1957
DATAMATION®
77
1977
July

PERSONAL COMPUTING

Also. From IBM to Amdahl, microcomputer software, Fortran portability, software testing . . .

Models 9100/9300 Vacuum Column Tape Transports. We didn't have to make them this good.

Kennedy vacuum column digital tape transports have been the standard of the industry from their introduction. Some companies would have stopped and relaxed. We didn't. We added features such as our capacitive tape-location detector, for improved tape life; air bearings and tribaloy coated read-after-write heads to reduce tape wear and improve data integrity, and we've achieved the lowest noise level in the industry.

Performance is just as impressive, with tape speeds to 125 ips (75 ips on Model 9100) and operating features such as crystal controlled timing, read threshold scanning, read-after-write shortened skew gate, front-accessible test panel, quick-release hubs and simplified tape loading.

Data densities are 200/556 cpi or 556/800 on our 7-track unit and 800 cpi, 1600 cpi or 800/1600 cpi on the 9-track transport. The format is NRZI/PE.

We could have eliminated some of the features of Models 9100/9300, and still have a transport as good as the best. But we didn't. It's a Kennedy product and it has to be this good.

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When CMC delivers... there's something for everybody.

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The Supersystem. To be honest, we didn't name it that. A leading computer magazine did—on its cover. Totally modular, it brings powerful distributed data entry to medium- and large-scale operations. Up to 64 local and remote keystations...or just a few. With concurrent operations, multi-volume disk storage, report writing languages, and a file retrieval bonus that tops off the package. It's our CMC 1800 KeyProcessing® System. But when you order it, just ask for The Supersystem.

The DREAM Machine. When your dream is a distributed processing system that does it all concurrently—Data Retrieval, Entry And Management. Everything you need to put processing power at the source—where information originates. Order the XL40 Distributed KeyProcessing® System. You'll get a microprocessor-based system for growth and flexibility. Plus expandable disk storage. A multi-task operating system. And COBOL Shared Access Method (COSAM) information retrieval. A dream that's yours for the asking.

We were the trail blazers in shared-processor data entry—the company that set the standards for the industry. Now CMC is a division of Pertec Computer Corporation, with over $100 million in revenues and solid financial resources. And we're still setting the standards wherever we go.

Start the truck rolling—when CMC delivers, there will be something for *you*. Send your coupon today. Or call CMC at (213) 822-9914. TWX (910) 343-6451.

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☐ XL40 DREAM Machine
☐ All three systems

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ITEL'S ADVANCED SYSTEM.™ THE SENSIBLE ALTERNATIVE.

As a matter of fact, it's the only sensible alternative to the IBM-370. Because Itel's Advanced System not only gives you everything its IBM counterpart does (in some cases, even more), but gives it to you at enormous savings.

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And the Advanced System comes complete (including a 180 cps printer, not shown). No optional "special features" that often cost you almost as much as the system itself.

To prevent obsolescence (and protect your investment), all of our six Advanced System models can be either upgraded or downgraded—as the situation demands.

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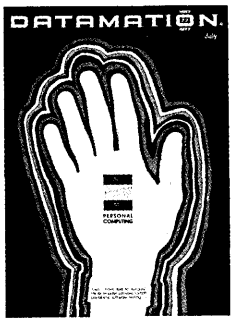
CIRCLE 55 ON READER CARD

DATAMATION®
1957 77 1977

VOLUME 23 NUMBER 7 This issue 130,000 JULY 1977

FEATURES



NEWS IN PERSPECTIVE

DEPARTMENTS

About the Cover
Whether it involves small systems built to your needs or put together with your own hands, personal computing means the extension of capabilities and the fun of pursuing unique possibilities. Our design is by Barbara Benson.

DATAMATION.

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EDITORIAL OFFICES
Headquarters: 1801 S. La Cienega Blvd., Los Angeles, CA 90035. Phone (213) 559-5111. **Eastern:** 35 Mason St., Greenwich, CT 06830, (203) 661-5400. 420 Lexington Ave., New York, N. Y. 10017, (212) 682-7760. 134 Mt. Auburn St., Cambridge, Mass. 02138, (617) 354-2125. 6605 Burlington Pl., Springfield, VA 22152. (703) 569-3383. **Southwestern:** 2711 Cedar Springs, Dallas, TX 75201. (214) 744-0161. **Western:** 2680 Bayshore Frontage Rd., Suite 401, Mountain View, CA 94043, (415) 965-8222. **Foreign:** 15 A St. Ann's Terrace, St. John's Wood, London, NW8, England; (01) 439-8466; 24 Stafford Road, Artarmon, Sydney, NSW 2064, Australia, 41-5748.

GRAPHIC DESIGN & PRODUCTION

Art & Production Director	Cleve Marie Boutell
Advertising Production Manager	Marilee Pitman
Production Assistant	Alberta R. Martin

CIRCULATION
35 Mason Street, Greenwich, CT 06830

Circulation Manager	Suzanne A. Ryan
Marketing Research Manager	Deborah Dwelley
Publisher	James M. Morris
Assistant Publisher	F. Douglas De Carlo

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Our high-speed, non-impact printer has just sharpened its teeth.

Now it's available in a lower-speed, lower-cost model.

Honeywell's Page Printing System will deliver up to 18,000 lines — that's 210 pages (11 x 8½ inches) a minute.

In fact, some of our busier customers have been printing nearly 3 million pages a month on a single system.

And for those who don't need 18,000 or 12,000 lines a minute, we've just announced a lower cost 8,000 LPM version with all the other features of the faster models.

All models print your forms or letterheads while they print your variable computer output. There's no need to stockpile forms.

And, since the Page Printing System works off-line, it can be used with nearly all IBM or Burroughs computers as well as Honeywell's. Without program changes.

The PPS prints from a continuous roll of paper. Pages can vary from three to 14 inches in length, and from 8½ to 11 in width. And since it cuts, punches, perforates, collates, stacks, and even applies addresses for mailing, all in one pass, you eliminate a lot of time-consuming handling and rehandling.

There's a variety of crisp, readable type fonts available. And when you need copies, you can forget about carbons. Every one is an original.

For still more facts and figures, write for our free brochure. And if you'd like us to arrange a demonstration, we'll do that, too. Your output tape or ours.

Sculpture, incorporating state-of-the-art CML computer circuit components, created expressly for Honeywell by Joe Veno.

Honeywell

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200 Smith Street (MS 487)
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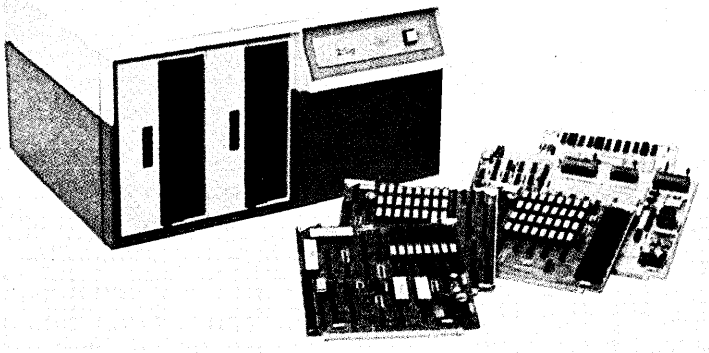
CIRCLE 44 ON READER CARD

Zilog introduces the first Z-80 disk based microcomputer system.

The Z-80 MCS Microcomputer—designed to be the most advanced general purpose microcomputer available today. You get massive computing power at a price so low you'll find it most difficult to believe.



A bold new weapon is Zilog's breakthrough Microcomputer System.

It's a general purpose unit that gives users high performance at remarkably low cost—and it features all the reliability and low maintenance you have come to expect—and get—from Zilog.

Just for starters consider these Z-80 MCS system features.

- Full use of the powerful Z-80 CPU with its 158 instruction set, considered to be the most advanced in the industry.
- Main memory storage capacity of up to 64K bytes of RAM, PROM or EPROM. The standard basic system comes with 3K bytes PROM and 16K bytes of dynamic memory.
- Dual floppy disks with 600,000 bytes of storage.
- RS-232 or current loop serial interface for communication with a CRT or TTY. And room is available to add more.
- Two parallel I/O ports for simple interface to other peripherals, and more ports are available.

And a nine slot card cage, housed along with everything else in a heavy duty metal chassis, allows the Z-80 MCS the expansion capability and flexibility you need for design options. And you get a full complement of expansion cards. Read on.

Standard software ready for development.

With the MCS you get a PROM Based Monitor. A Macro Assembler, File Maintenance, Editor, Debug and Utility Routines are also part of the standard package.

Available options: BASIC. MCS/RIO with relocating assembler and linking loader. And coming soon a powerful repertoire of programs including MCS-COBOL and PLZ.

Needless to say complete documentation and system support comes along as part of the package.

Get unprecedented power thanks to the Z-80 MCS internal architecture.

Not only does it include all of the instructions of the preceeding processors, but goes far beyond.

Memory Block moves. Up to 65K bytes can be moved at the rate of 8.4 microseconds per byte.

Memory Block searches. The entire memory of the system can be searched with a single instruction.

Block I/O operations. I/O transfers at rates of up to 125 kilobytes/second can be accomplished under software control.

Bit Handling. Any bit in any register or memory location can be set, tested or cleared with a single instruction.

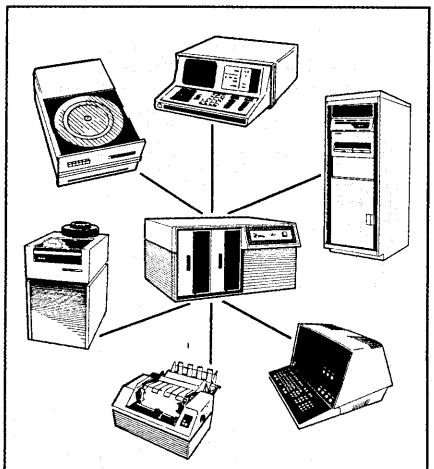
Relative Jumps. Short, two-byte relative control transfers reduce program sizes. Three-byte absolute jumps provide access to any memory location.

Eight and sixteen bit arithmetic operations provide fast data and address calculations. BCD arithmetic and shifting is also supported.

Plug in these cards to further expand the Z-80 MCS's capabilities.

- RMB: contains 16K bytes of RAM consisting of 4K dynamic RAM devices.
- IOB: allows you to expand the system by four I/O ports per board.
- SIB: allows you to add 4 Serial RS-232 ports per card.
- PMB: contains 16 sockets for additional PROM Memory per board.

Configure the MCS the way you want it.



8 connector slots let you add a variety of peripherals such as CRT, printers, paper punches, etc. It's your choice.

This is all a part of our pledge.

That pledge, to stay a generation ahead is further demonstrated by the new Zilog MCS. We urge you to learn more and a suitable brochure has been prepared. It can be yours, just write or call.

Zilog

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Looking Back in DATAMATION®

On our 20th anniversary

July/August 1958

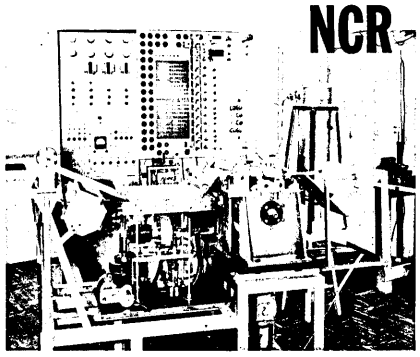
Our feature article, "Design of the Perceptron," reported that a machine operating on the principle of the human brain appeared to be possible, at least as a laboratory model. The model, performed on an IBM 704, simulated the presentation to a crude visual, sensory device of a number of different stimuli. After only a few applications of the appliance stimuli, the simulated system in the 704 was able to recognize which of the stimuli was presented to the input.

Is it possible for a machine to have original ideas? Said developer Dr. Frank Rosenblatt, a research psychologist at Cornell under contract to the office of Naval Research, "With regard to the perceptron, it appears that we must answer this question concerning original ideas in the affirmative."

New Systems:

The new Orthotronic Control system from Minneapolis-Honeywell was reported to insure virtually uninterrupted accuracy in dp by correcting mistakes "on the fly." The system was to recreate source data and provide instant data reconstruction of lost or garbled words or figures when discrepancies were spotted at one of a series of checkpoints throughout the system.

Our survey of high speed printers included units from Burroughs, Analex, Datamatic, Remington-Rand, NCR, SC, and IBM developed along three lines—mechanical printers, cathode ray tube display devices, and those using electrofax techniques.



Communications:

The newly established Center for Communications Sciences at MIT was studying the communications operations of the nervous system and of such machines as computers, as well as methods of communication between the two. Commenting on the program, director Dr. Jerome E. Wiesner said, "We build computers which analyze data faster than we can use the answers. Man can't think rapidly enough to keep up with them. On the other hand, computers are not sufficiently flexible to be as useful as they could be . . ."

July 1967

EFTS:

Attendees of the American Bankers Assn. National Automation Conference jammed sessions on "Toward a Checkless Society." It was expected that the checkless or near checkless society would be hitting its stride by 1975 to 1980, but that major problems would have to be overcome in areas of information system and communications development, identification hardware, cards, numbers, and other security measures . . . and acclimating the customer to this new way of buying.

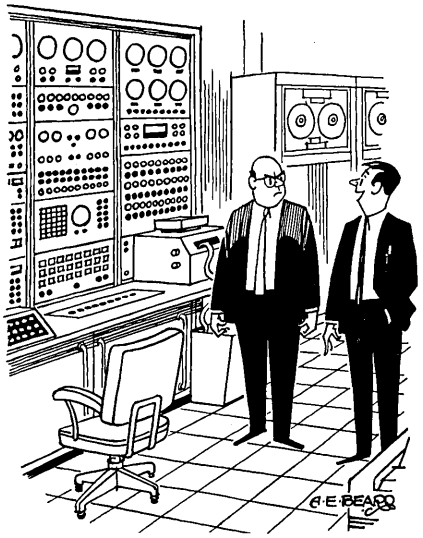
An ABA survey showed that as of March 1967, 1,371 banks were issuing or planning to issue credit cards. ABA v.p. James Vergari thought that elimination of the check was not the answer, but that the volume of checks could be reduced by vigorous use" of preauthorized transfer of funds and the computerized giro system based on a machine-readable stub bill issued by the creditor.

Penalties:

The liquidated damages section of California state's contract for dp system suppliers required that the hardware supplier pay $100 for each tardy day, or 1/30th of the monthly rental, for late software up to six months.

Companies:

There was big interest in Informatics' MARK IV file management system, with firm orders for more than 50 installations reported. In this summer of 1977, over 1,200 systems with a value of $40 million have been delivered. ❋



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Our new subsystem appears to a 360 or 370 exactly as an IBM subsystem. That's where the similarity ends. We build in a lot more efficiency for a lot less money. The DOC 2250 Line Printer is 12½% faster than a 3211. Over twice as fast as a 1403. With an integrated controller you need less space and can perform off-line diagnostics. The DOC 6520 Punch comes with an optional interpret feature. Our buffered DOC 6501 Reader, featuring the patented pick mechanism, virtually eliminates systems halt due to channel overruns. And, we think you'll especially like the price/performance we built in. Our reputation depends on it.

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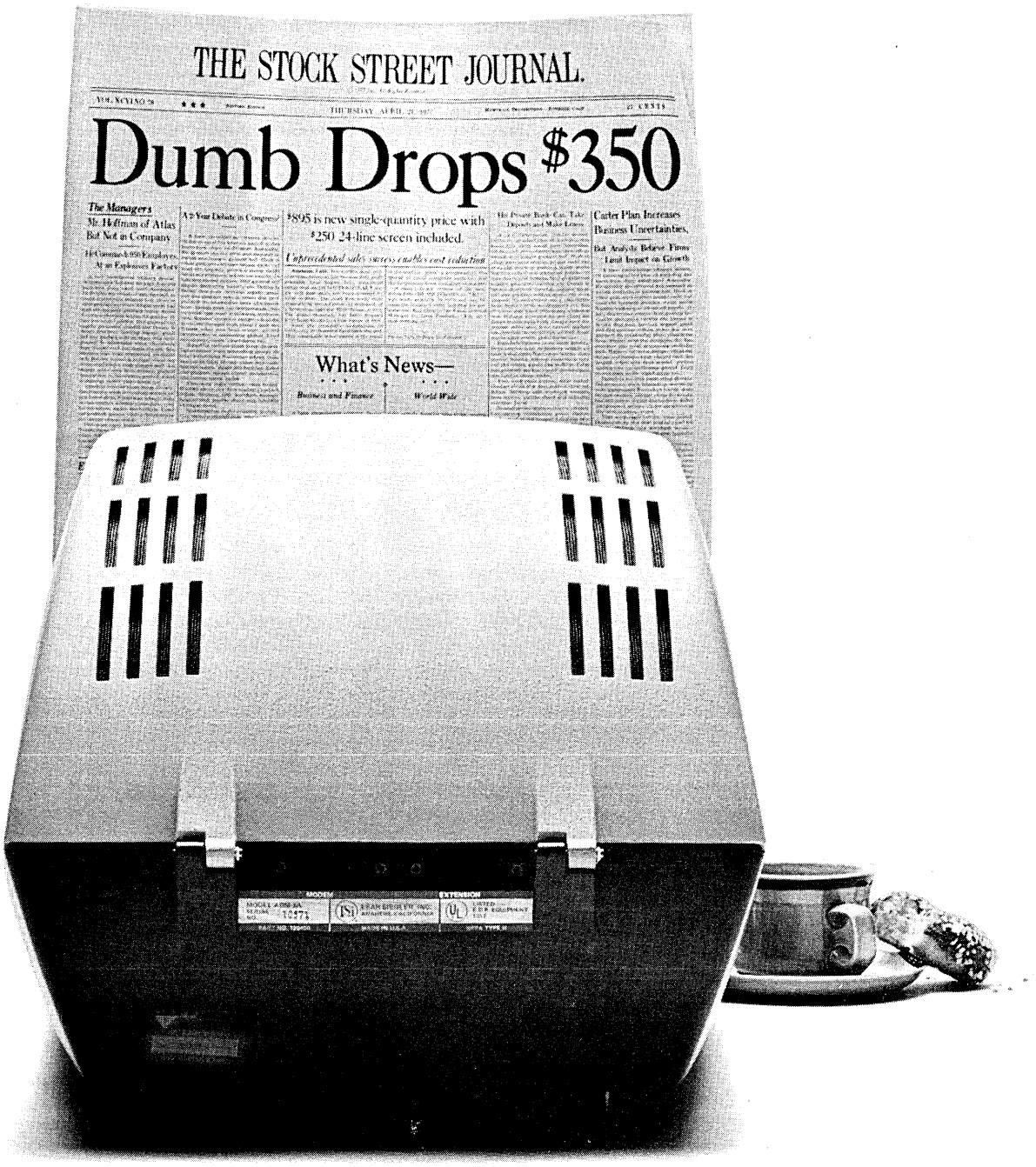
CIRCLE 45 ON READER CARD



Only the Dumb Terminal could sell itself short.

LSi®

DUMB TERMINAL™ EVEN SMARTER BUY.

The Dumb Terminal™ terminal is the registered trademark of Lear Siegler, Inc./Electronic Instrumentation Division, Data Products
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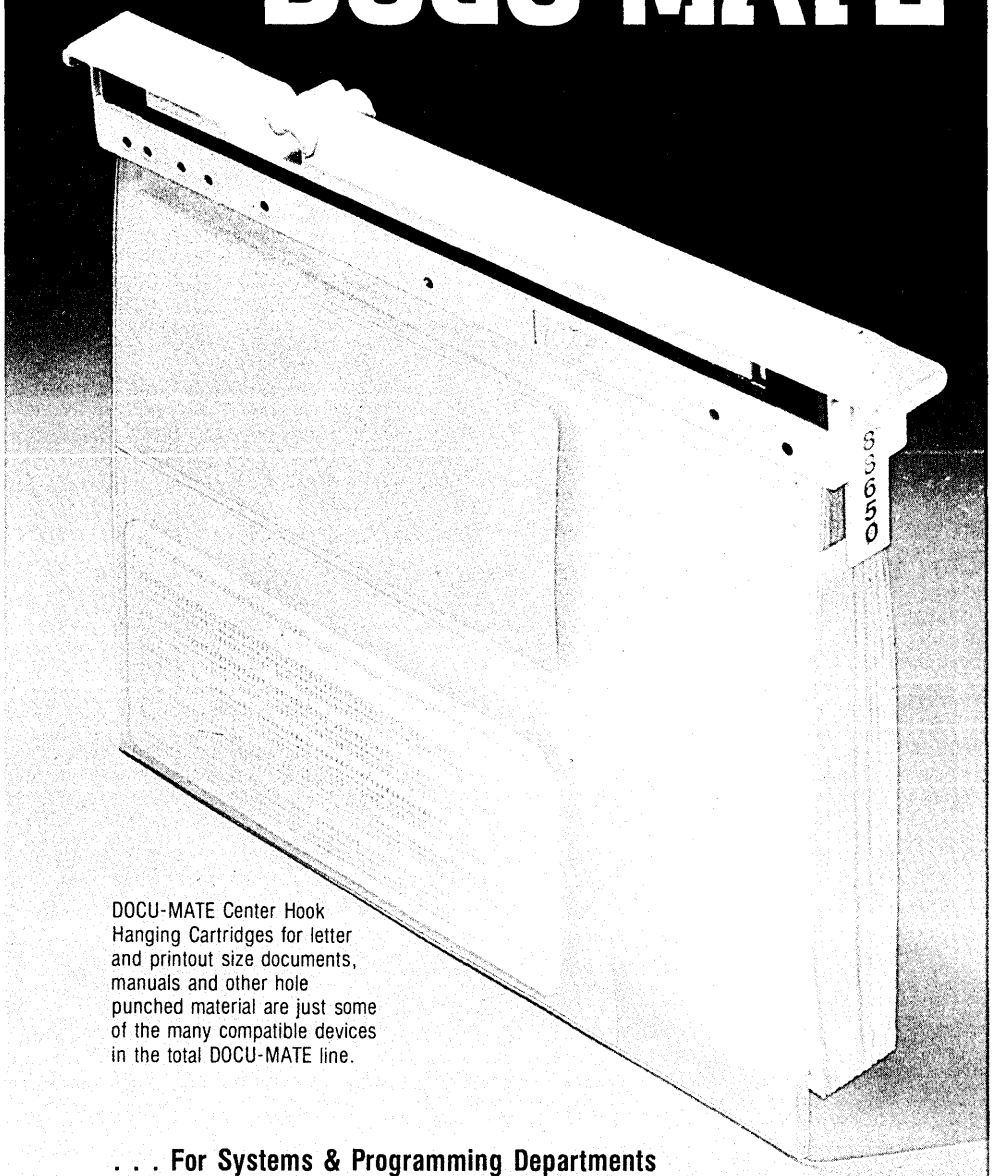
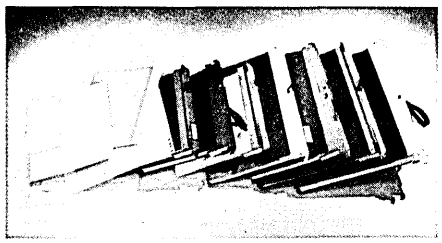
How to manage and control your DP Documentation with DOCU-MATE™



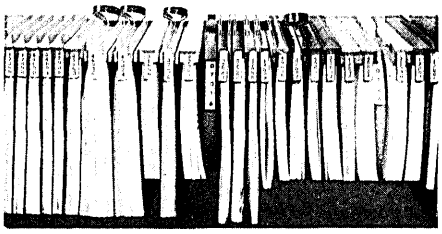
DOCU-MATE Center Hook Hanging Cartridges for letter and printout size documents, manuals and other hole punched material are just some of the many compatible devices in the total DOCU-MATE line.

. . . For Systems & Programming Departments

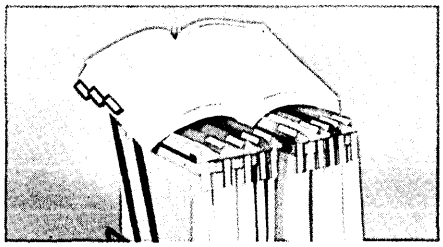
- **Improve Project Control**
- **Increase Programming Productivity**
- **Improve Inter-Department Communication**
- **Reduce Documentation Filing Cost**



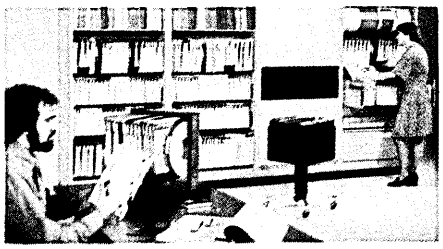
The DOCU-MATE System includes hanging cartridges, binders, folders and documentation holders for every size and shape of documentation including manuals, letter size documents, printout, cards and flow charting forms.



The DOCU-MATE System provides complete filing compatibility. Each DOCU-MATE device fits interchangeably in all equipment. You don't have to collect documentation packages from a number of conventional single purpose files and then explode them again for refiling.



The DOCU-MATE System recognizes both a filing and a reference mode. The same devices used for filing fit into an ingenious array of desk racks, desk sides, mobile units, reference stands and roll-out reference files that allow you to reference documents without removing them from the file.



The DOCU-MATE System provides equipment for every need as documentation flows through the information system including lockable filing cabinets, open library filing, units and work station configurations for programmers, systems analysts, computer operators and even user department personnel.

For complete information circle readers' service number or call today for new 32 page color brochure.

In the U.S.A.: WRIGHT LINE INC., 160 Gold Star Boulevard, Worcester, Massachusetts 01606, 617-852-4300; TELEX 920-452, Cable Address: WRIGHTLINE, WORCESTERMASS. Area Offices: Boston 617-879-4160, Metropolitan New York 201-263-5300, Hartford 203-677-8581, Philadelphia 215-563-8666, District of Columbia 301-468-2100, Atlanta 404-455-1146, Columbus Ohio 614-864-2096, Chicago 312-593-0600, Los Angeles 213-788-2343, Dallas 214-241-8761, Denver 303-770-7550, San Francisco 415-692-1741 and sales offices in all principal cities. In Canada: THE WRIGHT LINE OF CANADA, LTD., 51 Esna Park Drive, P.O. Box 600, Agincourt (Toronto) Ontario (MIS9Z9) 416-495-6303 Area Offices: Toronto 416-495-6303, Montreal 514-737-1188, Ottawa 613-233-7624, Quebec 418-527-6845, Vancouver 604-685-2812 and sales offices in all principal cities. In Europe: WRIGHT LINE GmbH, Orber Strasse 24, 6000 Frankfurt am Main, West Germany, 41 03 62, TELEX (841) 417361 Area Offices: Switzerland 01/820 9075 TELEX 54177, Sweden and Denmark 02/965366 TELEX 33468, Netherlands (02520) 21077, United Kingdom 01/644 4355, West Germany 41 03 62 TELEX 417361, Italy 2566849. For all other countries throughout the world, contact: WRIGHT LINE INC., International Division, Worcester, Mass., U.S.A.

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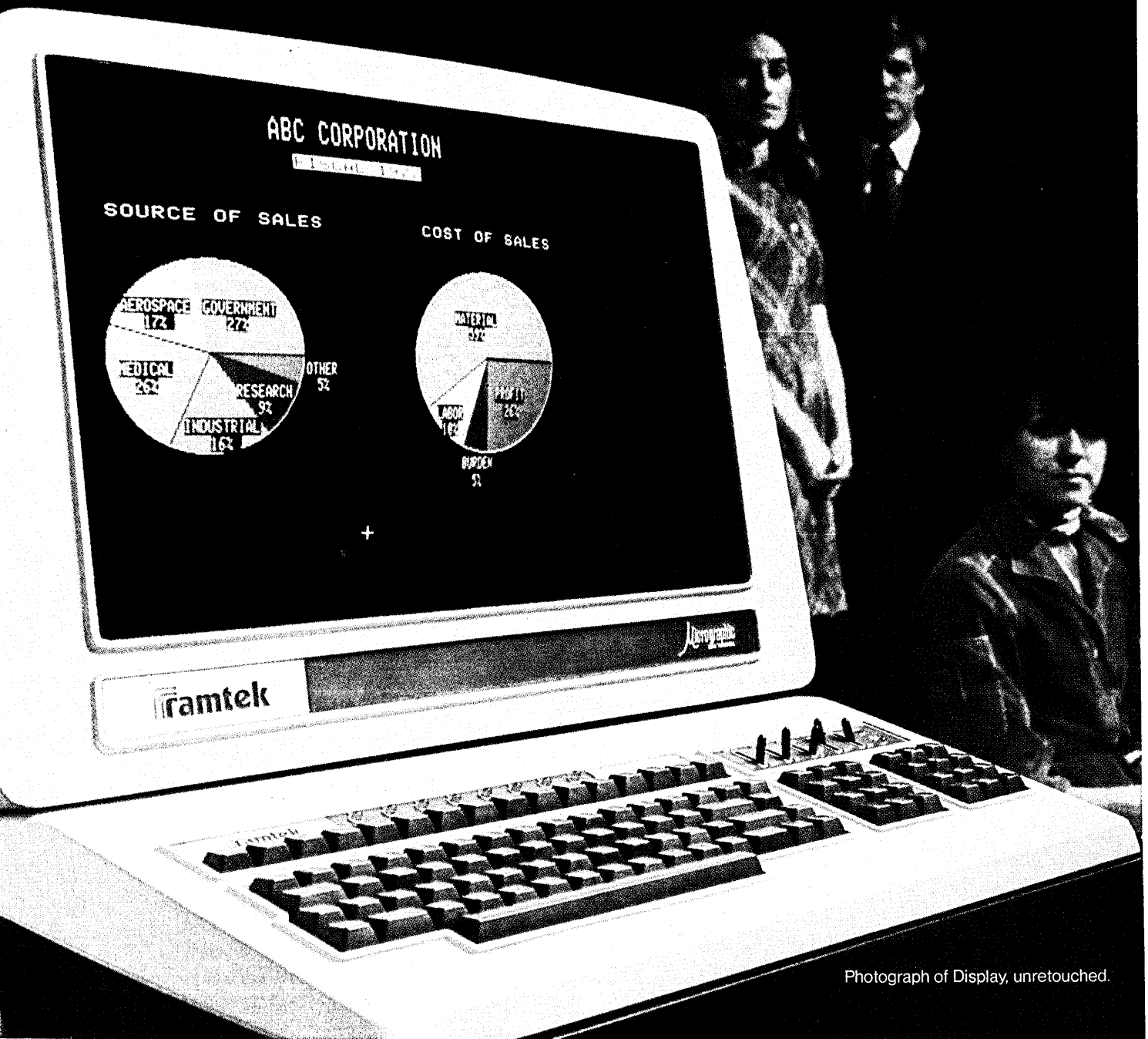
CIRCLE 5 ON READER CARD

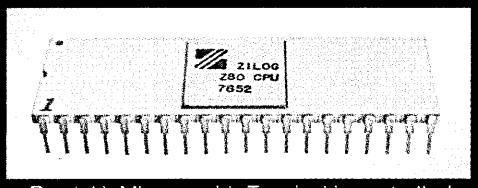
Look what Ramtek has done to graphic terminals.



Photograph of Display, unretouched.

Now you can get quality resolution and a combination of true graphics and true alphanumerics at an affordable price.

Ramtek introduces the new Micrographic Terminal. No longer do you have to settle for poor resolution or give up color in economy priced display terminals. Ramtek gives you a high resolution, flicker-free display on a resolvable matrix of 512 elements by 256 lines. And you get a choice of black and white or any 8 of 64 colors as well as split or dual screen capability. The independent alphanumeric refresh offers you single character addressibility within a visible matrix of 25 rows of 80 characters that are crisp, sharp and well defined.



Ramtek's Micrographic Terminal is controlled by a powerful Zilog Z-80 with 28K bytes of PROM and 16K bytes of RAM.

In addition you can program the Ramtek Micrographic Terminal and give it the dedicated capability and intelligence you need for your application. Ramtek's software gives you TTY compatibility and high level graphic functions commanded by ASCII text strings. You can choose from an extensive list of options such as floppy disc interface, additional serial I/O ports, alphanumeric overlays, user defined fonts, color selections and packaged software.

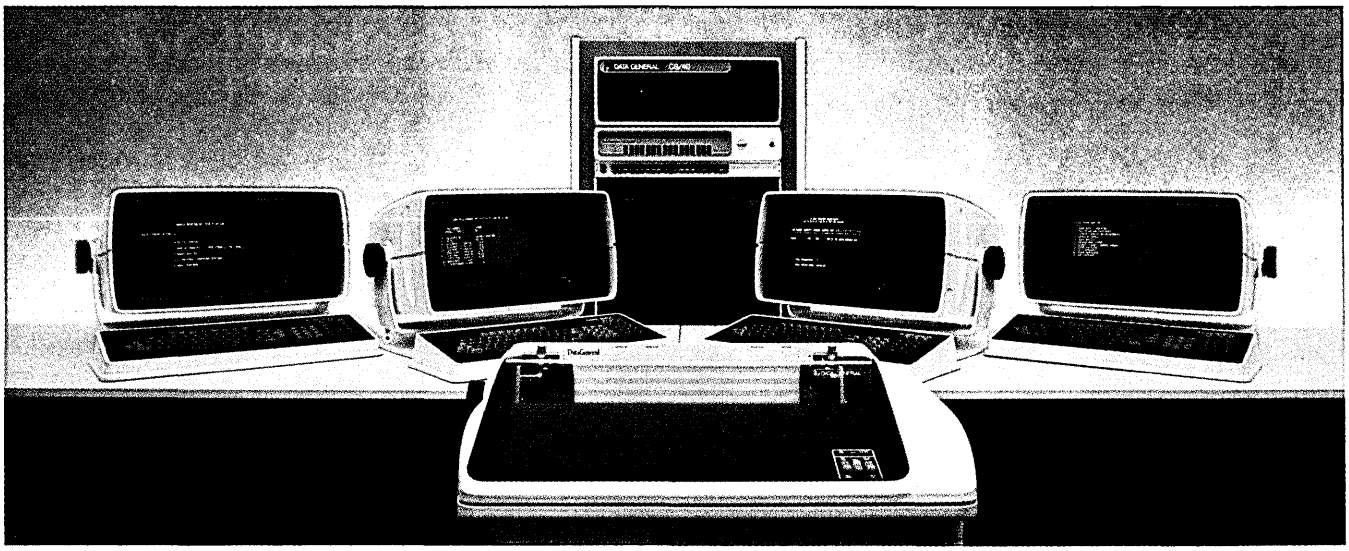
More good news: prices for a black and white basic system begin at just $4,700 and for color at only $5,400.

But to fully appreciate the contribution the Ramtek Micrographic Terminal can make to your application, you'll need to know more details. Just call or write Ramtek Corporation, 585 N. Mary Ave., Sunnyvale CA 94806. If you're really in a hurry call us at (408) 735-8400 and ask for Todd Martin.

ramtek

Our Experience Shows

At last. The small business systems nobody's waiting for.



Data General's new Commercial Systems CS/40 models. They don't keep you waiting because they work the way business works. Interactively.

Multiterminals, no waiting. CS/40 puts data processing power right where your people need it, when they need it. In a distributed network or as a stand-alone system handling multiterminal applications or multiple single terminal applications or both. So some users could be updating inventory, while others enter orders, check payables, and process the payroll. All at the same time. And managers can still access the system any time.

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LOOK AHEAD

CONGRESS UNEASY OVER COMMUNICATIONS SECURITY

The hot button topics of privacy and security have been revised again on Capitol Hill. This time, it's the House and Senate Communications Subcommittees that are taking a closer look at the need for security safeguards in communications transmission. Concerned over the potential threat of information interception through unsecure communications lines, communications experts have warned Congress of the danger of sensitive information falling into the hands of underworld operatives or foreign intelligence sources.

The Federal Communications Commission also may get into the act. With the increasing use of communications facilities for such things as electronic mail and electronic funds transfer, the commission will be "feeling the heat," says one source, "to do something in the security area."

What they might do, he speculates, is start up an inquiry to evaluate the need for and availability of security gear for all levels of communications.

AND NOW TENNESSEE

Bob Sherrin, who is gaining a reputation as something of a Don Quixote of the data processing software and services tax issue (June, p. 15), has added Tennessee to the list of states he has taken on. Sherrin, president of Nova Computing Services, Inc., Miami, won a legal battle in Florida to offset software sales taxes and has petitioned the state of New York's taxing body for hearings on the matter. Last month he filed a class action suit against the state of Tennessee in U.S. District Court, Middle District of Tennessee, alleging that state's legislature and governor were out of line in passing two bills taxing computer software as tangible property in the face of an earlier decision by the Tennessee Supreme Court that software is intangible and tax exempt.

He seeks an injunction against imposition of the tax on behalf of "all software persons." Sherrin said he has been promised a "notice of hearing" in New York and expects hearings next month. "I am extremely encouraged by New York. Companies with assessments can hold millions of dollars in abeyance pending the outcome of the hearings."

He deplores the fact that "people who can do things aren't doing anything." He said that both DPMA and ADAPSO, while involved, aren't funding any efforts. "I'm asking only for expenses now."

COMMISSION TO CONSIDER AT&T SPIN-OFF

The Federal Communications Commission is about to open another can of worms. Within the next several months, the communications authority will launch a full-scale inquiry into whether AT&T's competitive services should be spun off into a separate arm's-length subsidiary. The competitive services targeted for splintering would include Bell's private line services, Dataphone Digital Service (DDS), Dataphone Switched Digital Service (DSDA), as well as Dataspeed terminal gear.

Anticipating this move, AT&T is expected to file a timely tariff to lay the ground work for its not-so-secret Bell Data Network (BDN) which will bundle together all the company's data communications services. In the offing the last several months, BDN, according to AT&T watchers, will be run as a separate subsidiary. But the real clincher, says one anti-AT&Ter, is that the operation will be regulated. "That," he claims prophetically, "should send shivers through the computer industry's spine."

REMINISCENT OF THE PONY EXPRESS

One user's solution to the high transborder line costs involved in multinational data communications was described at the National Computer Conference last month by British consultant David Hebditch. This user, a petrochemical company, wanted to link a plant in Rotterdam, Holland, to a facility 60 miles away in Belgium. Transborder line costs would have

been $14,000 yearly. The firm chose instead to house a messenger at the border who would receive transmissions at home and hand-carry them into Belgium.

THE 32-BIT MINICOMPUTER SWEEPSTAKES

With Digital Equipment Corp.'s much rumored 32-bit computer, code named "VAX," expected within the month, Wall Street insiders who carefully track the mini market are talking about a quick follow-on entry from Data General. "When DEC brings out their 32-bit, DG will be right behind them," promised one major analyst. Other 32-bit touts talk of Prime Computer, already in the market with a hybrid model 500--a 32-bit processor that uses 16-bit memory with interleaving. Soon it will offer "a real 32" with a wider bus for 32-bit words.

DIABLO EXPLAINS DISC DRIVE SLIPPAGES

The Xerox subsidiary, Diablo Systems, Inc., will begin shipping in October two of the eight models of its series 400 disc drives, announced in December of 1975. The top-loading 411T, with 26.5 megabytes of storage, and the 413T, with 53.3 megabytes, will be shipped in October, but the six remaining models--four front-loaders and two top-loaders--won't be shipped until October 1978, almost three years after announcement.

Says Ted Charter, the company's marketing manager, of the slippage in deliveries: "It's still an important product to us. It takes longer to build a reputation than a product. Yet you can damage a reputation in short order with a poor product." The company's problems involved tooling up for manufacturing, says Charter, mostly with printed circuit board electronics. A change here may dictate a change elsewhere and it takes time to design and produce new boards, he says.

Some evaluation units are said to be in the field for hardware and software interface checkouts. Xerox is reported to have a series 400 drive in its new 9700 high-speed electronic printing system (page 162).

WHY STORAGE TECHNOLOGY IS ATTRACTIVE TO MEMOREX

Some gaps in its peripherals line make Memorex Corp.'s offer to acquire Storage Technology Corp. for $75.5 million in stock quite attractive for the Santa Clara company. For instance, Memorex last month announced a 6250 bpi tape drive--but it's being oem'd to Memorex by Japan's Fujitsu. Storage makes its own drive and has some 5,000 installed. Storage also has started to ship its version of the IBM 3350 disc drive--called the 8350--and had four installations in mid-June. While Storage ships the drives with its own controller, Memorex in June had not delivered a controller and instead hooked it to IBM computers through the internal Integrated Storage Controller.

But nobody at either company will discuss further the reasons for the proposed acquisition, other than to emphasize that an agreement in principle hasn't been reached--at least not in late June.

DEC TO ENTER USED COMPUTER BUSINESS?

"There's a big opportunity for vendors such as ourselves to get into the used computer market," says a source from Digital Equipment Corp. The source says the used computer area is receiving serious consideration by the minicomputer manufacturer who has been branching out into all kinds of new ventures lately: it introduced the VT78 word processing system (page 150) which will be sold by both DEC's wp group and the PDP-8 group, and more recently began oeming products to Heath Co. for home computing.

SOME RECOGNITION

While only some 17,000 out of an estimated 500,000 data processing personnel hold the Certificate in Data Processing (CDP), there is some

(Continued on Page 160)

Another MARK IV® success story:

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— L. R. Mezirka, Jr.
Manager, Custom Systems
Optimum Systems, Inc.,
Santa Clara, CA

"As one of the top computer service firms in the U.S., we provide everything from specialized player selection for professional athletic teams to an elaborate daily delivery and financial accounting system for a linen supply company. Both of these are examples where MARK IV is used extensively.

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"We recently did a large system rewrite in MARK IV in less than 90 man-days; I think it would have taken 200 to 300 with Cobol. Our clients are very impressed that we're able to make massive revisions on extremely short notice. And we find that MARK IV systems typically run 10% faster than Cobol.

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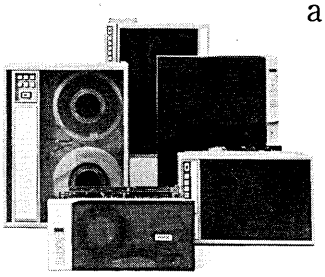

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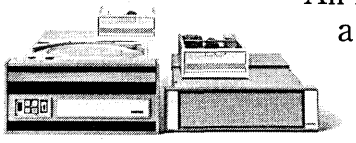

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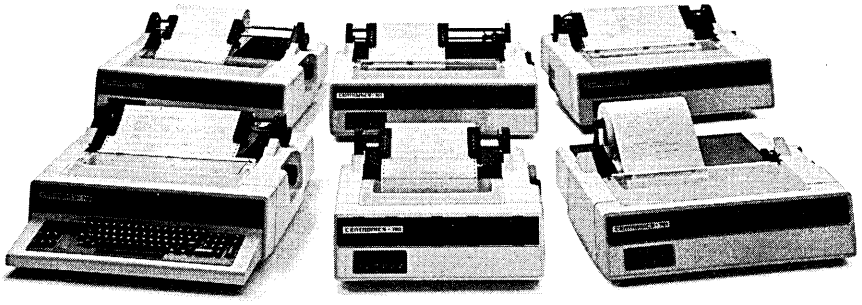

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High MARKs IV tools

I am surprised and disappointed that your "Editor's Readout" on Programmer Productivity (May, p. 63) did not mention the single most important fact about that productivity: over half the sizable computer installations in the United States still use only COBOL and COBOL-age language and systems. These installations have thus far ignored all the modern devices available as software products which have been developed in the last ten years, and now are proven systems for the increase of programmer productivity.

The biggest factor in the lack of programmer productivity is, and always has been, the extraordinary reticence of the programmer and programming organizations to adopt modern tools. FORTRAN was accepted very slowly and with reluctance. COBOL, with all its universal backing and wide base of support, was likewise slow in being adopted, requiring up to eight years after introduction to reach a 50% employment level. The delay in employing the modern systems is as inexplicable as the previous delays.

WALTER F. BAUER
President
Informatics Inc.
Woodland Hills, California

Discouraging development

Congratulations on the excellent article, "How It Works in Europe" (March, p. 65). I thought this was an outstanding example of "telling it like it is" for the benefit of readers trying to understand how time-sharing and remote computing have been discouraged from development in Europe in a situation that parallels the one in the United States.

PAUL SCHMIDT
Director
Basic Timesharing Inc.
Incline Village, Nevada

Re: solved!

A rare case of insomnia tonight finally gave me the time to look at W. D. Maurer's FORTRAN program ("Solved!" April, p. 21). My first reaction was to pen off a letter suggesting more efficient ways of doing it. (Why use an input buffer of 72 characters when the matrix allows for a max of 49?) But then I asked myself if I would be willing to expose my code to the nit-picking multitudes who read DATAMATION. Probably not. Anyway, hundreds have probably sent in better versions already.

So, I would like to commend Mr. (Ms.? You can't tell anymore.) Maurer for his courage and for doing a big turn for proper documentation. I just completed a thousand line time-sharing FORTRAN program and I used the same technique. Not only will it be an indispensible help for the person who will modify the program later, but it was worth its weight in gold to me as I wrote the program *sans* flowchart. (Since I am inherently lazy and somewhat impatient, I use '=' in place of 'IS THE')

D. C. STULTZ
Tampa, Florida

Counting in Cobol

I would like to suggest a small, simple modification of COBOL which I believe would be appreciated by many programmers (on both sides of the structured programming/GO TO debate). This is the introduction of a "PERFORM—DEPENDING ON—" feature. Such a feature could replace either a "GO TO—DEPENDING ON—" where control returns to the next statement, or a series of "IF—, PERFORM—" statements with the same effect.

This feature would be useful in such a common situation as, for example, keeping a count of different record types:

```
PERFORM 1st-COUNT 2nd-COUNT 3rd-COUNT
    DEPENDING ON RECORD TYPE
        next sentence
        .
        .
        .
1st-COUNT.
    ADD 1 TO RT-COUNT-1.
2nd-COUNT
    ADD 1 to RT-COUNT-2.
3rd-COUNT.
    ADD 1 TO RT-COUNT-3.
```

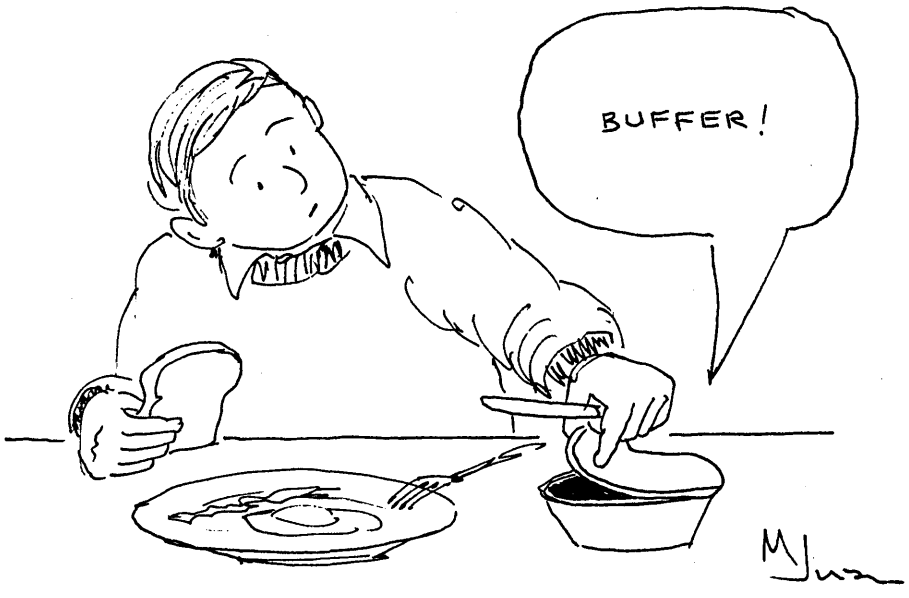
I would certainly find this facility useful, and I believe many other COBOL programmers would, too.

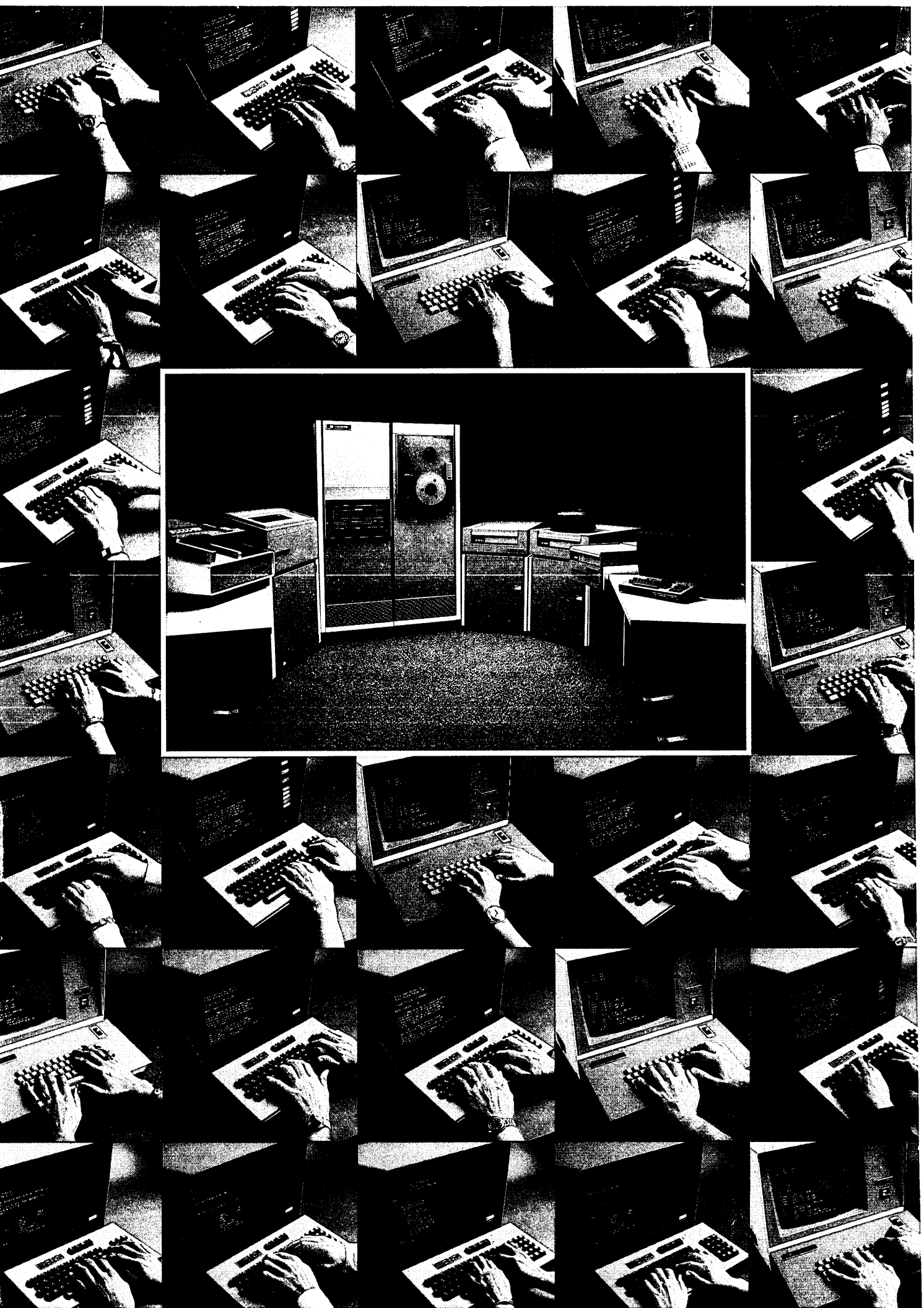
RODERICK A. PARKES
Kowloon, Hong Kong

Cobol can

What If—Indeed! If John Beamish's "Forum" suggestions were uniformly adopted (May, p. 294), confusion and duplication would result. The progress toward clarity and readability advocated by McCracken and Ledgard would be lost. Much of what Beamish wants is already possible. Considering Beamish's points in turn:

1. Though programs do process data, they are always going to be modified so they exist for this reason as well, and they certainly should be as clear as possible for programmers faced with this task. Upper and lower bounds of arrays are neither simpler nor more elegant ways of achieving readability. Wirth's use of the term "trickology" is appropriate here.
2. Though having compilers give all variables and tables default values of zeros or spaces would save many OC7 errors, the REDEFINES feature of COBOL already allows relatively easy initialization of table values.
3. Complex loops of the types envisioned needing a CONTINUE feature probably should not be written in the first place. If data values can blow up such a loop, they should be checked *before* entering the code, not in the computations.





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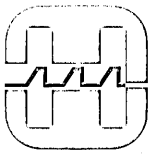

HARRIS
COMMUNICATIONS AND INFORMATION HANDLING

letters

4. Obviously GOTO's over hundreds of lines of code are bad, but forward GOTO's within a section cause little or no confusion and often eliminate a separate paragraph which would need to be performed.
5. Removing GO TO. . . . DEPENDING ON would deprive the COBOL programmer of his only facility to allow a CASE construction.
6. PERFORM . . . . UNTIL as well as other PERFORM constructs are so close to good structured programming practices that their presence should be preserved not pared. If desired, EXIT can serve as a delimiter for each module performed.
7. INSPECT and TRANSFORM could be made much more powerful (at some compile and execution expense), but this language is COBOL not SNOBOL.
8. Square root is easily available with ** .5. How many COBOL programs really need random numbers?
9. Allowing abbreviations in COBOL would remove the only documentation done by many programmers. COBOL comes as close as any language to being self-documenting. This is too important to give up—even if a compiler can make conversions.
10. Requiring the compiler to align and indent is a commendable thought (and ADR's METACOBOL does just this), but often it is not consistent with the program's logic—not to mention not being present in the source cards or source file which is what the programmer must edit.

PETER R. NEWSTED
Associate Professor of MIS
University of Calgary
Calgary, Alberta, Canada

Keeping cool

"Looking Back" (May, p. 8) was interesting, but perhaps we have advanced so fast we overlooked something important.

Cryotrons were very tiny in their day, but were later developed to switch very large superconducting currents. Electric motors are no more than a mix of logically controlled stationary and rotating magnets. What if we built larger motors of superconducting magnets which are, at the very least, 2,000% more efficient than electromagnets?

Could this liquid helium motor furnish itself a zap of current every week or two, overcome the low friction of today's bearings, recompress the helium gas back to a liquid and have some torque left over? Thermodynamic or heat logic says no, but cryodynamics extends the range of temperature down to less than a minus 455° Farenheit where superconducting motors would have no resistance or heat losses. Can computer logic solve our energy crisis?

JOHN W. ECKLIN
President
Cryodynamics Company
Alexandria, Virginia

CIP improves performance

I heartily agree with Paul Jalics ("Improving Performance the Easy Way," April, p. 135) that a very small number of critical paragraphs of a computer program are responsible for utilizing a disproportionate amount of computer resources (cpu, I/O). I also agree that if these paragraphs can be identified, program optimization can be an extremely cost-effective tool.

The problem is, given a large production system, how do you find these paragraphs? Or better yet, how does someone unfamiliar with the inner workings of the program locate these paragraphs? Eyeballing the listings, as Dr. Jalics suggests, is next to a hopeless task. The other methods documented by Dr. Jalics (measures of efficiency and critical job steps) are ways to get at the problem, but don't actually solve it.

I'd like to suggest a procedure for locating the critical paragraphs within a program. At the Dept. of Housing and Urban Development, we utilize the COBOL Instrumentation Package (CIP) and a computer program developed by the U.S. Navy.

CIP will automatically instrument a COBOL source program and produce an output report, which, among other information, lists each program paragraph and gives the cpu time utilized as well as the percent of the total cpu time. In this manner, the two or three critical paragraphs are isolated. The optimization effort can then follow Dr. Jalics' excellent tuning steps.

With the use of CIP as well as a number of other monitoring programs (I/O Activity Analyzer, Segment Load Analyzer), HUD has developed procedures for reviewing, monitoring, and optimizing production systems that have proven extremely cost-effective.

ALFRED R. SORKOWITZ
Office of ADP Systems Development
Department of Housing and
Urban Development
Washington, D.C.

Keyboarding obsolete

Mr. Patrick's book review of *Humanized Input* (April, p. 45) discussed some of his concepts on the professional keyboarding section that I feel should be discussed further.

While our data preparation manager has statistics to prove more than double the rate of 6,000 characters per hour mentioned, our experience indicates that a large professional keyboarding section is becoming irrelevant.

In our company, we have implemented three types of front-ends where the keying is performed by user department people as an incidental part of their work. These are using "intelligent" key-to-cassette terminals; on-line key-to-disc with only the keypunch type of edits; and fully on-line entry with edits, extensive logic, and file retrieval. In all three cases, we reduced the work in the user departments by having the clerks key into a terminal rather than work on paper. The reduction of clerical work seems to be roughly proportionate to the amount of "computer intelligence" available at the time of entry.

It appears that the "fill in the coding sheet" input operation, for example, goes at least five to ten times faster on a terminal. Even the typical edit operation (a document is scanned, a few codes written on it, and errors or omissions corrected) is faster if handled as a keying operation rather than with pencil and paper. Now that we can remove the complications formerly associated with keypunching, the keying becomes incidental. It apparently requires little more thought than forming letters or numbers with a pencil.

I, like Mr. Patrick, have admired the professional keyboarding people over the years for the ability to do a lot of work accurately. At times they have even produced good data from documents that looked illegible to me. However, it appears that in the future we will seldom be able to economically justify a large section with the single function of keying data.

WALTER SCHMITT
Supervisor, Accounting
Projects Systems Dept.
Wheeling-Pittsburgh Steel Corporation
Wheeling, West Virginia

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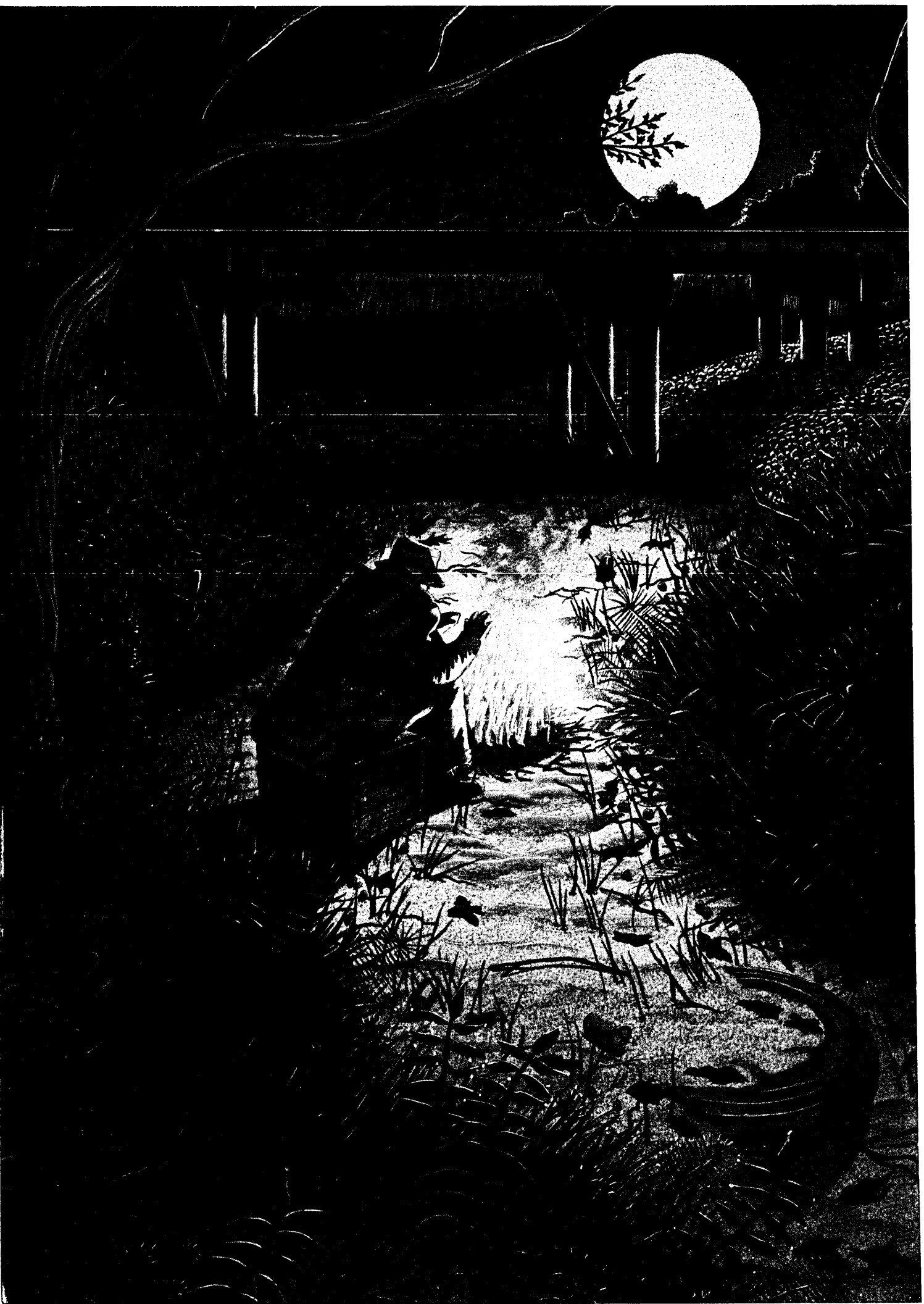
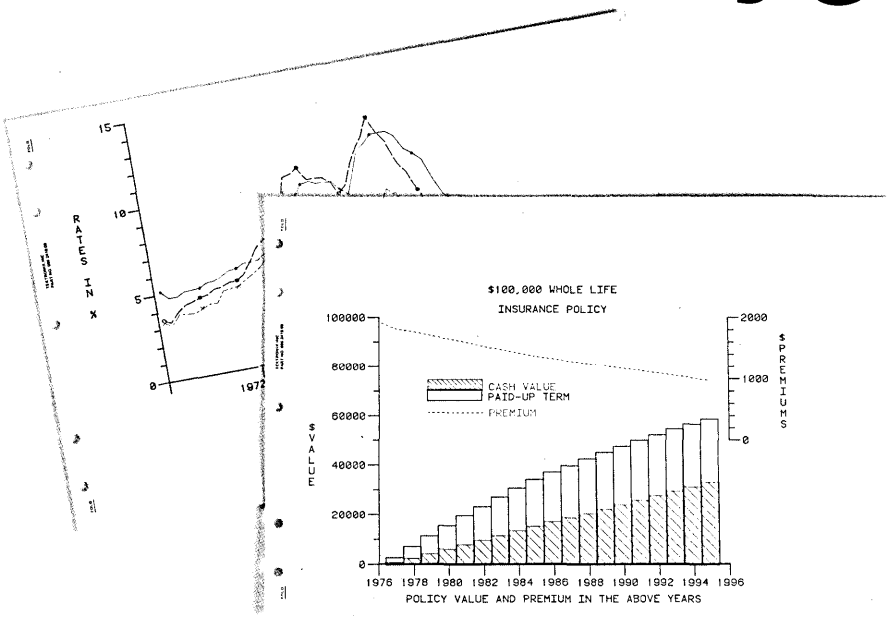
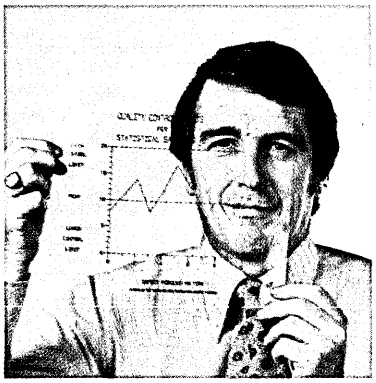


"There's no plotter like it. My terminal easily commands any graphics."





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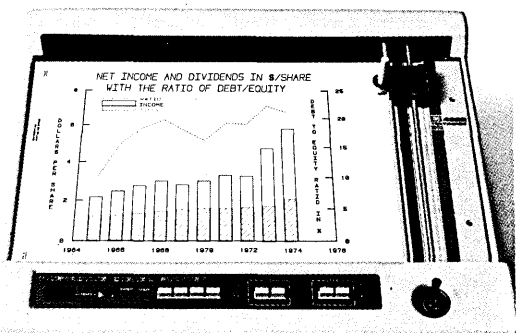

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people

The Man Who Blew The Whistle

"Jan Freese is the man who blew the whistle on transborder data problems," says Russell Pipe, a European consultant in computers and communication. This spring, in a move reminiscent of the Mad Hatter's Tea Party, Jan Freese moved around the table to take a different look at Sweden's Data Inspection Board, and the "Data Inspectorate" that administers Sweden's landmark data protection act.

Freese, a judge of the Court of Appeals, was involved with the Data Inspectorate from its inception. In 1969 the Swedish government appointed a Parliamentary Commission to examine the possible intrusion of computers into personal privacy and recommend new legislation. Judges in Sweden are often asked to serve on such commissions. Freese had already been involved with a number of commissions that had to do with medical legislation such as free sterilization, forensic medicine, and psychiatry. Soon after the data commission was appointed, he became its secretary. In that role he played a major part in drafting the report of the commission, which went to the government in 1972.

In spring 1973, the government enacted legislation along the lines suggested by the commission, setting up the Data Protection Act and the Data Inspection Board, which created the Data Inspectorate in July 1973. The board was to license every data bank in the private and public sectors. In a small country like Swden, the board could thus have a major influence on the government's practice.

Claes-Göran Källner, another judge, was selected to head the new data board and inspectorate. And guess who moved around the table to take over the prickly licensing task? Right; a cheerful man in his forties who looks more like a puckish marketeer than a sober judge or stern inspector—the energetic Freese. The task he faced was daunting. Because every data file in Sweden had to have a "responsible keeper" approved by the inspectorate, which also had to approve its purpose and manner of use, the problem was how to set up the mechanism without bringing Swedish business to a halt. The answer was to let old files go on, so long as they registered applications before 1975, while handling new applications as they arrived. Most companies got their applications in the last week of December 1974—and Freese's tiny staff (about 20) faced almost 15,000 applications. Many of these could be handled by "rubber stamping," trusting the keepers' assurances that they were standard files handled in standard ways. (In time, some kinds of software packages achieved defacto approval from the inspectorate, and could be used with minimal fuss.)

A data base of data bases (for which the inspectorate had to get a special license from the government) helped sort out the paperwork problem. So did the style evolved by the founders—one of minimum paperwork and a service philosophy. Users could phone and get status reports on their applications (from terminals at the inspectorate), or advice on new files they contemplated.

JAN FREESE
Moves around the table

The machinery was streamlined—and workable. Somehow the small staff plowed through the entire backlog, processing almost 19,000 applications from 1975 onwards. Freese says, with some pride, today: "Sweden intends to maintain the most advanced mechanisms for dealing with personal data."

Public awareness is an important part of the equation, and the Swedish inspectorate has done an excellent job of making its processes open to public view. "Open government and personal privacy" seem to be its watchwords.

One measure either of the inspectorate's success in increasing public awareness or of Sweden's current state of mind comes from an opinion survey carried out in late 1976 by the government's bureau of statistics. The Swedes put privacy in third place in their ranking of problems—after unemployment and inflation, but before such matters as old age or child care, which also are important issues today in Sweden. Freese points out, too, that 93% of Swedes do not want to be on junk mailing lists.

Working with a mandate like this, the Data Inspectorate keeps moving. The original parliamentary commission that initiated the law said the technology was moving so fast that it should be reviewed quite soon after its inception. In mid-1976 the government appointed a new parliamentary commission to evaluate the operations of the data inspectorate and recommend any changes needed in the law.

Guess who has moved around the table again to join the new commission as an expert member? Freese, of course, the man who knows where all the bodies are buried.

The new parliamentary commission will make a preliminary report this autumn, to be the basis for wide discussion. Then in 1978 they expect to make a final report, which probably will result in more changes to the law. The timing is important in Freese's eyes because it makes it possible to harmonize the laws of all four Scandinavian countries with respect to international movements of data—and it probably will give added impetus to a Europe-wide movement to create an international data law that gives data about a citizen the same protection it would have at home, no matter where it was handled—thus eliminating the danger of "data havens."

What kind of man is it who can build a reputation sufficient to be chosen to help design a pioneering data inspectorate, then move around the table to help set it up and get it running, then move around yet again to help evaluate and extend it?

"I attended more schools than most people," Freese says. He started school two years early because his widowed mother was unable to find someone to mind him while she went out to work. Then he stayed on for several extra years, to catch up in age. Then he embarked on a year of independent reading that enabled him to pass his student exam. Curiosity is one characteristic Freese shows. Another is the ability to balance a number of interests. He started out to become a doctor, but changed his mind and read for the bar instead—but he has been involved with a lot of medical legislation. Today he's working on a book about genetics and other medical situations, and the interface of medicine and society.

Freese looks back on his time at the Data Inspectorate with some pride. "When I left we had killed the backlog. The administration problems of a new organization were under control." Asked if he'd worked himself out of a

job, he smiled: "The question is to go on to cover new aspects of information and society." Earlier this year Freese published a book, *You and the Computer*, raising some of the social questions dealing with computers that will be more important to union members, now that most management decisions are subject to union consultation in Sweden.

Freese believes, along with 65% of Swedes (according to a recent survey), that the Data Inspection Board has to become a little tougher in the future. "People want less use of their personal identification numbers, for example," he points out. "So the board has to reexamine its policy. Another question is university research. Up until now, we have been approving a single professor as responsible keeper, knowing that a number of his students in a department might be using the data for different aspects of the research. They are usually dealing with the same population, and this way you can avoid some bureaucracy. But you have to get into the purpose of the research, and the board may have to go into this more deeply in the future."

What has changed in the years he has been involved with privacy and data? Freese smiled again, "I can tell you there is not one single personal file in Sweden that hasn't been affected. But we've done it without large costs."

A "Junkaholic's" Dream House

On his desk is an elaborate panic button. When pushed, it produces a blinking red light and a horrible noise . . . nothing more. Behind his desk are two "nothing lights" which wink and blink in intriguing patterns . . . to no end.

And partly because of all this, Honeywell Information System's Deer Valley, Ariz., plant, outside of Phoenix, wastes practically nothing. He is Dick Hotaling and he runs Honeywell's Apache Facility in Phoenix. The facility has been in existence since 1968. Hotaling has been its manager since January 1974 but he has been close to its operation since its inception. The facility recycles what the Deer Valley plant used to throw away. It's sales make it self-supporting.

It all started in 1968 when Jerry Hecker, then HIS' manager of material at Deer Valley, realized that the plant literally "threw away thousands of dollars worth of stuff a month." Hotaling was Hecker's administrative assistant. Honeywell went to the Arizona Public Service which owns and leases to Honeywell "for a minimum sum" the Apache St. facility. It got started as a facility to train adults who fit the category of "hard core unemployed." Hotaling was "the buffer between the store and the plant."

DICK HOTALING
Old computers never die

"It was an in-depth training program then," he recalls. "Trainees would spend from 12 to 15 months at Apache St. and were guaranteed automatic transfer to the main plant." This created a problem when business became bad. People were being laid off at the plant, and automatic transfer just didn't happen. "People were stuck here for as long as two years," said Hotaling. "Many became disgruntled and argumentative. We decided we couldn't do this any more." Early in 1974 the last trainee left and they started their current program with high school students.

The facility works with from seven to 13 students at a time, teaching them such things as use of hand tools, assembly and disassembly, stock keeping, material identification, and basic reading of blue prints. They get their students from Phoenix' "inner city" schools through the schools' counselors who work with HIS' personnel people. "The counselors have done a bang-up job," said Hotaling. "We've never turned down one student they've recommended."

The students work 20 hours per week for approximately 90 working days, tearing down whatever comes in from the sometimes three times per day deliveries from the Deer Valley plant into salable items which run the gamut from electronic parts to scrap metal and scrap paper. They get high school credits and $2.30 per hour.

What happens to some of the obsolete computer equipment that comes into the Apache St. facility? Well, some of the skins end up as out-houses in Phoenix' surrounding mountain resort areas. Lights and wires are helping out model train buffs with their layouts, and transformers and other electronic parts are the favorites of Citizen's Band and Ham radio buffs. Hotaling, who considers himself a "junkaholic," appreciates others of his kind who come into the store "and browse around for hours looking for something they don't need at a price they can afford."

He usually doesn't inquire what a customer wants unless the customer asks him. "One time I couldn't help myself. Three college-age girls were wandering up and down the aisles picking up three of this and four of that (things like loose wires, pieces of plastic, and electronic parts). I finally asked what they wanted the stuff for. They were art students at Arizona State Univ. and wanted the stuff for a collage."

Hotaling, who has BS and MEE degrees, joined General Electric in Schenectady, N.Y., in 1938 and has worked for the firm ever since, transferring to Honeywell with the 1971 acquisition by Honeywell of GE's computer operations.

Now 62, he has changed his original plan to retire at that age. "I'm having a hell of a time. They'll either have to fire me or retire me when I become 65."

