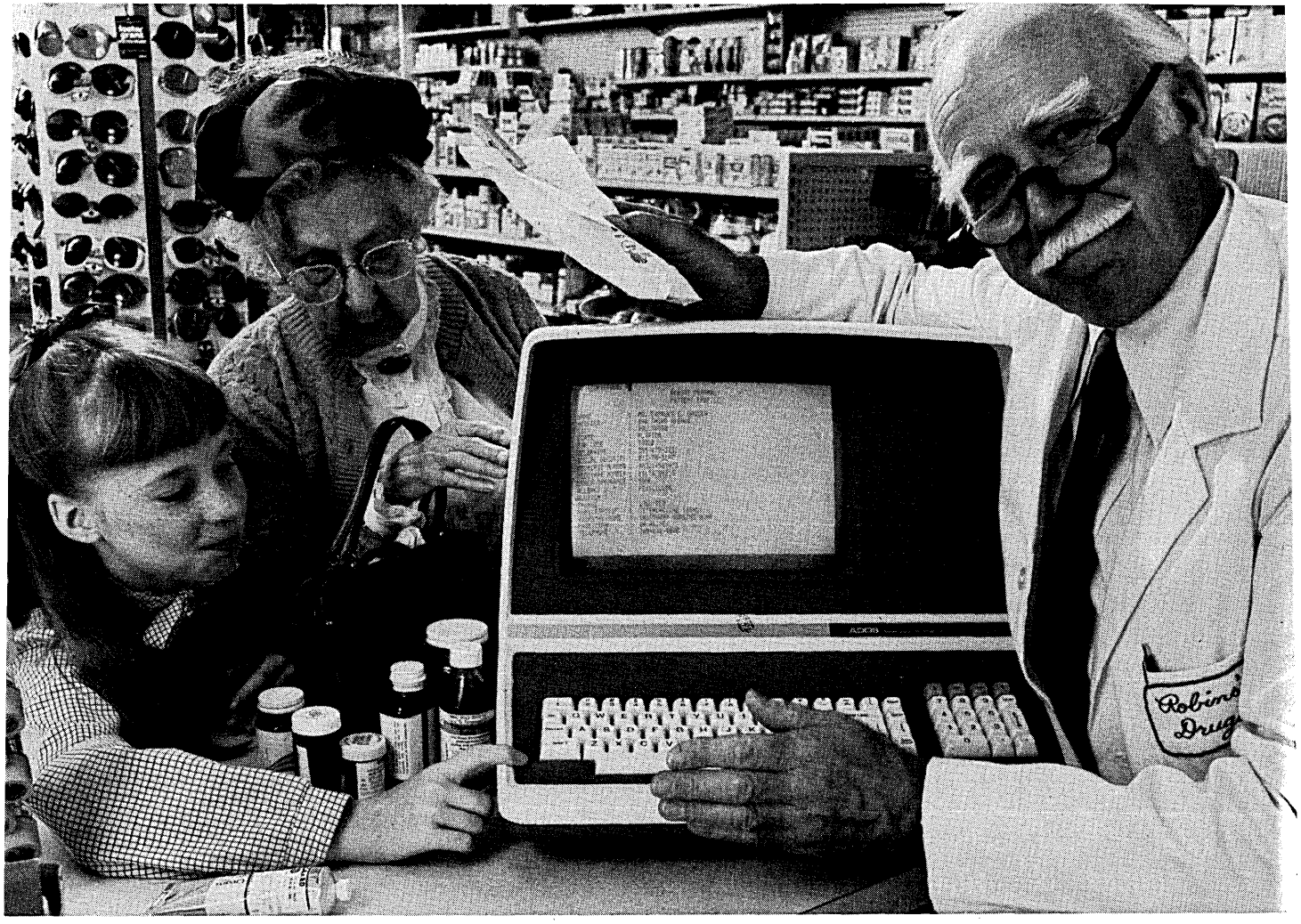

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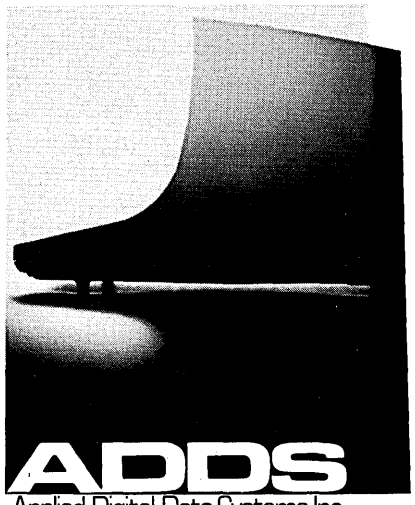

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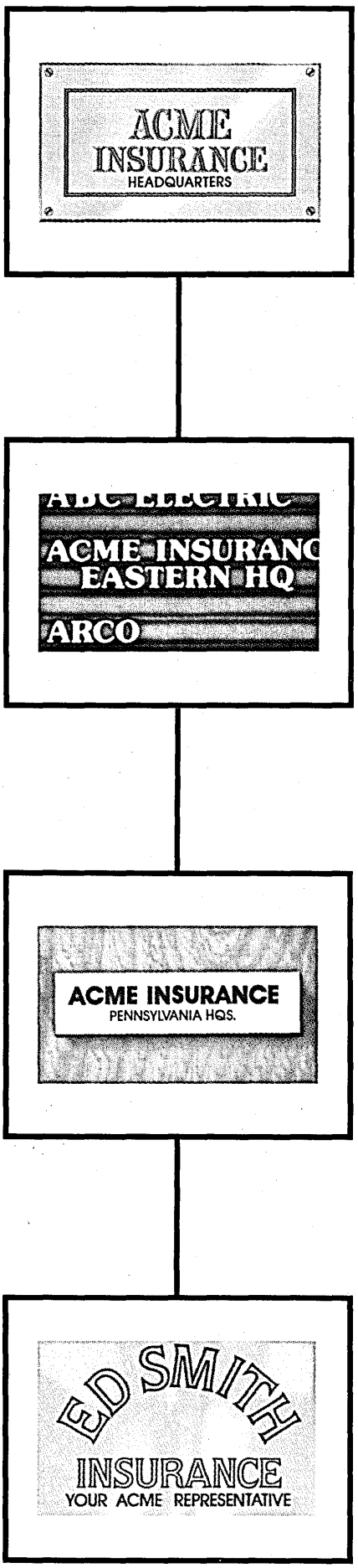

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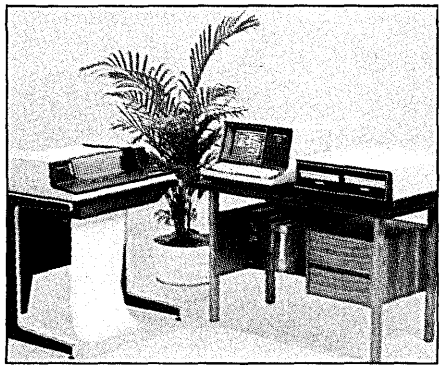

business organization. With the complete communications software provided, it tucks neatly into any network and telecommunicates freely with the home office mainframe or other Datapoint processors.

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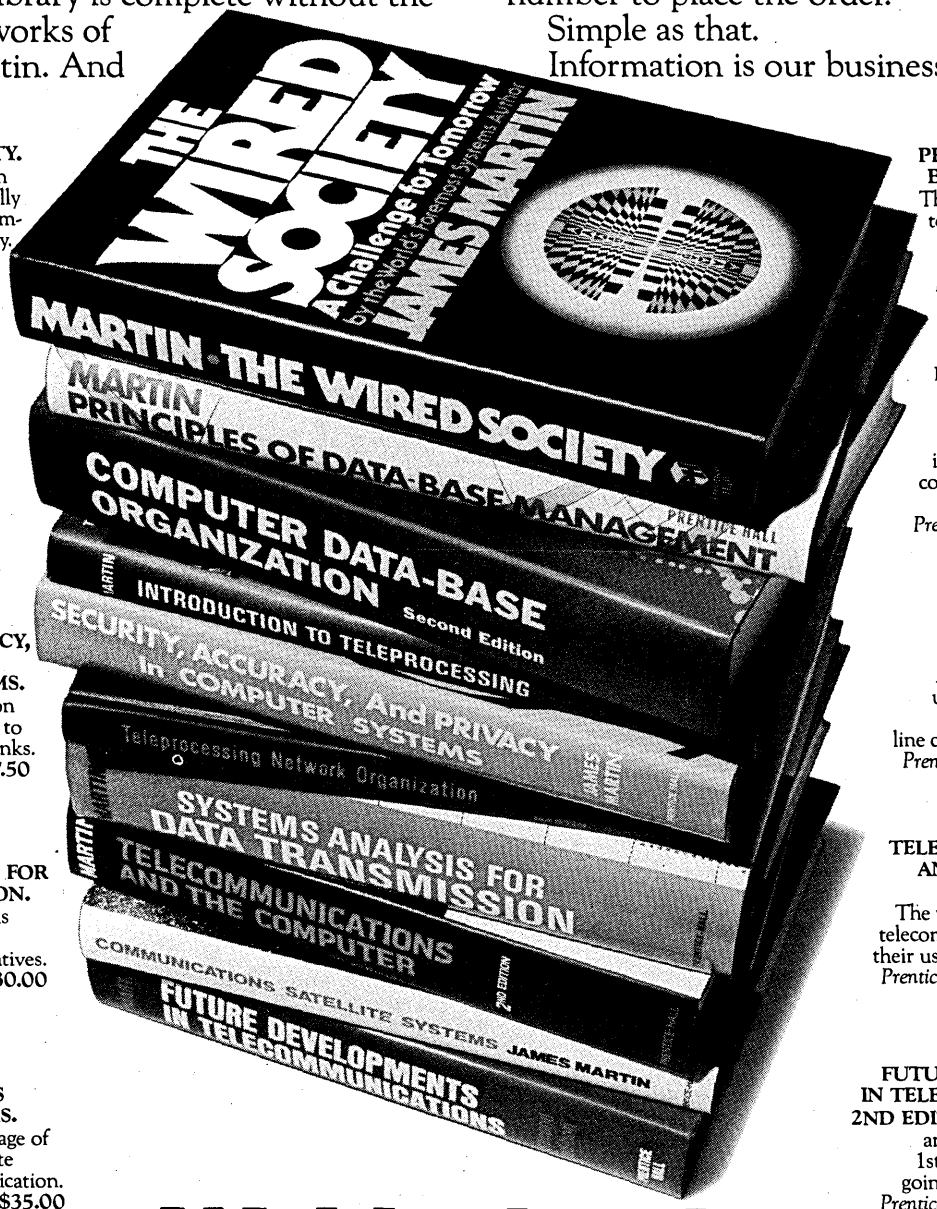

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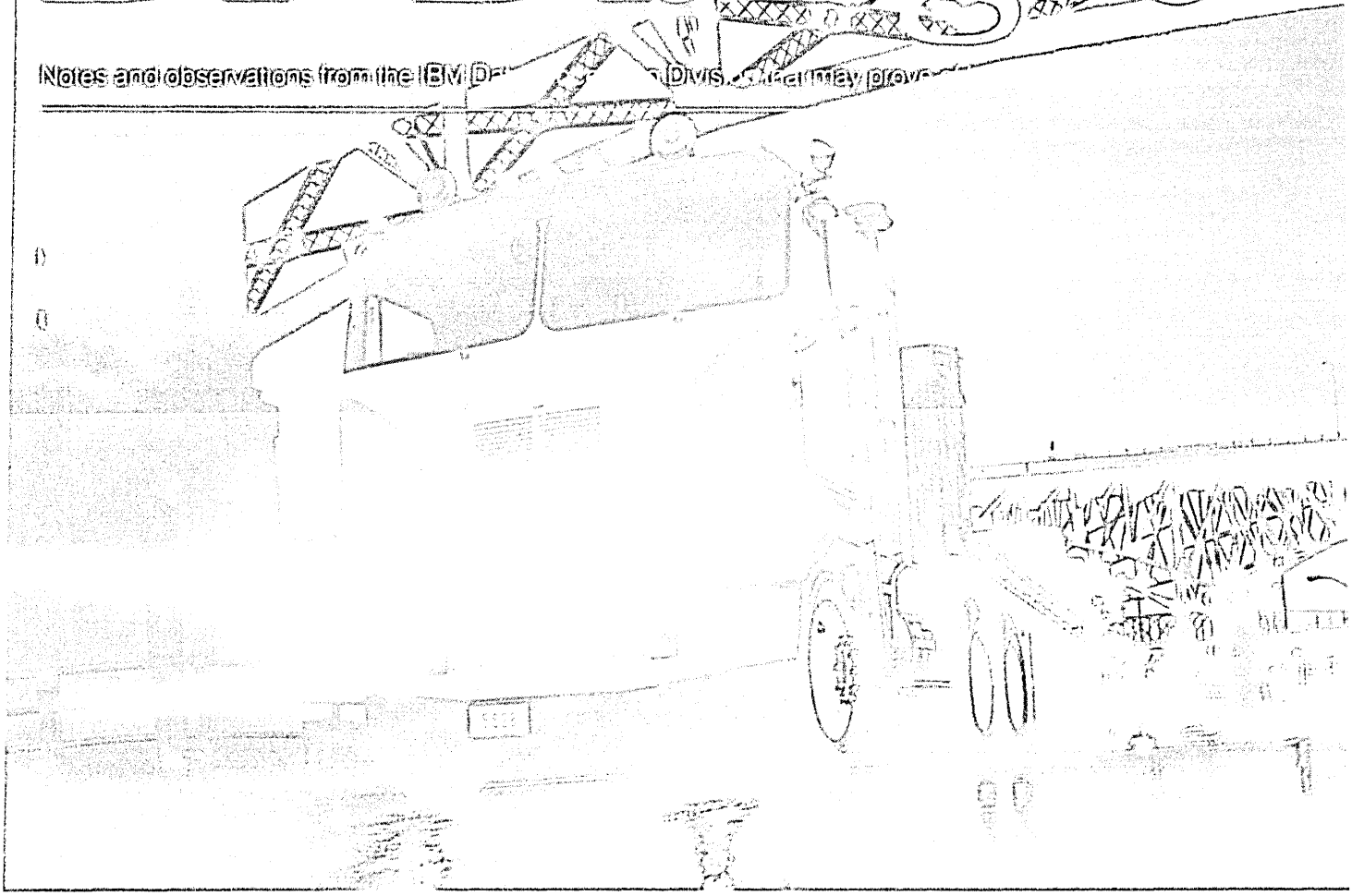
DP Dialogue

Notes and observations from the IBM D... Divis... that may prov...



Manufacture of Bendix heavy vehicle products – such as the brake-system components for this truck – is supported by an online computer system. Using DL/1, seven programmers put Bendix's Materials Management System online in only 18 months.

DL/1: A Vehicle for Making Truck Brakes at Bendix

At the Heavy Vehicle Systems Group of Bendix Corporation, an online computer supports every phase of manufacturing. Called the Materials Management System, it helps perform master scheduling, requirements planning, shop-floor routing, inventory control, and forecasting.

"Using DL/1, seven programmers got this big system completely operational in 18 months. At the same time, we had the flexibility to modify it as our needs changed," says Steven A. Bridge, director of management information systems. Bendix uses Data Language/1 (DL/1), an IBM data-base management program product, in a 3031 Processor at the group's Elyria, Ohio, headquarters.

In Elyria and at four other plants, Bendix makes truck brakes, brake-control systems, fan clutches, and other products for large vehicles. The five plants and two warehouses, scattered from Reno, Nevada, to Charlotte, North Carolina, are all online to the computer.

At each of these locations, IBM 3278 Display Stations permit direct inquiry into the data base – to determine, for example, the vendor, inventory status, or storage location of any part. Some Bendix sites are also equipped with IBM 3776 Communication Terminals, which allow batch jobs to be entered remotely.

"We've been able to build a data base that corresponds to our organization," Bridge continues. "The plants operate autonomously, except that accounting, design engineering, and data processing are handled at the group level. So manufacturing uses a common bill-of-material system, but there are separate inventory records – and even a different record structure – for each plant, though many parts are used in common. For the purpose of material requirements planning, DL/1 can – and does – automatically provide a different production lead time on the same item in different plants."

Revised manufacturing routings and other such changes can readily be entered, Bridge points out, or an entire plant can be added to the system with little or no new programming and no impact on existing programs.

"On the one hand, developing this data-base system forced us to do some planning," he notes. "But on the other, whenever experience showed us early planning had missed the mark, DL/1 let us back up and do the necessary rework."

You Ate 0.459 Gram of Phenylalanine Yesterday

Health professionals at Louisiana State University can determine the exact amount of each of 100 different nutrients in any list of foods, with the help of a computer. For example, a hospital dietitian can submit a series of planned menus, and receive back a complete analysis of the number of calories, the quantity of fat, carbohydrate, protein, and other nutrients from Vitamin A to phenylalanine (one of the amino acids).

Conventionally, a dietitian does such analyses with a desk calculator and a reference table. If one item of a menu is changed – say, a peach is substituted for a pear in a dessert – the entire list must be recalculated.

Insights into Disease

The nutrition data base at LSU is also very useful in studying the relationship between diet and disease, explains Dr. Prentiss E. Schilling, head of the department of Experimental Statistics at the university's Baton Rouge campus. "We can enter a person's food intake for 24 hours – items and quantities – and receive back a calorie count and the quantity of each nutrient," he says.

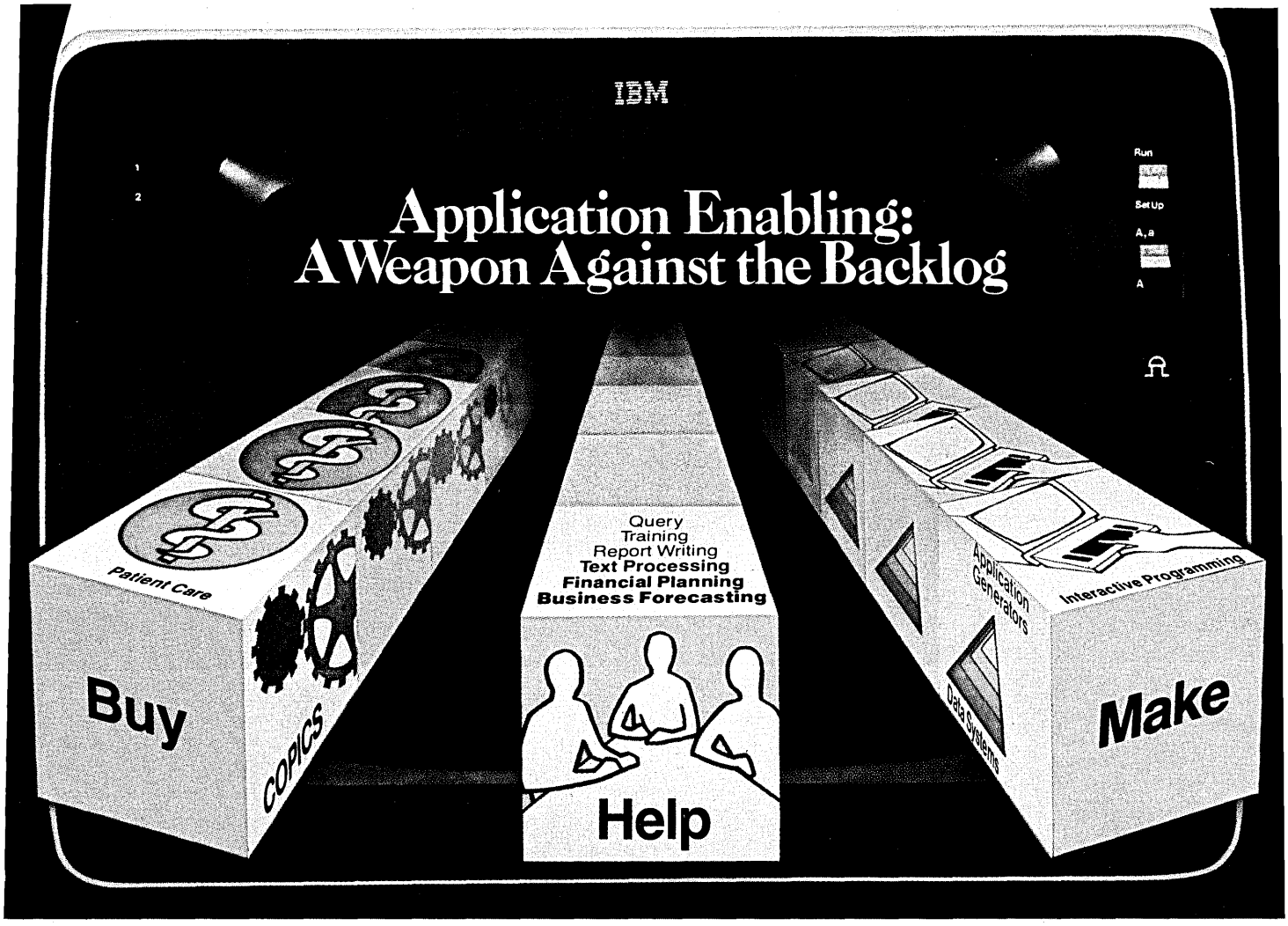
"In one project, a study of atherosclerosis, the researchers are measuring plaque formation in the coronary arteries of individuals, and comparing it to their eating histories by recording all food prepared in each subject's home for one month. Then the system converts each history into a complete nutritional profile."

The nutrition data base is maintained by the International Dietary Information Foundation, Dr. Schilling notes, which collects its information from laboratories in the food industry as well as government and academic sources. Currently stored in the university's IBM 3033 Processor is the complete analysis of over 3,000 basic foods and recipes.

Food Industry Aided

"Our system is very useful to the food industry," Dr. Schilling points out. "Frequently, a processor must reformulate a product, as ingredients become available – substituting, say, palm oil for soy oil in baked goods. And this significantly changes the nutritional analysis. We enter the revised recipe and receive back a printout of a complete table of nutrients, with the quantity of each constituent stated in the appropriate unit of measure. This provides the basis of the nutritional labeling most packaged foods are required by law to carry."

Under the direction of Dr. Prentiss E. Schilling, a data base in an IBM computer at Louisiana State University keeps track of the proportion of every known nutrient in more than 3,000 foods.



With rapid improvements in the price-performance of computers, many new applications are now economically very attractive. At the same time, the maintenance of existing programs is claiming a progressively larger share of programmer-analyst time. So the application backlog grows, and the need to control it, to begin working it down, is urgent.

New approaches to application development – faster and less costly – which IBM has organized into three specific *Application Enabling* strategies – *buy, help,* and *make* – offer an exciting new weapon against the backlog.

The first is to *buy* a packaged program. In manufacturing, for example, the key production planning and control functions are performed by IBM's modular COPICS system, which is easily "tuned" to a company's individual requirements. Similarly, the IBM Patient Care System automates many hospital functions with no programming by the customer.

There are other IBM industry application products, one of which may meet a specific need in your organization.

Under the second strategy, an *information center* is set up to *help* users develop their own applications. Staffed with teachers – rather than technicians – the information center helps business professionals from all functions of the company to take advantage of IBM program products designed for ease of use by non-data processing personnel. Examples include the APL language, A Departmental Reporting System (ADRS), and Query by Example (QBE). A small number of teachers can train hundreds of users of all kinds, with no background in data processing, to apply the computer to their business functions.

The third strategy is to simplify and expedite the traditional work of the programmer-analyst: to *make* the application in consultation with the user. Many large-scale systems which require central control of a data base that affects several business functions must still be developed in this way.

An IBM family of *application generators* vastly improves the productivity of the *make* option. The programmer uses a simple "fill-in-the-blanks" technique to specify pre-programmed functions, instead of writing in a procedural language such as COBOL or PL/1. The Application Development Facility (ADF) works in this way for users of Information Management System/Virtual Storage (IMS/VS), as does the Development Management System (DMS) for users of the Customer Information Control System/VS (CICS/VS) and the 8100 Information System.

Combining one of these facilities with interactive programming software and an IBM data system produces an "application development machine" for the professional programmer. Users of such IBM resources have reported productivity increases of two to one or more, ranging as high as 20 to one.

IBM offers *application enabling* products and education services for the *buy, help,* and *make* strategies of application development. By exploiting all three, you can launch a major attack on your application backlog.

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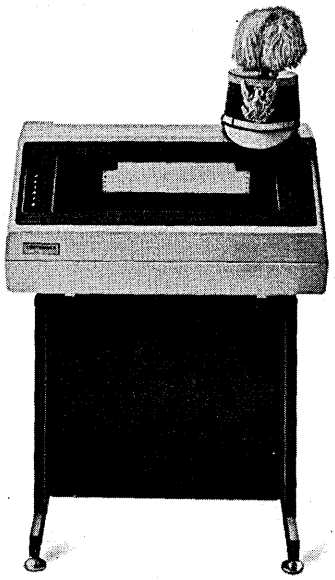

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LETTERS

ICL MARKETING SHIFT

Re: Look Ahead (August, p. 17): As an ICL user we found your item somewhat misleading. I doubt your comment that 2900s have sold steadily on the East Coast, since they have been marketing it for about three or four years and I know of only about a dozen or so users. Also, if your reference to 4,000 units of the 29CC is for the U.S. market, I would be interested in knowing how, because the U.S. sales and marketing force could in no way support that at this time.

If your assessment of a marketing shift from mainframe equipment to smaller machines is correct, I'm sure we ICL users would be interested in ICL alternatives.

ARMAND CARMILANI
Data Processing Manager
Schmid Products Co.
Little Falls, New Jersey

MORE IMPLICATIONS

Re: "Beyond Dp: The Social Implications" (July, p. 98): From the insulated comfort of the Rand Corporation's think tank it must be pleasant to send messages worldwide from one's own terminal, breezily exchanging blue-skies with one's look-alike peers. The resulting point of view is often disturbing: on the potential for abuse, Glaseman claims that "unscrupulous individuals may also wish to discover the rates provided by my insurance company to certain groups of people." Who is unscrupulous here in a matter where public disclosure is a legitimate argument?

Anderson speaks of decentralization for a company to attract secretarial and support staff—"reaching these people in the suburbs where they live...without inflating salaries." The implicit write-off of the central city population is not surprising from a man who can speak of predominantly women's salaries as being "inflated" if they increase. The throw-off remarks about "social equity" toward the end don't hide the "social implications" of the title: dp technology is increasingly benefiting the well-off minority of the world (yes, even we systems types who read DATAMATION) and leaving the poor, the untrained, and the nonwhite far behind.

Dp, like most technology, is too important to be left in the hands of the technocrats. What is even more frightening is its being almost solely in the hands of business. There is increasing social awareness beyond the ken of the Rand Corporation; I don't expect DATAMATION to go looking very hard for it, but I do expect better reporting than a cover story on someone's free lunch.

PETER S. GRAHAM
Systems Officer
Indiana University Libraries
Bloomington, Indiana

A MATTER OF FACTORIAL

The July issue is outstanding.

I realize that the example at the bottom of p. 148 (in the article "From PASCAL to Pebbleman...and Beyond") is just that, an example, but I must point out, to recall the wisdom of a classroom some 15 years ago, "the factorial of a negative integer will *not* be defined as the output produced by a variety of [FORTRAN] factorial functions [written by engineering sophomores—or for that matter postdoctoral fellows] when given a negative integer as input." Also, at last inspection, $0 \equiv 1$.

For those of us who still ponder efficiency (program, programmer, client/user...) we might consider the following:

1. The example presented, a clean structured form using a recursive definition.

2. A procedural type code—such as FORTRAN, assembler, or machine language.

```
If N lt 0 then...
If N eq 0 then...
Else
  FACTORIAL = 1
  DO I = 1,N
  FACTORIAL = FACTORIAL * I
  DO END
```

3. Since even 20! is a "big" number (whatever that means), perhaps close enough to infinity for many applications, might we simply use an array with predefined values for 0, 1,—20 factorial and use overflow or infinity at that point.

4. Also what of approximations for large (?) factorials and what of a gamma for nonintegers? Quite a bag of worms for one simple factorial function.

I also enjoyed your lead article, "Beyond Dp..." (p. 98). Having worked out of an office at home for nearly a year I can offer some observations:

Compensation for a "lost" room of the house needs to be taken into account. What used to be a family den is now 101% books, documentation, storage, terminal, etc. Communication problems are significant. Although the computer can be used for messages and documents, many people are unable or unwilling to use this method. It is difficult to use telephone or computer for quick and informal discussions. Isolation is an inconvenience—you can't pop your head into someone's office and ask a quick question.

You're never away from work. Last night I received a call at 6 p.m. with a user problem on a project I had worked on two years ago. By midnight the problem was solved—but at the expense of an evening with my wife. This is a disadvantage to all but the employer. (Since I am self-employed, I have only myself to blame.)

DR. CARL A. SINGER
Los Angeles, California

CALL FOR WIDER VIEW OF PROGRAMMING

In "VLSI: The Impact Grows" (June, p. 109), Jean-Michel Gabet writes that "most programs are inherently sequential in nature" (hence, even "if some sections of code could satisfy the parallelism criterion" [what parallelism criterion?] it would not pay to use many processors, except, perhaps, to pipeline).

I suggest that his view is too narrow: we may not yet understand parellelism, or sequence independence, the term I am coming to prefer, well enough to deal with it.

There is, for example, nothing inherently sequential about an assignment statement, beyond that implied by the manner in which we write it. Why does one programmer prefer A = BC + DE/F to A = DE/F + BC?

Perhaps, when we have acquired the discipline—including the knowledge and skill—to describe *what* we wish the computer to do, not *how* to do it, we will wonder why it took us so long to see the light.

ROBERT M. GORDON
Irvine, California

ERRATUM

Another omission from the survey article "Project Control Systems" (June, p. 147) has been pointed out to us. The product our author neglected to mention is called APECS, for ADP Project Evaluation and Control System, and is available from ADP Network Services, Inc., in Ann Arbor, Mich. We regret the error.

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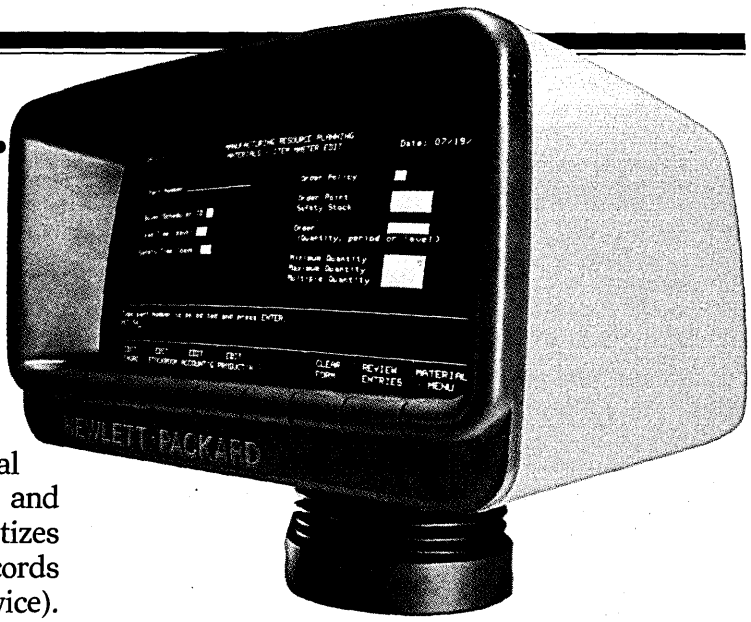

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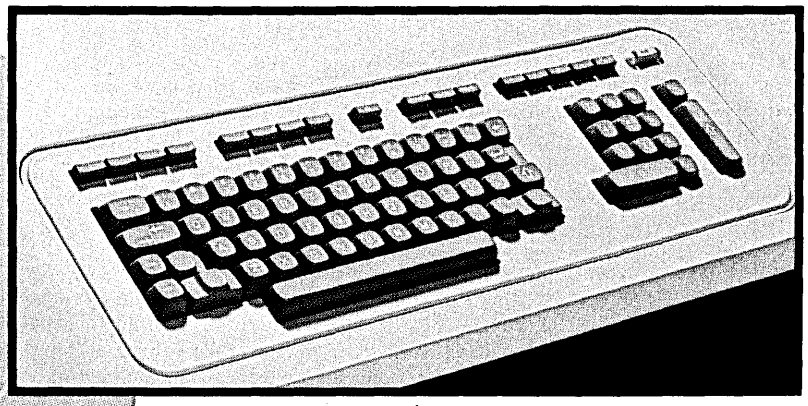

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LETTERS

"A" FOR HUMANISM

Re: "Seventy Years of Olivetti Design," (June, p. 84): I am thankful to the Olivetti Co. designers for making the office environment more humanistic. It is comforting to know that the man/machine relationship can be one of gratifying biological as well as physical concourse. The behavorial sciences are prevailing.

VERNON G. MEEK
Systems Programmer
Union Carbide Corp.
Greenville, South Carolina

COBOL CODING CONTROVERSY

Re: "Writing Legible Code" by Thomas Gildersleeve (February, p. 191): This article really requires an article in reply, but I will be as brief as possible. First, and most disastrous, none of the "more legible" versions of the code as given in the article work, i.e., none of them perform the same function as the original version. The following corrections are needed: Version 1: Insert GO TO G59-PAYROLL-EXIT just before the paragraph name G55-PAYROLL-DATA. Version 2: Delete the first two occurrences of the statement PERFORM VALIDATE-ALLOCATION. Version 3: Delete the statement PERFORM VALIDATE-ALLOCATION which immediately precedes the paragraph name G52. Version 4: Same correction as version 3.

Apart from being incorrect, none of the four versions is good, legible code. Version 1 pushes the detailed editing to lower-level modules, as should be done, but otherwise it does not differ from the original version in terms of overall control structure. Version 2 is structured, but in an awkward manner which results in needless code. (VALIDATE-TAX-CODE is performed three times and VALIDATE-EARNINGS-PERCENT is performed twice, when each only needs to be performed once.) Also, the indentation scheme used is very poor; I doubt that anyone can unravel this code without drawing lines to connect the IF-ELSE pairs. Version 3 (and 4, which is essentially the same) I can see no justification for at all. The logic resembles old assembly language programming in that branches are made into a sequence of actions depending on the case. This is not only difficult to read, it also often requires reworking the logic when new actions are added to some cases, but not to others.

Between versions 1 and 2, Gildersleeve indicates a possible way to rewrite the original code which he says is "instantly understandable and child's play to modify," and yet he does not pursue this approach because "it's probably too much to expect a programmer to write out all those PERFORMs." Would an architect dismiss a house design because it is too much to expect a carpenter to pound all those nails? Following the indicated approach results in code which is probably more legible and maintainable than any of the four versions given.

The code for FICA calculations is unstructured. It can be rewritten to eliminate four GO TO statements and three paragraphs names, resulting in much more legible code. Also, using COMPUTE improves legibility, as does shortening the data names. Exceedingly long names can be almost as much of a pain as cryptically short ones.

Gildersleeve's rule about switches should be ignored. A switch is a way of implementing a data type COBOL lacks, namely logical data, e.g., LOGICAL in FORTRAN, BIT in PL/1, and *boolean* in ALGOL. The logical data type is extremely useful, as anyone knows who has ventured beyond the confines of COBOL. A programmer who uses switches in an uncontrolled and undisciplined manner, resulting in bad code, will generally do an equally fine job of writing bad code without using switches. The problem is not switches; the problem is programmers who don't know how to program, usually because they were never taught to program, only how to code. Most of us know how to write, but few of us are authors.

Gildersleeve concludes by wishing for the possibility to use names longer than 30 characters. If COBOL is to be changed, let's do something really useful: start by adding functions and procedures with parameter passing; replace PERFORM with a decent loop construct; add ENDIF so the general selection construct is available; allow data to be declared local to functions and procedures; add the logical data type; and so on. There are aspects of programming that those who know only COBOL are ignorant of. Take a look at PASCAL.

ROGER HOUSE
Software Consultant
Sebastopol, California

BRAILLE OUTPUT SOUGHT

Recently the United States International Marketing Center in Milan, Italy, received a letter from a blind gentleman Italy requesting assistance in locating a U.S. manufacturer of equipment enabling the blind to read printed material. Specifically, the writer is looking for an optical character reader that would convert standard written words into braille.

We would appreciate it if DATAMATION readers could help us find the answer to this request. We will pass along replies to the writer. Correspondence and brochures may be in English.

JAMES C. CASON
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U.S. International Marketing Center
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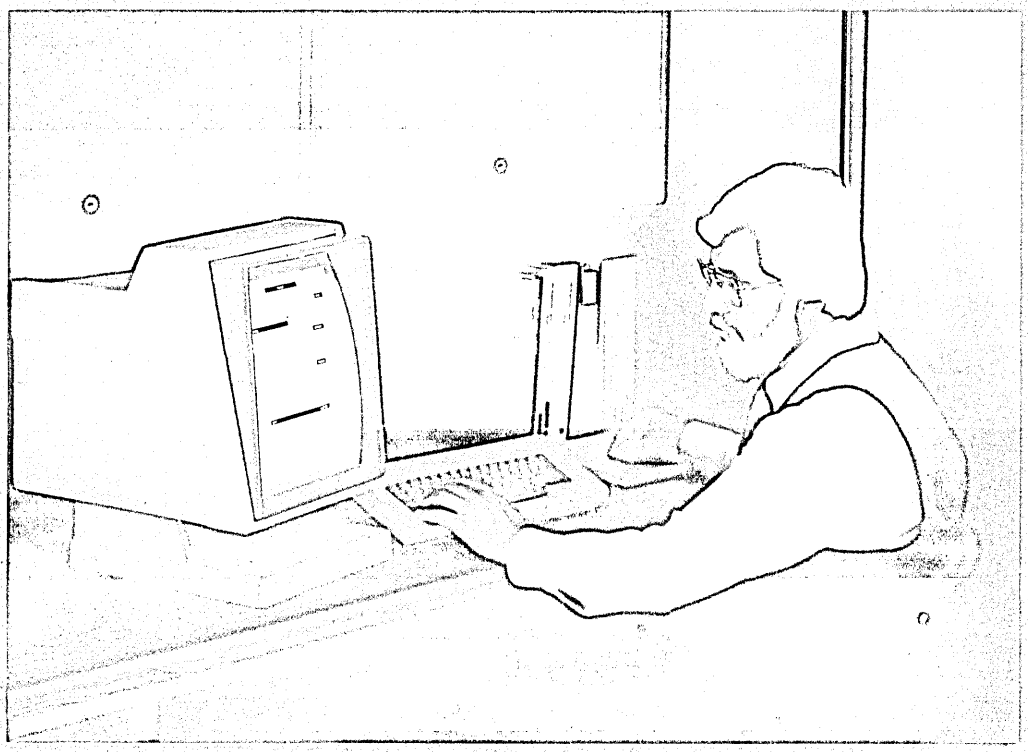

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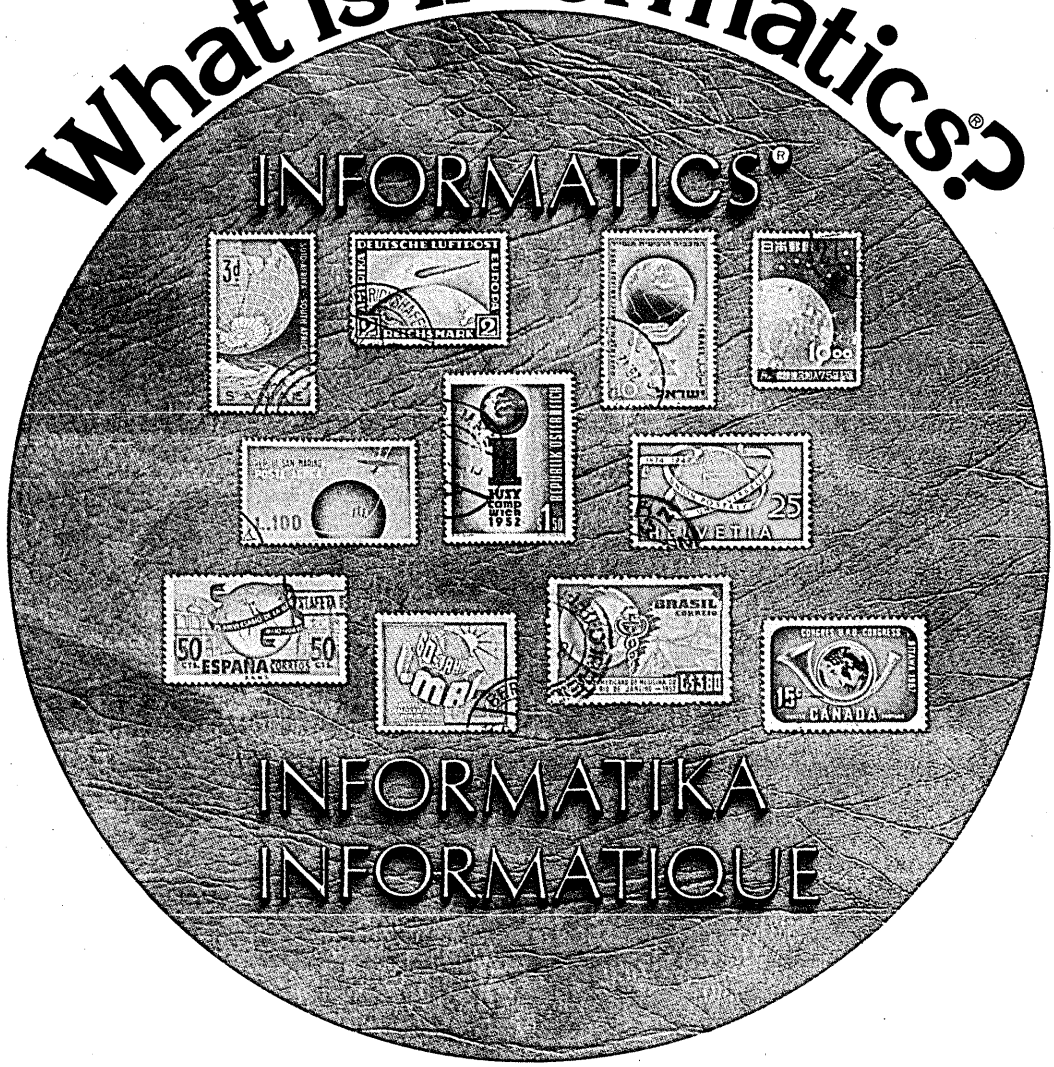

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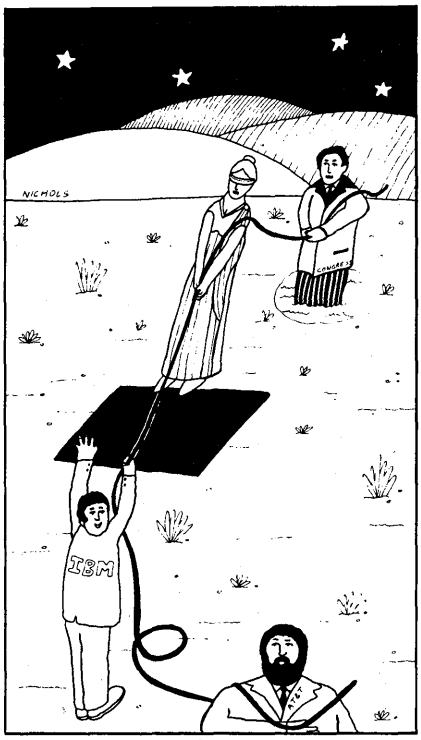
EDITOR'S READOUT

ANTITRUST REVISIONS



When Griffin Bell left the Attorney General's office last August, he, like others caught in the Carter reshuffling, spoke candidly about the post and the institution.

Particularly interesting were his comments on antitrust policy, as described in a *Wall Street Journal* interview.

Bell called for a consolidation of antitrust responsibility in either the Federal Trade Commission or the Justice Dept., not divided between the two as it now is.

And he urged that Justice find a way out of its tortuous lawsuit against IBM, suggesting that there may be something wrong with the court system, that the computer industry has changed substantially over the last decade since the suit was filed, and that the Justice Dept. might seek legislative relief through Congress before launching a major case in the courts. A cautious man, he warned that Congress too might become mired down in the seemingly endless and confusing course of a problem of this magnitude.

We hope that Bell's comments do not go unheeded. We agree that this country's fundamental approach to antitrust urgently needs revision. The IBM case long ago became a meaningless exercise, an enormous waste of money and time, and an impediment to the entire computer industry. The Justice Dept.'s action against AT&T could be even more futile and wasteful.

Bell may be gone, but we hope that his opinions are not forgotten.

THE GAO ... AGAIN

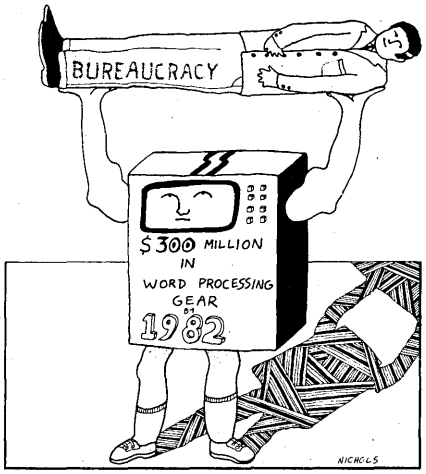
Several years ago we ran some articles predicting the merger of word processing and data processing and urged the dp manager to learn as much as he could about this emerging technology.

The trend has materialized and is beginning to accelerate as word processing equipment becomes increasingly more sophisticated.

For the dp manager who is facing this prospect within his organization, we have another Government Accounting Office report to recommend (last month we discussed a blistering GAO report on the abuses of data base management system procurement within the government).

This time the GAO has cast a cold eye on the acquisition of word processing systems by federal agencies and departments.

They are big users. Many of their 171,000 secretaries are flailing away at over $57 million worth of purchased word processing gear and another $67 million in annual leases. By 1982 the GAO extrapolates that $300 million worth of wp will be supporting the bureaucracy.



In the report, the GAO points fingers, names names, and makes recommendations to unsnarl the mess. On the positive side the agency does single out the Social Security Administration and the Department of the Army as examples of how to install a word processing facility correctly.

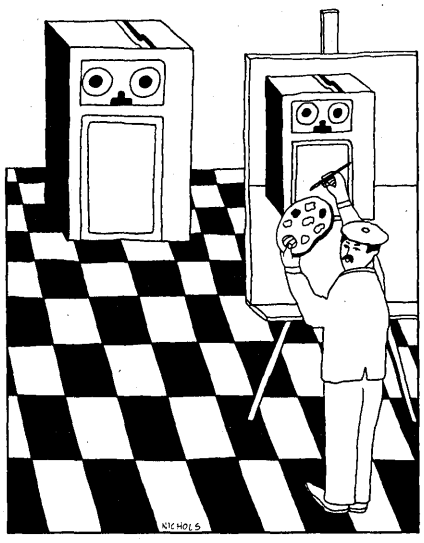
For the dp manager facing the possibility of implementing a system or taking over an existing system, the report is a

READOUT

short but pithy primer on the pitfalls to avoid.

For a free copy write to the U.S. General Accounting Office, Distribution Section, Room 1518, 441 G Street, NW, Washington, DC 20548. Reference report FCMSD 79-17, April 6, 1979.

PLATO AMONG THE DISKS



In his superb new book, *The Medusa and the Snail*, Lewis Thomas urges, only slightly tongue in cheek, that medical students be required to take ancient Greek before being allowed to become practicing professionals. Thomas is concerned with infusing a deep sense of humanity into a profession that seems to be more caught up with stock portfolios than with healing.

Perhaps something of the sort should be injected into the curriculum of future keepers and manipulators of data processing technology. A rash of failures to introduce Montaigne and Plato to budding EEs at the engineering colleges some 20 years ago should not deter our educators.

As the information revolution spreads, we think that all of humanity could breath a little easier if its practitioners had an appreciation for art, history, philosophy and literature, as well as the wonders of relational data bases and the like.

What a joy to find Dylan Thomas and Spinoza cheek-by-jowl with James Martin and the *IEEE Transactions* in the rarified air of the computer room. ✲

"I know that you believe you understand what you think I said, but I'm not sure you realize that what you heard is not what I meant."

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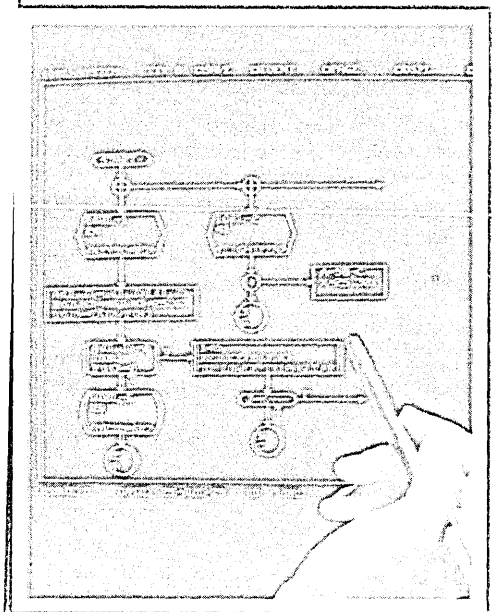

The source of most errors in the entire field of software engineering is the primitive way in which specifications are still being written. With a combination of pen and paper, broken English, a few graphs and a little math, many times the engineer who writes the spec is the only one who knows what he's talking about. Hours are lost. Days are lost. The cost of a system soars. That's why Teledyne Brown developed IORL, the Input Output Requirements Language.

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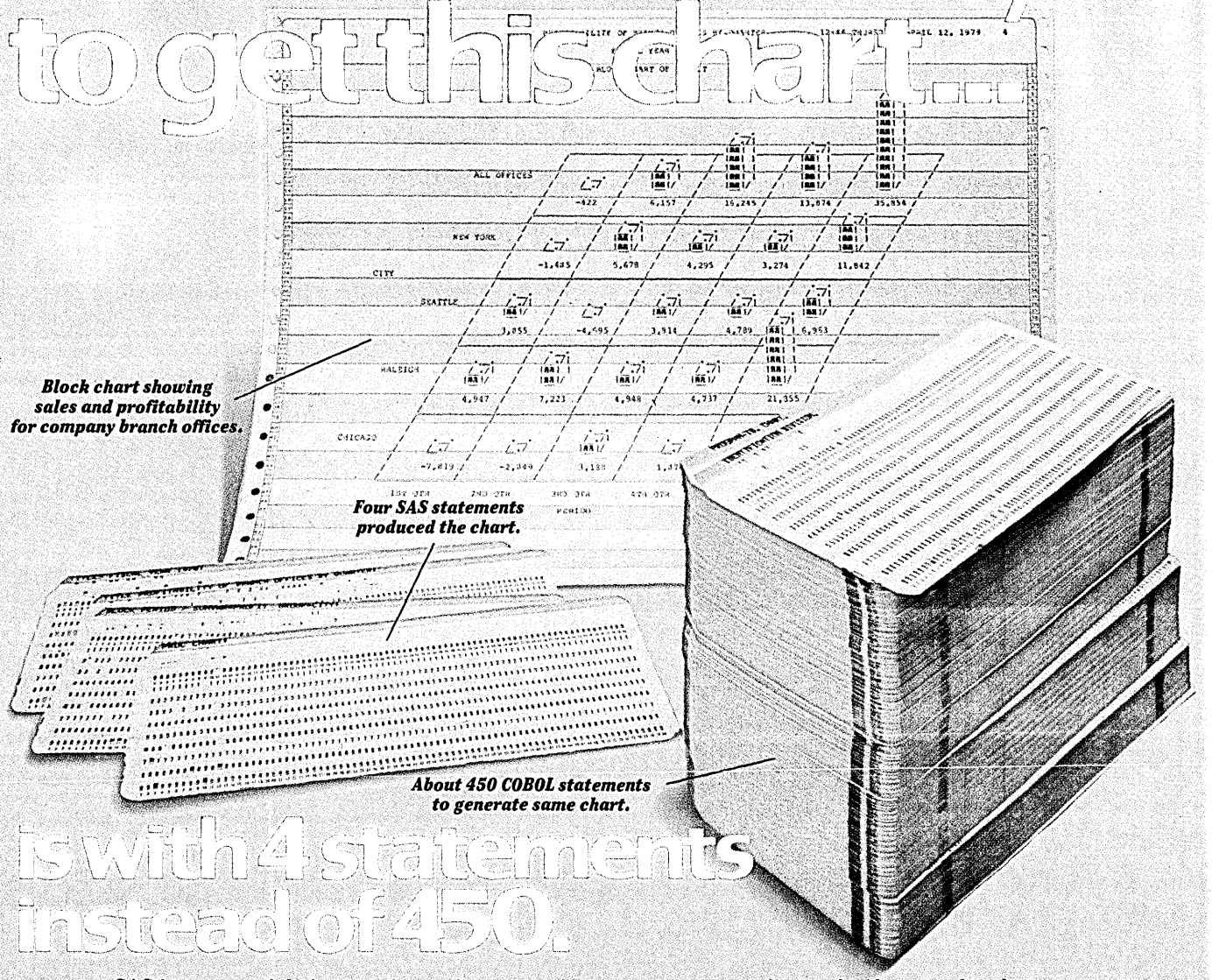

is with 4 statements instead of 450.

SAS is a powerful, time-saving software system. In the programming task shown here, 4 SAS statements produced the same report as 450 COBOL statements. That's a typical SAS application and a routine time-savings.

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We'd like to tell you a lot more about SAS. Just write or call. But do it now. Because there's no better time to start saving time... with SAS.

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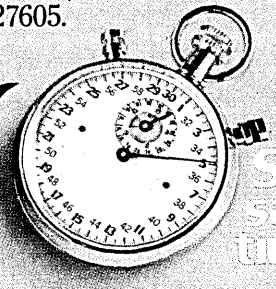


SAS saves time.

CIRCLE 46 ON READER CARD

LOOK AHEAD (continued from page 18)

Louis B. Perillo, president of Data Processing Power, said Liebert technical personnel had visited his plant "at a time when we were talking to them about selling our products along with theirs. "They'll be formidable competitors. They're good marketeers."

REPLACEMENTS FOR IBM DRUM MEMORY

IBM has long controlled the small but very sophisticated airline reservations system market, but recent collaboration of IBM, American Airlines, and several other users of the high speed special purpose ACT operating system has produced a multiprocessor release of ACT which will not support the old electromechanical 2305 drum. IBM, of course, has still not announced its solid state drum replacement, but Intel, STC, and Memorex have products on, or coming on the market. STC says it may be working with airlines to develop a version of its 3350 drum replacement "with, say, 30 megs."

SOFTWARE FOR NCR MACHINES

Not everybody develops software for IBM products only. Century Analysis of Pleasant Hills, Calif., has installed 87 packages for NCR equipment and has three new products in the works. PASS/4, a program generator, was developed by the company's founder, Leonard Lafrance, while he was an employee with NCR in Los Angeles. The others are BOSS/3, an on-line system for inquiry and data entry, and PLUS/4, a data base management system that is offered as an alternative to NCR's version of TOTAL.

A query language is to be announced in December, followed by a word processing system that runs under BOSS/3 and an interactive language with which nonprogrammers can generate computer reports will be introduced in 1980. The 15-person firm may be the only software house devoted exclusively to NCR, although another organization, Ivers & Associates, sells NCR packages developed by others.

TRANSLATE THIS IF YOU CAN

"Dignissum qui blandit praesent luptatum," starts a product description of Enable, something to be introduced by Able Computer, Irvine, Calif., early next year. Sound like Latin? A lot of people have thought so, said a company spokesperson who said its just a meaningless jumble of letter that "don't mean a gosh darned thing." The only thing understandable in the blurb, which is one of many that are totally understandable on Able's other products, is the parenthetical label -- "The ultimate PDP-11/34 class enhancement."

Why the mumbo jumbo? Seems somebody had written up Enable for the piece of literature telling more than the company wants known right now. All the firm will say is that it will combine just about everything it has announced to date in the way of PDP-11 enhancements.

RUMORS AND RAW RANDOM DATA

What's in a name? Could be taxes. The Los Angeles chapter of the Assn. for Computing Machinery was informed its accounts were being audited by the IRS because of the use of the term "advertising" to refer to sponsorship fees for its monthly newsletter, Data-Link. The chapter is changing its ways. The term "sponsorship" will replace "advertising" everywhere it occurs in its records.

NEWS IN PERSPECTIVE

SHINY PLASTIC CARDS

Fostered by technology, they are seen as "at least inflation sustainers."

"To a surpassing degree, shiny plastic cards are the symbol of a new era in consumer finance, reflecting the mobility and financial sophistication of consumers today."

John H. Perkins, president of the American Bankers Assn. (ABA) and of Continental Illinois National Bank and Trust Co. of Chicago, added to this comment, made at the ABA's National Bank Card Convention last month in Los Angeles, a warning note: "Yet—and this is related to inflation and the state of the economy—we have seen warning signs that consumers may be overextended."

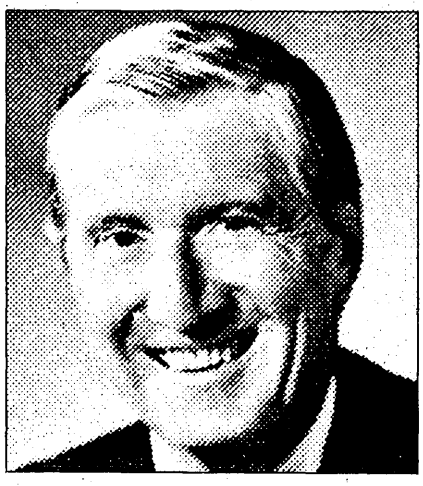
The conference's keynoter, Joseph J. Pinola, chairman of the board, Western Bancorporation, had similar worries. "Are bank cards," he asked, "like the Sorcerer's Apprentice, out of control and proliferating at an unsound rate?

"Americans," he said, "currently owe $21 billion on their Visa or Master Charge cards but, more importantly, they have—by some estimates—more than $40 billion of unused credit. In fact, it has been estimated that the total credit card purchasing power of this country exceeds $262 billion. Is it not at least possible that the use of our cards to beat tomorrow's higher prices is at least an inflation sustainer?"

New York's Citibank recently asked this true-false question in a monthly statement stuffer: "Using your Citibank Master Charge card can actually save you money. Answer: True. Reason: You can actually save money by buying an item before an expected price hike."

However they're used, cards are proliferating and technology is responsible. "Thanks to the electronics revolution," said Perkins, "we are able to process more transactions at lower cost.... We have put behind us certain kinds of misposting and manual handling problems of the 'country club billing' era. We have advanced to descriptive billing, with transaction data entered electronically—our systems are cleaner today." But, he noted, "they are more, rather than less, complex due to technological change and our huge reliance on computerization."

Perkins said year-end 1978 statistics on combined domestic and international bank card use, "show Interbank with nearly 69 million cardholders and Visa with about 75 million, with each system having about 2.9 and 2.8 million merchant outlets respectively. At year-end 1978 the gross dollar volumes for the two cards were around the $28 billion and $29 billion levels. The average outstanding balance per card at the end of the first quarter this year was between $425 and $430.



JOHN H. PERKINS—"We have seen warning signs that customers may be overextended."

He warned against overzealous marketing. "Our marketing efforts always seem to outdistance our ability to deliver the service. There is hardly a card issuer who has not been sorely tested by marketing success—success that has strained operating systems and processing capabilities and in some instances ruptured customer relations."

"Our biggest risk today," Perkins said, "would probably be a loss of confidence in the card by consumers and merchants. That confidence can easily be lost by an authorization system that hasn't been kept up to date and that rejects perfectly legitimate credit requests. Or it can be lost just as readily by a bank's inability to verify a billing item because it entered the system 100,000 transactions ago from another state or country."

Interbank has nearly 69 million cardholders and Visa about 75 million.

Rusty Watson, director of marketing, Bank of A. Levy, Oxnard, Calif., said at the bank card conference that with increasing promotion of cards and other electronic funds transfer programs "consumer fears are more pronounced."

But Herman Kahn, chairman and director, Hudson Institute, Croton on Hudson, New York, said he believes "we are exaggerating the resistance of consumers." He believes distrust of EFT does exist in the middle aged, "but in the young, no."

D. DALE BROWNING—"Those systems that have met with failure are those systems that have moved too fast."

D. Dale Browning, senior vice president, Colorado National Bank of Denver, put it another way. "Electronic banking is something the consumer wants but doesn't know he wants it." He believes "those systems that have met with failure are those systems that have moved too fast."

One pioneering EFT system that was called off this summer was not ended because of customer reaction. James Nelson Jr., senior vice president-personal banking, Hempstead Bank, Long Island, said of his bank's canceled "Instant Transaction" point-of-sale (POS) EFT system, "If merchant and customer reaction were the key to success then Hempstead Bank would never have dropped the program. The merchants loved it. The system worked for them, and they worked for the system. . . . As for the customers, the users had nothing but praise for the card."

"Electronic banking is something the consumer wants but doesn't know he wants it."

Hempstead's problem was it couldn't get other banks to participate. "If we could have gotten other banks to share, then it would have been a viable product," Nelson said.

The Hempstead system has been called the world's first true electronic payments system. All a customer had to do was insert a specially encoded card into a merchant terminal and the customer's account would be credited.

While Hempstead canceled for lack of sharing, a shared system got under way in California, but not in POS. It is a shared automated teller machine (ATM) network implemented by Tymshare, Inc., using an EFT switch it acquired from Savings Assn. Central Corp. Some 20 IBM 3624 ATM's are being deployed as part of the initial network serving savings and loans in the San Fernando Valley. They will become operational early next year.

Watson of the Bank of A. Levy thinks "ATM's are probably the most successful of EFT experiments."

Another bank card conference speaker, Edward J. Stevens, senior economist and advisor, Federal Reserve Bank of Cleveland, feels "ATM's today don't tell you what you want to know. . . . You ask for your balance and you get the balance at the close of the previous business day." He foresees for the future use of the home tv screen for interaction between households and their accounts.

Watson looks for more "self-service banking, consumer-convenient systems. There is more emphasis on staff reduction." She talked about telephone bill paying as an example of a consumer-convenient system.

In Seattle, where telephone bill paying first started and foundered in the early '70s, it's starting again. Telephone Computing Service, Inc. said it is establishing a Pay-by-Phone Service Center in Seattle to service financial institutions in the Northwest and other selected areas of the country. It is to become operational this fall.

And the development of telephone bill paying and the ability of the service to interface with the automated clearing house (ACH) network is under study by Electronic Banking, Inc., Atlanta, for the Mutual Institutions National Transfer System, Inc. (MINTS). Early response indicates that more than three quarters of telephone bill pay service providers follow the prenotification procedures of an ACH user, sending each payee company a list of customers that have signed up to pay it through telephone bill paying.

At the bank card conference, Dick Kane, president of Citicorp Credit Corp., worried about "the homogenization of products." He feels a bank card should "be a pocket billboard touting the message of the provider of services." He looks for a "Star Wars variety of banking services where the card will be a bank in the pocket giving the customer a feeling of an intimate relationship with his bank."

His concern is that customers should relate to their bank as opposed to Visa or Master Charge. It was a concern shared by Browning who said "they (Visa and Master Charge) should be limited in functions they perform as opposed to expansion."

Stevens of the Federal Reserve feels in the future everyone will have a plastic card but he looks for "a consolidation of all the various plastics—consolidation accounts. It boggles the mind the number of accounts individuals can have today."

He also feels the bank card industry faces a "regulatory burden that is too large. We will get regulatory reform. I do not think we'll see the end of regulation but we will see some rationalization of it."

Perkins feels today's regulatory agencies "have the awesome power to bring almost any undertaking in the private sector to a halt. Even more insidious, they have the power to slow it down and sap its efficiency—with paperwork required by the 58,000 new pages of regulations introduced every year, paperwork that regulators in 1979 will spend an estimated 92,000 man-years processing."

But regulation has not stopped the proliferation of plastic. Ted Amazeen, Jr., vice president, The First National Bank of Boston, said at the bank card conference that he carries nine pieces of plastic. "Eight times out of nine the issuance was not initiated by me. Only three come from my home city. This suggests that geographic limitations are not limitations today. We wouldn't have this without automation."

—Edith Myers

MINICOMPUTERS

IBM MINI A RADICAL DEPARTURE

New system architecture produces "remarkable" price/performance benefits.

An experimental IBM minicomputer called the "801," the product of a four-year development effort at the T.J. Watson Research Center in Yorktown Heights, N.Y., has drawn major attention from IBM's product line divisions with "remarkable" price/performance benefits due to a radically new system architecture.

Dr. Joel Birnbaum, director of the computer science department at the Watson lab, said the 801 development program was the largest on-going project at Yorktown and "one of the most ambitious projects we have ever undertaken." Birnbaum gave a first, albeit sketchy, description of the 801 project at a Brown Univ. symposium that marked the recent inauguration of a full-fledged computer science department at the Providence, R.I., college.

The Watson Research Center is the headquarters for IBM's Research Division, a group separate and distinct from both IBM's product divisions and the IBM R&D Division. The Research Division is generally regarded as IBM's group for blue sky, high risk projects—heavily dedicated

to basic research and the realm of possible but improbable potential. Set up in opposition to IBM's overtly product-oriented R&D, the Research Division explores radical alternatives, said Birnbaum—including some that are born, like the 801, with the idea of putting aside all the 360 and 370 architecture. "Starting from scratch," smiled Birnbaum. "Doing it right."

Although Birnbaum and other Yorktown staff cautiously avoid offering any specific performance data, Birnbaum at one point told his Brown audience that the 801, because of its extraordinary speed, will be used as an ultrasensitive "hybrid monitor" for both hardware and software on 370/168 configurations in Yorktown's experimental systems laboratory. In this application, he said, the 801—"executing three or four instructions in the space of a memory cycle of a 168"—could actually "snoop around" in the main memory of a 168 without slowing down the big cpu's performance under heavy burden, to provide previously unattainable performance data.

While considerably less than descriptive, as a hint this is rather exciting. The main memory cycle time on the Mod 3 168 is 320 nanoseconds. If the 801 is three times as fast, it would have a MIPS rate of over 10. As a measurement of performance MIPS rates are suspect, but it is startling to note that the internal speed of the 168 itself has it executing 2.4 million instructions per second (MIPS), and the 3033 has a MIPS rate of 5, according to IBM.

"If it does what it is projected to do, what the simulations indicate it should do, it will give us some fairly significant cost performance advantages over other

The 801 team is only now debugging the first prototype.

machines IBM has made in the past," acknowledged Birnbaum. The 801 team is only now debugging the first prototype, he cautioned, and despite the apparent results of simulation studies, without programs running through the iron "it's still hard to predict how successful it will be." Nevertheless, he said, the Research Division has decided already to build three or four prototypes for internal tests in varied environments.

At Yorktown, 801 project manager George Radin, one of the primary authors of the PL/I language, said the new minicomputer design has drawn unusual enthusiasm from the technical staff. "Good results always lead to good feelings," said Radin, "and from the beginning we've had surprisingly good results."

"We've got quite a few well-known people working on that project, people who have had successes before," said Birnbaum, "so it has attracted attention within the company's product divisions."

The 801 design appears to trade off some of the unused generality of conventional machine architecture—relying more on the support of an intelligent compiler and a high level language—to allow single-cycle execution of hardwired instructions which in conventional systems are interpreted through microcode and executed in several machine cycles. A unique dual cache separates data from instructions and thus allows the 801 to access both in a single cycle.

The 801 concept proposal is credited to IBM fellow John Cocke, who guided much of the architectural and compiler design over the last several years. Birnbaum described it as not so much a single idea as an elegant restatement of observations made over many years of IBM trace tape analysis: studies that contrasted patterns of actual machine use with the generality of function built into the machine primitives.

Trace tape analysis has long highlighted the fact that a relatively small number of a computer's instructions—usually the simplest (store, load, shift, simple branches, etc.)—get vastly more use than the many others. Yet system architecture generally required that even these instructions be interpreted through microcode instruction sets (which require several machine cycles to execute) in order to support a rich and changeable internal interface.

"The question we asked was, 'Isn't this rather silly in terms of the way people use machines?' " said Birnbaum. "Why not take this primitive set of instructions and hardwire them into the machine so that it executes them in a single cycle—and not make believe that we haven't been working with optimizers and compilers for 15 years or so!"

The follow-through involved an unusual multidisciplinary design team—one-third engineers, one-third compiler people, and one-third system programmers doing the OS and file system—who were brought together under Radin to work on the design from the onset. The joint design approach drew some of Yorktown's best talent, said Radin.

"We got together a bunch of programmers and engineers—men with a lot of experience with IBM trace tapes; men who know what our programs do on our machines—and we tried to understand what things are expensive or slow. What in the hardware can an intelligent compiler discover need not be there at all at run time? Or whose function can be done in some degenerate, fast or cheap way at run time?

"And it turns out," said Radin, "there are really many, many such cases. So, we developed a system in which the hardware and software sort of fit together more rationally. You get less of this over-generalized execution and therefore you get better performance and less cost."

Birnbaum, despite his managerial reticence, bridles at the suggestion that the 801 design loses true generality. "We don't sacrifice that, we just implement it differently," he said. "The question is, do you then pay a performance penalty for implementing those things which were

"Good results always lead to good feelings and from the beginning we've had surprisingly good results."

left out of the hardwire, the things we implement as subroutines of these primitive instructions?

"The question is, how much do you lose? And the answer *seems* to be, although I'm not sure yet, that not only don't you lose—in many cases you actually gain!"

The "almost cross-cultural" design team had several obvious opportunities to reimplement major functions once the architecture was open to challenge. Grafted functions could be integrated. High speed buffered memories and caches are now common, but in the IBM 370s, they were retrofitted into the machine and therefore made transparent to the software. "That seemed to us unnecessary when compilers and operating systems could take very great advantage of the information they could gather by analyzing what the program is doing with stored information," noted Birnbaum wryly.

"The combination of compiler and machine tries to move to compile time whatever can be moved there—because clearly whatever is done in compile time need only be done once, rather than upon every execution of the program," explained Radin. "For those things which *have* to be done at run time," the design team sought the hardware/software combination that would minimize the number of machine cycles, if they could not bring it into a single cycle.

The team adapted a subset of PL/I for the 801 design—PL.8—although Radin foresees no problem in putting FORTRAN and Pascal front-ends onto the compiler. With the complementary design of the 801 and PL.8, however, the user gets some additional security and program protection. "It's possible to do an analysis of what data a program touches and what data a program changes. Possible to do flow analysis on the program in compile time so that in fact you can guarantee that in this program—when it accesses X of I, for instance—I is going to be within the range of the declaration of that array. And, therefore, you don't have to check and see whether by some error it was too big and will clobber some other part of the program."

To limit the cycle requirements—indeed to make possible single cycle execution of instructions—the 801 has dual caches to separate instructions from data. The fetching and storing of data and the fetching and storing of instructions, are thus asynchronous and parallel so that the 801 can, in a single cycle, fetch instructions from the instruction cache, execute

"The combination of compiler and machine tries to move to compile time whatever can be moved there."

the instruction it's already got, and load or store data from the data cache. The dual cache structure is very difficult to build into any conventional architecture, explained Radin. "This was a lot more than just an implementation decision."

The 801 basically has two I/O buses; one a direct memory access high speed bus, a standard direct memory access, except it is designed to have high band width; and the other, a program input/output bus which will be used for control and low speed devices.

The 801 I/O structure is also highly unconventional. "We view I/O as being handled through adapters custom designed for the device being connected," explained Birnbaum. "We think those adapters are cheap and easy to do because we think that what has been done previously in a controller can (in the 801) be done in the central processor. We think we have enough performance to make that an efficient way to operate."

—Vin McLellan

OFFICE AUTOMATION

A TRIAL BALLOON IN D.C.

Xerox's experimental office information system gets high marks in the White House, but others are wary.

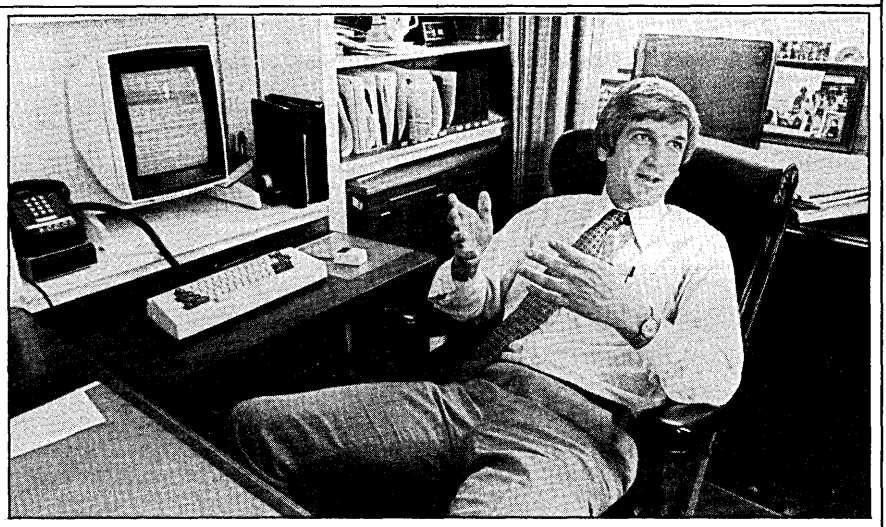
Washington, D.C., is a city quite familiar with trial balloons. Over the years, countless projects and schemes have initially surfaced this way so it isn't at all surprising to see a major office system vendor testing the Washington waters in search of a market. And that's exactly what Xerox Business Systems is doing in an effort to check out the potential marketing might of its sophisticated but still experimental office information system.

