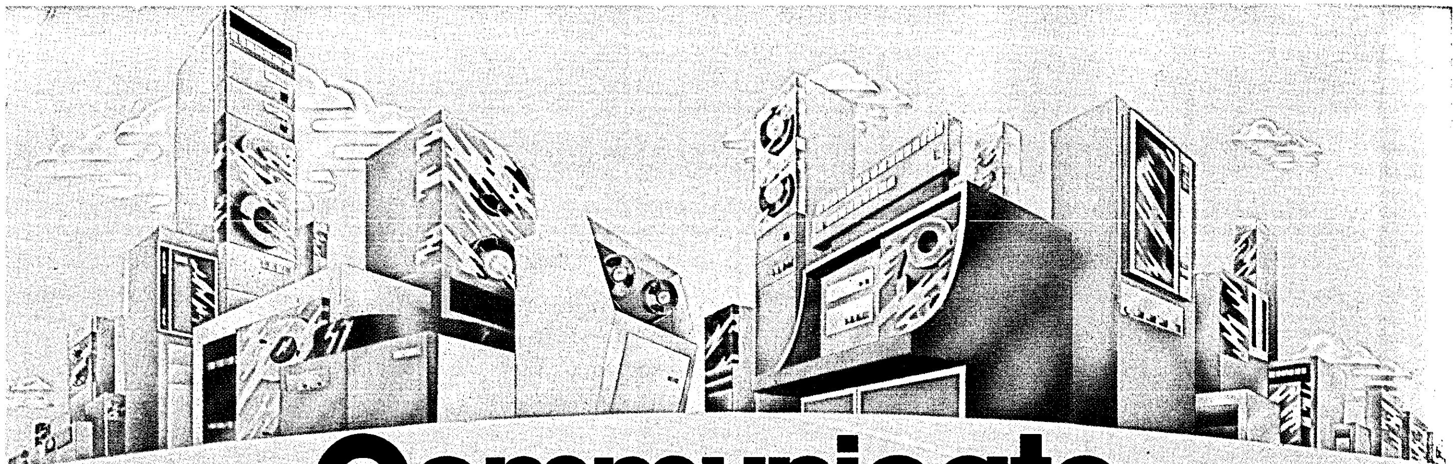
DATAMATION

75

January

dp salary survey

also: 1985 technology forecast,
dp career paths, and
1975 dp industry almanac...



Communicate with the computer world from a new position of power.

LSI's new ADM-2 video display terminal puts you in touch with the computer world. At a price that isn't out of reach. And with an industry standard interface to speed system integration.

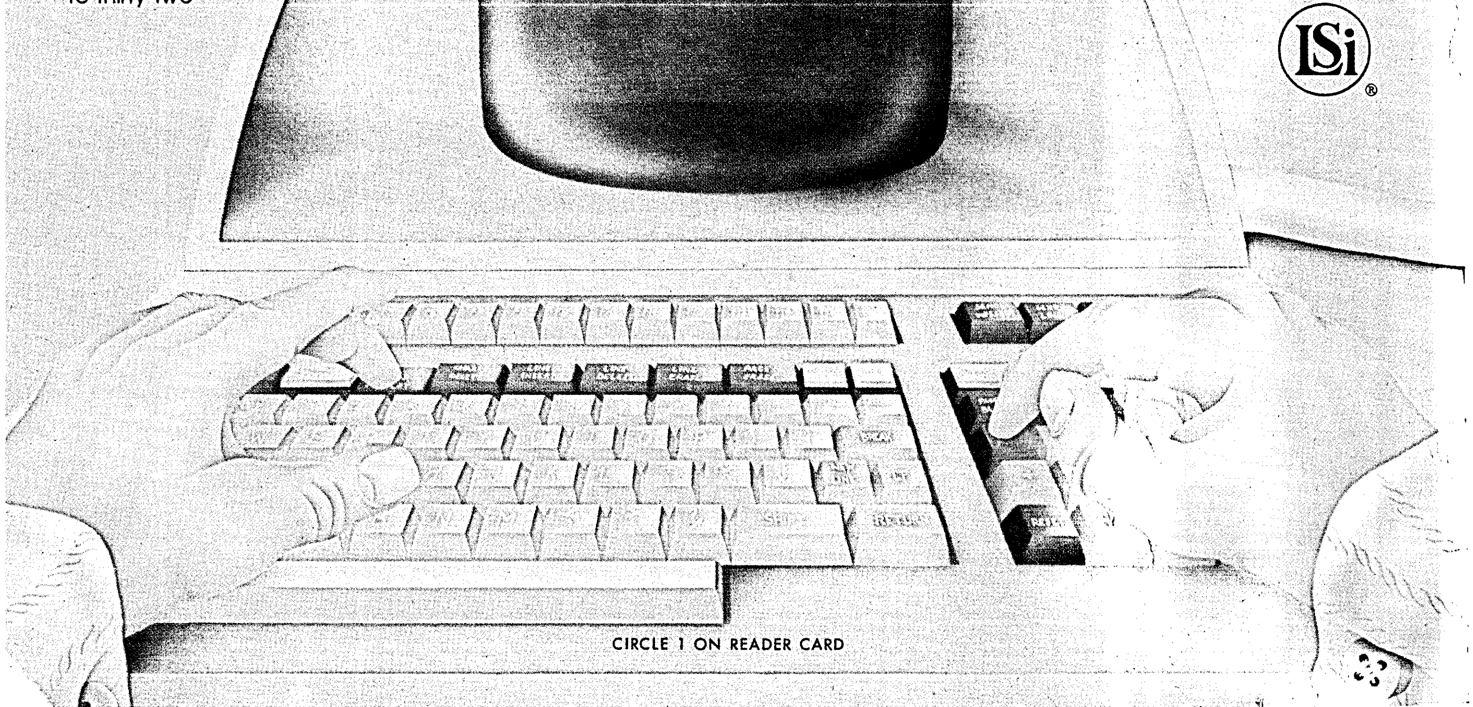
We've even gone beyond interface to outerface– the important person-to-terminal connection. Eight status displays, formatting, and a dual-intensity protect mode blend operator and machine into an efficient team.

Our basic keyboard can provide the full ASCII set, including upper and lower case letters. There's also a built-in numeric pad. Plus special function keys for instant access to thirty-two pre-programmed commands. Asynchronous data output comes in eight switchable rates up to 9600 baud.

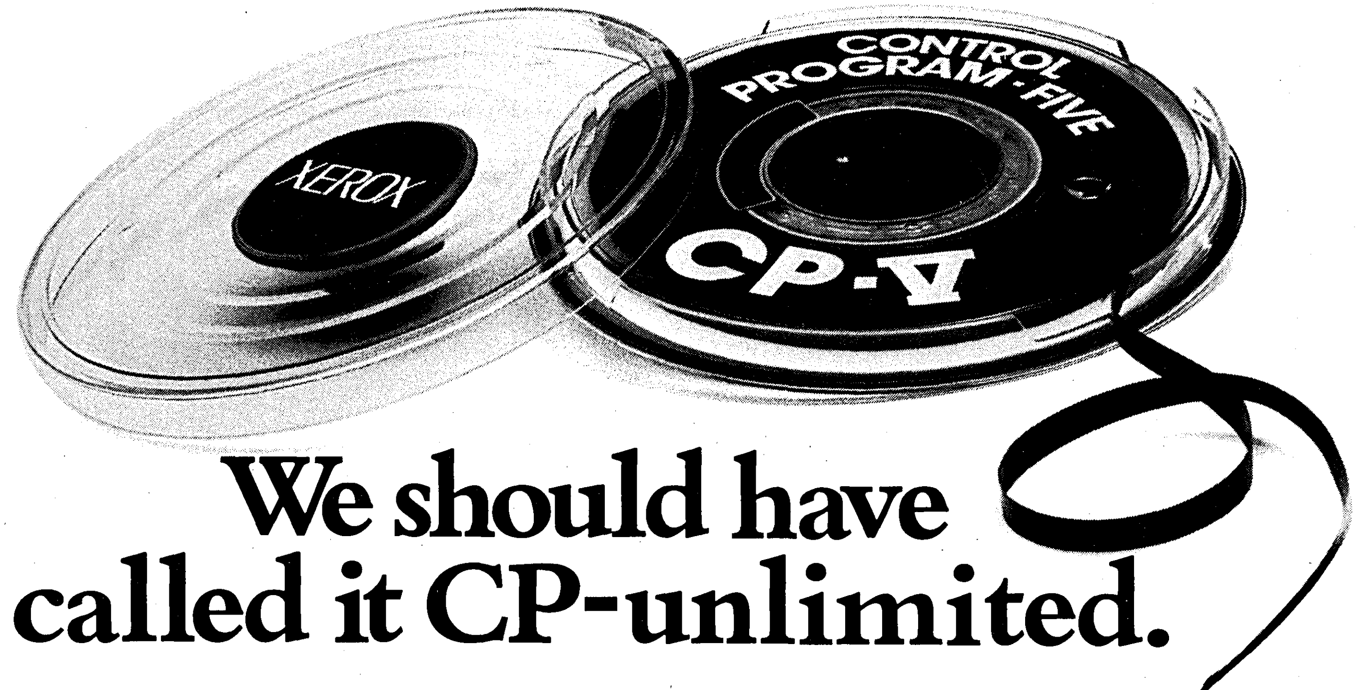
For more power, LSI options include polling, addressing and line printing. Find out how well we interface–and outerface–with your world. Call (714) 774-1010 for our attractive pricing structure or write for free literature. Lear Siegler, Inc., Electronic Instrumentation Div., 714 N. Brookhurst, Anaheim, CA 92803.

LEAR SIEGLER, INC.
ELECTRONIC
INSTRUMENTATION
DIVISION
DATA PRODUCTS

LSi®



CIRCLE 1 ON READER CARD



We should have called it CP-unlimited.

After all, it is the most advanced operating system around.

And it's already been proven. And tested. (As any of our customers will tell you.)

Plus, CP-V does give you simultaneous access in five modes. Real Time. Time-sharing. Multi-programmed Batch. Remote Batch. Transaction Processing.

There is the additional fact that Control Program Five (CP-V) ties together Xerox Distributed Multi-use computer systems.

And that CP-V is a key reason why our approach to hardware and software really works. (We've combined a unique hardware interrupt structure with independent processors and multi-port memory.)

All of which means you can talk to your computer and have it talk back to you intelligently. When you want to.

Not to mention that linking up CP-V to your present computer system presents minimal conversion problems.

It means more computer accessibility for more people in your company. Which means a smarter company. Which could mean a more profitable company.

And you can find out about CP-V for your company by calling (800) 421-6882. In California, (213) 679-4511, ext. 950. Or drop us a line at Xerox Corporation, Dept. 15-08, 701 S. Aviation Blvd., El Segundo, California 90245.

So why'd we merely call it CP-V instead of CP-Unlimited?

Modesty.

XEROX

THE SLASH 4 VMS. It's Time-Sharing PLUS....

...Data Base Management...Data Acquisition... Real-Time Control...Multi-Level Batch. And all can be configured to operate concurrently. Or independently. It depends on your needs.

What makes all this possible is our exceptionally efficient operating system. VULCAN. With its Re-Entrant Processors. Demand Paging. Remote Job Entry. Multi-Tasking. And Multi-Programming.

Along with VULCAN, you have a multi-task oriented architecture boasting the dynamic use of memory allocation that virtually eliminates software penalties. Then there is a wide selection of peripherals. And a range from 96K to 768K bytes of memory.

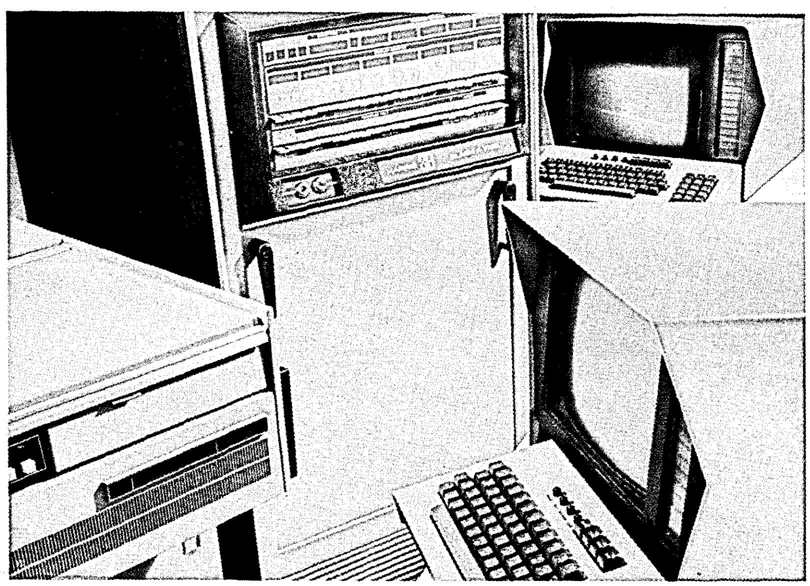
All this makes the SLASH 4 VMS efficient. Effective. Expandable. And Usable.

Because it does the job you want it to. With ease.

For more information on why the SLASH 4 VMS is the Usable Computer System, write Harris Computer Systems Division, 1200 Gateway Drive, Fort Lauderdale, Florida 33309. In Europe, write Techmation N.V., Gebouw 105/106. Schiphol-Oost, The Netherlands.

HARRIS

COMMUNICATIONS AND INFORMATION HANDLING

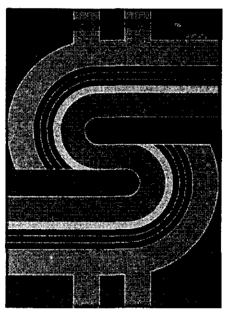


CIRCLE 42 ON READER CARD

DATAMATION®

VOLUME 21 NUMBER 1 This issue 119,954 copies **JANUARY 1975**

FEATURES



NEWS IN PERSPECTIVE

DEPARTMENTS

ABOUT THE COVER
Like our salary survey and the examination of career paths that follows, our cover explores the bright twists as well as the darker turns through the dp dollar. Design is by Barbara Benson.

DATAMATION®

**DATAMATION is published monthly on or about the first day of every month by Technical Publishing Company, 1301 South Grove Ave., Barrington, Illinois 60010; Arthur L. Rice, Jr., Chairman of the Board; James B. Tafel, President; Gardner F. Landon, Executive Vice President. Executive, Circulation and Advertising offices, 35 Mason Street, Greenwich, CT 06830, (203) 661-5400. Editorial offices, 1801 S. La Cienega Blvd., Los Angeles, CA 90035. Published at Chicago, Ill.

DATAMATION is circulated without charge by name and title to certain qualified individuals who are employed by companies involved with automatic information handling equipment. Available to others by subscription at the rate of $18 annually in the U.S. and Canada. Reduced rate for qualified students. Foreign subscriptions are available for £16.80 or for the equivalent of $40 U.S. in most West European currencies. Sole agent for all subscriptions outside the U.S.A. and Canada is J. B. Tratsart, Ltd. 154 A Greenford Road, Harrow, Middlesex HA13QT, England. No subscription agency is authorized by us to solicit or take orders for subscriptions. Controlled circulation paid at Columbus, OH and Form 3579 to be sent to Technical Publishing Company, P.O. Box 2000, Greenwich, CT 06830.

Microfilm copies of DATAMATION may be obtained from University Microfilms, A Xerox Company, 300 No. Zeeb Road, Ann Arbor, Michigan 48106. Printed by Beslow Associates, Inc.

letters

IBM—CDC

In your November issue (p. 11) you state ". . . when Control Data signed its antitrust settlement with IBM last year, IBM stipulated that CDC not be permitted to join the CIA."

That is absolutely not true. No such agreement was made or even considered.

FRANK T. CARY
Chairman
IBM Corporation
Armonk, New York

Mr. Cary might find it enlightening to examine the court record of the IBM-Justice Dept. case, specifically the section that deals with the IBM-CDC settlement. In the affidavit dated Jan. 23, 1973 given by government economist Ralph E. Miller, who talked with CDC attorneys about the "understandings" they made with Mr. Cary's attorneys, Miller stated:

". . . Mr. Lareau [Richard Lareau, CDC's attorney] characterized these oral understandings as constituting essentially an agreement to 'bury the hatchet' in regard to the issues raised by Control Data in its complaint against IBM, and also those raised by IBM in its counterclaim. Mr. Lareau and the other Control Data attorneys present gave at least three examples of what was covered by these oral understandings: (a) that neither party would issue inflammatory statements about the other; (b) that neither Control Data nor its attorneys would use other vehicles, such as the **Computer Industry Association**, U.S. v. IBM, or Telex Corporation v. International Business Corporation, e.g., to pursue the substance of the Control Data complaint against IBM; and (c) that counsel for Control Data agreed to destroy all of their work product."

The (W)right view?

Your November "People" column (p. 11) reports that "Whirling Dervish" A. G. W. ("Jack") Biddle's associates are awed by his "range of expertise." Perhaps it's not awe at all, but only collective dizziness deriving from Biddle's whirling and repeating of anti-monopoly chants.

I, for one, am not awed by Mr. Biddle's expertise, at least not in economic and political theory. If he really believed in free enterprise he would pack his bags, close the CIA's doors and whirl away back into retirement recognizing that the CIA is contributing to the destruction of what little freedom there is left for enterprise.

There is no way to reconcile belief in free enterprise and calls for greater government intervention. It is that—and that alone—from which enterprise is supposed to be free!

No authentic advocate of free enterprise would disagree with the statement that "business should be allowed to succeed or fall on its merits and not be susceptible to outside influences." The fact that Mr. Biddle and his CIA advocate the extension of the worst of all outside influences (i.e., the ruinous power of government regulation) proves that he most emphatically is not a "diehard proponent of . . . free enterprise."

What Biddle is a proponent of is a sort of affirmative action program for computer industry "minorities." He seems to think that every computer company has a right to another company's expertise and should be provided with the wherewithal to start competing against it. Why should any company have to work its way to the top, Mr. Biddle probably wonders. Why can't the government step in and allocate to all companies their "fair share" of the market?

But affirmative action programs—whether for racial minorities or computer minorities—are unjust because they involve the severance of rewards from achievement and seek to provide benefits expropriated from those who have earned them to those who have not.

Don't be dizzied by the unreasoned, illogical arguments of whirling dervishes! Recognize that government regulation and free enterprise are incompatible in principle and in practice, and that *only* the unregulated economy is a free economy!

JOE WRIGHT
Forest Hills, New York

Mr. Biddle responds: Clearly, Mr. Wright is ill-informed as to what I believe and what the Computer Industry Association stands for.

We do not wish to see government regulation of the computer industry, or for that matter, of any but the most essential (from a health and safety point of view) portions of the private sector. Many months before President Ford jumped on the "deregulation" bandwagon I had, in testimony before a Congressional Committee, suggested that the FCC be broken up and that regulation as a solution to competitive problems should be reexamined.

On the other hand, the free enterprise system cannot survive so long as a handful of giant corporations stand astride their respective markets. IBM holds more than 70% of the general purpose computer mar-

(Continued on page 136)

people

HE'S BEGINNING TO UNDERSTAND INFERENCE

Jack Minker has been working on inference problems—how to infer things from a data base—since he left college and went to work for RCA back in 1951. "Now I'm beginning to understand problems I didn't understand before. I'm finding out how to infer information out of a data base when data isn't explicit."

"And that's what artificial intelligence is all about," adds the new and first permanent chairman of the Department of Computer Science at the Univ. of Maryland. Minker, a prime mover in the Special Interest Group on Artificial Intelligence (SIGART) of the Association for Computing Machinery (ACM) is known for his work in artificial intelligence, with emphasis in question answering, problem solving, and information retrieval.

JACK MINKER
A concern for freedom

He also is active in political/social efforts. He is vice chairman of the Committee of Concerned Scientists which, he says, is concerned with freedom for all scientists but particularly for those in the Soviet Union. And he was first to urge SIGART to object to the Soviet Union as site for the 1975 International Joint Conference on Artificial Intelligence (December, p. 17) on technical, logistical and political grounds.

Minker joined the Univ. of Maryland in 1967 as a member of the faculty of the Computer Science Center. Last summer there was an administrative split of the academic from the computer service efforts and Minker became chairman of the department which concentrates on research and education.

He took his undergraduate degree in mathematics from Brooklyn college. He received a master's degree in math from the Univ. of Wisconsin and his Ph.D. from the Univ. of Pennsylvania. At the Univ. of Wisconsin, he met his wife, Rita, also a computer scientist. She worked with him at RCA, where he stayed from 1951 to 1963. His wife, says Minker, "was the first woman programmer at RCA and the second programmer RCA ever had."

Minker left RCA to join Auerbach Corp. in 1963, as technical director of the Washington office where he worked on associative memories, transportation systems, and operating systems, mostly for government agencies.

Minker's memberships in professional organizations are numerous as are his credits for organizational efforts for a variety of conferences. He is most proud of having served as program chairman of the 1967 ACM conference in Washington, D.C. which many ACMers look back on as having been the "biggest and best." He also is proud of his work as program chairman for the 1971 Jerusalem Conference on Information Technology. "It (the conference) really helped underdeveloped nations. It's regrettable that, in the world climate of today, such a conference wouldn't be successful."

Rita Minker remains active in computer science efforts. She's at the National Institutes of Health as head of a major development in computer research and technology. But the Minkers are not a totally computerized family. Their son, a student at the Univ. of Maryland, is interested in business and their daughter, a high school senior, likes photography.

TURING AWARD WINNER

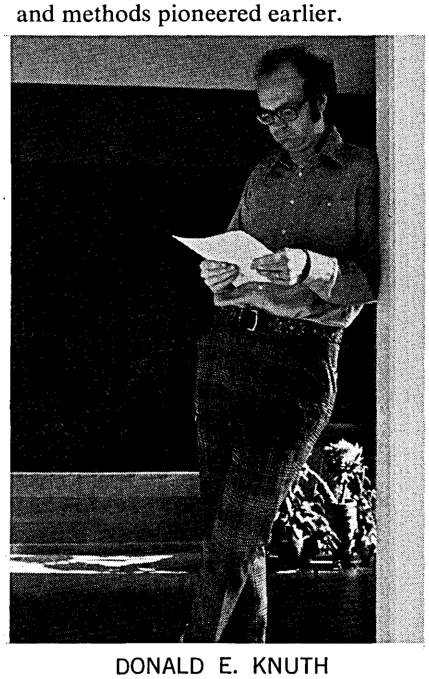
What started out as a one-volume, 12-chapter book by Donald E. Knuth on how to write compilers has brought him a lot of satisfaction, and the 1974 A.M. Turing Award, the most prestigious honor bestowed by the Assn. for Computing Machinery. The association cites what is now growing to a seven-volume series, "The Art of Computer Programming."

". . . His series of books have done the most to transfer the whole set of erstwhile esoteric ideas into the standard practices of computer scientists of today," says the ACM. "The collections of techniques, algorithms, and relevant theorems in these books have served as the nucleus for developing curricula and as an organizing influence on computer science."

Knuth, professor of computer science at Stanford Univ., says, "I wanted to be finished with 'my book' before my son was born, and he's now nine years old. Now I want to finish before he goes to college."

"I'm still trying to get the first five volumes done by 1980." He observes that an awful lot can develop in eight years in the computing field. He's now working on "Chapter 7." His first draft of the 12 chapters, which he began writing in 1962, took the form of 3,000 handwritten pages which he thought would be a 900 page book. The publisher, Addison-Wesley Publishing Co. said it would be more like 3,500. So Chapter 1 became half of Volume 1, and the series has turned out to be one of the 10 best sellers at Addison-Wesley.

Knuth's objective is "to summarize what's known about computer programming methods in a way that's well indexed and accessible." He says he wants to point to what's otherwise buried in the literature, thus avoiding the rediscovery by others of techniques and methods pioneered earlier.



DONALD E. KNUTH
The importance of algorithms

people

Knuth, 37, received a bachelor's degree in math from Case Tech, now Case-Western Reserve Univ. in Cleveland, working as an undergraduate in the computer center as a programmer. As a graduate student in math at Caltech, where he was to receive his Ph.D., he took the summer of '62 off to write a FORTRAN compiler for the Univac solid-state computer and decided to take a look at hashing techniques as applied to compilers. He says he found a way to predict mathematically how fast the method of hashing was. "That was the first time I had seen mathematics applied to computing," he says. The hashing problem turned out to be the start of what he now considers his main scientific activity, the analysis of algorithms.

At that time, math and computer science were still separate subjects and Knuth says he didn't think computer science would be a viable discipline, a subject with adequate depth for anyone to be majoring in it.

Computer science departments, however, did begin springing up at major colleges and universities. The best at that time, Knuth says, was at Stanford, which he joined in 1968.

Knuth is mindful of critics of college-level computer science departments. He says he can appreciate industry's demand for graduates who can step in and immediately do the work, students steeped in the latest products. But the technology is changing too rapidly, he explains, and two years hence industry will need a different type of person, someone comfortable with a different technology. Universities can't possibly shift with technology that rapidly.

"I think we could improve our program a lot by having students spend a year in industry before they graduate," he says. "They do that in England." And California Poly in San Luis Obispo has just such a model program set up in computer science.

In this subject, Stanford offers only graduate degrees, but Knuth feels they'll have undergraduate majors in the long run. Today, however, he doesn't feel they know enough about the subject to offer it as a major to undergrads. He thus favors a broader background for students, perhaps a major first in some other subject such as math. Too many institutions with undergrad programs focus too much on languages, not enough on algorithms, he says.

From his book-writing project, while surveying the various techniques, Knuth has also acquired an interest in the history of techniques, an important aspect of the history of computing. Some of this gets into his books. It's partly to set the record straight, he explains, but also to show his readers that they're a part of this evolutionary process.

He adds, "I'm looking for a graduate student to come along some day, one who's going to be a fulltime historian of computer science for the next generation." Knuth says he'd like to groom that student to be the leading historian, chronicling both the industry's methods and machines.

Far from being your typical bookworm, Knuth looks forward to the completion of his series ("I'll be a free man"). When his seven books have been written, he wants to write music. As a child, he recalls, he had thought the ideal life would be to be a college prof during the week and an organist on Sundays. For the Bethany Lutheran Church in Menlo Park, Calif., he designed a baroque-style pipe organ with about a thousand pipes made of various materials. He specified the voices it should have and its tonal qualities, working at the factory to develop this, and with the architect for its visual appearance.

He has also designed a pipe organ for his new home, one that's not yet installed. And with his wife, Jill, an artist who has worked with ceramics, he designed a tile panel for the entryway of their home. The design is based on what mathematicians call the dragon curve.

BEFORE PRIVACY BECAME AN ISSUE

"Well, I don't think anyone ever looked into my files," says Honeywell's Robert P. Henderson who was trying to remember exactly how he first became interested in the broad issue of data security and privacy back in 1969.

"We could see data bases becoming more important and I guess I was concerned that the role of the computer industry on the issue could be misinterpreted."

Henderson was a lonely and outspoken representative of the computer industry on the data security issue for a few years. (IBM, for example, didn't get wheeling on the issue until 1972). While he wasn't given much attention in those days Henderson now finds he is getting more requests for his old speeches than he received when he gave the speeches a few years ago.

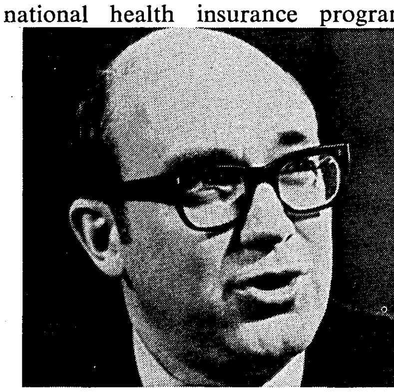
Henderson, an ex-IBMer who holds bachelor's and master's degrees from Dartmouth, came up through marketing at Honeywell where he is now vice president and general manager of Honeywell Information Systems' North American operations. In spite of his busy schedule as a manager, he still is deeply involved in privacy and data security issues.

Had there been any progress in the area, he was asked.

"I think the privacy issue is beginning to be resolved by legislation," says Henderson. "Many states, for instance, have passed legislation on privacy and I think that has gone a long way to define the issue which is important.

"As for data security, I'm seeing more Honeywell customers designing in security features when they're at the early stage of system design. That's the key thing—to do it right at the beginning."

Looking ahead on the issue, Henderson says he is "convinced" that a national health insurance program,



ROBERT P. HENDERSON
Watergate helped spur public interest in privacy

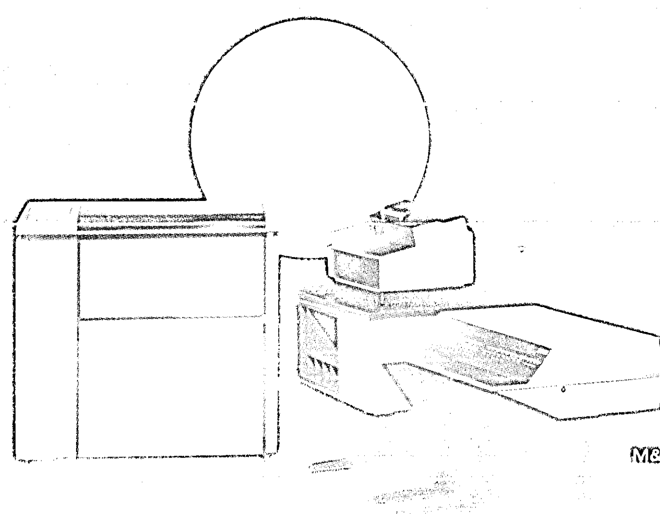
which he thinks is inevitable, poses "the biggest test ever of computer privacy."

"Once patient records are put into computers," he warns, "and that information is accessible from remote terminals, there may be no limit to violations of privacy.

"Many vital decisions regarding jobs, housing, education, and so on, are determined in part by the kinds of data known only to physicians and hospitals. It is particularly distressing to consider that a doctor's opinion in a patient record may be unknown to the patient himself, yet be available to others who use the information for non-medical reasons." □

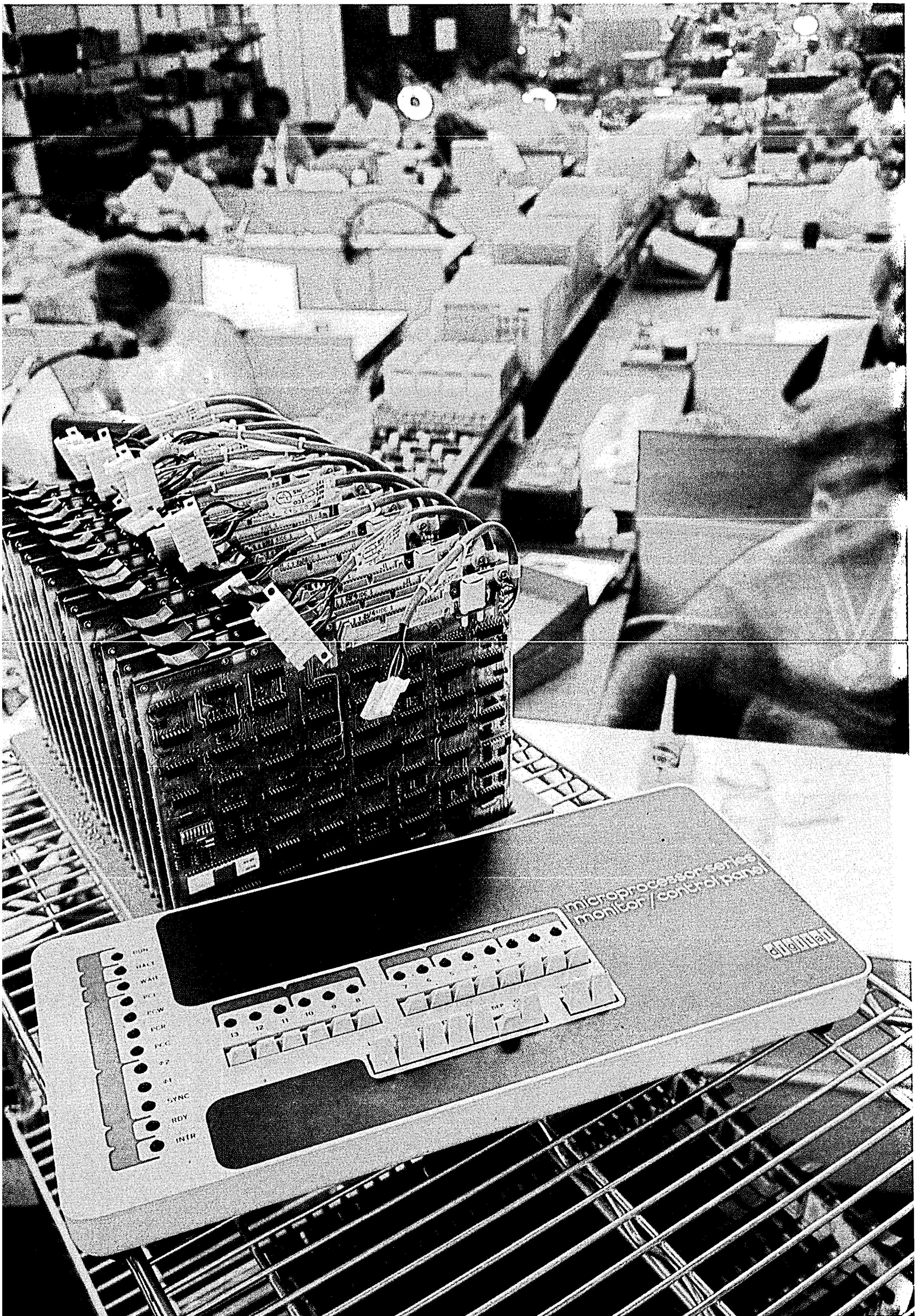
We can make all the difference in your world. We're Singer-M&M Computer Industries. The high-speed Intelligent Remote Batch Terminal people with the solid systems that are a proven success. **A WORLD OF DIFFERENCE IN PRICE** Singer-M&M means a money-saving difference. With the lowest priced High-Speed Intelligent Remote Batch Terminal System in the market. It's the one system that delivers more for less. **A WORLD OF DIFFERENCE IN SERVICE** We're also the service people. There are more than 1500 Singer-M&M service representatives within the U.S. And, even more throughout the entire free world. We're there. When you need us. Where you need us. **A WORLD OF DIFFERENCE IN CAPABILITY** Singer-M&M delivers more dependability, superb software support and field reliability. That's been proven. The Singer-M&M systems emulate IBM, CDC, UNIVAC, BURROUGHS and HONEYWELL high-speed terminals with communication speeds up to 50 KBPS — Line Printer speeds from 200 to 1800 LPM — and, card reader speeds from 300 to 1200 CPM. **A WORLD OF DIFFERENCE IN STABILITY** The world-wide Singer organization is the solid base for M&M Computer Industries operations. That means M&M management and financial stability is unequalled in the market. Singer-M&M Computer Industries. A difference that you can depend on.

A World of Difference



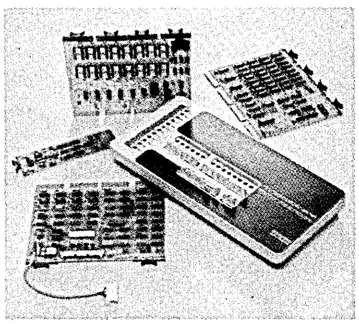
SINGER
M&M COMPUTER INDUSTRIES, INC.
2201 N. Glassell St.
Orange, California 92665
(714) 998-1551 Telex 65 5464

CIRCLE 94 ON READER CARD


microprocessor series
monitor/control panel
SYNC
RDY
INTR

The MPS microprocessor series: get it now and get it going. In volume from the Components Group.

The MPS microprocessor series of modules is available now. We designed it using only standardly available components with a proven track record. So we can make it and we can make it work.



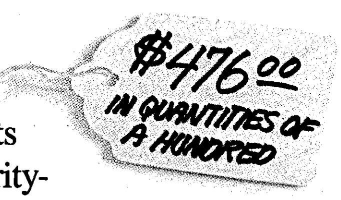
Plus, the MPS is easy to get up and going. Its external circuitry is TTL-compatible, which means you can interface to your computer or controller using Digital's broad line of standard logic modules.

Software development is easier, too. Control programs are prepared on a small, low-cost PDP-8 minicomputer, using the MPS software development kit of six basic programs.

And the modular construction of the MPS allows you to buy only what you need for your application.

Physically, the MPS is a series of four building-block modules and an optional control panel. A basic, fully-operational processor can be assembled from as few as two modules: the CPU and a memory module.

The CPU is an 8-bit parallel processor, employing reliable P-channel MOS/LSI technology. It will directly address up to 16K words of memory; cycle time is 12.5 μsec. Reprogrammable memory (PROM) is available in 256-word increments. Read-write memory (RAM) is available in 1K-word increments.



An external-event-detection module implements nine levels of priority-arbitration. These include application-defined six-level priority interrupt schemes, AC and DC power-failure detection capability, and the processor-controlled functions of Halt and Restart.

Volume buying will get you a very attractive discount. The MPS is priced at $476 for CPU and 1K of RAM, in quantities of a hundred.

So pick up the phone and dial 800-225-9480. Toll-free from 8:30 AM to 5:00 PM Eastern time. (US only. Massachusetts residents, please dial (617) 481-7400, extension 6656.)

We're the Components Group of Digital Equipment Corporation, One Iron Way, Marlborough, Massachusetts 01752.

In Canada: Digital Equipment of Canada Limited, P.O. Box 11500, Ottawa, Ontario, K2H8K8. (613) 592-5111, extension 127.

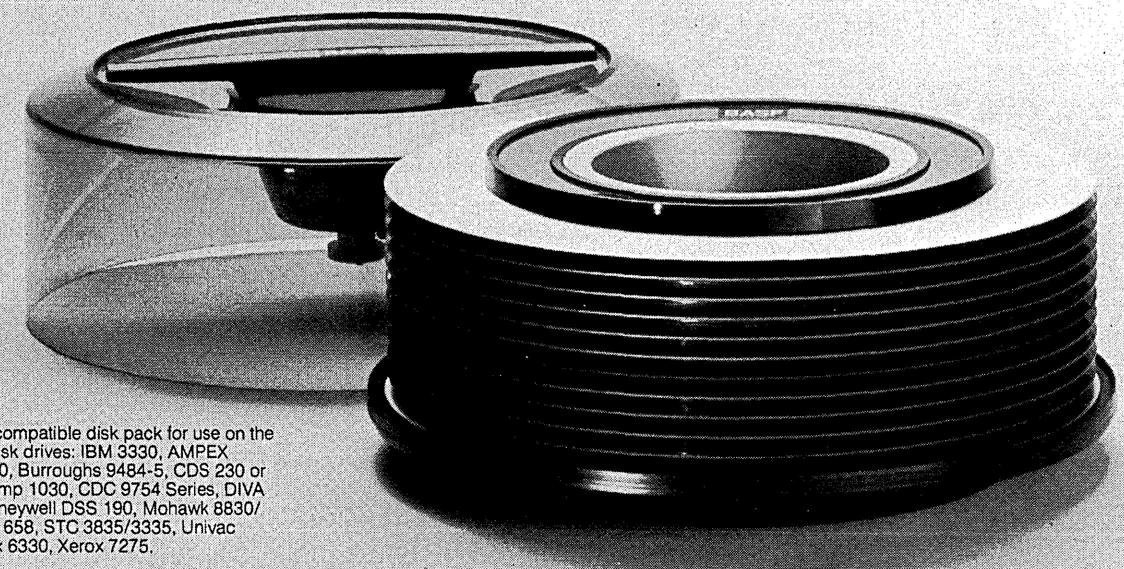
In Europe: 81 Route de l'Aire, 1211 Geneva 26, Telephone: 42 79 50.

digital
COMPONENTS GROUP

Unbundling the world's most popular minicomputer systems.

CIRCLE 50 ON READER CARD

If you think all disk packs are alike, take a closer look at the BASF 1236.



IBM 3336 compatible disk pack for use on the following disk drives: IBM 3330, AMPEX DM/DS-330, Burroughs 9484-5, CDS 230 or 231, Calcomp 1030, CDC 9754 Series, DIVA DD-40, Honeywell DSS 190, Mohawk 8830/8330, NCR 658, STC 3835/3335, Univac 8430, Telex 6330, Xerox 7275.

Because all disk packs conform to certain industry standards, you might think they're all equal. They aren't. The important difference is the extent to which a manufacturer is willing to go in order to *exceed* industry standards. It's a matter of making a disk pack better than you really need, because there could be times when you need it. Let's look at a few superior points of the BASF 1236 disk pack:

The binder that won't quit

As you probably know, magnetic coating doesn't stick to the aluminum disk all by itself. We use a special binding agent to produce an incredibly strong bond. The disk is sealed to prevent oxidation, so you can be sure that the coating won't peel or flake off.

Our own coating process

As the trend toward higher packing densities continues, it becomes increasingly important to monitor the thickness of coating deposited on the disk. The problem is compounded by the necessity for progressively varying the coating thickness from the outside toward the inside of the disk, because packing density is greater as the circumference decreases. For those reasons, we've discarded conventional coating methods in favor of an exclusive process using our own BASF-designed equipment.

A polished performance

Following the coating operation, we use our own exclusive polishing process to achieve optimum surface regularity. We've been able to achieve a surface so flat that the possibility of a head crash being caused by uneven disks is completely eliminated. We might mention here that the coating and binder formulation, combined with coating and polishing techniques, all are important factors in achieving surface hardness, which is the ability of the coated surface to survive excessive or extended head loading.

Achieving balance

Like any rapidly rotating object, a disk pack will behave strangely if not perfectly balanced. In our precision balancing operation, any weighting required is screwed into place, which eliminates the potential of shifting inherent in a conventional adhesive weighting system.

And to make sure...

We test our 1236 disk packs to standards much tighter than those of the leading equipment supplier. If anything unpleasant should happen, we'd much prefer it happen here than on your drive. As a regular procedure, we do scratch tests to check coating thickness, impact tests to determine head crash resistance, detergent tests to check resistance to wear and temperature variations, and drop tests to make sure balance and alignment don't shift during shipment. We test to make sure our 1236 disk packs are error free.

Finally

Our 1236 costs no more than other twelve-high disk packs. You're already paying for BASF quality... you might as well have it. For more information on the 1236 or other BASF disk packs or cartridges, write to BASF Systems, Crosby Drive, Bedford, Massachusetts 01730.

BASF

You're already paying for BASF quality, you might as well have it.

CIRCLE 12 ON READER CARD

LOOK AHEAD

THE HIGH COST OF EVERYTHING

Users of IBM hardware appear to be taking another hard look at the discounts offered by non-IBM peripherals sources. "If a 15% discount on 3330-like disc systems adds up to the amount an installation's budget is being cut, then they're going to go to that discount," says a spokesman for California Computer Products (CalComp), a supplier of 360 and 370 compatible disc and tape subsystems. CalComp, Itel, Storage Technology and Ampex--the traditional plug compatible manufacturers (PCMs)--were reporting unexpected year-end surges in their end-user business.

CalComp thinks end-user revenues will more than compensate for an expected 5% or more decline in oem revenues in its fiscal year which ends in June. Ampex which last spring had anticipated a decline in placements of end-user core and disc memories, now has revised those forecasts upwards by 15-20%.

Many factors contribute to the trend: the threat of recession-driven dp budget cuts, pressure on dp management to hurry up new application projects, and the soaring costs of everything. The dp department at Hughes Aircraft in Fullerton, Calif., saw its budget soar by $500,000 from salary increases and new projects in a single month. Paper and salaries most often are cited by users who seek ways to save by turning to microfilm and carefully monitoring paper use.

Meantime, the powerful IBM 360/65 machine becomes the darling of those who can find one. A Los Angeles service bureau last month threw out a 370/135 for a purchased 65 and independently-supplied peripherals. It had to convert from DOS/VS back to DOS, but the $3500 a month rental savings made it worthwhile.

DEC'S NEW OFFERINGS DESERVE A "W" FOR WIN

While IBM and the edp dwarfs have been raising equipment prices of late, Digital Equipment Corp.--sometimes called the IBM of the minicomputer business--doesn't appear to have gotten the message. Not only is DEC expected to weigh in soon with lower priced versions of both the high and low end of its mini line, the firm is also tinkering with a full blown mini system that represents a quantum drop in computer pricing.

The company is said to be hesitating only because it fears it could impact some of its current equipment lines. The system--a PDP-8A, with 32K of core memory, two floppies and a crt with hardcopy output--would sell for less than $8,000. That price would send shivers into the desktop programmable calculator marketing and the time-sharing terminal business as well.

While the system was developed in DEC's Education Products Group, similar systems with additional bells and whistles could easily be aimed at the business and engineering markets. The idea could also mean that DEC is close to committing itself to floppy discs while other mini makers are sticking with mag tape cassettes. Whatever DEC decides, it is committed to introducing a low-ball LSI PDP-11 (with chip sets made by Western Digital and not Mostek) and a high-end PDP-11 to bridge the final gap between the 11/45 and the PDP-10.

IBM OFFERING A PRICE CUT IN DISGUISE

Even IBM may be coming into the mini market with a price cut in disguise. The computer colossus' General Systems Division's Project Peachtree, a byte-oriented sensor based computer, is nearing a go-no-go point. GSD insiders think Armonk will give the go-ahead to the mini which would be priced lower than IBM's System/7, which has been a sales flop.

GSD is also expecting soon to announce a low-end extension of System/3. The new commercial system is usually called System/2 by outside sources, but is sometimes known internally as System/32 or simply as LEM (for low end machine). Whatever it's called, LEM should rent for about $800 a month in some commercial configurations.

The new system will feature industry software packages aimed at making the equipment nearly turnkey. Demonstration and training models of the new system have been installed at IBM sites under the strictest security precautions.

Two IBMers who were training on the machine in Rochester were almost fired when they were overheard discussing the machine after work hours.

WHAT'S SAUCE FOR THE GOOSE....

A company which advertises "computer brains for rent" looks for a year of tight budgets to augment its profits. John Discola, a partner in EDP Contractor's Group, Los Angeles, which he describes as being to the dp business what a major contractor is to the construction industry, says frozen budgets and personnel cuts through attrition without planned replacement, combined with an increased need for more dp, will mean business for his firm. The company provides "dp experts with an average of 15 years experience" on a subcontract basis.

ANOTHER ENTRANT TO SYSTEM/3 MARKET

Electronic Memories and Magnetics this month formally enters the IBM System/3 memory replacement market, joining such other suppliers as Business Systems Technology, CFI Memories and Standard Memories. The company is expected to announce core memory add-ons and an equivalent of the IBM 5444 disc drive with removable cartridge and fixed disc. The disc, made by the company's Caelus Memories operation, will be offered in the spring with a controller and 4.9 megabytes of storage. This later will be doubled through a double-density (200 tracks per inch) offering.

David Ferguson, publisher of System/3 World, thinks that some 35,000 System/3s have been installed worldwide, with about 20,000 in the U.S. EM&M hopes to penetrate that market through its Caelus distributor network in 25 U.S. cities and eight European.

GENERAL AUTOMATION YIELDS TO CONVENTIONAL CHIPS

"They were turning out like souffles--no two were just alike," says a General Automation spokesman of his firm's withdrawal of silicon-on-sapphire microcomputer products. Although a few working models of the LSI 12/16 and LSI 16 microcomputers are said to be up and running, the chip yield, which determines cost, apparently was not high enough to keep the products cost competitive with offerings from Orange County neighbor Computer Automation and giant DEC.

One of the reasons General Automation chose the SOS technology approach in the December, 1973 product announcement--the fact that the techniques had successfully been used in military and aerospace products for a decade--appears to have been a bad one on which to base a commercial product line. The military seldom worries about yields and costs as much as commercial businesses must. To meet commitments to its customers, GA expects to use Intel chips and different logic for the slow-speed LSI 12/16 equivalent, and develop a bipolar MSI product for the higher-speed equipment.

ANTITRUST FOE GONE, BUT IBM FRIENDS REMAIN

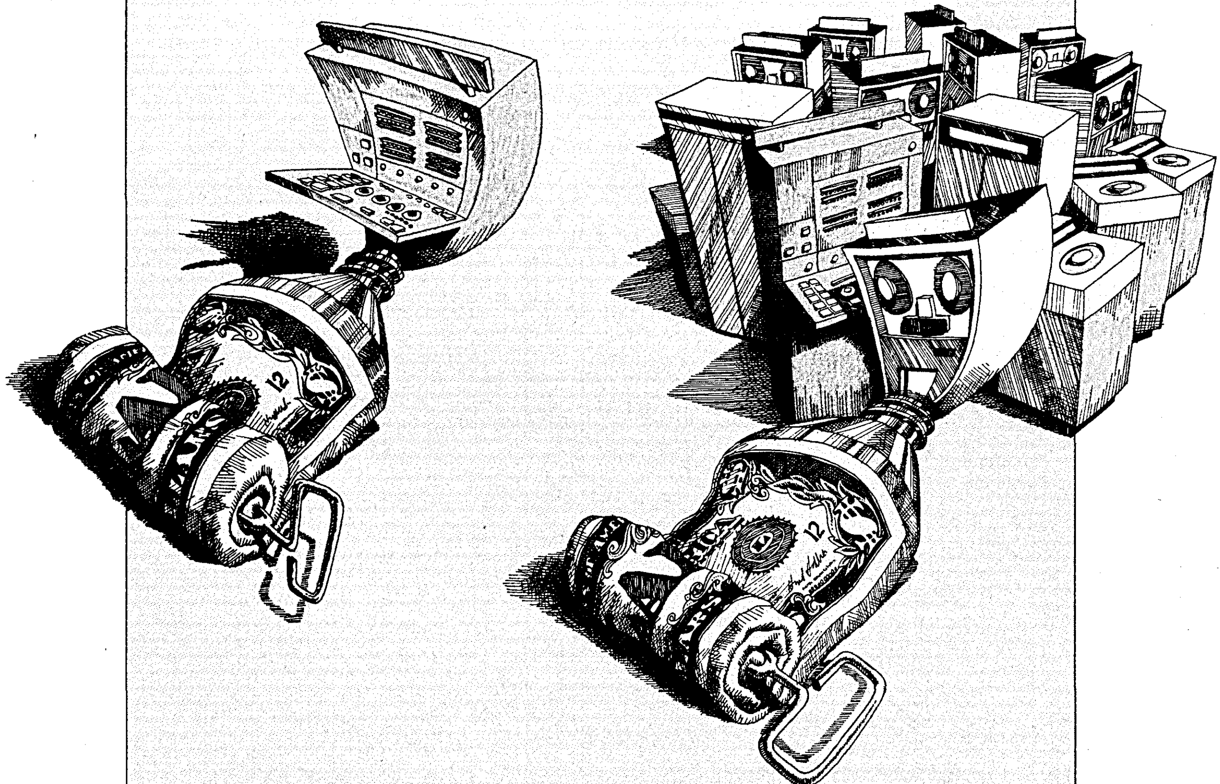
Attorney General William Saxbe is famed for saying the wrong thing at the wrong time. He did it in spades last month saying the Justice Dept. will crack down hard in the whole antitrust area. A few days later, President Ford sent Saxbe packing to India as U.S. Ambassador, the first of the President's cabinet members to be asked to leave. But that bodes well for IBM, because Saxbe had a deaf ear for the idea of settling the IBM antitrust case with a consent decree.

IBM still has outspoken advocates at the Justice Dept. in Solicitor General Robert Bork, and at the White House in presidential counsel Phillip E. Areeda. The latter, a former Harvard law school professor, examined the AT&T antitrust case before it was filed and briefed the President on the case. Many expect Areeda to play a role in any settlement of the IBM case, due to go to trial Feb. 18.

MORE IBM PAPERS

"The IBM Papers," is how the Computer Industry Association is billing the waterfall of internal IBM documents that is expected to cascade into the public record later this month when the documents are filed in federal court.

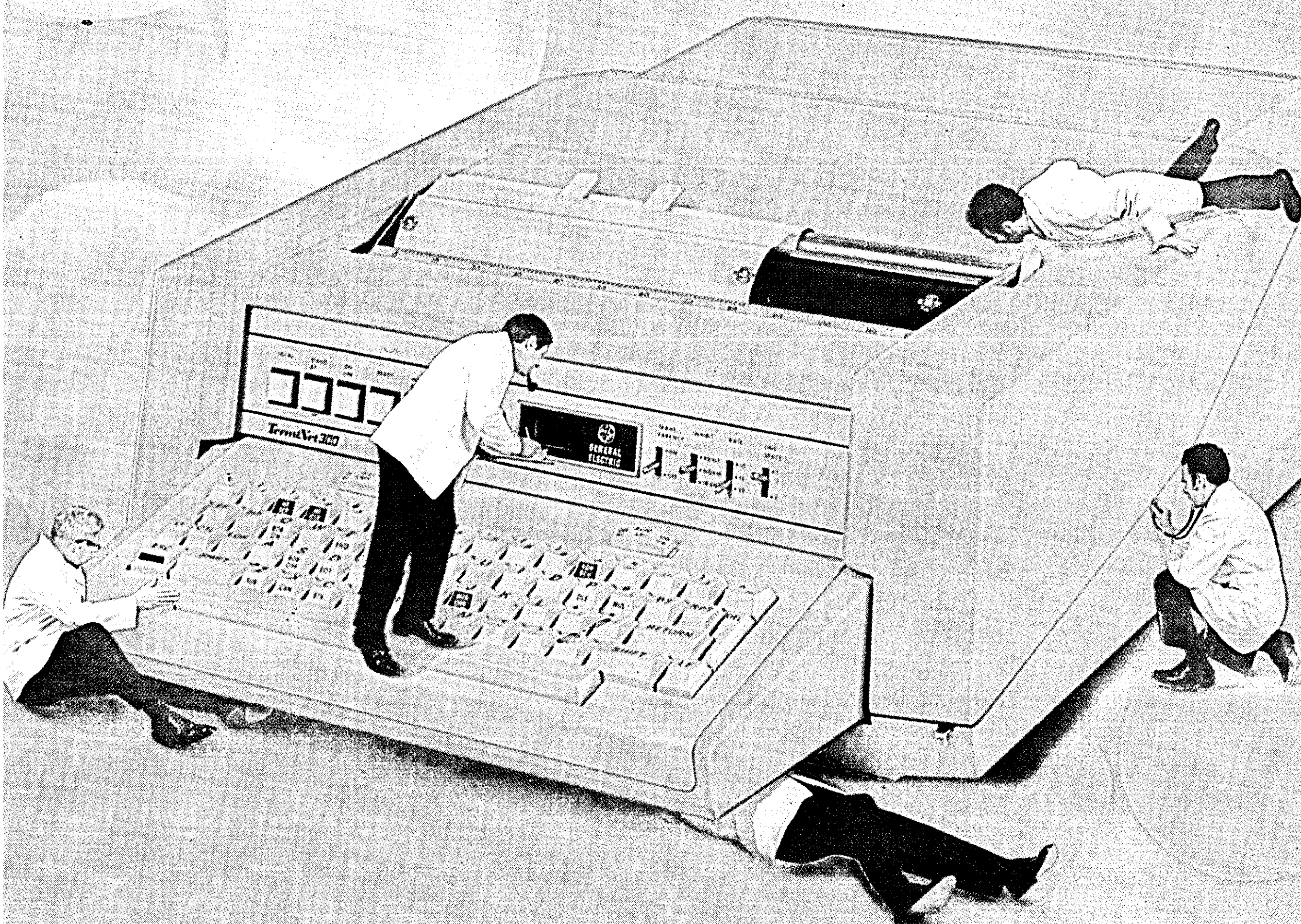
(Continued on page 122)



TermiNet® Printers

GE QUALITY is... 101 tests at the factory

. . . exercised, vibrated, inspected, verified, burn-in tested, and run-in tested, TermiNet printers get 101 different tests to insure customers they're reliable, quiet, fast and easy to operate. "Quiet room" noise testing and life testing are other ways General Electric makes sure TermiNet printers meet your management's functional requirements within budget. It's all aimed at saving you money by KEEPING YOU ON-LINE.



