

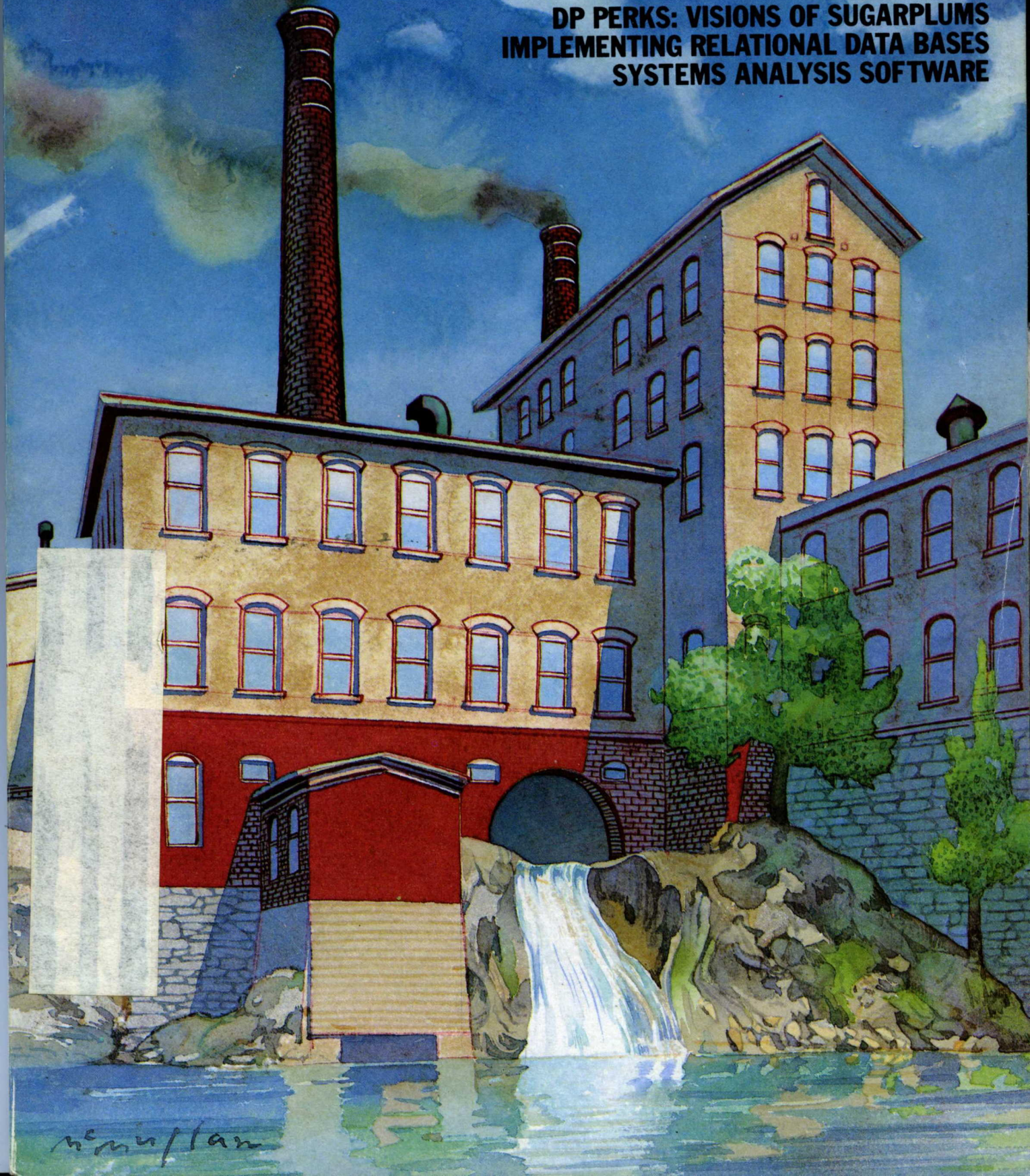
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OCTOBER/4.00 U.S.A.

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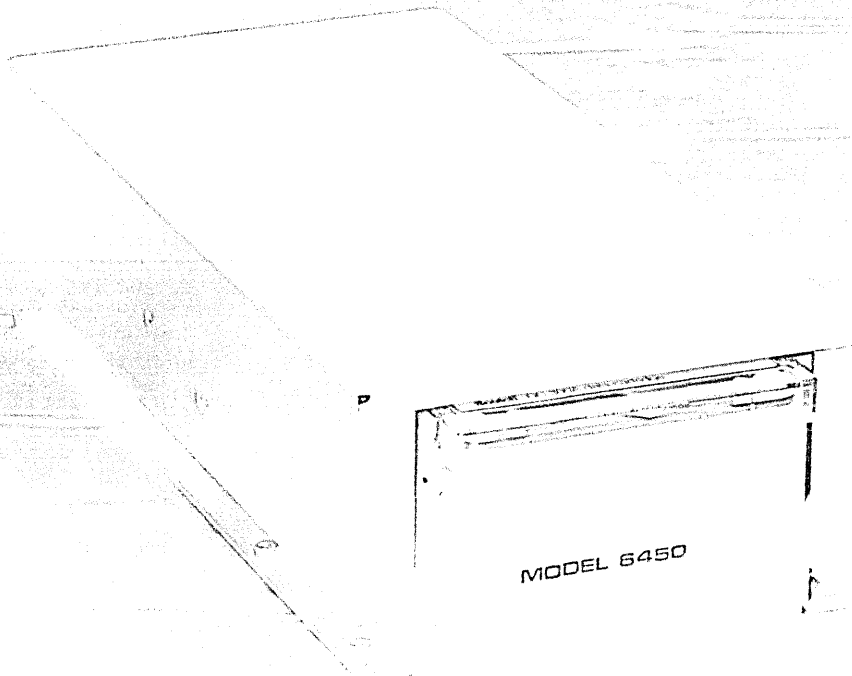
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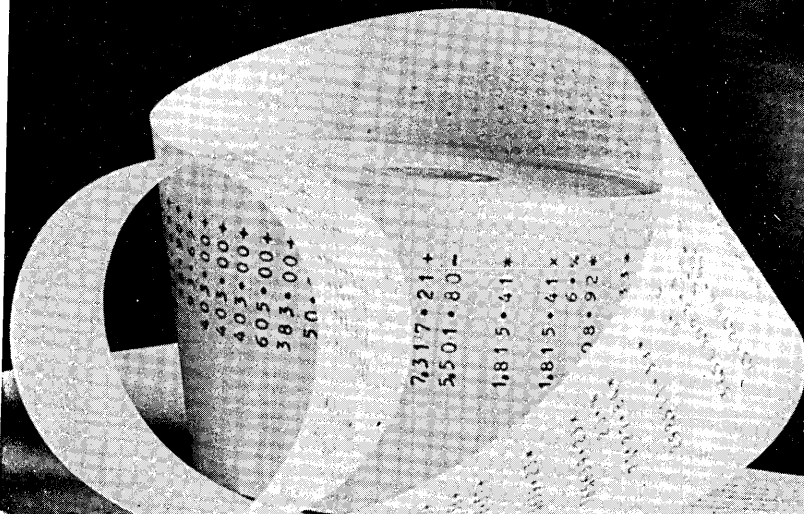


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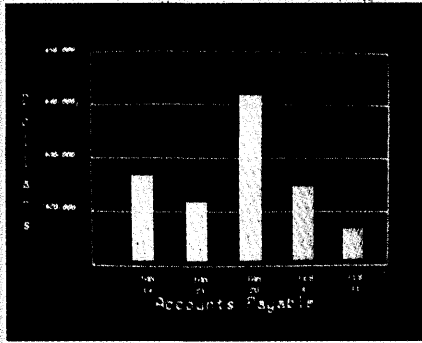
For more information, contact AM Jacquard Systems, the Informationists, a division of AM International, Inc., Dept. 777, 3340 Ocean Park Blvd., Santa Monica, CA 90405. (213) 450-1242, ext. 777.

LET'S TALK ABOUT FACTS AND FIGURES.

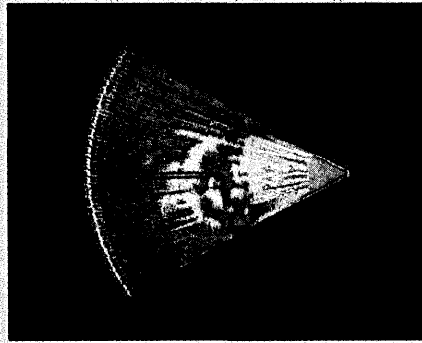


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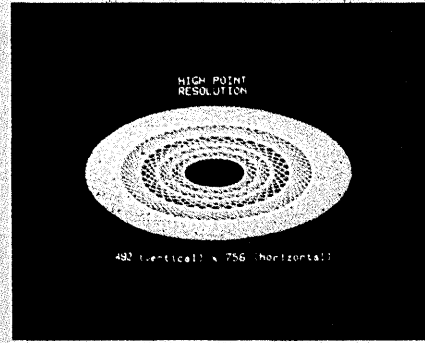
CIRCLE 3 ON READER CARD



Management Information Display



Ultrasonic heart sector scan



High-resolution display with alphanumerics

Get the professional color display that has BASIC/FORTRAN simplicity

LOW-PRICED, TOO

Here's a color display that has everything: professional-level resolution, enormous color range, easy software, NTSC conformance, and low price.

Basically, this new Cromemco Model SDI* is a two-board interface that plugs into any Cromemco computer.

The SDI then maps computer display memory content onto a convenient color monitor to give high-quality, high-resolution displays (756 H x 482 V pixels).

When we say the SDI results in a high-quality professional display, we mean **you can't get higher resolution than this system offers in an NTSC-conforming display.**

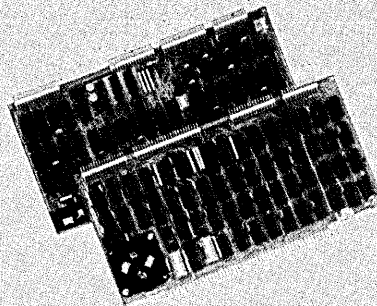
The resolution surpasses that of a color TV picture.

BASIC/FORTRAN programming

Besides its high resolution and low price, the new SDI lets you control with optional Cromemco software packages that use simple BASIC- and FORTRAN-like commands.

Pick any of 16 colors (from a 4096-color palette) with instructions like DEFCLR (c, R, G, B). Or obtain a circle of specified size, location, and color with XCIRC (x, y, r, c).

*U.S. Pat. No. 4121283



Model SDI High-Resolution Color Graphics Interface

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The SDI's high resolution gives a professional-quality display that strictly meets NTSC requirements. You get 756 pixels on every visible line of the NTSC standard display of 482 image lines. Vertical line spacing is 1 pixel.

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Model SDI plugs into Z-2H 11-megabyte hard disk computer or any Cromemco computer

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The Model SDI has been used in scientific work, engineering, business, TV, color graphics, and other areas. It's a good example of how Cromemco keeps computers in the field up to date, since it turns any Cromemco computer into an up-to-date color display computer.

The SDI has still more features that you should be informed about. So contact your Cromemco representative now and see all that the SDI will do for you.



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CIRCLE 4 ON READER CARD

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OCTOBER 1980/\$4.00 U.S.A.
VOLUME 26 NUMBER 10
This issue, 161,000 copies

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Oliver W. Wight

The computer can play a powerful role in improving productivity.



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ANALOG INVENTOR

Molly Gleiser

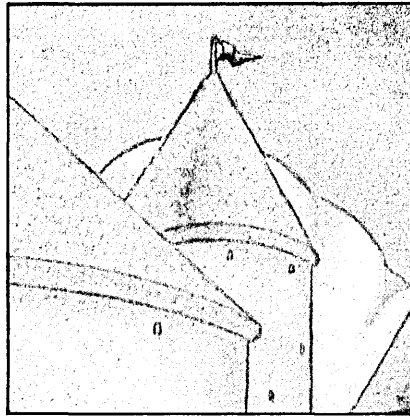
Another forgotten computer pioneer, Vannevar Bush, was the designer of the differential analyzer.

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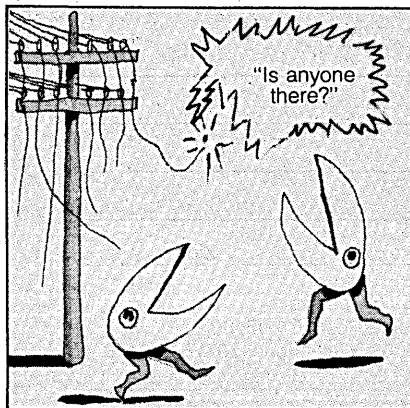
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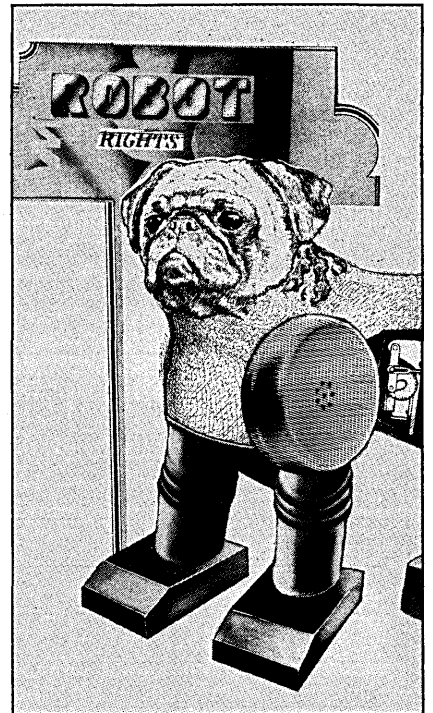
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COVER ILLUSTRATION BY JAMES McMULLAN

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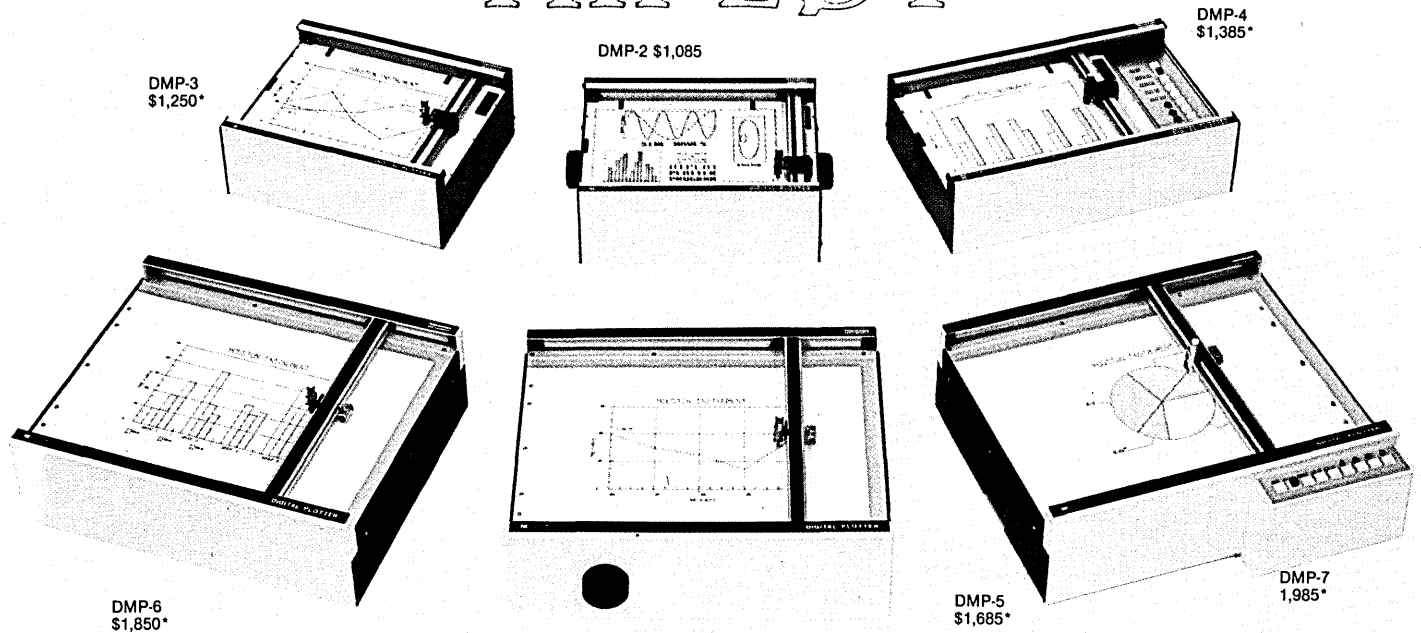
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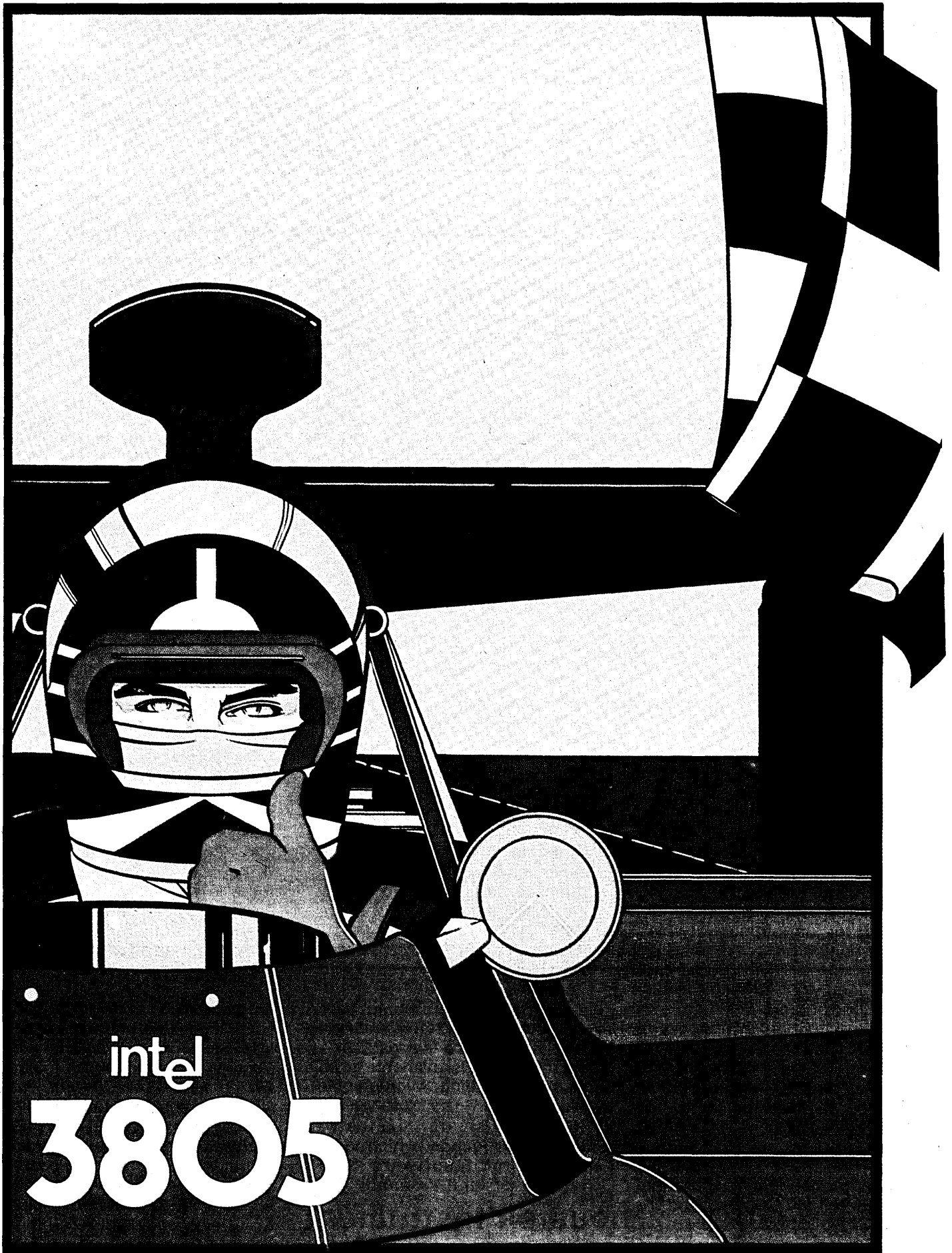
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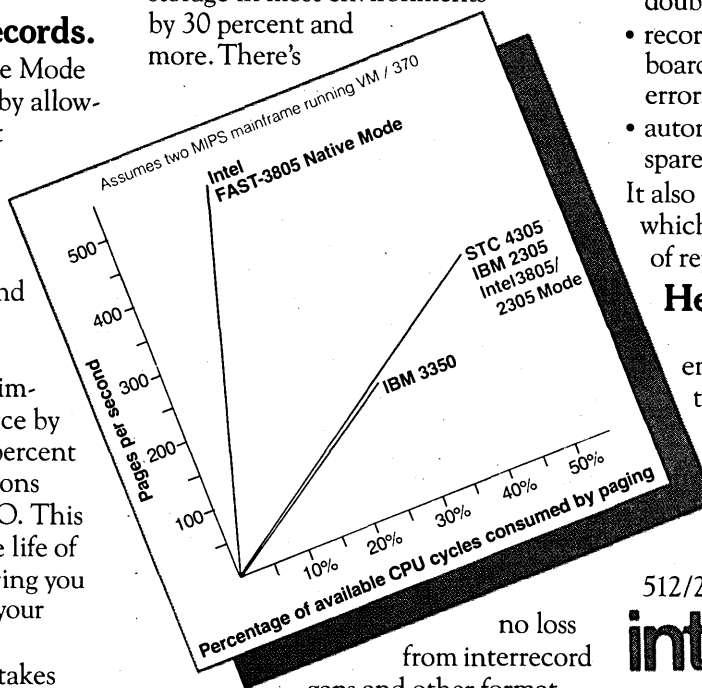
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CIRCLE 10 ON READER CARD

Twenty Years Ago/Ten Years Ago

LOOKING BACK

SEPTEMBER/OCTOBER 1960

In 1957, Herb Simon of Carnegie Tech and Allen Newell of the Rand Corp. predicted that within 10 years a digital computer would be the chess champion of the world (assuming computers were not barred from competition). This prediction was explored in a "progress report" by Daniel McCracken on machine intelligence (the early synonym for artificial intelligence).

The first example used by McCracken to illustrate the progress of machine intelligence was the series of studies by Dr. Art Samuel of IBM and his checker-playing 704. Samuel devoted several years of his spare time in the hope of developing a computer program capable of learning. Given a certain set of routines, the program was asked to "decide" on the most beneficial moves by use of generalization. In other words, rather than storing all possible board positions, the machine generalized on its experience, storing or modifying only the positions that could best be used to win the game. This produced a better than average checker player, but not the winner Samuel was anticipating.

Alex Bernstein, also of IBM, wrote a chess program for another IBM 704. The program "played an interesting game, even though it used a method that never looked ahead more than four half-moves." A chess program for Rand's JOHNNIAC computer was designed by Newell, Simon, and Cliff Shaw of the Rand Corp. The only goals included in the evaluation of possible moves were the balance of pieces, control of the board's center, and the development of pieces. Despite these limitations, this program was expected to become the first to beat human players.

OCTOBER 1970

Datran and two unnamed partners (an aerospace firm and a communications equipment supplier) were planning a domestic satellite system that would provide communication services to 52 metropolitan areas and compete directly with AT&T... "Satran"

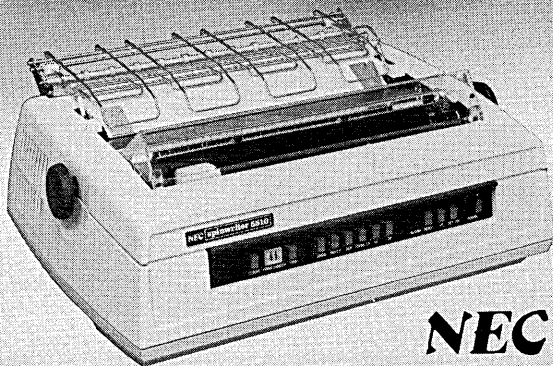
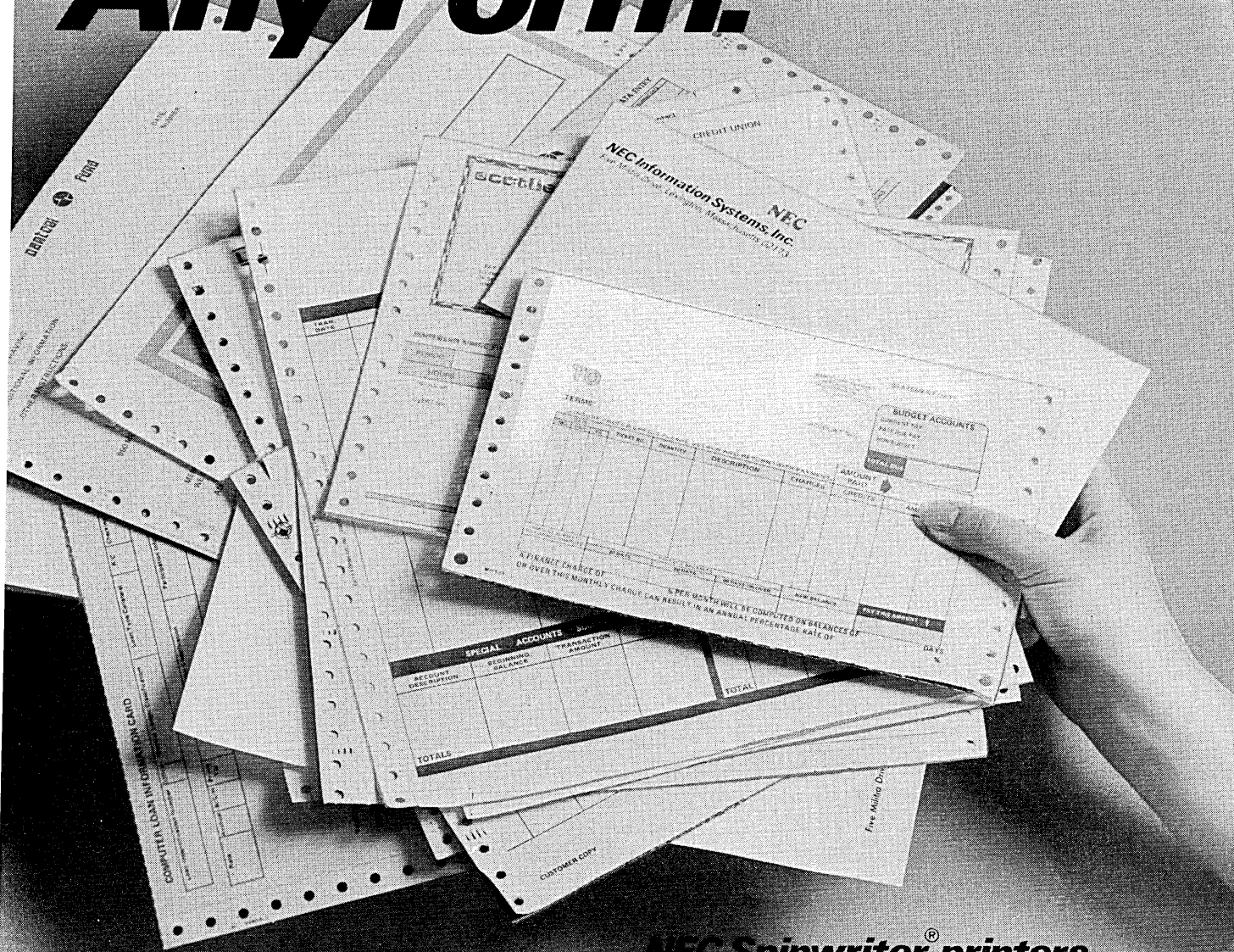
(Satellite Transmission Corp.) was the tentative name, and the total initial capital was \$426 million. Upon receiving FCC approval, a public stock issue was likely, reducing each partner's one-third interest to as little as 10%. Satran's proposed system included one to three satellites plus backup capabilities. Each satellite would be equipped with 24 transponders, each supplying a minimum of 1,800 voice-grade channels. Reportedly, Satran's communications supplier was working on a transponder that could offer up to 10,000 voice-grade channels. Linked to 150 ground stations, all but about 10 of the satellites would be capable of two-way transmission. Datran officials estimated construction costs for the system at \$300 million, and expected an "18-month to two-year" wait until Satran received the FCC go-ahead. Datran was not the only company contemplating entry into the domestic satellite field. About the time Datran made its public announcement, several other companies notified the FCC of their intent to do the same. Among them: MCI, Hughes Aircraft, and TelePrompTer Corp. (another partnership), RCA Global Communications. Comstat, AT&T, and the three major television networks.

*

Applied Data Research (ADR) and Data Processing Financial & General (DPF&G) decided to abandon their antitrust suits against IBM and settle out of court for "cash transfusions." ADR withdrew charges in return for \$1.4 million for legal expenses and IBM's promise to purchase a minimum of \$600,000 worth of ADR's Autoflow through 1973. Details of the DPF&G settlement were not available. These two withdrawals left Control Data's antitrust suit to proceed without further delay: the three suits combined as a "class action" were slowing progress. Industry sources doubted CDC would settle out of court for two reasons: IBM had no bargaining hold on CDC—such as debts to pick up—and, as sources noted, CDC was "out for blood."

—Deborah Sojka

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CIRCLE 11 ON READER CARD

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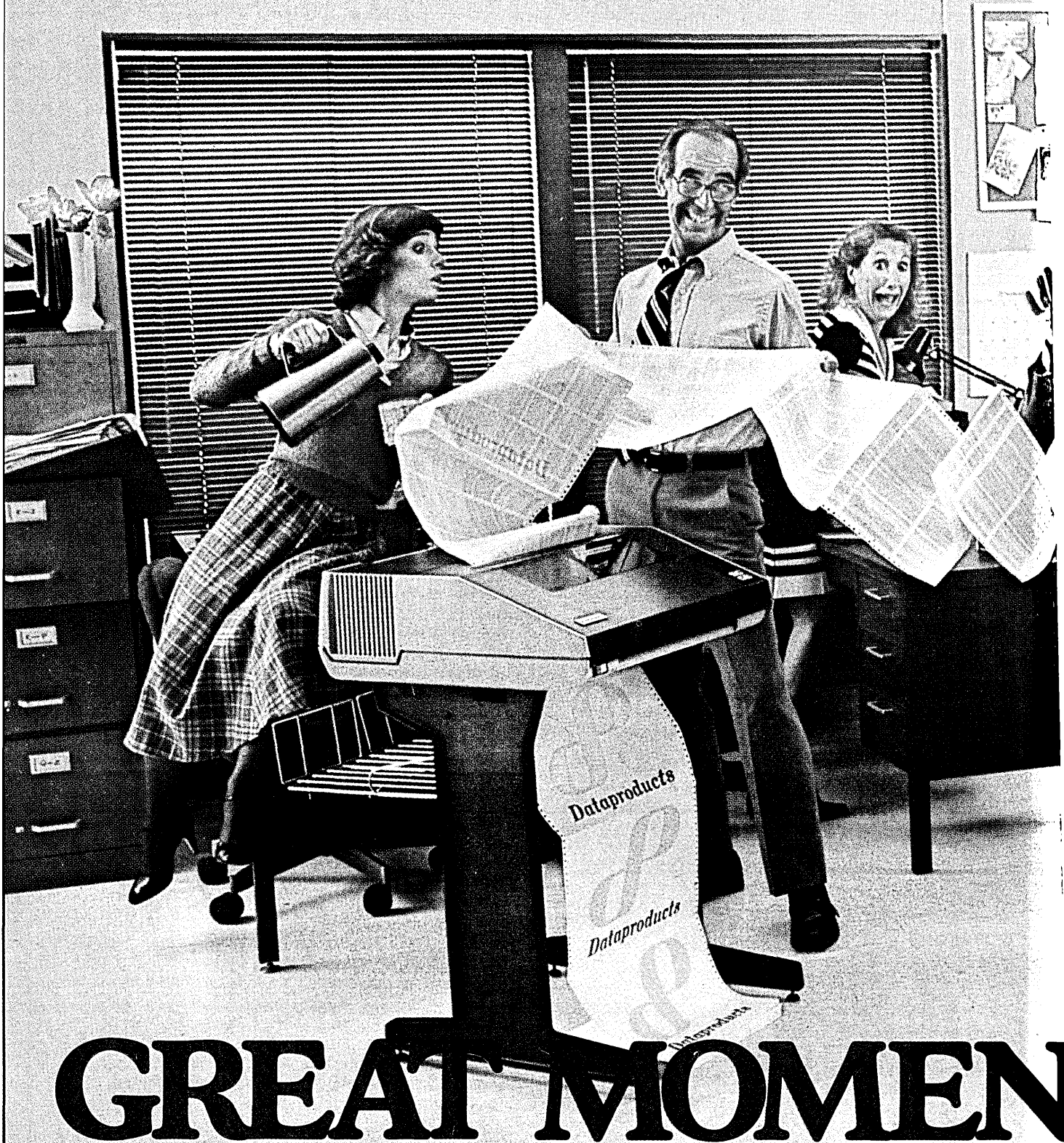
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Dataproducts is the world's largest independent printer manufacturer. For 18 years, we've built printers for the

biggest OEMs in the business, putting their names on our machines. These customers make sure our printers live up to some pretty tough standards.

Now our M-200—and our M-120, a 180 cps matrix—are available with *our* name on the cabinet. Or with your name. **30 day delivery.**

Often we can deliver a partial order even faster than that. If time is a problem, give us a call.

We're here to help.

We have distributors and sales rep- **CIRCLE 19 ON READER CARD**

representatives throughout the world. We'd love to show you how our printers can improve your system.

Call for more information. Or write our Marketing Department at 6200 Canoga Avenue, Woodland Hills, CA 91365. Telephone: (213) 887-8451

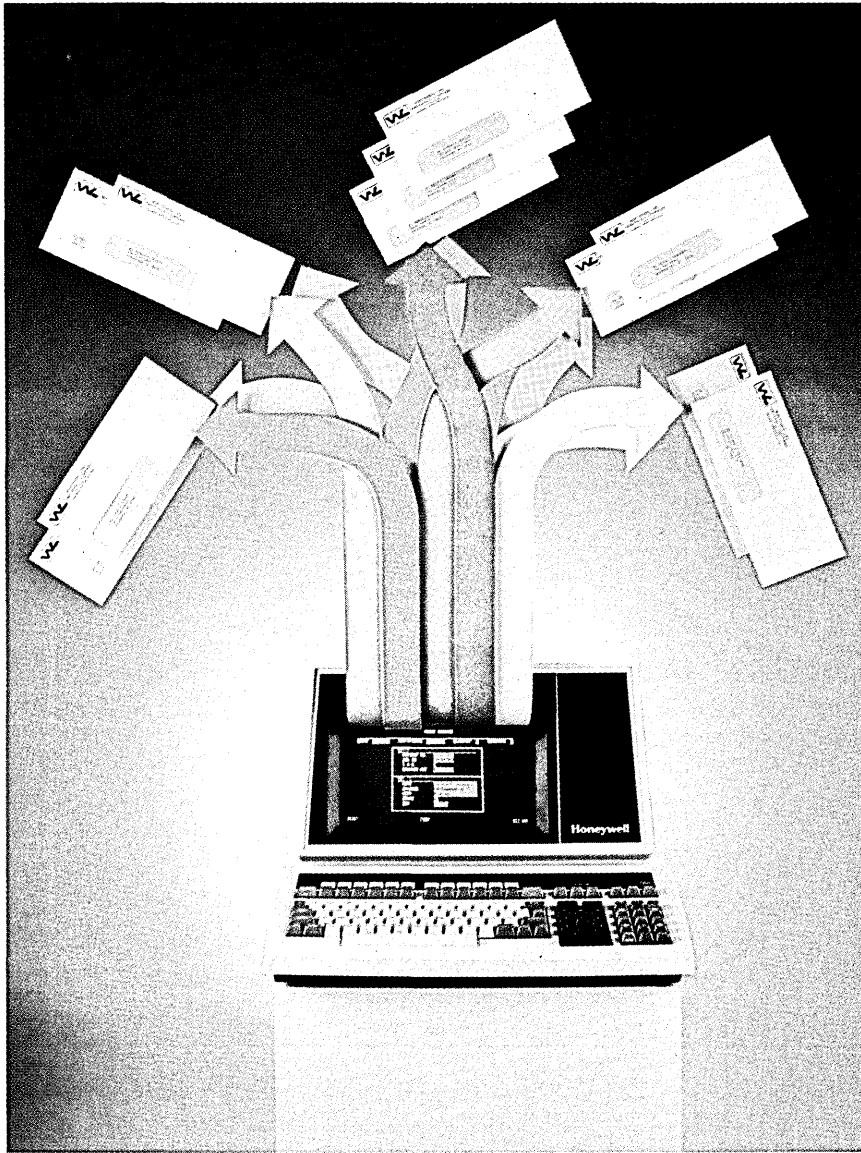
Toll Free—Calif. (800) 272-3900 ext. 201
Rest of U.S. (800) 423-2915 ext. 201

European Marketing Headquarters:
Neu Isenburg (Frankfurt), West Germany
Tel: 06102 3201



TS IN PRINTING

PREMIUM COMPUTER.



When Wisconsin Life added a Level 6 computer their customers were the real beneficiaries.

Not all insurance companies are slow-moving behemoths. Wisconsin Life just installed one of our Level 6 computers and is now processing most claims within 72 hours. Response time has been cut by a full 80%.

Businessware.

Wisconsin Life is benefiting from something we call Businessware. A well-balanced combination of the right hardware, the right software, and Honeywell's vast business experience.

Everything our salespeople have learned in 25 years of working with businesses has been put into Businessware.

TPS-6 is part of Businessware. Thanks to this built-in transaction processing system,

Wisconsin Life's new computer is helping in three key areas. First, linked to a network of 60 terminals, it's making clerical functions easier to perform. Clerks now use terminals to check the nuts and bolts of individual claims: Is this policy valid? Has this claim been paid before?

In all, there are more than 30 screen formats.

Once a claim has been approved, a check is written that night. Since the Level 6 arrived, many claims have been paid in a single day.

The Level 6 has also been helping Wisconsin Life develop new applications for their transaction processing capability. For instance, there's a program in the works now that will enable them to process all new business on-line.

One advantage is that the computer can be used to calculate premiums, thus eliminating a great deal of work currently done by hand.

Finally, the Level 6 runs a very efficient data entry facility. Once CRTs are installed, clerks will be able to correct errors immediately, substantially reducing overall system maintenance costs.

Services Improved.

Wisconsin Life's new Honeywell is doing precisely what we knew it would. It's giving them greater control of their operations. And in so doing, it's increasing the quality of service Wisconsin Life offers their customers.

On Wisconsin!

For a more detailed look at the Level 6, write Honeywell, 200 Smith Street (MS 487), Waltham, MA 02154.

Honeywell

CIRCLE 13 ON READER CARD

Freedom of choice.



VISUAL 100

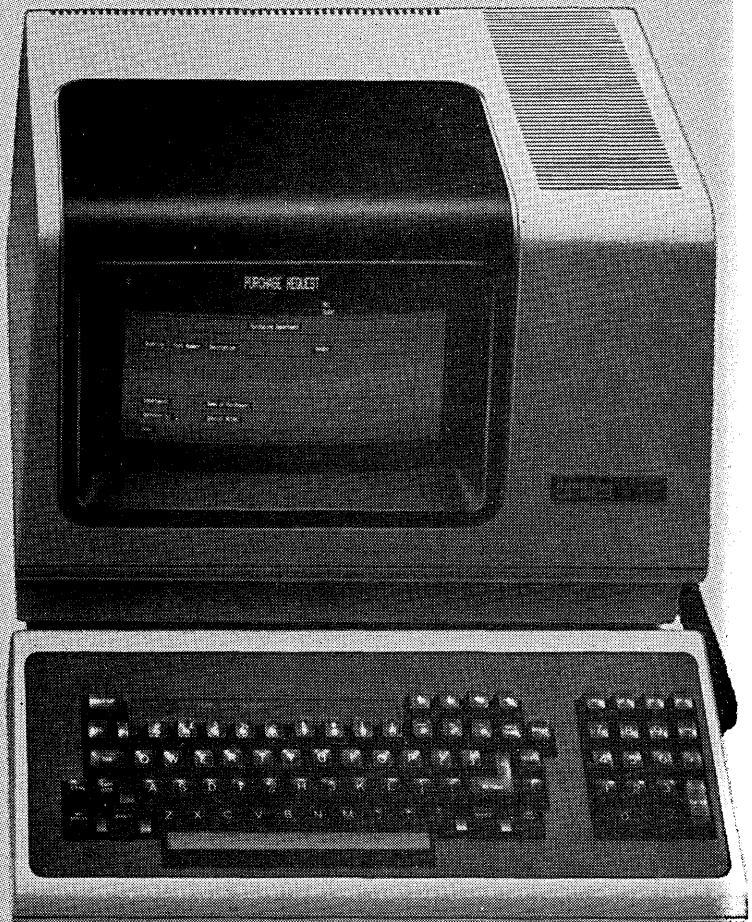
These two terminals not only look alike—they act alike. But ours is a little better.

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



Digital VT 100[®]

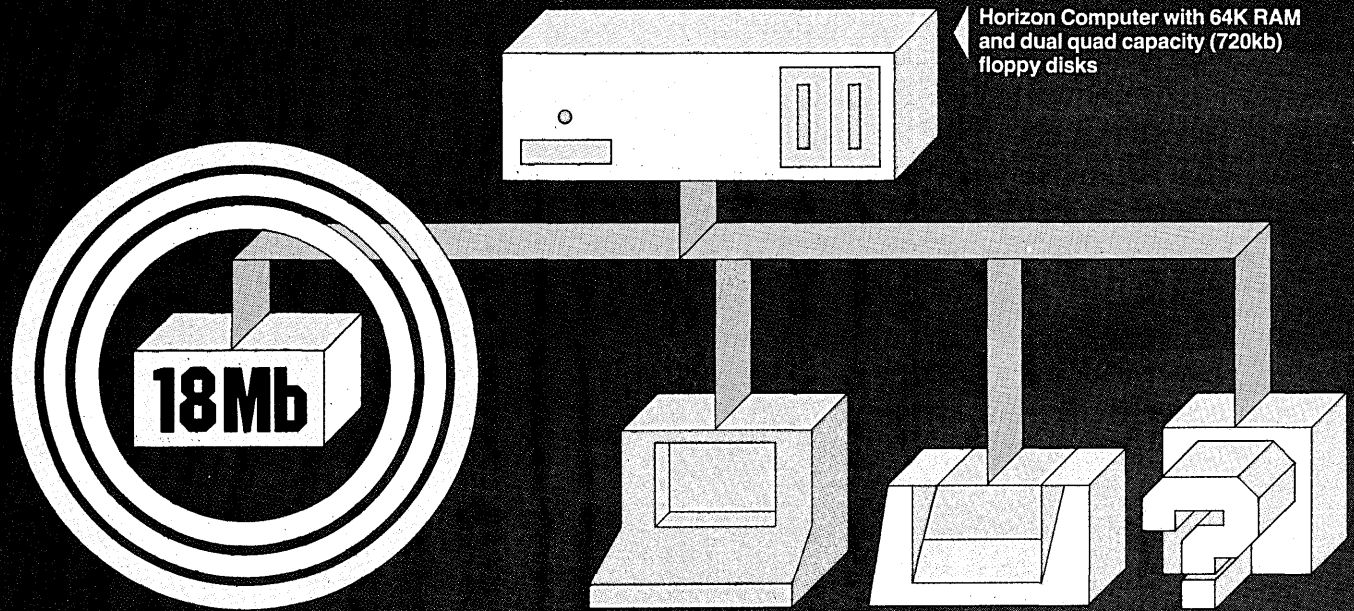
100 is a little better than the VT 100[®], we priced it a little lower. Plus it's from the Company that's delivered thousands of terminals emulating DEC, Hazeltine, Lear Siegler and ADDS. Call or write us today.

VISUAL See for yourself

Visual Technology Incorporated
Railroad Avenue, Dundee Park, Andover, MA 01810
Telephone (617) 475-8056 Telex 951-539

CIRCLE 14 ON READER CARD

New on the North Star Horizon: 18Mb Hard Disk Drive!



Up to four 18Mb Winchester-type hard disk drives

Display terminal

Letter-quality or dot matrix printer

Horizon I/O flexibility allows expansion to meet your needs

Unsurpassed Performance and Capacity!

North Star now gives you hard disk capacity and processing performance never before possible at such a low price! Horizon® is a proven, reliable, affordable computer system with unique hardware and software. Now the Horizon's capabilities are expanded to meet your growing system requirements. In addition to hard disk performance, the Horizon has I/O versatility and an optional hardware floating point board for high-performance number crunching. The North Star large disk is a Winchester-type drive that holds 18 million bytes of formatted data. The North Star controller interfaces the drive(s) to the Horizon and takes full advantage of the high-performance characteristics of the drive. Our hard disk operating system

implements a powerful file system as well as backup and recovery on floppy diskette.

Software Is The Key!

The Horizon's success to date has been built on the quality of its system software (BASIC, DOS, Pascal) and the very broad range and availability of application software. This reputation continues with our new hard disk system. Existing software is upward compatible for use with the hard disk system. And, with the dramatic increase in on-line storage and speed, there will be a continually expanding library of readily available application software. For further information and OEM prices, please contact the OEM Sales Department at North Star Computers, Inc.

NorthStar and Horizon are registered trademarks or trademarks of North Star Computers, Inc.
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NorthStar™
North Star Computers, Inc.

1440 Fourth Street, Berkeley, CA 94710 USA
(415) 527-6950 TWX/Telex (910) 366-7001

North Star Computers, Inc.
1440 Fourth Street
Berkeley, CA 94710

Yes!! Please Send More Information On North Star's
18 Megabyte Hard Disk System

Company _____
Name _____
Address _____
City _____ State _____ Zip _____
Phone _____

CIRCLE 15 ON READER CARD

DIGITAL INTRODUCES THE MOST AWESOME ARRAY

At Digital, network technology has just taken another giant step.

Announcing Phase III networking: a host of new capabilities that will make your computer power easier to allocate, easier to control, and easier than ever to justify to your management.

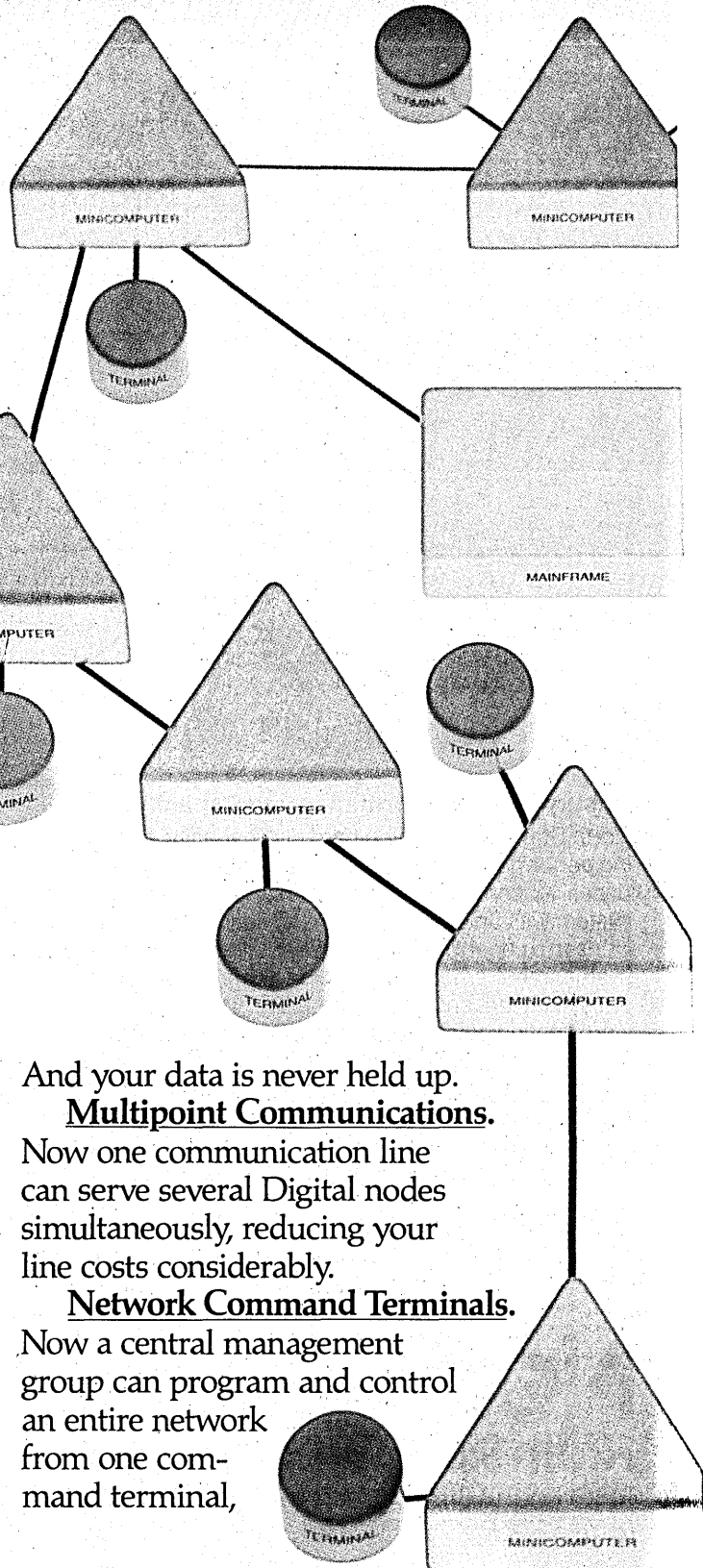
With Phase III, your options have never been greater. Or more cost-effective. As always, you can match the right Digital system to the right local job. But now, you can network those systems virtually wherever, whenever, and however you want. Even when your mix includes another manufacturer's mainframe.

And no matter how you network, you'll be doing it in the most economical way possible. Just consider these new capabilities.

SNA Protocol Emulator.

Now Digital systems can talk to and support IBM mainframes using the SNA protocol. Thus, you can protect an investment in hierarchical networks, even as you commit to more flexible distributed systems.

Adaptive Routing. Now Digital networks can automatically find the least expensive path between two nodes. Not only that, they automatically re-route information around problem areas. Your line costs are held down.



And your data is never held up.

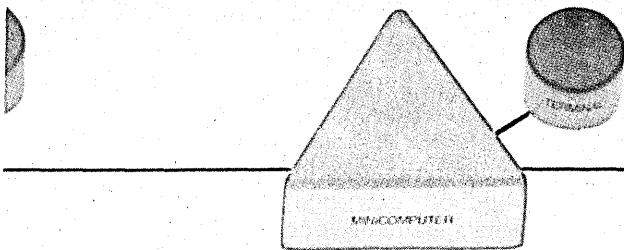
Multipoint Communications.

Now one communication line can serve several Digital nodes simultaneously, reducing your line costs considerably.

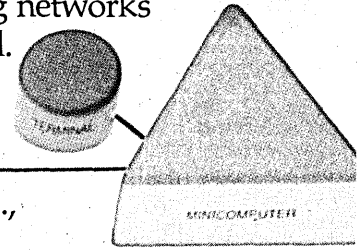
Network Command Terminals.

Now a central management group can program and control an entire network from one command terminal,

PHASE III. OF NETWORK OPTIONS EVER.



public packet switching networks using the X.25 protocol. Digital Packetnets are currently being tested

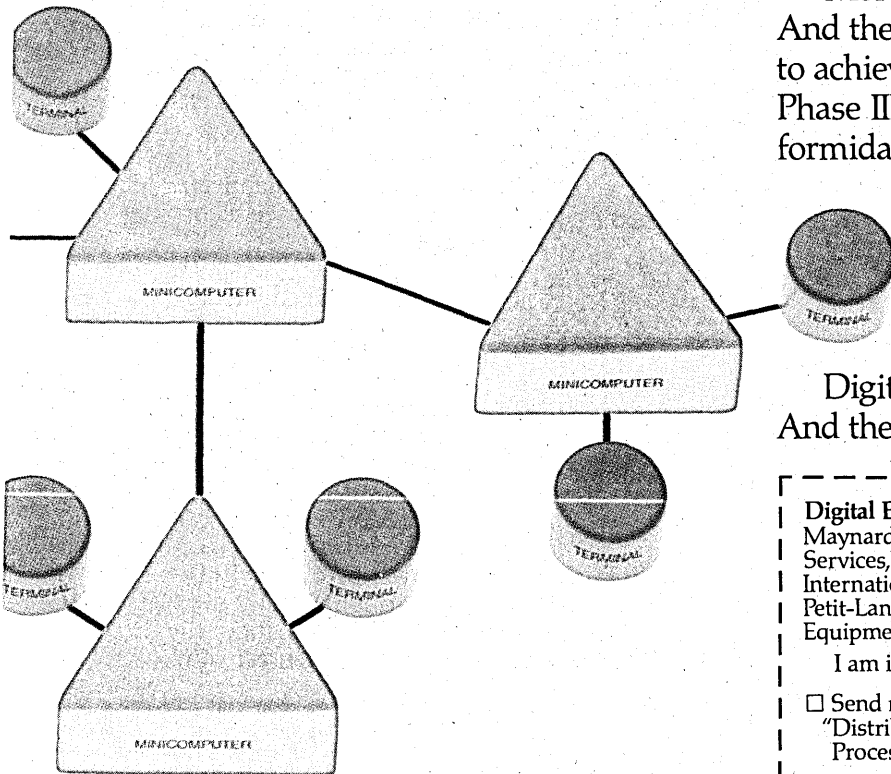


and certified in the U.S., Canada, and France.

More flexibility. More control. And the most cost-effective ways to achieve them. Add these new Phase III capabilities to the already formidable array of Digital

networking options, and you have the elements of an awesome network.

But then, that's just what you'd expect from Digital. Innovative technology. And the leadership to put it to work.



thus cutting the cost of programming individual nodes in widely dispersed locations.

Enhanced Network Management.

Now you can add on systems, change communication links, gather operating statistics, and detect problems, all without shutting down the network. Imagine the savings on downtime and expansion costs.

X.25 Packetnets. Digital is firmly committed to supporting

Digital Equipment Corporation, 146 Main Street, Maynard, Massachusetts 01754. Attn: Communication Services, NR-2/2 or Digital Equipment Corporation International, 12 av. des Morgines, 1213 Petit-Lancy, Geneva, Switzerland. In Canada, Digital Equipment of Canada, Ltd.

I am interested in Digital's Phase III. Tell me more.

- Send me the brochure, "Distributed Data Processing and Networks." Send me the handbook, "Introduction to DECnet."

Name _____

Company _____

Street _____

City _____ State _____ Zip _____

DX146

digital

BTI 8000 32-bit multiprocessor system

Now you can grow by plugging in resources instead of changing computers

Finally, there's a computer system that lets you grow by plugging in resources, instead of by changing models — the BTI 8000.

The secret is Variable Resource Architecture (VRA): a flexible mix of hardware resources controlled by a single, self-regulating operating system.

Hardware resources consist of multiple processors, memories, and input-output channels operating in parallel without the complex internal networking normally associated with such arrangements. The result is mainframe performance at substantially lower costs, plus unequalled flexibility.

You can tailor the BTI 8000 to serve over 200 on-line, interactive users. Or to handle large batch loads. Or to do a lot of each.

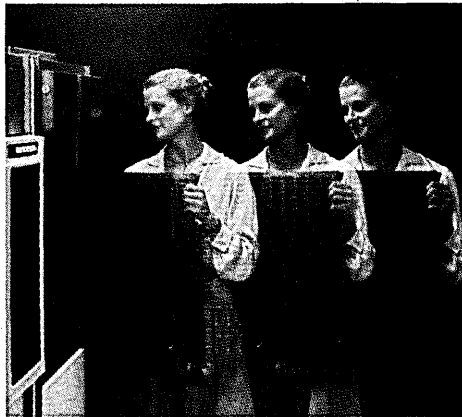
Furthermore, you can vary processing capability over a tenfold range by merely adding or deleting hardware modules. Differences in configuration are invisible to user software, and no reprogramming or recompilation is required.

Additionally, built-in growth potential allows

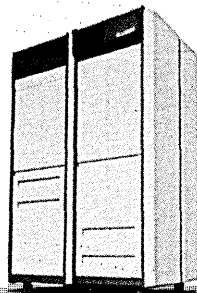
you to respond to changing workload requirements easily and quickly — without modifying either the operating system or your applications software.

Key features of each BTI 8000 system include:

- From one to eight 32-bit CPUs controlled and coordinated by one shared operating system.
- Up to 16 megabytes of main memory.
- From 4 to 32 input-output channels.
- Fail soft architecture.
- Secure multi-user operations.
- Demand-paged virtual memory.
- Task oriented assignment of hardware and software.
- Simultaneous use of ANS COBOL 74, ANS FORTRAN 77, PASCAL, and BASIC/8000.



As for reliability and support, they're established BTI traditions, proven by over 2,500 other BTI computers operating in the U.S., Canada and Europe. For full details about the BTI 8000, contact the BTI office nearest you.



 **BTI**
COMPUTER
SYSTEMS

CIRCLE 17 ON READER CARD

Corporate Offices: 870 West Maude Avenue, Sunnyvale, CA (408) 733-1122 Regional Offices: Piscataway, NJ (201) 457-0600; Palatine, IL (312) 397-9190; Dallas, TX (214) 630-2431; Sunnyvale, CA (408) 733-1122. Sales Offices in major U.S. cities. In the United Kingdom: Birmingham (021)-477-3846 BTI is a registered trademark of BTI Computer Systems

LOOK AHEAD

MA BELL MAKES
MORE MOVES

The Bell System's troublesome ACS network is undergoing additional upheavals. IBM Series/1 processors are now under serious consideration for use as front-ends to Western Electric 3B type switch gear in the network hierarchy. Between 50 and 100 Series/1 processors may be included in the network when it begins operating in 1982/83.

Also, the much-heralded Antelope intelligent PBX has been shifted to the ACS development organization. ACS users reportedly will get a choice of equipment for customer premise use. Voice/data applications would get the Antelope supercontroller, while data-only users would get a DEC VAX processor on site. One catch is that Antelope may not be ready until 1984 or '85, thus limiting ACS application options for the first few years.

WANG
SPEAKS OUT

Wang is hiring digital voice technology specialists. Watch for off-line voice capabilities (store-and-forward) in Wang's Mailway electronic mail system.

AMDAHL AT
IT AGAIN

Look for Amdahl Corp. to announce a uniprocessor offering 12 to 15 MIPS. It will be one of a new generation of mainframes that includes multiprocessors, says a report being prepared by Strategic Business Services. The San Jose, Calif., publisher says the uniprocessor will have hardware and special control software (transparent to users) to accommodate dedicated add-on processors, such as a data base machine. And, it says Amdahl will also introduce a true multiprocessor based on this uniprocessor.

HANDS-OFF
OPERATION

Technology expected to come from Intel Corp. next month will make it possible to reprogram from a remote location such computer-like devices as robots. It's strictly a hands-off operation.

STAY TUNED
TO IPL

IPL Systems, the Massachusetts-based PCM manufacturer, is about to introduce a new machine, the IPL 4446, to challenge IBM's latest 4300 model. IPL, partially owned by Olivetti, will also field a domestic sales force in five U.S. cities -- the firm's first direct sales effort. IPL's 4400 Series has been and apparently will still be marketed by Control Data Corp. as the CDC Omega line.

LOOK AHEAD

A NATURAL FOR CDC

Control Data Corp. is expected to add full text storage and retrieval capabilities via natural language to both its Cyber computers and its Cybernet. The capability, we hear, will come from Datafusion Corp., headquartered in Chatsworth, Calif.

JUDGMENT DAY AT ICL

Oct. 1 was judgment day for British-based ICL's foreign subsidiaries. A massive rise in the pound sterling against other currencies, especially the dollar, is expected to be reflected in the annual increase in transfer prices at which the parent company sells equipment to its overseas affiliates. These affiliates fear they will lose out either by having to absorb the increase, thus trimming profits, or by passing the price hike on to customers, making their products less competitive.

MICRO MAKERS SPECULATE

Microcomputer product manufacturers are worrying among themselves about "when" IBM will develop an S 100 bus capability. They seem sure the question is when, and not if. Latest speculation is that the giant will do it through a licensing agreement with a Japanese company.

ZILOG HAS EURO WORRIES

Zilog's European operation is hitting a few unexpected problems. The company has been trying to set up a French subsidiary since July '79. But the French government will not give the firm permission unless it forms a cooperative venture with a French company. And in Germany, the hang-up comes from private enterprise. Competitors are copying Zilog software, company sources allege. Despite this, European sales will be close to \$30 million this year, claims a Zilog European exec.

CANOVA LINKED WITH UTAH FIRM

Self-deposed president of California Computer Products, George Canova, is said by former associates to be trying to drum up venture capital for and looking to an association with Billings Computer Corp., Provo, Utah. Canova resigned his Calcomp position less than a year after that firm was acquired by Sanders Associates. A Sanders exec, M. Joel Kosheff, replaced him. In a trimming mode preceding the Calcomp acquisition by Sanders, Calcomp sold its floppy disk to Billings, a small business systems firm, for an estimated \$1.8 million. Billings moved the operation from Anaheim to Provo. The sources who believe Canova will go to Billings note that his son and brother-in-law are already associated with the Utah firm.

(Continued on page 47)



How can a Programming Manager go home at 5 o'clock?

These days it's easy.

There's a new version of MARK IV, our famous application development system, designed to get your applications up and running quickly.

You get productivity benefits only a non-procedural tool like MARK IV can offer. It's like adding programmers to your staff.

Sophisticated interfaces for IMS (DL/I) reduce your need for data base expertise. And a TP report writing language gets you out from under the backlog of user requests.


MARK IV frees your programmers from routine jobs to work on critical applications. And best of all, it's priced with your budget in mind.

If changes in your company are keeping you busy half the night, take heart.

Complete the coupon, or call and ask about MARK IV. Once you've tried MARK IV, you'll wonder how you ever went home without it.

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Send me complete details on MARK IV
 Have Sales Rep call me.

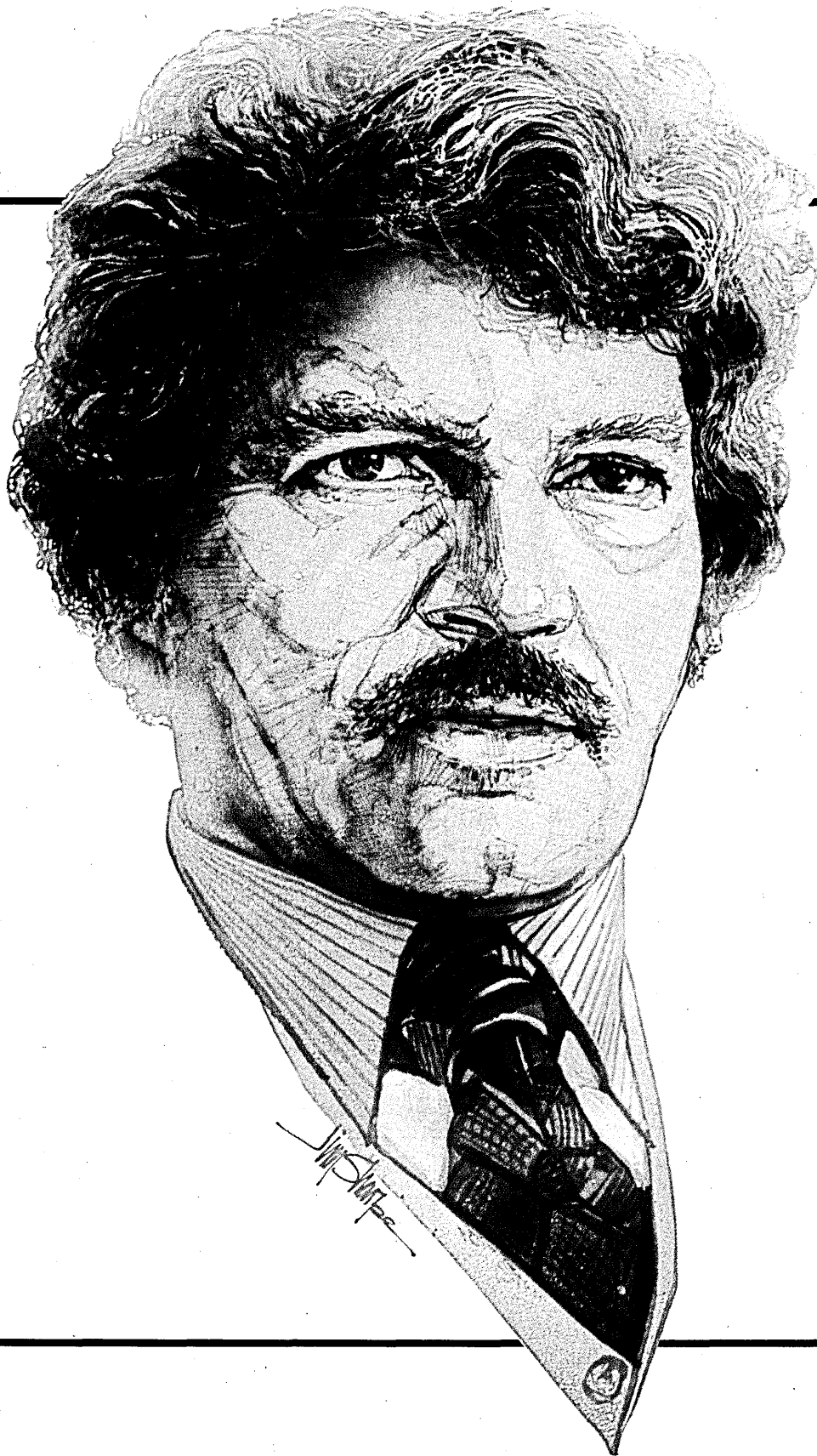
informatics inc 

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 Company _____
 Address _____
 City _____ State _____ Zip _____
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 Computer _____ Operating System _____
 Teleprocessing System _____ Data Base Manager _____ M-DM-1080

MARK IV[®] by Informatics[®]

CIRCLE 20 ON READER CARD

The Information Management Company.



TOTAL[®] AND ENVIRON/1[®]... ACHIEVED SO MUCH, IT TOOK THE HIGHEST AWARDS TO HONOR THEM.

A Personal Message From Thomas M. Nies President, Cincom Systems, Inc.

Recently, two Cincom Systems products were honored by International Computer Programs (ICP) with the industry's highest achievement award. These awards recognized TOTAL—our data base management system—and ENVIRON/1—our on-line control system—as the most successful products in their respective categories.

TOTAL is the "first single program product" ever to exceed the \$100 million sales mark. By doing so it has become the most successful DBMS—and the most successful software product ever developed.

But, perhaps the success and recognition of our on-line control system ENVIRON/1 is even more remarkable. Because until recently, ENVIRON/1 was *only* available for our TOTAL user community.

Clearly, these awards are an exceptional milestone for Cincom and for the software industry. And in view of the support and acceptance that you, our some 3,000 users worldwide, have given our products over the past decade, we want to send special thanks and congratulations.

Because it has been you—the leaders in all areas of business, including two-thirds of the 'Fortune 100'—that have helped us evolve a decade of products for all applications and processing environments.

- Your suggestions for new product enhancements and guidance in long-term direction helped us know we were "heading the right way."
- Your hundreds of "references" have helped us help others.
- Your successes have helped make our successes. Because especially today, data processing professionals want to be as sure as possible of data base and on-line success *before* they choose a vendor.

In essence, your exceptional cooperation has helped us develop the foundation data base/data communications software and supporting facilitative software you need for a true data resource management environment. An environment where integrated software tools help generate the quality of information your organization needs.

You have also helped us grow to become the world's leading full-service software supplier. Today, we provide solutions from minis to mainframes *for 28 different systems*, from manufacturing packages to financial packages, from education services to consulting services.

For all this, please accept our sincerest thanks, appreciation—and congratulations. And please accept our pledge to continue doing our very best to support your suggestions and requests in the future.

For you see, Cincom received these awards. But, we know who helped us earn these honors. You did.



Thomas M. Nies
President, Cincom Systems, Inc.



Cincom Systems

2300 Montana Avenue, Cincinnati, Ohio
513 662 2300

CIRCLE 21 ON READER CARD

Think of our new Shared System as a family of No Problem® Typewriters.



The first Lanier No Problem typewriters started solving problems right away.

No wonder.

With Lanier's unique No Problem Smart Discs™, a No Problem typewriter can perform tasks beyond ordinary electronic typewriters.

Introducing the Lanier No Problem Shared System™

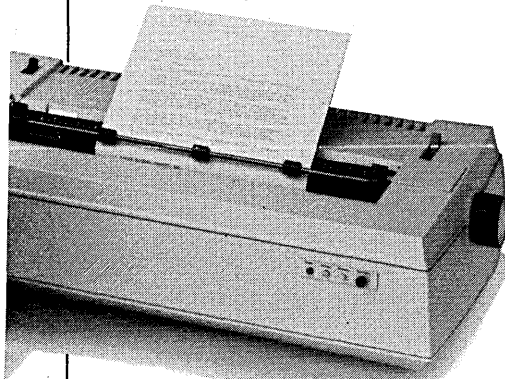
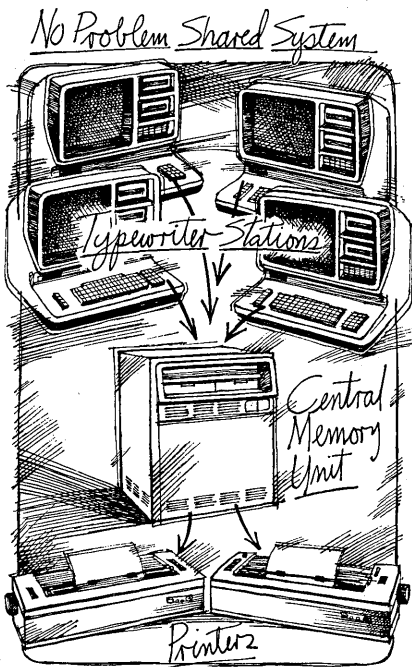
Now, the new Shared System gives you all the benefits and capabilities of the Lanier No Problem typewriter in a multi-

typewriter system. It gets your work back faster. And it's as easy to use as a No Problem typewriter!

Think of it as a family. A family of No Problem typewriters, working together, sharing the workload among several typists.

The power of sharing

The heart of the Shared System is its Central Memory Unit. The CMU lets all your No Problem typewriters share list merging, automatic repagination, statistical typing, standard document assembly, global search and replace, line drawing capa-



bilities, and more.

Want to type and edit over 250 different characters on the screen? No Problem. Even the Greek alphabet and math symbols can be typed and printed quickly and easily.

But what about printing? There are several printers and over forty type styles to choose from. For letter-quality pages printed at up to 540 WPM, there's a character printer. There's a wide track printer for paper up to 25 inches wide. And a twin track printer for printing

two type styles and two colors on the same page automatically. There's even a high-speed line printer that produces up to 300 lines per minute.

And the Shared System has remarkable record-keeping facilities. You can store over 30,000 pages. Your typists save time by reducing and often eliminating frequent media handling.

The best investments are No Problem

The new Shared System is better than a good investment. Sharing starts to pay for itself right away.

Typists can work independently, or they can share the burden of larger typing jobs by working together to get the jobs done on time.

While a typist types, the Shared System can simultaneously print, do list merging and more. It saves time and money by getting your work back faster. You can even share printers.

Wise investors have made Lanier No Problem typewriters the best selling display stand-alones in the business.

Lanier today, No Problems tomorrow

If you're considering a typing system, consider this: The No Problem Shared System is the only typing system your company will ever need.

Start with one or two typewriter stations and add new typewriters or printers as your needs increase.

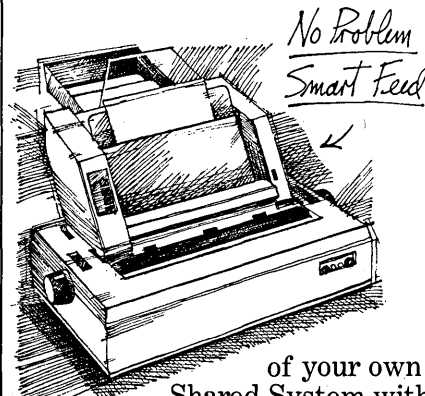
Add on the new *No Problem Smart Feed™* to automatically load paper and reduce time-consuming paper handling.

Send and receive information far beyond the boundaries



LANIER®

The No Problem Typewriter. It does more than just type.



of your own Shared System with *No Problem Electronic Mail™*

It's so simple to use. Now documents can be sent across town or country in seconds for the cost of a telephone call.

Service and support are No Problem

When we install a Shared System, we do more than just plug it in and leave. We offer No Problem blanket protection for your equipment and for your people. That means service and support when you need it. Just give us a call. In most cases, we'll be there before the day is out.

Want to know more about our family of No Problem typewriters? Ask for a Shared System demonstration and you'll find out how it can solve *your* office problems.

Send us this coupon and we'll call immediately to set up an appointment. Or call toll free (800) 241-1706.

Except in Alaska and Hawaii. In Georgia, call collect (404) 321-1244.

© 1980 Lanier Business Products, Inc.

Yes, I want to see the Lanier No Problem Shared System in action.

Name _____

Title _____

Phone _____

Best Time to Call _____

Firm Name _____

Address _____

County _____

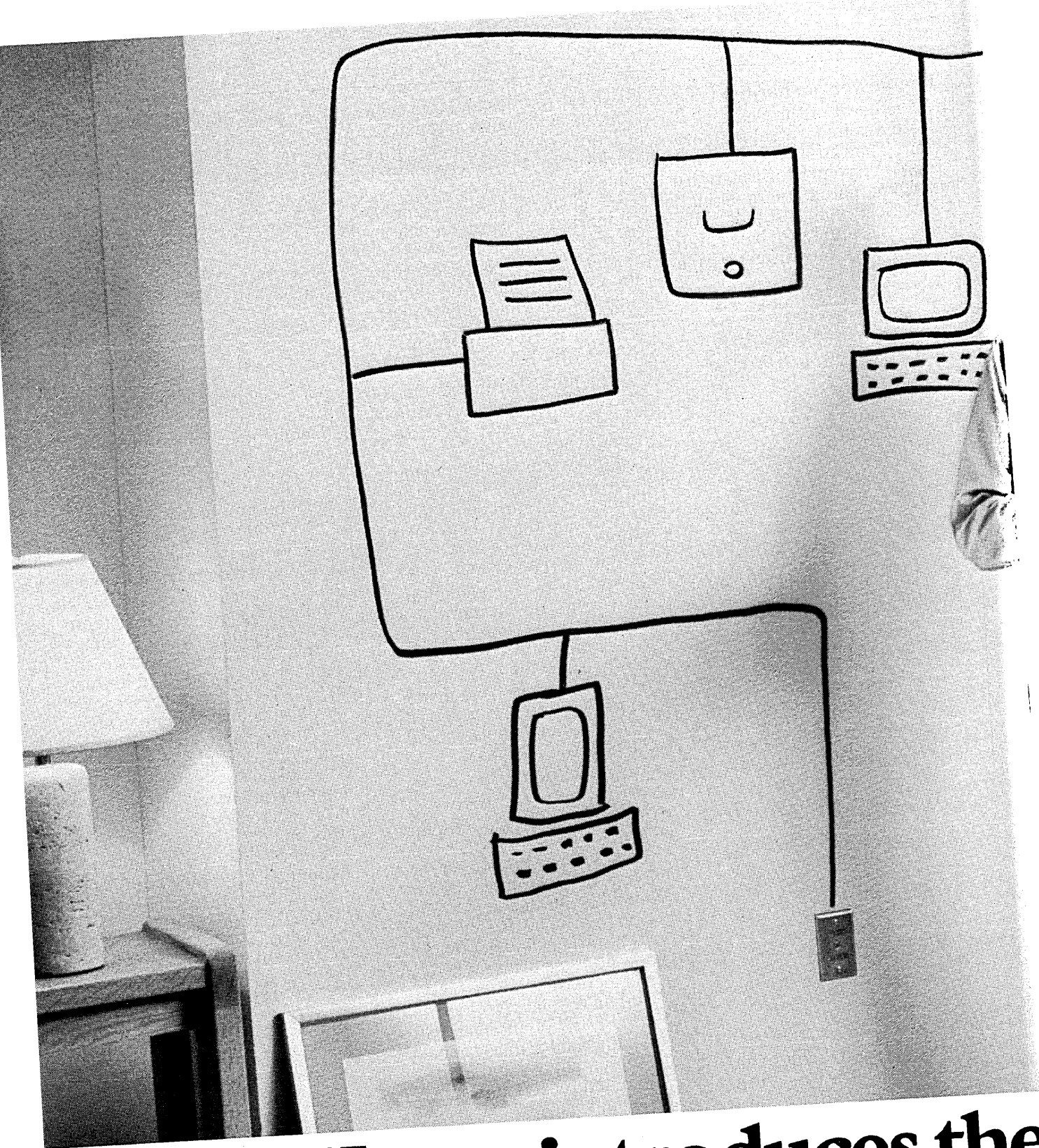
City _____

State _____ Zip _____

What kind of typing or word processing system are you using now? _____

Lanier Business Products, Inc.
1700 Chantilly Dr. NE, Atlanta, GA 30324

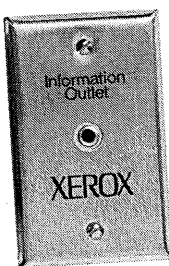
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Xerox introduces the

If you're wondering how business will handle information in the '80s, the handwriting is clearly on the wall.

We call it the Information Outlet—a new way for you to custom design an information management system that will give you maximum flexibility with minimum expense.



Here's how it works:
The Information Outlet gives you access to a special Xerox Ethernet cable that can link a variety of office machines. Including information processors like the Xerox 860, various electronic printers and files, and, of course, computers.

The Xerox Ethernet network will

If you'd like more information on the Information Outlet, write us and we'll



Information Outlet.

enable people throughout your company to create, store, retrieve, print and send information to other people in other places—instantaneously.

This network wasn't designed to work exclusively with our equipment. Other companies' products can be connected as well.

As your needs change, so can your network. You'll simply plug in new machines as you need

them—or as technology develops better ones.

So, through the Xerox Information Outlet, you'll get to the future the way the future itself will get here.

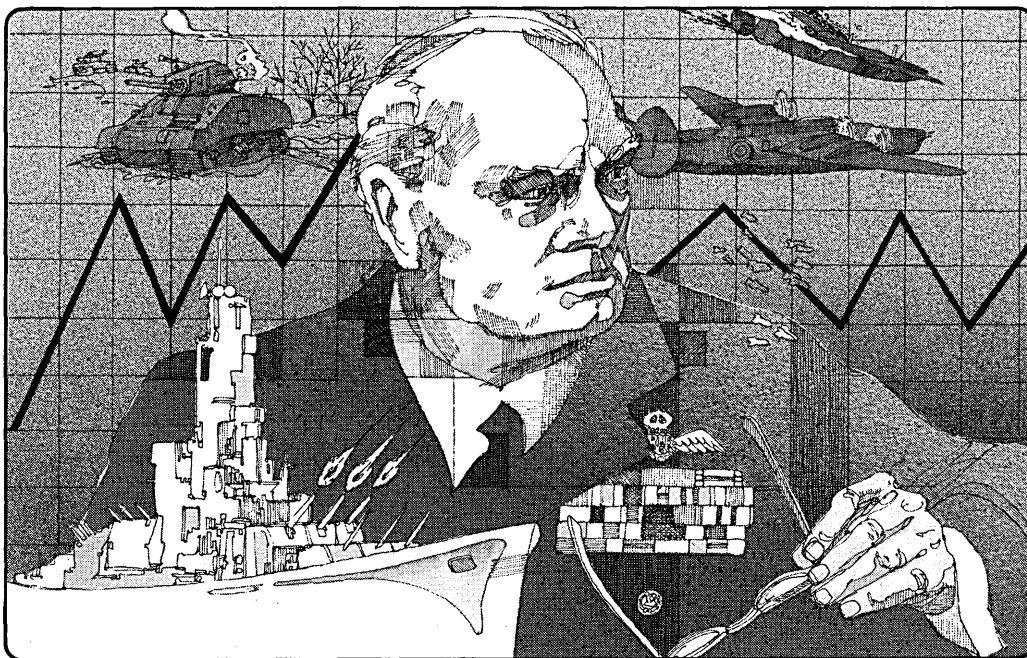
One step at a time.

XEROX

send you a booklet: Xerox Corporation, P.O. Box 470065, Dallas, Texas 75247.

CIRCLE 23 ON READER CARD

If Churchill had used SPSS[®], he might have saved his statistical department a lot of blood, sweat and tears



In waging war... and business... great executives know that good data analysis is a matter of life and death. Winston Churchill knew it:

"One of the first steps I took on taking charge of the Admiralty... was to form a Statistical Department of my own—one that I could trust to pay no attention to anything but realities. This group was able to present me continually with tables and diagrams illustrating the whole war. I (therefore) had from the beginning my own sure, steady source of information, every part of which was integrally related to all the rest." (*The Gathering Storm*—pp467-68)

Thanks to the honest and tireless efforts of his Department, most of the war's

critical decisions were based on facts, not hunches. Had they been able to use the SPSS Data Analysis Package, the Department's analysts could have explored the legions of data more quickly, efficiently, creatively... with easy-to-generate tables, graphs and reports, as well as sophisticated statistical analysis.

Using the SPSS Graphics Option, Churchill might have had graphs showing The Battle of Britain in terms of German and British aircraft losses by time. Using regression

analysis, Churchill would have had an excellent estimate of future losses.

As a matter of fact, Churchill might have been able to do it on his own, without the Department, because SPSS is so easy to use. Churchill himself could have learned from the excellent SPSS self-teaching manual. No special training in computer language would have been necessary—SPSS talks, listens and reports in the user's language: plain English!

When you decide which data analysis software

package is right for *your* life and death decisions, consider the facts, as Churchill would have done. SPSS is sophisticated in output, yet simple to input. It's extremely portable—works in almost all computer environments. And you needn't hire any extra data processing people—your data researchers work on their own... with considerably less "blood, tears, toil and sweat."

If you would like to see how SPSS-generated graphs and charts would have displayed The Battle of Britain to Churchill, or for more information on SPSS, call or write:

Roger Sack
SPSS, Inc. (Dept. D10-80)
Suite 3300
444 N. Michigan Avenue
Chicago, IL 60611
312-329-2400

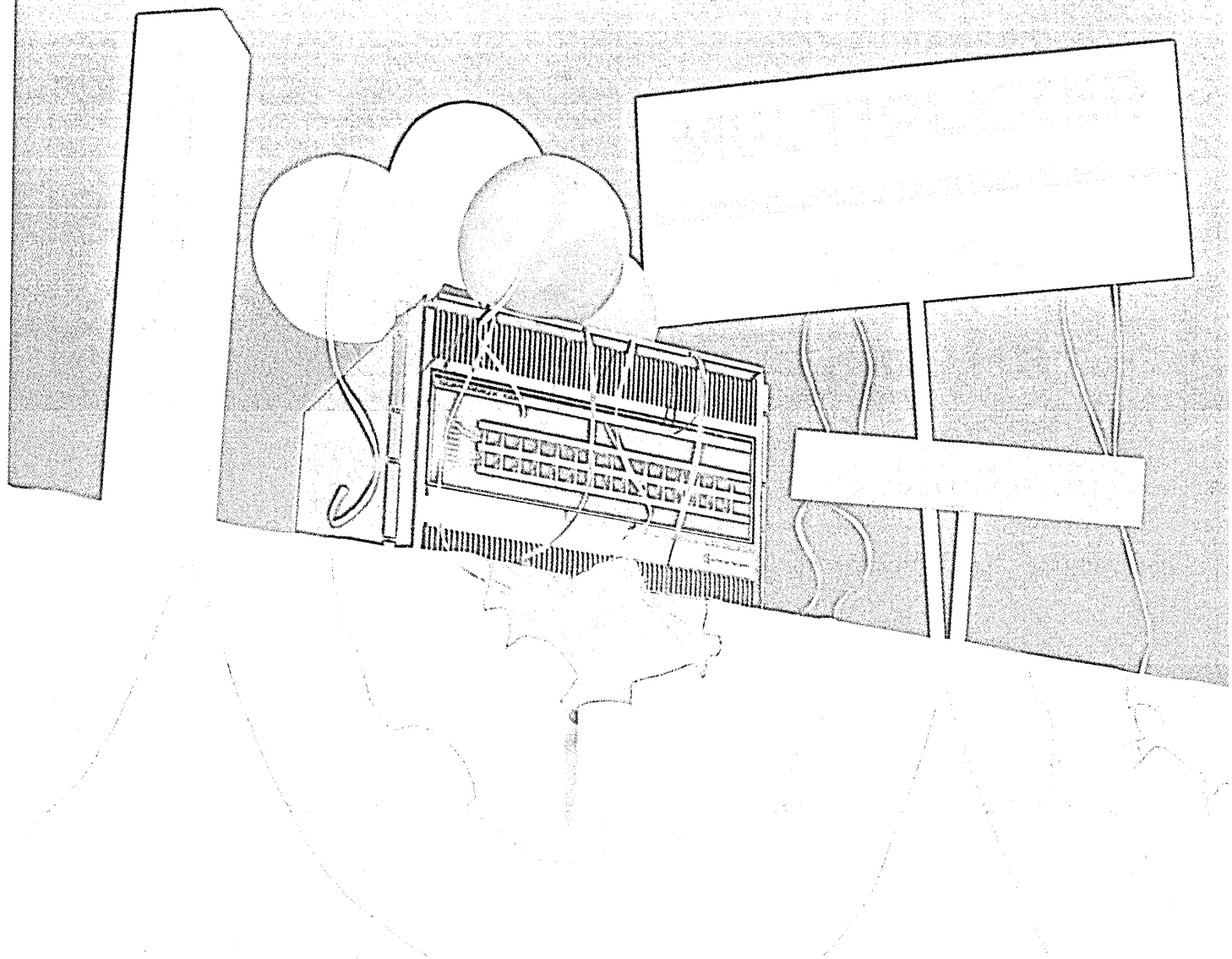


**DATA ANALYSIS
MADE SIMPLE**

CIRCLE 24 ON READER CARD

SPSS runs on: IBM 360, 370, 4300, OS, DOS, CMS and all IBM compatibles / Burroughs Medium and Large Systems / CDC CYBER & 6000 Series / Data General Eclipse & Nova / DEC Systems 10, 20, VAX, PDP-11 / HARRIS 4, 7 / HEWLETT-PACKARD 3000 / Honeywell 60 / ICL 2900 Series / Perkin-Elmer / Prime 400-750 / Siemens BS 2000 / Univac 70, 90, 1100 / Other SPSS Conversions are available. Contact SPSS, Inc. for more information.

