DATAMATION 74®

January

approaches to security

also. . . perspectives on 1974, credit systems and privacy. . .

Introducing the Statos 22-inch Printer/Plotter. Electrostatics all over the map.

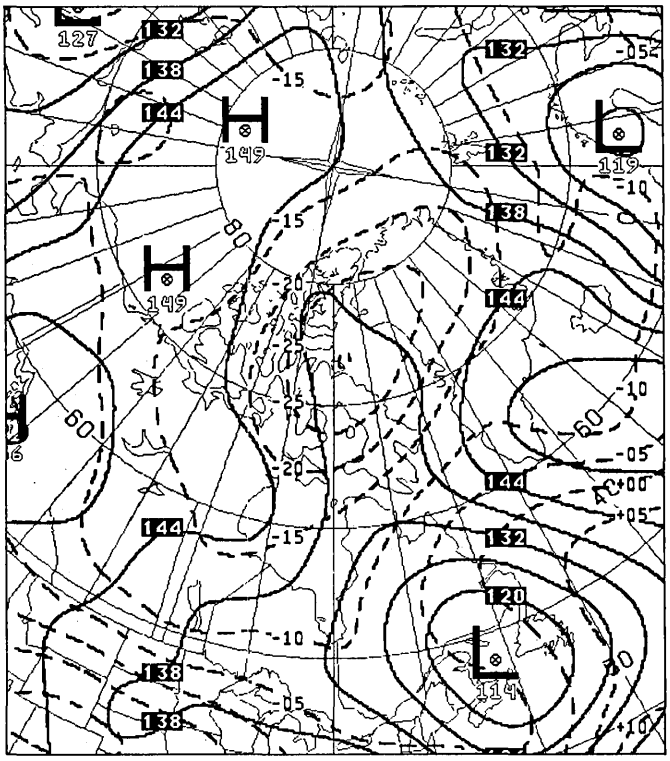
Here's the biggest member of our Statos® family. The Statos 22-incher.

It will take on the world. Weather maps, seismographic charts, logic diagrams, computer-aided designs, D-sized drawings. And anything else big you can throw at it.

It's electrostatic printout at its widest. And at its lowest price/performance ratio. In fact, we sell the 22-inch Statos at a lower price than any other 22-inch wide electrostatic printer/plotter on the market.

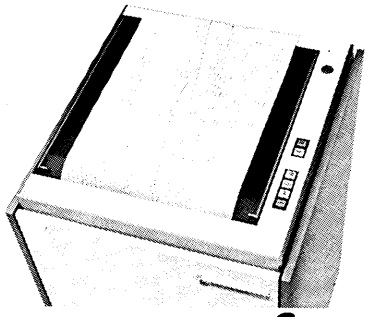
Electrostatics the Statos way has tremendous advantages over other plotting techniques. Variable area traces are a snap. As are printing bold symbols, designs and logos. And like all members of the Statos family, the 22-incher will print and plot fixed and variable data simultaneously. For example, the background geographics on this weather map is stored in disc and is plotted simultaneously with the latest incoming weather information. And you can make as many copies as you want.

With more styli than any other wide plotter, resolution is sharp and clear. Character generation is built-in, with easy-to-read 7x11 dot matrix fonts.



Although the Statos 33 is brand new, it's PLUG IN AND GO. With all major mini's and several maxi's. Because it's completely compatible with the industry's most powerful printer/plotter interfaces and software packages. And they're already on our shelf.

If you want further proof of what the Statos 22-inch electrostatic printer/plotter can do for your widest graphic computer output, while saving you money at the same time, call Dave Sloan collect at (415) 493-4000 or write Varian Data Machines, 2722 Michelson Dr., Irvine, Calif. 92664.



varian data machines

CIRCLE 1 ON READER CARD

LET'S MAKE A DEAL!

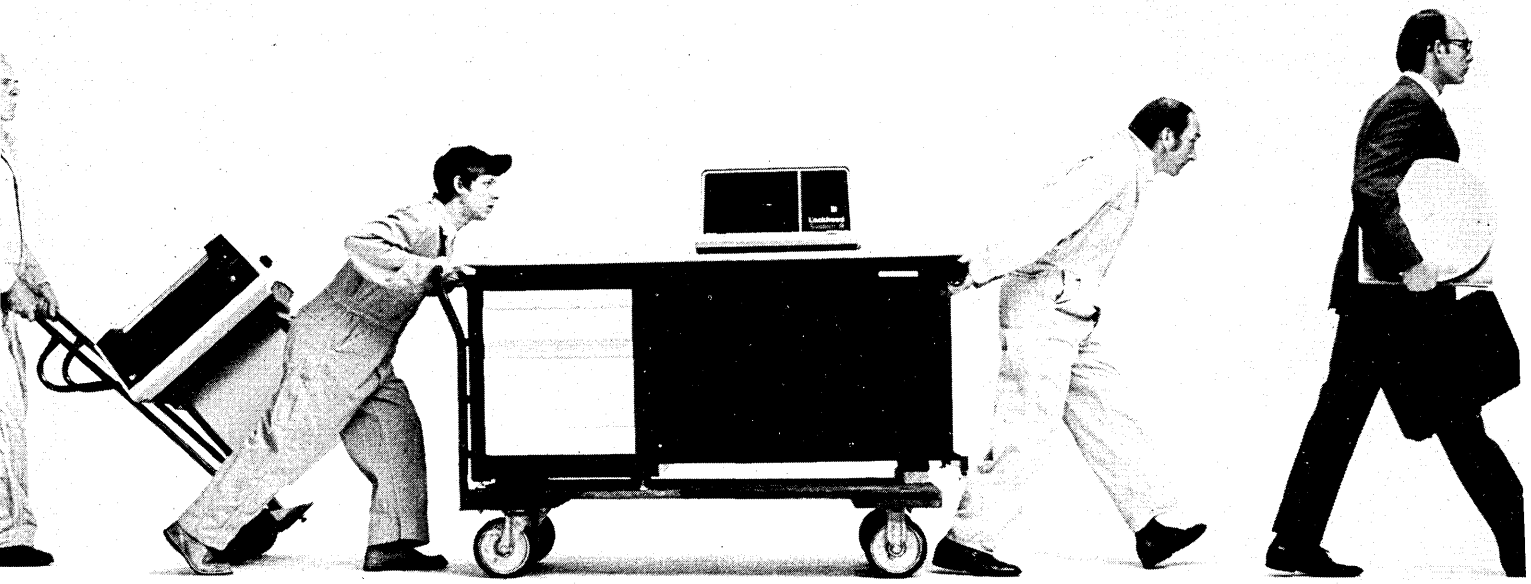
Why not deal with the printer manufacturer who really understands the tough, real-world performance demands of the remote terminal environment? Tally's years of experience in meeting the needs of data communications users are reflected in the no-nonsense simplicity and reliability of our Series 2000 line printer. Designed for the heavy printing loads of batch terminals and small business computers, it economically produces 6 beautiful copies at 200 lines per minute, day in and day out, without need for any more attention than an occasional cleaning. It has earned its reliability reputation as part of Tally's own Datascribe terminal. Let us prove it can do the same for you. Let's make a deal.

TALLY®

Tally Corporation, 8301 S. 180th Street, Kent, Washington 98031 (206) 251-6770
Data Terminals • Printers • Card Reader Terminals •
Paper Tape Terminals

CIRCLE 4 ON READER CARD

Why sell only software when you could be selling a complete turnkey system?



The Lockheed System III

If that question intrigues you, maybe it's because you've already begun to think about expanding your business beyond software. If it doesn't, maybe you should. In either case, Lockheed has the answer to how you might go about doing it. It's called the Lockheed System III.

Why the Lockheed System III? Because it offers you a unique opportunity to supply the total needs of your customers by combining your own application software with an inexpensive, flexible, minicomputer system. A computer built by Lockheed Electronics and backed by dependable, nationwide service.

How unique? Let System III speak for itself:

It has an RPG II compiler in operation with proven reliability. Others make this claim, we deliver.

You can use existing RPG II source level programs and tie in easily with new technology peripherals.

In addition to the RPG II compiler, we offer DOS, sort/merge, assembler and utilities.

The basic configuration includes 16K bytes of memory, CRT/keyboard, 100 CPS printer and 5 million byte disk. Furthermore, System III is easily expandable without a lot of hidden cost.

And what's probably most important to you and your customers: the cost of a typical System III can be substantially less than the cost of competing systems.

One more thing. Lockheed delivers in a hurry. So you don't have to miss a sale just because somebody missed a delivery date.

If selling turnkey systems makes good business sense to you, call us now (213) 722-6810 collect. Or write 6201 East Randolph Street, Los Angeles, California 90040.

Lockheed Electronics

Data Products Division

See it demonstrated at the Computer Caravan.

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Detroit 557-5037 • Chicago 833-4600 • Dallas 231-6163 • Houston 682-2617 • San Francisco (408) 257-3357

Fifteen years of leadership in electronics. 1959-1974.

CIRCLE 46 ON READER CARD

DATAMATION 74®

JANUARY, 1974
volume 20 number 1
This issue 117,400 copies

42 Computer Security: An Overview
HAROLD WEISS. Computer crime is increasing, but fires, earthquakes and storms are actually much greater hazards to dp installations. Few installations have taken even the simple steps toward protection, and even they need this checklist.

48 Privacy, People, and Credit Services
ROBERT L. PATRICK. Personal credit reporting is being handled like a clandestine intelligence operation, and this is unfair to all of us.

51 Software Security
JACOB PALME. The prevention of illegal access to, modification of, and interference with data.

56 The New Criminal
DONN B. PARKER and SUSAN NYCUM. The old "Trojan Horse" program trick, and others that have netted millions for enterprising, crooked data processing personnel, are described.

64 The Critical Issues: A 1974 Perspective
JOHN L. KIRKLEY. Frank T. Cary, IBM's Chairman of the Board, and other industry leaders from the U.S., England, Italy and the U.S.S.R. speak out on the key issues of 1974. As we expected, they don't always agree.

73 1974: As The Vendors See It
TOM MC CUSKER. Short-range prospects are not rosy. There may even be a few casualties.

78 News in Perspective

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JULIUS HONIG. In moving from one job to another, individuals often carry with them key information which could be of vital use to their new employers.

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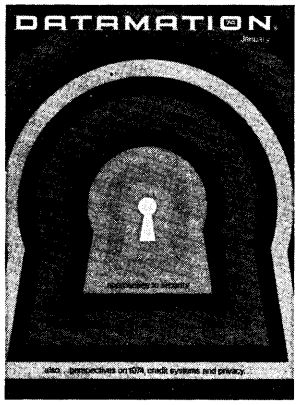
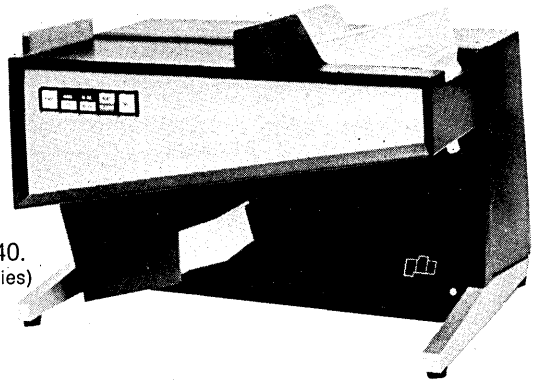


about the cover

Logical approaches to computer security are implicit in the imagery of successive, sequential, convergent stripes. Mixing our graphic metaphors, the theme incorporates incarceration, protection of the computer's peripherals, and the problems and barriers - as well as the more promising pathways - to the proper care of computer hardware and software. Design is by our art director.

A TWO-YEAR WARRANTY? ON CARD READERS ??

YES!!! Only by Peripheral Dynamics Inc.



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Standard: Full teletype compatibility • RS232 or 20/60 ma interface • Switchable 110/300 bps • Drives multiple displays • Output for printer or cassette

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DATAMATION

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MODCOMP IV.

MODCOMP IV is an entirely new kind of computer. If you think you've heard that before, consider these facts.

MODCOMP IV is nothing less than a 32-bit CPU with far-reaching capabilities, *at a price no more than you would expect to pay for a 16-bit CPU.*

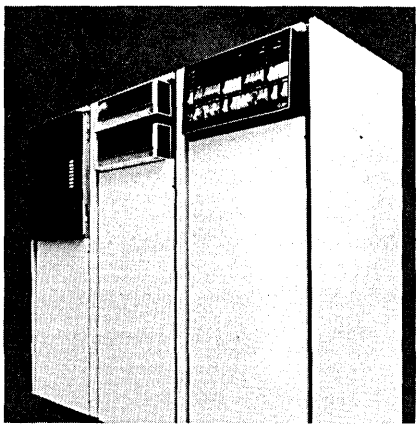
Over 1,000 registers, and a comparable amount of extra logic, have been included to optimize the efficiency of the operating system: in context switching, in resource allocation and in roll-in/roll-out operations — the bottlenecks in most systems.

With its 32-bit processing capability, low price tag and low-overhead operating system, MODCOMP IV is a new kind of computer without equal for real-time and time-sharing applications.

Try on these MODCOMP IV features for size.

240 general purpose registers in 16 sets of 15 registers each, permitting context switching in 2.4 microseconds.

1,024 address mapping registers enable up to 512K bytes of memory to be addressed in



256-word pages, and provide automatic hardware relocation for fast program loading and roll-in/roll-out operations.

32-bit parallel internal busses and adders, plus 64-bit floating point hardware for fast number crunching.

Push/pull hardware for efficient list processing operations.

Four memory ports for simultaneous input-output and CPU operations, and multi-processor configurations.

Compatibility. Input/output and upward program compatibility with all existing MODCOMP I, II and III computers.

Software includes our field-proven multiprogramming real-time executive, with a vast range of task-handling capabilities. FORTRAN IV, BASIC, RPG II and Macro-assembler. Plus a host of support software.

Price. A basic MODCOMP IV with 32K bytes of memory is priced at $18,500 list. With OEM volume discounts available.

Several MODCOMP IV's are now on order and set for delivery early in 1974, for applications that include electrical power generation control, multiple terminal time-sharing, host processor for factory automation, and control of traffic in a large Eastern U.S. city.

And that only scratches the applications surface. Contact us for full technical specifications and price information.

Modular Computer Systems
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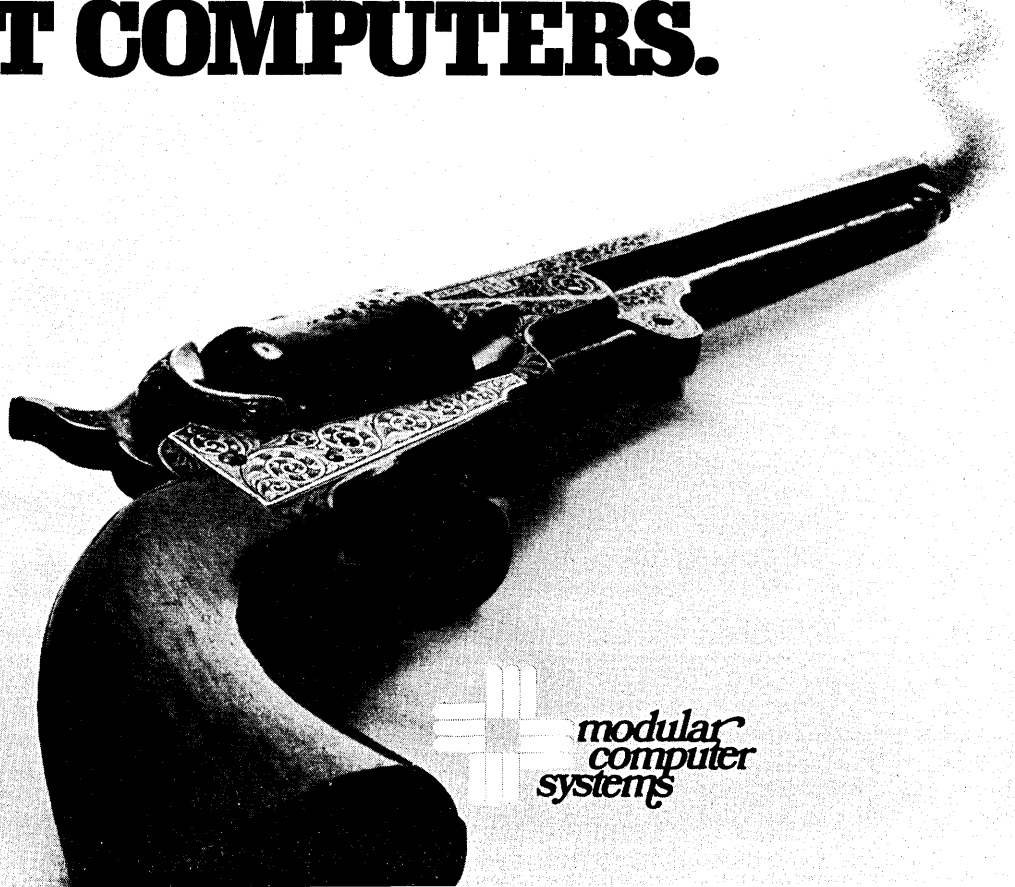
TWX 510-955-9820

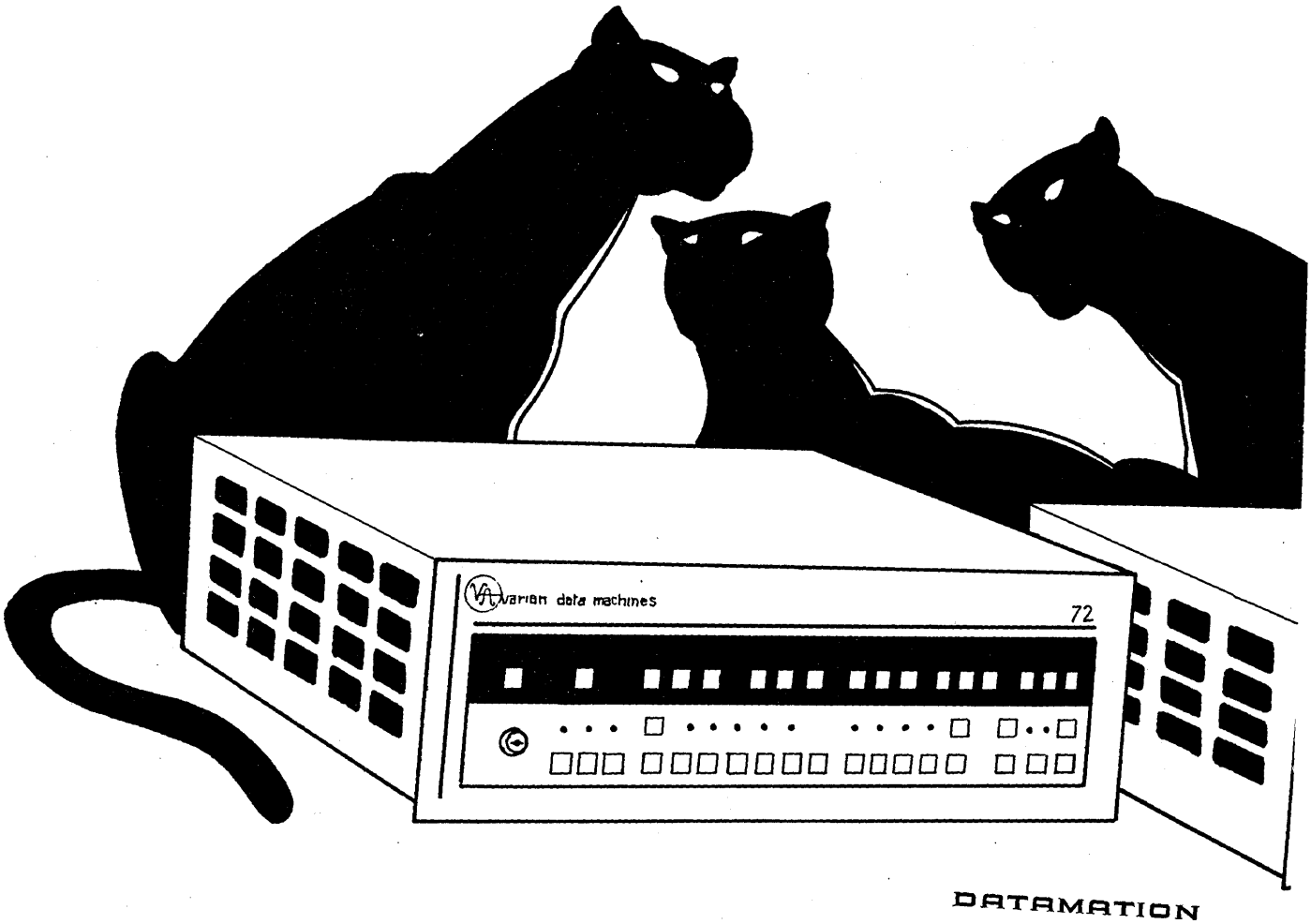
THE 32-BIT COMPUTER THAT SHOOTS DOWN ALL YOUR OLD IDEAS ABOUT 32-BIT COMPUTERS.



modular computer systems

CIRCLE 63 ON READER CARD

Introducing the Varian Family of Mini Killers.