IF WE CAN'T MAKE YOUR MINICOMPUTER SYSTEM DO MORE WORK FOR LESS MONEY, NOBODY CAN.

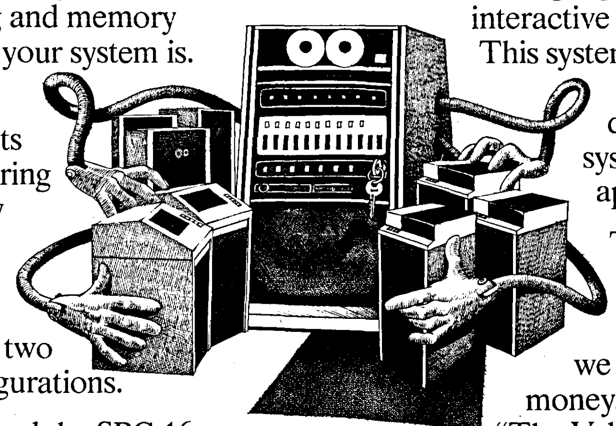
When we introduced the SPC-16, we promised it would be the world's most powerful, versatile, cost-effective family of minicomputers.

It was. It still is.

The SPC-16 isn't the lowest priced hardware you can buy. But it will give you the lowest cost solution.

Through advanced systems architecture, simplified interfacing and a powerful instruction repertoire, the SPC-16 allows you to minimize programming, interfacing and memory costs no matter what size your system is.

Six mighty minis.
The SPC-16 family consists of six minicomputers offering a choice of three memory cycle times (800ns, 960ns and 1440ns), memory expansion to 128K using efficient 16K boards, and two different packaging configurations.



If you build a system around the SPC-16, it will do more work for less money than any other system you could build.

And that translates into more profits.

We know it for a fact. In the past few years, we helped a lot of OEMs get the edge on their competition by designing our product into their products. We helped a lot of end users solve a lot of tough, tight-budget applications. And, we produced some cost-effective systems of our own.

Two hard working systems.
Take RTOS II for example. It's a multi-programming system offering real-time event driven foreground processing concurrent with background job development and computation.

You couldn't buy a better price/performance solution for applications such as process control, data acquisition, laboratory research, material handling, communications or overall manufacturing automation.

We also built a powerful disk-based general purpose system around the SPC-16. DBOS II lets you do more computation with less memory, in far less time, at a lower price than any system on the market. It offers both scientific and commercial languages and a combination of interactive and batch operation. This system is perfect for service centers, research and development groups and system house dedicated applications.

That's the short form.

To really appreciate how much power we can deliver for your money, write for our book "The Value of Power." It will give you the facts to back up our claim: If General Automation can't make your system do more work for less money, nobody can.

Write General Automation, 1055 South East Street, Anaheim, California 92803. Or call (714) 778-4800. In Europe, write General Automation, S.A., 24 rue du Sergent Bauchat, 75012 Paris, France. Telephone (1) 346/7973. In Canada, write G.A. Computer Ltd., 880 Lady Ellen Place, Ottawa K1Z5L9, Ontario. Telephone (613) 725-3626.

POWERFUL MINICOMPUTERS BY
GENERAL AUTOMATION

CIRCLE 45 ON READER CARD

calendar

JANUARY

Winter Conference, Optical Character Response Users Assn., Jan. 27-29, New Orleans. Session topics will include alphanumeric hand print, new credit card development, NRMA standards, and ocr education. There will also be vendor tabletop displays of new ocr equipment. Fees: $125 for company official representative, $50 for each additional person from the same company. Contact: T. David McFarland, 505 Busse Hwy., Park Ridge, Ill. 60068, (312) 825-8124.

FEBRUARY

IEEE Solid State Circuits Conference, Feb. 12-14, Philadelphia. Billed as the "foremost global forum for the annual presentation of new advancements in solid state circuits," the conference features the latest in solid state circuit technology used in the design of computers and allied equipment. The IEEE Solid State Circuits Council and the Univ. of Pennsylvania are co-sponsors. Fees: $35, members; $45, nonmembers; add $5 after Feb. 7. Contact: Lewis Winner, 152 W. 42nd St., New York, N.Y. 10036, (212) 279-3125.

Sixth Southeastern Conference On Combinatorics, Graph Theory and Computing, Feb. 17-20, Boca Raton. Mathematicians interested in these specialties will participate in instructional lectures given by representatives from Univ. of California, Berkeley; Kansas and Ohio State universities. Fee: $33 before Feb. 12, $40 after. Contact: Frederick Hoffman, Dept. of Mathematics, Florida Atlantic Univ., Boca Raton, Fla. 33432.

5th Annual SIGCSE Technical Symposium, Feb. 20-21, Washington D.C. This meeting is for those who are actively involved in teaching computer science, and runs adjacent to the 1975 Computer Science conference. In addition to the sessions dealing with instructional techniques and courses, there will be discussions covering the entry of computer science graduates into the dp industry, Fees: $20, ACM/SIGCSE members; $30, DPMA or ASEE members; $35, others; $10, students. Contact: Dr. Gerald L. Engel, Dept. of Computing and Statistics, VIMS, Gloucester Pt., Va. 23062, (804) 642-2111.

MARCH

Semiconductor International, 1st Annual Exhibition and Conference, March 4-6, Wiesbaden, Germany. Approximately 5,000 specialists in processing, assembly and testing of semiconductor devices and circuits from Europe and the U.S. are expected to view "the latest in semiconductor/microelectronics equipment and techniques," and attend technical sessions and seminars covering "semiconductor production advances." For fees and registration information contact: Janis Lindgren, European Product Mgr., ISCM, 222 W. Adams St., Chicago, Ill. 60606, (312) 263-4866.

Industrial Applications of Microprocessors, March 11-12, Philadelphia. Sponsored by the Electronics and Control Instrumentation group of the IEEE, the meeting will

calendar

emphasize developments in the applications of microprocessors to solve industrial control problems, and use of the microcomputer or microprocessor as a tool in the design of process control instrumentation hardware. Fee: $35, members; $45, nonmembers (advance registration). In addition, there will be a one-day tutorial session on March 10, for an additional fee. Contact: Roger W. Bolz, general chairman, 8437 Mayfield Rd., Chesterland, Ohio 44026, (216) 729-7275.

1st Annual Metric Conference and Exposition, March 17-19, Washington, D.C. Sponsored by the American National Metric Council, the conference is structured as "a report to the nation on the status of metric conversion in the U.S. and abroad." Topics include the economics of conversion, the legislative outlook, metric usage, and the impact on standards, education, and particular sectors of the economy. Representatives from Australia, Canada and the U.K., will discuss their countries' experiences in converting to the metric system. Fees: $100, ANMC subscribers; $125, nonsubscribers. After Feb. 28 add $10. Contact: Lou Perica, ANMC, 1625 Massachusetts Ave., N.W., Washington, D.C. 20036, (202) 232-4545.

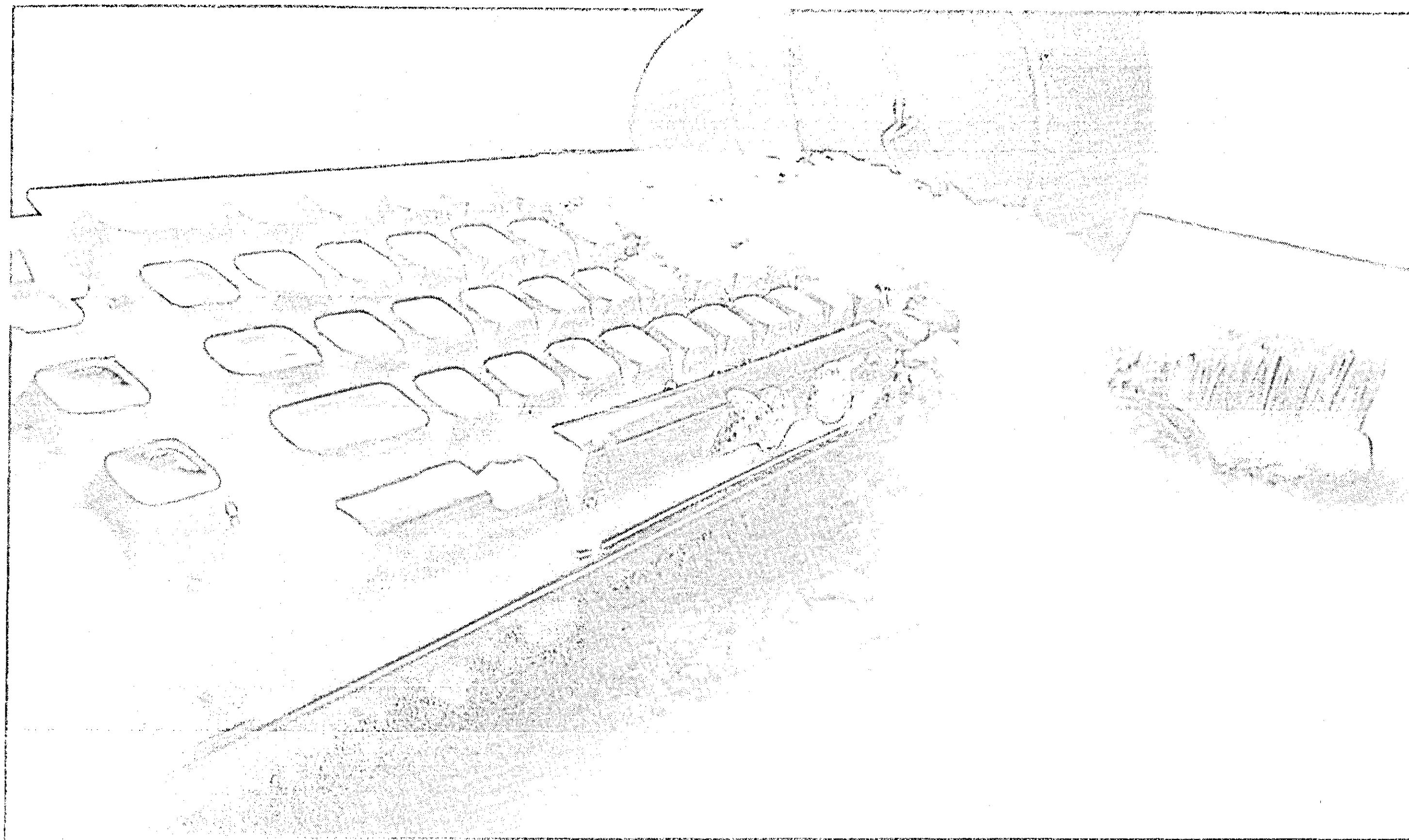
APRIL

EDUCOM Conference, April 3-4, Princeton, N.J. "Planning With and For Technology in Higher Education" is the theme of this meeting, sponsored by EDUCOM, the Interuniversity Communications Council, Inc. The program is designed for administrators, faculty and computer scientists connected with colleges and universities, as well as experts in educational television. Fees: $50, members; $100, nonmembers; $12 day, students. Contact: EDUCOM, P.O. Box 364, Princeton, N.J. 08540, (609) 921-7575.

ACM Pacific 75, April 17-18, San Francisco. The broad theme of "Data: Its Use, Organization, and Management" will be explored in sessions aimed at computer professionals from all phases of the dp industry and education. Tutorial, survey and research papers will be presented on data structures, data base management, data security, data communications, and data description languages. Fees: $25, members, $35; nonmembers (approx.) Contact: Anthony I. Wasserman, ACM Pacific, P.O. Box 2754, San Franscisco, Calif. 94126, (415) 666-2951.

Annual Conference, Association for Systems Management, April 27-30, Detroit. Approximately 1,500 systems analysts and managers, programmers, and dp managers will participate in 31 sessions, 16 of which will be devoted to management development. The Basic Systems Workshop, limited to 125 persons on a first-come basis, will emphasize the "human considerations required to involve users." Fees: $175, members; $225, nonmembers. Contact: Richard B. McCaffrey, ASM, 24587 Bagley Rd., Cleveland, Ohio 44138.

Conferences are generally listed only once. Please check recent issues of DATAMATION for additional meetings scheduled during these months.



You already have everything you need to keep our keyboards clean.

Getting any keyboard dirty is easy.

From that point on, things become more difficult. Because the contacts on mechanical keyboards are very sensitive to contamination. And, if the dirt hasn't already gotten to them, the cleaning process might.

MICRO SWITCH makes the cleaning process easy. All it takes is a bucket of hot, sudsy water. And maybe a brush.

Because MICRO SWITCH has solid-state keyboards. Designed around Hall effect chips that are completely encapsulated, they're impervious to just about any contaminant you can name.

So things like dirt and coffee can't get in. And neither can a bath in hot, sudsy water.

It makes your equipment maintenance a lot easier. And, in the long run, can substantially reduce service costs. Besides giving you a keyboard with all the built-in reliability of a solid-state design in the process.

If you'd like more information on MICRO SWITCH keyboards, call, toll-free, 800/645-9200 (in N.Y., call 516/294-0990, collect) for the location and telephone number of your nearest MICRO SWITCH Branch Office.

You'll see a line of keyboards that work like a dream. And wash like a coffee cup.

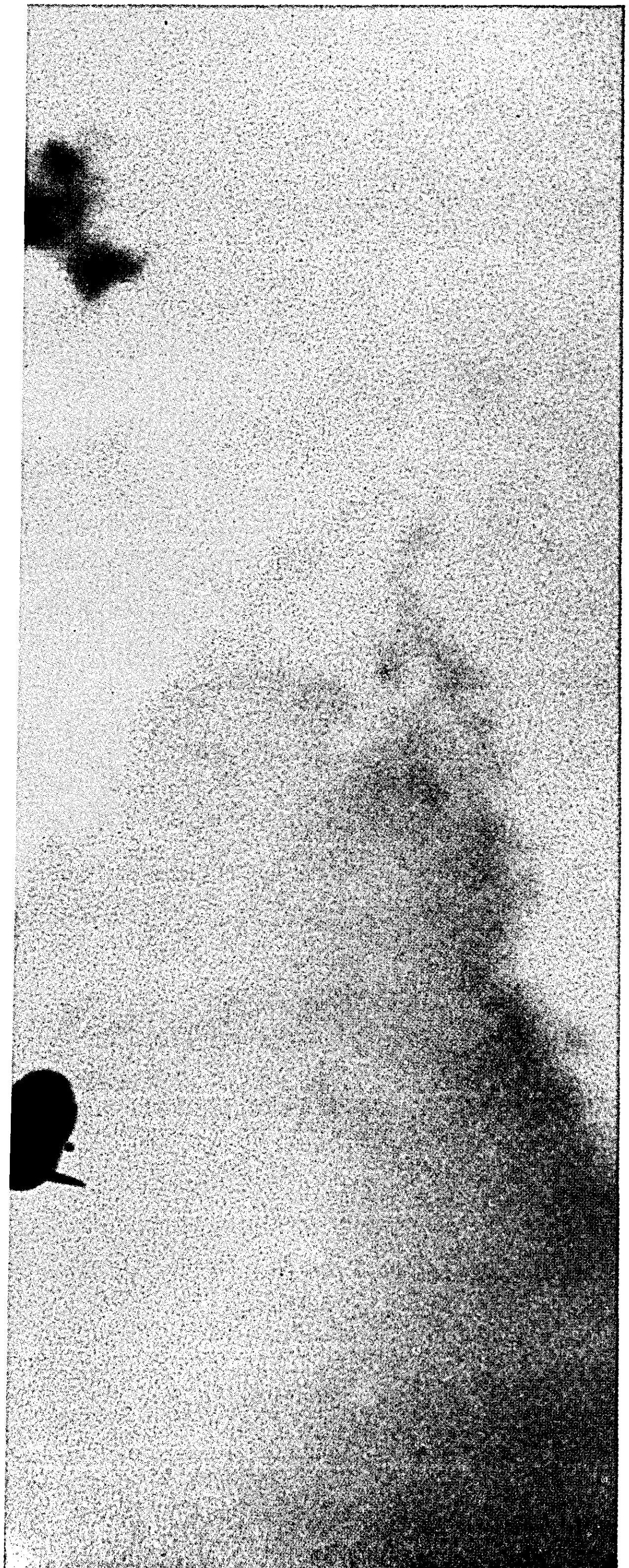
MICRO SWITCH products are available worldwide through Honeywell International

MICRO SWITCH
FREEPORT ILLINOIS 61032
A DIVISION OF HONEYWELL

CIRCLE 67 ON READER CARD


"Putting out routine information is
costing us so much, maybe we should buy
a paper mill. Have you got a better idea?"

Ask us



Sure. Chances are we've already helped you apply microfilm to some routine procedures and you're gaining good results from them. Now may be the time to look at other ways we can help you. For example:

An appliance manufacturer used to send 50-volume parts catalogs to 3,200 service centers. We showed him how to do it on film four times faster, for 90-percent less.

An insurance company put out 80-pound sets of rate books. We helped them trim the bulk with film. And their costs are reduced by a third.

A bank used to issue a directory of authorized signatures—100 pages, 700 copies, updated monthly. We showed them how to do it easier, cheaper, faster, with film.

To make this kind of progress in your business takes your determination to seek better answers. The sooner you ask us, the sooner we can help. Just write on your letterhead to W. O. Fullerton, Eastman Kodak Company, Dept. DP5506, Rochester, N.Y. 14650. Or call 800-447-4700. In Illinois, call 800-322-4400.

What you're saving now with microfilm is only the beginning.

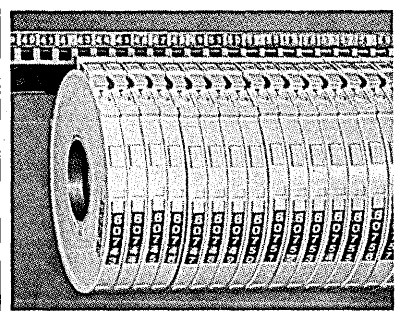
Clip this coupon–We'll clip your tape library costs!

Proven Tab CompuColor® Tape I.D. System

can make misfiled tapes a thing of the past. And, we can prove it! Let us send you a sample of colorful CompuColor Tape I.D. pressure sensitive labels. Then you can see for yourself how our specially formulated colors combine into a labeling system designed to eliminate misfiles, thereby helping you optimize your computer operation. Over a thousand installations already provide testimony that new Tab CompuColor Tape I.D. is a time and money-saving way to improve your tape library.

Tab Products Company,
2690 Hanover Street, Palo Alto, Ca. 94304.

TAB
PRODUCTS CO



Let me prove CompuColor Tape ID System's benefits for myself. Please send me a sample.

Name ____________________

Company ____________________

Address ____________________

City ____________ State ________ Zip ________

Clip and send to Tab Products Co., 2690 Hanover Street, Palo Alto, Ca. 94304.

source data

SOURCE DATA provides information on literature, books, films, courses, bibliographies, products, services, and other aids to professional development.

books

Computers in the 1980s
by Rein Turn
Columbia Univ. Press, 1974
257 pp. $12 ($3.95 paper)

The reviewer of this book is also the author of the article, "Beyond 1984: A Technology Forecast," in this issue. This would seem to make it easy to resolve any differences between book and article in favor of the article. Actually, only one major difference, discussed below, exists; in the majority of areas, both sets of forecasts agree very closely.

This degree of agreement is not entirely fortuitous, however, because the two forecasts are related. The book is based on a report by the Rand Corp. entitled "Air Force Command and Control Information Processing in the 1980s: Trends in Hardware Technology," completed in October 1972 for the U.S. Air Force (for a discussion of part of this report see May 1973, p. 48). The article is also based on an Air Force sponsored report, prepared later by Arthur D. Little, Inc., for a different purpose. The Rand report was one of its inputs, and was carefully read by this reviewer.

Does this mean that the ADL report was derived from the Rand report (i.e., from the material in this book)? Hopefully not, because a great many other sources were used, and each report covers numerous areas not addressed in the other. This association does, however, point up the inherently incestuous nature of technological forecasting in the computer field. There is only a limited number of locations where real research into computer-related technologies is performed. Many of these (including all the largest) belong to the computer manufacturers, which release only a screened subset of their results. There are only a few other analytic organizations not connected with computer manufacturers that possess the staff to develop comprehensive forecasts. Each group is aware of the same source material and of the others' work. The possibility exists of unintentional, systematic errors propagating through this small community, and of all forecasters being wrong together. In all fairness, this has not happened yet in a decade or more of forecasting—but it might.

The book contains a good deal more material than was in the original Rand report, mostly designed to generalize its coverage from the command and control application area to that of general-application commercial dp systems, the area of the ADL report. It is in this extrapolation to general applications that the major difference in findings between the reports develops.

Both studies agree that the fantastic rate of improvement in the cost-performance of LSI circuits will continue for at least a decade. The result, according to a Navy forecast reported in the book, is that a processor with equivalent speed to the IBM 360/195 will be available for $35,000 in about 1985, and one equivalent to the STAR-100 (designed to execute 100 MIPS or million instructions per second) will cost $50,000. The ADL forecasts contained in this issue are comparable (see Table 1 of "Beyond 1984: A Technology Forecast"). The book goes on to predict the performance in MIPS of processors with several different architectures, all employing components with this level of cost/effectiveness. The different architectures are the uniprocessor, pipelined processor, array processor, multiprocessor (sharing work among several identical processors), and associative processor (a special case of the array processor)

The ADL report takes a different tack. It suggests that the fundamental force driving the evolution of general-application systems is the requirement for software-related functionality. It forecasts the nature of operating systems, data base managers, and related system software. It then adopts the position that the evolved LSI circuits will be applied to system designs derived from the nature of the software. The result, it predicts, will be networks of component processors executing specialized subfunctions as determined by their microcodes and the overall supervisory software. No traditional speed measure such as MIPS is used despite its convenience, because it was felt to be meaningless: few if any of the component processors are expected to be executing old-fashioned computer instructions.

This is not to say that the book fails to recognize the importance of software. The contrary is true; at several points the overriding influence of software on the user-perceived performance of future computers is emphasized. Furthermore, the emphasis on conventional cpu architectures and on MIPS is probably appropriate to command and control computers, when fast execution of algorithmic computations is apparently of primary importance. Nevertheless, the two forecasts of the architecture of general-purpose computers remain sharply different.

In most other areas, in particular file storage and I/O equipment of all kinds, the two studies are in very close agreement. The two also agree that optical techniques (laser-holographic mass stores and perhaps light pipes) will enter operational use; the book makes the interesting extrapolation that eventually optical and digital processing techniques will be intermixed in the computer itself. The book contains lucid and thorough summaries and forecasts of cpu logic, and of semiconductor design and fabrication. Such summaries are not in the ADL report (only in its supporting studies); the book is the better source in this area. An interesting observation is that semiconductor performance is largely dependent on the fineness of the lines that can be drawn by electron beams making the fabrication masks—the issue of computer price/performance rests primarily on this one factor! The book also forecasts the development of processors designed to directly execute high level languages (as the Burroughs processors now do, to a degree). The ADL forecast does not specifically envision these entering general use, but they might well. The reports also agree that data communications quality and quantity will be adequate to support anticipated needs.

Because of the original orientation of the Rand report toward military command and control applications, the book goes into some areas that the ADL report does not. The environmental requirements of airborne and spaceborne computers are discussed: it is hard to believe that anything electronic could work under such conditions. More emphasis is therefore placed on volume, weight and power consumption, and less on cost. One specific difference in technology results from the pressure of environment: apparently plated wire memories are now and will continue to be used in airborne computers because of their superior environmental characteristics, even though the

technology is largely abandoned for general-purpose computers. The book also contains interesting forecasts of largescreen displays (several feet on a side) and of wide-band data recording technology. In the past these have been of little interest in general data processing, but who knows?

A particularly strong feature of the book is its discussion of technological forecasting methodology. The opening chapter discusses the available formal methods, in enough detail for readers to understand them without further reference. It objectively discusses the weaknesses of each, and the forecaster's responsibilities in dealing with inevitable uncertainties. The concluding chapter presents models for deriving forecasts of computer and memory performance from the projected characteristics of components. Both chapters are very well done, and would be useful to anyone interested in becoming a practitioner of this mystical art.

—Frederick G. Withington

A contributing editor of DATAMATION, Mr. Withington is a senior staff member of Arthur D. Little, Inc., and was edp task leader of the study on which "Beyond 1984: A Technological Forecast" in this issue is based.

reports & references

Air Force Dp

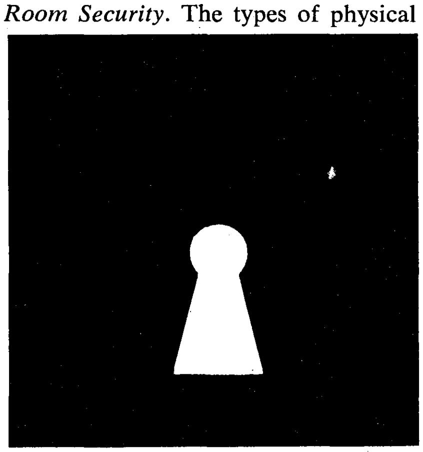
This issue of DATAMATION contains an extensive forecast of hardware, software, and communications technology through 1985. The source for some of the predictions is partly developed from Vol. III of the six-volume report, *Support of Air Force Automatic Data Processing Requirements through the 1980's (SADPR-85)*, coordinated by Robert W. O'Keefe. This report identifies the total automatic dp requirements of base level (below major command headquarters) organizations, and each volume is reasonably priced and separately available. Vol. 1 presents the basic report, with an executive summary (AD-783 766/9WC $4.50); Vol. II contains background and requirements, including dp workloads, environment, manual information handling, etc. (AD-783 767/7WC $5); Vol. III, technology (hardware, software, etc.) (AD-783 768/5WC $7.25); Vol. IV, concept of operations, criteria, alternative configurations (AD-783 769/3WC $6.50); Vol. V, economic analysis (cost structure, cost model, benefits, etc.) (AD-783 770/1WC $6.75); and Vol. VI, program planning (program management of technical development and implementation process) (AD-783 771/9WC $4.50). NATIONAL TECHNICAL INFORMATION SERVICE, U.S. Dept. of Commerce, 5285 Port Royal Road, Springfield, Va. 22161.

Dp Industry Report

The data services market is projected to surpass $8 billion by 1979, compared to $2.8 billion in 1973, according to the 8th Annual Dp Industry Report prepared by Quantum Sciences Corp. for the Association of Data Processing Services Organization (ADAPSO). The 90-page study reports trends in the industry, noting that network information systems and facilities management will comprise a third of 1979 sales. Other trends noted are that software products will grow from a 1973 figure of 9% to 14% in 1979, while software services will decline from 16% to 8%. The annual survey also contains discussions, statistics, tables, and analyses of trends such as peripheral usage, changes in customer base, ranking of competition, most significant short-range problems, and industry financial performance. Price: $125. QUANTUM SCIENCE CORP., 851 Welch Rd., Palo Alto, Calif. 94304.

Computer Room Security

What current equipment do dp facilities have to assure the *physical* aspects of computer room security, and what are their plans for upgrading? Answers to these questions have been compiled from more than 800 dp executives from government, business, and industry dp facilities of various sizes and levels of sophistication, in a market research report, *Trends in Computer Room Security*. The types of physical security covered are fire protection, environmental control, and premises access control. Contained in the report are a brief overview of the dp market, U.S. computer site profile data, a section on marketing computer security (including brand preferences), and a reprint of Harold Weiss' article on computer security (DATAMATION, Jan. 1974). Price: $25. Marketing Research Dept., DATAMATION, 35 Mason St., Greenwich, Conn. 06830.



vendor literature

Compatible Disc Drive

A saving of over $4,000 annually in basic rental or lease costs for a typical user with two drives and one controller is the result, according to BST, of their 5445 plug-compatible disc drive for System/3 computers. The first such system to be introduced by an independent peripheral manufacturer, the new disc drive and controller, it is claimed, exceeds the operating performance of the IBM 5445 at a lower cost, and offers up to four drive capacity for both Models 10 and 15. A brochure describes these things plus reassignable features of the drives, comparison of operational specifications between the IBM 5445 and BST/45, and the service provided by Memorex, manufacturer of the drive. BUSINESS SYSTEMS TECHNOLOGY, INC., Orange, Calif. 92667.

FOR COPY CIRCLE 202 ON READER CARD

Product Catalog

A 12-page catalog describes the complete line of ICC data communication products, including high-speed modems for end-users as well as oem. Featured is ICC's 40+ Data Display System, and information on communication system accessories, control systems, communications storage, transmission test equipment, and voice processors are also given. INTERNATIONAL COMMUNICATIONS CORP., Miami, Fla. 33166.

FOR COPY CIRCLE 203 ON READER CARD

Records Retention

How long must you keep important papers? This question is answered in detail for different types of records in an eight-page pamphlet, *Record Retention Timetable* (4th ed.). Included is a chart which names government authorities that by law require that more

How we got ahead of the pack

Six short years ago, we weren't number one in digital cassettes.

We weren't industry innovators in floppy disks.

We weren't first in certified word processing cassettes.

Fact is, we weren't. Period.

But that's when we decided the kids with their audio

cassettes might have something. Compact, easy to use and—best of all—cheap. So we developed a digital cassette that combined all those features with the reliability necessary in the lofty world of data processing.

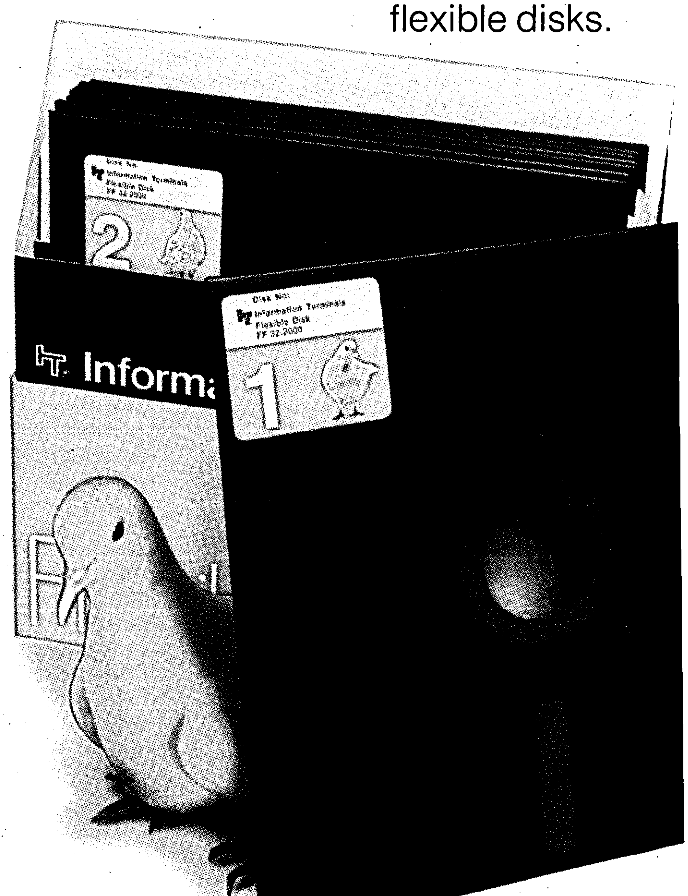
It was a winner. So much so, in fact, that it set the standards (ANSI and ECMA) against which the performance of all other cassettes are measured. And people asked us to

similarly develop a series of special-purpose cassettes designed to be just as good under different specific operating conditions. Plus the instruments to test them. We did.

Today, more than half of all the certified digital cassettes in use throughout the world are ours.

Comforting, but not enough.

So, with a little help from a friend named Gus, we found and filled still another customer need—flexible disks.



All with the same stringent dedication to quality exemplified by 100% certification and initialization after final assembly.

And then we became the first

than 170 kinds of office records be retained for specified times—records such as those which substantiate corporate income tax deductions, which serve as proof for local, interstate and federal regulations, those for plant and property, for personnel, and for security and contracts. ELECTRIC WASTEBASKET CORP., New York, N.Y.
FOR COPY CIRCLE 200 ON READER CARD

Birds Mailed
To publicize Singer-M&M's Series 500 terminals which emulate IBM, CDC, Univac, Burroughs, and Honeywell high-speed terminals, a series of mailers featuring such "rare birds" as the Unruffled Sage (pictured here) are offered. Other "birds-of-a-feather" are

the UNRUFFLED SAGE
Habitat: upstairs. In the cool climate where decisions are made.

the 2-Headed Tail Spinner, the Unflappable Go-Getter, and the Hard-Beaked Penny Pincher. Giant poster-size reproductions of this species are also offered. SINGER-M&M COMPUTER INDUSTRIES, Orange, Calif. 92665.
FOR COPY CIRCLE 204 ON READER CARD

HP BASIC Systems
A 16-page brochure describes the features of models 100 and 200 advanced BASIC timesharing systems of the HP 3000 minicomputer family. With a BASIC/3000 language and a BASIC compiler, these timesharing systems can be efficiently used in scientific, administrative, and data management applications. Multilingual and batch capabilities, time-sharing, system and data management features are detailed. HEWLETT-PACKARD CO., Palo Alto, Calif. 94304.
FOR COPY CIRCLE 201 ON READER CARD

courses

Repeat TV Course
Enthusiastic response to the 10-week color telecourse, "Making It Count: Computers and Computer Applications," given by the Univ. of Washington over KCTS-TV Channel 9 last fall, has caused it to be repeated starting Jan. 7. Inquiries about the 20 half-hour telecasts, which present a basic knowledge of computer hardware, have poured in from all over the world as a result of mention in this column (Oct., p. 33). Arrangements are in progress to give universities, colleges, and businesses requesting it, access to the course. KING-TV Channel 5 (Seattle) will also rebroadcast the course beginning Jan. 13. Continuing Education's Office of Independent Study, UNIV. OF WASHINGTON, Seattle, Wash. 98195.

Systems & Procedures
The fundamental tools and techniques of successful systems analysis are the subjects of an intensive five-day AMA course, "Basic Systems and Procedures." Aimed at newly assigned business systems personnel or analysts, business systems managers wanting a thorough review, and department heads or supervisors desirous of keeping up with the latest state of the art, the course will cover fact-gathering techniques, methods for fact recording, fact analysis techniques and documentation, work measurement tools, forms design and control, dp as a systems tool, and preparing and presenting systems project reports. The course will be given in Orlando (Jan. 20-24), New York (Feb. 24-28), Chicago (March 10-14), Boston (March 10-14), Minneapolis (April 7-11), and Toronto (April 21-25). (The course program is also available for in-house training.) Price: $495, AMA members; $570, nonmembers (team fees are less). AMERICAN MANAGEMENT ASSN., 135 W. 50th St., New York, N.Y. 10020.

periodicals

Privacy Journal
The increasing possibilities for invasions of privacy in our computer age are covered in a new, independent monthly newsletter, *Privacy Journal*. Developments in privacy laws, technology, governmental requirements, and public attitudes on privacy are tracked. News of governmental surveillance, criminal information lists, credit reporting, student records, medical records, mail lists, lie detectors and wiretaps, etc. plus stories of victims of privacy invasions, are related. The editor is Robert E. Smith, formerly associate director of ACLU's Privacy Project and editor of *The Privacy Report*. Subscriptions are $15/yr.; $100 for 10 subscriptions submitted at one time ($200 for 25). (An order of $100 or more includes the research services of the journal.) PRIVACY JOURNAL, P.O. Box 8844, Washington, D.C. 20003.

Digital Processes
An international scientific-technological journal, *Digital Processes*, featuring original papers incorporating all aspects of theory and design of digital systems, begins publication in January. Subjects covered include computer and systems architecture, memory and peripheral devices, evaluating and testing procedures, computer aided design, logic design techniques, etc. Also covered are the relevant theory and supporting disciplines of digital systems engineering, such as switching and automata theory, coding theory, computational methods, etc. Douglas Lewin (Uxbridge, U.K.) is editor-in-chief. Published quarterly, the subscription price is $64/yr. DELTA PUBLISHING CO. LTD., P.O. Box 20, Vevey, Switzerland.

Small Business Computers
During the next 10 years, the number of installed small business computers will grow from today's 50,000 to 350,000, for a total market value of over $10 billion. (Small business computers are defined as having a purchase price of under $100,000, or a monthly lease price of $3,000 or less.) To aid the small businessman in selecting, implementing, and operating computers, a monthly, *Small Business Computer News*, has recently been started. Published by Management Information Corp., the newsletter features editorial commentary by Lawrence Feidelman (author of numerous dp articles) on the impact of current dp events upon the small businessman. Announcements of new products, applications, publications, etc., plus a spotlight on key small business computer products, also appear. Subscription: $30/yr. MANAGEMENT INFORMATION CORP., 140 Barclay Center, Cherry Hill, N.J. 08034. □

Some people are on top of their job.

Others are buried by it.

Interactive computer graphics gives you the advantage.

So you can forget plodding through reams of alphanumerics. And the tedious, time-consuming hand plotting. With a Tektronix Graphic Display Terminal, you've got fast information. To work with. Change instantly. And work with again. As fast as your thought process. And incredibly more efficient than a hard copy terminal.

Any one of our clear display terminals gives you high resolution, flicker-free graphs, plots, maps, models, line drawings. Your visions immediately displayed on the screen. And we're the only graphics terminal maker who also provides you with a compatible Hard Copy Unit. Giving you the printed picture. Only when you want it.

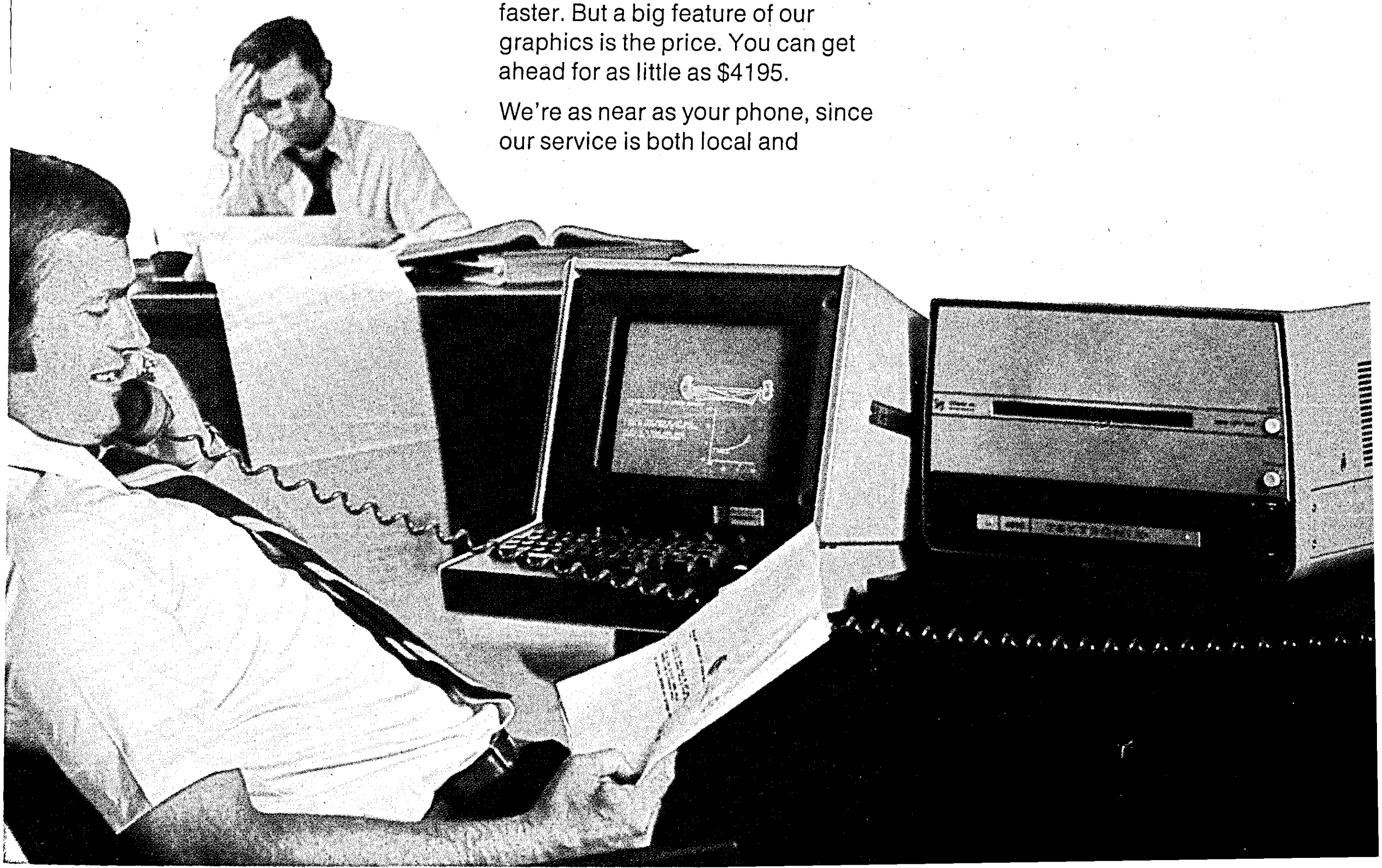
Our sophisticated software support is also a big advantage. We offer Flexible Disc Memory for convenient, user-controlled storage. For either off-line or auxiliary use. And our Graphic Tablet for menu picking makes digitizing even faster. But a big feature of our graphics is the price. You can get ahead for as little as $4195.

We're as near as your phone, since our service is both local and worldwide. So call your Tektronix Applications Engineer for some top information on the speed and efficiency of graphics today.

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

TEKTRONIX®

CIRCLE 61 ON READER CARD



Announcing DECsystem 1080. Every major timesharing breakthrough now in a single system.

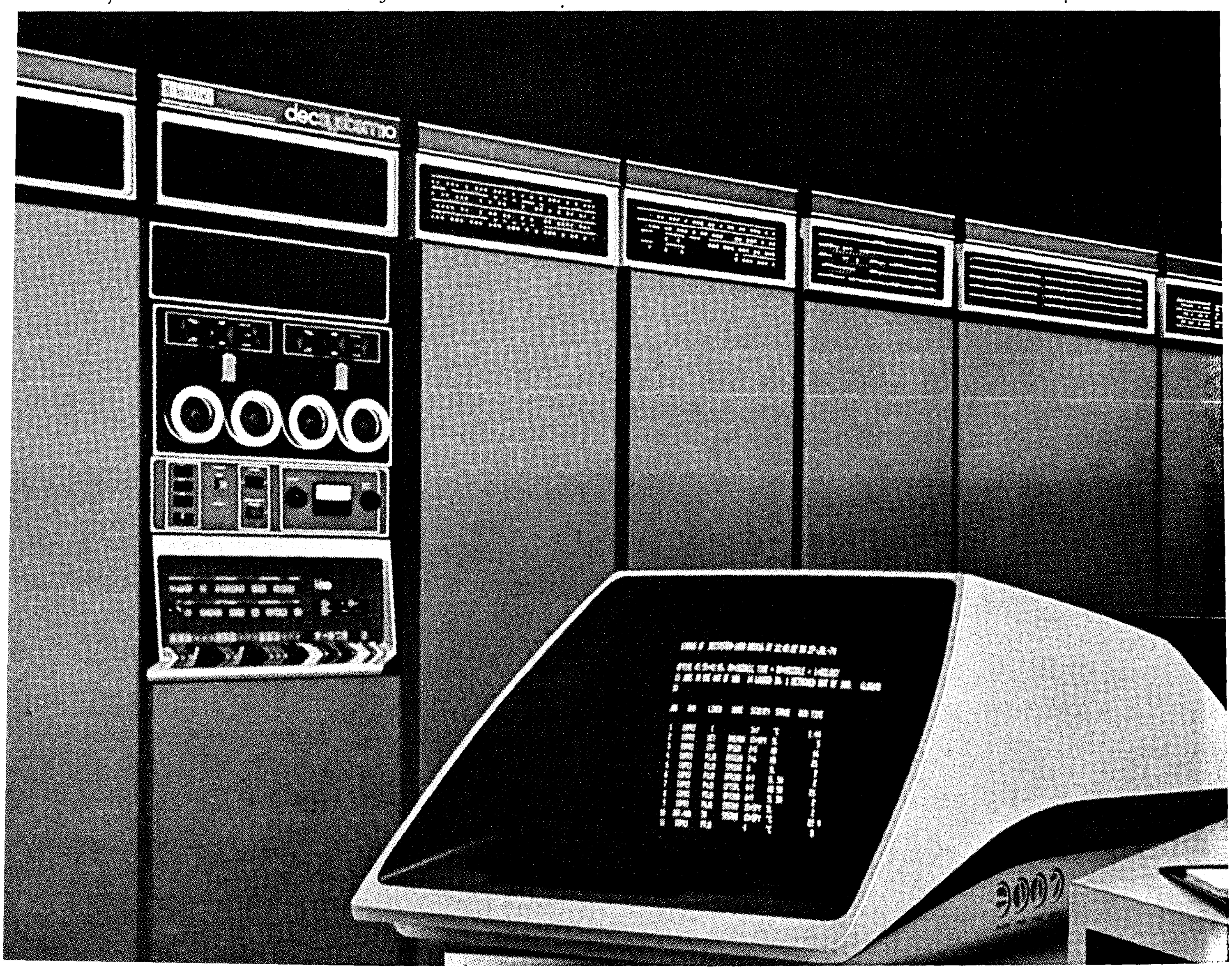
An all new DECsystem-10, the DECsystem 1080, just set an all new industry standard in timesharing. It's the first system that includes every major timesharing breakthrough of the past decade. Yet, remarkably, it costs about half what you'd expect to pay.

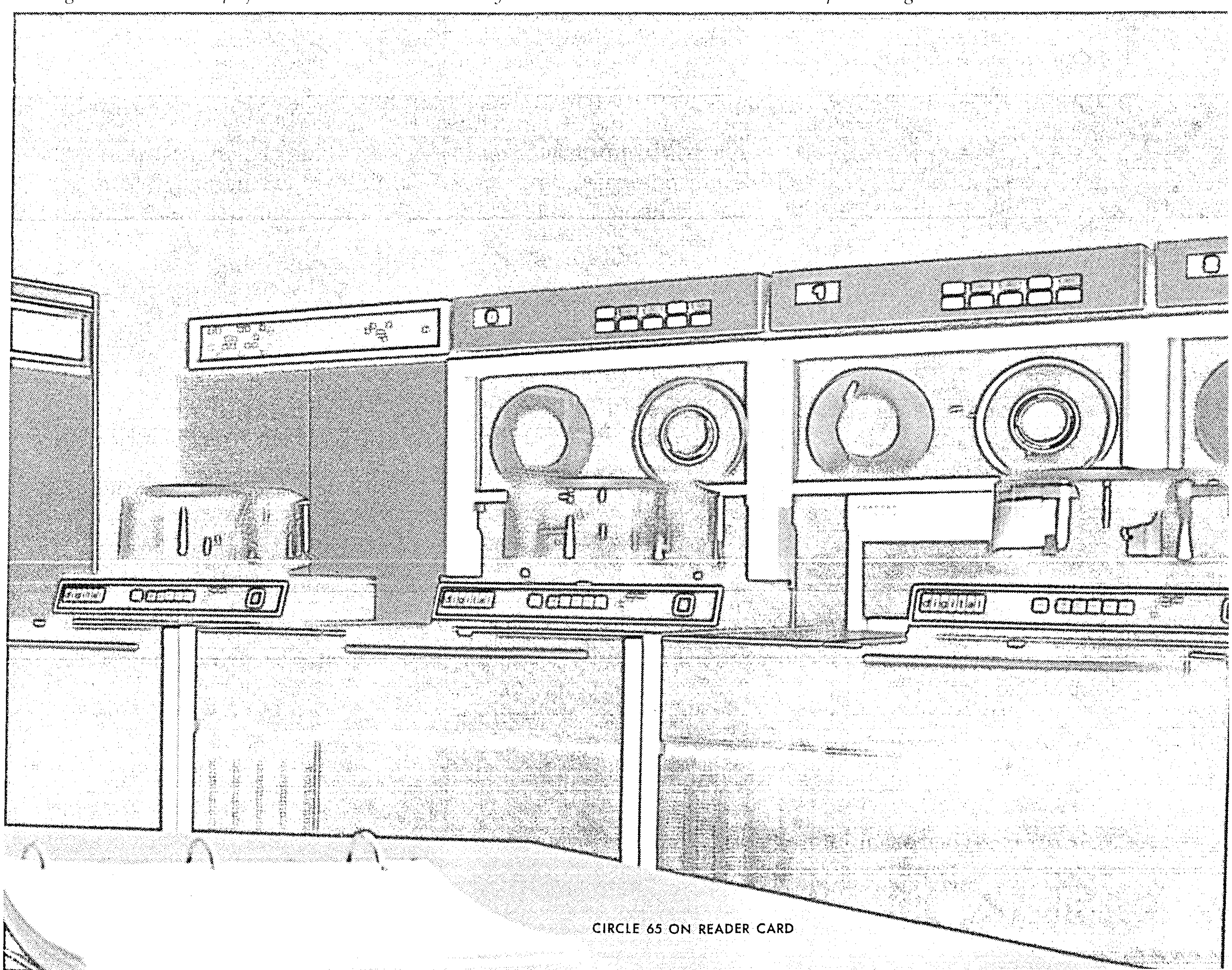
How did Digital do it?

By combining capabilities no one else could combine. Our minicomputer experience, our manufacturing economies, our systems architecture, and our experience of over ten years in large-scale timesharing. So now you can buy a low-cost timesharing system that includes not just one, but all of the following.

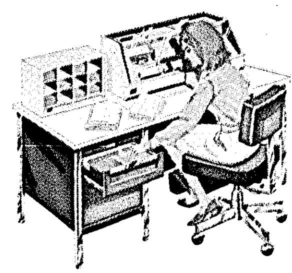
- A more powerful central system employing mini and microprogramming technology with ECL 10,000 logic, MSI and cache memory.
- An integral PDP 11/40 minicomputer dedicated to providing the most comprehensive machine diagnostics.
- An advanced Business Instruction Set to handle the most demanding batch and business data processing tasks.
- A host of high-performance disk and tape peripherals that facilitate optimum file integrity for most effective data base management, via our new DBMS-10 package.
- A completely enhanced operating system offering

Powerful KL10 CPU with cache memory. *Mini dedicated to maintenance.* *Advanced Business Instruction Set.*





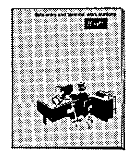
Keypunch Work Station includes Keypunch Desk, Cousti-Cover sound dampening enclosure, card rack, posture chair and footrest.



Microform Work Station uses Optimedia Reference Stand, Posture Chair, Footrest and Card Tray. Optimedia Reference Stands are available in a variety of colors with woodgrain or off-white plastic-laminate tops.

data entry and terminal work stations

You can improve the productivity of your data entry and terminal operators. Wright Line's specialized equipment used with operating devices creates highly efficient operator work stations. These planned work environments combine adequate work surface, proper viewing and keyboard heights, storage space, non-fatigue posture seating, and enclosures with cable access for machine accessories such as data phones and modems.



Complete information including typical work station environments for all types of data entry devices, CRT terminals, printer terminals and microform readers are shown in our new color brochure. For a copy circle the readers' service number or write direct to Wright Line, Division of Barry Wright Corporation, 160 Gold Star Boulevard, Worcester, Massachusetts 01606.

Printer Terminal Work Station with Optimedia Printer Stands and Posture Chair. Optimedia Printer Stand has bin and cut-out top for feeding continuous forms and basket for collection of forms.

Wright LINE
MEDIA MANAGEMENT SYSTEMS

Typical CRT Terminal Work Station uses Optimedia Reference Stand with two drawer pedestal, Wright Line Posture Chair, Footrest and Reference Manual Stand. Optimedia Reference Stands are available in several sizes and heights with or without drawer pedestals.

Editor's Readout

John L. Kirkley, Editor

Running the Gauntlet

As Eliot Janeway's glasses slip ever lower on his nose and the economic gloom in the U.S. deepens, manufacturers look to overseas markets to boost sagging sales.

Vendors of dp gear are no exception. And they're particularly aware of the enormous unrealized market potential in the Eastern Bloc countries. But, before even the most aging tape drive can be sold, U.S. computer equipment vendors have to run a tortuous bureaucratic gauntlet.

One roadblock is the Free World Coordinating Committee on East-West Trade (CoCom), now meeting to consider liberalized export controls. But, no matter what CoCom decides, the most formidable hurdles are here at home.

Back in what vendors may now regard as the "good old days," export applications were reviewed by a committee made up of members of DOD, Commerce, the State Department, and other agencies. Subcommittees routinely approved many requests. But even so, the wheels of bureaucracy ground slowly and delays were commonplace.

Now we have the new export control law, passed late last year—wheels within wheels. The Department of Defense has final say on controlled export applications and the word is that they view anything more complicated than a hand-carved abacus with a jaundiced eye.

Defense and the Office of Export Administration are reported to be working out guidelines on what does and what does not need Pentagon approval. (The Commerce Department's OEA also reviews the applications before passing them on to DOD.)

Vendors can only hope that they will come up with a responsive, smoothly operating system and reasonable criteria that keep in mind the intense international competition and our unfavorable balance of trade. And we can hope that OEA and Defense will be amenable to suggestions from both Congress and industry; that they can work together toward building better trade relations with the Eastern Bloc within the bounds of reasonable military restrictions.

And let us fervently hope that DOD doesn't decide that they need a new, massive department, awash with technical talent, to handle their role as final arbiter. We need another layer of bureaucracy like the Pentagon needs another general. □

A Change in Tactics

With the blessing of its 282 member companies, ADAPSO, the Assn. of Data Processing Service Organizations, is changing its battle plan.

In the past it's been a typical trade association, concerned mainly with helping its members cope with day to day life in the trenches. Occasionally the paid staff would cork their faces, break out their Sten guns, and climb over the wall for a foray against the forces of darkness. Their lawsuit of a year ago—aimed at keeping federally-regulated organizations from encroaching on commercial dp services—was a typical skirmish.

But the association's tactics appear to be changing. Jerry Dreyer, their full-time executive vice president, has taken on a new role—that of "industry spokesman." More time in Washington, more lobbying, and more importantly, what appears to be a commitment to a sustained struggle with pressing industry problems.

The association's recently issued resolution urging Congress to coordinate the numerous antitrust claims against IBM makes sense. But, instead of simply firing off a salvo and hoping it hits someone influential, ADAPSO is following up by personally contacting key congressmen, like Hart, Tunney, and Rodino. ADAPSO has also asked to be a member of the newly-created national commission on electronic funds transfer, potentially a long term commitment. And they're attempting to plug a loophole that permits circumvention of the Federal Reserve Board's jurisdiction over whether or not a bank can offer dp services in competition with commercial bureaus. This could lead to a drawn-out lawsuit.