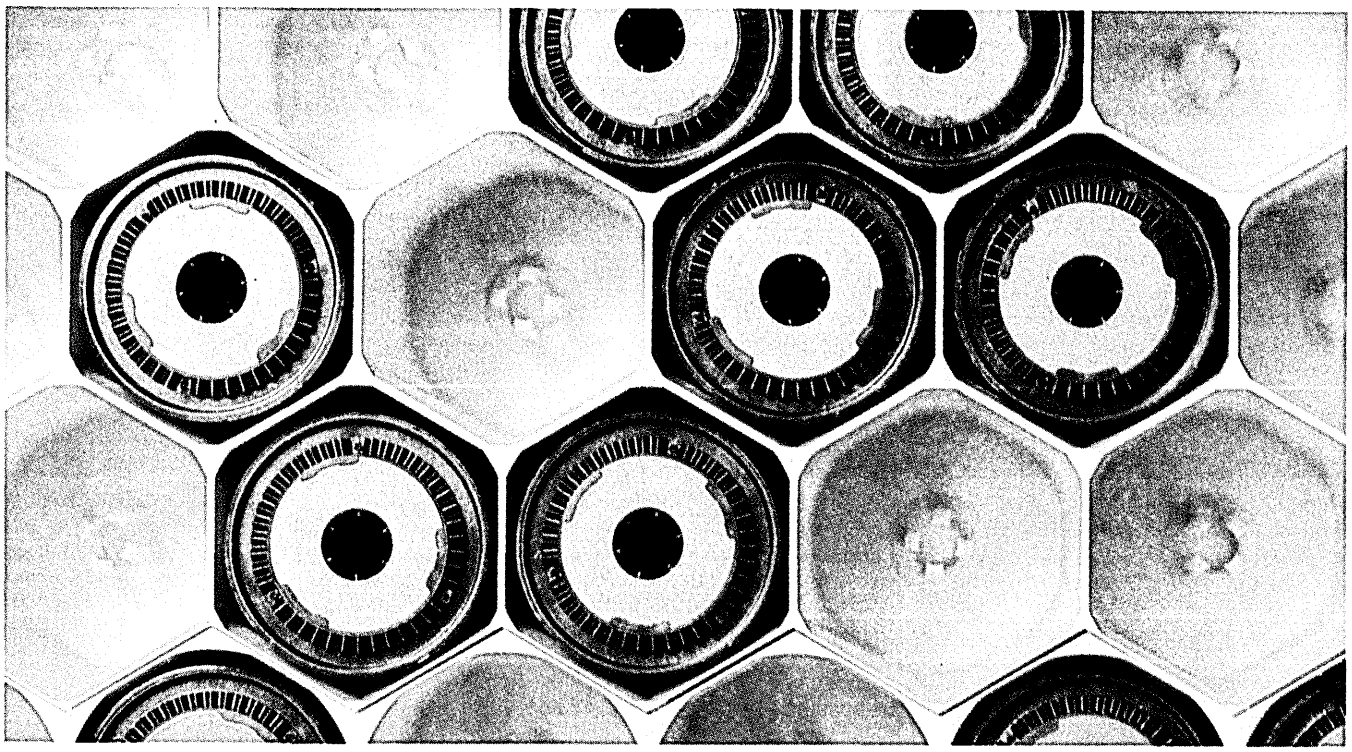
He's one of his own best customers to the chagrin, he says, of his wife. He doesn't only make gadgets for himself. Last Christmas Governor Raul Castro of Arizona visited Hotaling's store to see what was being done for the students. Hotaling presented him with a "decision maker" made up of switches, lights, a meter, and a control panel. The device can give the governor three different answers to critical questions . . . "pass, veto, or call Pat (his wife)."

In New Posts

MAURICE H. GREENFIELD was named director of corporate systems ITT World Commmunications Inc. . . . WILLIAM F. ZUENDT, recently named director of the computer systems division of Wells Fargo Bank was elected a senior vice president . . . GERALD N. SOMA joined Integral Business Computing, Inc., Harbor City, Calif., as vice president for systems development for the company's travel and reservations industries market . . . RICHARD E. WEBER was appointed vice president of Honeywell Information Systems' Product Management Operation. ❋

DP Dialogue

Notes and observations from IBM that may prove of interest to data processing professionals.



Honeycomb-like storage cells of the IBM 3850 Mass Storage System. The MSS can put as much as 472 billion characters of data online to the computer.

3850 Simplifies Life at Dun & Bradstreet

"Our business is information," says Dun & Bradstreet's vice president, Gordon J. Aubrecht. "Every day, some 2,000 people—trained business analysts—gather that data through direct interviews with business owners. It is then our job to store, assemble, package, and disseminate it. Computers make that possible. And computerized verification and security programs help us monitor accuracy of the information while safeguarding confidentiality of the file."

The wellspring of its credit and marketing services to the business community is Dun & Bradstreet's data base on four million commercial enterprises. So the company is assured prompt access to any part of this file, D&B has chosen to use an IBM 3850 Mass Storage System (MSS), designed for the online storage of large quantities of data.

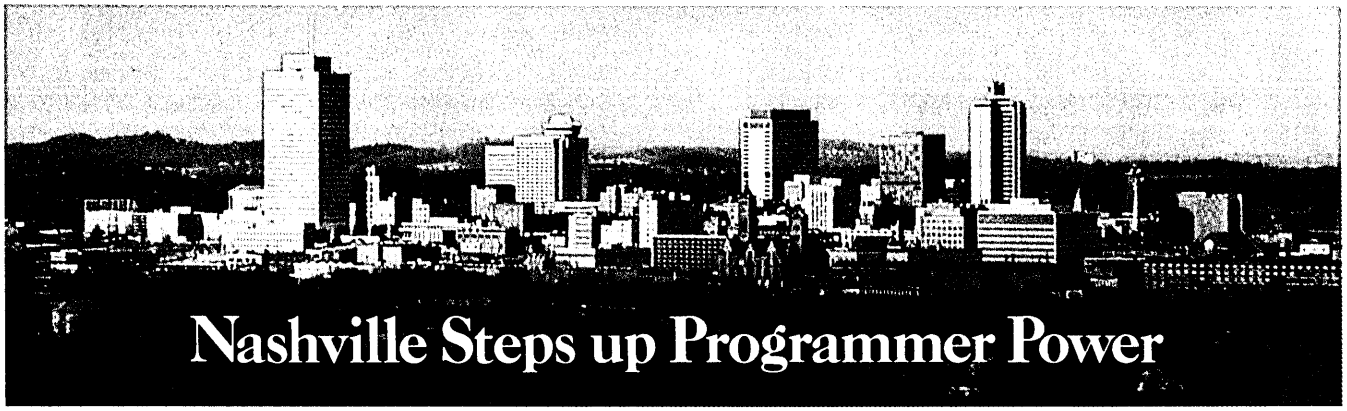
"The MSS gives us the benefits of high-speed disk storage, but at the cost of tape," Aubrecht says. "Since installation in our New York computer center, we have been able to cut back from 22 tape drives to eight, and have reduced our tape library from 22,000 reels to 16,000. And we expect that number to diminish to 8,000 before long." The center is equipped with two System/370 Model 158s.

"This file base is the foundation for many of our services," Aubrecht notes. "We computer-typeset—directly from the stored information—such publications as the Dun & Bradstreet Reference Book, The Apparel Trades Book and the Reference Book of Manufacturers. From the same file, we extract detailed, custom-tailored marketing facts, called Dun's Market Identifiers."

Adds Robert Porowski, director of computer operations and support: "The most important gain for us was the elimination of manual handling of tape. We've done away with thousands of mount/dismount operations each month and, at 2½ to 3 minutes per operation, that's hundreds of hours saved."

In the IBM 3850 Mass Storage System, data is recorded on magnetic tape enclosed in small cartridges, which are automatically retrieved by the system when required for read or write operations.

"The shift to MSS, along with other changes made at the same time, also yielded some direct hardware cost savings," Porowski added. "It's a new mode of storage, occupying a new place beside disk and tape in terms of cost and operating characteristics. By using it for the storage functions to which it lends itself—in our case, the equivalent of multiple data bases online—we're achieving important gains in performance and quality, significant cost savings and a real assist in internal operations."



Nashville Steps up Programmer Power

When the city of Nashville, Tennessee, adopted extended-area government, a metropolitan area of a half-million people was unified under one administration.

One resulting efficiency is data processing service provided to the entire metro area—known formally as the Metropolitan Government of Nashville and Davidson County—from one computer center with an IBM System/370 Model 158. To increase productivity, the center uses three new aids to develop and maintain application systems.

One aid, called Hierarchy plus Input, Process, Output (HIPO), approaches program design and documentation in terms of small, functionally defined modules. Another, Structured Programming, makes programs easier to read and understand.

The third aid is Data Language/1 (DL/1), an IBM data base manager. DL/1 structures data into a common format that allows many programs to access the same files, eliminating redundancies.

All three can reinforce each other to make application development and maintenance more productive.

How much more productive? Ron Dickie, director of data processing and computer services for Nashville, points out that—in addition to quantifiable improvements—many of the most important benefits are intangible, such as improved forecasts of development times and costs.

Other gains can be stated precisely. These include a doubling of workload without an increase in staff size and using 20% to 40% less computer time to test new applications. And new programmers can write online programs after only two months of training.

"On that quantifiable basis, we identified $173,350 of costs actually avoided during the first year with the new techniques," says Mr. Dickie. "That's particularly impressive to us because it was a busy year, in which we developed seven major application systems."

Because program development now is done in a modular fashion, a programmer needs only one week, on the average, for coding and testing a program.

And program maintenance activity was greatly reduced under DL/1. "We used to spend a lot of time in rework," says Mr. Dickie. "Now we alter data bases and switch storage devices without making program changes.

"All in all, HIPO and DL/1 and Structured Programming have proved to be a winning combination. They've helped us serve our citizens better while saving some hard-earned taxpayers' dollars."

Litton's 'Blue-Collar' Job for Finance System

Designed to meet the diverse needs of today's financial institutions, the IBM 3600 Finance Communication System is also proving highly useful in the manufacturing environment.

At the Data Systems Division of Litton Industries in Van Nuys, California, and Lubbock, Texas, a 3600 controls the flow of materials through plants that produce command and control systems for the United States Government. The key component is the 3604 Keyboard Display. Used as a teller terminal in many banks, it serves as a data entry and display terminal at Litton.

Whenever a shop order is created, the 3604 encodes product information on the magnetic stripe of a "traveler card"—much like a personalized bank card—which accompanies the material being processed as it passes through a series of work stations. After work is completed at each station, the worker inserts the card in a 3604 Keyboard Display, which reads the encoded data, times it and enters it into Litton's IBM System/370 Model 158.

At a Litton plant in Van Nuys, California, Liliane Perini enters production data, encoded on a magnetic stripe, into a terminal of the IBM 3600 Finance Communication System.

Production workers enter information at the 3604 through easy-to-use function keys, with step-by-step guidance provided by the system. Data captured at the 21 shop-floor terminals updates master files of open orders stored in IBM 3601 controllers, which act as local processors.

"The exact status of any order is available to production supervisors at any time through the terminals," says Bertram Voddon, vice president of operations. "Each night, accumulated data is forwarded to the computer in Van Nuys, where it is processed and made available the next morning in the form of production reports and analyses."

As John Lawrence, vice president of finance for the division, points out, the online 3600 system does for shop orders at Litton what it does for bank accounts at financial institutions—it makes full, up-to-date information available to authorized personnel.

"And with 9,000 shop orders active here at any one time, that's no small accomplishment," he adds. "The 3600 is keeping us on top of operations in a way that was never possible before."

J.I. Case: Super Service on Spare Parts

"We've been able to cut inventory by more than 12 percent," says Jack A. Chobanian, director of service parts supply systems at J. I. Case, one of the largest and oldest manufacturers of farm tractors and construction vehicles in the United States.

Four years ago, Case converted the management of its service parts inventory to an online computer system which it calls AIDS (Automated Inventory Distribution System).

"Even while reducing inventory, we eliminated 75% of our backorder count. Conversely, our 'fill rate'—the proportion of items delivered without backorder—improved by 8% in the same period."

Case, a Tenneco company, fills 2,000 orders a day, shipping a total of 20,000 line items from its main warehouse in Racine, Wisconsin, to ten regional warehouses and a network of distributors and dealers.

To support its broad line of current equipment models, in addition to earlier models spanning the past 35 years, the Case Service Parts Division maintains an inventory of 155,000 separate part numbers.

"We were able to cut $8 million out of inventory while increasing the fill rate because the online system gave us much better forecasting data," Chobanian notes.

"Previously," he continues, "we based our inventory projections on replenishment orders from the warehouse. Now, with order entry as an online system, we can look at accurate figures for real dealer demand."

AIDS runs on a System/370 Model 168 in Case's corporate computer center in Racine, under Multiple Virtual Storage (MVS) and Information Management System/Virtual Storage (IMS/VS). The system is accessed through 85 IBM 3277 Display Stations in warehouse and office locations.

Major online subsystems include order entry, depot replenishment, order inquiry, purchasing, receiving, forecasting and warehouse control. Under AIDS, orders received before 1:00 PM are shipped on the same day; those received later go out the next day.

"Before we installed AIDS, the division's warehouses were full to capacity just with agricultural parts," Chobanian notes. "When spares for the construction equipment line were added to its responsibilities, the division wanted to add new warehouse space. Now, with AIDS, we are handling both product lines from the same space.

"At least as important as the purely financial gains from slimmer inventories and fewer backorders," Chobanian asserts, "is the way AIDS has improved customer service. The lack of a small part, worth a few cents, for a work vehicle can stall an entire construction project at a cost of thousands of dollars a day. Similarly, a farmer's losses can be devastating if a tractor goes out of service during a harvest.

"With the online AIDS system, we're getting repair parts out where they're needed, faster than ever before. And our customers really appreciate it. We can't measure the business gain directly, but we know it's important."

J.I. Case uses an online IBM computer to help insure that service parts are always available for farm tractors (above) and construction equipment.

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.

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HP's Terminals: smart, but simple.

With 10,000 sold in just two years, Hewlett-Packard's CRT line has made a considerable impact on the terminal market. The secret? Human engineering.

By designing our smart terminals around a microprocessor, we've managed to uncomplicate difficult jobs and make simple tasks a piece of cake.

But that was just the beginning. We wanted to make our terminals easy to maintain and expand. And we wanted to make them easy on the eyes, both from the operator's point of view and as pieces of office furniture.

We did it all. Our terminals won design awards for their appearance. And our exceptionally clear, high-resolution displays have won the hearts (and eyes) of everyone who has to spend long hours in front of a CRT.

Reducing operator fatigue.

For our screens, we use a 9x15 character cell, with dot shifting to provide exceptionally clear definition. You don't have to peer at tall, skinny letters. Ours look like the best typewriter printing, with the right spacing and descenders below the line.

By using white characters rather than green, we've made the display brighter and easier to read. (Have you ever tried watching black and green television?)

Several other screen features simplify an operator's life. Inverse video, optional half-brightness, underline or blinking characters can be used to stress important information, and reduce mistakes in transmission.

Plug-in modules for quick changes.

That's the simplest way of adapting a terminal to your job. So we offer a variety of components that pop in and out.

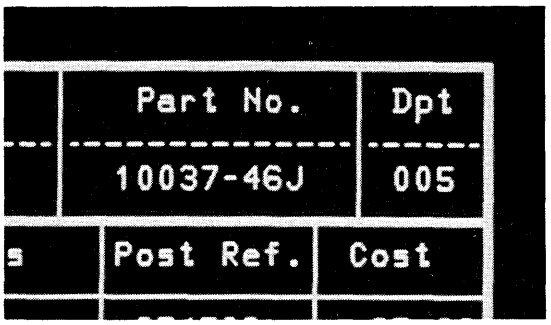
All our terminals have plug-in character sets to cover a wide range of computer languages. And a plug-in Forms Drawing option lets you generate almost any form your company uses.

Our smartest terminals let you plug in fully integrated mass storage. This takes the form of twin cartridges, each able to store up to 110,000 bytes of data or programs.

You can use this information locally (the terminal's "soft keys" save a lot of time and effort on off-line jobs) or transmit it to your central computer.

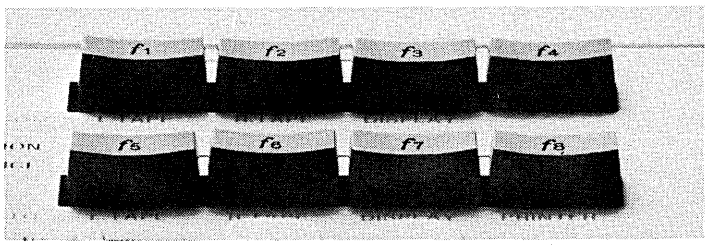
Another new terminal, the ultimate "have-it-your-way" design, should be extremely popular with OEMs. You can pick and choose from a variety of hardware modules, and write your own firmware. Everything plugs together for a virtually custom display station.

Some intelligent ideas for smart terminals:

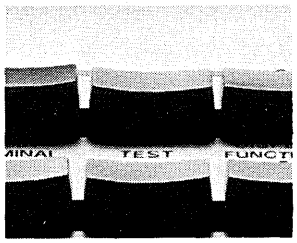


An exceptionally clear display eases long sessions at the CRT. A Forms Mode aids accurate data entry.

Plug-in mass storage: you can get up to 110,000 bytes per cartridge.



The "soft keys" on our smartest terminals let you execute complex operations with a single keystroke and eliminate many repetitive jobs.



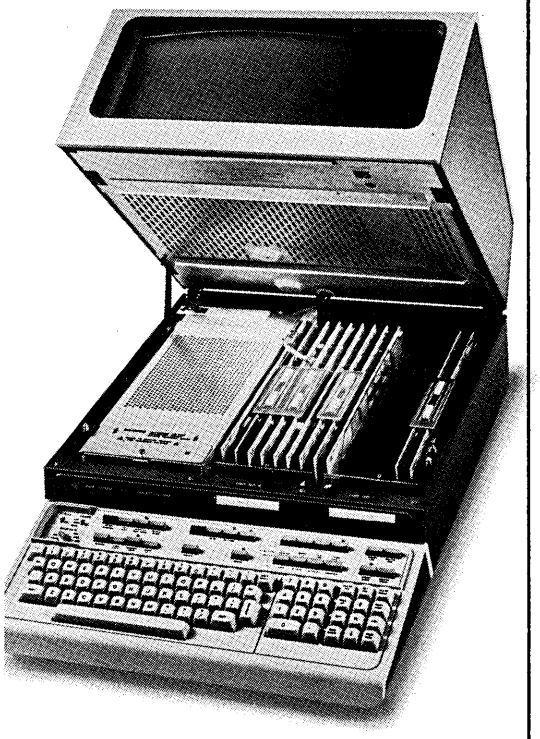
Problems? The self-test key helps pinpoint them for you.

Maintenance is a snap.

Unsnap a couple of catches and our terminal is wide open. The plug-in PC boards are right there. What could be easier for changing options or speeding up repairs by our servicemen?

Not that downtime is a problem. Our terminals have such a good MTBF that we've lowered our maintenance price twice in the past 18 months.

And when you do need service, you've come to the right company. We have more than 700 Customer Engineers ready to



give you support, documentation and training.

So when you're choosing a terminal, think of your people first. Then think of the terminals that are smart enough to be almost human. Your local Hewlett-Packard sales office can give you complete information. Or mail us the coupon and we'll send you the facts.

HEWLETT hp PACKARD

Smart doesn't have to mean complicated: eight HP terminals that prove the point.

The HP 2640B Interactive Display Terminal. Even our simplest terminal has many intelligent features, including an enhanced high-resolution display, plug-in character sets, dynamically allocated memory, microprocessor control, full editing, self-test, forms mode and more. It's a lot of terminal for the money.

The HP 2640C Cyrillic Display Terminal. This has everything you like about the B version, but it speaks Russian too.

Для *Cyrillic* Där *Swedish* سيبة *Arabic*

The HP 2640N is fluent in Danish or Norwegian.

The HP 2645S completes our Scandinavian coverage with Swedish or Finnish.

The HP 2645R. Designed for an application in Iraq, this model enters Arabic characters from right to left. It also works from left to right for standard computer languages.

The HP 2645A Display Station. Our smartest terminal, it can transmit at rates up to 9600 baud, has a forms mode, user definable "soft keys," and optional fully integrated mass storage. A very intelligent choice.

The HP 2641A APL Display Station. This is modeled after the 2645A, but also includes a full 128 character APL set, plus an APL 64 character overstrike set.

The HP 2649A Mainframe Terminal. This data station is ideal for OEMs. It lets you design custom firmware for your special application and pick the hardware modules your system demands. Available with all of the 2645A's advanced features.

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Mail to: Ed Hayes, Hewlett-Packard, 11000 Wolfe Road, Dept. 403, Cupertino, CA 95014

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calendar

JULY

Formstech 77, July 27-29, St. Louis, Mo. This year's symposium for the forms industry will examine problems and opportunities for the forms manufacturer as imposed by technological developments in production and business communications. Highlights of the conference include: a futuristic, though realistic, view of the office of the future; non-impact printing; electronic funds transfer; and new and emerging production applications. Registration: $200, IBFI members, first attendee, $175 each additional attendee; $300, non-member. International Business Forms Industries, 1730 N. Lynn St., Arlington, Va. 22209 (703) 841-9191.

ACM-Pacific 77 Regional Conference, July 28-29, San Jose, Calif. This year's regional conference is devoted to the small computer. From micros to minis, it will explore new hardware developments, trends in software, and current applications. It will also provide the opportunity to speak with those in the region directly interested in small computers and their software. A special evening will combine presentations in billboard style and a hobby computer session. There will also be an exhibit of homegrown gear and software. Contact: Peter Szego, Ampex Corp., Mailstop 3-22, 401 Broadway, Redwood City, Calif. 94063.

AUGUST

Microcomputer Systems Design, August 1-3, Buffalo, N.Y. This three-day conference and workshop will be sponsored by the Office for Credit-Free Programs of the State Univ. of New York at Buffalo. The conference will focus on the design of microcomputer systems for specific applications for control, signal processing, and communications. Emphasis will be placed on specific microcomputer configurations and I/O interfacing. Contact: Dr. Hinrich R. Martens, SUNYAB, 3435 Main St., Buffalo, N.Y. 14214 (716) 831-3211.

Third International Conference on Computing in the Humanities, August 2-5, Waterloo, Ontario, Canada. Intended to foster computer research and techniques in all areas of humanistic study, the conference is held in North America on alternate years with the European conferences of the Association of Literary and Linguistic Computing. About 70 papers on all aspects of computing in the humanities have been accepted for formal presentation at the conference. There will be a plenary session each evening and shorter sessions during the day. There will also be supervised displays of computer hardware, a book fair, and software advisory booths maintained throughout the conference. Computer art and music exhibitions will be offered, along with cultural events and a computer games room. Registration: $60. Contact: John S. North, Chairman ICCH/3/CIIH, Univ. of Waterloo, Waterloo, Ontario, N2L 3G1, Canada.

IFIP Congress 77, August 8-12, Toronto, Ontario, Canada. IFIP 77 marks the first return to North America in more than 12 years for this triennial gathering of computer professionals. The theme of the congress, "The Maturing Profession—Perspectives and Prospects," will be implemented through eight major categories of technical programs, plus exhibitions and demonstrations of the latest in global information processing technology. The program areas are: applications in management and administration; applications in science and engineering; computer-aided design; computer networks; information processing and education; theoretical foundations of information processing; computer hardware—developments in technology and their influence on computer system design; computer software—programs and procedures which facilitate the development, operation, and evolution of application systems. Contact: Canadian Information Processing Society, 212 King St. West, Toronto, Ontario, M5H 1K5, Canada.

During the same week of August 8-12, the IFIP Technical Committee for Information Processing in Medicine is sponsoring the Second World Conference on Medical Informatics (MEDINFO 77), also in Toronto. The theme of MEDINFO 77, "Information Technology for World Health," will place special emphasis on recent technological innovations, cost-effectiveness criteria, critical aspects of acceptance by medical staff, and patient-related factors. Contact: Dr. D. Lindberg, Chairman, MEDINFO 77 U.S. Committee, Univ. of Missouri Medical School, Lewis Hall, Columbia, Mo. 65201.

Registration for both conferences is $205. Individual registration fees are $145 for IFIP Congress 77, and $155 for MEDINFO 77.

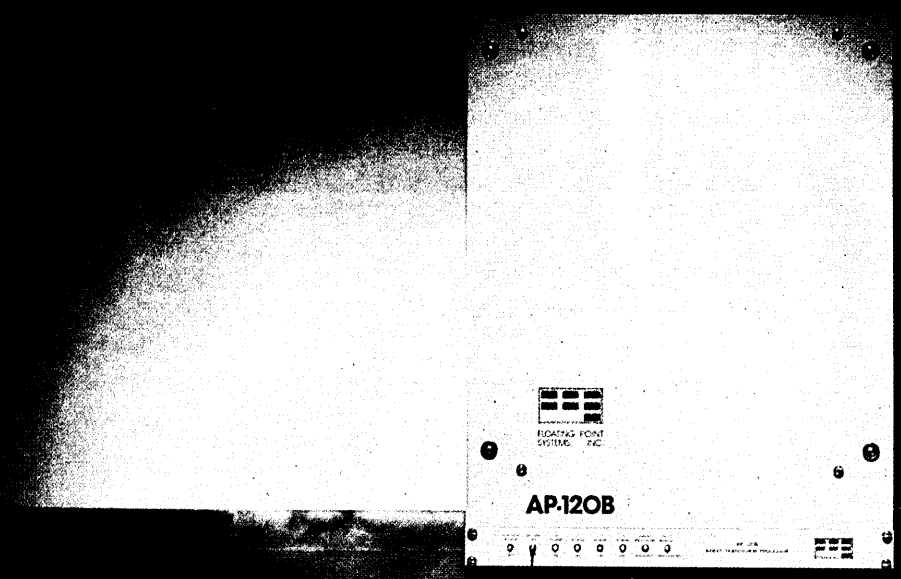
International Joint Conference on Artificial Intelligence, August 22-25, Cambridge, Mass. The program for this conference will consist of both contributed and invited papers, panel discussions, films, and demonstrations, as well as special events such as a New England clambake. Registration: $70; student: $35. A copy of the proceedings is included in the registration fee. Additional copies will be available at the conference for $20. Contact: Edward Fredkin, IJCAI-77, 545 Technology Sq., Room 826, Cambridge, Mass. 02139 (617) 253-5904.

1977 Conference on Parallel Processing, August 23-26, Bellaire, Mich. Co-sponsored by the IEEE Computer Society and Wayne State Univ., presented papers at the conference will describe recent advances in all aspects of parallel/distributed processing, including logic circuits; various concurrent, parallel, pipeline, or multiple-processor architectures; processor-memory interconnections; computer networks; and modeling and simulation techniques. Contact: Dr. Charles Elliott, College of Engineering, Wayne State Univ., Detroit, Mich. 48202 (313) 577-3812.

CALL FOR PAPERS

Proposals for participation in the Eighth Australian Computer Conference to be held August 28-September 1, 1978 in Canberra City, Australia, are now being solicited. The program for ACS-8 will be designed to focus on the theme "Computers in the Service of Society." The conference will promote an awareness that many more people and organizations are able to use computers in many more ways, not just specialists and large organizations. Proposals should consider: what having easy and cheap access to computing machinery will mean to people in their daily lives; how computing technology will affect social structures and functions; and what new or changed services will therefore be needed. The conference also will look at the use of bigger and faster computers, and at the use of networks, and will explore the social and economic impact inherent in their use. Proposals, including a working title, outline of the major components of the activity and its likely conclusion, and background subject matter should be sent by July 31, 1977, to ACS-8 Program Committee, P.O. Box 448, Canberra City, A.C.T. 2601, Australia. ❋

The age of array processing is here...



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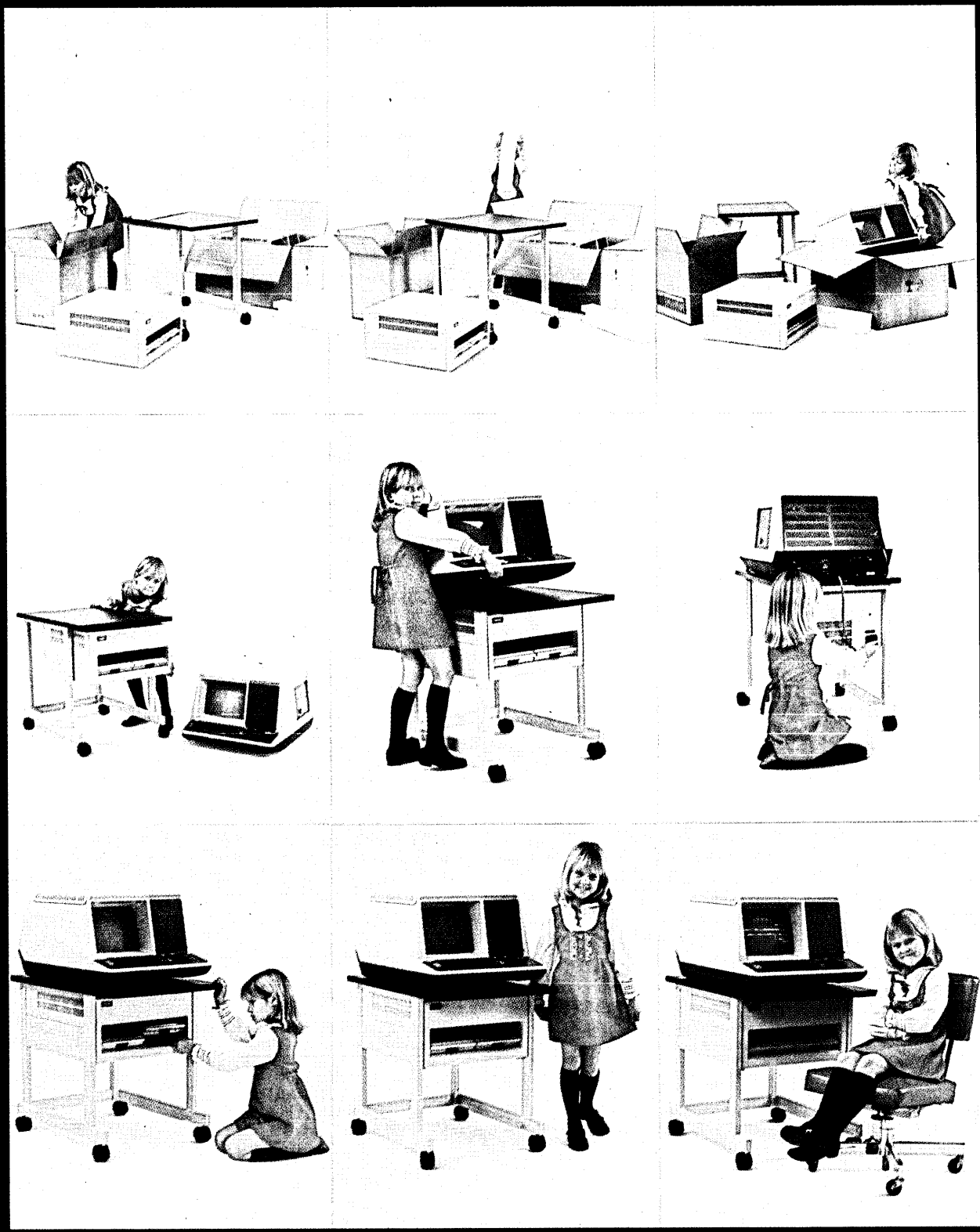

Digital introduces DECstation. A big computer system that's small enough for anyone.

Digital put an amazing LSI version of the PDP-8 inside a DECscope, added some ingenious interconnecting devices and created something new. The DECstation. A complete computer system big enough to do all kinds of work and small, simple and inexpensive enough to do it for almost anyone.

DECstation. A complete computer system in disguise. It looks like a terminal, but look again. The DECstation has a powerful general purpose computer, a video terminal, a dual diskette drive, and its own special operating system. What's more, you can hook up two different printers and a second dual diskette drive. Then put the whole thing in a mini-desk, and when you're done you'll have the smallest big computer you've ever seen.

The Video Data Processor. It's the big reason the DECstation's so small. The VT78 Video Data Processor is a computer wrapped in a terminal. Inside the familiar DECscope you'll find an LSI version of the PDP-8 with 16K words (32K characters) of MOS memory and built-in interfaces. Two serial asynchronous ports feature speeds from 50 baud to 19.2 kilobaud. A disk port interfaces with up to 4 diskette drives. A parallel I/O port for printers and custom interfacing provides data transfer rates up to 180 kilobits/sec. All standard.

You can go from carton to computer in less than an hour. If you can push a button, you can run a DECstation. Because one button is all it takes to start things up. The bootstrap and self-test routines are built in.

Put it together, plug it in, and immediately you can begin to run anything from the PDP-8 software library. Which means you start with one of the most comprehensive sets of software tools available in a small system. Including two proven operating systems: OS/78 for stand alone applications and RTS/8 for real-time. OS/78, an extension of OS/8, supports a number of languages, including FORTRAN IV and BASIC. So all you have to do is load the operating system and start programming your application.

Whatever that application, if you're looking for a sophisticated little system, at the right price, and a remarkable OEM tool, consider DECstation. $7995 each. $5436 OEM quantity 50.

For our free brochure, write Digital Equipment Corporation, Parker Street, Maynard, MA 01754. European headquarters: 81 route de l'Aire, 1211 Geneva 26. Tel: 42 79 50. In Canada: Digital Equipment of Canada, Ltd.

digital

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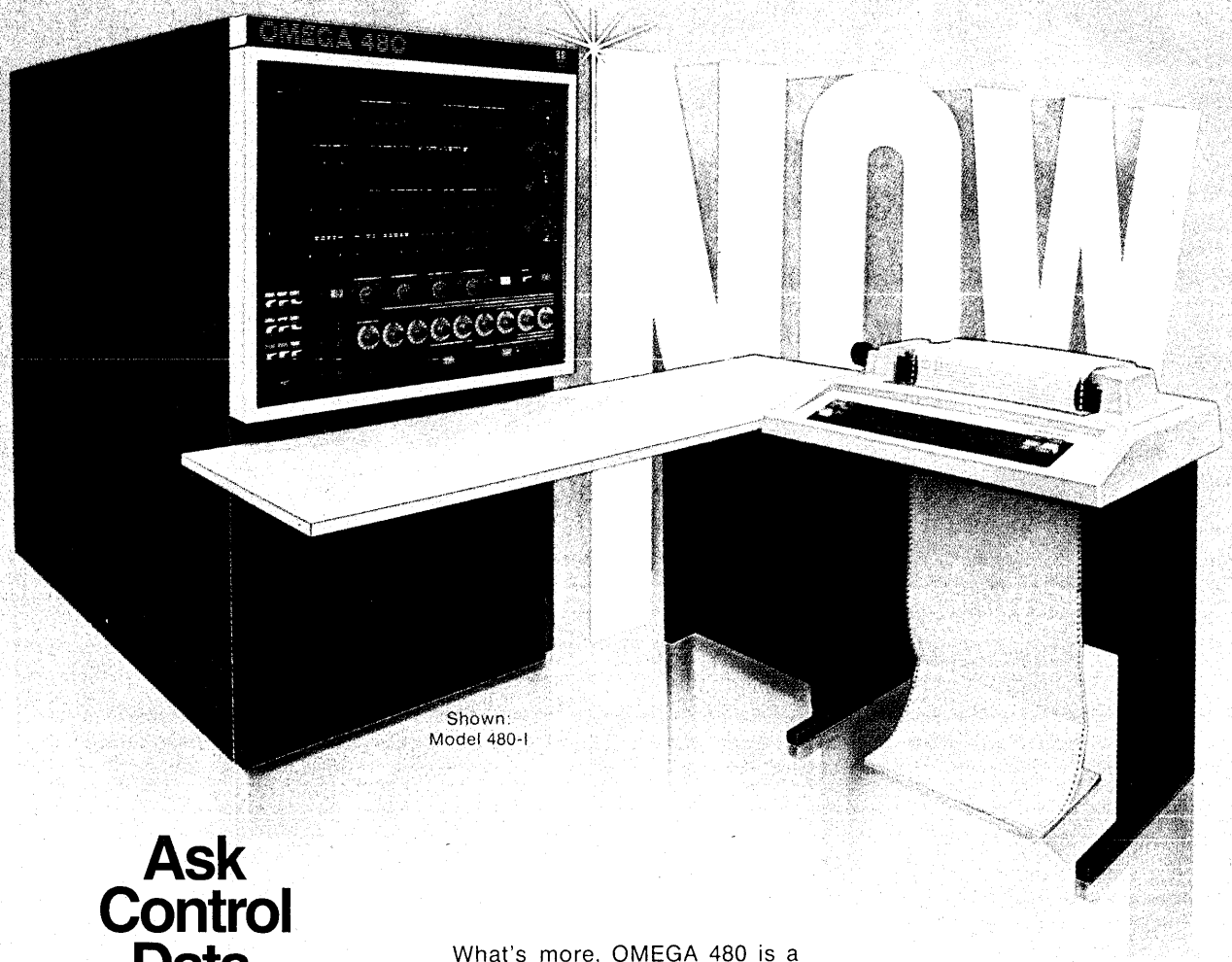

Shown:
Model 480-I

Ask Control Data.

Control Data introduces the OMEGA 480 System—two compatible, price-conscious alternatives to IBM's 370-135/138 and 145/148.

Our new OMEGA 480-I gives you half again as much throughput capacity as 370/138—yet costs about the same! And the OMEGA 480-II will exceed 370/148 performance while offering a purchase-price savings of $200,000!

What's more, OMEGA 480 is a space-saving one-half the size of the comparable 370! And, it's field-upgradable. That means you can get OMEGA 480-I now... upgrade it to 480-II capacity later!

Compatibility? OMEGA 480 supports without modification IBM Operating Systems, Program Products, and user programs.

Financing? Several options are available either through our competitively-priced Installment Sales Plan or a selection of 3- to 7-year leases.

But most important, you want service support. And you get it from Control Data! In our support organizations are more than 8,000 dedicated hardware and software specialists—including many with years of IBM system experience. Experience that comes from servicing more than 1,200 current IBM users, and maintaining such Control Data plug-compatible peripherals as Disk, Tape, Memory, Printer and Mass Storage Systems.

The OMEGA 480 Systems are available initially in: Boston, New York City, Philadelphia, Washington, Baltimore and Atlanta; Cleveland, Chicago, Detroit, Milwaukee, Minneapolis, Dallas and Houston; Denver, Portland, Los Angeles and San Francisco. For information phone your local Control Data Representative or write Thomas E. Phillips, Vice President, Peripheral Systems Marketing, Control Data Corp., P.O. Box 0, Minneapolis, MN 55440.

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books

Software Reliability: Principles and Practices

by Glenford J. Myers
John Wiley & Sons, 1976
360 pp. $19.95

The author makes his point of view clear early in this book with two definitions: "A software error is present when the software does not do what the user reasonably expects it to do." And: "Software reliability is the probability that the software will execute for a particular period of time without an occurrence of a software error, weighted by the cost to the user of each error encountered." The first definition implies that we can never expect to find all the errors in a piece of software because they are not an inherent property of the software alone, but a function of both the software and the expectations of its users. The second definition implies that software reliability is a function of the magnitude of the error within the software system.

It has been clear for a long time that the costs of software, not hardware, are the dominant factors in computer system design and implementation. Attempts to hold down these costs by improving programmer productivity, though interesting and at times even useful, are woefully misdirected. It's trying to fix a first order effect with second order refinements. The major costs of software development are not design and coding, but testing and maintenance. While there is some overlap between techniques for enhancing programmer productivity and software reliability, on the whole, the points of view and methodologies differ significantly.

The author diagnoses the primary cause of software errors as being mistakes in translating information. In developing software there must be a series of translations: from user requirements to overall software objectives, to external functional design, to high level system design, to detailed software design, to program code. Each translation must be performed with care and the result checked with care, since each step introduces vast opportunity for error.

After some preliminary chapters designed, as the author puts it, to motivate the reader to read the remainder of the book, the first major portion deals with principles and practices of designing reliable software. The author does deal with the by now overworked topic of structured programming, but the larger and more important part deals with the preprogramming design efforts in the areas of user requirements, software objectives, external system specifications, and so on. The emphasis is on fault-avoidance techniques, with some discussion of fault detection, correction, and tolerance.

The second major part deals with software testing. It is convincingly demonstrated that the job of planning and designing software tests should consume as much effort as the original design and coding. The author's definition is important: "Testing is the process of executing a program with the intention of finding errors," and must be approached with the assumption that there are errors to find. If testing is done with the goal of showing the absence of errors, most of the software errors will be missed and maintenance costs will go through the roof. With this viewpoint, the author presents a large set of proven principles and practices for testing. Debugging is also well covered.

To anyone whose acquaintance with contemporary ideas in software development has been limited to such things as chief programmer teams, stepwise refinement, structured programming, and interactive debugging tools, and who has not been exposed to the major principles and practices for holding down software costs, this book will be a revelation.

—William Stallings

Dr. Stallings is a senior staff member of Advanced Computer Techniques, Inc., Arlington, Virginia.

BOOK BRIEFS . . .

Introduction to Data Management

by William D. Haseman and
Andrew B. Whinston
Richard D. Irwin, Inc., 1977
423 pp. $15.95

Citing the need today's managers have for understanding and being able to use large scale data management systems, the authors demonstrate how a data base management system can be applied to real-world applications.

Part one includes an introduction to data management, and discussions of file structures including sequential, direct access, indexed sequential, and accounting file structures; data structure; and a history of data management.

Part two focuses on a CODASYL subset DBMS, GPLAN, which the authors have implemented in FORTRAN (and which is being distributed by the authors without charge to groups using the book so that students can actually program their own applications). Advanced issues, including systems design, file conversion, and designing optimal data structures round out part three of the book.

Three case studies, including an accounting system, an energy allocation system, and a pollution discharge monitoring system, which are examined in depth, illustrate how data base management systems can work in diverse disciplines. The authors use many flow charts and diagrams to illustrate the concepts discussed.

Secret and Secure: Privacy, Cryptography, and Secure Communication

by Clayton C. Pierce, 1977
P.O. Box 4747
Saticoy, Calif. 93003
84 pp. $13.25

This is a tutorial book on designing cryptographically secure communications systems. Two chapters discuss technical but non-engineering aspects of information processing, data processing, and telecommunication systems and their input-output relationship to ciphering. A methodology for cryptographic system design is presented and applied by a comparative analysis of several ciphers, including Vigenere, Beaufort, variant, Polybius, and Nihilist. Each of 6,603 computer compiled algorithms is classed by its ciphering advantage. There are also demonstration cipher systems with ciphering tables, formats, and instructions for use. The vulnerability of ciphers to cryptanalysis is also reviewed.

vendor literature

Hobbyist's Catalog

An introductory text to personal computing and catalog of the Byte Shop of Arizona's available systems and acces-

(Continued on page 44)

Price, Performance

That's an uncommon advantage covering a full family of field-proven Mag Tape Drives.

Family resemblance goes deep. The Cipher Series X was designed from the ground up for maximum commonality of electronics, accessories and hardware. Full family parts-in-common include the head, tape guides, EOT/BOT, File Protect, a single universal Read/Write Board for NRZI, PE or NRZI/PE, plus mechanical, electrical and electronic parts and sub-assemblies. All of which means lower stock requirements for spares, less cost, and far greater flexibility in system design for the OEM. The savings are truly remarkable.

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Simplicity of design and ease of access. Those PC Boards are not only elegant solutions to design requirements, they're easy to get at for service and

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maintenance. All Cipher Boards are hinged for ease of access to all components. No extender boards required. No blind spots. No nonsense. These are simply the easiest machines to service in the industry. Bar none.

Reliability is built-in—and demonstrable. With full documentation. A calculated MTBF of 7912 hours—RADC standards. And a significant history—more than 10,000 units shipped to date. With all components pre-tested and burned-in to ensure reliability. Precision castings to ensure ruggedness. And large, powerful reel motors with a highly efficient servo system for less power consumption, lower operating temperatures and longer life. Cipher Mag Tape Drives are reliable by design, by manufacture and by testing. And we stand behind them with a no-nonsense, no-quibble Warranty. What more could you ask?

Service when and where you need it. With more than 100 field service locations in the U.S. and Europe, we're ready and responsive. And our factory service group maintains a 24-hour, 7-days a week phone contact for problems which exceed local capabilities. We don't let our customers down.

Call collect for immediate requirements. Or write or TWX for the full story. We can deliver to your needs, at highly competitive prices, and our spares program is pacing the industry. For full particulars, contact your nearest Cipher Representative or Cipher Data Products, Inc., 5630 Kearny Mesa Road, San Diego, California 92111. (714) 279-6550. TWX: (910) 335-1251.

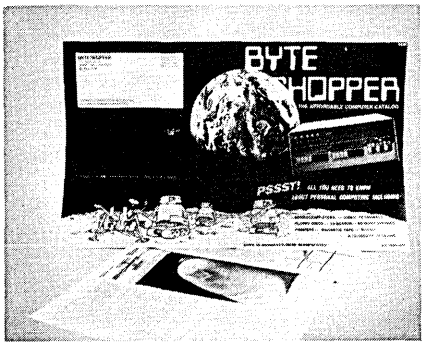
Cipher Data Products

CIRCLE 22 ON READER CARD

source data

(Continued from page 41)

sories, the *Byte Shopper* is now available to personal computing hobbyists. Over 50 manufacturers of microcomputers, video terminals, floppy discs, I/O boards, memory systems, printers, and magnetic tape are represented, in-



cluding specifications for each system, pictures of nearly all the systems offered, and a discussion of how to use each product and how it relates to an overall computing system. Several typical systems are pictured and examined in detail. Most products are based on the S-100 bus, the Intel 8080A, and its successor, the Zilog Z80. The large-paged (11 x 14-inch) catalog also includes graphics explaining how microcomputers work, a 50 word glossary of commonly used terms, a list of computer-title books, and a price list for prospective buyers. Price: $2. BYTE SHOPPER, Dept. DM, 803 N. Scottsdale Rd., Tempe, Ariz. 85281.

Complete Calculator Catalog

A complete catalog of Hewlett-Packard pocket and personal calculators and accessories, and several informative pieces are contained in a new 30-page publication "The Hewlett-Packard Personal Calculator Digest." The digest includes articles on the advent and impact of the pocket calculator and HP's "smart card reader." Extensive background is given for each of the hand-held and printing calculators, with an explanation of functions, physical specifications, accessories, and software. Charts to aid readers in comparing the capabilities of each model are also given. As part of the magazine format, Letters to the Editor and a question and answer section are included. HEWLETT-PACKARD, Palo Alto, Calif.

FOR COPY CIRCLE 285 ON READER CARD

Foxes and Owls

Two new low-cost crt terminals featuring built-in microprocessors are described in separate brochures now available from Perkin-Elmer Data Systems.

The FOX-1100 ($971 in quantities of 25) offers a basic terminal with 9 x 12-dot matrix character, 96 character ASCII set, special keys to eliminate extra keystrokes, 24 line by 80 character display, complete cursor addressing and control, and other advantages gained through the use of the microprocessor.

The OWL-1200 ($1496 in quantities of 25) is said to provide a powerful editing terminal including protected, low-intensity, numeric-only, blink, and inverse-video fields. The microprocesor in this terminal also allows simplified programming, minimized loading on the host computer, easy program debugging, and up to 16 programmable function keys. PERKIN-ELMER DATA SYSTEMS, Randolph, N.J.

FOR COPY CIRCLE 286 ON READER CARD

Intelligent Terminals

A new 8-page, color application brochure, "How Blyth Eastman Dillon Moves Millions of Dollars an Hour," describes how Incoterm intelligent terminals improve customer service for that financial institution. The brochure details the system used to perform a variety of functions such as branch office data collection, transaction processing, remote printing, retrieval of in-house quotations, and data communications management. All offices in the U.S. are linked over data lines at rates of 2400 to 4800 baud. Within each office, clusters of terminal stations are linked by terminal processors. The vendor's terminals replaced tty equipment as the primary on-line data entry mode. Use of the crt display/keyboard station is claimed to move data up to 30 times faster than before. Keystations provide order format validation, data validation, forms control, and automatic sequencing. INCOTERM CORP., Wellesley Hills, Mass.

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Solid-state Disc

The Megastore 1223 is an all-electronic alternative or replacement for fixed-head discs on the Nova 2, 3, and 1200 computer. A new 6-page brochure describes the reliability of the product as compared to mechanical disc and drum storage devices. It consists of a controller, card rack, power supply, blowers, and up to eight logical modules, each of which stores 262, 144 16-bit words. Initial installation of any capacity from 256K to 2048K words is permitted, with future growth requiring only the addition of plug-in modules as needs increase. AMPEX CORP., El Segundo, Calif.

FOR COPY CIRCLE 288 ON READER CARD

COM Illustrated

"Some Hard Facts About 3M Beta Software" is a new illustrated COM bro-

(Continued on page 49)

What's the big difference between the Intecolor 8051 Desk Top Computer and the IBM 5100? The price tag, for openers.

We've developed a very unique sales philosophy with the Intecolor 8051. We're simply out to give you more desk top computer for less money than anybody in the world. Just compare the capabilities and price of the Intecolor Desk Top Computer with any unit on the market, and you'll see.

Take the Intecolor 8051 versus the IBM 5100, for example. You get the same high-level BASIC Language with both units. But the Intecolor 8051 gives you 8 colors to work with instead of the antiquated, black and white IBM format. Study after study has proven that color means more efficient man-machine interaction, a reduction in operator fatigue, and better use of operator time. And we all know what time is. Money.

Now compare screen sizes. The Intecolor 8051's got a big, 19" diagonal screen that can display up to 3,840 characters—in color. On the other hand the IBM 5100 screen measures a meager 5"x6." But that's not bad if you've got 10/10 vision. And don't forget memory. Sure you can expand both units to 64K, but the Intecolor comes stock with 26K of memory compared to the IBM's 16K. And graphics? The IBM 5100 can't touch the graphics capabilities of the Intecolor 8051. Not by a long shot. But that's understandable, because not many computers can.

And here's the real zinger. Compare prices. The Intecolor 8051 Desk Top Computer retails for a modest $3995, while the IBM 5100 starts at a whopping $8500. That's a lot to pay for a name, especially when you can get a better unit for less than half the price.

The Intecolor 8051 Desk Top Computer. It's selling now for just $3995. And at that price you can probably afford two. Call us today with your order and we'll prove it to you.

*Domestic USA Prices

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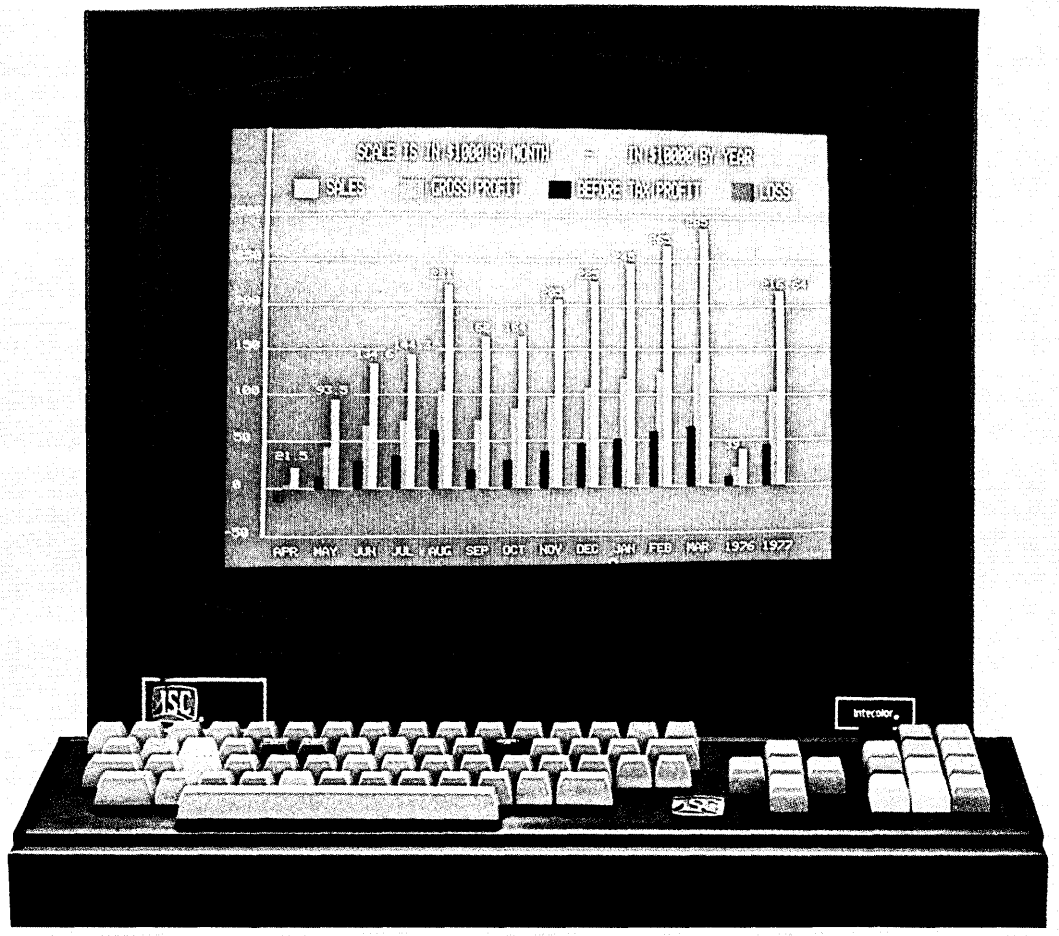
Telephone (404) 449-5880



Unretouched photograph of screen.

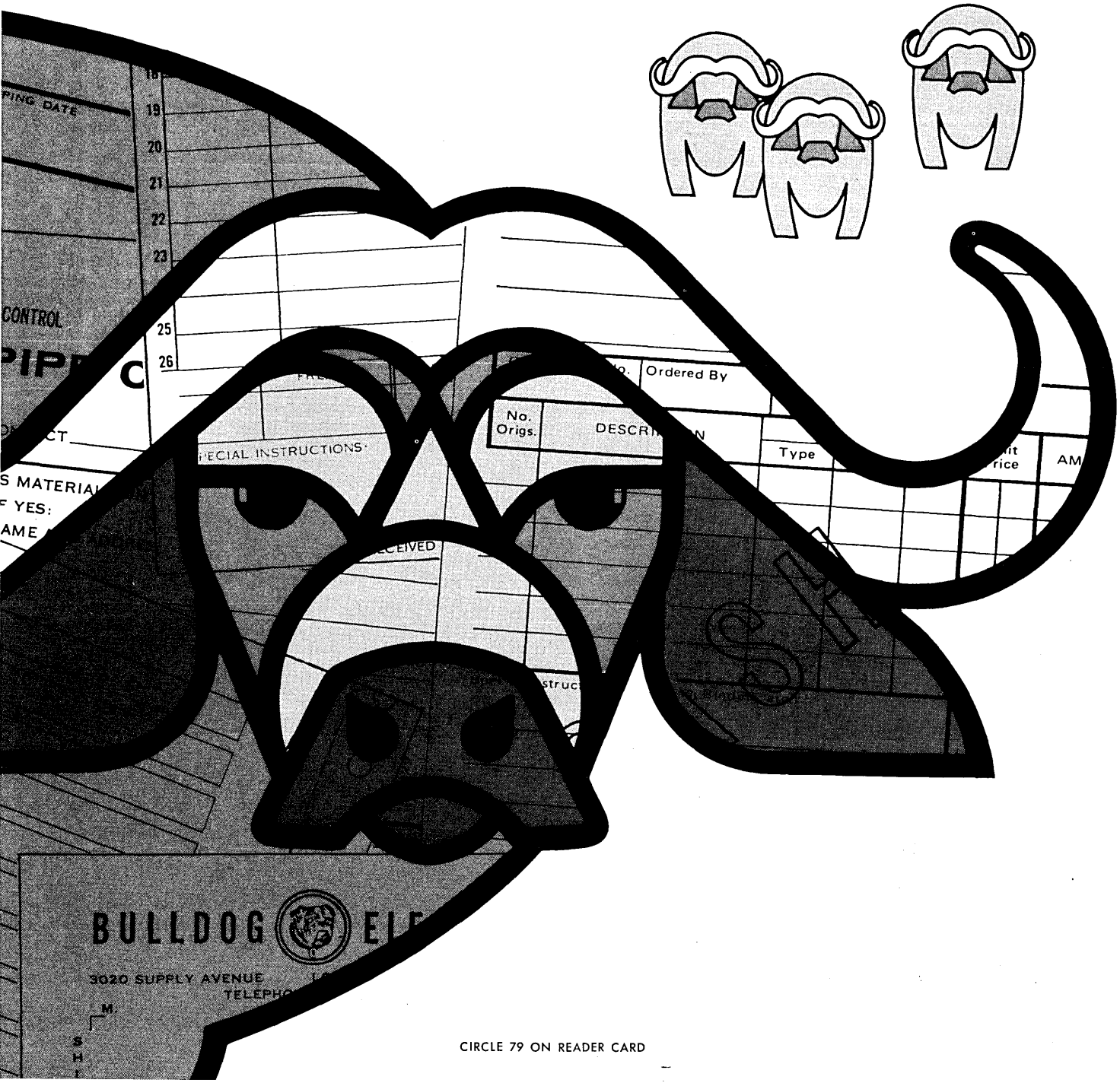
An NCR custom forms system sets you apart from the herd.

You are missing a chance to establish your unique identity if your invoices are just like all the others. By using an invoice that is distinctly yours at a glance, you reinforce the business image you've worked so hard to develop.

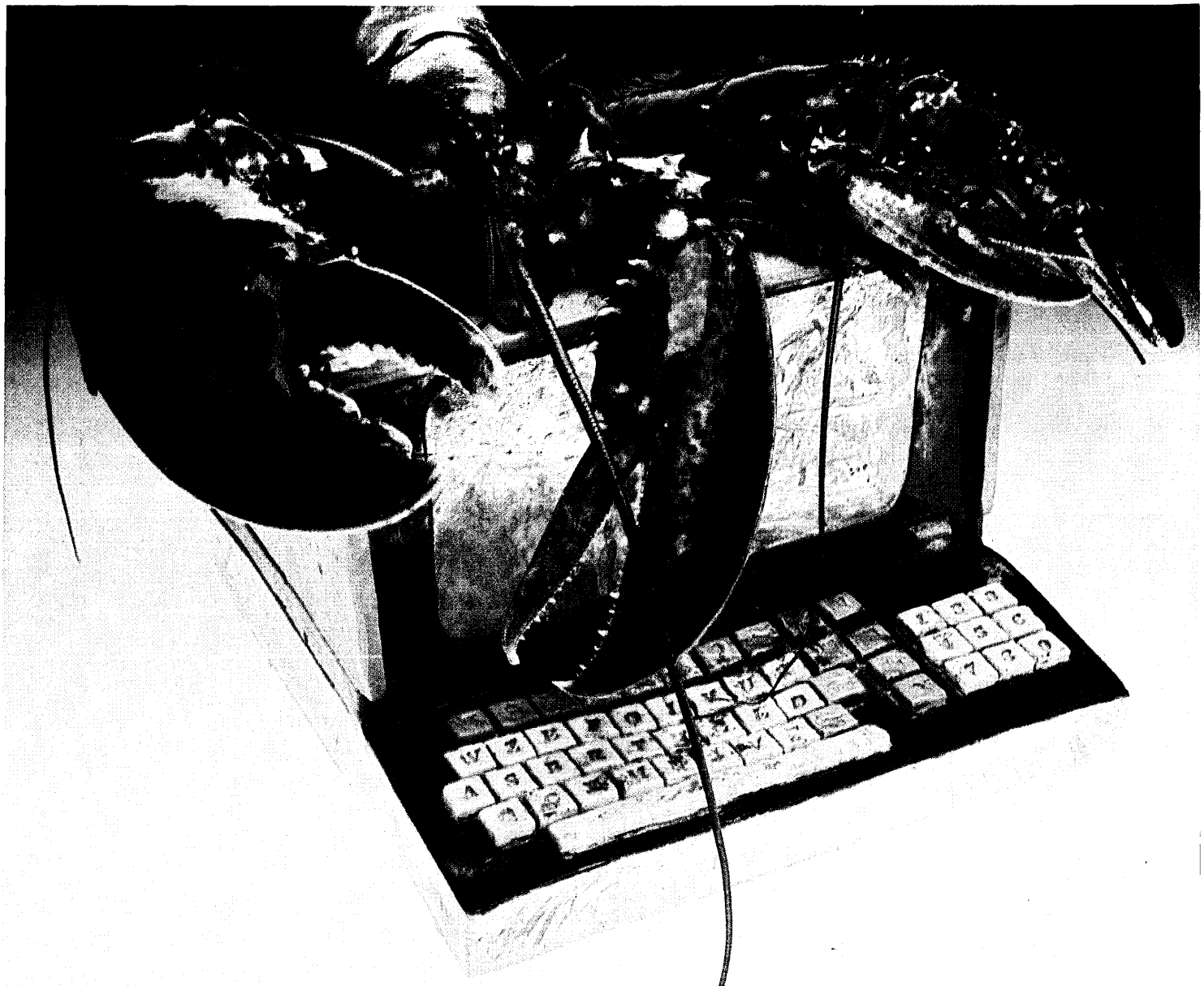
That's one of the advantages in using an NCR custom forms system. And, because your forms handling is now part of a system, you'll achieve greater productivity, too. What's more, a streamlined paper flow saves you time and money.

For a free appraisal of your company's methods of handling forms, call in an NCR Systemedia Marketing specialist. He is trained to customize a forms system especially for you. Contact your nearest office, or write to NCR Corporation, Systemedia Marketing, Dayton, Ohio 45479.

NCR Unforgettable invoices for that rugged individualistic image.



CIRCLE 79 ON READER CARD

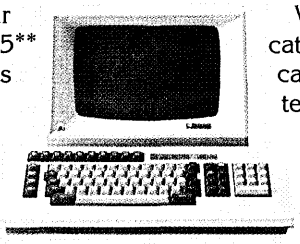


Does your Honeywell VIP take a big bite per byte? Our Harris 8770 doesn't.

Our new Harris*8770 can do everything your Honeywell 7700 or 775** can do—yet ours costs 10% to 30% less.

That's not all.

When you call us, we respond. For example, our average response time for maintenance is less than three hours. And you can understand why. Terminals are the only things we design, make, install and service. They're our entire line, not just a small piece of it. Stands to reason we give terminals all our attention.



And that's not all.

We build communications monitoring capabilities and self-test programs into our terminals. This not only lets you detect system failures and debug new applications. It also helps isolate any problems in your front end, communications lines, modems, terminals or printer's basic operations.

Result? A lot less downtime But even that's not all.

Harris terminals run without glare, heat, noise. They're lightweight, compact, trimly designed. Easier to work with, look at, move around.

Harris terminals. They help you fight the big-cost bite. Why not phone or write for details and a demonstration? **Harris Corporation, Data Communications Division, Daniel Webster Highway South, Nashua, NH 03060. 603-885-6685.**

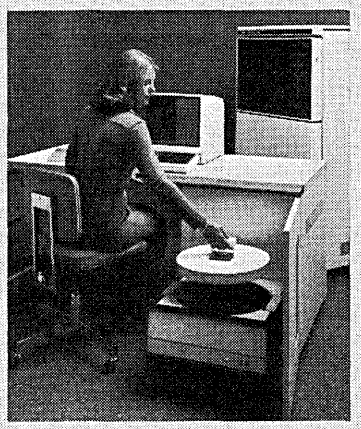
HARRIS
COMMUNICATIONS AND INFORMATION HANDLING

*Formerly Sanders Data Systems **Trademark of Honeywell Corporation

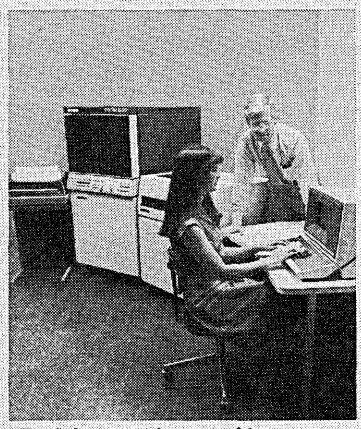
CIRCLE 81 ON READER CARD

Inforex 1300 and 1301 offer highly cost effective data entry capability for smaller installations (4 to 8 keystations) or remote locations where you can take advantage of our communications capabilities.

The 1303 provides medium range data entry capacity, with about triple the disc capacity of the 1301. It supports up to 16 keystations and the addition of edits, table look-ups, range checks and cross-footing. The 1303 also offers communications capabilities such as *spooling, HASP* and *RJE*.



With the 1330, you can consolidate remote job entry and batch data entry applications without compromising either function. The system features expandable disc storage (up to four—10 Mb. drives) foreground and background editing and bisync communications.



The Inforex 3300 is a powerful pre-processing system that allows you to edit data at the point of entry, enabling you to offload your mainframe. Its sophisticated editing capabilities can also handle many of those applications which you haven't had time to put on your present mainframe.

source data

(Continued from page 44)

chure which explains input and output capabilities of this vendor's product, and relates them to all major computer print tape processors. It also includes information on input, control, and graphic software, as well as magnetic tape and discs. 3M COMPANY, St. Paul, Minn.
FOR COPY CIRCLE 289 ON READER CARD

Interface Brochure

This new 12-page brochure offers a concise, easy to read explanation of instrument/computer interfacing, and describes the Hewlett-Packard Interface Bus which allows instruments and computers to be linked compatibly into efficient measurement systems. As many as 15 different devices can be linked on each bus. The HP-IB is being used in many fields, including space research, pollution monitoring, energy control, industrial manufacturing, and electronic testing. Also included are application notes, instruments and accessories, standard interface systems, and a bibliography of pertinent literature. HEWLETT-PACKARD, Palo Alto, Calif.
FOR COPY CIRCLE 290 ON READER CARD

A/D Conversion

A new application note, "Software Controlled Analog to Digital Conversion Using the 8080A Microprocessor," describes what is claimed to be a simple, low cost method of software, controlled, 8-bit A/D conversion said to eliminate the need for peripheral isolation devices. 8080A I/O interface considerations, I/O control using memory-mapping, and the successive approximation A/D conversion algorithm are discussed in a section preceding a description of the actual hardware and software implementation. Flow charts, the actual program (which requires 16 lines of assembly code), and a complete schematic of the hardware used also are included. PRECISION MONOLITHICS, INC., Santa Clara, Calif.
FOR COPY CIRCLE 291 ON READER CARD

Badge/Card Readers

A new 4-page, color catalog on badge/card readers is now available from this vendor. Four standard Series H Reader models for oem and systems applications are described, including units able to read 10, 20, 30, or 68 columns of data with up to 12 rows of data per column. All four models scan optically and are without moving parts to ensure reliable performance, long life and minimum maintenance, we are told. The brochure also presents the method of operation, circuitry description, and physical characteristics of the units. TAURUS CORP., Lambertville, N.J.
FOR COPY CIRCLE 292 ON READER CARD

Plotter Data

Information on products for use on drum and flatbed-type pen plotters is contained in two new catalogs entitled "Drum Plotter Supplies" and "Flatbed Plotter Supplies." Products include a wide range of papers, films, pens, ink, and adaptors for us on most all manufacturer's models. GRAPHIC RESOURCES CORP., Huntington Beach, Calif.
FOR COPY CIRCLE 293 ON READER CARD

Telecommunications Circuits

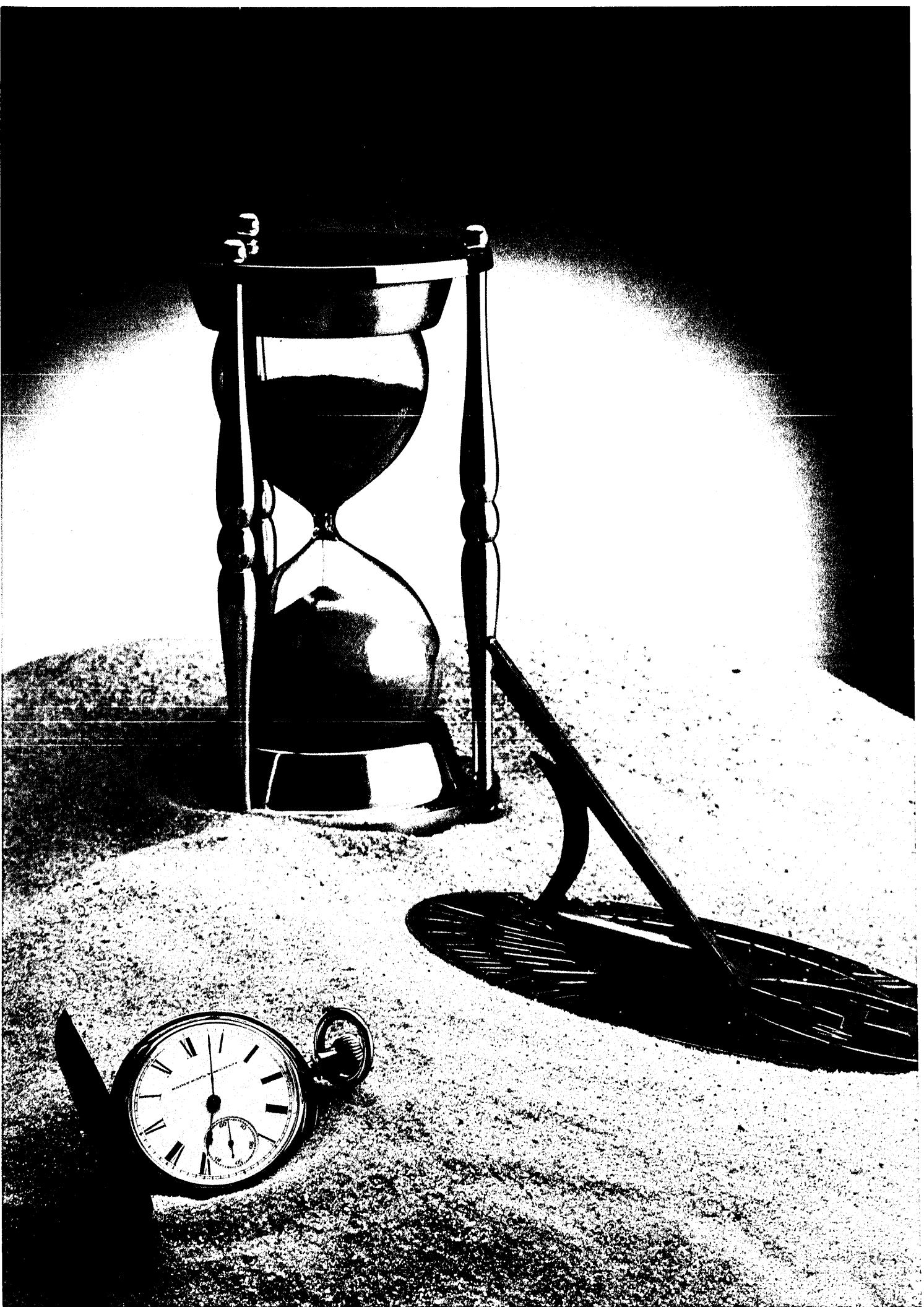
This brochure tells us that the world market for microprocessors and associated components will grow from $186 million in 1976 to around $1,130 million by 1980. To meet market needs, National Semiconductor produces families of product lines which involve both large capacity end user systems, and a range of oem memory products tailored to a variety of applications. Those families are described in this 12-page catalog, which includes descriptions, data, applications notes, and diagrams of 12 different subsystems product lines of particular interest to manufacturers and users of telecommunications systems equipment. NATIONAL SEMICONDUCTOR, Santa Clara, Calif.
FOR COPY CIRCLE 294 ON READER CARD

reports & references

Terminals Survey

Terminals from Memorex and Teletype were rated tops in overall performance, closely followed by products from Hewlett-Packard, NCR, Applied Digital Data Systems, Genesis One, IBM, and Lear Siegler in this survey of alphanumeric display terminals. The 61-page report, *All About Alphanumeric Display Terminals* also presents the detailed characteristics of 220 current terminals from 79 vendors. The survey questioned 711 users with a total of 18,390 terminals, and found that IBM displays were the most widely used, with 290 users rating 8,358 IBM terminals. The survey also compares the users' ratings of IBM terminals with the collective ratings of equipment

(Continued on page 52)



Real-time problems? Systems has timely solutions.

Systems Engineering Laboratories has dedicated its 16 year corporate life to solving challenging real-time problems. The experience gained in solving these problems is what led us to pioneer the development of true 32-bit computer systems.

Look into the operating systems, the languages, the data base system, the real-time device handlers and terminal systems, and you will see that we build for the real-time environment. That's our business.

Choose from a well-bred family of computing systems: The SEL 32/35, the SEL 32/55, or the SEL 32/75. Unlike other so-called "32-bit minis" that are only bridge-the-gap systems developed from essentially 16-bit architecture, all SEL 32 systems are true 32-bit machines. This results in richer instruction sets, more precision in data representation and larger, directly-addressable memory. All are available with throughput rates in excess of 26 million bytes/second.

Systems computers fit the term "minicomputer" in price alone. If your application is performance-sensitive, we'll save you money. If you're budget-sensitive, we'll give you more performance for your dollar.

The SEL 32/35 can be configured from 64K bytes to 512K bytes of 900 nsec memory. Resembling its more powerful brothers, the SEL 32/35 is a complete package, including control processor with floating-point arithmetic, memory, chassis, power supplies and cabinet.

The SEL 32/55 is offered in a variety of both single and multiple CPU configurations, with from 32K bytes to 1 million bytes of 600 nsec memory.

The SEL 32/75, with up to 16 million bytes of main memory, has a concept so new, we had to coin a special term to describe one of its main features: Regional Processing Units. Working independently, these RPU's contain sufficient control and buffer storage areas to process an I/O region and transfer the resultant data directly to main memory. Computer system throughput is further enhanced by High-Speed Floating- Point Hardware and Writeable Control Storage.