Officially called the Advanced Multi-Function Office Station (AMFOS), it was developed at the Xerox Palo Alto Research Center around a work station called the Alto. It's attracted much attention despite Xerox's concerted efforts to keep it under wraps. Up until the fall of 1977, Xerox did not allow the prototype system to be used outside the company. Operating internally at Xerox in an exclusive evaluative mode, the AMFOS wasn't installed at an outside site until May 1978.

That outside site happened to be the White House, which had a contract with Xerox to test the AMFOS system through the National Bureau of Standards. In addition to the White House, the Xerox systems also are being evaluated by the NBS, the House and Senate. "Washington," confirms a Xerox spokesman, "is definitely a major test site for the AMFOS system."

While Xerox readily acknowledges all this AMFOS activity in Washington, up until recently the company has been reluctant to talk about it. All the Capital city contracts, in fact, carry specific nondisclosure clauses. As part of these confidentiality conditions, neither the White House, Congress nor NBS is supposed to say anything about the experimental system. Xerox itself, a company spokesman explains, is also "not supposed to use the fact that the system is installed in these places to advance the marketing of the system in any way should we ever want to market it."

But despite the hush-hush atmosphere, AMFOS systems in Washington are no secret. The key system element is the Alto workstation which features advanced alphanumeric and graphic capabilities. The station includes a keyboard, a high resolution crt, a 16-bit minicomputer and a disk. Another important system component is the xerographic printer which receives digital images from the workstation. (While the printing is done xerographically, the imaging is done with a laser.)



RICHARD HARDEN of the White House uses Xerox AMFOS "to improve the productivity of the executive as opposed to just doing the fancy text-editing type applications."

Communications is through an Ethernet-type distribution arrangement which allows up to 256 communicating workstations to be connected to the sys-

Richard Harden of the White House says, "It's the most powerful piece of equipment I've ever worked with."

tem. Using this wideband link, the stations can broadcast brief bursts of information at frequencies of 50KHZ or more.

The White House complex has five AMFOS systems in operation. To prevent them from shooting off megahertz-range emanations, Xerox designed special shields for the gear for the White House environment. Some of the system's high-speed logic caused these broadcast problems and troubled security-conscious White House personnel who found that the system was jamming their own bug detection devices.

As part of the White House project, the Office of Management & Budget put in a standalone AMFOS for its energy task force. Installed in August, the system helps track the Administration's energy initiatives and legislation. Most of the AMFOS systems in the White House have been aimed at sophisticated word processing applications. These chores basically involve document and newsletter production. Some interactive graphics experiments are also under way, but no production jobs have as yet been tackled.

Fascinated by AMFOS's wide-ranging applications potential, President Carter's assistant for information management, Richard Harden, has launched an experiment in his own office with the equipment. Harden, who also serves as director of the Executive Office of the President's Office of Administration, had two

shielded Alto workstations installed in June—one in his office and one directly outside at his administrative assistant's desk.

Harden views his AMFOS arrangement as an executive workstation. He says he wants to explore the possibility of using this technology "to improve the productivity of the executive as opposed to just doing the fancy text-editing type applications."

Xerox has been working closely with Harden to develop certain applications. Harden is currently using the system for such applications as document preparation, project tracking and list maintenance. He's also considering a scheduling/time analysis system which would maintain his appointments schedule as a byproduct.

"By now I would have expected Xerox to have announced the product. And that makes us a little bit uncertain about it."

Harden is impressed with the Xerox system and sees the White House experiment as a mutual learning experience. "It's certainly the most powerful piece of equipment I've ever worked with," he declares.

Another AMFOS experimenter, House Information Systems (HIS) chief Boyd Alexander, is less enthusiastic. Alexander, who has been using the system (currently configured around five workstations) about a year and a half, says "the newness has worn off." HIS, which is currently evaluating the AMFOS project, has found the system lacks capabilities needed in a total office automation application.

Alexander reports that while the system is good at handling large volumes of text such as committee reports, it isn't particularly good on small correspondence work. "The communications aren't quite there yet," he contends, "and that's the weakest link. Also, the graphics package, while a unique approach, is a little difficult to use."

While AMFOS has potential, "right now it looks like it's probably going to be more costly than alternative methods that could give us the same product," he says.

Xerox spokesmen repeatedly point out that Xerox is still in a marketing probe phase with AMFOS and will eventually get all functions running smoothly. "It's kind of a battle," concedes a Xerox source, "between maintaining a certain degree of functionality, and yet making it available to terminals which have no capabilities in terms of implementing those functionalities. It's a very difficult problem to wrestle with."

John Swearingen, director of technical services for the Senate, is cautiously optimistic about his AMFOS experiment which began in August 1978. "We're getting use out of (the system) but we're not ready," he insists, "to make a general application out of it." Swearingen also admits that Xerox's reluctance to talk about even a tentative timetable for any follow-on product has given rise to uncertainty. "By now I would have expected Xerox to have announced the product. And that makes us a little bit uncertain about it," he confesses.

The Senate, which is running an AMFOS setup with eight workstations and three xerographic printers, is using the system mainly as a pure word processor to get material such as committee reports ready for printing. "As far as the printing aspects of the system are concerned," Swearingen notes, "we think it has great possibilities."

AMFOS project workers in the Senate, according to Swearingen, did send Xerox back to the drawing boards for more software. Xerox came up with some fixes but some of "the changes we've asked for we understand could be substantial," says Swearingen.

To date, around 1,200 Alto processors have been manufactured by Xerox. Some are workstations and some have been incorporated into filing systems, communications stations or laser printers. Most of these Alto's are being used in-house by Xerox in an R&D mode. Several large U.S. corporations are also pilot testing the prototype system. Xerox, however, declines to pinpoint exactly which companies are on the test circuit. But the company does admit it's searching for new test candidates.

"We're looking for additional probe sites to test different functionality for the workstation," affirms one Xerox insider. "We're very interested in the clerical aspects of it as opposed to the secretarial aspects." But what will that future product be like? The Xerox source sheds some light on what may unfold: "We're really looking at this system in its product form as a terminal which would have multi-uses based on the kind of software we would develop to put into it. It would be a common set of hardware tailored to a specific application based on the software. . . . And all communications would be over both the intraoffice network, Ethernet, and the interoffice network which could be a combination of leased lines, satellite communications, XTEN or whatever communications facility might be available in the future."

Xerox's future in the office-of-the-future market clearly hinges on the AMFOS system. Today the company seems content to garner feedback from its various marketing probes, including the highly visible ones in Washington. But the cautious company also knows some of its system testers are getting anxious. Declares the Senate's Swearingen: "I'm pleased with the test we took. Now we're waiting on Xerox to see whether the market is there for them—whether they are finally going to follow up and give us all the benefits of a production model."

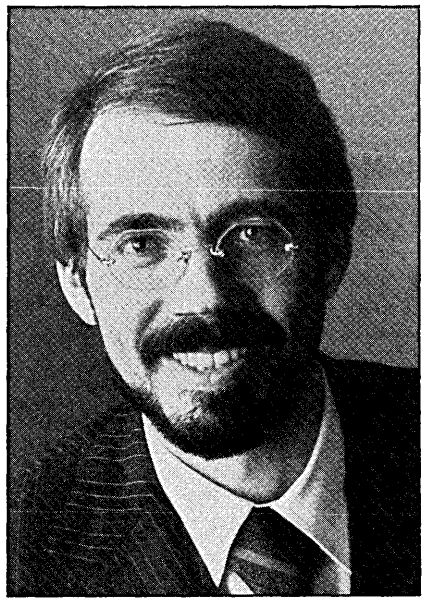
—Linda F. Runyan

SETTING THE PACE FOR EMS

Qyx could make big bucks in electronic mail market for parent Exxon.

Question: What is Qyx? a) An intelligent typewriter, b) A word processing terminal, c) A data processing communications terminal.

Ask Dan Matthias, the president of Qyx, the answer to the above question and he might well answer a, b, and c. And with justification because the Lionville, Pa.-based division of Exxon Enterprises, Inc., is by no means going to restrict itself to the electronic typewriter market.

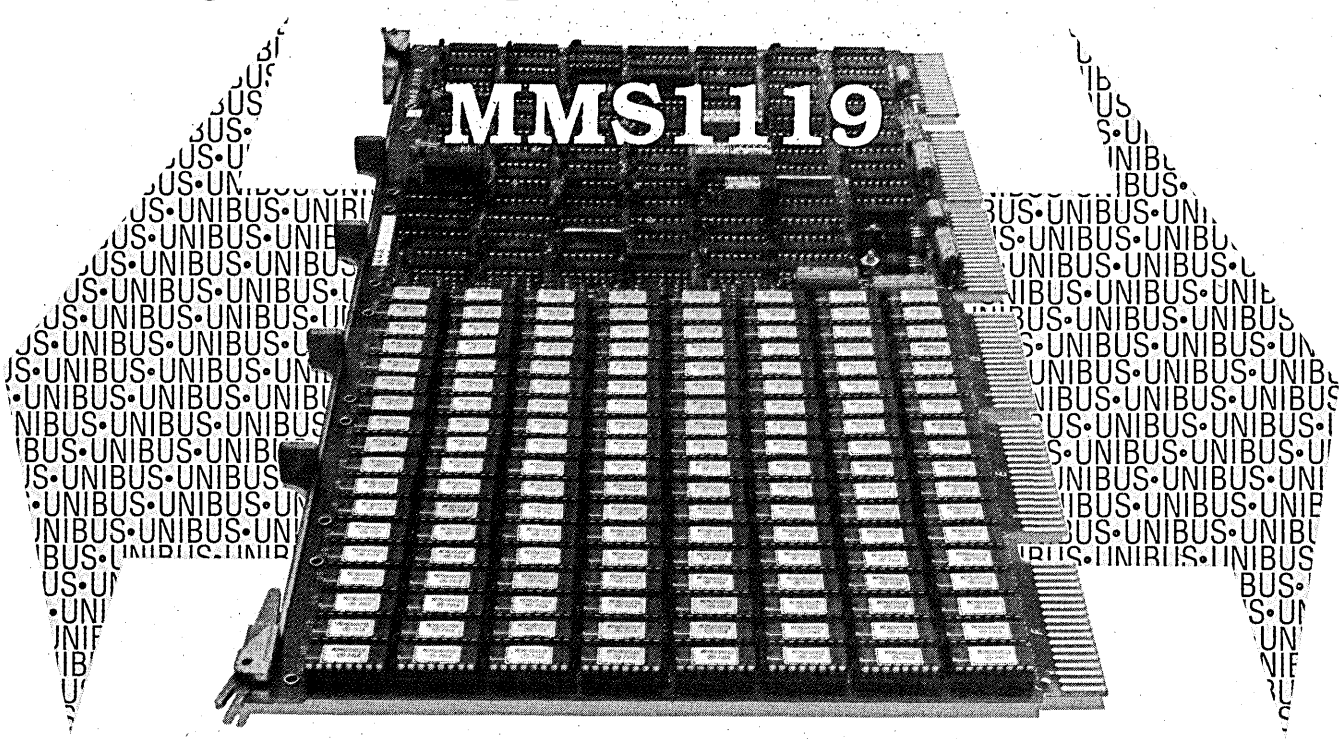


DAN MATTHIAS—He views Qyx device as a terminal rather than a typewriter.

"I've always perceived Qyx as a terminal rather than a typewriter," notes Matthias, who had the idea for Qyx and started the company three years ago. "But it's a terminal that is inexpensive enough to fit on every single desk."

However the product is perceived, it is evidently being well received in the marketplace. Several hundred machines are being shipped from the company's production facilities every month, and the

Technological leadership.



Introducing Motorola's one-megabyte PDP-11 add-in.

PDP*-11 users can now match the four-megabyte address capability of their Extended UNIBUS* system with just four of Motorola's new standard MMS1119 memory cards.

When the MMS1119 is populated with 144 of Motorola's new MCM6664 single-supply 64K dynamic RAMs, this Extended UNIBUS compatible add-in memory provides a full megabyte of storage.

It's organized as 512K words by 18 bits, with 22 address lines. On-board parity is standard, with no degrading effect on speed, and may be omitted.

The MMS1119 is also available in 64K, 96K and 128K word configurations, which are function-for-function and pin-for-pin compatible with the DEC* MS11-L series of PC boards. These smaller capacity boards use Motorola's MCM4116 16K RAM and are Modified UNIBUS compatible.

Typical access time of the MMS1119 is 300 ns, and cycle time is 420 ns. Stored data is automatically refreshed every 2 ms, with a single refresh cycle initiated every 16 μs.

The one-megabyte MMS1119 uses less power than the comparable 128K-word board using three-supply 16K RAMs. Motorola's fully-populated MMS1119 is only a single UNIBUS load.

The MMS1119 is built with a standard HEX slot PC card, compatible with PDP-11 backplane connectors and card cages. All boards are given extended burn-in at 70°C, and a one-year limited warranty is standard.

*Trademark of Digital Equipment Corp.
†Trademark of Intel Corp.

MMS1119 — available now.

Evaluation units of the MMS1119 are now available. Production quantities are available in 30 days ARO (16K RAM versions). The 1119 is priced to save you money, and there are no delivery problems.

A broad line of add-in memories.

In addition to the new MMS1119, Motorola's line of cost-saving add-ins includes several others for DEC PDP-11 and LSI-11, General Automation 16/110 and 16/220, and for Intel SBC† systems.

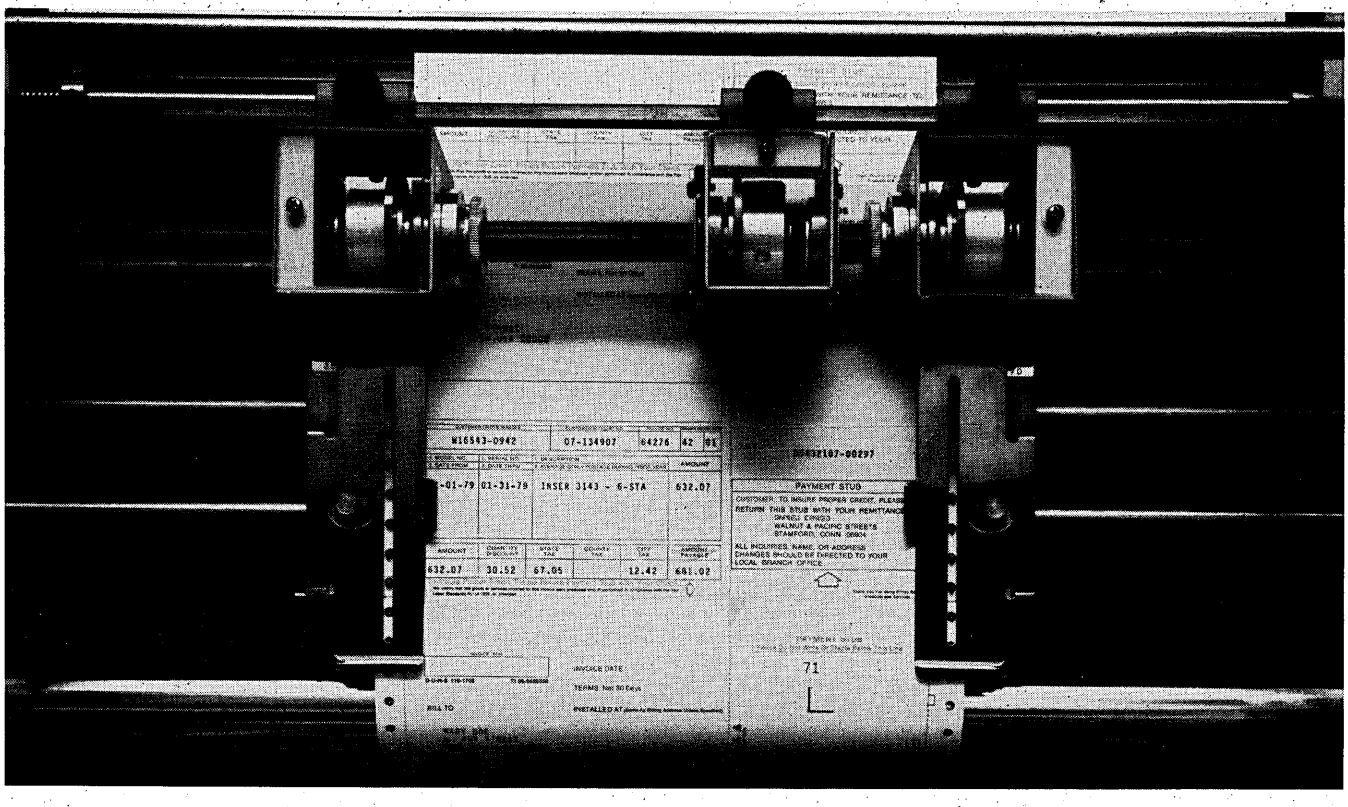
Motorola also has extensive custom memory expertise for your one-of-a-kind requirements.

For immediate information on the new MMS1119 or any of our other boards, contact your local Motorola sales office or write Motorola Semiconductor Products Inc., P.O. Box 20912, Phoenix, AZ 85036.

Leading edge storage is one of the many technologies with which Motorola is serving the designers of

Innovative systems through silicon

MOTOROLA INC.



Minutes ago these bills were in the computer.

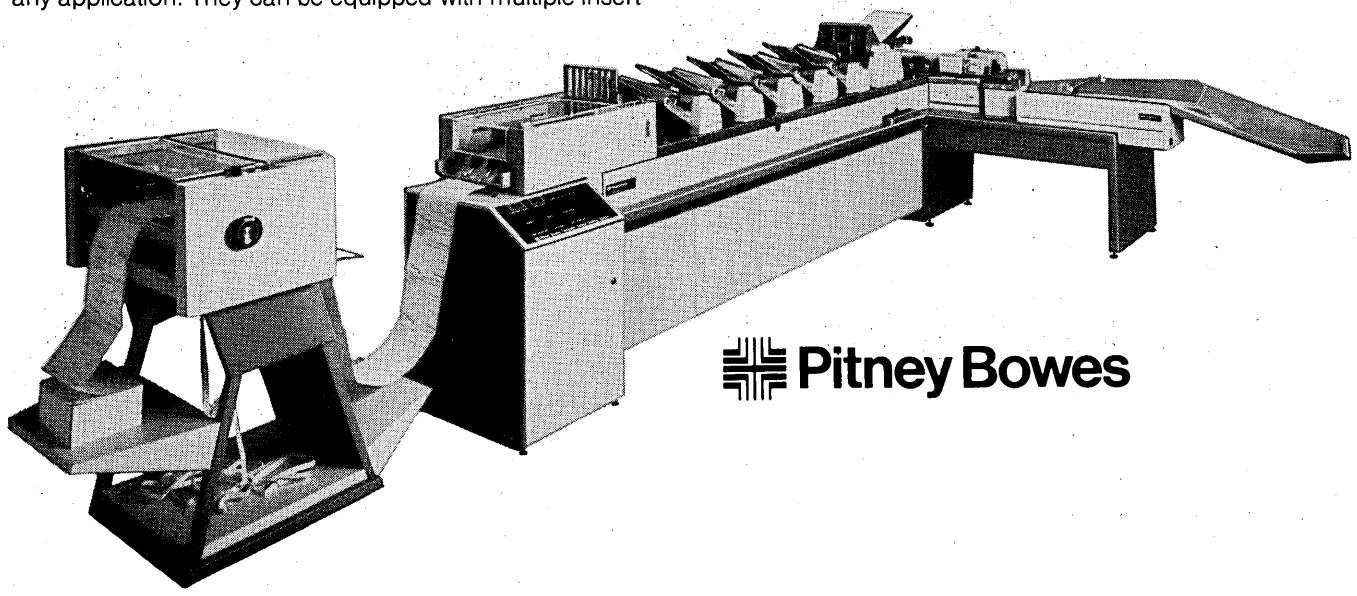
Minutes from now they'll be in the mail.

The Pitney·Bowes high-speed Computer Output Mailing System takes over where your computer leaves off. It performs an entire range of forms-processing, inserting and mailing steps in one non-stop sequence, completely eliminating the stop-and-go pace that has previously hampered computer-to-mail operations.

You simply thread your continuous forms web into one end of the system, press a start button and get ready-to-mail envelopes at the other end. Bursting, folding, trimming, slitting and imprinting operations are all performed at web-fast speeds without a single manual interruption.

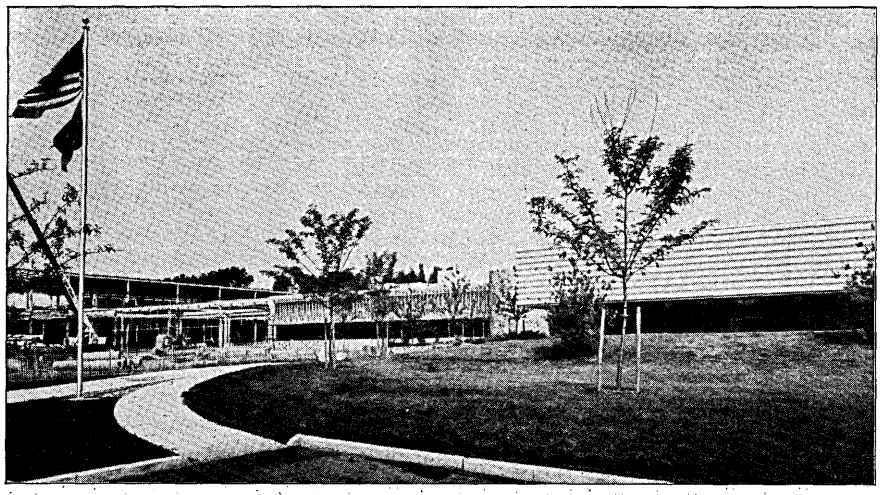
Systems can be custom-assembled to meet virtually any application. They can be equipped with multiple inserting stations, electronic scanning, document verification, group feeding and selective collating. And thanks to the postal service presort discount and the system's zip code sorting options, you can save 2¢ on every invoice or statement you mail first class. In short, everything you need to add real zip to transactional mailings.

For complete facts and figures, write to Pitney Bowes, 2146 Pacific Street, Stamford, CT 06904. Or consult your local yellow pages. Over 600 sales and service points throughout the U.S. and Canada. Postage Meters, Mailing Systems, Copiers, Labeling and Price Marking Systems.



Pitney Bowes

CIRCLE 21 ON READER CARD



FOUNDED in 1975 by Matthias and a handful of consultants, Qyx is adding on to plant in this 36-acre tract in Lionville, Pa.

capabilities of the machine, which employs Zilog Z80 microprocessors and large system integration (LSI) technology, are being enhanced. Recently, as an example, Qyx introduced options enabling the machine to transmit documents to other Qyx units over standard voice grade lines, or to Vydec word processors. "With this development we have set the pace for widespread electronic mail use," Matthias asserts, "and by interfacing with the Vydec word processors, we can start to realize the promise of the automated office."

Eventually, Matthias sees Qyx as forming the key element in a workstation that will include a modular package of video display, voice response, word processing and communications technologies. But the evolution from office electronic typewriter to a far more sophisticated dp or executive workstation is restrained, for the time being at least, by several factors,

Vendors and users still are undergoing a learning process.

Matthias says. Among them: the still prohibitive costs of incorporating some of these technologies into a single unit and the learning process that vendors and users are still undergoing.

Meanwhile, Qyx, the company, continues to grow. Founded in the summer of 1975 by Matthias and a handful of consultants working out of a basement in Lionville and made part of Exxon a year later, the concern has expanded to the point where it now has branch offices in 16 cities across the country and should generate revenues in excess of $12 million for its first full year of operation.

But this is only the first chapter in what ultimately may prove a big business for Exxon if Matthias' projections are on target and the product itself evolves into much more than an electronic typewriter.

—L.M.

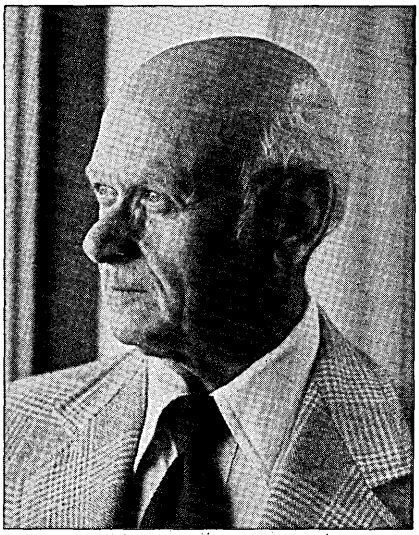
ENVIRONMENT

MOVING TO POWER SYSTEMS

Air conditioning supplier, Liebert Corp., ventures into a new part of the computer industry.

The Liebert Corp., which makes precision air conditioning systems for computer rooms, is venturing into a new part of the industry. It has brought out a line of electrical power systems designed, like its air conditioning products, specifically to meet the demands of computer installations.

A significant feature is that the new power systems will provide flexible distribution, using adjustable cables, rather than the rigid, "hardwired" distribution systems currently used. The use of standard connectors between the cables and the mainframe also will speed reconfiguration of the user's computer room whenever the inevitable moving day arrives.



RALPH LIEBERT—He took his first garage-built unit to IBM.

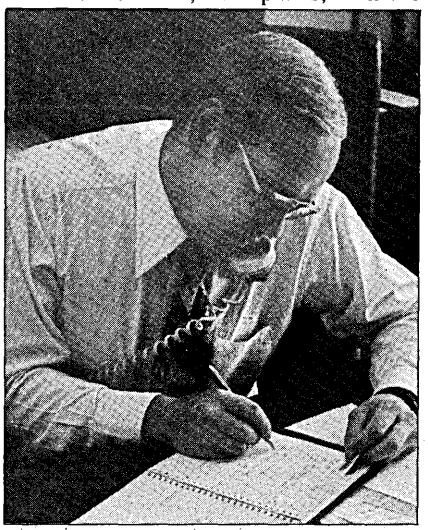
Liebert designed and built its own transformer for the power systems. Officials said it is intended to reduce "spikes" of up to 15% over normal power or as low as 30% below normal to a variance of no more than 2%, plus or minus. The system will monitor itself constantly and will provide LED readings of the performance of various functions in serial fashion. Or it can give continuous readings of just one function, they added.

The power systems have been designed and are being built by the Conditioned Power Corp., a wholly owned subsidiary of Liebert, which sells them to Liebert. They will be sold to the user by the Liebert sales force of some 175 manufacturer's representatives.

Computer power systems is only one new field the company is plunging into, says Larry Liebert, the executive vice president. The son of Ralph C. Liebert, who established the company in 1966, Larry's main responsibility is setting its strategy for the future.

He sees the expansion of Liebert's international business as another fertile field the company can plow in the next few years. "It means continued security as far as our business goes," he says. "The market potential is not only there, but it's also untapped."

The privately held company had revenues of a bit over $48 million during the fiscal year ending last Sept. 30. Larry Liebert says about 75% of that came from domestic sales, while the remainder came from international marketing. He wants to increase the international portion of the mix to about 50%, he explains, with the



LARRY LIEBERT—"We will remain private. I don't anticipate us needing public money."

NEWS IN PERSPECTIVE

other half coming from domestic efforts.

The company has charted a third category of expansion, but it is unrelated to the computer industry. Its Special Products Division, headed by Robert A. Liebert, another son of the company founder, is developing complete heating, cooling and refrigeration systems for the food retailing industry.

Liebert now has about 575 employees and about 300,000 square feet of

The market potential is not only there, it's also untapped.

manufacturing and office facilities at its Columbus, Ohio, headquarters, and is adding another 150,000 square feet, which will be finished next spring.

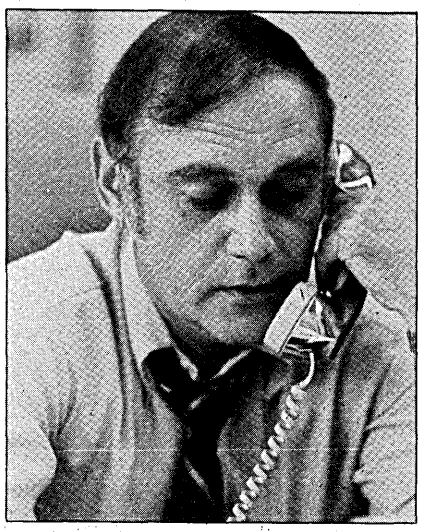
All of it is a long way from Ralph Liebert's garage, where in 1965 he and his son-in-law built the first of the computer air conditioning units which have become, together with water and other types of cooling systems, the mainstay of the family's business. It is even farther from his arrival in Columbus in 1946 as a refrigeration mechanic franchised by one of the major manufacturers in the then-new field of air conditioning to sell five-horsepower units. This was the foundation of the Capitol Refrigeration Co., which the senior Liebert ran as an air conditioning and mechanical contractor for 20 years, until he turned it over to a cousin in 1966.

Ralph Liebert believed the computer was the wave of the future and he had learned that if the machines got too hot, they would become balky or even collapse entirely. So he took his first, garage-built unit to IBM and offered to supply Armonk with more of the same. IBM was impressed with the technology, but had reservations, Larry Liebert recalls. "They said 'Great!' But when we asked them how many they wanted, IBM told us flat out they had no intentions of going into the air conditioning business."

On the other hand, IBM did not turn the senior Liebert out into the cold. Instead, it allowed him to set up inside IBM's booth at a large data-processing show in Philadelphia. "We spent that show explaining who we were and why they needed us to anyone passing by, sold the one unit right out of the booth and went home with enough leads for our first year's business," Larry Liebert says.

"While other manufacturers also produce computer cooling units, our biggest competition is a building's central system," says James Good, Liebert's director of marketing. "People just don't understand that people systems can't handle the computer room."

The most important functions controlled by a precision cooling system, he explains, are the temperature and relative humidity of the computer room. In addition to the debilitating effect of heat itself



JAMES GOOD—"Our biggest competition is a building's central system."

on the cpu, a relative humidity which is too high can cause deterioration of tape and paper jams in the printer. If the humidity is too low, however, it can lead to static electricity in the system, Good adds.

And the costs of downtime can be horrendous—up to $7,000 per minute in the case of airline operations, which are particularly dependent on computers. Good says the company used to estimate the maximum cost of downtime at about $1,000 per minute, but when the airlines heard this, "they laughed at that."

Liebert's systems cost more than building-wide comfort systems—$15 to $20 per sq. ft. installed for the former, compared to $10 to $15 per sq. ft. for

IBM was impressed with the technology but it had reservations.

building systems—but company officials say their's have the advantages of redundancy built into each system, as well as independence from building systems, which may be required by federal regulations to shut down at night or run at temperatures uncomfortably close to the maximum recommended by the computer manufacturers.

"They're the Cadillac of the industry," says Thomas G. Ringkamp, vice president for design and construction of the American Express Co., which has been a Liebert customer "for years." "You pay more, but if you want to have no problems, it's well worth the price," he says.

Texas Instruments is another satisfied customer. "We've had no complaints whatsoever," says Jim Ferrell, a project engineer in charge of computer facilities in Dallas. His group now has 31 Liebert units, having bought them through competitive procurements with another manufacturer.

How Rental Electronics helps you avoid terminal obsolescence.

As soon as you take delivery on a new printer or data terminal these days, it seems the next generation is already being announced. Chances are, it has capabilities that begin to make your "new" equipment obsolete. Now, thanks to Rental Electronics, you can have your terminals and highest technology, too.

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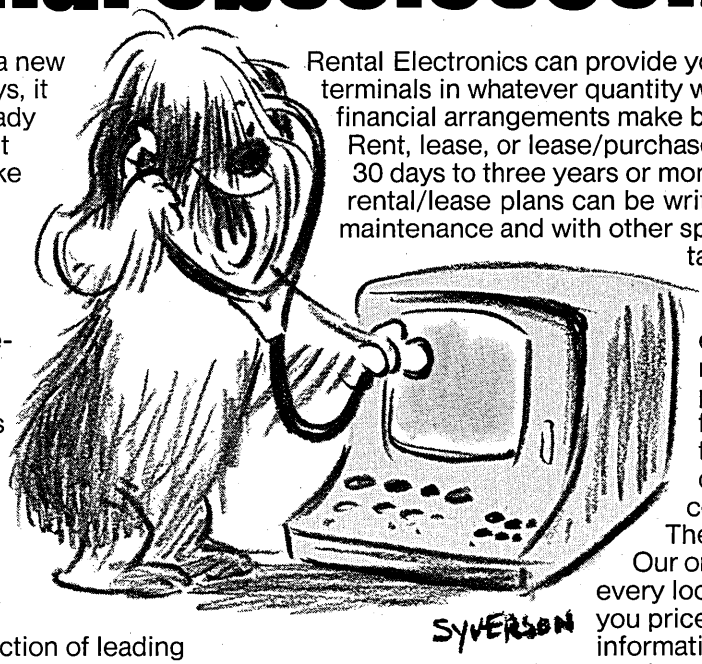
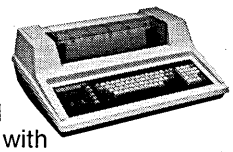


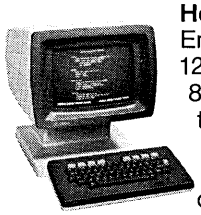
If you're interested in more information on renting printers or terminals from Rental Electronics, call one of our local rental centers today. They're listed opposite. Our on-line computers at every location let us give you price and availability information instantly, while you're still on the phone. In the meantime, check some of our featured rental offers below.

Printers and Data Terminals

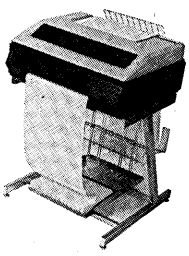
Here is a sampling of the printers and data terminals available from Rental Electronics. Call or write today about your specific needs.



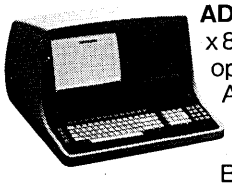
TI Model 820 Keyboard Send-Receive Data Terminal/Printer Printer operates at 150 cps on 9 x 7 wire matrix assembly printhead. Full ASCII Keyboard (ANSI-compatible) with N-key roll over. Operates in Asynchronous, USASCII, RS232C interfaces and is compatible with Bell 103, 113, 202 and 212 units. Selectable baud rates of 110 to 9600.



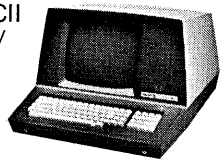
Hewlett-Packard 2621A/P Terminals Enhanced 9 x 15 dot character cell, full 128-character ASCII character set in 24 80-character lines. Two pages of continuously scrolling memory. RS232C and Bell 103A compatible. 110 to 9600 baud. 2621/P includes built-in printer operating at 120 cps.



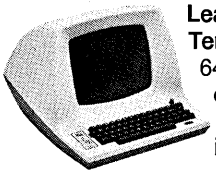
Tally T-2000 Hush-Tone Line Printer Acoustically designed enclosure. Operates at 125 (Model 2100) and 200 lines/minute (Model 2200) with standard 64 character USASCII. Line spacing switch selectable, 6 or 8 per inch.



ADDS Regent 200 Terminal 24 lines x 80 characters, 25th "status" line shows operating mode. 128 character ASCII. RS232C/CCIT V.24 communications interface operating 75 to 19.2 BPS, switch selectable. Buffered transmission, auxiliary ports.



Beehive Micro B 1A Terminal 128 ASCII character set; switch selectable scroll/non-scroll mode; X-Y addressing; 24 x 80 display format; single key memory lock; fully buffered communications to auxiliary peripheral device.



Lear Siegler ADM-3A Data Entry Display Terminal 12" diagonal, 24-line screen. 64 ASCII characters. Full or half duplex operating modes, switch selectable, baud rates from 75 to 19,200. RS232C interface, 20mA current loop.

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CIRCLE 52 ON READER CARD

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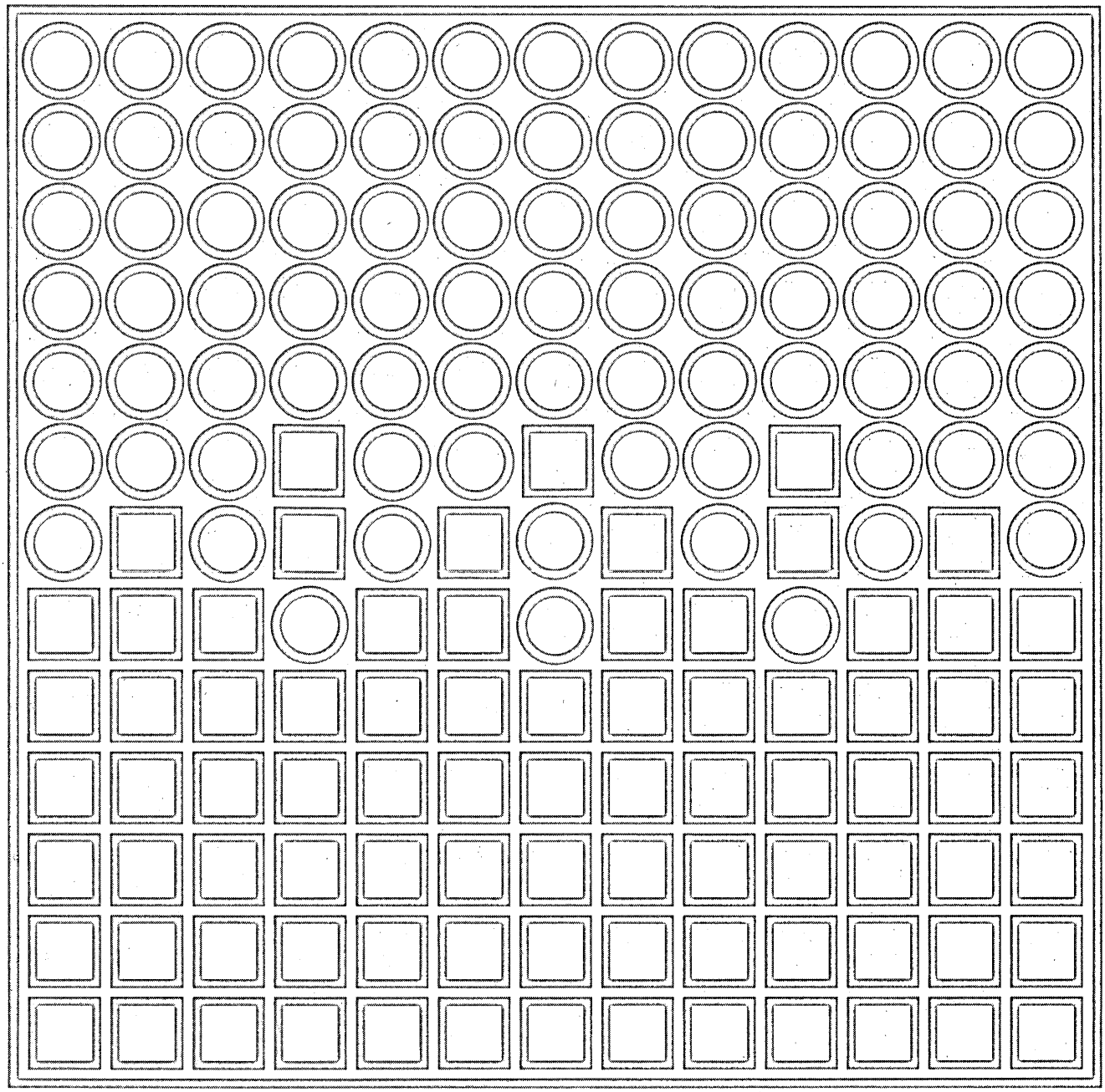


BECAUSE MANAGING DATA MEANS MANAGING CHANGE

Computer Corporation of America

CIRCLE 19 ON READER CARD

TI went on to buy two of the first power control units as well and its experience shows the active role in the company played by Ralph and Larry Liebert and their concern for detail. The control units were shipped to TI without their "power monitor consoles" because the Lieberts were dissatisfied with the original design.

Liebert company officials say that although they had invested $20,000 in tooling for the original console design the Lieberts ordered that the display be redesigned. New ones were built from scratch and shipped to TI to be retrofitted on the power control systems after they were installed.

Larry Liebert wants to maintain close involvement in details of the company's work, when he feels it is necessary, and he wants to keep the "family feeling" within the company. "We're all on a first name basis and when we recruit for management positions we make sure they understand that," he says.

The family has had numerous feelers about whether they want to sell the company, but Larry Liebert says "we will remain private. I don't anticipate us needing public money." Liebert employees voted against the United Auto Workers in a union representation election two years ago and Larry Liebert says he wants to maintain the company's non-union status as well.

For the future, he sees tighter environmental requirements for the new generations of computers. IBM's 4300 series shows the way to the future. "They had the tightest specifications on the environment we have seen. The power specs they listed were the tightest ever," he says. All of which, Larry Liebert believes, will mean plenty of demand for the company's products in coming years.

—Louise Shaw & David Williams

CONTROLS

CONTROLS WITH BRAINS

T-Bar's intelligent switching and control systems allow users to call up backup units faster.

Can a company that makes switches find success in the wide world of dp and data communications? Decidedly so, according to A. Henry Morgan, chairman and chief executive officer of T-Bar Inc.

"We're not a dp company nor a data communications company, we're a controls company," Morgan said. The significance of the statement begins to come through as he explains what T-Bar systems do for a user.

A. HENRY MORGAN—"We're a controls company."

Tracing the evolution of his control systems, Morgan went back to the early days of airline reservation centers. "When a cpu or a major peripheral subsystem failed, an operator would manually have to switch to backup devices to keep the reservation system operating. But today's on-line systems are too complex and manual switching would take too long," he added.

Today the company offers microprocessor-controlled systems that offer "adaptive comparative control features."

Essentially, what T-Bar has done is automate the switchover function which allows the user to call up backup units faster and also reduce the amount of redundancy needed in a system. In the early days, a data communications network that required continuous up time would have to be configured with backup modems in each line in case of failure. But with automatic switch systems, or matrices, one backup modem might serve five lines. The switch matrix would connect the spare modem to a failed line almost instantaneously, Morgan said.

From these early switch systems, the company has expanded its basic concept until today it offers microprocessor-controlled systems that offer "adaptive comparative control features," he explained. Morgan said these intelligent switches are able to monitor a system to make sure all elements are operating properly; they are able to display the operating environment to the user and to make decisions based on anticipated failures.

While the latter category appears to be total automation, the T-Bar chief emphasized that anticipated failures are based on making comparisons with existing operating data of the system. "That's where the comparative control comes in," he said, "but ultimately the operator still makes the decisions."

Morgan claims his company's systems have no real competitors. Asked about the so-called tech control centers that have been added by many large network users, he acknowledged that these systems have many of the features that T-Bar has, but he pointed to some major differences. "Most tech control centers are supplied by equipment vendors. Thus a modem maker will concentrate on controlling modems, and these systems often stop at the front-end."

In contrast, T-Bar intelligent switch systems check the network, its equipment, the cpu and its peripherals. "We look at everything," Morgan said.

The intelligent switches of today evolved from several generations of monitoring equipment. The first stage was the introduction of diagnostics into networks. The diagnostic systems could spot problems but they had no control elements.

Next, users began to install network control systems which added such functions as loop-back testing to check a network from modem to modem. These systems were designed to keep the network operating by monitoring how it was operating, Morgan said.

The most recent development has been network management which adds efficiency measurement to the monitoring function. These systems have the ability to accumulate operating data and reduce this data. The goal is having the network operate in the most efficient manner.

Today's intelligent switches evolved from several generations of monitoring equipment.

Despite his contention that T-Bar systems do not have competition, Morgan admits that other vendors duplicate certain functions. "But we look at a user's data communications and dp as a single dynamic entity. We control a network in the same way that Honeywell automation controls a building," he emphasized.

If his firm has mastered communications and dp systems, are there still new worlds to conquer? Yes. Morgan said the next step will be to automate the switching of multiple data bases. "We're already working to monitor and control back-end processors," he said.

Morgan also sees new applications in integrated corporate networks that combine office automation with data communications and dp functions. T-Bar is currently working on a network for a major U.S. manufacturer that interconnects

We control a network in the same way that Honeywell automation controls a building.

three continents and two oceans combining facsimile, digital telephone switches, data terminal switches, and other functions. The entire network is monitored and controlled with a customized T-Bar intelligent switching system.

There are also new uses developing in computerized data base services to the home where the consumer will have the ability to select from a menu that includes stock data, movies, travel information, sports, etc. All this will require switching between data bases as users make their selections, Morgan predicts.

And even the switches themselves are sure to improve. Today's magnetically latched relays will be replaced by mechanically operated optical switches by 1982, he said.

With all these advances coming up, Morgan does not feel threatened by the thought that other firms may come out with intelligent switching and control systems. He feels T-Bar will hold its own—and he certainly doesn't want to be accused of being a monopoly supplier.

—Ronald A. Frank

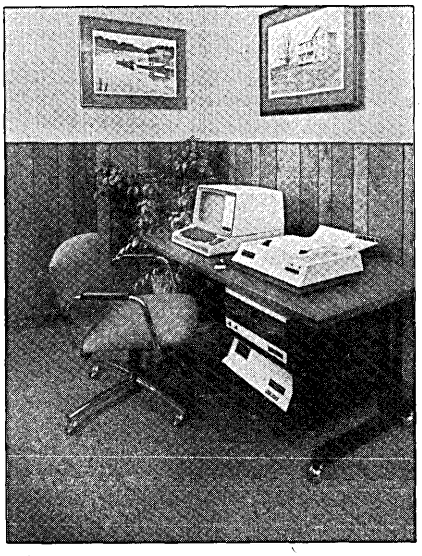
SMALL BUSINESS SYSTEMS

SYSTEMS FROM HEATH

Kit maker envisions becoming the IBM of small business microcomputer systems.

The two giant suppliers of computers to the hobby market made a logical move this spring and summer to offer higher priced computers to the emerging very small business market.

Tandy Corp. in May launched its TRS-80, Model II, which under a variety of configurations offers twice as much speed and several times the power of its tremendously successful TRS-80, marketed to hobbyists and professionals through its 4,000 Radio Shack stores. Heath Corp. in late summer announced two successors to hobby computers it sells in kit form in 55 outlets. But it is adopting a somewhat different strategy than Tandy, which will sell the Model II through its own stores.



READY TO TURN ON: Heath's WHS11A consists of the mainframe in lower right under desk, the floppy disk drive above it, a microprocessor-based video terminal at left on top of desk and an optional printer.

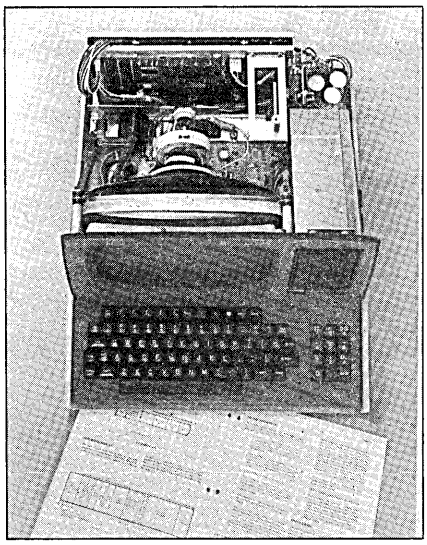
Heath has formed a separate business—Heath Data Systems—to design and market the new computers, but not the kits, through independent distributors and oem's. And last month it was completing negotiations with a third-party maintenance organization, Sorbus, to service them nationwide.

Heath already has two products ready for shipment—the 16-bit WHS11A and a lower priced WH89. (The "W" is for "wired" or assembled to differentiate from its kit versions, the H8 and H11.) And it has more new products and software in the works at its 75-person Data Systems headquarters in Benton Harbor, Mich., which eventually will be named the Heath-Zenith Data Systems Division when Zenith Radio Corp. completes its acquisition of Heath (for $64.5 million) from Schlumberger, Ltd.

"We fully intend to become the IBM of small business microcomputer systems," says William E. Johnson, Heath's marketing vice president who has spent 19 years with the company. Forecasts show the company will be selling $50 million worth of computer systems by 1982, but Johnson says this easily could double to $100,000,000.

In mid-September, Heath had signed on with four distributors—Computerland, Byte Industries, MicroAge, and Compushop—as well as a half dozen oem's. Although it won't sell the kit line, it will use its 55 outlets to store spare parts.

Its 16-bit WHS11A, compatible with Digital Equipment Corp's PDP-11/03, lists for $6,289, about 26% lower than DEC's comparable systems, and uses LSI 11/2



HEATH'S WH89: Floppy disk system is built into the right front area of the terminal on this system which Heath says is ideal for word processing or use as an intelligent terminal.

technology. As such it allows system designers to take advantage of Heath components in a "mix-and-match" configuration for the best possible cost and performance, Heath says. Its mainframe uses the DEC KD11 HA cpu board, a small size board that provides more space for memory and I/O.

Its 512K dual floppy disk drive, controlled by a Z80 microprocessor, also is compatible with DEC's RX 01, thus allowing the use of application programs

Its DIBEX product will take all applications software written for Digital's DIBOL 11.

written by users of DEC systems. Its Z80 controlled video terminal also is compatible with a DEC product, the VT52, and its operating system, called HT 11, was developed jointly with Digital Equipment as a single-user single-task system for interactive program development and for doing applications on-line. Heath is selling it for $350, along with a FORTRAN version at $250.

And for oem's who have a big investment in training and applications software written in DEC's business language, DIBOL 11, Heath will offer early next year a DIBOL compatible operating system, called DIBEX, which was developed by Information Access Systems, Inc., of West Caldwell, N.J. DIBEX is a series of programs that make up a time-sharing system for small-business users, allowing them to communicate with up to 20 terminals. Heath said any existing program written in DIBOL will run on the DIBEX operating system without change. The

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company said DIBEX software will be an additional $1,000.

Clearly, Heath is aiming at DEC oem firms for much of its marketing. Johnson said that eventually a third of its oem business could be with DEC oem's. DEC's announcement early this year of a distributor program and its high-handed methods of providing oem's with distributor status (September, p. 106), along with

There is a "confusing array of misplaced systems on the market."

a shortage of hardware deliveries by the company, could draw many DEC oem's to a supplier providing products that are compatible with what they've already been selling, particularly if the discounts are attractive.

And Heath says they are. An oem buying up to 34 systems is offered a 26% discount and discounts run all the way up to 39% off for orders of 1,000 and up.

Heath's 8-bit system, the WH89, carries a suggested list price of $2,295, which it says is 33% lower than the Tandy TRS-80, Model II. Both the crt terminal and the microcomputer have their own Z80 microprocessors, so the video terminal doesn't have to share processor power with the computer. It is supplied with 16K of RAM that is expandable to 48K. A single drive floppy disk system, built into the right front area, has a storage capacity of 100K per 5¼-inch diskette. An accessory two-port serial I/O interface is offered for communication with printers or time-sharing systems. It will run programs written in Microsoft BASIC and assembler languages. Operating software for the floppy disk system includes extended Benton BASIC, a two-pass absolute assembler, text editor to prepare source code for BASIC and other languages, a machine language debugger, and disk utility programs for file manipulation.

Company provided applications packages will include word processing and accounting.

Although Heath has done pretty well in the computer kit market—its annual volume of about $15 million represents about 85% of the kit market—that market isn't growing as fast as the business computer market. But Johnson admits that the small business market is "in a state of flux. . . . It abounds with manufacturers that are unable to keep up with demand, or unable to offer the kinds of products or margins retailers and oem's require," while at the same time prices continue to tumble.

Johnson says the entry into the market by hobby computer manufacturers who have found that the home computer market isn't developing as predicted, have created "a confusing array of misplaced systems on the market." He adds, "A great many of these systems are offered by companies that will simply not be around in a few years because their products were not designed for business applications."

Heath will be around, Johnson says, "because it has done a lot of listening to computer retailers, distributors and oem's." Also, it has the financial staying power to compete. Although Zenith Radio hasn't disclosed how it will support Heath's newest venture, Johnson says it has "shown a very high level of interest," and that it has the know-how to produce this kind of product in volume. (To make that goal of $100 million by 1984, Heath will have to be making about 10,000 copies of each of its two models.)

As for follow-on products, the company isn't talking. But Johnson points out that Heath has a two-year "multi-million dollar" research contract with Massachusetts Institute of Technology's computer sciences department. That, and Zenith's support, would insure that Heath won't be left out as new technology pushes the way the market goes.

—Tom McCusker

MARKETING

UNLIKELY SYNERGY

Three unrelated businesses work together for the mutual profit of a parent.

Can a computer company, a jewelry firm and an interior design organization be synergistic?

Dennis Jay Cagen would answer yes to this question. Cagen is president of the David Jamison Carlyle Corp., a holding company with operations in the three diverse but synergistic areas. And they all operate under one roof.

The David Jamison Carlyle Corp. is a large-scale distributor of computer

Both the design company and the computer operation are big among racquetball clubs.

terminals, data communications equipment and systems. Martin Zamir Co. imports and manufactures fine jewelry, especially jade and opal. Design 1 is a full service interior design firm specializing in commercial and professional applications. All are located in one suite at 2049 Century Park East, Los Angeles, Calif.

"We all have customers in common," said Cagen. "Design 1 is big in doing racquetball clubs and, as a result, the David Jamison Carlyle Corp. is becoming big with a system and software for racquetball club operators." The distributor operation was the first distributor for Rexon Business Machines Corp. Design 1 decorated the Rexon plant. "And we're the computer industry's biggest jewelry supplier," quipped Cagen, who admitted the synergy here isn't as direct. "Computer customers and Design 1 clients get-

He expects to be selling used Basic Fours and to have little competition.

ting a tour of our offices are shown our jewelry operation and our wholesale price list. They can't resist." He said this usually means more than one sale. Those who make the tour and see the jewelry tell others in their firms and "the next thing you know, every time somebody has an anniversary or a birthday . . ."

The David Jamison Carlyle Corp. wasn't always all these things. It was started three years ago by Cagen, then 31, to be a distributor of Teletype-compatible computer terminals. A former western regional manager for Lear Siegler's terminal operation, he had left Lear Siegler with four others to form Soroc Technology Inc. which today makes its own terminals; Cagen is one of its distributors.

"Being a marketing type, I didn't have the patience to sweat out the growth pains of a new manufacturing company," he said. So he decided to become a terminals distributor. He got the business going (September 1976, p. 177) at the National Computer Conference in June 1976 when he committed to buy $1 million worth of the then new Beehive B-100 video terminals. He had sold five of them by the next month. "I was able to get quantity prices and to undersell Beehive and offer faster delivery since I was already on delivery schedule and they were heavily backlogged."

In the ensuing three years he has operated this way with all firms for whom he distributes. These now number more than 40 and have gone beyond terminals to include printers, computers, storage media, modems and acoustic couplers and cables.

And the computer part of the David Jamison Carlyle Corp. has two subsidiaries of its own. One is Tava Systems Inc. which got started as the first distributor of Intel add-on memory and is organized to be a computer memory and peripheral supplier serving the small- to medium-size oem and end user markets. The second and newest is DJC System Corp. which delivers complete turnkey small business systems supported by "hundreds" of application packages and continuing software support.

Cagen built his software group around two former Basic Four software

engineers who brought with them to DJC 24 Basic Four customers for whom they had been doing on-going software support on an independent basis. DJC still has these customers and has increased this base.

And Cagen feels this could be an entré into another area the firm is cultivating, the used computer brokerage business. The firm already has a part interest in such an enterprise (Century City Computer Broker) and Cagen feels this ultimately will become a subsidiary.

Cagen's systems operation sells systems based on Rexon machines. He feels the 24 Basic Four customers ultimately will outgrow their systems and will become prospects and customers for the DJC Systems Corp. "And we'll have used Basic Fours to sell and nobody will be competing with us."

How the conglomerate that today is the David Jamison Carlyle Corp. got to be goes back to the beginnings of Cagen's distributor operation. The other officers in the holding company: Dr. Robert Firestone, a psychologist, chairman of the board; Barry Langberg, an attorney, chief executive officer; and Marty Zamir, secretary, had long been friends of Cagen's.

Cagen first told Langberg of his plans for his new company, which he named to conform to his initials, and Langberg expressed a desire to invest in it. Langberg told the others and they wanted in, too.

Two years later it was decided that, since Zamir's then 15-year-old jewelry company and Cagen's distributor operation were financially related, they should become closer. In the meantime, Langberg's then girl friend (now his wife)

He's now president of a $1.7 million company employing 70 people.

and Cagen's former wife had started Design 1 as a home interior decorating operation that fast blossomed into what it is today. The decision was made to bring the three firms, Cagen's operation, Zamir's and Design 1, together under a holding company and so—today's version of the David Jamison Carlyle Corp.

And for Cagen, once a one man band with a part time secretary, it means the presidency of a $1.7 million operation employing 70 people.

The firm's Century City offices are a showcase for Design 1 and lead a lot of people, Cagen said, "to think we have a big overhead. We don't." The company advertises that its computer inventory is housed in "six strategically located warehouses coast-to-coast." Only one of these actually belongs to the company. It's in Culver City. The others belong to trucking companies used by the firm.

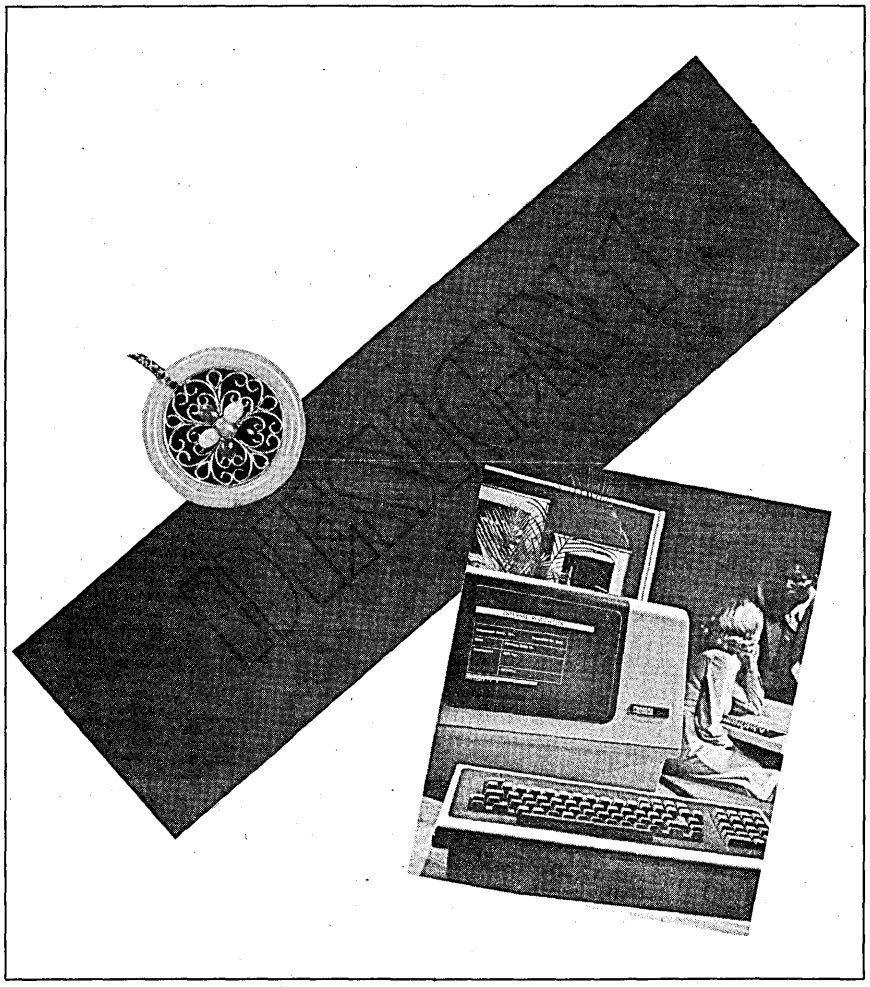
Where possible, they use literature printed by the manufacturers they represent. "We only print our own when there is no other recourse." Their only offices besides Century City are small ones in New York, San Francisco and Honolulu.

And, Cagen says, the company gets the most and best from its employees most of whom own stock in the privately held organization. And they own stock in something else, a company called EI for Environmental Investments formed to take possession of two boats, a 70 ft. schooner and a 40 ft. sloop.

When the first of these, the schooner, was acquired the company found a crew of young people, all under 22, to crew it around the world. The cruise took 18 months and while it was on, company employees on vacation could pick up passage on whatever leg of the journey was current. Cagen himself sailed from Honolulu to California on the final lap.

"Most of the crew members are now employees," he said. The schooner and the later acquired sloop are harbored now at Marina Del Rey within easy sighting of a telescope situated in Langberg's 30th floor Century City office and available for use by all employees.

EI, when the two ships had been paid for by contributions from its employee owners, invested excess monies in



THE ODD TRIO—Jewelry, computers and terminals, design . . . they can be mutually supportive.

the David Jamison Carlyle Corp. so it's difficult to say whether the company owns the ships or the ships own the company.

One of the David Jamison Carlyle Corp.'s operating philosophies is not to say no if the price is right. Cagen recalls an auctioneering concern which was planning a large scale auction in Los Angeles of exotic Eastern goods. "They asked us if we could automate the operation within a month's time. We were about to say it was impossible until they told us they had

One operating philosophy is not to say no if the price is right.

$20,000 to spend. We did it via National CSS and now we think we have a viable auction system we can sell."

And the company is on the lookout for new and synergistic ways to diversify. Maybe in another three years they'll be into scuba diving, fast foods and astrology. It's anybody's bet and that could get them a foothold in Las Vegas.

—Edith Myers

COMPANIES

RIDING HIGH

Storage technology, unaffected by IBM price cuts, envisions a billion dollar year in 1982.

At a time when a number of plug compatible manufacturers are having their difficulties, Storage Technology Corp. appears to be flourishing.

In fact, the Louisville, Colo., based memory systems manufacturer experienced the highest domestic end user sales in its 10 year history in August, and STC management is markedly bullish these days. So much so, company chairman and president Jesse I. Aweida is projecting an increase in revenues of 40% or more over the next five years and a billion dollar year in 1982.

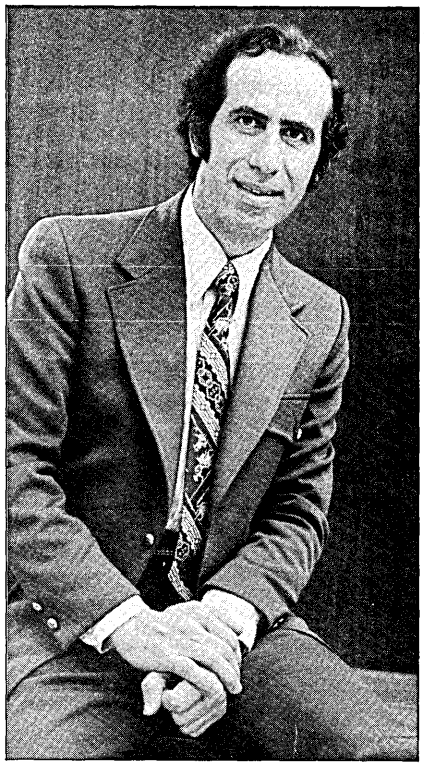
Not even the IBM price cuts and new product announcements have slowed down STC, which has shaved production costs and consequently could afford to pass on cost reductions in the wake of IBM's bargain basement strategy, Aweida claims. "We can afford to cut our prices when they do," he explains. "And when IBM comes up with a price cutting strategy, they create a two-edged sword. I think they may have overimpacted themselves in this case."

"IBM created some confusion in the marketplace," adds STC executive vice president for field operations—and Jesse's brother—Naim S. Aweida, "but now that's behind us and we are experiencing a strong order rate."

STC also reads two other key industry developments—the pending Amdahl-Memorex merger and Itel's near collapse—as potential boons. The company now stands to pick up some Itel business and may be in an even stronger competitive position against chief rival Memorex in the oem market. "When Memorex goes in to sell oem to a mainframe manufacturer, it will represent a potential competitor to that manufacturer if it's tied in with Amdahl," an STC executive reasons.

In addition to its end user tape and disk drive business, STC does a strong oem business with vendors like Univac, Burroughs, DEC, and Siemens.

Additionally, the firm is hoping to attract a wider play among minicomputer customers with "small box" oem products—the STC 1900 tape subsystem and



JESSE I. AWEIDA—"We can afford to cut our prices when IBM does."

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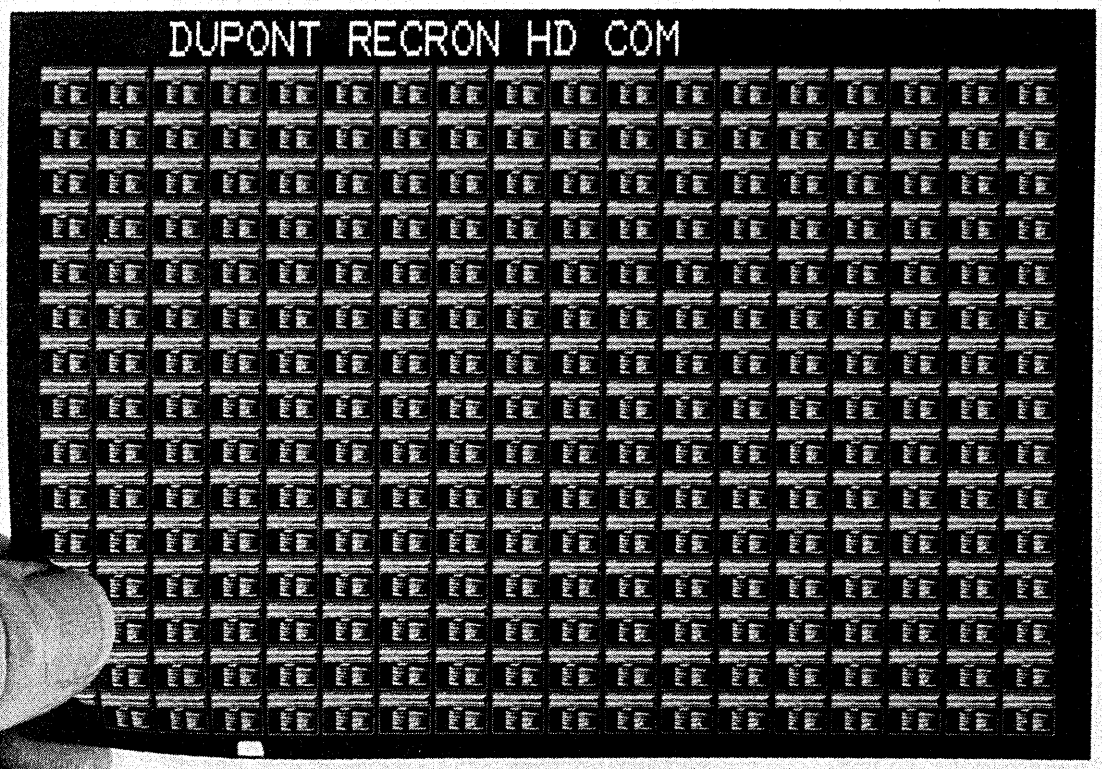

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NEWS IN PERSPECTIVE

the STC 2700 disk subsystems. "We'll be building up in this area with more powerful storage products for minicomputers," Jesse Aweida explains. "This should become an increasingly important business for us."

Chairman Aweida is also looking to gain a major share of two new business segments: office automation and telecommunications. Toward this end the company is currently developing a number of new products and has set up a wholly owned subsidiary, STC Communications Corp., under James M. MacGuire, its president.

IBM created some confusion in the marketplace, but that's behind us and we are experiencing a strong order rate.

The subsidiary's initial product, a voice concentrator called COM2, is now gaining acceptance after two years of product testing, STC asserts. Some 152 orders, not all of which are firm, have been placed to date, and the customer list includes Eastman Kodak, Shell Oil, Xerox and McDonnell Douglas.

"The telecommunications market is going to represent well over $100 million a year to us in revenues within a few years," Aweida estimates.

Perhaps significantly, STC recently announced a patent cross-license agreement with IBM that in effect allows both companies to develop new products without encroaching on the other's patent. In addition to data storage products the agreement also covers communications products.

This departure into new, non-IBM-compatible data storage product lines represents a significant departure for STC. "The 1970s spawned a 'me too' environment," observes STC vice president of sales John G. Hill. "But in the coming decade you won't be able to play 'me too' and be successful."

In effect then, STC, which has followed IBM's lead successfully enough to date to become the largest independent disk and tape drive supplier, is getting ready to chart an independent course in the 1980s. Still, it is using well-proven ground as a launching pad for this departure—specifically, strong technology, a blue-chip customer base, a service organization that is generally accorded high marks by STC users, and an aggressive sales team. These factors, plus STC's flexibility in selling its products to different markets in different ways, have gotten the company where it is today, and will go a long way toward determining where it will be tomorrow.

—Laton McCartney

STRATEGIES

EXPANDING THE HP 3000 LINE

Third member of 3000 family, introduced last month, is to be but one in a wide range of software-compatible products.

Taking a step at a time, Hewlett-Packard's General Systems Division moves inexorably toward a family of software-compatible computers priced from $20,000 to $100,000. The plan is to have such a product line by the early 1980s, one with a 5:1 price spread and performance spread.

"I guess if I were to pick one area that is the sort of cornerstone of the HP 3000 strategy, it's to have a very wide range of products that are all completely compatible," says Robert T. Bond, marketing manager of the division that last month introduced the third member of that family. The HP 3000 Series 30, priced at $50,000, joins the Series 33 priced from $58,500 and the top-of-the-line Series III priced from $105,000.

The HP 3000 represented HP's first venture outside the field of scientific and engineering computation and into the realm of business dp. The initial computer experienced what Bond calls a "kind of a painful birth" back in November 1971.

New Series 30 uses an LSI processor based on silicon-on-sapphire technology.

Software integration problems forced the company to withdraw it from the market and reintroduce it two years after the original announcement date. Recalling those days, Bond now chuckles over problems that IBM is having with the System/38 and says, "We have a lot of empathy with that. We were there."

And chuckle they can, for the 3,000th machine in the no-longer-troubled family should have been delivered by the time this story reaches print.

Bond says HP gets support for its compatibility strategy from its large users. He explains that hardware costs are a diminishing fraction of dp budgets today, thanks to advances in the technology. "What is expensive is the development of applications systems. Being able to take one set of applications and run them on a very wide range of products is attractive."

Not only does this appeal to the

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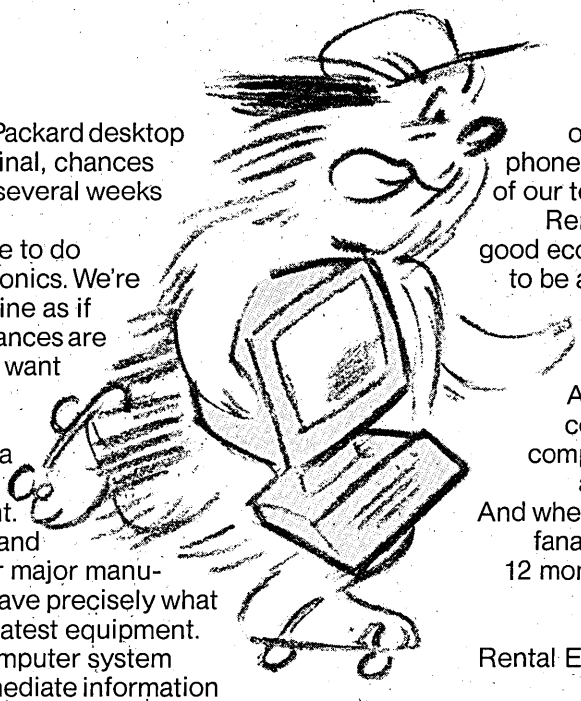

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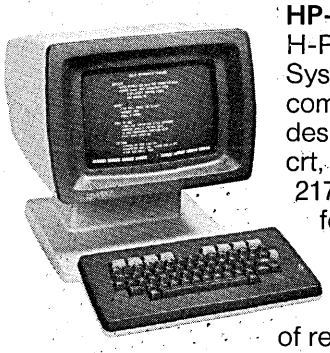

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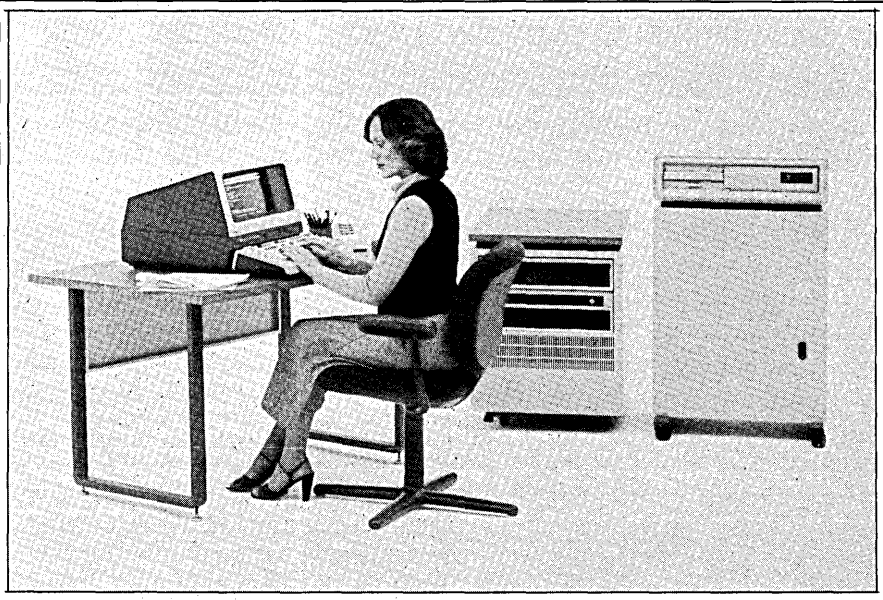


HEWLETT-PACKARD's low priced ($50,000) Series 30—third in a compatible family that is to be expanded.

end-user community, he adds, but also to the segment that HP calls "business oem's." This includes software houses that add applications programs to HP hardware and resell them as turnkey systems. One such oem is serving the health care market and has been selling repackaged HP 3000 Series III's to fairly large hospitals. "Now they'd like to take that same set of applications programs and go after the medium-size hospitals," Bond says.