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CALENDAR

OCTOBER

GPEUG '80, October 20-23, Orlando, Florida.

This is the 16th annual meeting of the Computer Performance Evaluation Users Group, and it concentrates on "CPE Trends in the '80s." It builds on last year's meeting by emphasizing new roles for CPE practitioners in the decade ahead. Contact T. F. Gonter, U.S. General Accounting Office, 441 G Street N.W., Room 6011, Washington, D.C. 20548.

DPMA's International Data Processing Conference and Business Exposition, October 26-29, Philadelphia.

The conference takes a close look at the dp and operational management user markets. Contact Conference Coordinator, 505 Busse Highway, Park Ridge, IL 60068, (312) 825-8124.

Canadian DP Education Conference, October 27-28, Toronto, Ontario.

"The DP Educator: A Professional" is the topic. Contact Jim Lowe, Shell Canada, Ltd., P.O. Box 400, Terminal "A," Toronto, Ontario, M5W 1E1, (416) 597-7025.

ACM 1980 Annual Conference, October 27-29, Nashville.

Dr. Alvin Weinberg will keynote this conference, speaking on "The Interaction Between Information and Energy Systems." More than 45 technical sessions will be featured, with the 11th ACM North American Chess Championship and many other special sessions and exhibits. Contact Charles L. Bradshaw, ACM '80 Conference Chairman, Box 1980, Station B, Nashville, TN, 37235, (615) 322-2951.

National Small Computer Show, October 30-November 1, New York City.

The fourth annual show features thirty 50-minute lecture presentations, and numerous hardware and software displays. Contact Ralph Ianuzzi, 110 Charlotte Pl., Englewood Cliffs, NJ, (201) 569-8542.

NOVEMBER

Federal Office Automation Conference, November 4-6, Washington, D.C.

This annual conference debuts with a special Office Automation Institute on its first day (Nov. 4), and continues with various sessions and workshops to create a well-rounded program for both novices and seasoned veterans. Contact Federal Office Automation Conference, P.O. Box E, Wayland, MA 01778, (617) 358-5119.

WPOE '80, November 4-6, San Jose.

The Word Processing and Office/Business Equipment Trade Show and Conference depicts the "Automated Office of the '80s." Contact Cartledge & Associates, Inc., 491 Macara Ave., Suite 1014, Sunnyvale, CA 94086.

Fourth Annual Data Entry Management Conference, November 10-14, Orlando, Florida.

"Improving Productivity and the Quality of Working Life for Data Entry" is the theme of this conference, sponsored by the Data Entry Management Association. Contact Marilyn S. Bodek, P.O. Box 3231, Stamford, CT 06905.

CAM-I 9th Annual Meeting, November 11-13, Dallas.

Also called by its theme name, "Man and Computers: Partners in Manufacturing," the meeting will feature papers on the "Human Side of CAD/CAM," and "Application of CAD/CAM in the Electronics Industry." Contact Rhonda Gerganess, CAM-I, Inc., 611 Ryan Plaza Dr., Suite 1107, Arlington, TX 76011, (817) 265-5328.

Canadian Computer Show & Conference, November 11-13, Toronto, Ontario.

The second largest computer show held in North America is sponsored by the Canadian Information Processing Society. Products to be displayed include minicomputers, peripheral hardware and software, consulting and contract programming, time-sharing, etc. Contact Reg Leckie, Industrial Trade Shows of Canada, 36 Butterick Rd., Toronto, Ontario, Canada, M8W3Z8.

Pacific '80 Conference on Distributed Processing, November 11-14, San Francisco.

Cosponsored by the ACM and its chapters of the Pacific region, the conference will hold tutorials on Nov. 11, with conference meetings on the 12th through the 14th. Contact Robin Williams, IBM, K55-282, 5600 Cottle Rd., San Jose, CA 95193.

INFO/MFG, November 18-20, Chicago.

The first show devoted entirely to the information needs of manufacturing companies. A "Guide to INFO/MFG," listing exhibitors and products to be demonstrated, is available. Contact Clapp & Poliak, Inc., 245 Park Ave., New York, NY 10017.

Western Educational Computing Conference, November 20-21, San Diego.

Conference will feature the use of computing in education for instruction, administration, and research. Luncheon speeches will be given by Grace Hopper and Bernard Luscombe. Contact Ron Langley, Director, Computer Center, California State University, Long Beach, 1250 Bellflower Blvd., Long Beach, CA 90840, (213) 498-5459.

DECEMBER

Fourth International Online Information Meeting, December 9-11, London, England.

The conference will offer a varied program, addressing current problems and opportunities that arise when providing information to business, industry, government, and academic institutions. Contact Organising Secretary, Online Review, Learned Information, (Europe) Ltd., Besselsleigh Rd., Abingdon, Oxford OX13 6EF, England. *

A whole world. Because our parent company, C. Itoh Co., Ltd. (pronounced "C. Eetoe") is a multinational organization with resources and subsidiaries located in every corner of the globe.

As C. Itoh Electronics, Inc., we're fortunate to be part of this international network. It lets us seek out quality materials and technologies wherever they can be found. And for a company that specializes in computer peripherals for the OEM, that's just as important as price or the capability to deliver.

Today, we're offering the latest designs in dot matrix and daisy wheel printers, card readers, CRT monitors, floppy disk drives, and a lot more.

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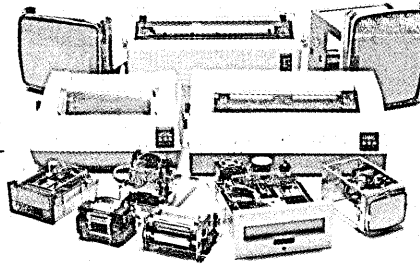
ates repair and refurbishment stations nationwide.

So when you deal with us, you can be sure you're doing business with people who are dedicated to the OEM. And a company whose parent organization has been around since 1858.

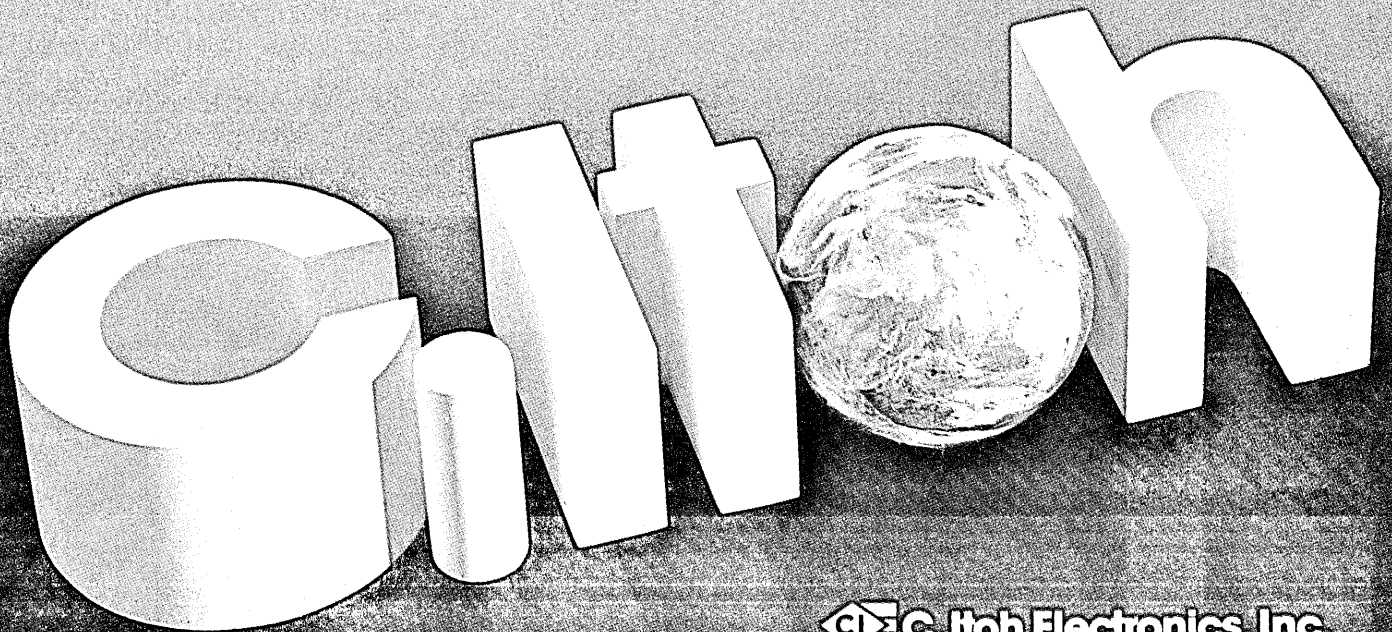
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For information on our product lines for the OEM computer systems manufacturer, contact C. Itoh Electronics, Inc., 5301 Beethoven St., Los Angeles, CA 90066, Tel. (213) 390-7778; Midwestern Regional

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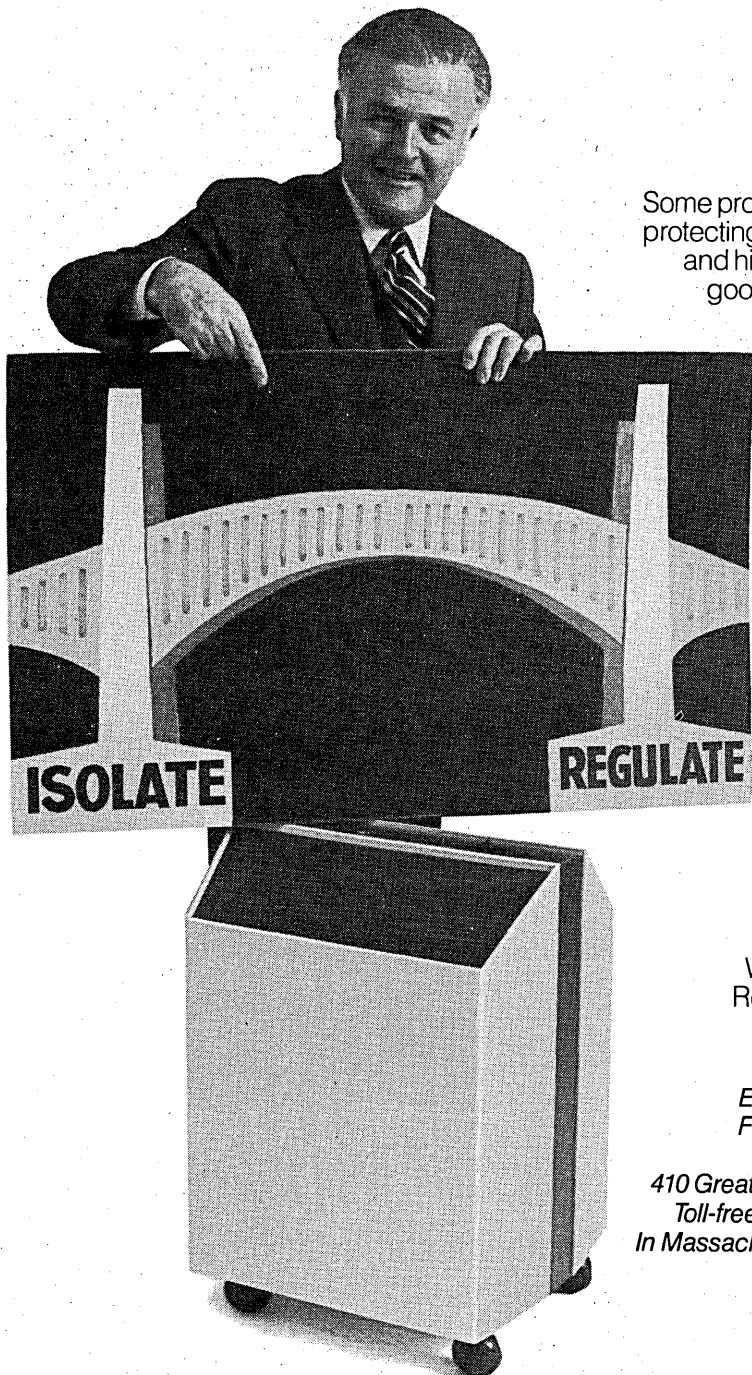


 **C. Itoh Electronics, Inc.**
One world of quality

CIRCLE 26 ON READER CARD

// Don't settle for half protection when you want to PUT AN END TO POWER-RELATED COMPUTER PROBLEMS //

Says Emil Rechsteiner, President of Frequency Technology, Inc.
Makers of ISOREG™ Computer Power Modules.



HALF A BRIDGE DOESN'T GET YOU THERE!

Some products are like HALF a bridge when it comes to protecting a computer from voltage spikes, brown-outs, and high line voltages. And half a bridge is not much good. For example, isolation transformers filter out voltage spikes, but DON'T REGULATE voltages. Many voltage regulators regulate voltages but DON'T ISOLATE a computer from raw utility power . . . thereby exposing the computer to voltage spikes that can scramble data . . . even destroy circuits.

GO FOR FULL PROTECTION . . . WITH ISOREG

ISOREG Computer Power Modules ISOLATE your computer from voltage spikes and REGULATE voltages within tight limits even when utility voltages drop to brown-out levels or shoot far above normal. Don't spend money on half a bridge! Go all the way for full protection . . . with ISOREG.

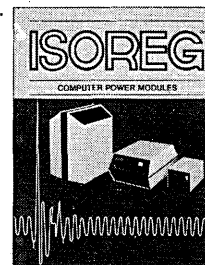
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*Emil Rechsteiner, President
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The future of word processing, information processing and communications.

It's the NBI System 3000, the word processing system designed to cope with what the future holds for offices everywhere — paperwork and declining productivity.

The NBI System 3000 is document oriented. So when you make one change the entire document automatically shifts to print out correctly as altered.

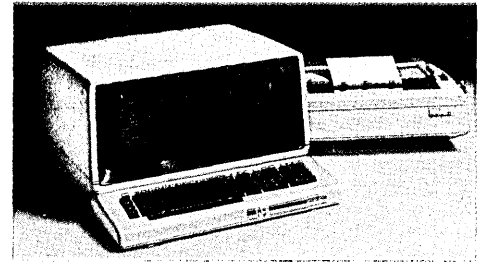
NBI also gives you the most totally

automatic outlining, indexing, footnoting, sorting and equation typing capabilities available. Capabilities that save hours of expensive human effort. Capabilities that no other system makes so easy.

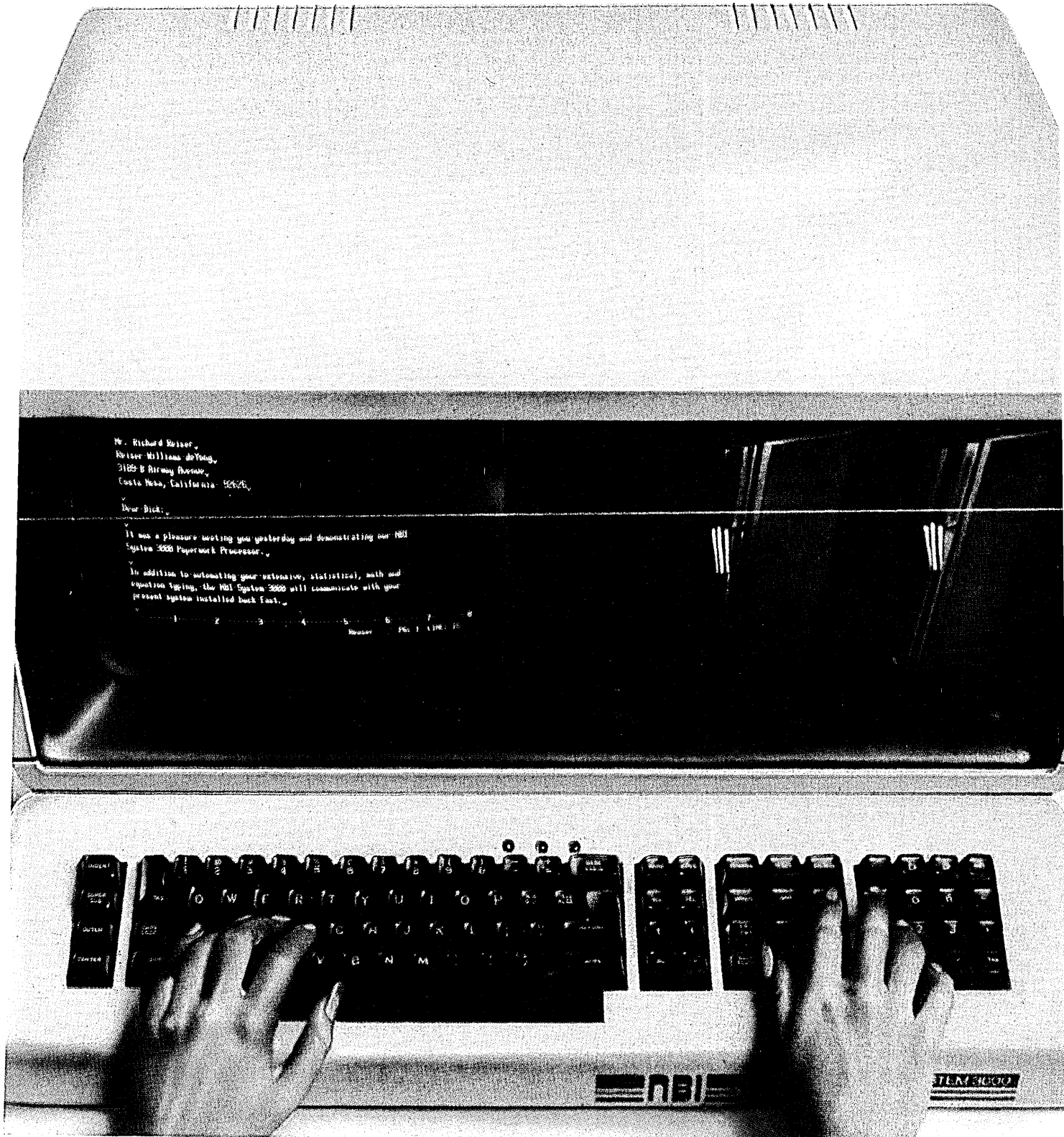
The NBI System 3000 takes the common, tedious problems that slow office workers down and solves them, automatically.

Take the future in your own two hands.

Call NBI. 1695 38th St., Boulder, CO 80301, 800/525-0844. In Colorado, call 303/825-8403. **CIRCLE 28 ON READER CARD**



Lifting America from under the paper weight.



38 delivers

**The productivity advances of IBM's
new System/38 are being
confirmed in early installations.**

IBM has started delivering System/38's to customers.

And customers have started delivering comments like these to IBM.

"I created a special equipment report in 15 minutes flat. Before, it would have taken a day and a half of programming,"

—Chuck Petter, Data Processing Manager, Road Machinery and Supplies Company, Minneapolis.

"We've developed an online order entry system with one-third the effort... and the application is much more polished. We're very pleased."

—Larry Brenner, Director, Corporate Information Services, United Merchants and Manufacturers, New York City.

"The System/38 significantly reduced the amount of code necessary to write a program and the time and effort required to move into new applications. We're extremely enthusiastic."

—Larry Petterson, Director of Data Processing, St. Olaf College, Northfield, Minnesota.

And we're enthusiastic, too.

Because the IBM General Systems Division's versatile new System/38 is a compact system with

many large computer features. Such as distributed online work stations so users don't have to go to the computer; a central data base that makes information easier to retrieve, revise and use; the Control Program Facility, which automatically monitors and manages the flow and processing of data; online program testing, so programs can now be debugged as normal processing continues.

And System/38 has advanced features rarely found in any computer, large or small. Like Single Level Storage, which treats all storage as a single unit and automatically keeps track of it.

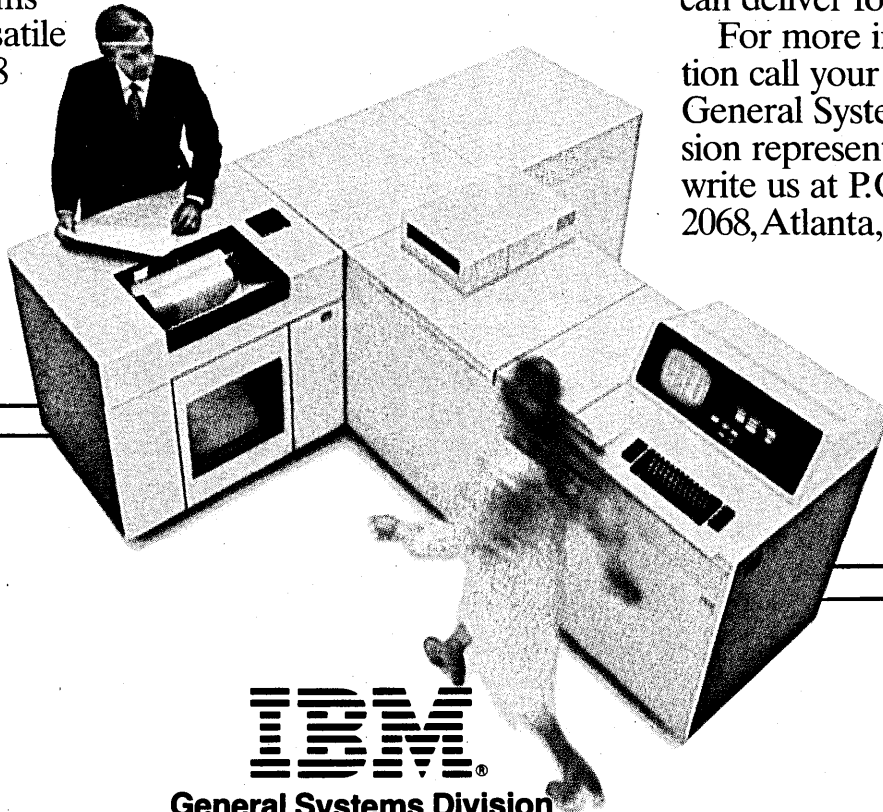
And thanks to System/38's streamlined architecture, many functions that previously required programmers' time have been absorbed into the system itself.

The result of these IBM innovations? A computer that lets you do much more, much more simply.

We're pleased that System/38 is already helping business function with greater cost-efficiency, productivity and profitability.

In short, System/38 delivers. And it can deliver for you.

For more information call your IBM General Systems Division representative or write us at P.O. Box 2068, Atlanta, GA 30301.



IBM

General Systems Division

CIRCLE 29 ON READER CARD

**Are you about to buy
a space age On-line system
with a stone age printer?**



Today, a lot of people can sell you basic, 3270-type On-line hardware. But only Northern Telecom's On-line system has the Sprinter™—a printer designed for all the new ways people use On-line.

Complicated printers are out-of-date.

When On-line systems work far from the DP room, you need a printer that's fast and easy to use. Sprinter is microprocessor controlled. So margins, alignment and spacing are adjustable with push buttons—even while you're printing.

The Sprinter is quick—up to 180 cps—so it doesn't keep people waiting an extra second.

Everyone stays clean around the Sprinter, because you can load paper—even change ribbons without making a mess.

Short forms in short order.

When your printout is tickets, or leases, or other short documents, you want a printer that handles cut forms as easily as it handles continuous rolls. Sprinter's front-feed module adjusts quickly and easily for cut forms of many different sizes.

When your printout is read by customers—or by top management, you need crisp, sharp, easy-to-read copies. With the Sprinter, your fifth carbon is just as presentable as the original.

Compatible. Economical. And ready to go.

You don't have to give up a thing to get the On-line system with the up-to-date printer. Our hardware is plug-compatible with IBM 3270s. Our price is competitive. And so is our delivery schedule. So if you want the option of adding a simple, high-quality printer someday, our On-line hardware could be a very smart buy. And if you're depending on your printer right now—it's a must.

Our bigger choice is another reason why we're a better buy.

Right now, we can deliver state-of-the-art systems for DDP, Data Entry, and Remote Job Entry as well as On-line. So when you work with Northern Telecom, one phone call can bring you factory-trained service for every part of your remote processing operation.

But the best reason to talk to Northern Telecom today, is tomorrow.

We're combining data processing expertise with telecommunications expertise—in a mix no other company can match. Today, it means better access to all the processing power you pay for. Tomorrow, it means a smoother transition to a single system that will meet all your processing and telecommunications needs. Talk to Northern Telecom Systems Corporation. Where computers and communications meet.

For the office nearest you, call our Marketing Services Department at 1-800-328-6760. In Minnesota call (612) 932-8202. Or write Northern Telecom Systems Corporation, Box 1222, Minneapolis, MN 55440.



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CIRCLE 30 ON READER CARD

The Prime 750. The best way to go big without going with the biggest.

Contrary to popular opinion, mainframe capability does not have to be purchased from a mainframe company. As evidence, we offer the affordable, interactive Prime 750.

The 750 is designed around a full 32-bit CPU. It supports industry-standard FORTRAN '77, ANSI '74 COBOL, CODASYL DBMS, BASIC, PL/I, RPG II, and a host of communications products. And it also supports up to 2.4 billion bytes of disk storage, and as much as 32 Mb of virtual memory for each of up to 63 simultaneous users.

The 750 can handle just about anything,

including huge computational analyses, big data processing tasks for business, and complex data communications applications.

And it's interactive—a highly desirable feature on a computer with mainframe power.

Also, the same 750 that runs your business programs can simultaneously crunch some very big numbers. And if you go to distributed processing, the 750 supports PRIMENET,[™] X.25, and a wide range of communications products.

The 750 is just one of the fully compatible Prime 50 Series computers—including the 250, 550, and 650—that share the same operating system, file system, and communications products. So you can start with a smaller Prime computer, and upgrade all the way to a 750 without program recompilation or software modification.

If you're thinking big, contact the nearest Prime office, or write Prime Computer, Prime Park MS 15-60, Natick, MA 01760. In Europe: Prime Europe, 6 Lampton Road, Hounslow, Middlesex TW3 1JL, England. Telephone: 01-570-8555.

PRIME Computer



LETTERS

LOVE 'EM AND LEASE 'EM

Re: "Fear and Loathing in Leasing" (June, p. 77), Mr. McLellan's colorful language is like the sound track from *Jaws*. The computer leasing business admittedly has its ups and downs. Certainly, IBM pricing and cost of money affects the amount of business we can and will write.

May I suggest, however, that in the future you get your facts directly from the leaders in the leasing community, rather than from only one source who is too small to have any significant effect, influence, or extensive day-to-day knowledge of where the major companies are and where they are going.

JAMES F. BENTON
Executive Director
Computer Lessors Assn., Inc.
Washington, D.C.

The article captured the essence of our business today; however, there may be some emotional responses from some of the more sensitive people in our industry. The judgments that Mr. Raynault made were accurate, if undiplomatically forthright.

It is better to get our problems out in the open before we have to raise several billion dollars to finance IBM's so-called H Series of computers. When the 360 leasing companies were announcing their massive writedowns in 1971 and 1972, we were trying to raise \$200 million on Wall Street. In that climate, it was almost impossible for our industry to raise money. Silence about problems might contribute to a similar dilemma next year.

It should be clear that Mr. Raynault's comments were about cpu leasing, not peripherals. The industry has done quite well with its peripheral leases over the past several years. Also, we should note the changed market conditions from early May, when Mr. Raynault was interviewed. Interest rates have dropped dramatically and IBM has made pricing changes which have contributed to the resurgence in leasing. The second half of 1980 should be very good.

TOM C. MARTIN
President
Computer Financial Inc.
Hackensack, New Jersey

We seldom see an article as accurate about the computer industry. Your choice of Mr. Raynault was excellent. I have known him

for many years, and have come to feel that Paul very frequently calls future events accurately. Among the IBM watchers, he has one of the best understandings of IBM and its potential courses of action.

ROBERT C. STEVENSON
President
Cowles Computer Co.
Lake Success, New York

SHORTSIGHTED?

Re: Letters (Aug., p. 73), J. Michael Storie chides John Ehrman about how difficult an IBM system is, and how easy a DEC VAX is. Storie, like so many others, must have used an IBM computer in the 1960s before really good time-sharing facilities were available. Since then, the IBMVM/370 CMS system has proven to be one of the most powerful, easy to use systems on the market. While the DEC VAX/VMS is also a good system, many DEC users simply assume that no IBM system can be of any value because they were bogged down with JCL, BTAM, etc., long ago. It may be educational for Mr. Storie to know that the IBM CMS system has a rather elaborate "help" facility as does VAX/VMS. Further, he may want to know that running a FORTRAN program in CMS is very similar to running one on a VAX:

FORTRAN PARTS
LOAD PARTS
START

However, the IBM VM/370 system permits *multiple* operating systems to run concur-

rently. This means that, for the first time, systems programmers can live like human beings and not be forced always to work the graveyard shift. A production and test system can run at the same time so that new releases of the manufacturer's operating system are not unleashed on the users without reasonable amounts of testing first.

In addition, the virtual machine facility allows one user to run a separate operating system from others, or develop a new or unique operating system without interfering with other users.

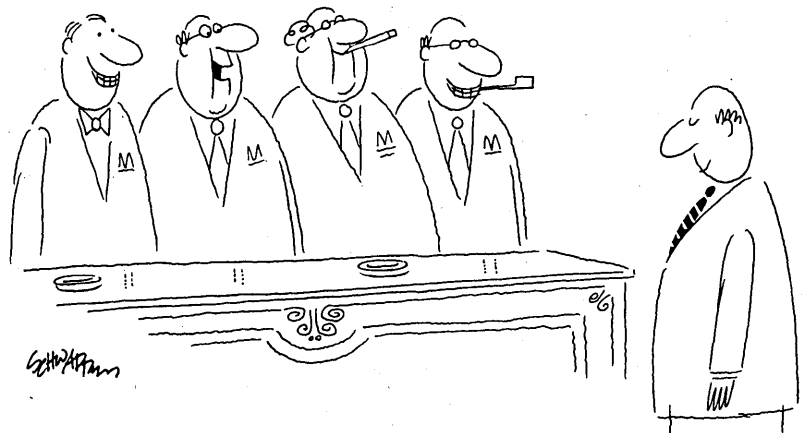
It seems only reasonable that people such as Storie should be willing to educate themselves slightly before they go ridiculing systems other than the one with which they are most familiar.

MARTIN B. SOLOMON
Director
University of Kentucky Computing Center
Lexington, Kentucky

WHO BELIEVES?

Re: "Who Believes in Top-Down Design?" (May, p. 293), I must object to the letter from E. G. Nilges (Aug., p. 23) which attempted to restore the thesis that pure top-down design is the only way to design good software.

To Mr. Glass' observation that wise software developers often use utilities such as SORT or PRINT, Nilges responded by resorting to the "extended machine" concept, claiming that SORT and PRINT should be considered part of the "extended ma-



"Congratulations, Higby! We've decided to take one of your memos seriously."

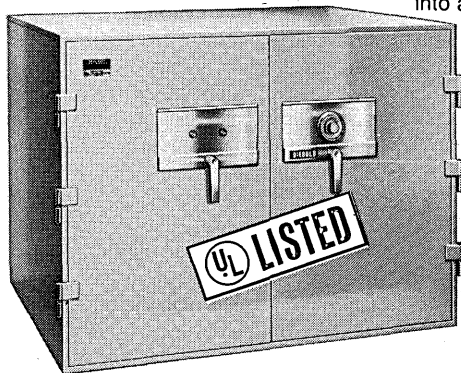
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PROTECT YOUR TOMORROWS

It wouldn't take much of a fire near your computer room to raise room temperature to 150° or relative humidity to 85%. Both are critical figures, however, because at either point, magnetic media can be damaged or destroyed. Without "input", you can't have "output".

But a Diebold Data-Safe can help protect input . . . and your tomorrows. It's been tested and has been listed with Underwriters' Laboratories for its ability to shield essential media from destructive temperature and humidity . . . Unlisted containers are untested.

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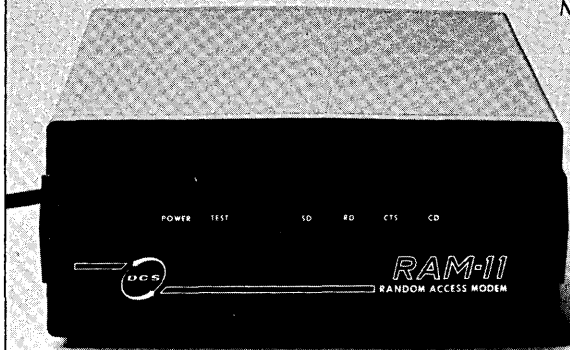


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CIRCLE 33 ON READER CARD

LETTERS

chine." But isn't this purely semantics? Surely, if my "extended machine" did not include the primitive functions mentioned, no arbitrary rule should prevent me from designing and building them early in the development sequence, rather than last, as pure top-down design would appear to dictate. In fact, any other primitive function for my application should be handled in the same fashion.

To Mr. Glass' observation that some components should be implemented in advance of the rest of the design to check their feasibility, he responds by essentially contending that no feasibility problems can exist in practice. He has obviously never worked on a real-time control system where some control elements are critically dependent upon an idealized model of the physical devices in the system and of the processes being controlled. Feasibility here is never "evident from its statement of purpose."

So, while the top-down approach to conceptual design is clearly preferred, it is not so clear that top-down implementation is always superior. This may disappoint those who prefer simplistic models of the world, but that can't be helped. The zealots who preach that "pure top-down design and implementation is the only acceptable way" remind me that the history of mankind is replete with examples of the great harm performed by those trying to do good (as subjectively interpreted). I fear that this may be one more example.

AUSTIN J. MAHER
Manager

Programming & Computation
Singer Co., Kearfott Div.
Little Falls, New Jersey

DATACOM CORRECTION

Despite the attempts to "... ensure an accurate and fair survey," some likely entrants for the "Top 50" table were unwittingly overlooked. We are certain that such was the case in omitting Dataproducts.

Fully 86% of the business generated in our Wallingford, Conn., subsidiary—Dataproducts New England, Inc.—is in the data communications field. Of its \$23 million in revenues reported for our fiscal year ended March 29, 1980, close to \$20 million represents data communications business.

Dataproducts New England, Inc.—formerly known as Stelma, Inc.—has been in the traditional voice and data communications market for over 35 years. This operation designs, manufactures, and sells equipment used in data communications systems including customized, switching and line management systems; test and analysis devices for technical control and network management systems; multiplex equipment; and modems.

GRAHAM TYSON
Chairman

Dataproducts Corp.
Woodland Hills, California

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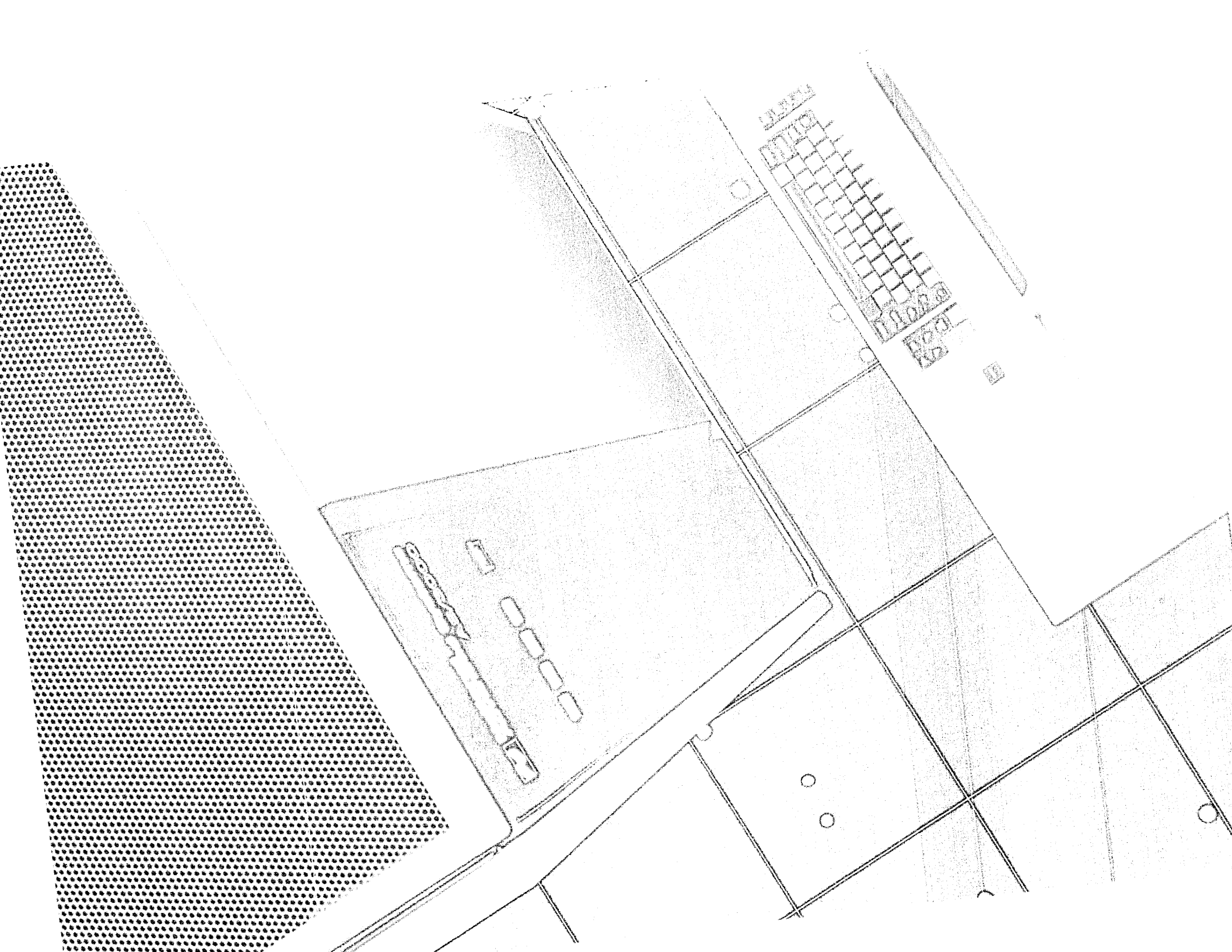
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JUST SEND US A MAGNETIC TAPE — WE DO THE REST!

CIRCLE 34 ON READER CARD



IBM-compatible computers explained - by the leader in IBM-compatible computers.

In these times of recession, inflation, and high interest rates, it's important to get the most for your money when expanding your computer installation. Especially when you're under pressure to increase productivity within your current budget limitations.

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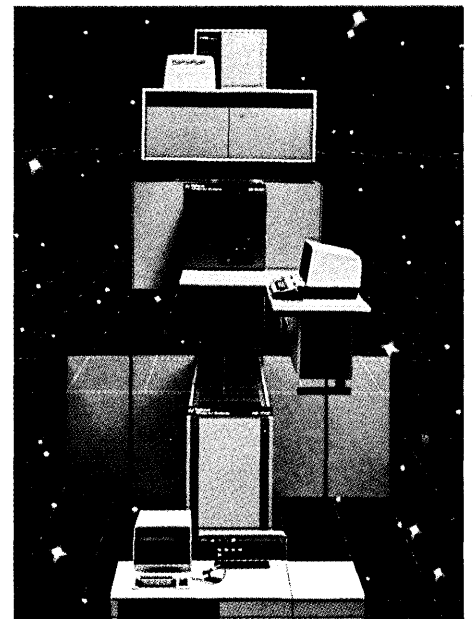
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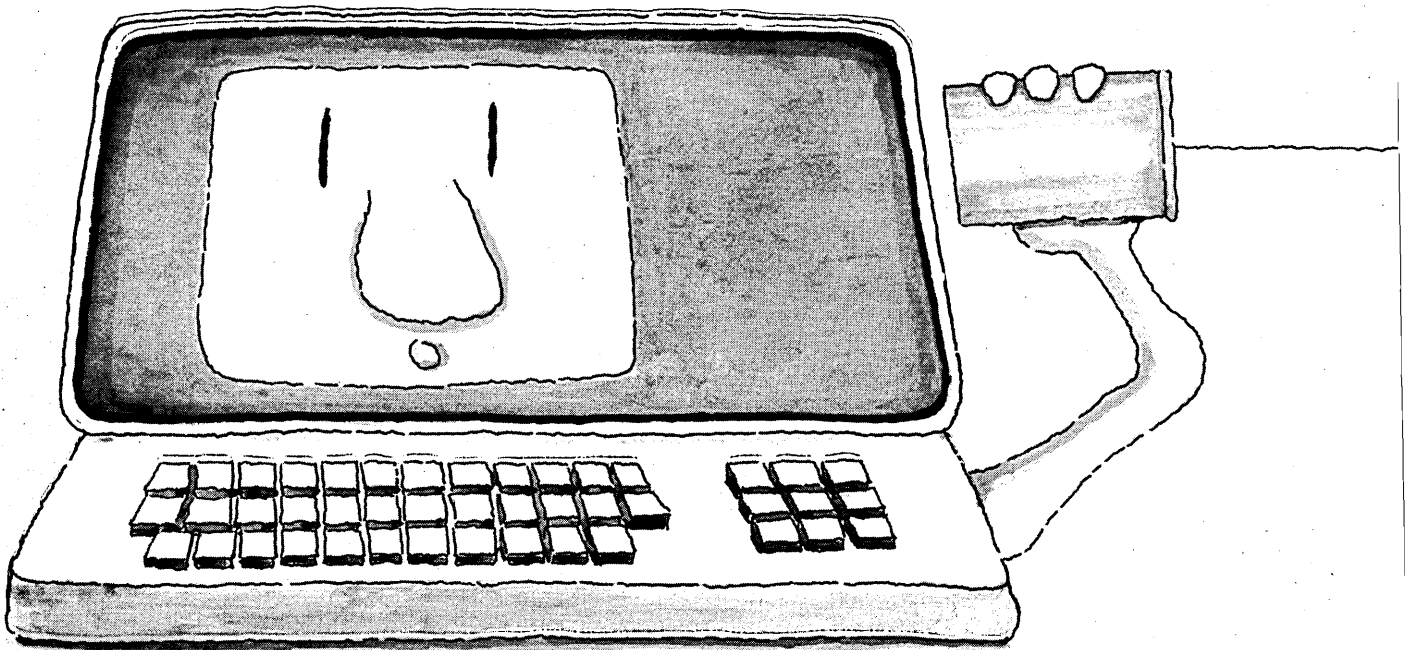
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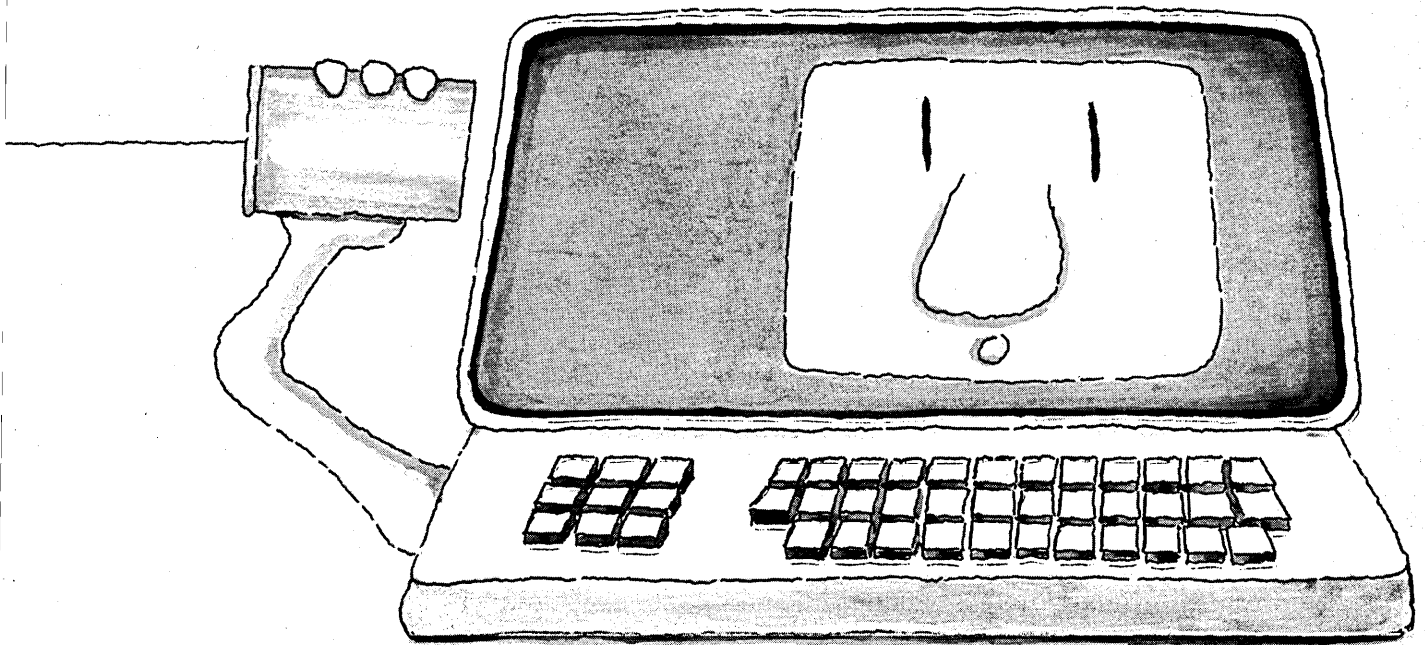
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Maintenance costs are now dramatically reduced. More important to the designer, system configuring couldn't be easier.

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WAITING FOR NETWORKING DPAGE?



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SCIENCE/SCOPE

Microelectronic chips that contain nearly a half million circuit elements and are hundreds of times faster than currently available devices are being developed at Hughes for a wide range of military uses. The first VHSICs (very high-speed integrated circuits) will be made using photolithography and have device geometries (jargon for the smallest dimension on the chip) as small as 1.25 micrometers. Chips in the mid-1980s will be made with electron-beam lithography and will boast device geometries with submicron dimensions. Applications for VHSIC chips include processors for multimode radars, communication systems, sonars, electro-optical systems, and advanced multimode "fire-and-forget" missiles. The major program goal is to develop common military chips and to limit the number of custom-built and special circuits used.

A spacecraft designed for a variety of missions will carry the most versatile propulsion module ever developed. The new Hughes module will be installed on NASA's Multimission Modular Spacecraft (MMS), which starting in the mid-1980s is to be used for a wide range of communications and scientific missions. In addition to new electronic controls and support structures, this compact module contains a unique monopropellant hydrazine thruster that requires no heater. Conventional thrusters, if used on certain proposed MMS missions, would need extra equipment to heat their catalyst beds to avoid reductions in performance or a complete loss of power.

A new series of PIN photodetectors uses high-purity intrinsic silicon for high responsivity. The devices operate over a broad wavelength range spanning the entire visible spectrum from 400 to 1100 nanometers. At 900 nanometers, responsivity is .63, and quantum efficiency is 87 percent. Applications include computed axial tomography, instrumentation using lasers, and fiber-optic communication and data links. Hughes HPIN diodes are available in single and multi-element arrays in standard or special configurations.

The Manufacturing Division of Hughes Missile Systems Group in Tucson has many immediate openings for engineers. These career opportunities require expertise in designing test equipment for advanced major electronic and missile system programs. Openings range from digital logic, analog, and IF/RF circuit design to electro-optical and IR system design. Also needed are industrial engineers and manufacturing production engineers. For immediate consideration, send resume to Engineering Recruitment, Hughes Aircraft Company, P.O. Box 11337, Dept. SE, Tucson, AZ 85734. Or call (602) 746-8484. Equal opportunity employer.

Field-effect transistors are emerging as strong contenders for microwave switch applications in communications satellites. Gallium-arsenide FETs are likely to replace PIN diodes in satellites due to advantages like higher speeds and lower power consumption. Using arrays of FETs, Hughes researchers built an 8x8 switch matrix for time-division multiple-access applications at 4 GHz. The device achieved a 1-nanosecond transition time at 10 milliwatts drive control power.

Creating a new world with electronics

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LOOK AHEAD

SAY IT WITH
FLOWERS?

(Continued from page 20)
The American Federation of Information Processing Societies (AFIPS) would rather not. Next June at NCC time, AFIPS will share McCormick Place in Chicago with a big flower show that generally attracts about 100,000 people. We hear AFIPS' executive personnel aren't even answering their phones these days. Maybe they receive flowers.

AIM TO
PLEASE

"It's incredible," said a Rockwell International public relations representative when he learned that a Rockwell AIM microcomputer was a featured attraction in a television show of that name. The AIM plays a big part of a British experiment in temperature sensing as applied to birth control. A user wears a deck-of-card-sized device in her bra to monitor body temperature and goes in once a week for readings of her fertility cycle. "Not exactly the kind of publicity staid old Rockwell wants," said the beleaguered PR man.

THE CHEAP
LABOR LURE

A delegation from the Peoples Republic of China was in the U.S. last month taking a hard look at high technology firms, including computer-related companies, with an eye most strongly focused on potential joint venture partners. Li Zhengang, president of the China Electronics Import & Export Corp., newly created government body which has sole responsibility for electronics trade between China and the U.S., said, "The level of automation in China is still relatively low. That's why we want to learn from the American electronics industry." He added, "Our present level of importing is more than exporting, and we don't like to see that situation remain that way forever." He indicated joint ventures, with U.S. partners lured by low-cost Chinese labor ("lower than Hong Kong's"), would be a positive step.

TERMINAL
SEARCH

Visa is in a breaking-the-cost-barrier test with low-cost terminals which could replace "hot card" lists. Nine Visa member banks are conducting a pilot test of low-cost, dial-up terminals, using them for both Visa and Master Charge authorizations. They're also considering the potential of using them for American Express, Diner's Club and Carte Blanche, as well as nationwide check guarantee.

RUMORS AND
RAW RANDOM DATA

The Magnuson rumor mill has it that both Storage Technology and Software AG will be using Magnuson CPUs for back-end processors...Word has it that IBM's Office Products Division will offer a new line of low-end copiers.

NEWS IN PERSPECTIVE

TRENDS

AI COMES OF AGE

Applications of artificial intelligence are appearing in many and diverse fields.

Don't look now, but artificial intelligence has risen above its ancient image, such as it was. No longer restricted to the campuses of major universities, its practitioners are being sought eagerly by government agencies and private industry. And the applications of AI are appearing in fields as diverse as consumer products, oil-field services, office systems, and military threat evaluation.

A recent convert to the faith is \$3.5 billion multinational Schlumberger Ltd., the company that last year entered the semiconductor business in a big way by acquiring Fairchild Camera. At its research center in Ridgefield, Conn., Schlumberger has gathered AI researchers to assist the oil-field services company in its job of collecting and interpreting geological data. Says David Barstow of that organization, "The potential role for AI at Schlumberger is immense. And Schlumberger is really serious about that role."

Hewlett-Packard, too, has AI researchers or people who stay close to what's happening on the AI scene in at least three departments, and they're working on specific applied research problems of interest to the company as it prepares for new markets and products of the 1980s. These research topics are said to include speech recognition and generation, better environments for programmers, and a restricted type of natural language facility for accessing data bases.

But this is not solely the purview of large, established corporations. Richard Wishner of Advanced Information Decision Systems, a year-old company in Mountain View, Calif., says his firm is employing AI in information control theory, decision analysis, signal processing, and computer science. "We see a synergism between the bottom four technologies and AI," he says, adding, "We're very bullish on AI. AI is coming of age."

According to Edward A. Feigenbaum, chairman of the Computer Science Dept. at Stanford Univ., everything seems to have come together in AI within the last year or two. And there's been an acceleration both in the pace of the work and the rate at which the outside world is becoming interested. "For people in the AI field, this really is the best of times," he adds.

Last August, the newly formed American Association for Artificial Intelligence held its first annual meeting on the Stanford campus. At a tutorial session designed to acquaint R&D managers from industry on what AI is and what it might be able to do for them, several facets of AI work were explained. In AI, a computer is used to manipulate symbols, instead of numbers, and to perform what's called symbolic inference by machine, rather than calculations. "By inference," Feigenbaum explains, "I mean nothing more, nothing less than what you mean by inference when you speak of logic or common sense reasoning."

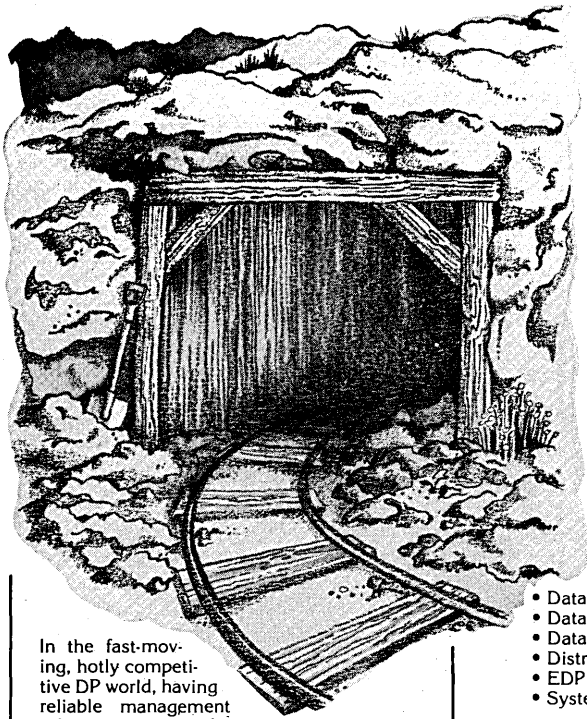
One type of system being developed is called an expert system, for it models in a computer the knowledge possessed and exercised by an expert in a narrow, confined discipline or pursuit. Since the expert cannot be housed within the mainframe, AI researchers attempt to draw out of the expert the knowledge he or she has gained from years of experience—"the knowledge of good judgment, the art of good guessing." This experiential knowledge, which AI people call heuristic knowledge, is then combined with textbook knowledge.

"So what we are getting at in this work is what I'd like to think of as expertise modeling," says Feigenbaum. "We are trying to model the expertise of the best practitioners in various areas of the world's work."

An example of such a system is called MYCIN, developed at Stanford in 1974 by Ted Shortliffe, an MD candidate who interrupted his medical studies to take a PhD in computer science, then went back to get his MD, performed his internship and residency, and now is an assistant professor of medicine at Stanford. MYCIN serves as a consultant to a physician (the user) on infectious diseases a patient may have, in partic-



EDWARD A. FEIGENBAUM: "For people in the AI field, this really is the best of times."



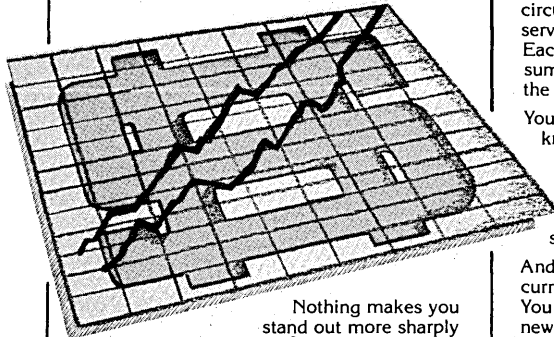
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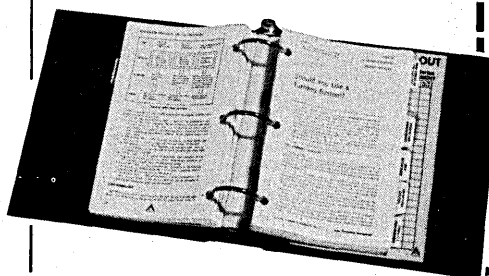
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535

NEWS IN PERSPECTIVE

ular meningitis infections. Provided with facts about a patient, the system comes up with a diagnosis, asks more questions about the patient, then recommends a therapy.

In the course of developing lines of reasoning that lead to the diagnosis and therapy recommendations, it allows the user to question those lines of reasoning. It provides English-language, well-reasoned explanations as to why it believes what it believes, but the physician is in no way obligated to follow MYCIN's recommendations. The "expert" for this system consisted of a number of people at the Stanford Medical School's infectious disease group, people who worked with the AI researchers for about three years to develop the set of facts and heuristics encompassing this particular discipline.

An expert system, then, consists of two parts. One is the knowledge base that contains the facts and heuristics of a particular discipline—blood infections, in the case of MYCIN. The second is an inference procedure with which to reason about the knowledge base. The latter fragment, without the medical knowledge base, was subsequently split off and dubbed EMYCIN. It is, in effect, an inference engine.

"If you add to an inference engine the rules for pulmonary function diagnosis," says Feigenbaum, "then you get another system, which we call PUFF." The

One type of AI system being developed is called an expert system.

first version of PUFF, using EMYCIN to perform the inference procedures, was built in a few weeks. It is now in daily use in the pulmonary function testing laboratory of Pacific Medical Center in San Francisco, running on a PDP-11.

EMYCIN has also been used to construct a consultation system for structural engineers in the aerospace industry (called SACON, for structural analysis consultant) and for a system for diagnosing and treating computer systems failures.

"So here you see one of the trends in knowledge engineering," says Feigenbaum. "We are beginning to develop packages, tools, for making the job of the knowledge engineers who follow us easier." He mentions another such package, called AGE (attempt to generalize), described as a system to isolate inference, control, and representation techniques so that it, too, can be used in various fields.

With the wider availability of a variety of such tools, several of these systems are finding broad applications in the real world. The granddaddy of the expert systems, DENDRAL, with which Feigenbaum himself has been associated, is said to be in use in hundreds of labs around the U.S., in Australia, and in England. It is a system that aids in the analysis of mass spectra and



D. RAJ REDDY: "Essentially, kits with voice input and output in chip form will be available for system integrators of various types."

other kinds of physical spectra of molecules. Another expert system called Intern, developed at Carnegie-Mellon Univ., is said to be "the hit of the medical field." It is a consultation system for doctors of internal medicine, and is said to have almost 500 diseases in its knowledge base. Rand Corp. developed a system for the Navy to perform threat evaluations, and a system called R1 assists configuration engineers at Digital Equipment Corp. in configuring VAX systems ordered by customers.

Capabilities of this sort are not lost on Texas Instruments, which has had an AI group for almost two years, now comprised of more than 20 people. "We're in the AI business," says Mark Miller of that group. He says the research team has two main thrusts. One is in education, the other in expert systems. He sees an important tie between those two.

"Expert systems provide you with, among other things, an explicit knowledge base that can be used for explanation in the teaching situation. Conversely, studying education gives you some idea of how to build expert systems that are able to acquire new knowledge."

The TI group, as at other research centers, is working on the design of a programming environment. But it is also working on things like an intelligent tutor, adaptable and easy-to-use screen-oriented editors, and expert systems for VLSI design—another narrow discipline where there are very few experts and where AI hopefully can help make up for the personnel shortage.

"We're particularly interested in providing what we call an intelligent help system," says Miller. "The idea there is to be able to watch the user as he's using the system, to build a model of what he knows and what he doesn't know, what things he understands. And then when he asks for help . . . be able to provide something a little bit more informative than what he cur-

rently gets from most systems."

Expert systems are also a natural for Schlumberger. One of the oil-field services it performs requires the lowering of instruments down oil wells; these instruments record various kinds of geophysical measurements in the well. The recordings, called logs, are sold to customers who use the data to help make decisions about the well and the drilling activity. The company's second service is the sale of interpretations of the logs, what the logs say about conditions around the hole in the ground.

"The initial interest in AI at Schlumberger grew up from the fact that our services are largely based on expertise," explains David Barstow. "We have had over 50 years of experience at taking the logs and making interpretations, and we've become very good at it." Again, there are but few such experts. So the company is looking into expert systems "as a way of propagating that expertise." In addition to the Schlumberger Doll Research Center in Connecticut, the company is also setting up a new AI center at Fairchild.

Aside from expert systems, the results of other AI research are slowly beginning to appear in industry. Automobile manufacturers are leading in the use of industrial robots, the primary research efforts for which are taking place at General Motors, Stanford, SRI International, and the Japanese makers of Toyotas. D. Raj Reddy of Carnegie-Mellon claims that a Toyota factory, for the same productive output, has half the floor space of a typical auto plant in the U.S., and requires only a third of the capital investment and only 15% of the inventory. In the U.S., he added, next to each machine tool is a week's supply of parts; Toyota has only two hours' supply.

But industry has been slow in applying the fruits of AI research in robotics and vision. More apparent have been consumer products that apply some voice recognition

An expert system consists of two parts—the knowledge base and an inference procedure.

and voice generation techniques. Texas Instruments took the consumer world by storm with its advanced Speak-and-Spell machine for children. And now, after some two years on the market, TI is making available the chip set for that device in kit form. National Semiconductor more recently came out with a chip with a limited vocabulary at lower cost.

"So, essentially, kits with voice input and output in chip form will be available for system integrators of various types," says Reddy. And we can expect to start seeing speaking appliances and cars that talk back at you. It's even been suggested by TI that the speech chip business would become larger than any other chip, including memory circuits.

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NEWS IN PERSPECTIVE

Larger systems that recognize utterances of isolated words are available from such companies as Threshold Technology, Dialog, Interstate Electronics, Heuristics, and Nippon Electric at prices from \$200 (Heuristics) to \$60,000 (NEC). The latter, says Reddy, uses a lot of special-purpose hardware and is probably the best performer of the lot. He explains that it takes a fast processor to recognize a limited vocabulary in real-time, one that can execute from 10 million instructions per second to 100 MIPS. Move to a larger vocabulary and expect the recognition of connected speech and one might need a Cray-1 computer. He added that a number of companies are working on specialized systems with the power of 10 MIPS to 20 MIPS on a single chip. This is expected to bring the cost of voice input devices within the range of toys—\$10 to \$20 in large quantities, rather than \$200 or \$2,000.

Reddy sees speech systems showing up in three categories of applications. One is for data entry, as in inventory systems or in product inspection. A second he calls command-and-control, as in the sorting of parcels or mail, on-board mobile carts, and in voice programming. A third is information retrieval, a form of data base inquiry.

He also looks for the adoption of vision systems in manufacturing, particularly in applications associated with inspection,

materials handling, and assembly. In the military, vision systems might be used for the navigation of Cruise missiles, in photo-interpretation, in cartography, and in object tracking using sonar or radar. In medicine, he said, they are already being used in blood cell and X-ray analysis, and in the future will be used in tomographic and ultrasound analysis as well.

As Reddy speaks of work in fields like speech, vision, and robotics, one can see convergence, a melding of features and capabilities, in future products. And Reddy

The AI group at TI is working on the design of a programming environment.

himself mentions such things as electronic locks, electronic identification and security systems, remote diagnosis and repair, talking dials and meters, and intelligent light bulbs. Intelligent light bulbs? He defines them as bulbs that go on when you enter the room and go off again when you exit. But he says one bulb maker is thinking in terms of the ability to sense when sunlight is entering an artificially illuminated room and trigger a 20% drop in light output, not only conserving energy but perhaps also prolonging the life of the bulb.

"In general," he says, "anytime you have problems of data acquisition, com-

mand and control, or information retrieval, you can begin to have intelligent assistants, and many of them fairly cheaply."

He mentions the impending unbundling of telephones in the U.S., the time approaching when each of us will have to buy our own phones. That creates a very large market for phones, leading to the design of new features and capabilities by the interconnect companies, as well as by Ma Bell. Already there are models that store frequently called numbers. The next step is a model that responds to voice commands of frequently called names: "Get me George Hall." We won't need our index fingers any more except to stir our coffee.

"Once you have that kind of a system," says Reddy, "with an appropriate display and sufficient power to do voice processing, things like a calendar and reminder processes become very easy." Could a built-in phone directory be far behind?

Stanford's Feigenbaum, too, sees the largest application of AI in home entertainment and consumer electronics. "That's where the most bucks are," he explains. As Reddy says, "Anytime you can sell 10 million of anything," you can get unit prices down to where the market size can become very large. But Feigenbaum adds that in the stage beyond the handheld calculator and games will be a handheld

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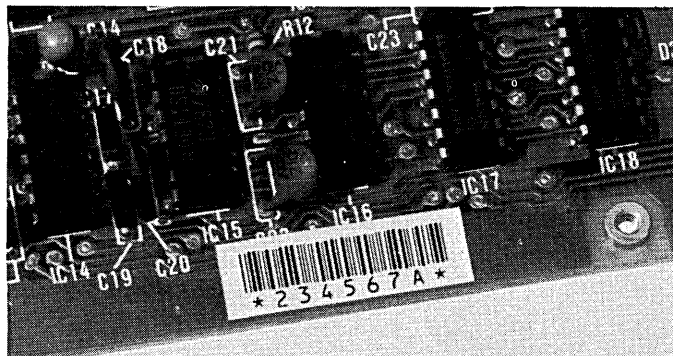
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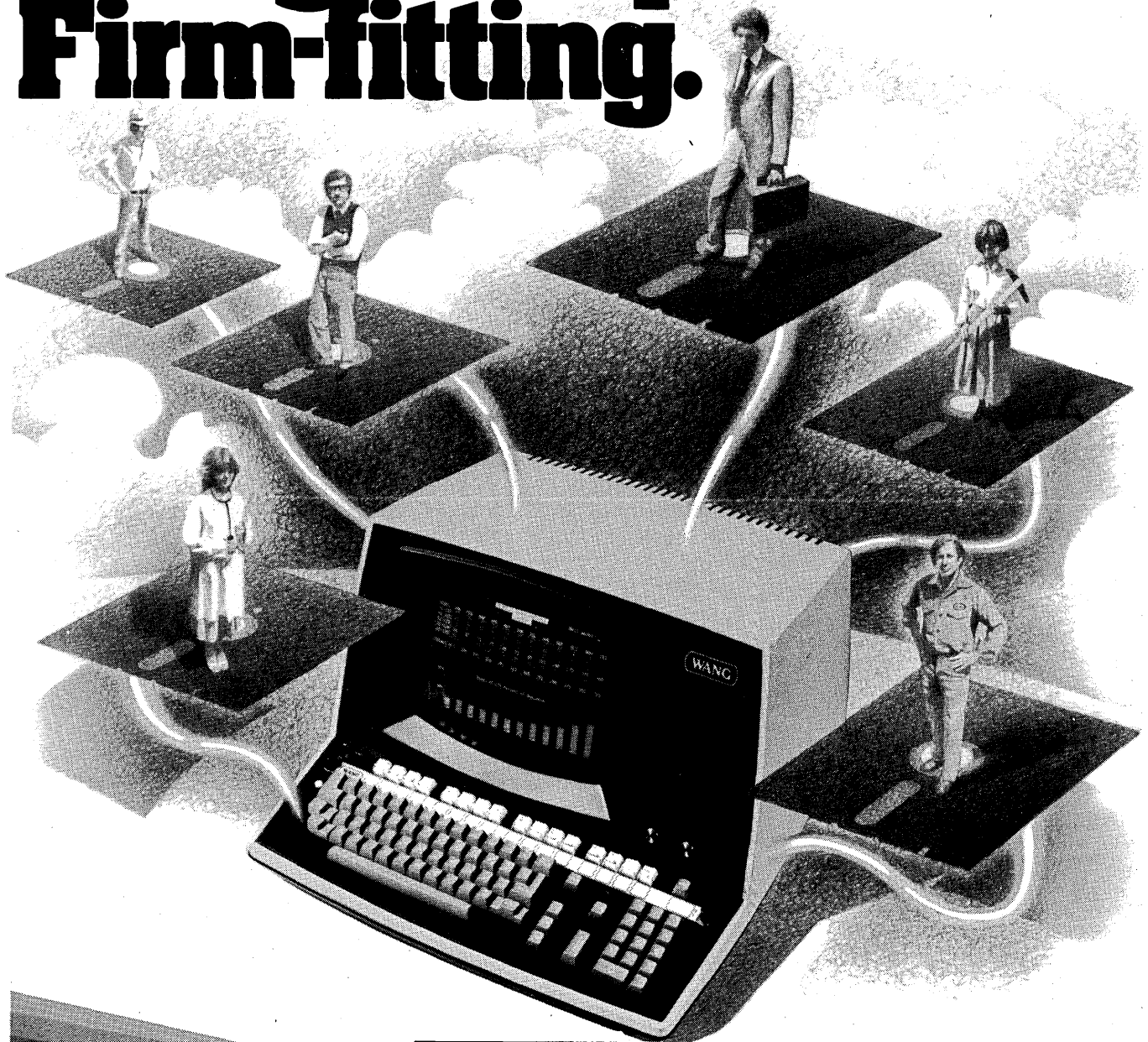
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symbol manipulating, intelligent assistant. A preview of this capability is afforded by devices that accept modules to perform simple language translation.

In the current decade, says Feigenbaum, there will be such devices with a small display and, for example, a plant-care module. The user will be able to key in that a house plant has developed white spots on the leaves. The program asks that you scrape off the white spot and describe the color underneath, and on the basis of your response will recommend the proper treatment.

But the Stanford academician, while noting the increased tempo in the lives of AI people, the many types of projects under way, and the demand for advice from those in government and industry, also expresses concern—concern over the need to turn out more people, as he says, "to fuel this science which is now turning into a technology."

—Edward K. Yasaki

COMMUNICATIONS

HOW SBS SERVICE STACKS UP

With service planned for early '81, it's time to take a look at how SBS compares to similar offerings.

As Satellite Business Systems (SBS) approaches the scheduled inauguration of its service early in 1981, users must evaluate how SBS compares to existing similar offerings.

Based on service details filed with the Federal Communications Commission earlier this year, it appears that SBS has slowly begun to modify its original goal of serving only the largest network users. In addition, the services planned by SBS appear to be most similar to the features that have been provided for some time by American Satellite Co. (ASC).

While basic differences exist between the two satellite vendors, a comparison based on user operating requirements, growth patterns, and applications indicates that the service offerings have important similarities—both now and in the next several years.

The IBM, Aetna, and Comsat General partners that make up SBS have defined three principal services. To be phased in from 1981 to 1982, these offerings actually will provide a variety of services aimed at small, medium, and large customers. The

initial service called Communications Network Service A (CNS-A) is aimed at the original very large nationwide network user that SBS has courted for a number of years. CNS-A includes dedicated customer-premise earth stations for integrated applications in the three major areas of computer-to-computer data transmission, high speed document transfer via facsimile, and video

While exact details of the SBS services are publicly available, they don't reveal the whole story.

teleconferencing. This service includes a minimum of three customer earth stations to be priced at \$12,500 each. A basic configuration for the CNS-A service, according to SBS, would include facilities that cost \$109,250 per month.

Since CNS-A is clearly beyond the requirements of many network customers, SBS has modified its basic concepts by introducing shared earth stations which will help lower costs and increase the utilization levels of existing facilities. The shared service is called CNS-B and, while it is characterized as a private network service, it combines dedicated earth stations with shared earth stations called Service Points. The CNS-B service has a minimum requirement of two dedicated earth stations at a reduced cost of \$7,500 per month plus \$3,000 per month for each Service Point.

Both CNS-A and CNS-B tariffs also include transmission capacity assigned in blocks called Transmission Units, which are available on either a full-time 24-hour basis or on a demand basis at an hourly rate. In addition, a user must select Connection Arrangement Units for analog voice-grade, digital nonswitched, and digital switched facilities to round out the CNS cost structure.

The CNS-B service will at first be available only for voice applications with 56K bit/sec digital facilities to be added later for data transmission. By 1982, off-net extensions will be available from the CNS-B service to interconnect with the switched telephone network.

The third major offering will provide a message service aimed at smaller users of WATS and long distance dial services now available from the telephone company. This projected message service is scheduled for 1982 and rates will be filed with the FCC next year, SBS said.

The exact details of the SBS services are available from the firm's representatives or in the public documents filed with the FCC, but they don't tell the whole story. In a recent interview, Jerry Engle, SBS director of tariffs and economic analysis, said the services "give us access to the total market. What we find is that the marketplace starts with MTS (Bell's basic dial Message Toll Service). Then it goes to WATS, then private line with the Electronic Tandem Switch

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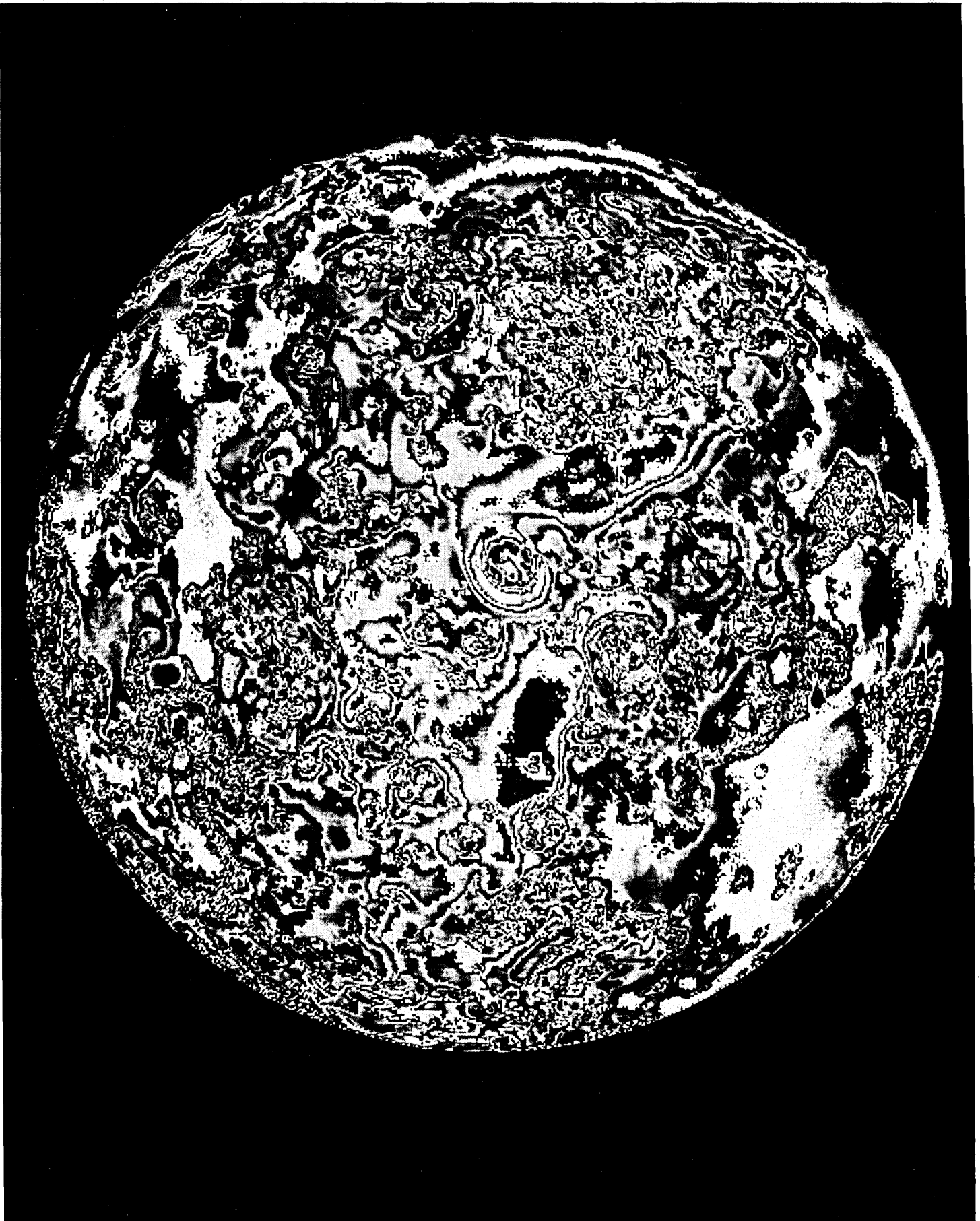
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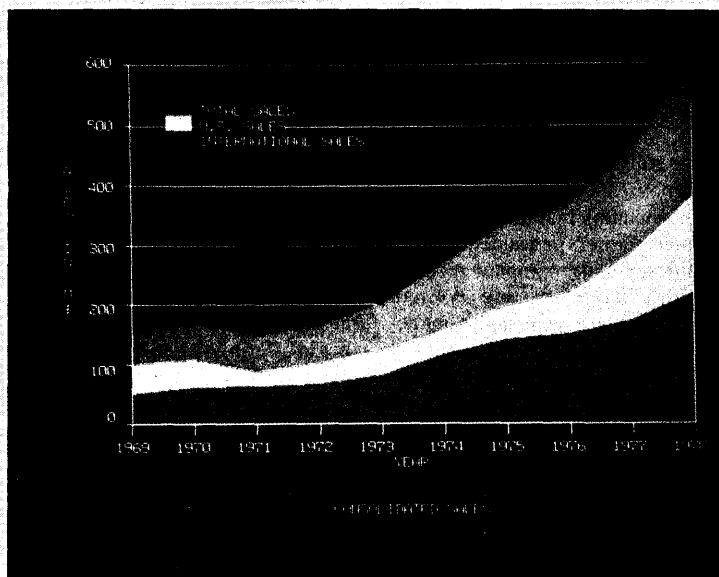
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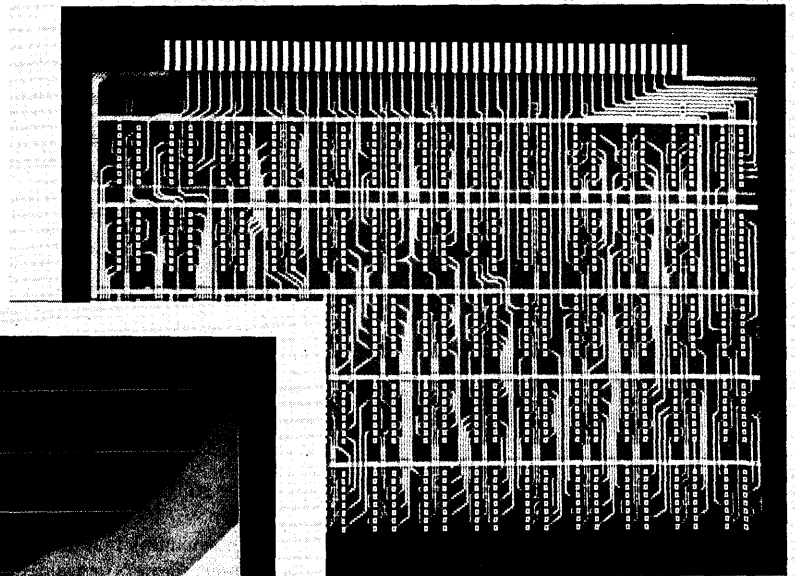
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Typical management information graphic from Tektronix color terminal. (Reduced from Polacolor 8 x 10 print.)



Computer-aided design of IC chip from Ramtek color terminal. (Reduced from Polacolor 8 x 10 print.)

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NEWS IN PERSPECTIVE

(ETS) for the CNS-B customer, and finally the Common Control Switching Arrangement (CCSA) or Enhanced Private Switched Communications Service (EPSCS) for the CNS-A customer."

Asked if he was really describing an upward migration path to take the small user from dial-up service all the way through to large private network, Engle said, "Sure, that's right."

According to Engle, the CNS-A service is most economical in the range of 20 to 25 earth stations, and he classifies this as the IBM, GM, GE-type network. Using extensive SBS computer modeling, this network typically will have access lines from local phone companies that are less than 100 miles to the nearest earth station. To stay within this 100 mile limit in the CNS-B service, SBS developed 20 geographically optimized sites for shared earth stations. And why the 100 mile limit? Because this represents a maximum of 25% of the user's monthly phone bill, Engle explained.

The typical CNS-B customer will have about 10 to 15 nodes with three to five dedicated earth stations, the remainder being shared Service Points. Both CNS services are strictly private line, although the B service has off-net extensions into the switched phone net. But the message services are aimed squarely at AT&T, Engle said. One is an MCI Execunet-type service which SBS projects as having "almost no revenue" or about \$25 million in 1983. But the other is an Out WATS type service that has more potential, he explained. This kind of service includes a dedicated line from a user location to the nearest telephone company central office. The next step up from this customized Out WATS is to private network and no other vendor besides AT&T is really focusing on it. While both MCI and Southern Pacific have this type of service, neither is expanding it right now, he said.

On the technical side, SBS will be operating in the 12 and 14 GHz frequency band using 5.5 and 7 meter earth stations, and the company is quoting 99.5% system availability to potential users. SBS points out that its all-digital time division multiple access (TDMA) transmission technology together with switching capability makes it superior to other systems.

The emergence of SBS and its service offerings has been monitored carefully by American Satellite Co. (ASC).

According to Kurt Thoss, director of specialized networks, ASC concentrates on customizing a service to fit a user's requirements. Rather than including a total commitment to an integrated corporate network such as CNS-A, ASC usually starts with only two 56K bit/sec channels, allowing the customer to move gradually into increased satellite facilities once satellite services have been tested.

ASC operates in the 4 and 6 GHz frequency band and offers users a choice of 3,

SATELLITE SERVICE COMPARISON

	ASC	SBS
system availability	99.9%	99.5%
4-6GHz band	yes	no
12-14 GHz band	1982	1981
encryption	yes	1982 (est.)
shared service	yes	1981
antennas	3,5,7,10 meter	5.5,7 meter
minimum bandwidth	56K bits	224K bits
FDMA	yes	no
TDMA	1981	1981
digitized voice	yes	1981
rainfall attenuation	no*	yes
no. of customers	12	8 (1981)
dedicated links	yes	1981
bit error rate	10 ⁻⁸	10 ⁻⁴ to 10 ⁻⁶
no. states covered	50	48

*4-6 GHz

5, 7, and 10-meter earth station antennas, depending on the bandwidth required. Three-meter service handles a typical 56 bit/sec link, while 10-meter has the capacity for a full 64M bit transponder, Thoss explained. ASC has 99.9% channel availability mainly because there are rainfall attenuation problems at the higher SBS frequencies and ASC does not operate there. While the 99.5% quoted by SBS seems like a small difference, users with critical applications must either cope or go to expensive solutions such as secondary earth stations for backup.

SBS' Engle admitted that violent rainstorms such as those that occur as thundershowers can result in degraded system performance. He added that SBS tests and research show that data is more affected than voice by the rainfall attenuation and he said that most of the violent storms typically occur in early evening hours, which he described as off-peak usage hours for most potential SBS customers.

Despite the attenuation during heavy rainfall periods, Thoss said that ASC will also be operating in the higher 12 and 14 GHz band by 1982. This will mean that users who cannot tolerate any system degradation will be able to use the ASC 4 and 6 GHz band for backup, he said.

Up to now, ASC has been primarily a resale carrier, meaning that it used satellite capacity of other carriers and added specialized capabilities. But the company recently purchased 20% of the existing Western Union Weststar satellite system and it has negotiated for 50% ownership of advanced Weststar capacity, which will include service at the higher frequencies by 1982, Thoss said. Another recent business change was an agreement with Continental Telephone Co., which gave Continental 50% ownership of ASC along with an equal interest by Fairchild Industries, which originally was ASC's parent company. As part of this restructuring, ASC changed its name from American Satellite Corp. to American

Satellite Co.

The Continental alliance gives ASC access to the Executone division, which could provide PBX technology. And the telephone firm recently purchased a majority interest in Network Analysis Corp., a network consulting organization which could provide expertise to ASC. Industry observers also point out that Continental has a physical telephone plant in place that could provide ASC with switching technology to compete more closely with SBS.

While ASC officials won't say much about using Continental switching and other technology, they point out that ASC already had plans to introduce all-digital TDMA into its offerings before the recent merger. At present, ASC uses single channel per carrier (SCPC) techniques that employ frequency division multiplexing compared with the TDMA time division multiplexing scheduled for the next year. SBS utilizes only TDMA in its system.

