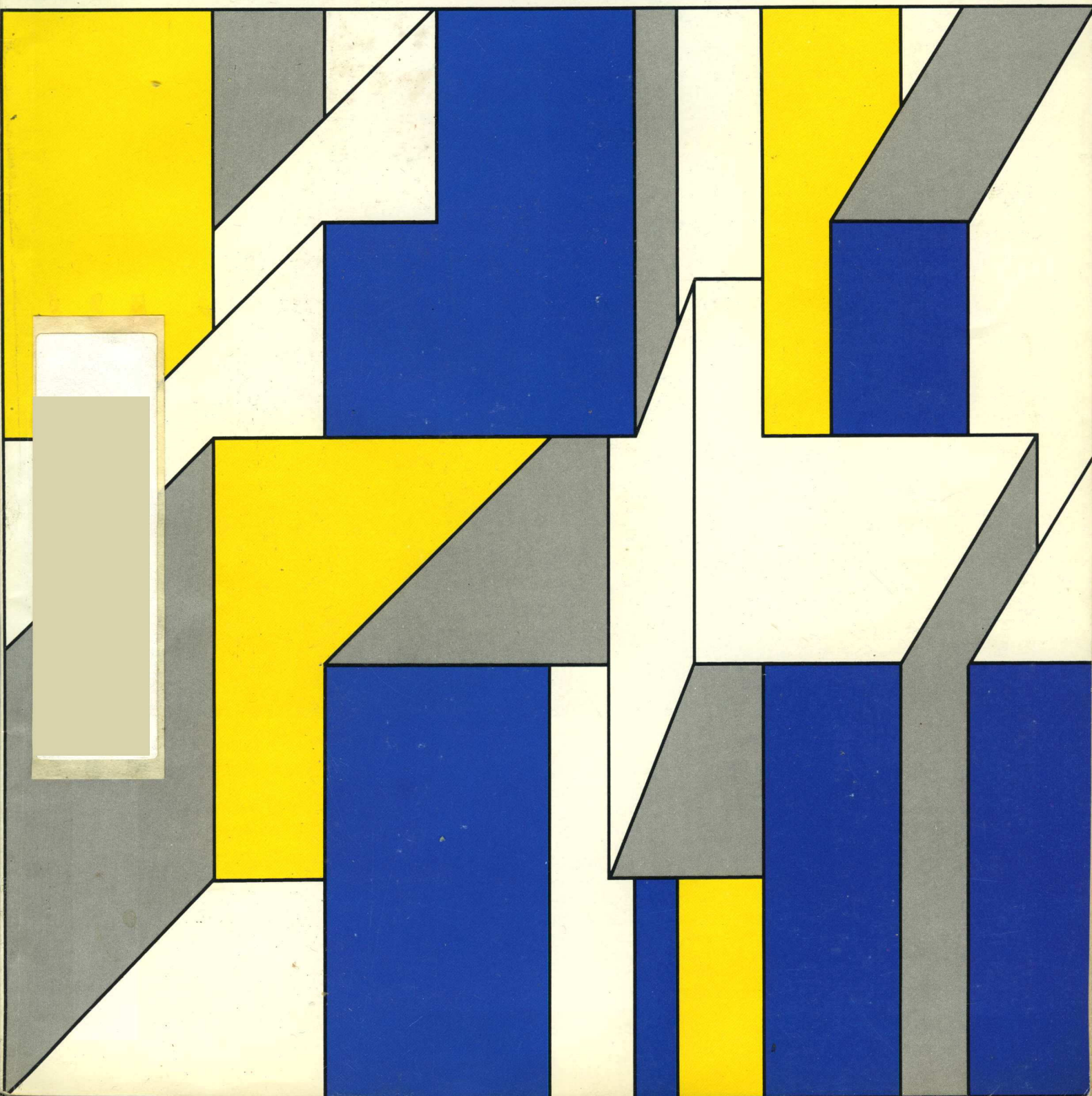
DATAMATION® 74
July

MINICOMPUTER SURVEY

Also: scheduling, communications, legal hassles, IFIP, and Japan



"These 60 Display Terminals will save our customer $75,000 plus 21,000 kilowatts of power each year."

When we designed the ADM-1 Display Terminal, we knew that OEMs and end users were conscious of the money crunch. So we designed the terminal to sell for half the price of other units, without sacrificing performance.

We didn't realize then that another primary benefit of the ADM-1 would be its low power consumption. At 92 watts, the terminal uses less power than a 100-watt light bulb, so we also helped alleviate some of the energy crunch.

Now that's two good reasons to invest in the Lear Siegler ADM-1.

Here are a few more: it utilizes a 600 n sec microcontroller to provide all the performance you'll need for years ahead; it incorporates a full 53-key TTY keyboard and a 12" screen displaying up to 1920 characters; for simpler servicing, the ADM-1 circuits are all on one, single board with socketed IC's; spare parts require only 4 discrete packages; the dual intensity protect mode is a standard feature, and a full editing capability is optional.

Now, do you see why we say you can afford twice the terminal capacity with the ADM-1. It's twice the machine.

Write for our new ADM-1 brochure.

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ELECTRONIC INSTRUMENTATION DIVISION
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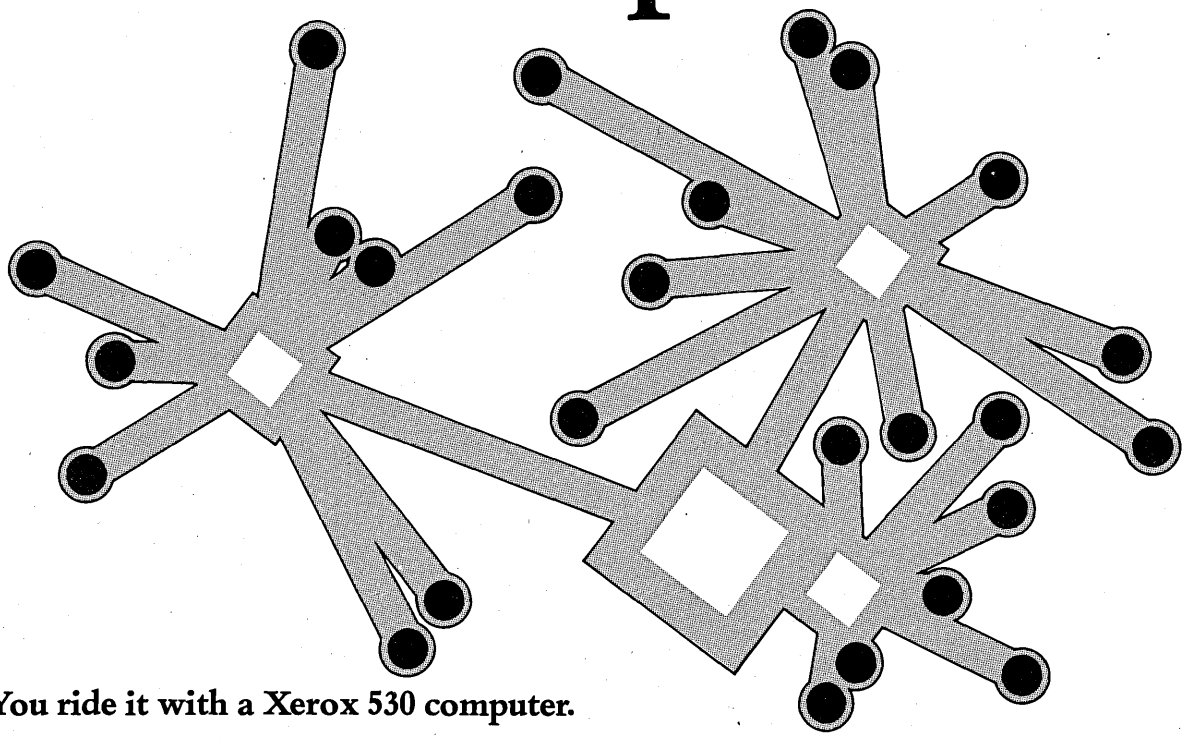
Telephone: (714) 774-1010

CIRCLE 1 ON READER CARD

Xerox introduces a rapid transit system for computers.



You ride it with a Xerox 530 computer.

And you really move data from where it is to where it's needed. (Like branch offices to headquarters. Or vice versa.)

Introducing IDEN: Interactive Data Entry Network. Our sophisticated new system of distributed information processing. Probably the quickest and most flexible way to get pre-edited, clean data available today.

IDEN is so advanced that it provides you with a framework to handle a myriad of jobs concurrently—data entry, inquiry/response and intelligent remote batch processing, to name a few. Yet IDEN is so simple to use that an order entry clerk can become an information processing pro in one day.

It's economical enough to meet your information requirements for today. And flexible enough to handle the growth you plan for tomorrow.

If your company has a long range plan for information management, IDEN is the rapid transit system that can take you there. All you have to do is climb aboard.

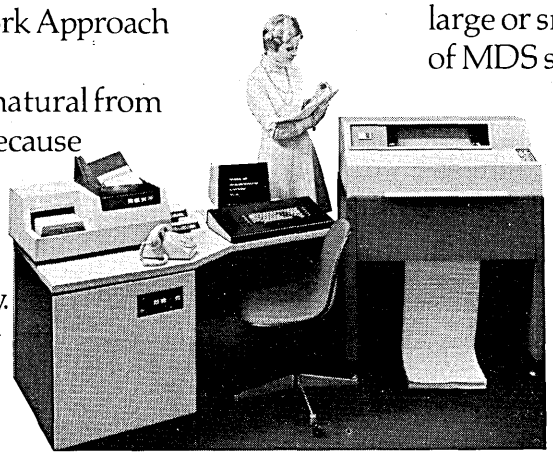
We can show you in detail what all this can mean for your company. Call us at (800) 421-6882. In California call (213) 679-4511, ext. 950. Or write Xerox Corporation, Dept. I 5-10, 701 S. Aviation Blvd., El Segundo, California 90245.

XEROX

Mohawk Data. A Network Approach to data entry.

The Network Approach to data entry.

It's really a natural from Mohawk Data. Because we're recognized everywhere as a very powerful force in data entry.



Today, that includes all forms of data gathering and preparation. Including communications.

Our gear spans the broad reach from stand-alone terminals through sophisticated key-to-disk. And from document preparation to data collection networks and systems.

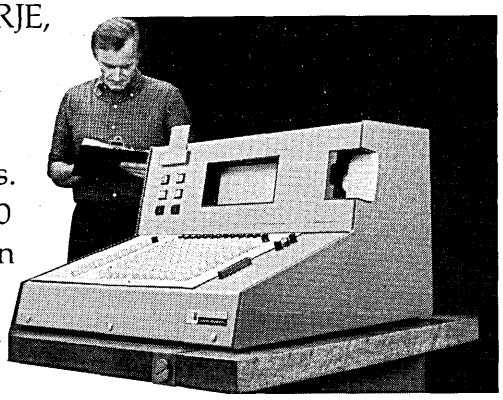
Which means we can look at your data entry problems in their totality. And offer an objective solution.

In fact, the data entry needs of all your EDP locations—central, remote, large or small—can be met by a single network of MDS systems.

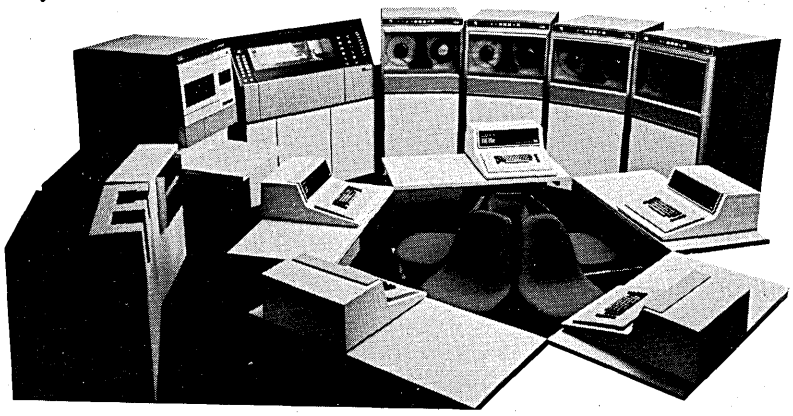
The Network Approach.

Each system compatible with the others, with interchangeable media. Each capable of working with the others, with common languages. Each conveniently compatible with the major mainframes.

The Network Approach. It works. Our new 2300 terminal and document processing systems. Our 2400 with key-to-disk, RJE, conversion, printing and concurrent combinations. And our 4400 data collection system.



To find out more, call an MDS representative now about our Network Approach to data entry. Or write for our descriptive brochure. Mohawk Data Sciences Corp., Utica, New York 13503. 315-792-2424

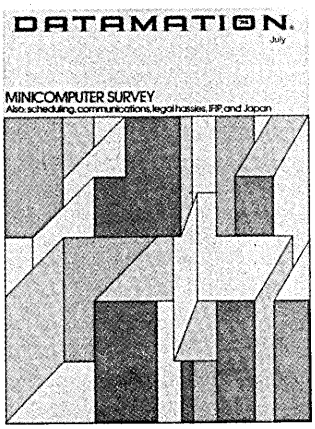


MDS®

Mohawk Data Sciences

DATAMATION 74®

JULY, 1974
volume 20 number 7
This issue 120,067 copies



about the cover

Our survey art is reproduced from "Spatial Metaphor No. 38381", a serigraph in five colors by Edward Zajec (Italy) from the "SDL Collection", a portfolio of nine original computer art prints. Commissioned by Systems Dimensions Limited, a leading Canadian-owned company in the information industry, the portfolio was coordinated and produced by Editions Gilles Gheerbrant, 2130 Crescent, Montréal H3G 2B8, Canada. More of Mr. Zajec's work appears elsewhere in this issue.

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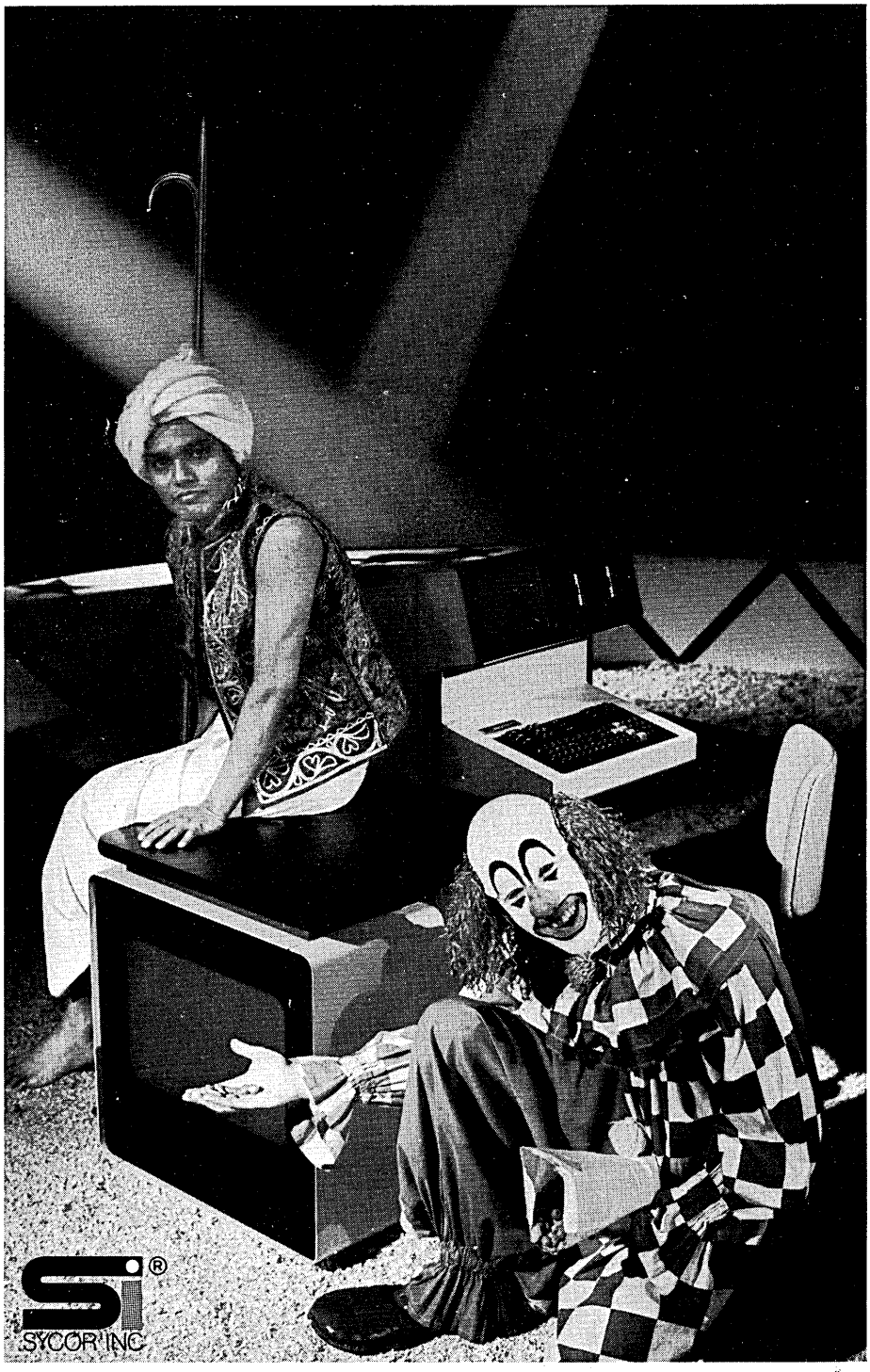
WHAT'S GRAY, HAS 2½ MILLION CHARACTERS OF MEMORY, AND WORKS FOR PEANUTS?



Our brand new Sycor-developed Hard Disk Drive.*

Its elephant-sized memory extends the capabilities of our Sycor 340 intelligent terminal into exciting new realms.

For one thing, you can now manage your own 2½ million character data base in remote branch offices. At an average access time of just 80 msec.** This new, larger memory reduces keyboard operations for better throughput and takes a load off the mind of your CPU.

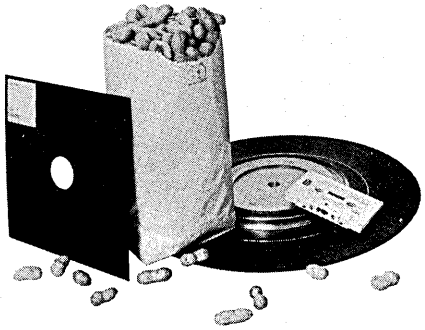
And it's available for only $165 a month, including maintenance, on a two-year lease.

If your needs don't call for 2½ million characters of memory, our Sycor 340 with the fastest Flexible Disk Drive* on the market might be just the ticket. With 500,000 characters of memory and an average access time of 176 msec,** it's ideal for order entry applications involving small to medium size customer, salesman and product/price files.

Finally, there's our popular Sycor 340 with one or two cassettes (each containing 200,000 characters). It's still the lowest priced intelligent terminal.

Whatever your needs in distributed data processing, you'll find an intelligent Sycor 340 right for your company. Ask your Sycor representative about our Model 340 and its wide range of peripherals—like its three speeds of printers, a card reader and magnetic tape drives.

And don't forget to ask about the new Hard Disk Drive. The elephant-sized memory that works for peanuts.



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SYCOR

*Patents applied for **Includes latency time

Announcing "take-along" computer power.

That's right, now you can have access to your central computer wherever you go. You can be on-line from the plant across the street or from a hotel room across the country. Weighing just 30 lbs., the portable NCR 260 KSR Thermal Printer Terminal is as easy to transport as your attache case.

Besides portability, the NCR 260 KSR Thermal Printer provides all the functions required to send and receive numeric and alphanumeric data. Included is an integrated modem with an acoustic coupler, a thermal printer, and an alphanumeric keyboard with an imbedded numeric pad. And even the cabinet is functional. It opens and becomes a nesting place for the terminal.

Equipped with a 30-character per second printing rate and non-impact printing mechanism, the NCR 260 KSR is the quicker, quieter way to transmit and receive data.

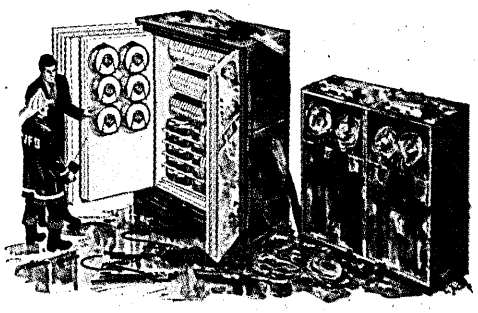
Portability remains the key, though. This advantage provides you with much more efficient use of computer time. And increased efficiency adds up to a better return on your computer dollar.

As with all NCR products, the NCR 260 KSR thermal printer is backed by the entire network of NCR support systems. With more than 7000 field engineers in more than 480 field offices, you are assured of fast, complete service when needed.

The portable NCR 260 KSR is a terminal you'll want to know more about. To get additional information just contact your local NCR representative. Or write to NCR, Dayton, Ohio 45479.

NCR

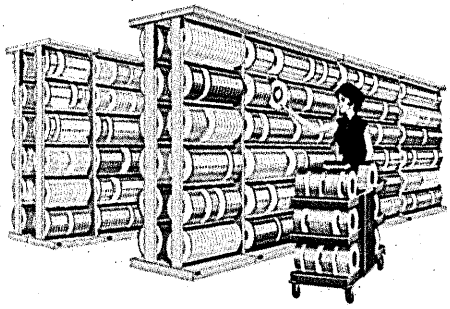
Complete Computer Systems



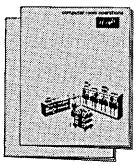
Safe storage and handling of disk packs is provided in Disk Pack Library Units with full-suspension roll out shelves. Cabinets may be configured for mixed media as shown.

Data Bank Safes provide protection for magnetic media. Units with UL 150° 4 hr., 2 hr. and 1 hr. labels are available. Flexible interiors may be configured for mixed media. Special brochure available.

computer room operations media management systems

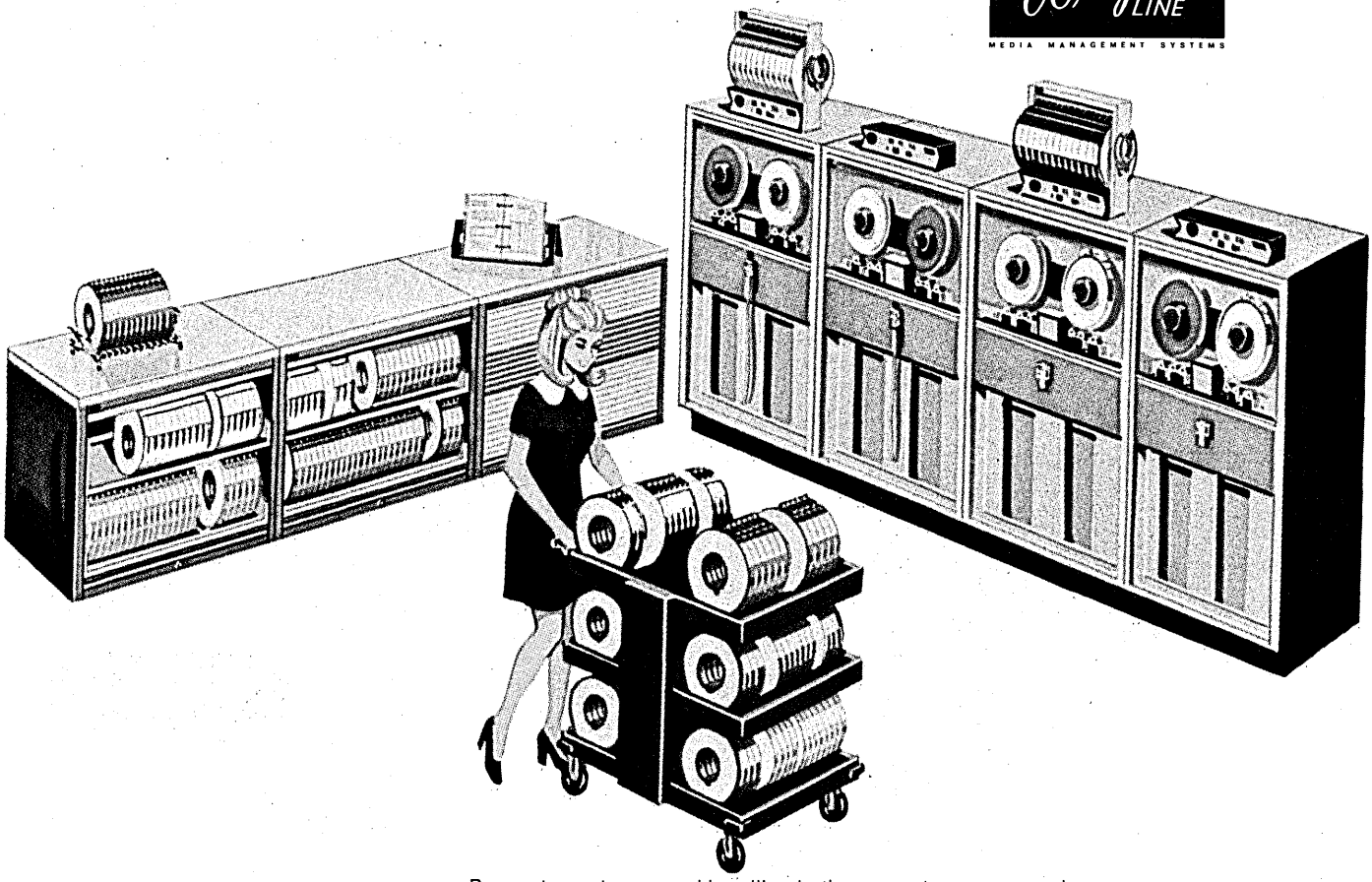


Properly managing the storage, flow and handling of input and output media allows you to take full advantage of the high speed processing capability of the computer. Wright Line systems are based on over forty years of specialization in computer media systems. Our new brochures show numerous examples along with Wright Line equipment. For copies, circle the readers' service number or write to Wright Line, a Division of Barry Wright Corporation, 160 Gold Star Boulevard, Worcester, Massachusetts 01606.



Maximum tape storage capability in minimum floor space is achieved with Tape-Seal Library Units which provide hanging storage for reels with Tape-Seal Belts or Self Threading Cartridges with Hooks.

Wright LINE
MEDIA MANAGEMENT SYSTEMS



Proper tape storage and handling in the computer room speeds throughput. Wright Line systems include Tape-Seal Belts, Self Threading Cartridges with Hooks, Storage Cabinets, Staging Racks and Trucks.

calendar

AUGUST

IFIP Congress 74 and MEDINFO 74, Aug. 5-10, Stockholm. The sixth triennial conference of the International Federation for Information Processing (IFIP) is a major dp event. Presentations will be in the categories of: computer hardware and architecture, software, mathematical aspects of information processing, technological and scientific applications, applications in the social sciences and the humanities, systems for management and administration, and social implications of computers. An exhibition of computer equipment, from more than 100 organizations in about 15 countries, will complement the program. Held in conjunction with IFIP will be MEDINFO 74, a conference and exhibit focusing on the expanding field of information processing in medicine and public health. Technical, financial, human, ethical, and political aspects will be considered. Fee for both conferences is Skr 475.00, or Skr 450.00 each. Contact: Stockholm Convention Bureau, Strandvagen 7 c, S-114 56 Stockholm, Sweden.

ICCC-74—International Conference on Computer Communications, Aug. 12-14, Stockholm. This second international conference aims to analyze aspects of computer communication in an interdisciplinary fashion. Lectures and invited papers will deal with fundamentals, interactive aspects, technical aspects, and applications. Fee: about $100. Contact: Edward E. Boyar, 1860 Wiehle Ave., Reston, VA 22090; or ICCC-74, Central Administration of Swedish Telecommunications (Gdk), S-123 86 Farsta, Sweden.

SEPTEMBER

Sixth International Conference on Urban Transportation, Sept. 8-10, Pittsburgh. This conference will focus on current problems and new developments associated with urban mass and rapid transit systems. Among the speakers will be San Francisco's Mayor Joseph Alioto, who will give a presentation on BART, America's newest rapid transit system. There will be approximately 30 exhibits at the conference. Fee: $125. Contact: Sixth International Conference on Urban Transportation, P.O. Box 2149, Pittsburgh, PA 15230.

INFO 74, Sept. 9-12, New York. The aim of this conference is to bring together corporate management and information systems execs. The conference will emphasize the use, rather than the technological aspects, of information systems. Twelve "mini" conferences within the general program will assist specialized audiences; among these will be special sessions for edp managers and technologists and courses for management executives who want an understanding of the fundamentals of information systems. Case studies, lectures, workshops, seminars, and roundtables will be among the formats used. Exhibits will feature demonstrations of equipment, supplies, and services. The emphasis here, as throughout the conference, will be on creating and adapting new applications for information systems. The fees range from $35-100 for AMA (American Management Assns.) members and from $45-120 for nonmembers, depending on the number of days attended. For a "Visitor's Guide to INFO 74," write to: Clapp & Poliak, Inc., 245 Park Ave., New York, NY 10017. For general conference information, contact: Vern Lautner, AMA, 135 W. 50th St., New York, NY 10020.

COMPCON 74, Sept. 10-12, Washington, D.C. The program for this conference focuses on applications and design of microcomputers and minicomputers. Topics include: embedded micros, virtual machines, and minis in communications, business, manufacturing, health care, and POS. The day before the conference there will be a tutorial covering a mix of hardware, software, and applications designed to appeal to those needing acomprehensive understanding of the major elements of minicomputers. Fee: $60, members; $75, others; $60 for the tutorial. Contact: Harry Hayman, IEEE Computer Society, P.O. Box 639, Silver Spring, MD 20901.

WESCON '74, Sept. 10-13, Los Angeles. The 1974 Western Electronic Show and Convention will feature over 500 exhibit booths representing approximately 280 companies. A professional program is being held in conjunction with the exhibition. This will consist of 28 half-day sessions including some on microprocessors, charge-coupled devices, data transmission, and computer security. The $5 admission fee covers the exhibits and the professional program for all four days. Contact: Don Larson, WESCON, 3600 Wilshire Blvd., Los Angeles, CA 90010.

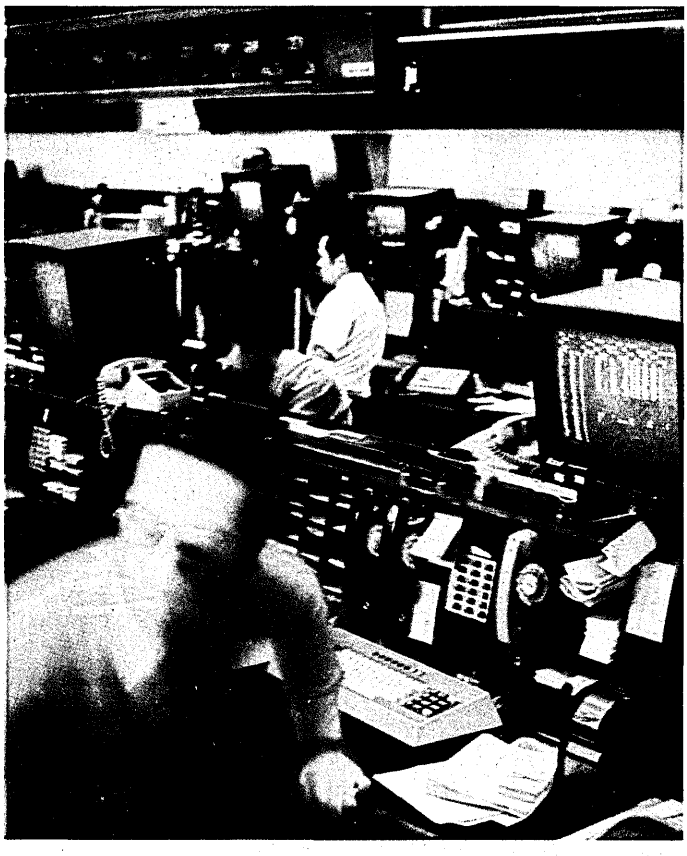
Sixth Annual Conference of the Society for Management Information Systems, Sept. 11-13, San Francisco. The theme of this conference is "Man in Systems—The Human Element in MIS (Management Information Systems)." The conference objective is to bring attendees face-to-face with cultural and communications gaps in MIS design. Prof. Marshall McLuhan will be one of the speakers. A full day of the society's workshop seminars will precede the conference. Fee: $200, members; $230, others. Contact: Patrick F. Cannon, SMIS, 221 N. La Salle St., Chicago, IL 60601.

International Symposium on Economics of Informatics, Sept. 15-20, Mainz, Germany. The three categories which comprise the framework of this program are: economic considerations of national policy plans, effectiveness of information systems, and efficiency of information systems. Areas for discussion include: theoretical foundations of information processing, hardware and systems, computer software, applications, and education. Fee, after Aug. 1: 600 DM. In the U.S. contact: Dr. Malcolm Gotterer, Dept. of Mathematical Science, Florida International Univ., Tamiami Trail, Miami, FL 33144. European contact: IBI-ICC Hq., P.O.B. 10253, 00144 Rome—EUR., Italy.

25th SICOB, Sept. 19-27, Paris. This international show for top management will feature: an exhibition of business machines and equipment, with emphasis on data processing and communications systems; demonstrations of advanced techniques; roundtable meetings, and seminars. Fee: 5.00 FFr.; free for foreign visitors. Contact: SICOB, 6, place de Valois, 75001 Paris, France.

Fourth INTERNET Congress, Sept. 30-Oct. 3, Paris. The theme here will be "Project Management in the Seventies." Topics will include: network techniques, cost estimating and cost control, stochastic tools, and on-line systems. Fee, after Aug. 1: 1 400 FFr. Contact: AFCET, C.U.D., avenue de Pologne, 75775 Paris—Cedex 16, France.

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



When our customers install Incoterm terminals, we install Incoterm people.

The PBW Stock Exchange, like most Incoterm customers, has a sophisticated terminal system – the first ever to use intelligent terminals to automate floor trading, quotations, order handling, reporting and clearing of stock trades.

It is the kind of system that requires sophisticated customer service. Service that is readily available. Service that can solve software problems, hardware problems, line problems, computer interfacing problems, printer problems.

At Incoterm, one-third of our entire organization is engaged in customer support activities. We maintain 36 service offices in the U.S. alone. But then, when you have almost 8,000 intelligent terminals in use, you need many intelligent people to support them.

Whether it's a remote batch unit at a railroad freight yard, a correspondent bank device in a small town, an airline ticketing terminal in a metropolitan airport, or a trader's station at a stock exchange, you can be sure that with Incoterm products, you get the Incoterm people to make them perform. We take care of our own.

Incoterm: More power to your terminal.

Incoterm service centers are located in Akron, Atlanta, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Columbus, O., Dallas, Dayton, Denver, Detroit, Honolulu, Houston, Kansas City, Lincoln, Neb., Los Angeles, Memphis, Miami, Milwaukee, Minneapolis, New Orleans, New York, Oklahoma City, Philadelphia, Phoenix, Pittsburgh, Portland, Ore., Richmond, San Francisco, Seattle, St. Louis, Tampa, Toledo, Washington and Winston-Salem. Additional Incoterm customer service coverage available in major cities in Canada, United Kingdom and continental Europe, and in selected cities in Africa and Asia.

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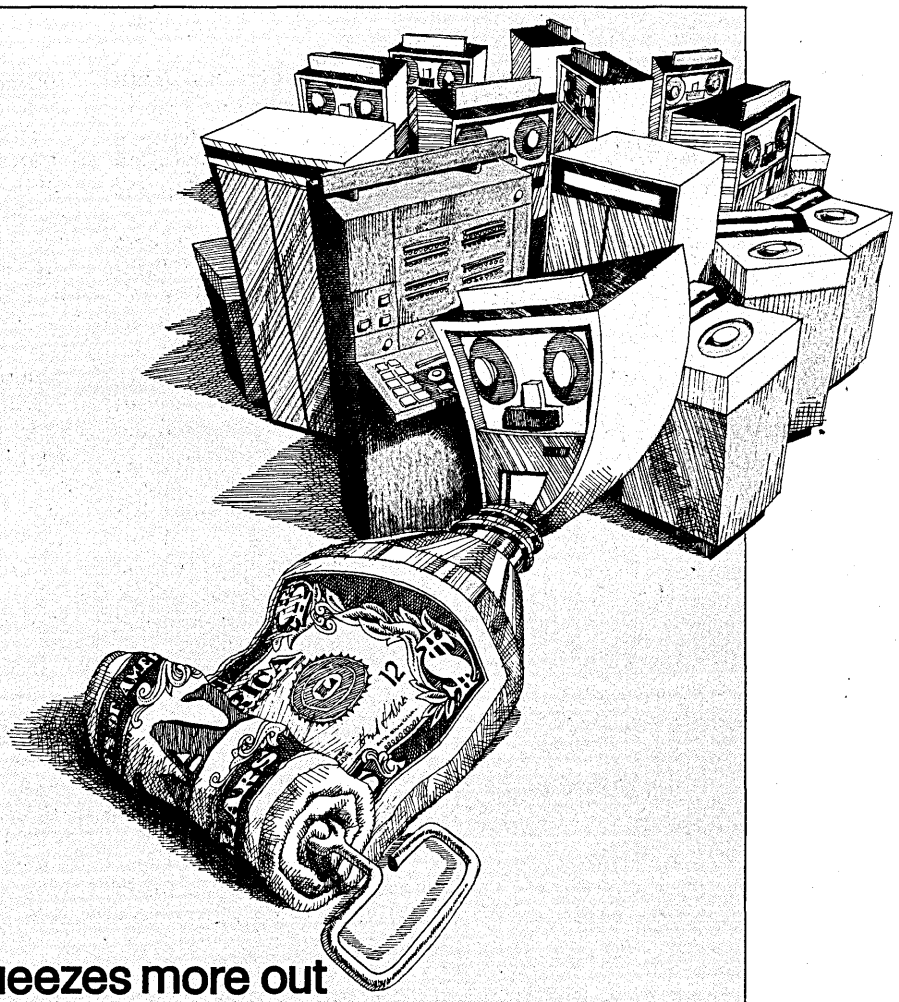

ITEL squeezes more out of your computer dollar than Brand X.

Now you can get a whole computer system from ITEL for less than what IBM charges for just a central processing unit.

The numbers speak for themselves:

For $51,238 a month, IBM rents you a single 370/158 CPU (includes two extra shifts). But for $48,406, ITEL leases you that same 370 CPU with ITEL Monolithic Memory, 24 ITEL disk drives plus their controllers, as well as 24 ITEL tape drives with their controllers.

To put it another way, if you were to rent a comparable system from IBM, it would cost you $81,846 a month. Almost double our price.

Furthermore, we'll lease any kind of 370 computer package at proportional savings. And we'll make sure that all terms and provisions are custom-tailored to meet your exact financial objectives.

At ITEL, we couldn't have acquired over half a billion dollars in IBM computer leasing experience without doing more for your money.

Your financial alternative.

ITEL CORPORATION
DATA PRODUCTS GROUP

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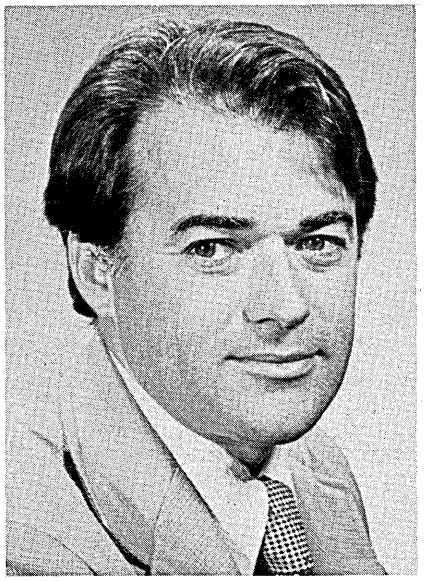
people

THE SHIP WAS THE ENTIRE U.S.

Scientists-turned-entrepreneurs often long for the less distracting careers in laboratories. As a founder and executive vp of Standard Computer Corp., Santa Ana, Calif., Laszlo L. Rakoczi, 39, logged more than 100,000 miles a year directing the company's time-sharing and computer leasing operations in Minneapolis and New England. Said Rakoczi, who this spring left Standard for Tymshare, Inc., in Cupertino, Calif.: "I was like the executive officer on a ship, going from one end to the other, only the ship was the entire U.S."



Laszlo L. Rakoczi

So, when former GE associates Tom O'Rourke and Warren Prince of Tymshare began talking, Rakoczi listened. "I'll still be traveling, but not as much," said the dark-haired Hungarian-born scientist of his new post as corporate vp and general manager of Tymshare's technical research and development division.

Rakoczi left General Electric's computer department in Phoenix in 1965 with a fellow GE associate, Dave Keefer, to form Standard, whose product was a language-independent "fourth generation" computer. The machine incorporated Rakoczi's microprogramming concepts—he held the basic patent for microprogramming until selling it to Standard—to emulate older generation machines. Thirty-four machines were built—the IC 4000, IC 7000, and IC 9000—and all but three are still installed, 14 with customers, others in Standard's time-sharing operation. Although company literature called it a "pioneering" invention, Rakoczi now thinks "we were missionaries, not pioneers," probably because the company survived the fatal arrows so often associated with pioneers, saving itself during the money crunch of the early '70s by acquiring Call-a-Computer, the Minneapolis time-sharing company which was one of Standard's first customers. Later, Standard acquired Computer Trade Corp., a Newport Beach, Calif., computer leasing company which now accounts for about 40% of Standard's revenues. The rest is in time-sharing.

Surprisingly, Rakoczi doesn't hold a degree, although while with RCA in 1958-60 he was accepted at the Univ. of Pennsylvania's Moore School of Engineering to follow graduate courses in computer science. His undergraduate studies in electrical engineering at the Technical Univ. of Budapest were interrupted when he fled the country in 1956 after Soviet armies crushed the Freedom Fighters revolution. Rakoczi and his wife Katalin, who then was his fiance, dodged Russian army patrols 14 days in the 100-mile escape journey in the cold of December from Budapest to the Austrian border. Their party of two grew to 40. "We were well-organized for so large a group," he recalls. "We scattered instantly into groups of four when Russian mobile patrols were detected."

Rakoczi envisions many opportunities for time-sharing as the companies enhance their specialties. "It's becoming a field of specialties, ours being networks." A possible wave of the future will be the increased use of communications technology to move jobs back and forth to computers most suited for these jobs, "polarizing our machines to do certain jobs by moving data over high speed lines (50KB)," probably through satellite communications, if not over telephone lines.

"And, at least among the leaders, there has been one big change from time-sharing of the late '60s and early '70s: we're keeping our customers. The industry isn't killing each other off stealing each other's customers anymore." □

ON THE STREET WHERE HE LIVES

In late 1968 when Art Speckhard, along with Jim Halverson and Tom Woods, set out to form a time-sharing company, their first efforts went into securing outside financing. They got it, survived what Speckhard called the "scary days," and launched Intranet Industries and a proprietary time-sharing system.

Late last year, Speckhard, 43, again founded a company, this one Granvia, Inc., formed to develop proprietary products in computer architecture, microprogramming, and computer logic. This time the approach is different. "One thing I am not looking to at the moment," he said, "is bringing in outside capital."

Intranet was a victim of its times. Both its biggest customer and its underwriter went under. Intranet itself went into Chapter XI in late 1970. It got off the bankruptcy rolls in late 1972 and is a going concern today, but not as a time-sharing firm. It's a producer of medical instrumentation and proprietary memory systems.

Speckhard last May severed all relationships with the firm he'd helped found and had once headed as president. He resigned as a director and sold his stock, which amounted to roughly 10% of what was then outstanding. "I finally made some money out of the company."

His new company has a working prototype of its first product, an interactive terminal designed to compete with the Teletype Model 33. Like the Teletype unit, it produces hard copy, but at a faster speed, 30 characters per second vs. 10 characters per second. The second product, Speckhard said, will be a microprocessor, and it already exists on paper. He said he did most of the design work himself, having had experience in designing a

Art Speckhard

people

microprocessor which is incorporated in Intranet's latest controller.

The president of Granvia wants to keep it small for a while, sticking to development work and seeking others to do the manufacturing, marketing, and servicing. "In this area there are many manufacturers looking for a product. I'd like to work on a royalty or licensing basis."

Speckhard's data processing career spans 22 years. He started with Gilfillan Brothers, Inc. as a field project manager in analog systems for missile guidance programs. Subsequently he was with IBM as a special marketing and technical representative; with Bellcomm, Inc., an AT&T subsidiary, where he established a data-processing department and directed development of time-sharing software; and with Computer Sciences Corp. as director of Northwest Operations, as head of a European subsidiary, and as a leader in the formative stages of Infonet.

Despite what happened at Intranet, Speckhard hasn't soured on time-sharing. "It (time-sharing) faced a rough world in the recession of 1970 but it still has a substantial future. It's beginning to mature and is changing more gradually than in the hectic early days." He cited Standard Computer Corp. for which he is a director. "Standard moved from hardware into time-sharing, opposite of the route taken by Intranet, and is doing relatively well."

Speckhard sees a trend among time-sharing companies toward "building more of their own things and doing much of their own equipment maintenance." He also feels t-s firms are tending to keep their equipment for longer periods of time.

And for Granvia, he banks on "the diversity of products that can be built around microprocessors." It could pay off. After all, he named the company for the street on which he lives—Granvia Altamira which, roughly translated, means "great street with a high view." □

A FETISH FOR PLANNING

Joseph F. Kruy, president of Cambridge Memories, has a fetish for planning. Ask him what's going to happen in virtually any segment of the computer or semiconductor industries, and he has a strong idea about what he thinks is going to happen and where he wants his company to be when it does happen.

It wasn't always so, though. While Kruy was a lecturer in mathematics at the Technical Univ. of Budapest during the Hungarian revolution, he decided to make a break for the West. He had a plan and he thought he had his escape route all worked out.

Unfortunately, he took the wrong route and he left Hungary under fire. "I just picked the wrong place," says Kruy. "If I had been right, we might have been met by a band and cheering at the border instead of a few bullets."

Kruy returns to his native Hungary for trips now and then and to visit relatives (one of his brothers was the wrestling coach of the Hungarian Olympic team). Kruy even thinks that Hungary one day might be a good market for his growing computer memory company.

Hungary, of course, is famed for its mathematicians. Kruy observes that most become teachers. "Hungary was a cemetery as far as a future in a technical business was concerned," he recalls. "It was an agricultural country.

Joseph F. Kruy

Technicians who wanted to go into business usually went to Germany."

When he crossed the border, Kruy's earthly possessions consisted of the suit on his back and his university degree. When he arrived in the U.S., he found that nobody ever asked him for his degree, though. He worked for Honeywell for 10 years until he formed Cambridge Memories in 1968.

His mathematics background may have something to do with Kruy's fetish for planning. "Mathematics teaches you to think things out from the beginning to the end," he notes. "There is no monkey business in mathematics, no cheating."

And what are Kruy's plans for his company's future? Cambridge Memories, which is located in Bedford, Mass., is chiefly in the business of adding on memories to IBM 370s and to minicomputers. He sees that business holding up and, further down the line, he sees Cambridge being a factor in the whole business of what he calls memory hierarchy. While Cambridge's chief memory business is in cores and semiconductors, the company has received widespread attention for its moving magnetic domain memory called DOT. Kruy believes it could be the wave of the future in the memory business. □

WILLIAM S. ANDERSON, president of NCR Corp., was elected chairman of the board and chief executive officer . . . FREDERICK R. ADLER was elected chairman of the board for Intersil, Inc., Cupertino, Calif. . . . FREDERICK B. SCHUDEL was appointed a senior vice president of California Computer Products, Inc. with responsibility for manufacturing, material, and facilities . . . CHARLES S. GIORDANELLA is the new executive vice president and chief operating officer of TBS Computer Centers, New York City, a division of National CSS, Inc. . . . ARTHUR MINTZ was named assistant general manager for the Data Products Div. of Lockheed Electronics Co., Los Angeles.

WILLIAM H. ABBOTT, formerly with Hewlett-Packard, joined Spectra-Physics, Mountain View, Calif., to head a new department formed to produce an electronic label reader . . . W. E. (BILL) WALKER was named marketing manager for Remex, a Santa Ana, Calif. miniperipheral manufacturer . . . R. LEE PAULSON was named corporate vice president of management information systems for Allied Supermarkets, Inc. . . . LEONARD E. MIKUS is the new president and chief executive officer of Intercomputer Communications Corp., Phoenix, succeeding KARL WENK, who remains as a director and financial consultant.

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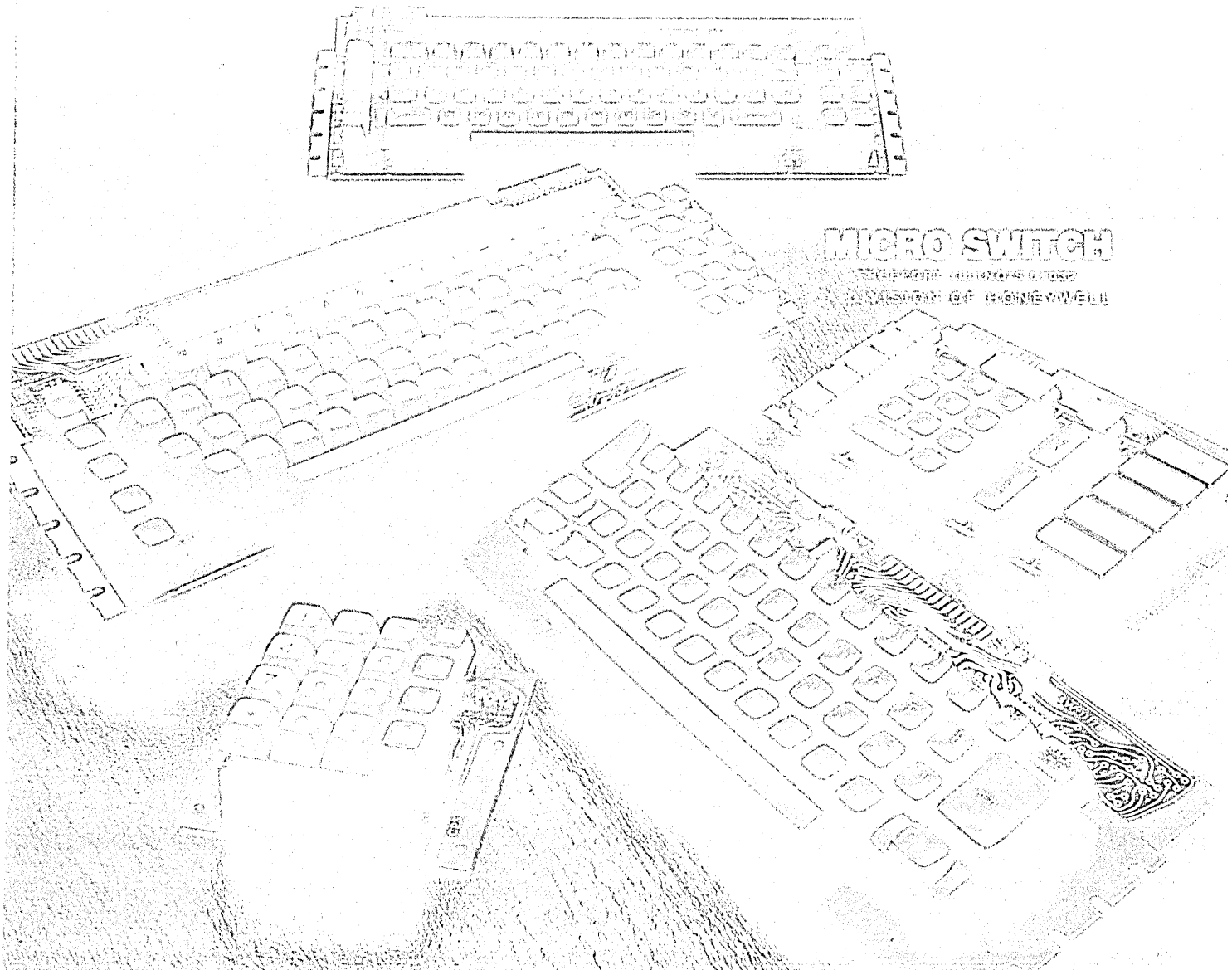

We've built our Series 3000 disc drives around a revolutionary rotary actuator that replaces the standard voice coil. It's smaller than the voice coil, which enables us to build a drive that fits a 24-inch rack. It runs cooler, greatly simplifying heat compensation problems. It's much easier to maintain. And it uses less power. About one-third the power required for comparable disc drives.

Engineering firsts, like the rotary actuator, are an integral part of the iomec story. We were also first with fixed disc systems. First to offer optical head positioning. First with 200 tpi technology. In fact, we've been shipping 200 tpi systems for about two years.

Someday, all disc drives will use rotary actuators. But you don't have to wait that long. They're available now in Series 3000 disc drives from iomec. The engineering leader.

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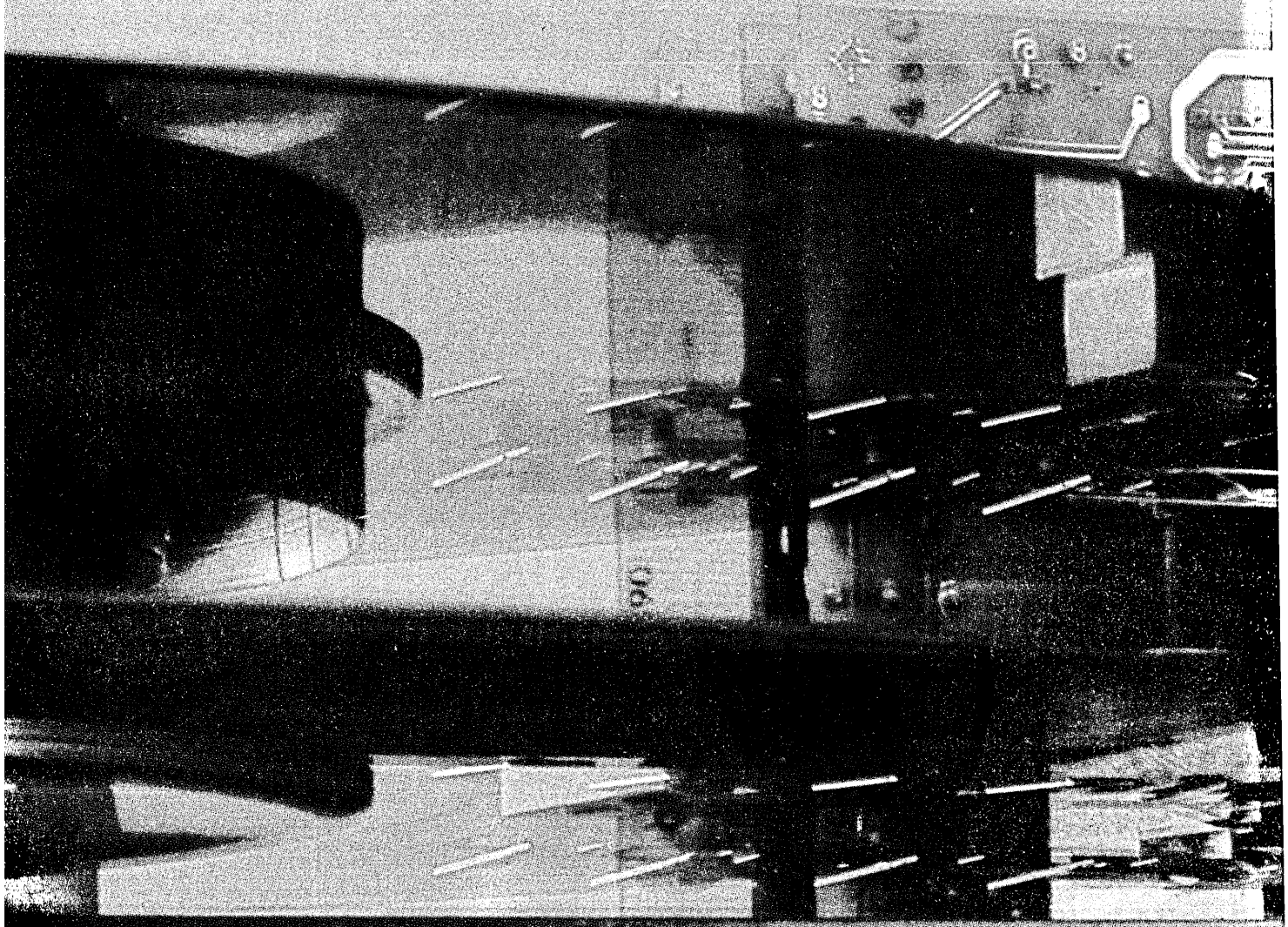

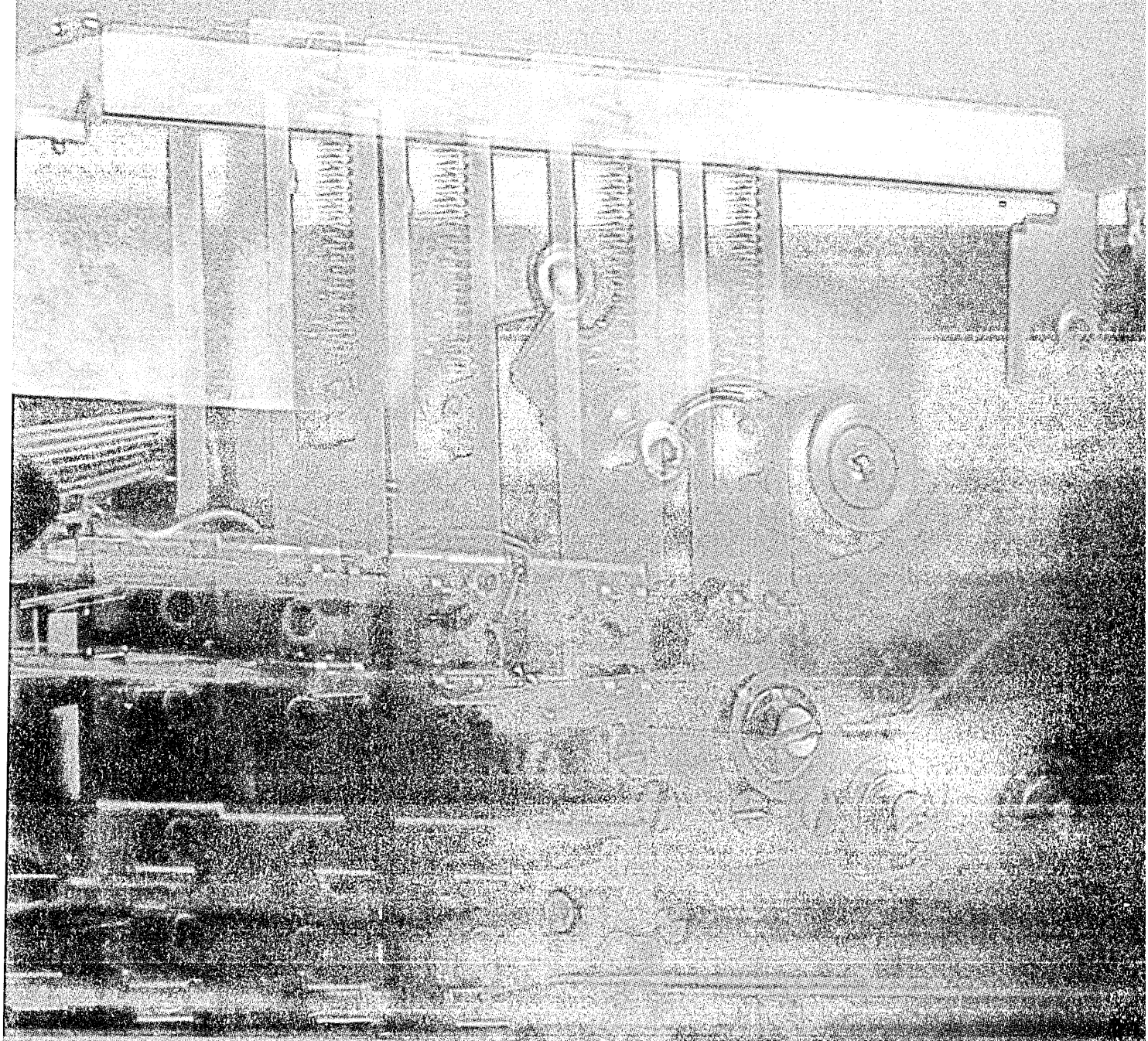

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How? Take a look at our 4010 family of low-cost graphic terminals. We'll show you how they cut endless hours of plotting . . . how fast they convert mounds of data into understandable charts, maps and drawings.

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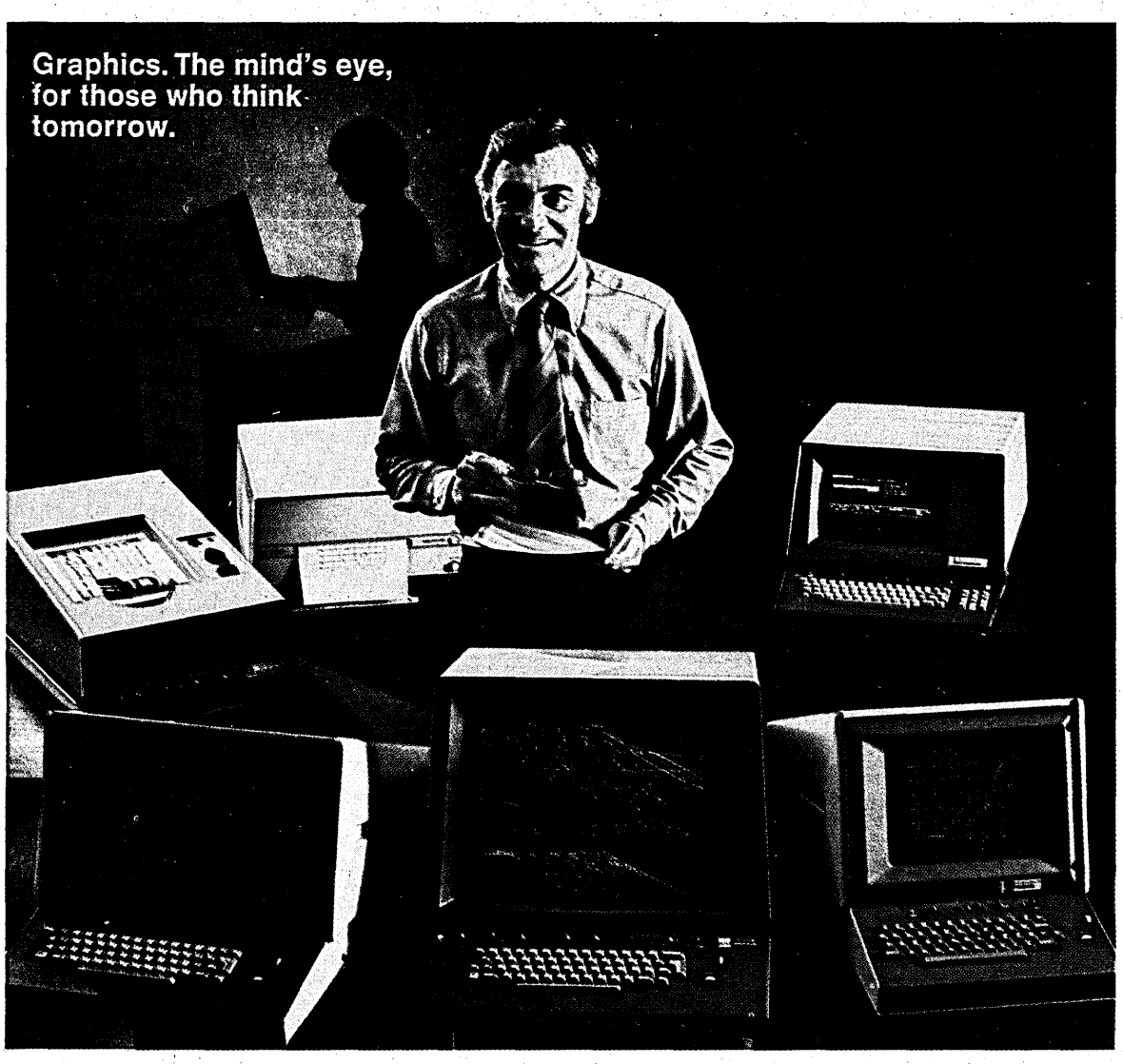


LOOK AHEAD

"WE WANT SOMEBODY TO ARGUE WITH US"

Only specific response so far to The Computer Industry Assn.'s offer to put up $50,000 to start up an independent user group, if two other groups would make matching offers, has been negative. "CBEMA (Computer and Business Equipment Manufacturers Assn.) turned us down," said CIA executive director, A. G. W. (Jack) Biddle. But CIA hasn't given up. "Users will be severely impacted by any restructuring and/or regulation of the industry," said Biddle. "The problem is, the people who should know, don't know and these are the management executives responsible for data processing." He said current data privacy legislation being considered could have "horrendous impact on the industry and there is no input from users. For them to rely on suppliers for this is ludicrous." He referred also to "inquiries of the FCC into interconnect where nobody is presenting to the user the major issues."

Biddle noted that it has been suggested that "with the right person to run it," the $50,000 CIA has offered to put up would be enough to get a user group going. "We don't think so," he said. "It has been our experience that $50,000 isn't enough and we don't want an independent user group being restricted by the label 'a puppet of the CIA.' We want somebody to argue with us."

SYSTEM 2 DELAYED BY DEBATE

The System 2 has been one of IBM's most widely-heralded unannounced machines. But what happened to it? We understand there was a disagreement between the field and headquarters over software support for the low-end business-oriented smart accounting machine. In brief, headquarters wanted to have many industry-oriented applications packages, a la Burroughs. But the men in the field wanted something that would offer customers more opportunities to customize software: perhaps something like the System/3 applications customizer, which has been a valuable tool for System/3 people.

It's understood the issue has been settled in favor of headquarters and the industry-oriented packages, probably resident on cartridges or floppy discs, will be offered when the machine is unveiled this fall carrying a price tag of from $800 to $1,000 a month.

HONEYWELL: PLUGGING THE GAPS

When Honeywell Information Systems wrapped its multiple machine lines up in the Series 60, some discerning users detected a gaping hole in the package--between the 64/20 and the 66/20. There is a 64/40 partially plugging the hole for European users and it may be announced soon in the U. S. Production should be in the Boston area. Moreover, it could be the first of Honeywell's "attack" machines. It's been laboring for years on such machines--that is, machines aimed at taking away business from other mainframe manufacturers rather than just another play in the upgrade game.

Even with the 64/40, there remains a gap in the line--roughly equivalent to IBM's 370/135 and 360/40. It's only logical to assume that Honeywell will announce something in that range, but that will be in the more distant future.

In the meantime, Honeywell is moving its medium range 200 and 2000 users up the 2000 ladder, which makes eminent business sense, because Honeywell won't have to absorb waves of equipment coming off lease. As for the Series 60 equipment itself, Honeywell says it shipped its

first machine in the line--a 62/40 to a Milan insurance company. Generally, the whole line is moving better in Europe than in the U. S.

BURROUGHS: LOCKING OUT IBM

Though some are flexible, most non-IBM mainframers jealously guard their markets against intrusions by makers of foreign attachments (page 120)--often to the frustration of innovative customers. Stanford Research Institute sought unsuccessfully to hook an IBM 1403 chain printer on to its Burroughs 6700. By using over-striking techniques, SRI felt it could use a total of 600 different characters for publishing computer-generated technical manuals. When SRI asked Spur Products of Los Angeles to build the interface, Burroughs refused to turn over technical details unless Spur agreed not to use the information to sell interfaces to other Burroughs users.

A one-shot job, with no chance of re-selling, would have cost SRI $50,000 to $60,000, says Ray Lorenz of Spur who instead supplied a 1403 interface for SRI's CDC 6400. Fledgling Spur Products has installed seven 1403's on DEC, General Automation and Xerox mainframes "with full cooperation of the mainframers," but its Burroughs prospects meet severe resistance regardless of their clout. One mid-western Burroughs installation, with more than a dozen B3500's, was spurned by Burroughs when it sought to add IBM 1403 printers and card readers to its equipment. It's too bad, says Lorenz, because his inquiries from Burroughs users exceed those of others four to one.

FEDERAL NETWORK STILL IN TROUBLE

"Son of Fednet," GSA's amended but still controversial RFP encompassing a big on-line dp system, was in dire peril at press time. The House Appropriations Committee has blocked funds for the bulk of the system to be used by the Dept. of Agriculture, and the committee was considering a similar cut-off for the remainder, which GSA would operate. The Senate Appropriations Committee was also considering a cut-off. Meanwhile, at a June 20 hearing, convened by members of the Senate Judiciary and Government Operations Committees, Clay Whitehead, Director of the Office of Telecommunications Policy, said the "character" of the project "has not been substantially changed" --i.e. it still poses a privacy threat. It was this threat that galvanized Congressional opposition to the original Fednet project.

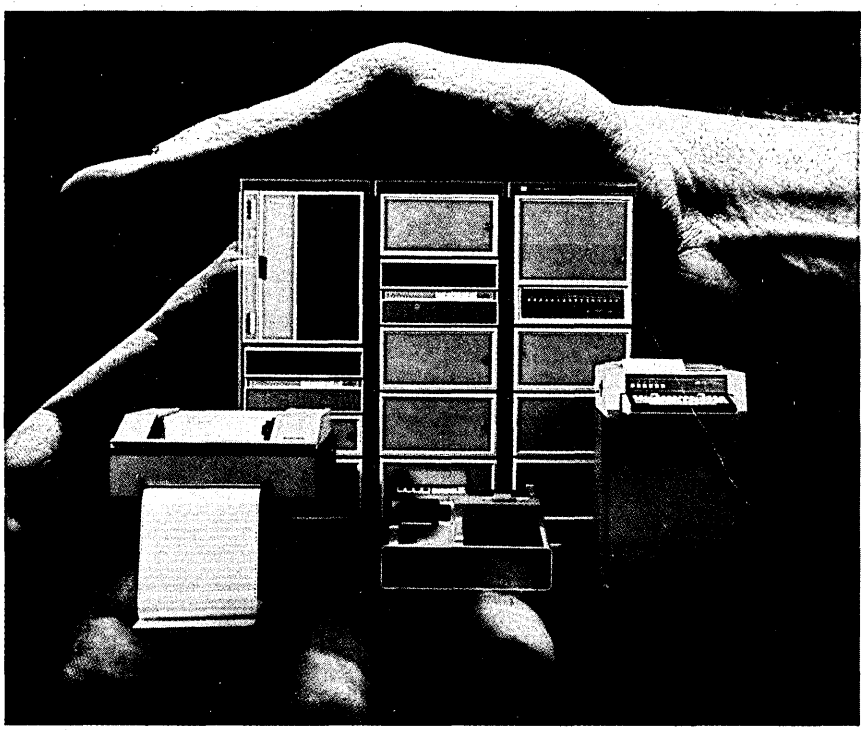
NOVAR FOUNDERS TO MAKE NEW MARQUE

A new company with a line of medium-speed printers has been formed by the people who earlier brought you Novar Corp. Bill Bennett and his management staff from the terminals company, continuing a business association that dates back as much as 20 years, have formed Hydra Corp. in Mountain View, Calif. They've scheduled a fall announcement of a family of impact printers for the oem market.

A GAS SHORTAGE FOR THE GOOSE; EXTRA STEAM FOR THE GANDER

Computer Shopping, Inc., a Washington D.C. company which had developed and is trying to sell a computer-based in-home shopping system to supermarkets, received a lot of attention during the "energy crises" with claims that widespread implementation of its system could save more than 600,000 barrels of gasoline per day (March, p. 129). It seems to have run low on gas since then. It's still without a pilot system. But another company with a similar offering has been quietly picking up steam.

(Continued on page 138)



This $129,500* timesharing system gives you better BASIC than any other minicomputer system. With batch at the same time.

HP's 3000 Model 100 lets you do more with BASIC than ever before. You can intermix integer, real, long precision and complex numbers. Share resources with any kind of peripheral. Call subroutines compiled in FORTRAN, COBOL, and our Systems Programming Language.

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At 9:30 a.m., you learn you've got to get that shipment to your customer 2000 miles away...by evening. How?

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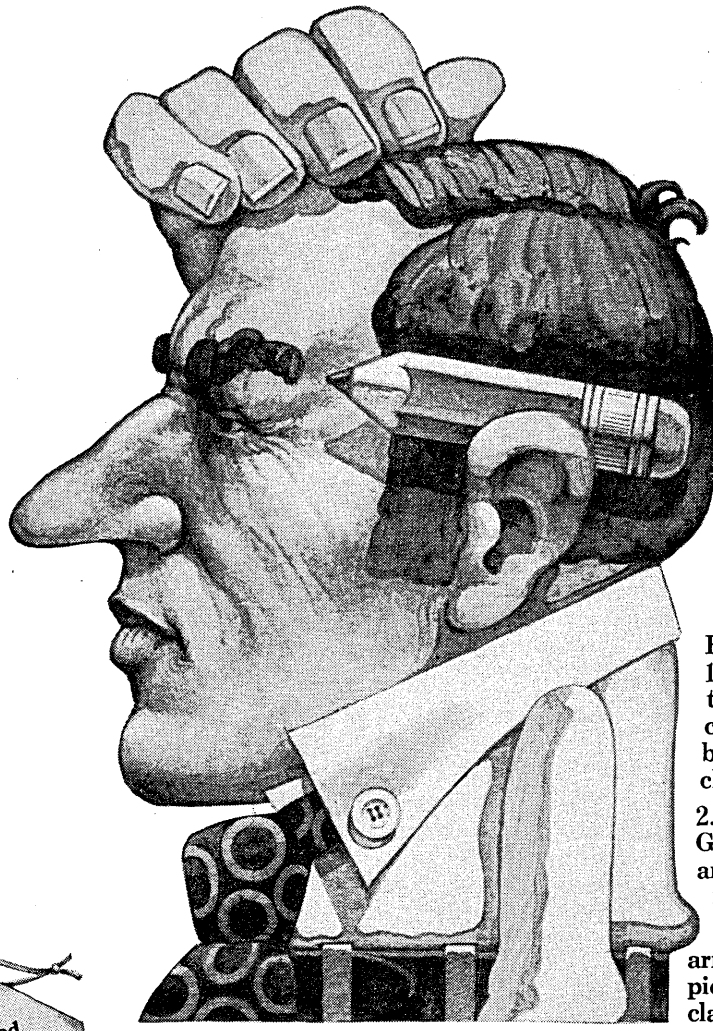
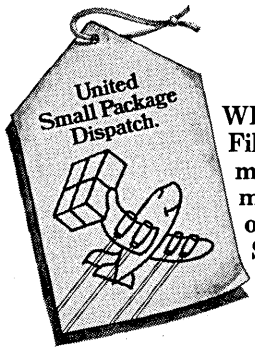
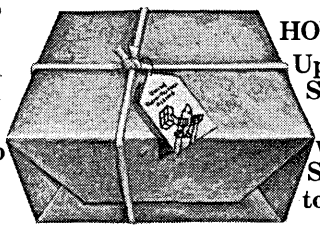


HERE'S ALL YOU DO:

1. Take your small package to United's passenger check-in counter 30 minutes before flight time. Pay the charges.
2. Phone your addressee. Give him the flight number, arrival time, and receipt number.
3. Thirty minutes after arrival, the package can be picked up at the baggage claim area.