The new Series 30, which bore the internal code name of Koala, uses an LSI processor based on the silicon-on-sapphire (SOS) technology, which is also true of the Series 33. In contrast, the older Series III computer is based on medium-scale integration (MSI) TTL technology. Over time, says Bond, he can foresee the S/III being replaced by something with four to five times its power but still within the $100,000 price range. The people at HP continually speak of the ability to increase performance or reduce hardware prices by 25% a year. That, says Bond, is HP's guideline, "and I don't see any reason why that shouldn't continue."

He stresses that HP has no intention of competing in the medium-scale mainframe market but says he feels the company could deliver in 1981 a computer of the IBM 4341 class at a price of $100,000. "The technology is there," he says, although that market does not have the growth that interests him. "I think the growth is in the distributed processing area."

But whatever the R&D people do, they reportedly must work under two heavy constraints. One is that the top of the HP 3000 line must bear a price tag of $100,000 for a minimum usable configuration. The second is that it must run the MPE operating system, maintaining compatibility with the last major version, which is MPE-III.

—E.K.Y.

INTERNATIONAL

GETTING TOUGH WITH BURROUGHS

European users talk of "strong-arm tactics" to influence better communications and support from Detroit company.

Burroughs Corp. is preparing sweeping changes in an effort to neutralize the growing threat of rebellion in its international user base.

The measures are designed to open new lines of communication with users and add greater weight to support. In addition, a new style of more open management from the company is expected to set the tone for the 1980s.

According to sources, Burroughs plans to build a network of international support centers, and transform its production scheduling and control operations. The measures—some of which could be outlined at an international Burroughs users group (ABCU) gathering in Madrid, Spain, later this month—are generally considered by the industry to be long overdue.

PAUL MIRABITO may lead group of Burroughs senior executives to explain company's plans for better service at users meeting in Madrid.

Until now, users feel they have tolerated poor service to gain Burroughs' innovative technology. However, hit by lengthening deliveries and no improvement in service, the users have grown increasingly militant over the past year.

By the summer of this year resolu-

tions from both ABCU and the U.S. equivalent, CUBE, which formally had nudged and prodded for improvement, had begun to sound more like demands. Though Burroughs has been expected to act of its own volition for some time, some users indicate they used "blackmail" and strong-arm tactics to influence the company's timing.

According to one Dutch banking user, the breakthrough was made about six months ago in Holland—where, ironically, Burroughs has a reputation for relatively good field engineering. He reports that seven very large systems users banded together to offer Burroughs an ultimatum: "Improvements now—or no more orders."

"Our economic pull was such," said the user, "that Burroughs decided to use Holland as the guinea pig for a new kind of facility—the installation center."

The center will have a resident pool of engineers (in the case of Holland about a dozen) and an installation manager. Their job will be to track down all the pieces of a configuration a user may need before assembling complete systems at the center.

Sources add that Burroughs plans to establish other centers in Germany, Switzerland, Belgium, and France, as well as other international locations.

At the heart of the plan is the creation of a new division, say users, known as Planning, to forge a link between the Burroughs production and marketing organization. Executive vice president Ray Strombach, who was international vp, has been given control of the new planning division.

"Burroughs has never had a central department to handle production scheduling or progress control," explained one European Burroughs user. "When a customer orders a piece of equipment, he is given a vague promise of delivery in say 9 to 12 months, and that is all."

Users agreed if they, or Burroughs front line staff, then wanted to know in which factory the kit was being made, when it would reach the production floor, or its estimated time of completion, there was no central department they could turn to for answers.

European users talked of the equipment being delivered both early and late, mysteriously getting lost, being delivered in the wrong configuration, or with someone else's name on it.

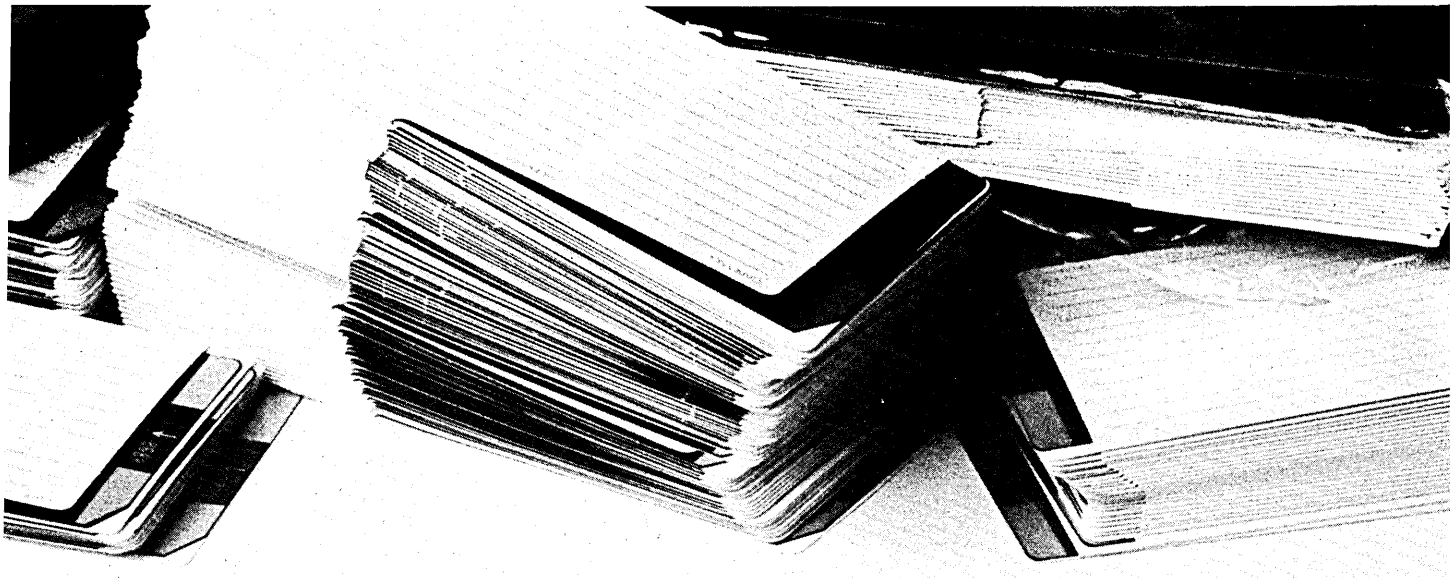
Burroughs decided to use Holland as the guinea pig for a new kind of facility—the installation center.

"Whenever you ask Burroughs what's going on they say only that everything is 'on schedule'; then, with little or no warning they tell you there will be several months delay," said one paper manufacturer that has just switched to Univac. Another user said he is still waiting for Burroughs to "find" a medium-sized mainframe that was due for delivery in the Netherlands 10 months ago.

"The trouble is," said one user, "getting information out of Burroughs is like squeezing blood from a stone." Burroughs' customers have been quick to point out that this situation is a legacy from former chief Ray Macdonald, who retired at the end of 1977. "He believed that computers were just like the accounting machines he had sold so successfully," said one. "He thought that all you had to do was crate them up and ship them off. He didn't seem to understand that with computers you get your memory from one place, disk from another, tape decks from somewhere, printers from oem's, and support services from somewhere else again."

One user said he was told by Burroughs chiefs in Detroit that Macdonald believed that money for administration of this situation was "money down the drain."

"As a result Burroughs seems to have little understanding of the logistics of getting all the bits of a system together in one site and at one time. The reason you can't track down a disk drive, cable or other peripherals in Burroughs, is that



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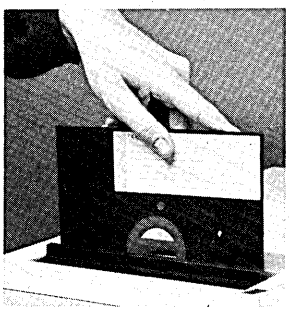

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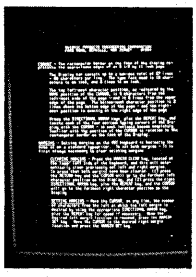

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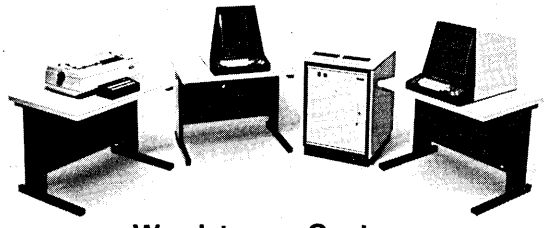

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they don't know where it is themselves!"

Many endorse the view that Burroughs is heavily underinvested in logistics, but sources said the new planning division could change this. There is currently an air of expectancy about ABCU which believes that major changes are imminent. As well as the installation centers, Burroughs is believed to be investing heavily in hardware to boost the availability of on-line order production information.

Sources expect that Macdonald's successor, Paul Mirabito, and other senior executives will come to the ABCU meeting in Madrid at the end of October to outline their plans. (At the time of writing, however, Mirabito's appearance had not been confirmed by Burroughs in Detroit.) Vice president of international and group executive William Conlon is scheduled to be the keynote speaker.

Mirabito himself is close to retiring next year, so the company's transformation will largely be the task of the younger aggressive executives now pushing their way to the front. But when they do put the company's delivery and support house in order, the highest peak will still be left to climb. One quality still appears absent within the company: the ability to communicate, to disseminate information, say observers.

"We would expect to see some signs of a change in this situation by next April," said a spokesman for ABCU. "We are looking for some indication that the channels for progress reports and user liaison are going into place," he added.

"Macdonald's dominance as an individual decision maker has left Burroughs a legacy of no channels for information exchange—internally or with customers," said an observer.

A lack of understanding of the need to communicate in an ongoing way was shown this summer when an ABCU resolution on deliveries was met with the comment from a senior Burroughs executive that it was pointless to pursue the matter any further. "Nothing will be gained through further correspondence," said the executive. ABCU replied by saying that it was its duty to pass on complaints as they occurred.

While at the Burroughs helm, Macdonald is reported to have prided himself on keeping users "sullen but not rebellious." But now users have made it clear that the one thing guaranteed to stir up revolution and wide scale defections is one-way communication.

"One way I've managed to justify my trips to the U.S. over the years," said one ABCU member, "was the chance it afforded me to get copies of handouts that CUBE obtained from Burroughs periodically. Copies of the overhead files and foils they used are in limited number, and like gold to us."

The feeling among users is that this dark side of Burroughs may be shrugged off with the old decade. They seem guardedly optimistic the company is laying down the mechanics of a corporate voice for the approaching decade. If so, 1980 could be the year in which Burroughs finds its tongue.

—Ralph Emmett

TELECOM MONOPOLY WEAKENING

Forces of free competition are winning in some nations, but hitting roadblocks in others.

The structure of the communications monopolies around the world is changing dramatically. And that spells good news and bad news for the multinational computer/communications users.

In mid-September, the British announced that they would split the telecommunications and mail services of the British Post Office monopoly into two separate publicly owned (i.e., government owned) corporations. More important for users is that the telecommunications monopoly will be "relaxed," allowing attachment of approved "foreign" telephones, modems, and some other equipment previously obtainable only through the British Post Office. This also opens up the possibility of value-added services provided through independent companies. The British telecommunications corporation would retain its monopoly over the circuits themselves.

The British unions, fearful of intrusion from too many foreign-owned firms into this new equipment opportunity, have already called for British industry to get itself organized.

The Canadians have also made a breakthrough in communications competition by deciding to permit interconnection of the Canadian National/Canadian Pacific (CNCP) network to Bell Canada's net. (Interconnection to independent telephone networks in the provinces, not subject to the federal decision, is still a question.)

The CNCP-Bell battle has been going on for three years. Bell Canada, in arguments reminiscent of AT&T in its battle to keep out independent competitors like MCI and Datran, has claimed that "interconnection would be so costly as to require substantial rate hikes." The new Canadian cabinet clearly did not agree.

While the forces of free competition are winning in some ways, they are hitting roadblocks in others. New public switched networks are going in all over Europe, and the telecommunications monopolies are doing their best to protect them against the evil forces of private networks. Under a decree drafted by the international telecommunications standards-making body, CCITT, some nations are serving notice on time-sharing companies and other multiple user networks that they'll have to change their methods of operation. The German Bundespost has already told these companies that after 1981 they will not be able to connect concentrators or nodes to private leased lines linked to centers in other countries. They'll have a choice of interconnecting to the volume-sensitive public switched network, or putting computers in Germany to do a significant amount of the processing locally before using the private line connection to overseas centers.

Both alternatives are expensive and should create havoc for remote computing service companies that have spent a fortune establishing efficient data transmission methods and large centers. Their centers are justified by huge volumes of processing done 24 hours a day for customers in different time zones around the world.

So far, other nations have been toying with the same idea, and Britain has said it will eventually go this route.

One of the problems with the public switched networks is that they have volume charges. And in some countries, the price increase for large communications users now on private lines would be enormous. Some big British users are calculating that the British packet switched net will cost them 50% more than private lines. (For instance, a 48K bps line comes with an access port charge of $21,000 a month and three year contract requirement, plus 23 pence per kilo segment of data, 64 bytes per segment, and other charges.)

A British consultant and close observer of the issue, David Hebditch, asserts that these monopolies "don't understand about marketing or pricing." He says, "They should start by charging much less, so that the first companies can justify the costs of creating the interfaces and meeting other requirements. If they do not receive the volume they need to be profitable then they can increase the rates."

Most feel the monopolies are just not good at management and should allow private value-added service companies to take over the headaches and overhead of packet nets—while they rake in the profits from providing the circuits. Many in Britain are hoping that the new British telecommunications corporation will come to that conclusion.

—Angeline Pantages

IBM 3800 users-see how new Laser-Feed eliminates all forms-feeding downtime

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A PICTURE WITH YOUR TELEPHONE

Within a few years France will provide keyboard and display terminals with telephones delivered to customers.

If French plans hold up, telephone subscribers in a few years will automatically receive a keyboard/display terminal with their telephones. French telecommunications authorities are projecting that by 1992, 34 million such devices will be installed. At such enormous volumes, the production cost will be less than 400 French francs or about $100.

The initial justification for this "unprecedented generosity," as one wag put it, is telephone directory information. The telecommunications monopoly calculates that automatic retrieval by the customer of telephone number information ultimately will be cheaper than the regional networks of information operators and their files.

This ambitious project is seen as one part of the French videotex or viewdata effort, in which an enormous number of data base applications will be offered the public via the telephone network.

The terminals, with 1,000-character screens and alphanumeric capability, are supposed to be an adjunct or alternative to the use of regular television sets for videotex. While some think that there could be a conflict, since most would want to have only one crt terminal, the French believe that differing needs will create the demand for the two types of terminals.

In 1980 they will experiment with tv sets installed for general videotex applications in 2,000 to 3,000 suburban sites in 1980. In 1981, the telephone terminal experiments will begin. Four suppliers have been working on different versions of these since last year: Thomson CSF, Telic (CIT-Alcatel subsidiary), TRT-Radiotechnique (Philips subsidiaries), and Matra. Each will deliver 1,000 terminals in 1981.

In September, the French telecommunication authority took the directory project one step further by calling for bids to build the central data base system.

Prototypes of the terminals have already been developed, and they were demonstrated at the Telecomms 79 conference in Geneva late last month. The applications shown included listing restaurants and hotels in Geneva, and the location and telephone numbers of the exhibitors. —A.P.

BENCHMARKS

TOWARD KNOWING ROBOTS: Promotion and spread of knowledge among experimenters and researchers in the field of robotics is the stated purpose of a new Robotics Interest Group. Founder George Gregoire said he has been following the growth of interest in robotics to a point where he wishes to act as a clearing house for information on products, projects, research and user information. "The explosion of knowledge," he said, "is taking place as a result of the desire to use microcomputers which are becoming increasingly affordable and capable of controlling robotic units. This explosion had evidenced itself by the increasing number of articles appearing in magazines which cover robotics and microsystems." Noncommercial information on robotics can be obtained from Gregoire at 837 Bourbon Court, Mountain View, CA 94040.

PERSONAL BUSINESS TERMINALS: Desk-top intelligent terminals will find uses in the aerospace, farming and utilities sectors of the economy, says a report on the Personal Business Terminal by International Resource Development, Inc., a marketing consulting firm. The 168-page report finds that up to 3,000,000 clerical and professional workers in 27 different industries will find uses for that kind of terminal and that shipments will more than double during the next two years, from 60,000 in 1979 to almost 120,000 units in 1981. Among other growth sections are travel agencies, insurance agencies, accountants and real estate. But all of this growth will depend on software development, particularly special programming to enable them to provide editing, limit-checking, training and electronic mail capabilities.

CHEAPER LOW SPEEDS: Gnostic Concepts, Inc., a Menlo Park, Calif., consulting and research firm, said a study it conducted indicates that competition will reduce the average unit price for low speed printers 6% per year to 1982. The study shows shipment values will reach $1 billion for receive only units and $450 million for key-send-receive printers in 1982. Unit shipments, Gnostic says, will increase 18% annually on the receive-only side and 11% on the key-send-receive side. Ink jet printers, the company reported, will find applications in the fast growing office automation and business graphics markets on the strength of their speed and paper handling capabilities.

MID-EAST MARKETING: Bahrain, one of the few Arabian Gulf states with limited reserves of oil, rapidly has become what its government officials like to describe as a major commercial trading center, like Singapore in the Far East. Next March 16-20 it hopes to attract exhibitors from the U.S., U.K., France and Germany to the Middle East Business Equipment Show, where it expects to draw some 5,000 persons from 23 Arab nations. The North American coordinator for the show, TMAC of 680 Beach St., San Francisco, says U.S. exports of business and related equipment to the gulf states totaled $66 million in 1978 and this rate should grow by 10% to 15% a year over the next four years.

U.S. VS. IBM: Talk of a settlement in the nearly 11-year-old antitrust suit brought by the Justice Dept. against IBM emerged late in September as the trial resumed again after a delay of nearly two months. A senior Justice Dept. official said the department probably would ask that IBM be split up into several full-line computer companies, much like that suggested early in the case when the Justice Dept. wanted the company split up into companies selling different sized computers. But the official, who asked not to be named, said he expected any discussions with IBM to have only a "one in 10" chance of resulting in a mutually acceptable settlement. IBM last July asked for a recess in the case while it pondered any future action—one of them being application for a consent decree in the prolonged case. But instead, IBM asked that the trial judge, David N. Edelstein, be removed from the case because of personal prejudice against IBM.

In turning down IBM's request for a stay in the trial until it appealed Edelstein's denial of the IBM request that he disqualify himself, a federal appeals court urged both sides to try to work out a settlement of the suit. In its 612 trial days (the case began May 19, 1975), the case has produced more than 90,000 pages of transcript from 71 witnesses and hundreds of out of court statements. A government subpoena, demanding additional IBM documents, is what made IBM call for the judge's dismissal, but the federal appeals court refused to grant IBM a stay while it studied IBM's appeal, a process that wasn't scheduled to start until Oct. 16. And so it continues.

NEW IBM MARKET: IBM's long awaited move into the consumer electronics business came late this summer as the company announced a joint venture agreement with MCA, Inc., to develop, manufacture and market videodisks and videodisk players. Although videodisks primarily contain video films; the technology lends itself to storing large amounts of digital data in a compact form. IBM also will sup-

ply the joint venture with two patents related to optical videodisks and an unspecified amount of cash. MCA turns over to the joint venture its videodisk business. The new company will be called DiscoVision Associates and as such will be the only U.S. supplier of videodisks. North American Philips Corp.'s subsidiary Magnavox also sells the system and RCA will announce a product early next year.

THE SPIRIT OF ST. LOUIS IN ORANGE COUNTY: McDonnell Douglas, which has offered to buy all outstanding shares of Microdata Corp. for $32 a share, was well on its way to an acquisition of the Orange County firm last month. St. Louis-based McDonnell Douglas had more than 1,630,707 shares, or about 72.4% of Microdata's outstanding stock tendered. If more than half but fewer than 90% of Microdata's shares are tendered, McDonnell Douglas will gain a minority interest of at least 45%, but does not plan to acquire more than half of Microdata's shares. Microdata has 2.3 million shares outstanding.

MORE CREDIT FOR AMDAHL: Amdahl Corp. last month got a new $260 million line of credit. The company signed a new agreement superseding a previous $100 million credit line with the Bank of America, agent bank in association with Citibank, Chemical Bank, Continental Illinois Bank, Crocker National Bank, Manufacturers Hanover Trust, and Security Pacific National Bank. European participant banks included: Algemene Bank Nederland, the Netherlands; Banco di Roma, Italy; Credit Lyonnais, France; Credit Suisse, Switzerland; and Dresdner Bank, Germany. The Toronto Dominion Bank of Canada is also participating.

HP COMPUTER CZAR: Paul C. Ely, Jr., will have all of Hewlett-Packard's computer activities reporting to him under a reorganization "to deal more effectively with the increasing breadth of our product line and the rapid growth of our computer business." The HP announcement said three new organizations have been formed: Computer Marketing Group, Technical Computer Group, Computer Peripheral Group and the Data Terminals Division, all reporting to Ely. Also reporting to him is the existing General Systems Division, headed by Edward R. McCracken, general manager. The company's former Computer Systems Group and Desktop Computer Division have been merged into a single organization under Ely who formerly was head of the Computer Systems Group. With the title of general manager-computer groups, Ely will report to Ralph E. Lee, executive vice president. The company's Corvallis Division, which was part of the Calculator Products Group, reports directly to Lee.

FABRI-TEK TROUBLES: Fabri-Tek, Inc., of Minneapolis, which said it will show an improvement in core memory business in its fiscal year 1980, is trying to recover from heavy losses in FY '79. In 1979 the company lost nearly $2.4 million, a factor that lead to the resignation of its executive vice president, Richard Fisher. The company, once a profitable leader in the core memory business, is negotiating with its bank lending group to avoid defaulting on a principal payment of $394,000, due to holders of its convertible subordinated debentures. The company wants to change its arrangement with the lenders "to meet the longer range needs of the company."

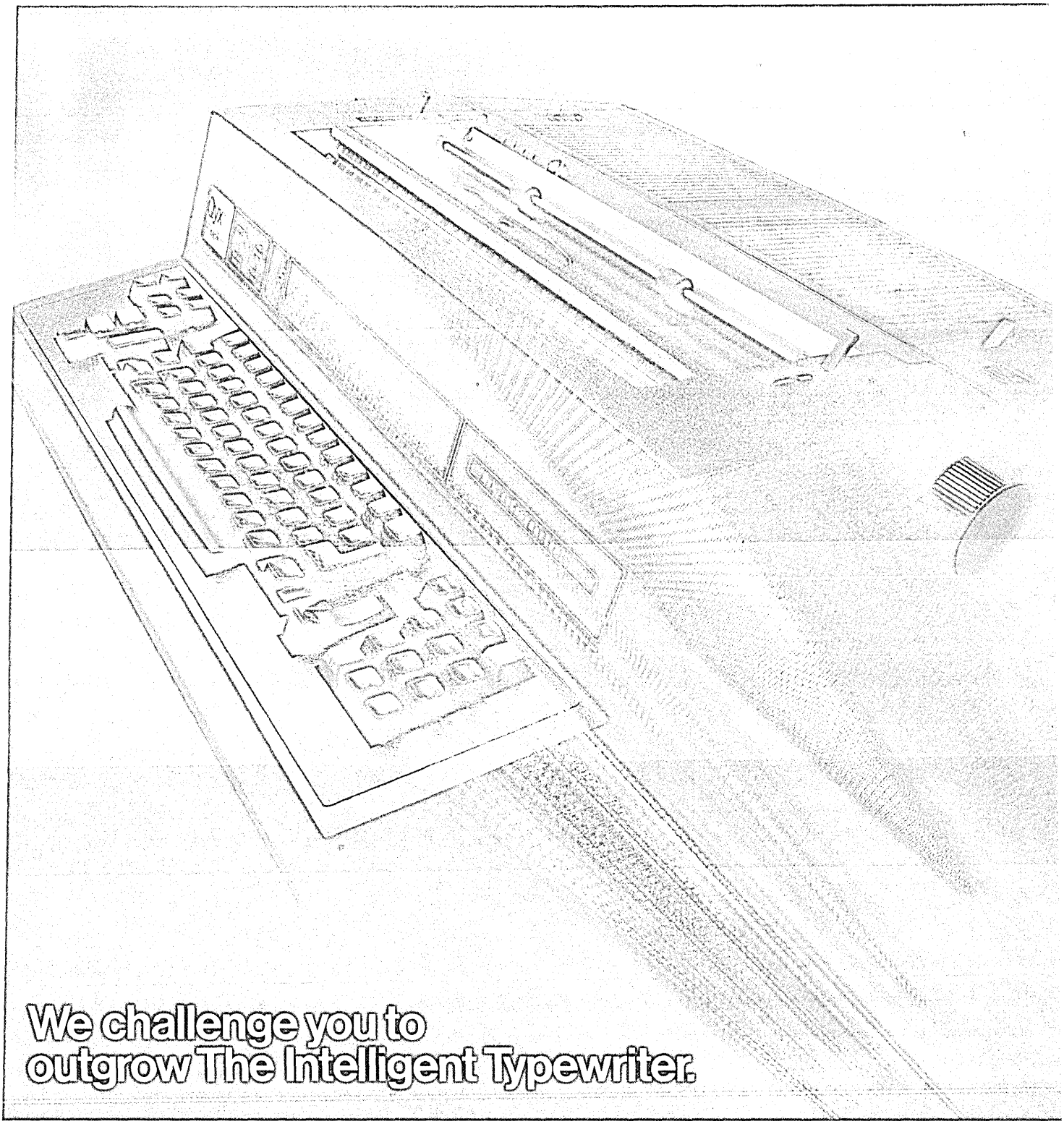
RESIGNATION IN TEMPE: Electronic Memories & Magnetics' Semi subsidiary in Tempe, Ariz., lost a president with the

resignation of Stephen P. Marcy "for personal reasons." Marcy was replaced by Thomas S. Benson who had been corporate vice president, business development. Trude Taylor, corporate president and chairman of EM&M, said Benson's former position will not be filled. Marcy, a nine year veteran with EM&M, said his resignation "was a very complicated thing, nothing simple." He denied he left over personnel conflicts or disagreements on operating procedures.

MILESTONES: Shugart Associates shipped the 2,000th copy of its 14-inch Winchester disk drive last summer to Ohio Scientific, a small business computer manufacturer. . . . IPL Systems of Waltham, Mass., delivered its 100th IBM plug compatible computer to Control Data Corp., which markets the system under the Omega name. . . . National Semiconductor Corp. shipped the one-millionth electronic basketball game to Mattel Corp., the toy maker. National's consumer products division has been making electronic basketball, hockey and soccer games for Mattel. The millionth basketball game was gold-plated and mounted on a basketball-shaped plaque for the occasion.

DOWN UNDER: Datronics Corp. of Australia has opted for electronic office activities over its IBM leasing endeavors. Datronics managing director Geoff Veel said, following IBM's 4300 announcement, that his company had assessed its growth potential and saw most of this in the electronic office. He said Datronics would continue to lease Qantel, Vydec and other products in its current business systems operations. "The 4300 costs so little for its price/performance that it is not worth putting in a lot of effort and human resources for returns we would get on remarketing," Veel said. He added that Datronics had taken "some quite savage writedowns" on its leased IBM mainframes in the wake of the 4300 announcement.

MICROPROCESSORS AND PROCESS CONTROL: The advent of minicomputers and microprocessors has increased the capability and complexity of process control systems and has changed the market, says Auerbach Publishers, Inc., Pennsauken, N.J., in a tutorial on process control titled "Auerbach on Process Control." The report says the process control market will grow rapidly over the next few years. "As minis and micros proliferate, a growing number of applications are being impacted." The study traces the origins of process control, the complexities of such systems and the advances that have occured over the years. While process control has traditionally been the domain of the control systems analyst and manufacturers, the article, its publisher states, is designed to serve as a primer for the individual who requires an overview of process control applications. ✲



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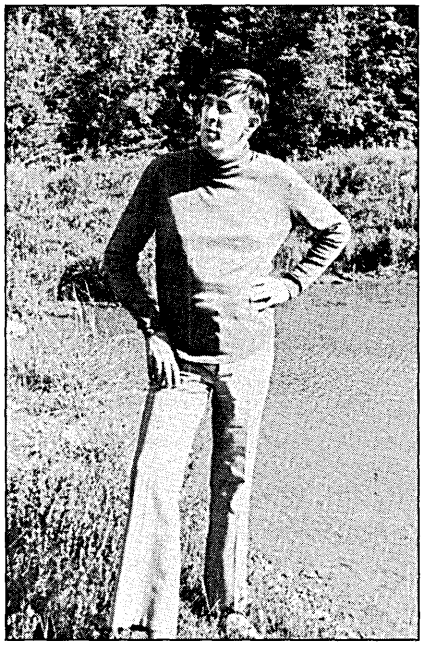
CIRCLE 45 ON READER CARD

THE FUTURE ACCORDING TO JAMES MARTIN

An exclusive interview with the noted industry authority.

by Ronald A. Frank

At his secluded Vermont farm, far away from the automated society he analyzes so accurately, James Martin, author, lecturer and an authority on emerging dp and telecommunications technologies, talked recently about data bases, networks, IBM, and user strategies for the 1980s. Amid splendid mountain views, Martin spends 10 hours a day on an upcoming six-volume series of books dealing with data base management, and preparing for a worldwide lecture tour that begins this fall. With his rustic 100-year-old farmhouse serving as a conspicuously out-of-place backdrop, Martin granted one of his few interviews to describe the impact of emerging trends for DATAMATION readers.



"A very major part of the future of all corporations is going to be data base technology. And it's now becoming clear that there are going to be many data bases, not just one, and these are going to be connected to networks. The data bases will be accessible from a diversity of end-user machines. And some of the office automation technology is also going to relate to the same end-user machines and to data base systems," according to James Martin.

Martin sees the new breed of end-user machines as intelligent terminals and minicomputers that contain data derived from the data base management system. These machines will be linked together via a corporate information network, Martin predicted.

To prepare for this new environment of the 1980s, users must develop strategies for handling data, for distributed processing, for networks, and for office automation. Although the processes are interrelated in many aspects, users should formulate an approach for each of them separately, he advised.

The data handling or data base area needs a lot of planning. It makes sense to have someone in top management who can determine which data resources are critical to the successful operation of the corporation. This person should determine what data bases, files and other dp information is vital.

Once this list has been assembled, the company should go into more detail to specify which data base management systems will be used, what the logical structure of the data will look like, and what tools and techniques will be used. Citing one option, Martin said it really makes sense to have a single data dictionary that applies to all corporate data. It also makes sense to have a single data base design tool that applies to the corporation as a whole, he said.

The overriding goal in establishing these priorities is to unify the techniques the company employs to design the logical information structure. Acknowledging that most companies have allowed their files and data bases to grow in a "fire brigade" manner, Martin stressed that it is vitally important for the corporation to bypass short-term goals in order to plan for the longer range. To make such an effort successful, it is critical for dpers to get the interest and support of key members of top management, he emphasized.

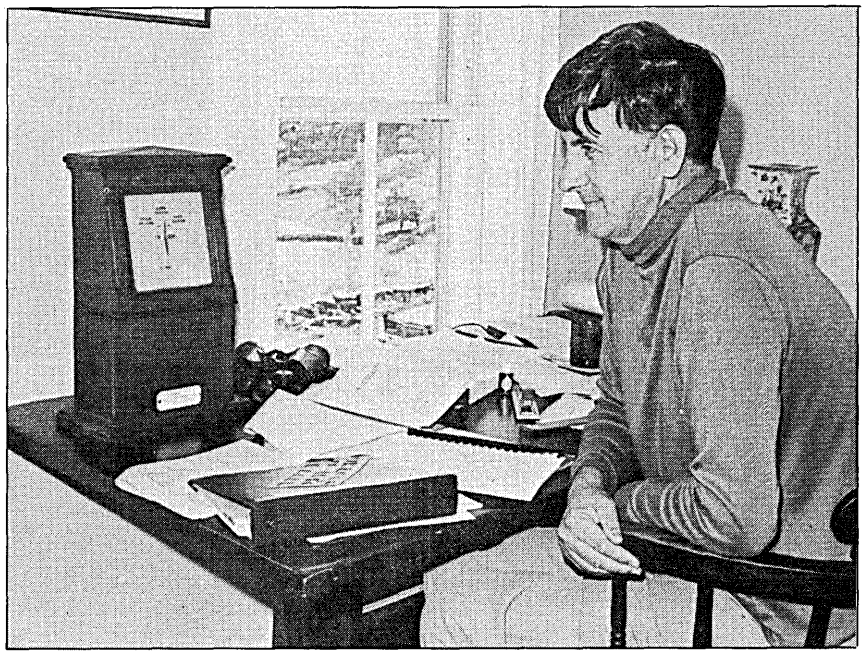
Four types of persons will be needed to implement a comprehensive data handling methodology for the company. The data base designer is the person closest to the machine. Closest to the end user is the data administrator, who evaluates user needs. A large number of data administrators will be needed in the average company.

The person at the top of this hierarchy will be in charge of the overall strategic planning of the corporation. This person will need a broad understanding of the corporation's requirements; Martin predicted this function will be performed by a corporate data strategist.

The fourth person will be in charge of distributed files and data bases and will decide where specific data should reside. As soon as decisions are made to replicate portions of the data in a distributed environment, problems arise concerning deadlocks and synchronization of the data. The technical solutions to these problems will be handled by this data distribution administrator, Martin explained. This latter job function is just beginning to emerge at a few leading edge organizations.

Although it is difficult to predict how long it will take for companies to adopt this planning on a broad scale, Martin warned that those not doing it already "are probably throwing money down the drain."

Turning to the role of transport



mechanisms or networks that will allow users to implement their information processing structures, Martin said the most important development is the emergence of wideband facilities. Today the term wideband usually refers to AT&T's Dataphone Digital Service (DDS). By 1985, DDS will have expanded to much higher data rates, taking advantage of the T-carrier technology of the Bell System. In addition, networks such as Xten and SBS will bring a wideband link into the user's premises. Xten will give the user access to "a quarter of a million bits each second," he emphasized.

NEW DEVICES WILL BECOME PRACTICAL

It is difficult for users to think in terms of wideband communications because up to now most devices built for data communications use have been designed to operate on common voice grade phone lines. But this is a chicken-and-egg situation, he said, pointing out that when the wideband services become available, it will become practical to introduce new devices.

"I think over the next six years you will begin to see copiers able to transmit and reproduce documents at a remote site with the same speed that a conventional copier runs today. Such devices will handle a steady stream of documents, and similar units will instantly send hard copies to supplement information being exchanged during a normal business call.

Then there are computer dialogues where it would be beneficial to have higher bandwidths, for example, when a user is interrogating a local machine with a question that requires data not stored locally. In such cases, a substantial amount of data or data base would have to be transmitted quickly to maintain the interactive sequence of the dialogue, he explained.

Video conferencing also has great potential, although this application "will only grow slowly." Conferencing where full motion is not required and can be replaced with freeze-frame images will gain in popularity. Freeze-frame transmission closely parallels the flip chart or foil presentation used in business meetings. The advantage of freeze-frame transmission is that those watching the presentation need not be in the same room but can be located at multiple remote sites, he said.

All this points to a proliferation of equipment and services operating in the 56K to 256K bit/sec bandwidth between now and 1985, Martin predicted.

While this growth will be pronounced in North America, users will find a drastically different environment in Europe. The common carrier facilities being planned in the U.S. are simply not emerging in Europe. "If Europe continues to fail to build wideband telecommunications facilities, it will damage the productivity of European corporations compared to their U.S. counterparts," he explained.

The world telecommunications scene between 1985 and 1990 will have three zones. North America and probably Japan will have wideband services to handle office automation and advanced dp nets; Europe and some other areas will have good X.25 public packet data networks; and the rest of the world will have nothing better than voice grade lines that allow little more than transmission at 4,800 bits/sec, he predicted.

This worldwide structure will create problems for multinational U.S. corporations, which will find the equipment and services used at home cannot be applied elsewhere. Even in Europe, voice grade line alternatives will be discouraged through higher rates to induce users onto the public packet nets.

The Advanced Communications Service (ACS) and AT&T will be X.25-com-

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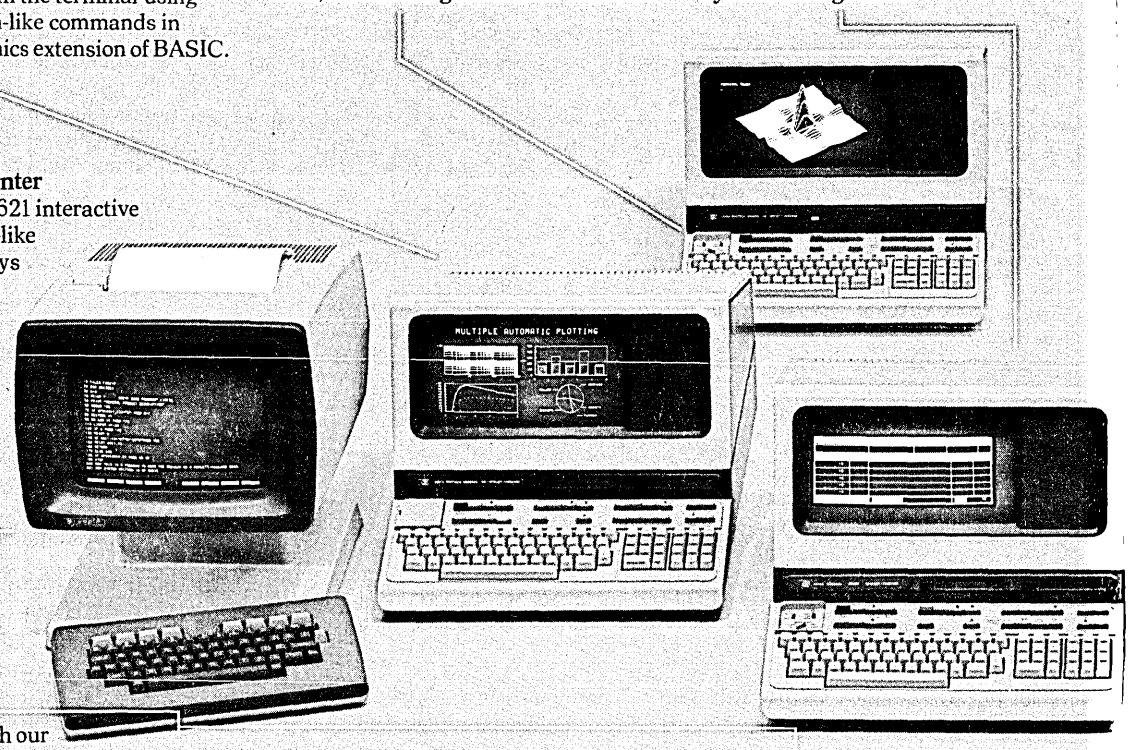

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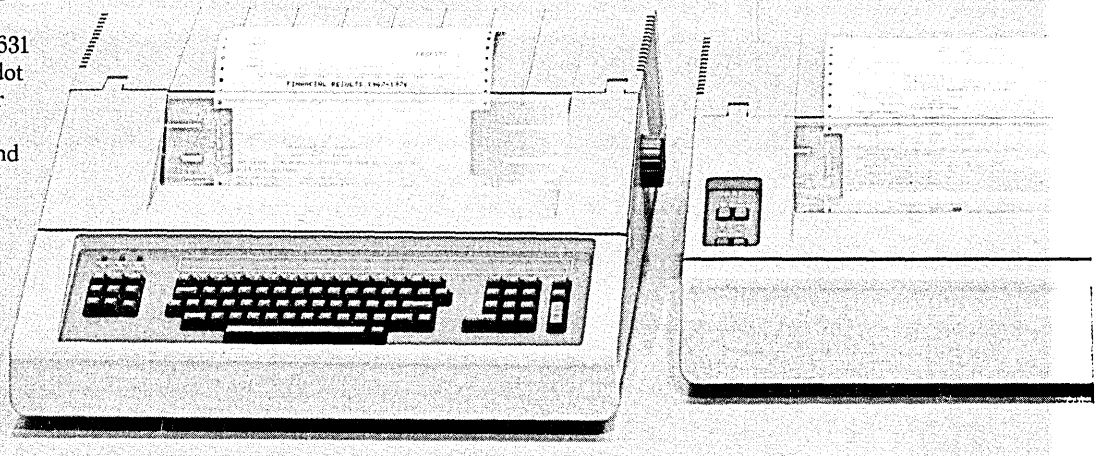

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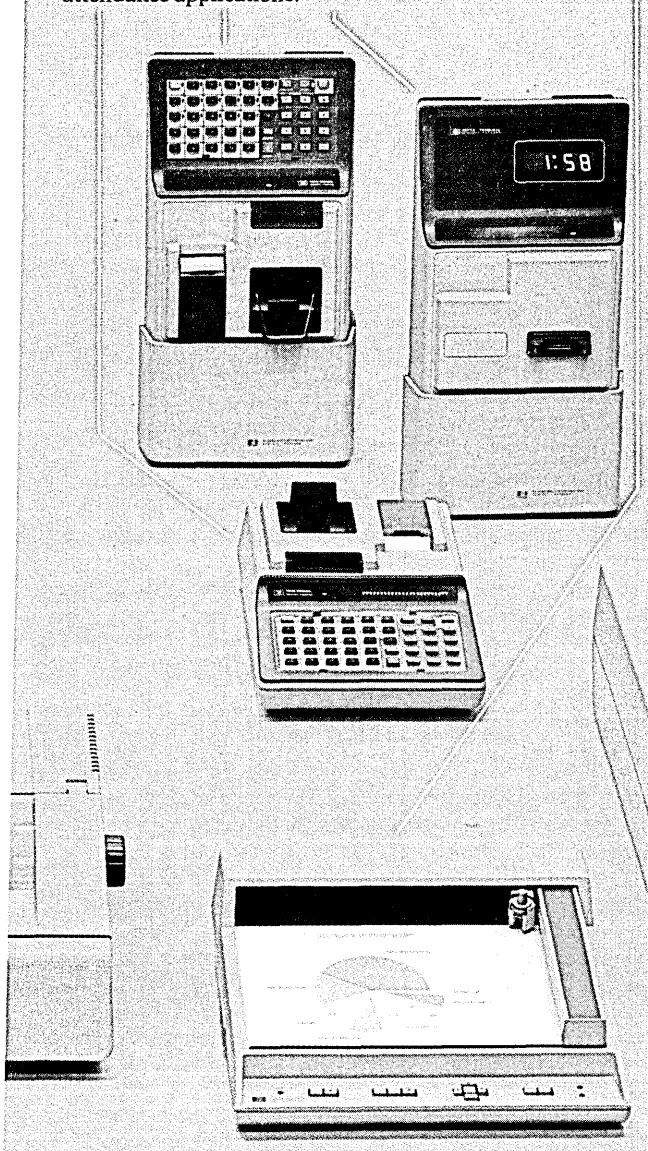

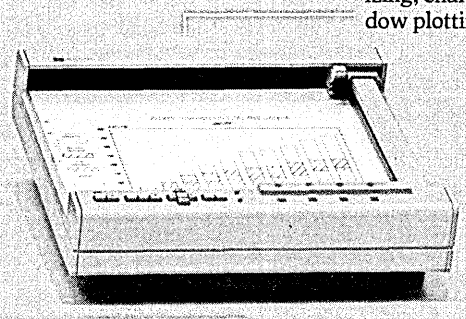

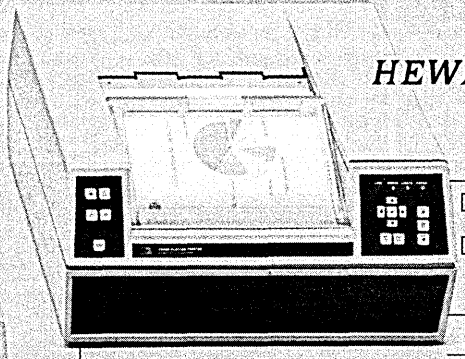

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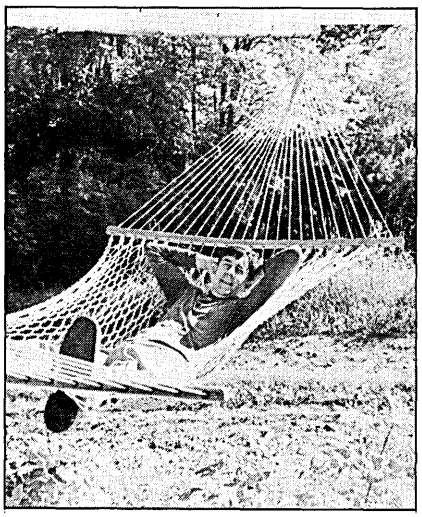

patible and thus will interconnect with the European public nets. It will be very important for Xten and SBS to also provide interfaces to other types of networks, Martin said. If there are no overriding technical problems, all three of these networks should be in limited operation by 1981, he added.

The one element not included in this environment is IBM's Systems Network Architecture (SNA). "SNA's path control is entirely different from X.25 and entirely incompatible with it. Thus it will cost a large amount of money for IBM to rip out the path control of the large number of SNA machines which now exist and replace it with an X.25 path control," he said.

Even so, at the link control level the two approaches are becoming more compatible, and IBM has already built a bridge in France and Canada that connects SNA with Transpac and Datapac—"it's not a particularly elegant bridge, but at least it works."

IBM will probably build an interface box that makes an X.25 virtual call or virtual circuit appear like a leased line to the SNA facilities, Martin predicted. This will provide the means for large multinational SNA users to connect with the public X.25 nets in other countries. While some of the intercontinental traffic will be X.25, the majority will continue to use voice grade private lines for some time to come, he said.

Moving to the subject of distributed dp, Martin said users will have to come to grips with the problem of determining which functions should be decentralized and which should remain centralized. Many functions that have traditionally been centralized should be decentralized. For example, much applications development work lends itself to being done closer to the user. Small peripheral groups like the plans and budgets department and people doing the processing work for the shop floor are creating applications programs that would never have been coded by the central dp staff, he said.

These people in the user departments have a better understanding of their own needs and a "high level of inventiveness about their own environment."

CENTRALIZING SOME OFFICE APPLICATIONS

The decentralization question also comes up in office automation. Up to now most office applications have been decentralized, "but you've got to have some functions that are highly centralized because you want to tie the machines together," Martin explained. These applications include electronic mail and "work queue management," where the user can process the jobs to be done into a priority list. Once this list has been generated, the computer can follow up to make sure the work has been done, he said.

All the terminals for these applications have to tie into a common network and they must be capable of accessing common data bases, he advised. The difficulty is that now there are small groups in isolated locations within the company, each doing their own thing and not communicating with one another. A more unified approach to these office automation projects must be developed, Martin said.

As a noted lecturer, Martin meets thousands of users in the course of a year. What concerns does the typical user have today? "One of the biggest concerns I always hear toward the end of my seminars is how users can get top management involved in the planning process. There seems to be a major gap between dp management and top management."

It's a very difficult question because top management style differs so much from company to company. While there is no single answer, it certainly helps if the top dper has an office next to the chief management officer. Frequent interchanges such as lunches should be encouraged. And video tapes designed to make management aware of the need for planning in the dp area can be effective. Of course once management begins to recognize the importance of dp planning, the process becomes much simpler. "The problem is getting the foot in the door," Martin commented.

Are there any product breakthroughs coming up in the next few years? "Well, we have most of the technology we need, so most of the new developments will be in the nature of refinements rather than breakthroughs. But one of the buzzwords of the last five years has been microcomputers. A buzzword of the next five years may be 'microfiles.' "

Microfiles will be the equivalent of a floppy disk in solid state that can hold up to 10 million bytes of information, probably implemented in bubble memory, he predicted. Microfiles will provide storage for desktop machines and ultimately for pocket computers, he added. The current pocket translators are the forerunners of the pocket computers.

As a former IBM employee, Martin watches the company closely. Asked for some insight into the rash of new cpu's introduced by IBM over the last year (the minicomputer line now includes five different families with five different engines and five different instruction sets—the 4300 series, the 8100 series, the System/38, the Series/1, and the 5110), Martin noted that two distinct machine architectures are evolving.

The 8100 fits naturally into the SNA world; the 4300 is "plain old 370," and runs all the 370 software. Actually, the 4300 has two modes—one is exactly compatible with existing 370 software, while the second has better performance with less compatibility. Even so, Martin sees few major differences between the 370 line and the 4300.

The really interesting machine, according to Martin, is the System/38.

"With the /38, IBM is telling people to forget about the past and start with a clean sheet of paper. Then, design a machine which will operate as a data base machine, as an interactive machine; batch processing would be a 'second-class citizen,' rather than dominating the design. This would be a machine that could be connected to teleprocessing networks, and use the best chips that we can get today."

The result is the /38—a machine that uses almost no applications programs, that doesn't need systems programmers, and isn't sysgenned. It has many advanced concepts that have not been seen in earlier IBM cpu's, he explained. The advanced features include the "one-level store, and a very high level instruction set that it is safe to say is not a von Neumann instruction set. They have moved a long way from the von Neumann machine," he suggested.

"In my view there is only one right place to put a data base management system. It burns up so many software instructions that it shouldn't be in software. And in the System/38, the DBMS is in hardware and microcode and so is the operating system, and you can't tell which is which. In my view that is the right thing to do—the DBMS and the operating system should be one entity. The data dictionary is very important and it is built into the hardware and the microcode. This means that the programmer does not have to describe any fields or records—they are all there in the built-in data dictionary. This is definitely one of the machines of the future." *

With this issue Ron Frank, an independent dp and telecommunications consultant, becomes a DATAMATION contributing editor.

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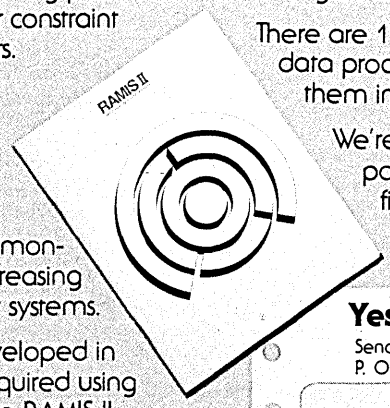

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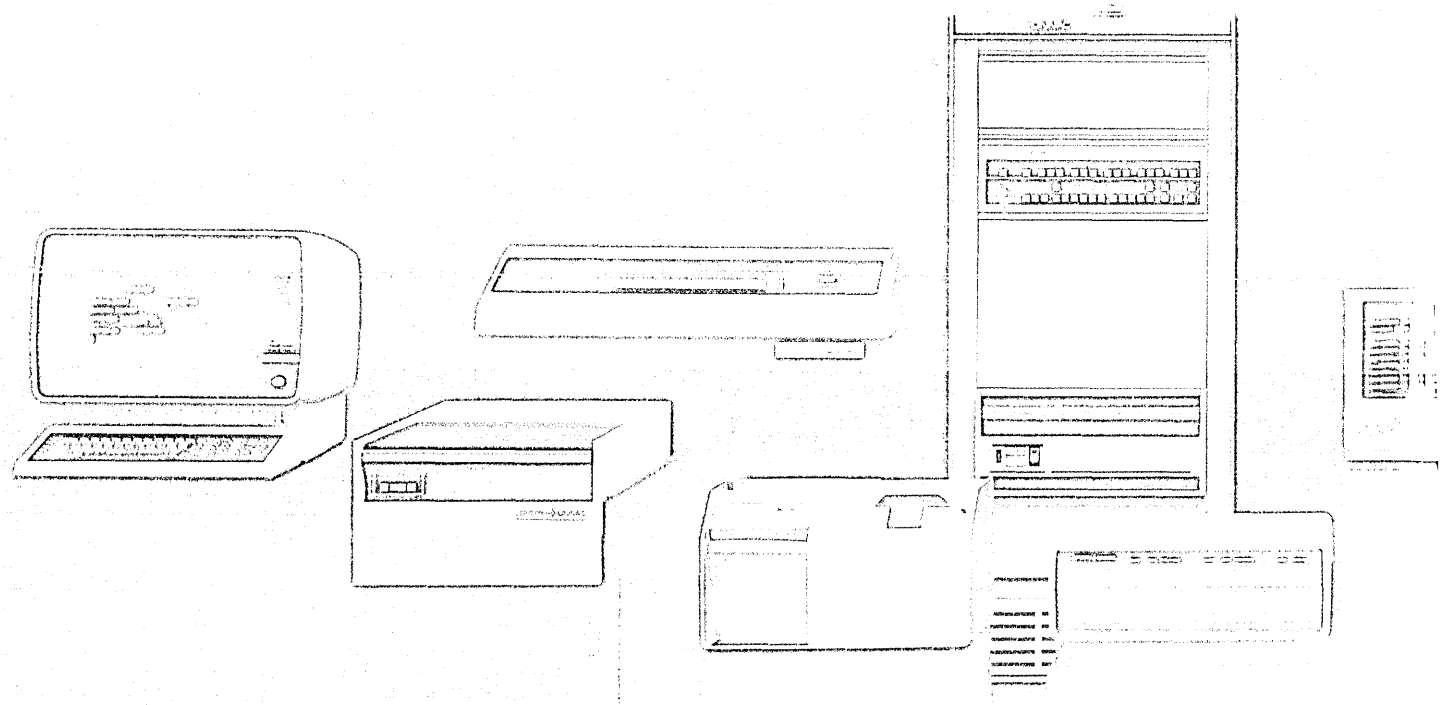

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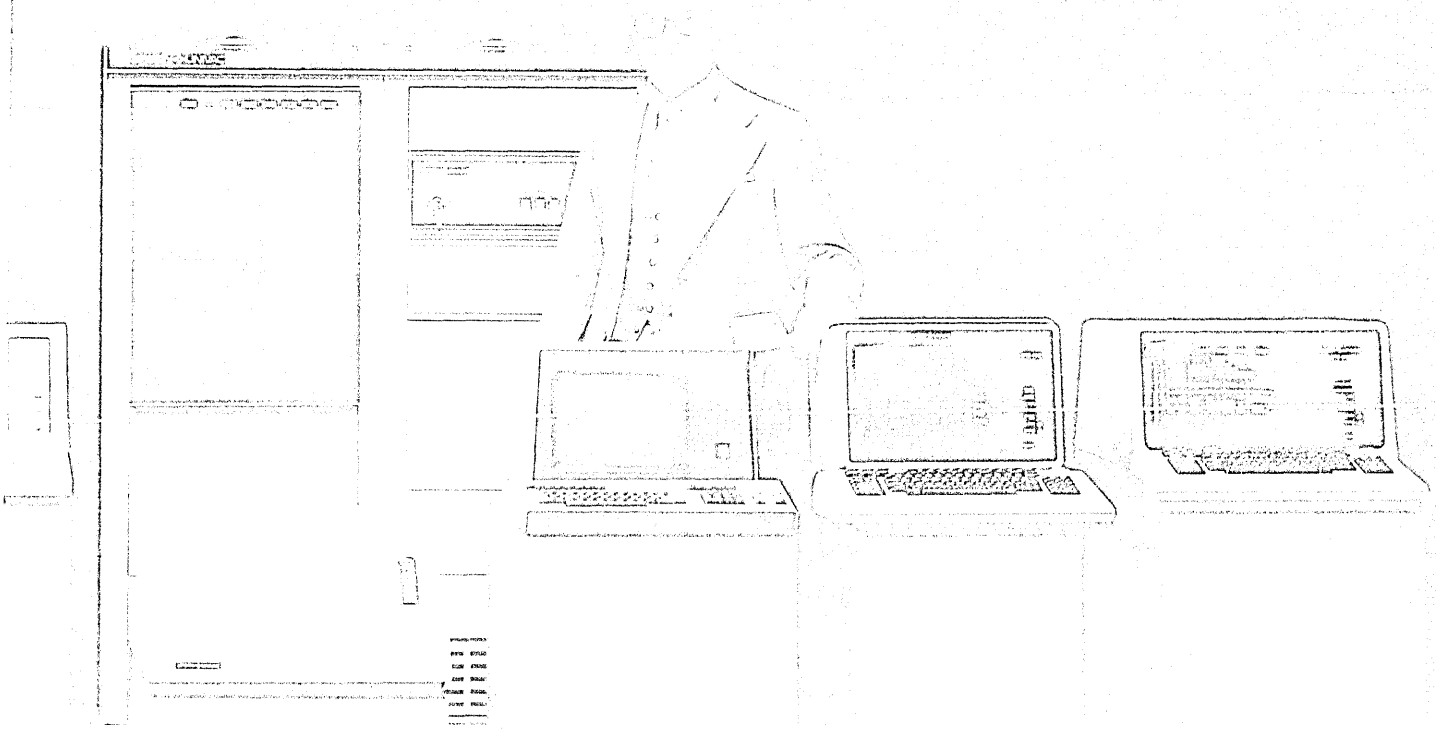

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An employee begins "leaving" on the day he is hired.

THAT OLD BUGABOO, TURNOVER

by R. A. McLaughlin

Two thousand years ago, being a citizen of Rome was like having a key to the world. Today, the keys to the world seem to be held by members of the data processing community, and the titles that command respect and tribute are "applications programmer," "systems analyst," and "data communications specialist." Having one of those titles, plus a couple of years' experience in the trade, opens thousands of doors.

The dp industry is a seller's market for skills ranging from keypunching to department management. The shortage of qualified personnel runs across all job functions, through all sizes of computer installation, over all geographic areas. The lack is creating delays in implementing applications, large financial rewards for professionals who are willing to job-hop, and high rates of employee turnover.

None of this is really new, except in scale. Since computer power became widespread, the demand for computer workers has always exceeded the supply, and turnover has always been uncomfortably high. What's new is how much the picture has worsened in the last 12 months, and how much worse it may yet become.

The results of a new DATAMATION study show that dp employee turnover is now running at about 28% per year. That's a *big* number; at that rate, half the employees at an average dp site won't be there two years from now. The odds are that every chair will have a new occupant within four years—and that in a profession where it may take 12 to 18 months for a new hire to become productive.

Fortunately, some qualified employees stay on, although they may do so at high personal cost in terms of lost opportunities. Unfortunately, those people must now spend a good deal of their time hiring and training new personnel. Thus, two of the industry's biggest challenges are to keep more employees with their employers and to reduce the time it takes to make new employees productive.

Half the employees in the industry may not be with the same companies two years from now.

But today's problems won't go away quickly even if we provide immediate solutions to those challenges. The imbalance between supply and demand is simply too great to correct quickly, and there is every sign that the demand will continue to escalate as computer systems proliferate.

M. R. Parr, president of the personnel placement firm Source EDP, tried to put the scale of the current problem in perspective: "Source EDP experienced an 80% growth rate in personnel requirements from our clients during the first half of 1979 as compared to the same period in 1978. We are currently placing the average candidate in less than half the time we used to require, and our clients are twice as willing to relocate candidates. Further, where a 20% increase in pay for a job change was unusual a year ago, these are becoming commonplace today."

Actually, the demand for people might be a godsend for the placement firms, but that's certainly not the way the dp managers of the world see it. "We've been recruiting for systems analysts and programmers for three months," says the manager of a local government installation in Wisconsin, "and we've had *no* response. *None.*"

Another manager, this one with a beverage container manufacturer in Colorado, says "in the past, it took us 30 to 60 days to hire someone. Now it takes six to seven months."

And finding prospective employees is only the first obstacle. The second is meeting their salary demands. Mr. Parr says, "The beginning salaries, for example, for commercial programmers have gone up by more than 30% over the last two years." In fact, the department manager in a manufacturing firm in Illinois says, "The starting salaries for this year's graduates are $140 a month higher than last year's."

That figure is certainly more of an increase than last year's new hire has seen in the meantime—the axiom "No man is a prophet in his own country" has a direct parallel in employee compensation. Although an employee with a year's tenure in a company is *worth* far more than a new hire with a year's less experience overall, this is not usually directly reflected in the existing staff member's paycheck. This leads to "compression," where the differences in salaries between junior and senior employees is artificially reduced by inflation.

Given President Carter's salary increase guideline of 7% per year, which does not apply to new hires; plus the middling increases prevalent even before the guideline, an employee who has worked somewhere for three years may find he is earning the same as Joe College with zero experience. We know what the veteran is likely to do: add his number to the turnover statistics.

"Carter's 'seven percent solution' has been a prime mover for high turnover," the head of a 500-person dp department in a New York bank tells us. "In 18 months to two years, a trainee is worth $3,000 to $4,000 more than when you hired him," says another manager, this one from South Carolina, "and it's darn difficult to get him that much more."

MANAGERS MOVE TOO

Of course, compression works all the way up the pay scale, with the result that the manager isn't being paid that much more than his top technicians, and eventually everyone runs into a fixed barrier—in spite of the fact that inflation knows no upper bounds. Result: add a few more digits to the turnover counts.

Whatever the cause, when employees begin to leave, the inevitable consequences include a further increase in demand for personnel, more recruitment, calls to the headhunters... and pirating. Like a school of feeding sharks, employers begin recruiting from each others' ranks, and at great cost to them all.

"A very large dp organization just plain outbid us for our most competent, multitalented staff member," says the head of a five-man shop in Columbus, Ohio. His complaint is typical. Says another, "Don't forget the problem of losing the *vendor's* personnel on your account."

Those two executives at least were in private industry. In government, it's even tougher to increase budgets or to violate salary guidelines. "As a public institution with recently publicized budget problems, we're stuck," one executive told us. Another, at a public library in Illinois, relates: "The Proposition 13 mentality makes it impossible to offer salaries adequate to attract anyone." And, from a man who runs a 12-person federal government installation in Washington, D.C.: "Within the last six months, 100% of our staff has left for other organizations." Hard to top that one.

Given that the local pool of talent won't erase the deficit, which is usually the case, the manager tries national (and international) advertising to attract new bodies. Sometimes this works. (For example, the British are again complaining about the North American "brain drain.") None of the mechanisms for recruitment work all the time, however, and some of them backfire.

"We hired referrals from a personnel agency," our man from South Carolina tells us, "but after two years, it began calling the people it had placed with us." According to the head of a 200-man operation in New York City, "In several cases, the agency has followed up after *one* year and tried to move the same people again. The placement services industry should develop some form of self-regulation."

"I wonder if a boycott [of the placement agencies] would be effective," muses a manager from Minneapolis who has clearly considered doing that.

The executive from New York suggests that another mechanism also may backfire. "There is a technique in vogue where companies are offering their employees a bounty, $1,000 to $2,000, for each new recruit brought in. This creates havoc in shops where old employees contact former associates and 'raid' the old shop to get the bonus from the new one."

Had enough yet? Oh, but there's more. What happens when the haggard manager and his personnel department lieutenants actually land a live one? Chances are, whether that new recruit is a beginner with college credentials or a veteran with some years of experience, the new employee is taking a step up the career ladder—meaning he may not be trained to do the job he's just taken.

Again, Parr of Source EDP knows the numbers. "More than 80% of all placements during '77-'78 were 'lateral.' That is, they were within a position title and corresponding responsibility. During the first half of 1978, nearly 50% of the placements were *promotions*. Further, in half of the *nontrainee* placements, the new employer was required to provide training (in-house or otherwise) in lieu of 'required' prior experience."

A dp director in a Texas bank supplies an example of what can happen once the employee moves into his office: "We hired three applications programmers. Two had BS degrees, the other an AA from a local technical school. Not one of them was trained in basic system logic, JCL, or even in a programming language."

One result is that a high percentage of employees are in over their heads. Also, many smaller shops, government installations, and public institutions become training centers instead of productive computer departments; this is especially true because these installations cannot pay well enough to hold senior staff members.

"We retain people for about three years," says the head of an Air Force computer installation in Nebraska, "and it takes 8 to 12 months of that time to

ANNUAL PERSONNEL LOSSES
Staff Size

	<10	<20	<40	<80	<160	≥160	All Sizes
Number of sites	90	82	58	31	15	13	289
Total personnel	518	1,237	1,510	1,678	1,631	5,445	12,019
Data entry	33%	28%	31%	24%	26%	29%	30%
Production control	27%	22%	12%	18%	32%	30%	20%
Operations	35%	30%	25%	21%	28%	24%	29%
Applications programming	40%	36%	30%	29%	38%	25%	34%
Systems programming	15%	30%	20%	28%	11%	18%	22%
Systems analysis	19%	12%	19%	35%	24%	15%	20%
Data base administration	27%	4%	24%	19%	25%	20%	8%
Data communications	0%	33%	17%	25%	23%	24%	21%
Other functions	12%	24%	12%	25%	18%	14%	18%
Total staff	31%	30%	23%	24%	28%	22%	28%

Table 1. As long suspected, applications programmers are the industry's most accomplished job-hoppers.

GROWTH/SHRINKAGE OF STAFF
Staff Size

	<10	<20	<40	<80	<160	≥160	All Sites
Data entry	−2.2	−2.4	−7.2	−2.7	+4.6	+0.1	−5.1
Production control	+3.3	−5.7	+11.1	−3.0	−0.7	+0.3	+1.8
Operations	+9.7	−3.3	+2.4	−5.0	−4.8	−0.4	+1.3
Applications programming	+4.0	+2.9	+3.3	+3.1	−3.0	−0.7	+2.6
Systems programming	−6.0	−9.2	+2.4	−2.7	−1.5	+1.7	−3.0
Systems analysis	0.0	+2.5	+3.9	+0.7	+1.4	+0.9	+2.1
Data base administration	+25.0	+3.5	0.0	+13.1	−16.7	−6.7	+2.0
Data communications	+20.0	−16.6	+18.2	+7.7	+19.5	+10.0	+11.7
Other functions	−1.2	−3.3	+7.2	−3.1	+2.0	0.0	−0.1
Total staff	−4.9	−2.4	+1.7	−0.9	−2.0	+1.6	−2.0

Table 2. The industry took on nearly 12% more data communications specialists in the last 12 months, reflecting a continuing shift toward more sophisticated on-line applications.

JOBS WAITING TO BE FILLED
Staff Size

	<10	<20	<40	<80	<160	≥160	All Sites
Data entry	9%	8%	13%	3%	8%	6%	9%
Production control	7%	1%	9%	8%	1%	4%	6%
Operations	12%	6%	7%	3%	6%	5%	7%
Applications programming	22%	18%	18%	13%	13%	8%	17%
Systems programming	16%	19%	22%	14%	13%	10%	17%
Systems analysis	23%	16%	19%	13%	15%	5%	17%
Data base administration	4%	29%	41%	7%	0%	27%	10%
Data communications	20%	89%	24%	8%	5%	39%	27%
Other functions	10%	8%	6%	9%	4%	3%	8%
Total staff	11%	10%	12%	8%	9%	7%	10%

Table 3. There are immediate openings for 10% more dp personnel than are employed today—roughly 1,200 persons for the 289 installations represented here, for instance.

train them."

"The average length of stay of a programmer/analyst is about 18 months," says the director of a city hall installation in Michigan.

"Our salaries are not competitive with private industry," a man from a Texas university tells us. "We hire them, train them, and they leave. Only the underqualified ones stay."

And there's another rub. If a good resume and some salesmanship can be the ticket for a 20% salary increase for the average Joe, what happens to the person with an unimpressive resume who can't sell himself?

A spokesman from Quebec answers that one: "Potential management, those people left, tends to be the tired-out 1401 analysts. Others move on before reaching leadership capability."

This is not meant to suggest that management is really a breed apart in terms of qualifications or turnover. Quite the opposite is true. As our polling was done across data processing executives exclusively, we had to go elsewhere for objective data on the executives themselves. We talked to Paul E. Putney, western region manager for Korn/Ferry International, which claims to be the world's largest executive recruitment firm. Putney appreciates the problem in the dp industry; he began his own career in the Bizmac days at RCA in the mid-'50s, and later joined Scientific Data Systems and Xerox.

He says: "There has been considerable turnover in dp management over the years, but largely because the type of manager required has changed. Early on, computer facilities were managed by technical people, usually people who started as programmers. The position often reported to the controller, since the information produced was generally financial in nature.

"In recent years, companies have come to recognize the contribution data processing can make to managing all aspects of the business, including production and material control, accounting, business forecasting, modeling, etc., and it has taken a much broader manager to oversee these activities. In order to attract this kind of executive, salaries have escalated considerably and turnover has been

It's the same for the manager as for the applications programmer or analyst.

high because competition is keen. A competent, experienced information systems executive with a good track record is in a very attractive position in the marketplace." In short, it's the same for the manager as for the applications programmer or analyst, except that there are even fewer to go around.

GENERATING NONRANDOM NUMBERS

To measure the size of the problem and to seek solutions, DATAMATION called for assistance from the members of its Computer Executive Panel. The panel is composed of several hundred dp managers across the country who provide information on industry phenomena and act as spokesmen for their peers. Besides a broad collection of anecdotes and horror stories, they also gave data on turnover and recruitment problems experienced by their installations.

Each manager was asked a series of questions relating to each category of worker on his staff. How many data entry operators do you employ? How many have you lost during the past 12 months? How many have you hired? How many more are you open to hire?

The numerical answers for the number lost, number hired, and so on, were converted to percentages, and the percentages averaged by staff size. The results of the compilation are shown in Tables 1 through 3. A series of additional questions on recruitment mechanisms led to the not-so-impressive findings in Table 4.

The overall findings are awesome, although not unanticipated. For example, the big increases in the number of persons employed as data base administrators and data communications specialists reflect the industry's movement to more sophisticated on-line operations and data base applications. The fact that many job openings exist for programmers and analysts of all varieties similarly reflects the general expansion of the industry.

Further, the percentage of personnel lost for each job category (the common metric for "turnover") is reasonably consistent across installation sizes, demonstrating that the dp community is truly a single entity with universal problems.

SOLUTIONS AND NON-SOLUTIONS

In spite of all the lament and doomsaying, there is hope. There are a few shops that have avoided high turnover and its attendant problems. Like the one child who makes it all the way through adolescence without a single cavity, there may be something those untroubled shops do right. Perhaps they are just lucky, but they are worth studying.

METHODS OF HIRING AND RECRUITING

Method	Used for Professionals	Used for Non-Professionals	Ineffective	Somewhat Effective	Most Effective
National advertising	■			■	
Local advertising	■	■		■	
Word of mouth	■	■		■	
Employee referrals	■	■		■	
Technical schools	■	■		■	
College recruitment	■			■	
Company personnel dept.	■	■		■	
Private employment agencies	■			■	
State & federal agencies	■	■		■	

Table 4. Data processing managers are using every means available to them for locating, attracting, and recruiting personnel—with only moderate success.

First, we can dismiss some potential solutions which apparently don't work. One is the business of playing with job titles in order to pay higher salaries to existing personnel. It is the first thing most folks try, but it leads to some horrible problems. For one thing, the organization fills up with people who cannot work at the level they are supposed to. Another is that, new title in hand, those employees are equally likely to try to leverage themselves into another company that does not recognize the title is "honorary."

"Playing with job titles is dishonest to the individual, too," according to our New York confidant with a 200-person shop to run. "We've seen several cases where the individual even *feels* qualified above his actual ability because of the title. So he expects even greater compensation."

But if changing job titles doesn't work, changing job functions may. "We've changed the separate jobs for programmers and analysts to programmer/analysts. This makes the jobs more interesting," said one correspondent.

"We are trying to train potential MIS personnel in-house by way of an internal promotion policy. So far it has been effective," says a Columbus, Ohio, MIS director. He may be on to something, since he also says, "We have virtually no problems. Our software programmer has 19 years with us, and our programmer/analysts average seven years."

A variation on that theme: "One way we have found helpful is to hire part-timers to whom we can later offer full-time positions."