We welcome ADAPSO's change in tactics, their commitment to the long fight that is won more often than not by dogged determination. We hope that manpower and funds will permit them to hang in there. We need more responsible voices representing major segments of our industry in Congress and the courts.

Because ADAPSO is one of the few associations vigorously tackling important industry issues, we'll keep you posted on their successes and failures, the stands they take, and, of course, the viewpoints of their opponents. □

Justice vs AT&T: Who Cares?

Several big dp users of Ma Bell's services that we contacted couldn't care less.

"I haven't thought much about it" said one. "The time span is too great (the case could last 10 years or more) . . . and as long as I get good service, I'm not worried."

Adding to the "ask me again in five years" attitude is confusion about the actual impact of the suit as it drags on towards a settlement. One source speculated that this "ill-timed" move on the part of the administration will slow AT&T's technological progress, progress that means benefits to, among others, the user of data communications. But others disagree. Citing IBM as an example, they maintain that AT&T will become even more competitive, jockeying for the most favorable market position as the trial decision date draws nearer.

Despite conflicting opinions on the impact of the case, one fact seems obvious: a decade of litigation will benefit no one. Every effort should be made to quickly reach an agreement that fosters competition without degrading existing services. "Quickly" may mean two or three years. But, compared to the lethargic handling of the IBM antitrust case, this kind of turnaround would be astonishingly fast footwork. □

DP SALARY

by Richard A. McLaughlin, Associate Editor

Nowhere have the economic forces of inflation and recession been more strongly felt than in personal paychecks. Most of us are uncomfortably aware that salary increases have been losing ground to the cost of living for four or five years. As a result, while a person may have grown in responsibility, capability, and take-home pay, he or she may not have stayed even in buying power.

Data processing professionals, as our survey shows, are very vulnerable to these outside economic forces. Where trades have unions to help establish pay scales, and professions like medicine have associations to help establish rates for services, most data processing people have neither. Each dp employee must bargain for himself or look for better opportunities.

The average dp professional hasn't done so well in bargaining, and may not know all the places to look for opportunities either.

What are his options? He can switch to a higher-paying specialty, like from applications programming to systems programming. Or to another industry, another company, another city. On the other hand, he may be better off staying where he is and working for a promotion. This article provides some of the information he needs in considering these moves and in better understanding his salary potential.

The data can be used not only by employees, but also by managers and salary administrators. The employee can use it in determining whether his rate of pay is reasonable for his position, and in choosing career paths. Managers and salary administrators can use it to insure that dp salary ranges are internally equitable—that a keypunch supervisor is paid a reasonable amount more than other keypunchers, for example—and that the firm is competitive in bidding for employees.

Before the charts can be used for any purpose, much care must be used in interpreting them. The managers in the firms which contributed to the data base had to make certain that an "Applications Programmer A" in their shops was equivalent to one in someone else's. To do that, a strict set of job definitions was developed; an abbreviated version is included below.

As with all surveys, this one deals mostly with averages—average installations peopled with average employees who are paid average wages. Fortunately, however, because the data base used is very big[1] and has been carefully constructed, we can eliminate some of the uncertainty in the averages by showing the pay differences between top employees, "middle" ones, and trainees. We can also split off installations by size, and attempt to neutralize the effects of industry and geography. (Some parameters, such as a person's age or years since degree, do not seem to have much effect in our industry, so we have not tried to factor them out.)

Trainees vs. experts

The charts separate salaries in two ways. First, all of the charts break down job "families" by skill level, running from a manager down to a trainee. Second, the *Nationwide Averages* chart reports five salaries for each position, whether manager or trainee. The first is "Average Low," which is the numerical average for the lowest rates reported in the survey (after throwing out a few stray values which

[1]The data was made available by the Philip H. Weber Salary Administration Services Section of A. S. Hansen, inc., publisher of the "1974 Weber Salary Survey Report on Data Processing Positions in the United States." The Weber survey includes an actual count of 110,611 employees in 82 dp positions in 1,461 companies. (Not all of the positions are reported in this article.) The 132-page annual report includes detailed information on positions in 98 cities, a means for correlating the data for a total of 58" cities, and more detailed breakdowns of industry salary ranges by city. Further information on the report is available from A. S. Hansen, inc. at 1080 Green Bay Road, Lake Bluff, Illinois 60044.

SURVEY

Averaged over 110,000 employees in 10 industries nationwide and in five different sizes of computer shops, the result is a loss for the year.

would otherwise bias the number). "First Quartile" (1st Q) is the rate which cuts off the lowest 25% of salaries reported for the position; 75% of the people make more than this figure. "Average" is the numerical average of all rates. "Third Quartile" (3rd Q) and "Average High" are the counterparts of the first two lowest categories.

Effects of installation size

The size of an installation will, of course, make a bigger difference in the manager's salary than in that of a keypunch operator. The size very likely relates to the sophistication of applications being processed too, and this means that some positions like systems programmer may draw a bigger paycheck in the larger shop.

The *Salaries by Installation Size* chart is divided into five categories based on how much the installation spends on hardware per month. The categories are shown here with model numbers for machines that commonly run "about that much per month."

1. *to 6,000* (e.g., IBM System/3s, 360/20s)
2. *to $12,000* (e.g., IBM 370/125, Burroughs B2700, HIS 1015)
3. *to $25,000* (e.g., IBM 360/40, Xerox Sigma 6, CDC 3400)
4. *to $50,000* (e.g., Univac/RCA Spectra 70/45, CDC 3600, IBM 360/50)
5. *over $50,000* (machines at least the size of an IBM 370/155)

Also note that this chart shows the first quartile to third quartile range, which includes the middle 50% of the salaries and seems more meaningful than the entire range.

Effects of industry

Some industries pay more than others. This too may be due in part to the sophistication of the applications and hence the skill levels of employees. Whatever the reason, the industries are fairly consistent in this from year to year. By averaging the late 1974 pay rates of 37 common job positions—ranging from dp manager to keypunch operator trainee—across 10 industry groups, we were able to order the industries in terms of high paying to low paying. Comparing this year's list with last year's, we found five industries had not changed position, and only one had shifted by more than one place in the list.

According to last year's list and this year's, the transportation industry is the best to be in. (This may have something to do with the airlines and their massive on-line reservations systems.) The industries and their relative positions compared to a numerical average for salaries is as follows:

1. transportation (8.6% over average)
2. communications (+6.7%)
3. utilities (+4.5%)
4. government (+3.0%)
5. manufacturing (+0.4%)
6. retail trade (−1.9%)
7. finance/insurance (−4.5%)
8. wholesale trade (−4.9%)

Actually two industries tied for the dubious distinction of last place:

10. services (−5.2%)
10. construction (−5.2%)

Effects of geography

Everyone knows that some places are more expensive to live in, and that some may be unpleasant or downright dangerous to work in, but these factors do not sufficiently explain the sometimes huge discrepancies in pay for equivalent jobs in different parts of the country. For one thing, the *Average Salaries by City* figures do not correlate with the cost of living index published

a look at 'real' salary gain/loss

JOB FAMILY	1970-71 Salary Increase	1970-71 "Real" Salary Gain/Loss	1971-72 Salary Increase	1971-72 "Real" Salary Gain/Loss	1972-73 Salary Increase	1972-73 "Real" Salary Gain/Loss	1973-74 Salary Increase	1973-74 "Real" Salary Gain/Loss	1970-74 Total Change	1970-74 Total Gain/Loss
Management	9.2%	+5.8%	6.5%	+3.1%	8.1%	− .7%	10.2%	−1.8%	+38.5%	+ 8.2%
Systems Analysis/ Programming	2.9%	− .5%	6.4%	+3.0%	3.6%	−5.2%	8.8%	−3.3%	+23.4%	− 6.9%
Systems Analysis	6.9%	+3.5%	4.8%	+1.4%	4.4%	−4.4%	8.7%	−3.3%	+27.1%	− 3.2%
Systems Programming	not surveyed		not surveyed		4.4%	−4.4%	10.8%	−1.2%		
Applications Programming	2.8%	− .6%	5.9%	+2.5%	5.2%	−3.6%	4.8%	−7.2%	+20.0%	−10.3%
Computer Operations	3.9%	+ .5%	4.6%	+1.2%	6.0%	−2.9%	7.2%	−4.8%	+23.5%	− 6.8%
Keypunching	6.8%	+3.4%	5.7%	+2.3%	3.1%	−5.7%	6.5%	−5.5%	+23.9%	− 6.4%

According to the figures published by the Bureau of Labor Statistics, the cost of living went up 3.4% in 1971 over 1970, another 3.4% in 72, then 8.8% in 73, and an estimated 12.0% in 1974. This makes for a compound total of 30.3% higher expenses in 1974 than in 1970. Of all dp personnel, only dp managers have received large enough raises to keep up with the rise, and they too have lost ground over the past two years.

by the Bureau of Labor Statistics.

As a general rule, companies in big cities pay more than companies in little cities. For example, a dp manager in Sioux City, Iowa receives an average salary of $364 per week. A dp manager running about the same size shop in New York City gets $656.

But the big city vs. little city explanation does not account for the fact that a dp manager in St. Paul is likely to receive $75 less than his counterpart in the supposedly twin city of Minneapolis. (The same holds for applications programmers, too; a level "A" programmer can get $40 more in Minneapolis.) Similarly, is a dp manager's or a programmer's job worth $50 more in Washington, D.C. than in Baltimore? That's the way the pay scales go. And if it costs 5% more to encourage a dp manager to move across the Hudson River from New York City to Newark, why can you bring over a programmer for 12% less?

Don't give up. For one thing, the charts include the average salary figures for 17 major cities. To determine how other cities compare, check with the Bureau of Labor Statistics. The Bureau keeps tabs on a few key dp positions for each city which can be used for the correlation.

Using the job classifications

The job titles and descriptions listed correspond to those on the questionnaire used for the survey. Using them, large computer departments should be able to find a good fit for most of their employees. (The questionnaires do use the more traditional position titles, however. There is not yet an entry for Chief Programmer, Data Base Administrator, or Software Coordinator. Some judgments will have to be made for people in these positions.)

Smaller departments may have employees who handle several of the positions defined. These people should be classified by how they spend the majority of their time. If even this cannot be done, they should be classed by the highest position that represents a significant portion of their time, provided that the majority of their time is spent on tasks related to the same job family.

The position descriptions are not the world's best, but they are ones on which the 1,460 participating companies could agree, and they work pretty well.

Types of shops

Finally, note that there are actually two types of shops represented. The first type, where the managers of systems programming, applications programming, etc. report to the dp manager, is by far the most common. Still, the second kind, where the manager of systems analysis and manager of applications programming report to someone other than the dp manager, accounts for 20% of the installations.

A final word

Here are the job descriptions and the dollar figures. Use them with caution, jobs are still scarce. And for a discussion of how to use the tables of numbers in plotting career paths, see the article by Robert J. Greene of A. S. Hansen, inc. which follows.

THE JOB DESCRIPTIONS

DP Manager & his staff

Manager of Data Processing

Plans, organizes and controls the overall activities of the data processing department, including systems analysis, programming, and computer operation. Consults with, advises, and coordinates between his groups and other departments. Reports to corporate management on data processing plans, projects, performance, and related matters.

Assistant Manager of Data Processing

Assists the manager in planning, organizing, and controlling the sections of the department. Usually has line responsibility but in certain instances may have only staff responsibility. Participates in research and procedural studies. Develops analyses of existing and newly developed equipment and techniques. Consults with and advises other departments with regard to feasibility studies, systems and procedures, and records control.

Technical Assistant to the Manager

Provides technical assistance for planning and directing the installation, modification, and operation of dp systems. Analyzes proposed and existing dp applications in terms of machine capabilities, costs, and man and machine hours. Usually has only departmental staff responsibility. Plans and recommends machine modifications or additional equipment. Directs the compilation of records and reports concerning production, machine malfunctions, and maintenance.

Coordinator of Data Processing

Coordinates activities of the dp operation with the company's other departments. Usually has only departmental staff responsibility. Assists in establishing systems analysis, programming, and computer operations priorities. Recommends standard policies and procedures.

Work Process Scheduler

Schedules operating time of the overall dp activities. Responsible for keeping idle time to a minimum. Schedules preventive maintenance.

Systems Analysis & Programming

Manager of Systems Analysis and Programming

Responsible for feasibility studies, systems design and programming. Assigns personnel to projects and directs their activities. Coordinates section activities with other sections and departments. Reports to Data Processing Manager or to Corporate Management.

Lead Systems Analyst/ Programmer

Assists in planning, organizing and controlling the activities of the section. Assists in scheduling and assigning personnel. May act as systems/programming project manager. May coordinate the activities of the section with other sections and departments.

Senior Systems Analyst/ Programmer

Confers with managers, scientists, and engineers to define business or scientific/engineering dp problems. Formulates statements of those problems and devises dp solutions. Prepares block diagrams illustrating the solutions and may assist in or supervise the preparation of flowcharts from those diagrams. Analyzes existing system and program logic and makes revisions.

Systems Analyst/Programmer A

Confers with dp personnel to determine the problem and type of data to be processed. Defines the applications problem, determines system specifications, recommends equipment changes, designs dp procedures and block diagrams. May prepare flowcharts and codes. Devises data verification methods and standard systems procedures.

Systems Analyst/Programmer B

Assists in devising system and program specifications and record layouts. Prepares flowcharts and logic diagrams for existing and proposed operations. Codes. Prepares comprehensive block diagrams in accordance with instructions from higher classifications. May assist in the preparation of flowcharts. Analyzes existing office procedures as assigned.

Systems Analyst/Programmer C Trainee

Carries out analyses and programming of a less complex nature as assigned and instructed. Usually works only on one activity under very close direction with the work being closely checked. Prepares functional process charts to describe existing and proposed operations. Designs detailed record and form layouts. Detail block diagrams to reflect specific procedures. May assist in the preparation of flowcharts.

Systems Analysis

Manager of Systems Analysis

Responsible for feasibility studies for new applications, and for systems design. Assigns and directs personnel. Consults with and advises other departments on systems and procedures. Reports to the Manager of Data Processing.

Lead Systems Analyst

Assists in planning, organizing, and controlling the activities of the section. Assists in scheduling the work of the section and assigning personnel to projects. May act as systems projects manager. May coordinate the activities of the section with other sections and departments.

Senior Systems Analyst

Confers with officials, scientists, and engineers to define business or scientific/engineering dp problems. Formulates statements of those problems and devises dp solutions. Prepares block diagrams illustrating the solutions and may assist in or supervise the preparation of flowcharts from those diagrams.

Systems Analyst A

Defines the applications problem, determines system specifications, recommends equipment changes, and designs dp procedures. Devises data verification methods. Prepares block diagrams and record layouts from which programming prepares flow-charts. May assist in or supervise the preparation of flowcharts.

Systems Analyst B

Assists in devising computer system specifications and record layouts. Prepares systems flowcharts to describe existing and proposed operations. Prepares comprehensive block diagrams in accordance with instructions from higher classifications. May assist in the preparation of flowcharts. Analyzes existing office procedures as assigned.

Systems Analyst C

Carries out analyses of a less complex nature. Prepares functional process charts to describe existing and proposed operations. Designs detailed record and form layouts. Details block diagrams to reflect specific computer procedures. May assist in the preparation of flowcharts.

Systems Programming

Manager of Systems Programming

Plans and directs all activities of the Systems Programming Section. Projects software and hardware requirements in conjunction with other managers within the department and with corporate management. Develops standards for all systems software and works to design and implement systems required. Directs the interfacing of systems software with the hardware configuration and the applications systems. Provides technical guidance relating to the operating system to all members of the dp staff. Reports to

(Text continues on page 46; Salary Survey Charts appear on pages 44 and 45)

JOB FAMILIES

The jobs have been grouped into a number of "families." The families range from "Manager" or "Supervisor" to "Trainee." There are two important things to know about the families. First, the levels in each category were *derived,* not arbitrarily set. A histogram was constructed for all people in "programming" by plotting "number of people" vs. "salary." If there were five "bumps" or clusters in the histogram, five levels of programmer were defined. These levels were worked back onto the questionnaire. Over a period of years, the listed classifications have evolved.

Second, the classifications have these general qualifying characteristics:

Manager (or Supervisor)	Usually in full charge of all activities of a section or department. May personally supervise the operations of his staff or direct the operation through subordinates.
Lead	Usually considered the assistant manager or supervisor in families where an "assistant manager" title does not appear. Instead may be a line supervisor with full technical knowledge but added duties of assigning, instructing and checking other section members.
Senior	Usually competent to work at the highest technical level of all phases of the activity. Works on his own most of the time. May give some direction to lower classifications.
A	Works under general supervision. Usually can work on his own in most phases of the activity. Requires only some general direction for the other phases.
B	Works under direct supervision. Usually fairly competent to work on several phases of the activities with only general directions, but needs some instruction and guidance for the other phases.
C	Works under immediate supervision, generally on only one activity. The work is carefully checked.
Trainee	Usually a probationary employee who has no previous experience.

SURVEY OF WEEKLY DATA

Job Title	Nationwide Averages						Salaries by Installation Size Determined by Monthly Hardware Rental				
Conventional Organization Reporting Through DP Manager	Low	1st Q.	Avg.	3rd Q.	High	Number in Survey	to $6,000	to $12,000	to $25,000	to $50,000	over $50,000
Department Management											
Manager	234	430	537	623	1055	1,210	281-587	301-556	342-690	413-696	364-692
Assistant Manager	203	374	467	542	917	366	244-511	262-484	298-600	359-606	317-602
Technical Assistant	177	326	408	473	801	284	213-446	228-422	260-524	313-529	277-526
Coordinator	154	283	354	411	696	230	185-387	189-367	226-455	272-460	240-457
Scheduler	103	189	236	274	464	235	123-258	132-244	169-303	181-306	160-304
Combined Systems Analysis & Applications Programming											
Manager	225	382	436	482	759	718	250-541	275-435	318-487	330-498	358-534
Lead Analyst/Programmer	182	310	353	391	615	1,240	202-438	223-352	258-394	267-403	290-433
Senior Analyst/Programmer	159	271	309	342	539	2,252	177-384	196-309	226-346	234-353	254-379
Analyst/Programmer A	150	256	292	323	508	3,324	168-362	185-291	213-326	221-333	239-358
Analyst/Programmer B	130	221	252	279	440	2,347	145-314	159-252	184-282	191-288	207-310
Analyst/Programmer C	114	195	222	246	387	1,193	127-275	140-222	162-248	168-254	182-272
Systems Analysis											
Manager	227	366	416	462	702	612	338-556	279-448	309-491	354-489	325-531
Lead Analyst	197	318	362	402	611	1,148	294-483	243-390	268-427	308-425	283-461
Senior Analyst	184	296	337	374	568	2,262	274-450	226-363	250-397	286-396	263-429
Analyst A	161	259	295	328	498	2,491	240-394	198-318	219-348	251-347	230-376
Analyst B	141	226	258	286	435	1,429	209-376	173-278	191-304	219-303	201-328
Analyst C	125	201	229	253	386	390	186-305	153-246	169-269	194-268	178-291
Systems Programming											
Manager	242	367	413	453	678	251	231-408	297-297*	276-449	320-455	348-503
Lead Programmer	210	319	359	393	590	278	200-355	258-258	240-391	279-396	302-438
Senior Programmer	196	297	334	366	549	647	187-330	241-241	223-364	259-369	282-407
Programmer A	172	260	293	321	481	836	164-289	211-211	196-319	227-323	247-357
Programmer B	152	231	260	285	427	499	145-257	187-187	173-283	201-287	219-317
Programmer C	140	212	239	262	393	228	133-236	172-172	159-260	185-264	202-292
Applications Programming											
Manager	183	323	367	408	678	572	264-501	265-374	262-426	285-442	293-442
Lead Programmer	160	281	320	355	590	898	230-436	230-325	228-371	248-384	255-384
Senior Programmer	139	246	279	310	515	3,131	201-381	201-284	199-324	216-335	223-335
Programmer A	123	216	246	273	454	4,672	177-336	177-250	175-285	191-296	196-295
Programmer B	106	187	213	236	393	3,464	153-291	153-216	152-247	165-256	170-256
Programmer C	93	165	187	208	345	1,984	134-255	135-190	133-217	145-225	149-225
Computer Operations											
Manager	153	266	306	341	584	1,377	230-318	199-351	229-338	251-349	226-383
Lead Computer Operator	125	217	251	279	479	2,196	188-261	163-288	188-277	205-286	185-314
Senior Computer Operator	102	178	205	228	391	4,037	154-213	133-235	153-226	168-233	151-257
Computer Operator A	90	156	181	201	344	6,855	135-188	117-207	135-199	148-205	133-226
Computer Operator B	79	138	159	177	303	3,898	119-165	104-182	119-175	130-181	117-199
Computer Operator C	70	122	141	156	268	2,157	105-146	91-161	105-155	115-160	104-176
Tab Operations											
Supervisor	139	206	234	257	393	305	172-269	197-291	163-280	176-271	200-269
Lead Tab Operator	114	169	192	211	322	408	141-220	162-239	133-229	144-223	164-221
Tab Operator A	100	148	168	185	283	1,245	124-193	142-210	117-201	127-195	144-194
Tab Operator B	87	129	147	162	247	1,031	108-169	124-183	102-176	111-171	126-169
Tab Operator C	78	115	131	144	220	430	96-105	110-163	91-157	98-152	112-151
Trainee	73	109	124	136	208	192	91-142	104-154	86-148	93-144	106-142
Keypunching											
Supervisor	112	169	195	215	352	1,281	144-203	137-226	153-217	150-225	148-238
Lead Keypunch Operator	93	140	161	178	292	1,898	119-168	114-188	127-180	124-187	123-197
Keypunch Operator A	81	123	142	157	257	10,830	105-148	100-165	112-158	109-164	108-174
Keypunch Operator B	76	114	132	146	239	13,219	98-138	93-154	104-147	102-153	101-162
Keypunch Operator C	68	103	118	131	214	2,914	88-123	83-138	93-132	91-137	90-145
Trainee	60	91	105	116	190	1,632	77-109	74-122	83-117	81-121	80-128
Other Operations Staff											
Tape Librarian	83	118	145	165	271	1,295	105-180	119-170	92-169	103-181	105-178
Controls Clerk/Scheduler	78	111	137	156	255	1,900	99-170	112-160	86-159	97-170	99-168
Organization Reporting Through Separate Managers											
Data Processing Management											
Manager	208	307	378	438	742	313	328-360	274-379	252-503	277-469	256-475
Assistant Manager	168	248	306	354	601	155	266-291	222-307	204-408	224-380	208-385
Technical Assistant	158	233	287	332	563	88	249-273	208-288	191-382	211-356	195-361
Coordinator	139	206	253	293	497	147	220-241	183-254	169-337	185-314	172-318
Scheduler	112	166	203	236	400	331	177-194	147-204	136-271	149-253	138-256
Systems Analysis											
Manager	191	385	434	480	665	115	228-526	356-414	334-484	316-526	304-506
Lead Analyst	166	335	378	418	579	329	198-458	309-360	291-421	275-458	264-440
Senior Analyst	145	293	330	365	505	737	173-400	270-315	254-368	240-400	231-384
Analyst A	128	258	291	322	445	993	153-353	238-278	224-324	211-353	203-339
Analyst B	111	223	252	279	385	514	132-305	206-240	194-280	183-305	176-293
Analyst C	97	196	221	245	339	112	116-268	181-211	170-247	161-268	154-258
Applications Programming											
Manager	213	320	370	413	651	108	239-413	293-375	246-475	296-402	297-455
Lead Programmer	185	278	322	359	566	211	207-359	255-326	214-413	258-349	258-396
Senior Programmer	161	243	281	313	494	867	181-313	223-285	187-361	225-305	225-346
Programmer A	142	214	248	276	436	1,089	160-276	196-251	165-318	198-269	199-305
Programmer B	123	185	214	239	377	890	138-239	169-217	142-275	172-232	172-264
Programmer C	108	163	188	210	332	462	121-210	149-191	125-242	151-204	151-232

*Limited Data

PROCESSING SALARIES

Average Salaries by City

Atlanta	Boston	Chicago	Cleveland	Dallas	Denver	Detroit	Houston	Los Angeles	Minnea-polis	New York	Phila-delphia	Phoenix	St. Louis	San Fran.	Seattle	Wash'ton D.C.
543	555	608	541	539	567	612	583	567	521	656	581	536	566	590	557	611
472	483	529	470	469	493	533	507	493	453	571	505	466	492	513	484	532
413	422	462	410	409	431	465	443	431	396	499	441	407	430	448	423	465
358	366	402	357	355	374	404	385	374	344	433	383	354	373	389	367	403
239	244	267	238	237	249	269	256	249	229	288	255	235	249	259	245	269
396	425	435	431	394	321	500	390	484	369	502	396	389	410	446	431	425
321	344	352	349	319	260	405	316	391	299	407	320	314	332	361	349	344
281	301	308	306	279	228	355	277	343	262	356	281	276	291	316	306	302
265	284	291	288	264	215	335	261	324	247	336	265	260	274	298	289	285
230	246	252	250	228	186	290	226	280	214	291	229	225	237	258	250	246
202	216	221	219	200	163	255	199	246	188	256	201	198	209	227	220	216
388	404	432	364	403	411	451	365	422	395	481	389	404	392	445	327	459
337	351	376	317	351	357	392	317	368	343	418	339	351	341	387	285	399
314	327	350	295	326	332	365	295	342	320	389	315	327	317	360	265	372
275	287	307	258	286	291	320	259	300	280	341	276	287	278	316	232	326
240	250	268	226	250	254	279	226	262	245	298	241	250	242	275	202	284
213	222	238	200	221	225	248	200	232	217	264	214	222	215	244	179	252
359	354	398	404	436	417	437	419	460	359	476	426	357	403	451	341	381
312	308	346	352	379	363	380	364	400	312	414	371	310	351	392	297	331
290	287	322	327	353	338	354	339	372	290	385	345	289	326	365	276	308
254	251	282	287	309	296	310	297	326	255	338	303	253	286	320	242	270
225	223	251	254	275	262	275	263	289	226	300	268	225	254	284	215	240
208	205	231	234	253	242	253	242	266	208	276	247	207	234	261	197	221
364	358	374	330	381	380	392	397	416	387	410	361	377	343	384	321	404
317	311	325	287	331	331	341	346	361	337	357	314	328	299	334	280	352
277	272	284	251	289	289	297	302	316	294	312	275	287	261	292	244	307
244	240	250	221	255	255	262	266	278	259	275	242	253	230	257	215	271
211	207	217	191	220	220	227	230	241	224	238	209	219	199	222	186	234
185	182	191	168	194	194	199	202	212	197	209	184	192	175	196	164	206
278	301	321	294	293	316	318	296	348	278	343	288	292	294	351	310	301
228	246	263	241	240	259	261	242	285	228	282	236	239	241	288	254	246
186	201	215	197	196	211	213	198	232	186	230	193	195	196	235	207	201
164	177	189	173	173	186	187	174	205	164	202	170	172	173	207	182	177
144	156	166	153	152	164	165	153	180	144	178	149	151	152	182	161	156
127	138	147	135	135	145	146	135	160	127	158	132	134	135	161	142	138
233	218	254	224	197	235	274	225	268	230	239	225	250	225	259	180	
191	179	208	183	161	192	224	184	220	189	196	184	205	185	212	148	
168	157	182	161	141	168	197	162	193	166	172	162	180	162	186	130	
147	137	160	140	124	147	172	141	169	145	150	142	157	142	163	114	
130	122	142	125	110	131	153	126	150	129	133	126	140	126	144	101	
123	115	134	118	104	124	145	119	142	122	126	119	132	119	137	95	
203	188	209	199	190	212	225	188	222	177	211	181	176	204	226	190	211
169	156	174	165	158	176	187	156	184	147	175	150	146	169	187	158	175
148	137	153	145	139	155	164	137	162	129	154	132	128	148	165	139	154
138	127	142	135	129	144	153	128	151	120	143	123	119	138	153	129	143
124	114	127	121	116	129	137	115	135	108	128	110	107	124	137	116	128
110	101	113	107	102	114	121	101	120	96	113	97	94	110	122	103	113
149	147	159	127	154	174	171	119	157	134	144	156	145	137	160	129	162
141	138	149	119	145	164	161	112	148	127	135	147	136	129	151	121	153

Atlanta	Boston	Chicago	Cleveland	Dallas	Denver	Detroit	Houston	Los Angeles	Minnea-polis	New York	Phila-delphia	Phoenix	St. Louis	San Fran.	Seattle	Wash'ton D.C.
339	331	384	354	479		506	357	418	367	431	370	368	488	407	365	453
274	268	311	287	387		410	289	338	297	349	300	298	395	330	295	366
257	251	292	269	364		385	271	317	279	327	281	279	371	309	277	344
227	222	257	237	321		339	239	279	246	289	248	246	327	273	244	303
183	179	207	191	258		273	193	225	198	232	199	198	263	220	197	244
376	418	433	386	449	300	472	394	449	391	459	469		327	426		385
327	363	377	335	391	260	411	343	391	340	399	408		284	371		334
286	318	329	293	341	228	359	299	341	297	348	357		248	324		292
252	280	290	258	301	200	316	264	300	262	307	314		219	286		257
218	242	251	224	260	173	274	228	260	226	266	272		189	247		222
191	213	221	196	229	152	241	200	228	199	234	239		166	217		196
309	363	354	343	364		374	336	427	357	386	340			376	299	347
268	315	308	298	316		326	292	372	310	336	295			327	260	302
235	275	268	260	276		284	255	324	271	293	258			285	227	264
207	243	237	230	243		251	225	286	239	258	227			251	200	232
179	210	205	198	211		217	195	248	207	223	197			218	173	201
168	184	180	174	185		191	171	218	182	196	173			191	152	177

either the Manager of Data Processing or to the Manager of Systems Analysis or to the Manager of Programming.

Lead Systems Programmer
Assists in scheduling systems programming projects and in assigning personnel to those projects. May act as a project manager for major systems applications and as the manager of the department in his absence. Usually assumes the responsibility for coordinating the activities of systems programming with the other dp sections.

Senior Systems Programmer
Develops specifications for extremely complex systems programming applications. May define the logic, perform the coding, testing, and debugging or may provide technical direction to lower classifications performing these operations. Usually is responsible for applications dealing with the overall operating system or with complex subsystems such as sophisticated file management routines, large telecommunications networks, or advanced mathematical/scientific software packages.

Systems Programmer A
Works from specifications to develop or modify programs to improve the efficiency of the operating system. Develops logic, codes, tests and debugs software defined by higher level categories. Modifies, tests and debugs vendor-supplied utilities, application packages and engineering releases. Assists in developing and modifying relatively complex software, such as routines supporting multiprogramming, telecommunications and file management.

Systems Programmer B
Assists in defining and programming moderately complex software such as utilities, job control language, macros and subroutines. May assist in the coding of benchmarks, job accounting and control modules developed internally by the firm. May assist with relatively complex software such as compilers, link editors, and assemblers.

Systems Programmer C
Assists in coding and maintaining utilities, job control language, and I/O programs, as well as other systems software of moderate complexity. May assist in maintaining the program libraries and technical manuals and in installing new vendor-supplied engineering releases. Assignments are generally under the technical direction of a higher level systems programmer. Usually possesses some background in applications programming and has a working knowledge of at least one assembler language.

Applications Programming

Manager of Applications Programming
Plans, organizes, and controls the preparation of application programs. Assigns, outlines and coordinates the work of the programming staff. Establishes standards for block diagramming, flowcharting, and coding. May write and debug complex programs. Collaborates with systems analysts and other technical personnel in scheduling equipment analyses, feasibility studies, and applications systems planning. Reports to the Manager of Data Processing.

Lead Applications Programmer
Assists in scheduling programming projects. Coordinates the activities of the programming section with other sections of the computer department. May act as programming project manager.

Senior Applications Programmer
Analyzes problems outlined by systems analysts in terms of detailed equipment requirements. Designs detailed flowcharts. Verifies program logic by preparing test data for trial runs. Tests and debugs programs. Prepares run sheets for routine programs. May do coding from flowcharts. May assist in determining the causes of computer or program malfunctions. May confer with technical personnel in systems analysis and application planning.

Applications Programmer A
Conducts detailed analyses of defined systems specifications and develops all levels of block diagrams and flowcharts. Codes, prepares test data, tests and debugs programs; revises and refines programs and documents all procedures used in finished programs. Evaluates and modifies existing programs to take into account changes in system requirements or equipment configurations.

Applications Programmer B
Assists in coding and in analyzing previously defined system specifications. Assists in—and in some cases carries out on his own—the preparation of all levels of block diagrams and flowcharts. Codes; assists in preparing test data and in testing and debugging programs. Assists in the documentation of all procedures used in the system.

Applications Programmer C Trainee
Assists in the analysis of system specifications and coding. Performs all work under close supervision.

Operations

Manager of Computer Operations
Plans, organizes and controls the Computer Operations Section. Establishes detailed schedules for the use of equipment. Assigns personnel and instructs them where necessary. Reviews equipment logs and reports to the Manager of Data Processing on operating efficiency.

Lead Computer Operator
Assists in scheduling the operations and in assigning personnel. Coordinates activities of the section with other sections in the data processing department. May act as shift supervisor.

Senior Computer Operator
Usually operates the central console. May give some direction to lower level classifications. Studies run sheets. Reruns job steps to recover from machine error or program error, consulting with technical staff where necessary. Maintains machine performance and production records.

Computer Operator A
Assists in running the machines and maintaining records. May assist in error recovery.

Computer Operator B
Assists in operating the computer and peripherals. May keep records regarding output units and use of supplies.

Computer Operator C
Carries out minor duties in accordance with detailed instructions. Usually works on only one activity under very close direction with the work being carefully checked.

Tape Librarian
Maintains library of magnetic and paper tape. Classifies, catalogs and stores reels. Maintains charge-out records. Inspects tape for wear or damage.

Data Examination Clerk (Controls Clerk/Scheduler)
Maintains the accuracy of processing by comparing source materials with reports, documents or other output. Maintains a schedule of work in the input queue.

Data Conversion Machine Operator
Operates any of several types of machines for converting source documents to paper tape, paper tape to cards, etc. □

DP CAREER PATHS

The salary survey charts contain two kinds of information for career planning: the salary potential of each specialty, and the best times to switch from one job family into another.

by Robert J. Greene

The salary survey illustrates prevailing pay practices relating to the position you hold, the industry your employer is in, and your geographic location. You may feel you can command more of a salary than you are likely to earn in your present position, given your education, experience, skills, and motivation. If so, here are the alternatives available to you, and some of the implications of each.

The typical company expends a great deal of money and effort to insure that its salary levels are internally equitable and externally competitive. It obviously behooves the firm to avoid overpaying (with its resultant payroll costs), underpaying (with its resultant turnover), or having its pay levels internally unbalanced (given the volatile kind of discontent unbalance breeds). The company defines salary ranges, which an employee should view as salary potential. Each range has a minimum rate, which typically is the hiring rate for the position, a midpoint, which represents a kind of average, and a maximum.

The chart below depicts the relative standings of the midpoints of the salary ranges for 35 of the positions defined in the salary survey article. Five job "families" (groups of positions with like work but with varying levels of expertise and responsibility), the two top dp management positions, and the manager's staff are included. (To determine where your own position fits, read the job descriptions in the survey; don't guess from the title.)

What are your alternatives if you feel your present or future salary potential doesn't measure up to what you feel you have to offer?

The alternatives

1. *Leave data processing.* Since you have probably spent several years developing skills in the field, you may think this an absurd alternative. Yet, consider that you are essentially a problem solver and a specialist at transforming data into information. Certainly these are skills necessary to General Management, Market Research, Production Management, and the like. Before leaping at this alternative, however, remember that you belong to a group of relatively well-paid problem solvers. You may be earning or headed toward a salary in a non-management position which is equal to that of line managers in other fields who have subordinate work forces and all the associated problems.

2. *Go to another firm that pays higher salaries.* This was the favored alternative of a number of dp people in the '60s. Unfortunately, this gave data processors a nomadic reputation bor-

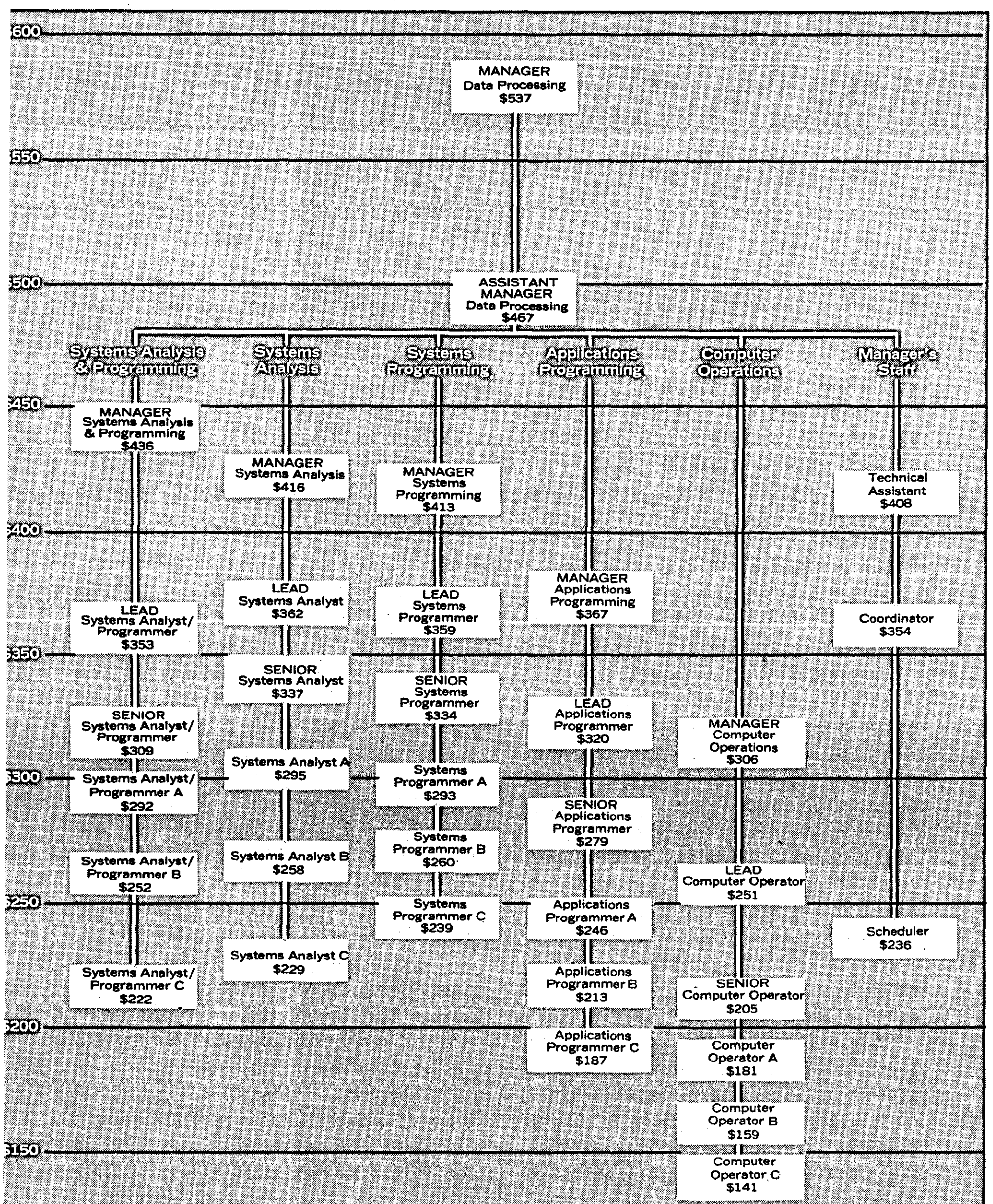
dering on the irresponsible. Going down the street for a 10-20% increase in salary potential for the same work is appealing on the surface, but a number of uncertainties cloud the issue: is the position promised the position delivered? is the *total* compensation package really larger (given that "fringes" may now represent 30-40% of total compensation)? is advancement potential equivalent or better? and is personal development more likely or at least as likely?

3. *Earn a promotion into a dp management position.* This is another seemingly smooth avenue fraught with potholes. A good technician doesn't always make a good manager; we all know that by now. Two cautions should suffice: (1) make sure that managing is something you want to do, and that you are not letting the earnings potential put you into a situation where you don't like the work and therefore might turn out to be a poorer performer; and (2) try to negotiate a trial period, if you choose this route, so you don't have to quietly leave by the back door if things don't work out.

4. *Earn a promotion within your position family.* To move from a Systems Analyst C classification to a Systems Analyst B will mean, on the average, a 15% increase in salary *potential.* This doesn't seem a lot. However, consider that moving over time from a Systems Analyst C to a Senior Systems Analyst (which still does not require managing other analysts) represents a 51.8% increase, not counting general rises in wage levels.

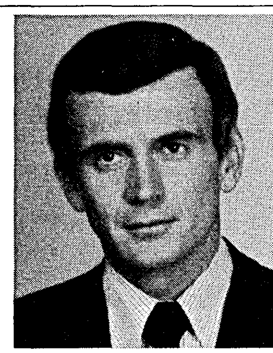
5. *Switch into another job family with greater potential.* The chart demonstrates that a number of career paths are available within dp. For instance, an applications programmer who prepares himself for systems programming or systems analysis can find a 15% higher salary range midpoint for an "equivalent" position level. Or a computer operator who prepares himself for applications programming can find a 38-39% increase in salary potential. Also, a career path into the top DP Manager's staff (Technical Assistant, Coordinator, etc.) offers attractive salary levels, in many cases as high as those of an Applications Programming Manager or Systems Analysis Manager.

The chart also shows that there are proper places to make such a switch. The most obvious example is the computer operator who wishes to move into applications programming. The place to do this without having to take a pay cut is probably at the Computer Operator A/Applications Programmer C level. On the other hand, a Lead Computer Operator has waited too long to switch. As a second example, an Applications Programmer A is in a good spot to switch to systems programming; a Senior Applications Programmer probably is not. The same kind of decision points appear on all the career paths.



Conclusion

To do what you do best and most want to do is certainly an attractive way to spend your working career. The intent here has not been to discourage you from pursuing this goal. Rather it has been to reveal some realities about salary potentials, at least as they exist today. You can find exceptions to everything that has been said. And what has been said can change in the near future. The purpose has been to show you your alternatives. The choices are up to you. □



Mr. Greene is a compensation consultant with the Philip H. Weber Salary Administration Services of A. S. Hansen, inc. He has an MBA from the Univ. of Chicago.

"Your debut has been a sensation. To what do you attribute your success?"

Hazeltine 1200:
"Good Breeding. I'm the latest in a long line of outstanding performers."

"But there are others who claim to be as good as you are. Could you be more specific?"

Hazeltine 1200:
"Take character for example. I have 1920 of them. 80 across and 24 down. Not only that, I'm available with switch-selectable baud rates in any combination of two standard rates all the way up to 9600.

"My options—such as upper and lower case, current loop and others—make me adaptable so that I can play to several different audiences."

"But Great Performers like you usually demand a high price. What do you have to say about that?"

Hazeltine 1200:
"Well! That's one of the other reasons for my success. I give people the features they want and need, at a price they can afford—only $65 a month, 12-month rental, maintenance included."

"How do you fit in with the other members of your family—the Hazeltine 1000, the Hazeltine 2000 and the Hazeltine 3000? How does your success affect them?"

Hazeltine 1200:
"Each of us is talented in different ways. But of course we all share the advantage of a worldwide sales and service network backed by more than a half-century of leadership in electronics and displays."

"I know that you're in great demand. Where will you be appearing next?"

Hazeltine 1200:
"That's up to my agents in Hazeltine sales offices throughout the world. A phone call at any time is all that's required to arrange for a personal appearance."

Hazeltine Corporation

Computer Peripheral Equipment, Greenlawn, N.Y. 11740 (516) 549-8800 Telex 96-1435

East: N. Y. (212) 586-1970 □ Boston (617) 261-5867 □ Phila. (215) 676-4348 □ Pittsburgh (412) 343-4449 □ Wash., D.C. (703) 979-5500 □ Rochester (716) 254-2479 *Midwest:* Chicago (312) 986-1414 □ Columbus (614) 868-5111 □ Detroit (313) 559-8223. *South:* Dallas (214) 233-7776 □ Atlanta (404) 393-1440 Houston (713) 783-1760 □ Orlando (305) 628-0132. *West:* San Mateo (S.F.) (415) 574-4800 □ L.A. (213) 553-1811 □ Denver (303) 770-6330 □ Seattle (206) 242-0505

Buy the numbers.

Typical FORTRAN execution times (microseconds)

	V74½	PDP-11/45	Nova 800	Mod Comp II	H.P. 2100
A=B+C	7	33	58	19	51
(double) A=B+C	10	82	61	29	98
A=B	4	14	35	7	13
Do Loop	4	22	10	11	17
A(I,J)=B	22	63	39	28	46
A=Sin(B)	100	251	266	197	1583

With all the claims being tossed around by various computer manufacturers, it's pretty hard to weed out the facts. What does winning horse races have to do with it?

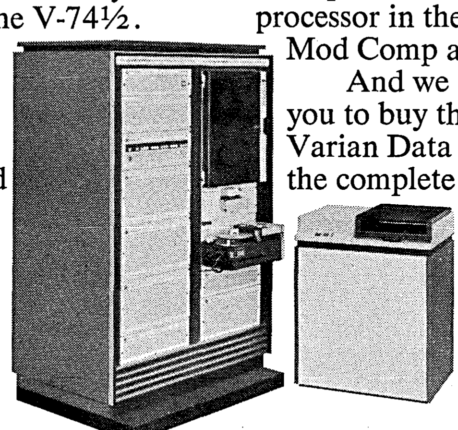
We figure it differently. Buying our computer or somebody else's, should come right down to getting the most for your money. And as these numbers show, that's the V-74½.

It out-performed everyone else's. Flat. The tests weren't stacked. They're only a few months old. Run on the latest available operating systems and compilers. And the same FORTRAN benchmark programs were used in every case.

To understand why we've been able to come up with such conclusive performance figures, you've got to understand the VORTEX operating system. Augmented by the firmware FORTRAN accelerator and our new Floating Point Processor, no one can argue with the fact that it's the fastest, most powerful, most sophisticated FORTRAN IV processor in the business. DEC, Data General, Mod Comp and HP notwithstanding.

And we have more numbers to convince you to buy the V-74½. Call your closest Varian Data Machines office for your copy of the complete benchmark results on the V-74½.

Varian Data Machines, 2722 Michelson Drive, Irvine, CA 92664. Or call (714) 833-2400.



varian data machines

With Inflation up... and the Economy down...

Where can you turn to improve your future?

Knowledge! Still the soundest way to ensure your future success. And here are five volumes from Wiley-Interscience crammed with enough of it to improve any computer professional's career. Offering much-needed advice on everything from the quickest, easiest way to learn PL/I and FORTRAN to the latest techniques in systems design, these mines of knowledge can increase your skills, and keep you on top of every development in your field.

MACRO PROCESSORS
and Techniques for Portable Software
By P. J. Brown, *University of Kent at Canterbury*

Brown shows how your organization can save time and dollars by fully exploiting macro processors and keeping reprogramming for new environments to a minimum. After spelling out all the basic concepts of macro processing, he demonstrates how macro processing, as well as several other techniques, can be used to aid software portability and provides a fully documented project which you can undertake yourself.

0 471 11005-1 1974 244 pages $15.95

AN INTRODUCTION TO GENERAL SYSTEMS THINKING
By Gerald M. Weinberg, *State University of New York, Binghamton*

A volume in the Wiley Series on Systems Engineering and Analysis, edited by Harold Chestnut

This volume will *not* teach you how to program computers, but it will teach you how to *think* the way a computer programmer should! Drawing on insights from both general systems theorists and disciplinarians, it lays out in simple, non-technical language all the basic concepts used in the general systems approach to thinking and teaching.

0 471 92563-2 1975 304 pages (tent.) $16.95

OS DATA PROCESSING
With Review of OS/VS
By Harry Carroll, *IBM Systems Development Division*

Carroll describes the many levels of hardware and software that make up a modern computer system, then shows how they interact with each other so that you can develop an understanding of the entire system. S/370 hardware, OS/360 software, OS/360 task management, OS/VS, job control language, job processing by job management, data management, and teleprocessing—all are covered in detail.

0 471 13600-x 1974 280 pages $17.50

QUEUEING SYSTEMS, Volume I: Theory
By Leonard Kleinrock, *University of California, Los Angeles*

Whether used as a textbook or reference work for people in computer science, systems science, industrial engineering, or operations research, here is a book with many important features, including:

- techniques of duality, collective marks
- queueing networks
- complete appendix on z-transforms and Laplace transforms
- a Venn diagram classification of many common stochastic processes

It's a book that presents and develops methods from queueing theory in sufficient depth so that students and professionals may apply these techniques to many modern engineering problems, as well as conduct creative research in their field.

0 471 49110-1 1974 432 pages (tent.) $19.95

FORTHCOMING:

COMPUTER AIDED EXPERIMENTATION:
Interfacing to Minicomputers
By Jules Finkel, *Weizmann Institute of Science*

If you're engaged in scientific experimentation, this book is a "must." Finkel shows how computer-aided experimentation can relieve you from ordinary, repetitive tasks and give you more time to devote to creative activities. His detailed examination of computer aided experimentation spotlights the design of minicomputers and how real time devices are connected to them, particularly input-output structures.

0 471 25884-9 1975 425 pages (tent.) $20.00 (tent.)

FORTRAN TO PL/I DICTIONARY
PL/I TO FORTRAN DICTIONARY
By Gary DeWard Brown

If you already know either FORTRAN or PL/I, here's a book that will teach you the other language quickly and easily. Unlike traditional language manuals that waste your time with descriptions of the computer, card readers, and computer applications, this ingenious guide explains FORTRAN and PL/I in terms of each other, by example (in much the same way in which French is taught in terms of English to someone who speaks English). And don't worry; if you're rusty in one of these languages, this book is detailed enough so that you can refresh your memory before proceeding to learn the new language through a statement-by-statement comparison.

0 471 10796-4 1975 225 pages (tent.) $9.95 - $12.50 (tent.)

WILEY-INTERSCIENCE
a division of John Wiley & Sons, Inc.
605 Third Avenue, New York, N.Y. 10016
In Canada: 22 Worcester Road, Rexdale, Ontario
Prices subject to change without notice. 092 A 4871-WI

Wiley-Interscience, Dept. 476
P. O. Box, 4569, Grand Central Station, New York, N.Y. 10017

Please send me the book(s) I have checked below to read and use free for 10 days. At the end of that time, if I am satisfied with my order and want to keep it, I will send you the amount indicated for each book received, plus postage and handling. Otherwise, I will return the order and owe nothing.

- ☐ 1 11005-1 BROWN: Macro Processors $15.95
- ☐ 1 92563-2 WEINBERG: An Introduction to General Systems Thinking $16.95
- ☐ 1 13600-x CARROLL: OS Data Processing $17.50
- ☐ 1 49110-1 KLEINROCK: Queueing $19.95
- ☐ My check (money order) for $________ is enclosed.
- ☐ Please bill me. (Restricted to the continental United States.)
- ☐ Please send me a list of local bookstores carrying your titles.

Name________________________

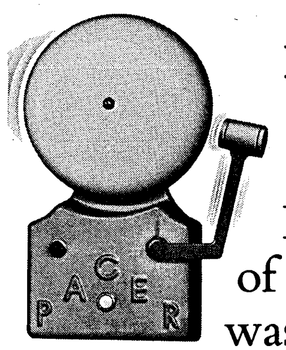
Address________________________

City/State/Zip________________________

Please add state and local taxes where applicable.
Prices subject to change without notice. 092 A 4871-WI

The Bully.

ADDS new Consul 980. It'll take on anybody in the magazine.



Round 1.

This is the tale of one tough terminal.

It seems like a month of Sundays since ADDS was just a new kid on the block. Back then, all we had were big ideas and a reputation to earn.

Well, we earned it. And the story of our new 980 TTY compatible terminal is a good example of how.

A Technical Knock-out.

If you've ever eyeballed our Consul 880, you know how the 980 looks: the "Gorgeous George" of CRT terminals. But these two have a lot more in common than good looks and 1,920 characters; they share a reputation built on design, engineering and service. Not to mention some 100% pure sweat.

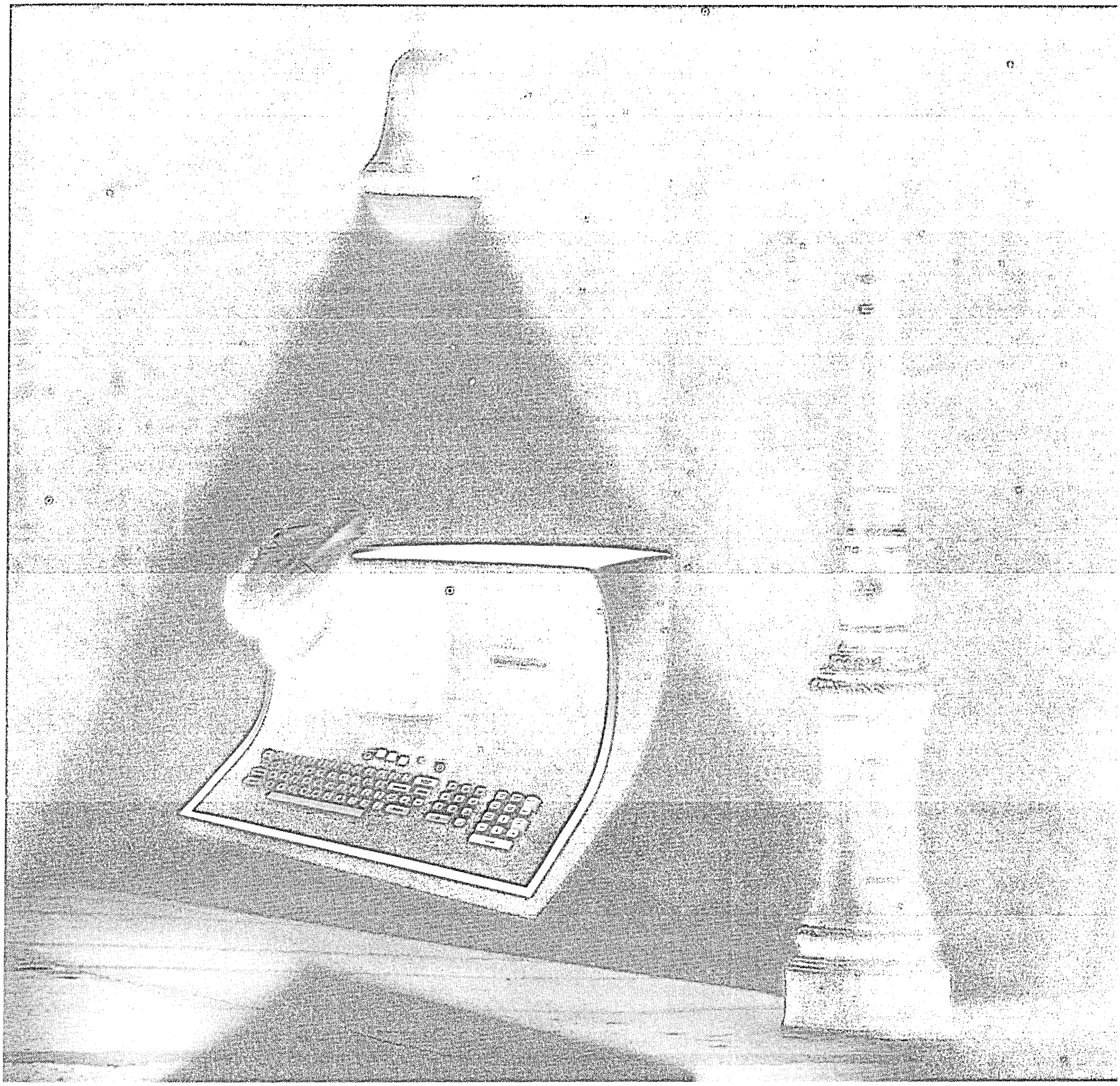
But the Bully goes an extra round.