WHAT CAN YOU SEND?
Film, computer tape, medicine, advertising material, machine parts—or anything you forgot. Sample price: Chicago to New York, $20.



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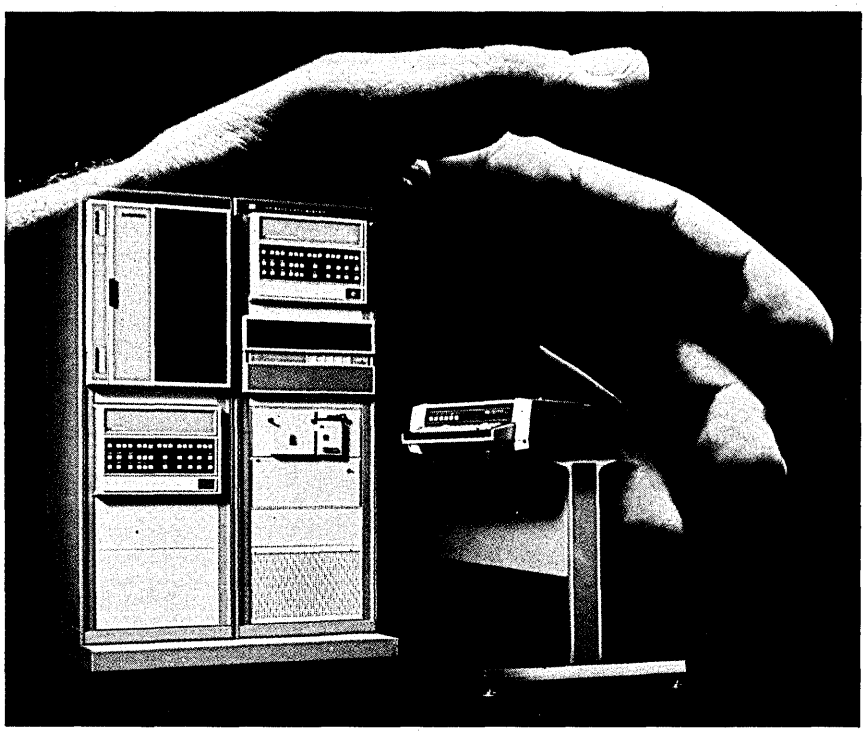

This $66,950* timesharing system gives you two processors and fast response for 32 users.

HP's 2000/F Timeshared Data System has one processor for data communications. Another for our operating system and your on-line data management and computation applications.

Your program segments can run up to 20K bytes long for each of 32 users. High-speed, on-line disc is expandable to 180 million bytes. And you get a BASIC language tailored for interactive use.

By itself or with your existing large system, this innovation works for a living.

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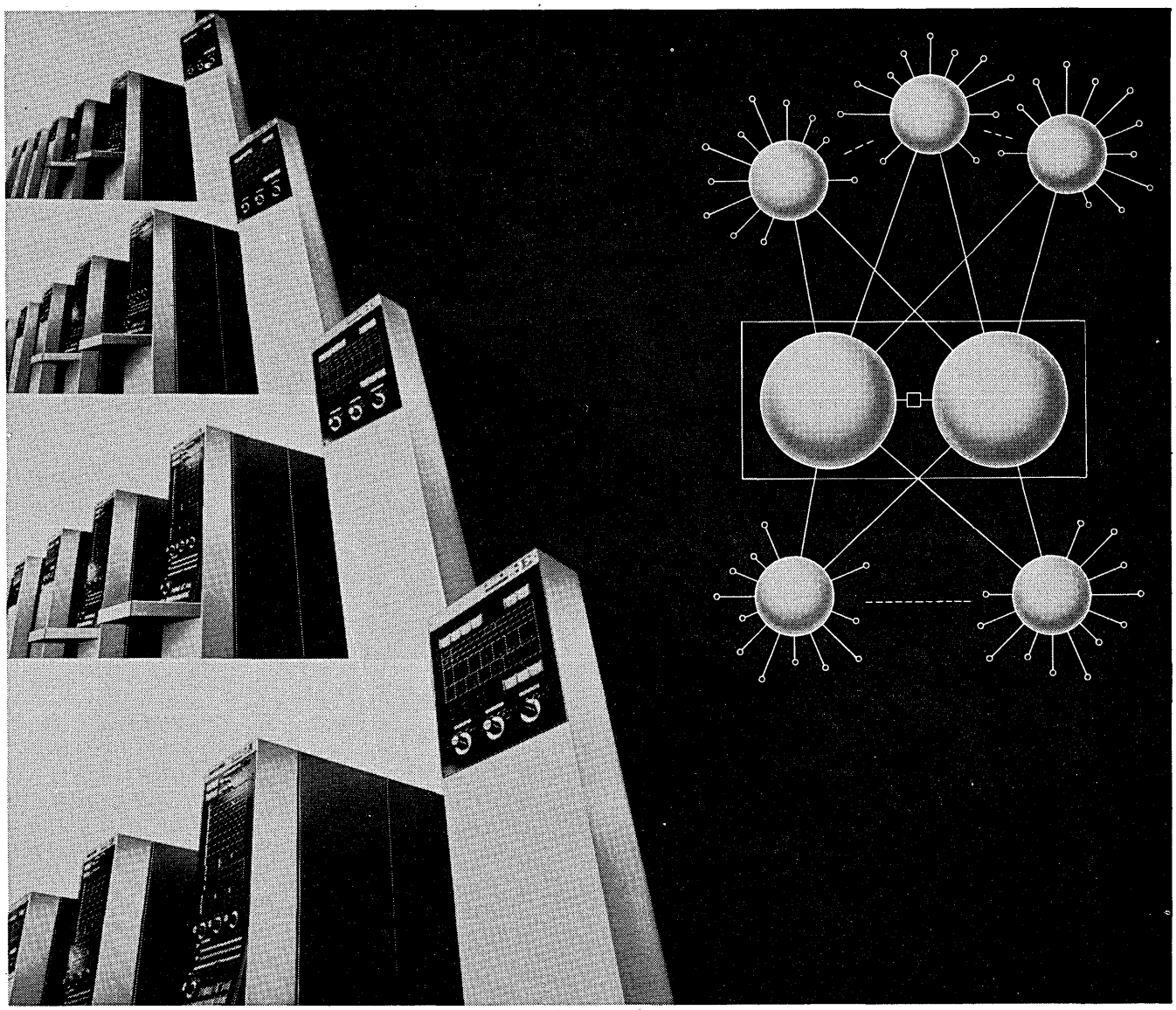
How 89 Different Banks, with 7,200 Branches, Carry on Exchange.



Most people don't know it, but April 9, 1973 marks a very important day in the history of banking. On that day, in Japan, the first truly nationwide, inter-bank computer "message switching system" went into operation.

FACOM

To help "rationalize" the handling of exchange transaction between 89 different banks and their 7,200 branches, FACOM computer played a major role in the creation of this gigantic data communication system for banking.

At the heart of the system are six Central Processing Units. By means of a "divided installation" system and a load sharing system, these processing units are connected with two or more terminals installed in individual banks by way of special computers.

This is just one contribution our FACOM computers, with more than dozen models ranging from large to small, have made to banking. If the task involves highly sophisticated data processing techniques in every field from business calculation to scientific computation, then you can rely on FACOM from Fujitsu — a pioneer and developer in electronics and communications the world over.

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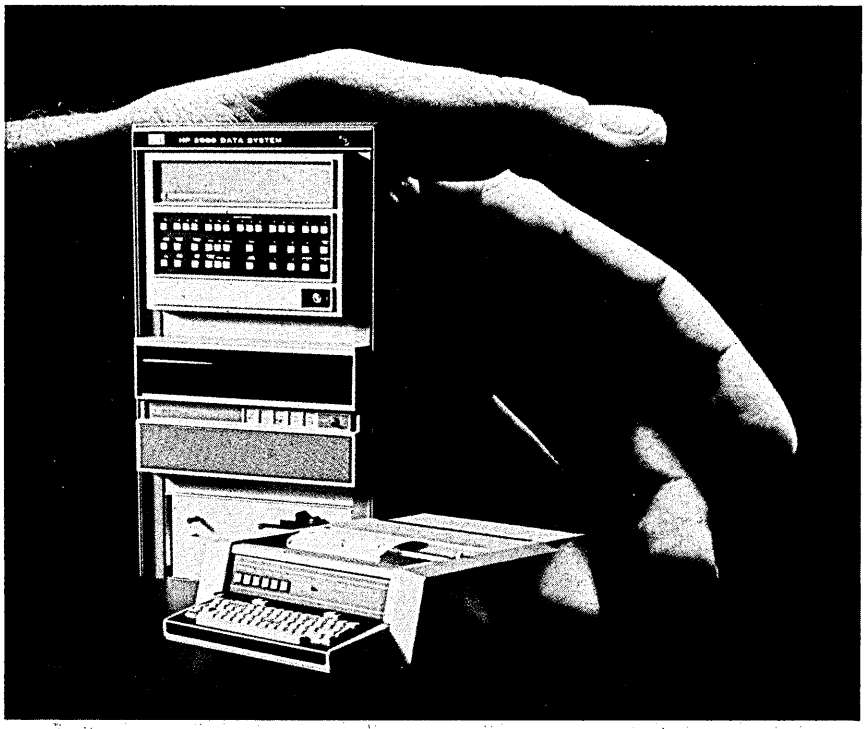

This $34,950* timesharing system gives 16 users low cost per terminal and the fastest disc in its class.

The HP 2000/E Timeshared Data System is small in price only. Each user gets an 8300 byte program segment area and instant response for all users. (Ask us to benchmark your programs.)

Microprogrammed floating point hardware cuts computation time. And conversational Timeshared BASIC/2000 ensures rapid solutions to problems.

You can easily expand to our two processor HP 2000/F system and support 32 users.

This innovation works for a living.

You do. So call us.

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This $4,000,000 baby is not paid to lie around.

Insist on ACE-SIL® rubber battery separators.

When a $4,000,000 computer "goofs-off" you've got problems. People scream. Everything backs up. And the cost of downtime can keep you awake at night. Sure, some computers are backed up by fail-safe standby systems. But, unfortunately, a standby system is only as good as its batteries. And a battery is only as good as its separator.

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CIRCLE 24 ON READER CARD

letters

Not merely enough

Your correspondent reviewing the U.K. General Elections (April, p. 154) missed the main action, and in particular the terminals, when she stated that the computer used by Independent Television News (ITN) during its election results programmes "was a mere PDP-11." In fact, fourteen terminals were installed in ITN's London Studio and these were linked direct to a powerful ICL 1905F computer run by Baric Computing Services Limited in Manchester (200 miles away) as a terminal time-sharing service.

As each result was received in the studio, brief details were fed via a terminal to the 1905F, which expanded the results and returned them to the studio for transmission to viewers. The 1905F was also used to calculate swings and turnout, up-date a results "score-board" and predict the final result, provide analyses and voting trends for studio commentators, and generate input data for a graphic display unit. The PDP-11 was used "merely" to drive this graphic display.

This was the fourth successive time that Baric, the leading British Computer Service Bureau, had assisted ITN during its television coverage of the U.K. General Election results. Baric is currently modifying the program in the light of operational experience, in readiness to assist ITN at the next election.

K. G. HOWE
Press Officer
Baric Computing Services Ltd.
London
England

Computer services

By 1983, perhaps the writers of "The Computerization of the ABC Widget Co." (April, p. 71) will have learned that there exists a substantial and growing computer services business in the U.S. Thus they can write another article showing how ABC Widget used computer services to solve some or all of their dp application problems.

Fortunately, many edp users know this now. In fact, since as far back as 1953, U.S. businesses, particularly small businesses such as ABC Widget, have found computer services vendors a viable alternative or supplement to in-house processing. Computer services embrace processing as well as packaged software sales.

The hard, complex planning work and acquisition of trained, talented staff the authors say are necessary elements in developing computer-based systems often can be accomplished more economically and effectively on a shared service basis, rather than on a standalone in-house basis.

DAVID C. JUNG
Vice President
Quantum Science Corp.
Palo Alto, California

Two-bit bite

We have been vexed (or is it hexed?) by the access problems of rectangular memories for some time. After much correspondence with, and several visits to, Caligari Systems Laboratories, we were convinced that the Marks 2 (April, p. 175) was the solution to our problems, and became the first user of that system. We have since made several enhancements to the software provided and have recently replaced the Management Indecisions Simulation System (April, p. 183), which we had been using with our own Virtual Assembly Management Package for Iterative Regressive Emulation. We are currently using this package to validate the Inverse Peter Principle (April, p. 123) in conjunction with its discoverer, Mr. A. Nonymous.

Contrary to many opinions, we do not find the two-bit bite (called a fang) to be a disadvantage, but rather have used its unusual deepness to great advantage in several penetrating problems. We have also solved the problem of the 28 day recycle time through the use of our Moon Orbit Reconstruction with Biased Integral Display system.

We are greatly impressed with the performance of the Marks 2 and have many plans for its use.

J. A. HAGE
Senior Member
Information Systems Staff
Western Electric
Columbus, Ohio

Programmer productivity

I found Dr. Scott and Dr. Simmons' article on "Programmer Productivity" (May, p. 71) extremely interesting, although I must point out that I feel that the authors have completely left out one major aspect of programmer productivity. They measure the productivity in terms of "implemented object instructions per unit of time," without distinguishing between productivity related to writing new development programs (development productivity) and the productivity related to modifying and maintaining existing programs (maintenance productivity). Obviously there is a great deal of difference between these two, since a given programmer's maintenance productivity will be lot less than his development productivity. This also means that not only the *kinds* of variables affecting each will be different but also the *degree* of effect each variable will have on these two productivity rates will be different. I feel that more meaningful results could have been obtained if the authors had distinguished between the two productivity rates and studied the

degree of effect of variables on each separately. In these times when more than 50% of the programming resources are being spent on maintenance of existing applications programs, the maintenance productivity factor cannot possibly be ignored.

This also might explain why the "structured programming" got such a low rating. During development stages, structured programming will have an adverse effect on productivity, since extra efforts are needed on the part of the programmer to make a program structured; but once a program is written in a "structured" fashion, it is lot easier to understand, maintain, and modify, and so structured programming will have a significantly positive effect on the "maintenance productivity" but a negative effect on "development productivity." This means that the effect of structured programming on programmer productivity could not be studied unless a distinction is made between the two productivities.

The same thing is also true about the number of unconditional branch state-

letters

ments in a program. Had the authors of this article mentioned "maintenance productivity," this particular variable would have ranked very high. Those readers who have had the pleasure (?) of modifying "bowl-of-spaghetti" COBOL programs would testify to that. As it turned out, the survey contributors must have assumed "development productivity" and ranked it very low, as it should be. This does point out the need for separate productivity studies.

Incidentally, now that the consensus of the survey ranks "the choice of programming language" as one of the variables having most positive effect on programmer productivity, I wonder how long the programming community can afford to ignore the ADPAC language, which results in two- to threefold increase in programmer productivity, as reported by over a hundred installations? And I do mean "development productivity," as well as "maintenance productivity."

MANOHAR D. APTE
Cal-Farm Insurance Co.
Berkeley, California

The article by Dr. Scott and Dr. Simmons presented an interesting approach to assessing the problem of how to produce better software and improve programmer effectiveness and productivity. I find, however, that the assumption has been made that the "experts" polled in the Delphi survey(s) are in a position to effectively evaluate the significance of all of the questions on the survey. I am not sure that this is the case. If it were, then I would like to know the reason that the ideas these "experts" employ do not result in better software than they produce. We have a consensus, but what is its value? In addition, the survey contained ambiguities. For example, from the information provided in the article, it seems that item number 6 in Table 1 (system response time) may be interpreted such that the scale is increasing or decreasing. At any rate, I feel that the study is valuable, but far from practically conclusive or applicable.

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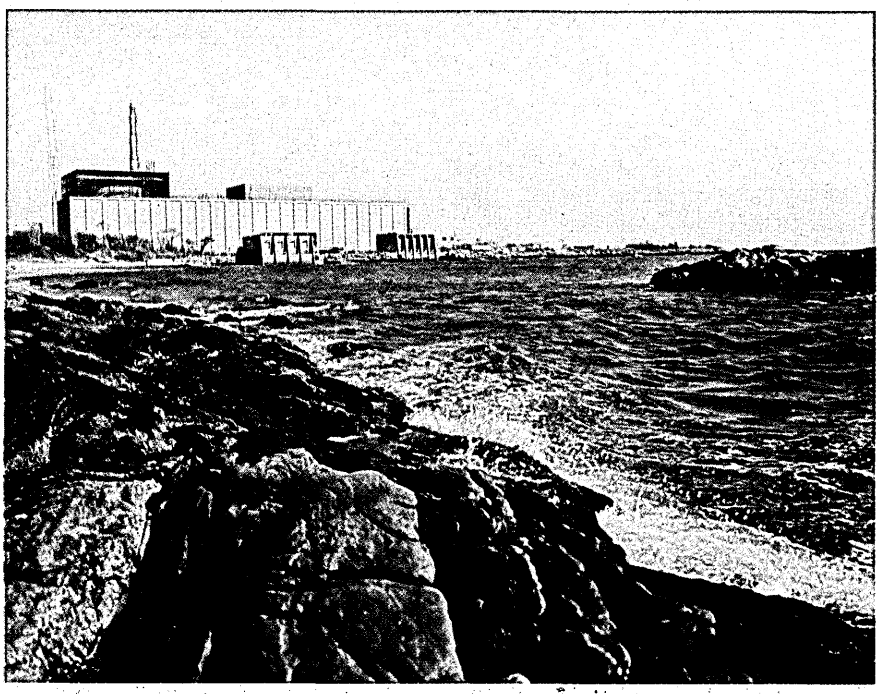
DATAMATION welcomes correspondence about the computer industry. Write to 1801 S. La Cienega Blvd., Los Angeles, CA 90035.

DP DIALOG

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

DP DIALOG appears regularly in these pages. As its name suggests, we hope DP DIALOG will be a two-way medium for DP professionals. We'd like to hear from you. Just write: Editor, DP DIALOG, IBM Data Processing Division, White Plains, N.Y. 10604.



Management of a two billion dollar construction program—including new nuclear power stations like this one in Waterford, Connecticut—is one of the applications under development at Northeast Utilities, a VS2 user.

Peak Computing Power for Northeast Utilities

To meet the growing demand for energy among its customers, Northeast Utilities, serving Connecticut and Massachusetts, will invest $2 billion in capital construction over the next 6 years.

To meet its own growing demand for computing power, and accommodate an ambitious information systems development plan, Northeast has already invested in dual System/370 Model 158's with OS/VS2, the virtual operating system which is the compatible extension of OS/MVT.

Through its three major operating subsidiaries, Connecticut Light and Power, Hartford Electric and Western Massachusetts Electric, Northeast serves nearly 1.2 million customers. A fourth subsidiary—Northeast Utilities Service Company—provides such services as personnel, purchasing, engineering and data processing to the operating units.

Explaining the selection of VS2, data processing manager Albert Schmitz says: "Since the company has been formed out of several separate entities, one important consideration was the need for a common, company-wide operating system capable of absorbing a variety of application programs and steadily increasing workload, while providing a foundation for growth."

The two Model 158's, which form the nucleus of Northeast's data processing operations, were both installed as VS2 systems. Installation of the first—over Veterans' Day weekend in 1973—coincided with the move into a new datacenter. The second was installed last February.

"The initial conversion was relatively trouble-free," Schmitz recalls. "Before the conversion, we spent several months testing application programs on a VS2 system at IBM's Boston datacenter. When the actual changeover occurred, we were able to run production work immediately—and we haven't looked back since."

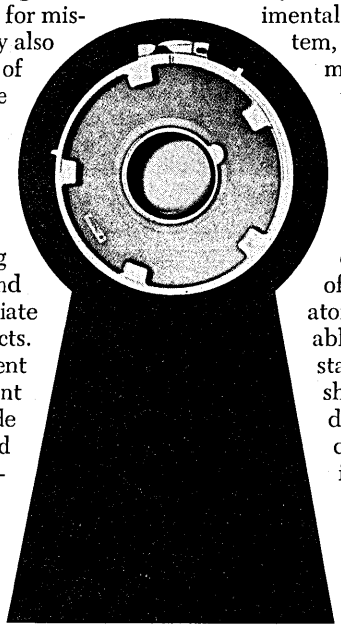
"One of the most important advantages of VS2," Schmitz notes, "is better memory management. Where once we had to carefully weigh memory size, the number of tapes and availability of disk before running a job, operators

(continued on next page)

Data Security: What IBM is doing

The evidence is clear: in the halls of Congress, in the editorial pages, in the proposals of public interest groups, and in the appointment of Vice President Gerald Ford to a top-priority Domestic Council Committee. There is a new urgency surrounding a timeless question: how to safeguard the right to individual privacy.

Defining what information is to be collected and who is to have access to it is the province of citizens acting through their government. But congressmen, citizens and the data processing community all recognize that data security as a day-to-day practice can make a major contribution to the protection of privacy as a social and legal principle. If the computer's incredible speed and prodigious capacity have the potential for misuse, that same technology also holds out the promise of protecting data far more effectively than any manual record-keeping system.



In 1972, IBM made a public financial commitment to the continuing study of data security and development of appropriate safeguards for its products.

Part of that investment went for a two-year joint study with three outside users; IBM also enlisted the help of its own Federal Systems Division, which served as an experimental control point. The groups completed their work this spring and the results will be placed in the public domain. The publications which will be available through IBM branch offices include six volumes: an Introduction and Overview of general interest; Study Summary; and in-depth technical papers from each of three principal study sites which will be of specific interest to particular audiences.

With their findings the study groups helped to advance data security from dialog to disciplined study and documentation, an essential step in finding workable solutions. In addition to a basic contribution to the literature on the subject and a foundation for future data security research and development, the studies also provide some practical, field-tested guidelines for immediate use.

At the State of Illinois, the emphasis was on detailed guidelines that other users can apply. A privacy action plan, for example, advises senior executives to establish what data is being collected, identify who needs it and why; assign an economic value to the data and qualify its worth to outsiders; review the probabilities of disclosure; and budget accordingly for security-related costs.

TRW Systems reported on a list of 187 requirements which could be used as a guide to determine whether a system is acceptably secure. They include five major areas: separation of programs and data, controlled access, identification, surveillance, and hardware and software integrity.

Massachusetts Institute of Technology considered the problem of authorization and delegation. While each study site installed IBM's experimental Research Security System, a software addition which made their operating systems more secure, MIT modified a procedure that previously allowed only a security officer to decide who could use or alter a particular set of data. By giving much of this authority to the creator of the data set, MIT was able to accommodate constantly changing relationships between users and data while enhancing security in their time sharing system.

At the same time, IBM has continued to work to make available a number of data security and integrity safeguards designed into system architecture and built into equipment itself. They range from special features like keylocks on terminals and other devices, to magnetic-stripe card or password identification, to high-level integrity in IBM's most advanced operating system, VS2 Release 2. Future IBM products will continue to stress provisions for data security as a formal engineering and design criterion.

Such safeguards are only tools, however. As Dr. Lewis Branscomb, IBM's chief scientist, noted in testimony before a special congressional committee, to be effective, they must be part of an over-all commitment to data security on the part of the data processing user, beginning with such fundamentals as locked doors, trustworthy people and conscientious supervision, and including controls like division of responsibility and periodic audits.

"There is no such thing as perfect security," IBM's chief scientist cautioned. "But," he added, "an appropriate level of protection can be achieved."

IBM

Data Security Information from IBM

In addition to the six study volumes, the following IBM brochures, available through local IBM branch offices, may also be helpful in developing and reviewing physical and data security measures.

1. Considerations of Data Security in a Computer Environment (G520-2169)
2. Considerations of Physical Security in a Computer Environment (G520-2700)
3. 42 Suggestions for Improving Security in Data Processing Operations (G520-2797)
4. The fire and after the fire... (G520-2741)
5. The IBM Controlled Access System (G520-2540)
6. IBM Data Security Symposium—April, 1973 (G520-2838)
7. Management Control of Electronic Data Processing (GF520-0006)

Northeast Utilities

(continued from page one)

now can concentrate on tape allocation. We've been able to open up the system and let the flood pour through. Over the first few months, throughput went up 50%, to 15,000 jobs."

In addition to current production work in payroll, personnel, purchasing and general financial applications, Northeast is also engaged in developing a comprehensive, company-wide information system. Understandably, construction management is a primary objective; so are an on-line customer service system and financial modeling capability.

Schmitz notes, "VS2 also offers our systems programmers much greater flexibility. They can now page libraries in and out and make modifications without affecting production."

"And our development programmers, who work with RJE, say they've never seen turnaround like it. Before, they counted their blessings with a once-a-day test shot. Now, they're used to once an hour."

Don Anderson, Northeast's director of systems and processing concludes: "VS2 is an effective way to handle the growth we anticipate—as a company and a data processing organization serving that company. We're confident it will make the progress of both a lot smoother and easier in the long run."

IBM

(Advertisement)

First System/370 Model 115 to Ski Distributor

Beconta Inc. of Elmsford, N.Y., the largest privately owned importer and distributor of ski equipment in the United States, has become the first in the nation to install the System/370 Model 115, the smallest member of the 370 line.

"The growth of our business in recent years is the main reason for our installation of a Model 115," says president James Woolner. "We needed a versatile system that would help us respond to customer demand for the quality lines we distribute."

Karl Wallach, treasurer and chairman of the board, adds: "We feel we're building for the future since the Model 115 gives us room to grow. This flexibility is something that only a virtual system can provide."

DP manager Dennis Hickey and controller Catherine Thomas confer on orders for the ski equipment their company distributes.

The firm is the U.S. distributor for such products as Nordica ski boots, Volkl skis, Look ski bindings and Puma footwear. In addition to its own headquarters and distribution center in Elmsford, Beconta operates distribution facilities in South San Francisco, Denver and Waco, Texas.

The Model 115, installed at Beconta in early April, replaces a Model 20. Woolner reports, "We can now take care of current business quickly and efficiently in addition to planning for other applications which would have been impossible before."

Beconta is using the Model 115 for such tasks as accounts receivable, accounts payable and inventory for part of the firm's sales line. In the future the company hopes to use the system for credit transactions, inventory of the entire sales line and sales forecasting.

Because Beconta's business is seasonal and international, the job of collecting and analyzing information is more complicated than in many other businesses.

The ordering cycle typically starts in late winter or early spring when buyers attend trade shows and place orders. Ski shops in metropolitan areas generally receive delivery of merchandise from July through September—those in ski areas from October through December.

Catherine Thomas, Beconta's controller, emphasizes: "It's very important we take these delivery times into consideration along with production schedules in the countries producing the goods. At the same time we have to calculate fluctuations in exchange rates."

"Another area we hope to get into is forecasting," she says. "We do a good job of it now, but we expect to do even better when we can develop on the computer a detailed history of past buying patterns."

Installation of the Model 115 went "as smooth as silk," according to Dennis Hickey, Beconta's data processing manager. "Conversion was impressive in both speed and accuracy. The task—involving the transfer of data from disk to tape to disk—took about three hours from start to finish."

"The way things went, we feel confident we can add additional applications just as readily. We look to the day when we will have an integrated management information system up and running." **IBM**

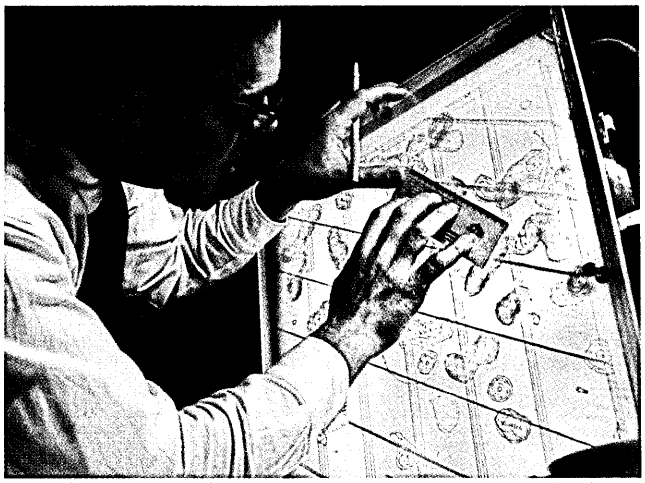
10,000 Equations and 15 Hours Later

It usually takes microseconds—perhaps as long as several seconds—for the computer to solve most problems. However, Dr. David Sayre of IBM waited almost 15 hours as a System/360 Model 91 computed the answer to his particular problem—a problem a team of scientists once worked two years to complete.

A mathematician at the T. J. Watson Research Center, Sayre has been engaged in refining the structure of a protein called rubredoxin. Beginning with an X-ray map at a resolution of 2.5 angstroms, Sayre used the Model 91 to process a complex system of more than 10,000 non-linear equations—one of the largest equation systems ever programmed for computer solution. A critical technique he employed, called conjugate gradients, was developed by Professor Magnus Hestenes of UCLA and was adopted by Sayre at the suggestion of a research center colleague, Dr. Philip Wolfe.

With the computation completed, and the resolution mathematically refined to 1.5 angstroms—about the distance between the centers of neighboring atoms—Sayre was able to identify some 400 of the protein's 424 non-hydrogen atoms.

In significantly reducing the computation time required for such high-resolution studies, Sayre's work may lead to improved understanding of molecules like DNA and RNA, key elements in the reproduction of human cells. **IBM**



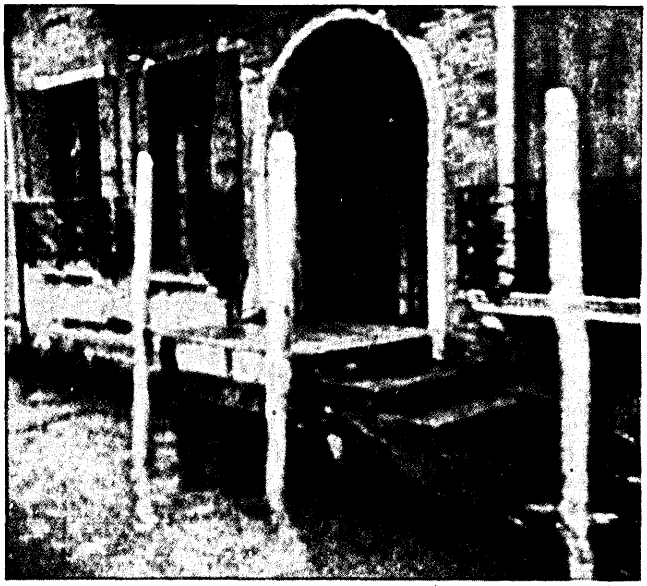
Dr. Sayre examines the structure of the protein, rubredoxin, on this electron-density map.

Computers Aid Scientific Study Groups Worldwide

In countries around the world, IBM Scientific Centers are experimenting with new ways of applying the computer to the solution of social, economic and technical problems.

In forming unique study groups with academic and government partners, the centers provide facilities and people with computer and scientific skills; the study partner provides experts of its own. Together, they decide what projects are most important and which will help the greatest number of people. Among those underway: studies of air pollution in New York, a sinking lagoon bed in Venice, feeding a growing population in Mexico.

Advanced approaches and ideas are already at work for business and industry. Today international scientists are applying the same powerful instrument, the computer, in coping with the more subtle problems of people and in keeping pace with the rapid changes which are shaping our future.



Breathing Easier in Manhattan

Curbing air pollution in New York City and other large industrial urban areas is an unending battle. But IBM scientists have enlisted the help of the computer in the fight.

This is a computer-generated picture of the sulphur dioxide buildup over Manhattan at 6:00 p.m. when it's at peak concentrations. When data on pollutants in the air is combined with values for every known atmospheric condition, the result is a numerical picture of air above the city.

Thousands of such pictures, calculated by the computer as a changing flow of information, make it clear where air pollution is coming from and where it is going.

The Manhattan air pollution model is a prototype developed by the Palo Alto Scientific Center in California.

The Future of Venice

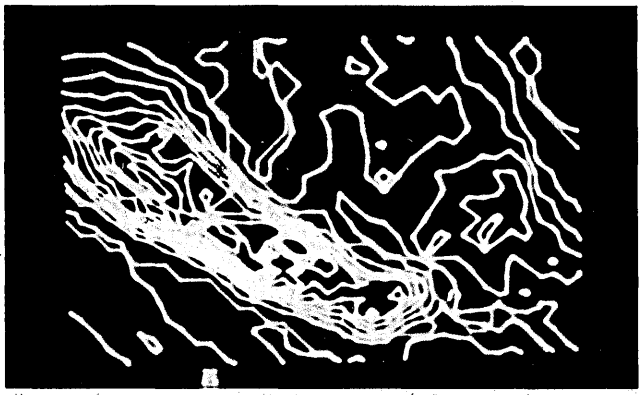
A study team with members drawn from IBM and Italy's National Research Council is preoccupied—as are many people—with the future of Venice.

Aqua Alta, or high water, is a phenomenon that plagues the City of Canals. A product of storms in the Adriatic, Aqua Alta floods the Venetian lagoon many times each year. The problem is further complicated because the lagoon bed on which Venice rests is sinking year by year.

To study the complex interaction of wind and water and tides, a seagoing laboratory belonging to the National Research Council is collecting data the study partners can incorporate into a computer model of the problem. With a mathematical substitute for the real situation, team members can test different theories and hypotheses.

One paradox has already been resolved: Venice is sinking because water is disappearing beneath it—drawn off by the fresh-water wells which supply a nearby industrial area.

It is not likely that the sinking will soon stop, or that Aqua Alta will cease to be a threat. But the study is giving scientists a clear analysis of the forces at work on Venice.



More Food for Mexico's Millions

Like many other developing nations, Mexico is faced with the problem of feeding a growing population while also cultivating crops for export.

Collaborating with the National Agricultural College, the IBM Scientific Center in Mexico City has tackled the job of developing a computer model of the agricultural economy. Its purpose is to allow planners to see the results of their decisions before they are committed to action. Among the "what if" questions they are attempting to answer: what are the implications of planning for more machinery in a certain area; what is the effect of substituting a crop for export, like an oil seed, for the basic staple of the local diet—corn.

These are important questions, and the computer is helping researchers to get accurate answers.

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SOURCE DATA is a new department through which we will provide information on literature, books, films, courses, bibliographies, products, services, and other aids to professional development. Information on this material is welcome.

books

The Origins of Digital Computers—Selected Papers
Brian Randell, ed.
Springer-Verlag, New York, Inc.
464 pp. $21.60

If a computer professional or student wants a good solid broadly-based background on the history and heritage of his profession, and can afford but a single book on the subject for his library, I would recommend this as that single book.

That is a strong endorsement for a book which, as the author is very careful to point out, is not technically a true history of computers, but merely a collection of 32 original source papers and manuscripts. The endorsement, however, reflects both the quality of the work done in assembling this book and the paucity of good books in this field. Only Herman Goldstine's *The Computer from Pascal to von Neumann* (Princeton), is a potential challenger. However, despite its broad title, it concentrates primarily upon the thread of evolution in which Goldstine was personally involved. Most other books available in English are either coffee-table non-books, like the very fine pictorial *A Computer Perspective* of Charles and Ray Eames (Harvard), or inadequate journalistic hackwork such as Rosenberg's *The Computer Prophets* (MacMillan).

This book starts with a previously unpublished 1837 paper by Charles Babbage on his analytical engine and finishes with two 1949 papers on the EDSAC. Along the way there are original papers by Aiken, Atanasoff, Couffignal, W. J. Eckert, Goldstine, Hollerith, Mauchley, Schreyer, Stibitz, von Neumann, Zuse and others.

The papers are organized into eight chapters, each containing, in addition to the papers, a brief but informative and well-thought-out introduction to the topic area covered in that chapter. A good half of the papers are previously unpublished, or have been available only in an obscure source, possibly in a foreign language. Though it is not hard to identify gaps or weaknesses in coverage, the papers are well-chosen and, taken as a whole, give a far more comprehensive view of developments than one would normally expect from a source book of original papers.

Though the book contains 120 figures and pictures, it does not provide anything near to a satisfactory pictorial history of computer developments. However, this should not be surprising; the figures and pictures were all parts of the original papers and are not pictures chosen for their present-day, historic interest. The great strength of this book is that it lets those who made significant contributions explain what they were doing in their own words—words not chosen today to support a thesis that this man or that was the most important or the "true inventor of the modern computer," but words that the individual used to communicate his ideas to his contemporaries at the time he was making the contribution.

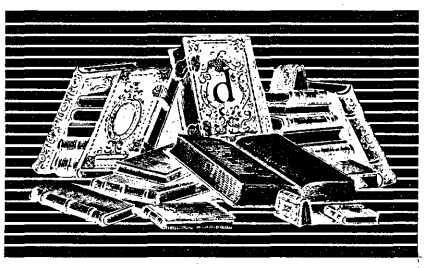
No matter what your prior background in computer history, after reading this book carefully you should be well-qualified to engage in a meaningful, and perhaps even scholarly, discussion of issues such as those recently raised in DATAMATION's article (Feb., p. 84), "Will the Inventor of the First Digital Computer Please Stand Up?"

—Col. William F. Luebbert
Colonel Luebbert, an instructor at the U.S. Military Academy at West Point, is chairman of the AFIPS Computer History Project.

Concepts of Programming Languages
by Mark Elson
Science Research Associates, Inc., Chicago, 1973
333 pp. $12.95

The classical approach to becoming a programmer in the United States has been to learn in detail a particular programming language (e.g., FORTRAN) that has a compiler available on the computer at hand. This approach is perhaps expedient but has produced a breed of technicians who equate programming with application of their pet language. Only recently, due in no small measure to the influence of the European school of programming (e.g., Dijkstra), has there been a shift from preoccupation with specific syntax to concern for semantic expressibility. This text represents a significant step by an American author to get away from the depressing "programmer's manual" approach to language study and programming by discussing concepts rather than syntactic detail.

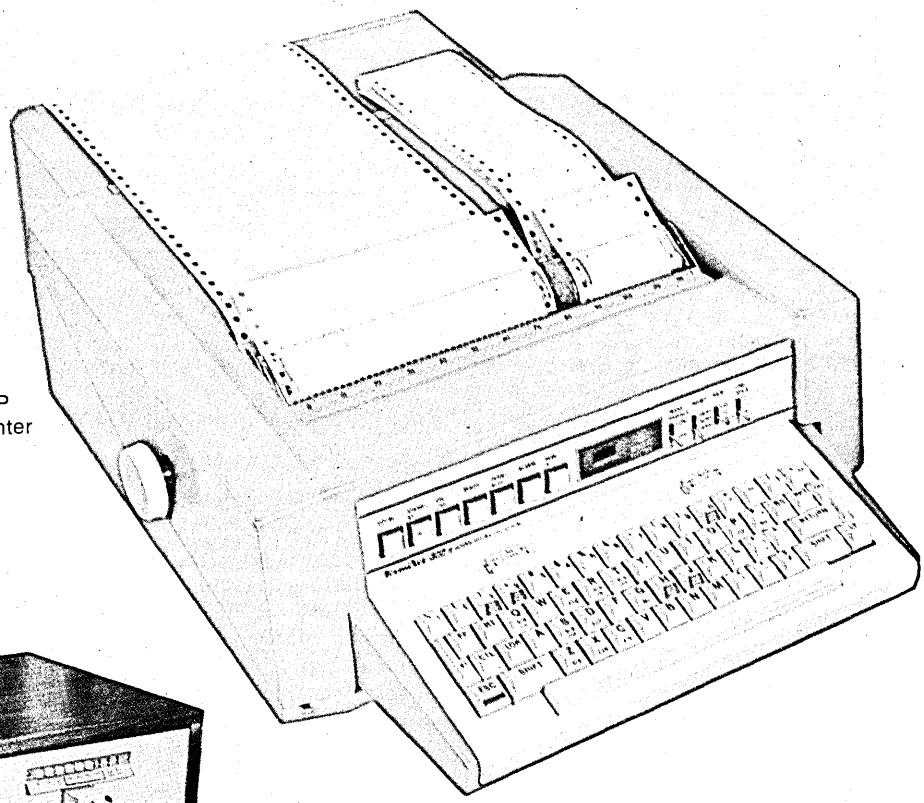
While it is perhaps an overstatement, one is prompted to label this book unique. Older books on languages such as the comprehensive digest *Programming Languages: History and Fundamentals,* by J. Sammet, and the anthology put together by S. Rosen, *Programming Systems and Languages,* are reference books more than texts. Elson's book has some resemblance to P. Wegner's book, *Programming Languages, Information Structures and Machine Organization,* but is less concerned with machines and implementation and has a less detailed, more top-down flavor. The book *A View of Programming Languages* by B. A. Galler and A. J. Perlis is somewhat more theoretically oriented. Coming closer is M. C. Harrison's *Data Structures and Programming,* but in that book the emphasis is more on specific approaches to algorithms than on the general structure and ideas of programming languages. In my opinion the uniqueness of Elson's book derives mainly from the degree of abstraction



achieved without sacrifice of readability and without undue isolation from the real world of programming.

The book has eighteen chapters organized into three sections followed by five appendices. Section I is a short introduction to the specific languages FORTRAN, ALGOL 60, PL/1 and APL. Section II discusses basic concepts such as information binding, data structures, and control structures. Section III covers more specialized concepts such as recursion, multiprocessing, and language extensibility. The phrase "structured programming" does not appear in the text, but there is a very short discussion of GO TO avoidance in the section on control structures. We mention as an aside that Elson's presentation of iteration in that section is classical and might find disfavor with some of the more avid followers of Dijkstra.

A noticeable omission is any mention of set-theoretic data structures such as appear in the languages MADCAP, PASCAL and SETL. Elson may have felt that it was too early to discuss this



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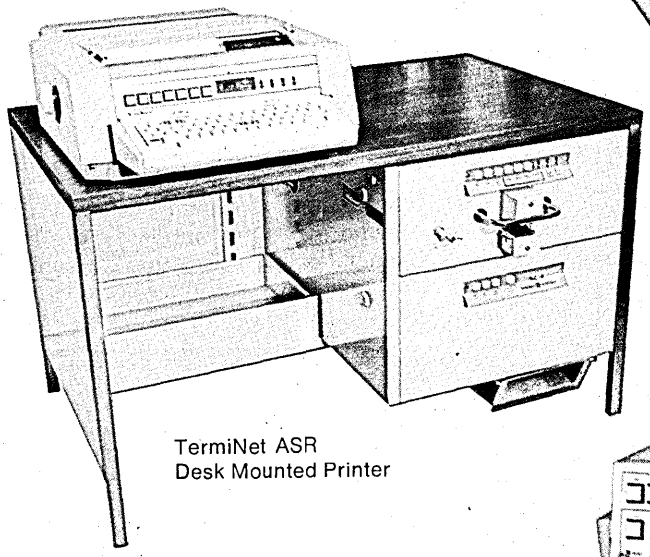

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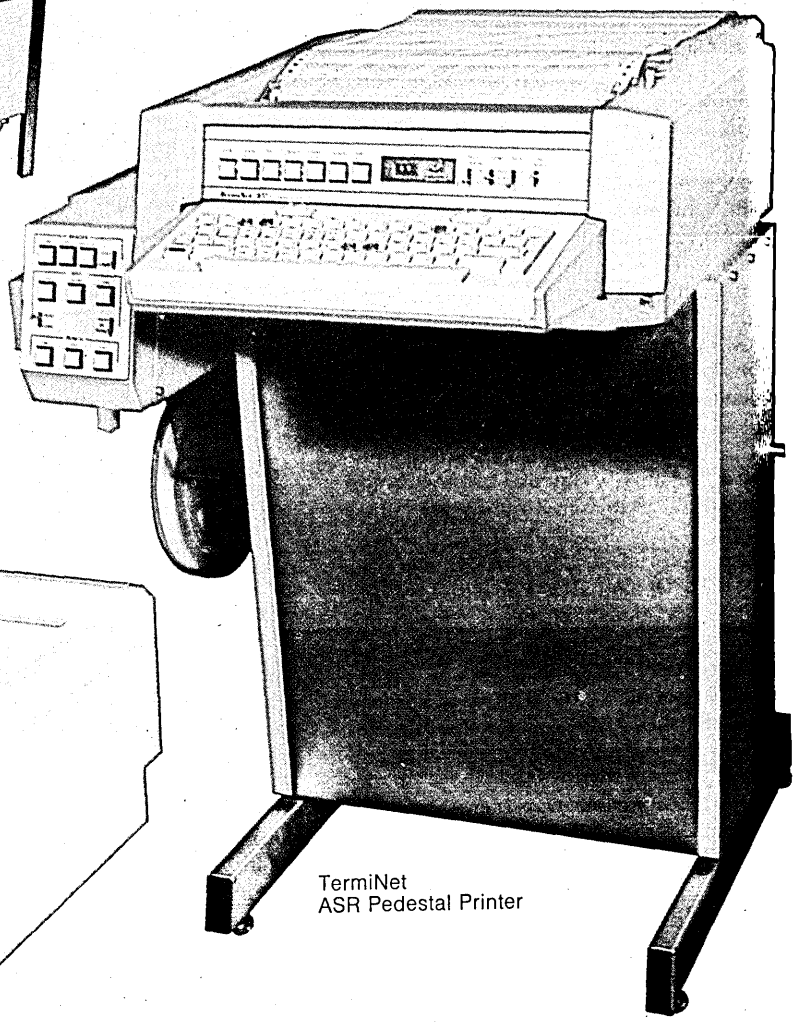

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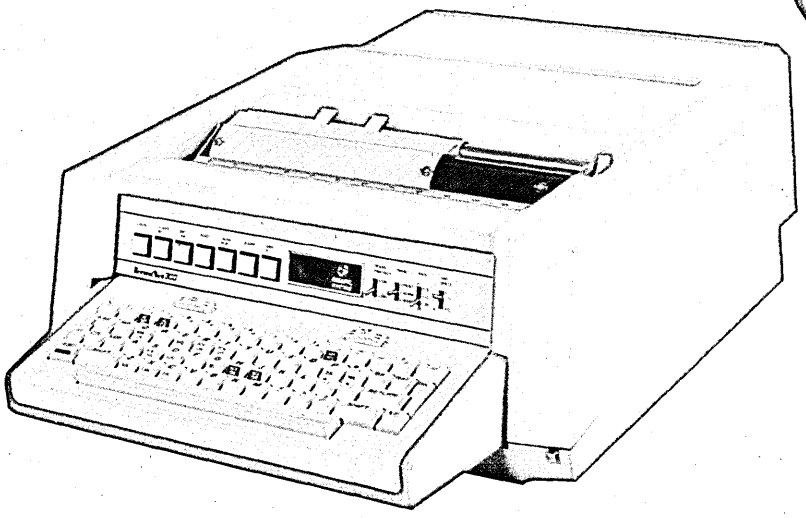

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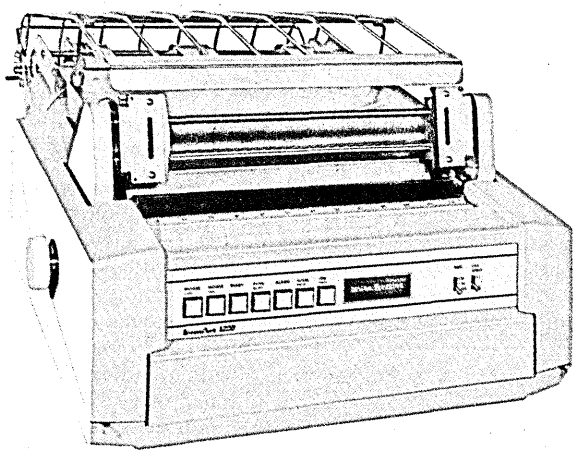

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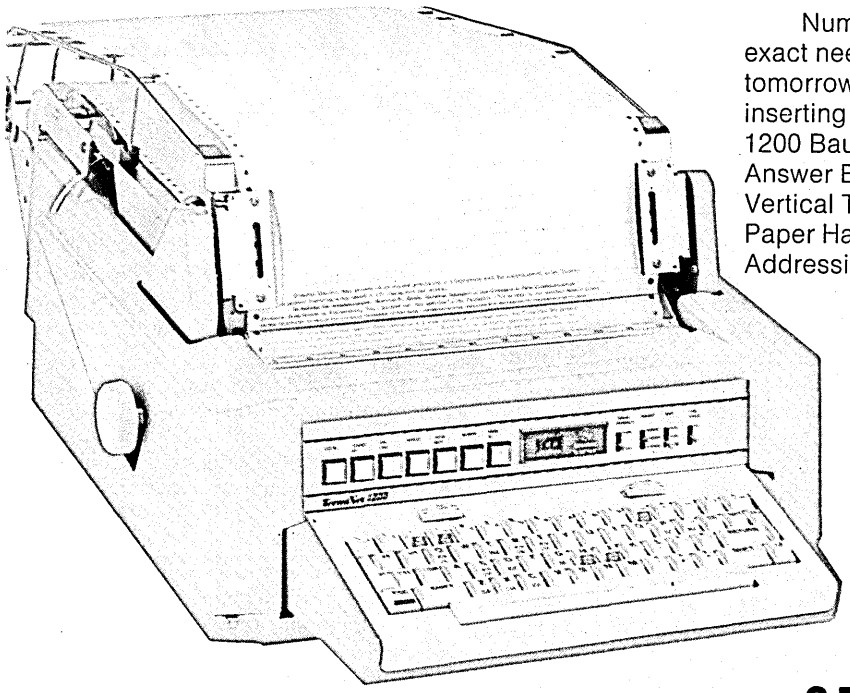

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source data

emerging concept. However, this important idea *is* examined in Harrison's book.

Elson expresses the view, which the reviewer currently also shares, that "language extensibility is the bright hope for the future of programming languages." In the relevant chapter, he presents the basic notions of language extensibility without reference to specific languages such as SIMULA 67, ALGOL 68, etc. One gets the impression that he would like to design a language himself with the features as he presents them. Actually, the style of presentation used here, in which constructs are introduced or invented as needed to allow for particular concepts arising naturally in the discussion, is used effectively throughout the text.

The book is attractively set in 9/11 Helvetica body type. However, certain lowercase letters look exactly like miniature versions of their uppercase counterparts. This does occasionally cause momentary confusion, especially in the appendix on theories of computation. A classical notational inconsistency of a different kind occurs with regard to the difference between text and program. For instance, at one point an asterisk is used for multiplication in a formula of the text that contains true subscripts and other mathematical notations that occur in very few programming languages. The point is that if, as Elson says, "We are, after all, dedicated by this time in computer evolution to aiding the user rather than the implementor," then a more serious effort should be made to incorporate natural mathematical notations into programming languages and inversely to avoid use of specialized programming language notations in general mathematical text. This is not meant as a special indictment of this book, but of today's typical computer scientist; in fact Elson does an excellent job of distinguishing program from text by propitious use of display and a small uppercase font.

In conclusion, this is a quite readable account of most of today's important programming language concepts. It would be a pleasure to teach a course on programming languages from this text.

—Mark B. Wells
Mr. Wells is a staff member of the Los Alamos Scientific Laboratory, which is affiliated with the Univ. of California.

literature

Learning Hexadecimal

This free fill-in-the-blank workbook on *Understanding Hexadecimal Notation* is actually a 16-page programmed course. The course includes 63 "frames" of information which lead to a working knowledge of the base-16 number system. It sounds just great for trainee programmers, machine operators, and others learning how to deal with IBM cpu's. FISHER CONTROLS CO., Marshalltown, Iowa.

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Standards Catalog

The 1974 catalog of American National Standards and International Standards is available free from the American National Standards Institute (ANSI). The 176-page listing includes more than 5,600 American National Standards (all those approved by ANSI through Oct. 31, 1973) and more than 3,000 international standards and recommendations (all those received by ANSI last year from the International Organization for Standardization, the International Electrotechnical Commission, and the International Commission on Rules for the Approval of Electrical Equipment). The standards cover such subjects as dimensions, ratings, terminology and symbols, test methods, and performance and safety requirements in 26 technical fields. The catalog also includes a 25-page index to the standards, with information on how to order their documentation, as well as a list of ANSI publications of interest to those working in the field of standardization. AMERICAN NATIONAL STANDARDS INSTITUTE, New York, N.Y.

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CODASYL Report

The *CODASYL Data Description Language—Journal of Development* (June 1973) presents the work of the CODASYL Data Description Language Committee, which was assigned the tasks of establishing "ways to aid the functions of data administration and systems administration." The 155-page journal contains three sections which treat the background and history of the committee, major concepts, and most importantly, the specifications of the Data Description Language. The committee based its work in part on the 1971 report of the Data Base Task Group. Cost: $1.70 prepaid. Include the SD Catalogue Number C13.6/2:113 when ordering. U.S. GOVERNMENT PRINTING OFFICE, Superintendent of Documents, Washington, D.C. 20402.

Hospital Applications

The report, *Edp For Hospitals—New Directions for Survival,* analyzes edp for financial applications in hospitals with less than 300 beds (80% of the total U.S. hospitals). The study forecasts the financial edp market in hospitals for computer hardware, software and services through 1979, detailing marketing strategies and analyzing the competitive environment. It presents guidelines for selecting edp equipment and services, and for preparing cost justification studies. Case studies are included. This 150-page report is priced at $450. QUANTUM SCIENCE CORP., 245 Park Ave., New York, NY 10017.

Networking Terminology

The National Bureau of Standards (Institute for Computer Sciences and Technology), under the sponsorship of the National Science Foundation, has prepared a report entitled *A Guide to Networking Terminology*. The guide is aimed at bridging the gap in terminology between data processing and telecommunications. Included are a glos-

(Continued on page 43)

Meet a brand new company with a fifty-year reputation for reliability.

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The products, described in detail on the following pages, are all used by Digital as components and peripherals in the PDP-8 and PDP-11 minicomputer systems, the most popular minis in the world. Our components—like our computers—are designed to deliver maximum price/performance.

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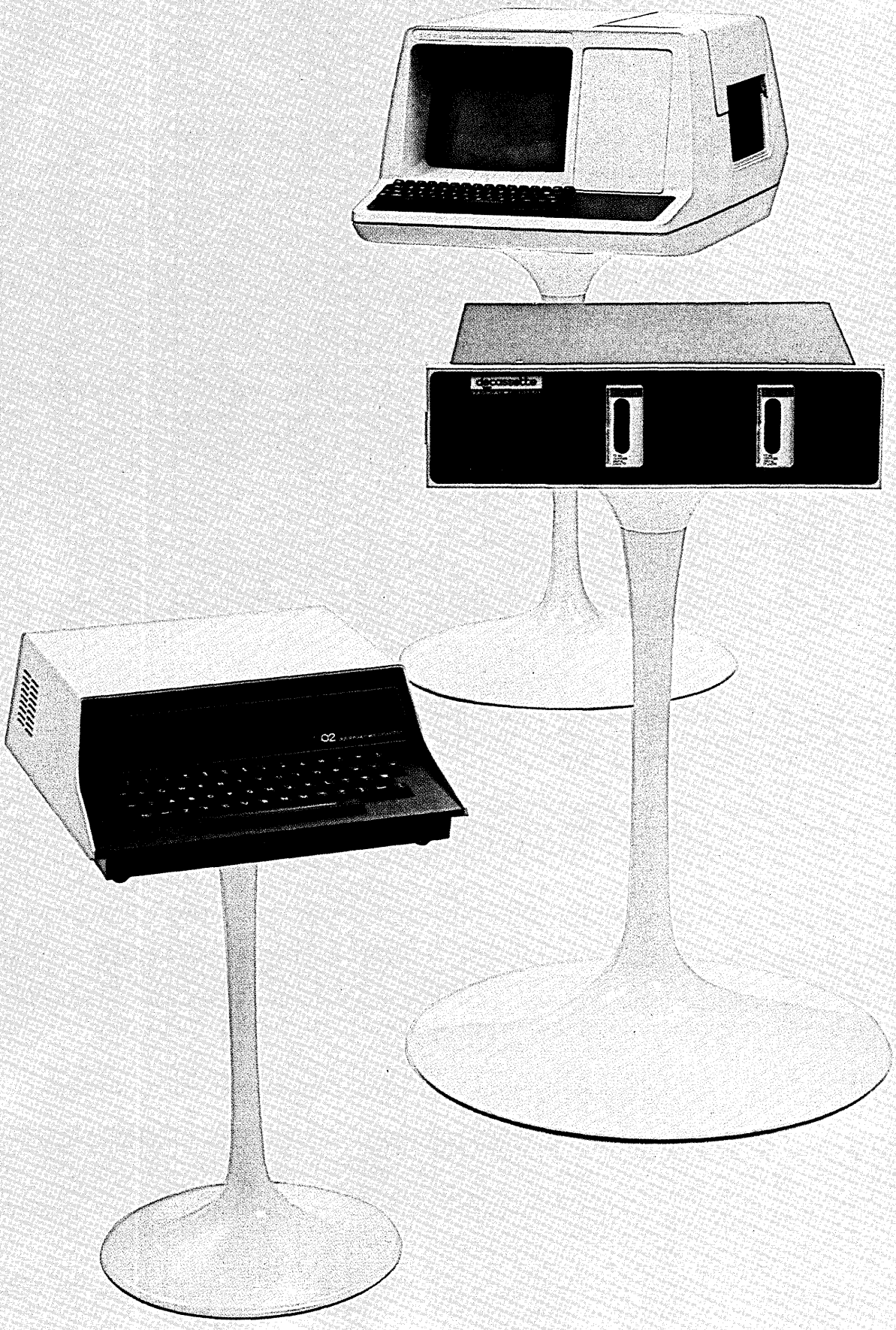
And you can have our components off the shelf. When we've established our nation-wide network of warehouse/depots (due this fall), volume deliveries will be made as fast as we can process your order.

Behind our commitment to deliver stands the entire Digital manufacturing capability—over two million square feet of manufacturing space in the United States, Puerto Rico, Canada and other countries overseas. These are the same facilities that have produced more minicomputers than anyone else, the facilities that manufacture and test the peripherals that support these computers. To meet your demands in the next year alone, we're planning several new plants in the United States and Canada and retooling present production lines to Components Group specifications.

To deliver these components quickly and to maintain our high standard of reliability, the Components Group is planning a network of warehouses. At these depots, products meeting our rigid specifications will be stocked for off-the-shelf delivery.

Our warranty is simple: all hardware is fully warranted for a specified time. If, during this period, any product should prove defective, you simply return it to the nearest depot for fast repair or exchange.

Over the next few years, we expect the cost of computer hardware—especially the cost of the computer itself—to keep going down. Entirely new applications will open up. Volume production of proven components and peripherals enables us to sell at greatly reduced prices. Our low-cost, high-quality products will provide our customers with an opportunity for enhanced profits and a competitive edge in an increasingly price-conscious market.



Terminals and peripherals.

Our cassette mag tape system. Under $1600 in quantities of 100.

Priced below even paper tape, the TU60 is a truly reliable dual cassette system. We designed it to stand up to repeated use—with cassettes spec'd at a minimum of 1000 passes, and an error rate that's a full order of magnitude lower than most other systems.

Our proprietary cassette design reduces the possibility of hard error. The extra-thick 1 mil mylar tape is specially coated to resist extreme temperature and humidity.

The TU60's reel-to-reel drive increases tape life even more—there are no capstans, pulleys, pinch rollers, or brakes. DC servo-controlled motors reduce stretching and provide precise start/stop characteristics.

To reduce noise interference and ensure that even very low data levels will be read accurately, the TU60 employs an independent high-threshold data block detector and low-threshold data peak detector.

And the TU60 can't accumulate error from tape-speed fluctuation due to power variation or mechanical difficulties: the read electronics adapt themselves to the tape speed by means of a phase lock loop. Other error-reducing features include redundant dual-track recording, automatic leader detection, and CRC-type error control.

Because the TU60 places the burden of recording-reliability on its electronics, not its mechanics, less maintenance is required to keep the system in good working condition. And when maintenance is necessary, it's no problem. The top flips open, everything is accessible, and the two main modules can be replaced in minutes.

Our new DECscope video terminal. Under $950 in quantities of 100.

The VT50 is the most inexpensive CRT display terminal in the world. It'll give you fast, quiet alphanumeric video capability for the cost of a slow, noisy teletypewriter. Hardcopy output is available too, with our optional low-cost copier.

For a groundlevel budget price, you get 12-line, 80-column good-quality display—64 ASCII-standard upperface characters, each on a 5x7-dot matrix. After displaying 12 lines, the page scrolls upward from the bottom; its speed can be adjusted by the user.

The keyboard is an easy-to-use, audible, typewriter-style board, with 3-key rollover to permit fast typing. Our optional copier fits right into the desktop display cabinet.

The VT50 is fast—a full range of baud rates are switch-selectable up to 9600. Interfacing is with a standard 20mA current loop, with inexpensive EIA option.

Installation is easy, just plug it in. The VT50 has few moving parts, so maintenance is simple. Its keyboard is the same field-proven model we use on the LA36 teletypewriter. And its low heat output means no fans, less noise, and low power consumption.

At such an incredibly low price, the VT50 will go far. And fast.

Our remote terminals. Starting at less than $600.

The RT01 and RT02 terminals provide easy, low-cost interactive data entry and retrieval.

Uncomplicated keyboards make it easy for untrained personnel to enter or retrieve data. There's no need for confusing, numerically-coded instructions. The RT02 will even prompt the inexperienced operator by spelling out on the display what information is needed next.

The RT01 displays up to 12 digits of data in a Nixie™ numeric readout. For non-numeric response, it has programmable status indicators. The 16-key pad will input 30 ASCII characters.

The RT02 costs more and gives you more. A 64-character gas-discharge alphanumeric readout that displays up to 32 characters at once. 16-key or 58-key input. Interactive display prompting.

Both terminals are ASCII-compatible, so you can interface them to any computer with a Teletype™ port. EIA modem interface is also available.

Both have simple displays and few moving parts, for built-in reliability and ease of maintenance.

Logic modules and interfacing.

Digital is the world's largest seller of solid-state modules. We give you the widest choice you can get—over 400 pretested modules, most of which we use ourselves, in our computers and controllers. We also carry a full line of compatible hardware, power supplies, plug-in boards, cabinets, racks and related equipment.

If you do your own interfacing, our Logic Products Handbook and Logic Systems Design Handbook will provide general support and solutions to specific standard problems. The Components Group will also supply, in volume, custom interfaces, custom modules, and custom variations of our standard terminals. Complete descriptive literature on any of these topics is available.

M Series modules.

These high-speed logic modules for computer interfacing use monolithic TTL circuitry to give you high speed, high fanout, large capacitive drive capability and excellent noise margins, in frequencies up to 6MHz. Some of our newer M Series modules also employ current MOS technology.

K Series modules.

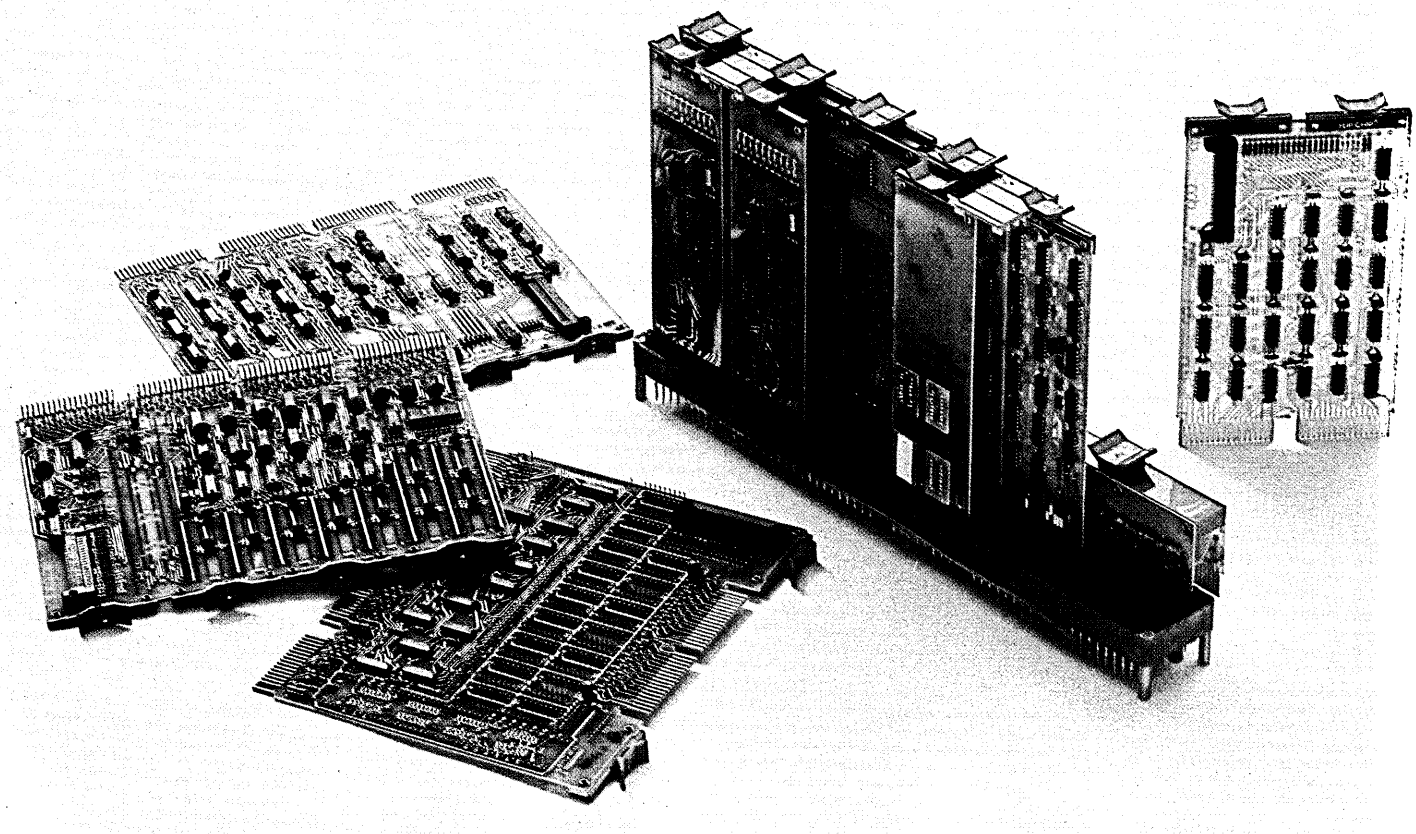
These noise-resistant modules are principally used for industrial control applications where noise-resistance is more important than speed. Frequencies from DC to 100KHz are typical, 5KHz frequencies can be obtained. K Series modules are designed for easy system checkout and troubleshooting and will fit both standard NEMA enclosures and computer mounting racks.

A Series modules.

For communications between the computer and the outside world, these analog modules give 10-bit and 12-bit performance in a family of mutually compatible functions—multiplexers, operational amplifiers, sample-and-hold circuits, A/D and D/A converters, reference voltage sources, and multiplying A/D converters.

DECkit interfaces.

Our DECkits provide pre-tested, fully-documented interfaces for a number of common interfacing situations. Basically just a few modules and a prewired systems unit, they eliminate design time, breadboarding, and wirewrapping in a number of areas. Complete descriptions of the specific interfaces are available.



The start of a new family of component computers.

The PDP-8/A. $572 in quantities of 100 (CPU & 1K RAM).

For minicomputer applications, the PDP-8/A computer-on-a-board gives you speed and performance at an extremely low price.

The newest, smallest member of the PDP-8 family of minicomputers, the 12-bit PDP-8/A uses only proven, readily available, multi-source MSI semiconductor technology. We know it's reliable, and we can deliver in quantity, starting in late 1974.

To reduce the size and enable low-cost, user-tailored memory capacity, we've added expandable semiconductor memories: ROM, RAM, PROM, and ROM/RAM combinations, expandable from 1K to 32K words. Cycle time is 1.5μsec.

The PDP-8/A uses the same powerful instruction set as the PDP-8/E and is fully compatible with other PDP-8 family hardware, operating systems, and high level languages (such as BASIC, FORTRAN IV, FOCAL).

The PDP-8 Omnibus™ backplane facilitates direct interface with more than 60 PDP-8 options and peripherals. Seven commonly-used options are available on two option boards: serial-line interface, 12-bit parallel I/O, front-panel control, and real-time clock on one board: powerfail/auto-restart, memory extension, and bootstrap loader on the other.

The PDP-8A gives the user the flexibility, reliability, and expansion capability of a minicomputer at an extremely low price.

The MPS microprocessor series. $476 in quantities of 100. (CPU & 1K RAM).

The MPS microprocessor series of modules gives you a simple, versatile 8-bit controller that's inexpensive and easy to use. It will replace hard-wired logic in control applications and perform processing tasks in many new applications.

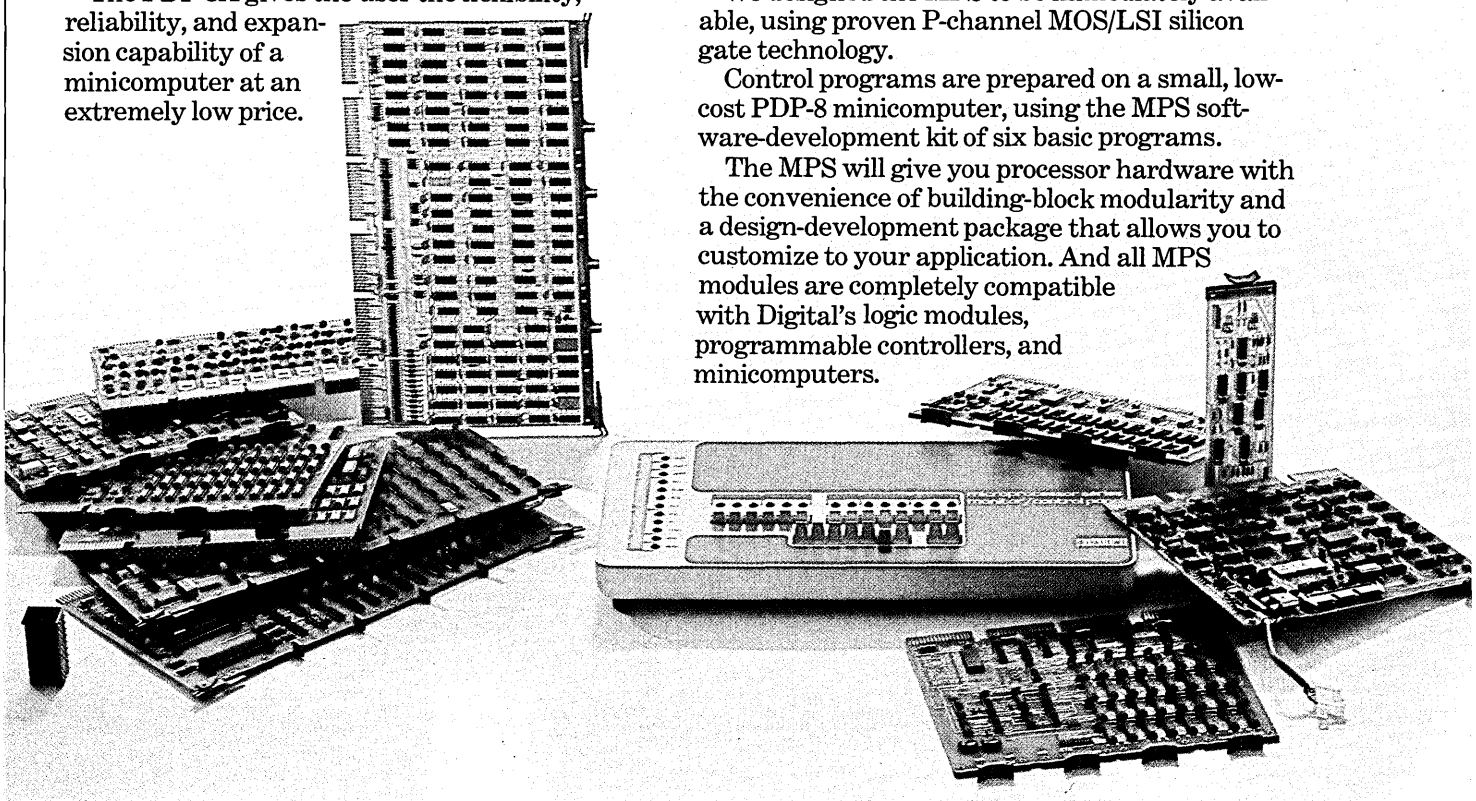
The MPS consists of four building-block modules and an optional control panel. A basic fully operational processor can be assembled from as few as two modules: the CPU and a memory module.

The CPU module with 8-bit parallel processor, 48 data-oriented instructions, and 12.5 μsec cycle time, can directly address up to 16K words of memory. There are two memory modules: the Read-write Memory module consists of a fully-self-contained random access memory (1K, 2K or 4K words) and all address decoding logic; the Programmable Read-only Memory module contains up to 4K words of UV-eraseable, completely reprogrammable semiconductor memory. The External Event-Detection module provides power-failure detection and automatic start, with 6 interrupt request inputs. The Monitor/Control Panel, which can be cable-interfaced to the CPU, will perform such typical functions as monitoring data paths, memory, and addresses, handling general system operational and diagnostic checks, and entering programs.

We designed the MPS to be immediately available, using proven P-channel MOS/LSI silicon gate technology.

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

The MPS will give you processor hardware with the convenience of building-block modularity and a design-development package that allows you to customize to your application. And all MPS modules are completely compatible with Digital's logic modules, programmable controllers, and minicomputers.



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Digital Equipment Corporation, Components Group,
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P.O. Box 11500, Ottawa, Ontario, K2H 8K8, (613) 592-5111.