"We have no special salary problems," a grocery chain reported. "We are a new shop, 370/148 OS/VS1. We had been running remote job entry to a DOS system. We now have lots of challenge for professionals, which most seem to need."

Then there was the manager who, safely under a cloak of anonymity, reported, "We don't pay enough to hire males, so 83% of our programmers are female — and excellent."

Again and again the shops that reported no problems struck some common chords. They hired from within other departments of their own firm to find employees whose allegiance was to the company rather than to the dp profession. They made the move to dp a promotion, for example, by training someone from the typing pool to be a data entry operator. They found ways to challenge and to add interest to jobs.

Sometimes taking these actions allowed them to move against the current, to retain good employees. Problems linger everywhere, however, for no computer installation can long remain a neutral island.

Very few information processing departments have been able to handle the compensation compression problem. Raises generally don't keep even a good worker much ahead of inflation. Existing systems for compensation are frequently unfair, and adhering to any arbitrary guideline, 7% or whatever, often make them more unfair. Further, we have no way to satisfactorily compensate an employee in any field who produces a great

INVERSION VERSION

Most people think turnover is bad, that it illustrates the organization cannot retain its people and that opportunities are better elsewhere. That's not always the case. Recently, I visited a client to review an application system. This particular client is a sophisticated manufacturer of a wide range of products, and recently updated his dp environment to a pair of 158s under SVS, with plans to move into MVS and an eventual conversion to a 303X mainframe.

Since I was reviewing a payroll system for the umteenth time, I felt comfortable about the review and started by asking casually for a listing from the tape library management system of current payroll master files. I was informed that there was no such listing, but that the site maintained a "high degree" of control over its master files by a series of application folders. After the initial surprise I said, "Fine, let's look at the payroll application folder." This turned out to be a manual list of specific payroll master file generations, as well as the scratch tapes that were considered part of the payroll application tape pool. It began to dawn on me that this site did not use the system catalogue or any part thereof to control its tape usage.

"Why don't you use the system catalog?" I asked. I was not prepared for the answer.

"Do you know what happens when the system catalog gets screwed up and the generation data groups are wrong?"

"Well," I mumbled, "yeah, that can be a problem, but there are ways you can prevent it . . ." I ticked off the usual litany of things that control the system catalog. "And how are you sure that the operator mounts the right tapes?"

"Well, that's simple. We take the JCL and put in the absolute volume-serial numbers so that the operating system prints the input and output tape mounts by actual volume-serial number."

"You mean, you override the 'PROC' with symbolic parameters?"

"No, we take the actual JCL deck and sit down at night and re-keypunch the actual volume-serial numbers into punched cards to put into the JCL deck to be sent into the operators."

"Well," I muttered, "at least the internal labels provide you some degree of control."

"Well, no," the technician admitted, "We don't have any internal or external labels on our tape files."

Since he was a client, I tried to control my reaction. I asked him why they were still using actual JCL decks for production purposes. After he responded with "Why not?" I came back with "Well, you won't have to worry about dropping a deck." His response, "We haven't dropped a deck in a year and a half," still ranks among my favorite client responses.

I also had had a chance to look at a report that showed the top 10 programs—in number of executions—per month. When I noticed that the linkage editor was the number one program executed, I asked why. The response was that since they had a number of routines commonly used by more than one system, they were concerned that a change to a routine would not, through oversight, be properly linked with every single user of the routine. As a result, their habit was to link edit every time they executed a production program.

By this time I was reeling from an overload of nonstandard OS practices. The usual excuses are "We don't have enough staff," or "We'd like to do that but there isn't enough time," or "We're gonna leapfrog a generation," or something like that. Rarely do I get the questions "Why is that useful?" or "What does that give me?"

Then it occurred to me. Looking into the history of this client, I found the dp organization had, within the last several years, migrated from a DOS to an OS environment. And the technical, operations, and system development staff was, almost to a person, exactly the way it had been in the DOS environment. What this particular shop needed most was some young turk with lots of OS experience to charge in the door, stagger back and say, "Good grief, you're running these 158s just as if they were 360/30s under DOS!" A data processing shop can easily become provincial without the input of new ideas into its ranks.

My summary to the client? "You pay too well, and your turnover is too low."

—John Diesem

deal more than his co-workers except by piece rates, and we have no mechanism in dp for applying even piece rates to work more sophisticated than data entry operations.

Turnover won't even be slowed until we realize an employee begins "leaving" on the day he is hired. "Sometimes," says Dave Samuelson of Quest, another placement firm, "turnover is a plan that comes to fruition. Hiring someone who is overqualified, for example, leads to boredom within a year."

Turnover frequently doesn't help the individual find satisfaction, either, he says. "Many people are suffering from declining expectations. They go off to another company to find a change, and find the same things they left.

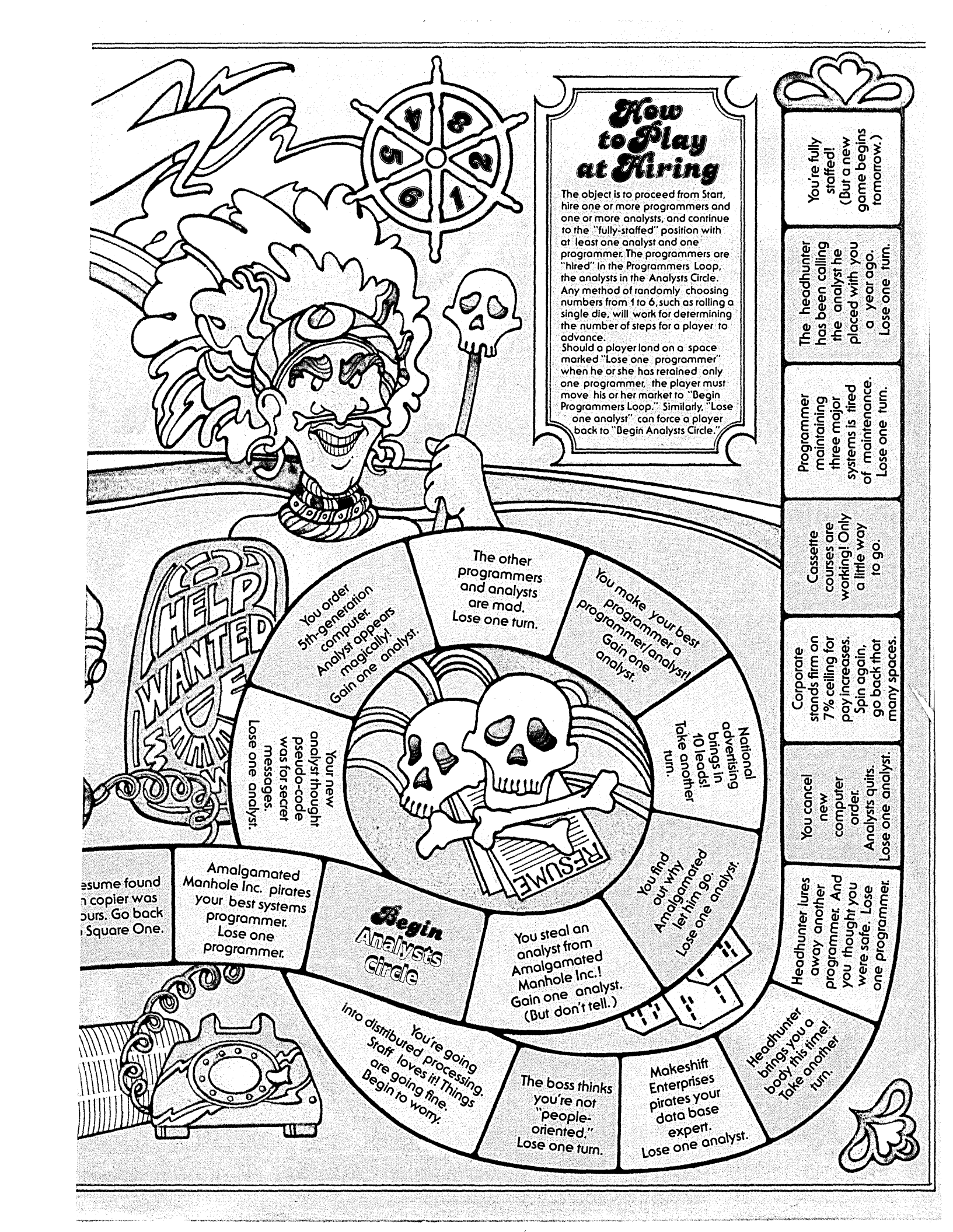
"There is no answer," Samuelson concludes. "We can move, mold, direct, mitigate. We can not alleviate."

The problems of turnover are not going to go away. If every salary administrator in the world had nightmares tonight that made him more generous to dp employees tomorrow, even that would probably not halve the turnover rate. However, coupled with that financial reward, if dp managers today could begin spending as much time on making jobs interesting as they do on hiring new persons for uninteresting jobs, the situation might begin to be alleviated. Certainly the expense, aggravation, and errors caused by continually replacing and retraining dp staff members sap the strength of what should be the world's most dynamic and productive industry. If the true costs of turnover were fully appreciated, we'd realize the alternatives are real bargains. ✲

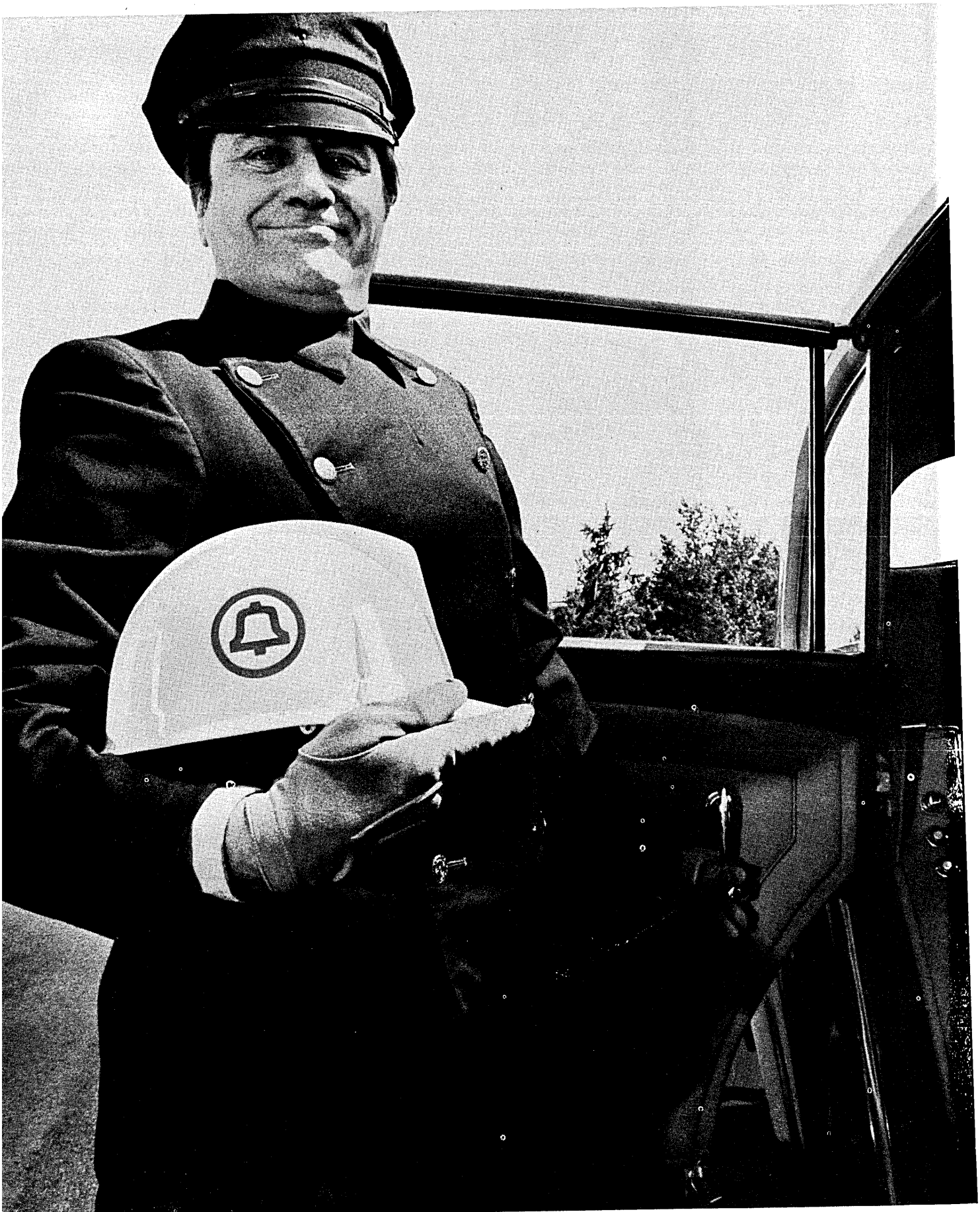
R. A. McLAUGHLIN

Mr. McLaughlin recently became director of corporate information for the Tran Telecommunications Corp., a generalized networking firm located in Marina del Rey, Calif. Before joining Tran, he spent 11 years on the DATAMATION staff in a variety of positions, including those of technology editor and articles editor. His dp experience includes a six-year stint in data processing operations within Hughes Aircraft's Aerospace Group in Los Angeles.

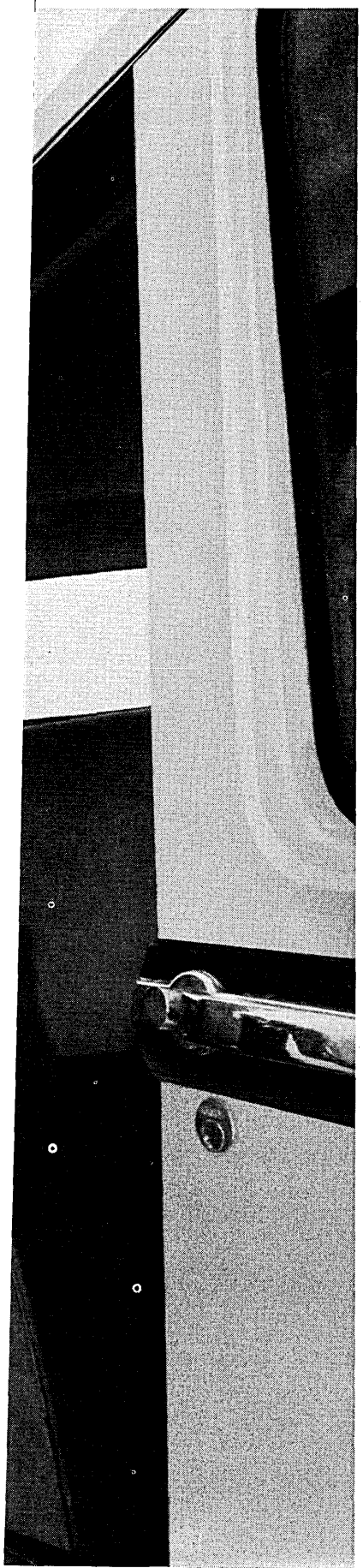

PIRATES &
DEADBEATERS
A GAME EVERYONE CAN LOSE!
Start
Square One
Typist wants to try data entry! Take another turn.
You push through new titles for 10 top staff members! Looking good!
Nine of them leave within six months. Ir figures. Lose one turn.
Salary administrators agree to review all dp positions! Think about asking for a raise.
Administrators decide dp professionals are overpaid. Spin again, go back that many spaces.
Begin Programmers Loop
Your new programmer thought JCL was a circuit technology. Lose one programmer.
One of your night shift operators has learned to program! Gain one programmer.
Local radio advertising works! Gain one programmer.
You find out why she was transferred. Lose one programmer.
Interdepartmental transfer brings you a job candidate! Gain one programmer.
This year's graduates want $2,000 more. Turn to pessimism. Lose one turn.
End of school term. New crop of programmers! Begin feeling optimistic. Take another turn.
Boss agr
to more or
applicatic
Programn
excited! You're
for a mome
1
2
3
Sign here
CLASSIE


How to Play at Hiring
The object is to proceed from Start, hire one or more programmers and one or more analysts, and continue to the "fully-staffed" position with at least one analyst and one programmer. The programmers are "hired" in the Programmers Loop, the analysts in the Analysts Circle. Any method of randomly choosing numbers from 1 to 6, such as rolling a single die, will work for determining the number of steps for a player to advance.
Should a player land on a space marked "Lose one programmer" when he or she has retained only one programmer, the player must move his or her market to "Begin Programmers Loop." Similarly, "Lose one analyst" can force a player back to "Begin Analysts Circle."
HELP WANTED
RESUME
Begin Analysts Circle
You're fully staffed! (But a new game begins tomorrow.)
The headhunter has been calling the analyst he placed with you a year ago. Lose one turn.
Programmer maintaining three major systems is tired of maintenance. Lose one turn.
Cassette courses are working! Only a little way to go.
Corporate stands firm on 7% ceiling for pay increases. Spin again, go back that many spaces.
You cancel new computer order. Analysts quits. Lose one analyst.
Headhunter lures away another programmer. And you thought you were safe. Lose one programmer.
Headhunter brings you a body this time! Take another turn.
Makeshift Enterprises pirates your data base expert. Lose one analyst.
The boss thinks you're not "people-oriented." Lose one turn.
You're going into distributed processing. Staff loves it! Things are going fine. Begin to worry.
You steal an analyst from Amalgamated Manhole Inc.! Gain one analyst. (But don't tell.)
You find our why Amalgamated let him go. Lose one analyst.
National advertising brings in 10 leads! Take another turn.
You make your best programmer a programmer/analyst! Gain one analyst.
The other programmers and analysts are mad. Lose one turn.
You order 5th-generation computer. Analyst appears magically! Gain one analyst.
Your new analyst thought pseudo-code was for secret messages. Lose one analyst.
Amalgamated Manhole Inc. pirates your best systems programmer. Lose one programmer.
esume found
copier was
ours. Go back
Square One.

24-hr. data pick



up and delivery.



Problem Data is one thing there's no shortage of. The business problem today is getting the right data to where it's needed in a form that's useful.

Not how much, but what and where.

In fact, American businesses are now spending nearly as much to transmit data as to process it. And as much as 40 percent of the nation's data processing capability is tied up in operations performed solely for the purpose of transmitting the data.

Solution We at the Bell System have conducted many-faceted studies of the data communication needs of our customers. And we've developed systems to meet those needs.

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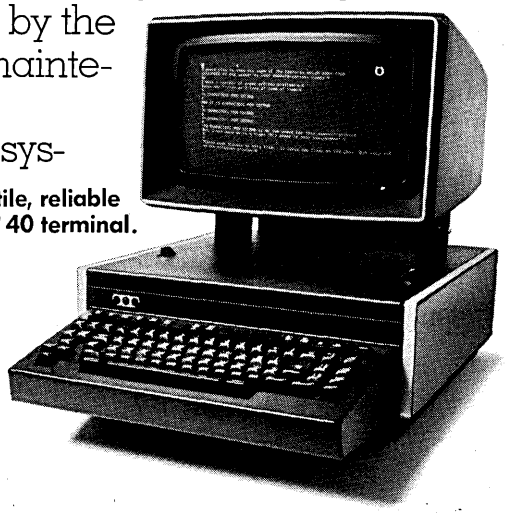

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Bell System

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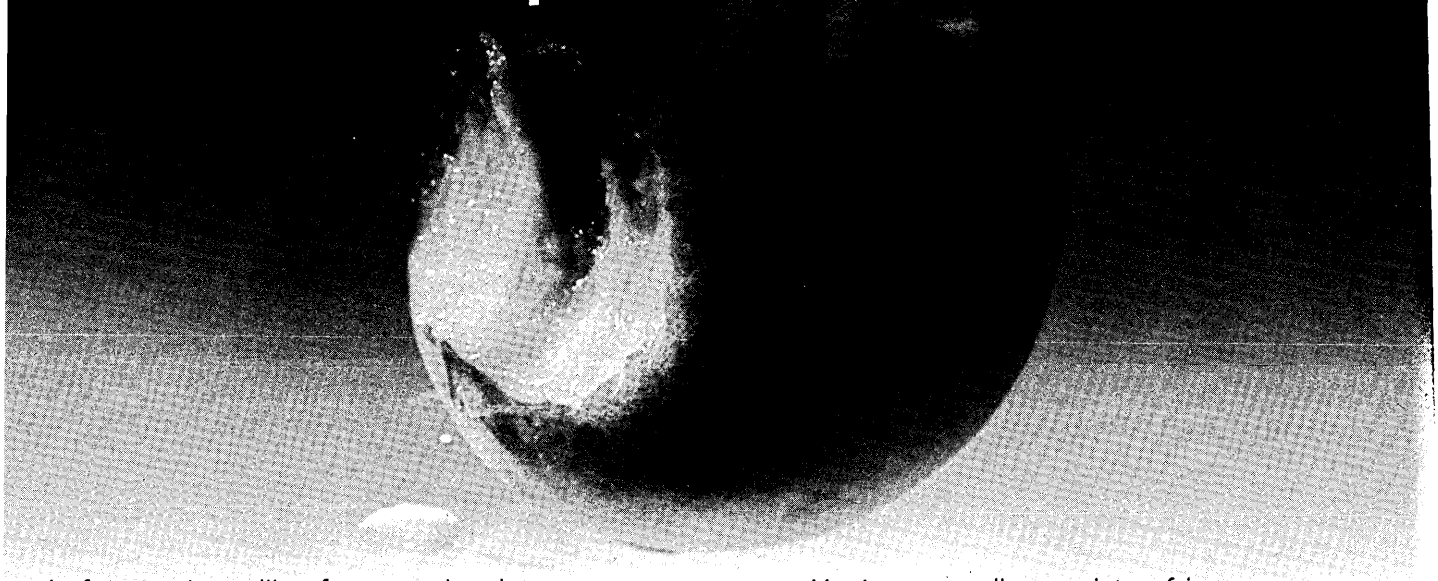

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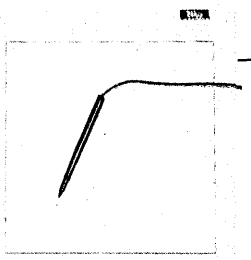

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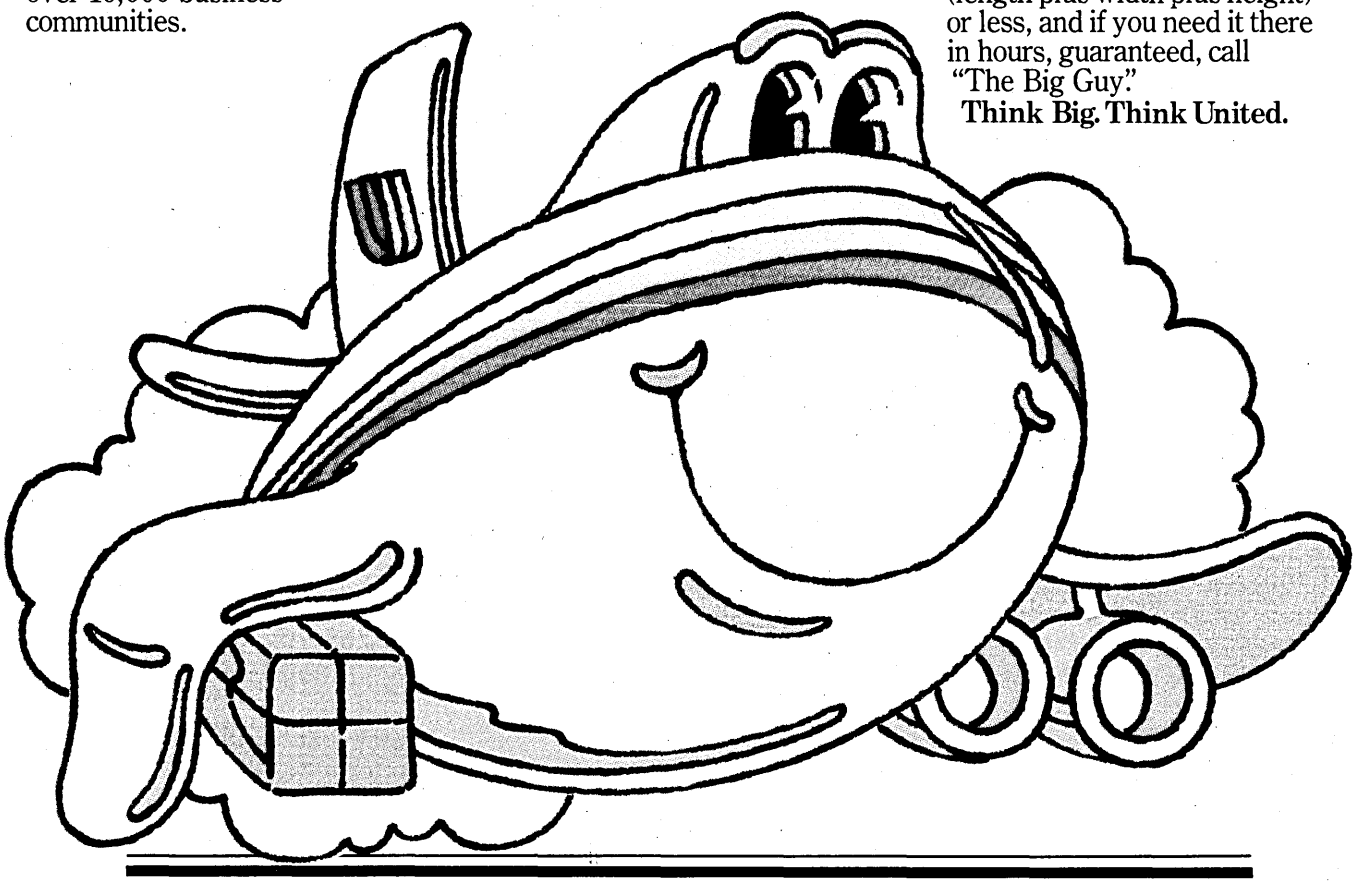

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UNITED AIRLINES

Although mountainous waves of documentation threatened to engulf the Poseidon, it emerged triumphant when Lockheed installed Autotext.

AUTOMATION CALMS A SEA OF PAPERWORK

by Frances L. Grant and Don F. Hamilton

The Navy's ballistic missile, the Poseidon, developed by Lockheed Missiles & Space Co. (LMSC) of Sunnyvale, Calif., did not happen without reams of paper and documentation. To convert a multibillion dollar underwater concept into a reality calls for a wide assortment of skills and facilities woven through the entire industrial framework.

How does a prime contractor for a multibillion dollar job get on top of manuals and documentation, meet contract deadlines, and still remain cost-effective?

The management of LMSC had the foresight in early 1968 to see that efficiency could only be bought at the expense of automating publication of the voluminous documentation anticipated for the Poseidon missile deployment in March 1971. The Navy contract stated that complete documentation for the Poseidon *at the time of missile delivery* was mandatory. This vital documentation would entail 30,000 pages, to be verified, edited, and typeset within six-weeks. Past experiences showed that engineering changes were made up to the time of delivery.

An analysis of the traditional method of handling heavy publication in such a short time indicated the job would require 400 typists. That would mean hiring a select work force and laying them off after the job was completed—not very efficient.

Thus it was decided to find an automated publication system designed to handle this volume. The envisioned system would have to accommodate last minute changes quickly and would have to include all of the stipulations dictated by the Navy contract. The system would have to automate printing of the table of contents and table of illustrations, and provide automatic formatting, phototypeset capability, and a data base of stored information designed for efficient retrieval.

In 1968 there were not many places to look. Word processing technology was in its infancy. Fortunately, Lockheed-Georgia had put together a text processing system for the Galaxy C5A that was geared to technical documents of high volume requiring ongoing reiterations. LMSC system designers took the Georgia CAMP (Computer-Assisted Manual Preparation) system and restructured the computer programs. Major changes were made to CAMP to meet LMSC needs, and in July 1968 an on-line system became operational; the first phototypeset copy was available to Lockheed users in November 1968. The outcome was Autotext, an automated publication system.

Putting together a new system, of course, entailed heavy initial cost. The first two years of implementing Autotext came very close to the cost of producing high volume technical manuals by conventional publication methods.

The data base concept was a real asset to the program. At the Navy's Charleston, N.C., facility, a task analysis was made of Navy personnel loading a missile. A step-by-step verification was made of every major job in missile maintenance. Then each job was broken down into work elements and assigned a number. When a procedure had to be changed, it was no longer necessary to redo the whole document and rush it to Navy maintenance personnel on site. With the computerized system, the stored work elements needed for the new procedure were simply retrieved in a new order. A 200-page procedure could now be redone and delivered to the missile site through a telecommunication network in minutes.

It was not uncommon for a one-time emergency procedure to be generated for field personnel. Here again, the data base, comprised of thousands of work elements, could provide an ad hoc document in seconds by simply pulling together selected elements. This data base approach removed the drudgery from the technical writer's work, in addition to reducing possibilities of error.

ONE APPLICATION AMONG HUNDREDS

Autotext is one of several hundred application systems that share LMSC's two IBM 370/165s (with 3 million bytes of memory each). Storage for on-line files totals 4 billion bytes while batch processing has a capacity in excess of 3 billion bytes. Multiple magnetic tape stations, available to both systems, are used by Autotext for print files and provide an off-line interface with an Information International COMp80 microform recorder. On-line upper/lower case high speed printers are used to print proof copies rapidly. Currently, over 300 typewriter terminals have access to Autotext's on-line files.

Autotext software is comprised of four major elements:

Text Input and Update provides access to an on-line draft file through Trendata 1000/4000 typewriter terminals. Text may be entered, deleted, changed, moved, copied, or listed.

Output Programs comprise the text composition system. Text extracted from the on-line draft files is produced, on request, in either of two output forms, E copy or R copy. The E (edit) copy is a proof copy of the publication printed by a high speed printer on 14¾ × 11½ inch computer paper. This copy of the document as it appears in the draft file, including all format specifications and commands with draft file addresses of each sentence, is the macro editor's working

Autotext's automatic readability index helped improve performance of ballistic missile maintenance personnel.

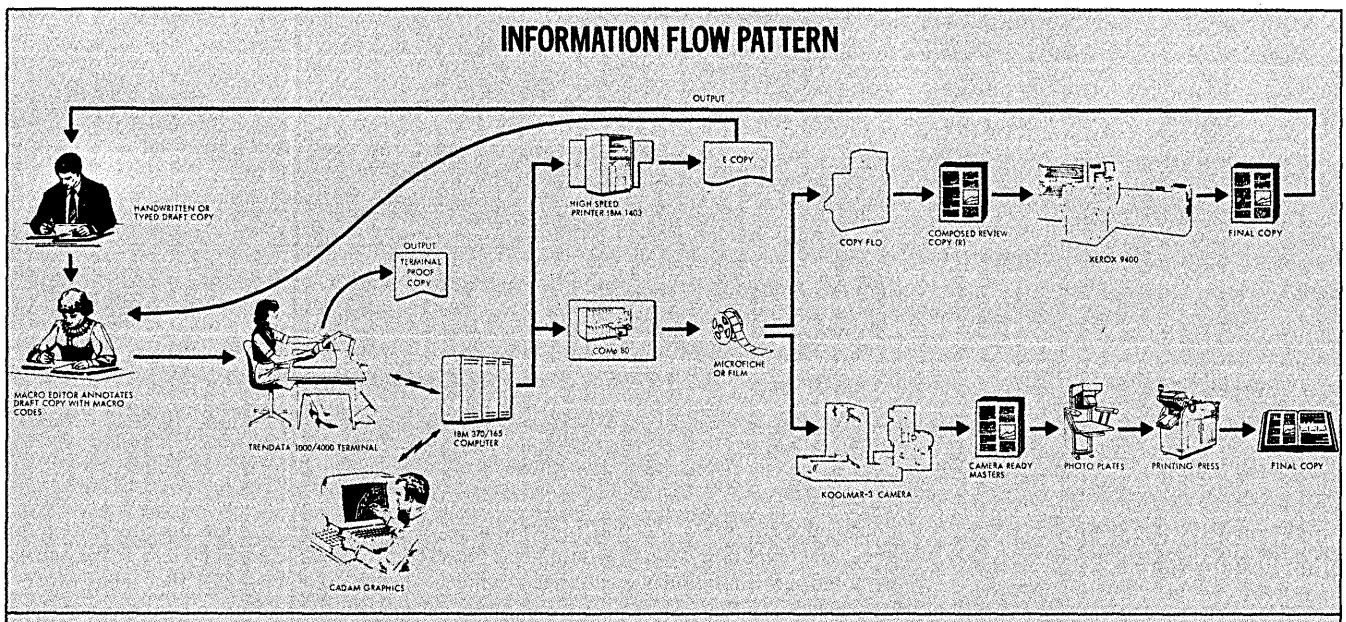


Fig. 1.

copy. It serves as a road map to the composed review copy given to the writer. The E copy calls out an assigned address for each sentence. This provides the flexibility to change a sentence without affecting the body of the composition.

The formatted copy, or R (report) copy, is a fully composed, paginated publication, including table of contents, list of tables, list of illustrations, and key-word-in-context (KWIC) index, produced on the COMp80. It shows line resolution and page makeup, including space reservation for conventional artwork and actual illustrations if generated by CADAM (Lockheed's Computer graphics Augmented Design and Manufacturing system). In other words, it looks exactly like the copy now being read. The R copy is frequently the first report the writer sees. Formatting readjustments and errors are more visible to the writer on the R copy than on the E copy.

File Management Programs move inactive documents to off-line files, transfer inactive documents back to the active on-line draft files, allow subsequent change-page-only publication, and provide reorganization and backup for on-line draft files.

Telecommunications for Autotext provide a data link to a remote computer. The transmitted data may be either a review or working copy, and can be provided to other users' remote locations by either ground or satellite communication. Note that the writer prepares the rough draft in the conventional manner.

The handwritten or typed draft is given to the macro editor, who adds macro format instructions. These instructions specify to the computer how the material is to appear in the final copy. (If a document is recognized by the Government Printing Office as a standard document, such as an Air Force manual, it is sent directly to the typist, bypassing the macro editor.) The terminal operator then enters the text and format instructions on a typewriter terminal. When the document is completed, a proof copy is requested with the typewriter terminal or high speed printer.

The E copy is reviewed by the editor or writer, who marks changes on it and then forwards it to the macro editor or directly to the terminal operator for processing back through the system. An R copy is then requested and reviewed by the writer and the editor. Any undesirable aspects of page makeup are resolved and any desired changes noted. At the conclusion of the prepublication review, the desired changes will be entered into the computer. The final copy is a fully composed, paginated, typeset, camera-ready copy. In addition, microforms (microfilm or microfiche copies) of the text can also be provided.

The system provides a sort capability for finding and inserting the profuse tables and figures typically found throughout technical manuals. The system also has the capability of merging computer-generated graphics with text. This is made possible by extracting drawings from Lockheed's CADAM system. Autotext is the first publication system to merge computer-generated drawings with text.

DESIGNS ENGINEERING DRAWINGS

At LMSC, CADAM is used primarily for the design and production of engineering drawings. The designer uses a lightpen, function keys, and typewriter keyboard to create the design, call up existing designs, or enter lettering on the display screen. The computer then produces a graphic representation of the design.

CADAM presents the operator with a program menu or the results of a computation. (The menu is a list of input options and instructions to carry out a computation or display.) By using the specialized function keys, the designer enters lines, circles, arcs, curves, dimensions, and standard symbols. With the typewriter keyboard, part numbers, dimensions, notes, or other design data are entered. The display image, or any part of it, can be moved around on the screen, expanded, contracted, superimposed, added to, deleted, reflected, or repeated. The output may be a layout or an engineering drawing, produced as a hard copy on mylar, vellum, microfilm, microfiche, or just plain paper.

The marriage of Autotext to CADAM was a real asset for LMSC publishers. For Autotext applications, schematic diagrams, block diagrams, logic diagrams, and pictorial illustrations are generated by CADAM operators, stored on disk, and subsequently merged with the Autotext data base. At merge time, the illustrations are automatically scaled and positioned to fit within the space reserved in the document.

Since high school graduates enter-

ing the voluntary military services are said to read at approximately the ninth grade level, the Department of Defense may require that only specified verbs be used in future military maintenance manuals. The purpose of this specification is to improve and simplify the publications for better comprehension.

Autotext has a feature called the automatic readability index (ARI) that is well suited for this task. The system checks for typos, misspelled words, acronyms, and abbreviations. Exception words detected are listed separately at the end of the document for easy reference, along with the location of the sentence containing the exception word and a list of statistical data based on character, word, and sentence count. An ARI factor is then calculated and is shown at the end of the word edit listing.

The ARI is derived from a formula that calculates the grade level equivalent the reader must have to understand a page. The computer program for ARI that has been used at LMSC since the late '60s calculates the readability index at the page, chapter, and document level. This gives the writer the capability of checking the ARI at various points in the document's life and adjusting the level of understanding either upward or downward depending on the reading level of the intended audience. The formula used at LMSC is:

GL (grade level) = 4.96 (strokes/words) + .50 (words/sentences)-22.52. The ARI can be calculated without reentering the complete document. Once the text of the original draft is stored in the computer, changes, deletions, and new information can be added on-line, making a complete retype unnecessary. The reading index is continuously recalculated to reflect the new revisions, so the writer can check the ARI at any time during the revision cycle.

The ARI saves time for writers, but even more valuable is the improved performance of ballistic missile maintenance personnel due to more articulate maintenance publications. The cost-effectiveness of handling large volumes of technical material is another real value. That is why the manipulation of data in this manner has a special appeal to managers in industry who must consider all aspects of the marketplace. With the automated systems available today, the daily flow of textual information can be handled more effectively than with traditional methods. At LMSC, for example, management's knowledge of readability requirements has helped them provide more readable documents for the customer and end users such as the Air Force and Navy.

STORES STANDARD, SPECIAL DICTIONARIES

Autotext can store standard and special dictionaries in the system. As the word scan routine looks at each word in the publication and compares it with the stored dictionary, all words used only once are recorded by frequency and page location. This becomes the standard or spelling dictionary, which is used to point out misspelled words.

Also, one-time-use words that are not misspellings can help an abstractor or cataloger quickly capture the essence of a particular document. The number of times a word is used determines the relative substance of a publication. High usage or noise words, such as *a*, *the*, and *for*, have no meaning for the publication, whereas low usage words are always very specific. The middle group of word usage typically reveals the true content of the publication.

These scans can serve still other purposes for the writer. If the ARI is high, difficult words can be quickly detected for editing. On the other hand, the redundancy of simple words that do not enhance a publication can be deleted. The same word scan analysis can also provide an author with information for detailed indexing, since location is already recorded.

Systems analysts are looking at language translations that can be executed automatically as a future enhancement for the Autotext word analysis routine. A word scan routine would be able to look at the word *cat* and change it to *gato* in a fraction of a second. Scanning for syntax is another area for development.

The Autotext cycle has many advantages over the traditional publication methods:

- high speed phototypesetting
- high quality final masters
- microforms of complete publication (including 35mm)
- CADAM-merged illustrations
- automatic assembly of table of contents
- automatic key-word-in-context (KWIC) index
- automatic indexing of paragraph headings, table and figure titles
- automatic pagination and change repagination
- automatic word analysis and dictionary check (scan for misspelled words, word validation, and word count)
- automatic readability index
- efficient assembly and manipulation of tables
- rapid retrieval of data from external data bases at run time for inclusion in publication
- word (global) search and replace
- ability to move data from page to page, section to section, or from one document to another
- various automatic formatting capabilities
- partial or complete twist pages (to twist a figure or table is to rotate it 90°)
- hyphenless right justification
- wide selection of type sizes and fonts
- special symbols for equations and formulas
- system flowchart symbols, vertical lettering, and change bar indicators
- no retyping or reproofing of unchanged material
- margin data repeated
- typing at a minimum 20% faster
- more text per page
- reduced writer, editor, and proofing time
- elimination of storage for manual filing systems

The cost savings of using Autotext is dependent on the quantity of documentation and the point in the document's life cycle at which it enters the system. The initial cost of producing new documents is reduced when Autotext is used in place of conventional production methods. However, the greatest savings are realized later in the document's life cycle, when revisions and changes are required. The total cost over the document's life cycle can be reduced by at least 30% when the document is entered in the system at the beginning of the life cycle.

The situation is somewhat different when existing documents well into their life cycle are considered. LMSC's experience over a six-year period has shown that when 20% or more of a document's content is affected by a change, it is cost-effective to enter the complete document into the Autotext system. The savings realized then for all future changes or revisions would be 30% or more of current method production costs.

When a single revision or change to a document represents less than 20%, analysis and judgment must be made to determine whether Autotext is economical for the remaining life cycle. If the revisions in this case are limited to selected sections or chapters changed by 20% or more, then it would be economically feasible to enter that particular section or chapter. Using this method the document would eventually reach 100% Autotext entry.

With the profusion of microprocessors and the advent of sophisticated word processors, the future for Autotext is boundless. Lockheed system designers plan to interface microprocessors with Autotext's large scale computers. For example, microprocessors and word processors will provide full-screen terminals for

macro editing and local text processing. This new hardware will allow whole chapters and documents to be edited in a local mode at far less cost than interacting with a large scale computer.

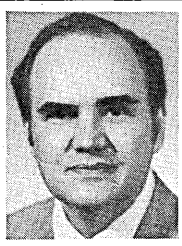
In essence, a microprocessor or word processor will be able to emulate a phototypesetter. For example, an editor will be able to preview formatted phototypeset copy on the screen as it will appear in hard copy. With new high resolution printers and plotters rapidly appearing in the marketplace, local phototypeset copy with graphics will be possible.

The more powerful capabilities of Autotext, such as automatic tables of contents, automatic key-word-in-context, automatic subject index, and the merging of CADAM drawings, to name a few, are currently most efficiently processed on large scale computers. However, as expected storage and processor advances are realized, even these functions will be duplicated on smaller systems, providing the users with extremely powerful and flexible publications capability. ✲

FRANCES L. GRANT

Ms. Grant is currently an associate professor at California State University at Chico in the Center for Information and Communication Studies. She was previously with the Technical Information Center of Lockheed Missiles and Space Co., Inc.'s Palo Alto (Calif.) Research Laboratory as a technical editor, research information analyst, and information retrieval systems assistant.

DON F. HAMILTON



Mr. Hamilton is manager of interactive data processing at Lockheed Missiles and Space Co., Inc., Sunnyvale, Calif. He is responsible for development and user support of AUTOTEXT, CADAM, interactive user language user counseling, distributed data processing, business graphics and automated office systems management. He has been with Lockheed for the past 20 years and has been involved in data processing for 31 years.

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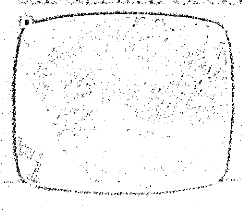

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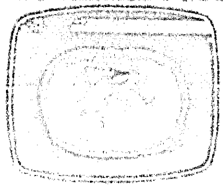

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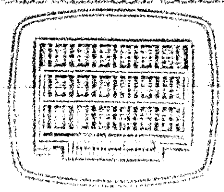

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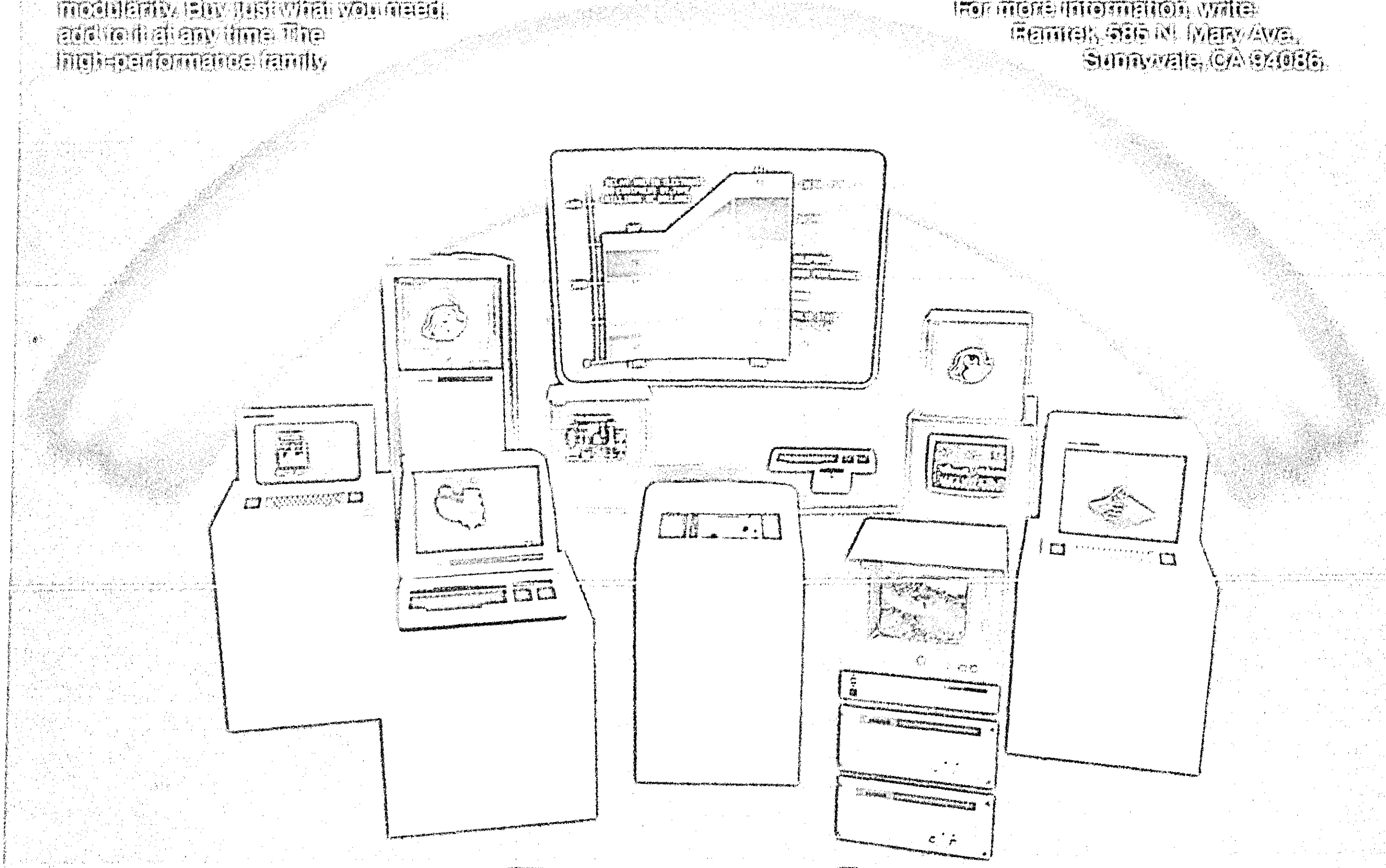

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CIRCLE 51 ON READER CARD

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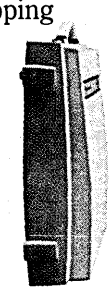
Model 745

IMC's sales force finds the portable 745 to be the perfect traveling companion. Using the data terminal's built-in acoustic coupler connected to a standard telephone, sales agents assemble data the night before a sales call. Or, in some cases, right in the customer's office. The responsive 745 provides IMC sales representatives with instant order status, customer credit history and accounts receivable information. And, with the 745's easy-to-use typewriter-like keyboard, they can access data seven days a week. By adding the virtually silent 745 to the sales force, IMC has cut down on communications costs by approximately 60%.

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XIII OLYMPIC WINTER GAMES LAKE PLACID 1980

If you would like more information on the Model 745 Portable Data Terminal, contact the TI sales office nearest you, or write Texas Instruments Incorporated, P.O. Box 1444, M/S 7784, Houston, Texas 77001, or phone (713) 937-2016.

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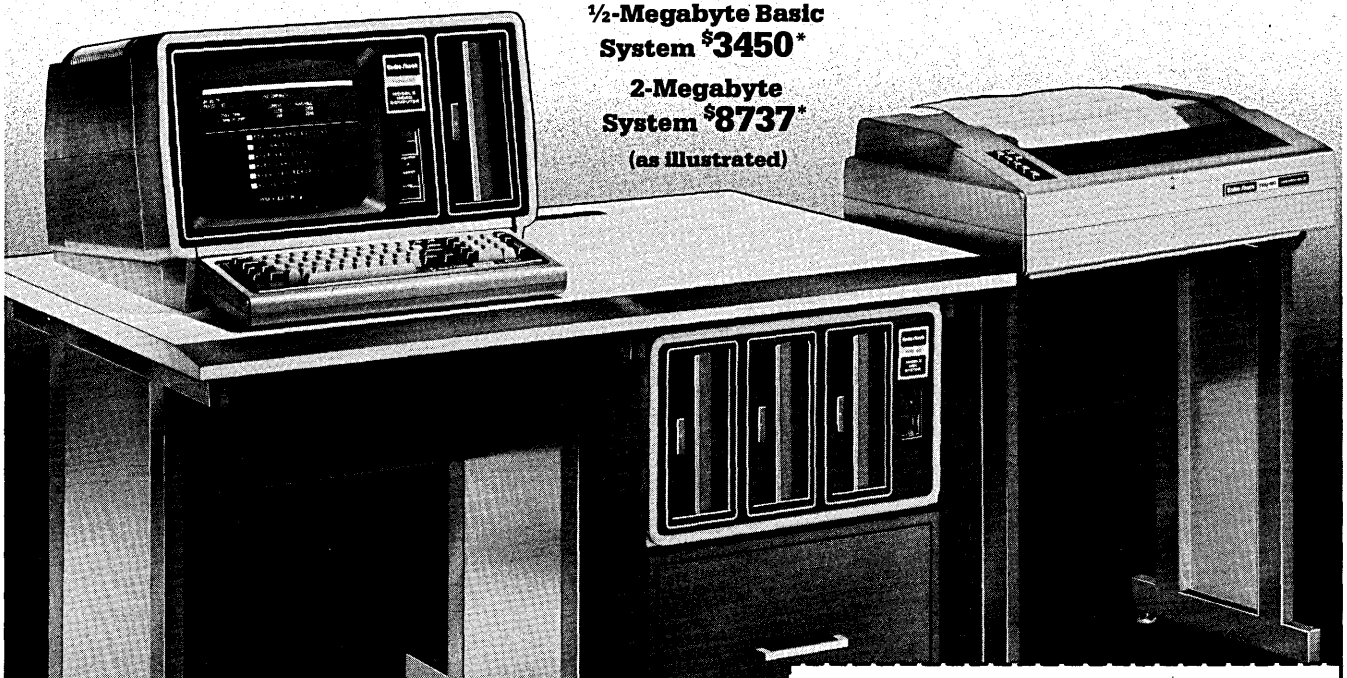
*Retail prices may vary at individual stores and dealers.



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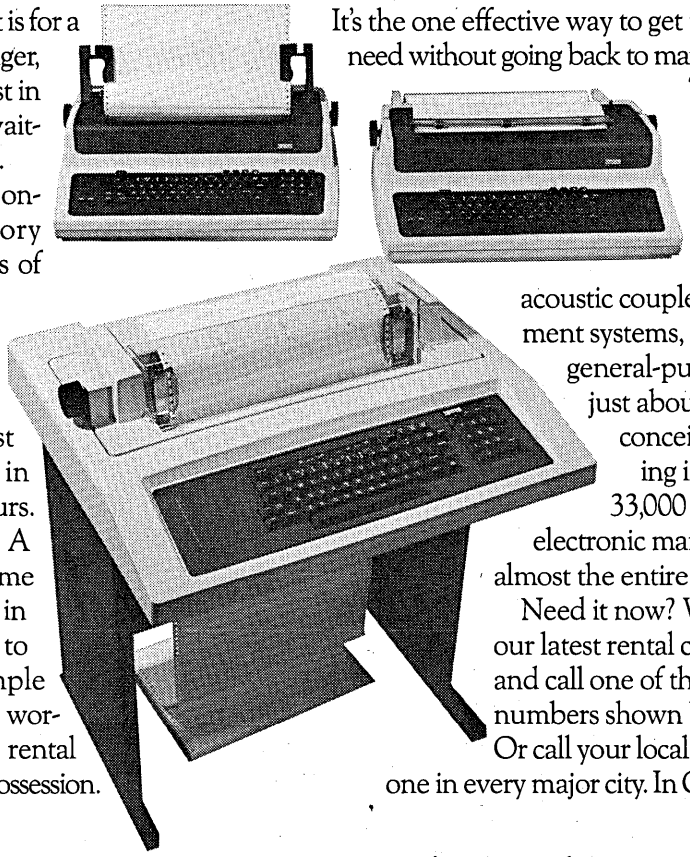

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BANKING ON INTEGRATION

by David S. Pottruck

In the late '60s and early '70s, Citibank significantly expanded its markets to include more services supporting domestic and multinational trade and finance and building a substantially larger customer base. As the number of people and operations in clerical support increased, productivity declined, bringing more expense and less customer satisfaction (see Fig. 1). The overwhelming volume of back office paperwork was one of the motivations for Citibank's well known decentralization (see "Project Paradise Comes Down to Earth," September 1978). The decentralization created separate marketing groups for various types of businesses (such as domestic corporations, multinational corporations, or overseas corps), which were then broken down by industry. The operations group also reorganized itself, identifying an operating division to "face off" against each marketing group. These divisions were further broken down into departments and channels. Each department, under the control of a line manager, often had its own computer system and its own systems support staff.

As decentralization continued, certain problems emerged. It became increasingly difficult to consolidate all the data for a particular customer relationship, the combination of a parent corporation and its subsidiaries. It was often found that a customer relationship might involve individual companies managed by different banking groups. Customer coding and cross-referencing problems surfaced.

There were also problems with interfacing different kinds of computer equipment as the necessity for intersystem data handoffs grew. Maintaining control and efficiency became difficult. And, as mistakes were made, the difficulty of finding and resolving the errors made matters even worse. Processing systems often lacked certain management information critical to the marketing areas. The proliferation of MIS processes, all separate from the bank's major accounting systems, resulted in profitability and accounting reports that were not reconcilable.

Accounting/MIS at Citibank is reported by three different systems (see Fig. 2). Account Profitability Reports (APR) measure profitability at the customer level. APRs give a complete picture of a customer's activity with the bank, including use of bank products, credit, balances, etc. The APR also summarizes individual customer information to the relationship level.

Management Profitability Reports (MPR) summarize the performance within a given management profitability unit of the bank. The Head Office General Ledger (HOGL) is the official accounting record supporting the financial integrity of Citicorp.

Theoretically, APRs, MPRs and HOGL should equal one another. One major factor that makes this difficult to achieve is that customers span multiple management profitability reporting units. Thus APRs do not aggregate neatly into MPRs. This situation is further confounded by each system's being fed by a different stream of data, so conventions for handling certain transactions in the accounting process might differ from the conventions used in the MIS process.

To integrate the accounting and management information systems and provide for corporate-wide data flows, Citibank began setting up IAMIS, the Integrated Accounting and Management Information System. The goal of IAMIS is to ensure that all the decentralized operating areas feed the same data to both accounting and MIS systems. IAMIS thus becomes the focal point for data capture, editing, transmission to downstream systems, and the construction of an institutional data base.

The daily accounting process involves both transaction processing to support customer level information and, ultimately, a series of aggregations to support the general ledger of the bank. Each day the individual transaction processing areas of Citibank's back office, i.e., loan processing, letter of credit processing, checking account processing, and so on update their customer records. Detailed transactions are processed through systems such as the ALLIS system for loans, the LOCAS system for letter of credit, the CAS system for DDA accounts, and so forth. Detailed data on each of these transactions is passed to the Citiproof I system, the front-end data capture system for IAMIS and the head office general ledger.

FED BY A NETWORK

Citiproof I is fed by a decentralized network of approximately 50 computers plus about 200 crt's supporting the accounting function within Citibank's head office (see Fig. 3). Debits and credits are passed to the general ledger in a "standard transaction," which includes five key data elements: a customer identifier, a transaction code, a volume count, a local transaction reference number, and a transaction dollar amount (see Fig. 4).

From these five data elements, additional data elements can be derived. These elements included in the standard transaction passed to Citiproof support the derivation of other data elements through what is called the expansion process (see Fig. 5).

To some extent, the expansion process is performed during the Citiproof operation and is then further continued during the IAMIS process. For example, when a transaction code is provided to Citiproof, Citiproof identifies that transaction code with certain general ledger accounts for debits and credits. IAMIS

continues to expand that transaction code by identifying a certain product ID number, a unit cost, and a product name.

Data flows into Citiproof via either a detailed tape handed off by another system at the end of its processing or by online crt entry directly into the Citiproof computer. Included within the Citiproof system is a customer edit file and a product edit file. These files ensure that the customer and product codes are indeed valid as they are input, and allow certain enrichments to occur. In addition to editing and validating the input, Citiproof creates certain departmental accounting reports and produces a "raw" transaction file (RTF), which contains all the detailed transactions. The RTF then enters the IAMIS system for inclusion in both the general ledger and the IAMIS data base.

The transaction entering Citiproof contains a control number, a customer ID, a transaction code, and a dollar amount. The Citiproof system generates the date. The system knows which channel is feeding information through the "log on" identification process. The system also knows the specific customer ID type, e.g., a DDA (demand deposit account).

At the end of the Citiproof posting session, accounting reports are produced and the information is then passed via the RTF file to IAMIS I. The IAMIS I software does not include producing the head office general ledger.

The output of the various Citiproof machines is collected, aggregated in a central Citiproof computer, and a tape is produced for the daily HOGL handoff. This tape is given to an IBM 370/158, which produces the general ledger each day.

The IAMIS process has two components: one examines transactions and the other examines customer balances and supporting MIS data. Therefore, the transaction expansion process is referred to as IAMIS I; the balance/MIS capture and expansion process is referred to as IAMIS II.

The IAMIS I process receives the RTF data from the Citiproof system and expands this data by adding further customer, product, and organizational identifying and/or qualifying information. This creates a very detailed data base using an enhanced version of the same basic transaction information that created the general ledger. This data base supports APR and MPR analysis within each corporate banking group. Additionally, IAMIS contains its own analytical reporting capability by organization, geography, legal entity, customer, product, and business segment.

The IAMIS II process involves the daily capture of customer balance and

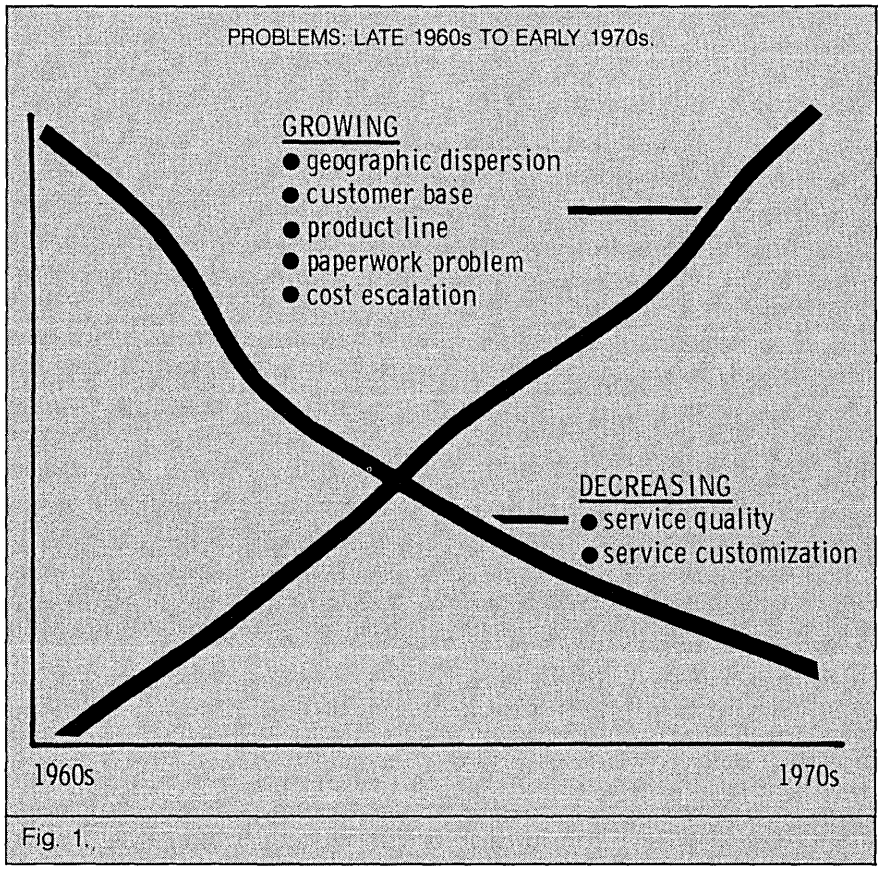


Fig. 1.

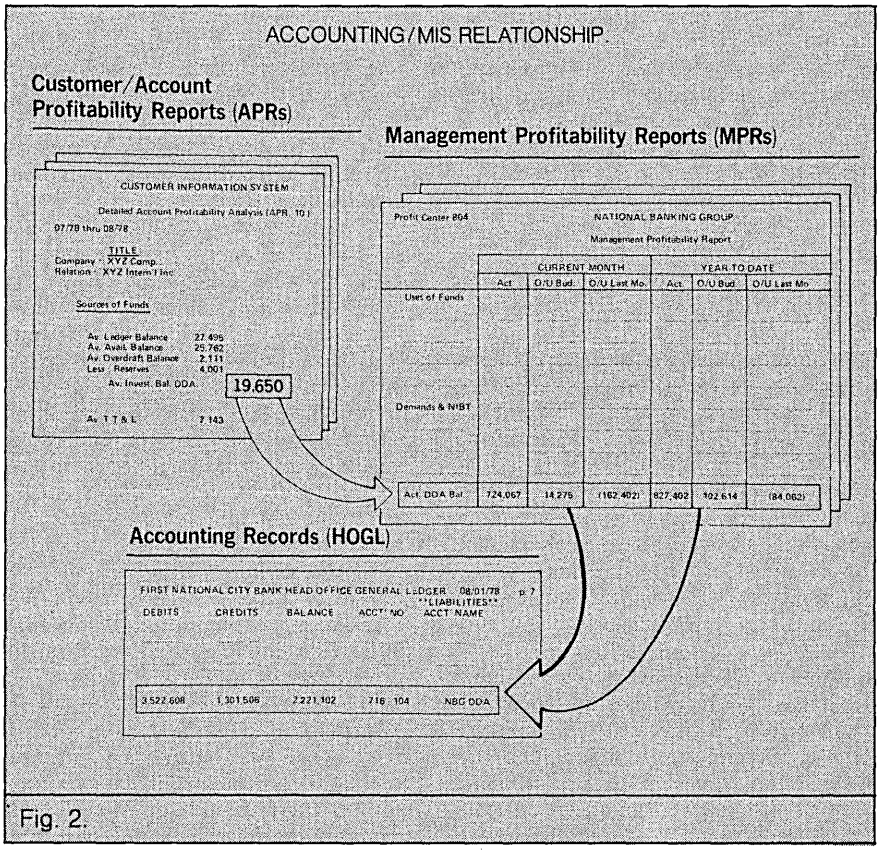


Fig. 2.

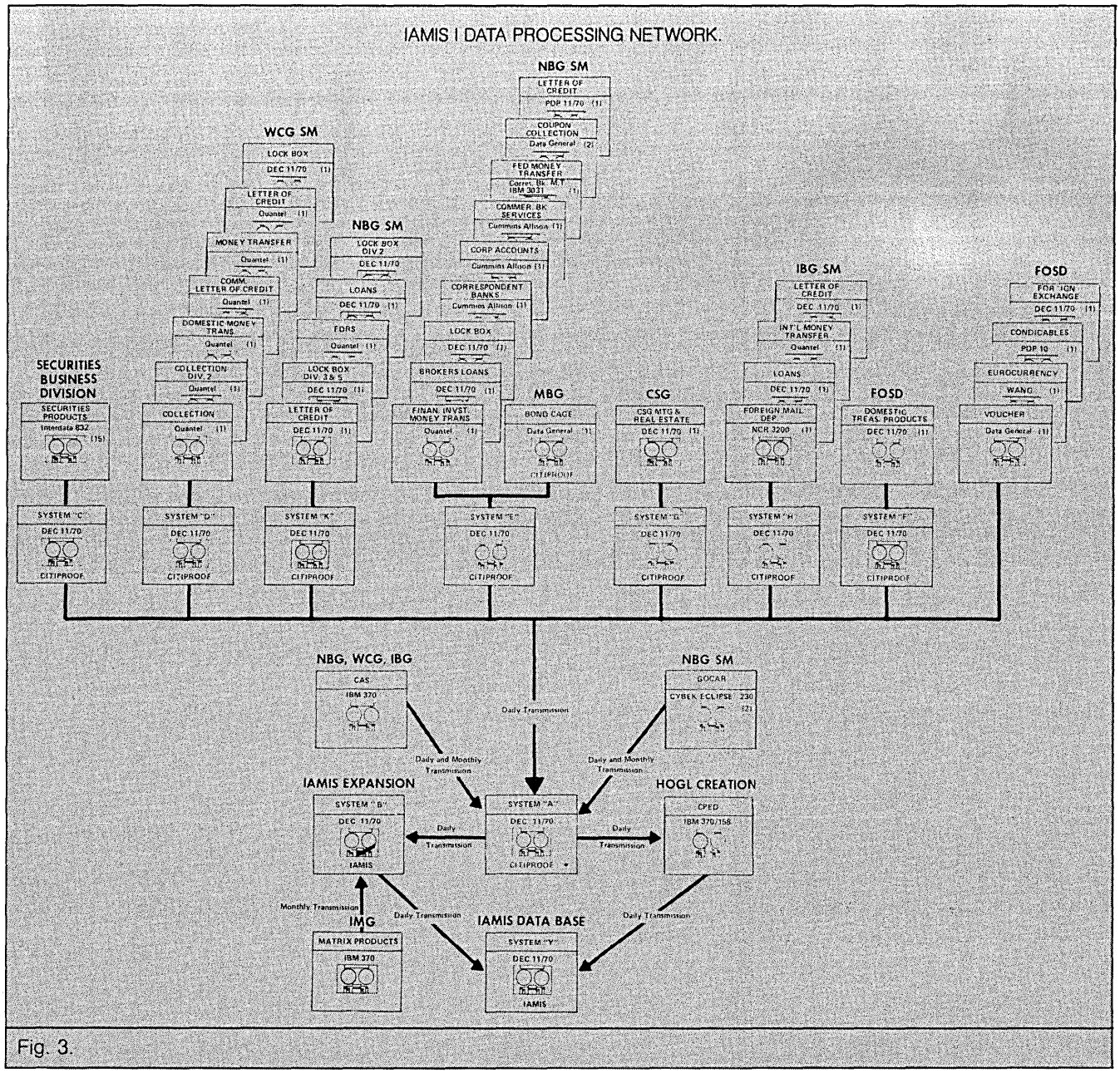


Fig. 3.

other MIS information. This information is edited and validated in a process analogous to Citiproof, which is called Citiproof II. This data does not pass into the general ledger system, but rather passes directly into the IAMIS data base.

IAMIS II is designed to receive customer balances and related MIS for the following major products: loans (including participations and facilities), treasury tax and loan balances (TT&L), letter of credit (LOC), time deposit (TD), foreign exchange, leasing, demand deposits accounts (DDA) (see Fig. 6).

Accepting handoffs for each of these products involves taking feeds from multiple systems. For example, letter of credit requires separate automated handoffs from each of five market-oriented operational units. In addition, general ledger account balances are taken into IAMIS from the head office general ledger.

Thus, within the IAMIS data base is found the aggregate general ledger balance for that given day as well as the customer balance details supporting each general ledger account.

The IAMIS process reconciles the individual customer balances to the appropriate general ledger accounts to ensure that the totals at the customer level reconcile to the total represented in the head office general ledger. Feedback reports reflecting reconciliation problems are then provided to the appropriate group or division accounting officer.

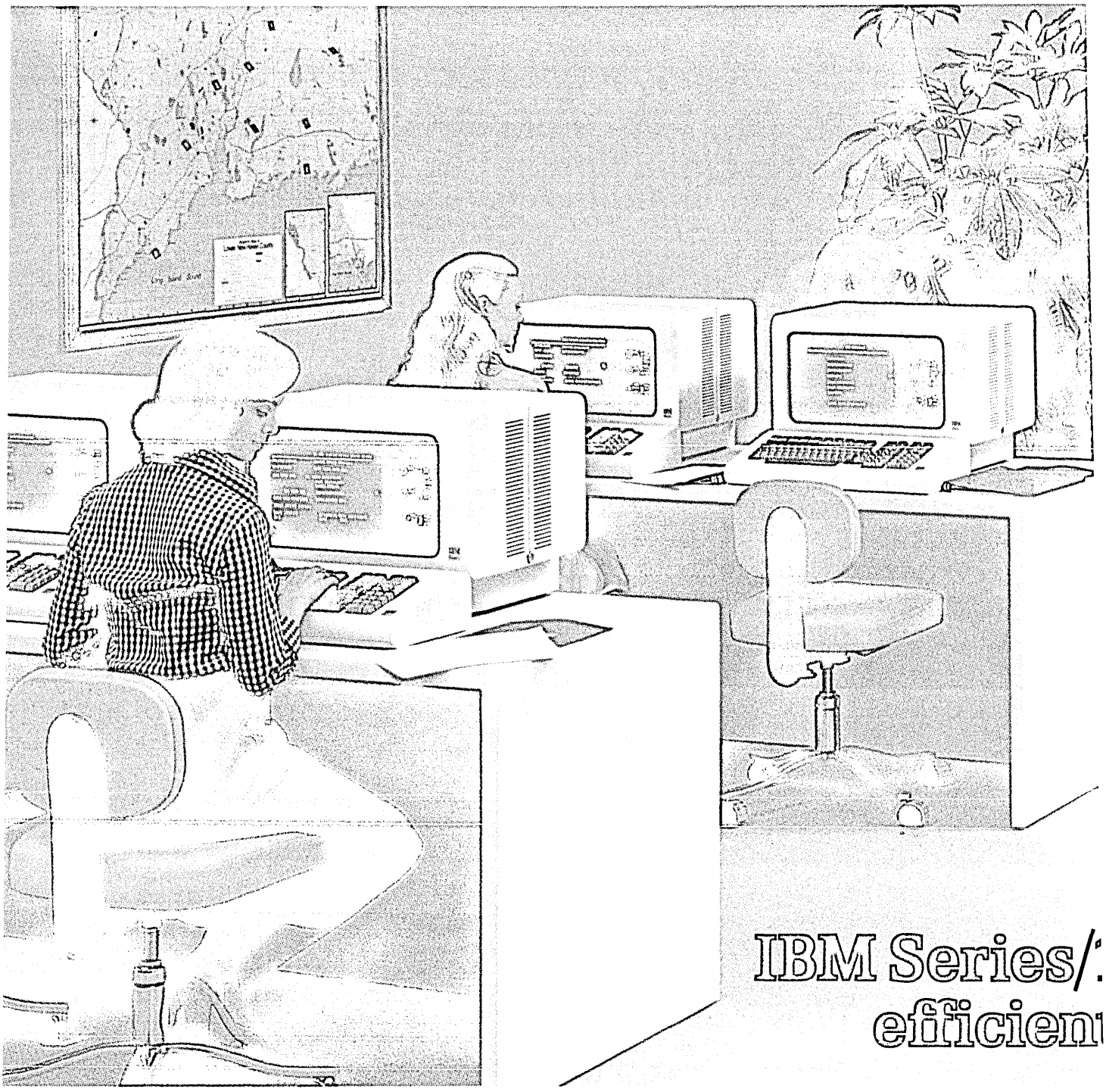
CREATING A POWERFUL DATA BASE

As in the case of IAMIS I, IAMIS II enriches the customer data contained within its data base with the same type of organizational, product, and customer qualifying data. Hence, a very powereful data base is ultimately created, reflecting up-to-date transaction service information via IAMIS I and customer balance information via IAMIS II.

This data base reflects information that either went directly into the creation of the general ledger, i.e., data flowing from Citiproof into IAMIS I, or includes data that has been reconciled to the general ledger balances. The IAMIS data base should be totally synchronized with the general ledger to the extent that good data is passed from the channels, and corrective action is taken whenever reconciliation problems are identified.

The IAMIS data base is designed to support multiple users around the bank. The system supplies data to the APR and MPR systems within each of the corporate banking groups, as well as providing feedback reports to the Services Management divisions—the initial source of most IAMIS information. In addition, IAMIS supplies data to the auditor's reconcilement and central liabilities functions through which Citibank provides financial information to customers' outside auditors (see Fig. 7).