Just circle our number on the Reader Service Card, or call us today. We'll send you the powerful story of the SEL 32 family.

SYSTEMS
ENGINEERING LABORATORIES

☐ CALL ME
☐ SEND ME MORE INFORMATION
☐ I HAVE PRESENT NEED FOR SYSTEM
NAME _____
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CITY _____
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SYSTEMS Engineering Laboratories
6901 West Sunrise Boulevard, Fort Lauderdale, Florida 33313
(305) 587 2900

source data

(Continued from page 49)

supplied by all the other vendors. Price: $12. DATAPRO RESEARCH CORP., 1805 Underwood Blvd., Delran, N.J. 08075.

The Grand Design

IBM: *the Grand Design*—SBS, SNA, *and* SDLC is an analysis of IBM's "Grand Design" and how it will affect the communications/computer marketplace. The technical analysis section details what the communications control procedures are, how to implement them, and what the timing and costs are. It also compares the SDLC, DDCMP, and SNAP protocols, including frame structures and packet switching. The report discusses options for other cpu mainframe manufacturers and plug-compatible vendors, and looks at the synchronous/asynchronous architecture. There is also an examination of computer/communications terminals, current markets for editing crt's, standalone processors, clustered processors, point-of-sale terminals, and others. Finally there is a discussion of IBM's strategy in telecommunications, the strategy of SBS, and the decision-making framework of communications and data processing users. Price: $695, with four updates during the coming year. THE YANKEE GROUP, P.O. Box 43, Cambridge, Mass. 02138.

Structured Programming

All the *Data Processing Digest* articles and book reviews on the subject of structured programming are included in their new publication, *Structured Programming*. There is also a bibliography of other references to structured programming from professional journals and conference proceedings, supported by an intensive subject index and a list of publishers of those original items, including names and addresses. Price: $15. DATA PROCESSING DIGEST, 6820 La Tijera Blvd., Los Angeles, Calif. 90045.

Mini Software Directory

A new directory addressed to the minicomputer/small business systems community is now available. The ICP *Mini-Small Business Systems Software Directory* lists more than 1,000 software products for over 50 industries, and covers a full spectrum of mini and small business systems hardware. Articles for non-technicians have been prepared, including one designed to assist in the selection of minicomputer software. The new directory also lists and describes both systems and applications software. The catalog will be published twice yearly, in April and October, with each issue completely updating the previous one. Price: $65, annual subscription; $40, single issue. INTERNATIONAL COMPUTER PROGRAMS, INC., 1119 Keystone Way, Carmel, Ind. 46032.

Profit-Oriented Dp

The subject of treating the data processing organization on a profit and loss basis is discussed in this report on the experiences of Dresser Industries in this area. *Profit-Oriented Management of Programming and Data Processing Operations* focuses on the need for a formal planning system for information services, the benefits of consolidation, and the need for performance criteria, and also describes possible ways they can be implemented and the difficulties of coordinating divisional activities. There is an analysis of the data processing management methods used at Dresser which have proven successful and profitable, providing a model for organizing and efficiently managing systems and operations for producing and forecasting profit plans. Price: $25. FAIM TECHNICAL PRODUCTS, INC., Box 1013, Melville, N.Y. 11746.

Ocr Applications

This new portfolio demonstrates how ocr is now being used by many industries to replace punch-card and other traditional input equipment. Six case studies document cost-savings and potential applications for ocr, and discuss its use in small manufacturing and government installations.

Illustrations, graphs, and explanatory text compare available ocr hardware and describe its use in business functions including record-keeping, sales reporting, inventory, and production control. The portfolio is available free of charge from AUERBACH PUBLISHERS INC., 6560 N. Park Dr., Rennsuaken, N.J. 01809.

Business At Home

The 113 page *Shoestring, Start-at-Home Computer Business Handbook* covers 21 low-capital ventures, including consulting, programming, software packages, COM, tape/disc cleaning, temporary services, used computers, and computer products and services for the home aimed at the computer professional who's either serious or curious about doing his own thing. The book also suggests ways to start up, go from part to full time, bid, and market to the computer industry. Price: $12. DATASEARCH, 730 Waukegan Rd., Suite 108K, Deerfield, Ill. 60015.

(Continued on page 56)

WANG'S PCS-II

THE END OF THE LINE FOR INTELLIGENT TERMINALS.

Wang's PCS-II. The small business computer that makes intelligent terminals obsolete. And introduces a whole new world of Distributed Data Processing.

Endowed with commercial BASIC and exclusive Wang minidiskette storage, the PCS-II delivers direct access data processing capabilities no ordinary terminal can. And with Wang's programmerless "EASYFORM" forms building and data-entry language, the PCS-II is a hands-on winner in any data-entry or forms-processing environment.

Wang modularity lets you expand memory, communications or peripherals as your needs grow. Or new technologies as they develop. Directly at the operator site.

The PCS-II even gives you a price tag no intelligent terminal can match—just $6,200. With 50K memory, dual minidiskette drives and bisynchronous 2780/3780 communications it's still only $9,200.

Hungry for more intelligence? Call your local Wang office or mail this coupon to PCS-II Product Sales, Dept. DDP, Wang Laboratories, Inc., One Industrial Ave., Lowell, Massachusetts 01851.

I'm hungry. Send me information on Wang's PCS-II.

Name _____

Title _____ Phone _____

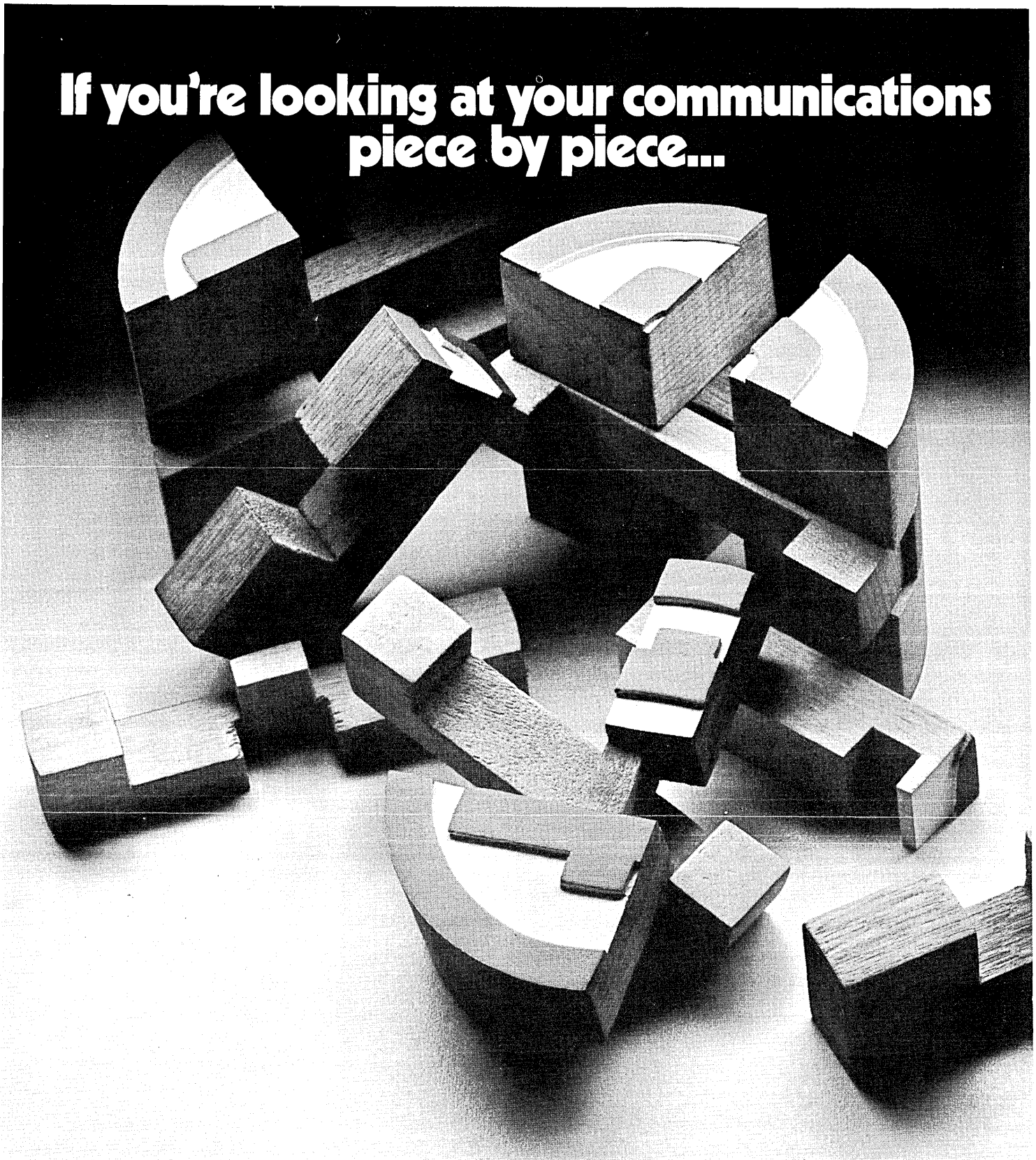
Company _____

Address _____

City _____ State _____ Zip _____

DP72/D77

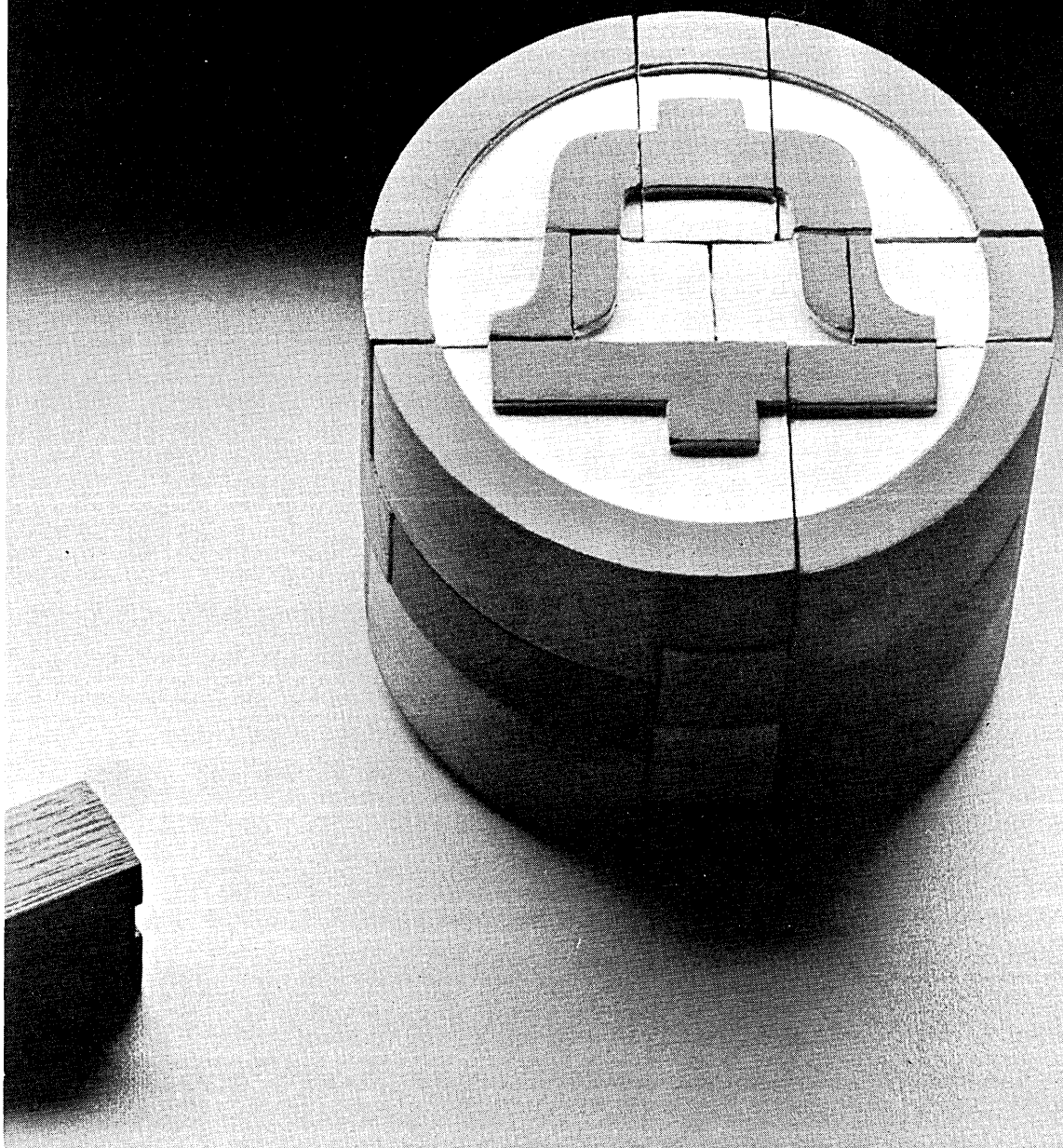
If you're looking at your communications piece by piece...



The Bell System recognizes that many seemingly unrelated business problems are really communications problems in disguise.

So we've provided our account executives with the skills and equipment they need to take a company's problems, and our solutions to them, and fit them together into a total communications system.

you're missing the whole picture.



For we firmly believe that, in solving problems for companies like yours, the system is the solution. If you haven't talked systems with your local Bell Account Representative lately, you're missing something.

The system is the solution.

Bell System

source data

(Continued from page 52)

courses

Dp Operations Management

This specialized three-day seminar emphasizes the management skills and techniques applicable to the data processing operations function. "Data Processing Operations Management," August 29-31 in New York City, and September 26-28 in San Francisco, will include sessions covering department standards, performance analysis, job accounting, equipment selection, conversion, quality assurance, center management, computer center construction, security, recruitment and selection, and employee motivation. Certificates from the Univ. of Chicago Center for Continuing Education will be awarded to all attendees. Fee: $395 per person, plus $50 registration fee per organization represented. Additional persons from same organization: $395 each. INFORMATION SYSTEMS SEMINARS, New York Management Center, 360 Lexington Ave., New York, N.Y. 10017.

Long-Range Planning

This workshop is intended for data processing managers, planning staff, and other management personnel concerned with effective long-range planning. The objective of "How to Develop an Effective Long-Range Data Processing Plan" is to establish a viable planning mechanism as a means of controlling the dp function, including: a technique for projection of future user requirements, a mechanism for mediating between computing user priorities, and procedure for estimating impending hardware, software, and personnel needs. Discussions also will be conducted to allow participants to exchange ideas on their approaches with others working in the field. The five-day workshop will be held August 8-12, October 3-7, and December 5-9 in Washington; September 12-16 in Jackson Hole, Wyoming; and November 14-18 in San Francisco. Price: $595. KESTON ASSOCIATES, 11317 Old Club Rd., Rockville, Md. 20852.

The Automated Office

"Word Processing: Toward the Automated Office" will present and explore the economics, management, and applications of word processing systems and services. Plenary sessions on the first day will survey the economics and technology of modern word processing and its application to document preparation. On the second day, workshops will examine capabilities of equipment and software systems, management requirements, administrative management problems, methods to improve dp productivity, and the supply of word processing services through centralized dp installations. All attendees will receive the conference notebook, which includes a hardware survey, vendor experience and product lines, an overview of application areas, case studies of successful applications, and procurement guidelines and a checklist. Fee: $295; $195, teams. AIIE SEMINARS, Dept. DTM, P.O. Box 3727, Santa Monica, Calif. 90403.

Data Communications

"Data Communications: Advanced Concepts and System" is a two-day seminar designed to provide a comprehensive overview briefing on what's happening in data communications today. It is designed to provide maximum benefits to the practicing data communications analyst/manager or systems planner. A knowledge of data communications terms, concepts, and contemporary practice is a prerequisite for this seminar.

The course will include discussions of digital transmission systems, value-added networks, high-level data link controls, modems and multiplexors, distributed computing and networking, network protocols, satellite channels and services, front ends and remote communication processors, and network management, concluding with a review of significant regulatory issues. The course will be held July 21-22 in New York. DATAPRO RESEARCH CORP., 1805 Underwood Blvd., Delran, N.J. 08075.

Issues in Information Systems

A five-day seminar, "Current Issues in Information Systems Research," will be held July 18-22 on the M.I.T. Campus in Cambridge, Mass. The seminar will discuss issues regarding the management of computer systems, and will present research results developed at the Center for Information Systems Research.

The seminar will follow a lecture-discussion format, giving participants an opportunity for hands-on experience with systems currently being developed. Issues to be reviewed will include distributed processing, data management, decision support systems, operating systems, end user needs assessment and problem diagnosis, and new technologies. The emphasis will be on management problems such as performance evaluation, configuration selection, privacy and security, information system effectiveness, and implementation strategies.

Designed primarily for managers and decision makers in public and private sector organizations, the prerequisite for the course is a general familiarity with computer-based information systems. Fee: $600. CENTER FOR INFORMATION SYSTEMS RESEARCH, M.I.T., 50 Memorial Dr., Cambridge, Mass. 02139.

periodicals

MIS Quarterly

A new publication by the Society for Management Information Systems and the MIS Research Center of the Univ. of Minnesota, the MIS *Quarterly* is devoted to the many aspects of management information systems, and is designed for users and builders of organizational information systems. The first issue included articles on application, such as "How to Survive a Management Assessment," and "A Contingency View of Managing the Data Processing Organization"; and on theory and research, with articles entitled, "An Experimental Investigation of Some MIS Design Variables," and "Case Studies of End User Requirements for Interactive Problem-Solving Systems" among others. There is also a section of interviews with chief executive officers of large organizations regarding satisfaction of their information needs. Price: $45, including membership in SMIS; $25, non-membership. MIS QUARTERLY, Editorial Office, MISRC, 269 19th Ave. South, Minneapolis, Minn. 55455.

Cryptology Quarterly

A wide variety of ideas related to cryptology will be presented in upcoming issues of this new quarterly, *Cryptologia.* Topics discussed will include computer encryption, paper and pencil cryptanalysis, history and literature of cryptology, mathematical cryptology, cipher machines, and reading ancient languages, with coverage by research papers, survey articles, personal accounts, reviews, education notes, and problems. Scheduled articles are "Automated Analysis of Cryptograms," "The M325 Cipher Machine," "Grille Reconstruction," "Beatrix Potter's Journal Ciphers," and "Poe Challenge Cipher Finally Broken." Price: $16/year (four issues); $5, single issue. CRYPTOLOGIA, Albion College, Albion, Mich. 49224. ❋

YOU'VE GOT THE REMOTE, WE'VE GOT YOUR GRAPHICS.

Gould's new Remote Graphics Processor gives you the speed, image clarity, ease of operation and cost effective graphics of an electrostatic plotter.

The RGP interfaces to most remote job entry and remote batch terminals, or can be operated stand-alone through a modem. With appropriate Gould host computer software, the RGP processes highly encoded character data which can be transmitted by your mainframe's standard spooling software.

Gould software is available for IBM 360/370, Univac 1100 Series and Control Data 6000, 7000 or Cyber 70 Series.

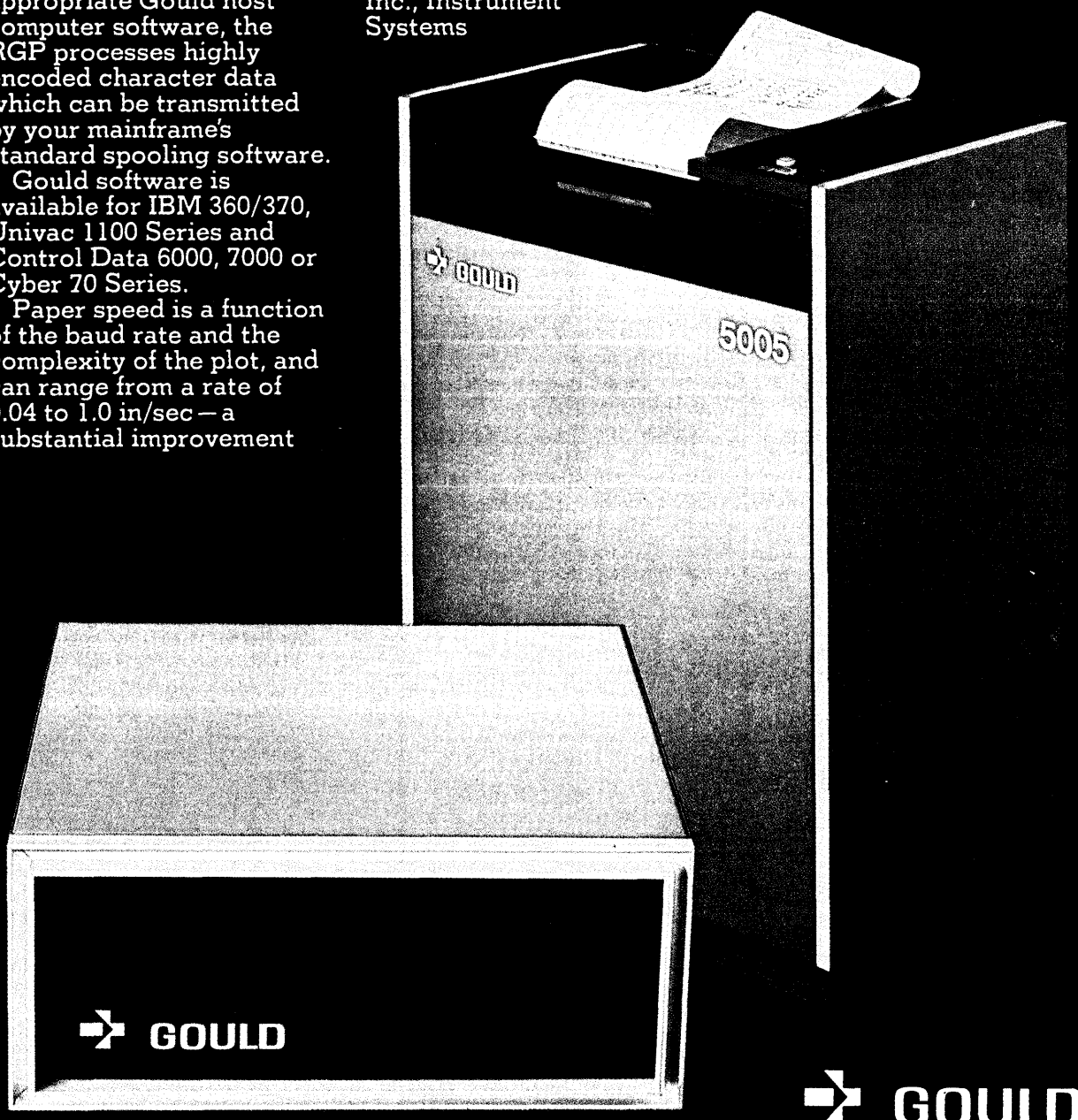
Paper speed is a function of the baud rate and the complexity of the plot, and can range from a rate of 0.04 to 1.0 in/sec—a substantial improvement over pen plotters.

If you're already into remote graphics, you owe it to yourself to examine the RGP's potential. And if you're not now involved in graphics, let's talk anyway. Because you might be soon.

For more information on Gould's remote graphic capability, contact Gould Inc., Instrument Systems Division, 3631 Perkins Avenue, Cleveland, Ohio 44114. Telephone: (216) 361-3315.

Or Gould Advance, Raynham Rd., Bishop Stortford, Hertz, Great Britain.

For brochure call toll-free (800) 325-6400 Ext. 77. In Missouri: (800) 342-6600.



GOULD
The product development company

CIRCLE 30 ON READER CARD

Seven tough problems in "On" and how Tandem's "NonStop"™

The Tough Ones.

1. System Down—Processor Failure.
2. System Down—Disc Failure.
3. System Down—Repairing Hardware.
4. System Down—Restoring Data Base.
5. System Down—Software Failure.
6. System Down—Changing to a Larger Processor.

Lots of things change when you go "on-line." Mostly for the better. That's why this is the most important trend in data processing today. But the one area which concerns management the most is "What happens when the computer goes down?" It's a good question, and until Tandem introduced "NonStop" processing last year the answers weren't pleasant. Service is interrupted; that's bad enough. But there is worse news still. At the instant of failure, a transaction in process could be lost (or duplicated), a record being updated could be destroyed, or a pointer changed incorrectly could cause the loss of untold records. In short, loss of service is the surface cost. Loss of data base integrity is an even greater problem. Tandem's NonStop System, hardware and software, is the first top-down, designed-in solution to both these problems. To make it even better, we've designed it so it's easy to program, easy to expand, and easily the most efficient transaction processing system around.

1. System Down—Processor Failure.
Every computer will fail sometime. The bigger they are, the more often they fail. Tandem has replaced bigness with a unique multiple processor architecture. Workloads are shared by the processors under control of Guardian, the only NonStop Multiple Processor Operating System available regardless of price class. When a component fails, Guardian automatically reassigns both processor and I/O resources to ensure that in-process tasks including file updates are completed correctly. You decide the priorities; Guardian does the work. And no interruption of your "on-line" workload occurs. Restart is virtually instantaneous.

2. System Down—Disc Failure.
When one of your disc storage devices fails in the middle of a file update, unknown damage to the record, to record pointers, or to indices can occur. Enscribe, Tandem's NonStop Data Base Record Manager, ensures that the damaged record is restored; and, with our optional Mirror Volume duplicate file technique, that operation is continued using the back-up file. The back-up files are created automatically and are used by Enscribe to improve system response time. When the down disc is repaired so are its files, automatically, by Enscribe. You decide which volumes to back up; Enscribe maintains them, and no interruption of service occurs.

3. System Down—Repairing Hardware.
With any system, a hardware failure must be repaired. But only with Tandem can the system keep operating, right through the failure and through the repair, too. Tandem's Customer Service Representative can remove and replace any failed module in your system without interrupting service. The operators at terminals and the programs in process are totally unaware of either the failure or the repair. And routine maintenance, too, is performed with the system fully operational. This is one more unusual feature of our system, but without it, no system can truly be called "NonStop."

4. System Down—Restoring Data Base.
When a hardware failure occurs during file update in any "on-line" system which is not NonStop, there is every reason to question the integrity of the data base. Integrity of the data base is crucial. For this reason, elaborate procedures to maintain restart points and backup files are required in almost all "on-line" systems. Not with Tandem. Using Guardian and Enscribe, the Tandem NonStop System ensures that all transactions are completed correctly even if a processor, I/O channel, disc controller or disc drive fails during that transaction. Equally important, the system downtime normally required for "restore" and "restart" operations is eliminated.

5. System Down—Software Failure.
System software crashes are an important source of downtime in ordinary on-line systems, but not in Tandem installations. Because all Tandem software is designed and tested to run in a multiple processor environment, it is also designed and tested for failure modes never considered in single processor systems software. Most important, the use of independent processors, each with its own memory, assures that a software failure in one processor cannot cause a failure in a second processor or contaminate the data or programs executing in that processor.

6. System Down—Changing to a Larger Processor.
On-line systems tend to grow, and as they grow they change. New applications, more stations, improved service; all of these result in a need for bigger, faster processors. With Tandem's NonStop System you can actually add processors, add memory, and add peripherals without any re-programming whatsoever. Using Guardian, Enscribe, and Envoy, Tandem's Data Communications method, all user programs and all files are geographically independent. They have to be for NonStop operation. You can also write your programs using a powerful high-level compiler for a multiple processor environment as easily as for a single processor.

7. System Up—Confidence Down.
When an "on-line" system is up, people come to rely on it. And because today's computers are reliable, people have come to rely on them quite heavily. Which makes it even worse when the system does go down, or the information it supplies is wrong. Confidence is severely damaged. And anyone who has tried manual back-up systems knows that they are not the answer. An automatic back-up, non-stop system is the answer. And Tandem has it.

Line" Data Base Systems System solves them.

Tandem offers a proven, field tested solution to the two principal questions everyone should ask about an "on-line" data base system: What level of service will it provide? What protection does it offer for my data base?

Someday all "on-line" systems will be NonStop. Tandem 16 Systems are NonStop today. And without price penalties. Not everyone needs an on-line, real-time, non-stop system, but for those who do there isn't another solution worth thinking about. Tandem Computers, Inc., 20605 Valley Green Drive, Cupertino, California 95014 or Tandem Computers GmBH, Bernerstrasse 50A, Frankfurt 56, West Germany.

Toll Free 800-538-9360 or 408-255-4800 in California.

Guardian

Multiple Processor Operating System

NonStop operation.

Automatic re-entrant, recursive and shareable code.

Virtual memory system.

Geographic independence of programs and peripherals.

Enscribe

Data Base Record Manager

Provides relative, entry-sequenced and key-sequenced files.

Each file may be up to four BILLION bytes.

Up to 255 alternate keys per file.

Optional mirror copy by disc volume.

Envoy

Data Communications Manager

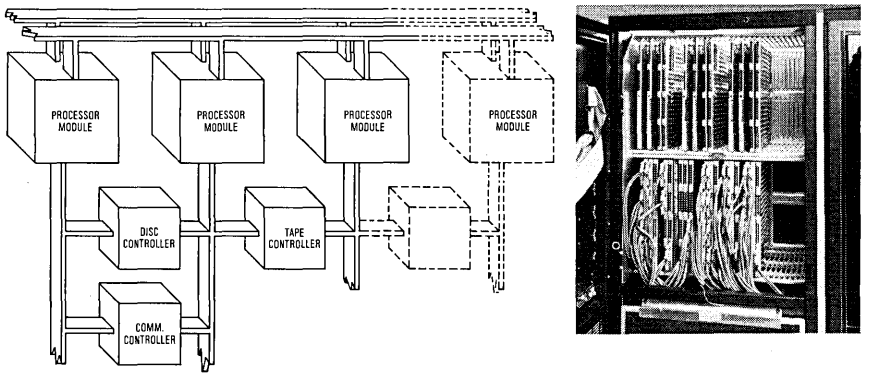
Communications with remote devices and/or processors.

Support of point-to-point, multi-drop, master and/or tributary.

All transfers via DMA.

Speeds up to 19.2Kb asynchronous and 56Kb synchronous.

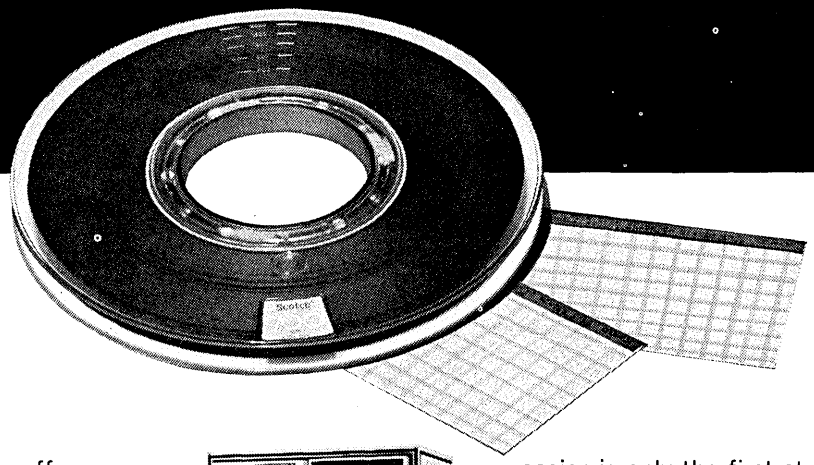
Photo and schematic show three processor modules with space for fourth module, interconnected to disc controllers, tape controllers and communications controllers.



TANDEM

The Tandem 16 NonStop System is composed of multiple, independent processors with dual redundant communications paths. The unique interaction between Tandem hardware and software assures not only continuous operation, and the integrity of your data base, but also throughput unmatched by any other computing system of comparable cost.

Nobody turns COM data into sound business decisions the way 3M can.



Only 3M Beta System offers programmable COM with the big plus of business graphics—to make your COM output more useful to your company's decision makers!

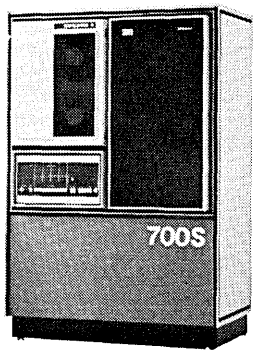
With 3M Beta COM, you make data easier to interpret, decisions easier to make in either of two ways:

Highlight the data. The 3M Beta System gives you underlines, italics, bold face, 8 different character sizes through simple operator-entered instructions. No host computer modification needed!

Graph the data. Reduce complicated numbers to easy-to-scan pie charts, graphs, tables. The 3M Beta System includes the software needed for graphic presentation of data.

But making business decisions easier is only the first step. Beta System makes your job easier, too. From software innovations to installation and operator training programs to field and home base service nobody offers you the unique total system support approach 3M can.

So whether you're interested in business graphics or want to move up to programmable COM, move COM in-house or expand your operation, let 3M show you the way. Call your local 3M Business Products Center or write Microfilm Products Division, 3M Company, St. Paul, MN 55101.



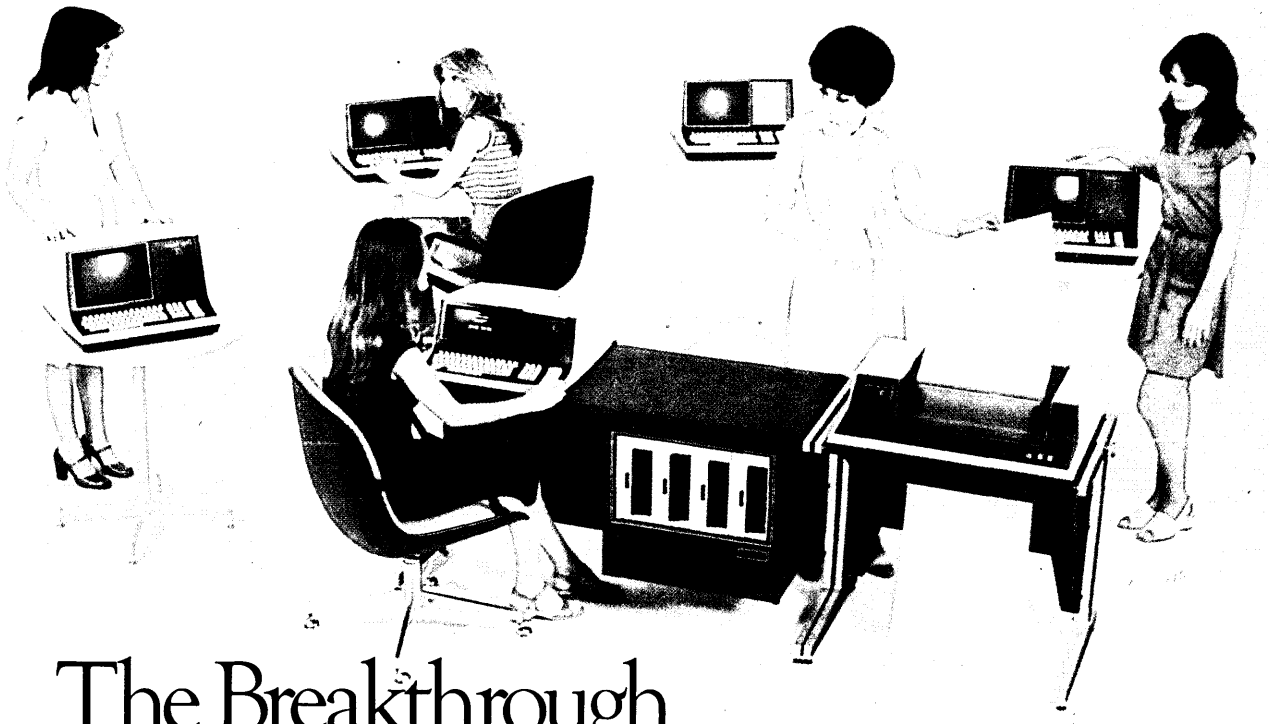
BETA Systems

For entry-level COM, let 3M show you "LBR"—the only **totally dry COM** and the most convenient way to record computer data on 105mm microfiche.

Better microfilm systems start here...

3M COMPANY

Diskette Datashare-



The Breakthrough Your DP Budget's Been Waiting For.

And waiting for. An inexpensive, multi-user system that increases your data processing capability without depleting your pocketbook.

Datapoint announces Diskette DATASHARE®— a new combination of hardware and software that features the power of our DATASHARE Business Timesharing System and the economy of a diskette-based processor.

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The leader in dispersed data processing™

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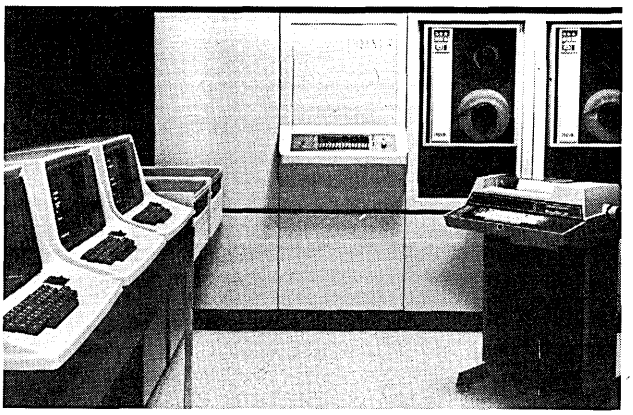
To the timesharing user who wants one computer to do it all:



Prime timesharing systems, like Swiss Army knives, are multifunctional, compact and easy-to-use. Both provide a collection of tools, each fitting a different need, all fitting together in one very reasonably priced, elegantly-engineered package. But a Prime computer, unlike the army knife, lets many people use all the tools all at once.

One Prime computer system has the right mix of tools. A family of program-compatible central processors, a broad range of input/output subsystems and a sophisticated interactive multi-user operating system are the starting points for selecting a system tailored to your exact applications mix.

One Prime computer system plays many roles. By providing virtual address spaces of up to 512 million bytes for each of up to 63 simultaneous users, up to eight million bytes of main memory and 2.4 billion bytes of disk storage, one system can be used for both interactive software development and computational processing.

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One Prime computer can do it all: complex simulations in FORTRAN, straightforward calculation in BASIC, text editing, transaction processing, massive number crunching and more.

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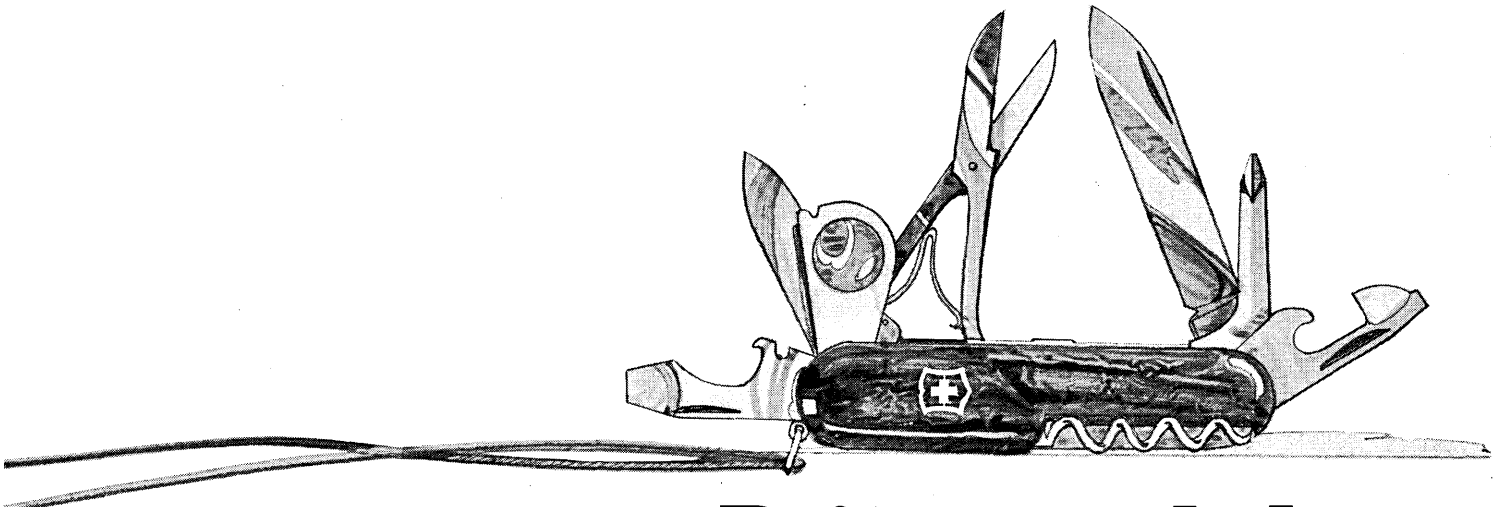
To find out how one Prime computer can do it all for you, contact David R. Johnson, Business Manager, Prime Computer, Inc., 145 Pennsylvania Avenue, Framingham, MA 01701, (617) 879-2960.

PRIME



Prime can help

The future has a way of becoming the present.

In 1970, distributed data processing was a visionary concept. Someday corporations wouldn't have to push vast volumes of data through a central computer to supply the daily information needed for corporate planning and control. Someday there'd be enough electronic intelligence at each plant and office to permit both source data editing and fast, cost-efficient local processing of such local tasks as order entry, invoicing and inventory control. Someday....

Distributed Processing Today. In 1977, hundreds of distributed processing networks are serving American corporations in such industries as retailing, transportation, manufacturing, wholesale distribution, banking, insurance, stockbrokerage and medical services. In implementing distributed processing, these companies have learned that optimal performance requires remote display/processing systems flexible enough to be precisely scaled to the needs of each individual site.

Clustered Displays. The most flexible remote site system for distributed processing has proven to be the clustered display, an idea pioneered in

1970 by Four-Phase Systems. At each site, a cluster of keyboard/video terminals share a single processor ... and terminals can easily be added or removed to suit the site's functional requirements and transaction volume. Four-Phase Systems has built and installed more clustered display/processing systems than any other manufacturer.

Orderly Growth Path. The flexibility offered by the clustered display concept is an important component of Four-Phase Systems' orderly growth path plan for the implementation of distributed processing. When a network evolves along an orderly growth path, each increment of growth is triggered by economic benefits proven in the previous increment. This unusually cost-efficient way to implement a network is made possible by the unique hierarchy of equipment developed for distributed processing by Four-Phase Systems.

Four-Phase Systems. Who uses Four-Phase equipment today? More than 500 major organizations. Including ten airlines. Thirty insurance companies. Forty banks. Fifty government agencies. And more than a hundred of America's leading manufacturing corporations.

Why has Four-Phase succeeded in the hotly competitive world of business data processing? A primary reason is the fact that the Four-Phase product line was designed from scratch for its intended application ... not "assembled" from commercially available electronic logic components. Of all the business computer manufacturers in America, only two have always designed and produced the integrated circuits which are the brains of their products ... Four-Phase and IBM.

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Editor's Readout

Edward K. Yasaki, Sr. Associate Editor

What's So Important About Personal Computers?

A couple of months ago, some fourth-grade students had the opportunity to pit their skills with electronic calculators against those of a local businessman using a *soroban,* or abacus. The Japanese banker, showing his speed off the starting line, finished first with problems in addition and subtraction. But the kids, with calculators in hand, crossed the finish line first in multiplication and division.

It proves nothing, really, but it shows the extent to which calculators are becoming a part of the lives of elementary school children. In some communities, kids are not only learning to use calculators but also acquiring hands-on experience with terminals and personal computers.

The microprocessor-based computers increasingly are showing up in homes even more than schools, too. The home hobbyist, in fact, is buying kits and fully assembled machines faster, in some cases, than manufacturers can supply them.

What we've found, however, is that many of the buyers are not truly hobbyists, but hardware and software folks by day, one-man systems houses by night. College students in various disciplines are designing turnkey systems, and moonlighting programmers are producing custom software. Real estate brokers have configured property management systems with microcomputers. One computer store sold a micro that is being use to control the temperature of chemical solutions in a photographic studio. The examples go on and on.

Thus these lean machines, more expensive than toys, are worthy of attention of the serious dp practitioner. Microcomputer systems are bringing to light new applications that don't require the power of a mini. In still other applications they are replacing minis. And they are being designed into remote processor stations for users in distributed processing environments, extending the processing power that might now exist for them only in a central dp installation.

The serious user, of course, has been justified in believing that only a few desktop machines from the likes of IBM, Hewlett-Packard, and Tektronix have been designed and built to provide the level of reliability that commercial users expect. That hasn't been the case with all home computers, especially those assembled from kits by the buyer. But that, too, is changing.

Indeed, some manufacturers won't sell you kits. And even among those that do, quality assurance measures are being taken and system tests performed in order to achieve commercial-grade quality. For awhile yet, software will continue to remain a problem, and an adequate network of field service offices will be lacking. But things are changing so rapidly in this segment of the dp industry that an occasional examination of it would be justified.

What one finds is a world populated by new companies bearing unusual names, some catering strictly to hobbyists, others to the serious user and oem, and some to both. There is no direct correlation between frivolity of name and seriousness of purpose. They're small companies, relatively speaking, and they're low-overhead operations that can, for example, sell you an additional 8K of static RAM for $200, a mere 10% of what some of the Establishment firms charge.

With this issue, then, we begin an examination of personal computing—not only a fun subject but also one that is rife with implications for all dp center managements. ❋

Microcomputers: For Fun and Profit?

by Edward K. Yasaki, Sr. Associate Editor

Are thousands of just plain folks really spending thousands of dollars each on computers for toys? Will ten thousand more one-man systems houses spring up tonight?

Adam Osborne knew nothing about the publishing business. He had a software company that specialized in business dp applications. But today, with the current rage in microcomputers, he's out of the software business and into a flourishing book publishing and distributing business—all centering on the personal or hobby computer. His book, *Introduction to Microcomputers*, sold to the tune of 50,000 copies in the first nine months and is expected to reach sales of 100,000 in its first year.

"The hobbyists are going to run the small software houses out of business very quickly," says Osborne in his new Berkeley, Calif., quarters. He explains that these tinkerers will continue to hold their jobs, programming at night and over their weekends and producing, say, a payroll package for a moderate fee that covers their hobby expenses rather nicely. Systems houses, too, are vulnerable, according to him, unless they have a strong technical expertise or are entrenched in a particular market. "In fact the reason we got out of the business data processing (software) business a year ago was that I saw this coming."

What started as a hobbyist movement has quickly grown into a serious business.

Thus what started out as a hobbyist movement, offering tinkerers the chance to assemble a computer at home to play simple games, has quickly grown into a serious business. When those with assembled machines found a dearth of usable software, they quickly developed the facility to write their own. Some of them, with an eye on this burgeoning market, are evaluating various methods of distributing those programs at a price that is low enough to discourage the buyer from reproducing it for friends but high enough to return a profit.

Much is happening. The popularity of micros has spawned the development of a number of small and relatively low-cost peripherals like the minifloppy. Newly configured small business dp systems are already being talked about for use as remote processors in distributed computing systems. Faster micros are appearing with multiuser, multitasking, time-shared operating systems.

Microcomputers have mass appeal, as the opening of the Computer Warehouse Store demonstrated last November. More than 2,300 people were said to have attended the affair, which included the giveaway of used computer equipment.

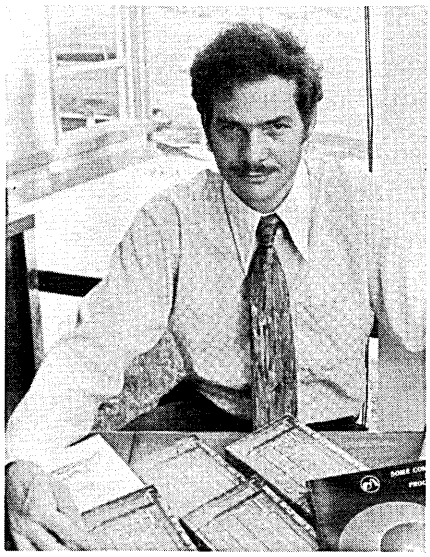
A field of Walter Mittys

It's almost as though everyone woke up the same morning with the secret aspiration to become a one-man systems house. For example, on the fringes of downtown Denver is the Computer Hut, run by a former cab driver. In its first three months of operation, the store had sold 15 systems, mostly to people who want to develop applications programs for a particular line of business. "I haven't sold one system yet to an end user," says proprietor Stephen Patterson. "But I will someday."

Dick Van Leer, general manager of the Computer Shack in Hayward, Calif., says he has a mailing list with 500 names, of whom only two or three can be considered pure hobbyists. Many, he says, talk like hobbyists, but their buying patterns suggest to him that they are developing systems for commercial applications.

Carl Burlin, sales manager for Computer Mart in Anaheim, Calif., says their business is split evenly among software people trying to learn about hardware, hardware people wanting to learn software, and people who know neither but would like to learn.

A large segment of the business of the Computer Warehouse Store in Boston, a division of Sonny Monosson's American Used Computer Corp., is comprised of students of computer sci-



Adam Osborne, who gave up his software company to become a publisher in the hobby field, claims that "the hobbyists are going to run the small software houses out of business very quickly."

ence, math, or economics who feel they can get more classroom work done with their own machines. Monosson, however, also counts small business people among his customers. One, for example, makes and installs burglar

Everyone woke up the same morning with the secret aspiration to be a one-man systems house.

alarm systems and buys a cpu every week or two. And then there's a third category. "Some of them have this grand design," he says in describing them. "They're going to develop a software package to save the world and make a fortune. They really think it."

Monosson, exhibiting still another departure from the typical computer store, offers a 20% discount to anyone who also buys a piece of used equipment from his inventory of peripherals. "For every cpu we sell," he says, "I think we end up selling two pieces of used equipment." Indeed his microcomputer catalog includes a used Olivetti replacement for the Teletype ASR 33 for $875 and a used Hazeltine 1000 crt terminal priced at $795.

A one-year guarantee on parts and labor on all assembled systems is provided by Computer Kits in Berkeley, Calif. The store, where some 60% of the customers are said to be noncomputer-types, also offers a three-month parts and labor guarantee on components purchased as a kit.

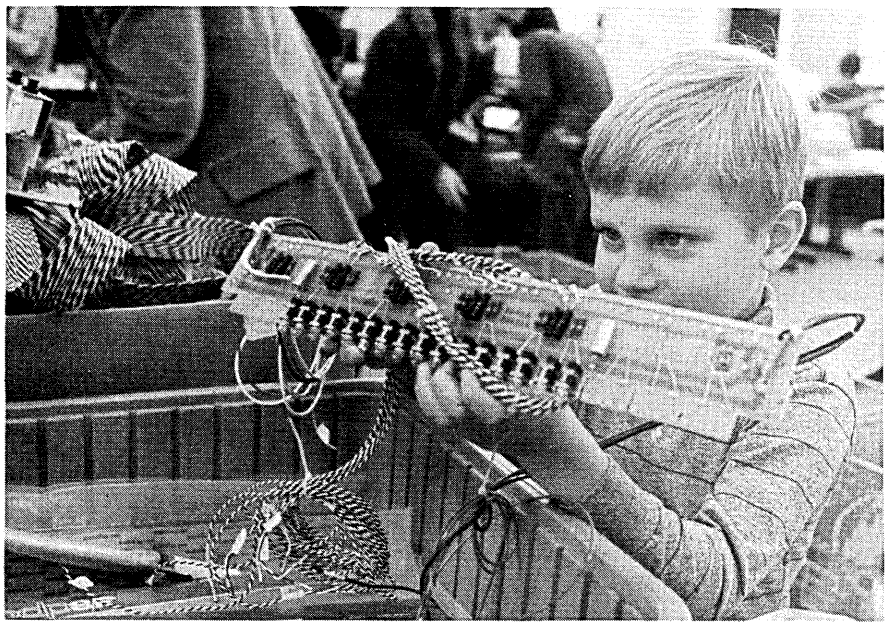
Pete Roberts of the same store says he is starting to see turnkey systems houses buying hardware from him. He says he has sold about 150 systems, large and small. A small system for business applications, available for $5,000, includes a 32K-byte Altair with one floppy, a Lear-Siegler ADM-3A dumb terminal, and Disc BASIC. The large systems he's selling for some $16,000 come with a 48K Altair, two floppies, a dumb terminal, 300lpm printer, and general ledger accounting software.

Roberts tells of a well-drilling com-

A micro can offer a 30:1 price/performance advantage over an IBM 5100.

pany that is using such a system for its internal accounting, and planning now to add payroll and inventory to the system. Computer Shack's Van Leer has sold to a few real estate firms that say they have a property management system up—and then refuse to provide further details. Another is in the business of taking inventory for businesses and sees the need for a small processor. In businesses from accountancy to zoology, microcomputer retailers will tell you they have customers.

But small businessmen having microbased systems up and running are still



Too young to be a hobbyist yet, this attendee of the Warehouse opening isn't too young to be as fascinated by the equipment as his parents are.

a rarity, according to Michael Levy of Jethro, a systems house in Wayland, Mass. He thinks many businessmen are buying machines for amusement and depreciating them as a business expense, a situation that will change as low-priced, turnkey systems become available.

"I have not seen an awful lot of present-day business applications," he says. "But that doesn't mean that there aren't going to be a lot. I think there will, but the equipment hasn't caught up with it yet." He sees the need for low-cost random access storage and the wider availability of software. He mentions, for example, that a small system would be ideal for the instant-printing shop's use in job cost estimating, stepping the proprietor through the estimating job and providing reasonableness checks along the way.

> How about a speech recognition system for $249?

Levy also tells of a minicomputer manufacturer that had visions of providing turnkey systems for the corner drugstore owner, until they found that the average drugstore has some 20,000 items in its inventory. Most of the items move off shelves so slowly that it isn't worth including them in an inventory data base. Statistically, Levy says, it's been found that in such examples 80% of the business comes from 20% of the inventory, so it is possible to get by with smaller storage capacities. Still, among people anxious to sell systems to that type of market, "I think there's a lot of glossing over of the difficulties."

A share of disaster

Levy worries that people will be developing systems for businesses with which they are totally unacquainted. "It's going to be an utter disaster," he says, for neither the vendor nor the buyer likes to document anything. Speaking of the owner of a small machine shop, for example, Levy says, "The last thing he ever wrote was his business card. That's why he went into business for himself. He'd rather tinker with a machine than write up a system." And neither the businessman nor the system developer will understand the other's business.

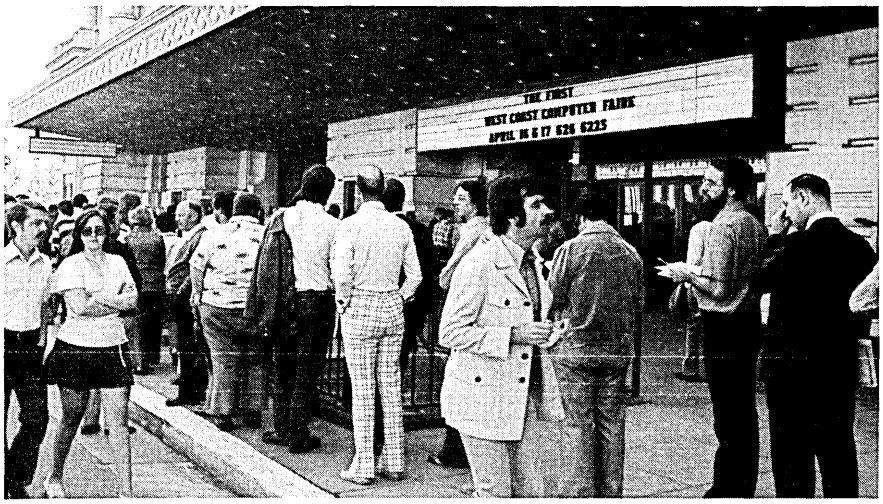
The small business market, nonetheless, will be significant. "The market for the $500 or $800 computer, when they're down to that, is going to be far more in small business than it's going to be for the hobbyist market," he says. But today there are still many manual systems that are better left manual.

> The microcomputer is **not** the equivalent of a mini.

Adam Osborne is publishing a series of three books with applications programs for business dp, and he also sees disaster ahead for systems developers. "I think business data processing applications represent one of the first things a lot of people are getting into. My advice to them is: 'don't.' " He feels that many people have the idea that because the hardware is cheap, the software will be equally cheap. "It will not. It will be more expensive," he says, "because you don't have the program development tools that you have on the mini system."

The typical micro-based system, he explains, might consist of $7,000 to $10,000 in hardware, considerably lower than the $25,000 minicomputer-based system. "However it's not going to take you long before the extra problems associated with programming such a primitive machine will consume the difference in price." Saying that one might spend $50,000 for software, "which you can easily do," he says a micro-based system might come in for $60,000, compared with $75,000 for a mini-based system. "And all of a sudden it's not such a big difference anymore."

Osborne cautions against the idea the microcomputer is the equivalent of the mini. "The average microcomputer can execute an assembly-language instruction every two to five microseconds," he explains. "And the assembly-



As the line for the First West Coast Computer Faire (April 16 & 17, San Francisco) illustrates, the market for the micro products is a nonhomogeneous group of hobbyists, businessmen, entrepreneurs, and others.

This scene from the Computer Faire strongly resembles many early Spring and Fall Joint Computer Conferences in the '60s.

language instruction doesn't do a heck of a lot. The average minicomputer is going to execute instructions at between one to two every microsecond, and each assembly language instruction will do as much as maybe half a dozen microprocessor instructions."

Success with toys and sharks

But the applications for these systems range widely, and speed may not always be critical. A hobbyist in the Chicago area is said to be using one to control his model railroad trains. A number of them purportedly are being used by investors for stock market analysis. A plastics maker has one in a production control system, and a rancher in the (formerly) lush San Joaquin Valley of California has a micro waiting for some water to come down an irrigation canal. A prospective buyer is looking to hook one up to his electronic organ so that he'll be able to get the computer not only to record what he has just played but also to make modifications to his performance. And the Computer Mart in Anaheim sold one to California State Univ. in Long Beach for shark research.

Paul Lamar, an automotive engineer and consultant, is developing a timing and scoring computer for automobile races, based on the MOS Technology 6502 microprocessor. Lamar, of Lamar Instruments in Hermosa Beach, Calif., used MOS Tech's Kim-1 computer with additional hardware to come up earlier with a road testing system for *Road & Track* magazine, a system that runs off a 12-volt battery. "The 6502 is probably the most underrated microprocessor there is," he says, ranking it on a par with the Zilog Z80. For real-time applications, he claims, he'll be able to run the 6502 at up to 8 MHZ. (This would be equivalent to about two million micro instructions/sec, however, and Zilog sources say that even the follow-on product to the Z80 (the Z80A) can do only half that much.)

Applications for handicapped people are a prime interest of Dr. Robert T. Suding, director of research at the Digital Group, a Denver, Colo., vendor of hardware and software. He has developed a voice synthesizer linked to a keyboard, allowing blind programmers to know instantly what they have keyed. He is also looking into the Opticon system, a handheld optical character reader that scans text and produces a Braille readout. "One of the problems of the blind person is that only 10% know Braille," he says. So he wants to try linking a synthesizer to the Opticon too.

Suding, an amateur radio operator for the last 23 years, has used the micro to perform a number of ham radio functions, including the sending and receiving of Morse (telegraph) code, of Baudot (teletypewriter) code, and tv pictures. He adds that some have set it up for keeping logs and for satellite tracking.

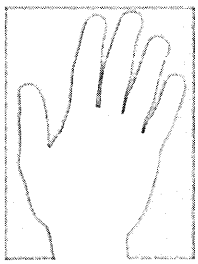
"I have my processor programmed to run a solar-heated house that I'm designing up in the mountains," he adds. One of its functions will be to take into consideration the time of day and outside temperatures to direct heat on a room-by-room basis, even monitoring whether anyone is in that room. It will require several temperature sensors in each room, instead of one thermostat for the entire house. Another application is lawn monitoring and the watering of only that portion of the lawn that is dry. A third is surveillance, the processor being linked to smoke alarms and to electrical contacts at all windows and doors. Already available, he points out, are circuits that will work with dial and pushbutton phones to make a call to a neighbor or the local fire or police department. Of course one could program a sequential list of numbers to be called in an emergency.

Finally, Suding says he will use the computer to determine the required capacity of the solar panels he will be using, thus keeping to a minimum his original investment. And then the computer will control their operation so as to maximize efficiency.

Impacting education

In schools, too, microcomputers are expected to become almost as preva-

Getting Involved



Can non-engineer members of the data processing community hop on the accelerating hobbyist bandwagon? The answer is a qualified, though optimistic, "yes." If you are a programmer, half the battle is won, especially if you know assembly language; luxuries such as high-level languages are not available on many microcomputers. If you know nothing at all about programming, you should probably consider getting a micro with BASIC to ease the transition. And if you have some electronics background, your entry into personal computing should be rapid and rewarding.

Those are our conclusions after several hours of assembling an SC/MP 16-bit microprocessor kit furnished by National Semiconductor, Inc. The kit is oriented toward engineers who are looking to familiarize themselves with microprocessor technology. After soldering seven resistors, eight capacitors, two memory chips, the microprocessor chip, a ROM chip, tty interface, timing crystal, and voltage regulator to a small printed circuit board, the SC/MP was ready to be attached to a Teletype terminal and exercised.

We didn't have a tty handy, so we may never know whether the SC/MP would have run—but it *probably* would have. The point is that hardware assembly is really more fun than work. All you must learn is how to solder pins spaced one-eighth-inch apart to a circuit board. It isn't too tough.

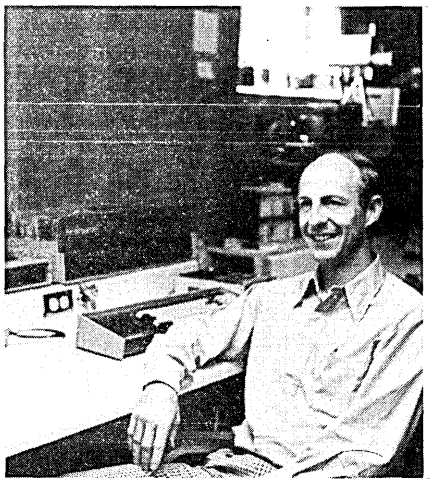
One of the tools recommended for assembling the SC/MP (and presumably any other microcomputer) is what's called a "solder sucker." This is used to remove excess solder and solder that's managed to reach the wrong places on the board. The device turns what would be a nearly impossible job into one which is only slightly challenging.

There is help available too. The owner of the local Byte Shop was helpful, for one. The electronics shop he recommended (for parts he did not have in stock) not only had books on how to get into personal computing, but also people behind the counter who could give assistance —people who had built kits before and even designed some of their own machines. Everyone seemed willing to answer questions, no matter how basic, and we felt they knew what they were talking about since they'd already done it.

So, roll up your sleeves (no nylon shirts or blouses, please—the static electricity is fatal to some components) and get busy building your own fun. **—Michael Cashman**

lent as the electronic calculator. "I think microcomputers in general will have a tremendous impact on the educational system," says Dr. Alice E. Ahlgren of Cromemco. Another hardware developer, Cromemco has a computer that will support up to eight terminals. Based on the Zilog Z8 processor and operated at a 4MHZ rate, the computer has eight memory bank select switches that allow the user to partition portions of memory for each user. In June the firm had scheduled announcement of a 16K BASIC for use with the so-called Z-2 computer, which could make it appealing to schools.

Agreeing with Ahlgren is Don Inman, a former high school math teacher who now consults with schools that are looking to integrate the computer into the curriculum. Inman, the editor of a new publication for schools called *Calculators/Computers,* taught 30 teachers in the San Jose, Calif., Unified School District, which bought a single-board micro for each school, the idea being to teach some computer science courses in those schools. The teachers assembled the machines, then programmed them in machine language. In nearby Sunnyvale, too, the intermediate-level schools have Imsai comput-



From this workshop, in the basement of Robert Suding's home, have come numerous designs for the products of the Digital Group.

ers, Lear-Siegler dumb terminals, and cassette interfaces for experimentation in math and reading instruction.

Sunnyvale's elementary schools have introduced the electronic calculator under consultant Bob Albrecht, who visits schools weekly to put on demonstrations. Not restricted to calculator games, however, Albrecht has at his disposal a wide variety of calculators, all the way from the four-function to the programmable, as he works with students and teachers to bridge the gap between calculators and computers.

Inman, aware of the limitations of having but one microcomputer for an entire class, or even for one school, nevertheless prefers the micro to a terminal, citing the former's even more personal nature. He tells of a school in Modesto, Calif., where the math teacher who had had no previous computer experience assembled an Imsai

> Many people are willing to pay $200 to have their kid learn programming in front of the tv.

computer, and then provided a plexiglass cover so that the students could see the components inside.

When the computer in the classroom catches on, he adds, "it's going to have to be a machine that's self-contained and not a kit." It must be turnkey, have BASIC or some such language on PROM or easily read in from a cas-

The do-it-yourself aspect does not appeal to all microcomputer buyers. Retailers often build the kits for the customer, as George Tate does for the Computer Mart in Anaheim, Calif.

sette. "I think we're getting away from kit building." He looks for the marketing of low-priced, packaged systems that emphasize applications, rather than programming. "That's where your mass market is," he says. "It's not with the computer buff or the teacher who has some knowledge," but instead with teachers who merely want to use it as a tool, like a typewriter. He explains that a reasonable price is $500 for a cpu, keyboard, minimum amount of memory, and the language on a ROM. "And the schools are going more to the display, rather than the hardcopy printer."

No sooner said than done. In September, first shipments are expected of the Pet computer, an approximately $500 machine from Commodore Business Machines of Palo Alto, Calif. The self-contained Pet has a 9-inch crt, a full but compact keyboard that includes 64 graphics symbols, plus a cassette drive, 4K to 32K of RAM, an operating system on 4K of ROM, and an 8K BASIC on ROM.

Not only is the low price significant, but the machine also takes a major departure in its use of the IEEE 488 bus. The industry "standard" has been the bus structure pioneered by the Altair computer, called the S-100 bus, for which a large percentage of low-priced peripherals has been developed. Now Commodore has adopted the bus structure pioneered by Hewlett-Packard, facilitating the interfacing of the Pet with lab instruments.

In addition to lower priced micros, however, there are also a number of faster micros available which are closing in on the minicomputer territory. Alpha Micro Systems in Irvine, Calif., has a multitasking time-shared system with a BASIC compiler, hardware floating-point, and a number of bells and whistles. A 64K system with text editor, line printer spooler, passwords, and two floppy disc drives sells in the neighborhood of $7,000. It uses a 16-bit microprocessor chip set from Western Digital.

Low prices can be found in peripherals too. At the First West Coast Computer Faire in San Francisco a 180 cps bidirectional printer available in kit form for $995 was shown. "About three years ago something like that was being sold for $5,000 or $10,000, if you could get it at all," noted Hal Singer of Lompoc, Calif. "And I think we can still see the price of an item like that going down to $200 or $300."

How about a speech recognition system, including the hardware and software, for $249? That's available in kit form from Heuristics Inc., Los Altos, Calif. Or a voice synthesis system for less than $400? What about Lear-Siegler shipping 250 to 300 kits monthly of its dumb crt terminal to retail stores, some 20% of total output?

And things no one's thought of

What happens when the mass merchandisers like Sears, J.C. Penney, and Heath Co. enter this market is still open to discussion. But enter they will. Tom Munnecke, president of Metasystems in Riverside, Calif., sees a large Christmas boom arriving this year,

> Hardware manufacturers are entering the market unaware of the "software vacuum" that exists.

similar to what happened with video games last season.

"I think the rumblings will begin at Christmas (if not a mad rush)," says Munnecke, who is preparing an introductory book on the subject for September publication. "But I think it's going to turn the data processing world upside down." He cites the Pet com-

puter, saying it offers a 30:1 price-performance advantage over the IBM 5100.

Less certain of this immediacy is Computer Mart's Carl Burlin, who thinks the large retailers will have to offer a packaged product, one that can be plugged in and made to run with little additional effort by the buyer. "It's not a packaged product yet," he says. "I'd say they're a good three years away."

Publisher Adam Osborne draws an analogy to the sales of hi-fi/stereo equipment. Department stores sell packaged systems, but the sophisticated shopper still goes to a hi-fi specialist where one can buy a receiver from one manufacturer, speakers from another, and a turntable or tape from still a third. "I see Sears getting into the type of product that you can package and sell and then forget about," he says. That includes things like video games or devices to hang onto the tv set for specific applications.

He can foresee, for example, a keyboard for the tv set that enables the user to work with BASIC, something that could be packaged today for $400. "And for the kind of volume that Sears could support, it could quite easily sell for $200. There are a lot of people willing to pay $200 to be able to have their kid learn computer programming at home in front of the tv set."

Software, indeed, is lagging behind the hardware, and Munnecke thinks hardware manufacturers like Commodore and Heath are entering the market unaware of the "software vacuum" that exists. The problem is compounded, he adds, by an incompatibility in language support. Munnecke, who is a member of the MUMPS language development committee, says, "MUMPS is the saving grace because its operating system, file management system, and application language are all wrapped up into one standard language." He says the language would be suitable for micros, and feels it would be an answer to all this incompatibility.

Accordingly, he is working on a MUMPS operating system for the micro. Concerned that the vacuum will be filled by "two-bit" software companies springing up in people's garages, he adds, "It'll certainly be 'buyer beware' for some time in the software area." Others who are similarly critical of BASIC are carrying banners for other languages, such as PILOT, APL, FORTRAN, and FORTH.

> "We're going to see about 10 processors in the average home in about three years."

"What interests me is that people are using computers, regardless of what they're being used for," says Computer Kits' Roberts. He sees a significance in people becoming acquainted with the technology. "Back into the hands of individuals has come this immensely powerful tool." He likens it to the early days of scientific discovery when one didn't need expensive equipment or tools to study science, and looks to the day when people will begin writing programs to do things others haven't even thought about.

Tom Munnecke, also drawing upon history, sees an analogy with the Gutenberg press being viewed initially as a Bible-making machine. He says people are looking at the computer as a . . . well, a computer, rather than a "whole new level of intelligence" that will reside in homes.

The Digital Group's Robert Suding asks his visitor how many motors there might be in an average home. "You start counting and you'll find about 50 motors. We're going to see about 10 processors in the average home in about three years." He cites their use in microwave ovens, sewing machines, the washing machine, automobile, and lawn control system, not including those for the hobbyist's use.

He talks, for example, of a programmable sewing machine that the homemaker can lead through the process of, say, making a new stitch. Once performed correctly, she'll be able to make a perfect stitch every time. But more significantly, so will everyone else in the family. And the same applies to baking something in a programmable oven.

"We're very primitive in the way we do things right now," he continues. "There are some exciting times coming up in the next five years." ❋

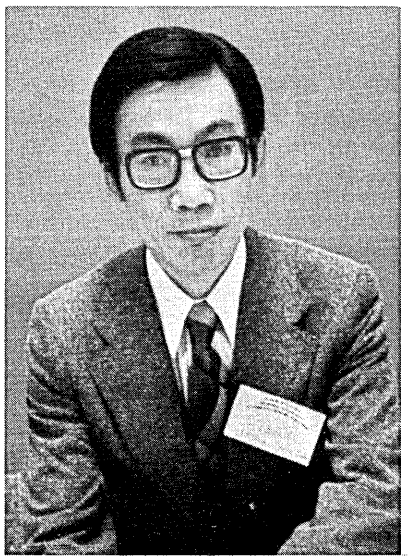
A Consumer Product in Japan

More than 30,000 copies of a $2 paperback on microcomputers were sold in the first three weeks in Japan, indicating the recent surge of interest there. The author, Prof. Toshiaki Yasuda of the Tokyo Electrical Engineering Univ., can see 100,000 copies being sold by the end of this year, in only the first nine months since its debut.

According to the author, the largest computer club in Japan was formed only nine months ago and already has some 6,000 members. He figures there are about 10,000 kit builders there, half of them in it for kicks and the other half hoping to make a business out of some aspect of microcomputing.

The former newspaper reporter is no newcomer to the technology. He says he saw his first Intel 8008 microprocessor chip at a Tokyo electronic components store back in 1972. It was one of the initial 20 of the 8008 chips shipped to Japan. He bought it for the equivalent of about $300, spending the summer months acquiring the supporting circuitry and assembling it at home, where it continues to operate. Four months later, he adds, the same 8008 chip was priced at $160. His machine has only 128 bytes of RAM; he says he then couldn't afford to buy more memory than that.

Yasuda, considered one of the two top microcomputer gurus in Japan, the other being a Tokyo Univ. professor, has four or five systems at home that he has assembled, putting to use the knowledge that came with his bachelor's degree in electrical engineering.



Pushing the use of BASIC for a Japanese population reliant on FORTRAN and COBOL is Prof. T. Yasuda of Tokyo, one of that nation's two microcomputer gurus.

He says that the most popular processor is the Nippon Electric TK-80, of which 8,000 have been sold in kit form alone. That processor sells for about $300, including 512 bytes of RAM and 768 bytes of ROM.

To show the degree of popular interest in the devices, he adds that computer kits first showed up in computer stores and in electronic supply shops such as those where the founders of Sony Corp. bought vacuum tubes and other components to begin their business. Now the kits are being sold in major department stores too. They've become a consumer product in Japan. ❋

Home Computers Versus Hobby Computers

by Alan R. Kaplan

Hobby computers are for people who are willing to spend a great deal of time and money on their toys, who are already knowledgeable in dp, and who are willing to repair their own systems. Home computers, when they come, will be for an entirely different audience.