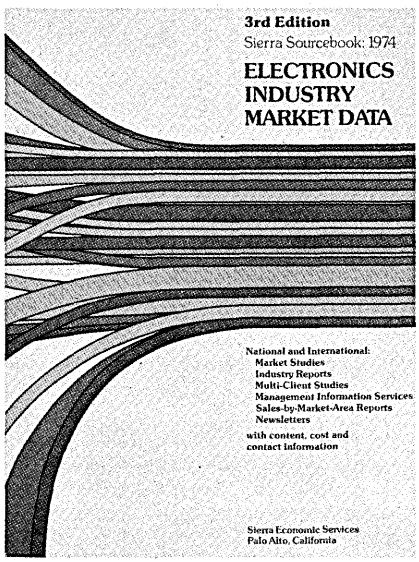
*Prices quoted are in U.S. dollars and will vary outside the United States.

source data

sary of 120 key terms and a selected list of source material. The report, designated NBS Technical Note 803, SD Catalog No. C13.46:803, is 80¢ prepaid. U.S. GOVERNMENT PRINTING OFFICE, Superintendent of Documents, Washington, DC 20402.

Electronics Market Data

A reference entitled *Electronics Industry Market Data: Sierra Sourcebook 1974* gives sources of market information available from 130 research, abstracting, and reporting organizations publishing in North America and overseas. Now in its third edition, the sourcebook gives profiles of more than 800 services in 20 electronics and related industry sectors. Among the sectors included are: aviation and aerospace; commercial electronics; computers, computer services, and auxiliary equipment; components; data communications, telecommunications,



and telephone interconnect; and microform, microfiche, COM, and microfilm. Additional sections of the book describe international market data sources, 75 low cost statistical and reporting services of the U.S. government, and sources of information about electronics companies. The cost of the 130-page soft cover reference is $50; free brochure available through reader service number below. SIERRA ECONOMIC SERVICES, Palo Alto, Calif.
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Computer Games

Remember *101 BASIC Computer Games,* the manual of how to play with your computer? If you liked the idea of using games in learning, you'll probably like *Understanding Mathematics and Logic Using BASIC Computer Games,* its 60-page companion volume, which is a teacher's guide, student workbook, and background resource manual combined. The cost is $1.50 (*101 BASIC Computer Games* costs $5); add 50¢ postage and handling to all orders. DIGITAL EQUIPMENT CORP., Software Distribution Center, 146 Main St., Maynard, MA 01754.

Micro Forecast

This 960-page study, *Microcomputer Industry Forecast,* forecasts worldwide market and technology trends of microcomputers and their components for the 1973-1982 period. Special emphasis is given to the three microcomputer use areas—logic replacement, minicomputer replacement, and new applications. The report concludes that minicomputers will not be threatened by microcomputers, and that new applications will become dominant. Research for the study included a nationwide interview program with several hundred present or future microprocessor users, manufacturers, and minicomputer companies. In addition, results of an extensive user survey program were incorporated. Price: $6,000. GNOSTIC CONCEPTS, INC., 2710 Sand Hill Road, Menlo Park, CA 94025.

Market Study

It has become feasible to put small dedicated information systems into firms which previously could not afford them, including small manufacturing companies, small retail stores, and branch offices of larger firms. This multi-client study began by identifying 150 applications for systems in the range of $5,000 to $40,000. These were distilled to 38 that offered promising market sizes, then finally narrowed to eight. The eight applications are expected to account for sales of 306,000 units between 1974 and 1978, for a total of $5.2 billion.

A two-volume set of the study results, plus counseling by the analysts, is priced at $8,750 (just over $1,000 per application). HOBBS ASSOCIATES, INC., Box 686, Corona Del Mar, CA 92625.

Structured Programming

The structured programming method has been extended to cover managing and designing too, in this five-day summer institute being held in the Colorado mountains July 19 through 23. Five separate courses in management, design, and programming are offered; two of them are actually three-day workshops. Attendance is priced on a course-day basis, ranging from $200 for a single day to $705 for the whole shot. (An extra $100 fee for machine time is added for programming courses.) The vendor claims to have taught more than 35,000 students in various seminars and workshops during the past 10 years. BRANDON APPLIED SYSTEMS, INC., Arlington, Va.
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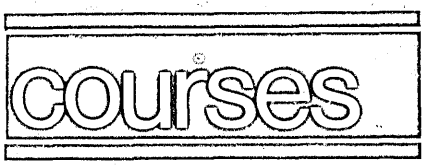
Dp Film Library

A group of computer experts, training specialists, and professional cinematographers have produced "The Computer Science Film Library," for use by such places as schools, universities, computer institutes, government installations, and corporations. The film series is modularized into 3- to 10-minute, single topic films grouped into the following 13 sets: tools, files, COBOL, FORTRAN, BASIC, problem solving and program design, computer concepts, information systems, data base organization, efficiency in ANSI COBOL, I/O device operations, IBM 360 and 370 operating systems, and operator training on the IBM 360. Each film presents fundamental concepts and relationships in carefully structured patterns, using advanced animation and color keying techniques. The films, available in either

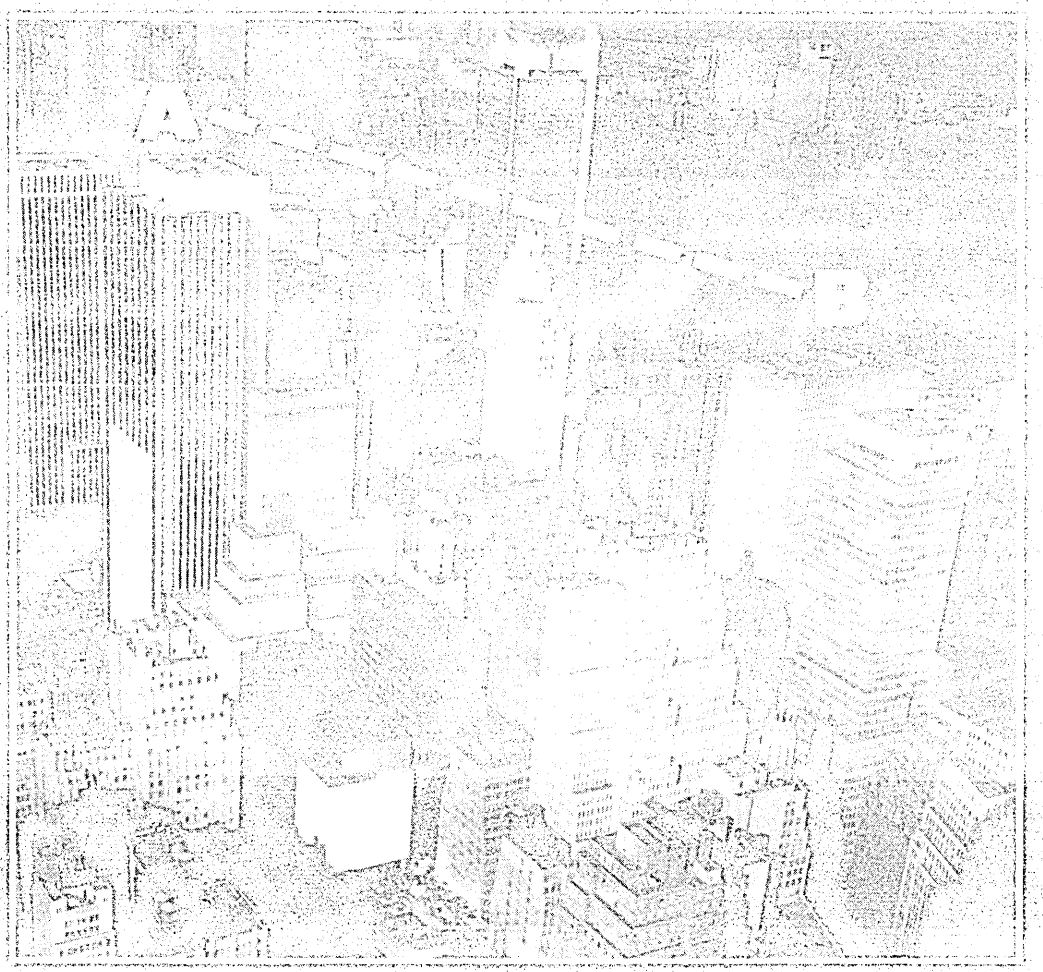


16mm reels or Super-8mm cartridges, range in price from $70 to $250, with a discount for complete sets. They are available for preview or purchase only —no rental. MC GRAW-HILL BOOK CO., Gregg/Community College Div., 1221 Avenue of the Americas, New York, NY 10020.

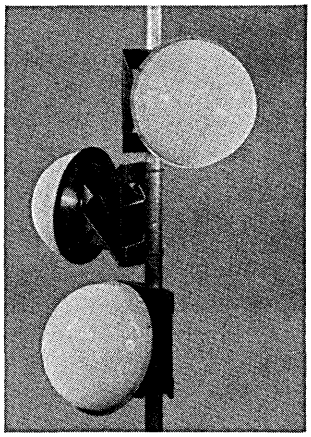
Short Courses

A 44-page catalog describes and outlines 39 seminars for management and data processing personnel, offered by Control Data Corp.'s Institute for Advanced Technology (IAT). The courses are grouped in three series: computer science, management science, and mathematical and statistical science. Most of them last two or three days

Now there's a whole new way for move voice and data between A and B.



Norden introduces the first operational Millimeter Wave Radio.



For the first time, there is a practical alternative to cable for short-haul transmission. It's the first in a family of telecommunication products now being introduced by the Norden Division of United Aircraft Corporation.

The new Norden Millimeter Wave Radio operates at high frequencies soon to be opened for local transmission. Available now — under FCC developmental license pending final rule-making — Norden radios are already entering service.

You simply mount one Norden radio on top of a building or mast (it weighs about 30 lbs. and takes minutes to install). Put a second radio on another building. Then transmit messages and computer data between them, simultaneously in both directions.

22 GHz and 39 GHz Models

Produced in 22 GHz and 39 GHz models, the Norden radio is a solid-state, full-duplex, transmitter-receiver system. It carries a digital bit stream at T1 or T2 rates. Power requirements are low, and the radio runs off commonly used battery plants, or 115V AC. Humidity and extreme temperatures won't bother it.

And a family of multiplexers

This remarkable new radio is part of a Norden family of telecommunication products, including: a time division multiplexer with four inputs and an output of 6.3 Mb/s, a voice multiplexer with 24 inputs and an output of 1.544 Mb/s, and a data time division multiplexer with 23 inputs and an output of 1.544 Mb/s.

Fast, nationwide service

Rugged and reliable, the Norden Millimeter Wave Radio requires no maintenance. If service ever is needed, one of 90 Norden field locations throughout the country will respond.

To get specific answers to your specific questions about the Norden radio and multiplexers, just pick up the phone and call (203) 838-4471. Or write Norden Telecommunication Products, United Aircraft Corporation, Helen Street, Norwalk, CT 06856.

Norden

DIVISION OF UNITED AIRCRAFT CORPORATION

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and are offered monthly. In addition, the catalog lists the titles of 30 special seminars, offered either at client locations or selected IAT facilities, that can be tailored to the specific requirements of an organization. INSTITUTE FOR ADVANCED TECHNOLOGY of Control Data Corp., Rockville, Md.

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products & services

Accessories

A 12-page brochure shows typical computer room and library layouts using Wright Line media storage and handling equipment. The firm's equipment and accessories are pictured and described. WRIGHT LINE, Worcester, Mass.

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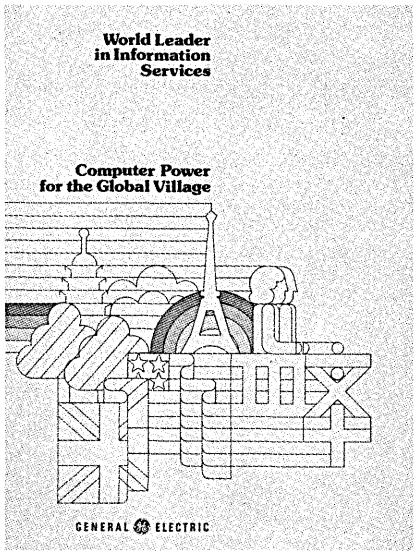
MARK III Network

A brochure entitled *Computer Power for the Global Village* describes the capabilities of GE's MARK III computer services network and gives examples of how it is being used. The MARK III service is a teleprocessing network of more than 100 computers linked to over 400 cities worldwide, used to solve problems in order processing, money management, manufacturing, transportation, and financial consolidation. The 12-page brochure also lists the independent local distributors who market and support MARK III service in Canada, Western Europe, Japan, and Australia. GENERAL ELECTRIC CO., Rockville, Md.



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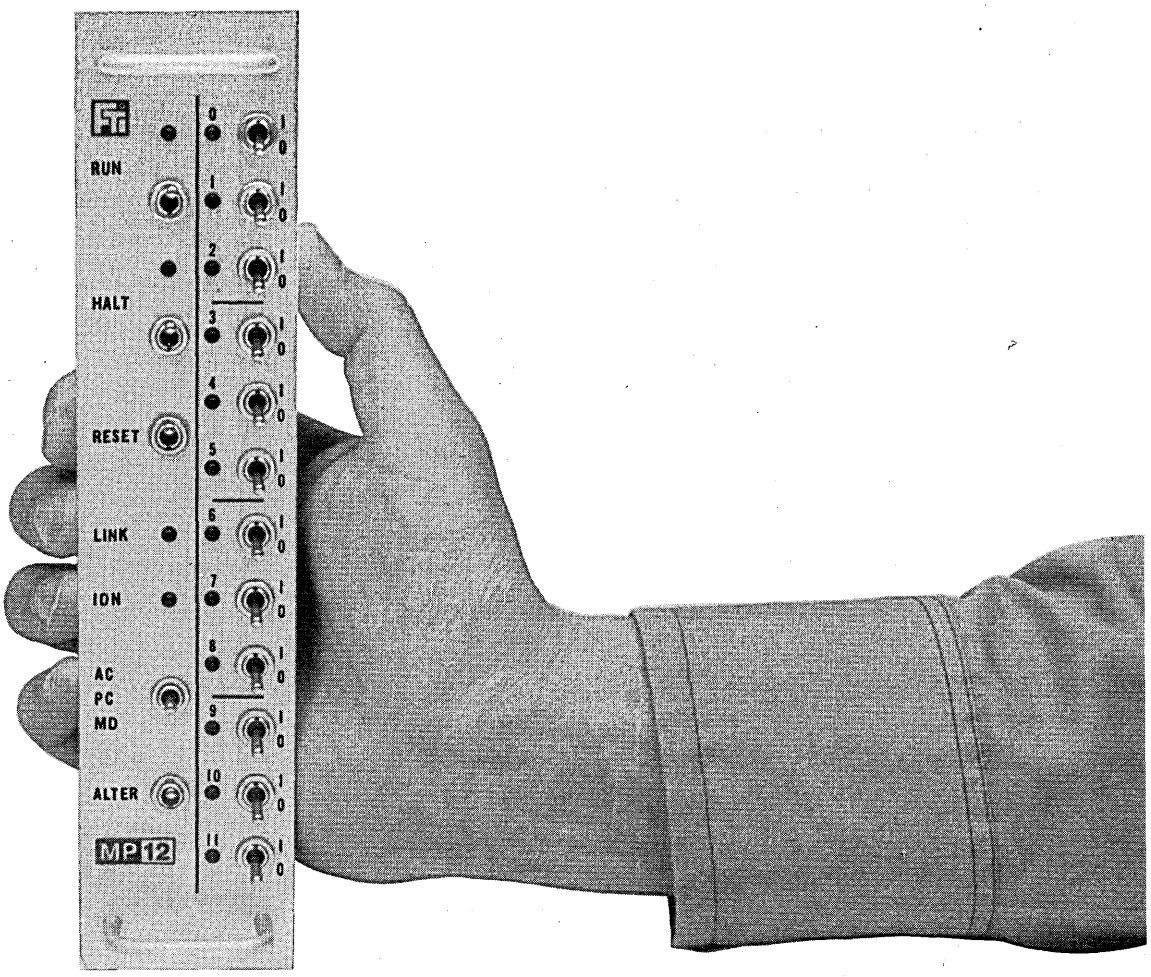
AL/COM Timesharing

The InfoGuide to AL/COM Time-Sharing is a 48-page booklet which contains the information needed to perform most operations on Applied Logic Corp.'s AL/COM time-sharing network. Intended for use while working at the user's terminal, the guide contains tips on accessing the AL/COM network, managing and editing files, controlling costs, and using the more common system commands. The price is $2.50. APPLIED LOGIC CORP., 900 State Rd., Princeton, NJ 08540. □



ANNOUNCING AN EXCITING NEW OEM SYSTEM COMPONENT.

It's the MP12 . . . Fabri-Tek's new microprocessor that performs like a minicomputer. The MP12 helps you get your application system up and running faster, easier and with more capability than ever before. No MOS microprocessor can match its performance in data acquisition, automated assembly, point-of-sale and other dedicated digital control applications.

Completely Operational—The MP12 CPU is a completely self-contained operational unit. All the digital electronics you need are built in along with 4K of reliable core memory, an operating console, power fail-auto restart and more. Everything comes in a compact 2.0" x 9.5" x 15.0" package.

Supporting Software—You also get all the software you need to develop and check out your own application programs. MP12 supplied programs are completely documented and include assembler, debug, loaders, 360/370 cross-assembler, source edit utility, processor diagnostic and utility sub-routines. Instruction set is PDP-8 compatible.

Easy Interfacing—You never had a processor so easy to interface. In fact, it's plug-in easy. The MP12 comes with all the timing and control necessary to interface with almost any peripheral. And it has enough power to drive up to 64 peripherals . . . printers, teletypes, CRT's, card equipment, on and off-line storage devices.

Quick Delivery, Low Price—There's a lot more you'll like about Fabri-Tek's MP12. Delivery and price, for instance. It's available for off-the-shelf delivery for as little as $990 in quantities of 100. It can actually help you cut your overall manufacturing costs.

The MP12 could be the most useful component you've ever seen. For complete specifications and option information just write to MP12 at the address below.

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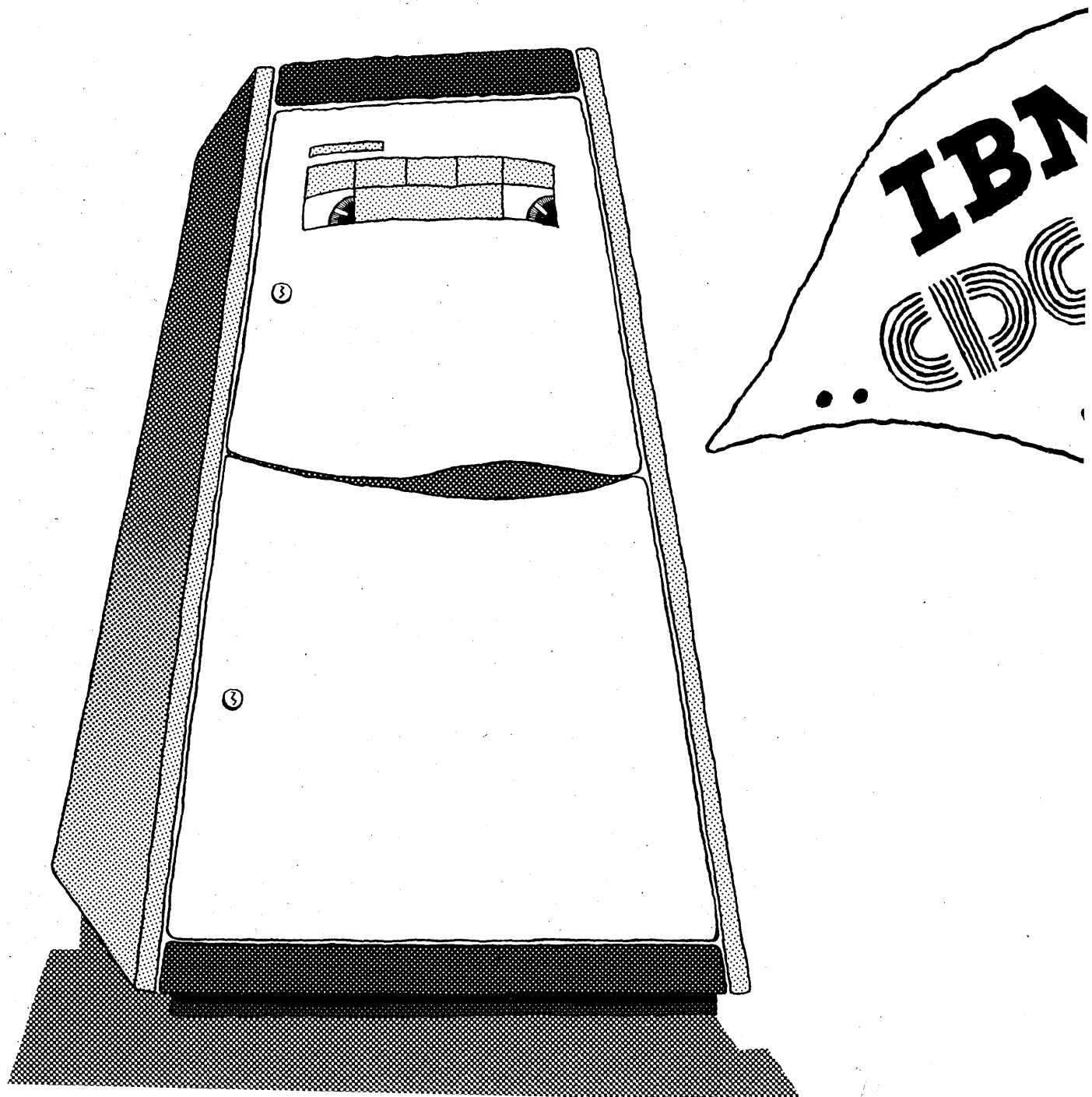
Linguist.

(Our front ends can talk to almost anybody.)



Our IS/1100 front ends can talk to most terminals, in almost anybody's system.

We've interfaced not only with IBM, but also XDS, CDC, Honeywell, Univac. And more are on the way.

And that's not all.

We support many enhancements to IBM front-end emulation, with no change in the host's access method.

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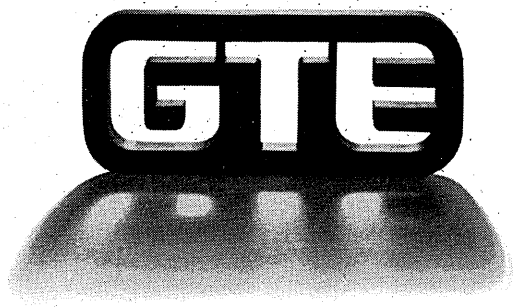
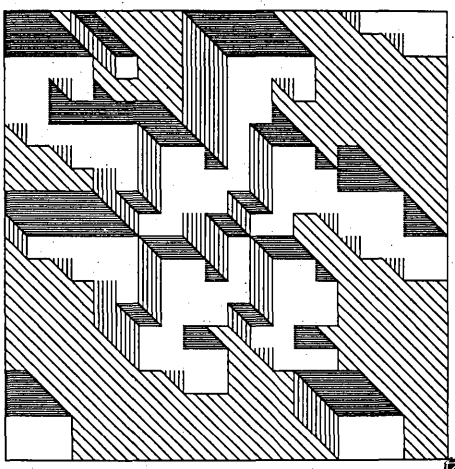
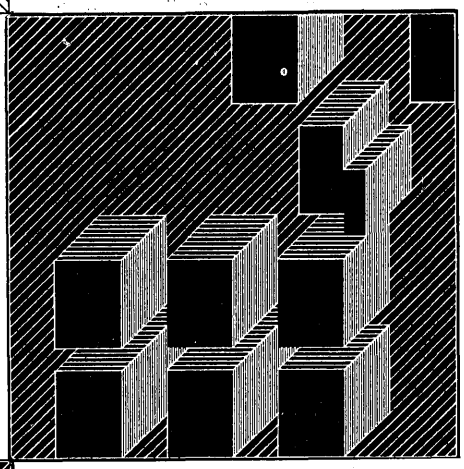


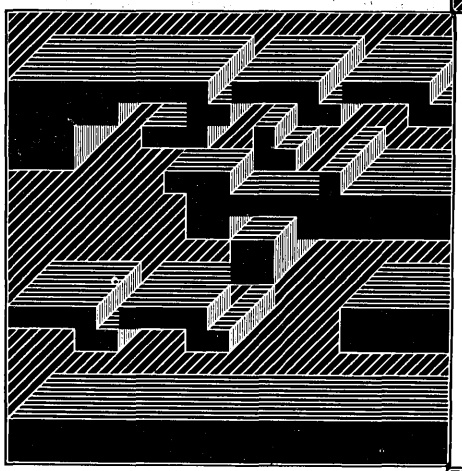


MINICOMPUTEF

Once limited to monitoring and control applications, minicomputers have matured into powerful and versatile machines. They continue to decrease in price, though not in number.

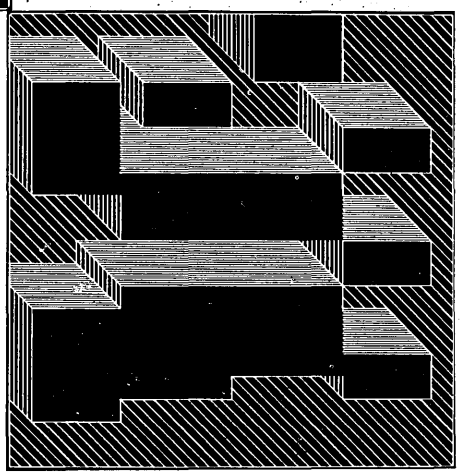


by L. C. Hobbs
and Richard A. McLaughlin,
Associate Editor



the cube:
theme and variation

computer drawings
by Edward Zajec



Judging from the results of DATAMATION's latest survey of minicomputers, the machines have met the price and performance forecasts made for them in earlier articles. But apparently the expected shake-out of minicomputer manufacturers never occurred.

The first DATAMATION minicomputer survey was published in March, 1969. It discussed hardware characteristics and minicomputer applications, which were primarily in instrumentation, test, and control systems. The second survey (May, 1971) uncovered cost reductions and performance improvements. In compiling the 1974 survey, we found the cost reductions and improvements in system capabilities are continuing, and the applications are now expanding rapidly too.

The surveys included 39 machines from 24 manufacturers in 1969, 49 machines from 28 manufacturers in 1971, and 44 machines from 23 manufacturers in 1974. These small differences suggest that the number of machines and manufacturers reached a peak in 1971 and has declined somewhat since. But these numbers also indicate that the shake-out in the industry, which many predicted would occur as the industry matures, has not taken place—at least not in terms of the number of manufacturers. A large number of companies have failed or dropped out of the minicomputer business during the past five years, but for each company that has dropped out, a new one has taken its place. Nonetheless, a few companies have come to dominate the industry, both in terms of units shipped and dollar volume.

The characteristics of the minicomputers presently offered are summarized in the charts. To keep the survey within manageable limits, we have included only minicomputers which: (1) sell for under $10,000 in a useable configuration with 4096 words of

SURVEY

memory; (2) can be used for a variety of applications; and (3) are available to the end user in quantities of one. Although many of the minis included can be used as components of small business systems, the small business systems themselves are not included. Similarly, microprocessors and microcomputers are being put aside for later surveys.

The information in the charts is based on data supplied by the manufacturers. Discrepancies may occur due to different interpretations of the questions. Any two machines should be compared carefully — especially when they are known to have different architectures. Discrepancies may also occur due to different marketing practices; price differences, for example, may result from bundled, unbundled, or partially unbundled software. In all cases, the manufacturers are the final authorities; they should be contacted for any clarifications.

The major differences and trends that have become evident since the 1971 survey include:

- lower costs
- higher system performance (but not necessarily faster basic circuit or memory speeds)
- increased use of microprogramming techniques
- increasing use of bus structures
- larger numbers and new types of peripherals and terminals
- increasingly complex software
- use of LSI and microprocessors
- new applications
- more sophisticated marketing and business approaches.

Cost

The 1971 article indicated that cost had been decreasing at a rate on the order of 20% per year, and then projected future prices on this basis through 1975. This approach forecast a 1974 price for a functional 16-bit word machine with 4096 words of memory of $3,300. The prices for basic 4096 word systems shown in the charts indicate that this projection is met by several machines available today. The annual rate of price decrease will probably not be maintained at 20% over the next few years. As prices for a typical basic system approach the $2,000 level, there is a tendency to add features and increase the capability of the system at the expense of maintaining the price decrease. For example, several of the machines are now offered with a minimum of 8K words of memory. Also, as the price drops below $2,000, there will be an increasing tendency for processors with appropriate logic and memory to be used as integral parts of some other type of equipment rather than as standalones. Hence, a price decrease on the order of 10% to 15% per year is a more reasonable expectation for the 1975 to 1980 period. Another important factor from the systems standpoint is that the price of electromechanical peripheral equipment is decreasing less rapidly than that of the cpu and internal memory. Hence, the rate of price decrease for a complete computer system with several peripheral devices is less than the rate for the cpu and internal memory alone.

Architecture

Two major changes in architecture, microprogramming and bus structures, were identified in the 1971 article, but have become much more widespread during the past three years. The trend toward the increased use of general registers cited in the earlier article is also still important. A large number of the machines recently announced include some type of bus structure and microprogramming capability which greatly increase the flexibility and usefulness of the systems. The bus structure is important for easily interfacing a large number of peripherals. It also permits easy memory expansion and is used in some cases to implement multiprocessor systems.

The use of microprogramming has been greatly accelerated by the availability of low cost semiconductor read-only memory (ROM) and programmable read-only memory (PROM). A microprogrammable machine can provide features such as hardware multiply and divide which previously required optional hardware units, and a powerful macro-level language which can insure compatibility with software and peripheral equipment developed for earlier machines. In some cases microprogramming is used by the manufacturer to permit emulating a machine offered by another manufacturer.

Another important use of microprogramming is to permit implementing a macro-level instruction set tailored specifically to a particular application, and to change this instruction set from one application to another. For example, through changes in microprogramming, one macro-level instruction set can be used for communications applications, a different one for scientific applications, a different one for control systems applications, and a different one for business-oriented applications. In a few cases, electronically alterable read only memories (EAROM) can be provided to permit changing the macro-level instruction set in the field to adapt it to different functions at different times.

Software

The early minicomputers provided little more than assembly languages and diagnostics, but compilers for higher level languages, such as FORTRAN, ALGOL, and BASIC, were soon added. Real-time executive monitors were also added by the time of the 1969 article, but these were relatively

limited. One of the major trends in recent years has been the addition of more complex and sophisticated software systems, including real-time disc operating systems and multi-user time-sharing executive systems which operate in conjunction with a higher level language such as BASIC.

Most minicomputer manufacturers now offer compilers, including at least a conversational BASIC and a batch FORTRAN. Conversational BASIC, or a similar language, coupled with a multi-terminal time-sharing executive system provide a strong basis for penetrating many end-user markets. Since the minicomputer manufacturers have been reluctant to develop the necessary applications software and market directly to end users themselves, a number of software or systems houses are developing the applications software, buying the minicomputer hardware, and marketing the system to the end user.

The important developments and trends in hardware technologies include some in peripheral equipment and some in central processors and internal memories. Perhaps the most important developments in peripherals are the increased use of on-line terminals with minicomputer systems and the development of lower cost auxiliary storage devices. By offering terminals that are Teletype compatible, at least in communications protocol, terminal manufacturers have made a wide variety of terminals useable with most current minicomputers. The two most common terminals used with minicomputers are keyboard/printer terminals and keyboard/crt terminals. The former, which use a character-serial printer with an integral keyboard, are usually direct replacements for teleprinters, but they provide additional or improved features such as higher speeds, better image quality, upper and lower case characters, lower noise, and buffers for higher speed communications. These higher performance terminals are usually more expensive than the ubiquitous Teletype—in some cases by a factor of four or five.

Crt terminals provide most of the advantages cited for the improved keyboard/printer terminals but with even higher data rates and lower noise, plus offer the ability to edit data on the screen using the terminal's internal buffer memory. In addition to the buffered models, both the printer and crt terminals are also offered in interactive or conversational versions which provide character at a time transmission to and from the computer. Using a multiplexer and communications interface on the minicomputer also permits using these terminals from remote locations over a telephone line through an acoustic coupler or a data set. Other types of terminals now offered for use with minicomputers include OMR and OCR terminals, badge or card reading terminals, and instrumentation terminals or couplers which interface remote instruments over communications lines.

Auxiliary storage for minicomputers was previously very expensive. A magnetic tape unit or a head-per-track disc frequently cost more than the minicomputer itself. However, the development of magnetic tape cassettes and relatively low cost single or dual-platter moving-head disc units provided significant cost improvements for auxiliary storage a few years ago. More recently, the development of floppy discs or diskettes has provided modest capacity semi-random access auxiliary storage at a unit price close to that for magnetic tape cassettes and significantly less than that for larger capacity dual- and single-platter moving head discs. During this same period, IBM 2314 type discs and double-density 2314 type discs have been interfaced with minicomputers to provide 24 and 48 megabytes of storage per unit, respectively, in contrast to the 2.5 to 5 megabytes for the single- and dual-platter disc drives. The capacity of the dual-platter drives is being increased to 10 megabytes with some indications that this may go as high as 20 megabytes. Also, a few manufacturers have recently interfaced the IBM 3330 type discs, providing 100 megabytes per drive. However, the double density 2314 type disc presently offers the most economic disc storage for minicomputers in terms of the cost per bit for applications requiring large capacities. Two or three different approaches are now available for acquiring several hundred million bytes of storage for minicomputer systems.

There have been other improvements in minicomputer peripherals. The primary one is cost reduction. Another is the increased flexibility of minicomputer input/output systems. Minicomputers now have the ability to handle larger numbers of peripherals simultaneously.

The primary developments in central processors and internal memories have been a result of advances in LSI semiconductor technology. The major impact to date comes from the availability of MOS LSI semiconductor memories. While this was discussed in the 1971 article, the real application of MOS memories to minicomputers has occurred primarily within the past year. Several machines have been offered with memories using 1024-bit P-channel MOS chips. These were faster than some of the core memories and provide lower cost in small capacities. However, the new 4096 bit N-channel MOS chip is having a major impact on minicomputers this year since it provides both higher speed and lower cost than comparable magnetic core memories. This is expected to become the major minicomputer memory technology within the next year or two.

Even the cost of core memories for minicomputers has been reduced dramatically. In the case of one manufacturer's minicomputer, the cost of the additional 16K words of memory to increase the memory from 16K to 32K words was over $20,000 in early 1971. For the same manufacturer's most recent core memory machine, the cost of adding 16K words is less than $5,000. As indicated above, the 4096 bit MOS

Reading the charts

A few items on the charts require explanation. For instance, the section on registers is difficult. The entries shown are numbers of *hardware* registers unless otherwise specified. And although general purpose registers can be counted as accumulators, index registers are never counted as general purpose registers. The interrupt response times shown in another part of the chart include the time to save registers.

Also, the maximum data rate quoted is for a regular I/O channel, not for a direct memory access channel; however, the rates for channels of any kind, including DMAs, are identical for some machines.

The prices listed are for single units configured for end users (with cpu, memory, power supplies, enclosure, and control panel). The prices are for functioning systems, and include some software. The charges quoted for minimum monthly maintenance presume scheduled maintenance and on-call service during prime shift.

The charts are intended as a guide to the range of models available. For detailed information on any model or series, contact the manufacturer directly using the address listed in the Vendor Index, or circle the appropriate number on the reader service card.

chip will reduce these prices even further.

The other impact of LSI technology will be felt in the cpu itself as a result of programmable logic arrays (PLA) and microprocessor chips, again using MOS/LSI technology. A few machines have been introduced recently using PLA, but microprocessors are expected to have a greater impact on minicomputers. Microprocessors have already been used in building several very small minicomputers (sometimes called microcomputers), and it is anticipated that multiple microprocessors will be used in some larger minicomputers in the future, with each microprocessor performing a different system function within the cpu. For example, one may provide the arithmetic and overall control capabilities, another may provide memory management, and a third may provide input/output interfacing and control.

There has been considerable discussion of the threat of microprocessors to the minicomputer market, but this is largely a specious argument. As indicated above microprocessors will be used to implement minicomputers in some cases in lieu of random logic or programmed logic arrays. In other cases, microprocessors will be used in applications which cannot afford the cost and do not require the capabilities of a minicomputer. Hence, microprocessors will not impact the present minicomputer market in any significant way but may tend to place a lower limit on the price and capability of what we normally consider a minicomputer. Microprocessor chips with read-only and random access memories may be used to implement microcomputers for such smaller scale, lower cost applications. However, the capabilities and applications of microprocessors are the subject of another article.

Applications

As mentioned, the early applications for minicomputers were primarily in instrumentation systems, test systems, control systems, and data acquisition and reduction. Communications and educational applications were next. More recently minicomputers have been used in a much wider range of applications with particular emphasis on those oriented toward business functions. Although some accounting machines and small business systems have specially designed internal processors, many are presently offered that use conventional minicomputers—the same ones used in instrumentation and control systems. This acceptance of the minicomputer outside its original narrow area of application has been one of the major factors in significantly enhancing the market potential for minicomputers. In this respect business applications are particularly important since there are more small business computers installed than all other types of computers combined. (For example, Burroughs recently announced that they have installed over 85,000 of their small business computers and related intelligent terminals.) Minicomputers are now used in business not only as general purpose small machines and as the central element in intelligent terminals, but also as processors in specialized applications, such as word processing, data entry and data collection, retail systems, accounting systems, insurance applications, and many others.

Marketing and business approaches

One of the major developments during the last three years has been the tendency for many minicomputer manufacturers to become much more sophisticated in their marketing approaches and business operations. While a number of successful companies have been developed to provide plug-to-plug compatible memories and peripherals for minicomputers from several of the major manufacturers, the minicomputer makers have reacted with new business and marketing concepts. These include increases in the minimum memory size, software licenses that inhibit the use of foreign peripherals, and pricing structures that reduce the cost for equipment offered on a plug-compatible basis by other manufacturers. Offering software packages in a bundled system configuration in some cases and on an unbundled basis in others is an example of the increasing marketing sophistication and business maturity in the minicomputer industry. In fact, the complexity of software pricing is a good example of this since the pricing of many individual software packages and the tie-ins between different packages is obviously based in many cases on factors other than programming costs.

The increasing tendency of minicomputer manufacturers to offer complete systems, including both hardware and software, is a further indication of the growing maturity in the industry. However, there is still much groping from the marketing standpoint in trying to find the best approach to reach the end user with minicomputer systems which include specific application software. In most cases the minicomputer manufacturers have tried to avoid developing unique applications software for specialized applications, and have concentrated on providing more powerful and flexible system software including higher level languages and data base management systems.

Several minicomputer manufacturers are now trying to approach the end-user market through third parties. A typical example is a minicomputer manufacturer selling the hardware and system software on a discounted oem basis to a systems house or software company which then adds the applications software and sells the system to the end user. The systems or software company may develop the applications software under contract on a custom basis for a specific user or may develop proprietary applications software and market a complete turnkey hardware/software system. In other cases a more sophisticated end user may buy the hardware and systems software directly from the minicomputer manufacturer and then contract with a software company for the applications software. An increasing number of software companies are specializing in business applications software for minicomputers. Although these approaches may be successful in some cases it is likely that the major minicomputer manufacturers will be forced to provide complete turn-key systems (including applications software) in the long run if they are to compete successfully in the small business systems market.

Conclusions

Although continued size and cost reductions and performance improvements are anticipated, the most significant developments in the minicomputer industry during the next five years will be in applications and systems, with cost and hardware following an evolutionary rather than revolutionary trend. □

(Survey charts and vendor index follow)

Mr. Hobbs is president of Hobbs Associates, Inc. He was previously with Aeroneutronic as manager of dp engineering, and has also held positions with Univac and RCA. His firm specializes in studies in computer technology, equipment evaluation, and market analysis.

Manufacturer	California Data Processors	Cincinnati Milacron	Computer Automation	Computer Development	Data General	Data General
Model	XI/35	CIP/2200	LSI-2	Opus III	2/4 and 2/10	800 Series
First installation	1/74	1970	9/73	1970	9/73	1/71
Number installed	10	575	not released	not released	not released	not released
Memory	8K-128K	8KB-64KB	4K-256K	4K-64K	4K-32K	4K-32K
Increment	8K or 16K	8KB	4K	4K or 16K	4K, 8K, or 16K	4K or 8K
Word size	16 bits	8-32 bits	16 bits	16 bits	16 bits	16 bits
Cycle time	675 nsec-850 nsec	1.1 usec	980, 1200, or 1600 nsec	1.0 usec	1 usec/800 nsec	800 nsec
Parity	optional	optional	optional	optional	not offered	not offered
Memory protect	optional	not offered	not offered	optional	not offered	
Processor						
Instruction length	16 bits	1-7 bytes	16 bits	8, 16 or 24 bits	16 bits	16 bits
Address	16 bits	16 bits	8 bits	not released	11 bits	11 bits
Operation code	4-16 bits	8-24 bits	8 bits	not released	5 or 15 bits	5-15 bits
Direct addressing	28K (330 nsec-2.5 usec)	32KB	768 words (2.0 usec)	64K (2 usec)	1K (1 usec/800 nsec)	1K (800 nsec)
Indirect addressing	28K (330 nsec-2.5 usec)	32KB	32K (2.98 usec)	—	32K (1 usec/800 nsec)	32K (800 nsec)
Bit/byte manipulation	✓	✓	✓	✓	✓	✓
Interregister operations	✓	✓	✓	✓	✓	✓
Registers	8	5	7	16	4	4
Accumulators	6	3	2	16	4	4
General-purpose	6	2	2	16	4	4
Index	1-6	1 (hardware)	1 (hardware)	16 (hardware)	2 hardware, 16 memory	2 hardware, 16 memory
Arithmetic						
Add	2.0-6.4 usec	12-13 usec	2.0 usec	2 usec	1 usec/800 nsec	800 nsec
Store	2.0-5.9 usec	9-11 usec	2.16 usec	1 usec	1 usec/800 nsec	800 nsec
Software multiply	not released	—	—	50 usec	not released	not released
Software divide	not released	—	—	75 usec	not released	not released
Hardware multiply	10.6-15.2 usec (firmware)	89-90 usec (standard)	14.84 usec (standard)	optional	6.4 usec (optional)	6.4 usec (optional)
Hardware divide	9.5-11.5 usec (firmware)	88-90 usec (standard)	12.44 usec (standard)	optional	7.2 usec/6.8 usec (optional)	6.8 or 7.2 usec (optional)
Hardware floating-pt.	optional	not offered	not offered	optional	optional	optional
Input/Output						
Data path	16 bits	8 bits	16 bits	8-bits	16 bits	16 bits
Max. rate	3.5M words/sec	86K words/sec	411K words/sec	25K words/sec	1.25M words/sec	1.25M words/sec
Max. channels	universal bus	32	248	256	62	62
Max. dir. memory access	unlimited	2 (optional)	16	unlimited (bus)	62	62
Max. DMA rate	3.5M words/sec	910 KB/sec	1.66M words/sec	250K words/sec	1.25M words/sec	1.25M words/sec
External interrupts	4 (standard)	32 (standard)	3-512	32	16	16 (standard)
Interrupt response	5.0 usec	25 usec	7 usec	11-14 usec	20-50 usec	20-50 usec
Other						
Power fail protect	standard	standard	optional	optional	optional	optional
Auto. restart	standard	standard	optional	optional	optional	optional
Real-time clock/timer	standard	standard	optional	optional	optional	optional
Software						
Assembler	for software,	2-pass	2-pass	2-pass	2-pass	2-pass
Relocatable assembler	see comments	yes (reqs. 8K or 12K)	yes (reqs. 4K)	yes	yes (reqs. 8K)	yes (reqs. 8K)
Macro assembler	below.	✓	—	✓	✓	✓
Relocatable loader		✓	✓	✓	✓	✓
Disc Operating System		✓	✓	—	✓	✓
Real-Time Oper. Sys.		✓	✓	—	✓	✓
Disc RTOS		✓	—	—	✓	✓
Conversational BASIC		✓	✓	✓	✓	✓
FORTRAN					✓	✓
Other		RPG II			ALGOL	ALGOL
Pricing						
4K system			$2,715	$3,500	$3,500/4,400	$6,100
8K system	$9,000	$6,680	$3,010	$4,300	$4,000/4,900	$7,500
16K system	$10,000	$8,680	$4,190	$4,900	$5,600/6,500	$10,700
Min. maintenance	$135/month	at factory	not offered	3rd party	$20/month (at factory)	$27/month (at factory)
Service offices	25	11	4	17	60	60
Comments	microprogrammable; emulates DEC PDP-11, runs all software of	microprogrammed, instructions implemented in ROM.	bus structure, oem sales only		both available only in min. quantity of 5.	

Manufacturer	Data General	Data General Controls	Data General Controls	Digital Equipment	Digital Equipment	Digital Equipment
Model	1200 Series	D-116H	D-116S	PDP-8E/8F/8M	PDP-11/05 and 11/10	PDP-11/35
First installation	1/71	12/72	1/72	3/71	2/72	9/73
Number installed	over 3000	25	2,106	12,000 (PDP-8s)	10,000 (PDP-11s)	10,000 (PDP-11s)
Memory	4K-32K	1K-128K	4K-128K	1K-32K	4K-28K	8K-124K
Increment	4K, 8K, or 16K	4K	4K	1K, 4K, or 8K	4K, 8K, or 16K	8K or 16K
Word size	16 bits	16 bits	16 bits	12 bits	16 bits	16 bits
Cycle time	1.2 usec	960 nsec	1.2 usec	1.2 usec	900 nsec	900 nsec
Parity	not offered	not offered	not offered	optional	not offered	optional
Memory protect	not offered	optional	optional	not offered	not offered	optional
Processor						
Instruction length	16 bits	16 bits	16 bits	12 bits	16, 32, or 48 bits	16, 32, or 48 bits
Address	11 bits	15 bits	15 bits	8 bits	16 bits	16 bits
Operation code	5-15 bits	variable	variable	3 bits	4-16 bits	4-16 bits
Direct addressing	1K (1.2 usec)	1K (2 usec)	1K (2.55 usec)	256 words (1.2 usec)	32K	32K
Indirect addressing	32K (1.2 usec)	32K	32K	4K (2.4 usec)	32K	32K
Bit/byte manipulation	✓	✓	✓	✓	✓	✓
Interregister operations	✓	✓	✓	✓	✓	✓
Registers	4	4	4	2	8	8
Accumulators	4	4	4	1	8	8
General-purpose	4	0	0	1	8	8
Index	2 hardware, 16 memory	2 (hardware)	2 (hardware)	8 per 4K (memory)	8 (hardware), unlimited memory	8 (hardware), unlimited memory
Arithmetic						
Add	1.35 usec	1.0 usec	1.35 usec	2.6 usec	3.7 usec	990 nsec
Store	1.2 usec	not released	1.2 usec	2.4 usec	5.4 usec	2.42 usec
Software multiply	not released	305 usec	400 usec	256.5 usec	—	—
Software divide	not released	480 usec	605 usec	342.4 usec	—	—
Hardware multiply	6.4 usec (optional)	3.0 usec (optional)	3.75 usec (optional)	7.4 usec (optional)	4.3 usec (optional)	9.16 usec (optional)
Hardware divide	6.8 or 7.2 usec (optional)	3.2 usec (optional)	4.05 usec (optional)	7.4 usec (optional)	4.8 usec (optional)	11.58 usec (optional)
Hardware floating-pt.	optional	not offered	not offered	optional	not offered	optional
Input/Output						
Data path	16 bits	16 bits	16 bits	12 bits	16 bits	16 bits
Max. rate	833.3K words/sec	1M words/sec	833.3K words/sec	134K words/sec	70K words/sec	150K words/sec
Max. channels	62	62	62	64	unlimited (bus)	unlimited (bus)
Max. dir. memory access	62	1	1	12	unlimited (bus)	unlimited (bus)
Max. DMA rate	833.3K words/sec	833.3K words/sec	833.3K words/sec	833K words/sec	2M words/sec	2M words/sec
External interrupts	16 standard	2-64	2-64	1	5	5
Interrupt response	not released	2.4 usec[1]	3.0 usec[1]	5.7 usec (min.)	5.42 usec (max.)	5.42 usec (max.)
Other						
Power fail protect	optional	optional	optional	standard	standard	standard
Auto. restart	optional	optional	optional	optional	standard	standard
Real-time clock/timer	optional	optional	optional	optional	standard	optional
Software						
Assembler	2-pass	2-pass	2-pass	1-pass or 2-pass	1-pass or 2-pass	1-pass or 2-pass
Relocatable assembler	yes (reqs. 8K)	yes (reqs. 8K)	yes (reqs. 8K)	yes (reqs. 8K)	yes (reqs. 8K)	yes (reqs. 8K)
Macro assembler	✓	✓	✓	✓	✓	✓
Relocatable loader	✓	✓	✓	✓	✓	✓
Disc Operating System	✓	✓	✓	✓	✓	✓
Real-Time Oper. Sys.	✓	—	—	✓	✓	✓
Disc RTOS	✓	—	—	—	✓	✓
Conversational BASIC	✓	✓	✓			
FORTRAN	✓	✓	✓	✓	✓	✓
Other	ALGOL			BASIC		
Pricing						
4K system	$4,000	$3,036	$2,975	$4,490 (8E)	$4,795 (oem only)	not offered
8K system	$5,400	$3,432	$3,365	$5,000 (8E)	$7,295	$9,495
16K system	$7,000	$5,432	$4,580	$6,600 (8E)	$11,695	$11,495
Min. maintenance	$20/month (at factory)	$30/month	$30/month	$60/month	$50/month	$94/month
Service offices	60	4 U.S. (15 foreign)	4 U.S. (15 foreign)	146 U.S., 226 world-wide	146 U.S., 226 world-wide	146 U.S., 226 world-wide
Comments		[1]depends on system size	[1]depends on system size	8F and 8M are small configs. limited to 46 chans.; prices start $3,200	11/10 is end-user version of 11/05.	11/35 is the oem version of 11/40

Manufacturer	General Automation	General Automation	General Automation	GRI Computer	GRI Computer	GTE Information Systems
Model	SPC-16 40/45	SPC-16 60/65	SPC-16 80/85	9930/9940	9950	IS/1000
First installation	1/71	1/71	1/71	11/72	new product	1970
Number installed	2,000 (SPC-16s)	2,000 (SPC-16s)	2,000 (SPC-16s)	600	—	500
Memory	4K-128K	4K-128K	4K-128K	4K-32K	4K-128K	4K-128K
Increment	4K, 8K, or 16K	4K, 8K, or 16K	4K, 8K, or 16K	4K or 8K	4K, 8K, or 16K	4K or 8K
Word size	16 bits	16 bits	16 bits	16 bits	16 bits	16 bits
Cycle time	1.4 usec	960 nsec	800 nsec	1.76 usec	1.76 usec	750 nsec
Parity	not offered	not offered	not offered	not offered	not offered	optional
Memory protect	optional	optional	optional	not offered	not offered	optional
Processor						
Instruction length	16 or 32 bits	16 or 32 bits	16 or 32 bits	16 or 32 bits	16, 32, 48 or 64 bits	16 bits
Address	5 or 15 bits	5 or 15 bits	5 or 15 bits	16 bits	16 bits	variable
Operation code	4 bits	4 bits	4 bits	10 bits	16 bits	variable
Direct addressing	32K (4.2 usec)	32K (2.9 usec)	32K (2.4 usec)	32K (3.5 usec)	32K (3.5 usec)	64K (750 nsec)
Indirect addressing	32K (5.6 usec)	32K (3.9 usec)	32K (3.2 usec)	32K (5.2 usec)	128K (3.5 usec)	64K (750 nsec)
Bit/byte manipulation	✓	✓	✓	✓	✓	✓
Interregister operations	✓	✓	✓	✓	✓	✓
Registers	9	9	9	up to 48	8 to 40	19
Accumulators	6	6	6	2	8 to 40	16
General-purpose	5	5	5	up to 46	8 to 40	3
Index	3	3	3	1	1 hardware, unlim. mem.	16 (hardware)
Arithmetic						
Add	1.4 usec	960 nsec	800 nsec	1.76 usec	1.76 usec	1.5 usec
Store	2.8 usec	1.92 usec	1.6 usec	1.76 usec	1.76 usec	750 nsec
Software multiply	420 usec	280 usec	233 usec	301 usec	not finalized	not released
Software divide	480 usec	320 usec	266 usec	439 usec	not finalized	not released
Hardware multiply	7.7 usec (optional)	5.28 usec (optional)	4.4 usec (optional)	68 usec (optional)	not finalized	7 usec (optional)
Hardware divide	13.3 usec (optional)	9.12 usec (optional)	7.6 usec (optional)	116 usec (optional)	not finalized	8 usec (optional)
Hardware floating-pt.	optional	optional	optional	optional	optional	not offered
Input/Output						
Data path	16 bits	16 bits	16 bits	16 bits	16 bits	16 bits
Max. rate	347.2K words/sec	520.8K words/sec	625K words/sec	270K words/sec	270K words/sec	86K words/sec.
Max. channels	64	64	64	unlimited (bus)	unlimited (bus)	unibus (64 devices)
Max. dir. memory access	16	16	16	unlimited (bus)	unlimited (bus)	8
Max. DMA rate	694.4K words/sec	1.05M words/sec	1.25M words/sec	550K words/sec	550K words/sec	1-1M words/sec
External interrupts	64 standard	64 standard	64 standard	unlimited	unlimited	8-64
Interrupt response	30.8 usec	21.1 usec	19.3 usec	depends on # regs.	15.8-20.9 usec	16 usec
Other						
Power fail protect	standard	standard	standard	optional	standard	standard
Auto. restart	standard	standard	standard	optional	standard	standard
Real-time clock/timer	standard	standard	standard	optional	optional	optional
Software						
Assembler	2-pass	2-pass	2-pass	1-pass	1-pass	2-pass
Relocatable assembler	yes (reqs. 4K)	yes (reqs. 4K)	yes (reqs. 4K)	yes (reqs. 4K)	yes (reqs. 4K)	yes (reqs. 12K)
Macro assembler	✓	✓	✓	—	—	✓
Relocatable loader	✓	✓	✓	✓	✓	✓
Disc Operating System	✓	✓	✓	✓	✓	✓
Real-Time Oper. Sys.	✓	✓	✓	✓	✓	✓
Disc RTOS	✓	✓	✓	✓	✓	✓
Conversational BASIC	✓	✓	✓	✓	✓	
FORTRAN	✓	✓	✓			
Other	BASIC	BASIC	BASIC	RPG II	RPG II	convers. FORTRAN
Pricing						
4K system	$5,550	$6,550	$8,550	$5,060	$5,595	$5,900
8K system	$6,950	$7,950	$10,150	$5,505	$5,995	$7,700
16K system	$8,950	$12,150	$14,750	$7,900	$7,995	—
Min. maintenance	$60/month	$60/month (PM, parts & labor)	$70/month (PM, parts & labor)	time & materials	time & materials	$55/month
Service offices	60	60	60	—	—	72
Comments	45 is the oem version of 40.	65 is the oem version of 60	85 is the oem version of 80		stack processing, block instructions, bit addressable	

Manufacturer	Hewlett-Packard	Hewlett-Packard	Honeywell Information Systems			
Model	2100 A/S	21MX	System 700	50	70	7/16
First installation	8/71	new product	1972	4/72	4/72	3/74
Number installed	5,200	—	1,000	83	1,031	120
Memory	4K-32K	4K-64K	8K-64K	4K-32K	4K-32K	4K-32K
Increment	4K	4K	8K	4K, 8K, or 16K	4K, 8K or 16K	4K, 8K, or 16K
Word size	16 bits	16 bits	16 bits	16 bits	16 bits	16 bits
Cycle time	980 nsec	650 nsec	775 nsec	1.0 usec	1.0 usec	1.0 usec
Parity	standard	standard	optional	optional	optional	optional
Memory protect	standard	optional	optional	optional	optional	optional
Processor						
Instruction length	16 bits	16 bits	16 bits	16 or 32 bits	16 or 32 bits	16 or 32 bits
Address	10-15 bits	not released	9 bits	16 bits	16 bits	16 bits
Operation code	5-10 bits	not released	4 bits	8 bits	8 bits	8 bits
Direct addressing	2K	2K	1K	32K (300 nsec)	32K (1.0 usec)	32K (1.0 usec)
Indirect addressing	32K	32K	32K (775 nsec)	not offered	not offered	not offered
Bit/byte manipulation	not offered	✓	✓	✓	✓	✓
Interregister operations	✓	✓	✓	✓	✓	✓
Registers	9	18	4	32	32	32
Accumulators	2	2	1	16	16	16
General-purpose	8	16	2	16	16	16
Index	0	2 (hardware)	2	15 hardware, 32K memory	15 hardware, 32K memory	15 hardware, 32K memory
Arithmetic						
Add	1.96 usec	1.94 usec	1.55 usec	1.0 usec	1.0 usec	1.5 usec
Store	1.96 usec	1.94 usec	1 usec	3.25 usec	3.25 usec	3.75 usec
Software multiply	—	—	—	250 usec	—	500 usec
Software divide	—	—	—	270 usec	—	500 usec
Hardware multiply	10.78 usec (standard)	13 usec (standard)	4.1 usec (standard)	not offered	10.25 usec (standard)	34 usec (optional)
Hardware divide	16.66 usec (standard)	17 usec (standard)	7.2 usec (standard)	not offered	12.25 usec (standard)	54 usec (optional)
Hardware floating-pt.	optional	standard	not offered	not offered	standard	optional
Input/Output						
Data path	16 bits	16 bits	16 bits	16 or 8 bits	16 bits	16 or 8 bits
Max. rate	1M words/sec	617K words/sec	1.2M words/sec	96K words/sec	220K words/sec	33K words/sec
Max. channels	45	41	63	255	255	255
Max. dir. memory access	2	2 optional	unlimited	4	4	4
Max. DMA rate	1M words/sec	617K words/sec	1.2M words/sec	1M words/sec	1M words/sec	1M words/sec
External interrupts	14-45	10-45	to 63	255	255	255
Interrupt response	40 usec	40 usec	not released	12 usec	12 usec	18 usec
Other						
Power fail protect	standard	standard	standard	optional	optional	optional
Auto. restart	standard	optional	standard	optional	optional	optional
Real-time clock/timer	optional	optional	standard	optional	optional	optional
Software						
Assembler	2-pass	2-pass	2-pass	1-pass or 2-pass	1-pass or 2-pass	1-pass or 2-pass
Relocatable assembler	yes (reqs. 4K)	yes (reqs. 8K)	yes (reqs. 8K)	yes (reqs. 4K)	yes (reqs. 4K)	yes (reqs. 4K)
Macro assembler	—	—	✓	—	—	—
Relocatable loader	✓	✓	✓	✓	✓	✓
Disc Operating System	✓	✓	✓	✓	✓	✓
Real-Time Oper. Sys.	✓	✓	✓	✓	✓	✓
Disc RTOS	✓	✓	✓	✓	✓	✓
Conversational BASIC	✓	✓	✓	✓	✓	✓
FORTRAN	✓	✓	✓	✓	✓	✓
Other	ALGOL	ALGOL				
Pricing						
4K system	$7,250	$5,950	not offered	$7,450	$7,450	$4,150
8K system	$9,015	$6,800	$10,800	$9,850	$9,850	$4,650
16K system	$12,865	$8,950	$14,000	$11,550	$11,550	$6,250
Min. maintenance	$63/month	$63/month	$70/month	$150/month	$150/month	$150/month
Service offices	170	170	not released	30	30	30
Comments		emulates the HP2100.	compatible with HIS Series 16.	equivalent to 70 but optimized for data communications	architecture similar to the IBM 360/370	architecture similar to the IBM 360/370

Manufacturer	Interdata	Interdata	Jacquard Systems	Lockheed Electronics	Lockheed Electronics	Microdata
Model	7/16 HS ALU	74	J200 Micro Mini	SUE	MAC 16	Micro-One Series
First installation	—	2/73	new product	9/72	2/69	new product
Number installed	—	263	—	250	2,000	—
Memory	4K-32K	4K-32K	1K-64K	4K-32K	4K-64K	1K-32K
Increment	4K, 8K, or 16K	4K, 8K, or 16K	1K	4K	4K	1K or 8K
Word size	16 bits	16 bits	16 bits	16 bits	16 bits	8 bits
Cycle time	1.0 usec or 750 nsec	1 usec	1.5 usec	800 nsec	1 usec	1.1 usec
Parity	optional	optional	not offered	not offered	optional	not offered
Memory protect	optional	optional	not offered	not offered	optional	not offered
Processor						
Instruction length	16 or 32 bits	16 or 32 bits	16 bits	16 or 32 bits	16 bits	8-40 bits
Address	16 bits	16 bits	16 bits	16 bits	16 bits	15 bits
Operation code	8 bits	8 bits	variable	3 bits	4 bits	5-8 bits
Direct addressing	32K (1.0 usec or 750 nsec)	32K (1 usec)	64K (7.7 usec)	32K (800 nsec)	512 words (1 usec)	32K (4.8 usec)
Indirect addressing	not offered	not offered	64K (9.1 usec)	32K (1.6 usec)	64K (2 usec)	32K (7.8 usec)
Bit/byte manipulation	✓	✓	optional	✓	✓	✓
Interregister operations	✓	✓	✓	✓	—	✓
Registers	32	32	4	8	4	6
Accumulators	16	16	4	7	1	2
General-purpose	16	16	2	8	1	0
Index	15 hardware, 32K memory	15 hardware, 32K memory	2 (hardware)	7 (hardware)	512 (memory)	1 hardware, unlim. mem.
Arithmetic						
Add	750 usec	1.5 usec	4.5 usec	2.79 usec	2 usec	9.6 usec
Store	2.25 usec	3.75 usec	7.7 usec	2.5 usec	2 usec	9.0 usec
Software multiply	80 usec	500 usec	650 usec	not released	not released	—
Software divide	80 usec	500 usec	900 usec	not released	not released	—
Hardware multiply	5.5 usec (standard)	34 usec (standard)	120 usec (optional)	15.45 usec (optional)	10 usec (optional)	59.8 usec (standard)
Hardware divide	11.0 usec (standard)	54 usec (standard)	not offered	15.39 usec (optional)	14 usec (optional)	90.0 usec (standard)
Hardware floating-pt.	standard	not offered	optional	not offered	not offered	optional
Input/Output						
Data path	16 or 8 bits	16 or 8 bits	16 bits	16 bits	16 bits	8 bits
Max. rate	100K words/sec	33K words/sec	125K words/sec	1.18M words/sec	800K words/sec	20K words/sec
Max. channels	255	255	64	unlimited (bus)	256	32
Max. dir. memory access	4	1	64	unlimited (bus)	1 (optional)	4
Max. DMA rate	1M words/sec	1M words/sec	650K words/sec	1.18M words/sec	1M words/sec	833K words/sec
External interrupts	255	255	16 standard	4	4-64	3-66
Interrupt response	13.75 usec	18 usec	40 usec	5.58 usec	6 usec	35.2 usec
Other						
Power fail protect	optional	optional	optional	standard	optional	standard
Auto. restart	optional	optional	optional	standard	optional	standard
Real-time clock/timer	optional	optional	optional	standard	optional	standard
Software						
Assembler	1-pass or 2-pass	1-pass or 2-pass	2-pass	1-pass	2-pass	2-pass
Relocatable assembler	yes (reqs. 4K)	yes (reqs. 4K)	yes (reqs. 2K)	yes	yes (reqs. 4K)	yes (reqs. 8K)
Macro assembler	—	—	—	—	—	—
Relocatable loader	✓	✓	✓	—	—	✓
Disc Operating System	✓	✓	✓	—	—	✓
Real-Time Oper. Sys.	✓	✓	—	—	—	—
Disc RTOS	✓	✓	—	—	—	—
Conversational BASIC	✓	✓				✓
FORTRAN	✓	✓			✓	✓
Other						
Pricing						
4K system	$9,050	$4,550	$3,200	$7,350	$7,700	$2,350 (Model 21)[1]
8K system	$9,550	$6,800	$3,600	$8,950	$12,650	$3,540 (Model 21)[1]
16K system	$11,200	$7,450	$4,600	$12,450	$17,600	$4,400 (Model 21)[1]
Min. maintenance	$150/month	$150/month	$60/month	$100/month (labor only)	T & M	$35/month (at factory)
Service offices	30	30	26 U.S. (2 foreign)	10	10	9
Comments	equivalent to 7/16 with high-speed arithmetic	architecture similar to the IBM 360/370		unibus, up to four processors per bus.	multibus architecture	microprogrammable, [1]avail. as single board, 2 smaller mods. avail.

Manufacturer	Microdata	Microdata	Modular Computer Systems	Modular Computer Systems		
Model	1600/Series	3200 Series	Modcomp I	Modcomp II	812	100
First installation	12/71	1/74	10/71	10/72	11/70	4/73
Number installed	1300	5	300	500	800	125
Memory	8K-128K	4K-128K	2K-32K	4K-64K	8K-16K	4K-64K
Increment	8K	4K or 8K	2K, 4K, 8K or 16K	4K, 8K or 16K	8K	4K
Word size	8 bits	16 or 18 bits	16 bits	16 bits	12 bits	16 bits
Cycle time	1 usec	400 nsec	800 nsec	800 usec	2 usec	1 usec
Parity	not offered	optional	optional	standard	not offered	not offered
Memory protect	not offered	optional	not offered	optional	not offered	not offered
Processor						
Instruction length	8-40 bits	8-32 bits	16 or 32 bits	16 or 32 bits	12 or 24 bits	16 or 32 bits
Address	15 bits	16 bits	4 or 16 bits	4 or 16 bits	8 or 12 bits	10-16 bits
Operation code	5-8 bits	4-8 bits	8 bits	8 bits	4 or 8 bits	4-16 bits
Direct addressing	32K (2.8 usec)	32K (500 nsec)	32K (800 nsec)	64K (800 usec)	128 words (4 usec)	64K (2 usec)
Indirect addressing	32K (4.0 usec)	128K (1 usec)	not offered	64K (1.6 usec)	16K (6 usec)	64K (3 usec)
Bit/byte manipulation	✓	✓	✓	✓	not offered	✓
Interregister operations	✓	✓	✓	✓		✓
Registers	6	5	3	15	6	32 (microprogrammable)
Accumulators	2	5 (plus mem. stack)[1]	3	15	6	2
General-purpose	0	32-unlimited (stack)[1]	3	15	4	31 (microprogrammable)
Index	1 hardware, unlim. mem.	1 hardware, unlim. mem.	3 (hardware)	7 (hardware)	2 (memory)	1 (hardware)
Arithmetic						
Add	4.6 usec	400 nsec	800 nsec	800 usec	2 usec	2.44 usec
Store	5.2 usec	1.08 usec	1.6 usec	1.6 usec	2 usec	2.32 usec
Software multiply	—	—	not released	not released	—	180 usec
Software divide	—	—	not released	not released	—	260 usec
Hardware multiply	49 usec (standard)	5.2 usec (standard)	10.27 usec (optional)	6.0 usec (optional)	10.75 usec (standard)	14 usec (optional)
Hardware divide	64 usec (standard)	6.0 usec (standard)	12.27 usec (optional)	8.2 usec (optional)	11 usec (standard)	18.2-19.6 usec (optional)
Hardware floating-pt.	optional	standard	not offered	optional	not offered	not offered
Input/Output						
Data path	8 bits	16 or 18 bits	16 bits	16 bits	12 or 24 bits	16 bits
Max. rate	35.2K words/sec	1.6M words/sec	60K words/sec	60K words/sec	500K words/sec	694K words/sec
Max. channels	32	1,023	64	64	4096	unlimited (bus)
Max. dir. memory access	4	unlimited (bus)	8	16	1	unlimited (memory)
Max. DMA rate	1M words/sec	2.5M words/sec	300K words/sec	833K words/sec	500K words/sec	694K words/sec
External interrupts	3-66	4 and up	16	16	4	handled in memory
Interrupt response	24.8 usec	15 usec	10 usec	12.5 usec	2-6 usec	—
Other						
Power fail protect	standard	standard	standard	standard	standard	optional
Auto. restart	standard	standard	standard	standard	optional	optional
Real-time clock/timer	standard	standard	optional	standard	optional	optional
Software						
Assembler	2-pass	no assembler, directly	2-pass	2-pass	2-pass	2-pass
Relocatable assembler	yes (reqs. 8K)	prog. in higher-level	yes (reqs. 4K)	yes (reqs. 4K)	not offered	yes (reqs. 8K)
Macro assembler	—	language (MPL)	—	✓	✓	✓
Relocatable loader	✓	✓	✓	✓	—	✓
Disc Operating System	✓	✓	—	✓	—	✓
Real-Time Oper. Sys.	—	—	✓	✓	—	✓
Disc RTOS	—	—	—	✓	—	✓
Conversational BASIC	✓			✓		✓
FORTRAN	✓			✓		✓
Other						
Pricing						
4K system	$5,700 (Model 30)[1]	$9,500 (Model 32/S)[1]	$5,600	$6,400	—	$4,600
8K system	$6,800 (Model 30)[1]	$10,400 (Model 32/S)[1]	$7,400	$8,200	$10,000	$5,500
16K system	$9,400 (Model 30)[1]	$13,800 (Model 32/S)[1]	$9,700	$9,500	$15,000	$8,900
Min. maintenance	$65/month (at factory)	$115/month (at factory)	$37/month	$60/month	$60/month	$46/month (1%)
Service offices	9	9	30	30	8 U.S., 5 foreign	15
Comments	microprogrammable, [1]5 smaller mods. avail. and 4 spec. purp. systems	[1]32/S is hard. stack-archit., 3 other gp models avail.				