In the name of performance, Varian has killed all limitations attached to the mini.

Feature for feature, capability for capability, Varian's combined software/hardware computer systems outperform any and all standards heretofore set by the mini.

And even challenge huge room-sized systems on their own ground.

But we have something that makes us even bigger than just one better mainframe or one better system. It's the Varian family. Namely our V-70 series which includes the V-72, V-73, and V-74.

The Varian 70 family is of tremendous advantage to the systems-oriented user. It lets your designer and programmer choose from three CPU's with different capabilities and three different price tags. But all three with the same Varian family trait of advanced open-ended hardware and software, extensive I/O options, and peripherals. It's really like having a series of computer system building blocks.

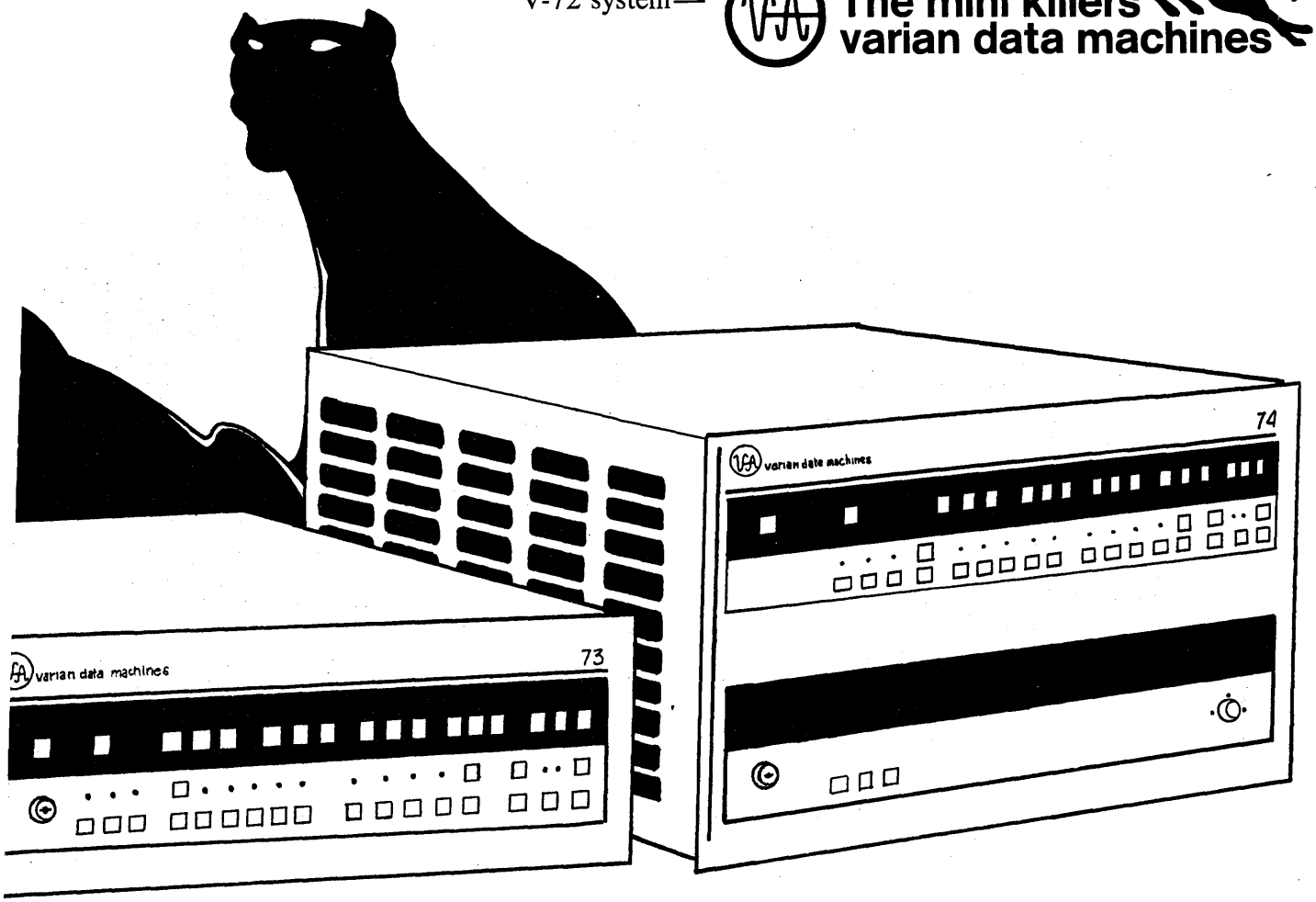
Building blocks that make our systems not only easier to understand, but easier to configure. It boils down to getting a system tailor-made to your own needs at off-the-shelf prices. Invest in only what you need technologically at the time. And when your needs change, invest in more capability to upgrade your system. And because all Varian hardware and software are open-ended and interface, just plug in more of Varian's building blocks.

Whether you start out with the 8K core, 1 port memory of our V-72 system— or need the Memory Map, parity, Writable Control Store, and the 330 nanosecond, dual port, 256K memory of our V-74—we'll support you with software that's not in our minds, but right on our shelves.

Complete with a multi-task executive and real-time operating systems which keep fast-response jobs in the foreground while processing away at batch jobs in the background. Plus Varian assemblers and compilers.

In short, everything you need to keep you operating right on the money. Introduce yourself to the Varian family of mini killers. Write for a detailed comparison of our V-70 family. Varian Data Machines, 2722 Michelson Drive, Irvine, California 92664. Or call (714) 833-2400.

The mini killers
varian data machines



IF THE IBM 3270 HAD INTELLIGENCE, IT WOULD BE A SYCOR 250.

And it would cost you less, too.

Because, while our new Sycor 250 does everything IBM's 3270 does and more, its monthly lease cost is lower.

And thanks to its intelligence, that's only the beginning of your savings.

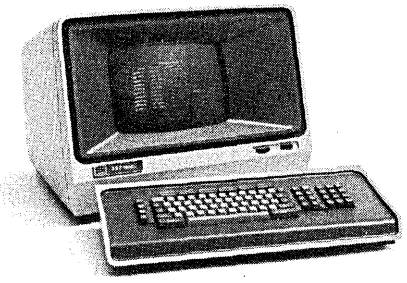
Take data entry. Our 250's high I.Q. insures every piece of data your operator enters is absolutely clean. So less time is spent on the line.

Which means you can install more terminals per line and probably end up needing fewer lines and ports.

Give your Sycor representative a call. He'll be happy to point out other money-saving ways the 250's intelligence can be tailored to your operation.

While you're at it, ask him about the 250's impressive optional equipment. Like the badge reader, the light pen and the whole family of versatile printers in speeds of 40, 80 or 165 cps.

He knows it takes a smart DP manager to pick an intelligent terminal.



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At $2600, our new 100 cps Centronics 500 is the lowest priced 132 column printer we've ever produced.

Price plus performance equals flexibility! LSI electronics, great interface flexibility and the low, low price makes the 500 a natural for all kinds of computer and terminal applications.

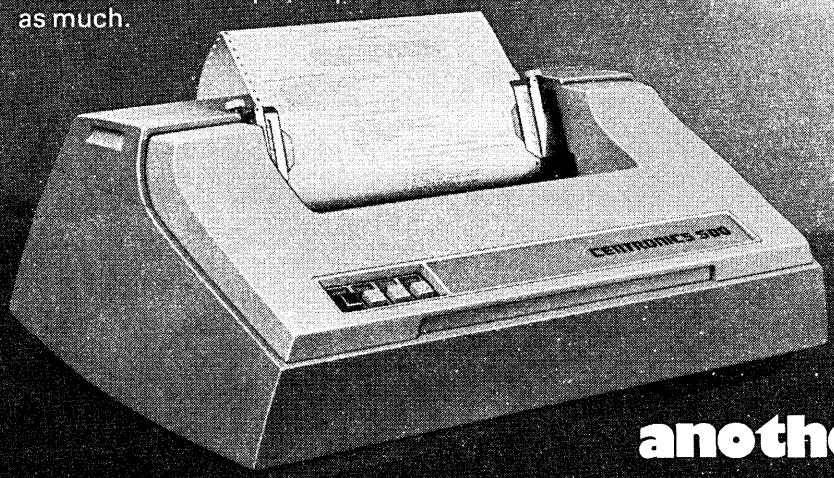
Multicopy. The 500's 5 x 7 dot matrix impact head produces an original plus four crystal clear copies. And the paper supply can be located to the rear or below the printer.

Need high performance in communications? Just add our optional RS-232 interface and you've got it—anywhere from 110 to 9600 baud!

Character set versatility. Expand from 64 to 128 characters in over a dozen different foreign languages! Upper and lower case is available too.

Nationwide service. You can expect prompt, efficient service anywhere in the country. Purchase or lease. OEM discounts too.

The 500. You'd expect a printer like this to cost twice as much.



another day, another phenomenon

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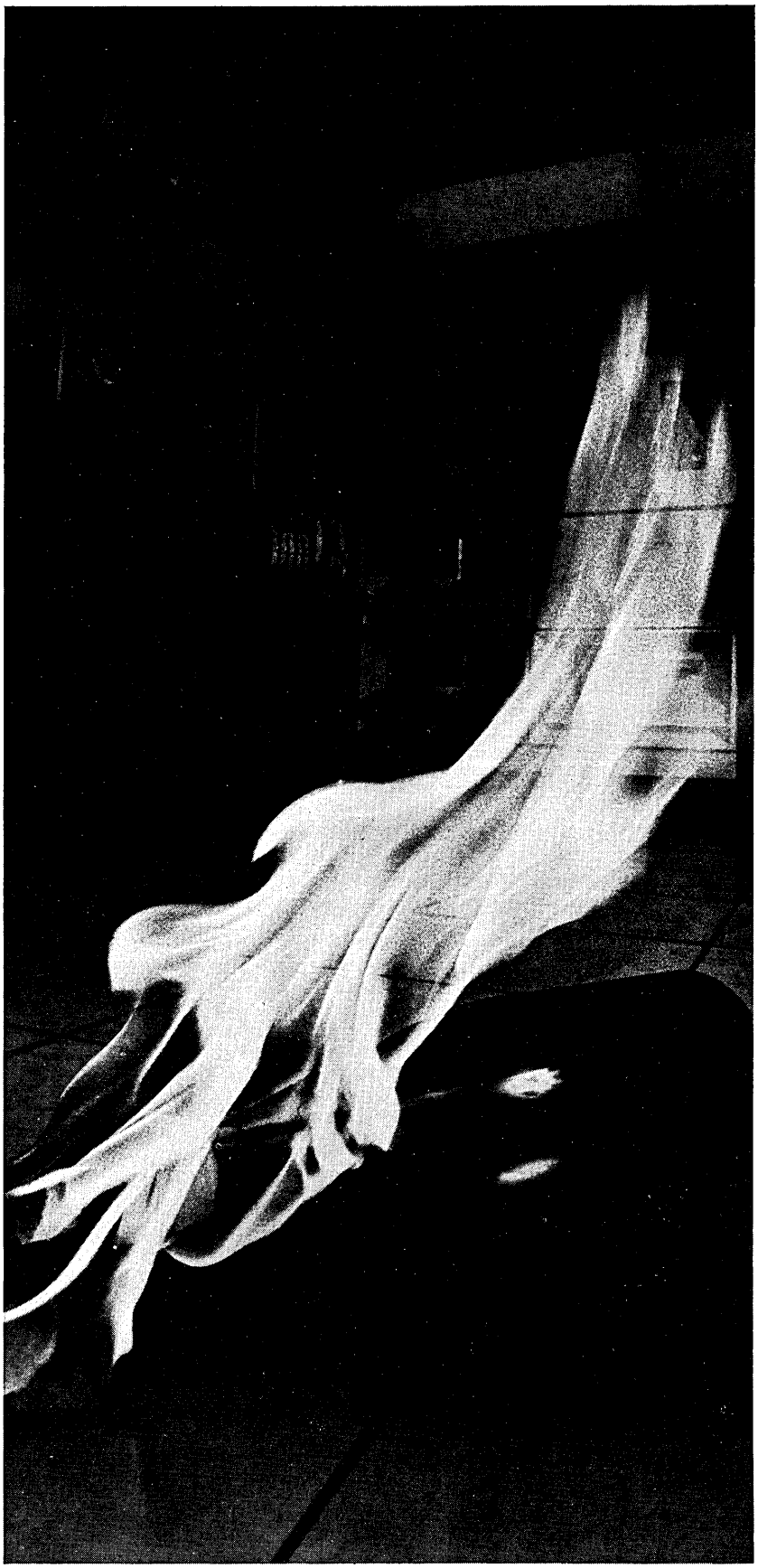
central region: (513) 294-0070 (ohio)
chicago office: (312) 398-4500
western region: (714) 979-8650 (calif.)

CIRCLE 88 ON READER CARD

We've tried every trick at setting off computer room fires.



We know what fire, smoke and water can do to your irreplaceable tapes and records. Even if they don't totally destroy them, they can shut you down for weeks, if not months.

So, to probe the causes, effects and characteristics of fires damaging computer rooms and peripheral service areas, we literally stop at nothing in the Fenwal Fire/Explosion Test Site. Here, Fenwal engineers actually make a career of arson, studying how to design the fastest, most effective systems for stopping fires dry in high value areas. Using Halon 1301, a clean, safe-for-people, dry suppressant, our system can snuff out a fire in seconds, leaving the entire area ready for immediate reuse. We're years ahead of everyone in the field of fast fire suppression. In fact, we're the only ones capable of stopping explosions after they start. If you want the best in Fire Protection Systems,* call us. We'll be pleased to arrange a showing of our color film "The Fireaters," featuring our systems in action. For a free copy of the Harvard Business Review Report on Safeguarding Computers, write Fenwal Incorporated, Ashland, Mass. 01721. Phone (617) 881-2000. Division of Walter Kidde & Co. Inc.

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In fire and explosion suppression systems, Fenwal has more experience than any other company in the world.

FENWAL

the centronics phenomenon:

now a 120 cps keyboard/printer for under $3000.

why pay 50% more?

The new 308. It's a 120 char/sec, 80 column incremental keyboard/printer. Now a teleprinter with line printer speed. There's nothing like it anywhere for less than 50% more.

Or, why get less? Compare the 308 with a 30 char/sec teleprinter—you can get 4 times the speed for the same money with the 308. Or, compared to a 10 char/sec teleprinter, the 308 gives you 12 times the speed and cuts telephone line costs dramatically.

Interfaces! With the Centronics RS-232 send/receive interface you can select from the full baud range of 110 to 9600 bps instead of the typical 110-300 range. Our current loop interface handles most teleprinter applications, too.

Innovations! Immediate viewing lets you see any characters you type instantly after you type them. A backspace key for editing (option). Horizontal tab set/clear (option). A lighted column indicator tells operator the next column print position.

Multicopy. The 308 prints an original and four copies in paper widths up to 9½ inches.

The 308. $2690. Add the communications interface and still be under $3000. OEM discounts available. A new era in price/performance. Purchase or lease. And service is nationwide. There's nothing like it. Anywhere.

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dawn of a new era

CIRCLE 89 ON READER CARD

Now a Single Documation Reader for All Three

Two heads make the new Documation "T" Series actually three readers in one. Read standard punched cards with one head. Then flip a switch to read optical mark cards with or without clock marks.

The new three-in-one Documation readers are now available in speeds of 150, 285, 300, 600, 1000, and 1200 cards per minute.

Proven electrical and mechanical specifications found on our standard punched card and optical mark readers are the same as those on the new three-way readers.

Punched or optical mark cards. Now you have a choice instead of a chance. The advantages of both punched and optical mark cards without the expense of two readers.

The many potential uses for a three-way reader are as varied as the demands we have received from the industry for such a reader. Your computer representative will have more details about the new "T" Series Documation readers.

Documation. Our name tells you what we stand for.

DOCUMATION
INCORPORATED
POST OFFICE BOX 1240
MELBOURNE, FLORIDA 32901
TELEPHONE (305) 724-1111
TWX 510-959-6286

Calendar

JANUARY

Seminar on Data Base Design, Jan. 14-16 (Chicago), **Jan. 15-17** (San Francisco), **Feb. 26-28** (Washington, D.C.), **Feb. 27-Mar. 1** (Boston), **Mar. 11-13** (New York), **Mar. 27-29** (Toronto). This seminar is designed to give managers, analysts, programmers, and others an understanding of the latest techniques for developing and implementing effective data base and file management systems. Fee: $375; reduced rates for three or more from a company. Contact: AMR International, Inc., 1370 Avenue of the Americas, New York, NY 10019.

FEBRUARY

IEEE International Solid-State Circuits Conference, Feb. 13-15, Philadelphia. Over 75 invited and contributed papers will examine such topics as integrated injection logic, millimeter-wave developments here and abroad, physical limits in digital electronics, and integrated electronics for medical applications. Fee (including conference report): $30 in advance, $35 at conference for members; $35 in advance, $45 at conference for nonmembers. Contact: Lewis Winner, 152 W. 42 St., New York, NY 10036.

ACM/SIGCSE Fourth Annual Technical Symposium, Feb. 14-15, Detroit. There will be sessions on structured programming and on industry reaction to computer science education; contributed papers on curricula at various types of institutions, on key courses and service courses, and on pedagogical methods; a book exhibit and an exhibit of computer-oriented teaching and research projects; an employment register; and a workshop on how to build an inexpensive tv-type computer terminal. Fee: $15, ACM/SIGCSE and ASEE/COED members; $25, ACM and ASEE members; $30, others. Contact: Douglas S. Kerr, Dept. of Computer and Information Science, Ohio State Univ., 2024 Neil Ave., Columbus, OH 43210.

COMPCON 74, Feb. 26-28, San Francisco. The theme of this Eighth Annual IEEE Computer Society International Conference is "Computer Peripherals—Benefactor or Bottleneck?" Aspects of peripherals to be examined include: applications, performance, intelligence, reliability, technology, innovations, economics, and security, and other problems. Fee: $40, members of IEEE Computer Society, IEEE, and ACM: $55, others; after Feb. 1, add $10. (There will be a separate tutorial Feb. 25 on computer peripherals and terminals, with emphasis on applications and technological advances. Fee: $50, advance; $60, at tutorial.) Contact: Jack D. Kuehler, vp-Operations, IBM General Products Div., Monterey and Cottle Rds., San Jose, CA 95193.

MARCH

ASTM Symposium on Computerized Laboratory Systems, Mar. 4-5, Cleveland. Sponsored by ASTM Committee E-31, and held in conjunction with the 25th Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, the conference aims to promote a better understanding of how to define, implement, evaluate, and document computer laboratory systems, and to provide a general reference based on current and future computerized laboratory system concepts. Typical subjects include: methods for specifying a computerized laboratory system, implementation criteria, functional design criteria, specific examples of evaluation methods, and examples of documentation criteria used for completed systems. There is no fee. Contact: Frank W. Kunz, Ford Motor Co., Center Laboratory Services, 3001 W. Miller Rd., Dearborn, MI 48121.

Seventh Annual Simulation Symposium, Mar. 13-15, Tampa, Fla. This forum on digital computer simulation will survey the state-of-the-art across a broad range of applications including: financial planning, container handling, health testing, police patrol and dispatching, and real-time missile simulation. The symposium will underwrite a $2,000 research grant to an individual using digital discrete simulation in his research. Registration limited to 150. Fee: $95. Contact: Annual Simulation Symposium, P.O. Box 22573, Tampa, FL 33622.

Sixth National Meeting of the Information Industry Assn., Mar. 19-21, Washington, D.C. On the theme "The Information Marketplace: An Alternative to 1984," this meeting will consist of several industry management forums, a user/vendor mix of five half-day programs, and an information resources exposition. Fee: $95, members; $150, nonmembers; $40, government employees. Contact: Paul G. Zurkowski, Information Industry Assn., Suite 904, 4720 Montgomery Lane, Bethesda, MD 20014.

Data Communications Interface 74, Mar. 25-27, Dallas. Sponsored by *The Data Communications User*, a monthly magazine, this conference is billed as "the nation's only conference and exposition designed exclusively to reach users of data communications." Participants will be corporate, financial, communications, and dp management in 17 application areas. Fee: $80 for entire session, or $40 a day; advance registration recommended. Contact: Richard A. Katzell, 160 Speen St., Framingham, MA 01701.