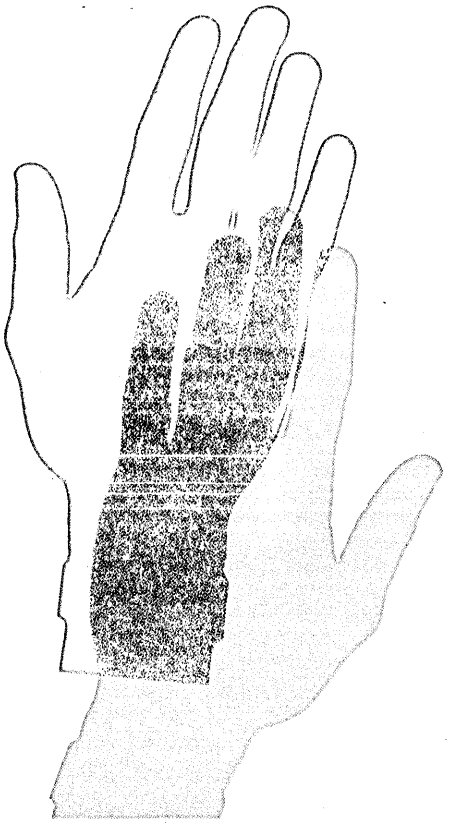
Less than three years ago, a computer in the home was unusual enough to warrant coverage in the general press. Today, there are more than 20,000 general purpose computers in American homes, and their number is increasing by over 40% per year. Also, where there were only a handful of manufacturers in 1975, there are now approximately 75 producers of kit-form and assembled microcomputers for home use, and their products are distributed by over 300 retail stores.

Clearly there is an enthusiastic and growing population of computer hobbyists. But are we seeing the leading edge of a true consumer market? Will the growth peak as it has for other hobbies, like amateur (ham) radio? Or keep going as it has for CB car radio?

Even if the growth peaks at a hobby level, the microcomputer market may surge to 15 times its present size (to as many as 300,000 units installed in five to eight years).

On the other hand, if the computer in the home becomes a consumer product, the numbers get very big very fast. There are some 75 million households in the U.S. If only one of every 25 purchased a home computer at $500 (which now looks like too low a number for what can be offered, but which will help keep the results conservative), then revenues would exceed those now generated by all mini systems suppliers put together.

Actually, it is likely that both of these things will happen, that there will be a hobbyist market and a home computer market. We know something about the former, and we've at least gone far enough into researching the latter to be able to guess at what a computer will have to be and how it will have to be priced before a home-computer consumer market will be established.



Who are the hobbyists?

The hobby computer market as it exists today was born in January 1975, when *Popular Electronics* published a cover story on MITS Inc.'s hobby computer, the Altair 8800. Experimental "home-brew" systems were in use well before then, however, and several computer buffs had even purchased commercial systems for home use. At the end of 1975, almost one-fourth of all hobby computers were either adapted from kits intended for industrial prototyping, built from "scratch" around microprocessors and MSI components, or assembled from commercial subsystems. Then, as now, hobbyists were a sophisticated, highly motivated lot.

Nearly two-thirds of today's hobbyists are programmers, technicians, or engineers.

Statistics on the backgrounds of computer hobbyists provide further evidence of the gulf between them and the general public. A mid-1976 Venture Development Corp. survey of over 1,500 hobbyists revealed that nearly two-thirds were directly employed as programmers, technicians, or engineers, and that nearly three-quarters of hobby computer owners used computers on the job. (See Fig. 1.)

Thus, hobbyists have not only been exposed to computers, they appear to be quite knowledgeable in their use. 40% of self-described computer hobbyists—people who all called themselves "hobbyists" but slightly more than half of whom did not own their own computer at the time of the study—considered themselves above the novice level in both hardware and software. (See Fig. 2, p. 74.)

Some of the most surprising results of the VDC study concern the nature, rather than the level, of hobbyists' software expertise. It was found, for example, that almost as many hobbyists knew Digital Equipment PDP-8 and PDP-11 machine languages as the assembler on the most popular hobby microprocessor, the Intel 8080.

Similarly, the study found that almost as many hobbyists cited experience with FORTRAN as with BASIC, even though BASIC is available as an interpreter and so far is the only higher level language in general use among hobbyists. These data further support the contention that, unlike the general public,hobbyists have had considerable

direct experience with computers.

The distinction between today's hobby computer user and tomorrow's home computer user becomes most meaningful where it influences their respective product interests. In the case of hobby computers, the desiderata are variety and flexibility. A cursory glance through any of the dozen or so hobbyist publications quickly impresses the reader with the strong "do-it-yourself" appeal of the advertisements for everything from board connectors to custom interfaces. Yet it is just this impression that home computer makers will strive to avoid.

Although an end-user, the hobbyist mentality is more akin to that of the oem. He (or she) is a systems builder, a designer of unique systems. By virtue of the sophistication noted previously, the hobbyist is usually capable of assembling at the chip level, always capable of customizing at the board level, generally required to configure at the subsystem level, and invariably forced to seek out (and/or develop) software

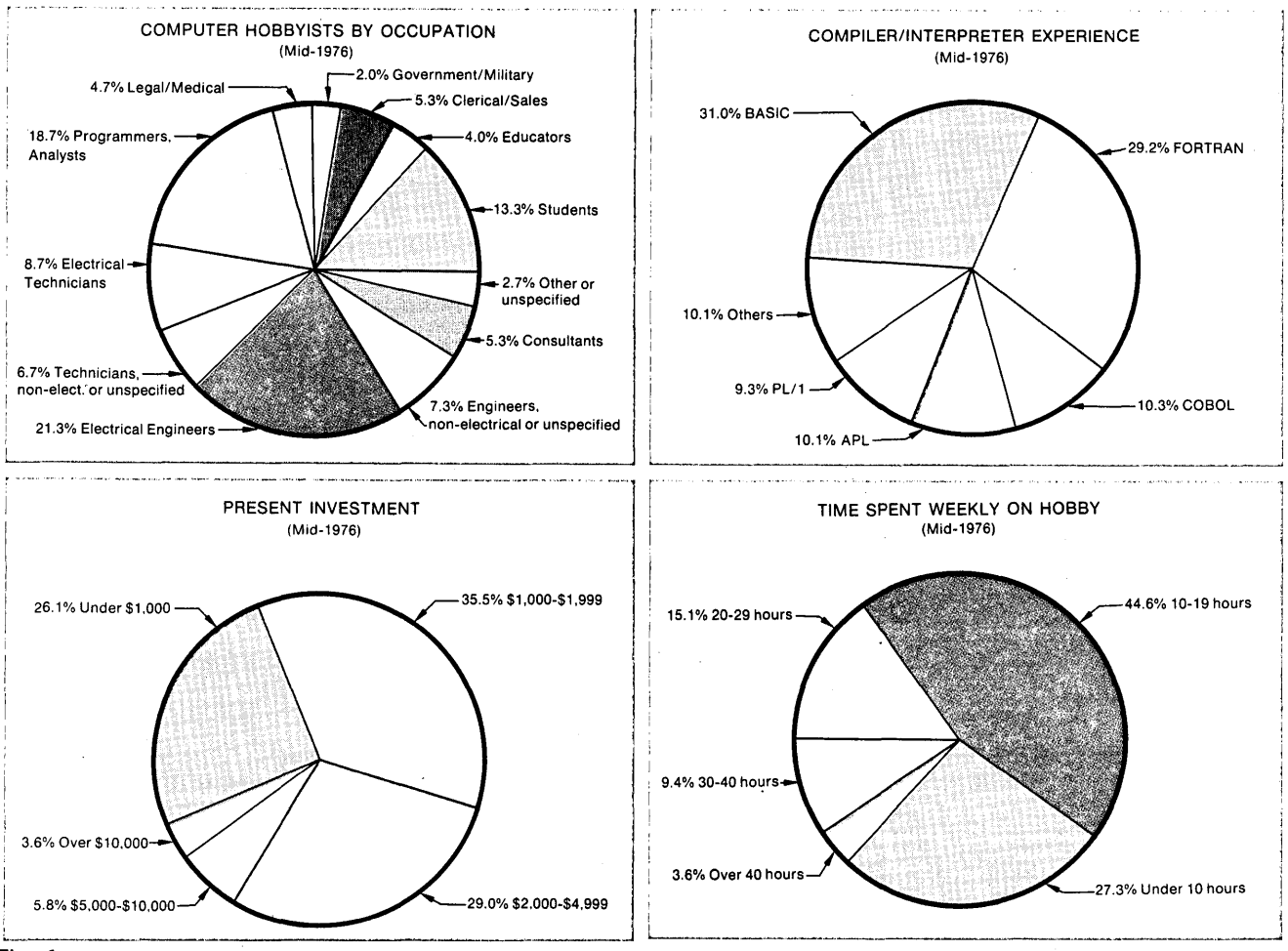


Fig. 1

beyond that available from his "mainframe" vendor.

General consumers, on the other hand, can barely be expected to customize, much less design, any significant part of their systems. The general consumer will be a classic end-user. His system must be preassembled and ready to go. Whereas hobby computers may or may not be provided with (or configured for) higher level languages, the general consumer's home computer will be required to interact immediately with the user via an interpreter prestored in ROM. Unlike hobby systems, for which the expression "includes I/O" usually refers only to the signal interface, home systems will be required to include the I/O device itself, together with the cables, sockets, controller, software drivers and everything else necessary simply to "insert plug *A1* into socket *A2* and press *'Run.'* "

Home computer users will, of course, have a range of selectable options. They will be able to choose their peripheral mix, memory size, and ap-

More than one-third of the computer-owning hobbyists have invested over $2,000.

plications software. But the relative ease required to implement these options will impose on them a much higher degree of integration. In contrast to hobby computers, which feature variation and flexibility, home computers must stress modularity and simplicity.

Analyses of hobby computer usage indicate that the hobbyist "does to learn" more than he "learns to do." That is, his prime motivation is educational rather than functional. Nonetheless, his commitment, both in terms of dollars and time, is significant. More than one-third of computer-owning hobbyists have invested over $2,000 in their systems, and nearly 10% have invested at least twice that amount! While $2,000 may not seem impressive, it represents more than 10% of the annual income of the majority of hobbyists, and more than 20% of the income of 20% of them.

Hobby systems are used in as many ways as their commercial counterparts. Even the most sophisticated areas of artificial intelligence have hobby parallels. For our purposes, however, we can classify all hobby applications into one or another of the eight specialized areas illustrated in Fig. 3, which presents the application data acquired from VDC's survey of hobbyists. Fig. 3

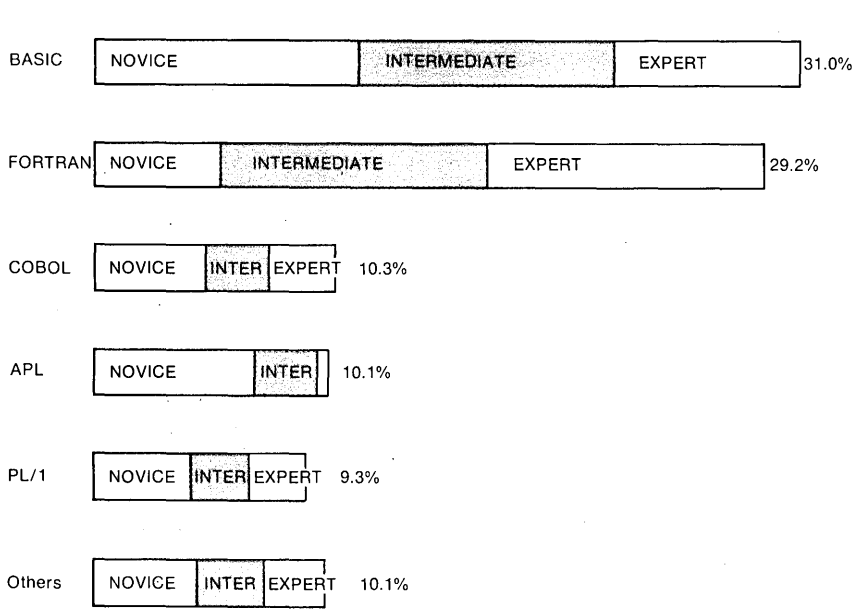


Fig. 2

further includes a "Non-Specialized, Development" category representing systems that at the time of the survey were intended mainly for internal study and experimentation or were still being assembled.

A central characteristic of hobby computers is that they are rarely dedicated to one application, a natural corollary of the "do to learn" philosophy. On this point, hobby computers differ from "real world" systems, but, as we shall see later, are not expected to differ from home systems even though general consumers will be of the "learn to do" variety. Of the seven specialized applications shown, only two, "Games" and "Real-time," were found to include users who had totally dedicated their systems, and those dedicated systems accounted for only 3% of all hobby systems noted.

Who will the consumers be?

With this application data from hobbyists in hand, VDC then sought to determine general consumers' level of interest in a potential home computer. The method used was the "focused group session." This technique, commonly employed in consumer market research on new products, consists of assembling small groups of consumers for participation in a highly structured but informal question and answer session during which the interviewee, rather than the interviewer, establishes the price and specifications of the subject product. Most of the interviewees were college graduates employed in professional and/or academic careers. Ages ranged from 23 to mid-fifties; income from approximately $12,000 to over $40,000.

The sessions were conducted in

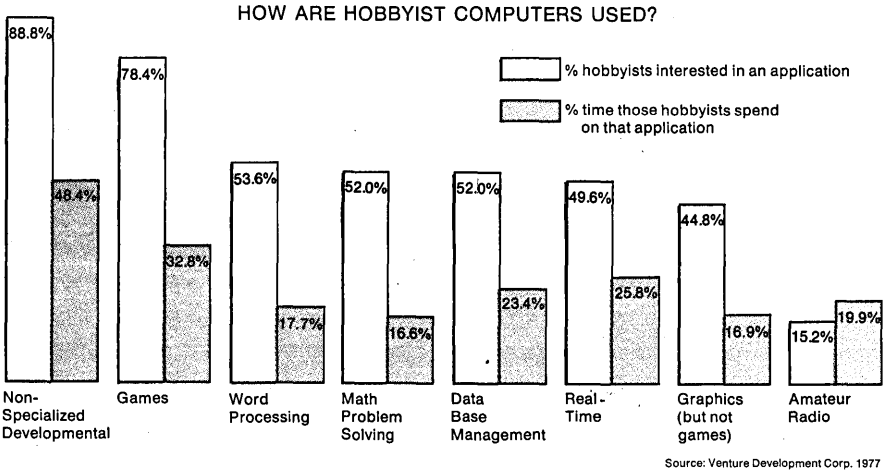


Fig. 3. Hobbyists claim already to be involved in, or plan to be involved in, a variety of interesting applications. How they spend their machine time, however, may reflect very different interests. For example, the 49.6% of the group who claim to be interested in real-time applications spent only 25.8% of their time on them—the remainder may have been spent on games.

three parts, beginning with the interviewer asking, "Would you consider purchasing a small general purpose computer for personal use in your home, and if so, what would you use it for and how much would you pay for it?" The general responses were: first, an expression of familiarity with the fact that hobby computers are available; second, an expression of ignorance concerning the ways hobby computers are used; third, skepticism that the interviewee would have a practical application unrelated to his or her vocation that would justify the investment in time and money. Estimates of the cost of a home computer ranged from $500 to $2,500, with the average about $1,500.

There is presently no hobby system under $2,500 capable of doing what a consumer would want.

The second part of the session began with the interviewer stating, "Among the general tasks that a home computer would be likely to perform are calculations, records management, text editing, and games. How much would you pay for a system capable of performing these tasks?" At this point the interviewees were able to suggest some examples of several of the general tasks mentioned, typically in the form of, "Do you mean by 'calculation' it will do my income taxes?" or, "I would consider any machine that would help with my typing." Usually, however, the subjects asked for specific examples of the general tasks mentioned, such as, "How would I (or "Could I") use a computer for_____?" Estimates of cost began to reflect the subject's own interpretation of the applications mentioned, such as, "I wouldn't pay more than *X* dollars for a machine that could_____."

The third part of the session began with a lengthy dissertation by the interviewer on specific applications, such as filing and retrieving addresses, entertaining and educating children, producing and correcting typed text, cross-indexing personal book and record collections, monitoring home security and environmental systems, etc. At this point most subjects were very interested and quite positive. Estimates of prices they were willing to pay began to be based on multiple applications, and were well above those offered in the second part of the session. Ease of use and ability of the system to perform as described became more important issues than price. The statement, "I'm not (or,"I don't want to have to be") a computer programmer (or engineer)" was made often.

Focused group data are rarely conclusive, but the sessions did reveal some clear patterns among potential home computer buyers to reinforce the thesis that what we have now in the hobby computer is a long way from what is needed for tomorrow's "volkskomputer." Consider, for example, that:

1. There is currently no hobby computer system below $2,500 capable of *immediate* general consumer interaction for any of the "practical" applications noted above. None is available (although some are offered!) in assembled form with integral I/O and operating systems applications software (other than games), and sufficient internal memory (at least 8KB of RAM) to perform any but the most primitive "practical" applications.

2. Although a great deal of hobby software is freely available, some of it quite good, almost all of it is either recreational, or developmental in the form of assemblers, interpreters (such as a 2K "Tiny BASIC"), editors, diagnostic routines, and utilities. "Practical" applications software is rare.

3. Hobby documentation is unsatisfactory even for hobbyists. It would be totally unacceptable to general consumers. This point is very important, and also happens to touch on the one similarity mentioned earlier between the hobbyist and the potential general consumer: neither is likely to dedicate his system, although for different reasons.

The hobbyist becomes involved in many applications because he is primarily a learner—he is willing to invest considerable time in education, which for him is a form of recreation. Conversely, the home consumer will be a doer. He will justify his dollar investment by distributing it over several applications, but he will resent investing any more "learning" time than the absolute minimum necessary to perform those applications. He has made it quite clear that he does "not want to have to be a programmer or engineer."

4. Although hobbyists find the reliability of their systems to be acceptable, giving that factor an average rating of 3.8 on a 0 to 5 scale, it is doubtful that general consumers would be as charitable. For the hobbyist, mean time to failure (MTTF) is not as important as mean time to repair (MTTR). He rarely sees his application as critical; he is typically a "regular" at computer stores and a member of at least one hobby computer club, both of which serve for parts and information; and he is capable of performing most of his own maintenance.

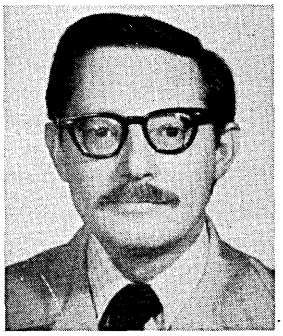
General consumers, however, *will* see their applications as critical, cannot be expected to diagnose or maintain their own systems, will resent frequent trips back to their vendor, and can be very demanding when they perceive that their right as a consumer to a product that performs exactly as advertised has been violated. Thus the hobbyist is prepared to react to a short failure cycle for participating in the repair cycle; the general consumer is not.

What's coming

The hobby computer, then, has not yet developed to the point where it poses any truly popular potential. Simply because hobby computers are found in homes does not make them "home computers" any more than are the Digital Equipment PDP-8s and used IBM 1620s that have also been purchased for home use. The hobby computer is, rather, a repackaged industrial microcomputer without the specialized software and peripherals backing vital for general consumer acceptance.

On the other hand, the hobby computer has given us a preview of what promises to become the most important home development since the roof. Hobby computer manufacturers, undercapitalized and inexperienced in mass markets, have sparked the interest of every consumer electronics manufacturer and mass retailer. It will be from these companies that we can expect to find a home computer, and their participation is imminent.

What we have seen so far is only the emergence of a fast moving but small and parochial market. What we are about to see is the machine that has changed our lives become a part of them. ❋



Mr. Kaplan is director of program development for DataComm Interface, Inc. in Framingham, Mass., producers of the national INTERFACE and INTERFACE WEST conferences and expositions. From 1969 to 1976 he was editor-in-chief of "Modern Data" (now "Mini/Micro Systems"), and from 1967 to 1977 he was director of computer industry research at the Wellesley, Mass., management consulting firm of Venture Development Corp. He is the author of "The Home Computer, 1976-1981," a VDC marketing and technological analysis for corporate strategists.

Developing Software for Micros

by Chris Hawkins and Alex d'Agapeyeff

In a system where the central processor is a disposable item, software becomes crucial—and programming a microcomputer is no picnic.

Practitioners of commercial data processing, the prime target of the computing industry for the past two decades, have suffered a quiet indignity. The records will show 1977 to be the year in which they ceased to be the main buyers of programmable devices.

The key to this transformation is large scale integration technology, which enables the fabrication of complex electronic circuits, these days of relatively high speed, on a single piece of semiconductor material. These can take a variety of forms, such as a programmable processing circuit (microprocessor chip), a support circuit such as a section of fast memory, or a fixed-logic circuit able to execute predetermined functions. But their most important characteristic is that they can be manufactured in quantity at very low cost, typically retailing at $8 to $80.

The principal market for the new LSI components is currently for the replacement of conventional circuitry in a great variety of engineering products including current computers and their peripherals. They will have a growing impact on the commercial mainframe also, to the extent that the data processing manager cannot merely dismiss them as some enhanced form of transistor.

Many of the latest terminals and remote job entry units are driven by programmable devices; there are devices soon to be announced for voice input which rely heavily on microprocessors for their operation; new mass memory systems will become available, based on LSI technology, which will partially replace rotating magnetic machinery such as discs and drums. The data processing department is unlikely to be able to assess these facilities unless it becomes aware of the concepts and potential of microcomputers and acquires the skills to adapt these developments to its advantage.

Yet this represents the least part of the impending impact of microcomputers on the dp scene. The time is now approaching for the mass exploitation of microcomputers as stand-alone computing devices. This trend has already been established, as seen in the rapidly increasing sales of small business computers, more and more of which are going to be found upon examination to be driven by single-chip microprocessors. But it will be further accelerated when users start to assemble their own microcomputer systems, a radical innovation which has been made possible by two recent developments within the LSI component industry, neither being initially prompted by data processing needs.

> The big majority of microcomputer programs are over 1,000 bytes long.

Standard components

The first of these is the appearance on the market of "standard" boards or so-called "computer" boards, each having the same set of LSI components and being able to act as a miniature central processing unit with some working storage. Even among the engineering community, which is able to configure individual components to its own requirements, such boards have grown in popularity with the fall in prices. They have also stimulated a commonality in simple board interfaces, together with the ready availability of ancillary boards—such as those which provide a working storage extension.

The second important development is found in the design of single circuit "controllers" for the attachment of a wider range of peripherals, notably the floppy disc. It is the availability of file storage which ultimately transforms the microcomputer into a workable dp system. At the same time, the peripherals themselves have been becoming cheaper.

The results are dramatic. It is now possible for a commercial user to configure his own computer system, embracing a processor, 16KB of memory, a visual display unit, a serial printer, and two floppies, for about $12,000. At that price it is probably justified to provide personal computing, such as file storage and inquiry, to the line manager, the very small office, and individual clerical staff members.

Some of the most cherished computing preconceptions have been turned upside down. It may be cheaper to offload dp tasks onto such systems than to upgrade a current mainframe. For the small organization, the cost of get-

ting started in computing can now be found by saving half a man-year of clerical effort.

The result is that now dp departments have a choice. They can wait for their established suppliers, such as IBM or Burroughs or Honeywell, to introduce the latest circuit technology (as they are doing) into existing and revised computers. This will be the simplest and sometimes the most convenient option, but the established computer suppliers may avoid any rush into microcomputer systems both to protect current lines and because of doubts about sustaining their current software.

Alternatively, they can start putting together their own microcomputer configurations, as already outlined. This offers them the possibility of exploiting systems with a startling improvement in cost/performance ratio through the use of the latest system components. It offers them the promise of a new dimension of user configurability and simplicity, to provide single user services for the clerk or manager. It offers them the opportunity to build up experience and understanding on which, eventually, to base choices for future systems.

Acceptance of the latter philosophy may be traumatic. The manufacturer of the original microprocessor chip (and standard board) is a new breed of supplier, who sees business data processing as only a small part of his marketplace. He is attracted to other, less demanding parts, where component sales in millions are possible for inclusion in automobiles, machine tools, domestic equipment, homes, the fast-growing hobbyist market, and educational institutions.

The dp manager cannot dismiss micros as some form of overgrown transistor.

It is left to the packaged systems vendor to assemble and sell complete working systems for the businessman, and even then, a user may find it convenient to have separate suppliers for the microprocessor, for several different peripherals, the maintenance, and the software. Cheap hardware makes bundled services impractical, and when he has to contract separately for his specific needs the user may decide to consider afresh what his particular needs are and how they can best be met.

The deciding factor for many user organizations is likely to be the available methods of programming their selected applications. This is crucial when considering the exploitation of very inexpensive hardware; the cost of producing 10 debugged micro instructions is comparable to the cost of the processor chip on which they will run.

Despite much past criticism, the established computer suppliers (especially the mainframe manufacturers) have a good record in the provision of basic software. This fact readily becomes apparent after actual experience in programming a microprocessor. A recent survey in the U.S. showed that over 36% of the programs for micros were being written in absolute hexadecimal. Even in the better environment of microassembly language, how many programmers are there who are readily capable of programming 64-bit commercial arithmetic on an 8-bit machine?

Programming, therefore, is the essential ingredient in the exploitation of low-cost microcomputers for commercial data processing.

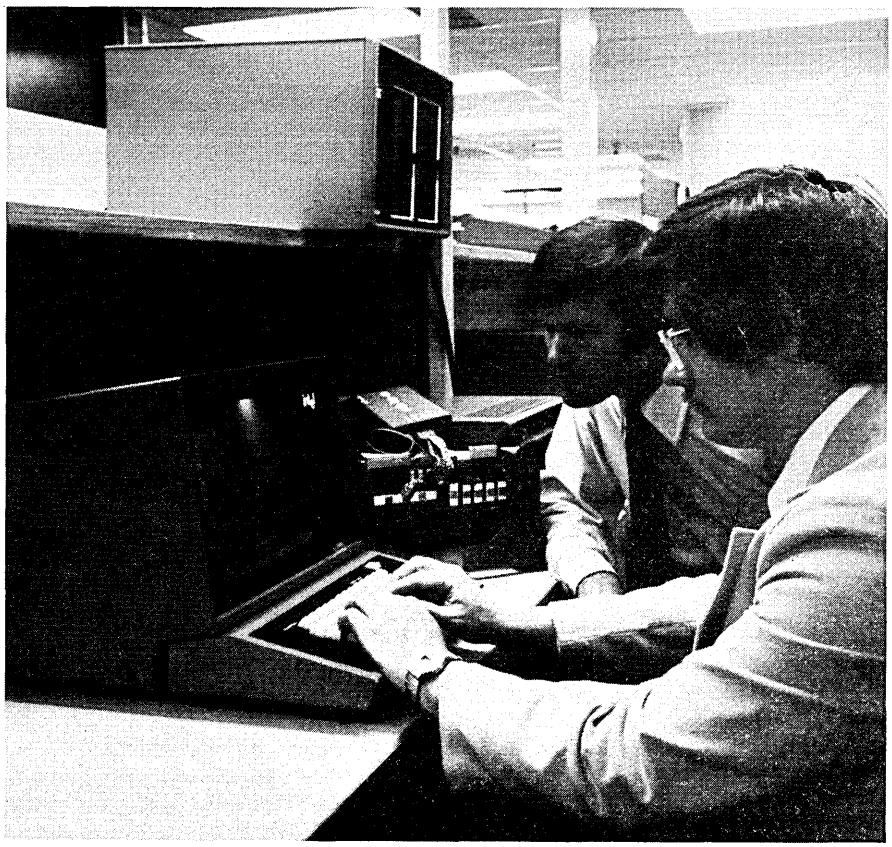
Reinventing programming

The history of software for microprocessors has been a reincarnation of earlier problems and a similar, albeit quicker, learning curve. Staggering improvements in circuitry have been accompanied by a surprise that micro programs grew so large (at least 85% exceed a thousand bytes), are so difficult to debug, and have their own development requirements in both software instrumentation and machine configuration. The need for documentation and ease of modification is being relearned.

And when the manufacturers make changes to the original, imperfect instruction sets, the conversion problems for users are rediscovered, and the phrase "nearly compatible" is reborn, this time with a choice of over 100 microcomputer types. Software development is now an issue of which microprocessor users are much aware.

The microprocessor manufacturer tends to provide development support to a standard sequence (Fig. 1). After announcing his microprocessor chip (Stage 1) he soon announces some "support chips" (Stage 2), a necessary complement to enable an engineer to develop complete hardware systems. At Stage 3, perhaps several months later, he mounts the microprocessor chip on a printed circuit board with 100 or so supporting components, producing what we have referred to as the "standard board," which he mass produces at a unit price which might be $300. A primitive software capability is provided at this juncture, through a small resident monitor.

At Stage 4, to support more serious



The purpose of an In-Circuit Emulation system is not to emulate the operation of a microcomputer, as its name suggests, but to help in debugging a microprocessor program by giving the designer "hooks" into the system which the microprocessor cannot provide. For example, a designer might use one to single-step through a microcomputer program. Here an Intel ICE-80 is being used to exercise an Intel SBC 80/10 "standard" single board computer.

programming, the manufacturer announces some cross-products—cross-assemblers, cross-compilers, simulators. These permit writing programs on conventional computers, using either specialized time-sharing services or in-house mainframes, to generate symbolic source language instructions for the micro.

He then usually creates and markets his own development system board, commonly called a "prototyping system," based around his own microprocessor (Stage 5). This is ultimately equipped with aids which help an engineer to debug his hardware as well as his software.

We shall look at some of these stages in more detail. But it is first useful to note that there are some alternative evolutionary paths. A "minicomputer manufacturer turned micro supplier," such as DEC or Data General, is faced with the problem of moving downwards rather than upwards in complexity, reversing his path of the past decade (Fig. 2).

Then there are the "second source" suppliers, those who sell copies of other manufacturers' components. Initially they will make pin-compatible circuits and leave you with the development support facilities of the prime supplier. They will then see merit in selling rival hardware configurations, and may then start getting their own ideas as to what development software should be.

A similar path may be followed by those who emulate the instruction sets of larger computers; for instance, the Intersil IM6100 microprocessor reproduces the DEC PDP-8/E instruction set and will run DEC's papertape software.

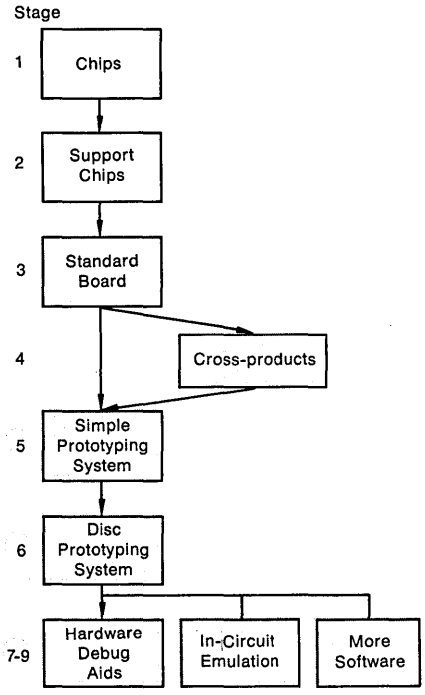


Fig. 1. After developing his microprocessor chip, the semiconductor manufacturer generally goes through this sequence in offering support for it: support chips like memory first, then a standard computer board, cross-products like cross-compilers, then prototyping systems (more expensive boards with specialized debugging aids), and finally in-circuit emulation kits which allow for testing the user's boards in a real-time manner.

Three ways to micro software

In essence, the evolution of the industry has provided three main environments for the development of microprocessor software: *the standard board, cross-products*, and *the prototyping system*. Combinations are possible too. For instance, standard boards are sometimes enhanceable to support better resident facilities, or a program can be partially developed using cross-products to produce code for the standard board, and then transferred to a prototyping system for completion.

Examples of standard boards are the Motorola MES6800, the Signetics PC1001, and the Intel 80/10. They are purchased both singly for evaluation purposes, or, where suitable, as a basis for actual systems. The resident monitor normally allows programs to be entered in low level terms, such as in absolute hexadecimal characters. Such an environment is not suitable for applications of any complexity, although users can be found struggling with substantial programs at this level, because any improvement calls for further expenditure.

Cross-products are commonly written in ANSI FORTRAN so as to be relatively transportable between conventional computers. It is inherent to the approach that one uses the large computer's utilities (such as its text editor), and the cross-product package will certainly include a good cross-assembler. Cross-compilers for high level languages are now commonplace: the microprocessor industry leans towards PL/1 derivatives, but BASIC and FORTRAN are gaining favor. There may also be an instruction simulator for each microprocessor simulator to permit testing the micro's software on the host machine.

Cross-products have been improved with the entry of independent vendors. The service bureaus have been particularly active (for instance, National CSS Inc. supports the products of 14 microprocessor manufacturers) and must be pleasantly surprised to be deriving commercial benefit from developments in computer "miniaturization." One can get off the ground speedily using a service bureau and can experiment

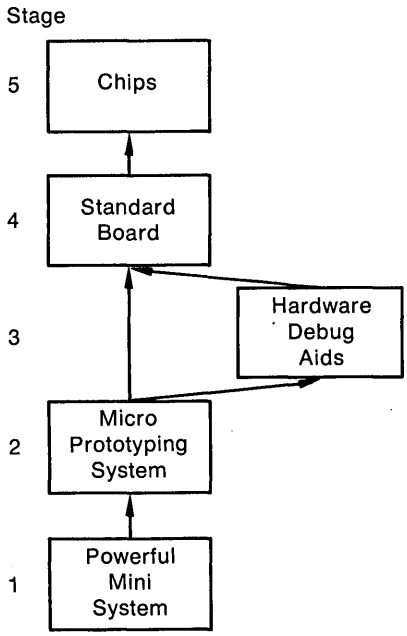


Fig. 2. Existing minicomputer makers "back into" the microcomputer business by delivering more sophisticated products first, and never getting to the point of offering the chips themselves.

with different micro architectures.

Program checkout using simulators can be helpful but expensive, as instruction simulation is processing-intensive. Simulator writers need to be knowledgeable, because microprocessors can have barely announced "eccentricities" and even unannounced instructions. But the most serious constraint is the inability to check out a program in real-time with the actual peripherals and interfaces. Ultimately, the program must be proven on the microcomputer system itself.

Prototyping systems are purchased from the microprocessor manufacturers (and their distributors) as standalone microcomputer systems carrying their own programming aids. Examples are Motorola's "Exorciser," Fairchild's "Formulator," Rockwell's "Assemulator," and Intel's "Intellec."

Initially such systems were papertape-based but soon moved on to the use of discs and other file storage. They are equipped with editors, assemblers (increasingly with subroutine relocation and linking), a debugging package, and a monitor. Resident compilers for high level languages are now available too. But in general, lacking the configuration size and utilities normally found with a conventional computer, prototyping systems may be less convenient than cross-products for initial program preparation.

Prototyping systems are, on the other hand, much better equipped for realistic debugging of user programs, running them on the actual microprocessor, and offer a clever blend of hardware and software weaponry for this

purpose. The demand for support of user-constructed target boards has led to novel hardware-oriented features, such as the "in-circuit emulation" technique (Intel's "ICE," Motorola's "USE," and others). On such a system the user's microprocessor chip on its multipin mounting is removed from the user's target board, and replaced by a plug with leads attached to the prototyping system. This enables the user's target board to be checked out in stages.

With these two latter environments available, cross-products and prototyping systems, the micro user can program and test his new applications with much greater ease than was once the case. But dissatisfaction remains. Service bureaus are an incomplete answer, and can be expensive. The manufacturers' prototyping systems are necessary but their high cost (typically $13,000) is a deterrent to many would-be users.

But the most serious problem may be that all the methods discussed so far have been addressed to a specific microprocessor—if you wish to change to a rival microprocessor at any time, you have to scrap your entire investment in development systems and programs, and start again.

Dp software

The first organizations to exploit suitably configured microcomputers for data processing had to rely on some combination of cross-products, prototyping systems, and their own, custom-built, system software. These items were not always satisfactory, but they could suffice for a determined user.

The organizations could use cross-products, but apart from their inherent debugging limitations, these are frequently proprietary and can mean a reliance on service bureaus. Then too, prototyping systems were not designed for, and are seldom very helpful with, file handling on target board configurations, and are nearly always dedicated to the programming of a particular processor. Finally, custom-built system software (for instance, to support file handling) also raises a similar doubt over the wisdom of investing in one processor among so many.

For the single installation user, or the user who must program at every site, an attractive alternative may be to purchase a ready-packaged microcomputer system equipped with its own development capability, including a familiar high level language.

The microcomputers which emulate minicomputers provide one source of supply, for instance the LSI-11 from DEC or the Micronova from Data General. These have a great software advantage with their existing languages and libraries, but some have constraints on the peripherals which can be attached.

The second source of supply is the vendor of small business systems who has created such a product around a mass-selling microprocessor. These vendors are often new to this marketplace, leading to price reduction pressures as they have no existing lines to protect, and they are tending to favor BASIC as their resident language. But it may be assumed that they, too, would rather the user bought their selection of peripherals rather than those of anybody else.

But what about the organization which expects to exploit microcomputers on a significant scale at multiple sites? It has an unfortunate choice to make. To go one way means a commitment to a single manufacturer and type of standard board, and to build up specialized expertise and program libraries accordingly. But this is done in the knowledge that new and faster boards are being announced in considerable numbers each year; even processors from the same manufacturer are changing fast, and obsolete lines are unlikely to be indefinitely sustained.

To go the other way is to exploit several different microcomputers on an opportunistic basis, but knowing at the same time from previous experience that software compatibility even at source language level is usually difficult. There is a further source of concern if it is necessary to invest in an endless variety of dedicated prototyping systems for the generation of their programs.

From the hardware cost viewpoint the large user, in particular, must be attracted by the second approach rather than the first. To take full advantage of the reversal of former computing economics, standard microcomputer boards at $300 each or less should be treated as replaceable. Peripherals are more expensive and should last longer by being attachable to a sequence of successive processors.

Standard computer boards at $300 or so each should be treated as replaceable.

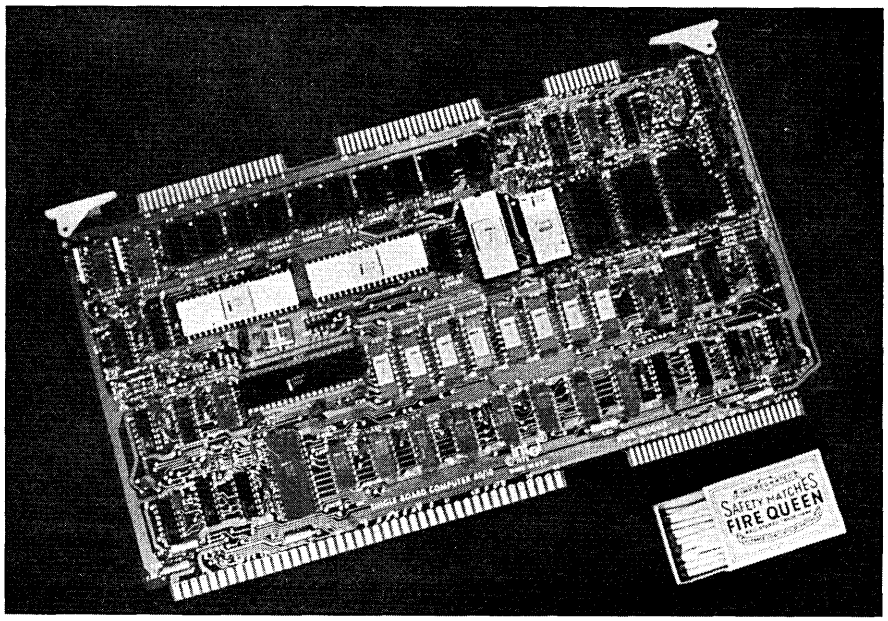
The biggest expense and value is then in the application programs. It is highly desirable that methods are found for the efficient generation of programs for an arbitrary microprocessor, such programs being hardware independent and truly portable from one processor to the next.

Host development systems

The problem just raised has traditionally been regarded by many as insoluble. But this ignores a line of experimentation which has been showing much promise.

An intuitively attractive idea for the generation of microprocessor software is to combine the hardware independence of a host computer configuration (as enjoyed by cross-product users) with the debugging reality of the micro-dependent prototyping system. This can be attempted by physically linking standard microcomputer boards to a permanent host.

A number of users have pursued this approach. They include Oxford Univ. where Intel 8080 programs have been developed with the help of a PDP-11. And Millenium Information Systems



The standard computer board serves several purposes. It allows the user to become familiar with the microprocessor and other components, serves as a test bed for software (which may have to be done at the hexadecimal machine instruction level), and may help in checking out other pieces of the user's application hardware.

has its Universal-One prototyping system, which internally comprises an invariant "host" microprocessor for target-independent functions such as file handling, linked to a more variable microprocessor (the same type as the purchaser's target microprocessor) for functions such as program assembly. And the authors' own organization, CAP MicroSoft, has exploited the concept as the basis for its micro applications development Workshop. And, no doubt, others await announcement.

Fig. 3 shows a schematic of a joint host-target configuration suitable for data processing. It has been found possible to provide software for the host (employing sets of macros) which allows micro source programs to be assembled, then loaded into the target microcomputer board for execution and testing under the overall supervision of the host.

Debugging facilities in the overall system allow the user, sitting at the host's console, to insert breakpoints in the running micro program, to call for trace reports, and to interrogate program locations in terms of the programmer's own symbols.

This general approach requires very little in the way of systems software in the target microcomputer. The manufacturer's own software monitor is used as the basis upon which facilities must be built for the handling of commands received over the host/target link.

In the many cases where the objective is portability of software, this will only be achieved by coming away from assembler source codes and using a common, simple, high-level language.

This host development system at large is currently oriented towards small, simple, single-terminal applications, but is capable of growth as the use of micros develops. Thus it seems very probable that from a set of standalone applications within an office environment will grow a network of office services linked by a communications facility. A host system linked into such a network then becomes the common development facility for the systems on the network. At the same time it can support, through library, editing, and debugging facilities, languages like BASIC offered on some of the machines.

What it means

Both the power of microcomputers and the ease and flexibility with which they can be configured continue to run ahead of their full exploitation in data processing applications. However, programming methods have reached the stage where dp departments can now consider microcomputers as part of their equipment mix. In particular, low microcomputer costs make it feasible to introduce small, local, almost personal forms of office automation.

The hardware, software, and systems are not yet sufficiently mature to think of the early and general replacement of existing computers. Such advances take time. During this time, the same LSI technology will introduce new options into today's conventional machines. But users need to think in terms of a strategy for growth that includes micros, so that they can accumulate experience as a basis for their decisions of the future. ✲

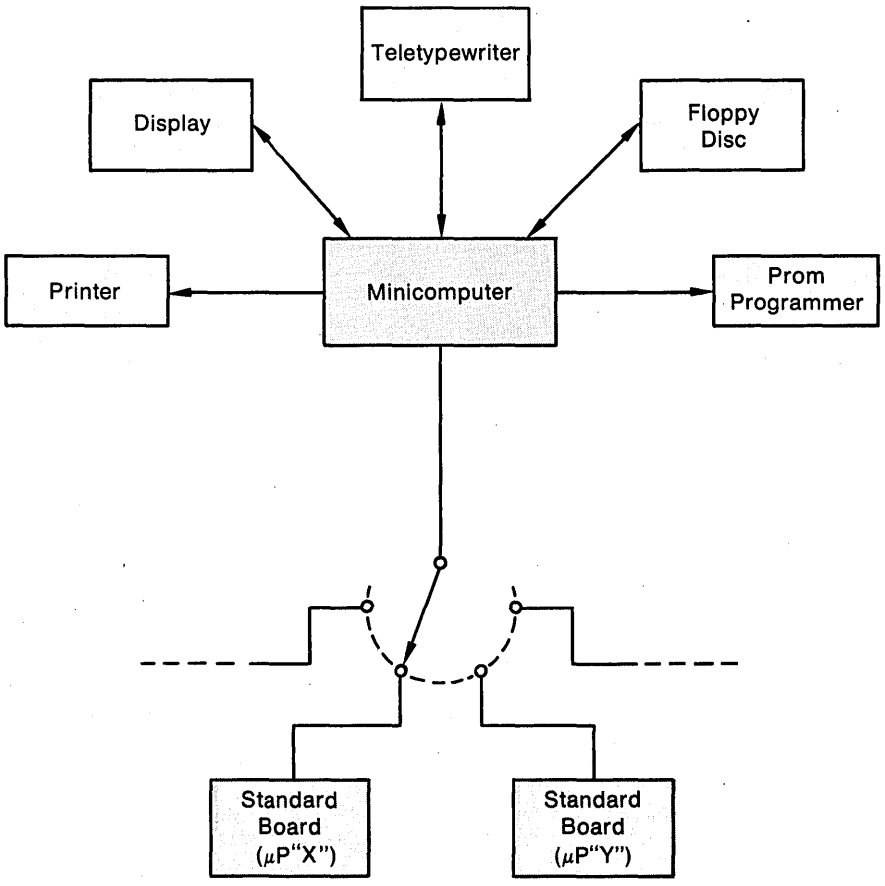


Fig. 3. Host development systems allow the user to test microprocessor boards by attaching them to a minicomputer as a peripheral. One advantage of the method is the low requirement for systems software for the micro.

Dr. Hawkins' training was in physics. In fact, his doctoral research was in proton-antiproton annihilation, and during 1963 to 1966 he served as a research associate at Yale Univ. and Brookhaven National Laboratory.

Somehow this prepared him for joining CAP U.K. in 1969, where he led several scientific software projects including the Concorde fatigue test. He is now general manager of CAP-MicroSoft, a company which specializes in programmable microelectronics.

Mr. d'Agapeyeff's background was originally in accounting. He became interested in computing and software, and cofounded CAP, a British software house, in 1962. He is presently the chairman of the CAP-CPP international group of companies.

A former president of the British Computer Society, he has served on a variety of British Government committees concerned with computing.

WE INTERRUPT THIS PUBLICATION FOR AN IMPORTANT ANNOUNCEMENT.

TI's new 765

Until now, a portable data terminal operated on-line with its computer via a telephone line.

Now it can operate when you or your phone lines are busy.

Add bubble memory and a terminal can remember while it waits to talk to your computer. That's the beauty of the new *Silent 700** Model 765 Portable Memory Terminal.

You can enter sales and order information using the typewriter-like keyboard all day long.

And store it in the memory that's built right-into your portable unit.

Then you can edit when you have time. And transmit when on-line rates are lower.

Here's an example of how the 765 terminal means business:

A traveling salesman story.

A garment salesman in Atlanta wakes up to a long day that will take him to St. Louis calling on a handful of major department stores. Leaving the house, he grabs his samples and a small compact carrying case. Weighing just 17 pounds, the new Model 765 Portable Memory Terminal includes a keyboard with upper- and lower-case characters, a built-in calculator-style numeric cluster, a quiet 30-characters-per-second non-impact printer, and an accoustic coupler for telephone connection.

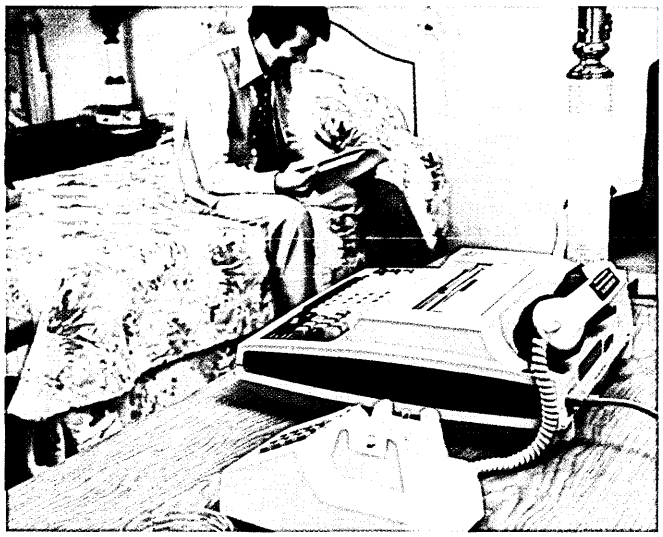
Texas Instruments is the first company to put bubble memory in a form you can get your hands on.

The *Silent 700* Model 765 Portable Memory Terminal.

ns business.

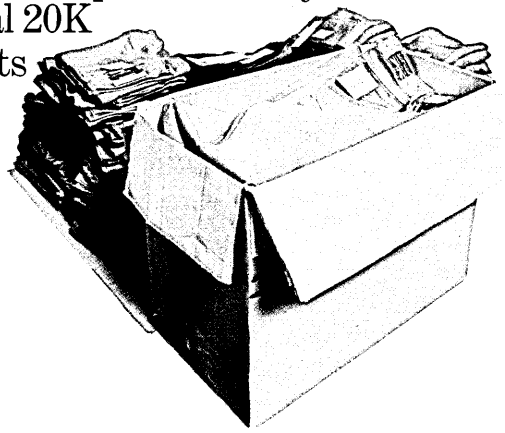
Later that evening.

With his orders prepared and the phone rates down, he dials up his central computer at his warehouse. The stored data is transmitted at 30 characters per second. And his sales are rung up. Saving time. And saving money.



Small price for remembering.

TI's new 765 is priced at only $2995†. Additional 20K increments of bubble memory storage are $500 each. And, of course, quantity discounts and lease programs are also available.



Wrapping up the deal.

The next day, his customer's orders have been processed. And his first deliveries have been packaged for shipment.

TI's new 765 Terminal with bubble memory has sold a good salesman.

Ask TI how the new memory terminal can help your business. Return this coupon today for more information. Or call Terminals and Peripherals Marketing at (713) 494-5115, extension 3286.

Yes! I am interested in the new Model 765/763 terminals with bubble memory.
☐ Please have your representative call me.
☐ Please send me more information.

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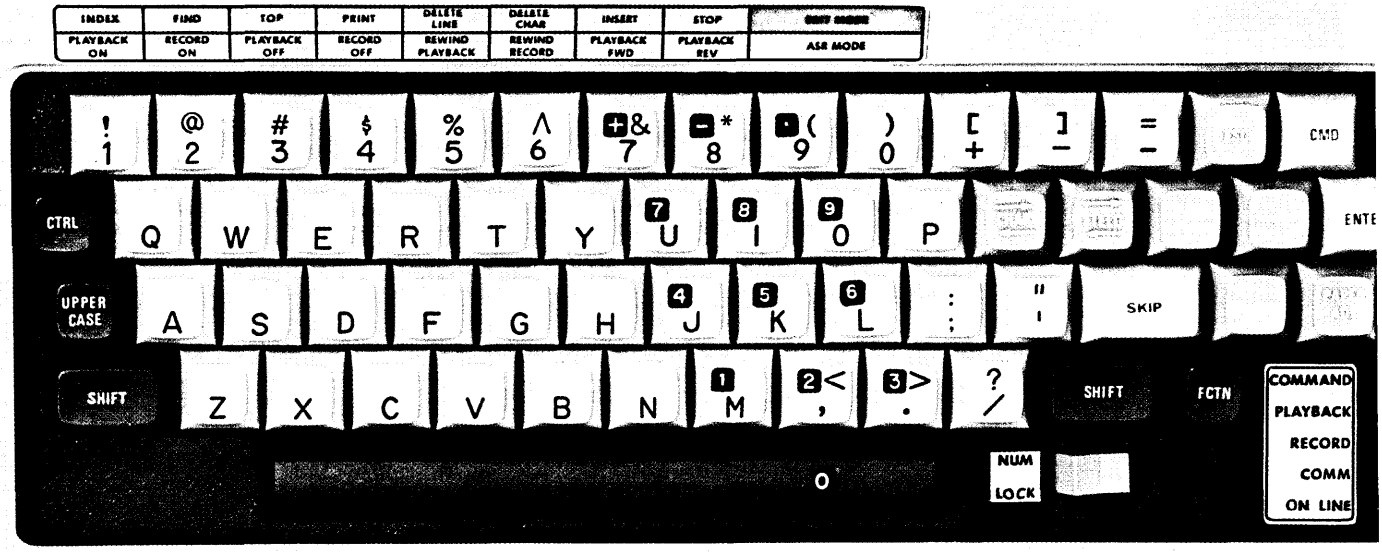
†U.S. Domestic Price.

Powerful editing functions...and easy to use.



Index. *Allows the user to locate a line of text for editing by specifying a relative line number.*

Find. *Allows the user to locate a line of text for editing by specifying up to 15 ASCII characters.*

Print. *Allows the user to initiate and terminate printing of text.*

Insert. *Allows the user to insert additional characters into the text being edited.*

Delete Character. *Deletes characters where desired.*

Delete Line. *Allows the user to delete multiple lines of text wher desired.*

Stop. *Allows the user to termin editing mode.*

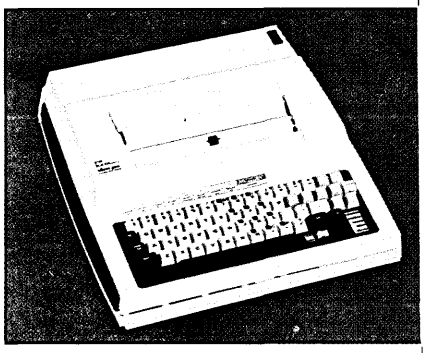
Top. *Allows the user to set reco reference to beginning of file.*

Bubble Memory...New Technology for Mass Storage
Contained in a small module, bubble memory is an electronic chip that stores digital information by changing the magnetic polarity of tiny areas in the chip called bubbles. The tiny bubbles are actually cylindrical magnetic islands polarized in a direction opposite from that of a film in which the bubbles function. The memory has no moving parts, and because it works magnetically, it retains information even when the power is turned off, a quality particularly important for portable equipment.

Bubble memory has advantages over electro-mechanical mass memory devices such as paper tape, cassettes or floppy discs. This new technology offers solid state reliability, higher access speeds, smaller size, and less weight and power consumption.

The 765 terminal can access any indexed record in memory in less than 15 milliseconds, compared to a search time from several seconds to several minutes for a cassette system. If the data location in the 765 memory is not known (not indexed), the character string search speed is 1000 characters per second, about four times the speed of a cassette search. Compared to a floppy disc, the bubble memory indexed record access time is more than ten times faster, but total data transfer rates are lower.

Also available in Model 763 Memory Terminal.
The 763 terminal, a stationary version of the 765, is available for applications requiring non-volatile memory and text-editing capabilities. The 763 is equipped with TTY or EIA interfaces for external communications. At under 16 pounds, the 763 is a compact unit appropriate for use in any fixed location.



TI's Model 763 Termina

At $2695†— quantity one price — the 763 terminal is another price performance leader from TI.

Nationwide Sales and Service
Wherever the Models 763 and 765 Memory Terminals are used, the Texas Instruments nationwide network of factory-trained sales and service personnel is available for support. Sales and service offices are located throughout the United States as well as Canada and major countries overseas.

†U.S. Domestic Price.

TEXAS INSTRUMENTS
INCORPORATED

terminal mea

Taking to the air.

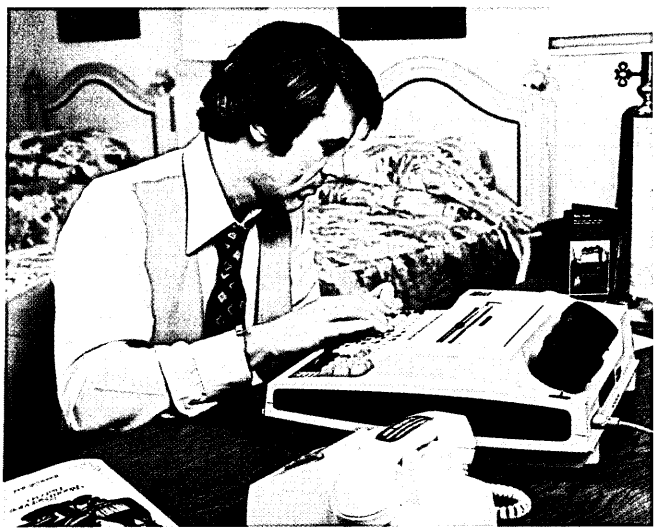
Minutes later he reaches the airport and boards his flight. His 765 terminal fits easily under his airline seat. With the revolutionary new dimension of bubble memory, he'll be able to enter and keep sales data without the added bulk and cost of cassette cartridges, floppy discs or paper tapes.

Third floor, sportswear.

Arriving at his first sales call, his memory terminal goes to work. Without connecting to a phone, he begins to enter his orders, prices and delivery commitments. He has at his fingertips a file management system and a powerful operator command mode that will let him easily select a communications mode, configure memory, and enter or edit his orders. And the story stays exciting to the close.

A last-minute change.

Later in his room, he reads back his sales entries, checks his inventory figures and edits a few changes on his hard copy record. Then he ponders the success and commissions of the day that have been stored up in the terminal's memory. The basic 765 terminal comes with 20K bytes of memory storage. And can be expanded to 80K bytes — the equivalent of 16 to 20 fully typed pages.



TEXAS INSTRUMENTS.

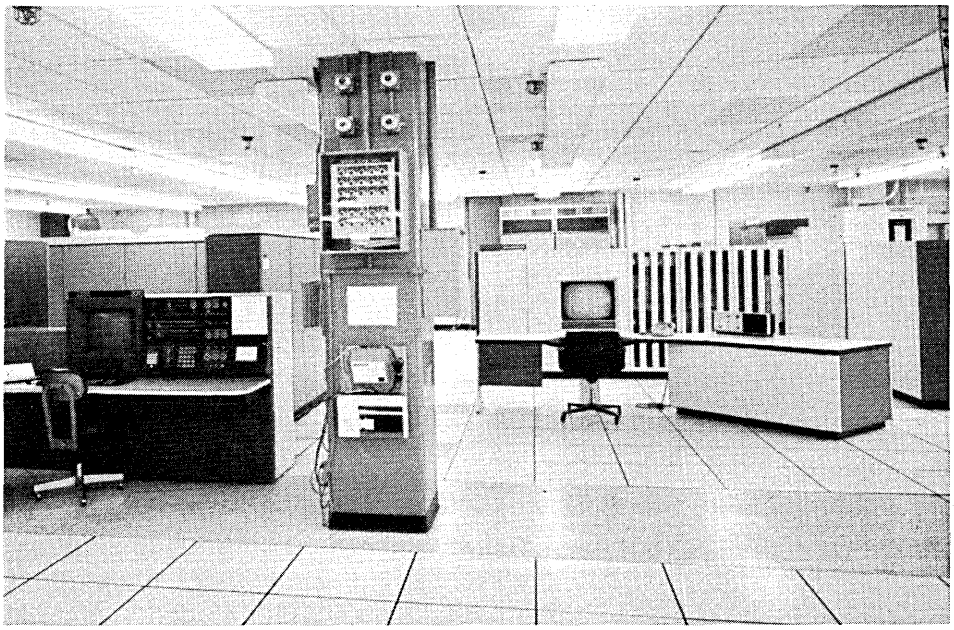
Converting from the 370 to the 470

by James B. Woods

It was easier and cheaper to upgrade to an Amdahl than to go IBM's way.

The corporate data processing center of Hughes Aircraft Co., located in Fullerton, Calif., recently swapped an IBM 370/165 for an Amdahl 470V/6. Since the 165 was paired with another to support a huge network, and since thousands of users and programs could be affected by the changeover, the move was made with some trepidation.

Now, a few months later, sufficient time has elapsed for the "honeymoon" with Amdahl Corp., the dp center personnel's initial enthusiasm, and IBM's "unhooking policy" all to have waned. And still the results look so positive that I am a little concerned about reporting them, as they may sound highly promotional.



The channel-coupled IBM 370/165-I's at Hughes Aircraft Co.'s central dp facility in Fullerton, Calif., couldn't keep up with the workload. The easiest, least expensive, and least risky upgrade proved to be to replace one 165 with an Amdahl 470V/6.

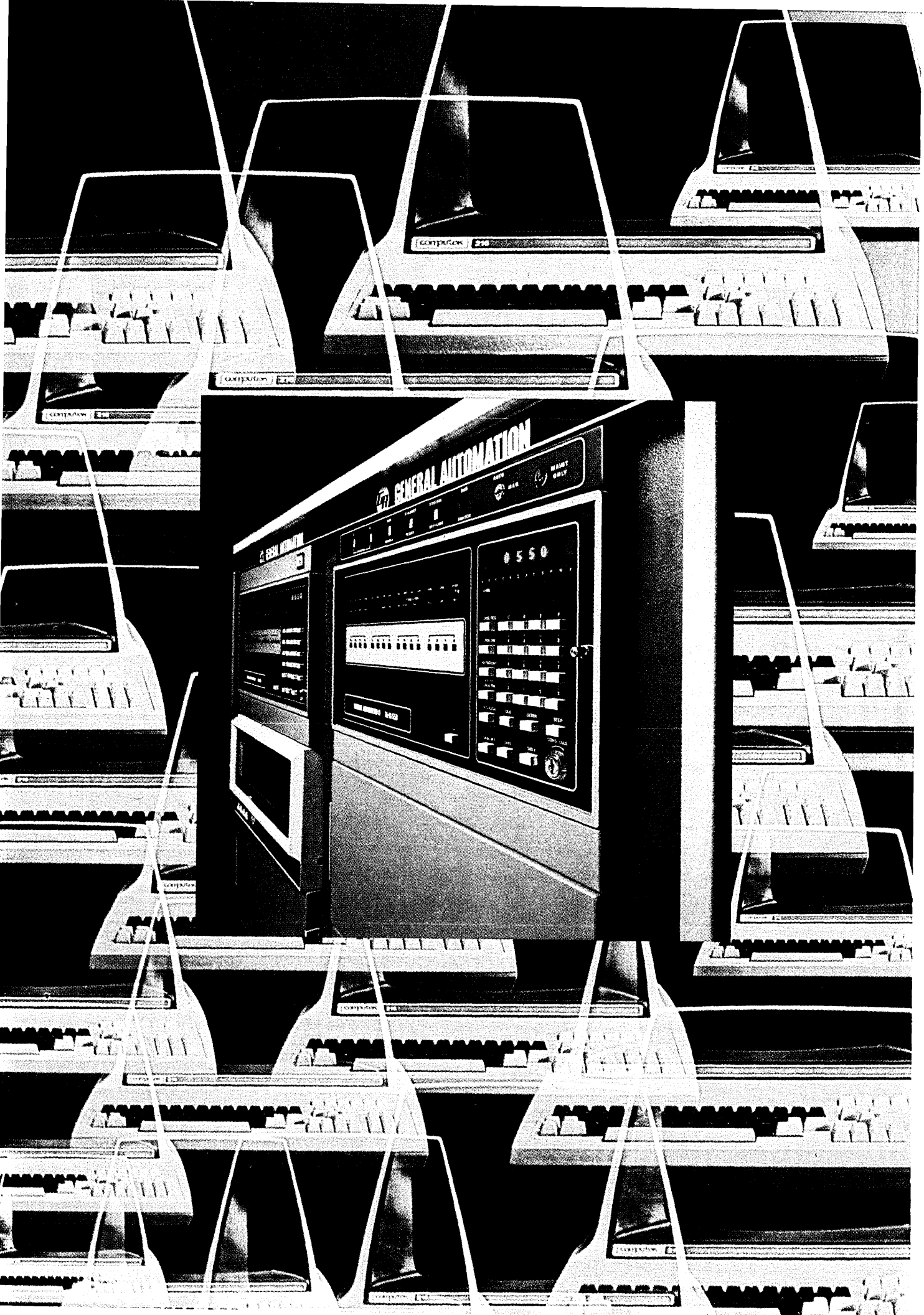
Hughes Aircraft is a high-technology electronics manufacturer. Principal engineering and manufacturing operations are located in 11 Southern California facilities and in Tucson, with marketing and field support offices spread internationally. The management is organizationally decentralized, employment is approximately 37,000 persons, and annual sales are approximately $1.6 billion. The corporate dp center, created in 1971 when major engineering and business data processing were centralized, provides a great deal of support for all those entities.

> . . . 800 batch jobs per day on prime shift, plus 53 simultaneous TSO users, 82 ATS, and 37 IMS on-line users . . .

Our problem was that 4,000 day-shift batch jobs per week (Monday through Friday), plus an average of 53 simultaneous TSO users, 82 ATS, and 37 IMS on-line users had saturated the prime shift capacity of the dual 370/165-I's.

The processors ran loosely coupled (channel to channel) under a locally optimized OS/MVT Release 21.8 and ASP Version 3.1 operating system.

That software had been used for five years, and the configuration was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4. **Save: 1.3 to 1 on communications costs:** "...recurring line costs for the communication network will be about 20% less with the (GA) distributive minicomputer system than an equivalent mainframe system."*

Plus users report GA start-up time 15 to 1 better; project completion time 3 to 1 better; system reliability improved 10 to 1 (99.8% uptime in the world's largest bank).*

GA network development capabilities cover the full-range of distributive processing requirements, with the most configuration options packaged in our Network Series modules. A typical 8-processor module (2x6) supports 2000 terminals and 2-billion bytes. For 40% less than centralized mainframes.

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CIRCLE 18 ON READER CARD

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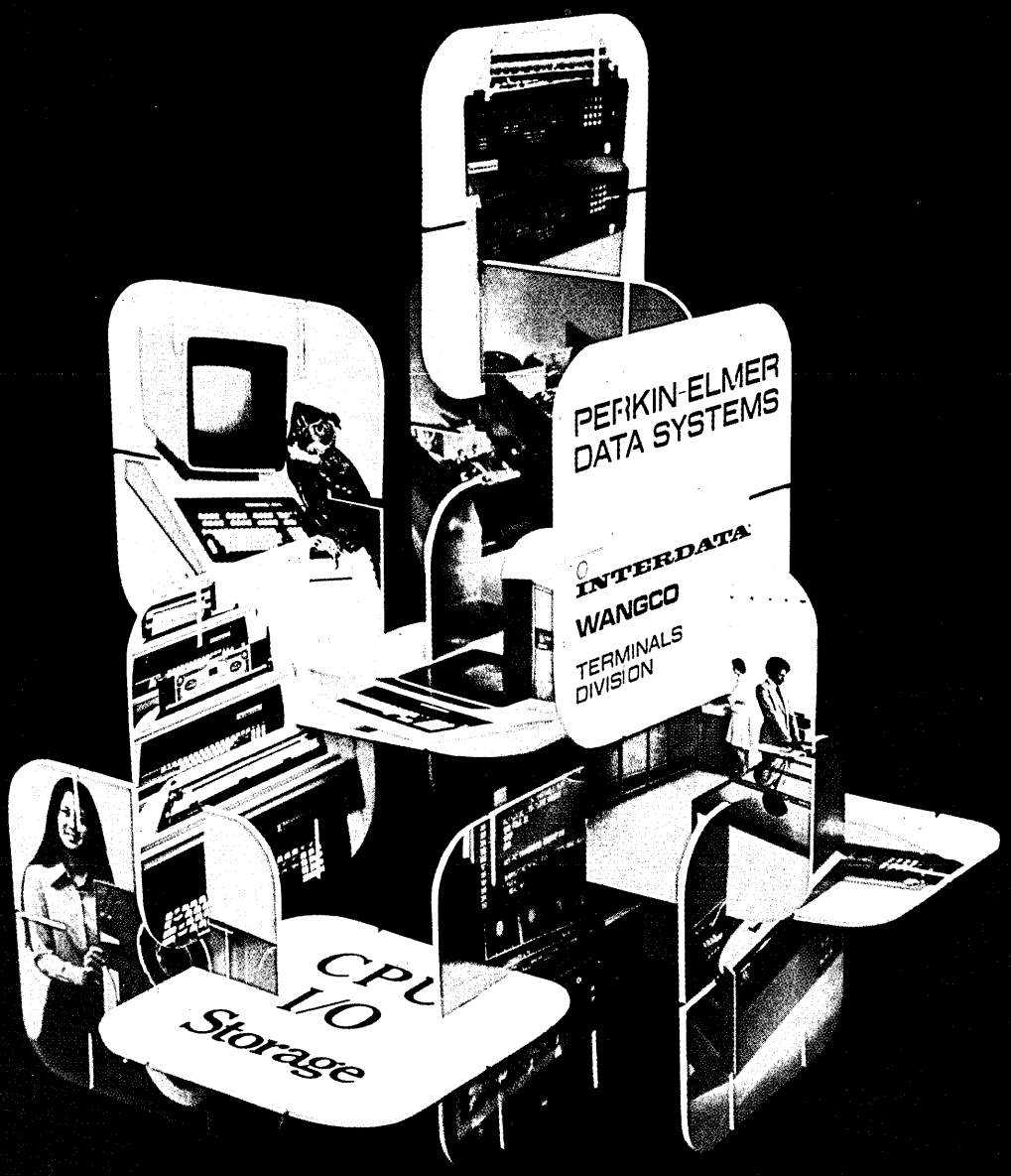

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CIRCLE 80 ON READER CARD

tuned and relatively reliable, just overworked.

The decentralization dilemma

This presented something of a dilemma. It is our philosophy *not* to increase the degree of centralization at Hughes (see "Issues in Centralization," Carl H. Reynolds, March, p. 91). Since centralizing, we have reversed ourselves, installing a DECsystem-10, two IBM 370/158s, and many minis outside of the central site. We expect to continue spreading some resources closer to the users. But the rise in usage of outside batch and time-sharing services was causing corporate management concern. In short, the demand for service was rising faster than we could decentralize.

Hughes will realize a 50% to 70% capacity increase at a cost increase of 1% !

Further, IBM's withdrawal of support for OS/MVT, coupled with the sparsity of 370/165-expert field engineers, presented us with other risks. Also, the fact that OS/MVT could not support cost-reducing peripherals, like the IBM 3800 page printer and the 3850 mass storage system, began to preclude additional productivity gains for our existing operation.

Our hand was forced. We initiated a competitive procurement study to upgrade. The absolute requirement for a 100% IBM-compatible system control program and program products narrowed the alternative vendors to IBM

We measured the power of the Amdahl 470V/6 at twice that of an IBM 370/165-I.

and the Amdahl Corp. Although we had been passively following the development of Amdahl since 1973, the firm was still an "underdog" with only a single product, the 470V/6, and 17 installations at the time we began our study. IBM, on the other hand, offered multiple solutions ranging from DAT boxes to 370/168-III Attached Processors and Multiple Processors.

To evaluate the offerings, we constructed a three-pronged program: (1) researching public information; (2) onsite evaluating at user installations and at the vendors' technology headquarters—Gaithersburg for IBM and Sunnyvale for Amdahl; and (3) processing multiple benchmarks reflecting our specific workloads. Our objectives were to improve our price/performance and to solve the capacity and obsolescence problems, naturally, but to do so while minimizing conversion time and risks.

PROFILE OF EXISTING DAY SHIFT WORKLOAD

2 X 165-I's	Average cpu minutes/hour 165 System 1	165 System 2	165 total Both Systems
Batch	16.6	21.9	38.5
TSO	—	25.7	25.7
ASP/ATS/IM'S	34.9	—	34.9
Wait state	8.5	12.4	20.9
Total =	60.0	60.0	120.0

Table 1.

Our formal analysis was begun on August 1, 1976, and culminated with the replacement of a 165 with the 470 on January 1, 1977. During the intervening months, we processed our benchmarks twice on the Amdahl 470V/6 (OS/MVT), debugged them once on an IBM 370/168-III (MVS), and then ran them on a 168-III Attached Processor system (MVS again).

We visited seven Amdahl installations, two IBM installations, participated in five meetings with Amdahl representatives, and 25 meetings with IBM. We also had HAC professional digital engineers perform an in-depth analysis of the V/6 LSI and ECL circuit technology.

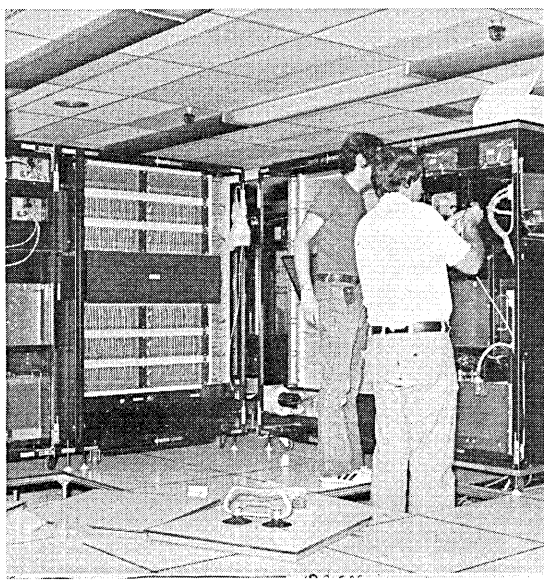
The benchmarking was difficult. The science of sampling and benchmarking computer system workloads is

The performance/price ratio for Amdahl was 4.0, for IBM 3.2.

at best inexact, offering margins of error of 50%. We had to grossly characterize our day shift workload based upon compute-state time utilized—even though our workload is non-homogeneous—as 50% batch and 50% on-line. (The batch is predominantly TSO-Submit and ASP RJE service. The on-line is 50% TSO, 25% ATS, and 25% IMS. Table 1 represents a summary.)

Part of the reason the benchmarking was tough was that our price/performance analysis resulted in two final candidate systems: the Amdahl 470V/6, which could run with OS/MVT or SVS or MVS or VM; and the IBM 370/168-III AP, which had to have MVS. Thus our benchmark construct included dissimilar variables.

