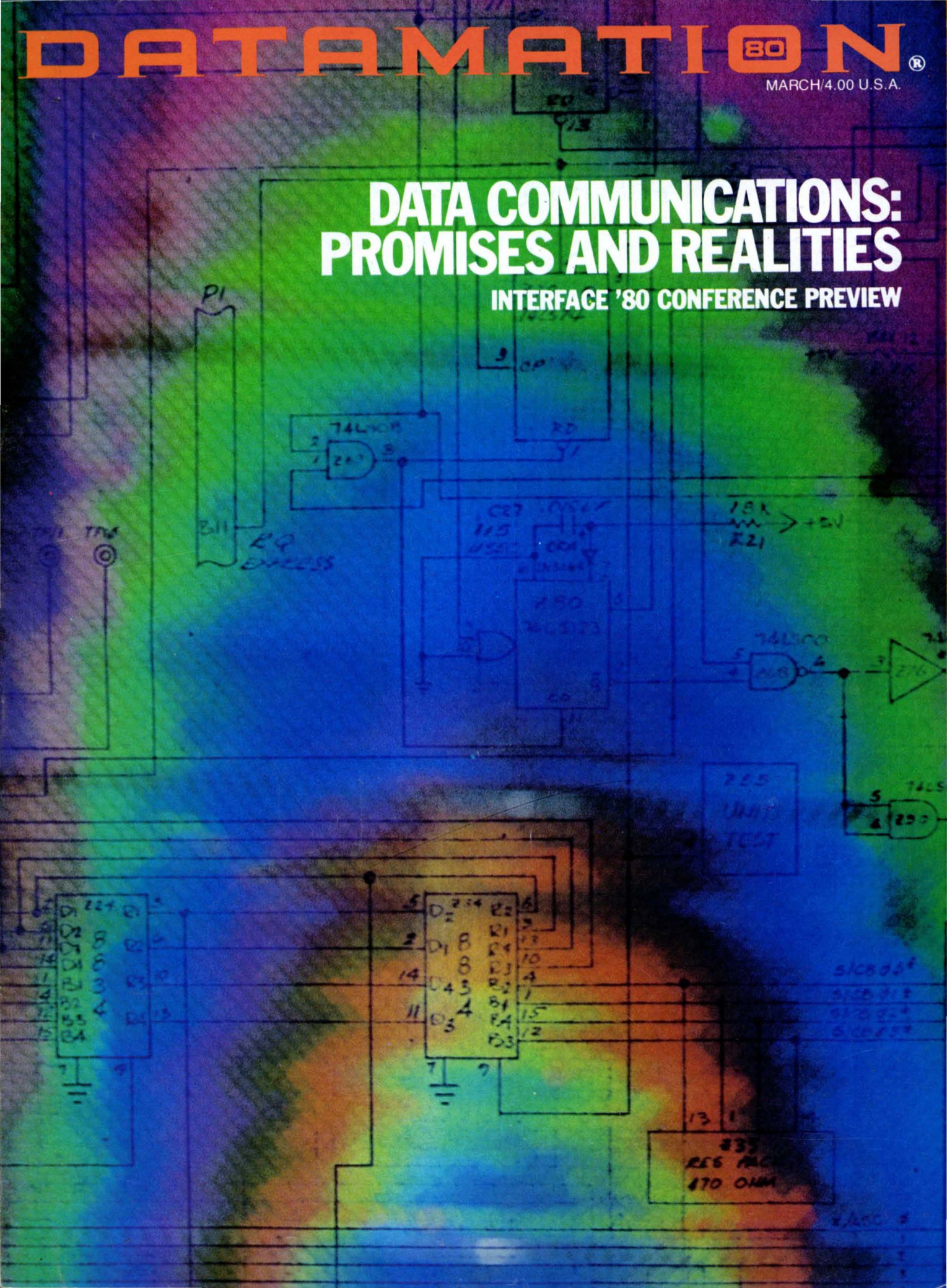
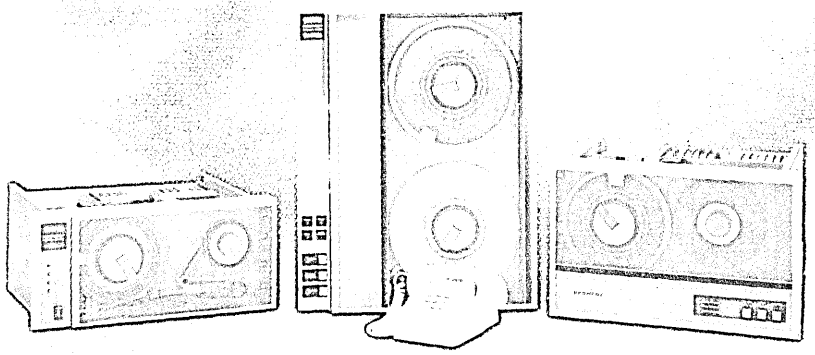
DATAMATION 80®
MARCH/4.00 U.S.A.

DATA COMMUNICATIONS: PROMISES AND REALITIES

INTERFACE '80 CONFERENCE PREVIEW



We take calls from Venus...



and Mars, Sweden, Switzerland, Norway, Brazil, Great Britain...

and virtually every other country on Earth. Kennedy Company and its digital tape products were pioneers in such demanding applications as telephone toll-ticketing, usage analysis, message switching control and electronic switching systems.

These years of reliable operation are one of the reasons NASA installations throughout the world utilize Kennedy tape recorders to telemetrically record and digitally reproduce such significant data and photographs from the Viking, Pioneer and Voyager probes of Mars, Venus and Jupiter.

Whether recording your call to a friend in Europe, or displaying the wonder and beauty of outer space, Kennedy digital tape transports can be relied upon.

Photo courtesy of NASA and
Jet Propulsion Laboratory, Pasadena, CA

KENNEDY
Subsidiary Magnetics & Electronics Inc
1600 Shamrock Ave. Monrovia, CA 91016
(213) 357-8851 TWX 910-585-8249

KENNEDY • QUALITY • COUNT ON IT

CIRCLE 1 ON READER CARD

BONANZA!

For PDP-11* users, the most cost effective, "no-compromise," SMD disc controller

Maximize your system's cost performance factor with the full capability DC-233 Disc Drive Controller. Its unique master-slave bit slice microprocessor architecture provides total DEC software transparency with up to eight drives. Use it with the CDC 9762 80mb drive to emulate DEC's RM02/03 (67mb of formatted capacity per drive). Or–use it with the Memorex 677 Series 100/200mb drives to emulate DEC's RP05/06 (up to 176mb of formatted capacity per drive). Or–use it with eight 300mb drives for up to 2.1 billion bytes of formatted data in non-software compatible mode.

AND THERE'S MORE

- **Embedded design fits all PDP-11's***
- **Dual drive porting**
- **Optional dual unibus porting**
- **Automatic NPR throttling**
- **ECC fully implemented**
- **Media compatible**

SEND FOR COMPLETE INFORMATION

Division of WESPERCORP

(714) 730-6250 — TWX 910-595-1775
Cable WESPER
14321 Myford Rd., Tustin, Calif. 92680

*Trade name of Digital Equipment Corporation

CIRCLE 4 ON READER CARD

JUN 2 4

Low-cost hard disk computers are here and field proven

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

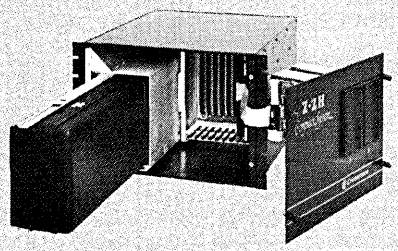
With the Z-2H you also get the broadest software support in the microcomputer field. Software Cromemco is known for. Software like this:

- **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 compact 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.

SEE IT NOW

Last summer we told you this new Z-2H would be a smash. And it is. So see it at your dealer's now. Have him put you in touch with a user—there are lots of them because Cromemco has been delivering for months. See for yourself how pleased our users are.

PRESENT CROMEMCO USERS

We've kept you in mind, too. Ask about the new Model HDD Disk Drive which can combine with your present Cromemco computer to give you up to 22 megabytes of disk storage.

CIRCLE 5 ON READER CARD

Cromemco
incorporated
280 BERNARDO AVE., MOUNTAIN VIEW, CA 94040 • (415) 964-7400
Tomorrow's computers today

MARCH 1980/$4.00 U.S.A. VOLUME 26 NUMBER 3 This issue, 159,805 copies

DATAMATION 80®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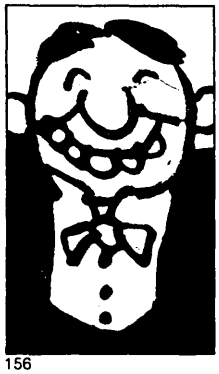
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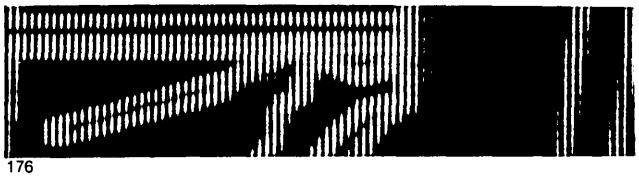
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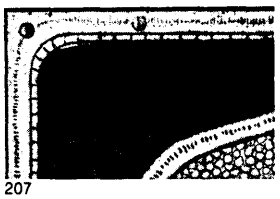
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NEWS IN PERSPECTIVE

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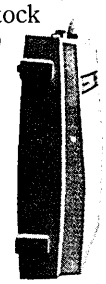
Hot off the wire.

Dow Jones News/Retrieval provides instant data for decision makers with TI's 745.

When corporate decision makers need information, Dow Jones News/Retrieval service and TI's *Silent 700** Model 745 Portable Data Terminal have the answers.

The reliable 745 supplies up-to-the-minute "hot news" from Dow Jones domestic and international newswires, articles from *Barron's* and *The Wall Street Journal,* plus current and historical stock quotes from over 6,000 companies.


Model 745

Professionals in all fields value the 745's quick access to a broad range of categories including financial, corporate, industrial and governmental developments. News stories appear within 90 seconds of "breaking" and are stored at Dow Jones for up to 90 days. Great for spotting trends and gaining perspectives.

With the portable 745's built-in acoustic coupler, users can dial up the latest news from anywhere there is a standard telephone and electrical outlet. And since the lightweight data terminal can travel from office to office or on out-of-town trips, decision makers keep in touch.

The 745's typewriter-like keyboard lets users instantly choose from an index of descriptive headlines for concise, informative stories, all printed at a virtually silent 30 characters-per-second. And its hard copy printouts assure that information is circulated accurately.

The versatile 745 is also providing high yields for businesses like banking, real estate and insurance companies.

TI is dedicated to producing quality, innovative products like the *Silent 700* Model 745 Portable Data Terminal. And TI's hundreds of thousands of data terminals shipped worldwide are backed by the technology and reliability that comes from over 30 years of experience in the electronics industry.

Supporting TI's data terminals is the technical expertise of our worldwide organization of factory-trained sales and service representatives, and TI-CARE†, our nationwide automated service dispatching and field service management information system.

That's why TI has been appointed the official computer and calculator company of the 1980 Olympic Winter Games.

If you would like more information on the *Silent 700* 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.

Fifty Years of Innovation

*Trademark of Texas Instruments †Service Mark of Texas Instruments

TEXAS INSTRUMENTS

We put computing within everyone's reach.

CIRCLE 7 ON READER CARD

From the graphics leader.

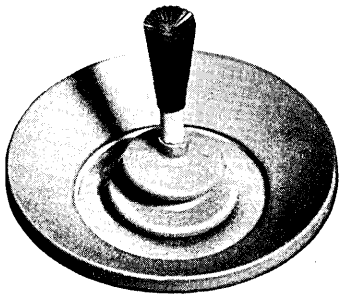
The Practical Plotters. By Tektronix.

Do your big plotter work. At a small plotter price. That's practical!

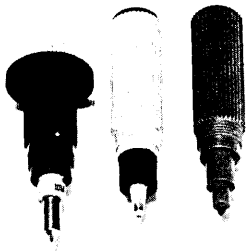
At Tektronix, we build plotters that pay for themselves.

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.

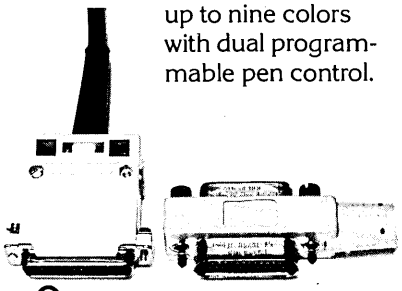
Economy. Instead of waiting in line for large plotter output, you can typically do two-thirds of your plotting on our 4663, with comparable quality. Faster turnaround. Tremendous cost savings.



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.

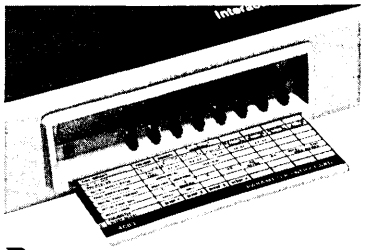


Versatility. The 4663 plots on paper, film or Mylar.® With felt tip, wet ink or ballpoint pens. In up to nine colors with dual programmable pen control.



Compatibility. From its RS-232-C and GPIB (IEEE-488) interfaces, to options like foreign language fonts and circular interpolation, our plotters mesh with your present system and particular needs. Powerful, wide-ranging software routines are both inexpensive and easy to use.

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.



Bring Tektronix into your bidding picture. It's the only practical thing to do. Next time you're shopping for plotters, let your local Tektronix representative show you output samples and examples of what our Practical Plotters can do for you. Call him directly, or call our toll-free automatic answering service at 1-800-547-1512. In Oregon, call 644-9051 collect.

Tektronix, Inc.
Information Display Division
P.O. Box 500
Beaverton, OR 97077

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Postbox 827
1180 AV Amstelveen
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The practical plotters

Tektronix®
COMMITTED TO EXCELLENCE

CIRCLE 8 ON READER CARD

TWENTY YEARS AGO/TEN YEARS AGO

LOOKING BACK

MARCH/APRIL 1960

Should you be talking to your computer? Professor H. Von Foerster, banquet speaker for the WJCC, 1960, San Francisco, discussed the possibilities of interacting with computers in the same fashion one would with living, intelligent organisms. Concerning his talk, "Living Computers," Von Foerster said, "those who run around on two, four, six or a thousand legs (as, for instance, people, dogs, ants, or millipedes) and those which are bolted to the floor, plugged into an electric power plant and perform intellectual tasks that cause an onlooker to exclaim: 'They are alive!' still have little in common. While the former are known to be extremely clever yet relatively slow, the latter are still relatively stupid yet extremely fast."

On the lighter side of the WJCC was the list of activities scheduled for the ladies. We think it indicates the progress of women up the corporate ladder in the past 20 years. "Delegates attending the 1960 WJCC may cheerfully neglect their wives for business-at-hand, knowing that a well-rounded program of social events has been organized expressly for the benefit of the ladies." Miss Mary Fraser of IBM, San Jose, headed the committee, with Mrs. Eleanor Schmidt acting as cochairman. Miss Phyllis Baxendale of IBM described "some oddities in the conference's technology in a speech entitled 'Conversations with Computers.' " On the following afternoon, the WJCC widows were led by Miss Fraser across the Golden Gate bridge to Sausalito for lunch and a fashion show. Next on the agenda was a shopping spree through that quiet artists' town, wrapping up the day by "rejoining their husbands for dinner that evening." Tours, shopping, and cocktail parties rounded out this busy schedule. Other women on the committee were Mrs. Marilyn Richardson, IBM, San Jose; Miss Marilyn Black, Stanford Research Institute; and Miss Connie Pope, General Electric, Palo Alto.

MARCH 1970

By March 1970, ADAPSO and the computer services industry had evolved into three major categories: traditional dp centers, time-sharing organizations, and the software firms. The membership of ADAPSO consisted primarily of organizations in these three categories, and they were either independents, chains, conglomerates, spin-offs, or vendors.

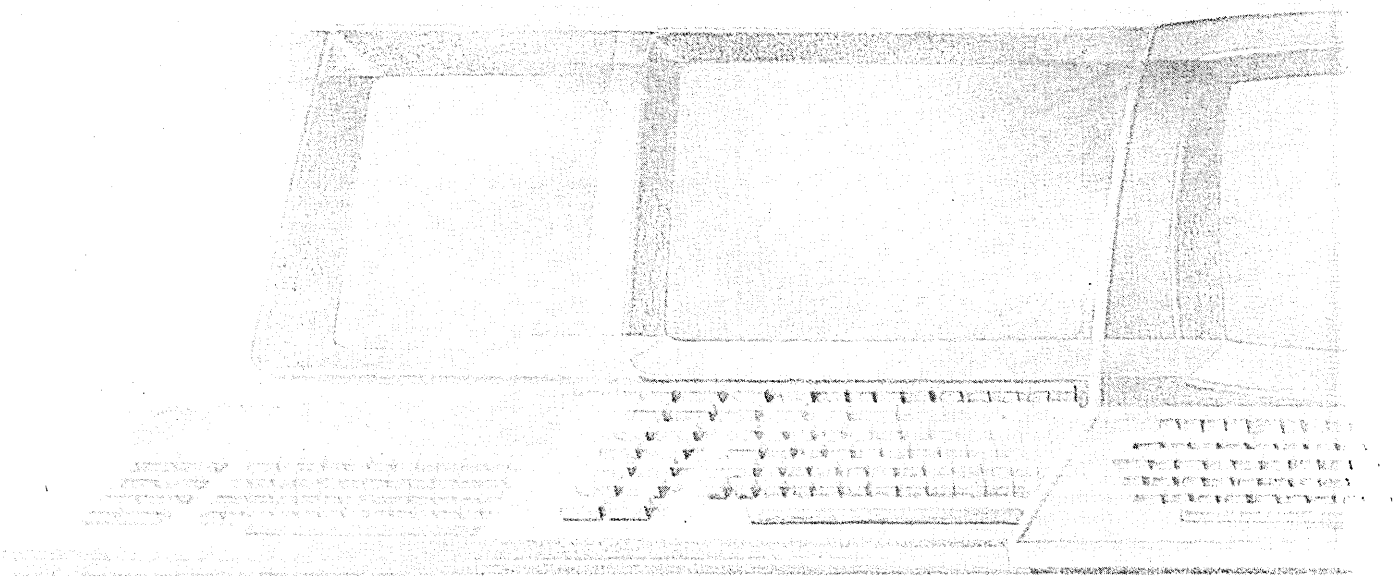
The association represented 34% of the computer services companies, almost 50% of the operating data centers, and 48% of the estimated sales volume. In the first quarter of the association's fiscal year, 1969-1970, 25 new companies joined. Industry acceptance had been a problem for ADAPSO in the past; many felt it lacked the maturity to confront the problems of the times. To a degree, this was true. The association simply mirrored the chaotic state of the industry, which was growing at an unparalleled rate.

Various goals of ADAPSO were (1) to unify all segments of the industry, (2) to extend recognition of the computer services industry, (3) to perpetuate, expand, and improve the economic status of the industry, (4) to improve management skills of the industry in order to accelerate profitability on a long-range basis, (5) to secure a useful understanding of user needs from manufacturers, and (6) to unify the industry in purpose and commitment in order to develop a responsive sounding board in government with a liaison in allied and competitive industry circles.

With continued growth, participation, and interest in the services area, ADAPSO has managed to do much more than merely stay afloat. However, this article (by Jerry Dryer (ADAPSO executive up) concluded with a strong recruitment pitch: "Will those of you sitting on the outside looking in please join with us in doing the things which must be done for our industry? . . . the time for us is now, gentlemen!"

—Deborah Sojka

Datapoint introduces Four systems,



Word Processing **Data Processing** **Electronic Message Service**

This is the only system which offers you full physical and functional integration of WP, DP, EMS, and Voice and Data Communications Management. Why settle for any system offering less?

If you thought multifunction systems just mixed words and data, we've got news for you. Now organizations of any size can significantly increase the efficiency with which they handle *all* the basic business media—data, words, messages and telephone communications. This is Datapoint's Integrated Electronic Office. It offers a unified approach to office automation that lets you grow step by step from where you are today to where you want to be tomorrow.

The multifunction system you can't outgrow.

Most multifunction systems work fine...up to a point. But no one can predict just when they'll run out of gas trying to support increasing terminal and application loads. Not with Datapoint. Here's why.

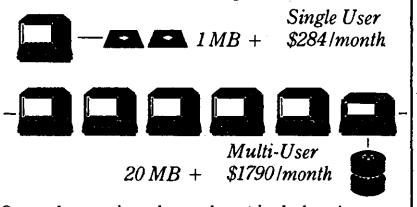
With our ARC™ system architecture, you can add on work stations, increase processing power, expand peripherals, and broaden the common database virtually without limit. And no matter how large the system, the same responsive performance is provided at every Datapoint work station without the degradation common in shared logic systems.

Put a hundred work stations at headquarters. Ten in each region. And one in every branch—each with local files and peripherals. Datapoint lets you tie it all together, uniting your organization with a two-way path for information flow.

Word processing with new search power.

Datapoint's Word Processing System speeds and simplifies the generation, revision, and distribution of general correspondence and other business documents. Complementing a full range of text-editing features is AIM (Associative Index Method), a content-oriented information retrieval system that lets you find any document quickly based on phrases, words, or even partial words. If you can't find it with AIM, it isn't there.

Pick the size you need.



3-year lease prices shown do not include printers (many types available) or maintenance/installation charges. WP & EMS software licensed at $750 and $1500 respectively including training.

Cut long distance telephone costs up to 40 percent.

One of the largest expenses in most offices is voice communications, often rivaling data processing costs. You

true office integration: one keyboard.

Data and Voice Communications Management

Datapoint has combined all four capabilities into one integrated system using a common database. And every function is available at each 3800 work station.

can control these costs with our Long Distance Control System, a key component of the Integrated Electronic Office. Operating with existing PBX or CENTREX exchanges, the LDCS reduces long distance costs by a combination of least-cost routing, queuing, and call buffering. You can add LDCS capability to your system at any time. Or begin building your automated office here.

Send messages across the hall or across the nation—free.

Datapoint's Electronic Message System enables documents entered through the Word Processing System to be stored, retrieved, and transmitted to other Datapoint work stations automatically.

By interleaving message traffic with voice communications and utilizing excess line capacity during off-peak hours, EMS gives your interoffice correspondence a free ride. You can also use EMS for automatic encryption/decryption, priority transmission, and downline loading of system software and application programs to remote Datapoint processors.

Process transactions and batches concurrently.

What about data processing? That's where we began. And it's all still here for source data entry, local processing, and printing with COBOL, BASIC, RPG, and our easy-to-use DATASHARE®. A choice of compatible processors and a broad range of peripherals lets you match system capacity exactly to the job.

Apply the power of integrated function.

New applications come up fast with Datapoint. The key — simple programming, a common database, and ARC.

ARC communicates easily with your central mainframe, in both batch and interactive 3270 modes.

Enter data...compute and store...retrieve and incorporate in text...transmit messages interleaved with voice...receive confirmations automatically. With Datapoint, anything goes.

We're ready to help you apply the power of the Integrated Electronic Office to your organization *now*. Our team of marketing representatives, systems specialists, and customer service engineers will support you with experience gained in over 30,000 user locations worldwide.

For further information, call (512) 699-7151 for the number of your nearest Datapoint office. Or write Datapoint Corporation, Marketing Communications MS-KO5, 9725 Datapoint Drive, San Antonio, TX 78284.

DATAPOINT

CIRCLE 11 ON READER CARD

Good news for Word People.

In business, there are basically two kinds of people.

Word People. And Numbers People.

If you're a Word Person, this ad is for you.

And so is this new machine: The Xerox 860 Information Processing System.

It can rearrange paragraphs, change margins, correct misspellings and type out a virtually endless series of text revisions at the speed of hundreds of words a minute.

And it remembers everything it's done for future reference. Or additional changes.

But it also does something you might not expect from a word processing system.

It processes numbers.

Because in business today, Word People have to manage numbers. And Numbers People have to manage words.

And everyone, but everyone, has to manage information.

XEROX

Good news for Numbers People.

"I give it a 10."

In business, there are basically two kinds of people.

Word People. And Numbers People.

If you're a Numbers Person, this ad is for you.

And so is this new machine: The Xerox 860 Information Processing System.

It can compute, do statistics and perform the routine work that's essential in managing records, measuring work performance and so on.

And it remembers everything for future reference. Or additional changes.

But it also does something you might not expect from a numbers processing system.

It processes words.

Because in business today, Numbers People have to manage words. And Word People have to manage numbers.

And everyone, but everyone, has to manage information.

XEROX

CIRCLE 12 ON READER CARD

WHAT SPERRY UNIVAC IS DOING IN THE MINICOMPUTER BUSINESS.

WE'RE GIVING OEMs THE BUSINESS.

Literally.

We're out to build the biggest, best OEM base in the industry. And we've decided to do it the fastest, surest way possible. By offering OEMs the best deal in the business.

HOW DO WE DO IT?

Easy. You tell us your problem. We'll solve it. For example:

Have you ever been interested in becoming a supplier to a specific vertical market only to find you already had too much invested in software to warrant conversion to a new system with an expensive start-up price tag?

We've got a plan that provides you with a specific vertical market software package. We know where to find software that runs on our hardware with all the necessary capabilities. So we can practically eliminate start-up time and make your new system profitable with your very first sale.

WE WANT TO SUPPORT YOU.

Opening doors to vertical markets is only the first step in our plan. After we get you started, we keep you going. We'll provide marketing support suited to your specific market. And we'll provide leads from your geographic area.

YOU CAN'T LOSE.

Because we're out to win. And we've got the support that can make it happen. Sperry Univac was first in the computer industry. And we're growing from the success established by Sperry Univac with over $10 billion in installed systems worldwide.

That total support includes a heavy commitment to the kind of research and development that produced some of the first systems to run COBOL, FORTRAN, PASCAL, RPG II, TOTAL, Timesharing, Transaction Processing and a mix of communications protocols concurrently.

And we're going to keep it up. Providing a wide-range of products at the forefront of technology is as much our business as selling and delivering equipment.

We've done just about everything we can think of to make working with Sperry Univac easy. And of course, all our products are supported by 10,000 technicians servicing our hardware worldwide.

If you can think of anything else we can do for you, give us a call right now. We mean business.

For more information write to us at Sperry Univac Mini-Computer Operations, Marketing Communications, 2722 Michelson Drive, Irvine, CA 92713. Or call (714) 833-2400, Marketing Communications.

In Europe, write Headquarters, Mini-Computer Operations, London NW10 8LS, England.

In Canada, write Headquarters, Mini-Computer Operations, 55 City Centre Drive, Mississauga, Ontario, L5B 1M4.

SPERRY UNIVAC

CIRCLE 13 ON READER CARD

SPERRY UNIVAC IS A DIVISION OF SPERRY CORPORATION


SPERRY UNIVAC
V77

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

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

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

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

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

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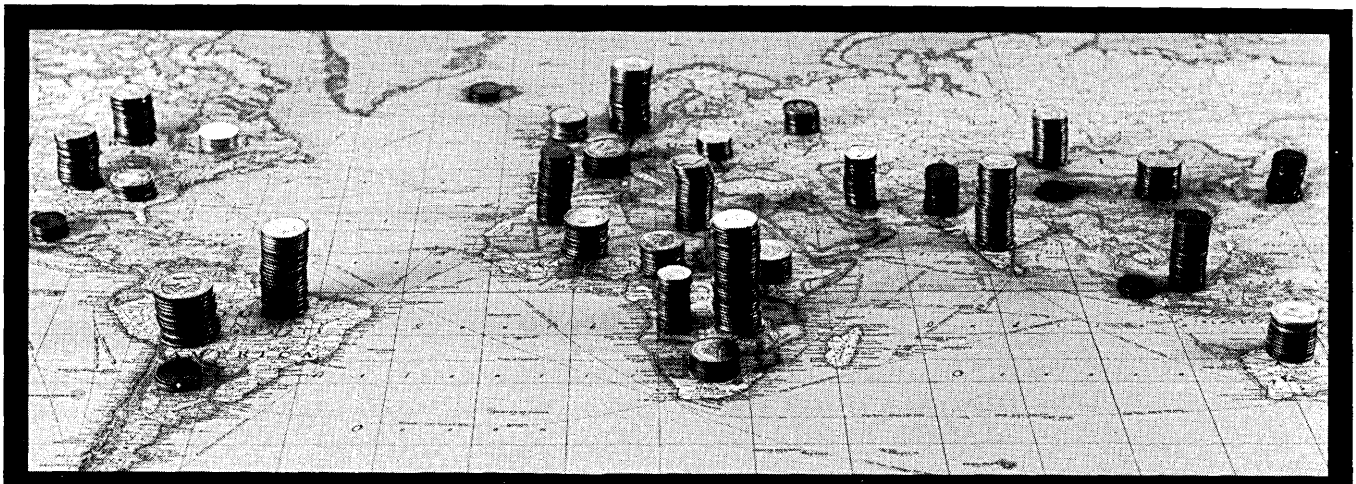

The latest words in communications: Rockwell-Collins.

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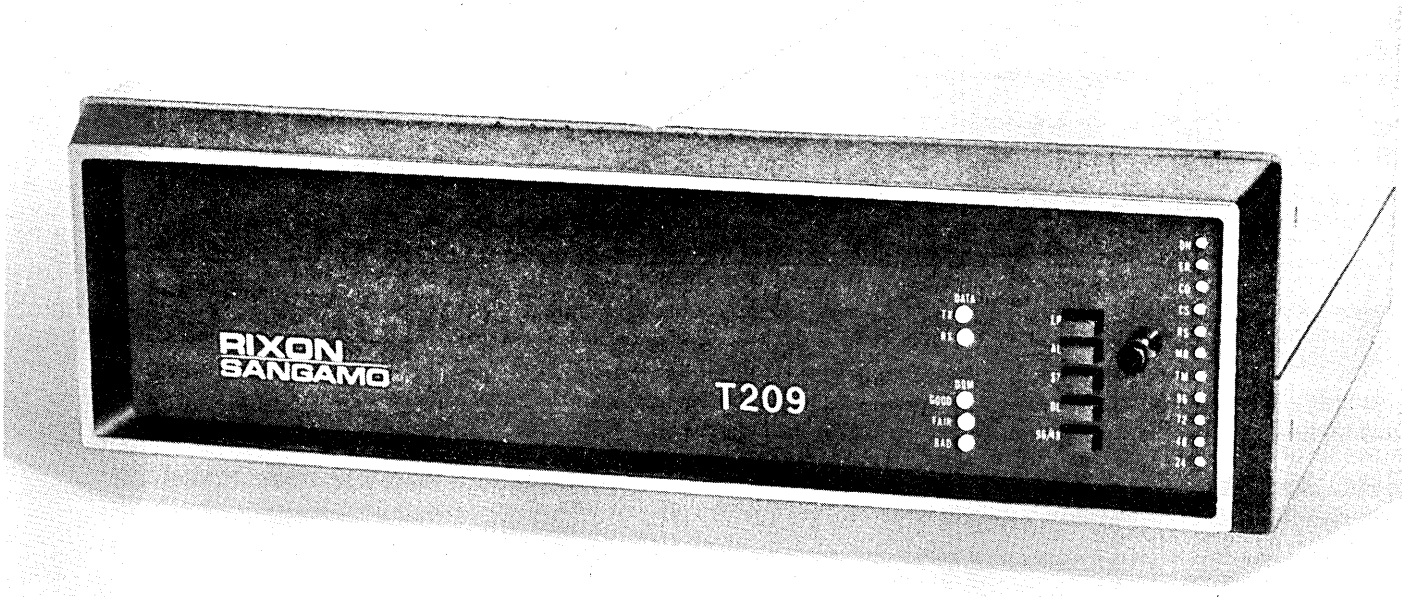
CIRCLE 14 ON READER CARD

THE RIXON T209 BELL COMPATIBLE 9600 bps MODEM



ANOTHER WINNER FROM RIXON...DESIGNERS AND MANUFACTURERS OF MODEMS FOR OVER TWO DECADES

The RIXON Microprocessor-Based T209 Features

- Bell Compatibility
- A Microprocessor-Based design for high reliability
- Fall-back to 4800 bps for DDD back-up operation
- Built-in four port multiplexer which handles any combination of 2400, 4800, 7200 and 9600 bps streams adding up to 9600 bps
- Automatic Adaptive Equalization
- Self-Test
- Use of 4-wire 3002 private lines with D1 conditioning
- Diagnostic LED's on the front panel
- Analog and Digital Loopback
- Optional received data quality monitor module with a signal constellation output

In addition to the T209, RIXON manufactures a complete line of modems up to 9600 bps. Write for Descriptive Literature. For further information circle the reader service number. Or, for immediate assistance, please call.

The RIXON T209 Data Modem is manufactured under license from Western Electric.

RIXON INC. A SUBSIDIARY OF
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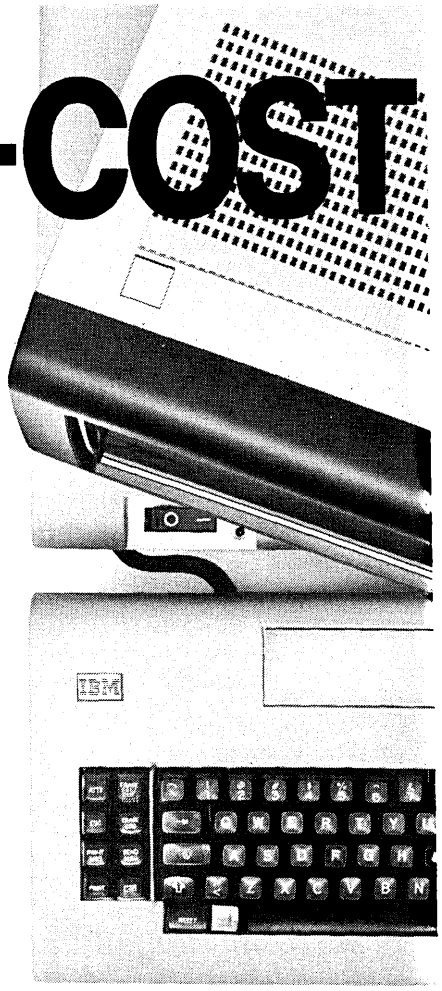
See it at Interface '80
Booth 1932

3023

CIRCLE 15 ON READER CARD

THE NEW, LOW-COST



If you use ASCII terminals in your business, you'll be interested in the low price and high quality of the new IBM 3101 display terminal. You choose from two basic configurations, which range in price from $1,295 to $1,520. Both connect to most business computer systems, be they IBM or not. You order the 3101 with just one phone call and, for the character-transmission models, get delivery as fast as 60 days after you sign the contract. To top it off, you get the high quality, performance and dependability you expect from IBM. Read on to find out more about this remarkable ASCII terminal.

Save up to 20%

Volume procurements can save you up to twenty percent for either of the two configurations of the IBM 3101. One configuration, with character transmission, lets you use it like a teletypewriter. The other has selectable character or block transmission. In block transmission, it provides sophisticated editing capabilities such as insert/delete and full cursor control, along with field functions like blinking, high intensity and protected fields.

A convenient ASCII terminal

Accessible setup switches allow do-it-yourself selection, such as line speed, parity, scroll and reverse video. And since the IBM 3101 weighs only 38 pounds, it can easily be moved to where the work is.

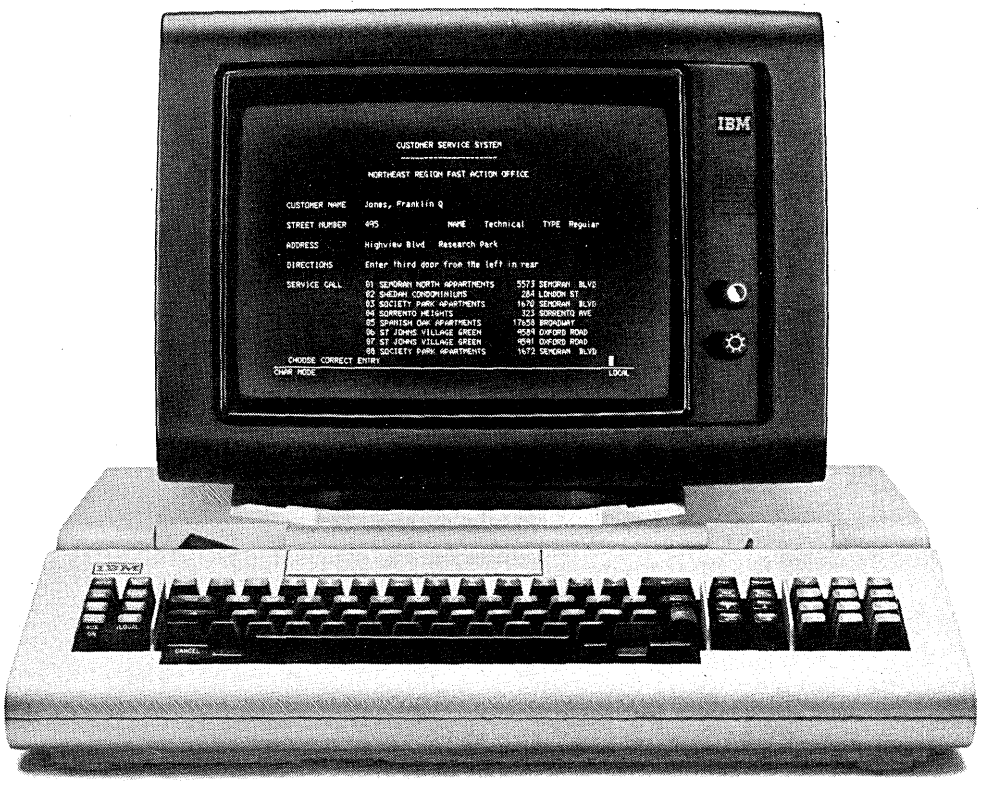
Both models, which can generate all 128 ASCII characters, are ideal for most interactive applications and may be used with an IBM or non-IBM computer. And these terminals are even more versatile when used with our new 3102 buffered printer.

Human engineering inside and out

The 3101 lets you decide what's best for you. The 12-inch diagonal screen can be swiveled and tilted to cut interference from overhead lighting. Display the maximum of 1,920 characters in 24 lines and you'll see they're as distinct in the corners as in the center of the screen. For your viewing comfort, with the flick of a switch you can select green characters on a black background, or black on green. And there's a detachable contrast-enhancing filter to reduce glare.

The keyboard is moveable, so you can angle it to the screen to suit your comfort and eyesight.

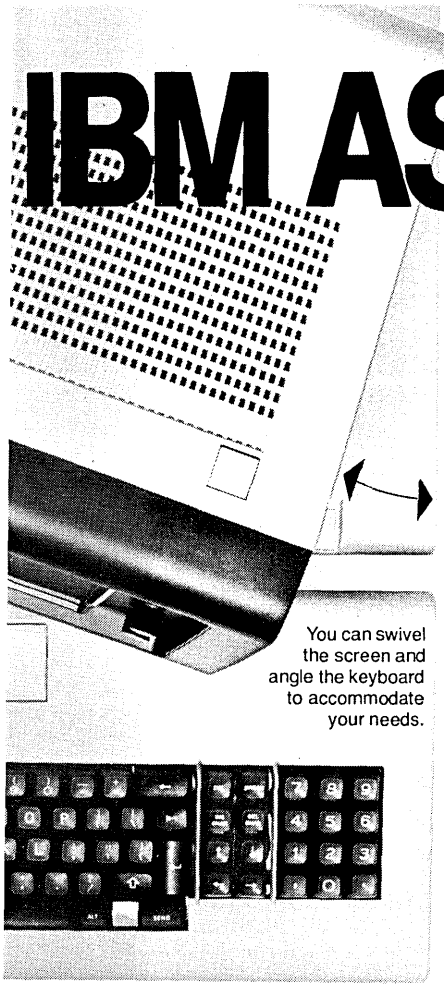
The keyboard looks familiar because it's much like the IBM Selectric.™ The 87 keys include a numeric keypad, graphic character keys, cursor positioning controls and dished home-row keys for touch typists. And the keytops are textured to reduce glare.



Diagnose malfunctions yourself

The terminal is designed to help you troubleshoot problems. The cause of equipment failure is displayed on the screen, using the twenty-fifth line. If you then follow simple instructions, you can generally isolate the source of the problem and correct it. If the equipment has a malfunction that can't be fixed in this way, the modular design of the 3101

IBM ASCII TERMINAL



You can swivel the screen and angle the keyboard to accommodate your needs.

lets you replace any of the three elements – video, keyboard and logic – while you send the faulty element to an IBM repair center for prompt service.

Out of the carton and into operation

Setup is do-it-yourself. You place the video on top of the logic element, connect the keyboard and video element and plug in the 3101. Then you simply use the appropriate setup switches to select the desired mode of operation.

Do-it-yourself printout too

You can also get a copy of the information that you see displayed on the IBM 3101 with the all-new IBM 3102 printer. A small, quiet, non-impact buffered printer, it attaches to the IBM 3101 and is just as simple to set up. You also get diagnostic functions so you can troubleshoot the IBM 3102 printer yourself. The purchase price for this printer is $1,295, which makes hard copy economical. And ask about our volume pricing.

Call our toll-free 800 number

We've made it simple to order these new products. You don't need to see an IBM salesperson. Either mail your order or do-it-yourself by a toll-free phone call. If you call, you can talk to a specialist who can take your order or answer your detailed questions.

Here are the numbers to call: In New York State, call *800-942-1918*. Elsewhere in the continental U.S., *800-431-2670*. In Alaska, Hawaii and Puerto Rico, call collect *914-696-6840*.

Our toll-free-center specialists can provide delivery and availability information for the 3102 printer and 3101 block-transmission models, and tell you about our demonstration program. Prices are subject to change.

IBM Data Processing Division
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I'm interested in these exciting new IBM products.

☐ Yes, send me a contract.
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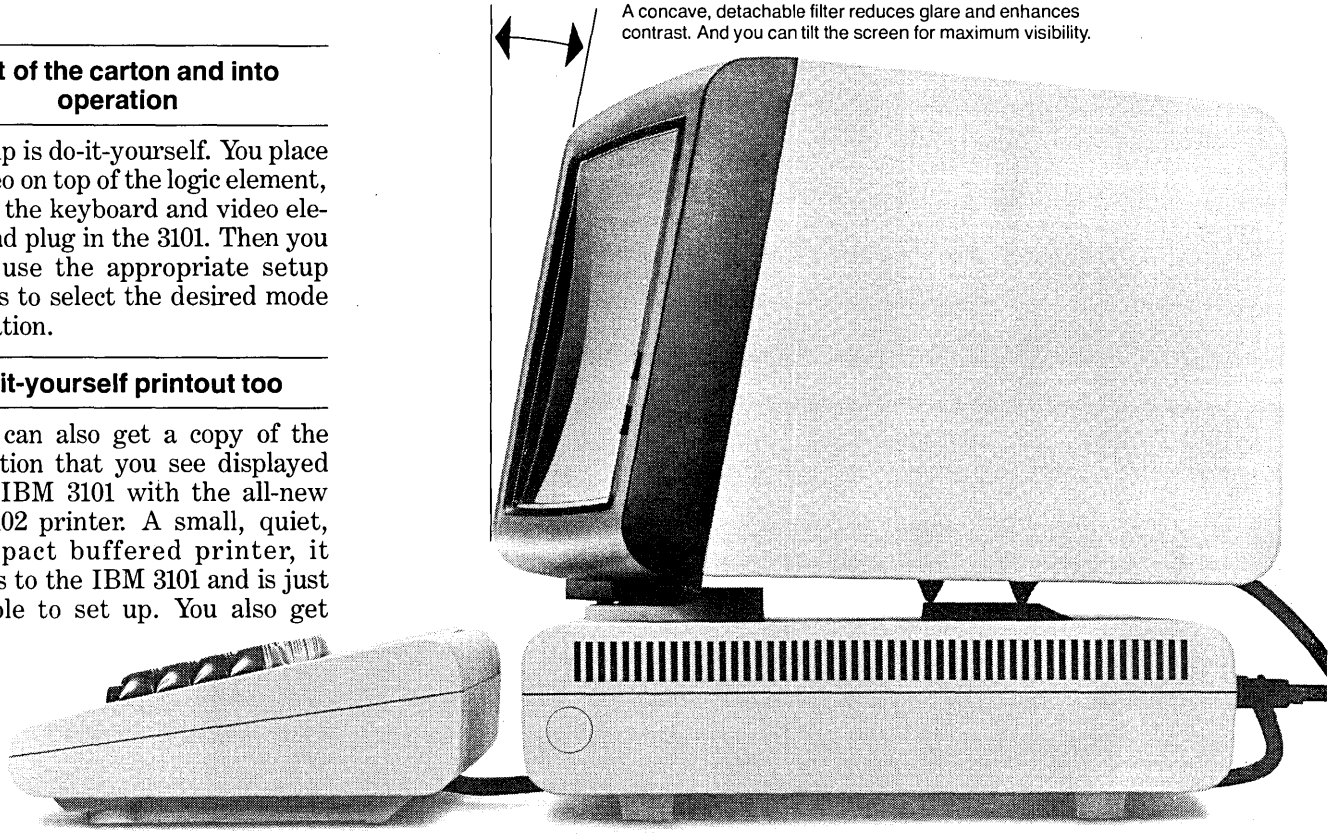
IBM Data Processing Division

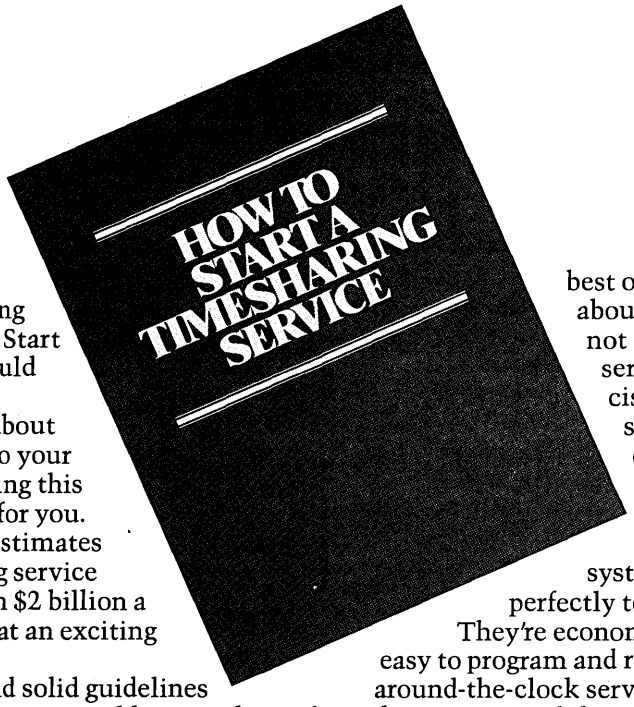
The way we put it all together is what sets us apart.

A concave, detachable filter reduces glare and enhances contrast. And you can tilt the screen for maximum visibility.



CIRCLE 17 ON READER CARD

HOW $2 COULD GET YOUR TIMESHARING SERVICE BUREAU OFF TO A VERY GOOD START



If you're thinking about starting a remote computing business, reading "How to Start a Timesharing Service" could help you get started right.

Or if you're thinking about adding on-line capability to your batch service bureau, reading this book could make it easier for you.

You've probably read estimates that the remote computing service industry grosses more than $2 billion a year, and that it's growing at an exciting 25-30% yearly.

In this book, you'll find solid guidelines to show you how your company could get its share of all that business.

Concise coverage of vital business functions. A vital part of managing any business is asking the right questions. This book covers these important questions and helps you get answers that are right for you.

Besides covering the technical aspects of setting up a remote computing system, this book covers the business aspects of running it for sales and profitability, including:

Business Planning—it tells you how to set up a business projection, and gives you examples of two-and-five-year projections.

Marketing—it describes how to conduct market research, how to analyze your competition, how to devise sales strategies, and how to prospect for customers.

Product Development—this book discusses the market, and how to develop or buy software to meet market needs. In addition, you'll learn how to diversify into areas such as OEM sales, software development, and facilities management.

Financing—this book covers estimating both start-up and operating expenses, setting up management controls, obtaining financing, and selecting a form of business organization.

A wealth of experience packed into 32 pages. For more than 10 years, BTI has supplied computers to service bureaus, to help them grow and prosper. The best of what we've come to know about what to do—as well as what not to do—in starting a timesharing service bureau is clearly and concisely set forth in this book. You can share in all this knowledge and experience for just our costs of printing and mailing the book: $2.

Why we're making this offer. At BTI, we make computer systems that lend themselves perfectly to remote computing services. They're economical, oriented to timesharing, easy to program and run, highly reliable and backed by around-the-clock service with over-the-phone diagnostic capabilities.

We've installed over 2,000 of these systems in the U.S., Canada and Europe. We would like to install a great many more.

Anything we can do to help your timesharing service increase its chances for success could very well help us become even more successful. And we believe this book could give you just that kind of help.

So, while our offer may not be wholly altruistic, it is still a very good offer.

We invite you to take advantage of it.

BTI COMPUTER SYSTEMS

☐ Enclosed is my check for $2, payable to BTI. Please send me my copy of "How to Start a Timesharing Service".

☐ Also send me information on your BTI 5000 Computer System.

Name _____

Title _____

Company _____

Address _____

City _____ State ____ Zip _____

Clip and mail with payment to BTI Computer Systems, 870 West Maude Avenue, Sunnyvale, CA 94086. (408) 733-1122.

D

CIRCLE 18 ON READER CARD

LOOK AHEAD

H SERIES WAITS ITS TURN

Large European users tell us they're hearing reports that IBM's H announcement is sliding further back in the pipeline. The first of the series will not be announced until late next year, they claim, with deliveries beginning in late '82. Moreover, they expect the price to be 30% higher than current estimates. The delay is due, they understand, to IBM's manufacturing problems with the 64K chip, as well as the fact that the company has not yet recouped tooling costs for the 303X series.

Such reports complement rumors in the U.S. that the Grey Giant will soon announce a 303X upgrade, the 3034, to counter Amdahl's penetration at the high end. But in Sunnyvale, the Amdahl rumor mill says a response is already being readied, the V9, which could debut as early as May.

UNIVAC'S UNIX IS LOOKING GOOD

We hear the UNIX software package for the Univac 1100/60 machines is looking good. UNIX, developed by Bell Labs to run on DEC PDP-11s, has been modified for the 1100/60s and will soon go on sale from Univac. An industry source postulated that one reason Univac may be interested in implementing UNIX is that AT&T's planned Advanced Communications Service (ACS) calls for UNIX use, and vendors other than DEC will want that tie-in for their machines as well.

LLOYD'S LOSS MAY BE YOUR GAIN

The First National Bank of Boston, which is handling recovery and marketing for the 370 machines on which Lloyd's of London guaranteed residual value, may have over 800 used cpus -- largely 158s and 168s -- coming off lease and into the market between 1981 and 1983. Industry sources, some gleefully anticipating fire sale values, nevertheless worry that the bank, Lloyd's agent, will be painfully slow in unleashing the systems. Lloyd's losses, sources claim, may well exceed the $340 million the insurance company has said would be its maximum loss.

HYDRA BEING HONED BY IBM

Those illustrious gnomes at IBM who gave us CMS (the Cambridge monitor system, as it was originally known) are working on an alternative approach to distributed processing that could be introduced at user sites as early as 1981.

Known as the Hydra configuration, the system is based on the VM/370 operating system and uses 370, 303X and 4300 cpus. Remote sites under Hydra use a microprocessor-based "restart processor" that is said to eliminate the need for on-site operator intervention. Such remote cpu configurations would simplify terminal-based communications in distributed dp networks.

Industry sources look for Hydra to get the soft sell for VM/370 users just the way the CMS system built up its own list of followers without a major IBM push.

Hydra is still being refined at the IBM Cambridge (Mass.) Scientific Center, but sources believe it is being eyed by

LOOK AHEAD

DPD as a viable competitor to similar distributed systems from Datapoint, Four-Phase, and others -- especially for users not yet ready for the 8100.

Since the Cambridge center also developed VM/370, sources suspect strong support for Hydra as a way to expand the use of the operating system. Additionally, the restart processor is expected to find its way into other communications-oriented IBM systems once the concept has been validated at Hydra user sites.

JUSTICE DREAMS UP NEW TRUST TACK

Among the possibilities for injunctive relief from IBM's alleged monopoly is a new one recently dreamed up by the Justice Department trial team. The government is reportedly looking at a proposal whereby it would force IBM to announce a standard bus interface, and one that could be changed only after preannounced disclosure. That would amount to PCM heaven if the next generation of IBM equipment develops as predicted -- bus-oriented with complementary but separate internal processor modules.

THE HARTFORD CONNECTION

Sources tell us that IBM made a private presentation to top insurance company dp execs in Hartford last month, during which it described SNA support for VM. As mixed shops become more common -- users with MVS for production and VM for software development and short-transaction applications -- IBM is urging gradual development of VM-based 4300 nets, promising SNA for local linkage.

VENTURE INTO THE UNKNOWN

Word is Fujitsu and TRW are still trying to determine what type of product would be the most fruitful in their recently announced joint venture. Fujitsu predictably wants big volume; TRW, more cautious, wants immediate return. At the moment, their pact is merely a joint decision to have a joint venture.

IBM PREPARES TO CACHE IN

IBM is said to be working on a buffered disk system for the 303X. Perhaps the beginning of a future file processor, a cache memory for the 3380 disk controller will allow super-fast access of whole files on an item query.

TI MAY HAVE TDF TROUBLES

Rumor has it that Texas Instruments is having transborder data flow troubles with its centralized data network in Dallas. All TI's computer centers in the U.S. and around the world are tied into the Dallas net, which is said to be violating TDF regs.

LITIGATORS VS LEGISLATORS

Watch for a showdown between federal trustbusters and the Congress on just how AT&T should be structured to ensure competition in telecommunications. Breaking its silence on a communications bill in the House that would scrap the '56 Consent Decree (see related story, p.88), the government late last month made its views on the matter known to the House Commerce Committee. While allowing AT&T to set up an arms-length subsidiary that could compete in unregulated

(Continued on page 65)

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The critical information management issues of the 1980s are forming today. Growing application program development backlogs...increasing demands for problem-oriented languages...unfilled requests for data base interrogation.

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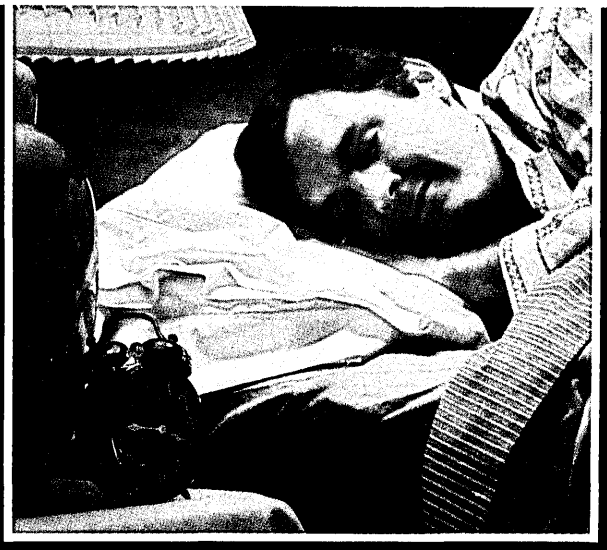
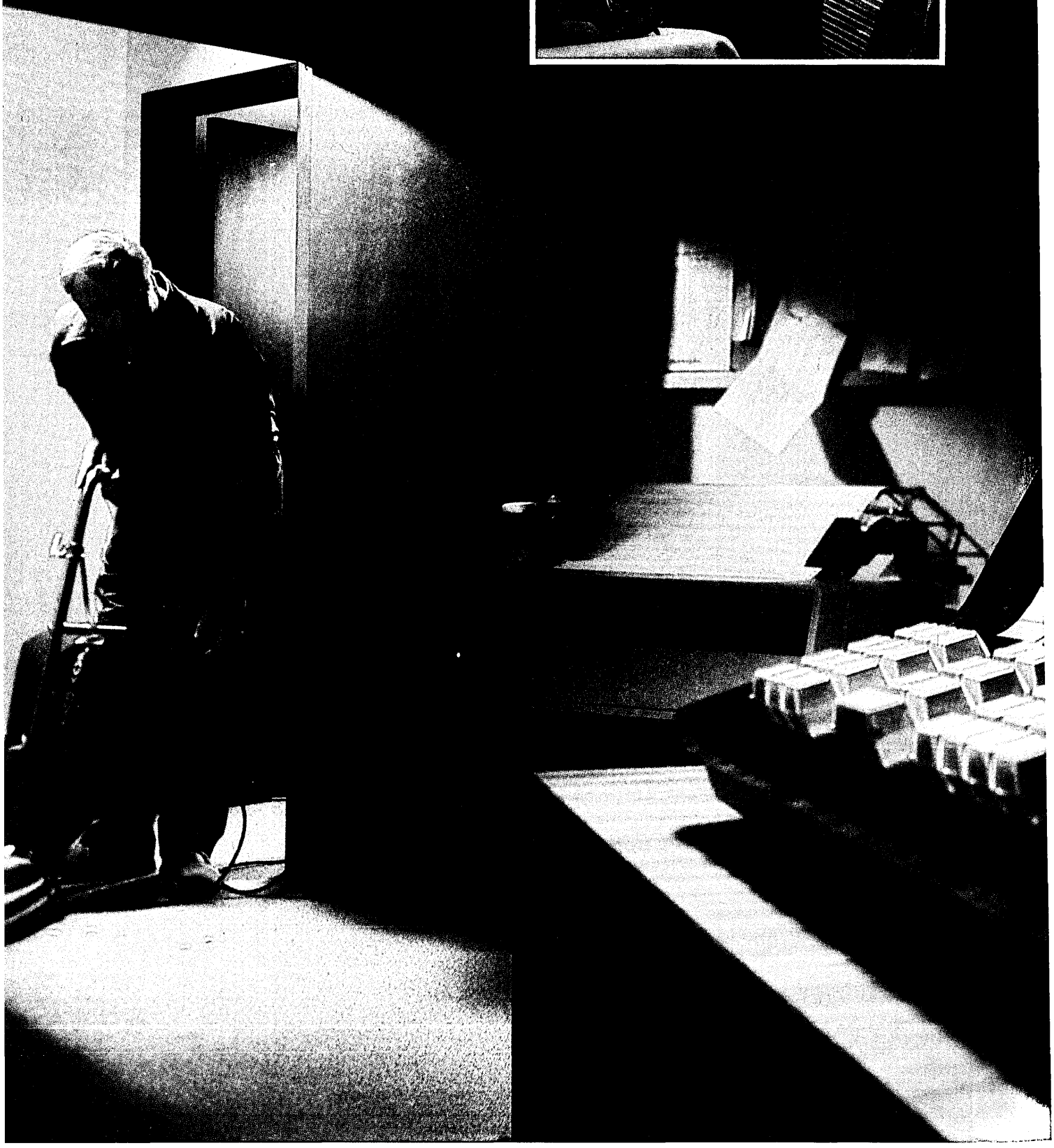
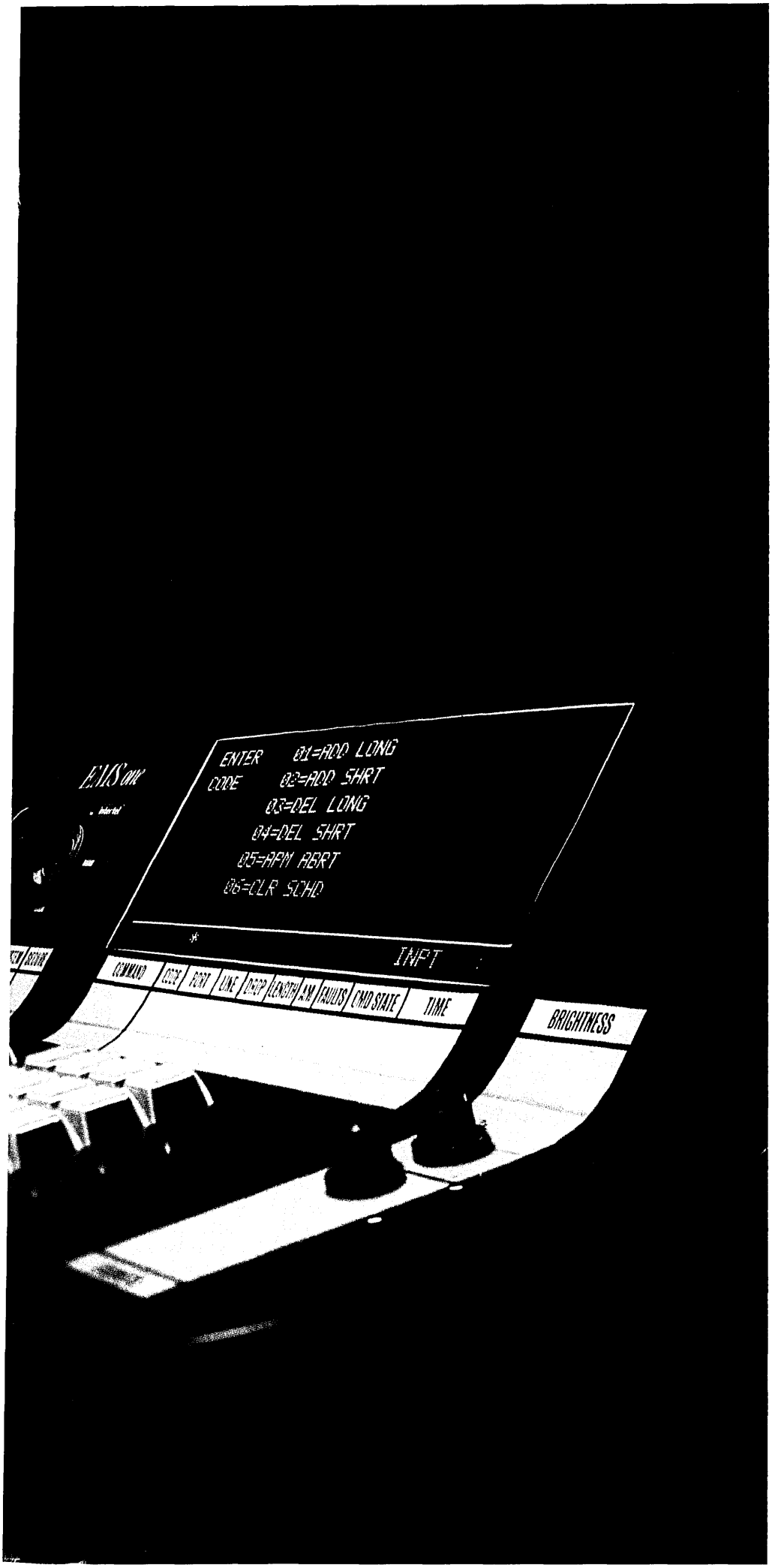
AMPPO

CIRCLE 19 ON READER CARD

INTERTEL NETWORK CONTROL... FOR A GOOD NIGHT'S SLEEP







It's 3:46 A.M. You're sleeping soundly because you know your day will begin smoothly. Before you left for home yesterday, you knew your Intertel EMS-One Network Control System would test throughout the night for network faults.

You're feeling confident because EMS-One is working unattended all night to give you a total status picture of your network in the morning. Only EMS-One has this automatic preventive maintenance (APM) function. It's looking at every line, modem, and interface... doing the work of a whole fleet of technicians at remote sites. A testing feat that sets EMS-One apart from any other network control system. In fact, at this very moment, APM is running tests and recording the results of these tests at the central site. All automatically. All accurately.

So when you go to work later on today, you'll have a complete printed listing of test results, giving you a clear, up-to-date picture of your network. You can then resolve or bypass problems quickly and effectively. With plenty of time left for other business activities and a second cup of coffee.

If downtime is keeping you up, look into Intertel EMS-One Network Control with APM. For a good night's sleep.

Zzzzzzzzzzzzz.

Write or call for our brochure. Intertel, Inc., 6 Vine Brook Park, Burlington, Massachusetts 01803. 617-273-0950.

intertel

CIRCLE 20 ON READER CARD

CALENDAR

MARCH

Interface '80, March 17-20, Miami Beach.

Will feature the data communications/ddp conference while the Datacomm School will be held to introduce newcomers to the fundamentals of data communications. Contact Peter Young, 160 Speen St., Framingham, MA 01701, (800) 225-4640; in Massachusetts, (617) 879-4502.

Printemps Informatique '80, March 18-21, Paris

Will feature an exhibition of oem equipment. Contact Pierre Jegu, Bureau International Relations Publiques, 183 Av. du Roule, 92200 Neuilly, France, (01) 747.53.09.

Viewdata '80, March 26-28, London.

The first world conference and exhibition on computerized tv-based information, education, and entertainment. Contact TMAC, 680 Beach St., Suite 428, San Francisco, CA 94109, (800) 237-3477; in California, (415) 474-3000.

APRIL

Second ACM Greater New York Regional Conference, April 3-4, New York.

Conference will discuss practical issues of data base management with software vendor presentations. Contact James Adams, ACM, 1133 Avenue of the Americas, New York, NY 10036, (212) 265-6300.

Federal DP Expo, April 28-30, Washington, D.C.

Update on trends, applications, and state of the art of all facets of ADP. Contact Sheldon Adelson, Conference Director, 160 Speen St., Framingham, MA 01701, (617) 879-4502.

Computerized Office Equipment Expo—Midwest '80, April 30-May 2, Chicago.

Will feature the latest developments in computers, word processors, copiers/duplicators, telephone systems, and other business equipment. Contact Industrial and Scientific Conference Management, Inc., 222 West Adams St., Chicago, IL 60606, (312) 263-4866.

MAY

Micro/Expo '80, May 6-8, Paris.

Will feature four major themes: Personal Computing, New Products, Industrial Applications, and Communications. This is the largest all-micro industry trade show in Europe. Contact Christopher Chambers, U.S. Sales Manager, Micro/Expo '80, 2020 Milvia St., Berkeley, CA 94704, (415) 848-8233.

NCC, May 19-22, Anaheim, Calif.

Will cover the broad areas of management, applications, science and technology, and social implications. Contact AFIPS, 1815 North Lynn St., Arlington, VA 22209, (703) 243-4100.

JUNE

National Computer Graphics Association Conference, June 16-19, Washington, D.C.

Will include tutorials in particular computer graphic fields, conferences focusing on new developments in computer graphics, and vendor exhibitions. Contact National Computer Graphics Association, Inc., 1129-20th St., NW, Suite 512, Washington, DC 20036, (202) 466-5895.

DATA COMM, June 17-19, Geneva, Switzerland.

DATA COMM is an international forum where developments in microprocessors, mini/microcomputers and associated services can be seen, together with new equipment for data communications and distributed processing. Contact Industrial and Scientific Conference Management, Inc., 222 West Adams St., Chicago, IL 60606, (312) 263-4866.

World Computing Services Industry Congress II, June 23-25, San Francisco.

Geared toward the serious discussion of responsibilities as custodians of the international information resources. Contact ADAPSO, 1925 Lynn St., Arlington, VA 22209, (703) 522-5055.

Syntopicon VIII, June 23-26, Minneapolis.

The International Word Processing Association conference will feature one day of conference and three days of exhibits from all major vendors of text processing systems. Contact IWP, Maryland Rd., Willow Grove, PA 19090, (215) 657-3220.

SEPTEMBER

Integrated Systems Expo '80, September 9-11, Washington.

The National Micrographics Association will feature the development and promotion of the effective uses of micrographics, including interfaces with other information-processing technologies. Contact John Bidwell, NMA, 8719 Colesville Rd., Silver Spring, MD 20910, (301) 587-8202.

Internepcon/Semiconductor International Expo, September 11-13, Singapore.

Keyed to the specific needs of engineering, manufacturing, and support personnel of Southeast Asia. Contact Industrial and Scientific Conference Management, Inc., 222 W. Adams St., Chicago, IL 60606, (312) 263-4866.

IPAD National Symposium, September 17-19, Denver.

NASA and an Industry Technical Advisory Board (ITAB) to report on progress of the joint industry/government computer-aided design project called IPAD (Integrated Programs for Aerospace-Vehicle Design). Contact IPAD Project Office, Mail Stop 246, NASA Langley Research Center, Hampton, VA 23665, (804) 821-2888.

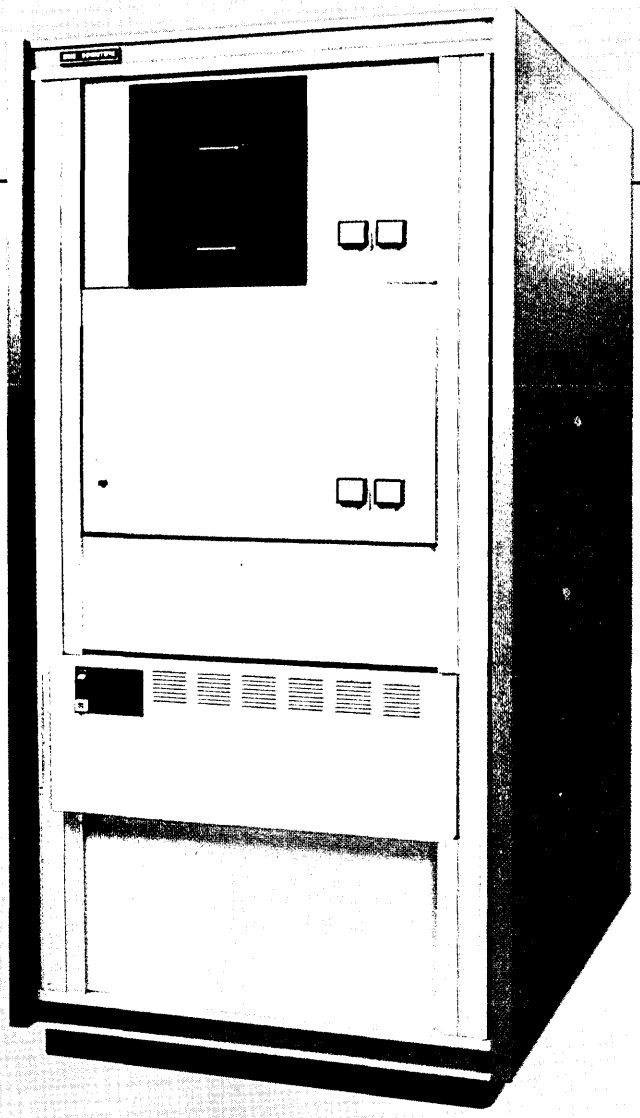
Federal Computer Conference, September 22-24, Washington.

Cosponsored by DATAMATION. Will address the management of change in the 1980s for federal dp users. Contact Ms. Lynn Green, P.O. Box 368, Wayland, MA 01778, (617) 358-5181.

Compcon Fall '80, September 22-26, Washington, D.C.

Theme will be Distributed Processing and Networking. Contact Executive Secretary, P.O. Box 639, Silver Spring, MD 20901, (301) 439-7007. ❋

Ohio Scientific: The leader in Winchester based micro-computers.



Ohio Scientific produced the first Winchester based microcomputer in 1977. Since then, we have shipped more of these systems than the rest of the industry combined. Among them are our C3-B and our C3-C microcomputers.

The C3-C.
23 Megabytes. Under $10,000.

The C3-C computer has been designed and engineered to fill the void that existed between floppy disk systems and larger hard disk systems.

In its normal configuration, the C3-C includes the Challenger III processors, 52K RAM, the 23 Megabyte Winchester drive and dual floppy drives for file system back up. And the cost is less than $10,000.

The CPU employs three micro-processors, the 6502, the Z-80 and the 6800. And the processor bus has been designed so new, more powerful micros (like 16 bit CPU's) can be added to the system later on.

There are also 10 open slots in the basic C3-C. The system supports up to 768K bytes of memory, in a multi user configuration.

The C3-B.
74 Megabytes. Under $13,000.

For those who require even more hard disk storage, Ohio Scientific offers another microcomputer in the C3 Series, the C3-B. Its specifications are the same as those of the C3-C. However, the C3-B offers a 74 Megabyte Winchester drive.

For those who do not need hard disk capacity now, but in all probability will need it in the future, Ohio Scientific offers the C3-A. It is like the C3-B and the C3-C in all respects but two. 48K RAM is standard in the C3-A, and it offers 12 open slots. When more storage is needed, the C3-A is easily expandable to either a 23 Megabyte or 74 Megabyte hard disk system. The C3-A is priced at less than $6,000.

For literature and the name of your local dealer, CALL 1-800-321-6850 TOLL FREE.

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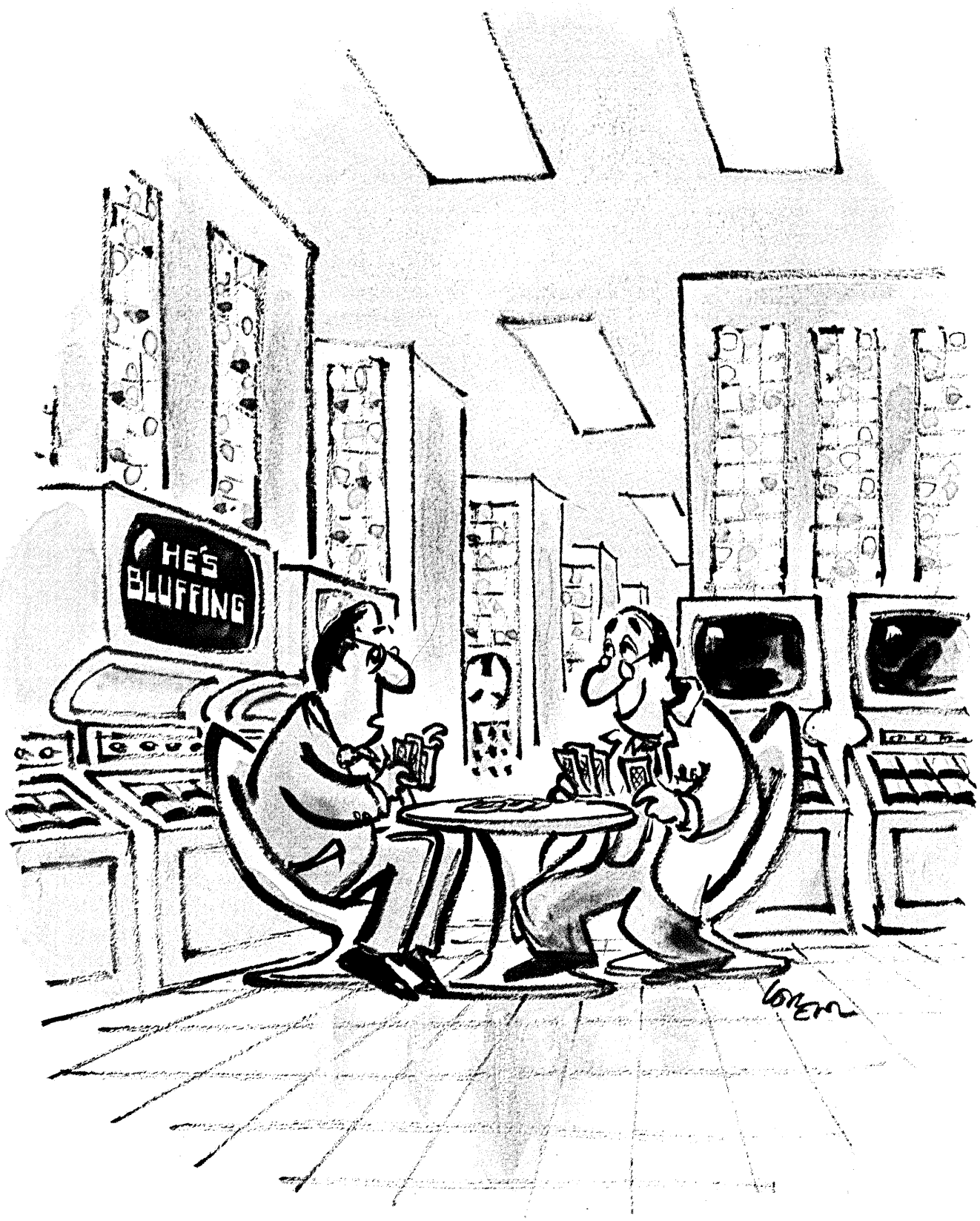
CIRCLE 21 ON READER CARD

Why our MARKLINK™ Terminal



"I don't know what you guys see in these computers..."

is how to use RCS best.

As a Data Processing manager, you've probably thought of Remote Computing Services (RCS) only in terms of functional applications such as financial analysis, problem solving and analytical forecasting.

But, now there's a computer services company that has expanded the scope and flexibility of RCS so that it can be of greater use to you.

The company is General Electric Information Services Company. And the reason we now can offer you this increased range of data processing capabilities is our new intelligent terminal, the MARKLINK Terminal. And MARK III® DDP. A fully integrated distributed data processing system from one supplier—General Electric Information Services Company.

Our intelligent terminal is a better means to more ends

What makes our MARKLINK Terminal so smart? Incredible versatility. In fact, it gives you local processing, distributed processing *and* timesharing capabilities, for either interactive or batch processing. Even more remarkably, you can use all of these capabilities *simultaneously.*

The more it does, the more you can do

By doing more, the MARKLINK Terminal opens up to you a whole world of computing possibilities.

Local Processing. As a minicomputer, the MARKLINK Terminal is ideally suited for local data entry, editing and storage. So, offices and factories can use it for everyday jobs such as local financial accounting, inventory control and order entry—without the expense of always being on-line to a large host computer.

Transaction Processing. The MARKLINK Terminal, accessing the host computers of General Electric Information Services Company, gives you the transaction power you need for large centralized data bases like master inventory files, consumer credit histories or international reservations information that must be continually accessed from multiple locations. And it does it more economically than simple timesharing.

Interactive Timesharing. The MARKLINK Terminal gives you direct access to our MARK III Service command system or our IBM compatible MARK 3000℠ Service. So, you can talk directly to the host computer for ad hoc reporting, program development and control of production runs.

Remote-Batch Processing. For scheduled daytime or overnight and weekend jobs like payroll and invoicing, large volumes of data can be captured and edited on the MARKLINK Terminal to be processed by our host computer on a delayed basis.

You even get more options

Another reason the MARKLINK Terminal is a better choice is the additional options it gives you. Like access to our extensive software library, including more than 1800 different programs covering key industry areas. You also get access to both Honeywell and IBM equipment, whichever best suits your needs. And the flexibility of both CRT and print capability.

Yet for more, you pay less

Your MARKLINK Terminal is linked to GEISCO's host computers by a single, synchronous 2400 baud communications line. This gives you high speed communications and flexibility at a low cost. Though you pay for only one line, its multi-stream capabilities can do transaction processing, timesharing, batch transfer—all at the same time.

The team behind the terminal

When you build your distributed processing around the MARKLINK Terminal, you get more than state-of-the-art hardware and software. You also get state-of-the-art services. Like a customer service desk that you can call 24 hours a day, 7 days a week. Like the attention of our technical support staff. And a training program that will give your people the documentation and expertise they need to get the most out of our services.

Who we are

We're General Electric Information Services Company. One of the world's leading companies in remote computing services.

We help make business more effective, more efficient and more profitable for our customers, over 5000 of them around the world.

If you'd like to know more about our MARKLINK Terminal, please send us the coupon below.

General Electric Information Service *is* how to use computers best.

General Electric D 380
Information Services
Company
401 N. Washington Street
Rockville, Maryland 20850
Dept. MC

Please send me more information on using the MARKLINK Terminal.

☐ Please send me your booklet.
☐ Please have your representative call.

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Title_____

Street_____

City_____ State_____ Zip_____

Company_____

Type of business_____

Do you have a specific application in mind? If so, please specify.

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GENERAL ELECTRIC

CIRCLE 22 ON READER CARD

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We'll ship within 24-48 hours—from Santa Clara, Fullerton, Chicago, Dallas, or Philadelphia—so you'll get the packs you need as quickly as you want them.

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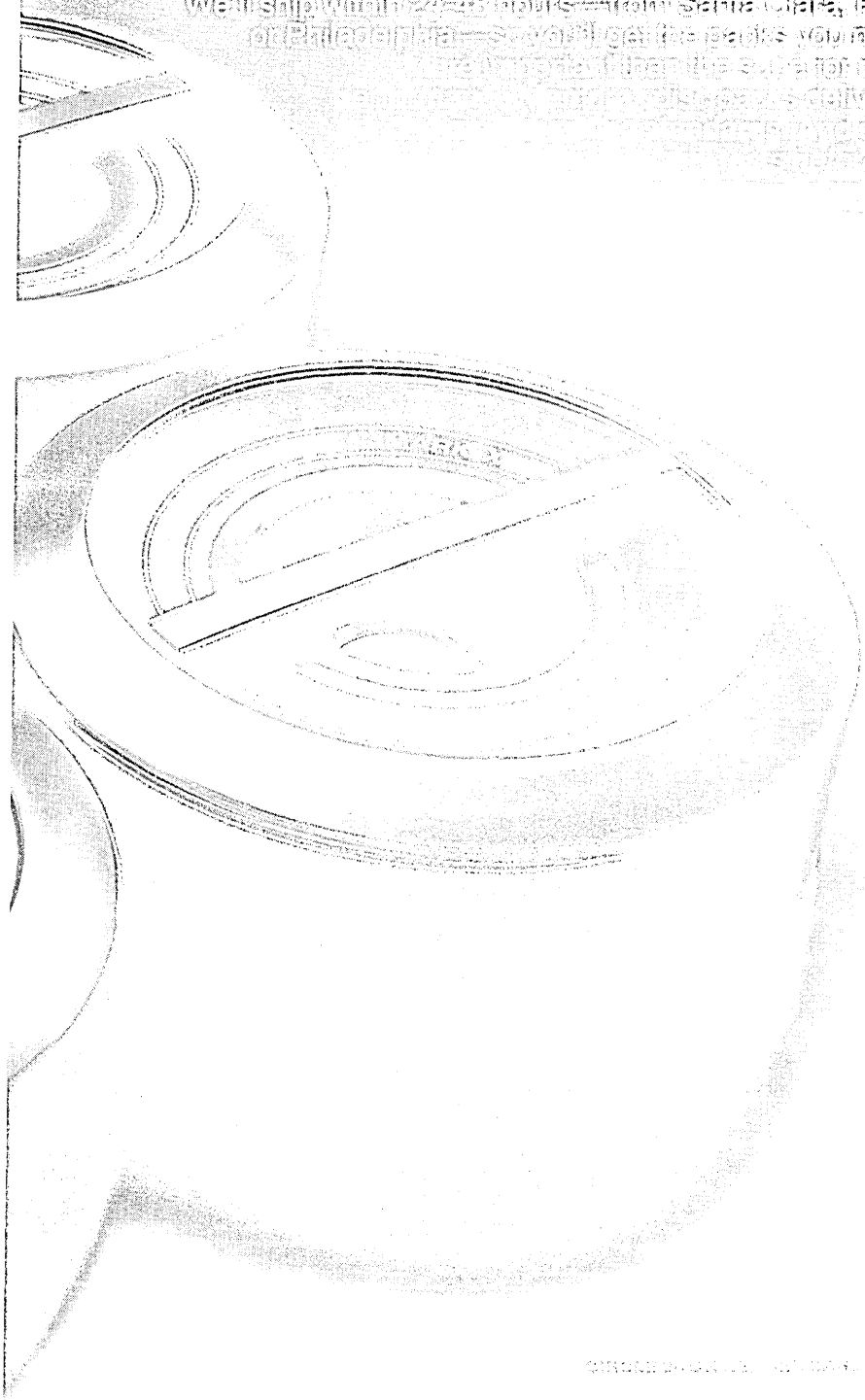
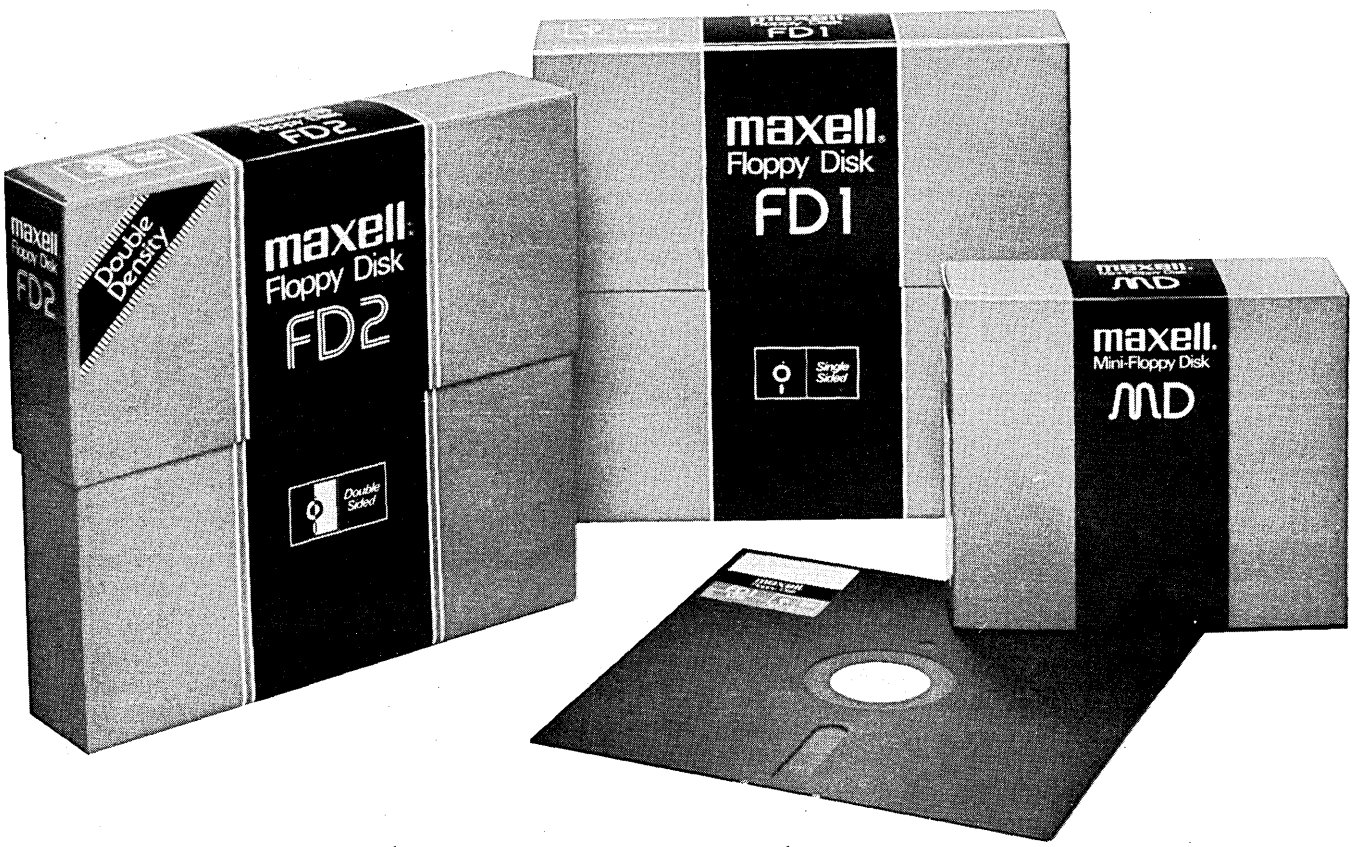
[illegible], CA 95052.





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In your work, data is too important to lose. So if you use a Floppy Disk with even a minor flaw—like a dropout—you risk a lot. That's why Maxell has taken the danger out of Floppy Disks.

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To guarantee complete interchangeability, all Maxell floppys conform to ISO, ECMA, ANSI, JIS, and IBM standards.

But even more important to you, Maxell's own tolerances are tougher than the industry's.

And our inflexible Quality Control inspections permit nothing to blemish our hard-earned reputation.

So when your job depends on full data retrieval, depend on Maxell Floppy Disks. They work best . . . and so will you.

Maxell offers the full range of Floppy Disks, from standard 8-inch to 5¼-inch, plus Data Cassettes. *Dealer inquiries invited.*

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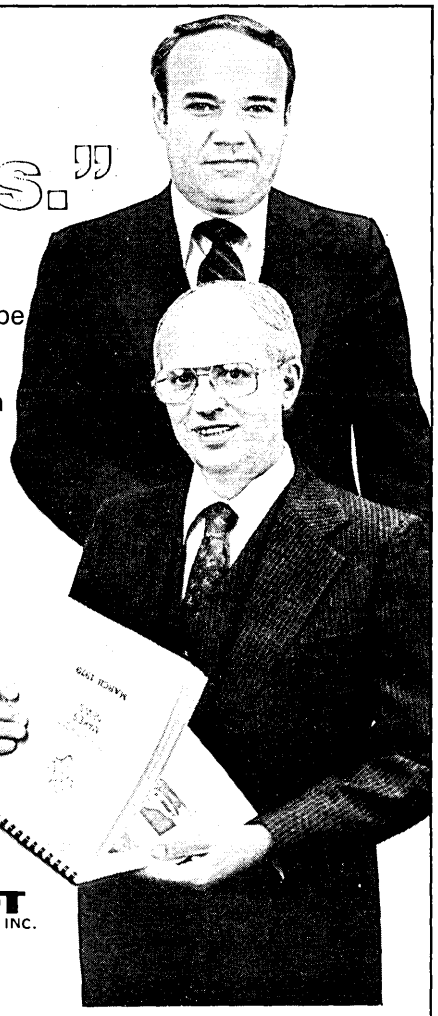
CIRCLE 25 ON READER CARD

"Up and running at Peugeot in sixty days."



"Peugeot, producing 2.5 million vehicles a year, is now the third largest automobile maker in the world. Domestically, Peugeot needed a comprehensive data base-oriented financial reporting system that could be implemented quickly, with the least amount of impact on data processing and accounting staffs and resources.

"We did not want to 're-invent the wheel', and after a thorough review, we selected Software International's Accounts Payable software package to start. We planned to follow that with their General Ledger a year later, but since Payables went in smoothly in only 60 days, we installed the Ledger six months ahead of schedule.

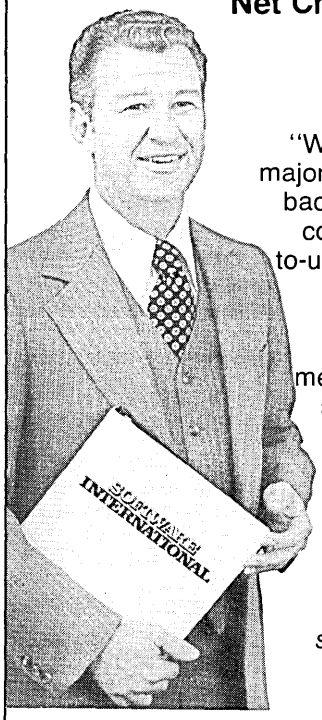
James F. Miller *Assistant to the President* PEUGEOT MOTORS OF AMERICA, INC.

"There was no need for either accounting or data processing to compromise with either system. Prior to choosing Software International, we surveyed their customers and our 'Big 8' auditors, and were well-satisfied with reliability, field support and system performance.

"Preparing for anticipated growth in the U.S. market, Peugeot recently completely reorganized its field operations. Changing from seven regions to three zones meant realigning our reporting system to the new organization. Within 24 hours, the General Ledger provided us with necessary management reports without skipping a beat."

Bernard F. Steiner *Treasurer* PEUGEOT MOTORS OF AMERICA, INC.

General Ledger and Financial Reporting
Fixed Asset Accounting • Accounts Receivable
Accounts Payable • Payroll/Personnel
Net Change Manufacturing Resource Planning



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"We believe, and more than 1500 major corporations around the world back us up, that we offer the most cost-effective, reliable and easy-to-use-financial and manufacturing control systems available.

"But it takes more than great systems for successful implementation. Software International supports all of its products with a world-wide network of local offices staffed with professionals whose wide range of experience covers both data processing and business. Users benefit from this expertise with *training, technical support, comprehensive documentation, maintenance* and *regular enhancements.*

Chet Domoracki
Vice President, Small Business System Division
Software International Corporation

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CIRCLE 26 ON READER CARD

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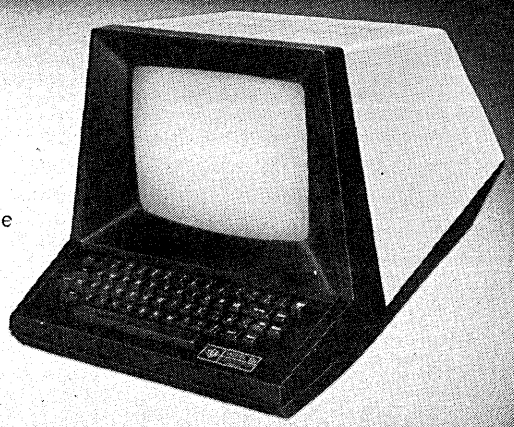
SERIES 70
Microprocessor based with powerful editing features and an exclusive card reader keyboard option.

SERIES 570
The most powerful of the Series 500 Terminals offering the Series 510 Features plus Editing. Buffered Hard Copy Output and Extra Pages of Memory



OUR NEWEST MEMBER THE SERIES 510

- Microprocessor/LSI Design
- Intergrated numeric pad
- Cursor positioning
- Buffered and conversational
- Upper and lower case
- 5 video attributes
- Character/line/page transmit
- Protect
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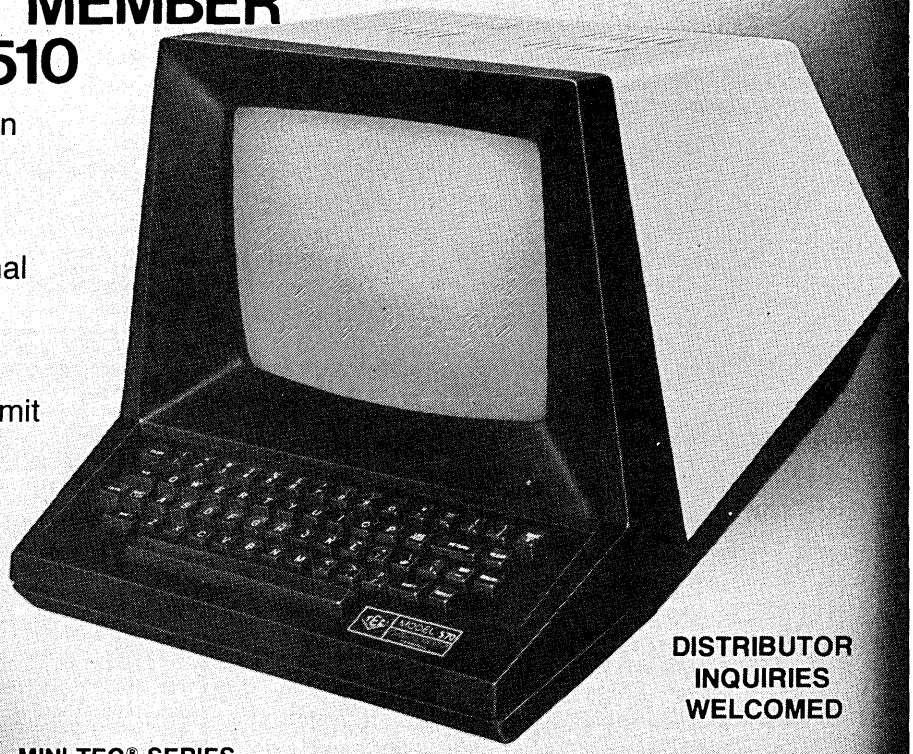

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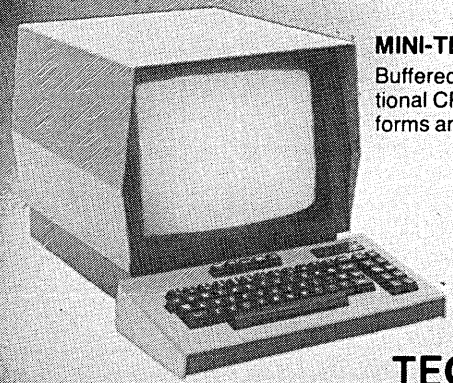

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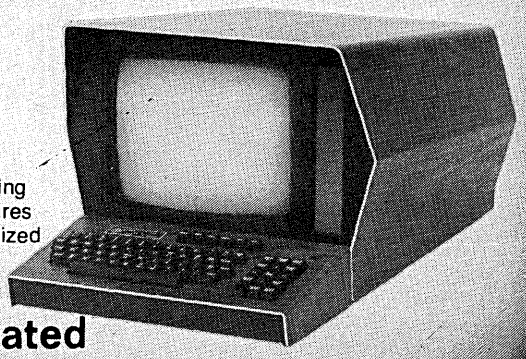
Buffered and conversational CRTS supporting forms and blinking fields.

SERIES 400
Versatile application oriented CRTS offering popular editing features and a host of specialized interfaces.



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CIRCLE 39 ON READER CARD

"SEE US AT INTERFACE 80 — BOOTH 650"

The 7 most common mistakes made in designing computer room environment.

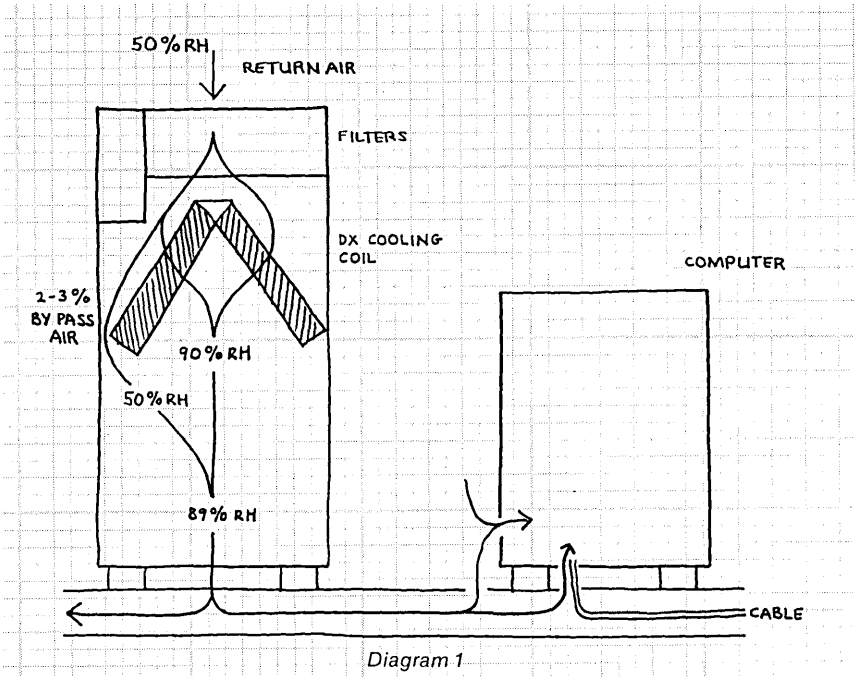


Diagram 1

Mistake No. 6
Failure to limit relative humidity to 80% under the floor.

Costly computer downtime can be caused by this expensive mistake. The IBM Installation and Planning Guide (Page 1.7) specifies that air entering computer equipment *must not exceed 80% RH.* All other computer manufacturers have similar restrictions.

Why 80%? Humidity over 80% causes physical changes in gold and silver contacts and circuits. The results are intermittents and chaotic operation. Eventually, the computer will suffer a hard failure causing loss of system time and dependent business.

Comfort air conditioning systems pass all the air through the cooling coil to cool and dehumidify the room. This brings the leaving air close to saturation.

The answer is to bypass the cooling coil with *extra air* which remixes with the cool humid air before leaving the system.

In an attempt to meet specifications, some systems provide a small bypass (Diagram 1) allowing only 2%-3% of the air to bypass the coil. This is often done without any increase in air quantity. The result: Relative humidity leaving the system is much higher than the required 80% and with it go all the problems that can occur.

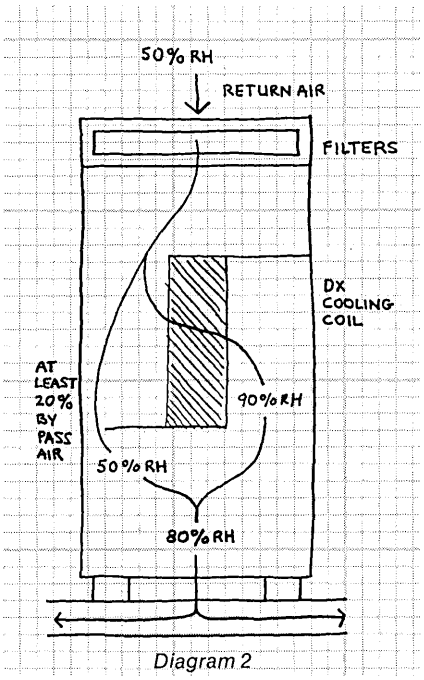


Diagram 2

The EDPAC Solution

EDPAC Process Cooling Systems (Diagram 2) handle at least 20% more air than comfort air conditioning. And, a full-size bypass is engineered into the system. This allows EDPAC equipment to supply air at the required 80% RH.

EDPAC Process Cooling Systems are designed and engineered to meet all computer manufacturers' specifications.

For a brochure detailing the solutions to all seven "mistakes," and additional information on EDPAC systems, contact your local EDPAC representative or the factory.

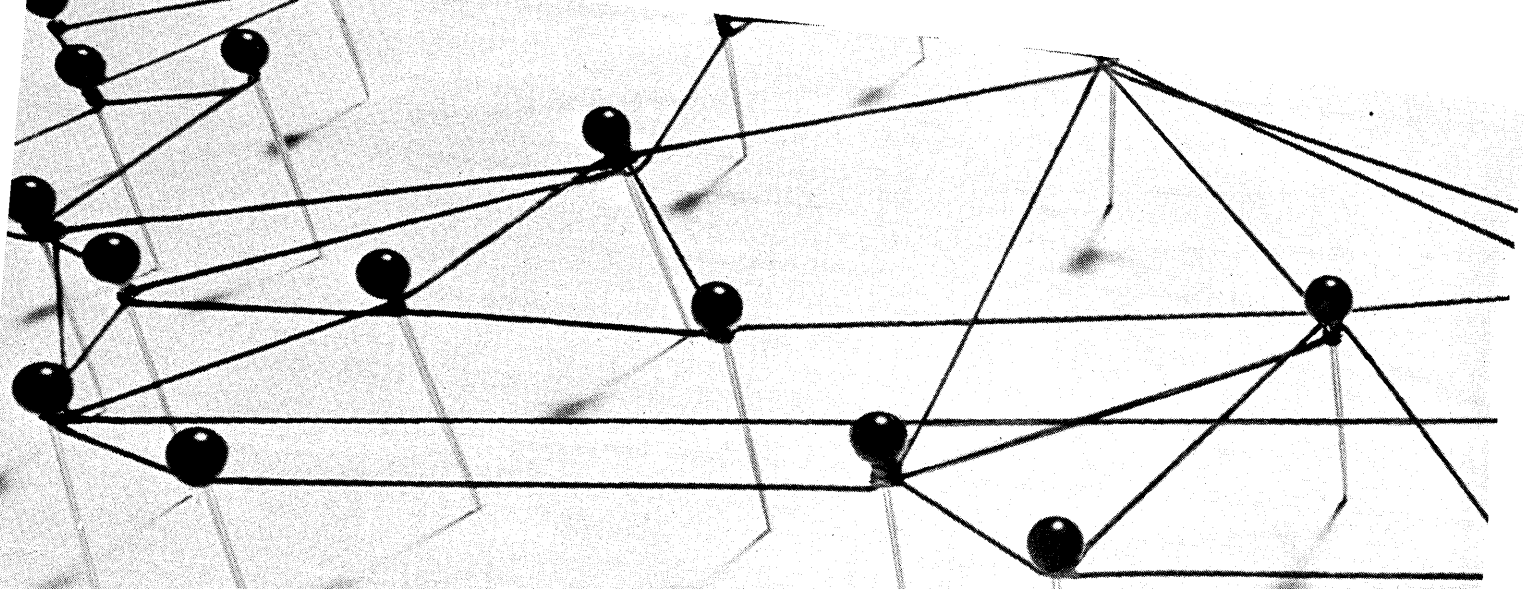
The 7 most common mistakes made in designing computer room environment.