The biggest selling point of ASC is that it has real customers and is turning up new ones on a continuing basis. Thoss said

The biggest selling point for ASC is that it has real customers and is turning up new ones on a continuing basis.

Sperry Univac, General Dynamics, Boeing, and similar large companies are ASC customers. He also revealed that ASC will begin offering shared satellite service called Metroline for Standard Oil of Indiana and other users in three major cities.

A recent customer is Abbott Laboratories, which will have an ASC link between Chicago and Puerto Rico that will include voice, data, facsimile, and may later include freeze-frame video teleconferencing. Thoss specifically points out that ASC has offered teleconferencing for some time. And instead of providing only high cost,

high bandwidth, full motion video such as SBS has, ASC has pioneered in freeze-frame and one-way video. Such variations often give users teleconferencing features with reduced bandwidth and lower cost.

"Rather than requiring the customer to switch totally to our system and equipment, we concentrate on providing features that will allow users to keep their existing facilities and add satellite capacity," he pointed out. ASC has routinely been providing users with satellite delay compensation units, encryption, digitized voice, teleconferencing, and other features not yet available from competitors, he said. ASC can handle double satellite hops for international data transmission, connecting with gateway facilities to international carriers; SBS provides only domestic service.

Since ASC is essentially a specialized carrier, it signs individual contracts with each customer for the specialized services to be provided. But Thoss said ASC is priced lower than AT&T's Dataphone Digital Service (DDS) in typical nets such as coast-to-coast, and the company will be competitively priced with SBS because of its system flexibility and service options.

—Ronald A. Frank

A NEW LINEUP AT AT&T

On Sept. 1, the world's largest company, American Telephone and Telegraph, began a metamorphosis that is designed to enable the company to meet the challenges of its second century. Among these challenges are compliance with emerging and expected government regulation, entry into areas beyond the fringe of regulated operations, adjustment to new technologies, and the development of an industry—data processing—that has confused the definition of communications which served Bell during its first hundred years.

Among the particulars of AT&T's announced plans are a reorganization of its top management, acquisition of stock in partially owned subsidiaries, a consolidation of employee pension funds that will produce an immense pool of capital, and the welding

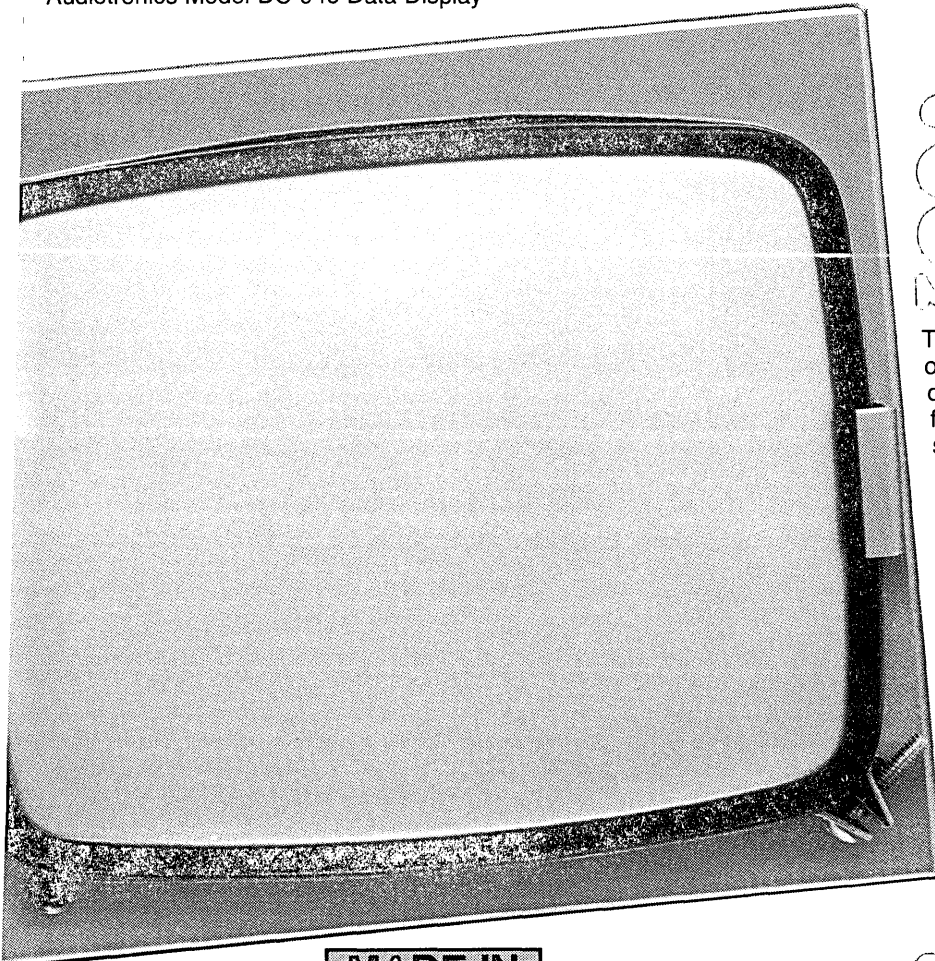
of various foreign operations into a new and more effective structure. In doing all this, AT&T is girding for a battle over unregulated but hotly contested business opportunities that could be a major source of growth.

For AT&T, growth must be phenomenal to be noticed at all. The company has a million people on its payroll now. Services, including four-fifths of the telephone business in the U.S., as well as other related activities, bring in some \$45 billion a year.

As a technology company, AT&T primes the pumps through its Bell Labs, whose 18,000 researchers and support personnel soak up \$1 billion in funds; in return, they have contributed to communications technology as well as to data processing via inventions and developments as diverse as the transistor and the Unix operating system.

To its shareholders, AT&T may be a company, but to most of its customers, AT&T is *the* company, the phone company. The love-hate relationship between Bell and America includes dealings with government, business, and individuals who simultaneously boast of the best telephone system in the world and seek more service for less money, who find that at times they can hardly live with AT&T and usually cannot

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NEWS IN PERSPECTIVE

survive without the organization.

So when AT&T changes, America changes, and as the nation matures, so does the largest business entity. Cause and effect in these matters become confused, while even a description of what is going on is difficult.

AT&T's move was announced on Aug. 20, just 10 days before action began. The decisions involved must have taken quite some time to be made, but one single force that may be considered the prime mover has been named by various observers and by AT&T itself: the Computer Inquiry II.

This investigation is the Federal Communications Commission's effort to separate communications from computing, a task that cannot be completed to the satisfaction of all the involved parties and which may be the start of an endless series of legal and business maneuvers.

The FCC said, last April 7, that if AT&T wants to keep moving in some directions it has hinted at, it can do so only through the establishment of a subsidiary, clearly defined in scope, that will compete in new markets unfettered by the regulations that define possibilities for the rest of

AT&T, the public utility with its public responsibilities.

The FCC wants AT&T to meet its new rules by March 1982, which may subject AT&T to a pace it cannot meet. But the company sure seems to be trying. The move toward the 1982 deadline must be made without AT&T's ignoring the 1956 consent decree, which had AT&T agreeing, under pressure from the U.S. Department of Justice, not to engage in unregulated business. This has kept the company in the public service business, although perhaps not to the satisfaction of all its competitors. How the apparent conflict between the 1956 decree and the 1980 inquiry determination will be resolved remains to be seen.

In the meantime, AT&T's competitors in the unregulated markets, companies like IBM (and its partially owned SBS), Tymnet, GTE/Telenet, Xerox, MCI, ITT and so forth, have to face some new and, presumably, tougher going as they try to market specialized communications services.

"The move was inevitable," says Sanford J. Garrett, vice president of New

One single force may be considered the prime mover: the Computer Inquiry II.

York stockbrokers Paine Webber Mitchell Hutchins. "It makes sense, given the size and scope of the unregulated [communications] market. The data processing side [by itself] is extremely dynamic, and it's huge."

In order to run the reborn AT&T, the company has made changes in its executive lineup. The names of these executives, more familiar to insiders than those in the outside world, will soon be better known—certainly by AT&T's adversaries.

Robert E. Sageman, former executive of AT&T's Long Lines, is going to head AT&T International, which spans all the company's overseas business.

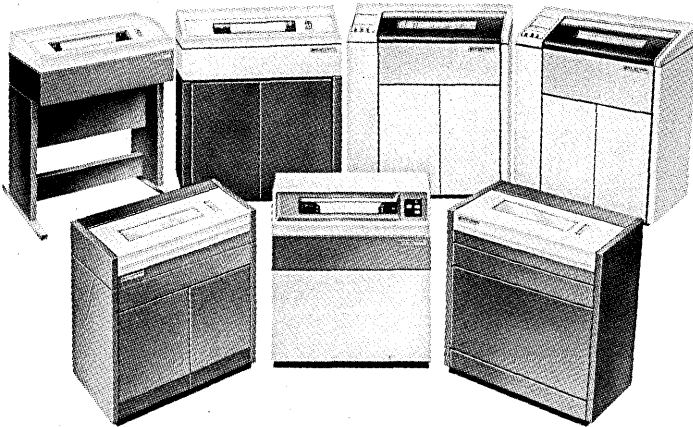
William M. Ellinghaus, AT&T's president, will head all the regulated activities within the U.S. His lieutenants include Richard R. Hough, executive vp for networks; Kenneth J. Whalen, executive vp for regulatory and staff activities; and William G. Sharwell, vp of corporate planning and now vp of staff.

James E. Olsen will oversee all unregulated operations, supported by Thomas E. Bolger and Charles E. Hugel. Bolger will run business marketing, Hugel residence and public service.

Morris Tanenbaum, formerly ceo of New Jersey Bell, will handle public relations, labor relations, and personnel as well as take over corporate planning. Tanenbaum will now report directly to AT&T's chairman, Charles L. Brown. Under Tanenbaum will be Paul M. Viller, named vice president of corporate planning.

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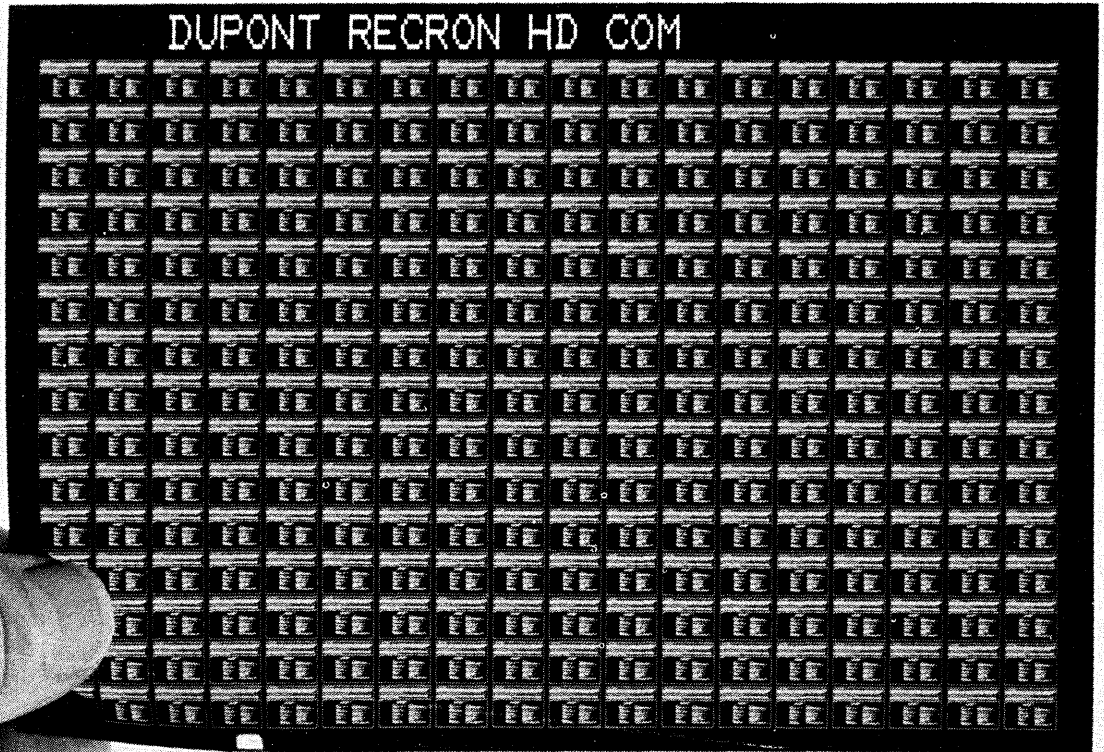
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the top penetrate all levels of the Bell family of companies, AT&T has decided to buy up the stock of subsidiaries it does not completely own. These subsidiaries are Mountain States Telephone & Telegraph, New England Telephone & Telegraph, Pacific Northwest Telephone, and Pacific Telephone & Telegraph. (The acquisition of common stock of the last of these will be accompanied by an AT&T purchase of a preferred stock issue.)

The value of these four acquisitions is about \$1 billion; the purchases will be made by AT&T's exchanging its shares for

those of the subsidiaries.

In consolidating operations and finance, AT&T will merge its various pension funds into two new ones, a fund apiece for management and for nonmanagement employees. Presently, Bell has 33 separate funds whose invested assets come to an aggregate worth of approximately \$28 billion. Moving all that money around will take the company until late next year. No information about the investment policy changes that might be made has been discussed by AT&T yet, nor has any specific effect on financial markets been anticipated

by Wall Street experts.

Along with all the domestic change, AT&T is going to consolidate independent efforts now made by Western Electric International and American Bell International (which is a corporation that has issued only one share owned, naturally enough, by AT&T) into AT&T International. ATTI, already in temporary quarters in Morris Plains, N.J., will provide goods and services to multinational companies, foreign telecommunications authorities, and overseas businesses. ATTI is expected to actively seek business that had previously been ignored for one or another reason, even though it was possible for AT&T to perform the required work. ATTI's offerings will most likely include everything from consultation on long-term national network planning to the provision of PBX gear.

While AT&T's official posture is that it "is just getting started," the reaction was

In order to run the reborn AT&T, the company has made changes in its executive lineup.

felt, although not openly discussed, by the company's present and future competitors.

"I think we all overreacted to the move, at least at first," says a GTE/Telenet spokesperson. "AT&T has to perform surgery on itself . . . and that will take time."

Time, indeed, is what AT&T may seek more of. Chairman Charles L. Brown has already said 1982 is too soon for the company to reorganize, and is pressing for a date more like 1988. But Tom Casey of the FCC's Common Carrier Bureau says his group is hoping to hold the line on the phone company—or block any unregulated offerings from AT&T.

And the reshuffling of AT&T will require a lot of fancy bookkeeping, at least according to Paine Webber's Bradford Peery. "Because the depreciation schedule for some assets is too long, these assets are overvalued on the company's books. AT&T has got to decide how to deal with this."

The impact of any fast moves could be a mess the company's thousands of shareholders will have to live with, as will bankers, bondholders, institutional investors, and regulatory bodies that look at the company's worth and writedowns.

It seems that every aspect of AT&T's operations will cause a stir when it is changed. The problems will be worse in areas that are already a problem for the company, like Advanced Communications Service (ACS).

ACS has been a thorn in AT&T's paw for years. The delivery of the announced network service is about two years overdue already; the blame has been placed on technological problems. Now organizational problems will be added to the list, and things will take even longer.

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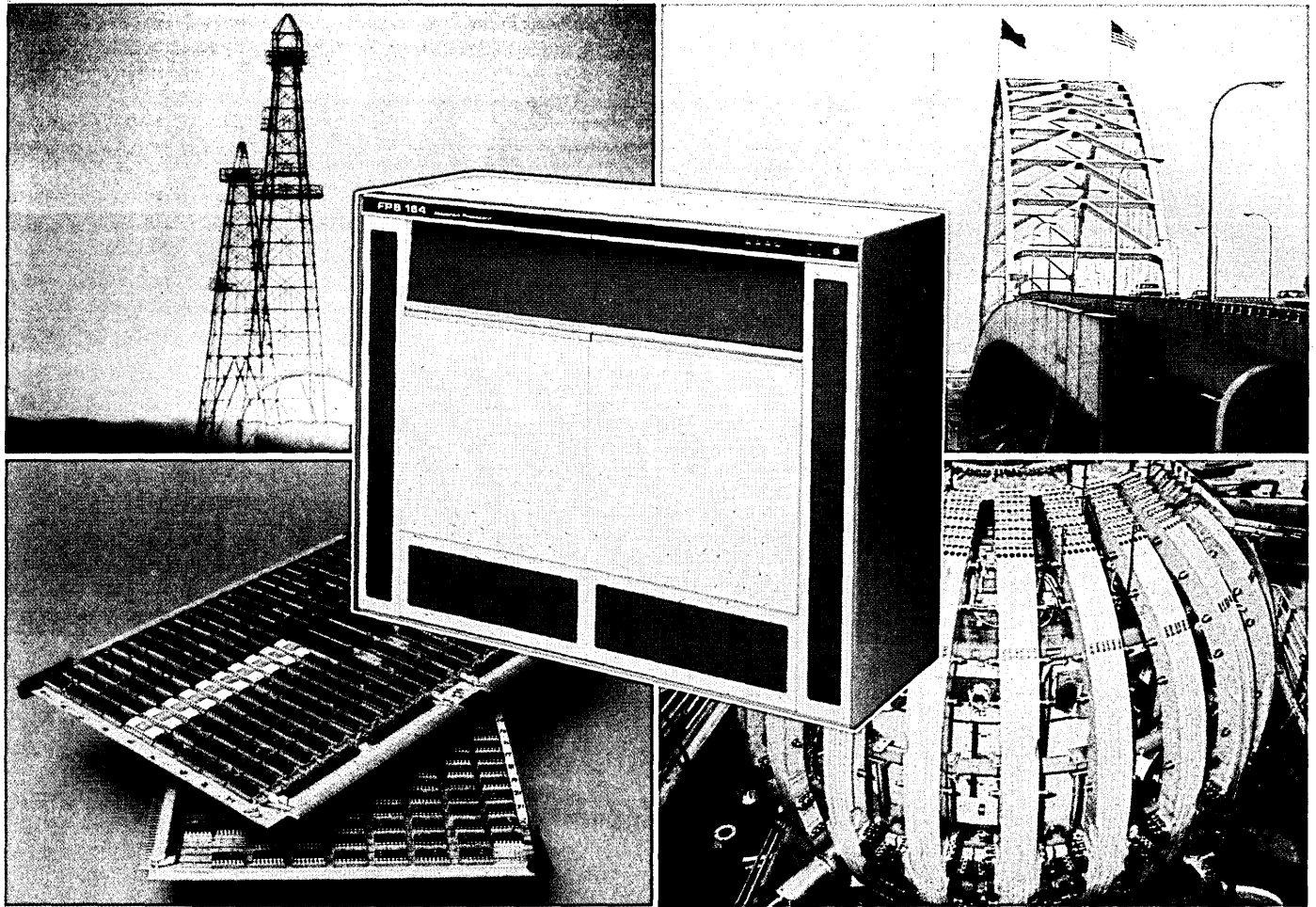
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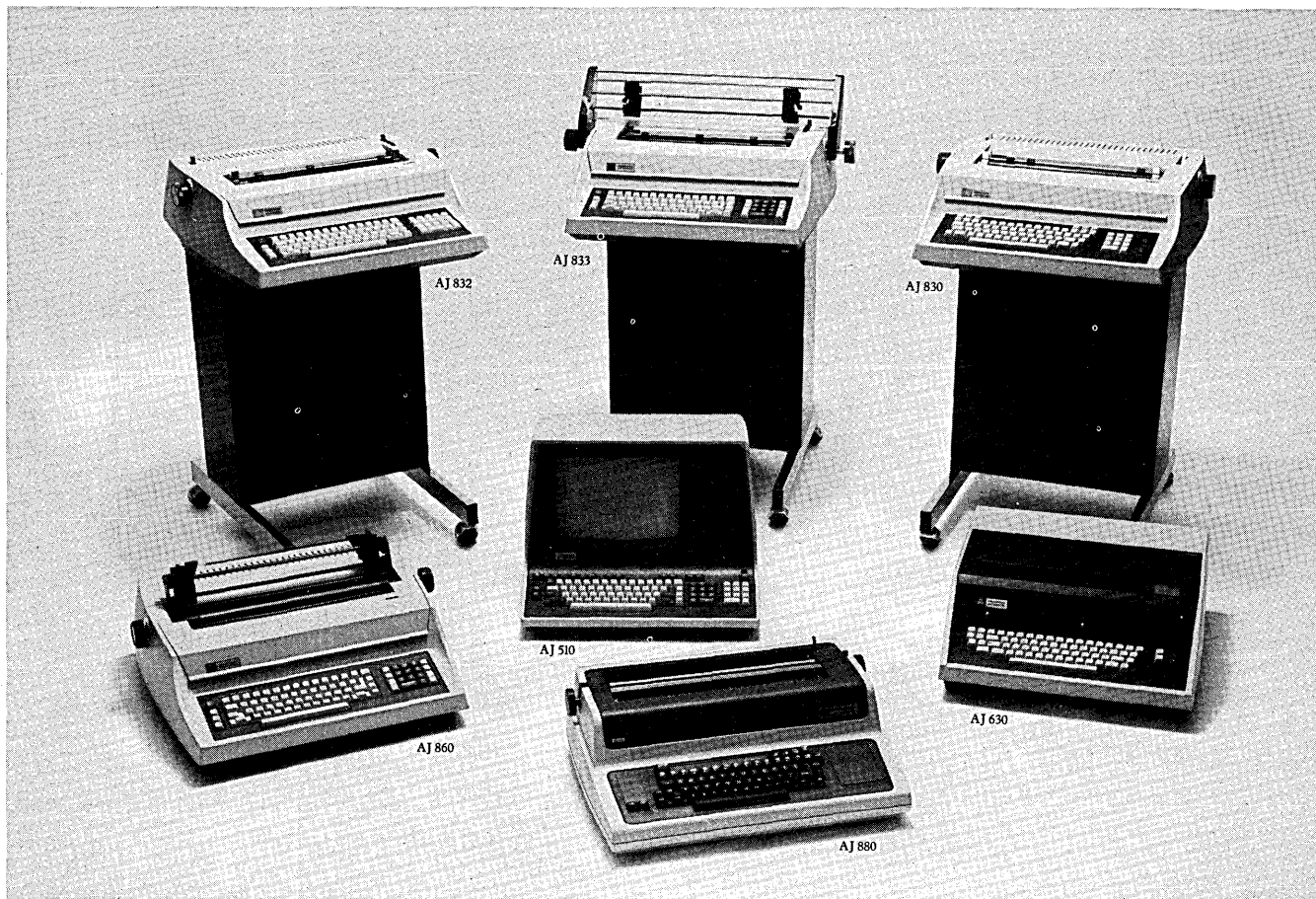
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NEWS IN PERSPECTIVE

Don Haback, of the Gartner Group, figures that ACS won't be around for another two years. But when it comes, it will be offered in conjunction with some kind of "intelligent wire" in offices that will have 10 times the capacity of Xerox Corp.'s announced Ethernet. This kind of offering will pit AT&T directly against IBM, a contest that has been on the way—in the view of nearly all the industry gurus—for some time.

"It will be interesting to watch [the battle of] AT&T and IBM," says Haback. "IBM will soon go into the PBX business and is on the way with Satellite Business Systems. AT&T will, of course, defend what it views as its turf."

Also in the future are voice store-and-forward systems, already announced and immediately put in the middle of a war between answering services and telephone companies (which never cared much for each other anyway). And later will come information services, stemming from an electronic yellow pages that has already been tested in several cities and from audio Dial-A's that give many telephone users access to data as diverse as ballgame scores and stock quotations. Can viewdata be far behind?

In the meantime, there will be a lot more speculation than substance. AT&T itself cannot fully define its future, for it has hardly clarified its intentions. This, of course, will not stop commentators and competitors alike from hotly debating possibilities that AT&T might or might not have thought of. And in doing so, these interested parties will most assuredly make use of the company's communications facilities, paying a small price for the privilege of voicing their views.

—Peter Krass

DEC SETS X.25 GOALS

Bit by bit, DEC is rounding out its Digital Network Architecture.

Digital Equipment Corp. has made a major commitment of ongoing support for the international X.25 communications structure. Rounding out the latest phase of its Digital Network Architecture (DNA), DEC said it ultimately intends to provide X.25 compatibility in six North American and European public data networks for users of most of its major operating systems.

Called Packetnet, the new DEC X.25 software product initially provides X.25 compatibility for only one major operating system and two public data nets—Datapac

in Canada and Transpac in France. The Packetnet program will allow users of RSX-11M, RSX-11S, and RSX-11M-PLUS operating systems to implement X.25 links on the Canadian and French public packet networks with few changes in the DECnet operating environment, according to Roy Graham, group product manager for distributed systems.

The Packetnet software will eventually be expanded to cover support for Telenet in the U.S., Datex-P in Germany,

The first version of Packetnet is designed for links that have PDP-11 processors at both ends.

PSS in the United Kingdom, and DN1 in The Netherlands. Also, the program will be upgraded to cover DEC equipment running under VAX/VMS, TOPS-10, and TOPS-20 operating systems, although Graham would not give a timetable for when the additional capabilities would be introduced.

The initial Packetnet software for the PDP-11 processor family provides modifications that change the link level of DECnet from the DDCMP protocol to X.25. The basic software costs \$4,000 and an enhanced version which includes file transfer and terminal communications features costs \$5,000,

the company said. The software requires 16K words of storage to implement and is used with the DUP-11 single line protocol handling interface. Up to four X.25 lines can be utilized per processor.

The first version of Packetnet is designed for links that have PDP-11 processors at both ends. Later upgrades will include the ability to interface to non-DEC network configurations and hardware, including the recently announced (Feb., p. 66) DEC emulator for IBM's Systems Network Architecture.

The major objective in making a commitment to X.25 support is to demonstrate to users that DEC intends to provide long-term compatibility with emerging public data networks, Graham said. Users will take a slow approach to migrating from private networks to incorporating packet switched links, he added, but DEC intends to make this shift as problem-free as possible.

In many situations users can achieve network economies by shifting to public data nets, but exact savings depend on volume of data transmitted and geographic sites in the network. In some cases users can also profit by shifting from central mainframe-oriented nets to more distributed peer processor communications systems. Each case must be evaluated individually to meet user needs, Graham said.

The Packetnet software will include upgrades to the X.25 structure as it evolves

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NEWS IN PERSPECTIVE

so that users will not be locked out by standards changes. Recognizing that international standards may be swinging away from pure X.25 packet-switched implementations, Graham said DEC is prepared to provide X.21 support for circuit-switched networks when this type of demand develops. Although other approaches may lead to hybrid combinations, X.25 will be "the big deal" for at least the next 10 years, he predicted.

Based on the Packetnet support and the commitment to later upgrades, Graham predicted that between 50 and 100 X.25 nets would be implemented within the next year by DECnet users. DEC has talked to some network customers about interconnecting IBM SNA and DECnet systems on public data networks. These talks have been on a "nondisclosure" basis and the company is not yet ready to talk about specific products, he said.

The Packetnet software for the PDP-11 family is available in 30 days and requires one day of installation time. The X.25 program includes the DECnet customer support plan, which provides various levels of network planning and design assistance as an extra cost option. Although DEC did not release a fixed schedule for additional X.25 products, industry sources said upgrades would probably be announced within the next year, based on previous DECnet introductions.

—Ronald A. Frank



GENE AMDAHL: "This time we will be starting with known information regarding the architecture of the future."

forth in the offices of General Construction Co., the outfit that is building his factory. Among the first pieces of equipment that will be installed in the new company's offices is a computer that Gene Amdahl says is "the smallest we can use to simulate functions for our forthcoming products." It's a Magnuson system, designed by Carl Amdahl. Only two other members of the

Acsys team have been named, although more than four have been chosen.

Financial affairs of this new company will be supervised by Clifford Madden, former vice president of Amdahl Corp. And Gene Amdahl's right hand, Marjorie Terry, who has been with the elder Amdahl since the IBM days more than 10 years ago, is already supervising the complex schedules required to keep technical and business projects running smoothly.

Notwithstanding the top talent brought to bear on the problems of designing and building very fast business computers, the job will be a real test of everyone involved.

"I think it will be tougher in some ways," Gene Amdahl observes. "The competition is certainly advanced over where they had been [when Amdahl Corp. was founded]. The opposition, in the form of IBM at least, is aware that it is possible for somebody to compete with them. They're not going to be sitting on their hands like they did before, thinking how best to maximize their position, assuming no real competitive struggle with somebody else."

But if the competition is tougher, the rules of the game are far better defined these days.

"This time," Amdahl asserts, "we will be starting with known information regarding the architecture of the future." The

STARTUPS

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Facilities for Acsys are still under construction in Santa Clara; the initial plant won't be completed until late October. In the meantime, Gene Amdahl is holding

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NEWS IN PERSPECTIVE

reference is to the never-to-appear IBM project generally called FS or Future Systems. That line of computers was believed to be a new wave that would make the original Amdahl Corp. machines obsolete almost as soon as they could be built.

"We're in a position to compete against something the industry will have to live with for a while," says Gene Amdahl, referring to the expected IBM H Series that all industry observers believe will preserve the users' investments in software, regardless of advances in technology.

It is in technology that Gene Amdahl has proved to be quite a bit ahead of others. The new systems that will come from his company will give "a sterling lead over what I expect competition to have at their disposal." The circuits will be silicon,

The job will be a real test of everyone involved.

as they have been in all the machines Gene Amdahl designed since the days of the IBM 360. They will be very dense, carved out of substrate material using electron beam technology. Acsys will have its own electron beam lab sometime in 1981.

The new machines will not be ready for quite awhile, perhaps not until late 1983 or 1984. But that time, which may seem far off for users running out of computer power today, is not very far ahead for a system to be planned. While the Amdahl clan may not make the Guinness book of records with its 3½ year gestation for a supercomputer, quite a few things will have to go very well for the new company to get a system out the door that quickly.

Some of the ideas that will go into the computer have been proved in existing designs, while others, at least in their initial form, are going to appear in the next products of Amdahl Corp.—a pair of systems generally called the Oslo series by industry observers. Among the innovations in these Oslo machines will be advanced microcode control and a type of multiprocessor architecture that is radically different from that of present machines.

These two ideas, which are now in Gene Amdahl's past, will be rethought and improved upon in any new system. They will have to be, because the expected power of the Acsys product is in the 20 million instructions-per-second range, four times the power of an IBM 3033 and more than twice the power of the Hitachi top-end computer being sold by National Semiconductor. The Oslo machines are still under wraps, but speculation puts them at 11 MIPS to 13 MIPS, or about 60% of the Acsys system in raw instruction processing power.

Acsys is likely to be a smaller company than Amdahl Corp., although not as small as Cray Computer, the other super-system boutique in the industry. "It may be a midpoint between the two organizations

[Amdahl Corp. and Cray] in development. But," Amdahl adds, "in marketing I want to make Acsys a big organization."

One restriction on size will be imposed by Gene Amdahl's philosophy, "to make sure the customers are treated the way you think they have to be treated," something that can get lost as a company grows large.

The customers for systems as powerful as those Gene Amdahl envisions are very large organizations. The key customer is likely to be AT&T, presently the best customer Amdahl Corp. has. Another restriction, or at least intention, of Gene Amdahl is to keep the company from being dominated by any one investor or a small group of investors. Amdahl Corp. is half owned by two shareholders, Fujitsu and Heizer Corp.

The initial funding of Acsys is likely to be different from that of other computer companies. The intention of the founders is to set the company up as a research and development tax shelter, which will probably involve a nominal headquarters outside the U.S. As the organization goes from development to manufacturing, initial investors will be paid out of royalties the U.S. manufacturing organization would owe to the R&D group that owns the designs. First Boston is likely to be the investment banker in this plan, and Oppenheimer &

Co. is also suspected by Wall Street sources of being involved. Precedent for this kind of financial structure may be found outside the computer industry, in the initial funding of Learjet and of DeLorean Auto.

—Hesh Wiener

COMPANIES

NIXDORF TAKES ON IBM

Although its new machines are compatible with IBM 4300 software, Nixdorf plans to sell its own total system.

Nixdorf Computer A.G., the huge German multinational parent to Nixdorf Computer Corp. in the U.S., last month unveiled its first plug-compatible processors, two small 4300-class systems called the 8890 Series. With the PCM bid, the company finally committed the enormous resources it has gathered over the last several years for an imaginative full-system challenge to IBM.

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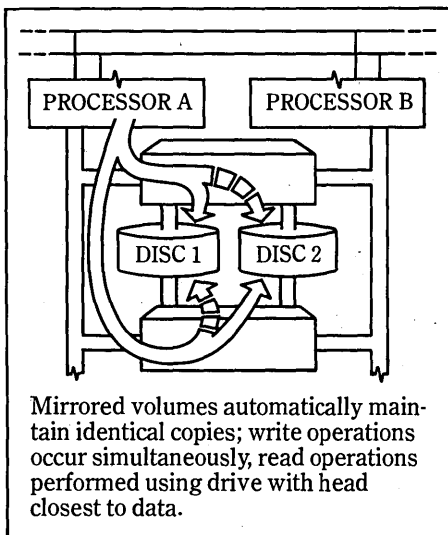
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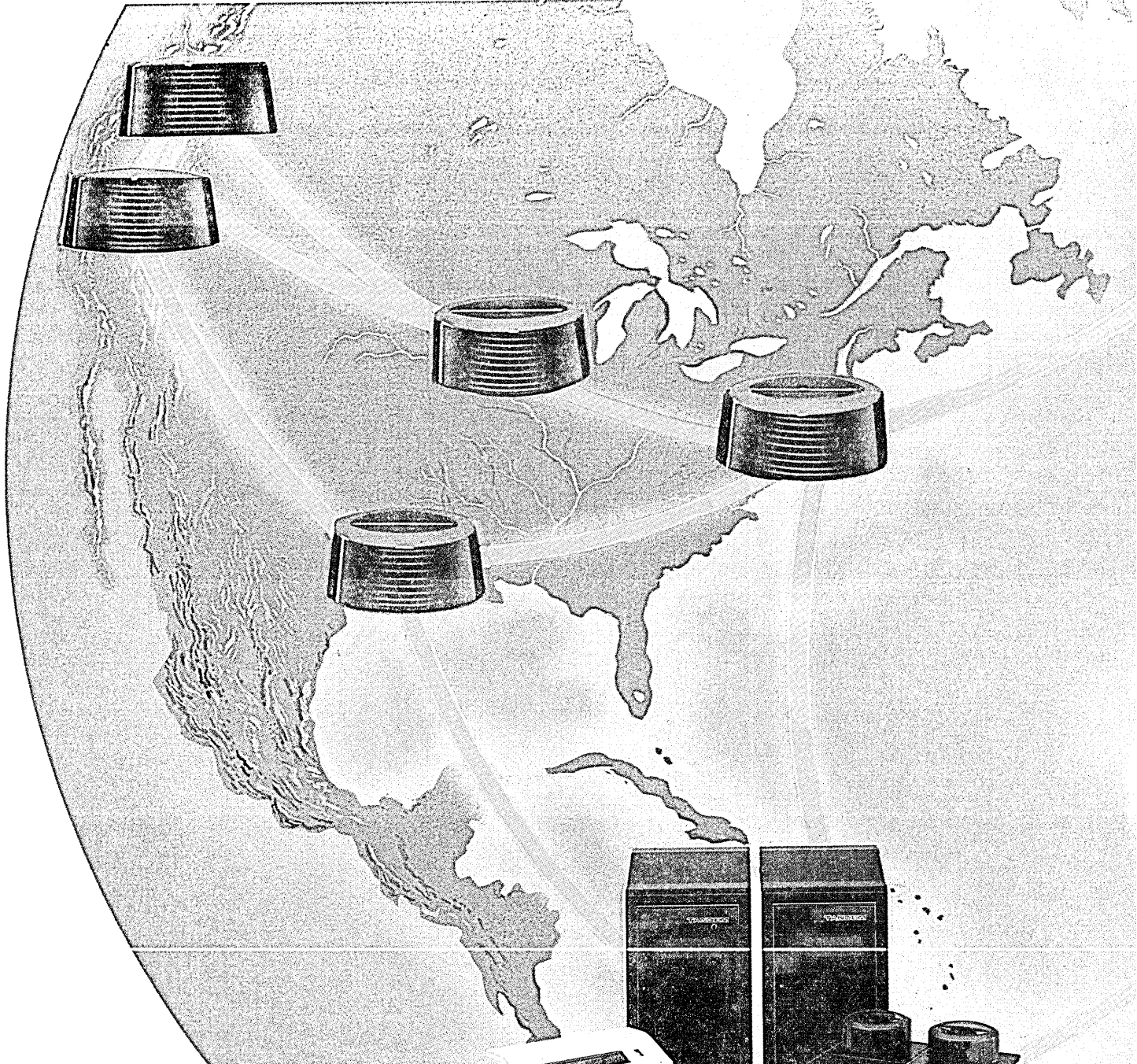
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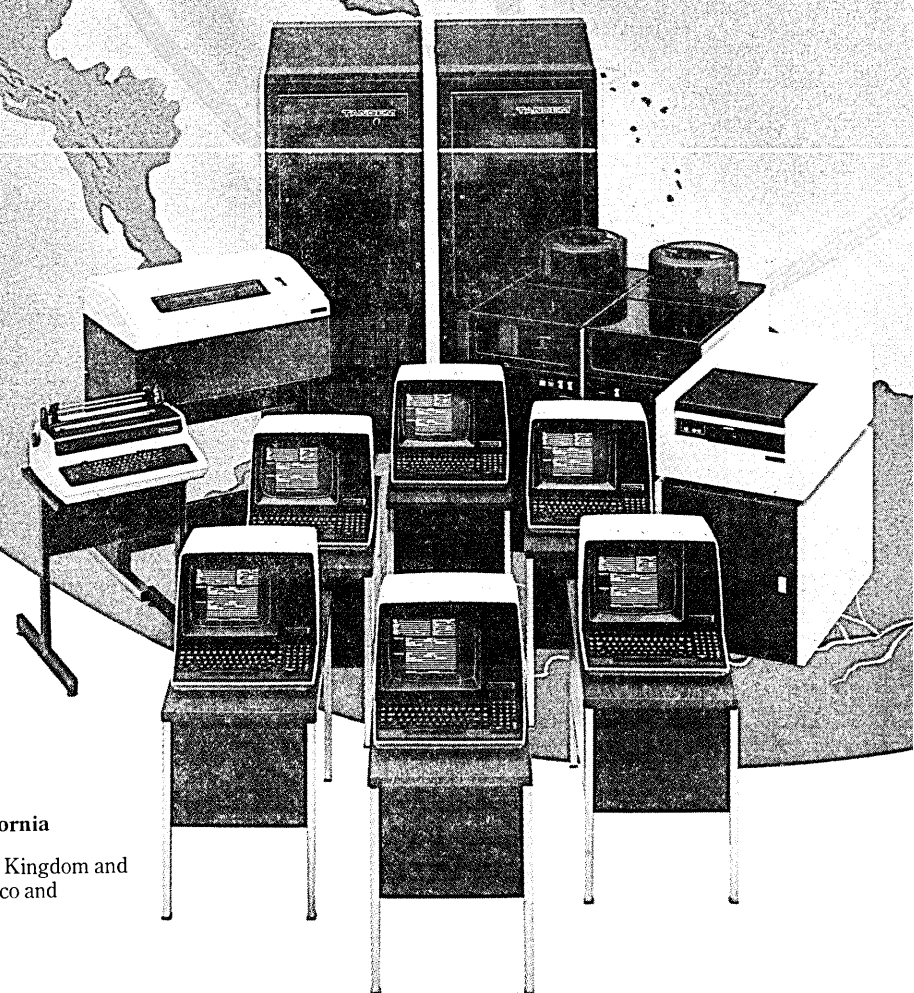
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NEWS IN PERSPECTIVE

Although the Nixdorf machines will reportedly be able to run all current IBM 4300 software—fully “PC”—Nixdorf will actually be selling the machines with its own operating system, EDOS/VS (reputedly comparable to DOS/VS); an OS product the firm acquired last May when it purchased The Computer Software Company (TCSC), of Richmond, Va. TCSC, now renamed the Nixdorf Computer Software Company, was a \$5 million independent software house that had successfully sold EDOS against IBM's free OS (and shrewdly supported laggards in the 360-370 migration) to build a user base of about 750.

“Actually, we hope to offer users a full system—all the hardware, not just the cpu, and all the software, both the operating system and our own applications packages,” explained Nixdorf vice chairman Klaus Luft. “We want to be the 100% partner for the user; we want to offer everything he needs.

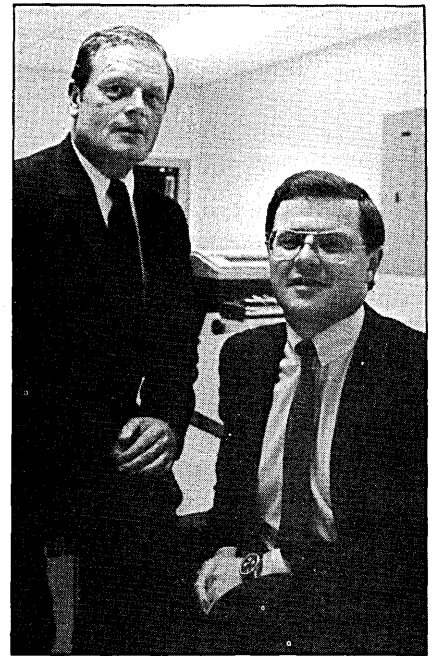
“For this class of machines, we think we have a unique approach,” he added. “We could be considered a PCM, but we're more than a PCM—much more.” Nixdorf has a track record in the computer business; in the applications end, it's in applications software, peripherals, and sub-systems, said Luft. The PCM machine with a Nixdorf operating system offers all this Nixdorf experience for a single-source procurement, he added.

With reported 1979 sales of \$722 million—over \$100 million from its U.S. business—Nixdorf is a major European multinational. A German giant in the small computer systems market, a world leader in the key-to-disk data entry business, Nixdorf is (by the installation numbers) the most successful foreign system vendor in the U.S. Ironically, Nixdorf still finds itself trying to develop an American identity and establish itself in the U.S. market.

Nixdorf still finds itself trying to develop an American identity and establish itself in the U.S. market.

Nixdorf became a major factor in the data entry business in the U.S. with its 1977 acquisition of Entrex, Inc., now the Waltham, Mass.-based Nixdorf Computer Corp. According to NCC president Carl Janzen, former general manager of international operations for Digital Equipment Corp., Nixdorf U.S. will install more data entry systems this year than any other firm for the third year running. Even the U.S. census was tabulated on Nixdorf workstations.

And for the last two years, Nixdorf has been preparing to break into the mainframe business. A minor shareholder in Amdahl early on, Nixdorf sold out for cash, reportedly when it became clear there was no room for joint development projects. In 1978, a new division, now called CIS (Com-



CARL JANZEN (left) and KLAUS LUFT: They plan to make Nixdorf the “100% partner for the user” by offering him everything he needs.

puter Information Systems), was formed at corporate headquarters in Paderborn, West Germany, to develop a viable entry scheme.

Nixdorf vice chairman Luft recalls a tour of U.S. computer sites two years ago as he was exploring the attitudes of dp executives. It was clear, he said, that the users were not willing to give up their enormous investment in IBM. They valued their applications software, and they were not willing to sacrifice the training and experience of their staffs.

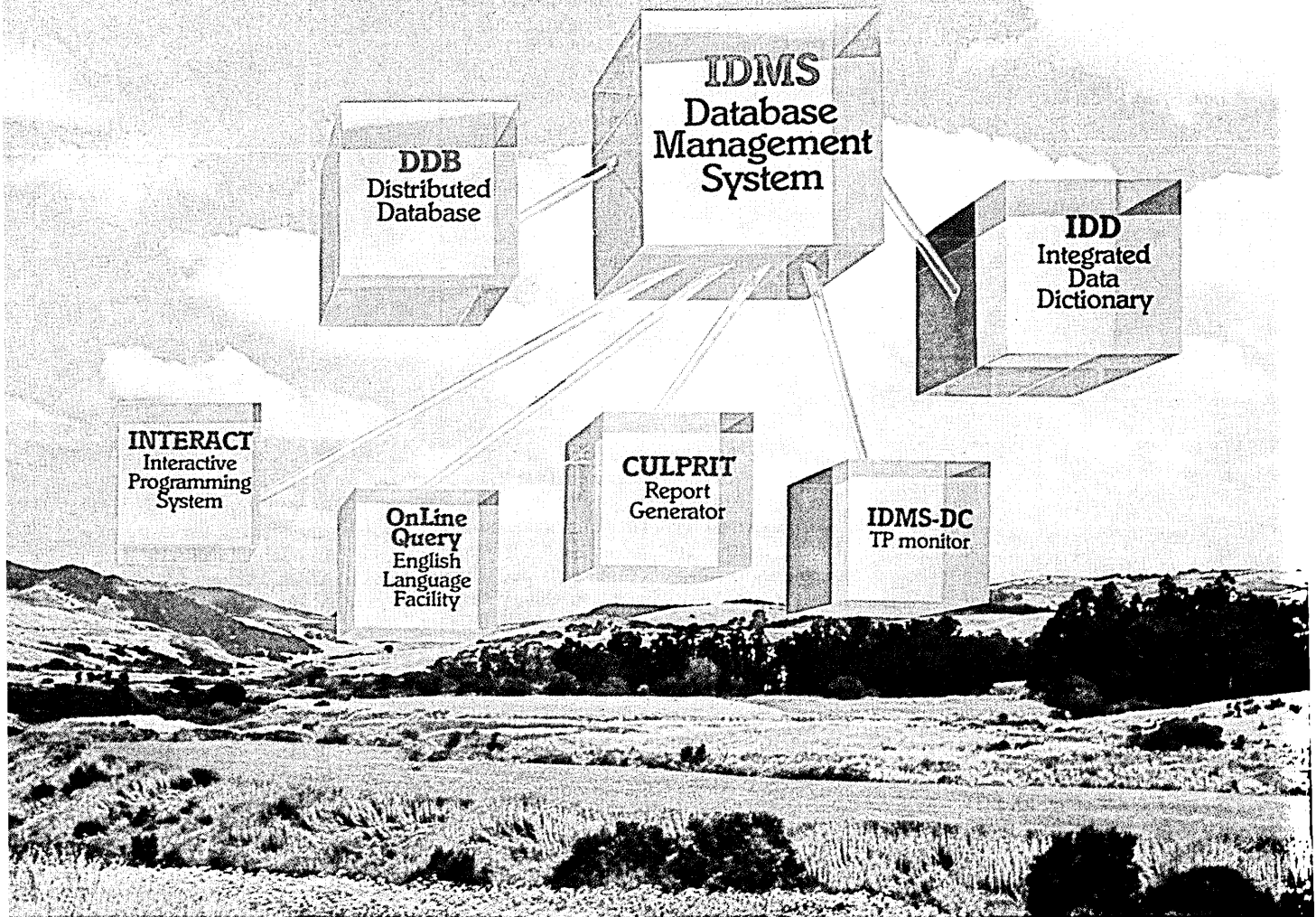
“But with the trend to distributed data processing—with all the new requirements for processing power out in the manufacturing sites, the subsidiaries, the branch offices—with all this new demand, the executives I talked to didn't want to be dependent on a single vendor. They wanted a competitive situation. Maybe they wanted to develop a competitive situation.

“In planning for the demands of the '80s, with office automation, these users wanted a more open market,” said Luft. “Yet, clearly it was going to be difficult to challenge IBM's dominance in the central site; the users just had too much invested. The question became, could we somehow use this IBM-oriented experience, the users' IBM background?

“Could we offer a product that was close enough to exploit the IBM experience, yet different, with its own capabilities that would be inherently attractive to a major class of users?”

Paderborn's conception of Nixdorf's mainframe potential began to center upon the workstation in the distributed processing environment. “That's a new and

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NEWS IN PERSPECTIVE

different environment," said Luft. "The user wants mainframe capabilities, but perhaps with additional workstations, more transaction-oriented—and this isn't a central site, so we want simpler operating procedures, more reliability, less demanding hardware and software support requirements."

Nixdorf's interest in offering a product that was an IBM PCM alternative, yet more than that—a PCM alternative, but also a system with virtues that themselves could attract users—led to a decision that Nixdorf would have to offer a whole system. "We realized we had to be competitive in both software and service in order to be competitive at all," said Luft. "We decided not to go into the PCM business."

It was a decision that led to TCSC—and the quasi-independent EDOS user base. Luft chortles with pleasure at the thought of the TCSC buy. "The Computer Software Company acquisition gave us a level of credibility that has been just unbelievable." After all, he said, the EDOS users chose to pay for TCSC software when they could just pick up a free OS from IBM. "And, I'm very happy to say, the EDOS user base seems to be very open-minded about the possibility of taking Nixdorf hardware too," Luft added.

Nixdorf introduced the 8890 machines only in the German market last month, but Luft and Carl Janzen agree that the products will be brought to the U.S. and the EDOS user base will be the keystone of the U.S. marketing strategy. While the timing of the U.S. introduction and the pricing for the U.S. offering remain unsettled, said the dapper German, "the overall strategy is clear.

"We have a long-term orientation," explained Luft. "Today, we're still building up our service and support. We know we get watched very carefully in this new arena. We want quality before quantity. We have to keep fighting with our sales organization; the problem today is how to say no, to exercise restraint."

—Vin McLellan

NIXDORF'S ISRAELI ENGINE

Whether Nixdorf found Elbit or vice versa, it was a good fit.

When Nixdorf decided it wanted to build its mainframe system on IBM-compatible hardware, it went looking for a PCM designer—a small vendor who wouldn't be too proprietary. A company with a design team that had the 370 principles of operation down

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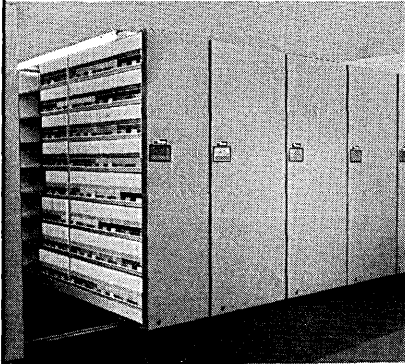


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CIRCLE 54 ON READER CARD

NEWS IN PERSPECTIVE

cold—but with a design that wasn't rigid.

Nixdorf had some strong ideas about what it wanted in the system. The Germans wanted a processor that could deftly integrate their subsystems, a design that could absorb IBM's microcode challenge and go beyond to bootstrap Nixdorf software.

"We knew we wanted to make it a Nixdorf product, not just buy a product like NCSS or CDC," explained Nixdorf vice chairman Klaus Luft. "We knew we needed someone with know-how in the IBM PCM area, someone who could work with us and accept our know-how in turnkey systems and field service."

For a while, Nixdorf thought it had

found its partner in Two Pi Corp.; then it found Elbit . . . or vice versa. "Who contacted whom?" mused Luft. "I really don't remember."

Elbit Computers Ltd. is a \$40 million Israeli minicomputer manufacturer.

By the time Nixdorf entered the PCM picture, Elbit had hardware.

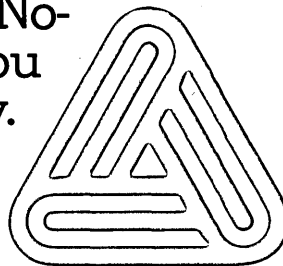
Still 37% owned by CDC, the Israeli computer firm exports 50% of sales, using its Common Market leverage to undercut American products in Europe. Although better known internationally for its terminal products, Elbit is into its fourth generation

CHARACTERISTICS OF ANAT

MODEL	ANAT/I	ANAT/III	ANAT/V
IBM counterpart	370/125-2	370/138,4331	370/148
Virtual storage capability	Yes	Yes	Yes
Multiprocessor configuration	No	No	No
Upgradable to	ANAT/III	ANAT/V	None yet
Packaging	Desk mount	Desk mount	Desk mount
Initial production deliveries	3Q80	4Q80	1Q81
PROCESSOR			
Relative performance level	0.5	1.0	1.7
Cycle time, nanoseconds	200	200	200
Technology	Schottky TTL	Schottky TTL	Schottky TTL
Prefetch/pipeline	None	None	Yes
Translation lookaside buffer	64 entries	64 entries	64 entries
Control store, bytes:			
Fast	4K	Up to 64K	Up to 64K
Auxiliary	Up to 128K	Up to 128K	Up to 128K
Micro-instruction retry	Yes	Yes	Yes
PROCESSOR FEATURES			
TOD, clock comparator & cpu timer	Standard	Standard	Standard
Direct control	No	No	No
Dynamic address translation	Standard	Standard	Standard
Floating point	Standard	Standard	Standard
Extended floating point	Standard	Standard	Standard
MEMORY			
Type	MOS	MOS	MOS
Chip density, bits per chip	16K	16K	16K
Bytes fetched per access	4/8	4/8	4/8
Read cycle time, nanoseconds	500/870	500/870	500/870
Write cycle time, nanoseconds	500/870	500/870	500/870
Minimum capacity, bytes	256K	512K	1024K
Maximum capacity, bytes	4096K	4096K	4096K
Interleaving	None	None	None
Cache	None	None	None
Error correcting (ECC)	Yes	Yes	Yes
I/O CHANNELS			
Programmable	Yes	Yes	Yes
Byte multiplexor channels:			
Number	1 std. +4 opt.	1 std. +4 opt.	1 std. +4 opt.
Maximum data rate, bytes per second	48K byte mode 250K burst mode	48K byte mode 250K burst mode	48K byte mode 250K burst mode
Block multiplexor channels:			
Number	1 std. +2 opt.	1 std. +2 opt.	1 std. +2 opt.
Maximum data rate, bytes per second	1.5 million	1.5 million	1.5 million
System totals:			
Number of channels	6	6	6
Aggregate data rate, bytes per second	5 million	5 million	5 million

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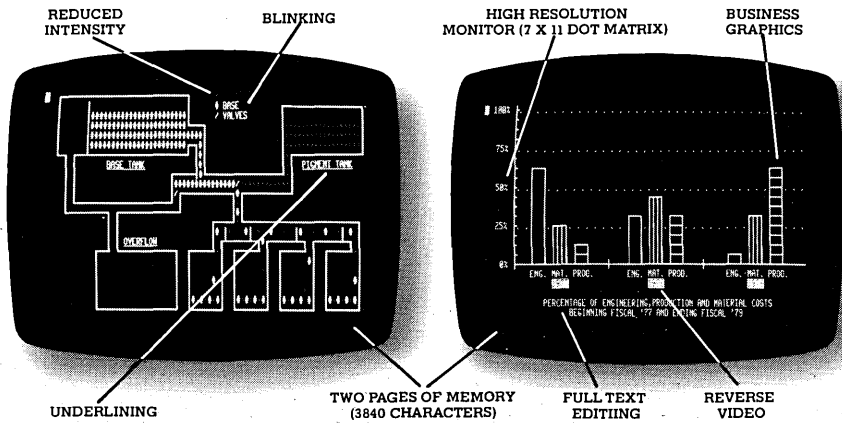
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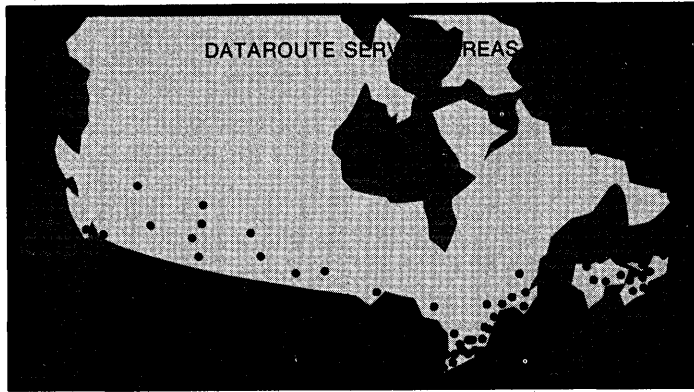
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Multiple Reports	YES	YES	YES
Automatic Report Composition	YES	YES	YES
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CIRCLE 57 ON READER CARD

NEWS IN PERSPECTIVE

of sophisticated minicomputer designs; the latest, a brazen effort to push an original PCM line, is the Anat Series.

According to PCM industry sources, Nixdorf was already deeply involved with Two Pi when the company came across the Elbit machine. In 1979, Elbit had reportedly approached both Control Data and Olivetti, seeking some sort of marketing agreement for the 4300-class Anat (although Elbit executives deny it), and were twice rebuffed.

"They only had a paper machine at the time," explained one knowledgeable European source. "The designs were interesting, the hardware they had looked good, and the price was cheap. But the machine didn't have any track record." CDC reportedly had decided to back out of the PCM business, and Olivetti chose to commit to the larger IPL Systems' PCMs. By the time Nixdorf entered the picture, however, Elbit had hardware.

Although both Nixdorf and Elbit will be selling the same cpu design, they do not expect to compete.

"We were well beyond the prototype machines," explained Elbit executive vp Hillel Weinstein. "You don't believe a substantial company like Nixdorf would make a decision of such importance without something more than the designs in their hands do you? Remember, they already had several Two Pi machines at their disposal."

It was primarily a straight price-performance comparison that knocked Two Pi out of the Nixdorf deal, said Weinstein. "That, together with our unique architecture." Elbit's Anat design uses a microcode structure for maximum flexibility and the design incorporates fully integrated internal controllers to interface IBM and mini-class peripherals and communications networks. "This is a supermini," said Weinstein, "a minicomputer that incorporates the strengths of an IBM PCM. We think of it as small and beautiful."

Nixdorf purchased a license for the Anat central processing technology. "They were very helpful, very easy to work with," recalled Nixdorf's Luft. "We sat down together and worked out the system components. Many of our ideas were similar and each was willing to work with the other." Particularly in the area of remote support, Nixdorf has been an industry leader, noted Luft, and Nixdorf wanted its PCM to contain a maintenance processor capable not only of remote diagnostics, but general support. Nixdorf's field maintenance is evolving into more sophisticated remote support, offering down-line loading for fixes, operating system updates, even application software.

According to Elbit's Weinstein, Nixdorf specs called for some unspecified

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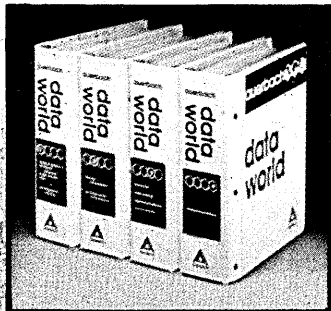
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NEWS IN PERSPECTIVE

redesign of the Anat packaging, but the cpu characteristics of the Anat models I, III, and IV—the three processors Elbit itself has introduced—"should be identical" to the processors Nixdorf will offer (although Nixdorf will apparently introduce only the two larger systems.) The Anat/I is roughly comparable to the 370/125-2; the Anat/III is comparable to the 4331, and the Anat/V to the 370/148.

Elbit is now manufacturing the Anat models I and III, and has delivered both to Europe. Weinstein said last month Elbit expects to have the Anat/V in production "soon."

Nixdorf's license agreement with Elbit gives the Germans the right to manufacture the whole system themselves, he added, but "for the time being, Elbit will continue to manufacture a number of key parts for the Nixdorf systems."

Elbit, however, also plans to continue to independently market the Anat series. In the U.S., salesmen have already begun approaching very large oem buyers and volume end-users. Elbit is still seeking joint ventures and marketing agreements to help exploit the Anat, said Weinstein. He stressed that although Nixdorf and Elbit will both be selling the same cpu design, they do not expect to compete: Elbit will be moving raw iron; Nixdorf will be offering complete systems, with extensive software.

Weinstein confirmed the Anat prices reported last month in DATAMATION's Look Ahead column (Sept., p. 13), but pointed out that these were "rock bottom, very large volume" oem prices. These prices, quoted by Elbit salesmen in the U.S., tagged the Anat/I processor with 256 kilobytes of main memory at a mere \$35,000; Anat/III, with 512 kilobytes of memory, at \$43,000; and the Anat/V, with a megabyte of memory, at \$63,000.

The Nixdorf prices on the 8890 systems have not yet been established for the American market, according to Nixdorf's U.S. ceo Carl Janzen. The 8890 Series, Nixdorf's version of the Anat, will be marketed first in Germany, then in Europe, then

Elbit is enthusiastic about the prospects of the Anat in the IBM software world.

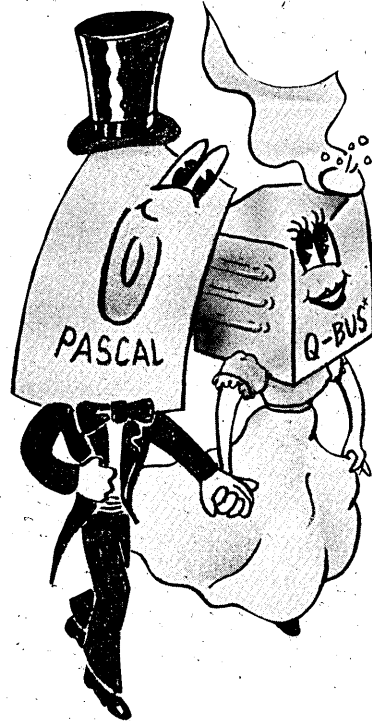
moved into the U.S. Observers note that Nixdorf's end user pricing is unlikely to have more than a very, very distant relationship to Anat's volume pricing. Still, noted another PCM executive, it offers some sense of the potential for system pricing.

Elbit, on its own, is enthusiastic about the prospects of the Anat in the IBM software world, said Weinstein.

"Don't underestimate the importance of that full-software approach," warned the Elbit executive. "It should be very attractive."

—Vin McLellan

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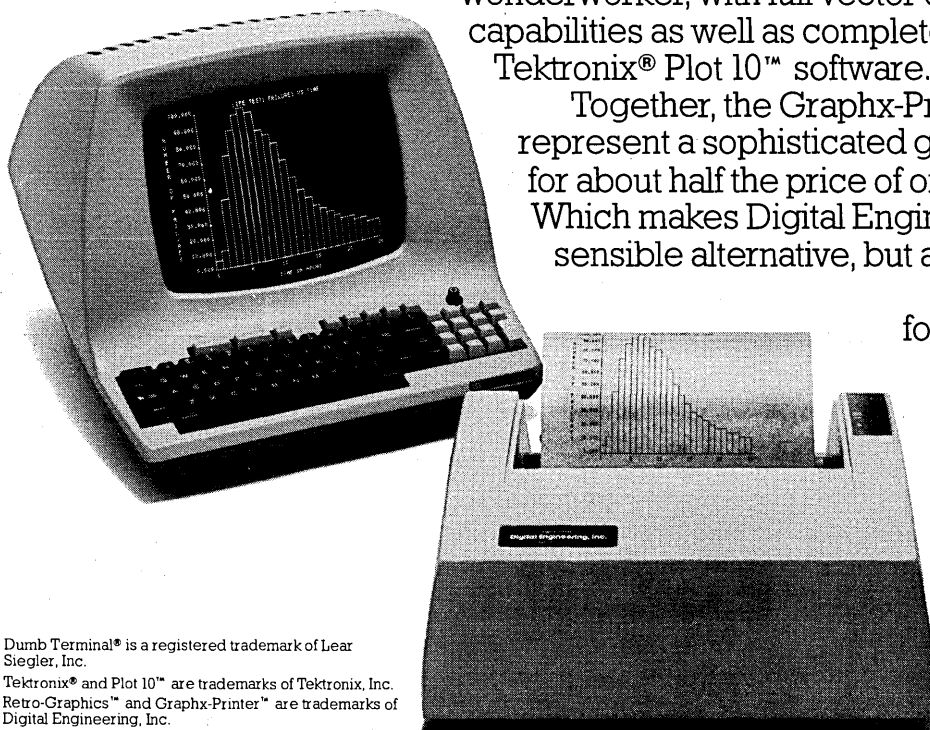
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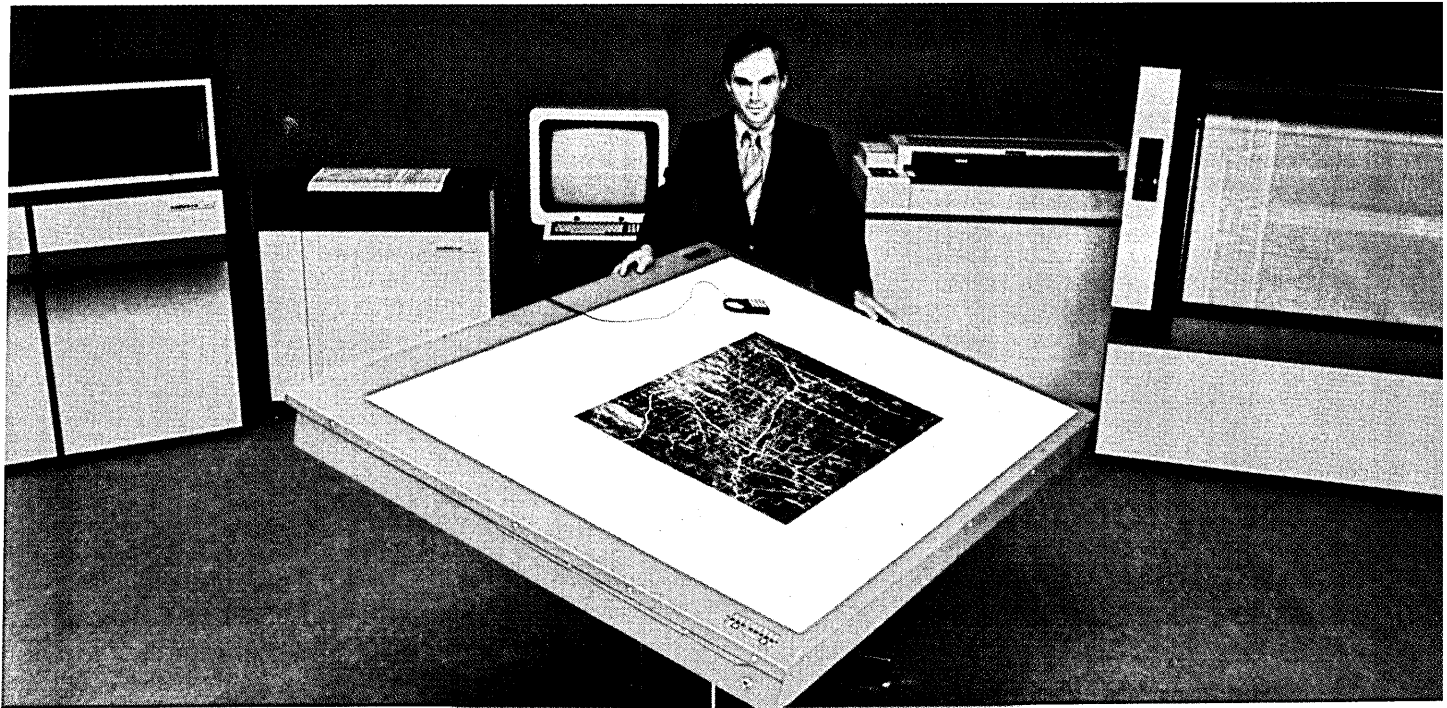
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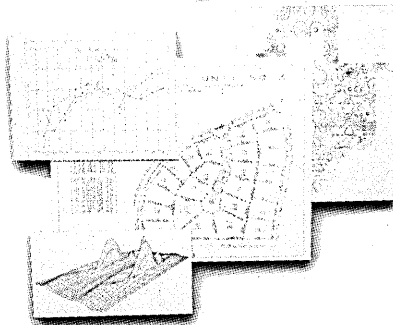
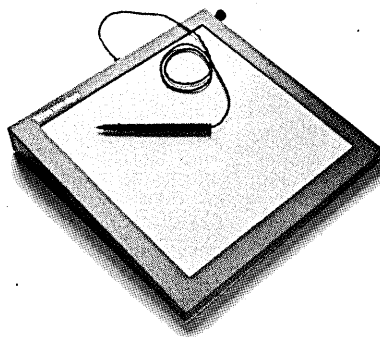
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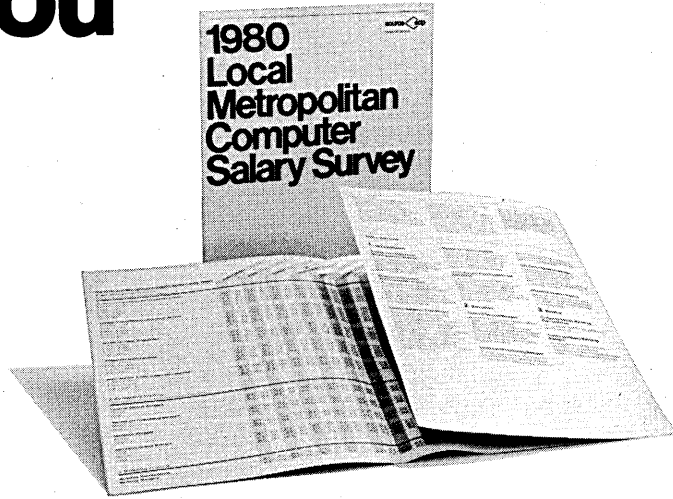
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- Computer-Grade Grounding
- Flexibility
- Power Monitoring

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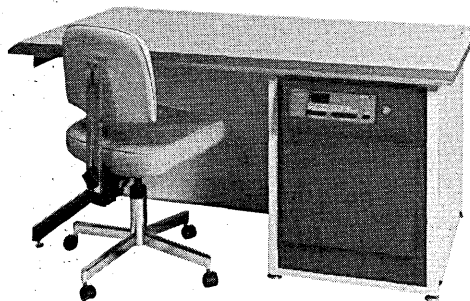
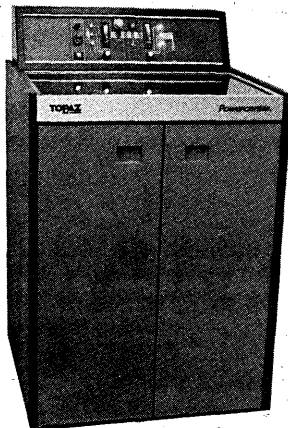
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BENCHMARKS

NCR COURTS ADDS: NCR has offered to purchase Applied Digital Data Systems, Inc. (ADDS) for \$60.6 million. NCR agreed to commence a tender offer for all outstanding common stock and \$1 cumulative convertible preferred stock of ADDS at \$12 per common share and \$27 per preferred share. ADDS directors were quick to endorse the offer, and they have recommended that ADDS shareholders accept it. NCR's basic interest in ADDS is to protect its primary outside source of crt terminals; ADDS designs, manufactures, and markets video display computer terminals.

BURROUGHS WANTS SDC: Burroughs has agreed in principle to acquire the System Development Corp. (SDC), Santa Monica, Calif., for approximately \$98 million. The present agreement calls for Burroughs to pay \$69 for each of SDC's 1.42 million shares outstanding, of which about two-thirds are held by the System Development Foundation, and most of the balance by SDC employees. SDC, a supplier of computer-based systems, earned \$3.75 million in fiscal 1979. The agreement is subject to approval by both companies' boards and by SDC stockholders.

ANOTHER ACQUISITION: Storage Technology Corp. has offered to purchase Documation Inc. for \$52 million. Under the proposal, Documation shareholders would receive a 0.85 share of Storage Technology common for each Documation share. Documation has about 3,050,000 common shares outstanding. Gordon Swartzfager, director of communications at Storage Tech, said that Documation, in spite of a loss last year, is still a very sound company with top-notch production plants. The acquisition is subject to approval by the board of directors of both companies and the Documation shareholders.

THE B 5900 ATTACKS: Burroughs has introduced the B 5930, an entry-level machine in Burroughs' large-scale computer family. This system can be used for central host data processing, distributed processing, computer and terminal networking, managing large data bases, transaction processing, interactive processing, and time-sharing. The B 5930 is program-compatible with other Burroughs large-scale computers, thus eliminating any need for reprogramming to expand or use the B 5930 in conjunction with larger systems. Burroughs estimates that B 5930 users will be able to increase their workload capacity by up to 50 times without reprogramming as they move up to Burroughs' largest data processors. Paul S. Mirabito, Burroughs chairman, said, "This can be the last conversion that competitive system users will have to make." He added that this one-time



VANITY PLATES?—Perhaps, but Toni Shetler with Xerox Office Products Div. hopes they will also have a promotional value for ACM '81, the annual conference of the Association for Computing Machinery of which she is general chairman. ACM '81 will be held Nov. 9-11, 1981 at the Bonaventure Hotel in Los Angeles. Shetler's new plates on her new car are unique. Anyone who wants to follow her lead will have to settle for ACM '81-2 or 3 or 4 or . . .

changeover from IBM, Honeywell, Univac, or NCR systems can be simplified with Burroughs conversion aid software. This is the first computer to use Burroughs' multilevel function processor architecture—an internal structure of computers within computers, each having its own responsibilities—enabling high internal efficiency with resultant high system productivity. Purchase price of the B 5930 is \$200,000, and it leases (under a one-year contract) for \$6,875 per month. The leasing rate includes 24-hour, 7-day-a-week maintenance service. The basic system software facilities include Master Control Program (MCP), Network Definition Language (NDL II), Generalized Message Control System (GEMCOS), and a One Programming Language Compiler. The software license fee is a one-time payment of \$36,300, plus an annual fee of \$5,808, or a single monthly license fee of \$1,210. Deliveries are slated to begin in the second quarter of 1981.

SATELLITE FEVER: Prompted by the Carter Administration's belief that the U.S. is lagging in satellite development, NASA has awarded three communications satellite contracts. NASA will pay Motorola Inc. \$4.7 million to design and construct a "switchboard in the sky;" TRW Inc. will receive \$3.2 million for work on advanced antennas to be carried on the satellites; and a \$2.7 million contract was awarded to Ford Aerospace & Communications Corp., a Ford Motor Co. subsidiary, also for work on the

antennas. Several years ago NASA had stopped financing experimental communications satellite equipment, expecting independent companies in this growing field to take over the workload. Now the government feels we've fallen behind and has reinstated its financing programs. The antennas that TRW and Ford will be working on are supposed to be able to send a heavy volume of messages to 18 U.S. cities, plus a smaller volume of traffic to individual rooftop antennas.

A HOME FOR A FLOPPY DISK: One of the first floppy disk drives made by Shugart Associates, a manufacturer of rotating memory peripherals, has joined the Smithsonian Institute's permanent collection. The device, donated to the national museum of history and technology, was the prototype of Shugart's original eight-inch, single-sided floppy disk drive, the precursor of the company's SA800 series. Introduced as the first IBM-compatible drive, the gift to the Smithsonian was the sixth type of floppy drive manufactured by Shugart since the company opened its doors in 1973. The drive was presented to the museum by Shugart president James Campbell and by Don Wartner and Al Chou, two members of the original Shugart engineering team. On exhibition, the prototype drive will be viewed by the general public, and it will also be available for study by interested visitors by appointment.

—Deborah Sojka

DP Dialogue

Notes and observations from the IBM Data Processing Division that may prove of interest to DP professionals



At night, sorting and loading of packages into outbound aircraft is done swiftly at Federal's "hub" in Memphis. IMS/VS helps the company's computer applications communicate with each other.

Federal Express is 'One Large Integrated Real-Time System'

"It's easy to use our air courier service: just pick up the phone," says James Barksdale of Federal Express Corporation. Behind that simplicity is the management of two fleets—vans for door-to-door pickup and delivery, and aircraft which fly nightly round trips between Federal's 132 full-service stations and a "hub" facility in Memphis.

Barksdale, senior vice president, continues: "As a company, Federal Express is one large integrated real-time system. And our data processing reflects that; every one of our applications relates to almost every other. Weather reporting affects flight planning and operations, which affects dispatching and crew management. Flight hours logged under the engineering and

maintenance system have an influence on parts inventory, and so forth. Many different computer systems must communicate with each other to keep this 24-hour operation tightly integrated."

With IBM's Information Management System/Virtual Storage (IMS/VS), all related data is under one master, Barksdale explains. "Any number of programs can access the same record," he points out. "Today's data bases are compatible with future uses, and we can add and subtract fields of information. All customer-related data, for example, is under one master, so that all spellings are the same and data is consistent."

The most crucial application is customer order processing, which puts more

than 30,000 transactions per day through the IBM 3031 Processor in Memphis. Representatives take calls from customers across the U.S. and enter orders for service through IBM 3277 Visual Display Stations in two telephone centers. The 3031 prints out each order in the nearest station to the sender, where a dispatcher radios the driver of a van to make the pickup.

"IMS made these applications much easier to implement," Barksdale adds. "We put together these online systems—950,000 lines of code—in 20 months. Once our staff had one or two IMS systems behind them, they put new ones online very quickly. IMS/VS lets us concentrate on the applications rather than data base management and teleprocessing."

Good Policy for Farmers Insurance: DDP With the 8100



"The simplicity of operation and maintenance of the 8100 is important to us," says Lewis J. Bohache of the Farmers Insurance Group of Companies. "Clerical employees in our regional offices have learned to operate it with only one or two days of training.

"The 8100 is easy to install—it plugs into a standard wall outlet. In fact, we were able to set up and start our system by ourselves. Since it does not require a special computer room, it is located in the policy service area."

Farmers uses the IBM 8100 Information System in a distributed data processing (DDP) network to provide better service to its property and casualty insurance customers. It has meant much quicker response and a much lower error rate.

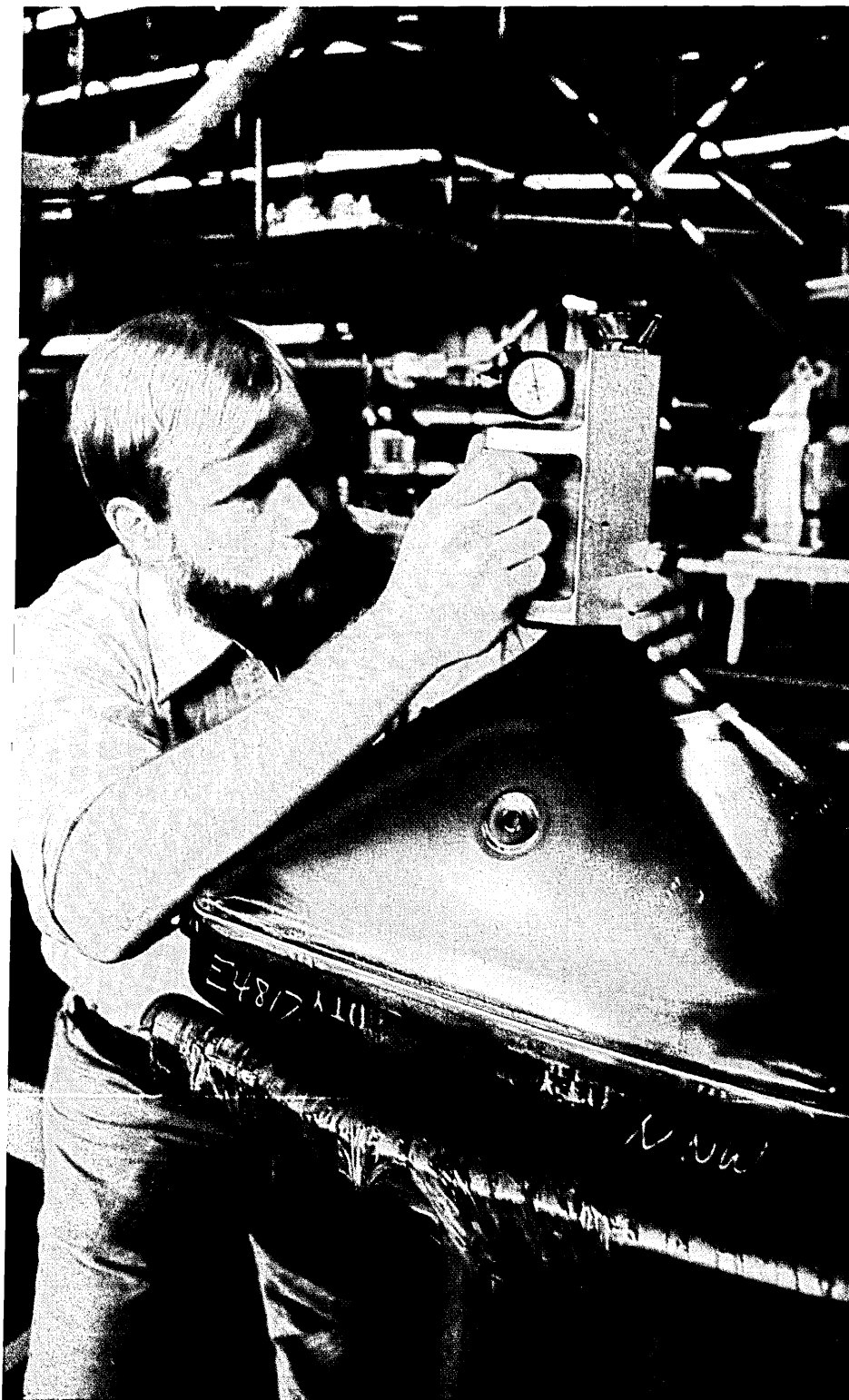
In each of Farmers' 11 regional offices, operators enter the details of new and revised policies into an 8100. Preparing the specifics of insurance coverage for entry requires the use of a complex code, which clerks formerly consulted in a printed manual. Today, the 8100 prompts the operator through the terminal display, providing guidance in the coding of input.

"The result," Bohache notes, "has been improved productivity as well as much greater accuracy. The prompting system has enabled us to reduce the operator training period to three to four weeks, from a previous three to four months."

Each 8100 operates as a stand-alone processor for data entry during the day, and then batches the policy data over a WATS line to an IBM 3033 Processor at Farmers' Los Angeles headquarters at night. The next day, the 3033 transmits the formatted policy data back to the regional office, and a printer there produces the complete policy under the control of an IBM 4331 Processor.

"We're installing an online inventory control system to run on an 8100 here at headquarters, to manage supplies and equipment," Bohache adds. "This is feasible only because the 8100 is simple and 'user-friendly' for online applications. We can train people from the purchasing department to use it."

A Farmers Insurance claims inspector examines damage to a policyholder's automobile. With distributed data processing on the IBM 8100, Farmers speeds up policy changes which assist its personnel in prompt verification of coverage for claims handling.



Checking the alignment of a GTE/Sylvania cathode ray tube. Financial analysts at GTE gain flexibility and accuracy by using PLANCODE for forecasting and budgeting.

PLANCODE Displays the Financial Picture for CRT Maker

Six months before the fiscal year begins, financial analysts at GTE start to prepare the operating budget for the Electronic Components Group. To organize and store the data, they use the Planning Control and Decision Evaluation (PLANCODE) system: an IBM program product com-

prising an easy-to-use, English-like planning language.

"We can revise the figures at any time by making an entry at a terminal," John J. Nugent, vice-president-controller, says, "because PLANCODE automatically recalculates all the affected variables."

At its Seneca Falls, New York, headquarters, the Electronic Components Group makes Sylvania cathode ray tubes for television sets and data systems. Analysts there use PLANCODE on an IBM 4341 Processor in order to forecast sales and budget its manufacturing and marketing operations.

Millions of Calculations

"A complete budget represents literally millions of calculations," Nugent observes. "Suppose we want to revise a sales forecast, expected selling price, or standard direct cost assumption. Each of these affects a lot of dependent variables. Changing the sales forecast, for example, has an impact on the extrapolation of cash discounts, defective returns, and transportation costs. With PLANCODE, we can revise any of these major parameters and the system automatically makes the necessary adjustments.

"PLANCODE lets us look at several variables and measure their effect. We can test the sensitivity of a forecast to the variables we're certain of. The plan is better initially, and is easier to revise."