The scenario was to run our benchmarks on the 470V/6 under OS/MVT (a very straightforward process), convert them to SVS and rerun them on the 470V/6, reconvert to MVS and rerun on the V6, and then finally to rerun on the 370/168-III AP. The inexact science of predicting cpu power through selective workload sampling benchmarks would be stretched beyond all reasonable expectations if we attempted to correlate four hardware/software configurations and two or three versions of subsystem software; therefore we elected to benchmark the V/6 with OS/MVT and the Attached Processor with MVS. Granted, we had a long-term objective to migrate to a virtual operating system, but the short-term goal was to convert only if the fi-



Only 12 hours after the vans arrived, Amdahl systems engineers were running diagnostics under VM. One day after that, Hughes personnel were running their own tests under OS/MVT. Then, only five days after its arrival, the 470V/6 was pressed into service to help recover from month-end processing problems.

nancial incentives were great enough and the risks low enough.

Although we were perplexed about the dissimilar system control program variable, at least we were comparing each vendor's best configuration.

The benchmarks

Our benchmarks were built around the two largest components of our day shift cpu load, batch, and TSO terminal processing. These represented two-thirds of our total day shift work. The design approach was to develop eight discrete experiments, in order to avoid low predictive precision due to small samples of finite simulations.

The formal approach was to:

1. Establish cpu utilization relationships for all classes of prime shift work.
2. Generate multiple job streams that profiled average batch cpu work for the day shift to establish cpu power and throughput-per-time indexes.

Five batch streams were generated to comprise all types and mixes of actual work processed:

- *Synthetic*—to sample and replicate percentages of actual cpu instruction volume and mix executed (measured with a Testdata 1185 hardware monitor)
- *Cluster*—to process a mix of job classes (based on mainframe resources consumed)
- *Scientific*—to represent engineering (cup-bound) work (including the Whetstone series)
- *Commercial*—to represent business (I/O-bound) work
- *Composite*—to represent a weighted-average mix of the preceding four experiments.

3. Generate a series of TSO "scripts," which would profile the average cpu drain to support TSO, again on prime shift. (The Boeing Computer Services, Inc., TIOS simulator was acquired to drive the scripts.)
4. Execute each batch job stream and the TSO scripts in a "standalone" environment for comparison. Then run the composite job stream with a developed foreground task absorbing varying levels of the cpu resource.
5. Run a stress test combining 40 simultaneous TSO scripts with varying levels of multiprogramming (batch initiators) of the synthetic job stream. Then add increments of 10 scripts at a time until saturation. (This experiment determines ability to process workload and measures available cpu power.)

The Amdahl machine benchmarks required no conversion and ran trouble-free. The IBM AP benchmarks required a conversion to MVS (with considerable IBM System Engineering assistance), were 30 days late, problem-plagued, and incomplete. Our initial MVS benchmarks were unable to use the TIOS TSO simulator under MVS, and we were not allowed to use our Testdata monitor at IBM. Those factors, plus the use of Virtual I/O on the IBM system, biased the experiment and made it impossible to fill in the right half of Table 2.

SUMMARY OF CPU POWER RATIOS		
Experiment	470V/6 vs. 165	168-III AP vs. 165
Synthetic*	1.90	(Note: Unavailability of hardware monitor and TIOS, plus incompatible cpu time calculations precluded development of similar ratios.)
Cluster	2.05	
Scientific	1.91	
Commercial	2.14	
Composite	1.96	
TSO Scripts	2.01	
Average	2.00	2.30 (estimated)

*heavy double-precision floating-point arithmetic

Table 2.

Price/performance comparisons

Of course price/performance comparisons were one key determinant in our final decision. Using a single IBM 370/165-I cpu as a power index of 1.0, we measured the Amdahl 470V/6 at approximately 2.0, on the average, across our processing spectrum. Similarly, we attempted to measure and extrapolate the IBM 370/168-III AP, with a resulting estimate of 2.2 to 2.4.

The approximate purchase prices for the V/6 and the 168 AP were $5.0M and $7.5M, respectively. (And we paid approximately $4.6M for a single 165-I five years ago! Sigh.)

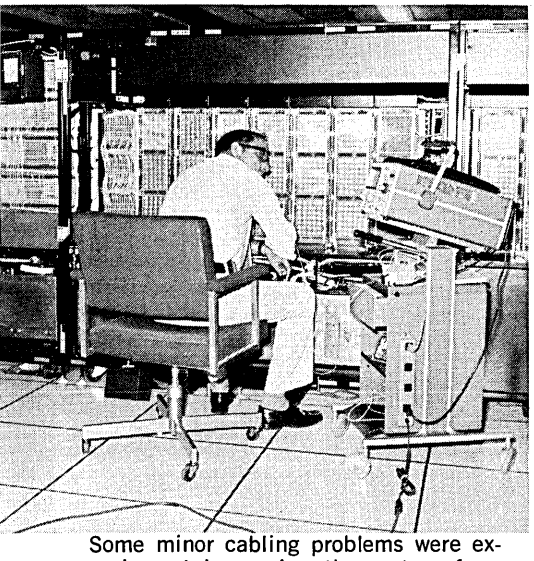
These purchase prices represented equivalent six megabyte memory configurations with the exception that the 470 included its standard 16 I/O channels and a 16KB high speed buffer, while the 370 had its standard 12 channels and a 32KB buffer. The relative mainframe price/performance figures (actually performance/price), after dropping leading zeros, were calculated as 4.0 for Amdahl and 3.2 for IBM.

> Thirty-six hours after the vans arrived, we were processing under OS/MVT.

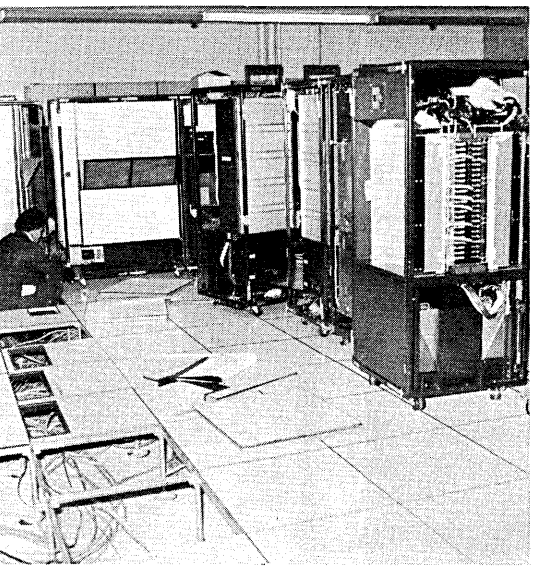
Recurring annual operating expenses of depreciation, maintenance, and insurance were approximately the same for either system, and represented a nominal increase over the 165-I which was to be replaced. Adequate computer room facilities, utilities, peripherals, and operating/support personnel were in place to accommodate either new machine. Since all other annual expenses were unaffected, a 50% to 70% increase in capacity was available at an annual operating expense increase of approximately 1%!

Software conversion costs, implementation times, and risks represented real concerns as we would not jeopardize our users' service and availability requirements to alleviate dp's internal problems. Converting to the bigger 370 would have required also converting to MVS, JES3, IMS/VS, ATMS, and TSO/MVS. IBM agreed this was a sizable task. Internally, we figured it at about $1M and 14 months elapsed time, with associated risks in converting our modified subsystems—ASP to JES3 (which we viewed as "shaky" in performance and reliability) and ATS to ATMS.

As mentioned, the Amdahl would require no software conversions. However, in order to eliminate the OS/MVT practical limitation of 15 initiators,



Some minor cabling problems were experienced in moving the system from place to place, but the Amdahl cpu was easily put into full production status 10 days sooner than expected.



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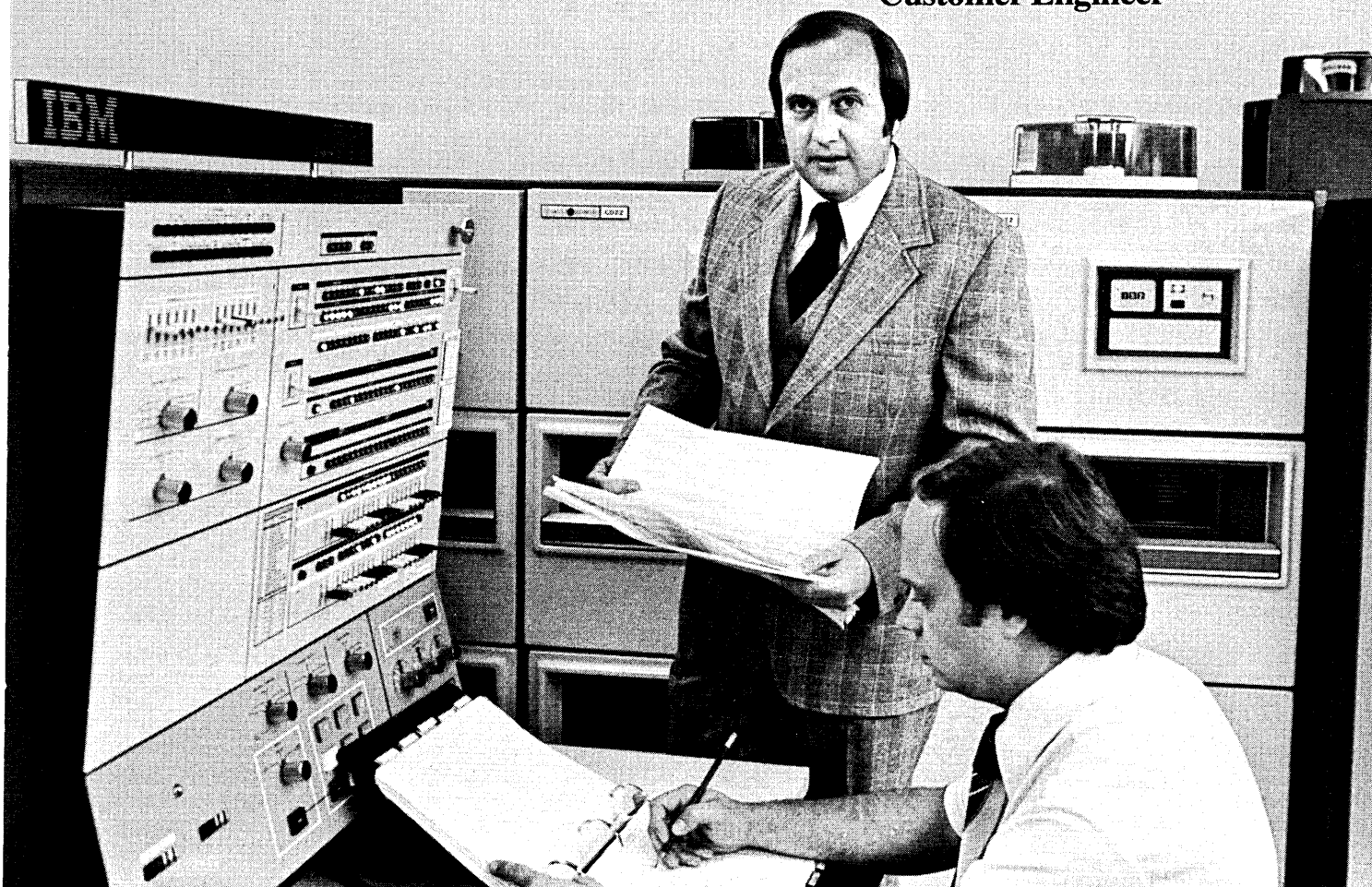


and to exploit the additional compute power, we planned to convert MVT to SVS and leave the subsystems unchanged. We "ballparked" this conversion at $100K and three months, expecting little impact on our users.

In our complex software and network environment, reliability and availability is very important. Our analysis of the V/6 projected a hardware MTBF of approximately 275 hours between unscheduled IPL's versus our average experience of 150 hours for the 165. There were no production 168-III AP user installations, so MTBP projections for those were not meaningful. However, the AP does not incorporate

The system is 100% compatible with our programs, compilers, peripherals, and even local modifications.

major hardware circuitry or technological advances over our 165, so significant reliability improvements would not be expected either.

The case for the 470V/6 was overwhelming, and based upon our own enlightened self-interest, we ordered one. Table 3 summarizes our key decision factors.

Moving it in

Our implementation plan consisted of installing the 470 in a temporary location, cabling I/O and unit record devices for a 30-day test, moving the system to its real location after acceptance, and removing the 370. It happened even more nicely. Only 12 hours after arrival of the shipping vans, the V/6 was operational in local mode for systems engineers running diagnostics under VM. Approximately 36 hours after the arrival of the trucks, we were processing tests under our own OS/MVT operating system. There were some intermittent hardware problems, no software problems, and some failures of our temporary cabling.

Independent of the 470 installation, we had made several errors in our month-end processing and were faced with reruns. We were also experiencing inordinate delays in processing tape jobs (later traced to an unauthorized change in processing priorities). The 470 had been installed only five days, but was already proven. We accelerated our original test plan, switched the ATS subsystem to the 470, reducing the load on the 370s, and operated with three machines. No batch work or other subsystems could be offloaded during this accelerated phase due to the I/O and temporary cabling restrictions.

The following weekend the recabling was done and the V/6 was returned to standalone testing, but still available for backup.

The new system was moved to its permanent location 19 days after its arrival. Emulating the success of the installation team, the local field engineers moved and tested the system in 12 hours and returned it to us fully operational. We were in full production with batch and TSO ten days prior to our planned date.

The system is 100% compatible with our IBM system control program, program products, compilers, peripheral devices, and even our IBM plug-compatible peripherals, proprietary software, and local modifications. System reliability exceeded our acceptance test criteria, with eight hardware IPL's, an average MTBF of 107 hours, total outage of 6.7 hours, and an average mean time to repair of 50 minutes.

Cpu power averaged in excess of 2.0 times the IBM 370/165-I with the exception of processing jobs with a high incidence of double-precision floating-point arithmetic—where it averaged approximately 1.7 times due to the 4-byte wide transfer path of the V/6 versus the 8-byte width of the 165.

Epilogue

The recent large system announcements and approximate 30% discounts made by IBM and Amdahl on existing products did not alter the business economics of our decision. And the Amdahl Corp. tempered the difference between pre- and post-announcement prices with other considerations. Actually, the residual value of the 165 dropped significantly after we sold it, so the overall change swung in our favor.

Our conclusion is that the 470V/6 product is as advertised. Our actual experiences matched or exceeded our expectations. Members of the Amdahl corporate office and local support personnel are competent, readily available, and vitally concerned about customer satisfaction. We have not had any support problems or finger-pointing in our mixed vendor environment—even though the 470 and 370 are physically linked. Local Amdahl field and systems engineers have worked well with our on-site IBM, Comten, and STC FE's. In fact, an Amdahl field engineer assisted one of

Painless two-for-one price/performance gains are readily available in large computer systems.

our peripheral vendors in trouble-shooting hardware interface problems and debugging diagnostics running on the 165!

At the time of this writing, the 470V/6 has been operational for more than seven weeks without an unscheduled IPL, for an MTBF exceeding 1,100 hours, representing unparalleled system reliability in our experience.

We now believe that painless two-to-one price/performance gains are readily available in the large computer systems segment of the data processing industry. These gains may be overshadowed by gains being made in the minicomputer area, but the era of selling large computer systems' advance functions without both improved performance and reduced price is over. The continued competition between IBM and Amdahl, especially, should assure price/performance and technology gains for large system users. ❁

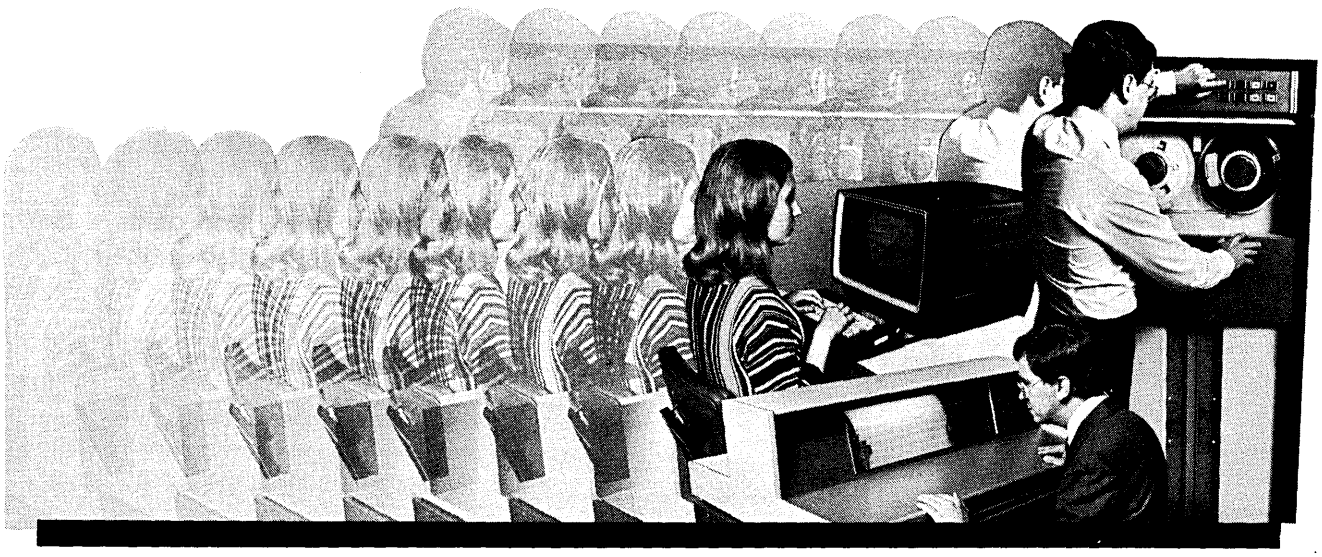
KEY DECISION FACTORS

Parameter	Current (370/165-I)	IBM Alternative (370/168-III AP)	Amdahl Alternative (470V/6)
Relative cpu Power	1.0	2.4	2.0
Purchase price	$4.6M	$7.5M	$4.8
Recurring operating expenses	$0.75M	$0.66M	$0.84M
Software conversion costs	—	$1.0M	****
Implementation period	—	14 months	15 days
Estimated hardware MTBF	150 hours	N/A	275 hours

****No conversion was actually required for the 470V/6, but switching from MVT to SVS was considered for convenience and improved performance. That switch was estimated at $100,000 and 3 months.

Table 3.

As associate director for computing and data processing at Hughes Aircraft Co., Mr. Woods is responsible for the technical support and operation of the corporate dp facility and a 450-terminal network bringing services from that facility to 11 major sites. His 10-year dp background has focused primarily on the development and management of on-line data base systems.



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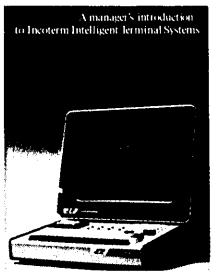

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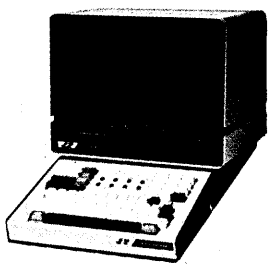

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Are the New Programming Techniques Being Used?

by John B. Holton

For all the fanfare, little of structured programming has been adopted.

It is often claimed that the use of effective system development techniques can significantly contribute to the success of the business data processing function, and much attention has been paid to the characteristics and advantages of the more modern of these techniques. The question often arises whether these newer techniques are coming into widespread use; and if so, whether they are effective.

We recently surveyed—with surprising results—several large business dp organizations to determine the extent and effectiveness to which they have implemented some of these newer techniques, including:

1. structured programming
2. top-down design and implementation
3. the structured walk-through
4. programmer team operations
5. use of a program development support library

Twenty-three of the largest corporations in the Los Angeles area participated in the survey. The corporations were chosen from the 1976 *Los Angeles Times* roster of "California's Leading Companies," in which companies are listed by amount of sales(revenue) for industrials and utilities, and by assets for financial corporations. For example, sales of the industrial participants in the survey ranged from slightly more than $100 million to over $7.5 billion in 1975.

Nearly a third of the participants were dropped because they hadn't even considered using the techniques.

Participants were selected so that a reasonable cross-section of types of businesses would be represented. They come from aerospace and electronics (4), the oil industry (4), banking and insurance (3), industrial manufacturing (3), utilities (3), transportation (2), food and beverage production (2), and entertainment (2).

Participation was limited to personnel representing the business data processing function in each organization. Therefore, the results do not include data on the use of techniques for government-contracted or scientific work.

The study was conducted during the late summer and fall of 1976. Initially, 33 corporations were contacted, but 10 of them were eliminated immediately since they had not seriously considered using any of the programming techniques to be examined in the survey.

Individual participants were either data processing managers or persons directly assigned to the task by a dp manager or higher level company officer. These people cooperated by filling out questionnaires and participating in a follow-up personal interview.

The questionnaire

The survey questionnaire contains an evaluation sheet for each of the programming techniques mentioned. (Fig. 1 shows the form used for collecting information on top-down design and implementation.)

To measure the perceived effectiveness of each technique in accomplishing a particular objective, individual

responses were scored according to a simple 0-to-3 scale ("not effective," "somewhat effective," "moderately effective, and "very effective"). Responses where the effectiveness of structured programming in meeting a particular objective was not observed at all were not used. For example, if a respondent indicated that structured programming was moderately effective in lowering program development costs, this response was assigned an effectiveness rating of "2."

Then the average of these responses was tabulated for each objective considered. (Table 1 describes the results for structured programming.)

A similar form, with the same set of operating objectives and the same scoring scheme, was used for each of the other techniques also.

To eliminate ambiguity, an addendum was attached to the questionnaire to explain the salient characteristics of each of the programming techniques under study. IBM's "Improved Programming Technologies Management Overview" publication served as a basic source of information for this addendum. Without such an addendum, we felt it would have been difficult to gain a consensus on the meaning of such terms as "structured programming" for purposes of this analysis.

Structured programming use

The following definition of structured programming was provided to participants—its simplicity serves to separate the concept of structured programming from those of top-down and other structured design techniques:

"At the basic level, structured programming deals with elimination of the 'GO TO' statement within individual program modules. That is, a structured program is one whose modules contain only the logic structures:

1. sequences of two or more operations,
2. conditional branches to one of two operations and returns (i.e., IF Y THEN b ELSE c) and/or
3. repetition of an operation while a condition is true. Emphasis is placed on restricting individual program modules to have a single entry and a single exit.

Structured programming may also include several practices in support of its use. For example, indentation rules may be used to clarify the description of particular control structures on a coded page."

In Table 1, the number "14" in parentheses behind the heading "Structured Programming" signifies that 14 of the 23 survey participants indicate that they are experimenting with or using this technique. (Coincidentally, the same maximum number appears for the users of some of the other techniques also, such as top-down design and implementation, but be aware that the sample is not the *same* group of 14 users each time.)

Of the 14 which had used it, the interviews showed that only three had fully implemented structured programming along with a well defined set of procedures and documentation standards for its use. The remaining 11 users were still experimenting with and evaluating this technique. This is certainly no indication that structured programming is in as widespread use as the literature may imply.

Also in Table 1, the numbers listed in parentheses behind each measured objective represent the number of participants who were able to observe the effectiveness of structured programming in meeting the stated objective. For example, 11 of the technique's 14 users were able to measure its effectiveness in lowering program development costs.

The average rating data implies that structured programming is not particularly a method for lowering development costs nor for faster implementation of application programs. It is also rated as relatively ineffective in lowering program processing costs. This is not surprising since use of structured programming reduces the flexibility of the programmer in performing the coding task.

One would expect that a significant improvement in the quality and maintenance of computer programs would be a key benefit to be derived from the use of structured programming. This should be especially important to our group of business dp users, too. In fact, a random sample of five of them provided an estimate of programmer effort spent on maintenance and minor enhancement work; the numbers ranged from a *low* of 50% to a high of 95%.

And maintenance is precisely where it received high ratings. That is, it is valued to be moderately to very effective in achieving better quality programs that are easier and less costly to maintain. It also received very high ratings for improving the efficiency of program debugging and testing. Moreover, it is described as reasonably effective in achieving clear and useful programming system documentation.

Note that the results indicate that structured programming increases programmer productivity but is not very effective in improving programmer

Top-Down Design and Implementation

The literature on the Top-Down approach to systems design and implementation suggests that its use may lead to accomplishing one or more of the objectives stated below. If you use the Top-Down approach in your installation, please indicate how effective it has been in accomplishing each of these objectives. If your installation does not use this technique, please so indicate by placing an X in this square: ☐.

Objectives	Impact on Software				
	Very Effective	Moderately Effective	Somewhat Effective	Not Effective	Not Observed
1. Lower development costs					
2. Faster implementation					
3. Lower program processing costs					
4. Better quality programs (e.g., more error free)					
5. Easier and less costly maintenance					

	Impact on Programming Staff				
	Very Effective	Moderately Effective	Somewhat Effective	Not Effective	Not Observed
1. Higher productivity					
2. Better morale					
3. More efficient debugging and testing					
4. More clear and useful programming system documentation					

	Impact on Users				
	Very Effective	Moderately Effective	Somewhat Effective	Not Effective	Not Observed
1. More flexible and timely response to user needs					
2. Less cost to the user (i.e., in time and/or money)					

Fig. 1. After the contact with the dp manager was made, sets of questionnaires like this one were mailed. Finally, personal interviews were conducted.

morale. Participants remarked that, in many cases, it was not easy for experienced programmers to adjust to the additional constraints imposed by implementation of the structured programming technique.

As for the users, structured programming is rated as being relatively ineffective in its impact on them, at least as the dp managers relate.

From the preceding comments, one might reason that with so much time being spent on systems maintenance and minor enhancement, the use of structured programming should significantly reduce the costs of information system development and maintenance to the user. Its use should also free up vital programmer time to provide more flexible and timely response to user needs.

However, there are several factors which contribute to rating the technique as relatively *in*effective in its impact on the user. Those installations whose systems and programming forces are doing a lot of systems and maintenance work often find it difficult to implement structured programming. This is because a great deal of their programming effort is expended on existing systems that were developed without the use of this technique. Moreover, it is highly likely that the technique has not been implemented long enough in *any* installation for its impact on the user to be significantly realized and visible.

Generally, the greater majority of participants who have experimented with or implemented structured programming, favor its use. They find that it can significantly improve the quality, debugging, testing documentation, and maintenance of their programming systems.

Use of the top-down approach

In analyzing the top-down approach to programming system design and development, the approach was conceptualized for participants as follows: "Top-down design and implementation organizes the system into a tree structure of program modules. With this approach, the first order of procedure is to describe a generalized structure or set of program modules to solve the programming problem. These first level modules are then divided into succeeding levels of modules to form a tree-like pattern for the design and development process. Given modules are expanded to as detailed a level of functional definition as is necessary to produce a relatively easily understood and manageable work break down structure. Coding and testing of subsystem modules follows the same hierarchical pattern of development with the highest or top level of system modules being coded and tested first."

STRUCTURED PROGRAMMING (14)

Effectiveness Rating	
	IMPACT ON SOFTWARE
1.5	Lower development costs (11)
1.5	Faster implementation (13)
0.8	Lower program processing costs (9)
2.3	Better quality programs (e.g. more error free) (14)
2.1	Easier and less costly maintenance (14)
	IMPACT ON PROGRAMMING STAFF
1.8	Higher productivity (12)
1.4	Better morale (12)
2.5	More efficient debugging and testing (13)
1.9	More clear and useful programming system documentation (11)
	IMPACT ON USERS
1.3	More flexible and timely response to user needs (12)
1.4	Less cost to user (i.e., in time and/or money) (11)

Table 1. Of the 14 users who had tried structured programming, 9 had been able to measure whether the technique had an effect on the eventual running costs of the programs produced. Their consensus, shown under "Effectiveness Rating," was that the impact (on a scale of 0 to 3) had little effect. Most users felt it led to easier debugging and testing, however.

Table 2 summarizes the survey results for the top-down approach to programming system development. With respect to its impact on the software, the approach is perceived to be moderately effective in the development and maintenance of application programs. However, at best, the technique seems to have little effect on the efficiency of computer program processing and is rated as only somewhat effective in reducing program processing costs.

Structured programming increases productivity, but not morale.

In its impact on the dp staff, the approach is rated as moderately effective in improving programmer/analyst performance. However, it, like structured programming, does not appear to build programmer/analyst morale.

As for the customers or users, the results show that the top-down approach is somewhat responsive to their needs. As such, it is appraised as moderately effective in reducing costs to the user of system development and useful as a tool for providing more flexible and timely response to user needs.

Since top-down development received favorable reviews, it would seem reasonable that a documentation technique such as HIPO (Hierarchy plus Input-Output-Process) might come into widespread use as an aid to support this approach. In fact, the participants did show interest in HIPO, but only two of them even had plans for using it.

This lack of enthusiastic support for a technique such as HIPO appears to stem from a general reluctance on the part of dp installations to implement a rigid set of standards and procedures to support the use of new programming system development techniques. It may also arise from the fact that many of these techniques are not that well defined nor proven in use.

While the top-down approach was used effectively as a design tool in many cases, it was not being formally applied during the coding and testing phases of system development. Such formalization may be relatively unnecessary, since application programming packages are quite easily and naturally broken into manageable individual programming modules for coding and testing.

TOP-DOWN DESIGN AND IMPLEMENTATION (14)

Effectiveness Rating	
	IMPACT ON SOFTWARE
2.0	Lower development costs (11)
1.9	Faster implementation (14)
1.2	Lower program processing costs (9)
1.9	Better quality programs (e.g., more error free) (14)
1.7	Easier and less costly maintenance (13)
	IMPACT ON PROGRAMMING STAFF
1.8	Higher productivity (12)
1.5	Better morale (11)
2.2	More efficient debugging and testing (14)
2.1	More clear and useful programming system documentation (14)
	IMPACT ON USERS
1.8	More flexible and timely response to user needs (13)
1.7	Less cost to user (i.e., in time and/or money) (9)

Table 2. Top-down techniques are closely related to structured program development, and therefore the user consensus would be expected to be similar. It is.

In general, the top-down approach was rated as effective in programming system development and maintenance. As expected, this evaluation is similar in nature to that given to its counterpart, structured programming. These technologies are obviously closely related and their use should be carefully integrated to achieve optimum results.

Use of structured walk-throughs

According to the IBM publication mentioned earlier, the "Structured Walk-Through is a generic name given to a series of reviews, each with different objectives and each occurring at different times in the application development cycle." It has six basic characteristics:

1. A walk-through is arranged and scheduled by the software developer.
2. Management does *not* attend.
3. Materials are handed out ahead of time.
4. Objectives are clearly communicated to attendees.
5. Emphasis is put on error detection rather than correction.
6. All technical members of project team have their work product reviewed.

A typical walk-through will include four to six people with someone designated as recording secretary. This person records all the errors, discrepancies, exposures, and inconsistencies that are uncovered during the walk-through. This record becomes an action list for the reviewee and a communication vehicle with the reviewers.

Table 3 describes the results of the questionnaire on the structured walk-through technique. The walk-through's performance falls in the same class with that of structured programming and top-down development. It is rated as moderately to very effective in achieving better quality programs that are less costly to maintain. It is also rather effective in improving the testing, debugging, and documentation of these programs.

One might suspect that use of the structured walk-through technique would breed unhealthy competition among programmers and analysts leading to poor staff morale. Just the opposite was found to be true. That is, proper use of this technique appears to improve morale and increase programmer/analyst productivity. The users felt that its use promoted a helpful and understanding relationship among analysts and programmers.

Will structured walk-throughs lead to bad feelings? Just the opposite.

However, the personal interview sessions did bring to light one word of caution in use of this technique. Namely, participants in walk-through sessions should be careful to concentrate on *detecting*, not correcting errors. If necessary, a better way of doing a particular task is more appropriately discussed in private conversations after the walk-through sessions have ended. This practice eliminates much of the embarrassment and conflict that can arise during these sessions.

Almost all the users of the structured walk-through had implemented the technique for their system planning and general design phases of programming system development. Only two or three had implemented it for the detailed design, coding, and/or documentation phases of this activity. But those that had were quite satisfied with their results.

In general, the survey results indicate that, if managed properly, the structured walk-through can be very effective in improving dp organization and system performance.

Use of programmer team

There is insufficient data to meaningfully summarize the results taken from the questionnaires used to evaluate the programmer team concept. Therefore, these results are not shown.

Only seven of the survey participants indicated that they had implemented the programmer team concept. Most of them were using some relatively simple variation on the project approach to system management. None of them were using the programmer team concept as formally described, where the programmer team consists of the chief programmer, a backup programmer, librarian, and other team members. None of the users had established a separate librarian function whereby a technician or technically trained secretary was assigned to each team to perform clerical and other less technically demanding tasks.

The survey results verify that it is difficult to economically justify the allocation of a librarian to each project team. But it may be appropriate to assign one of the less technically qualified team members, perhaps a programmer trainee, to perform the less technically demanding and/or clerical tasks.

One of the managers remarked that 10% to 15% of his programmer/analysts' workload was of a clerical or relatively non-technical manner. If he hired a less technically qualified person to perform these tasks, he could easily justify this person on a 10 programmer/analysts per clerk/technician basis. But he had not yet solved the problem of how to properly integrate the clerk/technicians into the operation of the systems organization.

The librarian is difficult to justify economically.

Although the programmer team concept does not seem to have a significant number of supporters, its has led managers to explore new ways of improving the productivity of the programmer/analysts by removing some of their responsibilities for performing clerical and other less technically demanding tasks.

Program development support libraries

Only two of the participants claimed to have a program development library anywhere near as elaborate and complete as that entity has been defined. The program development support library is supposed to be a system of office and machine procedures that permits the isolation and delegation of secretarial, clerical, keypunching, and machine operations during programming system development.

Delegation of such tasks to a librarian and setting up formal mechanisms to carry them out is in keeping with

STRUCTURED WALK-THROUGH (14)

Effectiveness Rating	
	IMPACT ON SOFTWARE
1.6	Lower development costs (13)
1.6	Faster implementation (13)
1.3	Lower program processing costs (9)
2.3	Better quality programs (e.g., more error free) (14)
2.1	Easier and less costly maintenance (11)
	IMPACT ON PROGRAMMING STAFF
1.8	Higher productivity (12)
1.7	Better morale (12)
2.2	More efficient debugging and testing (13)
1.9	More clear and useful programming system documentation (13)
	IMPACT ON USERS
1.8	More flexible and timely response to user needs (9)
1.3	Less cost to user (i.e., in time and/or money) (9)

Table 3. Structured walk-throughs didn't seem to be of great help in getting a program running quickly, but were seen to be useful in other ways. Even programmer morale, which could be expected to suffer from the method, was found to be actually improved by it.

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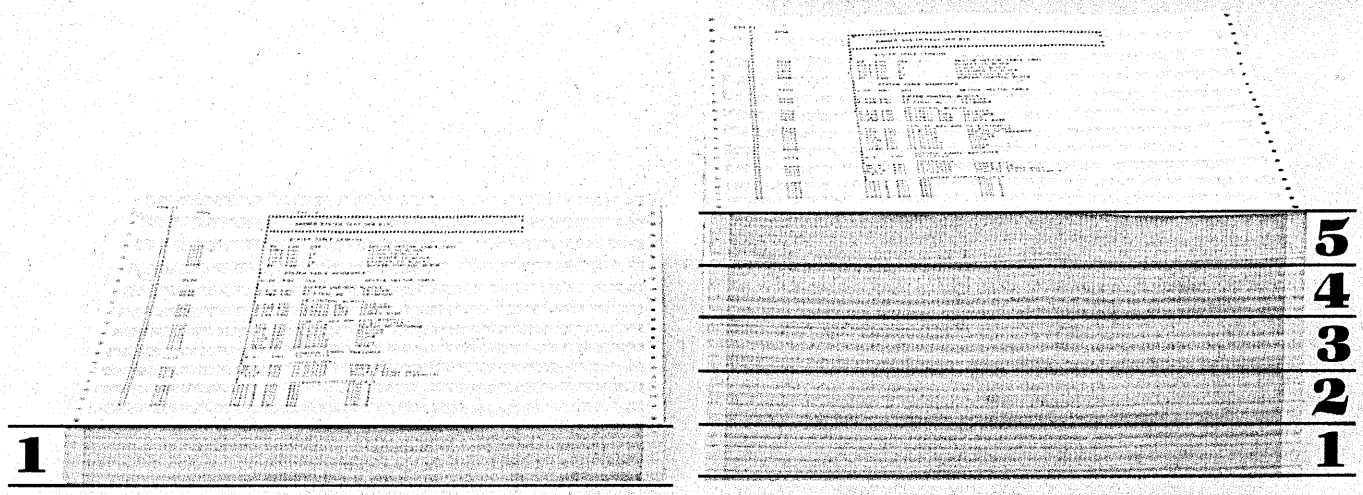

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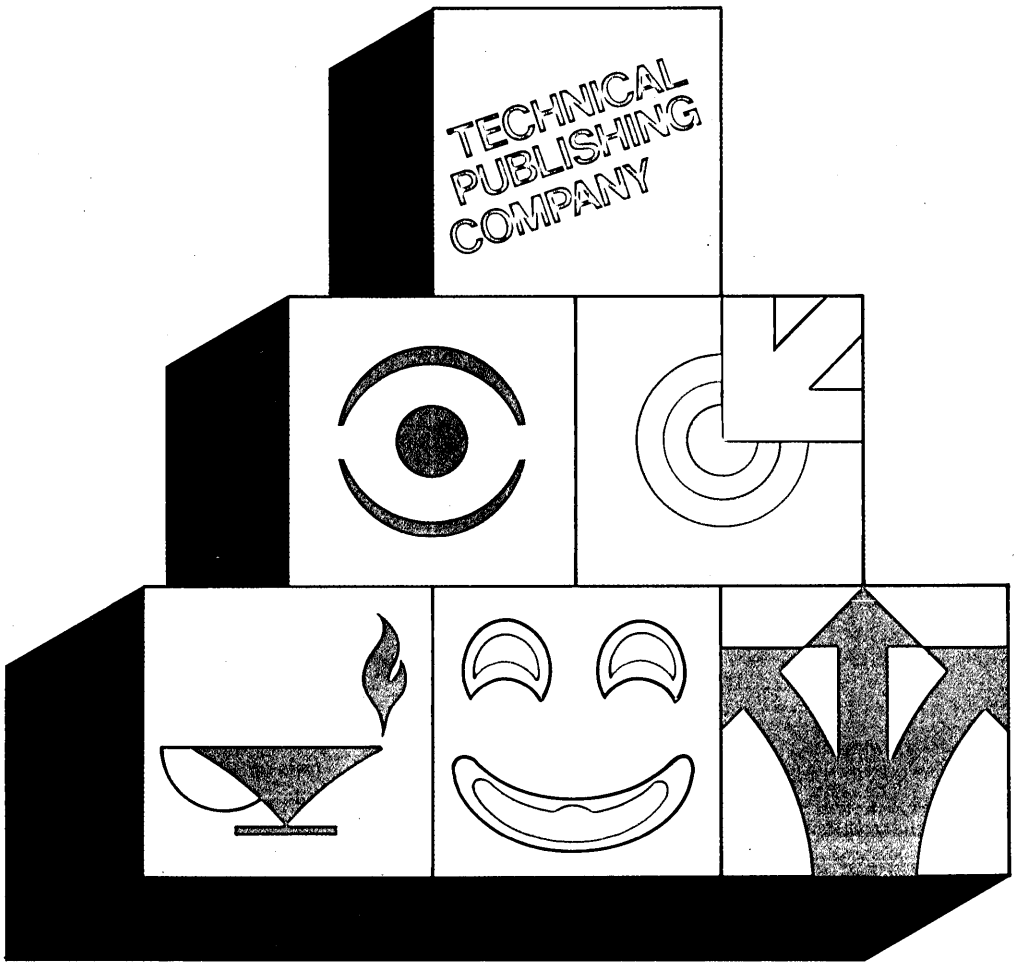

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the programmer team concept. In fact, the program development support library technique was originated to directly support the use of programmer teams.

Although the participants do not particularly favor the use of this technique, many of them have reasonably good systems documentation and procedure libraries. A majority of them have a librarian(s) whose major responsibility is to maintain and update these libraries. But very few of them made a serious attempt to maintain a central library of updated documents on programming systems that are under new development.

Is this true everywhere?

How likely is it that the rest of the real world strongly resembles this 23-member batch of big users? There's a pretty good chance. Here's a little more about them that leads to that conclusion.

First, although no attempt was made to seek out participants that deal with a specific vendor, all of them except one use IBM mainframes as their main processors of business data. IBM certainly encourages the use of the techniques studied. Therefore it is not surprising that a significant number of personnel from participating installations have received their educational exposure to the nature and use of these techniques by taking IBM's short course on the subject. On the other hand, it is unlikely that users of other brands of equipment from vendors which have not promoted the techniques as actively, would be more aware of them or would use them more.

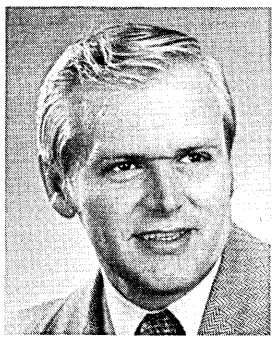
The shops are like most other commercial sites, too, in that all but one of them use COBOL as their primary language; in fact, they use it for more than 85% of their business programming.

> If these shops aren't much using the techniques yet, probably none are.

Then too, as mentioned earlier, 10 of the 33 installations originally contacted were dropped because they had not even considered using any of the techniques. Similarly, we contacted at least half a dozen smaller installations and found that none of them showed any interest in their use.

From these facts, it appears that the techniques are simply not widely used, for all the fanfare.

To end on a positive note, however, where they have been tried, some of the techniques have been found to be very useful. With proper commitment and diligent attention from dp managers, they *can* be implemented and used effectively. ✲



Dr. Holton is an associate professor at the Pepperdine Univ. Graduate School of Business in Los Angeles. He has long been a consultant to industry, having done engineering consulting for a large utility and management auditing for an international air carrier, among other assignments.

He became firmly entrenched in the computer field during a five-year stint as an IBM systems engineer. Now his interests include all aspects of computer based information systems and techniques for solving business problems.

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How Portable Are Minicomputer Fortran Programs?

by James W. White and G. David Ripley

Standards, like other rules, are meant to be broken—but not casually.

Believe it or not, FORTRAN is still the most popular higher level programming language in science and engineering fields. But it's changed. Years ago, FORTRAN programs were invariably developed using large scale central batch facilities or time-sharing networks. A few popular mainframes accounted for a large percentage of all applications. Today, the situation is indeed quite different. Dozens of general purpose minicomputers are being produced. Variations between the compilers used on them makes developing new FORTRAN applications or transporting existing programs troublesome.

As part of a project to develop a general purpose FORTRAN Syntax Scanner, we recently completed a detailed survey of 24 minicomputer FORTRAN dialects plus IBM 360/370 FORTRAN G. We estimate that the 24 mini dialects may be running at about 66% of all minicomputer installations and on about 50% of all current vendor products.

Initially, over 40 vendors were contacted with a request for copies of their FORTRAN manuals. After careful review of the material submitted, a preliminary matrix of FORTRAN features was prepared. From this matrix, each vendor column was extracted and returned with a request for corrections. All revisions were then incorporated into the matrix to obtain the revised survey results for our 25 basic dialects. (To the vendor personnel who labored to correct and verify our results goes our deep appreciation.)

Some extensions seem strictly for "My Fortran has more features than yours" appeal.

Even the brief survey results included here should prove especially useful to those involved in FORTRAN program conversion from one system to another or for those planning benchmark program development for use in evaluating competing minicomputer systems. (For those who need more detailed information, we can make copies of the full report available.)

How standard are the dialects?

The ANSI 66 FORTRAN standard has proven to be a mixed blessing. On the positive side, a majority (15 out of 25) of the dialects surveyed support full ANSI 66, and 80% (20 out of 25) contain at most one restriction to the standard (see Table 1). Hence in this

IDENTIFICATION		RESTRICTIONS						EXTENSIONS					
Vendor	Compiler	nil	minor	moder.	mixed	major	total	nil	minor	moder.	mixed	major	total
Control Data	CYBER 18/MSOS5	0	6	0	1	0	7	0	5	5	0	1	11
Data General/Rolm	FIV	0	2	0	0	0	2	4	13	6	5	1	29
Digital Computer Controls	D-116 F74	0	0	0	0	0	0	1	10	8	3	1	23
Digital Equipment	OS/8	1	9	0	3	5	18	1	2	2	0	1	6
Digital Equipment	OS/8 FIV	0	1	0	0	0	1	3	4	3	3	1	14
Digital Equipment	PDP-9,15 FIV	0	0	0	1	0	1	1	4	5	3	2	15
Digital Equipment	RSX-11M FIV	0	0	0	0	0	0	4	10	10	5	2	31
Digital Equipment	RSX-11M FIV Plus	0	0	0	0	0	0	3	11	11	8	2	35
Electronic Associates	PACER 1000 FIV	0	1	0	0	0	1	0	5	4	0	1	10
General Automation	SPC-16 FIV	0	0	0	0	0	0	1	13	4	5	2	25
Hewlett-Packard	HP-3000 II FIV	0	0	0	0	0	0	1	14	9	3	2	29
Honeywell	OS/700	0	0	0	0	0	0	1	14	7	3	2	27
IBM	1130/1800	0	7	0	3	3	13	1	3	2	2	1	9
IBM	System 7	0	1	0	3	0	4	0	15	6	4	2	27
Interdata	32-bit FVI	0	0	0	0	0	0	1	4	6	3	2	16
Interdata	16-bit FIV	0	0	0	0	0	0	1	3	4	2	2	12
Interdata	16/32-bit FV	0	0	0	0	0	0	1	6	6	4	2	19
Lockheed	LEC	0	0	0	0	0	0	0	5	3	1	0	9
Lockheed	MAC 16	0	0	0	0	0	0	0	0	1	0	0	1
Modular Computer	Modcomp II FIV	0	1	0	0	0	1	1	10	2	4	2	19
NCR	all levels	0	0	0	0	0	0	0	7	2	3	1	13
Prime Computer	FIV	0	0	0	0	0	0	2	5	6	2	2	17
Varian	V70/620 FIV	0	0	0	0	1	1	0	7	6	3	2	18
Westinghouse	FIV	0	0	0	0	0	0	1	8	3	0	1	13
IBM	360/370 FIVG	0	0	0	0	0	0	1	8	7	4	2	22
Total Occurrences		1	28	0	11	9	49	29	186	128	70	37	450
Types of Differences		1	12	0	4	6	23	8	21	11	18	2	60

Table 1. Number of variations from ANSI standard FORTRAN.

sense the standard is important: as long as programmers code in the ANSI subset, dialect variations are not a portability problem.

On the negative side, most dialects go considerably beyond the standard for a number of reasons and in many ways. Some extensions are for the programmer's convenience, such as typing variables using the IMPLICIT statement. Others are more substantial in that they extend the inherent capability of FORTRAN, such as adding bit and character data types, and allowing operations on these entities. Still other extensions seem to be directed toward specific applications, or toward more directly increasing the customer base by the "My FORTRAN has more features than yours" approach.

All of these reasons for ANSI extensions make sense, even if the resulting extensions make a rather odd lot. The programmer who has been forced to initialize an array element-by-element rather than all in one statement, that is: "DATA A(1)/0.0, A(2)/0.0, . . ." rather than "DATA A/100*0.0 (will certainly recognize the latter as a valuable "convenience" extension.

Unfortunately, many extensions, despite their value, have been done in diverse ways. Table 2 illustrates the great diversity of several of these extensions: differences exist in lengths of identifiers, syntax of octal and hexadecimal constants, and certain I/O commands.

A theoretician for whom "ansi" sounds like nothing more than a synonym for "fidgety," might well question the usefulness of non-standard extensions by noting that any function that can be computed in any FORTRAN dialect can also be computed in ANSI FORTRAN; why all the fuss over extensions and portability? To which the practitioner replies that we fuss over extensions because they can make life a lot easier, and we are concerned with portability even *within* the ANSI dialect because some aspects of a FORTRAN program are inherently machine-dependent.

As illustrated earlier, some extensions greatly ease coding. Others, such as the PARAMETER statement which permits naming of important constants, contribute to code readability and ease of maintenance. Thus programming in ANSI 66 can result in lower productivity. Worse still, some items such as endfile checking and random file I/O are not addressed at all in ANSI.

The new (proposed) ANSI standard simply ignores many problems.

Fortunately, many extensions are *siftable*. That is, the extensions can be automatically converted to ANSI-compatible code by a program (called a sifter). For example, quote-delimited Hollerith constants such as 'SAM' can easily be "sifted" to the ANSI 3HSAM form. Again however, while most features are theoretically siftable, most sifters are too simple to handle them all.

Whether siftable or not, many non-ANSI features can be avoided by simply coding around them. For example, by prohibiting Hollerith constants outside of DATA and FORMAT statements, ANSI merely requires the use of variables predefined in a DATA statement. By suitable choice of names and perhaps a comment or two, the fact that these variables do not really vary can be communicated. As another example, the compaction of data provided by byte arrays can be simulated by using pack/unpack subprograms that operate on full-word objects.

Anyone faced with writing portable FORTRAN code, or, more likely, moving an existing program, usually runs into a nastier class of problems: "inherent" machine dependencies. Included in this class are arithmetic precision, packing of character data, collating sequence, and alignment of different length data in COMMON and EQUIVALENCE statements.

Programming for portability

What can the programmer do to ensure fully portable, machine-independent FORTRAN programs? Probably nothing reasonable in *general*. But in a specific situation, much can be done to ease the task.

First, a programmer should be aware of which features in his dialect are not ANSI-compatible. Some vendors recognize this need and indicate this in their programmer's manual.

He should estimate the value of the extensions he is considering using in a

IDENTIFICATION		NAMING CONVENTIONS			SUBSCRIPTING
Vendor	Compiler	Symbolic name (max length)	Octal constants	Hexadecimal constants	Number of subscripts in arrays
ANSI	66 Standard	6	no	no	3
Control Data	CYBER 18/MSOS5	6	no	no	3
Data General/Rolm	FIV	31	nnnnK	no	128*
Digital Computer Controls	D-116 F74	24 (1st 6 used)	no	no	128*
Digital Equipment	OS/8	5	no	no	2
Digital Equipment	OS/8 FIV	6	Onnnn	no	7
Digital Equipment	PDP-9,15 FIV	6	#nnnn	no	3
Digital Equipment	RSX-11M FIV	6	Onnnn or "nnnn	no	7
Digital Equipment	RSX-11M FIV Plus	6	Onnnn or "nnnn	no	7
Electronic Associates	PACER 1000 FIV	6	yes (unspecified)	Znnnn (in DATA)	3
General Automation	SPC-16 FIV	6	no	X'nnnn' or Z'nnnn' (in DATA)	∞
Hewlett-Packard	HP-3000 II FIV	15	%nnnn	yes (in FORMAT)	255
Honeywell	OS/700	∞ (1st 6 used)	:nnnn	%nnnn	2047
IBM	1130/1800	5	no	no	3
IBM	System 7	6	no	yes (unspecified)	7
Interdata	32-bit FVI	6	no	X'nnnn'	3
Interdata	16-bit FIV	6	no	X'nnnn' (in DATA)	3
Interdata	16/32-bit FV	6	no	X'nnnn'	3
Lockheed	LEC	6	no	Znnnn (in DATA)	∞
Lockheed	MAC 16	6	no	no	3
Modular Computer	Modcomp II FIV	∞ (1st 6 used)	no	mZnnnn (in DATA)	3
NCR	all levels	∞ (1st 6 used)	no	mZnnnn	∞
Prime Computer	FIV	6	:nnnn or mOnnnn	no	7
Varian	V70/620 FIV	6	no	yes (unspecified)	7
Westinghouse	FIV	6	no	$nnnn	3
IBM	360/370 FIVG	6	no	Znnnn	7

Table 2. Sample of FORTRAN features by dialect.

*a lower bound may be specified, such as ARRAY-10:20)

given application. Those features which are neither of much value to the program at hand nor siftable naturally should be avoided.

Essential, nonsiftable extensions in a program should be *isolated and documented.* For example, sift routines can be used to ease data packing and field selection. They can even be written in FORTRAN, though somewhat inefficiently, or at worst in a few lines of assembler code. The point is that by implementing them as functions rather than distributing them throughout the program, these machine-dependent operations can be physically isolated for easier identification and modification when switching between machines.

Unfortunately, most of the "inherent" machine dependencies, such as math precision and collating sequences, have no easy solution in FORTRAN. While most hardware cooperates by detecting arithmetic overflows and underflows that occur when running a program on a different machine, the solution may mean simulating larger-word arithmetic—a burdensome task at best. Also, most machines will not monitor loss of precision, and that loss is often difficult to detect and pinpoint, let alone remedy. Character processing, on the other hand, can often be made machine-independent by transplanting all characters into an internal code prior to manipulation. However, this can be expensive as well as clumsy and inconvenient.

Certain kinds of dependencies, on the other hand, are fairly easily dealt with. I/O unit numbers, for example, are installation dependent. They should be set up as variables whose values are initialized in a conspicuous place at the beginning of the program.

The problem of portability in FORTRAN is a sticky one. A programmer can ease the problem in some ways, and good manuals and compilers can also help. But even then, many aspects of the problem remain.

And the new (and at this time still proposed) ANSI standard addresses some of these aspects, but ignores many others. The detailed survey of 24 minicomputers FORTRAN dialects, ANSI FORTRAN, and IBM FORTRAN G—with subsequent vendor verification—has shown a wide disparity between the various compilers. These variations, especially many of the widely used extensions, clearly indicate the pressing need for the ANSI committee (X3J3) to update its FORTRAN standards to reflect current practice.

Acknowledgements

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Dr. White is an associate professor of Chemical Engineering at the Univ. of Arizona, where he teaches and does research in Fortran-based real-time computing. He was formerly head of Research Computing for Rohm and Haas Co. He also consults in minicomputer-based real-time process control, and teaches industrial short courses in this field.

Dr. Ripley is an assistant professor of Computer Science at the Univ. of Arizona. His interests center around programming languages, implementation of compilers and interpreters, program performance, and other aspects of software engineering.

He came to Arizona from RCA Laboratories, Princeton, where he was a member of the technical staff in the Programming Language Research Group.

I/O HANDLING		SPECIAL STATEMENTS					
END=label and ERR=label READ (5, 10, END=100, ERR=50) x, y	Direct access I/O READ (L'I, 10) x, y where L=unit # and I=record #	ENCODE & DECODE	DEFINE FILE	FIND	READ format #, list	PRINT format #, list	PUNCH format #, list
no	no	no	no	no	no	no	no
no	no	yes	no	no	yes	yes	yes
yes	no	no	no	no	no	no	no
no	no	yes	no	no	yes	yes	yes
no	no	no	no	no	no	no	no
no	yes	no	yes	no	no	no	no
yes	yes	yes	CALL . . .	no	no	no	no
yes	yes	yes	yes	yes	yes	yes	no
yes	yes	yes	yes	yes	yes	yes	no
no	no	no	no	no	no	no	no
no	yes	yes	yes	yes	no	no	no
yes	yes (@, not ')	yes	no	no	no	no	no
yes**	no	no	no	no	no	no	no
no	yes (unformatted)	no	yes	yes	no	no	no
yes	yes	no	yes	yes	no	no	no
yes	***	yes	no	no	no	no	no
yes	***	no	no	no	no	no	no
yes	***	yes	no	no	no	no	no
yes	no	no	no	no	no	no	no
no	no	no	no	no	no	no	no
yes	yes	no	yes	yes	no	no	no
yes	yes	no	yes	no	no	no	no
yes	no	yes	no	no	yes	yes	no
yes	yes	no	yes	yes	no	no	no
no	no	yes	no	no	no	no	no
yes	yes	no	yes	yes	yes	yes	yes

**EOF used in place of END; STS (status)=Array Name also permitted ***REC=integer constant or variable

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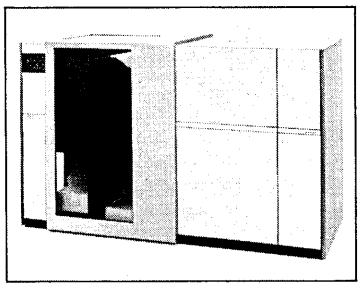

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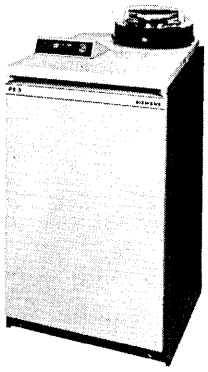

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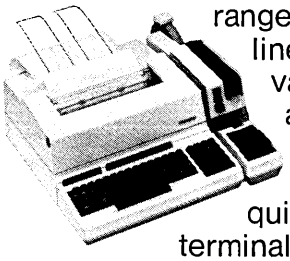

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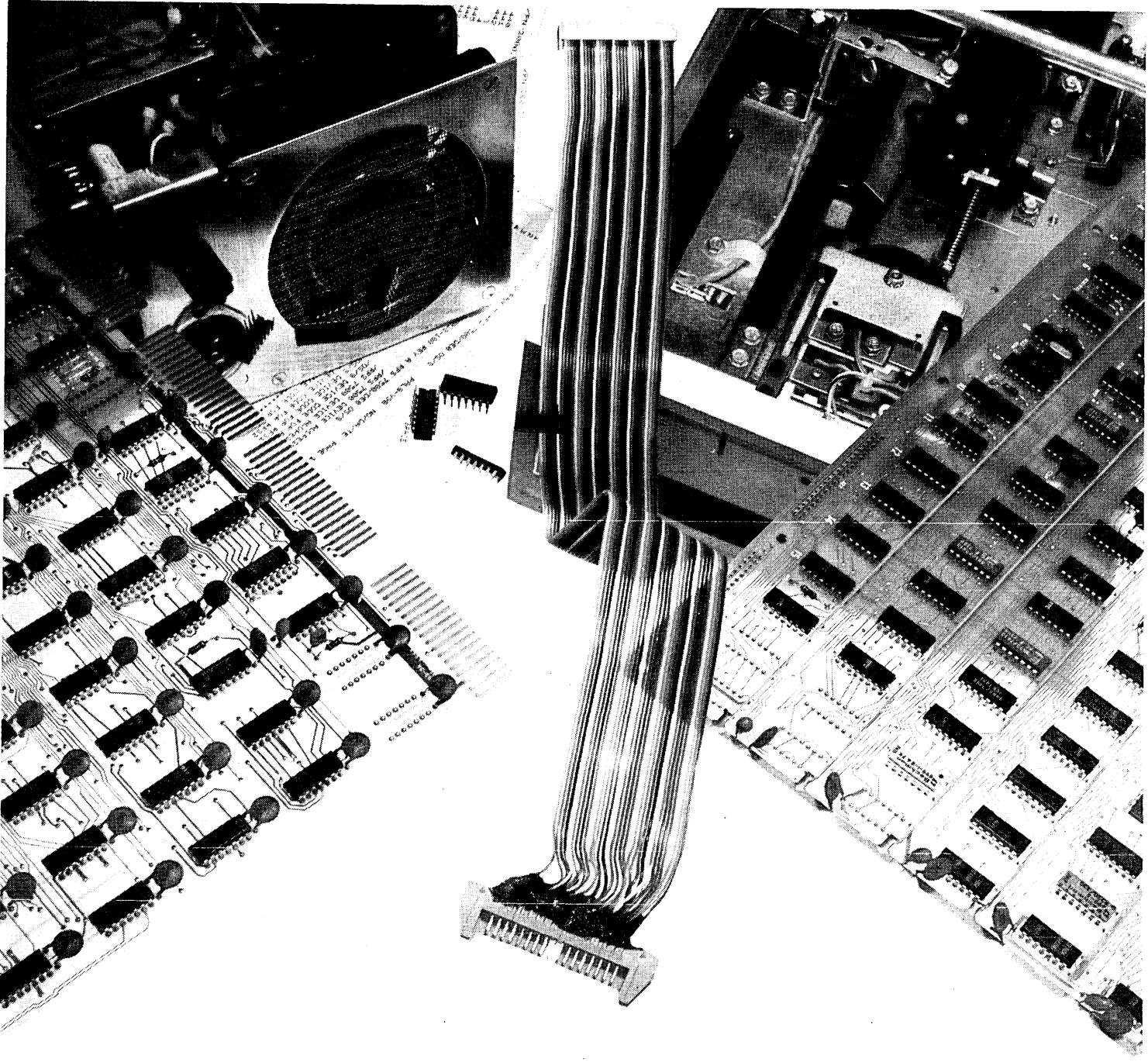

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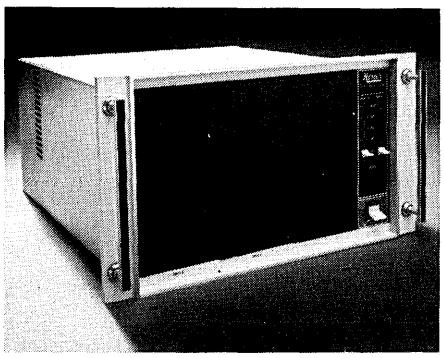

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Structured Testing

by Dorothy A. Walsh

Improved programming techniques may produce more reliable code, but they haven't done much to help in testing. This methodology does.

Testing is, in its own way, the Cinderella of the dp methodologies. Think for a moment about all of the recently proposed techniques for improving the quality of software: modular design, chief programmer teams, structured programming. None of these is correlated with a disciplined approach to verifying that the results expected are being achieved.

There has been no systematic attempt to develop complementary verification techniques geared to determining software reliability as software develops. Even structured walkthroughs do not fit the definition of a systematic testing methodology.

Too often, integration testing is a kind of super-expensive debugging.

Testing continues to be "a witch hunt." Yet it need not be. Structured design and programming techniques give an unprecedented visibility of software systems, that very visibility so often lamented as lacking when system testing takes place. What is needed is an approach that integrates testing into development, exploiting the improved visibility of *what* must be tested so that specific tests can be applied at pertinent stages of software evolution.

Structured testing is just such an approach. And more. It is a methodology devised to fill the gap between software preparation and verification disciplines while recording performance and reliability as the software evolves.

Structured testing, like other methodologies aimed at improving software reliability, grew out of experience in development and testing. It, too, prescribes procedures that may be looked upon as "what experienced programmers have been doing all along." However, also as structured design and structured programming, it formalizes the intuitive good practices that are its foundation and provides procedures for using them that may be carried out even by inexperienced programmers.

The steps ordinarily carried out in software testing are:

- identification of what must be tested
- design of test cases to include all test requirements that have been identified
- execution of test cases
- verification of results obtained

Each of the above steps should be—but usually is not—thoroughly documented.

Structured testing is, in essence, a systematic and disciplined approach to carrying out the normal testing tasks in a manner that maximizes the effectiveness of time spent and minimizes the effort required for satisfactory test coverage. As will be seen, an integral part of the methodology is the documentation which results from following the procedures it prescribes.

Path analysis

As an aid to ensuring that every condition, value, function, operation, etc. that must be tested in a given system is identified and included in at least one of the test cases used, structured testing employs a form of path analysis—but not path analysis of the structured walkthrough type. The latter is usually applied to complete programs, and has a single orientation (that of following a selected program path),

The end result was a better tested and demonstrably more reliable end product.

and can lead to finding oneself in an unexpected labyrinth. Structured testing provides analysis techniques that aid in detecting labyrinths before venturing in, and in correcting the causes rather than testing the effects.

Path analysis in structured testing is applied from the most elementary level of partial paths that can be defined. Gradually, such partial paths are linked to form complete, operative system paths.

To see how this works, consider any module of a programming system. At an extremely primitive level, for example, consider a card reading sequence in a simple COBOL program. The sequence ordinarily has at least two purposes: to bring in an input record, and to provide for an end-of-cards action which might be as simple as setting a

condition value.

Each of these could be considered a partial path. Taken together they form a more complete path. Integrated with the several routines that process the card information, they define ever more complete paths until, finally, a path is set up that exercises an entire program capability in the presence of some standard input.

Analyzing each partial path separately limits the amount of information that must go into any single analysis to a manageable volume. Once each partial path has been analyzed, the next step is to test it independently of any other partial path, if possible. In our present primitive example, desk checking would suffice. In more complex cases in which partial paths were programmed by means of larger functional sequences, automated tests of each partial path would be more desirable.

Once a partial path has been seen to be correct within the definition of what activates it—for example, that the end-of-cards signal gives rise to processing that is properly performed and consistent with specifications—the next step is to test passage from one partial path to another, "integration" testing.

This integration, viewed either as a part of unit development or as a separate activity of subsystem testing, is a further form of path analysis. The critical aspect of analysis at integration time is, however, the passage from one partial path to another: how it occurs, when, why, and what the overall result of traversing that path may be.

At system test time, the paths tested are typical complete program paths exercising some of the functions of the system. For example, a given input case is tested through its normal processing and preparation of related output.

When testing is carried out using this structured methodology, system testing can be oriented toward verifying that the software does what the user expects it to do. Unit test will have ensured that the behavior of individual units is satisfactory; integration testing will have ensured that interactions among system modules are smooth, compatible, and economical. The system test, therefore, can be directed toward ensuring the acceptable behavior of the software in its expected operating environment. All three orientations are necessary.

Who does it?

Structured testing has been designed to be integrated into the traditional software development cycle and applied at all levels of testing within that cycle. Introducing the use of these techniques does not imply revolutionizing the test activity, however. Test staff normally responsible for the several levels of testing carried out during software preparation simply perform their usual tasks using structured testing procedures.

This means that the originating programmers carry out the unit testing of their modules. Then at integration time the usual integration group carries on its test task using structured testing and the test documentation developed at unit test time. Finally, system test too continues to be the responsibility of staff normally assigned this task: either testing personnel in the development group, or outside consulting/testing personnel. In all cases, it is the methodology that is the key to effective testing.

In those cases in which all testing, from unit test through system test, is done by specialized test personnel, it is recommended that the basic analysis of what to test be done by originating programmers and passed on to test staff for use in designing tests. Even when unit test is carried out by specialized test staff, the development programmer is responsible for a certain amount of debugging. (Such debugging should be disciplined and system-

atic and, therefore, should also be done using structured test techniques.)

At the unit test level, the feasibility, in terms of time, cost, and visibility of the necessary information, of thorough testing is far greater than at any other time in software development. For this reason, the development programmer must carry out the basic test requirements analysis and test design, even when he is not responsible for complete unit test as such.

1. Defining test units

While there are several approaches to the problem of structuring programs, there is only one set of criteria for creating structures for testing. This set of criteria is designed to identify feasible test units. A feasible test unit differs in complexity from unit test to product test time, as does the software product itself. The criteria for defining such units remains the same however.

A feasible unit for checking or testing must:

- perform an independent, contained operation or function
- produce a verifiable result
- respond to controllable input data, conditions, etc.

As an illustration of what such units might be, consider a hypothetical billing system designed to prepare end of month and/or end of year statements for the customers of a large department store. For purposes of the example, let the payment options be three: monthly settlement of account, installment payments, or, maintenance of a balance in the account with interest being paid for all funds above a certain minimum. Further, let the system be made up of the following modules:

- IR—an input module which identifies payment type
- MS—a module to set up statements for end of month settlement
- IB—a module to set up statements for installment purchases
- CC—a module to set up statements for checking account customers
- PS—a module to print statements
- EX—a module to set up exception messages for irregularities found by the other modules

Each such module would normally perform a number of elementary related subfunctions. Take the CC module in our example. A module to set up statements for checking account customers would, depending on the conditions of the billing system, perform a number of subfunctions like:

- checking the customer's account to determine whether any transactions took place in the billing period, that is, to determine whether a statement is to be issued;
- setting up individual transaction statements or descriptions, and developing a total amount;
- checking balance left in the customer's account after payment has been made in order to determine whether a minimum balance is being maintained.

Each of these logically independent subfunctions defines a test unit at the level of module or unit testing. Where possible, these test units should be developed and tested one at a time.

At the level of integration testing, a test unit might consist of a combination of two related modules of the parent system which interact to carry out a standard subfunction of that system. In the present example, an integration level test unit might be made up of the IR module which identifies payment type and the MS module which sets up statements for end of month settlement.

Testing of functional sub-units at integration testing time can result in savings over the approach of running almost full system tests. Functional sub-units are defined by pairs, or groups, of modules that interact to perform a recognizable subfunction of the overall system.

Finally, at system test time, a test unit might consist of the IR module, for example, along with the MS, PS, and

EX modules to test behavior of the system when an error in a monthly transaction statement occurs. What defines the unit and the test requirement is precisely that system capability by which such errors are foreseen and handled. Recognition, detection, and treatment of such an error is a standard path in the finished system and thus constitutes a unit at system test time.

2. Analysis tables

Once a feasible test unit has been identified, its test requirements are analyzed and documented as basic information for subsequent test design. Analysis of test requirements must be seen in the light of a path analysis approach. The analysis becomes, therefore, an investigation of why each path is taken, where it leads, and what happens along the way. All of this information is useful for the correlation of paths, for demonstrating that nothing has been overlooked, and, finally, for determining whether a given path is the most satisfactory way to get from one process or function to another.

Documenting this information is a must. (We are always rediscovering the theoretic value of documentation in software development; practice falls far behind.) In order to avoid an *n*th case of prescribing documentation that doesn't get done, documentation is reduced to essentials and made a *sine qua non* of using the methodology of structured testing. Reducing documentation, incidentally, makes the result easier to use as well as easier to write. In the interests of simplicity and conciseness, tabular formats are used for documentation at all stages of structured testing.

To illustrate how an analysis table might look at unit test time, consider module CC of our billing system, the module that is used to set up statements for checking customer accounts. We have said that the important information is path description: input to the path, or conditions under which it is taken; functions and operations, or what happens along the way; and where it leads, or output. This information gives us the headings of the columns in Table 1, p. 116. Then to make reference and retrieval of information efficient, all test units at all levels must be given unique identifiers. These might be letters, numbers, actual names of pro esses, and the like. Table 1 shows how the analysis table might look in part for module CC of our billing example.

At unit test time, analysis information is best obtained gradually, a unit at a time, from the clean listing of each individual unit or set of units. That is, where possible, programs should be developed a unit at a time, written, compiled, and the compiler listing used to fill in the analysis table before the next unit is written. The reason for doing this is to impose a continuing awareness of interfaces within the program, of data formats, and the like. This preparation may be "top-down" where desirable but need not be. A critical unit such as some complex computation may be written and analyzed first, then other units may be built out from it.

Where it is feasible to perform unit test using special tools which simulate a live environment for test units, live testing should be done. Note that this testing is not to be confused with testing in which several units are simulated to the point of performing one complete, consistent processing pass through the entire parent program. That kind of testing is always hypothetical in the sense that the simulated components are not the real ones, and, therefore, act according to a limited set of definite rules of behavior. Instead, actual units as they are written and function, not as they are designed to operate, should be combined in a step

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by step testing/development process.

Units should be analyzed one at a time, even when there is no possibility of performing live testing immediately. Correlation of analyses of individual units should proceed much as integration testing of the units. This provides a desk check of each unit and its interfaces before a live operating context is set up. The effort is no greater than that needed to create support units for testing, and coverage of test requirements and unit behavior is more extensive.

At integration test time analysis information is obtained from unit test documentation. At product test time, user information serves for analysis.

3. Decision tables

Once a set of feasible units has been analyzed, the design of more complete tests begins. The combination step, which uses the analysis information prepared in the previous step as basic material, may be performed by staff other than that which prepared the software in question. But the basic analysis step must be carried out and documented by personnel who have the most complete knowledge of the software as it was written: the original programmers.

The inputs to the combinations step are the analysis tables. The method of identifying combinations of test units is an analytic/synthetic process that uses the techniques and format of decision tables. Decision table-like techniques are used because of the disciplinary and documentary advantages such tables offer. This third step is aimed at analyzing the relationships among the more elementary units in order to identify the minimum possible number of individual, distinct combinations that must be tested. As a result, the process also serves to identify the maximum (in theory anyway) effort needed to test the software under analysis.

The way in which decision table format is used is the following. The "conditions" stub is used to list the functions, input, etc., that must be tested, as they appear in the analysis tables. The "actions" stub is used to list the test units which make up the module or system under analysis. The "conditions entry" portion is used to identify valid combinations of functions, etc. The "actions" entry is used to show which test units interact in carrying out a given valid combination.

Combinations are identified using

Test Unit ID	Input	Functions/Operations	Output
CC1	Customer Activity Code	Check For Transactions Present; For Transac. Call CC4; For None . .	
.			
CC4	Customer Transac. Records	Prepare Total For Statement	Trans. Total
.			
CC7	Customer Balance; Trans. Total	Check For Zero Bal. . For Zero, Check Trans. Total, For Non-Zero	Irreg. Code 20
.			
CC12	Customer Final Balance	Check For Greater Than Minimum; For Yes Call CC20; For No . . .	. . . .
.			
CC20	. .	. . . .	. . .

Table. 1. Structured testing is based on path analysis. It begins with the analysis of partial paths, the smallest elements of a program which can be seen to perform a detectable function. This particular analysis table is for the checking account billing module example mentioned in the text.

Functions/Input/Conditions	Combinations 1	2	3	4	5	6	7	8	9	.	.	.	.	n
Transactions	Y	Y	N											
.														
Balance Negative	Y	N	—											
Balance Greater Than Minimum	—	N	Y											
.														
.														
Total Bills—CC4	X	X												
Get New Balance—CC6	X													
.														
.														
.														
Compute Interest—CC15			X											
.														
.														
Print Irreg. Code—CC20	X													

Table 2. A decision table format is used for determining the valid combinations of partial paths which must be tested.

the standard, systematic approach that serves in drawing up decision tables. The usual notation: *Y*, for the presence of a condition, *N* for its absence, and the dash for not applicable is employed.