EDPAC
Energy Efficient Process Cooling for Computers

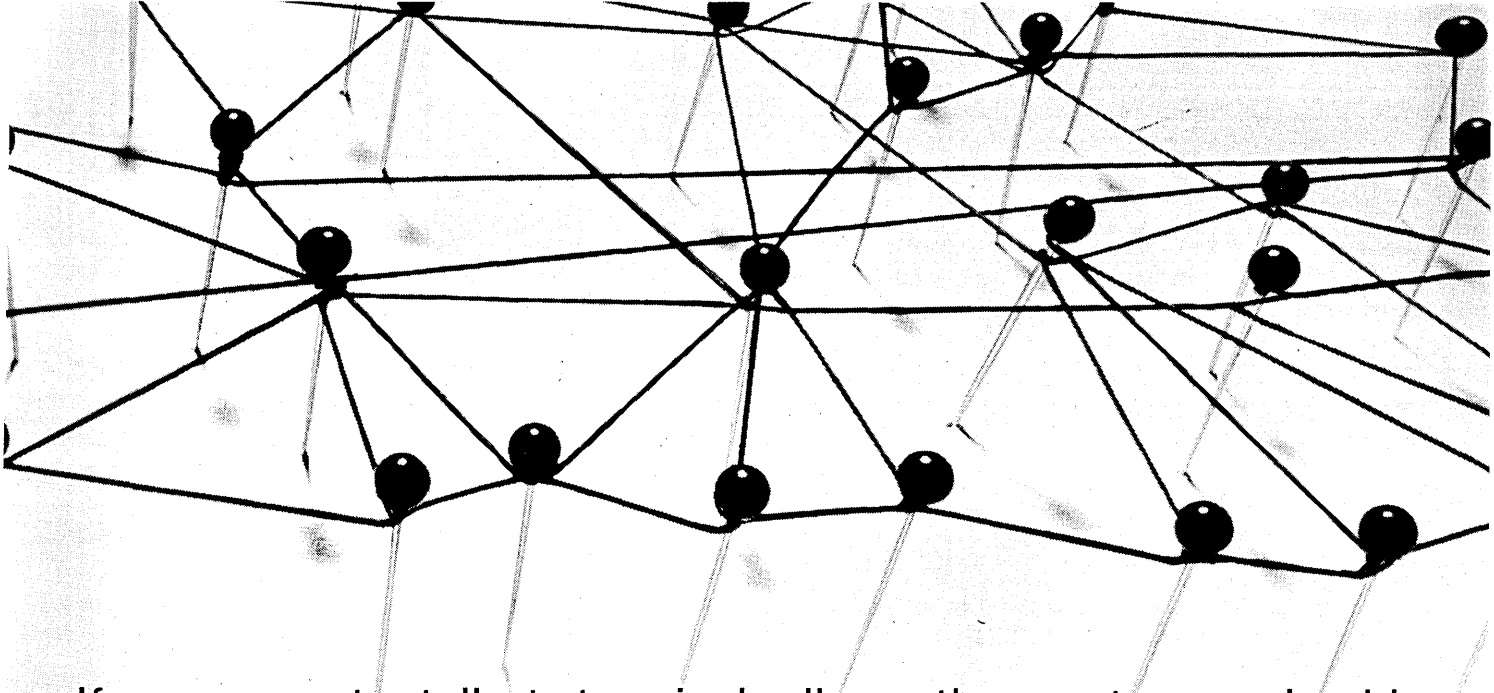
EDPAC is a product of AC Manufacturing Company, Cherry Hill, New Jersey 08034, Telephone (609) 428-9800

EDPAC also offers products for mini-computer rooms and water-cooled computers.

CIRCLE 27 ON READER CARD



The GTE Telenet data network. It's affordable, and it's here today.



If your computer talks to terminals all over the country, you should talk to GTE Telenet.

For as little as six cents a minute, your computer can use our network. And we can connect you quickly, without changing your present system.

Then you're only a local phone call away from data terminals in hundreds of North American cities, as well as major cities around the world.

Costly service disruptions are just about impossible because we automatically route data around defective links.

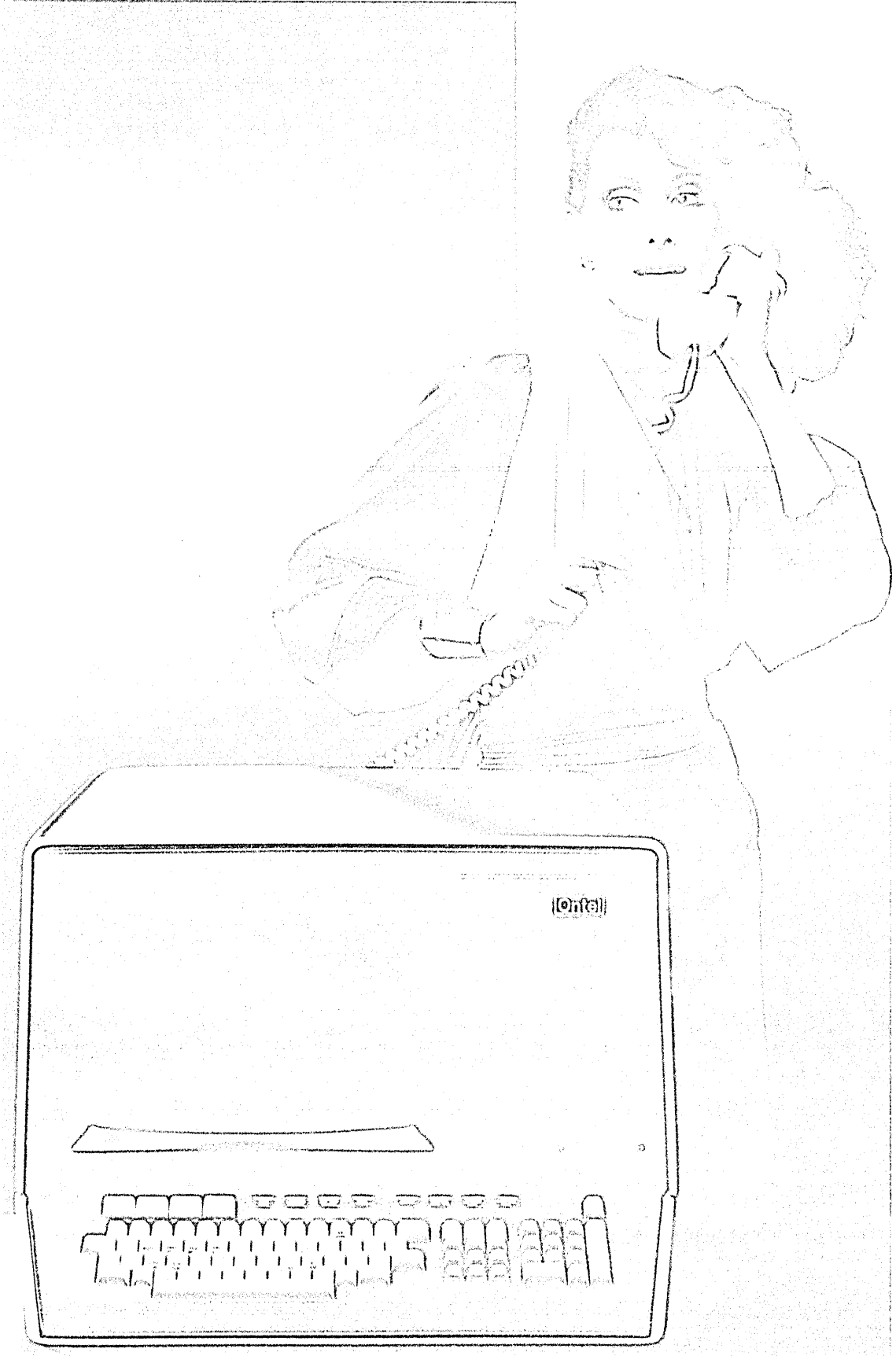
Our secret is an advanced technology called packet switching. This is a form of time sharing of transmission lines, in which costs are shared by many users. In 1975, we became the first common carrier in the world to do this, and we created the standards which all future packet-switched networks will use.

Let us show you how to save money with our public data communications network (or your own private system if you wish). Call us, collect, at 703-827-9565. Or write Marketing Communications Department, GTE Telenet, 8330 Old Courthouse Road, Vienna, VA 22180.

GTE Telenet
The data network

A part of GTE

CIRCLE 29 ON READER CARD



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(We speak many languages)

Over 15,000 Ontel intelligent systems are used worldwide with many languages—English, Italian, German, French, Spanish and Hebrew. Our software languages include—PASCAL, BASIC, FORTRAN and OP/L. Ontel provides everything for successful OEM installations...data processing...word processing...communications...delivery...customer support ...operating systems. And certainly not least—highly attractive pricing. Contact me today. You'll find we speak your language.

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CIRCLE 30 ON READER CARD

LETTERS

RATINGS GET AN F

Re: "Users' Ratings of Software Packages" (December, p. 138), the reporting of a single overall letter grade makes the article essentially worthless for reviewing and evaluating software packages. The net effect is that the article is little more than an advertisement for Datapro's complete version of the report. If space limitations pose a problem, the perhaps only packages with a larger number of users responding should be included. (A rating based on the responses of five users seems to me to be suspect in any case.) Otherwise, I would urge you to use those editorial pages for more substantive articles.

RICHARD L. COOK, PHD
Executive Vice President
K. R. Hammond Associates
Boulder, Colorado

STRUCTURED SELECTIVITY

Re: Robert L. Glass's views (November Forum, p. 181) regarding the program listing as a vehicle for software, documentation can be enhanced by the application of a selection discipline on the program/documentation text. Such selection can be achieved in a rudimentary way with COBOL implementations on most time-sharing systems. For example, programs in which top-down modules are coded using sections (and a structure-oriented nomenclature for the section names) are easily abstracted by using a time-sharing edit command to select (for listing) only those lines bearing the string "section."

A convention for attaching flags (indicative of level of detail) to all comment lines (a simple * or ** or *** will do) permits similar selectivity in comment listing.

Thus the manager could command a listing of all the module names and 3- (or 2- or 1-) start comments and not have his ego bruised by all that grubby program stuff.

A corresponding suppression function spares the working programmer from a listing cluttered with text irrelevant to the task (though this could subvert maintaining currency of the documentation by screening it from the program changes). Of course this structured selectivity can be applied to any computer-accessible text, a fact I hope will not remain unrevealed to text-processing software designers too much longer.

DICK BUTTERWORTH
Programmer
General Electric Co.
Lynn, Massachusetts

APL ENTHUSIAST

Re: Call for a Wider View of Programming (October Letters, p. 41), Mr. Gordon hit it squarely on the head: "Perhaps when we have acquired the discipline . . . 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."

It amazes me to see people still spoon-feed computers, minute instruction by instruction, step by step, as if in fear of the beast running away if they ask it to do more. And mostly because we don't teach problem solving to programmers. We teach them how to write code and as a result we get page after page of COBOL to solve some trivial problem. The FORTRAN, PL/1, BASIC, PASCAL programmer is not much better off either. All these languages are like shackles around a problem solver's neck, dragging him down to where he can't see the forest for the trees.

What saddens me most is that there is a way—with APL—if we could only teach the teachers to teach it, and teach managers to ask for it. In APL we can routinely do jobs in one-fifth to one-tenth of the time it takes in other languages.

For the most part all your DO-WHILE, IF-THEN-ELSE, GOSUB, and all your other beloved language imposed constructs can be thrown in the trash can as so much junk. Instead, you can immediately go to the heart of the problem (if your psyche lets you) and solve it without bothering with trivia.

So you want to know the factorial of 8, 15, and 17? Write it like this:

! 8 15 17

You want to sum up a set of accounts and compute the percentage of each to the total? Write it like this:

100 × Accounts ÷ +/Accounts

You want to find the year-to-date-total of sales on a monthly basis? Write it like this:

+/ Sales

You want to generate a multiplication table for the numbers 1 thru 10? Write it like this:

(i 10)° . × i 10

You would like to store accounts and sales on a disk for later recall? You write it like this:

[XW 'Accounts Sales'

You want to find the largest sale? You write it like this:

Γ/Sales.

As you can see we went from problem statement to solution in five minutes.

Ask your programmer to write all this in his favorite language but don't be surprised if it takes him an hour—the poor fellow doesn't know better.

ANTHONY AMORT
Senior Systems Analyst
Eaton Corp.
Kenosha, Wisconsin

REPORT BAD APPLES

Re: That Old Bugaboo, Turnover" (October, p. 96), The kind of situation described by R.A. McLaughlin is a shattering one to those with P & L responsibility in commerce and industry. But some of the personnel agency practices described involving subsequent contacts with prior placements are equally shattering to those of us concerned with professional ethics.

Unfortunately there are bad apples in every barrel, bad agency practices as well as companies attempting to sidestep their responsibilities to agencies.

Please understand that there are groups out here that abhor those practices and which take active steps to eliminate them. This kind of thing can be eliminated only through exposure: your readers would be well advised to inform the local professional association in their areas of these instances as they occur.

RAYMOND H. BROWN
Louis Rudzinsky Associates
Lexington, Massachusetts

LETTERS

FOR THE PHONE

Re: "Time to Retire the Telephone" (August, p. 185), I agree with the letter in the November issue from Dr. Cohen. Apparently Mr. Marill is so consumed by thoughts about the efficiency of electronic mail that he has forgotten it takes two to communicate.

J.L. HALLETT
Manager, Systems and Instrumentation
GTE Sylvania Inc.
Electronics Components Group
Seneca Falls, New York

WHOSE LIFE CYCLE IS IT, ANYWAY?

Re: "Estimating Software Costs" (September, p. 188; October, p. 171; November, p. 137), I'd like to note some alternative thoughts on software cost estimation.

The method suggested in the Putnam-Fitzsimmons article has, at best, a limited validity—limited, it would seem, to projects with full operational capability set to occur on one particular date ("revolutionary projects"). The method would also be limited to projects with the same quality parameters as those the authors claim to have observed. Project cost is sensitive to quality parameters such as performance, maintainability, reliability, security, and ease of use. Since the authors did not make clear the quality of their historic material, it might be dangerous for readers to make use of the theory. The distributed and interactive terminal environment into which most readers are moving might be quite different from the basis for the article. I think a clearer statement of the limitations of application should have been made, and clearer statement of the practical experience with the theory, or lack of it.

One solution to the cost estimation and manpower loading management discussed in the article is evolution—delivery of the system in many small increments (one each month for 30 months, for example). This method of planning and delivery has at least two advantages. First, the practical feedback at very early stages of the project allows us to improve all future cost/manpower/schedule estimates in a more realistic direction. Second, when a project is late or when it threatens to exceed available budgets, you normally have already delivered the most critical components of the system.

I wish authors such as Putnam and Fitzsimmons would stop writing about "the" life cycle as though there were only one possible.

TOM GILB
Kolbotn, Norway

I have just read the third installment of "Estimating Software Costs," and to my thinking, it is one of the best approaches to estimating, costing, and controlling projects I have seen in some time.

However, the approach will probably fail in most data centers, not because of the suggestions, but because of how the term "project" is usually defined. Project management and control is a system, not unlike a payroll or accounts receivable system. The implementation and maintenance of such a system should follow the same processes as those to implement and maintain other systems. Yet few, if any, organizations do this.

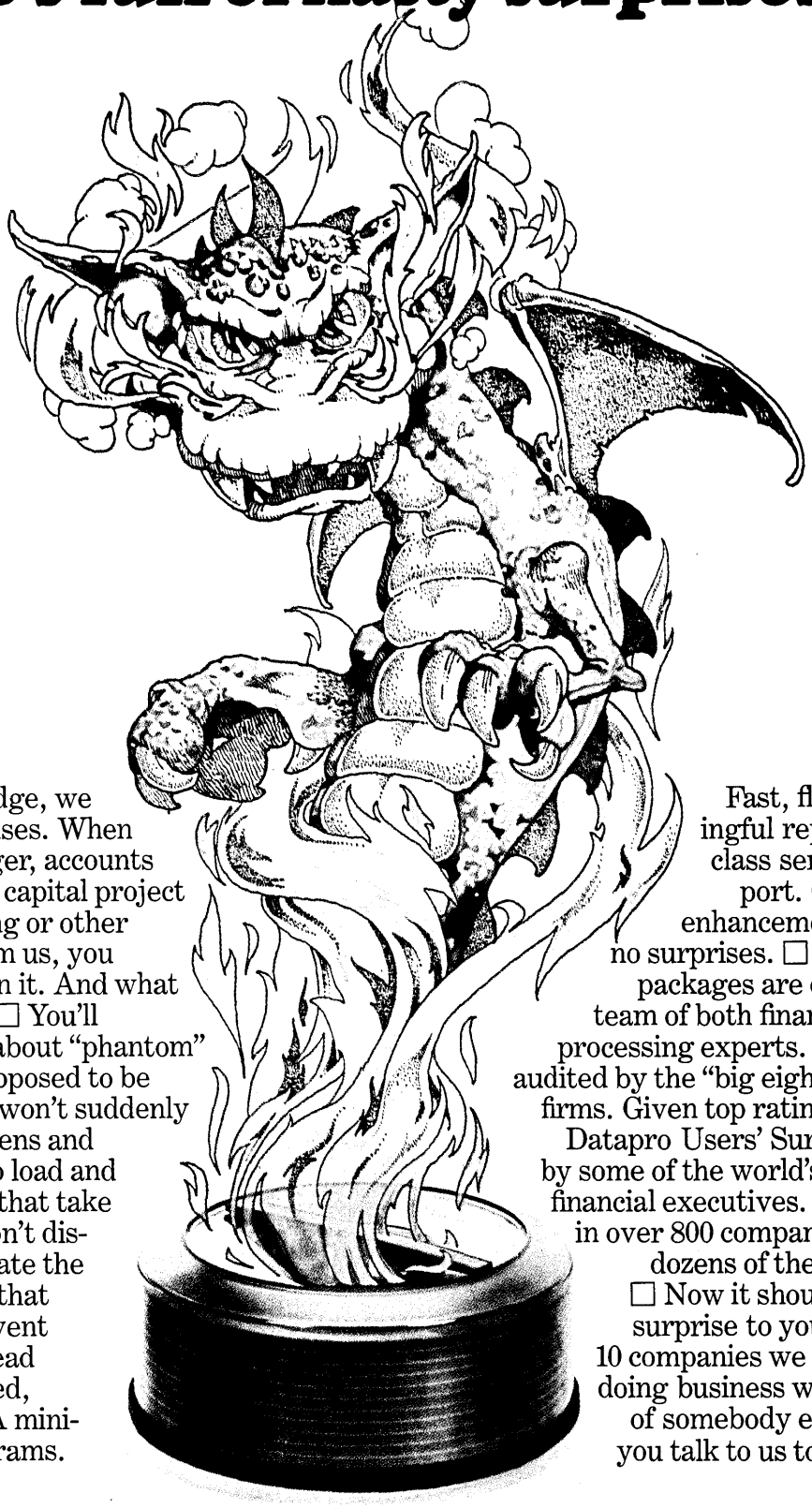
The project life cycle, so often quoted, really has nothing to do with a systems development life cycle. The identification of a problem, the feasibility study taken to justify using automation to solve the problem, and those steps to design and implement the solution, often called a system, is one set of processes. The identification and classification of the project, the identification of the tasks in the project, the identification of staff/skill requirements, and the estimatng, costing, managing, and control tasks make up a totally different set of processes. How projects are classified, how tasks are defined, how skill requirements are determined, and how deliverables are set are concerns that must be resolved before any methodology concerning project management is implemented.

HARVEY M. WEISS
President
Weiss & Associates
Consultants to Management
Denver, Colorado

(Continued on page 42)

"Monday, remind me to tell you about the row those investigative people had over who got your personnel records first."

You can buy financial software that's full of nasty surprises...



At McCormack & Dodge, we don't believe in surprises. When you get a general ledger, accounts payable, fixed assets, capital project accounting, purchasing or other software package from us, you know exactly what's in it. And what isn't. Right up front. ☐ You'll never have to worry about "phantom" programs that are supposed to be there but aren't. You won't suddenly find yourself with dozens and dozens of programs to load and unload. Or programs that take all day to run. You won't discover you can't generate the reports you need. Or that there's no way to prevent obsolescence. ☐ Instead you'll get a streamlined, easy-to-use system. A minimum number of programs.

Fast, flexible, meaningful reporting. First class service and support. Our continual enhancement plan. And no surprises. ☐ Our software packages are designed by a team of both financial *and* data processing experts. They've been audited by the "big eight" accounting firms. Given top ratings in the 1978 Datapro Users' Survey. Selected by some of the world's most critical financial executives. And installed in over 800 companies, including dozens of the Fortune 500. ☐ Now it should come as no surprise to you that 7 out of 10 companies we talk to end up doing business with us instead of somebody else. Shouldn't you talk to us too?

or you can talk to McCormack & Dodge.

Talk to us. **McCORMACK & DODGE CORPORATION**
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CIRCLE 31 ON READER CARD

LETTERS

CORRECTION

The following charts appeared in "Disaster Recovery" (Jan., p. 115) by error. They should have been published as an independent sidebar to the story and credited to Aileen MacGahan, a computer security expert who developed the components of the plan. Ms. MacGahan, now manager of computer security for American Express, was formerly an officer of the Chase Manhattan Bank. She has an MBA in computer systems from NYU and an AB from Vassar in mathematics. She is a coauthor of *Computer Fraud and Countermeasures* (Prentice-Hall, Inc., Englewood Cliffs, N.J.: 1979).

DISASTER RECOVERY PLANNING TASKS

I. Definition Phase
1. Set disaster recovery objectives
2. Choose a planning perspective

II. Functional Requirements Phase
1. Take inventory of resources listed in sections II-VII of Table III
2. Analyze applications and installations against recovery objectives
3. Determine what is to be covered in plan
4. Set priorities based upon critical time frames.

III. Design Phase
1. Identify design alternatives
2. Specify the details of feasible design alternatives (including such things as hardware, software, telecommunications, staffing, etc.)
3. Identify potential vendors and price their services
4. Select the final design

IV. Implementation Phase
1. Acquire any hardware, real estate, telecommunications lines, etc.
2. Negotiate and sign contracts
3. Write procedures
4. Train personnel
5. Prepare site(s)
6. Develop test plan
7. Develop maintenance plan

V. Testing and Parallel
A. Parallel
1. Schedule individuals to be "on call"
2. Make arrangements to use facilities external to your company
3. Attempt to run backup systems
4. Compare results obtained in backup system with those obtained in the "live" system
5. Correct errors in plan
6. Repeat 3-5 until no more errors are found in plan

B. Live Testing
7. "pull the plug" and attempt to run using only the plan
8. Correct any defects noted
9. Repeat 3-8 until no more errors are found in plan

C. Maintenance Testing
1. Repeat 3-6 for all revisions to plan
2. Repeat 7-9 annually

VI. Maintenance Phase
No tasks to be performed during plan. The maintenance plan is developed during the implementation phase and applied during the maintenance phase. Two tools that can aid in maintaining the software portion of the plan are software change control authorization procedures and software library packages such as PANVALET. Items that are frequently in need of maintenance in a plan include:
- Names, titles, and phone numbers
- Backup libraries (data, systems and applications software)
- Documentation and procedures

COMPONENTS OF A DISASTER RECOVERY PLAN

I. Statement of Purpose
A. Objectives
B. Scope
C. Priorities

II. Hardware
A. Cpu(s)
B. Peripherals (printers, tape/disk drives, consoles, etc.)

III. Telecommunications components
A. Message switches
B. Multiplexors/concentrators
C. Diagnostic devices
D. Modems
E. Terminals
F. Lines

IV. Data Conversion/Entry Devices

V. Firmware

VI. Software
A. Operating system
B. Utilities and compilers
C. Data base and data communications management
D. Applications (source, object and JCL)

VII. Data
A. Master files
B. Input
C. History
D. Logs and journals
E. Tables

VIII. Forms
A. Flatpacks
B. Checks
C. Turnaround documents
D. Input forms
E. Coding sheets
F. Special forms (if any) for backup procedures

IX. Procedures
A. Backup installation operation
B. Applications
C. Clerical procedures for manual operations
D. Software/data control
E. Training

X. Space
A. For hardware
B. Storage of files
C. Terminals, data entry/conversion systems, clerks
D. Storage of forms
E. Input/output control functions

XI. Utilities (power, air conditioning)

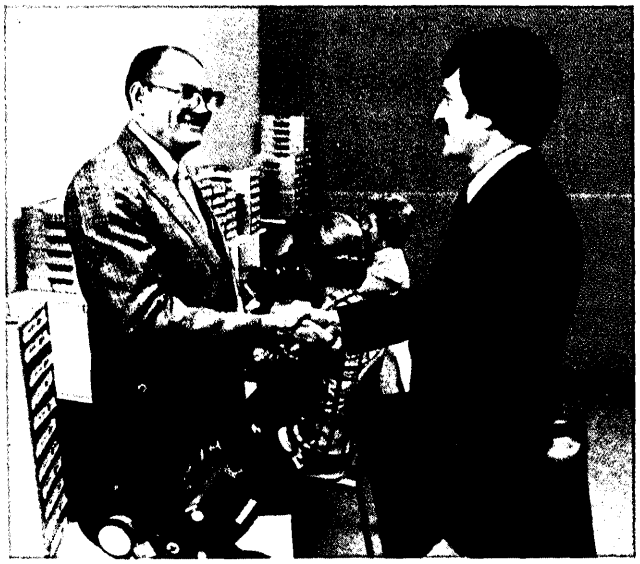
XII. Personnel Assignment
A. Recovery management
B. Site preparation
1. Site selection
2. Construction
3. Hardware installation
5. Telecommunications installation
5. Supplies and forms
6. Messengers, clerical assistance, administrative aides
C. Application Management
1. Application manager
2. System maintenance
3. System development
4. System reconstruction
5. Data base reconstruction
6. Supervision/performance of transaction procession
- transaction authorization
- input preparation
- data conversion/entry
- output proof/control
- error correction

7. Staffing and training
D. Data center recovery
1. Installation management
2. Shift supervision
3. Computer operation
4. Media librarian
5. Systems programming
6. Scheduling, input/output control
E. Plan maintenance
1. Overall administrative responsibility
2. Application responsibility
3. Installation responsibility
4. Testing of the plan

"We switched to NCR," says Fred Brown of Rogers Enterprises.

BROWN:
Rogers Enterprises is an optical laboratory that fills almost 5000 eyeglass prescriptions a day. We have a complex computer program that guides us through the entire operation. From selection of the lenses out of inventory through the highly technical grinding process to billing of our customer. We have five years of development tied up in that program. And still we switched from another vendor to an NCR system.

NCR'S DUBOSE:
We could offer you the speed you had to have at a lower price than anyone else.



Fred L. Brown (left) is comptroller/administrator of Rogers Enterprises, Inc., of Beaumont, Texas. Ben DuBose is an NCR district manager.

BROWN:
Yes. And NCR has a full line with no gaps. As our volume increases, we can expand our system in reasonable increments. Even better, we can move to a larger system without obsoleting our software. Now with NCR, I will not have to go through another conversion under the pressure of our daily workload.

NCR'S DUBOSE:
That's NCR's Migration Path Engineering. Your software always runs on the next larger system.

BROWN:
VRX (Virtual Resource Executive) really makes our NCR V-8550 go. Our lab program is very large and is used heavily in the morning, but only occasionally in the afternoon. Because we have virtual memory, this program resides in main memory only when it is advantageous. Otherwise, that program would choke our operation.

NCR'S DUBOSE:
VRX allows you to run up to 35 jobs simultaneously. It dynamically allocates memory and other resources. It controls virtual memory swapping. It constantly monitors for memory thrashing and program loops. And adjusts the job mix to eliminate them automatically.

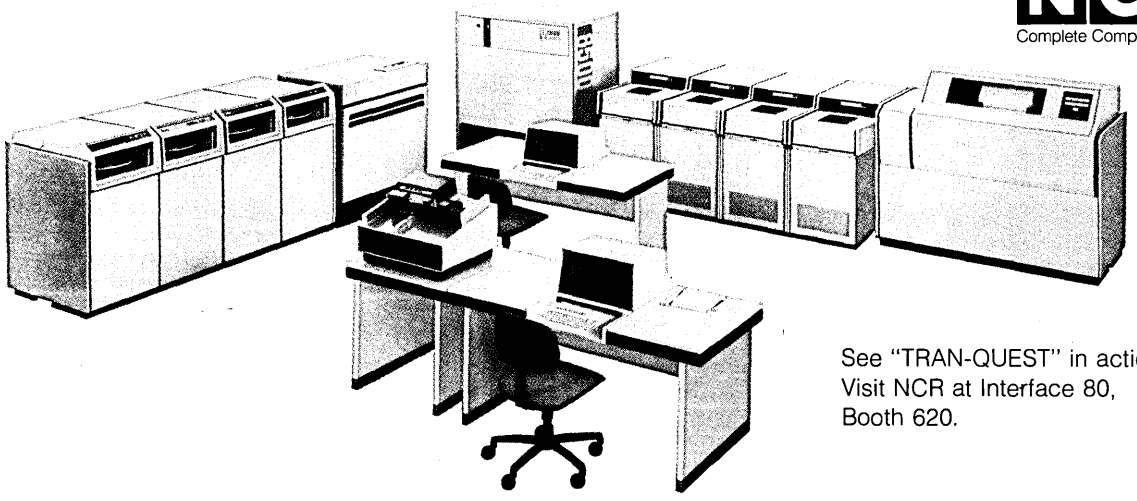
BROWN:
VRX also provides Online Program Development. Our EDP manager tells me OLPD has doubled our programmer productivity.

NCR'S DUBOSE:
System dependability has been important, too.

BROWN:
That's right. System operation is critical to our business. Before we switched to NCR, we talked to other NCR 8500 users and found they had all had excellent experience with this hardware. And with NCR service. We were particularly pleased that NCR had a service office right here in Beaumont.

In the NCR office nearest you, there is an NCR account manager like Ben DuBose who knows your industry and knows NCR systems, including VRX. To learn more about what an NCR system can do for you, phone him at your local NCR office. Or write to EDP Systems, NCR Corporation, Box 606, Dayton, Ohio 45401.

NCR
Complete Computer Systems



See "TRAN-QUEST" in action.
Visit NCR at Interface 80,
Booth 620.

CIRCLE 32 ON READER CARD

Freedom of choice.

VISUAL 100 Digital VT 100

These two terminals not only look alike—they act alike. But ours is a little better.

The new VISUAL 100 is 100% compatible with the DEC VT 100, right down to the spacing of the keys and the roll of the keyboard. Neither your operator nor your software will know the difference. Except your operator will appreciate the superior human engineering features of the VISUAL 100 like the non-glare screen, adjustable viewing angle and low slung keyboard.

Further, the Advanced Video package and current loop interface that are optional with the DEC terminal are standard with the VISUAL 100. And we've added an optional Buffered Printer Interface with independent baud rate, independent parity and printer busy via XON XOFF protocol or control line.

Although we think the VISUAL 100 is a little better than the VT 100, we priced it a little lower. Plus it's from the Company that's delivered thousands of terminals emulating DEC, Hazeltine, Lear Siegler and ADDS. Call or write us today.

CIRCLE 16 ON READER CARD

VISUAL See for yourself

Visual Technology Incorporated
Railroad Avenue, Dundee Park, Andover, MA 01810
Telephone (617) 475-8056

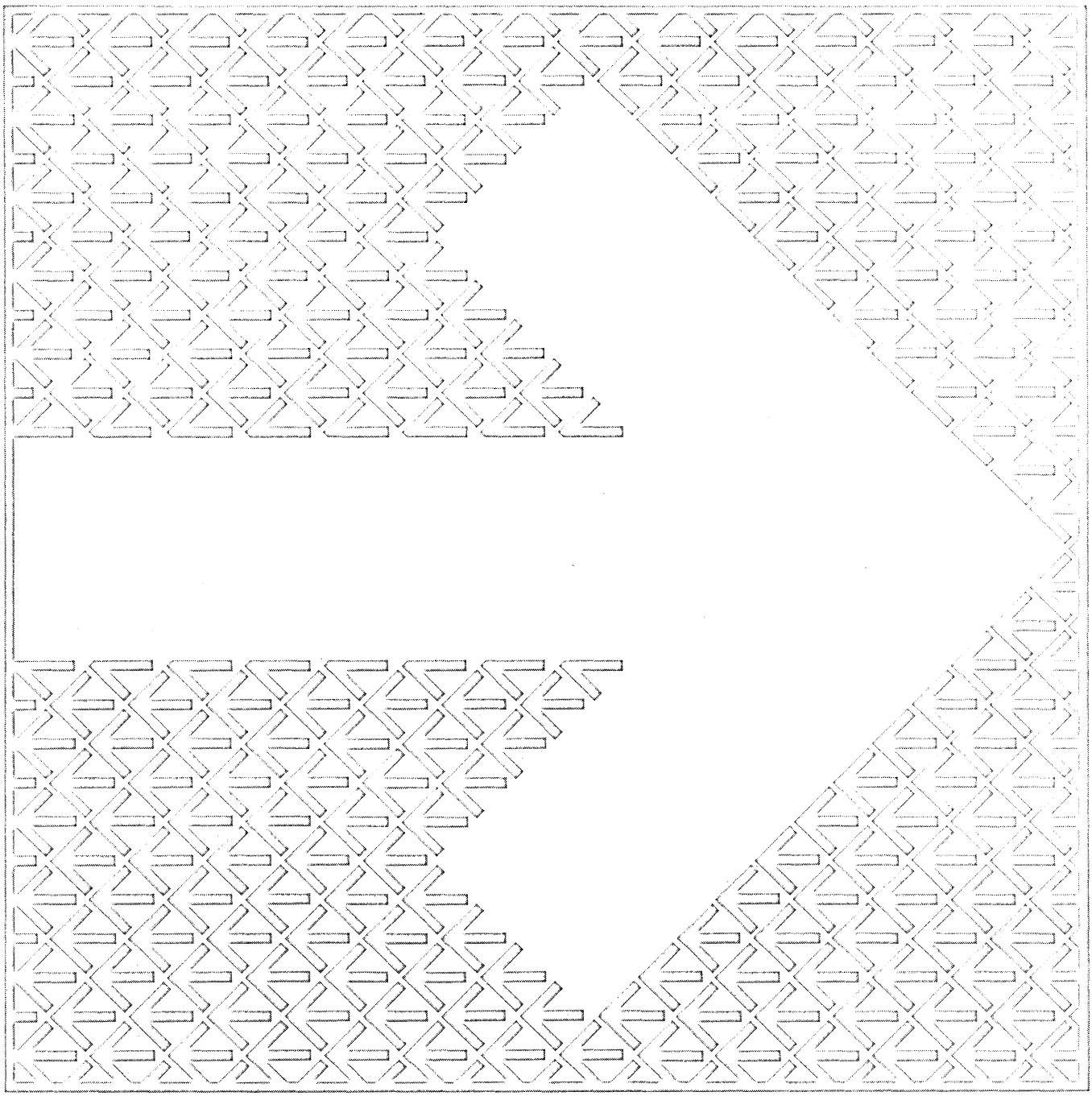
Model 204 DBMS

What happens when you need to change your existing database to meet new information requirements—new data, new reports, new structures?

With CCA's interactive Model 204 database management system, it's easy.

Our unequalled data independence makes any modification quick and simple. And our high-level user language holds your development time to a minimum.

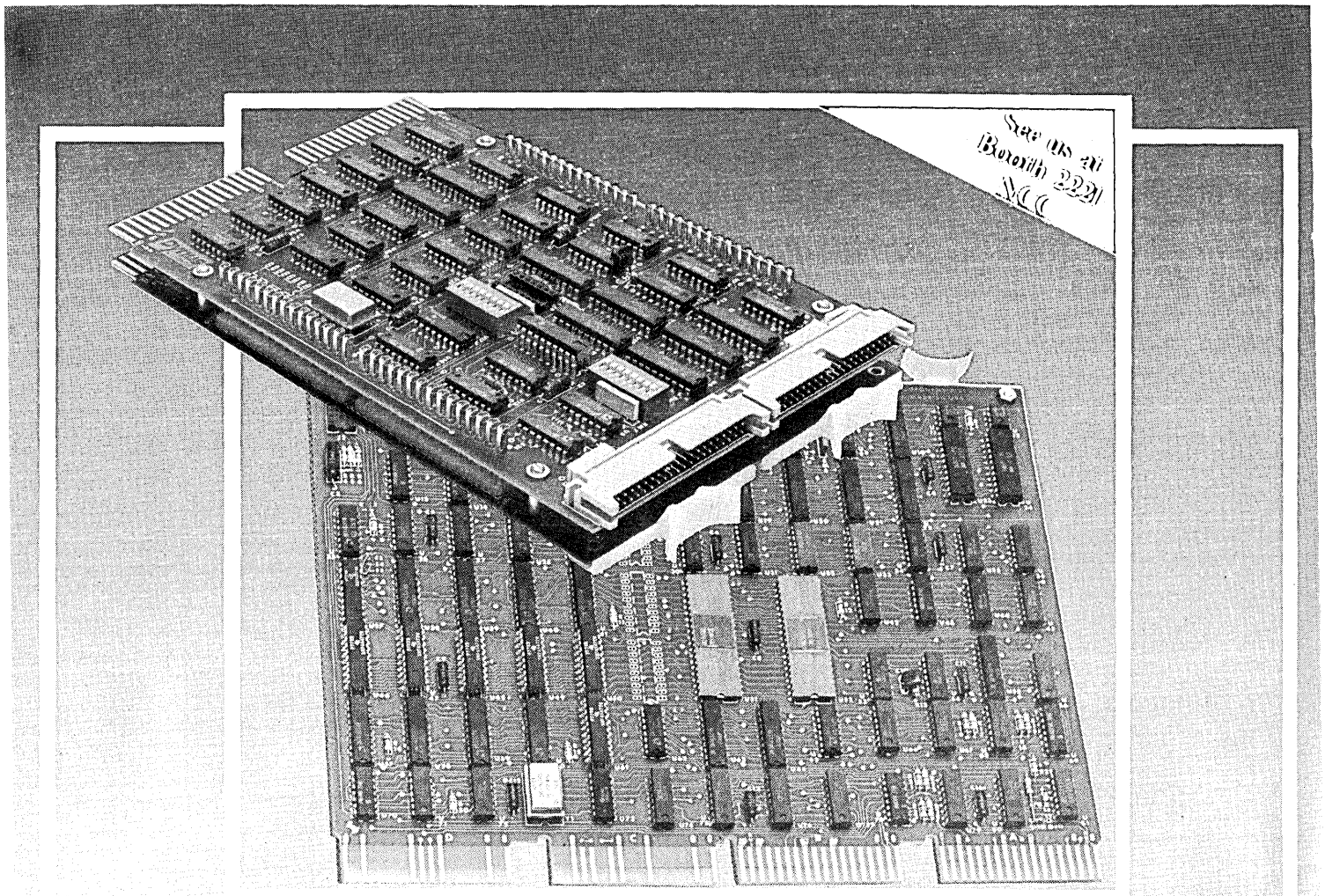
For a complete system description, with case histories, clip your business card to this ad and send to Computer Corporation of America, 575 Technology Square, Cambridge, MA 02139. 617-491-3670.



BECAUSE MANAGING DATA MEANS MANAGING CHANGE

Computer Corporation of America

CIRCLE 33 ON READER CARD



TAPE, DISK, SMD'S...DATARAM KEEPS THEM UNDER CONTROL FOR DEC® USERS

Now you can get the industry's widest range of peripheral controllers for DEC LSI-11® and PDP®-11 from Dataram Corporation — the company that's built its reputation by delivering performance, reliability, and savings on ADD-ON/ADD-IN mini-micro memory and disk emulation systems.

In its second decade of understanding and meeting the needs of end users, OEMs and system houses throughout the world, Dataram now offers DEC users an impressive array of state-of-the-art controllers, based on efficient, high-speed bipolar microprocessors. Controllers that follow in Dataram's proven tradition of providing LSI-11 and PDP-11 users increased performance, improved reliability, denser packing, and dramatic savings.

T03 reel-to-reel/tape controller. Emulates TM11/TU10 magnetic tape system and interfaces to DEC's LSI-11 Bus. The T03 is compatible with all DEC standard operating systems and occupies two DEC dual slots. Operates NRZI, 7 track (200, 556, or 800 BPI) or 9 track (800 BPI). Tape speeds up to 75 ips.

C03 and C33 cartridge disk controllers. The LSI-11 Bus-compatible C03 and the UNIBUS®-compatible C33 emulate DEC's RK-11/RK-05 disk system, and support industry-standard 2.5, 5, 10, and 20 MB drives. Both the C03 and C33 are packaged on a single standard DEC quad board. 1500 or 2400 rpm drives accommodated.

S33 SMD controller. The industry's first single-board software-compatible SMD controller, and it's available only from Dataram. It interfaces to DEC's PDP-11 and emulates DEC's RM02. Operates with industry-standard SMDs. Up to four SMDs per S33 controller. Internal self-test, with LED error/status display, is standard.

They're all ready to plug into your LSI-11 or PDP-11 backplane...they're all totally software compatible...they're all available now...and they're offered with confidence, not promises.

Tape, disk and SMD controllers...three more reasons — with more to come! — why Dataram Corporation is the recognized innovator and leader in mini-micro memory...and its control. And the largest company in the world dedicated exclusively to this important area.

Dataram...the company to call to get your peripheral applications under control.

DATARAM CORPORATION

PRINCETON-HIGHTSTOWN ROAD CRANBURY, NEW JERSEY 08512
TEL:609-799-0071 TWX:510-685-2542

JOHN L. KIRKLEY, EDITOR

EDITOR'S READOUT

GIVING AWAY THE SHOP

How ddp can relieve tension and the pain of lower backache.

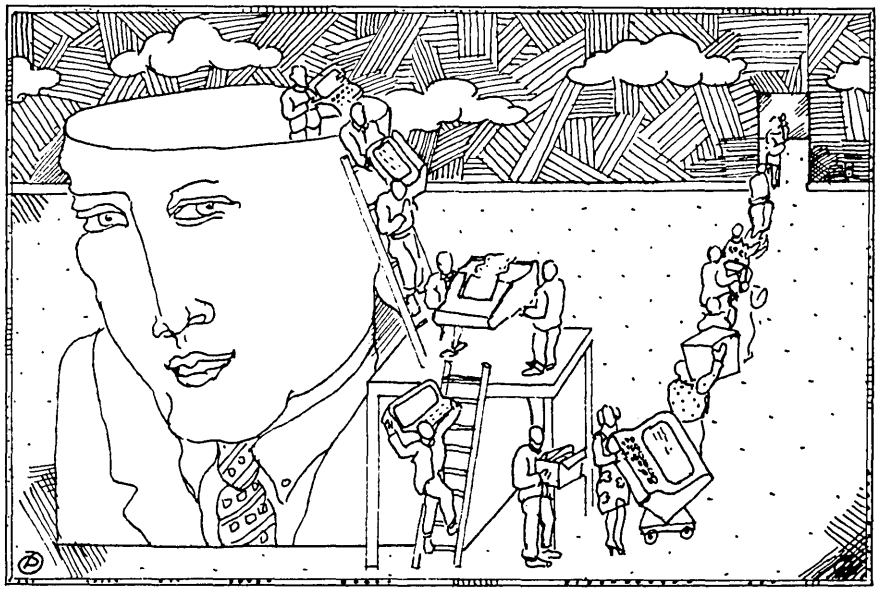


ILLUSTRATION BY DAVID ORNSTEIN

"If you would only recognize that life is hard, things would be so much easier for you," said Louis Brandeis just before leaving for a long lunch.

If you've been a data processing professional for any length of time, you know that life can indeed be hard. Maybe you started off back in the tab equipment days, working in a grimy office with walls that sweated. Perhaps you felt it was destiny that got you interested in those big, shiny, malfunctioning machines that were the early computers. When your fellow tab grunts who didn't make the switch were swept away like so much sawdust on a deli floor, you congratulated yourself on your acumen, foresight, and blind luck.

Or perhaps you're new to the dp game and can't remember a time when there wasn't virtual memory, an IBM antitrust trial, or James Martin.

No matter. Either way you've been around long enough to know that your users regard the central computer site with as much fondness as the Ayatollah feels for Jimmy Carter, that 85% of your shop's time is taken up with maintenance, that new applications are backlogged so far into the future that you have to take into account the possible melting of the icecap, and that all the major program developments you now have going will be completed late and over budget, if at all. To top it off, you need to hire three programmers, but anyone qualified is demanding a salary twice your own.

Before you buy that prune farm in Northern California, take heart. There is hope. It's called distributed data processing ("ddp" to those in the know).

Last year ddp was a buzzword much beloved by copywriters, vendors, and editors. This year conventional wisdom has it that there have actually been some installations embodying the concept (although no one has really defined what ddp is).

As more and more companies distribute their processing in a variety of imaginative ways, the term ddp will lose its meaning and be dropped from the dp lexicon. So, the time to strike is now. Because no one really knows what ddp is, you have a potent weapon at your disposal. Use it to shed much of the dreck that has been the cause of your nervous stomach and midlife acne.

Here are some things you might consider doing in the name of ddp:

- Sell your central cpu to the nearest scrap dealer, farm out all your programmers and analysts to the user departments, and try to develop your slot into a cushy staff job advising the corporate moguls on information resources management or some such twaddle.
- Don't buy that 3033. Instead get 10 PDP-11s and tell your users to do their own thing. You and the remnants of your staff will be available as consultants. Go to lunch a lot.
- If you're feeling a bit more scrupulous, tell your users something like this: "The central site is maintaining control over communications and the central data base. We'll also set up all dp standards and procedures. We'll handle cash management, human resources management, and information (as opposed to raw data) management.

"You, the end user, can buy any machine you want as long as it can transmit data to our cpu using our standard formats and protocols. If you want to ship your data some other way than the corporate pipe, go ahead . . . but have a very good justification. We'll maintain the data base; you send us your transactions and we'll plug them in. But again, you have to observe our standards. We don't do windows and we don't do conversions—ACS we ain't."

If that sounds a bit like Henry Ford's dictum—you can have any color you want as long as it's black—so be it. When your users begin carping, use the Brandeis quote at the beginning of this piece. And remind them that they are now part of the wonderful world of ddp.

If they remain in an ugly mood, here's another quote for your arsenal. "Men do not stumble over mountains, but over molehills." Confucius said that. While they're trying to figure out what it means, slip out a side door. *

Nixdorf Distributed Processing: Sophisticated, yet simple.

Nixdorf is synonymous with sophistication in distributed data processing and distributed data entry systems the world over. The **Nixdorf 600 Series Distributed Data Processing and 80 Series Distributed Data Entry** systems prove that every day. But equally important, they prove that Nixdorf systems have been designed to be simple, too.

Simple to learn and operate, for fewer errors and faster processing. Simple to implement, for quicker cost savings. And simple to expand, for greater flexibility in meeting your changing needs.

With the **Nixdorf 80 Series Distributed Data Entry system,** the operator simply enters data onto a screen replica of a source document, aided by a wide variety of keystroke-saving, error-checking features. Data is entered cleanly and efficiently right where it originates, reducing costly errors and eliminating needless delays.

Store and retrieve information at remote sites using the **Nixdorf 600 Series Distributed Data Processing system** and an extensive data base management facility that is simple enough to be understood by non-DP managers. This capability provides your individual offices with the instant information they need to do business in today's time-sensitive world.

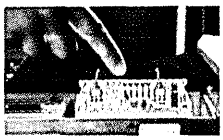
Put Nixdorf computer power where you need it most – at your fingertips, on the job. Start with an 80 Series system, and smoothly convert to the 600 Series – without re-programming or hiring new personnel – when you're ready for distributed processing. The Nixdorf 80 and 600 Series: so sophisticated, they're simple. At Nixdorf, we've been making reliable, economical and easy-to-use systems for distributed applications for over a quarter of a century, and we back up our more than 60,000 worldwide installations with a support network that numbers some 9,200 persons (1,400 of them in 120 North American cities). Call (617) 273-0480, outside Massachusetts toll-free (800) 225-1979, or write: Nixdorf Computer Corporation, 168 Middlesex Turnpike, Burlington, MA 01803.

NIXDORF COMPUTER

CIRCLE 35 ON READER CARD

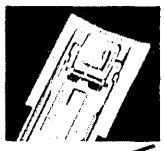
Removable storage and larger capacity

Attach your Series/1 to Control Data Storage Module Drives

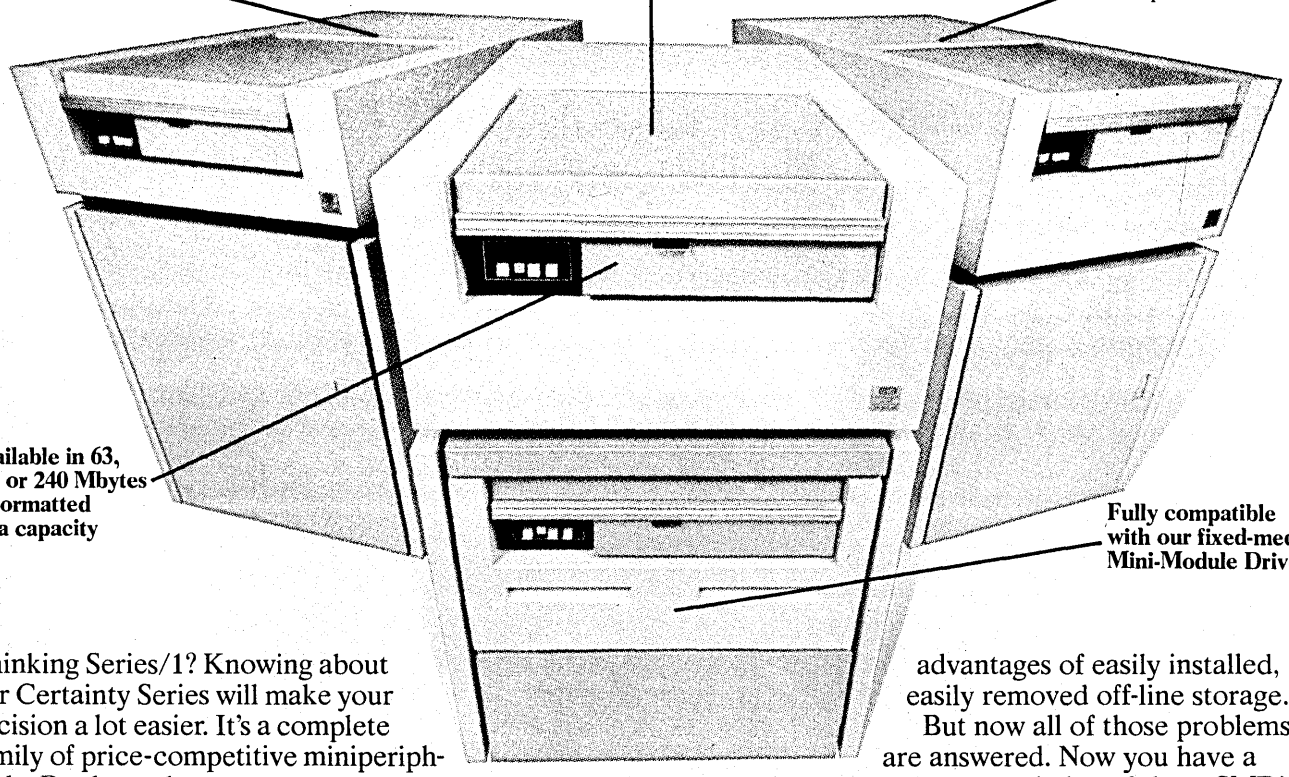


Microdiagnostics and modularity
Lessens your downtime for maintenance and speeds repairs.

Removable media
Gives you off-line storage and back-up advantages over fixed disk



Proven head technology
Low mass design and rigid quality controls bring you high storage density and exceptional reliability.



Available in 63, 126 or 240 Mbytes of formatted data capacity

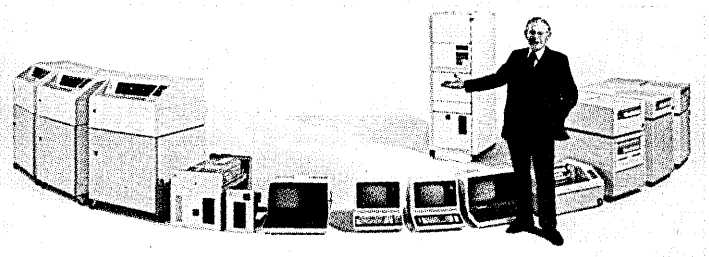
Fully compatible with our fixed-media Mini-Module Drive

Thinking Series/1? Knowing about our Certainty Series will make your decision a lot easier. It's a complete family of price-competitive miniperipherals. Products that go beyond mere plug compatibility—with added features to give you added performance.

Our Certainty 270 Storage Module Drives are good examples. Because until we made them available, you couldn't buy compatible disk storage units with capacities greater than 64 Mbytes. And you didn't have removable back-up capability, either. (Unless you wanted to back-up 64 Mbytes of fixed storage into 100 or so floppy disks!) Until the Certainty Series, you just didn't have all the advantages of easily installed, easily removed off-line storage.

But now all of those problems are answered. Now you have a choice of three SMD's. Three models with formatted data capacities of 63, 126 or 240 Mbytes of removable media. All are ready for direct connection to the I/O bus of your Series/1 processor. All are ready to give you more performance for your money.

You won't have to worry about service, either. More than 4800 Customer Engineers in our worldwide maintenance organization support our products. And Control Data also provides the required software support of all major releases of IBM operating software.



Available Now
Our Certainty 270 Series is ready to help you get optimum performance from your Series/1. For data sheets and more information, call today, toll free. 800/328-3390.

CONTROL DATA CORPORATION

Addressing society's major needs

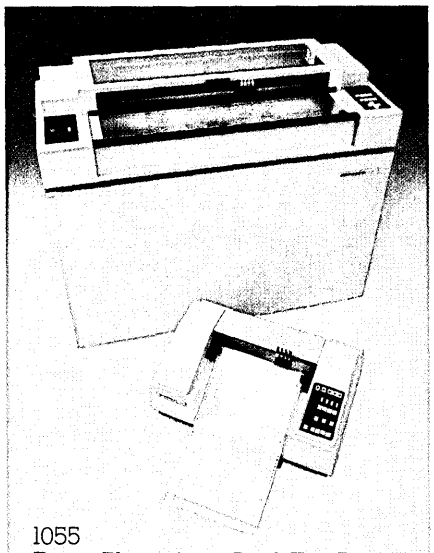
CIRCLE 36 ON READER CARD

WHATEVER YOUR CALCOMP HAS

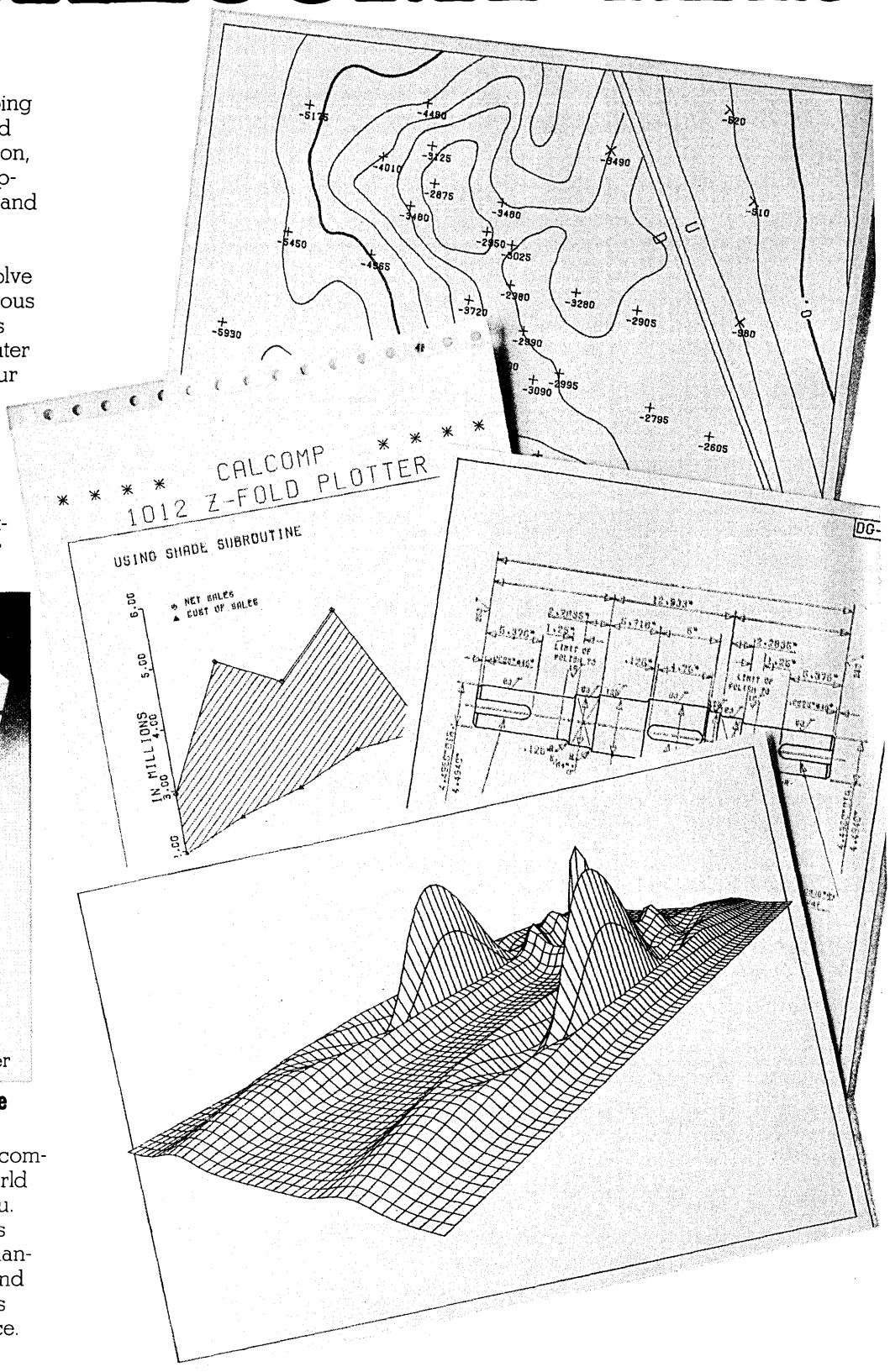
Whether your application is a general one like designing, mapping or schematics, or more specialized like 3-dimensional data presentation, structural analysis, contouring, piping isometrics or business charts and graphs, CalComp offers you the broadest line of plotters.

Nobody offers more ways to solve your graphics problems. Continuous roll, belt-bed and flat-bed plotters for cut sheet applications. Computer output to microfilm. On-line to your CPU. Off-line via tape-drive storage devices. And even on-line/off-line with floppy disk storage.

Add our extensive library of applications software packages to complement our operating software and you've got most of your problems solved.



1055
Drum Plotter/1012 Desk-Top Plotter



The best answers come from the best people.

Looking at the broadest line of computer graphics systems in the world may still present a problem to you.

Like choosing which solution is right for your particular needs; planning for growth and upgrades; and making sure your system delivers consistently excellent performance.

That's where CalComp's Sales Force can help. Because our sales

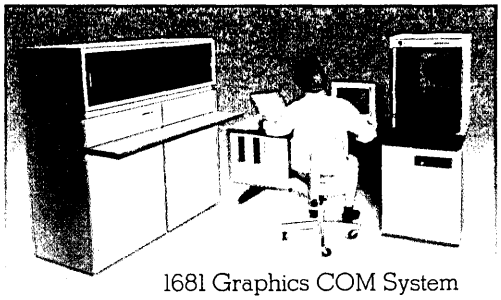
GRAPHICS NEEDS, THE ANSWERS.

representative is really a consultant. In every sense of the word.

They are, each and every one, expert listeners, too. Eager to understand all your special needs.

That's why you can expect in-depth answers to all of your questions. About system capabilities, controllers, software, delivery and more.

You can also expect to hear a lot of discussion about our systems analysts and field service engineers. And what makes them part of a support network that's truly worldwide and second-to-none.

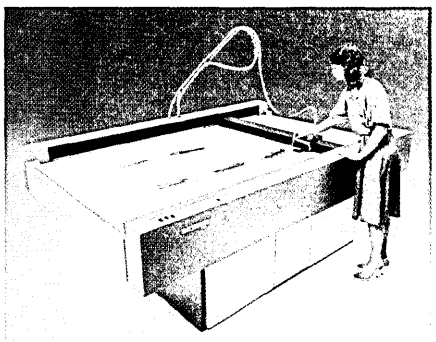


1681 Graphics COM System

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.

For bigger jobs, there are six other precision drum plotters to choose from. Including the largest, our new 1065, with an extra-wide 72" drum that plots at 30ips.

Or, for the best of high-end performance, there's our 960 belt-bed plotter. It delivers big 33" x 60" vertical plotting for any "E" size plot and 30 inches-per-second speed with 4g acceleration.

And nobody handles computer graphics on a grander scale than CalComp. And that's where a top-of-the-line family of flatbed plotters — the 7000 System — literally draws away from the competition. In dozens of applications and at hundreds of sites throughout the world.

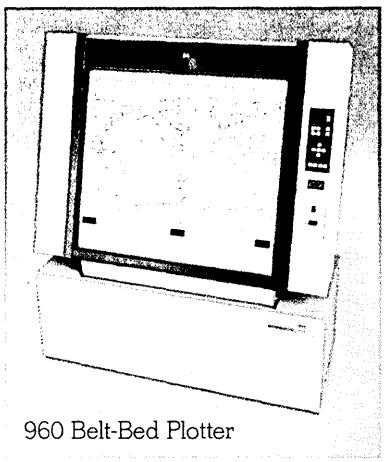
We do some of our best work on film.

Pen and ink plotters aren't all we make at CalComp.

In fact, for over a dozen years, we've also been designing, building, selling and servicing exceptional COM (Computer Output Microfilm) systems.

This year we're introducing two new high-speed, high-volume COM systems, the 1581 and the 1681. The former expressly for graphics-only environments. The latter for both graphics and alphanumeric applications.

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



960 Belt-Bed Plotter

Nobody has more experience to draw upon.

CalComp pioneered computer graphics way back in 1960.

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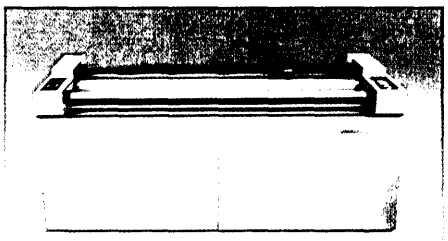

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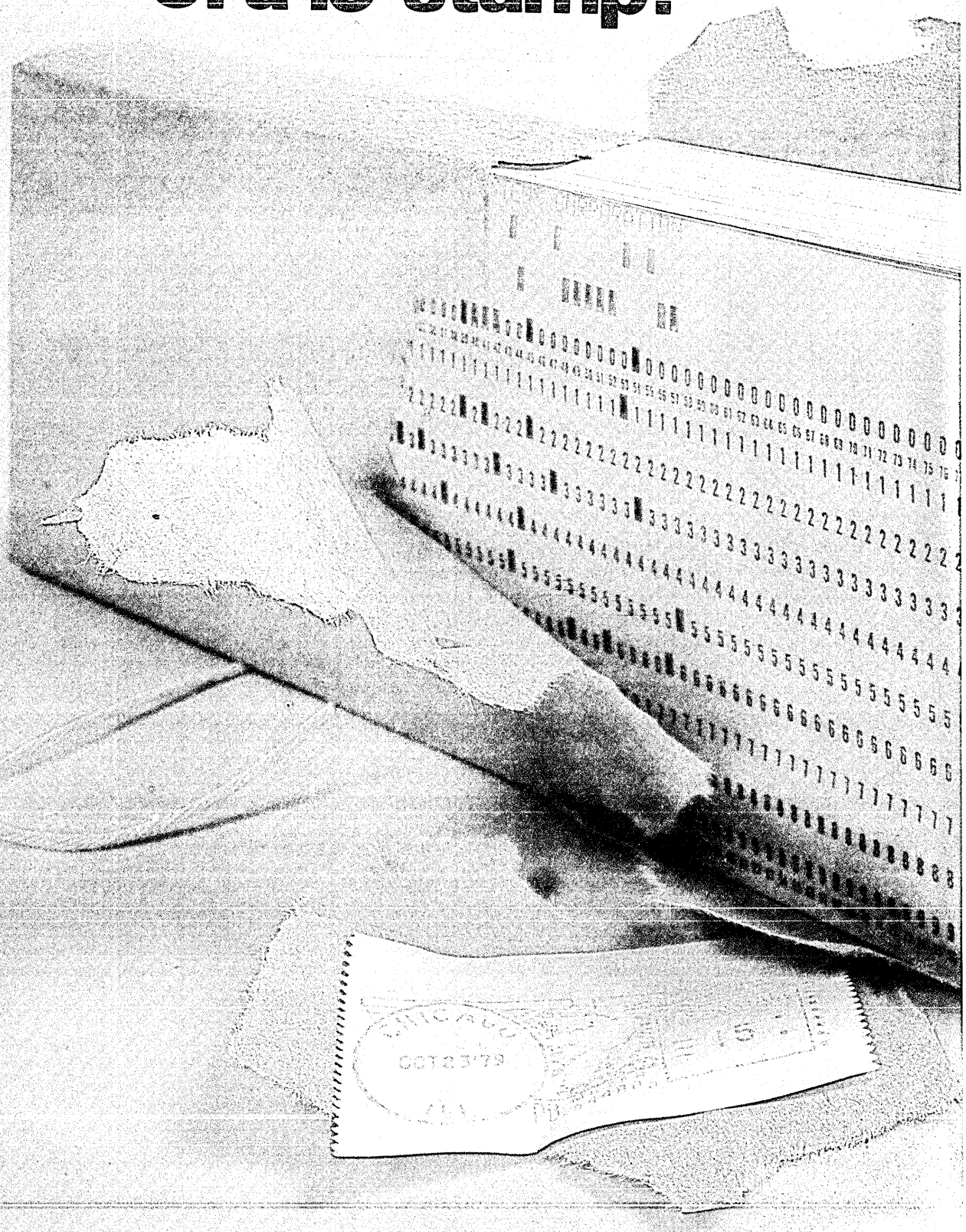

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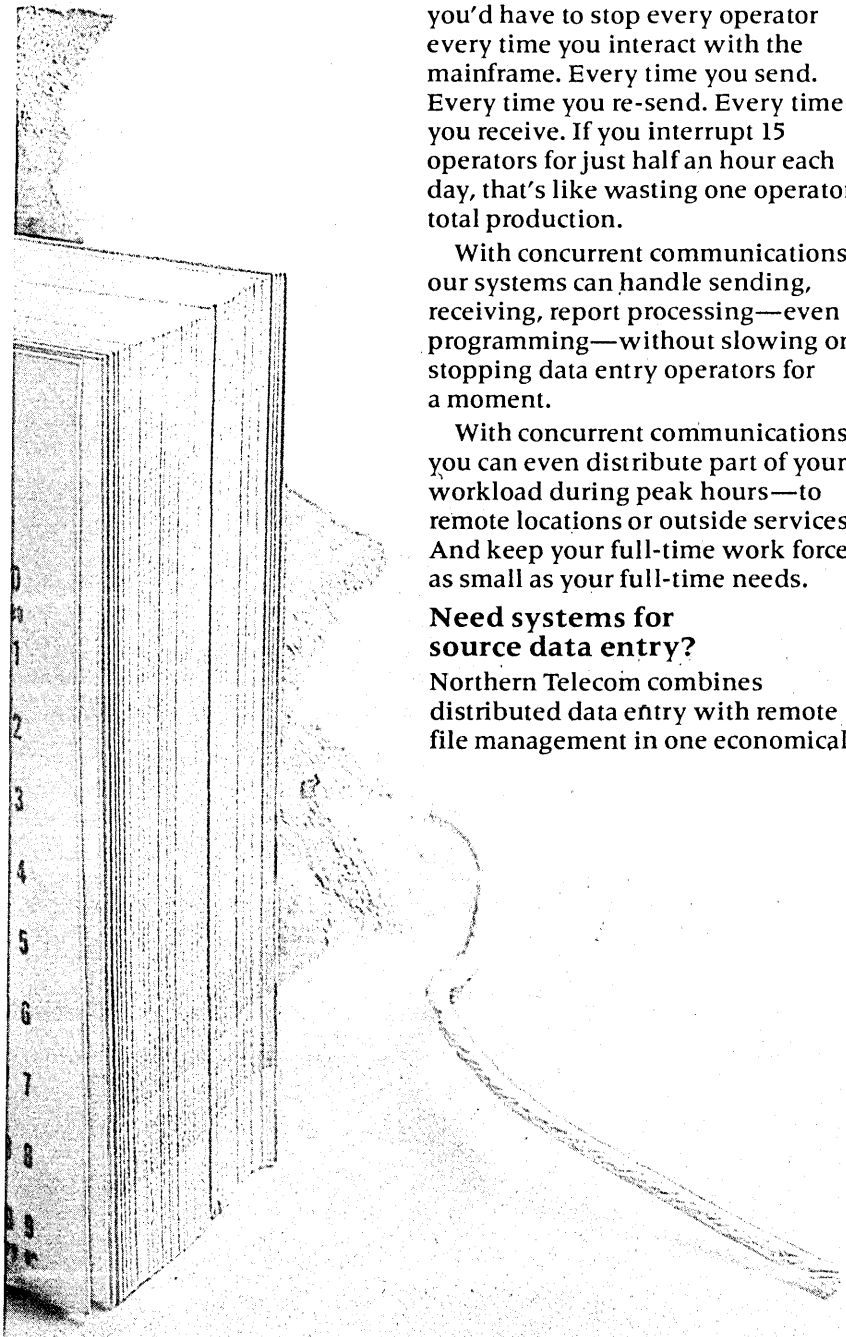

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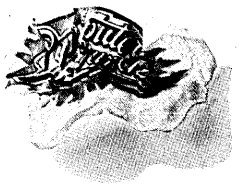

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CIRCLE 41 ON READER CARD

IN THE BEGINNING, THERE WAS MAUCHLY

From beginning to end, the life and works of Dr. John W. Mauchly exuded zest, ingenuity and warmth. DATAMATION pays tribute to this great scientist who helped spawn an industry.

HE WAS AN IDEA SPARKER

"His interest was not only in developing ideas, but in developing people as well."

"You know, Carl, back in the early days of working at Univac, we'd come up with 100 inventions a day. Nobody does that anymore."

That statement is one remembered by Dr. Carl Hammer, director of computer sciences at Sperry Univac; it was made by his good friend of 25 years, John W. Mauchly. "We were sitting by a fireplace at a Univac Training Center in Rome, Italy, in 1972," Hammer recalls, "and John was reminiscing about the pioneering days. He was truly an inventor at heart."

Dr. John W. Mauchly, coinventor of the world's first electronic digital computer, among other claims to fame, died on Jan. 8, 1980 at the age of 72 in a hospital in suburban Philadelphia. The world will remember Mauchly for his creative genius; his close friends and associates will remember him for much more.

"He was the finest boss I ever had," comments Capt. Grace M. Hopper, USNR, Ret., herself internationally known for original work in computer programming. "John was interested in all his people, in seeing that they grew and got to try new things. His interest was not only in developing ideas, but in developing people as well. What's more," Capt. Hopper adds, "he continued his interest in his people long after they ceased to work with him. He was a terrific man."

Like many other close associates of Dr. Mauchly, Capt. Hopper complains that the computer pioneer never received full credit for all his accomplishments. "For instance," she says, "he developed the C-10 code for the Univac I, which was the subset of every computer code since then. Few people know that. And though others have tried to take the credit, he was indeed the first to propose a computer programmed by internally stored instructions."

Dr. John W. Mauchly and Capt. Grace M. Hopper, USNR, Ret., receive honorary doctor of law degrees at the University of Pennsylvania in February 1974.

While Dr. Mauchly was not bitter about these omissions or commissions, Capt. Hopper contends, "they used to make me mad." As for Mauchly, she says, "He was a quiet man; he never grabbed for things." Nonetheless, she adds, "It's unfortunate that history got a little bit garbled."

But the history according to Mauchly is available, though not at present readily accessible. "John was a pack rat," comments Univac's Dr. Hammer. "When I visited his home, I discovered that he had at least 200,000 cubic feet of papers that had never been inventoried or cataloged. 'Oh, someday I'll get around to it,' he told me. Unfortunately, he never did."

That project, however, is now being pursued. At the time of his death, Mauchly was completing arrangements with the University of Pennsylvania to turn over his personal notes and papers to the school's Van Pelt Library. With the assistance of Mauchly's family, the effort is being undertaken by the History of Computing Committee of AFIPS (the American Federation of Information Processing Societies).

Once an archive has been established, the university will seek a federal grant, perhaps from the National Science Foundation, to support research projects based on Dr. Mauchly's papers. In the interim, however, funds are needed to organize the papers into a usable, indexed form, a project that in itself could take as long as four years at a cost of several hundred thousand dollars. (Donations can be made to the John Mauchly Memorial, Van Pelt Library, University of Pennsylvania, 3420 Walnut St., Philadelphia, PA 19104.)

To Mauchly's close associates, it comes as no great surprise that he never took the time to organize his papers; John Mauchly was not one to rest on his laurels. Until his death, he was busy working on his lifelong project—applying computers to weather predictions. Towards that end, he used two TRS-80s and a Nova 1200 minicomputer in his home. "He was delighted with these small computers," says his son-in-law, James McNulty. "He enjoyed pointing out that 'that little TRS-80 has more power than the ENIAC did.' "

—Becky Barna

MAUCHLY WAS HIS OWN MAN

Computer pioneer John Mauchly led a busy and diverse life.

Throughout his life, John Mauchly was his own man.

As a young boy in Cincinnati, he wanted to be a streetcar conductor, then a fireman.

When he was in high school in Washington, D.C., he expected to become a chemical engineer, and he won a state scholarship to the engineering college at Johns Hopkins University.

Engineering, he said later, bored him. However, because he was an outstanding student, the university advanced him in his sophomore year into the doctoral program in physics.

Physics was probably a natural inclination; his father was head physicist at the Carnegie Institution's Department of Terrestrial Magnetism not far from their home in Chevy Chase, Md.

After obtaining his PhD in physics from Johns Hopkins in 1932, Mauchly worked for a year there as a research assistant. Then Ursinus College in Collegeville, Pa., hired him as head of its physics department. Mauchly is remembered fondly by the students there for his famous Christmas lectures.

It started pretty innocently. Around Christmas, when his students tended to be bleary-eyed Professor Mauchly would wake them up. He would demonstrate the scientific methods of finding what's in a package without opening it. He would put a balloon in the package before class and then prick it with a pin. Or, he would fill the package beforehand with glass and then drop it.

Drawn by a professor playing pranks on students instead of vice versa, so many students packed the Mauchly Christmas lectures that they had to be held in the college auditorium.

Mauchly taught at Ursinus from 1933 to 1941. His scientific work at this time centered on weather, a field which involved long, tedious calculations. He hoped to develop a small, cheap computing device. The professor began experimenting with ways of counting electronically.

During the summer of 1941, still interested in weather research, Mauchly enrolled in an eight-week, government-paid defense course in electronics at the University of Pennsylvania's Moore School of Electrical Engineering.

The lab instructor was J. Presper Eckert, a graduate student, who had just received his bachelor of science degree in electrical engineering from the university. Mauchly had already given some of the experiments in his physics course, and he would rap with Eckert instead of going through them again.

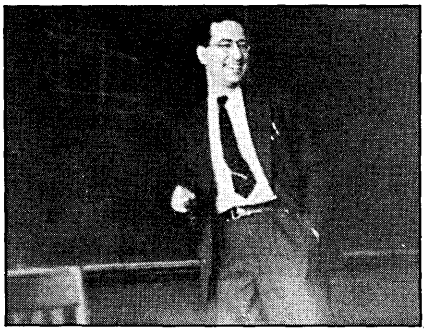
The two developed a mutual interest in calculating electronically. Eckert felt that if the design allowed for the fact that vacuum tubes were not perfect, you could use such tubes for a reliable computing device.

Their informal bull sessions developed into friendship. Mauchly joined the staff at the university after the course. The two would "talk computers" at Linton's restaurant near the university before going home at night.

The Ballistics Research Laboratory (of Aberdeen Proving Grounds) was then using the Differential Analyzer at the Moore School in a crash effort to compile artillery firing tables. In addition, more than 100 women, working day and night, used desk calculators in the effort.

Eckert and Mauchly thought an electronic computer using vacuum tubes could do the job much faster. After Dr. Mauchly made a formal proposal, the Army began funding their project in June 1943.

Thus ENIAC—the Electronic Numerical Integrator and Computer—was begun.



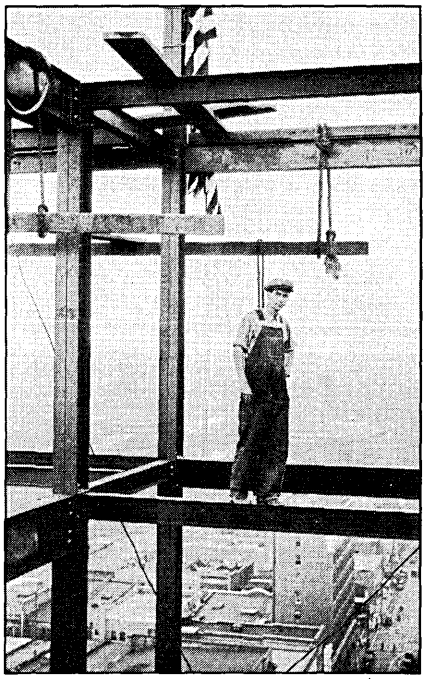
As a professor at Ursinus College, John Mauchly worked in a profession that he later said was his favorite.

In the project which followed, Dr. Mauchly supplied the theory, the specifications on what their creation would do, and how it would work from the user's point of view. Eckert was the specialist in building a reliable machine to do the job.

Most of ENIAC was working by the end of 1945. When it was dedicated in 1946, it had 18,000 vacuum tubes and occupied 15,000 square feet on the first floor of the Moore School.

ENIAC could do 5,000 additions or subtractions a second. In one hour, it could equal two months' production by the 100 people using desk calculators.

Moved to Aberdeen (Md.) Proving Grounds in 1947, ENIAC was used for designing wind tunnels, studying cosmic rays, and other research.



During summer vacation from college in 1926, John Mauchly worked on construction sites in South Carolina.

Eckert and Mauchly formed their own company, Electronic Control Co., in 1946. Two years later, this became the Eckert-Mauchly Computer Corp. In 1950, Remington Rand, Inc., purchased the company, which subsequently became, over the years, today's Sperry Univac.

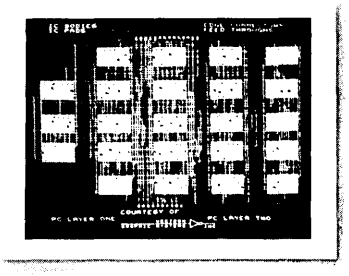
While still running their own company, Eckert and Mauchly developed BINAC, the first computer with internally stored instructions. They were well under way with UNIVAC I, the first digital computer for business and general statistical problems, when Remington Rand acquired their firm.

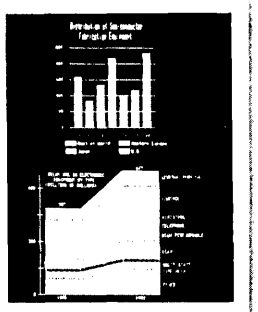
Dr. Mauchly directed Univac's applications research center in the late '50s, but left the company in 1959 to form Mauchly Associates, a consulting firm which developed the Critical Path Method (CPM). Then, in 1967, he founded Dynatrend Corp., a firm that specialized in computer-aided stock analysis.

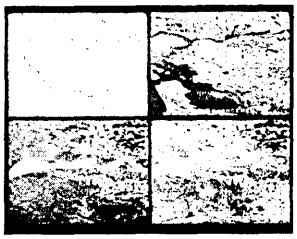
Dr. Mauchly rejoined Sperry Univac in 1973 as a consultant. He made significant contributions to the company's Law Enforcement Applications Package (LEAP).

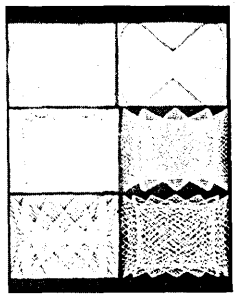
Dr. Mauchly was a founder and president of the Association for Computing Machinery, a national organization for computer professionals, as well as the Society for Industrial and Applied Mathematics.

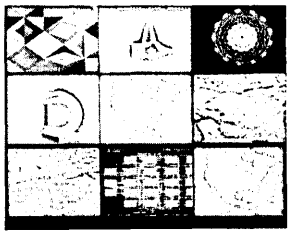
During his life, Mauchly received many honorary doctorates, as well as numerous other honors and awards, including the Goode Medal of the American

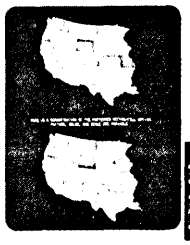












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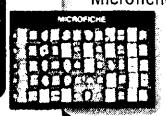

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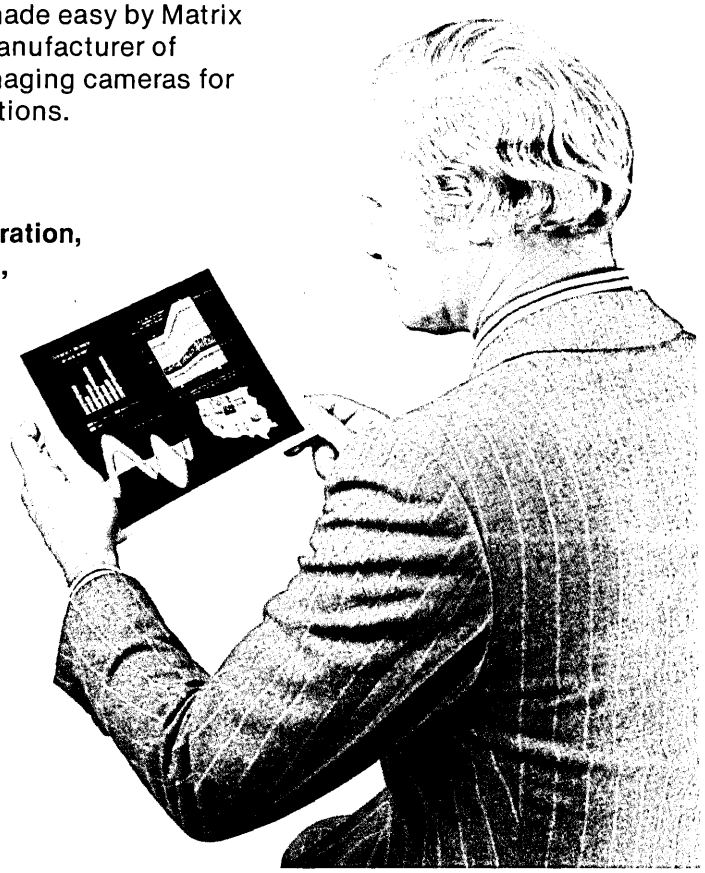

 # MATRIX INSTRUMENTS

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Federation of Information Processing Societies.

The Mauchly family lives in a large, Revolutionary-era home in Ambler, Pa. Dr. Mauchly met his wife, the former Kathleen McNulty, while she was working as a programmer on the ENIAC project. In addition to his wife, Dr. Mauchly is survived by two sons, five daughters, 17 grandchildren and two great-grandchildren.

—Anne Dewees

INTERVIEW WITH JOHN MAUCHLY

"I must admit I received satisfaction from a tv show explaining how computers were used to simulate scenes in Star Wars."

In what was perhaps the last formal interview with Dr. John Mauchly, Anne Dewees, associate editor of Sperry Univac News, *probed for anecdotes and sidelights to the computer pioneer's life—the kinds of things never before published. Portions of that interview, conducted a few months ago at Dr. Mauchly's home in Ambler, Pa., appear below.*

Albert Einstein once said if he had it to do over again, he'd become a plumber . . .

I can see lots of things along the road of life where I made the wrong turn in the sense that I didn't do the best thing as seen now. But they weren't major decisions like choosing a profession or subject matter. I've never regretted what I did.

What types of people do you prefer?

Open-minded people. I dislike the closed mind.

Whom do you admire?

I admire Pres Eckert for his immense capacity for getting things right in the electronics field. Jack Kennedy. I thought he had the ability to pull the nation together and get good things done. Dr. Jacob Bronowski, who was responsible for *The Ascent of Man* on public television. Prof. Thurstone, who invented a new mode of thinking about psychological and statistical problems. Golda Meir. And Johnny Carson for his quick wit.

Didn't you ever have an athletic hero?

Flatly, no. I never could see any sense in athletics. Sound mind, sound body makes sense. But I don't think what they call athletics in school is really a means to that end.

As a youngster, did you get along with your peers?

Yes, I never got into great battles with anybody. I got along well with my good friends, some of whom I helped with their homework. I was not out on the sandlot playing baseball; I wasn't even playing catch with my father. He could catch, but he was a scientist and had his own work. I let it go at that.

What kind of humor appeals to you?

I'm not a specialist in remembering funny stories, real ones or fake. You can put me down as a punster. Plays on words; I guess almost a mathematical kind of humor as opposed to situation humor. I think a pun is the highest form of humor.

Parts of ENIAC and UNIVAC I are in the Smithsonian. Do you ever go to Washington to look at them?

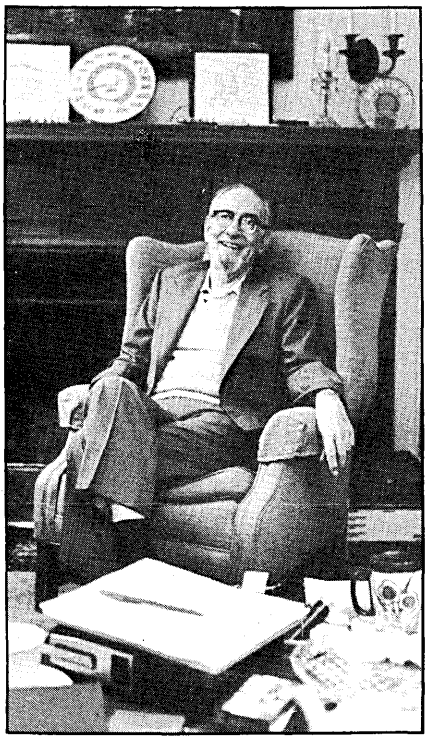
My wife, Kay, and I went down about four years ago, and we couldn't find UNIVAC I at all. A portion of ENIAC was in a dark, out-of-the-way corner. MIT had a huge display of Whirlwind, which made claims of being the first parallel computer. ENIAC was the first. Burroughs also had a large exhibit. ENIAC deserves better than that. It's a ready-made PR project for Sperry as an image builder.

When were you the most happy—as a teacher, inventor, or businessman?

It's hard to compare, but leaving out the question of how much money you need to live on, I was most happy teaching.

If you wanted to luxuriate in your success, what satisfaction do you get from what you've accomplished?

I've never concentrated on the satisfactions; I've spent too much time on the dissatisfactions. I'm satisfied that the ENIAC not only worked, but it was 10 years before it was retired. It produced a lot of useful computations at rates that were 100 times faster than anything else. It was a satisfaction to go along and start stored program computers and all the things that followed.



JOHN MAUCHLY sits for one of his last formal interviews at his home in Ambler, Pa., last fall.

Even though I didn't have anything directly to do with it, it's a great satisfaction just to be able to own some of these small computers that have come out of all this.

The dissatisfaction comes out of things I'd hoped could be done which would be of even larger benefit to the world—the improvement of weather forecasting, for example.

I must admit I received satisfaction from a tv show explaining how computers were used to simulate scenes in *Star Wars*.

How do you feel about all the jobs that have been created by computers?

People were afraid to put the computers in business and industry because it would put people out of jobs. We kept telling them it's going to make more jobs. Some people won't have the same jobs 10 years from now. But that's always been true in the world; it happens faster now. Eckert often says, "The buggy-whip business isn't very good any more."

Do you think there's any danger of machines taking us over?

There's always a danger. Just as there was a danger in Three Mile Island getting to a meltdown condition. We let our technology put us in a hole. But it's sort of silly of us to let that happen.

Our second computer, BINAC, was two computers working in tandem, each one checking the other. Forty years ago that system was more fail-safe than the analog system they were using at Three Mile Island.

Will computers ever have consciousness or creative thinking?

Probably. It's a matter of definition. People used to ask will computers ever think? Well, what do you mean by think? If you were having a conversation with somebody in another room and I couldn't tell whether you were talking to a computer or a person, that would be a test of how good computers are in doing what humans do. Whether you call it think or whatever.

You're the second generation PhD in physics in your family. Is there a third generation?

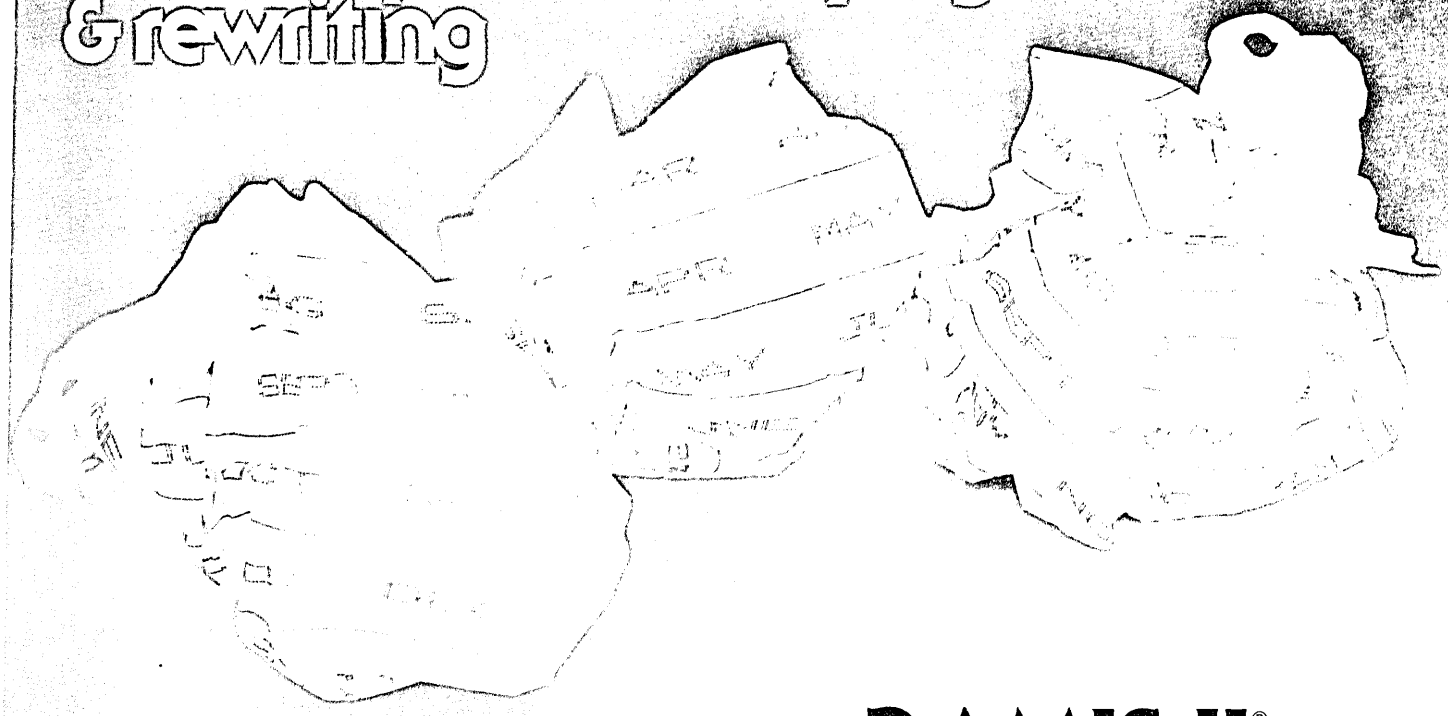
None of my seven children became scientists. They're interested to some extent, but . . . My wife is a mathematician; she was a programmer on the ENIAC project when we met.

You must have 3,000 books in you library. Have you read them all?

About 80%. They're mostly scientific; some novels. I just read portions. I've read a little bit of a lot of things.

What do you think the computer will be doing in the next 20 years?

70% of programming time is spent modifying & rewriting



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CIRCLE 43 ON READER CARD

That's a hard question. Whatever we say will be wrong. But it's an easy question in that it'll take 20 years to prove it's wrong. You can't really look much farther than the end of your nose.

Most of the predictions that people make are what a mathematician calls extrapolations. You just assume that things are going in the direction that you now see them going, and if they go just a little farther in that direction, well, that's a prediction.

We can predict many things that are going to happen in our solar system and in the galaxies outside . . . But we're not very good at predicting the weather.

Why not?

Eclipse predictions depend on a couple of heavy, large bodies like the moon, sun, and earth. The weather depends on lots of little things called molecules, of which there are trillions in this room. We just can't spend our time and energy trying to figure out what each of those molecules is going to do. All we can do is deal in averages.

The statistical laws of gases have proved out very successfully within a small room; but when we consider the size of the earth and its atmosphere we just have to lean on statistics and less on knowing what each individual molecule in the atmosphere is doing.

That's in part the difference between what I was proposing and what the weather bureau is still doing: trying to take smaller and smaller pieces of the earth and observations on it, putting in more and more details, figures.

What I wanted to do was take a larger view, standing off from the earth, you might say, and asking what's happening on the large scale. That enabled me in 1952 to prove (I proved it to myself) that the moon does affect our weather, whereas the meteorologists thought they'd proved the opposite: the moon has no effect on our weather.

In 1963 they got around to investigating whether there was anything wrong with my proof. I was right. That's only 10 years' needless lag. They could have done it 10 years before I did it. The moon affects precipitation.

Up to the present moment they're still not using the fact that the moon affects our weather. They're not using it because they don't know why it happens. There are some people working on it, but you might say a micro dollar is being spent on that while macro dollar are being spent on all other kinds of research.

Every time we have a big flood or tornado, the damage and loss estimates can be up to a billion dollars. That's all out of proportion to the amount we spend on research.

Do you think we would have gotten into space without the computer?

Wernher von Braun said they would have gotten nowhere—couldn't have put a man on the moon or anything. They've spent hundreds of billions and gotten into space with various exploratory probe devices to find out about other planets. Eventually this is going to teach us more about our own earth and the meteorology here. We'll learn; we're just not learning fast enough.

Is the government spending enough money on space?

I'm sure they're not. They cut back; that's why the space lab came hurtling down on us in June. If they'd put the money into what was planned for that lab, it would have been up there for years.

JOHN MAUCHLY and his wife Kay stroll through their grounds in Ambler, Pa., last fall.

Did you ever blame the computer for anything?

No, but I've blamed lots of people for blaming the computer.

What are the difficulties in raising a family of seven and being a creative genius?

I've been ultrapermissive and ultra a lot of other things, trying not to swamp my family with my problems and my job. That's why they're all so diverse. I never tried to make them do anything along any particular lines of interest. I've even kept hands off to the point where I tried not to influence them much.

Are you sorry about that?

I think sometimes that maybe I should have done a little more, but I'm not really sorry. I think it's more fun just to see what happens.

What's fun to you?

When I was a student at Johns Hopkins, a psychologist asked me that question. I answered that I used to play tennis, but mostly my work was fun to me. The research that I was doing then was more interesting than anything I could see to compare with it.

Now my interests are broader. If I get tired of one thing, I've two dozen other things that I feel are waiting for me to work on. I have mathematical theorems to prove yet.

What are you working on now?

I'd like to see some of the (computer) history written, because I know that I know pieces of history that nobody else knows—or that very few people know. If I don't get it recorded or written down somewhere, it may get lost. It may not be very important, but it may help as a little bit of glue to cement the pieces that somebody else has put into the pile.

What dangers do you see in computer science? Can we go too far?

There are dangers in everything. People right now are more worried about the dangers in nuclear science. But without nuclear science, we wouldn't be able someday to have electric power from fusion—and perhaps have unlimited energy with very little danger.

With computers, they're just tools which we can use badly or well. Somebody may go too far. It isn't the computer or mankind going too far; some individual may go too far.

If you had a moment in your life to live over, what would it be?

My honeymoon. It had one disastrous effect. It was awfully crowded—the hotel made a mistake and gave us a room with twin beds.

How do you think history will treat you?

History changes on how it treats various people. It's interesting to me, for instance, that on the centenary of Thomas Edison's invention of the light bulb, it was also the centenary of his first biography. He was already so well known by the time of the light bulb invention, he already had a biography.

History is certainly going to change its point of view about me and Eckert and lots of other people. We think it'll change with respect to who did what so as to reflect the part we really played in the invention of the computer. It will gradually lose its emphasis on thinking that big mathematicians or logicians were the people who played the important part.

What is your biggest deficiency?

I'm not a good salesman. I haven't seen how to sell some of my ideas. The selling of the original ENIAC to the Army Ordnance was a purely fortuitous thing based on the fact that there was a war going on, there was a need there and somehow I had gotten into the Moore School—the right place at the right time. It's a big game of chance. That time I happened to win, and the world happened to win.

—Anne Dewees

TRUTH #
ABOUT STATISTICAL MULTIPLEXING

2

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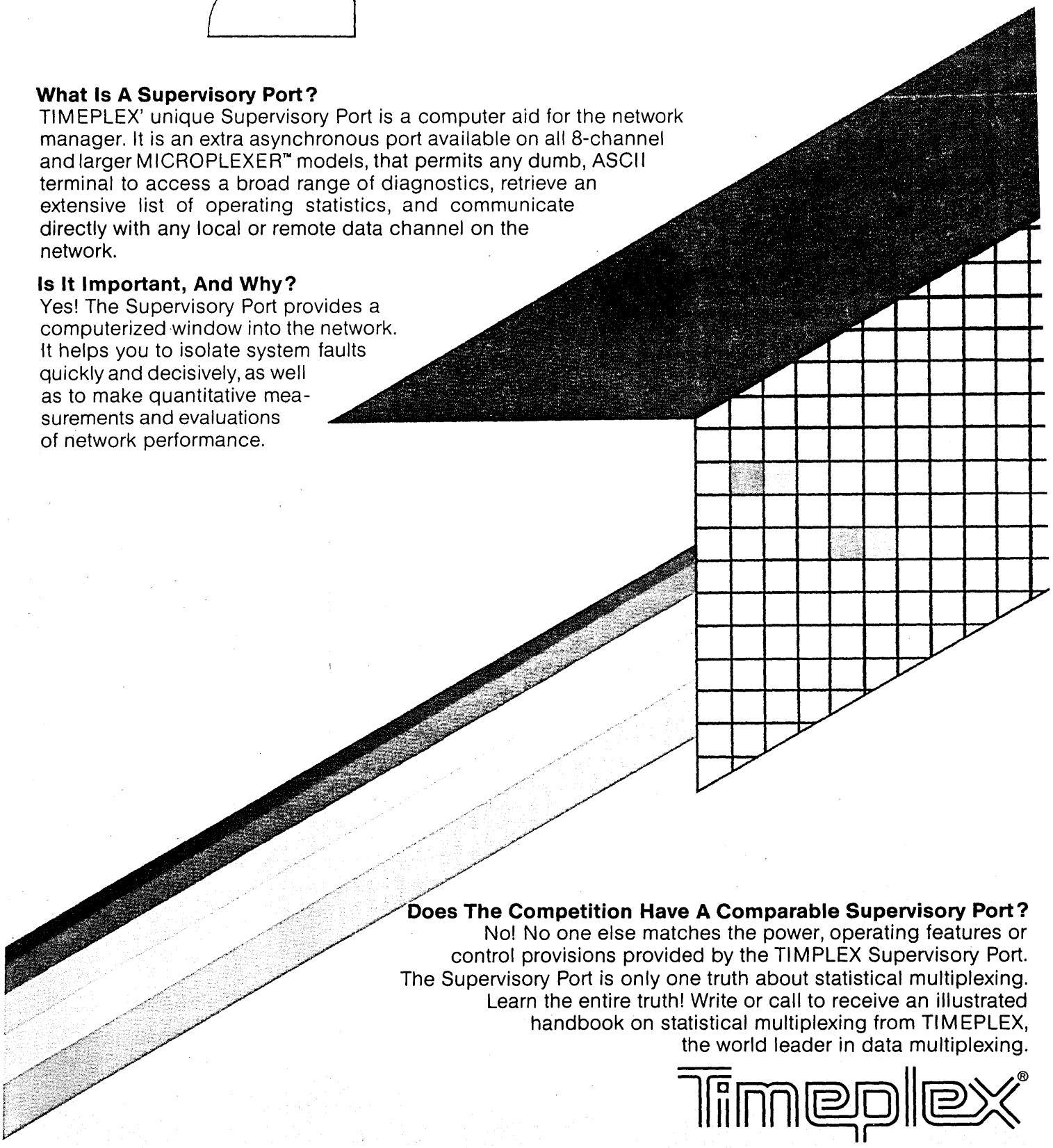

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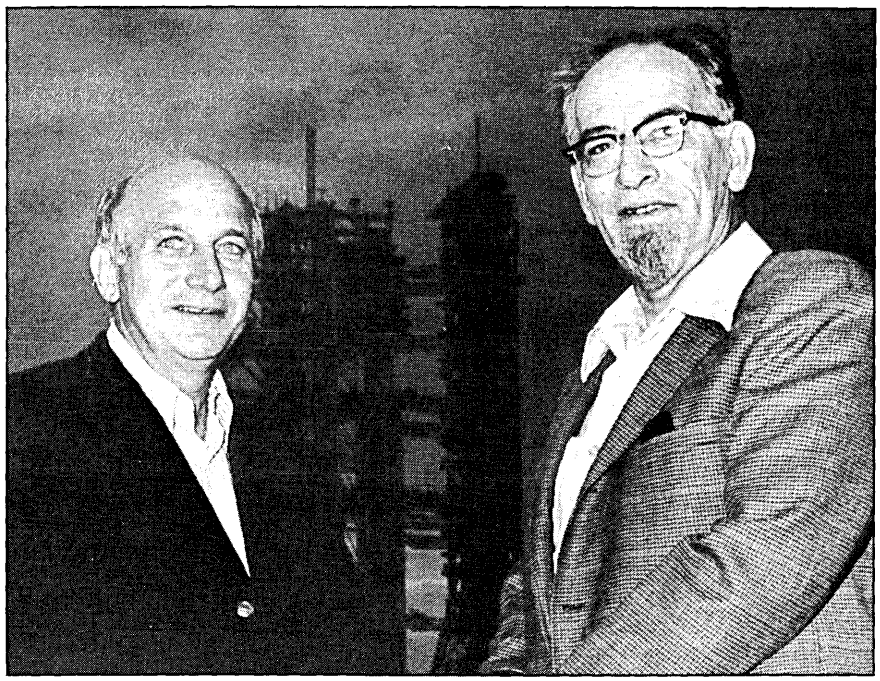
CIRCLE 44 ON READER CARD

BOOTH 1120 IN INTERFACE '80

A MAN NOT BOUND BY TRADITION

The following is excerpted from the eulogy delivered by Dr. J. Presper Eckert during funeral services for Dr. John W. Mauchly at St. Anthony's Roman Catholic Church, Ambler, Pa., on Jan. 11, 1980.



The coinventors of ENIAC, J. Presper Eckert (left) and John W. Mauchly, visit Cape Kennedy to witness the Apollo 17 nighttime moon launch in December 1972.

It's a privilege to be here this morning to talk about John Mauchly. I met John I believe in 1941, and so I knew him for something like 38 or 39 years—well over half his life. And therefore, I knew him well.

The first thing that comes to my mind when I think of John is that he was certainly one of the most brilliant people I ever knew. But I think brilliant is a cold word. And for all his brilliance, I think it is more important to say that John was a good man.

What do I mean by good? The word good means a lot of things to me. It means I think he was good to his family. It means that I think he was good to his friends. He was good to me as a friend and to my family. And perhaps in addition to all these, he was certainly good for the world—more than most people will be in my generation.

As the inventor of the computer, John created something which will last for a long, long time. And John will probably be heard about more in the future than he has been during his life.

One great thing about John was his synergism with other people. I had a skill in electronics when I met John, some knowledge of mathematics, and some knowledge of computers. John had a lesser skill in electronics than I had when I met him, but he had a greater skill in mathematics—a greater skill in what then were desk calculators, the calculators that were forerunners of the computer of that day. The efforts which we were able to put together synergistically allowed us to develop the first computer.

Many of you may not realize the prodigious effort that John put into that first machine because he was teaching as well as working on that computer. I worked full time on the computer. And full time in those days meant certainly in excess of 80 hours a week. All of John's spare time outside of teaching—and it was certainly more than what a normal 40-hour work week is—was spent working on the computer.

One particular crisis in the building of the computer came when one of our professional people saw fit to leave the project to take a vacation without telling us—except by a postcard which we got after he left. The panel this man was responsible for was the central timing unit which controlled the entire device. Everything else we were doing with it would have been brought to a standstill. I could not take the time away from the overall supervision of the assembly of the machine to finish that panel and make it work so that the rest of the work could be done. John somehow found the time along with his teaching and other responsibilities on the project to take that man's notes, notebook, and blueprints and make that timing panel work so that we got it done in time without holding up the rest of the project—something which neither of us thought he could do at the outset.

I can remember that when we first started to build the ENIAC we had designed an accumulator as far as an adding mechanism, subtracting mechanism, and carry-over mechanism is concerned. But we didn't really know how we were going to program the machine. We knew what we wanted to do in the program, and we knew we wanted to have a subroutine system. But we didn't know how to do it. It just so happened at this time that John became sick; he had the flu or something and was flat on his back in bed. I was at the point where I had to go tell the people what to do next, and we hadn't settled the programming question. I spent most of two days, I guess, with John in his bedroom, while he was feeling perfectly terrible. And during that period John came up with the suggestion as to how we might build some boxes and interconnect them with some cables and switches to perform this function. I don't think John knew exactly how to do this function, but he told me what he thought we had to do and I figured it out. I then went back and got it carried out while he was still ill for a few days.

"John was not tied down by the inhibitions about the world that most of us have."

I don't think I've spoken about either of those things in the past, in any circumstances, but they are certainly very intimate memories of how John came through in the real pinches that we had from time to time.

Everyone I've ever met that's known John has been impressed by the fact that they never found John when he wasn't in relatively good spirits. Even if something happening was bad, he was cheerful about it and joked about it—and cheered up the other people around him about it. There may have been times when John was depressed, but I almost never saw them.