Advance Knowledge is Critical

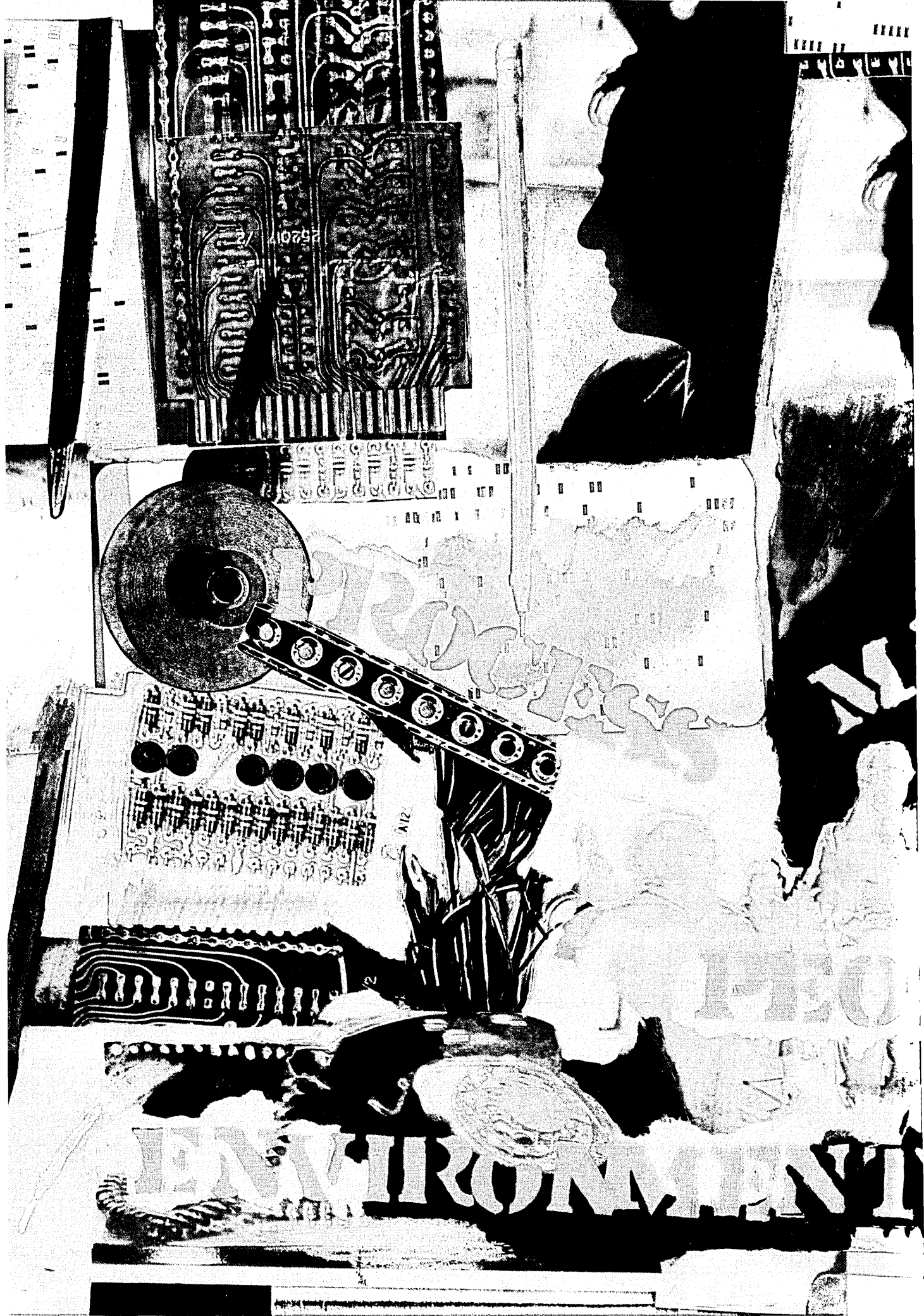
Budgeting has taken on added importance, Nugent points out, as the economy has become more complex. "Knowing our capital needs in advance is critical today," he notes, "so we can decide how to go to the capital market.

"And with PLANCODE we can react faster—if, for example, a major cost item takes an unexpected jump. We have confidence in our results, since we know the math is accurate. The users control the structure of the budget and of the forecasting models, as well as the format of each printed document.

"This self-service by the users frees the professional programmers to work on the company's primary computer systems, and gives us the flexibility we need for effective financial planning."

DP Dialogue is designed to provide you with useful information about data processing applications, concepts and techniques. For more information about IBM products or services, contact your local IBM branch office, or write Editor, DP Dialogue, IBM Data Processing Division, White Plains, N.Y. 10604.

Data Processing Division





Manufacturing Resource Planning is a way that marketing, manufacturing, engineering, and finance can work together.

TOOLS FOR PROFIT

by Oliver W. Wight

Productivity is the current theme in manufacturing—as well it should be. Over the last decade, we have watched U.S. productivity go up 23% while Japanese productivity went up 89%. The impact on the American economy shows up as inflation, and as the importing of more and more products, from television sets to automobiles, from overseas. American manufacturing is at a crossroads, and the computer is one of the most powerful tools available to address this problem.

Yet, of the reams of literature written on the subject of productivity over the last few years, and particularly in the last six months, virtually no article has recognized the powerful role the computer can play in improving productivity. Articles discuss computer-aided manufacturing (CAM) and computer-aided design (CAD) and surely these have great and proven potential. But as usual, those people writing the articles either know little or nothing about how manufacturing *really* works, or if they are manufacturing people, they are standing too close to the problem. We have a penchant for concerning ourselves with the exotics while overlooking fundamentals.

In a country where 60% of the average foreman's time is spent expediting, looking for material, and in general, firefighting because of poor scheduling; where 60% of the average purchasing buyer's time is spent shuffling paper and doing last minute expediting; where the automobile industry alone spends over \$100 million a year on premium airfreight primarily because of poor scheduling; there is an opportunity to improve productivity that is largely untapped, and for that matter, poorly understood.

If we're going to take advantage of the

opportunity, the problem needs to be properly understood. The problem is very straightforward. Before computers, scheduling in a manufacturing company was simply out of the question. The typical company has hundreds or thousands of components to be scheduled. Many components go together to make assemblies. They are made from raw materials and often put into finished goods. There are branch warehouses in many companies that have to be scheduled properly.

The problem is monumental, and is made insurmountable by the constant change that is part of normal manufacturing. Forecasts aren't right, machines break down, vendors deliver late, there are engineering changes, tooling doesn't work, new products are introduced, and all of this is occurring simultaneously. The only constant in manufacturing is change, and the problem is making valid schedules so that people don't have to work to shortage lists and dissipate their efforts firefighting.

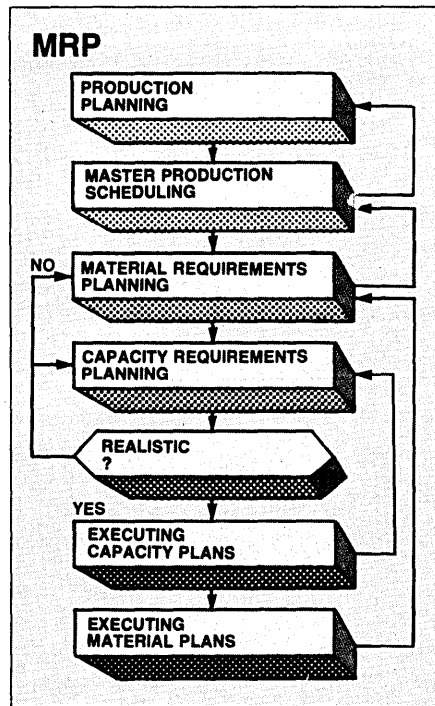
Before computers, all we could do was "order launch and expedite." The inventory control people ordered material and the



shortage list became the real schedule. For the first three decades we used the computer primarily for better "inventory management," really just better order launching. Even today, most people think MRP (Material Requirements Planning) is a better inventory control technique. And many companies would say that they have MRP installed—while they still *really* schedule to a shortage list.

A closed loop MRP system includes all of the elements shown in the figure on this page. It starts with a production plan that establishes the rate of production for product families in units. This is then broken down into a master production schedule that defines the specific items to be produced.

From this, the material requirements plan is developed, and this will be used to drive the dispatch lists down in the shop as a means of executing these material plans as well as giving purchasing valid schedules. The material requirements plan will also provide the input for capacity requirements planning to determine the man-hours required by the work center to produce the needed material. The capacity plans will be executed by fol-



lowing up to measure actual output against planned output in standard hours by the work center.

Closed loop MRP is a scheduling system that goes right down to the factory floor to produce daily schedules to tell manufacturing people what to work on. Properly managed—and this, of course, is the challenge—MRP can provide valid schedules and give factory management information well in advance so that it can be working on next month's "shortages" this month. It can provide the same type of information for purchasing. The result in improved productivity is not conjecture. When foremen have time to do the job that's in their job description, supervise and educate their people, install better methods, and foresee problems in advance, the result will show up in productivity.

For example, a manufacturer of electronic products reduced its overtime from 15,000 hours a week to 3,000 hours a month—and that translates directly into a productivity improvement. A pharmaceutical manufacturer improved customer service to 98% from 85%, reduces obsolescence 80%, improved inventory turns 69%, reduced distribution costs by 13%, while increasing productivity in the factory by 22%.

BETTER USE OF TIME

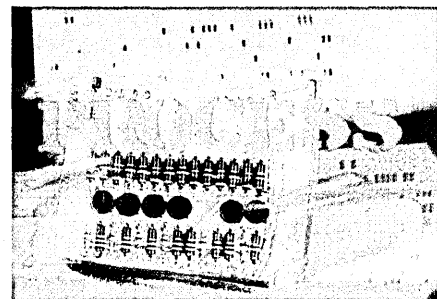
When customer service is improved, marketing and sales personnel can spend *their* time more productively getting new orders rather than defending why the customer hasn't received the orders that already exist. Reduced obsolescence translates directly into improved productivity, as does reduced distribution costs through better scheduling.

When purchasing people can spend their time working on negotiation, better sourcing, working with engineering on standardization, value analysis, and all the good

things that professional purchasing people know about rather than on firefighting, the typical cost reduction in purchasing for a company using a closed loop MRP system is approximately 5% of the annual purchased cost. A typical manufacturing company doing \$50 million in sales would spend about \$12.5 million on purchased material. This is usually *three times* what it spends on direct labor. So a 5% reduction in purchased cost translates into a 15% reduction in direct labor.

Today, MRP has gone beyond even the closed loop approach with material requirements planning at its core. MRP has developed into manufacturing resource planning, which ties in the financial numbers with the operating system. In a typical manufacturing company, for example, purchase commitment reports have a huge past-due quantity that everybody knows is unrealistic. Once again, the problem is fundamental. The formal system is the system that generates the numbers. When schedules are invalid and shortage lists are the real system, there will be a lot of past-due open purchase orders that simply aren't needed. When these are used as a basis for a purchase commitment report, the numbers simply won't be very meaningful.

Another excellent example of the problems that the financial people have because the operating system doesn't work is inventory shrinkage. Since the operating people are usually working primarily with shortage lists and expediting, they pay little attention to numbers and consider this mainly the concern of the "accountants." In the typical manufacturing company, there is an inventory shrinkage about once every four years because these numbers have gone awry. This shrinkage affects profits directly, and, of course, is a matter of great concern to every-

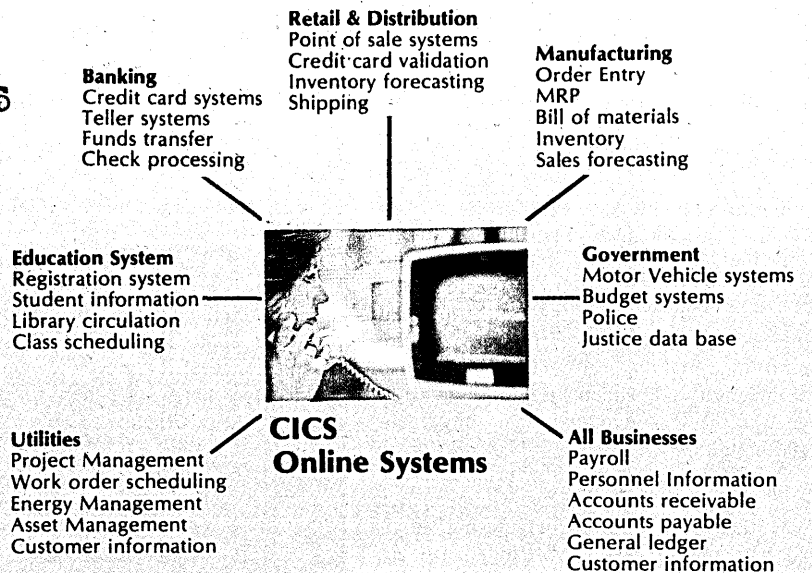


one in management. They spend 90 days trying to explain how this ever could have happened and why it will never happen again. And then the chief financial officer sets up an "inventory reserve" because he knows full well it probably *will* happen again.

Once again, the problem is fundamental. If the scheduling doesn't work well in a factory, if the people in the factory aren't using the numbers to run the business themselves, the financial numbers that result are

CHART BY CYNTHIA STODDARD

**Which of these
key business functions
are vulnerable to
problems in your
online system?**

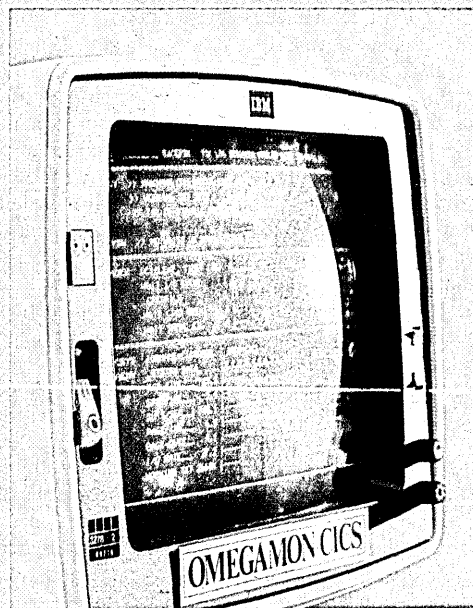


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CIRCLE 63 ON READER CARD

Most companies approach MRP as a computer system rather than a people system made possible by the computer.

going to be highly suspect.

In a company using manufacturing resource planning—MRP—II—the financial numbers are derived directly from the operating numbers. Obviously the prerequisite is that the operating numbers are correct and are used. One highly successful MRP II user had an inventory adjustment in total dollars last year of .0011%—enough to make any financial man happy.

Beyond that, manufacturing resource planning has become a company game plan, a way that marketing, manufacturing, engineering, and finance can work together. It is a virtual computer simulation of the business. Once again, this is not speculation or theory. Here is what George Bevis, former senior vice president of the Tennant Co., Minneapolis, had to say on that.

"Before long, MRP became more than a production and inventory control tool. It became a new way to run the business. It encompassed the whole business, not just manufacturing. We tied in finance, engineering, marketing. . . . In short, it became a company operating plan."

If this potential exists, why haven't more companies realized it? To be sure, many have improved inventory turnover and cus-

tomers, and, of course, this isn't going to happen.

3) Rather than recognize that MRP simply provides better tools for management to use to run the business, they somehow expect the tools to do the job. MRP is far from being a panacea. It simply shows people the problems sooner so that they can do what's necessary to lick them.



4) They don't do the necessary work to get the correct data to support an MRP system. This involves a major task of behavior modification in a manufacturing company. Foremen, for example, have had little interest in inventory record accuracy in the past because the shortage list did not require it. Bills of material didn't have to be correct to support a shortage list either. With MRP they must. And a common—almost prevalent—way to mismanage an MRP system is to overstate the master production schedule. This will destroy the credibility of the schedule faster than almost anything else.

5) And of course, they catch the old "computer virus" of making things so complicated that the users can't understand the system.

The thesis running through all of these reasons is the same: too many people think that the "system" does something, and if we just feed it the proper information and follow some instructions, wonderful things will happen. In a recent article* MRP was described as a system where the master scheduler has complete control and everybody else just runs around and follows instructions. Nobody who ever saw MRP work as a scheduling system in a factory would make a statement like that. It simply doesn't happen that way. The people in the factory and the purchasing people now have to work as hard to prevent the shortages as they once did to fix the shortages after they happened. And that requires plenty of personal effort, ingenuity, and cooperation.

The Japanese have done a fine job of showing us how to run a manufacturing economy more effectively. One of their strong suits is that they are culturally attuned to working as a team—whether or not they have a valid game plan.

In the U.S., it's one man, one vote. We are primarily function-oriented. Engineering, typically, doesn't work very well with manufacturing. Marketing and finance see each other as competitors. That must end if we are to get everybody working together to compete against the real competition.

The informal systems we have used encouraged finger-pointing. When the product didn't get shipped, the assembly foreman knew it wasn't his fault because he didn't have the parts. The marketing people knew it wasn't their fault because nobody worked to the forecast. The manufacturing people knew it wasn't their fault because the forecast was never right. . . .

A valid game plan is a prerequisite to operating effectively as a team. And perhaps, after all, that's the most important thing that MRP can provide: the opportunity for working together more effectively.

Data processing and systems professionals can provide a real service by spreading the word to manufacturing executives that the key to productivity is manufacturing resource planning. While it's important to install more productive equipment and to use better production methods, many companies have installed highly efficient expensive equipment only to make more of the wrong product at the wrong time on overtime. In manufacturing and distribution scheduling is fundamental. If the fundamentals are not done properly, much of the rest of what is done will fall far short of potential results.

And, most important, everybody in manufacturing needs to get the message that MRP is not *miracle* requirements planning. It does nothing but provide the tools: the tools to enable us to run our manufacturing businesses in our manufacturing economy at a much higher level of professionalism than has previously been possible. *



tomers service through the application of MRP. But few are really Class A MRP users who truly make it function as a scheduling system. Most of the users of MRP also use the shortage list and consequently have not taken the expediting burden off the foremen or the purchasing people. As a consequence, they have not seen the productivity improvements that can be attained when scheduling really works in a manufacturing company.

MRP HAS FALLEN SHORT

The problem is not so much that MRP has *not* worked as that it has fallen short of its proven potential in most American companies today.

And the reasons are always the same:

1) Most companies approach MRP as a computer system rather than a people system made possible by the computer.

2) Having done this, they now wait for the data processing and systems people to somehow write some programs that will make a manufacturing company run differ-

OLIVER W. WIGHT



Oliver Wight is president of Oliver Wight, Inc., a management counseling and MRP education firm. He is also president of Manufacturing

Software Systems, a company that reviews and evaluates computer programs for use in manufacturing and distribution scheduling. He has authored several books, including two on production and inventory control and management, and his latest book, *MRP II: Manufacturing Resource Planning*, will be released this year.

*MRP—Who Needs It?, William S. Donelson II, DATAMATION, May 1979, p. 185.



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Now you can watch your four favorite programs...

The new HP 2626 display station will give you a view of your computer system you've never seen before.

It lets you divide the screen into as many as four separate "frames," each attached to a different workspace in the terminal's memory. You can check a program listing in one frame and access a file in another. Fill out a form in one workspace while the computer loads the next form into another. Or do text preparation and editing in adjacent frames. Right before your eyes.

That's not all. The HP 2626 has two data communications ports instead of the usual one, so you can use the split screen capability to talk to two computers at the same time. Or log onto the same computer twice for simultaneous batch and interactive jobs.

More than meets the eye.

A high resolution character cell and a glare-reducing screen coating give the HP 2626 the sharpest, clearest display of any of our terminals. And that's saying a lot.

What's more, you can set line lengths of up to 160 characters in any workspace. Then scroll horizontally to get the entire picture. (The built-in thermal printer includes a compressed mode to print up to 132 characters per line.) Scroll vertically, too, or change the size of the frame at the touch of a key.

An interactive forms drawing module makes it easy to design forms, including drawing

horizontal or vertical lines with just a single keystroke. You can even program the terminal for audio tones to cue your operator to critical or non-critical errors, or other conditions within a program.

Split decisions.

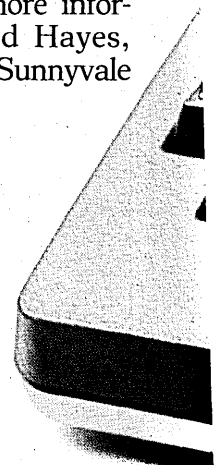
Hook up the HP 2626 to two computers (or the same one twice) and it's like getting a multi-tasking capability right in the terminal. Your systems designer can now compile, execute, monitor and edit programs as if two stations were available.

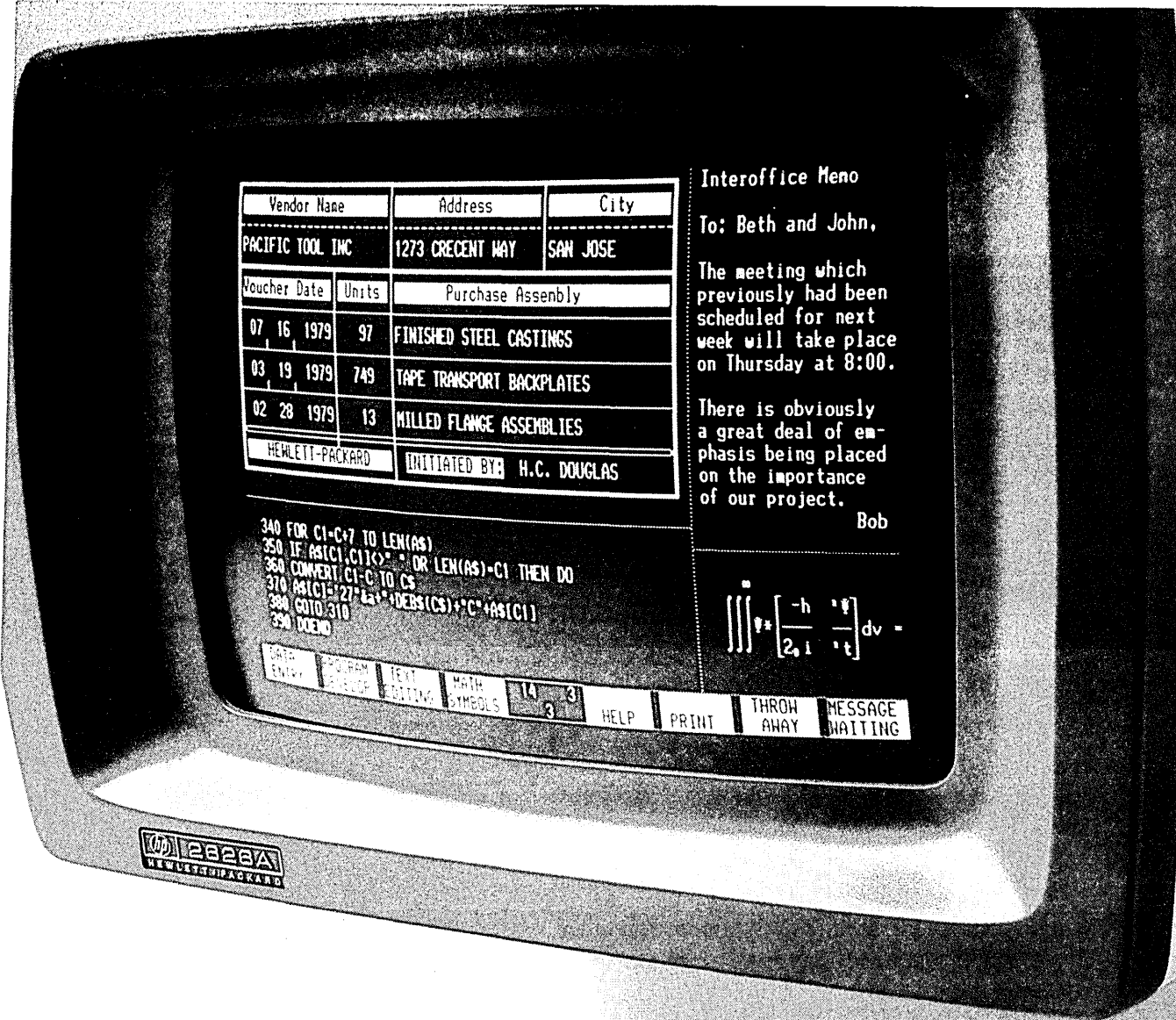
While your user is filling out a form, the terminal can be sending data from the previous form to a computer. And downloading the next form into an adjacent workspace. By smoothing out the "type and wait" of data entry, you can take advantage of less expensive, low-speed transmis-

...same time,

sion lines without sacrificing the efficiency of your operator. The result? You'll get more out of the entire system.

If you'd like to watch a program on the new HP 2626 display station, or any of our terminals, just call your local HP sales office listed in the White Pages. You can also write for more information to Hewlett-Packard, Attn: Ed Hayes, Dept. 471, 974 East Arques Avenue, Sunnyvale CA 94086. Or just return the coupon.





Vendor Name	Address	City
PACIFIC TOOL INC	1273 CRECENT WAY	SAN JOSE
Voucher Date	Units	Purchase Assenbly
07 16 1979	97	FINISHED STEEL CASTINGS
03 19 1979	749	TAPE TRANSPORT BACKPLATES
02 28 1979	13	MILLED FLANGE ASSEMBLIES
HEWLETT-PACKARD	INITIATED BY: H.C. DOUGLAS	

Interoffice Memo
 To: Beth and John,
 The meeting which previously had been scheduled for next week will take place on Thursday at 8:00.
 There is obviously a great deal of emphasis being placed on the importance of our project.
 Bob

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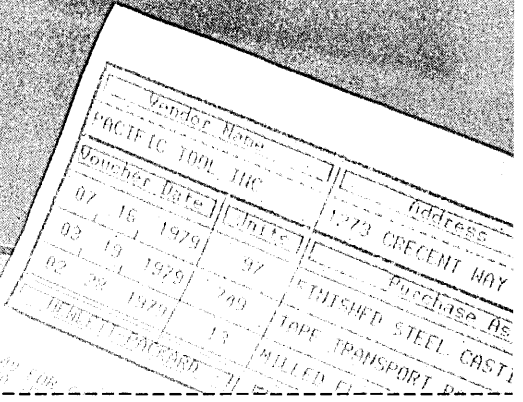
340 FOR C1-C7 TO LEN(AS)
350 IF ASC(C1,C1) <> " " OR LEN(AS)-C1 THEN DO
360 COMMENT,C1-C TO CS
370 ASC(C1)=27*LEN(AS)+DEB(ASC(C1))+ASC(C1)
380 GOTO 310
390 DDEND
  
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$$\iint \mathbf{F} = \begin{bmatrix} -h & \frac{1}{t} \\ 2 & 1 \\ 1 & t \end{bmatrix} dv$$

EXEC PROGRAM TEXT MATH 14 3 3
 ENTRY HELP PRINT THROW AWAY MESSAGE WAITING

HP 2626A
HEWLETT-PACKARD

same station.



Yes! I'd like to find out more about the HP 2626 display station. Please send me your brochure.

I'd like more information on HP's family of data terminals.

Please have a representative call me.

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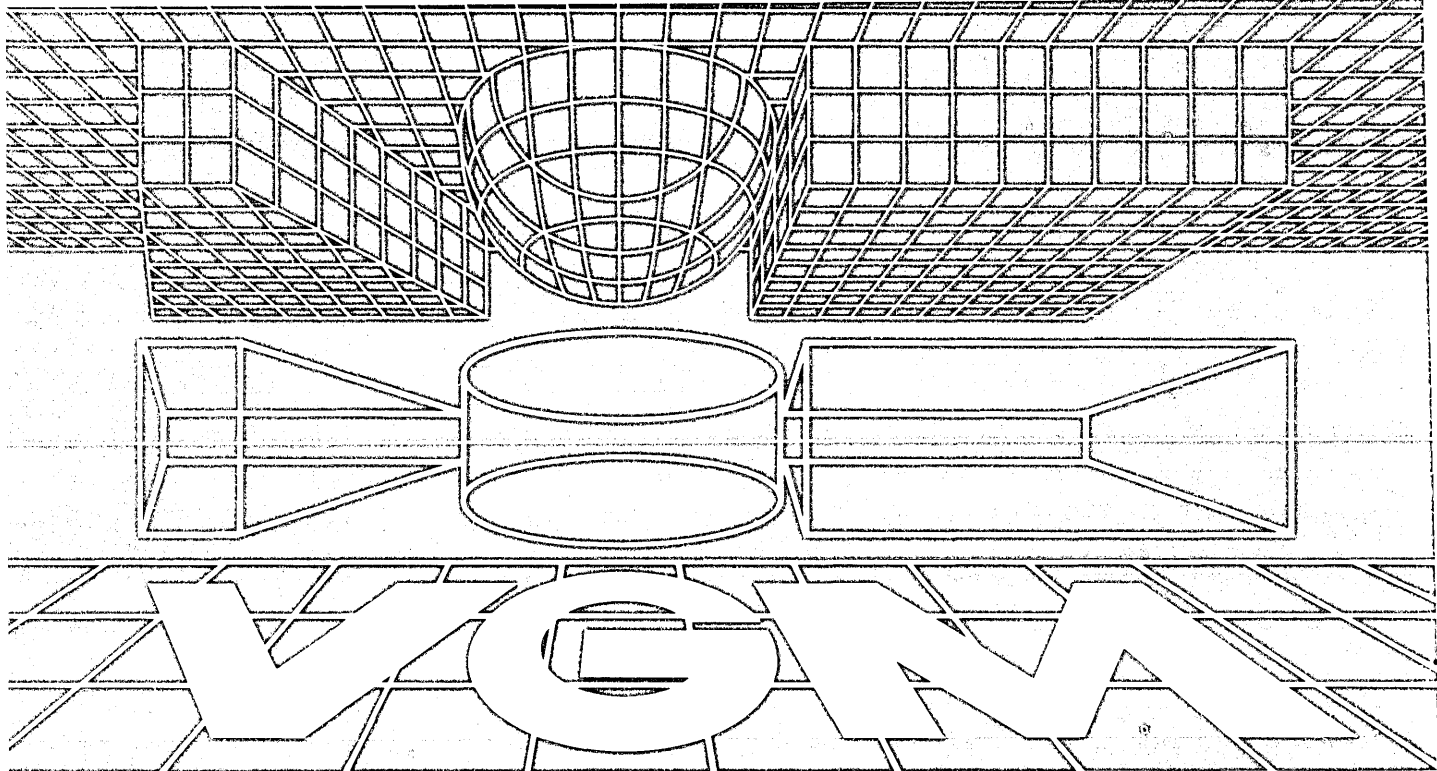
Company _____

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Mail to: Hewlett-Packard, Attn: Ed Hayes,
 Dept. 471, 974 East Arques Avenue, Sunnyvale CA 9408



Great visual applications need a great graphics system

VGM® - The Virtual Graphics Machine

A truly great graphics system providing a rich set of operations, developed for flexibility and device independence. This will allow your own applications to drive any graphics device without software direction. VGMs designed to support any output configuration based on any display technology, be it raster, vector, storage or hardcopy and any input device such as lightpen or joystick. With VGM you concentrate on what's important: the application, not the hardware.

Flexibility the Key

VGM provides a wide variety of selectable features to support a broad spectrum of graphics applications including engineering, architectural and business. She offers a set of graphics functions that not only exceeds the 1979 ACM/SIGGRAPH core System standards, program portability is guaranteed and significant reduction in programmer effort is ensured. In addition, VGMs written in ANSIFORTRAN and its compact enough to fit on most processors, including micros, making VGM machine independent - another key factor in VGM's flexibility!

The Basic Package

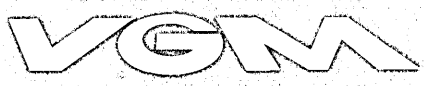
VGM is as you optimally use graphics by providing a complete set of 2D primitives including lines, arcs, text, polygons, choice of size, colour, orientation and intensity; an extensive debugging and error handling facility which speeds up application software development; introductory and user manuals; fully documented skeleton device driver; a user requested device driver from the current VGM library; Acceptance Package for system self-test; 90-day support. These are some of the key features now available for just \$5,000.

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VGM's modular design allows you to expand your system capability by using VGM options. Increase productivity through the ability to interactively build quality charts with our Business Graphics option. Using our PLOT 10® interface, existing PLOT 10 software life can be extended with minimal change. Other enhancements, starting at \$500, include: additional device drivers; a 3D graphics package which resides on top of VGM, with optional hidden line removal. Extended support, on-site installation guidance and consultation are also available.

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Oleg Lapozak
 Manager, Graphics Technology,
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Bell Northern Research is the largest privately owned research and development organization in Canada. It is widely recognized as a world leader in electronics and digital communications. VGM and many other quality software tools help maintain its prominence.

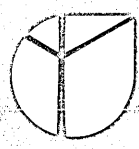


Illustration is an artist's impression. VGM is a registered trademark of Bell Northern Research. PLOT 10 is a registered trademark of Tektronix.

CIRCLE 66 ON READER CARD

SURVEYING THE SOFTWARE

Oliver Wight's MRP chart (p. 94) is widely accepted as the general definition of the elements of a closed loop system. But as you analyze the details of the various software packages in the following chart, you will notice variations in the definition of elements in each vendor's system. Naturally, there are variations among the software packages, but there are also differences as compared to the definitions found in the *Dictionary* of the American Production & Inventory Control Society (APICS).¹

Let's compare the terms in the closed loop MRP chart with the terms in the MRP package chart.

Where software vendors have capabilities in production planning, the application features are usually found in the module titled master production scheduling (MPS). Therefore, all responses were grouped under MPS. More and more, the vendors are offering rough cut capacity planning capabilities, a means to check the realism of MPS in terms of available plant capacity.

If the vendors have any software capabilities related to MPS, such as forecasting and order entry, notations were made in the chart. However, there was no attempt to define "forecasting"; the vendors' capabilities may range from single weighted averages to more sophisticated projection techniques.

The planning and executing activities following the MPS module require extensive data bases. For simplicity's sake, these data bases don't show on the MRP chart. One of the

most important elements of a system is the software to create, organize, and maintain information about the product and the processes required to make the product. The most common name is bill of material. Admittedly, this term is too narrow when describing many of the vendor offerings. Some vendors use "product data base" or a similar term to include not only bill of material, but also routings, work centers files, and perhaps change control, detail processes, and tooling files.

In addition to the data bases for product and process information, more files are needed to maintain inventory status, open order balances, and update the records representing demand data for MRP. Again, as a variety of vendor names exist for these functions, the all-inclusive term inventory management & control has been used.

On material requirements planning (MRP) and capacity requirements planning (CRP), there is more agreement. If the vendor claims to have either regenerative MRP or net change MRP, either or both are included in the term MRP. Regenerative MRP is when all of the data in the system is reprocessed each processing cycle, usually weekly. Net change MRP is reprocessing only the changes since the last run, usually daily.

When you begin to check details of the software, be careful: there are still a few vendors that claim a single level explosion of a bill of material is an MRP system.

In the executing phases of a closed loop MRP system, the applicable software subsystems are most commonly labeled shop floor control for control of the company's plant, and purchasing for control of the outside suppliers. You may see a few synonyms,

such as work in process. In most systems, the software logic to collect data from the plant operations is found in the shop floor control module.

Cost control is not specifically identified in the MRP chart but is often included by vendors as part of their product. In fact, the most common term for developing standard costs and analyzing actuals for variance comparison purposes is cost control. For the following chart we drew the line to include any modules relating to product cost accounting. No mention is made of general accounting modules although many of the vendors also offer these modules.

We have not discussed the software selection process, since that subject was beyond the scope of this article, but a point should be stressed. Often, prospective buyers will attempt to compare Vendor A's software to Vendor B's to Vendor C's. This is not a valid comparison. The only valid comparison is how each vendor's package compares to an individual company's requirements. Much ado has been made about keeping packages simple. Before you can judge whether a package is too simple or too complicated, you need first to identify *your* requirements. In truth, many manufacturing companies are complex environments and thus dictate extensive software with many application features. Reaching for simplicity is admirable but may be illusory.

Finally, we have made every effort to include all known sources of manufacturing resources planning systems; however, the field is expanding rapidly and is a labyrinth of vendors, oems, systems houses, and distributors, who often market identical packages.

—Richard Bourke

1. Wallace, Thomas, Editor, *Dictionary*, American Production & Inventory Control Society, Watergate Office Bldg., Suite 504, 2600 Virginia Ave. N.W., Washington, DC 20037, (202) 333-1660.

MANUFACTURING RESOURCE PLANNING SURVEY

COMPANY NAME	PRODUCT NAME	MODULES
American Software, Inc.	Manufacturing Management Systems	master production schedule, capacity requirements planning, bill of material, MRP, product costing, shop floor control, purchasing
A.O. Smith, Data Systems Div.	Manufacturing Data System	cost control, engineering data control, forecasting, inventory & stores control, shop floor control, purchasing, MRP
Applied Information Development Inc.	AID-Manufacturing Control System (AID-MCS)	MRP, inventory management & control, capacity requirements planning, master production scheduling, purchasing control, sales forecasting, customer order control, distribution requirements planning, resource requirements planning, work in process control
Arista Manufacturing Systems A Division of Xerox Corp.	Arista Manufacturing Systems	manufacturing standards, inventory records control, historical forecasting, master production scheduling, material requirements planning, shop floor control, capacity requirements planning, telecommunications access method (on-line), cost management system, procurement management system, simulated requirements planning
Arthur Andersen & Co.	MAC-PAC RPG	labor performance reporting, inventory control, master production schedule, MRP, shop floor control, capacity requirements planning, inventory accounting, manufacturing engineering, design engineering, product costing
	MAC-PAC COBOL	purchasing, inventory control, master production schedule, MRP, shop floor control, capacity requirements planning, inventory accounting, manufacturing & design engineering
ASK Computer Systems, Inc.	MANMAN*	inventory management & control, bill of material, MRP, purchasing, shop floor control, capacity requirements planning
Associates for Management Services, Inc.	Manufacturing, Management, and Control	order processing, purchase order control, shop floor control, routing, bill of material, MRP, inventory
Boeing Computer Services	PMS (Production Management System)	bill of material, master scheduling, MRP, inventory control, purchase order control, optional parts, shop order control, in process control, job & standards routing, performance reporting & accounting feedback, capacity requirements planning
Bristol Information Systems, Inc.	Manufacturing Systems	manufacturing order processing, billing, perpetual inventory, bill of material, material requirements planning
Burroughs Corp.	PCS III	engineering data control, inventory control, MRP, master production scheduling, work in process, operation scheduling and loading, capacity requirement planning, forecasting and inventory analysis
Business Controls Corp.	MIN-MACS (Manufacturing, Inventory & Materials Control System)	inventory control system, bill of material, purchasing, work in process, inventory control, job tracking, vendor performance analysis, MRP

LANGUAGE	HARDWARE	COST	AGE (years)	NO. OF USERS
COBOL	360/370 303X: 4300 Wang VS	\$15K-\$40K	4	35
PL/1	IBM 360/370 OS (software sale-time-sharing)	by quotation	5	40+
COBOL	370	\$15K per module	10	10
COBOL IMAGE	360/370 and up. HP 3000	\$30K/module \$250K/system	4	75+
RPG	IBM 34, System 3, DEC PDP 11/34, 11/70 Data General Eclipse 3030, Univac 90/25, 30, ICL 2903, Honeywell 62/40, other minis	\$30K-\$33K	5.5	125
COBOL	IBM 370, 4300, 303X series and PCMs HP 3000	\$100K-\$150K	2.5	35
FORTRAN	HP3000	\$50K+	9	75
COBOL	HP3000 & Prime 550, 650, 750	\$30K-\$45K	1.5	12
DATA BASIC	Micro Data Prime Information 500, 1000, 5000 Honeywell Level 6 Ultimate	\$18K-\$25K	5.5	120+
FORTRAN	HP 3000	by quotation	3	n/a
Databus Datashare	Datapoint	\$6.5K total	4	5
COBOL	B1000 B2000, 3000, and 4000 B5000, 6000, and 7000	lease: \$500-\$2,200/ month purchase: \$15K- \$65K	1.5	n/a
FORTRAN IV FORTRAN IV PLUS	DEC PDP-11	\$25K	5+	25

MANUFACTURING RESOURCE PLANNING SURVEY

COMPANY NAME	PRODUCT NAME	MODULES
Cincom Systems, Inc.	Manufacturing Resource Planning System (MRPS)	product control, vendor analysis & purchasing, master production scheduling, MRP, shop floor control & production planning control, bill of material
Computata Systems, Inc.	Manufacturing System for IBM Series I	bill of material, order processing, work order preparation, inventory, purchasing, sales analysis
Computer Covenant Corp.	Integrated Manufacturing System	bill of material, materials inventory, labor distribution, job costing, production scheduling
Computer Methods, Inc.	PROFIT	bill of material, production control & costing, MRP
Computer Systems Engineering	Total Manufacturing System	bill of material, materials requirements planning, production cost & control, inventory control, MRP, shop floor control, capacity planning
	Job Accounting System	job costing
Computer Technology, Inc.	MCS (Manufacturing Control System)	bill of material, purchase order tracking, work in process, tracking & costing, inventory control
Comserve Corp.	AMAPS (Advanced Manufacturing, Accounting, Production System)	bill of material, material control, material requirements planning, purchasing control, process & routing, shop floor control, capacity requirements planning, standard costing, master production scheduling
Data Systems for Industry	COP	customer order processing
	JCP	job cost processing
	SFP	shop floor processing
	MM/3000	materials management
	Mfg/3000	manufacturing
Data 3 Systems Inc.	MRPS 34/38	business forecasting, order entry, resource capacity planning, master production scheduling, work order management, inventory management, purchase order management, product structures, material requirements planning, detail capacity planning, shop floor control, standard product costing
De Bugge Computer Services	PRO III	sales order processing, sales forecasting, job costing, job forecasting, master scheduling, engineering/bill of material, purchasing (includes dock to stock), WIP control, stores control, production planning, materials requirement planning, cost accounting, physical inventory, shop floor control
Decision Sciences Corp.	SPARS	sales projection & requirements scheduling
Digital Business Systems Inc.	part of TAG distribution accounting system	bill of material MRP
Digital Equipment Corp.	LOTS (Labor and Operations Tracking System)	complete shop floor control
EDS Compusource Corp.	Distribution, Manufacturing	inventory control, bill of material, master schedule, shop floor control, cost control, MRP
Escom, Inc.	MMC (Manufacturing Management and Control)	engineering entry, sales order entry, inventory planning, work order launching, purchase order processing, work in process costing

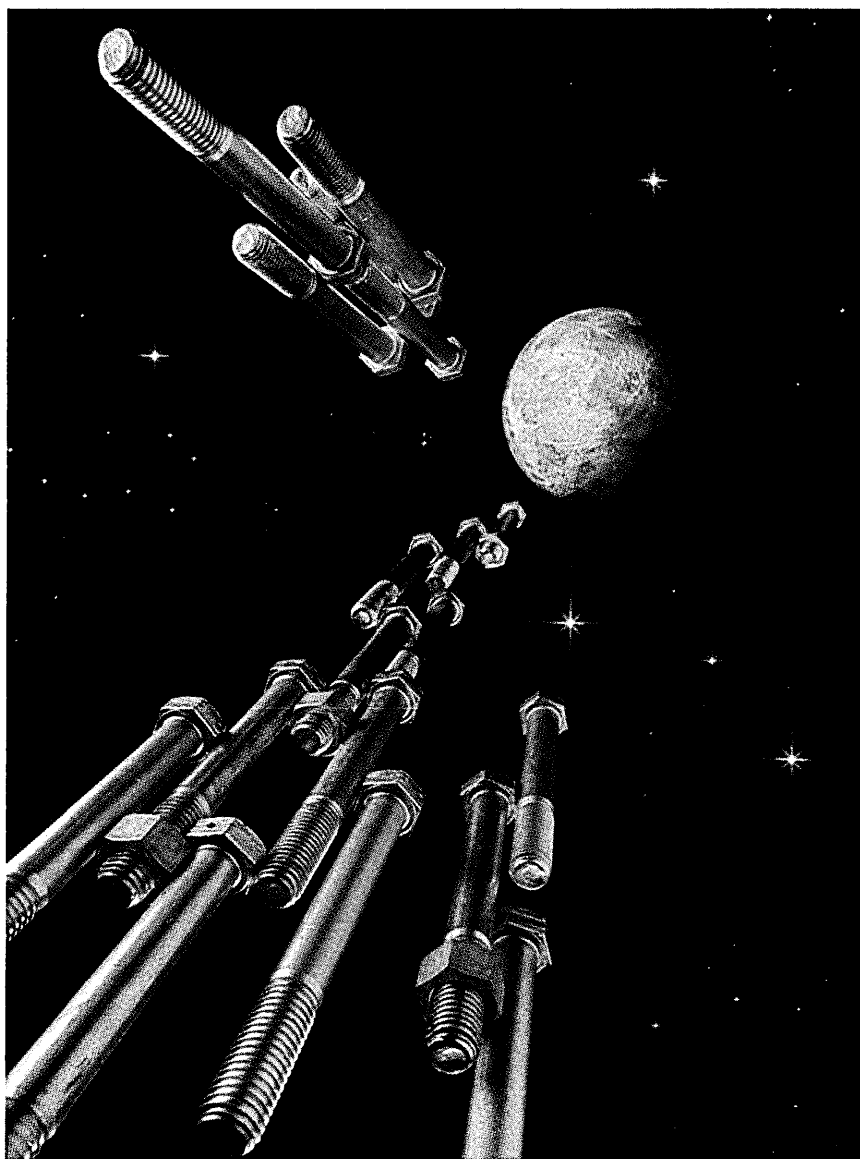
LANGUAGE	HARDWARE	COST	AGE (years)	NO. OF USERS
COBOL	303X 360/370 VAX/780	\$50K-\$200 K	2	40 +
COBOL	IBM Series 1—any configuration	\$2.5K-\$20.5K	2	30 +
DIBOL 11	PDP 11	\$19K	1	30 +
BASIC	Basic/Four	\$20K	5	200 +
business BASIC	Data General, NOVA, Eclipse	\$25K-\$50K	1	3
business BASIC	Data General, NOVA, Eclipse	\$8K-\$12K	1	3
COBOL	Wang VS	\$25K-\$60K	n/a	13
COBOL	IBM 370, 4300, 303X, Hewlett-Packard 3000 Wang, Prime	\$22K-\$55K/module	5	100
COBOL	HP 3000	15K	2	25 (among COP, JCP, and SFP)
COBOL	HP 3000	\$10K	1	
COBOL	HP 3000	\$17.5K	2	
COBOL	HP 3000	\$25K	1	
COBOL	HP 3000	\$18.5K	2-3	
RPG II	IBM Systems 34/38	\$70K	2	4
Data BASIC	Microdata Reality Honeywell Level 6 Ultimate OS Intertechnique Prime	\$50K-\$55K	1.5	2
FORTTRAN	370 System/3 Prime 400	\$50K	5	5
business BASIC	complete line of Data General equipment under DOS, ARDOS, AOS	\$18K +	to be released in spring of '81	new
COBOL	DEC PDP-11/70	\$34- \$200	6 months	n/a
DG Business BASIC	Data General w/DOS, RDOS, or AOS	\$750-\$10K initial license	6 (distribution) 2 (manufacturing)	150 + (distrib.) 55 + (mfg.)
BASIC and English	Microdata Reality Prime Information Honeywell Ultimate	\$15K-\$30K	4	25 +

MANUFACTURING RESOURCE PLANNING SURVEY

COMPANY NAME	PRODUCT NAME	MODULES
Factory Systems Division of Rolfe Assoc.	TRAC 80	shop floor control, production scheduling, work in process
Far West Data Systems	MAC-PAC/HP	design engineering, inventory control, material requirements planning, purchasing, manufacturing engineering, product costing, shop floor control, capacity requirements planning, inventory accounting, master scheduling, contract tracability
Formation, Inc.	FORMAN	MRP, capacity requirements planning, shop floor control, master prod. scheduling, purchasing, inventory control
Gains Systems Group	General Adaptive Inventory System	demand forecasting, inventory management
Hewlett-Packard	Materials Management 3000	master production schedule, bill of material, inventory management & control w/ purchase order tracking, purchasing, MRP, standard product costing
Honeywell Information System	HMS	MRP, master production schedule, forecasting, capacity requirements planning, inventory management control, manufacturing data control
IBM Corp., DP Div.	COPICS	engineering & production, data control, forecasting, MPR, inventory accounting, shop floor control, capacity requirements planning, product costing
IBM Corp. General Systems Div.	IPICS	engineering and production data control, product costing, inventory accounting, material requirements planning, capacity planning, production control
	MAPICS	order entry, sales analysis, inventory management, product data management, material requirements planning, production control and costing, data collection system support
ICL, Inc. Distributive Systems Div.	Extended SAFES (Small Factory Systems)	bill of material, costing, inventory, work in process, extended RP
Informatics Inc.	Manufacturing Systems	product cost control, shop floor control, inventory control, material requirements planning
Information Management Technologies	MACS	inventory control, purchasing, job costing, MRP, engineering
Integral Business Computing, Inc.	Manufacturing Management System	bill of material, WIP/job costing, inventory control, MRP, purchasing
Interactive Applications, Inc.	MRP Command System	bill of material, MRP, capacity requirements planning, shop floor control
Interactive, Inc.	Inflo	bill of material, shop orders, MRP, shop floor control, inventory control, capacity requirements planning, purchasing
Interactive Information Systems	Interactive Management Control System	inventory management & control, manufacturing standards, shop floor control, purchasing, MRP, bill of material, capacity requirements planning
Interactive Management Systems, Inc.	MRP IMS Systems	bill of material, shop floor control, purchasing, inventory, MRP
Jacobsen & Associates, Inc.	Manufacturing Control Systems	shop floor control, MRP, bill of material, capacity requirements planning, inventory control, WIP/job costing

LANGUAGE	HARDWARE	COST	AGE (years)	NO. OF USERS
FORTRAN IV COBOL	minis w/ruggedized shop floor terminals	basic system w/6 terminals: \$75K complete system w/25 terminals: \$350K	2	3
COBOL	IBM 370 and up HP 3000	\$49K-\$100K	2½ new (HP 3000)	3 n/a
BPL (enhanced PL/1)	F4000 (announced May '80)	\$130K	new	n/a
FORTRAN COBOL	303X,360/370. PCMs Univac 90/30,60,80 Burroughs 6800	\$2.5K/month	4	40
Hewlett-Packard SPL/3000	HP 3000 III, 30, 33	\$25K for 10 modules	9 months	70+
COBOL	Honeywell 66/DPS	\$5K-\$25K/module \$100K/total system	announced April '80	2 test sites
COBOL DMS assembler	370 4300 303X	\$50-\$195 month/ module	1	n/a
RPG II	S/3	\$150-\$1,045/month or \$3.6K-\$18.7K	6	n/a
RPG II	System 34	\$46-\$791/month (no paid-up option)	3	n/a
Assembler	System 10	\$2.5K-\$20K	4	200
COBOL	360/370 4300	\$16K-\$100K	6	40+
COBOL	Wang 2200VS	\$22K	2	5
FORTRAN IV	Data General	\$3K/module \$31K complete	5	12
BASIC	HP 3000 III	\$20K-\$50K/module	8	45
BASIC	Prime, Microdata, and Honeywell minis	\$30K-\$60K	5	60+
BASIC PLUS	PDP-11/70 VAX	\$69.5K	7	33
BASIC PLUS II VAX BASIC	PDP-11 VAX	\$5K-\$10K/module	3	n/a
COBOL, INFOS	360/370, Data General 330	lease: \$600-\$1,525/ month; purchase: \$42K-\$85K	11	50

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A powerful management tool propels manufacturing into the 21st century.

Many manufacturers still find it difficult to synchronize the various stages of production.

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HMS is a total system. People at every level of management receive the hard, timely information they need to function effectively.

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HMS also helps you schedule, monitor, and control the *flow* of work. Bottlenecks and idle machine time can be anticipated and avoided. Overtime can be minimized.

The system automatically compares the workload with available resources, pinpointing both overloads and underloads.

By monitoring work-in-process, HMS enables you to reschedule jobs to meet due dates. And to respond quickly to unforeseen developments.

Total Control.

The Honeywell Manufacturing System brings material, labor, and production facilities together into a smoothly-functioning unit. Increased productivity is the natural result.

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

CIRCLE 67 ON READER CARD

Honeywell

MANUFACTURING RESOURCE PLANNING SURVEY

COMPANY NAME	PRODUCT NAME	MODULES
Management Technology, Inc.	MIPS	forecasting, master production schedule, bill of material, MRP, shop floor control, inventory control, WIP/job costing, capacity requirements planning
Mandate Corp.	Manufacturing Management System	product costing, MRP, inventory management, job costing, shop floor control, purchasing, product data control
Manufacturing Resources Management	PACS	data base planning, bill of material, data base control, master production schedule, MRP, capacity requirements planning, priority dispatching, standard costing, standard job order costing, manufacturing order—material & stock locations, manufacturing order—labor purchase order & vendor shipping or sales order
Martin-Marietta Data Systems	MAS-E	MRP, master production scheduling, shop floor control, capacity requirements planning, purchasing, cost control
	MAS-II	production control, cost control, inventory control, purchasing, business planning
	MAS-I	same as MAS-II, plus customer order processing, master production scheduling
	MAS-H	same as MAS-E
Metasystems, Inc.	IMPACS (Interactive Manufacturing Planning & Control System)	bill of material, inventory control, capacity and material requirements planning, production control, shop floor reporting
Mid-America Computer Corp.	MACE	production control, inventory mgmt., shop floor control, capacity planning, MRP, bill of material, purchasing
Mitrol, an operation of General Electric Information Services Co.	MIMS: Industrial Management Systems Very High Level Language (VHLL) oriented to manufacturing systems	inventory control, engineering production control, shop floor control, capacity requirements planning, cost control, purchasing, MRP
NCA Corp.	Manufacturing MS-11 Manufacturing System	inventory control, bill of material, MRP, capacity requirements planning, shop floor control, purchasing
NCR	IMCSII	bill of material, inventory control, MRP, routing, work in process, capacity planning, order processing, sales analysis (released in July), in development for 1981 release: purchasing/receiving, master production scheduling
	MISSION	bill of material, routing, costing, material management on-line, inventory management, master production scheduling, material requirements planning, capacity requirements planning, WIP, order processing, purchasing/receiving
Optimum Systems Inc.	Manufacturing Inventory Control System	bill of material, inventory control, MRP
Praxa Corp.	MRP & Capacity Planning Systems	master production schedule, MRP, file maintenance, bill of material, inventory mgmt. & control, capacity planning
Professional Computer Resources, Inc.	Resource Management System	inventory management, MRP, production control, forecasting, capacity requirements planning
R.A.I.R. Inc.	MADIC	bill of material, inventory control, work in process, requirement generation, capacity requirements planning
Rath & Strong Systems Products	PIOS	master production schedule, shop floor control, work center and routing processor, bill of material, purchase order control, MRP, order entry costing

LANGUAGE	HARDWARE	COST	AGE (years)	NO. OF USERS
FORTRAN	IBM, Burroughs, and Honeywell mainframes & 32-bit minis	\$40K-\$140K	3	30
COBOL	HP 3000	\$144K total system, time-sharing req. initially	10	60
RPGII COBOL	System/3, 34, Wang, HP 3000, Burroughs, Data General 360/370, ICL, CTL8000	\$25K-\$40K	10	170
COBOL	4300, 370/138	\$79K-\$179K	4	n/a
COBOL	370/158	\$90K-\$225K	3	20+
COBOL	360/370	\$30K-\$180K	8	500+
COBOL	HP-3000	\$60K-\$137K	1	30+
Datashare	Datapoint 5500	\$50K total (plus installation)	4	n/a
ANSI COBOL	turnkey minis & maxis (remote services) w/256K	\$40K-\$130K	9	11
MIMS	IBM 370, 138, and up, 43XX, 303X (time-sharing available on Geisco's Mark 3000 services)	\$8K/month, av. depends on usage (time-sharing)	8	100
BASIC PLUS	DEC PDP-11 VAX	\$18K-\$60K	4	100
ANSI COBOL 74	8200 family & 8400 family (minimum 128K processor)	\$2,640-\$3,960/module	2	200+
COBOL	V8455, any V8500 or V8600	\$9K-\$9.5K/module	2	45
COBOL	360/370	\$2K-\$3K/mo.	8	5
COBOL	VAX PDP-11	\$65K-\$70K complete system	4	17
RPG	System/34	\$50K	2	100
BASIC	HP 2000 Onyx microcomputers Alpha microcomputer	\$40K/turnkey time-sharing \$1K/mo.	10	30
COBOL	IBM 360, 370, 303X, 4300 series, Data General C/S, Honeywell 60/66.	\$5K-\$50K	13	20



WEBER MARKING SYSTEMS, INC. LABEL PRINTING SYSTEM

FUNCTION SELECTION

- F1 - INFORMATION FILE MAINTENANCE
- F2 - PRINT LABELS
- F3 - CREATE A LABEL FORMAT
- F4 - EDIT A LABEL FORMAT
- F5 - SYSTEM MAINTENANCE
- F6 - STOP

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 MT PROSPECT IL 60056

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 QUANTITY 5
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 DATE PACKED 07-14-80
 WEBER MARKING SYSTEMS, INC.
 ARLINGTON HEIGHTS, ILLINOIS 60005

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 ENG. CHANGE 80052
 DATE PACKED 07-14-80
 WEBER MARKING SYSTEMS, INC.
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 F3101 8229 1013
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 WEIGHT THIS PIECE 43 LBS
 CUBE THIS PIECE 2.5

BOSTON MASS
 ROTTERDAM NETHERLANDS
 QUANTITY 3
 WEIGHT THIS PIECE 75 LBS
 CUBE THIS PIECE 13.0

SAH DIEGO CALIF
 TOKYO JAPAN
 QUANTITY 3
 WEIGHT THIS PIECE 75 LBS
 CUBE THIS PIECE 13.0

SAH DIEGO CALIF
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SAH DIEGO CALIF
 TOKYO JAPAN
 QUANTITY 3
 WEIGHT THIS PIECE 75 LBS
 CUBE THIS PIECE 13.0

LEGITRONIC
 5306 \$845
 SNAP-ACTION SWITCH
 125 V DC 1/2 AMP

2HBA-1 25 10-27-80
 INK SPECIALTIES CO
 1436 EAST DAVIS
 MT PROSPECT IL 60056
 Weber Marking Systems

LEGITRONIC
 5306 \$845
 SNAP-ACTION SWITCH
 125 V DC 1/2 AMP

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 SNAP-ACTION SWITCH
 125 V DC 1/2 AMP

2HBA-1 25 10-27-80
 INK SPECIALTIES CO
 1436 EAST DAVIS
 MT PROSPECT IL 60056
 Weber Marking Systems

Thanks to the memory

Meet the Weber *Legitronic II*, the newest member of the Weber family of electronic printing systems. The computerized label printing system that does something remarkable. It remembers.

The floppy disk remembers

Floppy disk memory. That's the heart of the *Legitronic II*. It lets you create and store a multitude of label formats and data to use whenever you want. And you only store the data once. It's simple and efficient. No more labeling delays. No more needless waste of labor and money. That's good to remember.



Don't forget, we wrote the program

That means you don't have to. Its question/answer prompting and proportional label format make operator training easy. If they can read and type, they can operate the *Legitronic II*.

Remember the name

The Weber *Legitronic II*. From the people you've trusted for quality and innovation in label printing systems for nearly fifty years.

Remember the place

For a hands on demonstration of the *Legitronic II*, stop by the Weber Exhibit, Booth 1420 at the Packaging Show, October 27-31, McCormick Place, Chicago.

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Arlington Heights, IL 60005
Telex: 910-222-1602

You can forget your labeling problems.

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Ext. 2353

CIRCLE 68 ON READER CARD

MANUFACTURING RESOURCE PLANNING SURVEY

COMPANY NAME	PRODUCT NAME	MODULES
Remote Business Services, Inc.	Manufacturing Systems for DEC System	bill of materials, MRP, purchasing, order processing, work order preparation, scheduling, inventory, sales analysis, archive (data base management system & report generator)
	Box Manufacturing System	same as above, only specifically designed for box manufacturers
The Service Bureau Co. Div. of Control Data	MFG/PLUS	master production schedule, inventory control, bill of material, shop floor control, purchasing, forecasting, capacity requirements planning, net change MRP, job costing
SESA, Inc.	SESAP	MRP, bill of material, shop floor control, inventory mgmt. control, master production scheduling, purchasing
Software International	Manufacturing Resource Planning System	master production schedule, advanced purchasing, shop floor control, MRP, capacity requirements planning
Software Management Systems, Inc.	Manufacturing, Management & Control	bill of material, master production schedule, price control, forecasting & analysis, inventory control, shop floor, tool inventory, purchaser & vendor performance, capacity requirements planning, MRP
Sperry Univac	UNIS 1100	production engineering data management, product costing, customer order processing, purchase order control, inventory status control, master scheduling, forecasting & analysis, material requirements planning, production planning, work order control
	UNIS 90 VS/9	same as UNIS 1100
	UNIS 90 OS/3	same as UNIS 1100
	UNIS 80	same as UNIS 1100
	MANMAN	bill of material, processing, cost accounting, work in process control, capacity planning, scheduling, materials requirements planning, inventory control, purchasing
STSC, Inc.	CMCS	data base maintenance, sales forecasting, inventory management, distribution, master scheduling, MRP, capacity planning, shop floor control, stock status and order entry (highly customized)
Systemation, inc.	MRP System	master production schedule, engineering data control, MRP, order release
Systems Management, inc.	Manufacturing Control System	bill processor and shop calendar, inventory control, on-order and master schedule, MRP, cost control, operational routing, shop floor control, capacity planning, work in process
Thomas, Laguban & Associates	E-TAPS and E-PICS	MRP, capacity requirements planning, master production schedule, purchasing, shop floor control
Tymshare, Inc.	MANUFACTS	inventory control, bill of material, MRP, shop floor control, master production schedule, capacity requirements planning, purchasing
U.S.S. Engineers & Consultants, Inc. (UEC)	Production Planning & Control System	order entry & planning, material scheduling, warehousing
Williams & Associates	IMP (Interactive Manufacturing Planning)	materials planning, order entry, inventory control, capacity planning, requirements pegging, cost control, WIP monitor, bill of material processor, purchasing
Xerox Computer Services	Manufacturing Services	inventory control, master production scheduling, production control, MRP, cost planning & control, capacity requirements planning, shop floor control

LANGUAGE	HARDWARE	COST	AGE (years)	NO. OF USERS
DIBOL	DEC any PDP 11	\$2.5K-\$35K	6	30+
BASIC DIBOL	DEC any PDP 11	\$25K-\$40K	4	7+
COBOL XL (SBC) MARK IV	time-sharing	\$100/mo +	5	40+
BASIC English	Microdata, Prime Honeywell Level 6	\$85K +	4	15
COBOL BASIC assembler	Prime, 360/370, HP 3000, Microdata	\$20K-\$245K	6	285
BASIC COBOL	Hewlett-Packard DEC Prime Microdata	\$28.5K-\$63K	3	100+
COBOL	Univac Series 1100, 1100/60, 80, 20, 40	\$750 per month	7	125
COBOL	Univac Systems 90/60, 70, 80	\$750/month	2	500 users (divided between VS/9 & OS/3)
COBOL	Univac Systems 90/60, 70, 80	\$275/month	5	n/a
COBOL	Univac Systems 80, 90/25, 30, 40	\$500/month	new	n/a
FORTRAN	V77 and Hewlett-Packard machines	\$50K	4 months	n/a
APL*PLUS	IBM 360/370 or equivalent	\$1K-\$20K/month on time-sharing basis \$50K-\$150K	3	50
BASIC PLUS	DEC 500	\$15K-\$25K	4	1
RPL English COBOL RECALL	Microdata (RPL & English) Prime (COBOL) Honeywell/Ultimate (RPL & RECALL)	\$3K-\$45K (RPL) \$3.5K-\$58K (COBOL)	3	100
RPG II COBOL	360/370 S/3, 34, 38	\$100K-\$700K	5	15
proprietary	time-sharing or turnkey on DEC PDP-10 or 2020	avg. \$4K/mo.	3	15
COBOL	IBM 370/168 Burroughs 4800	furnished upon request	10	3
BASIC	DG Novas & lookalikes	\$12K-\$80K	15	85
COBOL FORTRAN BASIC, APL	general time-sharing; 370, Sigma 9	\$1K-\$50K/month (average \$3K-\$7K/ month)	10	900+

VENDOR INDEX

To obtain additional information on the systems and modules in the MRP survey, contact the vendors on the list that follows.

American Software, Inc.
443 East Paces Ferry Rd.
Atlanta, GA 30305
(404) 261-4381

A. O. Smith Data Systems Div.
8901 North Kildeer Ct.
Brown Deer, WI 53209
(414) 449-2700

Applied Information Development, Inc.
823 Commerce Dr.
Oak Brook, IL 60521
(312) 654-3030

Arista Manufacturing Systems Div. of Xerox Corp.
Republic Square
7830 Silas Creek Parkway
Ext.
Winston-Salem, NC 27106
(919) 722-5167

Arthur Andersen and Co.
33 West Monroe St.
Chicago, IL 60603
(312) 580-0069

ASK Computer Systems, Inc.
730 Distel Dr.
Los Altos, CA 94022
(415) 969-4442

Associates for Management Services, Inc.

12611 Northup Way
Bellevue, WA 98005
(206) 453-9775

Boeing Computer Services
360 Corporate Dr.
Seattle, WA 98188
(206) 575-5220

Bristol Information Systems, Inc.
84 North Main St.
Fall River, MA 02720
(617) 679-1051

Burroughs Corp.
Burroughs Pl.
Detroit, MI 48232
(313) 972-7000

Business Controls Corp.
507 Boulevard
Elmwood Park, NJ 07407
(201) 791-7661

Cincom Systems, Inc.
2300 Montana Ave.
Cincinnati, OH 45211
(513) 662-2300

Computata Systems, Inc.
772 Post Rd. East
Westport, CT 06680
(203) 226-4791

Computer Covenant Corp.
790 Farmington Ave.
Farmington, CT 06032
(203) 677-6563

Computer Methods, Inc.
9401 West Beloit Rd.
Milwaukee, WI 53227
(414) 327-4471

Computer Systems Engineering
16 Second Ave.
Burlington, MA 01803
(617) 272-4348

Computer Technology Inc.
11101 N.E. 8th St.
Suite 238
Bellevue, WA 98004
(206) 625-9765

Comserv Corp.
1385 Mendota Heights Rd.
Mendota Heights, MN 55120
(612) 452-7770

Data 3 Systems Inc.
P.O. Box 441
Santa Rosa, CA 95402
(707) 528-6560

Data Systems for Industry
3450 E. Spring St.
Long Beach, CA 90806
(213) 595-5601

De Bugge Computer Services
91 Christine Dr.
East Hanover, NJ 07936
(201) 887-4284
In Florida: (305) 392-0541

Decision Sciences Corp.
528 Fox Pavilion
Jenkintown, PA 19046
(215) TU7-1970

Digital Business Systems Inc.
244 Main St.
Reading, MA 01867
(617) 942-0220

Digital Equipment Corp.
MK1-2/A13
MDCPG
Continental Blvd.
Merrimack, NH 03054
(603) 884-5439

EDS Compusource Corp.
14580 Midway
Dallas, TX 75234
(214) 661-6000

ESCOM Div. of Anacomp
12838 S.E. 40th Pl.
Bellevue, WA 98006
(206) 641-4990

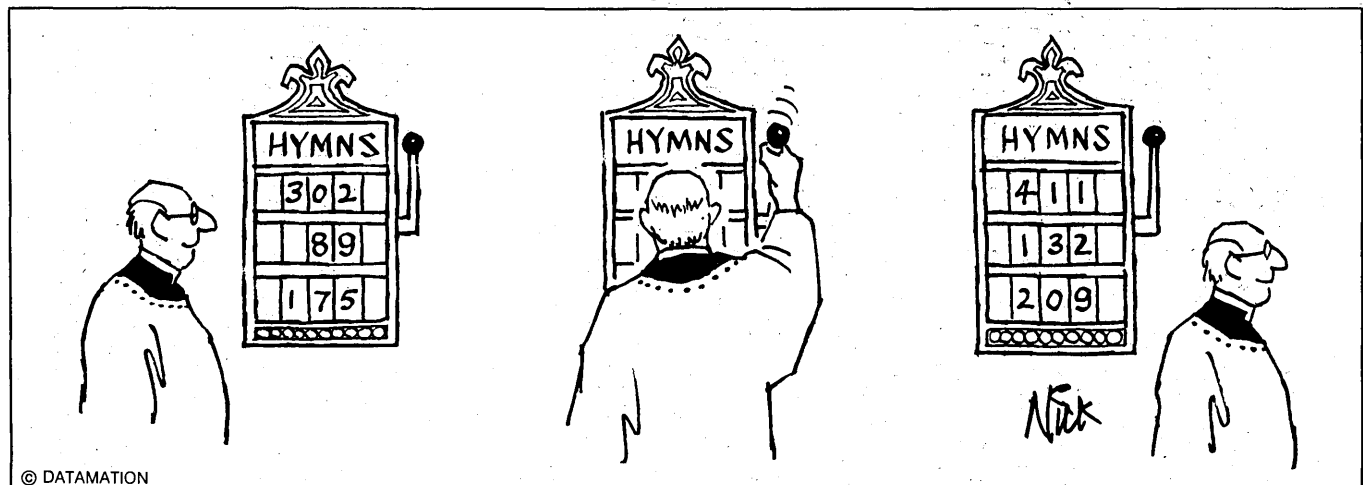
Factory Systems Div. of Rolfe Associates Inc.
2264 Silas Deane Highway
Rocky Hill, CT 06067
(203) 563-1343

Far West Data Systems
178-41 Fifth Ave.
Irvine, CA 92714
(714) 556-4585

Formation, Inc.
823 East Gate Dr.
Mt. Laurel, NJ 08057
(609) 234-5020

Gains Systems Group
2021 Spring Rd.
Oak Brook, IL 60521
(312) 325-9390

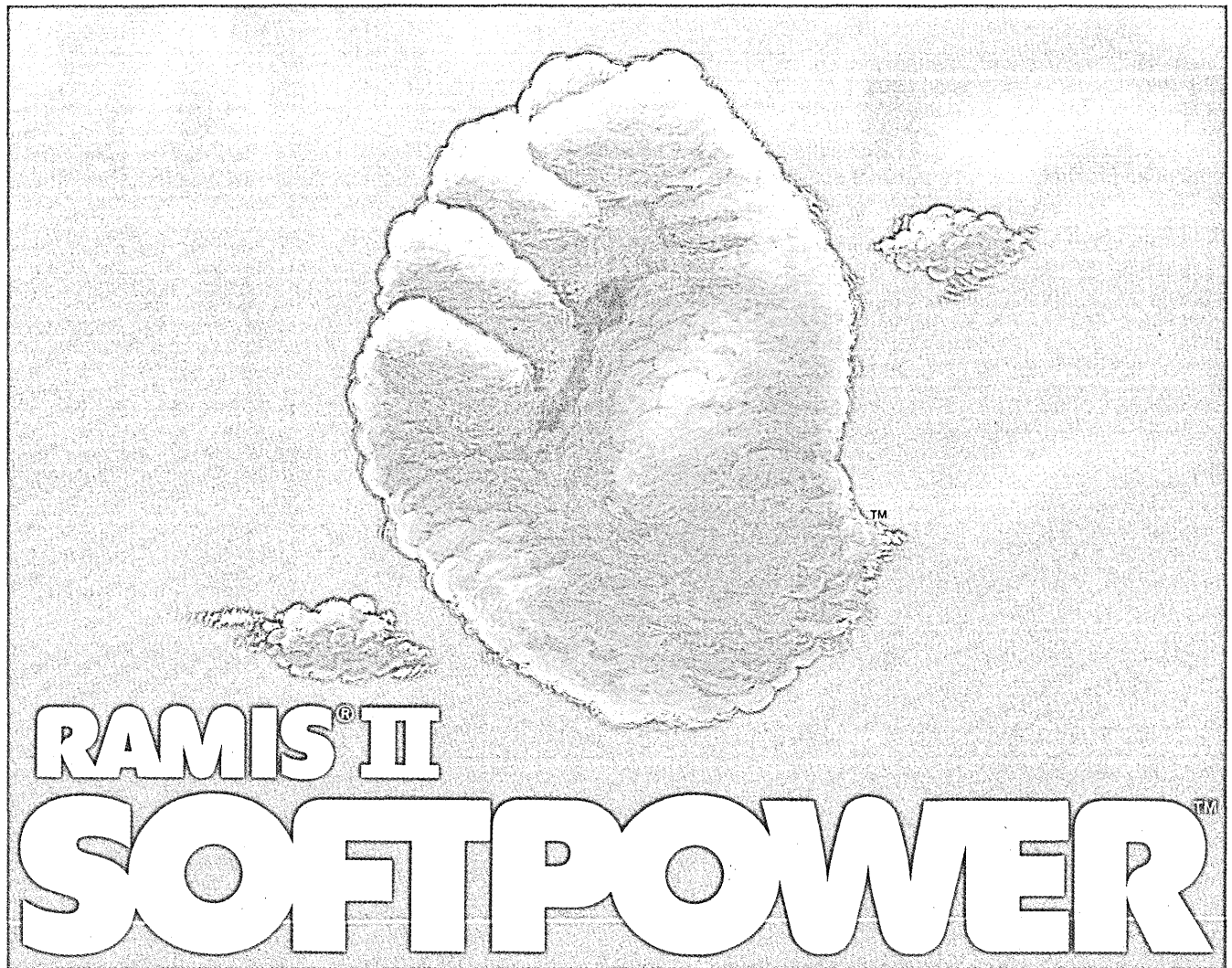
Hewlett-Packard
19447 Pruneridge Ave.
Cupertino, CA 95014
(408) 725-8111



© DATAMATION

CARTOON BY NICK HOBART

Most installations have a 2-3 year backlog of unimplemented applications



Turns backlogs into applications

RAMIS II is a complete information management system. It integrates an English-like nonprocedural language with a flexible DBMS. The DBMS permits the easy integration of data from a variety of sources, while the nonprocedural language lets you tell the computer what you want done without having to say how to do it.

Users report that RAMIS II systems can be implemented in 1/5 the time it takes using procedural languages such as Cobol or PL/1. This translates into a productivity gain of 400%!

Because RAMIS II systems are simple to set up and modify, there is no need to develop elaborate specifications in advance. In fact, users report that basic requirements can be agreed upon and a prototype implemented in 1/3 the time it normally takes just to develop the specs. The data structures and reports may then be modified and enhanced in an

evolutionary manner until the system is fully operational.

Eliminating programming also eliminates the need to talk about programming. This frees the user and dp staff to concentrate on the problem rather than the code—which results in both better communications and a better system.

In business, to stand still is to fall behind. More cost effective hardware, an increasing demand for computerized applications, and the decreasing availability of applications programmers means even bigger backlogs unless more powerful, more productive software is used.

For more information call or write today for a free RAMIS II factbook.

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Title _____

Company _____

Address _____

City _____

State _____ Zip _____

Phone _____

Mail to: Mathematica Products Group
P.O. Box 2392, Princeton, NJ 08540

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SOFTWARE THAT UNLOCKS THE POWER OF YOUR HARDWARE

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CIRCLE 69 ON READER CARD

VENDOR INDEX

<p>Honeywell Information Systems Inc. 200 Smith St. Waltham, MA 02154 (617) 895-6000</p> <p>IBM Data Processing Div. 1133 Westchester Ave. White Plains, NY 10604 (914) 696-1900</p> <p>IBM General Systems Div. 3715 Northside Parkway Atlanta, GA 30327 (404) 238-4000</p> <p>ICL, Inc. Distributive Systems Div. 415 East Airport Freeway Irving, TX 75062 (214) 258-8525</p> <p>Informatics, Inc. Manufacturing Systems Div. 701 Lee St. Des Plaines, IL 60016 (312) 298-9300</p>	<p>Information Management Technologies 180 N. Michigan Ave. Chicago, IL 60601 (312) 372-4222</p> <p>Integral Business Computing, Inc. 1440 W. Pacific Coast Highway Harbor City, CA 90710 (213) 539-0530</p> <p>Interactive Applications, Inc. 510 Oakmead Parkway Sunnyvale, CA 94086 (408) 736-9890</p> <p>Interactive Inc. 9787 Aero Dr. San Diego, CA 92123 (714) 560-8525</p> <p>Interactive Information Systems 10 Knollcrest Dr. Cincinnati, OH 45237 (513) 761-0132</p>	<p>Interactive Management Systems, Inc. 375 Concord Ave. Belmont, MA 02178 (617) 489-3550</p> <p>Jacobsen and Associates, Inc. 10229 Lower Azusa Rd. Temple City, CA 91780 (213) 575-7504</p> <p>Management Technology Inc. A-4562 64th St. Holland, MI 49423 (616) 335-5821</p> <p>Mandate Corp. 300 East Ohio Building 1717 East Ninth St. Cleveland, OH 44114 (216) 861-8100</p> <p>Manufacturing Resources Management 10721 W. Capitol Dr. Milwaukee, WI 53222 (414) 462-3500</p>	<p>Martin-Marietta Data Systems 300 East Joppa Rd. Baltimore, MD 21204 (301) 321-5744</p> <p>Metasystems, Inc. 2632 Charney Rd. University Heights, OH 44118 (216) 321-5262</p> <p>Mid-America Computer Corp. Thorndale at York Rd. Bensenville, IL 60106 (312) 860-6500</p> <p>Mitrol An Operation of General Electric Information Services Co. One New England Executive Park Burlington, MA 01803 (617) 273-4111</p>
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A fast, furious, five-day course for Software managers, to update you well into the 80's. Taught personally by Ed Yourdon and Tom DeMarco.

You're a seasoned, top-flight Software manager, but the world you manage has changed dramatically.

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CIRCLE 70 ON READER CARD

MRP Software Evaluations

Manufacturing Software Systems, founded by Oliver Wight and Darryl Landvater, now offers professional Evaluations of popular MRP software packages for most large and small computer systems.

Today, companies purchasing MRP software can have an objective evaluation so they know what the software will do for them before they buy it.

IBM

370

The purpose of the Evaluations

These in-depth Evaluations serve two functions:

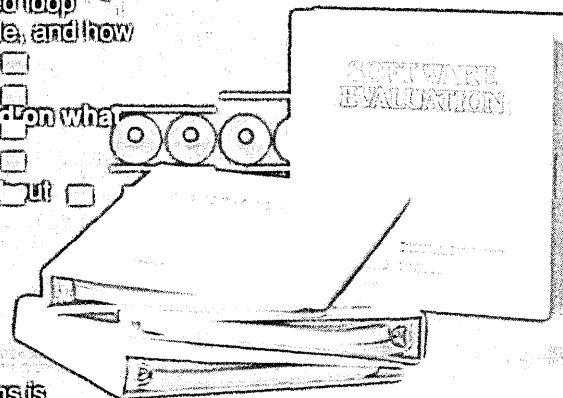
First, to evaluate the package and describe how it operates; and second, if a package should be modified, to explain why and how. The Evaluations reduce the time spent in evaluating and selecting software and in systems design.

The basis for MRP Software Evaluations

The Standard System is the basis for comparison. It is a comprehensive description of what a closed loop MRP system should include, and how it would typically operate.

Objective Evaluations based on what works in manufacturing

No theory or speculation about what might work, these Evaluations are based on years of experience working with successful Class A MRP users.



Manufacturing Software Systems is tackling—and solving—some of the practical problems of implementing MRP. For more information and a complete list of Evaluations write us or call 802-878-5254.

Oliver Wight, President
Darryl Landvater, Vice President
Christopher Gray,
Vice President

Manufacturing Software Systems Inc.

P.O. Box 278
Williston, Vermont 05495
(802) 878-5254

CIRCLE 71 ON READER CARD

VENDOR INDEX

NCA Corp.

388 Oakmead Parkway
Sunnyvale, CA 94086
(408) 245-7990

NCR Commercial/ Industrial Marketing

Bldg. 26, Third Floor
Dayton, OH 45409
(513) 449-4530

Optimum Systems Inc.

2801 Northwestern Parkway
Santa Clara, CA 95051
(408) 987-4444

Praxa Corp.

26 Springdale Rd.
Cherry Hill, NJ 08003
(609) 424-3600

Professional Computer Resources Inc.

2021 Midwest Rd.
Oak Brook, IL 60521
(312) 932-2200

R.A.I.R. Inc.

465 Castro St.
Mountain View, CA 94041
(415) 964-0413

Rath and Strong

21 Worthen Rd.
Lexington, MA 02173
(617) 861-1700

Remote Business Services, Inc.

9 Bettswood Rd.
Norwalk, CT 06851
(203) 853-1270

The Service Bureau Co.

500 West Putnam Ave.
Greenwich, CT 06830
(203) 622-2000

SESA Inc.

89 State St.
Boston, MA 02109
(617) 742-6620

Software International

Elm Square
Andover, MA 01810
(617) 475-5040

Software Management Systems, Inc.

1642 South Parker Rd.
Denver, CO 80231
(303) 752-1550

Sperry Univac

P.O. Box 500
Blue Bell, PA 19424
(215) 542-4011

STSC, Inc.

462 Boylston St.
Boston, MA 02116
(617) 267-6864

Systemation, Inc.

Two Commerce Park
Square
232 Chagrin Blvd.
Cleveland, OH 44122
(216) 464-8616

Systems Management, Inc.

10400 West Higgins Rd.
Des Plaines, IL 60018
(312) 298-3840

Thomas Laguban & Associates, Inc.

Box 523
Barrington, IL 60010
(312) 381-3200

Tymshare, Inc.

20705 Valley Green Dr.
Cupertino, CA 95014
(408) 446-7411

U.S.S. Engineers and Consultants, Inc.

Div. of U.S. Steel
600 Grant St.
Pittsburgh, PA 15230
(412) 391-8115

Williams Associates

626 Al-Hill Dr.
San Luis Obispo, CA 93401
(805) 544-5749

Xerox Computer Services

5310 Beethoven St.
Los Angeles, CA 90066
(213) 390-3461

THE BETTER TRAP

IDS's Hawk has more codes, protocols, trappings and interactive capability — in a standard unit!

The Hawk (Models 4000 & 4010) gives you more capability per dollar — and it's easier to use. Requires no special training course. The Hawk lets you monitor, transmit and receive data between a modem and terminal on a 5 inch, 512 character screen (Model 4000 has 9" screen). In the interactive mode, it emulates a processor, terminal or modem. There's a built-in tape interface. LEDs and test jacks monitor and access all signals in the EIA interface. A printer output is standard. The Hawk saves you money when you buy it — and when you use it.



- Captures and stores up to 4096 characters for later analysis.
- Searches for and traps on independent TD and RD data streams up to 126 characters long, including "don't cares."
- Operates with BISYNC, SDLC, HDLC, ADCCP, X.25, and other synchronous and asynchronous protocols.

- Asynchronous and synchronous data rates from 50 to 19,200 bps.
- ASCII, EBCDIC, Hex, Octal, Baudot, EBCD, IBM Selectric, PARS/IPARS and Transcode formats are standard.
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ON
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SCHEDULE

CIRCLE 72 ON READER CARD

To work well for Manufacturing, MRP* must also work on the computer.

When searching for an MRP system, many manufacturing firms reason that: "Only functional capability is important, not how MRP works on the computer."

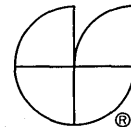
This misconception frequently results in a manufacturing control system that is unable to achieve its functional capability because it cannot be implemented by data processing. Manufacturing therefore never quite gets the system they need, where they need it—"outside" the computer room.

The functional capabilities of your manufacturing system are very important. But, by also ensuring the system works well on the computer, you can be confident it will meet your manufacturing information needs today and adapt to your needs of the future. Then you can truly reap the benefits of MRP—with a lot less time and expense.

Along with "How MRP works on the computer isn't important," there are many other misconceptions that prevent companies from realizing the benefits of MRP.

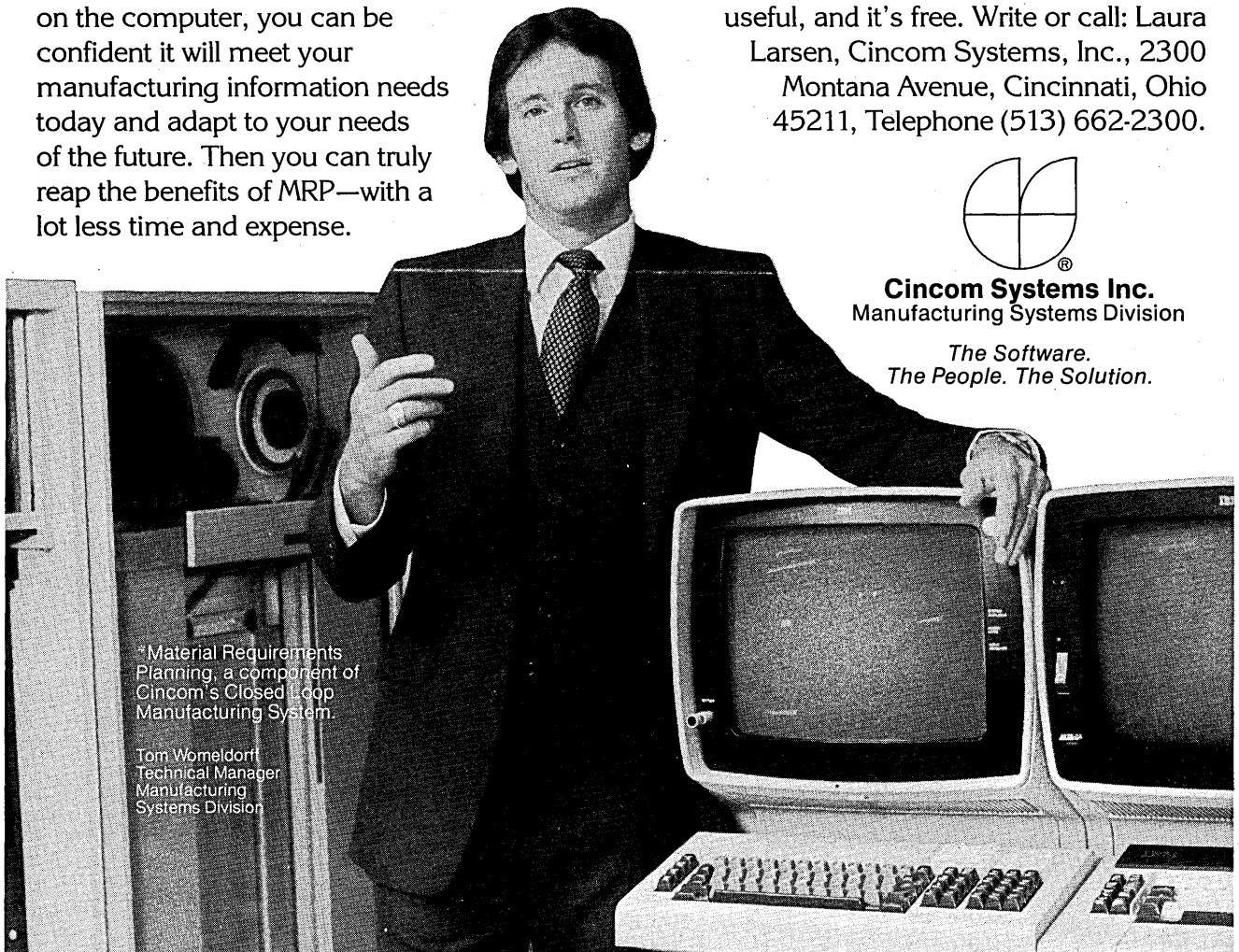
Misconceptions such as: "Once we've implemented MRP, everything will be all right." Or "Some people might need MRP, but our problem is capacity planning."