IEEE Intercon—1974 International Convention and Exposition, Mar. 26-29, New York. A technical program of about 40 sessions will complement the exposition of electronic products and systems on the theme "Getting down to business." Sessions will concentrate on solid-state electronics, computers and information, instruments and instrumentation, communications, and marketing and finance. Fee: $5, members; $6, nonmembers. Contact: Don Larson, IEEE Intercon, 3600 Wilshire Blvd., Los Angeles, CA 90010.

ACM/SIGPLAN Symposium on Very High Level Languages, Mar. 28-29, Santa Monica, Calif. Four sessions consisting of 15 papers will cover the subjects of nonprocedural and specification languages, data structures, optimization, and automatic program synthesis. Fee: $40, ACM/SIGPLAN members; $45, ACM members; $50, nonmembers. Contact: Prof. Michael Melkanoff or Prof. Bertram Bussell, Computer Science Dept., UCLA, Los Angeles, CA 90024.

APRIL

Hospital Information Systems Sharing Group (HISSG) Seminar on Hospital Data Processing Systems, April 23-25, Bethesda, Md. HISSG is a non-profit corporation organized in 1968 to promote better patient care in hospitals and other facilities through the use of advanced systems and information processing. The conference will emphasize attendee participation in workshop sessions, with a minimum of formal presentations. Fee: $190. Contact: Michael D. Dunn, 605 E. Algonquin Rd., Arlington Heights, IL 60005.

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

Texas Instruments announce for the 980A minicompute interactive terminal processin

DX980 is a general purpose operating system that supports the 980A computer in various applications including batch processing, interactive terminal processing, and real-time processing. It can support all of these applications simultaneously or each one individually.

The Memory Protect/Privileged Instruction feature of the 980A provides a "hardware protected" environment so that an executing program cannot destroy the operating system or another job.

DX980 features a modular organization. Executive functions common to several application environments are included in the nucleus, while executive functions unique to specific environments are embodied in subsystems.

The nucleus is partially memory resident and partially disc resident with the disc resident portions called into memory as required using a dynamic allocation technique. The nucleus provides for such functions as:

Job Management – to provide the facilities for job submission, resource allocation, job initiation, execution management, and job termination. The number of jobs active is limited only by available resources.

Task Management – for task creation, scheduling, synchronization, and termination. Multi/tasking is supported both across several programs and within a single program.

Memory Management – for dynamic memory allocation and release.

I/O Management – to provide I/O functions from programs to peripherals on a device independent basis.

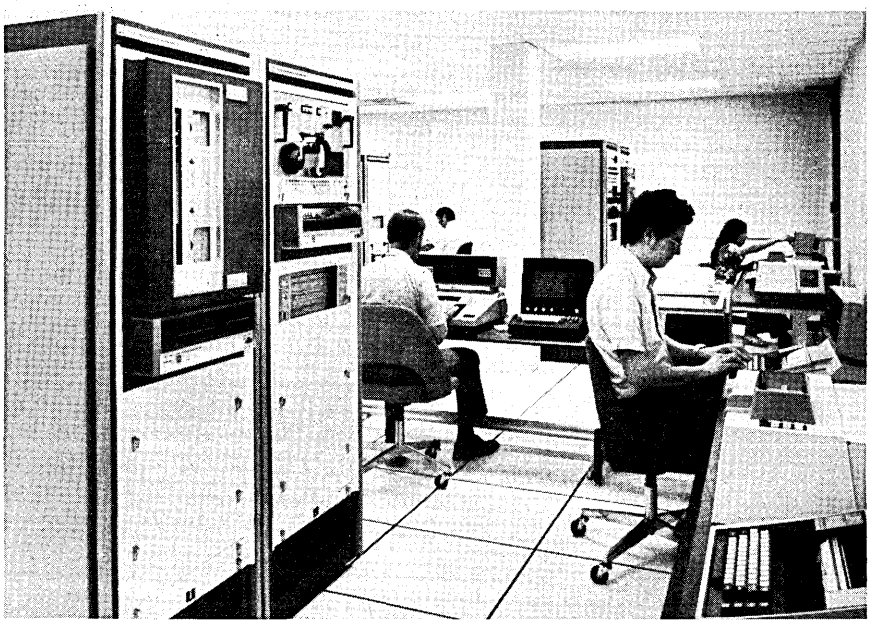
File Management – to provide a device independent interface from a program to data stored on disc. Three file types are supported:

Linked Sequential File – has an access interface identical to that used for the various sequential devices (magnetic tape, line printer, card reader, etc.). Consistency between sequential device and disc is achieved with the Linked Sequential File.

Relative Record File – provides a low overhead direct disc access to a contiguous section where I/O transfers may be either blocked or unblocked.

Indexed File – provides a directory-supported random access method based on a record identifier whose size is user specified. File operations include record addition, insertion, modification, deletion, and retrieval using either a random or sequential access method. A multiway balanced tree directory provides random access with extremely low disc access for search.

Operator Communications – provides an extensive command language that may be used from the system operator's console. Subsystems are individually activated and deactivated by the systems operator as needed. When active, a subsystem operates in privileged mode and is essentially part of the operating system. Main memory is allocated to the subsystem only when it is active so a user who is not interested in a particular operating environment does not pay a penalty for the ability of DX980 to support the environment.



Multi-terminal 980A System

Batch Processing

A batch processing environment is supported by three separate modules, referred to collectively as the Batch Processing Subsystem:

Batch Input Reader – is used to effect direct assignment of a sequential input device to a sequence of serially executed programs.

Batch Input Spooler – is used to effect spooled input from a sequential input device to a sequence of programs

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Trademarks of Texas Instruments Incorporated.

DX980—an operating system that supports batch processing, and real-time...simultaneously.

which may execute in parallel.
Batch Output Spooler – is used to effect spooled output to a sequential output device.

Interactive Terminal Processing

DX980 provides for interactive communication between the system and local or remote terminals through the Interactive Terminal Subsystem. The features provided include:

- An interface to support multi-user interactive applications programs
- Interactive file editing
- Remote job entry
- Job status retrieval

Real-Time Processing

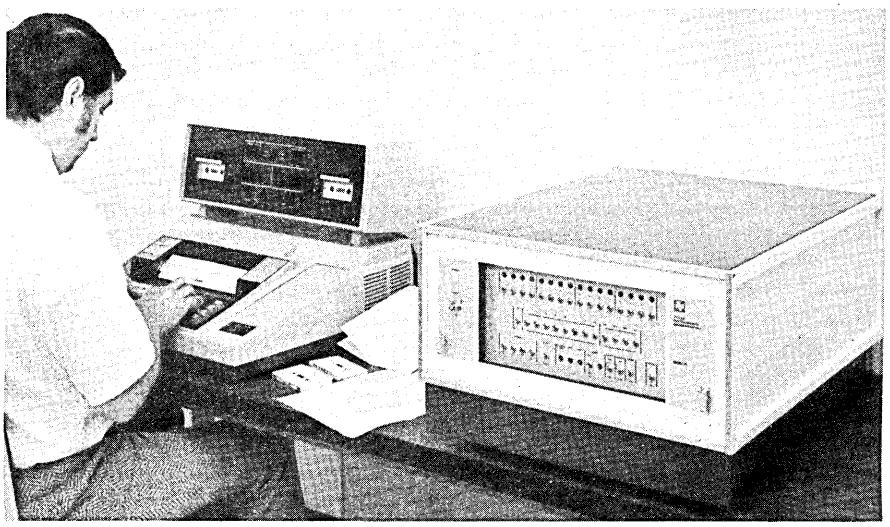
DX980 provides for multi/tasking on a priority scheduling basis. The processor may be switched from task to task by an I/O request, a supervisor call, a device interrupt or at the end of a task. It provides a roll-out/roll-in feature to insure real-time response to high priority requests.

Other Software

DX980 supports a variety of software including FORTRAN IV, symbolic assemblers, the TI language translator and the linkage editor.

It will operate on any 980A system with at least 16K memory, an interval timer, an operator's console and a disc. The modular structure allows expansion to include:

- Multiple 3330 type disc drives
- Multiple disc cartridge drives
- Magnetic tape drives
- *Silent 700** ASR or KSR data terminals
- Card readers
- Line printers
- Alphanumeric CRT terminals
- Paper tape readers and/or punches



Low-cost 980A Software Development System

- Communications interfaces
- Hardware vectored interrupts
- Up to 64K words main memory

DX980 allows users with big jobs to do their processing in an economical manner. However, Texas Instruments also offers software to support the many users who do not need a large disc-based system to solve their problems. For this class of user TI offers the Program Development System shown above. This system may be as simple as a $9225 package of an 8K 980A with a twin cassette *Silent 700* ASR terminal. It enables fast and easy development of new software. Speed, simplicity, and reduced noise level are the major advantages over a system equipped with a 33 ASR.

Standard software includes:

- Loader
- I/O support package
- Assembler
- Linkage editor
- Source editor
- Debug aids
- A wide variety of additional peripherals, plus expansion capabilities to support FORTRAN

Hardware

This software has been designed to take advantage of the powerful features of the 980A, which include:

- Hardware multiply/divide
- Memory parity
- Memory protect
- Privileged instructions
- Power fail interrupt
- ROM bootstrap loader
- Removable control panel with keylock
- Hardware breakpoint and program sense switches
- DMA interface port, expandable to 8 ports
- Four I/O bus ports, up to 256
- Auxiliary processor port

The 980A is the price/performance leader in the computer world.
Want more information? Get answers by writing or calling Texas Instruments Incorporated, P.O. Box 2909, Austin, Texas 78767; phone (512) 258-5121.

TEXAS INSTRUMENTS
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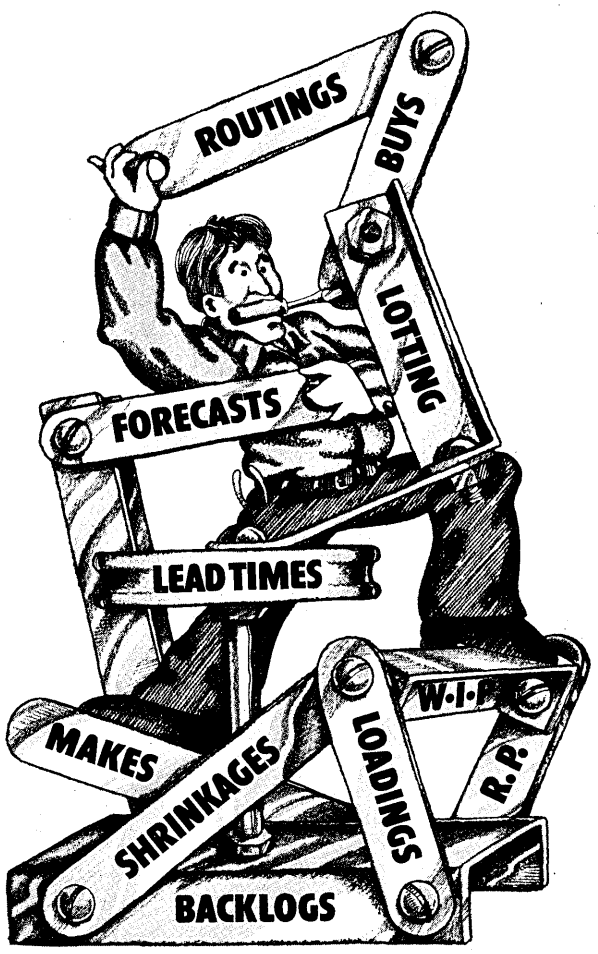
CIRCLE 39 ON READER CARD

Isn't production control too important for a "Do-It-Yourself" kit?



Burroughs offers you a comprehensive, integrated Production Control System that's ready to install. Ready to generate the information you need for reducing costs, for planning and forecasting, for meeting delivery schedules. It's already helping management to improve profitability, control and service in just about every area of manufacturing—from jet engine components to consumer products.

Burroughs PCS offers distinct advantages:

1—It's written in COBOL, the same higher level language your staff uses for business data processing. Language familiarity makes solutions to inventory and production problems easier to understand, which speeds implementation. (Your people have *other* problems to solve, haven't they?)

2—It's a complete system in five modules that you can install according to *your* schedule and *your* needs. And you can insert COBOL variations to "fine tune" Burroughs PCS to fit your company's unique characteristics.

3—It's a protected investment. You can change your computer or upgrade its configuration, yet keep your PCS procedures and programs intact.

If you need solutions *now*, forget about doing it yourself and investigate Burroughs Production Control System. Call your nearest Burroughs office for information. Or, for a PCS brochure, write to Mr. Don Winston in care of Burroughs, Detroit, 48232.

Burroughs

LOOK AHEAD

COPING WITH PAPER COSTS

Rising postage rates and the paper shortage force computer users to search for alternatives. Among them: microfilm and microfiche, fewer multi-part forms, and fewer custom forms. Says NCR's Robert M. Sweeney, vp and general manager of the Systemedia Div.: all computer users should be looking for ways to improve efficiency in paper use, such as re-thinking forms designs, the number of copies produced, and the way they're routed.

In Long Beach, Calif., Petrolane's edp manager David Reser, concerned about the postage he pays to send some 4.5 million pages a year of computer printouts to 300 branch offices, seriously examines buying a computer output microfilmer (COM). And eager COM salesmen point out that the traditional eight-to-one saving in microfilm over paper now has jumped to ten-to-one. Paper costs, up some 17% in the last year, will jump another 20% in '74. Add this to the 10-cent stamp for first-class mail, and there's a good case for big users to go the microfilm route. Petrolane's Reser also cites the annoyances caused by the thinner paper quality he's now forced to live with...the bursting and decollating machines need constant adjustment.

WHEN TWO WILL DO

A 30,000-lpm printer from Radiation Inc., delivered to the Lawrence Livermore Lab in California about 10 years ago, goes into retirement soon. It'll be replaced by more recent technology: Honeywell's 15,000-lpm printers. According to the lab's Sid Fernbach, print speed goes down but print quality goes up, and the page size will shrink to 8 1/2 x 11-inches. At those speeds, the reduced page size can mean significant savings in paper consumption. As a matter of fact, says Fernbach, they'll be getting two of the still-unannounced printers in a month or so, and users will have the option of getting their output on-line on coated paper or off-line on microfiche via the Information International FR-80 COM printer, in either case getting alphanumerics or graphics.

THE FOURTH TIME A CHARM????

The $40 million horse was gone but there were a lot of people in Sacramento last month still trying to close the barn door. The State of California, after three unsuccessful attempts, awarded contracts for the controversial procurement of equipment to implement the first stage of its $40 million Stephen P. Teale consolidated data center. And the company which came closest to getting the business the first three times around, IBM, got the lion's share, $19.9 million. Data 100 received a $700,000 order for satellite processors and Boeing Computer Services, $250,000 for training.

But the cries of both vendors and government officials, which started when the state first attempted a sole source procurement for the center from IBM and persisted through two competitive bidding cycles and through this latest attempt at procurement through direct negotiation, hadn't stopped even as the three firms were getting to work on implementation of the center.

At a Ways and Means committee hearing following the awards, the state's Legislative Analyst's office and the state Auditor General claimed procedures leading up to the contracts had not been legally proper. Vendors who'd sought a piece of the action, specifically

LOOK AHEAD

Univac, Control Data, and Sanders Data Systems, Inc. echoed this attitude and protested the awards. And there were hints of anti-trust violations. But work on center implementation continued and none of the protestors knew where their protests stood except to anticipate a possible withholding of funds in next year's budget for the Teale center. With $4 million plus already committed for the first year, this is viewed by many as a highly impractical move.

LET THE BUYER BEWARE

There are rumbles of continued irritation and clandestine meetings among owners of IBM gear about IBM's continuous anti-purchase moves. Adding fuel to their ire were IBM's recent price increases that went into effect immediately on purchases and wait until spring on rentals. One user is outraged that he can do nothing about any of it including the 155 he owns. He plans to run and extend his 155's until they drop, refusing to go VS. He also noted that on the open market, 155's are going for 52-55% of original purchase price.

PERTEC: NOT ALL OEM

Although Pertec Corp. billed its new key-to-disc system as an oem product, the first three installations will be sold directly by the company which also will carry the leases. The first system, a seven keystation configuration, replaced a CMC-5 at Petrolane, a diversified Long Beach, Calif. company. Pertec was about to sign orders from a bank and a sports equipment manufacturer last month. The company has an oem agreement with Scan-Data (see p. 104) and has been negotiating with Univac.

DEC THINKS SMALLER

Minicomputer giant, Digital Equipment Corp., isn't going to let the burgeoning microcomputer market get away from it if it can help it. We hear the Maynard, Mass. manufacturer is priming the pumps for the announcement of a PDP-16-like product that uses two Intel Corp. 8008 microprocessor chips. The product, which may be software compatible with both the PDP-11 and the venerable PDP-8, will be supplied in pc-board form and will mark DEC's first use of LSI chips in standard products.

TO SCRATCH AN ITCH:

When Nick J. Mazzarese left Digital Equipment Corp. to run his sailing marina in Bimini, many who knew him well thought he'd get itchy to return to the computer business sooner or later. We hear that it's happened already and Mazzarese, who once guided DEC's mini operations, will be returning to DEC, although probably not in the mini area. Further, there are those speculating on even bigger management changes at DEC: rumors are flying that DEC president Kenneth H. Olsen will move up to chairman but will continue his firm grip at the helm of his rapidly growing company.

IS THIS A PHONE?

A remote terminal with a touchtone pad, several registers, a 14-digit numeric display, and a four-function calculator--but cleverly disguised to resemble an enhanced office telephone, which it is--is under development at General Teletronics Inc., San Francisco. The credit-card crowd, small retailers, and executives making occasional on-line inquiries are considered to be prospects, but inquiries in writing from system designers are being fielded by marketing vp Dave Jones.

(Continued on page 125)

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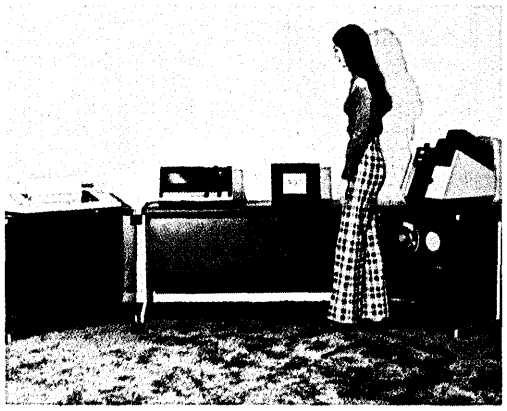
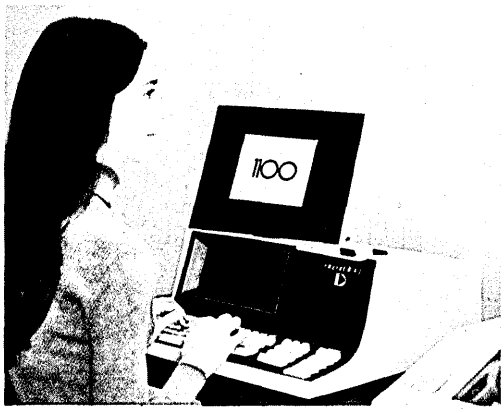
Datapoint 1100 processor based systems



Remote Batch Terminal



Intelligent Terminal

Datapoint 2200® processor based systems

Remote Job Entry

Terminal Processor

Datapoint 5500 processor based systems

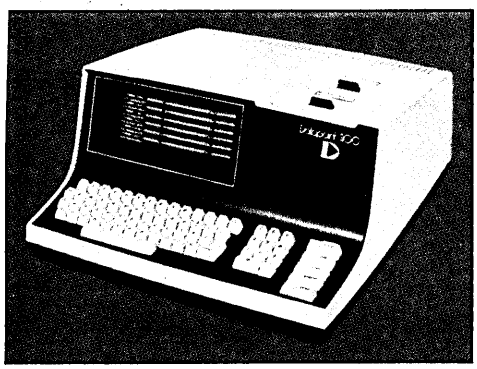
Local Processor

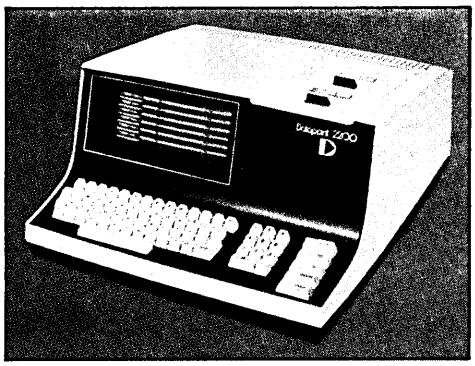
Remote Processor

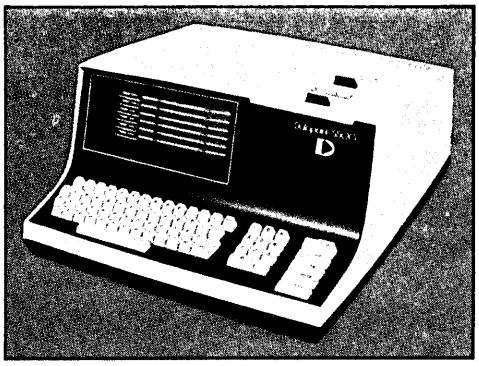
The pictures indicate a typical growth pattern of 1100-2200-5500 usage as a field office's work load increases. In the left-hand column, normal progression begins with the Datapoint 1100 for Remote Batch Terminal applications. In this mode, card readers, tape units, communication equipment, and printers are utilized as peripheral devices for efficient transmission of data between the remote location and host computer. In the second phase, the Remote Batch Terminal operation is upgraded to a 2200 to provide stand alone processing power to expedite Remote Job Entry applications. In addition to the expanded processing power of the 2200, disk capability and RPG II substantially enhance the effectiveness of the 2200 used in this way. In the third phase, a stand alone Datapoint 5500 is utilized as an independent Local Processor to meet all the dispersed processing requirements at the remote site without relying on a central host facility.