Manufacturer	Prime Computer	Prime Computer	Raytheon Data Systems	Texas Instruments	Texas Instruments	Varian Data Machines
Model	200	300	500	960B	980B	620/L-100
First installation	11/72	9/73	2/74	new product	new product	6/72
Number installed	75	50	not released	—	—	750
Memory	4K-64K	8K-256K	8K-64K	8K-64K	8K-64K	8K-32K
Increment	4K, 8K, or 16K	8K, 16K, or 32K	8K or 16K	8K, 16K, or 24K	8K, 16K, or 24K	4K or 8K
Word size	16 bits	16 bits	16 bits	16 bits	16 bits	16 bits
Cycle time	750 nsec	600 nsec or 750 nsec	800 nsec	750 nsec	750 nsec	950 nsec
Parity	standard	standard	standard	—	not offered	optional
Memory protect	not offered	standard	optional	standard	standard	optional
Processor						
Instruction length	16 or 32 bits	16 or 32 bits	16 bits	32 bits	16 or 32 bits	16 or 32 bits
Address	10-16 bits	10-18 bits	11 or 16 bits	16 bits	8 or 16 bits	9 or 16 bits
Operation code	4-16 bits	4-16 bits	4 bits	6 bits	5 bits	7 or 13 bits
Direct addressing	64K (1.5 usec)	64K (1.2 usec)	2K or 64K (800 nsec)	64K (750 nsec)	64K (750 nsec)	32K (950 nsec)
Indirect addressing	64K (2.25 usec)	256K (3.4 usec)	not offered	64K (750 nsec)	64K (750 nsec)	32K (950 nsec)
Bit/byte manipulation	✓	✓	✓	✓	✓	not offered
Interregister operations	✓	✓	✓	not offered	✓	✓
Registers	32 (microprogrammable)	32 (microprogrammable)	8	19	9	3
Accumulators	2	2	8	16	1	2
General-purpose	31 (microprogrammable)	31 (microprogrammable)	8	16	7	2
Index	1 (hardware)	1 (hardware)	8 (hardware)	16	64K (memory)	1
Arithmetic						
Add	1.96 usec	1.56 usec	1.6 usec	3.58 nsec	1.75 usec	1.9 usec
Store	1.96 usec	1.56 usec	1.6 usec	3.58 nsec	2.0 usec	1.9 usec
Software multiply	140 usec	—	—	512 usec	—	—
Software divide	200 usec	—	—	630 usec	—	—
Hardware multiply	10.48 usec (optional)	8.72 usec (standard)	6-8 usec (standard)	8.58 usec (optional)	6.25 usec (standard)	9.5 usec (standard)
Hardware divide	13.68-14.72 usec (optional)	10.95 usec (standard)	8 usec (standard)	10.42 usec (optional)	7.75 usec (standard)	9.5 usec (standard)
Hardware floating-pt.	optional	optional	optional	not offered	not offered	not offered
Input/Output						
Data path	6 bits + 2 parity	16 + 2 parity bits	16 bits	16 bits	16 bits	16 bits
Max. rate	1M words/sec	1.25M words/sec	2.5M words/sec	1M words/sec	—	383K words/sec
Max. channels	unlimited (bus)	unlimited (bus)	16	unlimited (memory bus)	256	32
Max. dir. memory access	unlimited (memory)	unlimited (memory)	16	8	8	4
Max. DMA rate	1M words/sec	1.25M words/sec	1.5M words/sec	1M words/sec	1M words/sec	383K words/sec
External interrupts	handled in memory	handled in memory	16	2-34	2-34	8-64
Interrupt response	—	—	4 usec (min.)	39.64 usec	10.25 usec	7.5 usec
Other						
Power fail protect	optional	optional	optional	standard	standard	standard
Auto. restart	optional	standard	optional	standard	standard	standard
Real-time clock/timer	optional	optional	optional	optional	optional	standard
Software						
Assembler	2-pass	2-pass	1-pass or 2-pass	2-pass	2-pass	1-pass or 2-pass
Relocatable assembler	yes (reqs. 8K)	yes (reqs. 8K)	yes (reqs. 8K)	yes (reqs. 16K)	yes (reqs. 16K)	yes (reqs. 8K)
Macro assembler	✓	✓	✓	—	—	✓
Relocatable loader	✓	✓	✓	✓	✓	✓
Disc Operating System	✓	✓	✓	✓	✓	✓
Real-Time Oper. Sys.	✓	✓	✓	✓	✓	—
Disc RTOS	✓	✓	✓	✓	✓	✓
Conversational BASIC	✓	✓			✓	✓
FORTRAN	✓	✓	✓	✓	✓	✓
Other			COBOL and RPG			RPG IV
Pricing						
4K system	$5,600	$9,700[1]	not offered	—	—	$5,400
8K system	$6,800	$11,700[1]	$8,000	$4,350	$4,975	$7,700
16K system	$10,700	$14,700[1]	$9,000	$5,850	—	$10,250
Min. maintenance	$56/month (1%)	$97/month (1%)	$50/month	$85/month	$85/month	$150/month
Service offices	15	15	42	25 U.S., 13 foreign	25 U.S., 13 foreign	20
Comments		[1]with 750 nsec memory				

Vendor Index

CALIFORNIA DATA PROCESSORS
2019 S. Ritchey St., Santa Ana, CA 92705
Subsidiary of Data 100 Corp.
Established 1971; 75 employees
Gross sales $250K
Ray Ball, president (714)558-8211
FOR DATA CIRCLE 300 ON READER CARD

CINCINNATI MILACRON PROCESS CONTROLS DIV.
Mason Road, Lebanon, OH 45036
Established 1884; 13,000 employees
Gross sales $370M
Joseph F. Mount, dir mktg (513)494-5261
FOR DATA CIRCLE 301 ON READER CARD

COMPUTER AUTOMATION, INC.
18651 Von Karman Ave., Irvine, CA 92664
Established 1967; 440 employees
Gross sales $11M
Dennis Bush, mgr mktg serv (714)833-8830
FOR DATA CIRCLE 302 ON READER CARD

DATA GENERAL CORP.
Route 9, Southboro, MA 01772
Established 1968; over 2,600 employees
Gross sales $53.3M
Edgar Geithner, mgr mktg info (617)485-9100
FOR DATA CIRCLE 303 ON READER CARD

DIGITAL COMPUTER CONTROLS, INC.
12 Industrial Rd., Fairfield, NJ 07006
Established 1970; 255 employees
Gross sales $3.7M
B. R. Erickson, corp commo (201)575-9100
FOR DATA CIRCLE 304 ON READER CARD

DIGITAL EQUIPMENT CORP.
Maynard, MA 01754
Established 1957; over 16,000 employees
Gross sales $265.5M
Contact local sales office
FOR DATA CIRCLE 305 ON READER CARD

GENERAL AUTOMATION, INC
1055 S. East St., Anaheim, CA 92805
Established 1967; 1200 employees
Gross sales $30M
Al Devault, dir stand prod (714)778-4800
FOR DATA CIRCLE 306 ON READER CARD

GTE INFORMATION SYSTEMS, INC.
5300 E. LaPalma Ave., Anaheim, CA 92807
Established 1968; 3,000 employees
Gross sales $80M
Contact marketing manager (714)524-3131
FOR DATA CIRCLE 307 ON READER CARD

HEWLETT-PACKARD DATA SYSTEMS DIV.
11000 Wolfe Rd., Cupertino, CA 95014
Established 1968; 3,000 employees
Gross sales $100M
R. M. Covington, pub rel (408)257-7000
FOR DATA CIRCLE 308 ON READER CARD

HONEYWELL INFORMATION SYSTEMS
80 Walnut St., Wellesley Hills, MA 02181
employees not released.
Gross sales $2,408M
Al Kluesner, director (617)237-4100 x3501
FOR DATA CIRCLE 309 ON READER CARD

INTERDATA INC.
2 Crescent Place, Oceanport, NJ 07757
Established 1966; over 800 employees
Gross sales $19M
Contact local sales office.
FOR DATA CIRCLE 310 ON READER CARD

JACQUARD SYSTEMS
1505 11th St., Santa Monica, CA 90404
Established 1969; 70 employees
Gross sales $1.5M
F. Peters, dir cptr mktg (213)393-3711
FOR DATA CIRCLE 311 ON READER CARD

LOCKHEED ELECTRONICS CO. DP DIV.
6201 E. Randolph, Los Angeles, CA 90040
Subsidiary of Lockheed Aircraft Corp.
Established 1959; 800 employees
Gross sales not released.
Computer sales & mktg (213)722-6810
FOR DATA CIRCLE 312 ON READER CARD

NUCLEAR DATA, INC.
Golf & Meacham Rd., Schaumburg, IL 60172
Established 1959; 669 employees
Gross sales $18M
L. Brown, natl sales mgr (312)885-4700
FOR DATA CIRCLE 313 ON READER CARD

PRIME COMPUTER, INC.
23 Strathmore Rd., Natick, MA 01760
Established 1972; 126 employees
Gross sales $1.8M
S. J. Halligan, vp sales (617)655-6988
FOR DATA CIRCLE 314 ON READER CARD

RAYTHEON DATA SYSTEMS
1415 Boston Prov. Turn., Norwood, MA 02062
Subsidiary of Raytheon Company
Established 1926; 45,000 employees
Gross sales $1,650M
Sales department (617)762-6700
FOR DATA CIRCLE 315 ON READER CARD

TEXAS INSTRUMENTS INC.
P. O. Box 1444, Houston, TX 77001
Established 1958; # employees not given
Gross sales not released.
Jim McEwen, sales mgr (713)777-1301 x261
FOR DATA CIRCLE 316 ON READER CARD

VARIAN DATA MACHINES
2722 Michelson Dr., Irvine, CA 92664
Subsidiary of Varian Associates
Established 1948; 8,500 employees
Gross sales $241.3M
R. Oakley, prod mgr (714)833-2400
FOR DATA CIRCLE 317 ON READER CARD

WESTINGHOUSE ELEC. COMPUTER & INSTRUMENTATION DIV.
1200 W. Colonial Dr., Orlando, FL
Established 1886; 150,000 employees
Gross sales over $5,000M
W. M. Brittain, cptr sales (305) 843-7030
FOR DATA CIRCLE 318 ON READER CARD

COMPUTER DEVELOPMENT CORP.
1650 Challenge Dr., Concord, CA 94520
Established 1969; over 200 employees
Gross sales $700K
Ray Cramer, vp mktg (214)233-3238
FOR DATA CIRCLE 319 ON READER CARD

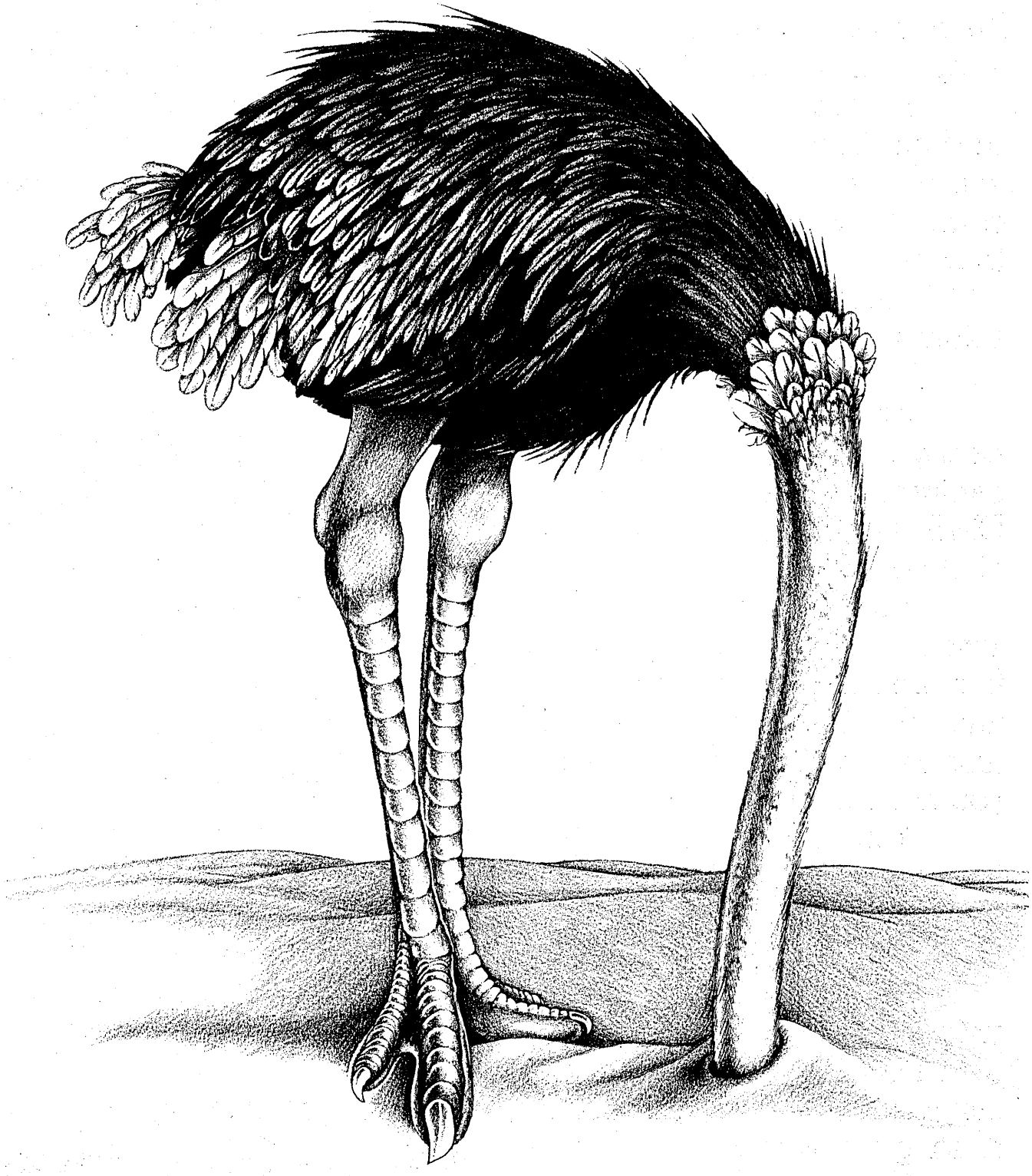
MODULAR COMPUTER SYSTEMS, INC.
1650 W. McNab Rd., Ft. Lauderdale, FL 33309
Established 1970; 570 employees
Gross sales $12.5M
R. L. Marlatt, dir mktg (305)974-1380
FOR DATA CIRCLE 320 ON READER CARD

MICRODATA CORP.
17481 Red Hill, Irvine, CA 92705
Established 1967; 500 employees
Gross sales $8.75M
R. C. Stack, mktg commo (714)540-6730
FOR DATA CIRCLE 321 ON READER CARD

GRI COMPUTER CORP.
320 Needham St., Newton, MA 02164
Established 1968; 80 employees
Gross sales $2.8M
Joseph Molina, mktg mgr (617)969-0800
FOR DATA CIRCLE 322 ON READER CARD □

Manufacturer	Varian Data Machines	Westinghouse Electric
Model	V72	2500
First installation	11/72	6/71
Number installed	184	150
Memory	8K-256K	4K-64K
Increment	8K or 16K	4K or 8K
Word size	16 bits	16 bits
Cycle time	1.0 usec	750 nsec
Parity	optional	optional
Memory protect	___	optional
Processor		
Instruction length	16 or 32 bits	16 bits
Address	9 or 16 bits	8 bits
Operation code	7 or 13 bits	5 bits
Direct addressing	32K (1 usec)	256 words (750 nsec)
Indirect addressing	32K (1 usec)	64K (1.550 usec)
Bit/byte manipulation	✓	not offered
Interregister operations	✓	✓
Registers	16	16
Accumulators	2	1
General-purpose	16	14
Index	1	2 (hardware)
Arithmetic		
Add	2.0 usec	1.7 usec
Store	2.0 usec	1.7 usec
Software multiply	___	___
Software divide	___	___
Hardware multiply	5.3 usec (standard)	22.3-26.5 usec (standard)
Hardware divide	5.8 usec (standard)	31.5-35.8 usec (standard)
Hardware floating-pt.	optional	optional
Input/Output		
Data path	16 bits	16 bits
Max. rate	2M words/sec	100K words/sec
Max. channels	64	2
Max. dir. memory access	4	128
Max. DMA rate	1M words/sec	1M words/sec
External interrupts	1-64	120
Interrupt response	6 usec	10.0 usec
Other		
Power fail protect	standard	standard
Auto. restart	standard	optional
Real-time clock/timer	standard	optional
Software		
Assembler	1-pass or 2-pass	2-pass
Relocatable assembler	yes	yes
Macro assembler	✓	___
Relocatable loader	✓	✓
Disc Operating System	✓	✓
Real-Time Oper. Sys.	✓	✓
Disc RTOS	✓	✓
Conversational BASIC	✓	✓
FORTRAN	✓	✓
Other	RPG	RPG
Pricing		
4K system	not offered	$10,700
8K system	$10,000	$13,700
16K system	___	$19,700
Min. maintenance	$150/month	$89/month
Service offices	20	12
Comments		

ONE WAY OF COPING WITH YOUR IBM 1130:



THE OTHER:

Face it. The 1130 has been discontinued.

That may not bug you now, but sooner or later you're going to be up a creek.

And the only solution IBM can offer is moving you up to a bigger, more expensive computer with all new software to write.

General Automation has a solution that's simpler.

The DMS.

Even if you think you're happy with your 1130 now, we can replace it with our basic DMS at a monthly cost savings of about 40%.

As your needs grow, our system can grow with you. In fact, we can give you up to ten times the throughput of an 1130. Just add what you need when you need it.

You can even add real-time capability. With a choice of two new operating systems: DPS or CMS.

But you'll never pay more for our DMS than you're paying right now for the 1130. And you can run more than 95% of your existing software without change.

Our specialists are constantly developing more peripherals and software for you. Our user group is constantly trading information on how to get the most from the system.

Now you can see why our DMS has replaced more than three hundred 1130's. Four times more than anyone.

We believe a system that can do all this for you is a much prettier sight than what you're looking at now.

☐ I want to know more about the DMS and why it's the number one replacement for the IBM 1130.

☐ Forget it. I still want to keep my head in the sand.

Name_____

Company_____

Address_____

City_____

State_____ Zip_____

Mail to General Automation, 1055 South East Street, Anaheim, California 92805. Or call us at (714) 778-4800.

DMS SYSTEMS BY GENERAL AUTOMATION

The macro instruction repertoire must be arranged into three subsets to preserve software transferability and make maximum use of microprogram architecture

THE NEGATIVE ASPECTS OF MICROPROGRAMMING

by Terry L. Dollhoff

There is an ever increasing tendency among computer manufacturers to opt for a microprogrammed architecture. There are probably many factors influencing this trend, but certainly the sharply decreasing cost of associated hardware technology and the increased flexibility offered by microprogramming are important contributors. This increased reliance upon microprogramming, particularly when read/write or other easily replaceable microprogram storage is employed, must be accompanied by a deliberate game plan for exploitation of its flexibility. Microprogramming flexibility, when improperly managed or controlled, can have definite negative side effects.

To examine the pitfalls in detail, assume that a new microprogrammable computer, called the UltraFlexibly Organized machine or simply UFO, has been manufactured and that its microprogram can be readily altered. The precise mechanics by which the alterations are accomplished (e.g., replace a read only memory or rewrite a read/write memory) are immaterial. Now, further assume that a potential user for UFO requires capabilities that the present UFO macro instruction set does not provide. To satisfy the new requirement, certain instructions within the UFO repertoire must be altered or new instructions added (i.e., a microprogram modification is necessary). In response to the user requirement, the manufacturer replaces many of the original UFO instructions with instructions tailored for the user's application. Herein lies a potentially enormous software problem.

Assuming that the customary cadre of support software has been developed (assembler, compiler(s), loader, etc.), then the manufacturer, by altering the UFO macro repertoire, has created the corresponding task of modifying the support software to support the altered UFO. Depending on the extent of the alterations, this task can be a rather formidable one. More importantly, perhaps, follow-on support must now be provided for two systems. Vice one. Since the cost of development and support of computer software is increasing at an alarming rate, it would be highly desirable to avoid modifying and supporting additional software.

Support problems

One might think that problems of this nature are not encountered when a read/write microprogram memory is employed, since such a memory allows the macro instruction set to be "dynamically" modified and hence host both the support software and the user software. Unfortunately, since the assembler and compiler(s) are generating instructions for the original UFO, the object programs which they produce do not utilize the modified UFO features. Therefore, as a minimum, the code generator portion of the compiler must be modified and supported. Here again the manufacturer is faced with a support problem.

How then can such problems of software transferability be avoided without sacrificing the flexibility offered by a microprogrammed machine? Before outlining a possible solution, it must be clearly understood that the emulation of one computer using another computer is distinctly different from enhancing a machine's capability to perform a given task. Certainly, in the case of emulation, the entire instruction set must be replaced by another set. Software transferability is usually not a problem when emulating, because the support software for the emulated machine can be used. Thus, the approach discussed here is specifically concerned with the user who

wants to enhance or modify the basic macro instruction set so the computer will perform more efficiently when used in his particular application.

The following technique (a blend of management, hardware design, and software design) allows maximum utilization of the microprogram architecture without sacrificing software transferability. The first step is to arrange the macro instruction repertoire into three subsets:

1. Basic instructions
2. Advanced instructions
3. User tailored instructions

The composition of these subsets is quite straightforward. The basic instruction set contains, as the name suggests, the basic macro repertoire. This set is an invariant one and will be contained in all configurations of the computer. The advanced instruction set contains more advanced features (e.g., floating point, double precision, square root) which may be selected by the user for inclusion in his configuration of the computer. In practice, the advanced instruction set will actually consist of several sets and the user may choose the particular sets, if any, required for his application. The final subset, the user tailored instructions, contains the instructions peculiar to a particular user application. Obviously there will be a large number of user tailored subsets since each individual user can define a unique set. The distinction between the advanced set and the user tailored set may not be clear-cut. The general rule of thumb for deciding whether a set is an advanced set or a user tailored set is to examine the set's application. Those sets of general application to many users are advanced sets and those restricted to a single user are user tailored sets.

If the instruction set has been subdivided as described above, either by physical design or by management constraints, the support software can be designed to avoid problems of software transferability. The basic software (assembler, compiler(s), loader) is written using *only* the basic instruction subset. Since all computers contain this subset, according to the ground rules established earlier, the basic software will execute without modification on any version of the computer. Although it is quite practical to restrict the set of instructions used to write the support software, the output of the assembler or compiler cannot be similarly restricted and still adequately support all configurations of the machine. Therefore the assembler or compiler must generate code sequences containing instructions from any of the three sets.

Interface philosophy

The interface with the advanced subsets is simplified because the advanced sets are designed by the manufacturer prior to the initial compiler or assembler design. Therefore the advanced instruction sets available in a particular configuration need not be indicated by the user until compile time. As an example, consider an advanced instruction set which consists solely of floating point operations: the user indicates, via a suitable option statement, that the floating point instructions are available; then, whenever floating point arithmetic is encountered in the source program, the appropriate instructions from this subset are generated. Alternatively, if the user indicates that the floating point instruction set is not available, then whenever floating point arithmetic is encountered in the source program, calls are generated to library routines which perform the required operations.

The interface with the user tailored sets can be handled in much the same manner. However, since not all user tailored sets are specified prior to the design of the support software, the interface is more abstract and the user must supply information over and above a simple set selection. The user must define, usually in the preamble to his program, the precise functions or procedures which are available in his user tailored subset. Such definitions would normally indicate the mnemonic name of the function or procedure, the number of parameters and registers into which they are to be loaded, the operation code of the instruction to be generated, and the register which is to contain the result. Whenever a call to one of these functions or procedures is encountered in the subsequent source program, the compiler will first generate basic instructions to load required parameters and then generate the proper user tailored instruction. It should be noted that since the interface between a user program and the user tailored instructions is a procedure or function call, the transfer of a user program from one version of the com-

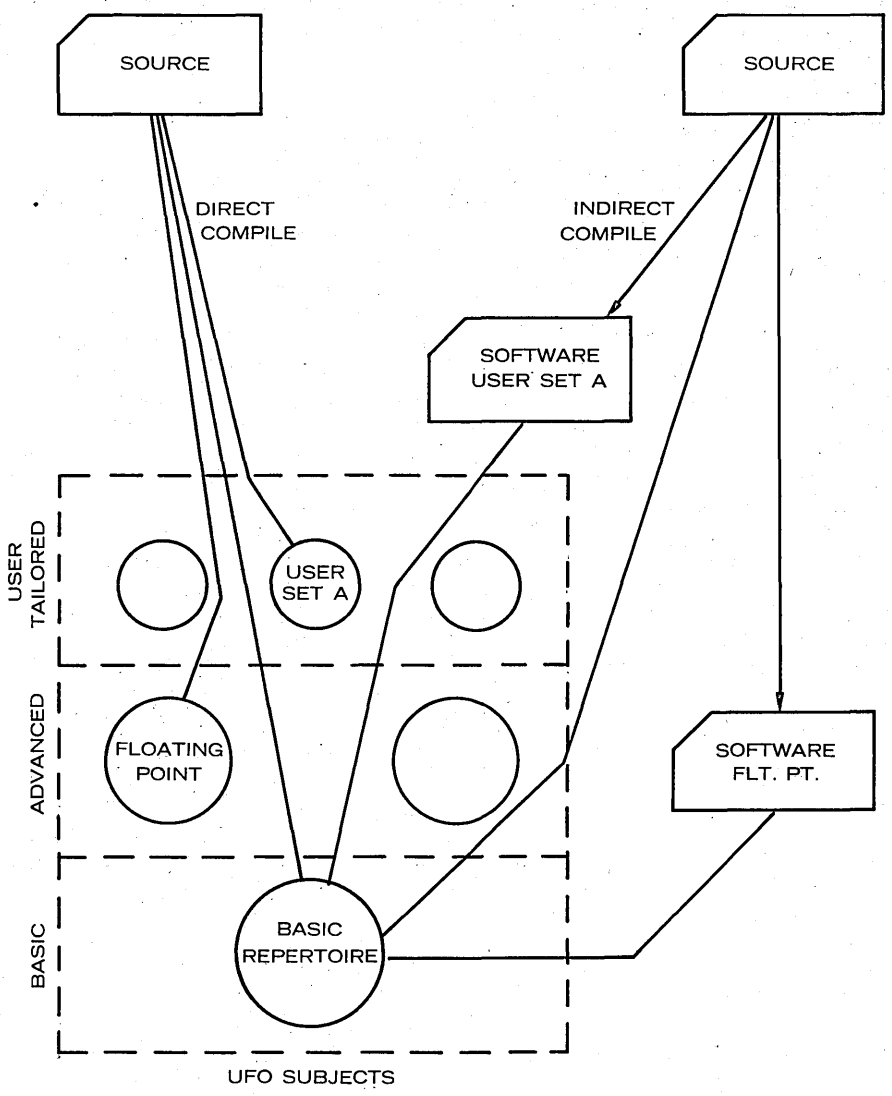


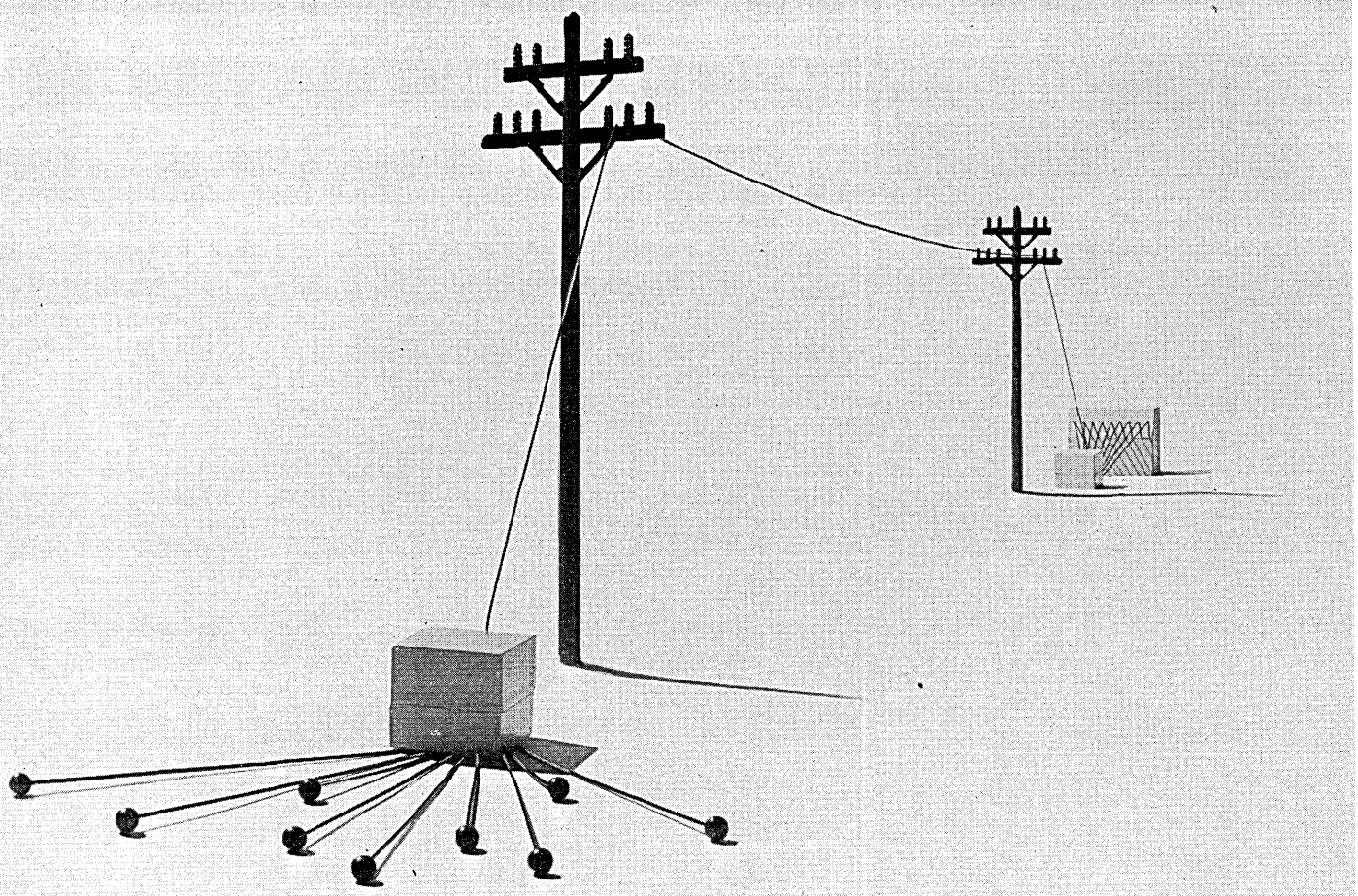
Fig. 1. Compile time flexibility.

puter to another has not been inhibited. If the definitions of user tailored instructions are removed from the preamble of the program, then the normal procedure or function call is generated. Therefore, by including new procedures which perform the functions previously allocated to the hardware, the software can be transferred to a machine which does not contain the user tailored instructions.

The major advantage to the approach outlined above is illustrated by Fig. 1; that is, any source program can be compiled to operate properly on any configuration of the computer. If the required advanced instructions or user tailored instructions are available, they are generated directly by the support software. If such instructions are not available, then the software procedure call is generated instead of the hardware instruction. Clearly, this avoids the problem of software transferability. Another, not so obvious, advantage to this approach is that the decision regarding which functions are to be implemented in microcode can be postponed until the software has been completed and actual timing analysis is available.

The blend of hardware/software/management techniques described above is by no means a cure-all to the problems encountered in the rapidly growing population of microprogrammed machines. But it is a logical alternative which can be employed, in whole or in part, to increase the flexibility of both hardware and software. The success of such an approach depends upon the extent to which the hardware design and support software design are combined. If they are approached in tandem, the flexibility of both will be greatly increased. □

Mr. Dollhoff is employed by the Naval Electronics System Command, with responsibility for the development of a compiler to support the AN/UYK-20 microprogrammed computer. He has an MS from the Univ. of Maryland.



Infotron multiplexing: After our unheard-of 30 day free trial comes our unheard-of two-year warranty.

The teleprocessing system shown here, based on an actual user's experience, costs $5,410.06 a month less than it would without our multiplexers.

Not bad.

And for you—depending on the number and location of remotes you have—it could be better.

But who wants to buy a could-be?

Not you.

So we took the big could-be's out of multiplexing.

Could-be Number one: Could be better than what you're doing now.

That could-be we demolish with our 30-day free trial. We'll come in, review your requirements, design a system, and propose the system to you.

If the proposal makes sense to you, order the system.

But make your order subject to cancellation during the first 30 days after we install. You can cancel for any reason and we'll give you your old system back.

What about after 30 days? Could be trouble, right?

Uh-uh. We've destroyed that could-be, too.

All of our equipment comes with a two-year warranty. Partly because we expect the equipment to last longer. And partly because we want our customers to stay customers even longer than that.

For the same reasons, our equipment doesn't consist of a low bid wrapped in extra-cost options. We don't play that game. Our equipment . . . and price . . . includes everything you need for an easy-to-live-with system.

Which is precisely why we're able to give you a 30-day free trial and a two year warranty.

Give us a call.

Infotron Systems

Infotron System Corporation/7300 N. Crescent Boulevard, Pennsauken, N. J. 08110/(609) 665-3864

CIRCLE 43 ON READER CARD

The best time to avoid disputes is before the contract is signed. Even in the worst of situations arbitration is better than litigation.

AVOIDING HASSLES WITH VENDORS

by Robert A. Bucci

Breach of contract lawsuits in the computer industry are generally caused by highly predictable, ritualistic actions engaged in by vendor and user. Unless some fundamental behavioral changes take place, the number of breach of contract suits will continue to mushroom. I intend to recreate a typical confrontation between Vendor and User to show how stereotyped thinking allows the dispute to get out of hand and reach the litigation stage; and then to suggest what can be done to minimize litigation.

Finger-pointing

User experiencing what is perceived to be a serious operational problem with his installed system zeroes in on vendor as the offending culprit. Vendor quite naturally vehemently objects to being typecast as the villain. Various attempts are made by the vendor to remedy the situation but to no avail. Pretty soon things heat up and the parties start firing heavy artillery at one another:

"You low-balled me. The system can't meet my needs."

"We did not! Your needs have changed."

"But, you're the experts. We're babes in the woods."

"Horsefeathers! We can't be responsible for running your business."

"Your support staff of highly trained specialists should join the Amalgamated Meat Cutters Union."

"Bull! Our people have gone the extra mile. We'd be millionaires if we had a dollar for every personnel change you made since the project began."

When the polemics start to wear thin, vendor pulls out the one-sided form contract the user has signed, points to it with considerable pride, and breaks into a chorus of "We never promised you a rose garden." Not surprisingly, user retorts with a few bars of his favorite song, "It's a sin to tell a lie."

And so it goes ad nauseam with neither party ever straying far from its initial position. Further meetings, rather than resolving anything, serve only to aggravate matters and heighten the tension because each meeting is a mirror image of the last.

The letter-writing contest

Countless meetings have taken place. The dispute has not faded away. Combat fatigue has set in and the front line troops have lost their effectiveness at the negotiating table. It's obvious that what is needed to get the matter off dead center are some fresh troops from headquarters. The problem escalates to a higher level. A key user executive starts sending registered letters to a top vendor executive. The content of these letters seldom varies, i.e., first the bad news:

- Your product is a bummer
- Your service is a disservice
- Please send a needle and thread because your salesman has ripped us off

then the good news:

- We desire to meet with you or your authorized representative to discuss how to amicably resolve the matter.

The vendor executive, having been on the receiving end of many a registered zinger during his career, then proceeds to do what any red-blooded executive would do—he calls up the responsible line manager and says, "Thanks, I needed that! Now what the hell's going on?"

Well, needless to say, the wheel gets reinvented and much time is spent educating the new cast of players and bringing it up to speed, but the problem persists and the logjam remains unbroken.

While this is happening, the vendor's credit department dutifully reminds all concerned that the user's payment record has been a model of consistency—it hasn't made a monthly payment in eons—and that this intolerable situation can no longer be endured.

The vendor game

High noon fast approaches. Vendor resorts to the ultimate weapon—the computer industry's brand of Brinkmanship known as "Plugmanship", i.e., pay up in full within X days Mr. User, or we're going to pull your plug.

User must now do some serious thinking about whether vendor is bluffing or fully intends to repossess the equipment. Does he or doesn't he? Only his maintenance men know for sure.

When backed into this corner, users invariably conclude that in contract hassles as well as football games, the best defense is a good offense.

The user game

User's game is known as "Cool Millions." The rules are very simple. He gets out his trusty minicalculator, lib-

erally computes what he feels his losses are, adds several zeros for effect and voilà!—we have the potential makings of a multi-million dollar law suit.

The inevitable

Barring eleventh-hour miracles, this sequence of events ends with vendor's equipment being thrown out on the street, or leads to a foot race to the courthouse steps with vendor trying to repossess the equipment and user attempting to obtain an injunction restraining vendor from doing so.

The rest is legal history. Who ultimately prevails is unimportant. The shame of it all is that had both parties acted in a reasonable manner, it never would have reached this stage.

Basic incompatibility and irreconcilable differences are often the enumerated grounds for divorce. And it is not uncommon for friends and relatives of the parties to be overheard muttering things like, "they weren't right for one another; they should never have been married in the first place." Similarly, when vendor and user part ways, many shortcomings of the just-concluded marriage become apparent. But, it would be simplistic to say that they never should have been married in the first place. A more realistic assumption is that had they taken the time and effort to get to know one another better before plunging headlong into matrimony, the likelihood of divorce would have been minimal.

Since our hypothetical vendor-user pair wound up in Divorce Court and left it to the judge to work out a property settlement, I think it would be worthwhile to go back to the beginning, examine some of the wrong turns along the way, and provide some recommendations which, if followed, will hopefully prevent the reoccurrence of such unhappy endings.

Presale activity

The cumulative effect of creative advertising, snappy brochures, slick proposals, and glib salesmanship can overwhelm a user and precondition him to expect outstanding performance from the vendor. But the record is replete with mediocre performances and let-down users. Let's examine some of the presale activity.

Advertising and Product Brochures. If one were to select some dp ads at random, he would be treated to assertions such as:

> "Your _____ system does not require a professional programming staff, nor highly skilled operators, nor expensive site preparation. We will train your people to run it."

If this were a consumer ad, it would have to be substantiated. That is, documentation must exist to support the advertised claim. However, since we are in the commercial marketplace, product claims such as the above go virtually unchallenged.

But there is no reason why a user should accept such ads at face value. Put them to the test!

- If the ad boasts of vendor's team of world-wide specialists who are at your beck and call, be sure to obtain written assurances that from time to time, such personnel will be available to consult with you.
- If the ad or product brochure makes a claim about cycle times, speed, price/performance ratios, etc., be sure to ask your technical people for verification or request that vendor provide substantiating documentation.
- If the ad extols the virtues of vendor's maintenance men who are so responsive, that to call them "Minutemen" would be disparaging, be sure that the contract provides for a guaranteed response time.

In other words, users have it within their power to help make vendor tone down advertising claims by adopting an "I'm from Missouri, show me" attitude.

One parting comment on ads: if the ad talks of vendor's "full service capability" or "total service capability," be sure that the contract contains a detailed list of these services. Because somehow, by some mysterious process which I have never quite been able to understand, the total service vendor who appeared in the ad is magically transformed into a hardware merchant by contract-signing time!

Proposals. Before discussing how proposals can be toned down, it would be worthwhile to briefly describe what proposals are and what they are not. Proposals are usually part chaff, part wheat, plus a generous portion devoted to vendor virtues. Their mission in life is to convince the user to lease or buy the system from vendor. It is not intended by vendor that the proposal be made part of the contract. All vendors without exception have language in their standard form agreements, which excludes prior negotiations and proposals from becoming part of the contract. Vendor's refusal to incorporate the proposal in its entirety into the contract is correct, because proposals are, as a rule, not prepared by lawyers, and because half the material contained in them doesn't belong in a contract.

However, the essential portions of the proposal, i.e., those that user relies on as a basis for selecting vendor over the competition, should be made part of the contract. User should make it crystal clear when soliciting proposals that he intends to make his selection based on the proposals submitted, and that a proposal will not be accepted unless the vendor agrees to incorporate commitments contained in the proposal into the contract. In addition, user should require that all submitting proposals agree that, if selected, they will furnish a performance bond, or in the alternative, agree to be bound by liquidated damages for failure to deliver or install the contracted-for system on time. This approach may scare off some vendors from submitting proposals; but it will hopefully achieve the desired effect of encouraging accurate proposals, which give user the "real story" instead of the story the salesman thinks user would like to hear.

Glib Salesmanship. User should keep a running record of his relationship with salesman. If user has key questions, they should be put in writing and written responses called for. Such a procedure forces user to think through his important concerns, provides the salesman with vital information as to what user's requirements are, and better enables him to respond to those requirements. Furthermore, it helps minimize the confusion and misunderstanding which frequently arises out of a series of verbal communications, and leads to better mutual understanding. And it provides you with a written record which may be of use if a dispute arises and several of vendor's marketeers are conveniently stricken by a severe case of amnesia.

User responsibilities

Many users look to their vendor for a turnkey operation and think they have joined forces with someone who walks on water. Unfortunately, there's a dearth of miracles being performed these days, with all but one vendor being fully preoccupied with trying to keep their heads above water. To insure a successful installation, the user organization must be dedicated and committed to the project.

And dedication starts at the top. The head man has to let the word go out loud and clear that he is behind the project and expects all departments to cooperate in working towards a successful installation. User must face up to his responsibilities and take the necessary steps to define, implement, and control the project. The myriad of detail work, designing the system, implementing the system, testing it, insuring the accuracy of the results, ad infinitum, must be professionally handled by user's staff if a successful installation is to result. No matter how much support and assistance vendor is providing, there is no way that he can be expected

to know as much about user's business as user does.

When user makes only a half-hearted commitment to the project, or relies on vendor to do it all, he is skating on thin ice, because the success of the project varies directly with the degree of user involvement.

Involved users know what they want and have a plan as to how to get it. The uninvolved user doesn't quite know what he wants, plans poorly, relies on vendor to make the decisions, and is invariably *never pleased* with the end result. He is potential plaintiff No. 1.

Quality of form contracts

The most charitable thing that can be said about vendor-supplied form contracts is that they are "X-Rated", and no businessman should be allowed to see one, much less sign one, unless accompanied by his lawyer.

The contracts are designed to protect vendors' interests, not users', and in many ways are vague, ambiguous, and lack definitions and objective standards. User can never be sure of what he's getting or to what he's contractually entitled. And if he's not sure, a potential dispute is in the works.

Vendors must adopt reasonable form contracts which will bring stability, certainty and predictability to the Vendor-User relationship.

Until such time as reasonable form contracts become the industry standard, user is well advised to protect his interests in contract negotiations with vendor. The following list of items to which user should pay particular attention is not an exhaustive list because it would take a separate article to completely cover the subject. For want of a better name, I have dubbed it the "Basic Protection Plan".

Delivery. The contract should specify a definite delivery date. In the event vendor misses the date for reasons within his control, liquidated damages should apply. You'll be lucky to get anything over $100 per day and, of course, no vendor would agree to unlimited damages; therefore, expect a maximum dollar limitation to be thrown at you. Likewise, no vendor will accept liability for delays caused by circumstances beyond his control. And if the delay is caused by user, liquidated damages shall not apply. Lastly, if the delay is of sufficiently long duration, which will vary according to the particular circumstances, user shall have the right to terminate the contract without penalty and seek substitute equipment elsewhere.

Since all vendors are of the rightful opinion that it wouldn't be commercially reasonable to agree to an open-ended liability clause, the practical effect of a liquidated damages clause is that it will act as an incentive or prod to vendor's performance. The facts of life are very simple: (1.) No vendor wants to pay one cent to a user in damages. (2.) Assuming one machine is coming off the production line, two customers have a need for it, one has a liquidated damages clause in his contract and the other doesn't, is there any doubt as to who gets the machine?

The amounts fixed in liquidated damages clauses must be reasonably related to actual damages, or they are likely to be shot down in court. When in doubt about the amounts, consult a lawyer.

Acceptance and Performance Tests. User must be careful to define exactly what it is that constitutes acceptance of the system and triggers his obligation to pay. If the crux of the matter is that the items of equipment contracted for must be delivered, installed, checked out, able to function interactively, and that certain essential programs must be "live and on the air", then spell it out.

Similarly, if the entire system must be able to run at a 90% uptime level for 15 or 30 days before performance criteria are satisfied, don't leave it to the imagination, put it in the contract.

Warranties. A satisfactory clause would warrant for one year that the equipment will be free from defects in material and workmanship and will conform to applicable specifications. In the event such defects show up within the one-year period, vendor's obligation would be to repair or replace the equipment at his own expense. Vendor will naturally insist that the above shall be user's sole and exclusive remedy, and that vendor shall not be liable for any special or consequential damages. Such limitations are reasonable and legally permissible in a commercial context. Do not expect any supplier to assume unlimited liability or exposure for breach of warranty. Most will refuse your order rather than agree to such an unreasonable request.

Equipment Flexibility Rights. Your contract should specify the conditions under which you can upgrade or downgrade, whether you'll get whacked for a penalty, whether you can add foreign attachments without having maintenance withdrawn, those situations in which you can assign the contract or sublet time, and whether relocation of the equipment is permissible.

Maintenance Response Time. User must obtain a guaranteed response time for major system failures, like three or four hours. If vendor fails to respond within that time, then liquidated damages should apply, e.g., $100 an hour. User should also try to obtain a provision that, in the event vendor fails to respond within so many hours, user has the right to call in someone else to make the necessary repairs, surcharge vendor, and not be in breach of any warranties or contractual obligations, or subject to additional charges for having unauthorized maintenance personnel work on the equipment.

Back-Up and Equipment Rental Credits. From a user standpoint, the key concern is to obtain productive use from vendor's system. The prudent user will strive for a backup commitment from vendor, at no additional charge, for equipment malfunction. Such backup will normally be provided at one of vendor's data centers or at another user site. Downtime is inevitable, but a properly administered backup arrangement will ensure that user's vital production gets done. If vendor is providing or arranging for an equivalent amount of backup, then user has no cause to seek rental credits, but if no backup is provided, user should have a provision in his contract for rental credits to be applied against the basic monthly rental for any downtime incurred.

Program Rights. What is user allowed or prohibited from doing with vendor-provided software? What about enhancements or modifications to vendor-supplied programs, made solely by vendor, solely by user, or jointly? Who owns them? Who has the right to use them? To market them? What about licenses? These are but a few of the thorny program problems which user must clarify in the contract.

Default. If a default provision is in the contract, user must be sure he has a reasonable period of time within which to cure the default. This period will vary depending on the nature of the default. For example, ten days would be reasonable to cure nonpayment, while 30 days might be needed to remove an attachment from property or to obtain a dismissal of a bankruptcy petition filed against the user by his own creditors.

Taxes. The entire area of computer taxation can be confusing to say the least. There can be real property taxes, personal property taxes, sales tax, use tax, income tax, and the investment tax credit. Be sure to obtain professional tax advice as to how your particular transaction should be treated. Be sure that the contract specifies who is responsible for appropriate taxes, including the amounts thereof.

Patents. Vendor should stand behind his equipment and indemnify user against any patent or copyright infringements occasioned by using the equipment in the normally intended

way. If use of the equipment is enjoined, vendor should procure for user the right to continue using the equipment, modify it so that it becomes non-infringing, or replace it with non-infringing equipment of equal performance. In addition, credits against the purchase or rental of the equipment may be in order to compensate user for periods of non-use.

Legal representation

We live in an age of specialization and nowhere is this more apparent than in the field of law. Yet users deprive themselves of effective representation either by not using the services of a lawyer, or by using a lawyer who is not knowledgeable in data processing. One would not retain a doctor for an operation or hire a consultant, without checking on their credentials. Follow the same procedure in securing dp counsel. Legal roulette is a dangerous game; those who play it frequently end up with a lawyer who doesn't know the difference between hardware, software, and Tupperware.

Arbitration

I hope I have at least partially succeeded in recreating a vendor-user dispute and making some worthwhile suggestions for minimizing litigation. I would like to close with one final suggestion of a remedy which vendors and users have not availed themselves of in any significant way, namely arbitration, pursuant to the rules of the American Arbitration Association. Why end up in court to prove a point? Why go at it hammer and tong when a middle ground remedy is available which is cheaper, quicker, doesn't leave such a bad taste in one's mouth, and most importantly, allows a long-term relationship to continue despite the existence of a serious dispute?

In addition, arbitration enables you to have your case heard by one who is knowledgeable in the industry and its practices. Other industries have successfully adopted the practice, why shouldn't the computer industry?

For arbitration to take place, there must have been an agreement to arbitrate. This agreement may be one of two kinds: (1.) Agreement in contract to arbitrate future disputes; (2.) Agreement to submit an existing dispute to arbitration. In other words, the parties can agree *before* or *after* the dispute arises that it should be settled by arbitration.

Standard clauses recommended by the AAA are:

For the Arbitration of Future Disputes. Insert in the contract: Any controversy or claim arising out of or relating to this contract, or the breach thereof, shall be settled by arbitration in accordance with the Rules of the American Arbitration Association, and judgment upon the award rendered by the Arbitrator(s) may be entered in any Court having jurisdiction thereof.

For the Submission of Existing Disputes. We, the undersigned parties, hereby agree to submit to arbitration under the Commercial Arbitration Rules of the American Arbitration Association the following controversy: (cite briefly). We further agree that the above controversy be submitted to (one) (three) Arbitrators selected from the panels of arbitrators of the American Arbitration Association. We further agree that we will faithfully observe this agreement and the Rules and that we will abide by and perform any award rendered by the Arbitrator(s) and that a judgment of the Court having jurisdiction may be entered upon the award.

Arbitration in other industries

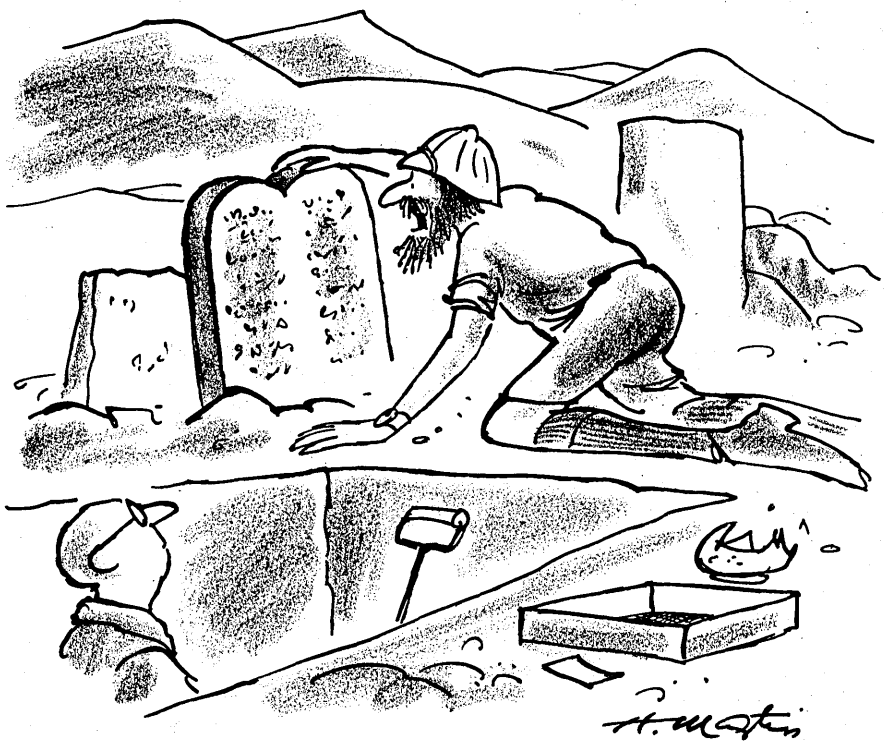
Such disparate entities as the labor-management community, the construction industry, stock exchanges, trade associations, the franchise industry, privately held corporations and partnerships have successfully used arbitration. In addition, many commercial purchase orders contain arbitration clauses.

Arbitration has become increasingly attractive as a way to resolve disputes which arise during long-term relationships. The reason is obvious: it provides the one solution which is of interest to the businessman, namely, it allows the relationship to continue.

To look at it another way: if a computer user reaches an impasse with his vendor, throws out the equipment, goes the court route, obtains money damages through a settlement or court award, will he be made whole? NO WAY! User's business will be disrupted, he'll have to find another supplier and he's likely to suffer conversion difficulties. His victory may very well turn out to be pyrrhic.

Although I have no statistics to bear me out, I would hazard a guess that arbitration has not received much play in the computer industry to date. I am not aware of any major vendor standard form contract which contains a preprinted arbitration clause. The usage of such clauses has probably been limited to large users who operate under specially negotiated master agreements. They have the economic clout to obtain special terms plus a dire need to establish a workable continuing relationship; i.e., for them to move from one vendor to another would definitely be Excedrin Headache No. 101.

One extremely important benefit of arbitration is that the dispute can be settled in private and the notoriety



"As best as I can translate it says, 'One: Get your prospect's attention. Two: If possible, let him see or handle your product. Three: In simple language enumerate the advantages your product has over similar merchandise . . ."

HASSLES

which often accompanies lawsuits can be avoided. The parties do not have to wash dirty linen in public. And although skeletons will come out of the closet at the hearings, they do not have to become part of the permanent record, because there is no requirement that a stenographic record of the proceedings be taken in arbitration, unless requested by a party. The parties therefore have it within their power to keep embarrassing information off the record, and keep the dispute low profile by not requesting that a stenographic record be taken. Further, the commercial arbitrator doesn't have to disclose the reasons for his decision. He doesn't have to furnish detailed written findings of fact and conclusion of law; this assures additional privacy.

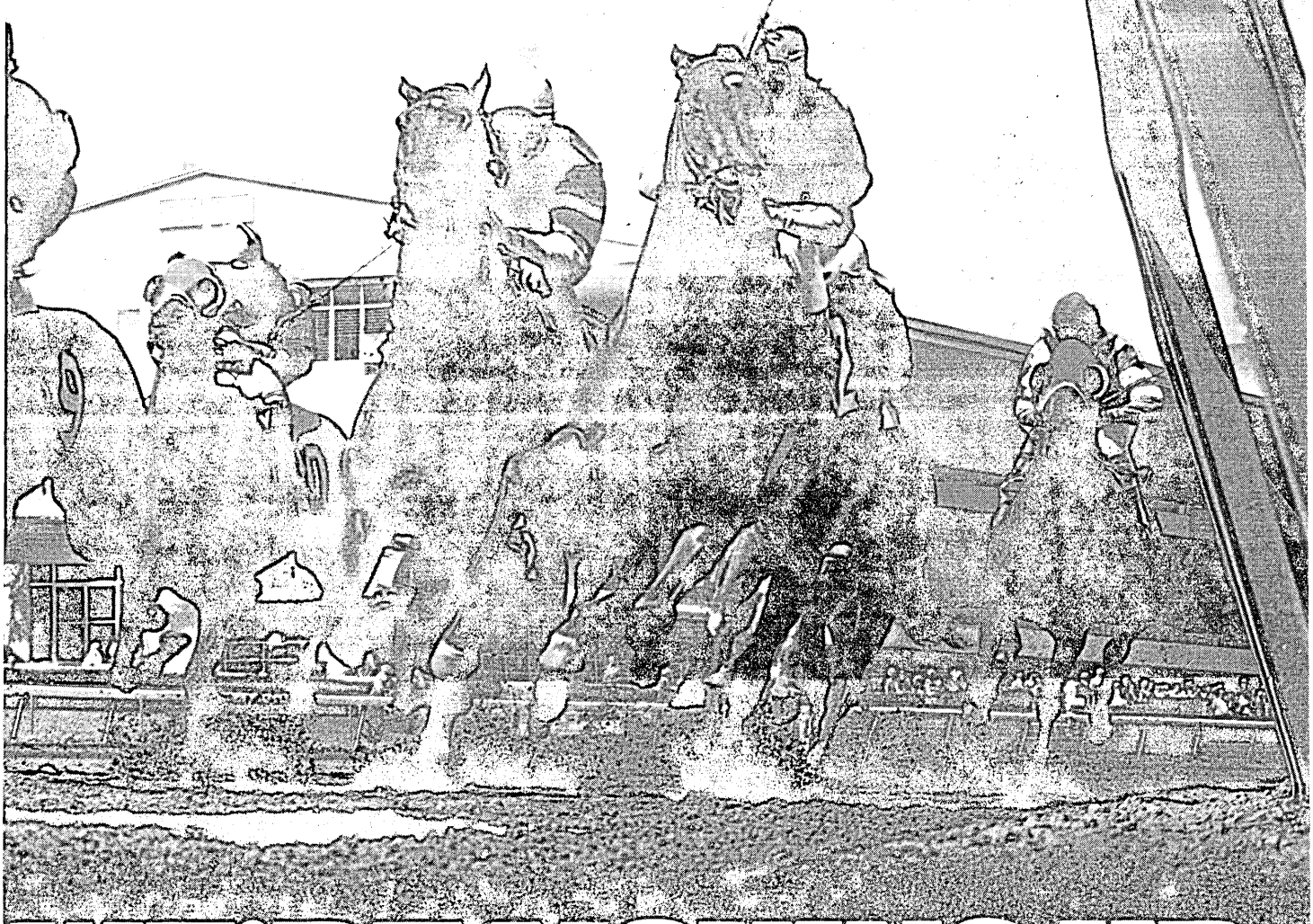
Contrast this with litigation, where pre-trial depositions and the trial itself create a permanent written record which serves as a living testimonial to how well vendors and users manage or mismanage their businesses.

In conclusion, arbitration is uniquely suited for the resolution of technical fact issues, such as issues of performance, quality of merchandise, and breach of warranty. These are the kinds of issues best determined by experts who understand the business. Courts are just not geared up to handle the typical computer dispute. It is almost a certainty that your court case will not be heard by experts.

I for one no longer find it amusing to read court decisions wherein the judge goes off on a tangent about how it took several weeks to educate him and the jury as to the industry and its practices, and that computer jargon is more confusing than any legalese he's ever encountered.

A preferable alternative to litigation exists—I believe arbitration is an idea whose time has come. □

Mr. Bucci, a member of the New York Bar and the Massachusetts Bar, has worked on contract negotiations while on the legal staffs of two computer equipment vendors. He previously authored "Beware the Standard Lease" (see March, 1973, p. 75).



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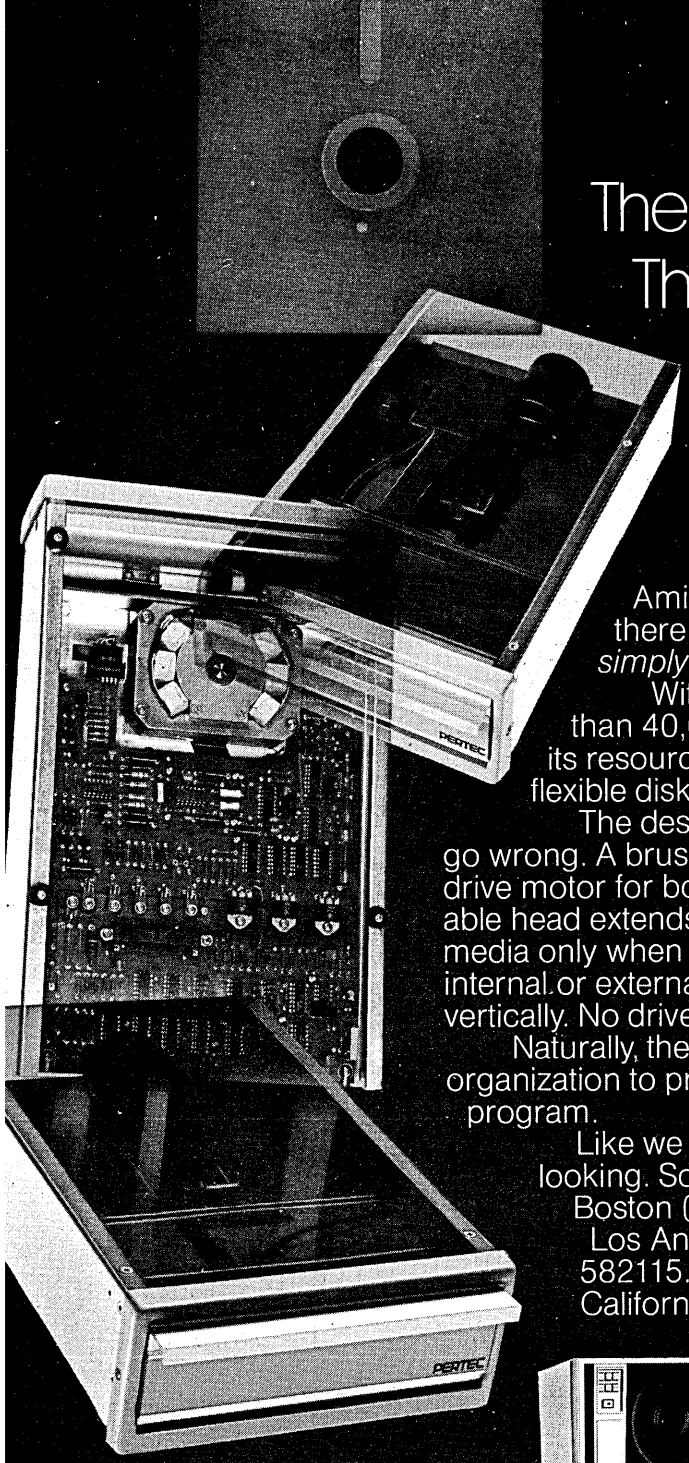

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Amid all the noise and competition in flexible disk, there is one drive so superior *you can tell the difference simply by looking at it.* The FD400 made by Pertec.

With the experience that came with marketing more than 40,000 tape and disk drives to OEM's, Pertec directed its resources to the manufacture of an IBM-compatible flexible disk drive to meet virtually every OEM requirement.

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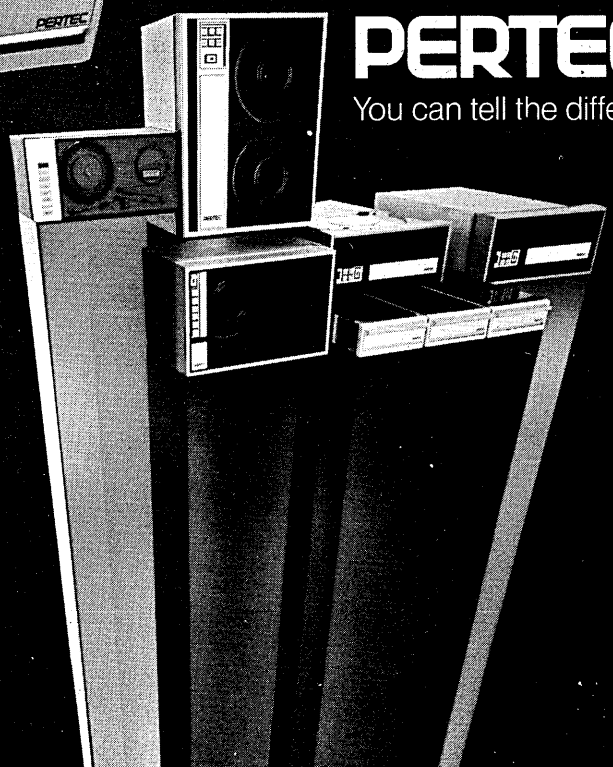

CIRCLE 42 ON READER CARD

This system automatically schedules and initiates jobs, prompts operators, and purges files.

AN AUTOMATIC SCHEDULING SYSTEM

by W. C. Hoffer

As the use of time-sharing and shared data bases increases, the number of reports required increases and the need for reliable job scheduling becomes apparent. Current methods of scheduling, ranging from large sophisticated multicolored wall murals to hand-written notes, have one thing in common—they are prone to human error. When the number of jobs reaches the point where considerable manpower is required for scheduling, new methods should be developed which will reduce costs, make better use of computer and human resources, and minimize human error.

A system has been developed and tested at Hughes Aircraft Co. which automatically schedules and executes time-sharing jobs and batch jobs submitted through time-sharing. The execution of jobs in the system is begun without human intervention, and the frequency of the job is unimportant to the system as long as it is consistent.

Operational since January, 1973, the system was developed on the General Electric Information Services Mark III time-sharing service, however, *any time-sharing or batch system can be used which has the following features:*

a) a real-time clock that can be read by a running program
b) a method to determine the current date from a running program
c) a job queue which will release jobs for execution at a specified time of the current day or the following day
d) a language which allows a running program to place other programs in the job queue
e) a system which allows a stored file of system commands to be executed.

This system in no way interferes with the operating system and therefore does not affect peripheral assignments and other operating system functions.

The system is called PASS, for Perennial Automatic Scheduling System. This article describes the minimum configuration of the system, and illustrates methods for expanding it to accommodate complex schedules. Program listings and flowcharts are included to help others configure their own versions.

System description

The minimum configuration of PASS (see Fig. 1) consists of one FORTRAN IV program and nine Command Files[1] (CMF). Each CMF contains a list of Independent Run[2] (IND) commands, one

[1] Command File—A GE feature which enables execution of a preset string of system commands contained in a file.
[2] Independent Run—Places a job in the deferred run queue for processing at some future time. The terminal does not have to be connected to the system when the job is being processed.

for each job to be scheduled. The CMF may also contain system commands to complete a given task.

PASS begins with the program DATECHK which determines which jobs are to be scheduled for the current day. DATECHK then writes the appropriate commands for execution to the file EXECUTE which will then contain all non-weekly jobs, the appropriate day-of-the-week job, and the command to execute the CMF called EVERYDAY. DATECHK then chains to the CMF EXECUTE and the contents are executed. The file EVERYDAY must contain, as a minimum, the command to schedule DATECHK for the following day; this command makes the system perennial. PASS is initiated by an initial execution of DATECHK—from that point on, scheduling and execution are performed automatically.

The heart of PASS is the FORTRAN program DATECHK shown in Fig. 2. The variables described in lines 1100 through 1150 are calculated in lines 1170 through 1210 using the ICAL[3]

```
1000C     PROGRAM 'DATECHK'—THE MASTER CHECKING AND SCHEDULI
1010C     PROGRAM FOR 'PASS'
1020C     WRITTEN BY W.C. HOFFER
1030      OPTION NOWARN
1040      IMPLICIT INTEGER (A-Z)
1050      REAL A
1060      STRING PUR,BRE,COMMAND
1070      COMMON PUR,BRE,COMMAND
1980      STRING DAILY(7)/'MONDAY', 'TUESDAY', 'WEDNSDAY', 'THURSDAY'
1090&     'FRIDAY','SATURDAY','SUNDAY'/
1100C     CALCULATE THE FISCAL WEEK-FWEEK
1110C     SERIAL WEEK-SWEEK
1120C     SERIAL DAY-SDAY
1130C     DAY OF THE WEEK-DAY
1140C     (1=MONDAY.... 7=SUNDAY)
1150C     TODAY'S DATE-TODAY
1160C
1170      TODAY=ICAL(0)
1180      SDAY=ICAL(TODAY)
1190      SWEEK=SDAY/7
1200      FWEEK=ICAL(SWEEK)
1210      DAY=MOD(ICAL(TODAY),7)+1
1220      BRE='$BREAK'
```

(Fig. 2 continues on opposite page)

Fig. 2. DATECHK program.

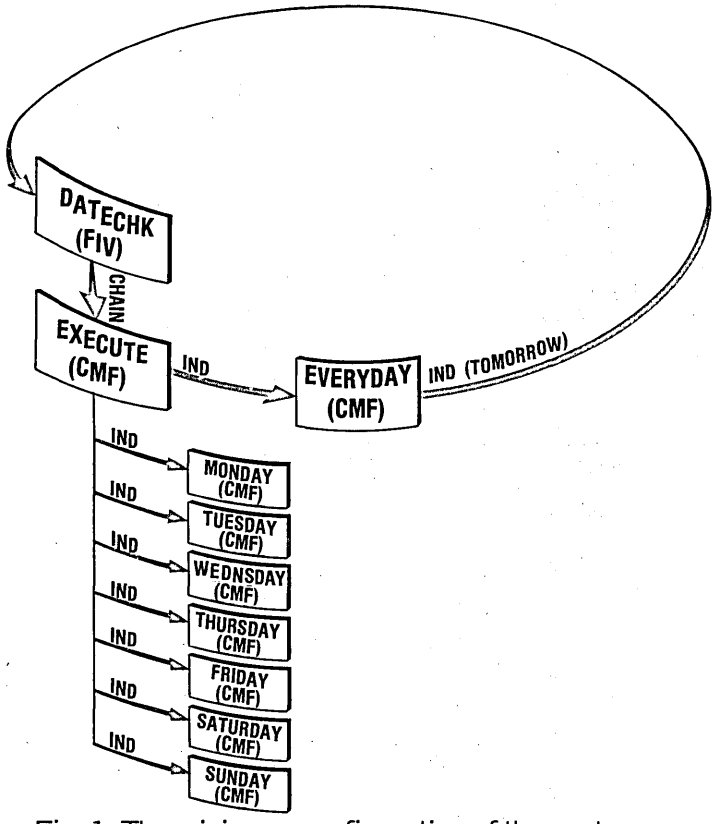

Fig. 1. The minimum configuration of the system provides the basic capability for scheduling all daily and weekly jobs. (As illustrated, however, PASS is doing no work other than scheduling itself.)

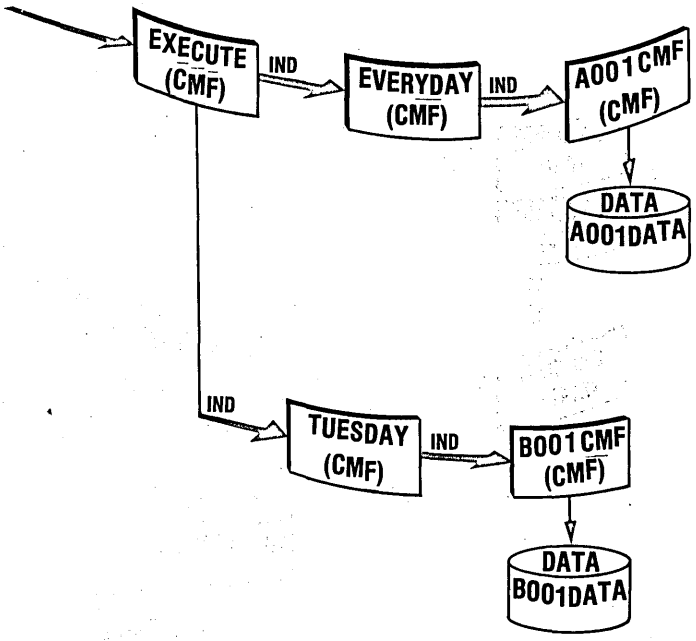

Fig. 4. A slight expansion of the minimum configuration shows how PASS schedules both a daily job and a weekly job to be executed on Tuesdays.

and modulo functions. In this configuration there are only two jobs to schedule. The first is dependent on the day of the week calculation. The IND command is formed in line 9020 and then written to the CMF EXECUTE using the subroutine WRITEIT which begins at line 9200. For the second job, the IND command is formed for the CMF EVERYDAY, as shown in line 9050, and written to EXECUTE. DATECHK then chains to the CMF EXECUTE and processes its commands.

The CMF EVERYDAY, listed in Fig. 3, must contain a minimum of one job. This job schedules DATECHK for execution tomorrow at 0330 hours with deferred priority. On most systems a substantial reduction in processing costs is realized any time jobs can be executed on a low priority, i.e., deferred or overnight. The LIST DATEOUT com-

[3] ICAL—A multipurpose calendar function that provides translation between normal calendar dates (of form YYMMDD) and a serial day representation. It also provides translation between a fiscal week (of form YYWW) and a serial fiscal week or serial week representation.

(Fig. 2 continued)

```
9000C     FOLLOWING IS ALWAYS EXECUTED
9010      PUR='PUR DAYOUT'
9020      COMMAND='IND-5,'+DAILY(DAY)+',,DAYOUT,,RET'
9030      CALL WRITEIT
9040      PUR='PUR DAYOUT'
9050      COMMAND='IND-5,EVERYDAY,,EVERYOUT,,PRIO(DEF),RET'
9060      CALL WRITEIT
9070      ENDFILE "EXECUTE"
9080      CHAIN "EXECUTE"
9090      CALL EXIT;END
9190C     WRITE THE COMMANDS TO THE 'EXECUTE' FILE
9200      SUBROUTINE WRITEIT
9210      STRING PUR,BRE,COMMAND
9220      COMMON PUR,BRE,COMMAND
9230      WRITE("EXECUTE",1)PUR,BRE,COMMAND
9240  1   FORMAT(A/A/A)
9250      RETURN-END
```

(Fig. 2 end)

```
*FILENAME 'EVERYDAY'
LIST DATEOUT
$BREAK
PUR DATEOUT
$BREAK
IND-5,DATECHK,,DATEOUT,,SYS(FIV),TOM,EAR(0330),PRIO(DEF),RET
```

Fig. 3. CMF EVERYDAY.

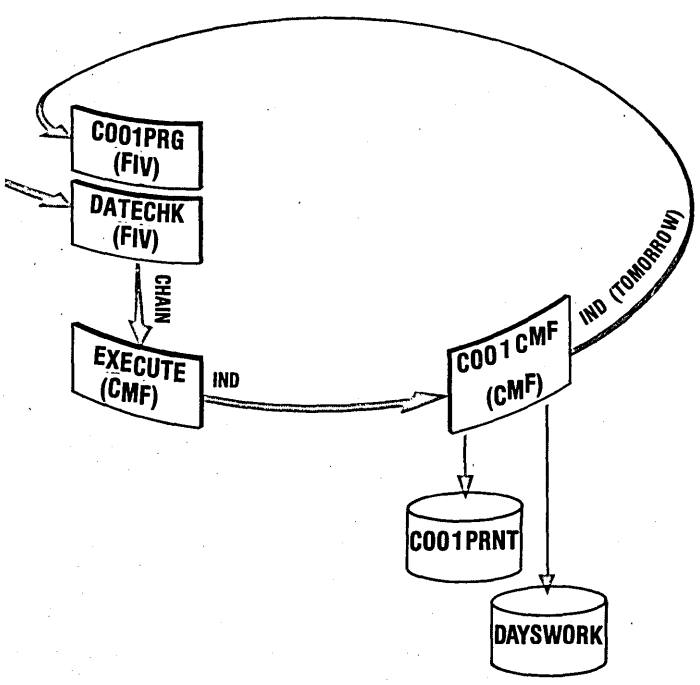

Fig. 9. The scheduler can handle jobs that are run on any regular basis. The job C001 might be run every other week, on Monday night after 9:30, for instance.

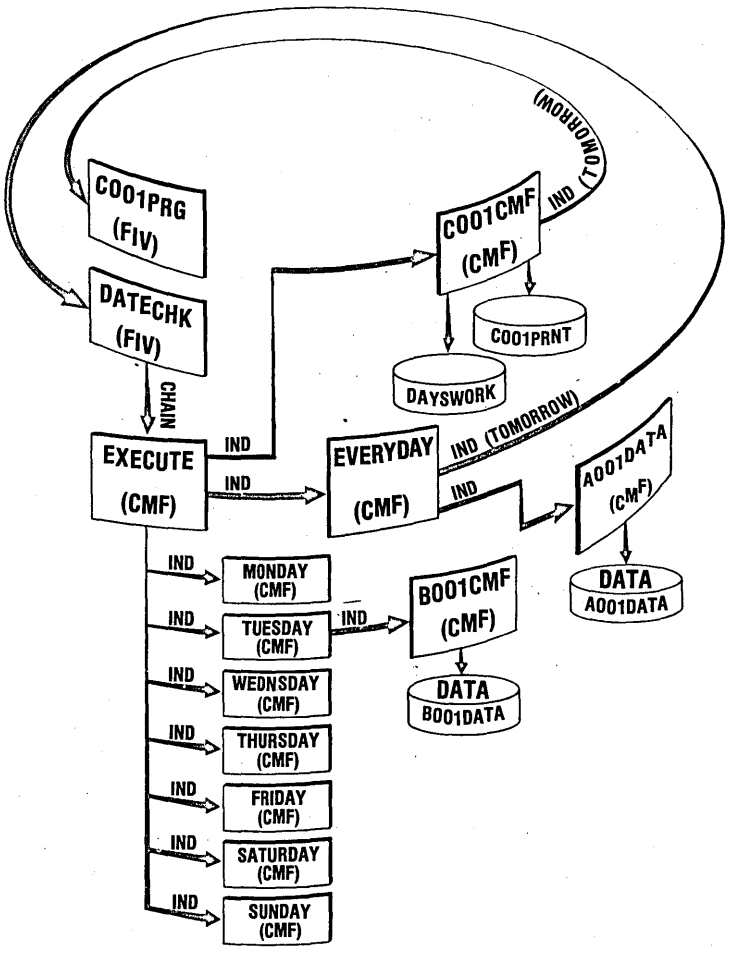

Fig. 14. The total system configuration shows the linkage to daily, weekly, and less frequently initiated programs.

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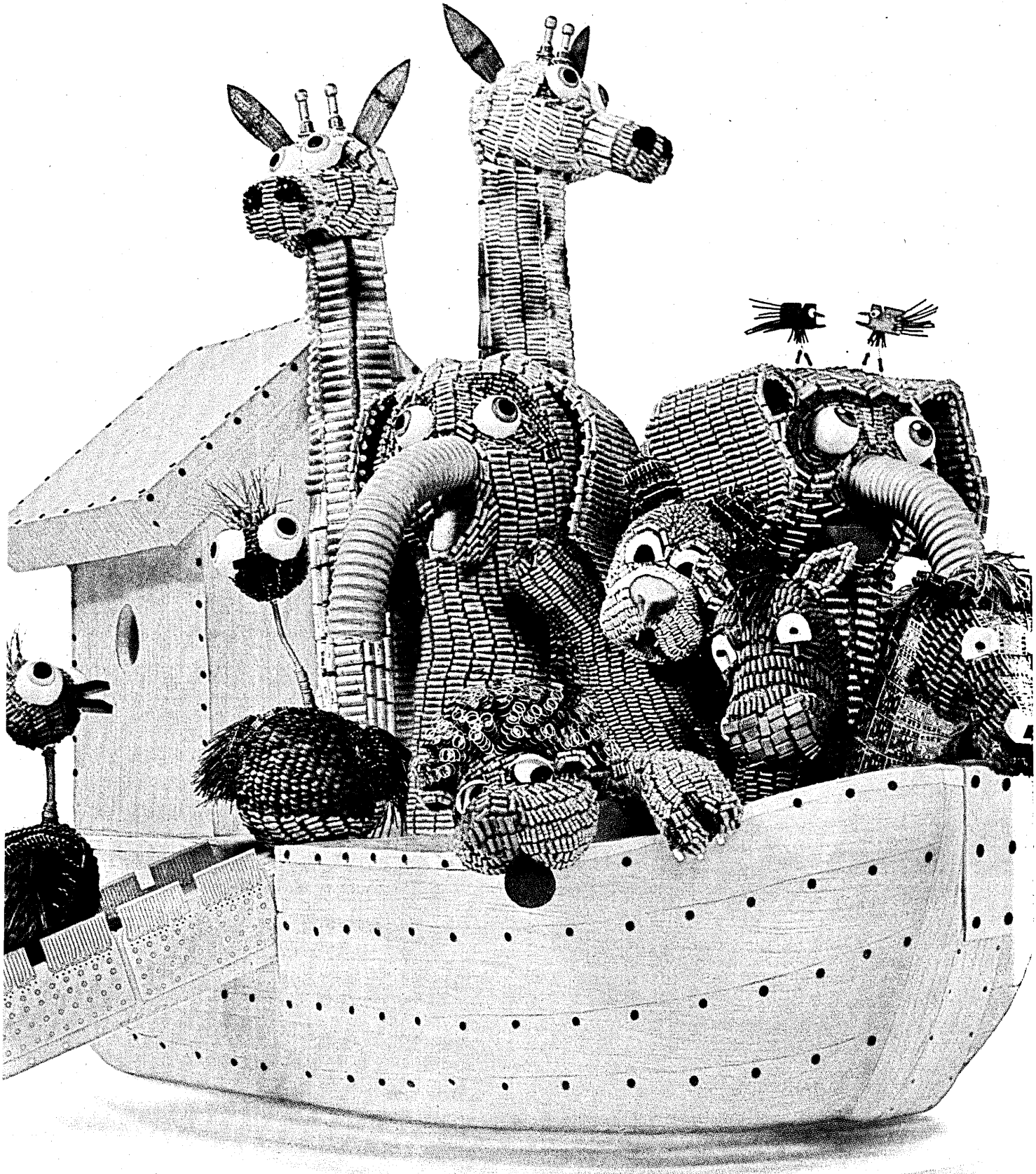

You're buying a lot of time sharing? Honeywell is selling a lot of time sharing. We helped pioneer the technology. We have broad experience; we have some of the best time sharing systems in the business. And we're particularly strong in that all-important aspect, software.