At Cincom, we've put together a booklet of the "12 Common Misconceptions about MRP." This booklet will help you get a better grasp of MRP. Then you can come to grips with manufacturing control. We'll be happy to send "Misconceptions" to you. It's useful, and it's free. Write or call: Laura Larsen, Cincom Systems, Inc., 2300 Montana Avenue, Cincinnati, Ohio 45211, Telephone (513) 662-2300.



Cincom Systems Inc.
Manufacturing Systems Division

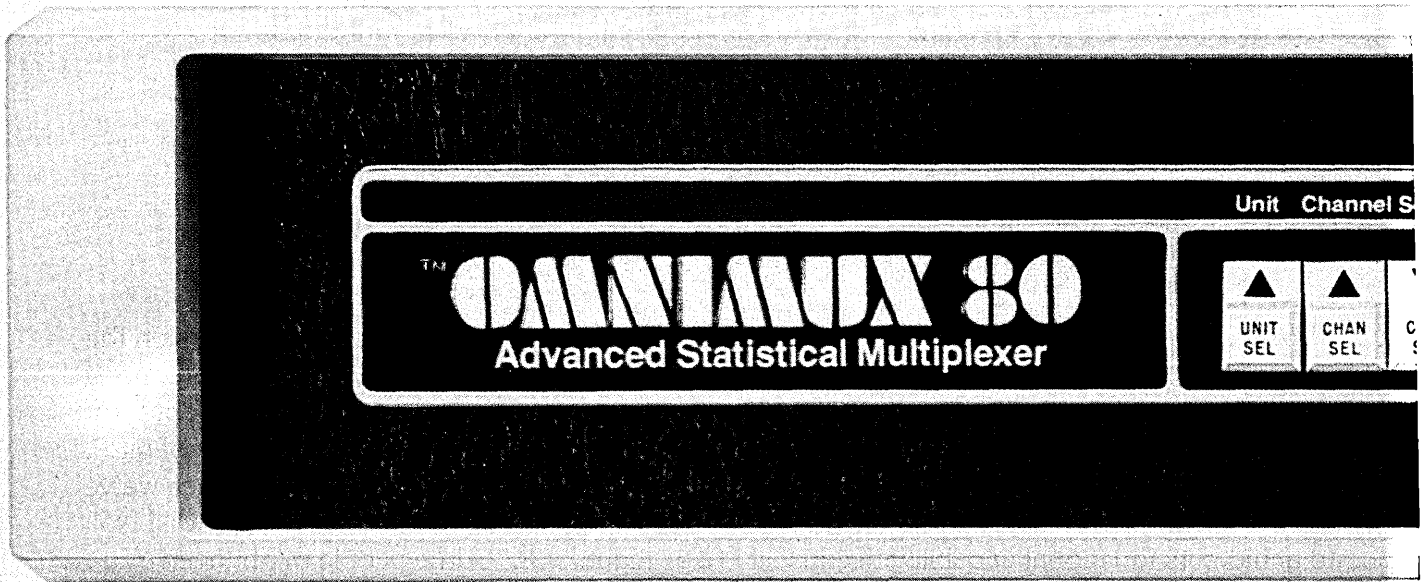
*The Software.
The People. The Solution.*



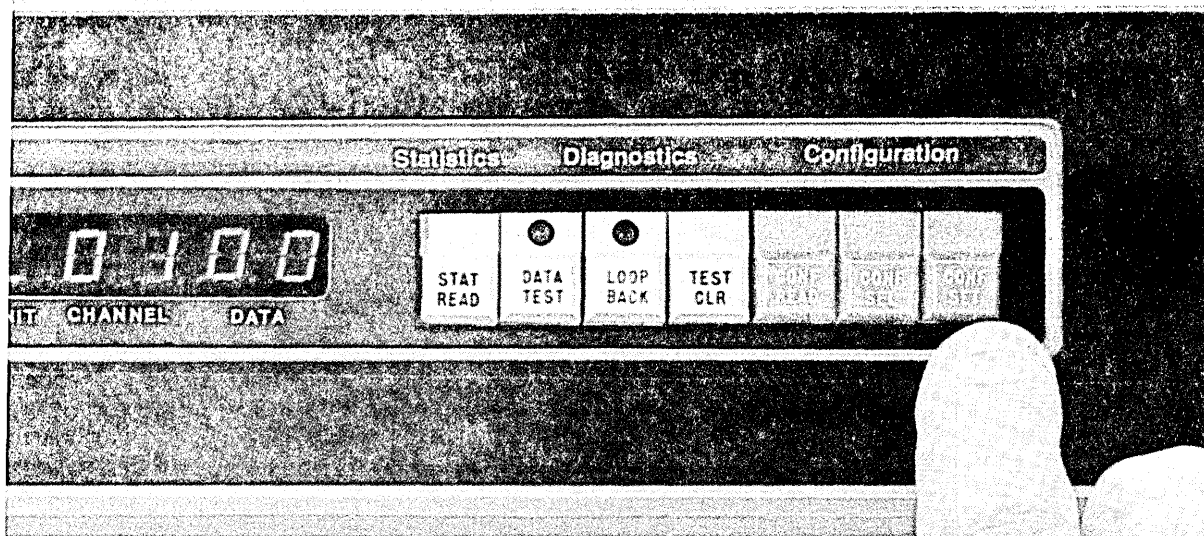
*Material Requirements Planning, a component of Cincom's Closed Loop Manufacturing System.

Tom Womeldorf
Technical Manager
Manufacturing
Systems Division

CIRCLE 73 ON READER CARD



**IT'S MORE
THAN A
MULTIPLEXER.**

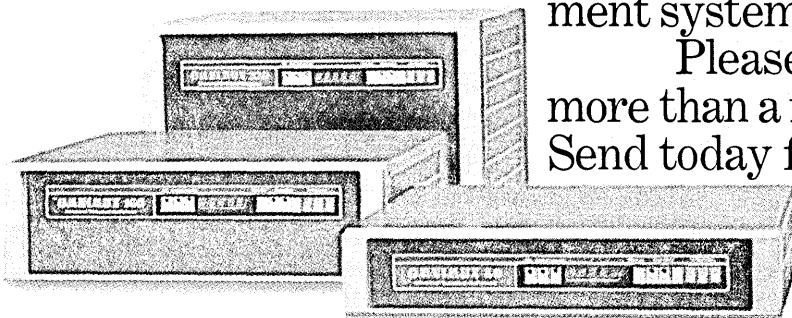


Most multiplexers can improve network efficiency. Now there's an advanced statistical multiplexer that can improve the efficiency of your data network. And your own efficiency. It's designed to be a working member of your management team.

Omnimux gives you the tools to manage. You get real-time status information on channel utilization—cumulative and channel by channel—so you can maximize data flow. Plus, you can accumulate statistical data for analysis and planning.

Omnimux has a wide range of management oriented features. Extensive monitoring and test capabilities, local and remote control, convenient front panel operation and compatibility with network management systems are just some of them.

Please let us show you how much more than a multiplexer Omnimux can be. Send today for our illustrated brochure.



Racal-Milgo™ **RACAL**
On-line around the world The Electronics Group

Racal-Milgo Information Systems, Inc.
8600 N.W. 41st Street Miami, Florida 33166
Telephone (305) 592-8600 TWX: 810-848-6588

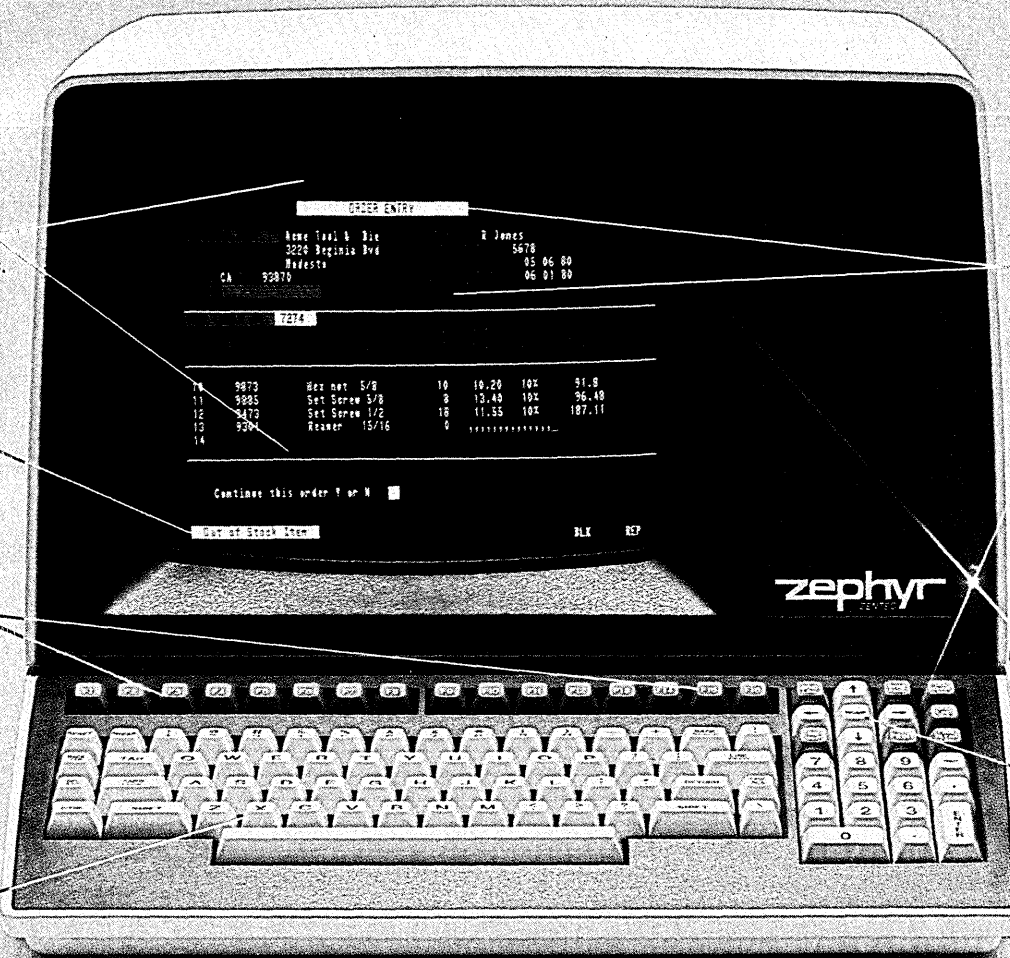
FINALLY, A SMART TERMINAL THAT DOESN'T SACRIFICE FORM FOR FUNCTION.

Bright, crisp, non-glare CRT is easy on the eyes.

Standard 25th status line lets you know what's happening as it's happening.

You have 16 function keys right at your fingertips, operable in shifted and non-shifted modes.

Sculptured, typewriter-style keys are smooth, responsive to the touch.



Displayed data can be enhanced with a wide choice of video attributes.

Reliable operation up to 19,200 baud.

Cursor control keypad is compact easy to use, with centrally located home key.

THE ZEPHYR™ BY ZENTEC.

There's really only one way to appreciate our new Zephyr. On the seat of your pants.

Go ahead. Sit down and touch test the Zephyr's typewriter-style keyboard. It's positive, yet responsive to the touch. And it's laid out for operator convenience. Above the standard 96 ASCII keys you'll find 16 function keys that operate in both shifted and unshifted modes. To the right, there's a compact numeric keypad and a cursor control pad with centrally positioned home control, both functionally designed to help you process more data, more efficiently.

The keyboard's not our only stroke of genius, though.

Zephyr's CRT is a sight for sore eyes, too. The large 12" non-glare video display incorporates a high resolution P-4 phosphor that makes it easier for you to work with words. You can quickly address two full 1,920 character pages of video display and enhance displayed data with a choice of video attributes including dim, blink, blank, reverse video and underscore.

Zephyr functions in both conversational and block modes, too, so you can transmit data with each keystroke, or transmit only unprotected data within a protected form, greatly improving your system throughput. And because

Zephyr is a product of Zentec experience, you are assured of reliable performance, day in and day out. Year after year. You have our word on it.

Isn't it time you found out how much more our Zephyr can do for you and your CPU? Just call your nearest Zephyr distributor and ask for a demonstration. He's listed below. Or call us at (408) 727-7662 and ask for Ted Atlee. It could be one of the smartest moves you've ever made. Zentec Corporation, 2400 Walsh Ave., Santa Clara, CA 95050.

ZENTEC

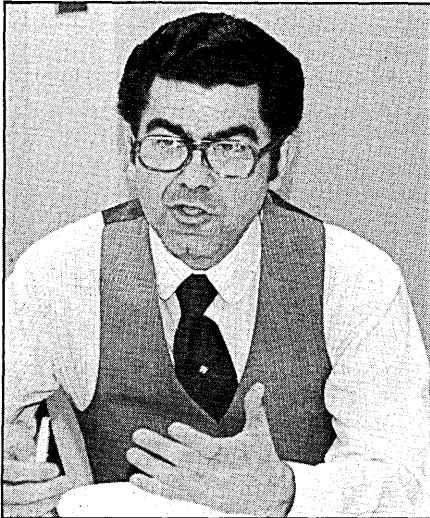
... the last word in intelligent terminals

Sales Offices: Santa Clara, CA (408) 727-7662; Carson, CA (213) 324-1155; Long Grove, IL (312) 634-9550; White Plains, NY (914) 428-2801; Bernardsville, NJ (201) 766-2403; Boston, MA (617) 935-4511; Rockville, MD (301) 762-7990; Richardson, TX (214) 690-9265; Authorized Distributors: ADL Enterprises Inc., Wharton, NJ (201) 328-1300; Comspec, Inc., Houston, TX (713) 461-4487; David Jamison Carlyle Corporation, Los Angeles, CA (213) 277-4562; Leasametric, Inc., Foster City, CA (800) 227-0280; RC Data, Santa Clara, CA (408) 988-7510; Zygal Dynamics, Ltd., Chesham, England (02405) 75681.

CIRCLE 75 ON READER CARD

Five manufacturing users discuss planning and implementation of MRP.

PUTTING THEORY TO WORK IN THE SHOP



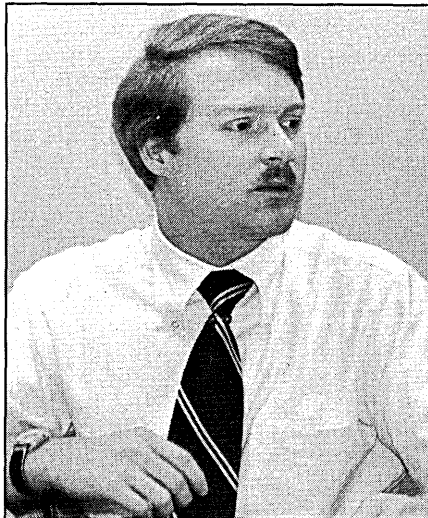
Robert A. Abair, Smith Valve Co.



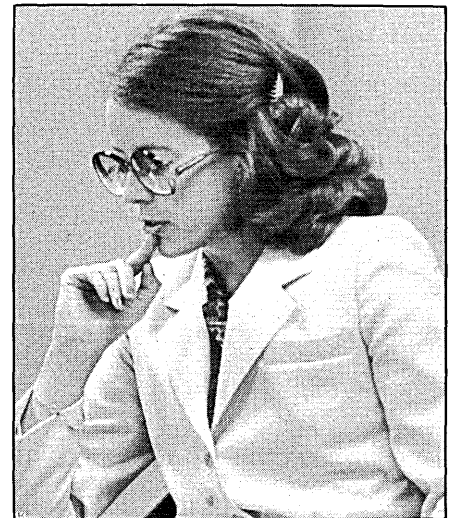
Edward Hooton, Jr., Remington Arms Co.



Daniel E. Hull, Corning Glass Works



Edward L. Motter, Motter Printing Press Co.



Sue Williams, The Tennant Co.

PHOTOGRAPHS BY DAVID GROSSMAN

ROBERT A. ABAIR is director of materials at Smith Valve Corp., Westboro, Mass., where he is coordinator of the MRP task force. He has had 15 years' experience in production and inventory control, the most recent at Simonds Cutting Tools where, as production control manager, he implemented an MRP system while task force cochairman. Mr. Abair received a BS from Clark Univ. and attended the Worcester Polytechnic Institute's Graduate School for Industrial Management. An APICS member for 13 years, he is currently serving as president.

SMITH VALVE CO. began its MRP planning in 1977 with the decision to install an MIS system with MRP as its base. Smith Valve considers itself a B+ user of MRP;

its features now include on-line master scheduling, shop floor control, capacity planning, etc. The approximate implementation cost was between \$500,000 and \$700,000, and the company is planning extensive MRP implementation. Smith Valve has a worldwide sales network and subsidiaries, in Manchester, Conn., and in Hong Kong. Gross sales for 1979 were approximately \$50 million.

EDWARD HOOTON, JR. was elected vice president of Remington Arms Co., Inc., Bridgeport, Conn., in 1976. He has been with Remington's parent company, DuPont, since 1950. Starting as an engineer, he subsequently handled a number of construction division assignments as field superintendent, field project man-

ager, district superintendent, division engineer, and manager of the business methods and investment division of the engineering department. In 1972, he was transferred to Remington as assistant director, and later, director of production. After serving in the Air Force during World War II, he earned a BS in mechanical engineering from Rutgers Univ.

REMINGTON ARMS CO., INC. is in the advanced project stage of MRP development with a pilot run scheduled to begin this fall at its largest plant. The company's gross sales for 1979 were approximately \$300 million; Remington has a partnership in Mexico (an ammunitions plant) and warehouses and sales offices in Canada and Germany.

ABAIR: Don't set your goals too high. You don't need perfect inventories, perfect bills of material. Go ahead live and work collectively in debugging the system.

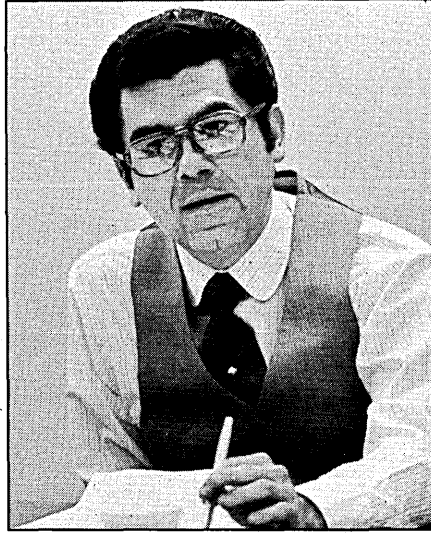


DANIEL E. HULL is corporate manager of inventory control at Corning Glass Works, Corning, N.Y. From 1973-78, he was manager of production planning and inventory control of Corning's Electronic Products Div. With Corning since 1956, Hull has plant experience in first line supervision, shipping and warehousing, inventory control, purchasing, production planning and scheduling. He received a BS from the University of Connecticut, and an MS from Cornell. Hull is also an APICS fellow.

CORNING GLASS WORKS is a multinational, multiplant manufacturing company with 35 factories in the U.S. and another 22 offshore. Sales in 1979 were \$1.4 billion. The company began its MRP program in 1977, and its goal is to have all plants operating as class A and B users by the end of 1982.

EDWARD L. MOTTER is vice president of Motter Printing Press Co., York, Pa. He became MRP project leader in 1977, when he joined Motter full-time. He has a BS in mechanical engineering from Bucknell Univ. and an MS in industrial administration from Carnegie-Mellon. He has been an APICS member since 1977.

The MOTTER PRINTING PRESS CO. manufactures web-fed printing and folding equipment for the publication and packaging industries. The company implemented MRP this year at its York plant. Gross sales for 1979 were approximately \$20 million. Motter Printing has one division, Kidder-Stacy Machine Co., in Agawam, Mass. Kidder-Stacy primarily manufactures printing equipment for the packaging industry and is presently working toward an MRP program.



SUE WILLIAMS is a senior design and project manager for manufacturing systems at the Tennant Company, an industrial cleaning equipment manufacturer in Minneapolis. At Tennant she chaired the task force that established MRP. Currently, she is on special assignment, working as a user of MRP systems in preparation for converting the system to closed loop MRP with net change in an on-line environment. Ms. Williams has a BA from the University of Wisconsin at Superior, and is a certified APICS fellow.

The TENNANT CO. is a medium-sized manufacturing firm with an international subsidiary in the Netherlands, a joint venture in Japan, and sales organizations in Mexico, Brazil, Germany, and Australia. Gross sales for 1979 were approximately \$100,000. Tennant implemented MRP in 1974-75; previously, a Material Requirements explosion was used, but the system operated in order launch and expedite modes. Tennant hired a consulting firm to assist in closing the loop, and it has continued fine tuning the system ever since. It uses a weekly regenerative system and plans to forecast, but builds mostly to order. Simulations run frequently enable the master scheduling group to test feasibility of changes responding to customer orders.

The state of the art of any application is best defined at the user level—what type of systems have actually been implemented, at what cost, with what personnel, and with what results. To find answers to these questions, and to elicit some candid opinions on the operations of an MRP system, DATAMATION corralled five users—all in various production positions, rather than dp people—and asked them to share their experiences.

Motter: Many people see the term "MRP" and think of material requirements planning. . .

What do we want to call it?

Hull: My preference is manufacturing resource planning.

Hooton: That's the broader definition.

Abair: It's a system that ties in the financial operation, the manufacturing operation, and the ordering operation.

Williams: We ought to make clear there are two definitions of MRP; I'm not sure how widespread "manufacturing resource planning" is, or how many of us are that good at it yet. Is there anyone here who has a good, working data base integrated throughout the company?

Hull: I'm with a multiplant manufacturing company that has one class A user.

Williams: Tennant is a class A user, too, and we attempt manufacturing resource planning, but it doesn't mean that our system supports it 100% like it will in five years.

Hooton: We're not operating on a company basis, we're operating on a plant basis.

Williams: Do your financial planning, corporate planning, and marketing all tie in with the manufacturing data base?

Hooton: They will. . .

Motter: We should concentrate on manufacturing, and not financial. . . We're not going to integrate our financial system with MRP, in the foreseeable future, although we will have closed loop MRP for overall manufacturing planning and control.

What can MRP accomplish?

Hull: There are the classic improvements: gains in manufacturing efficiency, inventory reduction, and better customer service. MRP can impact all three. In our company, however, we have had a difficult time in splitting out the savings achieved in other cost reduction projects. We have identified enough savings so that our MRP program is self-supporting, but our projection for the several magnitudes of improvement in return on investment we have not yet achieved.

Hooton: Our system is being piloted this month with one product in our firearms plant. We fully expect to have significant reduction in our in-process inventory—which we sorely need from the standpoint of space and cash flow.

Motter: Another consideration is that MRP can provide an overall game plan for everyone in the company. It increases morale with everyone working toward the same objectives.

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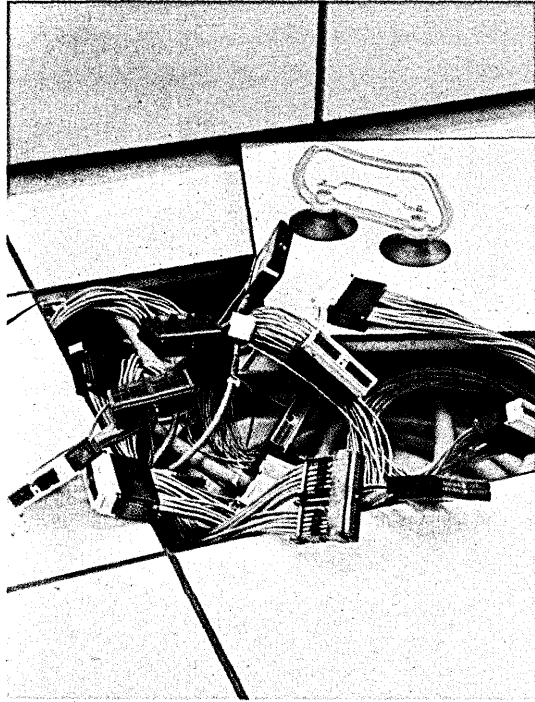
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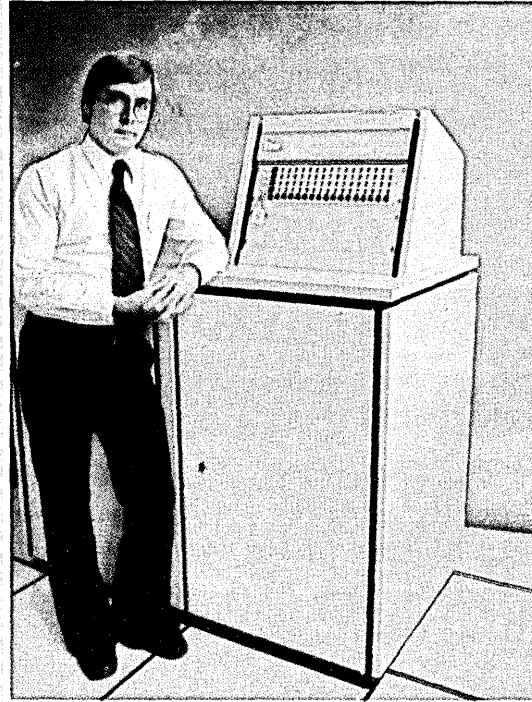
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HOOTON: We subscribed to the recommendation of our consultant who said, "For God's sake, don't put a systems man in charge of it." And we didn't. It's working very well, it has good acceptance in the plant.

Abair: We had substantial decreases in inventory and managed to offset a significant portion of inflation with improved manufacturing efficiencies. Also, the biggest accomplishment of MRP was that it caused management to work as a team. The departments that in the past had been autonomous have now been included. The engineering people can't operate in their own little sphere anymore because their bills are so important to us. The finance people have to work very closely with production people in forecasting cash flow. We have become a better company overall because of the cohesiveness MRP has forced on us.

Williams: One other thing: our manufacturing people now have credibility throughout the company. It used to be that if marketing wanted to change the plan—add an increase of model percentage of 20% of the given model, maybe two months out—manufacturing had to say, "We'll try, but we don't know." It would come true or it wouldn't, but they couldn't predict it and so they had no credibility. Now, we can run a simulation to identify problem areas. If we can't meet a marketing request, we can say so, and say why. Our management committee used to make only about four production plans a year—for the third month of each quarter—and then they'd pour on the expediting and the overtime in order to meet shipment goals. Now they can state what they're going to do and do it at least 11 out of 12 times.

Abair: Now that the shop floor is under control, the spotlight has focused on marketing problems and finance problems.

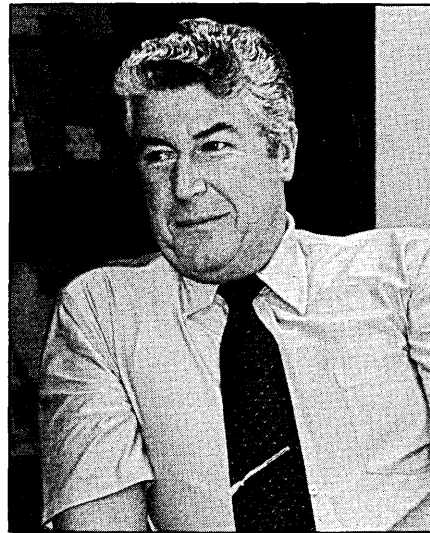
Williams: Yes. Manufacturing used to be the bad guys. But in recent years, at financial reviews, manufacturing has been singled out for contributing more than its fair share to profitability.

Who sets the goals?

Abair: An executive vice president or president. The higher the level, the more successful MRP will be. If it's brought in and sponsored by the production control manager, it usually will not succeed. It needs tremendous corporate management support both for funding and for general attitude. . .

Hull: We expect the individual manufacturing facility to set the goals because the general management usually doesn't know the technology of material control.

Abair: Don't set your goals too high. You don't need perfect inventories, you don't need perfect bills of material, you don't need perfect everything to go on-line. A lot of the MRP gurus spout perfection, and it has discouraged a lot of companies. My philosophy is go ahead live and work collectively in debugging the system.



Once a system is up and running, do new people participate in goal planning?

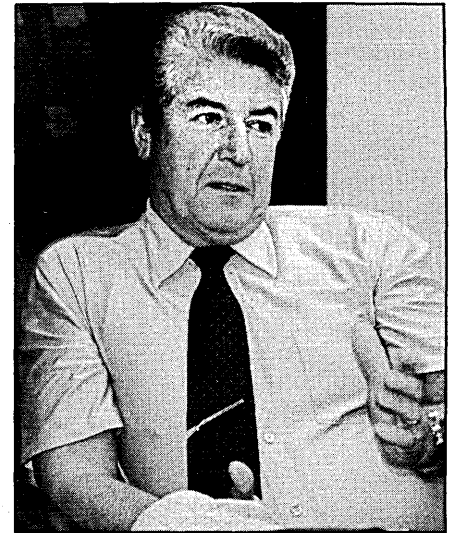
Motter: As you progress to the implementation phase, the users, the task force, the people who work the system are going to see other factors that can be improved, and they can establish new goals.

Abair: Once a system is up, it's amazing how the ideas spawn. "If we can do this, then why can't we do this? Why can't we have inventory projections now?" Even accounting is jumping on the bandwagon because it's seeing possibilities for some good cash projections—we do cash projections based on our master schedules system. There's so much that can be done once there's a good MRP data base.

If you're meeting your goals, are you experiencing payback? Can you measure it?

Williams: Measurement is something we have not done well. Most of our information is based on what people can recall. For instance, we used to have about 4,000 open production orders in the shop, and I think after MRP it was cut down to about 1,500. I'm not sure about the numbers, but I know the amount was significant. . . We used to operate with an average of about 12% overtime; now it's about 4%. We're certainly doing a better job of responding to marketing, and our inventories are down.

Hooton: What about improvements in purchasing performance and purchasing cost? We buy a lot of raw materials in large quantities. We also buy a lot of tooling that is very expensive. It's been scheduled haphazardly in the past, but now we believe we can merge it into MRP and buy our tooling along with scheduling the production. We can buy in the biggest quantities and concentrate it at the lowest cost vendor.



Are you experiencing any purchasing efficiency?

Williams: Yes. We turned on MRP over 1974-75. We didn't have many data processing bodies, so it took us a long time to get it up. In 1975, we had the recession, our orders fell about 30% from the year before—and manufacturing inventories skyrocketed. MRP was spitting out reschedule notices, but we didn't have an automated purchasing module to keep up with it. We didn't see the recession coming, we didn't act in time, and we really got burned in inventory. Well, that is why the next major step on MRP was a purchasing system.

Hull: We've reduced obsolescence in some plants and inventory in several plants, but we haven't had a dramatic reduction.

Abair: I'd like to add here that while most dp systems were historically justified on the reduction of personnel, most MRP systems will not reduce personnel. In fact, we ended up adding people in warehouse security, and verifiers.

Williams: We have reduced personnel in material planning, purchasing, and production control. But still the point is, manpower is not the justification for MRP.

Has MRP improved relationships with vendors?

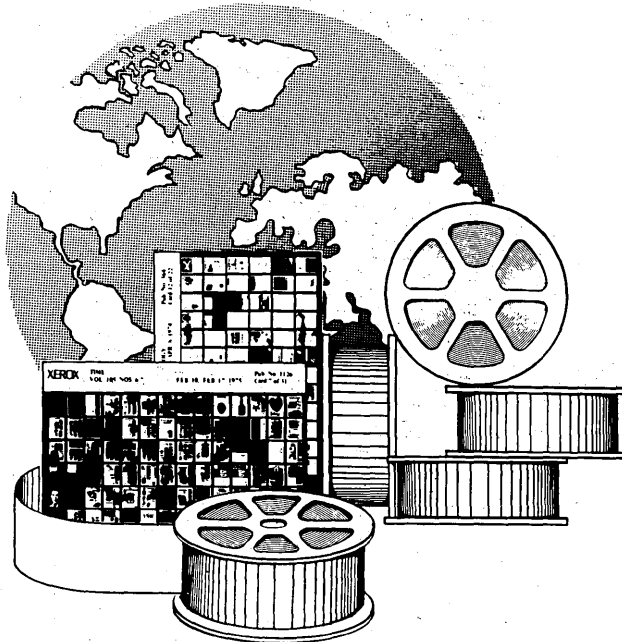
Abair: Our MRP hasn't met with good reception, I must say. Our suppliers are not convinced it's working.

Hooton: That raises an interesting point. We recognize the value of education for the people in the plant. Do you think there should be some educational effort with suppliers prior to the system coming on-stream?

Abair: Well, we listened to a lecture by John Shorr—he used to be purchasing director of

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HULL: We put up charts in the stockroom showing the goals and the inventory record. As it gets closer and closer to goal, the people take over. You try to sneak into the stockroom, and you get your foot chopped off.



Steelcase—and he said when Steelcase went on-line, it brought its suppliers in for intensive education. So, we sent out a notice saying ‘We’re on MRP now, and here’s what it’s gonna do, this is really great’ and . . .

(laughter)

Abair: Nobody believes me.

How do you educate your own people?

Motter: In our company, it wasn’t difficult. We are a fairly small company with a small group of supervisors and office people. Our primary education tool is a video course that I tailored to include the information our people would need. Then, I ran a series of courses for about nine months with various user groups. They each attended eight two-hour classes. To follow it up, we had a series of informal meetings to review where we’re going, what we have, what needs to be changed.

Hull: We use outside education for top management and a five-day production and inventory control course for middle management. Inside education is used with tapes where the bosses are the teachers. In our experience, it has been very important to get something up, some hardcopy people can see, instead of looking at bicycles and handlebars. If you can get a master schedule up with your own product, and people can see the output, that’s worth hundreds of hours of education on someone else’s product, on theory. . .

Hooton: Our education contains the whole spectrum from the production floor operator through to the ceo. The machine operators have at least five courses. We have an incentive wage plan, and we have the union so there are important labor relations concerns. . .

Hull: In one plant, with just the MRP portion without shop floor control, we have had a

\$167,000 reduction in incentive payments with no loss in productivity.

Who draws up the MRP plan?

Abair: I’m against a dp guy heading up the task force.

Hull: MRP’s not going to be successful if it’s perceived as a data processing project.

Williams: If you don’t have dp people on the team who know what they’re talking about, and can understand the application, you lose a lot of benefits. There are things the computer can do the user cannot even conceive of, does not even imagine can be done. . .

Hull: . . . and may not even want.

Williams: Well, it’s important that dp has a representative who really understands a manufacturing application.

Abair: We took our dp people and sent them to MRP school. Most of our dp people are APICS members, and three of them, including the dp manager, are going for certification in production and inventory control science. But the project leader has to be a user.

Ed, describe your project team.

Hooton: We subscribe to the recommendation of our consultant who said, ‘For God’s sake, don’t put a systems man in charge of it.’ And we didn’t. We have a fellow who’s been a foreman and area supervisor, he’s worked in methods and standards, he’s worked in planning, and he has about 20 to 25 years of service in this particular plant, mostly in production. He’s the project leader. Then we have representatives from marketing, dp, accounting, and purchasing. It’s working very well, and it has good acceptance in the plant.

What kind of problems have you encountered with MRP?

Abair: Systems problems. We came from an environment that up until this time had had very few manufacturing systems—three crts. We now have 50 crts and printers controlling this system, and about 50 programs that had to be written to support it. We almost tripled the size of our dp staff, and nothing can happen until the dp people get their act together. And, of course, it’s just as much a learning period for them, not simply in understanding the software, but in hiring and training people in teleprocessing, and the various channel communications devices that are available. Our dp budget has tripled in real dollars from what it was five years ago.

Williams: Do you know what percentage it is of sales?

Abair: No. It would be an interesting figure, but a dangerous one.

Motter: Bob, you mentioned crts, and I want to comment on that. It’s not necessary to go on-line with crts to run a successful MRP program. It enhances the information and makes the access easier, but it’s not essential to start up. That should be stressed.

Abair: Still, I can’t envision a good master scheduling system without an on-line crt for updating.

Did you have to make major hardware purchases to do the system right?

Motter: In most cases, you have to upgrade the computer for disk storage and processing time. The system requires a tremendous amount of disk storage space.

How long does it take to implement a good MRP system?

Abair: Three to five years.

Hull: It’s a tremendous advantage to compress the time and get it up in 12 to 15 months: original people leave, priorities change, products may change. There’s a high risk in a three-to-five-year plan.

Hooton: We’re following a time schedule of 12 to 15 months for the basic MRP and then another six months for shop floor control. My biggest concern is how to optimize the timing of the installation. So far, the schedule looks good.

Motter: We implemented shop floor control and capacity planning before we implemented master scheduling and material requirements planning. We make large printing presses, and we only ship about six a year, so we can easily plan priorities manually.

Let’s talk about the software.

Abair: Get a good software package from a major firm that has a good technical staff backing it up.

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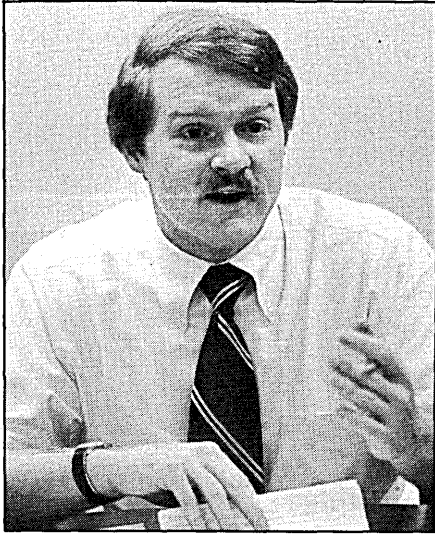
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MOTTER: It's a manufacturing program, not a computer program. You don't need crts to run MRP successfully; it's an enhancement, but it's not essential. That should be stressed.



Motter: We've had a very bad experience with our vendor's software support. We haven't been pleased at all. It discontinued supporting our package . . .

Williams: And then it forces you to keep up with every revision of the package or else the it has the option of discontinuing support for that reason, too.

Hull: We had a problem on the System/7 that the vendor no longer supports . . . We're left out on a branch someone is sawing off . . .

What about in-house development versus packages?

Hull: To recreate what had already been created by a software firm would have been a misdirection of our resources. We didn't have the resources, number one, and we would never have been able to justify adding the dp resources to develop the software. However, let me say in the same breath that many of the class A users in the country—Black & Decker, Steelcase—are companies that developed their own software.

Williams: Except for exposure, we developed our own.

Abair: You do a good job of evaluating the software vendor, find other companies that have had success with the same package, you can get the benefits of MRP faster.

Hull: Another advantage is vendors' user groups. The group performs a very useful function in keeping the package working the way we want it to work. Our vendor has 20 or 30 people in the shop making enhancements and writing documentation, all available to us at no charge.

Now, consultants. Did all five of you use consultants? How did you select them?

Williams: Talk to someone who has already used the consultant.

Hull: Ask if they were actively involved in a successful implementation.

Williams: Also, depending on your situation, you may choose one consultant over another. For instance, we used two consultants during the first couple of years. One was great to start with because he was a great salesman and generated the necessary enthusiasm, but when we started to need technical information, the other one took over, and we obtained more usable information.

Abair: A place to start looking might be a local APICS chapter.

Hull: Also, consultants are so busy they really don't need your business. So they can showboat a little. They make a visit, and two or three months later, they come in and not much has happened on the implementation plan, and they say, without concern, "Well, I'm not coming in again, you're wasting my time. Call me when you've made some real progress." That gets people's attention.

Abair: The consultant's got to have a track record. As MRP becomes a buzzword, it opens the door to more and more charlatans.

What kind of a price tag are we talking about?

Hooton: Phenomenal.

Abair: As part of the total, not much. About \$500 to \$1,000 a day, plus expenses.

Hull: Some are up to \$1,200.

Abair: Still, as part of the total project, it's minuscule.

Hooton: Budgeting about \$20,000 to \$25,000 for consulting fees on the project is about the right figure.

Abair: In the first six months, the consultant came in every month, then every two months, and every three months, and now we just have

annual checkups. Our consultant has really been responsible for putting a couple shots of adrenalin in our company. It looked like we were having so many problems, everyone was discouraged; the consultant comes in and hypes everyone up. . . .

Williams: That's one of the biggest contributions.

Hooton: Plus when you reach a bottleneck and you don't know which way to turn . . .

Abair: And he's been through it before. Someone else in another company has had the same damn problem and his solution will fit you 99% of the time.

What is included in budgeting for MRP?

Abair: Big bucks. We're a \$50 million company, and we spent \$500,000 to \$700,000 implementing MRP over a two-to-three-year period. That included upgrading the computer with all the peripherals, it included additional staff, in data processing, warehousing, production control, and purchasing. It included a full-time project leader, the consultant, and the educational program.

Hull: Do you have dp salaries in there too?

Abair: Yes, for the people who were assigned directly to the project.

Hull: We spent \$300,000 to \$500,000 for implementation, and that's not including the cost of the computer.

Hooton: We budgeted \$1.5 million for the first plant.

Williams: We had a large education budget.

Abair: The biggest cost to us by far was education. We sent all our vps to a three-day executive conference. Every manager, 30 of them, went to the five-day MRP school, and then all the purchasing and production planners. Then we bought the video tape recorders and ran our in-house training. Education was probably 50% of our costs.

Hull: Our biggest cost is salaries. A full-time project leader, a full-time systems person, a full-time data base accuracy person. . . .

Hooton: We figure about \$50,000 per person per year.

And it's been worth the cost?

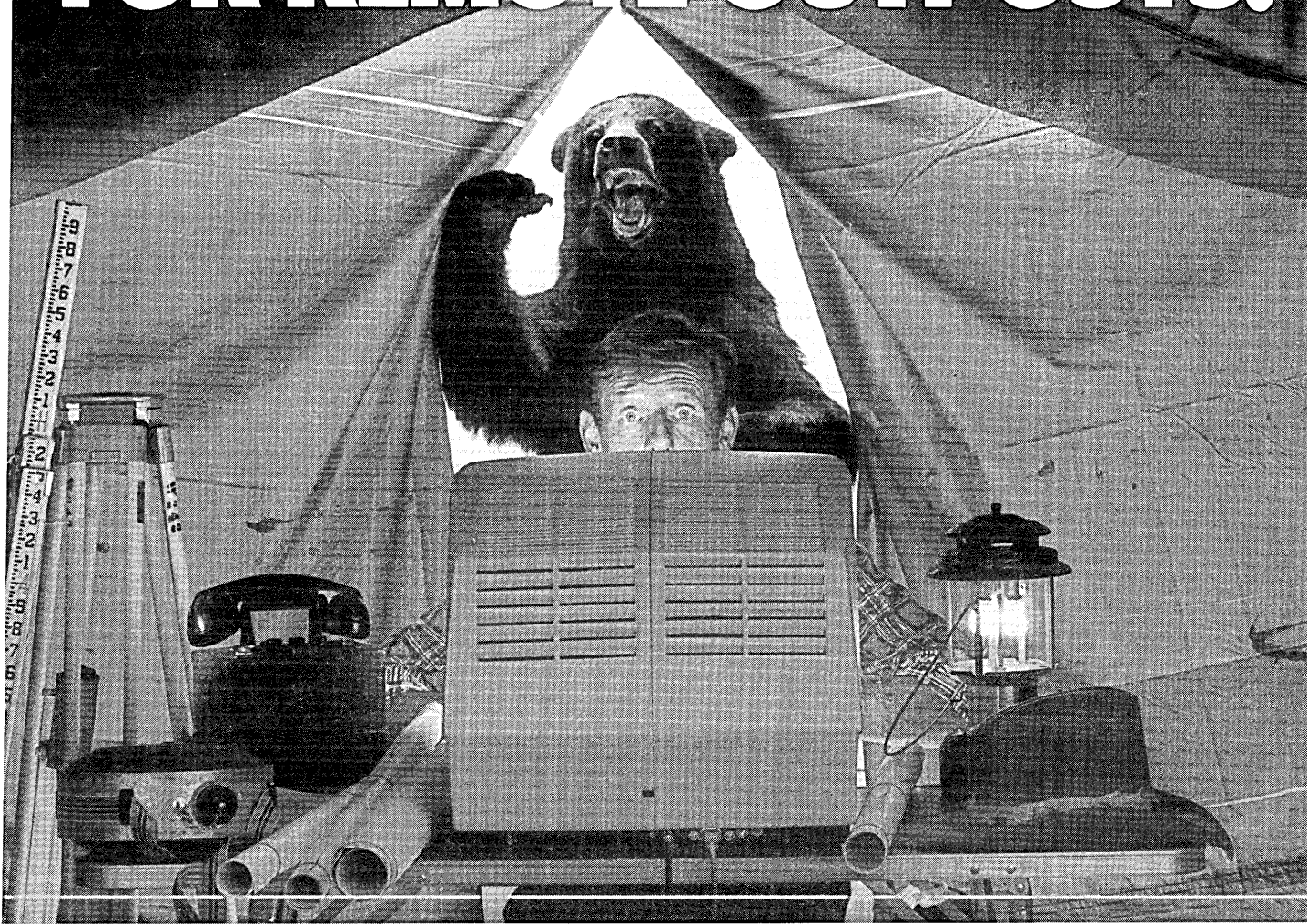
Hull: Yes. The plant is running better, the customer service is better. When we say we've got something on the shelf, it's there, the materials are there when the records say they are.

Williams: Has marketing supplied the dollar value of this better customer service?

Hull: No.

Hooton: I was wondering about that too.

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WILLIAMS: Manufacturing used to be the bad guys. But in recent years, at financial reviews, manufacturing has been singled out for contributing more than its fair share to profitability.



Williams: They don't want to sign on anything, do they?

Hooton: Dan, in your company who is responsible for finished goods, inventory, production, or marketing?

Hull: Production.

Abair: I would just as soon see all finished products be a marketing responsibility.

Hull: It's much cleaner that way.

Abair: Then there's accountability: you forecasted it, now you own it.

Hull: All the plant has to do is read the master schedule.

Hooton: I like it better in production because then marketing can't yo-yo the schedules that will affect production costs.

Williams: There is a problem in marketing not putting enough emphasis on making good forecasts. I suspect that there's not too much emphasis, either, on selling a product that is already in stock as opposed to one that's got a two- or three-month backup.

Getting back to budgeting, how did you present the price tag to your management?

Hooton: We put it in a project format, explained the current situation, what improvements we expected, qualitatively and economically.

Hull: We did the same.

Williams: When we first implemented, there was no formal budget plan. Our company usually requires justification for capital expenditures, but our data processing department was more informal at the time.

Abair: One thing all companies should do is set up separate MRP accounts. If production control is sending someone to MRP school, that shouldn't be charged to a production control account.

What changes, if any, would you make in the system if you had a chance to do it over?

Motter: You're always going to be making changes to enhance the capabilities of the system . . .

Hull: I would make as few changes as possi-

ble if even 20% of the system can get you 80% of the benefits.

Williams: Working with a system opens up avenues to new approaches, new ideas. You have to have a little experience to make a good decision.

Abair: We had a problem. There's one thing we'd do differently. We made the mistake of taking a weekend when the plant was shut down, and putting shop floor control and MRP on-line at the same time. We threw all the switches. Suddenly, there was lots of paperwork and lots of problems, and no one knew if MRP or shop floor control was causing the problems. We did some initial debugging and we said, "O.K., let's do it," and we bit off much more than we could chew. We should have done it nice and gradually, flip the switches once a month, get the system debugged next month, run a pilot, run parallel systems. We went through about four months of heartache we could have avoided.

Hull: There's an excellent technique—conference-room pilot—that we're using now.

Williams: What is that?

Hull: You have the implementation team in the room, you put in the paper, and you run on a pilot in the conference room before you run the pilot on the floor. People see the output and things are fixed before they can disrupt anything.

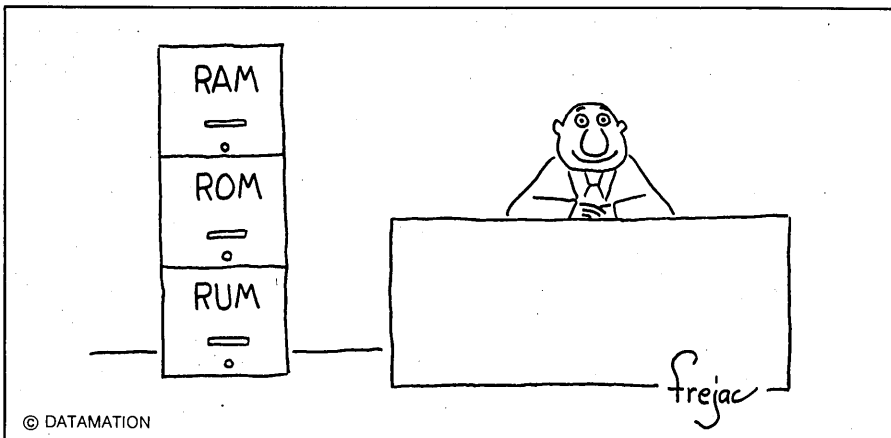
What about labor relations?

Abair: In our plant, it created a morale problem. We're a nonunion company that has frequent yearly union activity. The first year of implementation the pro-union vote was higher than we expected. We had slashed overtime 27%. Also, for the first time in the history of the company, we had begun the daily shutting down of several machines. The overall effect has finally died down, though, and now there's a good steady work flow. We have better morale; we went through a union vote in early spring, and we beat them significantly. We like to think that half of the increase in morale is because we're running the place better, and half is because the foremen are making it happen. The foremen have more time now to spend on employee relations rather than running around expediting.

Hull: We've had some very positive experiences in stockrooms and in record accuracy. We put charts up in the stockroom showing the goals and the inventory record, and as it gets closer and closer to goal, the people take ownership. You try to sneak into the stockroom and you get your foot chopped off.

Finally, what can MRP NOT do?

Williams: Guarantee success.



© DATAMATION

* CARTOON BY FREJAC

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Michael Berman,
Corporate Data Base
Administrator

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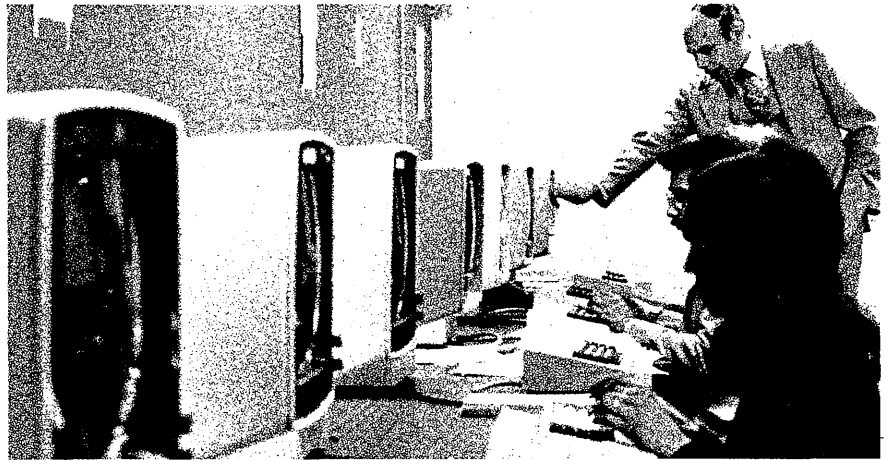
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CIRCLE 84 ON READER CARD



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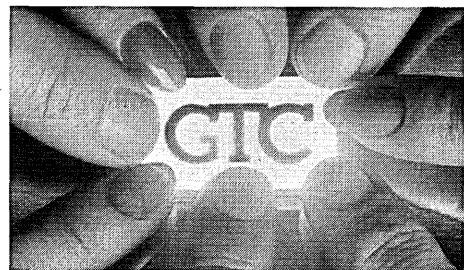
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CIRCLE 81 ON READER CARD

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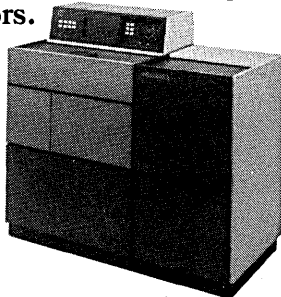
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If savings like these interest you, send us the coupon for more information. Or ask your Kodak representative for a demonstration of Kodak Komstar microimage processors.

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*Prices vary with geographic location and grade of paper purchased.
† Includes one original set and two duplicate sets.

Kodak Komstar microimage processors.



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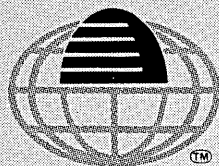
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Engineer, teacher, head of the wartime Office of Scientific R&D, Vannevar Bush was the designer of the differential analyzer.

ANALOG INVENTOR

by Molly Gleiser

"The inventor and the men who made the invention possible," wrote engineer Vannevar Bush, "were numerous . . . and in most cases the public knows nothing about them."

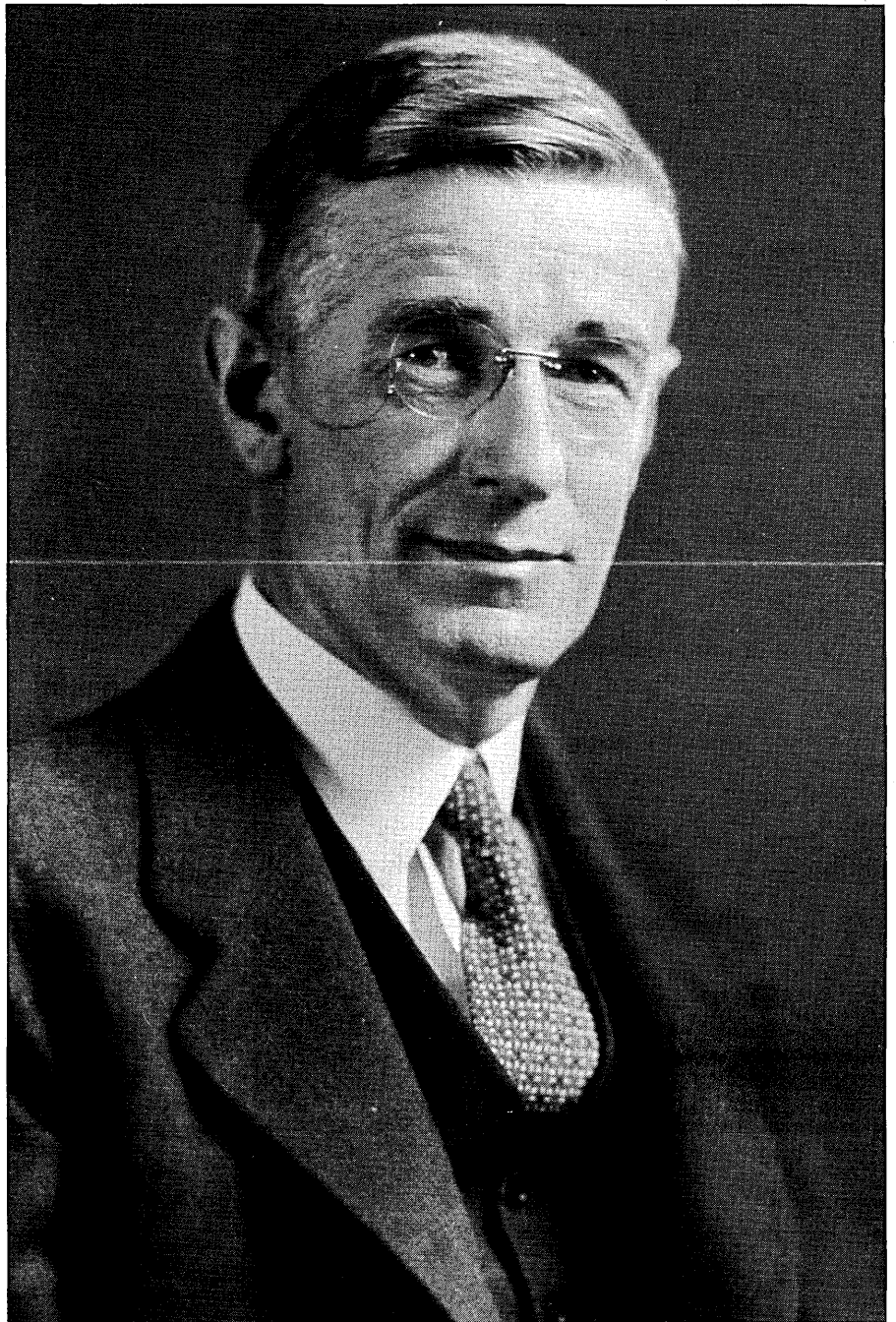
Ironically, such a forgotten man is the developer of the analog computer, Vannevar Bush. Bush, a descendant of seven generations of Cape Cod fishers and traders, was born in 1890 in Everett, Mass., a few miles north of Boston. One grandfather was captain of a whaler at 21, the other was master of the first commercial craft ever to sail up the Amazon. His father, Richard Perry Bush, left the sea to work his way through Tufts, later became a Universalist clergyman who served 50 years in Everett and nearby Chelsea.

As a child Vannevar (rhymes with "receiver") suffered typhoid and a year's bout with rheumatic fever. During this period he learned to tinker. While he was in high school he picked up radio conversations at a time when few people had even heard of radio. He worked his way through Tufts, first washing dishes and later tutoring math. He already displayed organizational ability, getting six students to round up further students who needed coaching.

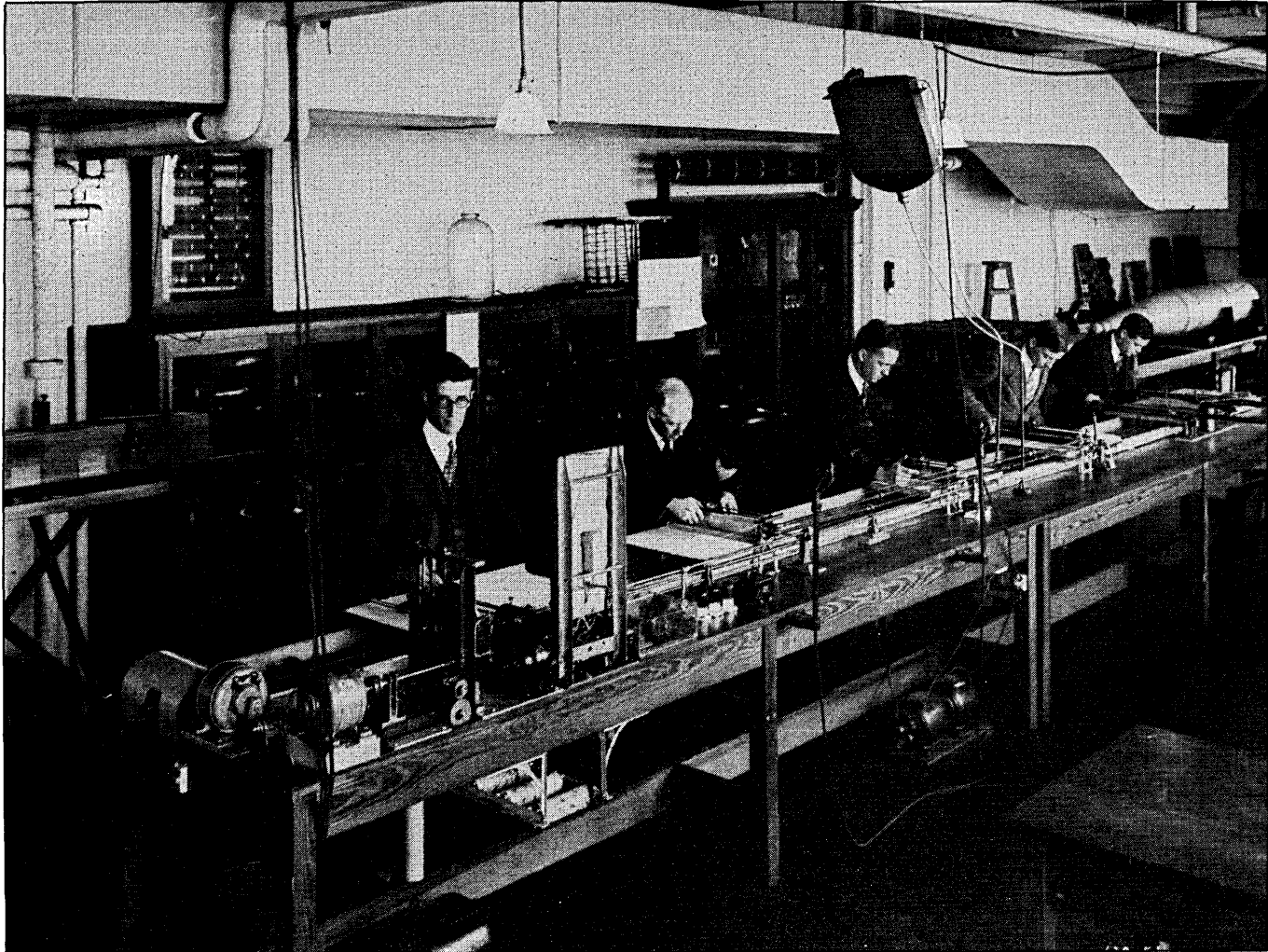
By graduation, in 1913, the tall young man had already taken out his first patent. The invention, a surveying machine to make a profile of the land, was an instrument box slung between two bicycle wheels. The surveyor pushed it by hand over the ground to be surveyed and the machine's movement was transmitted by gears to a disk. Two rollers rested against the disk: one recorded the vertical distance traveled, and the other turned the drum carrying the paper and recorded the horizontal distance. Bush's machine, called an integrator, contained a device that kept the spring wound up that provided the force needed to turn the drum. Both the servomechanism and the integrator were later used in the development of the analog computer.

Bush's surveyor worked fairly well, but although his professors authorized a master's degree on the basis of it, he failed to get it on the market.

After college, Bush accepted a job as



The Navy asked Bush to design a cipher-breaking machine; his invention was instrumental in breaking Japanese codes in World War II.



Product Integrator being operated in 1927 by (l. to r.) Bush, Walter F. Kershaw, Frank G. Kear, Harold L. Hazen.

a testman at General Electric for \$11.20 a week. The 20 cents was his discretionary income. Laid off because of a fire, Bush returned to Tufts and was offered an instructorship. Soon he was racing his secondhand Stanley Steamer up to Chelsea to court Phoebe Davis.

Married life would be expensive, so Bush, to progress quickly, decided to do the two-year engineering doctorate, a degree given jointly by MIT and Harvard, in one year. In 1916, he received the degree and was married.

During World War I, Bush worked on a magnetic submarine detector; after the war, MIT invited him to join the faculty. His position was as professor of power transmission, but his interests and experiments ranged far afield. Some of his inventions were trivial: a self-watering device for his greenhouse, an invisible fishhook, and a bird perch that dumped heavy birds like pigeons.

However, he also invented the justifying typewriter; he also developed thermionic

tubes and an improved method of examining sections of frozen tissue for cancer.

INVENTS RAPID SELECTOR

selector that selected a required item from a roll of photographic film in accordance with a margin code.

In 1922, one of Bush's students, David O. Woodbury, devised a small machine to do some of the calculation for a master's degree on three-phase transition in alternating current motors. "Dave," said Bush, "give up all that slipstick work and write us a thesis on your invention." Woodbury did, and he sold to General Electric.

A short time later, Bush became concerned with the problem of failures and blackouts in power networks, and although he developed the differential equations that described the problem, he could not devise rapid solutions. He therefore had to descend

to the infallible but lengthy method of graphical solution. It took months.

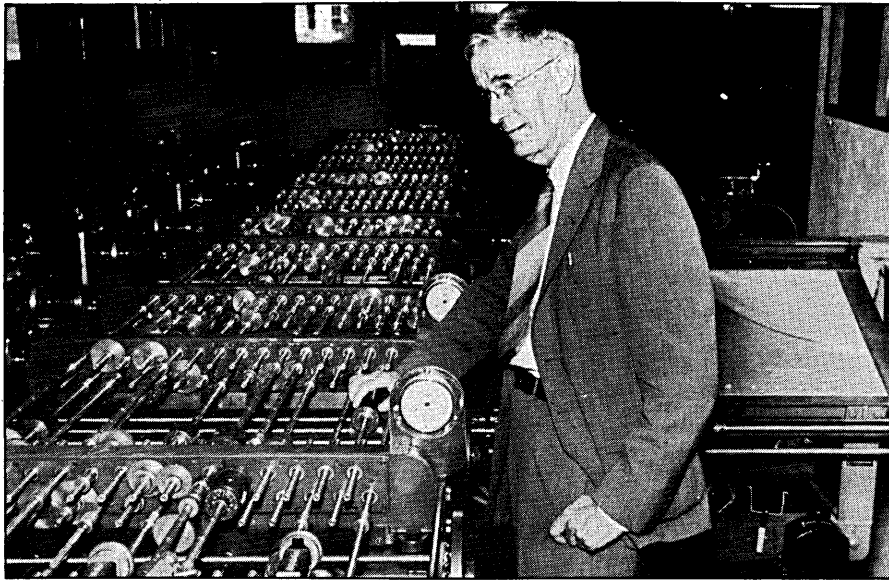
to the infallible but lengthy method of graphical solution. It took months.

Bush already knew about analog machines that simply simulated electrically the problem to be examined. He decided to develop a general analog machine applicable to more than one problem.

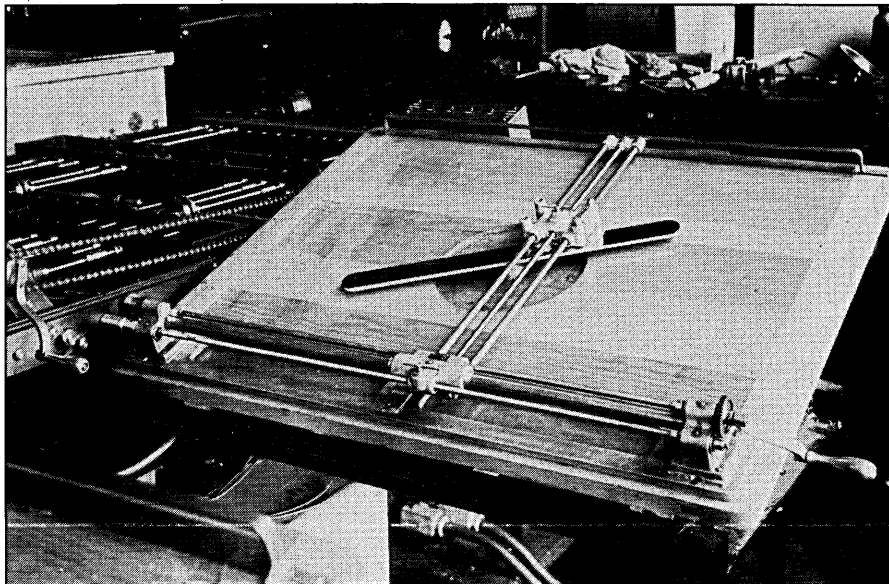
The Product Integrator, as he called it, made, as he later wrote, of "pieces of steel and anything else that was handy," consisted basically of two much older inventions: the integrator, and the ordinary Thomson watt-hour meter, which evaluates the integral of a product, the factors being current and voltage. The equations to be integrated were plotted by hand on sheets of paper that were passed slowly under pointers kept on the curve by men stationed alongside the machine. These pointers controlled the power flowing through a modified Thomson meter, the rotation of which was coupled to an integrator. A curve was produced that expressed the result.

The power of this machine was

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Bush and Differential Analyzer at Aberdeen Proving Grounds during WW II.



Multiplier section of the Differential Analyzer, photographed c. 1933.

limited to solution of certain first order differential equations, and Bush immediately planned work on a much more powerful machine, the differential analyzer, that could solve second order equations.

In the analyzer, a torque amplifier prevented slippage in the integrator, and the watt-hour meter was discarded for an almost totally mechanical design.

In 1933, a visiting British physicist, Douglas R. Hartree, saw it. He returned to England, produced a similar model almost entirely from about £20 of Meccano parts, and used it to make calculations in atomic theory. Engineers from the Ballistic Research Laboratory in Aberdeen, Md., and from the Moore School of Engineering at the University of Pennsylvania asked Bush to help them construct a similar machine. The machines were accurate to within .05%.

In 1935, Bush began work on an electrical machine, eventually getting rid of the lengthy initial setting and programming it instead with punched paper tapes. In this man-

ner, he reduced the preparation time to five minutes from one or two days.

Meanwhile, his administrative talents had not gone unnoticed. In 1932, MIT appointed him both its vice president and dean of the engineering school. He had also been active in industrial consulting for the American Research and Development Corp. (later Raytheon), and he was involved in the Metals and Controls Corp. (later a division of Texas Instruments). Bush still found time to run a turkey farm, play the flute, and build an 18-foot mahogany boat with his sons, Richard and John.

CIPHER-BREAKING MACHINE

Before the end of the '30s, Bush became known as an expert in machine analysis. The Navy asked him to design a machine to break a cipher. He did; his machine was instrumental in breaking the Japanese codes in World War II.

Before the war, Bush was appointed president of the Carnegie Institution in

Washington, where he supervised projects ranging from archeological expeditions to Peru to the atom-smashing laboratory in the Department of Terrestrial Magnetism.

Bush, aware of the movement of Nazi troops in Europe and knowing the next war would be a technological one, devised with his colleagues a blueprint for mobilizing scientists in wartime. He presented the plan to President Roosevelt and it was returned with "O.K.—F.D.R." across it.

When America joined the war in 1941, this organization became known as the Office of Scientific Research and Development and Bush assumed the top command. The organization eventually supervised 30,000 scientists and disbursed \$135 million a year. Bush's primary responsibility was for war research; he also had the tricky task of convincing the military to trust his civilian scientists without drafting them. Luckily, as he once admitted, he enjoyed talking with people and found them "more interesting than puzzling about electronics."

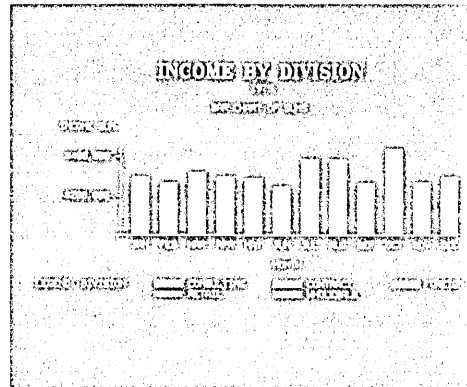
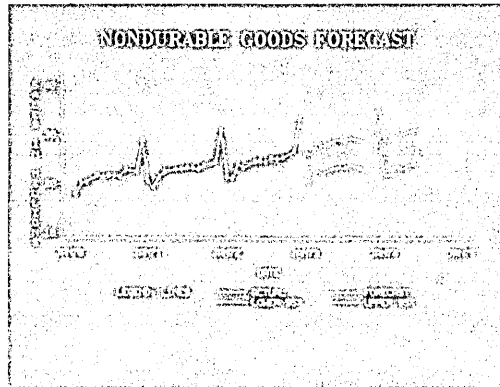
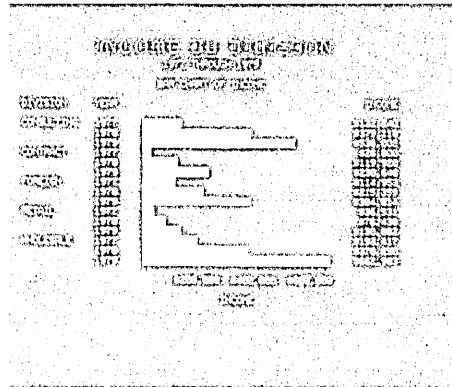
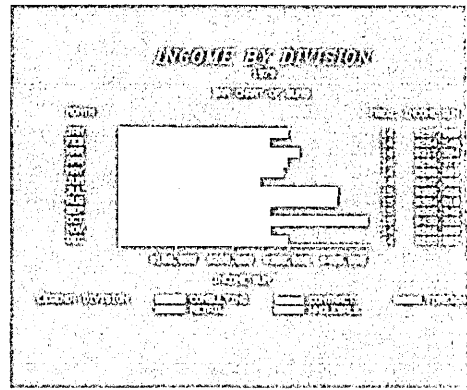
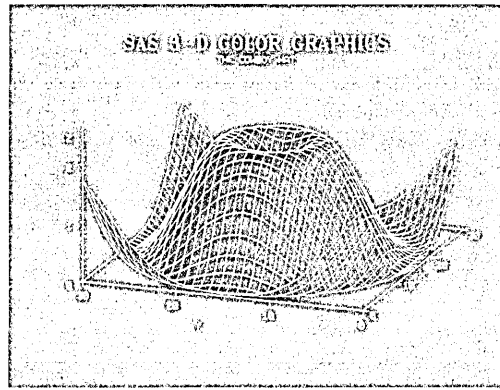
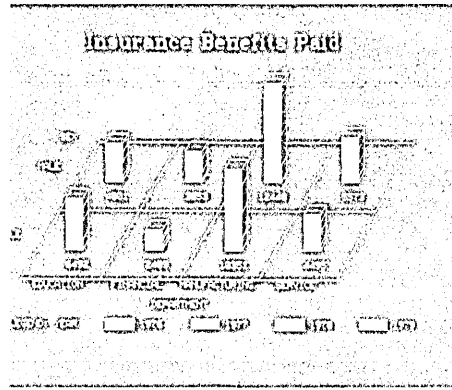
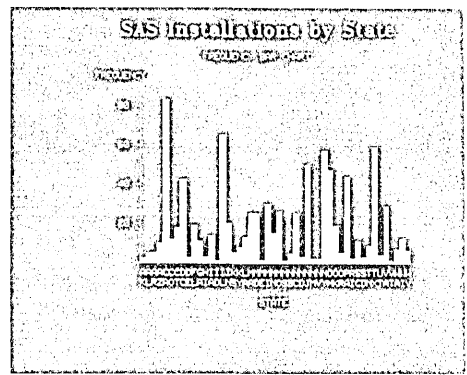
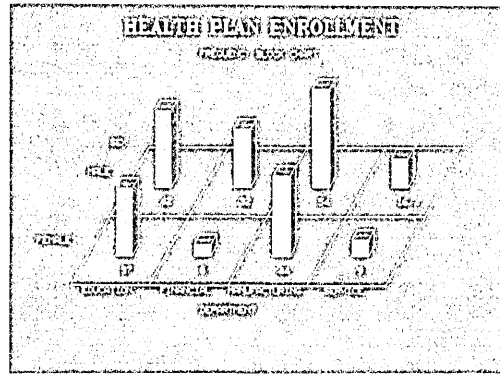
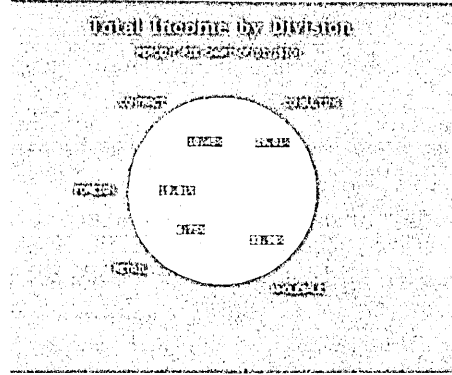
Back at MIT, the differential analyzer had not been forgotten. One of its descendants, an electronic analyzer, was housed behind closed doors, and students believed the contraption had been a failure. However, it had, in fact, been used during the war to compute gun range tables for the Navy as well as dealing with problems in fire control and radar antenna systems. The machine weighed 100 tons, contained 2,000 electronic tubes, 150 motors, nearly 200 miles of wire and several thousand relays, and it could solve differential equations involving as many as 18 variables.

Bush wound up the wartime Office of Scientific Research and Development in 1947, but as chairman of the new Research and Development Board, he was entrusted with the duty of national defense. For the rest, back at the Carnegie Institution, he directed ever more fantastic investigations, ranging from bacterial mutation to leukemia in rats.

In 1955, loaded with medals, Bush retired and returned to his first love, puttering in his home workshop on such inventions as a free-piston engine and hydrofoil boats. In 1974, at the age of 84, he died of a stroke.

The death knell of the analog machine as a mainstream device had been sounded by Bush himself even while he was still at MIT. He had given a young student, Claude Shannon, a part-time job operating the differential analyzer, and for his master's thesis in 1937 the young man had shown how to devise a simplified circuit that would automatically add, using only relays and switches. It operated on the binary system. *

Dr. Gleiser, who lives in Berkeley, Calif., turned to freelance writing and editing in 1970 after working for years as a research chemist.



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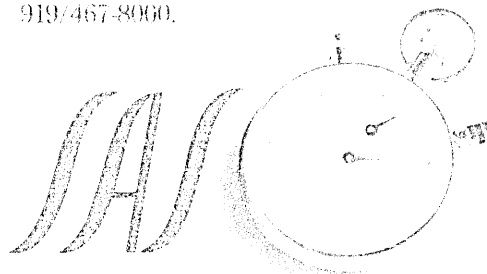
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If you're facing a large job, prepare to spend time extending the system analysis technique you choose.

SYSTEMS ANALYSIS: KEY TO THE FUTURE

by Dwight F. Townsend

Although the computer field has many problems, most problems are transient. The notable exception is systems analysis. Have you ever wondered why so many of the promising techniques fail to yield full measure? It may be time to review your systems analysis technique.

In the early days of computing, the programming language used for stating the solution to a dp problem was pinpointed, rightly, as inhibiting progress. In those days, many problems had been defined, and there was a backlog of solutions waiting to be implemented.

When I entered the field in 1965, all that was beginning to change. The stable applications with easy solutions were in the maintenance mode and the applications we faced required us first to define the problem and then to devise the solution before implementation. About the same time, data bases, time-sharing, and interactive computing were touted as solutions to the industry's ills.

Almost 10 years ago, it became apparent something was awry among the developers working on large military systems. They were missing schedules, overrunning massive budgets, and delivering products that were—just barely—acceptable. Also, the major computer manufacturers were embarrassed because they had become noted for announcing a product and delivering only part of it, late, and of questionable quality.

A flurry of new techniques were presented to solve this latest round of problems: HIPOS, structured programming, chief programmer teams, programmer work-

benches, and integrated program development systems were all advertised.

Still, despite these "cures," no one has ever seriously tried to uncover the disease. Many techniques got a bad name when they were tried without careful justification and achieved mixed results.

A principal problem that has inhibited progress is directly traceable to the way we keep development records. Programming labor is seldom precisely accounted for, and the cost collection systems to charge programming labor and machine time back to the development activities that incurred them are inadequate. Without such basics, is it surprising we cannot uncover cause-and-effect relationships in the development techniques?

There were, however, some data published by Boehm of TRW and some analyses performed by Mills of IBM. These data, plus my experience, lead me to the following conclusions. First, the programming problem has largely been eliminated; we can successfully program any modules that are properly defined and spec'd.

Second, trained people vary dramatically in their abilities. There exists not only a difference in the productivity among programmers, but even bigger differences among systems analysts. Some systems analysts, in fact, can fail to produce anything useful when faced with a job beyond their intellectual capabilities.

Third, since the schools and books and seminars for system analysts are all inadequate, we train systems analysts on the job in hit-or-miss fashion. Consequently, our shortage of seasoned systems analysts is going to get worse.

Fourth, experience supports the

limited statistics regarding the cost of errors and the difficulty of correction. The rule is clear. The earlier a mistake is made and the longer it stays in the developing system, the more expensive it will be to correct. For instance, compare the cost of correcting a program that calls the wrong subscripted variable with the cost of correcting a program that needs a data element that was forgotten in the data base design.

Out of this environment some profitable avenues for progress have appeared. First, programmer workbenches are becoming popular not because they provide a convenient integrated package of programming tools to use (although that's desirable), but because they provide management with progress reports as programmers develop code—an insight that is based on measurable accomplishments and is obtained without asking the programmer or his supervisor to complete any special forms or add any administrative burden to technical pursuits.

The second path to progress favors system development methodologies. There are a few umbrella methodologies available commercially, but the quality is mediocre and the coverage is spotty.

However, some of the larger companies are developing custom methodologies of considerable merit: they lead systems analysts and programmers along lines that have been proven to be successful in the employer's environment, developing indigenous systems. Assuming this all comes to pass, a blank spot remains in only one corner of the development mosaic. And even here, the outlines of some analysis techniques for defining requirements and preparing a system specification are appearing.

Some of the larger companies are developing custom methodologies of considerable merit.

COMPARISON OF SYSTEMS ANALYSIS TECHNIQUES

Method	Form	Phase of Principal Applicability	Principal Purpose of Analysis	Intended Audience	Size of Systems Applicable
BIAIT— Burnstine	Author plus working notes	Preliminary Design	Problem Diagnosis	Technician	Medium
BSP— IBM	Brochures plus classroom	Requirements Study	Original Implementation	Study Team	Medium
Mgt Info Sys Handbook— Hartman	Book	All phases	System Implementation	Study Team	Medium
PSL/PSA— Teichroew	Manuals and computer programs	Detail Design	System Implementation	Technician	Medium to Large
SADT— Ross	Consultants, brochures, & training	Requirements Study	System Specification	Study Team	Medium to Large
Structured Analysis— DeMarco	Book plus classroom	Preliminary Design	System Implementation	Technician	Medium
Structured Systems Analysis— Gane	Book	Preliminary Design	System Implementation	Technician	Medium
Systems Analysis Workbook— Carlsen	Book	All Phases	System Implementation	Study Team	Small

EIGHT ANALYSIS METHODS

Eight techniques are competing for the prize. They are in various stages of development, ranging from one first published in October 1979 to one that has been around so long the book was, at one time, out of print. Before describing each contender, a word of warning.

The project chief in charge of a leading-edge project may be tackling an application so advanced that none of these techniques will be sufficient. If this is true, the chief must be innovative; the available tools may not be suitable for the challenge. Also, each of the techniques has certain fatal flaws.

One highly touted technique was applied three times (almost in parallel) by a big firm. After all the reports had been published and all the charts prepared, the existing systems were documented (at a cost of about \$500,000 each). Management, however, still did not know what action to take since the documents produced described the existing systems but did not credibly support in-depth analysis and transition planning.

One of the other systems makes a strident claim concerning the ease of use of its notation and how executive managers, unskilled in dp, can, using this notation, easily absorb the meaning from charts produced and

therefore make design decisions promptly. On four known occasions this has been found to be patently untrue. Executive managers who lacked dp experience were frequently lacking in an ability to think symbolically, and, while they could promptly and correctly make decisions based on tangible facts (that's why they were executive managers), they froze into inaction when confronted with a strange notation and 500 pages of systems diagrams.

The situation is so fluid (and the proponents' claims so all-encompassing) that there is confusion between an end-to-end system analysis methodology and individual tools and techniques that accomplish part of the effort. At the risk of mixing apples and oranges, here are eight techniques that are either methodologies in their own right or tools around which people have attempted to construct methodologies:

- BIAIT - Burnstine out of IBM
- BSP - IBM DP Div.
- ISDOS (aka PSL/PSA) - Teichroew at University of Michigan
- Management Information Systems Handbook - Hartman, Matthes, and Proeme
- SADT - Ross at Softech
- Structured Analysis and System Definition - DeMarco

- Structured Systems Analysis - Gane and Sarson
- The Systems Analysis Workbook - Carlsen and Lewis

The well-read systems analyst has also heard the names of many of the contributors to the current milieu: Constantine, Jackson, Myers, Orr, Warnier, Yourdon. If one is an academic, he may even be familiar with the work of Dijkstra, Hoare, Mills, and Weinberg. Some SHARE members may even know of Burnstine.

In an effort to contrast these various techniques, one must first understand the "marketplace." Systems analysis techniques are developed in response to an opportunity or a need. People with academic credentials can apply their free time toward systems thinking and, as their ideas mature, the academics get them published in various journals or presented at various conferences. Once their thoughts get beyond the idea stage, the academics must either pass them to someone in industry for further development and perfection or find an ongoing source of funds (such as government grants, or the industry subscription program put together by Teichroew at the University of Michigan).