A very famous fighter would have probably put it this way:

Now inserting or deleting
characters is fine, but the 980 also
edits a line at a time!
Our character set displays a
black on white face, and it comes
in upper and lower case!
The computer can read the
cursor position, and that is
certainly a welcome addition!
Besides all that, if you please,
protected formatting; graphics
and function keys!
Printer and cassette ports, and
just in case, current loop as well as
EIA interface!
As if all these features didn't
suffice, it's an entirely remotely
controllable device!
Now we hope you understand
fully, just why we call 980 the
Bully.

Hitting below the belt.

If you're expecting a championship terminal like the 980 to



Predictions for 1977 and 1985 portray an evolutionary trend to a tenfold improvement in circuits, simpler operating systems, somewhat more complicated data management systems, and twenty times today's data traffic.

BEYOND 1984: A TECHNOLOGY FORECAST

by Frederick G. Withington, Contributing Editor

The computer industry's products are clearly in a state of transition, and many users faced with decisions about commitments to today's products need to know whatever they can about possible future successors. In early 1974 Arthur D. Little, Inc. prepared a comprehensive forecast of the nature of future data processing equipment, software, data communications services, and their costs for the Electronic Systems Div. of the U.S. Air Force, for use in a project called SADPR-85, *which dealt with base-level data processing operations through 1985. A substantial effort involving 25 investigators, the study produced a report 284 pages long with a bibliography of over 500 titles. The full report is available to qualified defense contractors from the National Technical Information Service, 5285 Port Royal Road, Springfield, Va. It is Appendix VI, in vol. 3, of the six-volume report*—"Support of Air Force Automatic Data Processing Requirements Through the 1980's," *document number AD-783-768. This article summarizes the contents of that report, adding new material derived from subsequent studies and industry developments.*

This article, like the report prepared for the Air Force, focuses on commercially available, general-purpose administrative data processing hardware and software. It covers the full spectrum of sizes and types, but omits specialized tools for scientific, industrial process, or dedicated commercial applications. Its objective is to provide forecasts of processing modules—computer, file and I/O *subsystems, etc.—that can be used as building blocks in studying alternative configurations. Each building block requires a specific forecast of functions, power, and costs, but not a detailed discussion of the components within it. Therefore, the discussion of technologies as such is limited to those likely to be available in proven, commercially available modules by 1982. Also, in cases where alternative technologies might be used in a module without materially changing its price/performance, no effort is made to determine which will be the technology of choice. Constant dollars are used; no allowance is made for inflation. Forecasts for each type of module are made for two target years, 1977 and 1985.*

HARDWARE

Computers

Within the next five years, circuits for computer logic and storage will probably exist that have switching speeds on the order of 10^{-8} second, 10 to 50 times faster than today's devices. Beyond that level further improvements will become harder to achieve, though another order of magnitude could be obtained beyond 1985. However, appearance of improvements in the laboratory precedes their appearance in commercially usable, reliable computers by about five years. This suggests that the improvement in circuit performance per dollar cost will be no more than tenfold (relative to today's circuits) for computers being delivered in 1985. A rather simplistic inference is that circuits of today's performance level will cost about one-tenth the present price, while computers in today's medium-high price range will have speeds approaching 100 MIPS (million instructions per second).

However, an important factor in determining the architecture of tomorrow's processors derives from the desirability of manufacturing circuits in the most standardized form possible. It is and will remain expensive to design an individual integrated circuit, the more so as the scale of integration rises. On the other hand, the manufacturing cost of the individual circuit is extremely low, so it is more economical to effectively waste circuit functions than to design a new circuit. This influence, already visible in the design and functioning of electronic calculators, will be very important in determining the future architecture of computers. To the degree possible, modules at the microprocessor and even higher levels will be used in preference to the design of new specialized circuits.

Architecturally, increasing parallelism in commercial computers is likely to be used to reduce the wait times now encountered in interlinked data transfer and manipulation operations. This parallelism is likely to be realized in the form of specialized processors dedicated to I/O and file management, memory management, interrupt processing, and similar functions. Paralleling of many identical, multifunction processors as in ILLIAC is unlikely in general purpose computers, because the jobs to be done (many of them involving emulation of today's programs) do not conveniently subdivide into array form.

Microcoding

These specialized processors are likely to have their functions determined primarily by microcoded stored logic, with wired logic used only where high speed is essential. The use of microcode facilitates standardized manufacturing and maintenance, while permitting the functions of the processors to vary in support of system objectives.

The set of microcodes in the groups of processors forming a "computer" will, in addition to facilitating the basic scheduling and resource allocation functions, support the following system objectives now normally addressed by the operating system:

- Support of several run-time environments, both for the emulation of past programs (and related operating systems) and for the convenience of multiple users simultaneously desiring several modes of operation. Some version of virtual machine concepts will be involved.
- Separation of I/O, communications, and file processing from computational functions.
- Dynamic allocation of processor functions, both to meet varying workloads and to support fail-soft operations (which will, in some form, be all manufacturers' approach to increasing system availability).
- Automatic management of the memory and file device hierarchy at a symbolic level, to facilitate ease of programming, convenience of use, and (through access tables associated with individual run-time environments) security and privacy of data.
- Self measurement, including error logging. This function will support routine maintenance, fail-soft operation, job accounting, and system tuning.

Other functions now associated with operating systems are likely to continue to be performed primarily by software, and are discussed below.

This set of system objectives applies to computers to be available in both 1977 and 1985, and across most of the computer price range. Success and generality in meeting the objectives (and cost/effectiveness in doing so) will be evolutionary, obviously greatest in the larger computers and the later ones.

Processors become components

Computers of both 1977 and 1985 will, then, consist of complexes of component processors automatically sharing microcoded functions under control of the operating system in a manner largely invisible to the user. The throughput of computers will be determined by that of their component processors. Three levels of component processors are defined here, designated level 1, level 2 and level 3, in order of increasing power. Then, four levels of end-user computers are defined in which they will be used. The four levels of end-user computers are enough to cover the normal price range for commercial data processing, and three levels of component processors appear to provide enough building blocks.

The price/performance forecasts for the component processors are summarized in Table 1, (page 56). The level 1 processor is similar to today's microprocessor, manufactured on one or a few semiconductor chips. Initially simple with a small programmable read-only memory (PROM) and minimal complexity, it will evolve in the direction of higher complexity and speed. Its speed in 1985 is forecast to be the same as that of the level 2 processor, reflecting the expectation that by then there will be no cost benefit in manufacturing circuits with cycle times any slower than 250 nanoseconds. The level 2 processor will evolve similarly, but will in both 1977 and 1985 be considerably more complex: it will be required to perform the functions currently associated with an I/O channel controller, or with the cpu of a small computer system.

The level 3 processors will correspond to the central computers in today's medium to high priced computer systems, but will have raw speed equivalent to that of today's largest computers. They will be used singly in batch-oriented monoprocessor computers as they are today, and in multiples under multiprocessor operating systems in large-scale systems with high power and automatic fail-softness. The cost (to the vendor) of level 3 processors is not expected to drop as much between 1977 and 1985 as the costs of smaller processors, because the complexity increase required to support the evolving microcode software is expected to be greater (as shown by the quadrupling of PROM size). Pipelined instruction interpretation and execution, probably used to achieve speeds approaching the microcode equivalent of 100 MIPS, will also serve to keep complexity high.

Larger, more powerful component processors than level 3 will be possible in both 1977 and 1985 and will probably be built for large scientific systems, but they will not be needed for even the largest commercial systems (partly because at least two cpu's will be needed in such systems to permit fail-soft operations).

These component processors will be combined to form the "computers," or "processor systems," offered by the manufacturers. They will also be used in I/O subsystems (e.g., intelligent terminals and remote batch terminals) and in file storage subsystems; these are discussed below.

The expected characteristics of the four levels of computers are summarized in Table 2, (page 56). Conventional terminology is used to identify them, mostly because terms such as "minicomputer" are traditionally associated with a price range that will still exist (though the power provided in each price class will change). Each computer is described as a module incorporating an average amount of main memory and of backing storage for program residence and working space. All file storage is additional; file modules are described below.

Multiprocessing

The microcomputer, including one level 1 component processor, will typically be used in intelligent terminals or satellites. By 1985, however, the power of the processor and the low cost of relatively large memory will enable the microcomputer to support small stand-alone systems of considerable versatility. The costs of such systems will be dominated by their peripheral equipment costs (see below).

The minicomputer will in both 1977 and 1985 be able to support a fully capable data processing system. The cpu will be a single level 2 processor, and from three to (in 1985) as many as 20 level 1 processors will be associated with peripheral equipment. Ease of use in interactive applications will be the primary design objective of these machines. This accounts for the very large average storage size of the 1985 machine and resulting slow decline in price. One batch stream is assumed in the background, though the 1985 machine could easily run more batch streams at the expense of some interactive capability (particularly since virtual memory management will be generally used).

The mono-computer is designed primarily for users whose intent is to perform fairly large amounts of batch processing, though some interactive capability will be present. In the 1977 system a single level 3 cpu will be employed and two or three level 2 processors for high-volume peripheral device control; level 1 processors will be used as needed for individual or low-volume peripherals. Because no multiprocessing will be present, and because (for efficiency) fixed partitioning of memory into batch and interactive virtual environments will be used, the functional system objectives listed above will be only partly met. In the 1985 system, however, the low costs of component processors will permit a second level 3 processor to be included and several more level 2 processors. These, together with larger memories, will permit the mono-computer to meet almost all the system objectives (except, perhaps, multiple run-time environments) even though its price will decline.

The multi-computer will incorporate at least two level 3 processors in 1977 and three, four or more in 1985. Four to six level 2 processors will be in the 1977 system and perhaps twice as many in the 1985 system, together with multitudes of level 1 processors.

The multi-computer's price difference from the mono-computer is due not so much to having more processors as to the much larger storage of the multi-computer, particularly the large backing store (which may use magnetic bubble or charge-coupled device technology as early as 1977. See discussion of auxiliary storage). This very large storage is needed to provide numerous run-time environments (one or more emulating past generations, several running batch streams, several varieties of interactive environments, etc.). Also, the multi-computer will be designed to completely intermix a wide variety of file-based interactive, batch, and system development applications. The multi-computer will in fact be a network of computers providing a number of processing environments simultaneously. The common elements will be two: the central data base around which the processing is distributed, and a central system executive that controls the functions of each component computer and provides overall monitoring. It is these two common elements which prevent the multi-computer from being broken up into a "federated network" of physically dispersed minicomputers. Perhaps in the farther future ways will be found to provide these common system elements in a dispersed network, but this seems unlikely in products being delivered by 1982.

Comparing the estimated purchase costs of the different classes shown in Table 2, it appears that wide gaps will develop in the price spectrum. This is partly an illusion caused by this article's objective of providing standard cost forecasts for typical modules; as now, variations in configuration will cause wider variations in price than those shown here. Nevertheless, between the mono-computer and multi-computer, a genuine price gap seems likely; the implication is that there will be no high-priced batch processing computers (except perhaps specialized scientific ones), and that there will be a minimum cost of entry to the high volume, interactive, data base oriented environment.

Auxiliary Storage

A great deal of research is being performed into novel auxiliary storage technologies including magnetic bubbles, charge-coupled devices, laser-holographic devices, cryogenic devices, and others. This will gradually result in the introduction of new types of auxiliary storage subsystems. However, much improvement potential still exists in conventional magnetic technology. Most of the improvement will be in the form of increased area density of recording: more tracks per inch laterally across a magnetic disc face, and more bits per inch longitudinally. An area density improvement factor of at least 40 appears theoretically possible. This will result in a much lower cost per bit for magnetic discs, lower through at least 1983 than newer technologies can match. However, access time to magnetic discs will remain a problem even if head-per-track arrangements become general. For this reason it seems likely that hierarchies of auxiliary storage devices will continue to be used through 1985, with the newer technologies appearing first at the high speed, low capacity end of the spectrum, and then gradually superseding slower technologies as their costs per bit drop. Either magnetic bubble or charge coupled device technology (or both) will be in widespread use by 1983, and are likely to appear in some product lines by 1977.

Table 3 summarizes the situation: four levels of auxiliary storage (in addition to the computer's main memory) are likely to remain in use in 1977 and beyond; only in the 1980s does the improvement potential of the new high speed technologies indicate that the number of levels of storage may be reduced. The multilevel hierarchy will be of less concern to the user than it is now, however, because virtual memory management techniques will be used to move data sets up and down the hierarchy depending on usage. The recent announcement of IBM's 3850 system exemplifies the trend in this direction.

	Level 1		Level 2		Level 3	
	1977	1985	1977	1985	1977	1985
Cycle time	2 usec	250 nsec	500 nsec	250 nsec	500 nsec	100 nsec
Bandwidth	4 bits	8-16 bits	16 bits	16-32 bits	32 bits	64 bits
Interrupt levels	0	1 level	1 level	2 level	2 level	4 level
PROM size	500 bytes	1,000 bytes	4,000 bytes	8,000 bytes	8,000 bytes	64,000 bytes
Cost to system vendor	$100	$50	$4,000	$2,000	$50,000	$30,000

Table 1. Future component processors.

FUTURE COMPUTER CLASSES

	Microcomputer		Minicomputer		Mono-computer		Multi-computer	
	1977	1985	1977	1985	1977	1985**	1977	1985
Typical use On-line (users) Batch (streams)	1 or 1	5-10 or 1	6-10 and 1	10-20 and 1	10-20 and 4-6	20-40 and 6-8	complete intermixing, job determines limit	
Main memory (bytes)	4-8KB	32-64KB	32-64KB	0.2-0.5MB	0.5-2MB	2-4MB	2-16MB	8-64MB
Backing store* (bytes)	300KB	500KB	500KB	4MB	10MB	30MB	50-200MB	100-500MB
Operating system	minimal	minimal	real, fixed partitions	virtual	partitioned virtual	virtual	multiple virtual memory or machine	
User cost	$1-2K	$0.3-0.7K	$10-20K	$7-10K	$150-250K	$75-100K	$1.5-2.5M	$1-2M

*Auxiliary storage for system programs, current application programs and data.
**This system will probably have multiple main processors by 1985.

Table 2. Future computer classes.

Auxiliary storage module performance and cost forecasts have been developed for 1977 and 1983, and compared with 1974 levels. These forecasts are summarized in Table 4. The modules were configured on the basis of the typical size and access time requirements assumed for the four classes of computers (multiple modules could, of course, be used to obtain higher capacity). Controllers are included in the cost of each module, ranging from a controller requiring a single level 1 component processor at the low end to a controller with dual level 2 processors at the high end.

In addition to the auxiliary storage modules for conventional random file access, forecasts are also summarized in Table 4 for very large, slow access archival storage systems that could be added to multi-computer configurations. These require advanced technology to obtain the very high capacities required; early models are available now and they are expected to see general use in the late 1970s. These modules are shown as if they are independent, for clarity and ease of reference. Their actual use in systems of both 1977 and 1985 will be in hierarchical arrangements, with data movements at least partially transparent to the user.

Forecasts for magnetic tape auxiliary storage modules are summarized in Table 5, (page 61). (The controller in each module is assumed capable of handling simultaneous data transfer to all drives). An eventual doubling of packing density (and therefore of data rate) and some reductions in cost are forecast, but the relatively mature electromechanical technology involved seems to preclude major improvement.

Batch I/O Equipment

The spectrum of I/O device types, speeds, and functions is so broad that for purposes of the Air Force report individual devices were combined into clusters or "stations," each station forming a cost/performance module that could be used in configuring overall networks with approximate accuracy even though the exact number of readers, printers, etc., would probably be somewhat inaccurate. The same procedure is followed in this article. Forecasts were developed for two types of basic batch I/O stations in which a line printer is combined respectively with punched card and magnetic I/O equipment; then two optional, additional batch options were forecast: optical readers and computer output microfilm stations.

Punch card/line printer

The first of the batch I/O stations includes one card reader, one punch, and one line printer. Forecasts were developed for low, medium, and high speed versions of this station, and for 1977 and 1985. These are summarized in Table 6, (page 61).

During the last 10 years there has been little change in the price/performance of the card readers and punches offered for use with the larger computer systems. The only major innovation has been the 96-column card introduced by IBM; this did not cause a great deal of change in demand, and the price/performance of units de-

AUXILIARY STORAGE TECHNOLOGY PERFORMANCE CHARACTERISTICS

	Storage capacity (bits/unit)	Access time (sec)	Cost/bit (cents)
A. 1974 Technologies			
High speed/Low capacity (large core, hpt disc, drums)	10^7-10^8	10^{-5}-10^{-2}	0.1-2.0
Moderate speed/Moderate capacity (moving-head discs)	10^8-10^9	10^{-1}-10^{-2}	10^{-3}-10^{-2}
Low speed/High capacity (ultra-large storage devices)	10^{11}-10^{12}	1.0-10	10^{-5}-10^{-4}
Archival storage (magnetic tapes)	Unlimited (10^8/tape)	10-100	10^{-6}-10^{-5}
B. 1977 Technologies			
High speed/Low capacity (hpt discs, early bubbles or CCD)	10^8-10^9	10^{-4}-10^{-3}	0.1-1.0
Moderate speed/Moderate capacity (moving-head discs)	10^9-10^{10}	10^{-3}-10^{-2}	10^{-4}-10^{-3}
Low speed/High capacity (ultra-large storage devices)	10^{11}-10^{13}	1.0-10	10^{-6}-10^{-4}
Archival storage (magnetic tapes)	Unlimited (10^9/tape)	10-100	10^{-7}-10^{-6}
C. 1983 Technologies			
High speed/Moderate capacity (CCD, magnetic bubbles)	10^8-10^9	10^{-7}-10^{-5}	0.01-0.1
Moderate speed/Very high capacity (discs, holographic, cryogenic)	10^9-10^{14}	10^{-5}-10^{-1}	10^{-6}

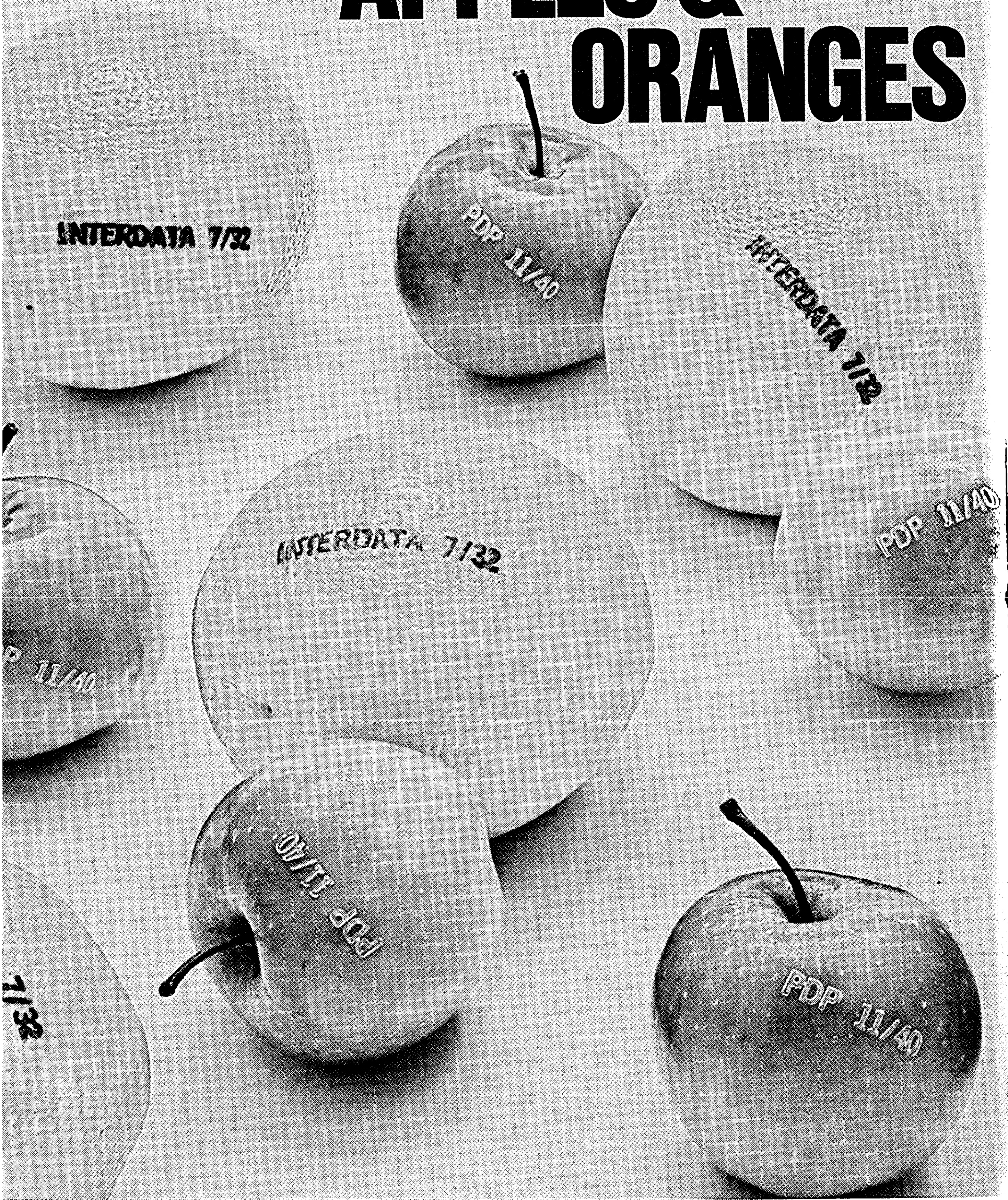
Table 3. Auxiliary storage technology performance characteristics.

AUXILIARY STORAGE MODULE COST/PERFORMANCE FORECASTS

	1974	1977	1983
Microprocessor auxiliary storage			
Capacity	1 million bytes	5 million bytes	5 million bytes
Medium	small fixed disc	small fixed disc	semiconductor, CCD
Access time	10 msec	10 msec	10 usec
Cost	$5,000	$2,500-3,500	$1,500-2,500
Minicomputer auxiliary storage			
Capacity	20 million bytes	50 million bytes	50 million bytes
Medium	small removable disc	small removable disc	bubble memory
Access time	100 msec	30 msec	100 usec
Cost	$35,000	$15-20,000	$15-25,000
Product example	IBM S3/10 disc (5445)		
Monoprocessor auxiliary storage			
Capacity	200 million bytes	200 million bytes	500 million bytes
Medium	head/disc cartridge	head/disc cartridge	head/disc cartridge
Access time	25 msec	25 msec	20 msec
Cost	$60,000	$35-45,000	$25-35,000
Product example	IBM 3340	IBM 3340	
Multiprocessor auxiliary storage			
Capacity	1 billion bytes	2 billion bytes	2 billion bytes
Medium	multiple disc unit	multiple disc unit	multiple discs
Access time	30 msec	25 msec	20 msec
Cost	$260,000	$180-220,000	$90-130,000
Product example	IBM 3330		
Archival storage option			
Capacity	200 billion bytes	1 trillion bytes	10 trillion bytes
Medium	tape cartridge	laser, video recording	holographic systems
Access time	10 sec	10 sec	1 sec
Cost	$1,000,000	$400-600,000	$700-1,200,000
Product example	IBM 3850		

Table 4. Auxiliary storage module cost/performance forecasts.

HOW TO COMPARE APPLES & ORANGES



OR THE INTERDATA 7/32 VS. THE PDP 11/40

It's a simple comparison when you think about minicomputer hardware in terms of software.

Interdata believes that hardware exists to make programming easier. That's the reason we invented a 32-bit minicomputer. And that's the reason there really can be no comparison with any 16-bit machine.

Just think about it.

Most 16-bit mini's were designed when memory cost you a dollar a word. Multiple registers meant four. Software was a set of diagnostics. And hardware was king.

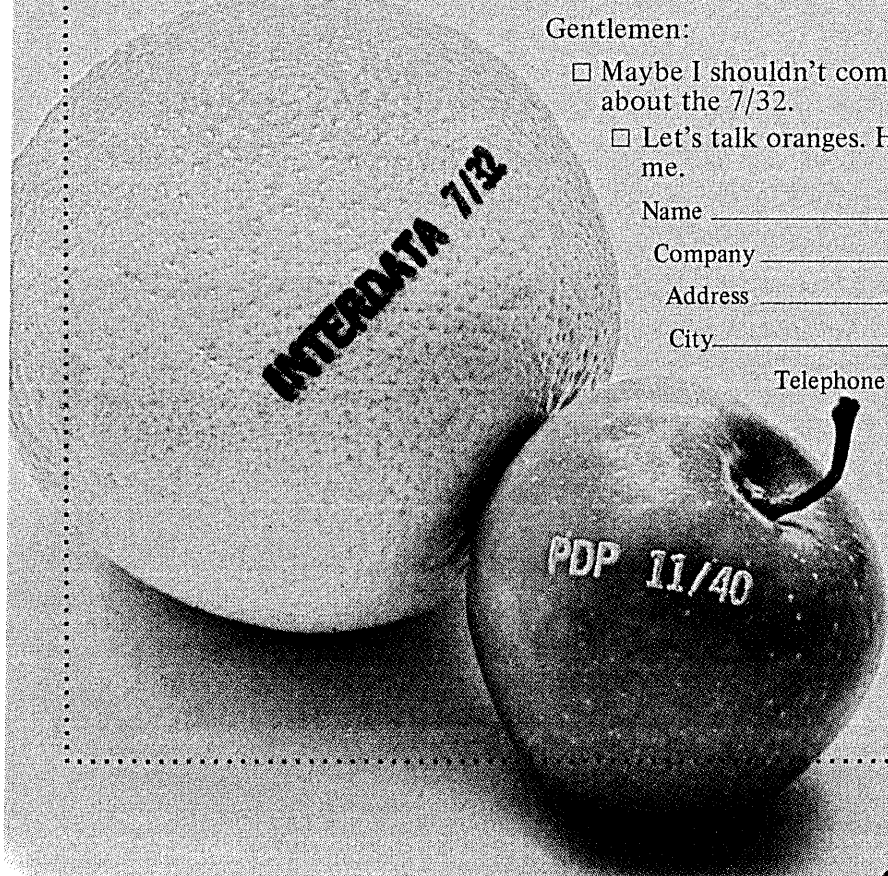
Not so now.

Large memories are the rule – not the exception. One program alone can exceed 65K. Multiple registers now mean 32. And most of your dollars are spent on software.

That's why Interdata made the 7/32 happen – to make your software simpler and cheaper.

For example, the 7/32 has a Real Time Operating System you can understand. A system optimized for FORTRAN programs. And a set of editors, debuggers, and file packages to brighten any programmer's day. All with a CAL assembler that gives you efficient code and is compatible not only with Interdata 7/32's but with our 7/16's as well.

So don't try to compare apples and oranges. It's unfair to the apple. Especially when their apple only has 16 bits to help their software and our orange has 32.



Interdata, Inc., 2 Crescent Place, Oceanport, N.J. 07757 (201) 229-4040.

Gentlemen:

☐ Maybe I shouldn't compare, but I've got to try. Send me more about the 7/32.

☐ Let's talk oranges. Have an Interdata representative contact me.

Name ____________ Title ____________

Company ____________

Address ____________

City ____________ State ______ Zip ______

Telephone ____________

INTERDATA®

A subsidiary of The Perkin-Elmer Corporation

2 Crescent Place, Oceanport, N.J. 07757.
(201) 229-4040.
6486 Viscount Road, Mississauga, Ontario,
Canada L4V 1H3. (416) 677-8990.
Arundel Road, Uxbridge, Middlesex, England.
Uxbridge 52441.
8032 Grafelfing bei Munchen,
Waldstrabe 31, West Germany, 854-20-34-38.
92 Chandos Street, St. Leonards,
Sydney, Australia 2065. 439-8400.

CIRCLE 47 ON READER CARD

No terminal is an island.

"Because a terminal is only as good as the service that keeps it working, we give you Termicare®."

Z. V. Zakarian, president

This Termicare Center is the heart of our nationwide terminal support system. It consists of 5,000 square feet full of sophisticated communications and diagnostic equipment, service records and highly skilled people.

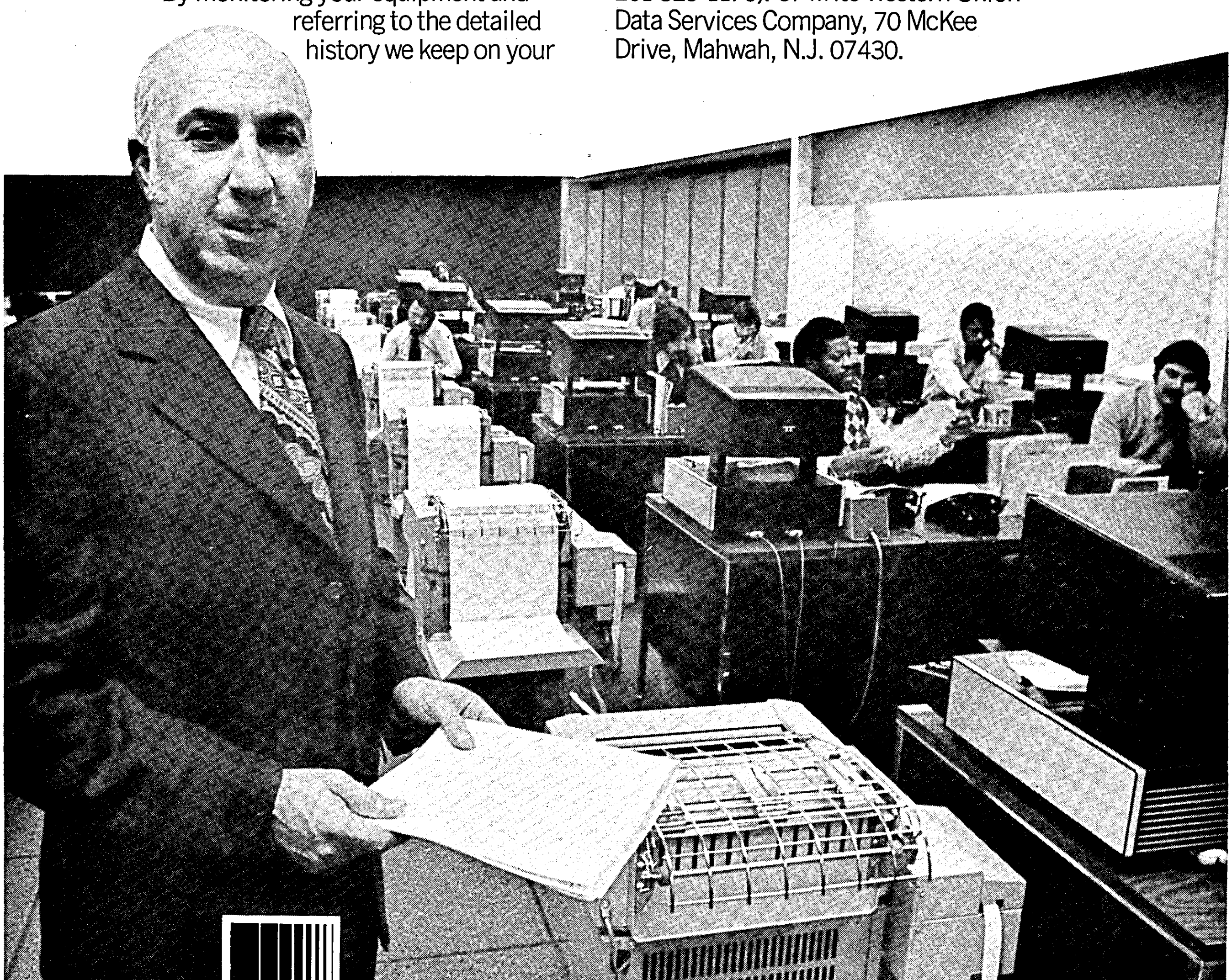
Because Termicare is centralized, we can focus all our resources on solving your problems. You don't have to rely on just one man in the field.

For example, if a terminal malfunctions, you call our Termicare Center toll-free. Within minutes, one of our analysts takes charge of your problem and sticks with it until it's solved. By monitoring your equipment and referring to the detailed history we keep on your terminals, he can quickly pinpoint the cause of most problems.

Almost 30% of all terminal malfunctions do not originate in the terminals themselves. So our analyst, with the help of a pool of experts, can frequently restore your terminals on the spot. If not, we will send a field man from one of 400 service locations. We'll alert him to the nature of your problem so he can bring the necessary equipment and parts.

Once the problem is resolved, it becomes part of your system's history. Future malfunctions will be avoided or solved more quickly.

Thinking about a terminal system? Let me prove what Termicare can do to keep it operating. For a free brochure on Termicare, without obligation of course, please call 800-631-7050 (in N.J. 201-529-1170). Or write Western Union Data Services Company, 70 McKee Drive, Mahwah, N.J. 07430.



wu western union data services company

CIRCLE 63 ON READER CARD

signed to handle the 96-column card is comparable to that of conventional units. A check of devices offered by 15 vendors showed that maximum speed of punched card readers now available is 1,200 cpm, and the maximum punch speed is 300 cpm. These speeds were first achieved more than 10 years ago. Further speed increases obviously pose mechanical problems, but if there had been substantial market demand for units of higher speeds, it would have been technically possible to develop them. We infer that these speeds are regarded by the market as adequate for high-performance units. Prices of high-performance units have also changed little.

The growth of the minicomputer has brought with it a set of slower card readers and punches at lower prices designed to match the throughput capabilities and prices of the minicomputers. Readers capable of handling 400 cards per minute typically have a purchase price of about $1,200, and punches capable of handling 100 cards per minute typically cost about $9,000.

Price/performance evolution of these devices will be constrained by the fact that they are predominantly electromechanical and reflect a mature technology. We may expect manufacturers to substitute electronics for mechanical components wherever they can, and there is some possibility of using different technologies (such as fluidics) for the direct control of mechanical modules. It is also likely that the manufacturers, faced with the inherent high failure rates of these devices, will continue to work to improve their reliability. However, their willingness to invest in either new technology or more reliable designs will be moderated by the fact that the total demand for card readers and punches will probably decrease; the popularity of data collection with other media should diminish the overall use of card readers and punches. We therefore forecast relatively little change in price/performance over the entire period 1977-1985.

Printers are similarly constrained by the limits of electromechanical technology, but nonimpact techniques (thermal, electrostatic, electrographic, inkjet and Xerographic) have led to a greater rate of change. In the time period of this article, the development of nonimpact devices may lead to improvements of 15%-30% in overall printer price/performance with greater improvements at speeds of 3,000 lpm and up. This improvement factor appears in Table 6 as an increase in speed for the medium and high speed printers without any decrease in cost; for the low speed printer, both speed and cost are forecast to improve.

The forecast for the second type of batch I/O station simply substitutes magnetic tape drives for the card reader and punch, arriving at only slightly different cost forecasts.

OCR station

System designers are rapidly developing more sophisticated circuit designs that, combined with LSI technology, are producing character recognition logic components of much lower cost and smaller size. Electro-optics developments are also contributing very small, light, inexpensive scanning arrays for low-cost units, and also very fast, more accurate scanning elements (using such technologies as laser beam control) for the larger, more complex systems. The most difficult design barrier to dealing with the less constrained patterns of handprinting and script is still the development of a true "gestalt" pattern recognition methodology (probably of a software nature) with powerful heuristic capabilities. Little progress in this area is foreseen.

A combination of continued rapid development of newer electro-optic materials and improvements in the power, speed, and cost of integrated circuits will lead to an increase in the price/performance of all types of OCR's by an overall factor of at least 2 and, in some cases, as much as 4 by 1985. These assumptions are expressed in tabular form in Table 7. The most significant product development will be that of a family of multiple-font, medium-speed document readers in the

MAGNETIC TAPE COST/PERFORMANCE FORECASTS

	1974	1977	1983
Low performance (single drive with controller)			
Data rate	40,000 bytes/sec	40,000 bytes/sec	40,000 bytes/sec
Cost	$10,000	$7,500-8,500	$6,500-7,500
Example	IBM 3411-2		
Medium performance (three drives with controller)			
Data rate	600,000 bytes/sec	1.2 million bytes/sec	1.2 million bytes/sec
Cost	$75,000	$45-60,000	$25-40,000
Example	IBM 3420-5		
High performance (six drives with controller)			
Data rate	7.5 million bytes/sec	7.5 million bytes/sec	15 million bytes/sec
Cost	$220,000	$140-180,000	$80-120,000
Example	IBM 3420-8		

Table 5. Magnetic tape cost/performance forecasts.

COST/PERFORMANCE FORECASTS FOR BATCH STATION (PUNCH CARD/LINE PRINTER)

	1974	1977	1985
Low speed			
Performance	300 cpm read, 60 cpm punch, 100 lpm print	400 cpm read, 100 cpm punch, 200 lpm print	400 cpm read, 100 cpm punch, 300 lpm print
Station Cost	($15,000—20,000)	($12,000—16,000)	($12,000—15,000)
Medium speed			
Performance	900 cpm read, 200 cpm punch, 600 lpm print	1,000 cpm read, 200 cpm punch, 800 lpm print	1,000 cpm read, 200 cpm punch, 900 lpm print
Station Cost	($32,000—37,000)	($32,000—37,000)	($32,000—37,000)
High speed			
Performance	1,200 cpm read, 300 cpm punch, 1,100 lpm print	1,200 cpm read, 300 cpm punch, 1,300 lpm print	1,200 cpm read, 300 cpm punch, 1,300 lpm print
Station Cost	$65,000—75,000	$65,000—75,000	$65,000—75,000

Table 6. Cost/performance forecasts for batch station (punch card/line printer).

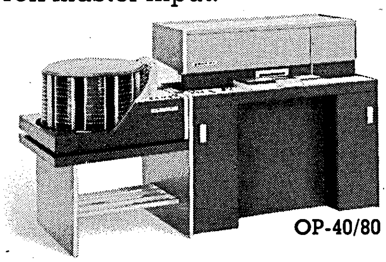
Why Bruning makes more kinds of microfiche duplicators than anybody.

There are no easy answers; no one or even two microfiche duplicators are right for everybody.

So we make six. They vary in speed, type of input, kind of process and degree of automation. They are alike only in the high quality of duplicates they deliver; sleek functional appearance; and in easy, pushbutton operation. All fit right into any office environment.

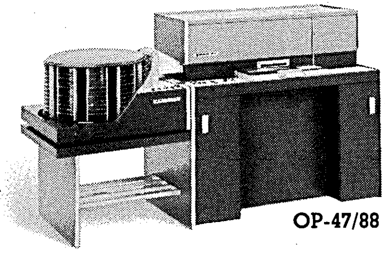
Plus, any Bruning microfiche duplicator can be linked with an optional automatic collator to deliver either collated or separated sets in order of master input.

All Bruning microfiche duplicators produce cut microfiche to meet or exceed all industry standards—from either cut or roll master input.



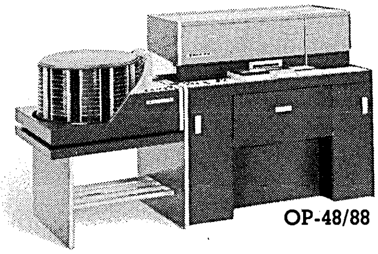
OP-40/80

Bruning's OP 40 uses diazo film to deliver up to 720 cut fiche per hour from cut masters.



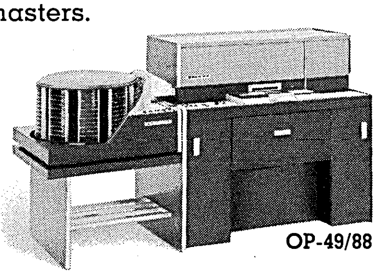
OP-47/88

Bruning's OP 47 delivers up to 900 cut fiche per hour from fiche masters using vesicular film.



OP-48/88

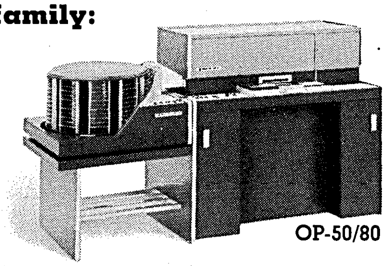
Bruning's OP 48 uses vesicular film to deliver up to 900 cut fiche per hour from cut or roll masters.



OP-49/88

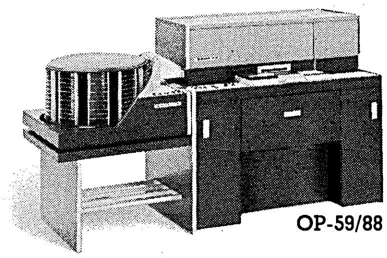
Bruning's OP 49 delivers up to 750 cut diazo fiche per hour from cut or roll masters.

Two new additions to our family:



OP-50/80

Bruning's OP 50 delivers cut diazo fiche at the remarkable rate in excess of 1400 per hour from cut masters.



OP-59/88

Bruning's OP 59 uses diazo film to deliver in excess of 1400 cut fiche per hour from cut or roll masters.

We got to be number one in microfiche duplication by meeting or exceeding your needs. Now, we're working on tomorrow's needs.

Call 800-447-4700 toll-free (in Illinois call 800-322-4400) to get the whole story. Or write Bruning, 1834 Walden Office Square, Schaumburg, Ill. 60172.

THE BOLD FORCE IN MICROGRAPHICS!

ADDRESSOGRAPH MULTIGRAPH
BRUNING DIVISION

$50,000-75,000 price range with flexible software by 1985. In high-speed modules there should also be substantial improvement by 1985 in the reliability of recognition of more unconstrained, hand printed numeric information and some alphabetic forms.

The emergence of effective low-speed (and low-cost) OCR stations in the 1977-85 period should also enhance the development of sophisticated, modular, multi-media data entry systems combining low-speed, batch processing, character recognition stations with keyboard data entry and editing terminals, a local processor, and auxiliary memory.

A computer output microfilm station was assumed to include an off-line COM printer, a developer, a duplicator, and binding equipment. Significant price declines are believed likely because of reduction in LSI and electro-optical costs, and because of economies of scale as manufacturing volumes rise. These are expected to be moderated by the highly electromechanical nature of the system, with the results summarized in Table 8. No low-speed units are shown, because developments in display devices are believed likely to satisfy any demand that may exist.

Terminals

Remote batch terminals require no separate forecast; a combination of the appropriate speed level of batch I/O station and a component processor (probably level 2) results in a price/performance forecast which should be grossly accurate. Interactive or "transaction" terminals were separately forecast, however.

Again, to simplify configuration details the forecast was developed on the basis of "stations" in which each basic terminal would have sufficient electronics to interface directly with a line connected to the host computer, whether the host be remote or a local satellite. The purpose of this assumption was to eliminate the need to allow for shared controllers and modems; this trend to integral electronics is visible in recent products. "Intelligent" terminals were assumed to contain a level 1 component processor and auxiliary memory in addition.

As Table 9 shows, three kinds of transaction terminal stations are considered. The two "standard" stations are the familiar combinations of keyboard with low speed, serial printer and of keyboard with "soft" display. Forecasts of the costs of these are shown for 1977 and for 1985, and for two versions: "basic," with only minimal interface electronics, and "intelligent," incorporating a degree of independent processing capability. Two "optional" stations are also shown; these are in the form of optional additions to standard stations. (An intelligent hard-copy printer is considered nonexistent within these definitions since it would be associated with an intelligent standard station. Basic OCR units are also considered nonexistent since all OCR devices require at least the intelligence associated with a level 1 processor.) Finally, three kinds of "special stations" are shown: a small badge reader for credit checking, identification, and similar applications (no intelligent version needed), and voice input and response subsystems (both of which require intelligence).

Keyboard and low-speed serial printer mechanisms are not expected to change much in price. While thermal printers will largely replace mechanical ones and bring a substan-

COST/PERFORMANCE FORECASTS FOR OCR STATION

	1974	1977	1985
Low speed			
Performance	50-100 lpm*	50-100 lpm	50-100 lpm
Station Cost	$35-75,000	$25,000-50,000	$20,000-30,000
Medium speed			
Performance	100-500 lpm	100-500 lpm	100-500 lpm
Station Cost	$75,000-100,000	$60,000-80,000	$50,000-75,000
High speed			
Performance	500-1,200 lpm	500-1,200 lpm	500-1,200 lpm
Station Cost	$100,000-500,000	$100,000-250,000	$75,000-125,000

*average line length of 50 characters

Table 7. Cost/performance forecasts for OCR station.

COST/PERFORMANCE FORECASTS FOR COM STATION

	1974	1977	1985
Medium speed			
Performance:*	5,000—10,000 lpm	5,000—10,000 lpm	7,000—10,000 lpm
Station Cost	$50,000—$75,000	$40,000—$60,000	$25,000—$50,000
High speed			
Performance:*	10,000—25,000 lpm	12,000—25,000 lpm	20,000—30,000 lpm
Station Cost	$75,000—$125,000	$60,000—$70,000	$50,000—$65,000

*COM printer speed only, not system throughput

Table 8. Cost/performance forecasts for COM station.

COST FORECASTS FOR TRANSACTION TERMINAL STATIONS

	Basic	Intelligent*
Standard stations		
No. 1 keyboard/teleprinter	1977: $ 700- 2,500 1985: $ 600- 2,000	$ 4,000- 9,000 $ 2,000- 2,500
No. 2 keyboard/display	1977: $ 900- 3,000 1985: $ 700- 1,500	$ 4,000- 8,000 $ 2,000- 2,500
Optional stations		
No. 3 hardcopy printer	1977: $2,000- 5,000 1985: $1,000- 4,000	nonexistent
No. 4 low-cost OCR unit	nonexistent	1977: $ 500- 1,000 1985: $ 500- 750
Special stations		
No. 5 minimal badge reader	1977: $ 500- 600 1985: $ 300- 600	nonexistent
No. 6 voice input	nonexistent	1977: $ 8,000-12,000 1985: $ 7,000-10,000
No. 7 voice response**	nonexistent	1977: $50,000-150,000 1985: $25,000-100,000

*Including small processor and auxiliary memory
**A special case combining telephone receivers as remote I/O stations plus a specialized unit associated with the central system.

Table 9. Cost forecasts for transaction terminal stations.

There is a better way to meet the paper crisis.

Paper costs are on the rise. Pending paper shortages are making matters worse. Postal rates are up adding to the crisis. The paper explosion occurring in American business is causing inflationary havoc with company operating budgets. There's no end in sight.

It's time for a better system. 3M has that better system — 3M Microfilm Systems. An efficient tool for better paper management. An efficient tool that in some cases can substitute for paper. Example: **Computer data** transferred to COM (computer output microfilm) can completely eliminate the need for computer printouts. Large, bulky **engineering drawings** can be transferred to a 3¼″ x 7⅜″ aperture card — eliminating costly reproduction — giving way to easy handling and economic postal rates. Also consider **micropublishing.** Now costly catalogs, price sheets and spec. sheets can be transferred to 4⅛″ x 5¾″ microfiche saving paper costs, printing costs and shipping costs.

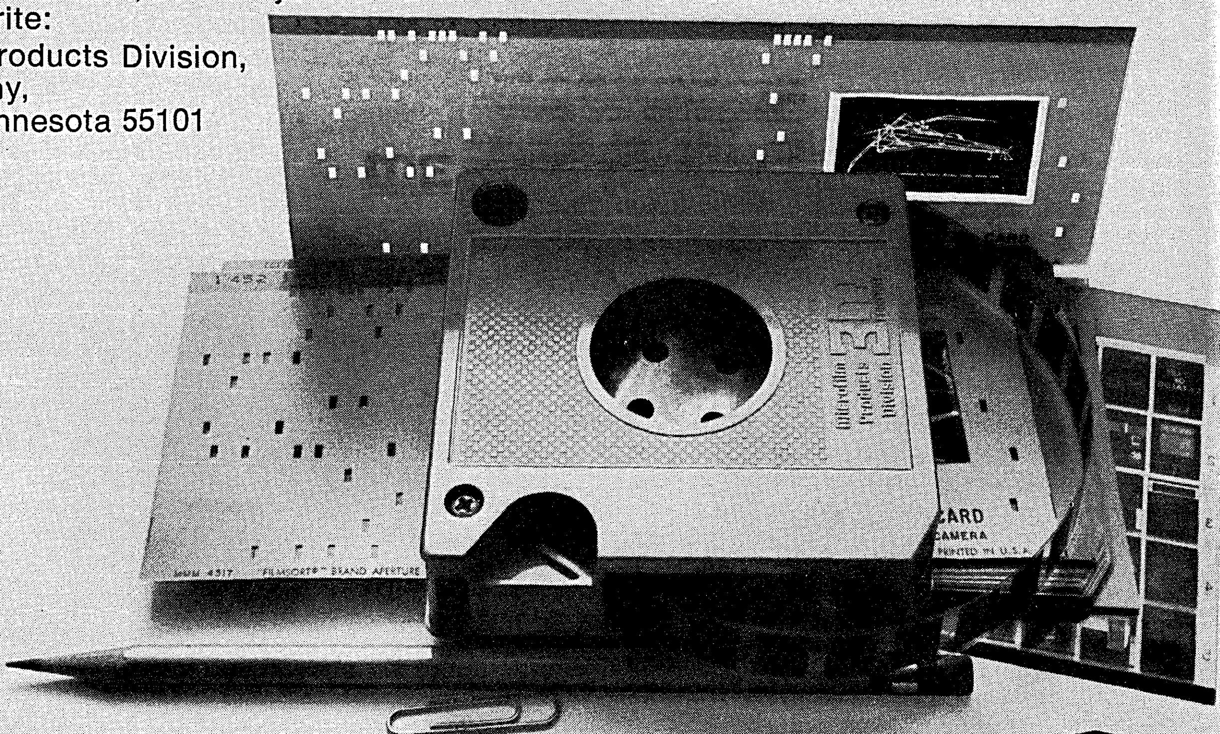
Another effective way to cut operating costs is the efficient management of paperwork. And once your documents are safely locked on microfilm, there is no paperwork to mishandle. That's efficient. You deal with manageable size microfilm cartridges, aperture cards or microfiche. All at your convenient disposal for record retrieval in a matter of seconds. And 3M Microfilm is effective as a storage medium too. Cutting document storage space up to 90%.

Efficient, effective, essential to today's business world — 3M Microfilm Systems. Take a look at your paper explosion — isn't it time for a better system.

3M Microfilm, Internationally Recognized Systems Leader

For more information, contact your local 3M Business Products Center or write:

Microfilm Products Division,
3M Company,
St. Paul, Minnesota 55101



The age of microfilm is here...3M BUSINESS PRODUCTS CENTERS

CIRCLE 53 ON READER CARD

tial speed improvement, they will not cost much less. A somewhat greater cost reduction is forecast for "soft" displays, primarily because of the larger amount of circuitry associated with the displays which will drop in cost very sharply. For large displays (over 1,000 characters), the crt will remain the dominant technology in 1977 and perhaps in 1985. Planar gaseous displays and/or light-emitting diodes will become steadily more competitive, however, dominating the smaller displays (under 500 characters) and eventually challenging the crt.

The intelligent versions of the standard stations incorporate a level 1 component processor of very low cost. They also require a substantial memory, however, as well as interface electronics, power supply, etc., which add considerably more cost. Between 1977 and 1985 decreasing electronics cost and increased manufacturing volumes should bring these costs down sharply.

Nonimpact printing technology will have a major effect on the hard-copy printer option (number 3), not so much in price as in speed. A typical speed range of 120-200 cps is forecast for such printers in 1977, rising to 200-1,000 cps in 1985.

The low-speed ocr device (number 4) is assumed to be hand fed, often using a hand-held "wand" rather than an automatic scanner. The cost of a paper feed mechanism is thereby avoided, so the cost of the device is largely determined by its case, power supply, and the very low cost of its electronics. Similar logic applies to the badge reader (number 5); marketing, packaging, and similar costs become dominant as electronics cost becomes insignificant.

The voice input device (number 6) is novel; only a few exist today in limited applications. Limitations on the recognition capability of the devices are expected to remain severe, but gradual improvement should permit the devices to see more use in controlled applications. Costs are not expected to decline much between 1977 and 1985, because complexity is expected to increase as recognition limitations are reduced. The voice response device (number 7) which might complement a voice input device is a central subsystem rather than a terminal; the need to handle multiple lines at high speed will keep its costs relatively high. In this area, too, there will be a tendency to trade off lower electronics cost for greater flexibility.

SOFTWARE

The purpose of this article is to forecast the capability of future software as perceived by the user, and as it affects his system development and operating resource needs. Coverage of such matters as scheduling algorithms of operating systems, evolution of specific language features, and data base structure is therefore relatively light.

Operating Systems

As was indicated in the discussion of computers, many of the functions now performed by operating system software are likely by 1985 to be performed by computer microcode. The major functions that remain, such as job scheduling, non-shareable device allocation, error monitoring, and recovery, will be performed by relatively simple monitors dedicated to specific modes of operation (e.g., batch, timesharing) operating in some form of virtual machine environment. Evolution to this functional pattern will be slow and will still be in its early stages in 1977, but the trend is already visible.

Operating systems today also perform a set of functions designed to help the user manage the flow of work fed to the computer, its effective overall utilization, and the events surrounding it. These system management software functions are expected to increase steadily in importance and sophistication, but are also expected to become more clearly separated from the operating system proper. They are therefore considered separately in the article.

System Management Software

By 1985, computer systems should automatically log and report the data needed to control related external activities including tape and disc library control, external job scheduling, and user accounting and billing. Logging will also be automatic for references to protected files: the file management system will control access codes symbolically, and the logging system (inaccessible to any user) will record all references. This capability, a subset of the automatic recovery logging process, should provide adequate file access control for many users.

System performance measurement facilities will be needed in addition to basic logging facilities, so that users can observe the performance of programs, the balancing of system resources, and the like. These measurement facilities will probably interface with the diagnostic and error-detection software. System manufacturers and specialized software firms have already developed very competent performance measurement software; little further evolution is needed for adequacy of measurement at an overall level. System simulation software, to help users predict the behavior of changed systems and configurations, will be based on the results of the measurement software and is similarly well advanced.