You can buy our DATANETWORK* remote batch and time sharing service. It's a nationwide network and you can buy a little or a lot, depending on your needs. It's a great way to consolidate and standardize if your past needs have been met in an uncoordinated fashion. It's a way to prepare for your own in-house time sharing system through a well-controlled, easy-to-justify transition.

Because DATANETWORK* is part of The Honeywell Information System, its hardware operates under the same standards, and utilizes the same GCOS time sharing and remote batch software as our new Series 60.

If your present or future time sharing requirements would seem to justify your own in-house system, DATANETWORK is the way to start and our new Series 60 is the way to go. Then, when your new system is installed, your programs are ready and your ready-to-go workload has already justified your investment.

Here's just one of many examples: A large midwest company had 100 different groups within the company spending as much as $60,000 a month with 11 different outside time sharing services. Now they're transferring their programs to DATANETWORK in anticipation of installing their own Honeywell system. They expect to save nearly 50%. What's more, when their computer arrives, they'll be off and running almost immediately because of GCOS compatibility.

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Level 66 (four models) of our newly-announced Series 60 systems offer a complete GCOS multidimensional capability: time sharing, remote access, batch, and transaction processing — all running on one system. By merging the processing dimensions in concurrent operation, you can tailor the mix — even make day-to-day and minute-to-minute changes. And there's a higher level of effectiveness than you could get with multiple-system installations.

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CIRCLE 60 ON READER CARD

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mand lists the activity for the day. With the scheduling of DATECHK, the PASS chain is complete.

Weekly job schedules

Fig. 4 illustrates scheduling of both a daily and a weekly job. The daily job is contained in the CMF EVERYDAY, and a weekly job to be executed on Tuesday is contained in the CMF TUESDAY.

The daily job, A001CMF, updates the data file A001DATA which is accessed each day by users on the system. The job is scheduled to run in a deferred mode. Fig. 5 shows the CMF EVERYDAY and Fig. 6 the CMF A001CMF.

The weekly job, B001CMF, is scheduled every Tuesday to be executed no earlier than 2200 hours on overnight priority. CMF TUESDAY is shown in Fig. 7, and Fig. 8 shows the CMF B001CMF.

Non-weekly jobs

Non-weekly schedules require additions to the program DATECHK. The following expansion demonstrates the inclusion of job C001, which must be executed every other week, on Monday night, after 2130 hours. The job was initiated for the first time on October 21, 1973, an odd serial week. Fig. 9 shows the flowchart for this expansion.

Additions to DATECHK for job C001, shown in Fig. 10, must include a method for determining the odd serial week. Lines 1230 through 1270 form and write the IND command to the CMF EXECUTE. Lines 9260 through 9340 show the function EVEN which determines whether the first argument is evenly divisible by the second. When the variable SWEEK is sent to EVEN with two as the divisor, EVEN will return a negative or positive "one" corresponding to the odd or even value of SWEEK.

Issuing operator instructions

To demonstrate another feature of PASS, job C001 will write a report file which will be directed to a line printer on six-part paper. The report must be decollated and delivered to a predetermined location. This usually requires a human to remember what to do and when. There is nothing PASS can do to physically move paper, but it can remind people to perform the desired tasks via a permanent file, DAYSWORK, which is listed each morning to issue instructions to data processing personnel.

A small BASIC language program is executed with each job that requires human tasks. The program for each job is identical except for the operator

Fig. 4 (See page 76)

```
*FILENAME 'EVERYDAY'
PUR A001OUT
$BREAK
IND—5,A001CMF,,A001OUT,SYS(CMF),PRIO(DEF),RET
```

Fig. 5. CMF EVERYDAY.

```
*FILENAME 'A001CMF'
PUR A001DATA
$BREAK
CRE A001DATA,,
$BREAK
RUN JOBA001
```

Fig. 6. CMF A001CMF.

```
*FILENAME 'TUESDAY'
PUR B001OUT
$BREAK
IND—5,B001CMF,,B001OUT,,SYS(CMF),PRIO(OVE),EAR(2200),RET
```

Fig. 7. CMF TUESDAY.

```
'FILENAME 'B001CMF'
RUN JOBB001
```

Fig. 8. CMF B001CMF.

Fig. 9. (See page 77)

```
1230C    SCHEDULE JOB C001 FOR EXECUTION ON MONDAY
1240C    OF THE ODD SERIAL WEEKS AFTER 2130 HOURS
1250   PUR='PUR C001OUT'
1260   COMMAND='IND—5,C001CMF,,C001OUT,,SYS(CMF),PRIO(OVE),EAR(2130)
1270   IF(EVEN(SWEEK,2).GT.0.AND.DAY.EQ.1)CALL WRITEIT
9260C    THIS FUNCTION DETERMINES IF THE FIRST ARGUMENT
9270C    IS EVENLY DIVISIBLE BY THE SECOND (FOR INTEGERS)
9280C    IF TRUE, EVEN IS SET TO +1 ELSE EVEN IS —1
9290   FUNCTION EVEN(J,K)
9300   INTEGER EVEN
9310C    ASSUME ODD SET FUNCTION TO —1
9320   EVEN=—1
9330   IF(J.EQ.(J/K*K))EVEN=1
9340   RETURN;END
```

Fig. 10. DATECHK additions for job C001.

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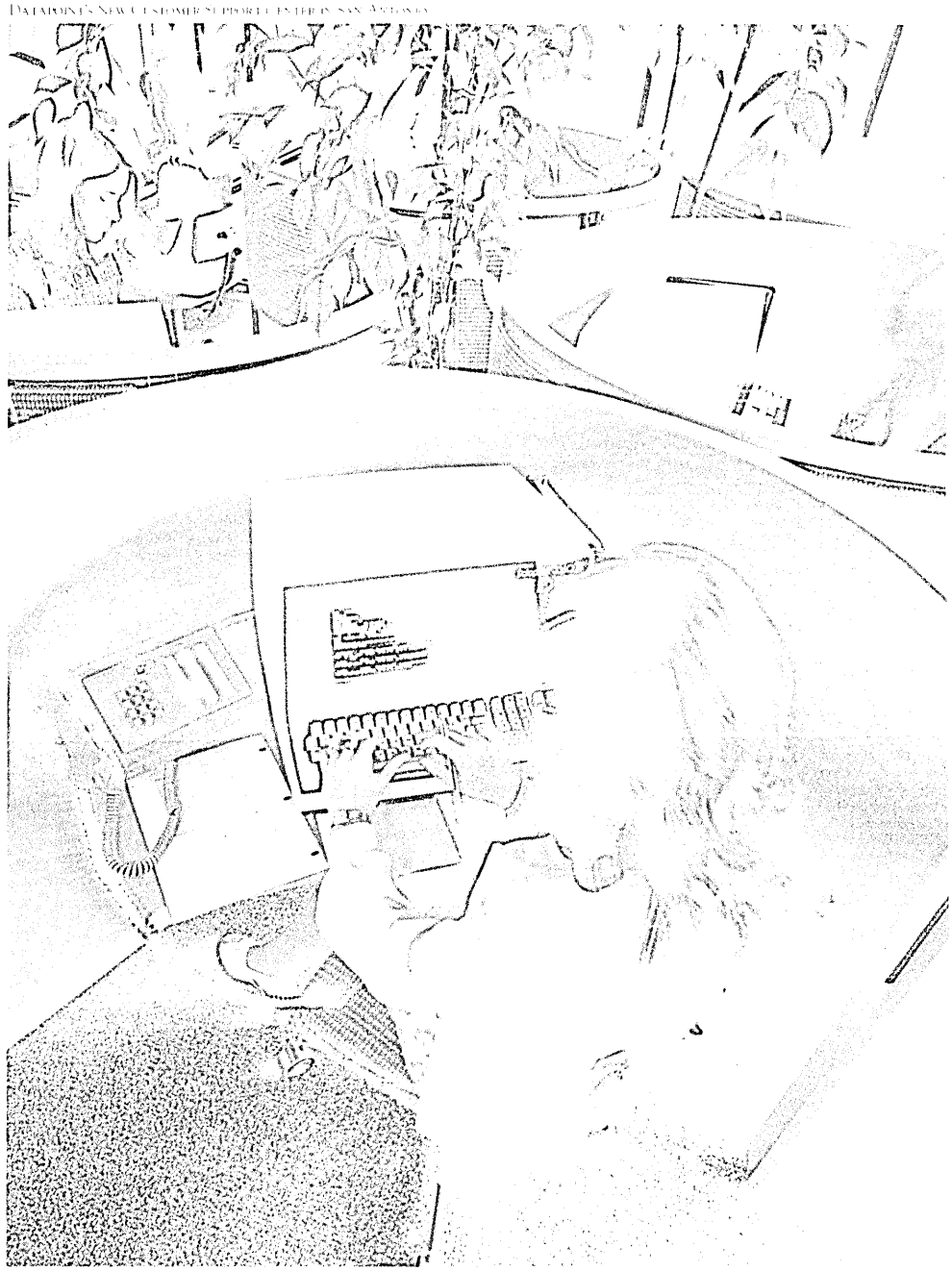

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instructions. Fig. 11 is a listing of C001INFO, which issues instructions for job C001. (See Fig. 10). This method of issuing instructions reduces man-hours and errors by eliminating the need for checking individual job schedules. At Hughes, the first machine operator arriving in the morning logs on the system with a special number. The DAYSWORK file is automatically listed and its current contents removed, leaving a blank file for the next day's information.

```
100REM    PROGRAM C001INFO-INSTRUCTIONS FOR JOB C001
110REM    WRITTEN TO FILE 'DAYSWORK'
120       FILES DAYSWORK
130       APPEND #1
140       PRINT #1,"*****JOB C001 INSTRUCTIONS"
150       PRINT #1,"MONDAY-ODD SERIAL WEEKS"
160       PRINT #1,"CALL HIGH SPEED PRINTER OPERATOR-EXT 6198"
170       PRINT #1,"PRINT FILE'C001PRNT' ON FORM 2156"
180       PRINT #1,"USE LOGICAL TERMINAL IDENT 'DIV21TUC' "
190       PRINT #1,"DECOLLATE REPORT-DELIVER TO ROOM 605"
200       PRINT #1,"*****END OF JOB C001 INSTRUCTIONS"
210       STOP
220       END
```

Fig. 11. Program C001INFO.

Purging files

Every user is plagued with remembering which files are his and purging them when they are no longer needed. The report file C001PRNT is such a file. It must remain on the disc until the high speed terminal operator prints the file, after which it should be purged. A small FORTRAN program can be added to PASS to determine when a file has been printed and automatically purge it. This feature enhances cost effectiveness and reliability by eliminating still another human task and unnecessary disc storage costs.

The program C001PRG, listed in Fig. 12, uses the subroutines DESCRI[4], SLEEP[5], and PURGE[6], respectively, to determine the number of accesses to the file C001PRNT, to become dormant for a predetermined time, and then to purge the file. To do this, the program must determine when file C001PRNT has been accessed four times. File accesses are updated for each activity on the file. Four accesses denote the file has been: (1) created, (2) written, (3) directed to the printer and (4) printed. Program C001PRG describes the file C001PRNT and, if the number of accesses is less than four, goes to sleep for thirty minutes and tries again. When the fourth access is found, the program goes to sleep for three hours to allow for any printer problems and then purges the file. File C001PRNT is written sometime during Monday night and C001PRG is executed at 0800 hours on Tuesday. (See Fig. 10).

```
100C     PROGRAM C001PRG-PURGES FILE 'C001PRNT'
110C     3 HOURS AFTER THE FOURTH ACCESS
120      OPTION NOWARN
130      ALPHA ARRAY(22)
140      EQUIVALENCE (ARRAY)(15),NOACC)
150      ARRAY(3)="C001"
160      ARRAY(4)="PRNT"
170  1   CALL DESCRI(ARRAY,I)
180      IF(NOACC.GE.4)GO TO 2
190C     GO TO SLEEP FOR 30 MINUTES
200      CALL SLEEP(1800,0)
210      GO TO 1
220C     NUMBER OF ACCESSES 4 OR MORE-SLEEP 3 HOURS
230  2   CALL SLEEP(9800,0)
240C     WAKE UP AND PURGE THE FILE
250      CALL PURGE("C001PRNT","      ",I)
260C     IF FILE IS BUSY TRY PURGE LATER
270      IF(I.EQ.1)GO TO 2
280      STOP
290      END
```

Fig. 12. Program C001PRG.

Fig. 13 is the CMF C001CMF which contains all the instructions for executing job C001.

Now all of the general capabilities of PASS have been reviewed and individually illustrated. The previously discussed schedules are assembled with

```
*FILENAME 'C001CMF'
RUN C001INFO
$BREAK
PUR C001PRNT
$BREAK
CRE C001PRNT,,
RUN JOBC001
*DIRECT THE OUTPUT TO A HIGH SPEED PRINTER
PRINT C001PRNT;DIV21;NONE
PURGE C1PRGOUT
$BREAK
IND-15,C001PRG,,C1PRGOUT,,SYS(FIV),TOM,EAR(0800),RET
```

Fig. 13. CMF C001CMF.

[4] DESCRIBE SUBROUTINE — Describes the characteristics of a given file under control of a running FORTRAN program.
[5] SLEEP SUBROUTINE — Suspends execution of the calling program for the number of seconds specified in the first argument of the subroutine.
[6] PURGE SUBROUTINE — Purges files from the catalog under control of a running FORTRAN program.

minimum PASS configuration into a al system flowchart in Fig. 14.

mplex schedules

The logic required in DATECHK for ermining complex schedules will de- id on the type of date function ilable to the user. A few examples complex schedules, however, might ve helpful.

Assume a schedule for the last Fri- of each month. The ICAL function es the current date in the integer m YYMMDD, allowing arithmetic erations to be performed on the e. Fig. 15 demonstrates one method determining the last Friday of the nth.

Frequently, schedules are needed for pecific date, for example, the fifth of ry month. This requires a real num- calculation to mask YYMM from MMDD as shown in Fig. 16. Looking k at DATECHK in Fig. 2, the variable " was typed "real" in line 1050 for s kind of schedule determination.

ally, Fig. 17 illustrates the pro- mming required to determine the ursday before the last Monday of month.

nclusion

With PASS to schedule and execute itine jobs, the user is free to sched- more efficient use of system re- irces.

The accurate instructions issued to erators by PASS have been found to minate the need for large volumes of cedural information about jobs as ll as the need for remembering to id them at the proper times.

The automatic elimination of un- cessary files frees disc storage.

PASS, used in conjunction with exist- system capabilities, has proved to vide better utilization of both sys- n and human resources. □

Mr. Hoffer is the head of data processing services at the Tucson Engineering Laboratory of Hughes Aircraft Co. He also has lectured on FORTRAN at Hughes and at the Univ. of Arizona.

Fig. 14. (See page 77)

```
1280C    CONVERT TODAY YYMMDD TO YYMM
1290     K=TODAY/100
1300C    CONVERT SERIAL DAY+7 TO YYMM
1310     K1=ICAL(SDAY+7)/100
1320C    IF TODAY IS IN THIS MONTH AND ONE WEEK FROM TODAY
1330C    IS NOT-THIS IS THE LAST DAY OF ITS KIND IN THIS MONTH
1340     PUR='FILENAME'
1350     COMMAND='IND—5,JOBNAME,,FILENAME,,SYS(FIV),PRIO(OVE)'
1370     IF(K.LT.K1.AND.DAY.EQ.5)CALL WRITEIT
```

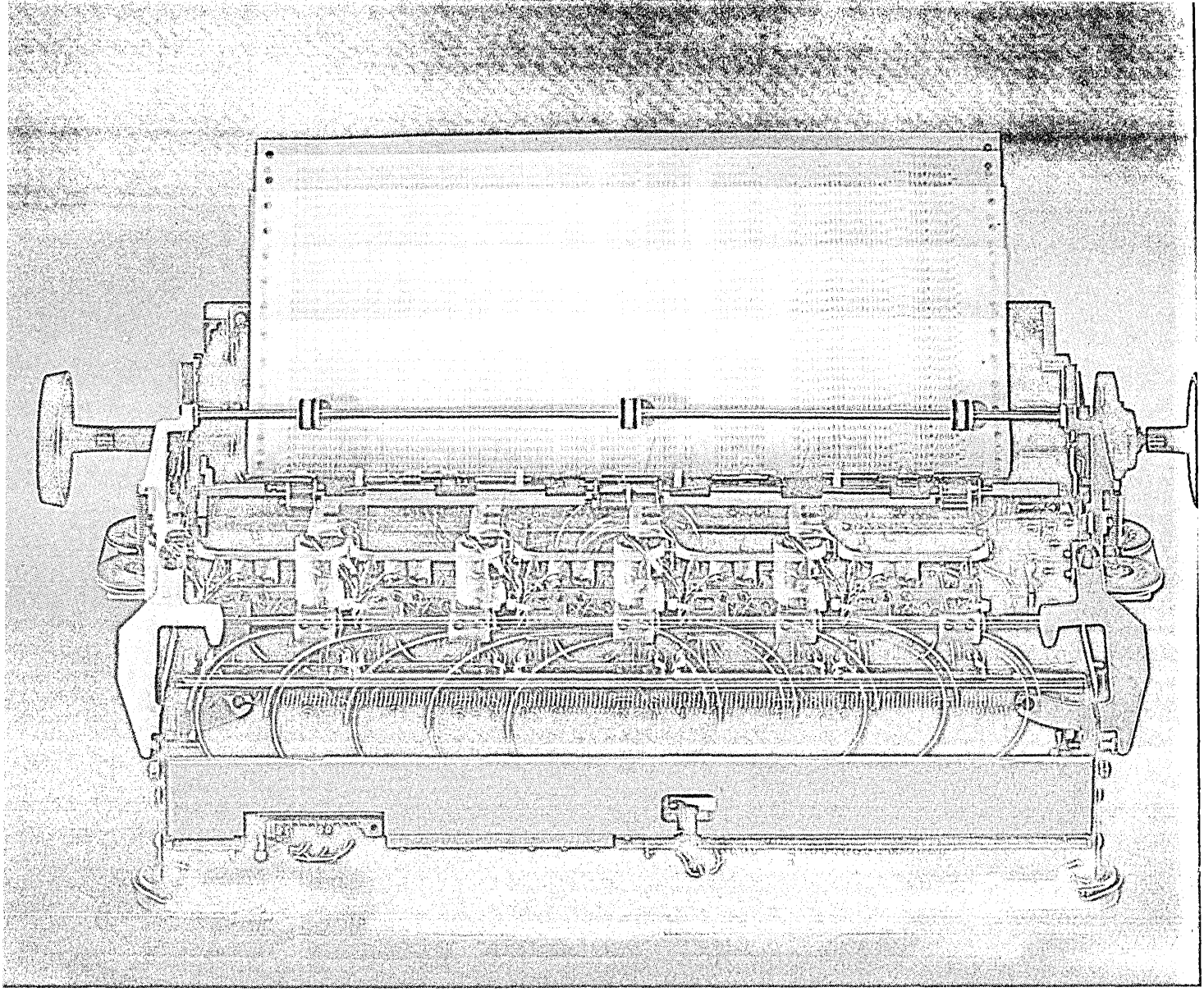
Fig. 15. Determining the last Friday of the month.

```
1400C    CONVERT 'TODAY' TO A REAL NUMBER AND MOVE DECIMAL POINT
1410C    LEFT 2 PLACES.ADD .0005 TO 'A' ALLOWING FOR CALCULATION ERROR.
1420     A=FLOAT(TODAY)*.01+.0005
1430C    SUBTRACT THE INTEGER PORTION OF 'A' FROM 'A' AND MOVE
1440C    DECIMAL POINT RIGHT 2 PLACES ASSIGNING RESULT TO INTEGER J
1450     J=(A—IFIX(A))*100.
1460     PUR='FILENAME'
1470     COMMAND='IND—5,JOBNAME,,FILENAME,,SYS(FIV),PRIO(DEF)
1480C    CHECK FOR "J" EQUAL TO THE FIFTH OF THE MONTH
1490     IF (J.EQ.5)CALL WRITEIT
```

Fig. 16. Masking the date.

```
1500C    CONVERT TODAY YYMMDD TO YYMM
1510     I=TODAY/100
1520C    CONVERT TODAY + 4 TO YYMM
1530     14=ICAL(SDAY+4)/100
1540C    CONVERT TODAY + 11 TO YYMM
1550     I11=ICAL(SDAY)+11)/100
1560     PUR='FILENAME'
1570     COMMAND='IND—5,JOBNAME,,FILENAME,,SYS(FIV),PRIO(OVE)'
1580C    IF TODAY IS THURSDAY THEN TODAY + 4 IS NEXT MONDAY AND
1590C    TODAY +11 IS MONDAY AFTER NEXT. THEREFORE IF "I" IS
1600C    EQUAL TO "I4" AND "I" NOT EQUAL TO "I11" THEN TODAY IS
1610C    THE THURSDAY BEFORE THE LAST MONDAY OF THE MONTH
1620     IF(DAY.EQ.4.AND.I.EQ.I4.AND.I.NE.I11)CALL WRITEIT
```

Fig. 17. Determining the Thursday before the last Monday of the month.



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Packet switching permits higher line efficiency and more reliable transmission. The proposed networks also will make it possible to share workloads between computers, to leave data bases geographically distributed, and to connect "incompatible" models of computers and terminals.

PUBLIC PACKET-SWITCHED NETWORKS

by Barry D. Wessler and Richard B. Hovey

The electronic transfer of information to or from a distant computer is the fastest-growing use of this country's telecommunications channels (Fig. 1). Spurred on by inadequacies in the services currently provided by the communications carriers and armed with recent technological and regulatory developments, a new class of "value-added carriers" (VAC's) has recently entered this multi-billion-dollar market. These organizations plan to add special-purpose switching equipment to transmission facilities leased from existing carriers and to offer new services specifically designed to meet the specialized communications requirements of computer users. The data communications services proposed by the VAC's differ from presently available services not simply in degree, representing marginal improvements, but rather in kind—and they offer significant cost and performance benefits for many computer users.

To date, four companies have applied to the Federal Communications Commission for permission to operate value-added networks. At this writing, three of these applications have been granted. It is anticipated that public value-added networks will be providing service on a nationwide basis within two to three years.

This article is concerned with the benefits subscribers can anticipate from the type of service proposed by two of the four companies: Telenet Communications Corp. (Telenet) and Packet Communications, Inc. (PCI). Both company's applications were approved. Both plan to offer nationwide terminal-to-computer and computer-to-computer data communication service using "packet-switched" carrier networks as discussed below. A third company, Graphnet Systems, Inc. has been authorized to build a specialized network for the transmission of facsimile images. The fourth, MCI Data Transfer Corp. (MDT), proposes what is essentially a data concentration service; like the other VAC's, MDT intends to lease transmission facilities from existing carriers, but the details of the switching technology to be employed are not described in its FCC application.

The packet-switched networks proposed by Telenet and PCI are based upon the technology developed for the Advanced Research Projects Agency (ARPA) Network, a private data communications network serving the computer science research community. Applications to provide a similar service commercially were submitted to the FCC by PCI (the first of the four VAC applications) in January 1973 and by Telenet (a subsidiary of Bolt Beranek and Newman Inc., the builder and operator of the ARPA Network) in October. Figs. 2 and 3 show the initial configurations of these two authorized networks.

Packet-switching technology was specifically developed to provide economical and reliable data communications service for both terminal-to-computer interaction, where fast response is required, and computer-to-computer data transfer, where high bandwidth is required. A packet-switched network operates by formatting data messages into small units or packets and transmitting each packet over the fastest available route among switching nodes for reassembly at the destination. The dynamically variable routing permits rapid and reliable service with high efficiency in the use of lines and resultant low cost; other important features include very low error rates, and the ability to transmit communications between ordinarily "incompatible" computers and terminals (through the use of communications processors which hook both terminals and computers to the networks).

Benefits

Potential benefits to customers of packet-switched carrier services are described below for three broad classes of computer user organizations engaged in: (1) operating internal teleprocessing systems; (2) exchanging bulk data between computers; and (3) selling remote access computer services.

As an example, consider a large manufacturer operating three private data communication networks that have grown up independently around three different computers (perhaps at different locations) in the corporation —one supporting administrative message switching, one for data collection purposes, and the third perhaps for inquiries to central inventory and customer files. While presently available communications services lead the manufacturer to develop separate networks, connection to a packet-switched network (either public or private) would enable the corporation to consolidate these separate networks to avoid duplication and underutilization of communication, computing, and terminal resources. Line costs, for example, are reduced through sharing, and a single set of terminals could use the network to access the special applications and data bases on all three computers. Finally, the three systems would no longer be separate and intercommunication would be feasible.

A corporation need not, however, have multiple systems to benefit from packet-switched network service; a company which operates a single teleprocessing network can realize advantages. Typically, such networks employ leased lines which are either underutilized at all but the peak hour or else offer degraded response time during the peak hour. When its terminals and computers communicate through a public packet-switched network, the corporation pays only for the data transmitted and not for idle, unused capacity. The packet network handles daily and seasonal fluctuations without degradation and can absorb long-term growth in traffic.

Bulk data transfers

A good model for a company involved in computer-to-computer data exchange is a national manufacturing

organization which transmits daily production and inventory information from regional manufacturing and warehouse facilities to a central computer facility. Currently, the data are sent over switched or leased voice-grade lines for a period of several hours a day. But costs tend to be high, errors which cause retransmission are frequent, and a long transmission period is required. Ideally, the manufacturer would like to transfer large volumes of data quickly and accurately, yet without being forced to lease costly full-period, wideband communication lines—a capability provided by the proposed VAC networks but not provided by generally available public communication services today.

Most of the benefits discussed so far have involved improvements in existing communications applications. In the area of computer-to-computer data transfer, the capabilities of packet-switched networks also facilitate a wide range of new computer applications. For example, a packet network will make practical rapid on-line access to a data base geographically distributed among many separate computer centers. This would be valuable, for instance, in a network of interconnected local or regional credit authorization files, insurance policyholder files, or airline reservation files. In addition to the transfer of data files or selected records from these files, the network makes it more practical to engage in dynamic load sharing—that is, the transfer of complete jobs for execution on remote machines.

Once a corporation's several computation centers are linked through a common network, a wider range of computing services can be provided throughout the corporation at a significant saving in overall data processing costs.

Benefits for vendors

As an example of a remote-access computer service vendor, consider a firm marketing time-sharing or data base services in only one region of the country. In the past, this vendor has expanded his geographic customer base by leasing telephone lines and providing multiplexing facilities in those cities where the number of customers economically justified such installations. As the customers have increased in a particular city being served, the vendor has had to make sure that enough multiplexer ports were available so that no customers would encounter an "all ports busy" condition.

As a subscriber to a packet-switched network service, however, the regional time-sharing vendor can provide local dial-up access to customers in all the population centers served by that carrier. The vendor will thus be able to offer his services on a nationwide basis, without needing to determine beforehand which cities are likely to yield the requisite number of customers. Rarely, if ever, will customers be denied port access, since the VAC will be capable of justifying a significantly larger number of ports in each city than could the time-sharing vendor alone. In those cities where the vendor has already installed multiplexing equipment, he can either remove and relocate the hardware or use the VAC system for backup or expansion.

In addition to increasing the time-sharing firm's geographic coverage, the public packet-switching network is likely to bring the firm a new class of customers. These are the users of teleprocessing terminals, many of whom cannot today readily access time-sharing and other commercial services because they are permanently linked to a corporate computer center via leased

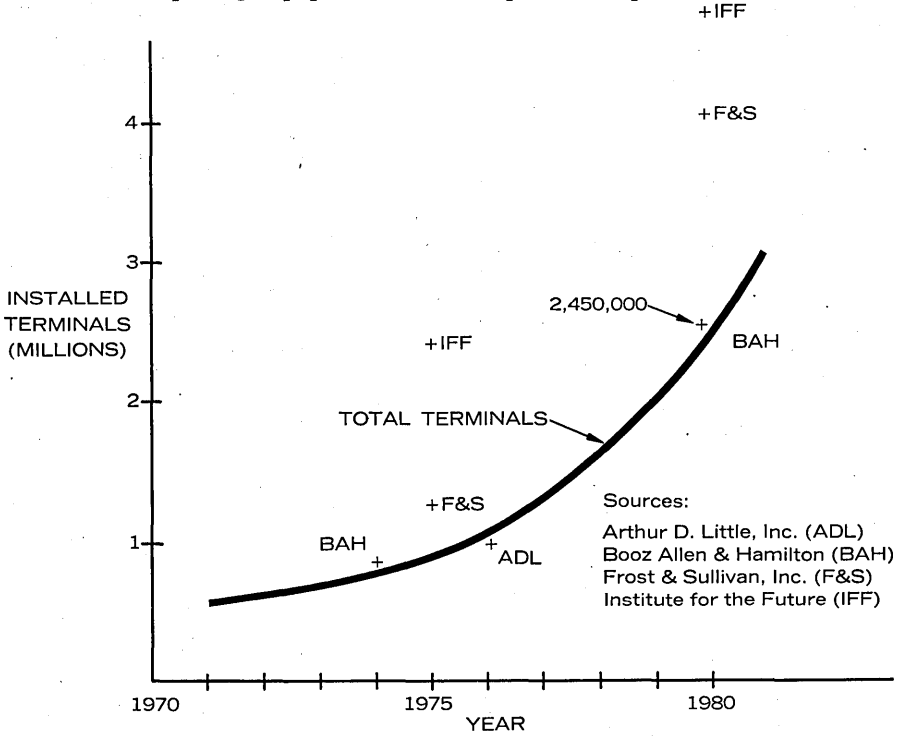

Fig. 1. The fastest growing use of this nation's telecommunications channels is in data transmission. The expected rate of increase in channel use is reflected in the projections for the population of terminals.

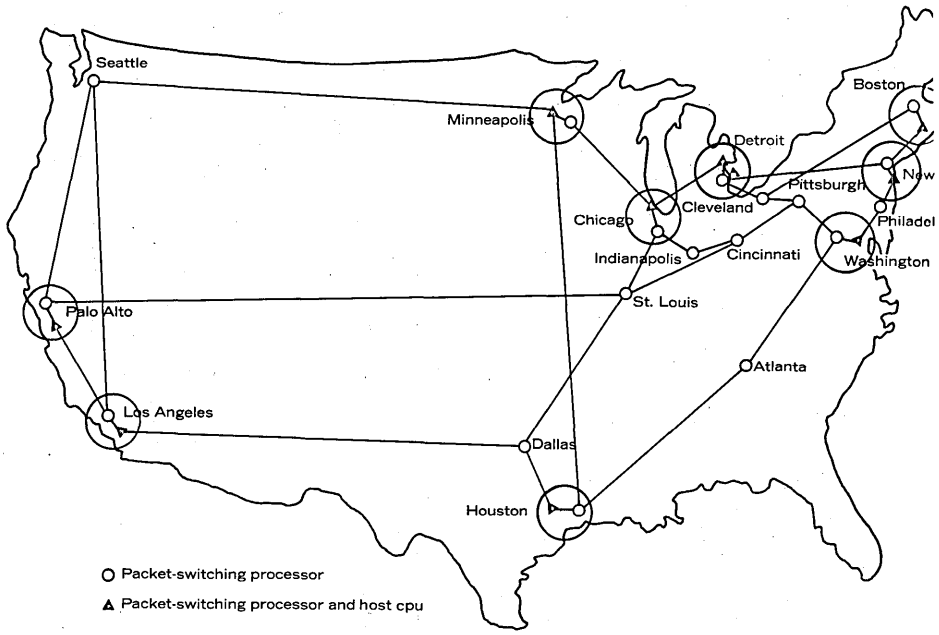

Fig. 2. Packet Communications, Inc., was the first to apply to the Federal Communications Commission for permission to operate a value-added network employing packet switching.

lines. If the connections between terminals and computer centers were made through a public packet network, the terminals could also access the services of vendors, such as the time-sharing company, whose computers were connected to the network.

When the time-sharing service in our example finds a need to expand its computer facilities, the packet-switching network creates new alternative means for doing so. A computer at any location can be connected to the network by a leased line. Thus, for example, if the firm acquires another service vendor with computer facilities in a distant city, it can connect acquired as well as present computer centers to the VAC's network and can offer its customers access to all centers through the network.

For corporations in all three categories above, various other savings may result from the use of a public packet-switched network. These include: (1) a reduction in the size of the support staff needed to monitor and diagnose communication problems; (2) the ability, in many cases, to reduce the amount of central site equipment such as modems, line termination units, terminal control units and front-end processors; (3) a reduction in the communications processing overhead in the user's computer; and (4) the ability to select the terminal type most appropriate for a particular application, without being constrained to the models supported by the computer vendor. In many cases, the most significant advantage will be the intangible savings associated with less frequent network outages and the reduced downtime due to single-source responsibility for end-to-end communication service.

Conclusions

Prospective packet-switching carriers have proposed the establishment of a fundamentally new type of communications service, designed specifically for computer users, and based upon extensive technological research and development efforts. The proposed services are closely matched to the data communications requirements of computer users as articulated in proceedings before the FCC. By offering high-speed, reliable, and virtually error-free data communications through switched facilities, the new carriers will provide service superior in quality to that of dedicated wideband lines and at substantially reduced cost, together with the flexibility and geographic coverage available through a public switched network.

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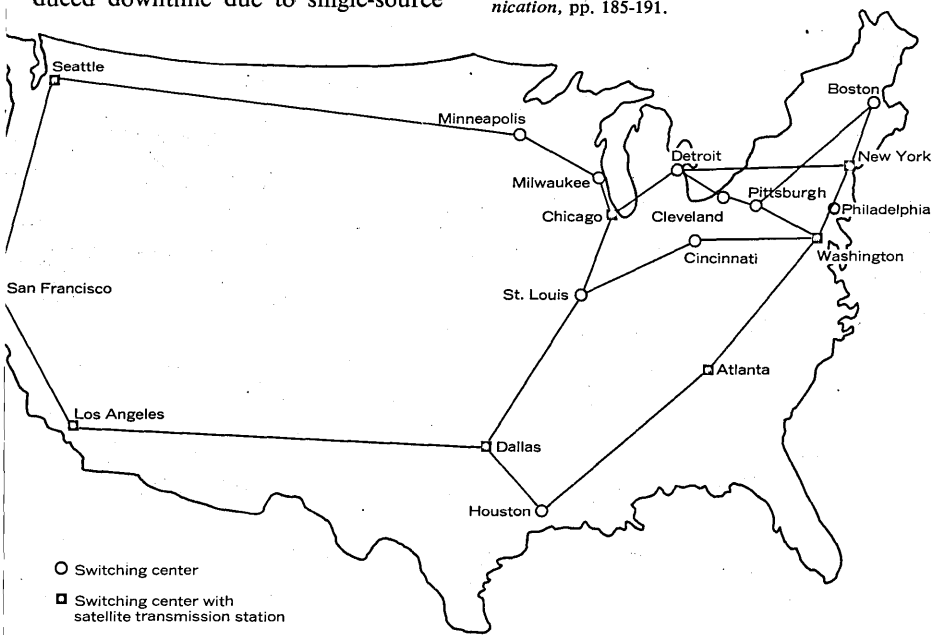
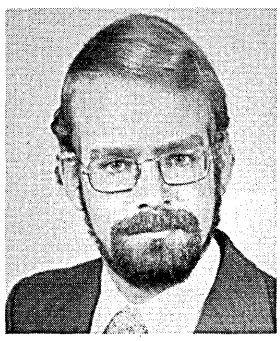
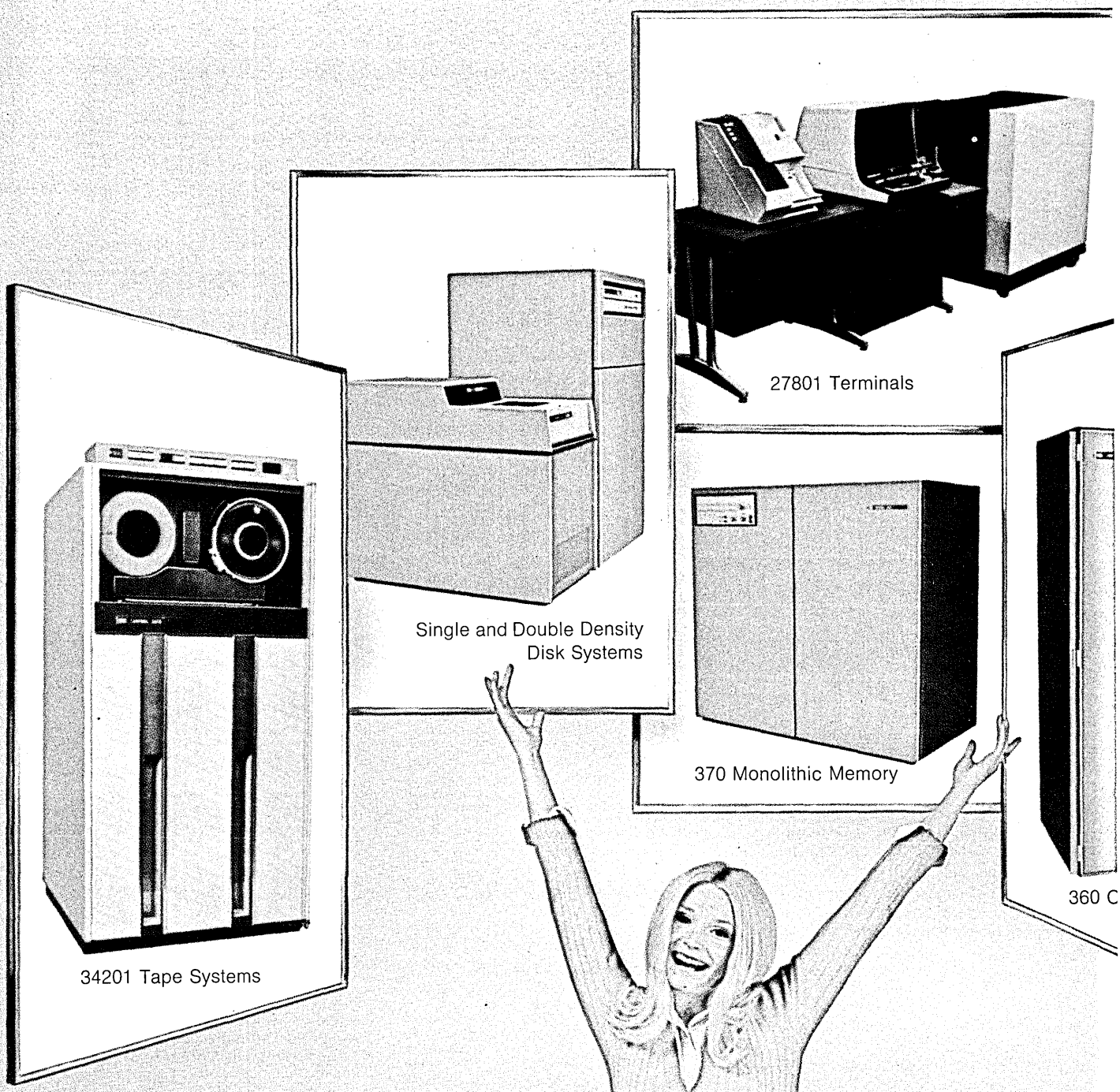


Fig. 3. The proposed network of Telenet Communications Corp. is much like that for PCI, but includes earth stations for 1.544 megabit satellite channels.

Dr. Wessler is manager of applications engineering at Telenet Communications Corp. He previously worked for the Advanced Research Projects Agency in the Department of Defense, and has served as a consultant to the Board of Governors of the Federal Reserve System.



Mr. Hovey is a member of the technical staff of Telenet Communications Corp. He has worked as systems analyst at the Westinghouse Learning Corp. and the New England School Development Council.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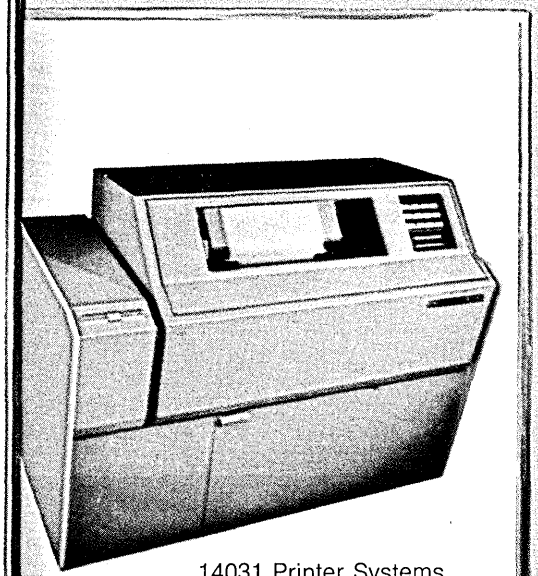

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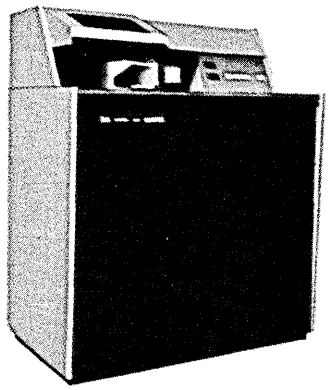

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IFIP CONGRESS 74

by Philip H. Dorn, Contributing Editor

Has it really been three years since the last straggler inched out of Ljubljana? The last IFIP Congress was so long ago that RCA was still in the computer business, four named Heath, Brandt, Pompidou and Nixon were in charge, and Telex had not yet even filed suit against IBM. Once again it is time for the triennial gathering of the clan, and this time Stockholm draws the nod.

The Congress of the International Federation for Information Processing is dominated by academics, a sort of super-professorial version of the summer ACM meeting where papers have long, forbidding titles and everybody seems to frown a lot. The handful of brave exhibitors, just over 100 at last count, offer a refuge for those interested in something more tangible than a discussion of eigenvalues or computer-enhanced image processing.

Concurrent with the Congress will be MEDINFO 74, an IFIP-sponsored meeting attempting to straddle the twin worlds of data processing and medical technology. It is not easy to get these two into the same hall, and TC 4, the IFIP group concerned with medical informatics, should be commended for this attempt. The rapidly expanding fields of computer-assisted clinical practice and computerized administration of health care facilities have not yet been given proper attention at major conferences. Hopefully this First World Conference will be the forerunner of regular meetings.

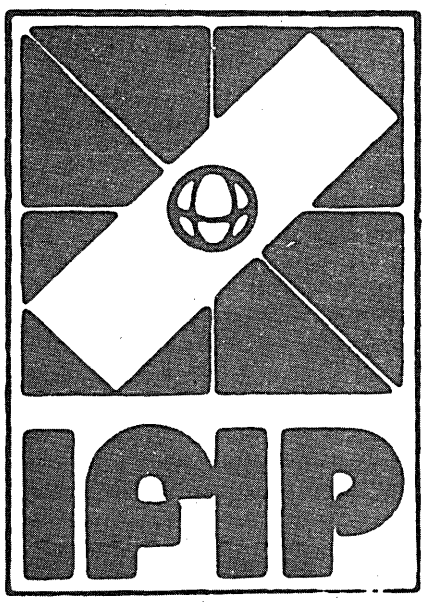
Technical Program

Prof. Herbert Freeman (New York Univ.) and his multinational Program Committee have finished their work. The final score was 41 invited papers, 174 refereed papers and 18 informal panel discussions. These are divided into 88 sessions in addition to the formal opening and closing ceremonies. Opening day is Monday, August 5 and the closing session (featuring Ruth Davis of NBS) will be on Saturday morning, August 10.

The papers are divided into six categories: computer architecture and hardware, software, mathematical computing, computers in scientific and technological applications, computers in the social sciences and humanities, and a broad category called management and administration.[1]

Computer architecture and hardware

This section appears loaded with papers on unbuilt systems and papers discussing networking. One that ought to be of special interest is the lead-off paper for the Congress, "Trends and Problems in Computer Organizations," to be delivered by Johns Hopkins Univ. microprogramming expert, M. J. Flynn.



An invited pair, "The Impact of LSI Technology on Computer Systems," Gerald B. Herzog (RCA Laboratories) and "The Design and Impact of Pocket Calculators," Thomas M. Whitney (Hewlett-Packard), nicely represent the large and small of things based on today's semiconductor technology.

One session has an interesting pair of sleepers, "Computers in the 1980s—Trends in Hardware Technology," Rein Turn (Rand) and "On Attaining the Near-Perfect Availability Required in Future Information Processing Systems" (that means "making it work good"), by M.J. Marcus (IBM). The Turn paper takes a good look at semiconductor technology for the next 15 years while the IBM paper is really a discussion of the many factors outside pure hardware that must be paid attention before one attains total system reliability.

Remember Atlas, the second-generation machine with virtual memory? That was long ago, but the Univ. of Manchester is now working on the MU-5 and Prof. Frank Sumner plans a report on their current progress including the first performance monitoring experiments.

Have you considered multiprocessing your microprocessors? If not, you may want to listen to the session describing the MICS system developed by the team from Nippon Electric. Interested in the computing state of the art in Israel? You might want to hear about the latest "Golem B Computer System" from M. Melman of the Weizmann Institute.

Communications systems, packet or otherwise, are a major topic these days. You can hear about packet switching from the French on "The CIGALE Machine," or the English and Canadians with their "BNR Network."

Software

This group of papers can easily be divided into a 2 x 2 matrix, where one axis represents "planned" or "implemented," the other deals with "operating systems" or "languages." This makes for a bit of a split that attendees will need to watch when selecting sessions. Worth special note are two panels, one on Tuesday morning covering "Structured Programming" and the other to be chaired by Werner Frank

[1]Not every session is covered in these pages. All selections reveal the author's biases as to what he thinks important or has guessed from the abstract may be of above-average interest.

(Informatics) on Friday afternoon covering "The Future of Software Products."

Niklaus Wirth has the credentials to speak about "The Design of Programming Languages." The creator of PL/-360, a most useful system implementation language, and author of the famous remarks about the impossibility of programming a multi-register machine, here addresses the pitfalls of language design in an invited paper. No matter how correct the language may be, you will not have much luck in solving the problem if the requirements are not stated precisely, a point to be addressed by Barry Boehm (TRW) as he looks toward a more formal mechanism for stating problem requirements (see May 1973, p. 48).

Data base was not invented by CODASYL. One who exposed the terms and concepts years ago is George Mealy (Harvard), long a voice in the wilderness for sanity and structure. He will be discussing "Data Structures: Theory and Representation." Hutt of ICL suggests that there is "A Data Base Approach to System Architecture," a coherent approach to the total operating system interface and the software that lies beneath the interface.

One practical network problem is sending a job 3000 miles and having it collapse because the sending party doesn't know the receiving system's command protocols. Raymond and de Masle (Grenoble) offer a solution in "NCJL: A Network Job Control Language." Jalics and Lynch have collaborated between Stuttgart and Case Western Reserve to take "Some Selected Measurements of the PDP-10 Timesharing Operating System," information highly useful to those running TOPS-10. Another highly useful paper should be the one by Dr. Saleeb and Eng. Riad (Cairo Univ.) describing some modifications to ICL's GEORGE 2E to optimize the system's performance.

Mathematical aspects of information processing

The bulk of these papers arrived from research laboratories and universities; it is no surprise to find that most lean to the highly theoretical.

Parallelism and parallel computing appear to be an "in" subject this year, which *is* surprising in view of the limited interest shown by machine designers. Carnegie-Mellon has some active research ongoing in these matters and J.F. Traub will be reporting on current progress. Ashok Chandra (IBM) is already convinced that parallelism plays a role in such areas as pushdown stacks, counters, and facilities for testing data structures. Parallel programming may demand a different programming language; Gilles Kahn (IRIA) is suggesting such in "The Semantics of a Simple Language for Parallel Programming." Peterson and Bredt (Stanford) are describing "A Comparison of Models for Parallel Computation."

Technological and scientific applications

The definition of what constitutes "scientific" and "technological" was extremely loose: apparently there was no bias shown toward any area. A number of papers are mated in sessions with others that have little in common except (hopefully) excellence. Come to think of it, what's wrong with that?

Of special note is "An Experimental Investigation of the Performance of a Computer-Aided Building Design System," a joint effort of Thompson (U.K. Dept. of the Environment) and Hughes (Royal College of Art). This paper reports some results of a pilot version of their CABD system from a live test in an architectural office.

A Thursday afternoon session with three business-oriented papers may be of interest. Leading off is Pollack (Lockheed) covering his "Interactive Approach to Airline Route-Frequency Planning," a system which recognizes the value of tossing some of the solution decisions back to the analyst at the terminal. This will be followed by Fisher's "Order and Charge System," a discussion of a pseudo on-line order entry and invoicing system for 7500 outlets which notes what the abstract calls "human resistance to change," a tantalizing hint. Finally, Westhagen and Hope will describe the "SDS-Project," not a group of disenchanted collegians but an administrative control system for the Norwegian shipping industry.

The main sessions will be divided into three separate series, each at different levels of specialization.

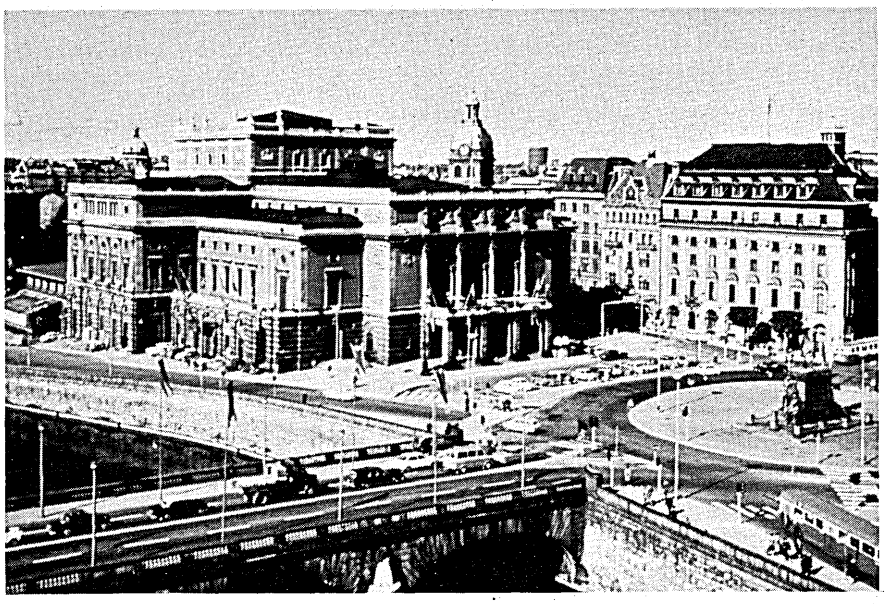
Series 1 is for those with wide responsibilities and interests in the field of medical information science, health science management, and education. Divided into six sub-sessions, the topics range from confidentiality of data to some techniques for introducing computers into the health care units (where a certain number of resistors will be encountered).

Series 2 is made up of topics of interest to people professionally involved with medical informatics and the day-to-day responsibility for providing health care. The sessions deal with such topics as medical data base, operation of community health care services with the help of a computer, and improving patient administration in a hospital.

Series 3 takes on specific topics in the use of a computer in the clinical practice of medicine, for example, in radiotherapy, signal analysis (EEG, EMG, etc.), drug data handling and intensive care.

Both the IFIP Congress and MEDINFO will be held at the Stockholm International Fairs and Activities Centre at Mässan. No matter which sessions are attended, visitors will enjoy their stay in the city. Called the "Venice of the North" because it is built on 13 islands, Stockholm is warm and sunny in August, and its countryside should be pleasant and green. For the first time in twelve years, there should be little grousing about site selection.

When writing about scientific appli-



Though parts of Stockholm are ultramodern, its old-world charm and character remain in places like the Royal Opera House.

cations, there are always a few titles that are "grabbers" even when they describe serious work. The IFIP championship for 1974 is hereby awarded to Zadeh's "Fuzzy Logic and Its Application to Approximate Reasoning." The runner-up is Siklossy and Roach with "Collaborative Problem Solving Between Optimistic and Pessimistic Problem Solvers."

Applications in Social Sciences and Humanities

The social (soft or squishy) sciences do not classify easily; the papers sometimes are only vaguely related to one another. A good many appear interesting to the layman trying to get a feel for the use of computers in non-scientific applications.

There is the usual run of education papers, either dealing with use of the computer as a teaching tool or teaching the use of the computer (these seem to get confused at most conferences).

In the arts and literature section, "A Computer-Aided Analysis of Lawrence Sterne's A Sentimental Journey" by Pasta (Dist. of Columbia Teachers College) demonstrates four types of analysis of Sterne's imagery. "Computer Painting with Some Subjective Data" is the title of Dr. Brione's contribution. This Univ. of Madrid researcher is using the computer to move parts of a painting about. Musician Peter Barbaud from Paris has an invited paper with the imposing title of "Composing Music and Sampling Sound by Computer." Anyone who submits his abstract to the Program Committee in Latin with a remark that he feels this is the best common language has to be worth hearing. Gregorian chants on a computer?

Grouped in one session are Norm Nielsen's "The Implications of Star Computing Networks" and Mangad and Hanna's "Computers and Health Insurance Models." Both papers seem to be touching the point that it is not so much the use of the computer but the way in which the computer changes relationships that may be more important.

A session with all invited papers leads off with the well-known Nigerian Prof. Fagbemi discussing the use of computers in developing nations. Henderson (Univ. of Witwatersrand) will be describing some 10 years of experience with computer courses as an extracurricular stimulus for exceptionally bright children.

There is a Friday morning session chaired by Prof. C.C. Gotlieb of the Univ. of Toronto on the "Social Impact of Computers." Gotlieb's impact as advisor to the Program Committee was clearly demonstrated by the outpouring of papers from Canada.

Systems For Management and Administration

When shown the IFIP session list a pragmatic programmer was heard to mutter quietly "If that's what the professors mean by "management," I'll keep my manager at home." Missing from this program is any discussion of how a system can be created, implemented, and installed on time and within the budget. If these subjects are beneath the notice of the IFIP attendees, some hint of the real world arrives with Conway et al. discussing the already implemented "Technique for File Surveillance," a method for keeping an eye on file activity unbeknown to the users. Is this a way to attain security while sacrificing privacy? Maybe H. Gassmann's Friday afternoon panel discussion on "Privacy and Computers" will discuss the subject.

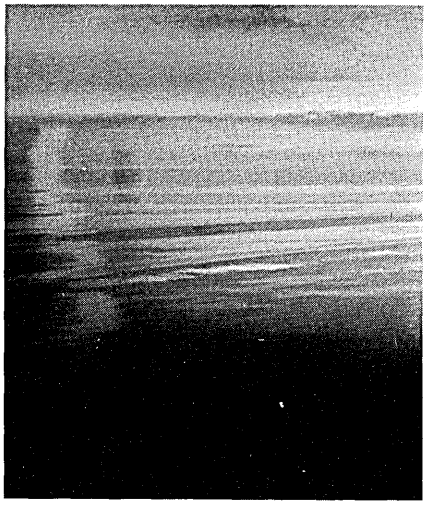
Decision Support Systems are represented twice, irritatingly in separate sessions. Morton's "DSS: Some Lessons from an Ongoing Application" will look into the need for some new methodology to permit better measurement of some of the variables; Stabell's paper on "Design and Implementation of DSS as a Marketing Problem" deals more with the perception of the system by individuals affected than with the actual system.

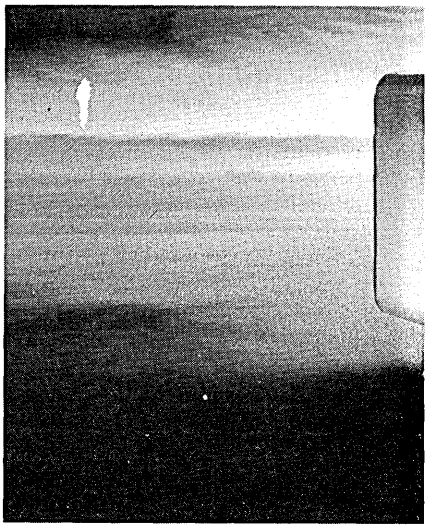
"Forum: A Computer-Based System to Support Interaction Among People" (Amara and Vallee) wins our prize for the IFIP paper most nearly resembling previously published material. The May 1974 DATAMATION carries a very similar article on Forum by Vallee.

Two papers dealing with national economic planning, Gabrovski (Bulgaria) and Bagrinovski (USSR), are being presented in the same session. National economic planning is rarely discussed publically by western nations; the closest approximation this year is Sibley's "Extremely Large Data Systems for National Statistics" and his paper was co-authored by Rabenseifer from the Computer Center at Bratislava.

Medinfo 74

At press time the program for MEDINFO 74 was still somewhat incomplete but a number of the overall features are known. There will be an opening session late on Monday afternoon featuring an inaugural address by A. Grönwall, President of the International Hospital Federation as well as a number of other invited papers. Special tours of Swedish hospital facilities are being arranged. □





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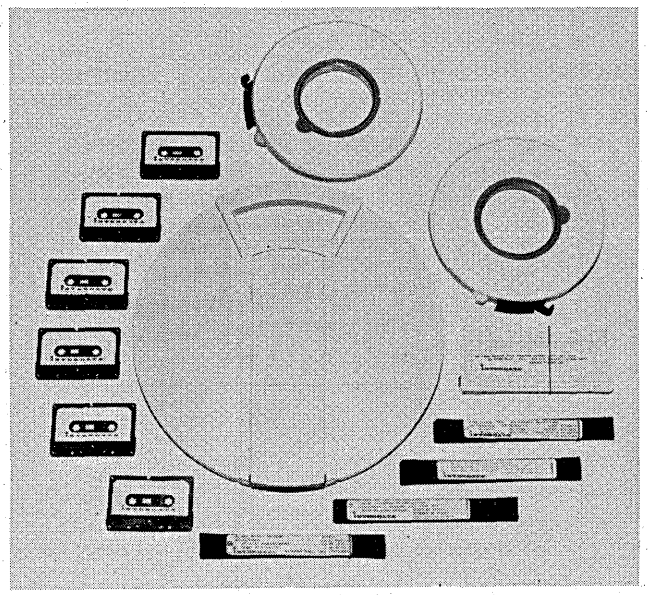

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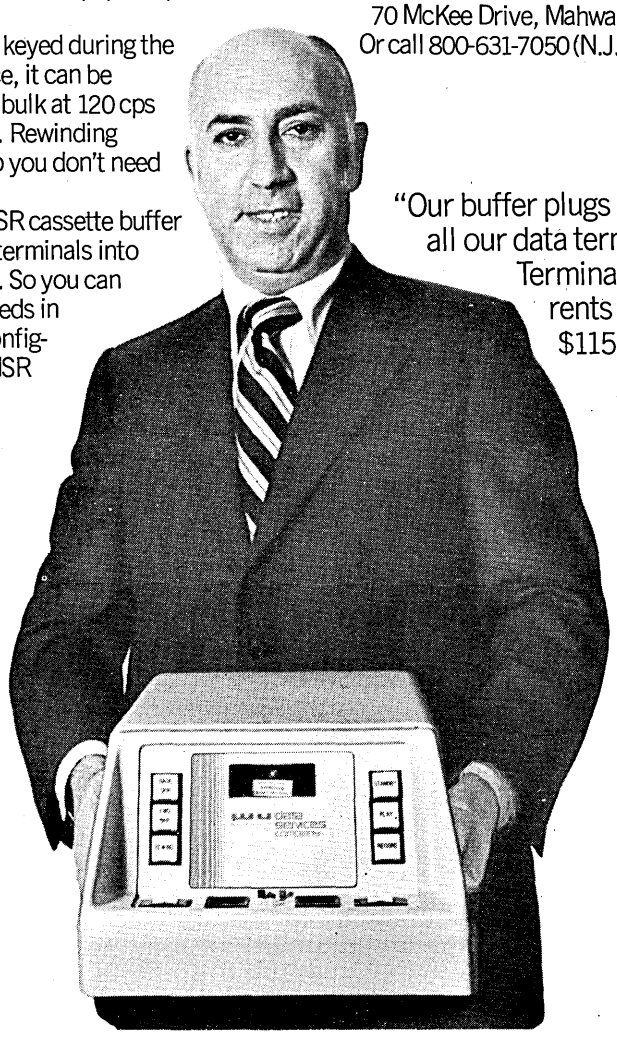

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Problems at home are forcing mainframers to target for customers in South America, Europe, and the U.S.

JAPANESE AIM FOR WORLD MARKETS

by Edward K. Yasaki, Far East Editor

Early in 1971, Automation Sciences Inc. of New York announced an order from Squibb Beech-Nut Inc. for a 48K Facom 230-25 computer, made by Fujitsu Ltd. The system was not accepted, the order never consummated, but the announcement had a telling effect. It was widely believed the Japanese had begun their "invasion" of the American computer market. Three years later, nothing like the feared onslaught has occurred.

But indications are that during 1974 and '75 there will be a significant and growing amount of such activity by the major Japanese mainframe manufacturers.

In the U.S., of course, Fujitsu took the lead, not with its abortive attempt to sell through ASI but with a huge investment and subsequent manufacturing/marketing agreement with Amdahl Corp. (see June, p. 114). Fujitsu, which has a few sales offices abroad, prefers nonetheless the joint venture approach. Dr. Toshio Ikeda, managing director of Fujitsu's Information Processing Systems Group, says the Spanish government has asked the company to provide the R&D and manufacturing know-how to start its own computer industry. Fujitsu is interested in participating.

The company is also holding discussions with the Brazilian government and companies there that are interested in getting into the manufacture of small-scale computers, such as the Facom 230-15, and minis like the U-200, Dr. Ikeda said. Perhaps after three years they will get into larger machines. The electrical engineer and former computer designer added that Fujitsu is prepared to provide any type of know-how for such a joint venture; he speculated the contract might be signed in mid-'74 with production to start next year.

Interestingly, Spain and Brazil are also recognized as the two fastest-growing markets by Jacques Maisonrouge, president of IBM World Trade (see May, p. 105).

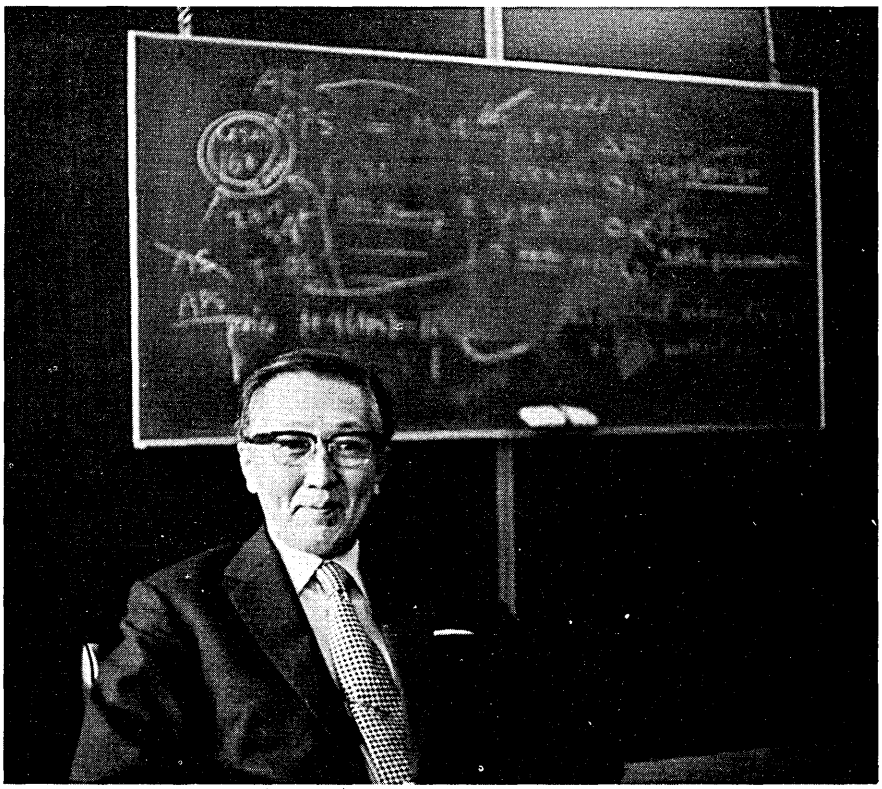
This expansion into international markets by Japanese computer manufacturers is more than an attempt to become another multinational company. Rather, it stems to a great extent from domestic problems they face. There is, above all, a limited market at home. And mainframers must strive to enlarge their customer bases and amortize their expenses over a greater number of installed units.

Added to this are the prospects of ever-increasing competition in their home markets by foreign manufacturers. Under pressure from other governments, the Japanese are liberalizing their restrictive import laws, and by the end of next year are scheduled to lift the laws governing foreign ownership of computer companies as well. Asked whether they were prepared for these scheduled liberalizations, spokesmen for many companies said the barriers were, in effect, already gone.

But compounding their problems, manufacturers are also being told to increase exporting activities, cut pollution, shorten the workweek, and raise wages. In short, the list of factors leading them abroad is long.

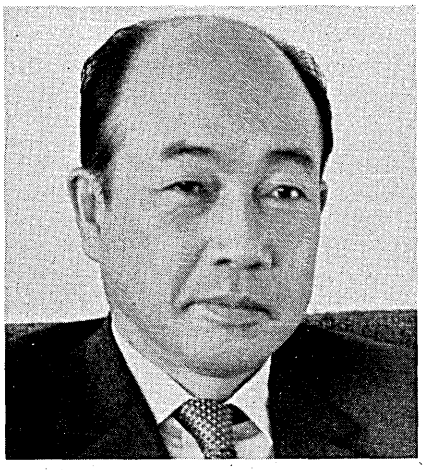
Pay raises of 30%

This past spring, during the one week of the year when cherry blossoms appear and become a tourist attraction for Japanese and foreigners alike, labor unions staged an unprecedented showdown and managed to get pay increases of close to 30%. It set a pattern for other unions that, in the famous words of American Samuel Gompers,



Fujitsu's Dr. Ikeda sees mainframes being built in Brazil and Spain.

wanted "More! More!" At Fujitsu, a 30% increase suggested by management was turned down as insufficient by its unions. The seriousness of the situation was explained by Dr. Ikeda. For the last half of the past fiscal year, he said, the company had a profit of five billion yen, which projects to a 10 billion yen annual profit. But a 30% raise to employees would cost more



Oki Electric's Sato can point to manufacturing and marketing facilities his firm already has in the U.S.

than that, between 15 and 20 billion yen.

Caught in such a bind, companies have few alternatives but to raise prices. Evidence of this pattern, a pay increase followed by a price rise, is abundant. In Tokyo, for instance, even the taxi meters can't keep up. As prices continue to spiral, the fare on the meter has become about 30% below the actual fare, which is printed on an equivalency chart handily suspended within the passenger's reach. Fares have doubled in the last year.

Along with this problem, a number of companies complain of a personnel shortage, and the government has been trying to do something about that. For some five or six years the government has been running nationally televised courses on the fundamentals of dp, and publishing textbooks to go with them. Examinations are conducted to indicate proficiency in programming, and certificates are awarded to those who pass at three levels: junior and senior programmer, and a class called information analyst. The percentage who pass is very small.

On the other hand, the government has been compounding the personnel shortage problem. Reacting to public pressures, it has been encouraging employers to adopt the five-day workweek and a few companies have done so. Many more firms, however, give employees every other Saturday off, some rotating their staff so that there's always someone in the office on a Saturday. Banks, too, appear anxious to switch from 5½ to 5 days a week, and are adopting off-line cash dispensing machines to facilitate this trend. The reason for the off-line mode stems from difficulties in getting phone lines from remote locations to banks.

Omron Tateisi Electronics Co. builds the cash dispensers and other dp-related hardware. By no means blind to emerging technologies and markets for its products abroad, Omron has had a facility in California since 1970, even before the Fujitsu/ASI caper. It subsequently acquired two American companies, Newell Industries, a maker of tape transports, and Data Memory, producer of a disc file for storing video images. And now Omron Systems in Mountain View, Calif., is producing crt terminals.

Taking a similar tack with facilities in the U.S., is Oki Electric Industry Co., Ltd., the most active in international markets of the six major mainframers. Oki, which has close ties to Univac, has begun to develop a service force around the world, something it wisely recognizes as a prerequisite to sales activity. Throughout Japan it has about 1,600 service personnel working out of 80 offices. And it now has them based also in New York City, Paris, Dusseldorf, and Kenya, says Tokuji Sato, general manager of Oki's Data Processing Systems Sales Div.

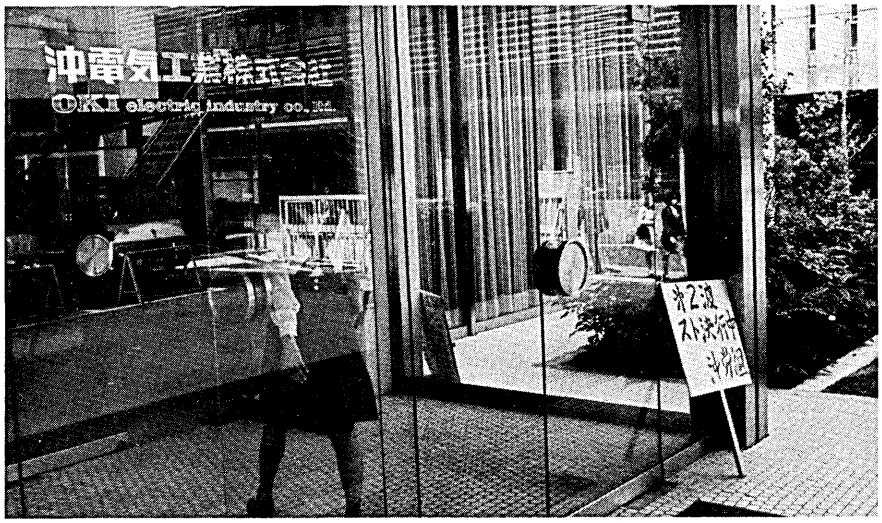
A director of the company, Mr. Sato speaks confidently of Oki's role in expanding world markets—without minimizing the effort required. The company has a wholly-owned subsidiary in New York, Oki Electric Overseas (OEO), which was established in 1972. OEO owns a third of Oki Electronics of America, Fort Lauderdale, Fla., which is manufacturing and marketing communications equipment. OEO also owns 50% of Okidata, the Morristown, N.J., firm that has acquired Bridge Data Products and the computer memory division of Applied Magnetics.

IBM, like Coca-Cola, is a well-established trademark in Japan. The Japanese would like to turn the tables and export dp products to international markets, including the U.S.

Oki also acquired rights to the non-impact printer developed by Electro-Print, the Cupertino, Calif., research firm. Sato says Oki has sold 10 of them, has also shown it to a delegation from the Peoples Republic of China, but the Chinese were interested more in how to make the machine than in buying it. He says they've had the same experience with Russians and mini-

computers. Rather than buying a license, they purportedly wanted to establish a joint manufacturing operation, the Rumanians providing the facilities and manpower and Oki providing the technology, and the two parties sharing in the profits. Oki turned that one down. Sato says they also had to turn down an offer from an American company to buy Oki's minis because Oki still lacks an adequate service staff.

Oki Electric, perhaps more than any other mainframe maker, sells a very large percentage of its systems through the Japan Electronic Computer Corp. (JECC), the company formed to finance the leasing of domestic installations. According to Mr. Sato, JECC gets about 95% of Oki's sales. JECC finances the leases of mainframes and peripherals, but nothing that rents for less than 1.5 million yen per month (about $5,500).



An unmanned strike sign decorously rests against the entrance to an Oki Electric facility in Tokyo while employees hold a rally in back. Raises of 30% are not unusual.

Asked whether JECC would also finance the exports of computers, an executive of the leasing firm said, "We have no such plans." He paused, then added, "But it is a possibility."

Mr. Sato considers Oki to be the only company taking the department store approach to hardware. Clearly the company is viewed by outsiders as having more strength in its peripherals than its mainframes. According to the marketing executive, end-user sales comprise 80% of the total, oem sales 20%. But he says the company must start abroad with oem sales, at least until it can offer its full line of products to end users.

As with the people at Fujitsu, the South American market also appeals to Nippon Electric Co. According to Yukio Mizuno, general manager of NEC's EDP Market Planning and Product Planning Div., there's a market in South America for small business systems that, as he describes, could be rented for $10 a day.

Dr. Mizuno, a computer designer in both the analog and digital fields who switched fields and built up the company's systems software group to a staff of some 550, says NEC has a technical licensing agreement with Honey-

Tokyo: The Orient's Computer Center?

Japan's domestic common carrier is trying to become a computer utility serving all of Southeast Asia, according to Yasuo Makino, managing director of Nippon Telegraph & Telephone (NTT). Unlike Ma Bell, NTT is chartered to provide both communications lines and data processing services. It therefore is interested in making computing services available as widely as its phone services. Accordingly, he added, he is working to extend NTT's computer network to the South Pacific in the next three years, and then to the U.S. "It is the Japanese government's purpose to aid the people of Southeast Asia," he said in explaining this desire to become a computer utility.

With its network, NTT is currently performing on-line automobile registration for the Ministry of Transportation and a funds transfer function for banks. For small and medium-sized businesses, it also offers an on-line sales and inventory management system called Dress and a scientific/engineering computation system called Demos.

To date, however, the time-sharing or remote access services business has been slow in growing. Akito Yanai, director of the Time-Sharing Service Div. of Dentsu Advertising Ltd., the largest ad agency in the world, says users are trying to determine which applications should be handled inside, which ones outside. "I believe a big boom is coming some time soon," he adds optimistically.