For the competitive practitioners, i.e., those senior systems analysts working in

Data Flow	Control Decisions	Topics Addressed				Cost
		Geographic Dispersion	Time Delays	Organization		
Yes	No	No	No	Yes	No	
Yes	No	No	No	Yes	No	
Yes	Some	No	Some	Yes	Some	
Yes	No	No	No	No	No	
Yes	Some	No	No	No	No	
Yes	No	No	No	No	No	
Yes	Some	No	No	No	No	
Yes	No	No	No	No	No	

the field but not affiliated with the government, an academic institution, or a research laboratory, progress is fueled by need and financing. After a technique has sufficiently matured, the development investment may be recouped by publishing a book (the most frequent route) or by setting up a company to exploit the technique commercially (as Ross has done and Burnstine is attempting).

In December 1977, ACM's *Computing Surveys* carried an article by Taggart which identified about 60 references to systems analysis of MIS systems. There may be as many as 100 techniques in various stages of development throughout the country.

FLAWS OF METHODS' SOURCES

For those with interests that are more pragmatic than academic, we will address here only the most popular techniques. With no exceptions, all proponents of these techniques share two common failings. First, they neglect to state the goals the technique hopes to satisfy, i.e.:

- Does it help to take an unstated set of requirements and get them stated and structured so decisions relating to a formal development project can be made?
- Or, do they presume all such global questions have been addressed and the only prob-

lem remaining is to devise a computer system for carrying out the automated portions of the process?

Second, they fail to describe the "domains of applicability" for the proposed technique. A small-to-medium scientific application is intellectually quite different from a dp application having a large data base and many different types of transaction. Further, system size and geographical dispersion affect the success of any specific technique or, phrased another way, they will dictate the amount of innovation required to extend a technique so it is applicable to a broader environment.

As a result, many systems analysts, justifiably more interested in the daily conduct of business than in the evolving state of systems analysis, continue to plod along with old and familiar techniques until a highly readable book like DeMarco's appears. Then they mindlessly absorb the new offering without critically evaluating its strengths and weaknesses.

After making a cursory analysis of the leading techniques (an in-depth analysis would require using each one on a live problem), and attempting to enumerate the important attributes of systems analysis techniques that will allow discrimination between the

various offerings, the following table was constructed.

Before we discuss the content, a few comments about the right side of the matrix. All eight techniques adequately address batch data flow. They all need some innovation, however, when used for on-line or distributed systems. The principal problem lies with the failure to explicitly treat flow time.

Information flow in batch systems is usually so lethargic that the logic of the process is dominant. Thus, if one merely illustrates the logic of present and proposed processes adequately, design decisions can be made and management approvals obtained.

Today, however, we are selling on-line systems as a solution to the response time problem. If your systems analysis technique does not allow you to illustrate the present problems with response time, you cannot justify (and get management approval for) a system design that purports to solve flow time problems by putting users on-line.

Two types of information systems predominate in nature. In one type, information flows in one end and all the decisions regarding the processing of that information are preordained—while the information is processed in many steps and stages, the flow is mostly pipeline. Thus, an analysis technique can record the individual steps in the existing process and analyze them separately and in groups to determine where automation is appropriate and what the cost tradeoffs should be.

In the other system, decisions are made during processing that affect the processing itself. When an information system is saturated, management decisions are made about whether to work overtime (thereby temporarily increasing system capacity), or to defer processing of certain classes of transactions (creating queues and backlogs which must be worked off later). Such flow balancing techniques, together with priorities set by management, or decisions made to exploit some business opportunity, are important in this class of information system.

Unfortunately, most systems analysis techniques fail to treat explicitly these control decisions. They are satisfactory for analyzing systems with preordained process flow but fall short (and need innovation) if they are used to record and analyze adaptive processes.

THREE ANALYSIS FACTORS

Geographic dispersion, time delays, and organizational responsibilities are three important criteria when analyzing for a distributed environment. We need to know *what* processes are performed and *where* they are performed. Many systems analysis techniques presume

Most of the current techniques do not help the journeyman address real problems.

all labor, all cost, and all delay occurs in the process blocks, and materials are somehow transported instantaneously from process to process without any time delay or cost.

While these factors may be true within the automated portion of some systems, most large systems are a meld of manual and automated processes. Therefore, when upgrading an existing system, it is important to understand the time delays between processes—that is where courier runs, security leaks, and transparent backlogs of in-process work occur. Unfortunately, most systems analysis techniques presented fail to account for these three important factors.

The last column—cost—is notable for its omission. The state of the art does not allow total automation of any system. While we do automate larger and larger parts of systems, the manual component is still significant. Therefore, it is surprising that most of the published systems analysis techniques do not explicitly address cost.

Most methods provide for the collection of gross costs, but none assist the analyst in breaking down those costs and allocating dollars to the individual process blocks. Thus, we may easily determine that it costs \$10,000 a month to operate a system and that \$3,000 is for computer charges for which we have detailed job statistics, but how are the manual charges allocated to the work units, and how much time do individuals in each work unit dedicate to the system under consideration?

In certain high volume operations, the work force applies 100% of its billable time toward processing paper. Where the volume of flow is lower, however, personnel frequently divide time among several functions. Without detailed labor breakdowns, displaceable costs cannot be estimated accurately.

Further, none of the systems explicitly encourages the analyst to record staff skills, special facilities, or the depreciable equipment required to perform each notion. Without this level of detail, it is no wonder that many cost-benefit analyses are suspect.

It is clear there are many conflicting definitions of the word "system." If your definition is something you can get your hands around in a month or so working alone, and if the entire system supports only a single business function and that function can schedule a week or two of down time while a new system is being installed without jeopardizing the health of the parent corporation, you've got an easy problem and most systems analysis techniques will be satisfactory.

If your system, however, involves many business units, is geographically dispersed, and even mainlined to the parent corporation so that an outage of even a few hours becomes a senior management concern, then you're talking about a system that must be

carefully understood, upgraded only through incremental improvement, and operated satisfactorily through all systems transitions. (To do otherwise is to court disaster, as Citibank did with its demand deposit accounting upgrade several years ago. It's an interesting case study in case you haven't read it.)

Mainline systems require substantial systems analysis efforts before the first programming specification is written. The existing system must be understood, a satisfactory new system devised, and a determination made about how to incrementally make the transition from the old to the new. All this must be put on a schedule that is reasonable to the system developers and provides change in steps which can be easily understood by the system users.

If these are your criteria, then most of the listed techniques will require innovation. The techniques that evolved from government and military work will handle big systems, but they don't address incremental migration.

DEFINING YOUR SYSTEM

Some of the commercial systems set system boundaries too narrowly, and concentrate almost totally on the automated portion of the system without giving adequate attention to the organization in which that automated system is imbedded, or without detailing the manual processing that occurs immediately adjacent to the computer.

- Consider input checking: If a person checks transactions prior to input, where does he get the data to check them against? How are these tables of allowable values kept in sync with the computer edit tables?

- Or, consider computer error reports: What is the process that reconciles these errors and reenters corrected data? Is this process designed to maintain data integrity and guard against fraud, or do the manual processes merely attempt to remove the item from suspense?

- Or, consider the computer output: Are screens designed to fit the needs of the people requiring the data? Are the data in the correct sequence so that they match the physical storage sequence of the items in the warehouse?

These and similar questions confront every analyst who attempts to analyze a system. Unfortunately, most of the current techniques do not help the journeyman address these real problems.

The state of the art is dominated by the skills of the lead systems analyst. If this person knows his business environment, if he has successfully matured in each functional area until he has mastered the subject, and if he is well read and unusually well organized with checklists and notes and lessons from history, then he is likely to be effective the

next time he undertakes a large systems analysis task.

Those of us who don't live under such happy circumstances however, need a mature systems analysis technique that will lead us through the process and increase the probability that we won't overlook something important. If we fail to identify all the necessary data elements, or if we don't recognize those decision points and provide for proper management controls, or if we are so overwhelmed with the size of the job and the technology that we overlook human factors, security, or privacy—then we've set the stage for a development project that may meet the spec and deliver a timely, quality product only to find that significant changes are required prior to cutover for production, or that system maintenance exceeds expectations as overlooked items continue to emerge from the woodwork.

In summary, it seems we have adequate systems analysis techniques for the standard small or medium-sized job. However, if you're facing a large job or a job that is beyond your technical expertise, it is unlikely the published tools will be adequate. Unless, of course, you define what you need in a systems analysis technique, critically review the techniques available, and prepare to spend time extending the technique so it can adequately address the problem. *

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Mr. Townsend has been a dp management consultant in design and analysis for nearly 20 years. His company is headquartered in southern California.

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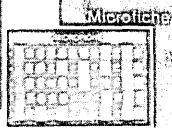
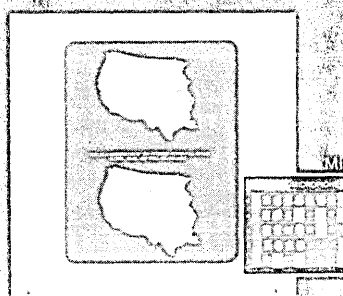
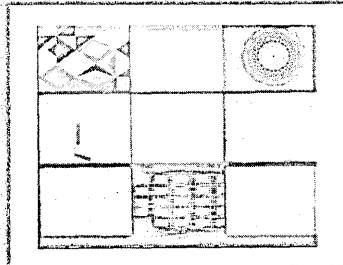
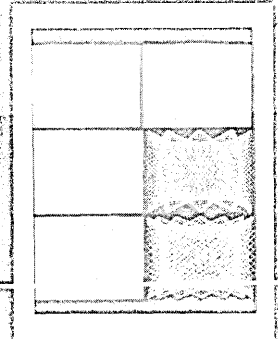
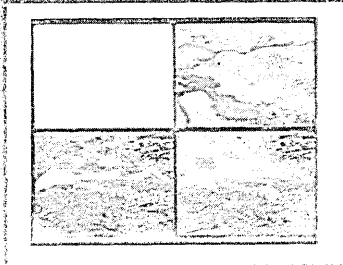
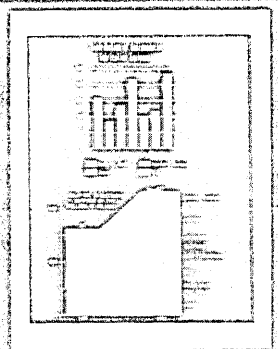
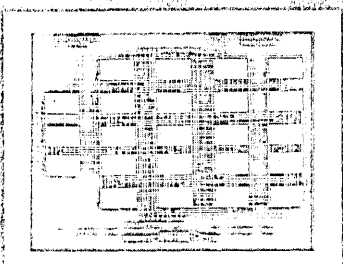
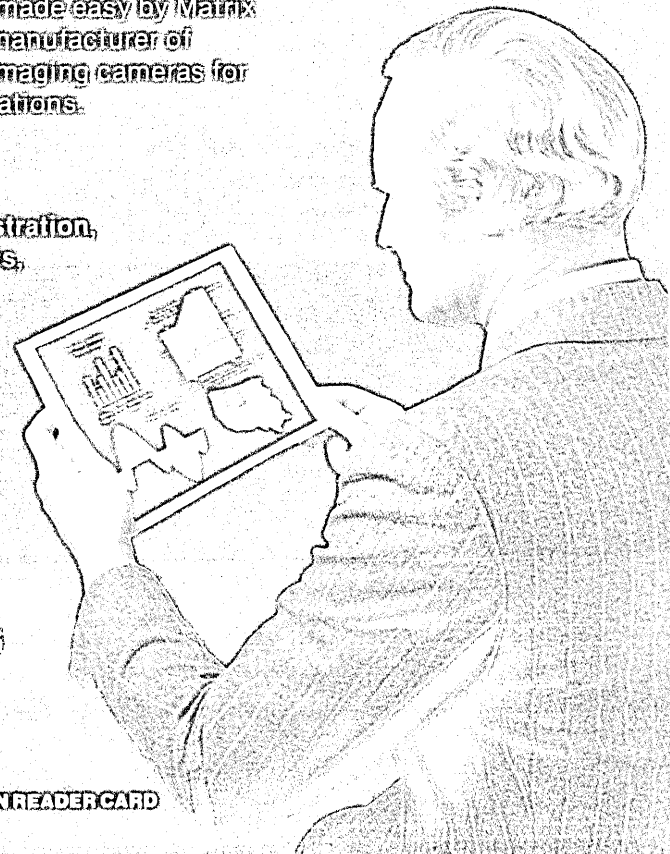
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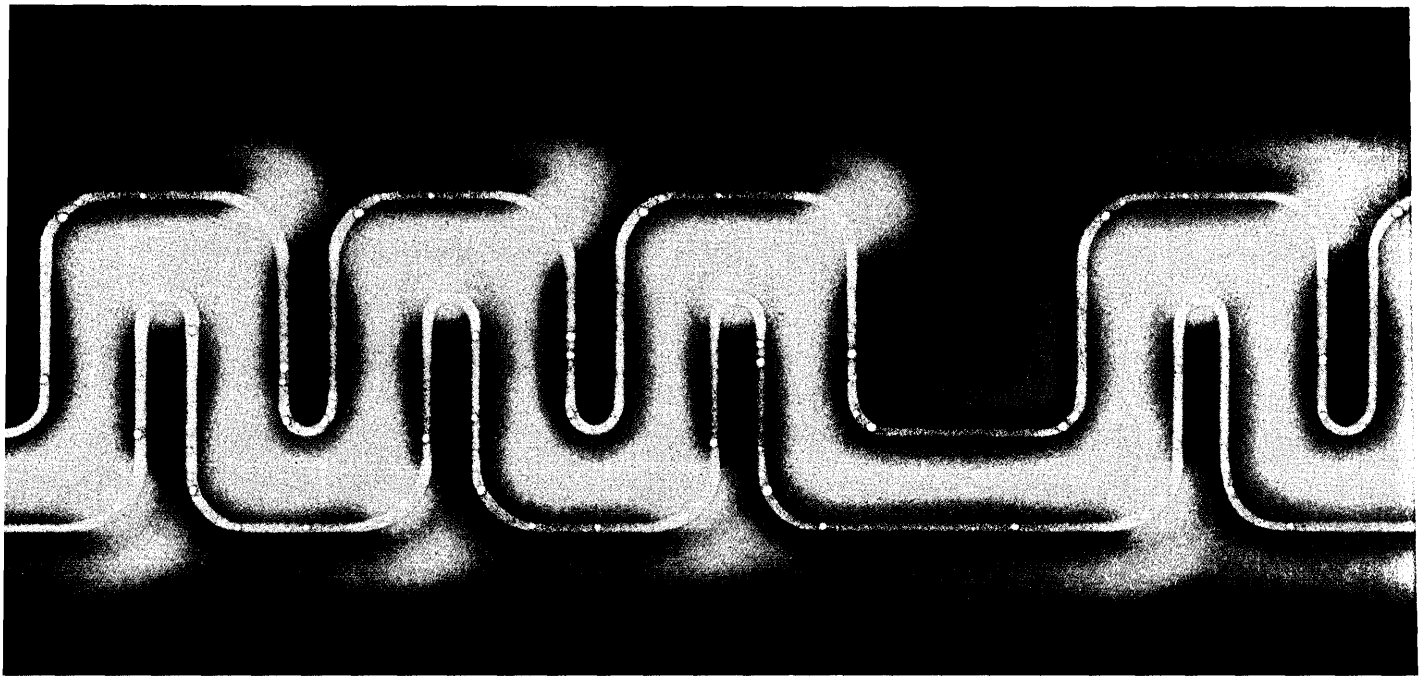


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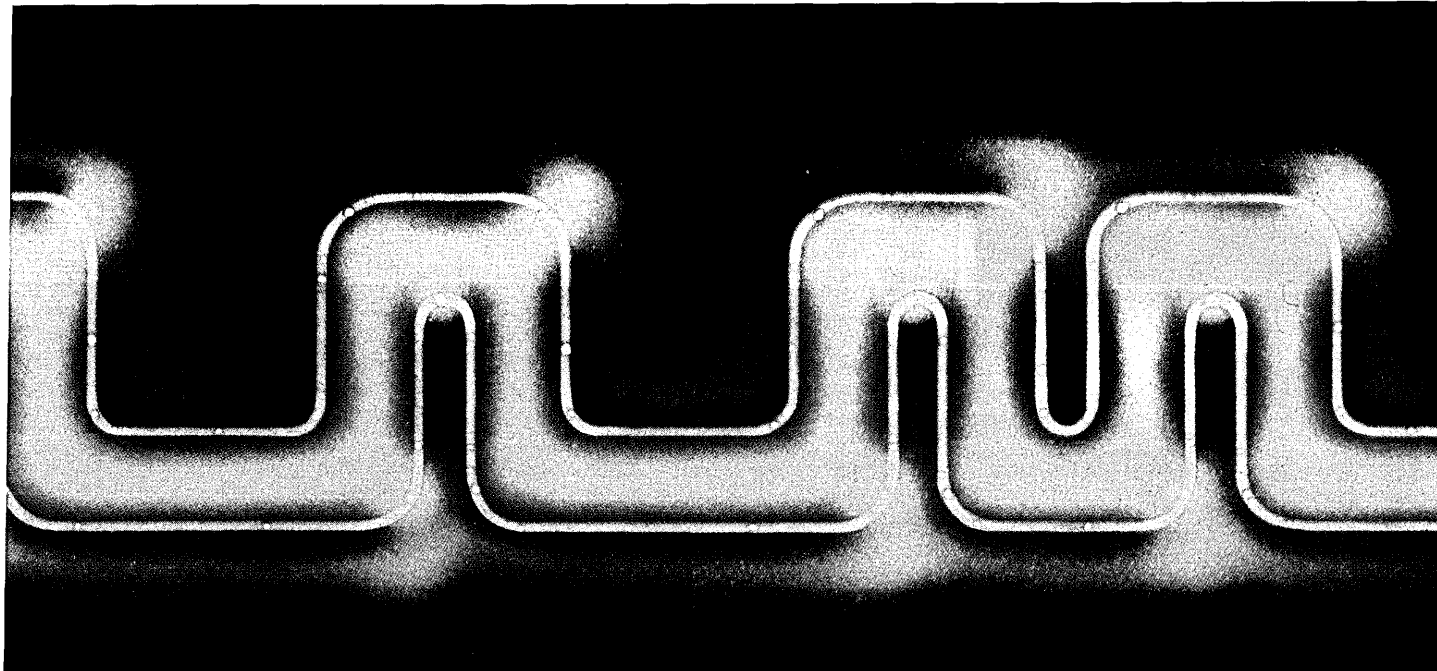
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The knowledge business



Up in the stratosphere of the corporate hierarchy, vice presidents of MIS command six-figure salaries ... and a giant's share of extra goodies.

PERKS

by Merrill Cherlin

They're known as the new breed of information processing executive, and they first appeared on the scene with regularity about six years ago. At that time, perhaps 10% of large corporations had them; now it's about 25% and growing fast.

Beyond dp managers, beyond directors of information services, these are vice presidents of MIS, often at the corporate level. Herbert Halbrecht of Halbrecht Associates, an executive search firm, 70% of whose business is in information processing, says, "This executive has a more significant, participatory role as a member of the management team running the company. He isn't preoccupied with how much bang for buck he gets out of a computer. His function is to be an early participant in the corporate business plan to identify the systems implications, the costs, the alternatives. He's a different animal.

"If there are not more people around in this position at the moment, in most cases it's the company's fault. Top management, in many cases, does not get sufficiently involved in such a way as to permit and encourage that kind of individual to come to the fore. Many companies allege that they want this, but they really don't. That individual is very strong and forceful and sees himself as a more generalized businessperson who happens to have strong technical credentials but is not a computer jockey. A lot of companies don't really want this kind of person at the head, regardless of what they say. Part of it is because they've had such bad experiences with computer jocks in the past; part of it is that they don't understand it [what someone of this caliber could do for their company] and they're not prepared to treat it properly. To have that caliber of individual you really have to have a very knowledgeable top management team that has developed the fertile ground for such a person to flourish. If they're not all in sync with the management of information technology, then they're not going to get it."

How did this dynamic job evolve? "At the very beginning of computer use, companies used a stage 1 person—someone who was just gimmicking around with it and

didn't really understand too much. At stage 2 you had a technician—someone who was good technologically but had no real understanding of the implications of what these things were and what impact they'd have. At stage 3 you had an expert—someone who not only had the technology but who'd also gone beyond that and had at least an understanding of the implications of the technology he was in charge of. But stage 4 is the generalist, the businessman, the salesperson who has been that effective in selling his wares that his technology is woven into the warp and woof of the management process."

Typical comments by the various vps of MIS we talked to go like this: "I created dp at X company—before that, all their divisions had their own separate accounting systems," and "I automated the largest bank in New York," and "I created the entire dp system for a major airline," etc. There aren't many people around with experience like theirs and they're in great demand. They command six-figure salaries, perks to kill for, and power. Most of all, they seem to want a challenge. They go from automating a chain of hotels to creating a system for a huge conglomerate, knowing that there are fewer and fewer businesses left that are without effective information management. As one says, "I think this type of job, where you start dp from scratch, has really only existed for the past 10 years. Now others like me are moving on to other companies or higher up in their own companies."

Does this mean that after the past 10 glory years for vps of MIS, there will be no new fields to conquer, and they might in fact become obsolete? No, rest assured. As this vp further explained, "Let's take the case of an insurance company with several huge computers. It's not that the applications are necessarily so new as is the fact that their processing is getting bigger. They'll get heavily into medical as well as life insurance, so they're processing millions more transactions. That end of the business grows like mad. They'll put it into the hands of a very capable guy who's now thought of as being a very important person in that organization. So from that point of view, yes, there are more and more people at this level, nationally. But what I'm saying is that in most situa-

tions it's evolving on top of whatever had been in place before—whereas a few years ago, many companies hadn't been doing *anything* centrally."

THEY'RE SUPERIOR PEOPLE

Whether they're starting fresh or building on a present system, these new information processing executives are seen, within the largest companies, as being of tremendous importance. Roy E. Hunt, a vice president of the executive search firm Spencer-Stewart, says, "At this level you don't talk about satisfactory, you talk about someone who will be able to come in and scope the direction that a function should go in and be able to attract the kind of subordinates he needs to build his organization. We're talking *superior* people, and there's always a shortage of superior people in a field, especially these newer, emerging glamour fields. There's also a trend toward a hybrid type of position—a title like vice president of technical resources, which would include MIS and would also include some other computer-based, more complex functions like computer-aided design of engineering or computer-aided manufacturing. This job is becoming recognized as having major impact on the strategic planning of the corporation and that's exciting to a good professional."

Dick "created dp" for a major corporation whose sales went from \$150 million to \$1.5 billion during his tenure. He says, "My dp installation was considered the best in the field and one of the best in the entire country. I was looking for a new and exciting challenge. The installation at my former company was mature, it runs very well and it doesn't need me. I wanted to get someplace where I could take an organization and help it grow into a mature, capable one that could produce the kinds of things a dp organization ought to be producing—on time, on schedule, on budget. Things that work. There's no question that I can produce something that really works, something that can be built on without starting over. I wanted to go someplace that needed me, where they were willing to pay what I wanted, give me the perks I wanted, give me a piece of the action, and some additional responsibilities."

ILLUSTRATION BY RICHARD EGIELSKI



R.E.

"You can't give an individual a salary that is too far out of line, so you give him all kinds of other bonuses."

He decided to go onto the job market and turned up several offers. Companies far-sighted enough to realize the value of a person like Dick will often create a new position especially for him. Of his new job he says, "Actually, there was no job here. What I turned out to be for them was a candidate of opportunity." He has the directors of MIS planning, dp, and internal communications reporting to him and expects to pick up a few more things soon.

Understandably these vps are well paid for their efforts. Herb Halbrecht says, "We're continually replacing people who made \$60,000 to \$75,000 with people making \$100,000 to \$200,000. And when you bring in people at the \$100,000 level you give them tremendous amounts of perks—all the same perks that you'd give other top executives of the corporation. The companies don't differentiate at all between their information processing executive and their other top executives making that kind of money."

Perks are routinely given to high level execs but additional ones can be used as bargaining chips to obtain a sought-after candidate. Significant extra salary is usually out of the question because, as Halbrecht says, "You can't give an individual a salary that is too far out of line with those of other top executives. So what you do is give him all kinds of other bonuses, stock purchase and stock option plans. These people are getting richer all the time. Even though there's a recession on now, the difference in impact that a truly well-managed information function can have on the corporation is so important that there's no diminution in salary or perks. A company can lay off 25 programmers because of cutbacks because nobody really good is being laid off. The highly productive people are protected. At the same time that company may be looking for some key people with a combination of technological and managerial skills."

People are not anxious to have their perks publicized, but with the promise of anonymity, lots of vps of MIS were willing to discuss the topic. Those we spoke to all work at multimillion dollar corporations; in fact, many were in the top 500, if not the top 50 companies. That's where the best perks are. We also talked to Don Simpson, a partner in the reward management division of Hay Associates—the largest human resources consulting firm in the country. Simpson has originated surveys of salaries and perks and has the statistics from 600 companies at his fingertips. The companies run the gamut from small to jumbo, so he offered these guideposts.

"The size and geographic location of the company are really what determine the perks. A small company in Dayton, Ohio, may be able to give cars to its three vice presi-

dents, but a huge bank in New York City would have to give hundreds of cars to its hundreds of vps. They wouldn't want to drive in New York, anyway, most likely. So the statistics are misleading."

PARKING, PENSIONS, PLANES

Simpson says the great big companies, the "dynamic" ones, in his words, are the ones that give the big perks like stock options. The combinations of perks differ from company to company, but most of the big-time companies have all of them except, perhaps, the car. Actually, in cases where a new car every year is not standard, the executive may have the use of a chauffeur-driven car to ferry him around. Sometimes, Don Simpson says, "They'll send a car to Connecticut to pick up four key vps and bring them downtown to the financial district." And, especially in cities, fully paid parking is a perk that, if withheld, may make owning the car less desirable.

Very sizable, fully paid medical, life and disability insurance policies are standard, as are yearly physical exams, a week or two extra vacation time, and whopping pensions.

Use of the company plane is often included. Halbrecht says, "You can get on the list to use it. Depending on where you rank you may be number 29 or 35, but then there may be several planes. If you're on company business and you want to impress people you use the corporate plane."

Many execs receive membership in a luncheon club, a health club, and/or a country club. Again, geographical location is the guiding factor—lunch clubs in major cities, country clubs in small cities or suburbs. In some cities, belonging to a certain club confers a high degree of status, so the ability to bring clients or associates to it is quite important. Most of the big corporations have small, luxurious executive dining rooms to separate the wheat from the chaff during lunch hour, and entrance to these is considered a perk.

Simpson says a big comer on the perk scene is one-on-one personal financial counseling. Almost half the vps of MIS of very large companies would have access to this service. However, they're all entitled to attend estate planning seminars if their companies provide them.

What with out-of-sight mortgage payments and interest rates, Roy Hunt says, "It's getting harder to move people from city to city, so a company's ability to pay a large part of the extra expense a new candidate assumes when he moves is important." Besides paying for the physical move, the company may guarantee sale of the vp's former home at a certain price and take the selling of it off his hands, and may lend the down payment for a new one at a low rate in order to keep his mortgage payments constant in the two cities.

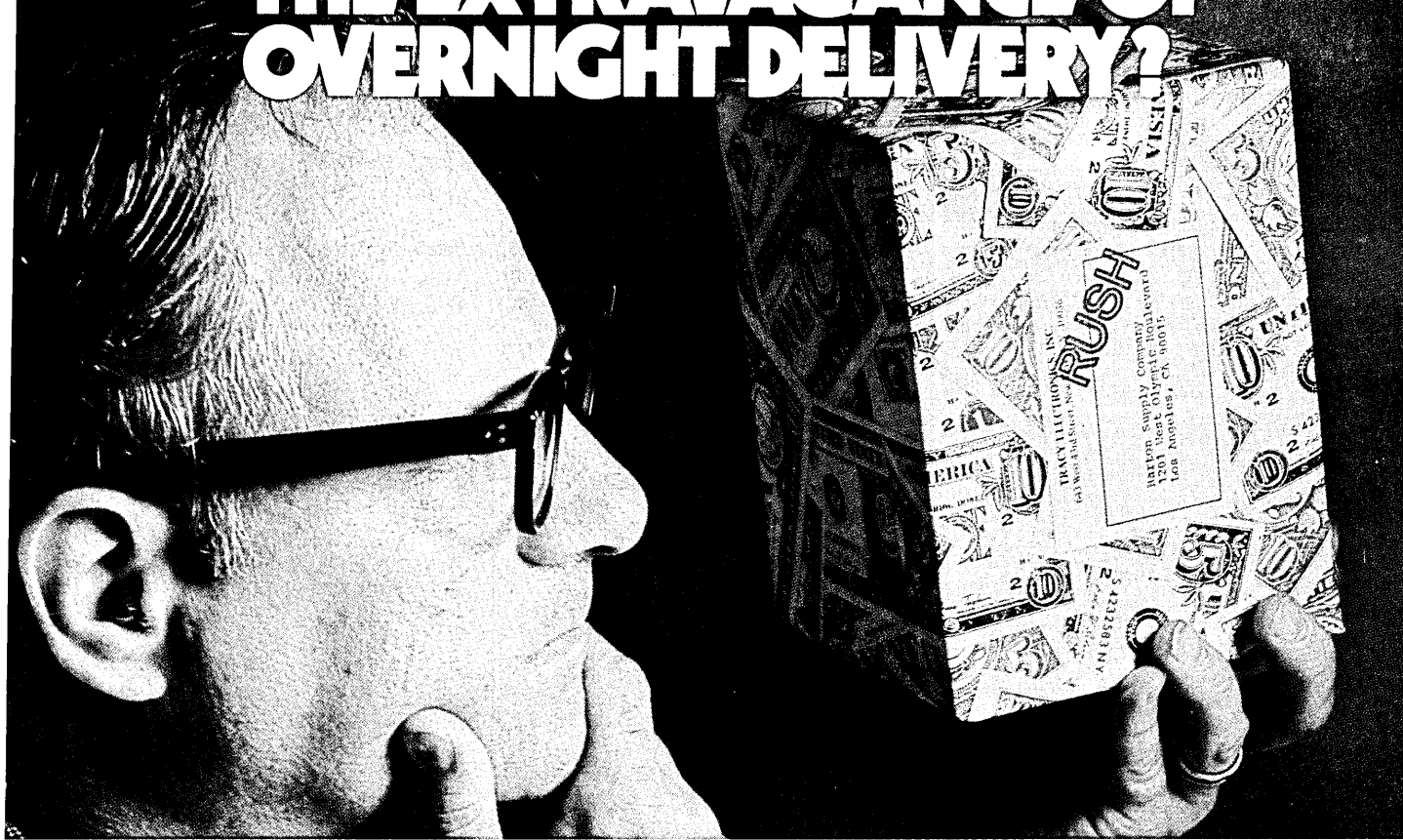
Stock bonuses and stock options are extremely important perks and almost no vp worth his salt will consider moving to a corporation without them. Besides being awarded a certain number of shares upon joining the company, he may take part in interesting deals like the one Halbrecht describes: "You may be permitted to put away, say, 10% of your salary to corporate stock. Say you're making \$70,000 base salary. You could buy \$7,000 worth of stock. Then, as an additional bonus they'd give you another 40% or \$2,800 worth of stock. That piles up."

A vp named Ray says, "My package is a six-figure one. There's a certain guaranteed minimum stock performance, not speculative stock performance. And if the stock does what I think it's going to do—it'll be worth a whole lot more than a six-figure package. The stock is figured in at a very minimal level."

Cash bonuses are also vital these days, and come in a few varieties. The "front-end" bonus is receiving lots of attention lately. It's a chunk of money given immediately or, if the vp prefers, doled out in the form of deferred payments. In addition, annual bonuses of up to 35% of base salary are usual. The percentage actually awarded is based on a combination of the company's productivity and the individual's performance. In a few cases there are even termination agreements; even if the executive's contract is not renewed he can continue to receive annual payments beginning a few years after the expiration of the contract. These individuals obviously inspire great faith. The combos of bonuses are as individual as the people who are filling these jobs and agreements have to be hammered out painstakingly for each one.

A man whose title is senior vice president of systems research and development and operations services says that in his case "they made an exception in their contract period. They made it for five years instead of the usual three. You just can't do a job like this in three. And beyond what they paid me, I got 50% more for every year of the contract I completed. But if I walked away before the five years were up I wouldn't get nuthin'. Let's say that my salary was going to be \$100,000. For every year of the contract I completed I would earn another \$50,000. But I don't get that unless I complete the whole five years. Then it's only paid to me when I leave and over a 10-year period. But the key was—they had me. Last year another company wanted to talk to me about joining them, but I had already done four years of my contract. By the way, the actual numbers are larger than what I'm mentioning. As it stands now, there is a person trained to take my place. I could leave and it wouldn't be a problem. The bulk of the job is done."

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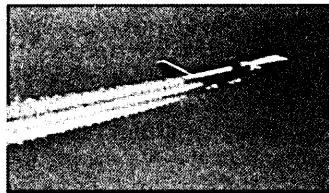
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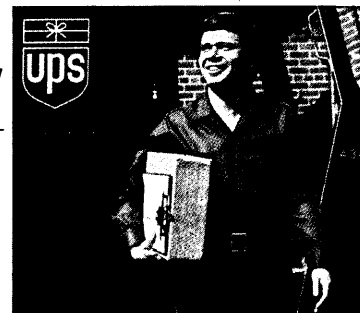
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They insist the challenge of the job is more important than the perks, but implicit is the fact that these jobs bring power.

DOING THEM A FAVOR

On the other hand, one person we spoke with "didn't go for a contract." He says, "If you exercise a contract, everybody's lost. I have an offer letter, right? It spells out the agreement. Beyond that, if something doesn't work out here, with my reputation and my abilities I'll go back on the market. I'm here to do them a favor. If, sometime, someone decides I'm not doing them a favor, hey—there are too many other places where I *could* be doing someone a favor. No way I need the security. Ha!" No

shrinking violet he.

Really high up in the perk echelon is the rank of corporate officer. One person feels it's important because, as he says, "We have only 35 corporate officers in a company of over 50,000 employees, and I'm one of them. This should establish for you how the company feels about this particular function. It's a way of management's saying to the organization: we think this is sufficiently important to give it that kind of recognition. It's an additional element in my being able to capture people's attention, to be able to have

the important broad-based access.

Someone else says, "I've got an office on executive row. I can look out my door and see the president's office and that's important. You gotta be there. Coming in at the right level makes a big difference in your success or failure. It's a status thing. Corporate officers go to lunch with corporate officers. It's ridiculous, but that's the way things are."

Still another info exec, one who moved from a corporation where he had successfully established the dp system and left it running smoothly, says, "The guy that took my old job has a base salary of \$89,000, and he got a car, but he didn't get a corporate officership—he made a mistake going in. It's who you're rubbing shoulders with and what kind of information you're getting. You have to be sure you're in tune with company futures. You really need to be dealing at that level—at the peer level."

Everyone we talked to insisted that the challenge of the job was more important than the perks that come with it. But implicit in their talk of great challenge was the fact that these jobs bring power.

Richard says, "Fundamentally, opportunity lured me—a company with a deservedly strong reputation for marketing excellence, high quality people, *very* strong financially. A *very* substantial company, with an anticipated \$7 billion in earnings this year, which puts it up in the top 50. Here was a major opportunity and a management that was quite receptive. There was a very strong, felt need. I could do something significant. I felt that was a unique set of circumstances. The perks were not the 'A' items. The 'A' items were those of opportunity. I'd put the perks at the 'B' level."

And with the power, the opportunity to see a little past the information processing rainbow. As mentioned earlier, these guys are businesspeople first, dpers second. Bill says, "I'm not a job-hopper. I like to do things and make them very successful. I may well move out of my current job into other disciplines. The president of this company is ex-IBM as is the senior vp of marketing. So one of the things I picked was a company where dp backgrounds had been successful in disciplines other than data processing. Not that I'm definitely going to do that, but it's nice to have options. I think that's important for somebody going out on the market. You still want to go for the six-figure salary, but you certainly don't want to do that somewhere where you're just going into a dead-end situation."

Heaven forbid.

*

Ms. Cherlin, a former DATAMATION copy editor, is a freelance writer in Baltimore, Md.



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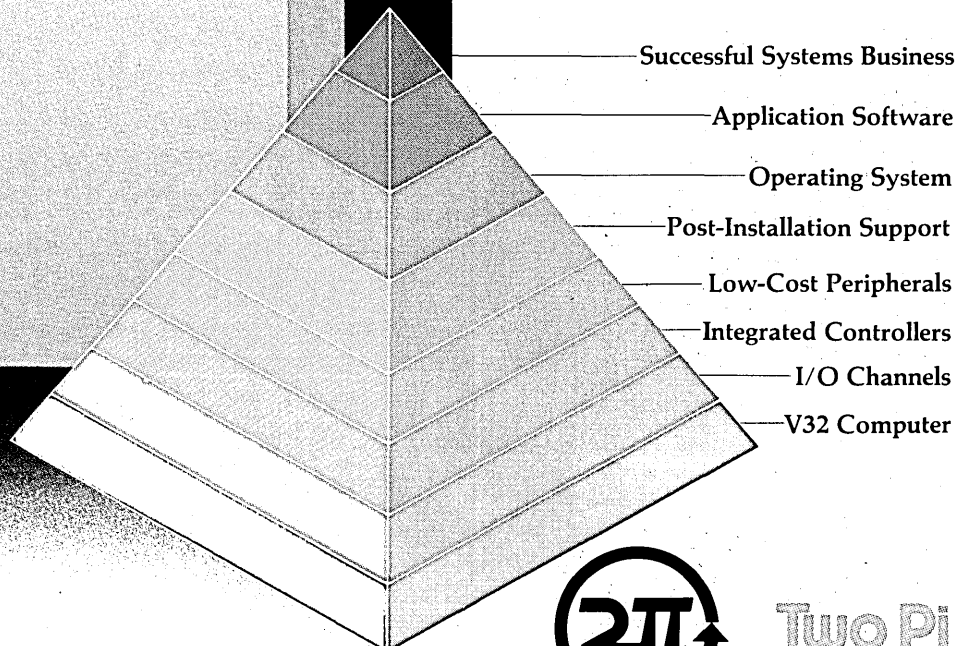
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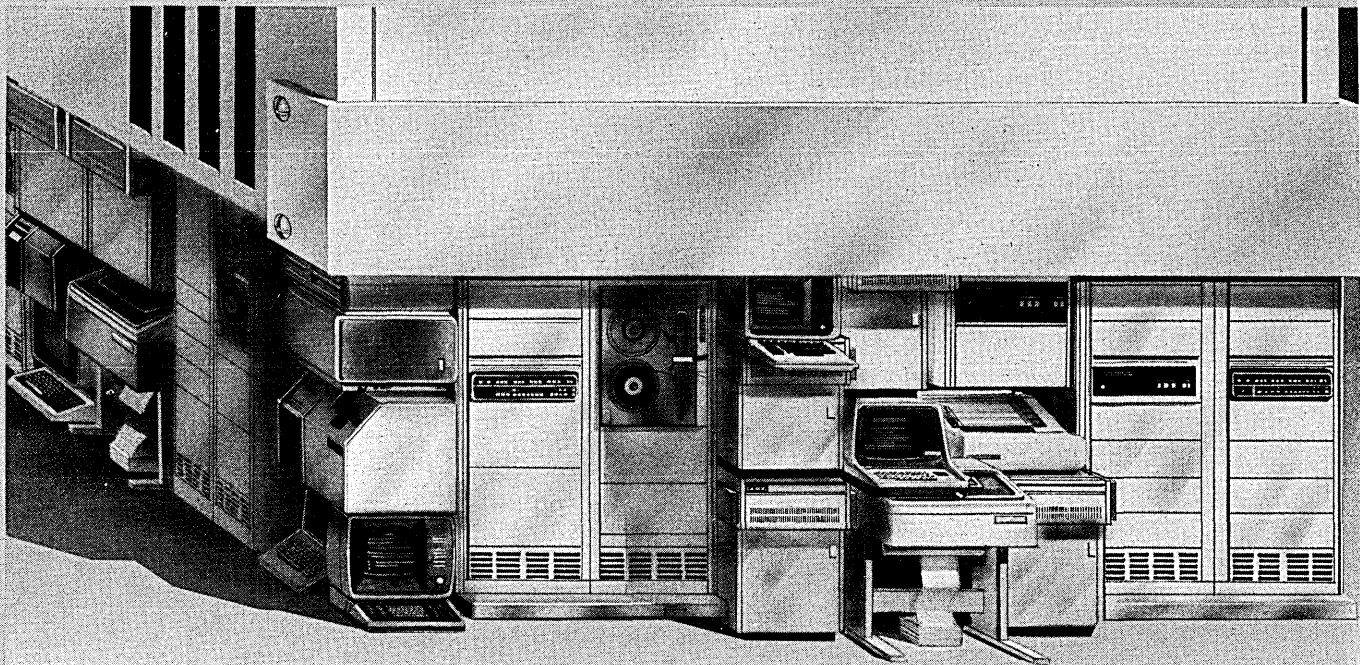
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
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The relational approach can make it easier to design more precise data bases.

IMPLEMENTING RELATIONAL DATA BASES

by Robert S. Barnhardt

Perhaps the most difficult aspect of data base design is creating a data representation that not only satisfies management's information needs but does so in a way that management believes is useful. If the representation does not do both, the data base, the application, and the organization often suffer.

One can use various methods to represent data, depending largely on the type of relationships in the data base. For example, a simple one-to-one relationship, such as an employee and his job, can be represented as a flat file; that is, a collection of records of the same size containing information about both the employee and the job. But a one-to-many relationship is more complex. A data base of bank accounts, deposits, and withdrawals, for example, might be represented as a hierarchy or tree. In this instance, each account is associated with a collection of deposit and withdrawal records. The even more complex relationship of many-to-many, such as a collection of all courses needed for a college degree versus all degrees that require a specific course, is usually represented as a network. Most data base management systems (DBMS) use the network or the hierarchy.

Networks and hierarchies, however, are not always easy to describe to the managers who own the data bases. A hierarchy of names on an organizational chart, for example, usually appears as an upside-down tree. At the top is the boss and beneath him are subordinates. The subordinates may be bosses with their subordinates, and so on. A network can also resemble a tree, but on the organization chart just mentioned, a subordinate might have more than one boss. Thus the organization chart for a large organization is often complex. Some relationships, such as ad hoc committees, may not even appear on the representation. Likewise, descriptions of complex data bases are often difficult for managers to understand, and they frequently hide important relationships.

As random access storage devices came into common use, hierarchies and networks emerged as the leading data base design strategies, despite their complexity. Through the 1960s, both techniques gained wide acceptance because they could represent complex relationships and because they offered performance and storage efficiencies during a period of limited computing power

and expensive secondary storage devices. But during the 1970s, which saw phenomenal increases in the power of computers accompanied by exponential decreases in the costs of computers, memories, and secondary storage devices, complexities of networks and hierarchies began to attract attention. Data base theorists such as E. F. Codd began to argue for simpler, more logically precise representation of data in terms understandable to users and management. The relational model first appeared in 1970; relational data bases have since been proclaimed as the wave of the future. A common complaint is the lack of commercial data base management systems that implement the relational model.

The relational view has gained an increased following because it offers a simple but precise approach for logically describing a data base. Development of the model begins with a collection of data called a relation, which can be thought of as a standard fixed-format file or a two-dimensional table. Thus, in relational terminology, one refers to a row across the table or a record in a file as a tuple and to a column down a table as an attribute or a domain of the relation.

The relational model derives its precision from mathematical set theory by using relational operators to manipulate relations. The model is simple in the sense that all relations have the same basic tabular form and only a few relational operators are needed to manipulate the most complex relations. It is then possible to describe an organization's data as a collection of tables defined by a precise set of rules and procedures for gathering, updating, and using the data.

One may then ask why there are no commercial DBMS to implement the relational model. For one thing, a complex relational data base would contain a large number of relations, and current storage technologies require large computer resources to manipulate relations. Several experimental systems have addressed the problems of manipulating relations, but these efforts have generally been limited in scope and size. A relational DBMS is reportedly under development at IBM, but a production version has still not appeared. Most knowledgeable specialists in data base design agree that, as large-scale associative memories are developed, relational systems will become commercially available. In the meantime, data base specialists continue to face the day-to-day problems of designing

data bases to satisfy the needs of organizations.

DESIGN MADE EASIER

Does this mean that data base specialists and managers should ignore relational theory? Not at all; the relational model can make it easier to design clearer and more precise data bases. By following three logical steps in defining a data base through a process called normalization, the designer can precisely describe the important relations and relationships in the data base. The end product, a collection of tables, provides management with a graphic description of the data base, and the logical description becomes a basis for validating the completeness of the data base.

In the absence of a relational DBMS, the designer must rely on conventional DBMS to map the logical relationships defined in the relational design to the physical constructs of simple flat files, networks, and hierarchies. But if he implements the relational design as a network or hierarchy, he will lose many of the advantages of a relational data base. A better approach is to use the flat file facilities common in most commercial DBMS to implement the relational design physically.

The relational model can be implemented with most conventional DBMS. To do so, the system must support simple flat record structures and retrieve records by logical keys. It should also add and delete records efficiently and provide facilities to implement the relational operators SELECT, PROJECT, and JOIN. Most DBMS have the necessary facilities to implement a relational design, but many data base managers, more concerned with performance than with design, are reluctant to try the relational approach. This is a natural concern because the data base must meet the objectives of a given organization; otherwise, it becomes a liability rather than an asset.

Like most large organizations, the Air Force uses automated data bases as integral and necessary tools to manage valuable resources. A major concern of the Air Force is to acquire data bases that reflect management goals, respond to changing environments, and provide reliable support to users. Thus, when it decided to integrate a number of independent data systems that supported various training components, it was vitally concerned with the design strategy for the training data base.

The data base must meet an organization's objectives or it becomes a liability, not an asset.

The Air Force training program resembles the curriculum of a university, except that its program is much larger than the average civilian institution. For example, the program will cost \$1.7 billion and will train more than 159,000 officers and airmen at Air Force technical training centers during 1980. Another 140,000 will be trained locally at field training detachments. The program provides formal training in more than 250 skills for 91% of all Air Force recruits. Each year, the Air Force conducts training in some 50,000 classes for more than 4,000 training courses. The size of the program alone requires a large and complex data base.

The purpose of Air Force education and training is to provide enough skilled and knowledgeable people to meet Air Force requirements. To achieve this goal, program managers rely on complex procedures to determine skill requirements, plan training programs, schedule courses and classes, recruit qualified men and women, and train those people.

Early in 1977, an Air Force study identified several deficiencies in a sequence of training events that begin when the Air Force recruits and enlists an individual and end when the individual is assigned to an Air Force unit. The study concluded that many organizations in the training process lacked adequate information to identify problems and support critical decision making. As a result, organizations made decisions without realizing the impact on the activities of other organizations. Many examples of inadequate information were directly attributed to deficiencies in data processing support.

At that time, data processing support for training came from a number of independent subsystems that had evolved in increments over many years. The earliest applications were oriented toward record keeping, and each subsystem developed unique applications to support a specific organizational mission.

RECRUIT SYSTEM STARTED

In 1974, the Air Force implemented the Advanced Personnel Data System (APDS) on a large third-generation computer and included several training applications in the APDS as subsystems. In 1976, the Air Force implemented a real-time data base to manage and control its recruiting activities across the United States. All eight of these subsystems were tied to the APDS master personnel files and to each other in a maze of more than 50 interfaces. Like many other data systems, the complex exchanges of data in this system evolved from a growing interdependence of functions and organizations in the training pipeline.

To solve system deficiencies identi-

fied in the 1977 study and to support solutions to other management problems, the Air Force undertook a project to upgrade the capabilities of the system. The project began with an analysis of the subsystems to identify the management processes that require automation support. It next identified data system goals to support the management processes. Finally, it set goal priorities according to high payoff or near-term payoff and low payoff or significant elements of risk.

The project identified four processes that required automated support. The first process collects training requirements from more than 60 major users of Air Force training, including the major air commands, the Army, the Navy, agencies of the federal government, and foreign governments. The second process validates training requirements and schedules training, facilities, and instructors. The third process matches individuals with training quotas in specific classes and tracks them through the various phases of training activities. The four management processes form the framework for identifying data system goals.

The purpose of the data system goals was to organize a common, responsive basis for decision making. Consequently, the first goal was to integrate the training program, quota control, and student accounting systems for the Air Force, the Air National Guard, and the Air Force Reserve into the APDS. The Air Force could then use the APDS computers to determine optimum training schedules and student flows, select travel routes and training sequences for students, and monitor all personnel training. The final goal was to maintain a centralized, on-line data bank of education and training requirements, approved training programs and course schedules, and available training resources. The goals were achievable, but success depended, in large part, on the data base design.

My task was to design the centralized data base. Analysis of existing subsystems indicated that data base design would determine the success or failure of the project. Performance, recovery, and user understanding were common problems in all the subsystems. Even the two subsystems with data bases (one a flat file and the other a hierarchy) had performance problems stemming from slow response and excessive queuing. Since the centralized data base would integrate the data that supported several organizations, reliable data base recovery was absolutely essential. Furthermore, the data base design had to represent complex relationships with the DMS II data base management system available on our Burroughs computers. Thus, in view of the size, complexity, and central role of the data base in enhancing information support, the first and most critical step was to

select the most effective design strategy.

The relational approach was selected over the traditional network and hierarchy. The training data base had to represent many complex relationships created by the training requirements of more than 400 Air Force skills supported by some 4,000 courses and classes of 50,000 to 75,000 students. It also had to track and control 250,000 students through those classes each year.

The network and relational approaches could represent the necessary complexities equally well, but the hierarchy was very poor in comparison. On the other hand, the network showed some performance advantages, but certain types of common inquiries were very difficult. The relational design offered adequate performance for both update and inquiry, especially for the inquiries that proved difficult for the network. And other factors swung the decision toward the relational design.

Management wanted an incremental project so that some parts of the project could be completed early. (Other parts would require a longer development effort because of their size and the complexity of conversion.) The relational approach had obvious advantages for an incremental design. The simplicity and clarity of the relational design were additional advantages.

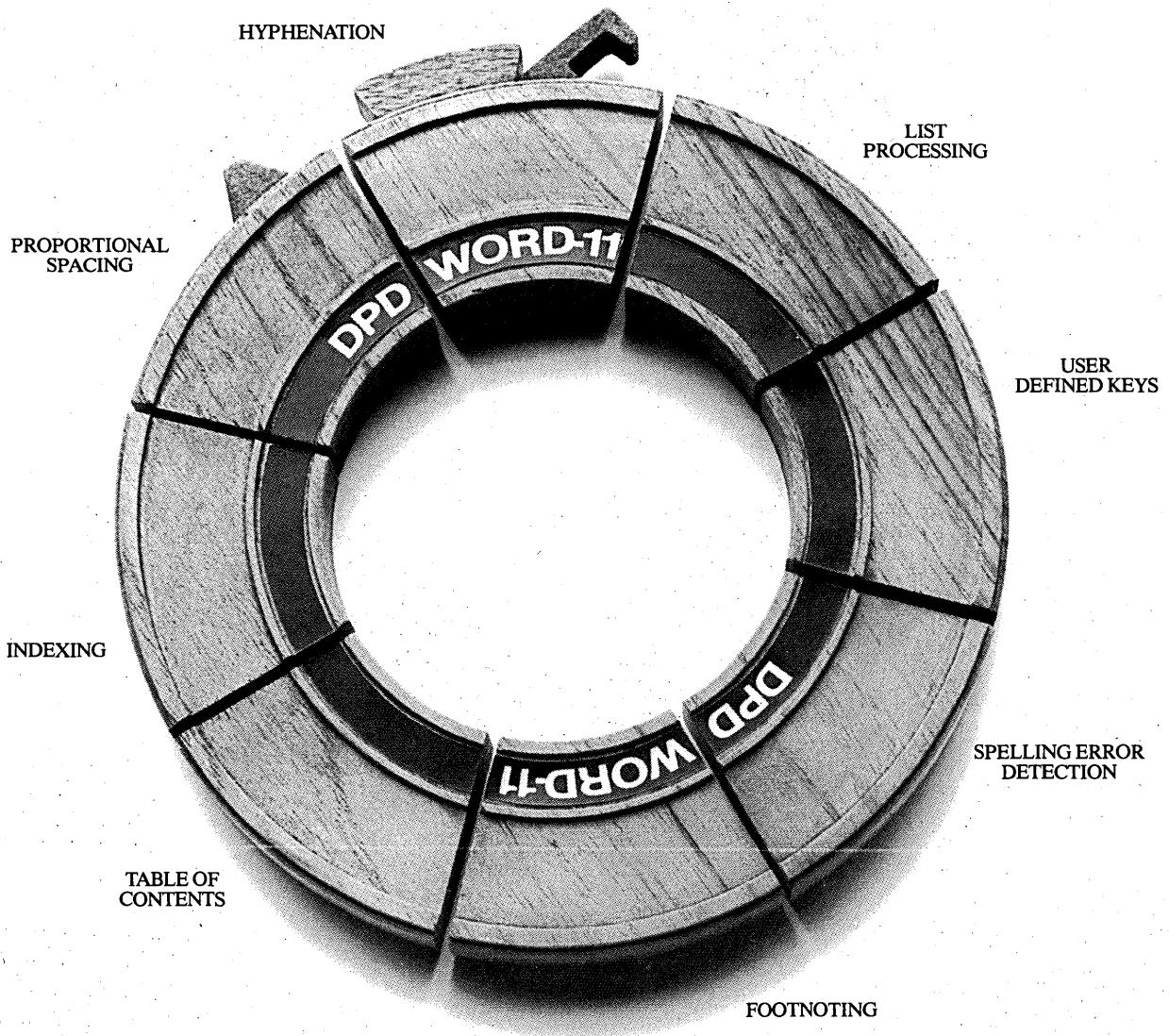
LOGICAL, PHYSICAL DESIGN

The next critical step is to translate requirements first into a logical and then into a physical design. The relational model provides valuable help to the data base designer at this point because it describes three steps (called normalization) for converting traditional data groupings, such as hierarchies or flat files, into the tabular format of relations. The reader probably recalls that if data are represented as two-dimensional tables called relations, one can apply precise relational operators to manipulate those relations to form new arrangements of meaningful data. Therefore, by applying the three steps of normalization, one can reduce existing unnormalized groups of data into a logical collection of normalized relations.* The result is a logical and precisely defined data base that becomes a sound basis for completing the physical design.

Normalization of the data base for the project began with existing independent subsystems. All the necessary data were contained in the subsystems, primarily in the form of flat files and hierarchies. (Fig. 1 shows the primary sources of data.) The first subsystem was a small hierarchical data base that contained classes with embedded quotas. The hierarchy duplicated a number of data elements, such as course-related items in

*E. F. Codd, "A Relational Model of Data for Large Shared Data Banks," *Communication, ACM* 13 (1977), p. 381.

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September 5, 1980

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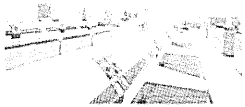
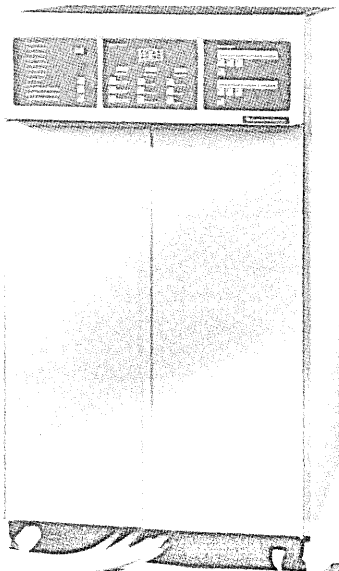
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class records and student-related items in quota records, and the design used a separate manual cross-reference to locate individual students without searching every class in the data base.

The second subsystem was a standard batch processing design that consisted of two primary master files—one for courses and one for classes. Both master files used repeating groups of data to store information about course users and class users.

The third subsystem, designed to manage Air Force skills, used a flat file of very large skill records (more than 8,000 characters per record). The skill record contained repeating groups of 12 months of classes, and each month contained repeating groups for six classes. Although the skill subsystem performed a critical and very specialized function, it duplicated the entire class schedule in the second subsystem. Thus, the combined subsystems represented the primary requirement for the data base.

One can view the data base as a simple hierarchy: at the top are skills supported by courses that consist of classes containing quotas or seats. But the hierarchical view oversimplifies the problem because a course can support more than one skill and more than one user, and a user can have requirements in many courses. The same complex relationships apply to users and classes. Similarly, a class has many students, and a student can attend more than one class.

The first step in normalizing the data base is to start with the basic unnormalized relations: skill, course, class, and quota. One first removes the repeating groups and forms a new relation with the key of the parent relation and the key of the repeating group. Fig. 2 shows that the repeating group of courses has been removed from the skill relation to form a new relation that represents each course for each skill. Likewise, user attributes have been removed from both the course and class relations, and removal of these attributes created the course-user and the course-class-user relations. Thus, the objective of a first normal form is to remove the repeating groups from the unnormalized relation and form a new relation in which each occurrence becomes a tuple in the new relation.

One next converts relations in the first normal form to the second normal form by removing the attributes that depend only on some but not all of the key attributes in the relation. Such attributes as, for example, the user's organization, mailing address, and phone number should be removed from the course-user relation and placed in a separate user relation. Likewise, any skill-course attributes related only to the course should be moved to the course relation.

One can finally make the transition to the third normal form by removing items that

FIG. 1
PRIMARY SOURCES OF DATA

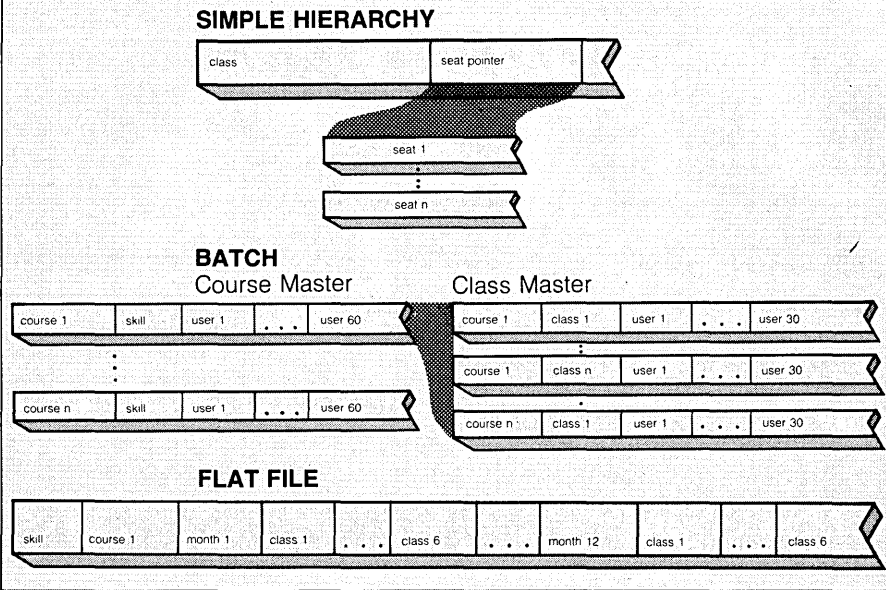
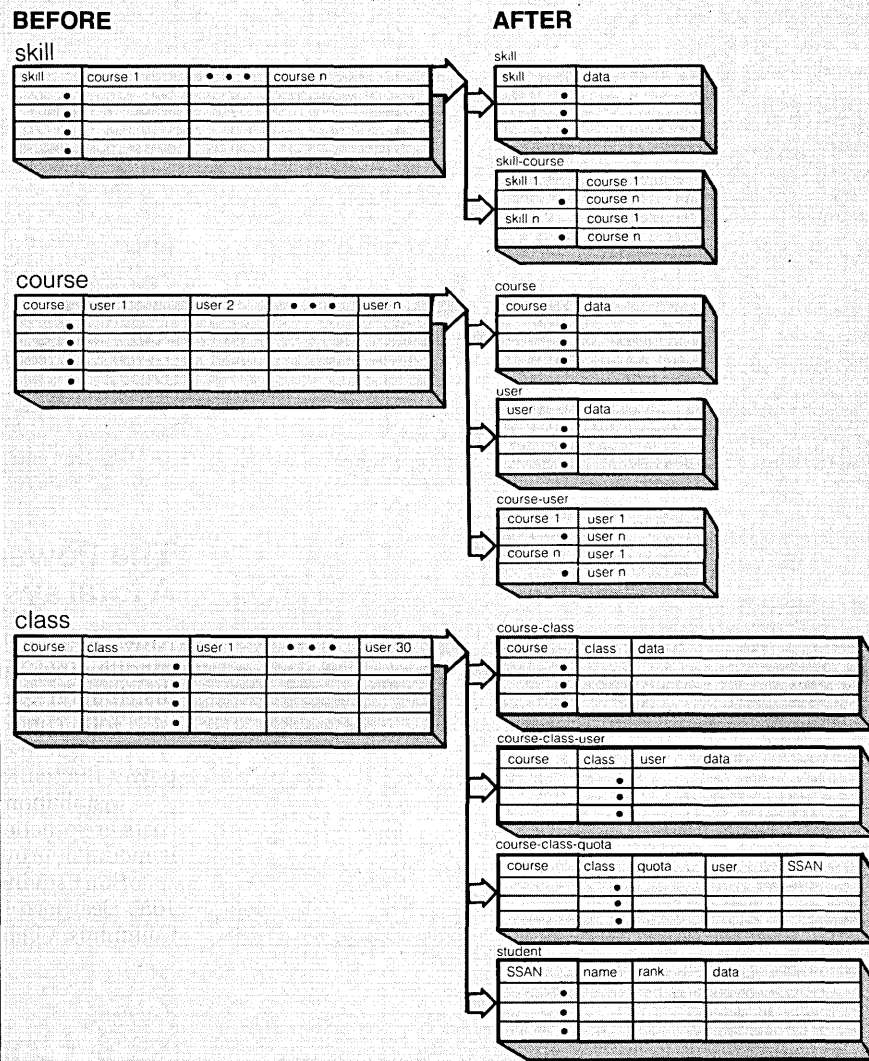


FIG. 2
RESULTS OF NORMALIZATION



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NCR's SCHULTE:

And at least a bit lower than the other alternatives you explored.

DOOLEY:

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NCR's SCHULTE:

NCR representatives are specialized. All the people in my group work exclusively with financial institutions. So we are in tune with current financial trends. Other



Dale A. Dooley (left) is executive director of Iowa Transfer System, Inc., in Des Moines. Jim Schulte is NCR district manager.

NCR representatives have parallel specialties so they can be more responsive to the problems peculiar to their industries. It's a concept that is working well for us.

DOOLEY:

The third reason is software. Only NCR could provide the switch software we needed when we had to have it.

NCR's SCHULTE:

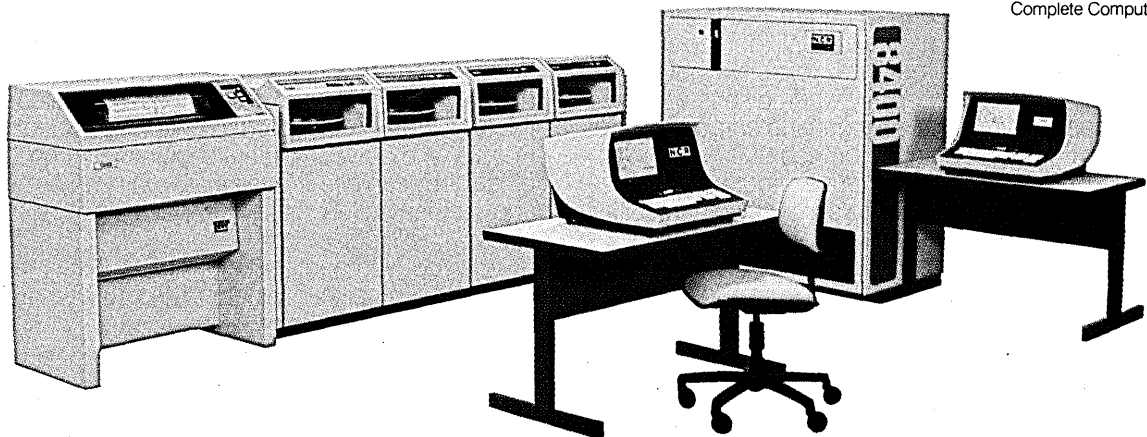
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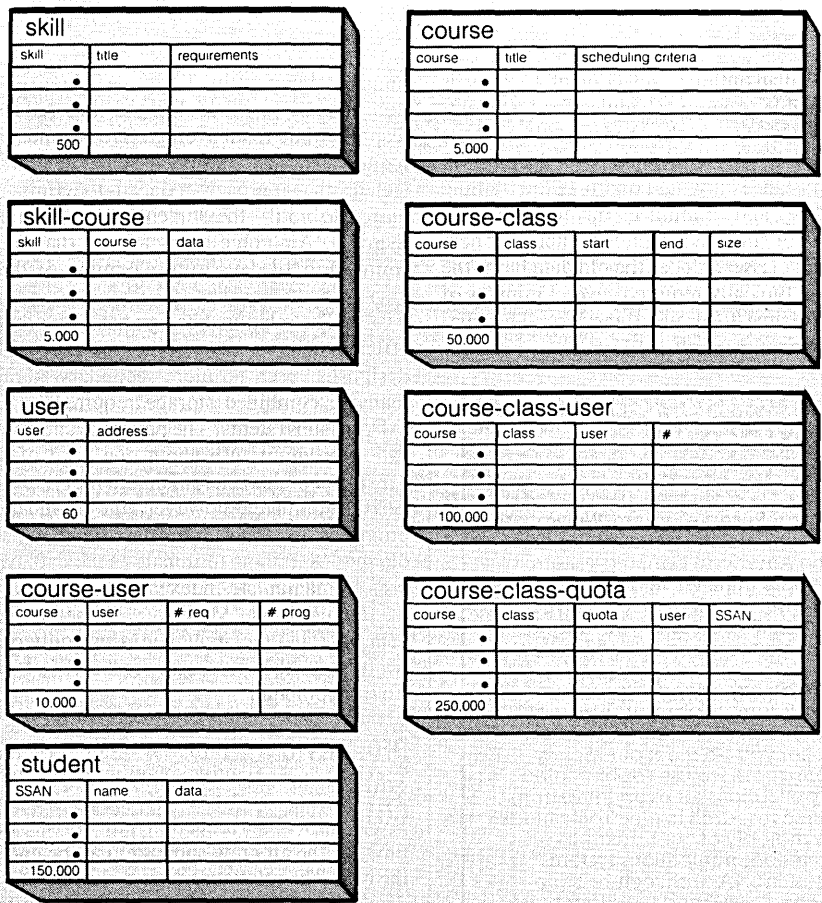
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Photo Courtesy of Pan American World Airways, Inc.

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FIG. 3
EDUCATION AND TRAINING DATA BASE



depend only on non-key attributes in the relation. For example, social security account number (SSAN) in the course-class-quota relation identifies the student assigned to that quota, and, since only one student can be associated with a quota, SSAN depends on the course-class-quota key. However, such attributes as name and date of birth depend on SSAN, not the key; therefore, one should create a student relation and use SSAN as the key.

Of special significance, however, is the fact that SSAN remains in the course-class-quota relation as the pointer to the student relation. After all relations have been normalized, an arbitrary primary key for each relation will uniquely distinguish each tuple in the relation from all other tuples.

Fig. 3 shows the basic relations in the training data base after completion of normalization. The names of the relations and the names of the keys clearly describe the contents of each relation. Furthermore, by identifying keys and attributes that appear in more than one relation, one can easily visualize the process by which data from those relations can be combined to form meaningful information.

It is equally easy to visualize the formation of relationships by moving forward and backward among the relations. If one knows a course, for example, one can easily

find all the classes. Likewise, one can retrieve all the quotas and students associated with the quotas for a particular class. And, by first locating the quota records with the SSAN and then working backward to the class relation, one can just as readily locate each class a student will attend.

ANOTHER PLUS

The relational design has another advantage. Since the tabular presentation of relations gives depth to the data base, it becomes possible to visualize and even quantify the number of tuples or rows in each relation. That information enables management to appreciate the size of the data base, and it provides a sound basis for the designer to estimate storage requirements. Thus, logical representation of the data base produces a sound basis for addressing the physical representation.

The physical representation of a relation is a flat file, and, in DMSII, a flat file is known as a data set. Therefore, each relation was described as a separate data set, and an index set or access was defined for each key associated with a relation. Although a number of access methods can be employed, a standard index-sequential access technique is usually adequate unless a relation contains an exceptionally large number of records. For this particular data base, index-sequential

subsets were effectively employed for several nonprime keys to reduce the size of the index. The important point is that the index sets provide automatic ordering for the relation and the data base management system automatically maintains the relationships created by the ordering.

As noted earlier, one index set for each data set is designated the primary index. A principle of the relational model is that each tuple in the relation can be uniquely identified by a key. The primary index should represent that key, and the data base management system should enforce the no-duplicate principle. Furthermore, the primary key may be useful in physically ordering some data sets.

Once the indexes and accesses have been described, the data base management system should accomplish the three basic relational operations: SELECT, PROJECT, and JOIN. DMSII implements the SELECT operator with the following constructs: FIND FIRST, FIND NEXT, FIND LAST, and FIND PRIOR. The FIND verb can locate a specific record or the first of a series of records that match a major attribute in the key. PROJECT is the ability to access only selected attributes from a relation. DMSII enforces PROJECT by requiring applications to reference only the attributes in a data set required for that application.

It achieves the JOIN by recursive SELECTS on two or more relations. Each relation must have at least one common key to accomplish a JOIN. Although the JOIN is not ideally implemented with DMSII, the operation is effective and efficient. Certainly, DMSII, like most conventional data base management systems, provides the essential building blocks to implement the relational operators.

RESULTS OF PROJECT

Although our project is still a year away from completion, the data base has been in operation for more than a year and a half, providing daily real-time access to more than 190 remote users. It currently contains more than 100 physical structures, approximately one-third of which are relations and the other two-thirds index sets. The final data base will contain more than 150 physical structures, more than 40 of which will be relations. DMSII effectively handled that number of relations. Not only does the relational design look good on paper; it can produce substantial improvements in performance over network and hierarchical designs.

The first subsystem in the data base used the relational design to implement mailbox coordination of airmen applications to retrain from one Air Force skill to another. In the retraining process the data base has been used to verify basic eligibility, route the application to action offices, and schedule training for the approved applications. The time to process a retraining application was subse-

An advantage of the relational design is the ease with which it can be used by programmers.

quently reduced from four to six months to an average two to four weeks, depending on eligibility requirements for the skill.

The second increment, support for aircrew training courses, produced equally impressive results. The aircrew subsystem was originally implemented as a DMSII hierarchical data base of classes and quotas. One particularly critical process examined all possible classes for two to six courses and

provided an optimum selection of as many as 20 feasible training schedules for a student.

Of course, the model could be constrained by departure and arrival dates. In such instances it would optimize the training schedule and minimize travel costs and delays for students waiting to enter their next training classes. Under the old data base, the process typically required several minutes of elapsed time to provide answers. The rela-

tional design permitted more efficient selection of feasible schedules and thus reduced response time to an average five seconds per request. And, once a student schedule was selected, the approach reduced the time required to notify the student at one of more than 100 Air Force bases around the world from 10 to 14 days to a maximum of three days.

The relational design has also proved efficient in its use of computer resources. The design has used no more secondary storage than the combined storage required by the existing subsystems. The data base and application programs use about one-third of the 4.2 million-character main memory of the B6700 computer; however, the application programs use as much buffer storage to handle the 190 remote terminals as the data base uses to manipulate indexes and relations for the applications. Moreover, the combined data base and the applications use only one-twelfth of the processor resource of the B6700 computer.

DRAMATIC TIME CUT

But the most dramatic improvement with the relational design was the reduction in processing time for the air crew subsystem at the end of the day. The relational design eliminated update and verification of a manual cross-reference into the old hierarchical data base and reduced processing time from seven hours per day to 20 minutes per day.

The design also permitted an orderly incremental development of applications. Several benefits discussed earlier could not have been achieved without the ability to modify the data base with a minimum effect on existing applications. The relational design makes modification possible because a single relation can be dumped from the data base with a simple COBOL program, modified, and reloaded with new data items. Recreation of the index sets is automatic, and they can be added, deleted, or modified without affecting the relationships in the data base. Indeed, I am convinced that a relational approach is essential for any data base subject to frequent change.

A final advantage of the relational design is the ease with which it can be used by application programmers. Since they didn't have to be concerned with maintaining relationships, the programmers had only to locate records in relations by logical key, modify the record, and store it back in the data base. The DMSII automatically updated all indexes and thus maintained all relationships. The result was more logical, less complicated, and more easily maintained application programs.

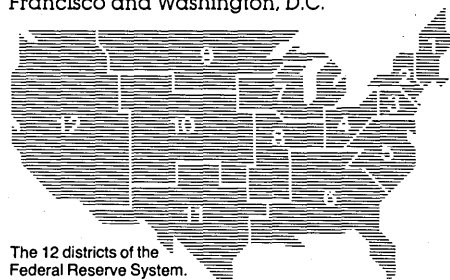
The relational approach has exceeded all expectations. Certainly one should not conclude that the relational approach will

DATA PROCESSING

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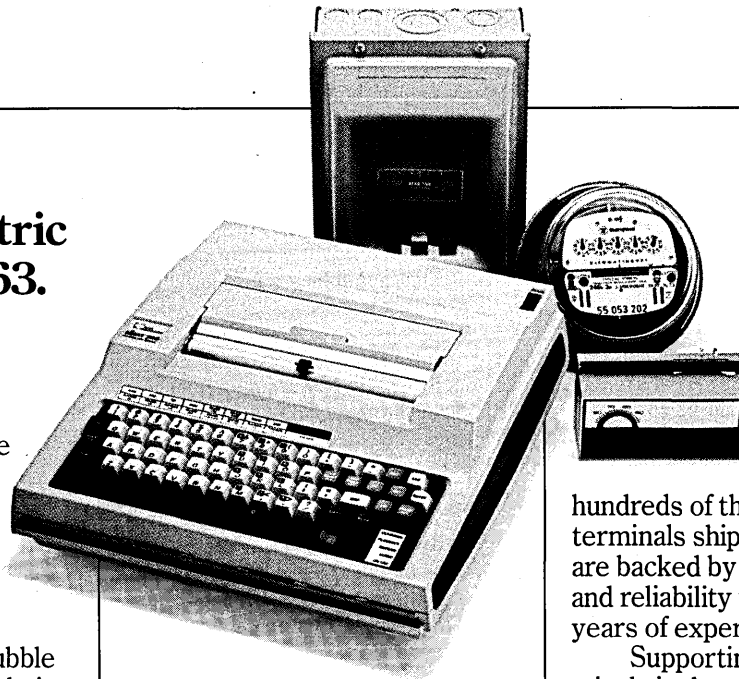
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TEXAS INSTRUMENTS

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The relational design can produce substantial improvements in performance over network and hierarchical designs.

solve all data base problems, especially when the design is implemented with a conventional data base management system. A relational design, like hierarchies and networks, still requires significant input and output operations to manipulate relations.

A data base designer can, however, minimize some input-output limitations by maintaining certain physical relations in logical order and by taking advantage of record blocking techniques. In one case, the training data base has averaged less than one physical access, including index accesses, per logical FIND even though the data set contained more than 100,000 records and seven index sets.

Other input-output demands can be reduced by judiciously duplicating a few high-use data items rather than implementing a pure third normal design. Such a compromise makes critical trade-offs between redundancy, update anomalies, and performance. For example, in the course-class-quota relation, almost every access to an individual by social security account number also required access to the student's name. Therefore, "name" was carried in course-class-quota to eliminate extra accesses to the student relation. The relational design thus produces excellent results, especially in comparison

with network and hierarchical models, which frequently appear to perform better in theory than in practice.

I am convinced that most data bases could be implemented with the relational approach and provide the advantages attributed to the relational theory. The more notable advantages were clearly achieved with the education and training data base, including the ability to modify the data base and add new relationships as the needs of the organization change. And, contrary to opinions expressed by critics of the approach, the relational design can provide adequate performance, and it will perform better than networks and hierarchies for some applications.

In the absence of a relational data base management system with powerful relational operators such as the JOIN, programmers must still navigate through relations. But it is better to navigate than to maintain the complex relationships and manual cross-references associated with networks and hierarchies. Moreover, the simplicity and clarity of the relational design sharply reduce the complexity of a data base and contribute immeasurably to user and management acceptance.

Thus, until software and hardware

technology permits development of a general purpose relational data base management system, data-base designers can combine relational concepts with their own data base management systems to solve a variety of data base problems. *

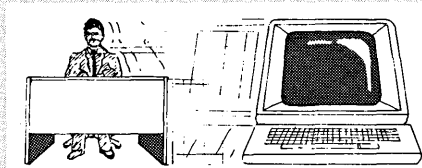
ROBERT S. BARNHARDT



USAF Major Barnhardt has been vitally interested in data base design and the application of data bases to management problems for over

12 years. He has a BS in Business Administration from the University of North Carolina and an MBA in Computer Science from Texas A & M Univ. Currently on assignment to the Royal Air Force in England, Major Barnhardt has held Air Force positions as dp manager, systems analyst, and manager of system software and data base design.

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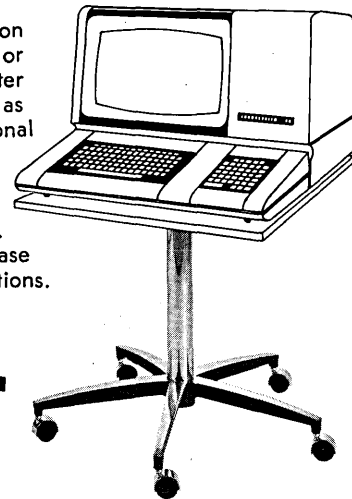
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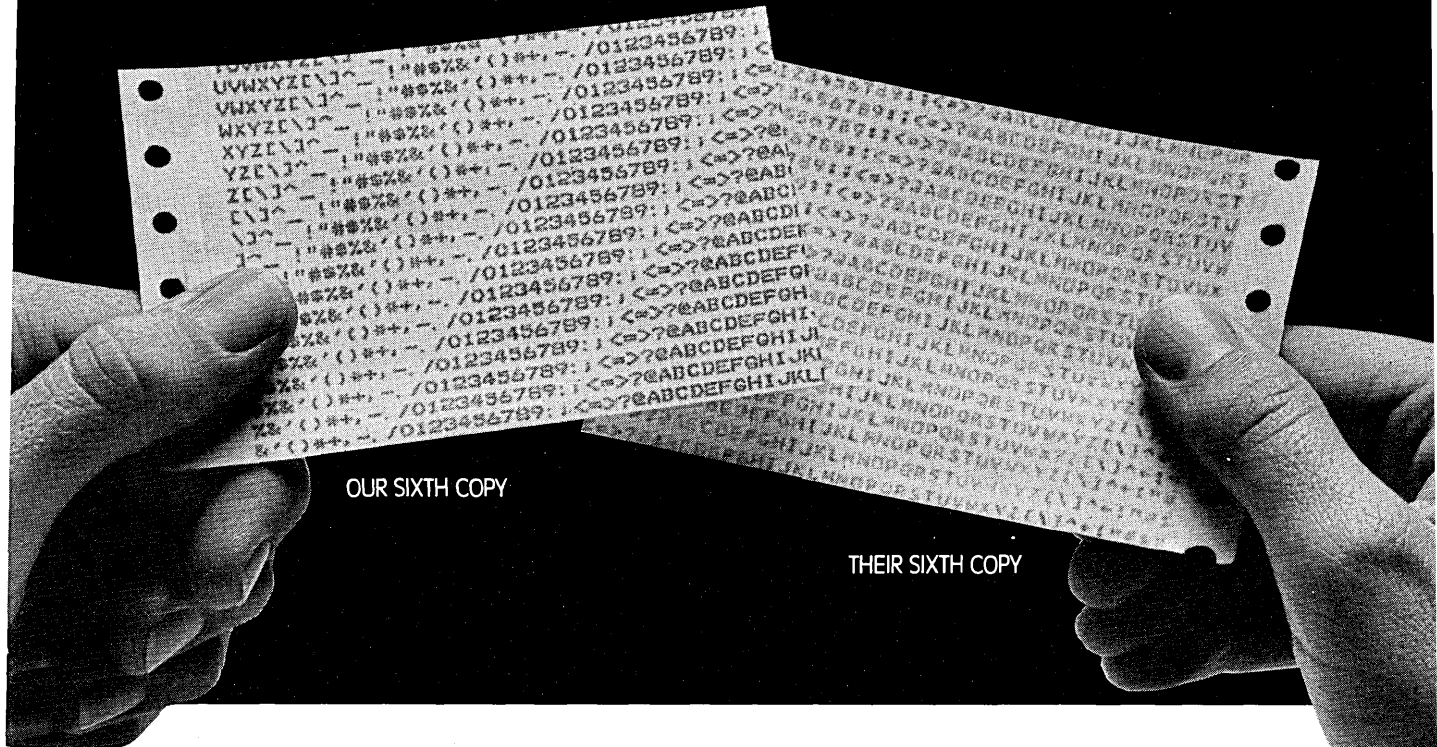
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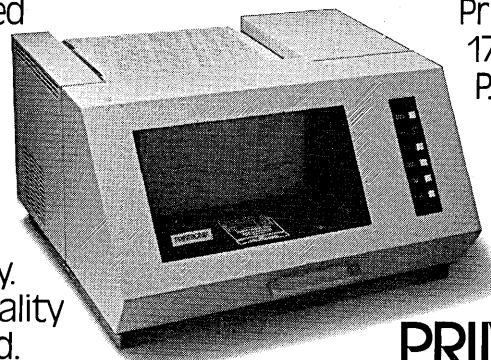
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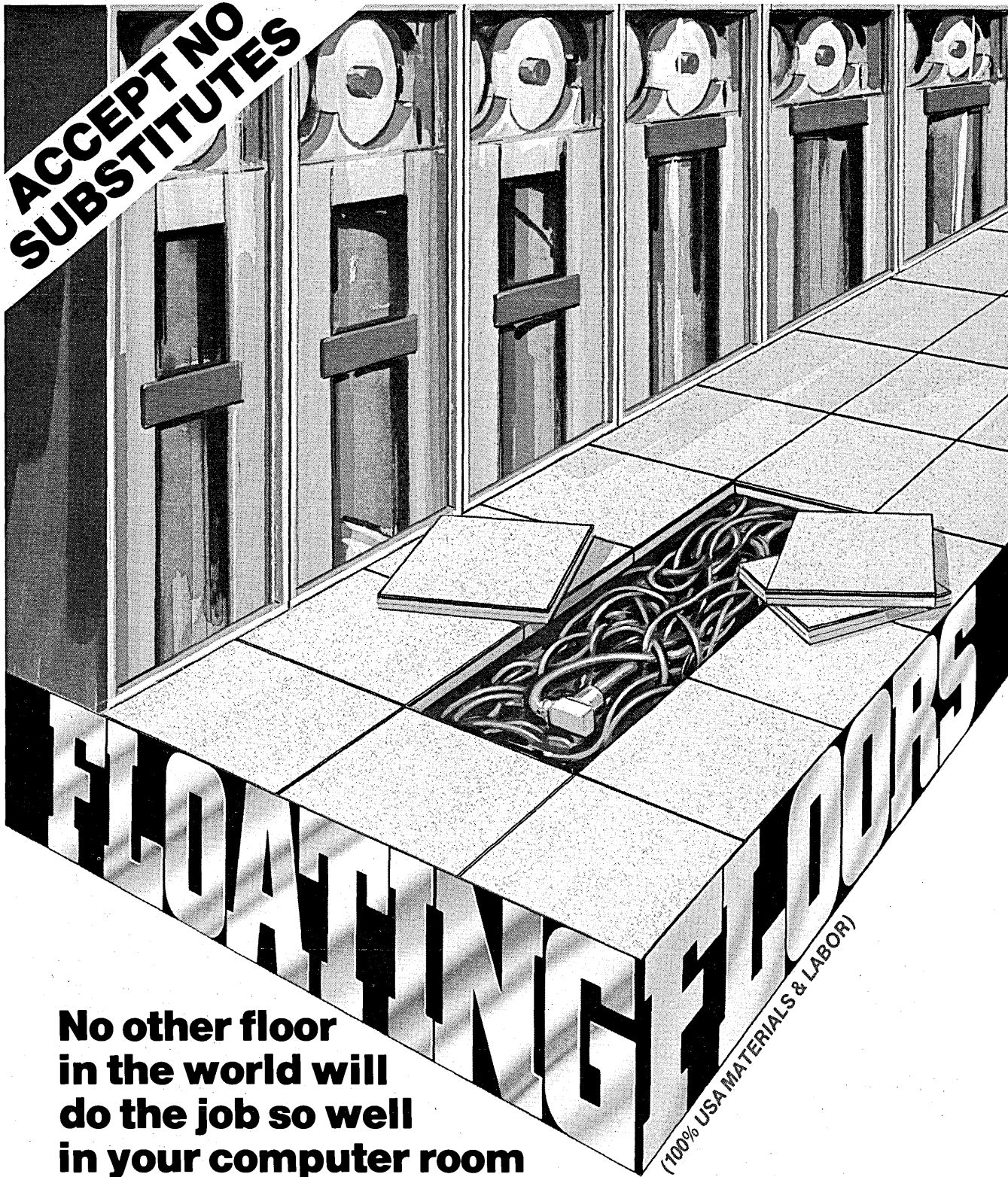


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PEOPLE

TOUCHÉ, GAUJARD!