Data Management

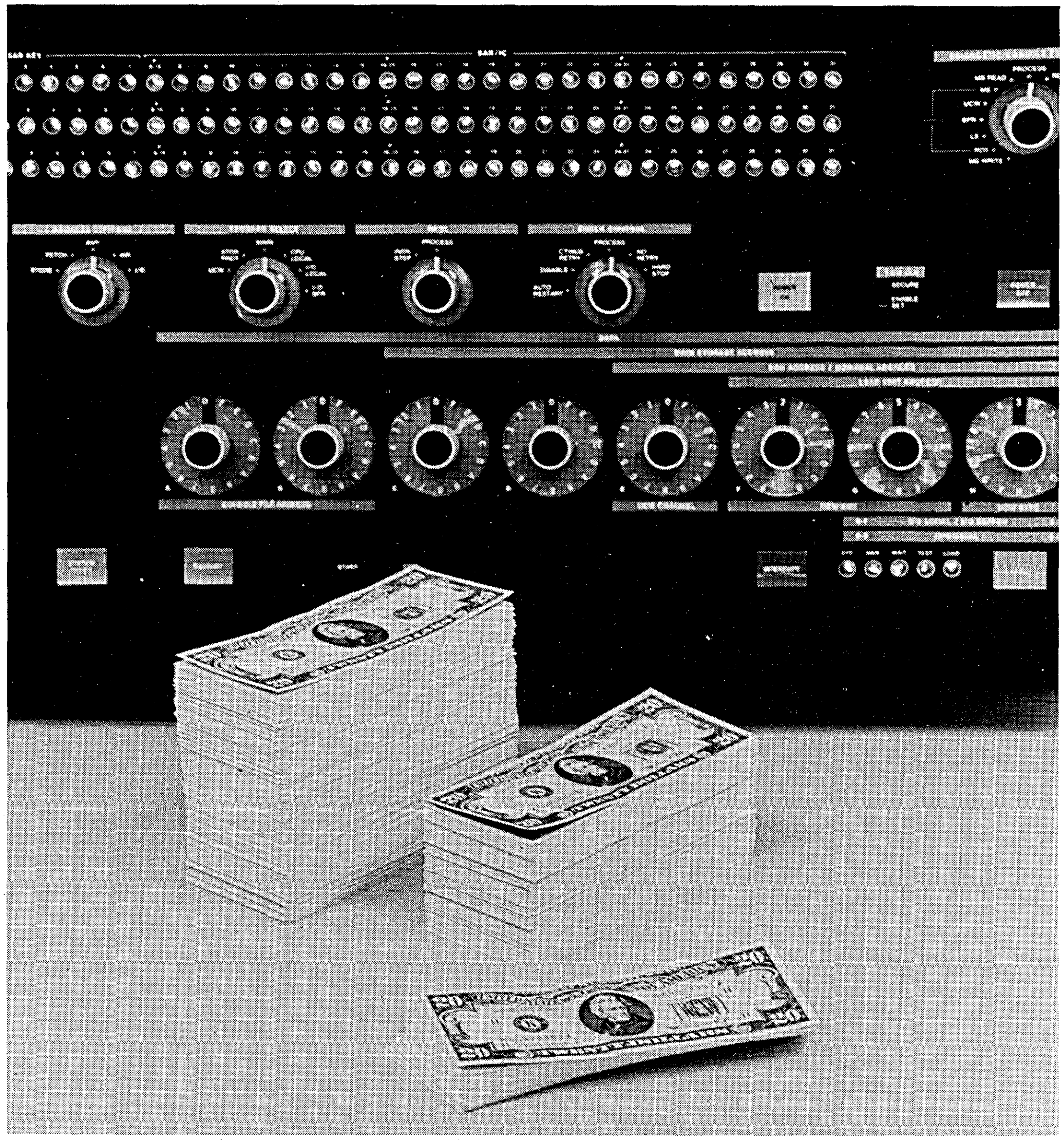
The structure of data base management systems will evolve toward that shown in Fig. 1 (page 67). The major elements of such systems will be a unified data management supervisor (roughly corresponding to current host language processors), an inquiry/report module which will become a front end to the DMS, a data definition processor, a reorganization/backup module, and a performance statistics analyzer. The evolution and function of each of these modules is described below.

The data management supervisor (DMS) is the heart of the data management system. Its main function is to manage inputs to and outputs from the data base that originate from on-line or batch application programs or from the inquiry report module. To do this, it makes use of the separately stored data base definition, which is output from the data definition processor. The DMS may call upon standard I/O service programs or special ones built to support itself. One of the reasons for this will be the trend toward modularity in system level software; this will enable users to select certain options which the DMS provides and to omit other options, thereby reducing overhead for features which are not desired.

Specific functions which will be provided by the data management supervisor are as follows:

• *Access Control.* One function of the DMS will be to control access from programs to the data base. Users accessing the system via the inquiry/report module or interfacing directly from application programs will have to supply passwords or equivalent identification means. The DMS will ascertain whether a particular user or class of users is entitled to access the data base in a variety of ways. This includes read-only and read-and-write capabilities.

• *Record Performance Statistics.* Another function of the DMS will be to record access and usage statistics in a variety of ways. These statistics will be utilized for several purposes: (1) they will enable the data base administrator to determine who is accessing the data base and how; (2) they will enable him to tune or reconfigure the data base



YOU OWE IT TO YOURSELF . . .
to get the most from your computer!

You've invested a lot of money in your data processing system. It's important to you that it deliver the performance you've paid for.

Our Uninterruptible Power Systems (UPS) can protect your computer's performance by eliminating power related problems.

Lost hours of processing time due to commercial power fluctuations are prevented. Damaging commercial power transients never reach your computer.

You spend more time processing data, less time on reruns and maintenance.

In many instances, our customers break even on their UPS investment in the first few months of operation. The rest of the savings is money in their pockets.

You owe it to yourself to investigate our line of Uninterruptible Power Systems. Write or call for our *Brochure* and information on our next *UPS Application Seminar* in your area.

International Power Machines Corporation

3328 Executive Blvd. • P. O. Box 724 • Mesquite, Texas 75149
214/288-7501 • Telex: 73-0992
Contact Frank Perkins

CIRCLE 38 ON READER CARD

structure for optimal performance by the application programs; and (3) they will help him to reorganize the data base at appropriate points for performance or backup purposes.

• *Handle Concurrent Updates*. Partially through improved software, but possibly including additional hardware facilities such as test and set instructions, the ability to handle and resolve conflicts in multiple concurrent update situations will be greatly enhanced. Lockout mechanisms at the individual record level will be provided. Deadlock resolution capabilities will be provided which will enable the system to hold one particular requestor in a suspended state and allow another transaction to be processed to completion before the first transaction gains control of any record. Improved performance in handling multiple requests of all types will be provided through reentrant coding of the DMS.

• *Backup/Recovery*. The DMS will record on an independent device all activities which have affected the data base. This will entail the writing on a data base journal log file of before-and-after images of data base records, which are time stamped and linked to the source that caused the change. Using this file, the DMS will be able to restore the data base to its condition prior to a failure, either by applying after-images to a backup copy, or by applying before-images to the present copy if the failure was not physical in nature.

• Integrity Checking. Future data management supervisors will pay increased attention to insuring the integrity of the data base. This will include the ability to code into the data base definition certain relationships and consistency checks which must exist between individual records or fields. Each time a record or field is altered, these consistency checks will be invoked and the transaction rejected if the prescribed conditions are not met.

The functions of the inquiry/report module will evolve into a front-end general purpose routine for the unified data management supervisor. From the user's point of view, it will provide many of the same features that current inquiry/report systems provide, such as the ability to specify a variety of searching criteria, to locate records which satisfy these criteria, to perform elementary calculations on appropriate data, and to format specialized or one time output reports from the data base. In addition, provided authorized access permission has been obtained, the user will be able to write simple programs that, in effect, update the data base. These can be used for data entry operations or can be utilized to process simple transactions.

As greater numbers of systems are built with a data base system in mind, normal output report requirements will be met through the inquiry report module. This will permit easy modification of report formats and contents as desired by user departments. The reporting function will be carried out by application programs only in the case where reports are a direct by-product of application program update functions, or where complex computations or high volumes are involved that require high efficiency.

The data definition processor is utilized to define the structure of the data base and other characteristics such as access limitations. Two evolutions can be seen in data definitions for future data management systems. These are:

• A greater degree of data independence. Data independence refers to the separation of the data definition and processing from the application program. This is provided by the independently stored data base definition, which is output from the data definition and processing application program. The individual programmer will need to know less about the structure of the data base, and additional degrees of freedom in reorganizing or altering the data base structure will be possible without affecting the operation of individual programs. Specifically, it will provide for independence from physical media, the ability to add new record types to the data base, the ability to add new fields to existing records, and the ability to alter relationships among elements and records.

• Additional flexibility in data structuring and access methods. Currently, most data management systems impose a primary data structuring scheme, usually a variant of an inverted index or chained organization. Future systems will allow the user more flexibility in selecting data structures and access methods, and will make it easier to accommodate different and more complex data structures. This will be done in such a way as to optimize the data structure for the given application and thereby improve the performance of the system.

The functions of the reorganization and backup module include selectively copying the data base and reorganizing it for improved efficiency. These functions are included in the same module because they can be done concurrently. Backup copies of the data base need to be kept on a volume basis so that recovery from an individual volume failure is possible.

The performance statistics analyzer module is responsible for analyzing the statistics which are output by the DMS and reporting them to the data base administrator. This is one way that the administrator will monitor the activity against the data base. He may either choose to reorganize the data base or restructure it on the basis of the ana-

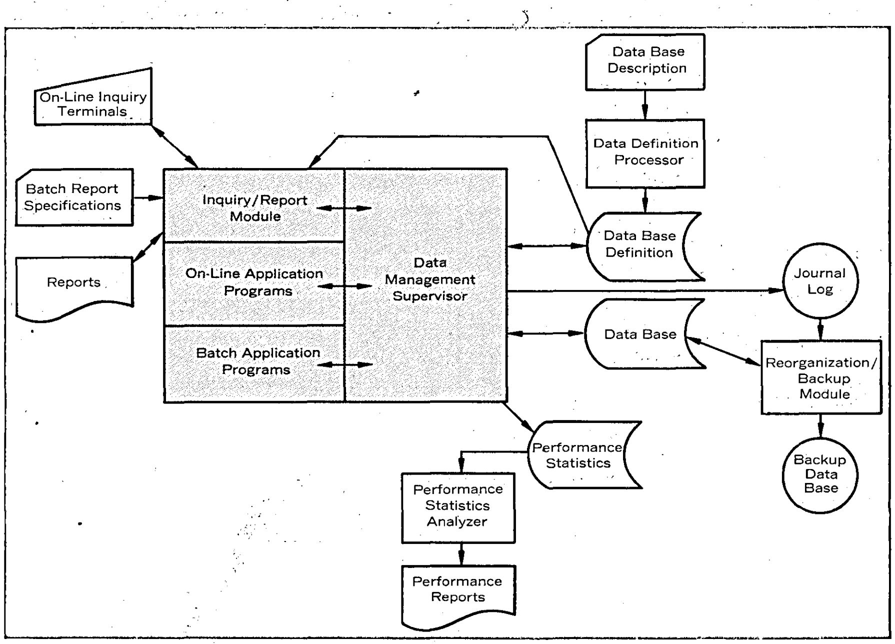
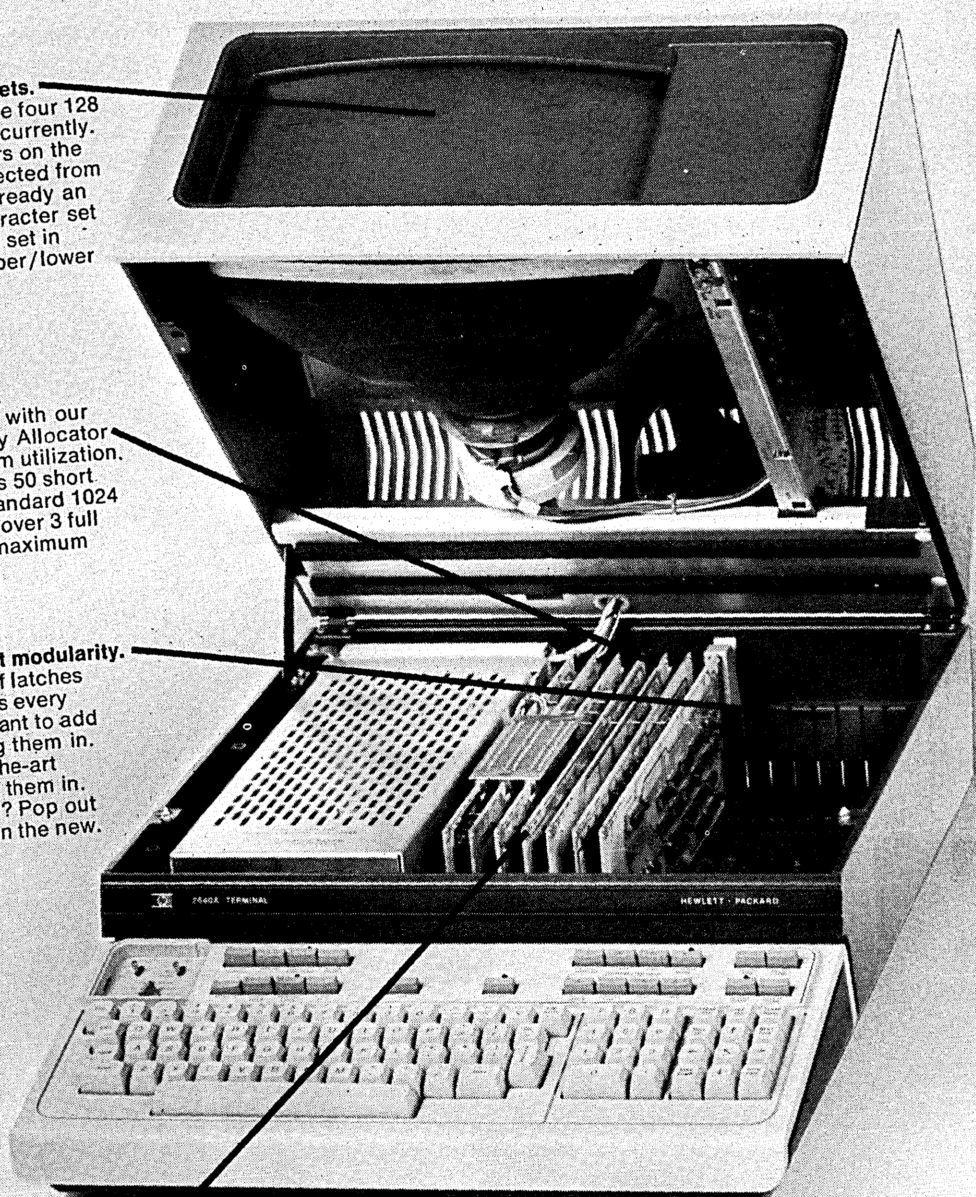


Fig. 1. Data base management systems will evolve toward the structure shown here, with the unified data management supervisor as the heart of the system. The inquiry/report module acts as a front-end to the supervisor, while the reorganization/backup module and the statistics analyzer help to constantly improve efficiency. A greater degree of independence between the data definitions and the applications programs can be expected, as well as more flexible data structures.

Now Hewlett-Packard next terminal an open



Plug-in character sets.
The 2640A can store four 128 character sets concurrently. Adjacent characters on the display can be selected from any set. There's already an optional math character set and a line drawing set in addition to full upper/lower case Roman set.

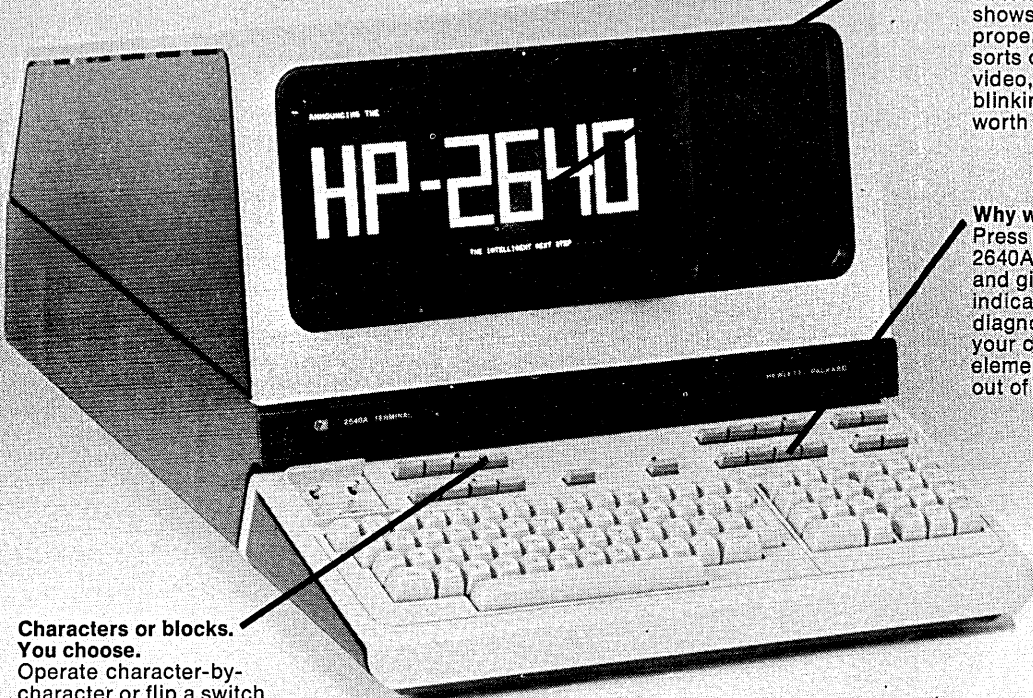
Smart memory (with 4K RAM's).
Efficient storage with our Dynamic Memory Allocator assures maximum utilization. Store as many as 50 short lines with the standard 1024 byte memory or over 3 full pages with the maximum 8K memory.

Pop-in, pop-out modularity.
Flip a couple of latches and you access every component. Want to add features? Plug them in. New state-of-the-art options? Plug them in. Need a repair? Pop out the old. Plug in the new.

Computer-born microprocessor technology controls the show.
An on-board microprocessor supervises memory allocation, data communication, keyboard scanning and display control.

makes selecting your and shut case.

Inspect its features. At $2640* you won't find another terminal that comes close. Inside or out. HP's 2640A. The terminal that grows with your system. It's from Hewlett-Packard. Come and get them.



A display that *people* like. Precise. Crisp, with 9 x 15 dot character cell. Character curves are smoothed by dot shifting. The 5"x10" screen shows characters in their proper 2x1 aspect ratio. All sorts of options, such as inverse video, underlining, half bright, blinking, because a picture's worth a thousand words.

Why wait on us? Self-test. Press the TEST key and the 2640A agreeably tests itself and gives you a go/no-go indication. Or load our diagnostic test program into your computer for complete, element-by-element check out of the entire unit.

Characters or blocks. You choose. Operate character-by-character or flip a switch and operate a line or page at a time. Text can be composed and edited locally allowing user verification before tranmission to the CPU. Editing and CPU connect time are slashed by user-oriented features such as character or line insert and delete; programmable protected fields; and off-screen storage with scrolling. Plus, eight special keys for user-defined functions.

HP terminals. They work for a living.

HEWLETT hp PACKARD

Sales and service from 172 offices in 65 countries.
1501 Page Mill Road, Palo Alto, California 94304

*Domestic USA price in quantities of six.

22430A

The Prime Computer User Plan Fights Inflation:

One Prime 300 system gives each of 15 users a completely independent virtual computer. Each with a 128k byte virtual memory and disk operating system. Each for less than $7,400!

A Complete Virtual Computer for Every User.

Think about it. For less than $7,400, each user has access to a complete system that if purchased separately would cost over $60,000. The Prime 300's virtual memory disk operating system automatically and transparently allocates all real system resources among the users of the virtual machines. By applying virtual machine techniques to the handling of I/O operations, each user terminal has direct on-line communication with any peripheral device in the system. Disk back-up can be handled on-line, data can be read directly from cards, tape or disk, and output can be transferred directly from a terminal to cards, tape, disk or printer.

A File Management System supervises the Prime 300's memory hierarchy and provides each user with a variety of direct and sequential file access methods.

A Multilingual System.

Each user is free to write programs in FORTRAN, BASIC, Macro Assembler and Micro Assembler languages. So they can fit the language to the problem instead of the other way around. In fact, problems can be divided into subtasks and each written in the language best suited to the task. For added convenience, programs written in one language can call subroutines written in other languages. And to wrap everything up, all Prime programming languages used the same file system so that any program, written in any language can access any data base without any modification or reprogramming.

A Multifunction System.

A virtual memory Prime 300 is like having up to 15 separate computers in one box. So there's a lot of computing muscle available to tackle just about any mix of applications. Users can develop real-time application software, execute batch command files, use the system as a sophisticated calculator via immediate-mode BASIC, handle data base management, even develop microprograms for the Prime 300's writeable control store or other microprogrammable devices.

Three Systems to Get You Started.

Prime has put together three starter systems, each with a different price/performance balance. If you buy them as packaged, you get a system complete with all necessary system software, one year maintenance policy and an attractive packaged system discount.

You can select a small system for up to four users built around a 300 with 64K byte main memory and 6M byte moving head disk for $44,000. Or a system for up to eight users we call "The Personal Archive System," that features four diskette units for loading and unloading individual user files, a 12M byte work disk and 300 processor with 128K byte memory, for only $68,000. For 15 users you can get a system with 256K byte main memory, 60M byte moving head disk, and 16-line asynchronous multiline controller for $110,000.

Virtually Unlimited Expansion.

Any of these starter systems can be easily and economically expanded. You can add main memory up to 512K bytes. Attach a total of eight 60 million byte disks, four 12 million byte disks and eight diskettes. Add multiple printers and tape drives. Mix terminal types and speeds. And support it all with exactly the same operating systems and language processors you started with.

Try it Before You Buy It.

Find out how a Prime 300 virtual memory system can help you fight inflation. Attend a Try It Before You Buy It seminar at the Computer Caravan. In every caravan city, Prime will conduct seminars to help you test and evaluate the Prime 300. Complete details are available from any Prime sales office or by writing to Prime Computer, Inc., 145 Pennsylvania Avenue, Framingham, MA 01701.

PRIME

145 Pennsylvania Avenue / Framingham, MA 01701

CIRCLE 43 ON READER CARD

lyzer output.

Languages

Job control or command languages will become simpler, partly because the greater degree of automation within computer systems will mean that the user is required to provide less detailed instructions, and partly because of specific efforts to make them so. Simplifications will include higher level symbols closer to natural language and interactive command language facilities to help users specify their wants. In the inquiry/report module of the data management system, command language and programming language will have combined, in a sense; the user will not be conscious of providing one or the other but addresses the machines in a combination of both. Command languages with these features have already appeared in some systems; they can be expected to become general early in the forecast period.

The functional capabilities of APL, PL/1, COBOL, and FORTRAN will not have changed dramatically by the early 1980s. Dialects for these languages will have been developed to accommodate structured programming techniques and to help with testing and event synchronization problems. They will also have better capabilities for dealing with data bases.

For the smaller machines, cross-compilers will be available, and subset dialects of the full-scale languages will be used for these machines. For the medium- and large-scale monoprocessor or multiprocessor machines, compiling will be done on the target machine, and complete sets of the languages will be available. Special versions of these common languages will be utilized on machines which have special architectures, such as array processors.

The development of very high level languages (problem-oriented languages) will continue, perhaps to the point where users can more easily develop standard applications such as payroll, accounts receivable, billing, materials control, accounts payable, and similar systems. These will be implemented most widely on minicomputer-class systems so that the user can be his own programmer; several software offerings approaching this ideal have already appeared. Problem-oriented languages will not, however, become the standard way of developing an application system. Most systems that require heavy production use will probably be developed using procedure-oriented languages. An "end-user language" may become available for the nonprogrammer, evolved from COBOL, BASIC and inquiry languages.

Program Development Aids

While programming languages are not expected to change much, facilities for supporting programmers will evolve considerably. Concepts of structured programming will have evolved enough by the early 1980s to be incorporated in interactive syntax and logic checking software that automatically accumulates code into modules for subsequent batch linking and initiation; a combination of interactive and batch debugging processes will be used. Listings prepared as a result will probably be useful as part of the documentation for programs. System testing, where numerous programs are involved, will be facilitated by automatic generation of test data (a by-product of the data base management system), and by automatic linking and generation of tables including data names, and symbolic identifications of system resources used, and the like. These, too, will be available to form part of program documentation; these program development aids will make the programming process partly self-documenting. These programming aids should have a substantial effect on programmer productivity; on the average, the time required to write and test a program should be reduced by half or better. This assumes, however, that the programmer is working in the structured form which the software is designed to accept.

Software Cost

The trend toward separate pricing of software should continue. The operating system is not expected to be software priced, largely because (as discussed above) it will have fewer functions and be less visible to the user. The other varieties of software discussed above will be separately priced, however. The prices will vary by function and by level of computer system for which they are designed, but for the large multiprocessor system, 1985 software prices are forecast to be as follows:

Data Management System	$60,000
Language Processor (each)	$12,000
System Management Complex	$60,000
Message Control Program	$50,000

These are generally higher than prices for equivalent products today, because of their greater value and complexity (the data management and system management software will often dominate the user's interaction with his computer). Separate prices for program development aids are not shown, because they will probably be bundled with the compilers.

COMMUNICATIONS

Controllers

Small computers and terminals will usually be provided with a limited degree of communications control capability, since the great majority will be connected to communication lines at least part of the time, and the cost of incorporating an extra level 1 component processor for the purpose will be insignificant. With the larger monoprocessors and multiprocessors, and perhaps in some cases with miniprocessors used in networks, stand-alone communications controllers or front-end processors will be generally used. The host dependent communications controllers that are now widely used will, in general, be superseded by them. These stand-alone controllers will receive, route, sequence, and account for streams of message traffic of varied kinds independently of the connected host processors. They will have their own disc storage, I/O equipment, and software. Their functions will be essentially the same as those now performed by comparable devices, but their costs are expected to drop dramatically because of the decreased costs of their

COST FORECASTS FOR COMMUNICATIONS CONTROLLERS

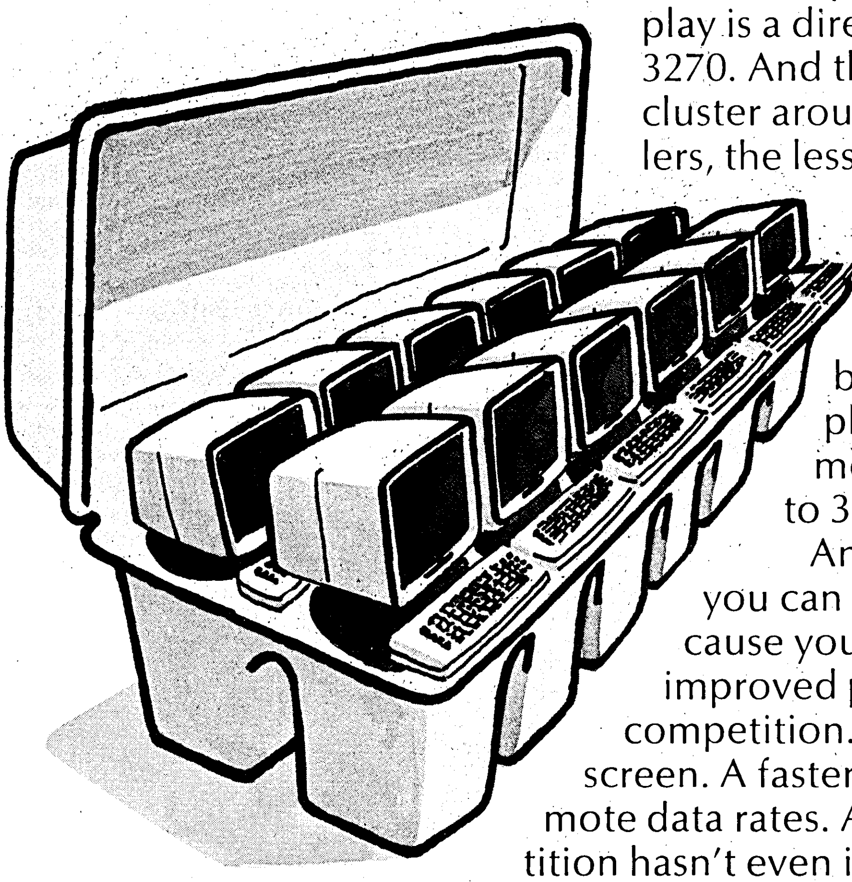
	1974	1977	1985
A. Large systems			
2 CPU's* + 128K memory	$ 80,000	$30,000	$15,000
100-megabyte disc	55,000	22,000	10,000
Line adapters (100)	45,000	25,000	10,000
Host interface	12,000	8,000	2,500
Total	$192,000	$85,000	$37,500
B. Intermediate systems			
CPU* + 16K core	$ 12,000	$ 6,000	$ 3,000
2-megabyte disc	5,000	1,000	100
Line adapters (20)	6,000	4,000	1,500
Host interface	8,000	5,000	2,000
Total	$ 31,000	$16,000	$ 6,600

*Processors include teleprinter control, power supply system, power fail/auto restart, memory protection, and similar features.

Table 10. Cost forecasts for communications controllers.

Cheaper by the dozen.

The more IBM 3270 Information Displays you have, the more you can save with Computer Optics. Because the Computer Optics CO:77 Display is a direct replacement for the 3270. And the more CO:77's you cluster around one of our controllers, the less each unit costs.

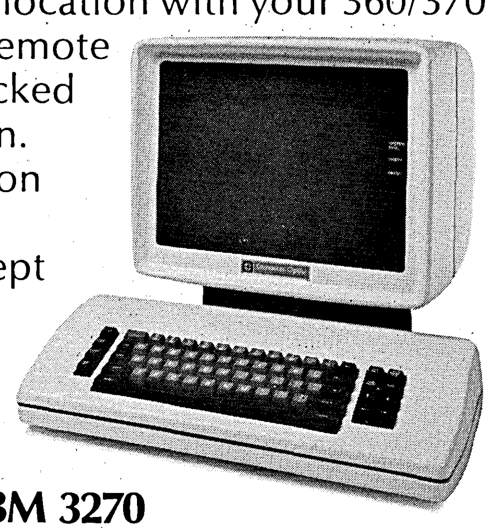


If, for example, you replace eight IBM units with CO:77's, you can cut your monthly rental bill by 29%. But if you replace 32 units, then the monthly saving climbs up to 38%.

And with Computer Optics you can enjoy what you save. Because you get features that offer improved performance over the competition. Like a bigger display screen. A faster refresh rate. Faster remote data rates. And features the competition hasn't even introduced. Like a 275-character per second printer with vertical format control. N-key roll-over on keyboards.

You can install CO:77's in a central location with your 360/370 main frame. Or you can install them in remote locations. Wherever they go, they're backed by our national field service organization.

Call Computer Optics for a quotation on your exact saving. Dial 800-243-1314 Toll Free from anywhere in the U.S. except Connecticut. In Connecticut call (203) 744-6720 collect.



The Computer Optics CO: 77
Direct Replacement for the IBM 3270

Computer Optics, Inc., Dept. B, Berkshire Industrial Park, Bethel, Conn. 06801

®

processors and other components. Table 10 summarizes their expected costs by major component. Costs are shown only for large systems (incorporating redundant cpu's and fail-softness) designed to work primarily with multiprocessors, and for intermediate systems that will work primarily with monoprocessors.

Small systems are not expected to exist, because the small host computers should have a limited degree of intrinsic capability. Message control software will be unbundled and priced separately; an estimated software purchase cost for a large system is shown above in the software cost section. It is conceivable that the cost of software for communications controllers will become greater than that of hardware.

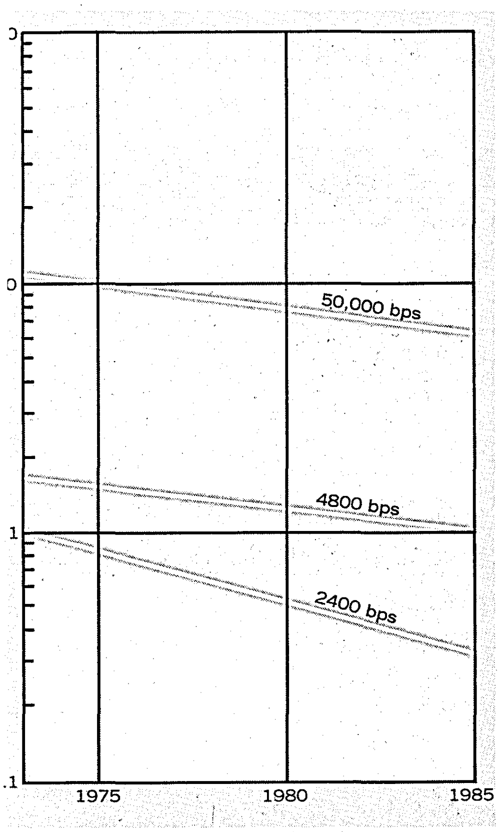


Fig. 2. The trend of data transmission line costs will be down through 1985, with an average cost reduction of 50% for transmission at each of three standard speeds.

Networks

Data traffic in the U.S. is expected to continue growing at its recent 35% annual rate continuously through 1985. A variety of new and expanded carrier services will evolve to meet this demand.

The Bell System expects to be serving about 100 major metropolitan areas in the United States with an interconnected digital data service (DDS) by about 1978. We anticipate that the initial point-to-point networking of DDS will be followed by switching digital transmission service before 1985.

The first of several domestic satellite systems commenced operation in early 1974, offering new flexibility to data communications services in terms of routing, capacities, and pricing structure. Western Union's Westar network typifies one approach to domestic satellite systems, wherein large earth stations are looped to users via conventional terrestrial links. A more innovative approach, where small earth stations are placed at the user's operating location, should be implemented in this time period.

The emerging specialized common carriers, such as MCI and Datran, have entered a critical period of development. We expect that at least two of the MCI-type networks will achieve economic viability. However, it will be several years before the form of their unique service offerings is definite.

This expansion of common carrier services is likely to be accompanied by substantial reductions in charges, brought about both by technological improvement and increased competition. Fig. 2 forecasts the overall trend of line costs through 1985 for three standard speeds; the average reduction should be about 50% through 1985. (The actual reductions will of course be discontinuous because they will result from specific tariff changes; these are overall trends.)

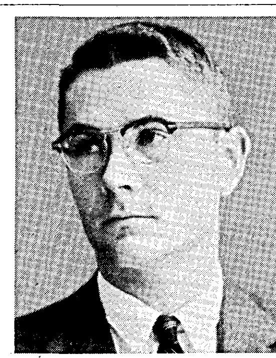
In addition to acquiring leased or dial-up lines, users will increasingly have the alternative of using packet switching. Packet switching technology was developed specifically to improve data communications services and make possible network performance capabilities suited to the requirements of terminal-to-computer and computer-to-computer communications. Briefly, these capabilities are as follows:

- Rapid response time—packets are transmitted through the network with an average delay of less than a second. The network delay incurred in the establishment of a connection between a terminal and a host is on the order of a second.
- High reliability—multiple transmission paths between packet switching nodes protect against line failures. High reliability at each node can be insured with redundant packet switching equipment.
- Very low error rate—powerful error detection systems insure that transmission errors are detected and corrected before packets are delivered to users, thus providing users with virtually error free data communications.
- Dynamic allocation of transmission capacity—the capacity of a packet switched network is dynamically shared among the nodes so that if any node is momentarily relatively inactive, more transmission capacity is available to all other nodes.
- Charges proportional to traffic volume—a user consumes significant network resources only when he is actually sending or receiving data. Thus, his charges can be based primarily on the quantity of data transmitted rather than on-line holding time, line capacity (bandwidth), or distance, as is the case in communications circuit tariffs.
- Improved transmission facilities—as new transmission facilities are introduced by the carriers, a packet switching network can quickly take advantage of these developments and pass the improvements in cost and/or performance on to the user without any effort on the user's part.

Because these advantages of packet switching will appeal to many users it is expected to become widely available and to grow steadily. However, since its growth involves the establishment of extensive networks requiring a great deal of capital, the rate of growth of packet switching services will be slower than demand would permit.

A final word

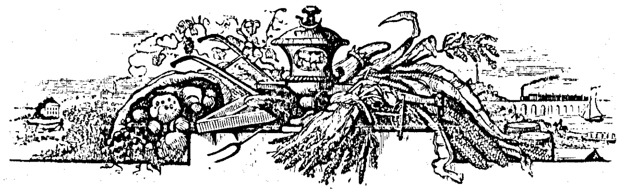
This article includes many generalizations and brief, overall forecasts of product areas that are in fact broad and complex. The data processing industry is heterogeneous, and many products will prosper that vary widely from those forecast here. Nevertheless, at an overall level this article may provide useful guidance to users concerned about tomorrow's products. □



Ted Withington, a senior staff member at Arthur D. Little, Inc., was the edp task leader of the study. He has published three books and numerous articles, and has been a contributing editor of DATAMATION for five years.

Why are other computer companies refusing to run benchmarks against the Eclipse?

1975



DP INDUSTRY ALMANAC

by W. David Gardner, Industry Editor

There's no need to wait for the December issue to review 1975's news. Here's what's going to happen:

JAN. 13. The Justice Department's antitrust case against IBM opens in New York City. IBM's outside legal team from Cravath Swaine and Moore arrives in a chartered train while the government team arrives on the subway. Outside Madison Square Garden, where the event is being held due to heavy public interest, Memorex announces that it has won the hot dog concession for the duration of the antitrust case. "It's a natural extension of our computer peripherals business," says a Memorex spokesman.

JAN. 15. In Armonk, IBM chairman Frank T. Cary says there is no truth to the rumors that Arab oil interests are preparing to take over IBM.

FEB. 1. IBM reveals the contents of its massive "census" of the computer industry and discloses that some 3,000 firms across the land are in hot competition with IBM. The competitors include Bendix, General Electric, RCA, Viatron, and McDonald's hamburger chain.

FEB. 15. In Washington, President Gerald Ford proclaims "National Computer Day" and endorses the future of large standalone mainframe computer systems.

MARCH 1. U.S. Navy Capt. Grace Hopper says that minicomputer networks are the wave of the future in the computer industry.

MARCH 15. President Ford announces that Capt. Grace Hopper has been promoted to Admiral. In her new assignment as head of a Polaris submarine fleet, she will spend several months under the North Pole.

APRIL 1. IBM chairman Frank Cary announces that IBM's outside legal counsel provided by Cravath Swaine and Moore is the largest legal armada ever assembled this side of the Nuremberg War Trials. "This fact is reflected in their bills, too," groans Cary. Once again, Cary denies that Arab oil interests are preparing to make a stock acquisition of IBM.

APRIL 15. Meanwhile, back at Madison Square Garden, Control Data's Ticketron division announces it has won the ticketing franchise for the IBM-Justice Dept. case; General Automation captures the breakfast crowd with a mysterious dish called SOS; Inforex goes after the lunch set with a floppy burger; Cambridge Memories is hawking clip-on opera glasses and the Computer Industry Assn. is selling programs. "We'll give you a program anyway you want it," says the CIA's Dan McGurk, "On magnetic tape, video tape, microfiche, hardcopy printout, COM, or just plain paper."

MAY 1. Bendix, General Electric, RCA, Viatron and McDonald's hamburger chain all deny IBM's contention that they are in the computer business, the first four saying they once were, but have since dropped out. McDonald's says it never was in the computer business.

MAY 19. Wernher von Braun, the guest speaker at the National Computer Conference in Anaheim, praises American computer technology and says the U.S. couldn't have landed a man on the moon without the computer. On his way back to the airport, Anaheim's computerized traffic control system breaks down with the result that von Braun's driver gets lost. When he finally arrives at the airport, von Braun finds that his flight reservation has been cancelled due to computer error. He takes the bus home.

IBM's earnings heavily impacted by legal expenses paid to outside law firm, Cravath Swaine and Moore.

MAY 22. Also at the NCC, a caravan of Cadillacs carrying a group of sheiks from Arab oil-producing nations arrives at the show, touching off rumors once again that Arab oil interests remain interested in acquiring IBM. The Arabs spend several hours in the IBM booth.

JUNE 15. In separate press conferences, William Norris, chairman of Control Data Corp., and Clancy Spangle, president of Honeywell Information Systems, each announce that his respective firm has finally developed a foolproof data security system. The following day, an MIT freshman reveals he has "broken" both systems and as proof he displays computer printouts showing that the chairman of Control Data is behind on his car payments to Commercial Credit and that the president of Honeywell Information Systems is being dunned for payment for a Honeywell thermostat for his new home.

JULY 4. Minicomputer tycoons, Kenneth Olsen of Digital Equipment Corp. and Edson de Castro of Data General Corp., each piloting his own plane in a cross-country light plane race, finish in a dead heat at Los Angeles International Airport. In a post race inspection, it is revealed that Olsen used a Data General Nova and de Castro a DEC PDP-11 as instrument aids. Each says he would have won the race if it weren't for the lousy computer instrument aids he used in the race.

AUG. 1. After months of courtroom haggling over the IBM census, Bendix, General Electric, RCA and Viatron finally go along with IBM and concede they are still in the computer industry. McDonald's hamburger chain, however, holds out, saying that its automated hamburger checkout system doesn't really qualify as a computer system.

AUG. 15. Minutes of the IBM Management Review Committee, made public in the IBM-government antitrust case, reveal that IBM top management feels it is "inappropriate" for its employees to frequent Playboy Clubs on business.

SEPT. 1. A New York City vice squad raid on the Playboy Club nets 28 IBMers. They are whisked out of the club, holding newspapers to their faces to shield them from the popping flash bulbs of newspaper photographers.

SEPT. 15. IBM chairman Frank Cary announces at a press conference that IBM earnings this year will be heavily impacted by extraordinary legal expenses paid to its outside law firm, Cravath Swaine and Moore. "That company should go public," says Cary. In response to a question, Cary says he knows of no plans on the part of Arab oil producers to take over IBM.

OCT. 1. McDonald's hamburger chain, weary of multiple appearances in the courtroom at Madison Square Garden, finally gives in to IBM's contention that it is in the computer business.

OCT. 15. The president of GUIDE, the IBM users group, calls upon IBM to simplify its product line nomenclature by moving away from its numerical designation of equipment. "All these 3705s, 3340s, 3420s and 3740s are downright confusing to the user," the GUIDE leader says.

NOV. 15. At the GUIDE annual convention, IBM president John Opel announces a new combination tape drive-disc drive with floppy disc terminals. "We're calling it Geronimo," says Opel. "With the terminal capability it's known as King-Kong, but without it, we call it Eunuch. As many of you know it's really a sister-in-law to Winchester and came from Commanche, although our competition will no doubt call it Viking."

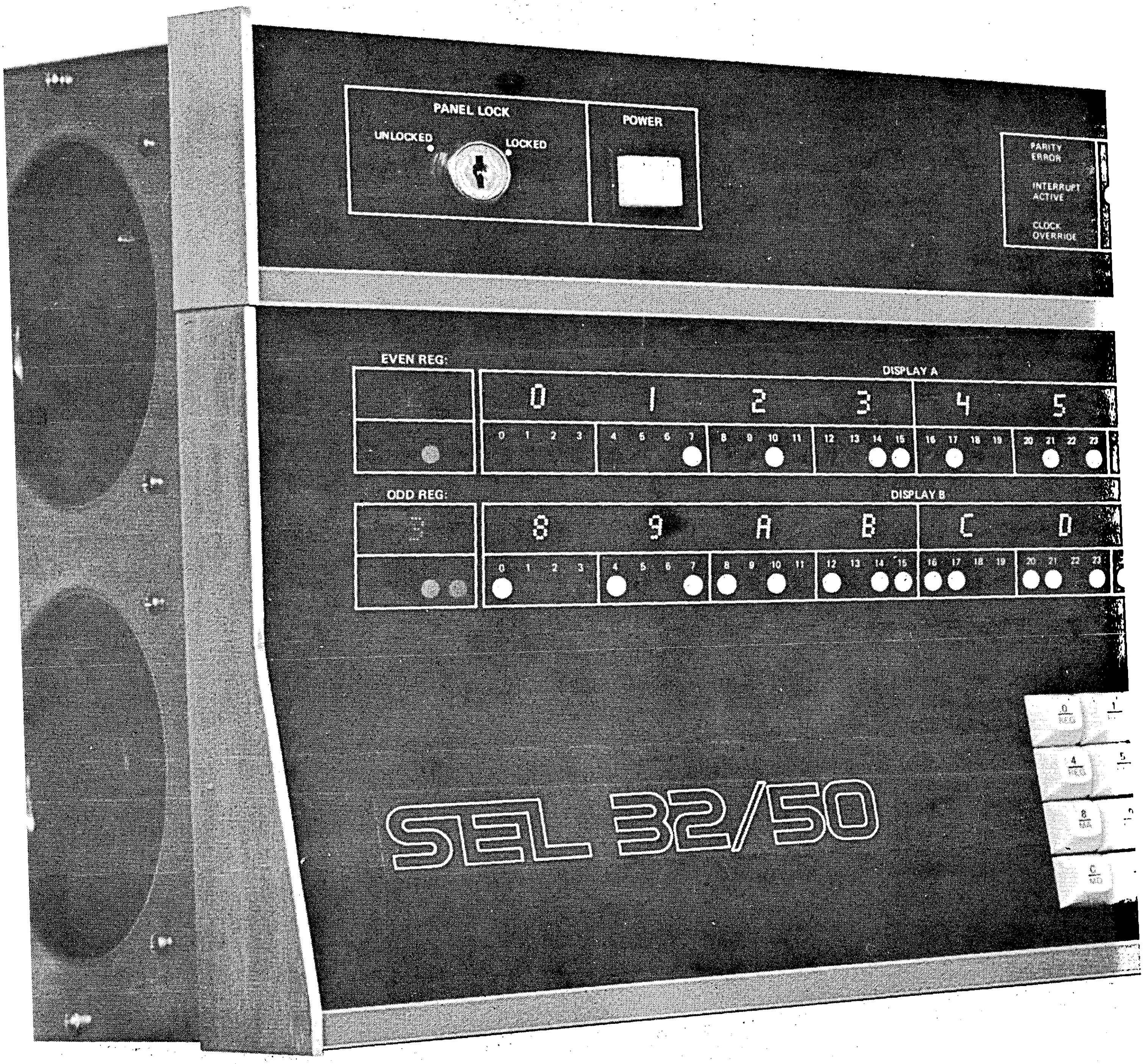
NOV. 16. The president of GUIDE announces he is leaving the computer business to return home to Canton, Ohio, to take over his father's shoe store.

DEC. 1. IBM chairman Frank Cary, citing massive legal expenses from Cravath Swaine and Moore, announces that IBM is filing Chapter XI bankruptcy proceedings. "We had no choice," says a grim-faced Cary.

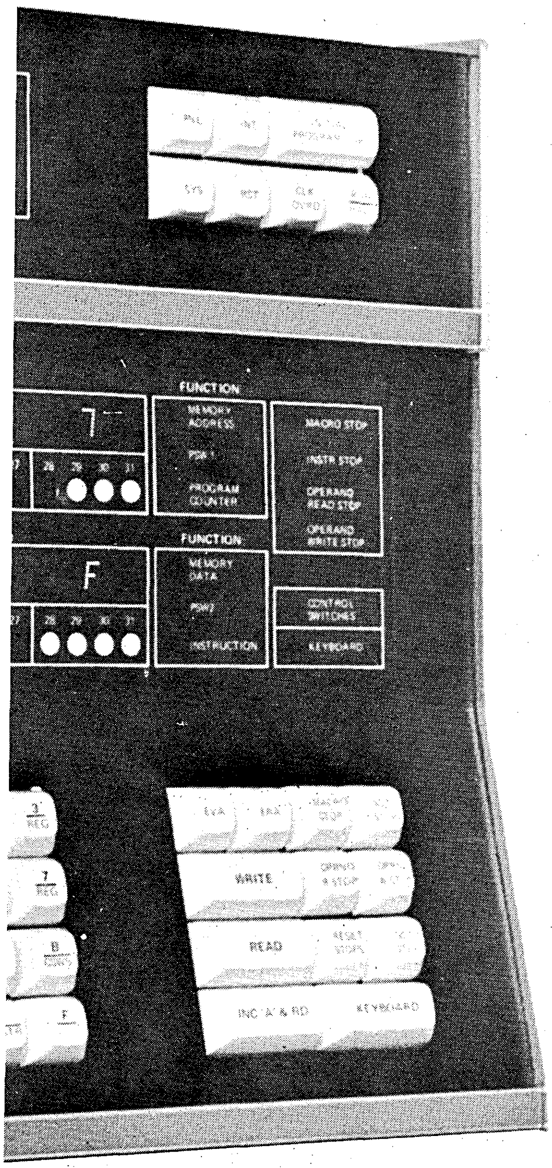
DEC. 15. Cravath Swaine and Moore announces record-breaking revenues and profits and reveals that it has embarked upon an acquisition and diversification program. The law firm reveals that it has completed its first deal—a successful stock tender offer for a computer company named IBM.

DEC. 30. In Saudi Arabia, a consortium of Arab oil interests announces that it is on the lookout for acquisitions and reveals that it has agreed in principle to take over a U.S. firm called McDonald's hamburgers. In a press release, the Arabs say: "We like the computer business." □

The first two of 32 bit virt



# of a hierarchy
ual machines.



Virtual Machines... your insurance against obsolescence. Object machine firmware implemented on one PC board. Allows simple, inexpensive upgrades in coming years.

Newest Architecture... proprietary parsing logic, look ahead, 35 nanosecond bipolar register file, and 65 nanosecond local store. Assures longevity of the host structure.

- Thruput: 26 million bytes/second continuous data rate
- Storage: 16 million bytes direct addressing design
- I/O: Discrete microprocessor controllers

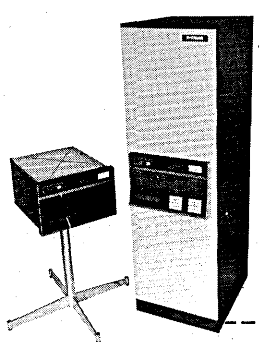
SEL 32/50. If you're an OEM, you'll want to find out about the 64KB single chassis system for 19 inch EIA mounting. You can also meet your multiprocessor and distributive configuration needs.

SEL 32/55. End User? You'll be interested in key features like large computer capability, instant software maturity, 32 bit data paths, and two floating point processors.

Priced to put a lot of money in your pocket (and a little in ours).

European Inquiries:
85 bis Avenue Albert 1er 92 Rueil-Malmaison, FRANCE

SYSTEMS
ENGINEERING LABORATORIES
6901 W. SUNRISE BLVD., FT. LAUDERDALE, FLORIDA 33313, (305) 587-2900



☐ SEND ME MORE INFO A
☐ I HAVE PRESENT NEED FOR SYSTEM
NAME ______________ TITLE ______________
COMPANY ______________
ADDRESS ______________
CITY ______________ STATE ______________ ZIP ______________
SYSTEMS Engineering Laboratories, 6901 W. Sunrise Blvd., Ft. Lauderdale, Fla. 33313

CIRCLE 26 ON READER CARD

By 1985, user and dp departments will interchange many functions.

THE CHANGING DP ORGANIZATION

by James R. Johnson

Just as nature has a "Life Cycle," so does the dp organization have a cycle in which functions performed in one organization are terminated only to produce growth and expansion in other organizations. This article describes the "Life Cycle" of data processing, and shows that functions of the dp organization, as it existed between 1950 and 1960, will be eliminated by 1985, only to emerge in other areas—namely, user departments (see Table 1).

The responsibilities of the dp organization have been changing over the years. User departments now perform tasks traditionally done by the dp dept. This shifting of responsibilities will continue for two important reasons: (1) new technological advancements encourage such shifts; and (2) because of human nature, in that people desire to control factors that influence their performance—in this case, dp systems.

To provide a perspective for the future, it is appropriate to start by discussing how both technology and human nature have historically influenced the dp organization.

1950-1960

First, what functions did the dp organization perform in the 1950-1960 era? (They are listed in Table 1.) The initial applications on the computer were the systems such as accounting and payroll, which were previously supported by electronic accounting machines. Elimination of repetitive manual work was the justification for the newly acquired tool.

To the users, computers were unknown, complex technical machines. Even programmer/analysts did not understand the complete technical aspects of the machine, and certainly did not understand fully the commercial customers' information processing needs.

Users expressed their mistrust of the computer by maintaining files long after the data had been placed on the computer. The control for systems design was in the dp dept. Systems were implemented by programmer/analysts, with part-time, often reluctant, user participation. The dp dept. also selected and maintained the computer hardware.

1960-1970

In this era, the concept of project management teams to design dp systems emerged and became a way of life. The project manager was in the dp organization. User personnel, however, were assigned to the project on a full-time basis. This active user participation in design and implementation of dp projects is the dominant reason that today, individuals outside of data processing are well acquainted with the capabilities of computers in the business world. Of course, more extensive education in universities and just plain additional exposure to computers have also contributed to general knowledge of the computer's capabilities.

Another concept evolved during this era. With the proliferation of new software (operating systems, application languages, utilities) and hardware (storage devices such as discs and

ERA	TECHNOLOGY/CONTROL FACTORS	FUNCTIONS OF USER DEPARTMENTS	FUNCTIONS OF DP DEPARTMENTS
1950-60	1. Computers are new tools 2. Lack of understanding of computers	1. Part-time participation on design of dp systems 2. Maintain data base	1. Select and maintain hardware 2. Control the design effort 3. Full-time participation on project teams 4. Employ programmer/analysts
1960-70	1. Proliferation of technology 2. Project teams emerge	1. Full-time participation on project teams	1. Select and maintain hardware 2. Control the design effort 3. Full-time participation on project teams 4. Employ analysts 5. Employ programmers 6. Maintain data base
1970-75	1. MIS 2. Teleprocessing 3. Better understanding of computer usage	1. Control of project team 2. Full-time participation on project teams	1. Select and maintain hardware 2. Full-time participation on project teams 3. Employ analysts 4. Employ programmers 5. Maintain data base
1975-85	1. Distributed processing 2. Corporate data base 3. High level language	1. Control of project team 2. Full-time participation on project teams 3. Employ analysts 4. Limited programming	1. Select and maintain hardware 2. Part-time participation on design 3. Employ programmers 4. Maintain data base
1985-95	1. High level application software for minicomputers	1. Select & maintain hardware 2. Control the design effort 3. Full-time participation on project teams 4. Employ programmer/analysts	1. Part-time participation on design 2. Maintain data base

Table I. The "Life Cycle" of data processing

tapes; input devices like key-to-disc systems; output forms such as microfilm), it became a full-time job just to keep current in dp technology. It was also becoming obvious that greater emphasis had to be placed on learning business functions in order to design a business system. Thus, one man was required to know too much.

A separation of functions offered a solution to the problem; and programmer/analysts were thus replaced by programmers *and* analysts. Analysts specialized in understanding user functions, and programmers specialized in programming. Program run write-ups became the means of communication between analysts and programmers.

1970-1975

During the current time frame, most organizations have studied some form of MIS (Management Information System). MIS is defined as a system, usually complex, which converts raw data into valuable management information. Examples of MIS applications include forecasting, automatic scheduling, exception reporting, and programmed decision rules. Progress in this area of computer usage has been judged essential to an organization's existence. Those companies not profiting from the huge potential payoff may simply not stay competitive.