The discipline imposed in analyzing all possible combinations serves to identify invalid program paths that may have crept in due to programming techniques used, incomplete specifications, and the like.

The analysis also serves to avoid the creation of redundant tests because the information about when a given function is tested emerges in a graphic form which makes it easier to identify duplications. Further, the need to classify and synthesize information before entering it into the table imposes the use of operative limits to express conditions and values. Such expression serves to ensure that representative cases are tested, and not simply a number of repetitions of a logically single case.

To see how this works in practice, consider the analysis of the checking account billing module, CC, that served in Table 1. The combinations analysis table for the module might appear in part as shown in Table 2. As can be seen from an examination of the combinations represented in Table 2, no test is made of the "transactions present, balance positive, and greater than minimum" case. There is no need for a separate test for this case. We have "yes" and "no" conditions for all of the variables shown, and at least one test of each of the test units.

A complex program may require more than one combinations table to determine valid program paths. In such cases, tables are divided logically at some clean processing breakpoint: prior to printing, etc. At integration testing time and product test time a number of tables is required to complete combinations analysis. An example of how integration test combinations might appear is shown in Table 3.

At integration testing time, conditions are expressed in terms of their interface representation. What is being tested is precisely interface compatibility. This gives rise to several levels of tables. Another combinations level would be needed to show the relationship between the finding of an error in one of the processing modules and the call to EX, for example. These analyses should proceed in parallel with programming, and be corrected and checked using the unit test documentation. Then integration tests should be run as soon as the interacting modules are ready.

Subsystem testing, that is, the test of interactions among three modules or so, should be carried out thoroughly before subsequent modules are added to create a full system. In this sense, integration testing is best done in a top down manner, where feasible, to permit the economical use of time spent in running increasingly complex systems. It should also be remembered that thorough testing at unit test time should reduce the time needed to carry out integration testing and permit true integration-oriented test efforts. Too often, integration testing is a kind of super expensive debugging of units.

Interface/Functions/Input Conditions/Etc.	Combinations 1	2	3	4	5	6	7	8	9	10	.	.	.	.	n
Type Code 1	Y	N	N	N											
Type Code 2	—	Y	N	N											
Type Code 3	—	—	Y	N											
.															
.															
.															
.															
.															
.															
Get CC	X														
Get MS		X													
Get IB			X												
Get EX				X											
Get PR															
.															
.															
.															
.															

Table 3. Once the combinations of partial paths have been tested to prove the operation of individual units, another combinations analysis is performed to test interfaces between units.

4. Then the test plan

Creating all possible valid combination of sequences, or paths, in the software under test is not the end of test design. Individual combinations sometimes require corresponding distinct test cases. This latter situation may occur, for example, in developing unit test combinations for full module testing of a relatively simple program for which all combinations can be represented in a single table. However, it is the exception rather than the rule.

Nonetheless, a final step is needed, even when the rare instance of number of combinations being equal to number of tests occurs. This final step is the preparation of a detailed test plan, showing individual test cases and what they test, with reference to the combinations previously identified. Normally, a distinct test case will be made up of a number of different test combinations. Following the progressive character of structured testing as a methodology, test design builds upon what has gone before. Test design relates combinations tested on one hand, to distinct test cases that must be run, on the other, to give thorough coverage.

As has been said, this relationship should be shown explicitly even for those cases in which combinations are not further combinable to form test runs. The reason for this latter requirement, in addition to the documentation of the test effort that is provided, is that the preparation of a test plan aids in optimizing test effort.

A number of combinations will invariably be "failures," combinations that are *intended* to give rise to the detection and indication of some error. Such combinations can generally be tested using related test cases which are designed to go on to perform the functioning that was erroneously specified in the "failure" case. Thus, a certain number of test cases may normally be made to serve as "successes" and "failures" by the change of a parameter, input value, etc. These cases are easily identifiable in the test plan document.

Combinations of combinations can also be analyzed from the test plan to ensure that all test requirements identified in the analysis steps have been covered in test design, and without repetition. In addition to the information about what is tested, it is recommended that the test plan show briefly what was expected, and allow for indicating what took place.

Table 4 illustrates the test plan format and how it might look in part for the billing system that has served in prior examples.

Structured test documentation can serve to optimize testing at all levels. The methodology is designed to provide a systematic means of identifying total test requirements at each level and of planning efforts to economically achieve complete coverage. The proponents of the methodology, having been around a while in dp,don't expect that there will always be sufficient time to permit thorough testing. For this reason, the nested or progressive character of testing is emphasized to point up how integration testing can concentrate on what is seen to be missing at unit test time, and product test can make up for cases overlooked at integration testing time. This approach is suggested as a means of reducing risk in cases in which time is short. It is not advised as common practice.

5. And the test cases

Once the test plan has been completed and any desired priorities assigned, test cases must be created according to the standard procedures and specifications used in any given installation. A test plan, as Table 4 shows, provides basic specifications for distinct test cases that must be run to ensure total testing. Each combination shown in the test plan is correlated, through analysis tables, with some particular configuration of input, conditions, etc. that cause it to be activated.

A given test, then, must treat the input or conditions required to force the combinations that compose it to operate. Test descriptions or specifications must, therefore, describe the particular set of input records, values, etc. that will be needed for each test, and the expected results.

Where support software permits, the specifications for test cases should include the use of control traces to show passage of control from one test unit to another as a final check of the coverage of all possible paths in the testing effort.

Is it expensive?

Emphasis on total definition of test requirements and on exhaustive testing may give a false impression of the costs of structured testing. High costs are avoided by the exploitation of ordinary software development tasks and the information they generate to serve in test definition and design.

Testing is integrated into the development activity and the results of one test level are used to aid in designing tests at the next. More significantly, thorough unit test provides a level of confidence in the behavior of program modules that permits integration to be carried out as a true interface compatibility check, not as a second phase of debugging.

The result is that integration testing can be carried out in a shorter time. The analysis of interfaces as shown on unit test documentation permits detection of incompatibilities during interface test design, prior to running possibly costly tests.

The same effect of reducing effort is felt at product test time when structured testing is used. The all too frequent case in which costly full system tests are mounted only to serve as vehicles for debugging units or checking interfaces is avoided. Product test builds on the foundation of thoroughly checked unit behavior and interface compatibility. It thus serves its proper function: checking system performance in applications contexts.

The possibilities for overlapping integration testing with unit test and the reduction in time for integration and product test more than compensate for any increase in the programming/unit test phase that may arise from introducing structured testing. An increase in time spent on programming and unit test using structured testing should not be regarded as a foregone conclusion, except in those cases in which the comparison is between that and virtually no unit test at all. Also, the optimization step in structured testing aids in eliminating redundant tests at all levels and the nested or progressive character of development of full coverage serve to reduce overall test costs.

A final cost factor in software development is maintenance. One of the contributing factors to high maintenance costs is lack of documentation of system structure, behavior, and test requirements. Test plans for all three test stages prepared according to structured testing formats provide invaluable aids for maintenance personnel and can be expected to permit them to perform their tasks successfully in less time than is customarily required.

The present formulation of structured unit testing, a result of a maturation process in applications of software development, served as part of a total test effort for typical dp applications. Experience with its use showed that documentation and test design imposed by the method were absorbed into reasonable testing time frames. However, the end result of the testing effort, especially at unit test time, was found to be a better tested and demonstrably more reliable end product than had been the norm. ❋

Test ID	Combinations Tested	Expected Results	Outcome	Comments
Used to give a unique identifier.	Used to list the combinations that enter into a given test.	Used for a brief description of expected results.	Filled in after testing to indicate success, failure, partial success, etc.	May be used to relate "failure" tests to corresponding successful ones, to assign priorities, to note reruns, etc.
Example:				
1	ES/4, CC/3, EX2	Type Code Error		Same as Test 6, with Code Change

Table 4. The final test plan is not developed until late in the software production sequence, and at that time it falls out of other documents constructed along the way.

Ms. Walsh has been a dp consultant since 1955, when she became a charter member of Computer Usage Corp. In 1965 she joined Advanced Computer Techniques, an international dp consulting firm, and took over responsibility for teams working in France and Italy. Leaving that firm in 1973, she became an independent, and now works out of Rome. Her fields of expertise span compiler design, computer center management, personnel selection, software quality control, and documentation design.

She has authored a book on programming ("Programming the IBM 360," Wiley, 1965), another on documentation ("A Guide to Software Documentation," McGraw-Hill, 1969), and has taught graduate courses at the Bernard Baruch School of Business Administration in New York City.

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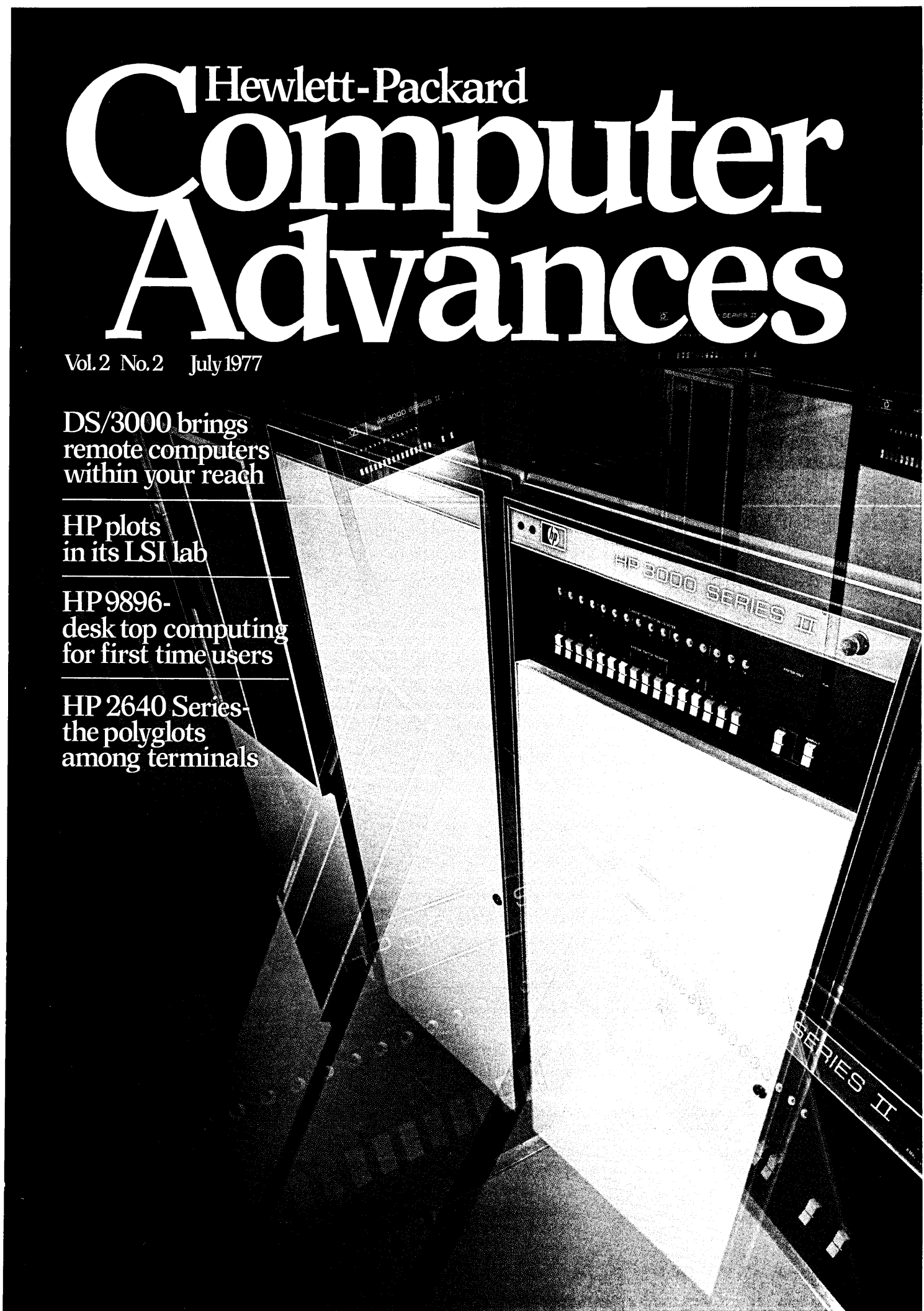
HP 2640 Series- the polyglots among terminals



What can one HP 3000 say to another?

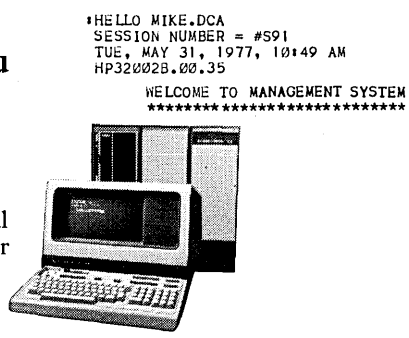
Plenty!

With Distributed System/3000 (DS/3000), it is now possible for one Hewlett-Packard 3000 Series II to communicate with others. A group of HP 3000 systems can now pool and share their resources and data. Plus, a user on one system has access to the capabilities of all ... no matter where the computers are located. In DS/3000, a remote HP 3000 can be just across the room from your local HP 3000, or as far away as standard data communications facilities can reach — across town; across country; across the world. And all this with no significant increase in complexity for the user.

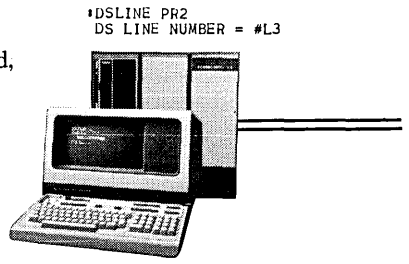
Using a DS/3000 network is straightforward and simple. Programming in a DS/3000 environment is just like programming a local HP 3000. Interactive users and applications programmers do not need to learn new communications commands or do special function programming. To access a remote HP 3000, the interactive user need only add the word "REMOTE" to each command to indicate the system he or she wishes to use. DS/3000 is integrated into MPE II — the HP 3000's innovative Multi-Programming Executive operating system that provides for multiple interactive and concurrent batch operations. With this approach, the same powerful MPE II facilities used for local sessions are also available on a remote HP 3000.

If you can type the word "REMOTE," you can use DS/3000

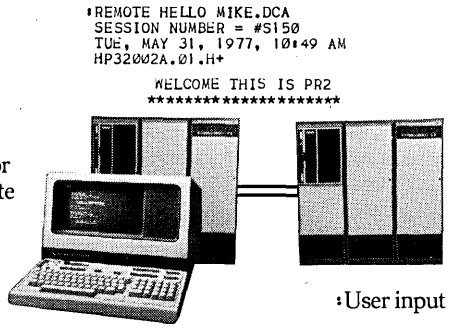
Start a local session
To gain "virtual terminal" access to remote systems, log-on to your local system in the normal manner. Enter the HELLO command.



Open a communications line
Use the operating system command, DSLINE, to establish a link with one or more remote HP 3000 systems (either hard-wired coaxial, or public telephone with modems).



Go remote
By using the same HELLO command as before, but by adding the word REMOTE, you start your interactive session on a remote HP 3000. Now, all the powerful MPE II commands are available for you on both the local and the remote HP 3000 Series II. Your terminal conveniently serves as "virtual terminal" for both.



MPE II also brings an accounting structure and file security that provide protection against unauthorized use of local or remote HP 3000 systems and their data files.

DS/3000 networks strategically disperse computing power wherever day-to-day work is being done. They implement in hardware and software the organizational communication lines that already exist among the people of a company. The result is computer processing and data communication mapped onto existing company structures, with a lot of timely and accurate information flowing back and forth.

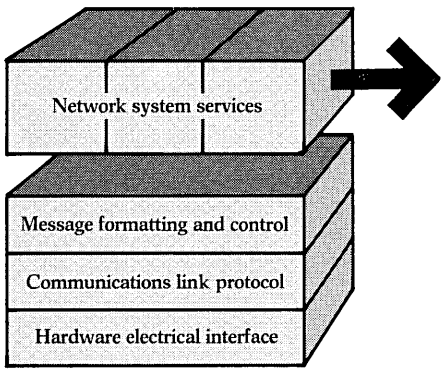
DS/3000 software costs $9,000* for each HP 3000 in the network. System prices start at $110,000.* **For further information check A on reply card.**

Layered implementation

Computer users want high level network capabilities that do not require specially trained professionals in data communications. A logical way to accomplish this is to integrate data communications into the operating system and provide transparent access to remote processing and remote facilities. Complex requirements of the data communications environment, such as modem and line control, error checking, and recovery, should be handled by vendor hardware and software and should be invisible to network users.

This principle guided the architectural design of DS/3000. DS/3000 software is organized into structural layers so as to separate matters of routine from matters of user concern. HP software and hardware automatically handles the first three layers.

Accommodate new technology
Technology in communications is rapidly changing. HP is committed to bringing these advances to customers. A layered approach facilitates this. Each layer to a large extent functions independently. HP can make network enhancements to DS/3000, for example, a new line protocol, by providing a new software/hardware update to one layer. This change does not affect either the structure or the usage of DS/3000. HP can move with industry technology. The customer simply purchases a software upgrade or new hardware interface. Applications and programs need not be changed. With DS/3000, users have today's and tomorrow's communications.

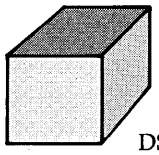


The layers
The first layer, the electrical interface to external modems, meets EIA RS-232C and CCITT standards. Systems can be linked over common carrier facilities at speeds up to 9600 bits per second or over hardwired lines (coaxial cables) at line speeds up to 2.5 million bits per second.

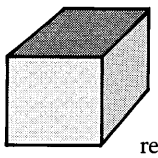
The next layer is concerned with link protocol in a point-to-point configuration. It concurrently multileaves data bi-directionally over half or full duplex common carrier facilities using IBM-compatible Binary Synchronous Communications (BSC) protocol.

The third layer automatically handles conventions of message formatting and manages the flow of messages between systems. Here HP designed its own standard format.

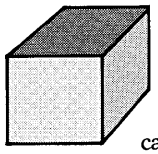
The top layer is the most exciting, for it represents the set of full, high-level system services available to the user on DS/3000.



Interact Locally and Remotely
The remote command processing capabilities of DS/3000 make it easy for interactive users of a local HP 3000 to utilize that same set of capabilities on a remote HP 3000. The local terminal becomes a "virtual terminal"; with it the user has full use of a remote system as if it were local. That includes all MPE II commands, language and utility subsystems, and remote user applications programs.



Share A Resource
MPE II treats all devices as files. With DS/3000, you have full remote file access to all devices and data files on another HP 3000 (after validating your authorization, of course). Smaller HP 3000 sites in a network can share the processing power of a larger HP 3000 using its software subsystems or a variety of peripheral devices. Simply expand the MPE II FILE command to identify the remote system. No application reprogramming is required.



Communicate Program to Program
With DS/3000 separate applications programs running in separate systems can directly and efficiently exchange data and control information with one another, thanks to a set of nine new easy-to-use program callable procedures. Program to program communications facilities also allow one user program to initiate or terminate programs on remote systems.

*U.S. domestic prices only

It's 2pm Thursday in San Francisco, 5pm Thursday in New York, and 8am Friday in Tokyo

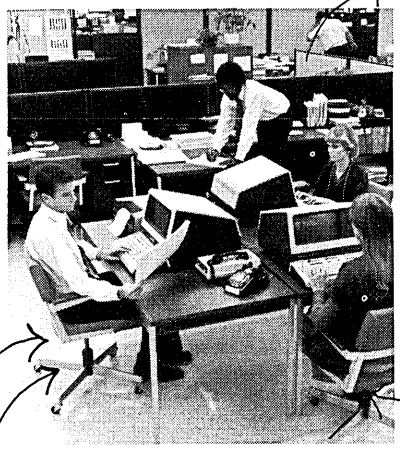
Glimpses of an HP distributed system

HP 3000
Sales Office
Tokyo

On a daily basis, the field transmits customer **orders** to the San Francisco factory and New York warehouse. In return, latest factory order **status information** is updated to sales office's files so customer credit checks and factory **acknowledgments** can be made on-line.

HP 3000
Service/Parts Warehouse
New York

The warehouse validates Tokyo's **orders** against on-hand quantities and generates shipment documents while updating inventory status.



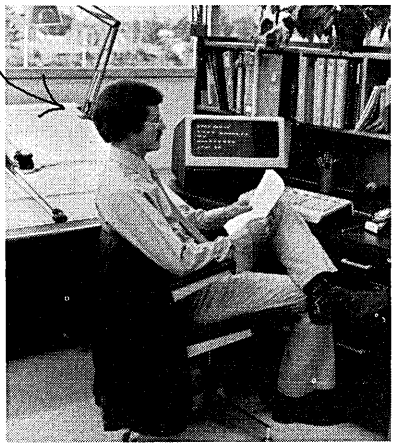
HP 3000
Financial Control
San Francisco

The latest **master production schedule** is used to generate the company's next period's financial plan.

Product costing results are reviewed to evaluate latest **engineering data control** changes.

HP 3000
Order Administration
San Francisco

The factory allocates **master production schedules** to customer **orders** and transmits updated **information** to sales offices. For example, Tokyo's customer ship dates are **acknowledged**. While monitoring order statistics, the **master production schedule** is prepared using forecasting information and current backlog data.



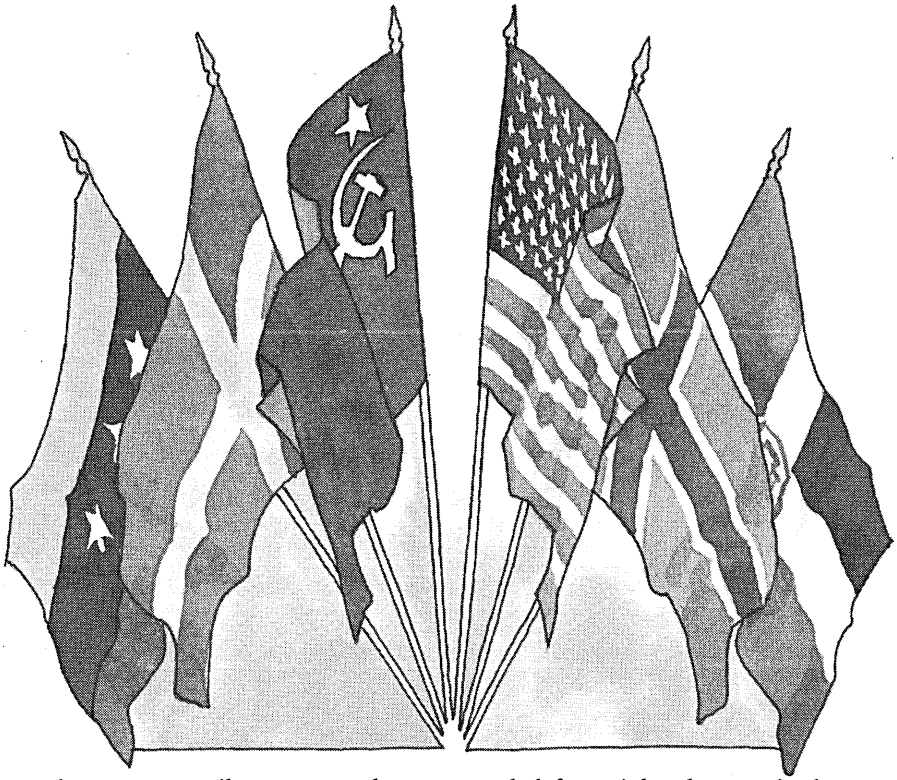
HP 3000
Engineering/Manufacturing
San Francisco

Prior to exploding the master production schedule, the engineering staff makes changes on the **engineering data control** system.

HP terminals overcome the language barrier

Being an international company involves more than maintaining overseas operations. It means being sensitive to language, cultural, and social differences.

The sophisticated HP 2640 series terminals respond to one of those differences—language.



Functional modularity
To simplify implementing new languages, HP localized all the language capabilities on just two character set modules. These modules provide all the capability to use concurrently a combination of four sets —128 characters each. Characters from bilingual sets can even be displayed adjacent to each other.

Hardware modularity
A single bus is common to all logic modules. Therefore, any module, including those that control the character sets, can plug into any slot in the bus. Any combination of enhancements (more display memory, cartridge tape units, printer capability, or data communications) can be added by simply plugging in the appropriate logic module. For easy repair, just open the terminal, pop out the board, and pop in a new one.

Microprocessor control
All 2640 operations, for example, memory allocation and data communications, are microprocessor-controlled.

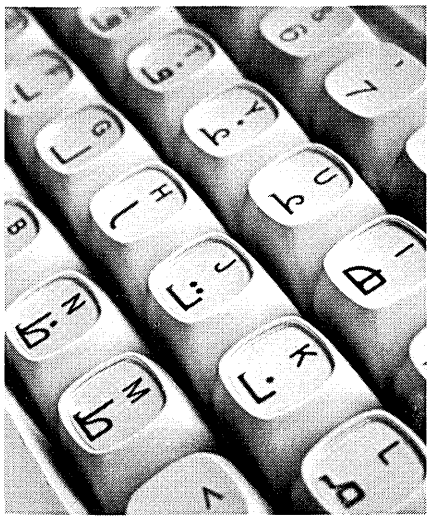
This microprocessor also controls the keyboard. Key functions are independent of their respective position on the keyboard. With this approach, engineers can easily accommodate not only the unique character sets of different languages, but also preferred keyboard layouts.

New Arabic terminal
A new terminal, the 2645R, displays both Arabic and Roman characters. Special design considerations were encountered in implementing the Arabic language. First, the characters had to be aesthetically pleasing, readable,

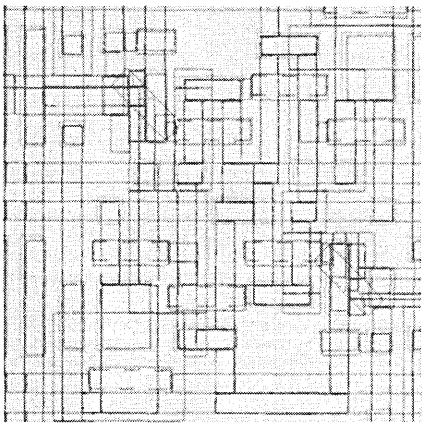
and correctly drawn to capture the script-like Arabic style. A character set allowing for horizontally continuous characters was designed.

Also, since Arabic reads right-to-left, while the Roman language reads left-to-right, the terminal required a special selector switch to provide both capabilities.

For more details on the 2640 series international terminals, check B on your reply card.



Small and powerful



A life-size section of an intricate, computer drawn plot used in the design process of Hewlett-Packard's new CMOS/SOS single chip 16-bit Micro-CPU.

The XYZs of plotters

We needed a plotting system for our Large-Scale Integration design facilities in Cupertino, California. Our choice: Gerber Scientific Instruments' Superplotter, driven by their choice, an HP 21MX computer.

This computer-controlled plotter draws the line on expensive hand artwork. It offers design engineers the benefits of computerized plotting: flexibility, accuracy, economy, easy interface, and quick turnaround. The heart of the Superplotter, the HP 21MX coordinates and optimizes the plotter's performance to achieve dramatic 0.004 inch accuracy, 42 inch-per-second speed, and 2.8G acceleration.

Automatic drafting machine throughput for most drawings is primarily a result of such high acceleration and speed.

Actual size of HP's Micro-CPU Chip. To ensure exactness of detail, one-ninth of this surface is plotted on a 2½ foot square.

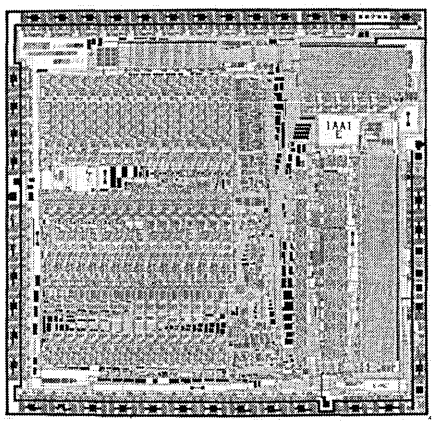
Precision in miniature

In sophisticated integrated chip design, precise measurement and fast throughput are critical for producing mask level artwork.

In our LSI lab, a technician uses a computerized digitizer to produce artwork for the masks of a new chip. Masks are glass plates, each containing the details of one of the chip's eight thin layers.

The technician then loads data corresponding to that particular drawing into the plotter system. Each line is plotted in one of four colors, depending on the material shown.

The finished plot is compared to the hand drawing to verify accuracy; then it's on to manufacturing.



An enlarged photograph of the MC² Chip.

Hewlett-Packard's MC² chip

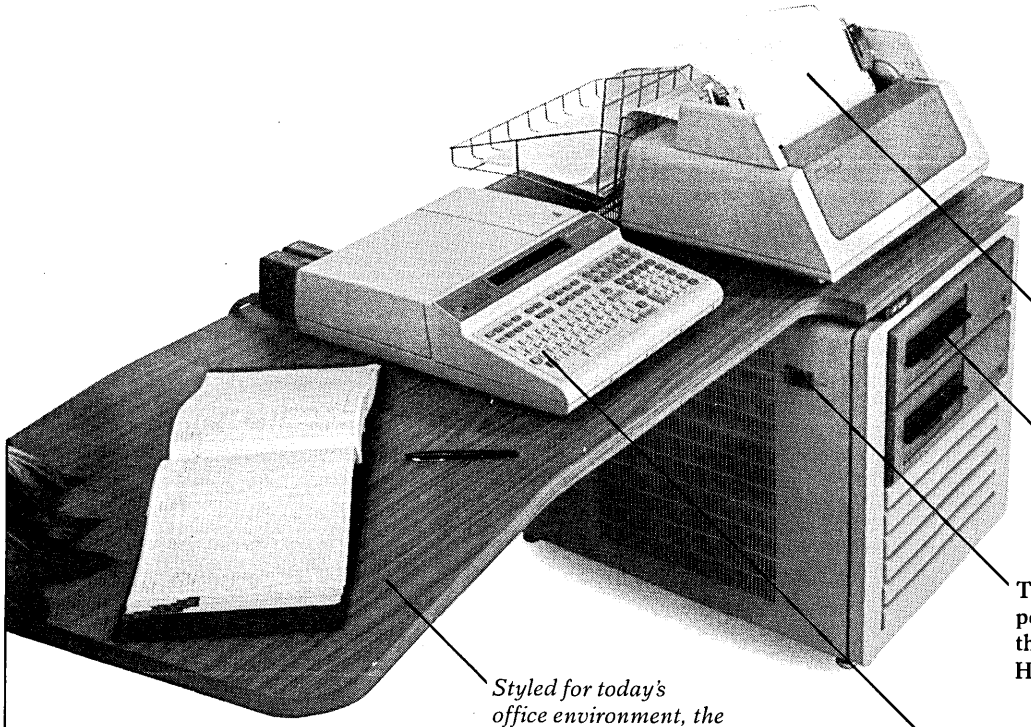
HP's Micro CPU Chip (MC²) is based on silicon-on-sapphire technology with complementary metal-oxide-semiconductor processing (CMOS/SOS).

With SOS technology, new designs are possible, with far more favorable trade-offs between high speed and low power consumption.

SOS provides superior dielectric isolation, thus circuit elements can be very closely spaced. In only a 34mm² area, MC² is a complete 16-bit parallel microprocessor that contains 10,000 transistors.

The MC² executes 34 classes of 16-bit instructions and is capable of performing a full register-to-register addition in 875 nanoseconds. Power consumption is typically 350 milliwatts.

Check C on the reply card for more information on CMOS/SOS.



Print typewriter quality reports on standard or custom-designed forms.

Store data on convenient and inexpensive flexible disc memories.

The flip of a single power switch activates the completely integrated HP 9896 desk top computer.

Styled for today's office environment, the HP 9896 has ample work surfaces.

Enter a BASIC program on the keyboard of the high-performance desk-top computer.

The HP 9896 computational system

With the HP 9896, small businesses and first-time computer users have general computational power right at hand, and in their control. Easy to program in BASIC, the HP 9896 has extensive editing capabilities, and programs can be custom tailored to commercial uses: finance, manufacturing, distribution, and sales.

Scientific and engineering applications

The HP 9896 is also a powerful resource for scientific and engineering applications that require analysis and manipulation of technical data in medium-size data bases.

For more advanced applications, the HP 9896 system includes peripheral options—a high-speed (200/1pm) printer and a matrix plotter, for example. You can also expand the memory in increments of 8k bytes up to 32k bytes.

Double density discs

To put more data on-line, HP innovated flexible discs with twice the density of previous industry standards. Each holds nearly 500,000 bytes of information, and as many as four flexible discs can be supported by a system at once, for a total on-line capacity of almost two million bytes.

Full price for the HP 9896 system hardware is $18,700.* HP has an OEM quantity discount schedule. **If you wish further information on the HP 9896, indicate D on the reply card.**

*U.S. domestic prices only

Automate financial accounting in as few as five days*

The HP 9896's new business information management system helps companies with annual sales of $250,000 to $10,000,000 establish their own EDP facility. FICS (Financial Information Control Software) is a complete package of programs to handle general ledger, payables, receivables, payroll, and inventory. Further, HP has an innovative five-day conversion plan that enables qualified* customers to switch over quickly from their manual or ledger card systems.

For larger businesses, the HP 9896 system can also handle selected tasks in such areas as production control, financial analysis, forecasting, and personnel records management.

The Hewlett-Packard customer is assured of a single responsible source. The completely integrated hardware and software package—the HP 9896 and FICS—costs $21,700* and includes installation, conversion, and training. The total system leases for approximately $500/month including maintenance. **To learn more about this advance, indicate E on the reply card..**

*Offer available in the U.S. only; contact your local sales office for more details.

New & Noteworthy

Incremental growth: two Hewlett-Packard products help you grow "byte by byte."

Upward compatible RTE-M

RTE-M is Hewlett-Packard's newest Real-Time Executive operating system for HP 1000 systems and 21MX family computers. Memory-based rather than disc-based, RTE-M is suited for dedicated applications that require fast response time in collecting and controlling data. Minicartridges or flexible discs may be used for program and data storage.

Versatile RTE-M is upward compatible with HP's broad family of larger disc-based systems—RTE II and RTE III. HP lets you choose the system that's right for your present application; and you can expand without high conversion costs or retraining.

RTE-M is available in three modular versions—MI, MII, and MIII—depending on your requirements and hardware resources. RTE-M software is priced at $1750.* **Check F on the reply card for details about RTE-M and RTE II/III.**

DISCoveries

What can be stored on fewer than 100 megabytes of disc memory?
a) The Encyclopedia Britannica from Aardvark to Mustard
b) Enough typed characters to span the Golden Gate Bridge 25 times
c) Materials control and accounting operations of a firm with over 400 employees, 52 products, and annual shipments totaling $42 million.

Guess again. The correct answer is A, B, *and* C. Two 50 megabyte discs offer more memory than you may realize.

Let's visit the company mentioned in "C." Surprisingly, 100 megabytes—the equivalent of two formatted HP 7920 discs—can store much more than the materials control and accounting data bases. There's also system software, applications programs, and plenty of room for growth.

Look at some of the data processed during a typical month:

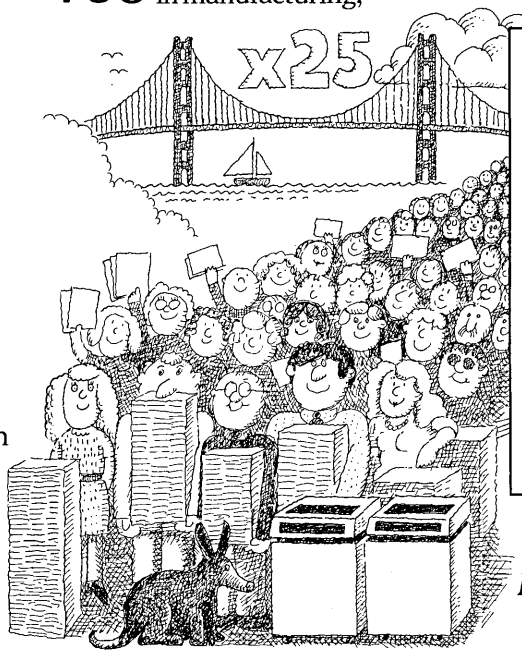
1200 checks written in accounts payable;
17,000 material vouchers and
4000 labor vouchers processed in cost accounting;
1500 purchase orders and
700 work orders processed in manufacturing;

not to mention daily status reports on inventory levels, backorders, and product activity for **5000** different parts. Remember... all these data, and more, stream from fewer than 100 megabytes.

This company's disc storage is part of an HP 3000 computer system which utilizes the IMAGE data base management package. The HP 7920's function as integral parts of a totally on-line, integrated system, for a current and close-at-hand data base. Six more HP 7920's—another 300 megabytes—can be added to the original microprocessor-based controller for a total of 400 megabytes.

The HP 7920 add-on multi-spindle version is $14,000, or two for $26,000.* **Check G on your reply card for details.**

*U.S. domestic prices only



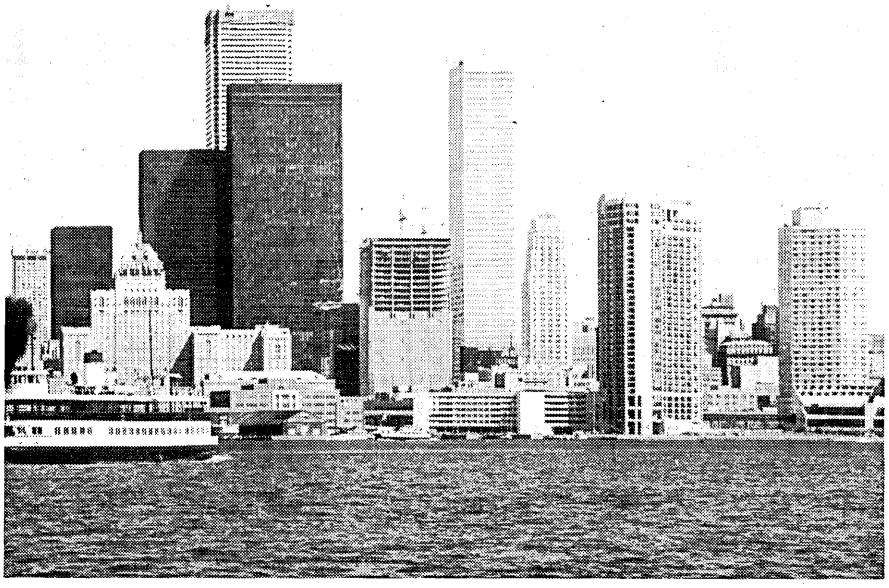
Computer Advances, written to inform professionals of the latest technical contributions from Hewlett-Packard's engineering labs, appears regularly as a compilation of product and customer innovations.

You are invited to receive issues at your place of residence or business. Write Computer Advances, Editor, Hewlett-Packard, 11000 Wolfe Rd., Cupertino CA 95041.

HEWLETT hp PACKARD

Congress Has a Business Side

Triennial Meeting Adds Practicality to Sessions on Theory



TORONTO skyline includes two IFIP host hotels: Harbour Castle on extreme right where Medinfo is being held and Royal York in center background where Congress is held.

IFIP Congress 77, the triennial meeting of the International Federation of Information Processing, returns to North American shores in Toronto next August 8 to 12 after an absence of 12 years. (In 1965, the American Federation of Information Processing Societies dropped its Spring Joint Computer Conference to host the congress in New York.) While, as always, the program contains a speakers list of "who's who" in international computer science, the 1977 congress signals a growing change in tradition from purely academic subjects to those dealing with the business side of computing.

Long known as a meeting exclusively "of, by, and for international academia," this one offers a well-balanced set of sessions that may attract the people who toil in computer rooms and manage information systems for business and industry. Program chairman Prof. W.M. Turski of Poland said the emphasis is on practicality and applications. "Even in 'Theoretical Foundations of Information Processing,' we prominently asked the contributors to address themselves to such problems of extreme practical significance as program verification, programming methodology, and data bases." The thirty panel sessions—more than ever before—should assure lively debate throughout the five-day Congress.

Perhaps that practical emphasis on "theoretical foundations" isn't enough to drag an information manager out of his office, but there are more than 30 sessions on business and administration that are. (That's 30 out of 97 sessions, an impressive share.) Numerous papers and panels will be presented on such topics as the impact of information systems on organizational structures, on the "management of change," and on productivity. Senior managers from major corporations will discuss their own experiences in these areas.

Ford's Roark on change

For example, Mayford Roark, Ford Motor executive, will discuss a "Successful Approach to the Management of Change," and also appear in a panel on the topic. Xerox executive Paul Strassmann will chair a symposium on "Organizational Productivity: The Role of Information Technology" and participate in another on "Interactive Approaches to Corporate Planning and Control." Michael Samek of Celanese will head a symposium on "Programs of Data Management and Teleprocessing in Larger Organizations." An overview of the impact of systems on organizational thinking will be presented by Dr. R.I. Tricker of the U.K.'s Oxford Centre for Management Studies, which has been working with executives in this area for several years. There will also be numerous sessions on data base management, distributed processing, telecommunications, and programming aimed directly at the managers.

The man responsible for gathering together multinational executives and computer professionals for this segment is Paul Dixon, director of information systems for Massey-Ferguson in Toronto and the chairman of the IAG, the business data processing arm of IFIP. Dixon is trying to make both the IAG and the IFIP Congress an "international forum for user management."

The goal is to organize and educate this segment of the community to assume their proper place and responsibility as part of top management. "The moment one hears a director of management information systems talking about 'serving top management,' he should be fired," says Dixon. "He is top management," and should be taking responsibility for his part in the change that is occurring in his organization "because of information systems."

The responsibility of the computer technologist and manager in society is another topic to which IFIP has accorded more importance than ever before. At the last congress in Stockholm in 1974, there was a lone session on this, chaired by Dr. C.C. Gottlieb of the Univ. of Toronto. This year Dr. Gottlieb and the IFIP committee on social implications have put together five panel sessions covering computing's impact on employment, job content and satisfaction, privacy, and leisure. The fifth will cover social accountability of computing.

The "Social Accountability of Computing" panel will be led by Dr. Robert Kling, of the Univ. of California at Irvine, and IFIP is looking for strong debate on his "go slow" views on major trends such as electronic funds transfer.

Lots of theory

Naturally, in addition to management and social implications, IFIP Congress 77 will emphasize its traditional areas, such as theoretical foundations of information processing, hardware and software technological development, education, and applications in science and engineering. But two new major areas have been added: computer networks and computer-aided design. The sessions on these topics are examples of Turski's goal of practicality and application. Packet switching pioneers Larry Roberts of Telenet, Louis Pouzin of IRIA in France, and Paul Baran of Cabledata will discuss the issues and future potential of such networks. C.I. McGibbon and H. Gibbs of Canada will talk about "Datapack: Start-up of a Public Packet Switched Network."

The USSR on CAD

Sessions on computer-aided design include an overview of computer-aided circuit design by Prof. M.A. Gavrilov of the USSR Institute of Problems of Control. Another expert, Prof. N. Negroponte of MIT will talk on "Being Creative in CAD"; and Dr. J. Hatvany of the Hungarian Academy of Sciences will cover "Trends and Developments in CAD."

As is obvious, the Congress is well-stocked with international stars in all major computing fields. Dr. Andrei Ershov, internationally acclaimed Soviet computer scientist, will present a paper at the programming languages session and appear in a panel on natural languages. Dr. Fred Brooks, Univ. of North Carolina, promises an interesting discussion on the "Computer as Toolsmith." Computer pioneer Prof. M.V. Wilkes of the Univ. of Cambridge, U.K., will go "Beyond Today's Computers" with prognostications on the future of such developments as distributed processing.

Parallel sessions

There is no question that the attendee wishing a full education in any one of the topic areas—from research and study, to implementation, to management, to social impacts—will receive it at this congress. The problem will be to cope with the rich offerings: 142 papers and 30 panels presented in sessions that will run five at a time.

But papers and panels are not all IFIP offers. While not as much an exhibitor's show as the National Computer Conference, the Hannover Fair in Germany, or SICOB in France, IFIP Congress 77 will have nearly 100 exhibitors, including the likes of IBM, Honeywell, Univac, and a host of peripheral, terminal, and software firms.

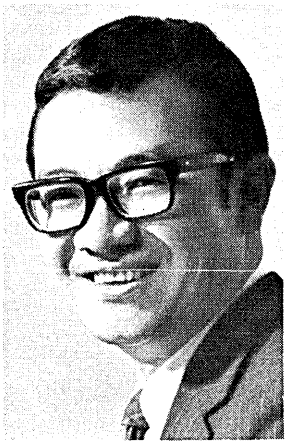
Toronto will offer cruises, wine and cheese socials, banquets, picnics, receptions, and dances. And for the chess buff, there will be the 1977 World Computer Chess Championships, pitting defending world champion "Kaissa," developed at the Institute of Control Science in Moscow, against a field of 11. Your move . . . to Toronto, the "People City." **—Angeline Pantages**

Medical Talks Share Spotlight at IFIP

While dozens of IFIP Congress sessions go on at the Royal York Hotel, and exhibits are displayed at the Sheraton Center, another major conference will be held concurrently at the Harbour Castle Hotel. This is the Second World Conference on Medical Informatics, MEDINFO 77. The program committee, led by Prof. W. Schneider, Uppsala Univ., Sweden, will present sessions on: management, clinical medicine, public health, theoretical aspects, services and special care, education, and other topics. Clearly in keeping with the week's emphasis on practicality and social responsibility, MEDINFO's program appears well-balanced.

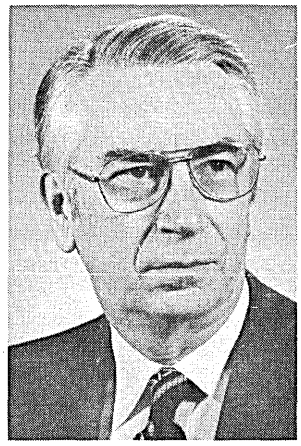
Coverage will range from theory and research, such as the "Theory of Medical Decision Processes," to "Financial Management Systems," to "Social, Legal, and Political Aspects of Data Protection." ❋

SOME IFIP HEADLINERS



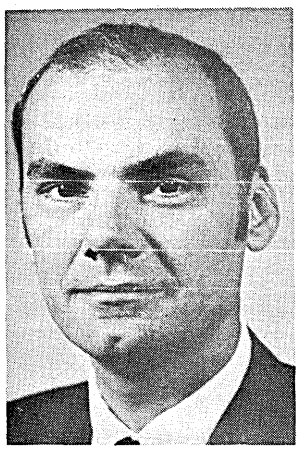
RICHARD I. TANAKA—President of IFIP

P.J. DIXON—Massey Ferguson, Ltd.

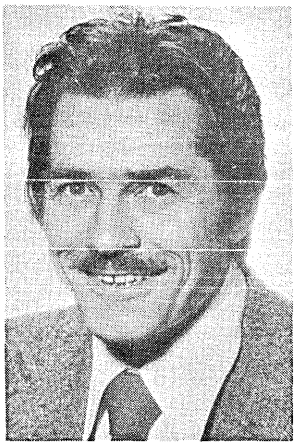


MAYFORD ROARK—Ford Motor Co.

R.I. TRICKER—Oxford Center for Management Studies

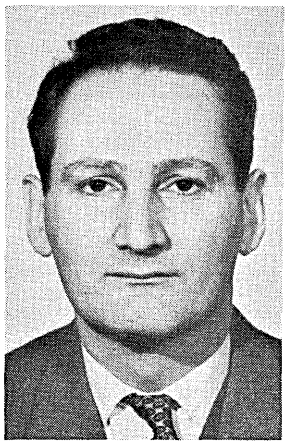


LARRY G. ROBERTS—Telenet Communications



LOUIS POUZIN—IRIA in France

M.A. GAVRILOV—USSR Institute of Problems of Control



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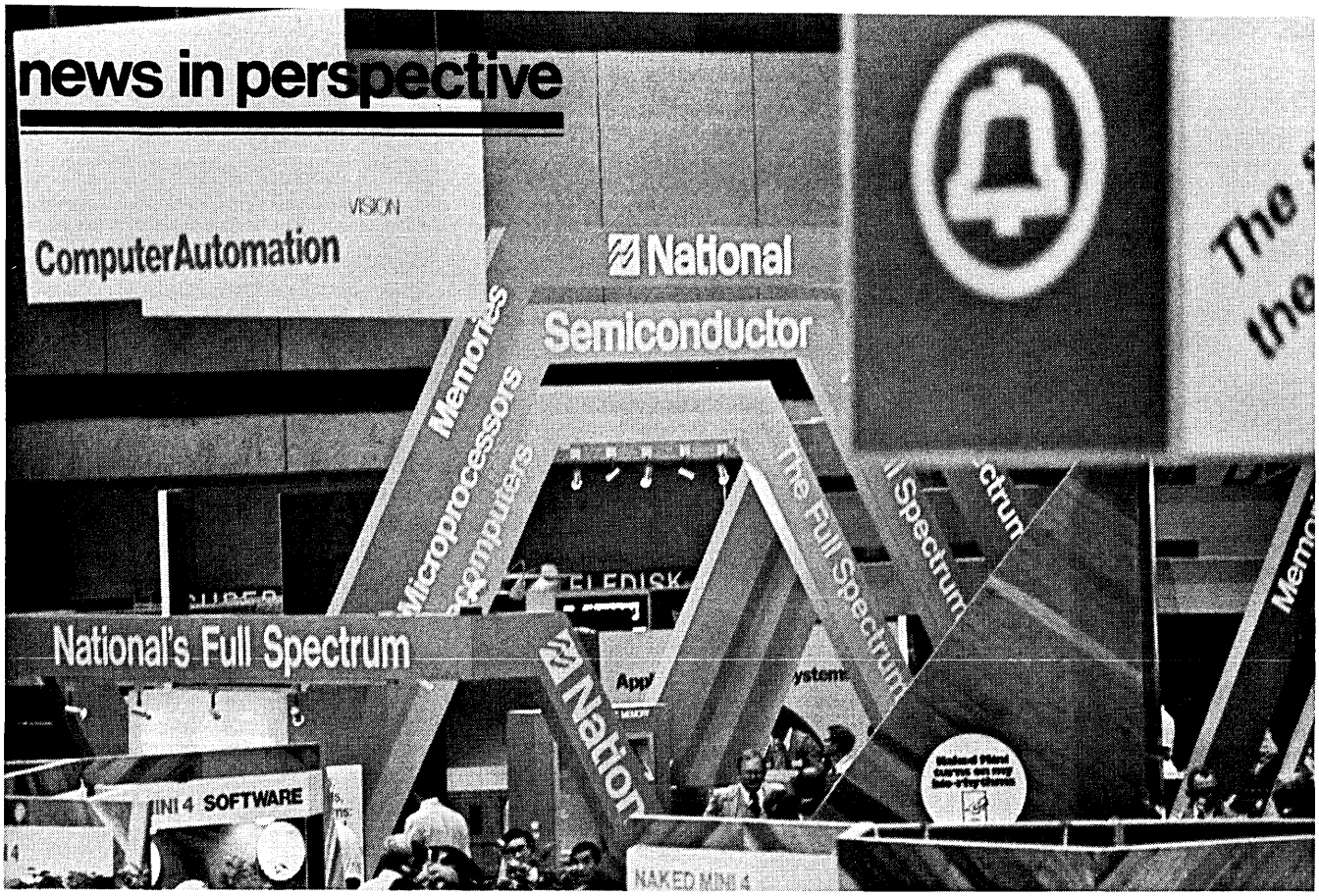


Conferences

The Big "D" Delivers

NCC exhibitors were more than happy; session room crowds were a problem; personal computing fair was an unknown but powerful factor; next year looks good already, the show was sold out in this year's second day.

A violent thunderstorm that heralded the arrival in Dallas last month of the National Computer Conference was somewhat prophetic.

Its activity was matched by the conference itself as was the surprise of conferees caught in it. Not even the most optimistic organizers of the sponsoring American Federation of Information Processing Societies (AFIPS) expected the Dallas event to out-pull last year's conference in New York City and to set a new attendance record, but – at 35,601 compared to 35,085, it did.

At a press briefing on the show's third day, a jubilant conference chairman, Dr. Portia Isaacson, announced that the conference committee's projected attendance figure of 25,000 had been reached by the close of the second day.

How much the NCC's first Personal Computing Fair contributed to the record turnout will never be clear. AFIPS included the Fair in a check list it presented attendees asking their interests, but there is no way to determine if this was an exclusive interest and the factor that drew them to the conference.

Dr. Isaacson said no local promotion was done to attract visitors from Dallas and surrounding areas and that no special rates were offered. Nevertheless, computer hobbyists have an unusually active grapevine, and one member of the NCC volunteer committee on attendance said before the show that "the Personal Computing Fair is Portia's ace up her sleeve to generate a respectable turnout. They'll be coming in by busloads," he predicted.

From Oklahoma City

Indeed, the committee did arrange busing from several areas. Three busloads from Oklahoma City alone arrived on the third day. Whether all those bused were computer hobbyists was unclear.

Dr. Isaacson, herself a computer hobbyist and the owner, with her husband, of Dallas' first personal computing store, said that future NCC's might be opened to the public.

While pleasing to AFIPS, the crowds brought with them the usual problems with hotel accommodations. The Hilton Hotel was reported overbooked by 300 rooms. Some attributed this to a discontented manager who deliberately overbooked prior to quitting. The Computer and Communications Industry Assn. (CCIA) lost a block of 40 rooms as a result.

One session speaker, given his choice of sitting or standing for his talk, chose standing because, "I arrived late without a reservation and ended up sleeping on a cot in a conference room at the Baker Hotel. If I sat, I might fall asleep."

Session seating also was a problem.

AFIPS assigned a room with a capacity of 75 persons to a session of headliners that drew 500 persons.

Such incidents of poor planning and a huge and confusing convention center, drew a lot of grumbles from persons attending the conference program. In contrast, a speech by A. Douglas Murch, senior v.p., Prudential Insurance Co. of America, drew fewer than 75 persons to a theater that accommodated almost two thousand.

The session that drew

The session that drew the 500 persons featured such eminent panelists as Gene Amdahl, chairman of Amdahl Corp.; Herbert Grosch, president of the ACM; Harlan Mills, an IBM fellow; Gordon Moore of Intel Corp.; Albert Hoagland, IBM; and Charles R. Vick of the Ballistic Missile Advanced Technology Center in Huntsville, Ala. The chairman was Lowell Amdahl of Computer Sciences Corp.

Halfway through a talk by Intel's Moore, the session, "Toward the Computer of Tomorrow: A Multi-Faceted Challenge," was moved to larger quarters in the convention center's theater where a slide presentation by the CCIA was interrupted. The change was announced over the center's public address system to persons who, after standing around for 20 minutes in hopes of a change of location, had finally left in disgust. That drew several hundred additional persons to the theater and the audience soon swelled to 720.

At the end of the session, Gene Amdahl, who also is president of the CCIA, announced that the CCIA slide presentation would resume.

An attendee in a wheelchair, who was being pushed around the convention center by her husband, arrived too late to get into an overcrowded session, and was heard to complain: "Well this is dumb. Everything has been. We've searched half an hour to find an elevator so a wheelchair can come downstairs, only to find the session overloaded. And no map of the facility. Somebody sure never thought of handicapped people when they built this place."

Not next year

Stephen Miller, Stanford Research Institute, chairman of the 1978 NCC to be held in Anaheim, said his committee would strive to avoid the seating problems experienced in Dallas. He also said the AFIPS board would try to develop a new plan for allocation of booth space which was another problem this year. Prospective exhibitors for the '78 show stood in line as long as 13 hours to get good locations in the show which was sold out almost immediately. Many names are already on the waiting list. Miller said attempts were being made to get additional exhibit space in the arena of the Anaheim Convention Center.

If the attempts are successful, this space undoubtedly will sell out too, and companies like Four Phase Systems, Honeywell, and others who indicated they will only be in the show next year if they have something new and significant to show, may change their minds.

THEY CAME and they came until there were 35,601.

Among the exhibitors at this year's show, the superlatives flow thick and fast. "Fantastic show – a lot like the old SJCC's and FJCC's," said Ken Krechmer, national sales manager of Vadic, a modem manufacturer. He said his company was "averaging 100 sales leads per day" where last year they barely hit 200 for the entire show.

"I'm tickled pink," said Rich Lorrigan of Inforex. "We got twice as many good quality inquiries as three years ago in Anaheim."

"This is the best. We didn't expect this many people. We're amazed at the turnout," said a spokesperson for Harris Corp. whose mammoth blue booth, loaded with terminals at which attendees could play games like Star Trek and Tic-Tac-Toe, was biggest at the show.

IBM's experience

"Very outstanding show," was the comment of Fran Ward, senior marketing representative, Series/1 Marketing for IBM. Theme of the IBM booth was "Help Put Information to Work for People." Products eliciting the most interest were the System/34 and the Series/1. Ward said the company was getting a record number of leads and a lot of interest from competitors, namely major peripheral companies.

A spokesperson for Ames Medical Record Systems, which makes a bar code scanner for hospital applications, said the show is launching them into the oem business which will get its scanners into a variety of new applications. "There's been a lot of serious interest."

Randal Walti, president of Randal Data Systems, who went into the show primarily to attract distributors for his small business systems, said he'd talked to 100 good prospects by the end of the second day.

Rod Dobson, account representative with Comtech, a Canadian software house, was a rarity. "I'm disappointed. We've been coming for four years and I think it's time we stopped. Let's face it – it's turned into an oem and mini show. I don't know where the DOS and OS users are. They've gone somewhere else."

Another software company, Software AG of North America Inc., reacted more positively. "We put a lot of money into our booth and a little bit more show business," said a spokesperson, "and our leads are up by 50%." The firm used a software doctor theme, "the doctor that can cure all your software ills."

James Palmer, president of Spectron Corp., a Moorestown, N.J., data communications firm, in the show for the first time in several years, said he liked it because "there's not so much carnival atmosphere."

There were gimmicks

But there were some gimmicks. Datum and Management Science of America did repeat acts with their crowd-pleasing magicians. Computer Automation's gimmick was a computer-generated biorhythm offering, using the firm's Naked Mini computer to produce biorhythms on a Documation printer. It drew a constant flow of persons who waited patiently in consistently long lines and, by show's end, the company had handed out some 2,000 biorhythm charts. Qantel Corp. offered biorhythm charts attendees could take

away and use to run their biorhythms on their own computers.

Data General attracted lines of people to its miniature planetarium. Jacquard Systems was popular with its automatic embossing machine which allowed attendees to sit at a crt and produce their own embossed baggage tags.

That the value of gimmicks in trade show booths could be suspect might be indicated by conversations concerning a contortionist who performed in the booth of Powertec Inc., a Chatsworth, Calif., power supplies firm. Many attendees talked about the remarkable contortions but few could remember the name of the firm.

One of the most attractive booths at the show was Lear Siegler's Little Red School House – a nostalgic display of desks, tables, and a blackboard on which Lear Siegler went to the "Head of the Class." ADM terminals were placed on top of the desks and tables in a simulated classroom designed by Shirley Nelson Interiors, an Orange County, Calif., interior design firm. The company continued its homey style of displaying products at the NCC, started last year in New York when it used a living room effect.

Pet Computer impressed show attendees with its $595 personal computer. Although it came in $100 over the original price projection, it's still a bargain with a cassette, BASIC interfaces, display, and 2K of memory.

A verifier

American Magnetics Corp., Torrance, Calif., introduced a new magstripe verifier for instant reading of encoded ABA data on magnetic stripe cards. It has a display screen that accommodates a 38 digit LED display. The user simply passes a magnetic stripe card through the reader and the encoded data is displayed on the screen.

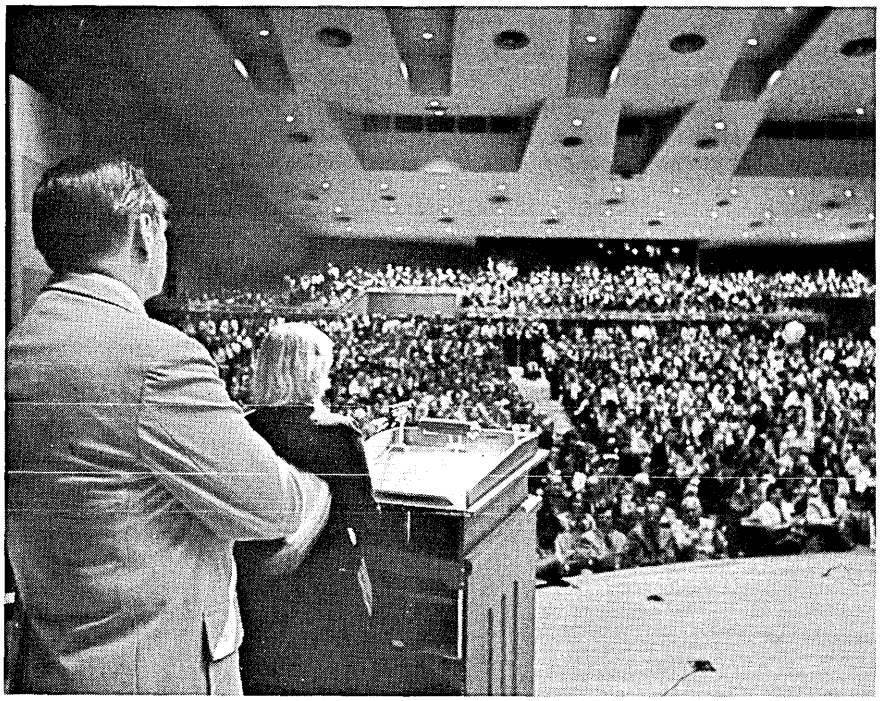
Spatial Data Systems, Inc., Goleta, Calif., which two years ago attracted crowds at the NCC in Chicago with its picture input and retrieval system used to create computer-drawn likenesses of attendees, this year introduced its Eye-Com for business data entry. It can input and retrieve both photographs and line drawings.

Memorex introduced its first magnetic tape subsystem, the 3220 series, which includes 1600/6250 bpi tape drives and controllers for use with IBM 370s models 135 through 168.

Siemens announced availability in the U.S. of its 21,000 lpm laser printer, strictly for oem sales.

Yourdon Inc., New York-based education specialists, announced they would be making available their "C" compiler as a software product of their company. The "C" language, originally developed at Bell Laboratories to write Bell's PDP-11 UNIX operating systems, is one of the most powerful structured programming languages yet implemented.

A STANDING ROOM only audience heard conference keynoter Mark Shepherd, Jr., introduced by Portia Isaacson.



Good software, it seems, can be produced on time, at reasonable cost, and with poor human resources. At least Gruia-Catalin Roman of Washington Univ., who spoke at a session of "Software Validation," thinks so. He told of using a crew of two part- timers to remake a 10-year old, 10,000-line biochemical simulation system written in FORTRAN. The trick, he said, was to force subroutine independence, separate control code from working code even within routines, and restrict yourself to simple, standard parts of the language.

Software in hardware

Conference keynoter Mark Shepherd, Jr., chairman and chief executive officer, Texas Instruments, Inc., talked about software executed in hardware which he said had "begun in fixed-function applications with ROM programs built-in as an integral part of the product. Now we are seeing plug-in ROM's create multifunction products. In the next phase, libraries of solid state software functions will be built up, impacting personal computers, home computers, and small standalone business systems."

The fact that there was standing room only in the Dallas Convention Center's huge theater for Shepherd's keynote address was still another testimonial to the success of the 1977 NCC, as was the fact that Dr. Isaacson and other AFIPS officials received a standing ovation as they came on stage prior to the address.

Shepherd's address immediately preceded the opening of exhibits on the show's first day. How many from his audience followed him directly to the Convention Center's basement to view the NCC's first Personal Computing Fair is impossible to say, but it's a fair bet that a lot did. The Fair's aisles were crowded from the beginning to the end of the show. It was a low-key event with few glamorous trappings on the booths, reminiscent of the early Joint Computer Conferences.

"Downstairs, in the hobbyist area, is where the real leading edge is," said Sol Zasloff of Micropolis. "What we're seeing is a show of refinement. Upstairs you don't see much of anything new, but you do see a lot of stuff introduced several years ago that runs. It works. But it's a schizophrenic show, too."

Personal computing wasn't all exhibits. There were sessions on the topic that took up the whole third day. Among other things, Jim C. Warren, Jr., chairman of the first of these sessions, noted that hardware appearance doesn't mean much to the hobbyist, it's performance that counts; that price is critical.

Always personal

The always colorful Ted Nelson, Swarthmore College, said, "The ulti-

mate use of computers has always been personal." He predicted that the dollars spent in personal computing will exceed the commercial market by 1985. "You people who are here to report back to top management on this market will not be able to put it into words."

What's going on in personal and hobbyist computing is typical of the whole computing field since its inception – constant change. Prudential's Murch touched on this in his plenary address in which he was representing the computer user. "In walking around the floor of this show, I find it hard to believe that the developments in computer use in business have taken place in only the last 25 years. We could now not possibly get along without you even if we should want to."

Murch was talking about business computing. Ted Williams, AFIPS president and professor of engineering and director, Purdue Laboratory for Applied Industrial Control, made a similar point on behalf of computers in industrial control. "When one considers the pervasiveness of computer systems in industrial plants of all types today, it is hard to realize that the first viable proposals for such systems were made just 20 years ago."

Shepherd talked of change to come. "The remarkable fact is that in computing technology, we probably still have another five or six orders of magnitude change ahead of us; that is, we stand today about at the midpoint of a twelve orders of magnitude change in the nature of the computing world."

"Each year," he said, "will see more powerful computing and information processing functions moving into the domain of personal possession and individual work stations."

THE AISLES in the Personal Computing area were crowded throughout the show. Local tv newsmen were among those attracted.

A moving "bandwagon"

It was evident in exhibits and in the conference sessions that the distributed processing "bandwagon" was moving at high acceleration, although there were many indications of confusion in terminology.

Harry Vickers, marketing v.p. at Entrex Corp., added the term "source data processing" to such other buzzwords as "distributive, dispersed, and distributed" data processing. Vickers said the phenomenon has many meanings: to the data processing professional in a centralized organization, it sounds as if "you're throwing your computing away." To the department manager in a company – the end user – it meant "bringing computing to the source for decision making."

Gene Amdahl called distributed processing a "bandwagon" trend – one in which there is considerable noise and talk at first, then a period of silence, as with such other "bandwagons" as multiprocessing and time-sharing that Amdahl said he experienced with IBM where he was the architect of the 360 line. The builder of IBM-compatible 460/V machines said his negative attitude to such bandwagons often made him "not welcome in the halls of Armonk."

He predicted the phenomenon would wear off and finally emerge not as a system of minicomputers, but of major computers doing distributed functions. Amdahl spoke at a session on tomorrow's computers. Vickers and Larry D. Woods, manager of distributed computing at Deere & Co., the huge Moline, Ill., machinery maker, spoke at a session on managing distributed processing.

Woods said there was not enough time for a period of silence. End users, with a lot more computer savvy than central dp organizations gave them credit for, were using minicomputers for engineering, financial, and marketing calculations, often doing things their central sites were unaware of and generating data over which they had no control.

Too late to recover

"The year 1980 could be too late to recover control of your computer operations," Woods said in a talk on the management of distributed computing in large organizations. He said Deere had made three surveys of their minicomputer power in the past three years and found the organization had 150 minicomputers today compared with 35 three years ago. He called for a network of nodal computers that would enable mainframes to communicate with remote computers of all kinds, "so that the corporation could keep control of data, while letting the computing go" to the remote sites.

Data bases came in for attention at a number of sessions. In one on "Advanced Concepts in Data Base Management," Christine A. Montgomery, Operating Systems Inc., Woodland Hills, Calif., urged listeners to think of data bases as "data vats. The data in them can and does ferment. It constantly changes and is never quite the same way twice."

The data base management of the future, she said, should assign priorities and detect changes in the real-world environment. "Systems are basically passive today – they really don't help the user. It's like groping in a black box and reaching for small answers that really are part of a larger question."

In a one-man, day-long seminar on "Distributed Data Base Networks," Leo J. Cohen, Performance Development Corp., Princeton, N.J., said, "If I only get one thing across, it should be: be conservative in data base and especially in networks." He spent seven hours of classroom time showing why.

In a session on "Emerging Legal Issues and Impacts of Electronic Data Processing," Michael S. Keplinger, senior attorney, National Commission on New Technological Uses of Copyrighted Works (CONTU) described the work of CONTU's Data Base Subcommittee noting that, "The introduction of a work into a computer memory would, consis-

tent with the new (copyright) law, be a reproduction of the work which is one of the exclusive rights of the copyright proprietor."

Privacy bills coming

Social issues were a prime NCC topic. In a session on "Privacy and Social Issues," Wright Andrews, a Washington, D.C., attorney, noted that the Privacy Protection Study Commission's final report is due July 12 and that "six bills are waiting in the wings which closely follow the text of the report." He expects educational hearings on the bills in the fall and more formal hearings and some legislation enacted next year. "The key question," he said, "is what the Carter Administration is going to do."

Both Andrews and San Francisco attorney Susan Nycum urged dp professionals to communicate with their management and with legislators. "We have to know: what does it cost; does it really protect; or might it (legislation) impose greater governmental control?" Andrews said.

In a medical session, Dr. Norman Weissman, Department of Health, Education and Welfare, Rockville, Md., called privacy "our greatest issue." He suggested the possibility of someone obtaining a list of people with psychotic tendencies and "using it for blackmail or whatever."

Telecommunications and privacy issues were discussed in a few NCC sessions and in an international marketing seminar held just before the NCC opened. While the seminar, sponsored by the U.K.'s On-Line Conferences Ltd. and DATAMATION, emphasized the how-to of marketing abroad, Jerry Dreyer, executive v.p. of the Assn. of Data Processing Service Organizations (ADAPSO)warned that privacy issues would affect the kinds of systems that will be bought in the future. He urged "the formation of an international policy-making body composed of data processing organizations" to create industry stands on such critical issues. "These stands will be communicated to already-established international forums created to deal with data processing related matters."

DISTRIBUTED processing bandwagon moved at high acceleration.

Adapso in the U.S.

ADAPSO, on the privacy questions, already has "urged the establishment of an industry/government advisory panel (U.S.) to implement privacy and security policy."

Security was discussed at the NCC too. In a session on "Computer Security Techniques," John Summers of RLG Associates suggested that encryption at the terminal is the way to go. Out on the exhibit floor, Motorola was showing the chip that can do it.

In a session on "Security of Computer Systems," S. Jeffery, National Bureau of Standards, told of how an ex-user broke into Bell Lab's UNIX system, a time-sharing system modeled after Honeywell's MULTICS. The user, he said, copied the password file. The technique used to defeat this type of activity was a summing routine that looked at how long anyone was spending in password entry activity. When the sum time of one second was exceeded, the user was thrown off the machine.

Electronic Funds Transfer (EFT) comes up at just about every type of computer conference these days, and the NCC was no exception. James B. Rule, a sociologist from State Univ. of New York, Stony Brook, N.Y., worried about extremes. "We don't address the fundamental fact that the balance of social power is changing . . . the inevitable pressure that EFT files will be subjected to . . . that there do exist unacceptable extremes." He suggested as a comparable extreme private ownership of tactical nuclear weapons.

In "The Coming Age of Computer Based Medical Consultation: Will It Be Fair?" Dr. Jerrold Maxmen, Albert Einstein College of Medicine, New York City, suggested an extreme of his own. "In 50 years," he said, "the physician will be rendered obsolete. Medics will work in collaboration with the computer. The technical tasks of the physician will be performed by the computer."

Home medical centers

Conference keynoter Shepherd touched on medicine. "The next decade could see the home medical center," he said, "and a computerized combination for monitoring the essential body parameters, managing exercise and diet schedules, tracking medication, and giving early warning of any unfavorable trend which may require professional care."

ACTION STARTED early on the show's first day in the main exhibit area. Slower to fill up was the adjacent arena (right), but fill it did.

Of interest to management was a session on "Contracting, Financing, Investing, and Third-Party Maintenance." A user got up during the session to tell of buying a B-1700 and attaching a letter of understanding to his contract that said what he understood the performance of the system to be as a result of Burroughs advertising. "The system fell far short of that performance," he said. He went to Burroughs management. The end result: Burroughs installed $17,000 of equipment to bring the system up to snuff – without added cost to the user.

At the same session, Stephen N. Hollman, a San Francisco attorney, said vendors should write clauses in their contracts that provide for the levying of retroactive taxes. (Some governments have decided to levy sales taxes on software that go back 10 years – May, p. 156.) In answer to a question from a user, Hollman said users, in turn, may want to add a time limit to their liability for retroactive taxes. He suggested one year.

In the legal issues session, Robert P. Bigelow, Computer Law and Tax Report, said the industry is not unified on the tax question. "The problem is that

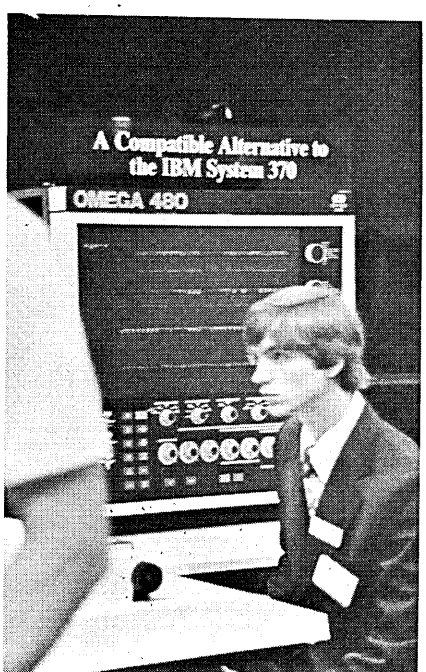
The Debate That Wasn't

It was dubbed as an Oxford-style debate where David would take on Goliath. It was supposed to give AT&T a chance to speak up and out on some of the stickier telecommunications policy issues. But, unfortunately, the debate session on "Data Communications Policy and Its Impact on the Consumer," held the third morning of NCC week, never quite came off. The communications goliath, opting for a low key approach, refused to take part in the public debate. Despite repeated last minute attempts by session organizer, Dr. Robert R. Korfhage of the Computer Science Department of Southern Methodist Univ., Ma Bell remained stubbornly intransigent.