In the right-hand column, the first picture shows the Datapoint 1100 used as a powerful Intelligent Terminal for data entry and limited processing tasks. In the next phase, field office needs have grown to an intelligent multi-station requirement and are satisfied by the Datapoint 2200 used as a Terminal Processor. In this mode, a single Datapoint 2200 can provide "intelligence" for up to eight keyboard/display stations with subsequent transmission of data between the host and remote sites. The final progression is to the Datapoint 5500 Remote Processor, used in field offices as local "computer utilities," still linked to the host processor system, but now providing substantial independent compute power of their own to an array of peripherals and terminals located in the field offices.

Dispersed data processing the Datapoint way —as easy as 1100-2200-5500







Dispersed data processing the Datapoint way is the productive, economic approach to providing your field offices with the on-site computer power needed to compete in today's business world, while yet being linked to a central computing operation. Datapoint's trio of upward-compatible dispersed processors—the 1100, 2200 and 5500—offer you a capability that can be readily and painlessly augmented as office work load increases, as your company's communications network becomes more sophisticated and your field office personnel more knowledgeable.

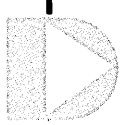
Let's look at these processors: the Datapoint 1100, available with 4K or 8K central memory, is the new Intelligent Terminal system from Datapoint Corporation that can bring your field offices into the on-line computer age immediately. Competitively priced, and with extensive capability for business processing tasks such as on-line (or off-line) data conversion and entry, it is a basic building block for creation of a multi-use dispersed data processing and data handling capability in your field offices. Once installed, the 1100 can do double duty for progressively more sophisticated data processing and data communications assignments including remote batch applications through utilization of card reader, magnetic tape, and printer peripherals. In software, Datapoint provides a CTOS operating system, Assembly Language, and the new DATAFORM language for sophisticated data entry and editing. Initial deliveries of the 1100, with a monthly lease price of $138, will begin in January.

When your field office work load grows beyond the capability of the 1100, it is an easy, painless transition to a more powerful Datapoint processor, without the need for jarring systems redesign and expensive software revision. The secret is in the upward compatibility of the 1100 with the well-established Datapoint 2200 Terminal Processor and the new Datapoint 5500 Remote Processor. It is as simple as pulling the plug on the 1100, plugging in the 2200. No complex systems changeover, no costly software rewriting is entailed; the user obtains the needed increment in dispersed data processing power in his field offices without disruption. The 2200, a widely used and well-established system with up to 16K central memory and dual ECMA standard cassette drives, will do everything the 1100 will do, and also provide an expanded on-site computer power. In a multi-station mode, it can service up to eight low-cost terminals for data entry and related tasks.

The 2200 is a natural step towards the 64K Datapoint 5500 Processor (deliveries in third quarter, 1974), which will do everything the 2200 does and also constitutes an on-site "computer utility" in your field offices. This system will provide computer power for a large number of associated peripherals and for a variety of low-cost, non-programmable terminals while simultaneously furnishing a high speed link to a central computer facility. These three Datapoint communications-oriented dispersed processors, progressively larger, faster and more powerful, open a new world of capability to the network-oriented user who sees the need for a growing satellite computing capability in his field offices, while still accessing a central computer facility for heavy duty processing and primary file storage.

Chalk up another innovative approach from Datapoint Corporation to the solution of business data processing problems. With the versatile Datapoint 1100, the proven Datapoint 2200 and the powerful Datapoint 5500; with their associated peripherals including line and serial printers, 7- and 9-channels magnetic tape units, a cartridge disk system, and synchronous and asynchronous communications adaptors; with full operating systems and extensive programming language capability including RPG II, BASIC, DATABUS and others under development, no other source can serve your dispersed data processing and field data handling needs so effectively, so economically. For further information on the growing Datapoint family of dispersed data processing systems, peripherals and software, contact the sales office nearest you or write or call Datapoint Corporation, San Antonio, Texas 78284, (512) 696-4520.

Datapoint



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CIRCLE 17 ON READER CARD

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These serial, buffered and conversational mode DATA-SCREEN™ Terminals—Models 450, 455, 456—include a host of important, often used display, data entry and interface options that can be set to customize the terminal when it is installed. A very few features do cost more: exclusive DATA•PANEL® fixed message display; automatic answer back; printer interfaces; and special function keyboards.

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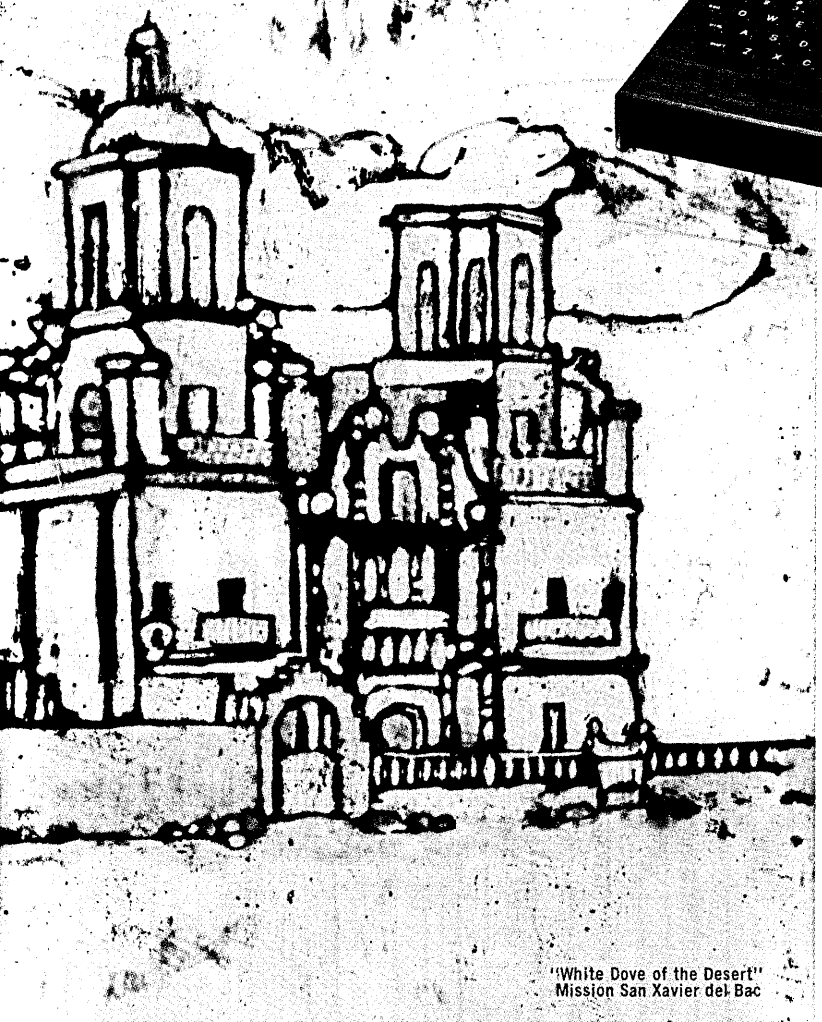
TEC, Incorporated, *25 Piper Rd., Kingston Upon Thames, Surrey, UK, 01-549-1920.*

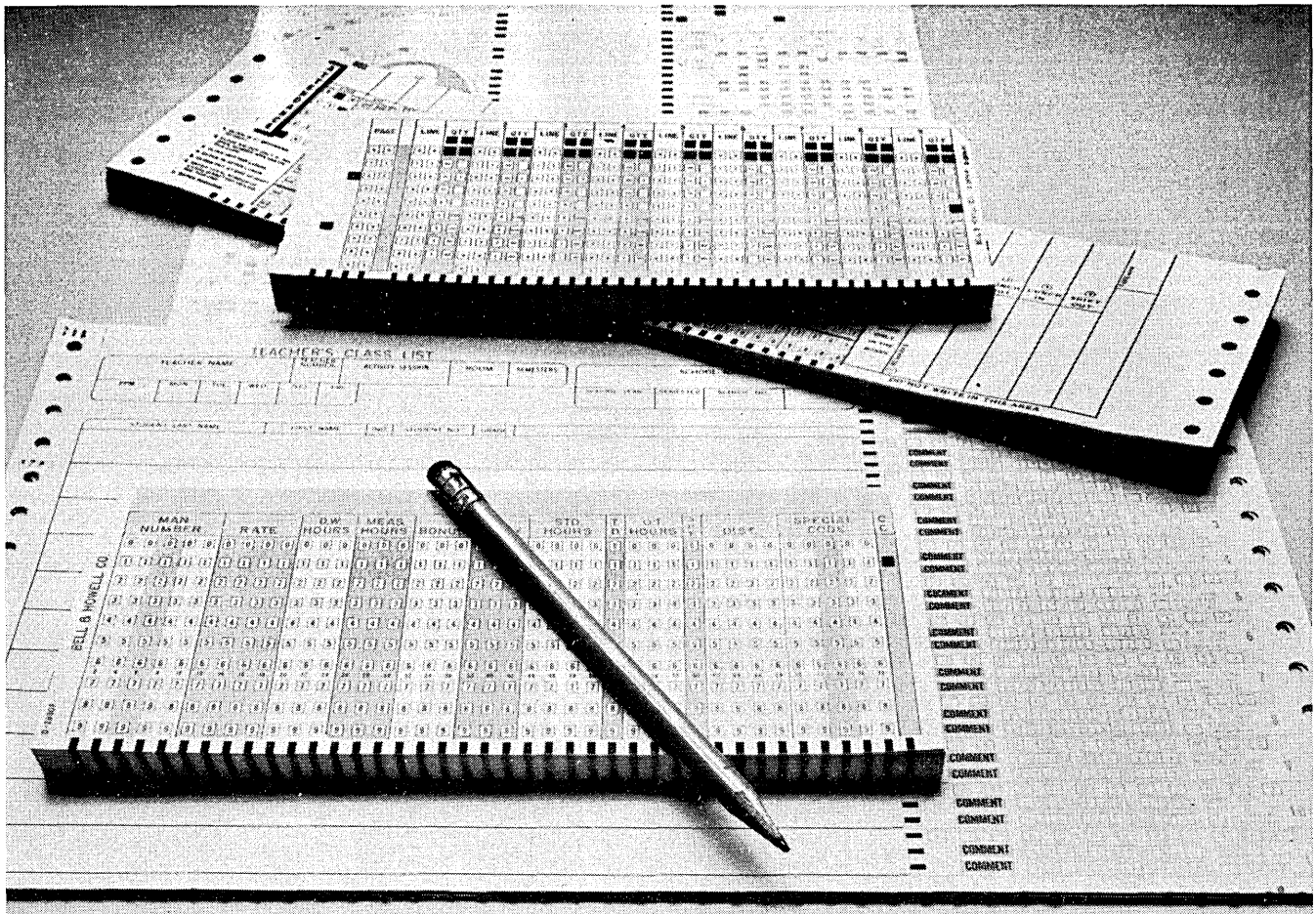
TEC® INCORPORATED

CIRCLE 31 ON READER CARD

*Complete with keyboard in OEM quantities



"White Dove of the Desert"
Mission San Xavier del Bac

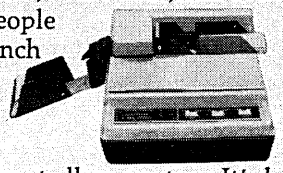


If you want to talk to your computer, write to it.

You don't have to use slow and cumbersome keyboards to talk to your computer. All you need is a pencil.

Because the Bell & Howell Mark Document Reader (MDR™) optically reads ordinary pencil marks from prepared forms. Fast and accurately.

Anyone can make the pencil marks—order clerks, route men, salesmen, assembly line workers—anyone. This means the people with the information can now skip separate keypunch operations and talk directly to the computer. Saving you time, money and mistakes.



A good mixer.

The Bell & Howell MDR is compatible with almost all computers. It's had great success in a wide variety of fields, from medical reporting to inventory control and order entry. With thousands of units working today.

A form of your own.

At Bell & Howell we do more than sell hardware. We'll custom design the MDR documents (cards or pages) to fit your exact needs, and print them. Our specialists will help maximize your system, install the MDR, train your personnel, and update the system when needed. That's what we mean by total performance responsibility.

Sound interesting? One of our Business Systems Representatives will be happy to provide concrete information on how the MDR has helped others in your industry.

BUSINESS EQUIPMENT GROUP

BELL & HOWELL

Bell & Howell Business Equipment Group
6800 McCormick Road, Chicago, Illinois 60645

Have a sales representative show me what the MDR is doing for others in my industry.

Name_____

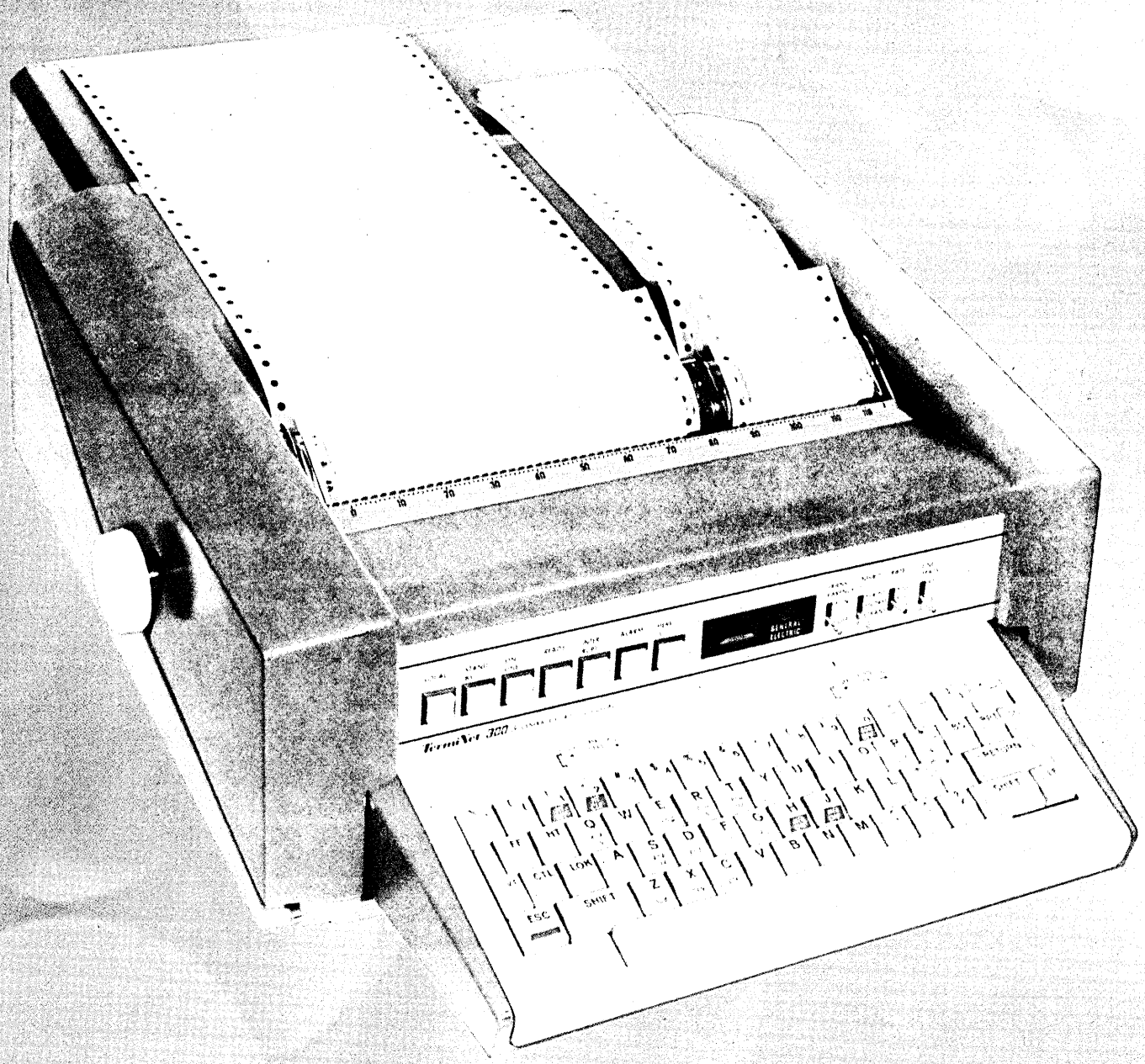
Title/Firm_____

Street_____

City/State/Zip_____

Phone_____

General Electric's answer to dual-output



The new split-platen TermiNet* 300 SP printer

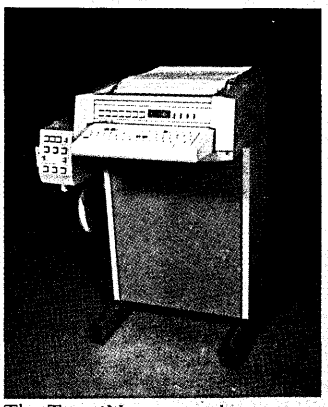
- **2 platens operate independently**
- **2 separate forms**
- **Unlimited application flexibility**
- **Reduces costs of printers**
- **30 characters per second**

With General Electric's new split-platen TermiNet 300 SP printer you now can prepare two separate forms at the same time.

The applications for this new concept in printers are endless. Any data communication system that requires hard copies for parallel but dissimilar information will find the split-platen TermiNet 300 SP printer an efficient and cost-saving method.

On-line inventory control, an order entry system providing simultaneous orders and credit memo, hospital admission systems are just some examples where the split-platen is ideally suited. In some cases the cost of printers can be reduced over 50%.

For more information on the split-platen TermiNet 300 SP printer and pedestal write: Section 794-08, P.O. Box 4197, Lynchburg, Virginia.

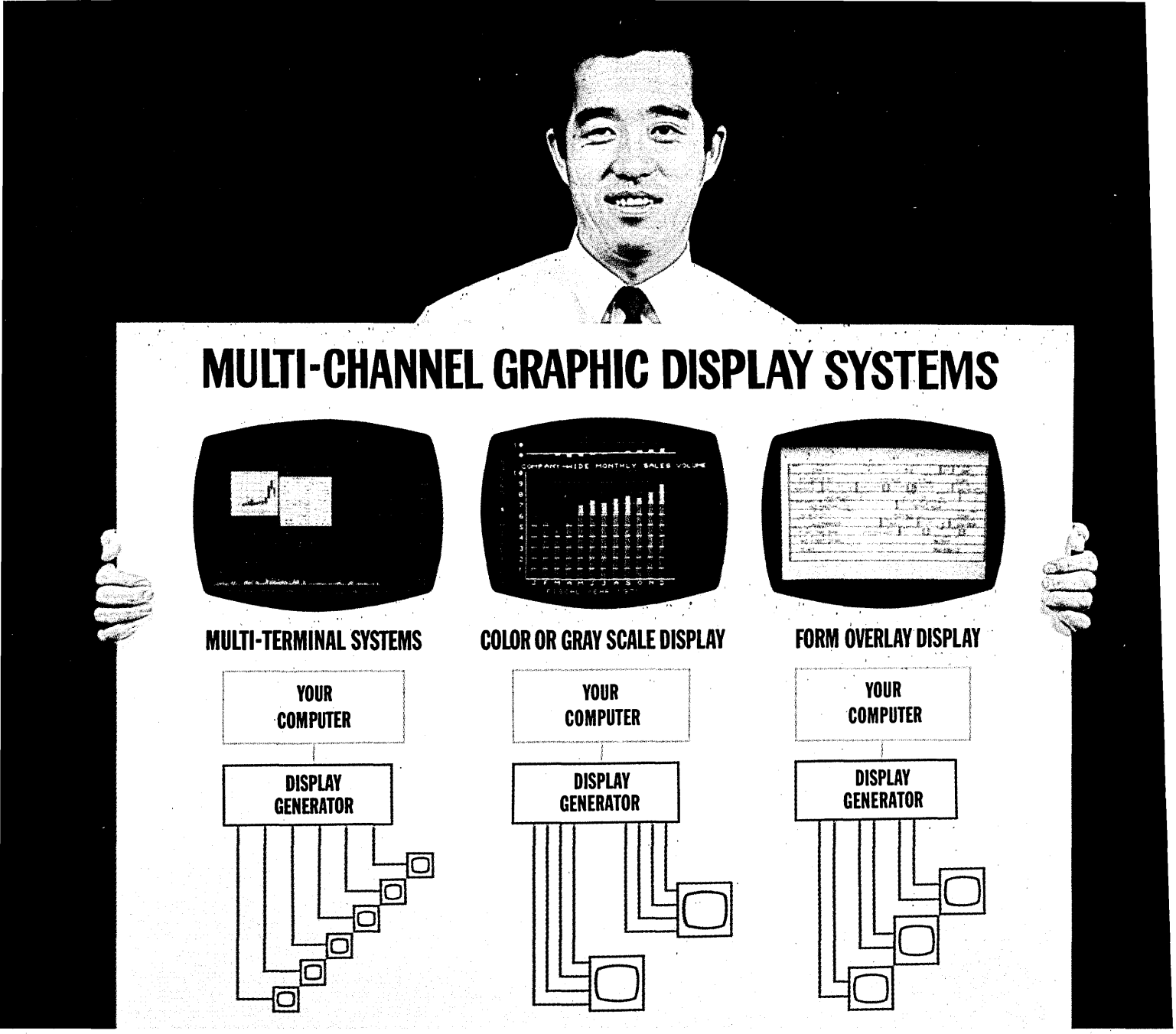


The TermiNet 300 and 1200 printers, in addition to the split-platen 300 SP printer, are available in pedestal configurations. These compact and convenient units offer major savings on premium floor space.