Dentsu is a distributor in Japan for GE's t-s service, just as Honeywell is in Western Europe. The unusual partnership with an ad agency stems from the fact that Dentsu long has been a GE computer user. It was thus asked to find a distributor for GE and did line up a number of candidates, but nothing panned out. So Dentsu decided to be the partner. At the time the Japanese government approved the deal, GE had the Mark II system, so that's what it's still called in the local market. Dentsu, however, is offering the full Mark III capability of both foreground and background processing, so a name change for the Japanese market is anticipated next year.

According to Yanai, Dentsu has signed up more U.S.-based customers with operations in Japan than Japanese firms with overseas facilities. He's thus hopeful he'll be able to sign up most of the 500-odd U.S. firms with offices in Japan. Among his local clients, however, are Nissan Motors (makers of the Datsun car), performing order entry and parts inventory control worldwide, and Nomura Securities (among the 10 largest securities firms in the world), doing its order entry on the system and getting a daily balance sheet out at each of its offices. Order entry is also the application for Sears, which in a joint venture has begun a catalog sales operation in Japan. Foreigners like this service because it enables them to buy items of clothing not available at local emporiums in their sizes.

GE's Paul Sage, in Tokyo, says the potential market is about a third of that in the U.S., though he doesn't know how long it'll take to reach its potential. Dentsu's Yanai pegs it at some $18 million next year if the people required to develop the market are available. About three years ago NTT had 90% of the t-s market, a share that reportedly has dropped appreciably. Currently Dentsu, NTT, and IBM dominate the market. □

well that requires NEC to oem its gear to Bull in France for subsequent marketing. In the U.S., he explained, it would be through HIS. But direct sales can be made in South America and in Australia, or NEC can market through Honeywell branches in those regions. Indicating that little has been done to date about selling abroad, the boating enthusiast and licensed skipper observed that the competition would be stiff in Europe. There's no thought of selling systems in the U.S., he added, but rather components or subsystems.

NEC, like Oki and Fujitsu, is big in communications equipment, which make up about half its sales, compared with only 18% for computers and "other electronic equipment." The company is manufacturing its communications devices abroad, says Dr. Mizuno, and could adopt those facilities to the manufacture of dp hardware.

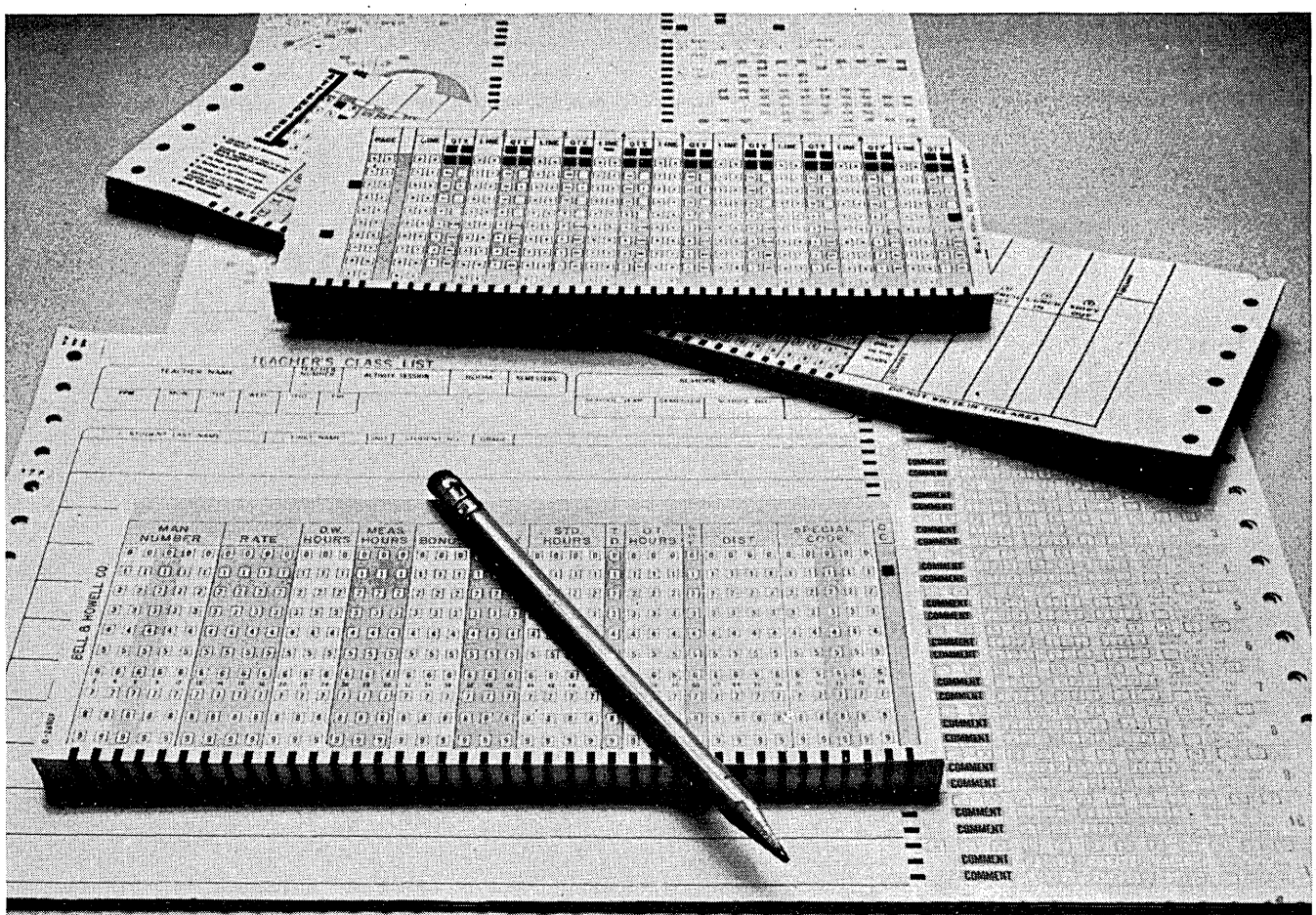
Another company where the Information Systems Group accounts for only 10% of corporate sales (and employment) is Hitachi. This firm, which has been deliberate in its moves abroad, has an oem contract with Siemens in Germany and has shipped several hundred mark-sense readers to them. The latest product being exported is an OCR page reader that can read handwritten numerals, five alpha characters (C, S, T, X, and Z) and the minus sign, at the rate of 50 cps, in addition to the OCR-A and B fonts. This system, depending on configuration,

Dr. Mizuno of Nippon Electric wants to offer a small business system for $10 per day.

leases for from $1100-1500/month. Some 100 have been installed in Japan since deliveries began last year, and first shipments recently went to Australia. Consideration was given to exhibiting this unit at the National Computer Conference this past spring, but it was decided instead to go slow in approaching foreign markets, says Yasuo Kajiura, section manager in the Planning Dept. of Hitachi's Large Scale Computer Div.

More to come

It's likely, of course, that this and other business decisions are being held up by the uncertain economic climate in Japan and elsewhere. But it's also clear that the Japanese, no less than the Europeans and Americans, will increasingly expand their marketing efforts into the international sphere. Indeed, a facilities management company based in Osaka, Computer Service Co., Ltd., has announced its intention to take over the operation of several computer centers being run now in New York City by huge trading companies. So, over the longer haul, hardware vendors will not be the only ones making their presence known in the Western World. For developers and users of information processing systems, this is good. Far from sounding an alarm, the user community should anticipate the introduction of a variety of competitive products, techniques, and services from vendors new to the marketplace. □



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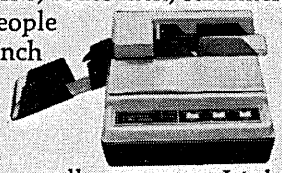

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Use of the data dictionary,
the table driven editor,
and the test data base generator
simplifys working with data bases.

SOME TOOLS FOR DATA BASE DEVELOPMENT

by Robert M. Curtice

Interest in data base systems has continued to increase during the past several years; there is now evidence that more than half of all medium- and large-scale installations are pursuing data base systems. As an example, the 1973 GUIDE questionnaire shows 806 of 935 installations have implemented, or plan to implement, data base concepts.

Certainly, the availability of generalized data base management software has contributed to the ease of developing data base systems. Even so, it is recognized that such systems are not very easy to construct, especially considering potential performance degradations, multi-application integrated data base designs, and problems of testing, recovery, and integrity of the data base. The tools and ideas presented below were developed and refined as a result of working with several large data base development efforts.

Data dictionary

The data dictionary is a recently developed tool which has found considerable success in data base development efforts. Its purpose is to aid in the important tasks of identifying, documenting, organizing, and perhaps even manipulating information about the data to be stored in the data base.

What are the basic functions of a data dictionary? In its simplest form, a data dictionary is a well-organized, up-to-date notebook containing basic information about data elements. Usually, a one-page form is developed which can be used to record such information as data element name, definition, format, editing rules, source or responsible organization, privacy level, and other characteristics, depending on the particular needs of the project. The data dictionary becomes the central authority source for all information about the data itself.

Additional data to be included in the dictionary permits cross-referencing each data element with the input and output transactions or documents of the system. This information is useful during the system development process because as data elements change, it is useful to be able to identify all affected transactions easily. A next step is to include entries in the dictionary for each transaction, identifying those data elements which are contained in the transaction. This information, of course, is merely the transposition of the data element to transaction information, and both can be represented in the form of a matrix, the columns of which are data elements, and the rows transactions. If the data dictionary is itself a computer file, this matrix can easily be generated as the dictionaries change.

The dictionary entries for the data base records can also be added to show which data elements are contained in which records. Moreover, entries for transaction processing modules can be shown, tying together the transactions they process with the data base records they access. For any large system, a data dictionary containing all this information should be mechanized, and can provide a means of identifying all affected entries when any entry is altered. It also provides a comprehensive documentation aid, and can be used by the data base administrator to control changes after the data base system is up and running. In summary, a data base dictionary can be used to document the relationships shown in Fig. 1.

This description of a data dictionary is by no means complete; many users

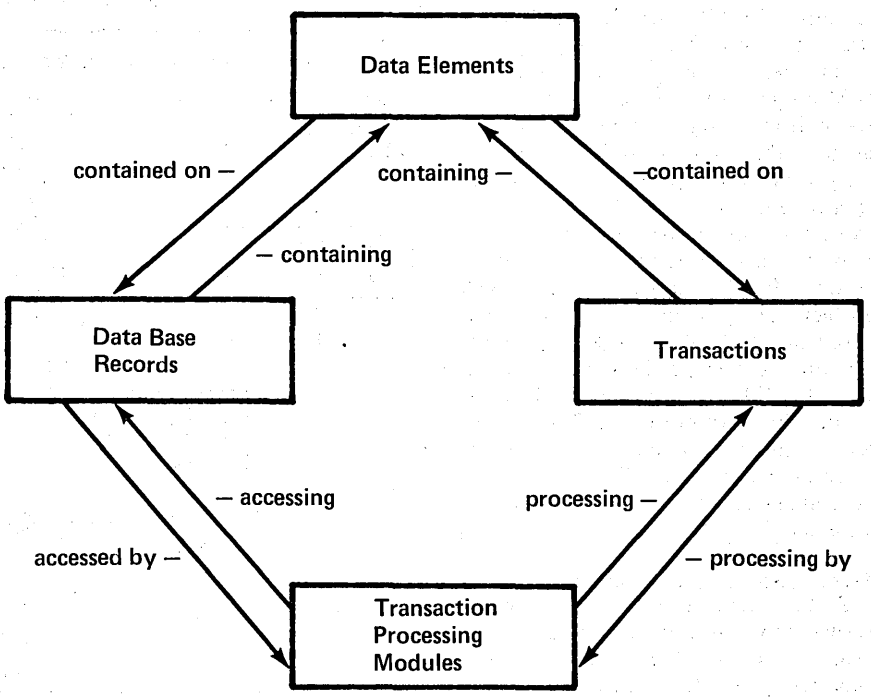

Fig. 1. The data dictionary documents data relationships and transactions.

have tailored their own to meet particular requirements.

Table driven editor

The table driven editor (see Fig. 2) is a logical next step, given a data dictionary. The basic notion is to remove all editing functions from applications programs and to consolidate editing into a single transaction editor. It works in the following way: First, each transaction type has a unique identifier which corresponds to an entry for the transaction in the data dictionary. The information provided by the dictionary can be used to locate specific data elements within the transaction and apply the edits indicated for each. For instance, transaction type x32 could call for a numeric field of numbers within the range 1970 through 1973 in positions 51 through 54 of the transaction; this is the data element named "YEAR." The editor, upon receiving the transaction, looks up x32 in the dictionary (table) and applies the edit.

The advantages of this approach, in addition to removing the burden of each program's doing the edit functions, is that the edits can be easily changed by altering the dictionary. The year 1975 is allowed by changing the dictionary—no programming is required.

Several data base management systems have generalized edit capabilities built into them. When a record is added or updated, the data elements are subjected to the edits. An error condition is posted if an edit fails. This approach is not nearly as useful as the table driven edit module, for several reasons. First, if a transaction is processed by more than one program, duplicate editing may result. Second, most programs reject a complete transaction if anything is wrong with it; this suggests the need for finding errors as early as possible—prior to attempting a data base update. In fact, considerable work may have to be undone when an error is detected at this point in processing. Finally, there is the logical problem of data already on the data base when edit rules change. It may be desirable to change the edit for YEAR, so that 1970 is no longer a valid transaction; this does not mean that a 1970 record already on the data base is in error as would be implied if the data base management system administered the edits.

Test data base generator

A test data generator is a well-known tool for use in system implementation efforts. It is similar to a test data base generator in that both generate data. However, the test data base generator takes on added significance in data base developments.

A facility for generating test data is needed because live data may not be available in time for testing, may be too voluminous, and may not test all the conditions required. A single test data base is needed so that multiple programs can test against the same data. It should be possible, incidentally, to generate a test data base using the data dictionary as input.

One requirement for a test data base generator is the ability to generate the same test data base from the same input. There are two reasons for this. First, during the testing process the test data base will be altered or even destroyed. In order to maintain a reasonable test plan, the same data base must be available to all testing programs at a given time. If it is destroyed or altered we need to recreate it to continue testing. Second, once the live data base is

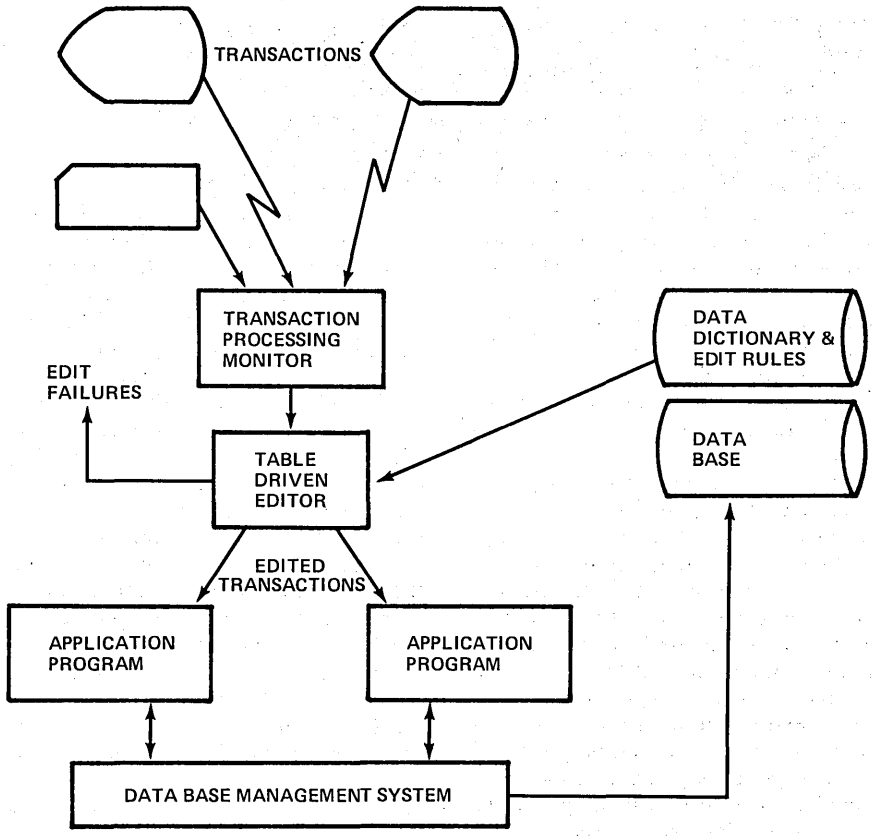

Fig. 2. All editing can be consolidated into a single table-driven editor.

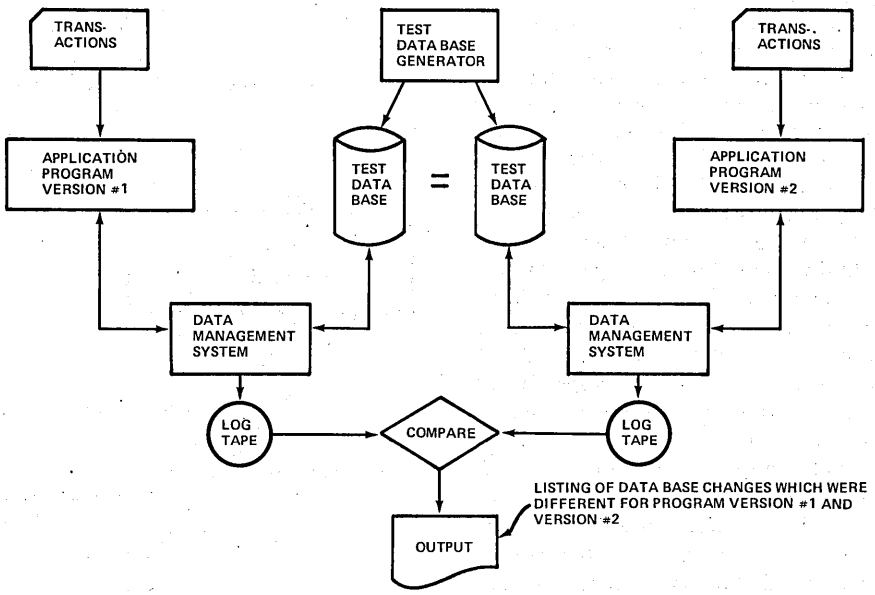

Fig. 3. A test data base generator should generate the same data base from the same input each time.

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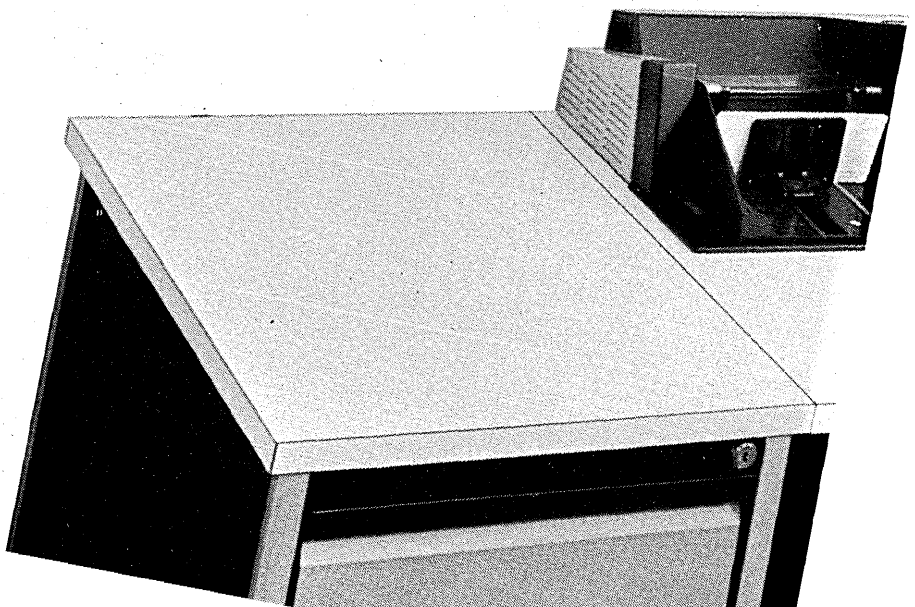

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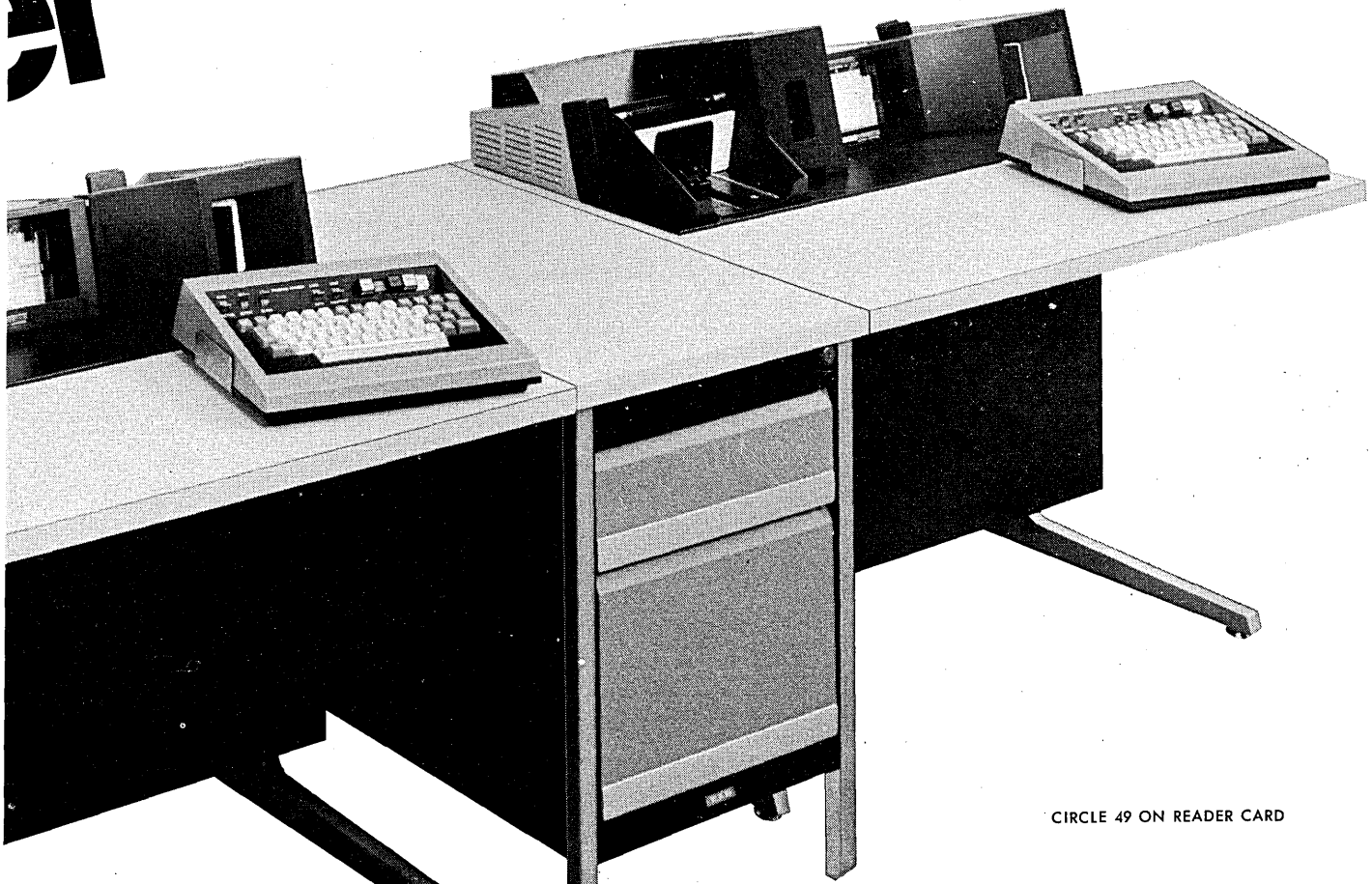


CIRCLE 49 ON READER CARD

DATA BASE

up, a need still exists to test program modifications or new programs. The live data base (or even its backup) cannot be subject to the effects of an untested program. Another copy of the basic test data base is required.

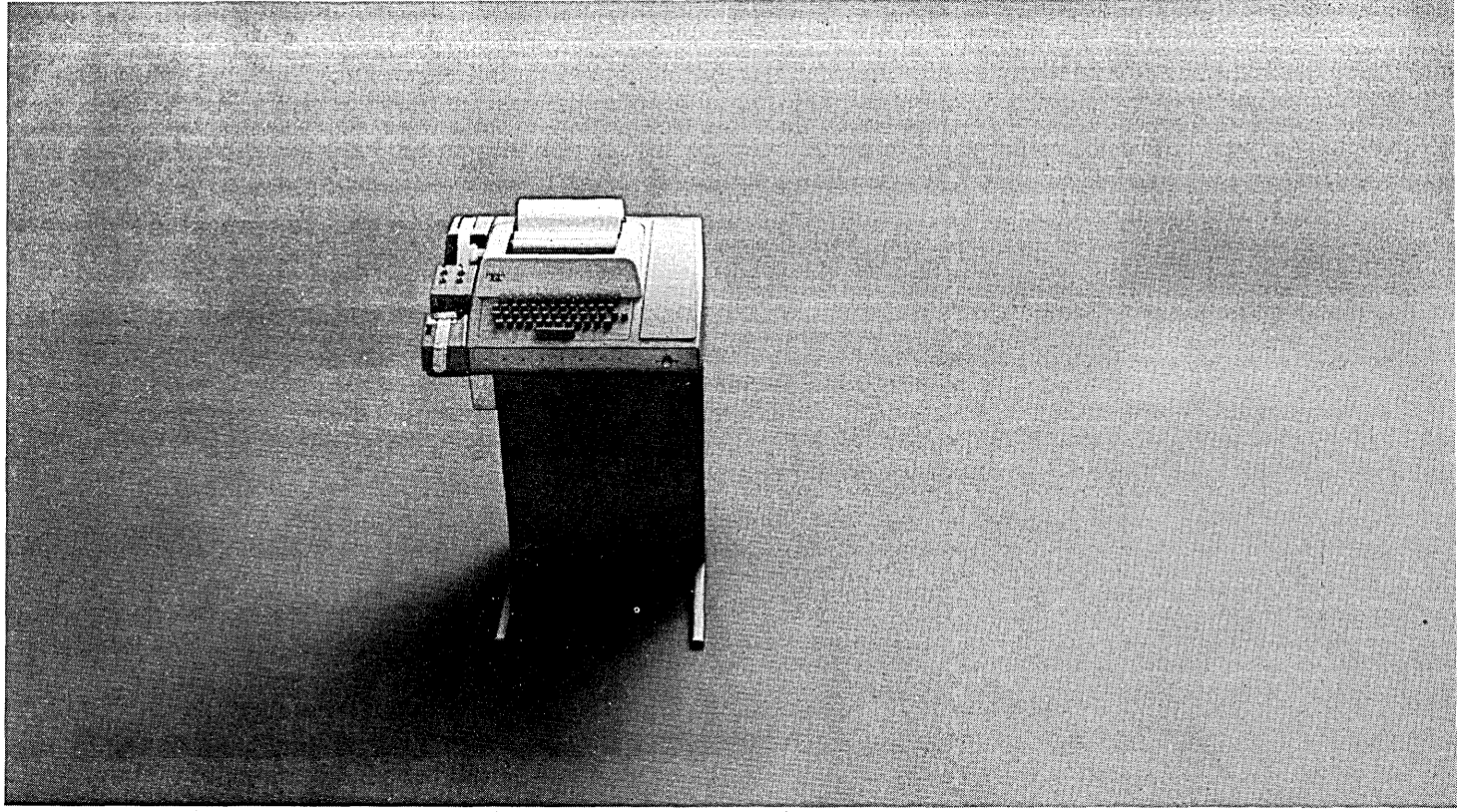
A test data base generator can be built using a test data generator as input to a user written program to construct a test data base. A sufficiently large test data base must be developed to include all possible record relationships, and to be indicative of access timings and overflow requirements of a full data base.

For testing program modifications to existing applications, a uniform test data base can be a very valuable testing tool. The following procedure is especially helpful when the program has no visible output—it merely results in changes to the data base.

The working version of the program is run with a given set of transactions against the test data base. Then the modified program to be tested is run with the same (or different) transactions against the same test data base. In both cases, the journal (log) tape of before and after images of data base records is generated. Then, these two journal tapes are compared; when a match does not occur, both images are printed. This procedure eliminates comparing two entire data bases and provides a simple mechanism to determine the effects of the program modification (see Fig. 3).

The three tools described here will be useful to most large data base development projects. Some proprietary software packages already exist to develop data dictionaries. Generalized edit programs and test data generators exist but have not as yet been geared for transaction oriented data base systems. It is reasonable to expect that such products will become available in the near future. □

Mr. Curtice is a consultant with Arthur D. Little, Inc., specializing in data base systems for manufacturing, insurance, and other industries.



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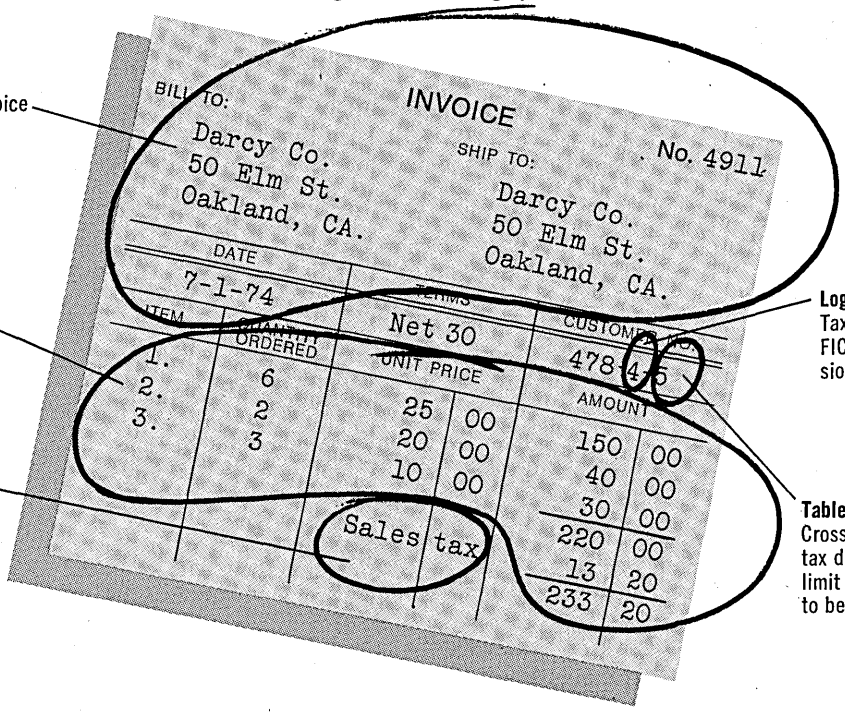

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CIRCLE 6 ON READER CARD

Better languages can be written for structured programming, but the industry's investment in FORTRAN will keep it around awhile. For now, here's what to do.

STRUCTURED PROGRAMMING IN FORTRAN

by Ted Tenny

Structured programming is a discipline which guides the programmer in the orderly development of a computer program. The effort invested by the programmer in designing a structured program can yield substantial dividends in program correctness, readability, and maintainability.

A structured program consists of blocks. These blocks may be combined according to six basic constructs, which govern the transfer of control between different blocks of a structured program. Structured programming, then, is the combining of blocks according to these constructs.

The idea behind block structure is that a block of statements may be substituted for a simple statement at any place where a statement can appear in a program construct. A block consists of one or more statements which are combined in some fashion and can be treated as a simple statement. Thus, a block may contain other blocks as part of its structure, or it may be constructed from one or more simple statements. A subroutine is a block. A program is a block. A structured program is a block which contains only the six basic constructs. They are illustrated by flowcharts in Fig. 1, and are described below.

Concatenation: Statements are executed in the order in which they appear, with control passing unconditionally from one statement to the next. This is so simple that it hardly needs explaining, but it's necessary for the construction of a block from statements that are to be executed sequentially.

If c DO s: The condition c is tested. If c is true, the statement s is executed; otherwise, s is not executed. Control passes to the next statement. Note that the statement s may itself be a block, or it may be a simple statement. This is true in each of the program constructs, wherever a statement can appear.

IF c THEN a ELSE b: The condition c is tested. If c is true, the statement a is executed and the statement b is skipped; otherwise, the statement a is skipped and the statement b is executed. Control passes to the next statement.

CASE i OF (s_1, s_2, . . . , s_N): the ith statement of the set (s_1, s_2, . . . , s_N) is executed, and all other statements of this set are skipped. Control passes to the next statement (following s_N).

WHILE c DO s: The condition c is tested. If c is true, the statement s is executed and control returns to the beginning for another test of c. If c is false, then s is skipped and control passes to the next statement.

REPEAT s UNTIL c: The statement s is executed and then the condition c is tested. If c is false, control returns to s for another iteration. If c is true, control passes to the next statement.

Simple statements can take whatever forms are allowed in the language one uses to implement the structured program. They may include arithmetic statements, READ and WRITE statements, etc. However, they may not include any kind of GO TO statement, since this would cause a transfer of control other than those allowed in the program constructs. Unfortunately, it may be necessary to use GO TO statements in order to implement the program constructs in a language that is not block-structured. In this case the GO TO is no longer a simple statement, but an integral part of the program construct.

Language considerations

What language are we going to use to implement structured programming? Well, ideally, there ought to be a language which allows only simple statements, blocks, and the six basic constructs. But in reality everyone uses FORTRAN. So, the rest of this article is concerned with how to write structured programs and implement them in FORTRAN IV.

FORTRAN does offer some advantages as a language for implementation. In particular:

- It is a fairly low-level language, and FORTRAN compilers tend to produce more efficient object

code than those of higher languages.

- Every installation has a FORTRAN compiler. A program written in ANSI standard FORTRAN can be adapted to run on many different systems without extensive reprogramming.

But FORTRAN has some disadvantages that are particularly serious for structured programming:

- The language is not block-structured. A FORTRAN compiler recognizes only simple statements, so the programmer is forced to use GO TO statements in order to implement the program constructs.
- Subroutines in FORTRAN are not recursive, i.e., you can't have two subroutines that call each other or a subroutine that calls itself. Recursion is important in certain kinds of programming but unfamiliar to most FORTRAN users. There is a way to program around it [6] although it isn't quite cricket within the strict rules of FORTRAN IV.
- The FORTRAN language encourages the use of GO TO statements of various kinds. People with experience in FORTRAN programming have learned to use these GO TO statements extensively, and it requires a lot of discipline to unlearn this habit in favor of structured programming (as has been my own experience).

Implementation

Structured programming in FORTRAN requires that the six program constructs be implemented by using simple statements available with the FORTRAN compiler.

Concatenation: FORTRAN specifically lacks a mechanism to define the beginning and end of a block built by concatenation. Therefore the programmer has to use GO TO statements to skip over blocks of this kind when implementing the other constructs. This is shown in the examples which follow. With the block, statement b follows statement a, as in other languages.

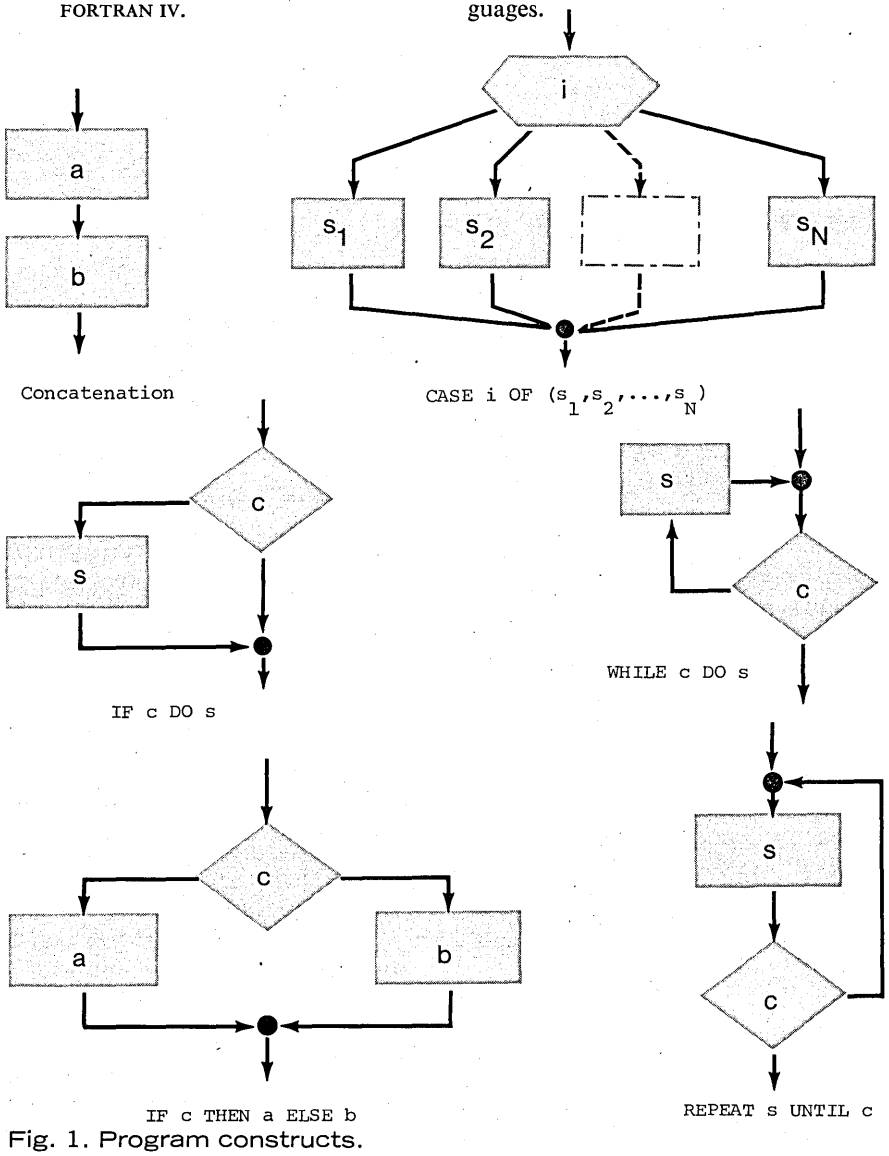


Fig. 1. Program constructs.

IF c DO s The block s must be skipped over if the condition c is not satisfied:

```
      IF (~c) GO TO 102
      s
  102 CONTINUE
```

In the case of s being a simple statement, a logical IF can be used:

```
      IF (c) s
```

or, if s is a subroutine,

```
      IF (c) CALL s
```

IF c THEN a ELSE b One of the blocks must be skipped; c determines which one:

```
      IF (~c) GO TO 103
      a
      GO TO 104
  103 b
  104 CONTINUE
```

CASE i OF (s_1,s_2,...,s_N) The case indexing can be programmed as a computed GO TO statement in Fortran:

```
      GO TO (201,202,...,2NN), i
  201 s1
      GO TO 300
  202 s2
      GO TO 300
      .
      .
      .
  2NN sN
  300 CONTINUE
```

WHILE c DO s

```
  400 IF (~c) GO TO 401
      s
      GO TO 400
  401 CONTINUE
```

REPEAT s UNTIL c

```
  550 s
      IF (~c) GO TO 550
```

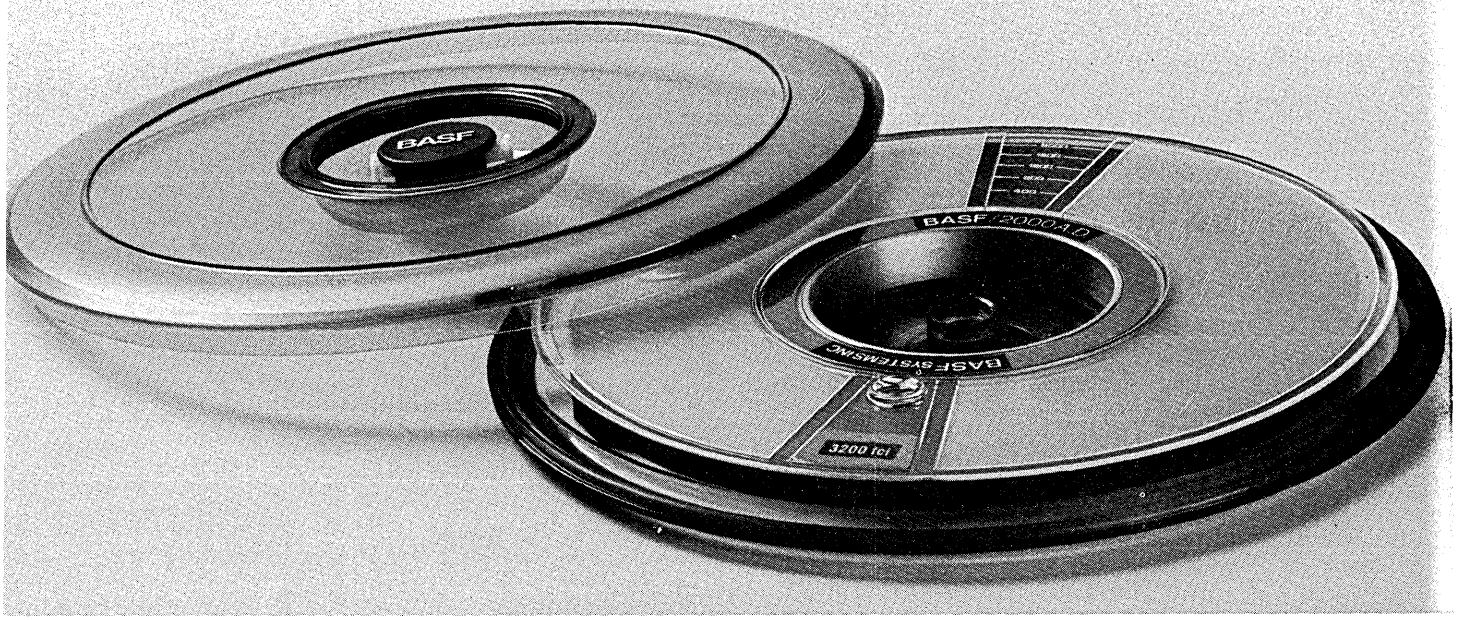
Note that a FORTRAN DO-loop is a special kind of REPEAT statement on IBM and Univac sysems, but a WHILE statement on CDC systems.

The process

With the implementation of the six program constructs, we can produce a structured program in FORTRAN. There are essentially three steps involved: 1) designing the structured program, 2) coding the FORTRAN statements which will implement the program design, and 3) program checkout and maintenance.

Prof. E. W. Dijkstra has provided an excellent writeup on the process of designing structured programs [1]. Program design is top-down, i.e. the programmer begins by designing the overall program, with blocks representing its major computational steps. Specific details of the computations are not included in the top level, but it does specify the relationship between the major computational steps. After the top level has been designed, it's a matter of expanding the blocks to include more and more specific operations, until reaching the level of indi-

If you think all premium computer tapes are alike take a closer look at BASF 2000/A.D.



Because all premium computer tapes are 100% certified and meet industry standards, you might think they're all equal. They aren't. The important difference is the margin by which a manufacturer's standards *exceed* industry standards. It's this extra margin that allows no margin for errors. Let's look at a few superior points of BASF 2000/A.D. computer tape:

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Another hassle, even with premium tapes, is edge waviness. This causes intermittent reading and writing errors. Dynamic conditions during tape transport can occasionally compensate for the waviness, so it's a tough job to track down. Again, our double-cut slitting technique keeps 2000/A.D. edges absolutely straight and symmetrical.

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Uniform tape width is essential, in order to avoid dynamic skew errors. According to industry standards, a width tolerance of ±.002″ is acceptable. We peg our 2000/A.D. standard at ±.001″. It's a small detail, but it could eliminate a few 3:00 a.m. debugging sessions.

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Hard surface

Head wear is inevitable, but it shouldn't be excessive. That's why we developed a finishing operation that gives 2000/A.D. a harder, smoother surface than anyone else's. It's a lot kinder to your tape head, and keeps your maintenance time to a minimum.

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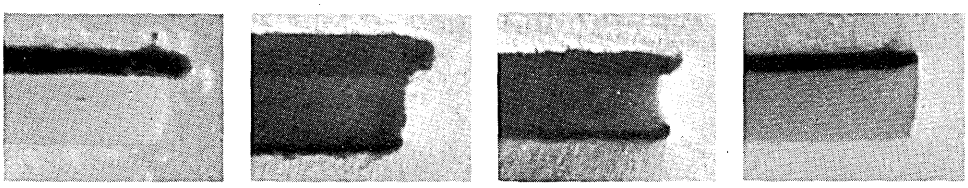

BRAND A BRAND B BRAND C BASF

CIRCLE 7 ON READER CARD

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

BASF

vidual FORTRAN statements. A characteristic of top-down program design is that you don't have to make commitments to any particular data representation until reaching the lower levels (although it is a good idea to think about possible data representations while you're designing the program). The whole subject of program design deserves a thorough treatment, and Dijkstra's "Notes on Structured Programming" (included in Ref. 1) is recommended as a good place to begin.

A natural question is how one should write down the design of a structured program. The program constructs themselves, plus simple statements, may be thought of as an Idealized Programming Language. Let's call it IPL. This language is convenient for writing down the overall design of a program, since it clearly shows how the program is structured. THERM (Fig. 2) is an example of a top level program design in IPL. In this example, BEGIN . . . END is used to show the limits of blocks built by concatenation. The subroutines INPT1, INPT2, CVGHB, HTRANS, and TGRAPH are major computational processes—they are indicated by writing their names in the program constructs which include them. THERM is used for temperature and heat flow prediction. The FORTRAN version, coded directly from this design, is shown in Fig. 3.

```
BEGIN
LOGICAL DONE, INIT, CONVRG, XIENT, PLOTD;
INTEGER LOCASE;
COMMON LOCASE, DONE, INIT, CONVRG, XIENT, PLOTD;
LOCASE ← 0;
DONE ← FALSE;
INIT ← TRUE;
PLOTD ← FALSE;
REPEAT
  BEGIN
  LOCASE ← LOCASE+1;
  IF (INIT) THEN
    BEGIN
    INPT1;
    INIT ← FALSE
    END
  ELSE INPT2;
  IF CONVRG) DO CVGHB;
  IF XIENT) DO HTRANS;
  IF (PLOTD) DO TGRAPH;
  END
UNTIL DONE;
END.
```

Fig. 2. THERM, a structured program in IPL (an idealized structured programming language).

```
      LOGICAL DONE, INIT, CONVRG, XIENT, PLOTD
      INTEGER LOCASE
      COMMON LOCASE, DONE, INIT, CONVRG, XIENT, PLOTD
      LOCASE = 0
      DONE = .FALSE.
      INIT = .TRUE.
      PLOTD = .FALSE.
C
    1 LOCASE = LOCASE+1
      IF (.NOT. INIT) GO TO 2
C
C       CALL INPT2
        INIT = .FALSE.
C
      GO TO 3
    2 CONTINUE
C
C       CALL INPT2
C
    3 CONTINUE
      IF (CONVRG) CALL CVGHB
      IF (XIENT) CALL HTRANS
      IF (PLOTD) CALL TGRAPH
      IF (.NOT. DONE) GO TO 1
C
      STOP
      END
```

Fig. 3. THERM, in FORTRAN.

When coding a structured program in FORTRAN, the programmer himself acts as a compiler. The programmer compiles a program in the process of translating it from the idealized language (which the machine can't execute) into FORTRAN (which the machine can use to generate an executable program). This is a straightforward process of implementing the program constructs by coding simple statements which are acceptable to the FORTRAN compiler. The only danger is that you'll be tempted to "improve" the program by changing things around slightly as you go along. Resist.

Some steps should be taken to improve the appearance of the FORTRAN listing so that it will be easy for another person to understand the structure of the program. One way is to punch the IPL version on cards, with a "C" in column 1, and include them as comments in the FORTRAN deck. Blocks built by concatenation can be shown by indenting their margins and using blank comment cards for vertical separation (as in Fig. 3). Statement numbers should be in ascending order. In general, one can't tell from a FORTRAN listing whether or not the program is structured, so it's very important to show the structure of the program by means of comment cards, spacing, or anything else that will clarify its structure to another programmer who looks at the listing.

The design of a structured program is machine-independent, but it's the implementation in FORTRAN that determines whether the program is portable from one computer system to another. To make the program portable, use simple statements which are common to the major FORTRAN compilers (or at least to the ones you anticipate using). "FORTRAN language extensions" should be avoided; if unavoidable they should be well annotated as to what each statement does and why it's being used. ANSI standard FORTRAN is largely machine-independent.

It's not unusual to spend 45% of a large programming effort in testing and debugging [3]. If a structured program has been properly designed, most of the bugs will be in the FORTRAN coding. They will tend to be localized, because a structured program is highly modular, and the flow of control in

a structured program parallels the listing—i.e., if you get to point P in the listing, then the program has done what comes before P and it hasn't done what comes after. This is generally untrue of nonstructured programs.

The payoff from structured programming really shows up in checkout and program maintenance. First, a structured program is comprehensible because there is a limit to how much information one can assimilate at a given time. The information contained in each of the program constructs is well within this limit, but a nonstructured program of any appreciable size exceeds it. Since a structured program is built from modules which are comprehensible, another programmer can look at the program and learn it, one module at a time. If the program is changed in such a way that it remains structured, then the change will be localized—it won't have the kind of side effects that occur in distant parts of a nonstructured program. And finally, if a structured program is correct and not very long, there is some hope of proving its correctness [1,2,4].

Structured programming can be thought of as a systematization of such ideas as "modularity" and "top-down program design," which have generally belonged to computer folklore. It has been proven that any program with one entry point and one exit can be written using concatenation, IF c THEN a ELSE b, and WHILE c DO s. Large projects involving structured programming have reported very favorable results [2,5], subject to proper management and otherwise professional standards.

The FORTRAN language has become quite out of fashion with the Academy, yet it is used predominantly in industry for most engineering and scientific applications. It isn't likely to be replaced in the near future. The reasons for this are mostly economic: a whole generation of industrial programmers have been trained exclusively in FORTRAN, and all of their programming (mostly non-structured) is in FORTRAN. Their training and programming represent a sizable investment, which management is unlikely to give up until they can be sold something better. There are better programming languages, in whatever sense one wishes to compare them, but it would take general agreement and active promotion by the computer industry to make another language the standard for applications programming. Eventually this will happen. In the meantime there is definitely a need for structured programming, and it can be done in FORTRAN. □

Mr. Tenny is a computer programming counselor at Lockheed Missiles & Space Co.; his work involves consulting, programming, teaching and writing.

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news in perspective

Bankers are moving into electronic funds transfer systems (EFTS) faster than once was thought, page 116. But their concern is not with the whole concept—only with implementing "one part at a time," said a speaker at the recent Operations and Automation Conference of the American Bankers Assn. There is pressure from everywhere to change banking—and dp is at the heart of it . . .

The Honeywell-Cambridge Memories litigation over add-on memories raises the question of whether—and how—non-IBM mainframers resist the intrusion of independent peripheral manufacturers hooking on compatible devices, page 120 . . .

What happened when management and programming personnel were forced to man the computers at Stanford University? The "temporary help" during a strike at the university learned a lot and remedied a number of operations problems they never knew existed, page 124 . . .

Paper shortages and rising prices may make 1974 a big year for those who sell computer output microfilm systems. But users of COM recording systems think there's a lot to be desired in the software and standards offered by the vendors, according to a report on last spring's National Microfilm Assn. conference in Boston, page 128 . . .

The last of the holdouts—a minicomputer maker who wouldn't offer end user systems—is now going into the end-user business, page 131 . . .

It comes up every time IBM has an annual meeting: how is IBM coexisting with apartheid in its South Africa operations? Here's a look at how IBM deals with—and tries to downplay—its problems there, page 133.

Banking

Change: It's Seen Coming Rapidly and Radically

Bankers "Goaded by Government, Non-Bank Competitors"

"Banking is changing rapidly and radically. Data processing is at the heart of it and it's exciting."

One long-time bank data processor explains why he chose, for the first time, to attend an Operations and Automation Conference of the American Bankers Assn. Could be that others who felt the same way helped boost attendance at the conference, held in late May in San Francisco, to a record 2112. Sixty-two exhibitors crowded into an exhibit hall that really wasn't big enough for them, attesting to the fact that vendors of bank automation products are ready, anxious, and able to help the change along.

The overriding feeling that emerged from the conference was one of pressure for change. "We are being goaded into change by government and non-bank competitors," said Jay Welman, Jr., chairman, ABA Operations/Automation Div. and senior vice president, First National Bank of Minneapolis. "Some day we'll look back on the last three years as the good old times of stability. We're seeing the tip of the largest iceberg of change in our industry."

The unlikely name Hinky Dinky (unlikely for a banking conference anyway) came up a lot when pressures to change were discussed. Welman didn't mention Hinky Dinky by name, just as "a couple of grocery stores in Nebraska."

Hinky Dinky is a Nebraska supermarket chain. Last January, two Hinky Dinky stores in Lincoln were outfitted with IBM 2730 terminals—selling at $500 apiece—linked by phone line to First Federal Savings & Loan Assn. of Lincoln. Via the terminals, a Hinky Dinky customer could register a deposit or withdrawal on his savings account by giving a store employee his magnetically encoded plastic card.

Accounts and lawsuits

The experiment brought the Nebraska S&L 672 new accounts and three lawsuits and, while the terminals are still in the supermarkets, they are idle, pending outcome of the suits. One suit, filed by the state attorney general, alleging such illegal activities as banking without a license, was set for hearing July 8. A second was filed by five commercial banks which sought, and got (under what John Dean, First Federal's executive vice president calls, a "freak statute") a restraining order pending hearing on a temporary injunction. This suit's allegations were similar to those in the suit filed by the attorney general. It had not been set for trial at writing.

The third lawsuit was filed by 11 banks and savings and loan organizations and was, Dean says, funded by Nebraskans for Independent Banking, the savings & loan organizations involved, and the National Association for Bank Supervisors. In addition to First Federal, Hinky Dinky and the Federal Home Loan Bank Board are named as defendants in this suit which attacks the validity of an FHLBB temporary order allowing the S & L and Hinky Dinky to conduct their experiment. "I had no idea this (the experiment) would draw so much blood," said Dean who hinted he'd soon be filing some kind of suit himself charging restraint of trade. "It's a hell of a note when Savings and Loans and Commercial Banks get in bed together."

Dale Reistad, president of Payment Systems, Inc., told a session at the banking conference that he believes the significance of the Hinky Dinky experiment is not in the litigation but in "what has happened, as a result, to the commercial banking industry in the Mid-West. They've had to dramatically re-think their entire concept of branch banking. You can't stop technology. Let's not stop John Dean. Let's do what he's doing."

Positive reaction

He cited as an example of a positive reaction to Hinky Dinky by mid-western bankers, the fact that the Kansas Bankers Assn. has set aside $75,000 for Electronics Funds Transfer Systems (EFTS) research.

Reistad said he doesn't think the major thrust toward EFTS is going to

occur in the big cities. "There's too much COPE (Committee on Paperless Entries) and SCOPE (Special Committee on Paperless Entries) and not enough point-of-sale." He urged bankers to "bring a retailer along to your next conference and after that bring your state legislators."

Another example of competitive pressure begetting action was offered by Vernon Wilson of The City National Bank of Tuscaloosa, Tuscaloosa, Ala. He was part of a panel discussing the use of on-line cash dispensers and automated tellers. His bank last November installed a Burroughs cash dispenser in the outside wall of a bank located in a mall, on-line to a B2700. Wilson said usage was small initially but had "picked up substantially in recent weeks." The bank has three additional cash dispensers on order. Why was the first one installed? "A new bank moved into town and started Saturday banking."

Like Wilson, the other panelists on on-line cash dispensers cited competition as one reason for their use. Another common reason offered was that they "get into EFTS efforts."

Ralph Wagner, Moll Associates, Inc., Boston, Mass., who chaired the session, said it should have been called, "Robot Banking Comes of Age." He noted this was the third time he had chaired such a session and "each time the crowd gets a little bit bigger. Robot banking is one aspect of EFTS that gets a lot of notoriety because of the technology and expense involved."

One part at a time

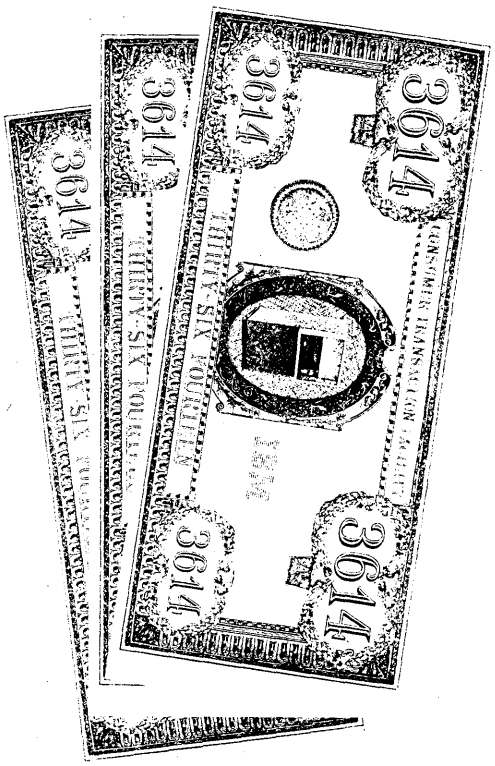
And bankers today appear to be more concerned with the various aspects of EFTS rather than with the total concept. George L. Whyel, president elect of the ABA, told a May 22 Utah Bankers Convention, "We need to stop evaluating the pros and cons of electronic transfers as a complete system and start implementing one part at a time. The entire system certainly isn't going to be dropped into place overnight, superimposing itself on the American public, retailers, bankers, and the government."

The exhibit floor at the Operations and Automation conference contained an assortment of goodies for that "one part at a time" implementation that would gladden the hearts of those who have stood in long, slow-moving lines in branch banks, watching tellers sauntering from their windows, to the card files, to the current balance listings, and back again.

There were similarities among the assortment of on-line teller terminals and cash dispenser displayed and there were differences including the price tags.

NCR was calling its newest teller terminal, the NCR 279, "the smallest on-line universal financial terminal offered in the industry." The terminal can be operated on-line, off-line, for data-collection, or for manual re-entry. It's of modular design so field engineers can simply replace a module. Modules include printed circuit boards, the display unit, keyboard printer, and power supply. Two circuit boards contain the read-only memory, input-output logic, and miscellaneous logic. The keyboard module includes three separate units—function keys, numeric data entry keys, and application keys. The terminal printer operates at more than 35 cps. Other features include a locked journal tape; supervisor-controlled totals clearing; consecutive transaction numbers; a printed tape for all transactions; and a 10-digit numeric display. Optional features include an integrated magnetic-stripe cash/credit card reader; a magnetic tape cassette for data collection; and a remote 10-key touchtone pad.

"Many banks are still using manual teller systems because they have been unable to afford conventional mechanized systems," said William F. Walsh, NCR vice president, Financial Systems Marketing. The new 279 starts at $2,375 for the off-line model. It is compatible with NCR's older teller terminals, the 270 and the 275, and, said Walsh, "you don't have to have a Century computer."



IBM's FUNNY MONEY
Money talks when you're selling bankers—even if in the form of these bills demonstrating IBM's 3614 auto teller

NCR's other new offering at the bankers' exhibit was its 770 programmable, self-service terminal (see accompanying story) which can serve as a cash dispenser, an automatic teller, or an EFTS terminal. It's priced from $18,000 to $33,000 and first deliveries are scheduled for this fall. Units have been in use as 24-hour automated tellers by the NCR Credit Union since last April 1.

IBM's automated teller, the 3614, whose introduction last fall was overshadowed by the simultaneous introduction of the 3660 point-of-sale system for supermarkets, was there, spewing out funny money for anyone who took the time to watch a demonstration. In actual use, the 3614 stores old or new real bills. It can dispense as many as 20 during a single transaction in denominations of $5, $10, or $20. The 3614's price ranges are $545/month to $745 on extended term plan; $640/month to $876 on standard rental; and $20,460 to $31,810 purchase price.

Two enhancements to the 3614, announced last February, also were demonstrated. A deposit/receipt printer feature is available for $70/month on extended term plan; for $82/month on standard rental; and $2400 purchase price. Prices on a transaction statement printer are $95/month on extended term; $112/month on standard rental; and $3300 purchase price.

The 3614 is a part of what IBM calls its 3600 Finance Communications System which also includes keyboard displays, document printers, passbook printers, an administrative printer, and a communications controller. A configuration for a commercial bank consisting of six 3604 keyboard display terminals, one 3610 document printer, two 3612 passbook and document printers, a lobby version 3614, one 3618 administrative line printer, and one 3601 financial communications controller, would go for $2295/month on extended term plan, $2703/month on standard rental, and $95,400 purchase price.

A study conducted for IBM by consultants Bruce Payne & Associates indicated that use of a teller terminal portion of the 3600 system could save from 16% to 45% of the time normally spent by a customer at a teller window, with 25% being the average savings.

Interesting to bankers in the IBM exhibit, because most agree that checks are here to stay even with the evolution of EFTS, was the 3890 document processor with microfilm capability that combines check sorting and record keeping operations into a single, high speed process. This unit, with 18 sorting pockets (fewer or more can be had) goes for $7600/month on extended term.

news in perspective

$8931/month on standard rental, and for $356,700 purchase price.

Burroughs was there with two teller terminals, the TT 100 which operates on-line and the TR 100 which operates off-line and offers a data communications option. Sale prices for the TT systems range from $2,940 to $3,935 and for the TR, from $1,595 to $2,995.

Bunker Ramo's Information System Div., which lays claim to having pioneered the first on-line teller systems in the early 1960's, introduced Bank Control System 90 which consists of crt data terminals with keyboards for data entry and retrieval; minicomputers for branch data processing and controlling data traffic between each branch and the central computer site; high speed printers; validation/journal printers; credit card readers; and mini-keysets for ID entry by depositers during a transaction. The company estimates that a typical branch office with eight teller positions could be outfitted for about $1500.

A crowd pleaser, even though it didn't do much of anything, was a Rube Goldberg type computer which looked as if it had been made from tinker toys and was full of blinking lights and buzzing and/or whirring things. In the booth of Management Science America, Inc., Atlanta, Ga. software firm, it illustrated the theme, "you wouldn't build your own computer so why build your own software."

A far cry from this crude but interesting mechanism were the discussions in the Automated Clearing House Workshops where it became evident that interregional EFTS is being goaded by pressures and is moving ahead.

Ready and waiting

The National Automated Clearing House Assn., to facilitate interregional paperless transfers, formally came into being June 24. It would begin activity, as one ABA speaker put it, "as soon as somebody has something to send to somebody else." Initially the somebodies would have to be in California or Georgia where ACH's already were operating but two more, in the Twin Cities and New England, were due to become operational July 1.

Welman noted during one workshop that it is "scary" that the government had gotten ahead of the banking industry in thinking interregional paperless exchanges. He particularly feared an Air Force pilot project set for the last quarter of 1974 which would have included Denver as an exchange point. Denver has no ACH. Since the conference, the Air Force pilot was delayed until Denver does have one; but a similar project by the Social Security Administration still is set for early next year.

On another level, Arthur Miller, professor of law, Harvard Law School, warned conferees of another kind of potential government pressure. He was talking about privacy and unregulated data collection. He urged the bankers to exercise self regulation. "If you don't do it there's going to be litigation and legislation to force it."

He offered the bankers "Miller's platitudes" which said essentially: you have a duty to the people who lie behind the files you maintain to make a best effort to notify them if any agency of the government seeks access; it is time to start re-thinking the kinds of information you are collecting; think high security; start bringing customers and employees into the inner circle of decisions by telling them that you're creating an information profile on them that others might use; and think electronic erasers; old data often does more harm than good.

—Edith Myers

(Continued on page 120)

Barclays Favoring NCR Bank Terminal

NCR Corp. is making a major play for international attention with the announcement this Spring of the model 770 self-service terminal, unveiled simultaneously in San Francisco and London. Participating in the London announcement was the U.K.'s largest bank, Barclays, which has purchased six of the new machines to evaluate in its systems department and a few selected locations.

Barclays, which has been IBM territory, with occasional incursions from Burroughs, played a major part in the design of the NCR terminal. Although IBM announced a similar device in the U.S. and pushed it energetically at Barclays, the bank has not purchased any other models besides the NCR 770 for evaluation. Barclays, however, signed a $11.7 million contract with IBM for a check clearing system at Barclays.

Barclays explained that the NCR terminal requires no changes to the bank's central computers—all IBM. It is fancier than the current breed of cash dispensers in the U.K. Although it is a simple mechanism—as easy to replenish as a candy machine with loose banknotes laid in two hoppers at the back—it also is an intelligent model, with 8K bytes of firmware and 2K bytes available to the bank's programmers. Interruptions in the phone service are covered by cassette recorders in the bank, so limited service can continue to customers offline even when the central computers are out of touch.

NO TELLER
NCR's 770 self-service banking terminal

NCR's largest factory outside the U.S., at Dundee in Scotland, will be producing the 770 for European customers, with delivery beginning in mid-'75, about nine months after U.S. shipments begin.

NCR seems to believe there is a market for the self-service bank terminal almost as broad as the point-of-sale retail market. However, with prices running from $20,000 to $47,000 in the U.K., European banks may be more slow to offer added service to their customers than their counterparts in the U.S. In Europe such services as cash-dispensing and check-cashing have so far been free, while a number of U.S. banks are charging for such conveniences.

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news in perspective

Peripherals

Same Story—Only the Names Have Been Changed

Garland Corp., in Brockton, Mass., is an apparel manufacturer which uses a Honeywell 2040A system with 196K bytes of memory, an assortment of peripherals, and 10 terminals. It runs multiple partitions on the purchased cpu and uses the Honeywell-marketed TOTAL data base system (developed by CINCOM), handling all data on its operation from production to shipping and receiving. Data processing manager Charles Jaeger is the chairman of the TOTAL special interest group of the Honeywell Users Association, a group which contains about 30-40 TOTAL customers. The Garland story has been presented to the association. Garland considers itself a showcase installation for Honeywell.

Garland also felt sophisticated enough to be a mixed shop, becoming the test site for the first Cambridge add-on memory for the Honeywell 200/2000 series. The savings of "thousands" was to be put toward system upgrade, not an unreasonable maneuver for a cost-conscious user. It notified Honeywell of its intentions and Honeywell agreed to inspect the memory at Garland's expense. Within about three months, Garland was caught in the middle of a legal battle between Honeywell and Cambridge. Judging by the Cambridge complaint filed on April 30 and Honeywell's answer May 1, the user was yanked around like a puppet.

Why should a bright showcase for Honeywell suddenly become a battered showcase for a legal fight against foreign memory attachments? It is fair to state that Honeywell's action in this specific case is a general argument about foreign or third-party memory, and perhaps about any attachments that "alter" Honeywell hardware. Asked for its policy in regard to independently supplied peripherals and memory, Honeywell stated that it was "inappropriate to comment because the matter is in litigation." Asked whether all such suppliers will have to wait until the case is over to deal with Honeywell, the spokesman came back with assurances that the firm will "talk to" any independent vendor and will negotiate on a "case-by-case basis."

The alterations

Honeywell gave several legal answers to Cambridge's legal filing, not the least of which is that it "requested certain interface specifications and maintenance documentation with which to prepare test procedures. That necessary documentation has never been received by defendant." Thus it couldn't make its inspection. Honeywell further denies that it told Garland it would provide maintenance service on a "best efforts" basis until a test or evaluation was made. Another argument concerns a Cambridge claim in referring to the Honeywell maintenance agreement: "Such agreement nowhere provides that the installation of non-HIS equipment, such as the CMI add-on memory, would constitute a breach." Honeywell readily admits to the truth of that statement except for the clause "such as the CMI add-on memory." A user informed us that the maintenance agreement lists alterations to the Honeywell hardware as cause for default of contract. Honeywell does not state it, but the alteration made to its cpu to accommodate the add-on may be one of its legal arguments.

Cambridge replaces one circuit board, although it has discounted this publicly as "minor" and said that it provides a switch on the memory to allow its effective "disconnection" from the cpu at any time. It also says, and Garland verifies, that it takes 40 minutes to physically plug and unplug the memory.

What Garland went through is a maddening series of events in which Honeywell withdrew maintenance. Cambridge was forced to yank out the memory. Honeywell reinstated maintenance. Cambridge installed the memory. Garland asked for "best efforts" contracts. Honeywell announced maintenance withdrawal after 30 days written notice. Honeywell withdrew maintenance without giving that notice, and finally the troublesome memory was unplugged. Cambridge and Honeywell never talked to each other, it seems.

What user wouldn't shudder at the prospect of going through this nonsense? One can hardly surmise who violated which letter of the law or legal agreement. But it is easy to see why the $12.6 million Cambridge is a threat to $1.2 billion Honeywell Information Systems.

Cambridge is offering memories up to 512K on various models of the 200/2000 series of equipment. While it has not released specific prices, Kevin Dowd, national sales manager, said they are running at about 90% of Honeywell list price for a one-year lease, 80% for two years, 75% for three, and 70% for four years. "Most of the Honeywell systems are getting into multiple partitioning," he noted, requiring larger and larger memory. He wouldn't say just what size that market is, but our own figuring is that if Cambridge could capture just 10% of the 200/2000 series systems installed (about 220 of 2200 systems in the U.S.), adding just 64K in each case, the value of that market is $7-8 million in approximate Cambridge prices.

Extending the life

No mainframer wishes for a situation in which users—purchasers or renters—enter multiple-year leases with a second vendor when it has new lines coming onto the market and trade-in deals to offer purchasers. Honeywell indicated the life expectancy of the 200/2000 series at its press conference by announcing that it will support that equipment's operating system only through 1976. Cambridge's initial offerings are within the natural memory limits set by the mainframer, but it could offer extended memories beyond these limits. This could broaden its markets and extend the life of a user's model 2000. Plans for controlled migration to the HIS Series 60 could be hampered. Also, while no peripheral supplier has made a real attack on the tape and disc drive part of a Honeywell system because of the complexities of the I/O architecture, at least one is interested and would take courage from a Cambridge victory. Clearly, any significant attacks on its customer base would rob Honeywell of some revenues in a period of high development costs.

Considering that Honeywell has less than 10% of the general purpose computer market, is it fair, some Honeywell users have asked, to force them to give any market up to "parasites?" Legally, any product line weakness, be it price or performance, is fair game for competition. The user has a right to competitive choice, whether he wants it or not.

As almost all mainframers, Honeywell has a monopoly in its own market, born of lack of competition for the elements or submarkets of that systems market. Judge A. Sherman Christensen found in the IBM-Telex case that IBM was indeed monopolizing its peripherals submarket(s). Prof. Michael Duggan, legal and computer expert at the Univ. of Texas, thinks this decision will not have "precedent force" in the Honeywell case, but may have "persuasive force." The real question is simply whether Honeywell was "reasonable" or

"unreasonable" in its action, he feels. Reasonable restraint of trade in this case would mean the motive was to preserve costly maintenance resources. Unreasonable would be action with intent to cut off competition; "You don't use your leverage in one market to obtain unfair advantage in another." explains Duggan. Duggan also mused that this case seems to pose a classic legal dilemma: "Do you allow a non-dominant vendor to use anti-competitive means (not violations like price fixing or tie-in sales) in hopes they'll become competitive enough in an IBM-dominated market?" The judge will decide what dilemmas exist.

Whether a user today wants a mixed shop or not, he does not know what opportunities will be available to him tomorrow, or in fact whether the mainframe vendor will be available to him tomorrow, at least with the services now offered. He can protect himself in several ways and one is by incorporating his rights in his contract. DATAMATION author Ted Withington in 1970 urged users to negotiate for the right to make foreign attachments to their own systems. But only IBM users are known to have such contractual rights. The federal government today has a clause in its standard contracts which all mainframers adhere to. Try this on your salesman:

"The Government (user) may make alterations or install attachments to the equipment. The Contractor will be notified of any such alterations or attachments . . . If the Government agrees that such changes substantially increase the cost of maintenance mutually agreeable arrangement for additional maintenance charges shall be made on an individual installation basis, outside the scope of this contract."

Go to the top

There are many ways a vendor may discourage a user or competitor. John Hunter of Delta Resources Inc. in New York notes that his firm has several contracts for full maintenance of Univac (RCA) installations. While he has met opposition from Univac employees "at the local level" in the past, he notes that he has always been able to go to Univac top management to remove roadblocks. He suggests that users, who may be harassed at the local level when they try to bring in a competitive service or hardware, don't realize that they can call Blue Bell (or Armonk or Detroit) and get results.

The Honeywell-Cambridge litigation raises questions about the whole non-IBM mainframe market: did IBM actually settle the issue by settling with Advanced Memory Systems in 1972 when it agreed to maintain its cpu's with foreign cpu-altering memory under certain easily adhered-to conditions? Doesn't the fact that the government demands, and gets, the right to make alterations and attachments to any mainframer hardware get some kind of precedent for the private sector? Apparently, nothing guarantees anything. The dominant supplier had to acquiesce and the dominant user has the advantage of clout.

Most non-IBM mainframers are vague about their company policies toward attachments by peripheral and memory firms. As noted, Honeywell won't comment. Burroughs and NCR couldn't muster an answer, although given two weeks to do so by this reporter. The NCR spokesman said, however, he wasn't sure the firm had ever faced the problem.

OK—but

Univac's spokesman stated, "The customer can add non-Univac equipment as long as the additional equipment does not damage or interfere with the operation or maintenance of the Univac gear, or degrade the performance of the Univac equipment . . . The customer is not to make any alterations to Univac equipment." The spokesman noted Univac is "flexible" on this point.

"Before the customer installs the non-Univac equipment, he should give Univac written notice of what he intends to do. Univac reserves the right to test the equipment, or it may give conditional approval without requiring such testing."

In making the tests, Univac doesn't guarantee the non-Univac equipment in any way including its fitness . . . . If under testing, Univac finds the equipment may cause damage or degradation to the Univac equipment, the customer is not to add the non-Univac equipment."

The customer is responsible for "providing and maintaining the software and special diagnostics," required by the foreign gear, and for "any damage to the Univac equipment caused by" these attachments. Univac is "not liable for property damage as a result of the non-Univac equipment."

Digital Equipment Corp.'s policies were not so specifically stated. They seem to allow attachments without prior notification and "when a field engineer enters a site and discovers foreign equipment, he requests that it be removed before he performs maintenance." It similarly makes no guarantees for the performance of the system with that equipment attached to it. DEC is "open to negotiation" if alterations are made to its equipment, since maintenance is affected.