IAMIS also supports many smaller



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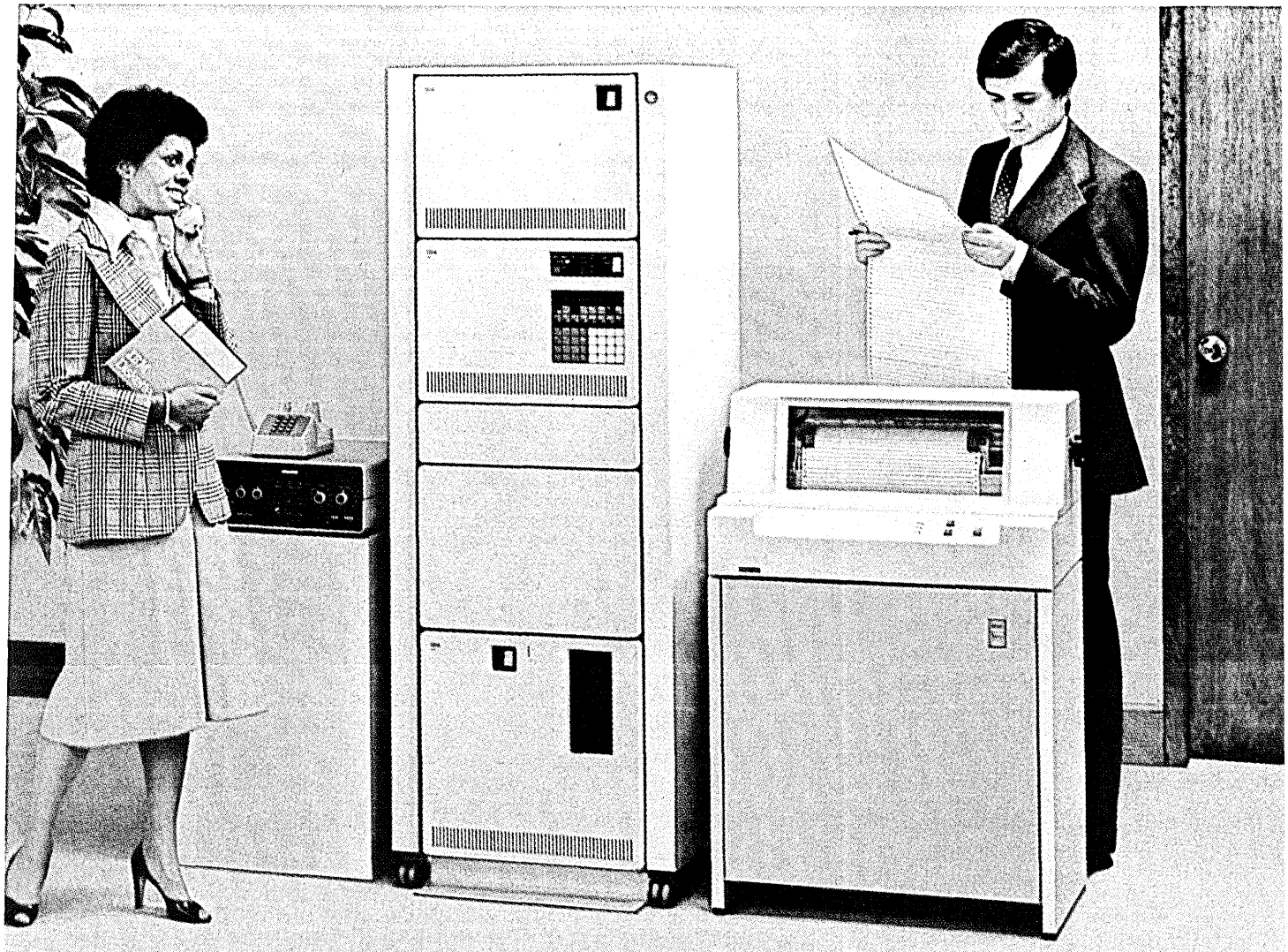

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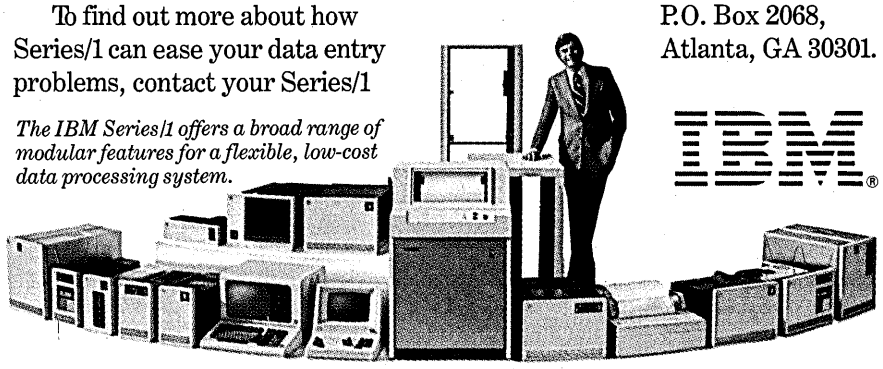

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The integrated system became the focal point for the construction of an institutional data base.

miscellaneous functions that require a central data base. For example, the "misdirected mail unit" inquires, through a terminal, into the IAMIS customer data base to identify the department responsible for mail addressed to "Citibank, N.Y."

The IAMIS data base is constructed using a very flexible data base management software package called ADMINS, which allows a great deal of ad hoc reporting in order to support any level of organization and MIS reporting requirements. In the future, IAMIS may support other critical senior management functions, such as corporate credit policy, where a financially sound centralized data base is necessary. IAMIS data is available through on-line screen inquiry, printed reports, or via tape handoffs to other systems.

A rather obvious question that is often asked is: "If IAMIS, through Citiproof, is already capturing detailed transactions on every customer, why don't you simply use these transactions to update the balances for each customer, and thereby eliminate the requirement of a separate balance feed from the processing system?"

Conceptually, this idea is sound, but in practice there are several problems associated with it. A major problem is that balance and credit profitability analysis requires more MIS data than the IAMIS I process can provide. This data is highly volatile and not available through the Citiproof/IAMIS I process.

For example, it is important to know the interest rate and expiration date on a loan. While the latter may change periodically, the former, as the case of a floating rate loan, changes regularly and is often tied to Citibank's or another bank's prime rate and to a "high collar/low collar" consideration.

For IAMIS to independently maintain this data base and stay synchronized with the loan processing system would require a level of tight coordination, control, and communications that is almost impossible to achieve in a decentralized environment.

Even if this coordination could be achieved, other formidable problems would still remain. For instance, in the software development sense, the technical complexity of building a system that would know precisely how to handle transactions from every different type of processing system throughout the bank including loans, letters of credit, demand deposits, foreign exchange, time deposits, and the like would be extremely difficult. More importantly, however, is the question of whether sufficient value is added and benefits received to justify processing

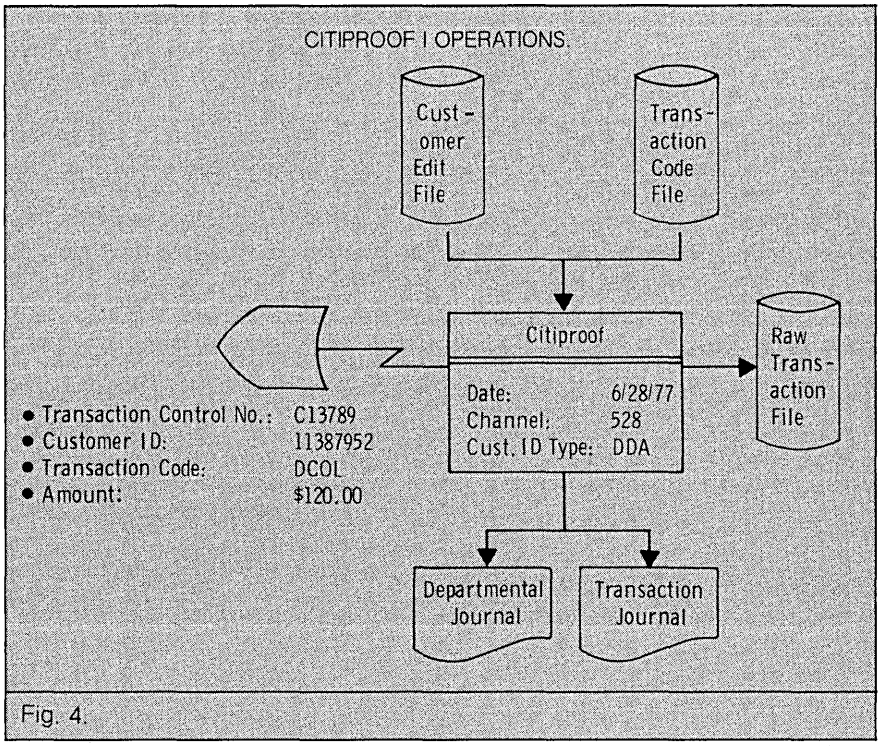

Fig. 4.

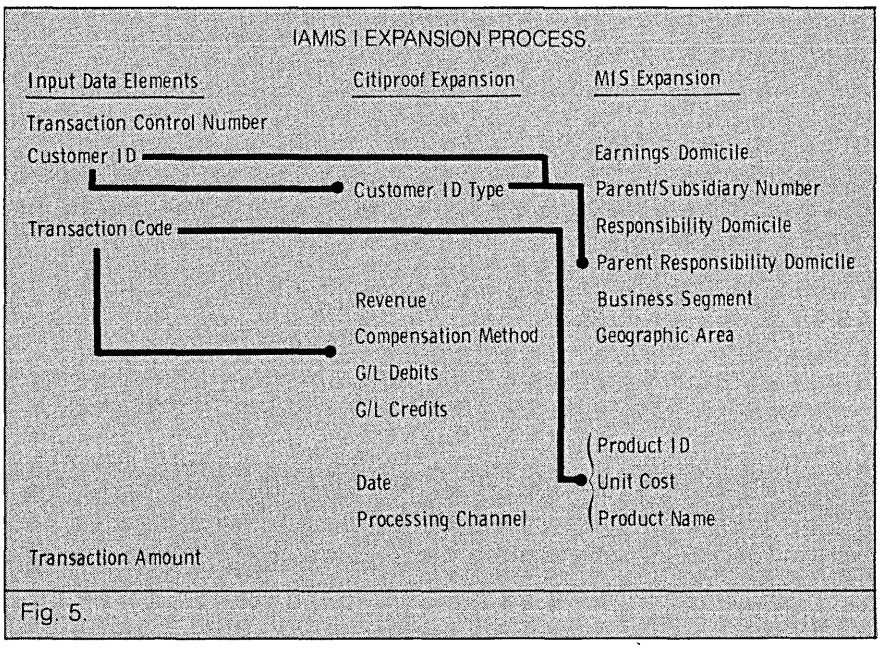

Fig. 5.

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data once for customer account maintenance and then completely processing it again for central accounting and MIS.

Even if such a system were conceptually justifiable, it might not be feasible to achieve the throughput that would be required to reprocess all the detailed transactions in a centralized Accounting/MIS environment.

Due to the separate processing that would be done in a central environment, the balances represented in that central system would occasionally be different from the balances resident on the customer processing systems in the individual channels, (e.g., coding errors, read/write errors, communications errors, and so on). Thus the data within the customer accounting systems and the institutional accounting and MIS data would not be fully synchronized. The problem of reconciling the individual customer balances in the centralized Accounting/MIS system vs. the decentralized customer accounting systems would still remain.

It was felt that simply capturing a daily replacement balance from each processing system would allow IAMIS to create a data base that was independent of the continuing decentralization and modification of the bank's processing system.

In summary, detailed transactions and balances are passed from the processing areas into Citiproof I and Citiproof II where the data is edited, verified and reformated for the IAMIS System. Citiproof I passes its information into the general ledger and also into the IAMIS data base. Citiproof II passes its data directly into the IAMIS data base along with the now updated general ledger, also providing a source of information for IAMIS.

The customer level data within the data base is enriched via institutional files that provide descriptive data regarding products, customers, and organizational entities. This data base is then capable of supporting ad hoc reporting needs, APR and MPR reporting system in the corporate banking groups, channel and business management reports from the operations areas, and on-line screen inquiry to support account management, credit liability management, customer service and overall business management within the bank.

IAMIS now plays a crucial part in Citibank's decentralized accounting and MIS process. The accounting and MIS data included within the IAMIS system are reconciled. The IAMIS data reflected in various MIS reports is consistent and reconcilable to the financial books of the bank.

The volumes and fees for all services are thoroughly measured. Account managers can ensure that sufficient customer balances are maintained to support these services when such balance arrangements are required. There is now one funnel for data flow from the back office channels to the general ledger of the bank and to the profitability reporting systems of the banking groups. This should prevent data from falling through the cracks as well as double counting. IAMIS also solved the cross-reference problem associated with customers being coded "123" in Department X, and "456" in Department Y.

Finally, a powerful data base of financial information has been created that is easily accessible, highly flexible, and can be used for many different purposes at all management levels. ✲

The material in this article will be presented in October at the Second International Computers in Banking Conference in Zurich, sponsored by LASTED, the International Association of Science and Technology for Development.

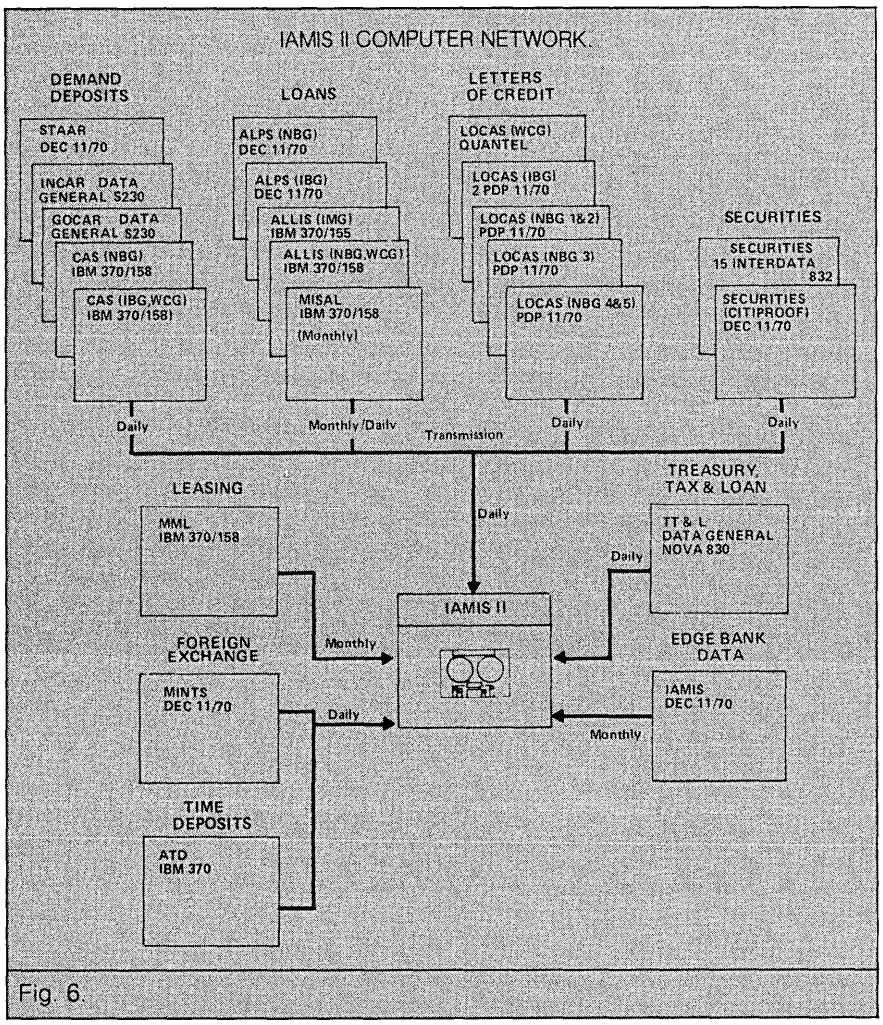

Fig. 6.

DAVID S. POTTRUCK

Mr Pottruck is vice president in charge of the Integrated Accounting and Management Information Systems Dept. of Citibank, N.A., where his duties include line manager responsibilities for a $2.5 million budget and a staff of 55 people. Prior to joining Citibank, Mr. Pottruck was with Arthur Young & Co. as senior consultant. A graduate of the University of Pennsylvania, Mr. Pottruck also holds an MBA degree from the Wharton School of Business. He is adjunct professor for master's degree programs at three New York colleges.

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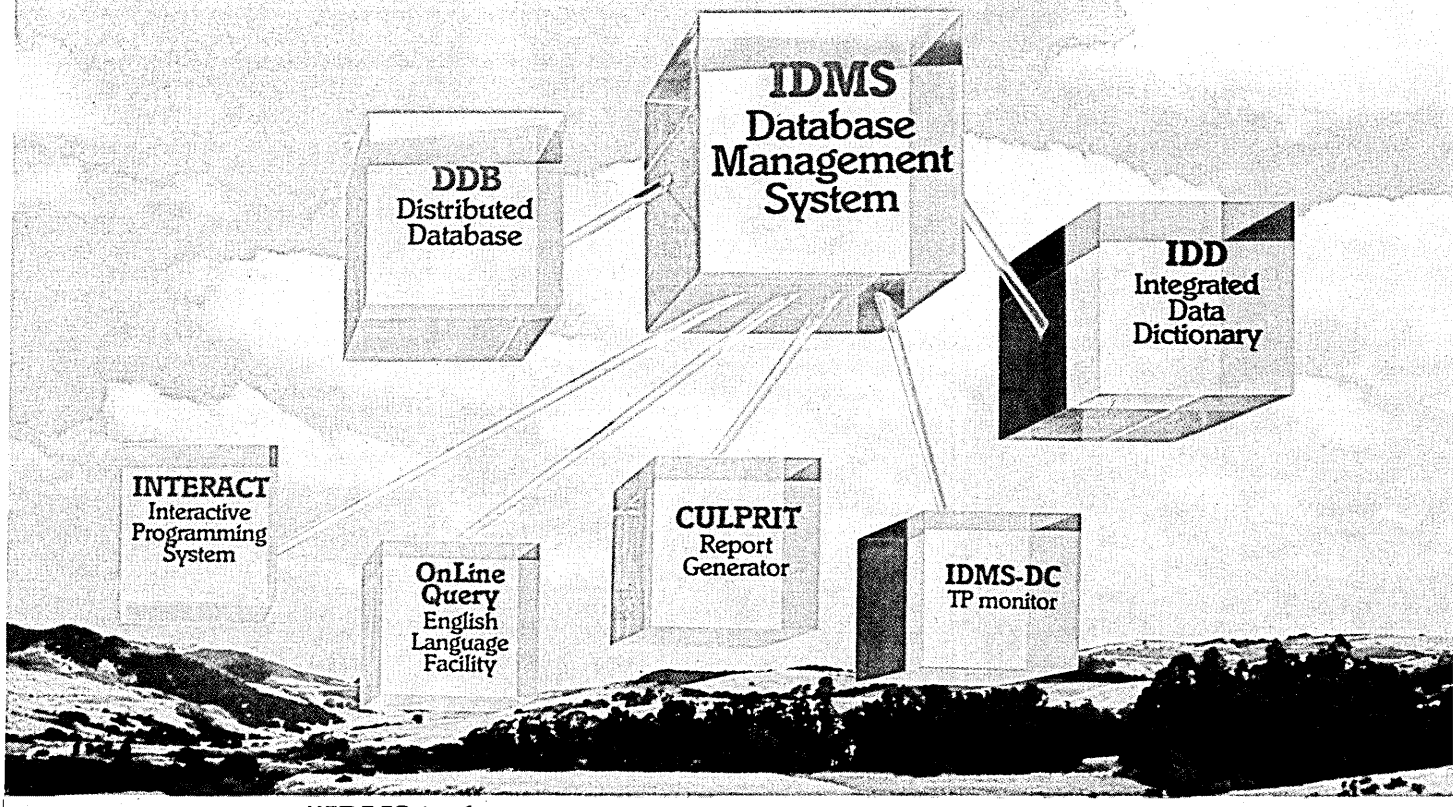

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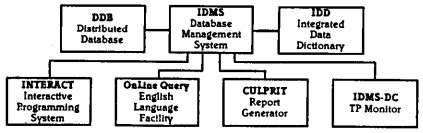

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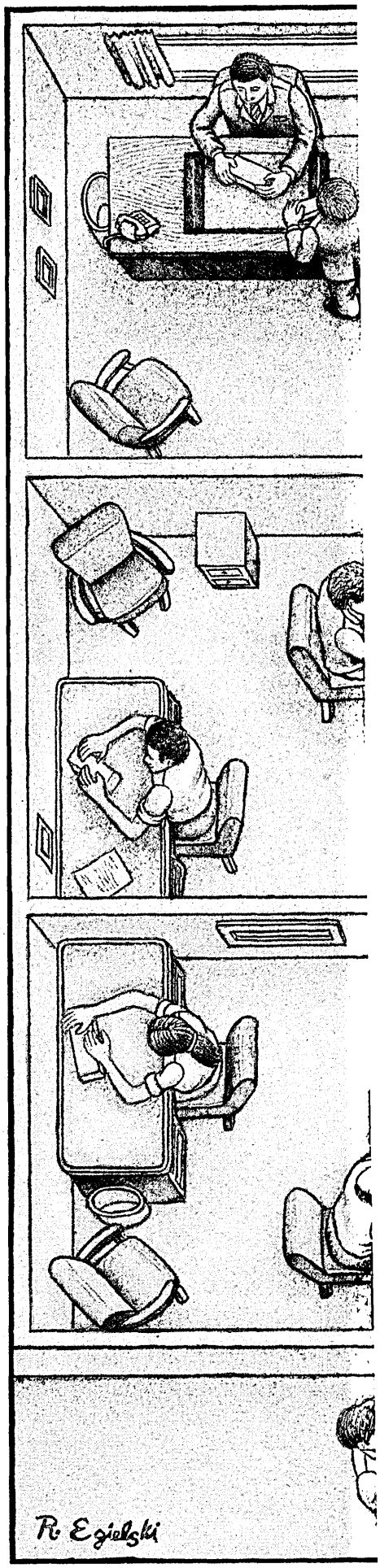
The first phase is specifying *what* the system will do; the second is determining *how* the system will do it.

STRUCTURED DECOMPOSITION DIAGRAM: A NEW TECHNIQUE FOR SYSTEM ANALYSIS

by Ralph I. Rudkin and Kenneth D. Shere



Traditionally, computer system design tools include system flowcharts, hierarchy diagrams, and narratives. As computer systems have increased in complexity, these techniques have been refined to create common understanding between designers and builders.

To meet system software requirements, the concept of structured programming was developed about 1969, primarily credited to E. Dijkstra of the Technological Univ. (Eindhoven) (see, e.g., Ref. 1). Further developments in hierarchical design, largely due to H. Mills of IBM, are known as HIPO (Hierarchical Input-Process-Output, Ref. 2).

Hierarchical design is a process whereby a system is specified in terms of a "top-down" structure. For example, a typical highway atlas of the U.S. may be organized as follows:

1. a map of the U.S., probably limited to interstate highways;
2. maps of regions, such as the Midwest, which show greater detail;
3. maps of each state within a region;
4. street maps of major cities within a state.

While the work was being done at IBM in the early 1970s, J. Warnier of Honeywell-Bull (France) developed data structure techniques for systems design (Ref. 3). This work was published in French, which delayed its immediate implementation in the U.S. The data structure technique uses a hierarchical approach which begins with the system data output, determines the data needed to produce the output, and iterates this approach until the basic elements of input data are determined. Given the data structure, the program can be developed in a straightforward manner.

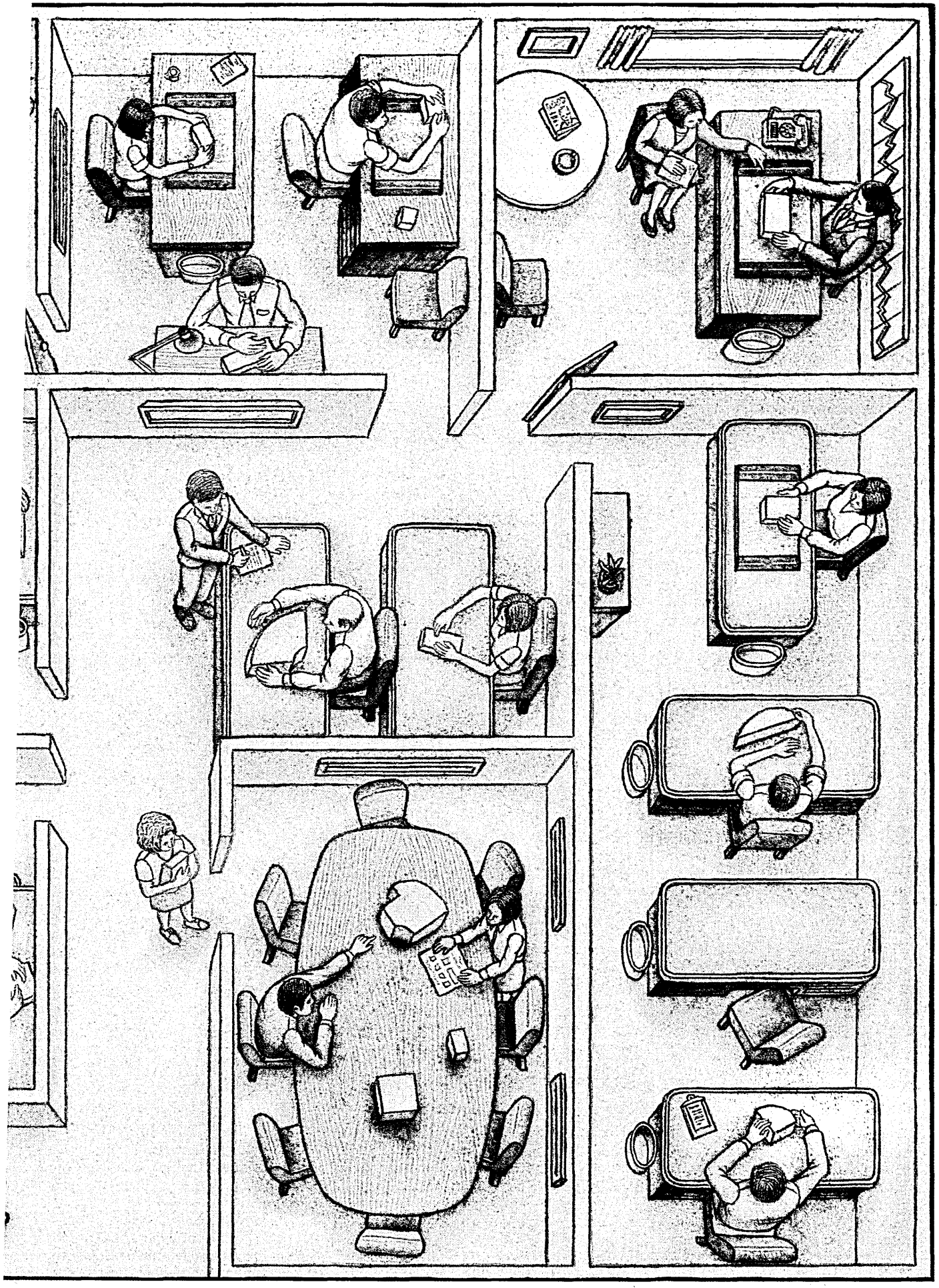
In the mid-1970s, functional decomposition techniques were pioneered by L. Constantine and E. Yourdon of Yourdon, Inc. (Ref. 4) and by D. Ross of SofTech (Ref. 5). Functional decomposition also uses a hierarchical approach. In this case, one begins with a "system function" and successively decomposes this function into subfunctions.

We at CTEC, Inc. have applied these new techniques to a variety of systems and software problems, and have found that such claims as "large computer programs can be written correctly the first time" are true. Functional decomposition techniques, especially, have been found useful for specifying systems requirements.

The development of large, complex systems frequently encounters problems of cost overruns, time overruns, and/or failure to meet system requirements. These problems can be avoided by systematically developing requirements and associating these requirements with system functions.

The technique we have developed for specifying system requirements is based on SADT (Structured Analysis and Design Technique), a registered trademark of SofTech, Inc. SADT is based on the concept of functional decomposition, and uses some features of Warnier-Orr diagrams, a data structure technique. To understand our process, no prior knowledge of Warnier-Orr or SADT is necessary.

Our approach, called the Structured Decomposition Diagram (SDD) Technique, has two phases. The first phase involves decomposing system functions in a hierarchical manner and deter-



mining the information/data flow associated with this functional decomposition. During this phase, we describe the system functions at the top level and successively decompose these functions to the level of detail needed. For this process, we use SADT. SADT, however, requires a lot of paper and doesn't have the flexibility for gracefully truncating the functional decomposition. We have provided this flexibility by applying, where appropriate, the Warnier-Orr technique. At the end of the first phase, data sources and characteristics are determined.

When we complete a specification of *what* the system will do, the second phase is determining *how* the system will do it—i.e., system design specifications. During this phase, the system requirements are matched to each system component, the functions it will perform, and the data it must process.

The method of detailing system requirements and design specs emphasizes planning. Although expensive, in the long run planning saves both time and costs; furthermore, should a change in requirements or component specs occur, the impact is traceable.

A second contribution to the documentation of structured analyses is the development of a matrix showing the relationship between the data structure and the structure of the system functions. This matrix makes the second phase of our approach possible.

BASIC ELEMENTS OF SADT

The basic conventions of the Structured Analysis and Design Technique (SADT) of functional decomposition are shown in Fig 1. These elements create a means of examining the required information and the output data. The figure shows these elements as applied to functional decomposition and information flow. Such an activity would take the input system function and provide output data on the hierarchical decomposition of that system function into subfunctions, the information required to perform that function, and the flow of information during the performance of that function.

How SADT provides the hierarchical decomposition of functions into subfunctions is illustrated in Fig. 2. The top level description of a function is confined to a single box using the elements defined in Fig. 1. In addition, the top level diagram usually contains a statement describing the viewpoint for the activity. At the first level of decomposition, the top level function (the parent) is decomposed into several component functions. The inputs, outputs, constraints, and mechanisms of the entire first level must be consistent with those of the top level activity box. In other words, the activity box of the parent becomes the entire sheet of the next lower level. The flow of information during the performance of a function, including the identification of any feedback loops, becomes apparent in this breakdown.

In order to keep track of the hierarchy of functions (librarianship), each activity box is numbered in the lower right-hand corner. Thus, the box numbered "23" in Fig. 2 is at the second level of decomposition because the number has two digits. Furthermore, the parent of this box is box number "2" at the first level of decomposition.

Data elements, as well as functions, may also be decomposed. As in the case of decomposing functions, all the parent data must be embodied in the de-

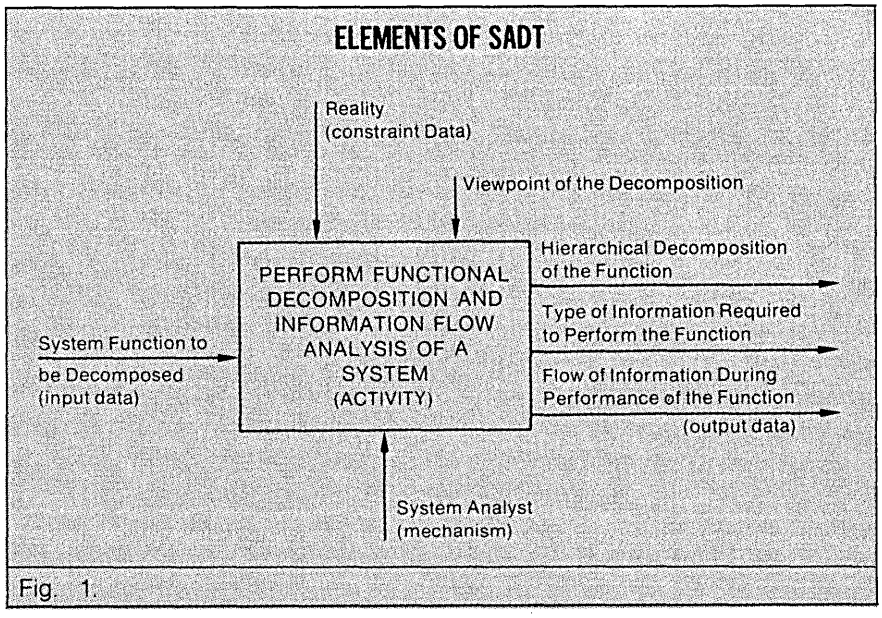


Fig. 1.

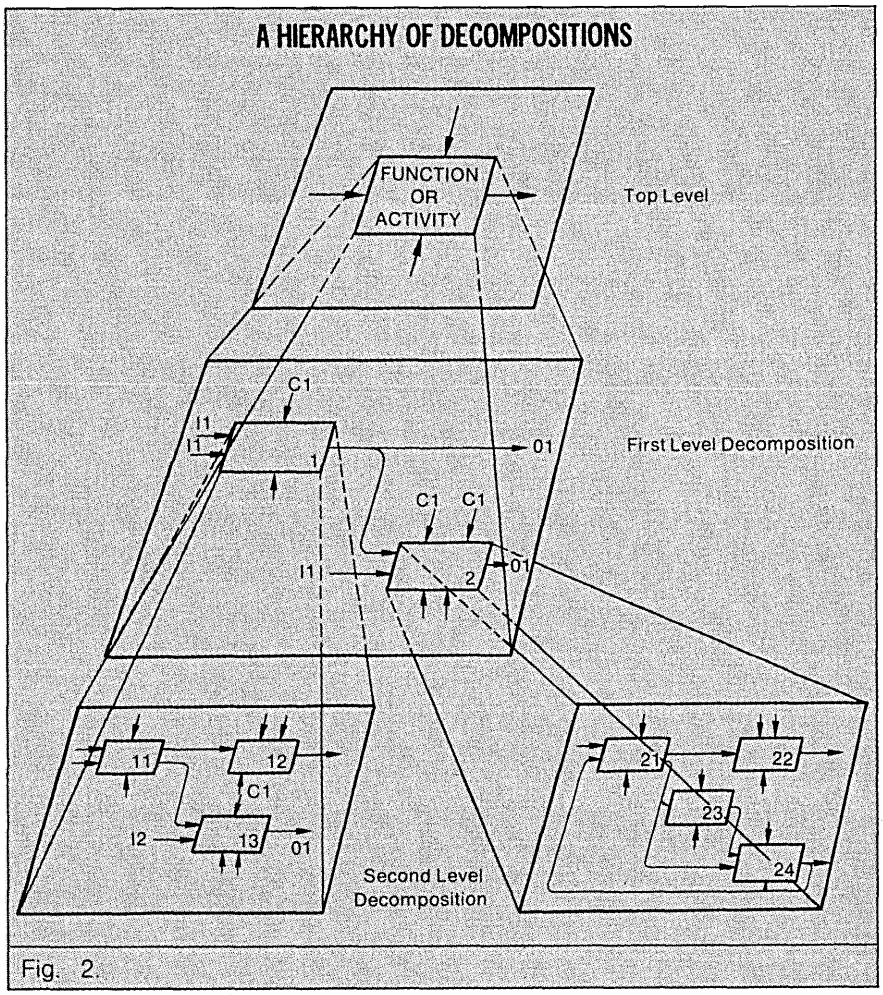


Fig. 2.

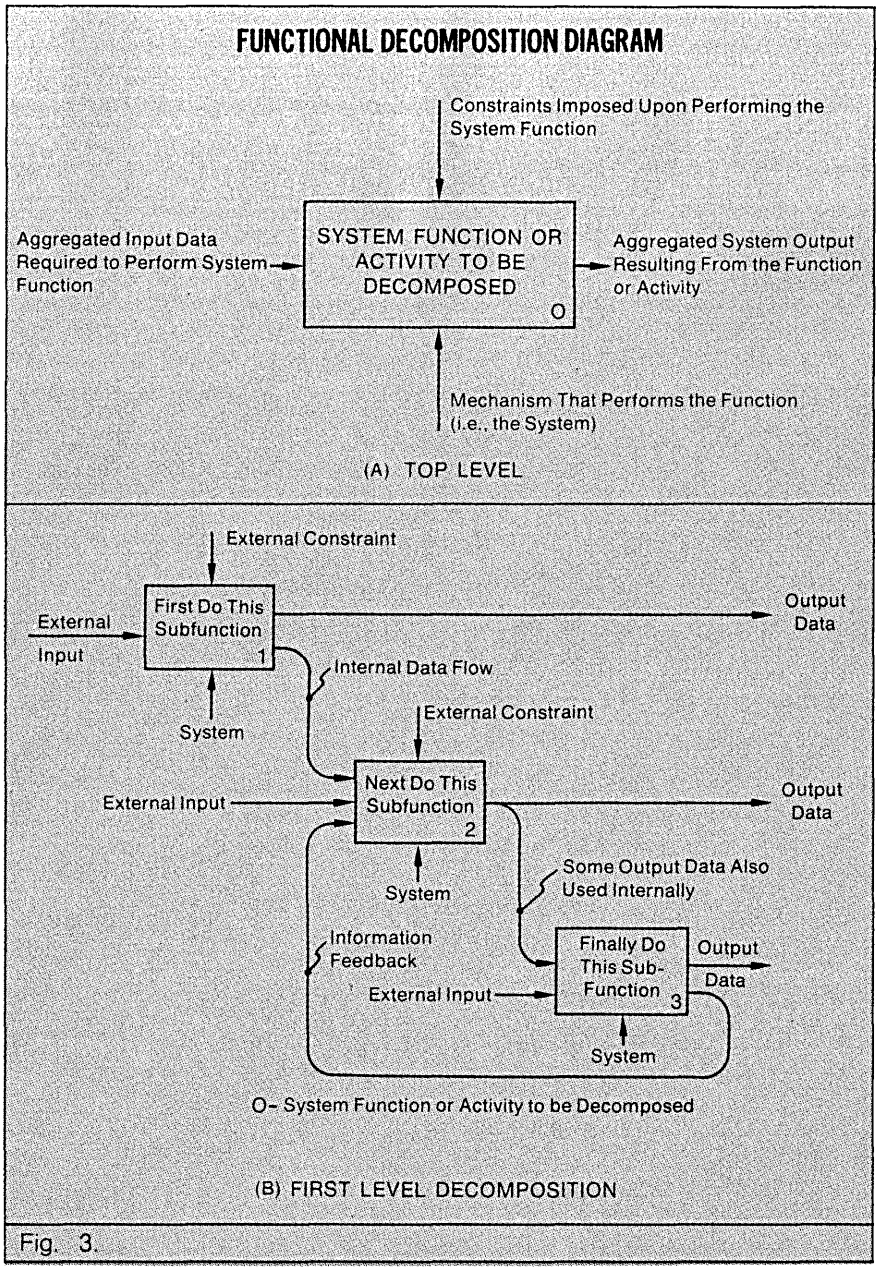


Fig. 3.

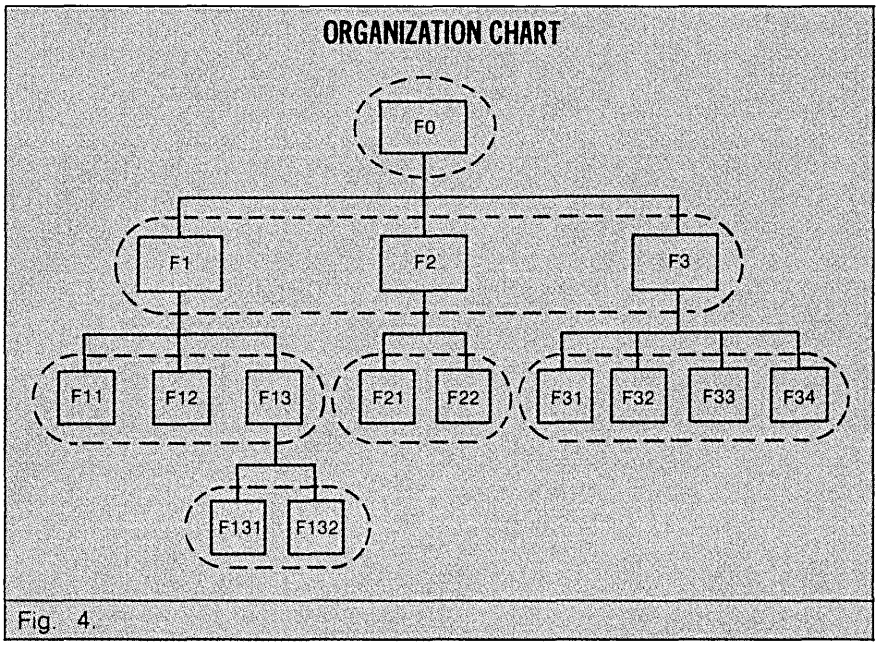


Fig. 4.

composition. To maintain continuity between figures, the SADT style is to number the inputs and outputs for each box from top to bottom and the constraints and mechanisms from left to right. The numbers assigned to an arrow refer to the parent arrow. For example, the two arrows indicating output data at the first level of decomposition are numbered 01 because there is just one output arrow at the top level. The two outputs at the first level, taken together, must compose the output of the top level; however, these two outputs may be different from one another. As another example, the input data "12" entering box "13" comes from the second from the top input data element to box "1." To trace the data, reference must always be made to the parent diagram. The structure data is not evident from the numbering scheme.

The documentation procedure for SADT (Fig. 3) has, at each level of decomposition, the name and number of the parent box written at the bottom of the sheet. For perspective, the previous level diagram, reduced in size, is placed on the facing page with the parent box marked by a heavy border. Typically, a short explanatory note is also provided on the facing page.

Since the output from one activity box may be required input to the following box, SADT can represent a flow or sequence of events. Note that SADT generally does not provide a time sequence. Activities may be repetitive, with recycled and/or feedback loop data. Furthermore, depending on the particular problem being analyzed, system outputs may result in an abrupt change of state imposed by an entity external to this system. Thus, the time sequence for performing functions may progress from one function to a parallel function. For example, referring to the functional decomposition given in Fig. 4, subfunction F13 may be performed immediately after performing F21. If this decomposition were presented as a series of SADT diagrams, one for each dashed region, it would appear that function F22 should be performed after function F21. These abrupt changes of state arise, for example, in applications involving command and control decision making.

WARNIER-ORR DIAGRAMS

Warnier-Orr diagrams are a formal method of successively decomposing entries into subentries. These entries can be either data elements (Orr's contribution), activities, or functions. All the entries of a particular decomposition must be of the same type.

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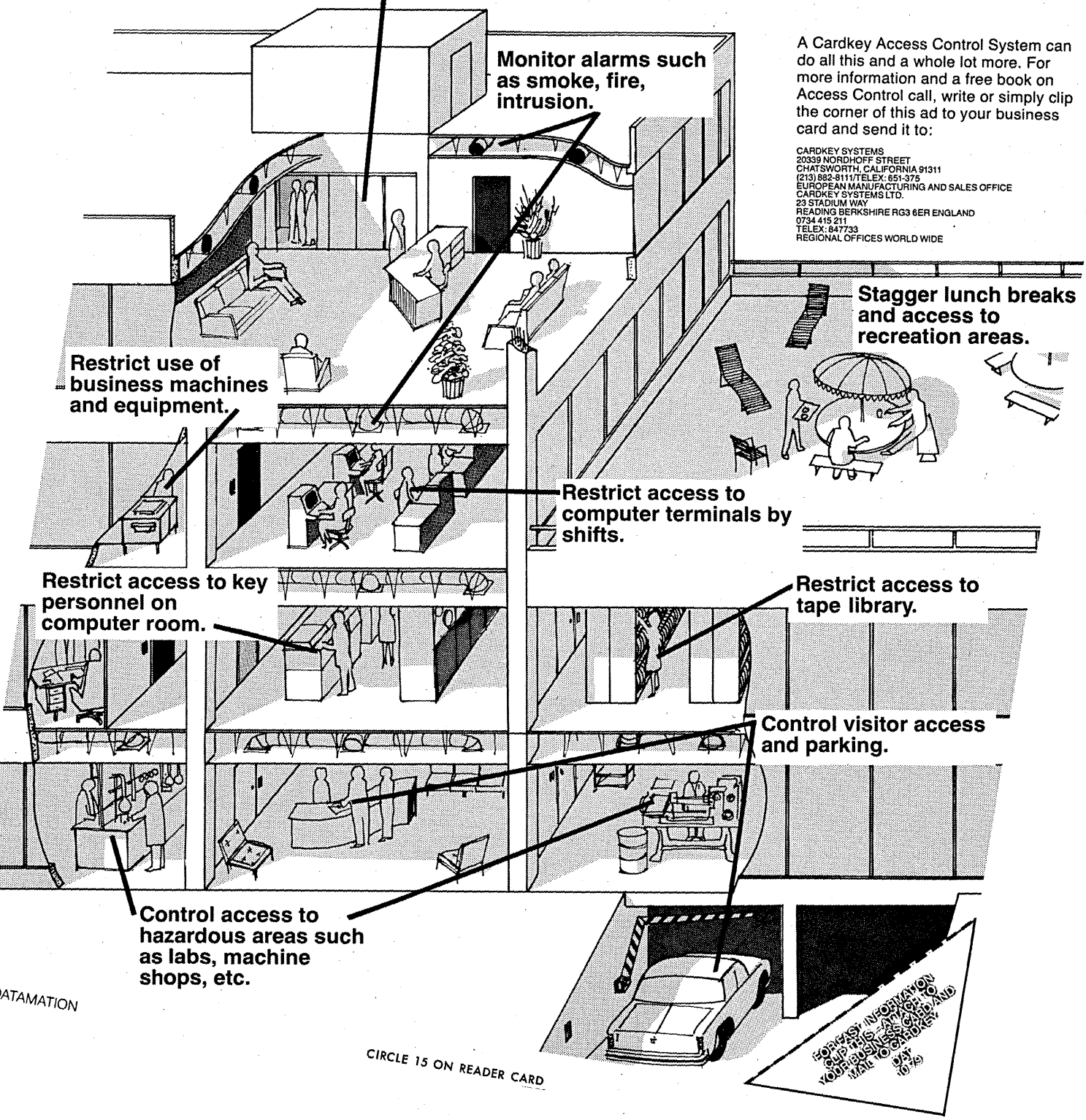

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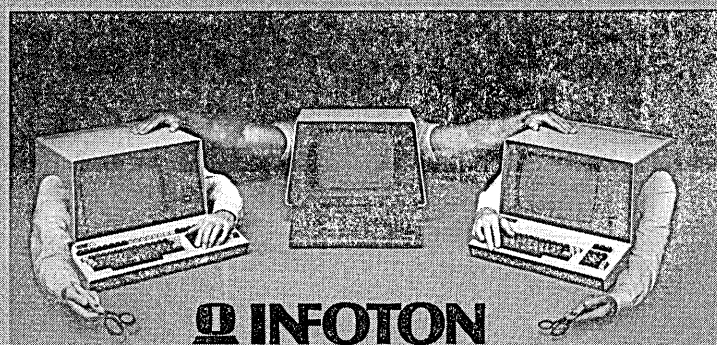

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given in Fig. 5(A). In this figure, the entry E is decomposed, or structured, into three subentries, namely E_1, E_2, and E_3. E_1 in turn consists of E_{11}, E_{12}, and E_{13}. These diagrams structure the problem by providing a hierarchy; the hierarchy is observed by rotating Fig. 5(A) 90° clockwise and comparing it to the traditional organization chart. Incidentally, this is the first step (the "H") in HIPO.

In addition to providing a hierarchy, Warnier-Orr diagrams provide a sequence of events, or flow of control. Fig. 5(B) shows the flow of control for Fig. 5(A).

Furthermore, it has been shown that for any flowchart there is an equivalent Warnier-Orr diagram. However, Warnier-Orr diagrams have two advantages over flowcharts. The first advantage is the ease with which one can communicate by using these diagrams. The second advantage is the transparency of the structure of the problem and the natural way in which the structure is presented.

Three aspects of Warnier-Orr diagrams are sequence of events, logic or case statements, and repetition statements. Entry E_2 (Fig. 6) consists of either E_{21} or E_{22}. The symbol O denotes the logical OR. The notation (1,N) under E_3 indicates that E_3 should be performed or sequenced N-times. This is equivalent to a DO LOOP.

Suppose, for example, we describe the process of negotiating to buy a house. Referring to Fig. 7, first the buyer makes an "offer on the house." Then a repetitive procedure begins. Either the offer is accepted and the procedures ends or the offer is not accepted. If the offer is not accepted, then either a counteroffer is made to the buyer or the deal is off. In either case, the buyer is informed of the results. The buyer then has the option of terminating negotiations (DONE), accepting the counteroffer when one has been made, or continuing negotiations by making a new offer. Thus, this example illustrates sequences, alternation (logical OR) and repetition (DO UNTIL DONE).

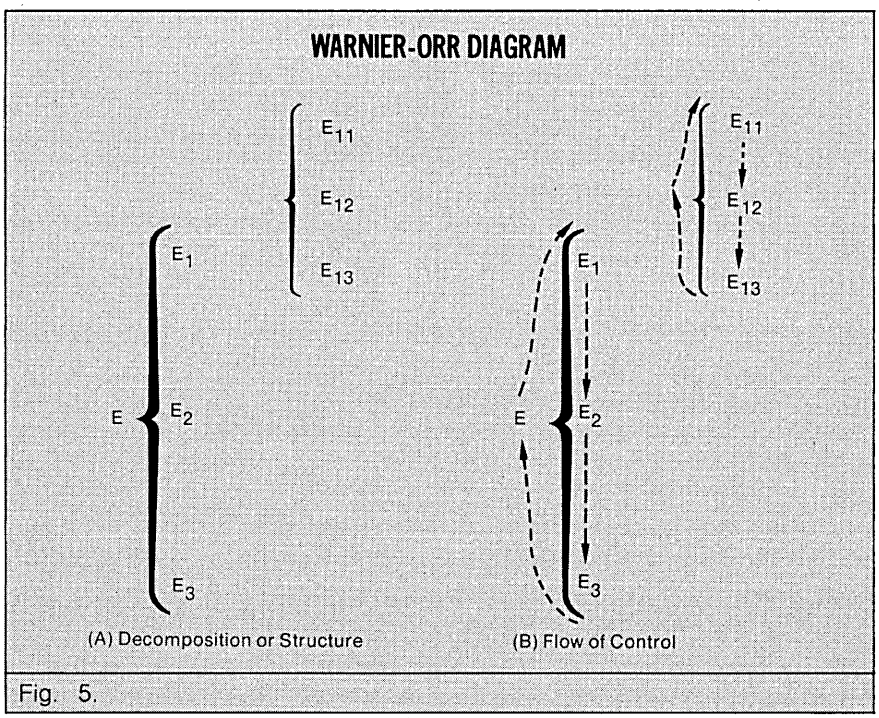

Fig. 5.

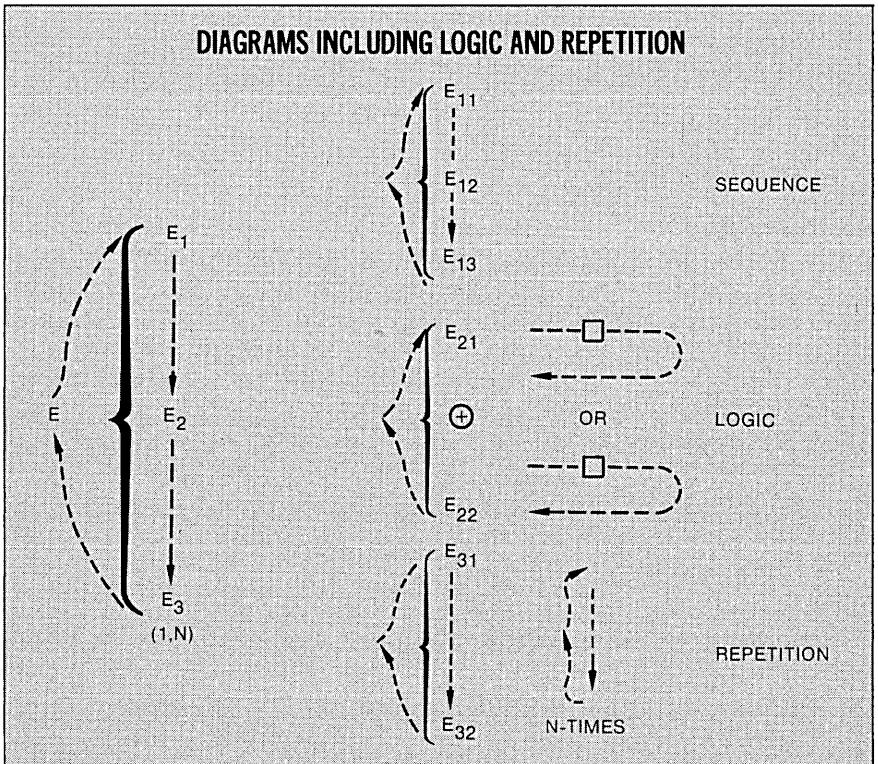

Fig. 6.

SPECIFICATIONS OF SYSTEM REQUIREMENTS

The process of determining functional decomposition and information flow combines some aspects of Warnier-Orr diagrams with SADT. SADT diagrams provide much information per page and help to clearly describe the system under consideration. On the other hand, as the structure of the system is being decomposed, the number of diagrams increases exponentially. After approximately the third level of decomposition, it is easy to lose sight of the overall problem under consideration. Thus, it is often desirable for high level systems requirements studies to truncate the SADT process by applying a modified Warnier-Orr technique.

In Fig. 8, a Warnier-Orr decomposition of an activity is placed below an activity box as a note. This procedure is useful whenever the events depicted in the last level are necessary for clarity but the information flow is not necessary. Notice there are no mechanism arrows. Since the system itself does not exist, it is not possible to specify system components or mechanisms during this first phase. During the second phase an association is made between the system specification and this decomposition.

If the Warnier-Orr diagram is complex, it should be provided on a separate page (Fig. 9). Note that the Warnier-Orr decomposition of activities is appended to allow for specification of input data and output data required for each listed activity.

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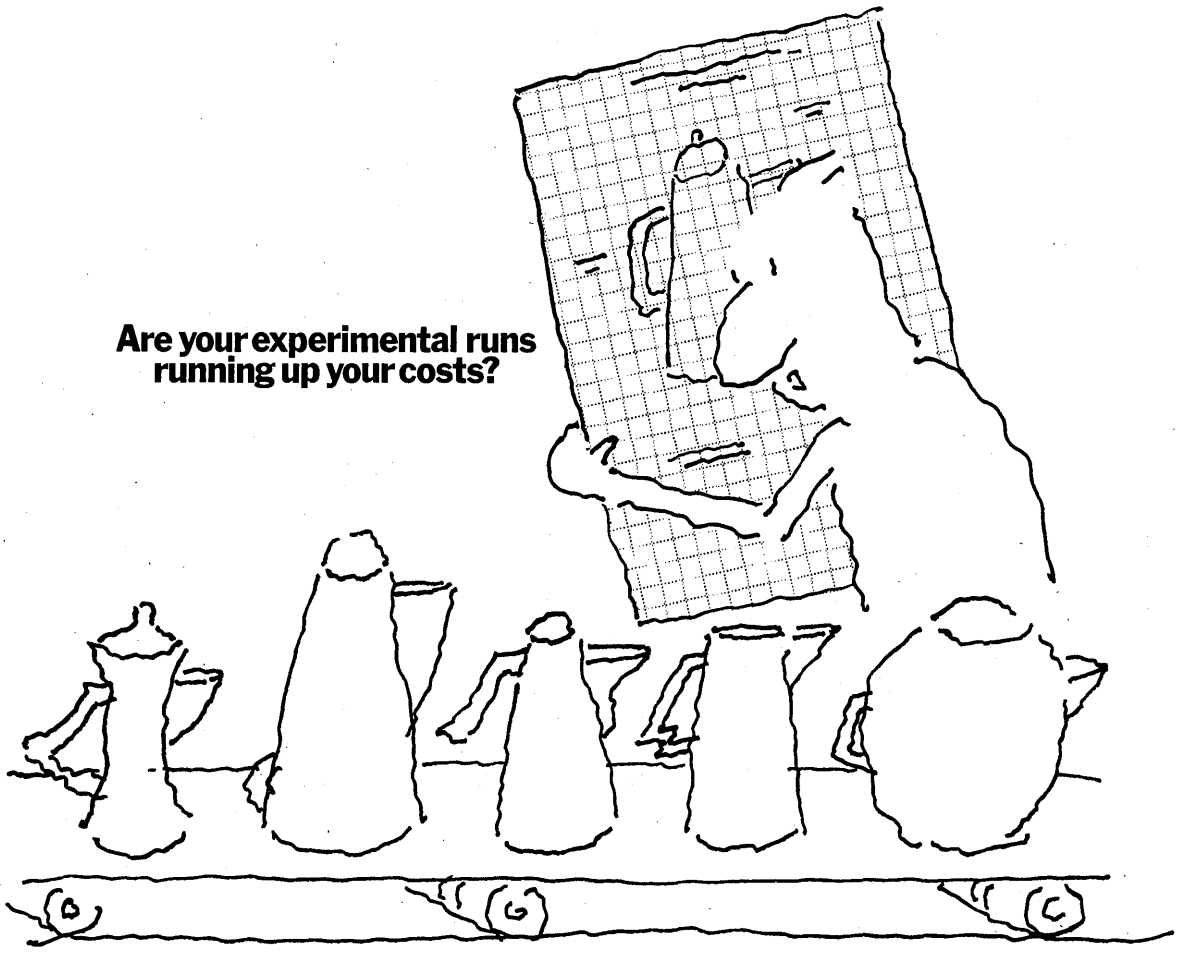

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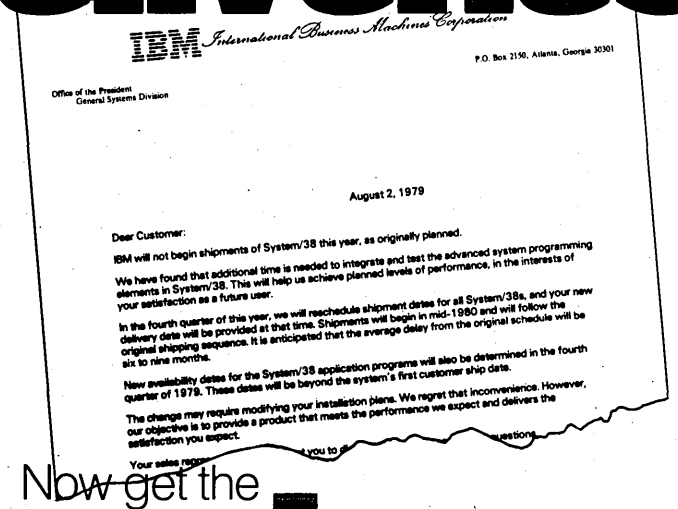

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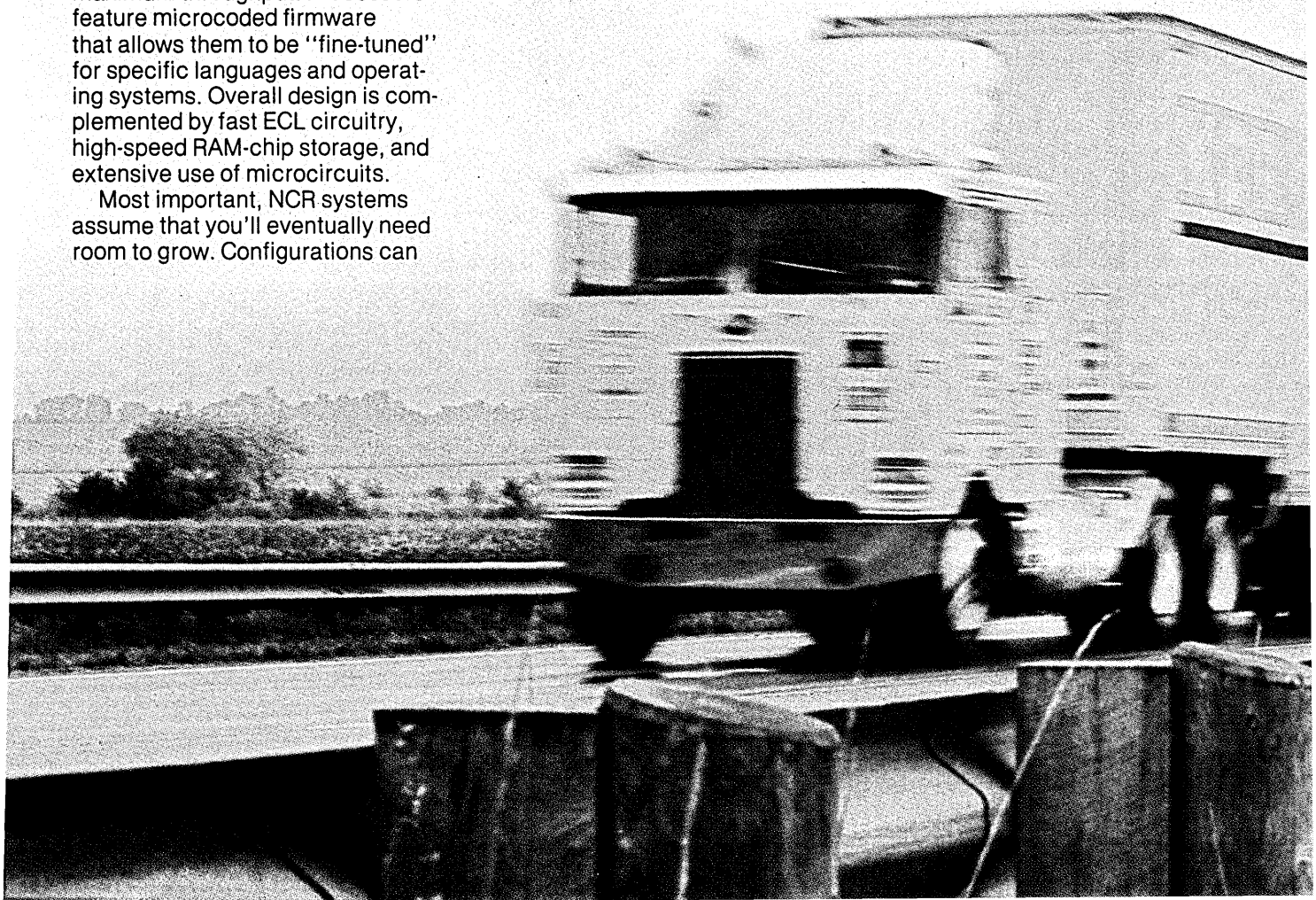

TWO BASIC APPROACHES

There are two basic approaches, then, to structured systems analysis/design; one is based on functional decomposition and the other on the data structure. The relationship between these two approaches can be depicted with a matrix (Fig. 10). The columns of the matrix present the functional decomposition and the rows present the data structure. At the matrix intersections, a keyed entry is made representing whether data is needed as an input to that activity (I), output data resulting from that activity (O), or a constraint imposed on the performance of that activity (C).

The SADT technique allows for the decomposition of data as well as the decomposition of the activities. Data decomposition is not really emphasized by the available descriptions of the method, but it becomes apparent during actual performance of the work. It is this data decomposition that appears as rows in Fig. 10. The matrix provides a good check for consistency. It also summarizes a lot of information. For example, entities in the first column that correspond to the activities or functions being decomposed indicate data input from external sources to the activity, external constraints, and output that the activity produces for external sinks. All top-level data with no entry in the first column are internal to the system being described. The matrix also provides the tie between the Warnier-Orr and the SADT approaches to functional decomposition.

Having accomplished this functional decomposition and having specified information flow/requirements, the first phase of the specification of systems requirements is completed. During the second phase of the requirements specification, it is necessary to determine both the characteristics of the data and the sources of the data that are not generated internally to the system. The data characteristics include descriptive information such as the volume/amount, rate, and format.

In phase two, first the required data characteristics are specified. The data/function matrix is then systematically analyzed to determine the data requirements for each activity. These data characteristics are usually presented in tabular form. Having completed this process, systems requirements are specified by system functions, information flow, and data characteristics. Both a functional structure and data structure are also provided.

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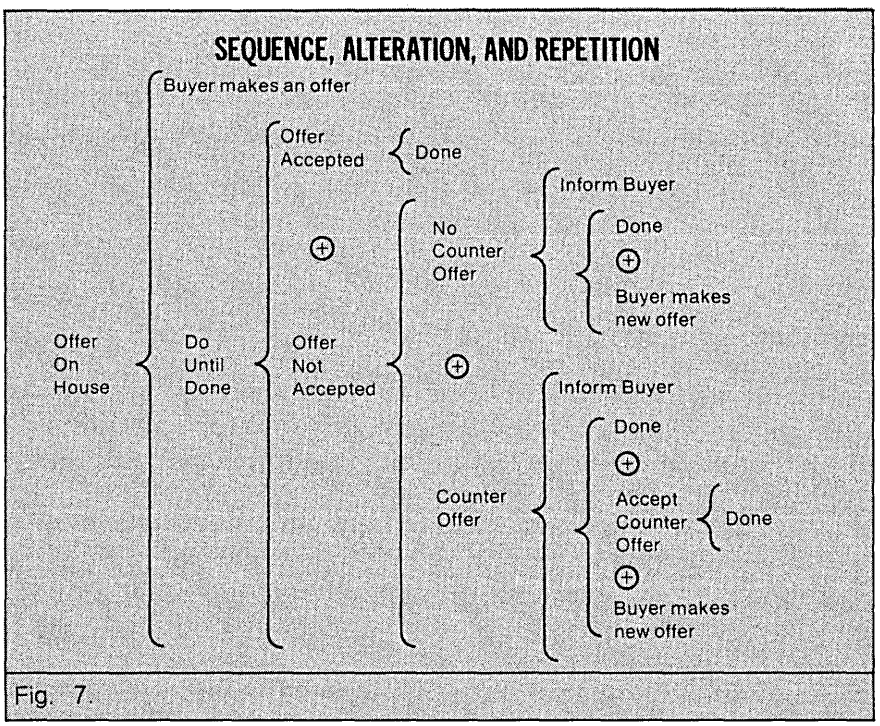

Fig. 7.

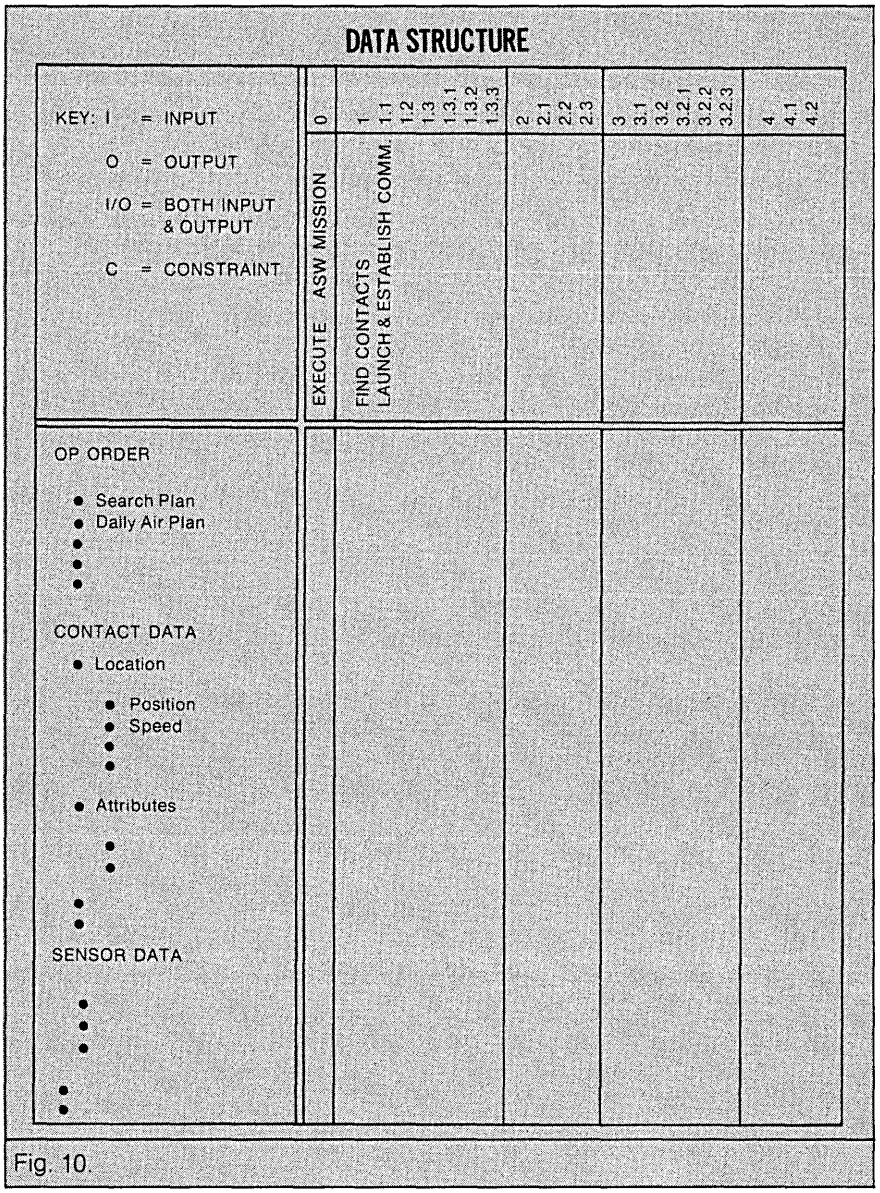

Fig. 10.

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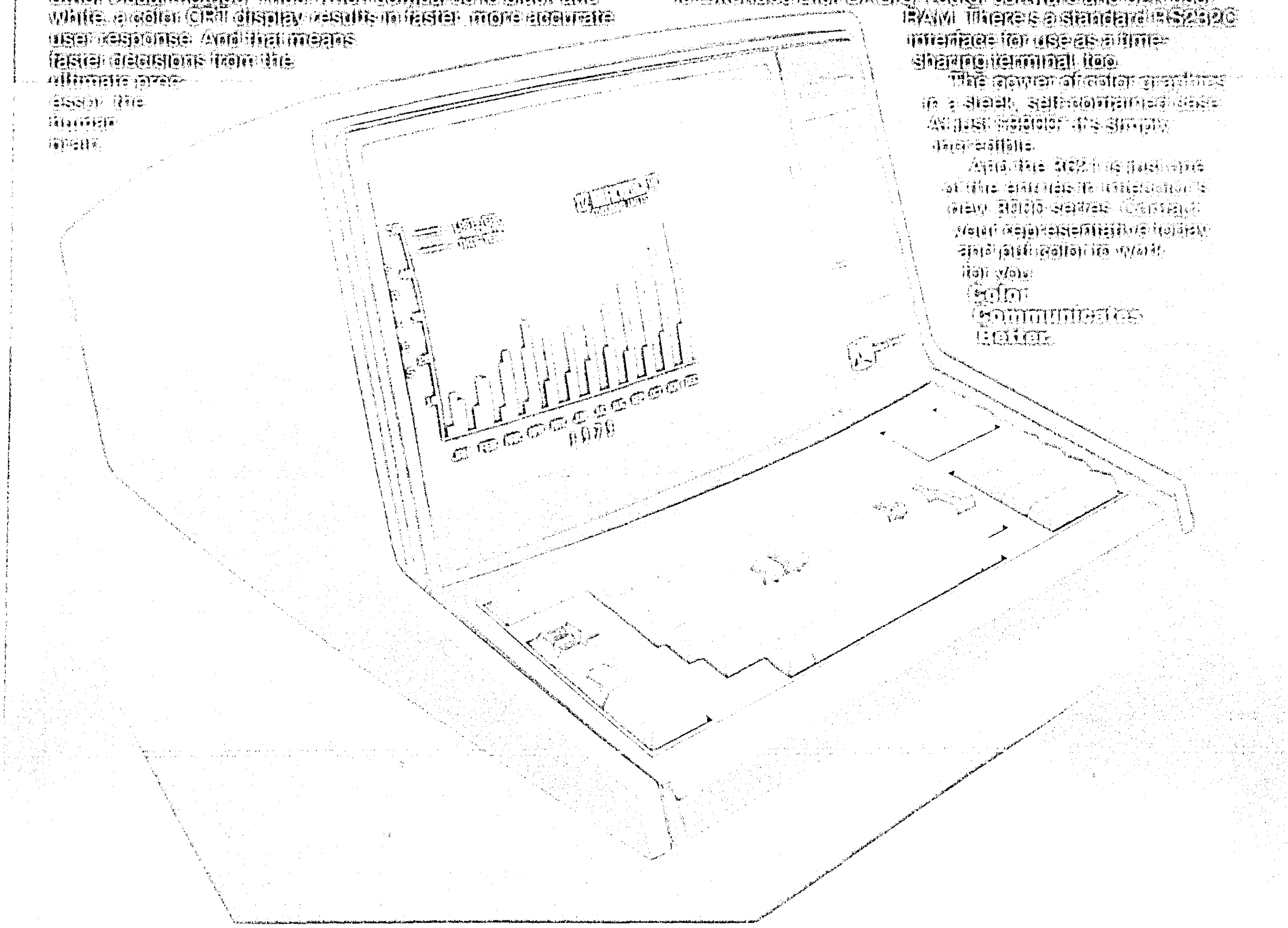

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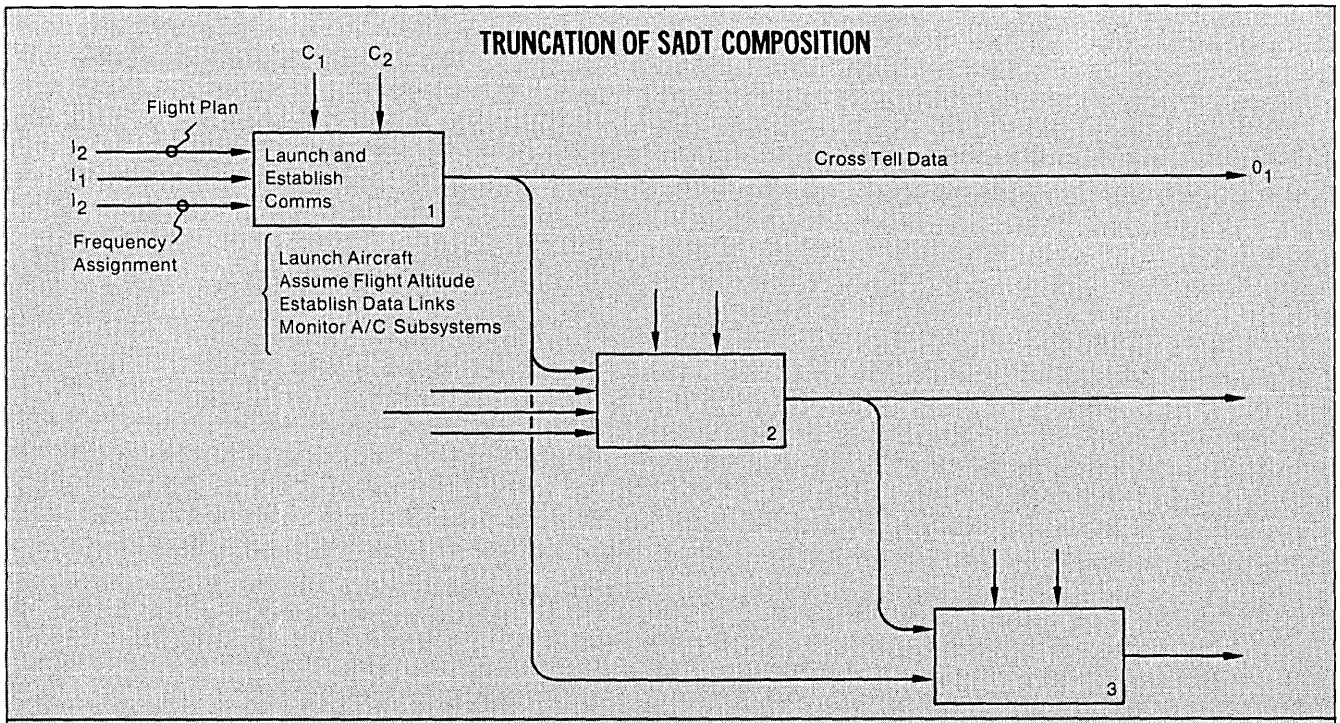

Fig. 8.

sufficient information to proceed with the system design specification phase of a system development. The design specification includes the identification of mechanisms to accomplish the activity. These mechanisms could include communications/data links and transmitting/receiving/processing equipment. For interactive systems, personnel are defined as system components.