However, a handful of AT&Ters did show up for the session, sitting quietly and demurely in the back of the room, listening to former Office of Telecommunications Policy boss John Eger defend their company's right to compete in the computer communications marketplace. An outspoken critic of Bell's monopolistic machinations, Eger did a quick about face, calling for AT&T to be freed from the regulatory shackles that have prevented it from selling its wares in the computer marketplace. "We must ensure AT&T," he argued, "the right to enter the data processing information handling field, but only so long as they enter, not as a protected, but just as another unregulated free market competitor."

Speaking out in support of the consumer's right of choice, competition advocate John McNulty, head of Modular Technology, a small U.K. communications equipment manufacturer, blasted the European Postal Telephone and Telegraph (PTT) big brother-like control over communications services. Citing bizarre examples of PTT policy, the Britisher urged his American audience to avoid the European governmental and dictatorial approach to communications. "Don't let it happen here," he warned ominously, "or you'll wind up in the same rocky boat as the Europeans." ❋

DATA GENERAL's planetarium from inside and out. CDC's Omega IBM-compatible computer and Informer's small terminals, one of which was a prize in the programming contest.



each user's situation is different, and whether or not software should be tangible or intangible really depends on the individual situation."

Susan Nycum, chairman of this session, talked about programmer liability. "Computer technology remains in a stage of development and imperfection. Despite exhaustive testing, a programmer can never have total confidence that his program is entirely debugged; hence, every program sold carries with it the possibility of error."

Professionalism as a standard

She suggested professionalism as a standard for liability. "The programmer holds himself out as a professional with special expertise and a canon of ethics he is required to follow. As a professional he would be held to the level of care exercised by a reasonable member of the profession under similar circumstances."

In a session "ICCP (Institute for the Certification of Computer Professionals) and Certification Move Forward," Merton Walker, State Farm Fire & Casualty Co., defined professionalism as "an attitude on the part of the profession, recognized by people, based on the actions on the part of the practitioners." He urged the dp community to "support a single code of ethics."

THE LONG WAIT for choice booth space at next year's NCC stretched to as many as 13 hours for some, including Datamation's western district manager, Alan Bolté, Jr., who snapped this picture of his fellow sufferers.

G. Gary Casper, Weber State College, Salt Lake City, and ICCP president, said data processing is not legally a profession. "There's not enough there to call it a learned profession, but the germ is there, the components are there."

Jack Stone, in a session on "Humanistic Perspectives on Computer Center Management," also worried about people quality. "Machines we have. It's leadership and management we don't. From the standpoint of management effectiveness, we have a disaster."

Seems a lot of people agree with him. James F. Towsen, in his session "Why Managers Fail," played to a standing room only house. He offered a series of commandments: keep morale high; watch out for drinking employees; and the like.

Job hopping

If managers are concerned about doing their jobs, so are employees about getting new ones. Questions in a well-attended session on "Executive Searches in the Data Processing Industry," indicated the audience was made up more of job seekers than of people looking for employees.

Regulation was touched on. In the EFT session, John M. Eger, Lamb, Eastman & Keats, Washington, D.C., warned that the dilemma faced by AT&T in its participation in EFT "could lead to complete regulation of the computer and communications industries. We're

National Programming Champ

William T. Bailey went home from the NCC carrying the title "1977 National Champion Programmer." Bailey beat out the field through four elimination rounds, winning the title, and more tangibly, a Texas Instruments Silent 745 Portable terminal and $500 worth of time-sharing services from Tymshare.

To enter the contest, the some 70 applicants had to write a qualifying program that would merge a variable number of files containing an unspecified number of records. Bailey and several others chose to write this program in PL/1; unfortunately, PL/1 was not available at the Burroughs B6700 installation used in the contest. The few entrants who started in PL/1 had to convert their qualifying programs into FORTRAN,BASIC, or COBOL, because the first elimination round called for modifying the merge program. Bailey chose FORTRAN for the rest of the contest.

The second round consisted of debugging a program prepared by the contest committee. Bailey said typographical errors presented his biggest problems, and indeed, one of the few bugs he missed concerned a zero masquerading as an "O."

In the third round, the contestants modified a poker-playing program supplied by the committee. At about this point, Bailey, 29, said he felt he would take third or fourth place. Apparently others had more trouble than Bailey.

One of the proctors commented that throughout the four rounds, Bailey looked very cool. "I guess it didn't show," Bailey said, conceding that he did feel the pressure. Of course, he experiences pressure on his job as a systems programmer for Standard Oil of Indiana in Chicago. When an on-line system goes down in our business environment, the pressure to get it back on-line far exceeds the pressure

of a contest, Bailey noted. The finalists, he said, appeared to be seasoned pros.

The six finalists competing in the last round had to write a program to statistically analyze a coded message and break the code. "Mr. Bailey produced the correct solution in the fastest time," according to the contest committee. Second through fifth places went to Saul Rosenberg, Flushing, N.Y.; Thomas M. Boger, Sault Sainte Marie, Mich.; Bernard M. Chester, Brooklyn Hts., N.Y.; and William A. Sheretz, Birmingham, Mich. Prizes to these four winners included crt terminals from Hazeltine and Informer, a minicomputer from Computer Automation, the Datapro 70 Information Service, and subscriptions to a number of industry magazines.

Bailey said the contest was "great fun." He'll try to be back next year, but unfortunately the conference will fall the same week as his exams at the Univ. of Chicago. Bailey said he expects to complete his MBA program in 1979, and will certainiy do his best to compete in that year's contest. ❋

halfway down the slippery edge."

Philip S. Nyburg, AFIPS Washington office, talked about the Computer Inquiry currently before the FCC in the legal issues session. "The FCC approach ... is left uncertain by a statement in the notice of inquiry that the commission intends to eliminate the 'hybrid service' category; one is left to question, for example, the intended regulatory treatment of a mixed data processing and communications offering which involved only an incidental degree of communications. There is a need for greater attention to this issue in the proceeding."

There were awards

And there were awards. Jay W. Forrester, Germeshausen Professor of Management at MIT's Alfred P. Sloan School of Management, received the Harry Goode Memorial Award.

Tom Aschenbrenner took first place in the Personal Computer Fair with a message store and forward system for ham radio operators. Second place went to Ron Jones for a digital logic indicator.

A winner probably every bit as happy as these, and definitely as happy as AFIPS with the conference turnout, was Bill Handel, advertising and public relations manager with Electronic Memories & Magnetics. His attendance estimate of 35,284 won him $52 in an attendance pool run by Show Management, exhibit managers.

Luck (if it was luck) is nothing new to Handel. Last fall he won a 17-day trip to Mexico at the Mini Micro show as part of an exhibitors' contest.

(This article was written by Edith Myers with reports from Tom McCusker, Linda Flato, Angeline Pantages, Mike Cashman, Bill Musgrave, Richard McLaughlin, John Kirkley, and Philip Dorn.)

Time-Sharing

Standards for Time-Sharing

The estimated 20,000 users of time-sharing services could be joined by thousands of others who do not use computers if someone would standardize the way they access the services.

Hillel Segal, president of the Association of Time-Sharing Users (ATSU), who made the comment in an interview, recently wrote in the association's newsletter *Interactive Computing:* "How many of us have had the experience of having to try several log-off commands such as END, BYE, LOG, or OFF at the end of a terminal session until we found the right one for that system?"

Says Stuart Lipoff, an electronics engineer with Arthur D. Little, Inc., Cambridge, Mass., "Rarely does a week go by that a vendor or a colleague doesn't try to acquaint me with a new, better, or cheaper application program. But except in the rarest instances, I refuse to switch, despite the fact that I may honestly believe the new program may have something to offer."

Why?

Because Lipoff finds it difficult to switch after spending so much time learning the grammar and nuances of one vendor's operating system and utility programs. "If I do switch to a new vendor's system for one application and also retain the old system for other applications, I will then need to struggle with the differences between the two operating systems."

Horrendous problem

"If you have to convert, the problem is horrendous," says Segal, who used on the average of two time-sharing vendors each day when he was a financial analyst with Hertz Corp. in New York before becoming full-time president of ATSU (whose headquarters now are at 75 Manhattan Dr., Boulder, Colo.).

"Time-sharing is very tempting," Segal says. "All you need is a phone and a terminal. But the problem is learning all of the different commands ... and that's why so many potential users shy away from using time-sharing."

The ATSU is thinking of establishing a standard access to time-sharing systems. They point to a recently announced front-end product named ROBOT, offered by Artificial Intelligence Corp., Kensington, Md., which uses artificial intelligence methods to break apart English sentences to find the meaning, and then translate the meaning into the code of the specific application program. That would mean, says Segal, that ROBOT could be used to translate English language requests into the command language of any DBMS system. It also repeats to the user the request he made in English, so that the user can verify that it understands the user correctly.

OS is a small factor

Lipoff, who says A. D. Little spends from $1 million to $2 million a year on time-sharing services used by about 200 of the 700 persons there who have use for computing services, says the development of operating standards by time-sharing vendors shouldn't be such a big thing. The operating system is a small factor in evaluating a vendor's service.

"If I find it not too cumbersome to use, then I tolerate it," Lipoff says. "Once the operating system passes my 'tolerance' test, I base my vendor selection on the more important factors: application program versatility, system reliability, vendor support, response time, cost, and language offerings."

Vendors, according to Segal and Lipoff, add bells and whistles to standard operating systems to make them salable. The effect is to lock in customers.

Lipoff feels it isn't wise for vendors to use their proprietary operating systems as "cages" for customers to preserve their user base. "Ultimately, they'll be fighting a losing battle if (they do so) with substandard program offerings. Because, he says, it will be only a matter of time until the users escape to the competition.

Standardize at three levels

Lipoff suggests three levels at which the vendors could standardize their operating systems on behalf of users: at the first level, they should aim at log on/log off, basic file management, and subsystem selection. At level two, the system might provide for accounting information, advanced file management, message handling, and command image files. Higher levels could provide additional features with the ground rules providing upward compatibility through each level.

Segal thinks participating vendors could offer an ATSU standard on the same day, so that users could assess each offering at the same time and with the same parameters. (The association recently found a way to standardize the way time-sharing customers can evaluate the prices charged by vendors. It hired an organization called Real Decisions Corp. to benchmark their vendor systems and compare the algorithms the vendors use to calculate cpu time charged.)

It would be helpful, says Segal, if vendors could announce: "Compare our system. It uses the ATSU standard." He admits though that ATSU is merely beginning to make its thoughts public. "We knocked around concepts and ideas about standards before committing them to print." (The association's March-April newsletter publishes three articles on the subject.)

Says Lipoff, one of these authors, "We won't feel confident until we have some dialog. He asked for contributions to the association's special interest group on standards (STAN-SIG), but hadn't received many responses a month later. Early in July he planned to issue a questionnaire to vendors and users that he felt would generate more feedback.

It had better, according to some time-sharing users who feel their vendors will continue to be challenged by local standalone systems (i.e., the IBM 5100) unless standards are arrived at to make it easier for users to sign up with more than one operating system offered by these vendors.

—Tom McCusker

Government

SSA's Huge Systems Scheme

Agency to Spend $489 Million for One Goal—Survival

When the Social Security Administration talks about survival, it's dead serious. So serious that doomsaying SSA Commissioner James A. Cardwell has unabashedly declared that the agency "is in danger of being strangled by its own patched-together computer system." To loosen this death grip, SSA has embarked upon a monumental new systems scheme to completely overhaul its unwieldy dp set-up.

Pinning all their hopes on this path-finding project, SSA planners are cautiously charting their computer course into the late 1980s. The ambitious program that will take them there is being honchoed by the Office of Advanced Systems (OAS) which was set up in mid-1975 to brainstorm a new systems design concept. Specifically, the group "directs and conducts comprehensive, long-range process and systems planning efforts within SSA. It develops the goals, objectives, policies, standards, practices, and timetables for the SSA process and related systems of the future."

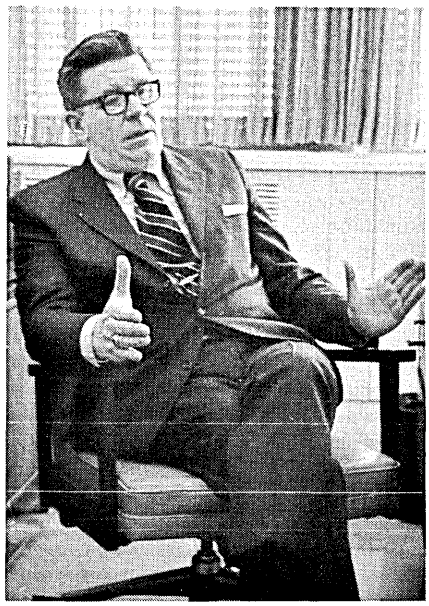
And behind all this frenetic planning and policymaking looms one goal—survival. OAS director Edwin R. (Ray) Lannon explains one reason why: "We have close to 400 active reels of magnetic tape. Now sooner or later, that one incremental reel is going to cause that house of cards to collapse. So we have to go to a direct access system as quickly as we can."

A significant part of SSA's trouble-ridden supplemental security income (SSI) system is direct access, but the systems supporting the regular Social Security programs still operate in a sequential, off-line, batch processing mode which "is not going to long endure," predicts Lannon. "It sounds alarmist," he confides, "but survival is the key to whatever we do."

$112 billion in payments

What's at stake in this struggle for survival is the agency's ability to dole out and process benefit payments which currently are running at 34 million per month and will climb dramatically to more than 50 million monthly payments within the next few years, according to SSA forecasts. In addition to payments to black lung victims, SSA administers five other main programs for which it maintains five separate data bases. These payment programs cover retirees, survivors of insured persons, disabled persons, people eligible for supplemental security income, and health care recipients. Total payment outlays for all these programs are $112 billion.

To handle this gargantuan workload, SSA employs some 88,000 people scattered throughout its 3,400 nationwide service sites. It also uses plenty of computers, 49 to be exact. The bulk of the mainframes, 37, are installed at the agency's main facility in Woodlawn, Md. These central cpu's include: six IBM 370/168s; two 370/165s; 13 360/65s; 10 360/30s; two Univac 1108 multiprocessors; and two Univac/RCA Spectra 70/35s.



EDWIN R. LANNON
"We can't afford to screw up. There's just too much at stake."

Under the new system shakedown, only the 168s will be "salvageable," according to Lannon. These six mainframes, he explains, may serve "as the nucleus of the new system," but he adds that these computers still "will not give us enough horsepower to do the job. Just to keep the existing system going between now and 1981," he contends, "we're still going to have to pump in about $125 million—some of which will go for mainframe-type hardware." Current SSA estimates target OAS project development costs at $489 million. According to SSA claims, this figure represents a cost savings of $114 million over the current system which, if continuously patched, would run $603 million.

Cost is a major factor in SSA's operation. One of the main goals of the OAS undertaking is to trim these escalating expenses. These cost considerations are part of the broad overall objectives which are spelled out in its original mandate: "To design and develop a process which will serve SSA through the 1980s and which will maximize efficiency, curtail constantly increasing personnel requirements and administrative costs, improve service to the public, and maximize the utilization of the most advanced technology."

Security safeguards

To implement this general goal, the OAS team has established several fixed requirements for its future system. In designing this revamped system, OAS is stressing, among other things, the need for confidentiality of client data and security safeguards for equipment, records, and data bases.

The OAS staff also has formulated service objectives for the new set-up aimed at squelching criticism of its public contact policies. Under the new proposal, a client will be treated as a "whole person," potentially eligible for more than one benefit program. To achieve this, SSA eventually will integrate all five of its data bases. Also as part of this image improvement drive, SSA hopes, with the help of the new system, to reduce errors, speed up processing time for major public services, and get into a direct deposit (electronic funds transfer) program.

These service improvements will naturally necessitate major operational and organizational overhauls. Organizationally, the OAS plan calls for enhanced telecommunications capability at the field unit level and the use of keying centers for high volume data entry. In the operational area, OASers see the need for "substantive redesign" of all the SSA data bases. This redesign will provide on-line data base access, real-time processing when needed, and hopefully eliminate the agency's heavy reliance on hardcopy files.

To fulfill these project goals, the OAS staff will be working in four phases into

1983 when the totally integrated system should be ready to roll. But OAS leader Lannon admits there may be a one to two-year slippage on that deadline. He also candidly admits that the system design overhaul will be "a lot of work." And that's an understatement.

The massive undertaking also will entail massive manpower. Currently, the OAS staff consists of 100 full-timers, which is expected to expand to 300 when the project hits its peak in the next few years. About 900 additional project personnel, made up of outside contractors and programmers from other SSA branches, also will add significantly to this work force. Lannon notes that the exact mix of insiders vs. outsiders hasn't been determined yet, but he hints that there may be more emphasis on outside contractors.

SOCIAL SECURITY ADMINISTRATION'S WOODLAWN, MD. HEADQUARTERS

Validation group

The OAS staff will be broken down into various divisions, the last one to operate at full strength being the validation group which will come onboard after the programs have been tested and debugged to make sure the system is producing the same results as the old system. When the system is finally operating effectively the office will "revert to some sort of permanent, long-range planning activity, gearing up for the next systems effort," says Lannon. He speculates that by 1985 this group would have a staff of about 50 people. Other SSA watchers claim that this stripped down OAS organization should be prepared to continually make changes, not just every 15 years or so when SSA is under the gun. "It wouldn't be a patchwork system," insists one observer, "if they implemented changes on a modular basis and did continuous planning."

But right now, the OASers seem too embroiled in their current system design effort to worry too much about future plans beyond 1985. What they will be facing within the next year or two are some crucial hardware decisions. To help them in making these decisions, the office in the next six months will be letting a series of technology assessment contracts in various areas including data base management and telecommunications.

To pin down its hardware alternatives, OAS is monitoring the current state of the art in computer technology and keeping a watchful eye on prognostications for the future. But OAS boss Lannon emphasizes that the agency won't

be opting for "one of a kind" futuristic gear. "We need back-up to our system," he explains. "We can't take the degree of risk that some small outfit can. So we tend to be fairly conservative in our approach to hardware."

Bubbles and CCD's are out

In laying out some of the hardware choices, Lannon bluntly dismisses some of the more innovative mass storage technologies. "In the period in which this system will be put on the air," he declares, "we don't think bubble or charged couple device (CCD) memories will be available to us." Instead, he believes the system will primarily use disc storage with some tape for files where interaction is minimal.

Getting into other hardware characteristics, Lannon describes the future system as large scale, with fast response times and linked to a "rather complex telecommunications network." He also notes that the office is looking into having interactive prompting on the system which he says will necessitate "more intelligence in the terminals." None of SSA's current terminals have intelligence and are hooked to concentrators.

Under the new scheme, OAS wants to shove more intelligence into the terminal network which is expected to encompass up to 35,000 terminals in district branch offices. By 1983, SSA hopes to have the terminals in place. And also in 1983, the batch sequential files will become interactive.

Question of distribution

However, before any final hardware decisions can be made, there's one central and very sticky issue that has to be resolved this year so the group can move into the design phase of the project next July. The issue centers around how the 1.1 trillion byte data base should be distributed—centrally or decentrally. Up until recently, OAS has seemed to favor a centralized approach. One of the reaons, speculates one source close to SSA, is the $70 million investment the agency has already made in a centralized computer facility at Woodlawn.

But apparently OAS has had a change of heart. The once fixed requirement to center all processing operations at the Woodlawn headquarters has been dropped. "We're keeping our options open," promises top OASer Lannon. "I'm quite convinced," he contends, "that given the size of the data base, it would have to be distributed. But," he adds, "it could just be physical distribution as distinguished from geographical."

Part of this change of heart over the centralization conundrum can be attributed to the objective input of a group of friendly advisors. These advisors, 12 in all, are part of the SSA Data System Management Panel which is under the National Research Council of the prestigious National Academy of Science. The think tank panel, which was formally set up last November, was handpicked by the NRC. Loaded with top computer industry experts, the group is chaired by Dr. Louis Rader, former Univac president and currently professor of business administration at the Univ. of Virginia. Deputy chairman is Dr. J.C.R. Licklider, professor of electrical engineering and computer science at MIT. In addition to Dr. Willis Ware

Assist from National Academy of Science

In putting together its future system game plan, the Social Security Administration's Office of Advanced Systems is getting a helping hand from the National Academy of Science. The think tank team, part of the SSA Data System Management Panel, includes the following top dp execs:

Ted E. Climis
v.p., Development
IBM Corp.

Dr. Lee L. Davenport
president
General Telephone & Electronics

Dr. V.E. Herzfeld
v.p., Business Planning & Development
Sperry-Univac

Dr. Robert R. Johnson
v.p., Engineering Div.
Burroughs Corp.

Dr. J.C.R. Licklider
Professor, Electrical Engineering
and Computer Science
Massachusetts Institute of Technology

Billy B. Oliver
v.p., Engineering
AT&T, Long Lines Dept.

Dr. Louis T. Rader
Professor, Business Administration, Univ. of Virginia

Bert C. Roberts, Jr.
sr. v.p., Corporate Planning & Development
MCI Communications Corp.

Sam K. Smith
group v.p.
Texas Instruments

Dr. Robert L. Sproull
president
Univ. of Rochester

Dr. Willis H. Ware
Corporate Research Staff
Rand Corp.

E. James Young
v.p., Management Service
Dept., Equitable Life
Assurance Society of U.S.

HELPING HAND: From left, Dr. Robert L. Sproull; Dr. Louis T. Rader; R. V. Mrozinski; Dr. Lee L. Davenport; James B. Cardwell, Commissioner of Social Security; and Edwin R. Lannon, director of the agency's Office of Advanced Systems. Sproull, Rader, and Davenport serve on the National Academy of Science's advisory panel. Mrozinski is the panel's chief staff officer.

of Rand Corp., the illustrious panel includes dp company executives from IBM, Sperry-Univac, AT&T, Burroughs, GT&E, Texas Instruments, and MCI Communications Corp. (See panel.)

Designed to provide an overall assessment of OAS project plans, the study group has held three meetings of the full committee as well as various task force meetings. (There are three task forces on privacy/security, district office operations, and special operations.) So far, Lannon maintains, OAS' relationship with the NAS advisors has been "excellent. It's a good healthy relationship," he insists. "They're not patsies. You can't snow them, so we don't even try."

R.V. Mrozinski, the panel's principal staff officer, echoes Lannon. "These (panelists) are all sharp cookies," he acknowledges. "I think it's going beautifully . . . Our panel members seem to really be digging into lots of details. They're visiting Social Security offices throughout the country. And they seem very interested in doing a good job."

The NAS group, which issued its first report on the OAS operation last month, is expected to come out with follow-on reports as the project progresses. So far, the panel seems in general support of the OAS effort to date, but they still want to probe the centralization/decentralization issue.

The one-year NAS contract for the panel runs out in November. Lannon hopes it will be renewed. "I'd like to have them (the panel) with us until all the basic decisions are made—right up through the detailed design phase which will be between September and December of 1979," he affirms. As far as taking their advice, Lannon says that if the panel thinks a particular OAS strategy is shaky, then his staff will review it, taking into consideration the advisors' suggestions. "I have tremendous respect for these men," he avows. "I think they're among the best in the business. So if you vary from something they recommend, you vary at your own peril."

SSA also, of course, has a relationship with its umbrella agency, the Dept. of Health, Education, and Welfare. As at all levels of the bureaucracy, there's always a certain amount of friction between the overseer agency and its branches. This is also true of HEW and SSA, even though SSA has been operating under HEW's wing for over 20 years now.

HEW opts for decentralization

SSA, wanting to keep at arm's length from the big bureaucratic bosses at HEW, naturally has been reluctant to let the agency scrutinize too closely all the details of its OAS operation. As a result, some major bones of contention between the two mammoth organizations have cropped up over the centralization and cost issues. HEW all along has been urging SSA to adopt a decentralized, distributed processing approach. It also wants to see some firm financial figures on system costs so it can verify them. To a certain extent, HEW Secretary Joseph A. Califano's final decision on the OAS scheme hinges upon the cost estimate break-downs that SSA will be turning over to HEW. After this is done, OASer Lannon expects the project to get the green light from the agency.

Many government ADPers have watched with interest the overhaul efforts being mapped out at SSA. One federal dper, who's been closely following the OAS operation, hopes the planners will reconfigure the whole SSA process. While the "concept they're approaching is a sound one, I'm concerned," he stresses, "that they don't blow this opportunity through traditionalist thinking —that they don't take the easy solutions in trying to come up with a future system, and that they don't deal just in improvements and procedures. Instead, they should really think about the way the system works, not just the computer system, but also the way the Social Security system works so they can go back to its roots and change it."

Another OAS follower is equally adamant: "It's an opportunity that SSA can't afford to screw up because they won't have another chance like this for 20 or 30 years." OASer Lannon agrees. "We have to be successful," he declares emphatically. "We can't afford to screw up. There's just too much at stake."

—Linda Flato

Service Bureaus

Palmer vs. Burroughs

Millions Were Awarded Him by Two Juries— And Now He's Broke

Seventy volumes of transcripts and depositions and three trials later, Leonard Palmer is broke and looking for work, in spite of the fact that two separate juries awarded him more than $3 million in damages in antitrust actions against Burroughs Corp.

Palmer, a one-time Burroughs employee, filed his first suit against Burroughs in March 1971. He believed, and still does, that Burroughs was in violation of the Sherman Antitrust Act in diverting its (Burroughs') customers to a third service bureau when it abandoned the service bureau business in the San Francisco bay area. Palmer, at the time, was president of a bay area service bureau called CompuTerminal Corp.

Following a five week trial which began in February 1974, a jury agreed with Palmer's allegations and awarded him $3.8 million in trebled damages. Federal Judge Stanley A. Weigel agreed that Burroughs was liable, but he didn't feel the liability supported the amount of damages awarded so he ordered a second trial on damages alone.

This trial began in October 1974 and lasted four weeks. Again it was a jury trial. This jury, said Palmer, "found for Burroughs on causation." It determined Burroughs' actions had not actually caused financial damage to CompuTerminal. Judge Weigel didn't like this decision either. He threw it out, ordered a third trial, and bowed out of the picture.

The third trial, presided over by Senior Federal Judge Charles E. Wyzanski, began Jan. 2, 1976. In February a second jury found in Palmer's favor and awarded $3.48 million in trebled damages. On April 28, 1976, Judge Wyzanski granted a Burroughs motion to set aside the verdict and ordered a new trial on Sept. 1, 1976. The judge couldn't make that trial date.

New trial date

In November 1976, pre-trial hearings were held. A new trial date of March 1, 1977, was set. In early January Judge

LEONARD PALMER
Five years of litigation

Wyzanski decided to reconsider all post-trial motions. In February the judge said in a letter that there would be no fourth trial, that he was rendering a final opinion that "not only did Burroughs not violate federal antitrust law, but also . . . nothing actually done by Burroughs was a cause of even nominal

loss sustained by CompuTerminal."

Palmer is appealing. His attorney, Joseph Alioto, son of the former San Francisco mayor, was expected to file a brief this month. But he's (Palmer) not optimistic. The judge's decision, he explained, was rendered in such a way as not to allow a simple reversal by an Appeals Court. A new trial would be required. "That could be two and one-half years away and who knows where all the people involved will be then. I'm not even sure I'd be available. They'll win by attrition."

If Palmer's current hopes are realized, he'll be back in the service bureau business by that time, probably in New York where he grew up.

He began his career in 1948, working for the state of California Department of Motor Vehicles as a decollator operator. After army service in 1950 and '51, he became a GS-5 project planner at the San Francisco Naval Shipyard, Hunter's Point. In 1955 he joined Dalmo Victor Co. as a tabulating machine operator and second shift supervisor. He rejoined the San Francisco Naval Shipyard in 1956 as an EAM supervisor. He trained there as a programmer for the Univac I.

He got into the service bureau business in 1958 as a salesman for the newly opened San Francisco branch of Statistical Tabulating Corp. In 1960 he was named western regional manager for Recording and Statistical Co., a subsidiary of Sperry Rand Corp. "I was the western region then," he quipped. "Our office was in an alley."

Liked the 1401

R & S was just starting to move into computers at that time, Palmer recalls. "I was interested in getting an IBM 1401 but was told I would have to wait a long time. A Burroughs salesman, Fred Meyers (still with Burroughs in an executive capacity), walked in off the street and I ordered a B 260 card system." Before he took delivery this was upgraded to a 280.

Palmer remembers that IBM suddenly found that they could find him a 1401 when it learned he'd placed an order with Burroughs. "I was treated to two lunches and offered a trip to view an installation in Hawaii."

The R & S western region, Palmer said, went from $15,000 per month to $90,000 per month in the three years he was there. "Burroughs was very interested in what we were doing and they sent some guys to look at our operation ... to possibly recommend a service bureau activity for Burroughs."

In late 1963 Burroughs hired Palmer as national director, service center market activities. "Mostly I just responded to salesmen's calls, but I actually sold some computers." Also, because his responsibilities weren't all that clearly defined, he spent time putting his ideas about service center management down on paper. Burroughs published these in what has become an industry manual, "Service Center Organization and Control."

Palmer's next career move actually started with a trouble call from a Burroughs salesman in Greensville, S. C. Seems a small service bureau in Ashville, N. C., was loosing money. "It was owned by a very wealthy guy, Dr. Logan Robertson. I suggested that they go national, start a national network in a small way by acquisition, and this preceded the heyday of acquisitions."

Somebody to do it

They had the money to do it, wanted to do it, and all they needed was somebody to do it," Palmer said. He thought he'd found that somebody in the person of Ray Johnson, president of Systems Data Processing, a Sacramento, Calif., service bureau.

"Ray and I talked about it at an

(Continued on page 149)

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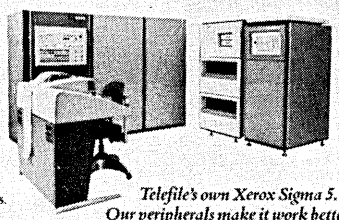

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REST OF WORLD

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Taiwan, Taipei	7812131-5
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news in perspective

(Continued from page 144)

ADAPSO (Assn. of Data Processing Service Organizations) conference in Portland and we flew directly from there to Greensville where it was agreed Ray would become president of the new organization. It was named Computer Servicenters, Inc., and was to be a service center holding company.

However, before things really got going, Johnson dropped out, so Palmer resigned from Burroughs and became president. During his tenure CSI grew from one to nine service centers in the eastern and southeastern U.S. and from $200,000 to $3.5 million in annual business.

"CSI went public in 1968 and the initial investors, on paper, made a profit of $7 million."

Palmer, in 1968, was "waiting for a high speed line printer that could be used on telephone lines. The first one announced was Univac's DCT 2000. I got the number four machine."

Slow but it worked

This, in a way, was the beginning of CompuTerminal. Palmer, with the aid of a CSI employee, Ace Grove, experimented in using the DCT 2000 for remote batch work in internal accounting. "It was slow but it worked, and I knew something faster would come along."

It was with this in mind that Palmer founded CompuTerminal. His aim was a large remote batch network but he began with a conventional service bureau operation. "All the initial investors in CSI became investors in CompuTerminal, and many of the people who worked for me at R & S came to work at CompuTerminal."

In the meantime, some changes had taken place at the San Francisco office of R & S. Jim Lowe, whom Palmer had hired to replace himself when he joined Burroughs, was still there, but the office had branched out into offering on-line service to savings and loans. And, in 1967, Burroughs had bought the operation from Sperry Rand.

"They (Burroughs) didn't pay anything for the business," Palmer said, "only for the equipment. There were actually two businesses, the on-line and the conventional stuff and I knew they weren't going to keep the conventional stuff."

Palmer said he had his first run-in on an account with Burroughs in November 1969. "It's deadly to compete with the manufacturer of your hardware. Burroughs salesmen were badmouthing our equipment. We had one B 2502 and they had two B 300s."

Burroughs decided in that same month to drop the batch business. "They lost three big accounts to us with no solicitation on our part." Palmer said Burroughs decided they'd better sell their batch business before they lost it. In January of 1970, he said, they "went out to scout, to dig up competitive bids to bring back to Palmer." He, he said, was the logical buyer.

Purity Food Stores, a California supermarket chain, was in the throes of diversification at the time and its dp operation had just begun offering service bureau services under the name Cubit. Palmer said Burroughs told him Cubit offered $150,000 for the Burroughs batch business. This was in March 1970. Palmer was interested in meeting the offer. "It would have meant something like $400,000 per year in revenue for $150,000."

He said he agreed to the deal at a lunch meeting at which his board chairman was present as was L. O. Browne III, a Burroughs executive who was to become a major witness in Palmer's later litigation. "The additional $400,000, added to the $400,000 we already were generating at the time, would have put us in the black," Palmer said.

> **"It's deadly to compete with the manufacturer of your hardware. Burroughs salesmen were badmouthing our equipment."**

"I asked to look at their contracts (with their customers) and was shown a sample contract form. When I explained I meant executed contracts I was told they were back at the office. Turns out back at the office meant Detroit."

Palmer said he wrote up an offer subject to customer ratification of the transfer of the business. In the meantime, he said, Burroughs continued to talk to Cubit. Cubit added an offer of $107,000 for one of the B 300s which, Palmer said, was fully depreciated, "and that ended me."

There was a clause

Burroughs signed an agreement with Cubit on April 18,1970. Palmer said the arrangement included a clause that said Burroughs had to deliver a minimum number of accounts or the deal would be off. Another clause said that the less Burroughs delivered the less Cubit would owe.

Palmer said the contracts which Burroughs had with their customers had all been signed by the customers at that time but not by Burroughs and "each contract had a clause saying 'subject to

approval by Burroughs Corp. within 30 days' or the contracts would be null and void." Palmer said the contracts were negotiated in January and not signed by Burroughs until June. "Some," he said, "were back dated to February."

Palmer contends that Burroughs and Cubit, after signing their agreement, pressured the Burroughs customers to go to Cubit, partly by bad-mouthing CompuTerminal in a way which had far-reaching effects. A big order for 40 Burroughs B5500 computers and a large number of University Computing Corp.'s Cope terminals had fallen through when CompuTerminal lost its financial backing for the planned remote batch network. "We were fully prepared to continue conventional batch," Palmer said, "but they used this to make it sound like we were financially unstable."

Palmer said CompuTerminal only needed another $6,000 to $7,000 per month in business "to survive this mess, but from April on we never made another sale. I knew something was wrong but I didn't know what. I never contended that, with the absence of Burroughs, we would have been a big success. No one can say. I do feel we had a right to fail or succeed on our own merits."

Sent to Detroit

Palmer reorganized his company in July of 1970 into Palmer Data Corp. In late 1970, prior to the filing of the first suit, he filed a complaint which was sent to Burroughs in Detroit. "Their response was to come out here and take the computer out."

In April of '71 Palmer sold what was left of the service bureau business to Tele-Com, a subsidiary of U.S. Leasing. "All employees retained their jobs," he said, "and every creditor except Burroughs got paid 100 cents on the dollar." In September of 1972, he said, "Burroughs petitioned us into bankruptcy." It was the trustee in bankruptcy for the corporation, Edward Walsh, who actually brought the court actions against Burroughs.

Today, Palmer Data's gone. CompuTerminal is gone. Tele-Com is gone. Cubit is gone and so, apparently are Leonard Palmer's hopes for getting any satisfaction from Burroughs.

What's left are the 70 volumes of transcripts and depositions and Palmer's belief in the future of the service bureau business. He wants back in. And he's writing a book on his experiences in the litigation, an activity which consumed most of his time over the last five years and left him broke.

—Edith Myers

Word Processing

Big Fish See it As a Marriage

Some hard evidence has emerged recently that the long projected marriage between word and data processing may become a reality sooner than anticipated. Witness:

—The most recent DATAMATION executive computer user survey indicated dp management is playing an increasingly active role in hardware, software, and design decisions for word processing systems employed by both dp and other end user departments.

On the vendor side:

—Digital Equipment Corp., as an example, just jumped head first into the wp market with the announcement of its VT78 system, a crt-based, standalone wp station driven by an LSI version of DEC's PDP-8. Significantly, the product will be marketed by DEC's PDP sales force as well as its wp group. "We at Digital . . . recognize the fact that word processing and data processing are complementary subsets of . . . information processing," Jack Gilmore, product line manager for DEC's wp Computer Systems Group, says. "We've definitely taken the plunge."

—Further, Wang Laboratories recently has installed systems incorporating its wp and small business (Wang's 2200) equipment. It's accelerating activities in this area while moving full speed into forms processing, a technology that Carl Masi, the company's director of computer product marketing terms, "a marriage of both word and data processing."

—In addition, IBM, which has traditionally gone after the wp market through its Office Products Division, now has its General Systems Division pushing System/32s with wp capability. Perhaps more significantly, the giant's Data Processing Division just made its first foray into a wp show (Synoptican V held last month in Portland, Oregon) with ATMS (Advanced Text Management System). Some industry observers read this as an indication that dp may be making a move to go after the upper end (a user needs at least a 370 to run ATMS) of the word processing market in a big way.

Systems-oriented selling

Equally as important, many vendors are now taking a dp approach towards selling wp.

Even IBM's Office Products Group has realigned its sales force into two

groups, one for traditional office equipment sales and a second systems-oriented group to handle wp.

"You used to find office products people selling word processing the same way they'd sell typewriters or calculators," says Larry Matte, a Burroughs dp alumnus who recently came to Olivetti Corp. of America as marketing manager. "That was features-oriented selling, but now we've become systems-oriented, selling solutions and not the fact that this or that typewriter may have a nicer touch."

"Today out of every 10 proposals, seven go through the dp department."

Concurrently, an increasing number of dp people are being brought in on wp buying and wp systems design and implementation decisions. "Today out of every 10 proposals we make, seven go through the dp department or involve an evaluation by people with dp experience," says William B. Mahony, a v.p. with Bowne Time Sharing.

"Once we were seeing only office people," Frederick A. Wang, wp program director with Wang Labs, observes. "But now in the larger companies we're going to the dp group and frequently the office manager now comes from a dp background."

DATAMATION's user panel study bears this out. Based on just over a 50% response on this magazine's 465-member panel, one out of every three computer sites reporting now say their dp departments are directly involved in wp activities and 72% of the departments involved are using, or planning to use, wp within their own departments. The remaining 28% are being brought in on wp activities outside the computer room.

Most, 71% in fact, of the applications for wp in dp departments relate to documentation and text editing, with the balance concerning business and form letters.

"What's happening is that top management in the larger companies is concerned that two separate empires (wp and dp) might be established, and they've set up task forces involving people from both sides to see what can be done to bring about the best cost efficiencies for the entire organization and eliminate redundancies in instances where the same equipment could be shared," Amy D. Wohl of Datapro Research Corp. believes.

Like dp and communications

Others in the field, like Elias D. Spater, product manager for Redactron

Corp., liken recent developments in the dp/wp field to what went on with dp and data communications a few years ago. "Those areas used to be autonomous and they were forced together. A similar thing is happening in these two fields—and for many of the same reasons."

For whatever reasons, however, the dp/wp convergence has clearly moved beyond the theoretical stage. "Some of our larger customers already see ways in which they could write specifications or do programs themselves to bring about the merger," says IBM's Bethke. "And they have very definite ideas of how it should be done."

Communications problem

Still, a number of problems persist that must be overcome before any meaningful merger between the two fields can really take hold. Bowne's Mahony points out that most of the wp systems today aren't compatible in terms of communications protocol. And as another industry observer points out: "Communications is the real key to tying the two areas together. It's absolutely critical."

Wohl of Datapro underscores the fundamental differences that persist between the flexible office environment in which jobs are often performed in any particular order, and the more rigid computer room environment where job sequence is essential to batch work. Before the office can really be an extension, in whatever form, of the computer room, it must accommodate itself to the more rigid dp disciplines, Wohl believes. And that can only happen at the insistence of top management, no matter what type of system is installed.

And Edward Rosen, a v.p. with Vydek, Inc., asserts that dp types must

NEW APPROACH: William B. Mahony, v.p. of Bowne Time Sharing, left, Larry Matte, marketing manager of Olivetti, and William C. Bethke, of IBM. All see a convergence of dp and wp, especially in communications-oriented applications.

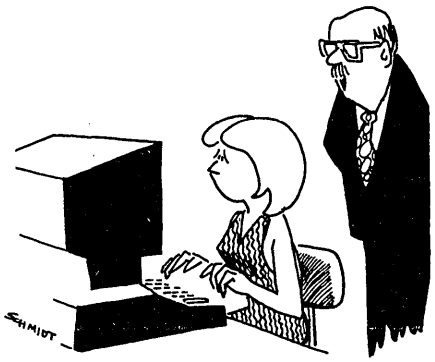
take the time, as well as make the effort, to understand the unique problems of wp before trying to put together any kind of hybrid system. "If someone from dp goes ahead and unilaterally says, 'This is how it's going to be done,' it's simply not going to work," he notes. "Number crunching isn't the same thing as word crunching."

Then, too, with the big rush by manufacturers to capture increasingly bigger chunks of the wp business, there's understandable confusion on the part of users as to which approach offers the best solution for merger. IBM, for example—and it's certainly not alone in this among the vendors—may have all of its divisions going after the same account with alternative wp proposals. And they could conceivably be talking to entirely different entities within the same organization.

"That's one of the reasons we set up a word processing task force," says a systems executive with a major insurance firm that's going to use wp as the basis for an electronic mail system with dp capabilities. "We were getting so many different proposals at so many levels, you needed a scorecard to keep track of the players."

Given these restrictions, many observers see the wp/dp merger as it's now shaping up on a limited, selective basis.

William C. Bethke, v.p., field operations, for IBM's OP Division and himself an alumnus of the company's DP division, sees large businesses with a need for multilocation records processing and electronic mail capabilities as being the pathfinders in dp/wp merger activity. "These kinds of communications-oriented applications are where a merger is most logical," he explains. "With high speed communications capabilities that exist today, the document's length is immaterial."



"... so you're the one who's trading recipes with the girl at the Dayton office ..."

Fred Wang of Wang Labs has a slightly different view. "You won't see the kind of total integration in which one large machine is doing everything at once, but you will see more sharing. Word processing systems are growing and growing with more discs, terminals, and the like, and with a small business system hooked into this system, dp and wp can share these facilities."

"But," interjects Carl Masi, Wang's computer marketing counterpart at Wang Labs, "the wp person will be doing 80% word processing at his own station, and will use the business system perhaps 20% of the time for things like cross-footing and sorting. And it's the reverse with the person at the small business system."

That's more or less the same message DEC was conveying to the user in its 78 announcement: flexibility of approach, selective integration, shared facilities. And those are probably the areas on which the dp/wp merger will find its firmest ground.

Finally, as the merger takes effect the traditional wp manufacturers, many of whom are relatively small concerns, can't help but start looking back nervously over their shoulders as more and more big fish like DEC and possibly IBM's DP division jump into the pond.

—Laton McCartney

news in perspective

Electronic Mail

A 'Conspiracy' to Turn the Mails Back to Private Enterprise

Some disquieting clouds have arisen, genie-like, from a recent federal study which recommends that the U.S. Postal Service (USPS) develop an electronic communications system to distribute the mail.

The study, conducted by a specially appointed Congressional commission, says the Postal Service should undertake joint ventures immediately with communication carriers and/or suppliers of computer-based message transmission services. The basic idea is to combine their facilities with the postal system's "unique collection and delivery network" and arrest the rapidly mounting USPS deficit. Also, the study commission wants the USPS to decide "as soon as practicable" whether it will develop a completely electronic mail distribution network as a long-term objective. "We recommend that Congress set April, 1979, as a time limit for announcement of this decision."

At hearings held recently by two subcommittees of the House Post Office Committee, some of the experts who helped the commission reach these conclusions shed further light on them. Drs. Joseph Margolin and Fred Wood, of George Washington Univ., suggested that an "electronic mail box" would be one offering the Post Office could market cooperatively with private industry—i.e., a computerized file in which individuals could store messages on-line for later retrieval, also on-line, by the recipients. Another example was a computerized mass mailing service; the Postal Service would receive the input in digital form from a direct mailer, convert it into hard-copy letters, address, and deliver them.

Be more competitive

"There is a lot of communication between computers that amounts to message (i.e., mail) transmission," added Dr. Wood. "Obviously, many . . . corporations resorted to their own communication systems for a number of reasons, including disillusionment with the Postal Service. By making use of electronic technology, the Postal Service could perhaps be more competitive and . . . reduce the diversion of business to these kinds of systems."

All of the above examples involve services which commercial suppliers are already providing, or are capable of providing, on their own. As Henry Geller, former general counsel of the FCC, pointed out, "Congress has deliberately decided to rely on private enterprise to serve the needs of the public for transmission of intelligence by electrical means." So, if the USPS does become more "competitive," it's virtually certain to stir up a hornet's nest of opposition from private suppliers.

Geller contended that the USPS can't win this political battle and furthermore lacks the technical capability to compete successfully with commercial vendors in the marketplace. Therefore, the agency must accept the loss of a substantial part of its present first-class mail volume (the most lucrative part of the business) and begin planning now to scale down its workforce and physical plant accordingly.

Not everyone agrees, however, that the Postal Service could survive such a cutback.

The Commission on Postal Service, in its recent report, estimated that if present trends continue, about 23% of the nation's first-class mail will be distributed electronically by 1985. Commission Chairman Gaylord Freeman, who was among those appearing recently before one of the House subcommittees, said that unless the USPS "finds dramatically new methods of combining its delivery system with some form of electronic communication, it will inevitably suffer such volume and revenue losses that services (will have to) be drastically reduced." Under such circumstances, the agency "couldn't survive in its present form."

It's doubtful that Congress would allow that to happen, considering the number of voters who depend on the present mail distribution system and the probability that their needs, in most cases, won't be satisfied by on-line systems for many years. One witness at the recent hearings—Roger K. Salaman, chief of the policy research division of the Office of Telecommunications—summed up this point succinctly when he said "traditional hard-copy delivery of mail must be maintained."

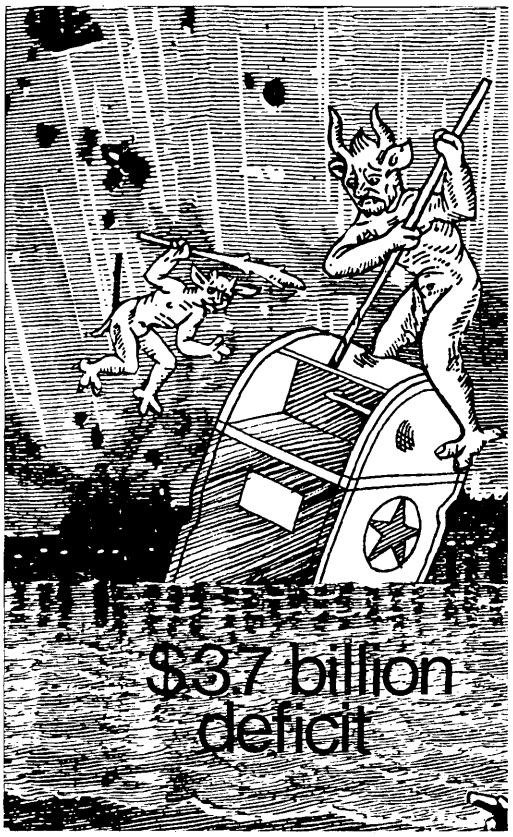
A key question

How to do this without restricting the options, and potential profits, of commercial telecom service vendors, is the key question. "Some have suggested that the survival of the Postal Service depends upon extending the postal monopoly to include electronic messages," Salaman explained. "However, one must question whether the postal monopoly should be extended into a market already actively served by competition. Furthermore, there would certainly be difficulty in defining the boundary of such an extended postal monopoly."

A friend in Bailar

The commercial suppliers' best friend in this battle is Postmaster General Benjamin F. Bailar, who told the Wall Street Journal that "the electronic network is a fundamentally different business, where we have nothing special to offer. If we jumped in, we'd be acting in a predatory manner and I don't think the government ought to do that." One result of this philosophy is that the postal system's R&D expenditures amount to only 0.05% of its budget, far less than what most companies spend.

Others within the USPS are pursuing a radically different path, however. Among those who appeared at the recent hearings was Assistant Postmaster General John G. Wise and his deputy, William G. Miller. They reported that



THE BATTERED U.S. Postal Service, already facing an accumulated deficit of $3.767 billion at the end of FY 1977, will become more competitive by going to electronic technology. But that is certain to stir up a hornet's nest of opposition from private suppliers.

since 1974, the agency has been engaged in an intensive R&D effort aimed at specifying an "electronic message service system" (EMSS).

Next month, reported Wise, three candidate EMSS configurations will be selected. Each will then be "subjected to a detailed economic analysis" and "at this point next year," the agency's front office will be given the results. The next step will be to decide what sort of EMSS, if any, to implement.

Among the options being considered by the Postal Service R&D staff are: direct input of letter-type messages from tape, cartridge, facsimile, and keyboard-actuated terminals, and direct output to data terminals, located on the patron's premises, that would record these messages on tape, microfilm, paper, or crt screens. Satellite transmission between entry and exit post offices is "likely," although "this is not the only approach to be considered," said Wise's deputy, William Miller.

Contracts already have been awarded to develop prototype EMSS equipment. Pitney-Bowes is working on high-speed printing and paper-handling devices, while Fairchild Camera and Instrument Corp., along with the Naval Electronics Laboratory Center in San Diego, is developing a high-speed optical scanner. A.D. Little is analyzing the market for EMSS on a continuing basis and assessing the technology for usable ideas. (Independently, Quotron has developed an electronic mail system for Cook Industries of Memphis, and has it up and running–June, p. 15.)

What happens next year when the EMSS package is dumped on the desk of the Postmaster General for a final decision probably will depend, to a great extent, on what happens in Congress between now and then. This helps explain why the recent House hearings were held at this time. (More are coming, according to a staff member.)

Contracts already have been awarded to develop prototype EMSS equipment

Want it modernized

One discussion was conducted by the subcommittee on postal operations and services, whose chairman is Rep. James Hanley (New York). The other hearing was conducted by the subcommittee on postal personnel and modernization; its chairman is Rep. Charles Wilson (California). Both legislators want the Postal Service to modernize, and Hanley has indicated clearly that he believes the agency has the authority to offer at least some services now being provided by commercial suppliers.

The USPS, rather than Western Union, should be offering Mailgram service, said Hanley during the hearing, adding that if the Postal Service had moved into this market before WU, the postal deficit now would be significantly reduced. "It is very distressing that the present Postal Service does not see the need to put greater emphasis on research/development of new electronic mail services," he said in his opening statement. "Postal officials believe their . . . priority should be improved mechanization in existing plants. However, if the Postal Service allows the private sector to fulfill the (demand) . . . is that decision going to cast a very dismal mold for the nation's future mail service?"

Hanley made it clear that the answer to this question is "yes" as far as he's concerned. Rep. Wilson added that he "is very much in agreement with Mr. Hanley insofar as the failure of the Postal Service to do something substantial in this field . . . If they don't do some-

thing substantial, we could lose our postal service."

One way the USPS might stave off the impending disaster is by interpreting the Private Express Statutes more broadly. Hanley indicated as much when, during the hearings, he observed that the Postal Service could be doing "more" under these laws. Basically, the Private Express Statutes confer upon the USPS the exclusive right to carry letters for others over postal routes.

" . . . The most effective form of electronic mail is the telephone call."

Rep. Lionel Van Deerlin (California), who heads the subcommittee now considering the Consumer Communications Reform Act (CCRA) opposes any broadening of the Private Express Statutes, however. "Any extension . . . to 'protect' the postal service from the competitive effects of electronic funds transfer or electronic mail could . . . cause grave harm to our domestic telecommunications industry," he told Hanley's subcommittee. "Many current carrier offerings, including TWX/Telex, Dataphone, Transaction Network Service, and all services of Graphnet, Telenet, and Tymnet, would necessarily collide with expanded private express statutes. The most effective and important form of electronic mail is, of course, the telephone call."

Henry Geller, the former FCC general counsel who's now with the Aspen Institute, pointed out that the statutes, as currently interpreted by the USPS, do not cover keyboard-entered messages transmitted to the recipient in binary bit streams, but do cover certain facsimile messages. Graphnet, he reported, has been asked to pay postage on many of the fax messages now coursing through its network. Geller thought the Private Express Statutes should be "reconsidered" by Congress.

It's hard to believe that the Postal Service will be allowed to abandon EMSS, after investing three years and several hundred thousand dollars in the project to date. It also appears likely, if not probable, that Rep. Hanley and/or Wilson will try to strengthen the competitive position of the Postal Service. One obvious way is by amending the Postal Express Statutes to show clearly that the USPS has sole authority to deliver newer forms of "letters," such as facsimile. Alternatively, commercial fax services could be allowed to continue, provided they or their customers paid postage on each message sent.

Tough to oppose

Opposing such legislation will not be easy. The USPS expects to rack up a loss of nearly $1 billion this fiscal year, on total operating revenue of about $13 billion. And as the Commission on Postal Service points out in its recent report: ". . . progress toward self-sufficiency has fallen far short of the expectations of Congress when it enacted the Postal Reorganization Act in 1970. Despite three substantial rate increases in five years, (federal subsidies) of $1.2 billion, and large borrowings, the Postal Service faces severe liquidity problems . . . " The agency's accumulated deficit, at the end of fiscal '77, according to the report, will total an estimated $3.767 billion.

Thus, any proposal that holds out hope of stanching the flow of red ink will be particularly welcome.

There's also the Postal Service constituency to contend with—the patrons and the employees. Both groups are well-organized. And, because postal rates and postal pay have been subject to Congressional oversight for many years, the user organizations and the employee unions have developed influential friends on the Hill

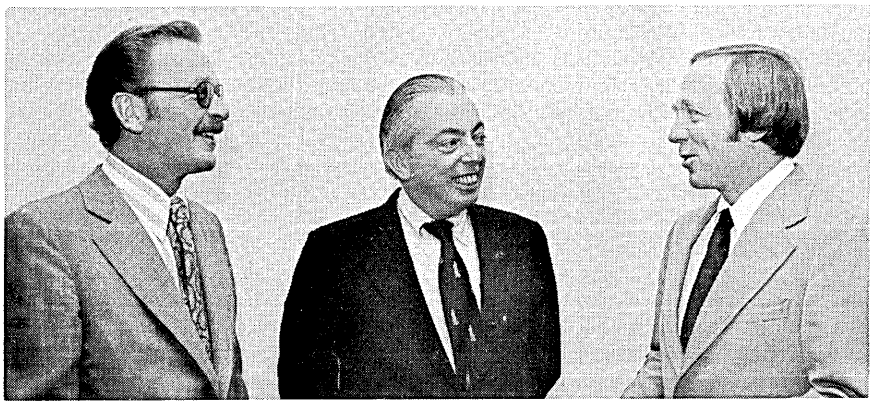
One indication of how these groups feel about electronic mail delivery is the recent comment of postal union leader James La Penta; he said it represents "a conspiracy to turn the mails back to private enterprise."

—Phil Hirsch

(Mr. Hirsch, a frequent contributor to this magazine, once was its Washington editor specializing in communications related affairs).

News in Perspective
BENCHMARKS . . .

Marketing Shifts: New marketing structures seem to be the in thing in the non-IBM segment of the computer manufacturing industry. At least both Burroughs and Honeywell are doing it. Burroughs changed the top command of its Business Machines group, its domestic computer marketing operation. James McCullough, who had carried the title of corporate excutive v.p. was put in charge of the group replacing Ben L. Rouse who, at writing, was awaiting reasssignment. Honeywell Information Systems divided its centralized end user sales and marketing force along user product lines, splitting the organization into four groups. Two already existing groups will handle national accounts and federal systems. Two new groups will handle large and medium-to-small systems. The reorganization involved appointment of two new v.p.'s, Richard G. Meise, director of medium and large scale systems in 12 central states, and Joseph P. Roebuck, covering 15 western states. And Univac's executive v.p. for worldwide marketing, Harry A. Steinberg, announced his resignation from the company effective July 31. He'll be replaced by Joseph J. Kroger, v.p. and general manager of Univac's Americas division. Steinberg, 57, took the top marketing spot in February 1973 after serving as the company's v.p. and controller. In that financial post, he put together the deal to buy the user base of RCA Corp. after that company decided to quit the computer business. A year later, Kroger, his 43-year-old successor, characterized the acquisition in an interview as "the buy of the century.



TWO NEW HONEYWELL V.P.'s, Richard G. Meise, left, and Joseph P. Roebuck, right, confer with Richard R. Douglas, v.p. and general manager of Honeywell's U.S. computer marketing division shortly after their promotions, part of a redirection of Honeywell's marketing efforts.

New Amcat Owner: Datatrol, Inc., a subsidiary of Applied Devices Corp., acquired the Amcat product line of terminals from Addressograph Multigraph, which will be added to the company's other terminals and systems for retail point-of-sale, credit authorization, check guarantee, and others. Some 5,000 Amcat terminals have been installed by some 30 major users, including American Express Co., First National Bank of Atlanta, Continental Bank of Illinois, Bank of America, and California Federal Savings and Loan. Addressograph Multigraph pulled out of the business because it said it found it to be unprofitable. It will provide support services to Datatrol during a transition period of an undetermined length, and there will be a two-year deferred payment of an undisclosed amount of cash.

Time Running Out: Two years ago the president of Benrus Watch Co., Victor Kiam, II, said, "I think the prices in the digital watch business are going to be so low that they will floor everybody." Last month, Benrus pulled out of the market, posting a loss of $7 million. It will concentrate on conventional analog watches. It was the fifth casualty in as many months, the previous casualties being Litronix, Armin, Gruen, and Gillette. Others are reporting losses and Timex is relocating its watch-making facilities offshore so that it can remain in the price cutting war.

New From IBM: IBM introduced the IBM 6240 magnetic card automated typewriter which uses a "daisy" print wheel which operates at up to 55 characters a second, instead of the rotating "golf ball" mechanism used on a previous model with a speed of 15 characters per second. The daisy-wheel subsystem is being bought from Qume Corp., Hayward, Calif.

Varian Acquisition: Sperry Rand's Univac Div. completed its previously announced acquisition of Varian Data Machines, paying an estimated $25 million for the Irvine, Calif., minicomputer manufacturer. Varian, which had sales of under $40 million last year, will be operated separately in Irvine and not as part of other Univac operating divisions, although it will be headed by John F. Horton, a Univac v.p. in charge of new marketing ventures. Donal Duncan, head of the Varian Associates subsidiary, will not join the approximately 1,000 Varian employees going to Univac. He'll remain with Varian Associates as president of the company's Information Systems Group and a v.p.

Green Light for Compucorp Plan: Compucorp, Los Angeles producer of programmable calculators which filed bankruptcy proceedings late last year, has been released from Chapter XI following approval by creditors of a reorganization plan. Major creditors are Litton Industries, which bought and sold Compucorp products, and Security Pacific National Bank. Litton stopped buying from Compucorp last October. Elmer R. Easton, founder and president of Compucorp, said the firm now has 28 employees and is completing new products to be introduced this year, including a desktop computer system with 65K of core memory to compete with small business offerings by Hewlett Packard, Wang Laboratories, Olivetti, and IBM. Compucorp plans to have its own marketing and distribution network, he said.

Conviction in Paper Case: Eugene Corey, central figure in a paper products ploy (March, p. 148) alleged to have defrauded Hartz Mountain Corp. of more than $75,000, was convicted by a jury of bribery fraud after a five day trial in New York. John P. Cooney, Jr., the assistant U.S. attorney who prosecuted the case, said evidence established that Corey defrauded the pet foods concern by having the company pay more than $200,000 for shipments of paper products it hadn't received, receiving more than $75,000 in kickbacks for doing this. Corey was v.p. of Hartz' data processing department. Hartz initiated the investigation of Corey when he elected to take early retirement at the age of 51 in April of 1976.

DEC Sues EM&M: Digital Equipment Corp. charged Electronic Memories & Magnetics with violation of four PDP-11-related patents in a suit filed in a Boston federal court. DEC's allegations cited EM&M's introduction of its PDP-11/34 emulator and said the California firm infringed two PDP-11 processor patents, one unibus patent, and one patent covering both. DEC is seeking a final injunction against further alleged patent infringement, an award of damages, an accounting of profits, and an assessment of interest and costs. No amounts were specified. The suit states the EM&M will make "unlawful gains and profit from the infringement." ❋

Commercial ECLIPSE Systems. Because a computer should be a vehicle for growth.

For most companies, buying a computer is a big step forward. So you want to be sure the computer you invest in will keep rolling with your company. That's why you want a Data General commercial ECLIPSE data processing system.

Our systems can be expanded in several directions at any time. For instance, as your transaction volume grows, you could move from two to eight, sixteen or more terminals. And as your files and records expand, you could add disc capacity from 10 megabytes and grow to over 1500 megabytes. And with our powerful communications capabilities, system configurations can range all the way up to a multiprocessor network with distributed processors as more applications are added.

Plus our commercial ECLIPSE data processing systems also work easily with larger commercial computers. They use the same high level ANSI '74 COBOL larger systems use, the same language your staff is already used to. So, even if you start with our smallest configuration, you're really beginning farther up the ladder than with any other small computer system.

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CIRCLE 28 ON READER CARD

LOOK AHEAD

(Continued from Page 16)
evidence that the certificate is gaining acceptance. Merton R. Walker, State Farm Fire & Casualty Co., Bloomington, Ill., v.p. of the Institute for Certification of Computer Professionals (ICCP) which prepares and promotes certification tests for computer personnel, said his company will pay a bonus to employees who pass the CDP test and the newly announced Certificate in Computer Programming (CCP) test which will be held next October (April, p. 178). Fred Harris, Univ. of Chicago, and past president of ICCP, said he knows of at least one instance at one of the eight major acounting firms where passage of the CDP test is a prerequisite for employment in its computer section.

JOTTINGS FROM THE NCC

The severe winter experienced this year in the East and Midwest has had an impact on data processing recruiting in the Southwest. Ron D. Anderson, Recognition Equipment Inc., Irving, Texas, told an NCC session on dp executive searches his firm is receiving an unprecedented 50 unsolicited resumes per week, mainly from people from the East and Midwest who want to relocate to the "sun belt."

Dr. Robert E. Rakel is a family practitioner who wants help from computers in the future but doesn't want to be replaced by one (page 132). "I envision a guy on a slab," he says, "being fed into a machine then coming out the other side while the machine's display flashes 'The operation has been completed.'"

A listener at an NCC privacy session who said he isn't impressed with the "high costs of mailing" arguments used by firms who are fighting privacy legislation suggested this way to get around these costs: "Suppose I give a firm a list of people and say 'I don't care if these people want to know about me but, if anybody else asks, let me know.'"

RUMORS AND RAW RANDOM DATA

Newly refinanced Cambridge Memories will offer three new product entries in August and September: an LSI plug-compatible memory for the DEC PDP-11 line, a "processor speed-up system" for the 370/158, and the industry's first 16 megabyte 370/158 add-on memory....Sometime before fall, Honeywell will offer their first ruggedized mini--the HIS model 6/36, manufactured at Billerica, Mass., and modified by the avionics division in St. Petersburg, Fla.....Laura Gibson, corporate computer operator at National Gypsum Co. in Buffalo, was married in late April to Erby Norris of National Gympsum's Huron Cement Div. in Detroit. Word got out the other day when it was learned their romance grew from daily voice communications over Codex modems installed seven years ago to allow Huron Cement's Univac 9200 to communicate with the Univac 1106 at Buffalo....California Computer Products, Inc. not only is expanding into the add-on memory business, it's also cutting back some lines. The man in charge of the cutback program said the other day its computer output microfilm business is among the cutbacks: "We don't sell viewers and we don't sell film. We were in the razor blade business and all we sold were the razors."....Computer lawyer Milton Wessel's book, "Freedom's Edge: The Computer Threat to Society," sells for $5.95, but friends can buy it at the author's courtesy discount of 10%--or so it seemed until Alan A. Benjamin, the head of Britain's Computing Services Assn., sent in a check for $5.35 (one-half cent below the discount price) and was told by the publisher, Addison-Wesley, it couldn't send him the book until it got an additional 1¢, which Wessel later paid by check.

Take an in-depth look at in-house timesharing:

You know the problems facing the data processing department:

Other departments in your company want faster response, broader capabilities, better service.

And your management wants you to hold down your operating costs.

You're probably looking hard for a solution. A closer look at in-house timesharing could give it to you.

Fast, long-lasting relief

Unlike upgrading a large central computer, expansion to an in-house timesharing system isn't a time-and-money-consuming ordeal.

And unlike buying outside computer time, you're not building in a monthly bill that inevitably keeps building up.

Adding an in-house timesharing capability is a shrewd way to add computer power. Because it won't add significantly to your operating costs; in fact, it can pay for itself by reducing current costs.

Especially if you add the system specifically built for timesharing: our BTI 4000.

A timesharer's timesharer

The BTI 4000 Interactive Timesharing System is made by us:

Basic Timesharing, Inc. We're the computer manufacturer with timeshare experience. Which has helped us produce a computer uniquely right for timesharing.

To help you do more—while helping your company spend less.

Easy to begin, room to grow

You can own your own BTI 4000 for as little as $35,950. For that you get a ready-to-go system with 10 megabytes of storage and 8 ports—just add terminals.

And start-up won't cause a departmental hang-up. The BTI 4000 can be installed and working for you in one working day.

Expanding to do even more work takes even less work. The BTI 4000 features modular construction, so system downtime for expansion is minutes, rather than days. You can add disk storage to 400 megabytes; increase user capacity to 32 ports; add peripherals like industry-compatible magnetic tape and a line printer.

Hard working, always working

The BTI 4000 is a true timesharing system. It allows doing any mix of tasks, all at the same time, all completely independent.

It also gives you continuous system availability, because software housekeeping can be performed while users are on-line.

There's also off-hours jobstream processing. So the BTI 4000 can be working for you, even when no one's around.

The BTI 4000 uses BASIC-X, an unusually powerful extension of the BASIC user language, enhanced for business programming.

What's more, the BTI 4000 offers heirarchal account organization and stringent security so that you can maintain total control over who's using it, and what they can do.

And it does all this without a full-time operator.

Inexpensive help

Used during typical office hours, the operating costs for a BTI 4000, including maintenance, are about $1 per terminal hour. And should you grow to 24 hour usage, your operating costs shrink to less than 10¢ per terminal hour.

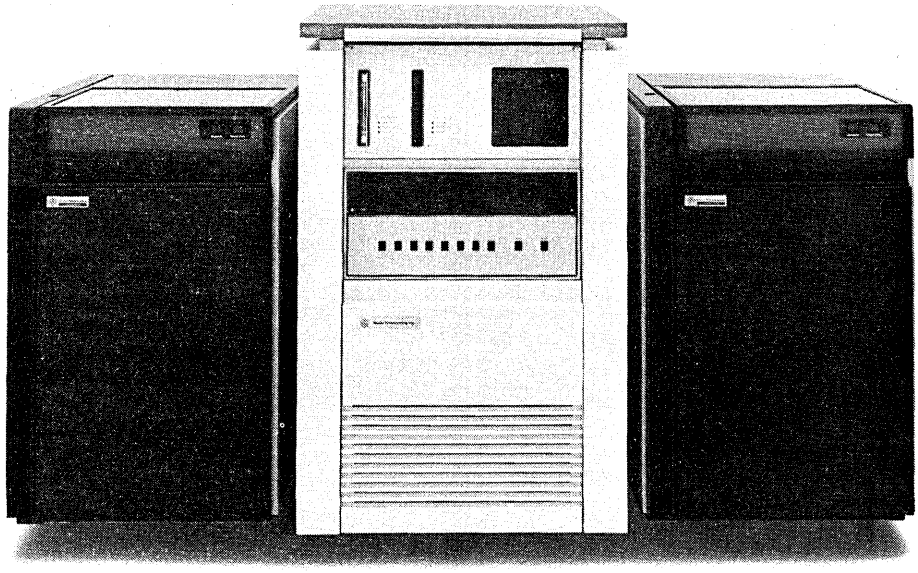
Around-the-clock help

We back our BTI 4000 with any-hour, anywhere, on-line support with dial-up access for problem diagnosis. Yet in a typical installation, our maintenance plan costs less than 1% of the system's purchase price per month.

Look to us

The BTI 4000. The interactive timesharing system that will help your data processing department do more, for less.

For more information, just look to the Basic Timesharing office nearest you.



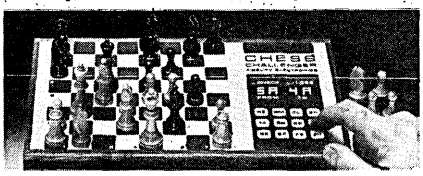
The BTI 4000 Means Business.

Basic Timesharing Inc., Headquarters: 870 W. Maude Avenue, Sunnyvale, CA 94086. Sales Offices: East: Cherry Hill, NJ (609) 662-1122; Midwest: Minneapolis, MN (612) 854-1122, Chicago, IL (312) 298-1177; West: Sunnyvale, CA (408) 733-1122, Anaheim, CA (714) 533-7161

hardware

Off-line

Although it's unlikely the "Chess Challenger" can beat the U.S. computer chess champ, CHESS4.5, it's said the Challenger can give a "good" player a run for his money. And, speaking of money, the $200 Challenger is orders of magnitude less expensive than the champ and its Cyber 170 host. Chafitz, Inc., a Washington, D.C., electronics specialty store reports selling nearly 500 of the microprocessor-



based games since early April.

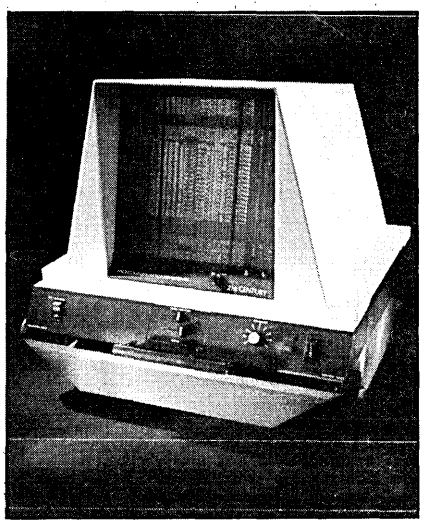
The Air Force is studying the use of fiber optics as a communications medium in secure communications systems. Unlike in wires, where passing electrical current creates unwanted signals detectable at a distance, passing light through fiber optics communications lines creates no radiated signals. With wires the Air Force must use either elaborate coding or physical protection of the transmission lines. Fiber optics are also expected to offer lower overall system cost.

Customers of Commercial and Farmers National Bank in Oxnard, Calif., can receive instructions in English or Spanish from the bank's "Tell/Star 24" automatic banking service. After inserting a plastic identification card into the machine, a voice greets the user in English and Spanish. An invitation to select either language for the balance of the transaction appears on the device's video instruction screen. This thoughtful touch is important because of the rich Spanish-American heritage of the bank's marketing area, according to executive v.p., Richard D. Spencer.

"For solar energy to pay off, you've got to have two things: sun and cold weather," says William A. Beckman of the Univ. of Wisconsin-Madison. "The sun supplies the heat and the cold weather makes the heat valuable." Beckman and John A. Duffie of the university's Solar Energy Lab made computer simulations of houses equipped with solar heating in 170 locations around the U.S. and Canada.

Microfiche Reader/Printer

The 21st Century microfiche reader/printer can make copies in any size from 4 x 5-inches to 12 x 12-inches. The fiche image is viewed on a 12 inch square screen; actual copy size is shown by vertical lines on the screen. The fiche carrier may be positioned manually or by turning horizontal and vertical "fine tune" knobs. An optional image rotator can turn the image up to 90° to align skewed fiche. Other controls handle focusing, print density, high or low lamp intensity, and corona polarity (for positive or negative film).



Warning lights indicate low paper or toner levels. Interchangeable lenses give magnifications from 24X to 54X, with higher magnifications available.