Not many peripheral and memory makers have entered the non-IBM markets for obvious reasons. The markets are not that big, the prices are often too low to fit under, and/or the system architecture makes the attachment complex. Vendors note that any independent in the IBM market wants to attack only those non-IBM systems that allow them to use their IBM-compatible techniques. When it comes to peripherals, Honeywell, Burroughs, and CDC architectures are not supposed to fit that requirement. "The non-IBM market is a small one, relative to the IBM market," says Graner Thorne of Ampex Corp., "and the successful competitors are those who are there first and who have identified the big users." The big users have the clout with their vendor to take advantage of the price bargains, while smaller users tend to shy away from offending the mainframer and having the maintenance security blanket pulled away.

Storage Technology Corp. has tape drives being installed on Digital Equipment Corp. and Univac equipment. Ampex and Computer Investors Group offer memories for Univac and Digital Equipment Corp. systems, CalComp and Ampex sell disc drives for Univac gear, and Cambridge memories plug into DEC, too. Formation Inc. teams up with IBM-compatible tape, disc and memory suppliers to interface that gear with the aging RCA systems. And numerous other companies seem prepared to interface somebody's peripheral with some mainframer's cpu. An example is Macro Products, which has been interfacing Data Products printers with both Burroughs and Honeywell systems.

"Peripheral Adaptor"

Charles Bozarth, president of the firm, says he has installed 30 Data Products-built printers (1800 lpm) at Burroughs installations. The cost is $36,500 vs. about $60,000 for a comparable printer from Burroughs. He says that the users simply hook his model 470 printers, for which he builds in the interface, through a cable connector. Honeywell, said Bozarth, has required users wanting a Data Products printer to obtain a "peripheral adaptor" from Honeywell. According to Bozarth, at first the adaptor cost $200 a month, but now it has been increased to $410 a month. A Honeywell user told us the purchase price is $16,000. Macro now offers its own model 470 (also DPI-built) for $1285 a month, plus the $410 the user pays for the adaptor—or $1695 a month to the user. Honeywell's competitive product runs $1800/month, so the user is not getting a big price break by going to Macro. Bozarth claims better throughput and print clarity, however, and has managed to install his first system with

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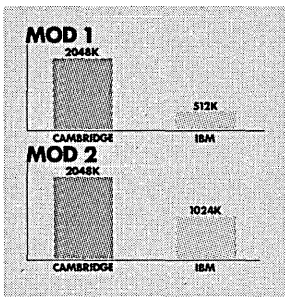

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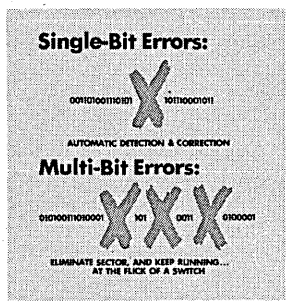

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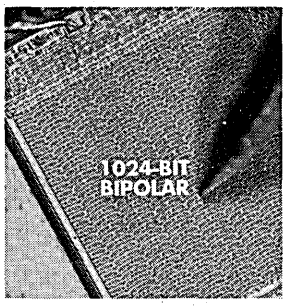

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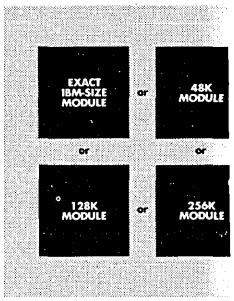

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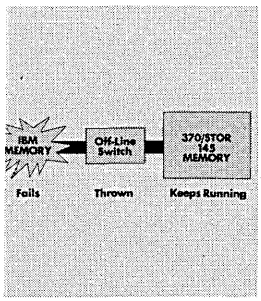

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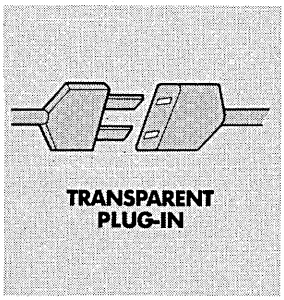

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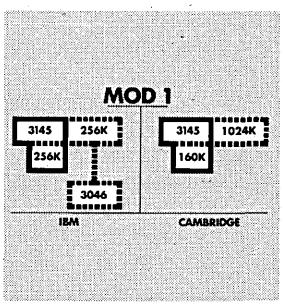

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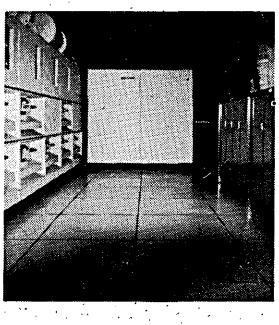

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CIRCLE 81 ON READER CARD

a Honeywell user. Process Computing and Consulting in San Diego. The big thing here is that Honeywell retains some of its revenue base from the customer by requiring the adaptor, described by Bozarth as an "electrical device with a few cards that isolates the printer from the mainframe." This rather reminds observers of the AT&T interface required to connect independent modems to communications lines. (One wondered "if Honeywell has a memory adaptor in the works.")

The criteria for daring among the users seems to be sophistication, self-sufficiency, and general independence from the mainframer. Users dependent on the mainframer for software, services, etc., get a little "squeamish" about mixed installations, according to Phil Ingals of Storage Technology. Storage, he says, is treading an already cleared path by attacking the Univac market. CalComp pioneered with that vendor. Storage also has started into the market through users who have its tape and disc drives on IBM systems and asked STC if it couldn't do the same for Univac equipment. This is a user with "experience, sophistication . . . " and clout.

—Angeline Pantages

Personnel

Strikes Are no Fun But Not All Bad

A recent advertising slogan said: "Try it, you'll like it." At Stanford University, people who manage the campus computer centers recently tried it, didn't necessarily like it, but feel they're better off for the experience.

Last month a three-week strike of employees at Stanford affiliated with the Service Employees International Union (AFL/CIO) ended. It signaled the return to their jobs of some 90 computer and keypunch operators at the Palo Alto, Calif., campus' four main data centers, which in the interim was staffed by management and programming personnel. For the latter, some of whom had little or no previous hands-on experience, it was a time that will long be remembered. Not too surprisingly, however, the "temporary help" discovered and remedied a number of operations problems—and promise to make a significant number of other improvements that stem from their brief stint as computer operators.

"As a result of putting systems programmers and others who previously had been operators together into the machine room, we were able to develop and document some procedures that make better use of systems tools," says William H. Yundt.

Adds Charles R. Dickens, "People who are generally committed to major development projects were put in the direct operations functions and were able to see some things that people in operations can't see . . . As a result, some good results came out of the unfortunate strike situation."

Dickens is director of the Stanford Center for Information Processing (SCIP), which, under a campus-wide reorganization a year ago, placed the four general purpose computer centers under one management. Yundt is SCIP's associate director, Business Services. SCIP manages a hardware complement that consists of a 360/91 and two 370/168s at the Stanford Linear Accelerator Center (SLAC) where the triplex system under ASP 3.1 runs under VS2 Release 1.6; a 360/67 at the academic facility running under OS/MFT, HASP, and a number of internally developed systems; a DOS 370/135 at the Stanford Medical Center; and a DOS 145 and VS 158 at an administrative facility.

Some rookie pinch-hitters

In the strike emergency, Mel Ray, the SCIP associate director for operations, was put in command of the center's management resources. He and his operations managers and supervisors formed the cadre for "overnight" training of the temporary workforce recruited from management and programming ranks.

Personnel were generally assigned to pinch-hit for the striking operations people by their geographical proximity, since there was a distance of anywhere from a mile to 3½ miles between one facility and another, or by system or historical familiarity. Some programmers from the 360/67 center helped run the huge SLAC facility although they had no familiarity with it. "And some of the people had never operated a computer before, had not so much as torn paper from a printer," says Dickens. So the familiarity with the new job ranged from those who had not touched a computer before to those who had designed the system that was running on the machine and thus knew quite intimately the software.

"Some of the people responsible for the creation of the software were put in the position of having to run it," notes Yundt. "Which made it abundantly clear to them that there were holes in the operations documentation and areas for improvements in procedures for running their own systems."

One of the managers of a systems programming group, called upon to operate the 67, found a number of procedural improvements that could be made, including the effective automation of operator instructions. What previously required operator intervention at the console in an MFT/HASP environment was changed so that Stanford's text editing/RJE system (WYLBUR) could sequence operator instructions. She essentially put the procedural instructions on the computer, itself, so the operator could interrogate the computer and find out what he's supposed to do next.

"In general, we did two things," says Dickens. "We put in machine-readable form, and hence accessible from a terminal through WYLBUR, those procedures that are in our manual. This enables an operator, from a terminal, to learn what he's to do. Secondly, we took some of the operator's manual functions and internalized them so that the computer could do them. It should make it much easier to run the computer over the long haul."

Learned a lot

Dickens says it took only a day or two of running the computer for them to realize there were a lot of things that needed doing. "Our learning curve was very steep," he says. "Ninety percent of what we learned was apparent in the first three or four days."

The experience, he adds, leads him to the conclusion that computer center management should periodically get the people who are doing development work, who are making major changes to the operating system or developing major applications, to run their own work. It would allow them—indeed, force them—to see what the human interface really looks like. He says they would be able to spot most problems after only a day or two of pushing buttons, mounting and dismounting tapes. But he also says this brief exposure should not occur more than, say, once or twice a year, depending on the amount of development going on in the system. If it occurs too frequently, the development personnel will adapt themselves to the system, rather than

getting the system to adapt to the people.

"People who run these machines, over the years, have learned to avoid the pitfalls," he explains. "That's why the periodicity of bringing people into the operations world should be rather long—long enough for them to have forgotten what the pitfalls are."

According to Yundt, this is a prime opportunity for management personnel to stay abreast of the technology while also getting a better feel for current operational problems. Yundt, who hadn't operated a computer since the days of the IBM 7094, mentions the tendency of people to become technologically obsolete, a position being advanced by social/behavioral scientist Paul Armer. Armer, who was formerly director of the Stanford Computation Center, hired Yundt.

He's up to date

"The experience tended to help bring me up-to-date," says Yundt. "I don't know if a little knowledge is dangerous, but it gave me a little more knowledge than I had. And as a result of that, I'm able to have better control over the work I normally have my staff do." This is with respect to the computer accounting systems and the systems that account for machine resources. He explains that he previously was aware of problems from the standpoint of systems maintenance and those on the programming side. But now he's more aware of how jobs are run by operators, what resources they demand, in what order of importance, and where problems might occur as a result of operations-type problems.

Dickens relates problems experienced with the ASP system, where they're running the 91 and two 168s as one system. When there's a hardware failure or systems crash, it's extremely difficult to bring parts of the system back up. Even when you apparently have the system back up successfully, the system in no way can tell you, for example, that some of its internal queues are fouled up. And four hours later it'll crash again because ASP has not cleaned itself up properly. "So there's a need to document much more carefully for operations people. Secondly, we're going to put in some kind of operator control language that is more natural, more consistent."

He explains that in running ASP on the multiprocessor triplex system, the operator is faced with the problem of having to talk to ASP, to VS2, and to MVT on the 91. If he wants to ask a question, such as the location of certain data sets, he must talk to MVT or to VS. So they want to place a shield in front of all that, obviating the necessity of the operator having to worry whether he's talking to a specific operating system. "He should be free to express himself in a simple manner without regard to a particular format of a particular system."

"That's something we knew of in advance," Dickens adds. "But when you have to run the machines yourself and you're responsible for development, you get a much better feel for what you must do and you have an incentive to move much faster. Our experiences have given us the impetus to implement these operator interfaces in a better way. Primarily we're forced to overcome a lot of problems that IBM has not managed to attack."

Night rates

At one of Stanford's open-shop facilities, there were times when the machine would be idle in the evening. Users submitting jobs specify whether they want a short turnaround, can even call for an evening run or a late night run, and are charged accordingly. In the evening, frequently, jobs are queued to run on the night shift. But user-initiated jobs in the queue in the evening couldn't be released to run, even though the machine

STANFORD'S RAY AND DICKENS
"Our learning curve was very steep."

was idle. Consequently a new function was placed into HASP, allowing the operator to release a job and have the charge to the customer based on the lower night rate requested by the user.

In addition to things that system programmers and programmer-analysts could do to change the operating system or their own applications programs, making things easier to run, there were also other improvements made. One is in tightening certain standards. It was found, for example, that the operator can have a devil of a time getting forms aligned. So a special forms mark, making alignment easier, has been added. They've also begun enforcing a tape labeling standard about which they've been lax until now.

"It turns out that when you have a very heavy tape mount situation, such as we have at SLAC where we mount hundreds of tapes a day, the nonlabeled tapes and nonstandard labels cause all kinds of problems. These problems, when you're mounting or dismounting tapes, increase the amount of work you have to do. We knew about this, but never really appreciated it. So now we want to enforce tape labeling standards."

Dickens also relates an experience Mel Ray had in the machine room, discovering it was impossible to see the printer from the operator's console. Within two or three days, that was remedied. "That's another example of management knowing there was a problem but not knowing how important the problem was," he says.

Not all problems spotted have been remedied. Says Dickens, "We have enough work for the next nine or 12 months. It'll take that long to correct all the problems we've identified. That's when it's time to go back in and do it again."

Nor were all the problems so serious. Yundt, relaxing a bit after the experience, says they were able to demonstrate that Murphy's Law is still operative. By placing untrained people in those positions, they were able to test just about everything that could go wrong. He tells of how he arrived the first day at his operation assignment and, in pressing various buttons, managed to push the silent burglar alarm. It immediately brought the police to the computer center. "We managed to test a number of emergency and recovery procedures," he says with deliberate understatement.

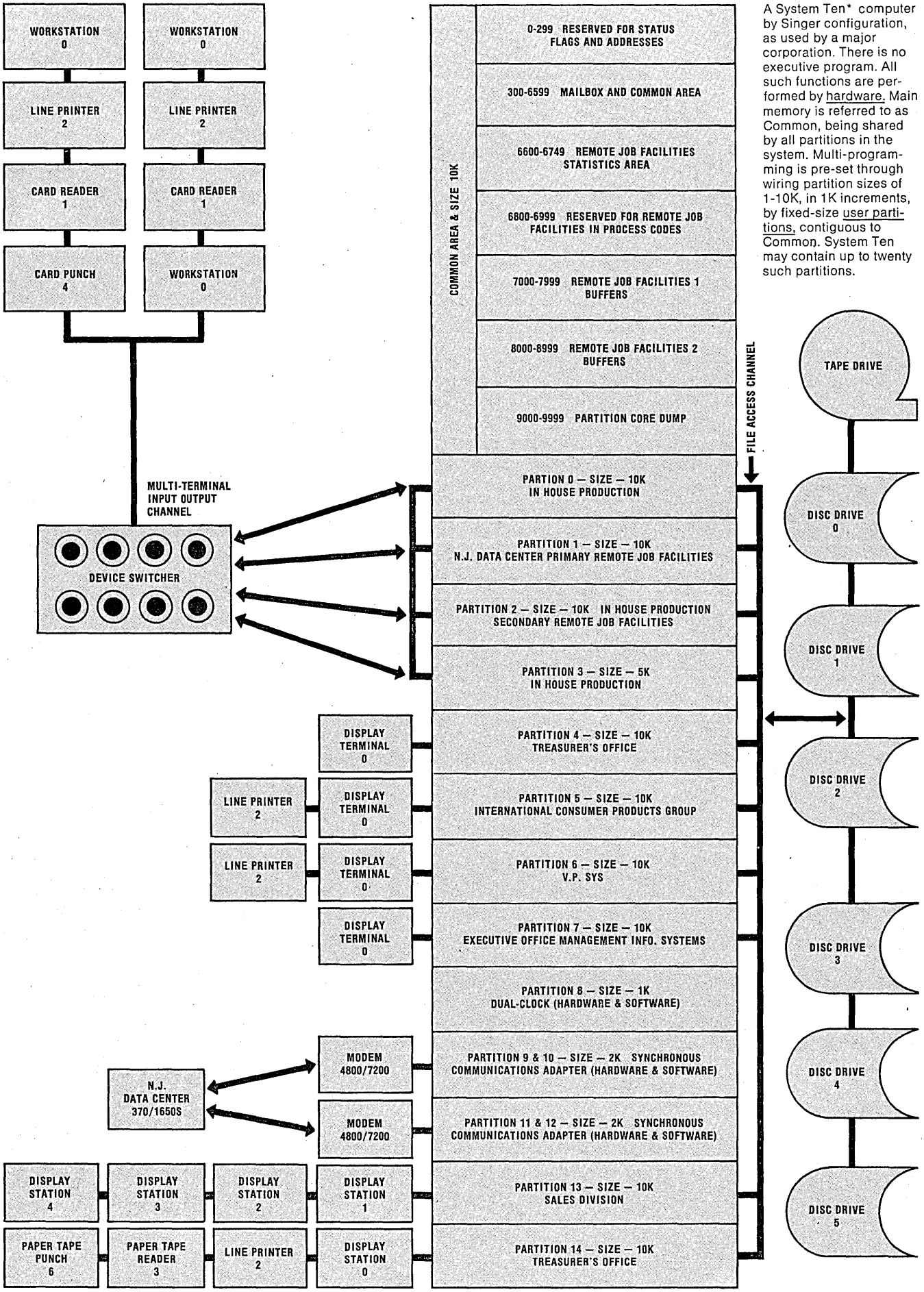
Still, despite the steps now being taken to improve the integrity and security of files, which were found to be vulnerable, and despite the reduction of red tape where that was found to be unnecessary, the strike period was difficult. Some urgent projects were delayed by it.

"I think one thing that in general was good about the strike was that it gave a lot of us a deep and sincere appreciation for the job that operations does in a very low-key fashion," says Yundt. "That is, we expect and have become accustomed to a level of service from operations without really understanding the problems and logistics, the procedural problems, problems in incomplete documentation or documentation that's outdated because we've given priorities to future development. The absence of those trained operators made us more aware of the complexity of the job."

—Edward K. Yasaki

(Continued on page 128)

SYSTEM TEN CONFIGURATION (110K)



A System Ten* computer by Singer configuration, as used by a major corporation. There is no executive program. All such functions are performed by hardware. Main memory is referred to as Common, being shared by all partitions in the system. Multi-programming is pre-set through wiring partition sizes of 1-10K, in 1K increments, by fixed-size user partitions, contiguous to Common. System Ten may contain up to twenty such partitions.

SYSTEM TEN BY SINGER

A system with up to 110,000 characters of memory on-line disc storage, magnetic tape, and up to 200-user multi-programming capability, all at a remarkable low price. Astonishing? Not at all. It is System Ten* computer by Singer.

System Ten is unique in that it is a fixed-partition, multi-programming system that does not need a large and elaborate executive program.

Instead, all executive functions are performed by the hardware.

System Ten provides fixed partition multi-programming: each program is assigned a fixed-sized, contiguous area of main memory referred to as a user partition.

System Ten can handle up to twenty such partitions.

Unlike other multi-programming systems, System Ten has an area of main memory referred to as Common, which is shared by all programs in the system. This makes it possible for otherwise independent programs to exchange information at main memory speeds and to share common subroutines.

Each partition's control of the processor is hardware-monitored through a round-robin time-slicing priority system.

Core memory can be divided into a total of twenty fixed partitions, each holding one program at a time, and serviced by a single I/O channel, to which up to ten peripheral devices operating at up to 1500 characters per second may be connected.

Multi-programming with hardware instead of software has some big advantages. It is far less costly than an expensive, core-consuming, software operating system. Operating in conjunction with the hardwired operating system is data management software: disc management facility (DMF). Its functions include task selection, priority assignment, I/O supervision, and interrupt handling. Another obvious advantage is that the total memory capacity is always available for the programs necessary to the system's application.

The hardware operating system allocates the processor to each memory partition in turn.

Despite its power and versatility, System Ten makes fewer demands on your programmers and service staffs. For instance, I/O supervision and interrogation handling are part of the hardwired system design. This relieves programmers of handling I/O completion tasks. Since the number and size of the partitions are plugboard-controlled, field engineers can make changes merely by changing the pins in the plugboards. The simplicity is also carried over into day-to-day operations. System Ten is ideal for remote locations. No technical people are needed to operate it, or even oversee it.

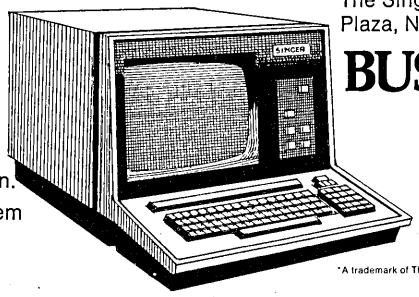
VERSATILITY IN PERIPHERALS

System Ten in a central location may have a host of peripherals in remote areas. Each user partition has one I/O channel. Up to ten I/O devices can be on line with the system per partition depending upon the I/O device buffering characteristics.

And you have a wide variety of I/O devices to choose from. User-oriented terminals, such as work-stations and CRTs. Communication interfaces directly into partitions. Low-speed I/Os, such as card readers and printers. High speed I/Os, such as magnetic tape drives, disc drives, on the file access channel (FAC).

No matter how many devices are included in the system, the large on-line data base is accessible to all partitions.

That is System Ten by Singer. But that is far from the whole story. We would like to share with you case histories, technical reports, and price/performance analyses. Contact your nearest Singer Business Machines representative. Or write: The Singer Company, Business Machines Division, 30 Rockefeller Plaza, New York, N.Y. 10020.



BUSINESS MACHINES BY SINGER

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news in perspective

Microfilm

User Clout Needed For COM Standards

The National Microfilm Association Conference held this year in Boston may be remembered as the time and place when COM—Computer Output Microfilm, or, more generally, the interfacing of microfilm with computers—became generally recognized by the microform industry as a mainstay of the business. The skyrocketing cost of printout paper and cards and the inconvenience of handling and transporting large amounts of data in the bulky 8-pica size generated by impact printers has left, or so the exhibitors at the conference felt, the $100 million spent by computer users each year on paper up for grabs.

The organizers of the conference set up a separate program, devoted entirely to COM-related topics such as business graphics and COM software, which formed a mini-conference of its own. The NMA also announced that it was forming its first division, CIP, or Computer Image Processing, which is intended to "represent all areas of COM in one organization." W.H. Libby of 3M said that the industry felt that a third of all the COM systems in the country were installed last year, and exhibitors throughout the hall seemed giddy over the prospects for this one.

Clout for standards

The market possibilities opening up have intensified and highlighted the classic tension between a desire for the convenience of standardization by users and the competitive edge promised to producers by the very latest technology. Throughout the conference user-oriented speakers lamented the proliferation of reduction ratios, film widths, and format techniques. There are 16 different companies putting out 30 different COM systems, the separate components of which, the complaint ran, have far too low a degree of interchangeability. The Chairman of the NMA's Committee on Standards, John Livsey, Microform Program Manager of the U.S. Government Printing Office, reported to the conference that while his committee had been in existence for three years they had not yet managed to get industry agreement on any standards for COM software.

"Standards follow industry," he said.

quoting the NMA's technical director. "they cannot lead it." and he suggested to the members that they organize and present the industry with what he called "user clout." After his address he said that his committee had only just succeeded in obtaining from manufacturers full statements of their proprietary features. and he had only obtained them by threatening to ask the Federal Information Processing Office to develop and announce standards on its own for all government purchasing. "That's an instance of 'user clout.' " he said.

Where's the software?

There is concern. too. over what was generally felt to be the poor level of software support offered users by manufacturers. Bobby Peebles. of the Dept. of Health. Education. and Welfare. referred to a study which showed that only 30% of all COM manufacturers provided diverse and responsive software support and that large numbers of COM users think software support is generally poor. Frank Malabarba of the Naval Ordnance Station at Indian Head. Md.. felt that COM users should have to face up to the necessity of having a skilled person who is both a programmer/analyst and a microfilm technician. He thought it was a mistake either to rely too heavily on manufacturer support or on a team of people among whom the different types of necessary expertise would be scattered. A number of users challenged him. declaring that that kind of investment in personnel training was not necessary.

On the floor of the conference the debate over standardization acquired a new example as U.S. Datacorp announced its new 72x system with the slogans "A Small Miracle." and "72x Fights Fat." The new process. aimed specifically at the COM market. reduces 750 pages of printout to a 4"x6" film card. Perhaps the single exhibit which attracted the most attention was 3M's laser beam recorder system. which writes directly on dry silver microfilm and needs no chemical processing. This feature. 3M spokesmen said. makes installation in the data processing area appropriate for the first time.

Among other new products announced at the conference was a new in-line processer developed by Datagraphix with optional in- and off- line capabilities and the Beta COM 600L and 700L. The Gould Data Systems product promises resident control and format flexibility plus a comprehensive resident data retrieval coding system.

—Fred Hapgood

Bureau Business Dominant in U.K.

There is new vitality in the European COM business. Several factors seem to be giving new impetus to micro-information in Europe—not least of them being the chronic paper shortage and rising prices.

Many of the applications tend to be achieving things that simply couldn't be done before. as was demonstrated at the mid-June Microform Exhibition in London. Exhibits ranged from sober displays of technical advances to an exuberant display by Lowndes-Ajax of case studies including British Airways. Hertz. and Trust Houses Forte use of COM on a bureau basis.

With COM. huge documents are being updated every week or month and copies are being shipped by the users to hundreds of branches at a fraction of the postage costs for paper documents. The British government is using COM every night to update its job availability records so that most Dept. of Employment offices have fresh microfiche every day.

The industry itself has indulged in self-help: the average price of an alphanumeric recorder system in the U.K. has dropped within the past five years to about $86.000 from $113.000. This in spite of inflation. And reader sales are running something like 600 a month in Britain alone. The bureau part of the market still is the largest single category. and has done a great deal to increase public awareness of the medium.

C.G. Baker & Associates. of Guildford. which keeps track of COM activity says some 87 recorders will have been installed in the U.K. by the end of this year. compared with 63 at the end of '73. On the European continent. the company expects that some 240 will have been installed by year-end compared with 182 a year earlier. Service bureaus own 19 of the 63 recorders installed in the U.K. and 44 of the 182 on the continent. Datagraphix. the traditional leader. still is far ahead of the closest competitor. Agfa-Gevaert.

U.K. micro-information people worry whether this rapidly growing market could lead to a price war at a time when the majority of bureaus are just barely into the black on their ventures and beginning to breathe more easily as the business comes out of the uncomfortable pioneering phase. The reason for this concern reflects a history of stiff price competition in the U.S. during the pioneering days there. They note. for example. that price competition in New York shrunk the 30 COM bureaus in that city to a mere handful.

Marketing

He Buys, Sells And Prospers

"I think IBM would prefer we weren't doing this." says Harry E. Goetzmann Jr.. president of Continental Information Systems Corp. (CIS) of Syracuse.

The Sphinx of Armonk doesn't comment on such speculation. but Goetzmann definitely does think that many other segments of the computer industry do prefer that he and CIS are doing what they are doing. And what precisely is that?

"Well. I think I would classify CIS as more of a dealer than anything else." says Goetzmann. "We're the world's largest 370 dealer. We've placed more than fifty 370s and I think we're probably IBM's largest commercial customer. I also think we're the largest used 360 equipment lessor."

HARRY E. GOETZMANN JR.
He predicts IBM's moves

For a man who started out in business for himself in 1968 with $2.000 in savings as backing and who ordered more than $50 million of 370s on one day in 1972. Goetzmann. 37. must be considered one of those rare birds in the computer industry—an entrepreneur who has made a go of it during bad times.

An IBM marketing man for five years. he thinks that his ability to predict IBM's moves has been a great asset for CIS. For instance. when the 155 and 165 were

news in perspective

announced. Goetzmann didn't buy all the hoopla about IBM announcing a dramatic new system. He looks upon the 155, for example, as not much more than a souped-up Model 50.

"We didn't place any large orders for 155s and 165s." he says. "We could see that there was something lacking in the architecture. But when the 158 and the 168 came along, it was a different story. We felt those machines represented a big departure for IBM and we felt that IBM would stay with those machines for a long period of time. When the 158 and 168 were announced on August 2, 1972, we ordered more than $40 million worth of them."

And how did IBM look upon a young company with limited financial resources from Syracuse, New York, placing such a large order? Goetzmann pointed out that CIS had always paid its bills to IBM on time in the past. "But as we came closer to delivery time, IBM became concerned, I think," Goetzmann recalls. "IBM put very firm constraints on us that they didn't impose on their commercial customers. They set up their own game plan for us."

Awe and annoyance

Goetzmann speaks of IBM with a mixture of awe, admiration and annoyance. His current annoyance is traceable to his company's recent moves in the European market from its base in Brussels. He says that while IBM follows an orderly delivery schedule in the U.S.—deliveries are made sequentially following the placement of orders—in Europe he finds that IBM has been able to move customers ahead in the delivery schedule when CIS attempts to make a sale. This has cut Goetzmann's firm out of some business in Europe, he claims.

Fast or "immediate" delivery of 370s—particularly 158s—is CIS' big selling weapon at present. Goetzmann says he can provide a 370 today, while IBM customers normally must wait several months for most 370 models.

He notes that computer users may want fast delivery of a 370 for any number of reasons ranging from unanticipated workload growth and conversion requirements to tax purposes and whim. A major reason a user will want fast delivery, however, is to take advantage of the 7% investment tax credit customers get for purchasing new equipment. For instance, the tax savings to a user on a typical 2-megabyte 158 costing $2 million is $140,000. Usually, companies decide they need the tax credit towards the end of the year. "Last November and December we could have sold every 158 and 168 we could get our hands on." says Goetzmann. "We did between 30 and 40% of our business in those two months."

Selling their place

Looked at from another direction, that means a simple order alone for an IBM machine can be worth money. Goetzmann finds that many who have ordered 370s are able to sell their waiting place in the IBM delivery schedule. Goetzmann says that an order for a 158 can be worth at least $20,000. ("I've paid more.")

Officially, IBM does not permit an order to be reassigned, so the original party that placed the order must buy it and immediately assign it to CIS. The equipment never goes to either the party that placed the order or to CIS, but to a user CIS has found. Even the original IBM salesman is pleased, because he still gets credit for the sale.

Another measure of Goetzmann's savvy in sizing up the 370 market is the

fact that he has supplied 370s to such sophisticated leasing firms as ITEL and CIG, with the former firm ordering in excess of $10 million worth of IBM equipment from Goetzmann's firm during CIS' last fiscal year alone.

CIS is in the leasing business, too—but, as might be expected, in a different manner from the traditional leasing company ways. While the typical 360 leasing companies bought new 360 machines early in the delivery cycle and subsequently stopped purchases and then expended major efforts to keep the equipment out in the field, CIS specialized in purchasing used 360 equipment. "Our average price of our 360 portfolio is 50 per cent off IBM list price," says Goetzmann. "We put it out on a full-payout lease and we can get our money back in as little as two years."

CIS also operates a facilities technical group called CIS/Corporate Facilities Group, which sells hardware and software support to smaller Blue Cross and Blue Shield accounts. The company has some 45 employees—a far cry from the one-man operation he ran from his home back in 1968. (He decided to move out when his small children answered his business phone too often.) His initial venture backing came from a group of Syracuse businessmen. Later financial backing came from a Buffalo venture capital outfit and, finally, through a public offering in 1972. Revenues are not a good gauge of CIS' progress, because of the high volume of outright equipment sales that CIS turns over, but revenues in fiscal 1974 should surpass $20 million. In fiscal 1973, CIS logged a net income of $383,000 and in 1974 income was expected to top the $500,000 mark.

—W.D.G.

Minicomputers

Computer Automation After End Users

There's hardly a minicomputer maker left that isn't after some portion of the end user market.

Computer Automation, Inc., Irvine, Calif., may have been the last hold-out. But CA's in the end user business now. It's formed an Industrial Systems Div. Initially it will offer systems built around its Capable Tester, a computer based logic tester it has offered as a product since September 1969. The difference now, says CA president, Dave Methvin, is "heavy software involvement" and, he admits, other things are in the offing, even commercial systems.

Methvin has been oft-quoted as not being interested in the end user market. "We're in the oem business and that's where we're going to stay," he said during a WESCON show back in 1971.

Now, though, he says he never said he'd never get into the end user market. "We've been an oem house and we still see growth there but the oem market is running out of gas. Profit margins are low."

Unlike Donald W. Fuller, president of Microdata Corp., another Irvine, Calif., mini-maker, Methvin won't go as far as to say he wants to make his business 50-50 between end-users and oem's. Fuller, whose firm plunged deeply into the end user market with introduction of its Reality system this spring, does say this.

Not competing

Both men insist they won't be competing with their customers for end user business. Methvin explains that "we will insist on high gross margins. Non-computer makers looking at the kind of systems we will produce would have to buy their computer-related hardware. Their costs would be higher than ours and to compete with us they would have to set the margins too low, so they wouldn't compete."

Methvin said there has been a separate group supporting the Capable Tester as a product, since 1969. The tester, he said, was developed, "the day after we developed our first computer, for our own use." The group was broken out as a division for two reasons, he said. "Number one, it's a hell of a product and number two, we'd developed a substantial software capacity to support large scale systems." Customers for the initial systems will be "practically all large manufacturers of electronics products."

DAVE METHVIN:
"I never said never"

And the new division will be looking at new systems, including commercial products. But if any commercial products are developed they won't stay with the division. "We decided commercial products would require a different approach," said Methvin. "They will be kicked off here, then broken off into a division of their own."

Data Entry

CMC Takes Big Bite of Remote Batch Market

There are those who say that IBM, with introduction of its 3790 remote batch terminal, gave its blessing to the satellite processing concept.

Whether this is good or not is debated. "Those who think IBM blessing a market is a good thing are ill advised," said Thomas Ringer, president of Computer Machinery Corp., Marina Del Rey, Calif. But his is one of the companies that is expanding into or within the remote batch market in the wake of the IBM announcement early this year.

Computer Machinery, already into remote batch processing with its Telebatch capability for its shared processor data entry systems, boosted its position substantially with acquisition of an installed base of 500 remote processing systems manufactured by the Remcom Div. of SCS Corp. of Dallas. CMC also acquired the rights to manufacture Remcom systems and probably will do this in its California plant.

The acquired Remcom line includes three systems: the 2775, a low cost machine, the 2780, which represents the bulk of the installations, and the 4780, an intelligent terminal.

In its leapfrog move into remote data processing, CMC crosses paths with Data 100 which, already strong in remote batch terminals, moved into CMC's domain, data entry, with introduction of its Keybatch system at the NCC.

Go to third place

A CMC researcher ranked remote batch system suppliers this way before the Remcom acquisition: 1., IBM; 2., Data 100; 3., Remcom; 4., Harris Communications Systems; 5., Univac; 6., Control Data; 7., Burroughs; 8., Mohawk Data Sciences; and 9., Computer Machinery (Telebatch). Now, says CMC, it's No. 3.

The CMC acquisition of the Remcom line was initiated by Transamerica Corp. which two years ago arranged CMC's acquisition of the customer base for Key Logic data entry systems produced

by the now defunct Redcor Corp. Ringer said most of the Redcor systems acquired are still out on rent.

The acquired Remcom systems are owned by Transamerica Computer Co. of San Francisco. Inleasing Corp. of Providence, Rhode Island, and end users. CMC will maintain and manage systems owned by TCC; will lease systems owned by ILC; and will be assigned user leases to the systems. End user owners will be serviced by CMC.

Ringer said results of the agreements are expected initially to add $5 million in annual recurring revenues.

Peter Zinsli, CMC's vice president of planning and product operations, said Remcom operations will be integrated into CMC's operations and will not be treated as a separate group. He anticipates the integration will take some six months and looks for initial production of about 10 Remcom systems a month.

Ringer said Remcom and CMC customer service people will be cross trained "as immediately as we can." Cross training for marketing personnel will go slower because "customers (Remcom's) at first, are bound to be uneasy."

—E.M.

Service Bureaus

Xerox 'on target' In Service Biz

Xerox Corp., which four years ago carefully dipped its big toe into the information services market. (Nov. 1, 1970, p. 91) has since then quietly immersed a whole foot and continues to wade in gradually, and apparently, successfully.

"We're tracking on target," said Jim Campbell, president of Xerox Computer Services. "The old piece is profitable." The "old piece" is the Los Angeles-San Diego area, where XCS got started. Its stated plan at start-up was to build a firm customer base in the Los Angeles basin before moving out geographically or up to big-company customers. Four years later it's done all three. It has a total customer base of 350 for its on-line services of which 200 are in the LA-San Diego area. It has opened branch centers in San Francisco, Chicago, and Hackensack, N.J. And, where it started out marketing to small business ($1-20 million gross a year), it's now lifted its sights as high as $60 million.

"Our capability to service larger accounts is better than we'd dreamed," said Campbell. "We're putting more emphasis now on larger accounts by encouraging our salesmen to sell in terms of revenue rather than number of accounts." XCS has a minimum charge of $1,000 per month and its average customer pays $3,000, but Campbell said they have a growing number in the $10-15,000 per month class.

Campbell is a veteran of the computer services business. He spent 12 years in marketing with IBM and made the 100% club selling services for Service Bureau Corp.—before the Consent Decree. After that he was president of Greyhound Computer Corp. for a time during which it was "a multi-service organization" including service bureaus, facilities management and, for a little while, was into time-sharing.

Backlash

He has a strong belief in the future of the services business. He likens his stand to that of Control Data Corp.'s Bill Norris, though he's quick to admit XCS' slice of the service business pie is small compared to that of CDC. "There is a backlash against in-house computers," said Campbell. "This will mean a boom in the service business over the next 10 years." While he anticipates "substantial growth" for the computer services business in the next few years, he cautions that it is a business requiring "substantial investment" which is why companies like CDC and General Electric will make it. Presumably he puts Xerox in that class too. He predicts XCS will double its current business in 1975.

Where once they had one Sigma 7 in Marina-del-Rey, Calif. they now have two Sigma 7's there and three Sigma 9's plus a "whole bunch of Sigma 3's there and in branch centers as front end processors. They also have a Sigma 7 in the San Bernardino, Calif. city hall (April, 1973, p. 120) which is used for processing that city's data and that of nearby, smaller cities. And they have an IBM 360/40 used to process a "few programs" inherited when Isaacs-Dobbs Systems, Inc. was acquired by Xerox in 1970. Add to all this more than 11,000 miles of interstate, leased, 9600 baud communications lines and 200 disc drives, being added to at a rate of 10-12 per month.

XCS plans to open additional centers in the Southeast and the Southwest in the "not too distant" future and currently is considering Atlanta and Dallas as sites. So it would appear that, in computer services anyway, Xerox is looking toward total immersion.

—E.M.

International

South Africa Issues Still Bedevil IBM

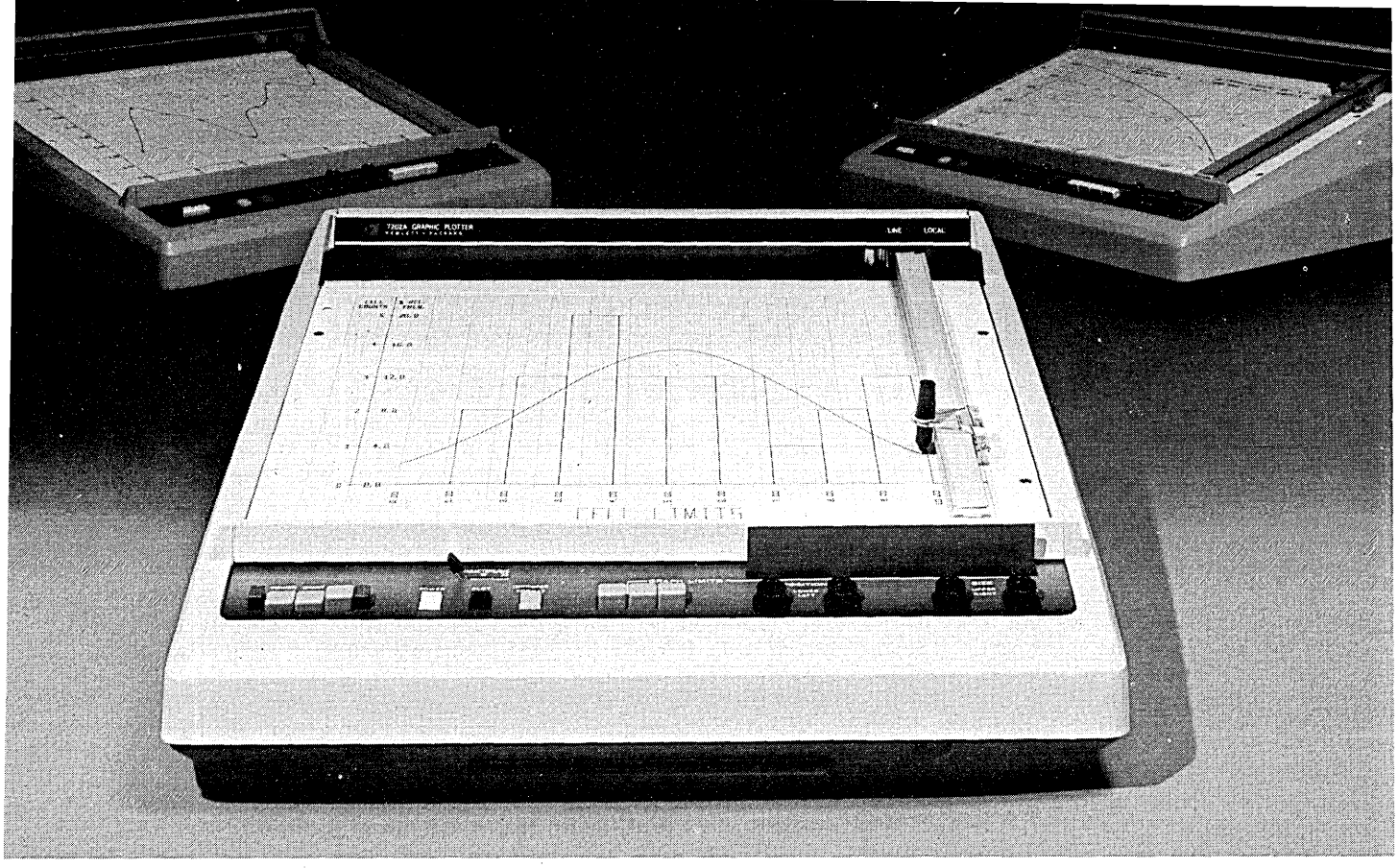
Two events have combined to keep South Africa near the top of IBM's list of aches and pains. The annual meeting always becomes a forum for South African questions, notably from Episcopalian shareholders. And this year's reorganization of World Trade has put the African problem squarely in the lap of Jacques Maisonrouge, chairman of IBM World Trade Europe/Middle East/Africa Corp. Although Maisonrouge claims that North-South travel is easier on the circadian rhythms than East-West travel (May, p. 105), old IBM hands recall that he was never very fond of the long haul to Johannesburg.

From the way the persistent South African issue refuses to die down, it looks as though Maisonrouge will have to undertake the long commute fairly often. He won't be the only one. A top-level triumvirate including Tom Watson, Jr., made the trek last year, and a statement to shareholders mentions that IBM has had executive visits to South Africa in each of the last three years and will have them in the future.

Will it go away?

This statement, whose existence is buried in the fine print of this year's proxy statement, has an almost wistful, Nixon-like tone, telling the issue to go away. "We do not believe it is necessary to have another report on South Africa at the 1975 stockholders meeting," says the proxy statement, noting that 97 percent voted down the ubiquitous Episcopal proposal in 1973. (The three percent voted over $1 billion in shares though.)

This feeble, almost defensive tone doesn't square with the facts in the controversial document. IBM's black employment in South Africa has gone from 43 of 1029 employees in 1972 to 93 of 1087 in 1973, and will continue to rise. Twenty have office jobs, and more are



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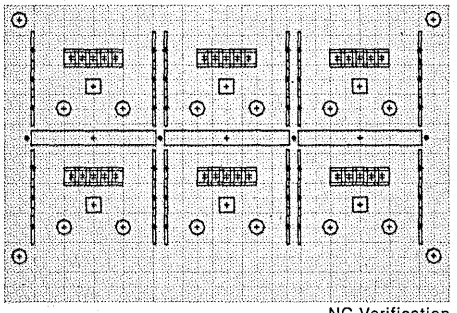
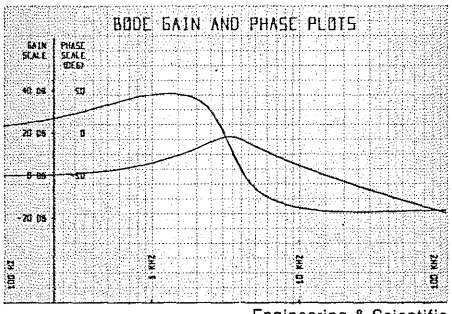


NC Verification

for you

No matter where your data comes from, it's always more meaningful in the form of graphics. Solutions buried in rows of numbers begin to make sense when you see them translated into charts and graphs.

And now that Hewlett-Packard offers a complete line of economical graphic plotters, you can draw those easy-to-understand charts and graphs



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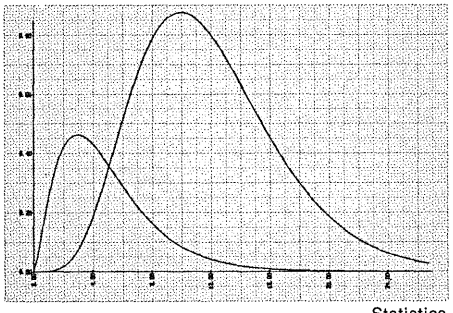

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being trained, with an average of about 15 days per black employee to prepare for new jobs or higher positions.

Wages are generally above the IBM South Africa minimum of $209 a month, which is well above the $93 'minimum subsistence level', itself a controversial issue. A *Fortune* article last year contained graphs showing IBM miles ahead of any other local or foreign employer in wages as well as job opportunities for blacks. The company has two small card printing operations in Johannesburg and Cape Town, and a growing sales operation.

A lively market

IBM has no intention, according to the detailed statement, of pulling out of South Africa. This makes business sense, and it fits the IBM culture. South Africa is a small but lively market, and IBM finds enough competition from ICL and Burroughs in particular to make the game interesting. Most of the country's computers are within 30 miles of Johannesburg. Culturally, the company has always cherished the notion that it can, should, and does set a good example to the other corporate citizens.

While IBM rather ducks the Episcopal demand to go out and see that none of the computers sold are being used to enforce apartheid, it lays heavy stress on the $76,000 it spent last year on contributions to the country's black community—most of it typical IBM Good Deeds with a strong educational flavor: classrooms in Soweto, high school and higher education scholarships, secretarial training for a girls school, and vocational training for urban blacks, under the government's auspices.

Like Nixon, IBM will no doubt find that the problem is still around next year. However, minor discomfiture in Armonk is more than offset by the increased corporate awareness of South Africa, which actually *does* result in slightly more investment in education, somewhat more care in the use to which systems are put, and some impetus to other companies to do business there in healthier, more open ways.

The trouble is, this kind of "circumlocquation," exemplified in the proxy statement and shareholder report, isn't much of an example of openness and social responsibility, simply because it keeps under wraps the problems and the delicate political aspects of the situation. Conceivably Maisonrouge's more open style will help IBM handle the problem more overtly next year.

—Nancy Foy

Benchmarks

A Bigger 370/145: By doubling the main memory capacity of its 370/145, IBM has substantially increased the life of the machine, to the delight of independent memory add-on companies. IBM announced two new 145 models this spring: the J12 with 1.5 million bytes and the K2 with 2 million bytes. Its first model had a capacity of 512K and in February of 1973 the company doubled this to 1 megabyte. Most add-on houses said they anticipated the increased memory and planned to offer their own alternatives to IBM's. Control Data had been planning a 2-megabyte add-on for six months. Although IBM denies it, some industry observers felt the new models will hasten the migration of 360 users to 370s without having to make a major upward move to the larger 158. Besides, they noted, IBM is having trouble meeting orders for 158's while the 145 market was considered to be soft.

What Computers are for: The peppery chairman of Control Data Corp. isn't worried anymore about competing with IBM. At a deposition-taking last month in St. Paul in connection with the Justice Dept.'s case against IBM, Norris said "we settled that," referring to a surprise settlement in January 1973 of the company's antitrust case against IBM. He also told IBM lawyer Frederick A. O. Schwarz that Control Data's "relationship with the Justice Dept. is a pretty cold one." When asked, during the three-day proceeding, if he could come back on a Saturday for more questions, Norris declined, saying "I've got work to do for Control Data." When asked about IBM's unbundling in 1969, Norris replied, "I can't put myself back to 1969. This is 1974." And when asked figures on another point, he snapped: "I don't carry numbers around in my head. That's what computers are for."

Spangle to Minneapolis: C. W. (Clancy) Spangle, the head of Honeywell's computer operations in Boston, is moving to Honeywell's corporate headquarters in Minneapolis, along with a small staff of aides. The company says the move will have no effect on the North American operations of Honeywell Information Systems which will continue to be headquartered in the Boston area under the direction of Spangle, who is an executive vice president of the company. In Minneapolis, Spangle will be joining Edson W. Spencer, who heads the Control Systems segment of the company, and Honeywell president Stephen F. Keating, as part of a triumvirate in the newly-formed Office of the Chief Executive.

No cuts here: Memorex Corp. is hiring 75 persons and reactivating a media manufacturing facility to meet growing demand in the U. S. and overseas. The company said it has received "substantial orders" for two new media products: Cubic tape, a thick computer tape, and Cromex video tape. The plant the company is reopening in Santa Clara, Calif., used to manufacture microfilm. The announcement followed an earlier one by the company's new management that it would trim the company's work force, including some 125 persons in middle management positions.

Staying International: Concerned that its affiliation with the American Federation of Information Processing Societies (AFIPS) might lead to its being labeled as primarily an American society, the Data Processing Management Assn. (DPMA) is taking steps to maintain its international image. A new Committee on International Organization has recommended toward this end, greater public relations activity within various countries to increase national awareness of local DPMA affiliates. It also proposed that feasibility of establishing a "national office" in Canada be investigated. The committee recommended that national DPMA organizations be established in each country and that these get involved with their countries' AFIPS counterparts.

Energy Study: System, Science & Software, La Jolla, Calif., is working with the San Diego Gas and Electric Co. in a study of the technical problems in producing electricity from geothermal sources—hot water buried beneath the earth's surface. Under a $178,000 grant from the National Science Foundation, the software company will use simulation programs to study the environmental problems and their potential solutions. Dr. T. David Riney, manager of geophysics and materials, said the study will provide a "useful tool" in the management of the energy extraction from geothermal reservoirs, by helping to answer such questions as how many wells should be placed in a specific geographical area, where they should be located, and what the pumping rates should be. He said the research also should provide new understanding on such questions as subsidence, earthquake implications and disposition of the water after use. □

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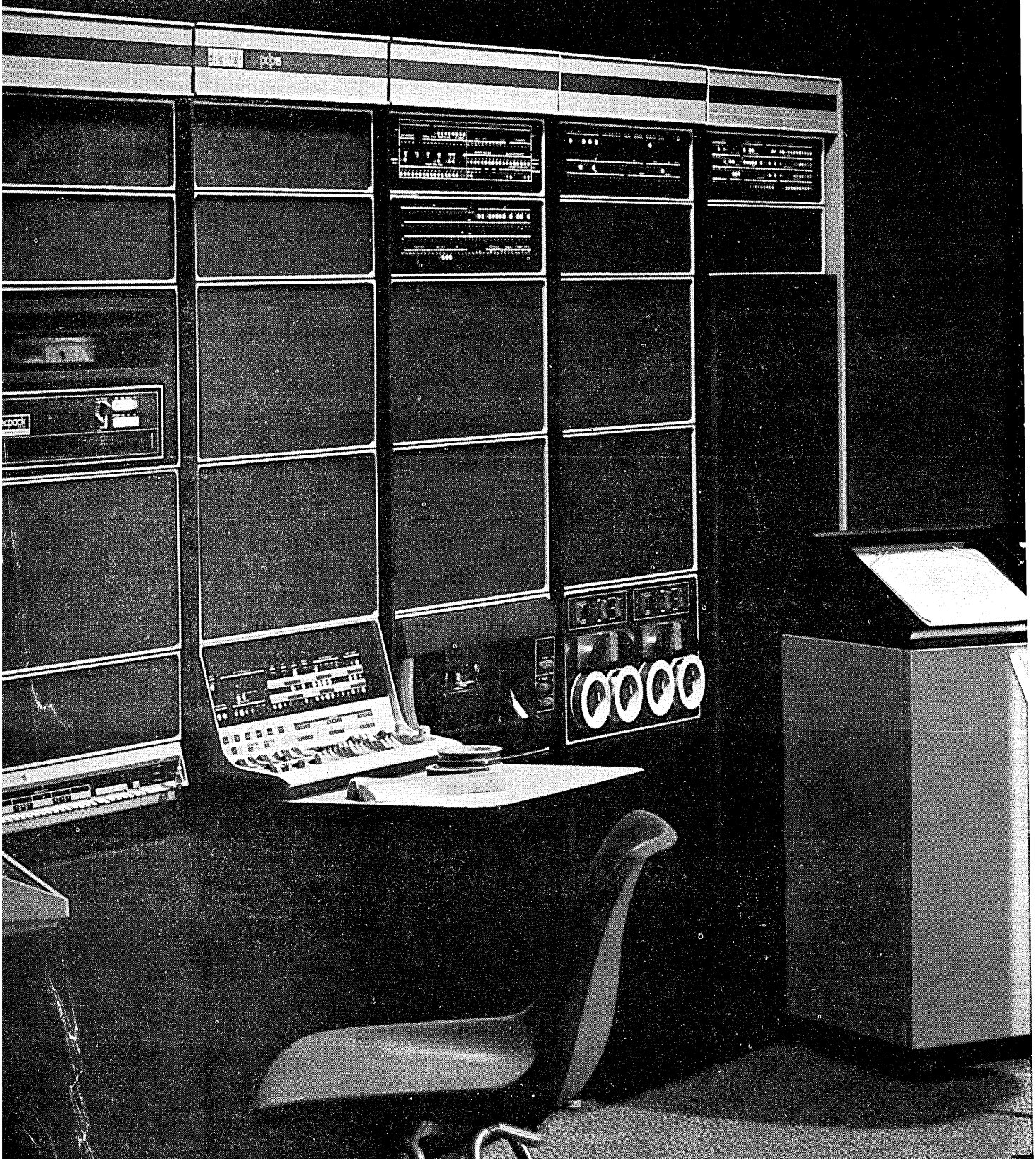

If you're like most people, nding a heavyweight graphics ystem for the right price hasn't een easy.

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Well now you can have it all. owerful graphics. Number runching computation. High- nd low-speed input/output perations. Great software.

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All at about one-fifth the cost ou would have paid in the past.

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And there's loads of software. Including packages for architectural design, electronic circuit layout, apparel pattern processing and structural engineering. $5 million worth of software in all.

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And what you see is what you get. The ManyComputer.

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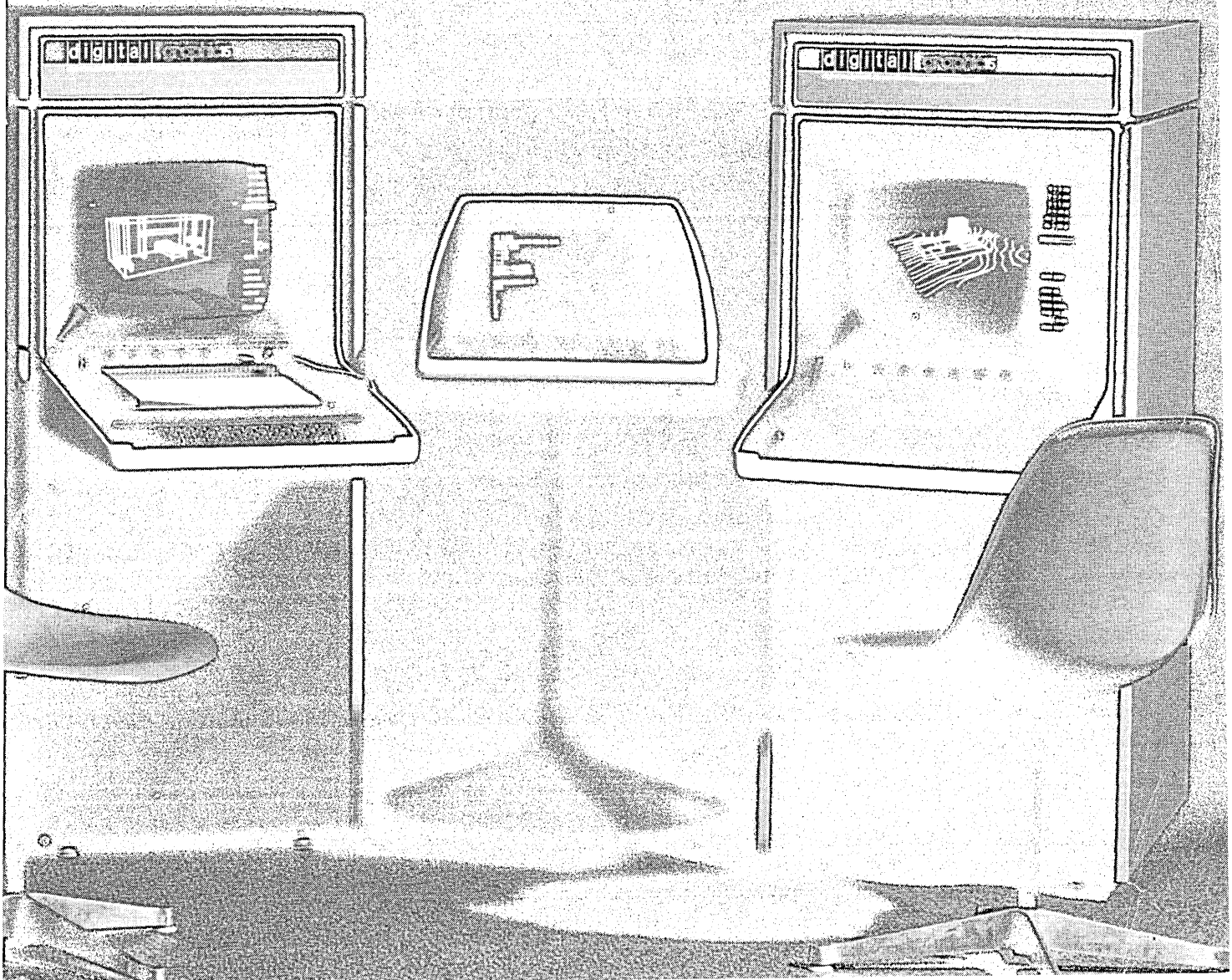

LOOK AHEAD

(Continued from page 18)

Lancaster Telephone Supermarket in Carlstadt, N. J., has been serving in-home telephone shoppers for some nine months now and has, says president Charles Ransdell, quadrupled its sales volume in that time. With a system based on an NCR Century 101, Ransdell's firm serves customers in 28 towns in Bergen County, N. J., all within a 50 sq. ft. warehouse. Ransdell said he worked two years on his system before he got it going. He feels a minimum response time of 1/2 sec. per item ordered is critical to its success. "We tested another vendor's system which was priced attractively but response time was 30 seconds, and that was no good." Last month Ransdell expanded into the wholesale business serving such customers as small delicatessens who could benefit from his ability to offer items on "a split case basis."

DON'T SHAKE YOUR TAIL FOR US, SAYS BELL

Julie Ashorn, a Houston travel agent, told Sen. Philip H. Hart's antitrust subcommittee that she had been instructed by Southwestern Bell to avoid booking its employees on Continental Airlines, apparently because Continental had acquired a digital telephone switching system from Collins Radio instead of from the phone company. Ms. Ashorn was the lead-off witness at a June hearing into allegations that Bell uses unfair marketing practices to frustrate competition from foreign attachment makers. A Southwestern Bell spokesman admitted that such an instruction had been issued, but he insisted it was done by a phone company employee acting on his own.

RUMORS AND RAW RANDOM DATA

Computer Machinery Corp. picked Germany for first introduction of its smallest data entry system with Telebatch (remote batch capability) but it will bring it to the U. S. soon, undoubtedly with a different designation. In Germany, it's called the CMC 5D (D for Deutschland) and is smaller than the CMC 5 data entry system...President Walter Nelson of Analysis & Programming Corp., Greenwich, Conn., called his recent deposition by IBM "a tea party." After his pleasant luncheon and 15 minute deposition, he noted that the Justice Dept. apparently isn't choosing (or isn't able) to participate in the questioning of many of the 2,000 companies. "They are allowing IBM to interpret the market figures in any way they see fit." The records, however, are not classified and open to public scrutiny..."I can sell Honeywell add-on memories for less than Cambridge Memories can, says Sunny Monosson of American Used Computer, adding, however, that he has none on hand--the order and price come first. Cambridge counters that there is not much used memory available...Peripherals giant Control Data plans to study the market for Univac compatible disc drives, according to notices circulating within the company. CDC drives are installed on 1108's at Computer Sciences Corp., but their operation is highly dependent on CSC software...The long-delayed STAR supercomputer from Control Data apparently will be installed this month at the Lawrence Livermore Laboratory. It'll be emplaced in space formerly occupied by the IBM Stretch computer... A big concern among those who worry about privacy and big data bases is the "need to know" quality of some of the data being collected by big public agencies. A "worst case" example offered by a recent speaker on the topic: the Social Security Administration, in a questionnaire for persons becoming eligible for Social Security checks, asks: do you call your mother and/or father more or less than once a month?

Cut your runtimes in half with Varian's new V-74½.

The new fully-optioned V-74 which we call the V-74½ can do that, and more. Pick your program, and watch the computer race through in half the time you expect. (If it's double-precision floating point, the V-74½ can float through in a tenth of the time.)

What's the secret? None, really. Just a synergistic combination of hardware, software, and firmware enhancements. Like 64K bytes of 330-nanosecond semiconductor memory. Varian's async memory bus allows you to intermix core and semiconductor at full speed in any ratio.

Then there's the new Varian VORTEX II operating system, with the fastest, most sophisticated FORTRAN IV compiler in existence. Memory can be expanded to 256K, with full hardware memory protection, optimum allocation, and dynamic relocation of multiple tasks.

But for real speed, you can go into overdrive with Varian's new firmware, specially constructed to accelerate FORTRAN-compiled tasks. And if you're in a real hurry, take advantage of the new Floating Point Processor that performs all floating point calculations in integrated hardware.

Sound good? Here's the best news of all. You can get the V-74½, with all this speed and power, at a price of less than $50,000. Write today for our "Fast FORTRAN And Floating Point" brochure.

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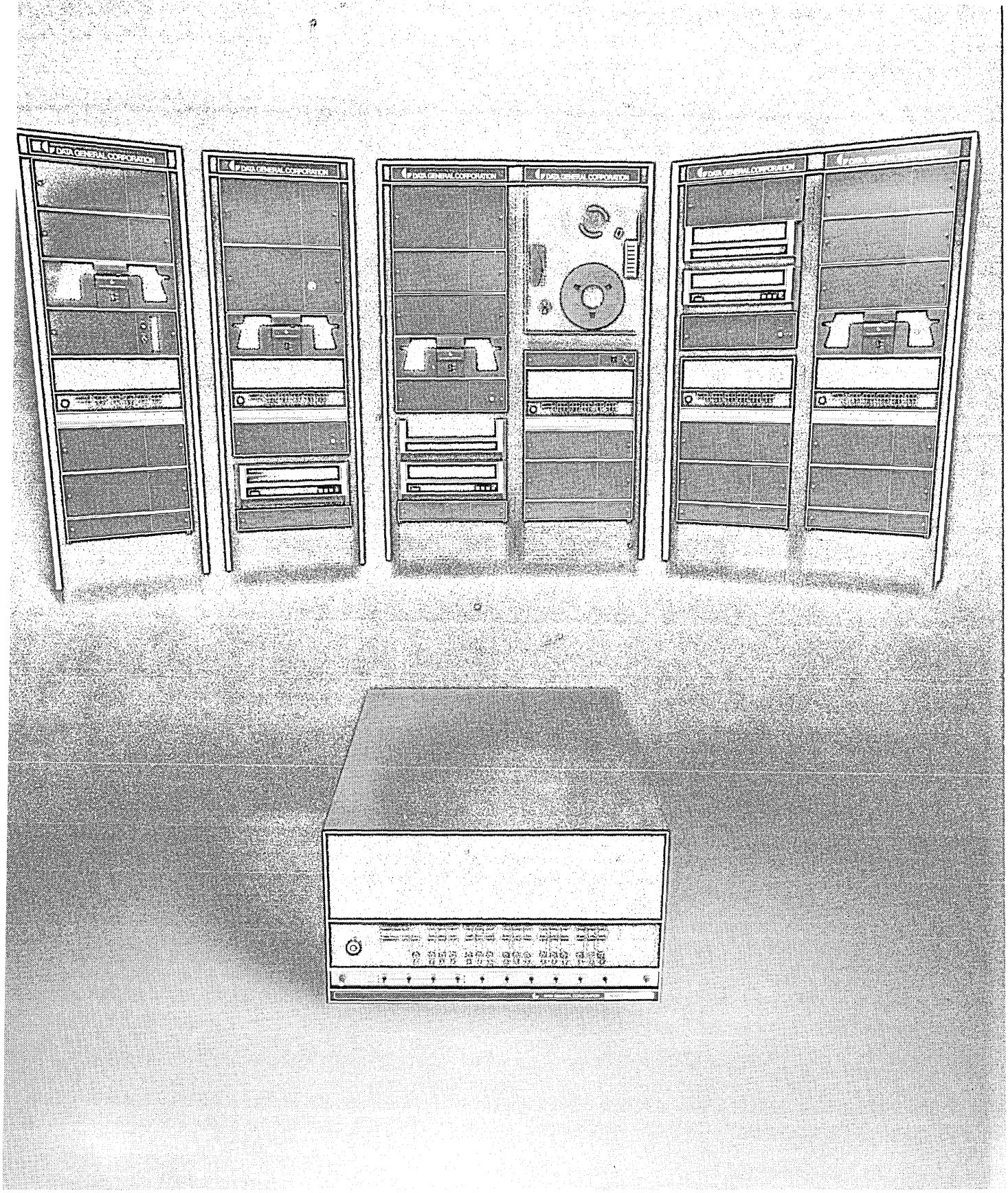

Introducing five Nova 2 systems for people who only want one.

Until now, the only way you could buy Nova 2's was five at a time.

Which obviously discouraged people who only wanted one.

So to make sure everyone who wants a Nova 2 gets one, we've come up with five different Nova 2 systems you can buy one at a time.

The smallest is built around our Real-Time Operating System. Which makes it a great little data acquisition satellite.

Next up the line is our Stand-alone Operating System. A small single-user computation system for people who don't need a disc.

Then there's the medium-sized Real-time Disc Operating System you can use to develop software and hardware interfaces, or to build your own medium-sized computation system.

Which is followed by a big Real-time Disc Operating System with more storage and faster output for higher throughput.

And for those who need a system with a built-in backup computer, there's the Dual Nova 2.

So no matter what you want to do, there's a Nova 2 system you can get to get it done.

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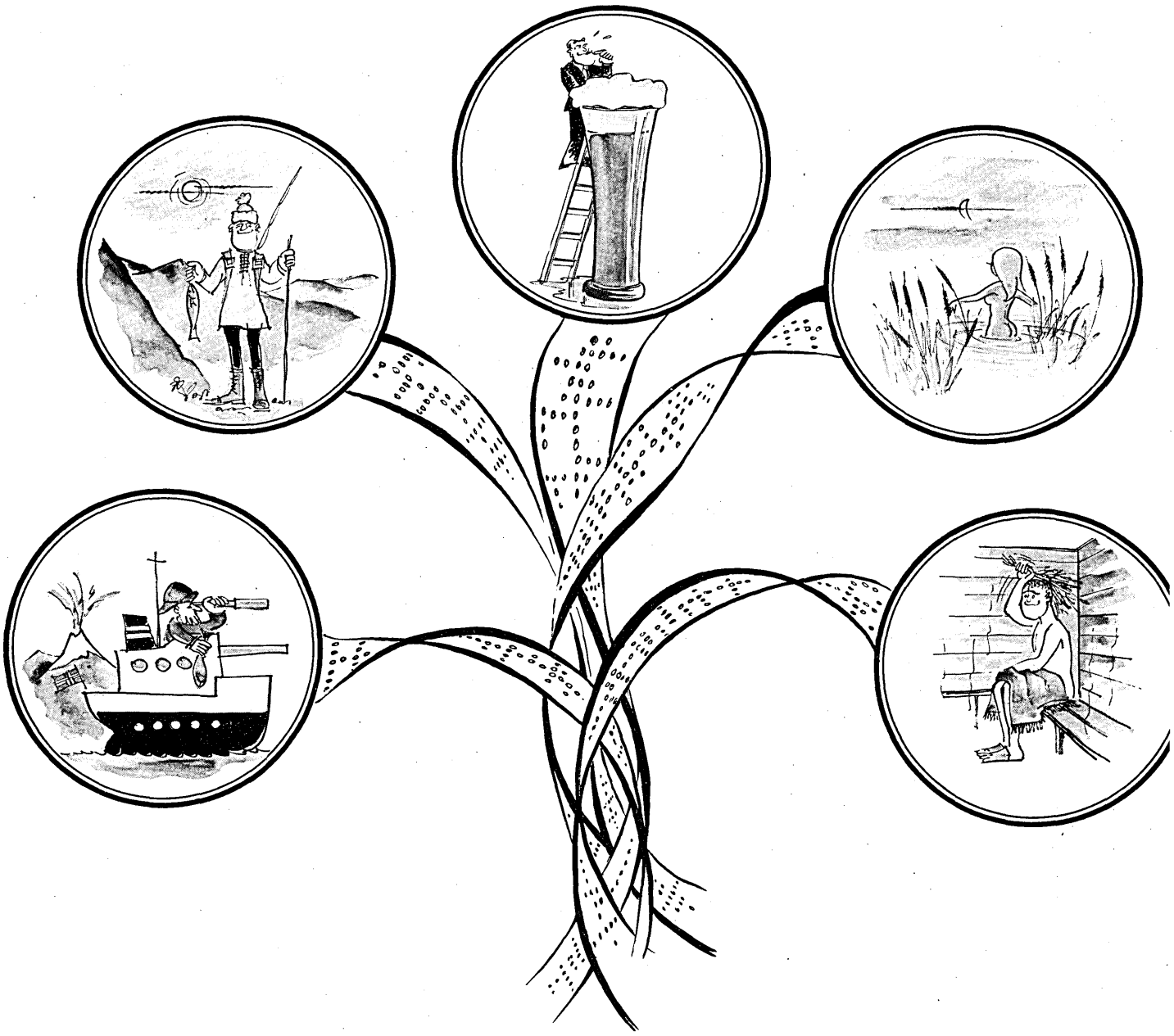

You may associate Denmark with beer, Finland with sauna, Iceland with hot springs and cod war, Norway with the midnight sun and Sweden with midnight sin. So you may be surprised to learn that the Scandinavian countries are also spending some effort on Information Processing. You are possibly not even aware of the fact that there is a Scandinavian Computer Journal, »data«, which reaches 90—95 % af all computer installations in Scandinavia and brings you in contact with a prosperous market.

»data« was started in 1971 by the Nordic user associations and has had a strong growth during the past three years.

We shall be pleased to furnish you with further relevant information on our Journal and how you will be able to use it in your marketing plans in the Nordic countries.

We will also gladly let you know how you can use »data« to form contact with the whole data world, viz. the 5,000 participants in the IFIP Congress at Stockholm this August.

Being the official Journal of the Congress, participants will receive »data«, No. 5/74. This issue will be in English only.

data

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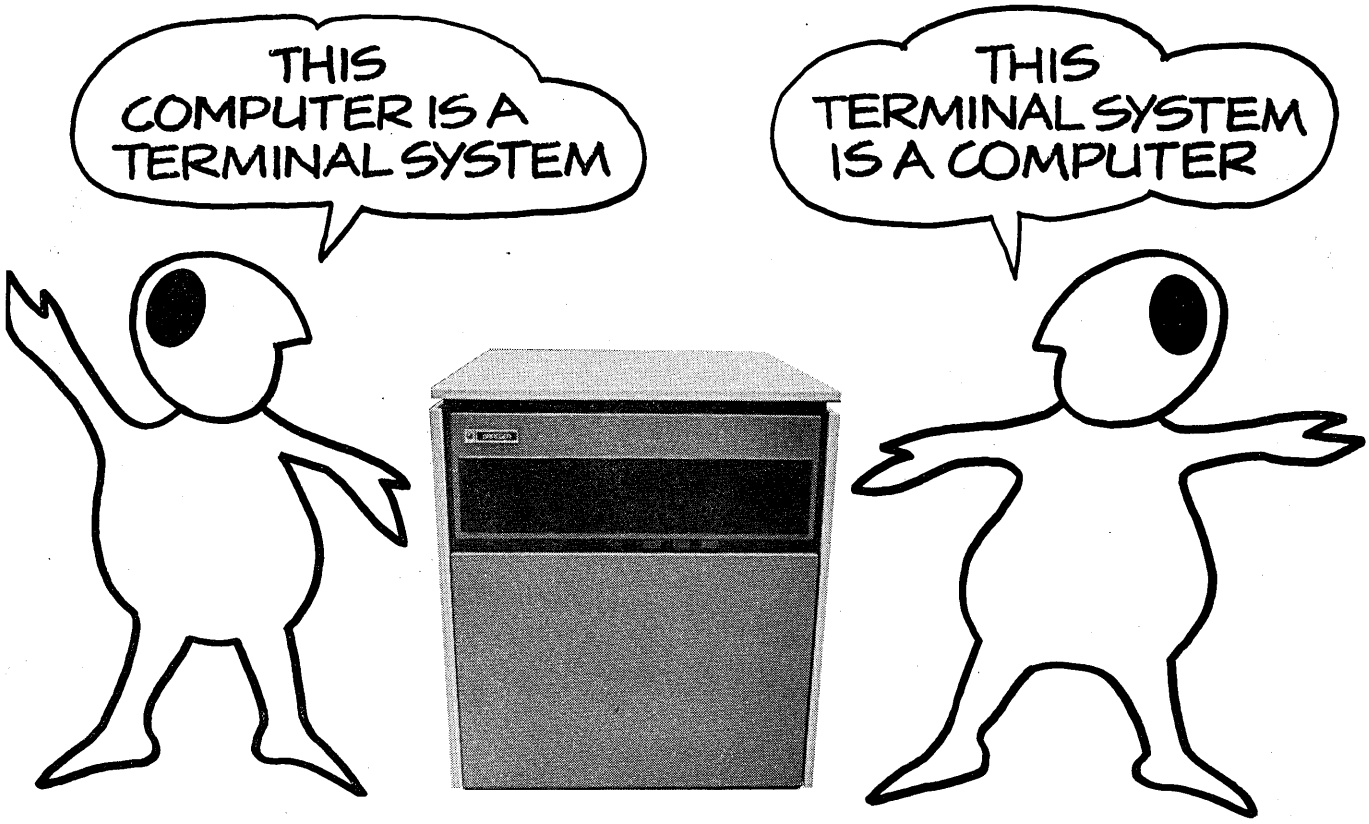
- DENMARK



Braegen's Virtual Terminal System is a Jack-of-all-trades. It's the terminal end of a huge computer system, a stand-alone data processing system, or anything in between.