The organization of project teams developing MIS has changed only slightly, but very significantly, during the 1970-75 era. The user has now become the project manager. This has happened for three reasons. First, user acceptance of designs for computer systems has in the past been a problem; this problem comes closer to resolution if it is the user-manager who has done the design. Second, for users, the unknown is becoming known; the mystery of what computers could do is gradually disappearing. And third, the human tendency to control those things required to perform one's job has become a major factor—users now desire to manage as well as design the project effort.

Technical advances in this era have also revolved around teleprocessing. Systems are designed to provide on-line retrieval validation and updating of data files. People in many company departments have direct access to data bases.

Having been exposed to on-line systems and MIS, users are becoming more demanding of their dp systems.

1975-1985

Moving into the immediate future will bring some significant changes. Users will now have experience in the design and implementation of major systems. Staff functions in user areas such as scheduling, manufacturing control, finance, and purchasing, will have grown in size. Since many users who had participated in designing dp systems will now be back in their home departments, the various user areas will have "systems" people in their organization.

In effect, what will occur is that the analyst (the former dp analyst) will now report to a user manager. And the dp organization will be relieved of the design responsibility for dp systems, which now rests with the user.

The popular concepts of the era will be corporate data bases and distributed processing. (On the surface, having a corporate data base seems to contradict the trend toward letting the user departments design their own dp systems. This apparent contradiction is resolved by letting the user department dp analyst work with the logical relationships of data, while having the dp dept. maintain the data base software which handles the computer relationships.) Distributed processing lends itself to centralized control since most of the programming is done in macro or assembler languages. However, part of the hardware will physically be located with the user—a trend which will continue.

During this era, individuals from user departments will start writing their own programs. Basic retrieval (extract, sort, and list) with a high level language, either on-line or batch processing, will be the main purpose of these programs. The need for such a tool, retrieval, will vary from application to application; however, there is no way that a system can be designed to meet all possible current and future variations that will occur. Users will thus find the retrieval capability an excellent tool for solving both one time and periodic problems. They will also laud the convenience of the process because they will no longer have to wait weeks for the dp dept. to process their requests since they now will be processing them themselves.

In short, during this era, users will experience for the first time the advantages of having their own programming staff, whatever its size.

1985-1995

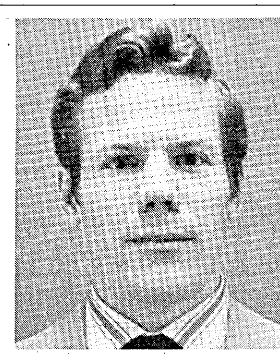
Distributed processing will by now have become very popular. Computer manufacturers will have expended most of their resources over a number of years developing minicomputer technology. High level programming languages will be application oriented. Users will now be able to design dp systems on their own minicomputers, and with their own personnel. The hardware will be physically located in user areas.

The job functions of analysts and programmers will also have changed. User departments will once again combine the job classification of analyst and programmer into one position: programmer/analyst. They will reason that higher level programming is so straightforward that it is not beyond the capabilities of one man to know both the business functions of the company and the language.

Well now, an interesting phenomenon will have occurred. Responsibilities that existed in the 1950-60 era for major company departments and those for the dp department will have been exchanged. Dp personnel will participate in system design, but only on a part-time basis. The responsibility for maintaining the corporate data base will have shifted from the user organization to the data processing organization. Users will now be the ones to select and maintain hardware, to control the design effort, and to employ programmer/analysts.

The factors influencing this almost complete shift in responsibilities between the user departments and the dp department will be primarily the advances in technology which will make such a shift possible, and the ever present variable of human nature, which manifests itself in the desire for control of the systems one works with.

Thus, a "Life Cycle" similar to that found in nature also exists in the data processing world. The elimination of the dp organization, as it existed in the 1950-60 time frame, will have been accomplished by 1985; but its functions will have found new life in other, namely user, organizations. □



Mr. Johnson, holder of a CDP, is a dp section manager in the production control systems and programming dept. at Hallmark Cards, Inc. He received an MBA from the Univ. of Iowa.

In borrowing modular structure from programming, information mapping can relieve excessive pains of documentation.

INFORMATION MAPPING

by Robert E. Horn

In putting together a large, complex system, there is always a lag between design solutions and the paperwork which documents them. During a recent project to design a computer program to handle large textual information data bases, we at Information Resources, Inc., used a method of writing called information mapping, to aid in creating, updating, and maintaining system documentation. Information mapping is a way of ordering and structuring information in consecutive logical blocks, which make the ongoing process of developing, changing, and following a system easier to accomplish. Originally developed to improve not only the efficiency but also the effectiveness of training materials dealing with complex technical subject matter, this method of writing has already found its place in sales training at Allstate Insurance, in professional training at Harvard's School of Public Health, and in management training at Cranfield School of Management.

Information mapping is a synthesis of current learning research, instruction technology, and good communication practice. It grew out of the recognition that information in today's business environment must be maintained in a form that can both be changed rapidly and scanned quickly by the learner who may be familiar with some but not all parts of the system.

In short, information mapping is a system of principles and procedures for categorizing, writing, interrelating and sequencing, and graphically presenting information required for learning and reference. A sample page is probably the best way to show what the technique does; such a page is presented in Fig. 1, (page 86) and comes from an information mapped book on CONVRS, an experimental computer language. We see that the page is divided by horizontal lines. Each chunk of information between the horizontal lines is called an information block, one of the innovations of information mapping. Separate blocks are labeled "definition," "example," "introduction," etc., and replace unlabeled, fuzzily defined paragraphs of conventional writing.

A second innovation of information mapping is a small, powerful, easily-learned set of writing rules. One rule is to put only information of *one* functional kind in an information block. That means that in a "definition" block, only sentences that define the topic are found. The "examples" block would contain only examples.

There are rules for organizing and writing information for different purposes such as reference, first-time learning, and documentation. There are other rules for interrelating and sequencing information; an example of this would be a systematic graphic method used to give precise answers to a question such as "What must I already know in order to learn such and such?" Still other rules govern the visual display of information for both print-oriented and computer-based systems.

The design of these information blocks allows the learner to scan a page to get only what he needs from it. The writer's task is easier since the number of these functional information blocks is small, and the topics are well defined. The supervisor's editing job is similarly made easier, and others can more readily understand the work.

Information blocks are normally assembled in various combinations to form information maps of different types. These types are represented in Table 1, (page 86). Each type of information map will look somewhat different to the reader, with results in the best cases such that good graphic communication is optimally synthesized with good technical writing.

One of the more important design principles of information mapping, deliberately borrowed from computer programming methods, is that the entire definition and rule structure must be modular. This modular structure means that changing, rewriting, and updating are significantly easier than in any other printed or computer-based form of writing.

Object: clear documentation

Early applications of information mapping have been in training situations where an already established body of knowledge is to be transferred to individuals. Such subject matters, particularly at the introductory level, change more slowly than typical information in a technology such as data processing, in which we find almost continuous change. Information mapping is a formidable technique for documentation of both types.

The objective of our project was to develop a system that would encourage the production of documentation at a level of detail, and in an accessible and understandable form such that it would serve:

- the creators of a system during the design process
- designers responsible for adapting a system for implementation in a given facility
- programmers who must translate a design into operational programs
- those ultimately responsible for operating the system
- system managers who at a later time must consider the feasibility of modifying or adding major system functions, or of adapting existing functions, to new equipment.

The information that forms the backbone of project documents must come from the creators of the system, and these people are often the hardest to extract systematic information from. Commonly we find that the thinking of creative people runs far ahead of their written output, and all too often they find the task of writing down their ideas in detail intolerably burdensome. Frequently they do jot down cryptic notes about an idea or possible future plan. Information mapping applied to the documentation task will not solve the problem of extracting information from designers, but it has developed procedures to relieve them of some of the more burdensome aspects of the job. It even finds a place for their scribbled notes so that the system does not risk losing an important idea.

Whether system designers can do their own documenting or must work with technical writers who can elaborate their notes or conversations into formal documents, the aids that information mapping can offer are these: (1) explicit procedures that enable support personnel to take over the burdensome aspects of document handling; and (2) a set of guidelines and procedures for writing documents in standardized, organized form.

The organization scheme for project documents will follow the nature of the project and must be worked out on an individual basis, although commonly it proceeds from general descriptive material about purposes, specifications and major components, toward increasingly fine detail concerning each of these aspects.

In our own application of the system, we keep documentation in loose-leaf books, and each member of the project design staff has his own copy of the documents. In general, our procedures consist of:

- instructions for adding, deleting, and modifying numerous parts of the documents—maps, tables, sections, terms, etc.
- instructions for carrying changes through to all areas affected by the modification
- special aids such as tables, lists, questionnaires, record forms, etc., that are intended to streamline staffwork in applying the procedures
- formating and typing policies made explicit for typists and editors
- various features to keep system designers informed of changes.

While the contents of many of these procedures are specific to the individual project, the principles and general policies are readily adaptable to other situations.

The daily routine

Fig. 2 shows how our people work on a daily basis. Each day one or more system designers, editors, and researchers work on particular tasks. Such tasks almost always involve writing new information maps or revising old ones. One person may analyze user needs for a particular mode of interaction which has not yet been designed; he would be writing new pages. A second person may be revising decision tables. A third edits some of the previously written pages for submission as part of a report.

Each person works with his own copy of the document, a five volume set of three-ring, loose-leaf notebooks, each notebook containing several hundred pages.

When these designers and editors finish a task for the day, they fill out one or more updating request sheets, attach the sheets to their rough copy, and give them to the information specialist. (Typically only a few seconds are spent filling out one of these sheets.)

The information specialist makes a time estimate and priority determina-

Values not present in data

Introduction

Occasionally, there will be a series of measurements, which, for one reason or another, have missing values. Perhaps the lab assistant forgot to take a measurement, or the sample was contaminated. In any case the value is not present.

Definition

You can indicate a not-present value in the INPUT statement by **not** placing a value between two commas or semicolons.

Example One

A series of measurements (say, in milligrams) is as follows:

Sample collected at time . . .	1	2	3	4	5	6	7	8
Measurements:	.01	.09		2.4	3.4	7.9	8.2	9.3

The value for this measurement is not present in the data because of a mix-up in labelling in the lab.

Here is how to input this data:

You type: INPUT SAMPLETIME: 1 (1) 8

Using the input with computed clause.

You type: INPUT MEAS: .01, .09, , 2.4, 3.4,7.9,8.2,9.3

Note that two commas occur in a row in the place where the value is not present in the data.

The system will set up vectors in memory as a result of your two input statements:

SAMPLETIME	1	2	3	4	5	6	7	8
MEAS	.01	.09		2.4	3.4	7.9	8.2	9.3

Note that the system will leave an element position open for the not present value.

Connections: missing values, input statement, vectors, arrays with undefined values, input with computed clause.

Fig. 1. A sample information mapped page shows separate information blocks which are immediately accessible, easily scanned, and conveniently updated.

TYPES OF INFORMATION MAPS

I. **Basic** information maps (defined as those which contain information "new to the student") divided into these types:
- Concept maps
- Procedure maps
- Process maps
- Structure maps
- Classification maps
- Fact maps

II. **Initial learning** information maps (defined as those added to basic maps to help a student's first pass through the subject) divided into these types:
- Overview maps
- Course objectives
- Prerequisites
- Learning advice
- Review maps
- Summary maps
- Compare & contrast maps

III. **Reference** information maps (defined as those added to basics to help a student review or look up forgotten material) divided into:
- Tables of Contents
- Index
- Special purpose lists and tables

IV. **Exercises and questions**, which can be sorted into:
- Prerequisite test
- Self-test
- Feedback
- Review
- Practice
- Structured exercises
- Simulation exercises
- Post-test
- Pretest

Table 1.

tion of which tasks to do first. He then may do any or all of the following:

- route important changes to the project manager
- restructure the document (all copies)
- automatically index a new term
- revise the index for a new or changed term
- update classification charts and other tables
- take care of all routine typing, formating, dating, numbering, modifying, copying, approval, distribution, etc., for everyone's copy of the document.

On some occasions, under special instructions, the information specialist may direct certain pages to be pulled out and formed into a spin-off document.

During the day, everyone's copy of the document may be updated. On other days, the information specialist may just catch up on indexing and retyping of pages. So the cycle goes.

Documentation at the start

There are several phases of system design. Initially there is an intensive design phase during which certain parts of the system description are evolved and change rapidly. Then come various editorial phases where minor changes are made in particular parts of the entire system. Later comes preparation of special documents such as interim reports and training manuals. All these require special work on the part of the community of creators and the information specialist.

Too often documentation is the final mopping-up task after the project has been finished, ideas have grown cold, and staff has grown impatient to turn to other things. Documents, in this case, could hardly fail to be superficial and incomplete. However, if documentation is to be accurate and complete on the one hand, and useful to the community of creators on the other, it must *begin* when the design phase begins. And to get good documentation, top management must support it seriously with a top priority rating and sufficient funding. Top management must also recognize the role of thorough documentation as an important tool throughout the actual design process.

If documents are begun at once, made easily accessible, and kept current, they can be an excellent aid to designers. In complex projects, it is very difficult for a designer to keep in mind all the consequences of a modification he makes in his own area, let alone the effects it might have on the work of others. But system documents, with lists that track each idea to all references in the system, let a designer see the ramifications of a change which he otherwise could not appreciate.

Documentation thus must be perceived by management not as the final straw at the end of a long project, but rather as playing a vital role in the design process right from the start. And any program for documentation will work only as long as it has not only top management support, but also clearly drawn lines of decision-making authority and responsibility for approving document entries, and an established list of priorities for accomplishing the various classes of tasks. Without the formulation of explicit policies to control the movement of materials in and out, documentation can deteriorate into a morass. The statement of such policies, lines of authority, and lists of priorities should be worked out by project managers before documentation begins. And periodic reviews should be slated to examine the efficiency of the procedures, and to revise them when necessary.

The results

The highlights of our documentation system to which we attribute much of our success are:

- A focus on the total system, from the beginnings in purpose and design, through system implementation and training.
- A focus on information transfer, an attempt to get the best techniques possible into our information mapping procedures and visual display, for greater ease of reading and learning.
- A focus on communication and training.
- A focus on teamwork; instead of too much dependence upon single individuals in system design jobs, the interdisciplinary team approach is fostered.
- A focus on separation of functions, assigning them to people who do them best as well as who like to do them (and not, for example, making the systems designer do an information clerk's job).

There are several problem areas in human organizational and design activity that the system won't solve by itself. Among these are:

- Human error (although we have some background scanning and reporting schemes which may take care of some errors)
- Insufficient analysis or informa-

DAILY DOCUMENTATION ACTIVITIES DURING SYSTEM DESIGN

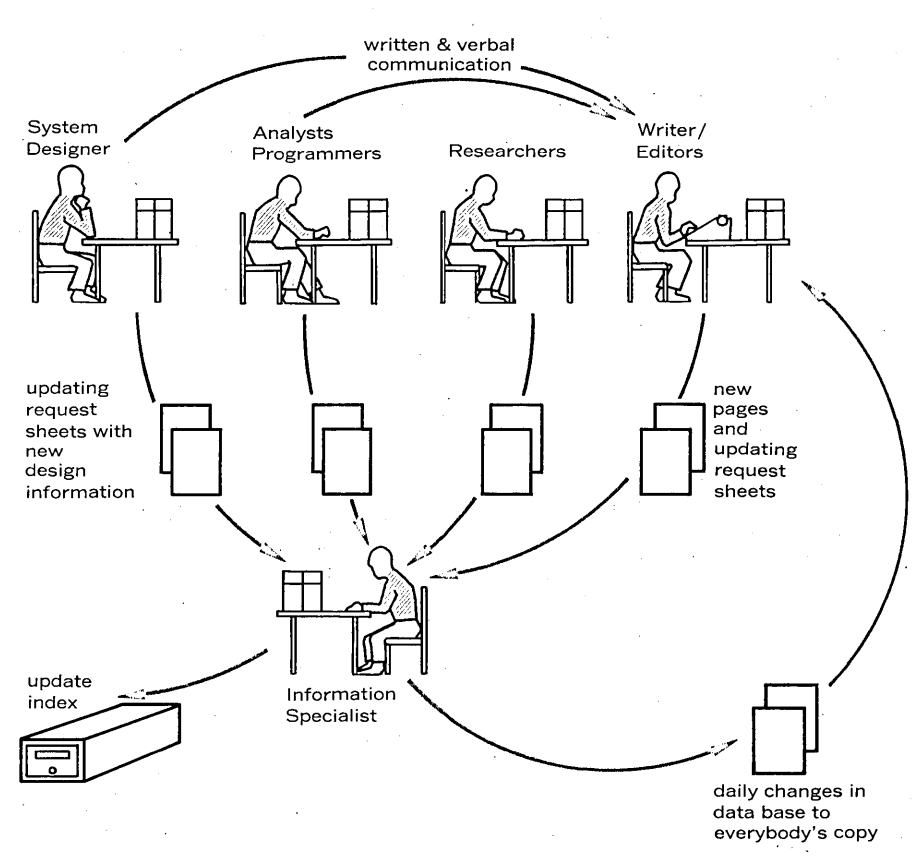


Fig. 2. The information specialist is the facilitator and coordinator of the information mapping system. He keeps everyone concerned current with newly produced or revised system information, while relieving system designers and others of many bothersome duties.

tion. People must put the information into the system in the first place. However, the system as planned will eventually have diagnostic routines for interaction between clerk and system designer, and checklists for completeness.

• Lack of management support. Unless top management wants them, the benefits of such a system will not be realized.

• The system does not replace the designers' constant need to communicate with the clerk and with their colleagues and clients.

• The system does not relieve the designer of responsibility for coming up with creative solutions.

In evaluating the positive aspects of our system, we reached the following conclusions:

• System creators did not have to rethink any parts of the system because of loss of information.

• All relevant parts of the system can be updated or revised by a single act on the part of the system designer.

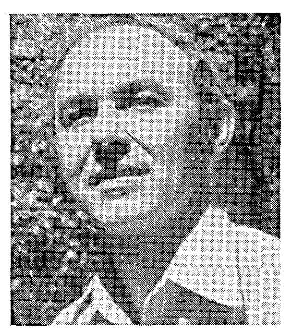
• Managerial personnel can readily assess the progress of the system design and determine if the staff has followed the design intent.

• The system designers are relieved of the burdensome aspects of documentation, but can conveniently make use of the benefits of documentation each day.

• Personnel turnover is less jarring since new personnel are readily trained on the system as it exists in its latest form. A training course for the entire system is in effect available from the information mapped documentation.

• System design production has been increased.

• The morale of the community of creators has been high due to the system. ☐

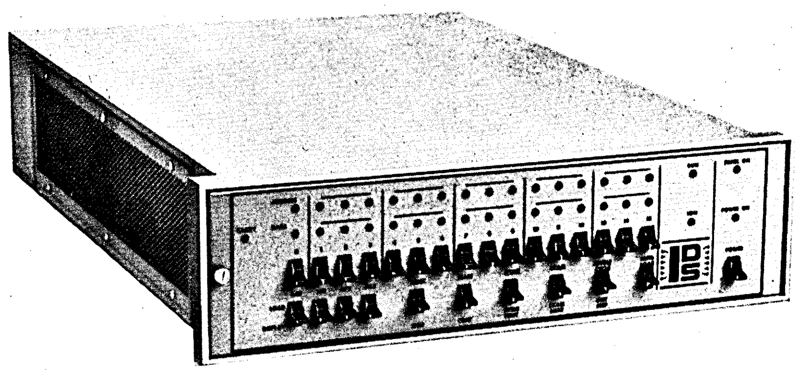


Mr. Horn is president of Information Resources, Inc., and has taught seminars in information mapping techniques and information retrieval at Harvard, Columbia, Sheffield (England), and American Universities. He has edited "The Guide to Simulation/Games for Education and Training."

Six New Minicomputer Products

Why would we enter an already crowded minicomputer market when we've been so successful with add-on memories? Simple. We can offer combined OEM product discounts with an exciting range of products. In fact the *best* discounts available. Bundled or unbundled. Nova compatible but *better.* Good enough to offer a *one-year warranty.*

IDS minicomputers. 16-bit, 800, 1000, or 1200 nanosecond models with up to 65K words of directly addressable memory. A versatile applications-oriented instruction set. Front loading. And standard features you would order as options with a Nova. *



Our four models feature, as standard, power fail/restart. A hinged front panel to front load circuit boards. Forced air cooling and an easily serviceable power supply with 50% more power than our competition.

Input/output board. Standard TTY control, current loop or EIA. Real time clock. High-speed paper tape reader and punch. And an RS232C modem interface.

Multi-communications adapter. Designed for connecting computers into multiprocessor systems. One microsecond basic cycle time. And up to 300 feet of cable between computers.

8-channel multiplexer. Offered for asynchronous data communications with a program selectable baud rate for each line. An RS232C data set interfaces up to 9600 baud.

Disk controller. Compatible with Diablo Series 40/50 disk drives. 100 or 200 tpi at 1500 or 2400

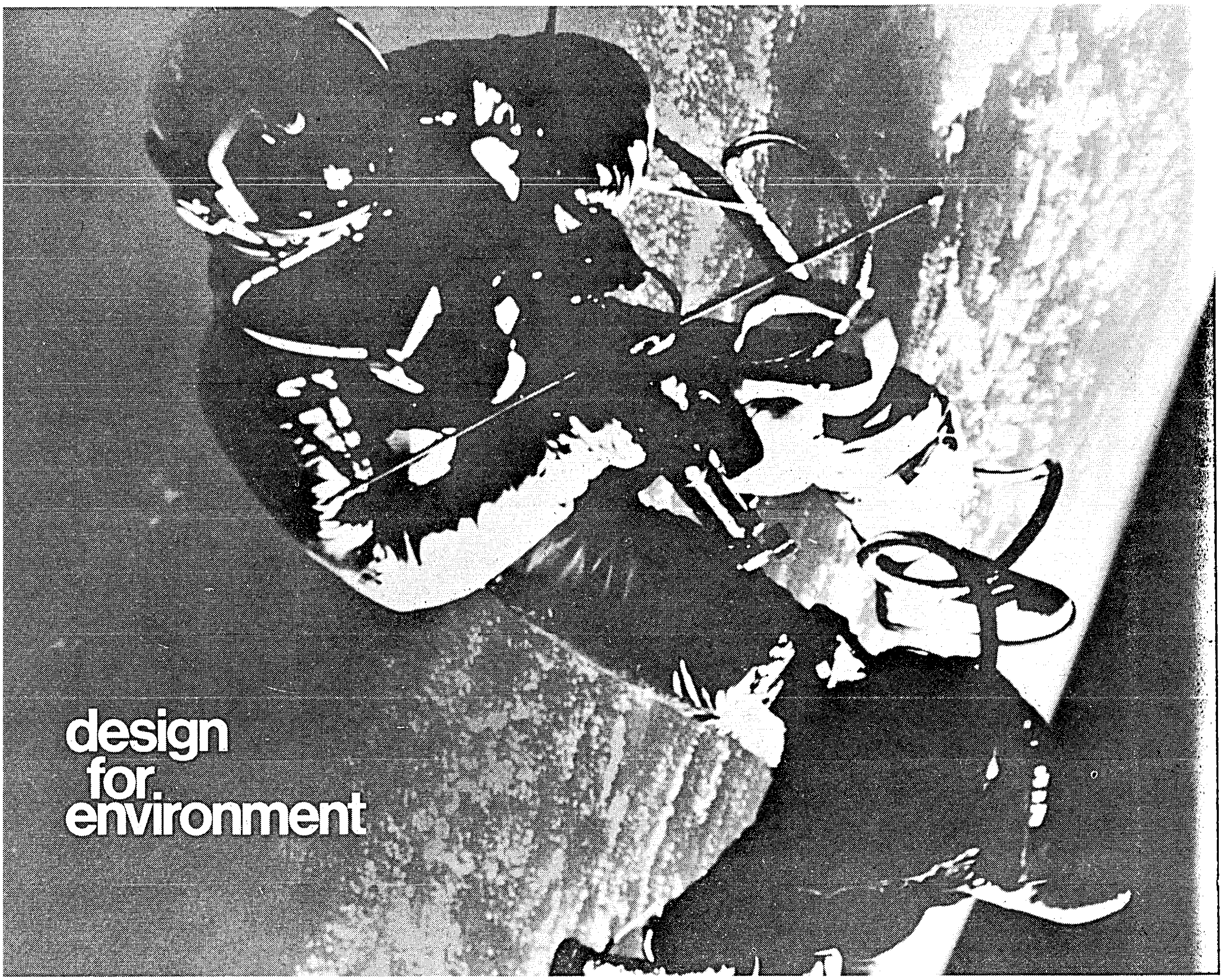
Tape controller. Only Nova-compatible 1600 bpi. 9-track industry standard tape.

Now *you can* benefit from our six new minicomputer products. Let us show you how. Call George Foldvary, Executive Vice President, (213) 829-3594. Or write Keronix, Inc., 1752 Cloverfield Blvd., Santa Monica, California 90404.

*Nova is a Data General registered trademark.

KERONIX

1752 Cloverfield Boulevard
Santa Monica, California 90404
(213) 829-3594 TWX 910-343-6480



MARK IV System/270 for Virtual Storage.

Design—

The new MARK IV/270 is the only high-level language system designed specifically for VS users. The MARK IV System now takes advantage of the inherent capabilities of VS for optimized storage allocation.

Compatibility—

Introduced in late 1973, this new model of the MARK IV System is now in use on IBM System 370 equipment in 20% of the more than 800 worldwide MARK IV installations. All existing MARK IV programs are fully compatible with the new model. MARK IV/270 is for IBM OS/VS1, OS/VS2, and DOS/VS, and fully supports the new Virtual Access methods.

Throughput—

All of the proven automatic programming and file handling efficiencies of MARK IV are added to the power of Virtual Storage. Available now with on-site support, training and documentation.

Look to MARK IV – the leader since 1968.

---

informatics inc
MARK IV Systems Company

North American Headquarters
MARK IV Systems Co.
21050 Vanowen Street
Canoga Park, California 91304

Offices:
- Chicago (312) 648-0280
- Dallas (214) 233-6861
- Los Angeles (213) 822-3552
- New York (201) 488-2700
- Washington D.C. (301) 770-5951
- Toronto, Canada (416) 493-9716

CIRCLE 40 ON READER CARD

International Offices
Informatics S.A.
18 Rue Camille Martin
1203 Genève, Suisse
Téléphone 022/45 22 00
London • Paris • Copenhagen
Rome • Dusseldorf • Mannheim
and
Computer Applications Co., Ltd.
2-3-1 Hitotsubashi, Shogakukan Bldg.
Chiyoda-ku, Tokyo, Japan
Telephone 263-7241

Technology

On-Line Computer Link Hastened Particle Find

Scientists Say it Wasn't Necessary but Frustrating Without it

A newly completed communications link to a triplex computer installation played a significant role in the recent discovery by physicists of two new subatomic particles. Scientists at the Lawrence Berkeley Lab and the Stanford Linear Accelerator Center (SLAC) in California reported within two weeks the discovery of two members of what could turn out to be a family of new elementary particles.

Discovery of the particles—Psi 3105 and Psi 3700—and their characteristics of large mass (three times the mass of a hydrogen atom) and long lifetime excited the world of high energy physics when announced last fall. While many expected new particles, the properties of these were totally unexpected, scientists said, and suggested some "new kind of structure."

To produce these particles, physicists at SLAC used a storage ring with huge electromagnets that causes counter rotating beams of electrons and positrons to collide. The beams, produced and injected into the rings by the two-mile-long linear accelerator, have a lifetime within the ring of at most three hours. During that time, before the current level becomes too low and the rings must be refilled, scientists conduct a number of different experiments simultaneously.

Data from the experiments is gathered by an on-line Xerox Sigma 5 with 128K of memory. The processor controls the storage ring, checking on the working condition of the apparatus, but also does sampling and partial analysis of experimental data, as well as the data logging.

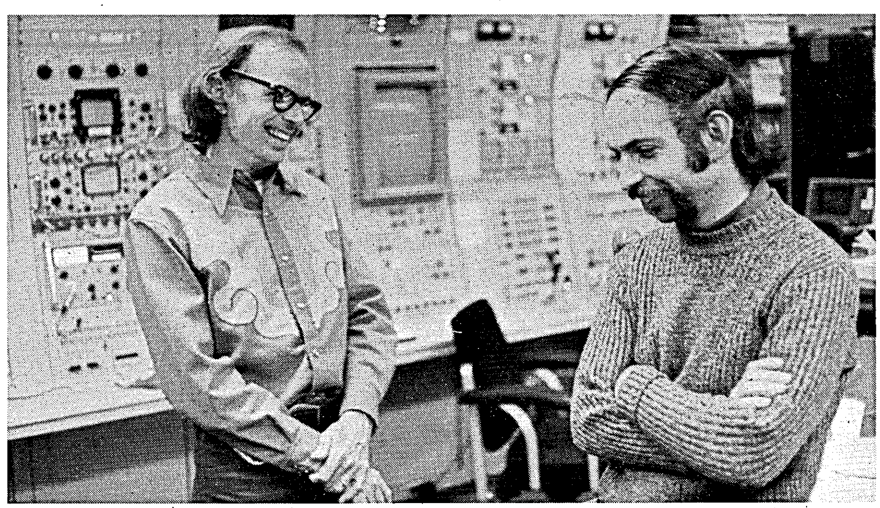
Controlling the storage ring, it appears, is no trivial task. The beam inside can be accelerated and decelerated—known as changing the energy levels. But this so-called ramping process cannot be done linearly without producing resonances in the machine. Thus the Sigma 5 must compute a complicated, tortuous path upward or downward to avoid these resonances. "It (this control) would be absolutely impossible without reasonably sophisticated computer control," says Marty Breidenbach, an elementary particle physicist who was part of the discovery team but who also understands the computer processes.

At first, off-line

Until late last summer, the data produced from the experiments was spooled onto tape by the Sigma 5, and analysis of the data for physics results was performed off-line on a triplex configuration at the SLAC computing facility. "Our style had been to make sure the apparatus was okay, and we'd figure out the physics later," says Breidenbach. "It meant a delay of a couple of hours, if one were in a rush and chose to run the tapes to the main computer center. Otherwise it was much longer."

According to Joe Wells, assistant director of the computing facility, it was only two weeks prior to the historic initial discovery that a real-time link was established between the Sigma 5 and the triplex. For the first time, physicists were getting an instant analysis of the physics and an active feedback to their experiments. Now the Sigma 5, with an IBM System/7 alongside, can talk to the triplex over a coaxial cable at speeds up to 200,000 bytes/second.

At SLAC, the configuration includes a two-megabyte 360/91 and two three-megabyte 370/168s. The dual 168s operate under VS2-1.6 and under ASP 3.1, and the 91 under MVT Release 21.0. The software that performs the sophisticated physics analysis, which is more than 800K bytes in size, formerly operated in the batch mode. It has been modified to run in real-time, says Wells.



REAL TIME link between Sigma 5 and triplex computer installation gave physicists instant analysis of experiments. In control room of storage ring at SLAC are Joe Wells (left) and physicist Marty Breidenbach.

Essentially what the physicists do is to measure the interaction of electrons and positrons at varying energy levels within the storage ring. They allow collisions to occur for a few minutes, then raise the barriers to prevent them while the data is being analyzed by the triplex configuration. The results that come back to a typewriter terminal are manually graphed.

Normally this plot shows up as virtually a flat horizontal line. Last summer, however, after several runs with the storage ring, they received what appeared to be statistically inconsistent data, raising suspicions and setting them off on a search for the cause. A concerted search, centering on a narrow spike in the graphed line, began on Saturday, Nov. 9. They got the machine up to the required energy level, got a real-time reading back, and decided that the energy level must represent but one edge of a conical-shaped spike. At a higher energy level, they plotted the other edge. This prompted a binary search for the tip of the cone. Working around the clock, the experimenters found the new particle on Sunday afternoon and were able to describe its mass and width.

"I'm sure we could have done it without the real-time link," says Breidenbach. "But a process that required a day with the link might have taken a couple of weeks without it. All that time would have been very frustrating. We would know we were onto something but wouldn't be able to find the center. Information that became obvious to us in something like a half-hour might have taken days. Considering the excitement, I'm not sure we would have survived it."

The following week was spent trying to learn more about the particle, and the hunt for more such particles also began. Normally the ring is used to make a run, stopped, then another run made. Instead the machine physicists transformed it into a scanning machine, changing the energy levels on the fly, so to speak, while the beams were colliding. It was, to be sure, something that could be done only with computer control of the complex ramping procedure and on-line analysis of the physics data.

—Edward K. Yasaki

Trade

"Reexporting": How Peter Lorenz Shipped IBM Hardware to Russia

The picture postcards of Stuttgart, West Germany, depict a charming but architecturally-modern plaza called "Der Kleiner Schlossplatz"—the small plaza. If one examines the postcards closely, he will find the familiar IBM logo on buildings in the plaza. Alongside the IBM logo, he will find the logo of a German computer firm called Lorenz.

The Stuttgart Connection is as simple as that: IBM computers and technology that have been banned from the Soviet Union by the U.S. Commerce Dept. have been shepherded to Moscow by the Lorenz firm.

PETER LORENZ is at far right in this German newspaper's montage of Lorenz next to a cluster of men including IBM World Trade president Jacques Maisonrouge, far left.

Moreover, it can be big business. The markup on smuggled computers can be as high as 200%, so a $2 million IBM configuration, say, will bring $6 million upon its successful delivery in Moscow. By comparison, "The French Connection", the narcotics smuggling incident that was the subject of a best-selling book and a popular movie, was said to involve a financial transaction of not more than $500,000.

The pivotal figure in the Stuttgart Connection is Peter Lorenz, whose name adorns a few computer firms in the Stuttgart area. In addition, there are indications that Lorenz has interests and connections in other computer-related enterprises, but Lorenz' involvement in these firms is clandestine, covered sometimes by that perennial cloak of international business everywhere—Swiss banking and business secrecy.

Two big deals

It is impossible to say precisely how many computers have been smuggled into the Soviet Union, but Lorenz is known to have been involved in at least two big deals—the smuggling of a 360/40 and a 370/145 into the Soviet Union. In the jargon of the U.S. Commerce Dept., Lorenz is accused of "reexporting" computer equipment into the Soviet Union.

"Early in 1971," the Commerce Dept. stated in 1972, "the Lorenz firm reexported from West Germany to the U.S.S.R. a computer system valued at approximately $1,600,000, which was subject to U.S. export controls, although the firm knew this was a violation of U.S. Export Control Regulations."

That system was the 360/40—possibly the first model of the 360 series to arrive in Russia. In addition, DATAMATION has learned that Lorenz was involved in the shipment of a 370/145 to Russia—almost certainly the first model of that line of computers to arrive in Moscow.

There are indications that the Commerce Dept. had knowledge that Lorenz was planning to "reexport" a larger system to the U.S.S.R. In a statement in 1972, Commerce said it had "evidence to show that the Lorenz firm ordered a more expensive and more sophisticated computer system which is now in the Federal Republic of Germany and that its intended disposition requires further investigation."

The Commerce Dept. has never said what happened to "the more expensive and more sophisticated computer system." The department presumably knows that Lorenz was successful in "reexporting" the 145 to the Soviet Union.

Software also a problem

"The 145 can be seen in Moscow," one West German computer broker told DATAMATION. "They had many problems getting the entire system in, though. And they had a tough time getting the software to work."

Lorenz has had ex-IBMers on his staff and he is known to have sent men to Moscow to work on IBM equipment. In addition, there have been unconfirmed reports that IBMers from West Germany were flown in on their vacation time to work on IBM equipment in the Soviet Union. Their activities were said to have been unknown to their superiors at IBM, which maintains its German headquarters in Stuttgart.

As for IBM, the smuggled computers have acted as a stimulus to the computer colossus to control the movement of IBM computers into Russia. Details are sketchy, but it appears that the Soviets attempted to obtain IBM computers from IBM first and when these attempts were unsuccessful, the Soviets turned to Western used computer brokers.

He won't talk

Lorenz was able to purchase IBM equipment and IBM supported the IBM equipment that Lorenz acquired. However, he shipped the 360/40 into Russia without a license. Later, after the Commerce Dept. placed Lorenz on the restricted list, Lorenz seems to have become more bold about his activities.

DATAMATION contacted Lorenz in Stuttgart, but he refused to discuss the matter. In a West German publication, however, Lorenz offered the argument that the model 40 was manufactured in Europe and, thus, was not of U.S. origin.

"We are a German firm," said Lorenz, "and I hope also that we are a sovereign state, so much so that the American influence cannot go this far."

The rationale behind the U.S. blocking or at least controlling the movement of high technology products like computers into the Soviet Union is that the Soviet Union might use the equipment for military or other strategic purposes. Western European nations including West Germany have agreed to restrict the flow of such strategic equipment into the Soviet Union and it is this restriction that Lorenz is accused of violating.

To Ryad's rescue?

IBM equipment is particularly important to the Soviet Union because it is basing its own computer technology, surfacing now as the Ryad Series, on IBM equipment. The Russians are using 360 software in the Ryad Series, and any new IBM equipment can be valuable to the Soviet Union for the purpose of copying the hardware and understanding the latest hardware and software. In addition, the sophisticated equipment—Lorenz is said to have been involved in the delivery of a 3330 disc drive also—can be put to use in Russian installations.

"But the Russians are having a rough time with the Ryad Series," says one computer expert conversant with the Soviet Union's work with computers. "It's way behind schedule."

IBM, once a reluctant trader in Russia, has been more aggressive in attempting to crack that market in recent months. On one hand, the firm was slow off the mark in the early 1970s and, on the other hand, the Commerce Dept. has been reluctant to approve sophisticated IBM equipment for use in the U.S.S.R.

According to internal IBM documents made public in the government's antitrust case against IBM, the firm's top management decided as late as mid-1970 to back off from doing business in Russia.

Evén after IBM's chairman Thomas J. Watson Jr. visited Russia later that year, the firm's president, T. Vincent Learson resisted doing business with the Soviet Union. "Does not want to do business with Mother Russia," the IBM documents say of Learson's feelings on the issue. "Does not feel it is appropriate for the IBM Company. Sees difference between Eastern Bloc and Russia. Maybe several years from now would feel differently, but right now does not want our company to be doing business there."

Change in policy

However, by June of 1971—by which time Lorenz had delivered the model 40 to the Soviet Union, although IBM may not have known this—IBM's Management Review Committee (MRC) was beginning to have second thoughts on the matter and prepared to begin to move in the Russian market. In this regard, the IBM documents state:

"Firm in Washington, D.C., International Computer Exchange Corporation, was granted an export license to sell a used 360 model 40 to Russia. This fact key in MRC decision to go ahead and explore the possibilities of sale of computers to Russia. Specifically our equipment will get there and it probably makes more sense to have it under our direction from both pr and business point of view." (The reference is to a high technology exporting firm called Intercontinental Computer Exchange—ICX).

Subsequently, IBM equipment has been beginning to flow into the Soviet Union, although it is earmarked for nonmilitary use. The largest machine to have been delivered by IBM is a 360/50. Model 145s have been approved for use in East European countries, but, as best as could be determined, have not yet been delivered.

Developing interfaces

As for Lorenz, German sources said he has at least one Soviet Ryad computer at one of his installations in the Stuttgart area and that he is attempting to develop interfaces for U.S.-developed peripheral equipment for the Soviet series. The Russians have had particular difficulties in developing peripheral equipment for their line of computers. Lorenz' progress, if any, with this project is not known.

The Soviets made a similar arrangement in the Netherlands with a firm called Elorg in which the Russians maintained controlling interest. That firm's charter was to adapt U.S. peripherals to older Russian Minsk-32 computers. The venture is said to have been less than successful.

In moving the IBM equipment into the Soviet Union, there are indications that Lorenz utilized a series of firms, computer brokers, and individuals. Some of the equipment was obtained in Europe, but some, it is said, was obtained in the U.S. Many of the parties involved were said to have been shocked when they learned that the equipment ended up in Russia. Some of the equipment went through the airport at Vienna and, after Austrian authorities plugged that gap, the smugglers became more bold and shipped the machines directly from Amsterdam's Schiphol Airport to Moscow.

Computer brokerage firms in both the U.S. and Europe have picked up bits and pieces of the smuggling operation and the grapevine has been humming for some months now that a 370/158 will soon be "reexported" into the Soviet Union. "All you have to do is one deal like that," said one broker. "And you'll never have to work again."

—W. David Gardner

Communications

Telecommunications: The Human Side

Technology took a back seat to the more human aspects of telecommunications at the National Telecommunications Conference last month in San Diego.

Speakers and those in attendance at the conference, sponsored by the Institute of Electrical and Electronics Engineers (IEEE) Communication Society and the IEEE San Diego Section, seemed agreed that technology is advancing at a more than adequate rate but people problems demand more attention.

For the first time at an NTC, four sessions were directed specifically at the social effects of telecommunications. "People have accused us of being too technical," said Terril Steichen, Office of Telecommunications Policy, chairman of one of these sessions. "We are trying to get away from the technical in these sessions which are an experiment." Judging from attendance and interest, the experiment was a success. The sessions were the conference's best crowd drawers.

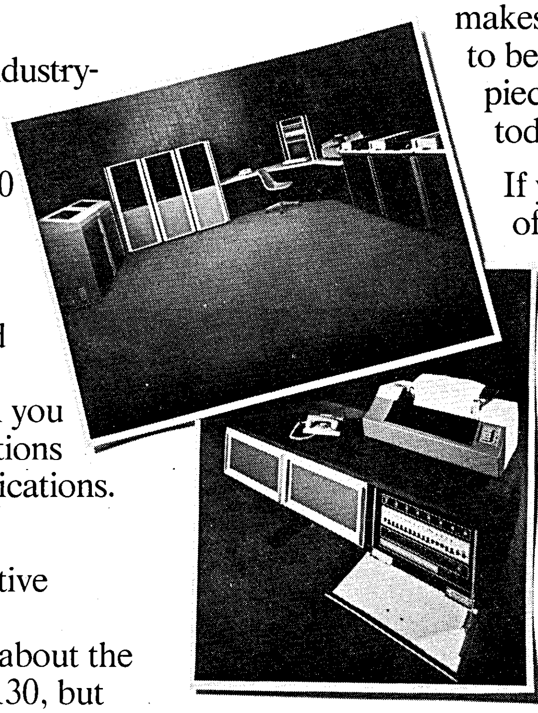
There were pleas for more involvement of the user such as from Jack Campbell, former governor of New Mexico and head of the Federation of Rocky Mountain States. "There should be an assessment of needs before technology rather than the other way around," said Gov. Campbell who would like to see the user involved even in semantics. Describing himself as non technical, a lawyer and a retired politician, he told of touring the conference exhibit area with his son. "Neither of us were able to understand most of what we saw even when it was explained to

(*Continued on page 96*)

If moderate performance, more centralized processing and a vast library of standard applications packages will work for you, you'll be interested in our DM-200 family.

The performance-oriented family.
Our DM-100 family consists of systems for remote job entry (DM-120), satellite processing (DM-130) and powerful central processing centers (DM-140)—each built around our high-performance SPC-16 computer. When tied together, they form a compatible network of products that can communicate with each other and provide upward expandability where you need it when you need it.

A number of specific industry-oriented application programs are available for use with the DM-100 family. We also offer general libraries for statistical analysis, operations research and financial planning. If needed, we'll work with you to develop custom solutions for your particular applications.



We also make a special low-cost, highly interactive system. It's called the DM-130/2 and has just about the same specs as the DM-130, but without the range of expandability. (It is available through a separate, nationwide network of distributors established to handle the special turn-key business system requirements of first-time users.)

The application-oriented family.
Lots of applications and less decentralization calls for our DM-200 family. It is based on our 18/30 computer and a vast library of standard software for applications in manufacturing, distribution, finance, engineering and publishing. To name just a few.

The DM-200 family includes systems for data transfer (DM-220), high-throughput batch processing (DM-230) and basic batch processing with on-line interaction (DM-240). We also offer the DM-230/2—the world's number one IBM 1130 replacement system.

One answer for a dozen questions.
This ad only scratches the surface of our new approach to data management.

So, in the space we have left, we'd like to impress you with the heart of our message:

General Automation is the only computer company that offers total as well as isolated data management solutions at a price that makes sense. Someone else may claim to be the expert at solving the piece of the puzzle troubling you today, but what about tomorrow?

If you consider the total package of system growth, compatibility, stability, power, software, field support, manufacturer involvement and price, nobody can beat us. Nobody.

Challenge us to prove it.
Write for specs.
Talk to our salesmen.
Compare us with our competition.

For further information on data management systems, write General Automation, 1055 South East Street, Anaheim, California 92803.
Or call (714) 778-4800. In Europe, write General Automation, S.A., 24 rue du Sergent Bauchat, 75012 Paris, France.
Telephone (1) 346/7973. In Canada, write G.A. Computer Ltd., 880 Lady Ellen Place, Ottawa K1Z5L9, Ontario.
Telephone (613) 725-3626.

DATA MANAGEMENT SYSTEMS BY
GENERAL AUTOMATION

us and we had read the descriptive literature."

H. Wallace Sinaiko of the Smithsonian Institute, expressed a similar concern. He said telecommunications technicians "pay far too little attention to the characteristics of users . . . and too much time on finding solutions to non problems."

There were promises of what technology can do for society from conference keynoter, Dr. Simon Ramo, vice chairman of the board and chairman of the executive committee of TRW Inc. "Science and technology can increase supply and lower costs . . . can create jobs. It's hard to find an area where technology is not ready . . . We must lead and help the rest of the world."

And from Peter Goldmark of Goldmark Communications, Inc. who said the substitution of telecommunications for transportation could free a lot of gasoline.

Universal garage principle

One of the most talked about notions to come out of the conference was the Universal Garage Principle put forth by the Smithsonian's Sinaiko. It states that an effective communications system must be designed to accommodate the status of the user and that the higher the status, the more the system has to adjust to the individual. The reverse is true too, said Sinaiko. "Senior people don't take well to new communications techniques. They don't want to be trained, to be shown to be uncertain in a public way, while those unencumbered with a lot of experience . . ."

Sinaiko didn't leave his audience guessing as to the derivation of the name of his principle. He explained that he had developed the principle with an associate and neither one of them wanted to give it their name. They were discussing this problem one evening while walking from the Smithsonian (which Sinaiko characterized as the nation's attic) to the Universal Building on Connecticut Ave. in Washington, where both parked their cars. They had reached an impasse in their discussion and looked up together to see the sign—Universal Garage.

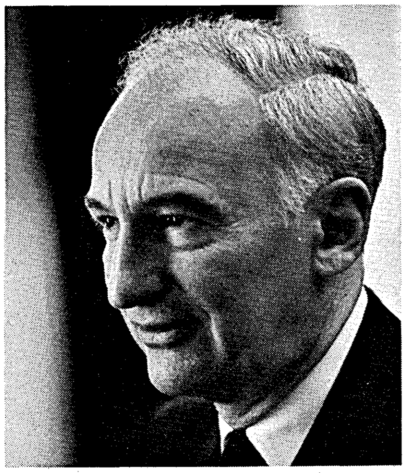
The UGP, as the principle came to be called, was picked up by Dr. Jon Wempner, a Waconia, Minn. physician who described a two-way interactive tv system for health care, which he had helped to implement on a pilot basis and which he called telemedicine. "The physicians had problems in using it but the nurses had no trouble at all."

It was picked up again by Frank Norwood of the Joint Council on Educational Telecommunications, who stated emphatically that the UGP is "best evidenced on the university campus. Nowhere else do you hear so many excuses, excuses."

EFTS: why worry?

There was concern about specific trends in telecommunications such as that toward Electronic Funds Transfer Systems (EFTS). Barry Wessler, Telenet Communications Corp., gave a talk entitled, "EFTS—Why Worry?" He answered the question posed by his title by referring to a cartoon he had seen in *New Yorker* magazine in which a husband and wife were trying to decide what movie to see. Queried the wife: "What would look good on our dossier?"

There is the potential for loss of privacy in EFTS, said Wessler. "I'm convinced it's coming. We can't stop it but we can affect it." He suggested that more attention be paid to "second order problems," citing as one the fact that



DR. SIMON RAMO
". . . lead and help the rest of the world."

most people in the United States are blue collar workers. "They have a different kind of payroll operation, time versus salary and they get overtime. A worker who never tells his wife about his overtime, who cashes his check at the nearest bar, will consider this (EFTS) a violation of his privacy."

Wessler is concerned about vendors of EFTS equipment who are "waiting to pounce, to get revenue. They're jockeying for position in the race, waiting for the pacing car to leave and if the pacing car leaves now all hell will break loose."

He predicted that "the EFTS will not be a single mutually agreed-upon, well-planned system. There are simply too many participants and too many conflicting, competitive viewpoints."

While agreeing that the idea of EFTS "growing out of natural selection based on competition has a great deal of appeal in our capitalistic society," he sees dangers to this approach.

He fears the use of "loss leaders," of certain services being offered at an economic loss by companies desiring gain in some other section of a system. He worries that "natural selection takes place which results in the most economic but not the best system for the overall public welfare, e.g. one which doesn't protect the right of personal privacy, doesn't protect the overall economy from massive fraud, or doesn't permit open competition in related areas such as banking and retailing."

Wessler also fears that "the potential business failure of a participating system can cause massive repercussions to the economy by disrupting the national payment system.

"These dangers," he said, "suggest that careful monitoring of the system evolution is imperative. In fact, government regulation, in addition to monitoring, may be required because of existing statutory authority on two fronts: (1) accepting financial responsibility for the transaction may well require the EFTS operator to be regulated by the Fed (Federal Reserve Board) or some other government banking agency, and (2) performing communications for hire in both financial and non-financial areas may require regulation by the FCC."

Separate systems

Wessler believes the communications and clearing functions should be separated "to allow the proper agency to perform its regulatory control. Once separation of these systems is accomplished in the design, many of the perceived problems with EFTS disappear."

Wessler predicted that the introduction of digital line switched services like switched DATRAN and switched DDS and packet-switched services like Telenet, "may well serve as the backbone of the evolving EFTS communications systems."

Concerns about privacy and communications networks, such as expressed by Wessler in connection with EFTS, emerged in many other sessions.

One session was devoted exclusively to "Privacy Systems" and while it was primarily a how-to-do-it session (how to insure a system against invasions of privacy) there was concern with threat assessment and evaluation of information stored in the system.

"Costs (of secure systems) depend on application requirements," said Rein Turn of Rand Corp. "Hardware costs are dropping. Programming requirements are minimal but computer time overhead may be considerable in very active files . . . you should get just as much security as you need."

Lance J. Hoffman, Computer Sciences Div., Dept. of Electrical Engineering and Computer Sciences and the Electronics Research Laboratory, Univ. of California, talked on "Construction of Security Ratings for Computer Systems," and described an effort he is making in this direction, calling it a "maiden voyage."

Pitfalls he enumerated included the fact that values are judgmental; need for attention to administrative security procedures, hard to come by; the potential that concern for security could overlook that for utility; and inconsistent raters. He suggested as possible ways to avoid these pitfalls the use of a panel of "expert" raters, industry standard weights, and an industry standard list of desirable features.

There was concern expressed from

the floor as to whether or not it is possible to build in during design stages, the opportunity to add security later. Turn's answer was: "You certainly should plan for it but with software it has to be built in from the start. You can't retrofit it."

Henri Busignies, ITT, a panelist in the final social effects session, was concerned with the issue of privacy, but more so with the issue of friendliness. "For the user we must have a friendly terminal, it must not be a monster. The computer must be an efficient assistant." On privacy as related to data banks, he was most concerned with "who will decide what (data) is to be kept."

What is a network?

On the somewhat more technical side was a bit of a debate on what a computer network is and/or should be. This between the first and last speakers in an afternoon-long session on "Computer Communication." The session's first speaker, Honey Elovitz, Univ. of Maryland, first defined a computer network as, "a collection of computers, terminals, and communications lines." Then she divided networks into two classes: centralized and distributed. She chose, she said, to look at distributed networks and she again came up with two classes: computer communications networks and "true computer networks."

Resource sharing, increased reliability, and load sharing, she said, are the advantages computer networks are supposed to afford. She used Arpanet as an example of a computer communications network. "Sure you can resource share but you have to know where the resources are. You gotta do it." As examples of true computer networks, she cited two, both research networks and both still in development stages. One is at the Univ. of Maryland and the other at the Univ. of California, Irvine. With these networks, she said, "the network operating system manages the resources. The user looks at the system as one entity and talks one language. The system decides what his resource is." She advocated a "true computer network" as advantageous for "someone who has enough money to buy a mini but needs something larger."

On the other end of the debate was Lt. Col Edward P. Schelonka, USAF, Arpanet manager, who extolled the resource sharing capabilities of Arpanet claiming it is not difficult to find out where the resources are and how to use them.

He also noted that Arpanet is handling 3 million packets per day and is capable of handling twice or perhaps three times as much "without any difficulty."

Col. Schelonka hit hardest on a nontechnical issue: that of the fact that Arpanet technology is free and open. "We cleared all legal impasses one and one-half years ago. All of our technology is free and open. It is available to anyone in the technical community."

—Edith Myers

Telephones Made in Japan

John Pierce, California Institute of Technology, thinks we'll all be buying our telephones from Japan if the Justice Dept. has its way with AT&T.

"What we will actually have depends as much upon government actions as on technology," Pierce told the IEEE Communications Society's NTC '74. And he used the Justice Dept.'s antitrust suit against AT&T as a case in point.

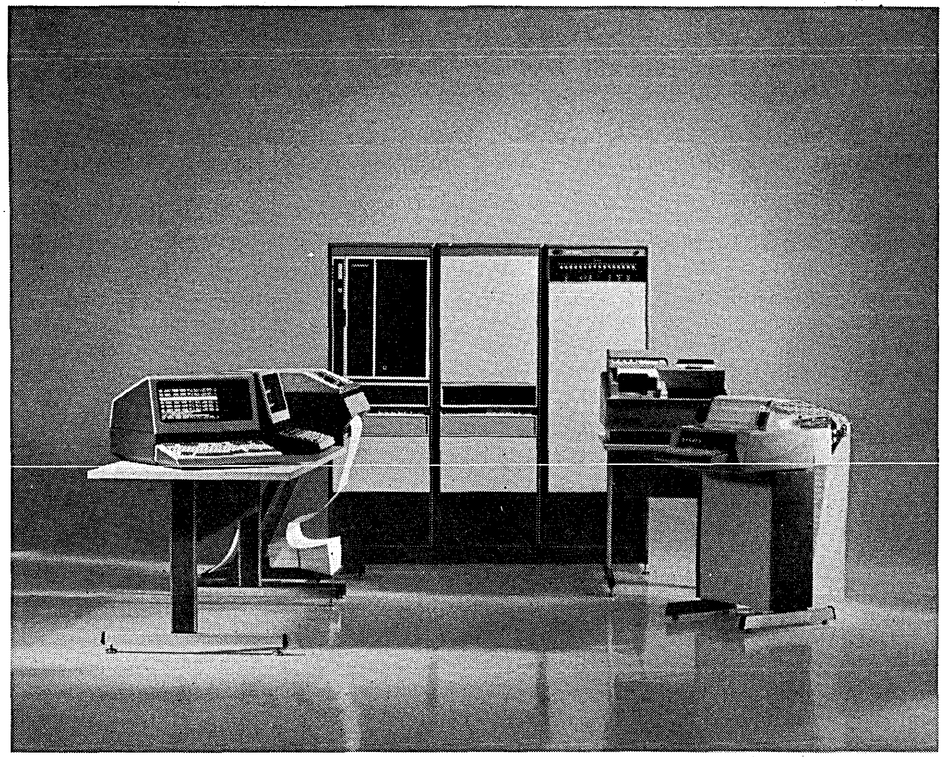
"It is beyond all reason that this could possibly result in better, cheaper telephone service," he said of the suit. "They (Justice) can't possibly predict what will happen if their suit is successful and I wish they hadn't tried."