GENERAL ELECTRIC

CIRCLE 29 ON READER CARD

*Trademark of General Electric Company.



MULTI-CHANNEL GRAPHIC DISPLAY SYSTEMS

Choose one from column A, two from column B

Or choose all from column C, or...

Because this is a multichannel graphic display system, you can choose most any combination you wish. And like a Chinese dinner, any way you order it, you get an excellent buy.

This system uses a common display generator and a disc memory refresh to drive up to 16 independent, high resolution channels.

For **multiterminal applications,** use each channel to drive a low cost, daylight viewable TV monitor. Cost for a 16 terminal monochrome system, complete with 14″ monitors, keyboards, and typical computer interface, works out to just under $4000/terminal.

If you want **color or gray scale displays,** just combine channels. Two channels give you three colors and black; four channels give you 16 colors plus black. And for a full color display (4095 levels) use twelve channels. Color can make even the most complex graphics understandable.

You can also use **multiple channels for convenience in editing or data entry.** Put a standard grid or form on one channel, your graph or data on another. Then superimpose the channels on a single display monitor. Because you don't have to regenerate the grid when you change the data, you can have more efficient software.

These systems have all the capability you need for most applications—there are over ¼ million individually addressable points in the graphic display. You can selectively erase any rectangular area of the screen; write up to 51 lines of 85 alphanumeric characters. And because the displays are disc refreshed, the CPU need generate each display only once.

So think of the multichannel display system when you need computer graphics. Call your Data Disc representative for more information, or contact us at 686 West Maude Avenue, Sunnyvale, California 94086; 408 / 732-7330.

And for dessert, have a fortune cookie.

DATA DISC

Regional representatives: Fullerton, California, (714) 879-3911; Cleveland, Ohio, (216) 228-0624; Orlando, Florida, (305) 644-5550; Elmsford, New York, (914) 592-8658; Buffalo, New York, (716) 839-5020; Ottawa, Canada, (613) 234-4797.

CIRCLE 58 ON READER CARD

Letters

Illumination

Once in a great while an article appears among the many in data processing publications that stands out like light in a very dark room. One such light appeared in the November issue (p. 60); an article by Gerald H. Larsen entitled, "Software: A Qualitative Assessment or The Man In the Middle Speaks Back."

The material shatters the bias held by many on software, contains sound logic, and is well constructed. One vote for more perceptive reading such as Mr. Larsen has given.

ROBERT G. FRERKING
Director of Data Processing
Missouri Farmers Assn., Inc.
Columbia, Missouri

Brilliant. Every office of the chairman should make Mr. Larsen's article required reading—on a daily basis. Every time there is a corporate urge for witch hunting in the edp department, all conspirators should read the article again.

It appears that expository statements by edp personnel in justification of this or that are construed as snow jobs as a matter of course, where the same variety of statements by an engineer induces awe, not distrust. Are engineers more erudite, or dp people more ingenious?

An article such as Mr. Larsen's has been begging to be written, and the task fortunately fell to an articulate talent whose insight and realistic attitude surpasses that of most corporate executives.

Of course, it will be easier to ignore Larsen than to address the real problems he has so aptly identified.

ALBERT C. PATTERSON IV
New York, New York

Larsen presents a well written, biased defense, intended for a rhetorical war, the solution of which cannot possibly be "to immediately fire the 35% or more" who don't belong, nor can it be to define "specific professional titles," etc.

The problem is not in firing or not firing the misfits—it is *finding* them to begin with. But my guess is that if we asked for volunteers to define "specific professional titles"—and then fired all that stepped forward, we'd come pretty close to getting the job done.

That leaves undone, however, the task of assigning specific professional titles, said task curiously resembling the making of silk purses by putting labels on sows' ears. Why on earth should we want to submit to ethical standards, regulation, examination, and control? Those things have done nothing to improve the quality of accountants, doctors, or lawyers and I see no reason for software people to progress in their consequence, either.

LARRY WELKE
President
International Computer Programs, Inc.
Indianapolis, Indiana

Mr. Larsen replies: The war stops being rhetorical if you **can** find the misfits. Fortunately many of us are able to do that. By the way, my aunt has a great cure for cancer—you take this potion and light two matches and . . .

On societies and showmanship

Congratulations on the November coverage (p. 97) of the certification question. Reinstedt and Berger present a rational, scientific approach to the construction of legitimate certification procedures. Their carefully understated case against the ad hoc nature of the DPMA's CDP exam must not be ignored.

The societies involved have a fine opportunity at this juncture to sponsor testing procedures of real merit. It would be shameful to put their prestigious seal of approval on anything less. Analysis is the business of our profession; to corner-cut on analysis in favor of short-term payout is certain suicide.

J. M. WELLS
Dept. of Computer Science
The Univ. of Manitoba

One type of person who may benefit from certification is the experienced programmer who is convinced of his own competence but has been consistently assigned to tasks which, however difficult, are regarded by management as trivial or obsolete.

During the boom of the '70s, a programmer could get recognition (if not advancement) by working on thankless jobs, but with the slump of the '70s, management is more inclined to disparage such experience, especially for older employees.

Certification may also help sort out the efficient programmers from the showmen who tell management what it wants to hear, and then use a lot of overtime and expensive hand-on time to further impress the manager.

WILFRED G. ROULEAU
Gaithersburg, Maryland

Between Scylla and Charybdis

The data processing industry is caught in a dilemma whose resolution will initially take place on the 5th floor of the U.S. Court House in Foley Square, New York, starting October 7, 1974.

This is the site of the landmark antitrust case against IBM. Its outcome will affect the industry for years to come, far more significantly than the Telex decision.

On the one hand, if the Justice Dept. wins and IBM is broken up, it will result in a disaster of some proportion for the industry. On the other hand, if IBM is not broken up, its continued exercise of such monopoly powers as it appears to exhibit today will inevitably result in greater user frustration, increased costs, contracting problems, lawsuits, and the like.

There is a third alternative, not much better, toward which we seem to be heading. If a consent decree agreement is reached, in which certain practices are stopped, the industry will be on its way to a then inevitable event: *government regulation.* This is but one of a confluence of factors which seem to be predestining the formation of a "Federal Computer Commission" to act as a regulatory body over the entire computer industry, setting rates and controlling usage and free competition.

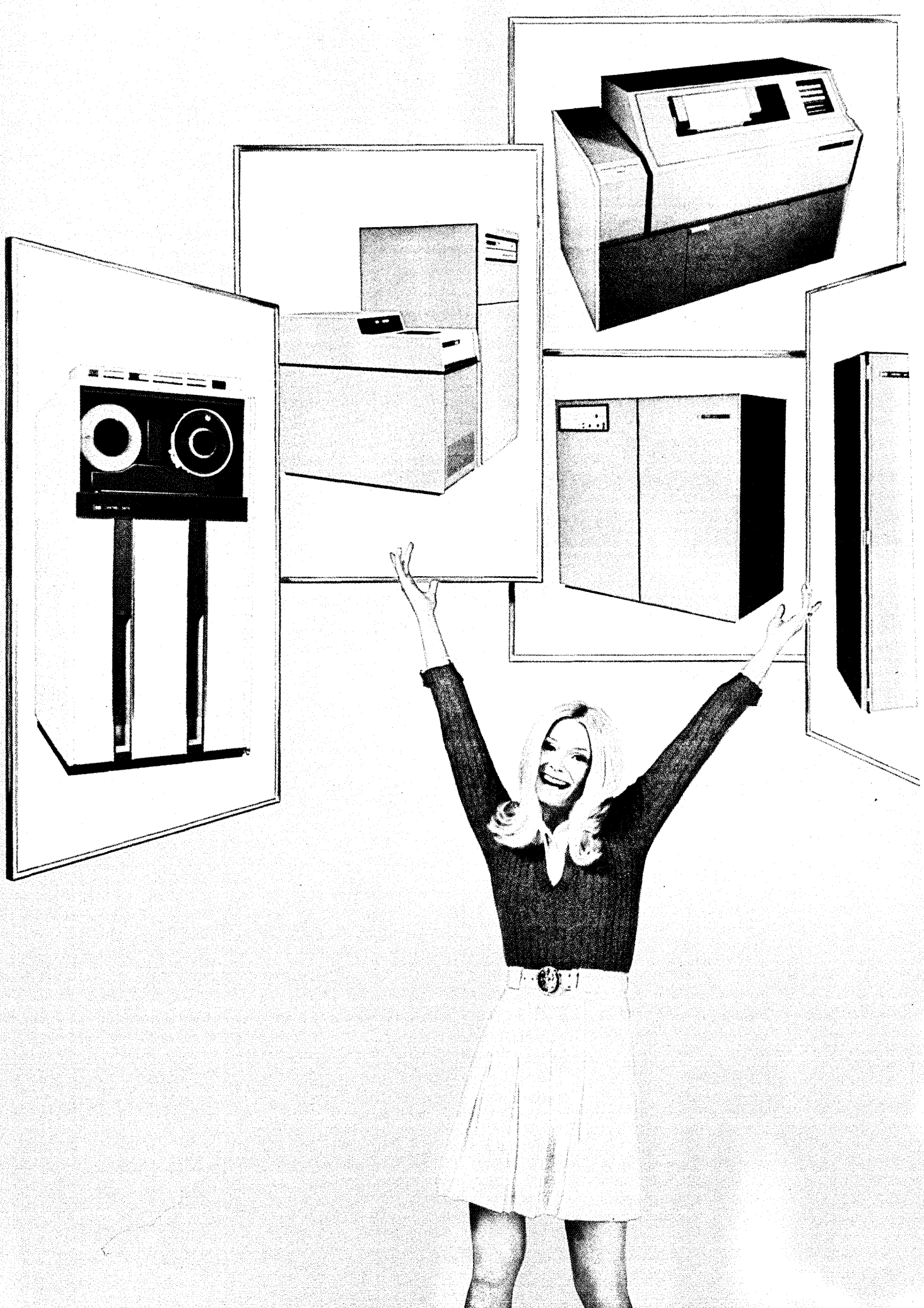
Other factors which presage the establishment of such a Commission are:

- —the trend toward unionism on the part of programmers, operators, and others associated with the field
- —increasing use of computers in data communications systems, and/or the use of data communications in computer systems
- —the software tax controversy, recently resolved in California
- —the software copyright/patent question, ignored by Congress
- —the general lack of professionalism on the part of our "para-professionals," resulting in unrealistic wage-and-hour law rulings
- —"computer-based" frauds, such as Equity Funding
- —the need for trade protectionism for computers, currently our most beneficial export
- —the "privacy" movement, and its attitude toward data banks
- —the general pervasiveness (and thus importance) of computers in our current struggle to maintain our standard of living

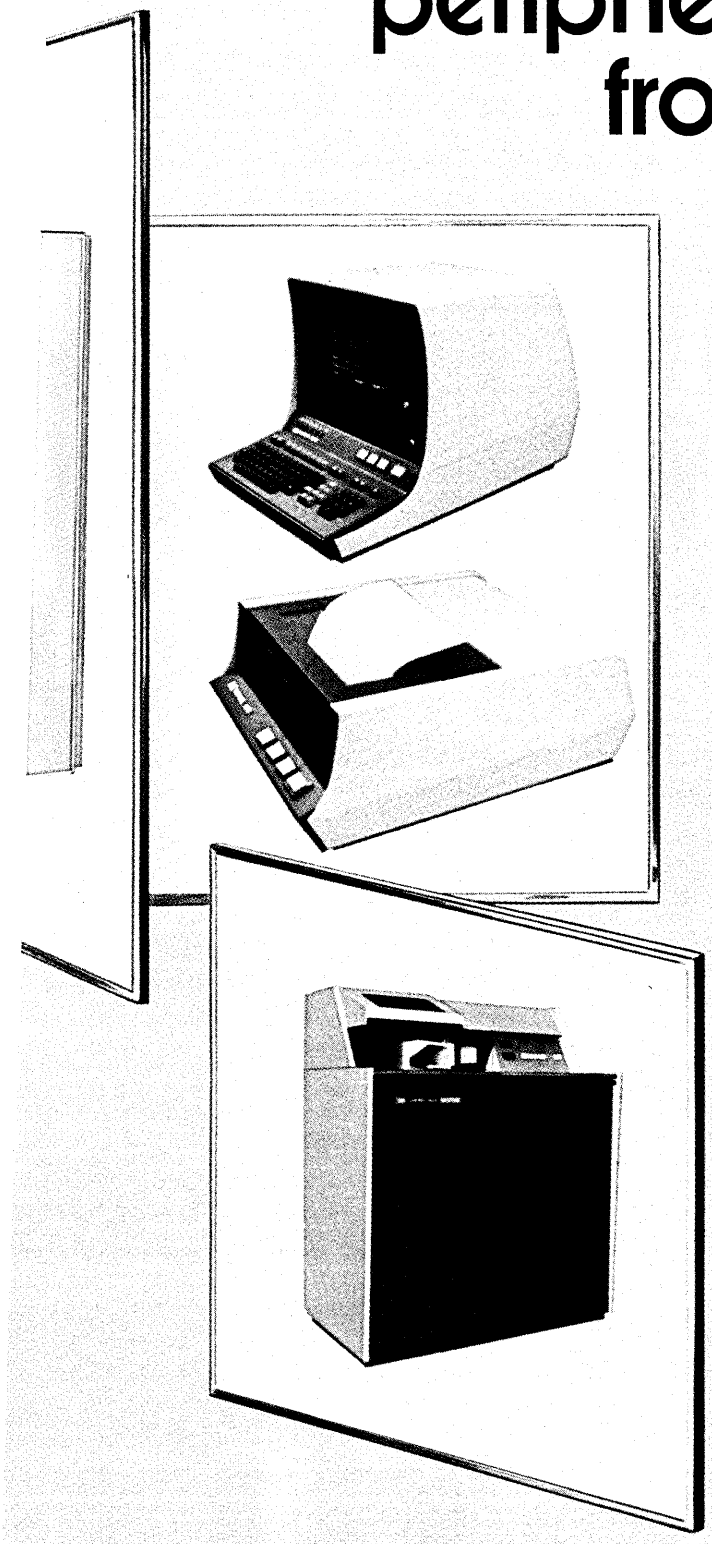
However, the key factor is the structure of the industry, the role of IBM, and its relationship to users. Perhaps we should all examine our positions, and determine whether or not we really want a regulated industry. It will be less competitive, more expensive, more cumbersome to work in, less imaginative, and far less exciting. At least, that is what experience indicates in our currently regulated industries.

DICK H. BRANDON
Brandon Applied Systems, Inc.
New York, New York

(Continued on page 116)



consider all these peripheral advantages from Control Data



Control Data is the only major mainframe manufacturer offering an extensive array of peripheral products for IBM and other central processors...plus worldwide services.

Replacement products often add up to much more than just that

CDC peripheral products usually enable computer users to upgrade system capabilities at lower cost.

In service, your world is our world

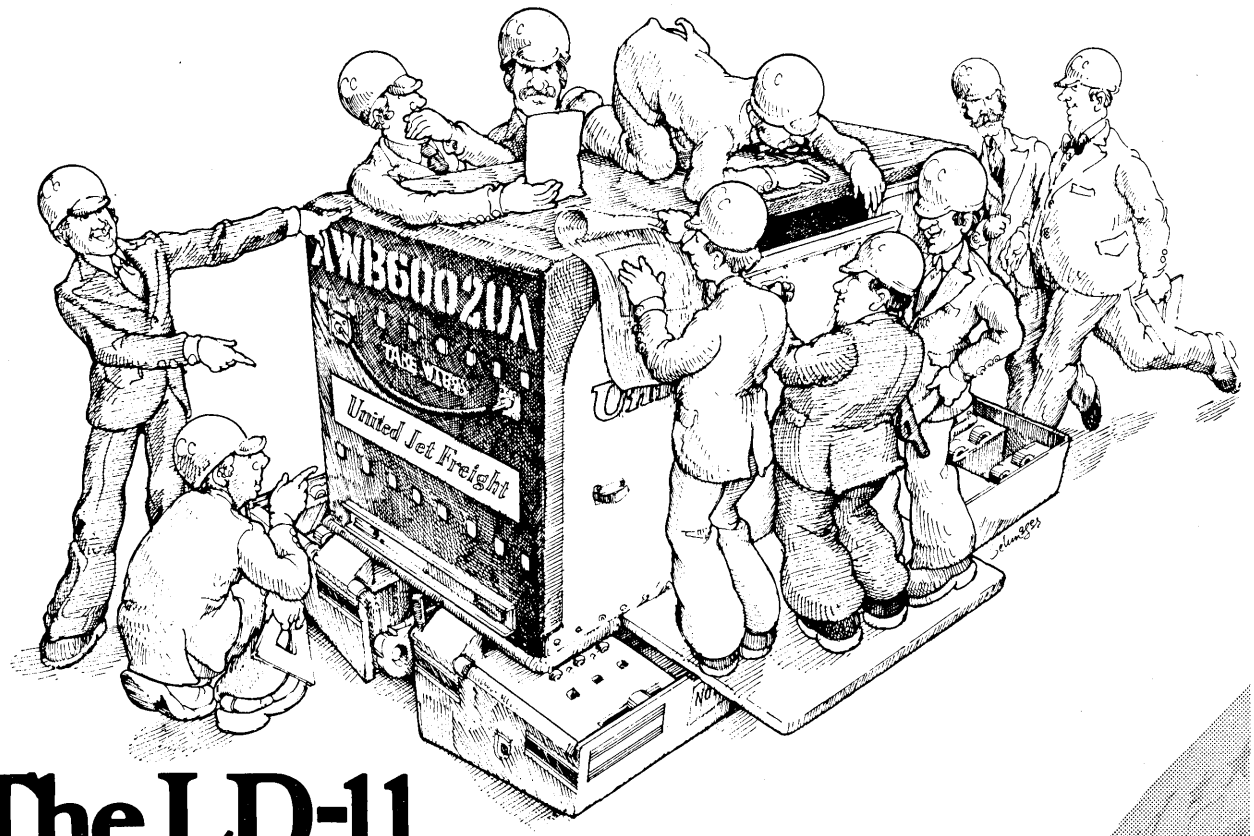
We back what we sell with a worldwide maintenance service organization. You would expect to save money by going to your original computer system supplier for any engineering needed to make the most of new peripherals. Actually, chances are good you will do as well or better with Control Data. We will even help with financing, if desired, through our Commercial Credit Company.

Contact your local CDC sales office...or dial our Hot Line collect (612/853-3535)...or write Control Data, Dept. D-14, Box 1980, Airport Station, Minneapolis, Minnesota 55111.

CIRCLE 16 ON READER CARD

CONTROL DATA
CORPORATION

United gives you
The box that you built.



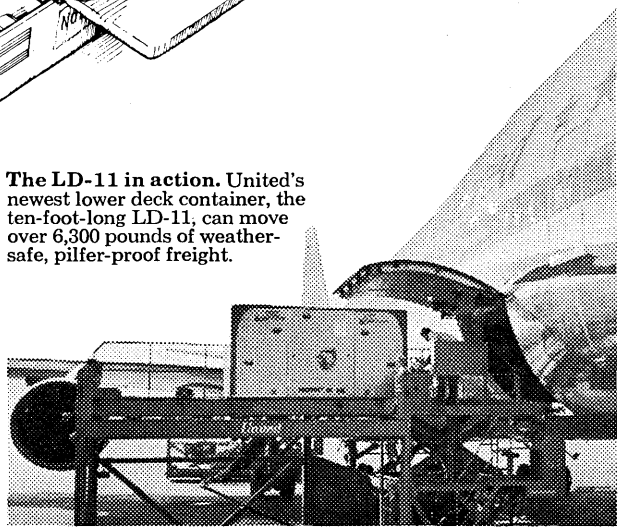
The LD-11.