What Pierre Gaujard has here is a willingness to communicate.

He has seen the future, and, in his eyes, it's videotex—preferably the videotex developed by Antiope, the French firm that has devised what may be one of the world's most flexible videotex communications system. As soon as possible, Gaujard's company would like to visit America's living rooms in the form of weather, sports, stocks, or whatever else strikes one's fancy.

"Information is moving quickly today, and it's important to understand that people have no time to read and hear everything," explains Gaujard, the president of Antiope Systems Inc., a Washington-based marketing company for its French parent. "So they have to make a choice, and they're going to want the right information at the moment they need it. No more, no less. We can give them what they need when they need it."

All they need is a television with a decoder and a handheld keypad. The information, which Antiope transmits through an unused part of the tv broadcast signal, called the blanking interval, is sent in coded form and visually displayed as the full picture on the screen. The user then requests the information by keying a code on a handheld keypad. The information is organized in a format similar to a magazine page. The user can call up the information he wants at his convenience. At the moment, the system is limited to a few stock market aficionados in and around Paris. Early next year it will be offered nationwide.

"When you're an information provider," Gaujard says, "you're very interested in providing information to your subscribers and clients that is cheap, expandable, efficient, and flexible. And of course you want quality."



PIERRE GAUJARD: His sights are set on introducing Antiope technology to the American market.

Mais oui. After all, would a man who earned a PhD in electronics from the University of Paris in 1968 and whose thesis was "Recognition and Numerical Analysis of Forms" demand anything less?

Three years after graduation, Gaujard became head of VISIODIS, a subsidiary of the French electrical manufacturer Compagnie Generale d'Electricité, formed to introduce cable tv systems in France.

He remained there until he became president of Antiope in May 1979. Now the 41 year old engineer's responsibilities include, among other things, introducing Antiope technology to the American market. Lesser men might quail at the prospect, but not even the bureaucracy of the Federal Communications Commission can stay Gaujard.

That august body has recently been asked by CBS to adopt its recommendation for a national standard for broadcast teletext in the U.S. Based on test results in St. Louis

and Los Angeles and its independent research, CBS advocated a modified version of Antiope as the standard.

"This country must have a standard for teletext," Gaujard says, "and it must have one soon. The cable information systems you have now are primitive and inconvenient. The quality of the pictures is not good. There's very limited information on a page, and if you miss one page you have to go back to the beginning and wait an hour before you see it again."

Gaujard's ecstasy at CBS' recommendation is somewhat tempered by the knowledge that the wheels of Washington grind exceedingly slow, if at all. The best he can hope for is a standard within 18 months. Other estimates range from two years to never.

"It isn't that the U.S. isn't capable of having this system," laments Gaujard, who spent August in France with his wife, Claude, and their children, Pascal, 12, Beatrice, 8, before returning to their Bethesda, Md., home last month.

"It surely is capable," he explains. "The problem is that no one has invested in it until the last two years. It's much easier in Europe, because there are only a limited number of television programs available to the public. The U.S. market is so large that it's very difficult to introduce something new or change things. But it isn't a technological or financial problem. It's a rule-making problem now."

And it will be for the foreseeable future. But Gaujard, undaunted, forges ahead and looks forward to the day when his company's words and pictures will become the equivalent of a fourth network.

"We have the technology, but not the large number of sets to make the system commercially viable yet," Gaujard says. "When we do, we will have the kind of system that will give you new information whenever you want it, even if it's 3 in the morning."

For Gaujard, it's never too late to communicate.

—Willie Schatz

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DM

HARDWARE

OFF-LINE

Despite advances from Asia, Germany, and the rest of the Western World, American innovation is keeping this nation on top, according to Dr. James Vollmer, RCA Group vp responsible for the Government Systems and Commercial Communications Systems Divs. Addressing the Boston Rotary Club, Vollmer described several future products that may spring from our electronic inventiveness. His examples included electronic language translators with voice input and output; position locators for cars, with satellites providing not only location information but also routing to a specified destination, and television-based home information centers. "The real issue is not the task of invention but that of investing and supporting the inventions," said Vollmer, adding, "our commitment to moving new ideas into the domain of daily use is what's in question."

Two scientists, Sadeg M. Faris, and David B. Tuckerman, have developed an experimental system for measuring ultrafast signals at the IBM Thomas J. Watson Research Center. Using superconducting Josephson tunnel junctions, the system reportedly has a resolution of six picoseconds (trillionths of a second); potential improvement could bring the resolution closer to the sub-picosecond threshold, the researchers believe.

Arizona State Univ. in Tempe is installing an integrated communications system from Tran Telecommunications of Marina del Rey, Calif. The system now links more than 200 terminals and computer ports; the number is expected to double soon.

PORTABLE TERMINAL

Hewlett-Packard's first portable printing terminal, the HP 2675A, also represents the first new product to be shipped from the company's Vancouver, Wash., division. The terminal can print variable width lines of up to 132 characters on 8½-inch-wide paper at 120cps using a thermal printing



mechanism that forms characters on a 7 × 11 dot matrix. The 2675A also comes with integral mass storage in the form of dual miniature 3M-type data cartridges (320KB capacity per cartridge). The upper- and lower-case terminal has eight user-definable soft keys, and a programmable RETURN key. A 300bps autodialing, direct connecting modem is optional; when installed, the user can connect to the telephone network using a standard telephone company modular phone connector. Auto answering also is supported, along with the ability to store received data onto tape or produce printed output. Editing capabilities, as well as tab and margin controls, are standard. Asynchronous point-to-point communications can run to 9600bps via the 2675A's RS232 interface. The HP 2675A sells for \$5,000, and the optional integral 300bps modem is an additional \$450. HEWLETT-PACKARD CO., Palo Alto, Calif.

FOR DATA CIRCLE 302 ON READER CARD

COLOR GRAPHICS OUTPUT

The Model 633 multi-image color camera system from Dunn Instruments provides photographic hardcopy of computer-generated color graphics. Images can be enlarged up to 8 inches by 10 inches or reduced down

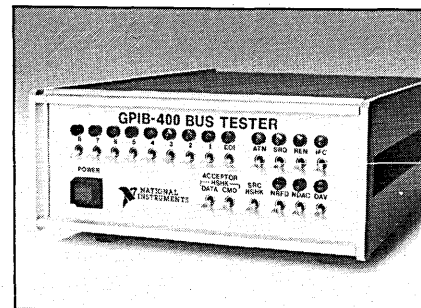
to microfiche size. Users can command the 633 to zoom, rotate, and create a range of special effects, without resorting to software in their graphics system. The 633 operates with a variety of film formats, including 8 × 10 transparencies or Polaroid prints, and optionally, 35mm slides, SX-70 prints, 4 × 5 prints and transparencies, and 16mm film. Users can select one, two, four, six, nine, 12, 16, 25, or 36 images per photograph. Control commands enter the 633 via its RS232 interface. Prices start at \$15,750.

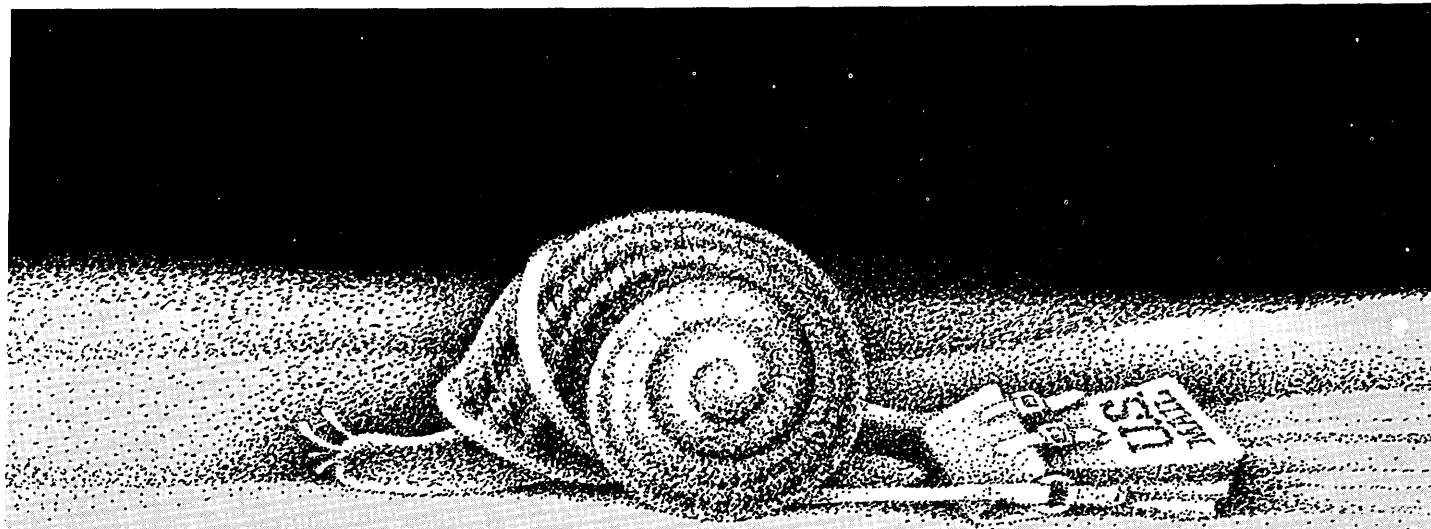
An option to the 633 and the existing 631 color camera systems simplifies the production of animated films. The 16mm Cine Animation system weds a 16mm Bolex camera to the Dunn system. The system controls exposure and other variables. Color quality is reportedly enhanced by the system's sequentially exposing red, green, and blue image information through filters. The Cine Animation option raises a color camera system's price by \$6,800. DUNN INSTRUMENTS, INC., San Francisco, Calif.

FOR DATA CIRCLE 300 ON READER CARD

IEEE-488 BUS TESTER

The GPIB-400 Bus Tester can be used to check out IEEE-488 standard Talkers, Listeners, and Controllers. It can also monitor bus management, handshake, and data lines. With the GPIB-400, a user can verify bus addressing and multiline commands, demonstrate step-by-step bus operation for a specific application, or simulate an instrument. LEDs are provided for monitoring individual bus lines, and switches let the user control each line. An RS232 or current





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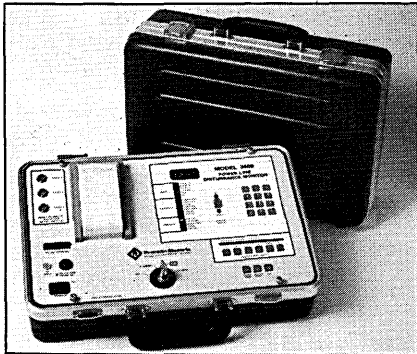
HARDWARE

loop interface allows attachment of a terminal for entering commands or data as well as printing information off the bus. the GPIB-400 sells for \$995. NATIONAL INSTRUMENTS, Austin, Texas.

FOR DATA CIRCLE 301 ON READER CARD

PORTABLE POWER MONITOR

Franklin Electric's Model 3600 is a portable three-phase AC and single channel DC power line disturbance monitor. The micro-processor-based 3600 monitors AC voltages in the 50 volt to 800 volt range. The



briefcase-sized unit can detect, analyze, and classify disturbance data. In addition to an LED display, the 3600 has a printer for hardcopy of disturbance data. "Post Threshold Tracking," a measurement technique the vendor says is new, follows a voltage disturbance for the entire time it exceeds a specified voltage threshold, sampling the voltage every 10msec. During this time, a new amplitude printout occurs whenever the sampled voltage varies by roughly 3% from the last printout. Prices start at \$3,700 for a single-phase unit, to \$4,800 for a three-phase Model 3600. FRANKLIN ELECTRIC, Programmed Power Div., Sunnyvale, Calif.

FOR DATA CIRCLE 305 ON READER CARD

IMAGE PROCESSING

The RIP-260 (Real-Time Image Processing) system operates in conjunction with a DEC PDP-11 or LSI-11 and features a Pipeline Image Processor capable of performing arithmetic operations over an entire 64KB image memory array in 16.7msec (1/60th of a second). A 64KB image memory represents 256 lines, each with 256 elements of eight bits (providing 256 levels of intensity). Applications include pattern recognition, image enhancement, linear spatial filtering, low pass or high pass filtering, and other mathematical transforms for image analysis.

RIP-260 hardware consists of an interface to either the PDP-11 Unibus or LSI-11 Q-bus, a memory management board, processor exchange board, pipeline image processor, two image memory arrays, master timing, and a digital-to-video converter. Image memory is dual ported and addressable through a block of bus addresses. To

the host, image memory looks like main memory, allowing access by any device with a Direct Memory Access controller with minimal cpu intervention. Interlaced or noninterlaced (60Hz refresh) operation can be selected by software. An optional digitizer, operating with RS170 or RS343 interlaced video formats, can filter and freeze an image of 512 by 512 with up to eight bits of intensity; images to be digitized can come from video cameras, disks, or tapes. The basic RIP-260 sells for \$15,870, quantity one, and an eight-bit digitizer is \$2,450. Oem discounts are available. RECOGNITION CONCEPTS, INC., Lakeport, Calif.

FOR DATA CIRCLE 304 ON READER CARD

DISK AND CONTROLLER

Storage Technology's latest direct access storage device, the 8360, is a dual spindle disk with a capacity of 317.5MB per spindle. Compatible with IBM's 3350, the 8360 requires no software modification on the part of current 3350 users; the new disk works with 370/135s and larger mainframes from IBM or plug-compatible mainframes. The drive is offered in two models: the A2 contains the circuitry to support an additional three Model B2 drives. The A2 can connect to the vendor's existing 8000-2 or 8000-4 controllers, or the concurrently announced 8880 controller. Both A2 and B2 have average access times of 18msec, data transfer rates of 1.198MBps, and average latencies of 8.3msec. Dual ports are standard on the 8360, allowing spindles to be switched between two 8000-2 control units, or two directors of an 8000-4 or 8880. Fixed head storage of 1.14MB per spindle is available as an option on both the A2 and B2 models. Two-year lease prices for the Model A2 start at \$1,200 per month and \$941 per month for the Model B2.

FOR DATA CIRCLE 314 ON READER CARD

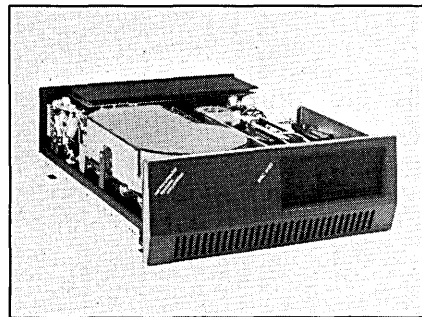
The firm concurrently announced the

8880 disk control unit, featuring two or four independent control unit paths for file positioning commands and data transfer. The 8880 can connect STC's 8350, 8650, and 8360 disks, as well as IBM's 3350s to IBM 4300s, 370/145 through 168, and 303X mainframes. One-, two-, four-, and eight-channel interface switching configurations are offered, as is 64-spindle contiguous addressing. The unit comes in two models: the 8880-12 with two independent storage directors, and the 8880-14 with four storage directors. Two-year lease rates begin at \$1,313 per month. STORAGE TECHNOLOGY CORP., Louisville, Colo.

FOR DATA CIRCLE 315 ON READER CARD

DISK

The MSC-8100 series of self-contained disk storage systems combines up to 19.1MB (unformatted) of eight-inch Winchester disk storage with an eight-inch floppy drive with an unformatted capacity of 1.6MB. The MSC-8100, from Microcomputer Systems Corp., comes in rack-mountable packaging, and also includes power supply for both rigid and floppy drives, as well as an intelligent controller/formatter providing IEEE-488 interfacing. Combining a floppy drive with the fixed Winchester drive allows backup as well as media interchange (via diskette) IBM formatting (1.2MB per diskette). The MSC-8100 is available with fixed disk capacities of 6.4MB, 12.7MB, or



HARDWARE SPOTLIGHT

PDP-10 EMULATOR

The microprogrammed F2 emulates DEC's DECSYSTEM-10 and 20; it's offered as a complete system or as processor and device controllers for integration into an oem's system. The F2 runs under the virtual memory Tenex operating system; a TOPS-10 compatibility package is included, and Tenex is said to run most TOPS-20 programs with few changes. Among the languages available are FORTRAN, LISP, PASCAL, BASIC, SIMULA, SAIL, and others. Users can take advantage of a wide range of applications packages developed for the earlier DEC machines.

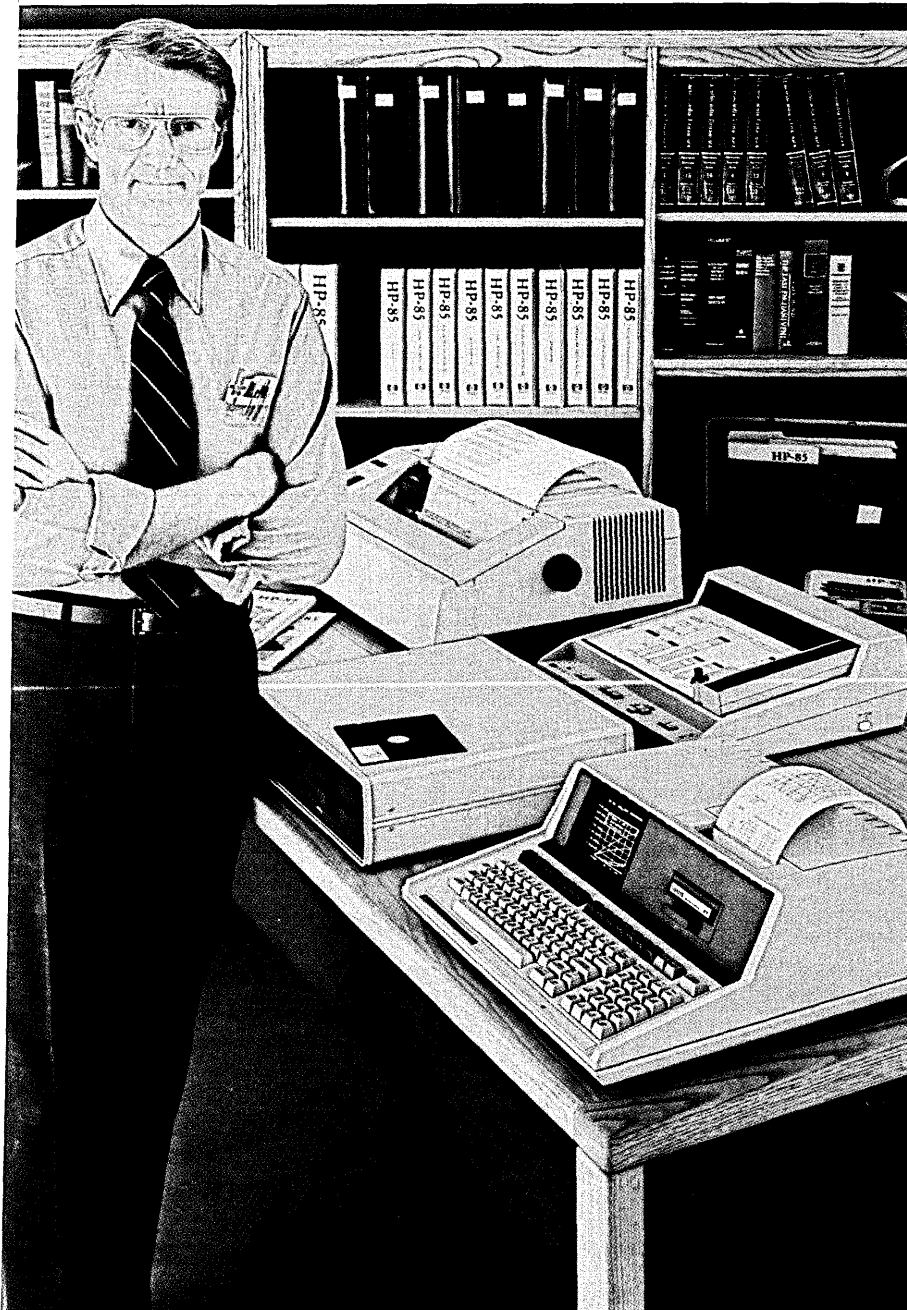
The microcoded cpu handles instruction interpretation, software fault handling, and i/o interrupt request processing. Additional customer-specific microcode can be implemented to enhance specific

critical functions. The vendor supports user development of microcode by supplying microprogram source listings, documentation, an assembler, and development consulting. The standard F2 microcode is said to emulate the PDP-10 instruction set at about the speed of a DECSYSTEM-20.

The F2 includes a mass storage controller capable of handling up to eight SMD disks, and a tape controller that can handle up to four medium-performance nine-track drives. An F2 system, consisting of processor with 256K 36-bit words (with ECC), 160MB Winchester disk, 125ips tape drive, 16 terminal ports, and system software, comes in at under \$100,000. Additional memory (the F2 can grow to 1M words) goes for \$10,000 per 128 Kwords. FOONLY, INC., Mountain View, Calif.

FOR DATA CIRCLE 318 ON READER CARD

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CIRCLE 106 ON READER CARD

HARDWARE

19.1MB (unformatted); the formatted capacity of 19.1MB drive is 15MB. The integrated controller provides all formatting, control, and management functions, including full-sector buffering, error detection and correction, error recovery including automatic retry, and other features. Self-test diagnostics isolate faults to the subassembly level, with on-board LEDs indicating faults. Single unit pricing starts at \$9,250. An LSI-11 interface is offered, as are custom interfaces for volume orders. The unit is known as the MSC-8110 when equipped with an LSI-11 interface. MICROCOMPUTER SYSTEMS CORP., Sunnyvale, Calif.

FOR DATA CIRCLE 313 ON READER CARD

AUTO-DIALER INTERFACE

Perkin-Elmer's 801 Automatic Calling Unit Interface (ACUI) allows the vendor's computers to control one or two Bell 801 Automatic Calling Units. With the 801 ACUI the host computer can establish a data link by dialing any number in Bell's Direct Distance Dial network. The vendor cites dial-backup as a major application of the 801 ACUI: in a system where intercomputer links must be maintained, the ACUI can establish a backup link should the primary line fail. Dialing begins when a program issues a Call Request to the ACUI. At this point the unit tells the program when it is ready for the

next four-bit digit in the phone number. After the number has been dialed, the program waits for a connection or a time out. The ACUI works with both Touch-Tone and rotary dialing telephone equipment; it has two independent ports, allowing simultaneous calling of two phone numbers. The 801 ACUI sells for \$1,600. PERKIN-ELMER CORP., Computer Systems Div., Oceanport, N.J.

FOR DATA CIRCLE 309 ON READER CARD

MODEM

The desktop Model 1022 Intelligent Modem offers Bell 103 compatibility, auto-dialing, auto answer, and FCC registration



for direct connection to the phone system. The modem uses RS232 interfacing, and the auto-dialer—with both tone and dial-pulse capabilities—is controlled by ASCII characters, allowing control of dialing functions

from programs written in high-level languages such as BASIC or COBOL. The Model 1022 Intelligent Modem sells for \$595, with discounts offered for quantity orders. BIZ-COMP, Menlo Park, Calif.

FOR DATA CIRCLE 310 ON READER CARD

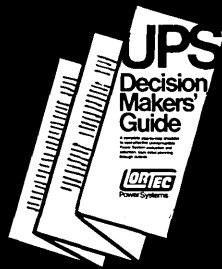
MULTIPLEXORS

Up to six digital devices can be multiplexed onto a single radio frequency channel carried by coaxial cable (not broadcast) using the Series 600 Data Multiplexors developed by the Interactive Systems unit of 3M's TelComm Products Div. Two models are initially offered: the low-speed Model 620 can handle up to six devices, each operating at asynchronous speeds to 1200 bps, while the medium-speed Model 630 can handle devices operating at rates of up to 9600bps.

Channel speeds are independently selectable; the 630 can actually handle several channels at up to 19.2Kbps with a consequent reduction in speed on the other channels. RS232 interfaces are provided for connecting to computers and terminal devices; a single co-ax cable connects the head-end and remote multiplexors. Front panel LEDs indicate the status of each channel. Pricing is \$2,500 per mux. 3M, Tel-Comm Products Div., St. Paul, Minn.

FOR DATA CIRCLE 319 ON READER CARD

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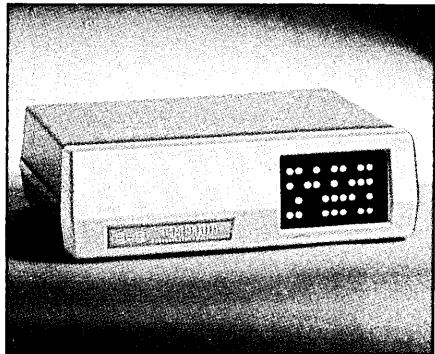
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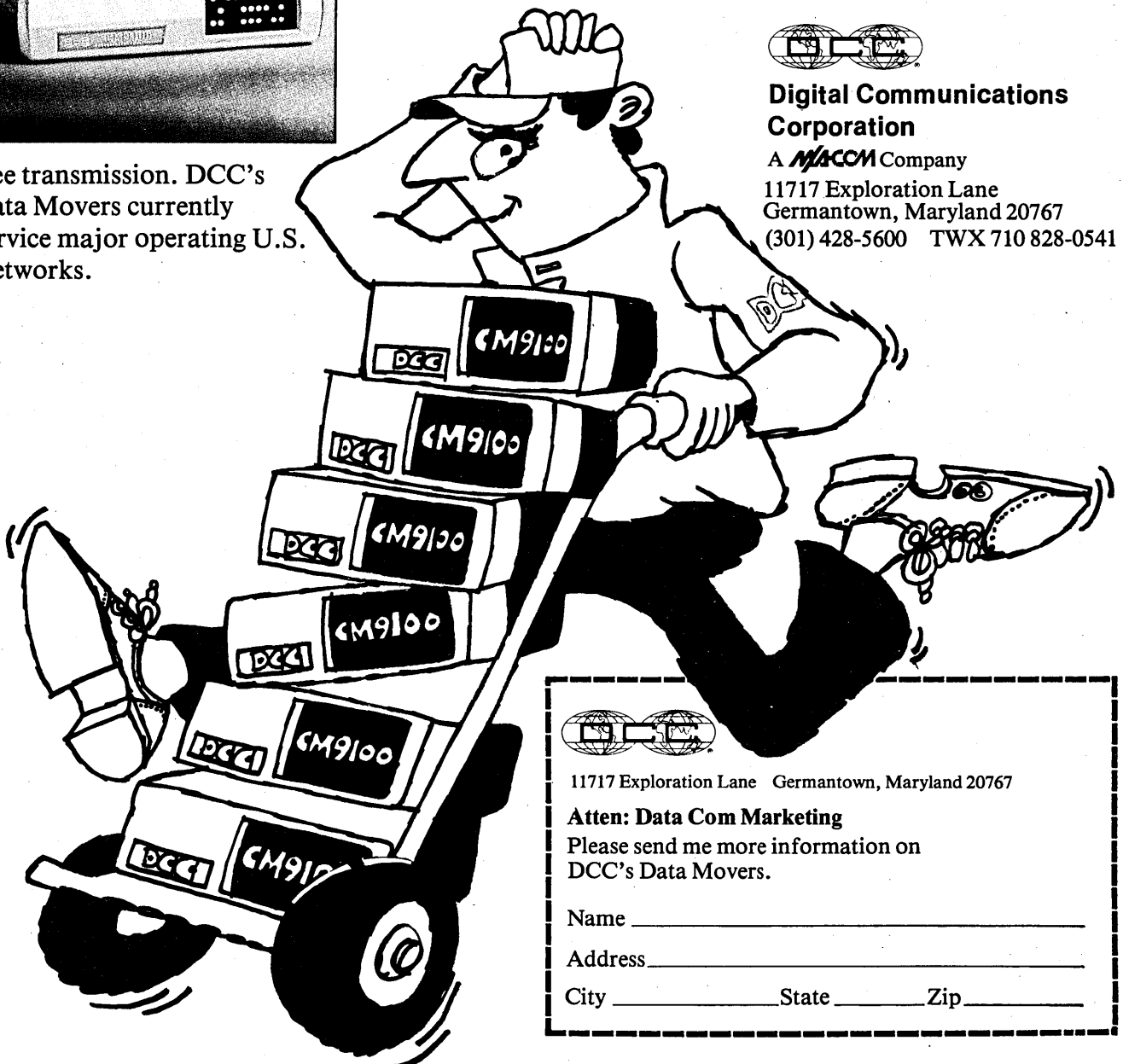
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HARDWARE

GRAPHICS ADD-IN

The Graphics-100 is a printed circuit board that plugs into the option slot of a DEC VT-100 or VT-103 display terminal adding



graphics capabilities without affecting any normal VT-100 series functions. Graphics-100 has its own display memory, and includes text and graph labeling functions, such as four character sets, three text rotations, and three type fonts. The board includes a vector generator, allowing users to specify the end points of a line segment anywhere within a 64K by 64K grid, with the Graphics-100 then computing the line and displaying in a specified viewing window. Maximum on-screen resolution is 1,220 points by 240 points. Hardcopy can be produced on a DECwriter II equipped with the

vendor's existing Graphics II enhancement board; a raster-dump port on the Graphics-100 is provided to drive a suitably equipped DECwriter. The Graphics-100 sells for \$1,195. SELANAR CORP., Santa Clara, Calif.

FOR DATA CIRCLE 311 ON READER CARD

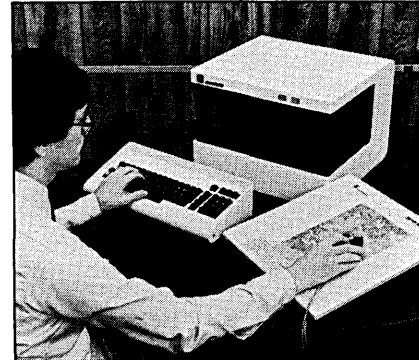
STREAMING TAPE DRIVE

Going to a nonstandard, 3200bpi packing density has allowed Cipher Data Products to produce a streaming tape drive providing up to 92MB of unformatted data on a 10½-inch reel of mag tape. The firm's Microstreamer 2 can back up a 200MB Winchester disk in less than 25 minutes, including the time it takes to rewind and change tapes, according to the company. The Microstreamer 2 offers, in addition to 3200bpi density, industry standard 1600bpi recording at speeds of 25ips and 100ips. In 3200bpi operation the tape speed is 50ips; thus the new streaming drive has the same 160KBps transfer rate of its predecessor, allowing existing customers to use previously designed controllers. In oem quantities of 100, the Microstreamer 2 sells for \$2,830. Initial shipments begin in December, with production shipments slated to begin in the first quarter of next year. CIPHER DATA PRODUCTS, INC., San Diego, Calif.

FOR DATA CIRCLE 320 ON READER CARD

DIGITIZING SYSTEM

Summagraphics chose the occasion of SIGGRAPH to unveil its Graphics Machine One (GM One), a turnkey programmable digitizing system that can function as either a standalone system or as an intelligent front-end to a host computer. GM One includes a 48KB 8085A-based microcomputer, nine-inch crt display, detachable keyboard, an 80KB minifloppy drive, and interfaces to a printer, data tablet, and asynchronous communications. Menu-driven software makes the system usable by nontechnical opera-



tors. Optional software for geometric analysis, strip charts, and graphics is offered to make the GM One a standalone problem-solving tool. Users also can program the GM One using routines callable from Microsoft 5.0 BASIC; the crt, data tablet, and all other

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CUSTOM • RIBBON
P.O.S. • Modems
Data Collection**

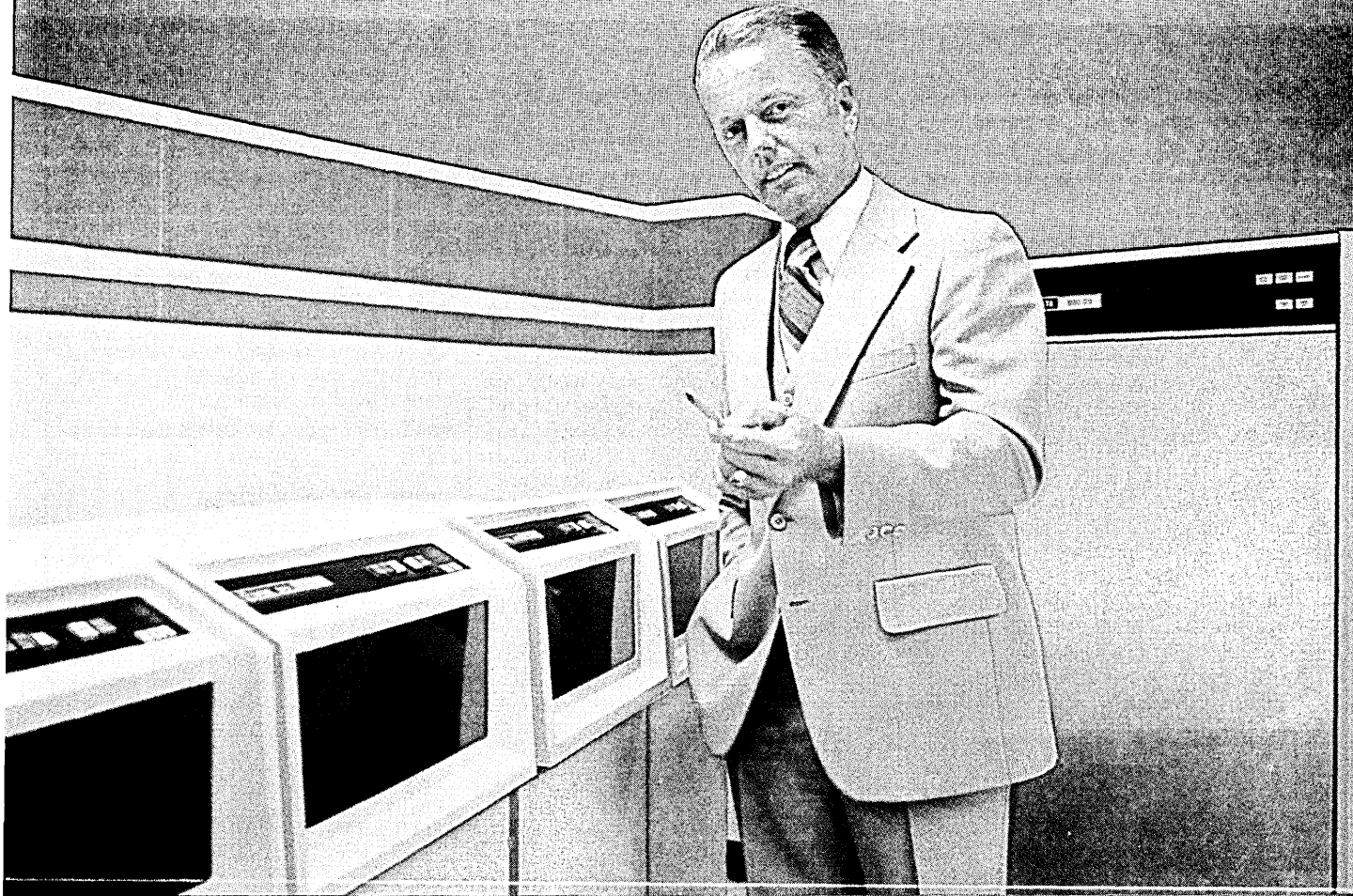
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"And when you choose Control Data's 33502, you needn't worry about conversion or com-

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"Besides technical considerations, there are many other reasons that make the 33502 a better business decision. Control Data's reputation is for reliability, service support and broad product experience. And there are more reasons. For the full story contact your local representative, or call 612/553-4153."

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CIRCLE 112 ON READER CARD

HARDWARE

peripherals can be accessed from BASIC. An optional programmable communications interface turns the standalone system into an intelligent terminal device. A graphics crt is offered as an option. GM One interfaces to Summagraphics' full line of digitizers, including the new, and as yet unpriced, Supergrid digitizer. A basic GM One, with an 11-inch by 11-inch tablet, sells for \$7,995, and will be available for delivery by year's end. SUMMAGRAPHICS CORP., Fairfield, Conn.

FOR DATA CIRCLE 303 ON READER CARD

COMPUTERS

Recently this vendor extended two of its product lines: the Commercial Systems (CS) family augmented with both a new entry-level system and a new top-of-the-line system; and the MBC single board computer family filled out with two additional single board computers, and an I/O expansion interface.

As with the existing members of the CS product family, the entry-level CS/10 and new top-of-the-line CS/70 both run an interactive version of ANSI-74 COBOL. Both systems run under the existing Interactive COBOL Operating System (ICOS), providing both program and data compatibility when upgrading systems. Extensions for screen formatting and file management simplify application development. Both systems can

use the MASTER menu and security system and PROXI program generator software packages. Both systems support 2780/3780 emulation software for communications; the CS/70 also supports HASP II communications software. A basic CS/10 Mod C1 system, including 64KB processor, one crt, and two 1.2MB floppy drives, sells for \$10,950. A CS/70 Mod C6, the largest system announced, including a 512KB processor, 12 terminals, two 190MB disks, a dual mode 800bpi/1600bpi tape drive, a 600 lpm printer, and RJE80 communications capabilities, sells for \$126,700. These prices include a license to use the Interactive COBOL software and system utilities. Other configurations are offered.

FOR DATA CIRCLE 316 ON READER CARD

The vendor's board computer line has grown with the MBC/2 and MBC/3 single board computers, and the MBC/SDX I/O expansion interface. Both single board computers use the microNOVA MN602 cpu, providing NOVA architecture, 16-bit hardware multiply and divide, real-time clock, hardware stack and frame pointer, and 16-level priority interrupts. The two computers differ only in memory capacity: the MBC/3 has 8KB of RAM, while the MBC/2 has 32KB. Both are socketed for a 1KB PROM console monitor, and 32KB of EPROM. Both have two independently programmable synchronous/asynchronous I/O interfaces, as well as

16 lines of digital input, and another 16 lines for output.

The MBC/SDX provides all of the I/O features of the MBC/2. It can be used as a debugging aid (as well as an I/O expansion). The board can be used with an MP/100 or MP/200 central processor, allowing designers to use the MP series microNOVA system for hardware and software debugging of MBC applications. MBC support software allows program development on microNOVA, NOVA 4, or ECLIPSE systems; run-time support on the single board computers is provided by the MP/OS operating system. An MBC/2 with 8KB of RAM, sockets for 1KB of PROM and 32KB of EPROM, 16 digital I/O lines, and two async/sync lines, sells for \$1,200; an MBC/3, an MBC/2 with 32KB of RAM instead of 8KB, sells for \$1,700. The MBC/SDX provides 16 I/O lines and two async/sync lines, sells for \$700. DATA GENERAL CORP., Westboro, Mass.

FOR DATA CIRCLE 317 ON READER CARD

FIBER OPTIC MODEM

For use in connecting RS232 devices over limited distances, Belden Corp.'s Fiber Optics Group designed its optical Bit-Driver (Model 222001) modem. The Bit-Driver moves asynchronous simplex and duplex digital data over fiber optic cables at speeds to 56Kbps. Transmission can reach

TERMINAL STANDS



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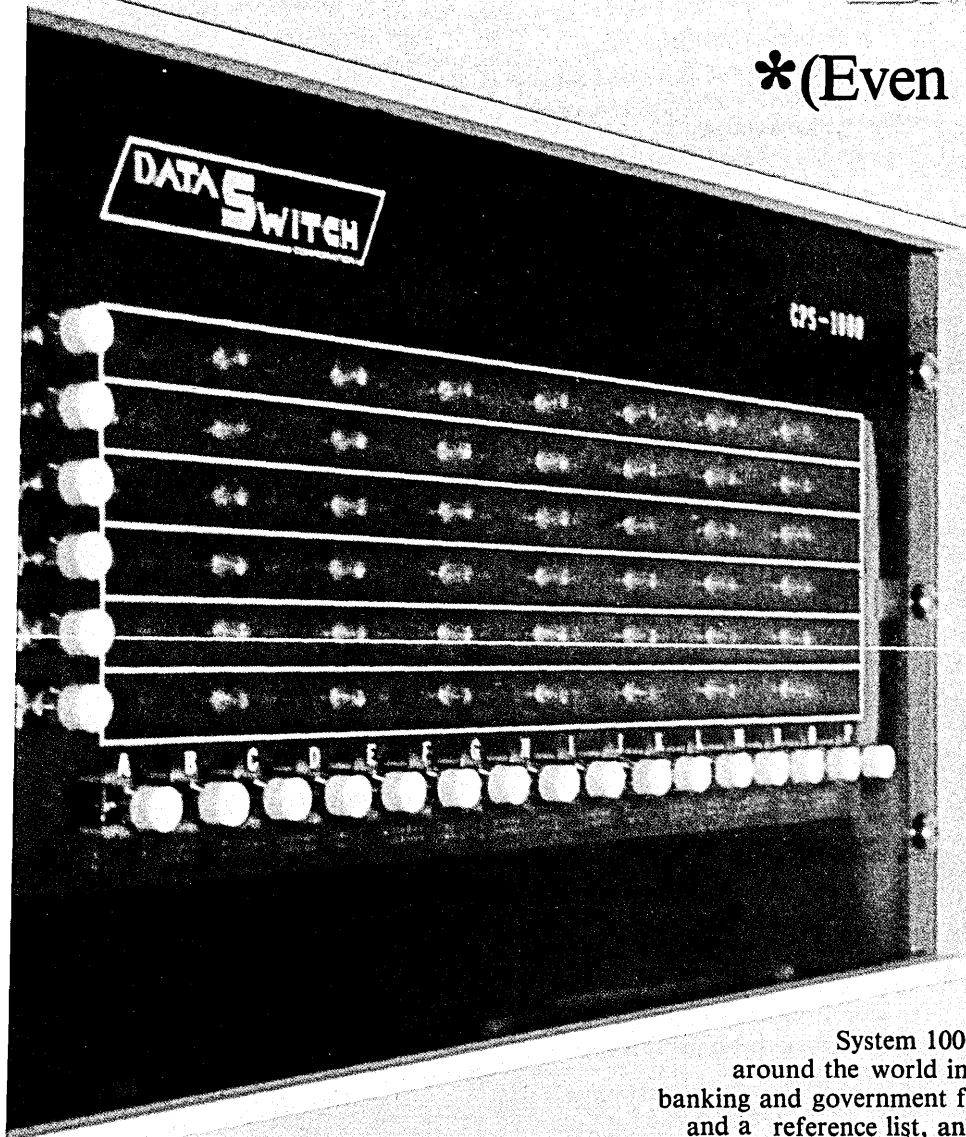
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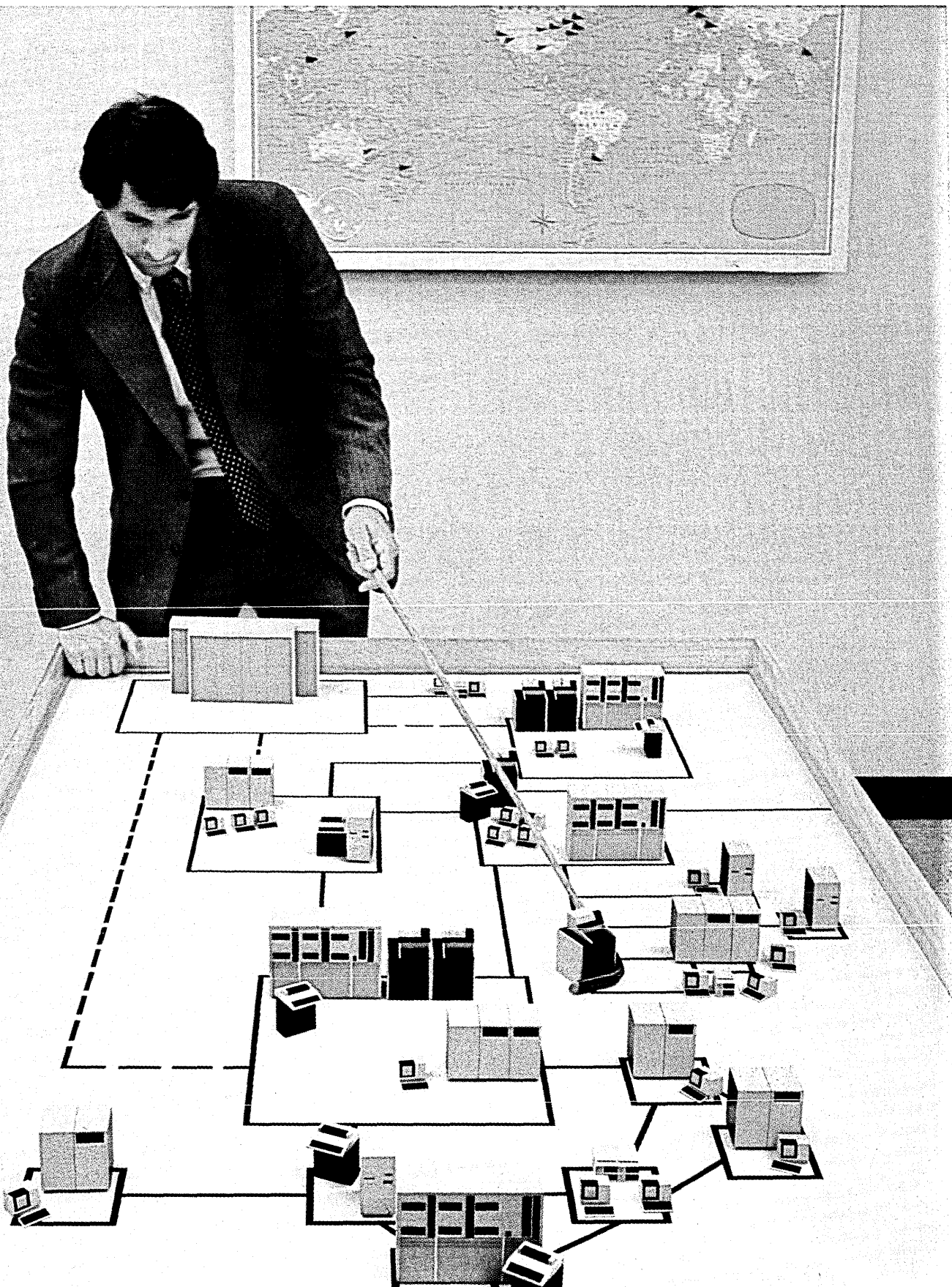
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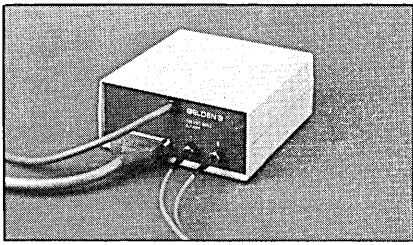
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HARDWARE



slightly over a mile, depending on the cable used. The Bit-Driver comes with RS232 cable assembly, and, on back of the unit, an RS232 25-pin Type D connector and a pair of AMP fiber optic transmission line receptacles. Three LEDs on the front panel display status and diagnostic information. The Bit-Driver sells for \$280. BELDEN CORP., Geneva, Ill.

FOR DATA CIRCLE 312 ON READER CARD

COMPUTERS

Just as Detroit doesn't wait for the first of the year to roll out its new models, Radio Shack has come up with three new varieties of its popular TRS-80 personal computer for 1981. The three range from the miniature TRS-80 Pocket Computer to the TRS-80 Color Computer to the TRS-80 Model III.

The tiny TRS-80 Pocket Computer can be programmed in BASIC. It has a 24-character LCD display and a 1.9KB user memory that can retain information for 300

or so hours—the life of the unit's internal batteries. The Pocket Computer also can be used as a calculator with provision for storing, editing, and reviewing data, as well as evaluating expressions with parentheses nested to 15 levels. An optional cassette interface allows use of preprogrammed tapes such as Personal Finances, Aviation, Games Pack, Math Drill, and others. The six-ounce Pocket Computer, which is less than seven inches long, sells for \$249.95; the cassette interface is \$49. Radio Shack says a printer is in the offing.

FOR DATA CIRCLE 306 ON READER CARD

Intended primarily for recreational and educational use, the TRS-80 Color Computer uses any home color television for a display and features instant-load Program Paks. In addition to using Program Paks, the Color Computer can be programmed in BASIC. User programs can control color graphics and sound generation; programs and data can be stored on an optional cassette recorder or on diskette when a planned drive becomes available. The computer has a 53-key typewriter-like keyboard, a screen format of 16 lines of 32 characters, graphics resolution ranging from 32 by 64 to 196 by 256, an RS232 interface, and a cassette interface. Plug-in Color Program Paks, selling for prices ranging from \$29.95 to \$39.95, include Chess, Personal Finance, Music, and others. Optional software and a

modem can turn the Color Computer into a Videotex terminal for accessing information through the Compuserve Information Service. With 4KB of RAM and 8KB of ROM, the Color Computer sells for under \$400; an extended BASIC Color Computer with 16KB of RAM will sell for \$599, or \$218 as an upgrade kit. Joystick controls are offered for \$24.95. And, if you don't have a color tv, Radio Shack will sell you a 13-inch receiver for \$399.

FOR DATA CIRCLE 307 ON READER CARD

The desktop TRS-80 Model III packs processor, 65-key keyboard, 12-inch video monitor, and space for two double density diskette drives in a single cabinet. The Model III will be offered in three configurations. A Level I BASIC system with 4KB of RAM offers full program compatibility with Model I Level I BASIC; it sells for \$699. A second version, with 16KB of RAM, upper- and lower-case characters, and Model III BASIC (reportedly compatible with most Model I programs) sells for \$999. A Desktop Business Computer configuration, with 32KB of RAM, two double density diskette drives (total capacity 313KB), and an RS232 interface, sells for \$2,495. Model I disks can be read by the Model III. The Model III can grow to 48KB of RAM and two more diskette drives can be added. RADIO SHACK, Fort Worth, Texas.

FOR DATA CIRCLE 308 ON READER CARD

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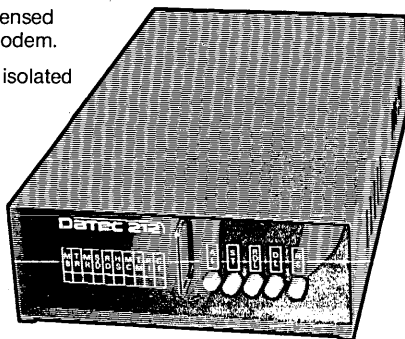
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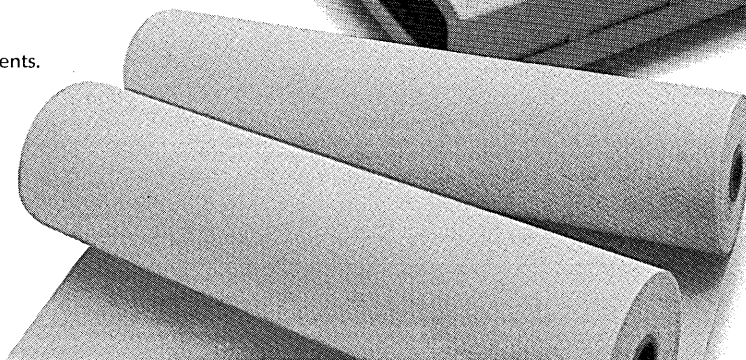
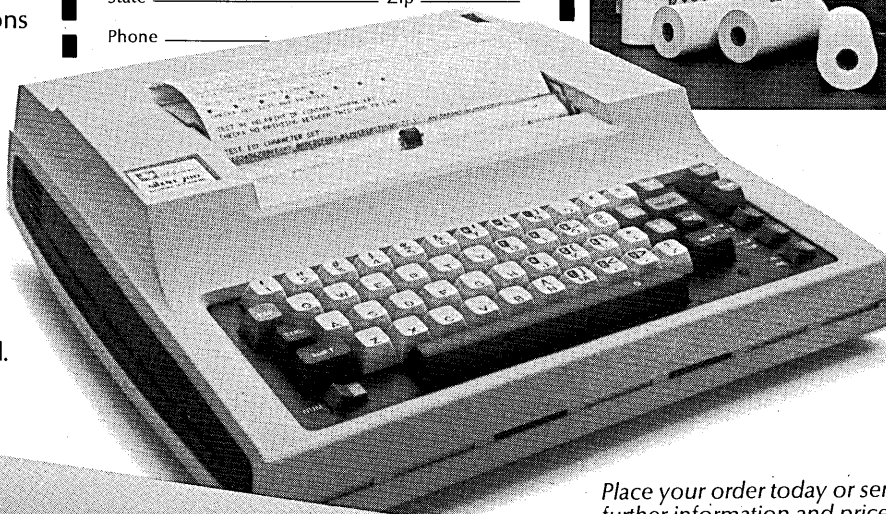
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CIRCLE 128 ON READER CARD

SOFTWARE AND SERVICES

UPDATES

We've decided to use the incentive plan to induce readers to submit more humor from programming (and hardware) manuals, a la our June "I for an I..." item (courtesy of R.A. Hopkins) and the September Groucho joke (thanks to Elizabeth A. Post). We're turning the whole thing into a Manual Madness contest, with a real, honest-to-goodness prize. Please mail your entry (lifted from any manual published by any manufacturer or systems house) to: DATAMATION Magazine, Manual Madness contest, 666 Fifth Ave., New York, NY 10103. We need to have your entry in our hands by Dec. 1, and we plan to publish the results in the January FORUM section.

Alan Weiss, manager of Systems Programming for Sambo's Restaurants, sent us two examples that will be entered in Manual Madness. One, from IBM's OS/VS2 TS) Terminal User's Guide (p. 134), illustrates a command procedure for splitting the bill at a pizza parlor. The manual suggests that you take the example command's tabular output on your next trip to the pizzeria "to provide a handy reference table for determining each person's share of the tab." Weiss may find it funny because he works in the food industry; I find it funny comparing IBM's example prices to those I had to pay last Friday night (40¢ per slice to IBM sure is more reasonable than the 70¢ I ran into). Weiss also sent three pages, since purged, from the OS/VS2 Access Method Services manual. Example parameters included "BEATLES," "JOHN," "PAUL," "GEORGE," "RINGO," and "TEENY. BOPPER."

DOS TO OS MIGRATION

University Computing's DOS to OS Transition System (DUO) is now available as Release 4.4 of UCC TWO. UCC TWO allows DOS programs to go into OS production without source code conversion. Any release of DOS, DOS/VS, or EDOS is handled by UCC TWO running under any release of OS or OS/VS. Extensions to UCC TWO in Release 4.4 provide improved use of OS features by DOS programs. New features include file reblocking for improved storage utilization (sequential files are reblocked through JCL

without requiring change to the DOS source program), support for DOS/VSE program products including sort packages, compilers, and DL/I, and support for native DOS RPS (Rotational Position Sensing) for speeding disk seeks. The package includes linkage editor improvements for DOS PL/I Optimized programs, support for hard-coded VSAM control blocks, and an optional one-page ABEND dump summary of key debugging information. Additionally, all documentation has been revised and reformatted to reflect the recommendations of current

SOFTWARE SPOTLIGHT

DISTRIBUTED DBMS

Applied Data Research's Datacom/D-Net provides the "glue" that binds together ADR's Datacom/DB, Datadictionary, and Datacom/DC (or CICS) into a cohesive distributed data base management system for mainframes running under DOS/VS, VSE, or OS/VS. D-Net allows a user with multiple mainframes to distribute a data base so that the set of most frequently needed data is close to its point of need, while transparently providing access to remotely held, less frequently needed data. Applications programmers can write programs without learning new Datacom/DB commands, as all standard Datacom/DB commands for accessing and maintaining data are interpreted, with the help of the Datadictionary, by D-Net and routed to the appropriate (local or directly connected) host DBMS. In addition to maintaining the directory used by D-Net to process distributed data base requests, the Datadictionary also controls part of D-Net's data access security system. Terminal-oriented functions are provided by Datacom/DC, CICS, or any other teleprocessing monitor that interfaces to Datacom/DB; Datacom/DC is preferred because D-Net was designed to interact most naturally with Datacom/DC.

D-Net acts as the manager in a distributed data base environment, coordinating the activities of the TP monitor, DBMS,

and Datadictionary. It handles all service requests, determining whether the requested data resides locally or at a remote site. Requests for data held remotely are sent in the form of "request packets" via VTAM.

The system allows concurrent processing of the data base by multiple mainframes. A computer need not have its own on-line terminals; it can be viewed strictly as a data base machine. Likewise, a connected host need not have its own data base; it can be seen as an additional applications processor. Each data base in the network is controlled by a specific node and is accessible to any other directly connected processor. The responsible node ensures adherence to all security, recover/restart, and data integrity requirements. D-Net provides compatibility between nodes running heterogeneous processors and operating systems.

Datacom/D-Net is slated for customer deliveries in the first quarter of next year. It's available on a permanent license basis for \$15,000 for the first cpu and \$8,000 for each additional cpu. Datacom/DB is priced at \$47,000 for DOS and \$57,000 for OS installations; Datadictionary is \$14,200 for DOS and \$16,500 for OS; Datacom/DC is \$32,000 for DOS and \$37,000 for OS. APPLIED DATA RESEARCH, INC., Princeton, N.J.

FOR DATA CIRCLE 331 ON READER CARD

FINANCIAL HIGHLIGHTS

Significant Figures (000 omitted)

For the Year
Premiums written
Underwriting income (loss)
Investment income before taxes
Net operating income after taxes
Net operating gains (losses) after tax
Realized investment gains (losses)
Extraordinary item
Net income
Composite ratio
Average shares outstanding

	1979	1978	% Change
	\$338,150	\$313,725	7.8%
	332,775	304,217	9.4
	(2,256)	(13,854)	83.7
	40,865	32,136	27.2
	38,957	17,054	128.4
	27,020	14,124	91.3
	(11,553)	2,360	
	\$ 25,467	\$ 17,705	43.8%
	99.8%	103.8%	
	\$ 407	555	

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- **CORNING GLASS WORKS** now executes an average of more than 16,000 ASI-ST runs monthly against TOTAL data bases and standard files.
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CIRCLE 129 ON READER CARD

SOFTWARE AND SERVICES

UCC TWO users. The package is available for an unlimited license fee of \$38,500, or on a limited lease arrangement for \$1,100 per month. UNIVERSITY COMPUTING CO., Dallas, Texas.

FOR DATA CIRCLE 325 ON READER CARD

S/38 AND S/1 LICENSED PROGRAMS

IBM's General Systems Div. has come up with an additional 12 licensed programs, five for the System/38, and seven for the Series/1 running EDX.

The System/38 offerings include four customer service applications—billing, accounts receivable, inventory control, and sales analysis—and a conversion aid for current users of System/3 Communications Control Program (CCP) applications. The applications programs, a part of the previously announced Distribution Management System/38, carry monthly license charges of \$75 for billing, \$65 for accounts receivable, \$70 for inventory control, and \$60 for sales analysis.

FOR DATA CIRCLE 326 ON READER CARD

The System/3 CCP to System/38 Conversion Aid is a set of RPG II programs and procedures that run on System/3 Models 8, 10 Disk, 12, and 15. The conversion aid lets a user perform part of his conversion on the System/3 while awaiting delivery of a System/38. The conversion aid will be available in February for a one-time charge of \$2,225.

Increased support for interactive applications and communications are now available in the form of seven licensed pro-

grams for Series/1 EDX users. The full screen capabilities of the IBM 3101 Display Terminal (locally or remotely attached) are now supported. EDX users can use the Series/1-System/370 Channel Attach licensed program to allow S/1 programs to communicate with S/370 programs for high-performance applications such as front-end processing. Data management facilities have been extended to cover larger data bases: data set size now is limited only by disk space (opposed to a 32K record limit previously enforced), and diskette support has been doubled to a maximum of 985KB per diskette. Five of the new programs comprise Version 3 of the EDX operating system. These programs (and their monthly license fees) are Basic Supervisor and Emulator (\$29), Utilities (\$24), Program Preparation Facility (\$28), Macro Library (\$53), and Macro Library/Host (\$150). The S/1-S/370 Channel Attach program goes for a monthly license fee of \$60, while the new EDX Multiple Terminal Manager (source-compatible with the current MTM) is \$15 per month. INTERNATIONAL BUSINESS MACHINES CORP., General Systems Div., Atlanta, Georgia.

FOR DATA CIRCLE 328 ON READER CARD

DURANGO F-85 SOFTWARE

Lifeboat Associates, which bills itself as "the Software Supermarket," now offers its wide line of 8080 software formatted for the Durango F-85 desktop computer system. Lifeboat concentrates its marketing efforts on CP/M-compatible software; its entry into the Durango market is heralded by a

version of CP/M that supports the F-85 with up to four floppy disk drives; subsequent releases are planned to support both 12MB and 25MB hard disks. The Durango version of CP/M has a recommended end-user price of \$170. With the installation of CP/M, an F-85 will be able to run much of Lifeboat's other offerings, including language processors for BASIC, COBOL, and PASCAL, word processing systems, communications packages, and accounting applications. Durango dealers are offered the chance to become Lifeboat dealers receiving a 30% discount on CP/M and a 20% discount on most other packages. LIFEBOAT ASSOCIATES, New York, N.Y.

FOR DATA CIRCLE 329 ON READER CARD

S/34 JOB ACCOUNTING

An RPG II utility program, Job Accounting/34 provides System/34 users with the ability to track job and print time by procedure, user ID, device, date, and time. The system allows generation of user-specified management reports, with control over report contents, sort order, and control breaks. These reports can be used for such purposes as client or departmental billing, as well as identifying available free time and times of heavy usage as an aid in scheduling and installation management. The Job Accounting/34 package is available for a one-time fee of \$435. CALVIN P. ALLYN & ASSOCIATES, Boston, Mass.

FOR DATA CIRCLE 330 ON READER CARD

GRAPHICS

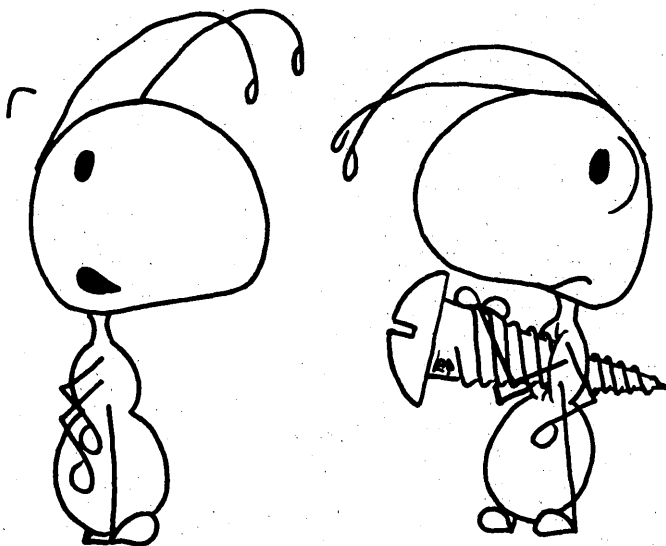
GP-10 is a set of FORTRAN-callable graphics subroutines for PDP-11 computers and Tektronix (and compatible) graphics devices. The package includes basic MOVE, DRAW, and POINT routines that can operate with device or user-defined (virtual) coordinate systems; absolute and relative addressing modes are provided. Utilities allow displaying text at any point, defining dashed lines, and performing such interactive graphics functions as cursor control and selective erasure (if the device allows this). Graphics memory readback routines are provided for producing hardcopy of screen displays. GP-10 currently runs under the RT-11, RSX-11X, and IAS operating systems; it is priced at \$450. SYSCON DESIGN, INC., Manhattan Beach, Calif.

FOR DATA CIRCLE 332 ON READER CARD

CROSS-ASSEMBLER

A cross-assembler and linker package from Ruben Engineering allows DEC PDP-11 and VAX users to develop programs and object files for Motorola's 16-bit M68000 microprocessor. The package runs under DEC's RSX-11M, VMS, or Bell Lab's UNIX operating system, and features Motorola-compatible instruction formats and mnemonics, macros with argument substitution, external and local symbols, and expressions (with logical AND and OR and shift opera-

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SOFTWARE AND SERVICES

tions in addition to the four basic arithmetic operations). The cross-linker combines separately assembled programs, resolving references to external symbols and relocating code. Output from the linker is an object file in Motorola "S" format, suitable for down-line loading into an M68000-based system. A binary license for the package goes for \$2,500. RUBEN ENGINEERING CORP., Cambridge, Mass.

FOR DATA CIRCLE 333 ON READER CARD

TAPE MANAGEMENT

More than four work-years of effort have produced 25 specific enhancements to Computer Associates' CA-DYNAM/T tape management system for DOS users. Foremost among the enhancements in Release 4.0 is support for Release 1 and 2 of IBM's DOS/VSE operating system, and support for the new Fixed Block Architecture (FBA) DASD devices. Other enhancements are said to improve operations efficiency, management control, and security. The installation procedure has been revamped, allowing selection or modification of system options through a generation macro. Testing facilities now allow temporary cataloging of test versions without placing them into production data sets. Catalog and data set password protection is provided. An automatic catalog facility will (optionally) add a new file name to the catalog the first time the file

is opened for output. Release 4.0 includes an all-new batch access module, DYNACC, that allows access to additional information stored in the catalog. Error recovery also has been enhanced, with procedures that detect tape I/O errors during automatic volume recognition, preventing errors such as incompatible tape/drive density combination. CA-DYNAM/T 4.0 has a perpetual license fee of \$7,500. COMPUTER ASSOCIATES, Jericho, N.Y.

FOR DATA CIRCLE 334 ON READER CARD

FORTH

FORTH, the extensible programming language, now is available in ROM from Rockwell International for its AIM 65 microcomputer. Rockwell says the language is "particularly useful in control applications." Users can extend the FORTH instruction repertoire with instructions unique to the application at hand. Nonprogrammer engineers can then use the new vocabulary to implement their applications efficiently on the microcomputer. The interactive language includes a built-in compiler, text editor, and run-time interpreter, all contained in two 4KB ROMs that plug into the AIM 65 master module. AIM 65 FORTH sells for \$150, including a user's manual. ROCKWELL INTERNATIONAL, Electronic Devices Div., Anaheim, Calif.

FOR DATA CIRCLE 335 ON READER CARD

COBOL SYNTAX CHECKER

Mainframe shops running VM/370 can simplify the task of interactive COBOL program development and maintenance by adding this vendor's VM COBOL Assist as an enhancement to IBM's standard CMS text editor. VM COBOL Assist adds DOS/VS COBOL syntax checking to the capabilities of the CMS editor. The enhancement can check each line for syntactic correctness as the line is entered, or it can be invoked to check an entire program or partial program. Two types of errors are detected: punctuation and syntax. The offending line is displayed, along with an indication of where the syntax checker recognized the error. On a one-year agreement, the package carries a monthly license fee of \$225. The vendor is offering a 30-day return privilege to prospective customers: the package can be returned to the vendor within 30 days at no charge to the user. IMPROVED PROGRAMMING TECHNOLOGY CORP., Towson, Md.

FOR DATA CIRCLE 336 ON READER CARD

IDMS ANALYZER

The IDMS Journal Analyzer system provides performance and integrity reporting from the journal produced by Cullinane's IDMS. The package, from the System Div. of DBMS, Inc., runs under any operating system supporting IDMS Release 5.0 or 5.5 on IBM and plug-compatible mainframes. The