The deluxe model 2001-D sells for $1,400, and includes the image rotator and corona polarity features. The standard model 2001-S sells for $1,180, with the image rotator available for an additional $180 and the corona polarity available for $80. A coin-operated mechanism that accepts nickles or dimes carries a price tag of $125. Delivery is four to six weeks. MICRO INFORMATION SYSTEMS, INC., Atlanta, Ga.
FOR DATA CIRCLE 269 ON READER CARD

Big Disc

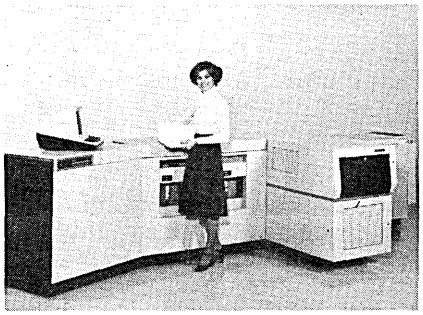
This mass-storage facility will let Hewlett-Packard 3000 users attach as many as 1.2 billion bytes of storage to each selector channel port. Each controller can handle four 300MB drives. A single drive and a controller sells for $29,900, each additional drive goes for $17,500. An I/O handler, supplied by the vendor, maps the larger drive so the change is transparent to an HP 3000 system operating under MPE II. The controller allows multisector operations across head and cylinder boundaries, thus increasing throughput and taking advantage of the controller's 1,209K bps data transfer rate. TELEFILE COMPUTER PRODUCTS, INC., Irvine, Calif.
FOR DATA CIRCLE 280 ON READER CARD

Crt

The Midas II, a microprocessor-based terminal, offers eight selectable data transmission rates ranging from 110 bps to 19,200 bps, and half- or full-duplex operation. It displays 24 lines of 80 characters in 7 x 9-dot matrix form on its 12-inch diagonal display screen. A full 128-character repertoire is available. The keyboard includes a numeric pad and cursor control keys. The unit offers either RS232C or current loop compatibility. It sells for $1,225 in lots of 100. The Midas III has the same features as the Midas II, plus full keyboard edit, field attribute edit, and a 2K paging option. It sells for $1,345 in quantities of 100. On a one-year lease, which includes on-site maintenance, the Midas II goes for $85/month, the Midas III for $95/month. Crt workstations, which are also available for purchase, have rental prices starting at $14/month. MINI-COMPUTER SYSTEMS, INC., Anaheim, Calif.
FOR DATA CIRCLE 275 ON READER CARD

High-Speed Printer

At first glance, the model 9700 electronic printing system looks pretty much like this vendor's four year old model 1200 printer. But that's only at first glance. New features and the use of newer technology make the 9700 both faster and more versatile than the



earlier 1200. As with the earlier printer, the model 9700 operates from either computer-generated output mag tapes or directly connected to a 360 or 370 mainframe. The 9700 can print twice as many pages per second (two vs. one) and up to four and one-half times as many lines per minute

(Continued on page 164)

Infoton has always produced a special breed of terminals.

Reliability is what has made seven generations of Infoton winners stand out from the field. And, like their predecessors, it's their reliability that makes the new Infoton 200 and 400 so very special.

They are just built better than other terminals in their class.

Take the 200, for example. A detachable keyboard of solid state construction guarantees 100 million operations . . . ten times the performance of most mechanical keyboards. And the keyboard comes in various configurations to suit users' unique requirements.

Other outstanding features include 96 character upper/lower case format, addressable cursor, EIA and current loop interfaces and non-destructive forward and back spacing.

The 400 has everything the 200 has . . . and more. Designed around the Z-80 microprocessor, it performs a multitude of functions. Capabilities include complete formating and editing with block mode transmission. Also character mode for normal log-in procedures or straight character operation.

Last but not least. Both the 200 and 400 have prices among the lowest in the industry. No wonder they are such favorites.

Write or call for full details.

Two new thoroughbred winners

Infoton

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For full facts, just contact any of the Infoton offices below:

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- Gaithersburg, MD (301) 840-9270
- Pasadena, CA (213) 796-9940
- Atlanta, GA (404) 455-0060
- Scottsdale, AZ (602) 994-5400
- Bellevue, WA (206) 454-9332

hardware

(Continued from page 162)

(18,000 vs. 4,000). This increase in lines per minute print rate is due to the 9700's ability to change type sizes (and fonts) under software control on a character-by-character basis. Type sizes range from four point to headline-size 24-point.

The printer uses 8½ x 11-inch paper in weights ranging from 16-pound bond to 110-pound card stock. Two paper hoppers let the user switch between paper types, even during the same print job, and output can be printed horizontally or vertically.

The 9700 also can print forms while printing data. Unlike the 1200, which projected form images from slides onto the page, the 9700 stores forms (and fonts, and other predefined images) on its 20MB formatted disc. The same modulated laser that images characters also draws the form (the 1200 used optical imaging). Users are said to be able to design their own forms in a matter of hours. As a service, the vendor will build a user library of logos and signatures which are stored on the disc for later projection (under software control) onto the printed page.

Off-line the 9700 accepts its input from 1,600 bpi, nine-track mag tape. Character codes accepted include EBCDIC, ASCII, and BCD (nine-track). These tapes may be written in any of the following formats: ANSI; IBM OS/VS/370, OS/360, DOS/VS/370, DOS/360/370; Burroughs MCP 2500-4700, MCP 6700; Honeywell OS2000, OS6000; Univac Series 70, and Univac 1100-OS Standard Files. The on-line interface is to 360 models 30 and larger and 370 models 135 and larger. The 9700 is compatible with OS/VS/370, OS/360, DOS/VS/370, and DOS/360/370. In both on-line and off-line operation, the units buffer data on disc.

The 9700 will be available in the third quarter of 1978. It sells for $295,000. Rental is $5,300 per month, plus a charge of 3.5 mills per page. XEROX CORP., Data Systems Division, El Segundo, Calif.

FOR DATA CIRCLE 277 ON READER CARD

Small Business Systems

Aimed at small businesses and operational units in Fortune 2000 firms, the CS/40 family uses a modified version of this firm's Nova 3/12 minicomputer to provide a multiuser COBOL business system. Each of the three members of the family consists of a processor, 10MB cartridge disc, printer, and a display terminal. Interactive COBOL and support software are also included. The two larger systems support additional terminals, and all can support diskette and mag tape subsystems and additional disc storage (up to 40MB total).

Developed by the vendor, the COBOL compiler meets level 1 1974 ANSI standards. Several modules contain level 2 capabilities. The compiler supports nested IF statements and the PERFORM verb with the UNTIL condition clause. Screen formatting and data field error detection and correction are also supported. Files may be sequential, relative, or indexed sequential. The CS/40 operating system is adapted from the vendor's real-time disc-based operating system, RDOS. The optional RJE 80 control program provides remote job entry and communications between other computers from the vendor or IBM-compatible systems.

The smallest member of the family, the CS/40 model C1, supports one terminal. A typical configuration, including one terminal, a processor with 64KB of memory, 10MB disc subsystem, a single diskette drive, a 60 cps printer, workstation desk, and single bay cabinet sells for $33,415. The CS/40 model C3 can handle up to four terminals. A typical C3 system, consisting of essentially the same hardware in the C1 system, plus two more terminals and workstation desks, sells for $40,245. The largest member of the family, the model C5, can have as many as nine terminals. In a typical configuration with five terminals (and workstation desks), processor with 128KB of memory, 20MB of disc, mag tape, 300 lpm printer, synchronous communications option, and two bay cabinet, the C5 sells for $82,100. All systems include COBOL and system utilities. First shipments will begin in September, with volume deliveries beginning in the fall. End user quantity and oem discounts are available. DATA GENERAL CORP., Westboro, Mass.

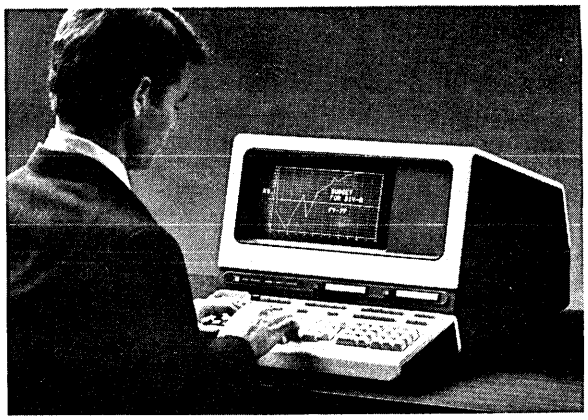
FOR DATA CIRCLE 268 ON READER CARD

Logic Analyzer

The 45-B logic analyzer allows users to display four channels of digital logic waveforms on a conventional, single trace oscilloscope. The user can simultaneously display input and output signals, or look at circuit operation with respect to clock and various timing pulses. The small 45-B can operate

(Continued on page 168)

product spotlight



Graphics Terminal

The 2648A graphics terminal can pan and zoom, draw vectors using its "rubber-band" line and keyboard cursor controls, and even draw graphs from tabular data. It also offers the data entry and data communications functions of its sister terminal, the 2645A. Separate memories hold graphics and alphanumeric data; both can be viewed separately or simultaneously. The standard 2648A has 8KB of alphanumeric memory, expandable to 12KB. Sixteen 16K RAM's provide 360 x 720-dot resolution in the graphics display. Zooming and panning can be done off-line with a single keystroke. Any part of the graphics memory may be magnified up to 16 times, allowing closer investigation, modification, and redrawing of dense areas. The rubber-band line lets the user stretch and draw lines from any point to the cursor. The automatic plotting feature allows a user to draw graphs of data in tabular form. This can be done off-line with the terminal guiding the user through a menu of questions about the tabular data to be plotted.

Capabilities shared with the earlier 2654A include user-defined soft keys, off-line data preparation and editing, built-in self test, both page and character-mode operation, and optional character sets. The 2648A displays alphanumerics in a 24-line 80-column format on its 5 x 10-inch screen. It can communicate at up to 9600 bps over an RS232C interface. Optional built-in cartridge tape drives provide 220KB of local data storage. The terminal sells for $5,500; with tape drives it goes for $7,100. Deliveries begin next month. HEWLETT-PACKARD CO., Palo Alto, Calif.

FOR DATA CIRCLE 279 ON READER CARD

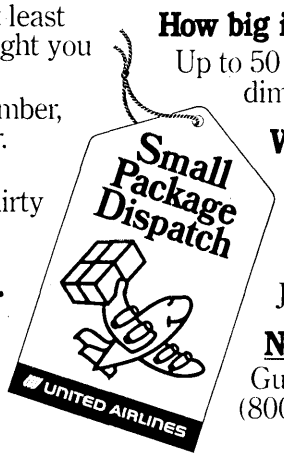
We'll move your small package in a big hurry.

We make SPD as easy as 1, 2, 3.

1. Take your important small package to United's SPD Center in the passenger terminal at least thirty minutes before departure of the flight you choose. Prepay the charges.
2. Call your addressee with the flight number, arrival time and the SPD receipt number.
3. Your package can be picked up at the destination baggage claim area within thirty minutes of arrival.

Send 'most anything 'most anywhere.

Printed matter, machine parts, film, legal documents, advertising materials —or the book your daughter needs at college. And SPD service is available at the 113 cities United serves, including Toronto and Vancouver.



How big is "small"?

Up to 50 pounds in weight and 90 inches in total dimensions (length, plus width, plus height).

We keep your cost low.

For guaranteed, same-day service between New York and Chicago, you pay just $27.50. Between Los Angeles and New York, $38.50. (Rates effective January 1, 1977, and subject to change.)

Now—SPD it door-to-door.

Guaranteed delivery at low cost. Call (800) 424-9899 toll free and ask about it.

See why United's No. 1 in the cargo sky.

UNITED AIRLINES CARGO

Distributed Confusion

There are almost as many approaches to distributed processing as ther
By letting your needs dictate the right solution, Hewlett-Packard can hel

You already have a large EDP investment. The last thing you need is a distributed data processing plan that makes your present operation obsolete. Or that will be out of date itself in a few years.

At Hewlett-Packard, we've worked out several ways to simplify the problems of putting your computer power where the work is. Our systems can help you make the most of your system, let you computerize many functions you're now doing manually, and still give you central control through links to your big computer. And they're so versatile that they can adapt to future changes in distributed data processing.

This all-around performance makes the HP 3000 an ideal departmental computer. You can dedicate it to solving a wide range of problems such as order processing, inventory control, cost accounting and materials requirement planning.

You'll see a dramatic improvement in efficiency at your plant or sales office or distribution center. At the same time, you'll have a better data entry system with the capacity to edit and check data before transmission to the central computer. By reducing inaccurate entries, you can shrink your communications costs.

Our system is also easy to expand, either within a department or into a complete network of computers that share information and programs.

Putting an entire network of computers at your fingertips.

We've developed new software, DS/3000, that turns a series of HP 3000s into the simplest, most functional network available today. You can sit down at a terminal and use the programs, files and data in any interconnected HP 3000. You don't need a special program to do it. Simply identify the computer you want to talk to and you're on-line.

With the same ease, you can shift programs and files from one HP 3000 to another. And you can do local and remote processing at the same time.

Imagine how much faster remote sites can get accurate, up-to-the-minute information this way than they could by depending on the overworked central computer!

How a small computer handles big computer jobs.

The HP 3000 has versatile executive software that manages all the computer's resources. Advanced design gives it the speed and power needed to handle more jobs more quickly than comparably priced computers. (Our U. S. prices start at $110,000.)

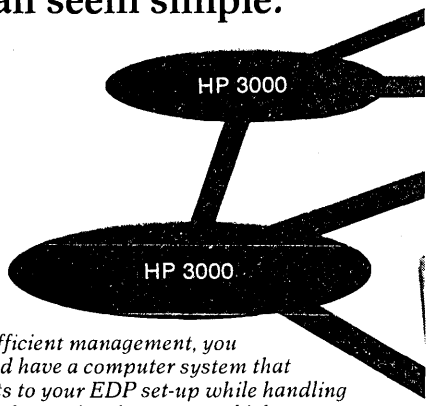
While you're getting information from the computer on one of the terminals, the system can be running batch programs.

You can also use as many as six "big computer" languages, run large programs on our small system and develop software quickly and inexpensively. (A very important consideration when you look at the climbing costs of programming.)

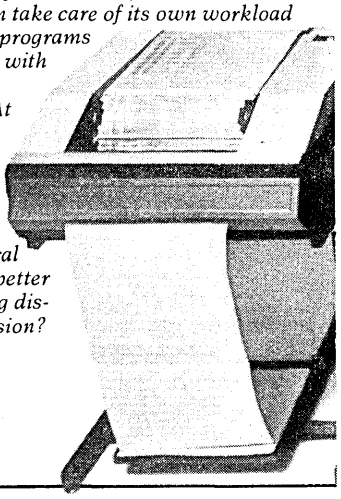
The executive software is so advanced that it will remain the heart of our computers for years to come. So you can keep adding to your system without having to throw your old programs out the window.

And the built-in flexibility of the HP 3000 helps you stay up with all the latest trends, no matter what direction distributed data processing takes in the future.

The HP 3000: The system that makes it all seem simple.



For efficient management, you should have a computer system that adapts to your EDP set-up while handling those day-to-day departmental jobs you need to automate. The HP 3000 does precisely that. By forming a network of HP 3000s, each department can take care of its own workload and also share programs and data bases with the rest of the organization. At the same time, you can communicate with your big computer so you don't lose central control. What better way of avoiding distributed confusion?



47703HPG5

re computer companies offering them.
ou clear up the confusion.

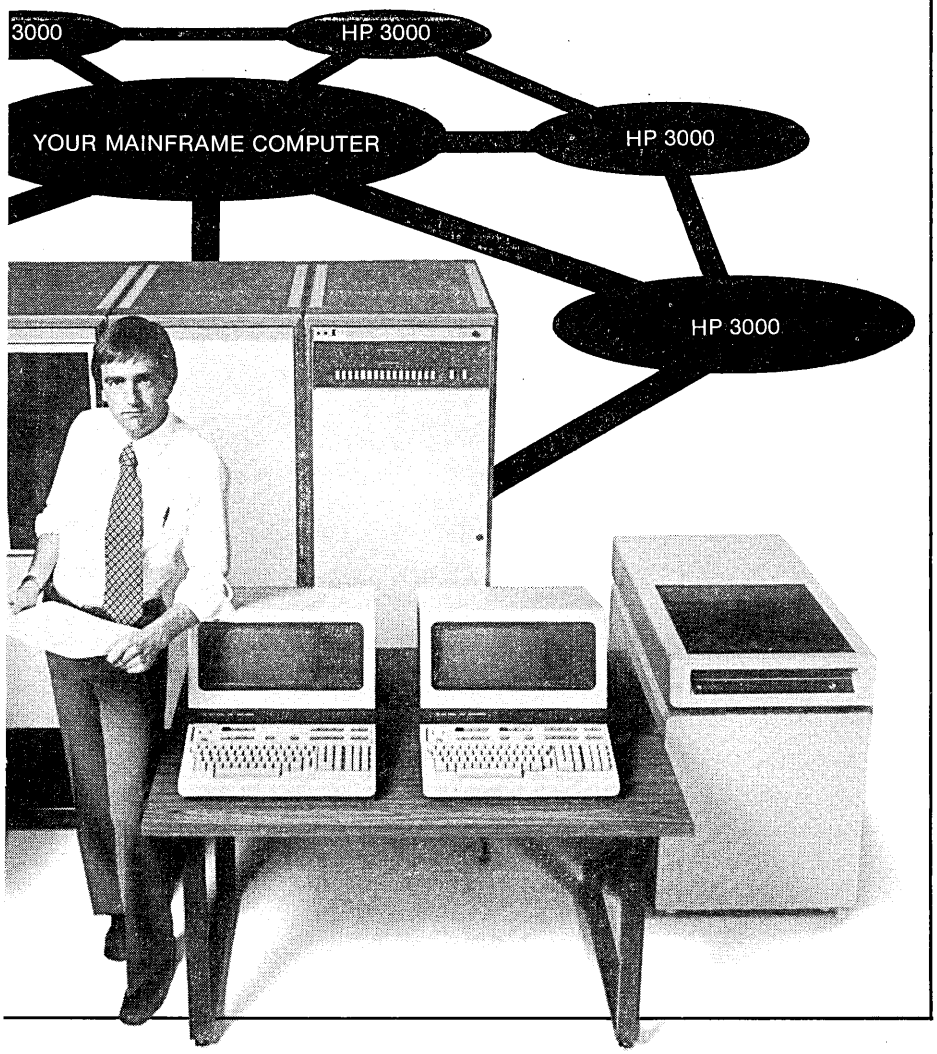
Turning raw numbers into usable information.

Your big computer has data base management to consolidate related information into easily accessible files. This capability is just as important at remote sites.

It allows your key people to call up the facts they need instantly, and get them in an easily understandable form without wading through reams of paper.

The HP 3000 has an extremely effective data base management capability. With its help, the computer will generate forms, titles, page and column headings, data sorted by categories, subtotals, totals and averages. And, through DS/3000 software, you can call up any HP 3000 data file in your network.

Data base management on the HP 3000 has proven so efficient that it was recently named to the Datapro Software Honor Roll, placing it among the 38 top software products in the country.



It takes more than a good product to make it a safe buy.

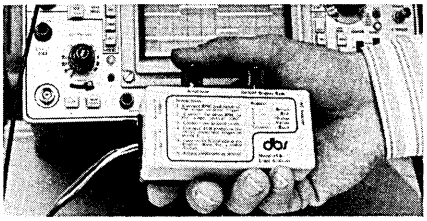
Support has always been a top priority at Hewlett-Packard. For our computer customers, we have complete service before and after the sale, with on-site training and full documentation. Nearly 1000 Customer and Systems Engineers provide regular maintenance and give you applications and programming assistance. They work out of offices in 65 countries around the world, offering you efficient service at a remote location as well as at your headquarters.

So if you want to take the confusion out of distributed processing, now and in the years ahead, call your nearest Hewlett-Packard office listed in the White Pages. Ask for a Computer Systems representative. Or write for more information to Bill Krause, Hewlett-Packard, 11000 Wolfe Road, Dept. 404, Cupertino CA 95014.

HEWLETT hp PACKARD

hardware

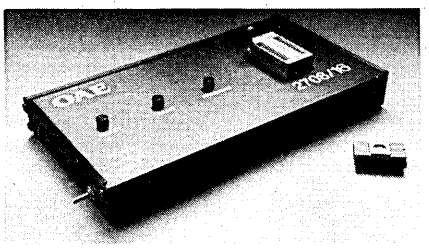
(Continued from page 164)



from AC or battery power, and is compatible with TTL, DTL, RTL, and CMOS logic. The device sells for $149.95. DIGITAL BROADCAST SYSTEMS, INC., Huntsville, Alabama.
FOR DATA CIRCLE 274 ON READER CARD

Prom Programmer

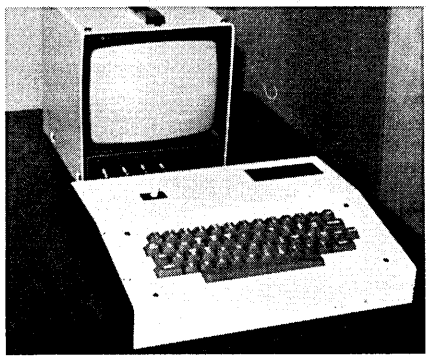
The PP 2708/16 can program a 1K 2708 PROM in less than 100 sec. or a 2K 2716 PROM in less than 200 sec. A TTL-compatible parallel interface connects the programmer to any microcomputer. An internal address counter eliminates the need for address lines. The unit requires an unregulated power supply that provides +8 to +12 vdc at one amp. Each unit comes with a black anodized aluminum case, a five-foot ribbon cable with prewired connectors, and software. It's available as



a kit for $249, or assembled for $299. Availability is 30 to 45 days ARO. OLIVER AUDIO ENGINEERING, INC., North Hollywood, Calif.
FOR DATA CIRCLE 270 ON READER CARD

Crt

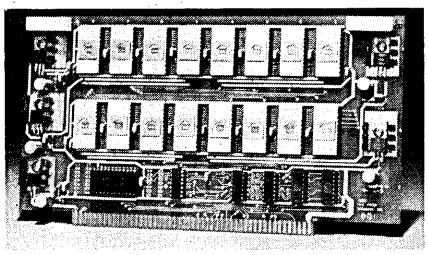
The Model 675 crt terminal offers switch-selectable speeds up to 9600 bps, switch-selectable parity, half- or full-duplex operation, RS232C interface, and a nine-inch display capable of showing 1,024 characters in 16 lines of 64 characters. A 20ma current loop interface can be substituted for the RS232C interface. The tty-like keyboard may be located as far as four feet from the display screen. The unit works with the upper case ASCII character set. With display, keyboard, and workstand, the 675 sells for $895. It leases for $39/month on a one year lease. Other configurations, including a suitcase version and one with an acoustic coupler, are also offered. The display monitor interface is RS170 com-



posite video; users can buy the terminal, without a display, and attach their own monitor or video tape recorder. Delivery is two to six weeks, depending on configuration. TERMINAL DATA CORP. OF MARYLAND, Rockville, Md.
FOR DATA CIRCLE 282 ON READER CARD

Eprom Board

Capable of holding 16 2708 EPROM's, this board can plug into a microcomputer's S-100 bus. Unused 4K sections



may be disabled to allow random access memory to exist within the board's address space. The board has sockets for, but does not include, the EPROM's. It sells for $85, with deliveries from stock. IBEX, Sunnyvale, Calif.
FOR DATA CIRCLE 272 ON READER CARD

Communications

The CV 1100 Com Pak series of communications hardware, based on DEC's LSI-11 microcomputer, can multiplex as many as 31 communications lines to the LSI-11. The unit may find its place in a communications application as a buffered line concentrator, a network node, a preprocessor, or a message switch unit.

Each line of the CV 1100 can be programmed to operate synchronously or asynchronously at standard data rates up to 19.2K bps. The unit offers full duplex operation and full modem control. The transmitter and receiver of each line can run at different line speeds. Characters may be five, six, seven, or eight bits. In synchronous mode, binary synchronous protocol is possible; SDLC is not currently available, but may be in the future.

A system consisting of an LSI-11 with 40KB of memory and a three line multiplexor sells for $4,425. Additional CV 1101 line multiplexors, containing the computer interface and three line controllers, sells for $750. The CV 1102 four-line group, consisting of four line controllers and bus cable for connection to the communications bus sells for $600. NETCOM PRODUCTS, INC., Santa Clara, Calif.
FOR DATA CIRCLE 267 ON READER CARD

Tape Cleaner/Tester

The SLT-80, an automatic unit that cleans, tests, and precision stacks a reel of mag tape in three and three-quarters minutes, now tops this vendor's line of tape cleaner/testers. This may be the first cleaner capable of handling conventional reels and designed to work with automatic loading tape reels. The unit comes in three versions: for nine track, 1,600 bpi format tapes; for 6,250 bpi, nine track tapes; and for a combination of both densities.

It is said that routine maintenance on the SLT/80 removes accumulated dirt, dust, and oxide debris that adheres to tape surfaces and causes signal dropouts and read/write errors. The unit also helps users identify unreliable tapes by reporting on their exact condition, computer correlated at subcritical, nominal, or hypercritical levels. The unit sells for $12,100; average lead time is 30 days. KYBE CORP., Waltham, Mass.
FOR DATA CIRCLE 251 ON READER CARD

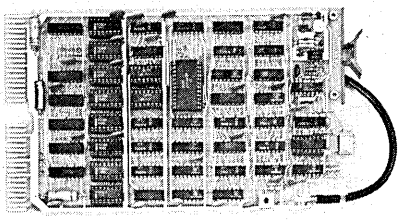
Video Interface

The VIURAM-L11/16 contains 1KB of random access memory and associated circuitry for generating a composite video signal from the ASCII characters stored in its memory. It works with DEC's LSI-11 and PDP-11/03 processors. The video output complies with the EIA RS170 standard for driving monitors with 75 ohm input impedances. The VIURAM (video interface unit random access memory), requires a half-slot in the LSI-11's backplane. Its addressing is strap-selectable to start at any 1K word boundary. The display format is 16 lines by 64 characters, and the unit can generate 128 characters from the seven-bit ASCII code, with the eighth bit selecting normal or reverse

hardware

video. If only 64-character, six-bit ASCII is needed, the seventh bit can select blink/non-blink or full-brightness/half-brightness, depending on how the board is jumpered.

The VIURAM-L11/16 sells for $575 for one to nine units, $530 for 10 to



24, and $495 for 25 to 49. Delivery is 30 days ARO. A PDP-8 version is also offered. A monitor for use with the VIURAM will typically sell for $200. COMPUTER TECHNOLOGY, Oakland, Calif.

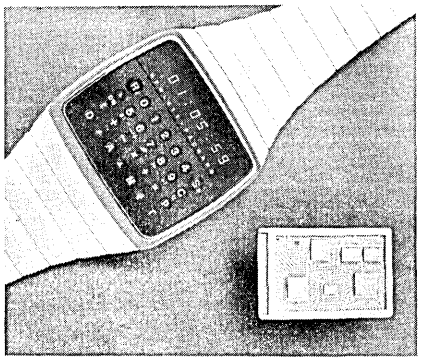
FOR DATA CIRCLE 273 ON READER CARD

Watch/Calculator

There have already been a few combination calculator/digital wristwatches brought to market, but they've typically been expensive (say $1,000) and rather limited in capability (four-function). At $650, the HP-01 hasn't entered the market where every school kid will buy one, but it does offer some interesting calculating and timekeeping capabilities.

The six-ounce HP-01 has six interactive functions—time, alarm, timer/stopwatch, date/calendar, calculator, and memory—actuated by 28 keys (six finger-operated, 22 stylus-operated). Time shows up at the push of a button on the LED display in 12- and 24-hour format. A two and one-half-second beeping alarm can be set up to 24 hours ahead of time. Using the timer, a second alarm can be set to signal the end of an interval up to 99 hours, 59 minutes, and 59 seconds. The timer/stopwatch displays elapsed time in hours, minutes, and seconds or minutes, seconds, and hundredths of seconds. It will take elapsed time readings and can store one of them in memory. This function, coupled with the calculating functions, allows dynamic calculations, such as telling a user, while on the phone, how much his call is costing, continuously updating the display every second. The unit can also display the current date and perform calculations on dates.

Calculator functions include add, subtract, multiply, divide, percentage, net amount, chain, and repeat operations on previous results or new data.

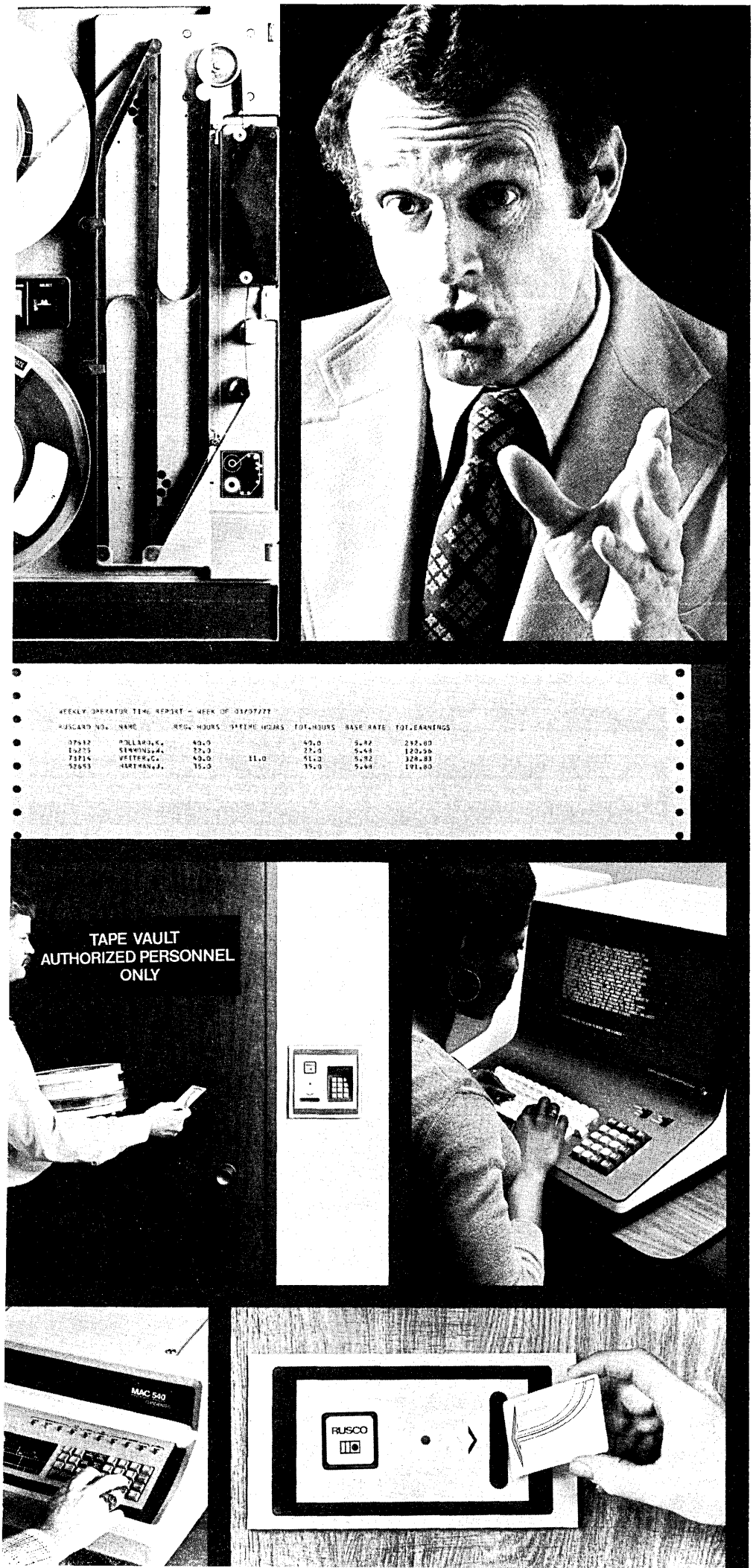


It has eleven digits of internal accuracy rounded to seven for display. Scientific notation is used for displaying numbers greater than 10^7 or less than 10^{-4}; the calculator's range is 1×10^{-99} to 9.999×10^{99}. HEWLETT-PACKARD CO., Palo Alto, Calif.

FOR DATA CIRCLE 281 ON READER CARD

Computers

After selling IBM-compatible peripherals for eight years, this firm has taken the next step and come out with six models of two IBM-compatible cpu's. The Omega 480-I and -II are said to provide system performance improvement of 10% to 100% over the IBM 370 models 135, 138, 145, and 148 they are intended to replace, at prices ranging from 5% to 30% less than the IBM equipment. Operational tests show



"Here's a hot tip for a hot topic-- *CARDENTRY for computer security."*

"Figure it out.

We've got a small fortune here in hardware alone.

And it'd be hard to put a price on all the information we store—especially if it fell into the wrong hands.

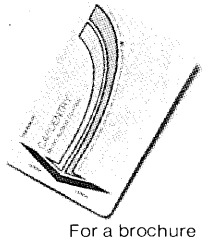
That's why I refuse to take chances with keys and locks to decide who goes where in this facility. Instead, I specified a Rusco CARDENTRY programmable access control system. It's not only far more secure—it's a lot more flexible, too.

For example, I can limit any employee's access to specified areas and time periods. After hours, I can make sure only the night shift supervisor can take the elevator to this floor. And I can key in commands to lock and unlock certain doors at preset times.

I even get a mag tape log of all comings and goings that plugs right into my payroll program to eliminate time cards! And if a power monitor or smoke detector trips, CARDENTRY sounds the alarm and pinpoints the location and time.

I really feel a lot more comfortable knowing CARDENTRY is on the job. Not just because it helps me manage better—I think of it as awfully cheap insurance for an awfully big investment!"

THE CARDENTRY COMPANY ...



For a brochure detailing CARDENTRY's exciting capabilities, call toll-free: **1-800-528-6050, Ext. 691**
(in Arizona call 1-602-955-9714, Ext. 691)
or write **Rusco Electronic Systems**
1840 Victory Blvd., P.O. Box 5005
Glendale, CA 91201

RUSCO
ELECTRONIC SYSTEMS

CIRCLE 85 ON READER CARD

that the Omega processors will run IBM software available for 370s—excluding time-dependent coded programs—without modification. Operating systems that support the Omega include DOS, DOS/VS, OS versions MFT and MVT, OS/VS 1, OS/VS 2 (both SVS and MVS versions), and VM 370.

The Omega 480-I mainframe contains the cpu, microprogrammed control storage, from 512KB to 2MB of central memory, and byte- and block-multiplexor channels. The memory is based on 4K MOS memory chips, and includes error checking and correcting to correct single-bit errors and detect double-bit errors. Data I/O channels support all peripheral devices compatible with published IBM standards, excluding those that require direct access control. One byte-multiplexor and two block-multiplexor channels are standard on the Omega; two additional block-multiplexor channels may be added as an option. Maximum data rate on the byte-multiplexor channel is 50KB/sec. in byte mode and 180KB/sec. in burst mode. The block-multiplexor channel operates at up to 1.85MB/sec.

Purchase prices for Omega systems begin at $355,000 for the 480-I with 512KB of memory. A 2MB 480-I goes for $505,000. Maintenance charges range from $1,320 to $1,925 per month. Omega 480-II systems will be available with 1MB or 2MB of memory, priced at $490,000 and $590,000 (with maintenance of $1,915 and $2,165), respectively. A field upgrade kit, including processor speedup, operator display console, and two additional data channels, will transform a model I into the model II. It's priced at $85,000. Deliveries of the 480-I began last month, the 480-II will be available in early 1978. CONTROL DATA CORP., Minneapolis, Minn.

FOR DATA CIRCLE 276 ON READER CARD

Line Printer

Designed for oem's, the model 10 line printer prints a minimum of 150 lpm in an 80 column format using the ASCII 64 character set. It's available in both friction feed and pin feed versions. A single friction feed model 10 sells for $1,800. The belt impact printer has a Centronics-compatible eight-bit parallel interface. Optional interfaces include RS232C and 20ma current loop. Deliveries are scheduled to begin in September. EPSON AMERICA, INC., Torrance, Calif.

FOR DATA CIRCLE 271 ON READER CARD

Big Computers

This firm is rounding out its Cyber 170 family by adding an entry-level system and a top of the line biggie. Both machines use the Cyber approach of using a large (60-bit) number-crunching cpu augmented by a system of smaller (12-bit) peripheral processing units for I/O and operating system support.

At the low-end of the line, the Model 171 has a cpu capable of executing about 800,000 instructions per second. Memory (MOS) sizes range from 65,536 words to 262,144 words. Lease price for a Cyber 171 mainframe starts at $5,200 per month on a three-year lease. A typical system with peripherals, software, and maintenance starts at $19,700 per month.

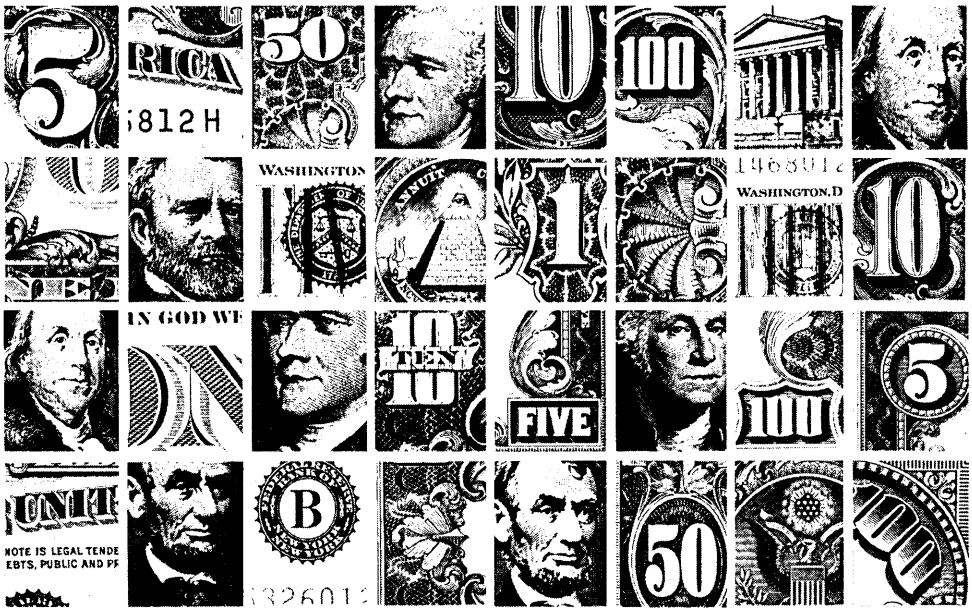
The top of the line Model 176 is about 18 times faster than the 171; it can execute about 15 million instructions per second. Bipolar memory sizes range from 131K words to 262K words. System pricing, including peripherals, software, and maintenance, starts around $150,000 per month.

Software for the Cyber series includes two operating systems, compilers for FORTRAN, COBOL, and COMPASS, and an assembler.

Deliveries of the 171 will begin next month. The 176 will be out in the fourth quarter. CONTROL DATA CORP., Minneapolis, Minn.

FOR DATA CIRCLE 250 ON READER CARD

32-BIT PROFITABILITY



Profit from our 32-bit experience.

Scores of customers are taking advantage of our lead in 32-bit design right now, because we were there first . . . with the first mini with true 32-bit architecture. Hundreds of Interdata Megamini® computers have been working throughout the world since 1973.

Interdata's 8/32 computer processes data at one-half the speed of the IBM 370/158, for about one-tenth the cost. And the Model 7/32 offers even greater economies. With our Multiport Memory System, up to 14 processors can share a single memory bank, increasing throughput and processor-to-processor operation even further.

And, although they cost as little as the 16-bit DEC 11/70 or DG Eclipse, Interdata's Megaminis are the only low-priced computers with no constraint on program size. That's just one benefit of 32-bit architecture.

You also get 219 IBM-like standard instructions, and can create even more of your own with up to 512 words of Interdata Writable Control Store, raising throughput by a factor of five. And for still greater throughput, Interdata's exclusive Hardware Floating Point option improves the speed of scientific calculations ten times faster than software-bound minis.

Send me 1977 specs on your 7/32 and 8/32 Processors and field proven software.

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From

There's nothing hard about Sycor software. Our step-by-step approach guides your operator through the maze of data processing procedures. Simply. And virtually without errors.

Even untrained clerical help can become comfortable with it—and productive—after a day or two of familiarization.

The reasons are simple. Sycor terminals and software are operator-oriented. They simplify data entry tasks by greatly reducing the number of keystrokes.

Our step-by-step approach has built-in checks to insure completeness and correctness of data. Since the system assures accuracy, your operators can concentrate on speed.

COBOL, BASIC and TAL II.

Sycor speaks your programmers' language. We now offer multi-terminal COBOL, so your programmers can use one industry-standard language for both data entry and distributed data processing tasks.

We also offer BASIC and TAL II. All three languages can be easily programmed to perform index file look-ups, range checks, calculations and edits of numerical information.

This kind of versatility gives your programmers the software capability they need to customize data entry programs. The result is software that answers your needs for fast, accurate performance.

You can communicate with Sycor.

You can operate in your own communications environment using Sycor software. We have BRJE, remote job entry software that operates in a Burroughs communications environment, and IRJE, for interactive remote job entry needs in an IBM environment.

For your multi-leaving applications, Sycor has software that can handle your HASP work station requirements. We also offer spooling, powerful systems utilities and command chaining to help get your jobs done as quickly as possible.

ucing
e software.
Sycor.

And Sycor software is configurable, so it works in a broad range of environments. Your systems analysts can adapt the communications protocols of one program to talk to a variety of host computers.

The Sycor 440 gives you concurrent processing. While communicating with the CPU in a variety of environments, it still has the processing power to do up to eight other jobs.

Sycor is a pioneer in the distributed data processing industry. Our experience over the years has helped us develop hardware and software that can get your job done better. At less cost.

Get the hard facts about Sycor software.

If you've been looking for a distributed processing system that won't boggle your workers or your budget, take a hard look at Sycor software.
Write Sycor, Inc., Corporate Offices, Ann Arbor, MI 48104.

Better yet, contact one of our nearby sales offices. We're in the Yellow Pages under "Data Processing Equipment."

Sycor puts computer power where the work is.

SYCOR

software & services

Updates

The minicomputer peripheral market will total $37 billion cumulatively through 1986, according to a market research study conducted by Frost & Sullivan. A two year old projection of a minicomputer/microcomputer market totaling $30 billion through 1985 "remains on target." Software for minicomputers should total $3.4 billion in the period from 1977 to 1987, the firm predicts.

"The most accurate municipal bond pricing system in the country" has been announced by Interactive Data Services Inc. and fifteen regional brokerage firms. Members of the Muni/Net network will feed regional market information to IDSI's municipal bond matrix system, which covers some 42,000 issuers and is capable of evaluating more than 1.75 million municipal bonds.

AT&T says it is enhancing its Transaction Network Service by adding an interface designed to more readily support character-polled terminals manufactured by other vendors. TNS is designed for high volume, short message, inquiry/response applications. The enhancement, described by ANSI Standard X3.28-1976, will be available in mid-1978.

As part of its mission to make the U.S. energy self-sufficient, the Energy Research and Development Administration (ERDA) has accumulated a data base of energy related information. This data is available for custom designed computerized retrieval at the New England Research Application Center in Storrs, Conn. The data base covers six basic areas: energy conservation; fossil fuel; solar, geothermal, and advanced energy systems; environment and safety; nuclear energy; and national security. An estimated 140,000 citations are added each year to the ERDA Energy Information data base.

The Chicago Tribune is installing a total publishing system with an estimated price in excess of $10 million. Hendrix Electronics, Inc. will design and install the system. The Tribune system includes editorial, pre-press, classified, and business functions. DEC System 10s will be used.

Series/1 Cobol

This COBOL compiler runs on Series/1 processors under CPS and conforms to a low intermediate level of COBOL (level 1 of: nucleus, table handling, sequential I/O, relative I/O, segmentation, library, debug, and interprogram communication). Compilations require a system with at least 32KB of memory, an operator's station, and two direct access storage devices (two diskettes or a diskette and a disc). Compiled code executes under a run time monitor which provides file assignments at run time and paging of the procedure division and working storage tables. Program size is limited to 15,000 statements when a diskette is used for page storage. Version 1 of the compiler supports a maximum of 64KB of memory.

Additional features to be added include ISAM and SORT during the third quarter, and Report Writer during the fourth quarter. A version of the compiler for IBM's Series/1 real-time system is planned for release by the end of the year.

The compiler and run time monitor are licensed on a cpu basis and include maintenance for a minimum of two years. The compiler license fee, including a single site license for the run time monitor, is $1,800. Additional run time monitor licenses have a one time charge of $120/cpu. Documentation is provided with the compiler license. Users are expected to acquire their own CPS licenses from IBM. ADVANCED SOFTWARE PRODUCTS, INC., Arlington, Va.

FOR DATA CIRCLE 255 ON READER CARD

ISAM Replacement

A functional alternative for current users of IBM's ISAM and VSAM, IAM is said to improve throughput and make more efficient use of disc space. At most one seek/search/read operation is needed to retrieve a record in random access operation, and the system keeps track of which records it has buffered, so it doesn't go to the disc if the record is already at hand. The system supports fixed and variable length records, and it's designed for use in both batch and on-line applications. It is said IAM requires no system modifications, will coexist with ISAM and VSAM, and can run under IBM's OS, VS1, SVS, and MVS operating systems. The package has such record manipulating facilities as GETNEXT processing, generic key search, program specification of data length, and dynamic record tabling. Utilities create IAM files directly from ISAM and VSAM files or recreate ISAM and VSAM files from IAM files. Programs interface to IAM through CALL statements. In an interactive mode, for users of CICS or similar teleprocessing systems, IAM supports multiple concurrent I/O requests, internal queuing of those requests, and buffer management of IAM's I/O buffers. An "interactive mode interface," uses a modification of the teleprocessing system I/O module to provide dynamic interpretation of standard ISAM I/O functions, allowing existing ISAM requests to invoke equivalent IAM functions.

IAM is offered on a lease basis. The price starts at $10,000 for the first year decreasing by $2,000 per year until the fifth and subsequent years when the price stays at $2,000 per year. These prices include maintenance INNOVATION DATA PROCESSING, Clifton, N.J.

FOR DATA CIRCLE 260 ON READER CARD

8080 Debugger

The Dynamic Debugging System (DDS) is a debugging facility for Intel 8080 assembly language programs. DDS can single-step a program, run in breakpoint mode, and automatically monitor and trap user selected conditions. It maintains and updates a status display showing the next five instructions to be executed, all operating registers, and the words pointed to by the BC, DE, and HL register pairs, the stack pointer and the last five words pushed onto the stack and the words they point to, mnemonic expansion of condition codes, and the return addresses from the last five CALL instructions. The user can request memory displays in a combined hexadecimal and character format, or as program mnemonic codes.

While debugging a program, DDS allows register modification, data modification, stack modification, breakpoint insertion and memory moves, memory filing, and memory searching. Users can have DDS monitor addresses and stop when a specific address is reached. It can also monitor opcodes, values (in registers, register pairs, bytes, or words), storage addresses or read addresses, and stack pointers, stopping when any condition is met.

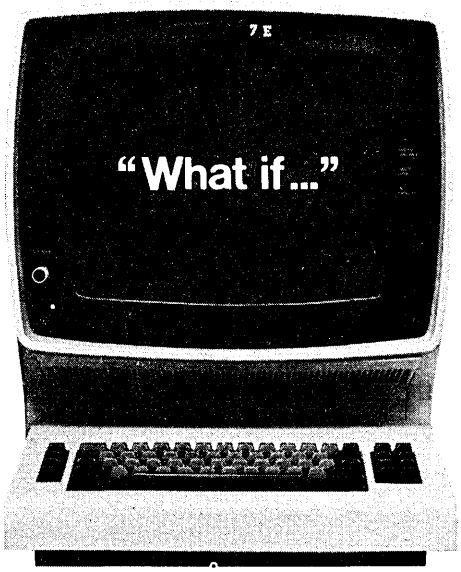
DDS is available on Tarbell cassette tape, hex paper tape, Altair cassette tape, or Icom diskette. On tape, including a manual and updates for six months, it sells for $30; diskette is $35. COMPUTER MART OF NEW JERSEY, INC., Iselin, N.J.

FOR DATA CIRCLE 254 ON READER CARD

asi/inquiry

The IMS DB/DC QUERY LANGUAGE

USED BY MORE IMS INSTALLATIONS THAN
ANY COMPETING PRODUCT



ASI/INQUIRY is an IMS DB/DC query language that operates completely as an interactive Message Processing Program. The design of ASI/INQUIRY is such that the *structure of the data base is transparent to the user*. Moreover, one need not have familiarity with DL/1 segment logic or the complexities of multi-pathing. Extremely rapid response time is assured.

MAJOR HIGHLIGHTS

- ☐ End-user oriented
  - —Easy-to-use language
  - —Requires no knowledge of IMS
  - —Comprehensive diagnostic messages
- ☐ Rapid response time for even the most complex queries
- ☐ Dynamic priority scheduling to maximize system performance
- ☐ Availability of default as well as user-defined screen formatting

Recently delivered, Release 2 of ASI/INQUIRY contained a number of major enhancements, including:

- Development of a TSO-supported version
- Full support of IMS/VS secondary indexing
- Open-ended computational facilities
- Ability to SORT display output

In summary, ASI/INQUIRY represents the state-of-the-art product in an IMS DB/DC or TSO-supported IMS environment. It is the only system combining an easy to use language, complete user flexibility, and rapid response time in a single package. If you want to start answering "What if . . . . " immediately, call or write today for further information.

asi

The Software Manufacturer

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software & services

Terminal Monitor

Providing a common application program interface between the operation system (OS/VS) and user-written programs, this Terminal Monitor System (TM) runs on 360/40, 370/135, or larger mainframes, and, according to the vendor, supports virtually any typewriter, display, or printer terminal. The software has on-line data management capabilities and can support line-image and structure data transactions, as well as handling source program library management. The package operates in a dedicated or multiprogramming environment. Services are accessed by a 360/370 Supervisor Call routine. Applications programs are written in COBOL, PL/1, FORTRAN, or assembler.

Project identifier codes and passwords provide system security. The package offers terminal-to-terminal message switching, controls over editing and printout, and provision for remote batch job entry. TM's data management component can compress data, saving an average of about 40%, according to the vendor. Disc space is immediately available for reuse, if not explicitly saved.

The vendor is using the system in-house to support on-line text processing and document file management systems. A permanent license is $23,500. On a one-year lease it's $885/month, on a three-year lease $690/month, and on a month-to-month basis it's $1,000/month. ASPEN SYSTEMS CORP., Germantown, Md.

FOR DATA CIRCLE 252 ON READER CARD

software spotlight

Word Processing

What DEC has done for small word processing users (with its PDP-8-based, two user WPS system), this firm has done for larger PDP-11 users. Operating under RSTS/E (or CTS 500/E), the WORD 11 word processing system provides up to 60 users with editing, printing, and list processing capabilities. Since WPS is just another job to RSTS, concurrent time-sharing can take place at some terminals while others are performing word processing. WORD 11 offers capabilities including editing based on grammatical entities, menu-driven operation, margin control, justification and tabs, simultaneous editing and printing, spelling error detection, shorthand abbreviations, block text insertion, and list processing (which allows record selection from lists of data based on Boolean operations). Selected records may be merged with predefined forms to provide automatic form letter generation. Diablo Hytype printers are supported, providing justification (with spacing increments of 1/120-inch), and super- and subscripting. Users also can use any other printer supported by their PDP-11.

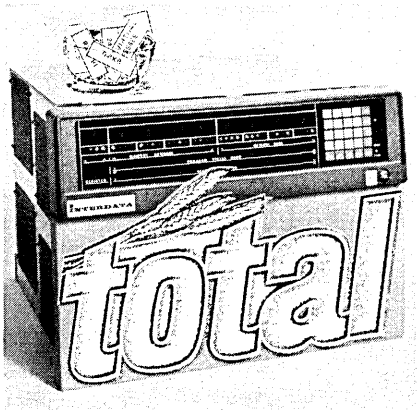
Minimum hardware required to support WORD 11 consists of any valid RSTS/E V06B-02 or CTS 500/E Level 2 system with at least 32K words of user memory, a hardcopy printer with upper and lower case, and DEC VT52 terminals. In addition to the operating system, BASIC-PLUS is also required.

Currently undergoing beta-testing, WORD 11 is scheduled for release August 1. A copy of the program on nine track mag tape (800 bpi or 1,600 bpi) goes for $12,500 including installation notes, user's guide, manager's guide, and six months' support service. DATA PROCESSING DESIGN, INC., Buena Park, Calif.

FOR DATA CIRCLE 257 ON READER CARD

Data Base Management

Add the team of TOTAL and Interdata 32-bit processors to the growing roster of small computers with big data base management systems. This version of TOTAL is said to offer the same capabilities currently available with all other versions of the product. Examples include data relationships in either network or hierarchical structures, reduction in data redundancies, and efficient utilization of disc space.



The package runs on Interdata's 7/32 and 8/32 processors under os/32. The package will initially be available in a basic version ($13,500) with a compatible central version ($16,500) slated for the fourth quarter which will allow users in different partitions to share a copy of the system resident in another partition. Multiple copy and oem discounts are offered. CINCOM SYSTEMS, INC., Cincinnati, Ohio.

FOR DATA CIRCLE 258 ON READER CARD

DOS/VS Balancer

Not just a partition balancer, this dynamic system balancer for IBM DOS/VS users balances I/O as well as cpu time, and it's said the package can help increase system throughput by 20%. Because DOS/VS only gives up control when a job stops using the cpu, the system can become unbalanced, with some jobs creating bottlenecks by hogging the cpu. This is said to be the first system that allows the user to "fine-tune the balancer," changing the composition of work as the job mix or job profile varies. The price is $2,100. VALUE COMPUTING INC., Cherry Hill, N.J.

FOR DATA CIRCLE 253 ON READER CARD

Basic

BASIC/TCP is a BASIC interpreter that runs on 360s and 370s under DOS or DOS/VS. The terminal control program (TCP) requires a minimum of 65KB of memory, and uses a dynamic priority assignment technique for cpu scheduling. TCP minimizes disc activity by ordering requests and combining compatible requests into single channel programs, allowing BASIC/TCP to run on machines as small as the 360/40 or 370/125, according to the vendor. The BASIC interpreter handles upper and lower case character strings, performs APL-like operations on arrays, manipulates random and sequential access files, and can segment large programs into smaller, more easily manageable parts. Editing and debugging facilities are also provided. BASIC/TCP may be licensed for $2,550/year with full documentation, source code, and maintenance included. Trial license arrangements are also offered. CBM ASSOCIATES, Lansing, N.Y.

FOR DATA CIRCLE 256 ON READER CARD

M6800 Floating Point

Users of Motorola's 6800 microprocessor can now get floating point packages and a cross-assembler with floating point pseudo operations. The floating point packages come in three versions with four and one-half, seven, and 10 digits of accuracy. The basic packages perform addition, multiplication, subtraction, division, fix, float, and conversions between ASCII strings and floating point numbers. Extended packages offer comparisons, square root, sine and cosine, conversations between polar and rectangular coordinates, natural log, exponentiation, floating point move, change sign, and

software & services

arctangent. Execution times run from 500 usec for a 4.5 digit add to 1,500 usec for a 10-digit divide. Basic and extended packages may be ordered as a combined package, if desired. The basic and extended packages sell for $120 to $240, depending on accuracy and whether they are loaded in 5204 or 2708 ROM's. The combined packages cost from $240 to $360, again depending on accuracy and ROM.

Written in Standard FORTRAN IV, the cross-assembler may be adapted for any computer with at least a 16 bit word length. For users of Data General minicomputers, the vendor can deliver the cross-assembler ready to run under RDOS or DOS operating systems. For DG's computers, the cross-assembler sells for $450 on paper tape (mag tape is an additional $20); the source program sells for $450; or both for $600. Delivery time on both the cross-assembler and the floating point packages is 20 days. SCI-PRO INC., Denver, Colo.

FOR DATA CIRCLE 264 ON READER CARD

Data Compression

This data compression package is said to save about 25% of the disc space used to store variable length alphanumeric records. It runs on any 360 or 370 system, and can be called from main programs written in any language. Compressed records can be sorted because the compression routine maintains the collating sequence of sort keys. The program compresses either complete or partial alphanumeric records. Fixed-length records remain fixed-length. A one-time license fee of $250 covers the assembler source decks of the compression routine, CMPRES, and EXPAND, a subroutine to restore data to its original form. COMPUTER ACTION, INC., Dallas, Texas.

FOR DATA CIRCLE 261 ON READER CARD

1130 Emulator

The Ellipse (Eleven-thirty Information Processing System) runs on Data General minicomputers under RDOS, MRDOS, or AOS, allowing the host mini to run programs and systems developed for IBM's widely used 1130. Data General ASCII files are interchangeable with IBM EBCDIC files, and it is said that no conversions are required.

Ellipse runs the full IBM 1130 operating system, DMV-2, allowing Data General users to run the 1130's language processors for COBOL, APL, RPG, FORTRAN IV, and COGO. It also lets users run 1130 applications, such as PCS, PERT, PHOTOCOMP, STRESS, A/R-A/P, STAT-PACK, and others. To run Ellipse, the DG mini needs at least 32K words of memory and a random access storage device (a 10MB disc is "more than adequate," the vendor says). Ellipse has a one time charge of $5,000, with quantity discounts available. ICON CORP., Rockville, Md.

FOR DATA CIRCLE 259 ON READER CARD

Assembler/Disassembler

This firm's MIKADOS assembler for Motorola's 6800 microprocessor now includes a disassembler which accepts object code and translates it into source code consisting of instruction mnemonics and absolute branch addresses. The assembler/dissassembler package, known as MIKADOS + D, is designed to simplify the assemble, debug, and modify cycle of program development. The package occupies 3KB of memory. The assembler generates object code for the micro's 72 basic variable-length instructions with all addressing modes, for a total of 197 different instructions. Debugging aids include breakpoints and monitor points. MIKADOS + D sells for $17.95, including a 28-page user manual, object code listing, and limited 90 day warranty. INPRO MICRO SYSTEMS, Van Nuys, Calif.

FOR DATA CIRCLE 262 ON READER CARD

I/O Device Assignment

DETOUR allows operators of 370s running under DOS/VS to assign or remove devices from any active partition without bringing the partition down. With one command, the operator can assign or release any I/O device to or from any active partition. If a partition is executing a long job and uses an input tape file for a short time at the beginning of the job, the operator may use DETOUR to release the tape driver without interrupting the job. Conversely, a device can be assigned to an active job at any time during its execution, as needed for an on-line application. The DETOUR system, including all enhancements for the next year, sells for $1,000. SOTA COMPUTER SYSTEMS, Great Neck, N.Y.

FOR DATA CIRCLE 266 ON READER CARD

Cyber 18 Software

Users of Cyber 18 minicomputers can now get an interactive terminal-oriented software system (ITOS) and a dozen application software modules. Of the dozen modules, eight apply to distribution businesses and the remaining four are for manufacturing concerns.

The ITOS package permits simultaneous, on-line communication between the mini and up to 16 remote terminal users. It has a monthly charge of $200, plus a $1,000 initial fee. The application modules for distributors include: order entry and invoicing, accounts receivable, inventory control and physical inventory, general ledger and payroll, and purchase order processing and accounts payable. Manufacturing firms can get modules for materials requirements planning, bill of material processing, and work in progress and routing programs. The twelve modules carry monthly charges from $10 to $27, and $150 to $750 is charged initially for necessary software licenses. Users can order any or all of the modules, which are available now. ITOS deliveries are scheduled 60 to 90 days ARO. CONTROL DATA CORP., Minneapolis, Minn.

FOR DATA CIRCLE 265 ON READER CARD

Data Base

Earlier this year this vendor promised a number of new products in its line of data management software. These management data query system (MDQS) enhancements, MDQS/II and MDQS/IV, are said to offer improved direct data base communication for experienced and inexperienced users of the vendor's Series 6000 and Level 66 large-scale computers.

MDQS/II is an end user facility with a data base retreival and report generation system. MDQS/IV offers these capabilities and data base creation and maintenance functions. Both offer an end user orientation for retrieval and report generation using conversational commands and procedural statements. They can access data managed under the vendor's Integrated Data Store (IDS), Index Sequential Processor, and associated sequential files. The systems can call subroutines written in other languages to manipulate data, and the system itself is callable from programs written in other languages. Data base maintenance is offered under MDQS/IV. Users can retrieve, modify, and place data back in the data base; update multiple data bases from multiple transaction files; read and write auxiliary files; create a subset data base; and combine data bases. A user-profile subsystem, subscripting, table look-up, removable media, check capability for data validation, and large record processing have also been added to MDQS. MDQS/II has a monthly license of $520; MDQS/IV is $908/month. HONEYWELL INFORMATION SYSTEMS, Waltham, Mass.

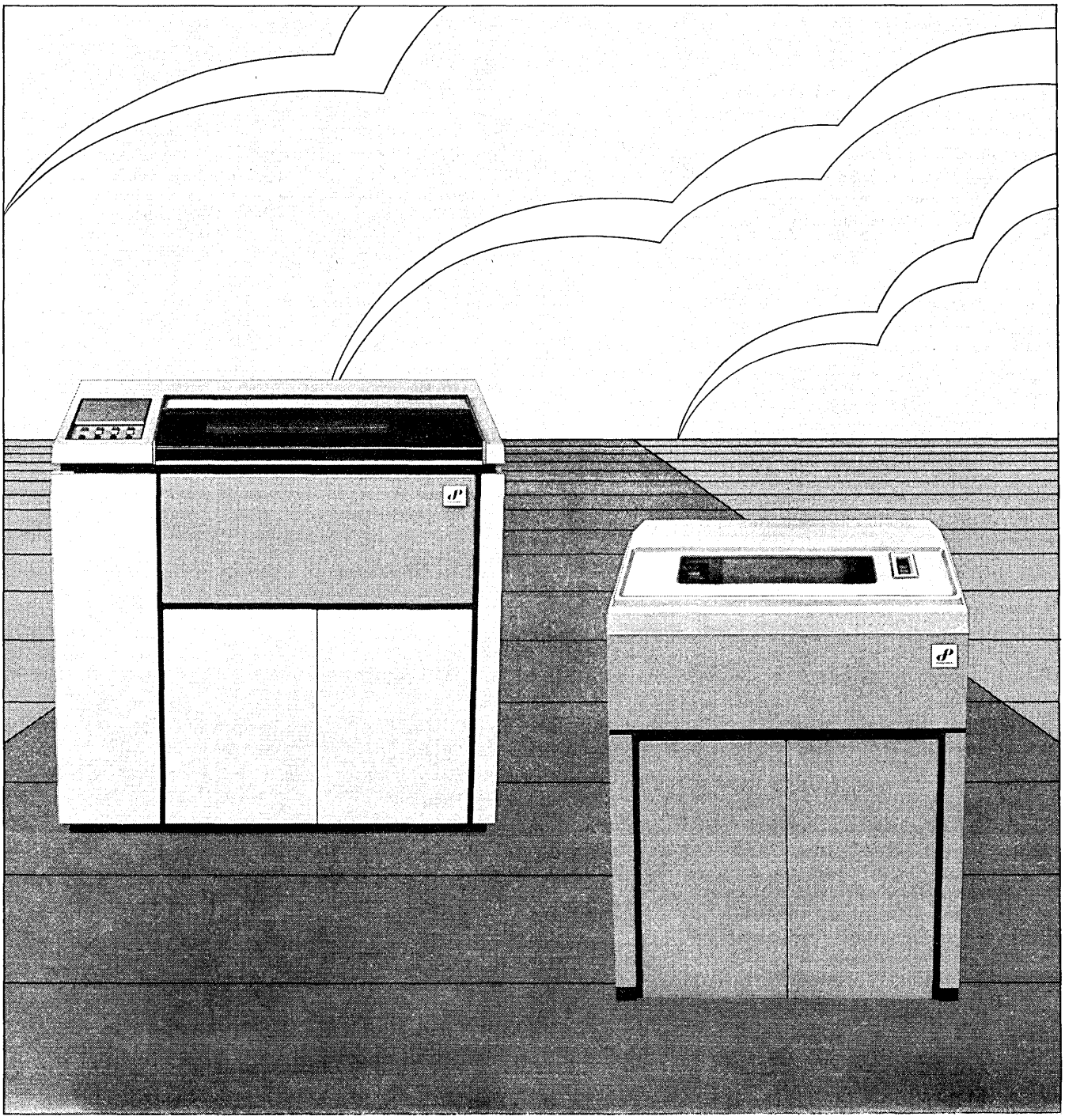
FOR DATA CIRCLE 263 ON READER CARD ❋

Afterthought

Capricious and troublesome muse!
Your promptings I cannot refuse
To insert some small ode
Twixt two lines of code
And the documentation confuse.

—David H. H. Diamond

PUT ON A BURST OF SPEED.



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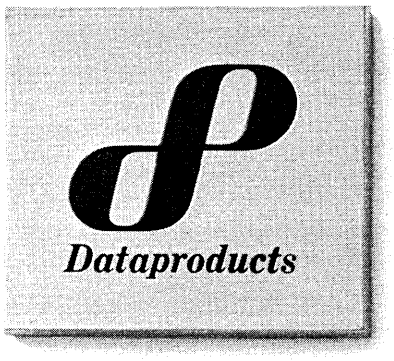

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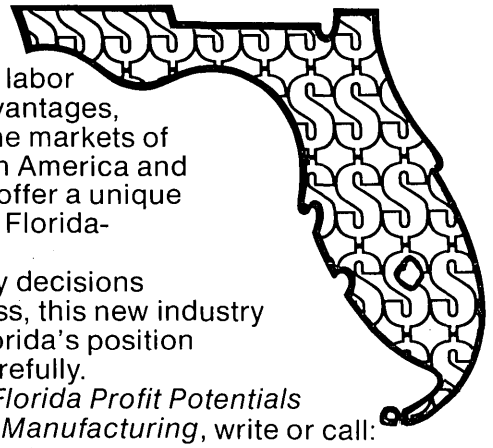

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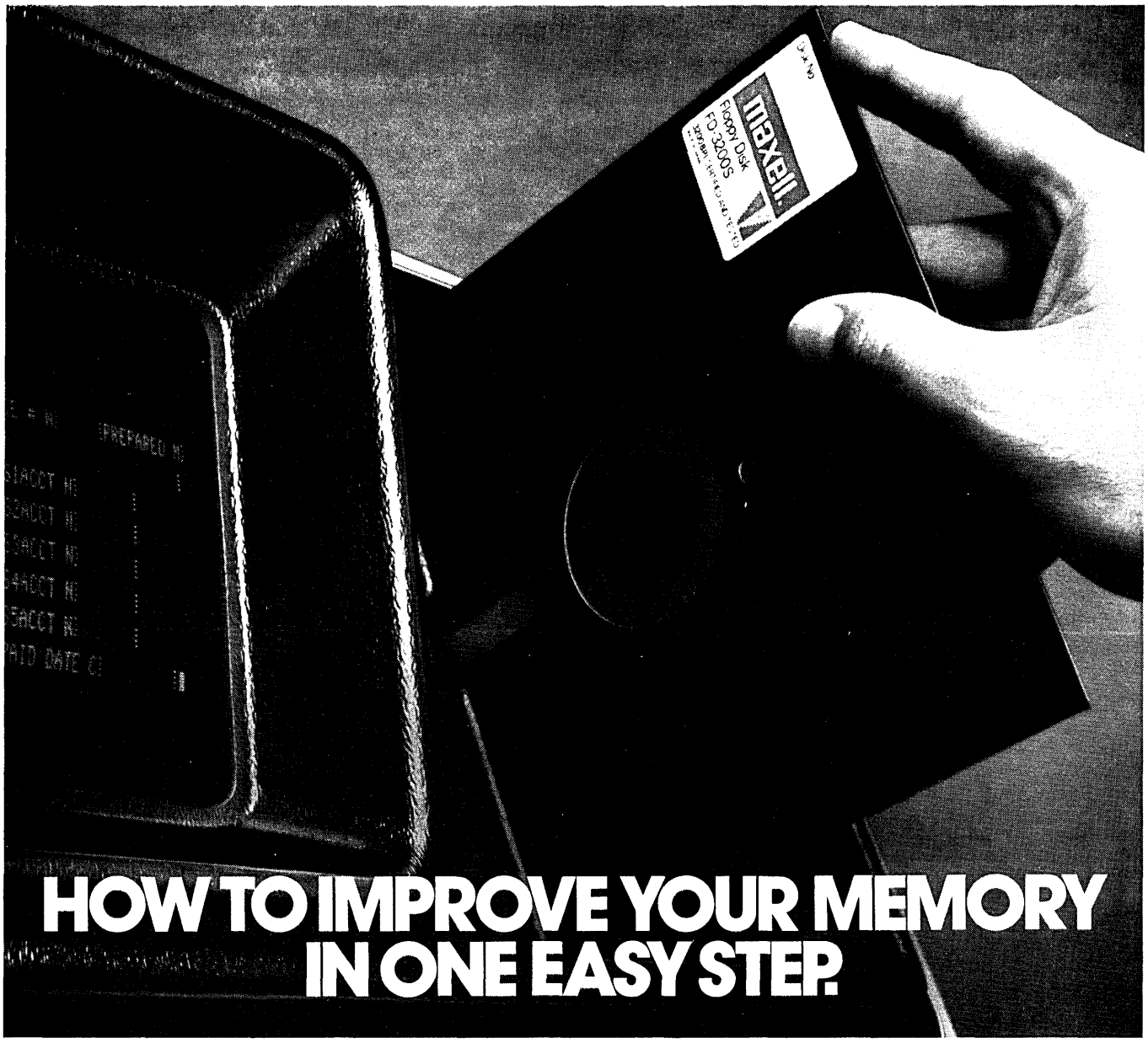

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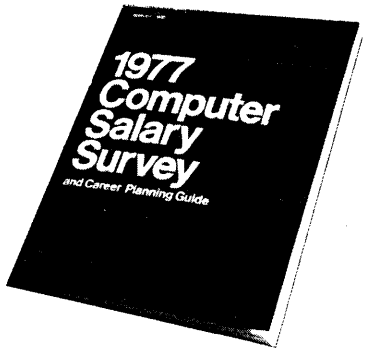

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Actually, Basic/Four Corporation has been making its own central processing units since August, 1976. We now make our own terminals, too.

We wanted tighter rein on manufacturing and testing, choice of the latest components, total control of quality, production and delivery. So we could offer even more reliable, better products.

Now we do.

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We also made sure our system would be the easiest to install. And operate.

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Full time commitment

Our specialty is small business computers; it engages our full attention, dedication and effort. And, of course, as the pioneer, we've been at it longer. Long enough to have established through SORBUS INC., our sister MAI company, a national network of support and service, 24-hours a day, if needed.

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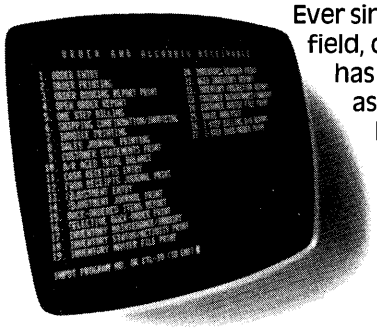
And now we make our own. So we *know* we're offering the best.

If you'd like to know more, call or write: Basic/Four Corporation, 18552 MacArthur Blvd., Irvine, CA 92714

Look to the pioneer



Ever since we pioneered the field, our operating system has been acknowledged as the best of any small business computer. It had to be–because our systems were always interactive, even when others were batch.

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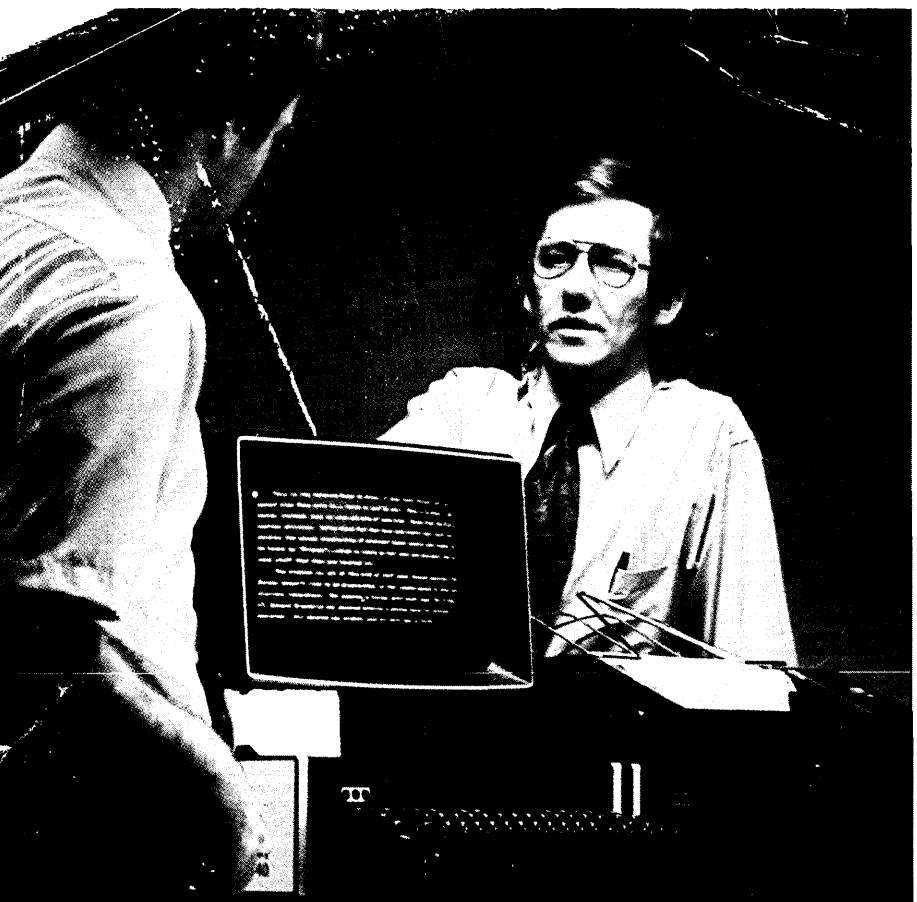

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Even though we probably go to more trouble to insure uninterrupted reliability than anyone else, we're still realistic enough to admit that sometime something's going to go wrong.

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