We knew our shippers wanted a container larger than the LD-3. So we asked a cross section of our best customers, who we knew would speak for all our shippers, specifically what you wanted in a larger container. *You* told us you wanted:

1. Straight sides
2. Structured fiberglass body (weatherproof)
3. Tie-down (United's "Soft Touch") capability
4. One-seal security
5. Bars for garment-on-hanger shipments
6. Off-airport dollies
7. Full-width door opening
8. Internal height of 61 inches
9. Pull-rings and Push-plates
10. 6,300-pound-plus net capacity
11. Most important to many shippers, a Time-of-Tender rate structure.

You've got it. It's United's LD-11. It fits in all our 747's and DC-10's. And our "Daylight Savings" time-of-tender rates are designed to make it fit your shipping budget.

Typical "Daylight Savings" rate: 6,300 lbs. in one LD-11 container from New York City to Los Angeles for $482—only $7.65 per 100 lbs.



The LD-11 in action. United's newest lower deck container, the ten-foot-long LD-11, can move over 6,300 pounds of weather-safe, pilfer-proof freight.

UNITED'S LD-11

Dimensions	Internal	External
Length	120″	125″
Width	56″	60″
Height	61″	64″
Capacity		
Cubic Feet	242	277
Net Pounds	6,300 plus	
Minimum Chargeable Weight (Pounds)	1,800	

United Air Lines

Jet Freight *No. 1 in the U.S. sky*

POWER PACKAGE!

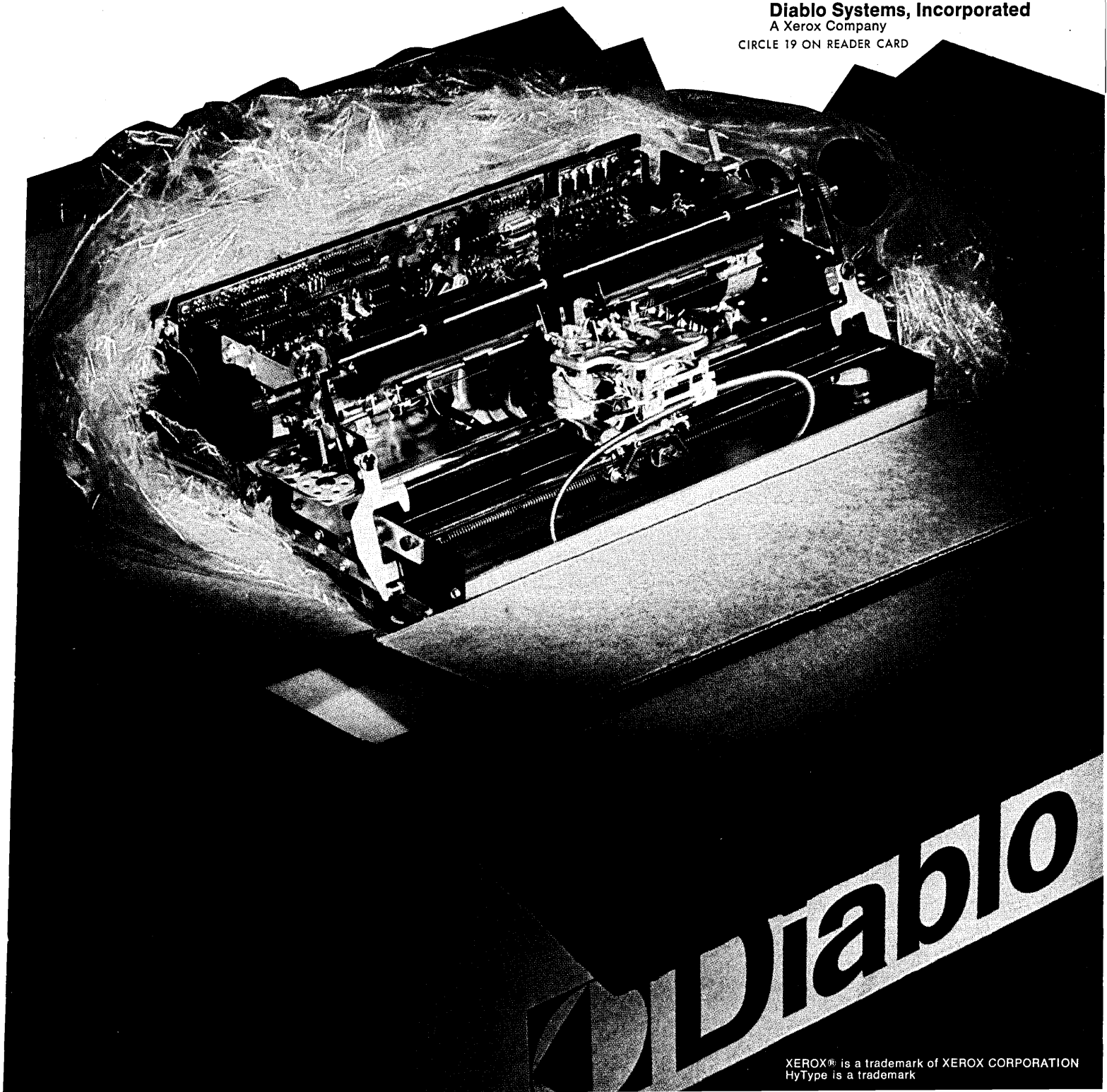
HyType I Reliability, Speed, Print Quality.

Most of the big names are equipping their systems with the Diablo HyType I Serial Printer. These facts tell you why: Reliability—Diablo has eliminated more than 80% of the moving parts common to most serial printers, replacing them with servos which provide trouble-free performance with minimum routine preventative maintenance. Quality and speed—HyType prints in clear, crisp easy-to-read type at average speeds of 30 characters per second on average text, two to five times faster than the most commonly used printer of the past. Quiet and economical—HyType is quiet, compact and priced to provide designers with the ultimate in efficiency and cost effectiveness. Options and accessories—HyType is available with pin feed, split platen and forms tractor. You can choose from over a dozen type fonts in snap-in character wheels. Multi-strike carbon, and two color ribbon cartridges are available. If you are investigating mini-computers, terminals, or business data processing systems, make sure the serial printer provides a full measure of high reliability in heavy duty service. Demand Diablo HyType I. For complete technical presentation write or call Diablo Systems Inc., 24500 Industrial Blvd., Hayward, California 94545, (415) 783-3910

Diablo

Diablo Systems, Incorporated
A Xerox Company

CIRCLE 19 ON READER CARD



XEROX® is a trademark of XEROX CORPORATION
HyType is a trademark

Our new low-profile Our new low price

MICRO SWITCH products are available worldwide through Honeywell International.

keyboard is solid-state. is mechanical.

We've expanded your keyboard options dramatically with our new SD low-profile keyboard.

It makes MICRO SWITCH solid-state prices (based on 1975 delivery) competitive with less reliable mechanical-contact keyboards.

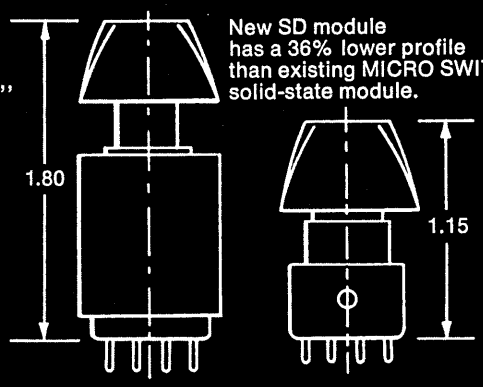
So price is no barrier. No matter what your need. Be it word processing, point-of-sale or other data entry applications.

We've coupled our unique Hall effect switch with an advanced "flip chip" ceramic mounting technique to further increase the reliability of our solid-state keyboards.

And our new low-profile design is ideal for modern compact terminal needs.

Picture a MICRO SWITCH keyboard in your system design. We're ready to talk prototypes now, with production in late 1974. Contact a MICRO SWITCH Branch Office for complete information.

It's the change you've really been looking for.



New SD module has a 36% lower profile than existing MICRO SWITCH solid-state module.

MICRO SWITCH
FREEPORT, ILLINOIS 61032
A DIVISION OF HONEYWELL

CIRCLE 32 ON READER CARD

"CFI flew in the disk packs and I drove them to the customer that night. Nothing unusual."

"We're a growing, privately owned firm," reports Chuck Lattanzio of Winbrook Associates. "So my brother Dale and myself take an intensely personal interest in cutting through red tape for our customers. If that requires one of us to make a personal delivery, that's exactly what we do."

"Our operation is extremely flexible and dedicated to doing a top-rate job. That's why we recommend CFI Memories disk packs and cartridges. CFI is a well-managed company that stresses personal service the way we do. And their quality products cover both IBM-compatibles and non-standards."

Personal profiles

Chuck and Dale Lattanzio, partners in Winbrook Associates, Brookline, Mass. Chuck, the firm's founder, is active in Big Brothers of America. Dale, who was formerly associated with IBM, joined Winbrook five years ago. Both brothers are family men and members of DPMA.

Chuck and Dale Lattanzio are committed to serving EDP operations. They're typical of the 186 representatives serving CFI customers here and overseas. Together, they've supplied users and OEMs with thousands of disk packs and cartridges. And they're all men who work hard to earn your business by providing the kind of personal attention you require.

A nearby CFI representative is waiting to serve you now. For his name, call us toll-free at 800/854-3290. Or write: CFI Memories, Inc., 305 Crescent Way, Anaheim, California 92801.

We take your business personally.

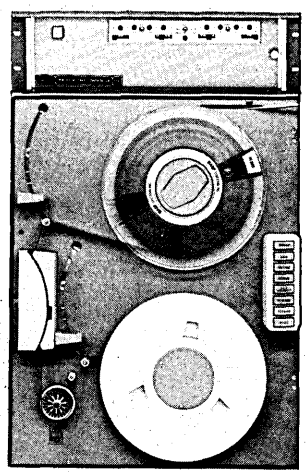
CFI memories, inc.

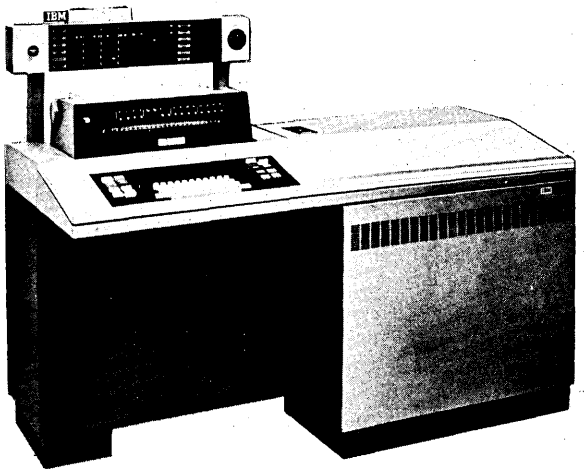
A LENCOR COMPANY

EUROPE: CFI Memories, Inc., Carolyn House, Sixth Floor, Dingwall Road, Croydon CR9 1NT, England. Tel. 01-681-3811 CANADA: Barshaw Office Systems Corporation, 9559 Cote de Liesse Road, Dorval (Montreal), Quebec, Canada. Tel. 341-631-8591

datum inc

SUPER SALE





5091 control system for IBM 1130 computer, including tape drive

was $11,300 now $7,450

Sales increases making DATUM number one in magnetic tape control let us pass on the real economy of mass production to you. ■ We also offer 600 line per minute printing systems and SAC channel multiplex adapters for two or three peripherals. The price of a complete DATUM 5091 Control System for the IBM 1130 has just dropped an average of $3,800. Depending on the tape drive you choose, the savings can be even more!

Look to DATUM for all your IBM 1130 peripheral needs.
We're the miniperipheral people.

Peripheral Equipment Division

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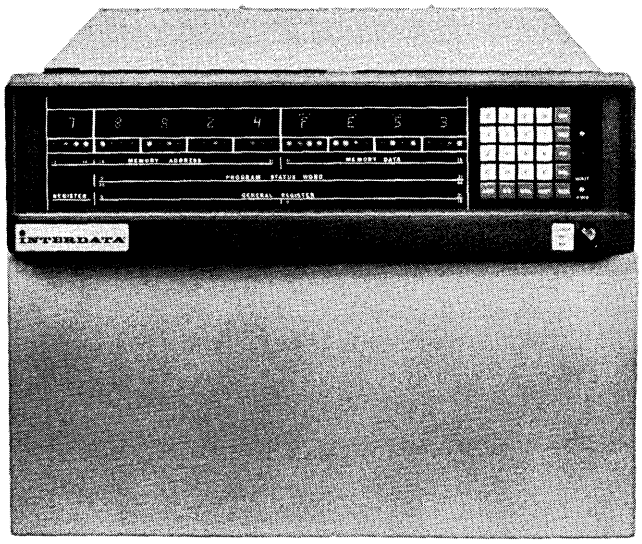
INTERDATA ANNOUNCES THE INDUSTRY'S FIRST 32-BIT MINICOMPUTER FOR UNDER $10,000.

WITH UP TO A MILLION BYTES OF DIRECTLY ADDRESSABLE MEMORY.



Performance	7/32	Nova 840	PDP-11/40
Word length	32	16	16
Memory speed (nanoseconds)	750	800	900
Maximum memory capacity (bytes)	1,048,576	262,144	262,144
Addressing range (bytes)			
Direct	1,048,576	512	65,536
Relative	±16,384	±256	±32,768
Indexed	1,048,576	65,536	65,536
Double indexed	1,048,576	No	No
General-purpose registers	32 32-bit	4 16-bit	8 16-bit
Index registers	30 32-bit	2 16-bit	8 16-bit
Vectored interrupt levels	Yes	No	Yes
Minimum interrupt overhead time (usec)	6.5	47.5	46.5

Price	7/32	Nova 840	PDP-11/40
32 KB processor	$ 9,950	$12,930	$15,345
64 KB processor	14,450	19,330	26,925
128 KB processor	23,450	35,630	44,725
256 KB processor	41,450	61,230	80,825
1 Megabyte processor	171,650	Not available	Not available

Source: Data General Price List, 5/15/73. DEC PDP-11/40 Price List, 6/73. DEC OEM & Product Services Catalog, 1972. Auerbach Minicomputer Characteristic Digest, June, 1973. "How to use Nova Computers", 1973.

Minicomputer myths you can live without:

1. There's no such thing as a 32-bit minicomputer.

2. Minicomputers have an absolute 64K addressing limit.

3. The only way to even access more is to resort to some sort of hardware kluge with a hairy software scheme that'll cost you an arm and a leg.

All wrong.

Because now there's the Interdata 7/32 – a powerful new 32-bit minicomputer with main memory expandable up to a million bytes and direct addressing up to 16 million bytes.

Big it is. But hairy it isn't.

Because it's simple, straightforward and efficient. And it's the industry's first uncomplicated extended-memory software environment.

Backed up by a lot of hardware muscle like thirty two, 32-bit registers, 1024 I/O interrupts with automatic vectoring, 239 instructions. And a lot more. All of which would lead you to expect to pay a lot more money, right? Well, that's also a myth.

The software muscle is all there, too. A new FORTRAN V compiler. An optimizing assembler called CAL. And the first extended operating system that's both powerful and simple – OS/32. Plus all the other field-proven Interdata software – it's all compatible.

The new Interdata 7/32.

We put our muscle where their myth is.

INTERDATA®

2 Crescent Place, Oceanport, New Jersey 07757 (201) 229-4040.
Boston – (617) 890-0557. Washington – (703) 525-4806. Philadelphia – (215) 436-5579.
Orlando – (305) 851-6962. Chicago – (312) 437-5120. Detroit – (313) 356-5515.
Dayton – (513) 434-4193. Kansas City – (913) 384-1606. Houston – (713) 783-3060.
Dallas – (214) 238-9656. Denver – (303) 758-0474. Los Angeles – (213) 640-0451.
Phoenix – (602) 968-2477. San Diego – (714) 565-0602. San Francisco – (415) 969-1180.
Seattle – (206) 455-0680. Toronto – (416) 677-8990. Tokyo – (270) 7711.
Sydney – 439-8400. London – Uxbridge 52441. Munich – 0811-8543887.

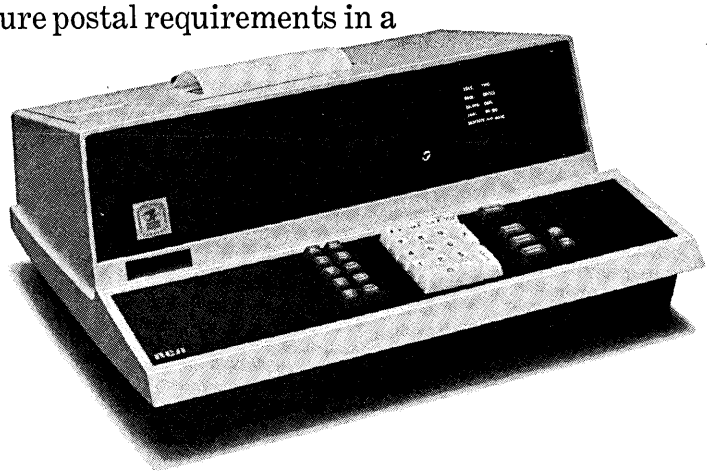
CIRCLE 44 ON READER CARD

FLEXIBILITY brought RCA and the Postal Service together

The Western Region Postal Service required terminals to perform a **broad range of functions** unique to postal operations – like commodity sales, bulk mail transactions, and overall accounting operations. Terminals **custom configured** with postal oriented keyboards and displays, and printers and card readers... a system **compatible** with existing procedures ...and **growth capability** to accommodate future postal requirements in a flexible and economical manner.

The results...

Terminals with ROM-programmable flexibility to meet a variety of user needs.