Another thing about John is that he was not tied down by the inhibitions about the world that most of us have. This is what allowed John to make the advances in computers and other areas connected with computers that he did. John saw things really for what they were, and not what people told him they were. And there's a big difference between those two things when you come to try to invent something. It's the difference between being tied down by tradition and being guided by tradition into doing something new. John imparted to those people around him—such as Joe Chapline, Dr. [Grace] Hopper, and myself—this spirit of looking at things for what they really were. And this enabled us to break with tradition and to advance tradition, rather than to be held back by tradition.

My association with John Mauchly is, of course, the high point of my entire life, professionally speaking. I'm sure that all of you who knew him well will miss him, and I shall miss him. I do miss him right now. *

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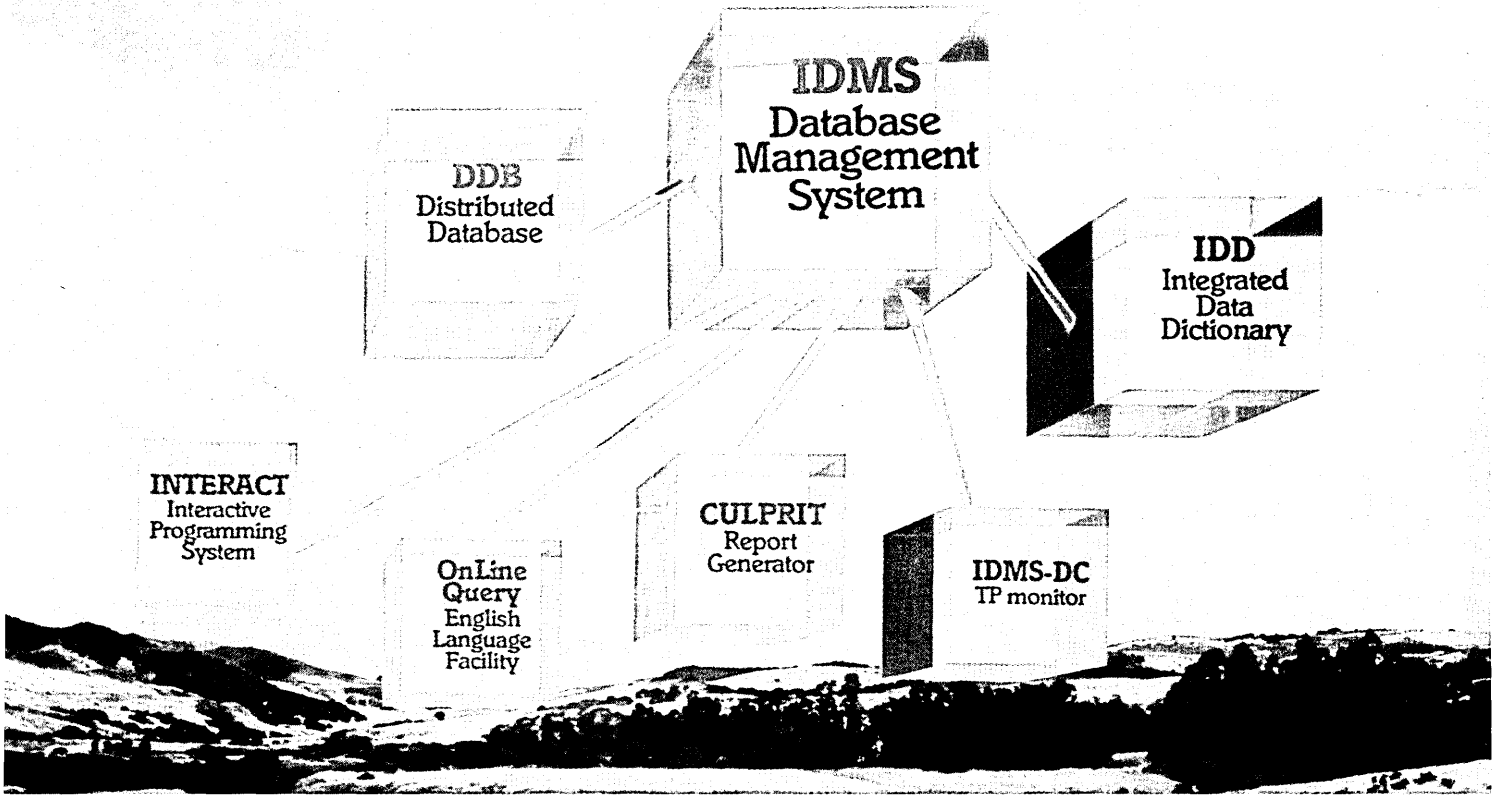

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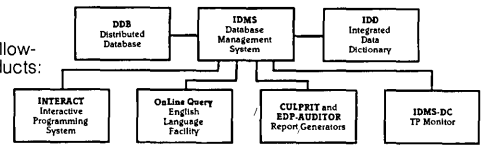

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CIRCLE 45 ON READER CARD

LOOK AHEAD

(Continued from page 22)

markets may be "a step in the right direction," the Justice letter said, it is "clearly an imperfect substitute for the fundamental structural and ownership changes the Department is seeking in the AT&T case."

Justice had earlier prepared a point-by-point rebuttal to the bill's proposals, only to have that critique squelched by Administration officials. "(Justice's) public posture on the bill is essentially the same as the one that was never released," a source said, "but it's a much watered-down version." The government's bout with the bill has only begun, he added.

AT LONG LAST DATACOM

After years of ignoring data communications, the International Telecommunications Union (ITU) in Geneva is at long last paying attention to this technology. One high level ITU source reports the 154-member international organization is planning a world conference on datacom for 1983 or 1984.

FRENCH EYE U.S. SOFTWARE MARKET

Several French service companies are joining forces to set up a bridgehead in the U.S. -- probably in California -- to support the sale of French software products in America. Backed by a couple of prestigious French software houses, the group will act as a two-way information point with each supporting company still responsible for its own sales.

SWEDES CONSIDER COMPUTER LICENSES

Computers may have to be licensed in Sweden if a new government report on vulnerability is taken to heart. The report, from the SARK Committee, says that large central systems are especially vulnerable to enemy or terrorist attack and espionage. "The government and Parliament have not exercised enough control over the development of today's computerized society," the report says in urging that computers be licensed. Vulnerability could become the burning issue of the '80s, according to the report, as it is bound to be interpreted as another attempt to block U.S. multinational sales.

THE FED WANTS ITS SHARE TOO

Look for the Federal Reserve Bank to begin edging back into government owned and controlled packet switching, blunting private sector efforts to capture this most lucrative sector of the electronic mail market. (Financial transactions are estimated at 50% of first class mail.) The Fed argues that to gain more control over the monetary system it should control the settlement process among the major banks.

RUMORS AND RAW RANDOM DATA

A representative of "Think," the IBM publication, recently phoned one of our editors to ask how many computers are now in use. Our editor replied that the closest count could perhaps be found in IBM's own marketing department. "Oh, they have numbers," she responded, "but we keep finding discrepancies."...Hertz, the car rental firm, is cutting over to a new reservations system. There may still be a few bugs in the system -- the agent renting a car to a member of our staff in midtown Manhattan mentioned that his office had received reservations for such "nearby" places as Los Angeles.

NEWS IN PERSPECTIVE

STRATEGIES

MEMOREX IN THROES OF CHANGE

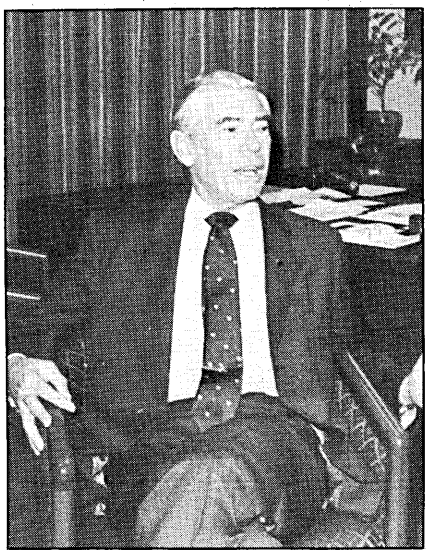
There's a sense of déjà vu in Spangle's move to Memorex at a time when merger talks run rampant.

When word was received that Clarence W. (Clancy) Spangle was assuming the reins of power at Memorex Corp., industry attention began to focus on exactly what the former Honeywell dp chief was inheriting.

Memorex headquarters is housed in a complex of light-colored stone, steel, and glass buildings in Santa Clara that first-time visitors have often compared to an IBM facility.

A recent visitor found the carefully manicured and landscaped grounds to be deceptively serene. Inside, the carpets appear to have less luster than in years past, and while the visitor was being ushered up to the executive suite, he saw a lonely wastebasket set in the middle of an aisle to catch leaking rainwater from an unusually heavy California downpour. Comments from present and former employees lend substance to the idea that this is a company caught in turmoil and even a touch of futility, based in part on a continuing stream of poor financial results.

But coming face to face with outgoing president and ceo Robert C. Wilson quickly dispels any doubts about the company's future.



ROBERT C. WILSON: "We like to say we extend and enhance, whereas IBM obsoletes in many cases."

Asked how things are going these days for the plug-compatible manufacturer, Wilson makes a careful correction, pointing out that the term is not precise: "We like to say we extend and enhance, whereas IBM obsoletes in many cases." Nevertheless, Wilson admits that everything Memorex does (in dp areas) is geared to having a better competitive stance with respect to IBM.

In this context, the Memorex chief feels encouraged by the recent IBM price hikes. The industry giant has done some rather dramatic things in a short period of time, like the low priced 4300 series, the 3880 controller, and advances in memory chips. The price increases are a sign that things have to stabilize because it is not possible for the industry to continue to absorb such high rates of change.

Does IBM create the opportunities for Memorex? Wilson replies that is like asking whether Alexander Graham Bell created opportunities for those that make telephones. Customer needs create the opportunities, Wilson insists.

What then is the major Memorex thrust these days? Upgrading rather than obsoleting, Wilson explains, is a major effort and one that has found good acceptance in the market.

He uses the IBM 3350 disk system as an example. "It is the end of the line for IBM" because it hasn't announced anything beyond it, while Memorex has announced a double density version plus an intelligent interface for that line. "We will have a high degree of parts commonality between the single and double density versions. So the user is really not dealing with a new product but only an extension of the old product. This should save the customer from going through a new startup situation," he points out.

Wilson admits there have been setbacks, like with the 3770 disk cache, which

CLARENCE W. SPANGLE: The position he'll be inheriting at Memorex is similar to the one he was given at Honeywell.

COMMUNICATIONS GROUP IS THE ONE TO WATCH

One of the most dynamic and least publicized operations at Memorex appears to be the Communications Group. Formed two years ago, the communications operation is headed by its president Richard W. Martin. In a recent interview, Martin, together with John King, strategic planner in his group, outlined some of the products being developed.

To set the scene, Martin said Memorex had installed more than 30,000 of its 1377 crt terminal, which is compatible with the IBM 3277-2. Typically the Memorex communications devices provide the customer with 10% to 15% savings over comparable IBM units while including additional operating features, he said.

This spring, Memorex plans to introduce a 3278 compatible product that will provide a separate controller. The IBM 3278 includes a built-in 3276 mini-controller that supports up to eight crts. The newly announced Memorex 2076 and 2078 are separate devices to provide increased configuration flexibility to the user.

Memorex is also planning to announce a screen printer that will attach directly to a 3270-type crt, thus avoiding the usual configuration of connecting to a subsystem controller. The screen printer will be similar to the IBM printer recently introduced for the IBM 3101 Ascii crt, and it will be a low cost device that is targeted at under $2,000, according to King.

Upgrades are also being planned for the Memorex 1380 intelligent communications controller. A major development effort is underway to add X.25 capability, and an "interim interface" which will provide this capability on a black box level will be introduced this year, Martin said. A full integrated X.25 interface for the 1380 is scheduled for 1981, he added. There are now about 125 of the controllers installed at user sites.

RICHARD W. MARTIN says Memorex is committed to continued enhancements for non-SNA networks.

JOHN KING reveals that Memorex will soon announce a screen printer that will attach directly to a 3270-type crt.

The earlier Memorex 1270 controller is also still going strong even though it has been around since 1971. King said an intelligent line adapter will soon be unveiled that will add microprocessor-controlled functions to the line side of the unit. This ILA will provide protocol conversion, speed conversion, error detection, and an X.25 capability to the 1270, King said. However, the controller will remain basically an IBM 2701-compatible device and while providing major upgrades for this binary synchronous environment, it will not support SNA network applications, King explained.

Martin explained that Memorex is committed to continued enhancements for non-SNA network users. Binary synchronous networks will be around for many years and the need will grow to provide X.25 features, he added, although the latter has developed faster overseas than in the U.S.

Within the range of communications devices that are offered, Memorex also supplies customized equipment on an RPQ basis. About 15% of the communications equipment is tailored to meet specific customer needs and users are willing to pay in advance for the engineering design work that is often required, King commented.

Memorex will continue to enhance its communications devices to provide continuing compatibility for users. As proof of this approach, Martin said the nine-year-old 1270 is still in production and new orders continue to be met. Some of the controllers operating in the field have never had a service call.

Not many other dp or communications products in the field can make the same claim, he implied.

—R.A.F.

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was touted as the first of its kind. The decision to use charge coupled devices (CCDs) for this product was wrong because "we found we could not get them." Then the design was converted to RAM and there were some beta test site problems, but shipments will begin some time in 1980, he vowed.

Why does Memorex have a relatively low profile in the communications area? Wilson responds that this group is only two years old. He concedes that the 1380 controller is really a computer and that the 3270-compatible display terminals are microprocessor controlled. These products are getting smarter and performing a wider variety of functions, Wilson points out, implying that they deserve greater attention.

Will Spangle provide an opportunity for Memorex to become more heavily involved in the computer area? Wilson agrees that Spangle, in his new duties, will give the company a better perspective to evaluate such a shift, but he adds that sometimes it is just as important to make a negative decision as a positive one.

"Memorex has found a corporate executive who can keep the company running until the missing part is found. If that means the Memorex name has to go, Clancy will not hesitate."

Wilson said he will not try to second-guess Spangle. But he does not look for any dramatic changes during 1980 since the corporate business plan for the year is already in place. For the immediate future Wilson will retain the post of chairman and will give Spangle his "best thinking" on problems facing the company. But everyone has his own management style and approach, and while he will discuss organizational alternatives with Spangle, Wilson's goal is to relinquish active control of the company, including the remaining post of chairman, by the end of 1980.

One associate who knows the Spangle approach first-hand is Robert Henderson, who worked for almost 10 years on the top management team at Honeywell Information Systems until leaving five years ago to assume his present post as president of Itek Corp. "He engineered the GE merger and acquisition—a real coup," Henderson said. The Honeywell/GE merger doubled the company's dp role, and integration of the two product lines came off smoothly despite the problems of working in a high technology industry, he said.

NEWS IN PERSPECTIVE

Donald Brosnan, president of MSI Data Corp., worked for Spangle as his managing director in the U.K. for three years. "He did a fine job of pulling together the Honeywell dp business after the acquisition of GE and Xerox under trying circumstances," Brosnan said.

Another former Spangle associate saw the GE merger as an indication of what Clancy will do at Memorex. "His position when he came to Honeywell was similar to Memorex today. He engineered compromises that made Honeywell a survivor in the difficult dp business. The whole GE 600 series has been the basis for Honeywell's success ever since the merger," the former HIS manager said.

"Spangle was able to evaluate that Honeywell could not survive by itself, that the two companies could survive, and he was prepared to merge the two operations regardless of who the remaining company was to be. He was prepared to give away the Honeywell name and the technology if that had been necessary to form a viable dp competitor."

"Memorex has found a corporate executive who can keep the company running until the missing part is found," Clancy's former associate concluded. "If that means the Memorex name has to go, Clancy will not hesitate."

—Ronald A. Frank

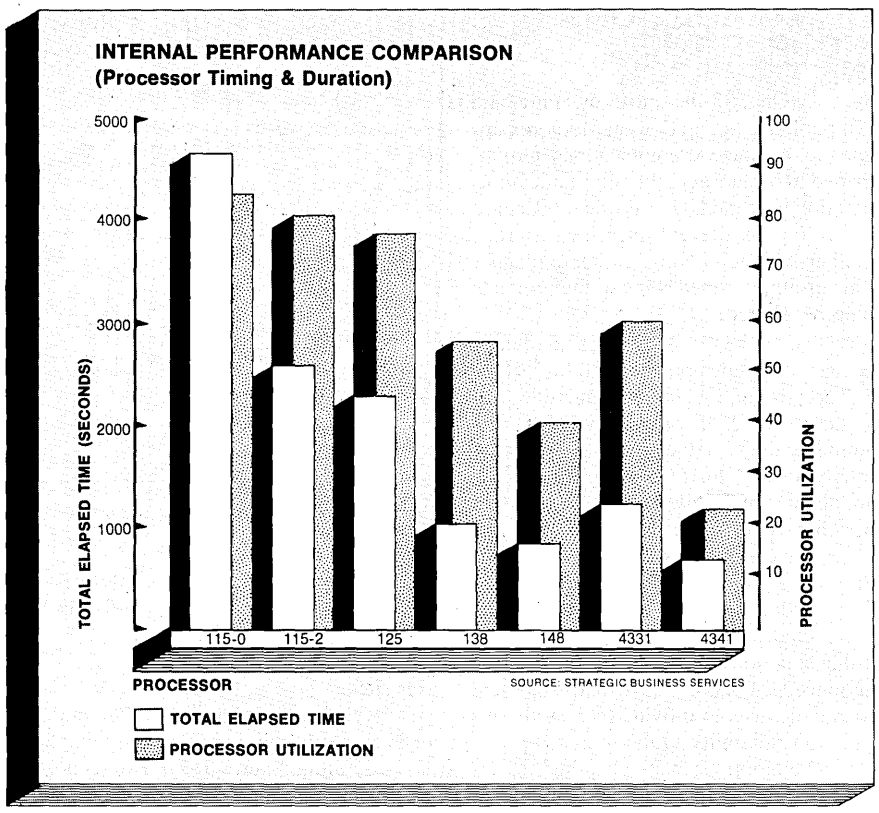
MAINFRAMES

HOW THE 4300s STACK UP

Strategic Business Services pits 4300s against 370s in its analysis of benchmark tests.

Benchmark tests of the IBM 4300 processors indicate that the new machines show up better in horsepower comparisons than in their abilities to process commercial job mixes. One such comparison, for example, shows that the 4341 has a cpu performance of 22 to 34 times that of the IBM 370/115-0, but in elapsed time the advantage is cut to 6.8 to 10.7 times.

This is one of the findings in a study released last month by Strategic Business Services Inc., San Jose, Calif. The tests were conducted by IBM, although none of the data has previously been available publicly. Much of the performance data was generated internally by IBM, using benchmark tests devised and agreed upon by its Systems Product Div., Data Processing Div., and other marketing divisions. The analysis is by SBS.



INTERNAL PERFORMANCE COMPARISON: Five S/370 processors are compared to the 4300s in batch processing benchmark tests, DOS/VS R.34 being used on the 370s and a prerelease version of DOS/VSE on the 4300s running in their native (ECPS:VSE) mode. Total Elapsed Time is the wall clock duration of the entire batch workload, while Processor Utilization is the ratio of total processor busy time to the total elapsed time. The latter is an indication of how busy the cpu is in executing the given workload.

With all the test results in, the bottom line is seen in this way:

- In the batch environment, under DOS/VS, the 4331 performs about like a 370/138, doing some jobs faster, some slower. The 4341, by contrast, is two to three times more powerful than a 148.
- In the CICS mode, the 4331 handled more than 80 messages a minute, while the 4341 did more than 160 per minute.
- Supporting up to 20 VM users, the 4331 provided a response time of 4.4 seconds, compared with the 4341's average 0.26 seconds.

A standard set of benchmarks, called a Standard Intermediate Workload, was used on more than 100 runs on the 4300s, as well as the 370/115-0, 115-2, the 125-2, 138, and 148. This workload consisted of seven batch jobs that were used to determine the internal performance of each processor. Along with this set of jobs was a transaction-oriented, CICS-based benchmark that tested the on-line performance. And an interactive benchmark simulated users working under VM and doing a variety of different jobs; the latter showed how many interactive terminals could be supported by a processor.

The amount of memory and disk configurations varied among processors, but the comparisons are said to be based on setups thought to be typical configurations, hopefully achieving apple-with-apple comparisons. Main memory sizes range from 192K on the 115-0 to 2 MB on the 4341 and the 148.

In the batch benchmarks—which consist of payroll job, billing, inventory, DL/1 batch, sort, COBOL compile, and a

The 4300s' performance improvements over the 370s stem from the use of new hardware, new operating system versions, and from new architecture (ECPS:VSE).

FORTRAN execution—the 4331 was found to perform most tasks a bit slower than the 138. The 4341, in contrast, was not only more powerful than a 148 but in some jobs was close to a 158. And in terms of cpu power, it is said, the 4341 is three to six times more powerful than a 4331. In those tests, DOS/VS Release 34 was used on the 370s, while a prerelease version of DOS/VSE

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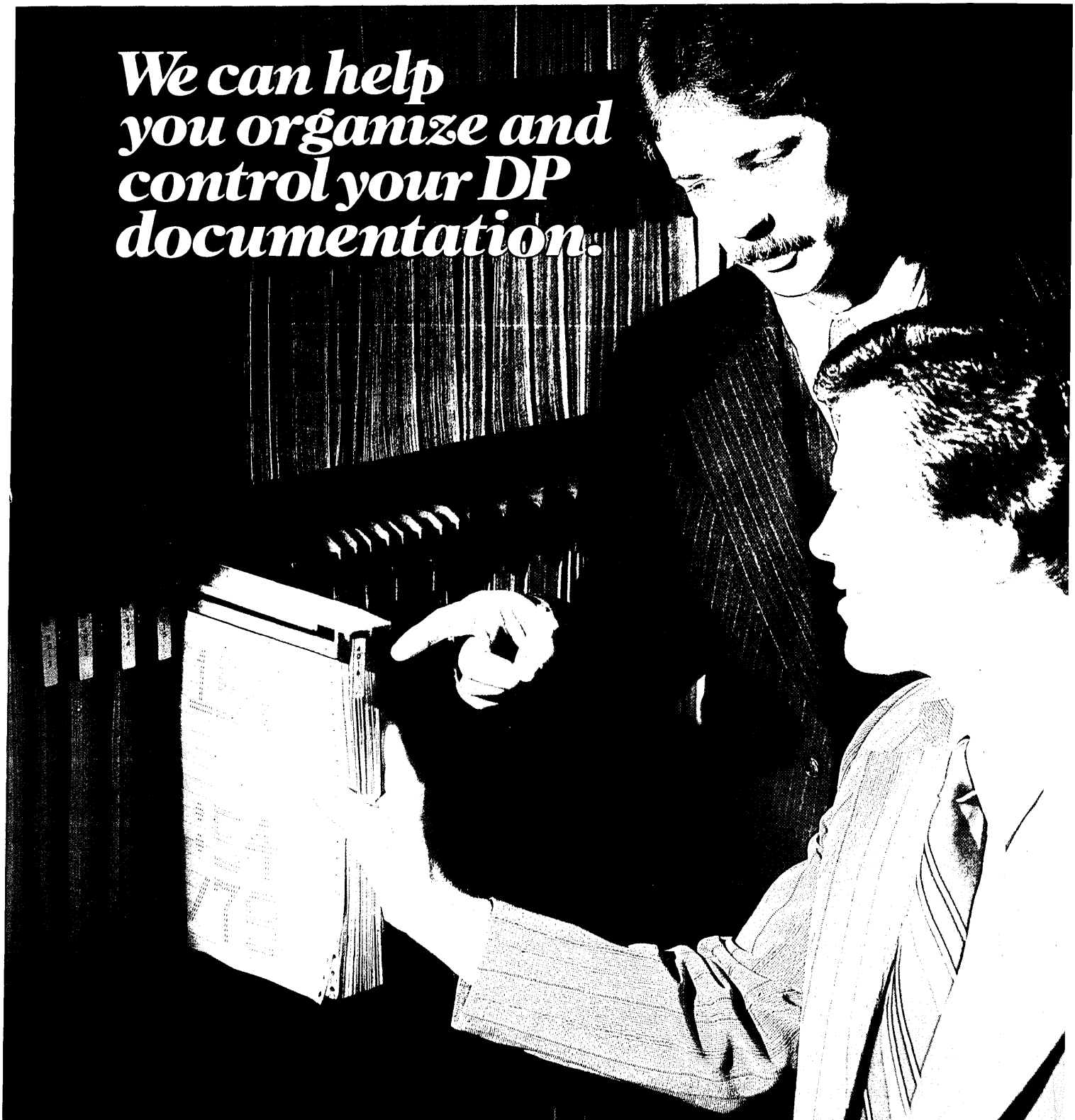

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ran on the 4300s in their native mode.

The study, however, notes that the batch throughput of the 4300s, measured in terms of job duration time (wall clock time) rather than processor time (supervisor and problem states), "is very much less impressive than the raw cpu power." In processing commercial work, the cpu time of the 4341 was found to be 22 to 34 times that of the 115-0, while in elapsed time the advantage was cut to 6.8 to 10.7. Interestingly, however, in FORTRAN execution the 4341 had an advantage over the 115-0 of 32.4 in cpu timing and of 28 in elapsed times; the discrepancy here is nonexistent.

A comparison of batch performance was also made using OS/VS1 Release 6 (but Release 7 on the 4341). Here it was found that the 4341 is 3.2 times as powerful as the 138 and 1.6 times as powerful as the 148 on the basis of cpu timings. But on the basis of elapsed times, the 4341 was 1.6 to 1.7 times as powerful as the 138 and only 1.1 times as powerful as the 148.

The study also notes that the 4300s' performance improvements over the 370s stem from the use of new hardware, new operating system versions, and from new architecture (ECPS:VSE). And IBM, in its performance study, tried to isolate the contributions made by each by juggling these factors. In separate sets of runs, they matched old hardware/old operating system/no ECPS:VSE *against* new hardware/old operating system/no ECPS:VSE *against* new hardware/new operating system/no ECPS:VSE *against* new hardware/new operating system/with ECPS:VSE. Among the results, elaborated in the study, were reductions in both processor busy time and elapsed time to run a job with the use of ECPS:VSE.

—Edward K. Yasaki

COMPANIES

PERTEC MERGER COMPLETE

Triumph Adler says the acquisition of PCC will round out its dp activities.

It took only five minutes for Pertec Computer Corp. shareholders to approve the merger of PCC with a U.S. subsidiary of Triumph Werke Nurnberg AG of West Germany.

Only a handful of shareholders were present at Pertec's Los Angeles headquarters for the Jan. 30 meeting which climaxed negotiations begun last October and formalized an agreement signed Oct. 21. But 6,702, 757 shares were represented and that was all it took since Triumph had already acquired some 98% of outstanding stock by meeting time.

"It's the conclusion of an era and the beginning of a new one," said Ryal R. Poppa, PCC chairman, president, and chief executive officer. He said the company is now a wholly owned subsidiary of Triumph Adler Inc., the U.S. subsidiary of the West German firm.

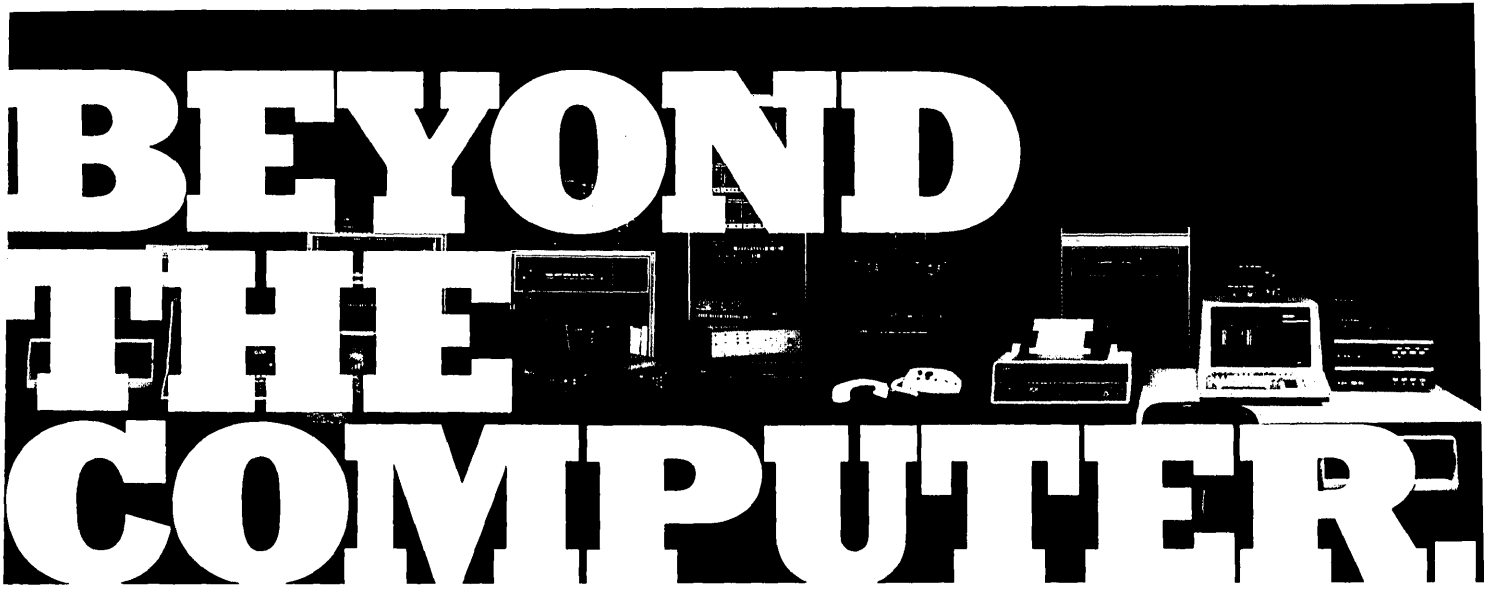
The January vote converted the remaining outstanding PCC shares into a right to receive $16.50 per share. The shares ceased to be voting stock of PCC.

Poppa admitted to one traumatic reaction to the merger. It was the delisting of Pertec stock. "I was so used to checking my paper every morning to see how the stock was doing. The first day it wasn't there I felt as if they'd hit my baby."

Poppa was elected president and chief executive officer of Pertec in April 1973, during troubled times for the company. He was brought in to stabilize the company, and he did.

The top job at Pertec was Poppa's fourth top executive job in three years. The others were president of Greyhound Computer, president of Data Processing, Finan-

BEYOND THE COMPUTER



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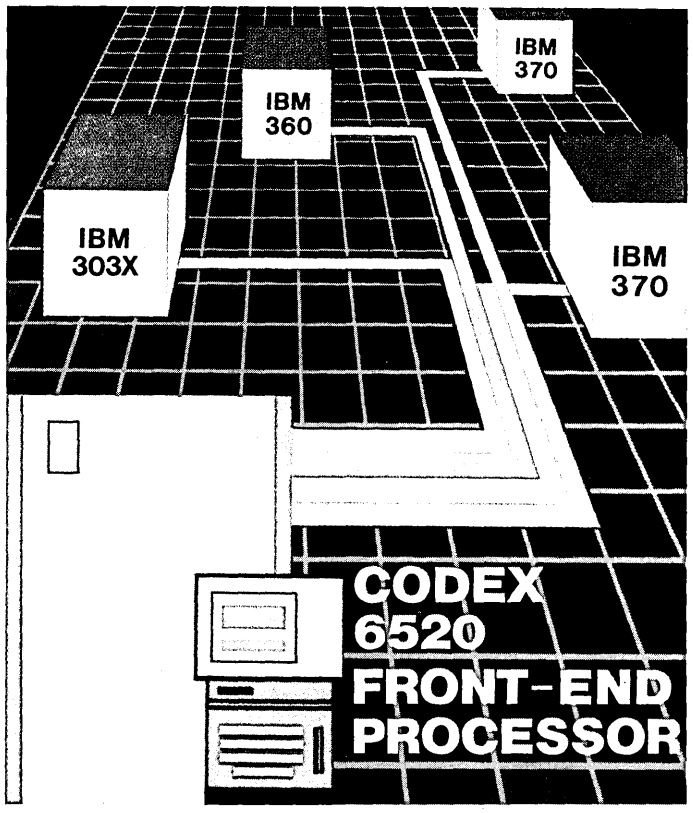

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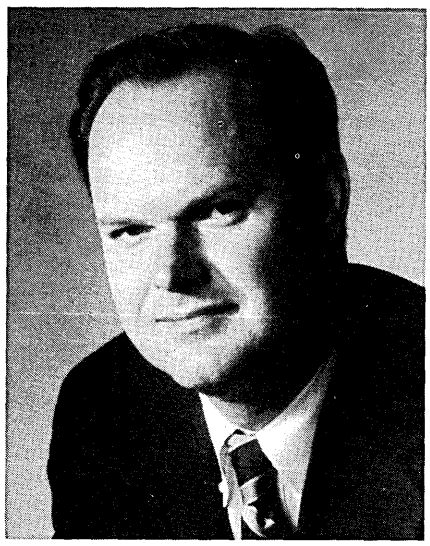


RYAL R. POPPA says the merger of Pertec with Triumph Adler represents "the conclusion of an era and the beginning of a new one" for PCC.

cial and General (now DPF), and vice president of Mohawk Data Sciences.

There was much speculation following the acquisition announcement that Poppa might move on to seek new challenges, but he seems to have found them where he is. He's excited about the prospects for Pertec opened up by the acquisition. The German firm is partially owned by Volkswagen and, said Poppa, "Volkswagen has lots of money, some $4 billion."

Volkswagen owns 54% of Triumph Adler. Diehl Data Systems of West Germany owns 26%, and 19% is owned by Litton Industries. The balance is held by other shareholders.

Triumph Adler had annual sales of $611 million in fiscal 1978. Pertec's sales for the same period were $150 million. Triumph Werke, the parent, had net profits in 1978 of $7.91 million.

Cooperation between Pertec and Triumph-Adler is not new. In 1978 the German firm signed an oem and manufacturing license agreement to build and market two of Pertec's distributed processing systems, the CL 30 and XL 40, designated by Triumph Adler in Europe as the TA 1530 and TA 1540.

A Triumph Adler spokesman said at the time the acquisition proposal was announced that Volkswagen had charged the West German firm with the job of rounding out its data processing activities. He said the Pertec acquisition was the first step in this direction.

Poppa said looking at future acquisition candidates would be part of his job with Triumph Adler. "We've had a good track record with acquisitions except for MITS, which is still in the red." Pertec acquired MITS, Inc. of Albuquerque, N.Mex., in May 1977. MITS produced the Altair line of personal computers and small business systems. Pertec has done well with the small business systems, but not with the hobbyist line.

The plan for Triumph Adler, Poppa said, is to achieve through acquisition the ability to provide a complete line of office automation equipment in five years.

Pertec designs, manufacturers, markets and services digital magnetic tape transports, rigid disk drives, flexible disk drives, controllers, and small computer systems.

Triumph Adler markets business computers, word processing equipment, copy machines, typewriters and calculators. But, said Poppa, it manufactures only the typewriters. The other lines are acquired on an oem basis from the outside. So producers of these lines would be likely acquisition candidates.

Poppa said he has picked up enough German during the merger negotiations to "hold my own at a business meeting." But he doesn't feel this is enough. "After all, there's a social side to business." He's going to take a four week "immersion" course in the language. "I'll live with a German family, ski with Germans on weekends, and speak nothing but German." Poppa said he has recommended the immersion route to two of his top executives. For all other employees, Pertec is making available either taped Berlitz courses or payment for courses at UCLA or the University of California at Irvine.

The announcement of Pertec's agreement with Triumph Adler was a sudden one. Last August the California firm had agreed in principle with North American Philips for an acquisition by the Dutch firm of approximately 45% of PCC common stock.

"Triumph had sounded us out early in the year," Poppa said, "but they didn't follow through. On a Friday in October they came in with a firm offer. We [Pertec directors] negotiated the deal over a weekend and announced it on Monday."

Poppa said he preferred the total takeover offered by Triumph Adler to the partial acquisition proposed by Philips.

He said he preferred the total takeover offered by Triumph Adler to the partial acquisition proposed by Philips. "I offered Philips the chance to make a similar offer but they didn't want to."

Poppa said there were no hard feelings on Philips' part because of the Triumph deal. He doesn't see that the falling off of Pertec's negotiations with Phillips blocks the Dutch firm's reentry into the U.S. business computer market. "There are lots of other firms they could buy into." Philips late last year sold off much of its Business Systems operation to Pertec for an undisclosed sum.

"I enjoyed the negotiations with Philips," Poppa said. "I'm Dutch, and even though I can't speak the language they seemed to enjoy having a Dutchman around."

He said the agreement signed with Triumph Adler provides for no changes being made in Pertec's organization for three years. "But there always are changes as a result of a merger. I feel any changes here will be slow and long range."

For the immediate future, headquarters for Triumph Adler Inc. will be with PCCs corporate offices in Los Angeles. However, other Triumph Adler subsidiaries, Royal Business Machines and Adler-Royal Business Machines, will retain their executive, administrative, and marketing headquarters in Hartford, Conn., and Union, N.J. respectively.

And Poppa is hoping there will be another goodie for Pertec employees coming out of the merger—good deals on Volkswagens. "In Europe, employees can buy them at cost."

—Edith Myers

UNIVAC'S BIG PUSH IN MINIS

No longer does Univac treat its minicomputer operation as an adjunct to its mainframe business.

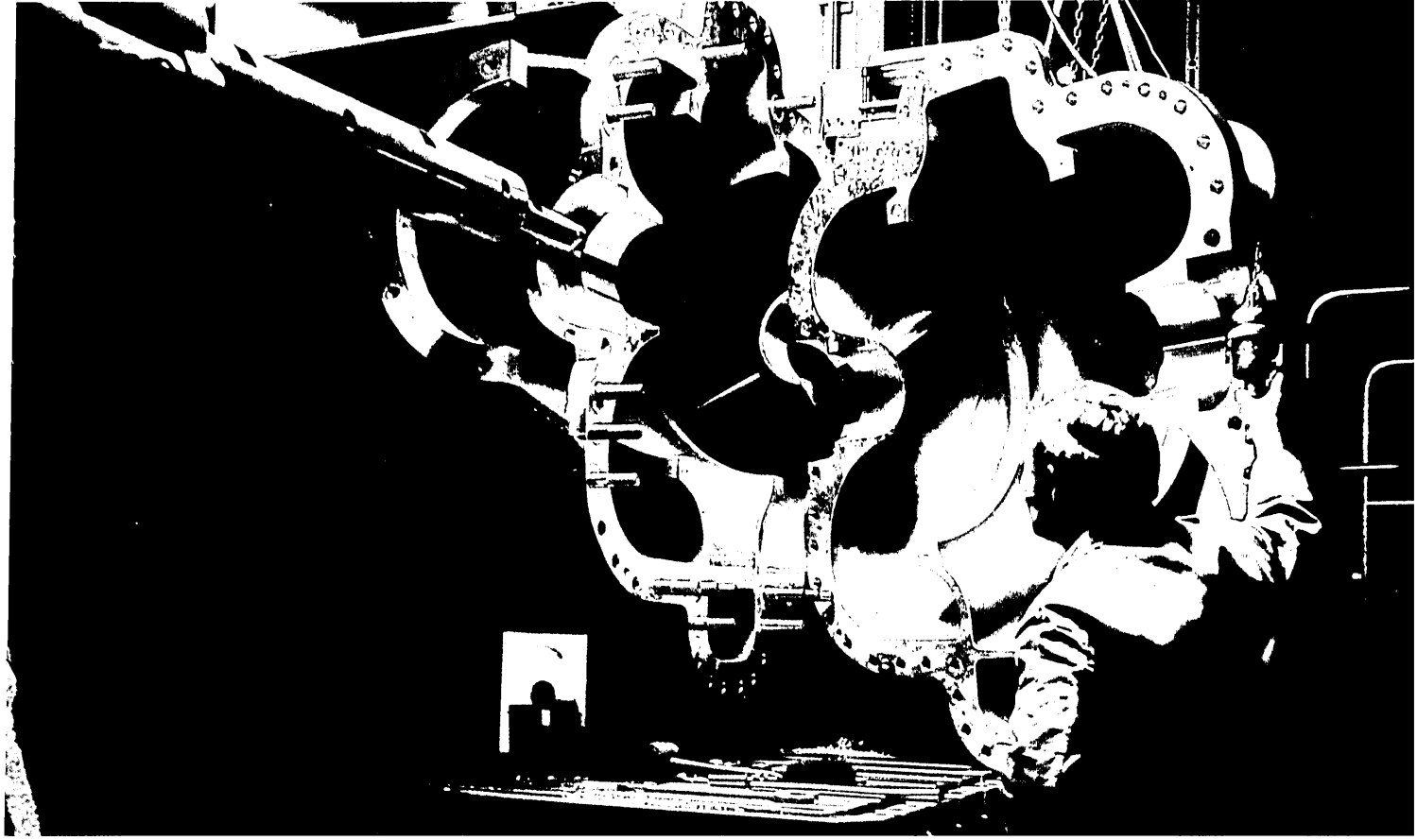
Sperry Univac has shifted into high gear in the minicomputer market.

The third ranked mainframe computer manufacturer has been keeping a low profile in minis since it acquired troubled Varian Data Machines in 1977. "That was deliberate," said William C. Grover, vice president, Mini-Computer Operations. "Now we want the world to know we're dedicated to the minicomputer marketplace."

Grover took over the Irvine, Calif., based minicomputer operation last spring, following 12 years of mainframe marketing with Univac. He replaced Jerome J. Meyer, an 18-year Univac veteran who took over the operation shortly after the acquisition.

Meyer resigned to take an executive position with Honeywell. His resignation and those of others have been attributed to discontent because of a perceived treatment of the minicomputer operation as an adjunct to Univac's mainframe business.

In the beginning, Grover conceded,



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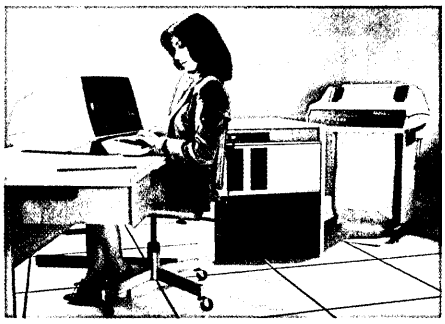

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it was natural and easiest to sell minis to established Univac mainframe customers who wanted to get into distributed data processing. "We're still doing that but we're also launching an aggressive attack on the traditional minicomputer markets."

Univac's mainframe sales force of some 950 is selling minicomputers to the firm's established companies for ddp operations. The minicomputer operations marketing force, 100 strong at the beginning of this year, is going to push as hard if not harder to get new business from oems and end users who are not current Univac customers.

Univac has poured more than $30 million into Mini-Computer Operations since it was acquired in 1977 from Varian.

"We expect to increase our marketing staff by four to five times in the next year," said Grover. Heading up this staff is Ronald N. Murray, a former marketeer for Microdata Corp. who joined Univac last summer after a stint as an independent consultant.

Univac's minicomputer sales were $50 million in the fiscal year ended March 31, 1979 and are expected to reach $100 million at the close of the current fiscal year. Murray projects sales of "close to half a billion in the 1984 time frame." He has a goal of 70% oem business in the same time period. The operation's business was 30% oem when Univac bought it. By mid-February it was 55% oem.

In January the operation's marketing staff was reorganized into 13 districts (up from six) and four regions. And they're going after vertical markets.

They've established what they call a software network. "We work with our oems in software through licensing agreements," Grover explained. "We're the middle person. We support them with marketing."

Grover said he expected to have 12 vertical packages on the network by March 31. "We identified 30." He said they have a municipal package "installed in a number of cities and we have 10 to 15 quotes out right now."

Murray said they have a package for the moving and storage industry, claimed to be the only one in existence, which contains an algorithm to handle Interstate Commerce Commission route selection and tariff calculations.

"The network program has had a very positive acceptance," said Grover. The oems set their own prices. "The packages are theirs. We're not competing with our oems."

Murray said oem customers like the fact that they can offer complete systems and service. "We insist that their [the oems'] customers sign maintenance contracts direct with Sperry Rand." The company has 10,000 customer engineers worldwide. "We have a special status with the field organization," said Murray. "Our stuff is new and they all want to fix it."

Murray sees the traditional systems integrators as "a dying breed. They're there but they're going to go away. The growing part of the systems house market is among those that want and demand total systems."

Although the Univac minicomputer operation was experiencing lead time problems in 1978, it appears to have them solved. "We can deliver in 90 to 120 days, depending upon size and configuration," said Grover. "We're not banging our heads against growth limit as some of the others are and we won't be for quite a few years."

Univac acquired 1,000 manufacturing, marketing, and administrative personnel when it acquired the Varian unit. "We now have 1,600 in manufacturing alone," said Grover. "We're geared up to build equipment." The company had 12,799 systems installed as of the first of this year and currently is shipping 175 units per month.

Univac has poured more than $30 million into Mini-Computer Operations since it was acquired. The old Varian facility was virtually gutted and rebuilt from the inside. Some $6 million in new production equipment has been installed and the operation now fills three and one-half buildings instead of one and soon will occupy a fourth.

Murray's staff even approaches large organizations such as banks as if they were oems. "We sell them computers and communications gear and our systems have total interface with Univac and IBM mainframes at the same time."

"We're not banging our heads against growth limit as some of the others [minicomputer companies] are."

He said terminals of theirs used by the First National Bank of Chicago have received approval from the Society for Worldwide Interbank Financial Telecommunicatons (SWIFT), the international message switching system, and will be sold in the U.S. for use with Automated Clearing House (ACH) systems. "So far," said Murray, "those sales are controlled from Europe."

Murray believes "we're at the right place at the right time and will be for at least the next three to four years."

—Edith Myers

CORRECTION

In last month's story titled "Spiffy Office at AMOCO" (February, p. 68), we inadvertently listed AMOCO's parent as Standard Oil of N.J. AMOCO is actually owned by Standard Oil of Indiana. We apologize for the error.

LITIGATION

ANTITRUST THRUST CHANGING

While the Justice trial team was once committed to a structural breakup of IBM, current thinking is that the government may be ready to soften that hard-line antitrust tack.

As the U.S. Attorney General and IBM's new cadre of Washinton lawyers/diplomats meet to discuss "procedural" details in preliminary settlement negotiations—a process of courteous sparring among fellow statesmen, no doubt, and one far different from the acrimonious bickering that has marked relations between the two antitrust trial teams in New York—persistent reports, although little more than rumors, hint at a shift in the focus of emerging negotiations.

Many informed observers of the case take these indications quite seriously. In big antitrust cases, the law becomes nearly as political as the New Hampshire primary, and rumor has a serious role in politics.

Pro-settlement sentiment is reportedly very strong in Congress and among the upper tiers of the Administration (and the rebirth of the cold war will only fuel it). And the IBM directors—many closely identified with the Carter team—have made it clear that they too would like to get out of the courts—preferably vindicated, but perhaps acceptably unvanquished.

Within the industry, at least among the professional and semipro "commentators," there seems to be a rising consensus —perhaps as a result of the de facto restraint the case has placed on IBM this past decade —that the structure and trends of the computer industry have changed so that the core trial issue, IBM's general purpose mainframe dominance, is ever less important relative to the emerging computer/communications markets.

So, while the Justice Department and IBM remain overtly committed to their very different interpretations of the law and industry history, there appear to be powerful tides pushing them toward compromise. Attorney General Benjamin Civiletti reported last month that while the settlement talks remain "procedural," they nevertheless have taken on a more positive, hopeful tone.

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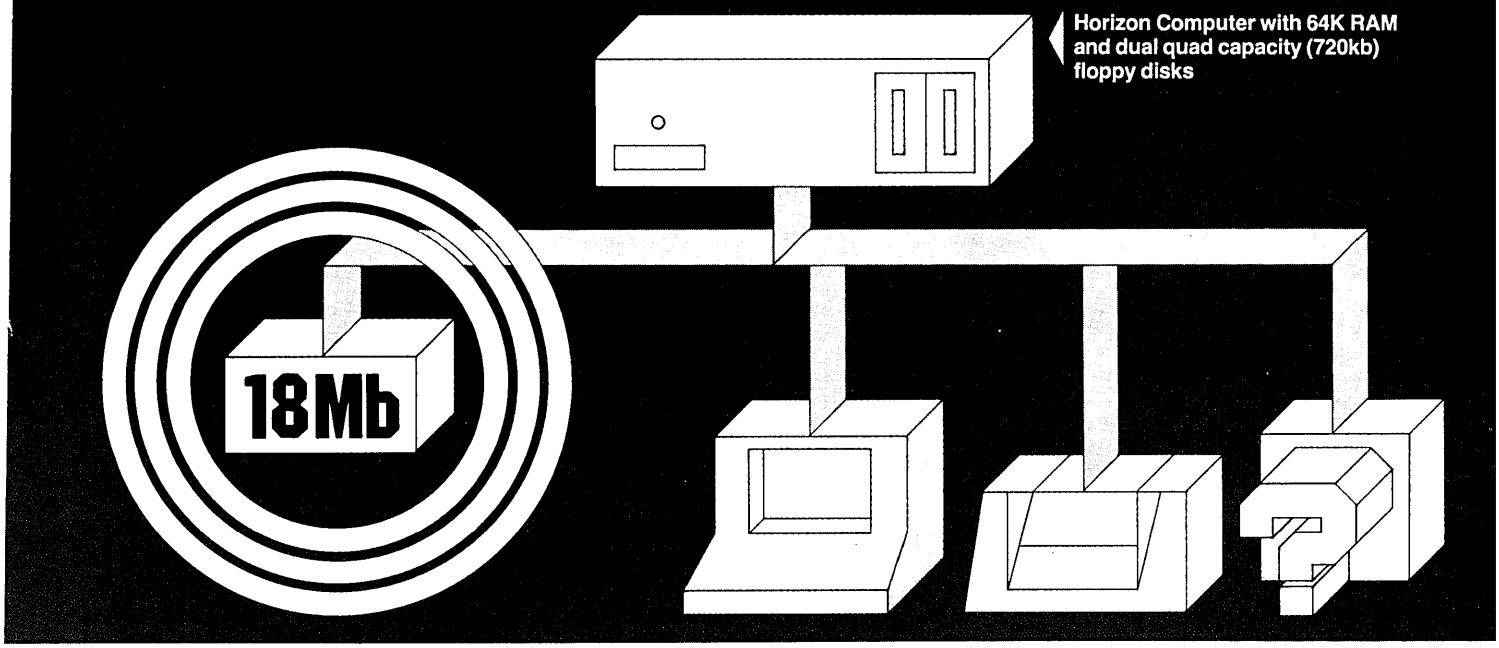

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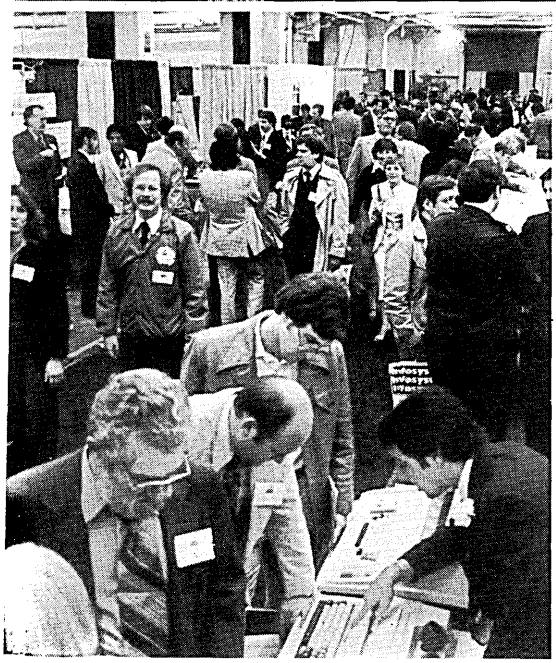


FRANK T. CARY: The taking of his deposition would have allowed inquiry into IBM future plans, IBM attorneys claimed.

Civiletti himself may be a major factor in the new mood. Former AG Griffin Bell, Civiletti's predecessor and former superior, retired with a parting blast at the case, suggesting that there was "something wrong" with the court system that allowed such a monster to evolve, and urging Congress to step in. Bell's early association with IBM had forced him to isolate himself from the case; Civiletti had no such problem.

Last year, prior to Civiletti's confirmation and subsequent involvement in the case, the Justice Department's Relief Task Force—comprised of Justice officials and technical consultants—had spent several months developing a new draft relief proposal. Although they had discussed the possibility of nonstructural injunctive relief —setting up "rules" that would constrain IBM by decree—the task force draft proposal that resulted was a very hard-line, tentative game plan for dismembering IBM as envisioned in the original 1972 Justice relief proposal.

"The draft report was never accepted, never even finalized," explained one Justice source. When Civiletti came in and the discussions with IBM began, the Justice focus seemed to move quickly beyond the hard-line "structural" approach.

Another measure of the policy shift at Justice can perhaps be found in the increasingly bitter private comments of government consultants long associated with the hard-line antitrust positions. "There's this great desire to settle it within Justice," griped one influential government expert, "and there is such a feeling in Washington that IBM is the greatest thing that ever happened, there may be a complete back-off by the government." There have been, he said, "a lot of changes" at Justice.

Others associated with the government case say that is an overstatement. Another government consultant explains that the key Justice strategists for the IBM case, in particular economist Alan McAdams, have for several years harbored doubts that IBM could be effectively tamed through divestiture. Although McAdams guided the Task Force in its attempt to develop a breakup plan, he has reportedly conceded in private that the IBM software "lock-in"—the users' enormous investment in IBM compatibility—effectively defines a captive market for one or several IBMs, all of which would share this almost exclusive base.

McAdams, other observers note, has always been "future oriented," always more concerned with IBM dominance of the evolving new markets. In 1976, the Federal Communications Commission granted Satellite Business Systems a license for the domestic satellite market only after shrugging off personal door-to-door lobbying by trustbuster McAdams, who warned of IBM's vertical integration from the sky down.

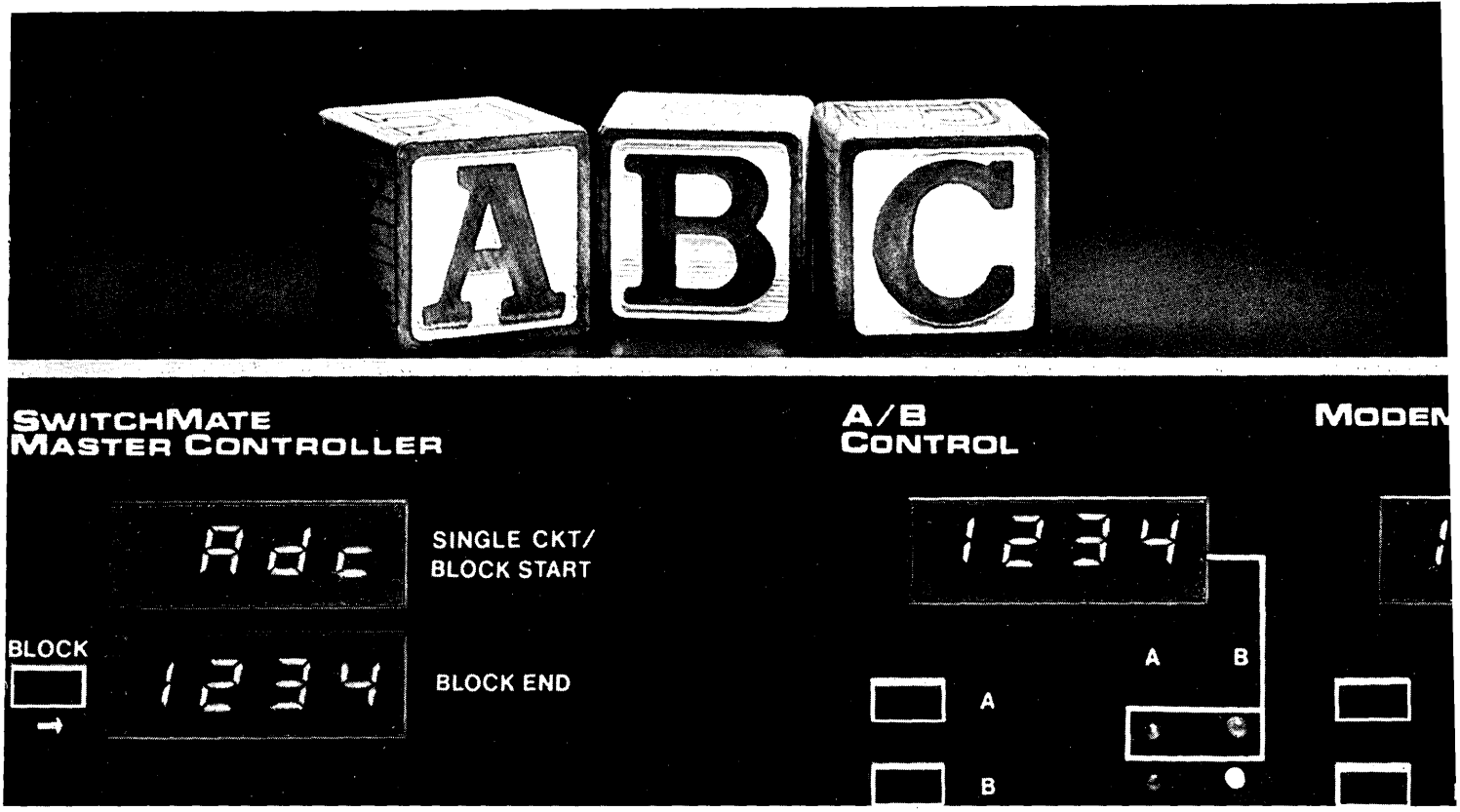
According to some government sources, even before the Civiletti discussions, McAdams and Justice trial attorney Robert Staal were working to develop a new relief proposal that would focus upon restricting IBM dominance in newly developing markets, particularly in communications and integrated office systems.

Key Justice strategists for the IBM case have for several years harbored doubts that IBM could effectively be tamed through divestiture.

Today in Washington, because injunctions of that sort would obviously be among options explored by Justice officials seeking compromise positions, such talk is common. Government sources claim, however, that this kind of relief consideration was the real issue behind the bitter courtroom and media fight whereby IBM sought to block a government motion to take IBM chairman Frank Cary's deposition, which would have allowed inquiry into IBM future plans. IBM screamed that preparing for such a government fishing expedition would require gathering 5 billion documents, would take 62,000 man-years of effort, and would cost $1 billion.

The government's subsequent outfront request for IBM planning documents to prepare a relief case has likewise been met by an IBM protest, this one claiming that such an inquiry would require gathering 350 million document pages from 100 different countries.

Meanwhile, from Wall Street sources and others closely identified with



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CIRCLE 54 ON READER CARD

IBM, there has been a flood of recent reports that IBM might be willing to consider a compromise whereby it would be reorganized into something like a holding company with various separate arms-length subsidiaries, an approach presently being pushed in Congress for restructuring Ma Bell. (Legislative proposals in the House and Senate which suggest a similar reorganization of AT&T are publicly supported by IBM.)

Citing McAdams' "futurist' approach and the "compromise" rumors out of IBM, one prominent antitrust attorney suggested that "IBM's strategy in these [Washington] negotiations must be to try to get as much of a future grant or hunting license as they can. They would probably give up an awful lot in terms of restraints on past and obsolete practices if they could get what they want for the future. And who knows, perhaps put in terms of what they can't do, IBM could get a pretty good grant of what it could do.

"I don't believe IBM is going to give anything away," he warned. "Whatever it appears to be giving away, it is more than recouping in some other part of the negotiations."

While the Washington discussions evolve, of course, the courtroom circus in New York continues. Until IBM sought to have Judge David N. Edelstein removed as the presiding trial judge for "personal bias and prejudice" against IBM, it was widely assumed that the trial itself would finally end this summer. The IBM attack on Edelstein is considered brilliant by many, since it devalues whatever political and moral weight a judgment against it could have, maintaining its presumption of innocence even into a prolonged appeal.

Barring either an out-of-court settlement or a new judge, a District Court ruling could not be expected before 1982, even if the trial itself comes to a close by year end. And regardless of the outcome, the judge's decision would be appealed up to the Supreme Court, adding at least a year, and probably two, before final settlement—say, 1984, a vintage year for the rhetoric of whoever loses. If IBM's attempt to get Edelstein removed is successful, however, bringing a new judge on board could extend the case considerably—a factor of some weight in the pressures for a negotiated settlement.

It's seldom noted these days that Judge Edelstein was actually IBM's choice as the trial judge.

It's seldom noted these days that Judge Edelstein—a veteran of the New York court whose eccentricities and acerbic manner were well known to the legal fraternity—was actually IBM's choice as the trial judge. Back in May of 1972, IBM counsel Thomas Barr publicly suggested that if the IBM case was to have a single judge assigned to it, then Judge Edelstein was the best choice because he had handled the 1950 antitrust case and had some familiarity with the industry. Barr went on to note that the 1956 Consent Decree—which forbade IBM from cross-locking customers by dominating both the tabulating machine and punch-card industries—and then the new case against IBM were "interrelated in a number of ways," as they focused on the same evolving industry.

As the Civiletti negotiations firm up, many observers expect IBM to seek a settlement which—like the '56 Decree—focuses on a frozen moment in the emerging technology, a moment in the past, and tries to spell out rules for polite and open competition. In 1956, the court decreed competitive status for the card tabulating market—but IBM's business was already in computers and software. With IBM's current business already shifting beyond machines and software into hybrid communication/computation channels, IBM would predictably seek a consent decree (if there has to be one) which sets forth the rules for open competition in the general purpose mainframe market of the 1960s. In a more sophisticated

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industry, with a more knowing Justice Department, there will be more of a contest. But the raw balance of power (political and legal) will ultimately define this past/future focus in any eventual settlement.

While acknowledging the political pressures in the arena, Justice Department sources caution against the "too-common pessimism" about the government's prospects for actually winning the courtroom case. Despite its long chain of recent victories in the private antitrust cases, IBM is not unscarred in the courts, noted one Justice official, citing the Control Data case so expensively settled by IBM. And, more important, noted another Justice attorney,

No substantive movement toward settlement is likely until a decision is made on IBM's request that Judge Edelstein be removed from the case.

the various private antitrust cases actually have little legal bearing on the current Justice Department case since the issues and jurisdictional powers are different.

In any event, no substantive movement toward settlement is likely until a decision is made on IBM's request that Judge Edelstein be removed from the case. If IBM manages to get Edelstein evicted from the bench, the resulting extension of the case could give the company strong, perhaps irresistable, leverage to negotiate a settlement with little sacrifice beyond some concessions on anticompetitive practices or perhaps the most painless restructuring.

It's curious to note that the new postures allegedly taken by both the Justice Department and IBM are actually role reversals of a sort. In October 1972, when the government presented the court with its preliminary memorandum on relief, the then Justice attorneys argued that divestiture was the "normal, natural, and appropriate form of relief in monopolization cases" and explicitly denounced solely injunctive relief which would bar the monopolist from parallel markets.

"On occasion, [injunctions] have been overly regulatory, inhibiting rather than preserving or restoring competition in the long run," wrote the Justice lawyers almost eight years ago, and decrees which bar "entry into specific business have adversely affected competition in the prohibited markets."

Given "futurist" goals among the current Justice IBM team, an optimal settlement for them just might be those once-scorned regulatory, market-forbidding injunctions.

—Vin McLellan

FEDS FIRE THIRD ROUND

In its third statement of contentions and proofs, the Justice Department makes it clear it intends to nab Ma Bell with the antitrust laws.

After five years, two judges, and several forests' worth of paper, the Justice Department's antitrust suit looks as if it's on its way to trial. If both sides follow the schedule established by U.S. District Judge Harold Greene, their attorneys will begin arguing where it counts on Sept. 1.

Following Justice's Jan. 10 filing of its third statement of contentions and proofs, both parties were reasonably optimistic about achieving the scheduled trial date. The government's two-volume, 2,006-page epic details the regulatory history of Ma Bell's performance as well as specific events and practices that Justice will use to support its claims of antitrust violations. In the 92-page historical submission, the federal trustbusters counter AT&T's long-standing defense that its organization, practices and structure have evolved under the specific direction of federal and state regulators.

AT&T was originally given 30 days to reply; then, in a motion unopposed by Justice, Bell was granted an extension to March 10—an extension welcomed even by the government, which suffered a setback when lead attorney Kenneth Anderson bailed out last month. The current schedule calls for discovery to be completed by April 1. The opponents will then share the summertime blues preparing for trial.

"The trial date is light at the end of the tunnel," says a Justice lawyer close to the case. "It's pretty clear the judge is committed to proceeding on schedule, which is fine with us. Greene's conduct has been tremendous. Instead of running from it, he's taken control of the case and said let's get it done. Their [AT&T's] interest in that is completely different, of course. They'd like it to go on as long as possible."

Au contraire, pleads a Bell spokesman. "We have made it plain that we're not dragging. Delay doesn't serve us because we're convinced there's no merit to Justice's case. Technology has changed rapidly and marketplace competition is now a fact of life."

Justice is not the only party that would take issue with the latter statement; so would the 48 companies that are currently engaged in private litigation against Ma Bell. One of those plaintiffs, Northeastern

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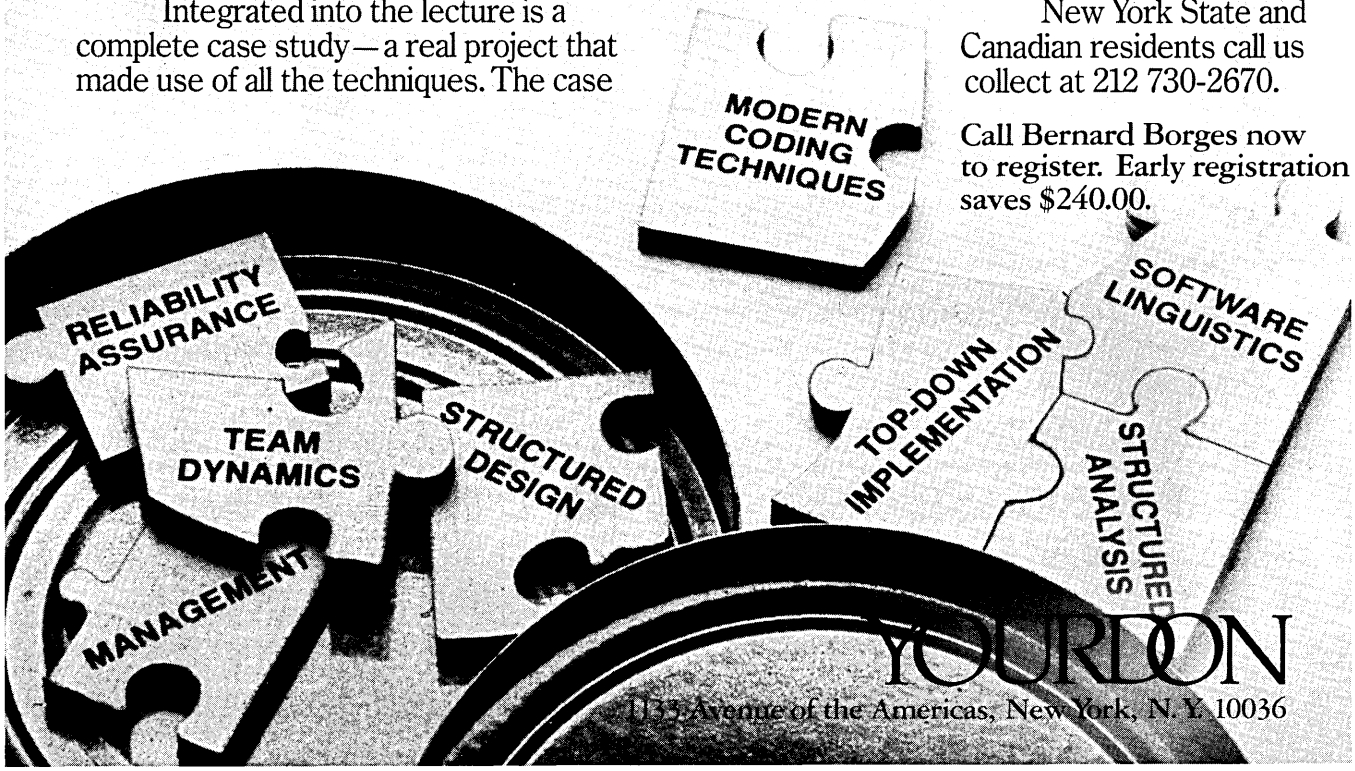

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CIRCLE 58 ON READER CARD

NEWS IN PERSPECTIVE

Telephone Co., in January was awarded over $16.5 million in damages after a U.S. District Court jury found AT&T, Western Electric, and Southern New England Telephone Co. guilty on six monopoly charges of blocking competitive sales of interconnect telephone equipment in violation of federal antitrust laws.

AT&T filed two motions that are pending to set aside the verdict—one for lack of evidence, the other based on regulatory jurisdiction. If District Judge Warren Eginton denies those motions, Bell is sure to appeal the liability and damage findings.

Nonetheless, the cheering has barely subsided. A number of sources in Washington consider the Northeastern case highly significant. Besides giving Justice an added boost of confidence, they contend, the case lends credence to complaints by AT&T competitors that Ma Bell does not play fair. If the government's case were decided on the prevailing mood in Washington, AT&T would be forced to plead no contest.

"There's a lot of anti-Bell sentiment around town," one industry source claims. "People want to see Bell zapped for the sake of getting zapped. I don't think this [Northeastern] case will hurt their chances."

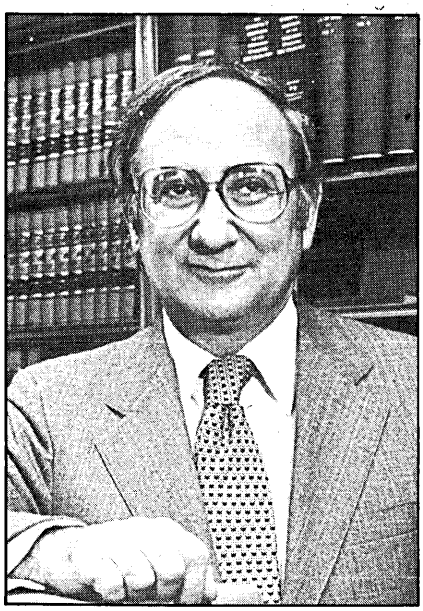
Also commenting on the Northeastern victory, a Justice attorney remarks, "This is a tremendously significant case because it's the first time a private litigant has survived the procedural bull that AT&T always throws up."

"It's tremendously important," adds Phillip Nyborg of the Computer & Communications Industry Association (CCIA), "because it was decided by a jury. To the extent antitrust laws are used to protect competition, this case makes it much easier for the financial community to invest in a potentially viable competitor."

When Northeastern Telephone was awarded $16.5 million in its private antitrust suit against AT&T, it was a shot in the arm for Justice and the more than 40 other companies suing Bell.

Justice contends that such roadblocks to competition will cease to exist if it prevails in the federal case. Its recent statement (on which 30 paralegals and attorneys worked so short a time that one Justice source said "would be a public scandal if revealed") leaves no doubt that the government wants Bell nailed to the wall.

"Only relief that eliminates the existing inherent, structural incentive and ability of AT&T to monopolize telecommunications services and equipment will be effective to restore competition in these markets," Justice asserts in its filing. If it proves its claims, the government will ask



JUDGE HAROLD GREENE: He's committed to keeping the case on schedule.

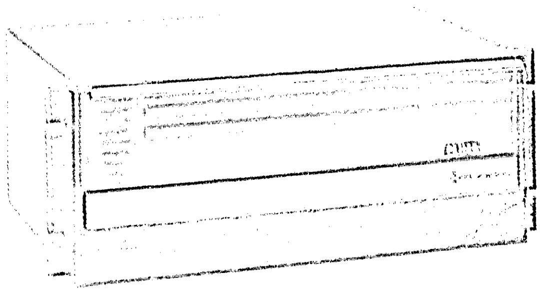
for the following structural relief: "Separation of AT&T's ownership of intercity facilities and separation of the current providers of telecommunications services from the manufacturer of telecommunications equipment and its allied research and development facilities." In short, the proposed breakup of AT&T would require the spin-off of Western Electric and Bell Labs.

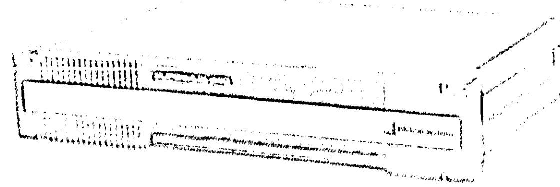
But some wonder if what the federal trustbusters are trying to get is what the industry necessarily needs. "It's not clear to me that simple divestiture of Western Electric would accomplish much," says an AT&T competitor's attorney. "I think Bell ought to be required to offer its equipment and services through a sensible structure, which is more than one subsidiary. I don't see that divesting Western Electric helps—it fixes a problem where there is none."

This source adds: "The whole relief is half-baked. Antitrust lawyers tend to automatically think of divestiture in monopoly cases. It's not the right solution to this problem, but I have no feeling that anybody in Justice agrees with me. My guess is that it will probably go to trial."

Just getting to trial is no great accomplishment, asserts Terry Mahn, a communications attorney with the Washington law firm of Wewer & Mahn. "Justice will never, never, ever get done with this case," Mahn argues. "It can't handle a big structural case, and this one involves too many sophisticated technical and economic factors which the antitrust laws are too archaic and vague to govern. AT&T has been browbeating the small interconnects forever."

But there is one possible bright spot, Mahn adds. "These private cases may soften AT&T's posture so that, despite their say-





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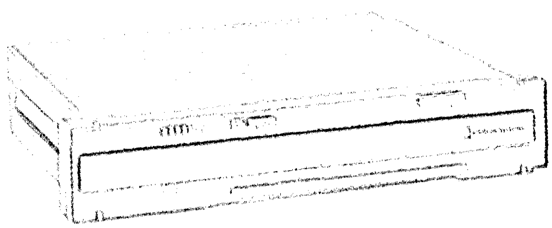

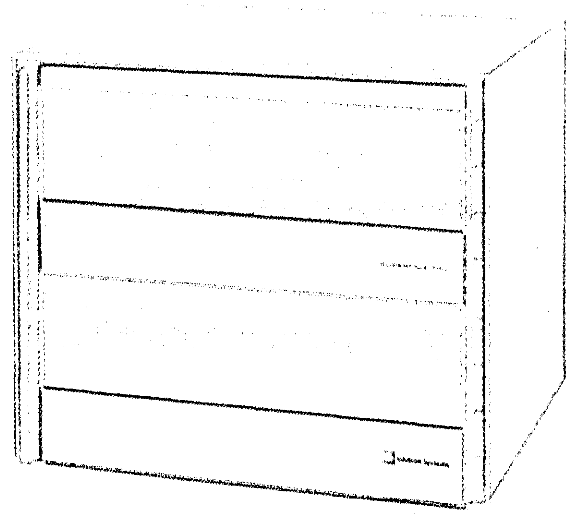

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CIRCLE 60 ON READER CARD

ing they'll never compromise, they just might. Besides, what Justice wants can be accomplished more easily by regulatory action or legislation."

And that just might be what will happen. On the legislative front, however, a number of industry factions—and perhaps the Justice Department too—find fault with that approach as well.

The House communications subcommittee last month voted 13 to 1 to send to the full Commerce Committee a bill that purports to increase competition in the telecommunications industry. But some portions of that proposal, essentially a rewrite of the 1934 Communications Act, appear to be stepping on the toes of the federal trustbusters.

The bill removes the 1956 Consent Decree barrier to AT&T's entering unregulated dp and communications markets and provides partial restructuring of the Bell System. AT&T would then be free to offer new data and voice transmission services through a separate arms-length subsidiary that operates outside the regulatory umbrella. In addition, Ma Bell could manufacture and sell telephone receivers and switchboards, interexchange telephone services, dp and other joint computer/communications services on a deregulated basis.

The proposed legislation has some heavy backing. The Carter Administration has given the bill momentum, and AT&T, through vice chairman James Olson, says the bill "moves us in a direction we can live with." Others, however, would rather stick to the status quo than risk the uncertainties of a new and questionable environment.

"I see several possible effects [from the bill], all adverse," says Herb Jasper of the Ad Hoc Committee for Competitive Telecommunications (ACCT). "The bill essentially ratifies the vertically integrated structure of the Bell System and gives it a monopoly presumption in the long distance field. It's analogous to pardoning a convicted felon while he's on trial for a repeat offense. It has to fail."

"Antitrust lawyers tend to automatically think of divestiture in monopoly cases. It's not the right solution to this problem."

To help it do so, ACCT, Congress Watch, and Consumers Union, along with other trade groups and some telecommunications firms, have made their negative views clear to subcommittee chairman Lionel Van Deerlin (D-CA). The bill, wrote Sharon Nelson of Consumers Union, could be "read as congressional sanctification of the present vertical integration of the Bell System and thus as precluding the divestiture remedy Justice seeks in the current litigation."

But the House subcommittee feels it has covered that possibility. One clause specifically states that it is not Congress' intent for the bill to alter ongoing litigation. A knowledgeable observer says Justice hopes that stipulation will prevent AT&T from using the legislation to suggest that divestiture remedies fly in the face of congressional intent. But no one knows how Justice views this potential conflict because it has kept a very low profile on the bill.

"I'm not sure Congress realizes what it's doing," an industry insider suggests. "I think it's going farther than it has to."

"What we would like," says a spokesman for MCI, whose private suit against AT&T went to trial last month, "is a fully separated subsidiary into which AT&T would put all long distance operations. We know we can beat them elsewhere."

But can Justice?

"I think the mood in the industry is that the government has a winnable case," a legal observer maintains. But if Justice loses, he adds, that would spell disaster for the slew of private litigants. "And if you think you've seen anything yet in terms of Bell's conduct, just wait."

—Willie Schatz

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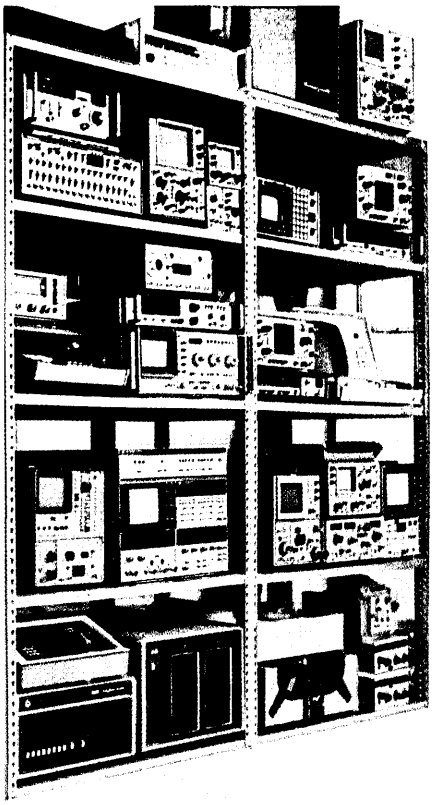

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CIRCLE 62 ON READER CARD

FOR THE COURTS TO DECIDE

"The linchpin of [AT&T's] monopoly of telecommunications service is the monopoly of local telephone exchange franchises controlled by the Bell operating companies. Local telephone exchanges are 'bottlenecks' under classic antitrust theory. The control of these franchises provides AT&T with the incentive and opportunity to protect, maintain, and extend its monopoly in telecommunications services overall."

So begins the Justice Department's charges on AT&T's alleged monopolization of telecommunications services. As for charges of equipment monopolization, the Feds' filing states: "By the simple expedient of having Western Electric manufacture the telecommunications equipment requirements of AT&T and the Bell operating companies, including equipment required to meet new demand as the market for telecommunications services grew, and by preventing, restricting, and inhibiting the Bell operating companies from purchasing telecommunications equipment from suppliers other than WE, defendants have achieved and maintained a monopoly in telecommunications equipment and have foreclosed other manufacturers . . . from selling to the Bell operating companies."

While the government's recent filing makes no new charges against Ma Bell, it includes revised or amplified allegations which the federal trustbusters say are the result of subsequent discovery in the case. But the backbone of all Justice's charges remains unchanged: the Bell System has evolved the way it has over the past 100 years, not, as AT&T has claimed, because of pervasive governmental regulatory policy and actions. Rather, Justice contends, it is the result of ineffective and inadequate federal and state regulation in the face of AT&T's domination of the industry.

Not only has the regulatory process been ineffective in controlling the Bell System, the filing states, it also has inadvertently aided and abetted AT&T in furthering its monopolistic stance. Through repeated and time-consuming filings of opposition petitions with the Federal Communications Commission, AT&T has essentially been able to buy the time it needs "to catch up to consumer demand with competitive service offerings or rate structures."

The filing continues: "In other words, AT&T is able to use the regulatory process together with its existing telecommunications monopoly . . . to prevent or at least delay a competitor from establishing itself in the marketplace until AT&T has finally developed its own competing offering."

Each of Justice's specific charges is backed by examples it says categorically demonstrate AT&T's monopolistic behavior in the terminal, switching, transmission, and service markets. The list of specific victims of such practices runs long, including IBM, General Electric, Northern Telecom, Nippon Electric, GTE, MCI, American Satellite, Southern Pacific, Data Transmission Corp., ITT, Lockheed, RCA, and many, many others.

Once AT&T files its response to Justice's third and final statement of contentions, the parties will then be able to proceed down the last stretch—that of obtaining stipulations—toward trial.

—Becky Barna

LEGISLATION

BELL BILL CRIES RESURFACE

The age-old cry has resurfaced that AT&T stands to gain the most from the bill.

"Controversy seems to be giving away to consensus," said James E. Olson, AT&T vice chairman. He was referring to H.R. 6121, the communications bill recently passed by a 13-to-1 vote in the House communications subcommittee and forwarded to the full Committee on Interstate and For-

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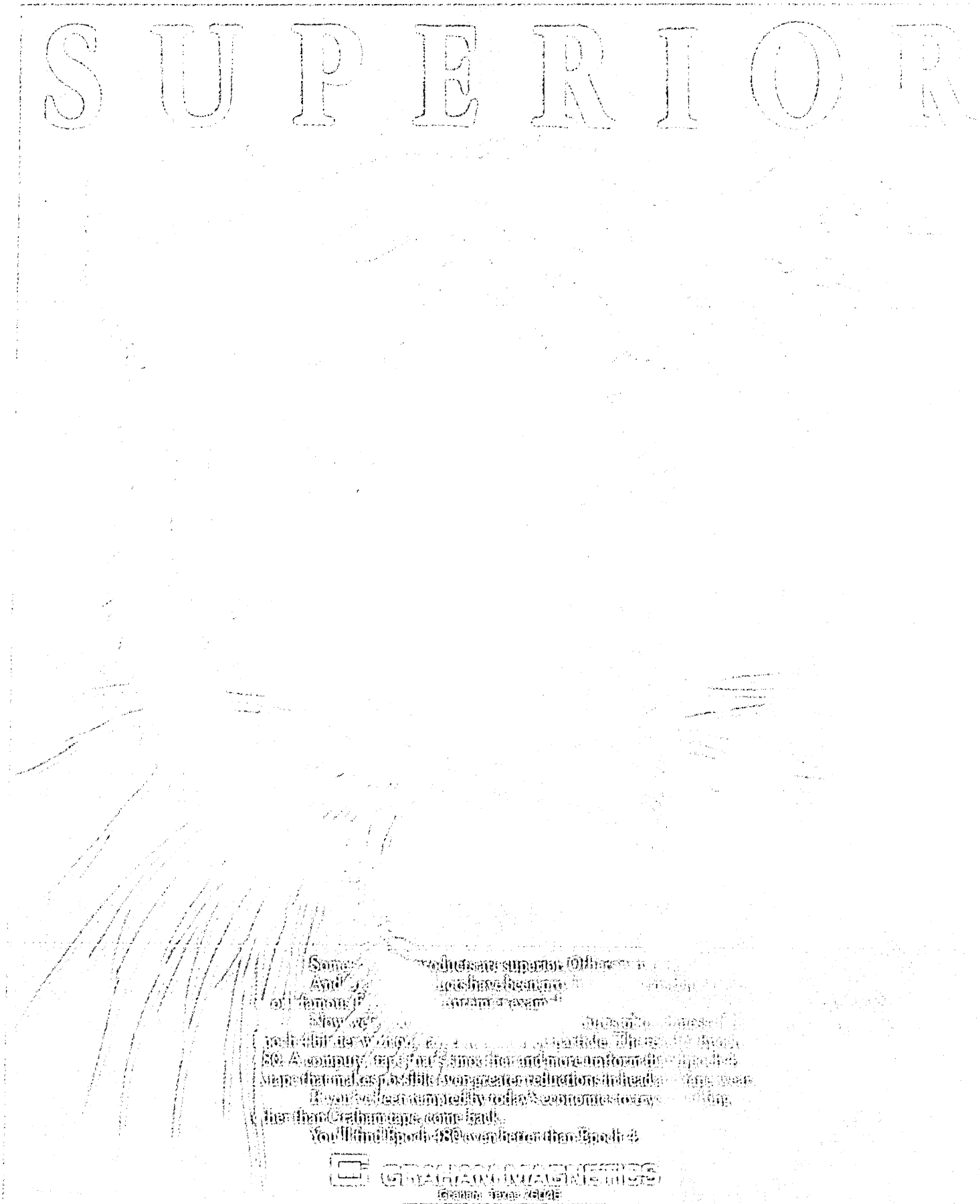
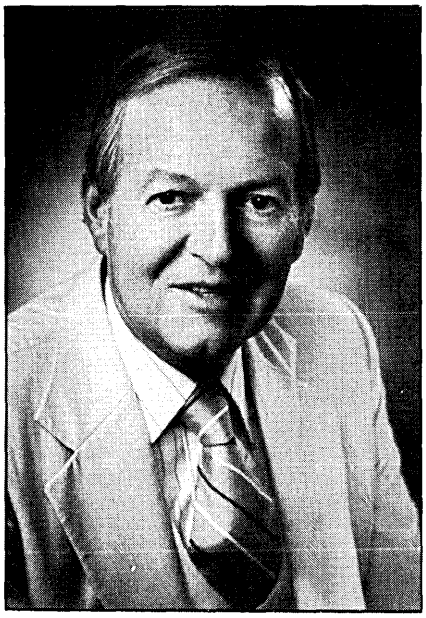


eign Commerce. But the clamor from communications companies competing with Ma Bell indicates that Olson's assessment is far from accurate.

Moreover, Olson's labeling of the legislation as a "consensus" measure has forced the resurrection of the very charge from anti-AT&T factions that Ma Bell had hoped to avoid—that the proposed legislation is a "Bell bill." Olson himself had warned Bell System managers back in December that such a label "could very well be the 'kiss of death' for any legislation."

A number of AT&T detractors are now trying to plant that kiss on the House bill, as was readily apparent in a debate at the recent Communication Networks '80 conference in Washington. William McGowan, chairman of MCI Communications, told conference attendees that one of his reservations about the bill is the fact that AT&T says it needs the legislation. "That makes me shudder," he said.

The House bill requires AT&T to set up an arms-length subsidiary to compete in unregulated parts of the business. But MCI's McGowan complained that the subsidiary provisions in the bill are too lax in that they allow AT&T to make its own judgments about the subsidiary's operations and accounting practices. To think that Ma Bell will make judgments that are in the public interest, McGowan charged, "flies in the face of the realities of this industry." The 48 private antitrust suits presently pending against AT&T attest to that fact, he said.



REP. LIONEL VAN DEERLIN: "Before the 96th Congress hangs it up, we will have a common carrier law that America can live with."

Also blasting the bill's "inadequate safeguards" to prevent cross-subsidies and predatory pricing by the Bell System, Herb Jasper, chairman of the Ad Hoc Committee for Competitive Telecommunications (ACCT), said the similar Senate bill, being prepared under the direction of communications subcommittee chairman Ernest F. Hollings (D-S.C.), is preferable to the House measure for two reasons: S. 611 calls for the separation of AT&T's exchange and interexchange services, and the deregulation of Bell's competitive services would not be "self-executed."

"Some thought we could remain silent on antitrust; that was not possible."

Also participating in the conference debate was Rep. Lionel Van Deerlin (D-Calif.), chairman of the House communications subcommittee and the man who spearheaded the bill in question. Speaking only one day before his subcommittee sent the bill to the parent committee, Van Deerlin said the proposal "preserves the best of the present system—basic telephone service at reasonable rates—while correcting what's wrong with the system." Some of the "corrective" measures Van Deerlin pointed out included abolishing the present "Byzantine" separations and settlements process,

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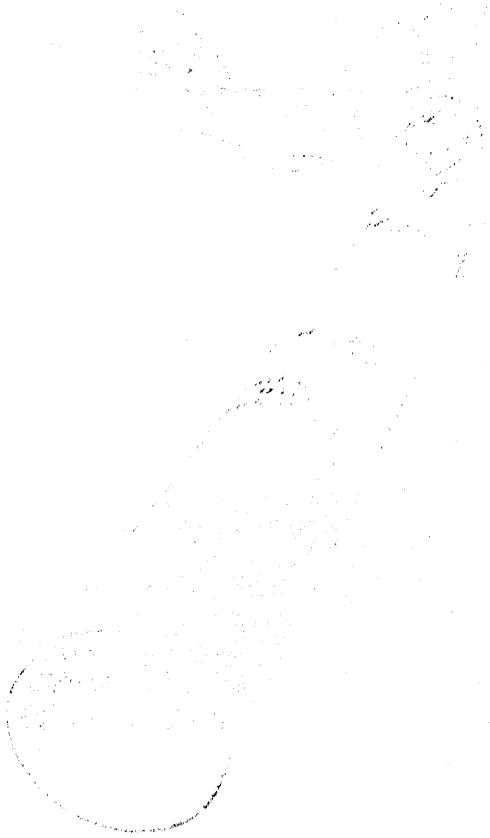

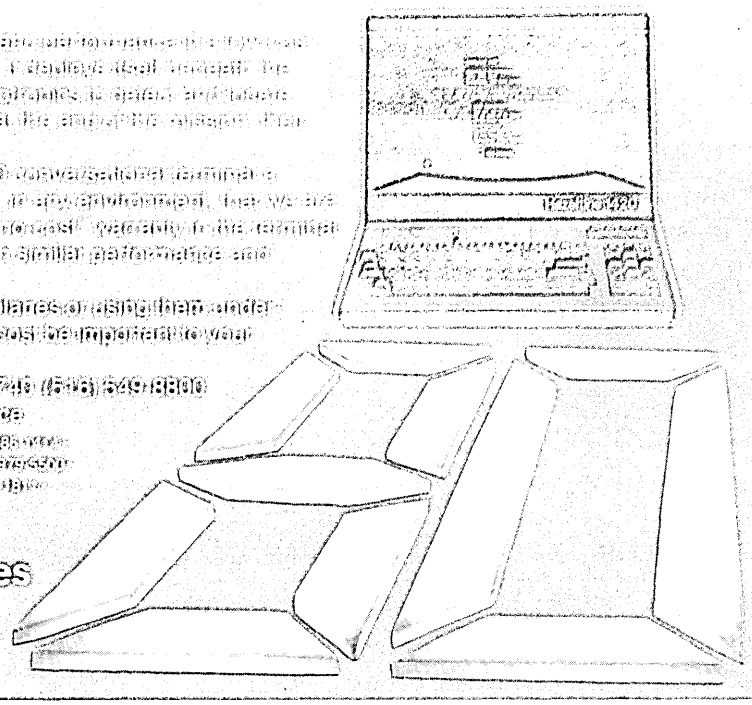

Answers for the eighties

CIRCLE 600 ON READER CARD

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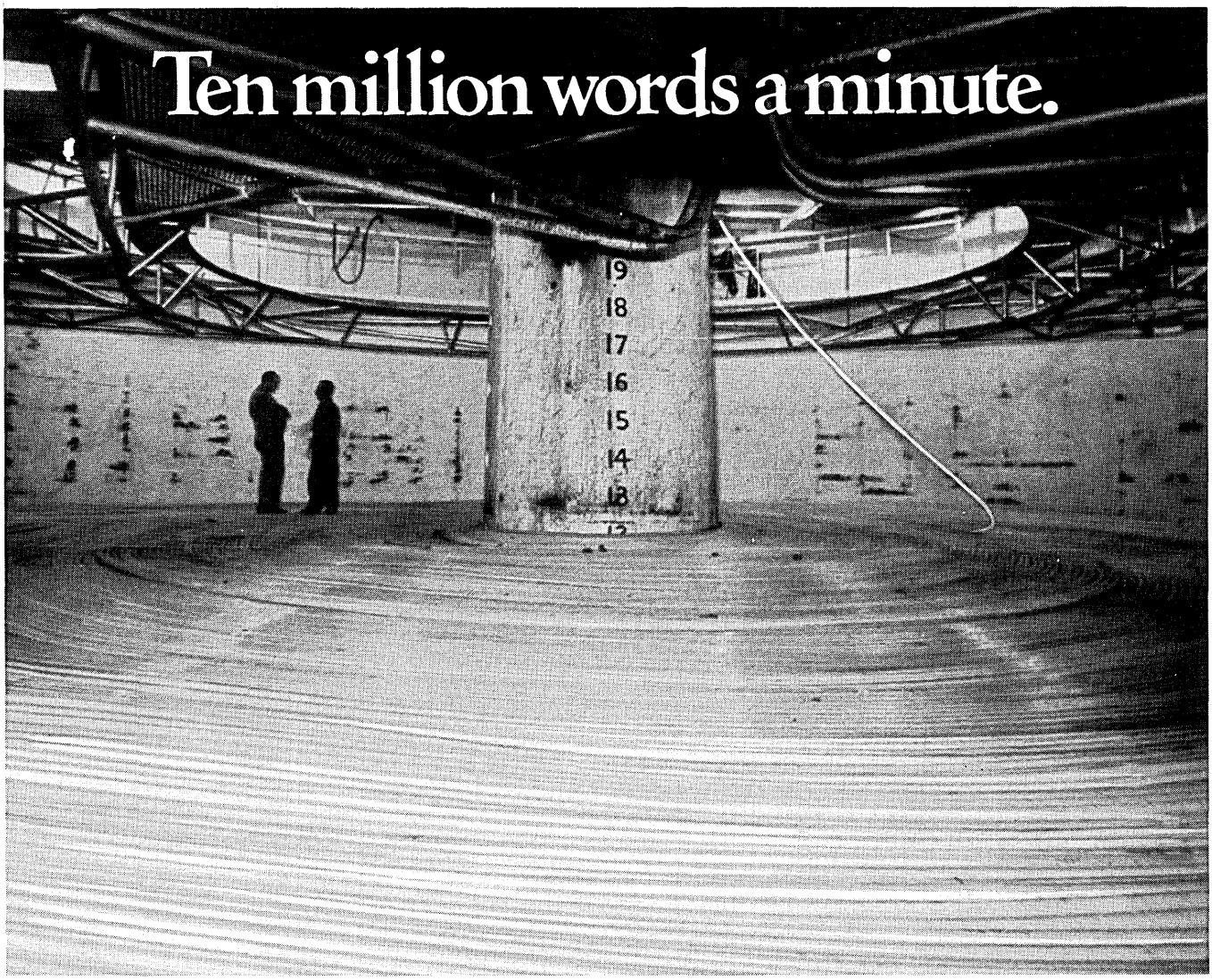

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CIRCLE 67 ON READER CARD

"that black art known only to AT&T"; establishment of an orderly transition process for AT&T to set up a separate subsidiary to compete in unregulated markets; and broad authority for the Federal Communications Commission to ensure that AT&T's regulated entity does not subsidize its competitive entity.

"Some thought we could remain silent on antitrust," the California Congressman said, referring to the bill's removal of restrictions placed on AT&T's entry into deregulated markets as set up by the 1956 Consent Decree. "That was not possible," he said, quickly adding that nothing in the bill "impinges on pending antitrust actions."

Van Deerlin said he was confident the House Commerce Committee would forward a bill to the Senate by mid-March, adding that he did not expect the House bill to be approved by the Senate without a contest and some compromise. "But before the 96th Congress hangs it up," he predicted, "we will have a common carrier law that America can live with."

—Becky Barna

THE PCMS

A WELL-PROTECTED PCM

With a good tactical game plan, says IPL Systems, there's actually little IBM can do to hurt the PCMs.

No plug-compatible mainframe manufacturer emerged from 1979 unscathed; the E-train, the Itel debacle, and fear of the H-bomb cut deep into sales and gutted the earnings of everyone. Yet in any triage among the victims (many of whom are showing astonishing recuperative powers), little IPL Systems in Waltham, Mass.—mainframe supplier for Control Data, the late-lamented Itel, and now Olivetti Computers in Europe—would have to be counted among the hale and hearty.

For those who market PCM machines, the business is something like war. But IPL prefers to be further from the front lines and closer to the bank.

IPL, explains company president Stephen Ippolito, was originally planned as simply a development company, a designers' haven for integrated circuit mavens such as he, and it was largely due to a spate of bad luck that IPL got into the manufacturing business at all. Yet each year since 1977, IPL Systems has introduced a new machine with higher price/performance, delivering 130-odd machines (largely under Control Data's Omega label), collecting cash for each, and never selling to an end user.

IPL, said Ippolito, has now been profitable for 10 straight quarters, has paid off a multimillion dollar loan from Control Data, and has cleared over a million dollars on sales of $12 million-plus even amid the market shambles of 1979. It's a private company, although 40% is owned by Cambridge Memories, which shared the expense

and supported IPL's design effort and was to be the manufacturer before it went through financial reorganization in 1976. Ippolito, rejecting numerous courtship offers, insists that IPL will continue to comfortably finance its growth out of cash flow. In 1977, when the books began showing black ink, sales were a little less than $5 million; 1978 sales jumped to over $10 million; and 1980, said Ippolito, will show "substantially higher revenues and higher profits."

"The important thing is building a good, steady business," explained the engineer-turned-manager, "so you don't have to worry about making a good buck this year, and next year writing it all down to zero. I'm patient. I don't have a bunch of investors breathing down my neck telling me to get the sales up, get the profits up. I'm not a public company. I don't look at the *Wall Street Journal* every day and worry about the stock going up a fourth or down an eighth or something like that. This company is being planned for strength and stability over the long haul.

"Especially in the PC business, if you're constantly running after the quick buck, that can make you more vulnerable to whatever actions IBM takes. If things look good for a minute and you immediately leverage yourself and overexpand, all of a sudden there is a change! Particularly in this business, I think it's important to be financially conservative. If you get overlever-

Olivetti evaluated most American and Japanese alternatives before signing with IPL, which it describes as "the price/performance leader in that market sector."

aged, you're vulnerable—and you may go down the tubes a year later."

Ippolito's IPL was born amid Cambridge Memories' struggle to survive IBM's crunch on the plug-compatible memory vendors. IPL's product introduction was delayed a costly year, said Ippolito. The lesson in caution was taken to heart by the infant corporation. Caution has led IPL to channel its wares solely through big oems. The technical prowess of Ippolito and his staff has brought them CDC—the first independent mainframer to market PCM equipment—and now Olivetti, the first large European company to begin direct marketing of PCMs in Europe.

In 1977 and 1978, IPL sold its 480 series Model 1 against the 370/145 and the Model 2 against the 370/148; last spring it introduced its 4300 response, the Model 3, with performance comparable to the 370/158 (which Ippolito helped design at IBM) and exceeding that of the 4341. All, said Ippolito, were based on an original IPL design, and with each model IPL had implemented IBM microcode assists. "We did VM Assist,

STEPHEN IPPOLITO: "This company is being planned for strength and stability over the long haul."

ECPS for VM and ECPS for VS/1, implementing each with our own design, the only company which did so, I think," said Ippolito. IPL has already implemented ECPS for DOS and VSE, to fully "shadow" IBM's 4300 capabilities.

Olivetti, which announced in late January its agreement to market IPL machines in Europe under a nonexclusive contract, said it chose IPL because of the PCM's "ability to remain compatible with IBM despite future architecture change . . .[and] retain a price/performance advantage over IBM."

Olivetti, a $2 billion Italian firm which is one of Europe's largest suppliers of communications and electronic office systems, will sell IPL machines as a complement to large-scale PCMs from Hitachi, and will offer a full range of PCM machines in the European market. Olivetti evaluated most America and Japanese alternatives before signing with IPL, said Ippolito. Olivetti described IPL as "*the* price/performance leader in that market sector."

The Olivetti contract "doubles the PCM market we can address," said Ippolito, but the bulk of IPL business still rests with CDC, which has a nonexclusive contract to sell Omegas in the U.S. and Canada. Prior to IBM's E series announcement a year ago, CDC had an exclusive contract with IPL, but surrendered it in price negotiations that followed the 4300 announcement. Ippolito said he is quite happy with CDC marketing, and has no plans to contract with any other domestic oem. The switch to a nonexclusive contract, he smiled, was simply "opening options, keeping loose."

There is no question that the E series announcement cooled off the PCM market, at least until IBM announced its delivery schedule in June, said Ippolito. "Then it picked up again and is now very strong. Probably most of the companies in this business are production-limited at present. Right now, things look very good for us." Ippolito said he knew what to expect in the technology of the 4300 announcement, but the pricing was about 25% less than he had expected—or, at least, looked that way until IBM's recent price hike.

"What IBM's motivation was, I can't say," he explained ruefully. "But the facts are there: they announced the machine in January, they are just starting to ship any volume to speak of now, and all during that year, IBM's competitors had to effectively compete with a paper machine, a machine that didn't really exist in the market. And just as IBM began shipping in volume, the price went up again.

"IBM has a way of playing a very good tactical game. All the plug-compatible people depend to some extent on the fact that IBM, in order to hurt them, is going to have to hurt themselves. Therefore, there is a limit to how much IBM will hurt the PCMs, because there is a limit to how much hurt IBM can itself withstand. But it seems to me that IBM is always trying to get very close to that limit. And that's just the world we live in. Period."

Yet, to a PCM company that can run lean, that has a solid financial base and proven technological skills, there is really nothing IBM can do, argued Ippolito. Microcode is no defense today; and if financial muscle is available to match IBM's lease terms, IBM has no hardware defense against PCMs.

"The thing you have to remember about IBM," said Ippolito, "is that their hardware costs are very low. Their raw production costs, their raw hardware costs represent a very low percentage of their actual selling price. Suppose their production cost is 15% of selling price, and by some miracle they reduced that down to nothing, they *still* could only reduce their selling price by 15% because of all the other

"The whole key to this industry is that the price umbrella is sort of a natural phenomenon, part of the IBM reality."

stuff they have in there. They're paying their sales force, their service force, their software groups—there are just a lot of people in there!

"The whole key to this industry is that the price umbrella is sort of a natural phenomenon, part of the IBM reality.

"There is always a large percentage of potential customers willing to pay a premium for the IBM name. And there are always some people around who are not willing to pay the premium. And for IBM to cut their price down to the point that the plug-compatible vendors will not be at

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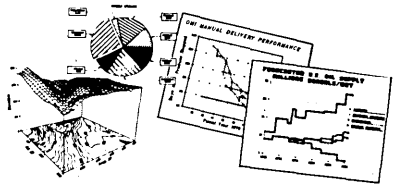

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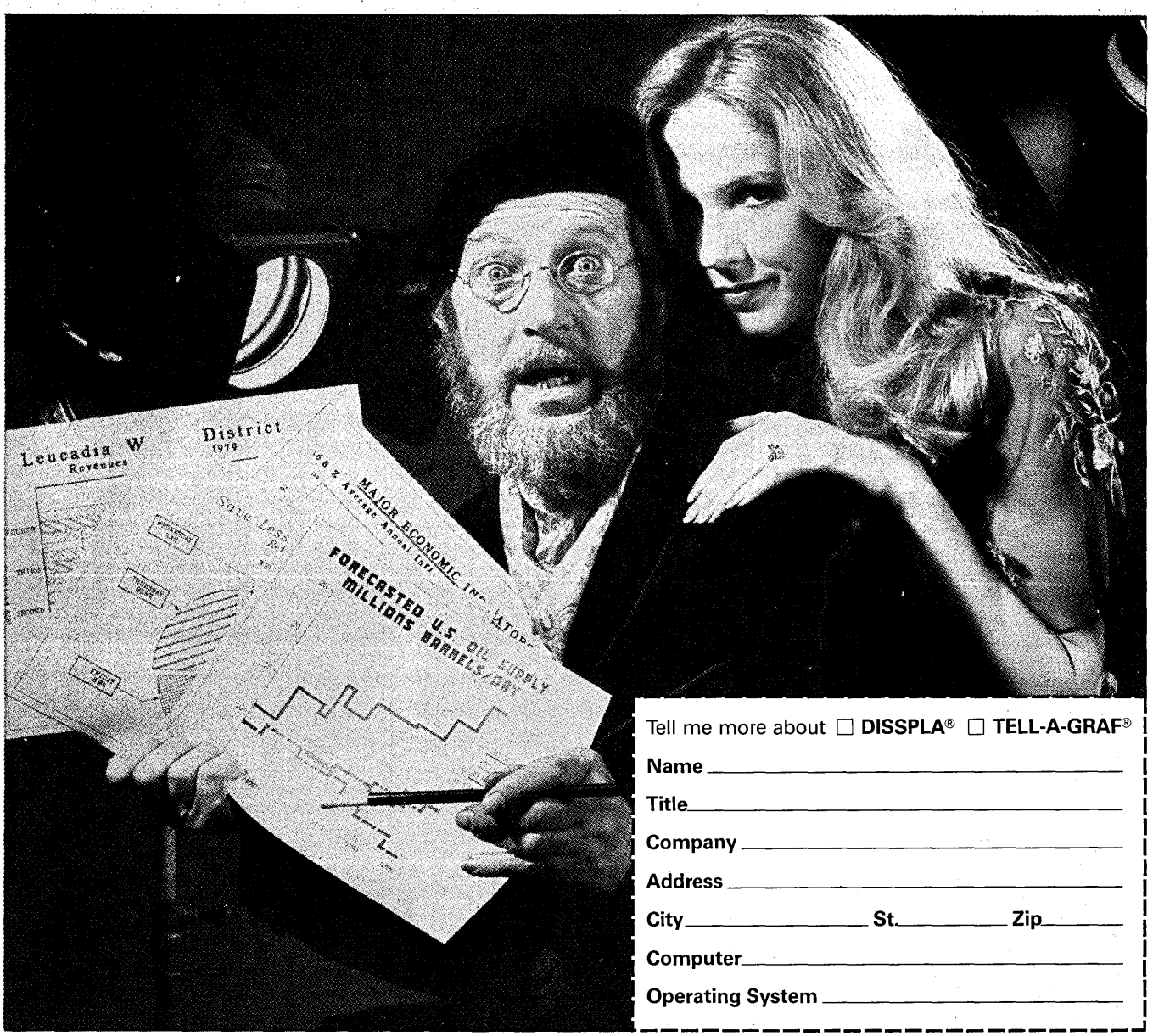

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NEWS IN PERSPECTIVE

some sort of price advantage—to go after the other 10% or 15% that are not willing to pay a premium for the IBM name—they would actually be *losing* money on the other 85% of the market!"