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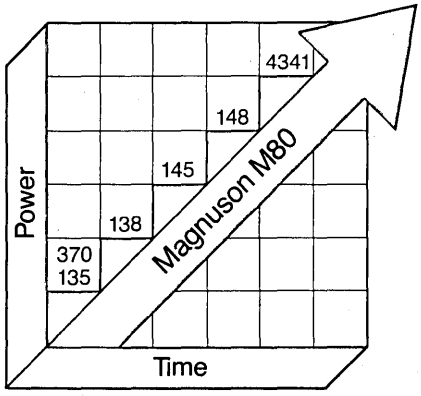

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procedure for specifying system requirements. In practice, the documentation has proven to be easily understood by both system users and system designers.

Specification of system requirements, however, is just one aspect of system design. Successful system development requires *systematic* development, from problem definition through detailed design to programming. ✲

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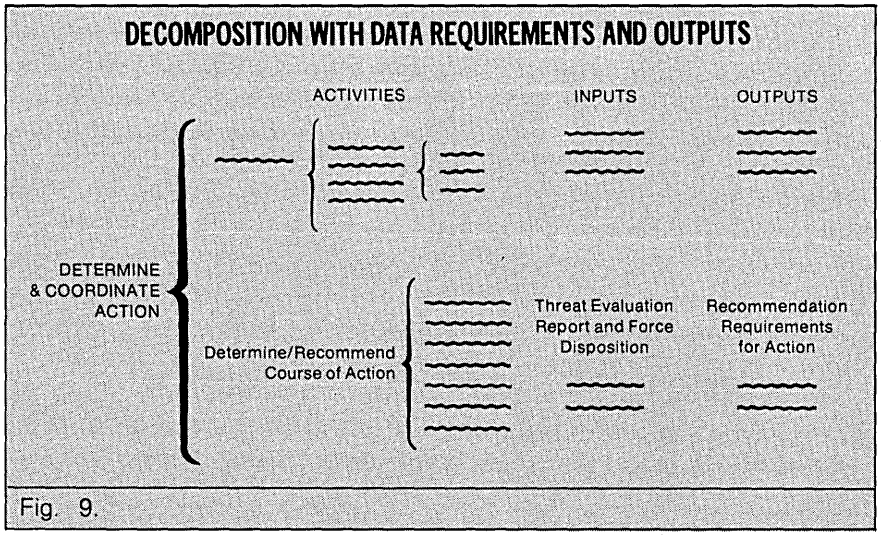

Fig. 9.

KENNETH D. SHERE

Dr. Shere has been an executive analyst with CTEC, Inc. since 1976. He has determined systems requirements for the federal government, has worked for 15 years in applied math and operations research.

RALPH L. RUDKIN

Mr. Rudkin has been manager of the System Architecture Dept. at CTEC, Inc. since 1976. Previously he worked for the Navy as a civilian employee in research and development and in scientific and technical intelligence activities.

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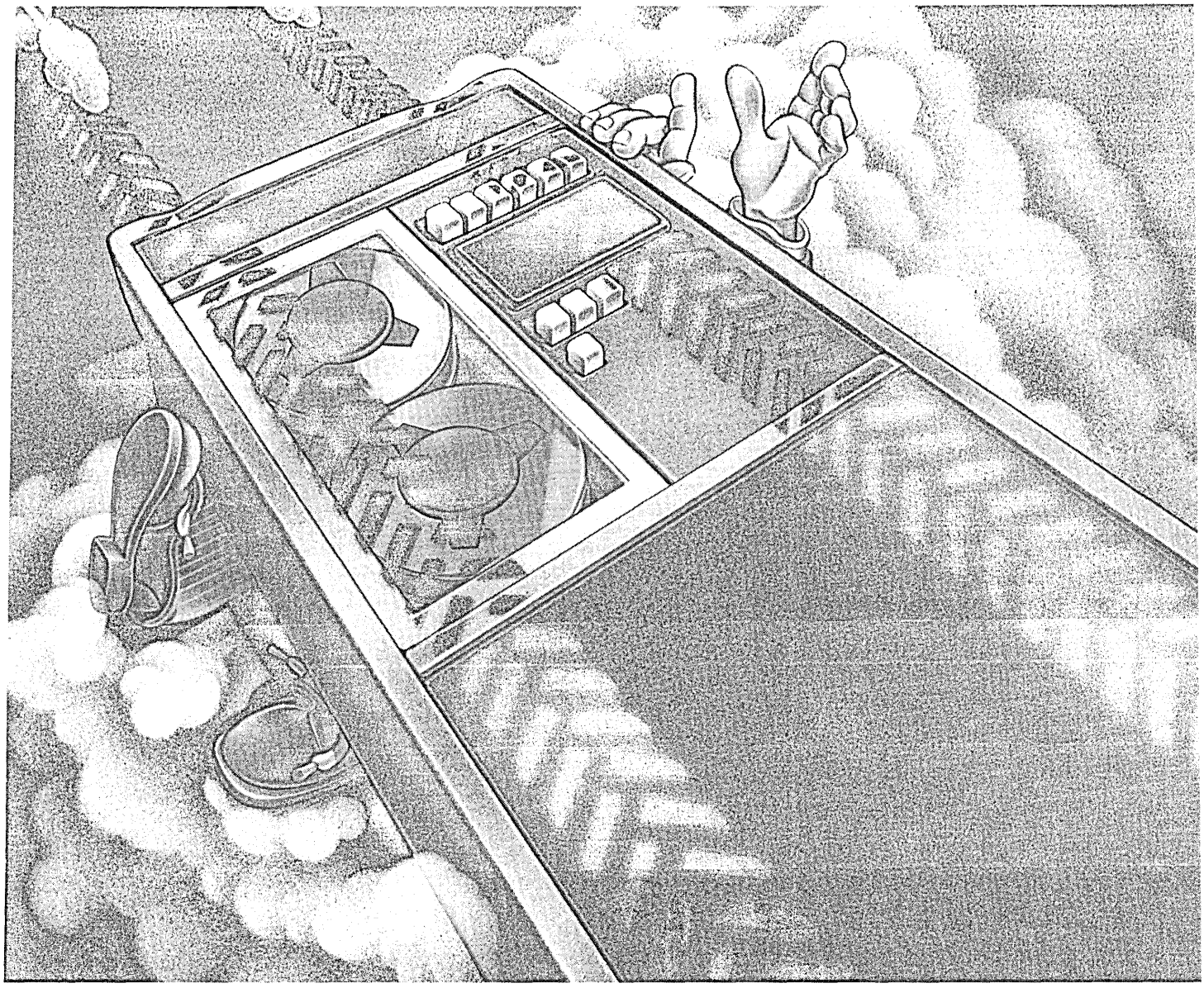

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The utility and applicability of structured techniques must be recognized before they can be successfully implemented.

ORDER AND DISCIPLINE: BENEFITS OF STRUCTURED TECHNIQUES

by David S. Iwahashi

In the last few years, many articles have been published expounding the virtues of structured programming concepts and techniques. These techniques reportedly have improved software manageability, productivity, quality, and maintainability. However, in spite of these claims, large software development efforts are still plagued with the classic programming problems:

- Inaccurate, overly optimistic percentage-complete estimates. Programmers have been characterized as notoriously unreliable in providing accurate completion estimates, as in the "95% complete" syndrome.
- Uneven productivity throughout the development effort. Disarray, overtime, and waived standards increase as the development approaches the due date.
- Excessively complex systems design. The result is fragile software that is difficult to maintain and modify.
- Inadequate documentation and a lack of appropriate standards and insight into the needs of the user.
- Inaccurate instruction count estimates. Deriving cost estimates entirely from software instruction count estimates is not a reliable technique; cost overruns may frequently result.

Theories and textbook methodology are often inadequate or unrealistic. Software systems are developed in unique environments with diverse characteristics. Furthermore, the human element is a major variable, with a complexity that is accentuated in large-scale software efforts. The art of effective large-scale software development requires insight, imagination, and creativity.

As the chief programmer on a large-scale effort, I attempted to maintain a perspective on problems and appropriate solutions. A technically sound system was paramount. Fundamental software and management control techniques were considered simultaneously in order to facilitate comprehension between programmers and nonprogrammers. The basic techniques and objectives were structured design to simplify system complexity and understanding, status and control techniques to provide progress visibility and realism, checkout milestones to impose steady productivity, and standards and guidelines to enhance code and documentation quality.

Here, we will discuss how several structured programming concepts were incorporated into a large-scale scientific software development effort (15 programmers, 100K lines of code, 200 man-months). This scientific software development effort consisted of two separate but dependent programs—the display program and the batch program.

The display program consists of approximately 19 separate displays that provide the user with the capability to generate and update controls for a real-time system; to specify data sets, schedule and optimize data; and to generate and update control files and list files. This program can read 12 different types of control and reference files and write nine. The approximate program size is 77 overlays and suboverlays, 790 subroutines, 60K total FORTRAN source instructions, 11K total machine language source instructions, and 117K total cards.

The batch program has the capability to generate, update, and list nine reference files in a batch mode; these reference files are used by the display program. The approximate size of the program is 42 overlays and suboverlays, 366 subroutines, 20K total FORTRAN source instructions, 4K total machine language source instructions, and 42K total cards. (Core restriction requirement for both programs produced numerous overlays and suboverlays.)

The programs were developed on Control Data 6000 series equipment. Initial requirements had been established during a nine-month study effort. Program development required approximately seven months for requirements generation, preliminary design, and detail design; about 11 months were needed for code, checkout, and testing.

STAFF DIVIDED IN THREE PARTS

The software development staff was organized into programming, software integration, and system engineering groups. This organizational structure had been in use for approximately nine years, producing similar special-purpose scientific software. These software products and development efforts met requirements, were delivered relatively on schedule (a few months late at worst), and required extensive programmer overtime (averaging 11% at worst), especially during the final phase of checkout. The efforts also occasionally overran cost estimates slightly (+10% at worst), and were relatively error free.

Several structured programming techniques were implemented on these previous efforts, including top-down code development, utilization of intermediate programming language (IPL), code indentation, GOTO-less programs, and code reviews.

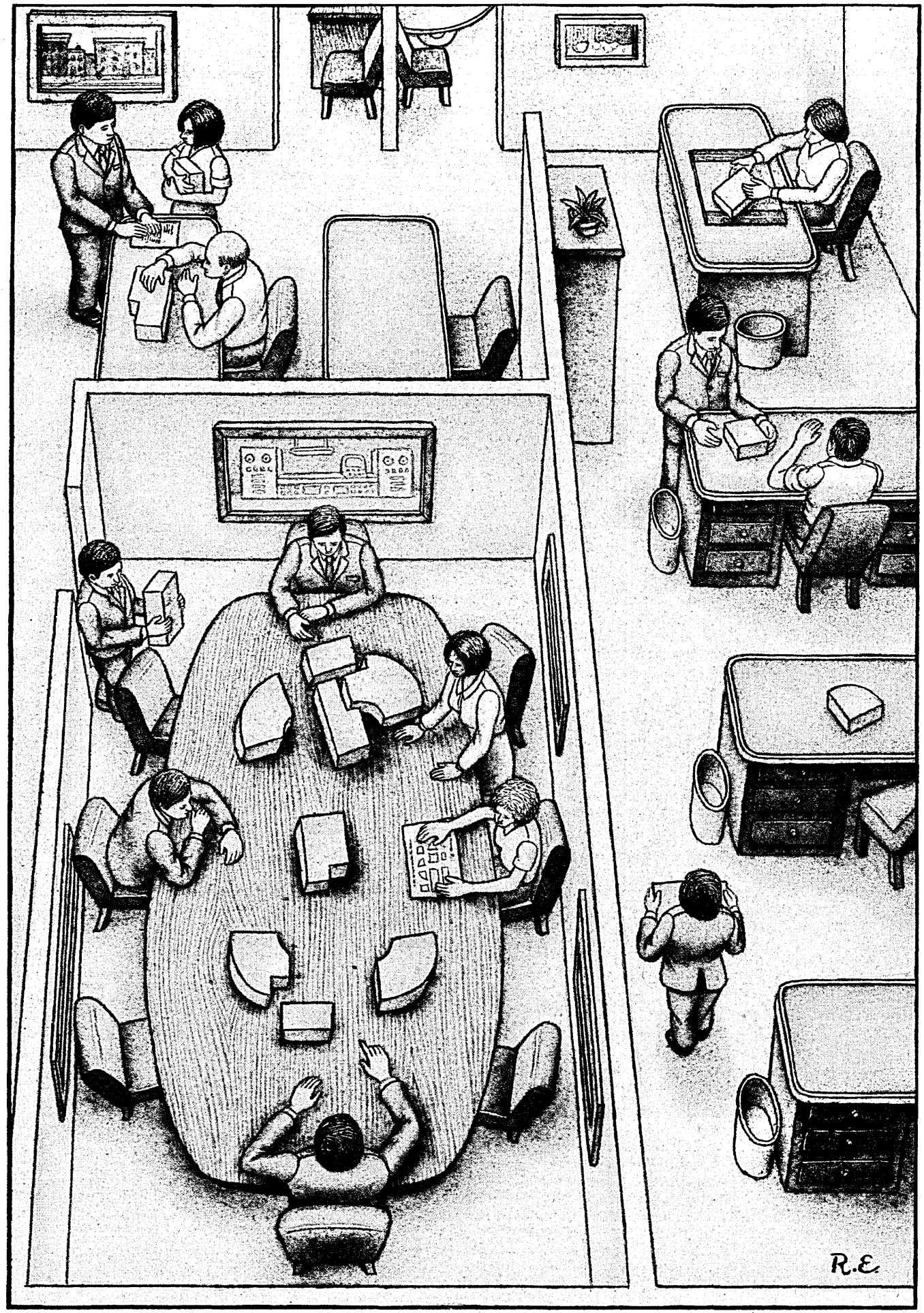
These earlier structured efforts experienced some software development problems. The indented code was difficult to update and maintain, reviews tended to be cursory, and extensive use of GOTO-less code took longer to execute and was difficult to follow. As a result, the maintenance programmers complained loudly about structured programming.

The organization, staffing, and responsibility on this software development effort were as follows:

Chief Programmer. The chief programmer performs a specific set of functions, and is not a position in name only. The chief programmer need not be a superprogrammer. On this effort, it was more important that the chief programmer be a software system designer, understand and appreciate software development problems, and have some imagination and insight for effective task assignments and control. The day-to-day programmer interface and guidance required for software design reviews and technical decisions indicate that the chief programmer should come from the software pits.

The chief programmer had overall responsibility for the entire development. A thorough and comprehensive understanding of all technical requirements was mandatory. The chief programmer had extensive, detailed experience (10 years) with the computer system, customer, and development procedures.

It is my opinion that the chief programmer can effectively direct, control, and offer technical guidance to only six to eight team members performing unique


R.E.

Ultimately, it is the individuals that use the techniques who govern the final outcome of a development effort.

tasks. If there are more subordinates, some capable assistants are required. On this effort, software integration personnel provided the necessary assistance through technical guidance on the complex algorithms, intermediate program checkout and verification, and documentation reviews.

Assistant Chief Programmer. The assistant aids the chief programmer and handles lower-level design decisions. An assistant is necessary on large software development efforts to review and critique technical decisions, follow up in problem areas, assist with external communication and interfaces, train and brief new personnel, and minimize stopgap programming. The assistant also gets valuable training and experience, which insures the project against the loss of the chief programmer.

Unfortunately, this development effort did not have an assistant because programming personnel were unavailable. As a result, the programmers and software integration personnel were required to work harder.

Programmers. The programmers had responsibility for detailed software design, design documentation, development of code, and program checkout. Up to 15 programmers were required to complete this development effort. Programmer experience ranged from one to 19 years and every programmer had some previous experience on the applicable computer equipment. Individual programmers differed greatly in ability and experience. The number of years of software experience does not measure a programmer's applicable experience, true ability, or overall professionalism. It is necessary to correlate an individual programmer's experience, capability, and track record with the complexity of the specific task.

Task complexity ranged from straightforward data manipulation (75% of resultant code) to complex mathematical scheduling and optimization algorithms. The hierarchical diagram and structured design provide a means of better understanding complexity and help provide a basis for appropriate personnel assignments. Attempts were made to assign tasks according to programmer experience, expertise, track record, and individual preference. Although no generalization should be derived, the following are interesting observations:

- The less experienced programmers tended to do checkout superficially and have more discrepancies.
- Competent programmers successfully completed tasks regardless of complexity.
- The less productive programmers tended to govern on-time product delivery.

All major tasks were sized into manageable subtasks; major subtasks were further subdivided so that each component required approximately three to six months' effort. Manageable subtasks made it easier to accommodate schedule slippages and personnel attrition with reassignments to supplement development progress.

Librarian. The librarian's function was to keep track of program versions and files, and verify program updates throughout the development effort. This was an important responsibility and a key reason the development made steady progress. The most recent program version and listing were always available for checkout; no time was lost due to improper updates being used.

System Programmer. This programmer was responsible for computer system problems and anomalies. Since this effort was developed on an established computer and operating system, the support was on a problem-solving basis only. On new large-scale developmental computer systems, it would be advisable to have a resident system programmer available to handle the day-to-day problems encountered during software development.

Software Integration Group. This group was responsible for the coordination of the development effort, algorithm support, intermediate program checkout and user's manuals. The integration group provided a useful interface buffer between the programming group and the system engineering group. The complexity of the mathematical scheduling and optimization algorithms necessitated one member of the integration group be assigned to follow, monitor, checkout, and verify each algorithm.

System Engineering Group. This group was responsible for the software requirements, formal software testing, and customer interface.

SOFTWARE REQUIREMENTS DOCUMENT

Nine months of earlier engineering effort culminated in a study report that identified existing system limitations and proposed improvements, a design approach, and design requirements. This report contained numerous separate engineering desires and concepts, as well as ambiguities and uncertainties.

The software requirements document was written by the system engineering group. Even though the study report provided initial requirements, additional effort had to be expended to rewrite the requirements to provide logical and functional specifications rather than detailed algorithm and implementation design specifics. Software development efforts frequently begin with a feasibility analysis. A structured top-down approach to these studies and reports could significantly enhance a structured implementation.

Preliminary Design. The overall problem and the computer system and resources must be totally understood before a feasible software solution can be designed. The initial design was in hierarchical form and indicated how the problem could be solved in an orderly, well-structured manner. The initial diagrams were completed by the chief programmer in a one-month period, prior to establishing the programming team. These diagrams provided program organization in a top-down, stepwise refinement manner, as well as verification that all requirements were included (diagram contained study report and requirement document paragraph numbers for cross-reference); an outline for preliminary and detail design documentation; identification of subprogram size and efforts for personnel assignments; a clear delineation of responsibility; new personnel indoctrination/briefing information; identification of areas of concentration; identification of common utility and library routines; minimization of intraprogram communication (key factor in simplifying programming tasks by reducing interfaces).

The initial hierarchical diagrams were of sufficient detail (10 to 12 levels for each function) to show that the problem could be solved, and that all requirements were incorporated. These diagrams were not superficial; rather, they had sufficient depth to identify the complexity and magnitude of the subprograms. The key design features were to establish communication and control high within the hierarchy, standardize and minimize communication between hierarchical components, and design manageable components which could be independently verified.

Good, detailed hierarchical diagrams simplify subsequent assignments of tasks and responsibilities, as well as simplify control. Hierarchical diagrams cannot replace flow diagrams. Flow diagrams identify sequences, controls, and data flow, and are useful in describing the details of complex algorithms.

The hierarchical diagrams were the entire basis of the 450-page preliminary design documentation, and took about three months to develop. The chief programmer developed the overall docu-

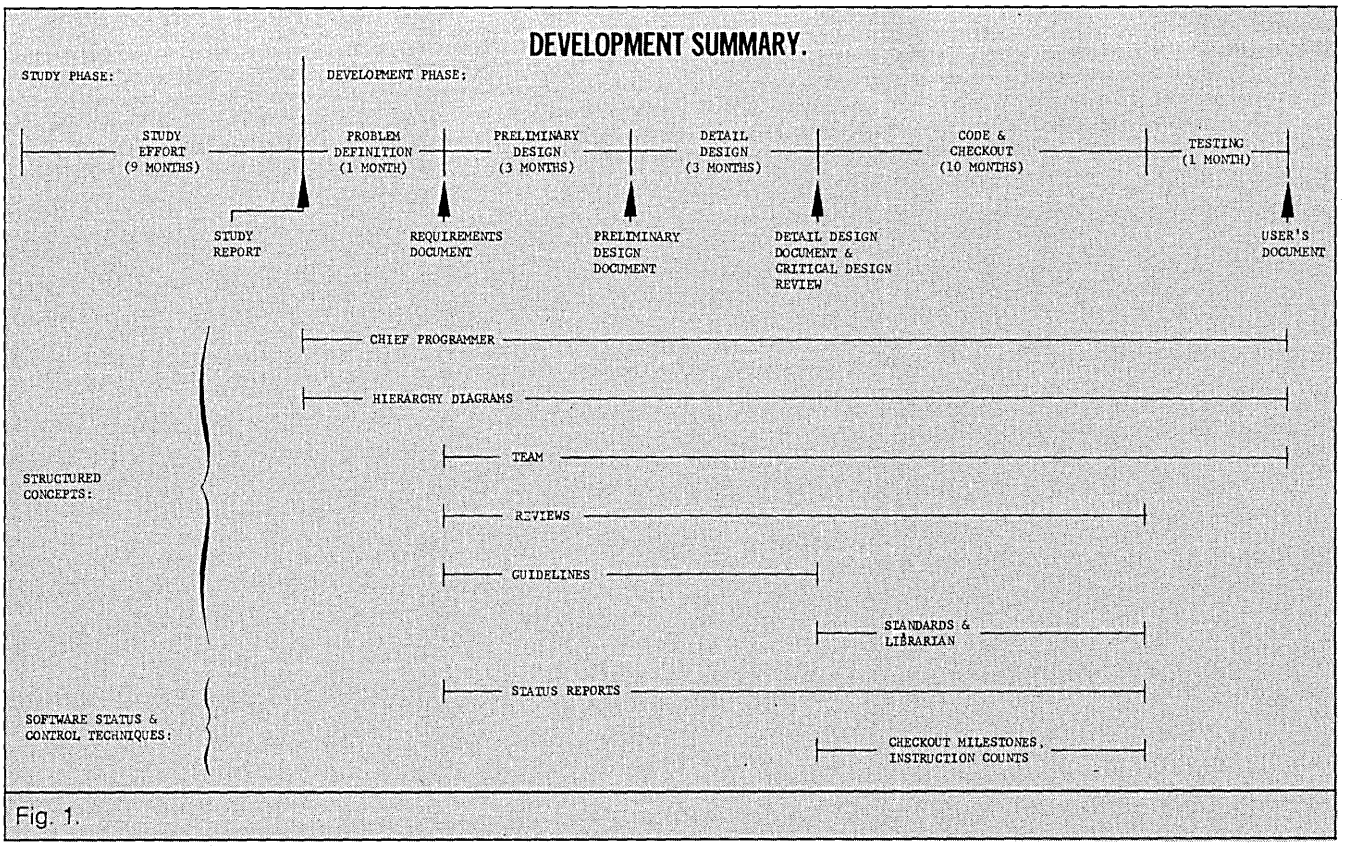


Fig. 1.

mentation outline and preliminary design guidelines. The basic documentation guideline was that the preliminary design should be of sufficient depth to verify a technical understanding of the problem and to indicate a viable solution. An estimate of the number of pages in each subsection was provided to scope the effort expected of each programmer.

Further, each programmer was required to submit an outline of his subsection. These initial outlines tended to lack organizational structure and consistency, and had to be modified. The chief programmer and integration group reviewed and proofread each programmer's initial documentation. In most cases, the initial documentation required extensive reworking to delete unnecessary detailed processing flow and to provide adequate depth for complex functions.

Previous experience with software design documentation indicated written material tended to lack organization, evaded complex problems, or provided repetitive detail about trivial matters. The documentation outlines and guidelines were an attempt to solve these shortcomings. For future efforts, I would also consider having each major section introduction, summary, and/or conclusion written and reviewed prior to supportive text. This could further scope documentation effort and minimize extensive reworking.

DETAIL DESIGN DOCUMENT

The detail design document of about 1,125 pages took about three months to develop. The preliminary design provided the basis for the detail design which described how the delivered software would be built. The chief programmer developed the overall documentation outline and detail design guidelines. The basic guideline was that the detail design should be a programmer-oriented document that would provide detailed information on how functions were performed. It was to be of sufficient detail to code from, yet general enough to reflect resultant code with a minimum documentation impact. Specific guidelines were identification of all inter-subprogram communication buffers and storage, subprogram overlays, suboverlays, and major routines, subprogram buffers and arrays whose size or structure is dependent on data external to the subprogram, subprogram defaults, and subprogram error conditions and corrective action.

As with the preliminary design, each programmer was required to submit an outline of his subsection. Again, these outlines proved informative but often had to be redone to reflect a hierarchical structure. Each programmer's initial documentation was proofread and returned for reworking. As with the preliminary design effort, I recommend each major section introduction, summary and/or conclusion be written and reviewed prior to the supportive text.

Code and Checkout. Software is frequently evaluated and remembered by its worst attribute (e.g., slow execution, difficult to modify, or awkward to use). Attempts were made to avoid these attributes during the code and checkout phase. Standards, reviews, checkout procedures, and software aids were utilized to enhance development and to produce quality software. The code and checkout phase took about 10 months.

Coding Standards. The basic coding standard was to develop software that was readable, sequential, and maintainable. It is difficult to derive all-encompassing standards due to the numerous peculiar situations and circumstances for which software is developed. Personal judgment is ultimately required to evaluate the detailed software development standards; there is no substitute for good judgment. Mandatory standards were provided regarding routine description, input/output identification, error condition descriptions, and comments. Programming conventions and guidelines were also provided regarding overlay

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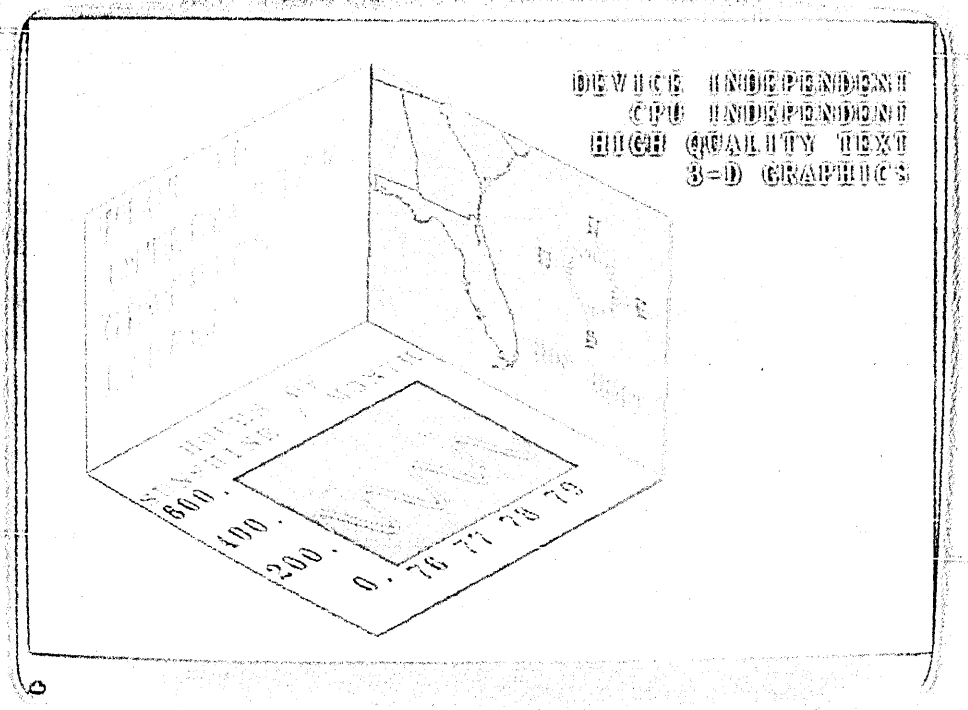

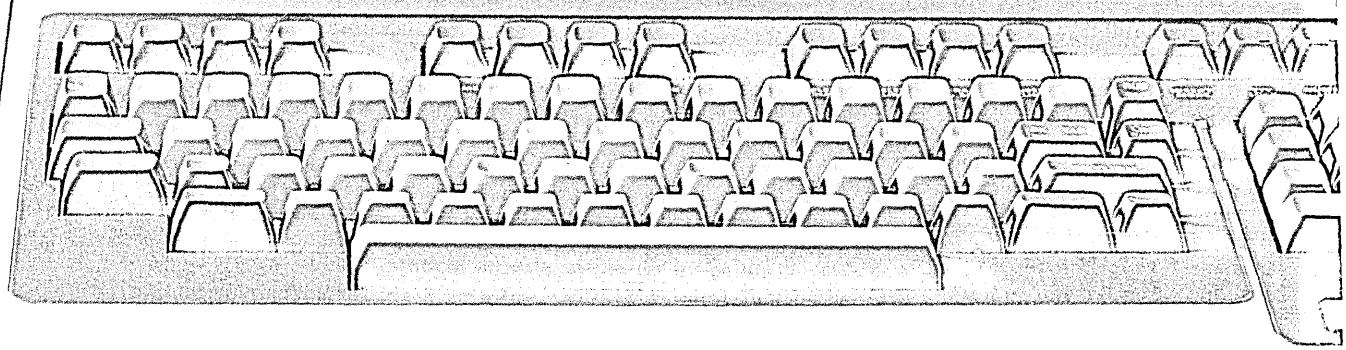

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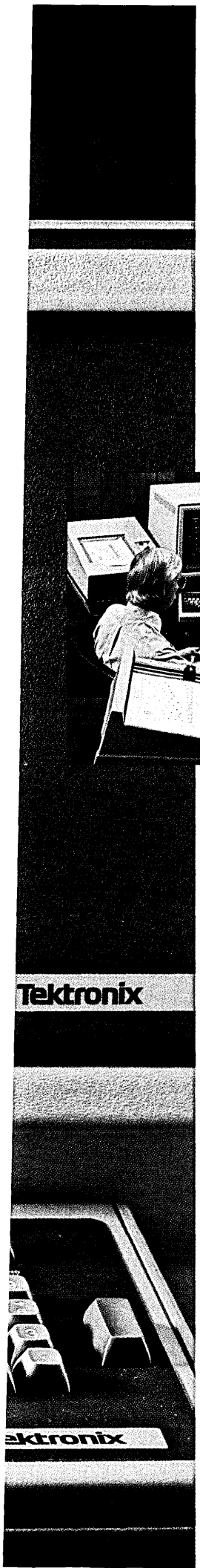

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Don't expect immediate success and miracles because structured techniques are used.

names, file utilization, variable utilization, variable names, variable assignments, and routine length. The standards, conventions, and guidelines attempted to achieve maintainable code without restricting the experienced programmer's judgment or habits.

Basically, these standards were adhered to; total adherence would require several people full time to monitor each line of code. The effectiveness of these standards will be realized in the future, when program maintenance and modifications are required.

Implementation Reviews. Following successful completion of the customer critical design review, implementation (code and checkout) began. Each programmer's implementation approach and initial coding efforts were reviewed by the chief programmer. Reviews were performed on detailed hierarchy and flow diagrams, and then on listings. These reviews were beneficial, necessary, and a key factor to the success of this software development effort.

It was particularly interesting (and amazing) to review and critique the initial implementation phase. Reviews indicated difficulty in implementing the details of the software design in a manner which was well structured, independent, and easy to check out. That is, the initial software implementation tended to impose additional complexities which could be avoided with a more straightforward approach. Some of the more common faults were:

- Lack of program structure and organization—implementation did not have clear, definable subsets which could be totally verified at intermediate points. Implementation increased program complexity and required extra checkout.
- Misuse of computer resources—one-word disk reads and writes.
- Lack of implementation flexibility —fragile software which was extremely data-dependent.
- Use and misuse of data statements —same data statement used in numerous routines, or buffer sizes not specified in data statements for easy identification and update.
- Redundant code—required extra checkout (vs one subroutine).
- Limited understanding and appreciation for the amount of time it takes to process large volumes of data—data was processed one item at a time.

These are merely personal observations made during the implementation reviews; it is not obvious whether these faults arise from a lack of understanding of the computer and its resources, beginning too close to the task, or not understanding the entire task. Team reviews were not held throughout the development effort; the size and complexity of each programmer's task was such that it would be difficult for other team members to understand and offer constructive detailed criticisms.

Team reviews during the design and especially during the initial implementation phase could alleviate obvious shortcomings and common faults, and could be educational for subsequent development efforts. I'm not convinced team reviews during the entire coding phase are beneficial and economical on all large-scale software development efforts. If code reviews are held, they should be performed by a code review board (vs entire team); the board approach appears to be necessary if programming requirements impose mandatory coding standards.

TEAM CODE CRITIQUE

Upon completion of the software development effort, each programmer was given representative listings of code generated by all other programmers on the team. These listings were reviewed and critiqued in a team review meeting. The intent of this review was to expose the development programmers to software maintenance and enhance their judgment of coding techniques.

The codes received a variety of comments. Some were described as well structured, maintainable, and easy to follow, with a few singled out as easier to read and follow due to the linearity of the task. A number received descriptive processing flow comments. Programmers pointed out restrictions or error conditions, occasional lack or misuse of data statements and external storage resources, and indicated where programming notes should have been more frequent and descriptive.

The effectiveness of these reviews will be realized in the future, when team members develop new software.

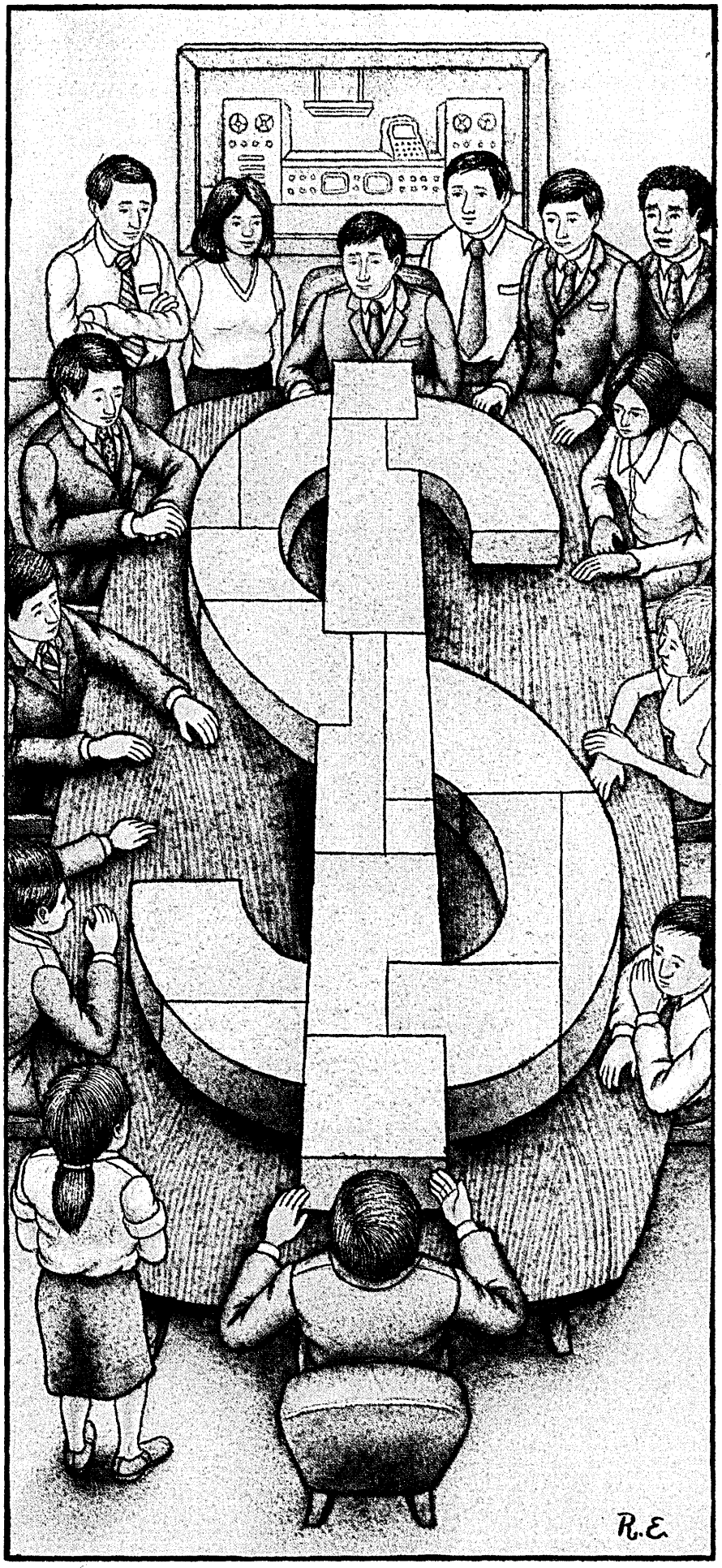
Top-Down Coding/Checkout. Code and checkout progressed in a top-down manner. Initially, the program executive was coded and totally checked out; "stubs" for all overlays were incorporated, and utility/library routines completed. Main overlays and suboverlay "stubs" were coded and checked out by the responsible programmer. Subsequent code and checkout sequences were left to the discretion of the individual programmer; emphasis was placed on completing the more complex and interoverlay/suboverlay functions first.

Software Aids. A useful set of software development aids and utility routines were factors in the overall success of the programs. The following are noteworthy:

- Display processing simulation program. This batch program saved significant checkout time by enabling the programmer to simulate execution of display subprograms without actually operating the display.
- Display program central memory, external storage, and internal file dump features. These online features provided the capability to dump pertinent data if errors were encountered during display checkout without subsequent diagnostic trace updates.
- Library containing frequently utilized functions such as data bit manipulations and disk access routines.
- General purpose file program used to create checkout files.
- Central file book. This book contained all pertinent file formats and specifications; modification to files were coordinated through one individual.
- Interactive computer terminals. Terminals significantly improved daily computer turnaround.

Testing. The system engineering group was responsible for the final formal program testing and demonstration. This test was deficient in that it did not demonstrate all the program's capabilities, or a realistic operational scenario; however, the test did identify several program discrepancies. The number of program discrepancies did not appear to be significantly less than on previous development efforts. Strict quantitative comparison as to the number of discrepancies is not the single most important software development evaluation criterion. Evaluation criteria should realistically include such things as requirement satisfaction, design flexibility, code maintainability, and fault isolation simplicity.

Software development visibility and realistic operational applications could be better demonstrated by distributing formal testing throughout the entire development phase. These incremental tests could include combinations of top-down, diagnostic, and subprogram component tests. (Diagnostic tests exercise program limits, error messages, conflicts, input anomalies, and abnormal operational sequences.) The formality of these incremental tests must be traded off with development costs and schedules. Effective software testing requires an understanding of the requirements, operations, and software design.



SOFTWARE CONTROL TECHNIQUES

Software control is a topic of much concern, especially on the development of large-scale computer programs. Effective software control requires a very detailed understanding of the effort, a design which may be partitioned into separate independent subprograms, and frequent periodic monitoring. Theoretical control techniques provide basic software management guidelines; the identification of applicable control techniques requires a range of programming and implementation experience.

This experience provides the insight required to develop effective software control techniques which fit the needs of the development effort. A single control technique is not adequate to effectively monitor and control a large-scale software development effort. Effective and realistic software development statusing and control require a combination of several independent techniques and objective evaluations. The following techniques were used during the code and checkout phase of this effort.

Completion Date Estimates. The hierarchy diagrams were used to identify tasks to be estimated. The responsible programmer for each task was requested to make an estimate as to the number of instructions and how long it would take to code and check out the task. Estimates were required for each task, subtask, and subroutine. Weight factors were also estimated to provide a subfunction's relative magnitude and complexity. The intent of having the responsible programmer estimate the effort was to force a more detailed analysis of the task and, hopefully, to instill a personal commitment to the estimate.

With allowance for the fact that programmers tend to be optimistic, the estimates were reviewed and a work schedule generated (see Fig. 2). Each week, the responsible programmer estimated the percent complete on each subtask. The chief programmer evaluated the reported percentages and estimated overall status of the task; the number of weeks ahead or behind schedule was recorded.

Checkout Milestones. Intermediate checkout milestones were established for each task. These consisted of 10 to 15 specific items or functions which could be verified with printer outputs, dumps, or on the displays (e.g., subroutine "A" complete, subtask "1" file generation complete, task "A" vector generation subfunction complete). These milestone dates were relatively evenly spaced throughout the code/checkout phase, and were consistent with the completion date

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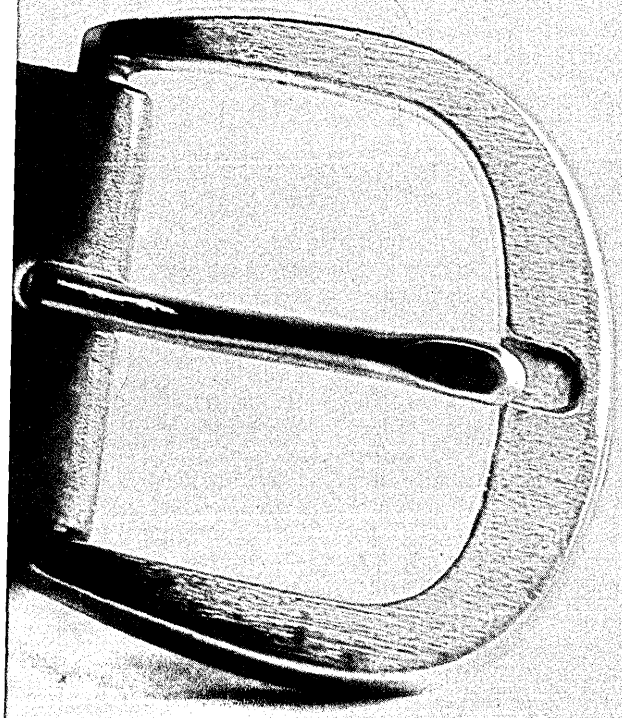

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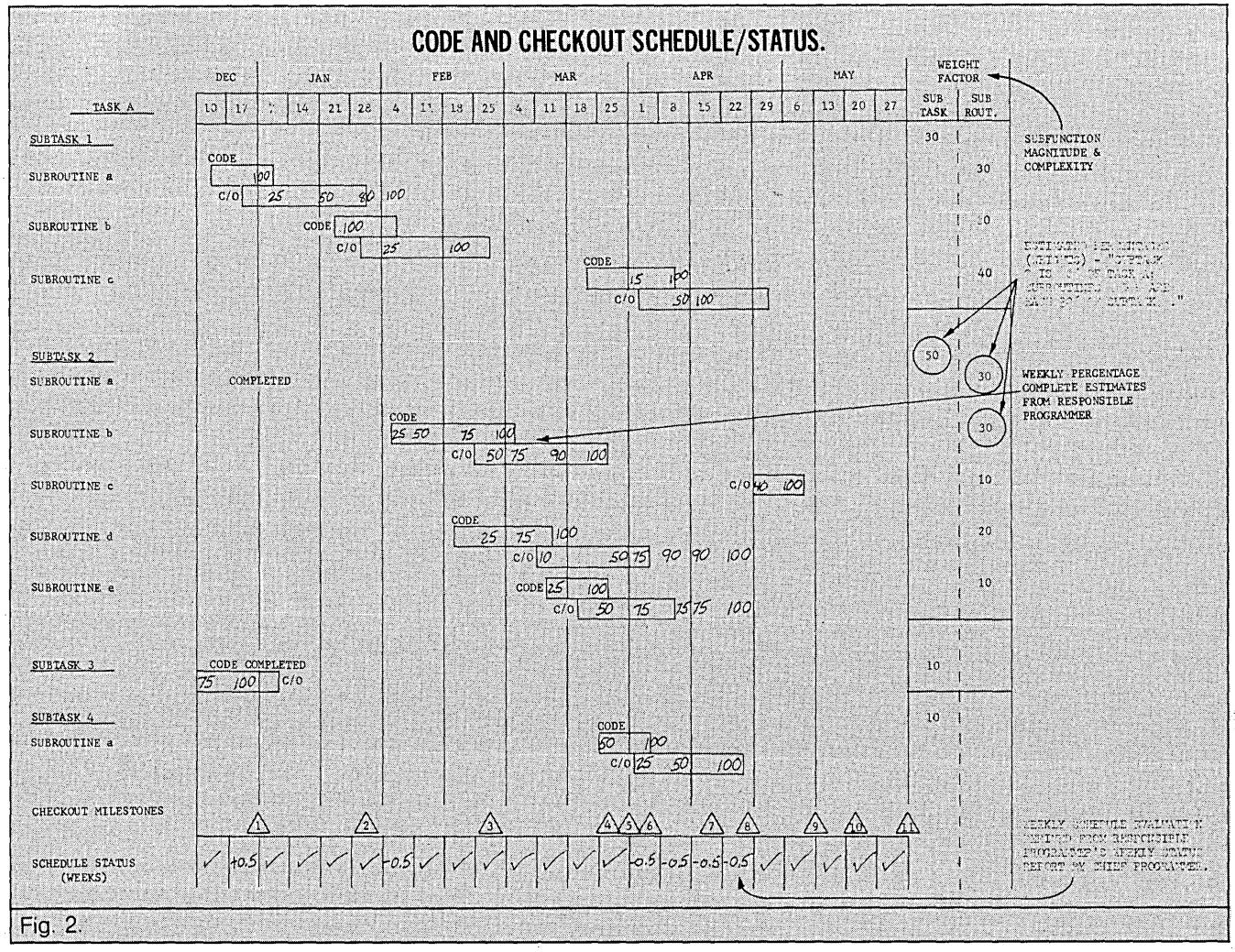

Fig. 2.

estimates. The objective of these milestones was to impose smooth productivity throughout the development phase, and to more clearly indicate schedule problem areas. These milestones were defined such that the item was a GO or NO GO situation; this alleviated subjective evaluation of the task as percentages complete.

Time-Line Charts. Time-line charts were used to indicate dates when "stubs," functions, and subfunctions were to be incorporated. These charts were simply bubble charts with associated dates and estimated critical paths. The dates on the time-line charts were consistent with the completion date estimates and checkout milestones.

Weekly Status Reports. Weekly status reports were required from each programmer; these contained an estimate of the code and checkout completed, status of checkout milestones, and written text regarding progress and problems encountered during the week.

These weekly reports helped to isolate problems and slippages so corrective action could be taken. Theoretically, the programmer updates the "estimated completion dates" as the programming effort progresses; this doesn't work too well with an overall fixed completion date. All schedules were developed with about a one-month margin; tasks which began to slip were monitored more closely. Minor slips (one to two weeks) were tolerable, but positive attempts were made to assist the programmer through job prioritization (keypunch, and computer turnaround), data analysis assistance (software integration personnel), and in a very few cases, overtime was allowed (less than 0.01%).

The programmers seemed to respond to this active concern for their tasks. Major slips required task partitioning and assignment of subtasks to other programmers; the design allowed this partitioning with minimum overall impact. Two major slippages were noted early in the development schedule, when task reassignments could easily be implemented.

A discrepancy log identified problems encountered during checkout by the engineering and integration groups. The intent of this log was to keep track of discrepancies and assure that they were being solved and not "forgotten." This log contained the date the discrepancies were encountered, description, and responsible programmer(s). The weekly number of open discrepancies per programmer seemed to vary significantly (from two to 25); the number appeared to be inversely related to the individual programmer's expertise.

MAKING COUNT ESTIMATES

Historically, accurate instruction count estimation has been a difficult task on large-scale software development efforts. Estimates and actual final instruction counts tend to differ by orders of magnitude. This instruction count difference is probably the area of greatest variance in large-scale software development efforts, that is, the area most likely to be wrong by the largest magnitude. The procedure for estimating instruction counts must be more accurate *if future software development efforts are to be realistically costed/priced according to these estimates.*

The estimation procedure is further complicated since a given task can be coded by different programmers and may result in an order-of-magnitude difference in the final instruction count. For this software effort, an "instruction" is defined as an executable or declarative source statement (comment or continuation cards are not "instructions").

Monthly Instruction Productivity. Source instruction count totals were obtained for each programmer and task on a monthly basis. These counts gave some indication as to how the overall effort was progressing and the productivity of the individual programmer.

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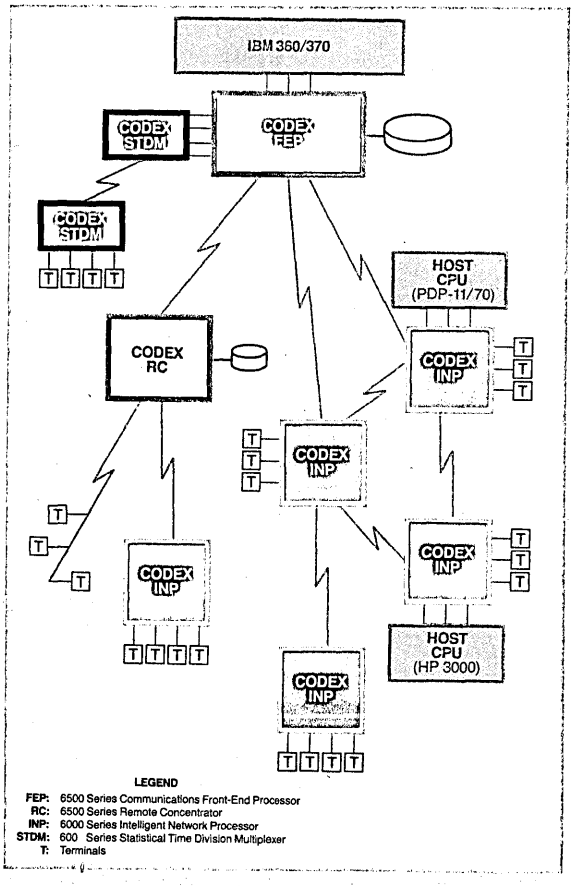

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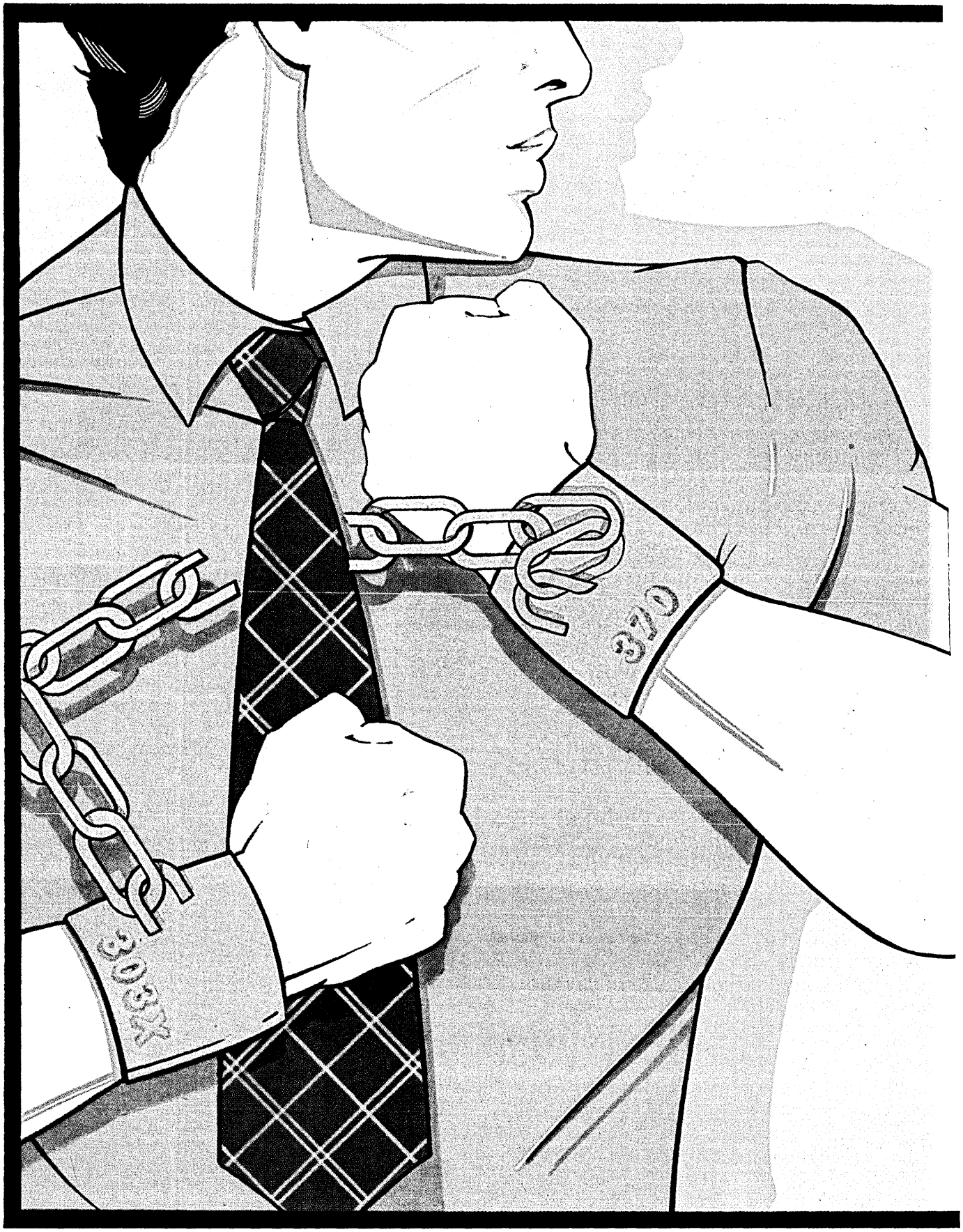

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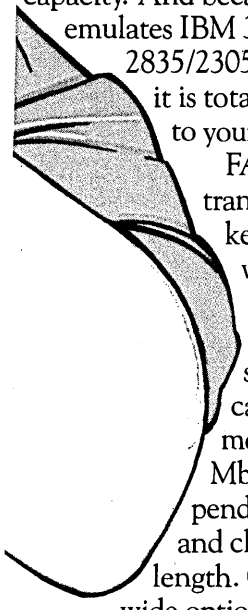

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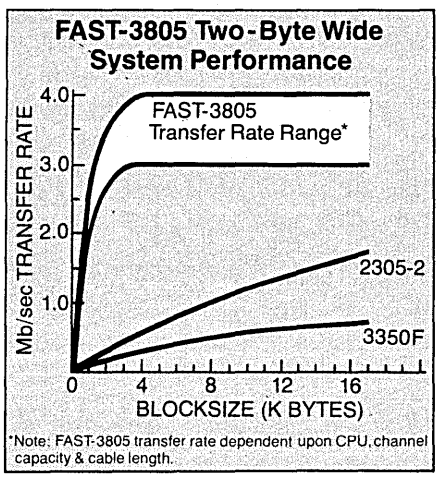

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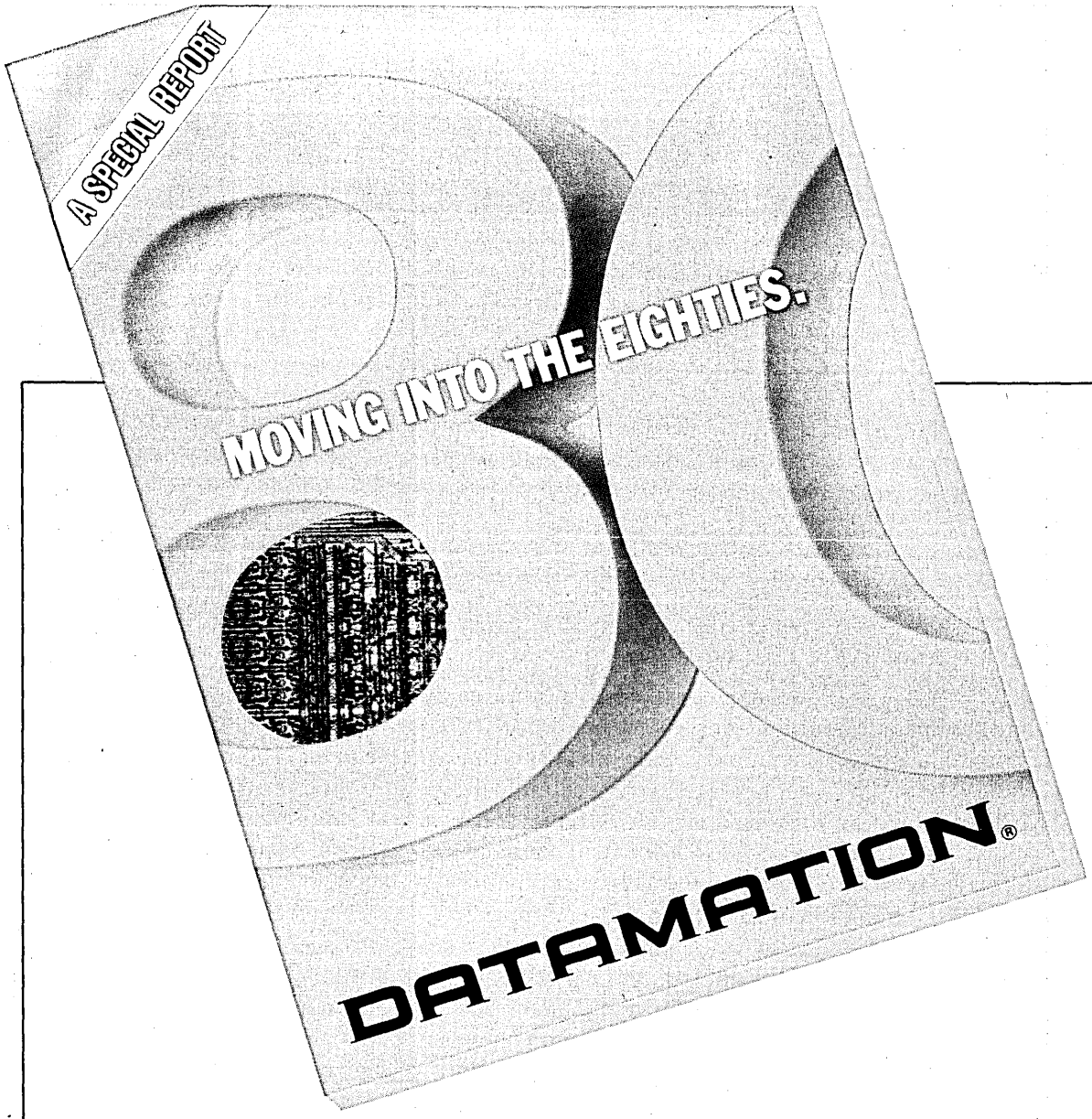

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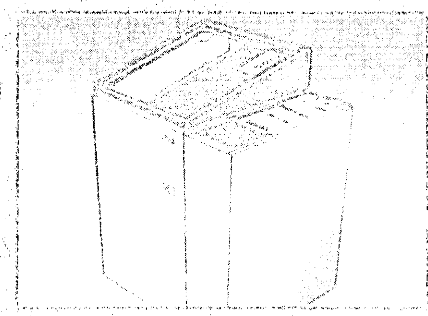

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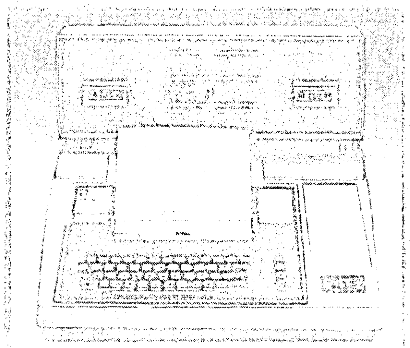

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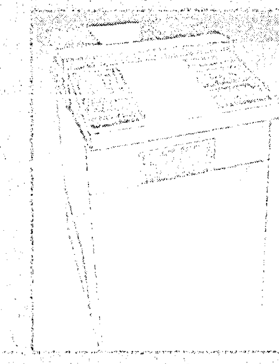

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CIRCLE 75 ON READER CARD

individual programmer productivity ranged from 150 to 2,000 instructions a month, with a nominal range of 400 to 1,000. The average productivity for the code and checkout phase (10 months) was approximately 490 instructions a month.

"Total cards" (instructions and comments) is occasionally a useful productivity figure. The "total card" average productivity for the code and checkout phase was approximately 890 cards a month. Programmer productivity varied from 680 to 1,360 cards a month.

Instruction Estimation Technique. Originally, each task was separated into subtasks and functions (as derived from the hierarchical diagrams). These functions were then evaluated against comparable functions in existing programs for which actual instruction counts were available. Estimates were made for program overhead and for functions which had no comparisons. These counts were summed to determine original program instruction estimates, but the estimates were as much as 100% off. Throughout the coding phase, the instruction count estimate was updated, based on actual monthly instruction counts and programmer estimates of percent code completed (see Figs. 3 and 4).

The display program code was reported 100% complete during the eighth month, yet the actual instruction count increased about 10% over the next two months.

The structured concepts, control techniques, and personnel led directly to the success of this software development effort. The top-down design and hierarchy diagrams provided the foundation from which the software was developed, managed, and controlled. A more structured top-down approach to feasibility-study report documentation and testing could enhance all aspects of a software development effort. The chief programmer and team concept was successful because of each individual's ability and willingness to meet the demands of the task. Documentation guidelines and reviews enhanced the quality and usefulness of the software documents. Additional guideline refinements and intermediate reviews appear necessary to minimize extensive documentation rework.

In-depth team reviews on large systems do not appear to be totally effective due to size-comprehension limitation; constructive detailed criticism appear inversely related to program size. The status and control techniques offered credence to the development progress and imposed steady productivity. These techniques provided the visibility and confidence required to manage the development effort and to achieve an on-time product delivery.

Don't expect immediate success and miracles because structured techniques and concepts are used on a software development effort. The value of structured techniques is to impose some order and discipline; ultimately, it is the individuals who govern the final outcome. Don't implement the concepts and techniques for the sake of being "structured"; one must recognize their utility and applicability before they can be successfully implemented. Software development and control techniques are evolving. The concepts and techniques incorporated in this effort fit its specific personalities and needs. ✲

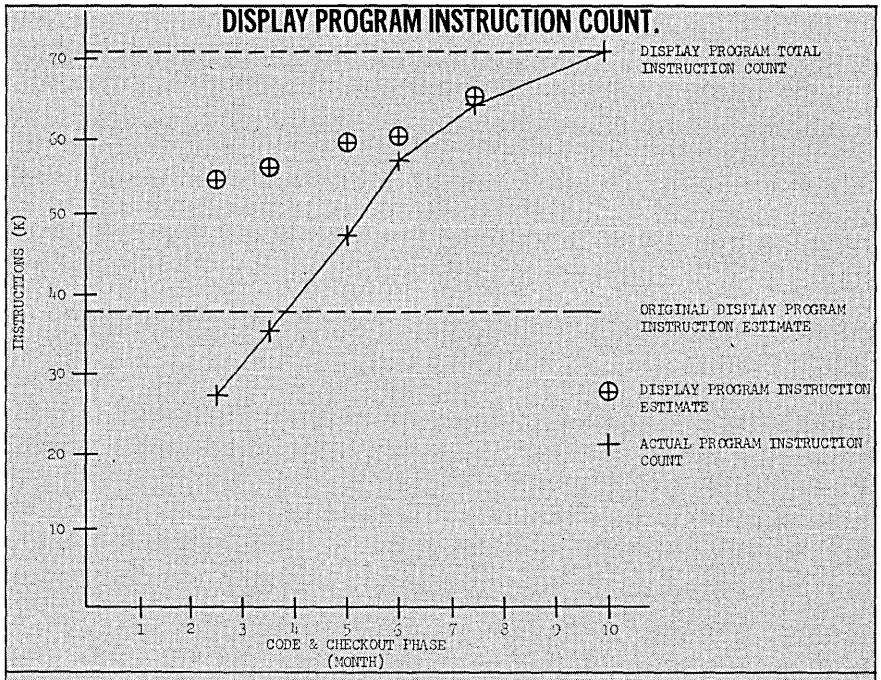


Fig. 3

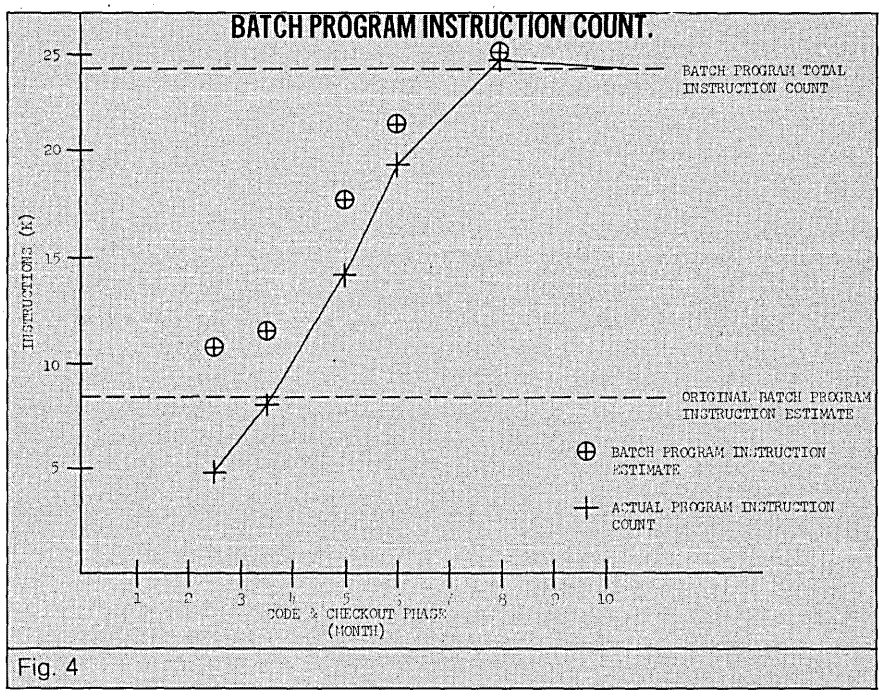
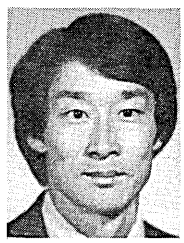


Fig. 4

DAVID S. IWAHASHI



Mr. Iwahashi is a staff engineer in software design and development at Lockheed Missiles and Space Co., Inc., in Sunnyvale, Calif. Since joining LMSC in 1966, his projects have included systems analysis and design, developing and maintaining programming, and software standards and requirements.

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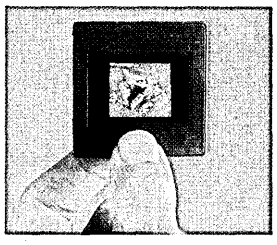

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DUNN INSTRUMENTS

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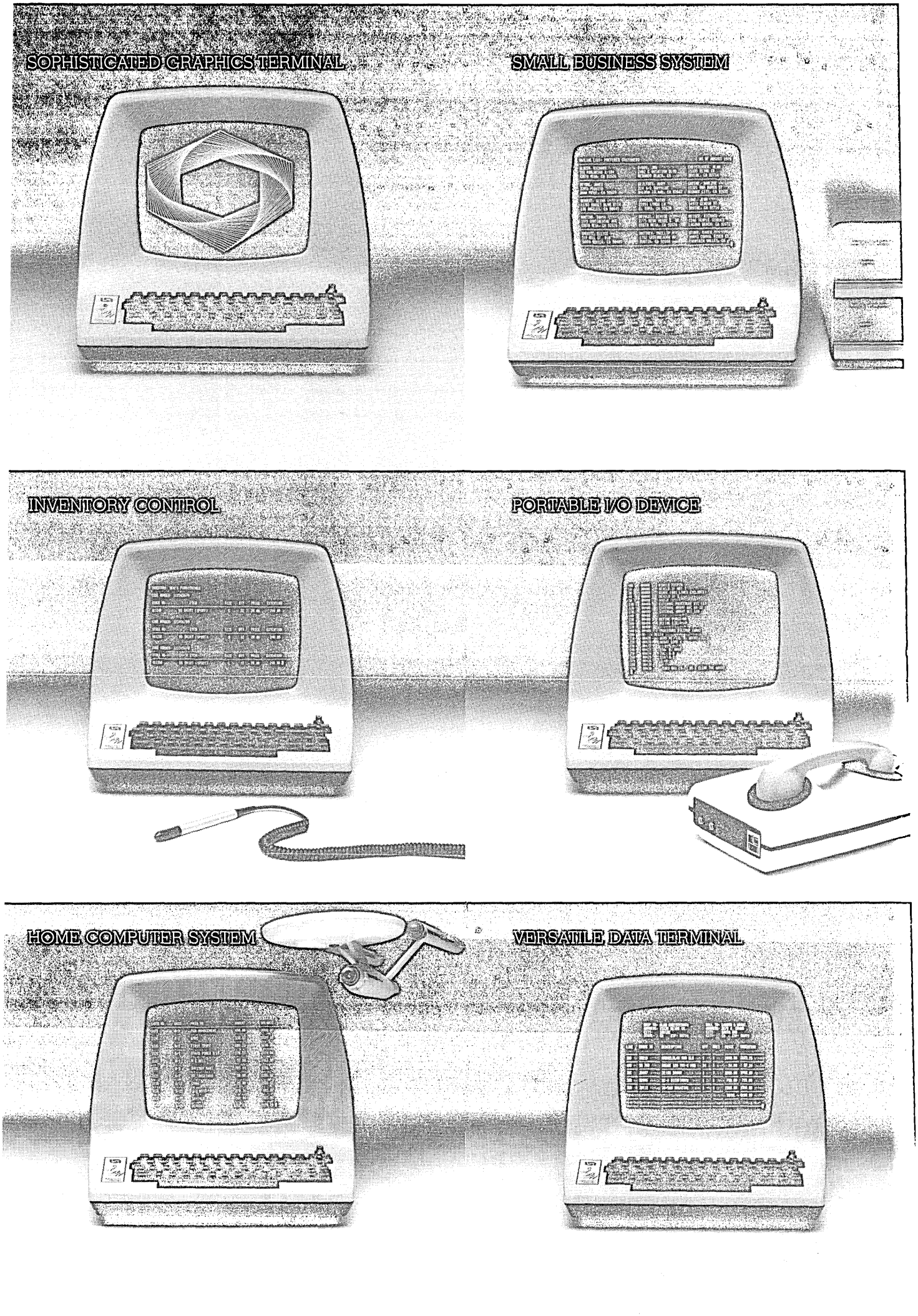
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And people call this a "dumb" terminal?