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10 Print "SHELL METZNER SORT": FOR X = 1 TO 100:
  PAUSE "DATA ITEM #": X: INPUT A(X+100): IF A(X+100)
  < 0 GOTO 25
20 NEXT X
25 M = X - 1
30 M = INT(M/2): IF M = 0 GOTO 107
40 J = 1: K = X - M - 1
50 I = J
60 BEEP 1: L = I + M: IF (A(I+100) <= A(L+100))
  GOTO 100
70 T = A(I+100): A(I+100) = A(L+100):
  A(L+100) = T: I = I - M: IF I < 1 GOTO 100
90 GOTO 60
100 J = J + 1: IF J > K GOTO 30
105 GOTO 50
107 BEEP 5: INPUT "PRESS ENTER FOR LIST": A
110 FOR I = 1 TO X - 1: J = I + 100: PAUSE "DATA ITEM #":
  USING "###": I: "": A (J): NEXT I
```

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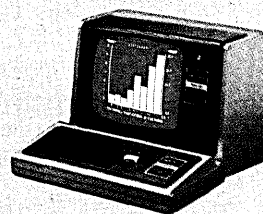
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SOFTWARE AND SERVICES

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FOR DATA CIRCLE 337 ON READER CARD

DESKTOP STATISTICS

For its 4050 series of graphic computing systems, Tektronix has developed the Plot 50 Tests and Distribution package of statistical programs. The disk-based software works with the vendor's 4907 File Manager, and is said to support the vendor's full line of graphics output devices. Standard file formats allow the same data to be shared among programs.

The \$600 package consists of 18

general-purpose statistics routines, 13 data management utilities, and 17 special-purpose function keys. Plot 50 Tests and Distributions can be used in management reporting, statistical research, and engineering design applications; the use of function keys simplifies use by novices. Plotting routines include cumulative and suspended histograms, stem and leaf displays, and box and whisker plots. One- and two-sample t-test and F-test programs are provided to show sample mean and variance, degrees of freedom, and value of the statistic and test conclusion. Other programs provide probability plots and distribution analysis, contingency tables, random number generation, and probability distribution tables. TEKTRONIX, INC., Beaverton, Ore.

FOR DATA CIRCLE 338 ON READER CARD

RPG LISTING FORMATTER

System/32 and /34 users can produce listings of ROG II programs with exploded procedure listings and indenting of nested procedures by using a package called the Procedure Exploder Utility. The user first specifies the appropriate user library, and then specific procedure names. The utility then scans nested procedure calls, EVOKE statements, INCLUDE statements, and JOBQ statements, producing a listing of the user-specified procedure with each level of nesting indented. The Procedure Exploder

Utility carries a one-time lease charge of \$300, and includes RPG II programming, documentation, and procedures. DAVIDSON SOFTWARE SYSTEMS, Lansing, Mich.

FOR DATA CIRCLE 339 ON READER CARD

VAX STATISTICAL PACKAGE

The BMDP Statistical Software package, originally developed at UCLA for IBM mainframes and subsequently adapted to a number of other machines, now runs in native mode on DEC's 32-bit VAX-11/780. Converted in FORTRAN IV Plus, the 1980 version of BMDP runs under all current versions of the VMS operating system. The implementation includes a VAX-DCL user interface, simplifying use of the package. BMDP's 1980 release adds three new statistical analysis programs—K-Means Clustering, Stepwise Logistic Regression, and Mixed Model ANOVA—to the 33 other routines available in the last release. This release also adds free-form and "stream" data input, an expanded transformation processor, and a built-in sort/merge. The complete package consists of both source and object code, as well as test data and results. For commercial users, the package is priced at \$1,500 per year; nonprofit users pay \$1,250 per year, and academic institutions pay \$750 per year. MANAGEMENT SCIENCE ASSOCIATES, INC., Pittsburgh, Pa.

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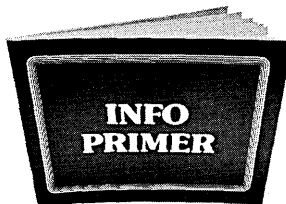
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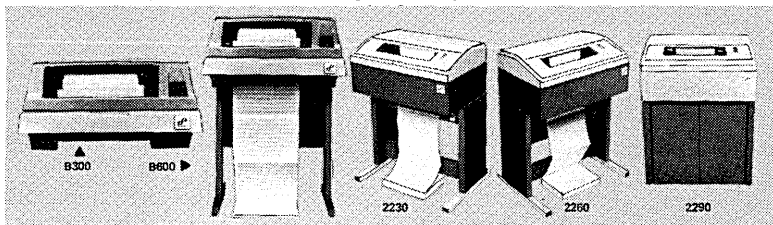


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SOFTWARE AND SERVICES

DOCUMENTATION AID

The Universal Structured Design Diagrammer (aka Flowcharter, aka program number LAR-12548) runs on CDC 6000 series computers, and can produce flowcharts and concordances for programs written in virtually any language. Universality is achieved by the Flowcharter's ability to accept definitions of new languages to be diagrammed.

Three sets of rules describe each language. The first set consists of a list of syntax rules written in Backus-Naur Form (BNF). The rules let Flowcharter perform a bottom-up parse of the source program. The second set of rules, presented in a one-to-one correspondence with the BNF productions, describes the semantics associated with each syntactic rule. The final set of rules, again in a one-to-one correspondence with the BNF rules, is used by the concordance part of Flowcharter; these rules specify positions where legal identifiers may appear, as well as classifying these identifiers as variables or procedure names. Flowcharter comes with a grammar description for PASCAL (Flowcharter is written in PASCAL for the Release 2 compiler distributed by the University of Minnesota).

Flowcharts produced by the program look quite different from traditional flowcharts: the package generates a diagram showing the main flow of control in a top-down format, with increasing levels of detail explicitly indicated. Documentation costs \$21.50; the program sells for \$1,000. COMPUTER SOFTWARE MANAGEMENT AND INFORMATION CENTER, University of Georgia, Athens, Ga.

FOR DATA CIRCLE 342 ON READER CARD

MICROCOMPUTER RPG

Cromemco broadened the applicability of its microcomputers with the offering of an IBM-compatible RPG-II compiler. Modeled after the System/3 implementation of RPG, the compiler requires a computer with at least 64KB of memory.

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FOR DATA CIRCLE 340 ON READER CARD



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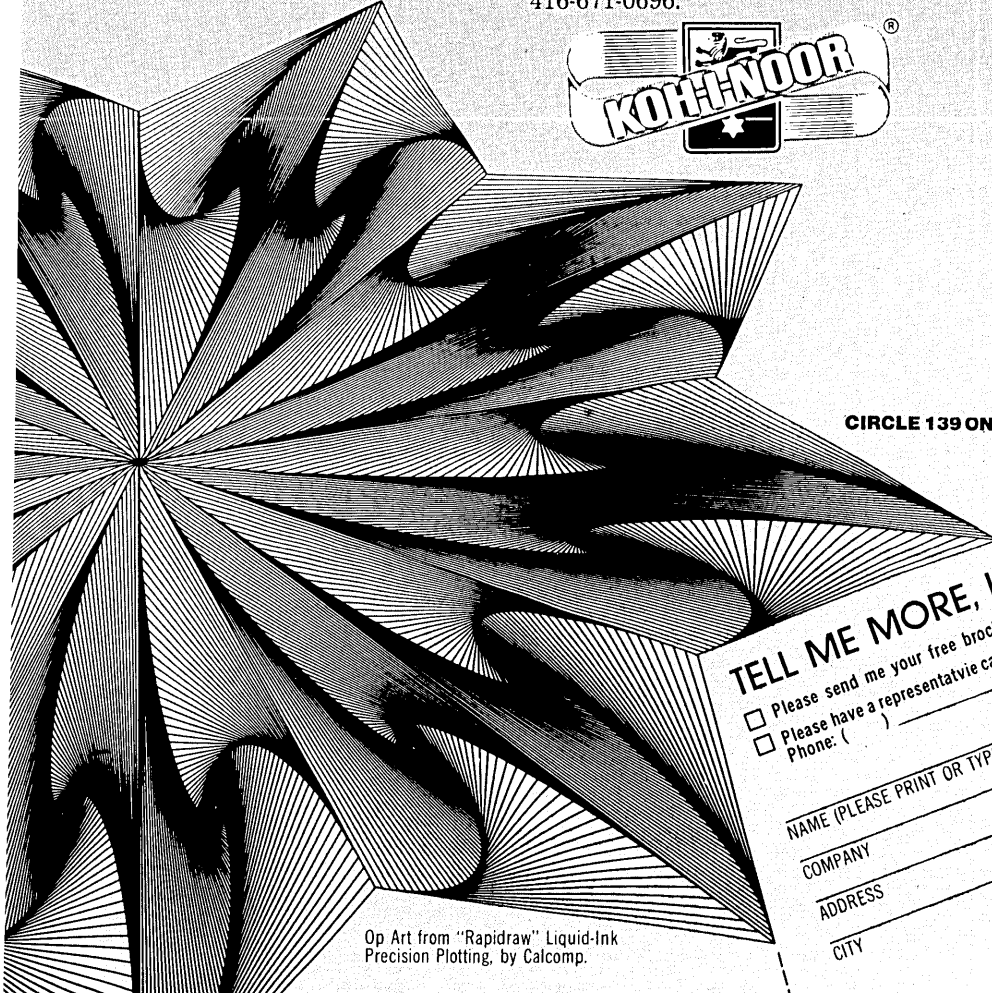
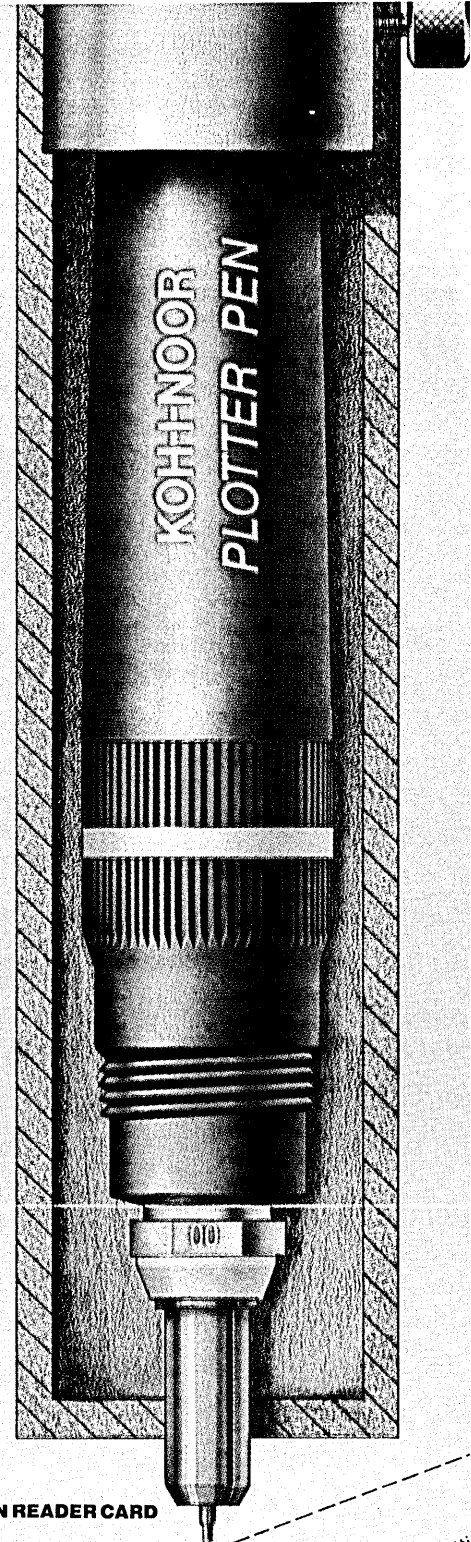
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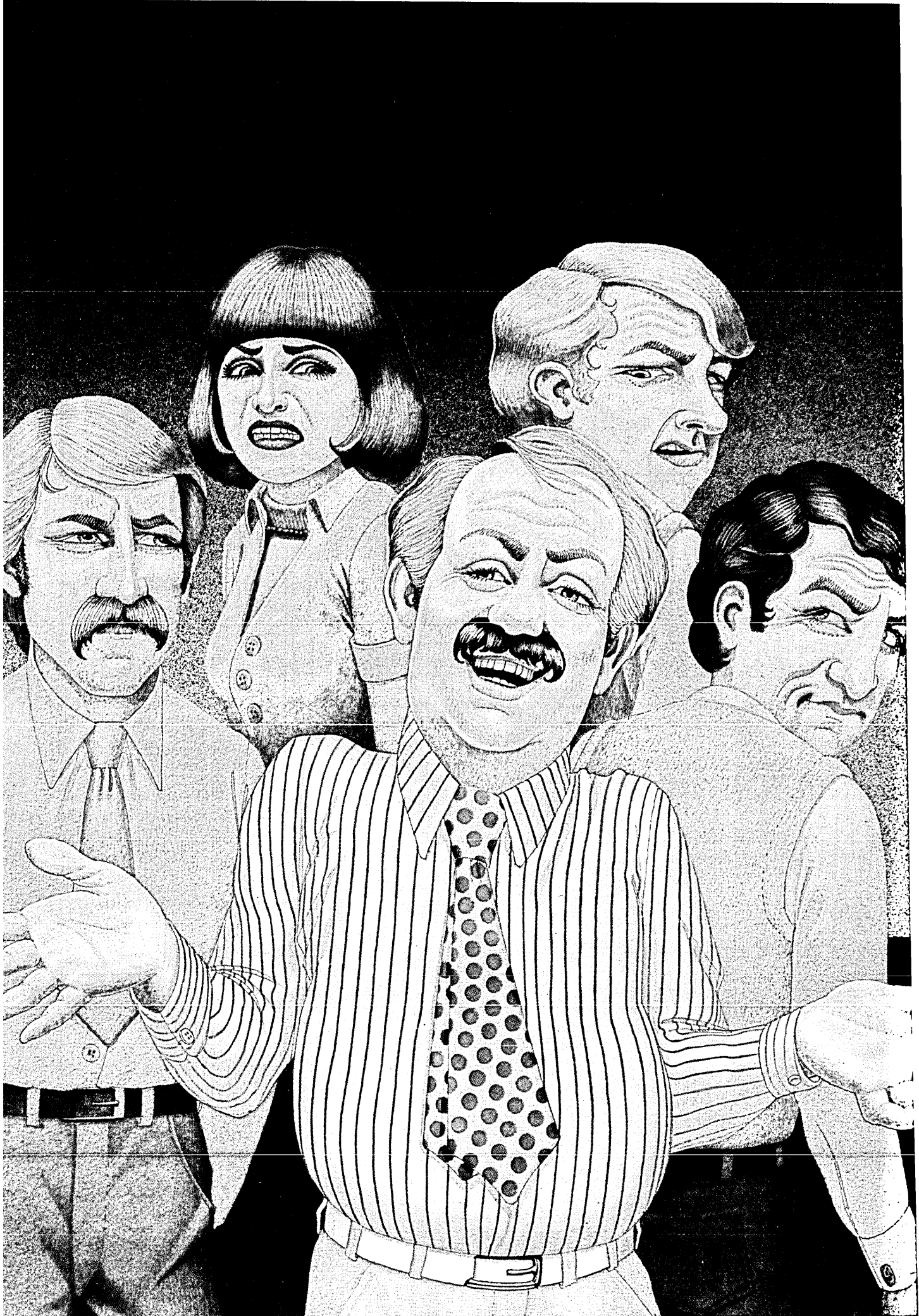
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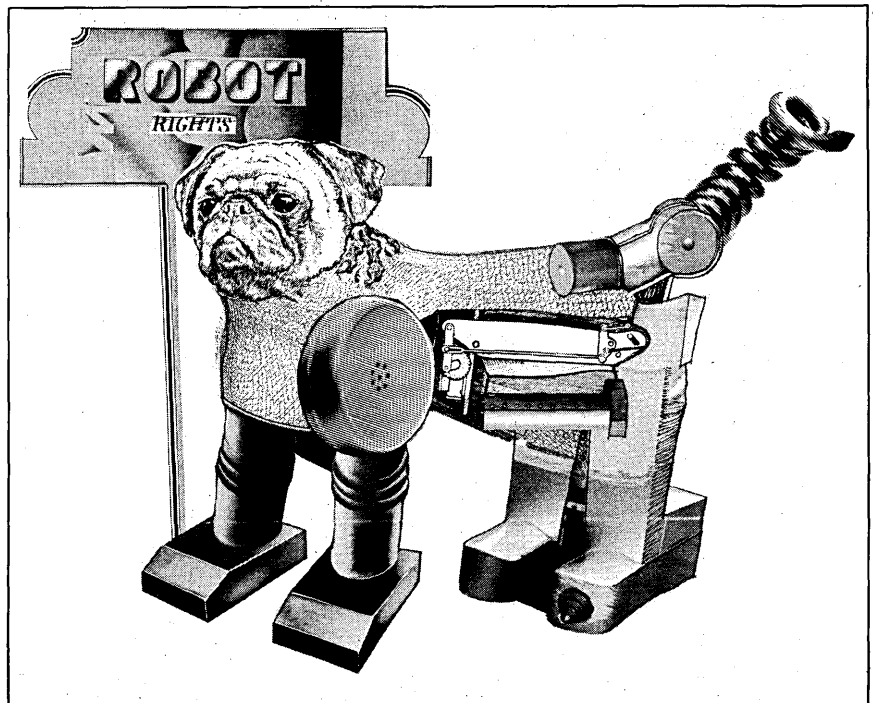
BOOKS

**HOW TO BUILD YOUR OWN
SELF-PROGRAMMING ROBOT**
by David Heiserman
**HOW TO BUILD YOUR OWN
WORKING ROBOT PET**
by Frank DaCosta

David Heiserman, in his compelling book *How to Build Your Own Self-Programming Robot*, offers the comprehensive instructions necessary for the construction of a self-regulating cyborg, supplying careful schematics and seemingly formidable directions. If the constructor is fortunate, the end result will be Rodney, an autonomous robot. Using feedback loops and other servomechanisms, Rodney is capable of learning, and will program itself to perform in unfamiliar situations. Although Heiserman's robot won't confound, frighten, or confuse the unwitting layman, it does cause us to reconsider the dominion of artificial intelligence.

Tab Books, again, has done a rather shoddy technical job with this edition. Typographical errors, although not abundant, detract from the author's heedful presentation. Addresses are incorrect (Jameco's address is 1355 Shoreway Blvd., Belmont, Calif., not as listed), photographic plates are mostly abysmal, and the general layout is disappointingly seedy. Although Heiserman's calculations seem precise and, one assumes, accurate, there is no absolute assurance they were set correctly.

Heiserman uses Intel's SN8085 8-bit microprocessor to supply his machine with the necessary coefficients for various tasks. These microprocessors sell for about \$8 apiece, which makes the cost of building the robot relatively modest. Not that this is an easy project; it requires many, many laborious hours and may entail more than a particle of frustration. But the ends would seem to justify the efforts. Rodney is a self-regu-



lating, memory-mapped device with an operating cycle of one hour running time to four hours of recharge time. Rodney seeks its recharger on its own initiative. Such features do not come easily.

Although this robot cannot shine shoes or repair the tv, it is capable of receiving instructions (along with other necessary data) and converting these messages into operational results. Writes the author: "Rodney's primary mode of expression is that of moving around the floor." There are alternate modes of expression, like optical tracking or pattern recognition that can be added to Rodney's system, making the robot a truly adaptive mechanism.

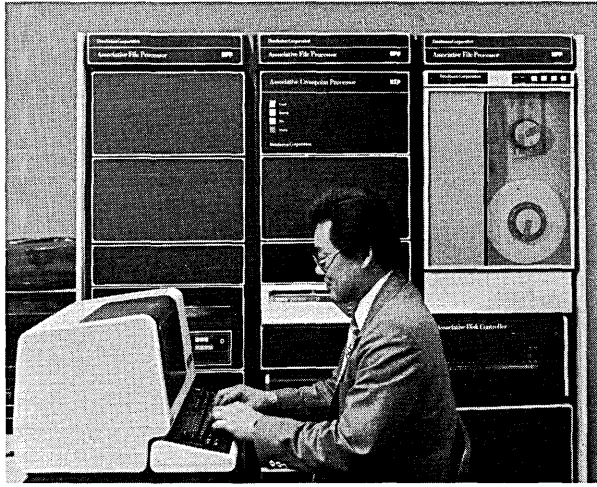
Heiserman defines three classes of robots: *alpha*, where response is limited to a basic reflexive activity (the organic counterpart to this type of robot would be the unicellular organism); *beta*, which is capable

of remembering these reflexive responses and applying them to similar circumstances; and *gamma*, which is able to generalize whatever it learns and adapt such generalizations to unknown conditions. Rodney may be constructed on any of these levels.

The first thing a potential roboticist must bring to this pursuit is a new understanding of the nature of the cyborg. Hollywood's blockheaded representation of the sleek and sentimental humanoid could not be more inaccurate. Anyone anticipating such constructions would be sorely disappointed with Rodney. Actual robots don't have flashing eyes and booming metallic voices. To perceive existing machines accurately, consider Norbert Wiener's description of control theory: "A machine is a device for converting incoming messages into outgoing messages," an apt description of an organism. It may be helpful to

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note the structural and functional likenesses between mechanical systems and organic systems. When Rodney seeks out his recharger, his action is analogous to that of an organism seeking out warmth or sustenance. If we accept Wiener's theories, we may perceive a machine as a controlled communication system.

In *Thought and Machine Process*, Alan M. Turing proposed a test known as the Turing Game, which might be used to gauge the effectiveness of artificial intelligence. In the Turing Game a human types random questions into a terminal for a limited period of time and tries to determine whether or not the answers were composed by a machine. We are a long way off from having a machine perform convincingly, but in any case this need not be the only method of proving artificial intelligence. Turing's Game may be appropriate only for determining the extent to which artificial intelligence corresponds to human intelligence. Machines may very well think, but perhaps it is rash to assume they will think like humans.

There's always an entelechial problem in dealing with thinking machines—an historical problem of vitalism versus mechanism, the classical question of souls. Many people are unable to accept a machine as a thinking entity because they limit such acceptance to organic systems, those possessing the élan vital. For these people, machines cannot "think" because they lack the vital agent that actuates thought.

Yet Turing, by way of Gödel, demonstrated that a perfectly logical machine is so far from being wholly predictable that it cannot predict what it cannot do, even while functioning perfectly. This means all systems will contain some surprises; or, as Babbage proved with his Difference Engine, miracles are indeed possible. Robots are not about to overrun the neighborhood since these devices are still in a rudimentary phase. But we may soon have a machine capable of substantial intelligence, as we may soon have mechanisms constructed along analogues to organic systems.

The field of artificial intelligence, especially as it may be applied to robotics, is as full of wonder and potential as the first man-made nuclear reaction. Heiserman opens a complicated can of worms, and does so with grace and humaneness. A robot like Rodney may help us to consider not only the effects of artificial intelligence but may serve to enhance our perceptions of organic systems as well. This is an encouraging beginning. Tab Books, Blue Ridge Summit, Pa. (1979, 237 pp., \$7.95).

How to Build Your Own Working Robot Pet offers the reader an opportunity to construct a prosthetic dog. DaCosta's mechanical dog-robot might not fare well in a fight with a pit bull, but if the experimenter suspends a portion of his disbelief he may find that his completed mechanical device does bear some resemblance to our *Canis*

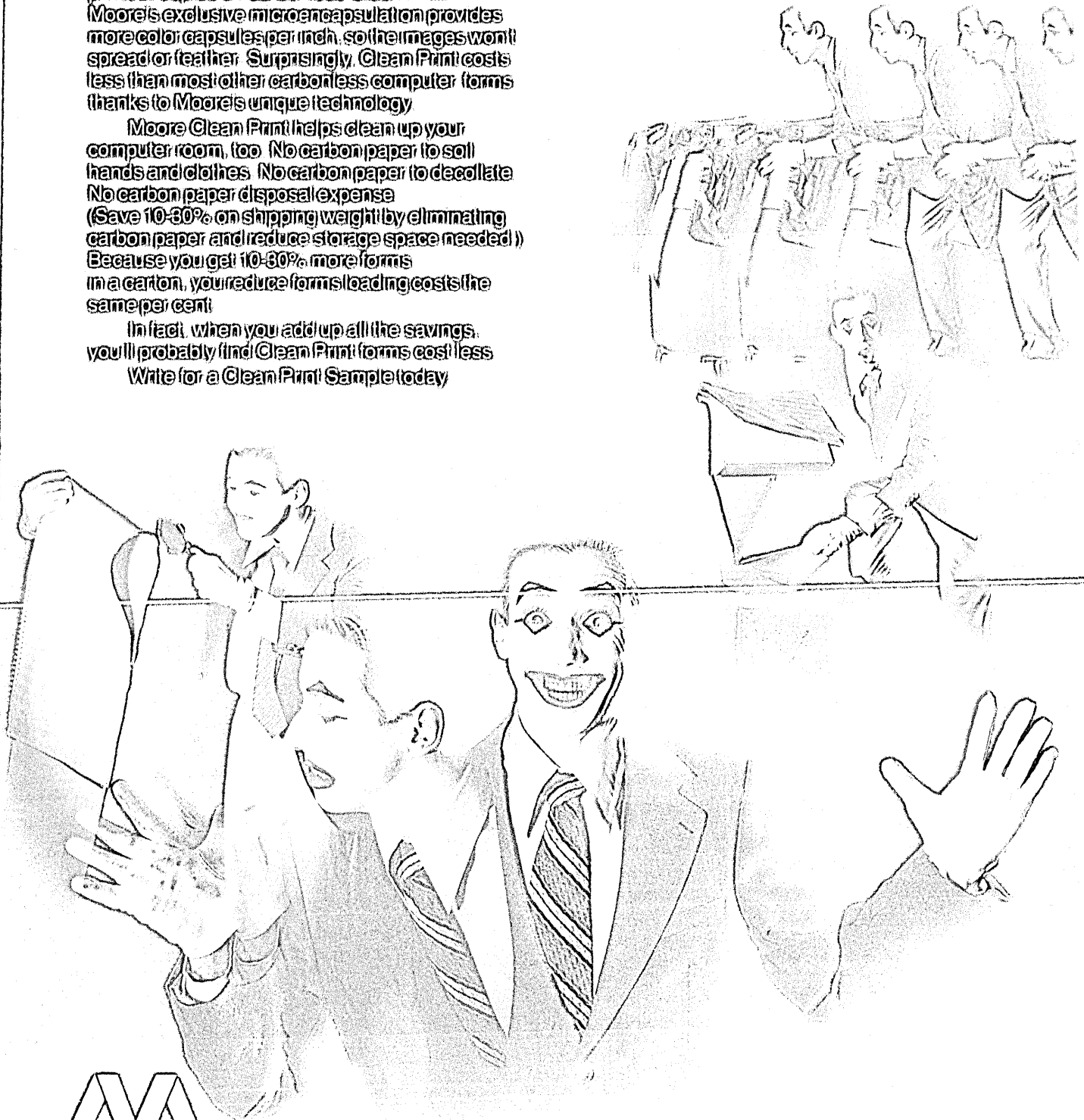
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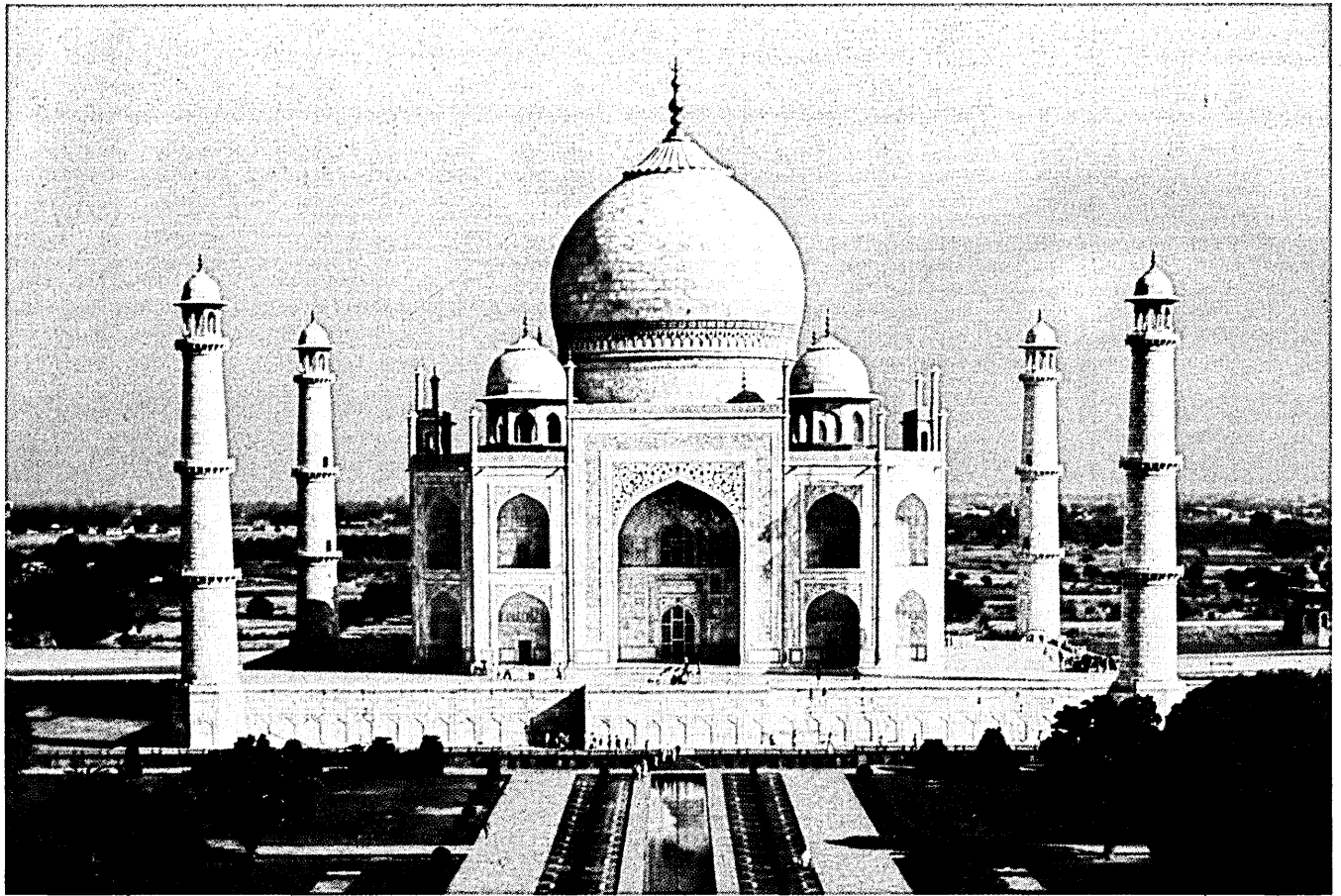
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familiaris. DaCosta has come up with some interesting functions for his pet robot, such as Soniscan, an echo-detection navigational system that uses an MK-109 piezoelectric transducer to simulate the navigation used by bats; Excom, an external command function whereby the roboticist can communicate with his creation; Fredian, or frequency differential analysis, a grammar that permits communication between the robot and the human by means of various pitches (the robot recognizes comparative pitch differences); and, most interestingly, something called ARASEM, or artificially random self-motivation, a programmed "free will" that offers the robot something of a mind of its own. For heightened authenticity, one can even add a wagging tail to the device. All of these functions tend to enhance the realism of DaCosta's playful simulacrum.

This is a coherently written book. The author avoids an imperious tone in favor of one that encourages experimentation. He instructs with clarity and precision, making this project appear much simpler than it must actually be. DaCosta manages to squeeze a lot of performance out of an 8-bit microprocessor (the Intel 8085A), with a small prototype that runs on two 6-volt batteries with two 12 amp-hours' running time. Robot control is supplied by an RCU-85 unit consisting of a brainboard and external TTL circuits interfaced to the input ports. DaCosta's design is efficient throughout: the robot will inform its master when it is running low on power, thereby protecting the random access memory from accidental erasure. All in all, DaCosta presents an intriguing contraption that should credibly perform various lifelike functions.

This book occasions a few questions: if we are to accept this device as a plausible simulation of a living creature, might it be too incredible to consider the religious or ethical status of such a creation? Admittedly, DaCosta's dog is not about to fool anyone; robotic creations are still too clumsy for that. Yet in the near future, we shall have to consider the nature of the robot and establish its identity.

A common belief among supposed-modern folk is that in the future robots will wait upon their owners, shining shoes, uncomplainingly scouring ovens—in short, will perform those functions which in the past had been performed by craven serfs and handservants. Potential Brainiacs, latter-day simonists setting themselves up as gods, bumbling roboticists like Trurl and Klaupaucius in Stanislaw Lem's *Cyberiad* (who construct erratic, insubordinate robots), slothful slave owners who never offer a personal consideration to their creation of Riley with their cyborgs as galley slaves, homeowners expecting to live like George Jetson—all are mistaken. The presence of robots will not necessarily make our lives luxurious.



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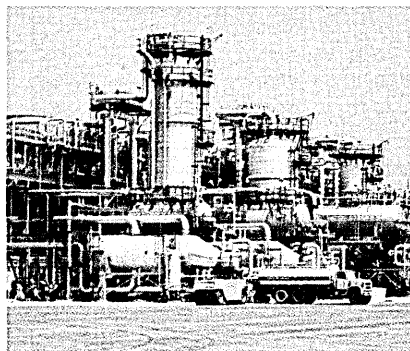
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Can one abuse a robot? The suggestion that this is possible is usually met with dismay by industrial roboticists. It may seem frivolous to urge humane treatment of machines, as it seems ludicrous to worry about our interaction with these mechanisms, but some serious ethical questions are raised by the increasing complexity and accuracy of life-stimulating devices.

Azriel Rosenfeld of the Computer Vision Laboratory at the University of Maryland believes that such ethical matters are still 30 to 40 years off, but adds that it is "never too early" to address these questions. Drawing from Talmudic scholarship, Rosenfeld concludes that man-made "men" may be halakically "human" provided they possess intelligence: "Human form is neither a necessity nor a sufficient condition for being legally human," writes Rosenfeld. He further proposes that a robot capable of passing Turing's Test (which should not be considered as a requirement for establishing machine intelligence) would be "in an excellent position to claim that it is entitled to all the rights and privileges of a human being. 'Hath not a robot . . . dimensions, senses, affections, passions?' " Ought not some concern be given to our treatment of future robots if we accord synthesized 'life' the respect we offer an organism? Do current robots need someone to champion their 'rights'? Are we in need of a sort of cybernetic William Ellery Channing? Not quite. But the matter deserves some thought.

"Consider Howard Lipton's letter to the editor of the *New York Times* on Nov. 2, 1979, wherein he relates an engaging situation: workers on a Pennsylvania assembly line complained of excessive heat. Managers replaced the workers with industrial robots, which in turn malfunctioned as a result of the intense heat. The end result: management was forced to air-condition the assembly line, which is what the workers demanded in the first place. It seems there isn't all that much difference between a robotic system that is down and a labor force that refuses to work. Clifford R. Meyer of Cincinnati Milacron points out "that, in a sense, robots are both capital and labor. That is a wrinkle new to the classical economics equation, and may have profound application."

These are not especially distant problems. Joseph Engleberger of Unimation Inc. says robots will be able to orient jumbled parts (the so-called nit-picking problem) "within a decade." The Japanese Industrial Robot Association foresees a voice-controlled robot coming into practical use by about 1987; robots with true sensory capacity should be with us by 1985. The time will come when human masters will be accused of brutality in their treatment of robots. Malevolent domination of robots, à la Simon Legree with push buttons, should be here in a few decades.

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Wiener has written of the perils of abusing the roboticist's position; he even finds an analogue in *Paradise Lost* between Satan and God and robot and its creator. When the roboticist arrogates to himself the function of creator he establishes a dangerous conflict. One can almost hear Peter's admonishment to Simon Magus: "Your silver perish with you, because you thought you could obtain the gift of God with money!" (Acts 8:20).

Nearly everyone knows by now that Karel Capek popularized the term robot from the Czech word *robota*, meaning forced labor. But consider the term *robot-patente* as it was applied by Maria Theresa and Josef II, which limited the amount of work a feudal lord could demand from his serfs. The time will come when we will have to place similar restrictions on the amount of work we can demand from our intelligent machines. Not necessarily because we are abusing the machine—we must not anthropomorphize—but because the master has acted incorrectly. Machines currently lack the self-consciousness which would make these ethical concerns more valid.

Marvin Minsky of MIT states that when robots develop a sense of fear (undoubtedly a complex sense), the time will have come to deal with robotic ethics. Otherwise, he suggests, all this is like worrying about "stepping on ants." But as creator, man must conform to certain rules. Perhaps it is wrong to toss your robot out the window, not because you have destroyed a lifelike machine, but because you have acted contrary to our ethical code, or perhaps, more prosaically, because you have just wasted an expensive piece of equipment by tossing it down the dumper.

We need not fear a robot rebellion just yet. We shouldn't have to worry about the kind of scenario detailed in *R.U.R.*, Capek's 1923 play. Yet we should not forget that the future will be an "ever more demanding struggle against the limitations of our intelligence," as Wiener warns, and not a "hammock in which we can lie down to be waited upon by our robot slaves."

DaCosta's book offers good experience to the robot experimenter. He has dedicated this volume to "the Creator, who in turn taught men to be creative." The author is a compassionate man who has given a great deal of thought to the subject of robotic ethics. He cites a regard for the works of Francis Schaeffer and shows a concern for the mistreatment of machines because such action "reflects poorly upon the nature of man." With this book, Mr. DaCosta reflects well upon that same nature. Let us hope that other roboticists can do as much. In the meanwhile, the roboticist might treat his mechanical dog with a little more consideration. Tab Books, Blue Ridge Summit, Pa. (1979, 238 pp., \$10.95).

—Lee Froehlich



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The thick, oversized volume carries the caution: "Warning—perishable information—read immediately." Proof of the

field's timeliness is the appearance of a two-page update within the issue covering late breaking developments.

The purpose of the volume is to present new electronic tools to art directors, designers, and writers in a positive light. From the introduction: "*Vision '80s* will explain the many new technologies to *U&lc* readers at their level of concern and in terms they can relate to. The editors of *U&lc* hope that *Vision '80s* will help you overcome any fear of or resistance to change you may have—resistance, we believe, that is due to a fear of the unknown. We hope that *Vision*

'80s, by making the unknown known, will whet your appetite for the exciting accomplishments that will be possible with the new tools at your command, so that you will become one of those who hunger for valuable change and who will adapt and thrive." Thus the issue is valuable not only as a comprehensive resource but provides a stimulating user perspective.

Discussions of equipment and technologies are arranged functionally and follow a natural progression under the following headings: information origination, image origination, input, electronic filing, vdt (visual display terminal) editing, page/area composition, electronic/stored formats, interfacing, typewriters, word processing machines and systems, typesetting (photographic and digital), reproduction (printing and copying technologies), and distribution/electronic mail. Each topic covers a huge variety of subject. Under distribution/electronic mail, for example, is found discussion of communicating word processors, fiber optics, FCC rulings and jurisdictions, ACS, XTEN and SBS, public data networks, local nets like Ethernet, teleconferencing, picturephone, and fax. *U&lc*, ITC (International Typeface Corp.), 2 Hammarskjold Plaza, New York, NY 10017, (212) 371-0699.

DISTRIBUTED PROCESSING

Pathways through Data Processing: Distributed Processing Systems is a handbook for company management. Aimed at providing a general understanding of distributed dp, the book advocates placement of the ddp responsibility with a vice president for information services. Most of the discussion, however, is about ddp equipment and usage, with only superficial mention of management issues.

There is a chapter on data communications which includes discussion of common carriers, with particular attention to Telenet's packet switching network, AT&T's ACS, Xerox's XTEN, and IBM/Atena/Comsat's SBS. There are short chapters on the selection of hardware and software, and a final chapter called Special Considerations, with a variety of tidbits, some seemingly useless, such as the recommendation that a universal industry standard programming language be chosen to alleviate conversion problems. An appendix gives manufacturers' names, addresses, and phone numbers, and a basic four-page glossary is included. \$39 (\$50 outside the U.S.). Management Information Corp. (MIC), 140 Barclay Center, Cherry Hill, NJ 08034, (609) 428-1020.

ON-LINE DATACOM

Input has issued a new study, *Data Communications Considerations for New On-Line Systems*. The study emphasizes planning as the key element for management concern. Other factors addressed as impor-

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Martin Marietta Aerospace, NASA's Contractor on the Space Shuttle External Tank, has immediate openings for Univac Application Analysts.

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SOURCE DATA

tant to the success of a system include assessing the level of competence needed for hardware and software selection, user participation and cooperation, resource planning, and step-by-step implementation. Also featured is discussion of the recent FCC move toward deregulation and Congressional efforts to rewrite the Communications Act of 1934.

IBM's SNA is discussed, as are the mainframe network architectures of Burrough's, Control Data, Honeywell, NCR, and Univac. Mini network architectures are also discussed: DEC's DNA, as well as offerings by Hewlett-Packard, Prime, Tandem, and others. The report sells for \$3,000. Input, 2471 East Bayshore Rd., Suite 600, Palo Alto, CA 94303, (415) 493-1600.

INK JET PRINTING

An in-depth report on ink jet printing discusses a surprisingly large number of companies with ink jet products and potential products. Company profiles include product development and marketing histories, specs and diagrams in many cases, quite a few photos, and company address and phone plus contact name. The product information is thorough and includes important details like patents information and oem contracts—even ones that have fallen through or are lying dormant.

A second major portion of the report results from a survey of 100 IBM 6640 users. The findings are analyzed with respect to the nature of the site, purchase motivation, future plans for equipment purchase, and machine reliability. The report also includes an overview of the technology, speculation on its future, some consultants to contact, and an annotated bibliography. The 249-page report sells for \$575. Quantity discounts are available. 'Ink Jet Printing—Its Role in Word Processing and Future Printer Markets' is from Datek of New England, P.O. Box 68, Newtonville, MA 02160, (617) 332-4576.

MICROELECTRONICS

Intelligent Computer Products: Technology Applications and Market Opportunity is an overview of microprocessor technology and applications aimed at an audience concerned with product marketing and assessment. Consumer products are emphasized. Software engineering is discussed in its own chapter, written by a specialist—in fact, written by the only consultant listed in the report's appendix of software engineers. (An association that provides names of independent software engineers is also listed.) Another chapter includes a brief review of existing products and major suppliers. There is a chapter entitled 'Requirements

for Product Success' which features some rather general advice—a severe example reads, "Use working capital wisely." A final chapter speculates on products of the future. Some of these potential products made us laugh. Components and product sources are listed. \$575, additional copies \$50 each. Electronics Trend Publications, 10050 N. Wolfe Rd., sw3, Suite 200, Cupertino, CA 95014, (408) 996-7401.

MICRO DBMS

A Primer on Data Base Management Systems outlines this vendor's approaches to microcomputer data base management systems. Two schema are discussed, a network system and a hierarchical system. Data manipulation is also covered. The primer is meant to offer an overview of data base management as provided by this company's software. \$10. Micro Data Base Systems, Inc., P.O. Box 248, Lafayette, IN 47902.

VENDOR LITERATURE

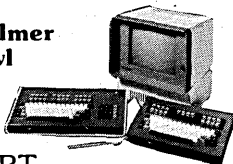
CARTRIDGE TAPE DRIVES

A description of this vendor's digital cartridge tape drive line is offered in a brochure which includes a description of the company and a guide to product selection. DATA ELECTRONICS, INC., San Diego, Calif.
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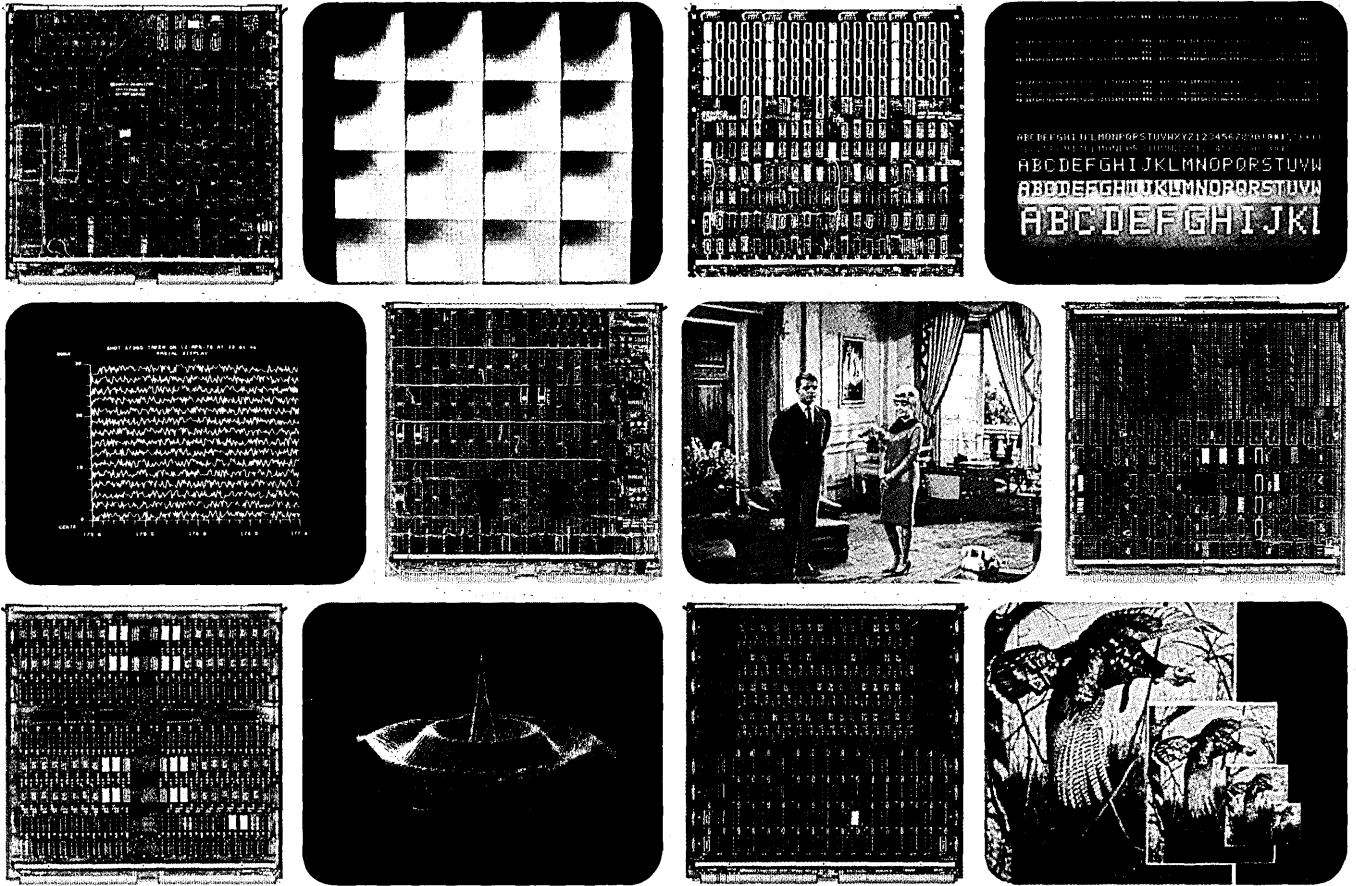


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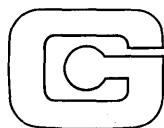
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PROM CONTROLLER

A brochure on this vendor's M980 PROM programmer control unit describes the product's ability to program 4-, 8-, or 16-bit PROMs, its editing, duplicating, prompting, and error coding features, and the data retention characteristics of the CMOS RAM buffer. Ordering and pricing details are also given. PRO-LONG CORP., Monterey, Calif.
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MEMORY TEST UNIT

In a color booklet this vendor's J389 Memory Test System is described, with emphasis

on testing new generation static and dynamic RAMs, including byte-wide devices. The brochure describes AEL—Automatic Edge Lock—a computer-controlled time-domain reflectometry technique, and PASCAL-T, in which the J389 software is written. TERA-DYNE, INC., Woodland Hills, Calif.

FOR DATA CIRCLE 351 ON READER CARD

SEMINARS

MINICOMPUTER DATACOM

A one-day seminar for nonengineers with emphasis on communications protocols. Presented by Micom, a datacom vendor.

\$50 prepaid or \$75 invoiced. Micom Systems Inc., 9551 Irondale Ave., Chatsworth, CA 91311, (213) 882-6890.

IMAGE PROCESSING

Dec. 9-12, Miami Beach; Dec. 16-19, New Orleans. \$975. Contact Dr. Hall, Computer Recognition Corp., P.O. Box 8067, University Station, Knoxville, TN 37916, (615) 966-7424.

DELTAK ADDS DATA BASE, DATACOM

New videotape courses from Deltak include Principles of Data Communication and Managing the Data Base Environment, both featuring James Martin. Deltak, Inc., 1220 Kensington Rd., Oakbrook, IL 60521, (312) 920-0700.

APPLICATION DEVELOPMENT

IBM is offering an Independent Study Program—in the form of a workbook—on *Estimating Application Development Projects*. A prerequisite to the course is their offering *Managing the Application Development Process*. The self-study text sells for \$195, with bulk discounts available. IBM, 1133 Westchester Ave., White Plains, NY 10604, (914) 696-1900.

STRUCTURED PROGRAMMING

Designing Structured Programs is the subject of a self-study course offered on audio cassettes. The course is based on the Warnier-Orr program development method. Included in the price of the course is a workbook with exercises and figures referred to in the recorded lecture. \$495, quantity discounts available. EduCassettes Inc., 7070 Upham St., Arvada, CO 80003, (303) 424-4425.

HARVARD ADDS NEW SEMINARS

New seminars in the series on information management offered by the Lab for Computer Graphics and Spatial Analysis include Data Communications, Office Automation, Computer Performance Review, Combating Computer Crime, Management of Software Engineering, Digital Image Processing, and more. For a free catalog of offerings, write Harvard Univ., Graduate School of Design, Laboratory for Computer Graphics and Spatial Analysis, Cambridge, MA 02138.

NEW CADAM COURSES

Lockheed has added four courses to its training programs for users of CADAM, Lockheed's interactive CAD/CAM product. The new courses are Finite Element Modeling, Advanced N/C Programming, Advanced Basic Graphics Terminal Operation, and a Management Overview. A detailed description of the courses is available from CADAM, Lockheed-California Co., Dept. 88-10, Building 94, P.O. Box 551, Burbank, CA 91520. *

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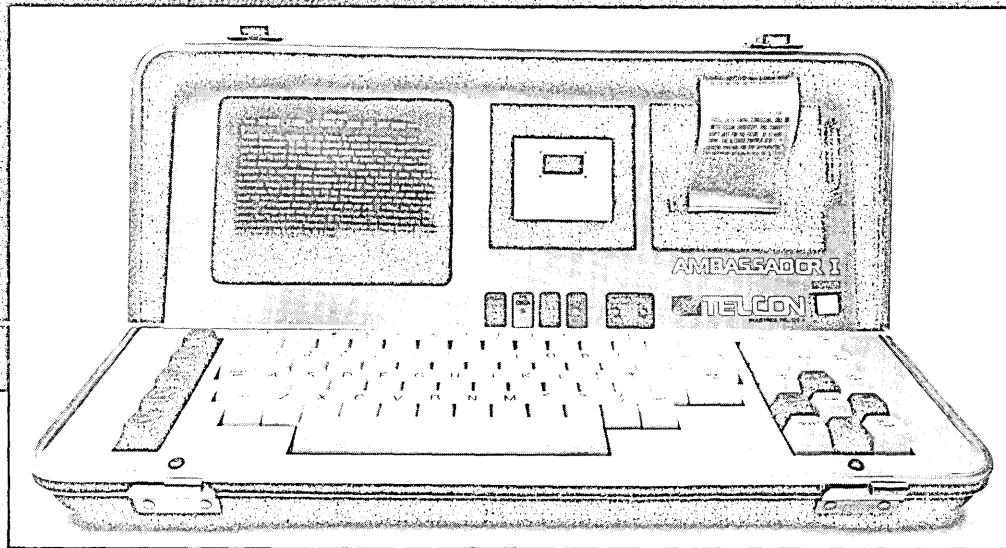
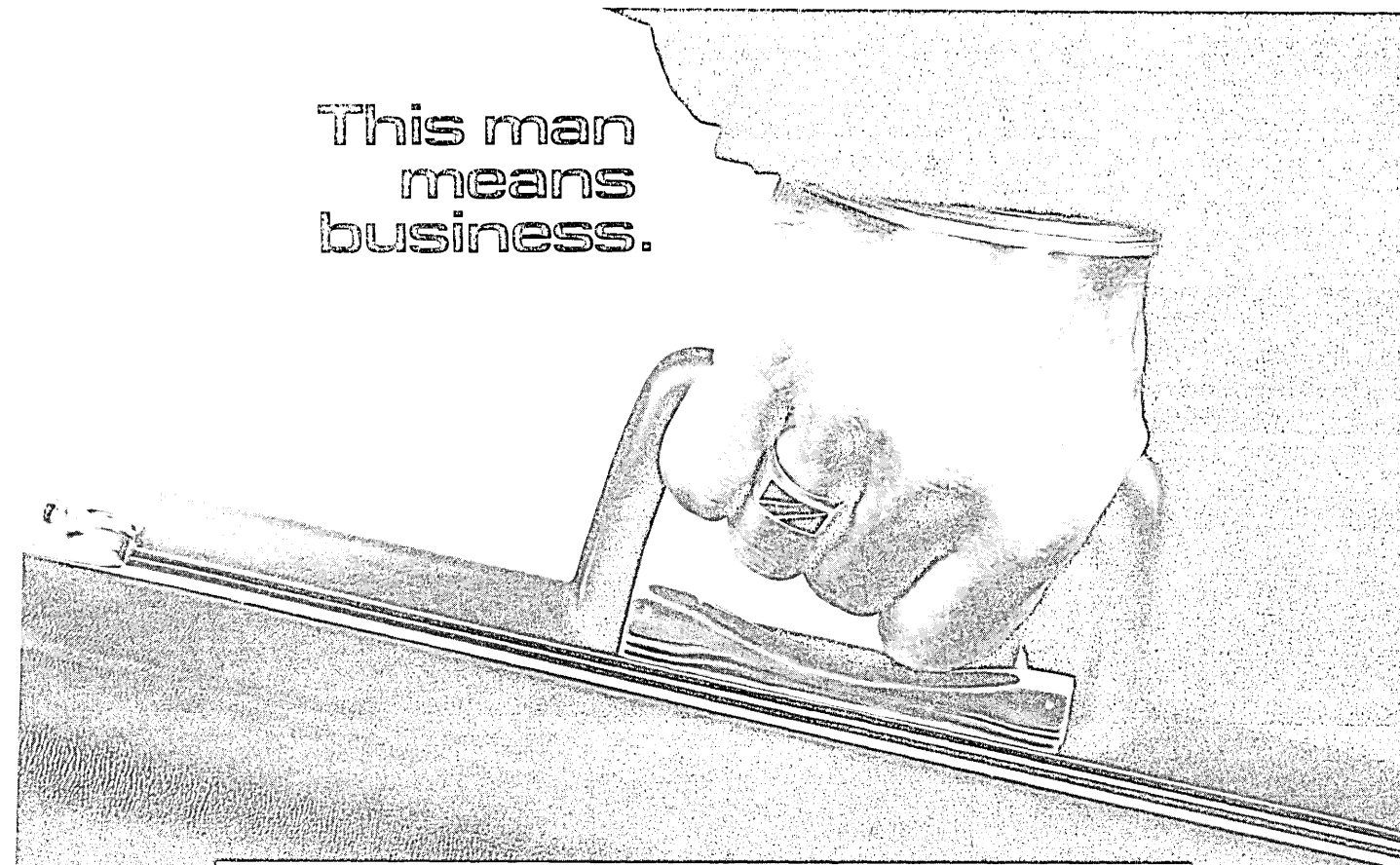
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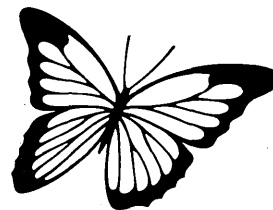
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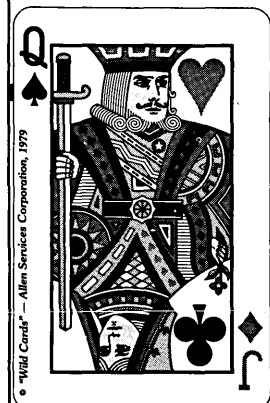
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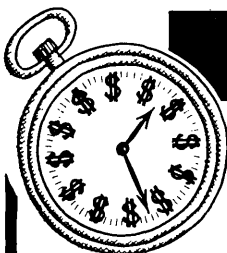
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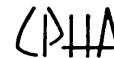


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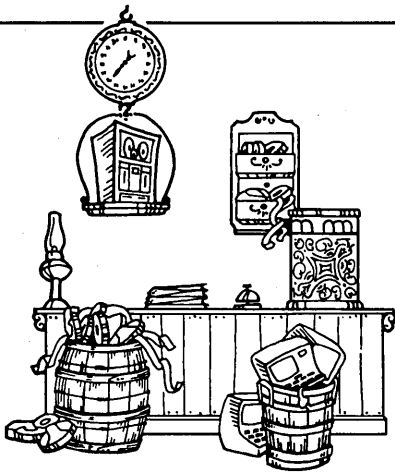
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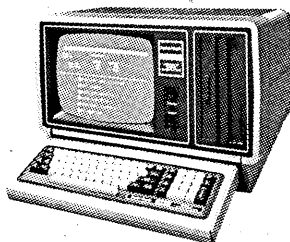
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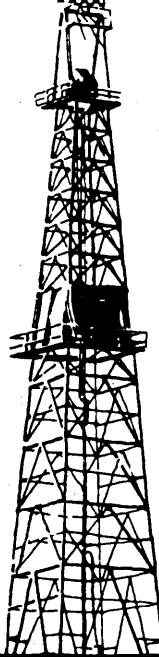
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READERS' FORUM



FIG. 1. THE FIREFISH OF FRENZY.

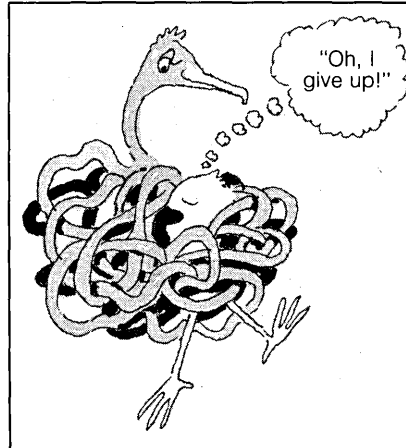


FIG. 2. THE DEMON OF DECAY.

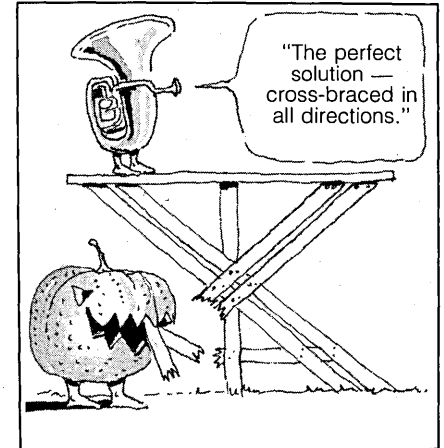


FIG. 3. THE PREDATORY PUMPKIN.

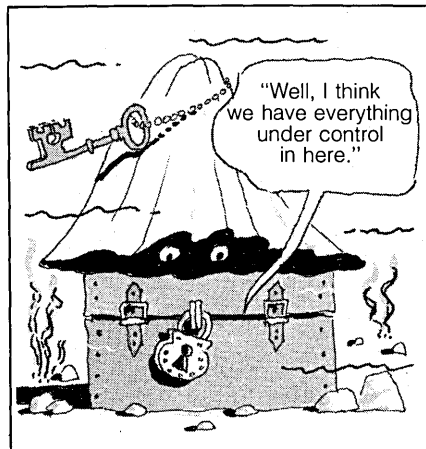


FIG. 4. THE LIMPET AND THE LOCK.

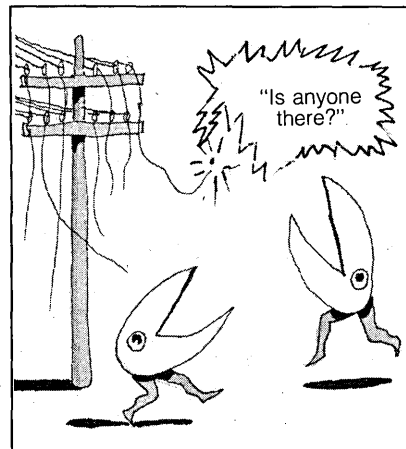


FIG. 5. THE SNEAKY SNIPPERS.

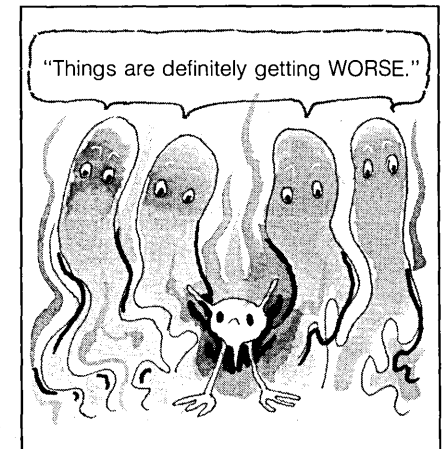


FIG. 6. THE GREY WIZARDS OF GLOOM.

SIX MONSTERS IN SEARCH OF A NIGHTMARE

The task of a project manager in a dp environment becomes more difficult as the applications increase. Distributed processing, data base management systems, office automation, and satellite communications can present any project manager with a host of difficulties. The complexity of modern life is not only intellectually and technically challenging, it is also a challenge to the whole fabric of a project manager's personality. He or she is responsible for pulling it all together without pulling it all apart. Consequently, the project

manager may be visited by a number of nightmarish figures not directly related to anything technical or intellectual, but which challenge some fundamental life skills.

Let us look at some of the fearsome figures.

First there is the Firefish of Frenzy (Fig. 1). This creature with its venomous spines of complexity, fuzziness, and unpredictability will drive us to distracted, fragmented, uncoordinated activity. It is a result of the failure to stay organized as the unexpected appears. Too often, we put together the perfect project plan with (perhaps) an occasional contingency plan, and then set it loose. Disruptions may stop the machine if the project plan is strained beyond certain limits. To avoid the Firefish of Frenzy we need to be aware that crisis may appear at any time. We must look at the project and decide what must be rescued or protected, what is vital to survival, and what are the priority objectives. Then, we must develop emergency plans to protect this core, and review and amend them frequently. Watchful awareness is the attitude we must cultivate.

There is more. We may weather our first crisis and perhaps

READERS' FORUM

our second. But what happens when a third crisis follows hot on the heels of the second? Do we give in to the Demon of Decay (Fig. 2)? Does yet another obstacle, snag, budget cut, underestimate, overestimate, or personality clash wear us out? Resilience and endurance are vital to prevent the sleepy coils of the Demon from winding about us as we relax and give up.

This Demon can be resisted in two ways. First, a positive attitude, although hard to develop, can transform the situation. When the nightmare characters are seen as challenges rather than as obstacles, a crisis can turn into an exhilarating battle. After all, what do we have to lose? We can give up now and definitely fail, or be a little more imaginative, sneak up on the problem from a novel direction, and add another victory to our list of triumphs. Even if the first few attempts fail, that information is valuable to us. We must exam-

ine every crisis closely to see how we can turn it into an advantage.

The second way to avoid the Demon of Decay is to avoid the Predatory Pumpkin (Fig. 3). This vigorous creature creates confusion and erodes our projects with wild ideas and shortsighted actions. To avoid him, imagination and critical analysis must be balanced. We need to imaginatively select suitable ideas and solutions to difficulties, and, secondly, to predict the results of our selected paths. This requires critical judgment and astute assessment of the implications of a decision. Blending imagination with judgment is not easy; although usually these attributes are seen as opposites, they are actually complementary. Imagination is necessary to entertain the idea of multiple possibilities. Judgment is required to untangle the implications and select a high probability path.

One of the reasons Predatory Pumpkins are such common

DATAMATION CROSSWORD

3 IN DP

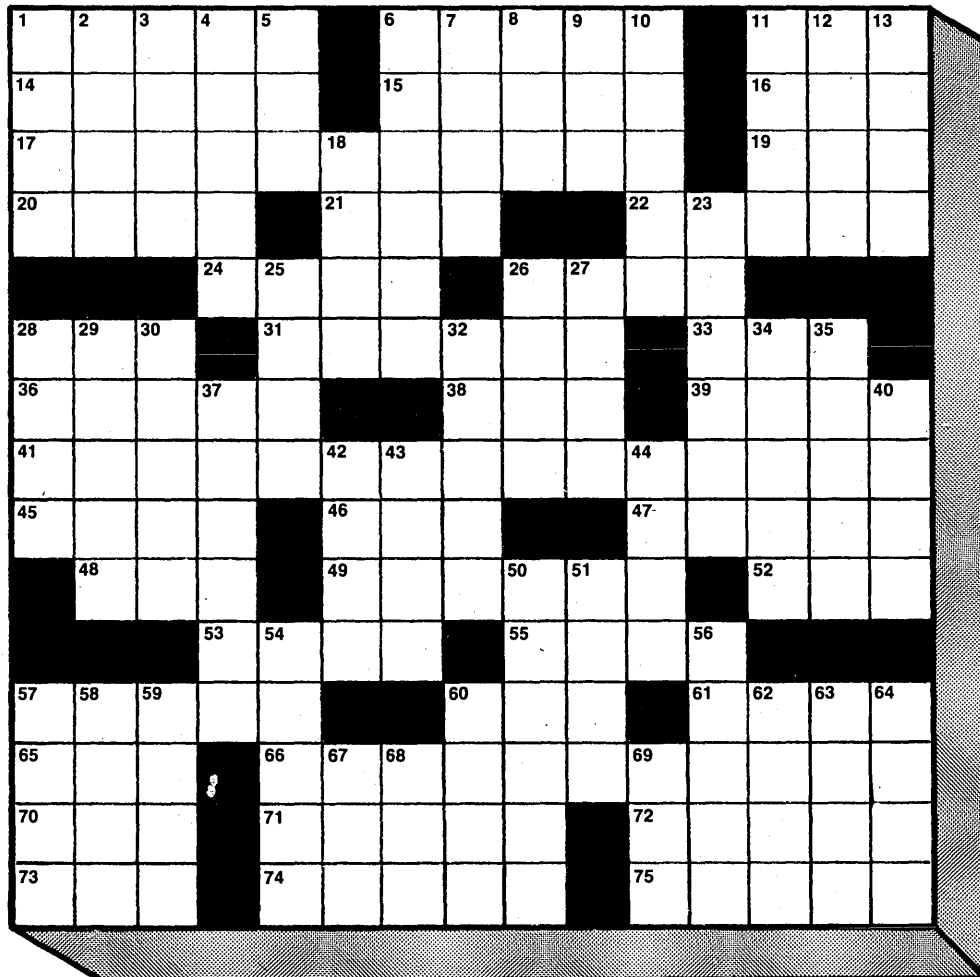
Edited by
Brian Fitzgibbon Burke

ACROSS

1. Age, to Ovid
6. Perfect
11. Deg.
14. Mourning band: var.
15. The part profundo
16. Ed or Mel
17. SDS activist
19. Nonlogical sect
20. Mathematician Post
21. Mine find
22. Kitchen effusion
24. Ornamental case
26. Merry old soul
28. Snake lyricized after Battle of Actium
31. Demosthenes, for one
33. Shannon of "Runaway"
36. OPEC delegate, probably
38. Black cuckoo
39. Greek consonants
41. Twice-fired guru
45. Kovacs' widow
46. Warner-_____ methodology
47. Met event
48. Cinque et al.
49. Ixtlan refreshment
52. Sweet dreams
53. Heirs to earth
55. Sell 49 across
57. One wearing scrambled eggs
60. Choose
61. Start of a familiar series
65. Above, to F.S. Key
66. Dropout who did his own thing
70. Compass dir.
71. African lilies
72. Russian edict
73. Classified material: abbr.
74. "_____ the cream in my coffee..."
75. Adlai's mate

DOWN

1. Summit
2. Eras precursor
3. Yellow, often
4. Biggest in cities, smallest in computers
5. Hamlet's metaphor for troubles
6. Spain and Portugal



7. Elimn8's Ferguson or Ozzie's first
8. Nineteenth in 61 across
9. Query
10. Kind of opposition
11. Firesign bus rider
12. Prow
13. Sicilian peak
18. Frown: obs. var.
23. NE lawn genus
25. Steve Miller's midnight activity
26. Part of speech: abbr.
27. Inventive: abbr.

28. U.S. Open champ: 1968
29. Sloughs
30. Risk
32. Be moratory
34. Facilitator
35. Mammon
37. Construction items
40. Sam the _____
42. Ensnare
43. Kirk trip
44. Deer
50. Combat
51. Dress for Leslie Browne
54. Attempt

56. Amateurs
57. _____ fide
58. Split
59. War god
60. Time between Passover and Shavuoth
62. Young sibling, often
63. Search
64. Colors
67. "Xanadu" band
68. Pronoun
69. Regret

Answers on page 242

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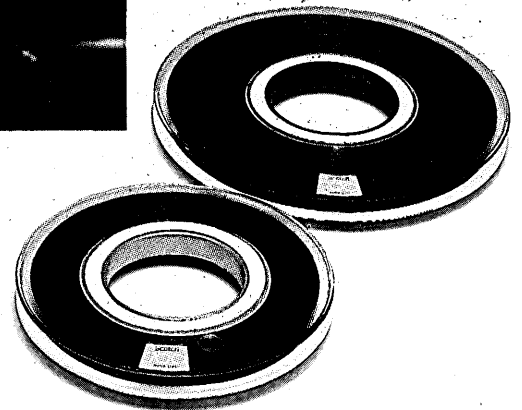
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pests is that they have friends. For example, there is the Limpet who locks us into a fixed set of ideas and then hides the key (Fig. 4). Getting locked in allows us to concentrate on the essential and ignore the irrelevant. However, life, ideas, projects, and problems do not stand still, and continual refocusing is needed to keep us alert. The idea that provides the breakthrough may come from looking at broader issues, or looking at particular details. The most devastating flaw in a plan may be seen by stepping back to take a long view, or by closing in for careful examination.

Keep your focus flexible. Strike a balance between concentrating on a particular level so your thoughts are not skipping around, and being so concentrated that your mind wears blinders.

Since all projects and problems involve people, effective communication is a basic requirement. However, this is a difficult skill; much care and practice is required to avoid the Sneaky Snipers (Fig. 5). These little creatures sneak around cutting communication lines, introducing misinterpretations, and, in general, fostering an unwillingness to appreciate another person. In working with our colleagues, it is not enough to state our position clearly; we also need to hear the other person's ideas and opinions. In all human interactions, emotional responses, unwarranted assumptions, and wishful thinking play a large and unpredictable role. We have to handle communication accordingly. Misinterpretations and the subsequent actions can prevent a problem being solved—and usually make it worse.

If we can avoid the five fearsome foes above we stand a very good chance of avoiding our final and most pervasive enemies—the Grey Wizards of Gloom (Fig. 6). These folk hang around and destroy confidence. If we consider that project management competence and powerful problem solving are skills that can be practiced, the nightmares can be avoided, and the Grey Wizards need not bother us. As long as we are struggling and learning, things are going to get better, because we are getting better.

—Mike Sanderson
Sacramento, California

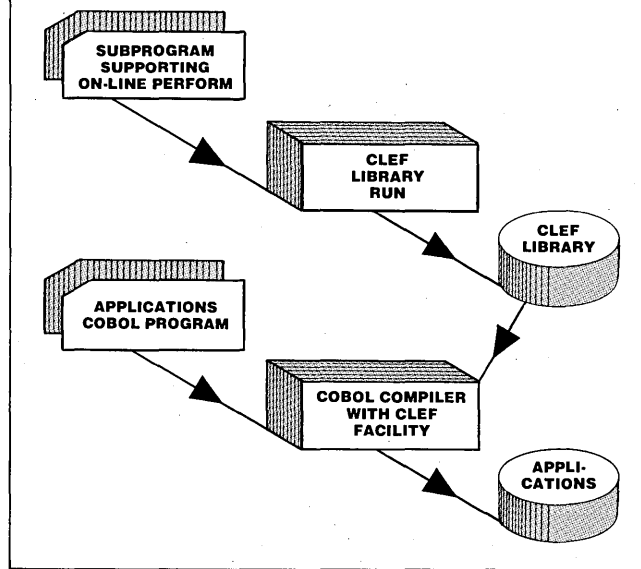
RECONFIGURING THE COBOL COMPILER

The great variety of COBOL compilers on the market is impressive. They vary from minimum ANS 68 COBOL, which can hardly be regarded as a high level language, up to ANS 74 COBOL compilers that support modular programming, indexed files, string handling, debugging, and telecommunications. In addition, the scores of compilers available also support a wide selection of extensions designed by the compiler writer. Soon, we will no doubt have compilers that support all this plus structured programming and data base handling.

With such a variety, it ought to be possible for every installation to find a version of COBOL that matches its needs. In practice, however, it is unlikely that any installation has the version of COBOL it needs. On the one hand, most installations lack some features they want, such as structured programming constructs. On the other hand, their compilers contain features not used, such as segmentation or MOVE CORRESPONDING. Worse still, they may contain features banned by installation standards, such as the ALTER verb or communications with the operator's console.

If installations don't like their COBOL compilers, why don't they go out and buy different ones? For a start, the user in practice has little choice: each computer has a limited number of COBOL compilers available (often only one). But even if an installation could choose freely from the whole range of COBOL compilers on the market, it would have difficulty in precisely matching its require-

FIG. 1



ments. The real problem is that *all* COBOL compilers are totally inflexible. Whereas the hardware configuration and, to a certain extent, the operating system are tailored to the requirements of the user, the version of COBOL offered is fixed when the compiler is written. The only choices the user has are the compile time options that offer only superficial flexibility.

The compile time option that causes all nonstandard features to be flagged is a step in the right direction. This can help when the user wishes to write portable programs, but it does not suit all users. It will not, for example, flag standard features that differ from another implementation due to ambiguities in the standard or the freedom offered to the implementor. Nor does it help the user who wishes to write in a COBOL subset compatible with a more recent standard. (Some compilers still flag extensions to ANS 68 COBOL.) The person who really knows what features should be flagged is the user. The solution to the problem is to have a compiler users are able to reconfigure to their particular requirements.

This might seem too much to expect but it is precisely what is being done by some users of macro preprocessors (the best known of which are ADR's MetaCOBOL and, in the U.K., Plessey's COBRA now marketed by ICL Dataskil). The problems with these preprocessors is that they are available only on a restricted range of computers and are incompatible with each other. In addition, a good macro preprocessor duplicates many of the functions of the compiler (such as lexical analysis, syntax checking, and setting up tables of the attributes of data items) so the macro facility more logically forms part of the compiler. The CLEF (COBOL Language Enhancement Facility) working party of the British Computer Society has designed such a facility, which it is proposing as an extension to COBOL. The enhancements it supports will look just like normal COBOL statements, and the applications programmer need not be aware of which statements are enhancements and which are supported directly by the compiler.

One possible application of the proposed facility would be COBOL's structured programming constructs. These will be in the next standard expected in 1981 but may well not be fully available until the end of the decade. The features could all be supported by the CLEF facility in a matter of a few weeks rather than months or years.

Let us take the example of the on-line PERFORM. One of the formats is:

```
PERFORM UNTIL condition
imperative-statement
END-PERFORM
```

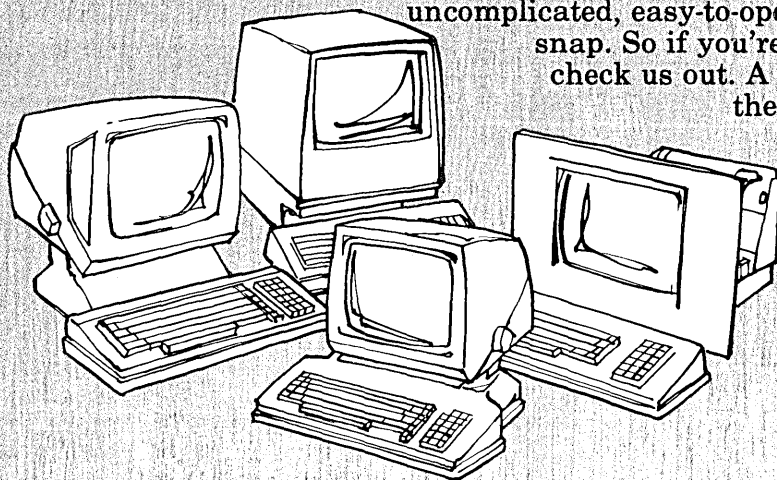
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FORUM

Using the proposed facility this could be supported by a CLEF routine written as a COBOL subprogram. This macro is submitted to a CLEF library run, which stores it as an object program in a CLEF library along with details of the format.

The COBOL compiler with the CLEF facility will now be able to recognize any statements which satisfy the above format. For example, the statement

```
PERFORM UNTIL MONTH > 12
ADD SALES (MONTH) TO SALES-TOTAL
SET MONTH UP BY 1
END-PERFORM
```

will be recognized as an on-line PERFORM statement. As a consequence the on-line PERFORM routine is read in from the CLEF library and (just like any other COBOL subprogram) it is executed. This subprogram will then translate the statement in the original source program into COBOL which is acceptable to the compiler itself. E.g.,

```
PERFORM P1 until month > 12
GO TO P2.
```

```
P1. ADD SALES (MONTH) TO SALES-TOTAL
SET MONTH UP BY 1
```

P2.

This generated code is "unstructured" but that does not matter because it will never be seen by the applications programmers. They will simply use the on-line PERFORM like any other COBOL statement and they need not even be aware that it is not supported directly by the compiler. This is possible because these extra statements are fully validated. Both the delimiters (PERFORM, UNTIL, and END-PERFORM) and the arguments (the condition and the imperative-statement) are checked. Thus

```
PERFORM UNTIL MONTH BIGGER THAN 12
ADD SALES (MONTH) TO SALES-TOTAL
SET MONTH UP BY 1
END-PERFORM
```

would not be accepted because MONTH BIGGER THAN 12 is not a valid COBOL condition. An error diagnostic which refers to the original source (not the generated text) is consequently produced.

This is, of course, a simple example. We do not have to go far to encounter a number of complications. For example if there are two on-line PERFORM statements in one program, the procedure names P1 and P2 must not be generated twice. The programmer must be allowed to nest the new statements—in the above example, SET could be implemented by CLEF and the on-line PERFORM might contain another on-line PERFORM. Sometimes coding will need to be generated to other parts of the program (such as the Working Storage Section). Finally what happens when the on-line PERFORM is embedded in an IF statement or is in a paragraph which is PERFORMED—how can we handle generated text with full stops and paragraph names?

PROBLEMS ALREADY SOLVED

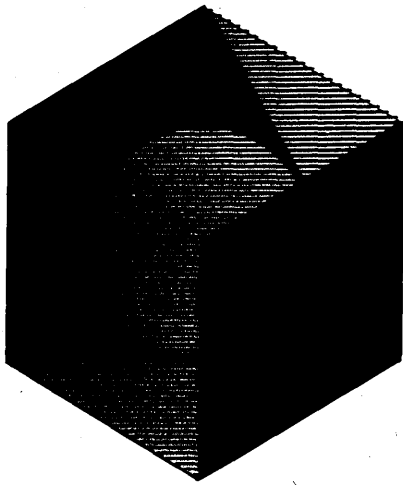
Not only have these problems been solved in theory, but they have also been solved in practice in an implementation at the University of Manchester Institute of Science and Technology.

It is estimated that this implementation could support via CLEF programs over half of the new features in ANS 81 COBOL and that more than 80% could be supported by a sufficiently enhanced version of the facility. Furthermore, those features which cannot be supported are generally the less useful ones in the new standard.

The facility is not limited to extensions to the language. For example, if the ALTER verb is to be banned,

```
ALTER SELECT-CODE TO PROCEED TO PROCESS-DEBIT
```

could be recognized and the corresponding CLEF routine could issue a suitable diagnostic message for inclusion in the compiler's diagnostic listing. Thus CLEF routines can be written to add extra features to and remove features from a COBOL compiler. If CLEF or some equivalent facility becomes generally available, users will be able to choose the version of COBOL they want, regardless of the compiler. This means that the applications source programs become portable between any two or more compilers by configuring them



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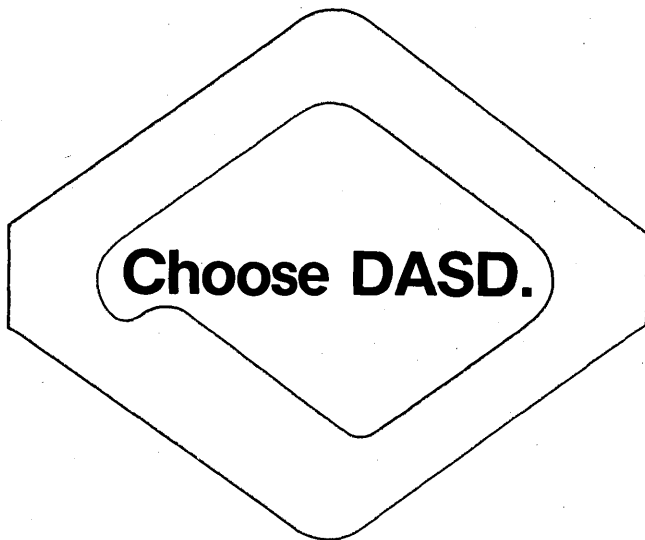
Theme of this year's Show is "**Computer Directions — 80s**" — which is apt because the more than 200 computer industry exhibitors at the International Centre will display and demonstrate the very latest state-of-the-art technology.

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both to the same version of COBOL. When transferring to a compiler, any CLEF routines currently in use which are needed on the new compiler can be transferred. Some new CLEF routines will, in general, be needed and some routines for features which are supported by the new compiler can be discarded. But the important thing is that the applications programs can remain unaltered.

A major danger with schemes such as these is that the COBOL language will diversify. At worst, every programmer might use a different set of ill-conceived enhancements for every program. The CLEF scheme is designed so that control can be exerted centrally within an installation. Enhancements can only be used after they have been submitted to the library run and a system of security locks can be used to prevent illegal submissions. This leaves each installation free to decide which version of COBOL to use and gives it the power to enforce its decision.

Larger installations may decide to design and code their own enhancements as many do now via preprocessors. It is envisaged, however, that medium and smaller installations will acquire pre-written enhancements from their compiler suppliers or software houses and that these will not be used to diverge from the standard. They will merely be used to provide what the user wants: an up-to-date, portable version of COBOL that is consistent with the installation's standards.

—T.M. Triance
 Manchester, England

NOTHING SUCCEEDS LIKE SUCCESS

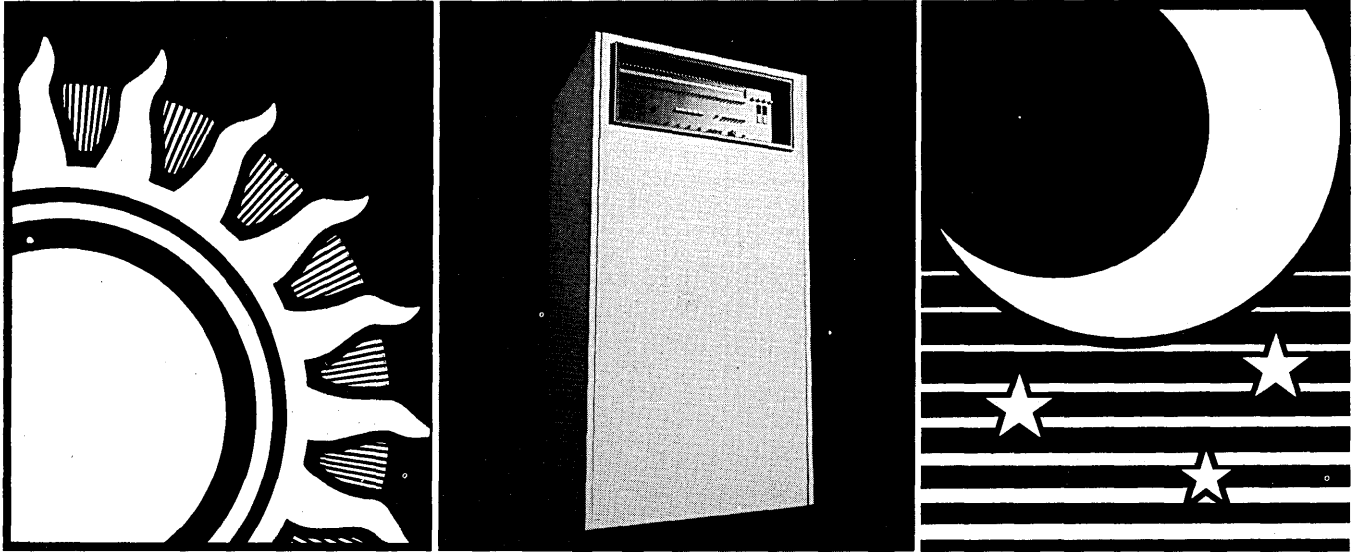
In the September 1979 "Reader's Forum" (p. 278), Robert L. Glass raised the question of why COBOL and FORTRAN have continued to be the most widely used programming languages despite the frontal assault of superior programming languages on the one hand and the more subtle challenge provided by structured programming on the other. I believe there are two reasons for this—both of which reduce to a simple common denominator.

Since many firms have a large investment in programs written in FORTRAN and COBOL, the conversion to another programming language would be very costly although it would likely produce considerable benefits in terms of increased programmer productivity and lower maintenance costs. Evidently, those responsible for the decision to convert to a "superior" programming language have perceived the costs to outweigh the potential benefits. Viewed in this light, their choice may be interpreted as a rational response to the facts.

Not unrelated to this decision are the preferences of programmers. Assuming they desire to maximize their income in the long run, talented programmers are understandably reluctant to accept employment in firms where a nonstandard language is employed since such experience adds little to their long-term income potential. As a result, firms choosing to employ a nonstandard language have to pay more to attract programmers of given quality. Obviously, this raises the cost, and therefore reduces the attractiveness, of using that language.

A new language, in order to be successful in displacing either COBOL or FORTRAN, must have outstanding potential. This sort of thing occurred years ago when the reduction in the cost of computing made assembly language programming inferior in the case of many applications to the then new high-level languages. FORTRAN and COBOL were seen to be overwhelmingly superior to assembly language because they dramatically reduced programming costs by substituting machine time for programmer time while providing nearly the same capabilities as assembly language.

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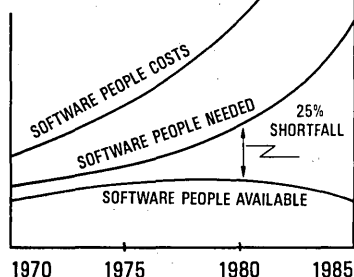
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The sharp decline in computation costs in recent years is likely to produce a similar result. Programming languages of the future will rely more heavily on the use of machine time and less on the programmer's time while providing the same power and efficiency of assembly language.

Basically the same reasoning can be employed in explaining the continuing success of IBM and DEC. Some of their competitors are producing superior hardware and software yet many buyers appear to continue to make irrational decisions in favor of these vendors. Once again, when one evaluates all the costs and benefits involved in the choice of a computer system, the decision to favor the established leaders is not necessarily irrational. One of these costs is that of finding people who are willing to work in a non-IBM or DEC environment. Once again, it appears that they perceive the long run benefits of experience gained working with nonstandard equipment to outweigh the benefits. Consequently, it is more difficult to find qualified personnel to work in such environments.

The competitors of COBOL and FORTRAN, and IBM and DEC can expect to make significant gains only if they can demonstrate greater long-term advantages to following them instead of the entrenched leaders. This is the challenge the innovators must address if they are to make a significant dent in the market. As long as the market is growing rapidly, this is possible. However, once growth slows, prospects dim as the leaders consolidate their positions, and the weaker competitors are forced to leave the industry.

—Raymond A. Pepin
North Easton, Massachusetts

LET SLIP THE DOGS OF WAR

In recent years the declining cost of digital hardware has led to an enormous proliferation of computers. The entire spectrum of machines (from the smallest home microsystem to the largest scientific number-cruncher) has permeated the marketplace, almost to the saturation point.

But the cost of *software* has shown no such happy trend. This combination of easy-to-get hardware and nearly impossible-to-afford software has come to what now appears to be its inevitable conclusion: frustration. This frustration, in turn, has had a secondary affect with implications that threaten to eat at the very foundations of the American way of life: crime.

If software can not be purchased at a reasonable price, there are always those who will steal it. People who normally wouldn't willingly commit even the most minor of violations now plot vastly skillful, daring, white collar crimes. A particularly illuminating example of this activity was recently brought to the attention of the authors.

As the founders of and technical principals in Watchdog Software Systems, (a New Hampshire corporation), we were approached by a well-known New England computer manufacturer. It had been able to determine that the latest version of its popular operating system had been purchased (by an unspecified individual), but with *no license to copy*. No matter. This individual proceeded to hand out copies of the operating system like political campaign leaflets, apparently to his financially strapped colleagues in academia.

Our response to this problem was the development of GUARD DOG I, a macrocoded package that rides piggyback on the operating system. GUARD DOG I periodically (once every 50,000 memory cycle times) checks the serial number of the computer it's running in (this number is stored in epoxy sealed PROM during manufacture) against a preprogrammed number. Any discrepancy (or if there is *no* serial number available) means GUARD DOG I has been stolen (along with the operating system) and is running bootlegged on an illegal machine. GUARD DOG I immediately trips into an unrecoverable error trap that HALTs the computer.

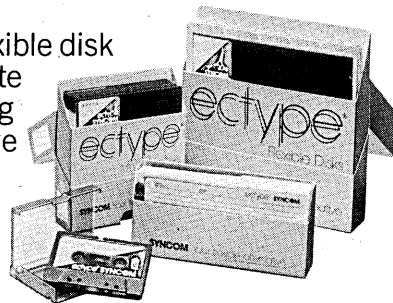
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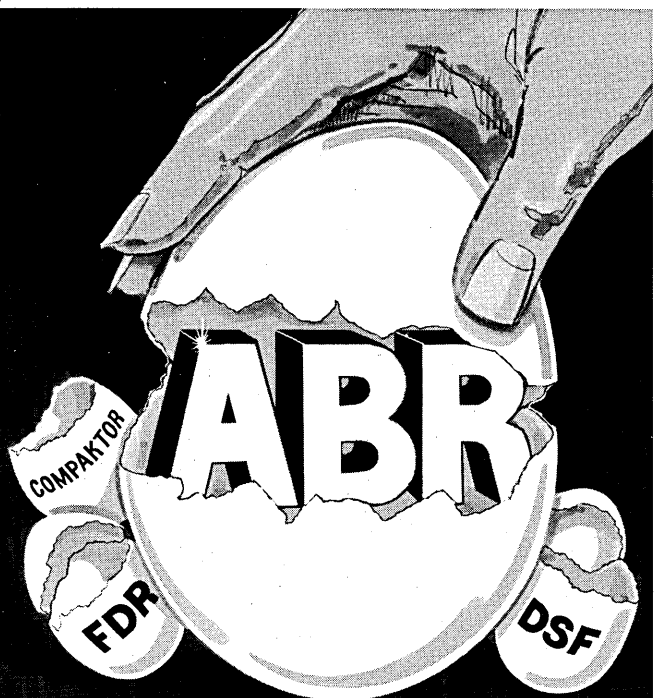
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READERS' FORUM

With GUARD DOG I the machine can be restarted. Another error trap will occur only 50,000 cycle times later, but extensive human factors testing has shown that even this will not deter the hardened software criminal. Hence, the creation of GUARD DOG II.

This new version doesn't halt the computer, but causes a programmed interrupt to one of three subroutines. During construction of its machines, our client now incorporates special I/O-drivers that interface the peripheral databus to a Klaxon, a tear gas bomb, and a radio transmitter. Upon determining it has been kidnapped, GUARD DOG II first interrupts to subroutine HORN, which activates a compressed air can coupled to the Klaxon. The resulting shrieking blast lasts 30 seconds, and reaches a noise level of 276 decibels, equivalent to the noise of an exploding steam boiler made of five-inch steel plate, at a pressure of 19,000 psi.

Immediately after processing HORN, a second interrupt transfers control to BOMB, which explodes a standard Army teargas grenade containing five cubic centimeters of liquid terchloroxyhydraline-metha-4. Besides causing the eyes of all nearby personnel to water, it will cause them to lose their hair; they will get ingrown toenails; and, in the next 10 years, they will have a positive blood test for social afflictions.

Finally, a third software interrupt activates subroutine BLAB, which turns on a 200-watt radio transmitter. This continuously broadcasts a sequence (stored in PROM) of the 50 most vile English words. This of course, will result in, the FCC using its radio direction finders to locate the offending computer, with the subsequent arrest, trial, and incarceration of all personnel.

But even GUARD DOG II is not the ultimate in computer software security systems. In retribution for software theft our manufacturing client desired something even more punitive. We have developed GUARD DOG III.

GUARD DOG III performs a software interrupt to just one subroutine. This subroutine drives the I/O-software that operates a special whistle at a carrier frequency of 23 kHz, a tone audible only to dogs. Special coded modulation on this audio carrier-wave induces all the local dogs to seek out the origin of the whistle and assume it is a hydrant. This causes short-circuit fires and the destruction of the computer. We believe GUARD DOG III to be a true breakthrough in the protection of software from those who would steal.

—Williard P., Hubert U., and Kermit W.
Watchdog Software Systems
Durham, New Hampshire

Solution to puzzle on page 232

A	E	T	A	S		I	D	E	A	L		B	S	E
C	R	A	P	E		B	A	S	S	O		O	T	T
M	A	X	P	A	L	E	V	S	K	Y		Z	E	N
E	M	I	L		O	R	E			A	R	O	M	A
			E	T	U	I		C	O	L	E			
A	S	P		O	R	A	T	O	R		D	E	L	
S	H	E	I	K		A	N	I		T	A	U	S	
H	E	R	B	E	R	T	R	J	G	R	O	S	C	H
E	D	I	E		O	R	R			O	P	E	R	A
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B	R	A	S	S		O	P	T		A	B	C	D	
O	E	R		S	E	Y	M	O	U	R	C	R	A	Y
N	N	E		A	L	O	E	S		U	K	A	S	E
A	D	S		Y	O	U	R	E		E	S	T	E	S

CIRCLE 195 ON READER CARD

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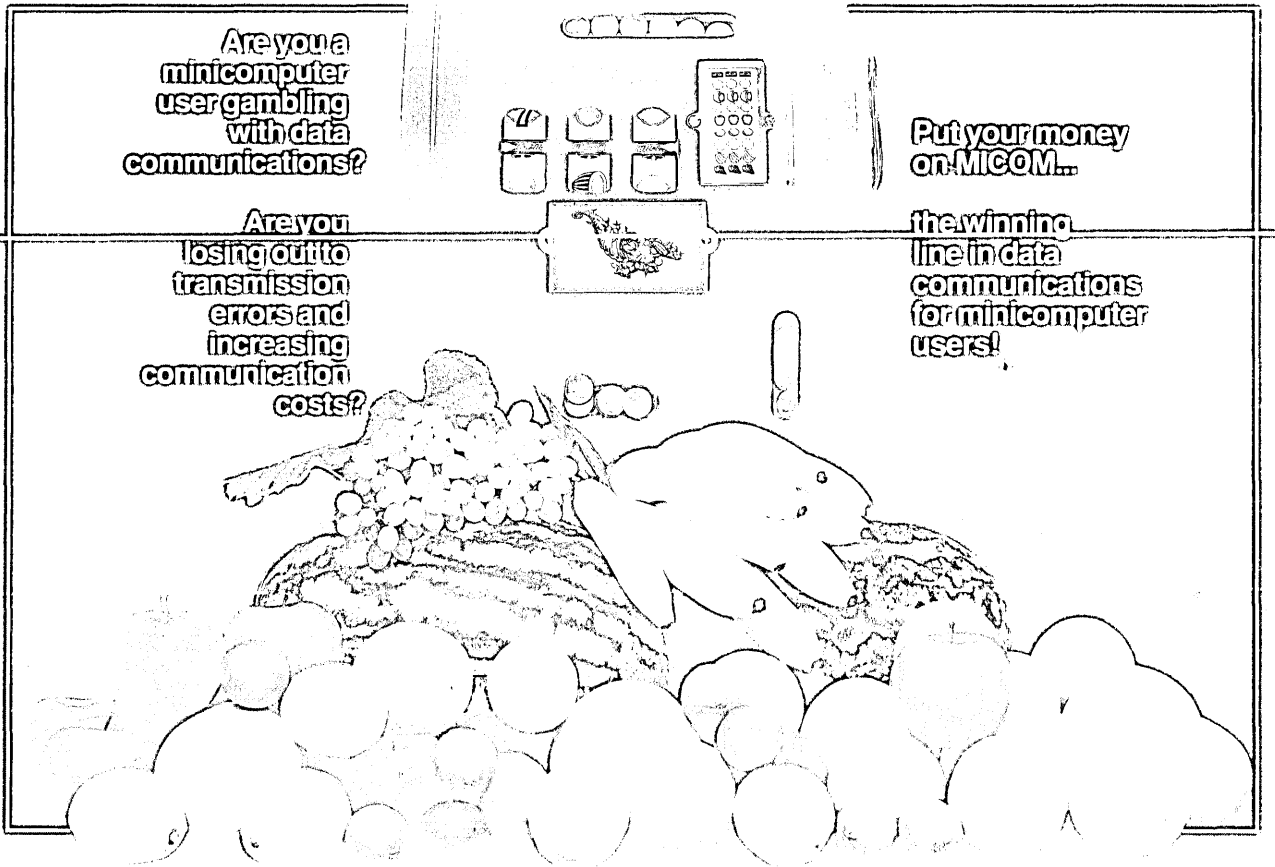
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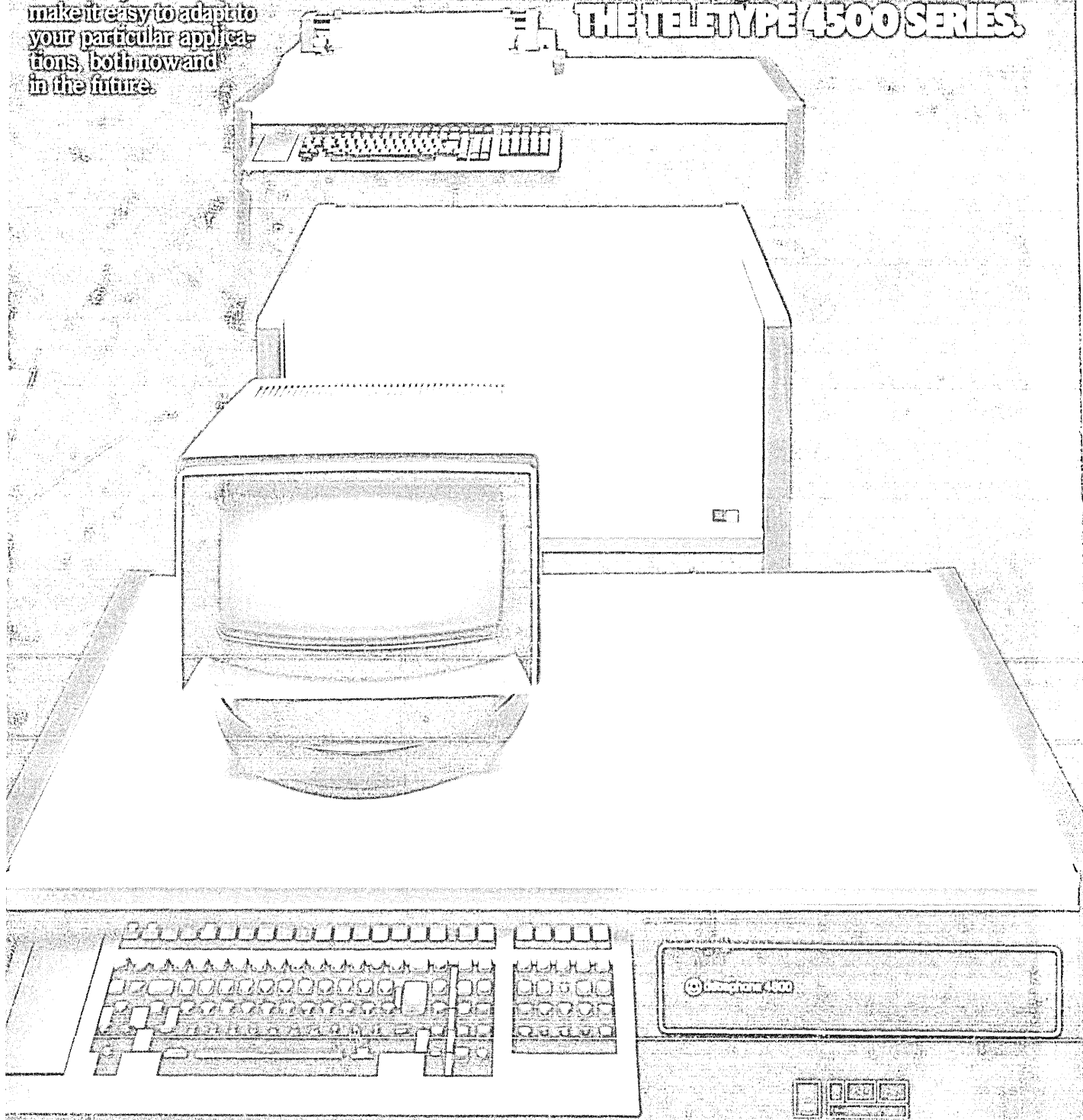
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