Even aside from all the PC potential in the "windows" that appear in the middle of an IBM product cycle for PCMs using more advanced technology; even now, with the PCMs head-to-head with the new 4300's price/performance, the simple math of the situation protects the PCM market, Ippolito grinned.

"If IBM were to go after the whole market, if they were going to squeeze everybody out, they'd have to leave all that premium money on the table."

—Vin McLellan

TECHNOLOGY

DBMS: MOVING UP IN STATUS

"As we move into the 1980s, the DBMS will be as important as the choice of hardware itself."

In the early 1970s, a data base management system (DBMS) was considered a utility to be used with special applications that required very large files—as in inventory control systems, for example. But as time passed, users of large mainframes discovered the efficiencies and economies that could be achieved with a DBMS. They began adding more applications to the DBMS environment. They put more of their data in the data base and began viewing that data as a valuable corporate asset. This meant the DBMS itself had become increasingly important in the total corporate environment.

The next step will be the so-called data resource management system (DRMS), which will have applications in the automated office.

"As we move into the 1980s, the DBMS will be as important as the choice of hardware itself," says Greg R. Leveille.

In the new decade of the '80s, he adds, data base processing will spread from large mainframe installations down through medium-scale hardware users, and include small business systems as well. By 1983, says the Creative Strategies Intl. researcher, those small systems sites will account for some 52% of all data base management systems installed worldwide. At that time, this

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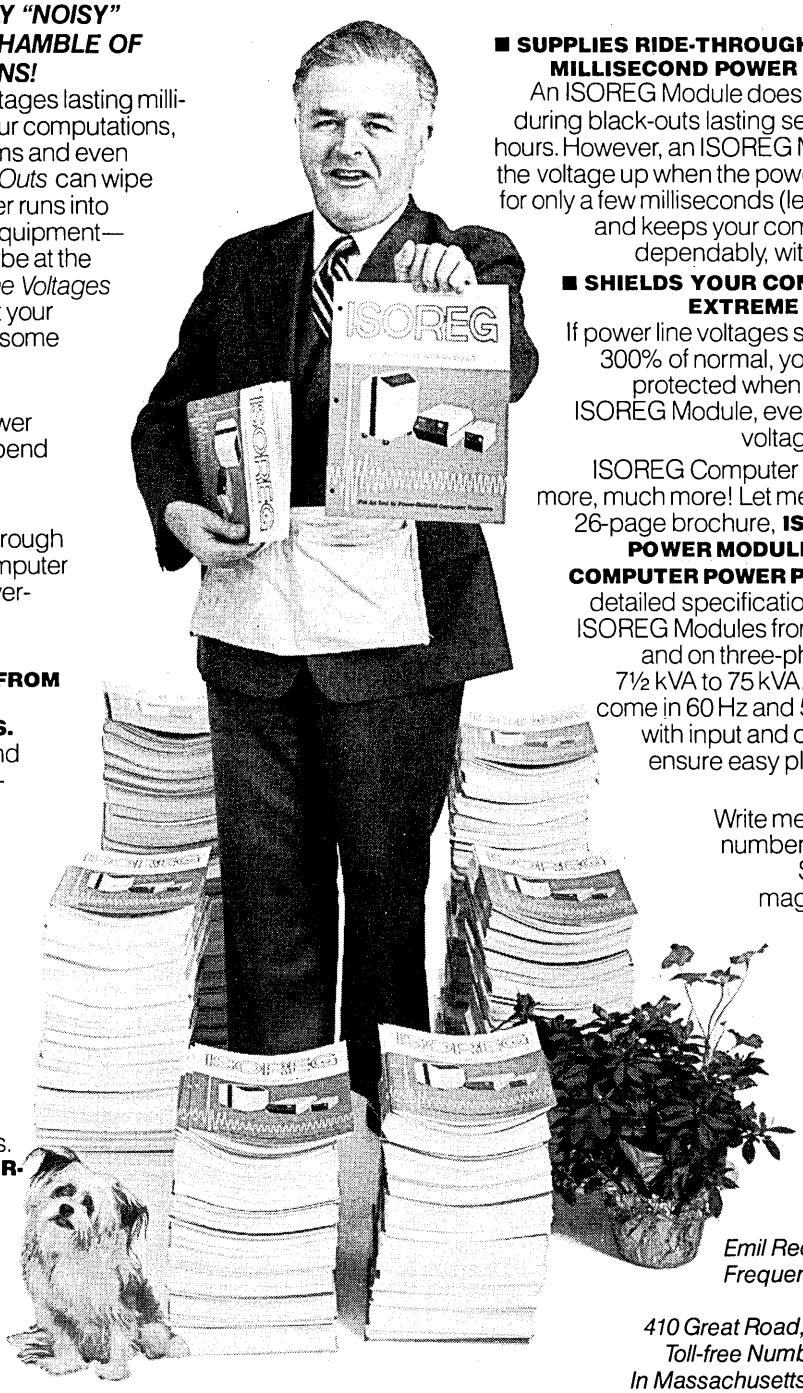

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CIRCLE 73 ON READER CARD

category of systems priced below $100,000 will represent worldwide DBMS revenues of $1.2 billion out of a total market of $4.9 billion. Although very few vendors of small business computers offer a DBMS today, by 1983 they will have to do so in order to remain competitive, says Leveille.

In the same period, he sees the implementation of data base systems increasing also on large machines. They will be used on 55% of all IBM mainframes installed worldwide, he predicts, up from some 38% in 1979. And their implementation on non-IBM mainframes through 1983 will grow at a high 49% compound rate.

As one moves down from large mainframes to the small business systems user, Leveille explains, one sees an increasingly easier job of implementing a DBMS. Not only does the computer system complexity and sophistication drop off, but so does the application complexity and sophistication. And the requirements for data base file capacity decreases.

"It's much easier to plan for and implement a smaller data base management system than it is a very large one," he says. And most smaller users are looking at implementing only one or two applications —perhaps inventory control with data entry from the shipping dock, followed a year or two later by tying in accounts receivable/payable.

Helping this course of events to unfold are vendors like Hewlett-Packard, which provides a DBMS with its small business systems. But there are also oem and systems houses that offer a DBMS with Digital Equipment and Data General hardware. And IBM, introducing lower end, lower priced hardware, is having its sales personnel visit smaller user companies, spreading the good word. "We find the end users are becoming educated as to the advantages of data base management systems," notes Leveille.

The researcher, who just completed a study of the market for DBMS, adds that vendors of systems directed at smaller companies admit that by 1982 or '83 they won't be able to compete effectively without some type of DBMS. By 1983, he says, at least 50% of shipments of computer systems priced between $50,000 and $100,000 will contain a data base system. "Today that percentage is very low."

In talking about an expansion of the market for data base systems, Leveille also explains that there will be an accompanying growth of the types of material stored in a data base. Not restricted to alphanumerics and the applications of that data, the so-called data resource management system (DRMS) wll also manage images in a data base. The DRMS will thus have applications in the automated office, managing files of reports and images and memos, he says.

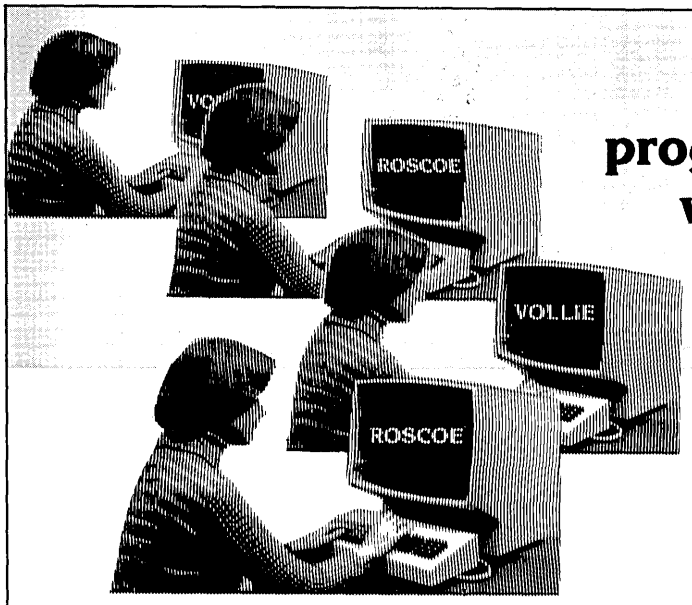
Vendors of systems for small companies admit that by 1982 or '83 they won't be able to compete effectively without some type of DBMS.

He expects vendors with capabilities in data bases and in data communications to concentrate on specific markets. Some will offer office automation products —word processing, text editing, electronic mail, and document storage and retrieval, for example. Others will focus on communication products. He anticipates by 1983 a number of companies will offer wp, dp, and telecom capabilities in one package called a DRMS.

This DRMS will have its own operating system, one that can communicate with the operating system in a host mainframe. This means the OS in the mainframe can be less complex, many of its functions taken over by the DRMS. And if the DRMS also has telecom functions, the job of the OS is even lighter.

Beyond that, he looks for a capability to produce business graphics output readily from data stored in a data base—an integrated DRMS with a graphics output capability.

—Edward K. Yasaki



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CIRCLE 75 ON READER CARD

MARKETING

AN ENTREE TO THE DP BUSINESS

Distributors are taking advantage of volume discounts and offering computer products to customers at the same price as the vendor would.

In May of 1978, Control Data Corp. introduced an intelligent terminal system at the National Computer Conference, but a few months later unexpectedly dropped the product and the following December licensed the manufacturing rights to Astrocom Corp., a small St. Paul, Minn., communications firm that wanted to sell it as a small business computer.

But Astrocom, with about $3 million in sales and rental revenue, said it was hard put to set up a dealer organization and instead planned to look to systems houses and electronics equipment distributors for support. The terminal, which CDC had introduced as the Pegasus, the mythical winged horse, was renamed the Model 760 by Astrocom. Then early in 1979, Astrocom engaged the services of a Kansas City, Mo., systems house called Integrated Micro Systems, and announced in April that it would have 200 systems shipped by the end of 1979.

In October it signed up its first electronic equipment distributor, Kierulff Electronics, a Los Angeles based company, which, with outlets in 15 U.S. cities, is ranked among the top five electronic distributors in the U.S. Although Kierulff didn't order any of the computers at the time, Astrocom said, "quantities of the series 760 computer are to be purchased by Kierulff and shipping dates will be established in the future."

But last month, when Astrocom still hadn't shipped a single system to Kierulff or anyone else and had named only three dealers, including Integrated Micro Systems which had developed its 12 applications packages, the people at Kierulff were wondering whether Astrocom's winged horse really was a white elephant.

"Astrocom no longer is significant in our plans for the computer distribution business," said Jack D'Arcy, the president of Kierulff, which is a subsidiary of Ducommon, Inc., a 131-year-old Los Angeles metals distributor.

Its difficulties with Astrocom, which resulted in a modification of the agreement, hasn't dampened the distributor's enthusiasm for the computer market. Like the other traditional distributors of semiconductors and discrete electronic components, Kierulff envisions "a significant new market opening" for them in the computer and systems business, says D'Arcy. These traditionally have been sold directly by the vendors, by their dealers, and by systems houses who purchased the equipment from the vendors and added value to them with applications software.

Distributors do not, at present, add value to computer products although most of the larger ones perform value added services to electronic components for customers who want some assembly functions added to the components they buy. Instead, the distributors take advantage of discounts from large orders and offer the products to customers at the same price as the vendor would. For instance, D'Arcy said, Kierulff expects to get $1.7 million back on the $1.2 million investment it made last year on computer equipment it bought from some 15 vendors.

Among these vendors were Control Data Corp. (floppy disk drives, floppy media, printers, and add-in memory); Data General (microNova micro products and peripherals); Applied Digital Data Systems (Regent line of terminals); and Minnesota Mining and Manufacturing (disk packs and cartridges). In early February it was completing an arrangement to sell printers manufactured by Dataproducts Corp.

AGREEMENT MODIFIED—Kierulff's Frank Hollibaugh (left) and Astrocom's chairman Sidney Jerson with the Model 760 small business computer. Kierulff will demonstrate it, but not purchase it.

It also stocks microcomputer board products of eight other manufacturers, including American Microsystems, Intersil, Mostek, Motorola, RCA, Texas Instruments, Western Digital, and Zilog. Most of these micro manufacturers have been using electronic distributors for a few years. But for Control Data Corp., Kierulff was its first arrangement with an electronics distributor. It later signed up Arrow Electronics, a distributor based on Long Island, N.Y. Kierulff and Almac/Stroum Electronics were the fifth and sixth distributors to be named by Data General, the Westboro, Mass., minicomputer manufacturer. Data General's William Jobe, who heads distributor activity, said the company's U.S. distributor network now is completed and gives the company an additional 600 salespersons in 55 locations.

Selling computer products is a new world both for the distributor and the computer manufacturer, but one that will offer the distributors pretty sizable returns. Kierulff's Jack D'Arcy said it accounted for about 3% to 4% of the company's 1979 sales volume of $136 million, but next year should rise to around 15% and in five years to at least 50%

One big obstacle lies in convincing the computer manufacturer that the distributor isn't competing with the vendor's local salesmen.

To enter the market, Kierulff last year spent more than the $1.2 million to buy up inventory. It invested $200,000 in advertising and merchandising, $300,000 in hiring sales people trained in selling computer products, and spent $150,000 to set up demonstration centers in each of its 15 branch offices. This year it plans to spend about a half-million dollars adding more inventory, but doesn't know how much it will cost to hire an additional 15 persons that will bring its staff of computer sales and marketing people to 25.

The company faced other obstacles, such as how to deal with product warranties that extend for only six months. "We've got to move them within that period; otherwise we can't send them back to the vendor," says Frank Hollibaugh, Kierulff's marketing vice president. "It requires very tight inventory control when compared to semiconductor products which have a longer shelf life."

But an even bigger obstacle was convincing a computer manufacturer that the distributor wasn't competing with the vendor's local salesmen, and that in some cases local salesmen should refer customers to the electronic distributor.

Kierulff, which will aim its computer products at original equipment manufacturers (oems), says its ability to provide faster delivery than the manufacturers (30 days vs up to 120 days) should attract small and large oems and users whose type of business makes it difficult for them to forecast their needs, but who can't wait 120 days for delivery when these needs are finally realized.

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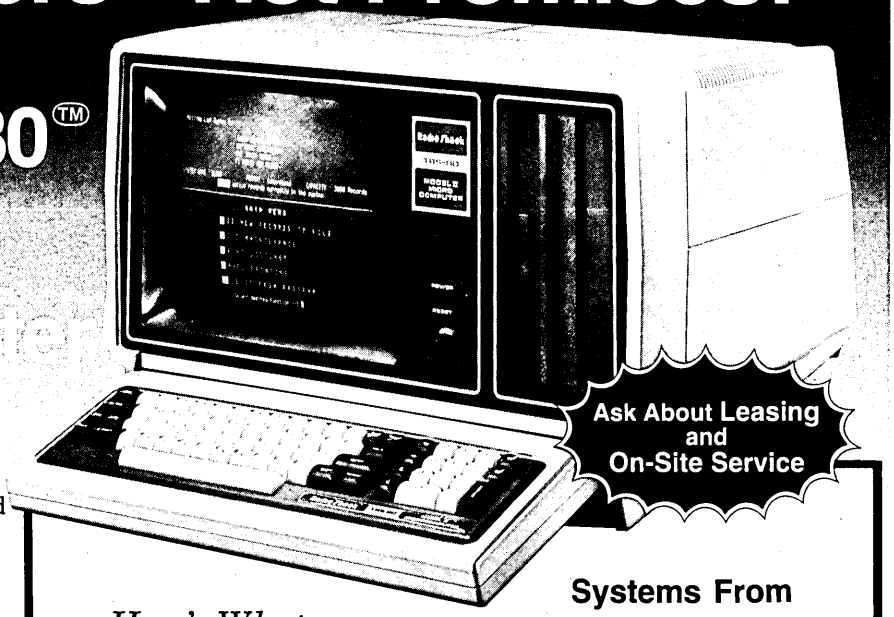

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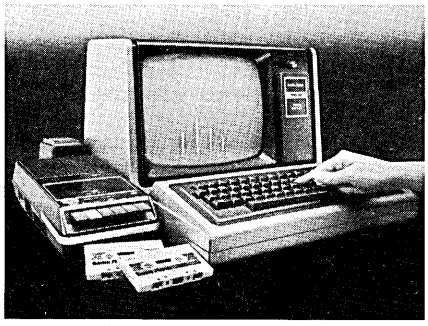

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CIRCLE 76 ON READER CARD

"In other words," says Samuel D. Lane, who heads computer marketing at Kierulff, "an oemer can work out of our warehouse, ordering products for a system only as he needs them." Smaller oems can work out credit arrangements faster with a local supplier than a huge vendor. Kierulff, for instance, stocks products in seven West Coast cities, five midwestern locations, as well as in Massachusetts, New Jersey and Florida.

Its plans call for stocking noncompetitive complementary products that can be sold as systems. And Hollibaugh says the company isn't ruling out selling applications software as well as hardware, "as the oem's way of doing business changes in the future."

He says, however, that the company is "reserving judgment [on that move] for the future."

Nor does Hollibaugh rule out eventually stocking small business computers in large quantities. Its arrangement with Astrocom was modified early this year. Astrocom now will ship at no charge four of its Model 760s to Kierulff showrooms "in locations where we don't have a dealer operation," says Sidney N. Jerson, Astrocom's chairman.

Astrocom will provide training to the distributor's salesmen who then will demonstrate the computer for dealers and their customers. Jerson said buying from a local distributor "costs less for the dealers than buying from Astrocom on a onesey, twosey basis."

Jerson said software delays did affect the company's schedule, but Astrocom has tested the software and announced its release of the 12 applications programs last January. He says a word processing capability soon is to be added to the software and "we're back on schedule and looking aggressively for a number of good leads."

Price for the computer with 64K of memory, IMB of floppy storage, a 180 cps printer, and the 12 applications packages is $19,985. The price to dealers and distributors ranges from $9,000 to $14,000.

And that to Kierulff's Hollibaugh is attractive, considering the new arrangement. "It allows us to get our feet wet [in the small business computer market] without diving into the pool."

—Tom McCusker

NO FLASH IN THE DARK

Flexible power distribution systems aren't catching on as fast as was once expected, but they're far from fizzling out.

In late 1978 the business of providing clean, flexible power distribution systems seemed to be one about to take off (Nov. 1, 1978, p. 61). Its progress since then has been more like that of a well-paced runner of the mile than that of a jet lifting off from an airstrip.

"We have a big problem in educating the world," said William R. Lennartz, president of Computer Power Systems Corp., Carson, Calif. Companies in the field contend that while computer centers generally account for less than one percent of a company's electrical use, they are voltage sensitive. Transients can cause unexplained halts and lead to garbage. Systems sold by CPS and others lock into a building's power system but isolate the computer center from variations caused by other users. "They catch the power, protect it from outside interference, and distribute it within the computer center," said Norman Conwill, marketing vp for CPS.

"The [computer] industry is living with the problem," said Lennartz. "We built the industry that way, to expect and tolerate downtime and loss of data caused by electrical troubles. But with more and

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CIRCLE 78 ON READER CARD

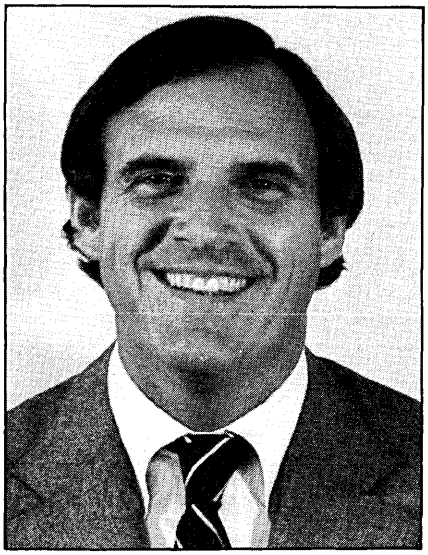
more real-time computing and distributed data processing, this can't continue."

There were three companies in the field back in late '78, all in Southern California. They were CPS, Data Processing Power, Inc. of Los Angeles, and Emergency Power Engineering, Inc., Costa Mesa. They're still there and were joined late last year by The Liebert Corp., Columbus, Ohio, a longtime producer of air conditioning systems for computer rooms. Liebert's power systems are built for the firm by a wholly owned subsidiary, Conditioned Power Corp.

Both CPS and DPP said they had more than 200 installations back in late '78. Last month CPS claimed 1,300 and DPP some 600. EPE, which reported 80 installations in '78, said it has between 600 and 700 now.

DPP, which had been privately held, was acquired last Nov. 1 by Topaz, Inc., a San Diego based producer of ultra-isolation transformers, regulators, and other power components. Its sales are in the $15 million to $20 million range. DPP's sales at the time of the acquisition were running at $3 million.

Louis Perillo, who had been president of DPP, is now a vice president of Topaz and general manager of the Topaz DPP Div. The division has 50 employees and, said Perillo, "expansion plans." He said his division is operating independently



WILLIAM R. LENNARTZ: "We have a big problem in educating the world."

of Topaz in marketing, "but we have common strategic planning." DPP remains in the Los Angeles area.

CPS moved late last year from a 17,000 sq. ft. facility in Long Beach to a new $80,000 sq. ft. plant in Carson built to its specifications. Lennartz said the new building "allows for all the expansion we will need here. The next step will be something on the East Coast."

The company had 110 employees in late January and was expecting to add 20 more within 60 days. Of its 1,300 installations, 700 were of its System II for large computer sites and 600 of its PowerMite, a system for smaller computer facilities.

Last month CPS completed redesign of its basic System II systems to achieve modularity, ease of manufacturing and easy maintenance. Lennartz said full conversion of manufacturing to handle the new family, which will be called System III, will be completed in April. "The family will cover the power range of 20 KVA to 500 KVA. Units will be field upgradable and each unit will take 25% fewer man-hours to build than the System IIs," Lennartz said. "Ease of maintenance will be achieved because all electronics will be in a package in a door which swings open."

In early February, CPS began shipping its newest product, Micropower, and expected to have produced 100 of these by the end of that month. "These will be an off the shelf item," said Lennartz. They're designed for minicomputer systems and multiple computer systems.

"They don't distribute, they regulate," said Robert M. Miller, vice president, sales for CPS. "We sell 'em as insurance," he said, recalling an instance where a former CPS executive who had a

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CIRCLE 80 ON READER CARD

small computer system in his home had his entire memory wiped out by a power fluctuation.

CPS has a lot of competition in this market including DPP's new parent, Topaz. "But ours are designed with computers in mind," Miller said. "They interface with a computer. They regulate on input to the transformer while others regulate on output." He cited as the most significant difference in their units the fact that "all computers have regulators and these must synchronize with the power regulators. With ours, they do."

He feels introduction of the Micropower will "drag them [other power regulator producers] into the computer industry. We're creating business for other people."

Both DPP and EPE say they are readying new products which will debut at the NCC, but they weren't ready to announce them last month.

Spokesmen for all three Southern California firms see Liebert as a formidable competitor in the long run, although they don't feel the competition much right now. "They're new. They're just getting started," said Warren Caves, marketing manager at EPE. But they have a strong financial position and a good marketing force. They'll be there for the long term."

DPP's Perillo said, "We're not seeing them yet but we know we've competed with them on a few sales and they've probably made some we don't even know about."

Lennartz feels Liebert will be a strong competitor, but adds "there's plenty of business out there for all of us."

CPS is thinking even smaller than the Micropower. The company is working on something for the home and hobbyist market. "We'd have to get something that would sell for $150 for that market," Lennartz said, "and if we can do that we probably wouldn't sell them ourselves. We'd probably go to a Tandy."

—Edith Myers

INTERNATIONAL

DATASAAB UP FOR GRABS

Alone, the Swedish computer maker doesn't look too healthy; as a merger candidate for a company like ICL, Datasaab begins to look more promising.

Sweden's only homegrown computer maker, Datasaab AB, is up for sale—only two years after being established. Sources say that the company has been anxious to find a partner since its 1978 creation from the terminal and small systems interests of the old Datasaab and Stansaab concerns.

Now British computer giant ICL has emerged as favorite to buy either a majority or all of the Swedish venture by year's end. ICL has made three major approaches to Datasaab during the past year, the latest of which was at the end of January. But other suitors are known to be waiting in the wings, including Finnish industrial conglomerate Nokia, and the Dutch electrical computing multinational, Philips. In the past, Datasaab's name also has been strongly linked with Sperry Univac.

Neither ICL nor Datasaab senior management wished to comment. But Hans Werthen, chairman of Swedish-owned multinational Electrolux and also chairman of Datasaab, confirmed that talks with "prospective partners" were taking place.

Since its launch in 1978, the new Datasaab has consistently lost money, and only last autumn lost its biggest customer, the Danish Savings Banks consortium, to

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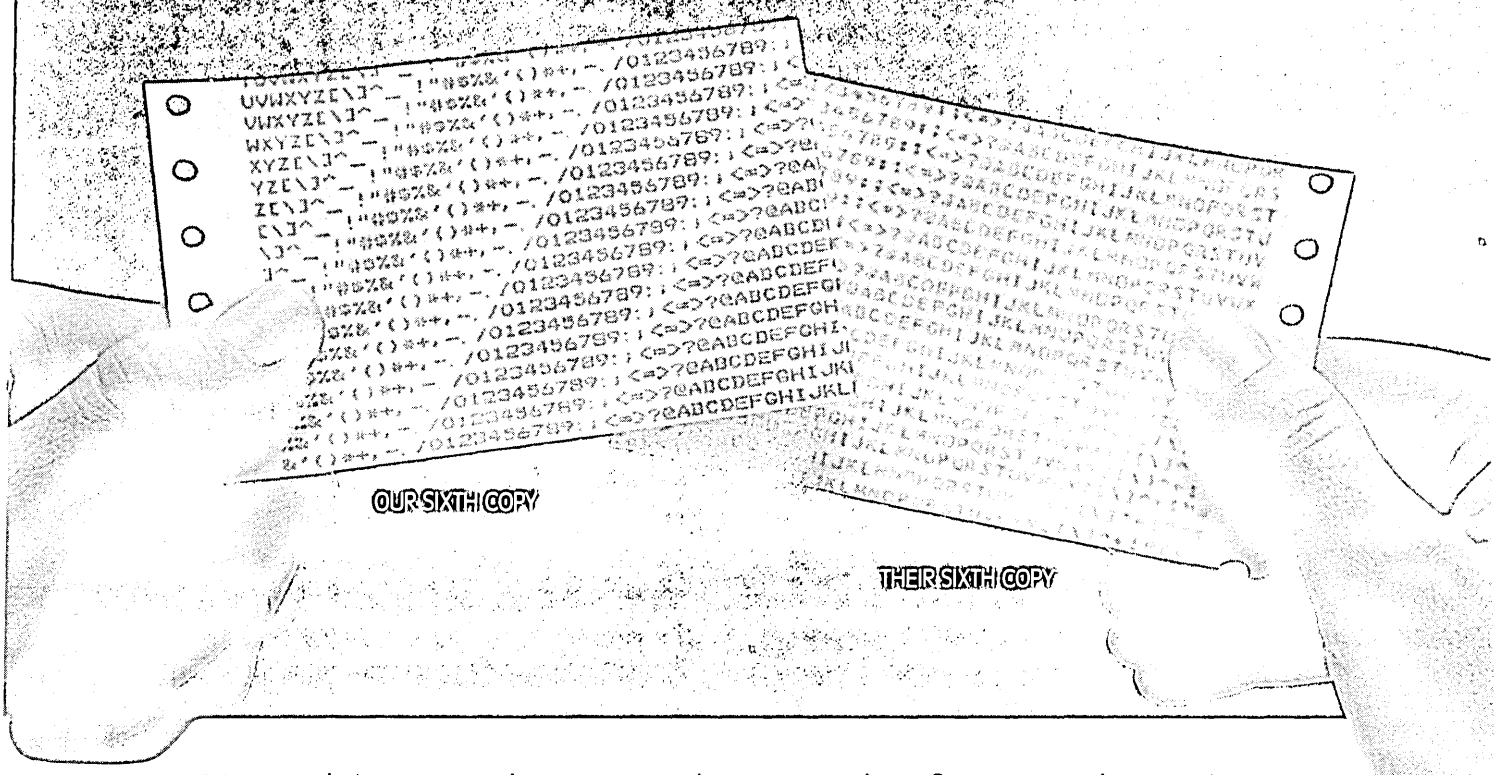

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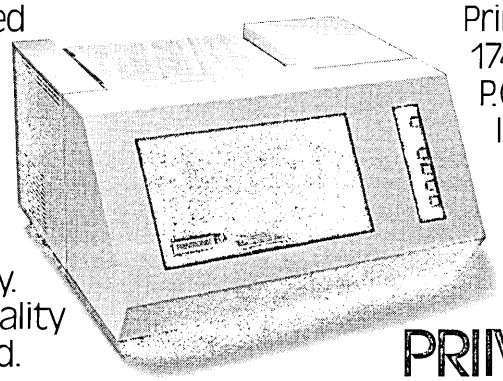

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CIRCLE 82 ON READER CARD

Olivetti. Datasaab is now halfway through a four year support program from its joint owners, the Swedish government and Saab-Scania, the car and aerospace conglomerate.

The support has been offered in the form of shares in the new Datasaab, with each partner guaranteeing some $43 million over the four year period. The idea was that this money would be enough to see Datasaab into the black by 1982. However, losses during the company's first two years of operation—some $90 million—have already exceeded the partner's equity stake, and they have been called upon to provide extra funds.

ICL's top objective is to build its image as "The European Computer Company," internal documents indicate.

Company sources stress that an extra $40 million will still be needed by Datasaab to cover losses over this year and next, and the partners have agreed to provide the money. But both owners have made it clear that if Datasaab has not crept into the black by 1982, there will be no more funds.

Though the losses suggest, on paper at least, that there are many things wrong with the company, informed opinion points to only one real deficiency at Datasaab—an inability to market its products successfully. Sweden is noted for its high engineering skills and belief that if a product is good it should sell itself.

But this attitude, which still has deep roots in Datasaab, seems to be the only thing that is "out of touch" with the company. ICL's own assessment is that Datasaab's marketing costs are too high and a constant drain on profits, but manufacturing methods are modern and well capitalized, and bear the correct relationship to revenues.

Opinion in Sweden on whether Datasaab will meet its target of a small profit in 1982 is divided. But one man who is in no doubt is Hans Werthen. "By 1982, Datasaab will have reached a viable level with sales of 1.5 billion Swedish kronor [about $300 million]," he claimed. "And with secure equity, and its debts and development costs written off, it would look like a bargain to any buyer."

According to internal ICL documents, "those development costs" have produced products—particularly terminals—that are more modern and marketable than ICL's own versions; and that, all around, the acquisition of Datasaab is "desirable" and in line with ICL's objectives.

First among these objectives, say the documents, is the building of ICL's new image as "The European Computer Company." ICL already claims to have the widest product range outside IBM, and is now beginning to stress a new role as a systems supplier. In addition, ICL is deemphasizing its traditional mainframe stance.

ICL clearly believes that the acquisition of Datasaab would give it a propaganda boost in its fights against the Americans and the Japanese, much as its purchase of Singer's international operations has done. Also of major importance to ICL is that the Swedish operation offers a readymade development and munufacturing center for its own range of specialized and general terminals.

In pure revenue terms, ICL thinks that by absorbing Datasaab into its operations, ICL could boost its European division sales by some $125 million in the first couple of years, and bring it back to its target growth of 30% each year. The company believes that the net effect of the injection of Datasaab's products into its lines could be to raise its international sales by as much as 5% during the two years following acquisition, sources say.

At present, only a few senior Datasaab directors know about the talks with ICL. Despite some misgivings about ICL's future in the mainframe area, the consensus seems to be that ICL would make a good partner. Datasaab managing director, Gunnar Wedell, is known to be anxious to secure a deal by the summer's end. But this seems unlikely. ICL intends to raise the cash for Datasaab and "other acquisitions" by an issue of its shares during 1980, one ICL source explained. No firm date for the issue has yet been agreed on, however.

If ICL does decide to proceed, its financial chief, Murray Stuart, will push to buy 100% of the company. When talks began in earnest last August in Sweden, ICL was looking at the possibility of buying some 52% of the company. Wedell began to explore the possibility of the government selling 2% of its stake in Datasaab and Saab-Scania selling all 50% of its holdings.

Saab-Scania has become disenchanted with the computer business since it lost a fortune on its ill-fated D23 mainframe developments early in the 1970s. The small business machine successors to this venture, the D15 and now the D16, have also been consistent loss-makers and have been a drag on Datasaab's more profitable terminal business.

Until recently, Saab-Scania had urged Datasaab to press on with its D16 small business system development in the belief that it was necessary to support sales of terminals. Managing director Wedell is known to oppose this view. At the time of the new Datasaab creation, he urged Saab-Scania to abandon the small business systems because they would prove to be unacceptably expensive in software and applications costs. Wedell was overruled. A later study commissioned by the company said that there was hope in some markets for the D16, so the company decided to keep the line going.

Last year, losses from the D16 were not as great as previous years. Wedell put them at about $6 million. But now both Saab-Scania and Wedell seem to be in agreement that a partnership with another company is essential to the future of the D16.

One drawback to the D16 is that it's largely incompatible with Datasaab's financial terminals and display and keyboard (Alphaskop) terminals. Another key disadvantage is that the hardware is very expensive outside Sweden (four members in the $30,000 to $300,000 selling range). Wedell is keen to merge with a larger partner so that together they could provide the necessary volume for more competitive prices and possibly oem selling.

In any event, it is now clear that Saab-Scania has had its fill of such problems and of the computer industry. "People have been telling them to get out of the computer business and concentrate on what they know best—cars and aerospace," explained one Swedish observer. "Now they seem to be listening."

This view was also expressed by Hans Werthen, who was brought in to handle the sale of Saab-Scania stock, among other duties. "I believe that Datasaab needs a partner that is not a car manufacturer," he said.

As yet, nobody is saying what the asking price will be.

—Ralph Emmett

BANKS IN EUROPE DEMAND DP

An expensive British study says European banks are ready to jump on the automation bandwagon but the vendors themselves have set up roadblocks.

The European banking market is on the verge of an automation explosion. From a 1979 installed base of dp products valued at $8 billion, the market should boast a $13 billion installed base by 1985—a surge that even exceeds the dp vendors' greatest expectations. That's the conclusion of a new study on "Automation in European Banking 1979 to 1990," compiled by PA Computers and Telecommunications Ltd. (Pactel) of London.

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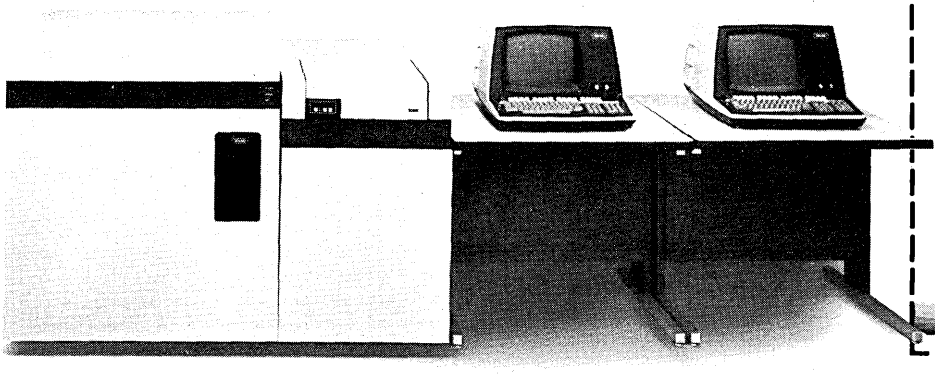

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main weapons of the European banks in their battle for survival in an increasingly competitive market," says Paul Todd, Pactel's director responsible for banking. Till now, he explains, vendors have concentrated on what has essentially been a replacement market—doing a job more quickly and more cheaply but in relatively the same way. "The replacement market will continue to exist," Todd adds, "but there will also be a huge growth in the use of text processing, office systems, telecopy/facsimile, optical character recognition, administrative terminals, terminals outside bank premises, and data base management systems."

"In the U.S., they fire the banker if the system doesn't work; in Europe, they fire the terminal."

Carrying a hefty price tag of $60,000 for vendors and just over one-fourth of that for users, the study is "one of the most expensive ever offered," Pactel concedes. However, the company points out, the study covers 13 European countries and unearths a number of critical issues for vendors, banks, communications authorities, and even governments. Though the pace of change is different from country to country, the British company says it is convinced that the injection of new technology into European banks will "fundamentally change the role of the branch"—a significant development, given that a country like the German Federal Republic has more bank branches than the whole of the U.S.

According to Pactel, banks are faced with two alternatives—retrenchment or aggressive marketing. If the banks do not try to make private account handling a profitable operation, they will be forced to retrench and concentrate on corporate customers—"which scares the banks to death because these customers have no loyalty." But if the banks manage to revitalize their branch marketing, offering new management, planning, and advisory services, they can make private account handling profitable. What Pactel has found is that most banks in Europe are raring to jump on the automation bandwagon, but the manufacturers are not yet able to provide the right kinds of products. One of the biggest gripes of banks is the vendor attitude toward ergonomics, or biotechnology.

"In the U.S., they fire the banker if the system doesn't work; in Europe, they fire the terminal," says Pactel's Todd. For example, European tellers sit rather than stand, a difference often ignored by U.S. manufacturers. Noise requirements are seldom met, and similar complaints are made about the size and quality of crt screens and the general layout of terminal equipment. The study says users are disillusioned at the apparent lack of any scientific work on the part of vendors to resolve the ergonomics problems, an important factor in the European banking market.

Another user complaint surrounds data base management systems. While the study found that DBMSs will form the cornerstone of future marketing efforts and client services, it also discovered that users find vendor DBMS offerings unsuited to banking needs. Most current DBMs are designed to handle tree structures, bills of material, or hierarchical file systems; what is needed in banking is the ability to take a very quick look at client-related data across a large number of files.

The study also points to a move away from the much-heralded distributed processing approach. Banks will tend to concentrate their processing in several regional centers, instead of delegating too much processing to branch minicomputers. Banks now feel that several regional computer centers avoid the vulnerability posed by the single center and afford greater security over branch level systems. Distributed processing, the banks also argue, requires more staff at higher pay levels.

Despite all these drawbacks, the Pactel study contends that banks will demand and get the kinds of equipment and services they need. By 1990, the study forecasts, the overall installed base of automated bank gear will rise to a value of $16.5 billion—more than double the present level even in light of falling product costs. The study says the Swedish and Swiss banks, the most aggressive of the European banks, are the most keen on acquiring new automated gear, particularly branch terminals.

The study also indicates how banks will change their patterns of operation. Pactel estimates that front-office terminals numbered 900,000 last year, compared to 970,000 back-office terminals. But by 1985, the study predicts, front-office terminals will total 2.3 million while back-office terminals will number 1.4 million. And by the end of the decade, 3 million front-office terminals are expected to outnumber the back-office units by two to one.

Even more phenomenal growth is anticipated in bank-linked point of sale terminals. While current quantities are negligible, the study states, the installed base could be more than 100,000 units by 1990. The survey also detects a swing from automated teller machines (ATMs) towards simple cash dispensers. Nonetheless, 60,000 ATMs should be installed by the early '90s.

Bank automation will also impact employment. Some banks told Pactel that they currently employ 50% more people than they will need in five years. A representative figure was a reduction by 25% to 30% in five years' time.

Mail service will also be affected. A huge chunk of Europe's postal traffic is computer-generated financial correspondence, which means an enormous opportunity exists to replace traditional postal services with electronic mail systems. If the banks do switch in a big way to the use of electronic mail, national postal services could be devastated. In Belgium, for example, 80% of the total mail volume would be susceptible to such developments.

—Andrew Lloyd

TRAVICOM TUSSLE BEGINS

Travicom ensures against passenger lock-ins by airlines, but Datasaab is convinced another lock-in does exist—that of terminals.

The British Travicom travel agency system is on the side of the angels as far as airlines are concerned. But according to one intelligent terminal manufacturer, there's a devilish side to the deal.

Travicom began operations in August 1977 in the London area and in August 1979 in Manchester. Although the system is jointly owned by British Airways and British Caledonian, it allows not only British-based airlines to connect their seat reservations systems to it directly, but foreign airlines can do so as well.

There are now some 20 airline seat reservations systems connected to Travicom, only two of which are British. Each airline offers its own highly selective "city pairs" tables, but it takes a Travicom user agent only the touch of a few buttons to look up a rival airline's city pairs table for the same route, so that no hidden lock-in of passengers occurs. But another kind of lock-in does occur—that of terminals, charges Swedish small business computer manufacturer Datasaab.

Datasaab recently filed a complaint against Travicom at the British Office of Fair Trading. For over two years, the Swedish company has been selling in the U.K. a computerized ticketing and accounting system for travel agents, known as TAS. It is based on Datasaab's D15 business minicomputer.

TAS does not connect directly with airline seat reservations systems, but allows travel agents—after making a reservation by phone—to have the ticket printed and the fare calculated automatically. TAS also prepares bills for customers.

TAS competes with a system called DPAS, which Travicom offers as an option to its user agents. DPAS was designed by a sys-

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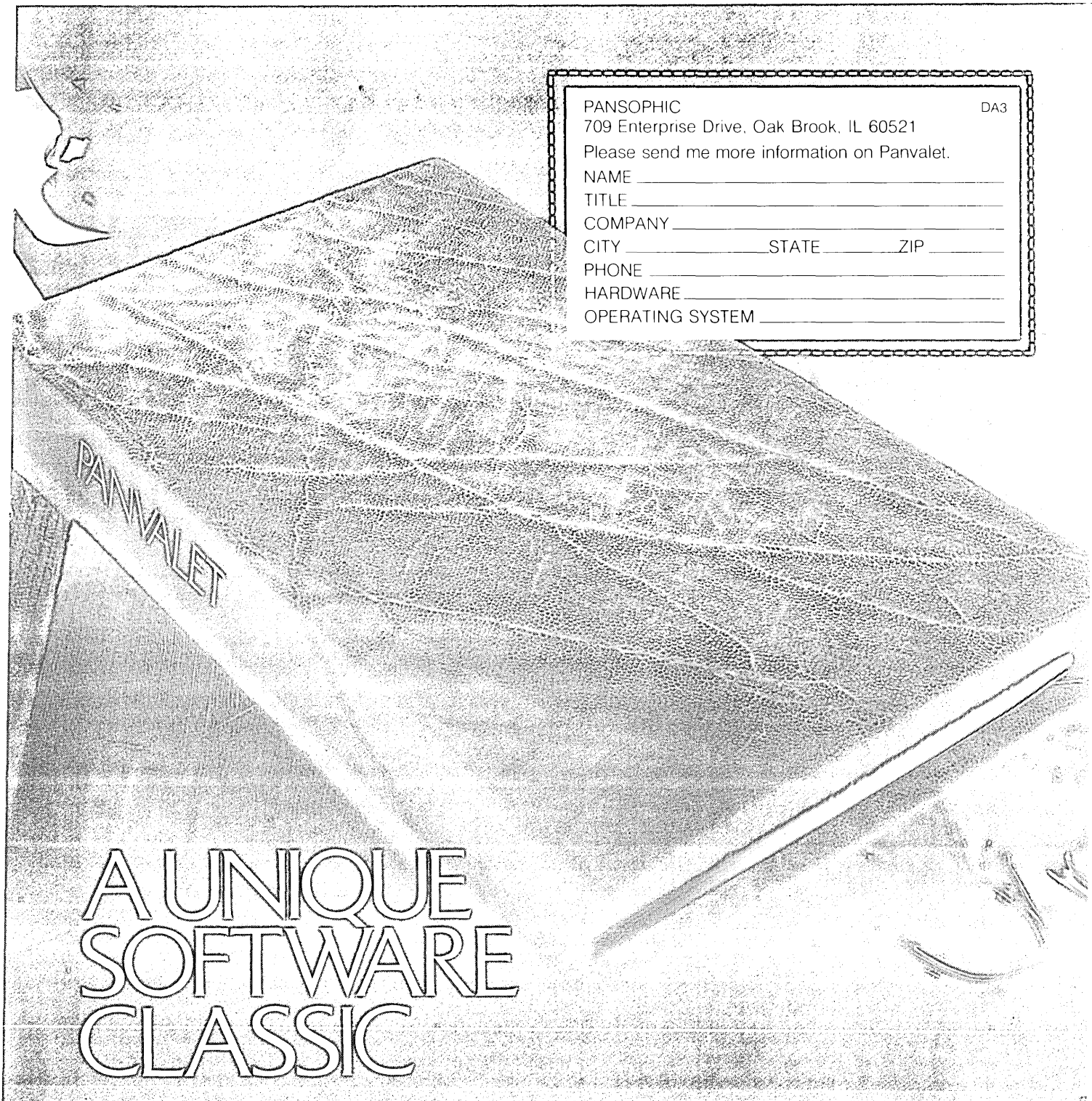

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tems house called Computer Communications Ltd. (CCL), a subsidiary of Thomson Travel and Hogg Robinson (another travel agent) and itself an 18% shareholder in Travicom. In its recent complaint, Datasaab charges that Travicom is using unfair means to promote DPAS at the expense of its TAS.

Travel agents already equipped with a Datasaab TAS accounting system and located in the London and Manchester areas are allowed to interface their systems on-line to Travicom—but the price is steep. Travicom charges these TAS customers $550 per month for the on-line connection, a fee that suddenly makes Travicom's DPAS look much more attractive, Datasaab charges. According to the Swedish firm, that charge is excessive, and a fair price reflecting the true technical cost of the connection would be more like $110 per month.

And that's not all. Following demand from travel agents outside the London and Manchester areas, Travicom is now offering a limited number of ports on its system to agents in Southwest England, the Midlands (Birmingham area) and Scotland —but only to agents prepared to order both the Travicom reservations terminal and the DPAS accounting system as a package deal.

Travicom claims that only in this way can it cover the maintenance overheads in these new areas while it has so few ports to offer. These restrictions will be lifted, it promises, as soon as the British Post Office makes available more lines, or the new PSS packet switching system, to Travicom.

Few expect that to happen before the beginning of next year, at the earliest. By that time, Datasaab contends, many travel agents will have been forced to install DPAS in order to obtain Travicom when they just might have preferred TAS instead.

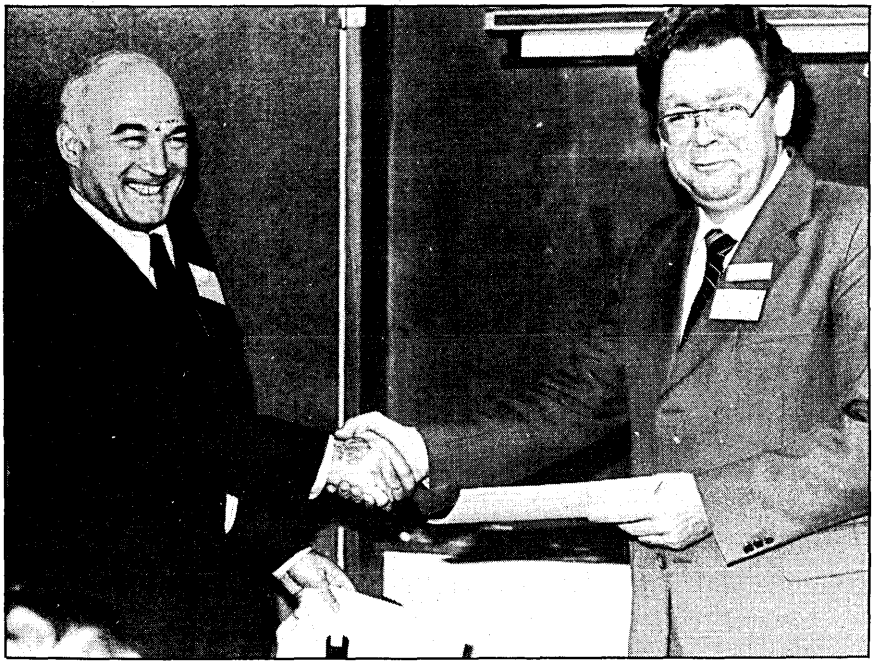
—Fred Lamond

TRADE

CDC PACT WITH USSR IN DOUBT

One benefit of MHD technologies is its potential lessening of the world's demand for crude oil.

Last December, Control Data Corp. signed a contract with Soviet authorities giving CDC exclusive U.S. representation for several Soviet technologies. Since then, in light of worsening relations between the U.S. and the USSR, doubts have appeared concerning the ability of the signatories to perform on the contract.



CDC's DR. HAJO ONKEN (right) and the Soviet's DR. E. M. SHELKOV inked the pact during better days for East-West relations.

The agreement was signed between CDC's technology broker organization, Worldtech, and the Soviet foreign trading agency, Licensintorg. More than 30 processes, including magneto-hydronamic electrical generation (MHD), are covered by the contract. Payments made to the Soviets for the technologies, if CDC could remarket the Russian ideas, would be in hard currencies.

CDC now hopes that MHD will be added to Worldtech's inventory of 150 Soviet technologies. According to Dr. Hajo Onken, vice president of Worldtech, the Soviets have had acceptable results with the MHD equipment and are running a pilot generating plant that feeds into the Moscow power grid.

There is concern at CDC that the Soviet technologies included in the December agreement could be embargoed by the Russians. Such an embargo would be in retaliation of President Carter's January announcement that U.S. high technology exports to the Soviet Union would be suspended for an indefinite period. Because the President's export freeze only covers trade originating in the U.S. and going to the Soviet Union, Licensintorg's exports to the U.S. are not directly affected. But a CDC spokesman did venture that the company was concerned the situation might escalate, with Soviet policies changing to block the movement of technologies from East to West.

"As of now," said the spokesman, "no transaction [involving the shipment of equipment or documentation] has taken place. It's up to the Soviets . . . and they've been quiet." CDC remains interested in acquiring rights to remarket the technologies, including MHD, but whether that dream will be realized, CDC commented, "we actually cannot say."

CDC's enthusiasm for the technologies is an echo of the Soviets' own findings. According to Dr. E. M. Shelkov, deputy director of the Soviet Institute of High Temperature (IVTAN), use of MHD generating techniques creates less thermal pollution than conventional energy technologies, requires less cooling water, and creates less of what he calls "harmful discharges." The Soviets claim MHD is 25% more efficient than steam turbine generation.

Another benefit of MHD is its potential lessening of the world's demand for crude oil. Shelkov added that the American energy crisis has encouraged some Soviet scientists to develop new energy sources. He also said that as technology transfers become more frequent, American needs would be increasingly important to Soviet scientists.

Some of the other technologies included in the contract with CDC are methods of eliminating high sulphur content from fuels to reduce atmospheric pollution, as well as a high temperature regenerative preheater with ball matrix.

IVTAN was formed in 1960 by a small group of Soviet researchers. It grew rapidly, and is presently a major contributor to the Soviet Academy of Science. The organization is currently researching such areas as thermal, physical, and electrophysical substance properties in various aggregate states, the processes of thermal exchange, and electrophysical power problems.

—Peter Krass

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BENCHMARKS

IBM POSTS DECLINE IN NET: While revenues were up for the fourth quarter and the year, IBM's net income for those periods suffered a decline. Fourth quarter net totaled $1.008 billion ($1.73 a share), down less than 1% from the $1.014 billion ($1.74 a share) in the 1978 period. For the year ended Dec. 31, net income slipped 3.2%—from $3.11 billion ($5.32 a share) in 1978 to $3.01 billion ($5.16 a share) in 1979. A major factor affecting the drop in net income was a $165 million swing in foreign currency adjustments for the year, which reduced net by $99 million. Fourth quarter revenue rose 6.1% to $6.83 billion from $6.44 billion in the year earlier period. For the year, total revenue climbed 8.5% to $22.86 billion from the $21.08 billion posted in 1978. Data processing operations accounted for $4.74 billion in 1979 operating income, a drop of 7.4% from $5.11 billion in 1978. An unprecedented amount of borrowing during the year failed to swing the balance for IBM in working capital, which suffered a 2.3% decline from $4.5 billion at the end of '78 to $4.4 billion at the end of '79. Capital spending climbed 48% to almost $6 billion, compared to the previous year's $4.05 billion. While 35% of that sum was used for plant and property, an even more surprising 55% went toward financing IBM's rental base, as customers continued the trend to lease rather than purchase.

WHILE IBM COMPETITORS' EARNINGS RISE: Despite IBM's disappointing financial results, the company's competitors posted promising gains. Record results were reported for the year by Burroughs, which posted a 20.6% gain in earnings and a 15.1% leap in revenues. Year-end earnings rose from $253.36 million in '78 to $305.54 million in '79, while total revenues increased from $2.46 billion to $2.83 billion. For the fourth quarter, Burroughs reported a 19% climb in profit to $132.48 million on revenues up 12.1% to $881.66 million.

NCR's annual earnings rose 21.1% after the firm posted a 9.3% gain in the fourth quarter ended Dec. 31. Earnings for 1979 climbed to $234.6 million, compared to 1978's $193.7 million. Revenues for the year amounted to $3 billion, a more than 15% gain over year earlier revenues of $2.6 billion.

Honeywell saw a 32.3% rise in annual operating earnings to $240 million, with a fourth quarter gain of 10% to $68.2 million. Total revenues rose 18.7% to $4.2 billion from $3.54 billion. Computer business revenues of Honeywell Information Systems jumped 12% from $1.29 billion in '78 to $1.45 billion in the year ended Dec. 31, 1979. HIS earnings soared 43% for the year, from $106 million the previous year to $152 million in 1979.

An astounding 79% surge in Control Data's earnings from the computer business brought 1979 profits from dp operations to $65 million from the year earlier's $36 million total. Revenues were up 21.7% to $2.27 billion at the Dec. 31 close, compared to the 1978 revenues total of $1.87 billion. Fourth quarter profit from computer operations was $9.5 million on revenues of $370.3 million.

For Sperry Rand, Dec. 31 represented the end of its third quarter, which saw earnings rise 19.8% to $68.4 million and revenues climb 14.8% to $1.19 billion. Typically, almost half of the corporation's total revenues are data processing-related. Computer orders at Sperry Univac jumped 9% during the third period, backlog gained 11%, and revenues were up 14%.

At Digital Equipment, the Dec. 31 close of the second quarter saw net income rise 42.2% to $53.9 million and revenues increase 30% to $553.9 million. For the first half of the year, DEC showed a 41.5% gain in net income to $99.2 million, compared to $70 million in the comparable period a year earlier. Revenues for the first six months rose 27.9% to $1.04 billion from $814 million in the previous year's first half.

FIBER OPTIC NET FROM AT&T: AT&T has announced plans to construct a $79 million fiber optic digital telecommunications system. The laser-based light-wave cable system will cover 600 miles, linking Washington, D.C., Philadelphia, New York and Boston, and will connect 19 No. 4 ESS digital switching offices in seven states and the District of Columbia. Operation is slated for two phases. The initial section, scheduled for 1983, will run from Washington to New York, while 1984 will hopefully see service from New York to Cambridge, Mass.

The lure of the laser system is its provision for all-digital transmission, which would eliminate the central office need for analog-digital conversion equipment. Another plus, according to Robert Kleinert, president of AT&T Long Lines, would be the projected savings to the Bell System network of a possible $50 million in construction and operating costs by 1990. The system would be expected to carry up to 80,000 simultaneous calls by 1984. AT&T is also looking at the eventual use of fiber optics for data and video communications. AT&T and eight other Bell System companies have filed an authorization application with the FCC and are looking for approval within the next five months.

I/O STANDARDS SUITS SCRAPPED: While it is conceivable that Burroughs, Honeywell, Control Data, and Univac could suffer financial loss if the federal I/O interface standards are implemented, those concerns "do not fall within the requisite zone of interest protected by the [Brooks] Act." So stated Federal Judge John Garrett Penn in his dismissal of the companies' challenge to government I/O standards for mainframes. The judge said the four mainframers have no legal standing to block the Commerce Department's authority to put the standards into effect on June 23. Last fall the companies filed four separate suits, each charging that the proposed standards were outdated, anticompetitive, and favored foreign manufacturers, particularly the Japanese who use one of the proposed U.S. standards as their own national standard. The four suits were later consolidated into one, as the mainframers continued to argue that it would take several years and millions of dollars to adapt their equipment to the standards' specifications. In his recent ruling, Judge Penn pointed out that the purpose of the Brooks Act is not to protect the interests of individual companies as much as it is to establish "a more economic and efficient system for procurement of ADP equipment by the federal government," a goal the standards would help promote. While the companies did not immediately comment on plans to file an appeal, Univac attorney James R. McAlee, speaking on behalf of all four plaintiffs, had earlier said the firms would "definitely appeal" if the judge ruled against them.

COLD WAR FREEZES DP EXPORTS: Acting on orders from President Carter, the Commerce Department has indefinitely suspended more than 800 export licenses of high technology products to the Soviet Union. The President recently tightened his early-January trade embargo to include products that had already received license approval as well as those with licenses pending. Major U.S. computer exporters indicated, however, that the trade ban with the Soviets would have little impact on their businesses. Spokesmen for IBM, Control Data, and Univac each said computer sales to the Soviets represent less than 1% of their total corporate sales. In general, the computer firms support the President's embargo, which resulted when the USSR invaded Afghanistan. The Commerce Department said computer-related sales constitute slightly more than 3% of total U.S. trade with the Soviets. Computer exports to the USSR last year totaled about $25 million.

IRANIAN CRISIS ALSO HITS DP WORK: American Bell International, an AT&T subsidiary, has filed a $167.8 million suit against the Iranian government for termination of a contract calling for integration and development of a nationwide telecommunications system in the politically unstable country. The suit cites political unrest in Iran as the reason American Bell cannot perform on the contract.

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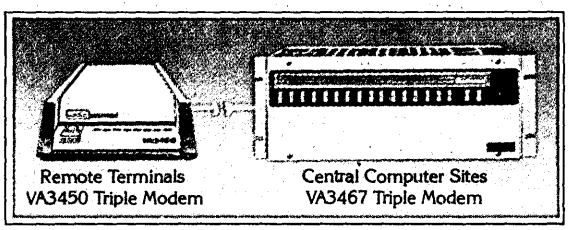

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CIRCLE 86 ON READER CARD

BENCHMARKS

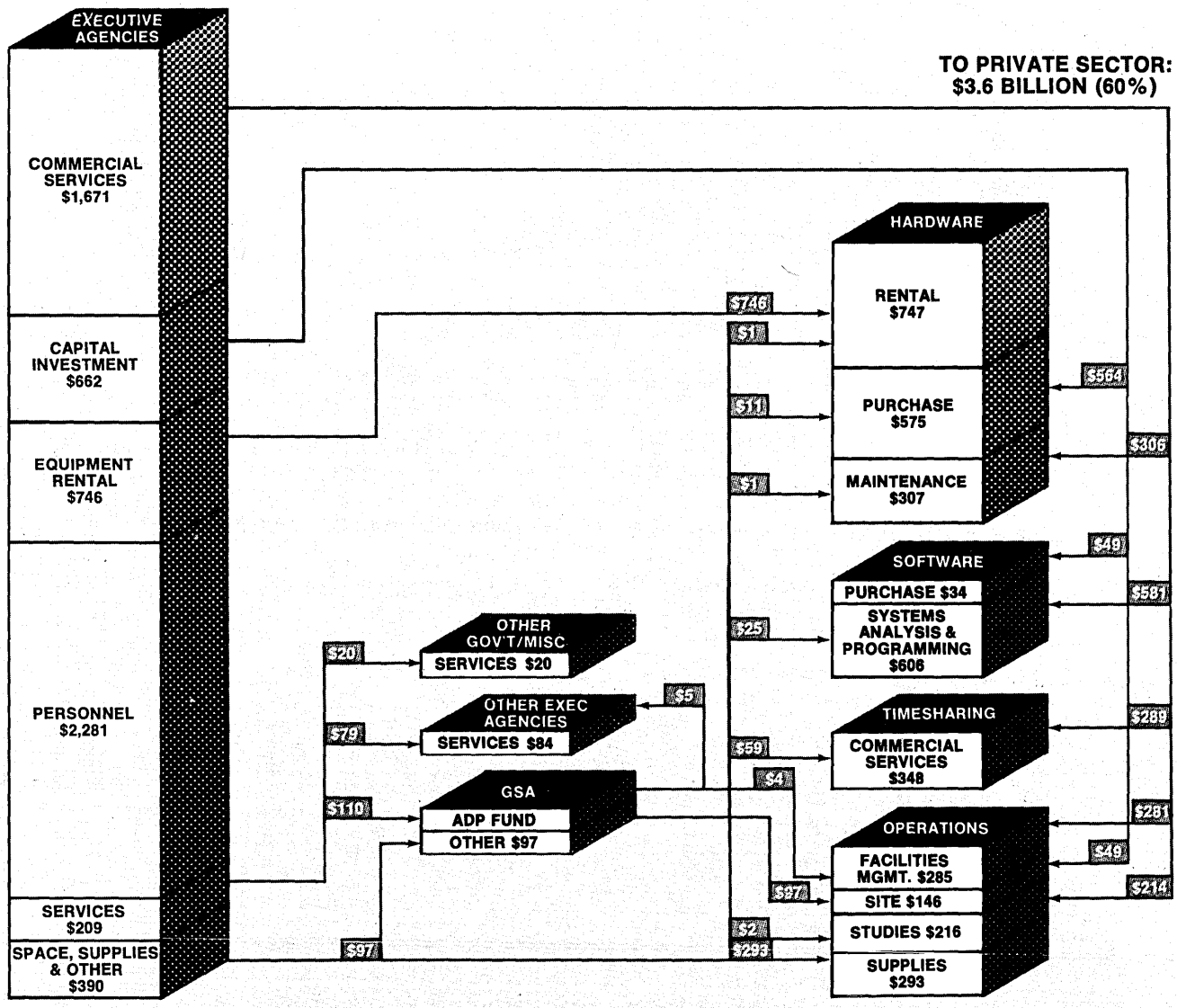
FEDERAL DP BUDGET TO EXPAND: President Carter's proposed budget for fiscal 1981, delivered to Congress last month, includes plans to boost the federal dp budget to $5.301 billion, a 9% jump over FY 1980 funds of about $4.727 billion. These figures do not include outlays for classified dp activities, weapons systems computers, or dp in the legislative and judicial branches. Federal dp represents almost 1% of the total budget of $615.8 billion slated for FY 1981, which begins Oct. 1 of this year. Despite the hefty dp budget increase, which reflects the government's continued reliance on dp to help trim other costs in the federal bureaucracy, the Office of Management and Budget explained that the federal dp work force will not be significantly expanded. Instead, the government plans to rely more heavily on the private sector for computer related services. OMB also pointed out that the federal computer inventory stood at 14,984 cpus at the end of FY 1979 and is projected to climb to 18,153 cpus by the end of FY 1981. More than 70% of the 3,169 computers to be acquired during the next two fiscal years will support Department of Energy R&D activities, Department of Transportation air traffic control applications, Department of Commerce weather applications, and administrative and logistic support for the Marine Corps.

INSAC VIEWDATA GOING STRONG: Insac Viewdata Inc. (IVI) has moved into the U.S. corporate market with a flourish. The company has signed agreements for Viewdata service with over 20 U.S. corporations, including Chase Manhattan, J. Walter Thompson, McGraw-Hill, Time Inc., and Merrill Lynch, Pierce, Fenner & Smith. Each of the corporations has installed between one and five terminals connected via Telenet to the GTE computer center, operating IVI's Viewdata system, in Tampa, Fla. IVI anticipates that several of the initial corporate clients will take licenses for its Corporate System in order to operate their own in-house Viewdata systems. The Corporate System, in addition to standard Viewdata facilities, provides enhanced system security, intelligent terminals, specialized interactive features, and links to mainframe files. The primary business applications for corporate customers include distribution of changing information such as service manuals, sales procedures, product data, and financials.

FEDERAL DP—HOW THE MONEY WILL BE SPENT IN FY 1981

($ MILLIONS)

TOTAL PLANNED: $6 BILLION



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Burroughs modular terminals give you the flexibility to match your precise requirements. And their advanced design allows you to expand at any time without disruption.

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This microprocessor supplies processing intelligence for the terminals. And for application programs, data storage and peripherals.

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You can also incorporate new hardware without systems reprogramming. You can change and expand your network, and take advantage of new BMT developments, without having to revise programs or replace equipment.

And remember, every Burroughs system fulfills the need which caused you to consider data communications in the first place: the need for increased productivity. Burroughs has understood this business need for over 90 years.

That's why we provide total capability in hardware, system software, application programs, customer training, maintenance and the business forms and supplies you need. We call it Total System Support. And it's there to help you realize your productivity potential.

For additional information, call your local Burroughs office or write Burroughs Corporation, Department DM-12, Burroughs Place, Detroit, Michigan 48232.

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If you're an OEM or system builder, no doubt you've been subjected to the 8-inch Winchester hustle.

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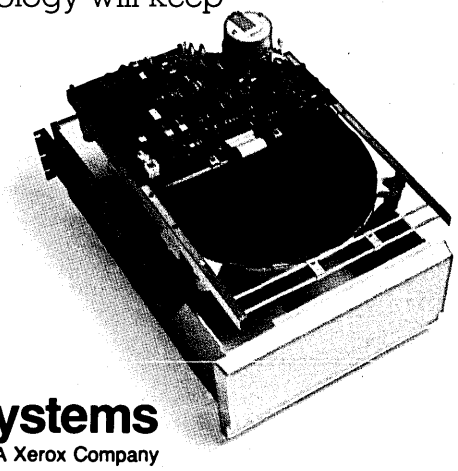

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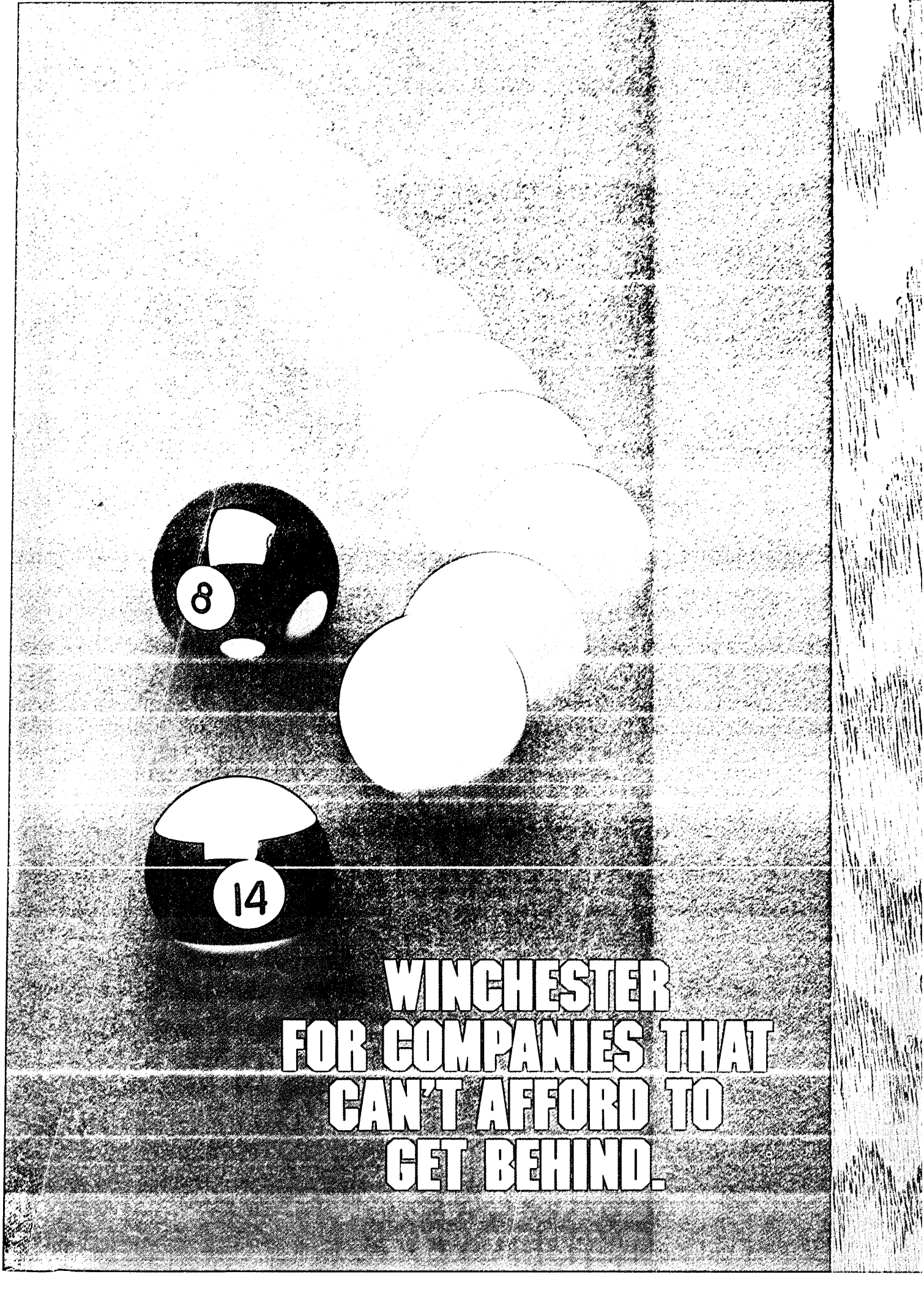
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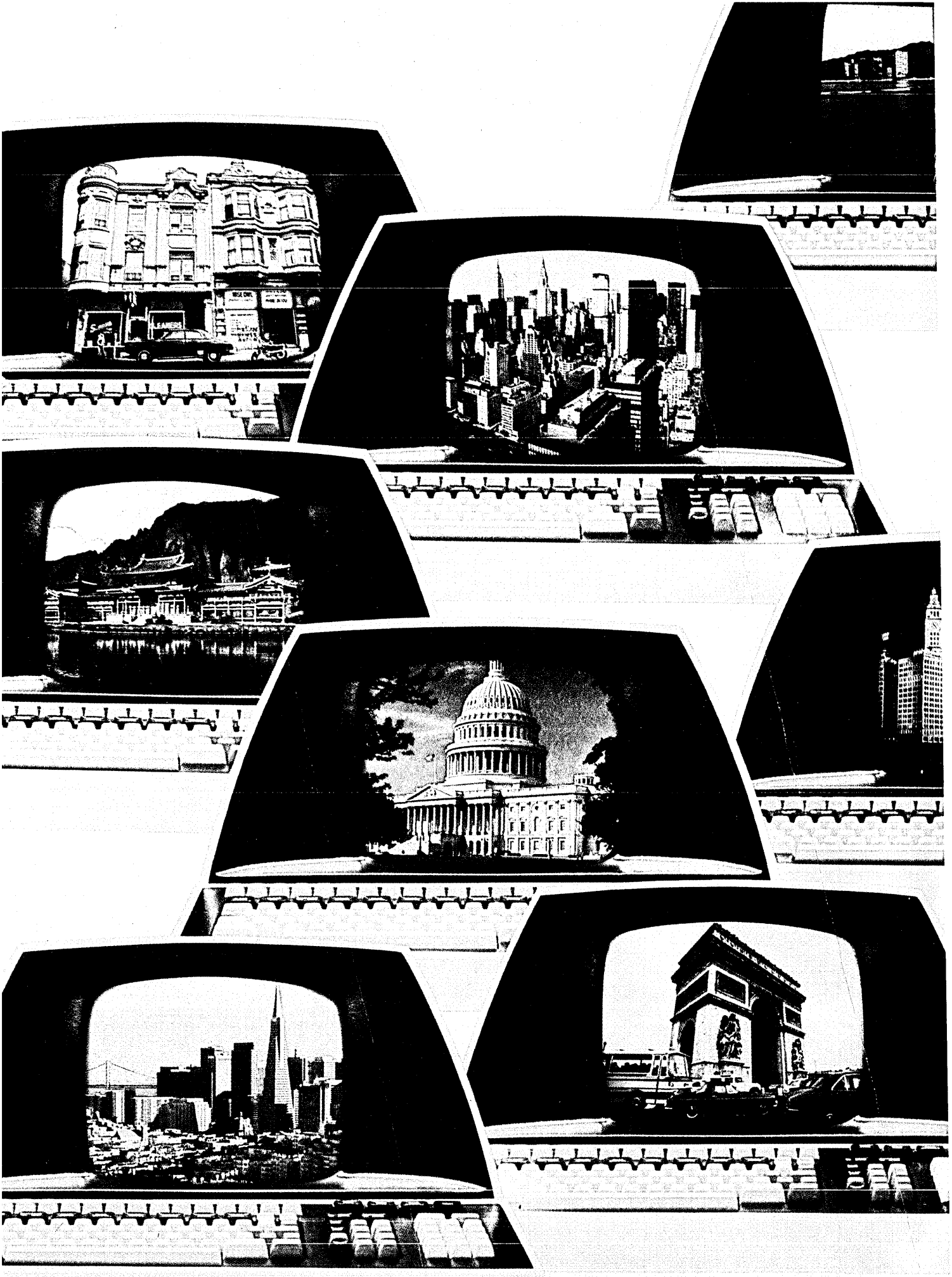

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Viewing the future conservatively, it looks terrific and it's much closer than we imagined.

NETWORKS AT LAST?

by Ray W. Sanders and Bill McLaughlin

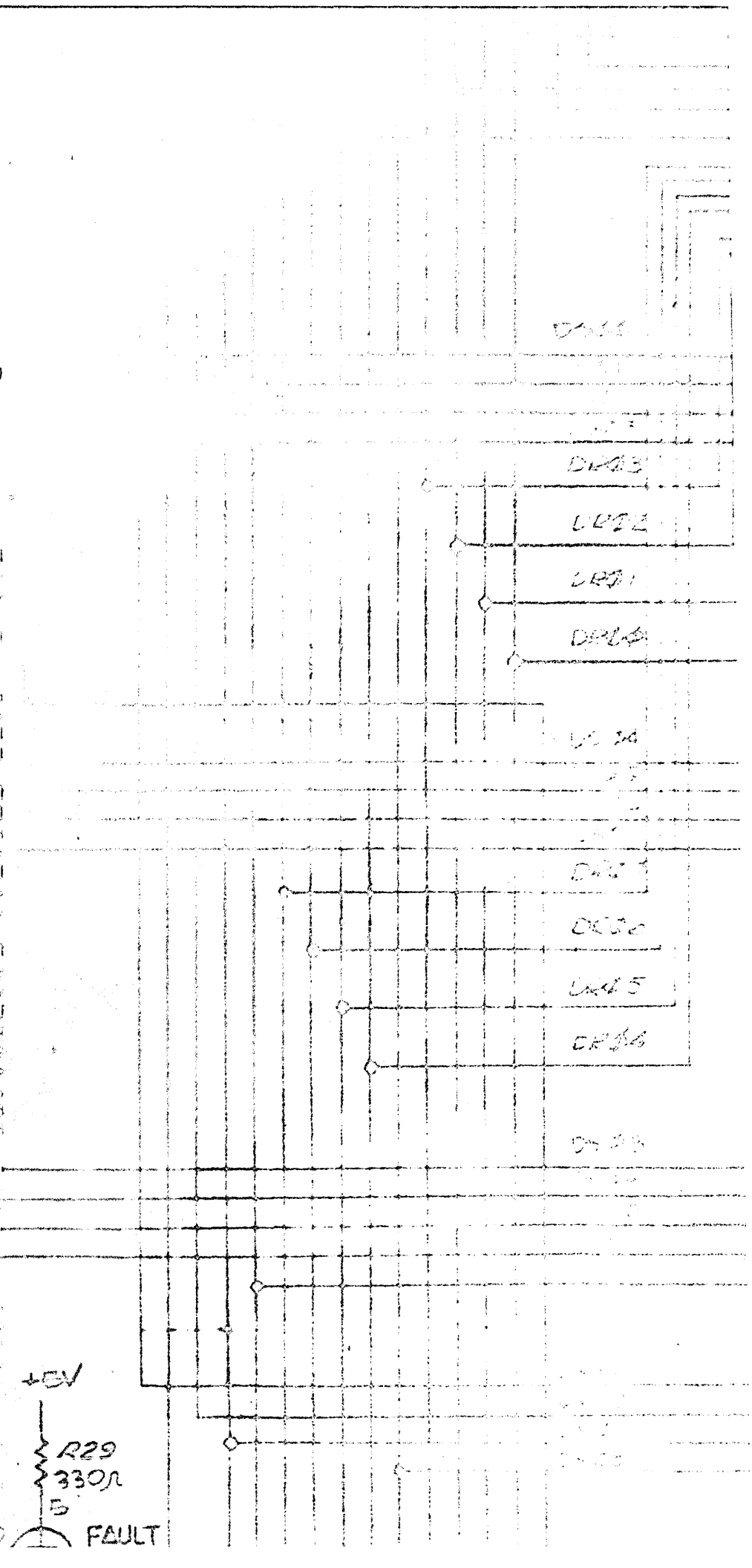
Standing at the threshold of 1970, it seemed a brave new world with unlimited horizons and vast blue skies. Yes, it was a new world. And yes, there was a bit of the sky overall was alive with four nodes and going to 10, as launched timesharing satellite Blue Cross and 2,000 private networks, but IBM's Service Bureau Corp. was thought to have the largest one. Other networks, still directly tied to data, included GSA's Infonet and GTE's just-announced Cybernet.

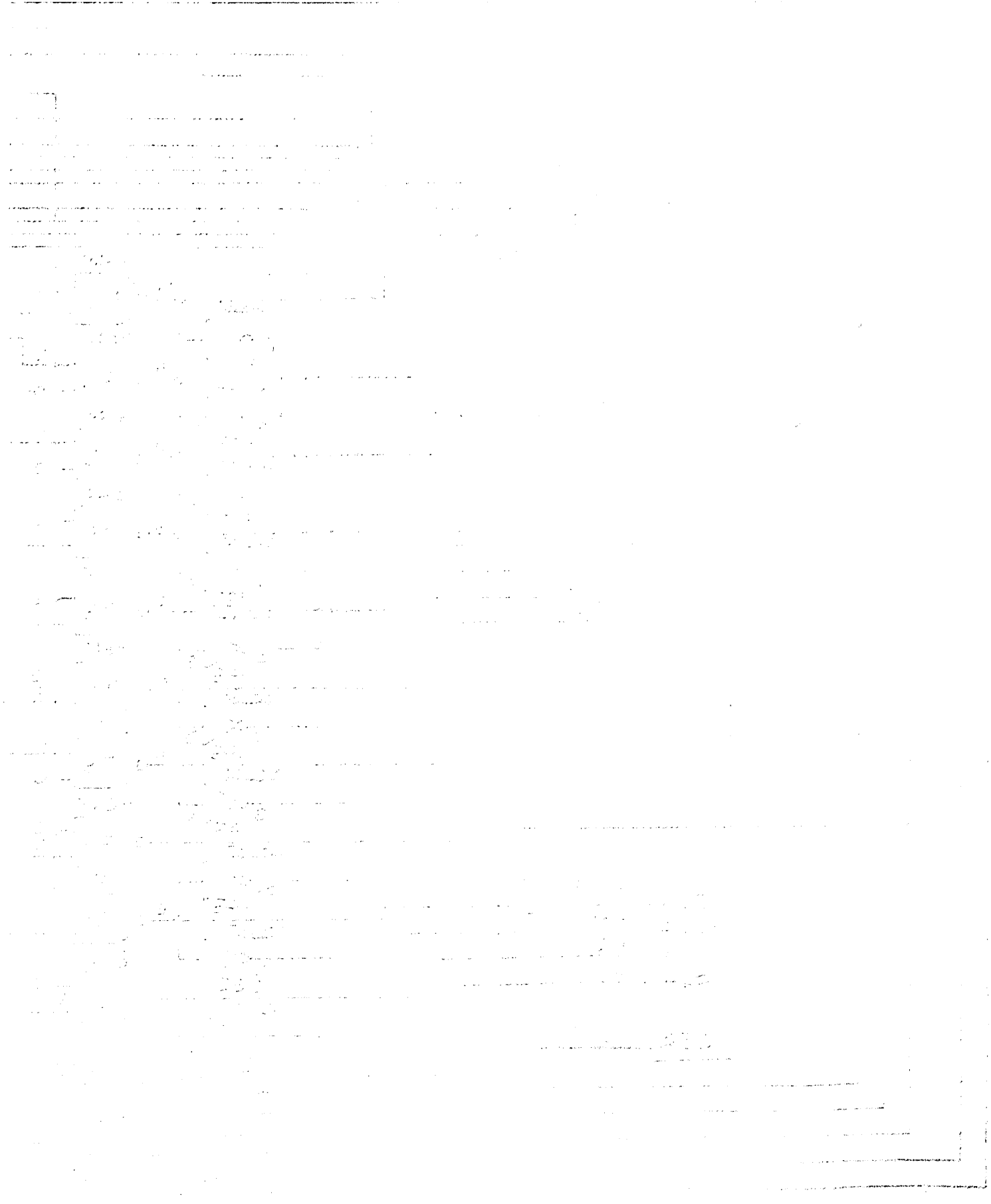
Dixon and ucc, for two, offered 2400bps datasets. Modems for 4,800 and 9,600bps already were taking on the telecommunities. The University of Georgia and a small California company called Computer Transmission Corp. had working optical datasets. The Bell System introduced the DDA.

In 1970 ucc, Southern Pacific, and Sharp requested microwave licenses for long distance phone traffic over, under some pressure, "agreed" to provide local loops to ucc and the others, complaining bitterly about "cream skimming." The ucc disagreed. It also called for giving the carriers the right to share Telpak lines, and for simplifying special surcharge rates levied on Information System Access Lines going to computers.

The Justice Department sided with the ucc in pressuring the phone company and even allowed that it might consider certifying "foreign attachments," maybe with a defense mechanism to protect the phone system itself. The Data Access Arrangement was coming.

President Nixon established an Office of Telecommunications Policy. The Computer & Communications Inquiry was completed. It was decided that service bureaus need not become common carriers, but that they would need protection from the common carriers. The carriers, on the other hand, were handed a split of separate subsidiaries if they were to do service bureau work for outsiders, including





In terms of the many value-added functions possible, the state of the world's data networks is still embryonic.

value-added services of any major significance.

Western Union announced it would have a digital network in two years. Datran was playing with "Satran" as the name of a satellite-based service offering. Hughes, RCA Globcom, GTE, and Comsat all filed for satellite services.

Even AT&T had moments of inspiration when it glimpsed another future. AT&T vice president William Ellinghaus spoke at a conference on "The Revolution in Transmission of Business Information," saying "By the middle of this decade, a long-haul digital network serving approximately 60 cities will be in operation . . . . The new circuits will provide a variety of data speeds, including something in every speed range that equipment manufacturers say they will want or need over the next decade. Call completion times—and that includes dialing, switching, and ringing—will be only a few seconds." He predicted maximum error rates of $1:11-^{7}$.

"By 1973," he was quoted as saying, AT&T would have an eight-city Picturephone network in service, capable of carrying data as well, at speeds up to 1.3Mbps.

Ellinghaus' was far from the only voice speaking in tones of elated optimism. Datran predicted a similar millenium in switched digital service; Telenet predicted $2 billion in revenues early in the '80s. Similar predictions were made by other prospective and actual network vendors, and by computer vendors. Users were told again and again that the answer to all their networking needs were just around the corner.

Datran, MCI, ARPA, AT&T, ITT, Telenet, Tymnet SBS, Xerox, and others inside the U.S and beyond its borders have promised a ubiquitous digital data network service capable of providing switching and value-added functions. Before the first year or two of the 1980s had passed, the promises went, most data terminals and computers were to be able to communicate regardless of protocol. In addition, significant message handling capability was to be placed at the user's disposal, and the market value of these public network services was to be approaching $5 billion.

The user was assured that if ACS didn't take care of him, certainly SNA or another architecture would.

Perhaps the technical questions seemed to have had the clearest answers 10 years ago: of the three basic types of network switching, only one was to inherit the world. Message switching was relegated to the days of telegraph keys and green eyeshades. Circuit switching was thought of in terms of the early days of computing—something like punched paper tape. But Paul Baran's packet switching? Ah, that was the favorite son. Its special characteristics of error correction and alternate routing left visions of little datagrams finding their own ways through a network maze like trained mice.

WHAT REALLY HAPPENED

The visions of 1970 were wrong. Datran died. MCI became a voice network. ARPA remained primarily a research net. ACS was sent back to the drawing boards. SNA has changed conceptually.

There are a few significant public digital networks, such as Bell's DDS in the U.S. and Dataroute in Canada, which provide better price/performance characteristics than past analog practices did. However, these networks, while dramatically better than their predecessors, provide few of the many value-added functions possible. In this regard, the state of the world's data networks is still embryonic.

Few value-added networks are in operation, including Telenet, Tymnet, Datapac, Transpac, Saponet, NDN, NTT-DDX, and perhaps half a dozen more, but the total revenues produced by all of these together are miniscule compared to the promises and expectations. For all the publicity and promotion which has been undertaken on a worldwide basis, the reality is that the average user has not much benefitted from existing advanced networks unless he happened to be tied to Dataroute or DDS.

Further, even the concepts of the technology changed. For one thing, packet switching and circuit switching have come to look more alike. Packet switching has largely dispensed with the concept of self-routing datagrams for the moment, adopting instead a circuit switching method of setting up a fixed link or virtual circuit between sender and receiver for the duration of a call.

The availability of inexpensive processors, meanwhile, has reduced both the time required to set up and process packets and the time to establish a call through circuit switching. As a result, the two supposedly competing switching technologies continue to become more similar in implementation and performance.

If public packet networks have seen only modest success while all this has been going on, private networks based on pure packet switching seem to have fizzled almost completely. Less than 10 are in any operational state, and of these, only one has been bought by the customer.

The acceptance of CCITT recommendation X.25 as a packet switched network protocol standard is a major accomplishment of immediate value. Examples of its effect are provided by Transpac in France, Datapac in Canada, Tymnet, Telenet, and the South African P.O.'s public network, Saponet.

Although X.25 does not solve all protocol compatibility problems, it does at least allow widely differing pieces of equipment to be served by the same communications medium. Saponet illustrates a means of achieving communications capability transparently as well; X.25 is used for packet transmissions, but the hybrid supports circuit switching and Pacuit switching also.

Internetwork connections have also been made possible in the last 10 years, and made to work. Telenet and Tymnet both link to Datapac, for instance, and Telenet links to Hawaii's Dasnet II interisland network.

More has happened on the international standards scene. Not only has an X.25 packet level protocol been adopted by the CCITT, but also a number of other X-series standards. The most important of these are the X.20 and X.21 recommendations, which relate to circuit level interfaces for asynchronous and synchronous devices, respectively. In fact, the X.21 standard is a part of X.25 as the latter is envisioned to eventually be mechanized. In many ways, both X.20 and X.21 perform the same functions as a full X.25 packet level protocol set without all of the complexities of packet switching. Both, but especially X.21, have been supported by carriers and computer vendors alike. Many of the details of the standards, in fact, directly result from AT&T and IBM contributions.

CHICKEN OR EGG PROBLEM

What so far has prevented these recommendations from receiving much attention has been the chicken-or-egg problem of who is to provide the standard first, the common carrier or the computer manufacturer. In January, IBM provided the answer. It announced that X.21 interfaces would be available in a number of products in the second quarter of 1981. A measure of the impact this announcement is bound to have can be seen in the anticipated price differential between the new X.21 interfaces and the older switched network interfaces in use. For an IBM 3705-type device, the per-line interface cost is expected to be $50 a month, where the existing interface runs $140.

Other pieces of the compatibility puzzle are now coming together too, even those relating to protocol translations. If features for matching incompatible devices have proven illusive on a universal basis even for ACS, they have begun to be attained for specific cases. For one example, ITT now offers to make dissimilar facsimile devices compatible through its international network.

A large British publishing and distribution firm, W. H. Smith & Son, Ltd., provides a second example. The firm was faced with a problem in connecting its base of asynchronous terminals to its ICL mainframes, which required synchronous terminals. The problem was solved by performing a data stream conversion at one of the firm's network's nodes—with the added complication

DOOR TO A NEW AGE

Some years ago, members of the American Mathematical Society met at Dartmouth College in Hanover, N.H., to hear presentations of technical papers. One paper discussed a new development at Bell Labs, a relay calculator. At the conclusion of that presentation, an operator sat down at a modified Teletype 26 keyboard, depressed a key, and quietly opened the door to the computer communications age.

The teletypewriter was connected over regular phone lines to Bell Telephone Laboratories in New York City, where the subject of the demonstration, the relay calculator, processed the data and returned its response to Dartmouth.

The year was 1940. In six years the ENIAC would begin operation at the University of Pennsylvania's Moore School. Nearly 20 years later, Dartmouth would again be the site of a related development in computer communications, the Dartmouth Time-Sharing System.

No flags waved. The first incidence of terminal-to-computer data communications was duly noted by the academes and then forgotten. It wasn't time yet for that industry to be born.

Ten years later, in 1950, it still wasn't time. The computer industry had forgotten whatever it had learned about time-sharing.

Computers were built of vacuum tubes—although the transistor had been developed a couple of years earlier—and cpus only knew how to do batch processing. Even operating systems were five years away.

In 1960, computers were capable but demanding, fast but expensive. In casting about for means to harness their energy, designers turned to new forms of processing, multiprogramming if not yet multiprocessing, multiple access, and time-sharing.

Off to a slow start, the data communications industry could be viewed as trailing the computer industry by almost exactly two decades, and there is some evidence that the same relationship exists today, if we will but recognize it.

How far had we gone in the first 20 years? Not far, but some pieces were falling into place. In 1960 Bell was boasting of its new DATA phone service; digital transmissions could be sent over the switched telephone network at speeds of 600 bps or as much as 750bps. Standing at the outboard ends of those DATAphones were computer peripherals, usually punched paper tape devices like Soroban's "standard communications tape," Comex's tape device "for transmissions up to 1,000 words per minute," and IBM's brand-new Model 7701 punched tape transmitter. Product introductions of the period, such as IBM's, were careful to explain the use of a "modulator subset" at one end of the phone line and a "demodulator subset" at the other.

Other exciting communications products of that year included a 3,000-word-per-minute teleprinter from Burroughs, Collins' Kineplex data transmission system, and Stromberg-Carlson's binary data link. We began to hear careful mentions of the possibility of shipping data over leased lines at up to 2,400bps with some reliability.

As always, the Federal Communications Commission played a big role. In 1960 the commission reinstated the right of private users to use the microwave spectrum, and a couple of organizations immediately applied for permission to do so.

Just two years after the 1960 decennium, a giant step was taken in the name of national defense. A computer engineer at a government think tank—Paul Baran at Rand—was given the assignment of conceiving a reliable, error-free communications system that could survive heavy damage during a war.

Baran's design moved the focus of attention from time-sharing to networking. His concept called for an all-digital, computer controlled, nationwide network using packet switching. At his prompting the industry began to think of digital communications as more than what happens between a computer and its terminals—and what a world of difference that has made.

—R.A.M.

that the translation was performed on a Honeywell computer. (It can be done.)

More important than any of these individual achievements in standards, network interconnections, and protocol translations is what they imply: we have come to understand networking more fully and to appreciate the magnitude of some of the problems.

Unfortunately, while we have hacked our way to this level of understanding, the user has been burned and the industry has lost credibility by the bucketful. The user has become inured to vender promises. Many users have decided that the options to be gained by waiting a few more years before jumping into networking outweigh the risks of getting started now. This is a bad decision.

Even viewing the future conservatively, we can say two encouraging things about it. First, it looks terrific. Second, it's much closer than we imagined. Here are some things we can reasonably expect:

- *Digitized voice*. This may not be 10 years away after all. Recent developments in voice encoders have reduced the bandwidth requirement by a factor of 10 or 20. In fact, one-way packetized voice using 2,400bps lines has already been demonstrated—although packetizing is and will continue to be the wrong way to go for two-way conversations because of its inherent delay problems.
- *Network populations*. Where there now are few private switched digital networks—perhaps less than 50 in the U.S.—there may be as many as 1,000 within these borders five years from now, and another 1,000 outside. These will be complemented by a significant number of public networks.
- *Network connections*. A vast growth in internetwork connections will come about in response to user needs.
- *Synchronous operation*. The trend will be toward synchronous networks, to support both synchronous and asynchroous terminals, as well as digitized voice, facsimile, and other graphic data. We can expect to see an international clocking system tied to a world time standard. Several European nations are already well along that road.
- *Hybrids*. Networks will continue to operate in packet-only and non-packet modes, but these will more frequently be mixed for purposes of flexibility and generality.
- *Virtual circuits*. Whether for packet switching or time division circuit switching, virtual circuits are certain to predominate for reasons of line concentration.
- *Self-diagnosis*. Look for increased levels of diagnostic and fault-isolation capabilities to be built into networking equipment.
- *Network management*. Expect a very strong trend toward decentralized control of switching and value-added functions but centralized control of network management functions.
- *Circuit switching*. The message of the late 1960s was wrong. As transmission facilities become better and cheaper and terminals more intelligent, circuit switching will gain in applicability and may well take precedence over packet switching for general purpose networks by the end of the decade. The support for X.20 and X.21 standards by computer manufacturers will be a major factor in causing this to happen.
- *Packet switching*. Packet switching will continue to be strong in those applications where transmission costs are high and transmission quality low.
- *Message switching*. Even this old telegraph-era technology should see a revival of interest, although we may be too embarrassed to give the new form the old name. (What are office automation, electronic mail, and computer-based teleconferencing applications, after all, if not message switching?)
- *Microwave*. This will remain a preferred medium for long distance communications, although not as much for local distribution due to bandwidth congestion problems. (An exception will be in its use for local broadcasting, as in the XTEN proposal.)
- *Fiber optics*. One wave of the future, even for cross-country cables.
- *Satellites*. They will continue to do well, although we are alredy beginning to see several limitations. Spectrum congestion is one. Inherent delay is another. The limitation of greatest moment, however, may be satellite vulnerability, especially in light of inter-

The protocol transparency problem won't be solved in the '80s either.

national tensions.

• *Transport technologies*. There will be a near-doubling of existing telephone plant capacity as TASI (Time Actuated Speech Interpolation) techniques are applied. After all, what do we care if someone else is using the speaking half of our pair of phone wires while we are using the listening half? This is another old technology, but with modern digital techniques to back it up, it becomes an exciting possibility on a very broad scale.

Simultaneously, CCIS (Common Channel Interoffice Signaling) techniques will speed call setup times for both voice and nonvoice services.

• *Local access*. The technical aspects of the local area distribution problem, how office equipment and computers and whatever else will link to on-premise communications facilities, will be largely solved by the end of the 1980s.

• *Universal translation services*. The likelihood of finding a universal solution to the problems of device incompatibility above the interface level is not much better in the 1980s than it was in the 1970s. Instead, we will learn that the solution is not as important as we've believed. We will find solutions for specific problems, however, and an ACS will probably exist in the decade.

"Sorry to let you go, Witherspoon, but your biorhythm just doesn't mesh with Barnaby & Smerch."

• *Higher level protocols*. "Open systems architectures," which attempt to guarantee universality by forcing devices to meet several more levels of complicated protocols (seven is the current thinking), will not become practical. We will probably agree that the approach is not desirable.

WHAT TO DO NEXT?

The fact that we do not yet know how the protocol translation and some other problems are to be solved might still be an excuse for not constructing the needed networks. But this "wait and see" attitude is not in the best interests of our organizations. For many companies, waiting is riskier than proceeding.

Anyone who looks seriously at the future of digital networks must address more issues than those related to technology. While digital communications technology has been coming of age, the world it lives in has been changing. Perhaps the most sobering news has been the shrinking productivity gain; the size of this problem has progressed from being worrisome to the point of threatening the survival of some major corporations.

Where we one evaluated new digital network alternatives on the basis of the costs of the physical communications facilities they replaced, this approach is now definitely inappropriate. If productivity is the main concern, the popular manner of considering networks completely misses the point. Study after study has shown that the average cost of communications is less than 5% of the total cost of an on-line data processing installation. Thus, even a substantial savings in communications costs can have but little impact on reducing overall outlays. More important, if the network can contribute to higher productivity, its value compared to its costs can be enormous.

What we must now ask, for *every* new technology, is "How can this increase productivity within my organization?" Fortunately, the answer is when the technology has to do with networking.

Some forward-looking organizations have set goals for themselves along the following lines:

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Certainly goals such as these depend to a great extent on data base technology as well as on network technology, and in some cases these objectives won't be attained for several years. However, nothing is lacking in technology right now for organizations to move *toward* these objectives. There already

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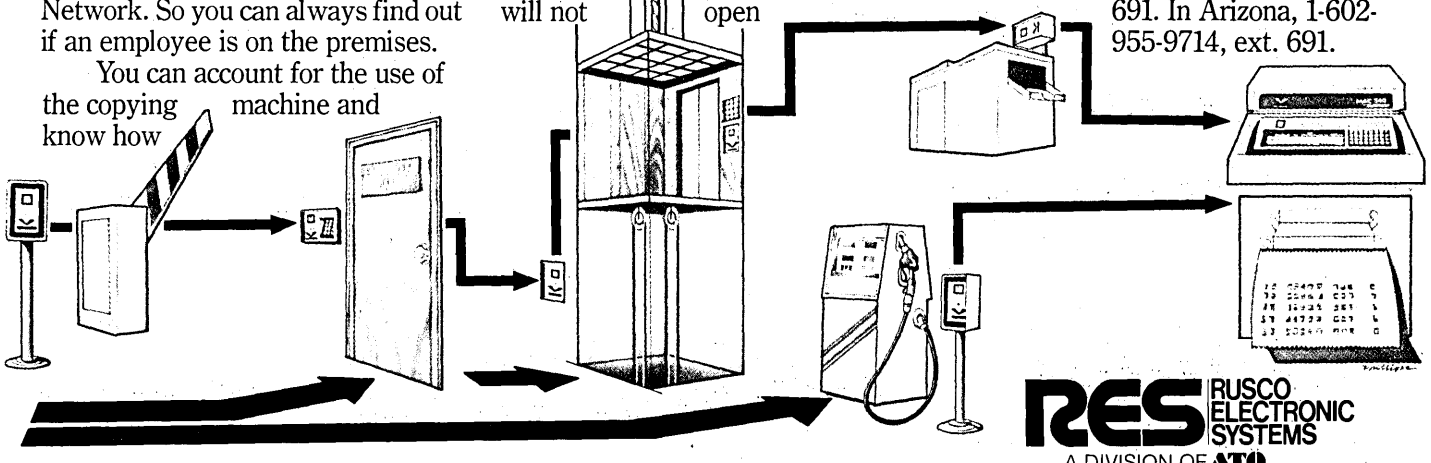

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There is now a greater risk in waiting than in proceeding.

is a low risk approach to networking which will allow any organization to fulfill the above objectives.

What is required is an approach to networking which satisfies the following requirements:

- Fulfills an organization's growing needs to access data bases and exchange information
- Achieves high reliability of operation through suitable redundancy and centralized management
- Guarantees compatibility with future network offerings
- Grows in terms of links and connections to keep pace with increasing user requirements
- Safeguards against obsolescence in the face of changing needs

These requirements can be met. The single most important fact that has been learned over the last 10 years is that the only low risk approach to networking is one that separates some of the key network functions into clearly distinct network entities. The most important separation must be between the "network transport function" (the fundamental transmission, switching, and network management functions which all networks must provide) and "value added functions" (such as protocol conversion, message storage, formatting, and what is now called "communication processing").

Most past failures have occurred because network architectures were devised which logically and physically intermingled these two main elements. If a truly flexible network transport structure separate from the value-added functions is implemented, there will be a low risk approach to satisfy networking requirements.

Fortunately, not only can this network strategy be implemented with readily available equipment, but doing so is vastly easier than attempting to create a panacea. ✲

RAY W. SANDERS

Mr. Sanders is chairman of the board of directors and chief executive officer of Tran Telecommunications Corp., which designs and produces hardware and software for medium- and large-scale digital telecommunication networks. Before founding Tran in 1969, Mr. Sanders was vice president and director of engineering at ITT Gilfillan. He was also one of the founders of Space Electronics Corp. (which became Space General Corp.).

R. A. McLAUGHLIN

Mr. McLaughlin is director of corporate information for Tran Telecommunications Corp. Before joining Tran he spent 11 years on the staff of DATAMATION as articles editor and previously as technology editor. His dp experience includes six years in dp operations in Hughes Aircraft's Aerospace Group in Los Angeles.