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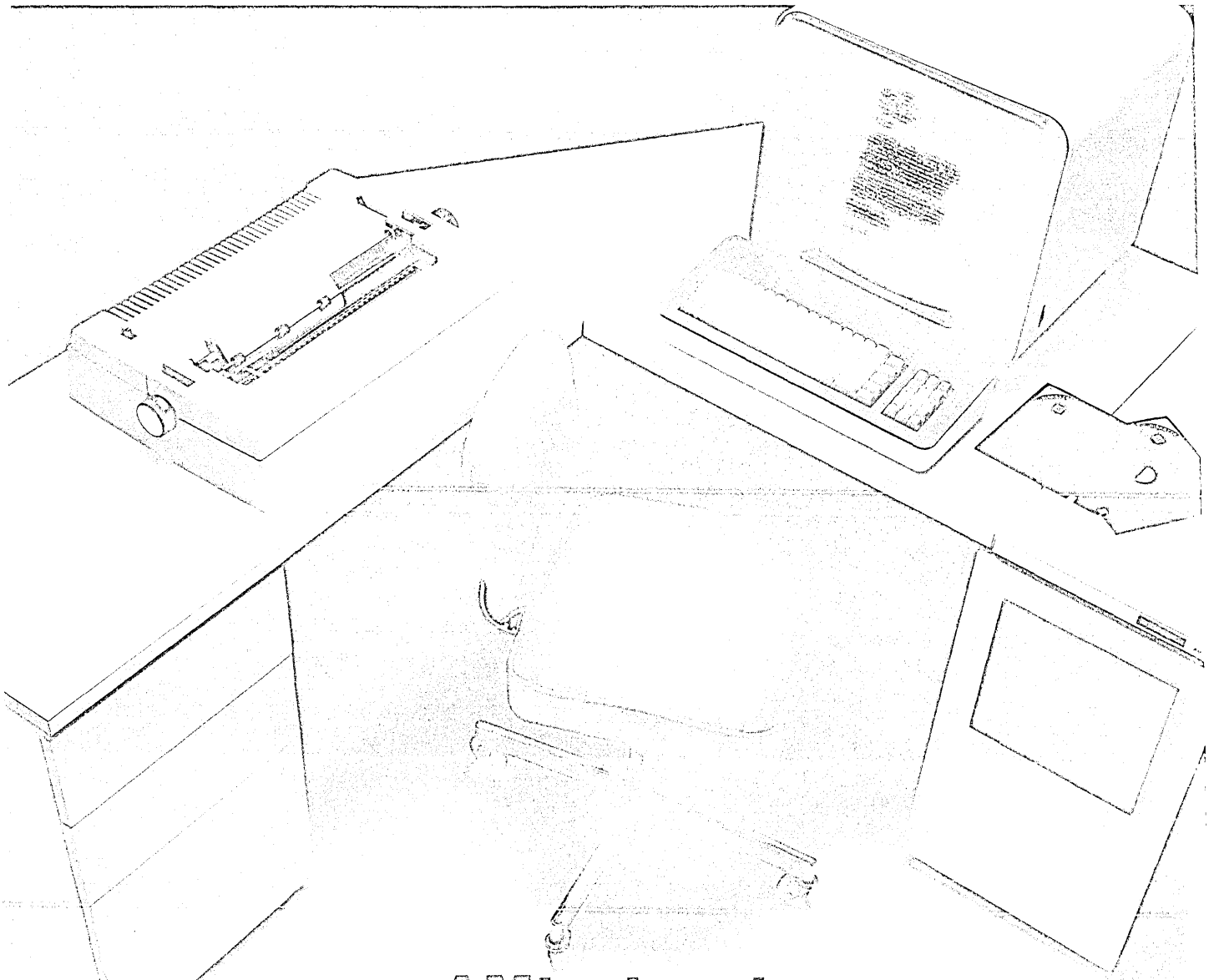

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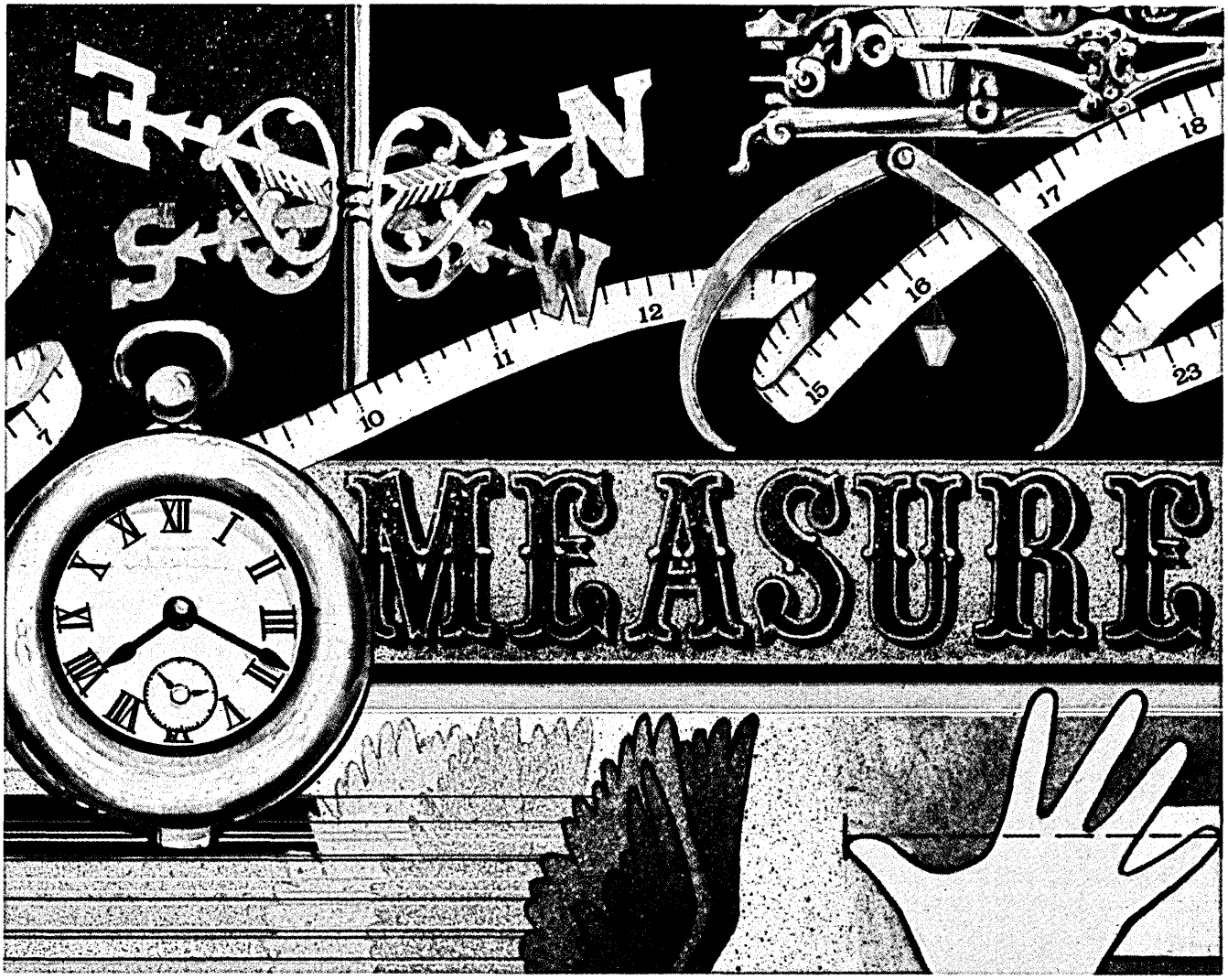

How to convert an estimate of system size into reasonable estimates of time, effort, and cost.

ESTIMATING SOFTWARE COSTS

by Lawrence H. Putnam and Ann Fitzsimmons

"How do I know how long a software project will take, and how much it will cost?" This was the question posed in the September issue in the first of three articles on software estimating. Part 1 described the problems associated with trying to determine the schedule and cost for developing software before the project begins. We showed some traditional approaches and why they failed. This series of articles is intended to show how to bring the problems of estimating, scheduling, and project control within reasonable limits.

Last month we described how to obtain good estimates of the size of the system—before development begins. This month we show how to convert this estimate of size into estimates of time, effort, and cost.

There is a fundamental relationship in software developent between the number of source statements in the system and the effort, development time, and the state of technology being applied to the project. This relationship was discovered by Larry Putnam partly from theory and partly from an empirical fit of a substantial body of productivity data. The equation that describes this relationship is:

$$S_s = C_k K^{1/3} t_d, \text{ where}$$

S_s is the number of end product source lines of code delivered
K is the life cycle effort in man-years,
t_d is the development time, and
C_k is a state of technology constant.

Fig. 1 shows a parametric graph of this equation. We have substituted development effort (DE) for life cycle effort (K) in this graph since this is usually the information that managers need. This relationship is approximately DE = 0.4K for large systems.

In Fig. 1 the darker line labeled constraint represents the minimum time

With these techniques we can quantitatively come to grips with software cost estimating and produce reasonable engineering answers.

in which a system can be developed. The area below this line represents the region in which it is not feasible to attempt development of a software system. For example, in this graph we can see that it is not feasible to develop a system of 200,000 lines of code in less than 2½ years. There are other constraint conditions, depending on the type of system. This particular constraint applies to a new standalone system that must be designed and coded from scratch.

While this graph shows the functional relationship between size, time, and effort for all systems, the absolute values will differ for most organizations and even for different projects within a single organization. The C_k value in the equation determines what these absolute values will be (and actually represents the state of technology an organization is applying to a system). This value will be determined by the use of modern programming practices, the language used, the development environment (on-line, interactive development versus batch), and the availability of the development machine, among other factors. While C_k is difficult to determine from its individual components because identification of these components and their relative importance is not well understood, nevertheless this value can be calibrated easily for an organization by looking at past projects. The constant should remain quite consistent for similar projects within an organization. The C_k value used in Fig. 1 (10040) represents an average state of the art development environment using on-line, interactive development.

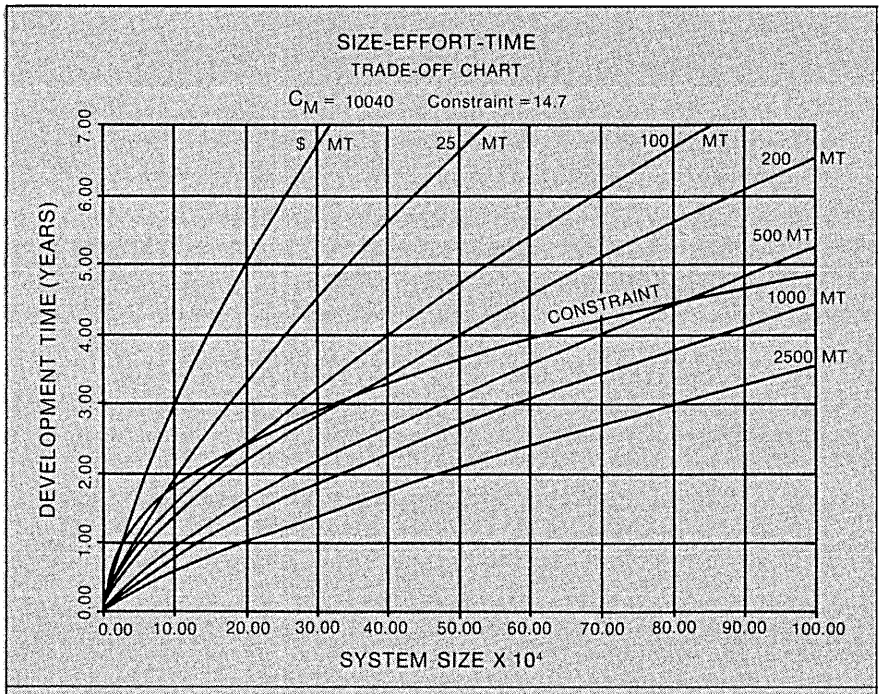

Fig. 1

	SS	t_d=2 yrs DEV. EFF. (MY) (COST X $1,000)	FASTEST TIME t_d	FASTEST TIME DEV. EFF. (MY) (COST X $1,000)
-3σ	77000	11.28 ($564)	1.63	25.80 ($1,290)
-1σ	91394	18.86 ($943)	1.75	32.16 ($1.61)
Exp.	98475	23.59 ($1,180)	1.81	35.40 ($1,770)
+1σ	105556	29.05 ($1,450)	1.86	38.71 ($1,840)
+3σ	120000	42.69 ($2,135)	1.97	45.65 ($2,280)

Table 1.

A FEASIBLE REGION FOR DEVELOPMENT

Last month we described a real world estimating problem for a system called SAVE. In this example, analysts were 12 weeks into the functional design of the system and had estimated the size to be 98,475, plus or minus 7081 source statements. We will now use this estimate and the graph shown in Fig. 1 to establish a feasible region for our development effort and development time for this system. Table 1 presents three scenarios for five different points of the size distribution curve.

From this table, we can see that the minimum time for development of the system at the expected size (98,475 source statements) is approximately 1.8 years, with a corresponding development effort of about 35 man-years. However, if we take two years to do the job, we can reduce our effort to 25 man-years. We call this the trade-off law in software development. Basically, this law states that if we can relax our schedule, taking more time, we can save a considerable amount of money. Conversely, if we compress the schedule, the cost will go up dramatically.

To many managers this trade-off law may not make sense. However, there is a logical reason for it. As the number of people who must interact and work together on a project rises arithmetically, the number of interactions will go up geometrically. This results in more and more time being spent on human communication and less and less being spent on productive work. One way to handle this problem is to limit the number of people working on a project at any one time, and the only way to do this in software development is to stretch out the time schedule.

From Table 1 we can also see what the minimum time schedule (and maximum development effort) would be for a broad range of sizes. Using the probability laws, we know there is less than a 1% probability that the size will be less than 77,000 source statements (as long as our initial input estimates do not change). At this size, the minimum time would be 1.63 years with a development effort of 25.8 man-years. Similarly, at the 99% level for size, the minimum time is two years with a required effort of 45.7 man-years.

We now have estimates of the expected time and effort as well as a 99% range on these parameters. How do we determine the costs?

Most of the costs associated with software development are people costs. Any extra costs, such as computer costs, supplies, etc., can be factored into the average labor rate if we assume this rate to be a fully burdened number, including overhead. Every financial department has

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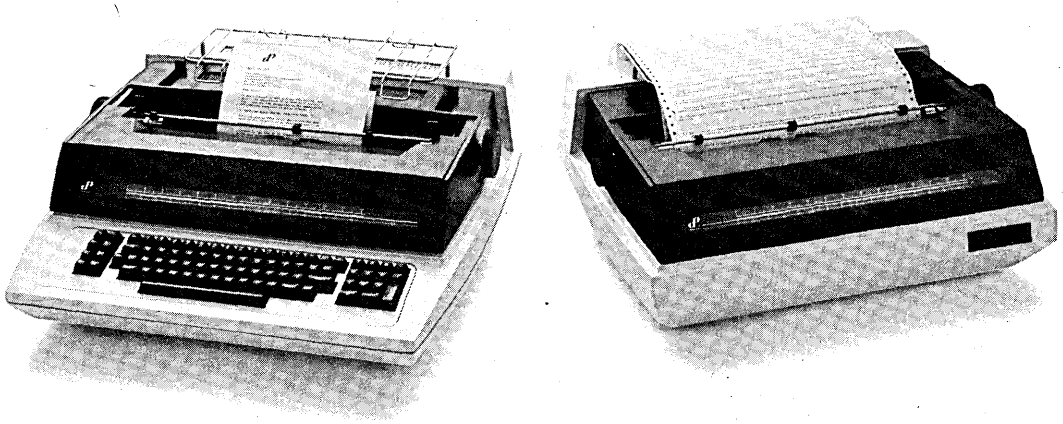

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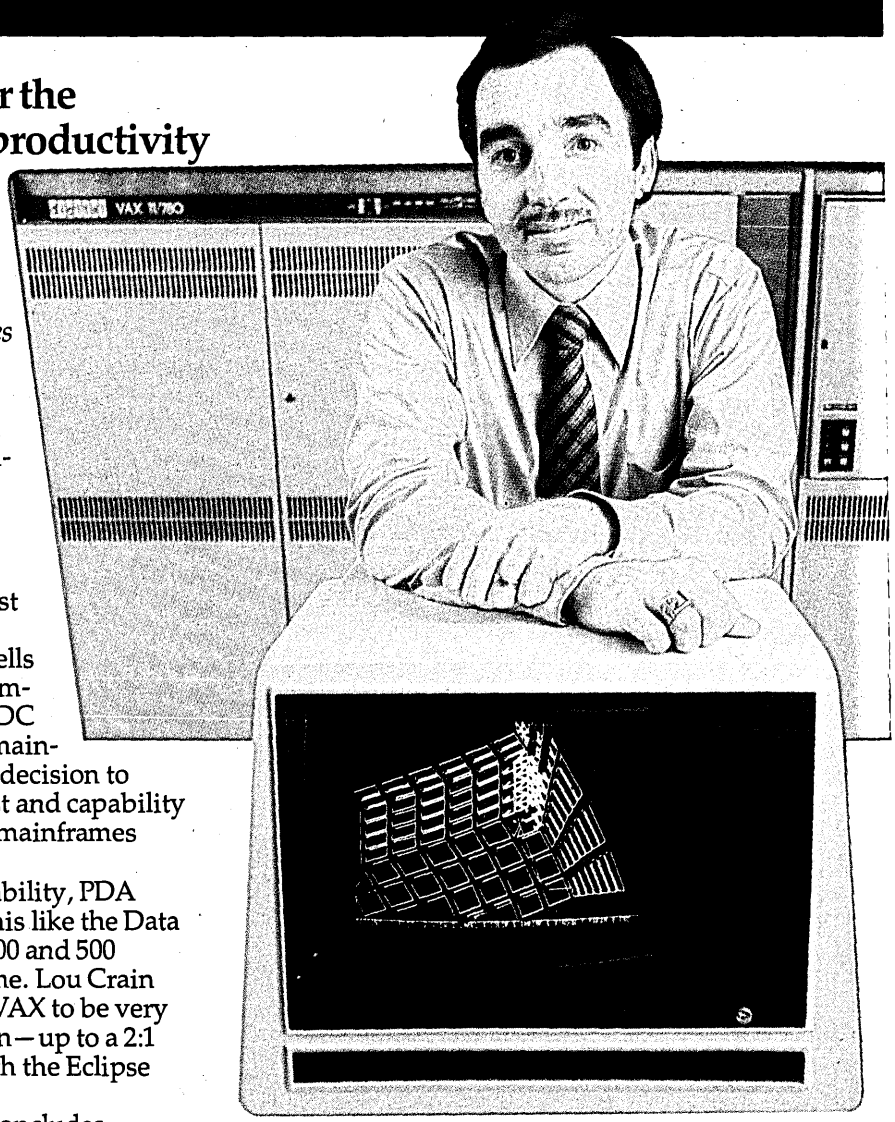

PDA is an employee-owned engineering concern whose business ranges from fundamental research in structural analysis to the manufacture of critical aerospace components.

The VAX-11/780 is PDA's first in-house computer. Lou Crain, Manager of Software Products, tells us, "We've been doing all our computing through utilities using CDC 6600, Cyber 74 and Univac 1108 mainframes. The key elements in our decision to acquire the VAX-11/780 were cost and capability — compared to service bureaus, mainframes and competitive minis."

From the standpoint of capability, PDA considered traditional superminis like the Data General Eclipse and the Prime 400 and 500 series, plus a used 1108 mainframe. Lou Crain says, "Our benchmark showed VAX to be very powerful against the competition — up to a 2:1 performance advantage over both the Eclipse and the 1108."

"After installation," Crain concludes, "VAX has lived up to our expectations and has performed impressively. It's resulted in better products for our customers, as well as improved cost-effectiveness. Having our own interactive capability in-house has meant an increase in engineering productivity of up to 300%."

"VAX turns out to be twice the machine for the same amount of money."

Roger Vossler,
Section Manager and Systems Engineer
TRW Defense and Space Systems Group
Redondo Beach, California

Sensor data processing and distributed processing systems in support of real-time embedded applications are among the specialties of TRW's Defense and Space Systems Group.

To find the right computer, TRW continues to evaluate numerous machines—including Digital's VAX-11/780. They've also conducted numerous FORTRAN and PASCAL benchmarks.

In every test, VAX stands out as a clear winner.

Roger Vossler, Section Manager and Systems Engineer, says, "VAX is one of the best implementations we've seen of a successful integrated hardware and software system."

Since TRW's sensor data processing applications require enormous memories—over a million bytes to store a single image, for example—VAX's true 32-bit address space is vitally important. In addition, says Vossler, "VAX's I/O bandwidth capabilities are extremely important for effectively moving large quantities of real-time data at very high data rates."

Because TRW already had an investment in Digital technology, Vossler is particularly impressed with the relative ease of moving PDP-11 series programs onto VAX.

"But," says Vossler, "Even if I were starting all over again—without our Digital experience—I would still pick VAX, on the basis of its architecture, both hardware and software, and its impressive performance."

"Implementation was faster on VAX than on 25 other machines."

Brian Ford, Director
Numerical Algorithms Group
Oxford, England/
Downers Grove, Illinois

The Numerical Algorithms Group develops and maintains mathematical and statistical software libraries for customers in industry, science and academia.

Before VAX, NAG had implemented their complex Mark 6 Library on 25 major machines, including the Burroughs 6700, CDC 7600, Univac 1100, and the IBM 370. The average implementation time was 13 man-weeks.

VAX took five.

In Dr. Ford's words, "A successful implementation requires the correct functioning of the 345 library routines to a prescribed accuracy and efficiency in execution of NAG's suite of 620 test programs. Whilst the activity is a significant examination of a machine's conformity to the ANSI standard of the FORTRAN compiler, its main technical features are file creation, file comparison, file manipulation and file maintenance."

And implementation performance was just the start. Dr. Ford comments on VAX's impressive record of reliability after the program was up and running: "No problems were encountered in the VAX/VMS software even though approximately 3000 files were being handled. The operational availability time for the machine was close to 100%, an outstanding statistic for new hardware and a new operating system.

"VAX," Dr. Ford concludes, "is an implementor's dream."

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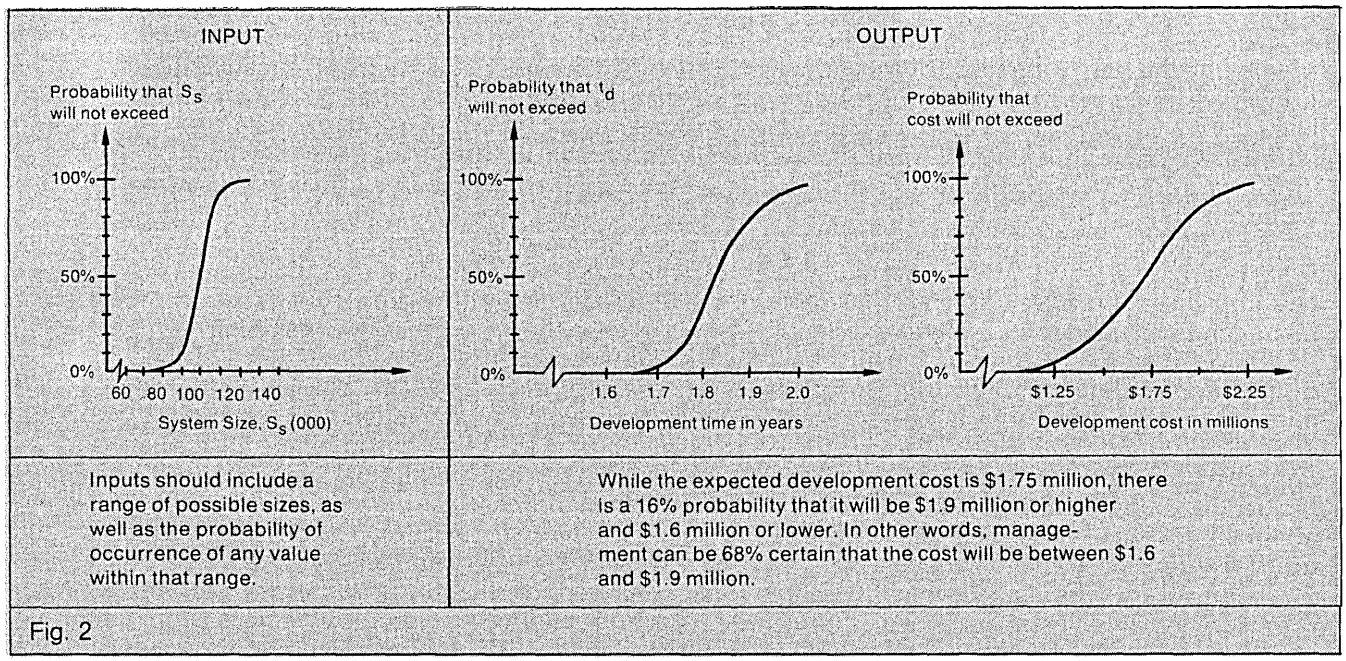


Fig. 2

a very good idea of what this will be for its particular organization; in fact, this is the only really good (stable) number we have in software development. In many industrial environments, this will be around $50,000 to $60,000 per man-year; government labor rates typically run about 10% to 30% less because of different methods of accounting for overhead. For SAVE, we assumed an average labor rate of $50,000 per man-year.

Multiplying this value by the estimates of man-years, we get an expected total cost of $1.77 million, with the range going from $1.3 million to $2.3 million. While this may seem like a disconcertingly large range, it is the best we can do at this time, given the uncertainties in our estimates of size. Moreover, it is very important to know that this uncertainty range exists and how big it is. Better to be approximately right than exactly wrong!

SIMULATION AND RISK ANALYSIS

While Table 1 gives a fairly broad range of solutions that answer many "what if" questions, they are based on the assumption that we know the input information exactly. Of course, we don't. Each input into the software equation (e.g., "the expected size of the final system is 98,475 source statements") involves its own degree—often a high degree—of uncertainty. This is where the element of risk enters the problem, and it is in the evaluation of this risk that the software manager has been able to get little help from currently available tools and techniques.

Let us look, then, at what the software manager really needs to know before he makes an investment decision.

Suppose a company is considering bidding on a large software project. The "best estimate" of the company's development cost is $1.75 million. However, there is also a 1-in-4 chance that the cost will be as high as $2.5 million, and a 1-in-4 chance that the cost will be as low as $1 million. Suppose this were a small software house and if the actual cost came in at $2.5 million it would put the company out of business. Management would be taking a 1-in-4 chance of going bankrupt if only the "best estimate" (expected value) were used. If a risk analysis had been performed, management might have chosen a safer approach.

How, then, does one determine this risk? Since almost every factor entering into our estimate of cost and schedule is subject to some degree of uncertainty, the manager needs to portray the effects of the uncertainty associated with each of these factors. Our objective is to get a realistic picture of the relative risk and the probable odds of coming out greater or less than the expected solution.

This is generally not feasible to do analytically but is nicely handled by Monte Carlo simulation. To carry out the analysis for SAVE, we performed the following steps.

1. Estimate the range of values for each of the key input factors—size of the system, difficulty of the system (handled by the constraint condition described earlier), average software development labor rate, and the probability distribution of the occurrence of each value.

2. Select at random from the distribution of values for each factor a single value. Combine each of these values for all factors and compute the time, effort, and cost for this combination of factors. For example, one combination might be a system size of 110,000 source statements, a gradient constraint of 18, and an average labor rate of $58,000/man-year. (More factors can be entered, depending on the particular problem being analyzed.)

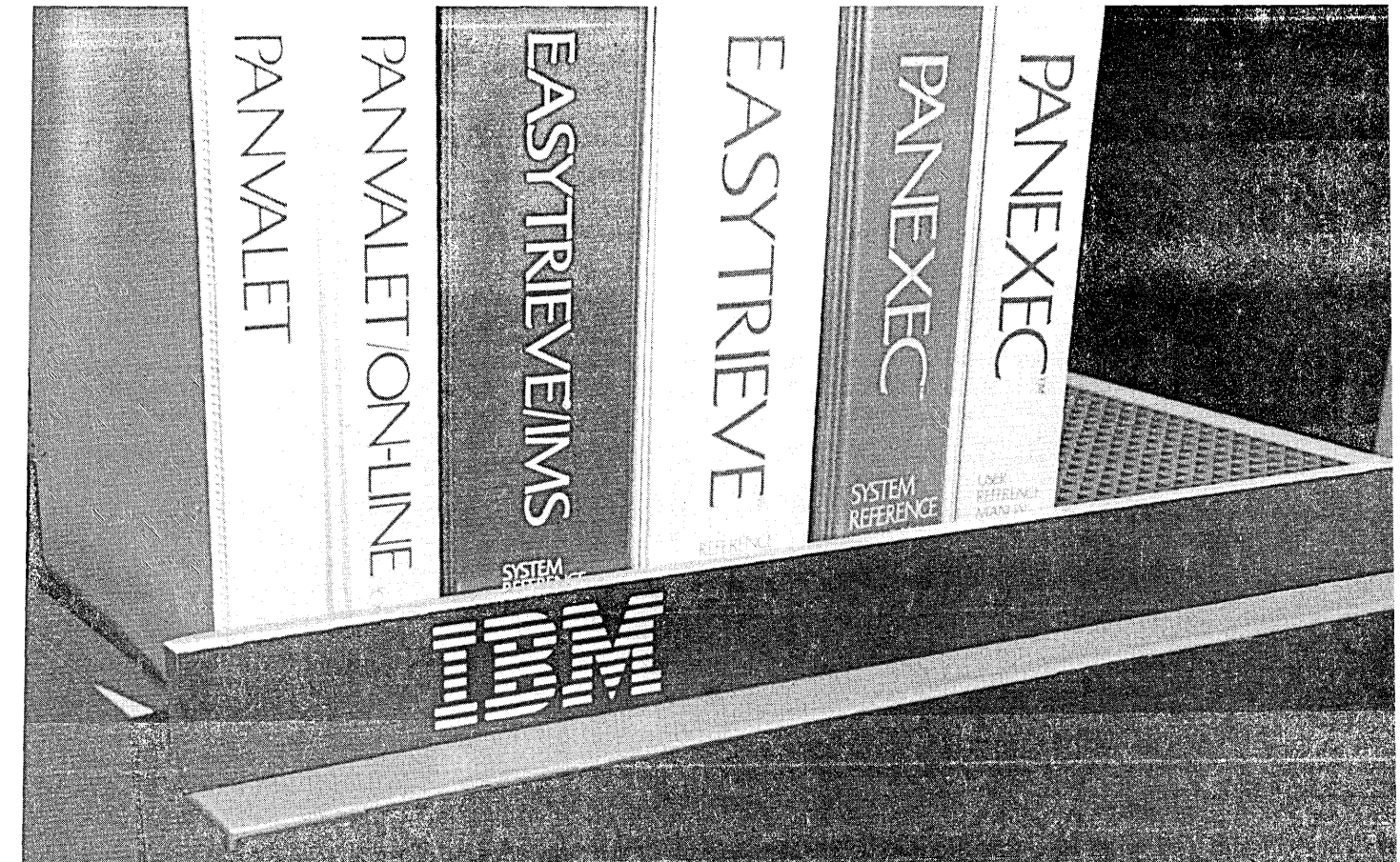
3. Run this problem on the computer several thousand times to define the outcome probability distribution. In other words, we want to find out not only that the expected (average) minimum development time is 1.8 years; we also want to know the probability of being able to complete the system by a contract deadline of two years.

The results of the simulation yield a much better estimate than just a single number answer. Note that the expected development effort is the same as the single point deterministic value. The expected development time is also the same. This is as it should be. The simulation produces the right expected (average) values. The real value of the simulation is an estimate of the variability of the outcome values—a feature heretofore not used in software cost estimating, but one that has been badly needed in view of the poor accuracy we have experienced.

The results of the SAVE simulation for development time, development effort, and development cost can be shown in the form of probability plots to generate the projections of risk as shown in Fig. 2. We can see from these plots that there is more than a 99% probability that the cost will not exceed $2.25 million. There is only a 1% probability (one chance in 100) that the cost will be as low as $1.25 million—given the uncertainties in our input information. As we learn more and more about the final system and development environment, we can reduce the uncertainties in our inputs, thereby reducing the risks in the final estimates.

The result for the development time is extremely important from a conceptual point of view. The small variability is both a curse and a blessing. It says we can determine the development time very accurately, but at the same time it tells us we have little latitude in adjusting the development time to meet contractual requirements.

For example, the standard devia-



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INPUTS (MANAGEMENT CONSTRAINTS)	
• Maximum number of people available at peak manloading (hiring constraint)	28 people
• Minimum number of people you want to have at peak manloading ("old faithfuls")	15 people
• Maximum cost	$2 million
• Maximum time (contract deadline)	2 years

OUTPUTS (TWO SOLUTIONS)	MINIMUM TIME	MINIMUM COST
t_d	1.83 years	2.0 years
Dev Effort (MY)	33.6 MY	24.4 MY
Cost	$1.68 M	$1.22 M

Table 2.

tion is 0.063 years or 3.28 weeks; this means that our 99% range on time is $6(3.28) \sim 20$ weeks.

This means that there is less than a 1% chance that development can be done in less than 1.6 years or a little over 19 months (1.8 years − .19 years = 1.6 years). Therefore, if the time schedule has been arbitrarily set by management or the customer at, say, 1.5 years, there is less than 1 chance in 100 of meeting this schedule. Similarly, we can be 99% certain that the minimum time schedule will not exceed two years.

This does not mean that if requirements change or delivery of a computer is late, the software will still come in at plus or minus 10 weeks of the expected time. These are external factors that will change t_d (development time) and must be specifically accounted for.

This is the curse. The system is very sensitive to external perturbation. Requirements changes and external disturbances (say, a 90-day delay in test bed computer delivery) will generally cause development time increments greater than two or three standard deviations.

However, management can use the knowledge of this great time sensitivity effectively in planning and contracting so that risk is always acceptable. The critical point is that time is not a free good. Development time cannot be specified by management; it is determined by the system. Software systems are inherently narrow band processes with sharp cutoff characteristics, and decisions need to be made with the minimum development time known beforehand. Until this fact is recognized and used, software projects will continue to "slip" and "overrun."

LINEAR PROGRAMMING TECHNIQUE

The solutions just presented are based primarily on characteristics of the software system itself. However, most managers must also deal with everyday concerns such as cost ceilings, contract deadlines, hiring practices, and capabilities.

Linear programming is a technique that produces the best possible solution to a problem bounded by an array of constraints. Typically, it is used on very large problems, such as optimizing the output of an oil refinery which is subject to such constraints as market demands and varying feedstock mixes. In the case of the software application, the mathematics is trivial, but all the power of the linear programming concept is brought to bear. More important, the manager has, for the first time, an opportunity to apply his own management constraints to the problem of developing large scale software systems.

DEV. TIME (YEARS)	MAN-YEARS	COST	
1.83	33.6	$1.68M	MIN. TIME SOLUTION
1.87	30.3	$1.52M	
1.91	27.8	$1.39M	
1.95	25.5	$1.28M	
2.00	24.4	$1.22M	MIN. COST SOLUTION

Table 3.

The linear programming algorithm allows us to enter as many of these management constraints as we need into the problem. Then we can solve the problem to either minimize or maximize some objective function (such as cost). In our case, we have two objective functions —cost and time—and usually a manager wants to minimize one or the other. For SAVE, we will solve the linear program twice, first minimizing time and then cost.

Table 2 shows the constraints entered by the manager and the two solutions provided by the linear program.

Our feasible development region is now identified in between these two solutions. In being able to invoke this powerful technique, we produce two constrained optimal solutions, the best that can be done within the constraints, and all other feasible effort-time choices. The simplicity of this statement should not cause us to overlook its importance. We have progressed from an inability to guarantee even one feasible solution to the ability to get all feasible choices and to select the best possible one from among those identified.

Let's examine the range of feasible, time-effort-cost combinations for SAVE identified in Table 3. This will let us identify excellent opportunities to save money on the project.

Note that we can save almost $500,000 by taking the maximum time and minimum cost solution. However, in doing this we increase our risk exposure. If we plan the job at t_d = 1.8 years and 35 man-years ($1.77 million), the probability that it will not take us more than two years to do is very high. But if we elect to take advantage of the trade-off law by planning the job at two years with 24 man-years ($1.2 million), we have reduced the probability that it will not take us more than the contract delivery time to 50%.

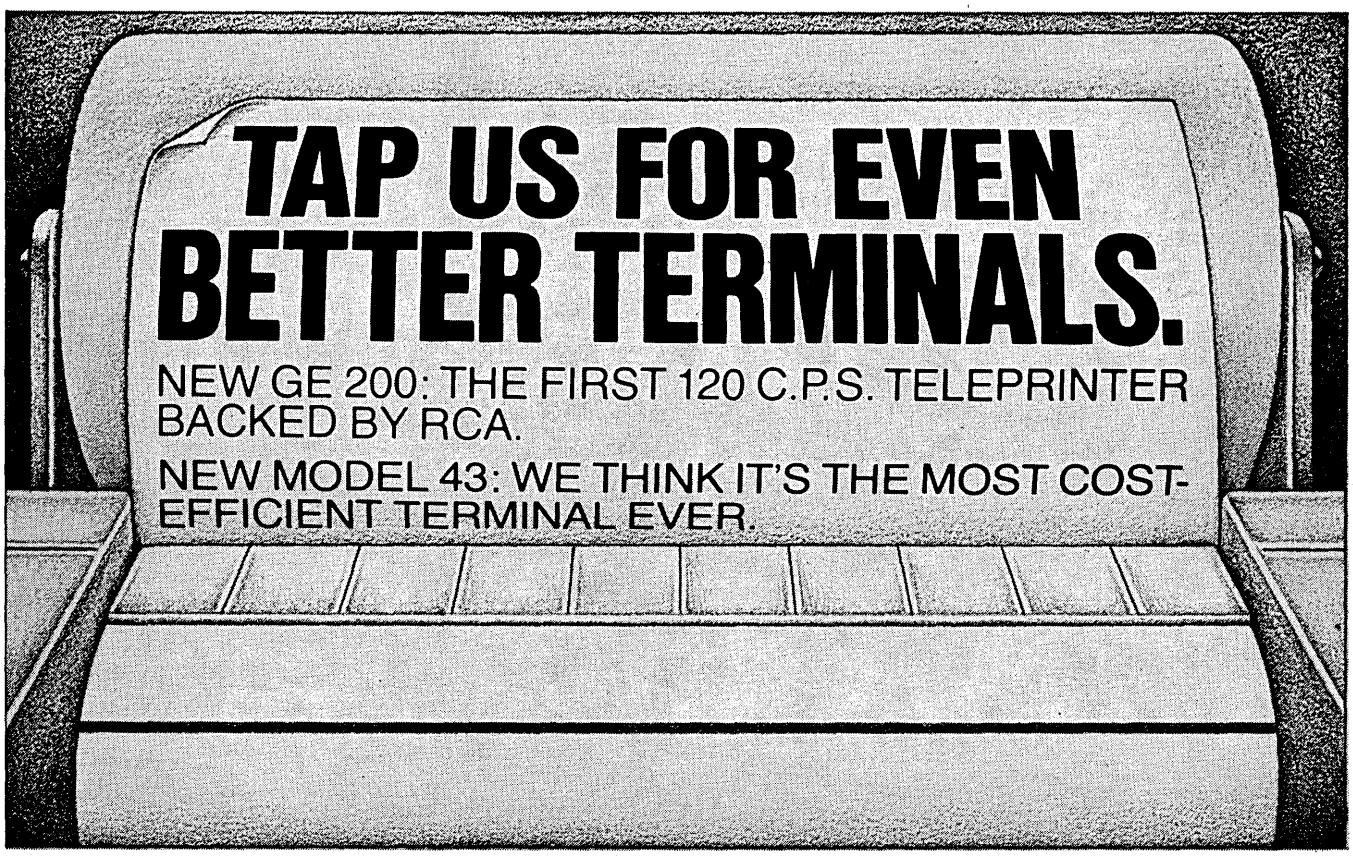
These odds are too low for most situations. However, a 90% probability may be very acceptable. This occurs at a planned development time of t_d = 1.92 years with 28 man-years of effort or $1.4 million. So it is possible to keep risk reasonable (<10% chance of exceeding delivery time) and save $300,000 compared with the minimum time solution.

The managerial questions—"Can I do it? How much? How long? How many people? What's the risk? What's the trade-off?"—can be answered with numbers.

With the application techniques described we have been able to quantitatively come to grips with the software cost estimating problem and produce reasonable engineering answers. We need only know the state of technology we are going to apply to the development (C_k), estimates of the number of lines of code, and the software equation which we solve along with a constraint relationship to get the management parameters (K, t_d) of the Rayleigh/Norden equation. Simulation provides suitable statistics for risk estimation. The linear programming alternative provides constrained optimal solutions and the range of all feasible solutions.

The economics of the software development process is startling. The indications are clear that apparently innocent management choices can be made that affect cost by multiples of 5 to 10. With that kind of variation on multimillion dollar projects, managers need to know the choices, sensitivities, and influences they can bring to bear, over the whole life cycle, and in numbers. ✲

(This is the second of three articles. Part 3 will appear in the November issue.)



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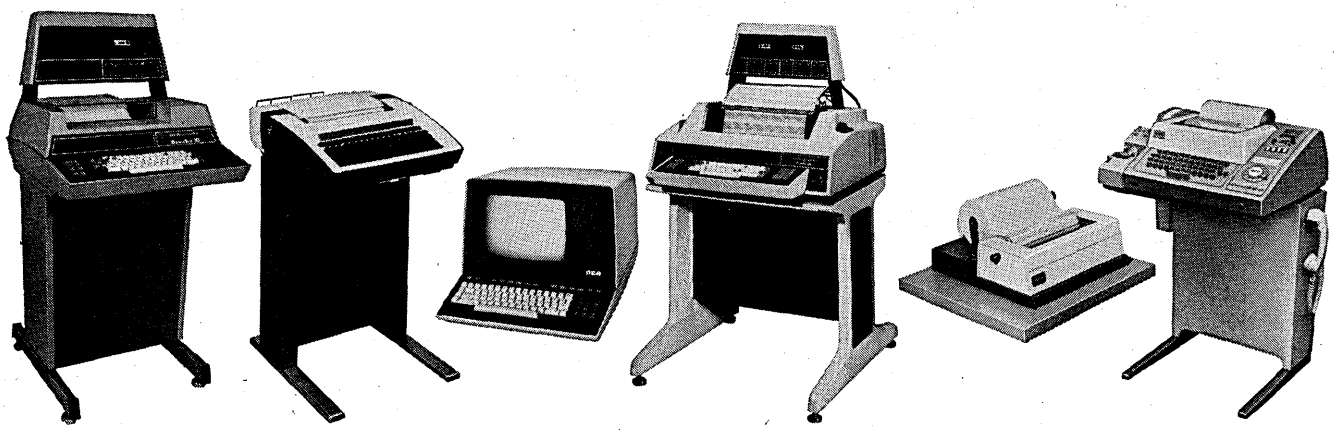

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NOT QUITE A FIRST

HERBERT B. SAFFORD—"The ingredients are the same. Only the magnitude is different."

As chairman of the 1980 NCC, to be held May 19-22 in Anaheim, Herbert B. Safford, a former international president of the Data Processing Management Assn. (DPMA) will be drawing on a number of years of experience in heading up DPMA conferences both national and international. "The ingredients are the same. Only the magnitude is different."

Safford doesn't think the 1980 NCC will draw the 80,000 attendance that the 1979 conference in New York City did, but he does feel the Anaheim turnout could top 60,000.

"We're drawing on comments from past shows and we're returning to the statistics of the 1978 NCC in Anaheim when the sessions and exhibits were under one roof. Topics that didn't draw well then will not be repeated."

He said in late summer that a theme had not been selected and that "I'm not convinced you really need a theme." He also said there will be a concentration of sessions on the use of computers in the entertainment industry. Safford, who was instrumental in DPMA's becoming a constituent society of the American Society of Information Processing Societies (AFIPS), sponsor of the NCCs, is the first DPMA person to chair an NCC. "I instituted negotiations with AFIPS in 1972," he recalls. "I laid the groundwork for affiliation and the actual invitation [to join AFIPS] was extended in 1973."

Safford, technical training supervisor for GTE Data Services, Inc. in Marina del Rey, Calif., has had some 38 years of data processing experience. He has been with GTE for 25 years and held positions in marketing, project management control, office services, and word processing in addition to his present duties.

A native of Slalington, Pa., Safford attended Rider College in Trenton, N.J., where he majored in business administration. He migrated to California prior to World War II and spent eight years working in dp for Lockheed Aircraft Corp. and five years managing a dp service bureau in Los Angeles before joining GTE. He is a holder of the Certificate in Data Processing (CDP) and was one of the founders of the Institute for Certification of Computer Professionals (ICCP).

His other AFIPS responsibilities include chairmanship of the Social Implications Committee and membership in the Professional Standards and Practices Committee. Charter of the former, Safford said, is "to study the impact of computers on society, but so many people are doing that these days that I wonder if it's needed as an AFIPS committee. I've thrown that question back to Hoagland [Dr. Albert S. Hoagland, AFIPS president]." The second committee, he said, is involved in developing a series of best practices manuals. "We want to tie them to a high integrity computer system, one like air traffic control or banking, where the public would be involved."

PRESIDENT AT 26

CHARITY ENGEL CHEIKY—"There's plenty to do."

At 26, Charity Engel Cheiky is president of a computer company in Aurora, Ohio, that expects to gross $20 million this year. This wasn't what she started out to do. Following graduation from Hiram College, Hiram, Ohio, she worked for a year as a high school teacher.

Then she and her husband, Mike, 27, and a former college professor of theirs, Dr. Dale Dresibach, founded Ohio Scientific "to make educational aids and employ college students part time." That was in 1974. Things did not go well at the beginning. "Our first products didn't even make a dent in the market."

But then came the mass production of microprocessors. Ohio Scientific built products around them, advertised, and found the world beating a path to its door. Mike designs the equipment, Dreisbach advises and Charity handles the company's finances and day-to-day operations.

The company really dates back to 1972, when Charity and Mike, both undergrads, got their hands on an IBM 1620 at a government surplus sale. Mike had it working within 48 hours.

Today the company has 250 full-time employees, 76,000 square feet of office and plant space in Aurora, another 30,000 square feet under construction, and a small sales and repair office in California. It offers some 350 products in the personal, home, and small business computer markets.

No rookie in the run-your-own-business arena, Charity learned from her parents, who owned their own small retail business. "The reading material in the bathroom," she recalls, "was *Fortune* and *Business Week*. Not only were you responsible for getting your homework done, but also to see if you could help out Dad."

This background has stood her in good stead in her dealings with the 300 computer dealers who handle Ohio Scientific's products. "I emphathize with things like cash flow, inventory, and customers who take up two hours of time and then buy one dollar's worth of goods because they feel guilty."

Like all company heads, her office hours are anything but routine. Her days are spent handling "fire-fighting" chores. "That's everything from working with vendors on getting payments or parts, to production problems, sales problems, and production planning.

"In other words," she adds quietly, "there's plenty to do." ✲

THE CHIPS ARE STACKED

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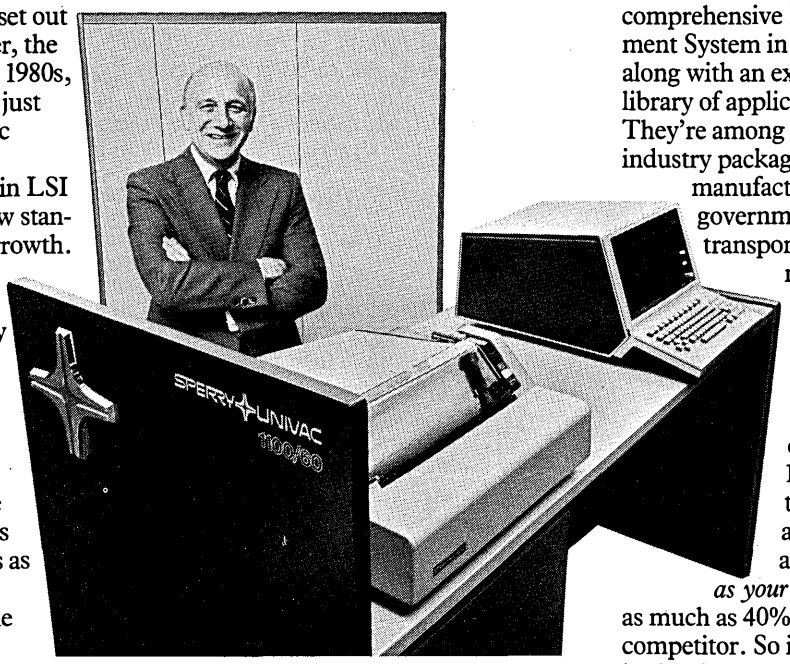


Five years ago, we set out to build a new computer, the vanguard system of the 1980s, if you will. And we did just that—the Sperry Univac 1100/60 system—a breakthrough, not just in LSI technology, but as a new standard in reliability and growth. We did it by stacking the chips in your favor. These chips are actually microprocessors put together in a totally unique way, so *they* become a large scale mainframe themselves. In a very real sense, the 1100/60 harnesses scores of miniature computers as a team to perform the work of a giant. And the benefits are just as big:

Reliability... The 1100/60's multiple microprocessor architecture makes it the most reliable general purpose large-scale computer commercially available. For instance, it's the first system that can afford to calculate everything twice, then compare the results—all through 100% paralleling of instructions. The 1100/60 hardware detects, resets and retries automatically, eliminating more than 95% of all single-chip failures...a new industry standard for system availability.

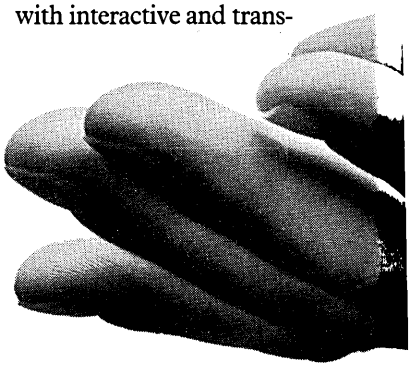
Growth Path... With the 1100/60, you can get only the power you need *as you need it.* There are six processing levels within the series, from entry level all the way into our 1100/80 range. That's a five-fold increase in capacity just by adding modules at your site. No swapout and no interruption. Overall, it can grow twelve-fold with easy migration into the top-end 1100/80 series.

Investment Protection... State-of-the-art technology...extended growth potential...systemwide compatibility. It adds up to investing in a sure thing: a computing capability that'll continue paying dividends for years to come.

And the highly acclaimed Series 1100 Operating System is just another plus. It supports the most comprehensive Data Base Management System in the business... along with an extensive, expanding library of applications software. They're among the best specialized industry packages available today—manufacturing, airlines, government, energy, transportation—just to name a few.

Price/Performance... More uptime through higher reliability, alone, might be enough to give the 1100/60 its edge. But there's more. You get a price/performance advantage that grows *as your requirements grow,* to as much as 40% over the nearest competitor. So it pays you to come in, but it pays you even more to stay.

The 1100/60 performs well and economically, no matter what the task or configuration. It's just as efficient with batch as it is with interactive and trans-



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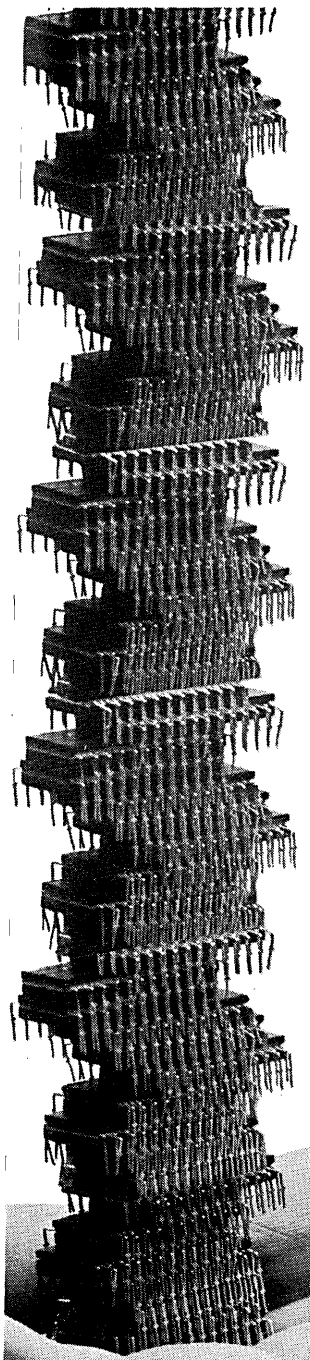

IN YOUR FAVOR.

action processing...and as comfortable in a centralized mode as it is managing a fully distributed communications network. Or it easily accommodates any combination of them all. And for extra performance there's the byte instruction set.

Ease-of-Use... As an 1100/60 user, you'd always have ready access to the right data, when and where you need it. That means full, on-line data base support for all those major decisions. And you don't have to be a computer expert. But if you are, the 1100/60 has a procedural language capability that virtually eliminates routine coding. You can have more time for creative programming and increase your productivity at the same time.

Maintainability... We know the 1100/60 is the most reliable computer we've ever made. And its instruction duplexing really puts it way out front. But things can happen. So the 1100/60 comes with its own System Support Processor. The SSP, a computer in its own right, performs all routine maintenance and runs diagnostics on the mainframe to monitor its *electronic heartbeat.*

For backup, there's the Sperry Univac multimillion-dollar Total Remote Assistance Center. A special hookup to the Assistance Center is built into every 1100/60 for immediate on-line diagnostics, 24 hours a day, seven days a week.

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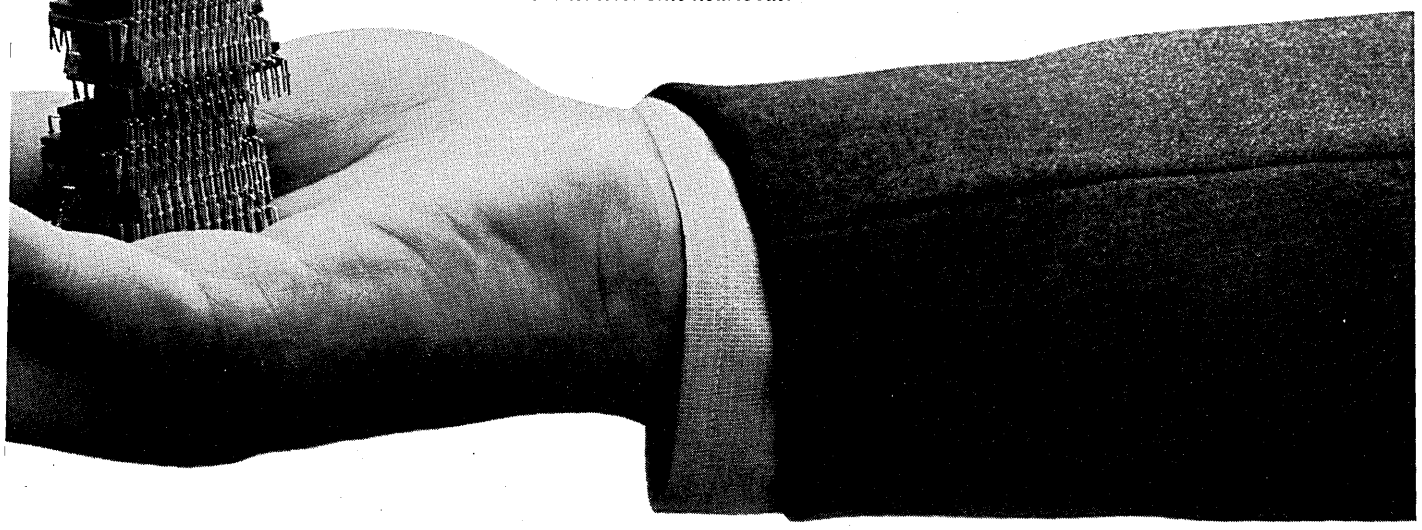

1100/60 COMPUTER.

SPERRY UNIVAC

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HARDWARE

OFF-LINE

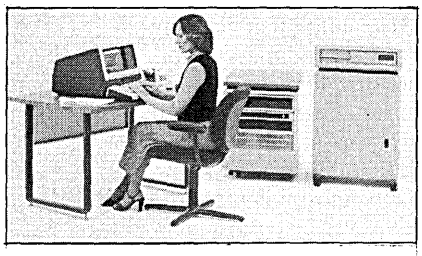
If the prognostications of Creative Strategies International, the San Jose, CA., market research and consulting firm, hold true, miniaturized disks will be a major force in the future. Over the next two years, the firm expects several new technologies to emerge, technologies such as very low cost consumer/commercial grade 5-inch floppies, 8-inch Winchesters, and even smaller 4- to 6-inch flying head micro-Winchesters. Japanese-built, low-cost minifloppy drives, made on the assembly lines currently used for cassette and 8-track decks, will hit the U.S. market by year's end, the firm predicts.

As for currently available disk technologies, the 1979 Disk Trend Report predicts that fixed disk drives in the 30MB to 200MB will grow in revenues through 1982 faster than any other group of moving head disks. The Mountain View, CA.-based Disk/Trend projects an annual growth rate of nearly 65% for these drives over the next three years.

Vendors of consumer electronics, particularly video and microcomputing equipment, may be looking for a toehold in the international market. According to Technology Marketing Analysis Corp. (TMAC), San Francisco-based reps for the TV-Microelectronics and Microprocessing Exhibition (TV-MEX, Jan. 15-18, 1980, National Exhibition Center, Birmingham, England), the current U.K. market for consumer microelectronics and television exceeds $1 billion annually. By 1985, TMAC says, the French market for microelectronics will pass the $500 million mark.

COMPUTER

A new lower-priced system has joined this vendor's 3000 series of computers. The 3000 Series 30, with prices starting at $49,750, should appeal to smaller users and large concerns wishing to install distributed processing nodes in locations not needing larger systems for local processing. Compatible with the larger members



of the 3000 family, the new system runs the same operating system (MPE-III), five high-level languages (BASIC, COBOL, FORTRAN, RPG, and SPL), data base software, and Distributed Systems Network (DSN) software. To off-load the cpu in a communications environment, an intelligent network processor (INP) has been developed for the entire 3000 family.

The 3000 Series 30 uses the same silicon-on-sapphire central processor used in the 3000 Series 33. The two systems differ in packaging and expandability: the 30 comes in a single bay (the 33 has two bays) and supports up to two communications lines, compared to a maximum of seven communications lines on the 33. In its basic configuration, the Series 30 includes 256Kb of memory, a 1Mb floppy, four asynchronous terminal ports, system/maintenance console, 20Mb of rigid disk storage, and eight expansion slots. The system can grow to 1Mb of main memory, 960Mb of disk, 32 terminal ports, four mag tape units, and two line printers. Two communications lines can be added, with each replacing four terminal ports. The system runs off standard 120 volt power, draws 15 amps, and requires no special air conditioning. IMAGE/3000 data base management software, QUERY, VIEW/3000 business forms generating software, and KSAM/3000 file access software are now bundled with all 3000s.

The INP, which works with any 3000, is an SOS microprocessor-based front end communications processor. While its primary application appears to be within the vendor's Distributed Systems Networks, it also can help in RJE situations. The INP supports communications at speeds of up to 56Kbps. It lists at $4,500. HEWLETT-PACKARD CO., Palo Alto, Calif.

FOR DATA CIRCLE 421 ON READER CARD

TAPE DRIVE

The TS11, a 45ips, 1,600bpi tape system, consists of a transport with integral formatter/controller, and single hex-size interface module for the PDP-11 Unibus. A four-chip microprocessor assembly provides self-diagnostics, speed control, read/write voltage threshold level control, and formatting. Read-after-write input verification, phase-encoded error correction, and parity checking along the entire data path are standard. Prices, including power supply and interface, are

$12,900 and $14,350, for rack- and cabinet-mounted versions, respectively. DIGITAL EQUIPMENT CORP., Maynard, Mass.

FOR DATA CIRCLE 422 ON READER CARD

FIBER OPTICS

A 32-channel fiber optic digital data link from this vendor provides interference-free communications over distances of up to 6,500 feet. Intended for computer-to-computer and computer-to-peripheral links, the system uses time division mul-

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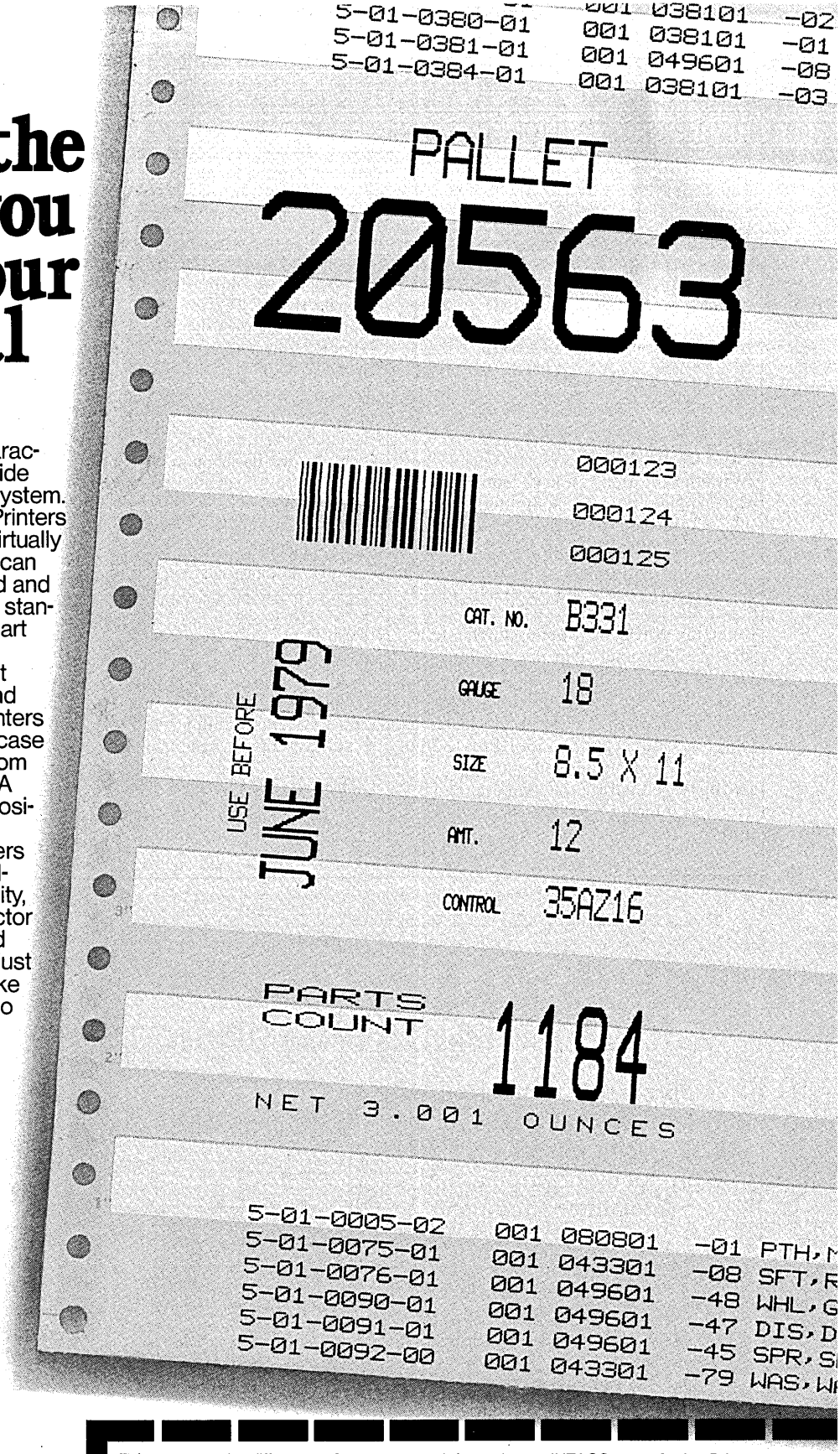

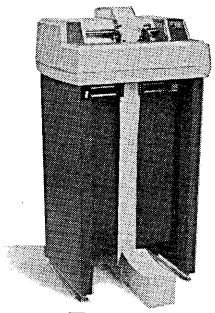

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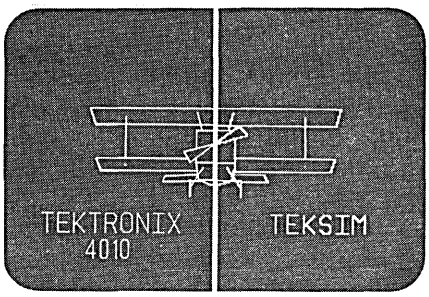
HARDWARE SPOTLIGHT



APPLE GRAPHICS

With the addition of a ROM from this vendor, Apple II personal computers can emulate Tektronix 4010-series graphics terminals. Dubbed Teksim, for Tektronix simulator, the ROM plugs into the Apple's motherboard and makes use of the Apple's high-resolution graphics capabilities. In addition to 4010 functions, the Apple retains its color graphics and selectable erase capabilities. Two caveats: the Apple's resolution is only about one-quarter that of Tektronix 4010 terminals, and the Apple uses raster scan displays so diagonal lines may look a trifle jagged. Still, at $795 (suggested retail price), Teksim is a relatively economical way to take advantage of the many graphics packages written for Tektronix equipment and available on many time-sharing systems. Teksim was developed by ABW Corp. of Ann Arbor, Mich.; this vendor handles U.S. marketing. CYBERSOFT SYSTEMS, Rochester, Mich.

FOR DATA CIRCLE 420 ON READER CARD

tiplexing. In asynchronous applications, up to 32 channels can operate independently at up to 50Kbps each (or 16 channels to 100Kbps each, or eight channels to 200Kbps each). Externally clocked synchronous rates are to 500Kbps (32-bit parallel), 1Mbps (16-bit parallel), and 2Mbps (8-bit parallel). Computer and peripheral interfacing can be supplied conforming to RS232C, MIL-STD-188C or other specifications. The system consists of two interface electronics units, interconnected by a fiber optics cable. The 32-channel full-duplex system sells for $12,000, plus cable. HARRIS CORP., Fiber Optic Systems, Melbourne, Fla.

FOR DATA CIRCLE 423 ON READER CARD

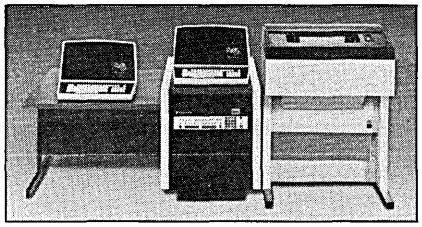
CRT TERMINAL

Designed for use with this vendor's time-sharing systems, the model 8200 Datastation is an 80-column by 24-line upper and lower case ASCII terminal. The 8200 has an RS232C interface (but note that the vendor uses a 50-pin connector, so use with other vendors' machines may require jerry-rigging a connection). Independent send and receive data rates (to 9,600bps) and other configuration parameters are set from the keyboard. The terminal also supports a variety of the vendor's serial printers (80cps to 340 lpm). An 11-key calculator-style numeric keypad and a group of 10 programmable function keys are provided. The 8200 sells for $1,450. It can be leased for $47 per month on a three-year lease. DATAPOINT CORP., San Antonio, Texas.

FOR DATA CIRCLE 424 ON READER CARD

SMALL SYSTEM

With an eye toward making further sales within its existing customer base and bringing other large organizations into the fold, this vendor has developed a small entry-level system for its SYFA product line. A two- to four-terminal system designed for dedicated applications and occasional communications with a central host, the SYFA JR-200 is software-compatible with existing SYFA systems, and field



upgradable to "senior" SYFA status. JR-200 also can be assimilated into the vendor's SYFA Virtual Networks. The system is offered in two configurations. For $29,950, a customer gets a 128KB processor, 32MB of disk, two crt terminals, 150cps printer, and 3780 RJE communications. The second configuration, priced at $39,950, substitutes a 600 lpm printer for the 150cps printer. Software—SYCLOPS virtual memory operating system, SYBOL applications language, utilities, programming aids, and 3780 communications emulator—are bundled with each system. COMPUTER AUTOMATION, INC., Commercial Systems Div., Irvine, Calif.

FOR DATA CIRCLE 425 ON READER CARD

COMMUNICATIONS TESTER

The 12-pound model 833 Data Comm Tester is a portable test device for field technicians. Intended to isolate the failed element of a downed network, the 833 can simulate data communications equipment (DCE) to test terminals or the cpu, and it can perform bit error rate test (BERT)/block error rate test (BLERT) to check modems and phone lines. The 833 has an RS232 interface, and can operate at speeds of up to 9,600bps, full or half

Announcing an Important Acquisition:

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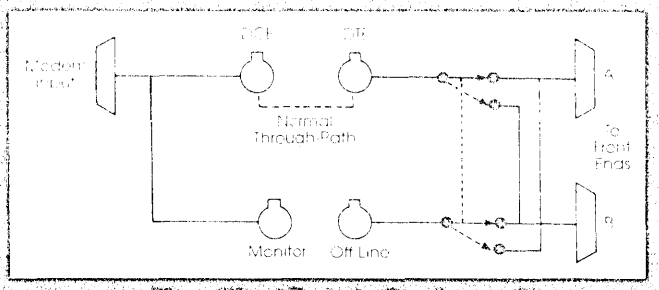
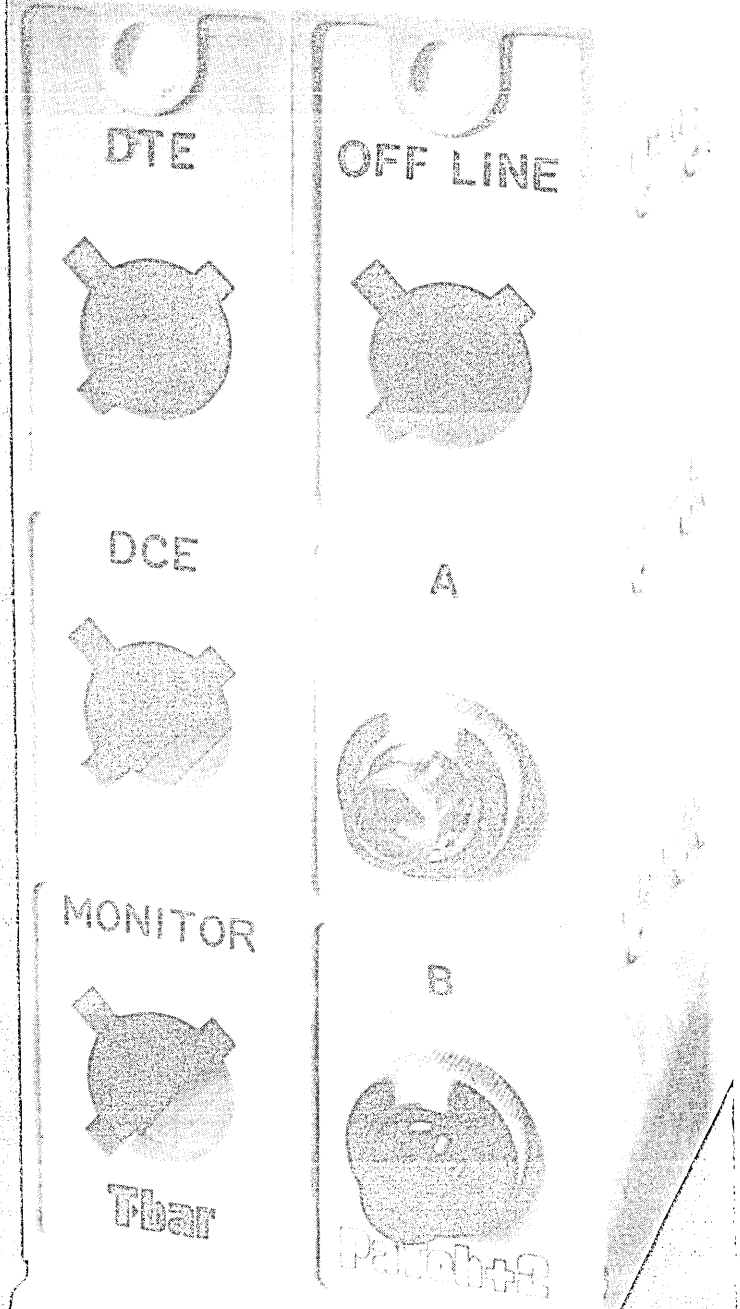
PaTch+2 with a fourth patch jack, makes the off-line DTE available for testing or additional patching. Patch+2 assures total System Availability for on-line network monitoring, diagnostics and back-up.