Pierce did some predicting of his own on possible consequences of a successful Justice suit. One was a severed Western Electric putting all other American manufacturers of telephone equipment out of business only to succumb to competition from the Japanese. "In the U.S.," he said, "we penalize success and encourage failure. In Japan it's the opposite." He noted that a Japanese executive had once told him that what Japan really needs is an "Eastern Electric."

Pierce worried about the future of Bell Labs, where he used to work, should Justice be successful. "Justice doesn't know what to do with Bell Labs." He feels research could be retained within AT&T but it would be a captive, ineffective research operation. The rest of Bell Labs' employees, he said, would probably go to work for Western Electric.

In the same NTC session, Lee Davenport, GTE Laboratories, Inc., was asked from the audience whether General Telephone, based on its experience with a Justice Dept. antitrust suit, would offer advice to AT&T. Davenport's answer: "If the General system is asked, it can provide help and assistance to the Bell system."

(*Perspective continues on page 103*)



HP 3000CX

Think. Think again.

Whatever your preconceptions about minicomputer systems, think again. We did. And developed a simple, new architecture and operating system that eliminates the redundancy and wasted memory inherent in traditional minis that echo big-computer design philosophy. The result is cost-saving efficiency.

Because no other mini has been designed for multiprogramming, no other mini can offer the performance of a Mini DataCenter.

Code and data are handled in separate modules. By dividing program elements into those that will change and those that do not, codes can be shared among all users while each maintains his own unique data space. Result. No memory is wasted.

Virtual memory is provided by a user-determined form of code segmentation. This approach permits a program to be larger than the main memory and avoids the thrashing between disk and memory that often results when segmentation is totally machine determined. The 3000CX automatically eliminates swap out of segments that are in frequent use.
A hardware-implemented variable stack design sharply reduces the amount of memory required to execute programs. No data area is wasted by unused sub-routines. The data stack also provides variable-size arrays, re-entrant code, recursive programming, and an extremely efficient method of parameter passing to sub-routines.

Performance from architecture designed for efficient software.

A 32 bit LSI ROM microprocessor is at the heart of every Mini DataCenter. This microprocessor implements 182 instructions, has a cycle time of 179 nano-seconds, utilizing overlapped microinstructions to provide both extreme speed and power — as many as 5.27 million operations per second.

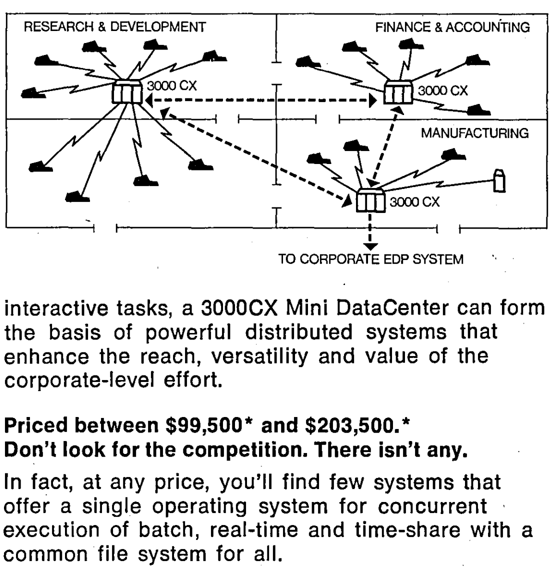
Add to this, interleaved memory modules for faster access, CPU and I/O processor designed for greater throughput and bus-oriented architecture for modularity.

Program size is kept small because of the very efficient code generation resulting from a strong instruction set, specifically designed to implement high-level languages. The subroutine call process is unusually fast because the microcode — not the user — shoulders the burden of determining whether code segments are in disk or memory. Program design is simplified because many features of the instruction set are reflected in the syntax of the programming languages.

The result is difficult to accept at first: a system that provides a range of operating features on a par with large-scale data systems.

At a fraction of the cost, it extends the capabilities of a major data system outward to users who want the features and convenience of a large system, but whose problems don't require the full brute force capabilities of a costly major system. In the corporate environment, it permits EDP management to shift time-consuming lower-priority management demands out of the central system's work flow with measurable savings in time and cost. Able to communicate with other HP computers and with major IBM systems, while performing other batch and

Mini DataCenters



interactive tasks, a 3000CX Mini DataCenter can form the basis of powerful distributed systems that enhance the reach, versatility and value of the corporate-level effort.

Priced between $99,500* and $203,500.*
Don't look for the competition. There isn't any.

In fact, at any price, you'll find few systems that offer a single operating system for concurrent execution of batch, real-time and time-share with a common file system for all.

Few systems let you work simultaneously in any mode from multiple interactive terminals concurrently. Or let you do it in RPG, COBOL, FORTRAN, BASIC and SPL at the same time; even mixing languages in the same program. Or permit terminal accessed input-output spooling.

Few systems implement virtual memory and code-sharing programming in hardware.

Few systems offer decimal arithmetic and extended precision floating point as time saving microprocessor features. Or come with a built-in debug and trace to cut program check-out time in half.

Few systems offer you as extensive an array of peripherals and input options available from the manufacturer.

No other system offers a BASIC interpreter plus a full BASIC compiler with execution as much as 10 times faster than those attainable with incremental compilers.

And, of course, no other system offers you the worldwide Hewlett-Packard delivery and maintenance network, the HP guarantee, or HP's tradition of quality.

Write for complete information.
Or phone your nearby HP field engineer. You work for a living. It's time you found out about a computer system that does.

*Domestic USA prices only.

HP minicomputers. They work for a living.

HEWLETT hp PACKARD

Sales and service from 172 offices in 65 countries.
1501 Page Mill Road, Palo Alto, California 94304

22511

IT'S NEWS WHEN ANY PRICE GOES DOWN.

IT'S BIG NEWS WHEN THE STATOS 31 PRINTER/PLOTTER IS SLASHED $1,000.

Down to $6,950.

That's quite a price for the most versatile electrostatic printer/plotter on the market. The Statos® model 3110, a 14⅞" unit with fan fold or roll paper capability that's been delivering performance no one else can touch.

Like plotting up to 3.3 inches per second with a special high-speed option. Or 2.2 inches per second just as it is.

And for printing applications, there's a choice of optional hardware character generators that give you speeds up to 2,000 lines per minute.

Other options include simultaneous print/plot, additional single-line buffer, and a programmable paper cutter.

Field proven on-line interfaces plus system and plotting software packages are available for most minicomputers. For larger computers, off-line mag tape systems and software are offered.

What's more, along with high performance at the most competitive price you also get the only free on-site installation in the industry. Uncrating, set-up, check-out, and user instruction by a Varian field service engineer.

Let us show you the price and performance advantages of the Statos 31. Write Varian Data Machines, 611 Hansen Way, Palo Alto, CA 94303. Or call (415) 493-4000, Ext. 6250.

varian data machines

Price effective USA only.

CIRCLE 71 ON READER CARD

Security

L.A.'s Check Fraud: Blame DP First

"The scheme involved programming the city's computer to pay out checks to phony corporations," said a *Wall Street Journal* account in December of a celebrated attempt to loot the Los Angeles city treasury of more than $3 million.

"Two Seized in L.A. Computer Fraud," was the headline in the suburban daily *Santa Monica Outlook* newspaper whose 450-word story's only reference to computer fraud was that "a city worker must have helped rig a computer to pay three treasury warrants for about $900,000 each." The *Los Angeles Times* said the plot involved "manipulation of the city's computer accounting system."

Later reports were to absolve both the computer and the city's ultra secure Data Services Bureau (DSB). In fact, it was at the bureau where 18 city checks were first found missing last March and where one stolen check for $902,000 that had been cashed in a Swiss bank was rejected during a reconciliation run.

The unsigned checks are manufactured by IBM at a plant in Campbell, Calif., and shipped to the Los Angeles city controller's office in packages of 3,000, sealed with masking tape and then housed in a wire cage at the rear of the DSB's underground operations center four stories under the city hall. Somewhere between the IBM plant and the DSB, the last 18 checks in a package of 3,000 disappeared. Investigators said the city controller's signature was forged and the amounts and names of phony payees were written with a typewriter.

The incident, said by investigators to be Mafia linked, is not the first to be uncovered by the DSB which does a daily reconciliation run on checks forwarded to it every day from the Los Angeles clearing house.

Tug Tamaru, general manager of the DSB, said 250 city checks were stolen three years ago by two employees of a midwestern supplier. They then worked their way west to Las Vegas on a bogus check cashing spree before being arrested in Las Vegas. In that case, though, the amounts were a considerably more modest $100 and $200.

Tamaru rejects the likelihood that the most recent caper was an inside job, as investigators first thought. He said he detected three procedural errors in the way the checks were written. The forgers had some knowledge of the city's system, "but no precise knowledge," he said. Tamaru, who regrets the initial "blame the computer" reaction, explained that the first public announcement of the forgery plot was made at a weekend press conference by the District Attorney without Tamaru's knowledge.

Although the computer seemingly has been absolved, the suspicion lives on. Shortly before Christmas, a practical joker gained access to a terminal and teletyped a message to all of the city's police stations that their paychecks weren't going to be available the next day because of a computer foul-up at city hall. Panicky police, who also were to receive Christmas bonuses the same day, awoke the city controller in the middle of the night for confirmation. It wasn't true, of course. It just rang true.

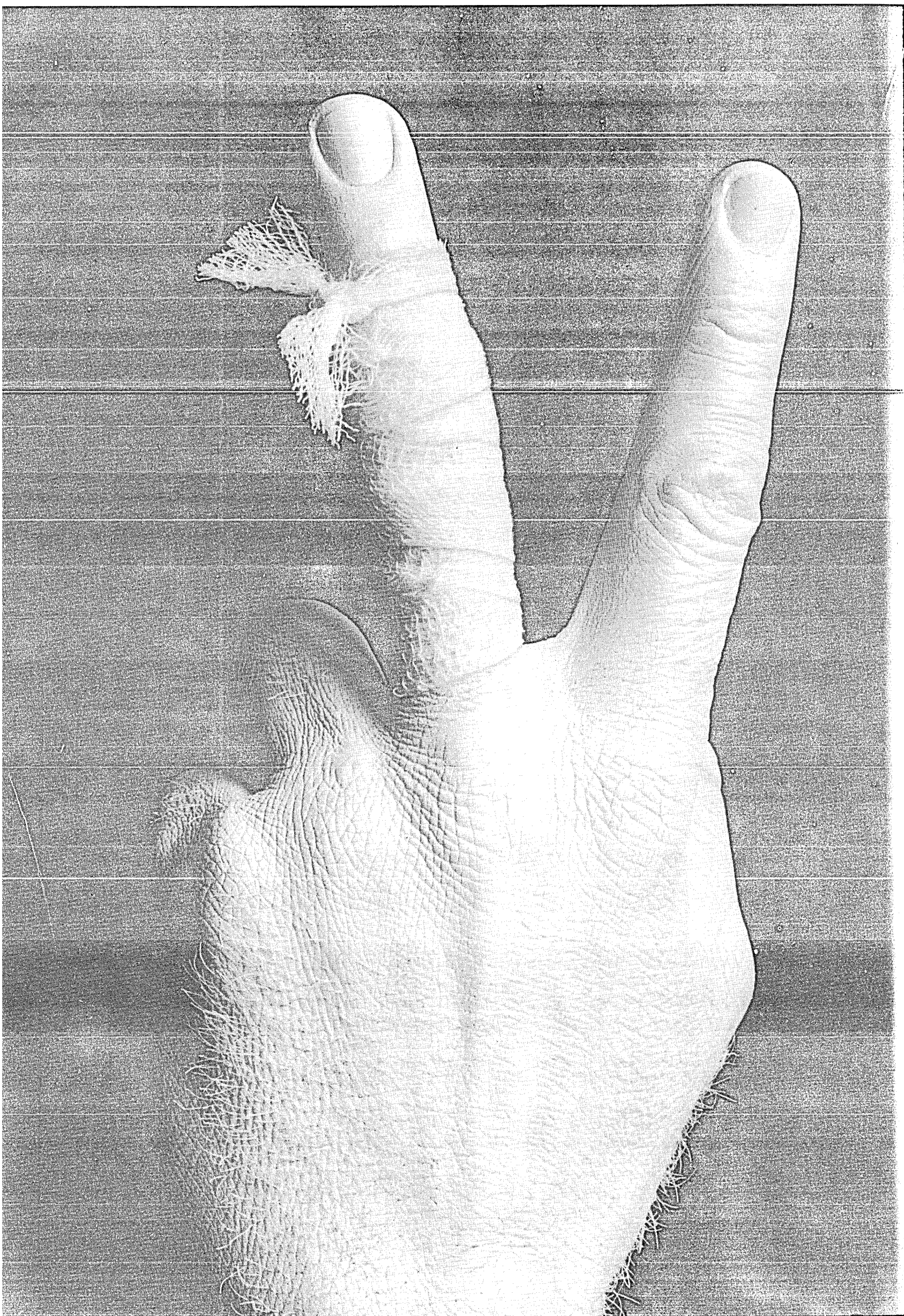
Companies

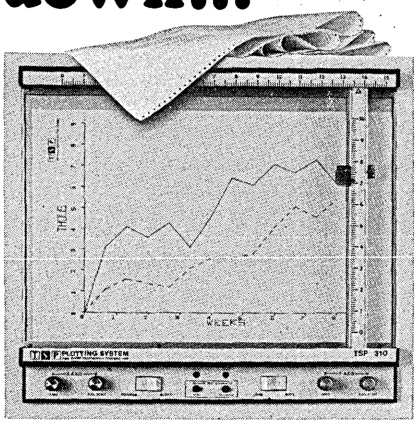
Working at Home And Liking It

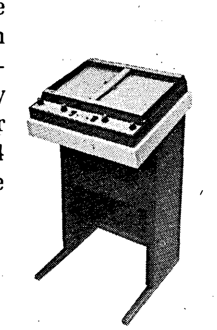
Goldmark Communications Inc. is in the third year of a five year Department of Housing & Urban Development funded project to use telecommunications to improve employment opportunities, health care, education, and cultural opportunities in rural America.

Peter Goldmark, president of the firm, said the project has borne fruit and without any new inventions. The big thing, said Goldmark, is substituting telecommunications for transportation. Looking beyond the five year project he foresees an end to commuting which he says accounts for 54% of the nation's gasoline use. He sees decentralization of businesses, people working from their homes via terminals, allowing them free choice as to where they will live.

This kind of operation may be way down the road for many. But for one San Diego software firm, Integrated Software Systems Corp., the time is now. The five year old company has five employees and no office. Each employee works from home via a terminal. And







news in perspective

most of the company's business is outside the San Diego area. "We live in San Diego because we like it," says Peter Preuss, vice president.

The company was formed when Preuss and its president, Ian Hirschsohn were graduate students at the Univ. of California, San Diego. Preuss had gone there from Germany and Hirschsohn from South Africa. The original version of the firm's product, DISSPLA (Display Integrated Software System and Plotting Language), a general purpose interconnected subroutine system for plotting graphs, surfaces, and maps using computer operated devices, was developed by Hirschsohn for a problem he was working on to earn his Ph.D. in engineering. The Naval Undersea Development Center heard about it and bought it. The company was launched.

Still studying

"We were two mathematicians and an engineer," recalls Preuss of the founding group. The second mathematician was Allan Frankel, now a vice president of the company. "We all had master's degrees and were close to our Ph.D.s. We still are."

With one customer, the Navy, Integrated Software Systems Corp. was incorporated in 1970. Its second customer was Shell Oil in the Hague, Netherlands. This caused some problems for Preuss. He was in the process of having his visa status changed from student to immigrant. He went to the Netherlands to supervise installation of DISSPLA at Shell. When he was ready to return to San Diego, as an immigrant, he was advised by U.S. authorities that there were too many unemployed programmers in the San Diego area. "It didn't matter that I had my own company." It took him a year but he got back. "Every day of that year was spent hand holding with the people at Shell."

Besides DISSPLA, the company has a scientific file management package offered as an adjunct to DISSPLA and developed by Hirschsohn in conjunction with a contour plotting package on which he is working. Preuss said the company is constantly enhancing DISSPLA and has, to date, extended its capability by approximately 30%. "We've added new fonts and streamlined the lower end."

The company this year also added staff. It hired Tom Unger, who had been a student at the Univ. of California at San Diego, and Sunni Harris, who had been a systems programmer at Lockheed's San Diego operation, which was a DISSPLA user. For Sunni, mother of a young son, working at home is particularly convenient.

Another advantage of the home terminals cited by Preuss is the fact that they can work at night, taking advantage of less expensive computer time. The five employees get together physically once a week in one of their homes. "Usually it's Sunni's," said Preuss. She lives half way between Solana Beach, where Hirschsohn and Preuss live, and El Cajon, home to Frankel and Unger.

Integrated Software Systems Corp. to date has installed 40 DISSPLA systems and is installing, says Preuss, at the rate of one system per month. DISSPLA sells for a flat $22,000 plus installation expenses.

—E.M.

Europeans Burst Into U.S. Computer Market

The U.S. computer market must look good from the outside. Three European computer manufacturers decided to enter it in the last few months.

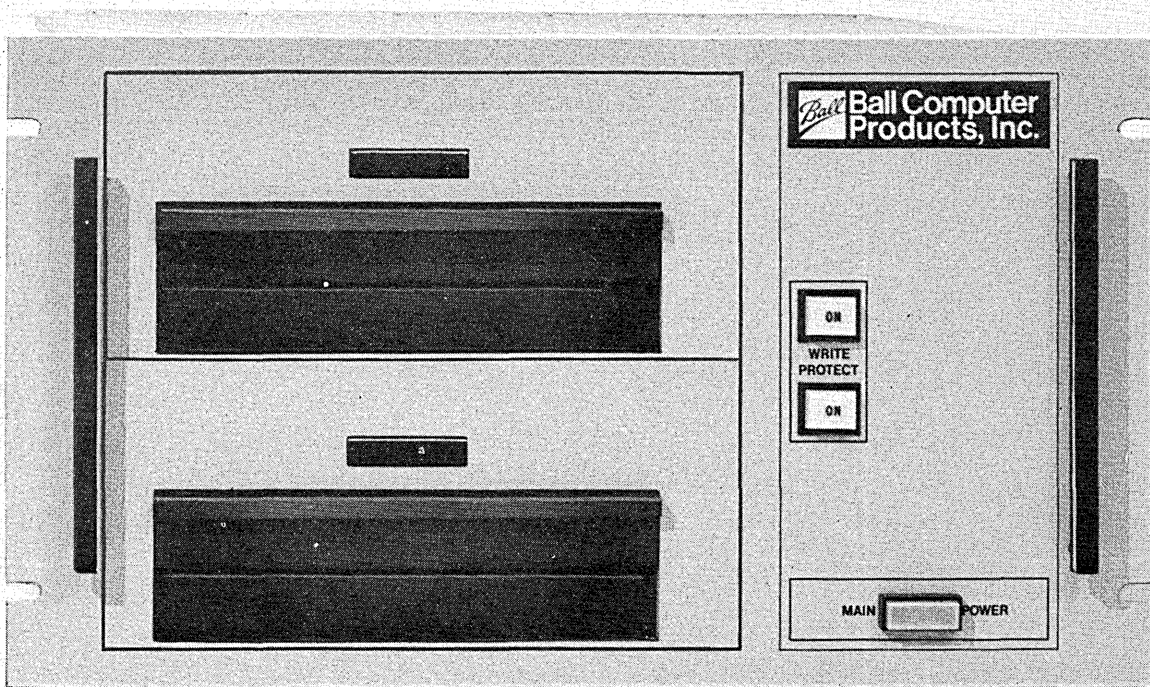
International Computers Ltd. of the U.K. began to market its System 3 competitor here and in Canada and is seeking a U.S. partner with "cash and resources." Olivetti of Italy, through Olivetti Corp. of America, added two small business computers and a programmable terminal to its Business Products Div. And Datasaab of Sweden has taken over from its U.S. distributor to market its savings bank terminal directly.

Initially, ICL is marketing its small business/satellite 2903 computer in the New York, Montreal, and Toronto metropolitan areas and invested $4 million in three centers which should be enough to support the 50 systems it estimates it will sell in 1975 (seven already have been sold in Canada, three in the U.S.) But, the profitable $500 million U.K. company, with 1.75% of the world market, promises to bring over its entire 2900 line within two to three years (see November 1974, p. 120). It expects to get $75 million yearly from Canada and the U.S. by 1979. ICL knows a $4 million investment isn't enough which is why it wants a U.S. partner, one which: would be willing to take minority ownership in the venture; could provide nationwide sales and support; and be smaller than ICL.

Control Data has been mentioned as a candidate but ICL chairman, Thomas Hudson, said the likes of CDC, NCR, Honeywell and DEC are "improbable."

(Continued on page 111)

calls for another.



The same differences.
We'll continue to make minicomputer systems in all shapes and sizes. Complete with peripherals, controllers, drives, power supplies, cables, terminators, diagnostic and operating software and documentation. All designed by hardware and software people working toward a unique objective —helping you solve problems.

The different differences.
And we'll continue to make the OMR6500 optical mark reader and mark capture systems. And the OCR7600—probably the most advanced, most reliable and yet most economical optical character recognition system in production anywhere by anybody.

Onward and upward.
As an independently operated subsidiary of Ball Corporation, we'll continue to do all of these things. We'll just be doing more of them. Bigger and better than ever before.

Ball Computer Products, Inc.
5601 College Avenue
Oakland, California 94618
(415) 654-8626

Ball Computer Products, Inc.
SUBSIDIARY OF BALL CORPORATION

But Peter Weill, General Manager of North America and U.S. president for ICL, says "we're not excluding anyone."

ICL's marketing target will not be the first-time user or the user with "horrendous" conversion. The firm thinks the replacement market is filled with customers it can support. It will aim at the Systems 3 customer and 360/20 and 1130 users. It also is looking at multi-site customers and multinational companies.

Few applications

ICL does not offer many applications packages yet. It lists PERT, file inquiry, finance project evaluation, on-line order entry, stock control, and bill of materials processing.

It is interested in inquiries from software companies that would like to become franchisees, marketing the 2903 with their own tailored software. ICL, says Weill, knows it must encourage ICL systems expertise among the U.S. software houses.

What are the vital statistics of the 2903? It is touted for batch, direct data entry, remote job entry, on-line file inquiry, and multiprogramming. Its MOS semiconductor store ranges from 16K-49K words (24-bit word, 6-bit character) and has a 1.1 usec cycle time per word. The 6-bit orientation is a problem, especially for bisync and SDLC transmission, but ICL lays claim to a highly sophisticated "microprogramming engine" which can handle even a 9-bit byte.

The 2903 has three levels of disc-based operating system, and offers RPG-2, COBOL, FORTRAN, utility programs. No assembler. RPG-2 is the applications language.

Examples of pricing: 28K memory, 20 megacharacters disc store, 300 lpm printer, four DDE terminals, card reader—$4,000/month. A full multiprogramming system with 40K words, 120 megacharacters disc, 1100 lpm printer, mag tape drives, six DDE and four crt terminals—$9,000/month.

Plenty of backing

Olivetti has a nationwide sales and support force in the U.S. and the entire Olivetti service organization to back up the new computer products it is selling here. It has 10,000 accounting machines installed here which will form part of the prospect list for the small Audit 5 and 7 systems. Olivetti's Business Products Div. is a $100 million operation.

Elsarino Piol, senior vice president and new head of the U.S. Business Products Div., wants to "keep enthusiasm down and start conservatively. We want to be a solid company with a decent share of the market." He said Olivetti wants to become well known in a few selected markets where it already has expertise, naming savings banks as targets for the TC-700, local government for the Audit 7, and the insurance industry for both the 5 and the 7.

The modular Audit 7 has four 16K bytes of main memory, ROM, video console, buggered keyboard and print unit, (40 cps) and a magnetic stripe card unit. The largest model can have disc drive with up to 40 million characters. Equipment can be added to handle magnetic stripe ledger cards, cassettes, and data transmission. Optional peripherals are serial and line printers and card and tape readers and punches. Software includes a two-level operating system, assembler, "Audit-PL/1" applications language, and "modular software packages."

The TC-700 terminal comes in single systems or cluster versions. Each station has up to 16K bytes and an alphanumeric keyboard. Optional are a 50 cps print unit for handling various size documents, 260-character-screen videoterminal, badge reader, floppy disc with up to 500K characters, mag tape cassette unit, serial and line printers. A compatible "automatic" teller has a cash dispenser, read/record unit, keyboard, and display and print unit.

Datasaab Systems, the U.S. subsidiary of Sweden's Saab-Scania, took over marketing of its banking terminal from former distributor, Trivex, naming John A. Magliana, an ex-vice president of Trivex, as president and chief executive officer. It currently has 400 banking systems on order and projects a $10 million backlog by year-end.

Included in the modular systems are numeric and alphanumeric keyboards, document printer, journal printer, crt displays, high speed matrix printer, and two minicomputers. The minis can function both off and on line to the bank's central processor.

Eventually Datasaab intends to provide systems for the railroad, trucking, and meat processing industries in the U.S.

—Angeline Pantages and Lynn Miller

(Perspective continues on page 112)

news in perspective

International

Ikeda Death Deprives Fujitsu of Key Leader

Dr. Toshio Ikeda, who has been described as the person responsible for the success of Fujitsu Ltd. in the computer field, died unexpectedly in Tokyo in mid-November after suffering a massive cerebral hemorrhage. The 51-year-old Ikeda was managing director of Fujitsu's Information Processing Systems Group, responsible for the r&d, production, and marketing of computers.

His tragic death creates a position that management must try to fill as best it can; more seriously, however, it also deprives the company of a strategist who earlier had been tabbed as a future president. While lying in a coma, Ikeda was honorarily elevated to an executive director. He has been succeeded by two of his assistants, Takuma Yamamoto, formerly general manager of computer operations, and Shiro Yoshikawa, gm of computer marketing.

Dr. Ikeda ran pretty much of a one-man show on the computer side of the company, very much unlike the traditional management by committee to which the company probably will return. It can be expected that sudden changes in company direction will be rare in the future.

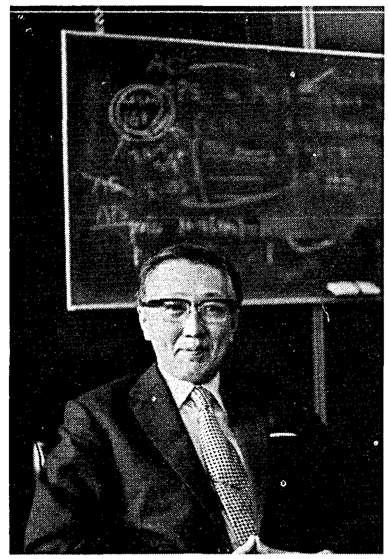
It was Ikeda, a computer architect in his own right, who led his firm into its close financial and technical ties with Amdahl Corp., under which Fujitsu is currently manufacturing Amdahl's computer. The two designers, Gene Amdahl and Ikeda, had established a personal friendship years before Amdahl was to leave IBM and start his own company. Both Fujitsu and Amdahl say there will be no change in their relationship.

Not conventional

Another close friend, Dr. Tosiyasu Kunii now on leave from Tokyo Univ., recalls how Ikeda in his early days at Fujitsu would invite his technicians to his home to discuss design and architecture. The unusual procedure had the company management climbing the wall. Undaunted, Ikeda continued the practice for several months, even holding all-night sessions at home with his designers.

"He was recognized by everyone at Fujitsu as the creative sparkplug behind the computer division," says Amdahl. He was an Easterner who thought like a Westerner. In Japan, Amdahl explains, "the man down below very seldom affects policy, but he did and that's why he rose so rapidly."

In an interview earlier last year, the soft-spoken Ikeda reminisced about his early years. He attended the prestigious Tokyo Institute of Technology, majoring in math and electrical engineering. His interests, however, were less in his studies and more in reading the classics and in playing basketball. A colleague says Ikeda was ranked as the nation's top basketball player and would have appeared in the Olympics that were cancelled by the outbreak of World War II.



DR. TOSHIO IKEDA
His strategy was the kind that makes plans come true

No Western ties

The degreed young man joined Fukitsu in 1946 where he met the girl who was to become his wife. It was a couple of years after he joined the company, he recalled, that he learned about the development of the ENIAC computer. Working in the research lab, he explained, he headed a group that spent a lot of time solving complex equations and thus needed a way to facilitate this. It was not until 1953, however, that Fujitsu entered the computer field; in that original group of five or six was Dr. Ikeda. Of course, the company was the only major computer manufacturer to have no technical ties with a Western mainframer. Either because of this or despite it, Fujitsu has a leading share of the market there.

More than a computer architect with progressive ideas, Ikeda had wide-ranging interests. "He loved music, art, and

Goh," says Prof. Kunii. In the Japanese game of Goh, Ikeda held a high national ranking of Rokudan, or sixth, only two or three levels below the top. Posthumously he was elevated to the seventh-level ranking. The logic of computers and the principles of Goh have some similarities, he told DATAMATION last year; one needs a strategy to win.

That apparently holds true, as well, in computer design. Gene Amdahl says Dr. Ikeda knew how to plan and strategize in a way to make plans come true. He knew what goals could be met and what was required as a maximum effort to achieve them.

—E.K.Y.

French Computer Merger: Who Would Buy What?

A long-rumored merger of France's two computer mainframers generated a rash of other rumors last month, including one that the French government was considering accepting Arab money for cash-hungry Compagnie Internationale pour L'Informatique (CII).

There were rumors that a merger of CII and Compagnie Honeywell Bull (CHB) was both off and on. One said the merger negotiations would be announced during the Christmas holidays. Honeywell, Inc., which owns 66% of CHB along with Compagnie Machines Bull which has the other 34%, said it was all "sheer speculation." Neither it nor its partner had ever negotiated with the French government or CII. And a source close to the company said Honeywell executives were denying even having any plans for a deal in France.

The merger speculation followed the French government's cooling off last fall on a program to make the government-supported CII a purely French company. It demoted a government proponent of that policy, 41-year-old Maurice Allégre, and let it be known that outside support might be acceptable (December 1974, p. 138). Likely candidate to provide this outside support was CHB. Its managing director, Jean-Pierre Brule, thinks European computer companies can't do without it. Brule said 18 months ago that Unidata—the consortium of three European companies, including CII—needed his company's financial and marketing ties with Honeywell Information Systems, particularly the entre it offered to the vast U. S. market.

Allégre promptly rejected the notion. It then was up to the French government to find financial support for the company to a degree that would make it a forceful partner in the Unidata consortium. But a squabble between two other supporters of CII—electrical giants Thomson/CSF and CGE—threatened to turn off all financial help to the company, other than government money, and the French government began looking elsewhere.

No compatibility

Those who thought a deal with Honeywell Bull might be underway wondered who would be buying who and what. Honeywell Bull has 16,500 employees and revenues of $500 million. CII, with some 8,500 employees, expected revenues of $300 million last year, up about $100 million from the year before. But most of CII's installations are purchased equipment, thus giving a buyer little rental revenue. And none of its installed equipment—the IRIS, Series 10,000 and Mitra lines—is compatible with either Honeywell or IBM hardware.

So, Honeywell Bull's interest in an investment in the French company would be as an avenue into Unidata, a three-nation marketing cartel of sorts whose other two partners are Siemens of West Germany and Philips of the Netherlands. Unidata's products, announced and unannounced, have some compatibility with IBM, such as the 370 instruction set and byte orientation. But they also have some architectural differences from model to model because each of the partners took part in the design of one or more models. A fully compatible line isn't expected until 1979 or 1980.

Unidata's model 7740 and 7750, which are CII designs, somehow manage to fit into the Honeywell line if one uses superficial measurements. They have a range of 96K to 2,048 megabytes of memory, offer very competitive access time of 615 nanoseconds per 8 bytes, and run about $15K to $50K a month. They would fit, seemingly, in size between the Honeywell Information Systems models 64 (CHB designed) and the 66. The 64 stops at 256K and larger 68 models would eliminate CII's (or Unidata's) need for the 7760 and 7770, now in the planning states at CII.

Market share

Siemens has 18% of the installed base in West Germany compared with 6.9% by the Honeywell affiliate. CII has 11% of the French market vs. 17.3% by CHB. Overall, CHB holds about 11% of the West European market, which is about the same as the Unidata partners. If CHB entered the consortium through a merger with CII, the Honeywell affiliate would enhance its share of the European market and in return provide the consortium with overseas marketing clout.

In such a deal the Honeywell sharp


Plug this in to ordinary power and your computer might teach you an expensive lesson.
Power put out by utilities is fine for toasters, light bulbs and electric typewriters. But sometimes it's not right for computers. Slight over-and-under voltages or changes in AC frequency can throw a computer off-stride. Cause it to drop random bits of data. Wipe off some or all of its programmed memory. Or even produce physical damage. The results? Data delays, late deliveries, dissatisfied customers —the same problems a computer is supposed to solve.
These disruptions are more than a headache. They're extremely costly. In some cases, they can run well over $100,000 in downtime and repair bills for a single year. And that figure doesn't include their overtime costs.
To achieve super-clean, no-break electricity, a computer needs an UPS (Uninterruptible Power Supply) system. Exide is the only company that makes the whole UPS system. A solid-state rectifier/charger. A static electronic inverter. And heavy-duty battery. As the utility's power passes through these components, any minor or major electrical fluctuations are eliminated.
In fact, a number of utility companies themselves use Exide UPS systems to protect their computers. Other applications for UPS include data transmission equipment, telephone switchboards, or any critical instrumentation.
ESB Exide
Box 5723, Phila., Pa. 19120
Exide is a registered trademark of ESB, Inc., Phila., Pa., for batteries and systems.
CPU A
All systems go with Exide.
CIRCLE 41 ON READER CARD

news in perspective

pencil boys would have to consider what to give up in return for that stronger foot in Europe. The French government no doubt would want a French majority interest in a merged company. This would require that Honeywell give up 17% of its 66% ownership. But it couldn't give up management control because the CHB company manufactures the models 61 and 64 of the new Honeywell series 60 line and some peripherals which HIS sells worldwide.

And there's the problem of untangling the interests in CII, a company formed in 1966 through a combination of pieces of computer interests of many companies. The French company's major owner is Fininfour, a holding company owned 52% by Thomson/CSF and 48% by CGE. Fininfour holds 59.6% of the CII action, followed by the French government with 28.8% and Schneider, S. A. with most of the remainder.

Where's the cash

Added to this is Honeywell's cash position. Has it enough to buy in? The company's 1973 annual report showed about $80 million in cash. It floated a $75 million bond issue in 1974. (Some observers suggested that it might be the other way around: CII might buy CHB. A French newspaper report suggested CHB might go for as low as $50 million, highly unlikely for 66% of a firm doing $500 million a year). Meantime, French government officials are known to have met last Dec. 16 with German government officials presumably to discuss Unidata financing. This led some to suspect that Unidata itself might come to the aid of CII.

Perhaps the wildest of the mid-December rumors was one that the French government had looked for support from Iran. French ministers supposedly visited the Shah of Iran to discuss both financial support for CII and preferential treatment for Unidata products in Iran's current aggressive industrial development and automation program. What was strange about this rumor is that the Shah is understood to have fixed on Honeywell as the supplier for its automation program. The Shah, it's said, is a distant relative of a Honeywell sales executive in Italy.

(This story was written from reports by International Editor Angeline Pantages and European Editor Nancy Foy).

(Perspective continues on page 118)


It's so good...
READ
EDIT
WRITE
ONLINE
REWIND
8400
datacassette
POWER
TECHTRAN
TECHTRAN

News in Perspective

BENCHMARKS . . .

ADAPSO Wants Fast Action: The Assn. of Data Processing Service Organizations (ADAPSO) has called for "prompt and determined action" from the Dept. of Justice in its antitrust case against AT&T. "The computer services industry, and the users of data communications services need rules and guidelines on which to base corporate investment and development plans. A prolonged case could have damaging effects," said John Duffendack, chairman of ADAPSO's Committee on Data Communications and vice president of Cyphernetics, Inc., Ann Arbor, Mich. Jerome Dreyer, ADAPSO executive vice president, said "increased competition within the data communications industries resulting from the Justice Dept.'s suit could improve technical and price performance for users of data communications.

AFIPS Now 15 Strong: Directors of the American Federation of Information Processing Societies (AFIPS) unanimously elected the Data Processing Management Assn. and the Institute of Internal Auditors, Inc. (IIA) as constituent societies, increasing AFIPS' membership to 15 nonprofit, professional societies involved in the development of information processing technology and its applications. Both DPMA and IIA will be represented on the AFIPS board. DPMA appointed Dr. Carl Hammer, Univac Sperry-Rand; Walter A. Johnson, Consolidated Paper Co., Inc., and James B. Sutton, immediate past president of DPMA, to the board. William E. Perry, Director of Research of the Institute of Internal Auditors, will represent IIA.

Million Dollar Freeze: Delay in conversion of a San Francisco traffic warrant system from manual to automated, could cost the city $1 million. The city began the conversion about two years ago and found the job bigger than expected. "A traffic program has so many ins and outs and ifs and buts, you wouldn't believe it," said one participant in the effort. Because it was impossible to run the manual system and the computer system at the same time, a freeze on traffic warrants was imposed last Feb. 2. Officials expect the conversion to be completed some time next month but agree there will be a loss. "It's bound to be large," said Dave Donohue, chief clerk of the city's traffic fines bureau. "You know the transient nature of our population and the longer you delay the greater your loss." The widely quoted estimate of $1 million has been called conservative by some.

Savings With COM: A General Accounting Office (GAO) study has estimated that conversion to computer-output-microfilm (COM) at eight federal agencies could save the government $1 million annually in data processing expenditures. The study noted that federal organizations currently using COM have obtained such benefits as lower cost, faster information output, more versatile output formats, and easier handling and distribution of reports. It showed that eight potential users of COM could convert 1.2 million pages of an estimated 3.9 pages of reports, produced monthly, to microfilm to achieve the $1 million saving.

Antimonopoly: Computer Industry Assn. president Dan L. McGurk has come up with three "embryonic suggestions" for curbing monopoly. Proposed at a meeting of the Executives' Club of Chicago, they are a graduated income tax on corporate profits above $100 million; tax credits for monopolies that

DAN L. MC GURK

break themselves up voluntarily; and an explicitly stated limit on just how much control one company can maintain over any single marketplace. McGurk called his suggestions the sort needed "if we are going to return to a real free enterprise system rather than continue on our present course of greater and greater concentration of power, imperfect market mechanisms, and the inevitability of greater and greater direct government intervention through regulation in our economic system."

Certification Legislation: The Society of Certified Data Processors (SCDP) has drafted model legislation for regulating data professionals and has submitted it to state legislatures as a guide for state dp licensing laws. The legislation would set up state boards of registration which would rule on titles and practices and could impose fines of $100 to $500 or jail sentences of up to three months, for violations. It also would require all dp shops to have at least one "registered" professional data processor on staff or to have one approve operations. It suggests a variety of combinations of education, experience and test taking which could lead to state certification.

And Now Xerox: Bringing up the rear behind IBM, Univac, Honeywell, CDC and NCR, Xerox Corp. has increased prices on most of its computer products by an average of 8%. The increase will not affect the purchase price of central processing units of the firm's new 530, 550 and 560 computers but lease prices for these models will go up. Sigma computers and their peripheral equipment, whether purchased or leased, will be affected by the increase. All computer maintenance services also will go up by 8%. The increases are effective immediately for new business. For currently installed equipment, the new prices will become effective on the termination date of lease or maintenance agreements, but in no case earlier than April 1, 1975.

New Route for Memorex: Memorex Corp. has gone into the third party maintenance service business. The Santa Clara, Calif., firm has 50 field engineering offices in the U.S. and 111 worldwide including Europe, Middle East, Africa, Canada, Japan, Australia, and Latin America. "By capitalizing on our existing large-scale maintenance capabilities and facilities, which we have in place to serve our large lease and purchase customer base, we are able to enter the big, expanding and specialized third party service business with minimal investment and in a very short time," said president Robert C. Wilson.

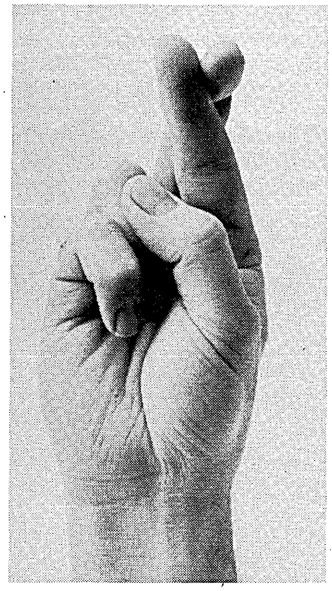
Watson Rejoins Time Board: Thomas J. Watson, Jr., chairman of IBM's executive committee, who resigned as a director of Time, Inc. in 1968 because the company went into a business venture with General Electric, then in the computer business, has been reappointed to the board and will stand for election at the annual meeting next April. The business venture of Time, Inc. and General Electric has been abandoned. Terms on the Time board are one year. Watson earlier had served on the board for 10 years. □

Congratulations: you didn't have a computer fire again last year.

You're one of the lucky ones.

Unfortunately too many companies last year did suffer major business interruptions due to fires in or near their computer rooms.

What's even more unfortunate is the fact that a lot of the damage, clean-up and downtime could have been avoided.



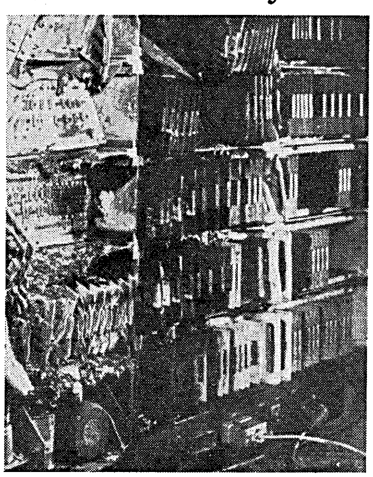
Days of Downtime vs. a Few Seconds of Halon

These companies could have been protected by a high speed Fenwal Halon Fire Suppression System.

The system that snuffs out fires dry. Just seconds after they start.

And lets you get right back to work. No wet mess to clean up.

With some systems you've got to evacuate a room before the extinguishing agent can go to work.



But because Halon 1301 is harmless to people, it can start snuffing out the flames immediately. Which gives you the fastest jump on the fire.

With ordinary systems there's usually at least 48 hours of clean-up before your computer can go back on line.

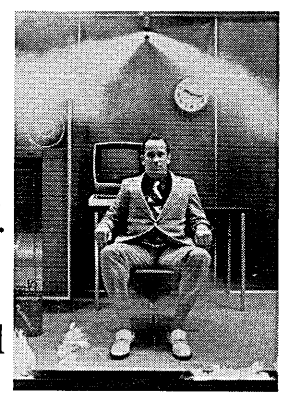
With a Fenwal system there's virtually no clean-up, no shorted-out wires. No electrical shock hazards. No damage to tapes or records.

Fenwal's unique, modular system permits rapid agent discharge and easy extension of existing systems.

Why Push Your Luck?

The consequences of a computer fire are a lot more devastating than you might think. Despite all the precautions you take.

At Fenwal we've got documented proof that our Halon Fire Suppression Systems are *the* solution to the damage and downtime of computer room fires.



It's proof you can see for yourself. In a film called "The Fireaters".

We think it will convince you that you need more than luck to keep your computer in business.

To arrange a viewing, call us at (617) 881-2000. Or write to Fenwal Incorporated, Ashland, MA 01721. A Division of Walter Kidde & Co., Inc. Our local, service-oriented distributors are listed in the yellow pages under "Fire Protection".

FENWAL

Nobody in the world has more experience in fire and explosion suppression systems. FM Approved – UL Listed

Cut keystrokes by what happens to

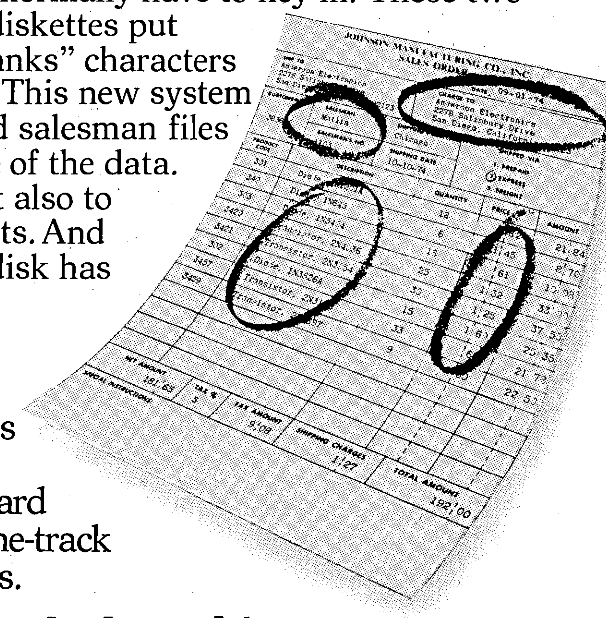
CORPORATE OFFICES: Ann Arbor, Michigan 48104 (313) 971-0900. DISTRICT SALES OFFICES: Atlanta (404) 457-1166 • Boston (617) 890-7290 • Chicago (312) 297-5200 • Cleveland (216) 831-8625 • Columbus (614) 888-8657 • Dallas (214) 521-6710 • Denver (303) 458-0794 • Detroit (313) 355-5770 • Greensboro, N.C. (919) 274-2964 • Hartford (203) 529-1100 • Houston (713) 688-5224 • Indianapolis (317) 784-6779 • Kansas City, Mo. (816) 842-7799 • Los Angeles (213) 640-0120 • Miami (305) 592-1533 • Milwaukee (414) 257-3780 • Minneapolis (612) 854-2309 • New York (212) 371-9050 • Philadelphia (609) 665-1170 • Pittsburgh (412) 922-3350 • Portland, Ore. (503) 227-5672 • San Francisco (415) 349-6626 • St. Louis (314) 878-0090 • Washington (703) 527-0200. SERVICE CENTERS IN 80 CITIES. CANADA: Sycor International Ltd., Toronto (416) 429-0883.

50% and guess data entry costs?

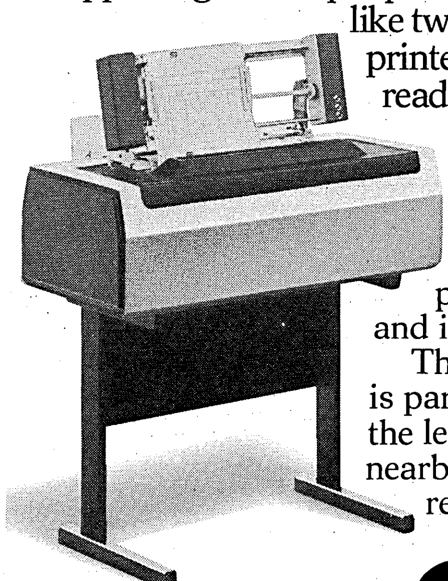
Costs are reduced and so are errors. Use of Sycor's 340 intelligent terminal with dual flexible disk in a typical order entry application can, in fact, reduce keystrokes by 50%.

And fewer keystrokes means greater throughput with fewer operators and a sharp reduction in error rates.

Our Model 340 with dual flexible disk may be used to automatically retrieve data from a file that an operator would normally have to key-in. These two IBM-compatible diskettes put 500,000 "fill-in-the-blanks" characters at your operator's fingertips. This new system allows you to store customer, product/price and salesman files right where you need them most—at the source of the data. And you can use it not only to retrieve data, but also to maintain and update files—even generate reports. And you can do it fast... because the Sycor flexible disk has the fastest access time in the business.



We'll surround you with peripherals. Another advantage of our Sycor 340 is its large supporting cast of peripheral equipment. Things like two speeds of matrix printers, a line printer, a card reader, and seven and nine-track magnetic tape drives.



From the people who brought you intelligence. This new concept of remote data base management wouldn't be possible without the intelligence of our Model 340 and its powerful TAL programming language.

The Sycor 340 and its wide variety of peripherals is part of the family of intelligent terminals that have made us the leader in the field. For more information, contact your nearby Sycor representative. He's got all the answers for reducing your data entry costs.

SYCOR

LOOK AHEAD

(Continued from page 18)

The CIA expects more than 10,000 internal IBM documents to be filed in the Justice Dept.'s case and from that number the association will cull the "most salient materials" and make them available. The CIA, at 16255 Ventura Blvd., Encino, CA 91316, has already received orders for the documents from such far-off places as Australia and Germany.

EXPLETIVE NOT DELETED
Aspen Systems Corp. claims that one of the big advantages of its Instant Index--a computerized litigation research system for attorneys--is the fact the service can store "every word of every document" including expletives. One client is grateful for that feature. The client was able to locate a discussion, buried in court transcripts, by using the index and keying in an expletive he remembered had been used frequently during the discussion.

THE THINGS DATA BANKS CAN BE MADE OF
Portions of a report by the Senate Subcommittee on Constitutional Rights, read into the Congressional Record during debate on the Senate Privacy Bill, turned up the fact that applicants for federal jobs in some agencies have been subjected to such true/false questions as: "I am seldom troubled by constipation... My sex life is satisfactory...At times I feel like swearing...I have never been in trouble because of my sex behavior...I do not always tell the truth...I have no difficulty in starting or holding my bowel movements...I am very strongly attracted by members of my own sex...I like poetry...I go to church almost every week...I believe in the second coming of Christ...I believe in a life hereafter ...My mother was a good woman...I believe my sins are unpardonable...I have used alcohol excessively...I loved my Mother...I believe there is a God." The portions were introduced into the record by Sen. Sam Ervin, the bill's sponsor, as "showing the need for this (privacy) legislation."

RUMORS AND RAW RANDOM DATA
Interdata this month is announcing a 30cps serial impact printer whose built-in 4K microprocessor allows it to be used as a communications terminal. Called the Carousel because of its cup-shaped print mechanism, the printer has been under development at Interdata by former employees of dormant I/O Devices, Mountain Lakes, N.J., and will sell for $1500...We hear the first Amdahl computer to come off the Japanese assembly line of Fujitsu Ltd. arrived in the U.S. late last month. It's installed at the Amdahl Corp. facility in Sunnyvale, Calif., where the operating system is expected to be running at month-end. Then in April the virtual memory 470V/6 will be delivered to an unidentified user on the East coast...Monday Night Football commentator Alex Karas, one of the few people in the world who still calls a computer a "Univac," repeatedly during the recent season complimented fellow ABC commentator Howard Cosell for his wealth of football statistics with "you're a real Univac, Howard." Sperry Rand people, though pleased with the exposure on national tv, haven't acknowledged it to Karas. Sperry sponsored a post football game show on rival network NBC... Some down under notes: Australia's Computer Society reports that the 2,500 computers installed in that country are worth $500 million and that at least 8,000 persons are involved in programming them at a total annual salary of $80 million. It says some 450 computers were installed in 1973 at a value of $100 million...Singer is the first to crack the Australian point-of-sale market with its model 10-based retail terminal, the 925. Forty-nine terminals are being installed at Waltons department store whose central computer is an IBM 360.

Three tape drives.
One inventory.

Compatible tension-arm and vacuum column tape drives.

Bright Industries' tension arm and vacuum column tape drives look almost the same, work almost the same, load the same and interface the same. That's because all three drives share 80% of the same parts. What that means to the OEM manufacturer is a drastic reduction in spare parts inventory requirements. Increased efficiency in field maintenance. And commonality of operator features that will not confuse the end user.

A drive for every application.

Up to 45 or 75 ips. 200, 556, or 800 bpi NRZI and/or 1600 bpi PE read/write electronics in the same transport. Three read thresholds. Individual track write deskew. IBM compatible head quides. Built-in daisy chain capability. And industry compatible interfaces. Name it, you'll find it. With us.

Low cost of ownership for a cost conscious industry.

Combine single-source availability with competitive pricing. Then, consider the advantages of lowered inventory costs, lower training and maintenance costs, and, greater customer satisfaction. What you get from Bright Industries is more. For less. But maybe you'd like to know more about our tape drives, what they do and how they can save you money . . . write us. Or call us. We're here to give you answers.

One source.

Bright
INDUSTRIES INC.

A Division of Data Disc, Inc.

686 Maude Avenue Sunnyvale, CA 94086 (408) 735-9868

CIRCLE 31 ON READER CARD

hardware

Off-line

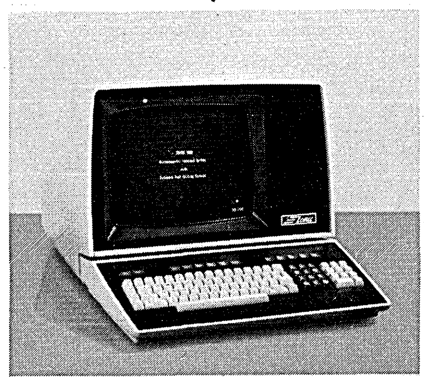
Computers have been around for so long that parts of them will soon start showing up at swap meets--as evidenced by this advertisement in a recent issue of "Hughes News", Hughes Aircraft Co.'s house organ. "Computer equipment: 16K x 36-bit 500 nsec core memory, needs work, $500; Teletype mod 28 print mechanism, $100; memory drum, $30; cassette drive, $100; core planes, $5; delay line, $20; hi-speed paper tape reader, $40; ASCII to EBCDIC ROMs, $15 pr." On the same subject, computer components are already being designed so that they can just be thrown into the dishwasher and run through the cycle with the dishes. At least Honeywell's Micro Switch claims its Hall-effect solid state keyboard can withstand this kind of treatment. Note: keep the water temperature under 135° if you try it.

National Semiconductor, who has been making microprocessors longer than nearby Intel Corp., has introduced a new one, called PACE, for Process and Control Element. It's a 16-bitter with a stunningly low price: $161 in quantities of 100. Prices like these lend credence to figures developed by Arthur D. Little that show that the market for microcomputer components could grow to about $200 million by the end of the decade with a significant fraction of that figure accounted for by new markets. Another interesting observation on the microcomputer phenomenon at A.D. Little's recent microprocessor conference came from a Motorola marketing manager. "Ninety percent of our customers are redesigning old products or creating new products around the microprocessor unit because it is more cost effective than traditional hardware logic." The December conference drew 175 executives interested in the economics, technology, and application of small-scale processors.