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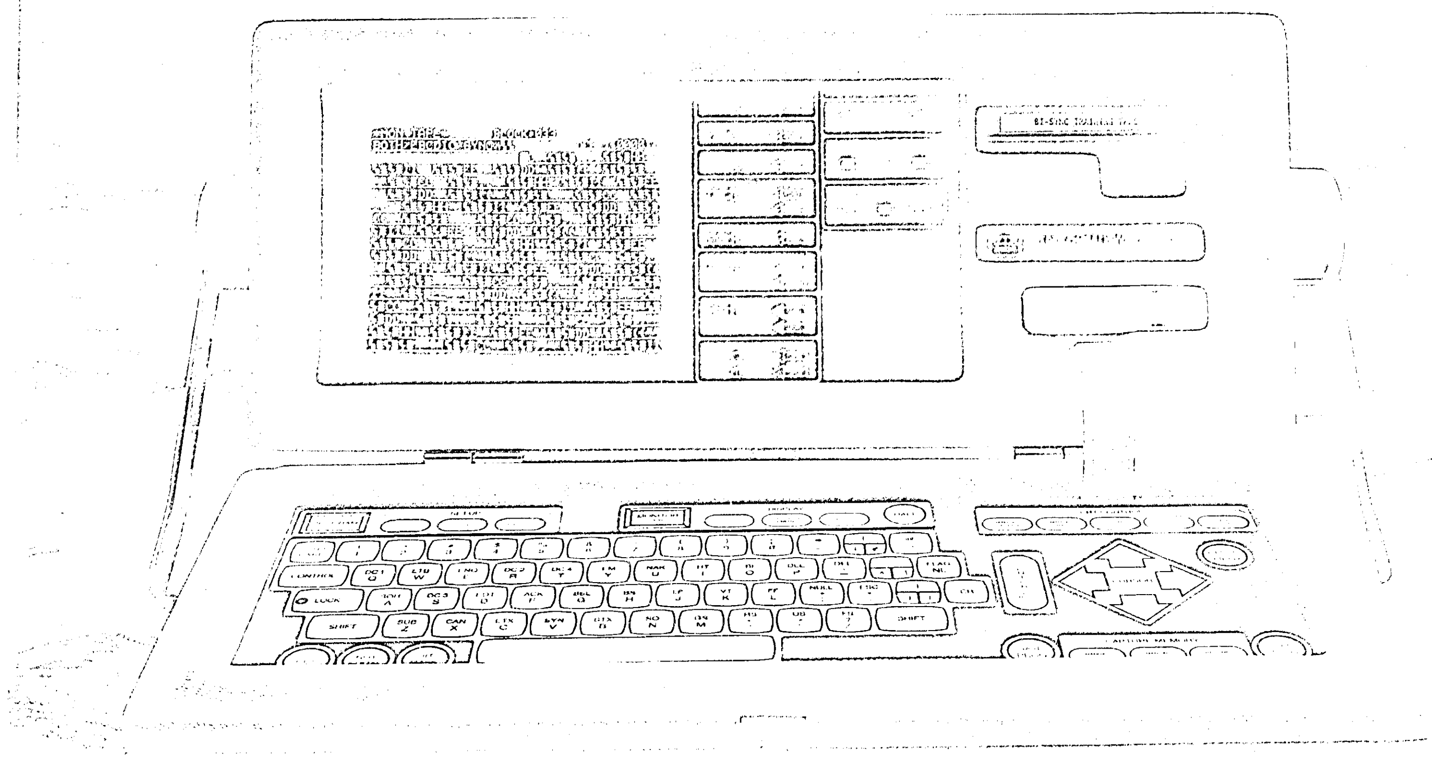

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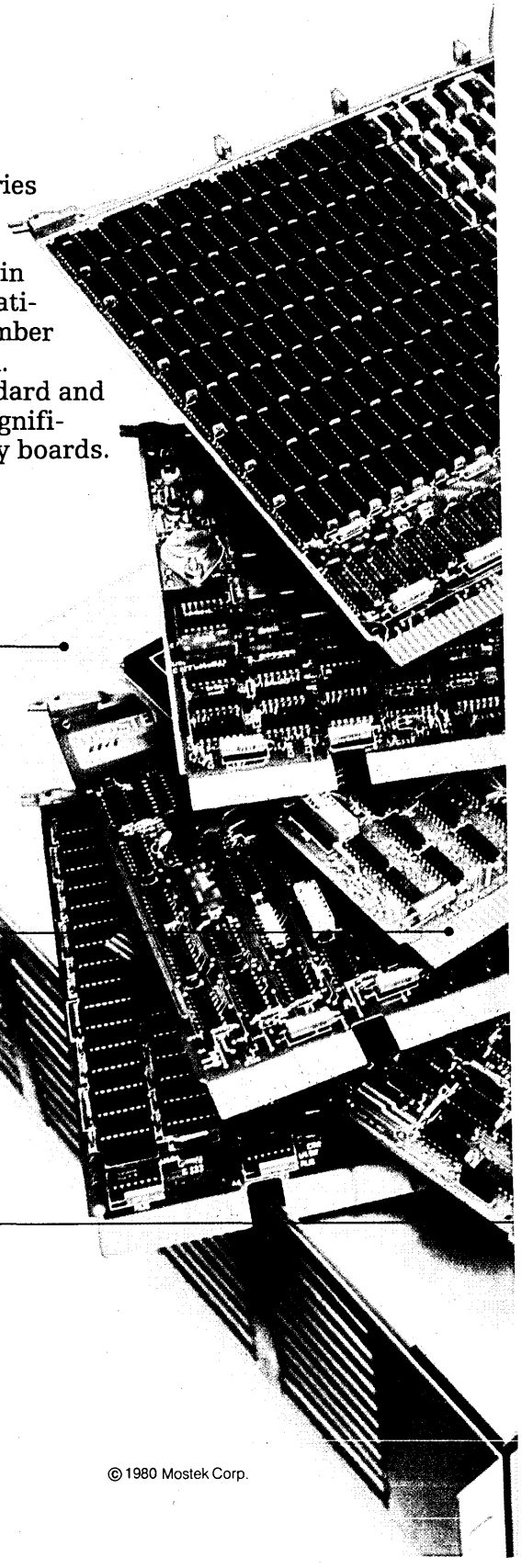

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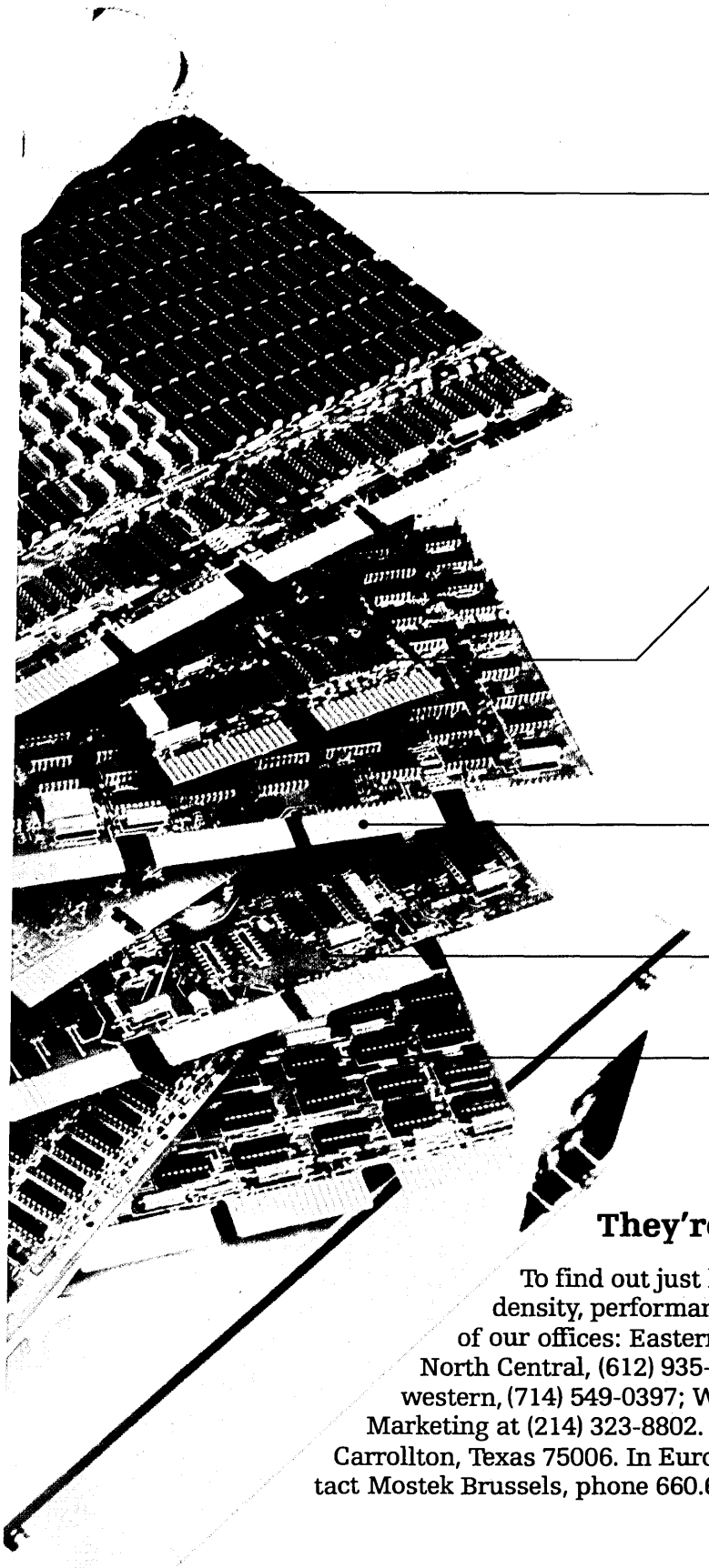

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As the glue that holds together a broad array of products, SNA will probably still be with us in the year 2000.

DOLL ON THE EVOLUTION OF SNA

Systems Network Architecture (SNA) was introduced in September 1974 by IBM; although there has since been a steady stream of announcements, refinements, and product enhancements from IBM, SNA still remains a confusing and complex set of rules for data communications.

To unravel the complexity, DATAMATION telecommunications editor Ron Frank visited Dr. Dixon Doll, president of the DMW Group, Inc., Ann Arbor, Mich., consultants. Probably no one outside IBM has delved more deeply into the nature of SNA, its capabilities, and its utilization than Doll; here, he pieces together its evolution—where it originated and how it grew—its current status, and what we can expect of SNA in the next few years.

ILLUSTRATION BY WINSTON MARSHALL

While SNA is actually a very complex set of rules, it is best explained in terms of products, not concepts. As the glue that holds together a broad array of products, SNA will probably still be with us in the year 2000.

Unfortunately, IBM adds unnecessary complexity to SNA. I have talked to principal architects of SNA within IBM and even they don't have all the answers. But it is absolutely a direction from which IBM is not going to turn back. Whether we like it or not, we are going to have to learn to live with it.

The traditional network environment before SNA included separate networks for each application. Most of these were binary synchronous nets running 3270 or RJE with variations of HASP. In this cumbersome environment, a new network had to be configured to each dp job that was combined with data communications.

In the early 1970s some flexibility was introduced by independent suppliers who offered alteratives like multiplexors, split-stream modems, and intelligent network front ends from such companies as Comten and Memorex. These independent products offered partial solutions to transparency problems, allowing some off-loading from the high overhead mainframe, and generally increased the flexibility of network users.

Complex programming was associ-

Whether we like SNA or not, we are going to have to learn to live with it.

ated with access methods like BTAM, QTAM, TCAM and similar software. The key element for both IBM and independent equipment users was the cost associated with having the people to support the application development process. The cost of finding the people, training them, continuing to depend on these approaches began to eat users alive.

There was no ability to interconnect the broad range of processors, subsystems, and terminals that were available. This presented problems for vendors as well as users. Each time new equipment was introduced it would only work with limited, earlier devices and often expensive modifications and upgrades were required to make limited products compatible. So, the evolution of network architectures helped vendors as much as it helped users. Vendors could not continue to develop device dependent nontransparent networks. The cost was too great.

INITIAL GOALS

A better approach to networking was clearly needed. A standardized architecture was necessary for the construction and implementation of teleprocessing networks. A layered concept was required similar to the structure used by many businesses. Most business organizations are at least partially layered in that they have different departments like marketing, finance, customer service, production, and engineering. Each of these departments has logically independent functions to perform. When modifications or changes are indicated, they can be made within the independent subsystems without having a monumental impact on the entire structure. Exactly this structure was needed for networks.

Another key objective was transparency, the ability of networking subsystems to take any bit stream and move it through the system without modifications. Also needed was the capability to remove communications control functions and device dependencies from the applications program to the maximum extent possible. This would relieve applications programmers from also having to be teleprocessing specialists, and worry about access methods, flow control, and other network problems rather than software problems.

If such an environment could be structured, it would allow a broad sharing of resources so equipment could be used for multiple functions to the maximum extent.

The first version and introduction of SNA really didn't achieve the overall objectives very well. It created an environment in which an access method could be fully shared and a communications controller could be shared so that any terminal of a particular class (like the new SNA terminals) could access any applications program running on a single host. There was no multicomputer network associated with the first SNA implementation. Thus, Version 1 of SNA was very restricted, since 3270 crts and other binary synchronous terminals would not operate under Version 1—only Synchronous Data Link Control (SDLC) terminals could be employed. These terminals were announced as part of the SNA introduction.

IBM made a serious error in assuming users would be ready to migrate immediately to the SDLC terminals. IBM assumed it would be easy to make users migrate. It was a significant marketing miscalculation; users were unwilling to go back to the drawing boards and instantly rewrite their applications to support the new terminals. And users were simply not ready to pay the high cost associated with such upgrades.

Version 1 could have been made easier on the user, based on what was included in Version 2. The second SNA implementation saw IBM backtrack to allow binary synchronous and SDLC lines to coexist in the same network. But bisynch and SDLC terminals could not share the same lines, though they could share the same front end and access method software. Version 2 relaxed some of the sharing constraints imposed in Version 1. There is every reason to believe that this could have been done at the time of the original SNA announcement.

With the announcement of Version 2, SNA supported SDLC terminals, binary synchronous terminals, and some start/stop devices, but it still operated in a single host system only.

MULTIHOST NET POSSIBLE

Version 3 was the most significant in the SNA series of announcements because it marked the first time that multihost networking became possible. IBM used two names for this capability. The more common one was Advanced Communication Function (ACF) but it was also known by the specific descriptor Multi-System Networking Facility.

It now became possible for terminals to obtain access to programs and data bases running on more than one host machine. The idea was to organize the SNA network into regions, which IBM called domains. Each domain was controlled by an application host in much the same way that previous versions of SNA had controlled single hosts. Systems software made it possible for the user of a terminal to set up a connection through the network to a host other than the one which normally controlled that terminal.

There were some strong dependencies on the availability of the applications hosts in the network to take advantage of these features. For example, a terminal first needed permission from its own host before it could establish a connection with a host in another domain. Technically there was no reason for this restriction. Operational limitations were due to the difficulty of dividing up the function of the Virtual Telecommunications Access Method (VTAM) and the Network Control Program (NCP) and reallocating the functions to multiple cpus in a network because of the manner in which VTAM and NCP had been structured. If these functions could have been readily reallocated, many of the problems associated with application host dependencies could have been eliminated.

These limitations could be partially explained by the traditional mainframe mentality of IBM, but mostly it was due to the complexity imbedded in the software, coupled with the fact that the network programs were not modular. There were also marketing considerations that entered into the picture.

A cumbersome multidomain operation became possible under Version 3. Every application host in an ACF network had to be explicitly loaded with the terminal addresses of all the devices that might want to communicate with that host. Managing the addition and deletion of terminals and hosts in this network environment became unwieldly.

Another constraint under Version 3 was the very rigid routing capability. When a primary transmission path in the network failed, a backup path could be selected only by restarting the network from scratch. All the nodes in the communications controllers were given fixed routing rules in advance which could not be modified without redefining the network parameters. This meant that users typically did not reconfigure their nets unless absolutely necessary.

With the adoption of layered architectures, it became important to manage physical networks that delivered virtual connections to end users. Traditionally, IBM and other mainframe vendors had left management of the physical network to the independent suppliers and the carriers.

Version 3 marked the first time IBM entered the area of network management. Users had previously turned to independent suppliers to provide network diagnostics. Now the first of these features began to appear in the SNA environment.

Actually, Version 3 included only a rudimentary start on network management, and it remained for the next implementation to expand it. But Version 3 introduced the Communications Management Configuration (CMC). Under CMC, all terminals were defined as being in the domain of one or more CMC hosts. These hosts ran dedicated applications strictly concerned with network management and administration.

The CMC concept was designed to bring network definition, control, problem determination, and change control to an SNA

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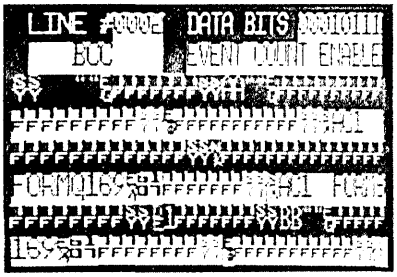

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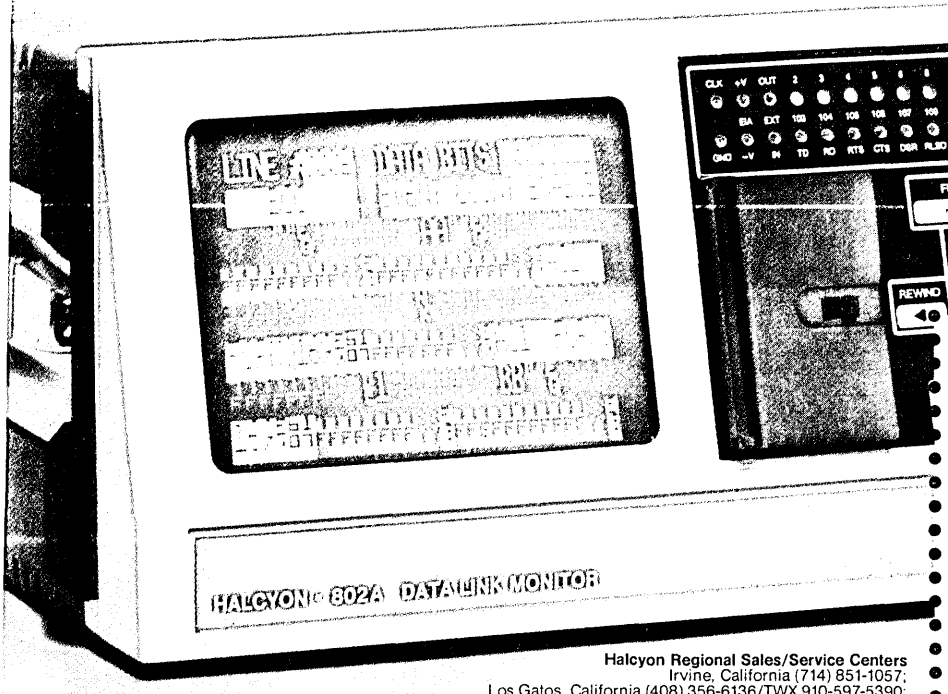

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While SNA has come a long way in meeting user networking needs, additional advancements can be expected.

network in a centralized machine. Although implementation of the CMC was vague, it definitely was meant to eliminate application host dependency from the network.

Version 3 also introduced the concept of network job entry, which allowed batch jobs to be input on any one of the application hosts in a network. Using network job entry, the user was able to specify where a job was to be executed and where it was to be output. By designating different processors in the network, the user had the capability to perform capacity sharing and load balancing for the first time, so the input data, the execution, and the output of a job might each be associated with a different machine in the network.

At this point SNA was still mainly an architecture that enabled relatively unintelligent terminals to communicate with hosts.

PAVING THE WAY FOR 4.2

After Version 3, IBM concentrated on some additional hardware announcements that all had a bearing on SNA. Support was provided for teletypewriters with the Network Terminal Option, and there were strong indications of distributed dp with the introduction of the 8100 and 4300 series. In addition to the 8100, the major SNA thrust in 1979 was an implementation known within IBM as Version 4.2.

Version 4.2 included the introduction of IBM'S first modems with diagnostic features. These modems were designed to be used with a program called the Network Problem Determination Application (NPDA). Operated in conjunction with other SNA software, NPDA collects network error data and stores this information in a data base of network problem statistics. When used with the IBM modems, NPDA can isolate line errors, modem errors, malfunctions in the modem interface, and malfunctions in the terminal control.

While indicating a great leap forward for IBM into the diagnostic area, these advanced SNA features still had a long way to go before they approached the features incorporated by users into customized technical control centers supplied by independent modem vendors.

In Version 4.2, IBM made significant improvements in the transmission network environment by adding alternate routing capabilities. Users now could define alternate data paths (routings) that could be predefined in the system. If one of these paths failed during network operation, an alternate path was automatically invoked by the path control layer of SNA. This was important because the end user and the network operator did not have to get involved. The alternate routing structure resided in each of the network nodes, so a failure in the primary transmission path would cause an automatic switchover to occur. This was a significant improvement in SNA'S alternate routing capabilities.

SNA networks now operated with multiple logical transmission groups, which allowed users to select separate data paths for different types of traffic. This meant users could select separate network transmission paths for interactive and batch data, as an example. While it was an important step forward, this alternative routing scheme still fell short of providing the dynamic adaptive routing capabilities found in public packet switched networks.

Nevertheless, Version 4.2 gave SNA users two levels of redundancy to provide fail-safe operation in the event of malfunctions within the network links. By running multiple links in parallel, it was possible to lose portions of the physical links along one route and still maintain network operation. This avoided the earlier requirement of having to reconfigure the primary route in such cases. As a second level of redundancy, alternate transmission paths could also be activated.

Introduction of the IBM 3863, 3864, and 3865 modems gave SNA users the ability to perform remote site loop-back functions through commands initiated at the central site 3705 front end. These commands were transmitted over the data stream as SDLC frames with unique command sequences that would not normally be interpreted by the terminal cluster controller.

Users had been able to utilize similar remote diagnostic features with independent vendor modems for some time, but now these capabilities were included in the NCP software. With independent modems, remote diagnostics typically required the user to deactivate the line from the NCP so that the diagnostic commands could be sent to a remote network node. This was no longer necessary with the IBM configurations.

Version 4.2 also included software improvements allowing terminals in SNA networks to operate more easily in cross-domain modes. A terminal that operated in the domain of one host cpu could now exchange messages with the domains of other host cpus through simplified network definition requirements.

FUTURE SNA CHANGES

While SNA has come a long way in meeting user networking needs, additional advancements can be expected. Among these are further improvements in the CMC concept to lower the cost and increase the flexibility. The entire process of making changes in the network—adding trunks, adding nodes, and adding terminals or taking them out—must be made trivial for the network operators. This should not require tremendous amounts of specialized expertise and training. IBM needs to develop a turnkey package under SNA or modular alternatives that can be loaded into the network machine to perform these functions.

Networks operated by multidivisional corporations will need features that allow a second level of network operators to control user subgroups. This would allow divisions to run subnetworks within larger physical corporate SNA networks.

New layers of software are needed to perform distributed data base management, to process network files, and provide system-wide directories of data bases and application processors. A significant need in the distributed dp area is software that allows an application program to access a data base even though the data base may be physically distributed among many nodes in the SNA network.

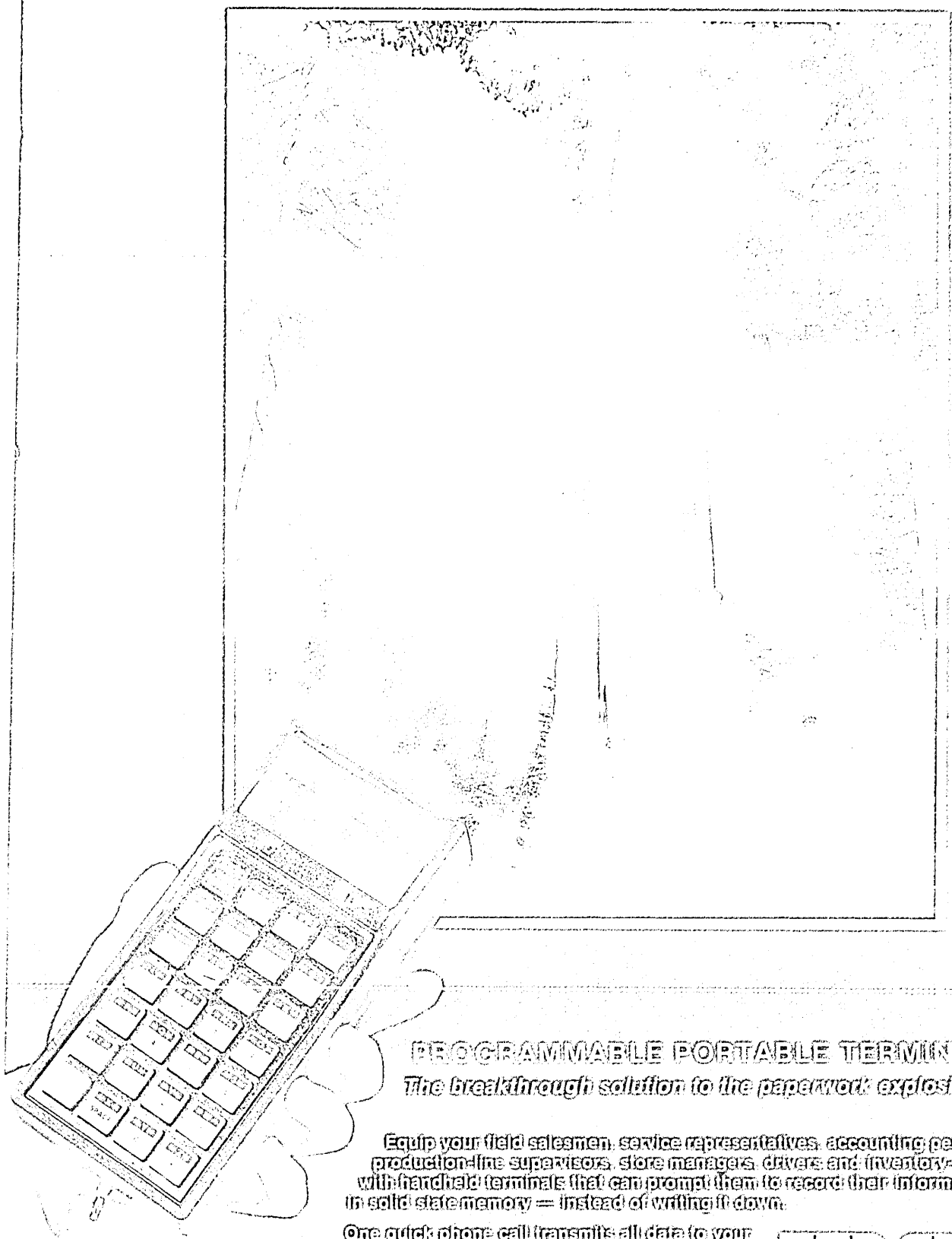
The key to these features is that they must be transparent to the user. Even though they represent some development hurdles, such additions to SNA can be expected within the next three to four years.

IBM is also going to have to address the question of interconnection between SNA and X.25 public networks. The "quick fix interface" now available for the Canadian Datapac and French Transpac networks to interface with SNA has not worked out. Customers in foreign countries which have X.25 public nets will have requirements to connect 4300s, 370s and H series processors on peer basis over the public nets. Thus far IBM has not announced any solutions to this problem.

New communications controllers including the long-overdue successor to the 370X will have to be introduced. These processors will have to be very reliable, fail-safe machines capable of terminating line speeds that operate at T-1 carrier megabit/sec rates and beyond.

The question of voice integration and how IBM will approach customer requirements for an integrated voice/data/message network is still unresolved. A natural evolution will probably be to have an inner layer of physical circuit switching performed by devices like the 3750 PBX and its successor products, which are available in areas outside the U.S. The 3750-type devices will interconnect to 370X and successor front ends to convert physical links to the layered logical links established in SNA nets. This would provide the bridge between internal office automation functions and network data communcations for SNA nets, as well as integrating voice, data, and message operations.

It is reasonable to assume that user requirements and competitive pressures will drive IBM to integrating these now dispersed functions into operational SNA networks. ✻



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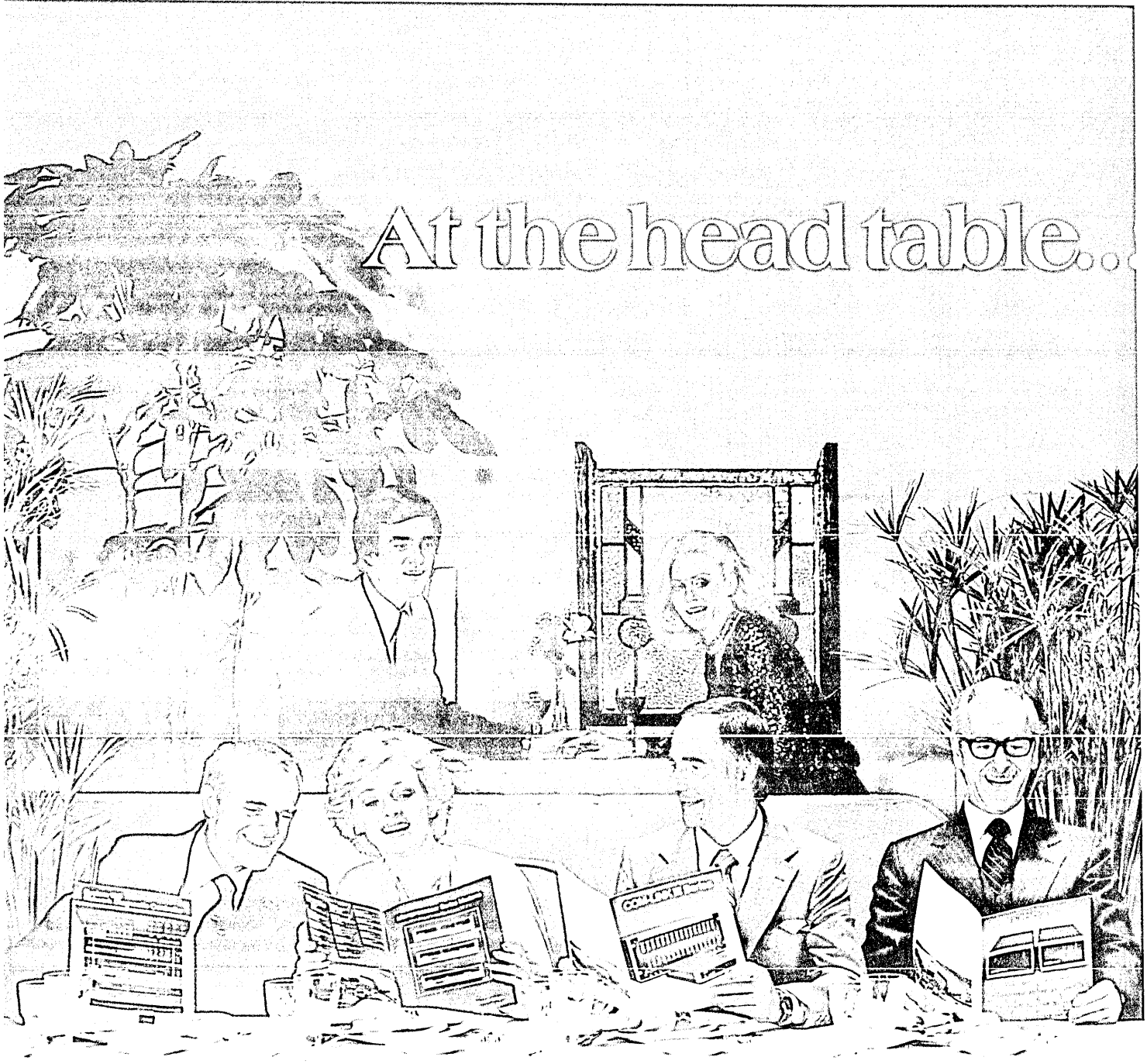

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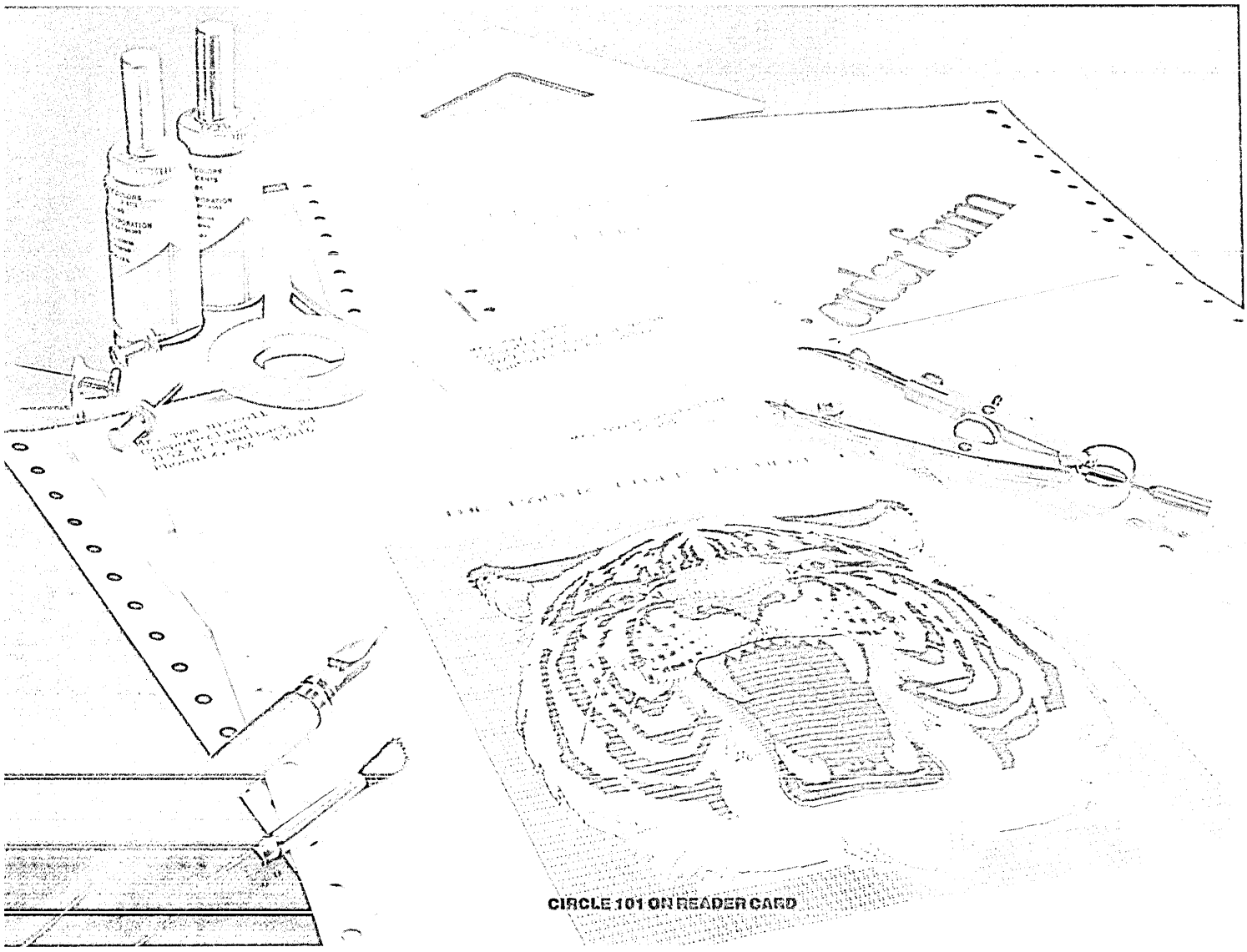

CIRCLE 101 ON READER CARD

From a modem and multiplexor conference in 1973, the data communications conference now attracts all disciplines. It opens in Miami Beach March 17.

INTERFACE: HOW IT'S CHANGED IN EIGHT YEARS

by Tom McCusker

"We're no longer a modems and multiplexor show," said Sheldon G. Adelson early this year as he prepared to stage the eighth annual Data Communications Interface '80 conference and show next March 17-20 at the Miami Beach Convention Center.

What once was a nuts and bolts conference and exposition for a handful of people engaged in data communications or people wanting to get into the field now is a "huge" computer show featuring "communications-based" computer products that will be displayed this year by some 225 exhibiting firms, including at least a half-dozen of the nation's major computer manufacturers. The exhibit and a program of 62 sessions are expected to draw about 10,000 people.

While that figure by no means makes Interface the Superbowl of computer shows —the National Computer Conference drew 80,000 last year—Adelson says new companies enter the show every year; next year, when Interface will be held in Las Vegas, he hopes to be able to offer a total of 1,300 booth spaces to exhibitors, a sizable jump from this year's 800. "We'll soon be as big as the NCC," he says.

Interface began in 1973 in Dallas as a joint effort by Adelson and a now-defunct data communications magazine with a turnout of slightly more than 2,000. The turnout in 1976 of 3,200 more than doubled to 6,500 in 1977 and went up to 9,000 a year later. Last year, Interface held its first conference in a large metropolitan center, Chicago, and Adelson was expecting at least 15,000 or more. (Previous conferences were held in New Orleans, Miami, Dallas, and Las Vegas.) But the timing for the Chicago event was bad—it coincided with Holy Week, Passover, and a United Airlines labor strike —and only 12,000 attended, according to Interface figures.

But, says the ever-optimistic Adelson, a onetime venture capitalist turned show promoter, "If you took the NCC from New York (where it was held last year) and moved it to Miami, there'd be a dramatic falloff in attendance too."

He adds, "It's a question of whether you're looking for quantity or quality." Adelson believes he delivers a quality attendance of people who for the most part have to travel long distances to attend. "A lot of people in New York and Anaheim go to the NCC during their lunch hour," he says.

And at Interface, the attendees pay a lot of bucks to attend. A conference registration fee of $95 gives them admission for the four days of the conference and exhibit; a one-day visit costs $60. (Further information is available at Interface, 160 Speen St., Framingham, MA 01701, (800) 225-4620, and for residents of Massachusetts (617) 879-4502.)

That seems to have attracted the bread and butter of any conference—the exhibitors. Hewlett-Packard, which hasn't exhibited at the NCC for three years, has decided to exhibit this year for the first time at Interface. Other large exhibitors include IBM, Sperry Univac, NCR, Texas Instruments, Datapoint, Northern Telecom Systems, and the Incoterm division of Honeywell. For the first time, says Adelson, software companies are entering Interface.

DATA-COMM, SCHOOL POPULAR

Although most of data processing today is communications-based, few people seem to have a familiarity with the fundamentals of communications. That's why Interface this year expects another record turnout at its popular Datacomm School, a staple at previous shows that always attracts standing room audiences. Adelson says at Las Vegas the schools drew up to 700 persons to each session. Four topics are to be addressed this year at the Datacomm School and will be repeated to accommodate the crowds. The first, Datacomm Fundamentals, will be headed by Tony Carlson, data network manager with the U.S. Senate. It will be held Monday and Wednesday afternoons from 3:30 to 5:30. The second, Hardware/Software Relationships, will be conducted by consultant Murray H. Robinson, of Murray Robinson Associates, Ottawa. It will be held Tuesday and Thursday from 9 to 11 a.m. The third, Databasics: An Introduction to the Communicating Data Base, will be conducted by Peter Moulton, a communications systems specialist with the U.S. Senate computer center, on Tuesday from 3:30 to 5:30 p.m. and Thursday from 11:30 a.m. to 1:30 p.m. The fourth, DDP Networking Concepts, will be conducted by Jon Gould, vice president of DDP Products, Inc., New York. The hours are from 9 to 11 a.m. on Wednesday and from 2 to 4 p.m. on Thursday.

Basic theme of the four Datacomm sessions will be the implications of distributed data processing. Gould, a onetime distributed data processing czar at Citibank, will discuss trade-offs between the lowering price of cpus and the rising costs of software development. Does an installation install cpus indiscriminately, or should it examine the software cost implications and add computers carefully? Moulton will discuss the distribution of parts of large data bases. He said the school won't make its attendees experts but will enable them to talk comfortably with experts. Robinson will explain what happens when numerous systems are linked together into networks and the software that is needed to make these networks work. Carlson's ses-

sion on fundamentals is described as a "nontechnical orientation for newcomers on the basic hardware, software, and transmission concepts of data communications."

Some aspects of office automation also will be introduced at the Interface conference. Don Young, president of Telesystems, Inc., Chicago, and Dr. Henry Petersohn, a consultant with the Department of Health, Education and Welfare, will discuss new tools for office communications on Tuesday. They'll note that last year's microprocessor-controlled sensation was the communicating copier. This year it could be the next generation of all-digital facsimile transceivers. And just ahead is the integration of these and other records management-storage-retrieval systems into one continuous message stream.

In what Interface organizers call a "snapshot of office automation," several sessions on Processing and Communicating the Word are scheduled. In one of these, "Key Trends for Multifunction Office Systems," Dr. Robert Landau, a director of the Information Group in Kensington, Md., and James Folts, vice president of marketing with Syntrex, Inc., of Piscataway, N. J., will help attendees plan for the automated office. Their papers will discuss eletronic mail, computer conferencing, all-digital facsimile transceivers and other multifunction systems for creating the "paperless office."

Ralph DeMent, manager of corporate network services with Digital Equipment Corp., will talk about "New Ways of Integrating Word and Data Processing on Distributed Networks." The Interface organizers said the session will focus on ways to optimize networks so that they can be used to integrate word and data processing as it is integrated on single systems.

Other office automation related subjects: "Developing a Corporate Message Network," "The Executive Information Service: Defining Requirements," "Routes for Delivering Electronic Mail . . . Today." Among the participants in these sessions are Dale Kutnick, Yankee Group, a consulting organization; Ron A. Frank, a journalist and communications authority; and Don L. Eddy, manager of telecommunications with American Can Co., Greenwich, Conn.

MIAMI BEACH convention center where the Data Communications Interface '80 conference and exhibition will be held March 17-20. An audience of 10,000 people is expected.

LARGE TURNOUTS at previous Interface shows drew standing room audiences in some instances and packed, but seated, attendees at others. Annual Datacomm School always draws the most—700 in recent years.

TOPICS TO BE COVERED

Titles of other sessions: *Multifunctionality Is the Mode.* This will be a discussion on how tools and systems can be made to work with more than one system. Robert Pap, Advanced Automation Concepts, Inc., Atlanta, will chair a session on how multipurpose microcomputers proliferate in data communications systems. Lawrence Feidelman, president of the consulting firm of Management Information Corp., Cherry Hill, N. J., will be the chairman of a session on how distributed data processing systems can be used to handle data entry. The session will discuss various approaches that have been used to implement successfully the use of multiterminal ddp systems for data capture, editing, and communication. A third session under this title, for which speakers had not been recruited in mid-January, involves the use of new graphic tools for managers and scientists. "Speakers will stress the multipurpose aspect of this new breed of graphic tools," says the Interface organization.

Trending Toward Extended Network Services. Anthony T. Easton, of Golden Gate Univ., San Francisco, will discuss Viewdata and similar systems whereby business and the consumer can access data bases through television-like sets. Easton, a consultant for 10 years on such subjects and the project manager for several global communications systems, will explain how a combination of extended network services, satellites, microwave towers, cable communications, and television can make such a service happen. "All that's left is the synergistic synthesis," he says.

Managing for Results. Five sessions will be devoted to looking at data communications from the point of view of traditional corporate objectives, such as cost and return on investment. Speakers at one session, "Delivering Information Utility to Remote Users," are Helen Wood, computer scientist with the National Bureau of Standards' Institute for Computer Sciences and Technology, and consultant Gary Audin, president of Delphi, Inc., Pompton Lakes, N. J. Journal-

132 columns underline 8 function keys row & col cntr half & full dplx
132 COLUMNS 8 FUNCTION KEYS HALF & FULL DPLX
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dual intensity menu set-up
STATUS LINE DUAL INTENSITY CURSOR CTRL MENU SET-UP VT-100 OPTION
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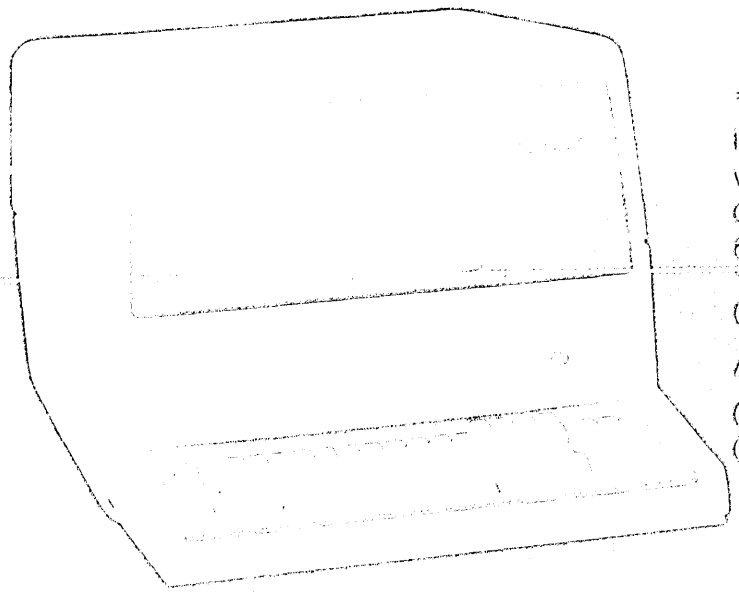

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ist Ron Frank is the chairman of a related session entitled "Five-Year Forecast of Datacomm/DDP Expenditures." Henry Petersohn will lead a session entitled "New Ways to Stimulate Corporate Growth Through Data Communications," and Marshall Johnson, director of organizational and management development with Prime Computer, Inc., will lead a discssion on "New Methods of recruiting and Developing Datacomm/DDP Professionals." Finally, Dennis O'Donnell, president of O'Donnell and Assoc., West Long Branch, N. J., will head a session on career paths for the communications and ddp person in tomorrow's corporate hierarchy.

Simplifying Datacomm Software. This session will offer methods for streamlining the program development process through the use of new software packages and languages. New techniques and tools to build solid operating systems and data base structures for distributed environments will be emphasized, say the Interface organizers. Helen Wood, of the National Bureau of Standards' Institute for Computer Sciences and Technology, is the chairman of a session on multifunction network operating systems in which the speakers will describe the use of new operating systems in off-loading more network programs. Multiple requirements for OS software are to manage data base applications, handle FEP loads, coordinate modal traffic and monitor systems integrity, the Interface organizers explain.

OTHER SUBJECTS LISTED

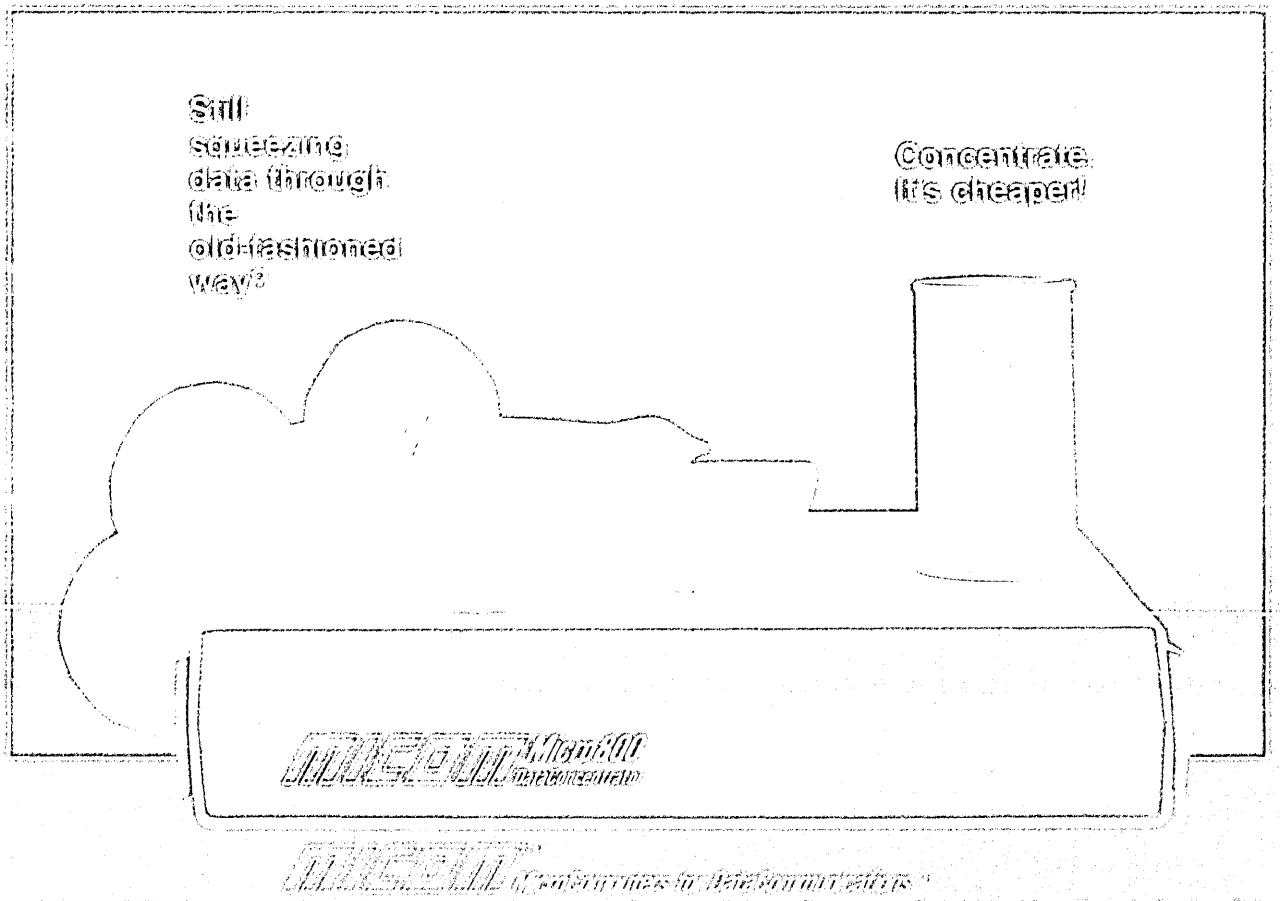
There will also be discussions on federal policy issues regarding data communications; a review of the implications of international telecommunications developments; even more talk than ever before at an Interface show on aspects of distributed data processing; a series of industry case studies such as ddp in manufacturing, retail distribution and insurance and banking; transparent networks interfaces and fail-safe network control; and a technology laboratory in which the Interface organizers say someone probably will talk about "Incredibly Large Scale Integration," the next step after Very Large Scale Integration. The program schedule, however, does not define "Incredibly Large Scale Integration," or list the speaker who will discuss it.

In fact, in mid-January, less than two months before the conference was to open, fewer than half of the speakers had been recruited, said Peter Young, a member of Adelson's 30-person staff that puts together Interface and three other related conferences each year. (Interface West, the Federal DP Conference, and Comdex, a conference for computer marketing people, are the others.)

"It's impossible to have everyone lined up at this time," said Adelson. "So many drop out if you appoint them earlier."

Still, the topics are interesting and possibly most are relevant. If Interface succeeds in matching speakers to the topics, the 10,000 people expected to attend Interface '80 should be in for a fruitful update on data communications. *

DEC, Data General, HP communications costs are down



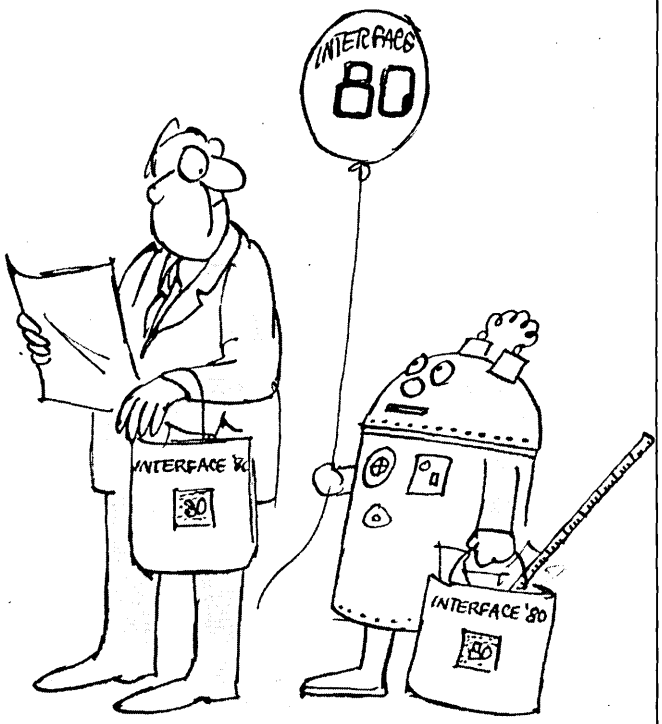
DATA COMMUNICATIONS

"On behalf of Commun-Dat Systems, I'd like to welcome you ladies and gentlemen of the press. First off, how about a show of hands for those who want scrambled eggs . . ."

"Mr. Mullens, this is Verna. Two of the guys called in sick. Can we skip the dance of the multiplexors and go straight to the networking number?"

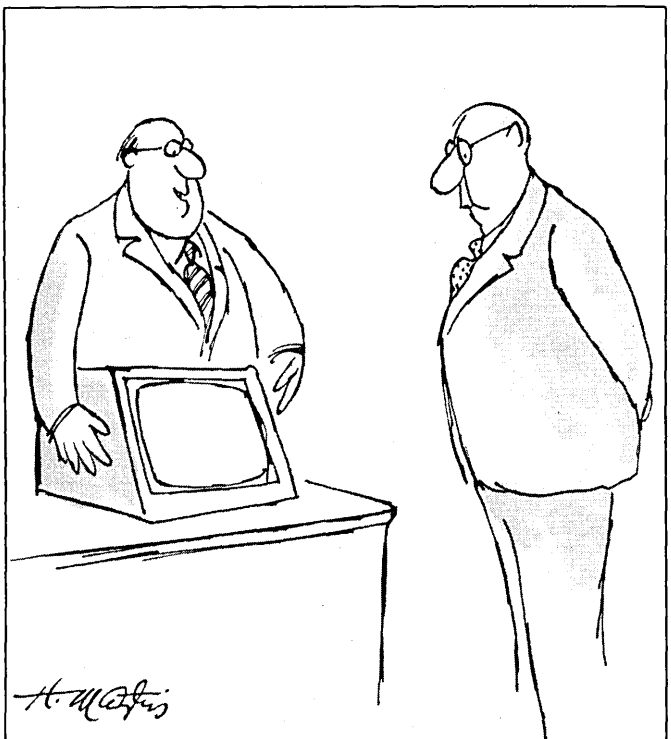
"You have reached an earth station linked to a satellite in the 6GHz band. Please hang up and dial again."

CONVENES IN MIAMI



"Look, if you can put in a good word, I'd appreciate it. This is my first gig since the NCC."

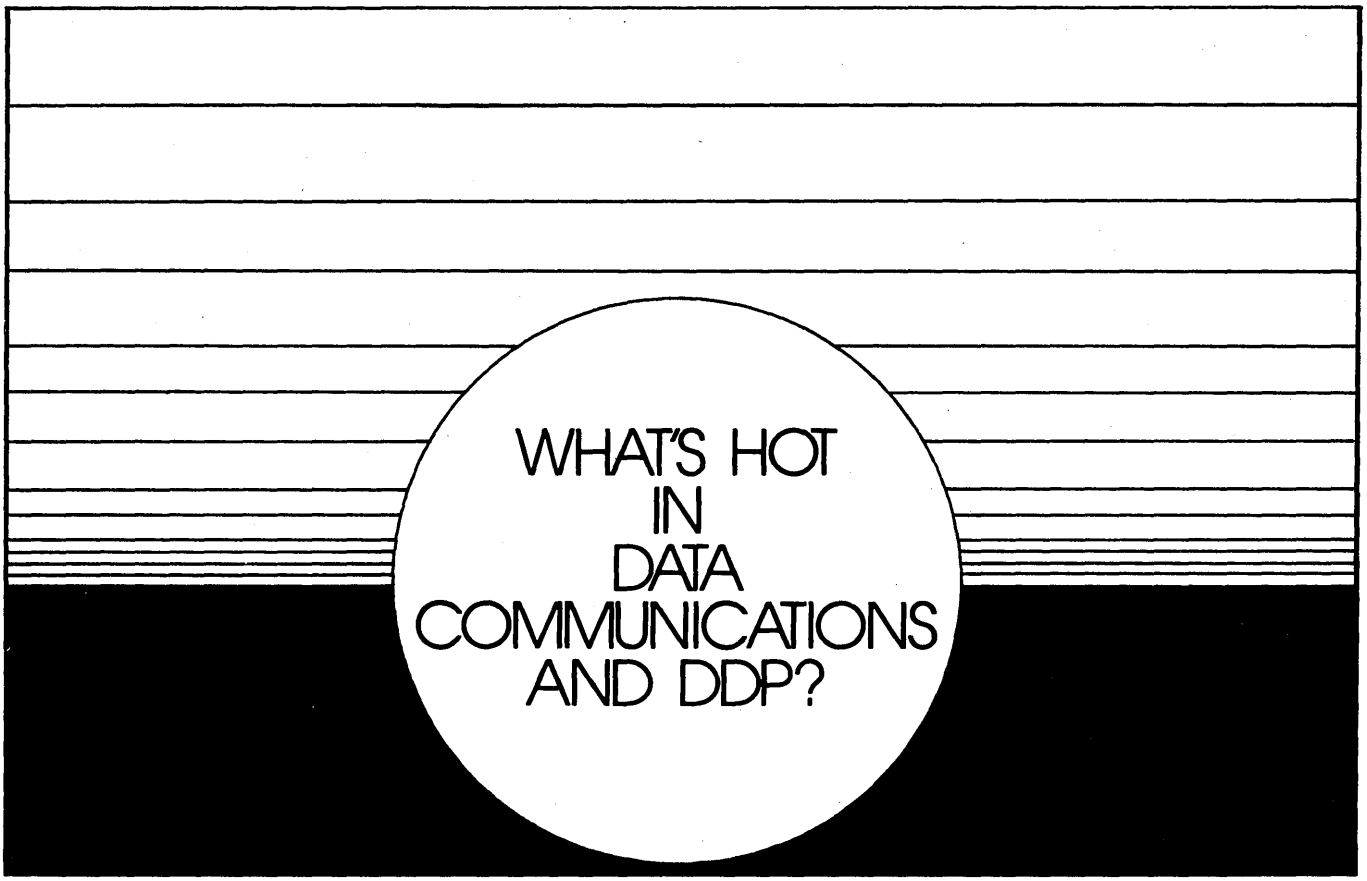
"I thought we were going to talk channel-to-channel architect versus shared-disk but instead we talked Disneyland versus Disney World."



"The real significance of on-line graphics is, of course, that you can create organization charts fast enough to keep up with your personnel turnover."

"It was the classic stand-off, Dot. They were talking 'consulting' and I was talking 'job.' "

DRAWINGS BY HENRY R. MARTIN



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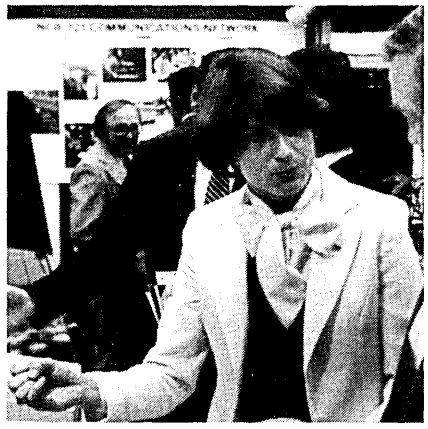

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R.W. Bare, Assistant Corporate Controller, J I Case, A Tenneco Company, Racine, Wisconsin

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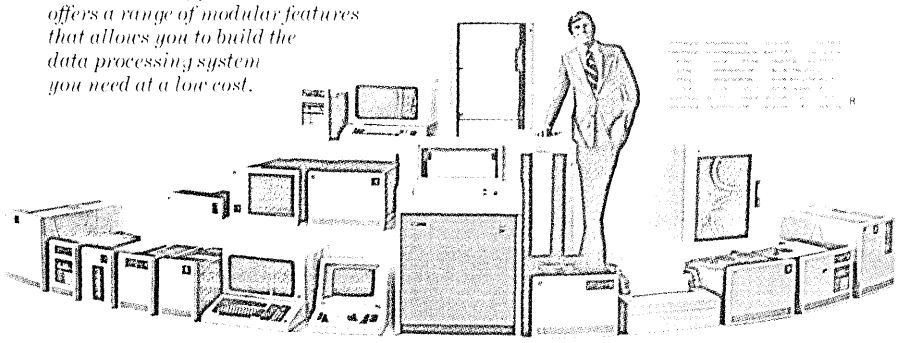

A small computer can make a big difference.

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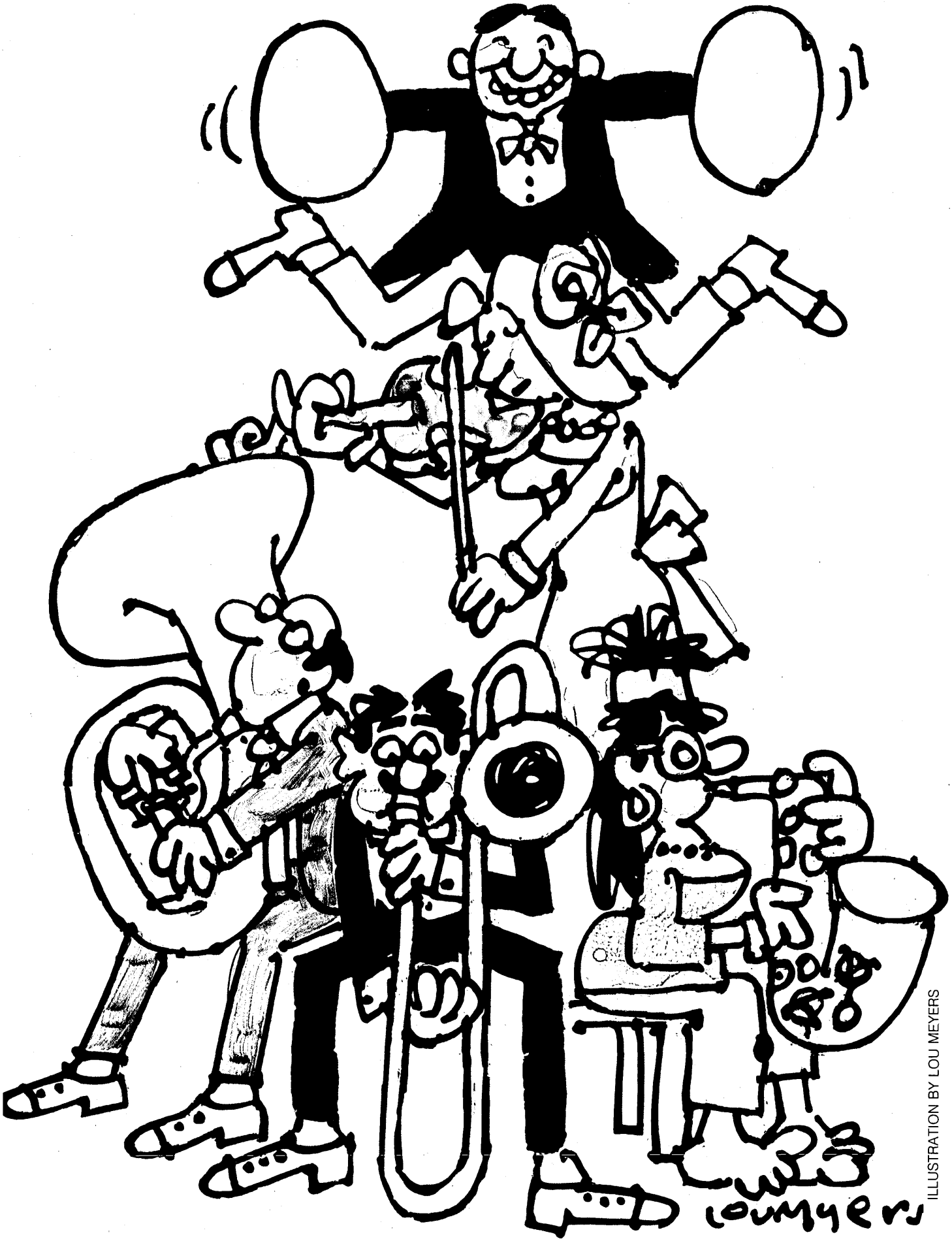

ILLUSTRATION BY LOU MEYERS

Programmers must know at least a dozen languages to create and maintain an application —a significant barrier to increased productivity.

THE NEW TOWER OF BABEL

by John R. Ehrman

We have done little to enhance the productivity of programmers, or to help them improve the quality of their work. In fact, we seem to be making the job of producing long-lasting application code harder, even as we try to simplify it.

One significant barrier to increased productivity is that an "average" application programmer must know on the order of a dozen different languages in order to create and maintain an application—and the number is not decreasing.

The problem will worsen. The widespread use of microprogrammed devices means the number of "language-like" interfaces is increasing, and in an ever-greater variety of styles.

The growing number of user interfaces is making it harder to combine new and old application programs to form larger and more general ones.

These problems can be alleviated by two changes in the way we view the application process:

1. We must no longer optimize the use of computer resources at the expense of human resources.

2. We should eliminate the artificial languages and replace them with a subset of plain English.

I use the term "language" to mean any interface between a computer and its user that requires the user to learn and understand the peculiarities and details of transactions across that interface.

Let's follow a typical program development process through a series of steps.

A programmer is assigned the task of implementing a new system to maintain a file of data relating to an inventory of parts. The programmer will devise the structure of the file containing the data, the layout of the reports to be produced from the data file, the organization of the program, and so forth. Let us follow her on an imaginary path leading toward (not necessarily to) the solution to the problem.

First, she sits down with the people who requested that the program be written and derives a detailed specification of all the requirements the program is intended to satisfy. Since the program is expected to be small and the programming effort limited to one person, the specifications can be written out and understood in a relatively small number of pages. (This is in marked contrast to some large software projects involving hundreds of programmers, analysts, and supervisors: the planning and control requirements of such large projects demand the use of large and complex computer-based systems just to help specify and track the phases of the job.)

After looking over the problem specifications and analyzing them thoroughly, she writes a set of hierarchically organized, top-down structured-programming data flow and HIPO diagrams.

The programmer chooses to write the program in PL/I, since it is the most general and flexible high-level language available. Part of the program is shown here:

```
IF (NUM_REMAINING <= REORDER_LEVEL) THEN
  DO; PUT SKIP EDIT FILE(REORDERS)
        (PART_NUMBER)    (F(20))
        (PART_DESCRIP)   (A(40))
        (ORDER_COUNT)    (F(12)) ;
    REORDER_COUNT = REORDER_COUNT+1 ;
  END;
```

In this example, two distinct programming languages are actually being used. The first is the language of statement flow and process sequencing, the "logical organization" of the code. (This language is the one that has been thoroughly analyzed by devotees of Structured Programming. There are no GOTO statements in the example.)

The second language is what we might call a "formatting and conversion language." It is needed to specify how the program's internal data must be rearranged and converted before it can be put onto an external file. Another example of this language appears in that part of the program where data is to be read into the program:

```
WHILE (END_FILE = FALSE)
  DO ; GET SKIP EDIT
        (PART_NUMBER)    (F(10))
        (PART_DESCRIP)   (A(32))
        (PART_COUNT,
         NUM_REMAINING,
         REORDER_LEVEL,
         ORDER_COUNT)    ((4)F(8)) ;
  END ;
```

As in the previous example, part of the code in this example involves the mapping of data from its representations and organization on an external medium into the format and organization it will have internal to the program.

There is a third language that must be used to specify the internal data types and structures to be manipulated by the processing logic of the program:

```
DECLARE (PART_NUMBER,
         PART_COUNT,
         NUM_REMAINING,
         REORDER_LEVEL,
         ORDER_COUNT)
              FIXED BINARY(31),
         PART_DESCRIP
              CHARACTER(32) ;
```

These three examples illustrate the fact that writing a program requires knowledge not only of an algorithmic language that can be used to manipulate the internal data in a prescribed fashion, but also a knowledge of the external format and representation of all data elements *and* the special "format conversion" language that transforms

the data between its internal and external formats and structures. Thus our programmer must know three distinct languages just to get the program down on paper:

- an algorithmic data-manipulation and statement-sequencing language;
- "format conversion" language specifying the structure of the external data, and the mapping between the external organization and representation of data and its internal organization and representation;
- a language for specifying the internal structure of the data elements to be manipulated by the algorithm.

The programmer compiles her program and gets rid of the errors detected by the compiler. To try to debug the program by actually executing it, she had to tell the Operating System what she wanted done. This required the use of Job Control Language (JCL) statements, such as the following:

```
//FLOTEST1 JOB FCODER,2631,TIME=(1,0)
//TESTCASE EXEC PL1XCLG,
//           PARM.PL1='STMT,NEST,LIST',
//           PARM.LKED='RENT,LIST,XREF',
//           REGION.GO=256K
//PL1.SYSIN  DD DISP=SHR,
//         DSN=DEPT23.E2631.CODER.TEST1
//LKED.SYSLMOD DD DISP=OLD,
//         DSN=DEPT23.E2631.CODER.LMOD
//GO.INPUT   DD DISP=SHR,
//         DSN=DEPT23.E2631.CODER.DATA
```

JCL is hard enough to learn in its "pure" form; in addition, each installation imposes local JCL conventions and requirements. Learning how to use and code these JCL statements correctly requires a substantial investment of time and effort. The programmer writes the JCL statements she needs to get her task started (not done!). To be able to do this, she has to learn both a new language (JCL) and a new set of concepts, to understand the objects to which the control language refers: the Operating System, its structure, and its many components.

Having the program accepted by the compiler, the programmer is ready to linkage-edit it into a test library from which it can be run with some sample data. She finds it is necessary to use some Linkage Editor control statements in order to obtain the results she desires:

```
IDENTIFY   ('INVENTO/FCODER/V0,M2')
INCLUDE    SYSTEM(MODULEA,MODULEB)
INCLUDE    UPDATE(FIXTOC)
ORDER      MAIN,A,B,C,D,E,F
ALIAS      INVENT
SETSSI     ABCDEF01
NAME       INVENTO(R)
```

Unfortunately, she has diagnostics from the Linkage Editor that require getting some help from the systems expert next door:

```
****INVENTO    DOES NOT EXIST BUT HAS
               BEEN ADDED TO DATA SET
****INVENT     IS AN ALIAS FOR THIS
               MEMBER
AUTHORIZATION CODE IS          0.
**MODULE HAS BEEN MARKED NOT
  REENTERABLE, AND NOT REUSABLE.
```

He explains the way the Operating System handles Load Modules, reusability characteristics, and what is really meant when the Linkage Editor says that something "DOES NOT EXIST." Thus, she masters yet another language—the properties, command syntax, and diagnostics of the Linkage Editor.

Having created a workable version of the program, she is ready to test it with some sample data. Due to various oversights and omissions, the program "blows" in unanticipated ways, and produces a dump of memory. In order to find the cause, she has to correlate the symbolic Assembler-Language-like listing produced by the compiler with the hexadecimal machine language code and data in the dump. Once she localizes the problem to a small area of the program, she adds some extra tests to the code to try to expose the error condition. Fortunately, she can use an interactive debugging system that allows her to trace the execution of the program on a statement-by-statement basis.

Thus, we find that program debugging requires a knowledge of three additional languages:

- Absolute binary machine language
- The symbolic Assembler Language for the machine, and the conventions of that language that apply to the program's executive environment.
- The syntax and semantics of the debugging language and the debug control system.

While some progress has been made in providing programmers with better diagnostic facilities for high-level languages, too much diagnostic information is still produced in the form of memory dumps.

In order to set up different test versions of her programs and data, the programmer has to use a variety of utility programs such as IEHLIST (to find out what members and aliases exist in her Load Module library), AMBLIST (to determine the attributes and structure of the members), IEBCOPY (to copy load modules to other libraries), and so forth.

Each of these utilities has its own peculiar control statement syntax and format. For example, IEBCOPY:

```
COPY   OUTDD=INOUTA
             INDD=INOUTE
SELECT   MEMBER=MA,MJ
COPY   O=INOUTB,I=((INOUTC,R),INOUTD)
SELECT   MEMBER=((B,H),(C,J,R),A,(D,K))
```

Similarly, the VSAM Access Method Services language is oriented toward ease of computer scanning, not for ease of use:

```
REPRO   INFILE (SORT -
          ENV (RECORDFORMAT (F) -
               BLOCKSIZE (80) -
               PDEV (3330) ) ) -
        OUTFILE (NAME)
```

Learning the functions of these programs, and the control statements and JCL necessary to obtain needed results, requires another substantial investment of time and effort—the properties, command syntax, and diagnostics of the utilities, and the concepts and structure of the subjects they manipulate.

This is actually a generous grouping of the many distinct and often very dissimilar languages a programmer must use to complete even a relatively straightforward task.

So far, the programmer has used nine distinct languages, and there is still more to be done!

One important program development tool we've neglected to mention thus far is the text editor. In fact, it is probably *the* most important tool, since it is needed to manipulate the "source" (character) form of *all* the other objects. Because it is so fundamental to all programming tasks, it should be the easiest to use. It often is as difficult to use as any of the other tools; most programmers simply adapt because it is so frequently used.

```
top$alter ¬ af * *
dstring/weather/
getfile double items c 10 25
change /_+// 1 *
```

Our example installation is typical in offering half a dozen or more editors, each with different or inconsistent command and oper-

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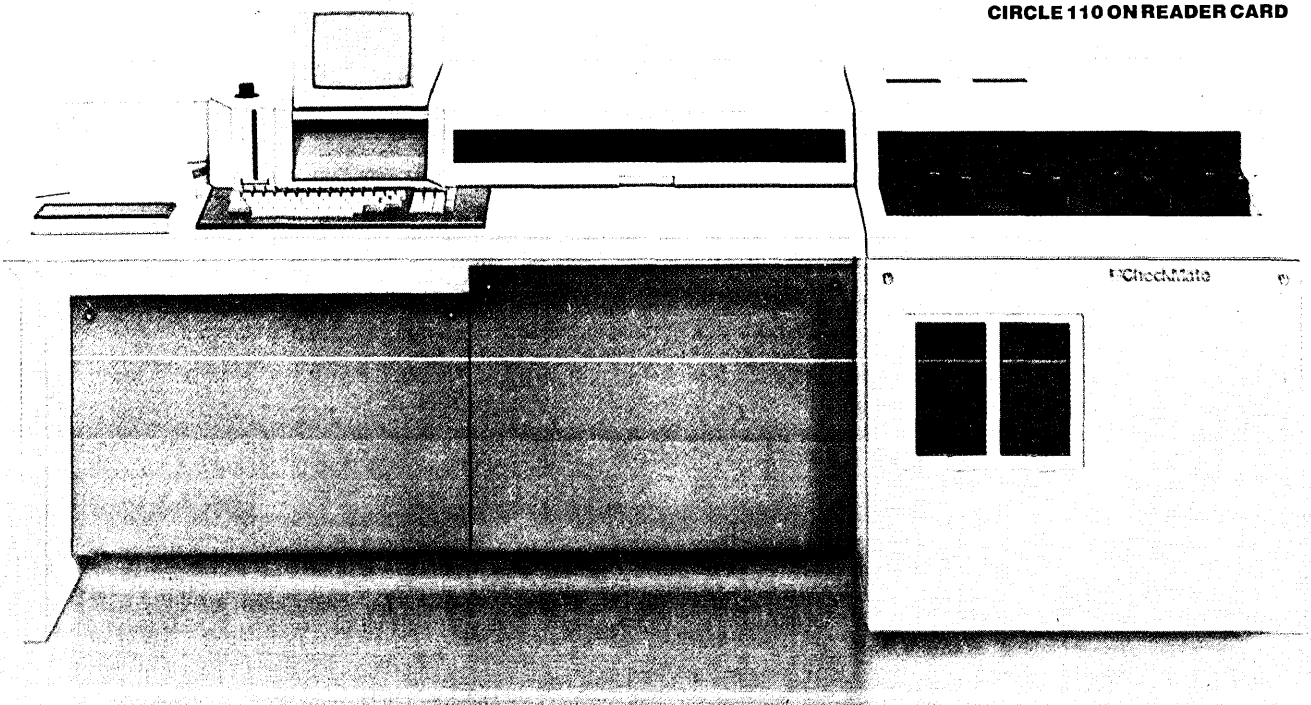

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A single language is not necessary to solve all problems, but it should be sufficient to solve a large set of problems.

and names. Furthermore, these editors use a wide variety of internal and external representations for the text: the records may be fixed or variable length, sequence numbers may or may not be part of the record, the text may be a stream of characters with embedded delimiters, and so forth.

Most of today's operating systems provide some simple form of command language procedure capability that allows users to collect and combine commonly used command strings into a single grouping. Examples are JCL cataloged procedures, TSO's CLIST facility, and the CMS EXEC facility.

```
&LNAME = &CONCAT &1 *
LISTFILE &LNAME SCRIPT * (EXEC
EXEC CMS &STACK
&LOOP -END &READFLAG EQ CONSOLE
&READ VARS &NAME &TYPE &MOD
&SUFFIX = &SUBSTR &NAME 3 6
&NEWNAM = &CONCAT &2 &SUFFIX
&IF &RETCODE EQ 0 &SKIP
```

Most system command languages are so difficult to use without command procedures that it is essentially mandatory to know the command procedure language as well.

The programmer finally arrives at the end of her programming task: the programs run correctly, they are to include specification changes, and the results are acceptable to the users. All that remains is the documentation.

However, the program documentation is to be computer-formatted, so she also has to learn the rudiments of a text-formatting language. A typical language used for formatting documents is SCRIPT:

```
.se pubTFnum = '&&&1'
.ur .pt &pubTFnum.              &2
.pt .sp c;.dh set 1
.ur .sr tmp = L'&pubTFnum
.ur .if L'&tmp lt &tmp1;.th .fo centre
.el .ur .of L'&pubFIhdr+L'&pubTFnum+4
```

Unfortunately, *writing* the documentation turns out to be the hardest task of all! In addition to all the other languages she had to master to get the job done, she is expected to be skilled in the use of plain English. Needless to say, it isn't easy to find people who can write clear English in addition to using many artificial computer languages.

Our examples of programming languages did not require some of the additional languages often needed in other applications, such as:

1. Different techniques and utility programs are necessary to maintain multiple versions of source, object, and executable code, along with the patches and temporary fixes at each level.

2. Special languages are used for stating problem requirements and task design specifications, and for project monitoring and control.

3. There are special languages used for describing and accessing the contents of data bases, and for describing the interfaces from other programs into a data base system.

4. Reports and statistical analyses are customarily produced with specialized report-generating and data-analysis languages.

5. Every programmer must plow through piles of incomplete, inconsistent, inadequate, and even incorrect documentation to try to learn all of the truly *necessary* languages.

Learning to program well requires learning each of these many languages well, and knowing which is appropriate under which circumstances.

So development of even the simplest applications requires knowledge of a round dozen languages:

- Algorithmic "processing-logic" statement flow
- External data description and conversion
- Internal data typing and structuring
- JCL or its equivalent
- Linkage Editor or Loader
- Absolute binary machine language
- Symbolic Assembler Language
- Debug and Diagnostic System
- Utilities
- Text Editor
- Command procedures
- Text Formatter
- Plain English

The artificial languages were designed to simplify the mechanics of translating them into actions for the machine to obey. Programmers are forced to learn a variety of unnatural languages. Because the managers of such programmers typically do not have the same levels of knowledge of these artificial languages, communication between manager and programmer is made more difficult.

Each of these programming tools has its own particular syntax, semantics, and data objects. There is little or no compatibility. The diagnostics of each language are couched in terms peculiar to the language and its area of application.

There is a further difficulty: as we move from lower to higher levels of control, the languages change. We have programming languages to manipulate data, command languages to control programs, command procedures to control commands, and text editors to manipulate the others.

These languages are all different, making it hard to combine procedures into a coherent application package. To do this now, a programmer must write scaffolding or bridging software with the sole function of holding the pieces together.

TWO POINTS OF VIEW

We can characterize our present situation from two perspectives: the programmer's and management's.

First, a programmer is a polyglot: he must be able to interpret the sense and intent of a problem statement, and translate it into a dozen other languages with as little loss of meaning as possible. And, like translators, the skill and effort required often leave little time for reflection on the process. A programmer is lucky if he can contribute much beyond the skill of his translation. It is difficult for a programmer to stand back and take a long look at the entire program development process to see what should be done to improve it. Another effect of having to program in so many different languages is that programmers must constantly reinvent the wheel. A function coded in one language must be recoded in another because it is very hard to mix and match among languages.

Secondly, management attention is still focused too closely on optimizing computer utilization, rather than on optimizing the utilization of resources, including people *and* the computer. Stated another way, we often emphasize quantity of computing instead of quality. We tolerate excessively high levels of complexity at the lowest levels of programming (e.g., in operating systems) to obtain greater hardware efficiency, making life difficult for application programmers.

It is clear what is needed:

1. We must reduce the confusing multiplicity of languages and syntaxes needed to develop even the simplest applications.

2. We must minimize the number of translations from the original English-language specifications into artificial languages.

3. There need not be a single language to solve all problems, but one language should be sufficient to solve a large set of problems.

4. Linguistic consistency and uniformity is needed to combine procedures written at different levels of procedural control. ✻

John R. Ehrman is currently the manager of user services, Computing Center, at the Stanford Univ. Linear Accelerator Center. Prior to that, Mr. Ehrman was affiliated with the Computer Center at the University of Illinois.

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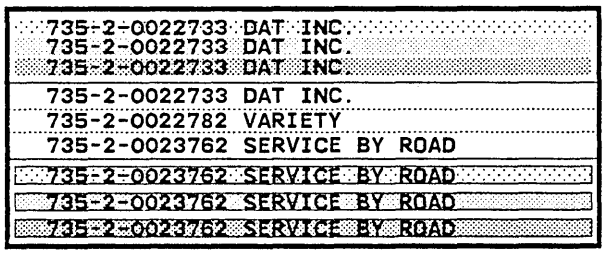

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One programmer working 60 hours a week can complete a project in the same calendar time as two others, but at three-quarters the cost.

SOFTWARE MANPOWER COSTS: A MODEL

by Bob Esterling

In any major software project, project cost and time schedule are the two quantities of highest interest to management, and manpower is the variable most easily manipulated to control these quantities: more people are hired to accelerate the completion of a project. However, as is well known,* the more people working on a project, the less efficient is the effort—communication takes a larger part of the working time.

Here, we will quantify the relationships among costs, time, and manpower so managers may better determine the optimum number of people on a project. Because the best and most productive programming often occurs in the wee hours of the morning, we will also examine the effect of a paid overtime policy. (Productivity increases after normal working hours because a task can be completed without interruptions; concentration and continuous thought are required in any creative process. In light of this consideration, the effect of interruptions on productivity plays an important part in our model of manpower cost and utilization.)

There are several assumptions implicit in the model. First, there is no learning period adjustment for new people joining the project. This is based on an assumption that all personnel start with the same knowledge and background or that no new people join an ongoing project. Secondly, it is assumed most people want to do a good job at their assigned task, and that workers are happiest when doing productive work. Third, average parameters for a project are used in this model to avoid unessential complexity.

Although the model is applied in this article to a programming environment, the model is general, and can be applied to different activities by selecting an appropriate set of parameters for that activity. A set of parameters that might apply to the typical factory worker is used here for comparison to a programming environment. Other creative activities—engineering design, systems analysis, research projects—will yield results similar to those for programming.

MODEL VARIABLES

The two major manipulated variables in the model are:

n: the number of *interacting* people in the project. Interacting people are the persons working directly on the project (Indians, not chiefs). Supervisors are included only if they are full-time contributing members of the team; otherwise, supervisors are considered part of the indirect project costs.

o: the average number of overtime hours per workday per person. A workday is defined to be an eight-hour period with weekends excluded. Any time worked over 40 hours a week is defined as overtime.

For purposes of the model, it is assumed that only productive work occurs during overtime. Meetings or nonproductive work are assumed to occur during the basic workday. Any other procedure would defeat the purpose of overtime and merely act as an extension to the basic workweek.

Two other important variables are:

md: the number of eight-hour mandays of direct work to complete the project. Direct work means productive efforts such as design time, coding, documentation, etc., but does not include discussions about that work. Given a level of programming expertise, any project will have a specific finite value for md, although if known at all, it is not usually known until the project ends.

s: average personnel base salary per hour. Costs in this model scale directly with s. A second order effect for which more experienced programmers have higher salaries and (sometimes) higher productivity is not taken into account here.

The results of the model are expressed as ratios independent of s or md so that in this model these are not true variables, important as they may be in determining the absolute cost and duration of a project. Estimating md for large projects is difficult; it is gratuitous that the results of the model do not depend on the absolute value for md.

Not all people want to work more than 40 hours a week or work well if they do. Some people will want to put in many hours one week, but no more than 40 the next. Some people cannot work continuous 50-60 hour weeks without burning out. Thus, to be effective, an overtime program must be strictly voluntary. Any hint of management imposition or the suggestion of expected extra hours will lead to employee resentment. All management can do is present an attractive situation for overtime work; this includes differential pay, free access to the facilities, and relaxing the 9-5 workday boundaries.

MORE PARAMETERS

There are five model parameters that affect work efficiency and two that affect cost:

a: average fraction of workday spent on administrative or nondirect work. This includes the preparation of budgets and schedules, department, company, or union meetings, the writing of status reports.

t: the average duration of a work interruption in minutes. This includes interruptions such as meetings, discussions with coworkers, visits to the bathroom, etc.

r: the average time in minutes to regain a train of thought after an interruption. Programming and other creative work need continuous blocks of time to follow a piece of work to its conclusion. Any interruption forces the worker to recall where he was before the interruption and to partially rethink some of the process. Errors are made most frequently after interruptions because the thought process was not continuous; thus the continuous work that often occurs during

*Brooks, Frederick P. Jr., *Mythical Man-Month*, Addison-Wesley Publishing Co., Reading, Mass. 1975.

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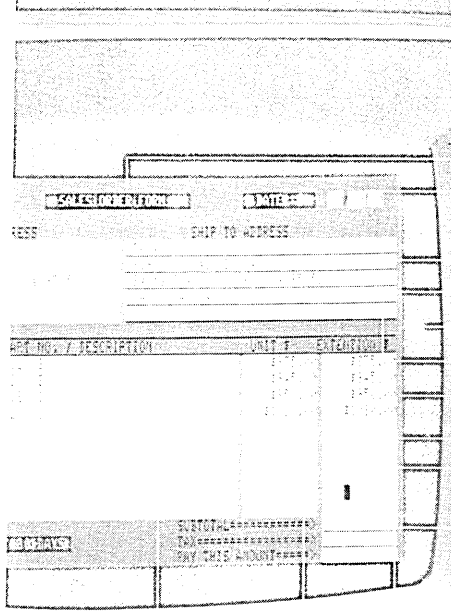

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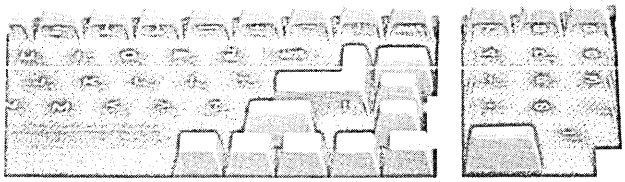

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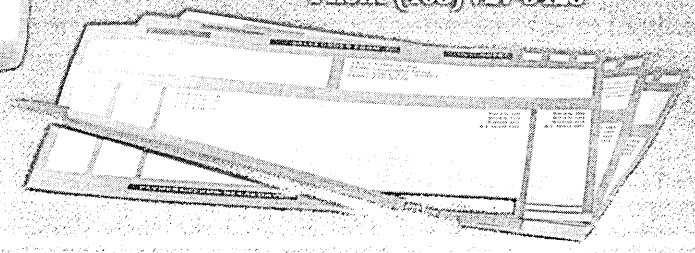

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overtime is often of better quality.

k: the number of interruptions per workday from people working directly on the project. These interruptions are usually necessary and valid. They are needed to coordinate efforts, to define interfaces, to have design and code walkthroughs, to discuss results, to integrate systems, etc.

p: the average number of interruptions per workday from all other causes. These include talks with the boss (unless he is a full-time worker on the project), talks with office-mates about vacations, weekend activities, etc., trips to the bathroom, vending machine, etc. It is assumed that p and k do not increase substantially with overtime.

i: indirect costs per person expressed as a fraction of base pay. These include employer social security taxes, janitorial services, supervisory costs, administrative and secretarial burden, building amortization for desk space, telephone and electric bills, computer costs, etc.

d: differential pay for overtime hours expressed as a fraction of the base salary. This is the time-and-a-half with double time on Sundays that hourly workers usually earn. Managers and programmers often are not paid anything for overtime hours, but are expected to work overtime on occasion. The effect of paid overtime on project costs is one of the results of this study.

Table I is a list of these parameters with the expected range of each and an estimate of their value for a factory worker, a typical programmer, and two sets at the extremes of what may be considered to apply to programmers. The optimistic programmer set does not imply that these values apply to the best programmers, just that this is an optimistic set of parameters for a given software situation. Values of these parameters may vary considerably with each situation. A survey might be needed to quantify the parameters. The values given in Table I are based upon the qualitive observations in several different programming environments.

There are five calculated ratios which represent the output from this model:

w: fraction of useful working time on project per workday per person; closely related to direct labor. This is computed as follows:

$$w = [\ 8 + o\ -8a\ -4r/60\ -p(t+r)/60\ -k(n-1)\ (t+r)/60\ ]\ /8$$

In the above, 60 is the conversion factor from minutes to hours and 8 is the number of hours in the standard workday. Within the brackets, 8 and 0 represent the standard and overtime hours on the job, but this time is diminished by the effect of the remaining four terms. The third term subtracts time at work but not on direct on project work. The fourth term represents thought reorientation time after lunch, two breaks, and in the morning.

TABLE I.

VALUES FOR MODEL PARAMETERS

Parameter	Range	Factory Workers	Programmers Optimistic	Typical	Pessimistic
a	0-0.5	0.0	0.05	0.10	0.15
t	1-120	3	3	5	10
r	5-10	0.5	0.5	2.0	8.0
k	1-10	1	2	3	4
p	1-10	1	1	4	10
i	1-3	0.2	0.2	0.5	1.0
d	1-2	1.5	1.0	1.0	1.5

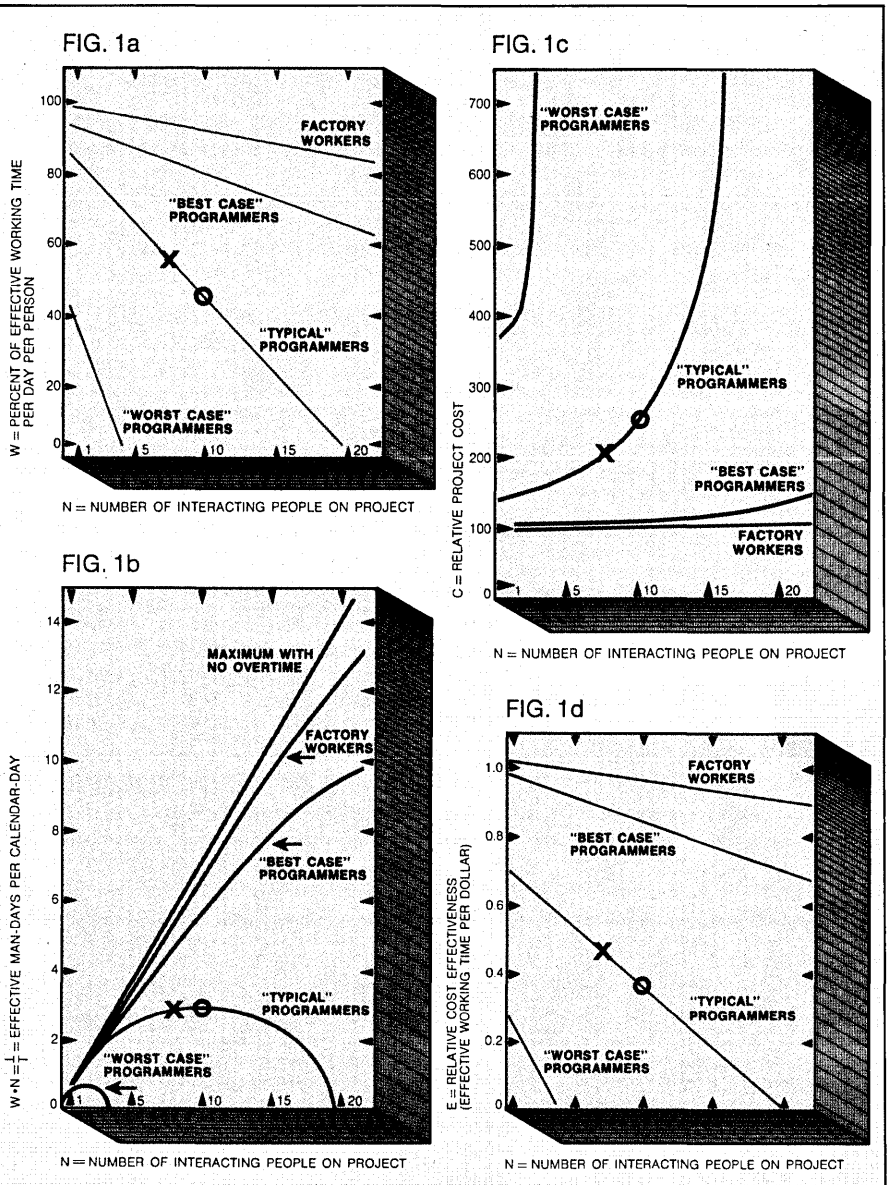

Fig. 1. a) The percent of effective working time per day per person, b) the effective number of man-days per calendar-day, c) the relative project costs, and d) the effective working time per dollar. In each case the horizontal axis is the number of interacting people on a project. The different curves are for the four sets of parameters given in Table I. The X represents the point at which the project time-cost product, CT, is at a minimum; the O is the point at which the project completion time is minimized. The maxima in the curves indicates that there is some n for which the addition of more people can increase the project completion time (and cost) even ignoring learning curves for new people.

CHARTS BY CYNTHIA STODDARD

FIG. 2

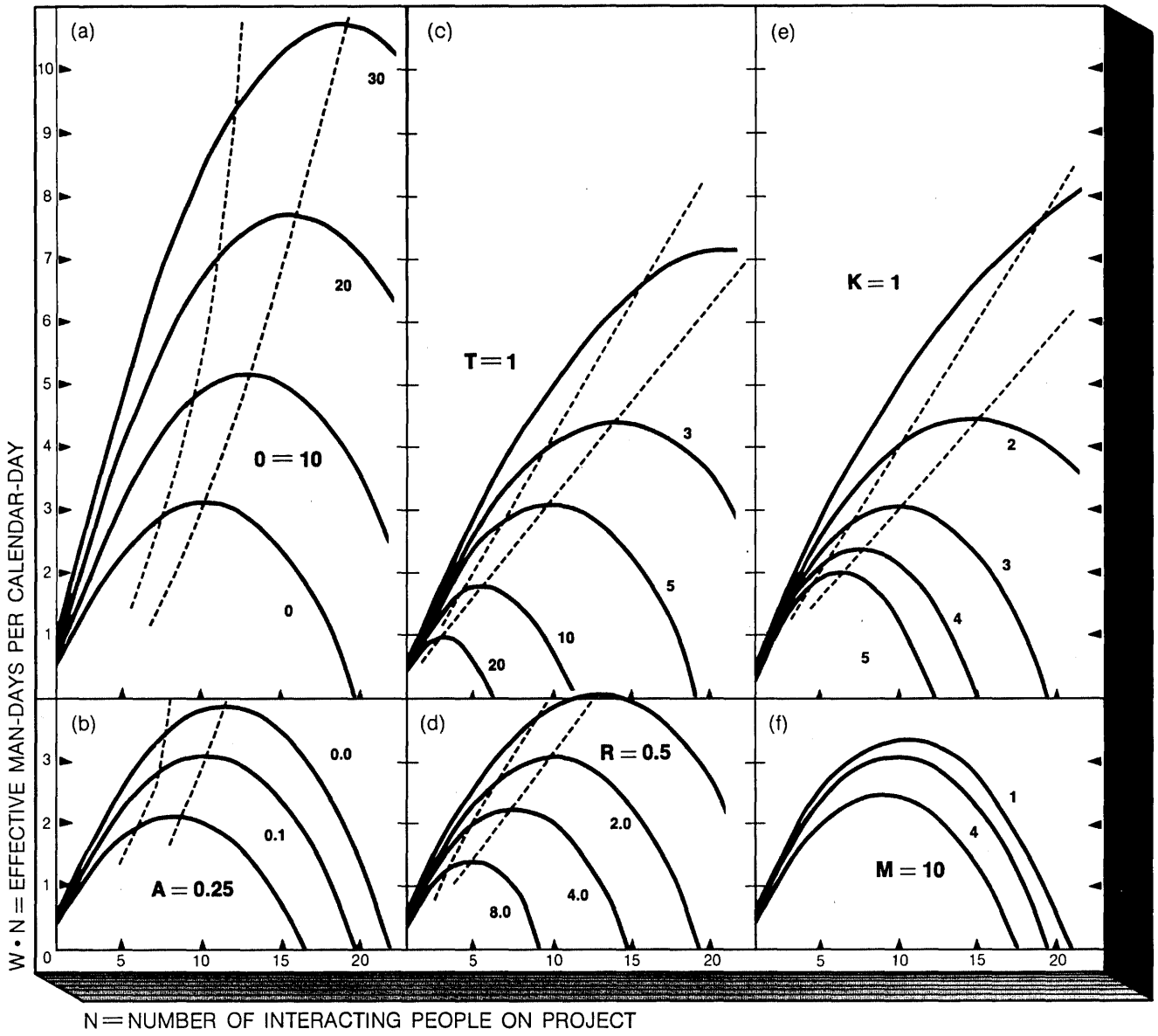

Fig. 2. Effective man-days per calendar-day versus the number of interacting people on a project for a) overtime of 0, 10, 20, 30 hours per week, b) an administrative burden of 0.01, 0.1, and 0.25 of each working day, c) an average interruption duration of 1, 3, 5, 10, and 20 minutes, d) an average interruption recovery time of 0.5, 2, 4, and 8 minutes, e) the average number of interruptions from project people of 1, 2, 3, 4, and 5 per day, f) the average number of interruptions from nonproject people of 1, 4, and 10 per day. In each of the six examples, the solid lines show the sensitivity of wxn if one of the parameters in the set for a "typical" programmer in Table I is varied while the other parameters are held constant. In each case the dotted line on the left is the locus of points which optimize project completion time (i.e., the point beyond which the project time increases for an addition of another person), and the dotted line on the right indicates the locus of points for which the project time-cost product is at an optimum.

The fifth term accounts for interruptions from people not directly in the project. The last term accounts for interruptions from project people and is assumed to scale linearly with the number of people working together; it contains n-1 since one does not need to meet with oneself. This ratio is closely related to employee morale since small values of w mean that not much productive work gets done in comparison to time spent on the job. The number of effective man-days per workday is nxw.

T: the ratio of calendar-time to md (the number of effective man-days required to finish the project) is given by:

$$T = 7/(5nxw)$$

The 7/5 accounts for weekends. Holidays, vacation, and sick time are not accounted for in this model, but could be added by multiplying the above by the appropriate dilution factor. Total elapsed calendar time for the project is given by mdxT.

c: the labor cost per workday is given by:

$$c = n (8 + 8i + od) s$$

The first term is the basic salary of each person; the second term is the indirect costs. The third term represents overtime pay. All hours worked are paid to provide the incentive to work the overtime hours; d should be adjusted to provide sufficient incentive. Indirect costs do not increase with overtime.

e: cost efficiency or effective working time per dollar is given by e = nxw/c. Stockholders are most interested in this ratio.

C: the ratio of project cost to md (the project man-days) is given by C = 5cT/7 = c/(nxw). The total project software labor cost is then given by mdxC.

CT: the project cost-completion time product, given by CxT, is something that

Fewer people should be part of the project team for more complex projects.

most projects try to minimize rather than C or T separately.

APPLYING THE FORMULAS

Some results of applying the above formulas to the cases shown in Table I are shown in Figs. 1-4. In Fig. 1 we see how the calculated quantities vary with n, the number of project people. The effective working time, w, varies linearly with n, and is best for n=1 since communication needs are at a minimum. The result of multiplying w by n is shown in Fig. 1(b). Project completion time can be decreased by adding personnel, but there is always a point of diminishing returns at which adding more people will delay the project.

The value of n for which wxn is a maximum (shown as an O) is the value that minimizes project completion times. The X on the typical programmers curve indicates the value of n for which the project time-cost product, CT, is minimized. At such a point the project time is increased by only 10% while costs are reduced by 25%.

Clearly, there is a wide range for the optimum n depending upon the operative values for the parameters. Depending on the working situation, n=1 may even be the choice that minimizes project completion time. For the pessimistic case for programmers in Table I, n=1 does optimize the time-cost product; yet the parameters in Table I for that case are not unreasonable and values that give even worse efficiencies are conceivable. Too often, software managers act as if the curve shown for factory workers applies to programming. In that case, the addition of one employee on a project does add nearly a full man-day of work, but this is rarely the case for software projects.

Fig. 1(c) indicates how project cost increases with manpower. Project cost can be nearly independent of n as is the case with the factory worker case. However, it is quite easy for project completion cost to escalate exponentially with n for programming situations. Fig. 1(d) indicates how cost-effectiveness varies with n. In all cases, project cost is minimized and the most work per dollar is obtained by having only one person working on the project.

Fig. 2 indicates how wxn, which is inversely proportional to project completion time, changes when each of the parameters are separately changed from the typical programmer set in Table I. Fig. 2(a) indicates that project completion time can be more than halved by working 60 hour weeks and that more people on the job are not as detrimental as when no overtime is worked, because working efficiency is higher after normal working hours. Project completion time is not as sensitive to administrative activities or to interruptions from nonproject personnel as

FIG. 3

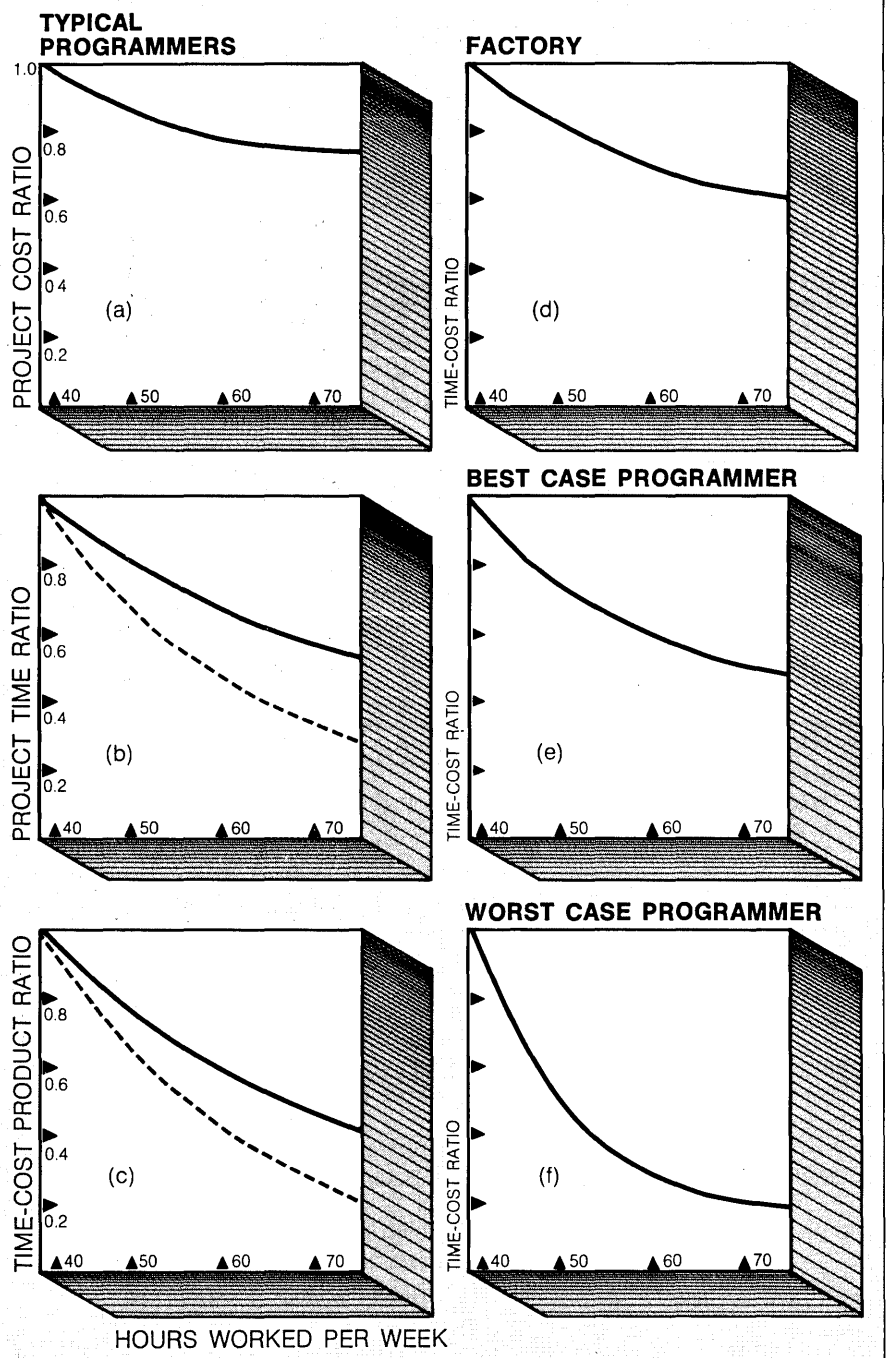

Fig. 3. The effect of overtime hours worked on a) project cost, b) project completion time, and c-f) the project time-cost product, CT, for the different set of parameters in Table I. The solid curves are for the case of one person on the project; the dashed curves are for the number of people that optimize project completion time.