Local pushbutton control at the module or remote control from a distance provides the flexibility to operate Patch+2 modules singly or simultaneously in groups of 8, 16 or more.



Simplified Patch+2 schematic



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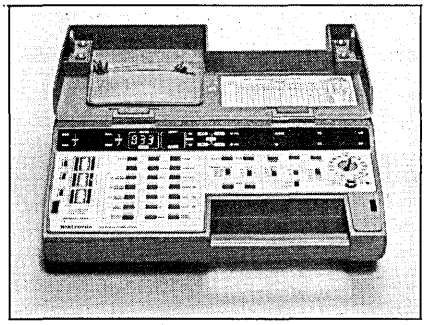
CIRCLE 59 ON READER CARD

HARDWARE



duplex, synchronous or asynchronous. It also can monitor HDLC/NRZI protocols. Standard stored test messages are provided, and a customized user PROM allows storage of product-specific test messages. Pricing for the 833 starts at $2,750. TEKTRONIX, INC., Beaverton, Ore.

FOR DATA CIRCLE 426 ON READER CARD

PASCAL GRAPHICS SYSTEM

A color graphics system supporting UCSD PASCAL, the 6114 Colorgraphic Computer is suitable for either standalone applications or use with a host computer. The system consists of a Z-80-based microcomputer with 64Kb of memory, 250Kb floppy drive, pedestal display unit, and PASCAL software. A crt-oriented editor, assembler, linker, and file manager also are supported. Optional interfaces are offered for RS232 communications, printers, plotters, and graphics tablets. The 6114 has a graphics refresh memory of 256 by 320, with 240 by 320 displayable pixels. Pricing starts in the neighborhood of $12,000; for a 6114 with black-and-white display (upgradable to color) the price is about $1,000 less. RAMTEK CORP., Santa Clara, Calif.

FOR DATA CIRCLE 427 ON READER CARD

FAST FAX

The Telecopier 485 is this vendor's fastest facsimile machine, with a transmission time for a typical one-page business letter of about one minute. Skipping the white space between lines, the 485 sends only the contents of the letter. Short letters or documents may take less than a minute for transmission. This high-speed transmission rate applies only to communications between 485s; the 485 is also compatible with the other members of the vendor's facsimile transceiver lines, including the portable Telecopier 400 and the automated model 200.

The 485 prints on thermal paper fed from continuous rolls. An automatic document feeder that can hold up to 30 documents of mixed lengths and weights allows an operator to initiate a transmission and then transmit multiple pages without further operator intervention. Auto answer allows the 845 to receive documents unattended. Purchase price for the Telecopier 485 with document feeder is $6,500. On a one-year agreement, the 485 rents for $230 a month. Order taking begins in five cities (New York, Washington, D.C., Houston, Chicago, and Los Angeles) in January, with marketing extended to over 50 U.S. metropolitan areas in the course of 1980. Deliveries begin in the second quarter of 1980. The 485 was developed by Fuji Xerox Co., Ltd., in Japan, and will be manufactured there. XEROX CORP., El Segundo, Calif.

FOR DATA CIRCLE 428 ON READER CARD

LINE PRINTER CONTROLLER

For use with Perkin-Elmer (Interdata) processors, this vendor's line printer controller provides an industry standard Centronics/Data Products/Data Printer interface. Software compatible with OS/16, OS/32, and diagnostics, the controller plugs into any available I/O slot in either 16-bit or 32-bit processors. The controller handles transfers at up to 50Kbps (3,700 lpm). Switches are used to select device parameters, such as device address and printer type. A single controller sells for $650, including cables, mounting hardware, and user's manual. Discounts are offered to oems. MACROLINK, Anaheim, Calif.

FOR DATA CIRCLE 430 ON READER CARD

HARDWARE

TERMINAL

The Series 300 Interactive Display System in this vendor's initial product offering. First in a family of multifunction clustered display systems, the Series 300 emulates an IBM 3270 Information Display System. Series 300 displays support standard 24-line by 80-column and expanded 27-line by 132-column display formats. The system communicates over bisync lines; SNA/SDLC support is expected early next year. Up to 32 devices—display stations and printers—can be supported on a controller. A typical Series 300 system, with seven displays and a 180cps printer, runs $811 per month (plus maintenance) on a three-year lease. LEE DATA CORP., Minnetonka, Minn.

FOR DATA CIRCLE 429 ON READER CARD

SYSTEMS

A five-member family of distributed data processing systems from this vendor is intended to cover the market addressed by IBM's 8100s and its competitors. In terms of performance, the family consists of three members smaller than the IBM 8130, one between the 8130 and 8140, and one member above the 8140. The five compatible models—600/15, 600/25, 600/35, 600/45, and 600/55—all run the vendor's Distributed Processing Executive (DPEX); users can program applications in Editor, a COBOL-like language that requires the user to write only a procedure division. The systems support communications (both batch and interactive using 3741, 2780, 3780, HASP multileaving, and 3270 protocols), local file processing, data base inquiry and update under a DBMS, data entry, and word processing.

All five systems, which are planned to phase out the existing 600/10, 600/20, etc., product line, are based on a minicomputer the vendor builds under license. This mini accepts the Data General Nova instruction set, as well as some additional instructions the vendor found desirable. The three smallest systems (15, 25, and 35) each cycle at 1,100nsec and offer virtual memory spaces ranging from 300Kb to 2Mb. The 600/15 is a diskette-based system that supports two terminals, a printer, and two communications lines; with software and a 165cps printer it sells for $31,450. The next larger system, the 600/25, is intended to be used as a remote terminal system for the three larger family members. The 25 supports up to six terminals, a 1Mb virtual address space, one communication line, 4.8Mb of disk, and printer. With four workstations, one diskette drive (315Kb), a 45cps terminal printer, and a 165cps printer, and software including word processing, the 25 sells for $45,070.

Smaller, remote offices may opt for the 35, which can support up to eight terminals, up to 9.6Mb of disk, and up to two communications lines. The 35, with six workstations, mag tape, 300 lpm printer, 45cps terminal printer, HASP communications, and software (including word processing), sells for $69,670. The 600/45 and 600/55 both have 8Mb virtual address spaces; the 45 uses a 700nsec processor, while the 55 cycles at 450nsec. Capable of supporting up to 132Mb of disk, the 45 supports up to 16 terminals; with 10 workstations, 33Mb of disk, mag tape, printers (600 lpm, and two 45cps), 3270 communications, and software, the 45 sells for $117,040. At the high end of the family, the 600/55 offers up to 32 terminals and 264Mb of disk. Configured with 16 terminals, 66Mb of disk, mag tape, printers, 3270 and HASP communications, and all software, the 600/55 sells for $159,050. Monthly lease rates (including maintenance) on a five-year term, for the five systems, are $761, $1,173, $1,787, $2,849, and $3,953, respectively. NIXDORF COMPUTER CORP., Burlington, Mass.

FOR DATA CIRCLE 431 ON READER CARD

NUMERIC KEYPAD

The KeyPad is a 13-key numeric pad for use with Apple II personal computers. For handheld or desktop use, the KeyPad has

keys for the 10 decimal digits, plus decimal point, minus sign, and ENTER keys. KeyPad lists at $125. ADVANCED BUSINESS TECHNOLOGY, INC., Saratoga, Calif.

FOR DATA CIRCLE 436 ON READER CARD

PLOTTING

A six-foot-wide drum plotter and an on-line plotter controller are the latest additions to this vendor's line of graphics products. The wide drum plotter, known as the 1065, uses continuous rolls of paper and plots at speeds of up to 30ips. Resolution is 0.0005 inches. The plotter has four program-selectable pens, and can operate in on-line, off-line, or remote/time-sharing environments. The 1065, available with interfacing for most mainframes and minis, sells for roughly $51,000.

Essentially an intelligent interface, the model 907 graphics controller supports both local and remote plotting. Remote plotting is possible using a modem and the 907's RS232 interface; 20mA current loop and IEEE parallel inputs also are supported. The 907 includes firmware for generating plotter commands for drawing lines, dashes, arcs, circles, and characters, which can be scaled and rotated. The 907 works with the vendor's drum plotters. The controller sells for $5,060. CALIFORNIA COMPUTER PRODUCTS, INC., Anaheim, Calif.

FOR DATA CIRCLE 432 ON READER CARD

EXTENDED MEMORY

The 8640 is a solid state alternative to extended core storage (ECS) for use with Control Data 6000-series, Cyber 70-series, and Cyber 170-series number crunchers. Available in capacities ranging from 512Kwords to 4Mwords, the 8640 replaces both the CDC 6640ECS controller and 7030 ECS. The memory system includes single-bit error correction and double-bit error detection. Four ports are provided for connection to cpus or DDPs (Distributed Data Paths). The 8640 has a 250nsec access time, 450nsec cycle, and a transfer rate of 10Mwords per second. Occupying roughly 30 inches by 65 inches of floor space, the 8640 runs off of 208-volt, three-phase power, with a 2Mword system drawing a maximum of 4 amps. A typical 1Mword system, capable of replacing both ECS and controller, sells for $600,000. INTERMEM CORP., Poughkeepsie, N.Y.

FOR DATA CIRCLE 434 ON READER CARD

SYSTEM

A smaller model has joined this vendor's Information system series. The Information 500, based on the vendor's model 350 processor, can support up to eight users, each with a virtual address space of up to 768Kb. The 500 runs the PRIMOS operating system, common to all the vendor's computers. The systems also can participate in networks under the vendor's PRIMENET software. Applications can be programmed in Inform, a proprietary, English-like language that lets users retrieve, update, and manage data through local or remote on-line terminals. Additional language processors for BASIC, COBOL, FORTRAN, PL/1, and RPG are priced separately. A basic Information 500 system, priced at $46,600, consists of processor with 256Kb of error correcting memory, 32Mb of disk, system crt console, character printer controller, and Information system software. A larger system, consisting of 512Kb processor, 80Mb disk, system crt, character printer controller, 800bpi 45ips tape drive, and Information system software, carries of $70,600 price tag. PRIME COMPUTER, INC., Wellesley Hills, Mass. ✲

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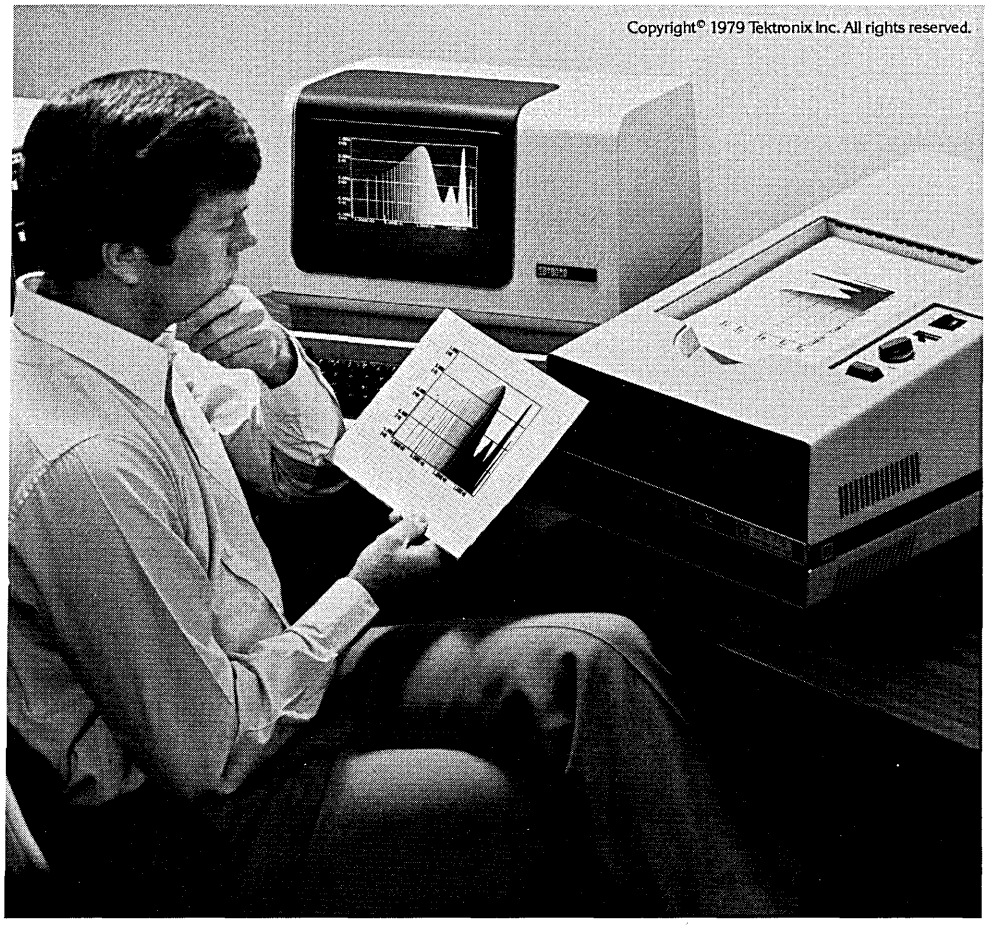

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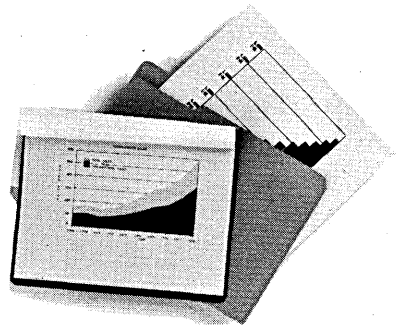

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SOFTWARE AND SERVICES

UPDATES

A 50% reduction in translation time is being cited by ITA International, Inc., vendors of the ITATS computerized translation system. The Kansas City, Mo., firm's translation tool is being used to prepare advertising materials, instruction books, and maintenance manuals. Currently the system contains about 5 million language equivalents covering better than 9,000 product and subject categories. French, Spanish, and German language equivalents can be retrieved to match translator-supplied English input. Comparisons of translator logs of traditional versus computerized translations show "a 50% reduction in translation time, " according to ITA president John M. Kirk.

A "validation suite" for Pascal has been developed at the University of Tasmania. Developed under the auspices of the Pascal Users Group, the suite consists of 283 programs. About 150 programs check that compilers and machines conform to the Pascal standard; other remaining programs check for implementation-defined features and the likes. The programs are distributed on mag tape for a $50 fee. U.S. distribution is being handled by Richard J. Cichelli, of the American Newspaper Publishers Association Research Institute, P.O. Box 598, Easton, PA 18042.

A new program leading to a master of software engineering degree began this fall semester at Texas Christian University in Fort Worth. The program, directed by Dr. A.A.J. Hoffman, will require 40 hours of specially designed courses in economic management, communications skills and technical design.

TAPE UTILITY

The Quick OS Label Display (QLAB) allows display of IBM OS/DOS standard tape labels on the OS system console device. ANSI labels aren't supported; if an ANSI label is found, QLAB indicates the fact. Running as a system task, QLAB can be invoked by the operator from any master, secondary, or alternate console device. The package can process multiple files from a tape volume; multiple tape volumes also are supported, and need not be entered in the sequence created. QLAB indicates when it encounters an unlabeled tape, and it alerts the operator when a tape's density isn't compatible with drive on which it is mounted. QLAB runs under any current release of OS/MFT, OS/MVT, OS/VS1, or OS/VS2 (SVS or MVS). QLAB goes for $1,200 per installation site; leases, for a minimum term of one year, go for $25 per month. SYSTEMS SOFTWARE INTERNATIONAL, INC., Miami, Fla.

FOR DATA CIRCLE 443 ON READER CARD

CICS DEVELOPMENT AID

Trans IV, an interactive processing system for CICS/VS installations, is said to simplify development of CICS applications systems. Under Trans IV, the applications development process, including testing and debugging, is interactive. The system can be used to interactively create inquiry, data entry, and update screen formats and asociated procedures for on-line systems. Trans IV handles formatted display screen definitions, integrated application procedures, formatted file defini-

TINY-C

tiny-c is a stripped down version of C, the language developed at Bell Labs by Kernighan and Ritchie. The language is a giant step forward for BASIC users. Modern in its philosophical underpinnings, structure is emphasized. There seem to be few of the syntactical oddities that mar older higher-level languages. Lacking a GOTO and including a WHILE, the language seems to fulfill most of the contemporary ideas about structured programming.

I particularly like the treatment of statement nesting, local and global variables, and the generality of expressions. The standard library functions seem more than sufficient for most jobs.

Tiny-c has been implemented on several machines. On the TRS-80 (16K Level II), the user must deal with system limitations that force odd constructs. For example, the absence of brackets, [], requires the substitution of arrows, ↓↑. The forced use of upper case characters is unattractive and creates some messiness since the manual shows programs in lower case. The locate command, normally a ^, has had to be changed to a #. The Program Preparation System, PPS, seems to be reasonably easy to use, although statement insertion is more complex than it ought to be. On the other hand, no single text editor has ever satisfied everybody and this may be more a personal complaint than a general weakness. Line and character deletion and changes are simple to make.

There are some problems with the tiny-c manual that stem from the author's desire to provide one physical manual for several tiny-c implementations. Obviously, material dealing with the 8080 version is of little interest to the TRS-80 owner and adds nothing but confusion. One can understand the approach, but perhaps the editors of the manual would consider distributing only those sections that are appropriate.

The TRS-80 tape cassette version loads easily. It might have been helpful to include a listing of the files on the cassette in the Installer's Guide. Also, a useful practice that many program distributors have instituted is to include a test program on their distributed tape. A new user will be far more confident that things have been loaded properly if there is a program immediately available for execution.

A professional programmer's language and system, tiny-c is not to be given over into the hands of the uninitiated—it is too complex and too powerful for the part-timer. Aside from these essentially minor criticisms, tiny-c is a major step forward for users of the TRS-80 who have felt badly inhibited by the limitations of BASIC. Owner's manual: $40. Interpreter and Program Preparation System: $25–$35 (depending on media and version). tiny-c associates, Holmdel, N.J.

—Phil Dorn

FOR DATA CIRCLE 440 ON READER CARD

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tions, and transaction definitions. Interactive report preparation, message and report routing, browsing, and security features also provided. DOS installations can license Trans IV for $25,000; the OS price is $35,000. Installment purchase and rental plans are also offered. INFORMATICS INC., Woodland Hills, Calif.

FOR DATA CIRCLE 442 ON READER CARD

IMS MONITORING

Data base administrators and other technical managers can use Manage: IMS to gain insights into their IMS systems performance. Installable without modification to either IMS/VS or the OS/VS operating system, Manage: IMS provides System Activity, Applications Performance, User Service, and IMS Planning facilities. The system helps identify transactions, applications, and terminals having response time problems. Conversely, the package identifies underutilization of data bases, lines, terminals, and message regions. The system also has trending and forecasting features to aid in resource utilization and performance planning. A site license for Manage: IMS goes for $7,500; 12- and 36-month lease rates are $330 and $275, respectively. CAPEX CORP., Phoenix, Ariz.

FOR DATA CIRCLE 444 ON READER CARD

SOFTWARE SPOTLIGHT

DOCUMENTATION SERVICE

Hate preparing documentation? Does your staff-prepared documentation lose the user in the introduction? Does it even have an introduction? If your shop has documentation problems, a group that describes itself as "communications support specialists" is available to help out. The firm specializes in creating, for large-scale users, reference, procedural, and training manuals. The firm will revamp existing documentation, or work with a development team to document new systems or modifications to existing systems. The vendors say it follows a seven-step development cycle. Initially, it seeks to define its users and their information needs, then it conducts a preliminary investigation to sharpen content definition. Next, an annotated outline is developed, describing the structure and sequence of the information to be presented. Then comes information gathering: task and job analysis, taped interviews, review of existing documentation, etc. The manual is then written, tested on a target audience (wherever appropriate), and finally revised based on reader feedback. A manual can typically take five to 12 weeks of writing, spread out over a period of four to eight months. The vendor bills $250 per diem, plus expenses, for writing and development. Full service package rates also are offered. RHODA STERN & ASSOCIATES, New York, N.Y.

FOR DATA CIRCLE 441 ON READER CARD

DIBOL MIGRATION AID

DTRAN is a tool to ease the migration of DIBOL programs from DEC CTS-300 systems to CTS-500 RSTS/E systems. The package reconciles the difference between the way the two systems handle file sharing, message sending, task building, overlaying, file opening, and file sizing. The package runs on the CTS-500, where it preprocesses CTS-300 source programs for subsequent recompilation and linkage. A list of the "one or two situations" that might interfere with proper DTRAN operation is provided with the package. Available on mag tape or RK05, RK01, RK06, or RK07 media, DTRAN licenses for $950 plus media charges. OEMs can recopy the package for use on their customers' systems for a additional $10 license fee. INFORMATION AND SYSTEMS RESEARCH, INC., Monroeville, Pa.

FOR DATA CIRCLE 445 ON READER CARD

REMOTE COMPUTING

This well-known remote computing vendor has added 10 software offerings to those available on its Mainstream timesharing service. Intended for use by the financial planning community, the new offerings include four internally developed packages and six licensed from other sources. The vendor developed packages, available under the Executive Information Service (EIS, priced at 16 cents to 27 cents per "CSU", the vendor's basic accounting unit of processor usage), carry no additional charges. The Cash Control system allows a corporation to reconcile its banking position on a daily or monthly basis, as well as manage fund levels. A Currency Conversion system provides analysis of daily, weekly, and yearly exchange rates for 30 world currencies. The vendor also offers its Economic Series—about 700 commonly used time series in a data base. A utility package, EXCL, allows users to extract, edit, convert, or reformat data from existing files into EIS files. Packages from outside sources are priced separately. For the Tell-A-Graf and DISSPLA graphics packages, the surcharge is $1.50 per 1,000 strokes (or vectors). Citibase, which contains more than 3,500 time series of various economic and industrial indices, indicators, production and consumption factors, carries an initial fee of $100, plus $92.50 per month. The remaining packages have their own associated per-CSU pricing. PAUS, a risk analysis system that lets the user calculate the probability of an event and its impact on profit, ROI, growth, etc., is priced at 16 cents to 27 cents per CSU. The SPSS and SCSS statistical packages also are available, priced at 21 cents per CSU and 26 cents per CSU, respectively. The vendor calculates a customer's bill based on csu's, plus charges for connect time ($15 per hour for a 30cps terminal) and on-line storage. The vendor estimates that a small customer might benefit from as little as $300 worth of computing over a year, while a large customer might use the system for as much as $1 million worth of computing over the same time. BOEING COMPUTER SERVICES CO., Morristown, N.J.

FOR DATA CIRCLE 447 ON READER CARD

IMAGE PROCESSING

The mini-VICAR/IBIS is a PDP-11 implementation of two Jet Propulsion Lab packages: the Video Image Communication and Retrieval (VICAR) image processing system, and the Image Based Information System (IBIS) geographical information management system. The system provides general purpose image processing and manipulation functions, as well as an information management system capable of accepting, converting, and operating on vector and tabular data. Standard image processing functions available to the user include contrast enhancement, filtering, geometric transformation, and picture display. Users also can merge imagery data with other data files, tabulate data statistics, and generate reports. The system comes with a set of library functions, which the user can add to as his application dictates. Written in FORTRAN and assembler, mini-VICAR/IBIS runs under RSX-11M. On 9-track tape, the software sells for $1,200; documentation is available for $16. COMPUTER SOFTWARE MANAGEMENT AND INFORMATION CENTER, University of Georgia, Athens, Ga. ✱

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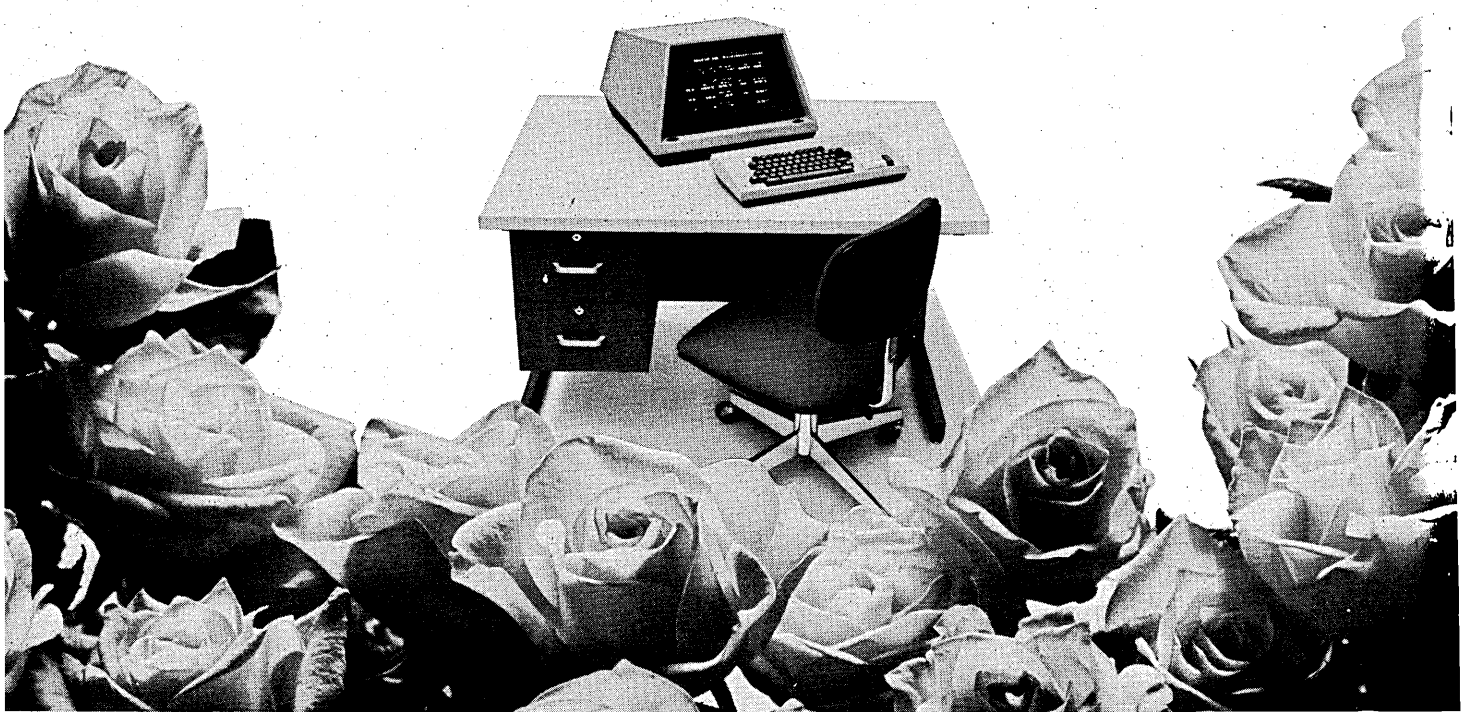

The Marketplace...

ADVERTISERS' INDEX

SOFTWARE & SERVICES

DP MARKETPLACE

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JOB MARKETPLACE

SOFTWARE SERVICES

The Insurance Institute for Research announces a forthcoming update of the Vendor Digest section of the IIR Agency Automation Guide.

The Vendor Digest contains information on vendors who provide automated processing systems for property and liability insurance agents and brokers.

To be included in this update to the AAG Vendor Digest, a system vendor must at a minimum provide programs for the generalized agency functions of processing accounts receivable, accounts payable, and general ledger.

A questionnaire is being distributed to obtain data for publication on complete or "turn-key" systems for insurance agents and brokers. In an effort to include all eligible vendors, the IIR urges that vendors who have not received a questionnaire prior to October contact the IIR at 222 Mamaroneck Avenue, White Plains, NY, 10605, or telephone (914)682-0800.

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SCIENCE/SCOPE

Fiber-optic cables allow sensitive information to be transmitted across unsecured areas without the need for encryption. A new communication link built by Hughes for the U.S. government connects command centers to computers in separate buildings with hair-thin glass fibers. Alarms are triggered anytime there is an unauthorized attempt to obtain access to the link. The new link, which may transmit at rates as high as 100 million bits per second, is less costly and allows considerably more system flexibility than protected wire systems using conventional security techniques.

Improved processing techniques have created silicon solar cells that produce 15 percent more power than their predecessors in converting sunlight into electric power for spacecraft operations. Advanced cells developed by Spectrolab, a Hughes subsidiary, generate 20 milliwatts of power per square centimeter. The increase in power is attributed to improving the thermal and optical properties of the cell and to a chemical etching method that sculpts microscopic tetrahedrons (pyramids) on the cell's surface. The result provides a dull-surfaced cell that abosorbs more sunlight than cells with polished surfaces.

Using special temperature-controlled chambers, NASA scientists will create clouds for study aboard Space Shuttle flights in the early 1980s. To properly form clouds in the weightlessness of space, the chambers, which are flat-plate heat pipes, must be extremely level over a large area (2'x3'x3/4") and uniform in temperature to within .01°C. Neither requirement has ever before been met in a heat pipe of this size. Hughes, under contract to General Electric, is developing eight isothermal vapor chambers to form the inner walls of the Atmospheric Cloud Physics Laboratory. The project is managed by NASA's Marshall Space Flight Center at Huntsville, Alabama.

Career growth opportunities exist at all levels at Hughes Support Systems for a variety of engineers qualified by degree or extensive work experience. They include systems engineers and software and hardware design engineers for major simulation and test equipment programs. Also, field engineering posts throughout the U.S. and the world offer travel, autonomy, and responsibility for the life cycle of Hughes electronic systems. For immediate action, phone collect (213) 670-1515, Ext. 5444. Or send your resume to Professional Employment, Dept. SE, Hughes Aircraft Company, P.O. Box 90515, Los Angeles, CA 90009.

A new traveling-wave tube for use in the ground terminal transmitter of commercial satellite communications systems has been developed by Hughes. The Ku-band device, designated Model 876H, provides 700 watts of CW power over the frequency range of 14.0 to 14.5 GHz. It incorporates a two-stage collector that enhances efficiencies to greater than 41 percent over the operating band. This design decreases total beam power when the drive level to the tube is reduced, making the tube desirable for operation in a pulsed mode, and minimizing the primary power drain when operating in the small signal region.

SOURCE DATA

BOOKS

COMPUTER SYSTEMS IN WORK DESIGN— THE ETHICS METHOD by Enid Mumford and Mary Weir

Enid Mumford's work has long been widely known and highly regarded in the U.K., where she holds the post of director of the Computer and Work Design Research Unit at the Manchester Business School. Mary Weir was a member of the same unit although she has since moved on to the University of Glasgow as a research fellow. These solid academic backgrounds should not be taken as evidence of ivory tower thinking; the authors have tested their approach in the field.

This brief book summarizes what the authors have chosen to call the ETHICS method for designing and installing computer systems. ETHICS, a first-rate acronym for the Effective Technical and Human Implementation of Computer Systems, is a methodology and an approach rather than a fixed set of analytic, programmatic, or graphic tools. The ETHICS method is based on a comparatively simple notion: that the technical details of a system design must not be allowed to overshadow the human or social implications that stem from the installation of that effort. In those shops that have adopted ETHICS, we should no longer see the rigid imposition of computer systems under the direction of authoritarian management edicts.

Developing system technical requirements is not a difficult task. Selection of one approach from among many generally presents the system designer with no special problems. This is largely because most data processing managements have historically ignored the well-being of employees and the psychological impact of systems. Giving the same level of attention to social climate is far rarer than even these authors suspect.

Mumford & Weir come at these problems by collecting input from all the various psychological and sociological schools that deal with job satisfaction. These practical people have realized that no single criterion, wage payment, motivation, leadership, etc., is enough. Rather they seek to merge many factors to develop the relationship between employee and employer job needs. The "fits" are in five areas: knowledge, psychological, efficiency, task structure, and ethical. The social side of ETHICS stems from these "fits" and the substructures they encompass.

When considering alternative solutions, Mumford & Weir set out the technical and social solutions and treat each separately in the first instance. When solutions from both sides are paired, the purely technical solution drops down to a far lower ranking than that which has strong social overtones.

ETHICS is a method that requires some fairly rigorous discipline on the part of those who would apply it. It needs to be taught; one doubts that it can be absorbed by reading the book without some formal training. Mumford & Weir have successfully taught ETHICS in the U.K. There is little reason why they or their students could not repeat the experience in the United States.

The book covers some of the theory and then proceeds to outline the application of ETHICS to some interesting case studies. This creates a problem in using the book as a training manual, since the printed forms are too small and the answers too readily available. For student use, the answers need to be developed during the sessions. What one really needs to go along with the printed text are worksheets of some sort. Alternatively, the book could be recreated in a workbook or exercise book format. Mumford & Weir will provide case studies and worksheets outside the text if these are needed. Finally, the authors have made some cassettes which they make available for self-training.

The socio-technical approach to systems design is not an easy notion for veteran analysts to grasp. It runs counter to much of the traditional training. Orientation towards the machine must give way to thinking about the effects of the machine. Reading Mumford & Weir would be a good starting effort for those who would redirect their purely technical idea patterns.

The book is clean, clear, and easy to read. The vocabulary in this edition, with only a few minor exceptions, is nonnational. For VDU, read crt. Forget the talk about use of paper tape in technical solutions. The stuff is only good to decorate the machine room at Christmas. These minor faults aside, this solid and important work should be of great interest to those designing the systems of the '80s. It's time American computer specialists paid appropriate honor to this work, which has achieved considerable recognition abroad for its pioneering incisiveness. Halsted Press (a division of John Wiley & Sons, Inc.)/Associated Business Press, London (1979, 295 pp., $32.50).

—Phil Dorn

A PARTICIPATIVE APPROACH TO COMPUTER SYSTEMS DESIGN by Enid Mumford and Don Henshall

It is not news that employers have been having a hard time attracting workers to certain jobs, or keeping them when they do. Data entry, in particular, has been characterized by rapid turnover, but the condition is common among other low-level office occupations. Managers have responded by redesigning clerical jobs in order to make them progressively more machine-compatible. Doing so reduces dependence on skilled workers and expands the pool from which unskilled replacements can be found. Paradoxically, the move toward capital-intensive clerical work often intensifies the very job dissatisfaction it was intended to overcome. Employees, feeling their work will be degraded or their jobs will be eliminated, often resist the new work organizations that come in the wake of new hardware.

Management theorists in turn have come up with new methods they hope will defuse employee resistence to workplace rationalization. One such method is reflected in *A Participative Approach to Computer Systems Design: A Case Study of the Introduction of a New Computer System* by Enid Mumford and Don Henshall. The senior author is one of the United Kingdom's best-known systems writers and an advocate of what she calls the "socio-technical" approach to work organization. American readers will probably be more familiar with its American variant, the so-called Quality of Working Life school of human relations theory. The junior author is a systems specialist with Rolls-Royce Limited (the one that makes the aircraft engines, not the cars). Together they have produced a diary of their efforts to reorganize two clerical departments at a Rolls-Royce manufacturing facility after the company had decided to introduce a new on-line computer system.

The book begins with an overview of the socio-technical philosophy es-

SOURCE DATA

poused by Mumford. In brief, it holds that workers be allowed to decide how their own workplaces are to be organized, that is, to decide distribution of tasks and responsibilities. Mumford and Henshall label this a "democratic" approach to work design. The consequences, according to the authors, are greater efficiency and greater satisfaction, implying that the latter is a cause of the former. The case for the socio-technical approach to work design, then, is based on both humanitarian and productivity grounds.

The rest of the book consists of a chronology of the Rolls-Royce experiment, plus various appendices of survey methods, office layouts, job descriptions, and so on, as well as retrospective assessments by Henshall and another Rolls-Royce systems specialist.

Mumford was hired as a consultant to Rolls-Royce at the urging of in-house systems people familiar with her work. After gaining approval from management for her approach, she asked for and got the clerks' agreement to participate in the project. Two committees were established: a steering group, made up of senior and middle level managers, technical specialists, and a company medical officer; a trade union official was added later. The second committee was a design group, comprised of six clerks representing their colleagues, two Rolls-Royce systems specialists, Henshall, and Mumford. The actual design process lasted some 10 months and produced three design strategies. Each was presented in turn for comment and approval to the steering group and to the clerks. After negotiation and modification, the third design was mutually agreed to and implemented. It is, in the authors' words, both "a success story" and "an honest story."

It may be, but *A Participative Approach to Computer Systems Design* is not a very convincing document, whether the reader is a clerk, manager, or academic. The participation Mumford and Henshall describe was crudely paternalistic and manipulative and could in no meaningful sense of the word be called democratic. Industrial democracy at Rolls-Royce, according to this account, meant an employee design committee *selected* by managers, not elected by the clerks; it meant getting a new hardware system—and inevitably an attendant work reorganization—whether the clerks in the two departments agreed to "take responsibility" for their design or not. It also meant being manipulated by the management group to accept one design proposal as a way of softening them up for one actually preferred by the managers but which they feared the workers were as yet unprepared to accept. In short, the book will convince any clerk who reads it that such management-promoted "democratic" work reorganization is a hoax.

Many managers may reach substantially the same conclusions, if for different reasons. Mumford and Henshall never get around to defining "satisfaction" or even "efficiency" in a precise way. This, obviously, makes it hard to make before-and-after comparisons. A follow-up study promised by the authors must therefore be tainted by the suspicion that whatever definitions do eventually appear (as well as the numbers attached to them) will be the beneficiaries of hindsight computations. ("Hindsight computations" is a term of my own; it refers to Kraft's Law of Empirical Studies of Computing, which holds that 73.8% of all quantitative statements about computing are made up.)

Those familiar with the extensive literature on employee designed work organizations will have still other reasons to be disturbed by this book. Henshall and Mumford neglect to discuss the long-term results of similar experiments.

The omission is not surprising. In the United States, at least, the results of employee participation schemes raise serious questions about the effectiveness of such carefully controlled attempts at "industrial democracy." In those cases where the redesigned workplaces were studied for more than a few months, productivity and work satisfaction did, indeed, go up, if by generally modest amounts. Once the new systems were in place and working smoothly, however, managers regularly succumbed to the temptation to revert to their old ways, i.e., to turn the screws without benefit of "democratic consultation." The predictable results: increased unhappiness, sliding productivity, and a high turnover rate. Nowhere are these findings presented or their implications discussed. The book's bibliography isn't much help, either. It consists of exactly four entries, three of which are either authored or coauthored by Mumford.

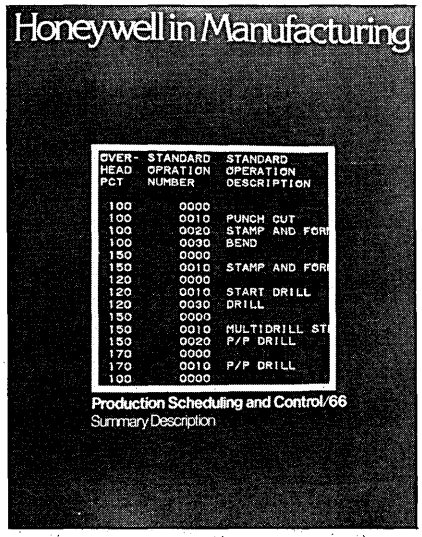
Finally, the book seems to slide around what may be the most important of all issues raised by worker participation in the design of computer-based systems. It was not possible for me to figure out whether the "democratic" approach to work design at Rolls-Royce extended to the selection and configuration of the hardware and to the making of the software. It appears that neither was included in the choices made available to the clerks, although the lack of precision in the authors' language may be hiding this. If, in fact, hardware and software decisions were excluded from what the clerks were allowed to discuss, then the substantive content of the report is considerably less than meets the eye. The effort was merely another exercise in rewriting job-titles and rearranging desks. Halsted Press (a division of John Wiley & Sons, Inc.) (1979, 150 pp., $18.95).

—Philip Kraft

VENDOR LITERATURE

MANUFACTURING

A 44-page brochure describes this vendor's Production Scheduling and Control/66 (PSC/66) information system. Presented in three sections, the description is illustrated with diagrams, flowcharts, and samples of computer generated reports. The first section of the



booklet explains features, benefits, and hardware requirements, while the second section gets into the three subsystems of PSC/66. The various user and control reports available from PSC/66 are described in the third section. Included as appendices are a glossary of production control terms and information on the PSC/66 data base. HONEYWELL INC., United States Information Systems Group, Waltham, Mass.

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NOISE CONTROL

Intended primarily for oems, this vendor's sample folder provides descriptions and samples of seven products used to absorb unwanted airborne sound, to block noise transmission, to suppress noise-causing vibrations, or to be used in combination for several purposes. Products include noise barriers, accoustical foam, and noise dampeners. SPECIALTY COMPOSITES CORP., Newark, Del.

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COMMUNICATIONS MONITOR

A four-page, four-color brochure describes the D-901 Datascope. After an overview of the line monitor and data analyzer, the brochure explains the D-901's programming language which is designed to let the user program diagnostic tests and emulation routines. Two pages of the brochure are devoted to a large picture of the D-901, with annotations describing more than a score of its features. Other section headings include "diskette units,"

"operation," "compatibility," "self-diagnostics," and "summary." SPECTRON CORP., Moorestown, N.J.

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PROJECT MANAGEMENT

An oversized, 40-page booklet provides a forum for this vendor to discuss its PC/70 project management software. Subtitled "The system that helps you make effective Project/Resource Management a reality," the booklet seeks to explain how the fundamental principles of management relate to key project management elements (a methodology, a project planning and control system, and training). Entries in the illustrated brochure's table of contents include "Challenges facing today's manager of information systems," "The fundamental principles of project/resource management," "Accounting for time and cost/charging back for services," "On-line 'interactive' planning and reporting," and "Engineering, auditing, legal and other applications of PC/70." An overview of the company and a postage-paid card for requesting more information complete the booklet. ATLANTIC SOFTWARE INC., Philadelphia, Pa.

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BOOKS

Although it concentrates primarily on books related to telecommunications, this vendor's catalog also includes programming books, telephone accessories, and (not for sale) a number of cartoons. It seems most, if not all, of James Martin's books are offered, along with books authored by Dixon Doll, Marvin Grosswirth, Donald D. Spencer, and buyers' guides from Auerbach. Section headings in the 64-page catalog include "computers and programming," "training manuals," "cable tv," "communications management," and "references & dictionaries." Two pages are devoted to accessories, such as an oversized touch-tone keypad that snaps on a telephone over its standard touch-tone pad. An index, ordering information, and order forms are provided. TELECOM LIBRARY INC., New York, N.Y.

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PERSONAL COMPUTING

Books, software, T-shirts, games, and more fill out this 20-page, illustrated catalog. Want to know pi to 625 places? You need look no farther than one of the T-shirts offered. Grown weary of coding (or inventing) games for your personal computer? The catalog offers a number of books containing games written in BASIC and discussions of games suitable for machine implementation. Also listed are a number of games, available on cassette, for the Radio Shack TRS-80, Commodore PET, Apple II, Ohio Scientific Challenger 1P, and Exidy Sorcerer. Ordering information, both telephone and mail, as well as a quantity discount schedule are provided along with an order form. CREATIVE COMPUTING, Morristown, N.J.

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MEDIA FILING SYSTEMS

An illustrated, six-page foldout brochure describes this vendor's filing systems for diskettes (both 8-inch and 5¼-inch), mag cards, cassettes, data cartridges, type elements, and print wheels. The systems include rotary files, desk files, and binders. A four-page price list accompanied our copy of the brochure. RING KING VISIBLES, INC., Muscatine, Iowa.

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DATA CONCENTRATOR

"Still squeezing data through the old-fashioned way?" asks the cover of this vendor's latest brochure. "Concentrate. It's cheaper!" we're informed on a foldout extension of the cover. The brochure then describes the company and its Micro800 Data Concentrator products. Block diagrams, photographs, and tables illustrate the 12-page booklet. Topics discussed in-

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clude port sharing, how the Micro800 works, and do-it-yourself troubleshooting. Features of the product line are enumerated, applications are discussed, and specifications are provided. MICOM SYSTEMS, INC., Chatsworth, Calif.

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ACCESSORIES

Paper and Mylar tape, magnetic tape, flexible and rigid disks, forms, and filing systems are offered in this vendor's illustrated catalog. Additional offerings include splicing equipment and reels (for perforated tape users), mag cards, cassettes, and a transparent rule with print positions marked for proofing output formats. COMPUTER ACCESSORIES CORP., Huntington, N.Y.

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WORD PROCESSING

A glossy, four-color, six-panel foldout brochure describes the operation, uses, and potential users of the Wordplex/7 shared logic word processing system. A variety of system components, including the cpu, video display units, and printers are pictured and briefly described. Technical, physical, and environmental specifications are summarized in tables. WORDPLEX CORP., Westlake Village, Calif.

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FLOPPY CONTROLLERS

This vendor's FDC 100-5 and FDC 200-5 disk drive controllers are the topic of a two-page product bulletin. Both are pictured and described. Features are listed and specifications are provided. The brochure also includes explanations of host commands, data buffering, block transfers, and sector interleaving. SIEMENS CORP., Anaheim, Calif.

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REPORTS AND REFERENCES

WP OUTPUT

Patricia B. Seybold, publisher of the *Seybold Report*, has put together a report comparing printout quality of wp peripherals. Marketing history and predictions are discussed as well. Products are compared by print element, print quality, speed, font types, character generation, special features, and interface to word processors. Charts and tables are used. Nonimpact printing, laser printers, intelligent copiers, and image printers are also said to be covered.

The "Seybold Report on Word Processing" sells for $10. Seybold Publications, Box 644, Media, PA 19063 (215) 565-2480.

SOUTHWEST COMPUTER DIRECTORY

An updated version of Texas A & M University's *Directory of Computer Facilities in the Southwest* is now available. The 400-page volume cross-references companies alphabetically, geographically, and by manufacturer and model. Information given includes: address, telephone number, dp manager (or other person in charge), type of computer, memory size, peripheral equipment, operating system, programming language, and whether rental use or programming assistance is available. Contact the Center for Strategic Technology, Texas A & M University, Box 83, College Station, TX 77843 (713) 845-5711.

SMALL BIZ SOFTWARE

A short report entitled "Evaluating Small Business Software" is available from the publishers of *Business Computing Newsletter* and the *Software Exchange*. The report discusses general considerations in the initial evaluation of software packages, including aspects such as ease of use, clear and concise reporting, complete audit trails, documentation, and vendor support. Also discussed are sources and contract negotiation. Applications evaluated in more depth are General Ledger, Accounts Receivable, Accounts Payable, Payroll, and Inventory. The report sells for $15. Business Computing Press, P.O. Box 55056, Valencia, CA 91355.

SPECIAL LIBRARIES AND INFORMATION ACCESS

A booklet entitled "Issues for Delegate Consideration, White House Conference on Library and Information Services" has been prepared by the Special Libraries Assn., Special Committee on the White House Conference on Library and Information Services and lovingly published, as a public service, by the H. W. Wilson Co. The issues addressed focus on federal and state use of data as a resource, including considerations such as information organization and retrieval, funding, education, and the need for library and information service programs to be conveniently tied together.

For a free copy of the 22-page booklet, contact the Special Libraries Assn., 235 Park Ave. South, New York, NY 10003 (212) 477-9250.

PERIODICALS

HARVARD GRAPHICS LAB INTRODUCES NEWSLETTER

An informative and nicely written newsletter has been introduced by the Harvard Laboratory for Computer Graphics and Spatial Analysis. Designed to interest both current and potential users and vendors, the twice-monthly newsletter features good summaries of newsworthy products and services, business and financial news, and a calendar of events. Subjects to be covered include engineering design, cartography, business and statistical graphics, image processing, animation, and "related disciplines."

Items in the premier issue include an update on the Census Bureau's extensive mapping project and a summary of a *Business Week* article predicting the growth of plasma displays, in which analyst Richard Braudy of Quantum Sciences Corp. is quoted as saying "IBM may make introductions in the next two years that will eventually make plasma an industry standard." Reasons for this prediction include semiconductor advances, crt drawbacks including eye fatigue and X-ray emission, and manufacturing improvements. A one-year subscription to the *Harvard Newsletter on Computer Graphics* sells for $125. Contact William Nisen, Laboratory for Computer Graphics, Harvard Univ., 48 Quincy St., Cambridge, MA 02138 (617) 495-2526.

COMPUTER CONSUMER'S GUIDE

Computer and Communications Buyer, a new eight-page newsletter, is characterized by its publisher as a "hard number publication." Dollar, not concept, oriented, the newsletter provides information to help the dp manager, vp for automation, or other executive concerned with buying computer or communications equipment and services, keep his bottom line under control. It's intended that each monthly issue will have at least one money-saving suggestion for any reader. The issue being readied for mailing as this is written includes a piece on how used computer prices are stabilizing, along with wholesale and retail prices for used equipment. U.S. and Canadian subscriptions are $125 per year, and overseas subscribers can get a year's subscription, via air mail, for $150. Orders accompanied by cash payment will get 14 issues instead of 12. Technology News of America, 26 Broadway, New York, NY 10004.

SATELLITE NEWSLETTER

Satellite News, a business management newsletter about the satellite industry, is now biweekly. Products and services covered include cable tv, telephone, computer-to-computer communications, broadcasting, common carriers, earth stations, telex, transponders, pay-tv, antenna systems, and receivers. There is also an emphasis on government action, as the staff is located in Washington, D.C. A subscription is $147. *Satellite News*, 8401 Connecticut Ave., Washington, DC 20015. ✲

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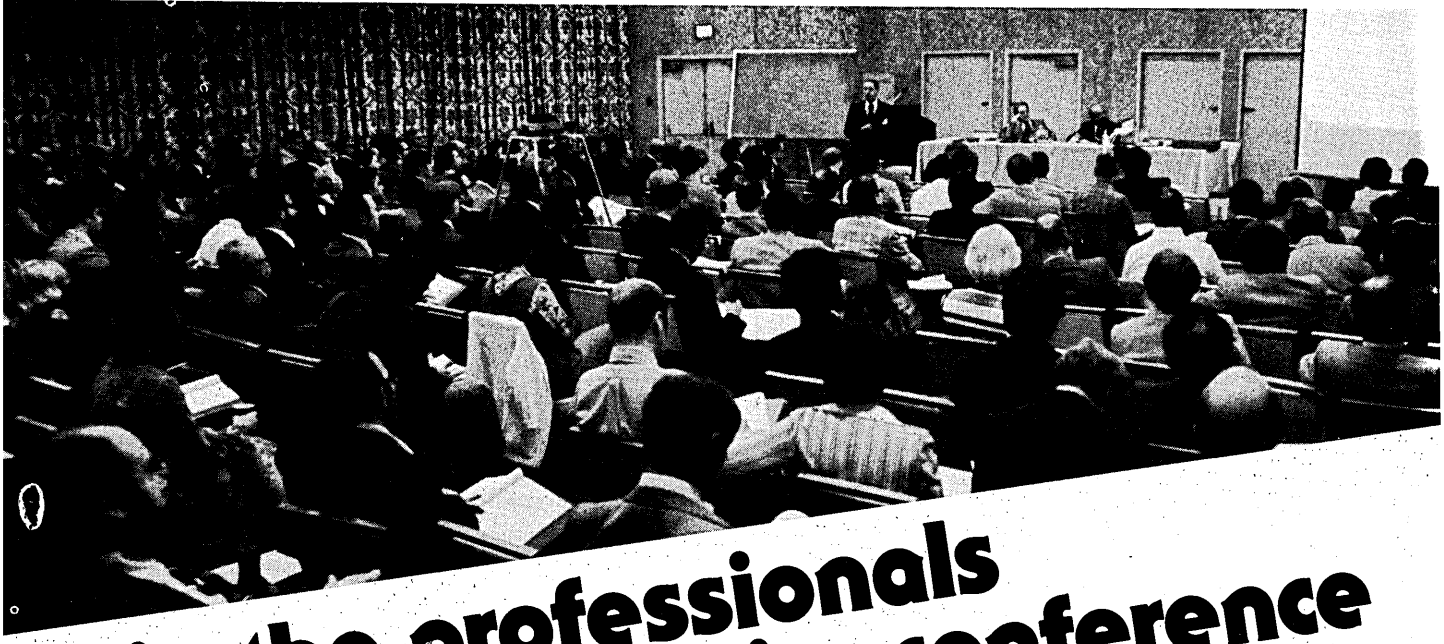

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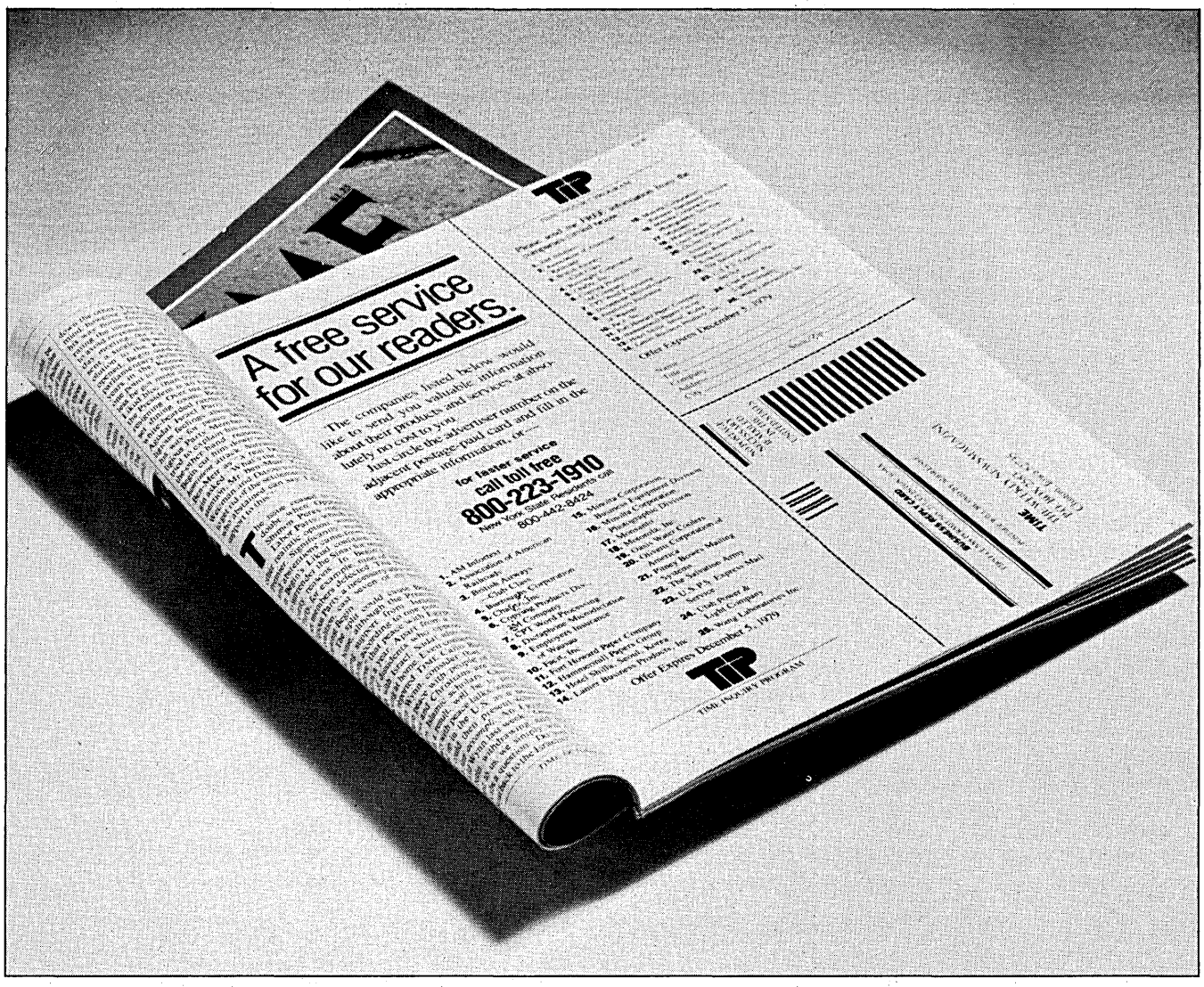

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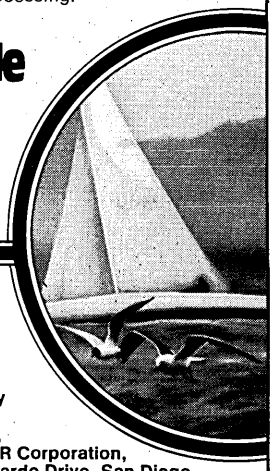

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Readers' Forum is designed for an exchange of ideas and experiences. Your contributions are invited.

READERS' FORUM

AMENDING THE ENIAC STORY

In the May 1979 issue of DATAMATION, Nancy Stern's article, "In the Beginning, the ENIAC," in part discussed the "stored program." I would like to add material that may interest some readers.

The EDVAC was the outcome of lengthy planning in which Eckert and I deliberately tried to overcome many problems of storage and control evident in the hasty state-of-the-art ENIAC system. Much of this planning took place in the early months of 1944, when most of the ENIAC design had been frozen (see, e.g., "Disclosure of a Magnetic Drum Calculator", January 1944, U. of Penn. Archives).

The principle guiding these post-ENIAC efforts was that of trying, in the next computer, to use the same device for all situations requiring the same function (such as storage). What had been out of the question with ring-counter storage was suddenly within reach because of the estimated economies with the acoustic delay line storage.

It was not until October 1944 that an Army Ordnance contract authorized work on EDVAC (without any specifications as to just what an EDVAC might be). We were still building ENIAC, and had to be sure it was properly completed.

But all through 1944, and in 1945 as well, we were leading a double life. For much of two shifts, from 8 a.m. to midnight, ENIAC construction and testing needed supervision. Then, as hourly workers went home and project engineers thinned out, Eckert and I were left to consider the "next machine." Naturally, "architecture" or "logical organization" was the first thing on the agenda, and we gave a great deal of thought to combining a serial delay line storage with the idea of a single storage for data and program. The January 1944 disclosure of the magnetic calculator was followed by the delay line ideas a month or so later; all this time, and on through the summer, Eckert and I were busy in the dual roles of doing ENIAC jobs and thinking of what that new machine might be like.

During part of this time, Goldstine was hospitalized and did not have direct knowledge of the late-night plans. But Harry Huskey, who came to the ENIAC project about April 1944 (his estimate), confirmed that soon after he arrived he became aware that the "next computer" plans involved programs and data in the very same "store." This was before Goldstine met von Neumann in August 1944.

Sept. 7, 1944 was the first day that von Neumann had security clearance to see the ENIAC and talk with Eckert and me about the classified digital computer projects on which we were working. When von Neumann arrived, Eckert and I were asked to tell Johnny what our plans were, and we did. We started with our basic ideas: there would be only *one* storage device (with addressable locations) for the *entire* EDVAC, and this would hold both data and instructions. All necessary arithmetic operations would be performed in just *one* arithmetic unit (unlike the ENIAC). All control functions would be centralized (in contrast to the ENIAC). Of course, there would be devices to handle input and output, and these would be subject to the control module just as the other modules were.

Johnny learned instantly, as was his nature. But he chose to refer to the modules we had described as "organs" and to substitute hypothetical "neurons" for hypothetical vacuum tubes or other devices that could perform logical functions. It was clear that Johnny was rephrasing our logic, but it was still the *same* logic. Also, he was introducing different but equivalent symbols; nevertheless, the devices still did the same things. Johnny did *not* alter the fundamental concepts we had already formulated for the EDVAC.

Johnny was fascinated with a subject that had somehow escaped his amazingly wide interests (until Goldstine told him of the Moore School project). Like a child with a new toy, he could not put it aside. When his consulting duties required him to visit the Manhattan Project, he took off for New Mexico, but his mind was on our EDVAC architecture.

He must have spent considerable time at Los Alamos writing a report on our EDVAC design. He sent this report to Goldstine with a letter stating he had done this as an accommodation for the Moore School group. But Goldstine mimeographed it with a title page naming only one author—von Neumann. There was nothing to suggest that *any* of the major ideas had come from the Moore School project.

Without our knowledge, Goldstine distributed "Design for the EDVAC" outside the project and even to persons in other countries.

HISTORY GAVE VON NEUMANN THE CREDIT

Small wonder, then, that computer history gave von Neumann the credit. Eckert and I, who left the University of Pennsylvania in 1946, no longer had access to the documents that might have helped to show who did what, when. But, after many years, litigation has unearthed some of those documents and historians can read what was once classified. (However, even after declassification, those reports are not accessible to most people, since they were reproduced in such small quantities.)

Of those who did check our ENIAC and EDVAC reports, Metropolis and Worlton published "A Trilogy of Errors in the History of Computing" (USA-Japan Computer Conf., 1972, AFIPS). Metropolis of Los Alamos was in an excellent position to notice such errors, for he knew von Neumann and Eckert and me and the history recounted above. But on "historians" who merely copy from popular sources, that paper had no influence.

Actually, an even earlier publication correctly gave the relationship of von Neumann to the stored program development. This was "The Computer Story," by 2nd Lt. James Clyde Thomas, in *The Military Engineer* for July-August 1966. However, Thomas says nothing at all about the BINAC, very likely not having found enough information on that computer to give it a place in his brief article.

Before discussing the BINAC, it is instructive to note the

FORUM

ENIAC really did have a stored program, but not in the sense in which that word is currently used. The ENIAC was much more than an analog of a mechanical desk calculator. Control of the calculations was more important than "just doing arithmetic fast," and that control had to be fast enough so that it did not lose all the time gained by doing the arithmetic fast. That meant any element of the program that changed fast had to be in "fast storage." Each of the 20 "accumulators" had a ring counter for "repeat operations," but more important were the electronic counters and stepping switches in the Master Programmer. These made possible immediate change from one program sequence to another, enabling the use of nested subroutines and other program variations.

Altogether, about 25% of the ENIAC's "fast electronic storage" was devoted to internal storage of those program parts that varied rapidly—one of the important features that made the ENIAC a far more powerful instrument than an "electronic speed-up of a mechanical computing device."

Now for a few words about the BINAC, which was not only the first stored program computer built by Eckert-Mauchly, but the fastest with delay line storage. Its clock rate was 4 megacycles, or eight times that of the first machine at Cambridge, England—the EDSAC. The BINAC was really two identical machines that checked each other on each clock cycle; these Siamese twins were completed and amply demonstrated for an entire week to scores of guests in Philadelphia. The demonstrations were reported in the *Journal of the Franklin Institute* for October 1949, but not much noted by the popular press. They were very carefully noted, however, by observers from the National Bureau of Standards and the Bureau of the Census: those agencies were expecting Eckert-Mauchly to build and deliver UNIVACs to the government. Apparently, these interested groups were satisfied Eckert-Mauchly would indeed be able to produce UNIVACs.

Then what happened? It would be more than a year before any computer of similar capacity and speed would be available in North America. ENIAC, for three years the *only* electronic computer in the world, now had a real rival, with 512 "words" of storage, any of which could be used for data or program. Northrop Aircraft, the BINAC contractor, did not see or

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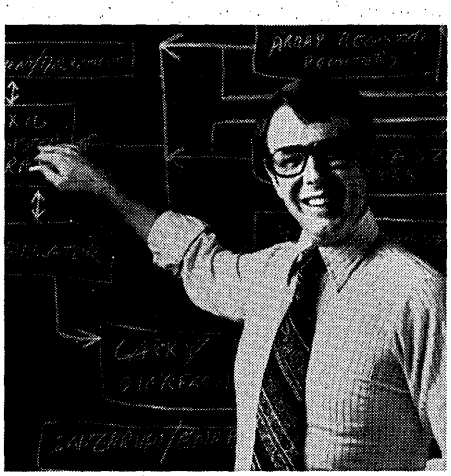

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realize the potential of what it had. While ENIAC was kept busy on scientific problems until 1955, the pioneer BINAC of 1949 was cast aside.

Northrop required immediate delivery in Philadelphia; then, the various modules of the BINAC were roughly crated, shipped to California, and apparently ignored.

But, for the sake of "stored program" history, the following should be recorded: the first of the two computers that became the BINAC was under test early in 1949, and ran nonstop without error for 44 hours in April 1949. The test was then interrupted so the engineers could get on with other work. The Cambridge EDSAC, we are told, made its debut in May 1949.

I will conclude with a few minor comments.

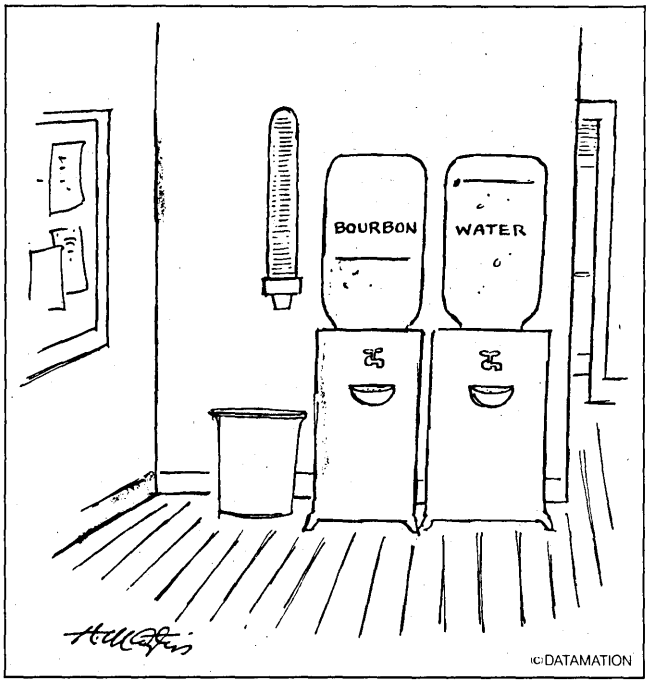
One common misconception Eckert and I have repeatedly tried to correct is that ENIAC technology was based on previous radar work. There is not a shred of truth in that idea. It was, to a large extent, based on the "scaling" circuits of nuclear and cosmic ray laboratories. The acoustic delay line storage device used in EDVAC, BINAC, and UNIVAC came from Eckert's previous projects for radar.

Additionally, in Dr. Stern's article there is a confusion between fixed function tables used in the multiplier unit to produce "partial products," and the three large "portable function tables" which could be manually set up for arbitrary function values for 104 arguments.

Also, I should answer Fred Gruenberger's remarks about my August 1942 memo. That memo was never intended to explain or propose a *control* method for electronic computation, but merely to "sell" the reason for developing electronic devices to overcome the limitations of mechanical devices, including relays. Fortunately it did that. But *it did not describe* even a calculator, much less a computer.

Anyone who wants to read what we proposed for the ENIAC should consult the April 1943 proposal Eckert and Dr. Brainerd and I put together and presented to the Ballistic Research Laboratory at a meeting where the "starting project" was approved. In that document was a "program chart" that I drew up to show how the iterations for a trajectory might be calculated. That may be the first program ever attempted for an electronic digital device. Perhaps Brian Randall will reprint that proposal in a revision of his book on *Origin of Digital Computers*.

—John W. Mauchly
Ambler, Pennsylvania



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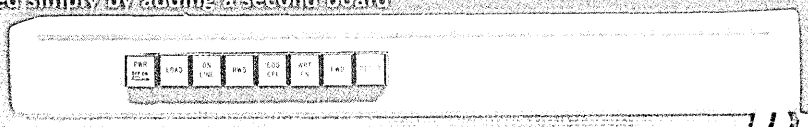

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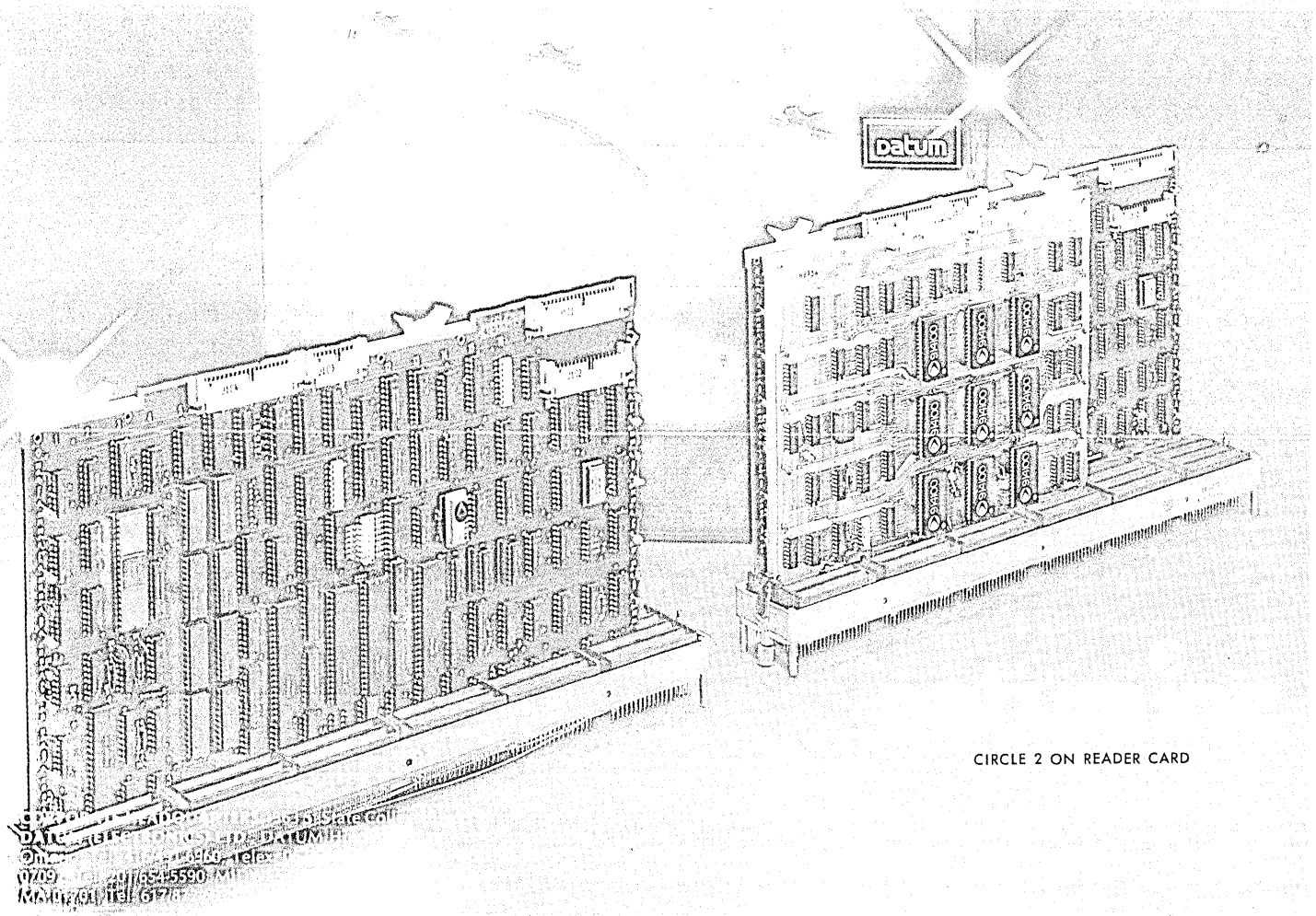

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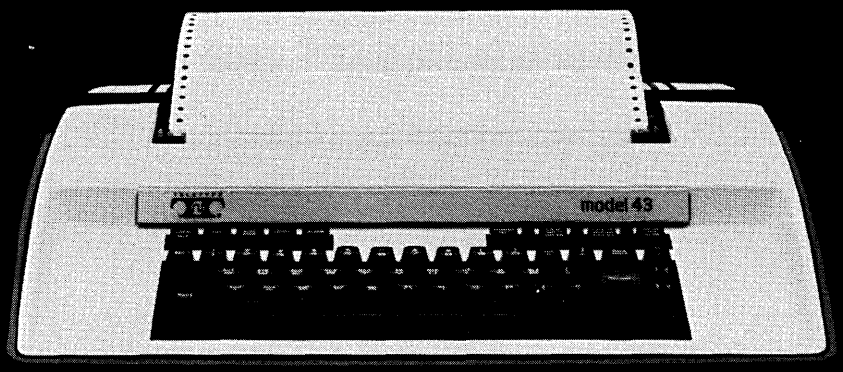

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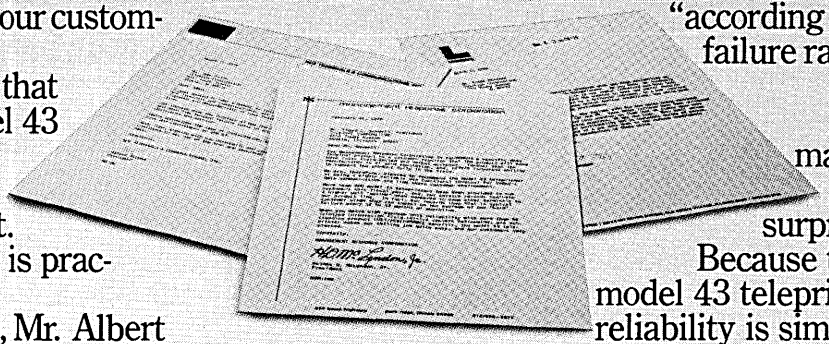

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