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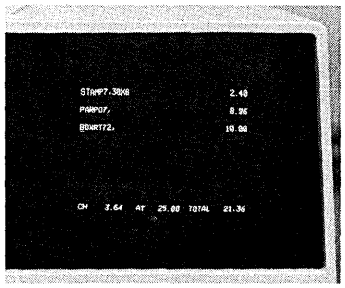

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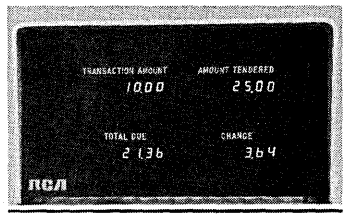

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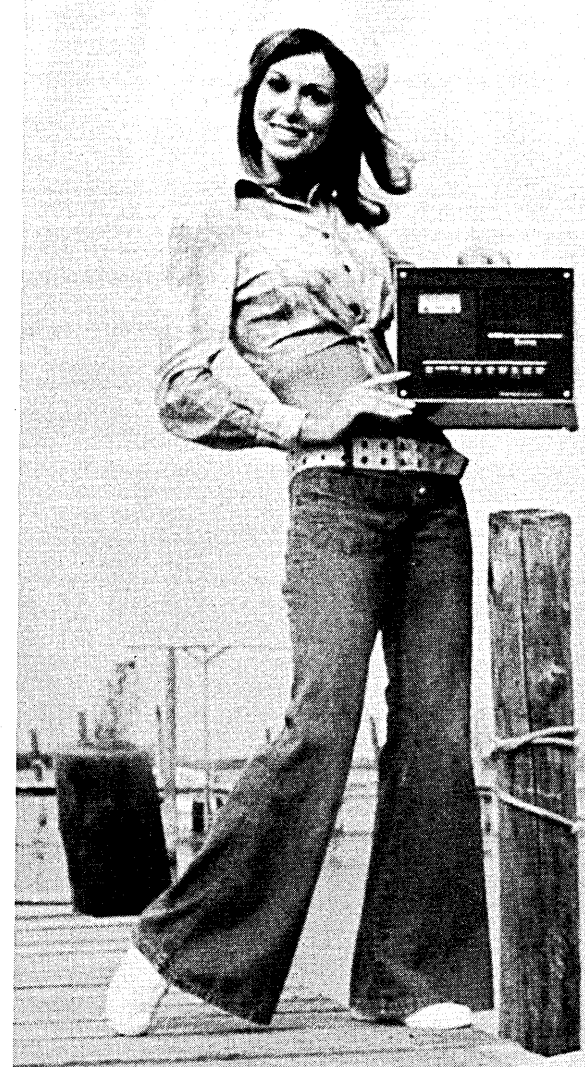

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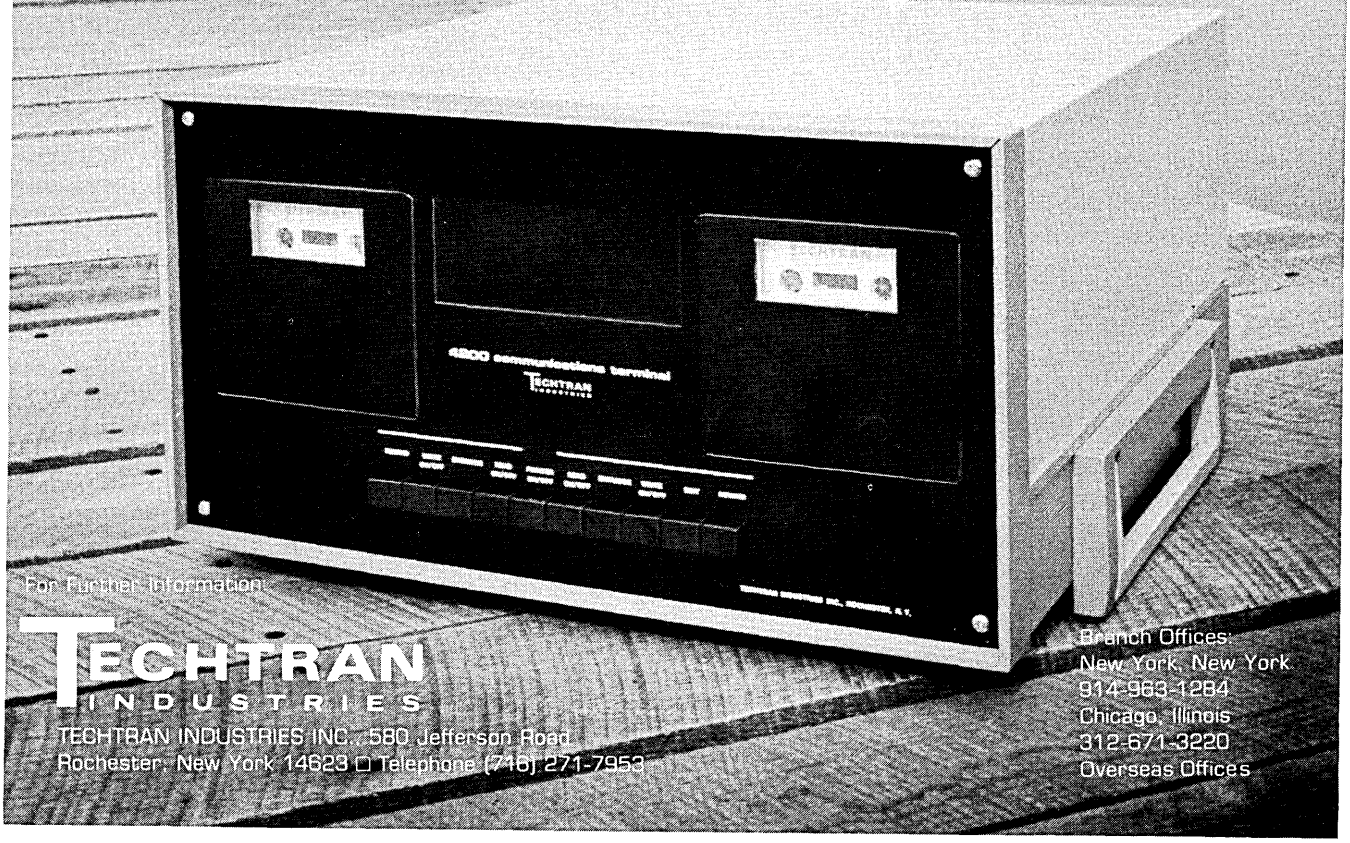

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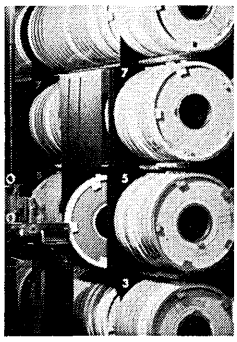

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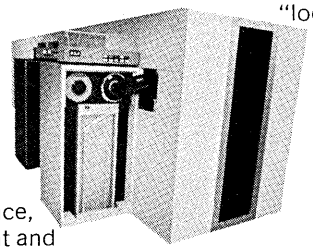

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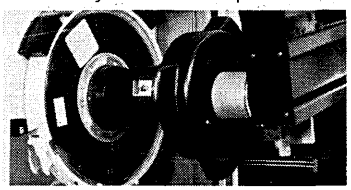

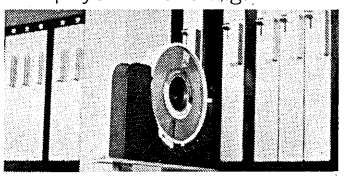

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COMPUTER SECURITY an overview

by Harold Weiss

TOP MANAGEMENT CONCERN about computer security was stimulated recently by several well-publicized cases of computer-related fraud. Most notorious of these is the massive Equity Funding scandal in which insurance policies worth some $2 billion were fabricated. This was only one facet of an incredible caper that has rocked the financial community. Around 1969 and 1970 there was similar management concern resulting from a rash of bombings of computer centers. In 1972, tropical storm Agnes with its widespread destruction of data centers, also caused a flurry of interest in computer security at the upper levels of the executive hierarchy.

This concern is well-founded since many chairmen of the board have effectively been playing corporate Russian roulette. At any moment their organizations might receive the equivalent of a bullet in the corporate brain. This would result from the almost total collapse of the organization's information system concentrated in and around the centralized data center. A localized fire, an unhappy employee, a storm, or numerous other events could trigger the disaster.

Aside from the catastrophic effects on employees, stockholders, customers, and other elements of the population, top management can expect to suffer personally from legal action if imprudence in security planning is demonstrable. Yet in relatively few companies does one find a resolute attack on the urgent problems of computer security and a commitment of appropriate manpower and monetary resources. Even in these cases, when profits start to sag, security and control are among the first areas to be cut, presumably as "frills."

With or without high level management prodding, the data processing manager must devote high priority to security planning and implementation because the stakes are so enormous. Some of the decisions made could easily cost or save the organization tens of millions of dollars or lead to its demise. In view of this awesome responsibility, the data processing manager should not be making such decisions personally, but should be passing on assessments of the hazards, the costs of security measures, and recommended actions. It is up to higher management to decide the level of permitted risk, to assure that it is acceptably low and at reasonable cost. They must be convinced that recovery will still be possible and relatively efficient.

In addition to the primary security concerns, which are survival of the organization and preventing the destruction of major corporate assets, attention should be given to the integrity, accuracy, and validity of the organization's information system; the prevention of large-scale computer-related fraud; and needed privacy of proprietary data.

The broad nature of the computer security problem will be explored in this article and some recommendations made to data processing managers. Disaster-level problems will be emphasized.

Experience with disasters

If one collects incidents of computer-related disasters, as I have done for about a dozen years, it is quite easy to go overboard and become a security nut or be obsessed about control requirements. As with all aspects of computer work, compromise is necessary. We must strike a balance between the need for various kinds of protection, the cost, and the interference with the operation of a system. It is possible to quality-control a manufacturing plant so tightly that nothing ever gets shipped or product cost becomes prohibitive. Similar considerations affect the information factory. The very first truly commercial application ever placed on a computer failed because, among other reasons, excessive controls and constraints placed upon a payroll system made it unworkable. So, security, while a major concern, should not normally be an overriding one in commercial data processing installations.

Data centers have proven to be very fragile things when one reviews the wide range of incidents that have destroyed them or seriously interfered with their functioning for prolonged

When a physical disaster, or loss of security, strikes a data center, the whole company may go down with the computer. The weak spots to look for and the precautions to take are all listed here, but the dp manager needs a lot of help in doing anything about them.

periods of time. Fire, water, and malicious acts by people pose the worst threats of serious damage or destruction. The last statistics I saw showed about 2½ million fires reported annually in the United States. Other data indicate that probably over a million of these are to buildings. Inevitably, some of these building fires affect computer centers each year. The first large-scale computer disaster was the Pentagon fire in 1959. In July 1973 the Army Records Center in St. Louis experienced a very large fire that did extensive damage for which they were ill-prepared. IBM was the recent victim of a large computer fire apparently caused by arson.

Water damage to computer centers has occurred from numerous sources. Tropical storm Agnes was the worst offender. It was estimated that hundreds of computer systems were buried under tons of water and mud in the Middle Atlantic section of the country. In 1970 hurricane Celia caused devastating problems for many computer users in Corpus Christi, Texas. In addition to hurricanes, water damage to computer centers has been experienced from floods, the activities of firemen on higher floors, broken pipes, sprinklers, water mains breaking, sewers backing up, underground streams, and leakage in the computer's water cooling system. In the Army Records Center fire, water damage was much worse than that resulting from the fire itself.

Malicious acts by people are becoming more significant factors. A few years ago there were 4,330 bombings in this country in a 15½ month period. Several of these were of computer centers, particularly at universities. Such incidents also occurred in Canada and Mexico. A computer operator is reported to have physically sabotaged his company's computer at least 56 times in a two year period. Striking maintenance employees of a computer manufacturer allegedly sabotaged a customer's data communications network in a harassing action. I have been told of several sabotage actions by recently terminated data processing employees and of several cases of program sabotage, but these have not been verified to my satisfaction. In any event, this is a growing area of concern. The computer is a symbol of mechanization and automation; hence, it becomes a primary target of disaffected elements in society.

Other events which have taken out computer centers include explosions, an earthquake, a tornado, aircraft crashes, extended loss of electric power, strikes, war, lightning, serious equipment malfunction (eleven days of cpu outage at one installation), air conditioning breakdown, industrial chemicals or gases, sandblasting near the air conditioning intake, steel wool (two data centers), even hair spray sucked into a company's air conditioning system. Anyone wanting to research the problem need only scan the front pages of newsweeklies for the past four years. Many of the incidents are never reported in the press, however. Neither the victims nor the computer manufacturers are interested in this type of publicity.

Computer-related fraud merits special attention. Normally, this is not as potentially catastrophic an event as some of the hazards listed above. In the first 15 years of business computer applications, very few frauds surfaced and few of these had significant impact on the organizations affected. In the past few years, as computers proliferated and computer knowledge became more widespread, and perhaps because of changes in morality, computer fraud has become more prevalent. The size of the losses in a number of recent cases has become great. In addition to the huge losses resulting from the Equity Funding fraud, there have been several more cases in the million-dollars-and-up class and numerous lesser frauds have also been disclosed. One must be careful in reviewing reported incidents since many apocryphal stories keep circulating. Also, some ostensibly computer-related frauds turn out to be true frauds, but not true computer crimes. There is a feeling in the auditing profession that this is only the tip of the iceberg—that many more computer-based frauds have been uncovered but not publicly disclosed, and an even larger number remain undiscovered.

Recovery requirements

Since more and more of the critical information assets of an organization are being concentrated into a smaller and smaller physical area, the results of a localized computer disaster can be catastrophic. The computer is no longer a useful adjunct of business operation, an oversized bookkeeping machine, but a vital part of daily operations. The informational life blood of the company pumps through the corporate computers and relatively brief shutdown of the machines or loss of key machine language files and programs will quickly shut down a business.

To illustrate the critical nature of this problem (the bullet in the corporate brain previously alluded to), I shall take you through the recovery process assuming that your computer room and adjacent work and storage areas were destroyed by a fire or an Agnes-type burial under water and mud. I shall also assume that what are considered good computer center practices were followed. I shall try to establish that even these are grossly inadequate.

In order to recover you will need:

1. *A compatible computer or computers* (including essential peripherals, any special hardware or equipment options, terminals, data communications equipment, etc.). Backup facilities, while desirable, are becoming less and less realistic. Recovery will not be feasible until a large volume of computer time is available on compatible equip-

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ment. This means, in most cases, after you have gotten replacement equipment. How long might such replacement take? This might be weeks or months. In practice, the vendors, although refusing to be contractually committed, have recognized the customer's crisis and have done a magnificent job of rapid resupply. Each case, however, is a unique problem and the vendor may not be able to react rapidly because of factors not under his control.

2. *Programs* (both applications and key systems software). There is a possibility that programs kept in a safe or vault near the data center might survive the disaster. Remotely stored programs tend not to be absolutely current. We cannot pay people with obsolete or illegal procedures, for example. We need to know what changes should be made to perhaps hundreds of remote programs in order to make them current. Any program requiring change will then need to have test data developed, the changed programs validated, and surviving documentation (if any) revised. A considerable amount of computer time and calendar time may be consumed to accomplish this, if it can be done at all.

3. *Master files.* Again, good practice would require retention of key master files in secure safes or vaults and/or at a remote location. The only thoroughly reliable source of backup is the remote copy. Usually this is the grandfather generation of a file; a snapshot of a ledger produced three processing cycles back. It is unfortunately the son or current generation of a file which needs to be updated during the next processing period.

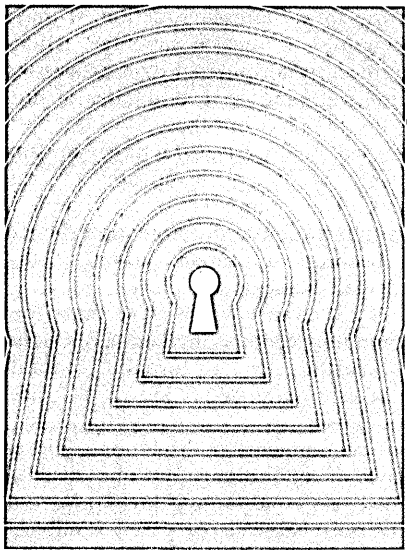
4. *Transaction files.* For each application master file that survives, you need all the transaction files subsequent to that generation in order to become current again with that single file. It may take huge amounts of computer time to process forward even two generations with a large file. If the transactions are not in machine-readable form, the recovery problem is greatly complicated. We want to go back as little as possible in each processing cycle to accomplish recovery. In a sequential system, edited and sequenced transaction files should be the ones retained. To come back two generations for a large number of master files becomes an almost impossible task. Also, there is the additional problem of the destruction of current transactions awaiting processing at the time of the catastrophic event.

5. *Know-how.* To recover efficiently after a data center disaster takes documentation. In addition to the knowledge of required program changes discussed in the second category above, we need to have key systems, programming, and operations documentation survive the catastrophe. Presumably, user documentation will remain, given the localized nature of the disaster which I have postulated.

6. *Ancillary facilities and services.* This includes an appropriate physical site, power, environmental controls, etc. In a number of incidents air conditioning was the limiting factor for recovery.

7. *Forms.* The special forms the organization uses must be on hand. Vast quantities of forms were lost in tropical storm Agnes. With the developing shortage of paper, rapid resupply may not be possible. It may be wise to stock an emergency supply of critical forms at a remote location. One utility estimates that it would take a railroad freight car to hold the forms urgently needed for a week's backup operation.

8. *Skilled personnel.* Hopefully, key



computer staff will survive the disaster, although they are particularly vulnerable to a bombing. Since recovery from a disaster may be very arduous, some of the less loyal members of the computer staff may decide to depart at this time. Experience indicates that in the event of widespread physical disaster, such as a hurricane or earthquake, needed computer personnel are initially tied up with family and other personal problems.

Planning for recovery

A little calculation by the data processing manager of almost any organization extensively utilizing computers will indicate the total unreality of attempting to recover from the type of computer area destruction which I have described. Recovery planning is really set up to recover from relatively minor problems—the brief machine outage, the need to recreate one generation of one file from one application, the need to restart from a system crash, etc. Many disaster plans do not provide for all the ingredients necessary for efficient recovery, hence will fail if and when the moment of truth comes. It is, of course, totally unrealistic to attempt to come back from true disaster by means of large amounts of hard copy or microfilm. The information in programs and files must survive in machine-readable form. Fallback to manual or other prior systems is also not practical in most cases since the current volumes tend to be much greater, the required people and skills lacking, the written procedures gone or obsolete, the old bookkeeping or unit record machines extinct, etc.

What, then, would happen if true computer disaster strikes the heavily-dependent computer user? Would the organization shut down for a lengthy period of time until adequate computer service was restored? Would a fantastic backlog of transactions be piled up awaiting restoration of service to a normally heavily loaded facility not capable of doing much catch-up? How efficient would your organization be during this recovery period? Would you retain your customers? What would happen to your cash flow? What would recovery cost, if still possible? I believe many organizations would be hard-pressed to survive this traumatic experience. Certainly, the chief executive should be given these facts of life before investment decisions are made regarding computer security.

A vital records program

What is needed to protect the organization then is assurance that current copies of all essential computer programs, files, and documentation will survive the serious disaster. Even safes and vaults on-site cannot provide sufficient protection. What is required is the storage of the most recent duplicates of machine-readable records and programs at a highly secure remote location. This location should be kept confidential and known to only a few of the most senior employees.

The cost for this protection is not exorbitant. Magnetic tape, the usual retention medium, is very inexpensive. With an available tape drive, key sequential files can be written simultaneously to two drives, in order to provide the backup copy. If this is not feasible, multiprogramming permits file duplication without excessive burden in view of the significance of the protection. On-line files and programs can be dumped daily to tape. What is critical here is the location and other aspects of copy storage. Data communications facilities, if already

available, should be considered as an electronic solution to the logistics of distribution. Regularly available courier service, such as to a bank, the intra-company mail, or the U.S. Postal service, may also provide low-cost shipment and return of vital media (although some methods may not provide sufficient security).

The hard part in a vital records protection program is deciding which records, programs, and documentation are essential to survival, and working out the mechanisms for handling the logistics and the necessary security. The operation of the plan should become routine. Experience, however, indicates that practices tend to deteriorate with time. Someone must be given the responsibility of administering the vital records program and providing quality control. The program should be occasionally reviewed by the internal audit staff to see if it is functioning as planned and in conformity with management directives.

Reducing the risk

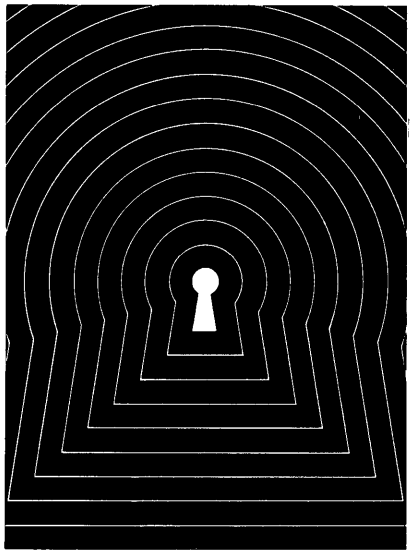
In addition to the critical requirement of designing efficient recoverability into the organization's data processing activities, a number of steps can be taken to greatly reduce the risk of disaster and the cost of recovery. For example, planning for security should take place early in the system design phase, not as an afterthought. Logically, priority should be given to the most hazardous risks and to the lowest-cost solutions.

There is no totally secure computer installation. This is not technically or economically feasible. Practical solutions, however, are possible and a number of organizations have achieved relatively secure systems at acceptable levels of cost. Clearly, the size of the processing facility is a primary factor in the planning. (It is difficult, for example, to get a good division of duties when the technical staff consists of one person.)

Consider these things in reducing the risk:

1. *Physical location.* A wise choice will greatly reduce many hazards. Computers have been located at airports, over garages, boilers, paint shops, in old wooden warehouses, basements, store fronts, on campuses, in earthquake-prone areas, in heavy traffic areas of office buildings, and other such choice sites. If a vulnerable site must continue for the present, steps can still be taken to reduce the vulnerability; for example, where water damage is a high risk, you can store media as high as possible, provide drains, pumps, emergency power for pumps and fitted plastic covers for equipment, and seal utility outlets.

2. *Physical access control.* This has received considerable attention at many installations, but I find serious deficiencies and token protection. Badges are not checked carefully; locks are taped open or released without adequate investigation of the visitor; security is lax at night or weekends; the facility is wide open and unsupervised during the weekly heavy cleaning period, etc. *Nobody* and *nothing* should be permitted into the computer room unless they or it needs to be there *then.* All legitimate visitors should be accompanied by a staff member. There should be as few windows and doors as feasible. Normal access should be via one tightly controlled entry point; other doors should have alarm devices on them—a wide range of devices are available for access control, including use of a computer for this purpose. The key defense, however, should be an alert computer staff which will immediately challenge all strangers who gain access by whatever means. Physical access control should include



bomb protection against packages and mail which should be opened outside the computer center.

Control of access to remote terminals is increasing as a problem.

3. *Fire protection.* Fires don't usually originate in the computer room. Consequently, the data center should be located so as to minimize external fire hazards. The room construction should be of flame retardant materials. The amount of combustible materials in the computer area, such as paper stock, should be minimized; cleanliness is vital in providing a noncombustible environment. An early warning fire detection and quenching system should be backed by small portable extinguishers spread around the computer area (and personnel should be trained in their use). A separate air conditioning system for the data center is recommended. All emergency procedures should be in writing and personnel should be thoroughly drilled.