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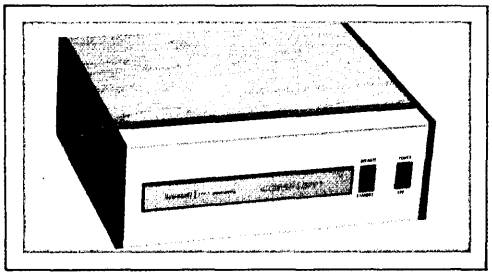

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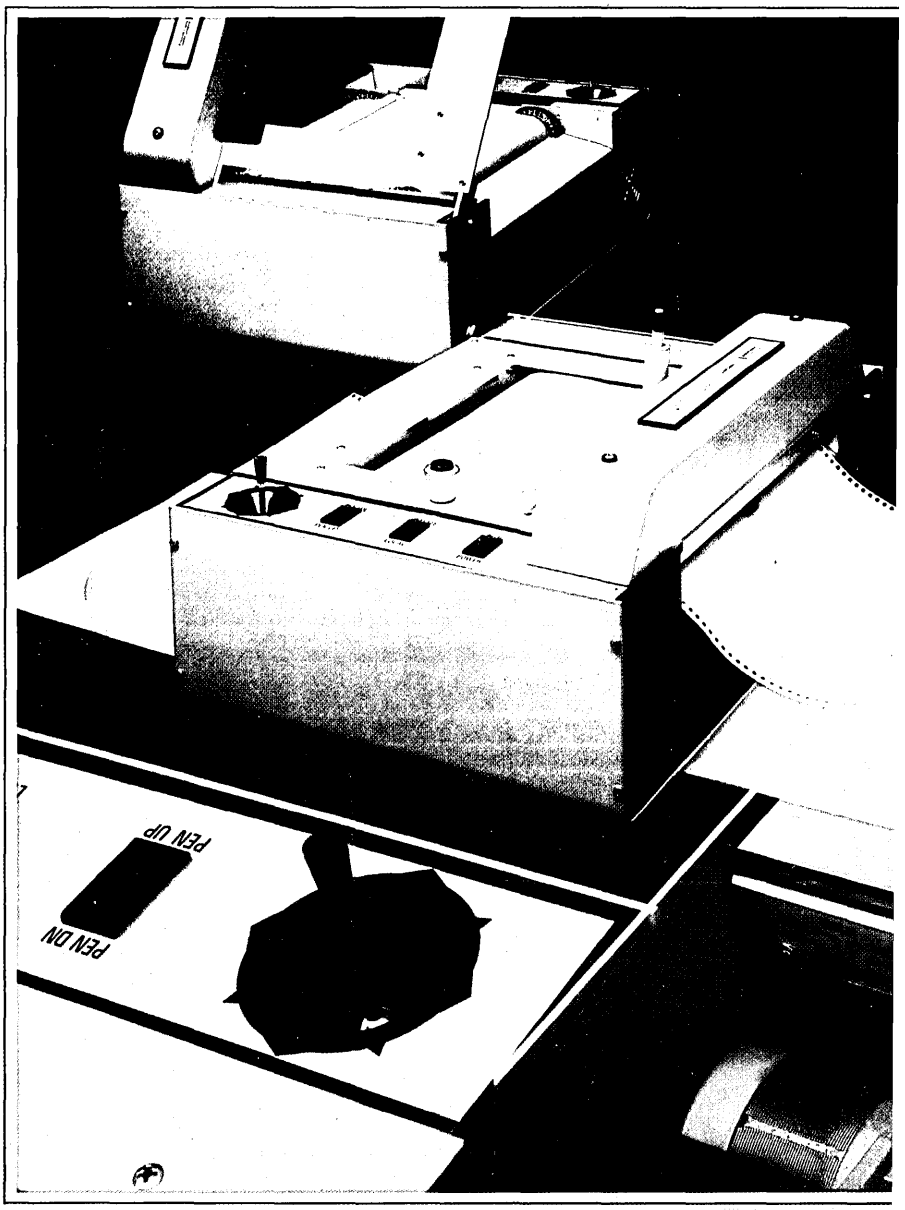
For complete information on how the CPS-11 can upgrade your plotting capabilities for only $5,390*, call or write Houston Instrument, One Houston Square, Austin, Texas 78753. (512) 837-2820. For rush literature requests or sales office information, persons outside Texas call toll free 1-800-531-5205. In Europe contact Houston Instrument, Rochesterlaan6 8240 Gistel Belgium, phone (059) 27 74 45.



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There is no doubt that interproject communication is essential.

FIG. 4

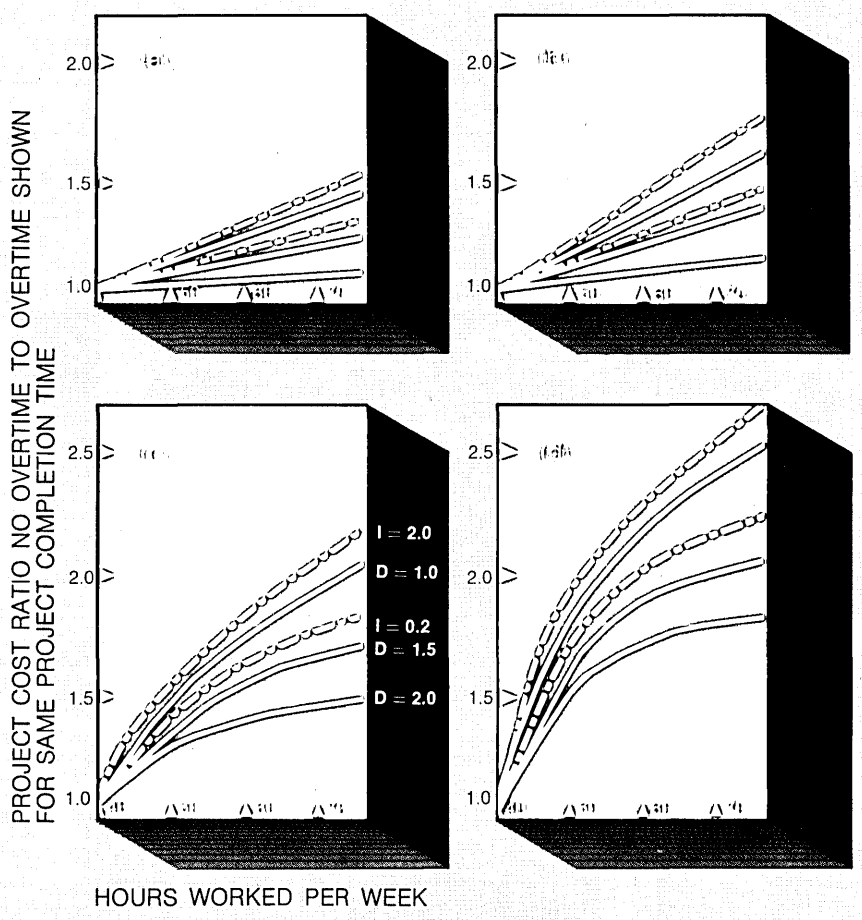

Fig. 4. The effect of overtime hours on project cost for the same project completion times. The value plotted is the ratio of the cost of having M men who work no overtime to the cost of having N men who work the average hours per week shown. M is chosen so that the project completion time remains the same for a) N = 1, b) N = 2, c) N at the optimum time-cost product ratio, and d) N at the optimum project completion time. In each case the five curves are for different values of differential overtime pay (solid curves: d = 1.0, 1.5, and 2.0, i = 0.5) and for different indirect costs (dashed curves: i = 0.2 and 1.0, d = 1.0).

shown in Fig. 2(b) and 2(f). However the model is quite sensitive to interrupt duration time and to rate of interruptions from project personnel as seen in c, d, and e. Interproject interruptions can be quite brief, but, if so, their frequency tends to increase, so that *kxt* tends to be constant.

There is no doubt that interproject communication is essential; the model shows that the more complex the project, the fewer people should be working on it if completion time is a factor. The model also indicates that working efficiency can be increased if an interrupt-free environment can be created during the main shift, perhaps a few hours every day when no discussions are ever permitted. Flex-time, in which a person can choose his own working hours, will also increase working efficiency.

Figs. 3 and 4 show how project completion time, project cost, or the time-cost product varies relative to the amount of overtime worked for the typical programmer set in Table I. The natural tendency is to guess that project cost will increase even though project completion time will decrease if overtime is paid. However, the model shows that project cost also decreases even if time-and-a-half is paid. For the case of straight pay for overtime work, one person working 60 hours a week can accomplish the same as two people at about three-quarters the cost. The crossover in cost is at about double pay for overtime hours—in other words, project cost is nearly constant if double time is paid. For the pessimistic parameter set for programmers in Table I, even double time is cost-effective. The greater the indirect costs, the greater the impact of overtime work since the indirect costs do not change with overtime. If indirect costs are high, the use of outside experts, consultants or hire-by-the-hour people becomes justified.

If average values for the model's parameters are known or can be estimated, this model can quantitatively indicate the best way to utilize a project manpower budget. Depending on the relative importance of cost or schedule, an optimum number of people for the project can be chosen. The model's results and common sense indicate that projects should be divided up into small, independent units; but the keyword here is independent. If there is not a natural separation between projects, it is a delusion to divide up what should be a single project. An artificial division of a project serves only to introduce artificial barriers to interproject communication needs and will lead to a longer overall project duration.

For a given software job, it is not possible to decrease the scheduled project time at will be adding more people. There must be a finite elapsed time to do the work. Project schedules can be effectively accelerated by encouraging flex-time and/or overtime work, i.e., to encourage an environment free of interruptions. Overtime is not a cure-all; it does not help bad management or make good programmers out of bad programmers and will not be effective unless the project members can work independently without interruptions. However, paid voluntary overtime in a programming environment does lead to better quality work done at a faster pace at less cost. ✻

BOB ESTERLING

Mr. Esterling is lead programmer for new distributed process control system products based on the DEC PDP-11 microprocessor at Fischer & Porter Co., Warminister, Pa. Prior to that, he was an engineering specialist and programmer/analyst for Aeronautic Ford, Willow Grove, Pa. He was also a research associate at Rutherford Laboratory, England, and the Fermi Institute, Chicago, and he taught at Rutgers College, New Brunswick, N.J.

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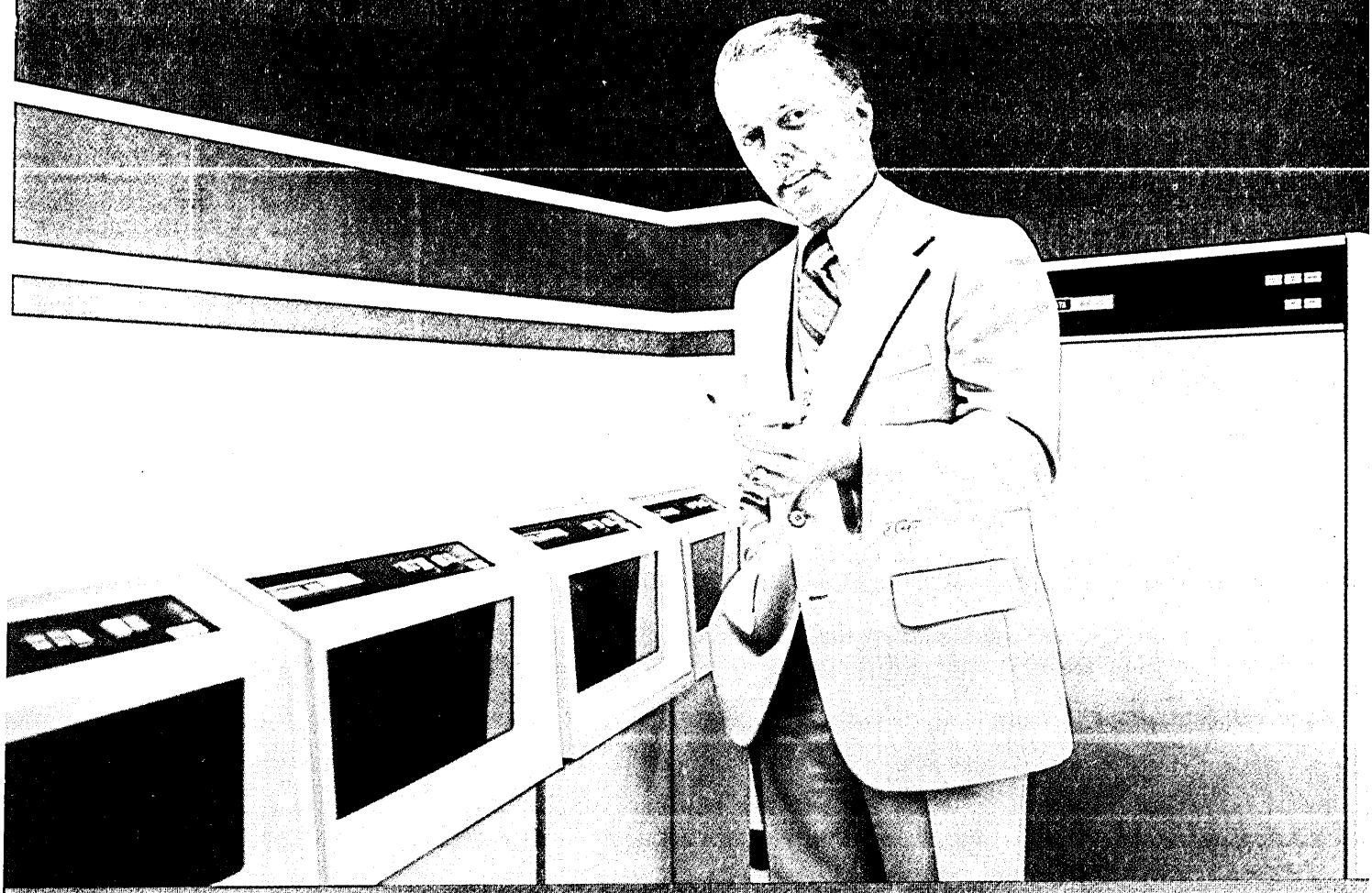

Jim Cron, General Sales Manager, Peripheral Systems Marketing

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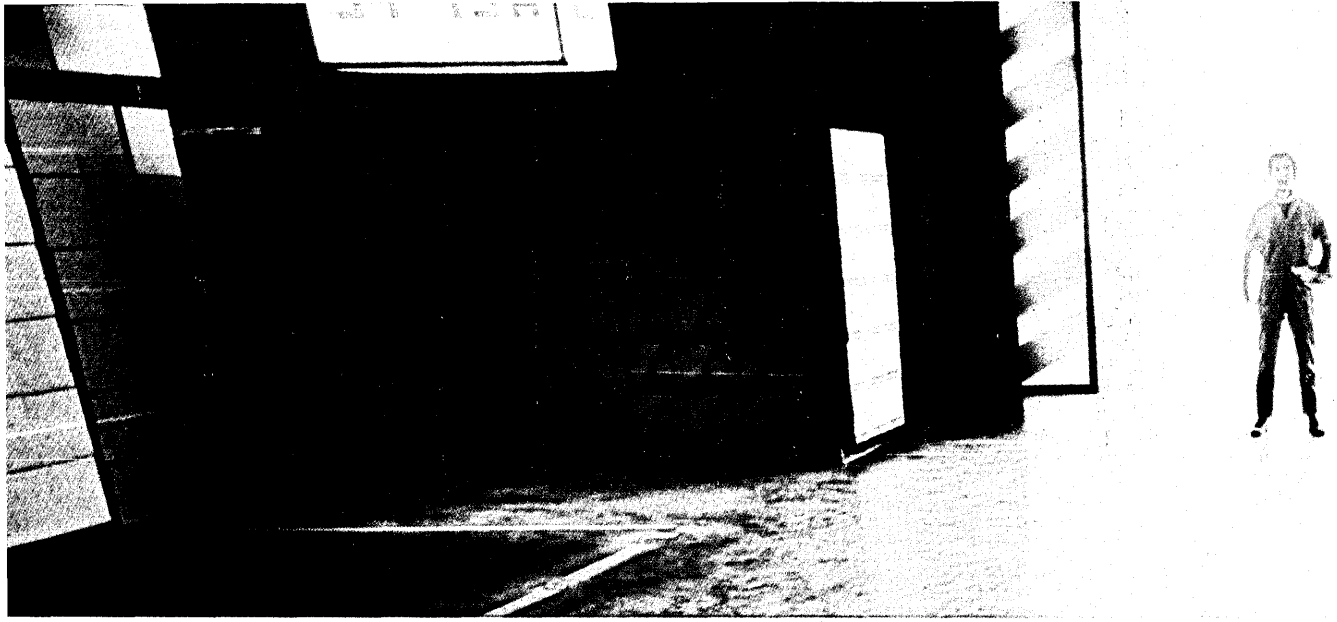

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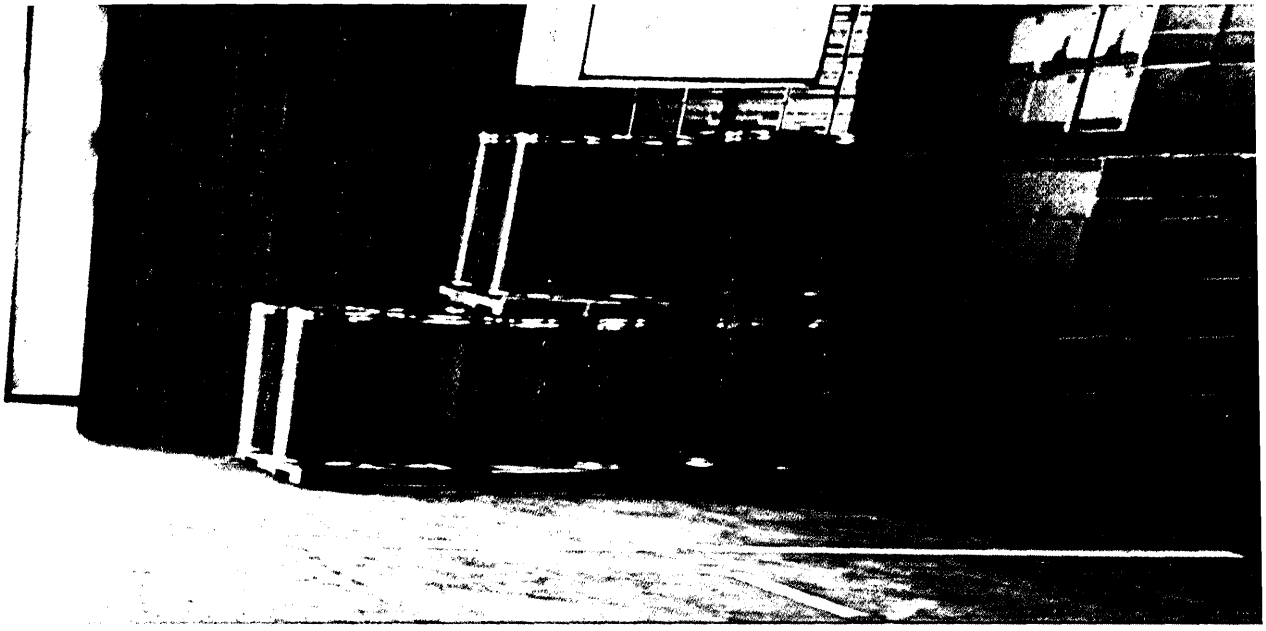

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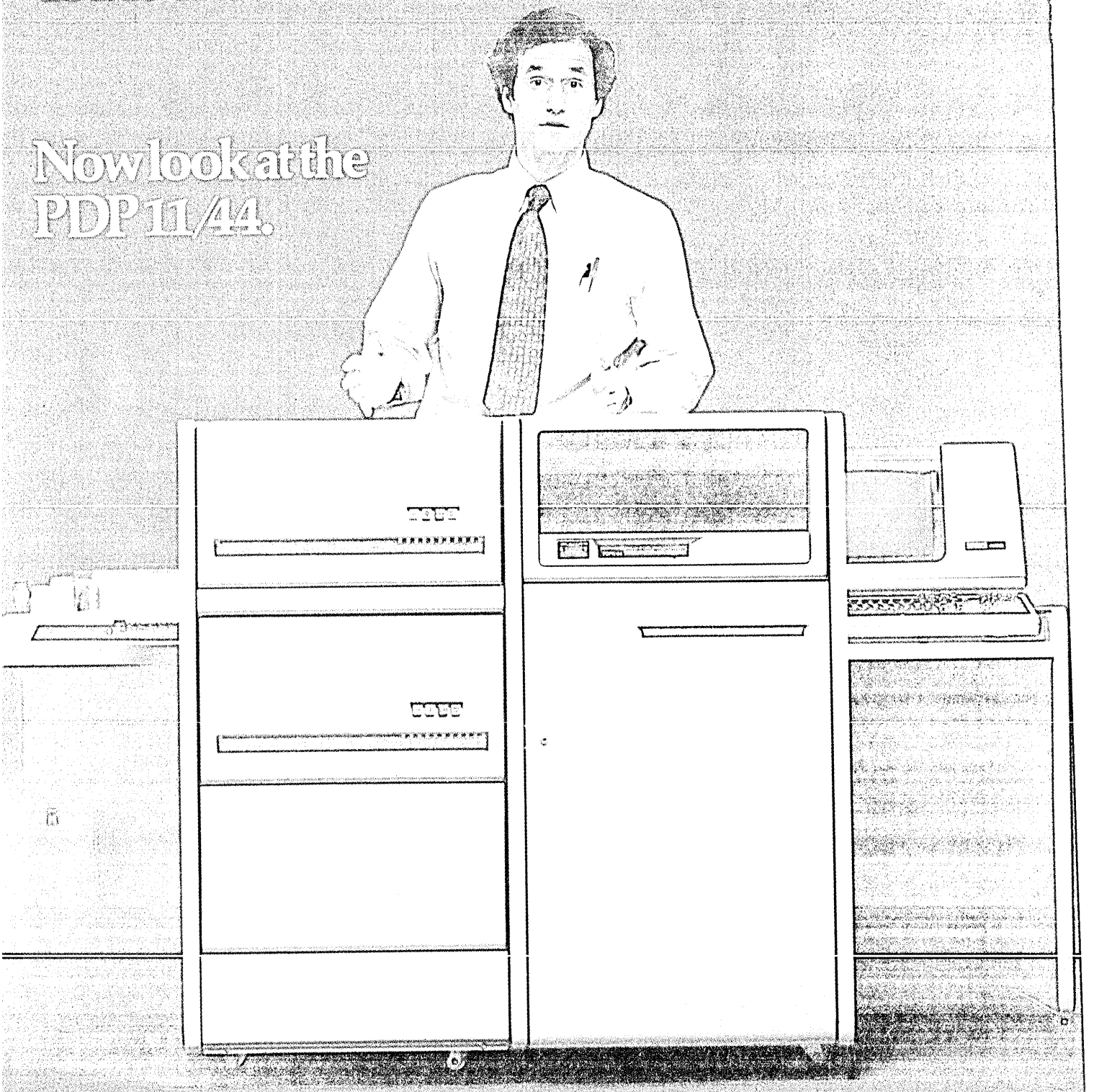

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TOOLS: MINI-BASED TURNKEY GRAPHIC SYSTEMS

by Eric Teicholz

Minicomputer based integrated (turnkey) graphics systems are a relatively recent phenomenon in the world of interactive computer graphics. One need only read the financial pages of newspapers to discover the exponential growth rate (25%-60%) of such companies as Computervision, M&S Computing, Gerber Scientific, and Applicon.

The reasons for the rapid growth center around the word "turnkey"—meaning that manufacturers both service and support a wide range of graphic hardware and software and provide broad-based applications programs. Users are given a complete set of hardware and system software tools with which they can either build application packages or, in the case of many applications, use an existing set of cost-effective software. As the cost of the technology decreases, the costs for software development increase, and the use and acceptance of computer graphics rises, we will increasingly see new applications and new user groups spring up around the turnkey vendors.

What has traditionally been, for turnkey vendors, almost an exclusive market for electronics design (printed and integrated circuits) is rapidly expanding into such areas as general purpose drafting, engineering design and production drawing, piping and utility mapping, and, to an increasing extent, business graphics.

This article deals exclusively with turnkey graphic systems that are minicomputer-based. These systems comprise the vast majority of the over 2,000 graphic systems delivered to users over the past 10 years. Excluded are graphic systems that use large host computers such as IBM's 3277 and are not standalone for sophisticated graphic applications, and a large and rapidly expanding group of microprocessor-based turnkey graphics and image processing systems.

What is left is a large group of 16 bit word architecture minicomputer graphics systems that date as far back as 1969, when Computervision Corp. introduced its first Designer I system (it is currently on the fifth generation of Designer systems). The suppliers listed here probably represent a 95% complete listing.

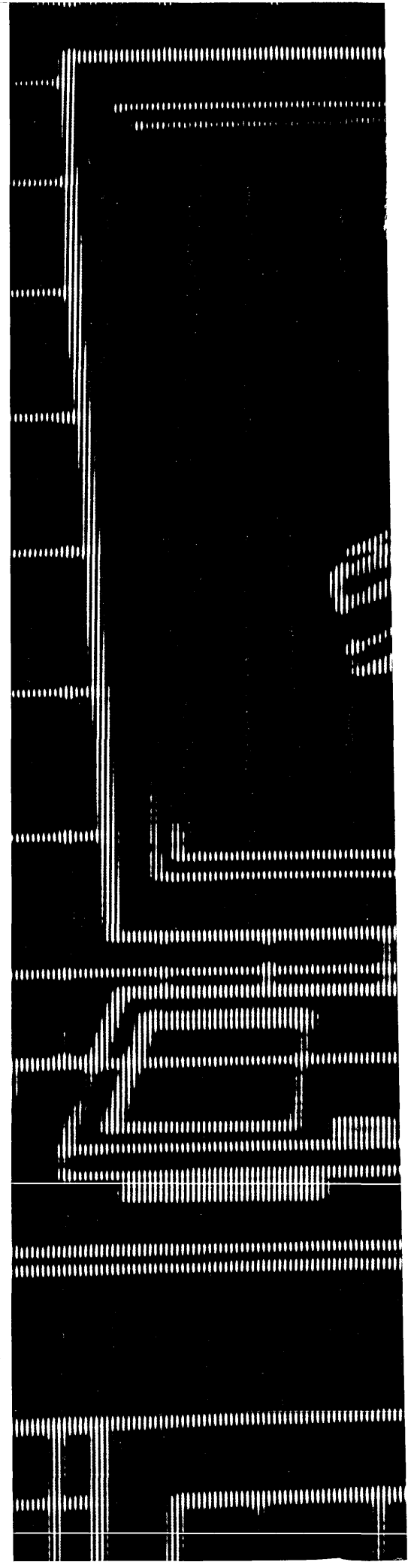
THE TURNKEY HARDWARE

A typical turnkey system consists of a graphics input system composed of a free or constrained cursor digitizer tablet to encode X-Y coordinate data. Many vendors will also support a host of other input devices: function keys, joysticks, keyboards, or photogrammetric input from a stereoplotter. Output stations will consist of a flatbed, or rotary drum, or table plotter, but, once again, vendors will support other hardcopy output devices such as a light-beam, microfilm, or, increasingly, an electrostatic plotter.

The interactive graphic edit station, the heart of the turnkey system, consists primarily of direct view storage tubes (DVSTs) and a keyboard, but more often of raster and vector refresh crt displays. The graphic workstations tend, for the most part, to be menu-driven, with the user specifying such functions as adding or erasing lines, circles, or other output graphic primitives; adding attributes (nongraphic information) to the graphic data base; calculating distances and areas; and specifying graphic and nongraphic data base functions.

In addition to these graphic workstations are the usual complement of computer peripherals such as disks (average systems are shipped with at least 80 megabytes) and tape drives, printers, the minicomputer cpu itself (usually DEC 11s or NOVAs) and, in some cases, communications capabilities to a remote host cpu. The communications interface is not a prerequisite for the turnkey system.

In general, minibased graphic systems cost in the range of $150,000 to $300,000, depending on the desired hardware and software options and the number of



DRAWING BY DENNIS ORLOF/
PHOTOGRAPH BY PETER ANGELO SIMON

Manufacturers service and support a wide range of graphic hardware and software for these rapidly growing systems.

TURNKEY VENDORS

1. System Name:	APPLICON GRAPHICS SYSTEMS	AD/380	A/E/C CAD SYSTEM
2. Manufacturer:	Applicon Inc.	Autotrol Technology Corp.	Calcomp
3. First Delivery:	1970	1973	1979
4. Size of Company:	$28.4 million for FY '78	$22 million for FY '78	$131 million
5. Primary Application, Areas/Users:	60% elec. (PC/IC), 30% mech. engr./mfg. (drafting fixture design, numerical control output), 10% engr./arch. (elec., piping, drafting, mapping)	22% petro chem and energy related, 14% arch. engr. const, 10% EE, 9% ind. machines, 8% chemical, 6% other manuf., 7% primary metals, 6% transport., 3% mdsrs. 15% other	50% A/E/C, 10% A/E, 30% E/C, 10% mapping
6. Systems Delivered to Date:	600	145	16
7. Specifications—Input/Edit Station:	Data tablet, raster and DVST crt terminals, alphanumeric keyboards.	CC-80 Graphics workstation/tablet, alphanumeric, crt.	Tablet and alphanum. workstations
Display Type:	Raster (CONRAC 21"), and DVST crts & color Ramtek terminal	Combination DVST and graphic refresh (96k local micro refresh memory)	Dynamic graphic raster display (picture processor) 15" (400 x 300) or 20" diag. (1,000 line res.)
Output Station:	Flatbed, drum and matrix plotters plus Applicon color plotter, photo plotter & electrostatic plotter	Calcomp vector/electrostatic/Autotrol Mark IV plotters, disks	Calcomp plotters, matrix, electrostatic plotters, Trident disk, tape drives
No. of Workstations:	4 graphic, 1 nongraphic	12 max.	4
Processor:	DEC PDP-11 plus Graphics 32 bit proprietary minicomputer for graphics utilities	Varian V77	CC 16/40 mini
Operating System:	RSX 11M for DEC and IMAGE (2-D, 3-D) & on-line program development for Graphics 32	VORTEX II	RTES Real Time Executive System
Compilers:	BASIC, FORTRAN	BASIC, FORTRAN, COBOL, RPG	IGL Interactive Graphics Language, ASSEMBLER, FORTRAN
8. Cost—			
Min. Configuration:	$100,000	$200,000	$150,000
Average Configuration:	$200,000	$275,000 (5 workstations)	$210,000 (2 workstations)
9. Comments:	Color plotter support (50,000 with mag tape unit)	Primarily designed for production drafting and engineering software	CAMRAS compatibility

workstations. This, in turn, will depend on the desired application of the turnkey system that determines factors such as speed, accuracy, resolution, whether color is necessary, and other relevant factors.

For example, a small digitizing tablet with a resolution of .01 inch can cost less than $1,000, while buying an extra thousandth of an inch of resolution and a larger digitizing surface will cost upwards of $20,000. Photogrammetric stereoplotters for encoding X-Y or X-Y-Z coordinates from aerial photographs cost upwards of $30,000, and automatic scanning digitizers will probably cost the user in excess of $100,000.

In the area of plotters, Hewlett-Packard, Tektronix, or Houston Instruments can sell you single-pen, .01 inch resolution, 8½×11 inch plotters starting at $1,100, or multipen, .0005 inch resolution, 46 inch/sec., 6 foot table plotters costing upwards of $100,000. Electrostatic plotters start at about $4,500 (8½ inch, 100 points per inch) and run over $40,000 (72 inch, 200 points per inch). Color cameras start at about $12,000, COM at about $150,000, etc. In general, the graphic peripheral/workstation world is large and growing daily. Let the buyer beware!

Software from the turnkey vendors includes both systems and application capabilities. Standard minicomputer operating systems are sometimes rewritten by the vendors to more efficiently support graphics, and a variety of graphic utilities for data creation, editing, output and data base management are always included.

Most of the manufacturers provide sophisticated data base management systems for handling graphic and nongraphic attribute data, write the graphic display drivers in host assembler code, and provide a high level capacity (usually FORTRAN, but sometimes in a vendor-generated graphic problem-oriented language) for the user to develop applications programs and interface them with the vendor's data base management capabilities.

Proprietary applications of software are often extensive and will represent the primary market area of interest to the manufacturer—drafting in the case of Auto-Trol Technology Corp., Calcomp (Sanders), and

CGI: CALMA GRAPHIC INTERACTIVE SYSTEM	COMPIS	DESIGNER SYSTEM IV
Calma	Comrak	Computervision Corp.
1971	1976	1969
$26 million for FY '78	$1.5 million FY '79	$110.5 (4 Quar. '78 & 1-3 Quar. 1979)
40% IC design, 30% mechanical, 30% other	Mapping	50% mech., 30% elec. design, 20% other
500 plus	7	800 plus
Calma 42" digitizer, b/w 128 x 1,024 (DDM), alphanum. terminals	crt tablet	Design Console with 19" DVST crt, 20 x 20" Menu pad, CVD Digitizer (36 x 48), alphanum. crts
Tek 4014 DVST, alpha-numeric keyboard, color raster (GDSII)	Color raster	19" DVST
Matrix, thermal, vector plotters, mag tape, Decwriters	ZETA plotter, Gerber plotter	Variety of vector and matrix plotters, Compucircuit 150 photoplotter, Interact IV 50 x 60 dig/plotter, max. of 300 MB disk
up to 6	up to 8	8 plus 2 background
Eclipse S2-30	Data General Eclipse, NOVA, and DEC LSI-11	CV-CGP 100 cpu
CDOS	AOS except RT-11 (DEC)	CV Graphics Operating System (CGOS-100)
FORTRAN IV, V, ALGOL, BASIC, Display Graphics Language	FORTRAN, ASSEMBLER	PPL (user programmable), FORTRAN
$250,000 (DDM BASIC) $400,000 (3 stations w/plotters	$175,000 $230,000	$150,000 $300,000 (3 workstation system)
	Strong date base management	Thinking of color

Information Displays, Inc., printed and integrated circuits and computer-aided design and manufacture (CAD/CAM) in the case of Computervision Corp. and Applicon Inc., and mapping in the case of M&S Computing, Inc., Synercom Technology Inc., Keuffel & Esser Co., and Comarc Design Systems.

Since we last wrote on the topic of turnkey systems (DATAMATION, December 1975), application software has increased, data base support has gone from two to three dimensions, display processors have become much more sophisticated (off-loading the computational load on the cpu), and a host of new peripherals are being supported—particularly refresh displays to support selective erasure and color.

A DOZEN SYSTEMS COMPARED

Defining the vendors that can be called turnkey manufacturers is somewhat difficult. At one end of the graphic hardware spectrum are either dumb or intelligent graphic terminals, consisting of either refresh or storage tube displays—some with microprocessors that, in many cases, are either programmable or include memory from which the display can be refreshed. Clearly the leading manufacturer in this category is Tektronix Inc., which has more than 12,000 DVST crt terminals in the field. At the other end of the spectrum are sophisticated displays produced by such companies as Evans and Sutherland, Sanders Associates, and most of the manufacturers of image processing systems (CDC, GE, I2S, ESL, COMTAL) that are either very specific in their applications or represent extremely sophisticated display processors rather than stand alone graphic systems.

In any case, about a dozen systems have been investigated and compared in terms of functional characteristics. These comparisons include data on the following:

1. *System name*
2. *Manufacturer*
3. *Date of first delivery*
4. *Size of company (in dollar sales)*
5. *Primary application areas/users*

We are interested here in primary areas of application software. Whenever possible, percentage breakdowns for either the application areas or the types of users are presented. In some cases, vendors could not supply this information and, in almost all cases, they were quick to point out that the boundaries dividing how their systems were used were often fuzzy. That is, a system could be used for more than one application area and the manufacturer was not at all sure into which category to put a particular system. In other cases, certain application areas might fall into different categories. That is, an application program that did piping layout or utility mapping might be the same program used for general purpose drafting. In any case, ranking of application areas by numbers of users was done in all cases.

6. *Total systems delivered to date*
7. *System specifications*

Several categories of technical data were included in this section. "Input/edit" station contains information on the types of digitizers and tablets supported and, in general, input and edit system characteristics. "Display type" contains information on the type of technology supported at the interactive crt station. "Output station" contains information on the types of plotters (e.g., raster, vector, thermal, matrix, photo) directly supported. "Number of workstations" is the number of on-line user stations that can be supported in foreground and background mode. The "processor" is the cpu supported by the vendor. What is interesting to note is that some of the companies, such as Computervision, are building their own cpu to support their turnkey system, and others, such as Applicon, are building special purpose display processors to take away some of the graphic overhead from the main cpu.

"Operating system" contains data on the op system supported. The reader will notice that many of the vendors have written their own system to directly support interactive graphic applications. "Compilers" relates to programming languages supported by the vendor. In all cases, assembler and some higher level language such as BASIC and FORTRAN are supported. Other vendors have writ-

One forecaster estimates that the market for turnkey systems will grow at the rate of 311% during the next 10 years.

TURNKEY VENDORS

1. System Name:	DESIGNER SYSTEM V	IDS	IDI SYSTEM 150
2. Manufacturer:	Computervision Corp.	Gerber Systems Technology	Information Display Inc.
3. First Delivery:		1973	1974
4. Size of Company:		$40 million for FY '78	($3.6 million for FY '78 (mostly turnkey))
5. Primary Application, Areas/Users:		50% aerospace, 30% electrical, 10% misc., CAD-CAM, 3-D geom. construction, engineering dwgs, tool design, structural analysis, PCB layout	
6. Systems Delivered to Date:		75	45
7. Specifications—Input/Edit Station:	17 x 24 digitizer, Instaview terminal	Combination digitizer/plotter, 19" crt, 40 x 60" digitizer Random refresh display terminal, design terminal: crt, display term., desktop cursor, function display	Diablo or TI-700 Alpha terminal, lightpen, Summagraphics 42 x 60d
Display Type:	Raster, 19" crt	Modified Tek 19" DVST crt	21" diag. vector refresh crt: addressable pts. 1.5K x 2K
Output Station:	Interact-4 Compucircuit photo plotter, industry standard plotters	Pen and photo plotters, CDC 25 or 40 MB disks mag tape	Calcomp 960, 19" DVST review station, disk, mag tape, plotters
No. of Workstations:	8	4 per processor	2 per processor
Processor:	CV CGP-200	HP 2117 and 2113	Sperry Univac Varian V77-600
Operating System	CGOS		HIGHER (optimized for graphics)
Compilers:	FORTRAN	FORTRAN	FORTRAN IV, ENHANCED, ASSEMBLER
8. Cost— Min. Configuration:	$150,000	$140,000	$150,000 64K, 1 station, 90M disk, 9 trk tape, no plotter
Average Configuration:	$300,000	$225,000 for 4 workstations	$200,000
9. Comments		Each workstation has its own dedicated mini	Operating system written in FORTRAN; disks can be shared between 2 processors, also can link up to 9 systems with communications interfaces, thus 18 terminals can cross-access data

ten their own high level graphics compiler language to facilitate user-generated application programs.

8. *Cost information*

This item contains two types of price data: the first is a "minimum configuration" cost which is the minimum cost of a system that includes a digitizer input station, an interactive edit station, a digital plotter, and at least 40 megabytes of disk storage. However, several vendors pointed out that almost no system is delivered with under 80MB of disk and most go out with 300MB of storage; the second cost figure is an "average" system configuration cost which includes from two to four interactive workstations.

An interesting comparison with the author's December 1975 DATAMATION article on turnkey systems is that the minimum configuration cost has not decreased and has even increased over the last four years. This is in spite of drastically decreasing hardware costs. The 1980 minimum and average cost numbers seem to reflect the fact that turnkey vendors are offering new and improved services and application software (e.g., more powerful systems) as well as sharply increased software development costs.

9. *General comments*

This category contains miscellaneous information such as Applicon's support of a color plotter, M&S's split-screen DVST capabilities, and the like.

TURNKEY FUTURE UNCLEAR

The future of turnkey systems is still unclear regarding both software and hardware technology. The vendors are increasing their sales at a rate about 25% higher than other graphics markets. Industry forecaster Frost & Sullivan in New York estimates that the market for turnkey vendors will grow at a rate of 125% during the next five years and 311% during the next 10 years (*Computer Graphics: Software and Services Market*, report no. 653, February 1979). Another forecaster, Venture Development Corp. of Wellesley, Mass.,

AIDSX IGS/330	IGDS INTERACTIVE GRAPHIC DESIGN DATA SYSTEM	INFODRAFT
K & E	M&S Computing	Synercom Technology Inc.
1970 (H. Dell Foster)	1973	1972
$100 million	$20 million for FY '78 (90% in turnkey)	$5 million plus for FY '78 (Frost and Sullivan)
Mapping 75%, industrial 25%	Mapping and network analysis	80% mapping (50% public agencies, 30% utilities, 20% service bureaus), 20% other (engr., drafting)
25	150 plus	50
K & E Digitizers, stereo plotter, analytic compiler	DEC LSI-11 micro controller-advanced graphic terminal, dual tablet stereoplotter, menu digitizers	Dual tablets, Decwriter, Graphic workstation
Tektronix 4014	19" Tek DVIST (4014) support Ramtek color, YES	DVST 19" crt, dual screens
K & E Plotter, Calcomp Software, Xyonetics	Calcomp 960 plotter (others supported)	Hardcopy (TEK), alphanum. terminal (Lear Siegler), Versatel Electrostatic, Calcomp plotters
4 Traverscan, 4 stereo plotters, 2 editor stations	16	8 max. on DEC 11/70
Nova 3D	PDP 11/70, PDP 11/34	DEC 11/34 or 11/70
RDOS	RSX-11M	RSX-11M
FORTRAN IV	FORTRAN IV, MACRO, others (optional)	BASIC, FORTRAN, COBOL
$150,000 64K, 2 edit stations, plotter	$150,000	$200,000
$150,000	$350,000 (2 workstations)	$325,000 (2 workstations)
moving into CAD/CAM, Eng. drafting	System supplied with one standard application software system (300 menu commands) which user can modify/e.g., deleting unneeded functions) CAMRAS support	CAMRAS support

VENDORS LIST

To obtain additional information on mini-based turnkey graphic systems, contact vendors on the following list.

Applicon
32 2d Ave.
Burlington, MA 01803

Autotrol
Turnpike Towers
7475 Dakin
Denver, CO 80221

Calcomp
2411 West La Palma
Anaheim, CA 92801

Calma
707 Kiefer Road
Sunnyvale, CA 94086

Comark
315 Bay Street
San Francisco, CA 94133

Computervision
201 Burlington Road
Rt 62
Bedford, MA 01730

Gerber Systems
83 Gerber Road
South Windsor, CT 06087

Information Display
150 Clearbrook Road
Elmsford, NY 10523

K & E
20 Whippany Road
Morristown, NJ 07960

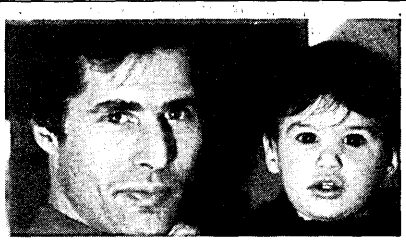
M&S Computing
P.O. Box 5183
Huntsville, AL 35805

Synercom Technology
P.O. Box 27
500 Corporate Drive
Sugar Land, TX 77478

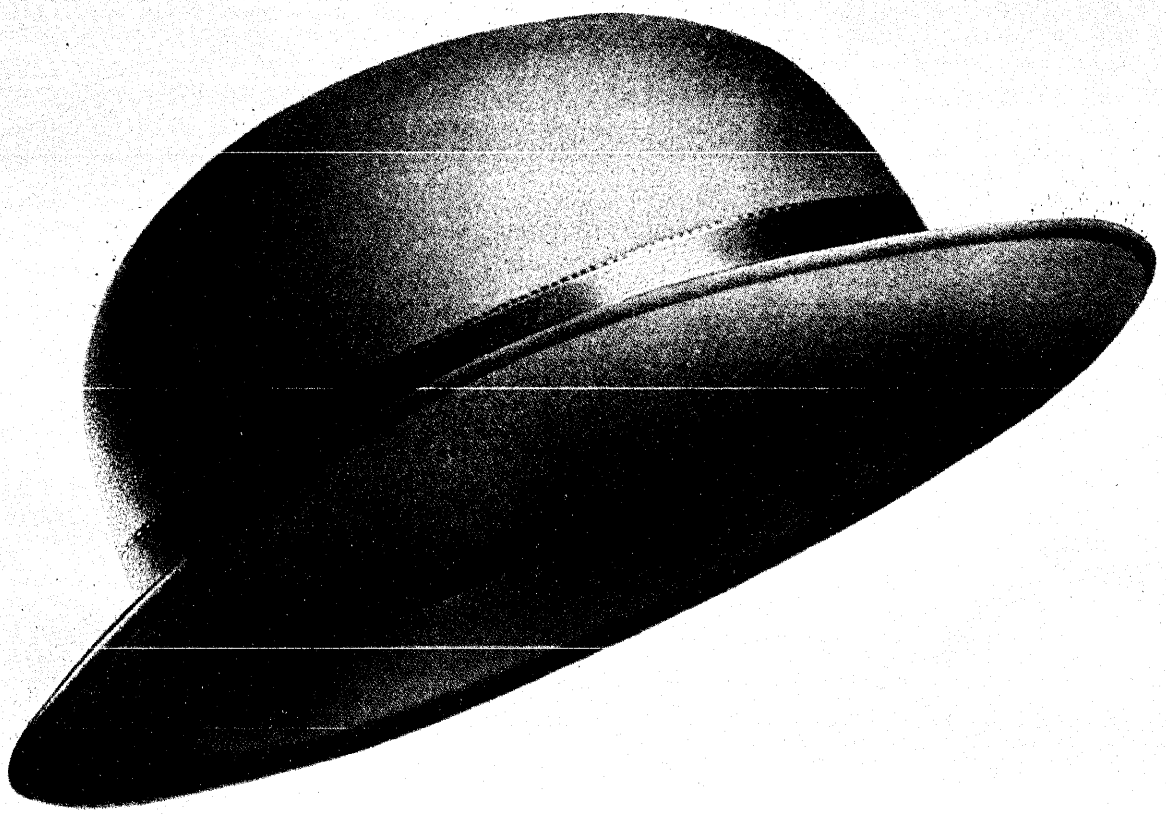
points out that the use of color for business graphics, image processing and laboratory applications will fuel the further transition to raster displays. VDC anticipates the shipment of 200,000 color displays by 1983 (from a current 15,000). Many of these displays will be on turnkey systems. This is particularly true given the rapid proliferation of color hardcopy devices by companies such as IBM (to support its new 3279 color display), Trilog, Matrix, Dunn Instruments, and others. VDC further estimates the business graphic market at $243 million by 1983 (from a current $14.5 million). Clearly, the turnkey vendors will go after this market.

We are already seeing voice input to support the demanding and difficult task to digitize data entry. Cpus will probably increase word size from 16 to 32 bits and larger. Microprocessors will continue to proliferate and the world of "desktop" graphic systems (see DATAMATION, May 1979) based on micros will become more sophisticated and provide higher resolution graphics and more application packages. Raster scan technologies will merge increasingly with the primarily vector based turnkey systems of today, which should greatly increase the number of graphic application areas currently available. These predictions are all near term (one to two years); after that the sky—our imagination—is the limit. ✲

ERIC TEICHOLZ



Mr. Teicholz is associate professor of architecture and associate director, Laboratory for Computer Graphics & Spatial Analysis, Harvard Univ.



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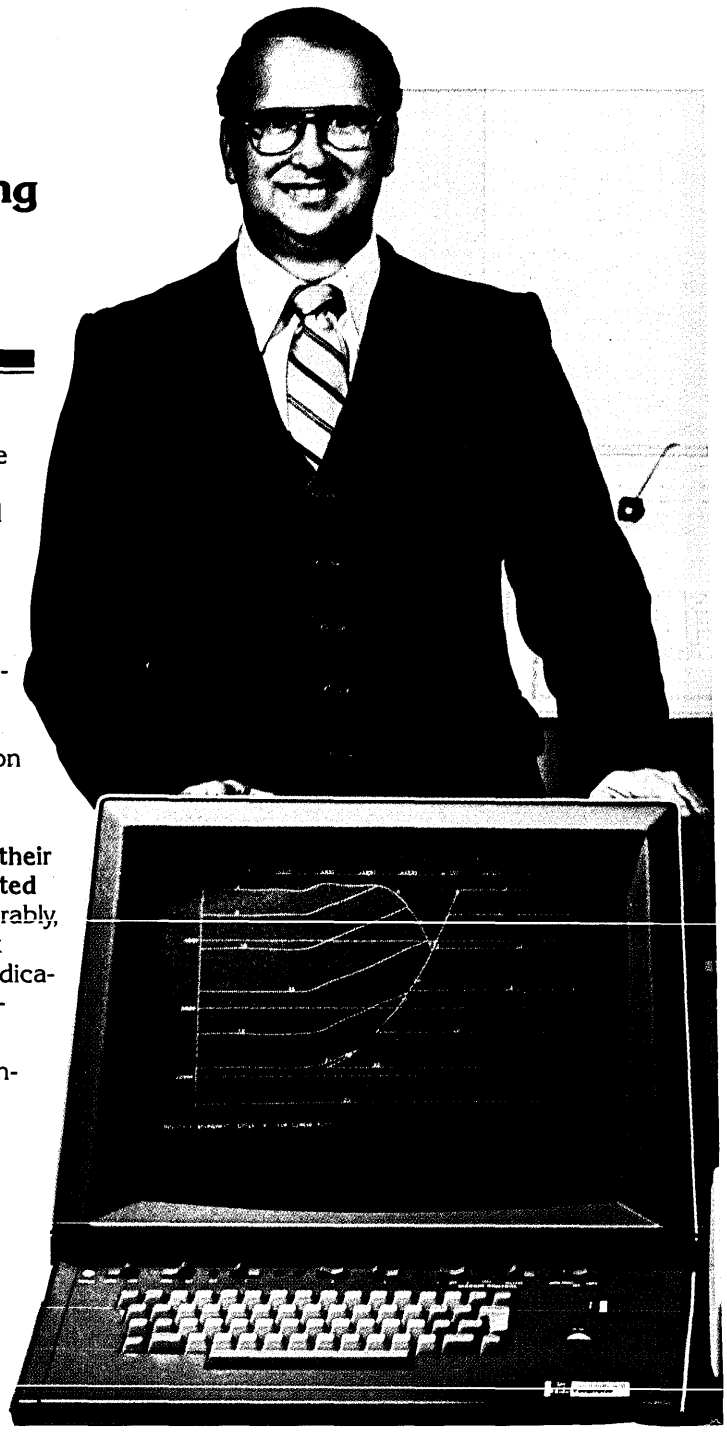

Wes Rice
Coordinator,
Computer Systems
Exploration
Research Division
Conoco Inc.

Conoco's search for hydrocarbon fuels begins by pounding the test site with mechanical vibrators, and recording reflected sound waves as two-dimensional seismic graphs.

Enter Tektronix graphics. Rather than bundle guesswork interpretations of those graphs back to the home office for batch processing, geologists and geophysicists at the nearest exploration center digitize and display their theories of subsurface layer patterns on the high-resolution Tektronix 4014-1.

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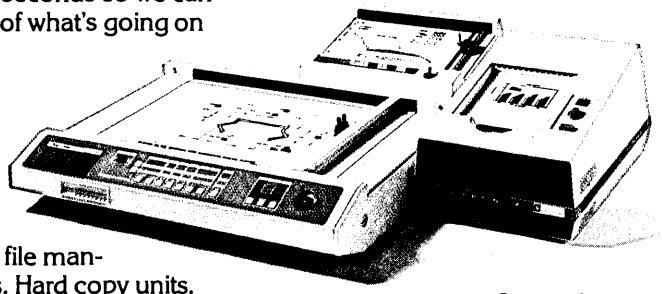
"There can be more than 300 layers involved," says Conoco's Wes Rice. "Our

teams used to wait a week for
With Tektronix graphics,

graphics equipment lets us digitize each rock layer configuration in seconds so we can quickly test concepts of what's going on in the earth."

Conoco's equipment includes more than the 4014-1. Research and operations facilities also include Tektronix file managers. Graphic tablets. Hard copy units. Digital plotters. To lessen loads on their mainframes and cut data transmission costs, Conoco is adding Tektronix' intelligent options. These fully equipped 4014 work stations, along with Tektronix 4081 graphics systems, effectively address Conoco's expanding graphics needs.



From exploration to refinery engineering, Tektronix is a proven resource for cutting the costs and speeding the processes of energy supply. Whether you're wondering what's under the earth or what's going to happen down the road, we'll give you the clearest picture. For more information, call your local Tektronix sales office or our toll-free automatic answering service at 1-800-547-1512 (in Oregon, 644-9051 collect).

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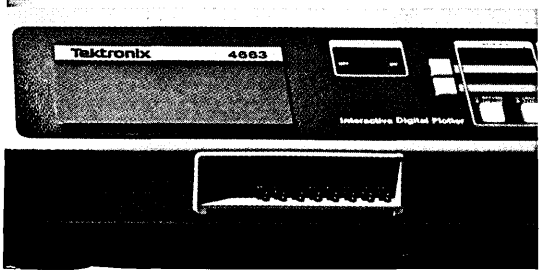
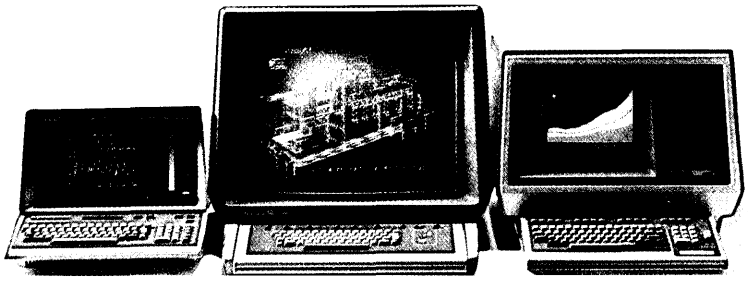
CIRCLE 119 ON READER CARD





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CIRCLE 120 ON READER CARD

DCA announces new high-performance network processors that lower data communications costs

A new concept in datacomm networks will be introduced at Interface '80. The DCA Series 300 statistical multiplexor/network processor line is the foundation for a range of products that can be upgraded with future technology. A unique "building block" approach based on DCA's proven Integrated Network Architecture (INA) allows networks to grow either in size or performance — or both. Thus, small networks can be configured without paying for performance that would never be used. And by the same token, any network — large or small — can have "big network" features.

Modular Network Expansion. For networks that are bound to grow, Series 300 continues a DCA tradition: highly cost-effective modular expansion. The series supports from 1 to 127 trunk links so networks that begin small can grow into the future. The new series is also completely compatible with all existing INA network processors — the current Series 100 line can even be upgraded in the field to the Series 300 level!

Modular Performance. Common hardware is used extensively, and Series 300 actually achieves greater results (10 to 20 times the throughput of presently-available technology) with less hardware than ever before. This unique growth-oriented architecture allows system performance to be improved at very low cost and without obsoleting investments made in DCA components.

DCA's microprocessor-based processing modules (PMs), for example, can be interchanged to achieve just the level of performance that's needed for a particular network. Because system programs are software loaded, the same PMs can be used throughout the entire series. They can be programmed and updated to perform any networking function, yet since they are identical until programmed, a single PM acts as a spare for the entire series.

Advanced Features. Series 300 supports any asynchronous and certain synchronous terminals, plus a multitude of network protocols — including X.25. Series 300 offers a private network as a superior performing, low-cost alternative to packet-switched networks. DCA's exclusive protocol conversion modules will give terminal users access to virtually any host computer. Extensive self-diagnostic capabilities surpass anything currently on the market.

Like other INA systems, Series 300 offers multipoint multiplexing, error-free data transmission, port contention, host selection, and a multitude of other features that reduce data communications costs.

Before you buy a network to meet today's needs — check out the network that's designed to meet tomorrow's needs as well. See the new Series 300 network processors at Interface '80 — or contact DCA for complete details.
Digital Communications Associates, Inc., 135 Technology Park/Atlanta, Norcross, GA 30092. 404/448-1400.

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CIRCLE 121 ON READER CARD

TECHNIQUES: COMPUTER-INTERGRATED MANUFACTURING

by David Chris Allen

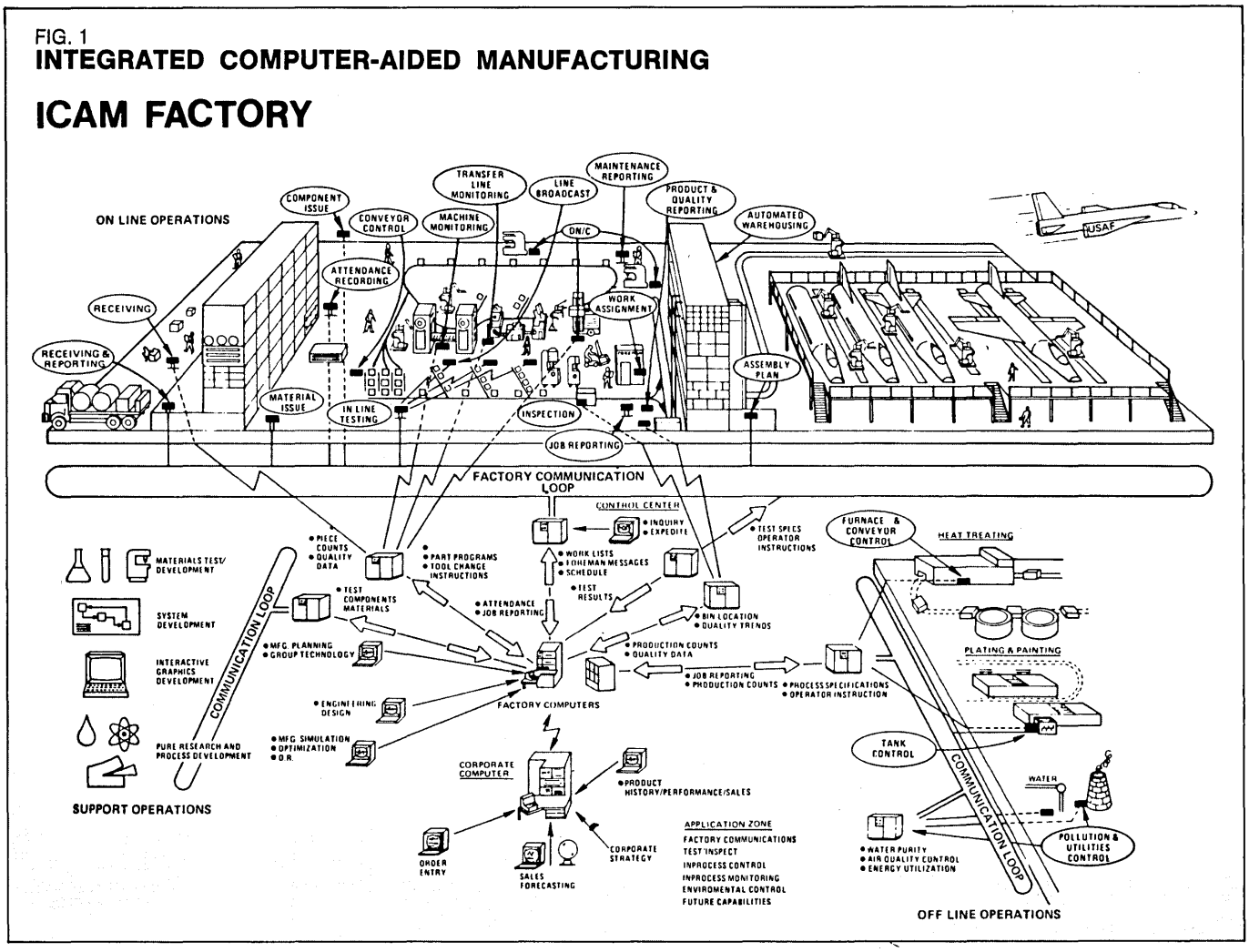
There are few aspects of design and manufacturing that have not been augmented by computers. Computer-aided design (CAD) and computer-aided manufacturing (CAM) systems addressing nearly every phase of the manufacturing process are found, for example, in the aerospace, ship building, and auto industries. Recent progress in integrating the capabilities of the separate CAD and CAM systems has resulted in computer-integrated manufacturing systems (CIMs). Several full-blown production CIM systems are already operational.

Computer-integrated manufacturing refers to complete systems in which every aspect of the manufacturing process has been computerized and tied into a single controlling, coordinating system. All applications of CAD and CAM, including management planning and control, are in the system. Data communications among different responsibilities in the manufacturing process—from management decision-making to shop floor managers—is accomplished through shared access to the system's data base files.

The development of CAD/CAM technology has been well subsidized by the government. The pioneering work, beginning with the development of numerically controlled (NC) machine tools in the early '50s at MIT, was funded by the Air Force. In the '60s, the Air Force again sponsored the development of APT (automatically programmed tools) at MIT, and arranged for additional project support from machine tool manufacturers, control system builders, and the Aerospace Industries Association. The program SKETCHPAD, the beginning of interactive computer graphics and computer-aided drafting, also developed by MIT, was another Air Force project.

With the advent of the space program, NASA became a major force in the stimulation of CAD/CAM technology. When NASA was established, Congress stipulated that technology developed with federal funds must be transferred to industry to achieve maximum benefits. NASA's Technology Utilization branch carries out that function, funding R&D projects to stimulate aerospace technology, including the application of computers to aerospace manufacturing.

FIG. 1
INTEGRATED COMPUTER-AIDED MANUFACTURING



With the advent of the space program, NASA became a major force in the stimulation of CAD/CAM technology.

FIG. 2
MANUFACTURING STAGES AND NEEDS

	PROCESS	STATION	CELL	CENTER	FACTORY
SOFTWARE	•	• APT • CUTTER SELECTION • ADAPTIVE CONTROL • MAINT. & DIAG. •	• STATION • SOFTWARE + • MATERIAL FLOW • OFF-LINE PROGRAMMING •	• CELL • SOFTWARE + • MFG. CONTROL • MATERIAL MGMT. • TIME STANDARDS •	• CENTER • SOFTWARE + • SIMULATION • GENERATIVE PROC. PLANNING • GENERAL MODELING SYSTEM • CAPACITY RESOURCE ALLOCATION • ENERGY MGMT. • ATTENDANCE & JOB REPORTING • • •
HARDWARE	• MILLING MACHINE • TUBE BENDER • BRAKE PRESS • TAPE LAYER • HYDRO PRESS • LATHE •	• NCMM NCTB • NCBP • NC ROUTER • ROBOT •	• STATIONS • MATERIAL HANDLERS • WAREHOUSE •	• CELLS •	• CENTERS •

CHARTS BY CYNTHIA STODDARD

The NASA Structural Analysis computer program, NASTRAN, has also become a standard tool for structure design, and NASA's zero defects philosophy encouraged increased computerization of manufacturing to meet high reliability requirements.

From the private sector, a nonprofit R&D organization, Computer Aided Manufacturing International (CAM-I), in Arlington, Texas, funds and coordinates work on projects involving computerized manufacturing. CAM-I produces solutions for the manufacturing problems and needs of university and industrial members, and reports on all developments. One project jointly funded by CAM-I and NASA, for example, aims to develop computer-aided process planning at McDonnell Douglas in St. Louis.

AEROSPACE PROJECT

NASA has also established and funded an organizaton concerned with Integrated Programs for Aerospace-Vehicle Design (IPAD), which is currently funding a project at Boeing to develop the technology of aerospace CAD systems. Aerospace companies participate in the planning of IPAD projects through representation in an Industry Technical Advisory Board.

The National Science Foundation funds R&D work in computer-aided manufacturing through grants for man/machine research. Westinghouse Electric Corp., supported by an NSF grant for the development of automated programmable assembly technology, is building a pilot production line for small motors using robots with vision.

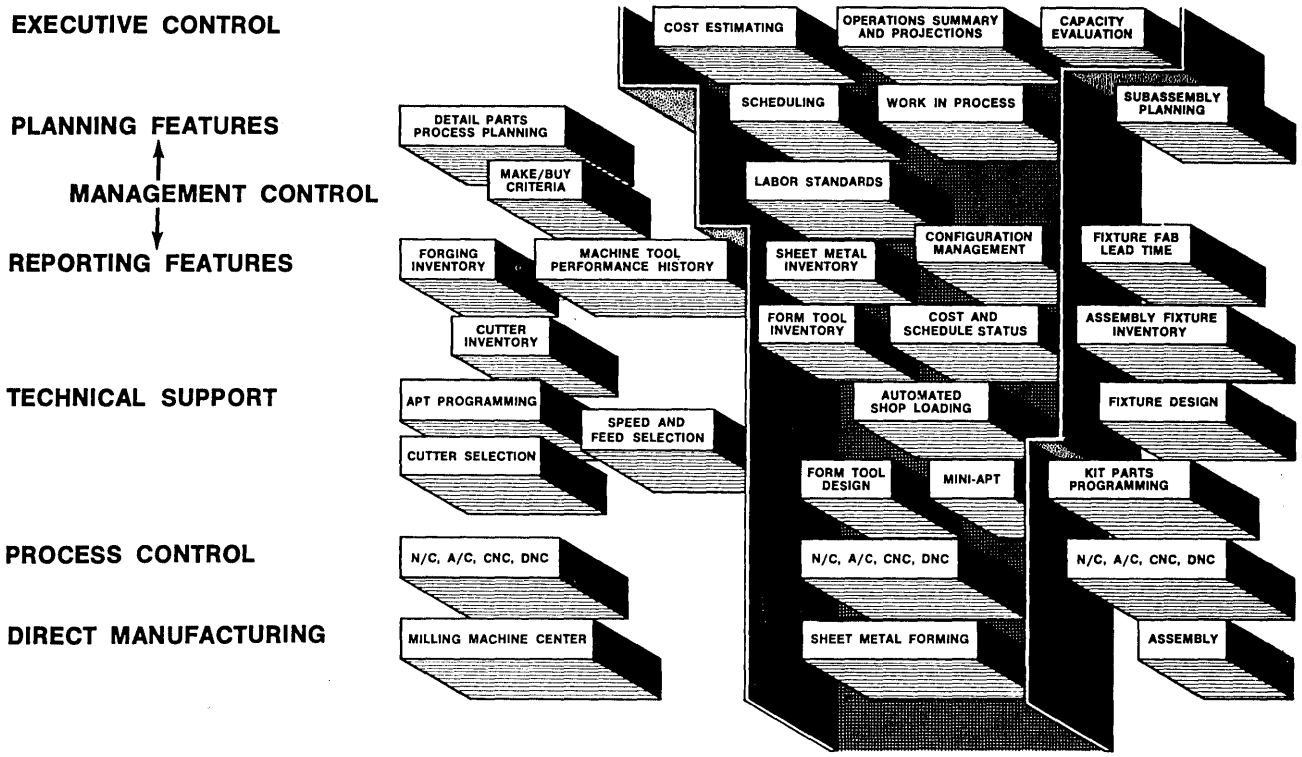
At the Air Force Materials Laboratory, Wright-Patterson Air Force Base, Ohio, the Integrated Computer-Aided Manufacturing (ICAM) program supports all areas of CAD/CAM technology (Fig. 1) and is concentrating on the integration of that technology in a comprehensive automated factory system (Fig. 2). To this end, ICAM plans to develop a standard software structure. As a framework for its programs, it has defined an evolutionary hierarchy of factory composition (Fig. 3) and has developed an architecture of manufacturing as a model for batch manufacturing. ICAM has also developed a special language, IDEF (integrated system definition), which it plans to establish as a standard for defining and analyzing manufacturing systems. ICAM has also contracted with nearly every aerospace company and software house to develop and apply parts of the ICAM architecture in real manufacturing applications (Fig. 4).

Industry participation in the development of ICAM's modular architecture approach is through a formal group of private sector advisors known as the Committee on Computer-Aided Manufacturing (COCAM). COCAM is administered by the National Academy of Engineering. The two programs, ICAM and IPAD, are the largest single government funded programs in CAD/CAM, with ICAM focused primarily on manufacturing and IPAD primarily on design.

Since standard interfaces among most of the components of integrated CAD/CAM systems have not yet been defined and accepted, it is not yet possible to build such systems by purchasing subsystems and plugging them in. There are some highly integrated systems in operation, but these are specialized, built by companies with large amounts of capital that began work on computerized design and manufacturing early and developed their own interfaces for specific applications.

One such system is at McDonnell Aircraft (McAir) in St. Louis. McAir became a pioneer in computer-aided design when it developed the Computer Aided Design-Drafting System, CADD (pronounced "caddy"), an interactive graphics system. The first CADD system was operational 10 years ago and was used to design the F-15 Eagle. Originally implemented on a System/360 model 195 connected to an IBM 2250 graphics display console, CADD has grown into a CAD/CAM system that uses five 370/168s sharing disk files and support over 48 CADD termi-

FIG. 3
MACROVIEW OF CAM



nals. An Evans and Sutherland Picture System 2 has replaced the IBM terminal as the graphic display device in the newer CADD terminals. The Picture System 2 is a random vector display supported by a PDP-11/70 interfaced to the 370 complex.

The CADD terminals are used for more than product design and drafting. Central to the total system concept is the use of shared data bases for communication and control throughout the manufacturing plant. Production planning and scheduling, project management, production control and quality assurance work together using CADD terminals and alphanumeric terminals to interact with common data files.

A few of the other major components of the system include Direct Numerical Control, Adaptive Control, Improved Reliability, and Management Data Acquisition. The DNC system includes 80 machines, from automated inspection machines to drafting machines, and from point-to-point drills to large multiaxis, multispindle profilers operating in the system. Adaptive Control monitors the spindle deflection, torque and heat generated, and adjusts the speed and feed rate of the cutting tool. Improved Reliability protects expensive parts from being ruined when there are failures in the machine tools or the control mechanisms. The Management Data Acquisition system continuously senses and records the utilization status of all machine tools and generates reports indicating production bottlenecks requiring corrective action.

TWO NEW SUB-SYSTEMS

To produce the part programs for the NC equipment, two CAD/CAM subsystems have also been developed and implemented: Graphic Numerical Control (GNC) and Remote APT Processing via Interactive Devices (RAPID). The graphic numerical control subsystem enables a part and tool programmer to generate NC programs in APT source statements using interactive graphics at a CADD terminal. The RAPID subsystem enables the part and tool programmer to access an APT program in an on-line file from a large number of crt terminals via teleprocessing. From a terminal, the programmer can modify a program, verify it, have it plotted, or have it translated and sent to the target machine tool.

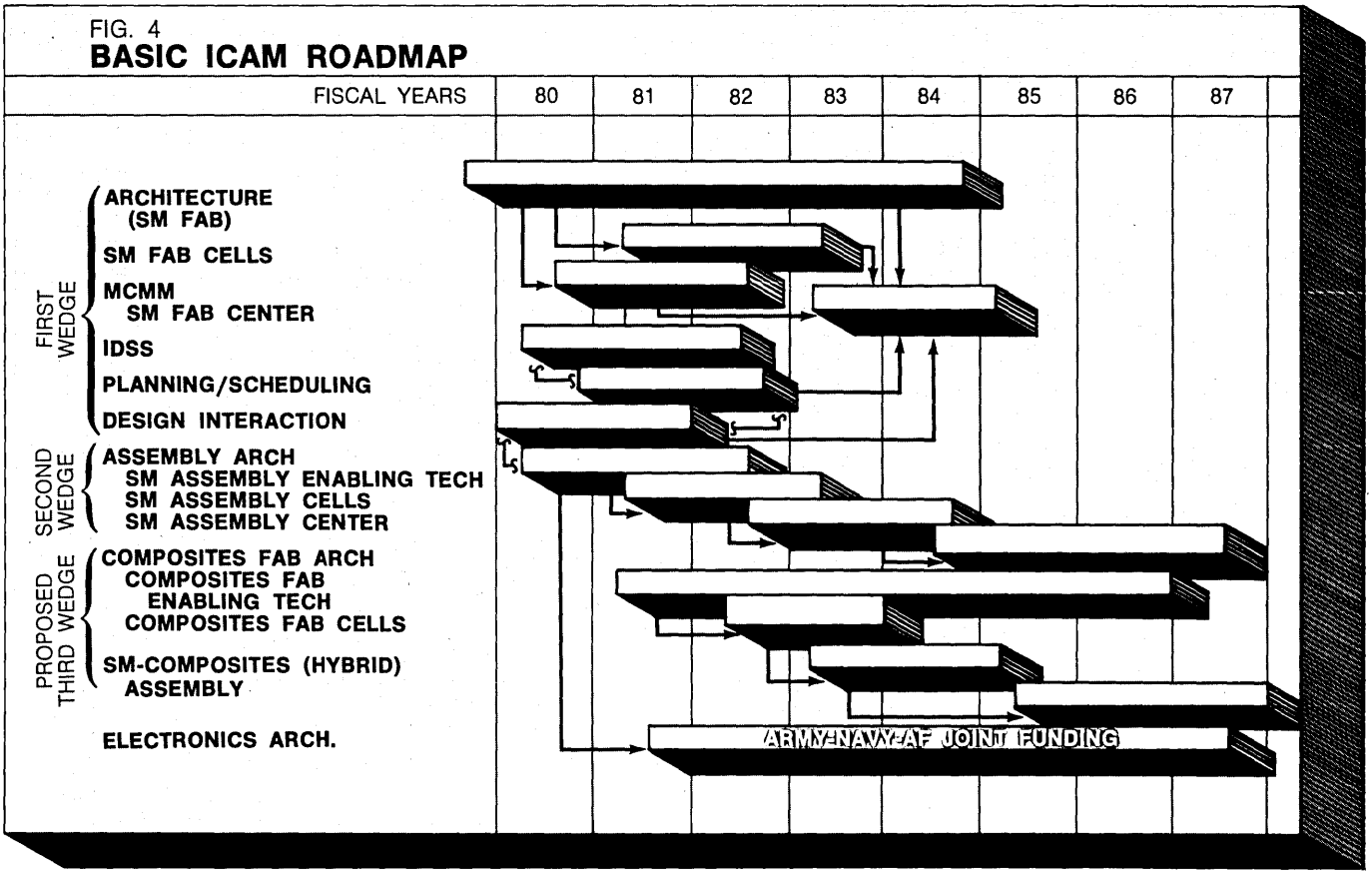
Other subsystems help planning and management tasks. One keeps shop managers informed by generating, for each shop, a series of production status reports telling the number of completed units, actual per-unit cost, productivity by operator and work center, and supervision.

The development of an integrated CAD/CAM system on the scale of McAir's required the commitment of huge financial and personnel resources. Few companies, even with active support from the government, have been willing to make this commitment. One way, however, to reduce risks has been to bypass the initial development costs and arrange to acquire proven technology from the pioneers. This has made it possible for other manufacturers to obtain working hardware and software, and to tailor it to specific environments and applications at lower costs and with less risk.

The Northrop Corp. has developed an integrated CAD/CAM system in this way, adapting two systems, McAir's CADD and a simpler, two-dimensional system from Lockeed, CADAM (Computer Aided Design and Manufacturing). Northrop developed an interface permitting the conversion of three-dimensional models in CADD format into various two-dimensional models in CADAM. The combined system is used for the generation of loft data, for three-dimensional layout, structural analysis using NASTRAN, detailed design and drafting, tooling design, graphic numerical control programming, and quality assurance support. Using the system in building the main structural box skin for the vertical tail of the F-18 aircraft, Northrop estimated an 800% increase in productivity for the pro-

A nonprofit R&D organization, CAM-I produces solutions for manufacturing problems and needs of university and industrial members.

FIG. 4
BASIC ICAM ROADMAP



cess, including design, manufacturing, and inspection.

Probably the most important advantage of using integrated systems is the efficiency derived from developing and communicating basic working information through common computer data bases. By sharing common data, instead of developing and maintaining independent records, different departments can coordinate work earlier and easier.

A disadvantage of CAD/CAM systems has been the expense of purchasing the systems and setting them up, and the cost of tailoring them to specific manufacturing needs. If the product being manufactured was not sufficiently complex and did not require the manufacture of many parts, a CAD/CAM system could not be justified. But the declining cost of hardware and the increasing sophistication and reliability of both hardware and software are changing that situation. One of the goals of the ICAM project is, in fact, to improve CAD/CAM technology so that it is practical for small quantity production. ✲

FOR INFORMATION

ICAM

Dennis E. Wisnosky
Program Manager
Integrated Computer Aided Manufacturing Program
Air Force Materials Laboratory (LTC)
Wright-Patterson AFB, OH 45443
(513) 225-2676

The annual "ICAM Industry Day" seminar will be held in Washington, D.C. in September. The proceedings of past seminars are available from ICAM.

IPAD

NASA IPAD Project Office
NASA Langley Research Center
Mail Stop 246
Hampton, VA 23665
Attention: Dr. Robert Fulton
(804) 827-2887, 2888

For information on the IPAD National Symposium, see Calendar, p. 26.

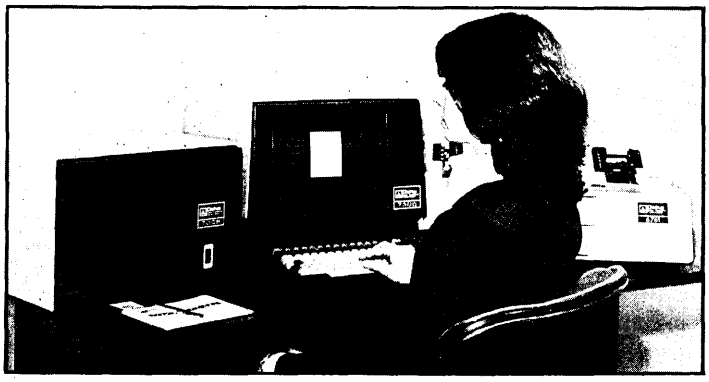
CAM-I

Neil Snodgrass
Senior Project Manager
Suite 1107
611 Ryan Plaza Drive
Arlington, TX 76011
(817) 265-5328

CAM-I is holding an International Spring Seminar on "Systems Modeling & Data Management" in Denver, Colo. at the Sheraton Denver Tech Center April 15-17. Also, the ninth annual meeting of CAM-I members will be in Dallas—Ft. Worth Nov. 18-20.

DAVID C. ALLEN

Mr. Allen is a senior programmer at Sperry Univac, General Systems Div., in Salt Lake City. Mr. Allen has extensive experience in systems design and analysis. His interest in CAD/CAM systems began in 1967, when he developed graphic output for an electrical circuit analysis program. He has an MS in electrical engineering from Rice University.



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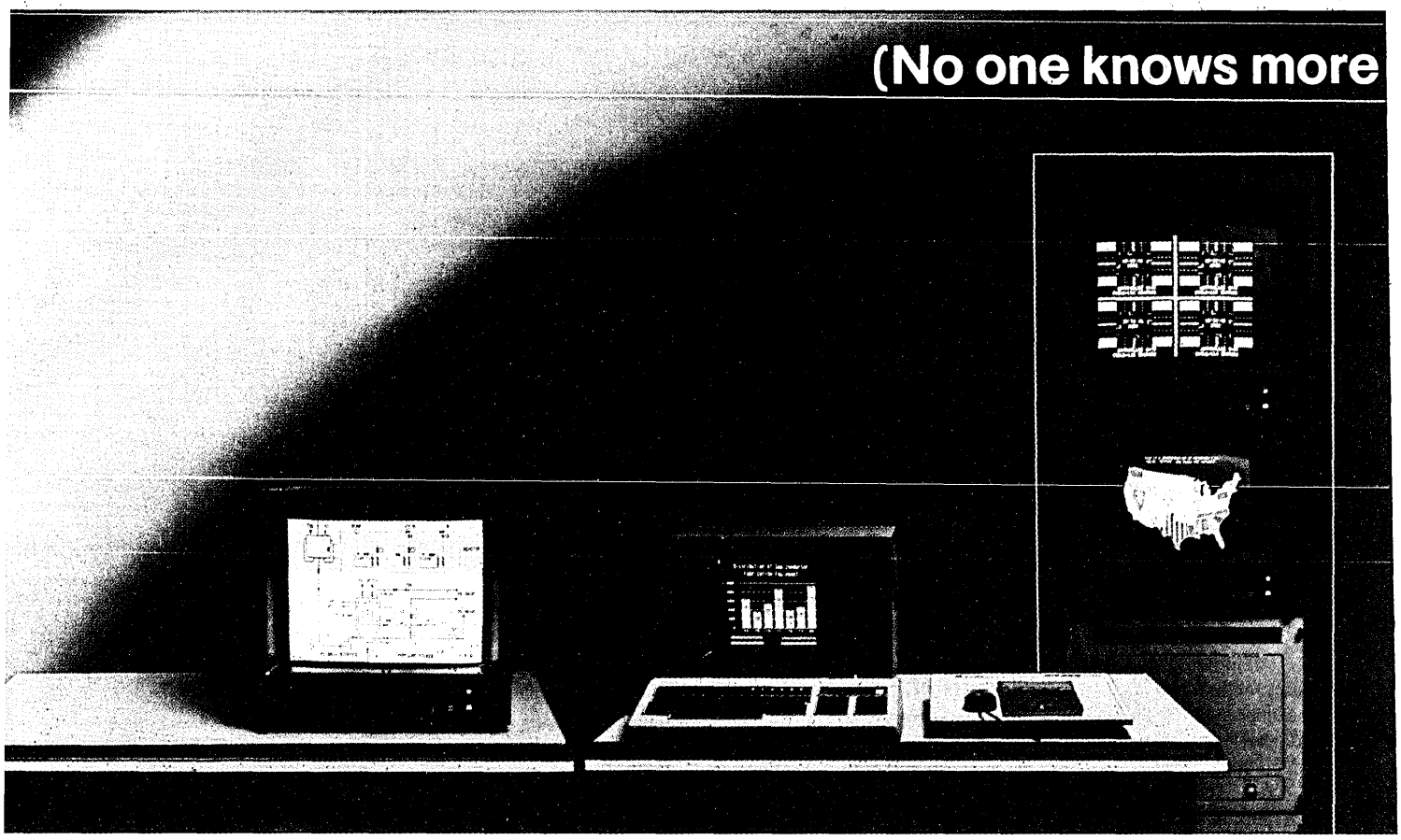

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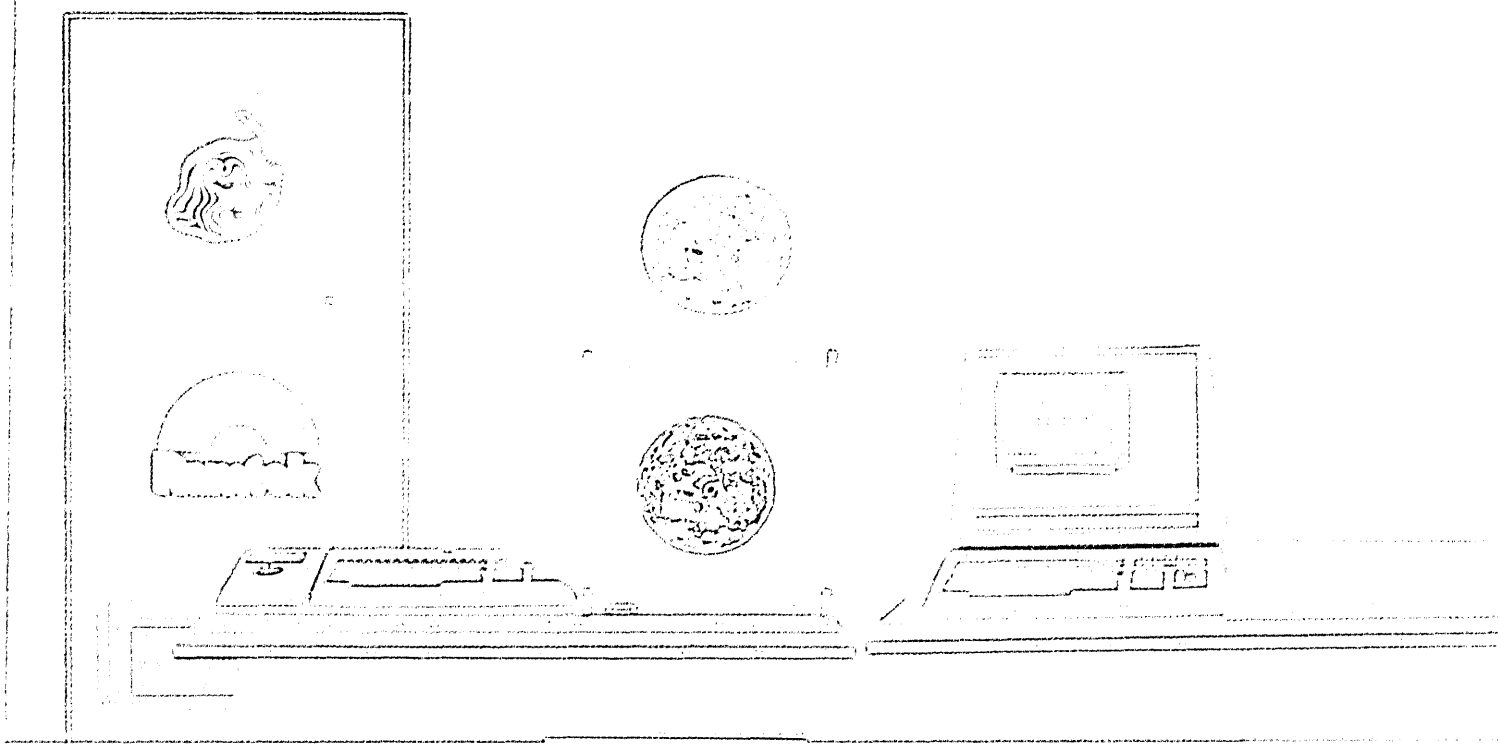
about Colorgraphics)



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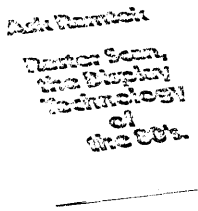
Why raster scan?



Raster scan has become the preferred technology whenever computer-based information and images must be displayed. To find out what raster scan is and how it compares with alternative display technologies, write for "Raster scan, the display technology of the 80's. It's Issue Number 2 of Ramtek's "USE OUR EXPERIENCE" series.

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For complete information on the Ramtek system that best fits your needs, write Ramtek, 2211 Lawson Lane, Santa Clara, CA 95050. Or, call your nearest Ramtek Office.

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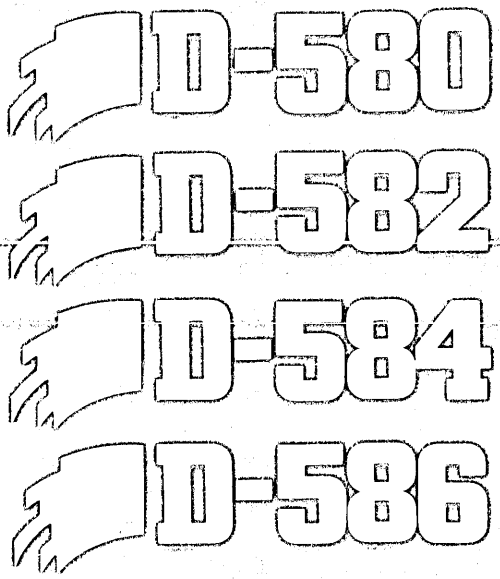

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CIRCLE 123 ON READER CARD

TRAINING: CAD COURSES FOR RPI STUDENTS

"Engineering education has changed—and not always for the better—over the past 20 years," says George Ansell, dean of engineering at Rensselaer Polytechnic Institute (RPI). The wide use of conventional time-shared computing, while permitting complex problem solving and precise solution output, has deprived modern students of the intuitive understanding of engineering concepts. A student of 20 years ago gained insight into concepts through the slow process of manual problem solving, using approximate solution techniques usually based on easy visualized trigonometric and exponential functions, according to Ansell.

The curriculum used to include mechanical drawing, drafting, and descriptive geometry, but by the '60s, there was a move away from drafting and geometry, a lessening of emphasis on lab work, and a new emphasis on analysis. Ansell believes that this shift has created a disastrous situation, with today's students unable to think visually.

In 1974, the Troy, N.Y., school planned a $30 million Engineering Initiatives Program (EIP), which focused on excellence in engineering education. EIP's five-year goal was to improve lab facilities, increase faculty, increase graduate enrollments, increase funded research volume, and strengthen an already strong curriculum. EIP also included a new $17 million engineering building, named for RPI alumnus J.E. Jonsson, a founder of Geophysical Services, Inc., the forerunner of Texas Instruments.

Ansell claims the EIP is a success, even though it still has a year and a half to go (it officially began in 1976). So far, more than 40% of the engineering faculty has been at RPI less than four years; faculty publications have more than doubled; the research volume has more than tripled, ranking RPI sixth among engineering programs; the curriculum received solid accreditation from a recent ECPD (Engineers' Council for Professional Development) evaluation; and the graphics facility has been successfully integrated into the curriculum.

The computer graphics facility, also a part of the EIP, was purchased in mid-1977 with a substantial contribution from General Motors. RPI hired Michael J. Wozny (then with the National Science Foundation in Washington, D.C.) to run the million-dollar facility. As director of the engineering school's Interactive Computer Graphics Center, which administers the facility, Wozny reports directly to the dean of engineering.

Prof. Michael J. Wozny directs the Interactive Computer Graphics Center at RPI.

RPI's dean of engineering George Ansell thinks graphics will improve the engineering curriculum.

PHOTOGRAPHS BY CARL HOWARD

Wozny is also a professor in the Electrical and Systems Engineering Department. His graphics experience goes back to the late '60s at Purdue, where he developed graphics software for instruction with several colleagues under a National Science Foundation (NSF) grant.

The graphics center, housed in the Jonsson Engineering Building, sports three dozen IMLAC Dynagraphics 6220 refresh graphics terminals, split between two interconnected PRIME 500 supermini computers (soon to be upgraded to top of the line 750s). Ansell feels that the addition of graphics terminals to an educational computer system marks the beginning of something better in engineering education. Students can now get visual solutions (representing generic families of solutions) just as easily as they can get a numeric answer for a specific problem. Additionally, the interactive nature of the system prolongs students' attention spans.

The Interactive Computer Graphics Center isn't an ivory tower for students with a graphics bent. As of January 1979, the center was in full swing, with almost 2,000 undergraduate students and 100 graduate students using the facility each semester. All 720 engineering freshmen are involved, learning graphics in their introductory computing courses.

Wozny says that these freshmen and all succeeding classes will use graphics in a variety of courses and disciplines throughout their careers at RPI. By getting started early, they will grow up with graphics, and understand it in a very intuitive way. They will be in an ideal position to apply this tool to solving engineering problems not even imagined today.

Senior students can opt to specialize in graphics and computer-aided design (CAD) if he (or she—22% of RPI's freshman class is women) desires. A mechanical engineering student may use the system to study vibrations in a physical system, while an electrical engineering student studying filters can use the system to vary parameters and see how a proposed filter design will perform. Many of RPI's graduates wind up in responsible management positions, according to Wozny; this across-the-board use of the Interactive Computer Graphics Center will help bring about the often-predicted generation of managers who see computers in the same light as graduates of 20 years ago saw slide rules and pencils and paper.

For the past three semesters, Wozny has taught a computer-aided design course for seniors and first-year graduate students. The course attracted almost 50 students (equally split between mechanical, electrical, and civil engineers plus a few computer science, physics, and architecture students) the first time it was offered in 1978, and another 50 when it was taught again the following semester due to student demand; the third continuous offering saw an enrollment of roughly 80 students. Many of these students felt that their education was incomplete if

they did not get an exposure to the graphics system before graduating. Related courses are offered at RPI in computer graphics and computer-aided manufacturing.

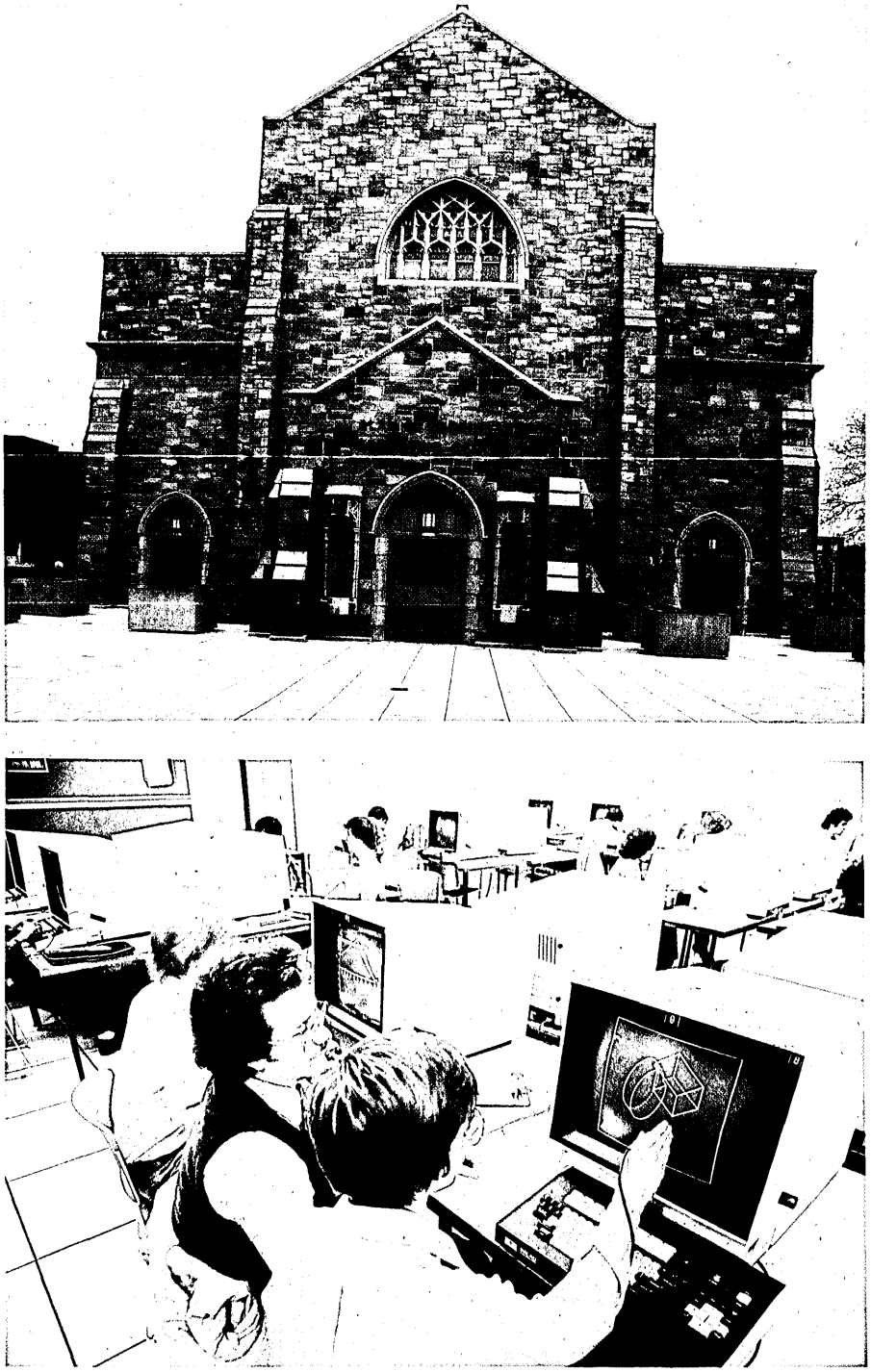
But RPI doesn't offer a degree in computer-aided design or in computer graphics: these students still graduate with degrees in electrical engineering, civil engineering, mechanical engineering, or whatever their field. Wozny feels very strongly that the graphics methodology needs to be thorougholy integrated into the entire engineering program over all four years, but should not replace conceptual learning such as Newton's laws of motion, or thermodynamics. Integrating grapics into an already tight undergrduate curriculum must be done very carefully.

The development of graphics software is a slow and expensive process, according to Wozny. Consequently, successful integration of graphics will require the cooperation of many universities. Wozny recently received a three year, $250,000 grant from the NSF to study how this cooperation can come about. There are many issues to deal with, says Wozny. A major one is the transportability of software, so that programs developed at one school can be tested and evaluated at other schools. Universities will also have to adopt some types of graphics standards and documentation procedures. Pilot studies will begin shortly in four subject areas at several schools, as well as surveys on graphics hardware and current best practices.

Industry has a large demand for people with CAD experience, Wozny notes. In the '60s, CAD was limited to the automotive and aerospace industries due to its high cost: it took a large mainframe of that era to support the graphics. But things began to change as we moved into the '70s: Tektronix introduced low cost storage tube graphics displays, and powerful minicomputers began to appear. However, it took the development of the right kind of software to bring the whole system together and create the turnkey graphics market. This market really began to take off around 1974, according to Wozny, and shows no signs of saturation. Today, software is certainly the driving force as turnkey systems are used in a greater variety of applications, and as more industries attempt to create their own engineering design systems.

RPI tries to make its engineering curriculum reflect the real world. To avoid the stereotypical academic environment, Wozny started an Industrial Associates Program that allows participating companies to submit real problems for students to investigate and solve. These problems should lead to generalized solutions that will help others with similar needs; confidentiality is respected where proprietary information is involved.

Participating associates pony up $20,000 a year, which helps support graduate students and defray overhead costs. The program provides a two-way flow: the university gets real-world problems, and industry, in addition to getting solutions, also helps train the engineers it will be hiring in the future.

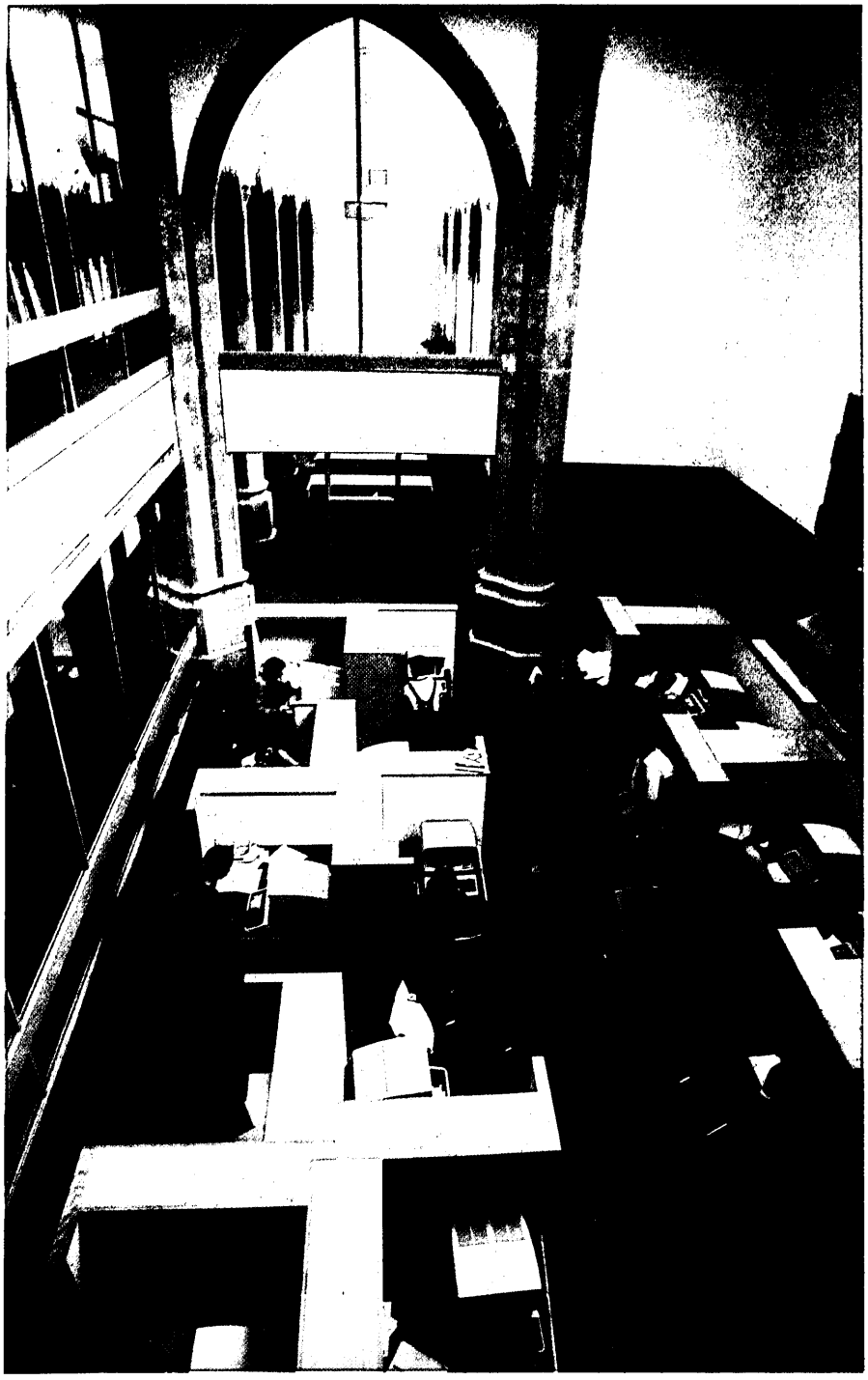


While retaining its original exterior, the renovated chapel (top) now houses RPI's computer center. Students in the center (below) use the system to explore a wide range of engineering problems.

Currently, the program has 10 participating associates, including AMP, Bethlehem Steel, Boeing, General Electric (both R&D, and Electric Utility divisions), Grumman, IBM, Lockheed, and equipment suppliers Prime and Imlac.

Problems of general applicability are sought. There's work on "solid primitives." Consider a three-dimensional line drawing of a box. If you pass a vertical plane through the middle of the box, the intersection will be four points, instead of the desired rectangular cross-section. A real-world application of this problem is laying out the plumbing at a refinery, so nothing meets at a physically impossible junction. It's said that finding and correcting such conflicts during the planning stage adds little to the project's cost, while finding unexpected interference during the actual building of the refinery can cost a significant amount (well in excess of the $20,00 per year associates' fee).

Another project deals with animation.



Rebuilt interior provides three levels—office, student work area, and equipment. Stained glass and high ceilings are visible from both office and student work levels. Basement houses an IBM 3033.

Specifically, one company wants to be able to animate its products, to see beforehand what tolerances will be required to ensure that each part mates properly with its neighbors. Still another project deals with the graphical evaluation of roller designs for rolling complex steel geometries.

Lockheed's CADAM package provides yet another area of research. At least one associate uses the package extensively, and it wants additional flexibility as well as training programs. The package is expensive and it runs on large 370s (RPI's campus computer center, housed in a beautifully modified church, runs a 3033). Lockheed has joined the Associates Program and made CADAM available to RPI for the project and the instructional program. Students will learn how to use CADAM and how to hook new application programs into CADAM's data base. This will help make the package useful to a wider audience while at the same time letting students learn the system—a salable job skill. Wozny says a number of companies, including toy manufacturers, are interested in the CADAM work.

Prime and Imlac benefit from RPI's software development. Imlac has hired one of Wozny's students to continue software development. Some projects use other hardware made available to RPI. For example, the graphics center has several of the new IBM 3277 graphics attachments. These units include an IBM 3277 alphanumeric terminal with a light pen, a Tektronix 618 storage tube with a joy stick for write-through mode, several Tektronix hardcopy units and a pen plotter, and a Summagraphics tablet. Another project involves the development of a special software interface to a Zeta four-color pen plotter, which will allow the Zeta to be used directly with the IBM 3277 Graphics Attachment for hardcopy from the Tektronix crt.

A new project involves the recently announced Applied Dynamics International LIGHT color raster graphics system. The Ann Arbor, Mich., company has plans to develop an effective color raster graphics engineering design system. RPI is working closely with ADI in the development of this system. Wozny has a class of 20 advanced students doing software development projects on the LIGHT terminal.

Other projects just starting involve the Calcomp plotter and the Summagraphics digitizing/drawing system, Wozny says.

The graphics center has been invited to serve on the Industrial Technical Advisory Board for the NASA IPAD (Integrated Programs for Aerospace-Vehicle Design) project. The goal of this $15 million NASA development is to define and implement an integrated computer software system to support planning, data definition, and control of an integrated engineering design process. Wozny says that the NASA software, including the AD 2000 design package, is currently being implemented on the RPI facility.

The associates program received a major boost last September when the National Science Foundation awarded Wozny a $1.2 million five-year grant to carry the concept of the associates program into a full-fledged University-Industry Cooperative Research Center. The funds have been used to hire full-time professional staff to augment the graduate students, to provide continuity in long term projects, to enforce standards, and to make the program attractive to industry.

The use of industry-supplied research problems should help RPI's students appreciate the problems of the real world while gaining experience that will prove immediately applicable when they enter the job market. Ansell notes that, in the past, the government was the dominant source for graduate research support, sponsoring problems, which often tended to be of the ivory tower variety. With RPI's increasing proportion of industrial graduate research support, says Ansell, RPI graduates will have their feet wet before donning mortarboards and gowns.

—Bill Musgrave

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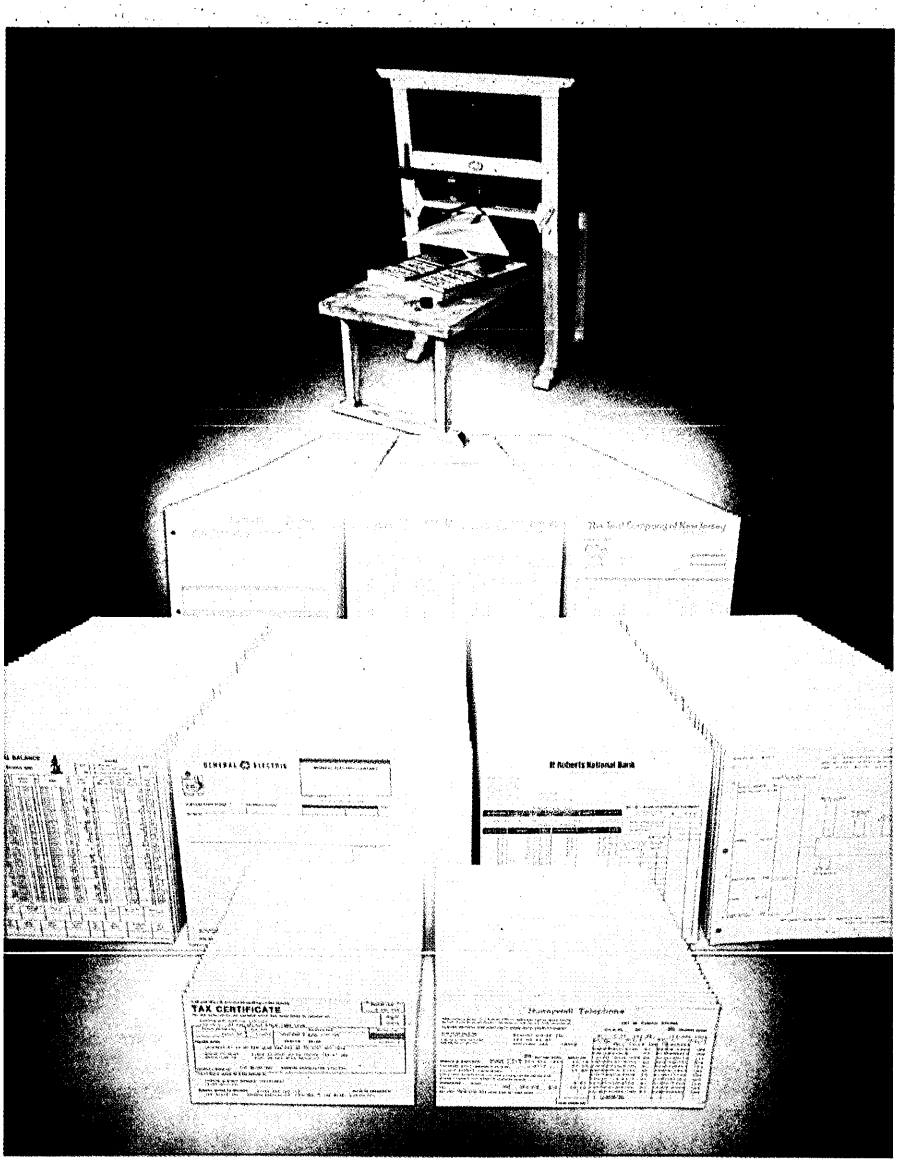

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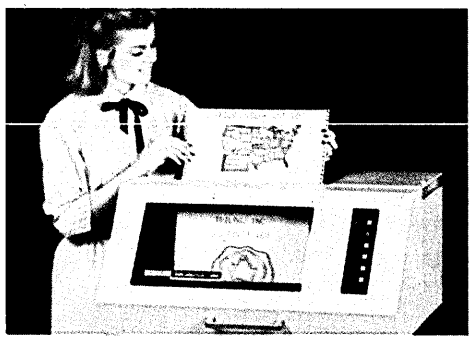

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An independent audit dramatically improves top management's ability to gather timely, accurate information.