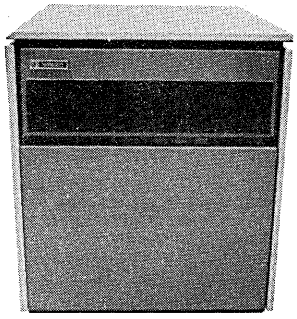
Braegen's B-40 processor is a most unusual computer with an internal memory of 256K words and a cycle time of 800 nsec. External storage capacity can be any size you wish, in disc cartridge increments from 256K to many millions of bytes.

The terminal part of a Braegen VTS installation can be interactive alphanumeric video terminals with keyboard, card readers, line printers, character printers, tape, the whole works. And if you don't need your own unique configuration, Braegen can emulate IBM 3270, 2780/3780/HASP and 2821/1403 performance.

Best of all, VTS saves money. It allows distribution of terminals and peripherals over a 7500 ft. radius without the complications of line modems. It allows more terminals and peripherals to be added without the cost of specialized controllers. It even serves as its own CPU in applications such as word processing and other data base systems. And it keeps on growing to match the growth of your operation.

Virtual Terminal System. Data Processing Computer. Call it what you wish. But call Braegen today for a brochure or a sales engineer. Say goodbye forever to overpriced peripheral purchases and hello to the Braegen Virtual Terminal System.

B-40 TERMINAL SYSTEM/COMPUTER



BRAEGEN

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CIRCLE 5 ON READER CARD

If you miss IFIP '74 you'll have to wait until 1977 to catch up with the rest of the world.

The next triennial IFIP Congress will meet in Stockholm, Sweden during the week of August 5-10, 1974. Everything will be under one roof. Both the technical program and equipment exhibition will be held at St. Erik's Fair, site of the 1972 Nobel Prize ceremony. It's a rare opportunity to share the world's progress in information processing.

MEDINFO '74 at the same time and site.

The First World Conference on Medical Informatics will run concurrently with IFIP. And you'll get a deep view of one of the most rapidly growing segments of your profession.

The IFIP program and exhibits.

Some 241 papers on specific subjects and recent advances will be presented. Plus 10 panel discussions exploring the present state of the art and current trends. To complete the information spectrum, there will be a wide range of hardware, software and other service-related exhibits.

Devaluation sales opportunities.

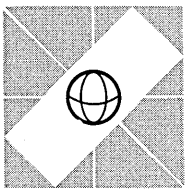
If you provide equipment or services to the information processing industry, you'll have fantastic sales opportunities. Recent dollar devaluations give your products greater sales potential in a rapidly growing European market. And you'll find it at IFIP '74.

You must book far in advance.

If you want to see and be seen at IFIP, now is the time to sign up for participation.

For registration and travel information write to: U.S. Committee for IFIP Congress '74, Box 426, New Canaan, Connecticut 06840.

Exhibitors write to: Arthur Hutt, IFIP '74 Exhibits Chairman, Bowery Savings Bank, 110 East 42nd Street; New York, N.Y. 10017 (212) 697-1414



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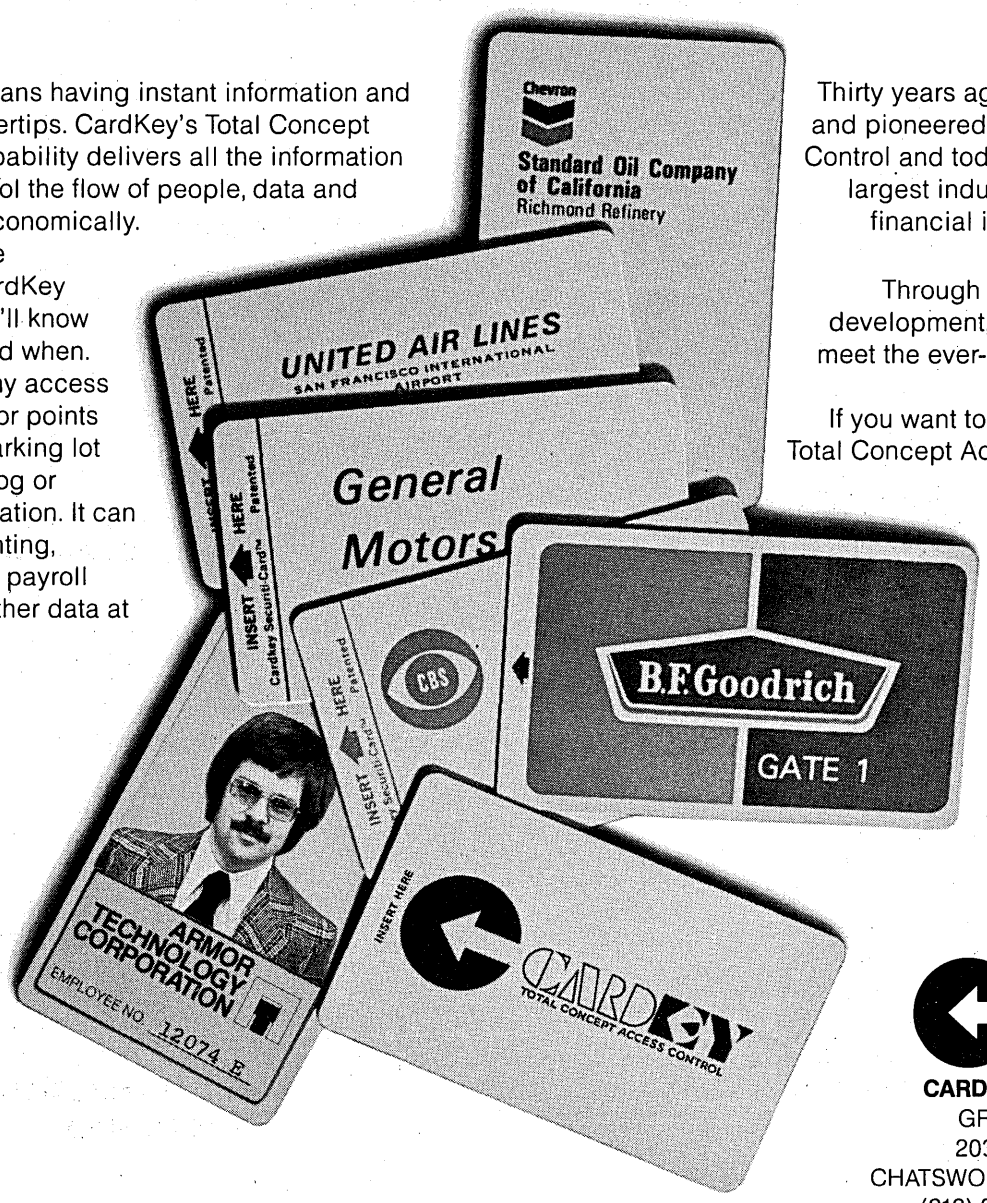

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hardware

Updates

One of the most impressive demonstrations at the recently concluded National Computer Conference was in the Data Products booth, where potential customers were shown a line printer generating script writing that was unusually pleasing to the eye--at a speed of 600 lpm, or 4 1/2 pages per minute. Drum printers are notorious for their inability to maintain good registration adjustments, leading to wavy lines. Data Products solved the problem by turning the characters on the print drums sideways, so that one hammer is used to produce each line. The resulting script is fully bridged (connected) and very pleasing to read. This development may lead to increased use of computer printers for printing manuals and form letters without the need for a printing press.

One of the fundamental questions about hand-held calculators is whether they are a crutch or a learning aid in mathematics. The experience of an academic year at Menlo College, Menlo Park, Calif., suggests that students learn more--not less--mathematics by using the surrogate brain. The college believed so strongly in the potential of pocket calculators as learning tools that it equipped a classroom with 20 Hewlett-Packard 45 machines for use in math and business classes. One professor had to rewrite the final exam in a statistics course because the class had covered so much more material and understood the subject matter more thoroughly than in previous years, according to a faculty member.

Digital Equipment Corp. is to be congratulated for an outstanding public relations coup: getting Alphonse's Powder Mill Restaurant to list Maynard, Mass. as the "minicomputer capitol of the world" on all its placemats.

Oops Dept. Norden's unique data radio (May, p. 128) is line of sight, due to the high frequency involved. The data rate is 1.544 or 6.132 megabits per second.

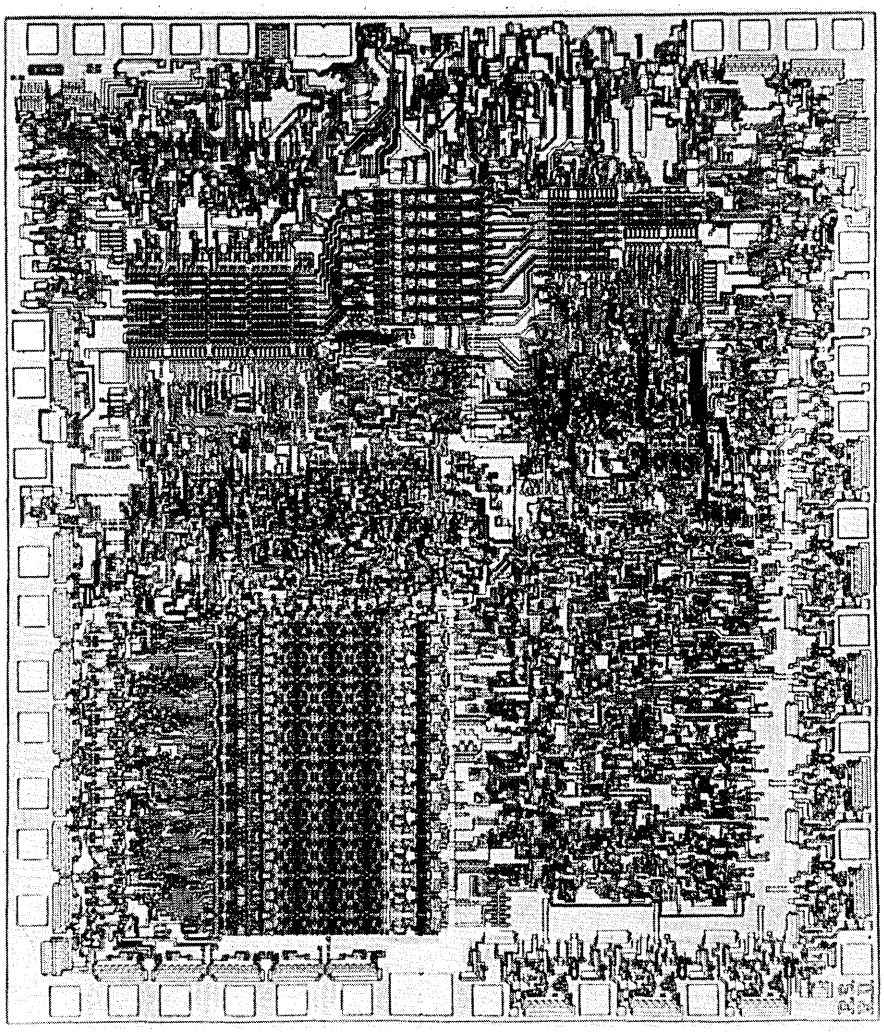
Microprocessor

Intel started the whole microprocessor revolution three years ago with a 4-bit set of chips that moved intelligence closer to the user than it had ever been before. A year later it introduced its familiar 8008 set, a fully parallel 8-bit unit ten times more powerful than the 4004. The third generation, just announced, is the 8080 chip; and although it's still an 8-bit machine, the performance is billed as ten times that of the 8008, thanks to the use of much faster n-channel MOS technology.

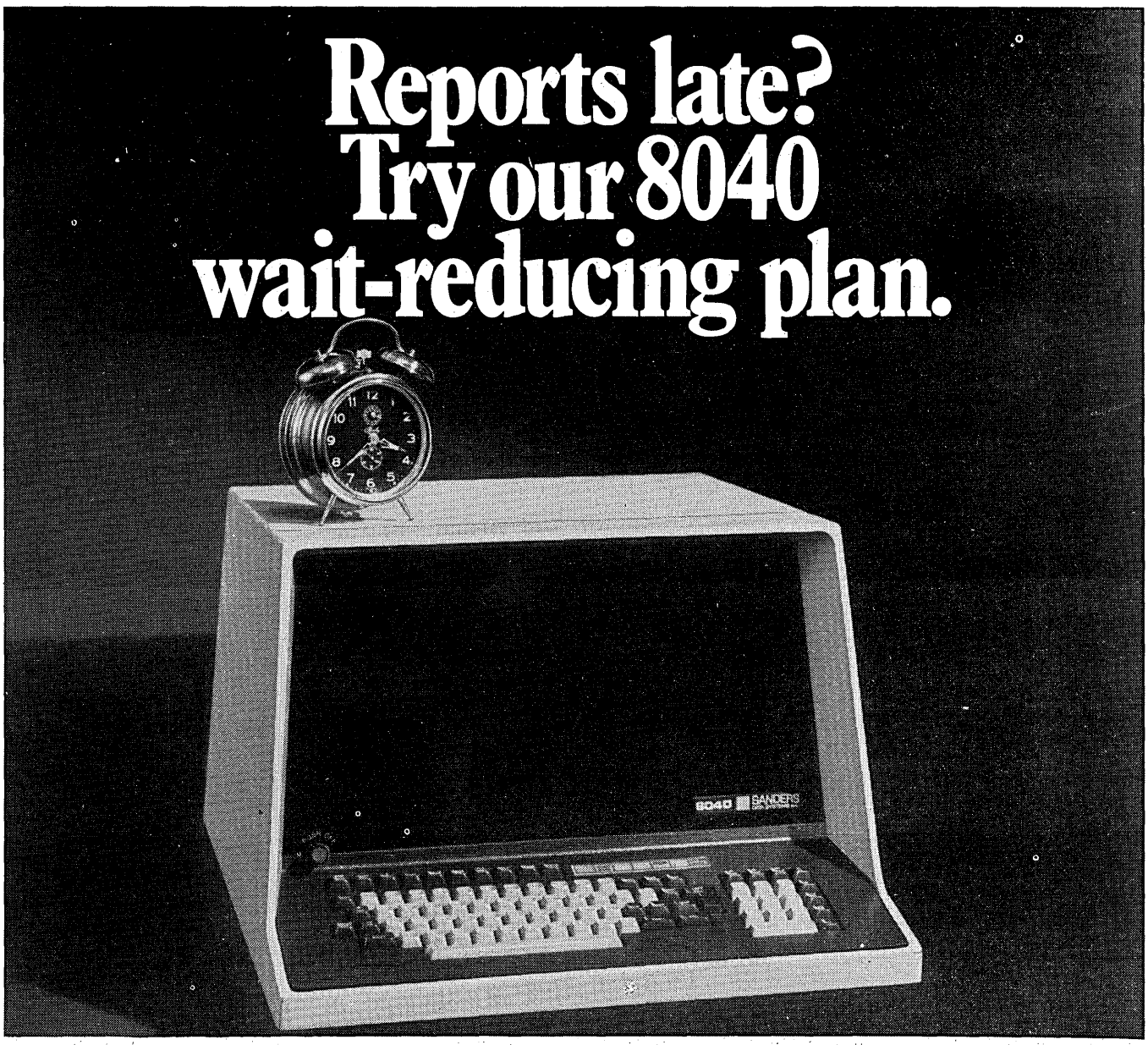
On a chip of silicon less than one-fifth inch square is contained a complete 8-bit computer with 78 mnemonic instructions—a superset of the 8008's set, which means the 8080 can run the 8008's software unchanged. The new instructions facilitate such operations as handling strings of data and doing decimal and double-byte arithmetic. The cycle time is 2 usec, and the cpu can access up to 64 kilobytes of memory through its bus structure. It can operate up to 256 input and 256 output channels (eight bits per channel) and handle up to eight interrupt levels. Except for the clock inputs, all I/O for the 40-pin device is TTL-compatible, easing its incorporation into most standard products. The first ones to receive the 8080's smarts will be intelligent terminals, point-of-sale systems, process and numerical controllers, word processors, and other business machines.

Source programs for the 8080 can be written in either PL/M, a high-level systems-oriented language recently designed for the 8008 series, or in a new macroassembler language introduced with the 8080. Programs generated for the 8080 from the PL/M source program will use about 20% fewer instructions than those generated for the 8008.

Perhaps the best news of all is the pricing schedule for the microcomputer. In quantities of 1-24, it's priced at $360 each. This should make possible a raft of new and excit-

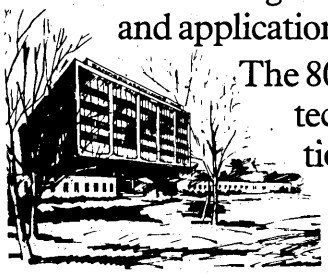


Reports late? Try our 8040 wait-reducing plan.



The function of any data collection operation is efficient, accurate data entry, storage and transmission — so reports from central processing can be generated fast enough to be useful in decision making.

Sanders' 8040 Remote Batch Terminal System does it well. An intelligent, single-terminal system using dual-cassette storage, the 8040 can simulate source-document formats on its CRT screen — and has superior data validation, editing and error-checking features. It does not require highly trained, costly operators and application software and complete maintenance support are included.



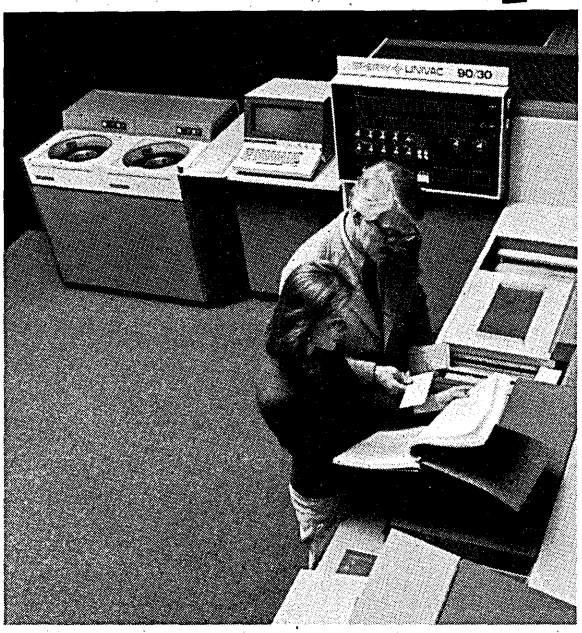
The 8040 system is another example of Sanders' great depth in technology and terminal-industry experience. A demonstration will open your eyes. Sanders Data Systems, Inc., Daniel Webster Highway-South, Nashua, N.H. 03060. Call (603) 885-3727.

Sanders...the intelligent answer

European Sales Offices: Sanders Data Systems, Ltd., 51/53 Brick Street, London W1Y 7DU, England; Sanders Data Systems, GmbH, 6000 Frankfurt/Main, Rennbahnstrasse 72/74, West Germany.

CIRCLE 62 ON READER CARD

Announcing an ideal computer marriage: The Sperry Univac 90/30.



High performance and moderate cost are not often compatible. But in the case of the 90/30, the newest member of the SPERRY UNIVAC™ Series 90 computer family, they're the perfect match.

High performance. Start with the OS/3 operating system, designed specifically for the 90/30 system. It's an advanced disc-resident system that meets the total computing and operating requirements of today's advanced data processing environment. With OS/3 your data can be processed in either sequential, indexed sequential or random manner.

More high performance: The 90/30 provides you with multi-tasking benefits so that programs can be constructed as a series of individual tasks which can be executed asynchronously. In addition, multi-jobbing capabilities allow the system to run up to seven programs concurrently.

Then, for communications applications, the 90/30 provides for up to 12 full-duplex or 24 half-duplex communications lines. This means you can expand your information processing capability at a rate consistent with your needs.

Moderate cost. Not only is the new 90/30 system reasonably priced, but your investment is protected, too. Your upward move is economical. No competitive system has the growth potential of the 90/30. In short, the price/performance ratio of the SPERRY UNIVAC 90/30 makes it a system in a class by itself. How many computer marriages can you say that about?

To find out all the reasons why the new SPERRY UNIVAC 90/30 computer system makes performance and cost so compatible, just talk to your Sperry Univac representative. Or write Sperry Univac World Headquarters, P.O. Box 500, Blue Bell, Pa. 19422.

SPERRY UNIVAC

Only when our customers succeed do we succeed.

SPERRY UNIVAC IS A DIVISION OF SPERRY RAND CORPORATION

hardware

ing products within the next few years. INTEL CORP., Santa Clara, Calif.
FOR DATA CIRCLE 287 ON READER CARD

Remote Plotters

This firm manufactures plotters that run at speeds far higher than a 300-baud line should let them run; and its latest plotter, the 3640, is no exception. It operates at 3,240 steps per second at a resolution (and repeatability) of 2.5 mils, or 8.1 ips. In diagonal mode, the speed jumps up to 11.3 ips, and all from a 30 cps time-sharing hookup. The drum plotter has four pens standard for drawing across the 36-inch wide drum to produce a plot 34 inches wide and as long as 120 feet. Software and hardware interfaces are available for nearly 50 systems. The model 3640 is priced at $19,200. A second plotter just being introduced is a 12-inch drum plotter that is software programmable to plot at resolutions of 10 mils, 5 mils, or 2.5 mils. This allows a user to take a quick look at a plot at the high resolution figure, and if all the data is correct, replot it at the smaller resolution to make a better-looking plot. This model is priced at $9,950 and is just now coming off the production line. ZETA RESEARCH, Lafayette, Calif.
FOR DATA CIRCLE 281 ON READER CARD

Magnetic Card Reader

An Intel 8008 microprocessor has been placed inside a magnetic card reader to create the MCR II microprocessing system. The MCR II can be used to enter variable and format information onto a crt screen, and to store the data by writing it onto magnetic cards. Up to 2K bytes of information can be paged in from each card, and the microprocessor is bootstrapped from the card reader for performing its respective chores. An additional feature of the MCR II is a built-in diagnostic program that indicates which portion of the mechanism is failing. A six-function keyboard, display panel, two-digit readout, plus a serial I/O port that uses either EIA or TTL interface levels, completes the MCR II.

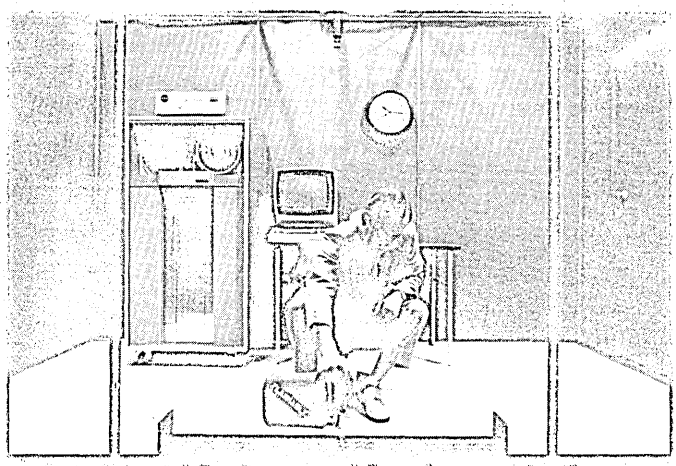
The unit will be marketed to both end users and oem's. Complete with interface and supporting firmware, it's priced at $3,050, and can readily be hooked up to any Hazeltine crt ter-

product spotlight

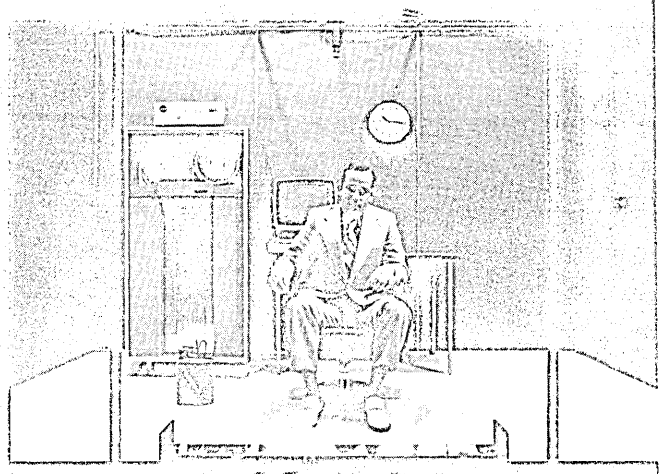
$595 Terminal

The only disappointment about the Comter 256 crt terminal is that it won't be marketed to end users at the $595 price, but perhaps all that could change if enough grass roots support is drummed up for it. The price in no way prepares a prospective purchaser for its list of features: a built-in acoustic coupler; a 32-character Selfscan display, with storage for eight lines or 256 characters (expandable to 1K); a cpu-addressable cursor; automatic transmission to the computer as each line is completed; and others. The standard character set is ASCII, with 64 alphanumeric codes. The Comter 256 also has a tape play/record feature that allows almost any type of tape recorder to be used for auxiliary storage—giving the 256 almost unlimited storage capacity. The unit can either be wired directly to the computer or linked with an RS232 interface. Basically full-duplex in operation, the 256 can be modified for half-duplex mode operation at 110 or 300 baud.

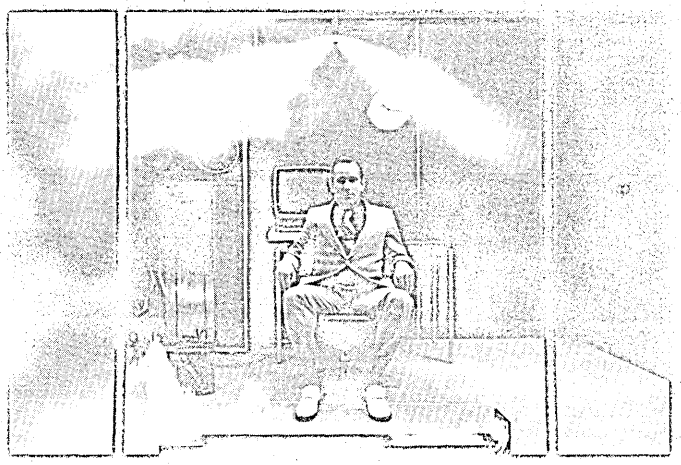
The Comter 256 is in production, with 60 to 90 day delivery being quoted. The $595 price includes the acoustic coupler and the first 256 characters of memory; each additional memory page is $79.50, or three for $230. MITS, INC., Albuquerque, N.M.
FOR DATA CIRCLE 280 ON READER CARD



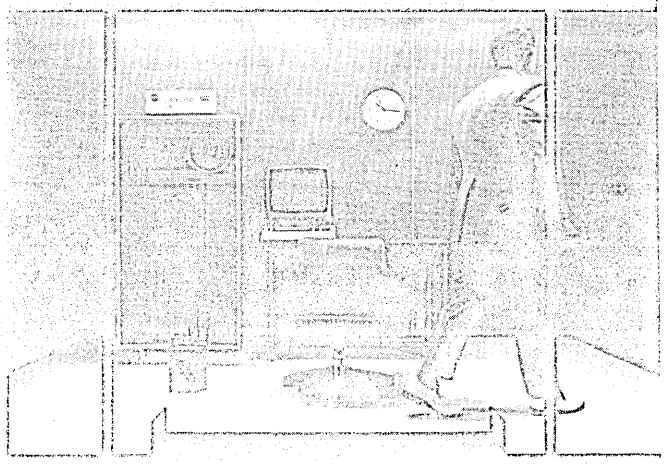
1. Liquid fuel poured for demonstration.



2. Fuel ignited.



3. Halon 1301 released.



4. Fire out. Man safe. No residue.

In the time it takes to read this sentence, Halon 1301 extinguished this fire with no harm to man or equipment.

It's protection you need against damage, downtime and loss of records.

If you can't afford to be without your data processing equipment or records, you can't afford to be without Du Pont Halon 1301 protection.

A total flooding system using Halon 1301 works fast and can be released fast—while people are in the area, because exposure to usual extinguishing concentrations for up to five minutes is not harmful. The National Fire Protection Association has approved a standard for the use of Halon 1301 (Standard 12A).

Halon 1301 is the ideal extinguishant for protecting electronic equipment. It is a chemical vapor that can penetrate cabinets, above ceilings and under floors. Yet it doesn't leave residue or cause thermal shock damage to equipment. It's electrically non-conductive and non-corrosive. And systems using Halon 1301 are economically competitive with other gaseous fire protection systems.

For more information on automatic total flooding systems using Halon 1301 fire extinguishant, write or call Du Pont Company, Room 23891-B, Wilmington, DE 19898. 302-774-7381.

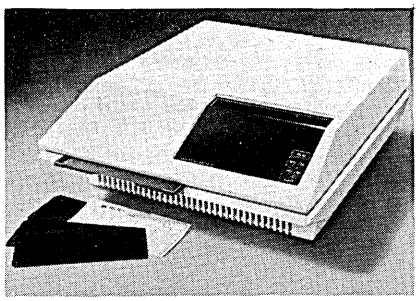
Total flooding systems using Halon 1301, with UL and/or FM approval, are manufactured by:

The Ansul Co.
Cardox Div. of
Chemetron Corp.
Fenwal, Inc.
Walter Kidde & Co., Inc.
Norris Industries
Safety First Products

CIRCLE 100 ON READER CARD

DUPONT HALON 1301 FIRE EXTINGUISHANT

hardware



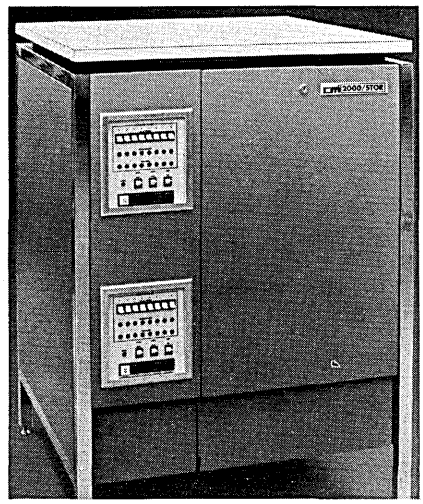
minal. Delivery times of 90-120 days are currently being quoted. WILTEK, INC., Norwalk, Conn.

FOR DATA CIRCLE 282 ON READER CARD

H-2000 Expansion Memory

It's up to the courts whether Honeywell will allow Cambridge Memories to expand the memory capacities of many models in the 2000 series, but users of the models 1200, 1250, 2200, 3200, 2070, and 2050A should be apprised of the fact that such products exist. Called 2000/STOR, the memories can, in some cases, double the capacity of the computers, with pricing set for approximately 70% of whatever Honeywell gets for the same size memory, up to the limits of the machine. Beyond that level, minor cpu modifications must be made, and CMI doesn't want to quote pricing until after the courts have had their say.

The storage boxes are being made available in 64K, 128K, 256K, and 512K character increments that can be



connected directly to the processor, or to any resident Honeywell memory module, to increase the storage capacity. The memories are currently available (60 days ARO), but you'd better talk to Honeywell before you firm up your plans. CAMBRIDGE MEMORIES, INC., Concord, Mass.

FOR DATA CIRCLE 283 ON READER CARD

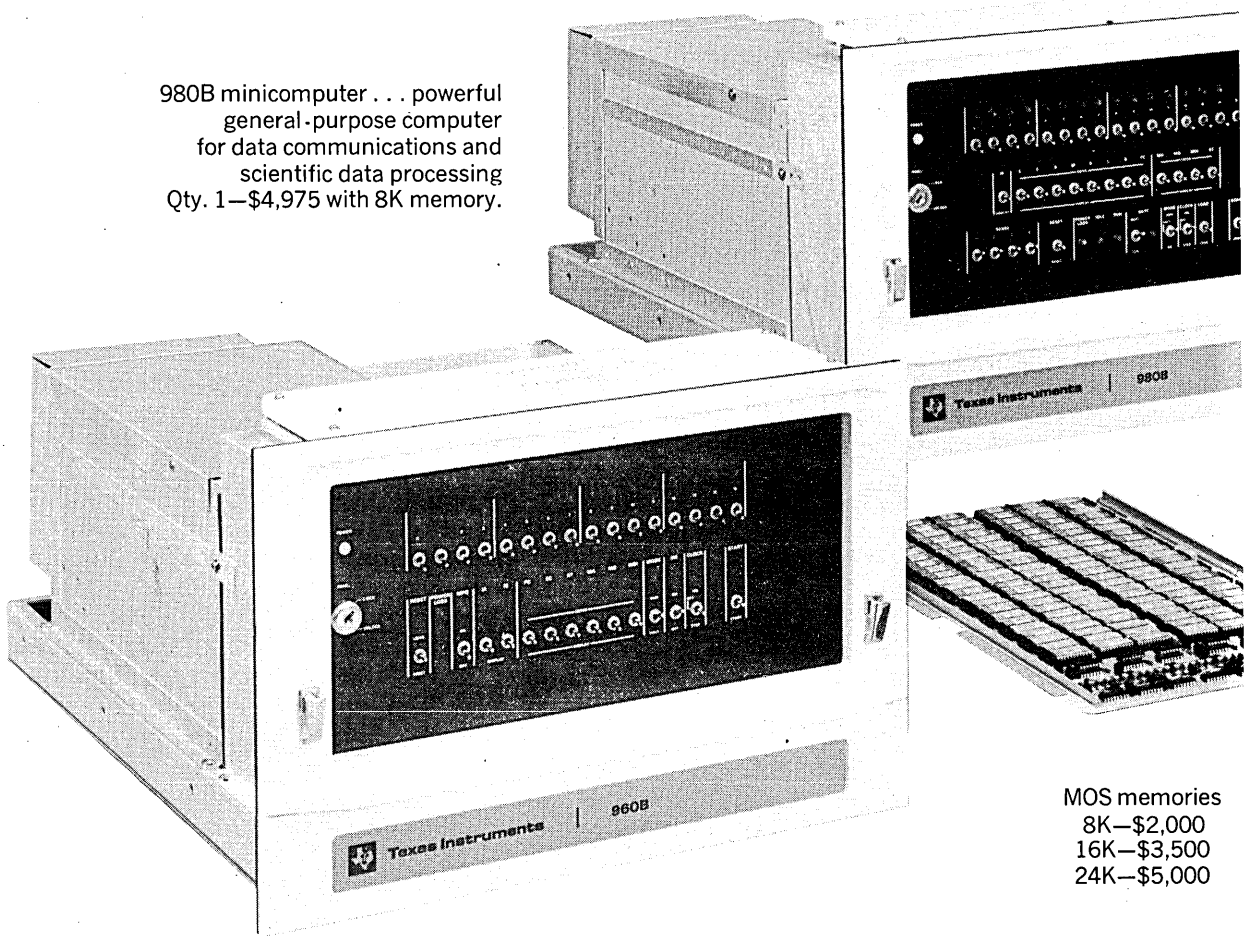
Three Small Systems

NCR is evidently fairly satisfied with the architecture of its Century series computers, but is apparently concerned that the jumps in performance between its current offerings are too great. The Century 50/Mod I, 151, and 201 models have been announced to fill the gaps in the lineup.

The 50/Mod I is a fairly limited system in terms of how much memory you can put on it (only 16 or 32K capacities are offered), but comes in at a nice price of $1,275/month for the smaller memory size, 125-lpm printer, 300-cpm reader, and a 16.8-megabyte disc storage subsystem that uses two 8.4 megabyte removable packs. The rental rate is based on a five-year lease that includes maintenance charges. We'll venture that this is the last Century series computer announced with short rod memory technology, as NCR is clearly in the midst of changing to MOS technology. The basic operating software for the Mod I is bundled with the purchase price, with some applications programs separately priced. Any and all software that will run within the 32K byte memory constraints is

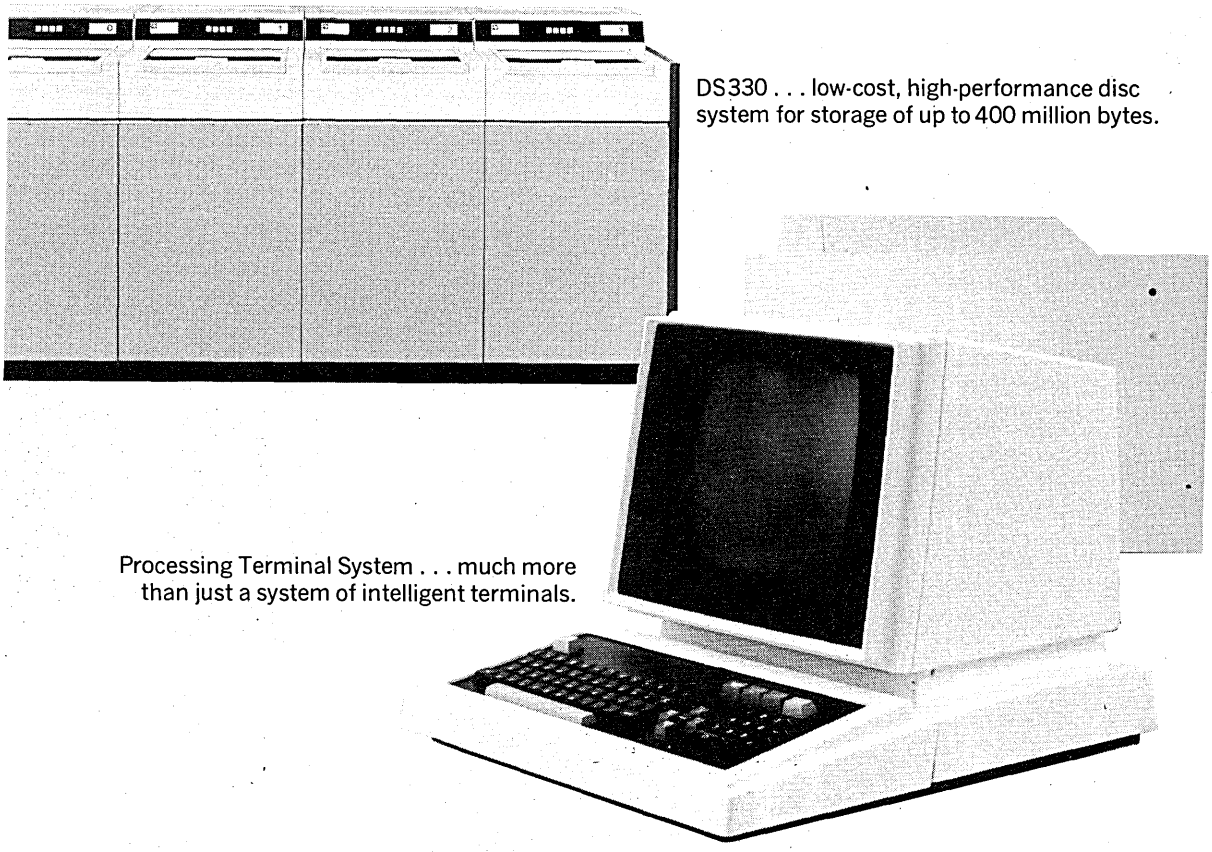
TI announces four new computer products

980B minicomputer . . . powerful general-purpose computer for data communications and scientific data processing
Qty. 1—$4,975 with 8K memory.



MOS memories
8K—$2,000
16K—$3,500
24K—$5,000

960B minicomputer . . .
process control computer
for manufacturing and testing systems
Qty. 1—$4,350 with 8K memory.



DS330 . . . low-cost, high-performance disc system for storage of up to 400 million bytes.

Processing Terminal System . . . much more than just a system of intelligent terminals.

New price/performance standards!

900 Series Minicomputers
These two new additions to the TI computer line use memory featuring the new generation TI 4K RAM plug-in devices, error correction/detection logic and fault isolation indicator lights . . . achieving new standards in reliability and maintainability.

System architecture accommodates direct interfacing with high and low-speed devices, for a broad range of applications.

DS330
The new DS330 Disc System yields a dramatic increase in data storage capability previously not available in minicomputer systems. One to four drives per controller provides 100 to 400 million bytes of data storage.

Processing Terminal System
Ideal for data collection and retrieval systems, this versatile and expandable interactive terminal ensemble includes up to eight Model 913 CRT displays linked to a powerful controller/processor. The programmable keyboard provides instantaneous operator/terminal dialog, to achieve powerful operator prompting and dialog techniques that are impractical with other terminal systems. The Processing Terminal System's front-end processing ability relieves host computer loading.

These and all TI products and systems are backed by extensive user-oriented software, a nationwide sales and service network, and the TI-CARE* Computer Aided Repair Effort . . . the automated remote diagnostic and customer service dispatching system. For more information on TI's new price/performance leaders, call your nearest field engineer in the sales offices listed below or contact Texas Instruments Incorporated, Digital Systems Division, P.O. Box 2909, Austin, Texas 78767, phone (512) 258-5121, ext. 539.

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Versatec does it again!

Announcing 200-points-per-inch resolution

Versatec is making points like crazy.

While the rest of the electrostatic printer industry is plugging along at 80 points per inch . . . or 100 . . . we now introduce our tour de force . . .

The Matrix 1200A Printer/Plotter. Clearly the most impressive performer **ever** in electrostatic printers and plotters.

Consider. We can plot 3,600,000 points on a standard 8½ x 11 inch page!

In nine seconds.

Produced by 2,112 writing nibs in a **dual-array** configuration.

This staggering capability delivers overlapping dots and the kind of fine line resolution you expect from the best pen plotter... but 100 times faster.

And as for the printed page, the 1200A will print 132 16 x 16 dot matrix characters across the page at 500 LPM...in a typeface that is more handsome than that of any impact printer. You're looking at a sample of it right here.

You're probably thinking — "How come it's Versatec, Versatec, Versatec all the time who's making the breakthroughs?"

We are the only one with MEWT™, a true electrostatic writing technique. Years ago, we broke the price barriers with the least expensive electrostatic printers and plotters. And now we offer twice the resolution of anyone else.

With over 1,500 Matrix units in 20 countries around the world we're designing better products than anyone else.

But back to our Matrix 1200A. Write us today for more information including a 200 points per inch print and plot sample that will knock your eyes out.

You have to see it to believe it.

Versatec, Inc., 10100 Bubb Road Cupertino, California 95014. (408) 257-9900.

VERSATEC

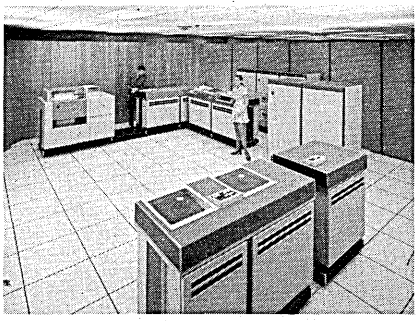
Specialists in hard copy information display

CIRCLE 41 ON READER CARD

available to the user. Additionally, the Mod I can be equipped with the B-2 operating system to transform it from a batch-oriented system to on-line operation. Users aren't limited to the 125-lpm printer, either. Two additional models offer 450- and 750-lpm performance. Deliveries are scheduled to begin during the current quarter.
FOR DATA CIRCLE 284 ON READER CARD

While the Century 50/Mod I looks like an able competitor in the small business computing market, the Century 151 will square off against the System/3 model 15 and the Burroughs 1726. The 151 fits between the Century 101 and 200 models and features from 32-128K bytes of 750-nsec MOS memory. Two optional, high-speed channels on the 151 make possible the addition of NCR's large disc unit, the 657, which, with its 96 megabyte-per-pack capacity, makes data base applications on the 151 possible. A 32K system with 10 megabytes of disc storage, a 300-lpm printer, 300-cpm reader, and 30-cps console sells for $133,695 or rents for $2,675/month on a five-year lease, including maintenance. Deliveries begin early next year.
FOR DATA CIRCLE 285 ON READER CARD

The Century 201 (shown) promises a lot of performance for the money, and its memory size of 64-512K should be a strong selling point against the IBM 370/115 and the Burroughs B 1728



systems. Multiprogramming is supported by 650 nsec memory times and eight I/O channels, one of which operates at close to 1 megabyte/second data rates. NCR will sell the system into on-line applications such as savings and loans, bill of materials and production control environments, hospitals, retailers, and law enforcement agencies. A 64K system with 300-cpm reader, 1,500-lpm printer, and 96-megabyte disc unit sells for $300K and rents for $5,525/month on a five-year lease. The 251 will be available later this year. NCR, Dayton, Ohio.
FOR DATA CIRCLE 286 ON READER CARD

Data Compaction

Final touches are being placed on a device that should measurably increase the performance of this firm's line of remote batch terminals without having to resort to higher speed phone lines. It's a data compactor that accepts IBM bisynchronous data at a relatively high rate, shrinks it down to a small block size, transmits it across a lower speed line, and expands the data at the other end of the line. The developers are understandably hesitant to claim that it will double every user's throughput, but do say that the first four test installations suggest that to be the case.

Three or four fairly standard data compression techniques have been implemented in the compactor's firmware to achieve the performance increase. There is an element of security in the compactor's operation, since the shrunken data is scrambled and cannot readily be interpreted without the use of another compactor. Additionally, the smaller information blocks being sent across the line should be somewhat less prone to transmission errors.

Two models are available. The mod-

hardware

el I attaches to 2,000-4,800 baud lines and rents for $150/month, and the model II attaches to 4,800-9,600 baud lines and rents for $350/month. DATA 100 CORP., Minneapolis, Minn.

FOR DATA CIRCLE 288 ON READER CARD

Mini Disc Storage

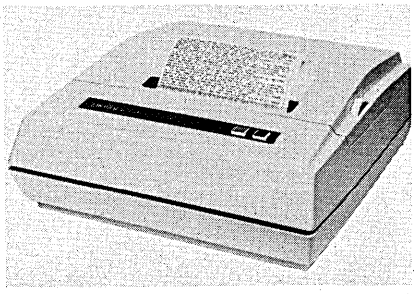
Nearly one billion bytes of information on-line to a minicomputer is possible using a newly developed, buffered (4K) controller and from one to four 116- or 232-megabyte 3330-type disc drives offered by this manufacturer. The cpu buffer transfer rate is strappable to 250 kilobytes/second, 500 KB/second, 1 megabyte/second, or 2 megabytes/second to permit optimum timing for software applications. The buffered controller handles disc data rates of 624 KB/second. Buffer expansion up to 16K is offered as an option.

Among the features of the system are a seven-byte code in record headers, and a seven-byte code for data permit error corrections of up to 11 bits in each field; overlapped seeking on files; soft sectoring of up to 128 sectors/track; fully isolated DMA interface; and variable record formatting. A complete, single-spindle system sells for $27,100. Interfaces are available for all DEC PDP-11 models, the PDP-8, the Digital Computer Controls DCC-116, all Interdata cpu's, and the Texas Instruments 960A and 980A models. DIVA INC., Eatontown, N.J.

FOR DATA CIRCLE 289 ON READER CARD

Oem Peripherals

This company, a joint venture between Oki Electric Ltd. of Japan and a U.S. management group, came to NCC with some very good-looking oem peripher-



als—one of which might be a real breakthrough for high-speed serial printers. It's a 110-cps impact printer designed to complement crt's and provide hard copy of data stored on a crt display. It prints a 5x7 dot matrix character from a 64-character ASCII subset across 80 columns at 110 cps or 70 lines per minute. The bi-directional unit has a 400 lpm capability paper feed mechanism that contains no brakes, clutches, or dampers, which should aid reliability, as should having all the control electronics on a single pc board. It can be supplied with limited control electronics, with cabinet, or completely interfaced to oem terminals. With a price of $900 for orders around 100 (depending on actual oem requirements), the only thing we could wish for would be an RS 232 interface for using it as a medium-speed serial output printer.

Also on display was a nicely engineered 500-lpm line printer called the LP500. Jumping from a 64-character ASCII set to 128 characters only drops the 500's speed down to 330 lpm across 136 columns. A "near end of form" and "end of form" alarm is standard with the LP500. After all the haggling over oem orders is finished, the price for the LP500 will be right around $7500 for quantities on the order of 100. OKIDATA CORP., Moorestown, N.J.

FOR DATA CIRCLE 290 ON READER CARD □

What would you do with a Statistics and Number-Crunching Computer that starts at $7,100,* has 16K Hardwired Basic Language and 28 Major Peripherals?

Plenty!

The new Wang System 2200 is a System. It gives you the raw power and the peripherals you must have for a wide range of problem solving. For under $7,200 you get a CPU with 16K bytes of BASIC language instructions hardwired into the electronics . . . plus a 4K operating memory. You also get a big 16 lines (of 64 characters each) CRT display, a console mag tape drive and your choice of either alpha or BASIC Keyword keyboards.

Some Words About Language: The hardwired MOS ROM language in your System 2200 finally ends your dollar tradeoffs . . . economy systems that are costly to program or very expensive systems that are relatively easy to program. Many, if not most, of your people already know BASIC. They'll be solving problems the day your system is delivered (and, we can deliver in about two weeks). Most of your budget will go into problem solving; not system support.

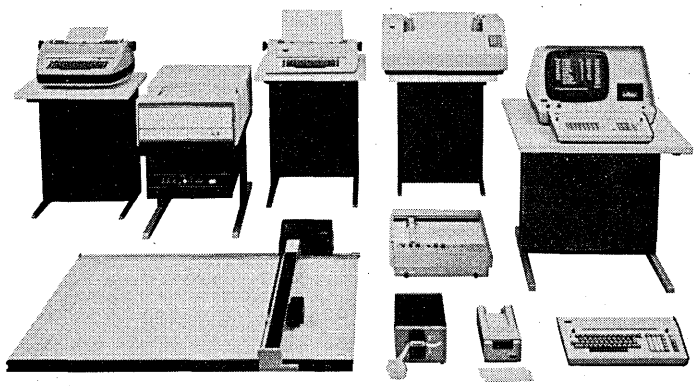
Try To Out-Grow It: Main memory is field expandable in 4K increments (at $1,500 per 4K). Up to 32K. You can choose from three kinds (and 7 price ranges) of printers . . . one even has a stepping motor for very precise 4-quadrant incremental plotting. Speaking of plots, we have a new, very large flatbed (31" × 42") for only $7,500 or a smaller one if you plot small. Both print alphanumerics and plot under full program control. Been appalled lately by disk prices? Starting at just $4,000, we offer you our new "floppy" disk in single, double and triple disk configurations (.25, .50 and .75 MB's). For big disk power, you can have 1, 2 or 5 megabyte fixed/removable disk systems. All peripherals, including punched or mark sense hopper card readers, paper tape readers and on- line BCD or ASCII controllers are easily added-on in the field so your System 2200 will grow with your needs.

The Wise Terminal: If you are now or may soon be getting into terminals, we have several new products that will instantly upgrade your System 2200 for telecommunications with any other System 2200 or a mainframe computer. And, you still have a powerful stand-alone system. Another approach, of course, is to justify it as a powerful terminal and get a "free" stand-alone computer. Wise?

We Do A Lot For You: System 2200 is backed by over 250 factory-trained Wang Service Technicians in 105 U.S. cities. Naturally, we guarantee or warranty everything you buy from us. If you want, there are free programming/operating schools here in Tewksbury, Massachusetts, almost every week. We have a growing program library on a wide range of statistics and math/science applications. Our user group (with the unlikely name of "SWAP") could help you cut programming costs even further. We do a lot for you.

* All prices U.S. List. If you're the entrepreneur type, we've just announced a new 7-module Basic Accounting System software package for the business end of your business like payroll, invoicing, inventory, receivables and some really fancy management reports.

WANG



Even if you call the Wang System 2200 a small system . . . you have to admit it's a big idea.

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software & services

Updates

Make plans now to attend the 1975 International Conference on Reliable Software, sponsored by the IEEE Computer Society and Reliability Group, and ACM's SIGPLAN and SIGMETRICS groups. It'll be held at the International Hotel, Los Angeles, on April 22-25. The conference will bring together theoreticians, tool developers, and practitioners for an exchange of ideas and experience contributing to the achievement of reliable software. A varied program of contributed and invited papers, tutorial presentations, panel and ad-hoc discussions will be featured. Among the topics to be covered by the conference are theory of reliable software; aids to constructing reliable software; practical aspects of reliable software; the impact of reliability on software equality and cost; fault-tolerant software; and security and privacy.

Significant examples of management and computer software innovations initiated in the aerospace industry and subsequently adopted by private industry and other government agencies is being analyzed by the Univ. of Denver's Research Institute as a project for the Smithsonian Institute's Air and Space Museum. The aim is to develop an exhibit at the Smithsonian demonstrating air and space technology applications in other fields. Readers who know of any such managerial technology transfers, whether successful or not, are asked to contact the Industrial Economics Division, Denver Research Institute, Univ. of Denver, Denver, Colorado, 80210.

People aren't the only ones being put into data banks: every dog licensed by Detroit during the last two years is now on-line (on-leash?) to that city's Health Department, via the municipal computer. An $11K computer program will attempt to bring in an additional $150K annually by insuring that Fido's owner renews his or her license each year. "Hot Dogs" seems like a suitable name for the program.

COBOL Sort/Merge

One of the more progressive large-scale computer users is making available a program product with sorting and merging capacities 16 times (32 times with modifications) greater than those of IBM's Sort/Merge 1 (s/M 1) package. The immediate benefit of Extended COBOL Sort (ECS) is that it reduces programmer concerns about hardware availability or the volume of data to be expected during actual production runs. Merging files is simplified by using a merge simulation feature. The programmer uses a language compatible with the proposed ANSI standard MERGE statement, and a true merge can be executed in a COBOL program.

ECS should be a hit with operations personnel, too, since its automatic expansion feature means that sorts will no longer be terminated because of insufficient file space allocation, and ECS automatically checkpoints itself to ease restart operations when they are necessary.

ECS resides in one program data set of four tracks on a 3330-type disc unit. To convert from using S/M 1, installations need only eliminate the use of the SYSIN DD card from their programs, and prepare a MERGE control card for each program converted to ECS. ECS operates with OS release 21.7 and VS2R1.6 monitors. A perpetual license is $3K per installation, with multiple installation discounts available. Included in the price are one copy each of the installation guide, user guide, and internal documentation, as well as one copy of machine readable material containing both the source code for ECS and a load library. FIREMAN'S FUND INSURANCE COMPANY, San Francisco, Calif.

FOR DATA CIRCLE 251 ON READER CARD

Network Analysis

SCOPE (System for Computing Operational Probability Equations) is a large program, developed by North American Rockwell Corp., that can be used in industry to determine the probability of success or failure for any large network or system where the functioning of the system is dependent on each step. SCOPE computes from a combination of logical block diagrams, success or failure modes, success or failure equations, and success or failure probability indices. It can be used to merge a PERT-type path generator with an algorithm for combining failure or success modes to obtain failure or success equations. The mathematical mode for SCOPE is based on the Fundamental Law for the Addition of Probabilities and its extension to cases of more than two events. Written in FORTRAN IV, SCOPE is set up for operation on an IBM 360 model having a minimum of 365K bytes of storage available. The documentation is priced at $16.50 and the program itself is priced at $350. The program reference number is MFS-24484. COSMIC, Athens, Ga.

FOR DATA CIRCLE 252 ON READER CARD

Intel 8008 Debug

MIKE is the name of this alternative debugging package to the one Intel supplies with its 8008 microcomputer chip sets. Among the advantages claimed for the new offering are that it performs both octal and hexadecimal I/O (including the punching and reading of tapes), generates "computer-style" horizontal memory dumps that conserve both paper and time (to produce as well as to read), has built-in tape checksums, reduces the length of load tapes by a factor of five, and more. MIKE runs inside three 1702A PROM's (same as Intel size), and is supplied on a program load tape along with source code and user's manual for $475. APPLIED COMPUTING DEVICES, INC., Terre Haute, Ind.

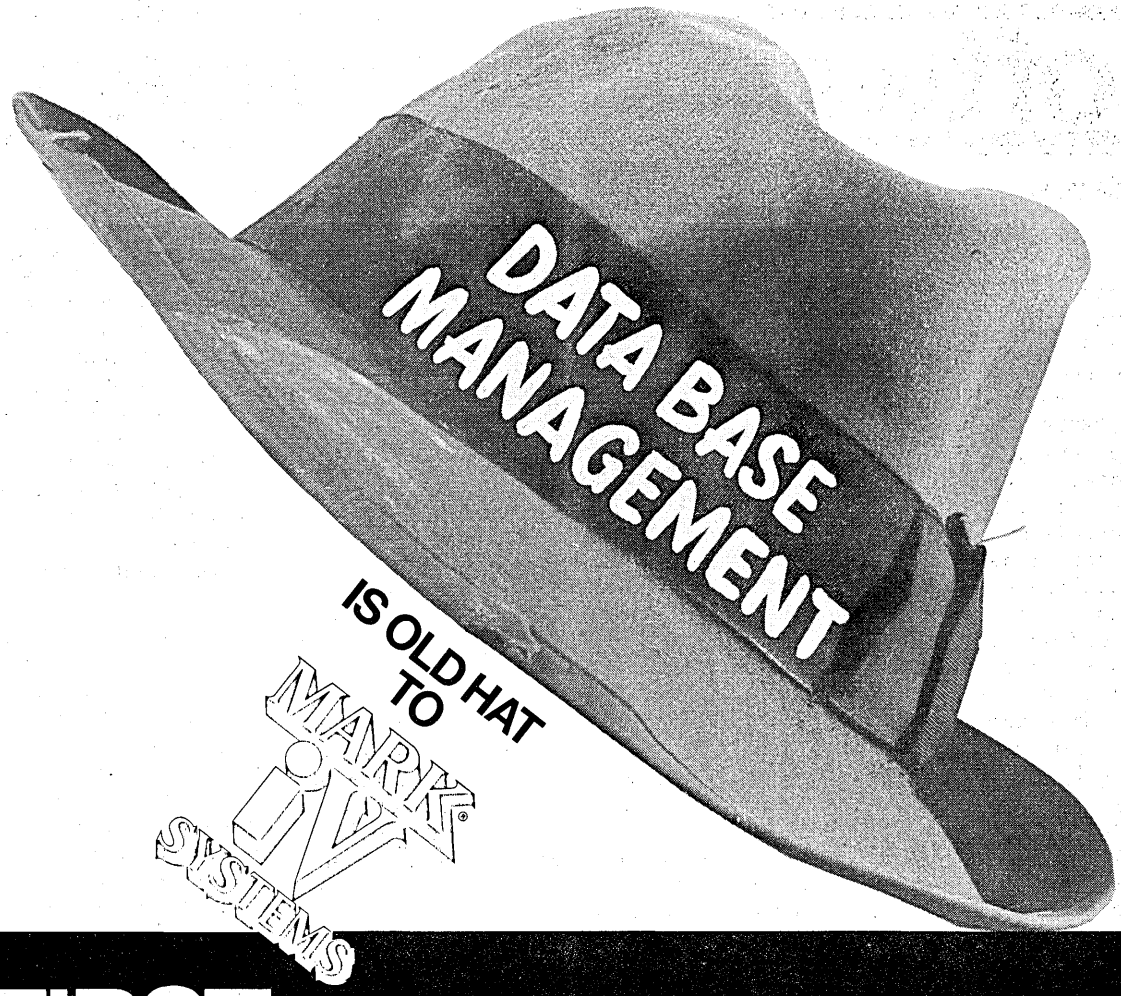
FOR DATA CIRCLE 253 ON READER CARD

Tape Utility Program

The Boolean Tape Utility Program enables IBM DOS installations to perform operations on magnetic tape files, ranging from relatively easy copy operations to complex search, dump, copy, sequence, and reposition manipulations controlled with Boolean statements containing AND, OR, and NOT conditions. As distributed, core requirements are approximately 32K bytes. For smaller partitions, one or both I/O blocks can be reduced from the present 10,000 byte size. Commands are entered through the system console. The program is priced at $150, which includes a 15-day free trial, one-year maintenance agreement, and the source code of the assembler language product. INTERNATIONAL BUSINESS INFORMATION SYSTEMS, New Orleans, La.

FOR DATA CIRCLE 254 ON READER CARD

(Continued on page 160)



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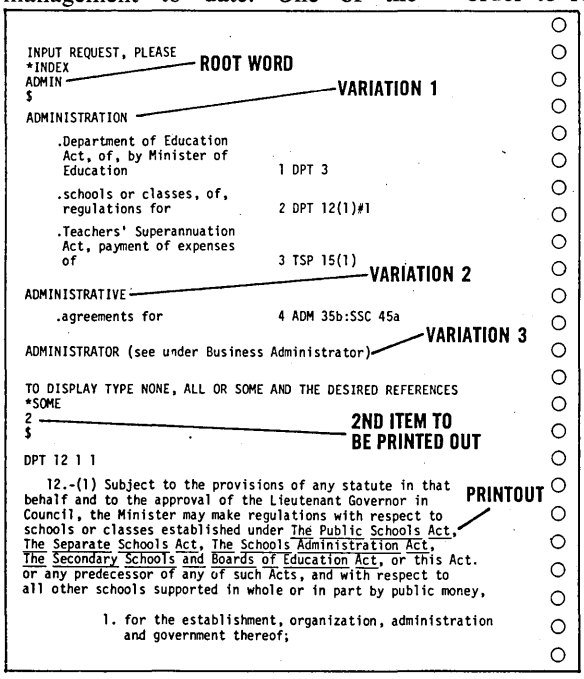
software & services

Text Retrieval

The CONTEXT information retrieval system appears to be the most user-oriented product developed for textual management to date. One of the chronic problems with ambitious systems of this kind has always been that users had to have a pretty good idea of the location of specific materials in order to retrieve them, and so users had to code the identification symbols. Not so with CONTEXT, however; the system needs no coding (we're told) to use it, opening up its use to unsophisticated computer users.



software spotlight

CONTEXT's developers suggest using their firm's time-sharing service as an easy entree to the system, especially if the size of the data base is relatively small. Optical readers or IBM MTST stations would probably be the most common method of building the data base. There are two basic search techniques that can then be applied against the data base: index and conditional. The index search allows the user to see if a particular word or symbol occurs in the text. If it does, the system lists all locations in the text where the word is used and allows you to print out or display one or as many of these text locations as required. In addition, a root word can be specified, and all variations of the root will be listed, along with their locations. If two or more words are entered that specify an idea, a situation or a concept, the system automatically indicates all locations in the text where these words occur in close proximity to each other. This technique can look for a set of specified conditions, such as A *and* B *or* C *not* D. All updating of the files is handled automatically.

CONTEXT is designed to handle as many terminals as a particular computer system can accommodate. Considering that the vendor is claiming that three hours of connect time using the system for complex Boolean searches used only 57 seconds of cpu time on an IBM 370 system, response times for CONTEXT should be good. An additional feature of the system is its built-in security measures, allowing users to restrict the use of entire files and various levels of text within those files, as well as the entire system. CONTEXT will not even acknowledge the presence of restricted text to an unauthorized user—which seems like the way to do things.

Versions of CONTEXT are currently available for all IBM 360 and 370 systems, DEC's PDP-10, and most Burroughs systems. The memory requirements range from 67-110 bytes (or equivalent), depending upon which modules are loaded. The CONTEXT system sells for $50K, or rents for $1K/month with a $250/month maintenance charge. BASE, INC., New York, N.Y.

FOR DATA CIRCLE 250 ON READER CARD

Documentation Generator

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users of its Century series systems. DOCUMAT scans source program statements and generates descriptive documentation on special printed forms. Because DOCUMAT develops each document in the same manner, using standard symbols, the programs can be transferred to magnetic media relatively easily. Having the document in storage allows for easy access and updating. This provides interim documentation until final program specifications are completed, and does away with retyping entire pages when text inserts are required.

The program is available in two levels. Stage I is based on the NCR documentation standard manual and generates standard format documents, whereas Stage II allows free-flow narrative text, text justification, and parameterized tables. This version permits programmers to tailor the format of the computer output to his or her particular requirements. Stage I has an annual license fee of $375, or a monthly rental of $35, while Stage II costs $650 annually or $60/month. The documentation generators are also available packaged with a flowchart generation program, and as such are called DOCUFLOW. NCR CORP., Dayton, Ohio.

FOR DATA CIRCLE 255 ON READER CARD

DOS Enhancements

This vendor's Extended Disc Operating System (EDOS) hardly resembles the IBM DOS on which it was originally based two years ago, and the announcement of automatic job scheduling and execution capabilities move it a step further away. For all the changes made to DOS, however, this firm is still claiming 100% compatibility with IBM distributed programs, and all user-written programs operate without modification.

PISCES is the name of the automatic job scheduling capability, which has been integrated into the system's nucleus so as to eliminate overhead as much as possible. Jobs are automatically scheduled and executed in any of EDOS's six partitions without operator intervention. PISCES is also concerned with optimum use of the system's hardware resources, so the $40/month charge could conceivably pay for itself within days. The scheduling is based on user-specified job and partition classifications. THE COMPUTER SOFTWARE CO., Richmond, Va.

FOR DATA CIRCLE 257 ON READER CARD □

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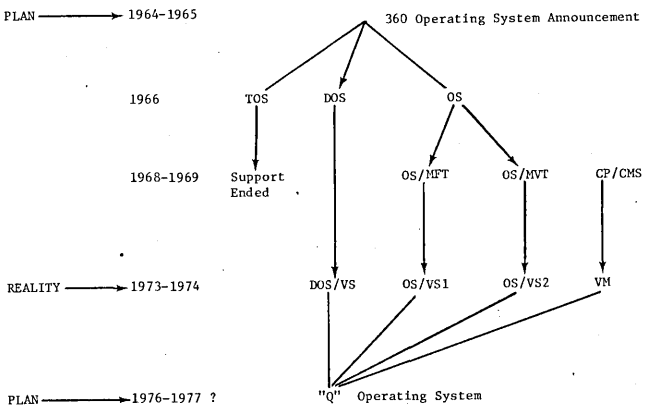
IBM'S OPERATING SYSTEM MONOPOLY

IBM currently monopolizes the development and support of IBM operating systems. This monopoly, which started almost 10 years ago, has played continuous havoc with IBM 360/-370 users. Operating systems are almost unanimously viewed as being the most critical element of any computer system: they permanently occupy large portions of memory; they are responsible for all I/O queueing, scheduling, device allocation, and resultant computer throughput; they are responsible for the support (or non-support) of all peripheral devices; and they control memory allocation, multiprogramming and, in the case of virtual memory, page accessing and allocation. Application programs are dependent on the unique resources of operating systems; when the resources are changed or support is discontinued, the user is at the mercy of the operating system's developers and supporters.

In 1970, the operating systems were the *one* piece of software that IBM chose not to unbundle. Was it an act of kindness? IBM doesn't charge its customers for DOS, DOS/VS1, OS/MFT, OS/MVT, OS/VS1, OS/VS2 or VM/370 and surely IBM wants to increase its revenue. They charge for

IBM 360/370 OPERATING SYSTEMS

FAMILY TREE



compilers, sorts, data management packages, and other pieces of system software (all of which have competition). Why wouldn't IBM want to increase its revenue by charging for operating systems?

IBM doesn't charge for them simply because it is significantly more profitable in the long run to lock customers into inefficient operating systems and lock out competition. After being trapped, the computer user "lamb" is strategically led to the next generation of IBM operating systems. 360 users have no choice but to move to the 370 line, because new devices are supported only on the 370 operating systems. 370 DOS and OS users are led to VS operating systems

because support of the current operating systems is discontinued. "Functionally stabilized" is IBM's way of telling users it will no longer improve on DOS, OS/MFT, and OS/MVT—a slow death no matter how you look at it.

Competition does not happen spontaneously—especially in the area of operating systems. Sure, some software companies can "pick up the crumbs" and try to sell support and enhancements to IBM's "free" operating systems. But the harm is already done—there is no effective or economical way for a would-be competitor to break into the field. New operating systems *are* being planned and most users won't stay with current "free" operating systems if they have to buy support from some non-IBM firm. Besides, soon there will be that new IBM state-of-the-art free operating system and it'll solve all of those problems of the past . . . Wanna bet?

Competition and antitrust laws made IBM cut the price of its peripherals and memories. But there *is no* operating system software competition so far, because the monopoly has not yet been challenged.

Consider this hypothetical situation: in 1964 IBM announced the 360 at an average cost of $10,000 per month; IBM also announced an operating system software package at $1,000 per month. With IBM predicting sales of 20,000 computers, and third party leasers predicting 10-year life spans for 360 computers, the total 10-year revenue for the 360 hardware line was predicted to be $24 billion. During the same 1965-1975 period, the operating system software package market alone was predicted to be $2.4 billion. By 1967, three software companies had developed compatible operating systems to sell for $750 per month; they were compatible, operated in half the space, and provided faster throughput. IBM responded by announcing a new version of the operating system. The wheels of competition keep turning, and the needs of the user community—as well as those of the industry—are served.

But look at what we have in 1974: IBM locking in its customers with free vs operating systems and IBM users facing obsolescence of their 360 hardware and current operating systems, and no competition in sight. It's all going to happen again, two to five years from now, with IBM's new, and as yet unannounced, "Q" operating system. Where is the Justice Department and where are the voices of the users? IBM's 360/370 line of computers was successful in spite of its inefficient and error-prone operating system. Talk about the need for conservation and improved productivity! It would be an interesting exercise for an economist to calculate the resources that have been wasted because of the marginal operating system software that IBM has produced and supported over the past 10 years.

In defense of its position in the TELEX case,* IBM recently stated that antitrust laws exist "Because through competitive battles resulting in innovation and price reductions, the consumer benefits." But, IBM, may I ask one simple question: how do you propose that those "competitive battles" in the field of operating systems be waged with only one side willing to fight? It still may not be too late to introduce competition into the next generation of operating systems, but time is running out.

There's no technological reason why IBM can't unbundle their operating systems; CDC has announced that they will charge for *their* operating systems. Obviously, free operating system software is merely a marketing decision and unless IBM is pressured into changing its policies, things will remain, unfortunately, the same.

—Martin A. Goetz
Mr. Goetz is a vice president of Applied Data Research, and director of its Software Products Div. Past president of the Software Industry Assoc. and of ADAPSO, he is the holder of the first U.S. software patent.

Brief of International Business Machines Corp. presented at the U.S. Court of Appeals, Tenth Circuit, Feb. 7, 1974, p. 45.

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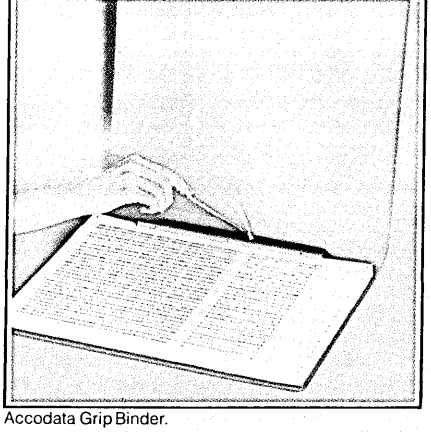

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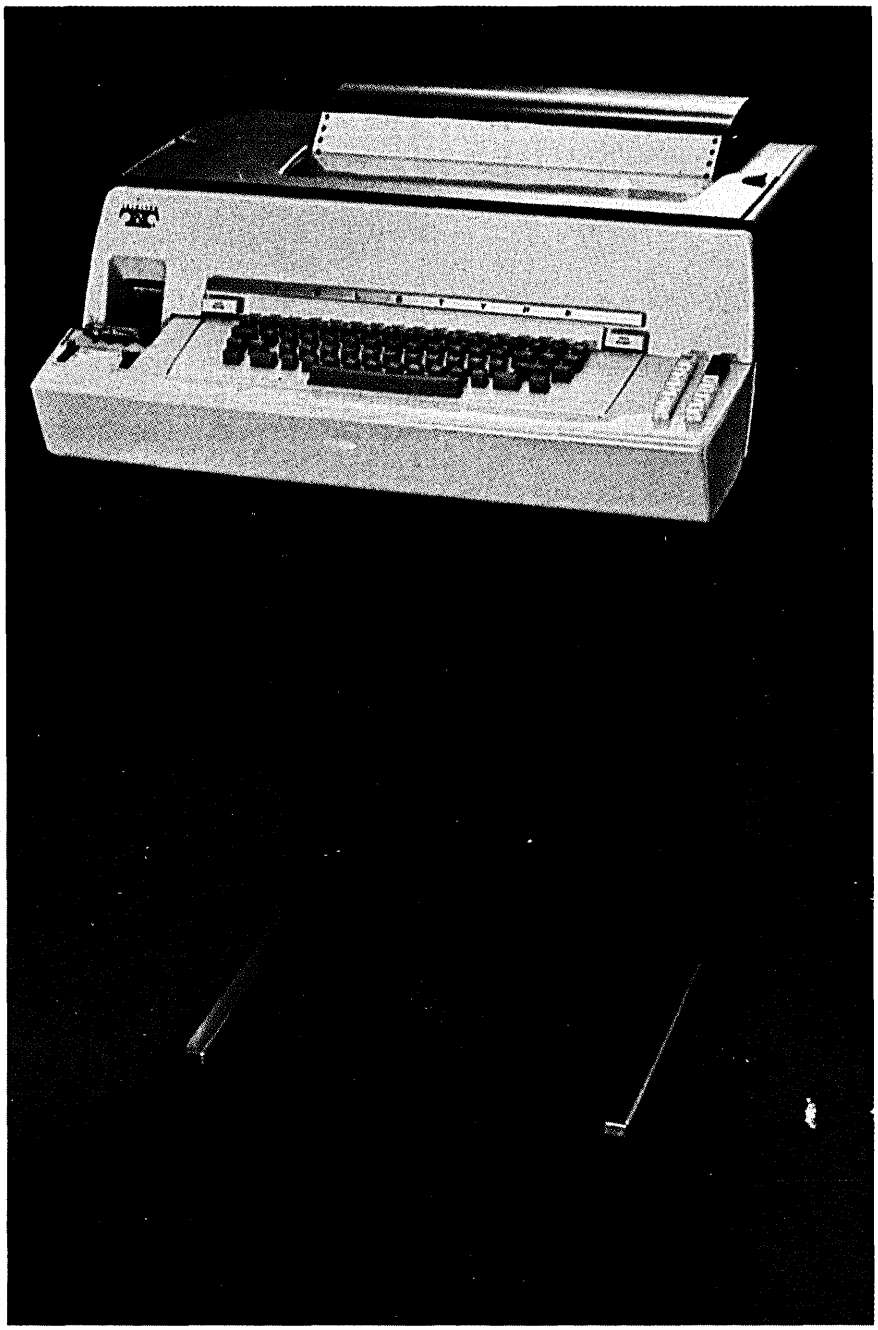

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