Intermem Corp., Wappingers Falls, New York, has received one of the coveted IBM "it's okay" letters for attaching the memory manufacturers 7195 core memory to IBM's largest machine, the 370 model 195. It's claimed that a 4-megabyte 195 so equipped costs less than two 3-megabyte 168s.

Intelligent Terminal

This relatively new manufacturer has come out with a powerful intelligent terminal with a very competitive price tag. The 9002 features data bus architecture; ROM/PROM control programs; RAM/ROM/PROM application programs; 128 code ASCII set; 15-inch diagonal crt for displaying 2K characters; stand-alone or clustered operation; task oriented function keys, etc. There are operator controls for contrast/brightness, volume (acoustic feedback level), and baud rate. Communications are asynchronous at rates



of 110-4800 baud, full- or half-duplex, character or block transmission. Options include synchronous transmission at 1200-9600 baud rates, and asynchronous transmissions up to 9600 baud. The list price is $3,485 for 2K of refresh memory, an RS232 interface, microprocessor, power supply, and 2K bytes of RAM. An order for 10 drops the per unit price to $2,614. Deliveries have begun, with small orders quoted as 30-45 days. ZENTEC CORP., Santa Clara, Calif.

FOR DATA CIRCLE 216 ON READER CARD

Intercomputer Link

More and more computers are being physically hooked up nowadays, and here's a product to simplify the task. It's a coaxial cable capable of linking remotely located computers over a single line, for transmission at up to 500 kilobaud. The cable interface unit, CCI4000, permits operation asynchronously over cable lengths up to 40,000 feet long. Loop back capability provides for redundancy in the event the cable is opened or shorted. Typical applications include redundant cpu installations, remote processing, remote memory dumps, and various process control and time-sharing applications. The price for each interface is typically less than $2K. Plan on four months for delivery. COMPUTROL CORP., Danbury, Conn.

FOR DATA CIRCLE 217 ON READER CARD

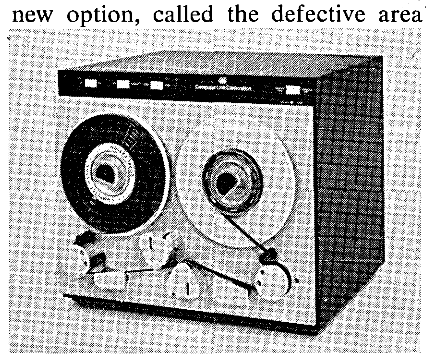
Communications Processor

The 3650 has been groomed to do battle with IBM's 3704 and 3705 communications processors. It can terminate up to 64 lines in any combination of synchronous and asynchronous protocol, and provides for a sustained data throughput rate of 30,000 cps. It provides support for all standard IBM terminals, and for a number of non-IBM terminals. The system has a maximum main storage size of 256K bytes and operates at 650 nsec. Fully compatible with the 3704/3705 in either emulation or NCP mode, no changes in host application or teleprocessing software is required. It can simultaneously support two active IBM host processors, and allows for dynamic network reconfiguration through commands initiated either from the 3650 console or from the terminals. When used as a remote communications concentrator, the 3650 features down-line program loading from a locally-connected 3650 or the manufacturer's larger 3670 product. Sale prices range from $45-150K, with monthly lease rates starting at approximately $900. COMTEN, INC., St. Paul, Minn.

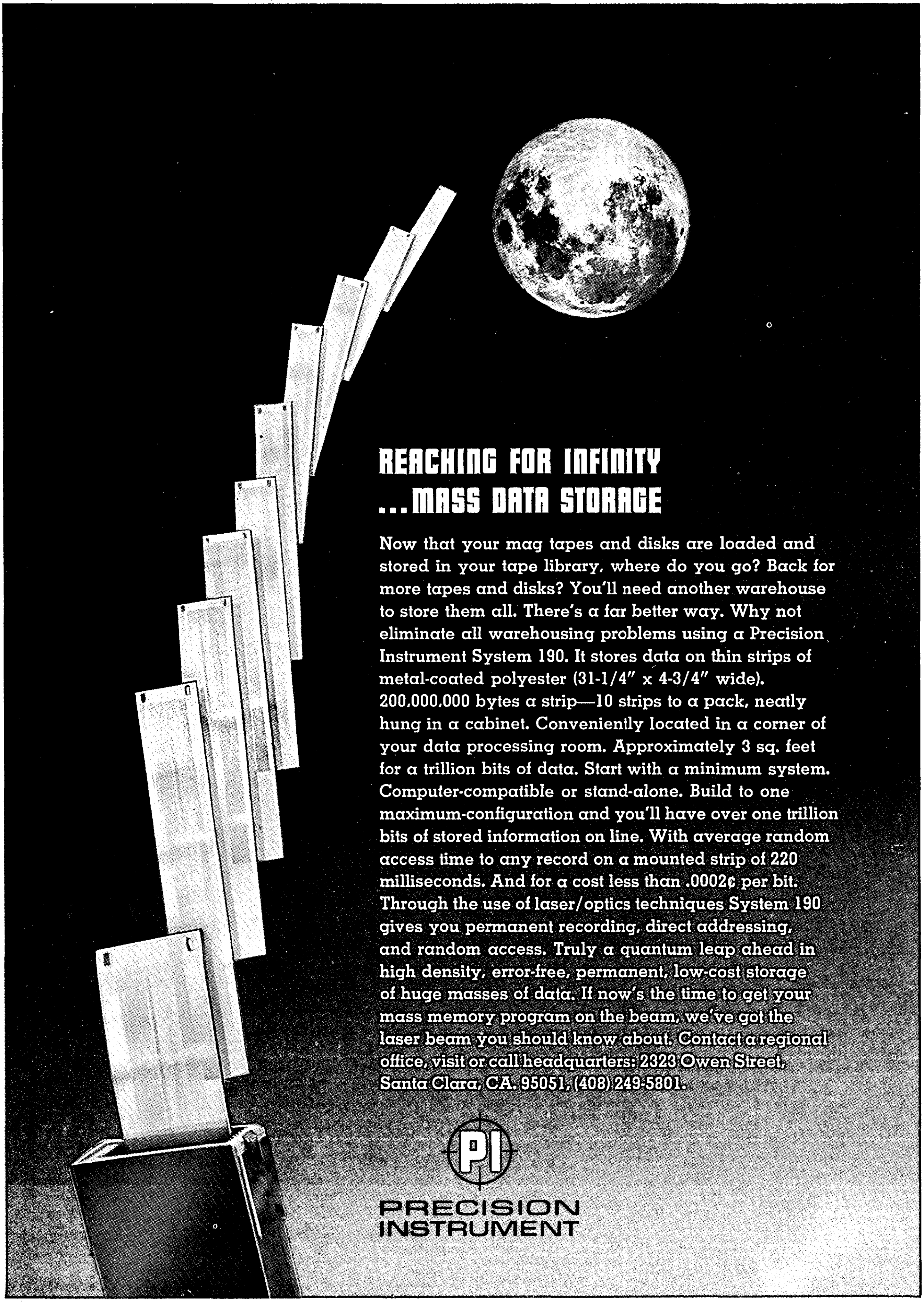
FOR DATA CIRCLE 218 ON READER CARD

Tape Cleaner/rewinder

The model 101 is a double-pass tape cleaner/rewinder with dual capstans for independent tension control during both cleaning and winding modes. A new option, called the defective area



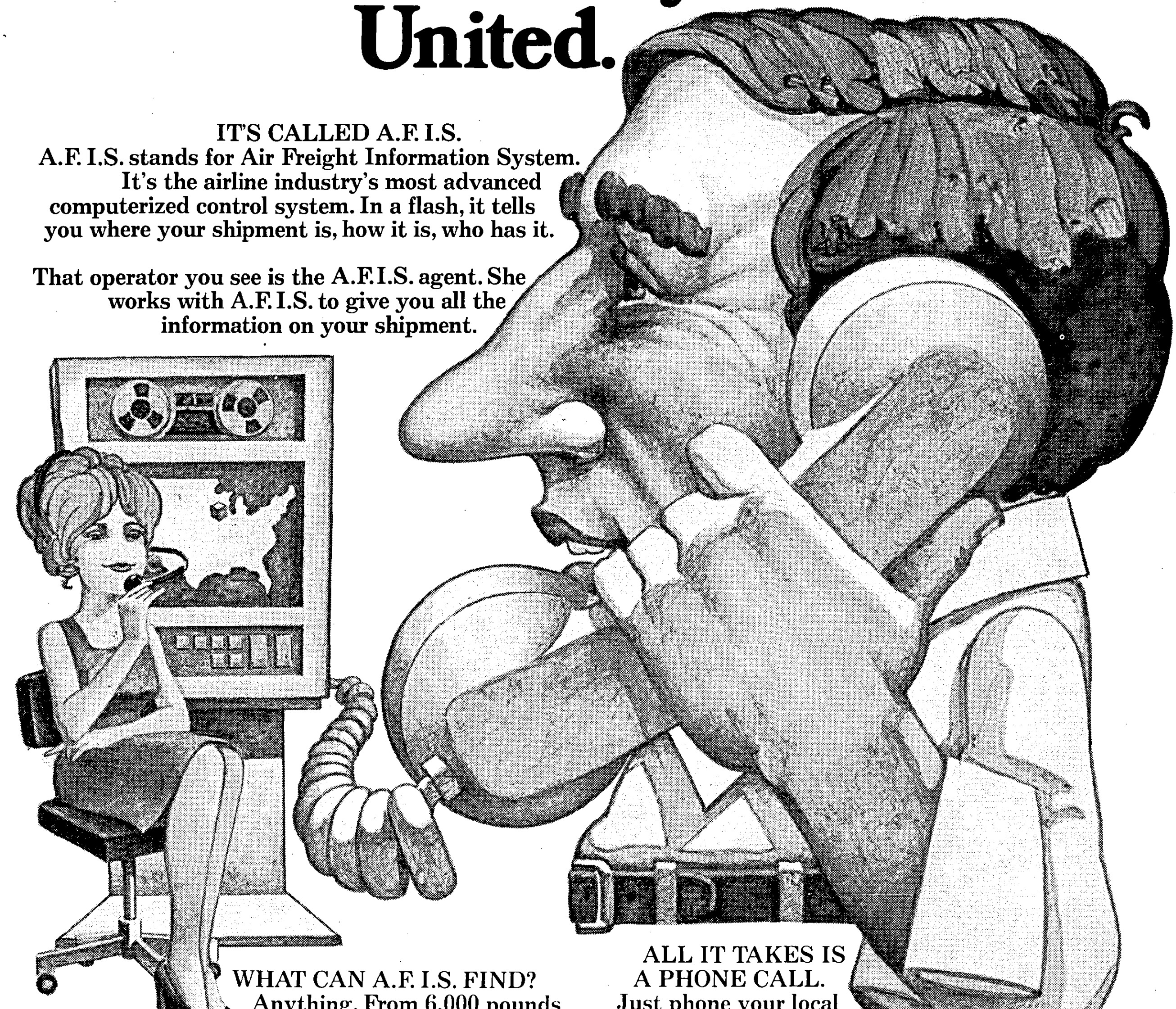
locator, allows the operator to more easily and precisely locate errors on tape. The unit operates at 180 ips. The price is $2,200. COMPUTER-LINK CORP.,



Regional Offices: New York, Washington, D.C., Houston, St. Louis, Los Angeles, and San Francisco.

You wish somebody had an electronic genius to tell you where your shipment is-while you're still on the phone?

Somebody has. United.



IT'S CALLED A.F. I.S.
A.F. I.S. stands for Air Freight Information System. It's the airline industry's most advanced computerized control system. In a flash, it tells you where your shipment is, how it is, who has it.

That operator you see is the A.F. I.S. agent. She works with A.F. I.S. to give you all the information on your shipment.

WHAT CAN A.F. I.S. FIND?
Anything. From 6,000 pounds of machinery in our new LD-11 container, to 100 pounds of clams in the belly of a freighter. If we have it, we know where it is. And so do you.

ALL IT TAKES IS A PHONE CALL.
Just phone your local United Jet Freight office. All you need is the airbill number. Or we can locate your shipment with your United account number. Or the shipper's order number. Or just the shipper's name.

No.1 in the U.S. sky

UNITED AIRLINES CARGO

hardware

Burlington, Mass.
FOR DATA CIRCLE 219 ON READER CARD

Microcomputer

This subsidiary of the Corning Glass Works has developed a microcomputer it claims operates 10 to 20 times faster than any microcomputer now on the market. If that's true, it would be the first microcomputer with approximately the speed of the average minicomputer. Each system includes a central processor, memory (ROM/PROM for program storage and RAM for working storage), and direct register input/output interface with variable field address capability. Instructions are executed on the order of one every 300 nsec. Program storage for the first four models of the MicroController systems varies from 512 to 4K 16-bit words, and I/O ranges from 32-224 interrupts. In quantities of 100, the systems are priced from $370 to $1,460 each, depending on memory size. Production quantities will be available during the first quarter of the year. SCIENTIFIC MICRO SYSTEMS, Mountain View, Calif.
FOR DATA CIRCLE 221 ON READER CARD

High Accuracy Plotter

Scientific and Engineering applications requiring .2% accuracy in plotting graphics will probably be the first homes for the model 5200 electrostatic printer/plotter. With a resolution of

200 dots/inch both vertically and horizontally; the 5200 prints alphanumeric data at 650 lpm and plots graphic material at 1.65 ips. Both Helvetica Medium and Times Roman type fonts are available as standard equipment, with other graphic arts fonts as extra cost options.

The 5200 has an eight-bit data path

product spotlight

Intelligent Terminal

The G77 is offered to replace or expand the present IBM 3277 model 2 terminal. Nicknamed "The Plug", the terminal is offered without a matching controller; it uses the IBM 3271 or 3272 model 2 control units. That way, neither the user, nor this vendor, installs a product that could be obsoleted by any future IBM development.

The G77 contains all 3277 features, but adds as standard equipment a home key to immediately return the cursor to home position from any display location; a repeat key used with any character key to write the character repeatedly on the screen; automatic variable initialization, which identifies all variable fields on the screen by means of a tiny dot in each position in which data is to be keyed; and an adjustable response keyboard.

Optional features include a blinking cursor, upper/lower case character sets for textual work (no extra cost), a numeric lock to prevent entering incorrect data, an audible alarm, a 10-key numeric pad, and a key lock. Depending on specific configuration and options, prices for "The Plug" are generally 25% under IBM's product. GENESIS ONE COMPUTER CORP., New York, N.Y.
FOR DATA CIRCLE 215 ON READER CARD

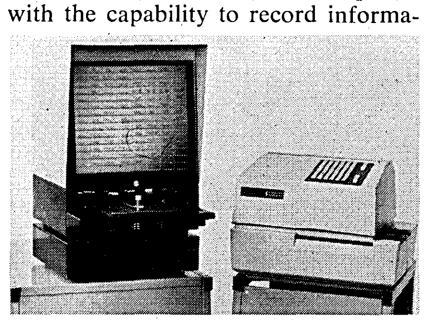
for input from the host computer, and comes with a full 96 character ASCII upper/lower case font. The printer has a 1,000-sheet fanfold paper-handling capacity and accepts 400 feet of paper rolled on a three-inch internal diameter core. A paper cutter is available as an option. The 5200 is priced at $9,700. GOULD INC., INSTRUMENT SYSTEMS DIV., Newton, Mass.
FOR DATA CIRCLE 220 ON READER CARD

Honeywell Interface

The S100 is an asynchronous interface unit designed specifically for use with Honeywell H316, DDP416, and DDP516 minicomputers for interfacing virtually any RS232C compatible device. These devices include line printers, crts, modems, and ttys. Models are available with from 1-8 channels. Baud rate, data word length, parity mode and number of stop bits are independently programmable. Other choices include 5, 6, 7, or 8 data bits, odd/even or no parity, full- or half-duplex operation, etc. The baud rates range from 75-9600 baud and jumper selectable addresses extend this capability. Prices range from $3500-5K depending on configuration. STRITEC, INC., Westlake Village, Calif.
FOR DATA CIRCLE 222 ON READER CARD

Electronic Catalog

There's no telling what applications might be found for this product, called by its developers an electronic catalog—which might not be the best possible name but we can't think of anything better. The system is, in effect, an electronic code generator within data collection units to provide storerooms, tool cribs, or other transaction points with the capability to record informa-



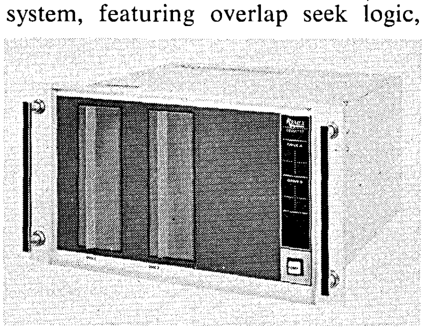
tion without manual coding or handwriting. The terminal, when connected to a punching unit, generates unique code numbers in man- and machine-readable form as items are selected from a microfiche menu displayed on the screen. Up to 5,400 printed item descriptions can be stored on one microfiche and presented as 45 pages of

hardware

up to 120 items each (tools, materials, tests, supplies etc.). The punching unit records the selection in its numeric equivalent automatically on a document that can be immediately used for action or file items, and as direct punched card input for data processing. Prices start at $4,530, or $125/month. THE STANDARD REGISTER CO., Dayton, Ohio
FOR DATA CIRCLE 223 ON READER CARD

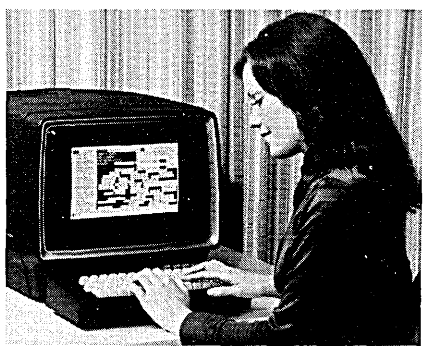
Modem
What is claimed to be the first 9600 bit per second modem to operate on unconditioned private telephone lines has been introduced. The MCS9600 can be multiplexed to mix 2400, 4800, and 7200 bps data rates. It also possesses a switched carrier control capability that enables multiplexing to take place in multipoint networks without any hardware or software modification to the central computer or communications front-end. The manufacturer says the need for line conditioning equipment has been obviated with the MCS9600 by designing noise filtering and equalizing techniques that significantly reduce the problem of signal distortion within the modem itself, so that the unit's total filtering and equalizing capabilities can be devoted exclusively to improving leased line signal quality. The MCS9600 is priced at $9700 and is in production. INTERTEL, INC., Burlington, Mass.
FOR DATA CIRCLE 224 ON READER CARD

Floppy Disc Peripheral
DEC PDP-11 and Data General Nova minicomputer users are offered the RFS system that consists of from one to four floppy disc drives, power supply, cables, and formatter electronics. The system, featuring overlap seek logic,



will simultaneously step four drives to new tracks. The interface controller option includes both direct memory access and programmed I/O, the latter for more efficient diskette initialization. Data is stored in IBM 3740 format, providing 1.9 megabits of data storage per drive. The transfer rate is 250 kilobaud, and the random average seek time is 176 msec. Basic systems start at $2,695. REMEX, Santa Ana, Calif.
FOR DATA CIRCLE 225 ON READER CARD

Input/Display System
The TD 820 input and display system can be made up from various combinations of crt terminals, cassette tape stations, small disc units, and three different types of keyboards for applications in data collection and display, and transmission in on-line networks. The crt features the ability to display conventional white characters on a black background as well as black characters on a white background, so that selected fields of data can be displayed in contrast to each other. Additional capabilities permit selected character or



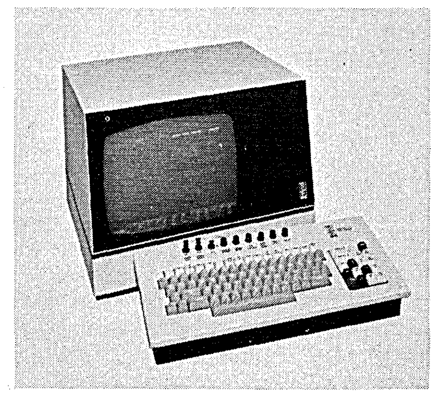
field blinking, and "blank video" to allow security codes to be entered but not displayed. Both 960 and 1920 character formats are offered, 12 or 24 lines of 80 characters.

Up to two magnetic tape cassette stations can be used with the TD 820, or two floppy discs, each with a capacity of 243,000 bytes. Line printers operate at 85, 160, or 250 lines per minute. Typical systems are in the $6K range, or $160-170/morth on a one-year lease. BURROUGHS CORP., Detroit, Mich.
FOR DATA CIRCLE 226 ON READER CARD

Minicomputer
This manufacturer's very successful line of 2200 model desk-top minicomputers has been broadened with the addition of a smaller-scale machine, the 2220/2200S. The combination minicomputer/calculator/crt unit, running the BASIC language and using a Philips-type cassette unit, is priced something under $5,500. The cpu includes a complete hardwired BASIC interpreter, 4K bytes of memory (expandable to 16K), and the ability to operate an additional peripheral, such as a printer.

Frequently used data manipulation statements and mathematical functions such as SIN, LOG, HEX and CONVERT, are built in. Output is displayed on the 9-inch diagonal crt in 16 lines of 64 characters. Delivery is quoted as four weeks. WANG LABORATORIES, INC., Tewksbury, Mass.
FOR DATA CIRCLE 229 ON READER CARD

Text Editor Crt
The 500-TE intelligent terminal features 8,000 character data capacity, with up to 4,000 characters displayable at a time on the 14-inch crt in a 100 x 40 array. All data can be browsed or edited by scrolling, up-down as well as



left and right. The left-right scroll feature permits viewing line lengths of up to 165 characters.

The terminal features reverse video, underline, blink and dual intensity, as well as selectable transmission rates, open and close, tab, word wraparound, character strike over, and move or copy any block of text. An RS232 interface is standard. Prices start at $7K. SYS COMPUTER CORP., Hackensack, N.J.
FOR DATA CIRCLE 230 ON READER CARD

Disc Subsystem
Data General has introduced a high-performance moving-head disc subsystem that attaches to its line of 16-bit minicomputers, enabling the Nova or Eclipse lines to take on increasingly complex applications. Each drive stores approximately 46 million words on the 20-surface pack, with each of 19 data storage surfaces containing 411 tracks. The head positioning time is 30 msec, and the transfer rate is 403,000 words/second from the 3600 rpm unit. The first drive and controller are priced at $30,500, with subsequent drives priced at $24,500. Shipments begin in February. DATA GENERAL CORP., Southboro, Mass.
FOR DATA CIRCLE 227 ON READER CARD □

software & services

Updates

The jury is still out on whether computer techniques will ease the learning of arithmetic in the schools, but early results suggest that might just be the case. Two Chicago-area elementary schools are using a CAI system developed by Automation Software Associates of that city with good results. An unexpected benefit of the system is its use by so-called "learning disability" children, students who have for some reason other than mental retardation been unable to learn basic arithmetic. Preliminary results are very encouraging. The system, built around a Computer Automation, Inc., Naked Mini cpu, features the ability to remember specific types of problems the child is having trouble mastering and to alter the testing "menu" to each particular child's needs. Additionally, the system does its own grading and supplies figures on "mean time per problem--an indication of how proficient the child really is.

We recently stated that American Used Computer Corp.'s bargains on orphaned Memorex MRX 40 and 50 systems was only tarnished by the fact that nobody was providing any software support for the impressive hardware. Thanks to Programming Research Associates, Inc., Crystal, Minn., we stand corrected. Former Memorex employees founded the firm one year ago this month for the express purpose of continuing support for the equipment. Products supported include the operating system, assembler, sort, IBM 360 model 20 emulator, utilities, COBOL and RPG language processors.

The Association for Educational Data Systems has announced plans for its 12th Computer Programming Contest conducted annually for students in grades 7-12. The deadline for entries in the contest is March 1. Students wishing more details and an application form should write to AEDS Programming Contest, Dr. Gary Bitter. Arizona State Univ.. College of Education, Tempe, Ariz. 85281. The winner will receive a $100 U.S. Savings Bond plus an all expense paid trip to the AEDS convention later this year. Other prizes will also be given.

Microprocessor Programming

Lingua-franca is a perfect name for this software package (check your *Webster's* for the definition) that is used to program microprocessor memories. Written in BASIC for minicomputer portability, the package is a hybrid of an assembler and a simulator. The user creates assembler language subroutines for each command in a particular microprocessor's instruction set, and the simulator is used to debug the logic until it is honed to production status. This output, usually in the form of a paper tape, is then used to load the microprocessor's instruction storage module.

An interesting feature of Lingua-franca is its practice of "plagiarizing" from the BASIC language on whatever minicomputer the package is operating on to generate the object code for the simulator. The intent is to shorten the development cycle for programs by using streams of code already checked out, and may be a legitimate software first. Lingua-franca requires approximately 4K 16-bit words of memory or equivalent. The package sells for $1K, or $50/month for both the assembler and the simulator. MICROPROCESSOR ENGINEERS, Scottsdale, Ariz.

FOR DATA CIRCLE 213 ON READER CARD

Performance Monitoring

A large midwestern manufacturing company is making available a performance monitoring system for other users of IBM's OS/360 HASP operating system. Called Dynamic Display Monitor, the module collects and updates information on 38 system characteristics 12 times per minute for display on a system crt terminal or operator's

software spotlight

COBOL Validation and Benchmarking

A lot of exciting new computers are appearing on the scene currently, and users interested in evaluating their performance now have access to a COBOL benchmarking program for the nominal fee of $97.50. The Benchmark Portability System (BPS) takes user source COBOL programs from the native machine, and creates machine interchangeable user benchmark programs and data translation programs. Data translation programs, referred to as data translation routines, translate machine dependent data to machine interchangeable data and validate it as to data content. The programs (benchmark and data translation) are placed in a source COBOL program library on tape (population file.)

FOR DATA CIRCLE 205 ON READER CARD

An additional program offered is the COBOL Compiler Validation System, CCVS Version 6.0. CCVS validates COBOL compilers to ensure their conformance to the Federal Standard as prescribed in FIPS-PUB-21. The system consists of a comprehensive set of audit routines, their related data, and an executive routine that prepares the audit routines for compilation in a particular hardware/operating system environment. Each audit routine is a COBOL program which includes several tests and supporting procedures indicating the result of the tests. The executive routine provides a method for resolving implementor names within the source COBOL-programs. A means for the user to update source programs and generate operating system control cards is also provided. The package is priced at $500.

FOR DATA CIRCLE 206 ON READER CARD

A small library of synthetic COBOL programs has been developed to help users evaluate a large range of computers. While perhaps not as indicative of the true effect a new computer would have on a particular installation's job stream, the SPL stream does have the advantage of being highly portable. Experiments are currently being conducted to determine exactly how representative of a general job stream the package is. SPL is task oriented; can accept compile time or executive time variable parameters, and has had its behavior measured both running independently and in a mix. The package is priced at $97.50. FEDERAL COBOL COMPILER TESTING SERVICE, DEPT. OF THE NAVY (ADPESO), Washington, D.C.

FOR DATA CIRCLE 207 ON READER CARD

console. Among the 38 readouts are initiator numbers; os job classes; priorities; memory requested; jobs backlogged by class and priority; jobs on hold and those awaiting execution printing and punching; present utilization of allocated spooling space; number of tape and disc drives available for mounting; and number of disc cylinders and tracks available for allocation. The Data Display Monitor is priced at $7,500 or $375/month on a perpetual lease. The user gets the source code and, supporting documentation. A.O. SMITH CORP., Milwaukee, Wisc.
FOR DATA CIRCLE 214 ON READER CARD

Data Security

CRYPTEX is a small software package said to be easy to integrate into existing computer programs to protect sensitive data from unauthorized access. Encoding and decoding of user data is by means of a multi-pass byte transformation technique controlled by a pseudorandom number generator. The same process that encodes the user information also decodes the enciphered data. CRYPTEX does not require the user to supply a code key, thus avoiding the problem of inaccessible data in case the key is lost or forgotten, and each CRYPTEX package is structured so that another user of the package cannot decode another user's data. Another feature of the package is that it does not require that encoding and decoding be done in serial fashion: records

Packet Switching

A lot of U.S. computer industry people are still wincing over Canada's oneupmanship in establishing a nationwide digital network in February of 1973. If you're one of them, gird yourself for an even more significant announcement: our north-of-the-border friends will have the first four nodes of a nationwide packet switching network that uses the Dataroute digital circuits operational by the middle of 1976. Packet switching differs from conventional circuit switching transmission techniques by using address codes to route it to its intended destination instead of closing physical switches, like the telephone network. This means that virtually any computer can be on-line to any user using any available (and authorized) data base, from almost any kind of terminal. Another advantage is in error rates: Datapac, the new service, is predicting one undetected error in every 10^{12} bits. For all practical purposes, that's error free performance.

Initially, two types of service will debut, Datapac 1000 service and Datapac 1500. Datapac 1000 is a service for transaction-type communications, involving short inquiries and responses, such as might be used in credit checking applications or point-of-sale. A typical terminal using Datapac 1000 service will handle between two and ten thousand packets (kilopacs) per month, with packet sizes basically consisting of 32 characters. Rates for 1500 level service will be based on a monthly minimum usage of 75 kilopacs. The rate tables get a little complicated, but overall it's estimated that Datapac could reduce the cost of data communications from 10 to 50%, depending on various factors, compared to present systems. TRANS-CANADA TELEPHONE SYSTEM, Ottawa, Ontario.

encoded serially can be decoded randomly. Encoded and decoded data have equal length.

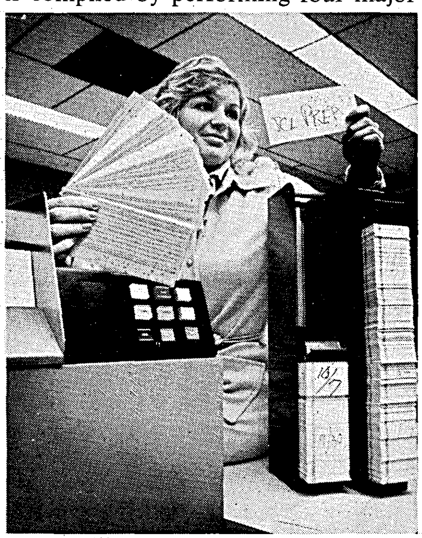
The package is claimed to be highly resistant to known cryptanalytic techniques, and can stand moderate amounts of I/O errors and still be decoded. The possibility of unauthorized use of a dump containing the approximately 1K bytes of CRYPTEX program has been anticipated, so the CRYPTEX program encodes and decodes portions of itself during execution. The package is available in object code form only for IBM OS, DOS, and VS systems for $750. BI-HEX, INC., Teaneck, N.J.

FOR DATA CIRCLE 209 ON READER CARD

JCL Preprocessor

There's certainly a lot of attention being paid by numerous companies—both software vendors and computer users—toward making IBM's JCL (Job Control Language) easier to use. This product, JCL Preprocessor, was developed by an OS user for in-house use, and is now making it available to other 360 and 370 users.

JCL Preprocessor interprets data from macro level control statements, regular JCL statements and transactions for processing, and produces as output a job ready for execution. Data is compiled by performing four major



functions: merging input from three files and a library; execution of control statements allowing conditional selection of output statements; symbolic substitution where required on output statements, and overriding of job steps. This procedure substantially reduces the size and complexity of JCL decks, with the result that reruns can be specified by a single control card. All unneeded steps are automatically eliminated from the rerun procedure. JCL Preprocessor is priced at $10K. A.O. SMITH CORP., Milwaukee, Wisc.

FOR DATA CIRCLE 210 ON READER CARD

Operating System

A redesigned operating system is now available to users of this manufacturer's 16-bit minicomputer line that provides facilities for background program development, resident and transient task areas, bulk storage dumps, file allocation commands, and an interactive program for system generation. For use on model 7/16, model 80, and model 85 processors, the monitor requires only 2-6K words of memory. One feature that sets OS/16-MT (multitasking) apart from other minicomputer operating systems is that this one is not limited to just one foreground and one background job running concurrently. The number of jobs that can be run depends solely on how many will fit into the amount of memory on the particular machine. Additional features include 16 priority interrupt levels, task-to-task communication, device independent I/O operations, and a claim that it's relatively easy to upgrade applications programs should the user decide to move to one of the 32-bit machines. OS/16MT is priced at $950. INTERDATA, INC., Oceanport, N.J.

FOR DATA CIRCLE 231 ON READER CARD □

(Continued from page 9)

ket, AT&T more than 85% of the telecommunications market. We can argue at some length as to whether these companies became kings of their respective mountains through industry, skill and foresight, or through refusal to provide interface specifications and other anti-competitive strategies. I will leave these questions for the courts to decide.

However, the fact is they are able —through sheer financial muscle, sophisticated and subtle anticompetitive practices (many hidden under the guise of technology), political clout, and almost absolute market control—to block the efforts of even the strongest to climb the hill. What happens when the forces of competition no longer work? What happens when the RCAs, General Electrics, Bendixs, Honeywells, Littons, Philco-Fords, Univacs and Singers finally give up trying? What happens when the Carters, MCIs, Datrans, Telecoms, Storage Technologies and Stromberg Carlsons of the future don't even get to try, because Wall Street, the bankers, and now the Arabs have learned that "the only safe investments" are investments in America's giant monopolies.

If free enterprise is to survive, we must restructure the giants so that we can have healthy competition between near equals. After this has been accomplished we can safely eliminate the government regulations—knowing that the forces of competition will once again work for America.

DONT loop

Professor Carpenter (November, p. 23) has omitted the most fundamental FORTRAN example of all, the infamous DONT loop; for example:

```
DONT 9 I=1,20,-3
IF (ILL*) COME FROM 50
IF (.NOT.ILL) STAY HERE
9 DISCONTINUE
            * Any illogical variable
```

Clearly, this statement form is essential for avoiding illegal transfers into DO loops!

BRUCE A. MARTIN
Upton, New York

Less is more

I was happy to read "Wynne's Law" (November, p. 23): ". . . negative slack tends to increase." It seems to be a corollary of a more basic law I discovered some years ago: "If one programmer can do it in one day, then two programmers can do it in two days."

The relationship between the two laws is this. As a programming task progresses, management worries about it and assigns more programmers to it. The larger the number of programmers, the longer the task requires. Hence a gradual increase in negative slack!

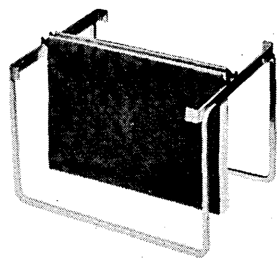
The obvious solution is to minimize the number of programmers on the project, which means taking a chance on another law: "If a project is completed on time, it is either a success, or the results are utterly useless."

I think programmer Wynne understands these related laws quite well. On the Polaris program he was able to meet a very rigid schedule through the simple expedient of not having all the help that would have made him miss his schedule.

ROBERT E. MAY
Honeywell-Phoenix
Phoenix, Arizona

DATAMATION welcomes correspondence about the computer industry. Please double-space your letter when you write to 1801 S. La Cienega Blvd., Los Angeles, CA 90035.

Acco is the only manufacturer to offer retractable hooks on all 14-7/8″ x 11″ data binders at no extra cost.



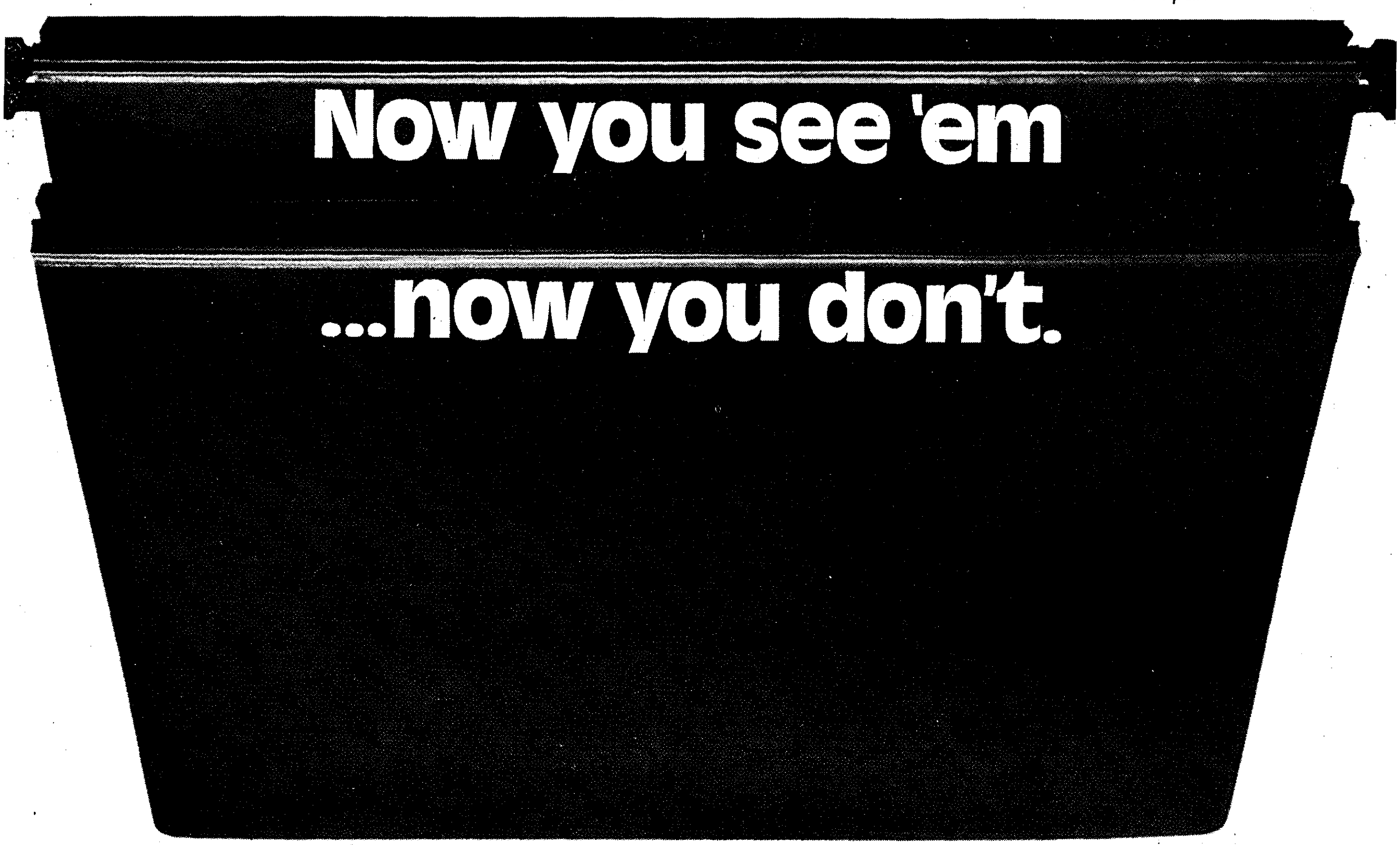
Versatile, high-impact plastic Accodata hooks. Slide out easily for hanging. Push-in flush for everyday use. Permanently attached to all our 14⅞″ x 11″ (9007) P1P, P4P and P6P Accodata Binders. No extras to buy. No hooks to get lost. Our famous Accodata Binders come in 20 pt. genuine pressboard in 7 colors. 23 pt. Accohide* in 4 colors and heavy-duty 90 pt. Accohide* in 2 colors — practically indestructible. New, all metal binding mechanisms provide greater compression. Steel Dataflex™ posts. Top and bottom loading for easy access. Holds up to 8″ burst or unburst printout. Write for our 4/color catalog or see Accodata Binders (with the *no extra cost* data hooks) at your office products dealer. Seeing's believing.

*A chemical resin.

Innovators . . . by design

ACCO

ACCO INTERNATIONAL INC.
5150 N. Northwest Highway/Chicago, Illinois 60630
New York, Los Angeles, Boston/Canada/England/Holland/Mexico/Venezuela/El Salvador/Jamaica/Japan



'75 NCC PREVIEW

AN IMPERATIVE FOR COMPUTER PROFESSIONALS

Visitors to the 1975 National Computer Conference in Anaheim, Calif., May 19-22 will be able to choose from approximately 90 program sessions and over 900 exhibit booths. The '75 NCC is shaping up as the most varied and comprehensive computer conference ever held on the West Coast. All events will take place in the ultra-modern Anaheim Convention Center.

An estimated 400 speakers and session participants will explore key issues and answers in three vital areas . . . Data Processing Methods and Applications, Science and Technology, and Societal Issues. Under these broad headings, over 20 critical topics will be analyzed in depth. Many will be covered in "mini-programs" — one- or two-day updates on the most recent developments within each topic and held, where possible, at one specific location.

The '75 NCC exhibits are expected to fill 90,000 square feet, with some 300 exhibiting organizations anticipated. They will provide the visitor with a unique opportunity to examine the latest in data processing products, systems, software, and services.

THE INDUSTRY ON DISPLAY

The '75 NCC will include the largest computer exhibit ever held in a major West Coast city. Visitors will find a wide assortment of products and services — including minicomputers, mainframes, peripherals, terminals, package programs, communications systems, data processing services, technical publications, and much more. Many products will be displayed for

Donal A. Meier
'75 NCC General Chairman

the first time. There will also be live demonstrations, new product literature, and the opportunity for personal contacts with industry representatives.

A PROGRAM VITAL FOR TODAY

The '75 NCC program has three primary objectives: to update the specialist on the latest in computer science and technology; to update users on methods and applications; and to promote interdisciplinary discourse leading to increasingly cost-effective systems and software.

Among key areas to be explored are training of user technical personnel, defining operational requirements and management objectives, privacy and confidentiality, and advanced system design techniques. Additional important areas will cover such subjects as government and legal issues, electronic funds transfer, medical/health care, computer architecture, interaction of hardware and software, memory technology, microprocessors, data base management, programming technology, interactive graphics, and communications and networking.

'75 NCC HIGHLIGHTS

- Approximately 90 program sessions.
- Over 400 leading speakers and program participants.
- Approximately 300 exhibiting organizations.
- Addresses by leading national authorities, high-interest special events, and a variety of social activities.

Stephen W. Miller
Program Chairman

MORE NCC DETAILS

Mail coupon for advance information on '75 NCC, or to preregister. With preregistration, you'll receive your NCC *Everything Card* covering the full conference and exhibits. Benefits include: a $15 saving over registration at Anaheim, conference luncheon discounts, advance housing arrangements, and the '75 *NCC Proceedings*.

DTM-175

'75 NCC, c/o AFIPS, 210 Summit Ave., Montvale, N. J. 07645

_____ Yes, send me my *Everything Card*. I've enclosed $60, covering the '75 NCC program and exhibits, plus preregistration benefits.
_____ Please continue to send me all the facts.
_____ My company is interested in exhibiting at '75 NCC.

Name ________________ Title ________
Company ________________
Street ________________
City ________ State ______ Zip ______

'75 NCC The Biggest Computer Show on Earth

c/o AFIPS, 210 Summit Avenue, Montvale, N. J. 07645
Telephone toll-free (outside of New Jersey): (800) 631-7070

Amdahl Corporation
1250 East Arques Avenue
Sunnyvale, California 94086
(408) 735-4011

amdahl™

Memorandum

To: OS/MVT, VS2 systems programmers
From: Gene Amdahl
Subject: Employment
Date: January 6, 1975

In a few months, we will deliver our first computer systems. Amdahl 470 V/6™ computers will be the world's first large scale, fourth generation systems.

Our CPU is totally designed with proprietary LSI circuitry. It has subnanosecond switching, 16 high performance inboard channels, an ultra high speed buffer, and up to 8 megabytes of monolithic memory. With a cycle time in the 30 nanosecond range, it delivers 2 to 3 times the performance of comparably-priced systems.

At this moment, the 470 V/6 is in the final stages of systems checkout. To date, we have run MVT, VS2, VM/370, TSS, and other operating systems. We are pleased with our progress to date, and our enthusiasm is shared by an increasing number of future users.

Which brings me to the subject of this memo.

Right now we are looking for highly proficient systems programmers and customer support personnel with expertise in OS/MVT and VS2 internals to help us install and maintain our systems. We offer the usual company benefits plus one distinct extra: the opportunity to make computer industry history with us.

If you are qualified and are sincerely interested in learning more about a unique challenge, we'd like to talk with you. To start things off, send a resume outlining your background and experience to Vern Todd in our Systems Engineering and Programming Group. He'll be in touch with you.

Gene Amdahl

Technical Publishing Company

Arthur L. Rice, Jr., Chairman of the Board
James B. Tafel, President
Gardner F. Landon, Exec. Vice President
Calverd F. Jacobson, Financial Vice President and Treasurer
Thomas A. Reynolds, Jr., Secretary
M. Jay Turner, Jr., Director of Circulation
Paul C. Jarvis, Director of Information Services

Advertising Offices

Eastern District Managers
A. Treat Walker,
Warren A. Tibbetts: Greenwich, Ct. 06830
35 Mason St. (203) 661-5400

New England District Manager & Vice President
Warren A. Tibbetts: Manchester, N.H. 03104
112 W. Haven Rd.
(603) 625-9498

Midwest District Manager
John M. Gleason: Chicago, Ill. 60606
205 W. Wacker Drive
(312) 346-1026

Western Manager and Senior Vice President
Hamilton S. Styron: Los Angeles, Calif. 90035
1801 S. La Cienega Blvd.
(213) 559-5111

District Manager
Alan Bolté, Jr.: Los Angeles, Calif. 90035
1801 S. La Cienega Blvd.
(213) 559-5111

Western District Manager
James E. Filiatrault: Mountain View, CA 94043
2680 Bayshore Frontage Rd.
Suite 101
(415) 965-8222

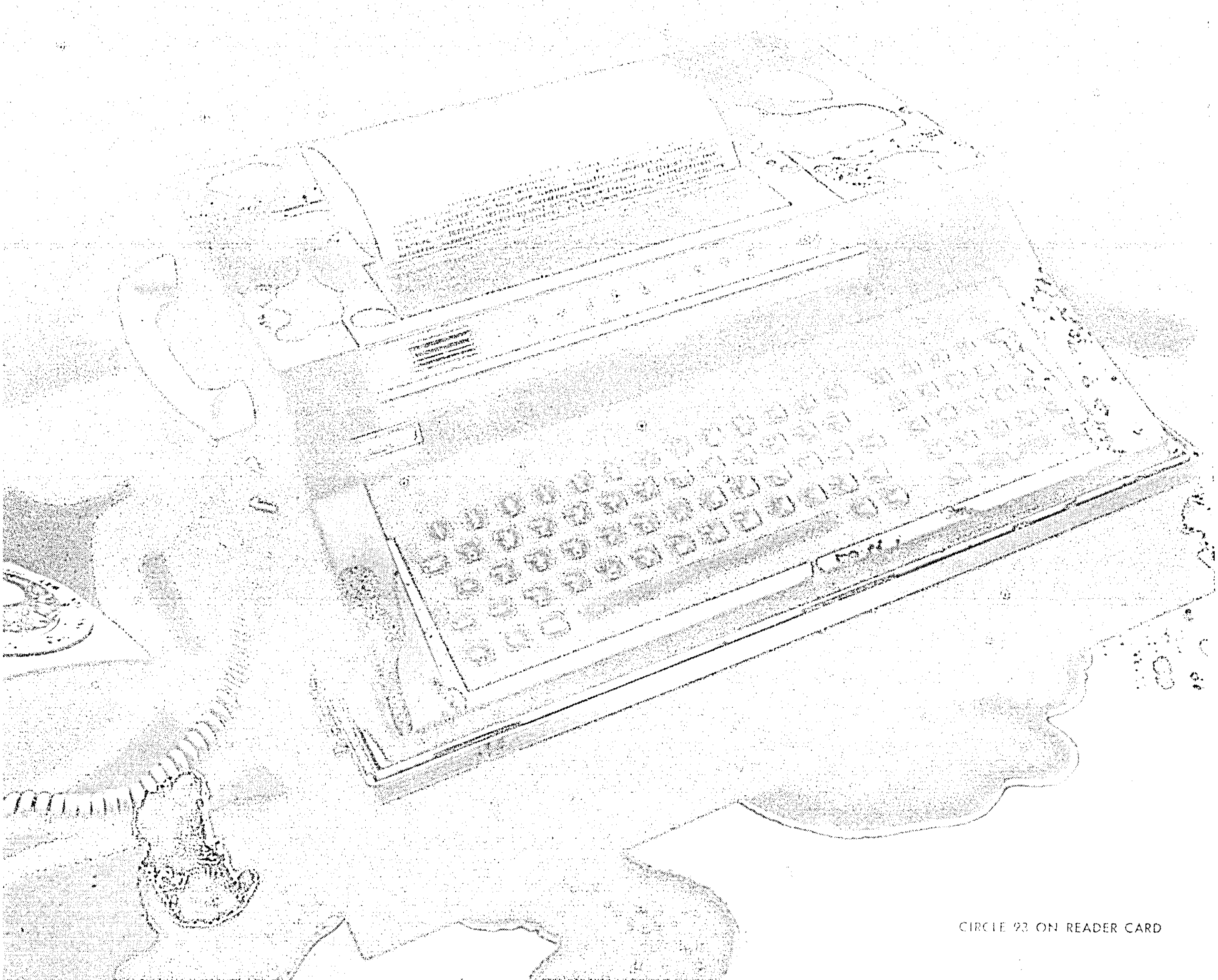
U.K., Scandinavia, Benelux, Germany
Intergroup Communications, Inc.
Wallace K. Ponder, European Director
Paul D. Dimmock, Regional Manager
31 Lyncroft Avenue
Pinner, Middx. HA5 1JU
England
Tel: (01) 868 9289
Cables: PACOM, Pinner

France, Switzerland, Italy, Spain
Gerard Lasfargues
32 rue Desbordes Valmores
75016 Paris
France
Tel: (1) 288 90 22

Japan
Shigeru Kobayashi
Japan Advertising Communications, Inc.
New Ginza Building
3-13 Ginza 7-chome
Chuo-ku, Tokyo 104, Japan
Tel. (03) 571-8748

Other tp Magazines

Plant Engineering	*Pollution Engineering*
Power Engineering	*Purchasing World*
Research/Development	*Consulting Engineer*



This forum is offered for readers who want to express their opinion on any aspect of information processing. Your contributions are invited.

the forum

SETTING STANDARDS CAN BE ILLEGAL

The computer industry needs effective ethical guidelines and production and performance standards, if it is ever to realize its full potential to our society. But the growing industry demand for codes of ethics and certification programs and standards generally (all of which are in one respect very much the same kind of thing) too often overlooks the dangers of such activity.

History teaches that professional certification is often used by the "ins" to exclude the "outs"; that codes of ethics are frequently designed to prevent such "unprofessional" conduct (to the defeated competitor!) as price cutting and advertising for increased business; and that "standards" are sometimes used to prevent others from disturbing the peaceful equanimity of a pleasantly competitive environment by offering new and improved products.

Of course, few would state such nasty purposes in outlining their intentions. Rather, objectives are stated in terms of serving the public by improving performance and easing interchange among systems. But the test is not stated *purpose;* it is competitive *effect.* For example, a joint antipollution development program of the major automobile manufacturers was attacked and defeated by the federal government over a decade after its adoption, on the ground that its effect was to inhibit the individual competitive efforts of each of the participants, by giving the benefit of whatever each developed to all members of the group. No one could get an "edge" in antipollution offerings.

Unfortunately, only a handful of computer industry leaders seem to appreciate that industry efforts of this kind are very carefully restricted by law. Indeed, contrary to the common misconception, even the National Bureau of Standards has only the most limited authority to influence the setting of standards. The danger is that effective programs which *are* needed and *might* have been developed, will be cut off at their inception because of this improper initial understanding. Already at least one professional computer association's ethical guidelines have been challenged in court (in a private suit) on this ground. More may follow.

American National Standards Institute (ANSI) is about as representative an organization as one could find in this area. The Federal Trade Commission's opinion to ANSI is therefore most enlightening as to the considerations involved, and what others *must* consider even more so. It reads (omitting citations):[1]

1.) Standardization and certification programs must not be used as devices for fixing prices or otherwise lessening competition.
2.) They must not have the effect of boycotting or ex-

[1] Datamation has synopsized the actual reference for publication in these pages . . . ed.

the forum

cluding competitors.

3.) They must not have the effect of withholding or controlling production.
4.) Construction or specification standards should not be used except in exceptional circumstances and never when performance standards can be developed.
5.) Standards must reflect existing technology and allow for technological innovation.
6.) No applicant may be denied certification because he is not a member of the standards organization, because he is a foreign competitor, or because he cannot afford the certification fee.
7.) Fees charged must be reasonable as related to costs involved.
8.) Membership in standards groups must be open to all competitors, domestic or foreign.
9.) Due process, including timely hearings and prompt decisions on claims and certification, must be accorded to all interested parties.

> "Unfortunately, only a handful of computer industry leaders seem to appreciate that industry efforts of this kind are very carefully restricted by law"

10.) Unless clearly required by safety considerations, standards may not restrict the kinds, quantities, sizes, styles, or qualities of products.
11.) Proposed standards must be checked by an independent entity to insure they are meaningful and relevant.
12.) An independent entity should determine whether products are certified.
13.) Representations made of testing procedures, standards, etc., must be truthful.
14.) In challenges to standards, the burden of proof respecting reasonableness is upon those who develop and enforce the standards.
15.) All standards must be voluntary.
16.) Certification programs should avoid "pass/fail" standards and use instead graded systems which preserve consumer and user options.

Standards, codes of ethics, and certification programs *can* be adopted and *can* be enforced, if approached properly rather than blindly by the well-motivated but inadequately informed. A careful, interdisciplinary effort is essential, participated in by economists and representatives of the public in addition to computer scientists and lawyers. The principle guiding them should be:

STANDARDS: Computer standards, performance guidelines and ethical codes should be determined by fairly selected and representative public organizations, so as to improve performance and encourage maximum reasonable interchange among computer systems and between economic units, without unreasonably impeding technological development or restraining competition.

—**Milton R. Wessel**

Mr. Wessel is an attorney, one of Datamation's contributing editors, and a highly respected author; his recent works include "Government Regulation of the Computer Industry" (co-authored by Bruce Gilchrist) and "Freedom's Edge, the Computer Threat to Society" (Addison-Wesley, 1974).

We think the Teletype® model 40 system is so good nothing even comes close.

In fact, we believe our model 40 system is so good it'll change the way business looks at data.

It's a complete, versatile, reliable terminal system delivering maximum efficiency in a wide range of applications. From message communications to computer input/output on switched network or private-line systems. Right now, the model 40 system is being used by airlines, news services, brokerage firms, manufacturers, law enforcement agencies and time-sharing services.

Significant features of the model 40 are speed, ease of data preparation and editing, quiet operation and extremely low maintenance. And since the system is completely modular, you can forget about obsolescence. It's designed to grow as your needs grow.

If the model 40 sounds like something your business has been looking for, we'd like to tell you more about it.

The Teletype model 40 system. It's every bit as good as you've heard. And probably even better.

For complete technical data, please contact our Sales Headquarters at 5555 Touhy Avenue, Skokie, Illinois 60076. Or call TERMINAL CENTRAL at (312) 982-2000.

TELETYPE

The Teletype model 40 system.

CIRCLE 3 ON READER CARD