INDEPENDENT AUDITING AS PROJECT CONTROL

by Michael G. Walker and Randolph Bracey

Imagine yourself responsible for a large system development effort being built for your organization. A project team is developing the system and the project manager or contractor reports to you. You have been put in charge of this project because it is vital to your organization and because your career indicates to your organization the growth and maturity it can trust.

Three-quarters of the way into the development cycle, you are unpleasantly surprised by the following scenario: the project manager reports the team is significantly behind schedule. Those past reports that showed him on schedule were overly optimistic. This means he is also over budget. You have bought less progress for your expenditures than expected, and those budget targets you thought were being met are actually overrun. The project manager also reports he will not deliver the system capabilities originally specified and the capabilities he now promises will not meet your minimum needs. Worst of all, you have signed months of rosy reports that now testify to your imprudence.

Your organization has lost time, money, and capability, and you have severely damaged a well-earned reputation. The only recourse open to you, including litigation, is admission of failure.

How do you ensure yourself against being caught again by such a disastrous surprise?

Knowing that software system development is difficult to measure, difficult to control, and fraught with risk, you have already taken pains to establish a system of managing software development to protect both your organization and yourself. You prefer tried and proven technology—offered a choice, you will employ a hardware and software mix that has been successfully demonstrated in other environments. You are content to follow meekly, but safely, the pioneering work of others.

But let's say a project arises on which you cannot employ antiquated technology. Proven technology simply isn't sufficient, and the new system requires a mix of hardware and software not attempted in any other environment. Your recourse is to establish sound management and control practices. You are familiar with current management literature, you have attended recent software engineering conferences, and you are pleased with the evolution of management methodologies. So you establish software engineering policies and procedures, and institute a methodology that mandates:

- a project management plan
- a computer program development plan
- modern programming practices
- quality assurance
- configuration management
- an independent test team
- binary status reporting
- earned value accounting

Yet, you are still not at ease because you know others have also initiated similar techniques and the results have been unpredictable. You are well aware of the people problems, especially the problem of goal displacement—your goals and those of the development team are not a perfect fit. The team is rewarded for meeting schedules and operating within a budget. It must produce a system within those constraints for its performance to be judged superior. Those criteria do not always correspond to your goals of reliability and flexibility. You know when the inevitable crunch comes, your goals will be sacrificed for those of the team. Since you depend on it not only to implement the technology but to report on the project status, the information you get is likely to be tardy, partial, and overly optimistic.

FORMAL REVIEW CYCLE

You go one step further. You initiate a formal review cycle. You insist on a System Requirement Review, a Preliminary Design Review, and a Critical Design Review; you also want a representative on the Configuration Control Board to represent your interests in all baseline changes. If you cannot expect the development team to sacrifice its interest for yours, you institute processes to protect your own. You attempt to track the developer closely through a series of reviews.

Still, you are not satisfied. While you are confident these new techniques provide the ability to handle problems you recognize, what about unrecognized problems? You need an insurance policy against these surprises. This insurance is provided by the independent development audit.

The independent development audit is a disciplined inspection of a software system development effort performed by a team of specialists independent of the development team. Doing a development audit is appropriate at any step of the software system life cycle but it is especially valuable in the beginning stages.

There are essentially three reasons for commissioning an independent audit. Each of these is an answer to the manager's question: how do I protect myself from surprises?

First, the audit will evaluate the present status of the project, indicating its quality and risk. Secondly, the audit will foretell the system's future quality and risk. Finally, the audit can be used as the first step in righting wrongs. If the system is evolving into a disaster, the audit will not only indicate this trend, but may also offer suggestions for remediation.

There are at least seven distinct steps in conducting an independent development audit that should be carried out in order. The first step is to establish a small team of experts experienced both in software development and auditing. If people with these skills are not currently members of your organization, you should employ a contractor with auditing experience.

The authority of the team cannot be compromised. The audit team must be the direct arm of the highest level of management,

The audit team must be the direct arm of the highest level of management.

and the project development team must respond to the audit as it would to top management.

Second, the team should familiarize itself with the background and requirements of the project by reading the RFP, the proposal, and the planning documents such as the project management plan and the computer program development plan. The team also should be formally briefed by the project manager concerning the evolution of the project and its current status. After this process of familiarization, the audit team should know enough about the goals and history of the project to place its inspections in the proper context.

Third, the team should audit the project on-site. The audit team should interview key project personnel, including chief analysts, designers, programmers, testers, quality controllers, configuration controllers, and managers. The audit team should read key project documents including the requirements, design plan, code, test plans, test procedures, test results, engineering notebooks, engineering change proposals, and anything else deemed appropriate. The audit team should look for deviations from the project plan, project methodology, and expected output.

A LOOK AT TEAM MORALE

The audit team should also conduct interviews with randomly selected project personnel. The morale and sentiments of the project staff are an important predictor of success, and the audit team needs a perspective on this vital component.

Fourth, the audit team should debrief the project management following the completion of the audit. It is not necessary to divulge any major audit findings at this time; the debriefing is simply a courtesy.

Fifth, the audit team should produce a report of its findings written according to a format and a schedule you specify when the auditor is selected. The audit report format should be contained in an audit guide. If you do not have a guide for the audit report, then the guide of the contracted auditor may be used. The applicability of this guide should be considered when selecting an auditor.

Sixth, the audit team should distribute the report to you and to the project team. Usually, the project team will be allowed to respond to the report before any remedial action is taken. You can then use the combination of the audit report and the response of the project team to guide your actions.

Seventh, the audit team should follow up the audit by inspecting the project to verify that your recommendations have been incorporated and your interests are thereby reflected. This follow-up should await a period sufficient for the development team to make the recommended corrections. The follow-up is not an audit, but it is a check on the response of the project team. You should procure additional audits if the project's risk warrants it. Usually, several audits should be conducted during the development cycle of a complex software system.

An independent audit dramatically improves top management's ability to gather timely and accurate information; it is, indeed, an effective insurance policy against disastrous surprises. ❋

"They deleted my password to the management information data base."
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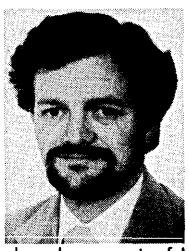
MICHAEL WALKER

Dr. Walker is a senior scientist with EDS. He has functioned as chief programmer and project manager, and has been an auditor of software systems under development. Dr. Walker has authored a software engineering guide, books, and papers. His latest book, *Managing Reliable Software: The Paradigmatic Approach,* will be published this spring.

RANDOLPH BRACEY



Mr. Bracey is a computer scientist with Sterling Systems, Inc. He has been a programmer, systems analyst, and consultant. He specializes in the development of large scale software systems and is currently involved in the area of project management.

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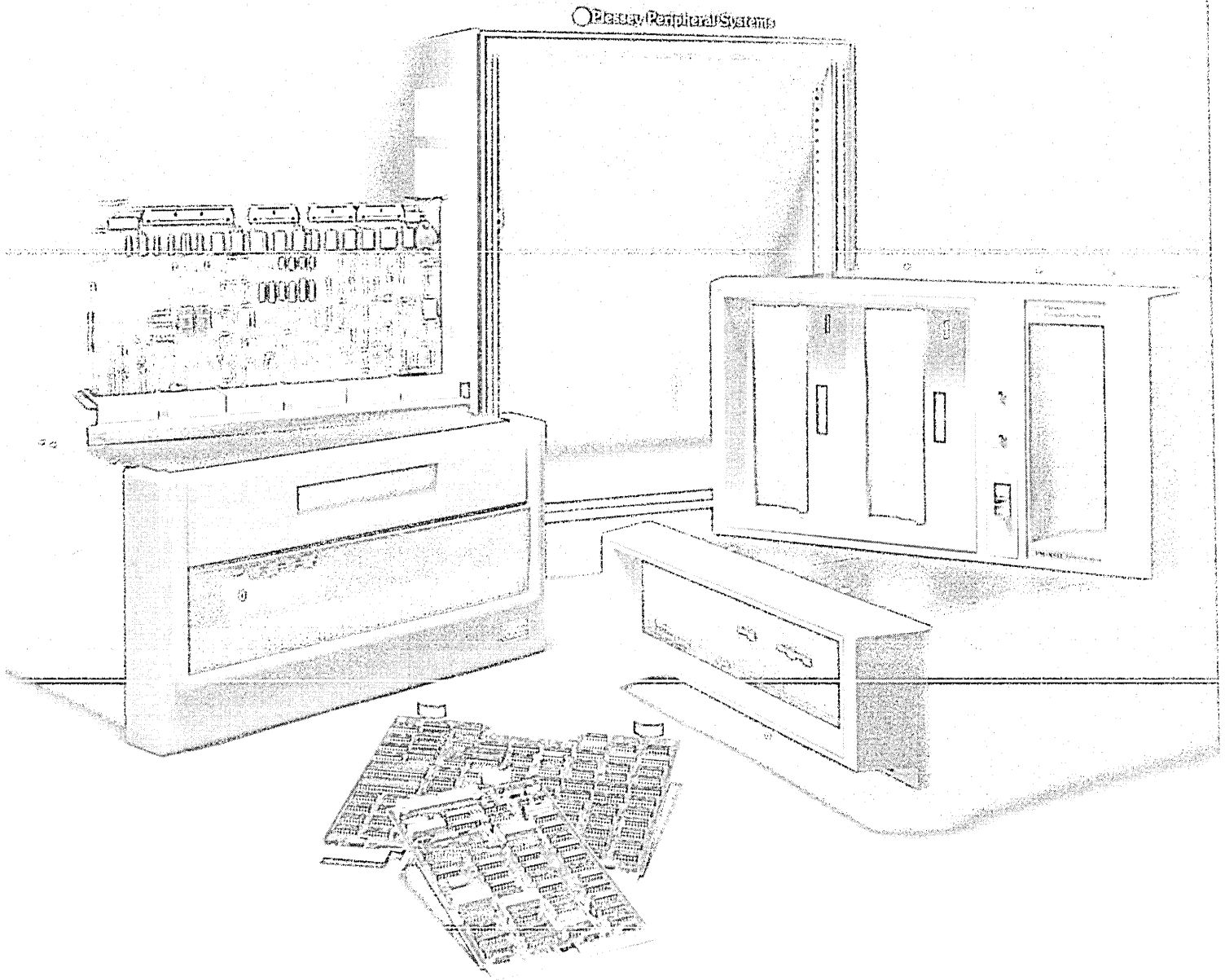

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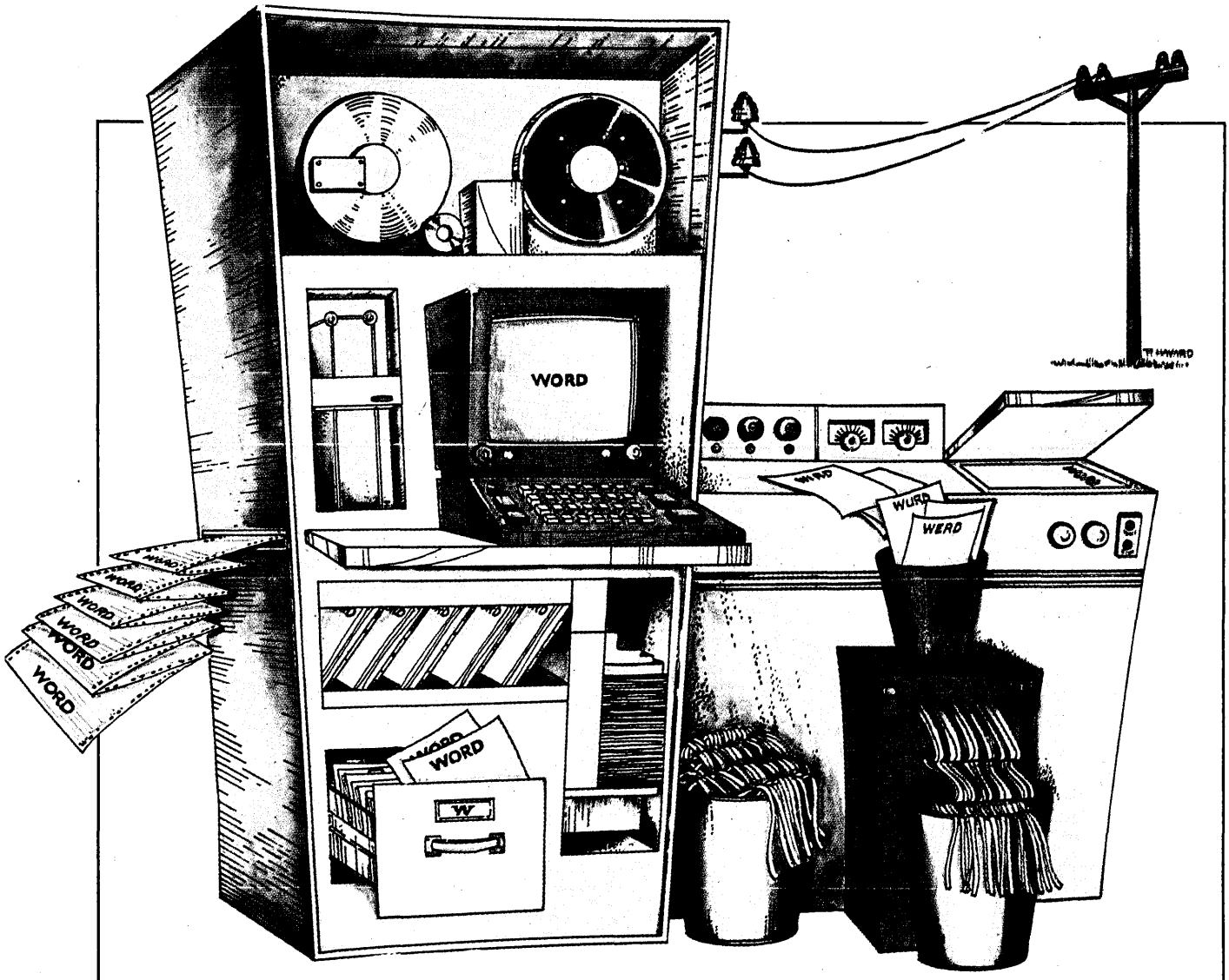

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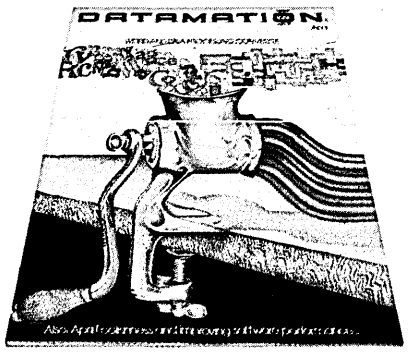

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MAYO'S MEDICAL MINI-MICRO

Few members of the medical profession (if any) work in isolation. Modern medicine is a product of interdependence among many specialties, and scientific advances in medicine require close interaction with technical disciplines not ordinarily considered medical. A single area of human health care—in the following case, understanding lung disease and function—may bring physicists, chemists, and engineers from several fields together with physicians.

At the division of Thoracic Diseases of the Mayo Clinic in Rochester, Minn., nearly 40 staff members are involved in pulmonary (lung-related) medicine and research (some are temporary staff, such as those on postdoctoral assignment for special research training). This consortium brings together backgrounds in internal medicine, cardiovascular and pulmonary physiology, anesthesiology, mechanical engineering, aeronautical engineering, and computer science. The major emphasis of the research is lung mechanics—mechanical factors that determine the function of the lung as an air pump and that govern the distribution of ventilation and blood flow—in short, the factors that determine the lung's efficiency as a gas exchanger. Investigations of lung function at Mayo, which embrace both human studies and animal experimentation, depend on repetitive measurements to obtain reliable data on lung volume, air flow, pressure, diffusion, and other variables. Data acquisition used to involve strip-chart recording of information from a variety of analog instrumentation. Laborious measurements were taken directly from charts and manual calculations were performed to derive lung characteristics and performance values for a human patient or animal subject before and after some intervention (either surgical or noninvasive). Tables were then compiled, and cards were punched and fed into a batch processor at the Department of Medical Statistics for statistical analysis. The procedure was long, labor-intensive, and only a limited number of samples could be obtained.

Research applications like these are ideal candidates for an on-line system that can automate data collection with a maximum

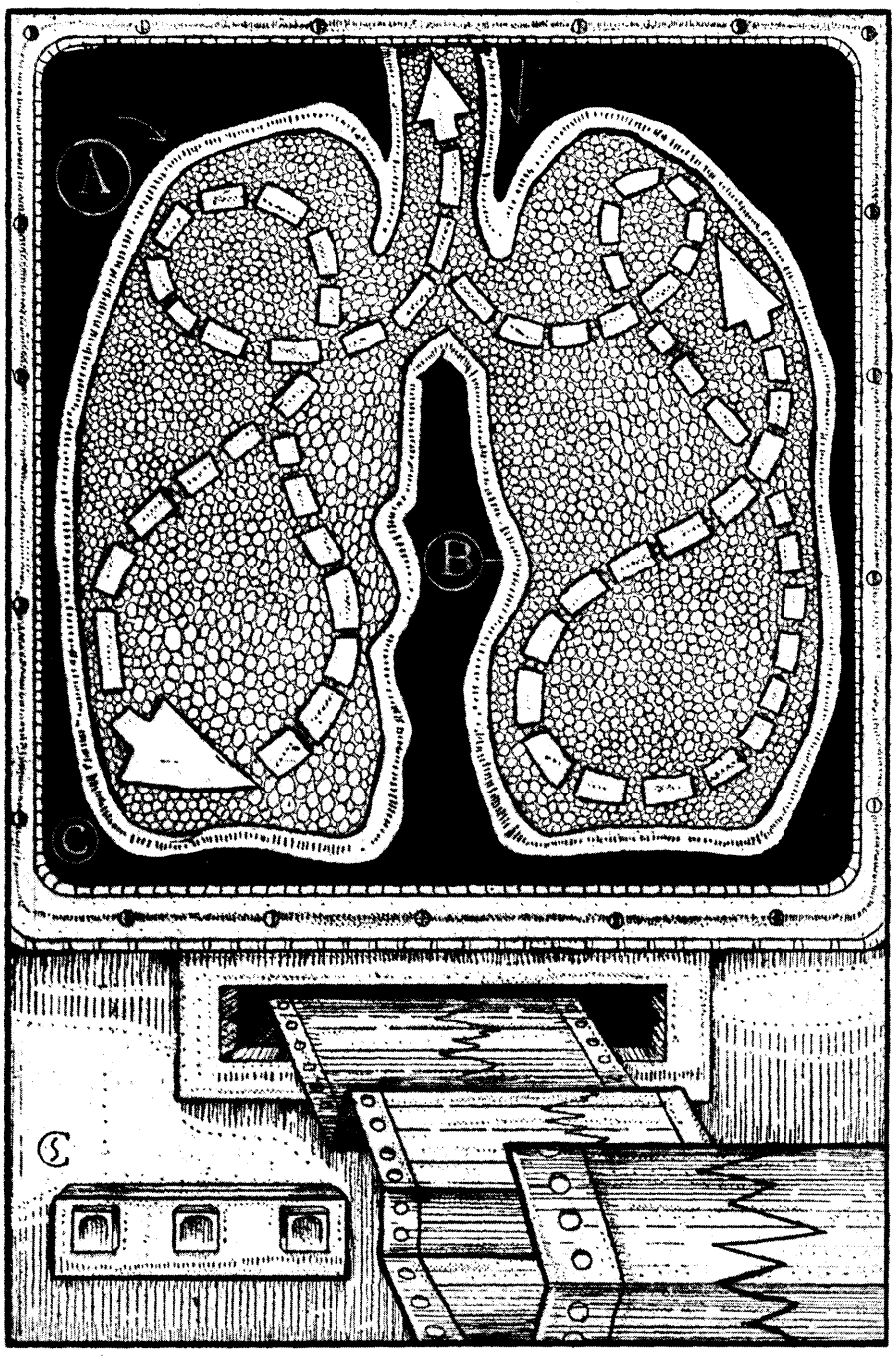

ILLUSTRATION BY CHRIS SPOLLEN

With an on-line system, data collection is automated with a maximum assurance of reliability and a minimum risk of data loss.

assurance of reliability and minimum risk of data loss. Some experiments cannot be repeated or easily duplicated because of expense, unavailability of subject, or unique conditions. In research it can be disastrous to lose data, and it is important to be able to ascertain during experiments that test data is valid and equipment is functioning properly. And of course, aside from data acquisition, computers offer the mathematical means for elaborate analysis beyond any manual means.

STAR NETWORK SET UP

To enable simultaneous monitoring of several experiments, the thoracic research team elected to construct a star network consisting of a host minicomputer and a series of distributed microcomputers, patterned after a network already in use at the Clinical Pulmonary Function (PF) Laboratories at Mayo. System requirements for the research network included the ability to perform initial data reduction on-line for sampling inspection, sufficient power for more complex off-line number crunching, such as finite element analysis, and time-sharing capability for independent program development and data manipulation.

The separate clinical and research networks are programmed and maintained by staff personnel at the Mayo Clinic, where medical administrative support encompasses about 70 mainframes and a considerably greater number of smaller machines.

The distributed network at the Mayo Clinical PF Labs had demonstrated the operational advantages of the distributed processing concept as well as its economic promise: to add more functions or bring another lab on-line, simply install another satellite microcomputer. Thus, as research needs for greater computational power and time-sharing capability began to be felt, the network concept became the basis for Mayo's proposal to the Heart, Blood and Lung Institute of the National Institutes of Health for funding for a system devoted entirely to lung research.

Familiarity with the clinical network's RSX-11M software and vendor hardware influenced the choice of a PDP-11/70 computer as the research network's host system (see Fig. 1). With 512K bytes of main memory and floating point processor, the central system includes two 67-megabyte disk packs, floppy disk, nine-track magnetic tape, and line printer. Four LSI-11 microcomputers, each with 64K bytes of memory, are distributed in laboratories ranging from 100 feet to 1½ miles from the host system. The remote systems run under core-only, real-time RSX-11S, and are equipped with analog-to-digital (A/D) and digital-to-analog (D/A) converters, digital I/O interfaces and local keyboard-controlled graphic crt terminals. All operating and application software is downline-loaded from the PDP11/70.

To avoid a large investment in further software development, DECnet-M and DECnet-S interfaces and software were chosen to control network communication. The network is currently limited to point-to-point and task-to-task communication, although capabilities for file transfer and remote resource access exist if the need should arise.

Two of the LSI-11s are situated in the Thoracic division's Plummer Building and are hardwired to the central system; each monitors a pair of PF research laboratories and is outfitted with duplicate sets of A/D, D/A, digital I/O and crt equipment. Another remote system performs image processing for the Biodynamics Research Unit in the Medical Sciences Building, half a mile distant, and communicates with the host through a null modem. The fourth microcomputer system, in the Anesthesiology Research Unit of St. Mary's Hospital, utilizes a Codex intelligent multiplexor to permit both intersystem communication and time-shared terminal access to the PDP11/70 at 4,800 baud. All other network traffic moves at 9,600 baud.

The central system also supports eight time-sharing terminals (graphic crts) for program development and independent research activity; two are situated at Medical Sciences and St. Mary's and can be switched between remote and central systems.

Currently, research involving humans and animals is divided into six project areas. Common to all experiments are measurements of air flow, lung volume, and pressure that require use of spirometers, often in conjunction with plethysmographs—airtight, total-body enclosures that enable highly accurate measurements of lung volume—plus additional measurements peculiar to the experiment. Signals from analog transducers feed eight-channel strip chart recorders and 12-bit A/D converters for capture and storage by the network. Other analog equipment for project-specific investigations is added to the basic configurations.

DYNAMICS OF THE LUNG

The Biodynamics Research Unit uses animals to investigate regional stress-strain relationships within the lung. The project's purpose is to understand the dynamic phenomenon of lung expansion by discovering the distribution of strain involved and the elastic properties of lung tissue. Results of the study will contribute to construction of theoretical models of lung expansion and deformation.

Preexperimental preparation calls for surgical implantation of small markers (commonly called "beads") into the lung of an animal such as a dog. Two types of markers are used for differentiation: spheres, 1 mm. in diameter and rods 2 mm long by 1 mm. in diameter. Distributed in more or less random fashion, the markers become encased in a 100-micron-thick fibrous capsule within two weeks and remain in position even under 8G stress. The fibrous capsule is the only pathology observed following this procedure.

In the experimental phase, displacement of the markers in three-dimensional space throughout a respiratory maneuver is tracked with a complex graphics system incorporating custom circuitry. The system is made up of two imaging chains, each consisting of X-ray source, fluoroscopic screen, image intensifier, and television camera. Each image is scanned at the rate of 30 complete 512-line frames per second; images from the two chains are paired as left and right halves of the same video frame, displayed and recorded on videotape in temporal synchrony with up to 16 channels of analog data (vascular, pleural and airway pressures, ventilation volume and velocity, electrocardiogram). Calibrations and reference axes for spatial localization of markers are added at the end of the experiment.

For analysis, images are transferred from videotape to a stop-action video disk system. Using a computer station consisting of alphanumeric keyboard, disk controller, video monitor and a Doring unit, which combines an interactive video cursor with the video image, an operator tracks all markers identifiable on both images of each frame and enters geometric coordinates into computer memory. The procedure is repeated for all or selected frames for the duration of the respiratory maneuver to build dynamic representations of marker displacements.

At the completion of each frame, the LSI-11 transmits X-Y coordinates and converted analog data for each frame in 200-byte bursts through the DECnet link to the PDP-11/70 for magnetic tape storage and recall. Subsequent analysis corrects for magnification and pincushion distortions and calculates X-Y-Z coordinates for each marker.

Changes in lung shape and volume during respiratory maneuvers cause relative displacements of the markers. However, since lung distortion is nonuniform, it cannot be adequately mapped from linear distances between pairs of markers. Instead, four markers are used to define a tetrahedron of lung tissue; with the help of a large deformation analysis program adapted from one employed in mechanical engineering, displacement rotation and three-dimensional distortion (strain) of that lung region can be determined. These data are analyzed to gain insight into how respiratory muscles, rib cage, abdomen, and lung interact to govern the distribution of ventilation within the lung in normal and pathological conditions.

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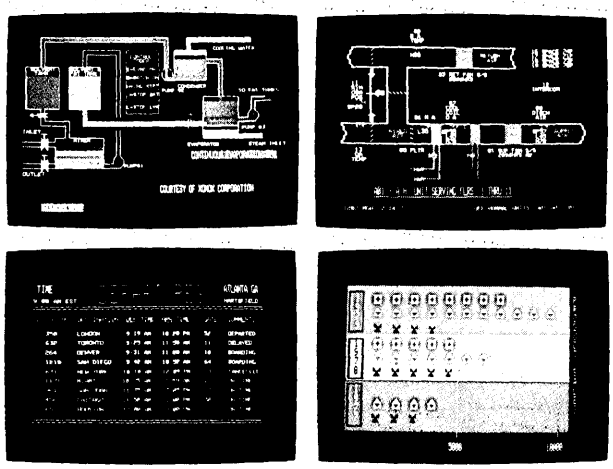

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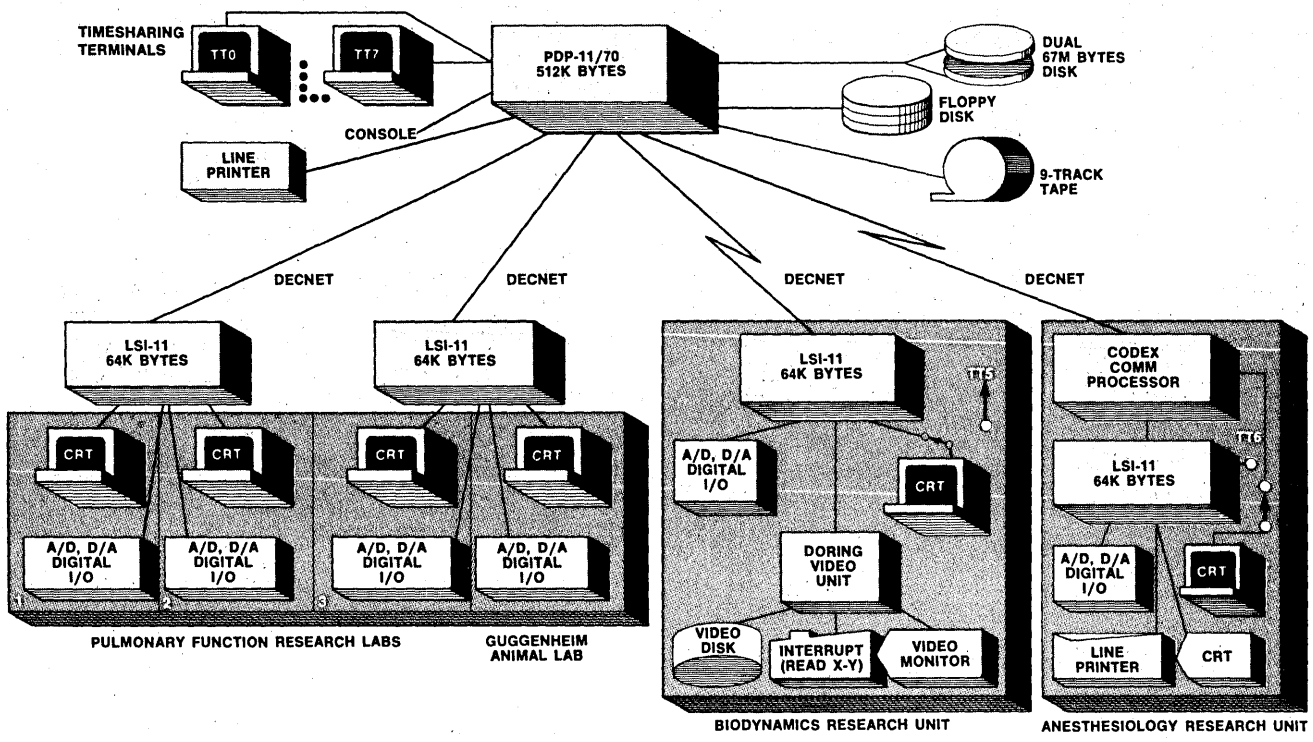
FIG. 1.
THORACIC RESEARCH COMPUTER NETWORK



CHARTS BY CYNTHIA STODDARD

opment is under way on an algorithm that will enable automatic tracking of markers after an operator makes initial identifications in the first frame. Automatic tracking has been successful in peripheral lung fields, where great differences in marker and tissue density exist; problems in differentiation are encountered near the heart and central regions of the rib cage. A partial solution is expected with the acquisition of a new imaging system with 100 times the dynamic range of the current equipment. The system will permit an operator to command automatic tracking of any set of succeeding frames following initial identification; after each frame, the system will ask for operator evaluation, during which corrections can be made.

The biplane fluoroscopy studies also provide a body of actual data for engineering analyses of lung deformation. Understanding the mechanical behavior of the lung during nonuniform deformation, such as from gravitational stress, involves studying the lungs as an engineering material—the interaction of supporting parenchyma with blood vessels and airways, which tend to collapse when subject to nonuniform pressure distribution. Finite element analysis is used to interpret material properties and stress factors to build theoretical models that simulate and predict lung behavior. Current task memory management of the host system requires use of a relatively simple but adequate finite element analysis program; to avoid interruption of other activity, the computer-oriented program is normally assigned a lower priority and run in the background to real-time tasks.

ANESTHESIOLOGY RESEARCH

Impairment of lung function during anesthesia has been the subject of a 16-year research effort at St. Mary's Hospital. It has long been recognized that patients under anesthesia need more oxygen and must breathe a greater volume of air than if awake, but the causes are not well understood. Studies indicate that different anesthetic agents do not affect lung tissue but do have varying effects on respiratory muscle and the central nervous system. Resulting changes in regional lung mechanics bring about unequal ventilation distribution and a deficit in gas exchange.

Research procedures seek to isolate the changes in regional mechanics and their specific causes. Observation of abnormal lung behavior also permits a more thorough recognition of normal mechanical functions and ventilation.

Experimentation involves the use of various animals that exhibit mechanical changes under anesthesia similar to man—rabbits, dogs, pigs, and baboons. Occasionally, human volunteers also participate. While asleep, the subject breathes a gas mixture containing a trace amount of radioactive xenon. An external scintillation detector counts emerging particles to measure gas distribution, and magnetometers monitor magnetic fields induced across the thorax that indicate changes in vertical and lateral dimensions of the chest cavity.

In this project the remote LSI-11 acts primarily as a buffer to prevent loss of data from detectors and magnetometers. Computations of gas distribution, thoracic and abdominal configurations, and correlation with regional ventilation are carried out by the central system; results are returned to the laboratory for paper plotting and display in quasi-real time (i.e., sufficiently fast for experiment quality control). Sample data are used to construct a calibration curve using least squares—best fit to maintain measurement accuracy. On-line data acquisition enables continuous measurements of lung and thoracic activity, whereas previous sample-and-record methods permitted only spot checks. Without computer-aided computation, analysis of a single study required three months; the potential now exists to accomplish the same work in 10 minutes.

While Xenon tracing does not provide the fine resolution of bead tracking, it is far simpler to administer and allows human participation, requiring no surgical intervention and posing a much lower level of radioactive exposure than biplane fluoroscopy.

Another facet of the anesthesiology study, investigation of ventilation-perfusion ratios within the lung, calls for intravenous infusion of trace amounts of six inert gases. Chromatography is employed to determine levels of each gas in the arterial and venous blood and expired air. Subsequent matrix inversion defines the distribution of ventilation and perfusion among lung units with differing ventilation-perfusion ratios. This distribution determines the efficiency of oxygen-carbon dioxide exchange by the lung.

The technique gives valuable insights into the underlying mechanism for impaired

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gas exchange during anesthesia. The computations, which require a large matrix, are conducted off-line on the PDP-11. This study too owes its feasibility to computer assistance; hand calculation of results would take years.

AIR FLOW RESEARCH

Most common afflictions of the human lung fall within the category of obstructive lung disease, such as bronchitis and emphysema. Symptoms include loss of tissue elasticity and narrowing of the airways, which case a reduction in maximal flow of air during respiration. Precise understanding and treatment of the effects of obstructive lung disease depend on thorough knowledge of the lung's internal configuration and material properties. Engineering backgrounds are of particular value to this study because maximal flow is essentially a complex problem in fluid mechanics, involving the interaction of driving pressure, properties of transfer tubes, and surrounding lung tissue. Much of the study involves building theoretical models that can predict maximal flow and related functions for varying conditions of health and age.

The air flow project uses data from all pulmonary research activities and from tests conducted in pulmonary function laboratories with animals, human volunteers with mild obstructive lung disease, and lungs from autopsy. Many of the tests are simple flow-volume spirometry with added measurements, particularly for pressure. Accurate measurements of lung volume are critical here, because the performance of a given lung is largely volume-dependent. Plethysmographs, which measure changes in total body volume during respiration by the displacement method, are more precise than spirometers. Spirometers measure volumes of inspired and expired gases and do not take into account changes caused by O_2-CO_2 exchange, substitution of warm, damp air for cool, dry air, compression or expansion of gas by respiratory muscle action.

Determination of airway pressure/flow relationships is important to discovery of impedance characteristics of transfer tubes within the lung. Pressure differentials must be measured at each stage of lung passage from alveoli to bronchi. For living subjects pressure is usually measured at the mouth; nonroutine procedures may call for estimating pleural cavity pressure with an esophagal catheter or placing a catheter in the airway after anesthetizing the vocal cords (done mostly with animals). Postmortem examinations allow direct insertion of catheters into the upper and lower lobes of the lung for multiple simultaneous readings.

Oscillator resistance methods, sometimes regarded as distant relatives of seismic exploration, are used to study airway geometry in the absence of appreciable airflow. The technique requires modulation of air pressure at a certain frequency or combination of frequencies at the airway opening and monitoring of pressure changes at points further down. Low-frequency analog signals (1-30 Hz) are fed to a long-excursion loudspeaker connected to the airway; resultant pressure fluctuations are monitored along with flow and volume signals, recorded on a strip chart, processed and stored by the laboratory microcomputer system—or, occasionally, passed through an eight-channel A/D converter directly to the central PDP-11/70.

Simple, fixed-frequency oscillator resistance and flow-volume curve programs are available through the LSI-11. Fast Fourier Transform and data reduction for tests involving a spectrum of frequencies are performed in real time by the central system to enable in-process adjustment of input signals.

The real-time network permits continuous data collection and on-line editing for comparison and selection of the best single or best average test result. As in most other pulmonary research laboratories, local video terminals are used for experimental quality control; final hardcopy is produced by a line printer attached to the central facility.

Of great clinical importance are the causes and treatment of airway narrowing, as occurs with asthma. The airway smooth muscle study is an off-line investigation of pharmacologic control and enervation of airway smooth muscle in vitro, deriving data from experiments with small strips of muscle tissue (currently from animals, although human postmortem and surgical specimen examinations are planned). The strips are mounted and exposed to various internal and external agents—histamine, pollen, and other allergens as well as antiallergenic drugs—in order to discover the types and sensitivity of receptors on the muscle surffface. An electronic strain gauge monitors muscle constriction, while radioactive tracing measures neuronal release of muscle mediators, principally norepinephrine.

At present, data are assembled off-line and submitted to the central research system for storage and sorting to enable comparisons of average effects of both allergenic and therapeutic agents.

Approximately four years remain on the original term of the renewable National Institute of Health grant that funded acquisition and operation of the research network. Expansion of central system and network resources and addition of further research projects will probably await conclusion of this term and, to some extent, are dependent on favorable evaluation of the initial research phase. Project directors are confident that the medical significance of the research and the feasibility of computer networking can be demonstrated to ensure the facility's continuing function.

THE CLINICAL NETWORK

The Mayo Clinic has had a long-standing commitment to the diagnosis and treatment of pulmonary disorders. Pulmonary function testing at the clinic antedates World War II, and the staff of the division of Thoracic Diseases currently lists 18 pulmonary specialists, more than in any other single institution. Pulmonary function testing is considered a basic tool, as is the chest X ray, and necessary to the practice of good pulmonary medicine, since it can detect the presence of lung diseases not discernable in any other way.

The clinical computer network grew from a PDP-8/I minicomputer acquired in 1968 to automate three PF testing rooms (principally to measure lung volume and inspiratory and expiratory flow rates rates in patients) and a facility to measure diffusing capacity for carbon monoxide. After a year of operating system and application development, the 8K machine with paper tape input proved sufficiently successful that the clinic went ahead with automation of some high-volume research tests conducted on animals and human volunteers. The operating system was modified to accommodate fixed-head disks, and the system was subsequently moved to a PDP-8/E.

Eventually the difficulties of single-system dependence, such as down time during periodic maintenance, led to the adoption of a distributed processing system plan. In 1975 the division acquired a PDP-11/10 minicomputer and several LSI-11 microcomputers. While the PDP-11/10 used Digital's RSX-11M real-time operating system, all LSI-11 software, including network protocols, was written by Mayo systems programmers assigned to the Thoracic division.

Shortly thereafter, the division of Thoracic Diseases placed in practice a new Outreach program, through which small community hospitals and clinics in the five-state region surrounding Rochester may obtain PF test units with dial-up access to the Mayo network. To support Outreach, four LSI-11s with associated terminals and chart recorders were added; the host PDP-11/10 was replaced with a more powerful PDP-11/34. The current configuration of the clinical network is shown in Fig. 2.

The PDP-11/34-based system is devoted entirely to clinical duties, including routine screening of lung functions for Mayo Clinic patients and diagnostic testing of patients referred by physicians at Mayo and elsewhere. The clinical network monitors testing of about 12,000 patients yearly, nearly evenly divided between examinations in the Thoracic division's five patient-testing

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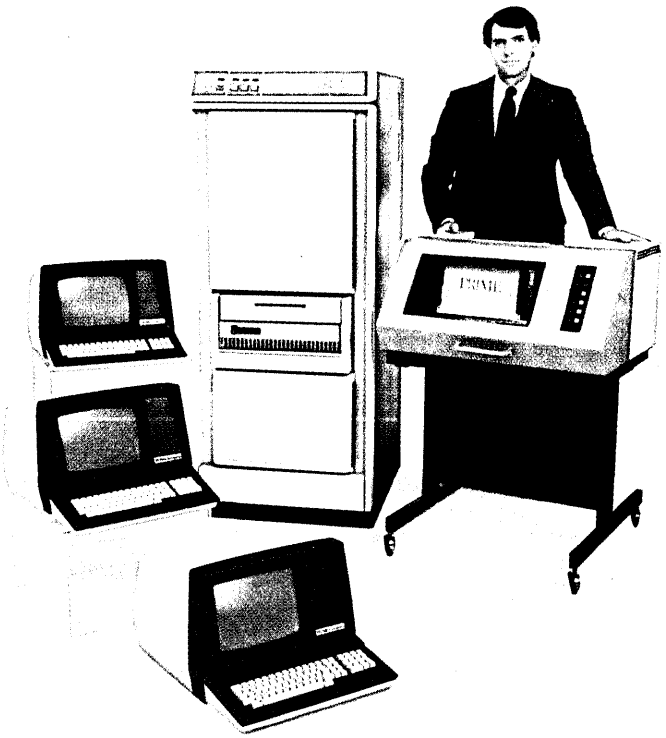
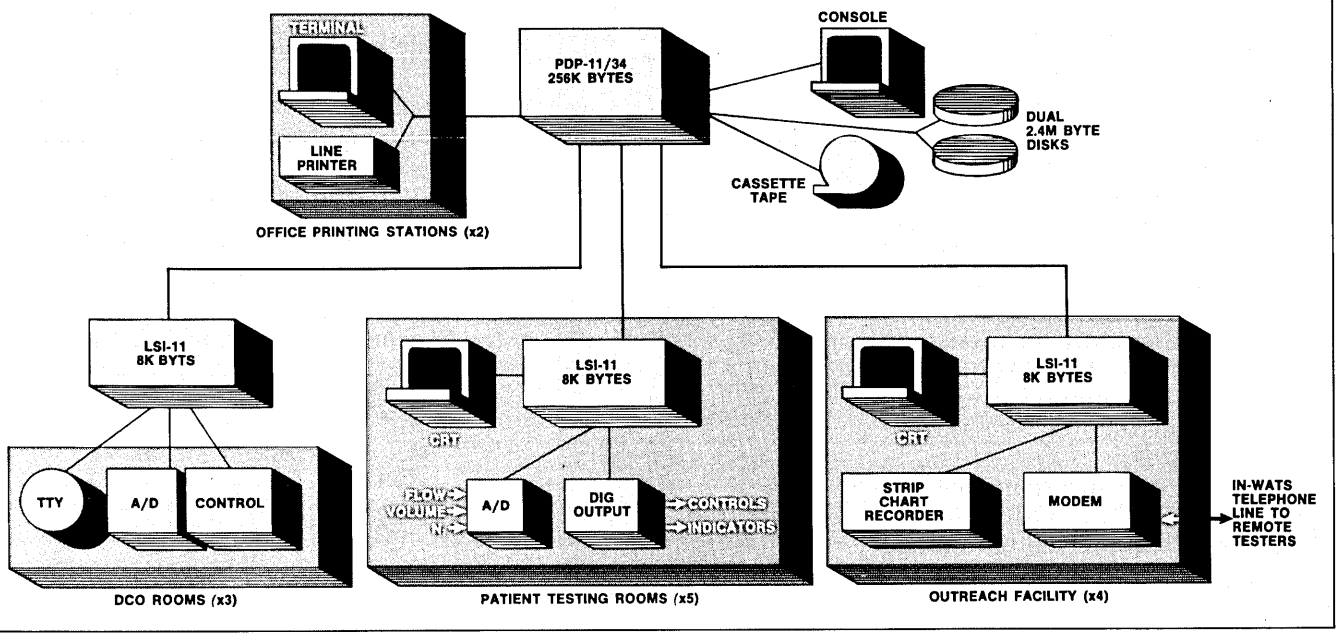


CIRCLE 131 ON READER CARD

Without computer-aided computation, analysis of one study took three months; the same work can now be done in minutes.

FIG. 2.
MAYO PULMONARY FUNCTION COMPUTER NETWORK



rooms and three DCO rooms and remote tests conducted through the system's Outreach facilities.

The PDP-11/34 minicomputer at the core of the network contains 256K bytes of main memory with two 2.4-megabyte cartridge disk units and a small cassette tape data storage device. Ten LSI-11s, each with an eight-kilobyte memory, perform on-line monitor/control duties for tests conducted in local laboratories and at remote Outreach sites as far as Chicago. Six of the microcomputer systems are situated within the Plummer Building—five for PF testing with wedge spirometers and nitrogen analyzers in the patient testing rooms, and the sixth to monitor the DCO labs, where much of the testing is hardware controlled.

Whether performed at local or remote laboratories, procedures for pulmonary function testing are similar. For each patient the technician initializes a data file through the test system's video terminal, specifying whether the patient is new or old. Test equipment is then automatically calibrated using barometer and thermometer readings and standard input flow-volume samples using a super syringe. The desired testing program is then selected.

During actual testing, the patient is coached through a series of breathing maneuvers, some quite strenuous, to produce data on spirometry including forced vital capacity, static lung volumes, ventilation distribution, and other functions. Upon receiving the start command, the test system starts a strip chart recorder, begins sampling signals, and sends data over the network link to disk storage on the PDP-11/34. At test conclusion, the LSI-11 stops the chart recorder, shuts PF test equipment valves, and passes the stop command to the central system.

An analysis program in the larger system recalls the test data from disk, performs required computation, stores results in the patient's file, and sends to the LSI-11 a data stream containing computed readings and graphic information for video display. The technician can then observe and judge the results for validity and either order a repeat or call the next test.

DCO tests, conducted only locally, investigate gas transfer within a patient's lung by diffusion. Carbon monoxide is used as the diffusion indicator because it is one of only two gases (oxygen is the other) that combine with hemoglobin so readily that gas uptake, for clinical purposes, is not a function of blood flow. The patient breathes a basic room air mixture with an added 0.1 percent concentration of carbon monoxide. Instruments measure volume, pressure, and CO concentration of inspired and expired gas to determine alveolar concentration and CO uptake.

To save time and effort, readings of O_2 saturation in the bloodstream during rest and exercise maneuvers are taken simultaneously with the DCO test, by measuring infrared absoption from a light source clipped to an earlobe.

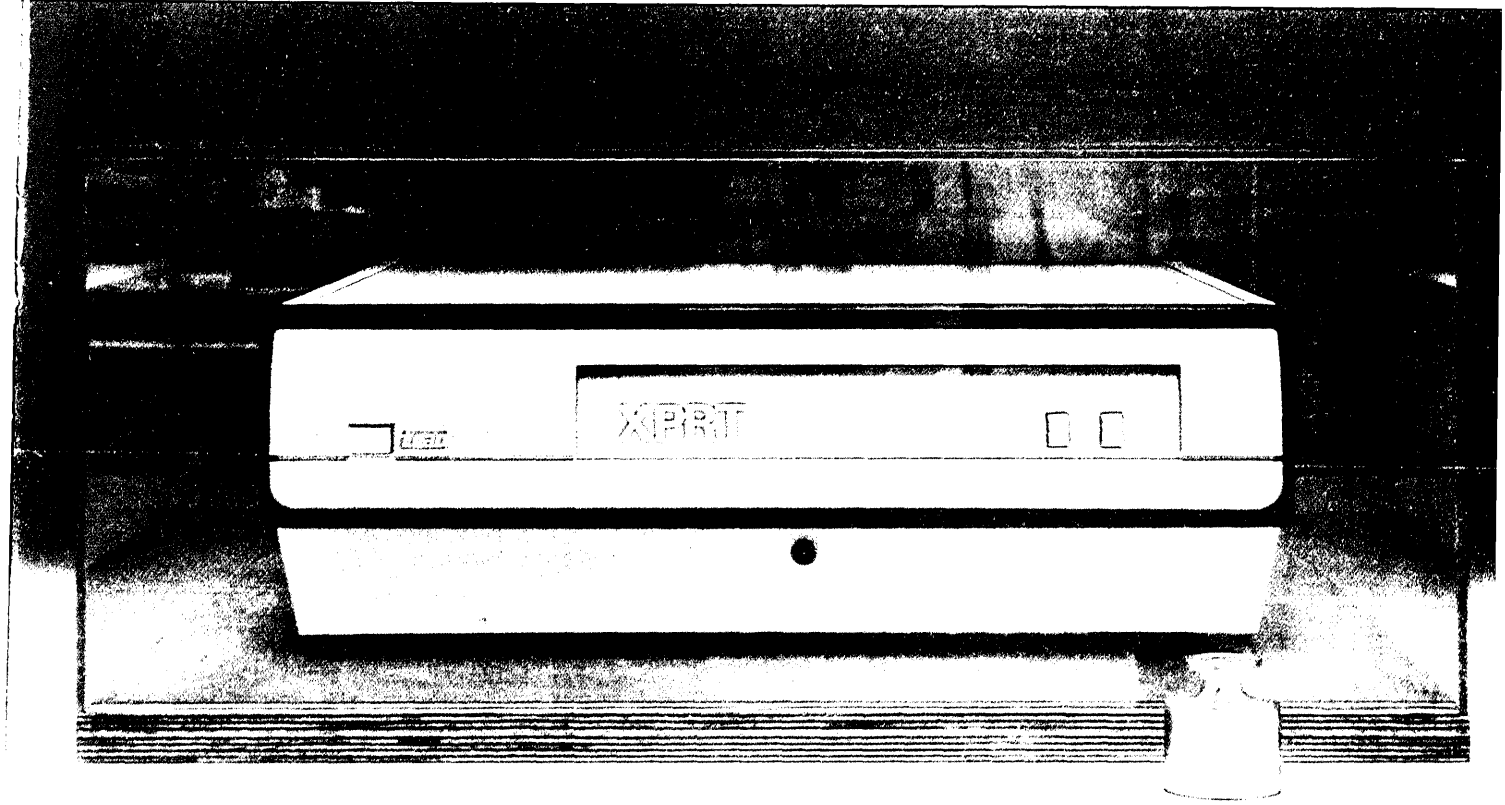
The presence of hardware controllers in DCO testing relieves the LSI-11 of most control functions, allowing it to monitor, buffer, and send data from all three DCO test labs in real time. Quality control uses the test equipment's own instrumentation; local video terminals are not required.

When all procedures have been completed for a patient, a final report with graphic information is generated by a printer/plotter and given to a pulmonary specialist for interpretation. Dictated comments are added to the final report, which the specialist signs and sends to the patient's examining physician. A copy of the final report is microfiched for permanent storage, and the patient's file is deleted from disk storage.

MAYO'S OUTREACH PROGRAM

The Mayo Clinic's Outreach program had its inception in the early 1970s when the federal Department of Health, Education and Welfare proposed the establishment of regional lung examination centers and offered to fund demonstration projects in delivery of health care. There was also a long-standing concern at Mayo for the quality of care at smaller hospitals for patients with pulmonary disease. PF testing at such institutions was either nonexistent because of lack of equipment, or inadequate because equipment was inaccurate or incorrectly used. In addition, recognition of PF test significance was minute.

The problem with PF tests, unlike



A New Standard

The fast and cost-efficient way to X.25 compatibility.

There's a new addition to the world's family of standard weights and measures, one with a story all its own . . .

In the 1970s, an international standard was established for packet-swtiched digital telecommunications. Called "X.25," this standard defined how terminal equipment and digital networks should operate with each other. The standard was very careful in spelling out physical connections, plus link- and packet-level protocols.

But there was a hitch. Those who wanted to use the standard could never be certain that their products would be X.25-compatible until *after* constructing them — which could lead to some expensive "learning experiences."

The need for another kind of standard became apparent, one which would provide:

- a means of learning X.25 *inexpensively*
- a logic specification for use in designing X.25-compatible hardware and software
- a mechanism for interactively testing those products *during* their construction, rather than afterwards.

The XPRT™ X.25 Protocol Tester meets all those needs. It has proven itself again and again in terminal manufacturing and network construction worldwide . . .

. . . which is how it has come to be recognized as a standard in its own right.

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CIRCLE 132 ON READER CARD

blood tests and EKGs, is that they are an event —for the patient, an athletic event.

Test quality depends on the examiner's ability to elicit a good performance from the patient and to recognize it. Assurance of quality testing and proper equipment function requires on-line monitoring by computer of tests in progress.

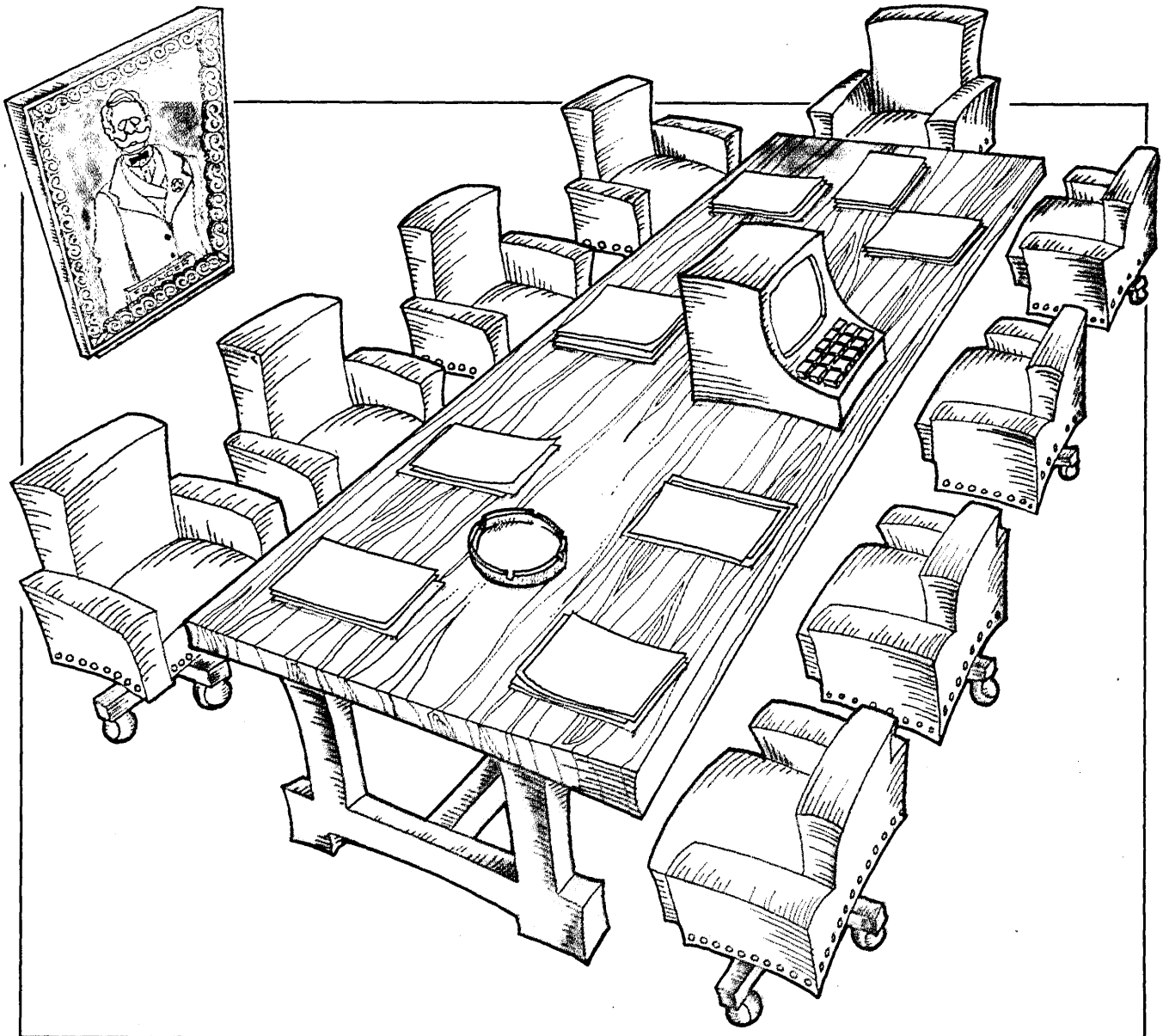
A proposal was drawn for an ambitious project that would provide PF testing at remote community hospitals with computerized monitoring and calculation of performance for immediate judgments of test quality, plus interpretation by a Mayo specialist that could translate the project into terms of better patient care. The project was never federally funded, but has gradually been implemented over a number of years with internal support.

Equipment placed in medical facilities is manufactured to Mayo specifications by Modified Systems Research Laboratories, Inc., and acts as remote input devices. Dial-up access through in-WATS telephone lines provides communication with any of four LSI-11 microcomputers in the Outreach section of the clinical network. Tests are conducted as described before, with oral communication between hospital and Mayo Outreach Laboratory technicians.

In the three years since Outreach entered practice, 33 test units have been placed at hospitals and clinics in Minnesota, Iowa, Wisconsin, and Illinois. Units are also present at St. Mary's and Rochester Methodist Hospitals and at Mayo's own Department of Preventive Medicine, where adults patients who smoke are screened. Technicians from participating institutions are brought to Mayo for training in test unit operation and in techniques of patient coaching (aptly described as "cheerleading") to elicit maximum performance. Mayo specialists also make periodic visits to Outreach members for continuing education of staff and evaluation of procedure.

The Outreach program is proving to be cost-effective at both ends; it promises to become self-supporting (from test fees) for Mayo, and furnishes sophisticated PF test capability to outlying hospitals at a small fraction of the cost of a complete equivalent system. In addition, it has become an effective avenue of educational support to make PF testing a meaningful element of patient care in the detection of lung disease before overt symptoms occur. ✻

This report was prepared with the cooperation of the following members of the professional and technical staff of Mayo Clinic's Division of Thoracic Diseases: Joseph R. Rodarte, MD, associate professor of physiology and medicine and codirector, Thoracic Research Computer Facility; Peter A. Chevalier, PhD, associate professor of physiology and codirector, Thoracic Research Computer Facility; Philip R. Westbrook, MD, director, Mayo Pulmonary Function Laboratories; Randall Brown, systems design and development engineer; and Randolph Biallas, Thoracic Research systems manager.



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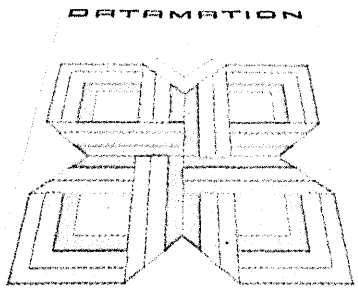

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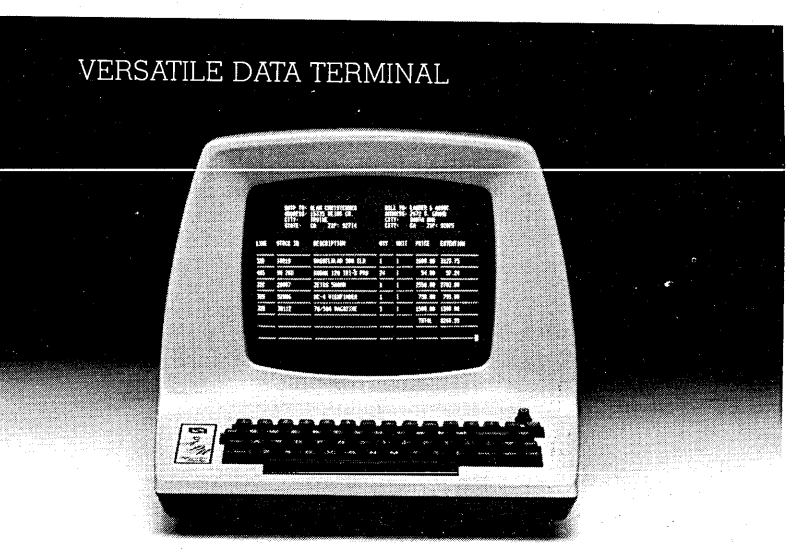

What could anyone possibly do with 85,000 Dumb Terminals®?

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But we wondered if all 85,000 Dumb Terminals were being used for just everyday data entry. So we checked around.

And found that people are using Dumb Terminals for things even we never thought of.

THE ADM-3A GOES INTO BUSINESS.

More and more OEM's are putting the Dumb Terminal into small business systems. They assemble a package that usually contains a disk, memory, a printer, and a video display terminal—the adaptable ADM-3A.

So the chances are that when you buy a small business system from someone, it'll contain, you guessed it, the amazing Dumb Terminal.

IT TAKES STOCK OF THE SITUATION.

Many businesses are using the Dumb Terminal, along with a light pen (Universal Product Code Decoder), to keep track of their inventory. The decoder is interfaced to the Dumb Terminal, and when a piece of merchandise imprinted with a Universal Product Code passes under it, the item is entered into a computer for tallying.

Simultaneously, the item is also displayed on the ADM-3A's screen—so it's instantly available for quick double-checking.

PROGRAMMERS LIKE IT, TOO.

Surprisingly enough, many computer programmers use the ADM-3A as an effective, portable I/O device. They can take it into a back room or, along with an acoustic coupler, to their homes if they wish, and compile programs nearly anywhere.

By using telephone lines, they can have direct access to a computer. Or, with the addition of an inexpensive cassette, the programmer can store the program on tape and enter it into the mainframe at a later date—with no loss of data.

THE DUMB TERMINAL PUTS ON A NEW FACE.

Some of our more ambitious customers have transformed their ADM-3A's into sophisticated graphics terminals. Simply by installing another PCB, they've enabled their terminals to perform complex plotting, graphics, and even draw charts.

And the Dumb Terminal is so adaptable that these industrious people had no trouble with installation—the graphics PCB required not the slightest cutting or soldering. It simply slipped right in and started working, all in a matter of minutes.

YOU CAN EVEN TAKE IT HOME TO MEET THE FAMILY.

We discovered that many computer buffs are using the Dumb Terminal as an inexpensive way to upgrade their systems. After all, the equipment found on most microcomputers leaves a lot to be desired. Such as the tiny five or six-inch screen, for instance.

By upgrading to the ADM-3A, they get a full 12-inch screen that's easy on the eyes. Not to mention a lot of capabilities they wanted, but just didn't get on their systems.

All for only $895.

THE DUMB TERMINAL. THE HALLMARK OF VERSATILITY.

When you get right down to it, the Dumb Terminal's applications are pretty amazing.

It can be interfaced with a staggering variety of RS232 devices. Such as cassettes, disks, floppy disk drives, printers, paper tapes, and readers, to mention just a few.

In fact, the ADM-3A is compatible with just about any RS232 device you can name. Even other video terminals, if you wish.

And people call this a "dumb" terminal?

WHAT WILL THEY THINK OF NEXT?

Who knows? But it seems that as long as there are Dumb Terminals, people will find new, unsuspected uses for them.

Of course, the ADM-3A will continue to be the same dependable data entry terminal that's made it an industry legend.

With good, reliable features and a minimum of frills. Nothing could change that. The fact is, we think that's probably the main reason that so many people have come up with so many uses for the ADM-3A.

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CIRCLE 136 ON READER CARD

Emil Post's investigation of unsolvability ultimately led to the modern theory of formal language in computer science.

THE EMOTIONAL LOGICIAN

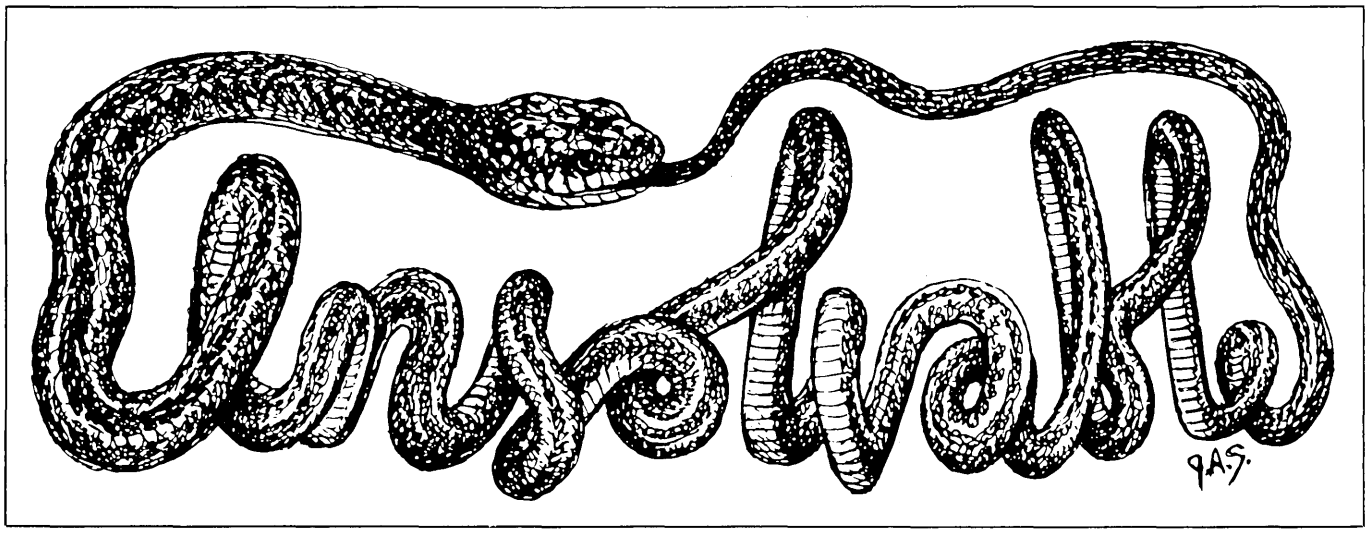

ILLUSTRATION BY JOSEPH SMITH

by Molly Gleiser

At the age of 12 Emil Post lost his left arm, and as a result, he abandoned his ambition to become an astronomer.

Instead, he discovered an analysis of the computation process anticipating today's digital computers: he showed that certain mathematical problems are incapable of computational solution—that is, they are unsolvable—and he made the first investigation of unsolvability that provided a classification of unsolvable problems.

His work ultimately led to the modern theory of computer languages.

Post's family were Orthodox Jews: in 1897, the year Emil was born, his father Arnold recognized growing anti-Semitism in their home town of Augustów, Poland, and he left to join his brother in America. Seven years later, having established a profitable clothing business, he sent for his wife Pearl, his daughters Anna and Ethel, and his son Emil. The family settled in a comfortable home in Harlem.

Before Emil's 13th birthday tragedy struck. He reached for a ball that had rolled under a parked car, and a second car crashed into it. Emil lost his left arm below the shoulder, an incident he would never discuss. How deeply he felt about it can only be inferred from his comment that he had never had a proper bar mitzvah. Although he had stood on the temple platform to sing his portion of the Torah, he had been unable to fulfill the major ritual obligation of binding phylacteries, the small leather boxes containing four sections of the Torah written in parchment, on his left arm during morning prayer.

Nearing the end of his studies at Townsend Harris High School, a New York school for gifted boys, Post, describing his handicap, wrote several observatories about the possibility of becoming an astronomer. The answers were apparently negative; at City College in New York, where he went at 17, he majored in math, not science.

City College, a free school in Manhattan attended predominantly by poor but ambitious Jewish boys, had high academic standards on which young Post thrived. While still an undergraduate, he worked out a generalization of differential calculus. Not published till 1930, it is still used by engineers.

In the stimulating atmosphere of City College, he also began the scientific diaries he kept all his life. (Something of their flavor may be obtained by reading "Absolutely Unsolvable Problems . . ." with its long appendix published in *The Undecidable,* edited by Martin Davis.)

In 1917, Post went to Columbia University, where he lectured and wrote a remarkable thesis. In it, he proved the consistency and the completeness of the propositional calculus as developed in Russell and Whitehead's monumental work on mathematical logic, *Principia Mathematica*. Post's thesis marked an important beginning in the study of how proofs can be made. Post wrote

in his diary, "I study mathematics as a product of the mind and not as an absolute."

Everything seemed set for a brilliant career. Princeton awarded him a prestigious fellowship, and, using his thesis as a springboard, he went on to produce a theorem, the Post Normal Form Theorem, which presented the complex system of *Principia Mathematica* in simple form. His theorem, Post realized, would lead to the existence of problems that could not be solved by algorithms (or "finite processes," as he then called them): they were unsolvable. Also, there would be sentences of *Principia* that, contrary to former beliefs, could not be solved by the logic of *Principia:* they could neither be proven true nor untrue; they were undecidable. Years later, after Post's death, this work turned out to be the basis Noam Chomsky needed for formulating the linguistic theory that led to the modern theory of formal language in computer science. Post, a pure mathematician, never thought of himself as a computer scientist.

TACKLING A TOUGH PROBLEM

Post threw himself into his work with a peculiar intensity he brought to everything. But now, the harder he worked, the more intractable became the specific problem he was tackling. He was working on the problem of tag, a problem involving strings of symbols in which parts of the string are deleted from the front and new parts added at the end. The problem is to determine whether the beginning will eventually catch up with the end and wipe out the string entirely, like a snake eating its own tail. Marvin Minsky, a computer scientist, later proved it unsolvable.

At the time Post felt unhappy and isolated. Princeton seemed like a foreign country after New York, and the mathematicians looked askance at a logician, a rare discipline in American science.

So Post did not publish his results. And at the end of that year, 1921, he collapsed with the first attack of the manic-depressive illness that haunted him for the rest of his life.

After hospitalization, he recovered briefly, returned to teach at Cornell, and collapsed again. Then, no one wanted him, and he was fortunate to find a job teaching at George Washington High School in New York.

It took his alma mater, City College, to rescue him from this situation, but he taught mathematics there only one month before collapsing again. Even then City College stood by him.

Post came under the care of a general practicioner, Dr. Levy, who devised a common-sense method of self-control; tranquillizers, antidepressants, and lithium were

Rarely photographed during his adult life, Post sat for this 1927 portrait at the request of City College.

In 1929, the year Emil Post married Gertrude Singer, he drew this sketch of his bride.

Emil Post, in his early teens, peers out shyly from behind his mother Pearl (left) and his sister Anna. The family home was in Harlem, in New York City.

not then available. The attacks, more often extreme elation than depression, occurred when Post became excited by his work. The fine mechanism of his brain had to be stabilized against all shocks and surprises by making his life completely routine, and could include no more than three hours a day spent in research. He arose at 6 a.m. and went to class at City College; in the afternoon he went home to nap; he worked until 5 p.m. Then he went for a walk and was always quite annoyed if he met anyone, since the main purpose of his walk was to clear his mind. At exactly 7 p.m., after dinner, he started work again, laying down his pen as the clock struck 9 p.m., when he went for another walk. He retired at 10 p.m.

Even his leisure became routine: pinochle with his wife (the former Gertrude Singer, whom he had married in 1929), sister Anna and nephew Marvin on Friday night; a play or movie on Saturday; visits to his wife's family, or sister Ethel, on Sunday. He also wrote poetry and sketched still lifes, relatives, and movie stars from magazine photographs.

In 1936, Post became a figure in scientific history when he wrote "Finite Combinatory Process—Formulation I," an analysis that led to a theoretical understanding of computation. The analysis involved a computation scheme in which a worker could solve all problems in symbolic manipulation by performing only the machinelike primitive acts of following "go-to" and "print" instructions on a tape coded only with the symbols 0 or 1. The instructions and code, something in the manner of a child's snakes-and-ladders game, sometimes sends the worker repeatedly in a continuous loop that has no end. Crucial here was Post's assertion, later amply verified, that all possible computational procedures could, in principle, be reduced to this scheme.

Post's work was a close variant of the work of Alan Turing in England, but Post's formulation is closer to the spirit of modern programming, since, unlike Turing's, his approach to solution was primarily a software one.

By this time, the one-armed emotional man who strove to keep himself under such tight control had become a familiar figure at City College. He never wore a prosthesis, and could light his own cigarettes with such dexterity his students hardly noticed his handicap.

Post's lectures, laid out on 3″ × 5″ cards, lasted exactly 50 minutes.

"We're doing very well," he would say seriously. "We're 10 minutes ahead of where this course was last year."

By today's standards, his teaching load was horrendous. At first, he officially taught 16 hours a week, but in fact he often taught more. Once, shortly after World War II, when too few students—five—were registered to justify giving a variable theory course, he taught it anyway as an "honors" course. He even took time for a meticulously prepared capsule lecture of the fine points, and he required his students to go to the blackboard and reproduce the proofs verbatim without any text.

"A pressure cooker experience," Martin Davis, one of the students, described it, but all five became mathematicians. They included Seymour Ginzburg, now a professor of computer science, who wrote the definitive treatise on context-free languages.

A NEW LOOK AT ALGORITHMS

In an invited address given before the American Mathematical Society in 1944, Post propounded a new way of looking at algorithmic processes as well as the idea of creative set, a purely mathematical notion, which he followed with a statement of his philosophy: "Mathematical thinking is, and must remain, essentially creative. To the writer's mind," he added with his usual attention to detail, "this conclusion must inevitably result in at least a partial reversal of the entire axiomatic trend of the late 19th and early 20th centuries, with a return to meaning and truth as being the essence of mathematics."

After this, he focused intensely on the topic of unsolvabilty, showing, for example, that there were no algorithms for certain key combinatorial problems, a finding with important applications in theoretical computer science's formal language theory. He also related the degree of unsolvability of certain unsolvable problems to their logical representation.

Post was an anxious man, always obsessed by the notion he couldn't finish his work in time; at moments of great discovery, his illness would recur. Then he would forget the curriculum and talk about his latest ideas, imagining his students working alongside him. Sometimes he would ramble about the vicious effects of sexual repression, the dangers of nuclear weapons, or the plans for disarmament. His students would murmur, "Emily Post," as they sometimes affectionately called him, "is going off the rails again."

He would wind up in the hospital talking vaguely of discovering a new star that he sometimes called "Post," or "Jesse Douglas" after another great mathematician.

The hospital doctors, thinking to halt his runaway mind, deprived him of paper, but not cigarettes, and he used the wrappers to jot down notes that he handed to his wife to ensure nothing of value was lost.

The creative process by which he made his discoveries always interested him. He believed in the existence of a "psychic ether . . . the seat of the birth of new ideas . . . the region where all vaguer processes operate, especially intuition, 'hunches,' etc." and that when these ideas become precise "they crystallize from the psychic ether."

In 1947 he once again tapped his psychic ether to produce a landmark paper in which for the first time he used the technique of computability to obtain the unsolvability of a genuine mathematical problem that had nothing to do with either logic or computability.

When Post was 50, his health vastly improved. In 1952, he even dared break his routine to take a Greyhound bus journey across the country. He had finally learned how to be happy without being elated.

It is not known what precipitated his last illness in 1954. Perhaps excited by a new discovery he was tempted to break the rules. In the past Post had been treated with electroconvulsive shock, and had responded well. Now, however, he objected to it, and was afraid it might damage his memory. But what if his depression continued for years?

Shock was administered, and a short while after receiving it, Emil Post, while still in a hospital in upstate New York, suffered a coronary and died.

His last poem, part of a "work in progress" and written on a scrap of paper, was titled "Ode to God":

Gentle as the summer zephyr on the infant's cheek
Patient as the men and women in these halls so bleak
So great our pain Oh Lord above
What must thine be for those you love.

Dr. Gleiser would like to thank Phyllis Goodman, Emil Post's daughter; his nephew, Prof. Marvin Friedman; and his student, Prof. Martin Davis, for contributing information to this article.

MOLLY GLEISER

Dr. Gleiser was born in England and came to the U.S. as part of the fabled brain drain in 1952, to work at places such as Ohio State Univ. and MIT. Later she worked on solar energy at the National Physical Laboratory of Israel. After doing more on thermodynamics at the Lawrence Berkeley Laboratory until 1970, she turned to freelance writing and editing.

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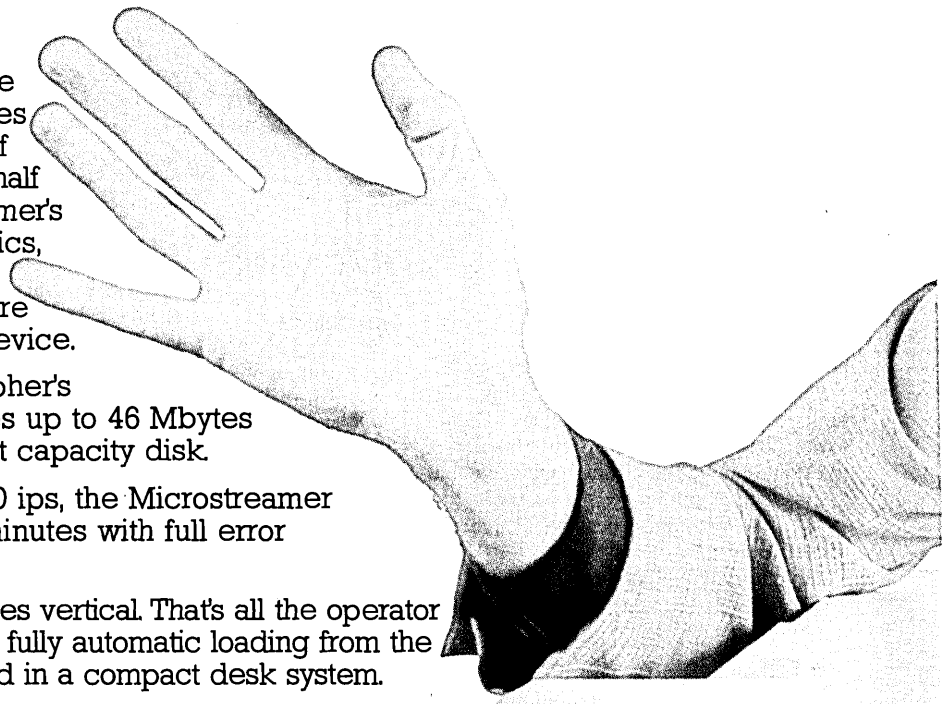

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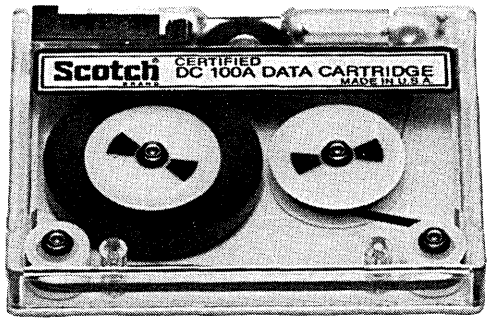

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PEOPLE

IN FACT, IN CONTROL

To most onlookers, Electronic Data Systems Corp., (EDS) in Dallas, Texas, is synonymous with H. Ross Perot—the founder of EDS and the much-publicized philanthropist known for his personal crusades to free U.S. prisoners of war in Vietnam, and more recently for masterminding the escapes of EDS employees from riot-torn Iran.

However, in an announcement last June, Perot turned over the presidency of EDS to another man—a man who has been almost a stranger to the public. And, since that announcement, the new president, Morton H. Meyerson, has, in fact, been in control.

Members of the EDS family have known Mort Meyerson for some time; many of them credit Meyerson with the success of the firm.

Before he was elected president, the financial press did not report much about Meyerson.

It did not report that, in the late '60s, Meyerson was the computer expert behind EDS's health care division—the fastest growing (and now the largest) of the EDS divisions.

And it did not give Meyerson much publicity when, in the early '70s, he was the man Perot sent to New York to try to save DuPont Glore Forgan, Inc., then the nation's third largest brokerage firm. It was too late to save DuPont. Meyerson, whom Perot made president of the brokerage firm in 1971, says that straightening out its records was like "going into a room filled with a scrambled up fire hose and trying to trace your way to the end of it."

EDS hired Meyerson in 1966 as a trainee. Today. he laughingly calls himself the lightest trained employee EDS hired at that time.

He soon joined EDS's five-man health care operation, where he landed a computer processing contract to handle Medicare and Medicaid for Blue Cross and Blue Shield of Texas.

MORT MEYERSON—His goal: to make EDS a billion-dollar-a-year company.

"We just kept building and building the company," Meyerson said.

After the stint at DuPont, Meyerson returned to Dallas and rejoined EDS's health care division. In 1976 he was named president of EDS Federal Inc., which is the firm's largest subsidiary and which handles all health care and government accounts.

Now, as president of EDS, Meyerson says his goal is to make EDS a billion-dollar-a-year in revenues company by 1987, with earnings of $100 million.

When away from his office on EDS's North Dallas campus, Mort Meyerson is busy with other things.

"I fly airplanes, jog, scuba dive, read, play with my children," he began. "I am on the board of the Dallas Symphony Orchestra.

Meyerson also plays the piano and guitar. He feels his philanthropic duties are with health care and care for the elderly.

"How we are going to care for the increasing number of elderly citizens is a problem that bothers me," Meyerson said. He serves on the board of directors of a nonprofit nursing home in Dallas.

"The cost of health care is escalating more than any other part of the economy," he said. "If health care is everyone's right, how are we going to maintain the quality and make it more affordable?"

Meyerson does not think nationalization of the health care industry is the answer to the problem. He does think we soon will have a national health plan. And EDS will have a major role in administering that plan, he said.

The grandson of Russian immigrants, Meyerson and his wife Marlene have two children, David, 12, and Marti, 10.

"Being a parent is the most challenging and difficult thing I do. My responsibilities at EDS come second," Meyerson said.

But right now, his mind is on EDS.

"The company has tremendous momentum. There is nothing to turn around or fix—just a balance to maintain."

Meyerson does not expect to be the president of EDS for long.

"I hope to build a team of capable executives so that any one of them can replace me in five years," Meyerson said. He does plan to stay in other capacities.

"One thing we will be looking at is, should EDS expand through acquiring smaller firms?

"The answer," Meyerson said, "is probably so. We will probably become an acquiring company."

But EDS will, for now, only acquire high technology computer service companies like itself. Meyerson has no short term plans for diversification.

"EDS doesn't have a product. Instead, we have the talents and creativity of our people," Meyerson said. "That's our product."

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RCLE 140 ON READER CARD

Distributed data processing is a long term commitment. So before you marry any system get to know the Data General distributed processing story. Data General full capability DDP systems start as low as $10,000, with COBOL-compatibility, so you can grow from the smallest CS model through our CS and ECLIPSE® Data System families, right up to our M600 "mini-mainframe" without expensive reprogramming.

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The Computer of the U.S. Olympic Sports Medicine Committee

NO BENCH FOR HIM

"I was always interested in science but I didn't want to get stuck behind a bench."

And so, when Herbert B. Landau, while working toward a BA degree in chemistry from Hunter College, found himself "by accident" working in an engineering library in New York City and found that many of the people he was working with had science degrees but had gone into library work, he decided that was for him. He received his chemistry degree from Hunter in 1963 and an MS in library service from Columbia Univ. in 1964.

Today Landau is the new president of the American Society for Information Science (ASIS) and is assistant director for information systems at the Department of Energy's (DOE) Solar Energy Research Institute (SERI) at Golden, Colo. He's not behind a bench.

As ASIS president, Landau was one of 100 delegates to participate late last year in the first White House Conference on information policy. The conference resulted in a list of resolutions which were to have been presented to Congress and the President before the end of February.

The delegates, he said, were one-third information professionals and the rest lay people, including representatives from youth groups and groups of handicapped people.

"It was gratifying to find how much they all wanted to get information out to everyone and to use computer technology to do it." Landau regretted that no computer technologists were among the delegates.

At SERI, Landau manages the development of the Solar Energy Information Data Bank (SEIDB), the national information network for solar energy. The SEIDB is a cooperative activity, mandated by Congress, involving the particpation of four regional solar centers in Portland, Ore.; Atlanta; Minneapolis; and Boston, and the National Solar Heating and Cooling Information Center. "They're our retailers," said Landau of the regional centers.

He looks forward to a nationwide on-line network of solar information by 1985. There were 50 organizations on-line to the SEIDB at the beginning of this year. "We're talking to the State of California," said Landau in mid-January, "and hope to go through the state's universities, having them act as nodes."

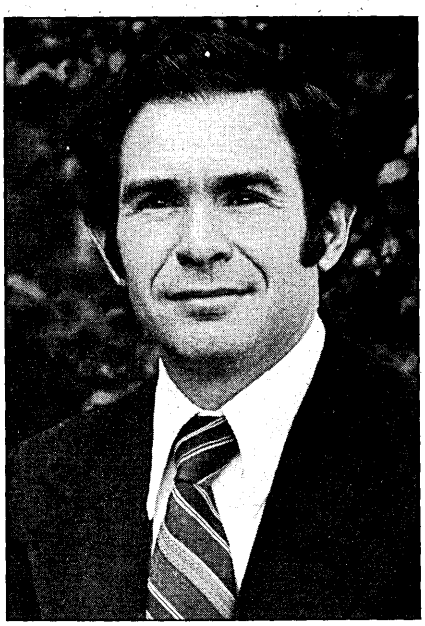
SERI has one computer in, a Cyber 76 and has a proposal out for a data base computer it hopes to install in 1981. "We'll operate the scientific computer and the data base computer back to back," said Landau.

SERI currently is located at the foot of a 6,000-ft.-high mesa, which ultimately will become its home. "Forty states competed for SERI," he said, explaining that the states competed in partnerships with research institutes, universities, and private industry. The team that won was that of the State of Colorado and Midwest Research Institute in Kansas City. "They offered us 300 mesa-top acres." Landau said ground will be broken this year for a $95 million facility.

He said climate was one of the reasons for Colorado's selection. "The state has 320 days of measurable sunshine each year." What could be better for a national center dedicated to solar research, development, and demonstration?

The SEIDB director joined SERI in August 1978 with the charter of starting an information systems division. SERI itself was started in July 1977.

Before joining SERI, Landau served 11 years with Auerbach Associates in Philadelphia in information storage and retrieval related work. Earlier, he was with Bell Labs in Illinois.



HERBERT B. LANDAU—A nationwide on-line network by 1985.

"I started as an indexer," said Landau of his Bell Labs job, which he accepted shortly after receiving his master's degree. "That's about as low as you can get in information science." He soon was charged with the responsibility of developing and managing Bell's Illinois information center.

He likes his ASIS job because he sees ASIS as "an umbrella society encompassing all aspects of information sciences, anything to do with information transfer including computers, libraries and linguistics."

He notes that ASIS started out 42 years ago as the American Documentation Institute with a charter to look into "innovative techniques of handling information."

AT NEW DESKS

RALPH A. PFEIFFER, JR., chairman of the IBM World Trade Americas/Far East Corp., was elected chairman of the U.S. Council of the International Chamber of Commerce . . . . Citizens Savings and Loan Assn., San Francisco, named JACKLYN POPIUL vice president, director of administrative services . . . . P. DESMOND CRAIN was appointed vice president of the new western division of Software International . . . . GEORGE PRATT, a New York city financial consultant, is the new chairman of Computer Automation, Inc., Irvine, Calif . . . . CATHERINE VIVONA was named users' group liaison for Software ag of North America, Inc. . . . . DENIS K. DUGAN was named manager of information processing systems and configuraton management for Raytheon Co.'s Missile Systems Div., Bedford, Mass . . . . JAMES A. BARTH was promoted to senior vice president, finance and administration for Pertec Computer Corp. . . . . Dialog Systems, Inc., Belmont, Mass., elected GERALD B. BAY president and chief executive officer.

GOOD OLD COUNTRY BUSINESS

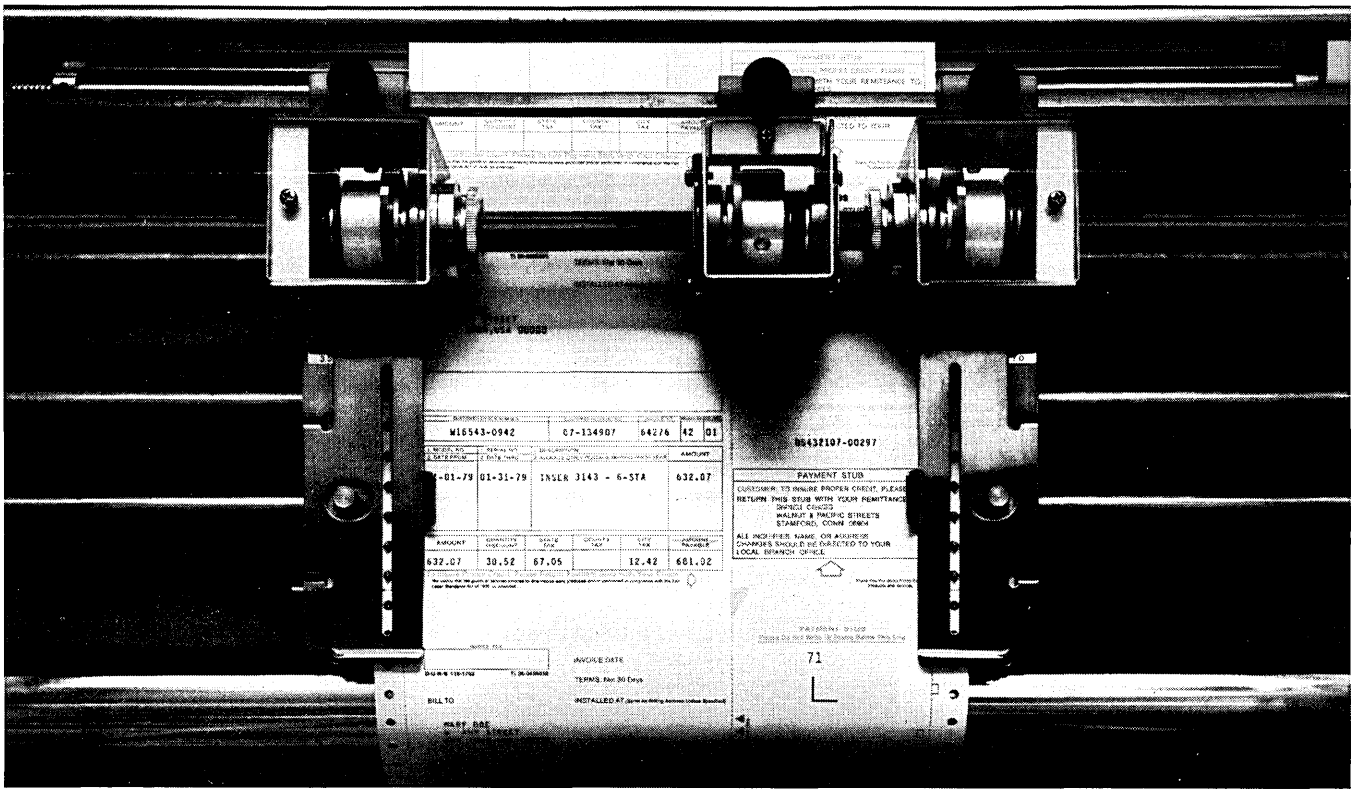
In the sleepy town of Fairlee, Vt., nestled beneath the hills alongside the Connecticut River, there is a sign that at first glance seems out of place: *Country Programmers, Ink!* That's what the sign says.

Programmers in the countryside? What are they planning on programming, the milking?

Yale Grayson, the 49-year-old president of Country Programmers, Ink! has plenty to say about what programmers can do in the country, and why they can do it better and cheaper. And it's no fairy tale, because he and his staff of 20 are going to town up there, programming for a lot of city slickers and now and then a country gentleman.

How do you get to be president of a software firm in the middle of Fairlee, Vt.? You need at least two things: a whole lot of experience in the computer business and the desire to have what Yale describes as "a better quality of life." Yale lays claim to both.

Since the early '50s, Yale has been



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.

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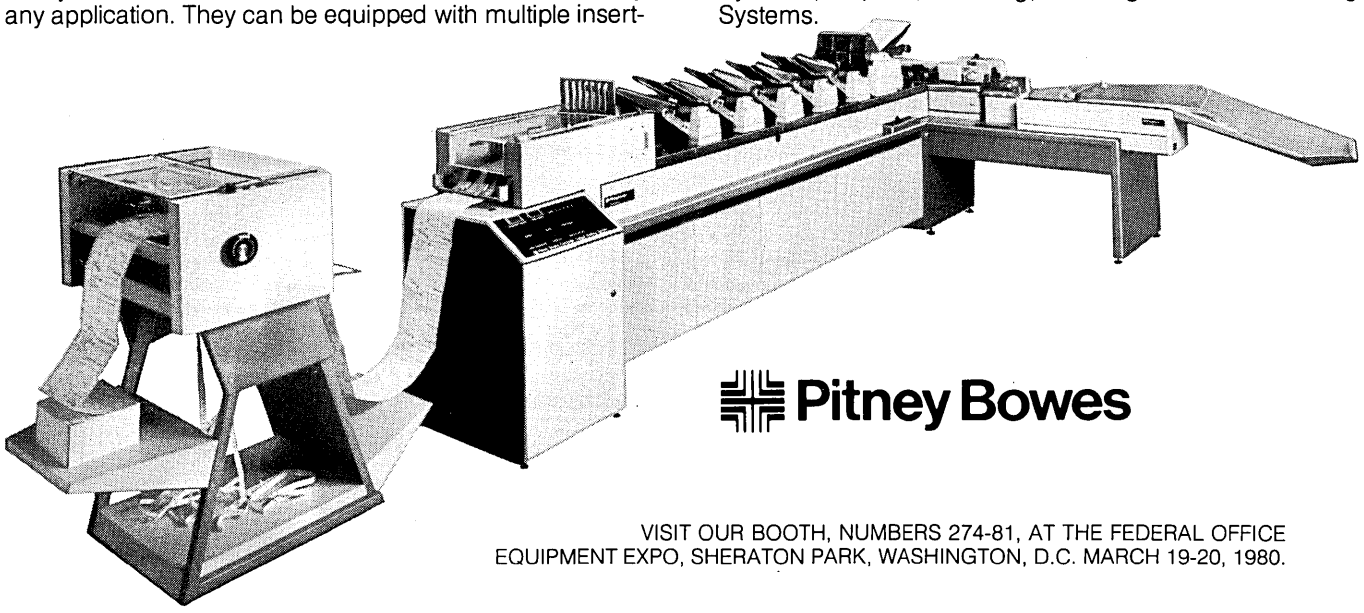
For complete facts and figures, write to Pitney Bowes, 2146 Pacific Street, Stamford, CT 06904. Or call toll free anytime (except Alaska and Hawaii) 800-621-5199 (in Illinois 800-972-5855). Over 600 sales and service points throughout the U.S. and Canada. Postage Meters, Mailing Systems, Copiers, Dictating, Labeling and Price Marking Systems.



Pitney Bowes

VISIT OUR BOOTH, NUMBERS 274-81, AT THE FEDERAL OFFICE EQUIPMENT EXPO, SHERATON PARK, WASHINGTON, D.C. MARCH 19-20, 1980.

CIRCLE 141 ON READER CARD

actively involved in the computer field. Starting in 1950-55, when General Electric's computers were in the R&D phase, Yale was there. Then on into the early days of software development with IBM: SAGE, Lincoln Labs, the BOMARC Project, Whirlwind II. In the early' 60s, he was manager of software development for General Precision Laboratories.

In 1962, Yale started forming his own companies. His first one, On-Line Brokerage Systems, looked like it was off to a good start, but it was clobbered by a downturn in the economy. He then spent some time learning more about marketing and selling. His first venture taught him that he needed to become proficient in that area. RCA's Computer Div. in New York City provided his education in marketing.

He again turned to starting companies. His most successful venture was eventually bought out by the Sanders Corp.

Yale took a break from entrepreneuring to work for ITT World Data Systems in 1969 and 1970, but running his own business was in his blood. In 1971 he cofounded Minimation Corp., a firm that produced turnkey systems for yacht manufacturers. He had the fun of sailing the world over to market the systems. Eventually, his expertise was absorbed by a firm named Benetronics, where he continued to direct the creation of turnkey systems for numerous businesses.

With that experience, what on earth are he and his company doing in the quiet countryside of Vermont?

"I came to Vermont to be free of hassles. To get some values out of life. Values that suburbia is making meaningless. I used to be sold on the 'Great American Dream,' which is to make a lot of money. The G.A.D. is a bunch of bananas. It says you become a success by making a lot of money, living in a wealthy community. That you send your children to the very best schools that these communities supposedly provide. "I believed that bologna for a long time. I found myself living in a suburb where the average family had an income of over $100,000 a year. Then one day I went and took a look at the high school that my kids attended. I saw more Cadillacs and high-priced cars (the kids' cars!) than I had ever seen in one place, and more psychological stress problems than I could believe. I realized the peer stress on those kids was absolutely incredible.

"That's where I said that way of life is bananas. You had to be crazy to live like that." So Yale moved his family to Vermont. That was in 1978. He had a little money saved up from his previous ventures that provided a meager income. The quality of life was a great improvement. But he needed something to do. Before long he was poking around the countryside talking to businessmen. Soon he was advising a young start-up company on how to market a computer it had designed.

Eventually, a man like Yale had to start another company. "It was just a simple idea to keep myself and a couple of programmers occupied. I would get contracts; two associates would develop the software. We worked on a custom basis. That was in October of 1978."

It took three or four months to establish an office, train a secretary, and hang out a sign. Then he made contacts with old friends to get the word out and start drumming up business. The company landed its first contract in January 1979, and work has been pouring in since.

In just six months signed contracts included:

- Systems analysis and design of a computer network for a retail distributor.
- An order entry system.
- An operating system and diagnostic programs for a computer disk and drum manufacturer.
- Programs written in assembly language that speed up the operation of a system originally written by another firm using a high level language.
- Programming for a substantial life insurance firm to aid it in doing mutual funds forecasting.
- Serving as a consultant to an oil distributor to iron out problems associated with the installation of a new computer system.

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CIRCLE 143 ON READER CARD

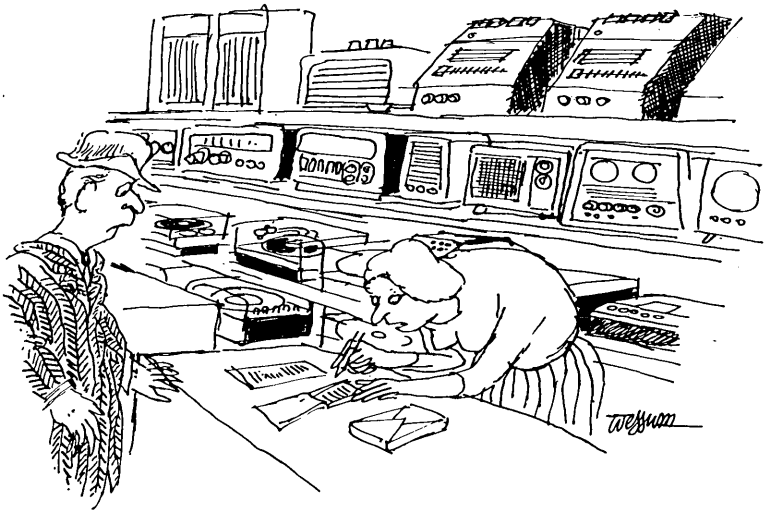
PEOPLE

• The design of a real-time program for a large manufacturer. The program is used to control machinery that measures tolerances for the blades on jet aircraft engines.

These and other projects have come in so swiftly that Yale already has had to add 18 programmers. By December 1979, the company was billing more than $100K a month. Where is Yale drumming up business? From all over the countryside. Only a small fraction of his business comes from Vermont. Most of it is for firms in Boston, New York City, and San Francisco.

How does he attract all this business? He charges a lot less than his city competitors. The cost of living in Vermont is a lot less than in the suburbs of the major metropolitan areas. His programmers, happy to be getting what they perceive as a better quality of life in an area where the dollar goes a lot farther and where they can grow their own food and chop their own firewood, earn a lot less than their city counterparts.

How much less? Well, Yale looks primarily for highly experienced programmers. The ones he hires typically have been earning $30,000 or so in the big cities and have 10 to 15 years of programming experience. They make about $20,000 at Country Programmers, Ink! Consequently, Yale is frequently able to underbid his city competitors by 25% to 50%. The work is done in the peaceful serenity of the countryside, which Yale says is more productive for programmers. When a software package is completed and needs to be installed, the project leader makes a trip to the customer's site to perform the task. An occasional trip to the city is tolerable, his people say, as long as they don't have to live there.

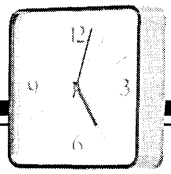


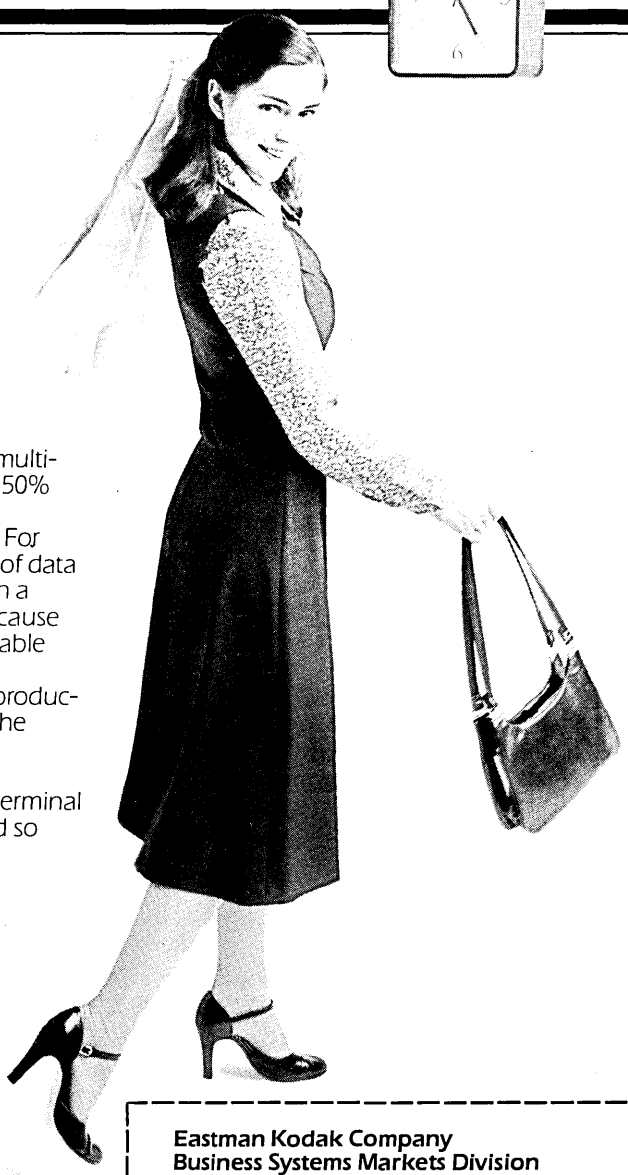
One pocket calculator: Fourteen dollars ninety-five. Two Batteries; Eighty cents additional tax; three dollars fifteen, that makes twenty seven dollars forty five, no, twenty eight dollars fifty five, I mean twenty eight dollars thirty, no, twenty seven and forty . . . ©DATAMATION

Yale's concept of living in the country and doing programming for the city folks may be spreading rapidly. Yale himself is helping to spread the idea through a form of franchising. He already has a second Country Programming, Ink! operation beginning in a rural town in Massachusetts.

—NAT WADSWORTH

How to get 12 hours of work out of an 8-hour day.





The Kodak IMT-150 microimage terminal can increase dramatically the productivity level around your office or department.

How? The IMT-150 terminal has its own intelligence—an inboard microprocessor capable of performing its own information lookups. In seconds. At the touch of a button. Without help from your mainframe.

It follows then that, if the IMT-150 terminal itself is more productive, the people who operate it will be, too. They can find needed data quicker and easier, resulting in more lookups per hour/day.

In fact, in one test in the adjustment department of a multi-branch department store, a productivity increase of more than 50% has been recorded.

The IMT-150 terminal is productive in other ways, too. For example, it helps lower your operating costs, because storage of data on microfilm is much cheaper than on-line magnetic storage in a computer. Also, operating errors are practically eliminated, because the IMT-150 terminal relies on the intelligence of its programmable microprocessor to do all the hard work.

Today everyone is looking for ways to squeeze more productivity out of existing budgets. With existing personnel. Within the existing workday.

Sounds like an impossible task, doesn't it?

Yet, when you stop to consider that a Kodak IMT-150 terminal can get 12 hours of work out of an 8-hour day, it doesn't sound so impossible after all.

1880 Kodak 1980

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HARDWARE

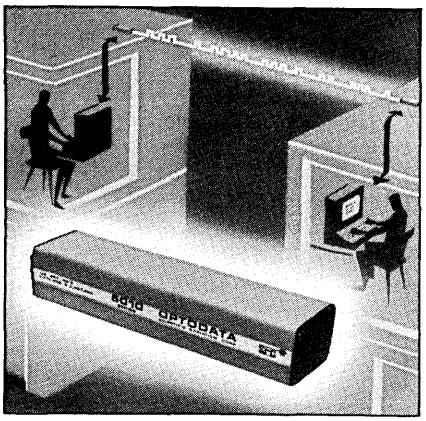
OFF-LINE

"You mean your new products programs are still going? Haven't you heard there's a recession?" asks Stanley T. Burkoff, president of the W.B. Doner and Co. advertising agency. As an expedient method of maintaining profits, nearly two out of three manufacturers scrapped new product development efforts during the economic downturn of 1974 and '75, according to Burkoff. In most cases, cutting out new developments proved rather myopic: it helped during the recession, but left the companies in a weak position at the best time to bring new offerings to market -- when the economy is pulling out of a recession. Burkoff doesn't advocate developing radically new products with wild abandon in these uncertain times. He suggests staying in familiar territory, concentrating on products and markets already known. Also, many companies can score advances by finding new applications for existing products. Burkoff cites an example in the consumer market (W.B. Doner handles a number of consumer accounts). When baking leveled off in the early '70s, Arm & Hammer Baking Soda pressed into new markets. Its product was promoted for its absorbency and cleaning characteristics, first as a bath additive, then as a kitchen cleaner, and most successfully, as a refrigerator deodorant.

Memo to NCC Exhibitors: if you haven't yet responded to our letter requesting information about any new products your firm will introduce at NCC, please send us a product description a.s.a.p. Address your responses to: NCC Product Preview, DATAMATION magazine, 666 Fifth Avenue, New York, NY 10019. Please take a minute and do it now.

OPTICAL DATA LINK

For short distance communications at speeds to 2,400bps, the 5010-series Optodata transceiver provides an alternative to stringing cables. The units use an invisible modulated infrared light beam to communicate at distances of up to 100 meters (328



feet). They provide line-of-sight communications indoors or outside. The infrared beam is said to be impervious to fog, airborne particulates, and bright sunlight. RS232 and 20mA current loop interfaces are available. Versions are offered for 117 volt and 230 volt AC operation, as well as 12 volt and 24 volt AC or DC. Optodata transceiver pairs sell for $395 (12 volt DC version) and $455 (AC line versions). SCIENTIFIC RADIATION CORP., Mountain View, Calif.

CIRCLE 301 ON READER CARD

SMALL SYSTEM

Attempting to increase its share of the U.S. computer market, this British computer-

maker has developed the System 10 Model 320. The third major product offering since the firm acquired Singer Business Machines in 1976, Model 320 will compete against small- and medium-size computers, such as the IBM System/34, Univac BC7, and smaller NCR and Burroughs machines.

Model 320 is designed for compatibility with earlier System 10s. It can function as a standalone system or communicate with mainframes. The multiuser system gives each user a memory partition (each jumper-selectable in size, ranging form 1KB to 80KB); a common memory partition, available to all users, can contain from 1KB to 80KB of frequently used routines. Hardware allocates time slices to each user partition, and each partition has its own I/O channel capable of supporting 10 devices. The system can handle up to 20 partitions; semiconductor memory capacities range from 60KB to 200KB.

A Disk Management Facility (DMF) is provided as the basic operating system; applications can be written in assembler, RPG II, or COBOL (currently under development, with availability expected by mid-year). Applications packages also are offered.

A new crt terminal, storage module and cartridge module disk drives, dot matrix and line printers also have been developed for use with the System 10 Model 320. A recently formed Customer Service Division will handle field service and maintenance support.

Model 320 prices start at $34,245 for a 60KB processor, 20MB of disk (10MB fixed, 10MB removable), 120 cps matrix printer, and one crt terminal. ICL INC., Distributive Systems Div., Irving, Texas.

CIRCLE 302 ON READER CARD

PRESENTATION GRAPHICS

A pair of offerings from this vendor seemingly form the alpha and omega of a graphics presentation system. The pair comprise an in-house system for creating color slides (or transparencies and Polaroid prints) and an intelligent slide projector.

CompuSlide, lets a graphic artist create business graphics—including bar, pie, and line graphs. The artist uses a touch-sensative screen to select the desired slide format and source of input. Data for the slide can be entered on floppy disks from another computer or from a keyboard, or the artist can use a digitizer to trace or sketch the image. A 19 inch color display shows the image with up to 64 color shades and a

Miniterm. The only portables that won't cut you short.

Our new optional switch-selectable 80/132 column printing capability makes Miniterms® even more flexible and versatile. With the flip of a switch, you can go from a conventional 80 column data processing format like this:

CONSOLIDATED SUMMARY OF EARNINGS

INCOME:	1978	1977	1976
OPERATING REVENUES	$1,918,988	$1,686,696	$1,383,442
OTHER INCOME, NET	10,873	16,810	20,787
	$1,929,861	$1,703,506	$1,404,229

to a 132 column statistical tabulation on the same standard narrow 8¾" paper like this:

CONSOLIDATED SUMMARY OF EARNINGS

INCOME:	1978	1977	1976	1975	1974
OPERATING REVENUES	$1,918,988	$1,686,696	$1,383,442	$1,163,204	$1,013,357
OTHER INCOME, NET	10,873	16,810	20,787	13,005	12,956
	$1,929,861	$1,703,506	$1,404,229	$1,176,209	$1,026,313

This unique feature can be very useful when you want to line up multiple columns of figures side by side. Or do other extended financial or tabular comparisons without having to change to wider paper.

As you can see, either format prints in crisp, dark, highly readable characters. For one thing the printhead is temperature compensated so print density is constant. And it should stay that way for a long time due to the reliable microprocessor design.

The new switch-selectable feature is available with every Miniterm portable and desktop terminal. Including the Model 1206 portable computer family.

Miniterms with switch-selectable 80/132. To see how other portable terminals stack up to the Miniterm, send for our free comparison brochure. Computer Devices, Inc., 25 North Avenue, Burlington, MA 01803, (617) 273-1550. Or call 800-225-1230. Europe: Computer Devices, Inc. 108 Place Des Miroirs. 91000 Evry, France. (1) 079 0077. Telex 692 671.

COMPUTER DEVICES INC.

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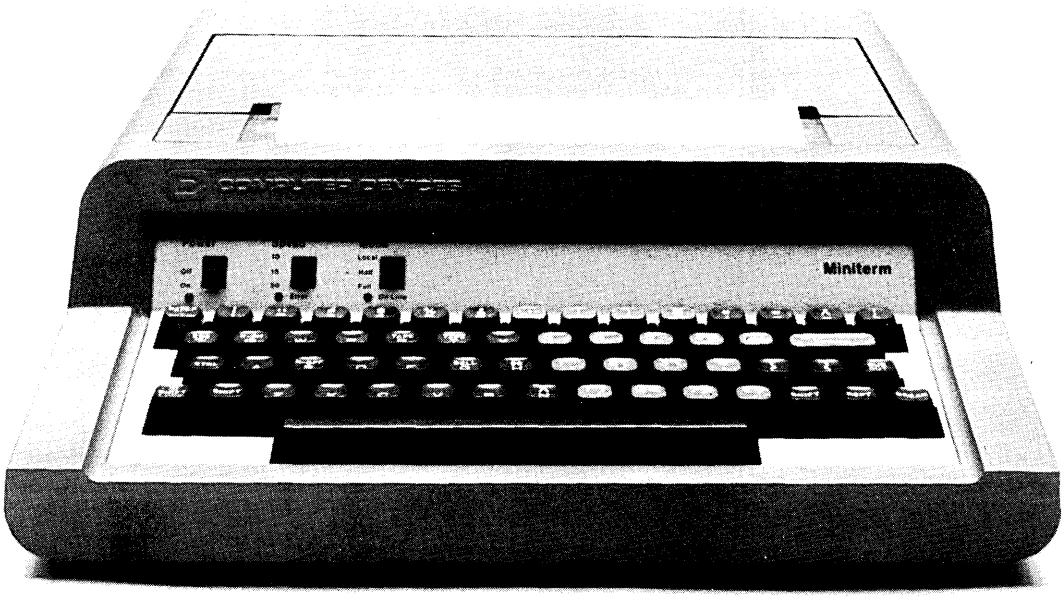


CIRCLE 146 ON READER CARD

resolution of 512 by 512 pixels. This image can be reviewed and edited as needed. Pressing a button exposes either a 35mm slide or an 8 × 10 transparency (either in six seconds) or an 8 × 10 Polaroid print (in 70 seconds). Depending on the user's choice of options, CompuSlide systems carry prices ranging from $49,500 to $79,500.

The Intelligent Projector is based on either a Kodak Ektagraphic or Singer slide projector; an integral microprocessor provides random access to any slide in the projector's magazine in less than two seconds. The projector can be controlled by a computer through an RS232 port, or the user can buy a handheld, push-button controller. The intelligent slide projector sells for $795; the handheld controller is $295. SIMONS OFFICE SYSTEMS, INC., Los Angeles, Calif.

CIRCLE 303 ON READER CARD

DATA ENCRYPTION

The DataLock family of encryption devices uses the National Bureau of Standards' Data Encryption standard to protect a computer user's data. The units can encrypt and decrypt communications between system users, as well as encrypting data being sent to the computer and decrypting the same data upon retrieval. Existing files can be retrieved, encrypted, and returned to the host in secure, encrypted form.

Two models are currently available. The DataLock 150 sits next to the user's teminal. The user can tell the 150 to encrypt only specified segments of his messages: the unit can insert "triggers" in the encrypted data system, and automatically decrypt the data when it is later retrieved. The 150 also can encrypt or decrypt stored files, automatically reading, processing, and returning the file to the computer. The 150 accepts its key from the terminal operator.

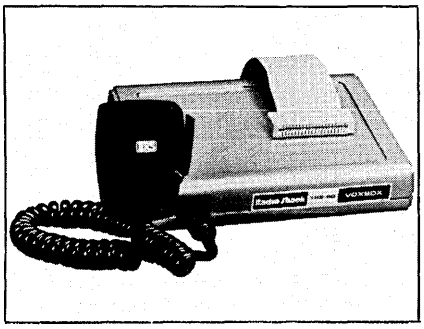
The DataLock 250 is similar to the 150, but it can also accept commands from the computer. Both units use RS232 interfacing, and are transparent to the system when not in "security mode." Asynchro-

nous communications speeds are switch-selectable from 110bps to 9,600bps. A bisync version is expected in April. A single DataLock 150 sells for $2,390, and a single 250 goes for $2,950. SPI DATA SYSTEMS, INC., Palo Alto, Calif.

CIRCLE 304 ON READER CARD

VOICE INPUT

Recommended for use in experimental or entertainment applications, the TRS-80 Voxbox lets a 16KB Level II TRS-80 recognize a spoken vocabulary of up to 32 words. The "speaker-trained, isolated-word, speech recognition system" is said to cor-



rectly recognize 85% to 95% of the words used, assuming the user takes care to speak clearly and distinctly. The Voxbox comes with a machine language driver, three demo programs, comprehensive owner's manual, and a push-to-talk microphone. Voxbox sells for $169.95. RADIO SHACK, a Division of Tandy Corp., Fort Worth, Texas.

CIRCLE 305 ON READER CARD

TYPESETTER

The APS-Micro 5 is this phototypesetting vendor's new offering for small- to medium-sized newspapers, commercial printers, publishers, and companies with in-house compostition requirements. The Micro 5 accepts parallel input from virtually any front-end text preparation system, and optionally from paper tape, magnetic tape, of floppy disk. Capable of setting 1,250 newspaper lines per minute, the Micro 5 is offered in 45, 57, and 70 pica line widths; resolution is up to 3,600 lines per inch. When configured with an 8-inch Winchester disk, the Micro 5 can store up to 200 typefaces. Pricing ranges from $48,500 to $57,500, depending on output line width and font storage disk. AUTOLOGIC, INC., Newbury Park, Calif.

CIRCLE 306 ON READER CARD

DISTRIBUTED PROCESSING

The 5280 family of distributed data systems provides data entry at the point of origin, local processing and printing, and communications (either bisync or SNA/SDLC) with 370s, 303Xs, 4300s, Systems/3, /32, /34, Series/1, 3740s, 5260s or other 5280s. Systems can be configured with intelligent terminals or with dumb terminals attached to a free-standing programmable control unit. Applications programming support is provided in the form of DE/RPG (data entry with RPG subroutines), and a pair of COBOL cross-compilers and libraries (one for DOS/VSE, the other for OS/VS) that run on mainframes.

The family includes two programmable data stations, the 5285 and 5286, two auxiliary (dumb) data stations, the 5281 and 5282, and the 5288 programmable control unit. The 5285 programmable data station, offered in 480-, 960-, and 1,920-character display sizes, has a built-in controller with 32KB, 48KB, or 64KB of main storage, and an integral diskette drive; a second diskette drive is optional. The 5286 dual programmable data station has two diskette drives, and functions as two independent 480-character programmable display stations.

HARDWARE SPOTLIGHT

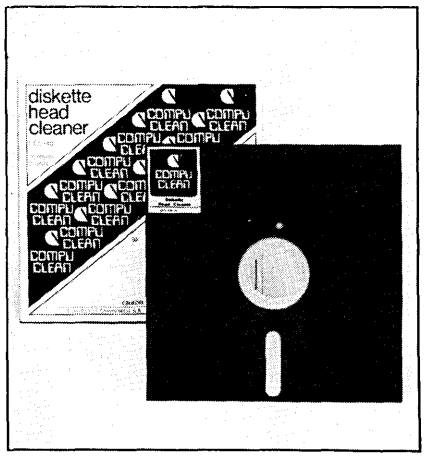
DISKETTE HEAD CLEANER

Six months ago, a friend travelling in Europe sent us a flyer describing diskette head cleaners made by Chemimetal in Belgium. Across the flyer she wrote: "This company has a fun little product. They want an intro to the U.S. market. They're going like hotcakes in Europe."

Chemimetal has since found its gateway to the U.S. market and has signed a vendor to distribute its products.

The CCL diskette head cleaner looks much like a standard diskette. But, instead of an oxide-coated diskette, the CCL envelope contains a nonabrasive, lint-free fiber-coated diskette that wipes loose oxide particles, greasy fingerprints, and other debris from the diskette drive's read/write head. The user simply inserts the CCL into a drive in the same way as a diskette, and 30 seconds later the read/write head is clean.

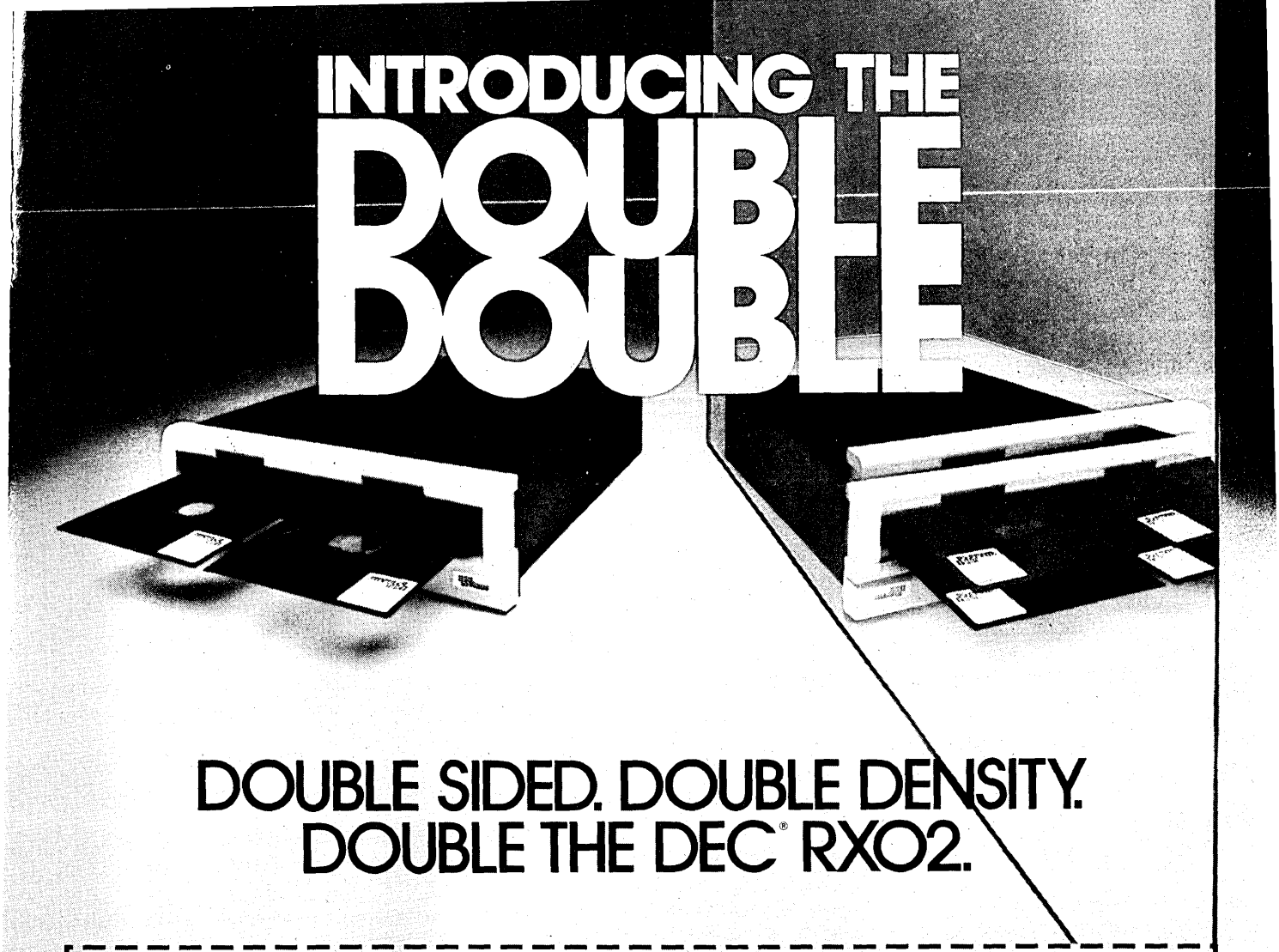
Produced under the label of Compuclean, the CCL comes in four versions: single-(CCL 140) or double-(CCL 140-1) sided 8 inch, and single-(CCL 1400) or dou-



ble (CCL 1400-1) sided 5¼ inch. Each comes packaged three to a box, and each box is said to be able to keep one drive clean for a full year's usage. All four versions carry the same $75 price tag for the box of three. COMPUTER RESOURCES, INC. Cleveland, Ohio.

CIRCLE 300 ON READER CARD

INTRODUCING THE DOUBLE DOUBLE



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CIRCLE 147 ON READER CARD

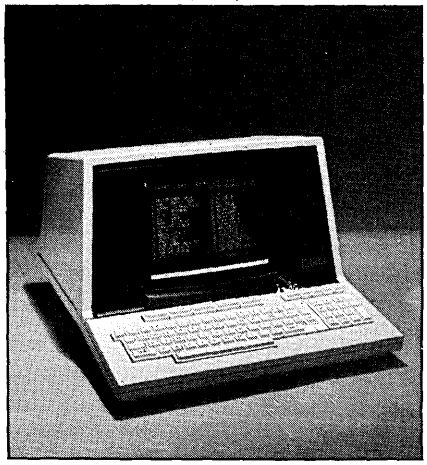
The 5288 Programmable Control Unit includes one diskette drive (and room to add three more) and from 32KB to 160KB of main storage; it can handle up to four data stations and a maximum of five printers. The 5281 data station and 5282 dual data stations must be connected to a 5285, 5286, or 5288; each can have one or two optional diskette drives. The 5281 is offered in 480-, 960-, and 1,920-character displays; 5282 displays can contain 480 or 960 characters (960 only when attached to a 5285 or 5288).

A typical 5280 configuration, consisting fo a 64KB programmable display station, two diskette drives (1.2MB each), a 120cps 5256 serial printer, and a communications adaptor, leases for $517 a month over two years; this configuration sells for $16,660. Depending on configuration and quantity, 5280 pricing begins at $166 a month (for two-year leases) and $5,630 for purchase. Shipments are scheduled to begin in June. INTERNATIONAL BUSINESS MACHINES CORP., General Systems Div., Atlanta, Ga.

CIRCLE 307 ON READER CARD

CRT TERMINAL

The first of a new line of terminals from this vendor, the 7900 Model I is intended to fulfill most of the company's requirements for



teletypewriter-compatible display terminals; it succeeds the vendor's 796-101 terminal. The ASCII terminal communicates via an RS232 interface at asynchronous data rates ranging to 19.2Kbps. The 7900 Model I has a 12-inch screen capable of displaying 24 lines of 80 characters, plus a 25th status line showing the microprocessor-based terminal's operating parameters. Communications speeds and transmission modes (character or line) can be selected by the operator or changed remotely by the host computer system. A printer, thermal or matrix, can be attached to the terminal. The 7900 Model I sells for $2,000; it can be rented for $95 per month. NCR CORP., Dayton, Ohio.

CIRCLE 308 ON READER CARD

VIDEO BOARD

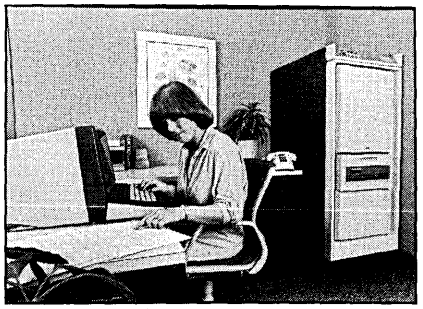
For use with Data General Nova and Eclipse processors, the Lexiscope 4000 video display controller provides the system integrator a means to emulate alphanumeric display terminals and to display graphics. Consisting of a single printed circuit board for insertion into the processor, the Lexiscope 4000 can operate at standard terminal data rates, allowing emulation of standard terminals, such as DG's 6052. In a second, high-speed mode, the board accepts data at processor speed. The board is used with a serial keyboard and a raster scan video monitor (RS170 and horizontal and vertical sync outputs are provided to drive the display). It provides separate graphics and alphanumeric cursors and display memories. The alphanumeric memory holds two 25-line by 80-character pages, with blink, dim, underscore, and reverse video attributes selectable on a character-by-character basis. Graphics resolution is 560 (horizontal) by 500 (vertical). Upper- and lower-case ASCII and 32 special pseudo-graphics characters are provided in the board's standard firmware. In oem quantities of 50 units per year, the Lexiscope 4000 sells for $2,200. LEXICON, INC., Waltham, Mass.

CIRCLE 309 ON READER CARD

32-BIT SYSTEMS

Ever broadening its potential market, this vendor has developed a pair of new entry-level systems. The model 250 is intended for end users, while the essentially equivalent model 150 is configured for systems builders and sold in minimum quantities of five. Both machines are compatible with the remaining larger members of the vendor's product line, providing users with a painless path into larger systems as user needs increase.

Both systems offer approximately 60% the performance of the vendor's existing models 450 (system integrator version) and 550 (end user) processors. Both run the vendor's PRIMOS operating system, and each supports a variety of the vendor's soft-



ware products (priced separately, ranging from roughly $2,000 to $7,000) including language processors for FORTRAN (both the 1966 and 1977 standard), COBOL, PL/1, and BASIC/VM. Each system can participate in networks under the vendor's networking architecture PRIMENET.

Intended for five to eight users, each system can run user programs of up to 32MB (virtual memory); real memory can grow to 1MB. An entry-level model 250, configured with 512KB of ECC MOS memory, 2KB of 80nsec cache, floating point instructions, business instruction set, virtual control panel, 32MB cartridge disk subsystem, eight-line asynchronous multiline controller, crt console, and PRIMOS, sells for $59,500. An entry-level 150, configured identically to the aforementioned 250 with the exception of a 256KB main memory and ommission of the crt console, sells for $49,000, with a minimum purchase of five systems. Both become available in June, with deliveries quoted at 90 days ARO. PRIME COMPUTER, INC., Wellesley Hills, Mass.

CIRCLE 310 ON READER CARD

CRT TERMINAL

The D100 and D200 are the latest additions to this vendor's Dasher line of crt terminals. Intended for use with the full range of the

vendor's computers, the terminals display the upper- and lower-case ASCII characters formed in a 7 × 11 dot matrix cell; the display screen has a capacity of 24 lines of 80 characters. Both terminals have typewriter-style keyboards and 14-key numeric clusters; additionally, the D200 has a 12-key screen management keypad, and a 15-key function keypad. A subset of D200 func-

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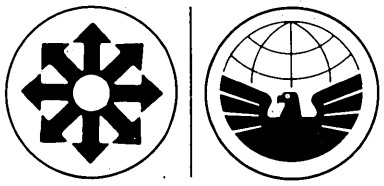

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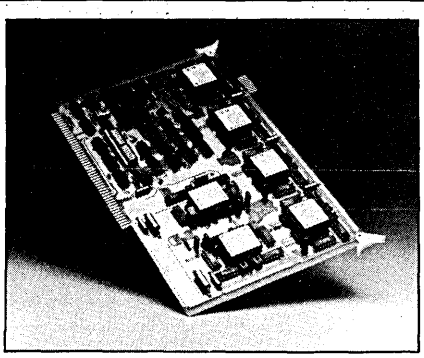
CIRCLE 148 ON READER CARD

tions can be invoked on the D100 by simultaneous depression of a combination of keys. An optional printer interface lets the user get hardcopy of the screen's contents; in lieu of attaching an auxilliary printer, this second interface can be used to send data at a different speed than the terminal's selected receive speed. Both terminals communicate at speeds to 9,600bps via either 20mA current loop or RS232 interfaces. A Dasher D100 sells for $1,750, and a D200 goes for $1,950; adding the printer interface/split speed option increases the cost of either terminal by $400. DATA GENERAL CORP., Westboro, Mass.

CIRCLE 311 ON READER CARD

BUBBLE MEMORY

Bubble memories are now a part of this vendor's TM990 series of microcomputer modules. The TM990/210 board is offered in three versions, with capacities of 23KB, 46KB, and 69KB of nonvolatile magnetic bubble memory. The board contains all required support circuitry, and two, four, or six 92Kbit TIBO203 bubble memory chips. The TM990/210 boards are the first nonvolatile memory boards in the product line. Data transfers occur in a memory mapped mode; both single and multiple page transfers are supported. Access time is 4msec, and the data transfer rate is 45Kbps. In quantities of



one to nine, a 23KB TM990/210-1 sells for $775, a 46KB (210-2) sells for $1,150, and a 69KB (210-3) sells for $1,535. Deliveries are quoted at four weeks ARO. TEXAS INSTRUMENTS, INC., Dallas, Texas.

CIRCLE 312 ON READER CARD

MICROCOMPUTER

Designed for use in turnkey systems (or developing turnkey systems), the Sprint 68 includes a 6800 microprocessor, 48KB of memory, dual 8-inch floppy drives, and an RS232 serial I/O port. Software includes the vendor's proprietary Wizrd disk operating system, editor, assembler, and 12K BASIC. Development software includes a full C compiler, PL/W compiler, and UCSD PASCAL. Sprint 68 accepts any of the vendor's 15 micro-modules for I/O (parallel, serial, and analog), IEEE-488 instrument interface, etc. The basic Sprint 68, with 48KB of RAM and floppies, sells for $3,995. WINTEK CORP., Lafayette, Indiana.

CIRCLE 314 ON READER CARD

PRINTER

The model 877 printer is a bidirectional upper- and lower-case ASCII dot matrix impact printer capable of 120cps operation. The printer uses 8½ inch wide roll paper, printing up to 80 characters on a line. An RS232 interface accepts asynchronous data at speeds from 300bps to 9,600bps. Single unit price for the 877 is $999; the 100-unit oem price is $830. PRINTER TERMINAL COMMUNICATIONS CORP., Ramona, Calif.

CIRCLE 313 ON READER CARD

MICROCOMPUTER

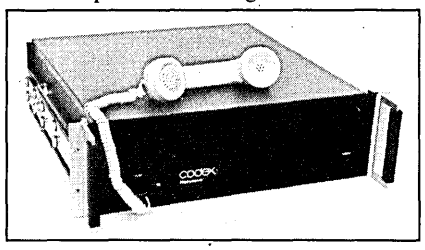
The single-card ZBC 80 is a Multibus-compatible microcomputer based on a 4MHz Z80A microprocessor. The single-board computer's arithmetic processing capabilities are augmented with the addition of an AMD math chip, either a 9511 or 9512, as the application dictates. The 9511 handles 16- and 32-bit fixed point and 32-bit floating point arithmetic, as well as trigonometric, logarithmic, exponential, and square root calculation. The 9512 provides greater accuracy—32-bit fixed point and 32- and

64-bit floating point arithmetic—at the expense of speed and number of functions. The ZBC 80 also includes 16KB of on-board RAM, 16 levels of interrupt, six countertimers, six programmable parallel I/O ports, and a serial communications (RS232) controller. Sockets are provided for up to 40KB of ROM or PROM. Bus arbitration logic is included for multiprocessor applications. The ZBC 80 supports the CP/M 2.0 operating system. A full-blown ZBC 80, including math processor chip, sells for $1,595; a pared-down version, without math processor and some other bells and whistles, sells for $995. MATROX ELECTRONIC SYSTEMS, LTD., Montreal, Quebec, Canada.

CIRCLE 317 ON READER CARD

VOICE DIGITIZER

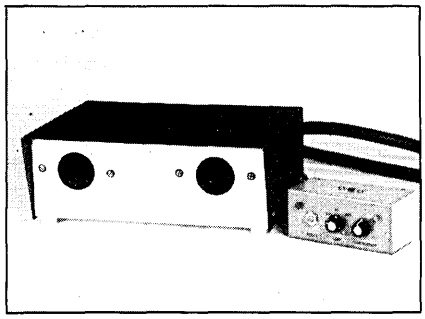
The Digi-phone voice digitizer converts voice signals into 2,400bps streams of digital data, allowing voice communications to be multiplexed over digital communications lines. For secure communications, the digitized voice signal can be encrypted using an auxilliary data encryption unit. The Digi-phone digitizer sells for $13,500; one-, two-, and three-year lease rates are $725, $550, and $495 per mouth, respectively. CODEX CORP., Mansfield, Mass.



CIRCLE 315 ON READER CARD

ENVIRONMENTAL PROTECTION

Designed for use with small computer systems that run on standard 115 volt power,



the PTI-1 Power Temperature Interrupt monitors power and temperature fluctuations, powering-down the system when either varies beyond preset limits. The temperature monitor cuts the power when the computer room temperature exceeds a preset value ranging from 70°F to 120°F. A power interruption occurs if the AC line drops below 90 volts or rises above 140 volts for at least 16msec. Operator intervention is required to restart the computer. Outfitted with the proper plug recepticles for your system, the PTI-1 sells for $575. A 220 volt version, the PTI-2, is expected later this year. NEWTRONICS SYSTEM DESIGN, San Jose, Calif.

CIRCLE 322 ON READER CARD

VAX ADD-IN MEMORY

This vendor's MK8016 is a 256KB add-in memory for DEC's VAX-11/780 computers. A direct replacement for DEC's M8210 memory, the MK8016 uses an eight-bit error checking and correcting code for each 64 bits of data. The board is warranted for one year. It sells for $4,500. MOSTEK CORP., Carlton, Texas.

CIRCLE 316 ON READER CARD

CARD READER

For use with PDP-11s, the CR400/11 card reader comes complete with interface and cabling. The unit uses a vacuum feed mechanism, and can read 400 80-column cards per minute. It's compatible with DEC's CR11 card reader software and diagnostics. The CR400/11 sells for $3,980. The price drops to $3,290 for orders of five to 19 units. CARDAMATION CO., Frazer, Pa.

CIRCLE 321 ON READER CARD

SOFTWARE AND SERVICES

UPDATES

The use of optical communication systems continues to grow among both civilian and military users. Western Electric and local operating company Pacific Telephone recently began sending live voice traffic over a 2.7-mile fiber optic link connecting two central offices in Sacramento, Calif. The system, known as FT-2, was developed by Bell Labs; it uses a 36-fiber cable. The Sacramento application makes use of only six fibers, leaving the remaining 30 for future expansion.

In the East, ITT's Electro-Optical Products Div. has installed a four kilometer link at the U.S. Naval Air Station in Norfolk, Va. The link carries six channels of data, at rates ranging from 20Kbps to 10Mbps. The error rates between the tech control facility and two terminal sites is said to be better than 10^{-8}.

The Australian Government has selected Software Module Marketing's DASD Management System, DMS/OS, to support a pair of FACOM M200 mainframes. The machines, largest of Fujitsu's M-series, will be used by the Australian Bureau of Statistics and the Department of Trade and Resources

Memo to NCC Exhibitors: if you haven't yet responded to our letter requesting information about any new products your firm will introduce at NCC, please send us a product description a.s.a.p. Address your responses to: NCC Product Preview, DATAMATION magazine, 666 Fifth Avenue, New York, NY 10019. Please take a minute and do it now.

FORTRAN DEBUGGING

The FORTRAN Error Recovery System (FERS) is a package of routines said to help FORTRAN programmers identify and correct run-time errors without the need to consult an Abend dump. FERS is invoked whenever a FORTRAN program terminates abnormally. It analyzes the cause of the termination, displaying relevant data to aid the programmer in correcting the error. Data are displayed in their correct formats (i.e., floating point numbers are shown as signed decimal real numbers). If the number is an array element, the array name and subscript are also given. FERS requires no JCL modifications, and uses no cpu time if the FORTRAN program terminates normally. FERS works with all IBM OS/VS systems and all IBM FORTRAN compilers. The package sells for $190. PILKERTON INTERNATIONAL, Anaheim, Calif.

FOR DATA CIRCLE 331 ON READER CARD

STRUCTURED BASIC

Available for use on Hewlett-Packard 3000 and BTI Computer systems processors, S-BASIC allows creation and maintenance of structured BASIC programs. The package consists of a monitor and three major modules: an editor, a program design module, and a preprocessor. An optional module, S-Convert, can be used to convert existing BASIC programs into S-BASIC program files for maintenance or further development.

The editor is used to create program source files for subsequent processing by the program design module and preprocessor. The program design module helps design and document programs and systems. Designs are entered into the PDM, via the editor, in a structured English format. PDM output, said to obviate the need for flow charts, includes a user-controlled source listing, document title page, table of contents, module title pages, procedure sections, and optional procedure and variable cross-reference tables. The preprocessor translates S-BASIC constructs into standard BASIC for the host. It recognizes five elementary constructs (extensions to BASIC): IF . . . ELSE . . . ENDIF, repetitive and non-repetitive DO (with FOR, WHILE, and UNTIL clauses) loop exit constructs and PROCEDURES. Native BASIC statements pass through the preprocessor unchanged. The preprocessor also handles INCLUDE functions and string replacements. Loops are automatically indented during listing. S-BASIC is priced at $1,500; S-CONVERT is an additional $50. MINI COMPUTER APPLICATION SOFTWARE, Orcutt, Calif.

FOR DATA CIRCLE 334 ON READER CARD

GRAPHICS

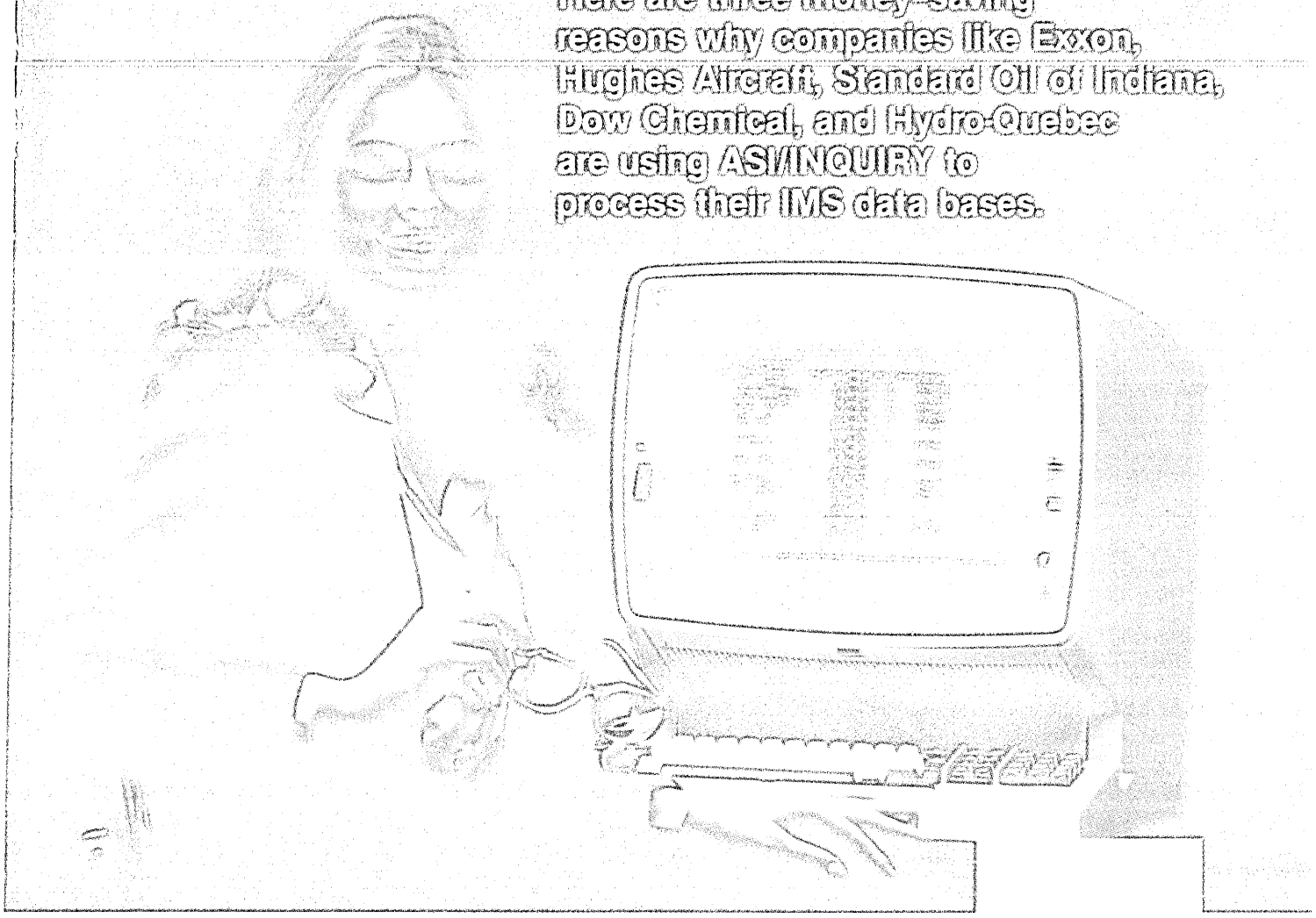
Written in UCSD PASCAL for this vendor's PASCAL-speaking RM-6114 and RM-6113 graphics computer systems, Graphpro is a set of routines and procedures supporting color and black-and-white graphics. Graphpro includes procedures for displaying text in programmable fonts, windowing, clipping, scaling, using programmable patterns, and drawing arcs and circles. The Graphpro set of graphics procedures carries a one-time license fee of $1,750. RAMTEK CORP., Santa Clara, Calif.

FOR DATA CIRCLE 326 ON READER CARD

C COMPILER

Developed for Hewlett-Packard (which has exclusive rights to market the product to Bell System and U.S. government customers), this C compiler runs on HP-1000s under RTE-IV and RTE-IVB. The compiler implements the full C language, and comes with a run-time library of portable I/O functions (covering most of the functions supported in the original Bell-developed system). The compiler supports integer, unsigned, character, long and double float arithmetic, as well as pointers, structures, and functions. Recursion is supported by a run-time storage management system, but the user can instruct the compiler to generate nonrecursive code (thus dispensing with stack overhead) if it suits his application. The compiler generates assembler code, which is then processed by HP's assembler. Compatibility is provided with other HP pro-

Here are three money-saving reasons why companies like Exxon, Hughes Aircraft, Standard Oil of Indiana, Dow Chemical, and Hydro-Quebec are using ASI/INQUIRY to process their IMS data bases.



1. ASI/INQUIRY Is Easy To Learn and Easy To Use.

Because inquiries are stated in simple English, nonprogrammers can learn to use ASI/INQUIRY quickly. DL/1 structures are completely transparent to the user. You need not understand the complexities of multipathing or multiple data base access. Comprehensive diagnostic messages simplify error correction. ASI/INQUIRY automatically displays data in the appropriate format—horizontal, vertical, or overflow. Or you can specify any desired screen format. Repetitively executed queries can be saved in an on-line catalog. New release 5 features include the ability to defer query execution to batch and a powerful user exit facility.

2. ASI/INQUIRY Assures Faster Access and Response Time.

ASI/INQUIRY lets you access your DL/1 data bases through IMS or TSO faster and more efficiently. That's because it eliminates need to write and debug those highly procedural programs usually required to access data bases. ASI/INQUIRY operates as an IMS message processing program executed from any IMS DB/DC-supported terminal. Execution priority is dynamically controlled through automatic program message switching. High initial priority assignment assures fast response. Priority is then automatically adjusted to the rate that to-be-displayed data is encountered, which optimizes *load leveling* of IMS DB/DC resources.

3. ASI/INQUIRY Provides Complete Security.

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CIRCLE 152 ON READER CARD

gramming languages, so C can call FORTRAN and assembly language routines, and vice versa. The HP/C compiler and run-time library are priced at $4,000 for the first copy and $2,000 for each additional copy. Source code is available for $10,000. CORPORATE COMPUTER SYSTEMS, INC., Aberdeen, N.J.

FOR DATA CIRCLE 324 ON READER CARD

INQUIRY LANGUAGE

PDP-11 users can now make interactive inquiries into data bases maintained by Total by using a companion product, T-ASK, an on-line query facility. T-ASK was developed for the PDP-11 after a 370 version of the query facility proved popular among Total users. The package runs as a separate disk overlay using 24K-words of memory; it runs with Total version 2.0 on PDP-11/34s through 11/70s under either RSX-11M or RSTS/E. T-ASK's English-like language is said to be usable by nonprogrammers. Capabilities include the ability to process an entire Total data base, instead of searching a file at a time. Procedures can be created and saved for later use. Security is controlled through the use of passwords; access can be controlled at the file, element, and subelement for each password. Arithmetic operations are provied for data manipulation. Three data types are supported: alphanumeric, data, and numeric (further divided into floating point, binary, packed decimal, and ASCII). Hardcopy reporting also is supported.

T-ASK carries a single-use charge of $12,000. There's an annual usage charge of $1,200, and an installation fee of $750. T-ASK can be rented for $300 per month. CINCOM SYSTEMS, INC., Cincinnati, Ohio.

FOR DATA CIRCLE 330 ON READER CARD

SOFTWARE SPOTLIGHT

PROGRAM GENERATOR

The System/34 file maintenance program generator (FMGN34) creates workstation-oriented RPG II file maintenance programs based on simplified user specifications. FMGN34 generates the RPG II source code based on user inputs; it handles the creation of screen formats, and procedures to maintain user disk master files. Generated programs can handle add, change, delete, and inquiry functions, as well as printing an audit trail. User edit routines are supported, as well as both indexed and direct disk master files. The vendor says FMGN34 may be able to replace workstation utility (WSU) and data file utility (DFU) jobs. Additionally, generated programs adhere to a standard format, simplifying subsequent maintenance or modification. FMGN34 is offered for a one-time fee of $800. BANCROFT COMPUTER SYSTEMS, INC., West Monroe, La.

FOR DATA CIRCLE 318 ON READER CARD

OPERATING SYSTEM

For users of Bell Labs' UNIX operating system on PDP-11 minicomputers, this vendor offers a means to use and develop RT-11 software. RT/EMT allows RT-11 software to run concurrently with the UNIX operating system. The vendor says that "only very minor changes" are needed in the Bell software.

RT/EMT allows execution of RT-11 binary programs, including MACRO, FORTRAN, LINK, and TECO. The package consists of an RT-11 emulator and an RT-11 command interpreter; the command interpreter recognizes most commands of the RT-11 keyboard monitor, and its use is optional. The emulator portion of RT/EMT can be invoked from the UNIX operating system command level. The RT-11 file system is simulated under the Bell Labs operating system; a utility program can copy files to and from RT-11 media. Supplied with full source code, RT/EMT carries a one-time license fee of $1,350. Users also must have licenses for the UNIX operating system and RT-11. HUMAN COMPUTING RESOURCES CORP., Toronto, Ontario, Canada.

FOR DATA CIRCLE 332 ON READER CARD

DISK UTILITIES

Written in BASIC-Plus for use under RSTS/E or PDP-11s, Dumper is a disk backup and restore package; a second, unnamed, package provides support for RMS-11 (Record Management Services) file structures.

Dumper can transfer individual files, entire user accounts, or single and multiple disks to and from mag tape; the package handles all disk and tapes supported by RSTS/E, with the exception of floppies and DECtape. A short dialog, which can be saved in a command file, initiates transfer operations. Dumper reportedly executes in roughly 60% the time required by DEC's BACKUP package. Dumper carries a single-cpu price tag of $725.

RMS-11 support is provided by a set of BASIC-Plus subroutines that access RMS files directly, and then interpret the file organization as RMS would. The package provides read and write support for RMS sequential files, and read-only support for indexed files. Extended capabilities are in the planning stages. The RMS-11 file support package is priced at $500. ENTERPRISE TECHNOLOGY CORP., New York, N.Y.

FOR DATA CIRCLE 328 ON READER CARD

TRANSACTION PROCESSING

A joint development effort between this vendor and Decision Strategy Corp. has produced HTP, a transaction processing system for use on the vendor's computers under the Vulcan operating system. HTP is based on Decision Strategy's TAPS (a mainframe transaction processing package); reportedly, it is a simple task to transport mainframe-based TAPS applications to this vendor's systems running HTP.

HTP supports development, operation, management, and maintenance of on-line applications. Under Vulcan, it can operate concurrently with other applications. Application development and maintenance are simplified by HTP facilities for interactive screen definition, sign-on and security, menu processing, automatic editing, and format and message scheduling. The system also supports terminal network management and data base recovery. The system generates statistical reports for accounting, system tuning, operator guidance, and measurement. A single site license for HTP goes for $15,000. Discounts are offered for multiple system installations. HARRIS CORP., Computer Systems Div., Fort Lauderdale, Fla.

FOR DATA CIRCLE 323 ON READER CARD

FORMS MANAGEMENT

Modifications to this vendor's forms management software, FMS-11, now make it possible to use the package with any PDP-11 minicomputers and PDT-11 intelligent terminals; the package now runs under the RSX family of operating systems (from the memory resident executive RSX-11 to the RSX-11M-Plus monitor used with PDP-11/44s and PDP-11/70s). Previously, FMS-11 ran only under the RT-11 operating system.

The package allows forms development, data entry and display. Consisting of a number of utility programs, FMS-11 takes advantage of many features of the VT-100 terminal, including reverse video, blink, underlining, scrolling, and 132-column display. Applications written in FORTRAN, COBOL, BASIC, or assembler can call FMS-11 to input data from an entire form or a single field. The new implementation of FMS-11 licenses for $2,700. DIGITAL EQUIPMENT CORP., Maynard, Mass.

FOR DATA CIRCLE 333 ON READER CARD

CICS ACCOUNTING

A transaction accounting and charge-back system, TRAC-CICS has its own data capture facility, or it can interface to the IBM Performance Analyzer program product. The on-line data capture component of TRAC-CICS is said to require "significantly less" overhead than the Performance Analyzer. Users have the ability to specify the level of detail data captured, thus giving the user control over overhead. The package requires no operating system modifications. It works with all versions of CICS running under DOS/VS through MVS/SE. A DOS/VS version of TRAC-CICS goes for $3,000; an OS/VS version is $4,500. VALUE COMPUTING INC., Cherry Hill, N.J. ✻

FOR DATA CIRCLE 325 ON READER CARD

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MA

CIRCLE 153 ON READER CARD

SOURCE DATA

BOOKS

IN THE NAME OF EFFICIENCY by Joan M. Greenbaum

The following two reviews of the same book differ so widely we expect readers will be doubly prompted to read the book for themselves. We welcome comments from readers as to whether the distortion to which Mr. Dorn refers cancels out the insights to which Mr. Sharpe refers, or vice versa—or whether yet another analysis might be in order.

What can you say about a book that alleges operating systems and higher level languages to be part of a management-inspired conspiracy to "deskill" the "workers"? Perhaps the most reasonable explanation is that Marxist economics and data processing don't mix.

Veteran dpers remember when machine code was king, hands-on testing was the norm, and the machine room was open to all. Most view the changes as a step toward making the use of dp more effective in fulfilling end user needs. Perhaps Ms. Greenbaum is a bit too young to remember that very few programmers were even marginally adept with machine language. She might be surprised to learn that almost all programmers are terrible machine operators. She seems to view the moves since 1955 as some sort of a devious management plot to grind down the workers. (Perhaps she would get more sympathy if she wouldn't call a $35,000 senior analyst or programmer a "worker.")

Most of the author's historical remarks are about five years off what was really happening. She seems to have totally missed the impact of microcomputers, minicomputers, and data communications. The few remarks on distributive data processing appear to have been patched in as an afterthought.

A few special technical points. Ershov is hardly a dp "outsider." The SAGE system was not "time-sharing." The 702, 704, and 705 do not a "family" make. SHARE and GUIDE are not "corporate" user groups, they are installation based groups. The first commercially available solid state machine was not Univac's SS-80, it was Philco's S-2000. RCA's machines were not compatible with IBM's, they were almost compatible which is roughly equivalent to being a little bit pregnant. The Spectra series did not offer virtual memory before IBM "had even announced plans for it." Corporate dp budgets are not showing swings toward greater labor intensivensss than in the past decade, the number stays in the 50% to 55% range. Citing Alan McAdams as merely a witness without mentioning that he was the government's chief anti-IBM strategist is playing fast and loose with the facts. This list could be extended.

Ms. Greenbaum's pet hate is not IBM or even corporate management. It is Frederick Taylor's Scientific Management. There are at least 10 countable derogatory references to Taylor's work, which is now more than 70 years old.

If you want to be mildly amused by seeing how a philosophical bent can distort dp history and practice, read this book. Otherwise, stash it with your 1401 manual and 7074 core dumps.

—Phil Dorn

●

As we stagger into the 1980s, the dp industry in the Western world will be increasingly constrained by the relatively low efficiency of software production.

There is well-documented evidence to show that falling hardware costs are not being matched by software costs. But the increasing penetration of computer-based systems into industrial, commercial, and governmental uses as well as private lives clearly cannot be sustained if it depends on training the whole work force in programming. Hence, more complex software is essential if that penetration, which is the only guarantee of a continually expanding market for vendors, is to be achieved.

There have, until recently, been only two answers to this problem—answers that are reflected in current practice within the industry. One answer places emphasis on formal authority and coercion and views the labor in software shops as a recalcitrant resource that needs to be pushed into line. The other school emphasizes worker motivation, collaboration and human relations in its plans to overcome the software bottleneck. Programmers and systems analysts are, according to this argument, basically agreeable people who can be motivated to produce more for the firm as long as their humanity is recognized.

Even if you are not yourself an advocate of the first school, you must know many examples from the field of dp management. Those with the more humanitarian approach, like Gerald Weinberg, give some hilarious examples of the results of applying coercion and authority.

Joan Greenbaum, in *In the Name of Efficiency—Management Theory and Shop Floor Practice in Data Processing Work,* makes a valuable contribution to a third and deeper approach. She argues that management, in the name of efficiency, has divided, subdivided, routinized, and, therefore, dehumanized most of the work processes in current dp. But, despite this, programmers, operators, and systems analysts—the actual people who do the work—have managed to retain a tenuous control over their working lives by informal resistance that is seldom officially recognized and only shows up in a "problem of productivity." This split between formal organization and informal practice not only leaves management with a weak hold on reality but prompts it to launch periodic forays into the process of software production with the aim of wresting back control. She argues that structured programming unified standards for design and coding, and chief programmer teams are only the latest manifestations of this continued struggle for control in the workplace. This analysis may help explain why data processing is facing a people crisis which may irreparably damage its public and corporate image just as the car industry was damaged by ecology concerns.

The implications of Greenbaum's insights into the problem of "software productivity" are not just contained within the dp industry. As we enter the 1980s, software productivity is only one aspect of a broader crisis of industrial profitability. The oil crisis in the early 1970s marked the end of nearly 25 years of prosperity; a fundamental restructuring, as extensive in its effects as the rebuilding of the 1930s and '40s, is essential before a new era of prosperity dawns.

But success in this period of restructuring is far from guaranteed and the outcome depends partly on the success of our own industry in "overcoming the software productivity problem." Dp will be one of the key industries for the new era of prosperity and the search is on, says Green-

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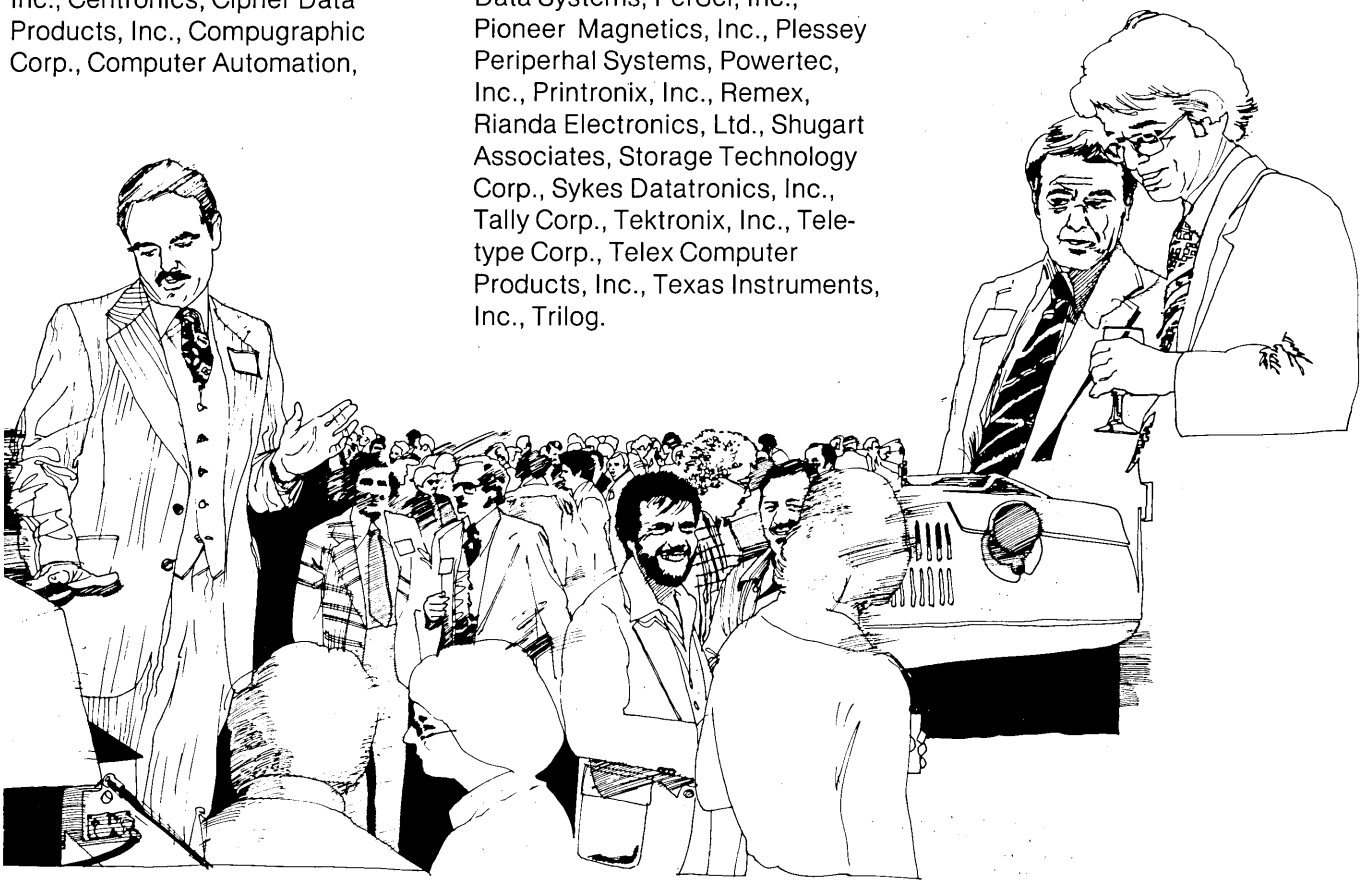

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CIRCLE 154 ON READER CARD

baum, for the people and methods that will do for software production what Henry Ford did for automobile production. But who, Greenbaum asks, will pay? Increased productivity is being sought "in the name of efficiency," and Greenbaum feels that it will only come at the expense of those working in the programming shop. In her concern to champion their position she must be dubbed one of the real humanists in our industry. Temple Univ. Press, Philadelphia, Pa. (1979, 165pp., $15).

—Richard Sharpe

THE NEW SOFTWARE ECONOMICS by Werner L. Frank

This look at the software industry offers valuable insights both to users and prospective users of software products and to those engaged in the still fledgling field of developing and marketing packaged software. In contrast to the plethora of books and articles of the "how-to-buy software" genre, including a few of my own, Werner Frank provides an insightful analysis of the software package industry as it exists today after roughly a decade of somewhat slow and shaky development. Frank presents the dollars and cents rationale underlying this increasingly important sector of the computer market and documents both strengths and weaknesses of the software package marketplace.

A seasoned software industry executive, Frank is well qualified to dissect the business in which his firm has played a major role with the Mark IV file management system. He begins his well-documented analysis by reviewing today's data processing situation and identifying major issues in software development. He states the case for software products in terms of their ability to significantly enhance users' productivity, as measured in hard dollar savings, as well as a higher level of confidence in the reliability of the operational software system. He then surveys the software products industry and contrasts IBM's marketing approach with that of the independent software suppliers.

The role of IBM in the software marketplace has been of paramount significance since the unbundling decision of 1969, and Frank notes the effect of the IBM umbrella on the software products industry. One anomaly of IBM's competition with the independent suppliers, all of which are of course minuscule compared to IBM, is that IBM has been able to impose terms and conditions on its customers that these same customers do not accept when dealing with other software suppliers. For example, according to Frank, IBM has the option of changing its monthly package lease charges on three months' notice and can modify *any* of the terms of its agreement on six months' notice. Moreover, IBM undertakes no obligation to achieve service results and does not warrant that errors or program defects will be corrected.

But competing with the IBM software product offerings is just one problem besetting the software industry. Under the heading of "fallacies and traps" to which early software suppliers succumbed, thus setting certain trends for the industry, Frank cites the following:

Demonstration. There is a belief that users are entitled to demonstrations without obligation. This is simply not an inherent right.

Free Trial. Associated with the free demonstration idea is the free trial which users have come to expect as part of the inducement to buy process.

Multisite Discounts. Why should software be discounted any more than hardware?

Warranties. Unqualified and unlimited warranties of performance against specifications at the time of sales and continued operation against unknown future environments seem to be expected—even though IBM does not offer anything like this.

The author believes that these and other fallacies and traps dictate a need for "redirection" of the industry.

In his critical appraisal of the industry, Frank points out problems that are well known to those of us who have been in the packaged software business but which are not all that obvious to the typical user. He correctly points out, for instance, the unusually high cost of marketing software packages and of maintaining them. Frank concludes that "given the demands now placed upon them by customers, a 20% gross profit on sales is a legitimate aspiration," though at the present time his figures suggest that the overall industry average is more like 11%. He makes the plea that while hardware prices started high many years ago and are continually falling, software prices started low and must increase. He notes, for example, "in the case of the newly announced IBM 8100, the hardware monthly fee is essentially equal to the totally unbundled fee for a representative set of operating software."

Despite his insights into the problems of the industry, Frank seems optimistic about its growth potential. He recognizes the unquestionable need on the part of users for greater productivity in application development and maintenance—a problem that has plagued users from the beginning but is becoming increasingly acute as the demand for additional applications continues to rise at the same time the burden of maintaining the existing application portfolio is going up.

Frank aptly asserts that "when all is said and done the ultimate factor in software productivity is the capability of the individual software practitioner. Even in the presence of better techniques and aids, productivity in the software process is heavily dependent on individual performance. This, of course, is software's Achilles' heel and the basis for its labor intensiveness." U.S. Professional Development Institute, Inc., Silver Spring, Md. (1979, 86 pp. + appendixes, $15).

—Robert V. Head

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SOURCE DATA

MODELING AND SIMULATION IN PRACTICE
edited by M. Cross, et al.

The book collects in one hardcover volume a disparate set of continuous function modeling papers presented at the 1978 proceedings of POLYMODEL 1, held at Sunderland Polytechnic in Great Britain. There are 19 papers, usually followed by several pages of lively discussions between the authors and the session chairman or the floor, as well as a small number of references (mostly European and U.K. sources). Subjects covered include coke oven modeling; iron ore sintering; flow models for multistage compressors and turbines; a kidney model; a high level language called ISIS, which solves sets of differential equations and plots the results; several papers discussing modeling approaches and philosophies; and a final section ranging from economics and urban development to ship panel vibration and surface roughness effects.

None of the papers are complete or exhaustive, but the editors have made a concerted effort to include something of the *process* incurred in model building as well as the pristine results.

If you happen to be involved with any of the subjects covered, the book may well be your cup of tea. Halsted Press (a division of John Wiley & Sons) (1978, 358 pp., $39.95).

REPORTS & REFERENCES

TELECOMM IN CHINA

The proceedings from a conference on the potential market for telecommunications equipment in China are now available. Papers include the text of a speech by Dr. William Raney of NASA in which he predicts China will select a single U.S. contractor for both the space and ground components for its proposed satellite system, but that the system is probably more than four years away. Sometime DATAMATION author Bohdan Szuprowicz's comments on the trade agreements between China and Africa, and Control Data Corp.'s Hugh Donaghue tells about the near-demise of a $67 million deal with China in 1976/77 in a paper called "How Not to Do Business with China." The proceedings are available for $100 from Information Gatekeepers, Inc., 167 Corey Road, Suite 111, Brookline, MA 02146, (617) 739-2022

ON-LINE SYSTEMS

Knowledge Industry Publications, publishers of reports about automation and libraries, and distributors of American Society for Information Science (ASIS) reports, is offering the 14th *Annual Review of Information Science and Technology* (ARIST). The volume discusses how users of on-line and data base systems actually learn to use these services. The firsthand trial-and-error discussions are intended to improve training procedures, share cost and program information and point out potential uses of materials.

In one paper in ARIST, data base management is discussed, particularly as it presents disruption problems to an organization. Other papers include "Experimental Techniques of Information Retrieval," "Unconventional Computer Architectures for Information Retrieval," and "Library Automation." The 376-page hardbound book sells for $35.

Also newly available are *Minicomputers in Libraries,* an analysis of commercially available systems and their library uses (softcover, $24.50), and *Computer-Readable Data Bases,* a monster volume (over 1,500 pp.) from ASIS. More than 500 data bases are listed, with the name and producer of data base, mode (batch or on-line), coverage, year of origin, number of items included, frequency of update, pricing, etc. The directory was compiled from the data base on data bases at the University of Illinois Information Retrieval Research Library. Professor Martha Williams, chief editor of the directory, estimates that almost 3 million on-line searches of computer-readable data bases were conducted through public sources last year alone in the U.S.

The data base directory sells for $95 (ASIS members get a 20% discount). Knowledge Industry Publications, Inc., 2 Corporate Park Drive, White Plains, NY 10604, (914) 694-8686.

SOFTWARE DIRECTORY

The *International Directory of Software* will be published this month, covering over 3,200 software products from U.S. and European suppliers. Details of hardware compatibility will be included. Software types to be addressed include communications, compilers, data management, development aids, systems software for mainframes and for microprocessors, utilities, accounting, administration, production and distribution, banking, computer aided design, modeling, simulation and statistics, and insurance. Software suppliers will also be profiled in the directory. $140. CUYB Publications, Inc., 633 Third Ave., New York, NY 10017, (212) 867-8833.

AUERBACH GIVING AWAY REPORT CATALOG

A free catalog describing Auerbach reports is now available, describing offerings on such subjects as minicomputers, mainframes, financial, retail, and office systems, peripherals, software, data communications, and distributed processing. Another report described in the catalog is on data banks. It looks at the recent proliferation of data bases, their advantages and disadvantages, and how to find them. A list of commercially available data banks is included. *Data Banks* is the most expensive of the reports at $35; others range from $15 to $30. Auerbach Publishers Inc., 6560 North Park Drive, Pennsauken, NJ 08109, (609) 662-2070.

CIRCLE 335 ON READER CARD

COURSES

ACM SEMINARS

The Association for Computing Machinery is offering a series of Professional Development Seminars this spring for the low fee of $55, including lunch and texts. The speaker March 22 will be Christopher J. Date of IBM on data base systems. April 12 features Dr. Daniel Wood of the Mitre Corp. speaking on communication protocols. On April 26, Grayce Booth of Honeywell, Phoenix, will speak on distributed processing. The seminars will be held at Framingham State Univ. in Framingham, Mass. Contact the Greater Boston Chapter of the ACM, P.O. Box 465, Lexington, MA 02173.

PROJECT DESIGN

MIT Professor Robert Alloway at the Sloan School's Center for Information Systems Research will use his research on dp project design to give a workshop on management guidelines for designing successful dp projects. Planned for senior project managers and managers of systems development departments, the workshop "is not a traditional project management course, belaboring the details of sign-offs, PERT, or documentation standards. Rather, it is a managerial state-of-the-art approach to selecting from basic alternatives the best design for each project. The critical dimensions which differentiate and classify dp applications will be identified, and systematic and viable methods for diagnosis of the organizational context for the project will be specified." June 23-27, $750. Contact Director of the Summer Session, Room E19-356, Massachusetts Institute of Technology, Cambridge, MA 02139, (617) 253-2936.

LEARN PASCAL AT NCC

A special two-day course in PASCAL programming will be given in Los Angeles May 18 and 19, just before NCC in Anaheim. The fee will be $300. The course is taught by Drs. V. Ledin and J. Faletti of the University of Calif., Berkeley, and is given by the Computer Science Education Extension, a division of Computer Science Press, Inc. The company will also offer Principles of Compiler Design, taught by Professor J. D. Ullman of Stanford Univ. in New York City in late June, for which the fee is $575. These and other courses are also available to companies on their own premises. Comput-

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OFFICE AUTOMATION

A series of one- and two-day workshops will be held in the Paperless Office Learning Center in Washington, D.C. Billed as a hands-on workshop, available machines will include word processing, ocr, electronic mail, computer output microfilm, and color graphics equipment. Lectures will cover technologies, office management, human factors, strategic planning, financial considerations, and selling new concepts and systems to management. One-day sessions are $250, two-day sessions $395. Office Automation Briefing and Workshop is to be given April 15; Office Automation Planning Workshop for Managers, April 16-17. Information Resources Management will be given April 8. Integration: Key to Office Automation will be given April 9 and 29. Productivity Information Technology & the Office will be held April 30. Contact Micronet, Inc., Watergate Mall, 2551 Virginia Ave. N.W., Washington, DC 20037, (202) 333-4800.

A three-day conference on office automation is being offered by another firm. Workshops, of which two may be chosen, will cover planning and implementation considerations, software/hardware/communications, managing word processing systems, advanced administrative systems, and input/output technologies. The workshops will be given April 28-30 in San Francisco and May 28-30 in Chicago. A related seminar in word processing will be given in New York June 11-13, and in Washington, D.C. July 16-18. $395. For teams of three or more from the same organization going to the same seminar, the third registrant pays $295. AIIE Seminars, P.O. Box 3727, Santa Monica, CA 90403, (213) 450-0500.

A word processing workshop for managers, said to be designed for both wp and dp managers as well as administrative managers and systems analysts, will use small group discussions and case histories to study wp feasibility, planning, and personnel considerations, as well as to provide a basic understanding of equipment. The workshop will be given April 21-23 in Washington, D.C., May 5-7 in Boston, June 2-4 in Los Angeles, and July 9-11 in San Francisco. Fee: $495 (for three or more attendees, $395 each). NIMR Seminars, P.O. Box 3727, Santa Monica, CA 90403, (213) 450-0500.

WOMEN IN DP

Seminars on Women in Data Processing are soon to be offered nationally. Guest panelists in management positions share their experiences in juggling career and personal life in discussions designed for audience participation. Options such as free-lance consulting, part-time work, and flexible hours will be discussed in the course of exploring the intricacies of personal and professional growth. The premise of the Women in Data Processing organization is that women have the power to shape their own professional futures. Upcoming sessions will be held in March and April. Contact Deidre Griffith at Women in DP, 275 Madison Ave., Suite 1511, New York, NY 10016, (212) 686-6474.

SOFTWARE QUALITY

A course on software quality assurance will be taught by Richard Foster July 15-18 at Rutgers Univ. in New Brunswick, N.J. Datamatrix Institute, P.O. Box 2021, Menlo Park Station, Edison, NJ 08817, (201) 548-0600.

GEOMETRIC MODELING

A five-day course in the mathematical theory and software techniques for modeling mechanical parts and similar rigid solids such as for CAD/CAM systems is being offered June 9-13 at the University of Rochester, Rochester, N.Y. Principles from set theory, geometry, topology, and computer science will be presented as will graphics al-

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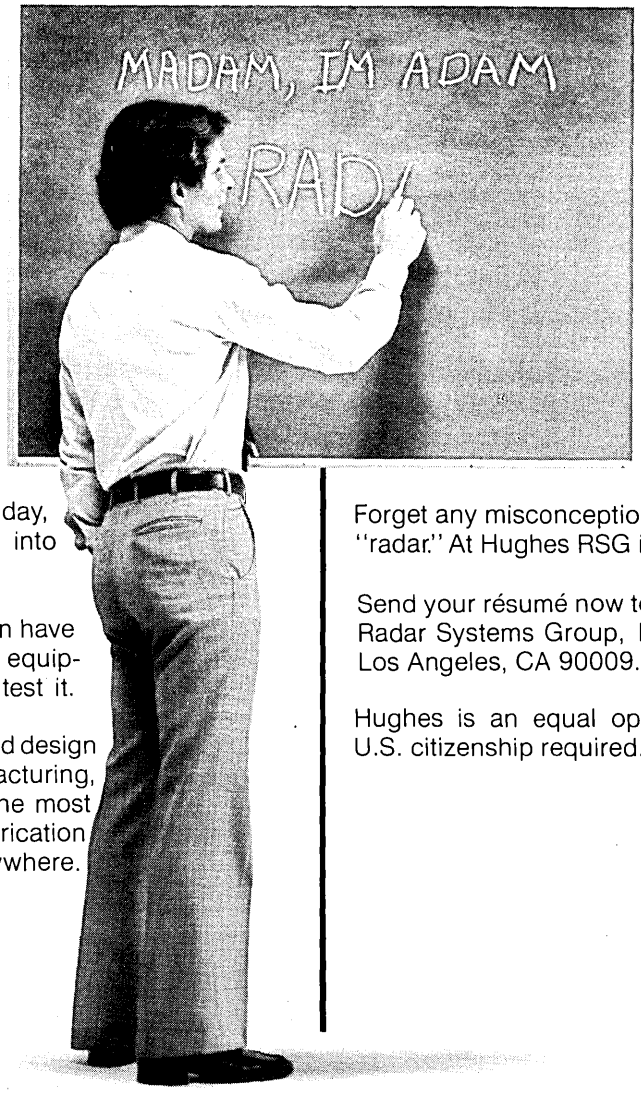

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gorithms. Fee: $600. Contact Colleen Hudgens, Administrator, Production Automation Project, College of Engineering & Applied Science, University of Rochester, Rochester, NY 14627, (716) 275-5342.

USER RELATIONSHIPS

A course entitled In-House Consulting Skills for Systems Analysts aims to help systems analysts, programming managers, systems managers and consultants to interact more effectively with computer users. Working with difficult users, communicating sensitive information, dealing with technical and interpersonal problems, gaining influence with users, and discovering unspoken needs are to be addressed. The course will be held April 14-15 in New York City and costs $575 per person plus $75 per organization per seminar. In-company presentations are available. University Conference Center, 360 Lexington Ave., New York, NY 10017.

COMPUTER LAW

The University of Southern California Law Center is giving a program on computer-related litigation in Los Angeles on May 22 and 23, immediately following NCC. The first day will address proprietary rights, including how to evaluate a litigate breach of confidentiality, trade secret, patent, and copyright cases. The second day will focus on contract disputes relating to procurement, from both the seller and user viewpoints. The advantages and disadvantages of arbitration will be discussed. Cost for one day is $120, for two days $195 ($175 before May 8). Contact Ami Silverman, USC Law Center, University Park, Los Angeles, CA 90007, (213) 741-2582.

FREE CATALOG

The Hartford Graduate Center offers a free catalog of courses it gives on a variety of dp topics, including COBOL programming, assembler language coding workshop, computer auditing and security, data base systems, management of computer operations, and systems design workshop. Courses for both the beginning and the experienced dp employee are included. The Hartford Graduate Center, 275 Windsor St., Hartford, CT 06120, (203) 549-3600.
FOR DATA CIRCLE 336 ON READER CARD

OPERATIONS

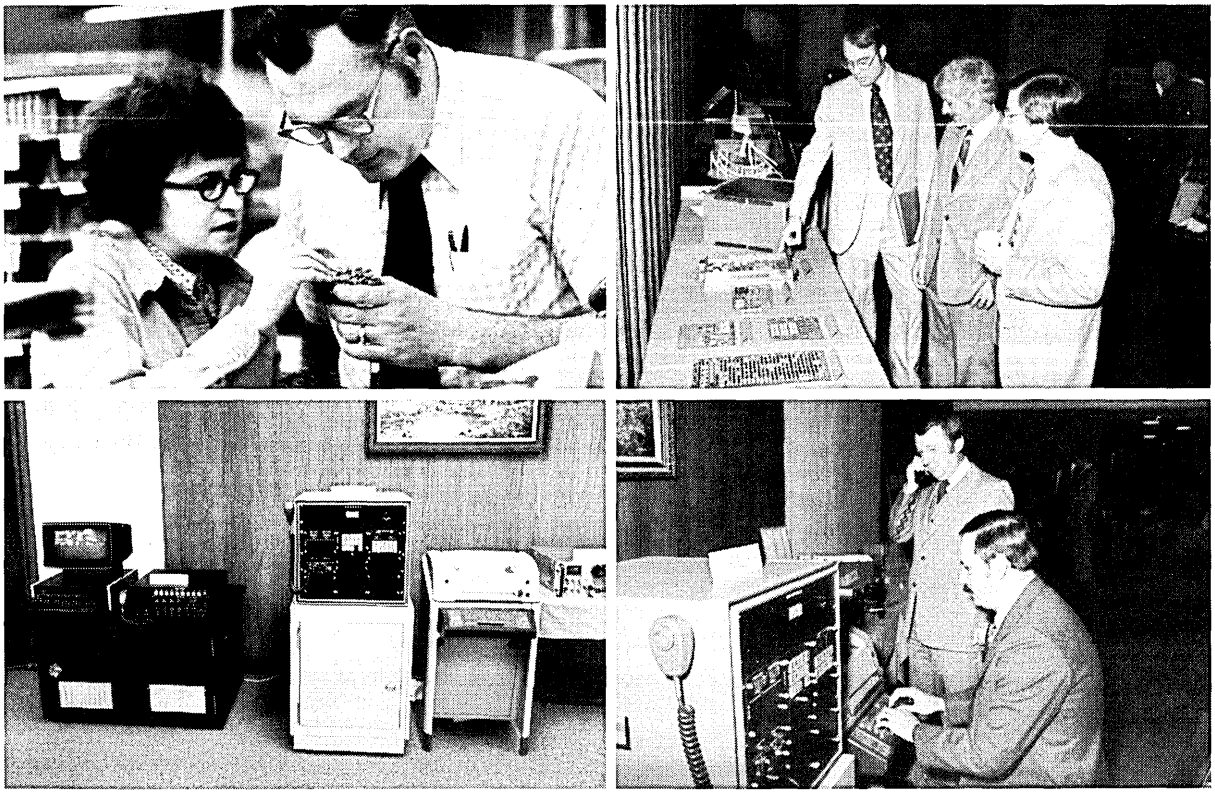
A seminar on dp operations management will be held in Boston April 14-16, in Houston May 14-16, and in Atlanta June 16-18. Hardware, software, and personnel factors will be discussed as "factors in cost/benefit equation." Fee: $740. Contact Heidi E. Kaplan, Dept. 20NR, University Conference Center, 360 Lexington Ave., New York, NY 10017, (800) 223-7450 (toll free); in New York State or Canada, call (212) 953-7272, ext. 289.

BURROUGHS ON OCR

A slide presentation on the use of optical character recognition equipment with word processing is available for loan at no charge to training and professional organizations. Contact Heidi Osborn, Burroughs Corp., 9 Ray Ave., Burlington, MA 01803, (617) 273-2222.

THIRD-PARTY LEASING

ICN will give its seminars Third-Party Leasing and Computer Contracting in tandem for the convenience of those who wish to attend both. The seminars will be given in Orlando, Fla. April 30-May 2 (Leasing), May 5-7 (Contracting); New York City July 16-18 (Contracting), July 21-23 (leasing); Chicago Aug. 20-22 (Contracting), Aug. 25-27 (Leasing); and in Newport Beach, Ca. Oct. 15-17 (Contracting), Oct. 20-22 (leasing). Individual seminars are $595; together, $1,100. International Computer Negotiations, Inc., 1331 Palmetto Ave., Winter Park, FL 32789, (305) 628-4640.



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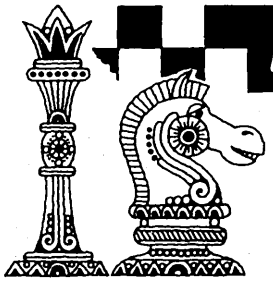

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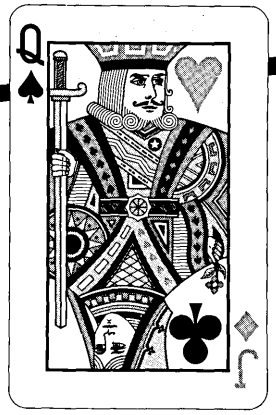

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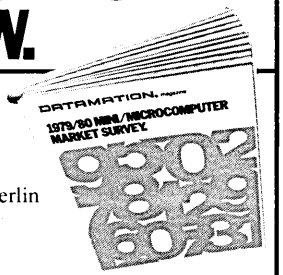

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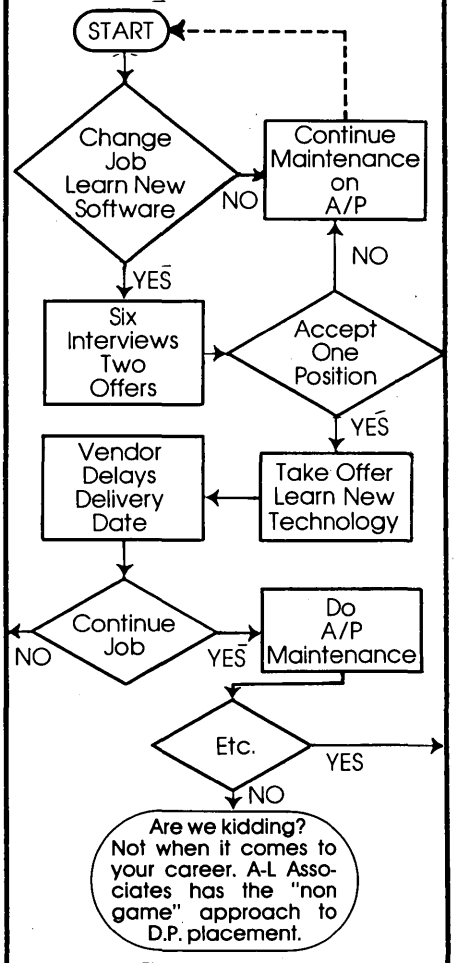

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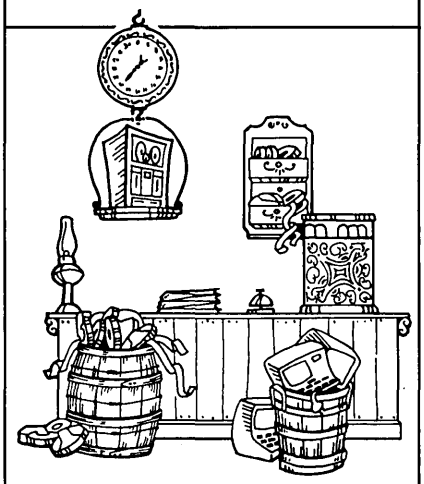

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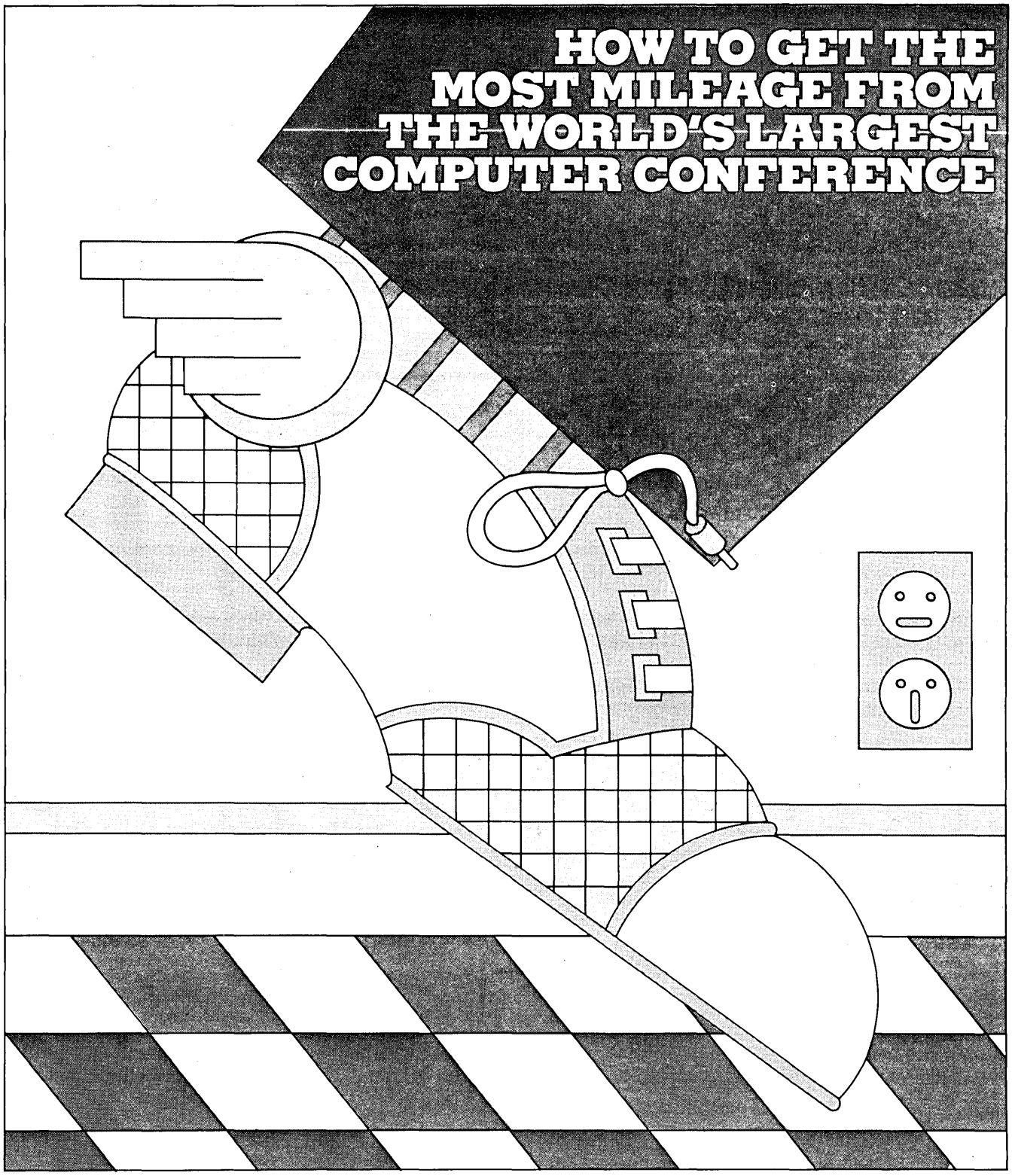

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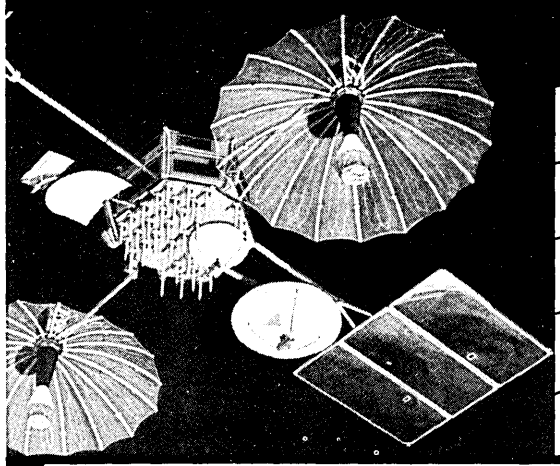

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SCIENCE/SCOPE

A new weapon guidance system uses satellite radio signals to accurately guide medium-range tactical missiles to targets on land or at sea. The on-board system determines a missile's precise position and velocity anywhere on earth by calculating the time it takes signals from four NAVSTAR Global Positioning System satellites to reach the weapon. The information is used to correct the missile's inertial navigation computation. The technique offers several advantages over conventional guidance methods, including simplicity, stealth, and the flexibility to fly over any terrain. A missile launched beyond enemy defenses would be hard to detect on enemy radar because the missile would emit no telltale radar signal. Hughes is developing the system for use by the U.S. Air Force in the late 1980s.

A new liquid-crystal reticle for a gunner's telescopic sight is significantly smaller and less expensive than the mechanical devices now used in fire control systems on military vehicles. The computer-generated crosshairs move on two axes to provide an accurate aim point for the gunner. The all-digital device has no moving parts and has a flexible format for numerical displays. Hughes is developing the reticle under contract to the U.S. Army.

The cable television industry is reducing the cost of high-quality multichannel TV transmission by using microwave equipment. Hughes AML (Amplitude Modulated Link) systems are relaying TV signals (up to 40 TV channels per transmitter) across areas where construction of coaxial trunklines is too slow, too costly, or too difficult. These areas include rivers, mountains, and urban expanses crowded with freeways, airports, bridges, and parks. In addition to transmitting more channels at less cost, an AML system delivers a higher quality TV picture because it has much lower signal distortion than similar lengths of cable. Hughes AML systems are carrying more than 7500 video channels to receiving sites in the United States, Canada, Switzerland, Austria, Belgium, and Denmark.

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Two new TV-cameras-on-a-chip will serve as eyes for machines in a wealth of commercial and industrial applications. The devices, made possible by advanced charge-coupled technology, are called Hughes Omneye™ imagers. One chip consists of 1,024 light-sensing picture elements, the other of 10,000 picture elements for higher resolution. Typical uses of the imagers would be on assembly lines to help machines size, orient, and identify parts and objects. Compared to standard vidicon cameras, the devices are more reliable and rugged, and require less voltage and power.

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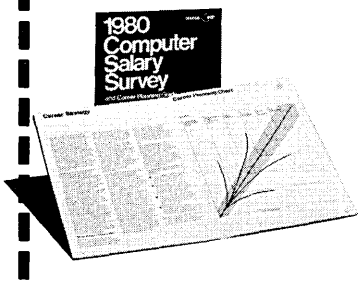

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READERS' FORUM

THE PROJECT THAT FAILED

This is a "project that failed" story; and yet, in human terms, it is also a "project that succeeded." Maury Halstead, the computing genius who died early last year, would be proud of what happened to this piece of his technology.

Machine-Independent Computer Programming, by Maurice Halstead, was a pioneering dp book of the early 1960s. It told of a new programming language, NELIAC, an ALGOL derivative defined for Naval Electronics Laboratory (NEL) use, which had certain magical properties. One such property was that the language was defined so as to make it easy to build a compiler for it. In that, it succeeded admirably. The listing for the full compiler, a marvel of simplicity, was so small and light it could be held easily on one fully extended hand. Another property was that the compiler was coded in its own language, an idea so daring for its time that it boggled the software mind. ("But how do you *start* one of those?" was the most frequently asked of many incredulous questions.)

NELIAC, as Halstead described it in his book, was a language for systems and scientific programming. This story is about the attempt by an earnest group of programmers at Aerojet-General Corp. in Sacramento to make the language viable for commercial programming.

In the early 1960s this, too, was a daring concept. Traditionally, there was a dichotomy between scientific folk and commercial folk. The scientific computer of the era was a seemingly blazing fast binary wonder that spoke in octal. The commercial machine of the era was a slower, decimal-operating computer that operated on strings of alphabetic and decimal numeric ("alphameric") character strings of varying length. The operator used controllable flags or "word marks" to define the bounds of a computer-manipulatable string.

The group at Aerojet included Donald W. Starr, the compleat programmer. Don could conceive a solution, sell the need for the solution to management, assemble and lead a team in performing the solution, play a major role in the solution, document the result with clarity and humor, and teach classes in the use of the product.

There was Pat Crisman. Pat was her own person, her own programmer. Tell Pat to invent a new or better solution to an old problem and she would do it.

There was Hugh Barlow, coder extraordinaire, whose programs sparkled with carefully conceived brilliance.

And there were us also-rans. Two or three others of us who, like all programmers of that era, knew we were the best programmers around—if only we didn't have the daily comparison with the Starrs and Crismans and Barlows who were so clearly better than we!

We were a chief programmer team, I now realize, in an era 15 years before the notion hit the literature. Don was our shining "starr" and we were his satellites, happy to hang onto his celestial coattails and be a part of whatever process he was pursuing.

An Aerojet management decision years ahead of its time had proclaimed that the scientific and commercial programming organizations in the company be merged, physically housed together, technologically served by the same computer and managerially amalgamated. "The same computer" was to be a binary, word-oriented IBM 7040, not as fast as the IBM 7090, the drag racing champion of its time, but a better compromise for an often I/O-bound dp workload. Studies had shown the 7040 was a more cost-effective solution than the decimal, string-oriented machines that had historically served the data processors.

The 7040 was to be driven by a homegrown software system. An operating system called Nimble was to be designed and implemented in-house; utilities such as math libraries and sort packages and report generators were to be added; and to bring the story back to its focus, a NELIAC compiler had been obtained from the government, put into immediate use for scientific applications, and work was begun on the necessary commercial language supplements. It was a truly impressive undertaking for an industrial, production-oriented computing ship. Essentially, we took a barebones 7040 and built a whole software system.

NELIAC WAS CRUCIAL

NELIAC was crucial to the scheme. Nimble, the operating system, was entirely coded in it. (Some parts were later recoded into assembler due to efficiency problems.) All the other system components were coded in it, too. For us, it had already become both a scientific and a systems programming language when we began to make the commercial enhancements.

The commercial enhancements were easy to define. We needed a good, capable sequential I/O package, buffered and blocked, callable from the language, and transparent to the user. We needed an indexed-sequential package to support pseudorandom, real-time accessible files (more innovation). We needed data structures, including the capability to define and manipulate heterogeneous data aggregates which often contained non-word-oriented bit and character strings.

FORUM

And we did it. We added what we needed to that elegant language of Halstead's, retaining its fast-compilation origins but enhancing it for a whole new domain. We implemented what we added, sometimes consistent with the compiler's simplicity, sometimes not. And we put it all, the language and the operating system and all its trappings, proudly, on the air.

Why, then, is this a computing project that failed? Politics reared its ugly head.

An adversary relationship suddenly developed between our little David-like chief programmer team, and the mighty Goliath IBM. Since I am fairly sure we did not start it, I have to believe it emerged from an IBM marketing strategy. But wherever it came from, it was an enormous shock.

Up until that time, IBM had been delightfully cooperative. In one of the finest of vendor gestures, it had put a predelivery 7040 in the basement of its own Sacramento offices, and had given us Aerojet software developers office space and free rein in its use. By the time the 7040 was delivered to Aerojet, and thanks to IBM's help, Nimble and NELIAC were well wrung out. The transition to production use went relatively smoothly.

And then it all changed. IBM marketing people began frequenting the offices of Aerojet computing management. The message gradually trickled down to us developers. IBM wanted Aerojet to scrap Nimble and NELIAC and switch over to the vendor-issued OS and FORTRAN/COBOL. We would be more like everybody else, it said. Job and program swapping would be possible with other IBM-vanilla companies, it said. And, of course, the mighty weight of IBM's own support folk would be available, it said.

Gradually, as the pressure on management continued, our team found that defending ourselves was taking a disproportionate share of our time. We had better, more innovative things to do than fight political battles. Then, one of the key managers who had sustained and supported our efforts from the very beginning left the company. His replacement quickly capitulated to IBM. Nimble and NELIAC were unplugged and trashed, and OS, FORTRAN, and COBOL washed over us.

Washed away, too, were Don Starr and Pat Crisman. Still, the technology of the story was a success—a project well ahead of its time. And the humanity of the story was also a success—a team of bright people merging their individualities into a functioning, compatible team.

And what of Aerojet? Over the years, that once-brilliant installation atrophied with the fortunes of the company, and eventually the computing facility in Sacramento disappeared entirely.

The NELIAC team may have lost the political battle but in the end, nobody won.

—Robert L. Glass
Seattle, Washington

A MODERN ALADDIN'S LAMP

As a consumer good, personal computers seem to be the greatest invention since popcorn. Shops have sprung up all over offering compact systems that can be taken off the shelf, carried home, and put to work. Magazines for computer hobbyists abound. And they are full of ads reminiscent of those old "you, too, can play the piano in 10 easy lessons" pitches. The current ones promise to make you a programmer.

The words personal computer have a nice ring to them. They conjure up visions of marvels performed by, if not a personal genie, a personal genius—electronic brain variety. But while Aladdin had only to rub his lamp to get his genie working, the genius in the personal computer is more demanding. Its user must speak a personal programming language (PPL), constrain his thoughts into rigid PPL

formats, and carry out his commands to his servant in precisely the order and format his servant decrees. Once the user has become an obedient slave of his personal computer, he can, indeed, have his marvels (within limits, of course). He can balance his checkbook, do his tax return or, if he is frivolously inclined, play games.

Once he has actually gotten his personal computer to obey, by following its rules, the user begins to have new fantasies. He imagines he is a programmer. He has learned to program in PPL, hasn't he? If he is a supporter of the traditional middle-class values he wants his children to become programmers, too. His personal has opened new vistas for them. They may not want to program. He certainly wouldn't force his child who speaks of medical school to become a programmer. But he does feel that children should know what computers are and what they can do. Thus, he is in favor of introducing personals into the schools. Along with the teachers he exclaims over the understanding his children have achieved when they have "programmed" their mathematics problems in PPL.

It should be noted that mathematics problems are about the best thing to program in PPL. The PPL insistence on numeric identifiers (line numbers) for operations to be performed and on letter references to data, as if everything was a variable in the sense of mathematical notation, is easily met in a context in which such notation actually does apply. Unfortunately, mathematics is not everything. Mathematical notation is intended to aid in expressing the relationships among abstract operators and quantities. There is nothing abstract, however, about a myriad of concepts and relationships that can be manipulated by machines after the human mind has abstracted them from their concrete expressions. Casting these concrete concepts into PPL notation is not an exercise particularly conducive to learning the rules of abstraction. Nor is getting a personal computer to solve a specific, predefined problem in mathematics or physics by translating the known solution into PPL what programming is all about.

EMPHASIS ON HUMAN INTELLECT

Computer professionals, by dint of serious, disciplined effort, have, after some 30 years' experience, formulated a general methodology of programming. This methodology emphasizes the contribution of the human intellect to computer use by an insistence on meticulous design. Whatever the particular technique of design used, the programmer is urged to analyze, synthesize, and organize his concepts before he thinks of how they are to be programmed. In this regard, the words of Nicholas Wirth, writing on well-structured programs, are worth remembering:

"Our most important mental tool for coping with complexity is abstraction. Therefore, a complex program should not be regarded immediately in terms of computer instructions, 'bits,' and logical words, but rather in terms and entities natural to the problem itself."

There are schools of thought in programming discipline that advocate hiding the coding sheets for the first several months (or weeks, or days, depending upon the project complexity) of a new program development effort. What their reaction to the usual personal method of sitting down at the keyboard and "programming" a problem might be, I leave you to imagine.

At the same time that disciplines are being formulated, the interface between man and computer is being humanized. The humanization of the programming effort is being extended to programming languages. References for data and procedure names can commonly take on some 30 characters. Selection of paths and repetition of functions can now be expressed in modern "human oriented," as opposed to machine or problem oriented, languages in meaningful terms suggestive of the control being exercised, of the logic of flow. The humanization of the interface between man and machine is the key to enabling a true computer based society to evolve—with the man in the street aware of what computers can do for him, rather than how they are constructed.

PPL clearly cannot provide these new humanized facilities. (MaxiPPLs are available on larger systems and introduce some of the

READERS' FORUM

concepts found in more modern, human oriented languages. Such versions of PPL serve only to point up the basic poverty of PPL itself). Our PPL user doesn't know about humanizing trends as he works with his personal. He obediently acts as a kind of crypto-communicator, bending his mind to the requirements (purely accidental) of a machine system. The discipline of programming—detailed, documented design; step-by-step structured programming; exhaustive systematic, planned, documented testing—cannot be learned in a context of PPLing a personal to do one's mathematics homework.

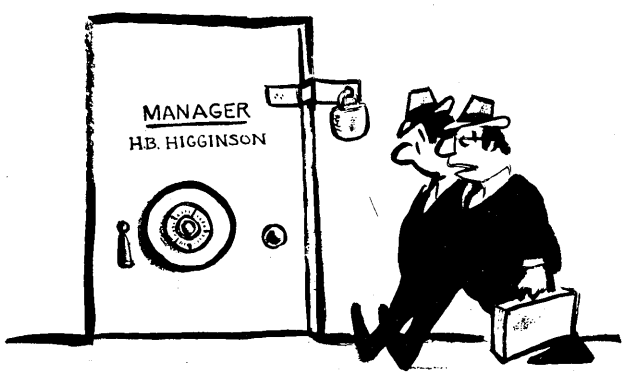
Where's the harm, you may ask. The answer is that there is none, of course, if the user is aware of the rules of the game. He is his genie's willing slave. But if he really thinks he or his children have learned to program and to understand the power and use of information processors, there could be unfortunate repercussions.

Think about having one of these self-made "programmers" as the manager of a group which has to put its procedures on the computer. He would probably view the detailed design as simple featherbedding. Can you imagine trying to explain the nature and use of a program skeleton to him? Or, imagine the product of one of the programming courses based on personals as a voter on appropriations for computer based local government or social service systems. He would, no doubt, look up the pure hardware costs of any proposal and regard the rest—design, programming, documentation, and installation testing—as almost all pure graft. Worse yet, how would you like to have one of them working for you as a programmer and have to undo a whole series of bad habits? He would probably begin coding as you started to explain the project. It would be better to start from scratch with, say, a music major.

Personal computers are fun. They are joining hi-fi, do-it-yourself kits, and movies as favorite pastimes. They are useful. But they are not computers in the classical sense. And PPL is not conducive to learning to program in the classical sense, that is, learning a disciplined, transferable skill. (Can you fly a jumbo just because you have learned to fly a Piper for fun?)

Therefore, for the time being, the distinction should be kept quite clear between personals and "computers." Computers, or information processors to be more precise, are here to stay. Computer science courses are serious business. They prepare not just programmers, but the citizens of a future information-processing-based world. Personals are just beginning to learn to talk. They should stay home and learn to communicate well while their older siblings go to school to show what information processors can do. Good programming languages are being developed along the lines of humanized interface between man and machine. Young students have shown how quick they are to grasp the essentials of language. Therefore, in the long run, tying their minds and imaginations to a PPL circumscribed system and information processing world may do them, and the future of information processing, more harm than good.

—Dorothy A. Walsh
Rome, Italy



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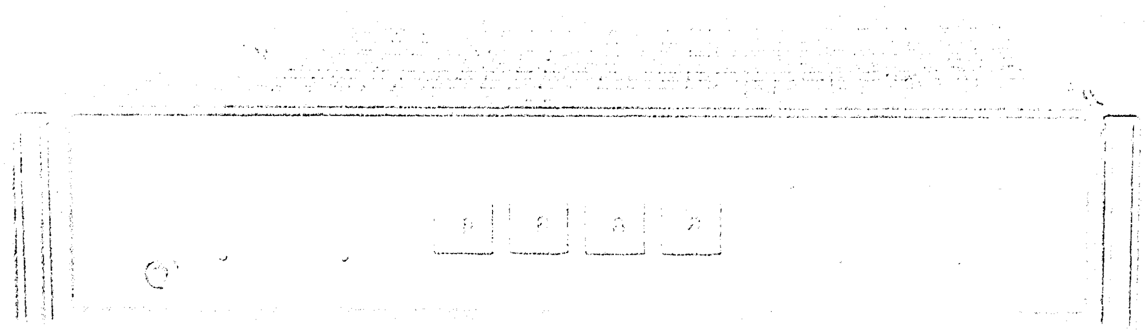

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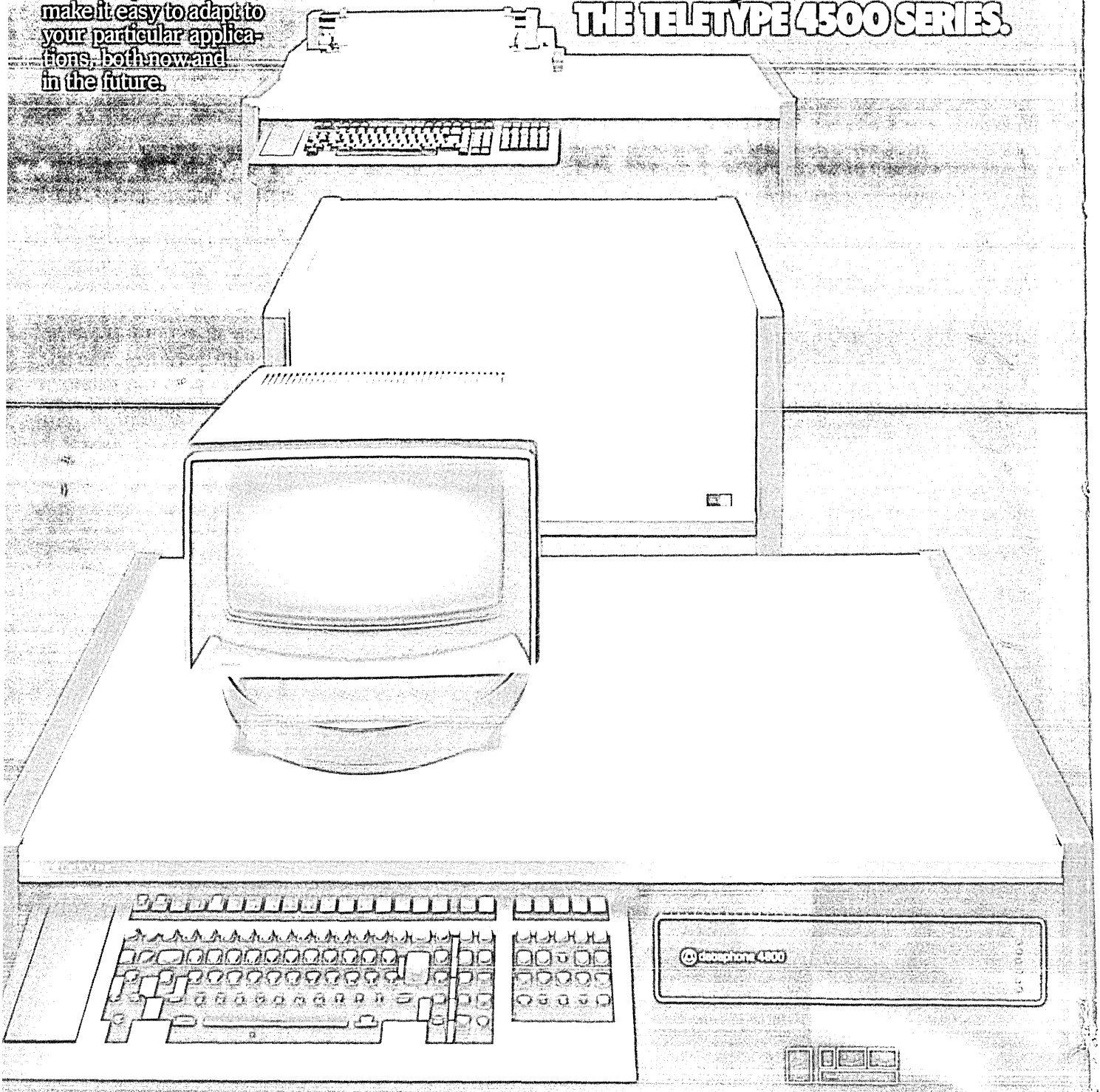

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