4. *Media protection.* A misconception should first be cleared up: there is no precise figure, such as 150°F, below which magnetic media are safe or above which they are destroyed. However, the degree of humidity is quite significant. High humidity can cause serious media deterioration without great temperature elevation and, conversely, at low humidity levels considerable temperature elevation may not result in serious damage. Up to about 125-130°F at normal humidity levels in data centers few problems are encountered. As the temperature is raised, a gradual increase in the error rate on reading magnetic media will be experienced. Over 150° deterioration becomes more rapid. There is also a lower limit of temperature tolerance. I heard of an incident in which an accounting firm ran into trouble with a portable audit retrieval system on a disk pack by leaving it in a car trunk on a very cold day. Another misconception is vulnerability to magnets. Magnetism is a very weak force which falls off very rapidly with distance. A magnet has to be very powerful or extremely close to the affected surface in order to cause a problem.

The organization's vital records program should lead to a "vital" classification for many programs, master files, transaction files, and related systems documentation. They merit top protection. A separate room is desirable for storage of this valuable property with very strict access control. If possible, a librarian should be constantly responsible for these media. Media should be released just before use and returned to secure storage immediately after use. The records management system must be periodically reviewed to make sure it is working properly (in one company, managers discovered that people were getting into a locked media library during "non-working hours" through a false floor).

Smaller organizations should also consider vault or safe storage with sprinkler protection. Exposure to water is not damaging to magnetic media for short periods of time.

5. *Computer fraud and internal control.* We are primarily concerned about computer-related fraud, where use of the computer was either a significant factor in perpetrating an embezzlement or otherwise increased the company's vulnerability to fraud.

Some types of fraud, such as those that require altering many balances, are more easily perpetrated on computers: Equity Funding is a prime example. Illegal revaluation of an inventory, another type of fraud involving small-scale skimming of many ac-

counts, has been called the "salami" fraud. A few cents taken from many accounts is placed in an account controlled by the thief. With magnetic storage there may be little obvious evidence of tampering.

To put matters into perspective, despite several recent well-publicized incidents, including the Equity Funding case (which has resulted in the indictment of three computer professionals), computer fraud is not comparable in hazard to many other potential disasters. A fire, an earthquake, a tropical storm is much more likely to cause serious computer-related damage to your organization. Computer crime is increasing, however, both in frequency and in the magnitude of individual incidents; hence it will be of growing concern to data processing management. Despite a flurry of concern when Equity Funding and other frauds were publicized recently, most top executives are not likely to take the steps necessary to really deter further dp crimes, such as investing in a strong computer audit function. Security costs money, and we must overcome the feeling that a disaster "can't happen here."

There are several steps that can be taken to improve internal control and reduce the hazard of computer fraud:

a. There should be a division of duties in data processing. It is desirable to separate programmers, operators, librarians, data preparation staff, and data control personnel. Separation of developmental programming from maintenance programming is also helpful. If possible, at least two people should work on a project. Operations personnel can be rotated on duties. There should be restricted access to the computer, programs, machine language files, documentation, and sensitive forms, such as checks. Many data processing installations are much too lax in this regard. In a number of cases, including Equity Funding, much of the hanky-panky was done on weekends.

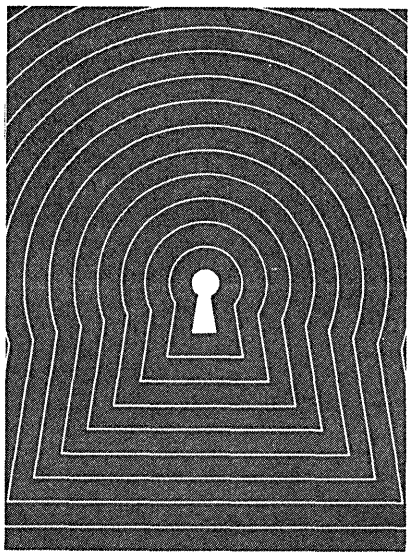
b. Systems need built-in controls. Where feasible in sensitive areas, external controls should be maintained by parts of the organization independent of data processing. It is useful to know the dollars to be accounted for, the number of people to be paid, to have a hash total on pay rates, etc. Terminals should be under strong programmed control. There should be well controlled error handling procedures.

c. There should be control over file and program changes. Authorization and review should come from outside data processing. It helps to have a software librarian to preserve the integrity of the program library.

d. A security specialist can be appointed in data processing, particularly when complex on-line systems are involved.

e. There need to be strong audits of the data processing function by both internal and external auditors. Equity Funding had no internal auditing and apparently weak external audit of the mechanized systems. The auditors reportedly never dealt directly with the data processing staff at Equity.

6. *Backup and "fall back" capabilities.* Even a little backup computer time in an emergency can be very helpful. The small user of a common configuration has less of a problem. I know of a case, though, where a company could not formalize a reciprocal backup arrangement with any of sixteen apparently compatible equipment users. This formalization is essential and should be arranged with several users, if possible. The technical problems associated with equipment, and to a lesser extent, software compatibility, are often severe. Also, appropriate communications need to be arranged. If compatibility is achievable with an



interested organization, the real crunch will be on the amount of backup time available. Backup must be tested initially and periodically thereafter. Backup is more secure if arranged internally in a large organization; some companies are paying regularly for options on emergency processing time. Others have contracts with cooperative service bureaus to assure the availability of backup time. Different industries have different peak processing periods in the day or month and beneficial arrangements can be made with the right kind of partner. It is safer if the backup facilities are not subject to the same hazards (earthquake, power loss, etc.) as the primary facility.

As to "fall back," some organizations can allocate jobs to smaller, compatible machines in a disaster. For short emergencies manual procedures may be possible. Certainly these alternatives should be explored, and well in advance of need. Priorities must be carefully evaluated. All backup and fall back procedures should be documented in detail and the computer staff trained in their use.

7. *Personnel.* This is potentially the weakest link in the security chain. How do you protect your organization against legitimate data processing staffers who have authorized access, but for whatever reason want to harm their employer? Some of these employees, such as the systems programmers, have considerable knowledge, and are involved in esoteric assignments not easy to monitor. There have been numerous authenticated security problems caused by data processing personnel, including physical and programmed sabotage; programmed frauds; theft of proprietary information such as programs, systems documentation, and customer lists; theft of machine time and supplies; and strikes.

Obviously, the best method of risk reduction is better investigation of potential hires for the data processing function and one of the key factors in selection is fitness for jobs of a fiduciary nature. The staff should be bonded. When a data processing employee is discharged, he should first be immediately removed from the company premises. All company identification should be collected and relevant combinations of locks and passwords changed. Also essential, but sometimes forgotten, is rapid communication of the termination to other members of the staff. There have been several incidents of sabotage when these procedures were not followed.

Voluntary termination of key computer people has been damaging to many companies. Good documentation, cross-training, and more than one person on a project can ease the problem, as can a strong staff development program.

8. *Data processing risk insurance.* We cannot design riskless computer systems, so investigate the potential for loss reimbursement. In some cases insurance is an acceptable substitute for certain security measures which may be more costly. Insurance helps cover some of the large out-of-pocket losses that may be incurred despite good data processing security. Conventional policies may be used for coverage, but they tend to be too restrictive. Special data processing policies, now written by at least twenty insurance companies, are not an off-the-shelf standard product and require quite a bit of

effort to tailor the coverage to a company's needs.

The best security procedures may never be followed because control and security constraints tend to be inconvenient. But there must be policing by management or things will inevitably get lax.

The first level of review should be made by the data processing management. However, this does not provide enough protection for the organization even when a separate control or review function is established within the computer group. Independent review is required. In most companies top management has delegated this assignment to the internal audit staff. (Some financial systems will get examined by external auditors and specialized audits also are made by a variety of government agencies.)

Auditors' role

The role usually assigned to internal auditors includes reviewing controls, ascertaining compliance with company policies, assessing the safeguarding of assets, determining the reliability of management information, appraising the quality of performance in carrying out assigned duties, and recommending operating improvements. There is a misconception among some data processing managers that audit of their function is an adverse reading on their ability or prerogatives. The most skilled computer staff in the world should still receive management review. The internal audit staff has been delegated this review function by top management since senior executives cannot perform enough of it on their own in a large organization. The internal audit function evaluates the effectiveness of the rest of the organization's controls, hence is itself one of the most important controls. It is a sign of maturity for the data processing management to encourage and invite review. The internal auditors can reduce the intrinsic high risk of data processing activities, help solve problems, and improve control and security.

Data processing managers are often unaware of serious deficiencies in their operations. Some accept excessive risks as a natural way of life in computer work. Auditors have found incredible practices even in large companies, such as the computer staff using hand fire extinguishers to cool soft drinks, a four-hour rated tape storage area which had a wooden door covered with metallic-looking paint, no inventory control over check forms, media vaults which couldn't be closed, and many others.

More and more edp auditors in progressive organizations are using computers in their work, including the use of a large number of generalized audit retrieval packages to analyze files. Less frequently used is test decking—running made-up transactions through the system off-line to establish the validity of the procedures. Some auditors use the integrated test facility technique which is similar to test decking, but is done to the live system. In program simulation a small but sensitive portion of a major system is modeled in a high level language and results compared to the live system. Among other techniques are sampling the files on- or off-line; tagging input and "picture taking," which is the output of the status of the tagged transaction at various points in the processing; and the use of flowcharting, test data generator, and librarian packages. The trends in edp auditing are significant. In a recent large class on advanced audit techniques almost half of the auditors were former computer professionals. More and more edp auditors are participating in system development projects as control specialist consultants and reviewers. Some managements are requiring an audit review of sensitive new systems as a standard procedure.

Disaster plans and simulations

It takes considerable time, money, and knowledge to develop a good computer disaster plan. (One company spent a full man-year of data processing staff time studying the recovery planning for only key cash-flow applications on the computer.) It helps to involve the many people outside data processing who can contribute and an attempt should be made to quantify risks and costs even if the numbers are very rough.

The few organizations that have conducted computer disaster simulations have almost always been appalled by the results. Typically, records could not be reconstructed, backup didn't work as planned, costs would be considerably in excess of insurance coverage, and so on. There are two basic approaches to the problem. The first involves a series of mock disasters of increasing severity; this gradually exposes vulnerabilities and deficiencies. The second is to have one large-scale, full-blown simulated disaster. As deficiencies are uncovered, they are corrected and the exercise is permitted to continue. The time and money invested in such simulations is very worthwhile according to the organizations who have tried them.

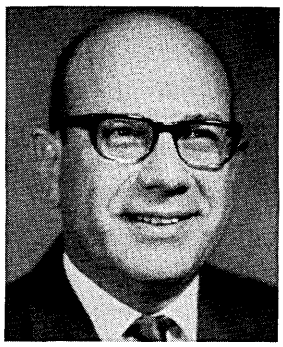
Conclusions

This overview of computer security has stressed the heavy responsibility of data processing management. But computer security is too great a hazard to be the exclusive concern of an often harried data processing staff. Hence, top management, auditors, security and insurance specialists, key users and others must be involved. You must assume that a disaster will inevitably afflict the computer function in your organization. The only question is when. How well prepared are you for this eventuality?

The problem should not be avoided because of prior assumptions of high cost solutions. Many of the steps that can be taken to reduce risk significantly are, in fact, low cost ones. The tendency is to want to rely on hardware, elaborate approaches, and to worry about the more improbable risks. A better procedure is sufficient attention to computer security by all levels of management, high morale on the part of a computer staff that is well-trained and alert to the problems, good procedures and internal control, regular security audits, and plain common sense. Modest investments for computer security are also wise.

In particular, the newer, more complex, and more hazard-prone systems under development today require more and better security planning at an earlier stage in the system cycle. The systems staff will need help in this activity from the hardware and software vendors, internal and external auditors, and consultants. We must have proper respect for the security challenges which such systems pose.

Computer security should rank high in a data processing manager's job description. It also merits a good deal of his time. The job (and company) he saves thereby may well be his own. The philosophy must be "It can happen here, but it must not!" □



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Credit reporting agencies are meeting the letter of the law, but the law was written without guidance, and the result is that incomplete or even inaccurate information about you may be circulating

Privacy, People and Credit Services

by Robert L. Patrick, Datamation's Technical Advisor

IN OCTOBER 1970 Congress passed Public Law 91-508, otherwise known as the Fair Credit Reporting Act. In 1971 this law began to take effect, and in 1972 DATAMATION set out to determine how the credit business had changed under the impact of the new law. Our investigation has been going on, as a back-burner activity, for over a year and we'd like to take this opportunity to give the computing profession a status report.

There are organizations in the United States which perform investigative reporting for a fee. These are colloquially called credit bureaus. The largest is Retail Credit of Atlanta. Under contract they will trace out your past history and build a dossier on you so a potential employer can determine if you have any hidden skeletons or are likely to become an untrustworthy employee. Such investigations are also frequently done if you are in a sensitive job that requires that you be bonded. Major companies and some civil agencies of the Federal Government have used these reports quite routinely as a method of screening employees. The general public might be impacted by these operations when buying a house.

Computers are only incidental to the operations of even a large credit bureau. On the other hand, more and more credit grantors throughout the United States are depending to a greater and greater extent on giant credit data banks. These data banks are built and maintained by a single profit-making company from information obtained through cooperative subscribers. These are not "credit bureaus" in the sense that Retail Credit of Atlanta is. They go by several names (data banks, credit reporting agencies), but a proper title might be "credit information clearing-house" because that most accurately depicts the function they really perform.

The largest of these clearing-houses is TRW Credit Data with primary offices in Anaheim, California, and other active locations in California, Illinois, New York and Michigan. TRW has approximately 6,500 subscribers, a pair of IBM 370/155s and 3.7 billion characters of on-line storage.

Their subscribers are usually department stores, auto agencies, banks, and local businessmen. A subscriber can obtain a credit report by phone, through one of more than 800 Teletypes located in the offices of their larger subscribers, or by mail.

If you ask for credit at a department store which subscribes to TRW's services, the store will take the identifying information from your credit application, interrogate the TRW data base and get a credit profile. If you discuss this process with TRW, it is made very clear that your *department store* determines whether to grant credit to you or not. Now it may happen that your credit profile contains some negative status codes on some of your accounts and these status codes will undoubtedly negatively bias the credit grantor, but TRW makes the point that they merely *supply the information* (that has been provided to it by subscribers) and the department store either grants or denies your credit application.

Where the data comes from

It is useful to probe into the information that a credit clearing-house supplies because you should understand where the data comes from and how it is handled to determine whether you are going to get fair treatment at the hands of your local credit grantor. Every credit grantor is encouraged to report to the credit clearing-house any credit transactions with you. Thus if you buy your wife a mink coat and make 12 easy monthly payments, the original transaction and your individual payments are entered into the accounting system maintained by the company that granted you credit (this may or may not be the same firm from whom you bought the coat). Approximately once a month the status of your account is reported to the clearing-house (often on mag tape) and its massive data base is updated. While all clearing-houses have some checks and balances in their systems, let us first note that they do not control the input, that the input is not prepared under their direction, and that the tape they get is a by-product of somebody else's accounting system designed for some other purpose!

Even if your local furrier has a good

accounting department and even if the data you supply him is correct, there is always the problem of ambiguity. In some cases you may use your full name, in other cases you may use your first name and middle initial, in other cases you may use both initials; with the current women's lib movement your wife may be known by her first name, middle initial, and your last name; and so goes the variety of inputs which can be reported by your furrier to the credit clearing-house. The clearing-house has a sophisticated computer program which edits all this information and tries to match it up with the master file. Now if your last name was keyboarded correctly the chances are better, and if you haven't moved recently the changes are very good that they can get an exact match on your last name and your home address. However, if you have moved, if your name is difficult to spell, if your name was not keyboarded correctly, if your name is a common one, if you don't use your name and initials consistently, if there were any errors in the accounting system or in the transmission from the credit grantor to the clearing-house, we can have a case of mistaken identity. *Despite all the programming done by all the clearing-houses to date, these mistaken identities do occur, they are troublesome, and they are one of the primary reasons why credit reporting agencies treat individuals unfairly.*

If we proceed further we will find the plot thickens and there are even more opportunities for precious data to go awry. The credit reporting systems devised to date are not very sophisticated from a systems analysis point of view. This is despite the fact that bright people are involved, modern computers are used, and the techniques are available—the designers are severely limited by the bleak input data they are fed.

Checking your own file

One of the provisions of PL91-508 allows you and me to interrogate the data bank and review the accuracy of our own personal records. Further, we can do this either in person or using a mail-telephone combination. I had my wife call Cordura Financial (nee Computer Credit Corporation), another credit clearing-house with offices in Los Angeles, and tried to review my record by phone. I was informed that the procedure was for them to mail me a request form which I was to fill out and return to them, after which they would interrogate the computer, call me and discuss my credit record with me or mail the printout to me. I started through the procedure and as I was completing the form I noticed it said,

> "I authorize Computer Credit Corporation to disclose my credit information to someone other than the name provided above (me)."

I hurriedly wrote "No" even though that was not an option formally provided. The intent was to allow *me* to designate an individual to pick up my credit printout, but it stopped short of allowing me any option over who CCC could pass my credit data to if *they* chose to.

I later went down to Computer Credit Corporation in person and found another IBM computer with its data banks loaded with information, some of which concerned me. When I appeared in person, Computer Credit took my name and identifying information and shortly I was invited into a room where a little girl had a recently-prepared computer printout about me. It listed my name and address, previous address, and wife's name. It contained no information on my house, my salary, the automobiles I own, the bank accounts I have, the credit cards I carry, or my Dun and Bradstreet rating. It did list an open account I had with a local department store and enumerated the last three inquiries from two firms and a government agency who had inquired to see if my accounts showed positive status.

I was appalled at the sparseness of the data. Several years ago, after a stroke of good fortune, I had paid off the mortgage on the house I live in here in California. That's fairly unusual, and I thought that would appear in my record so when I applied for credit from some place the credit grantor could be aware that I was a stable citizen and hopefully look benignly on my application for credit. While all of the information they showed was correct I was saddened—no, appalled—that the information that they had on me was no more or no less than they would have on an itinerant computer programmer who had recently moved into Southern California. Evidently I do business with merchants who are not CCC subscribers and hence they don't have complete data on me.

At a later date I appeared at a local office of TRW Credit Data. I went through the same procedure and was informed that since I had not been denied credit, that there would be a nominal charge for me to view my records. The nominal charge was $4! Again, after a suitable delay, a credit counselor took me into an interviewing room to discuss a computer-prepared printout which had my name and address, coded headings which were not explained, and a list of my open accounts (all were current). It too lacked information on property ownership, automobiles, bank accounts, earnings, or my credit rating. I was ready for this interview and started reading the credit profile upside down to see what it said. I was surprised to find out that my Social Security number was in error! The clerk tried to relieve my anxieties by telling me that Social Security numbers are frequently in error and if only one digit is in error, the computer handles it satisfactorily.

Here again I was humbled by my experience. Here was an error in what I considered to be a key data field which was treated quite casually, major pieces of information which I have filled out many times on credit applications were not in the record, and most of the problems were traceable to the poor input data on which these clearing-houses feed.

Later I had an occasion to visit the central computer facility of TRW Credit Data and was informed that they were producing an average of 1½ million credit reports per month, that only 1.3% of these have their validity questioned, and that less than 0.5% require reinvestigation. They have omitted age, race, religion, home ownership, automobile records and any information on criminal records or morals from their files. Furthermore, they have the Social Security numbers for only 30-35% of the people on file. Their files contain both positive and negative information on individuals, but approximately 75% is positive.

They are very careful to restrict their information to chartered subscribers and these subscribers must use passwords to get into the file. Further they are extremely careful and do not willingly cooperate with the IRS, the FBI, or law enforcement agencies. They are in fact a commercial credit information clearing-house. As part of this demonstration and tour, they obtained a copy of my credit profile for me and explained it to me rather thoroughly. I was amused to note that my Social Security number listing had all the digits correct.

We need the service

So much for the credit reporting agencies, how they operate, and where they fail. Let's step back a few paces and try and put all of this into proper perspective. I for one am damn glad we have credit reporting agencies. Living in a large metropolis the way I do, I find it very convenient to make my purchases on credit or by check since I don't feel comfortable carrying large amounts of cash. For the young professional and for the hourly worker the credit business is a useful adjunct to our complex society, one which makes his life better and our economy healthier. However, when Congress set out to curb the credit abuses within

our society, they either did not have competent advice or wrote a poor law in spite of it. Until recently our two largest credit clearing-houses printed out credit profiles in coded form. If I were unfamiliar with computers, I'd find the heavily coded credit profiles intimidating. Clearly the credit reporting agencies are only gradually embracing the intent of the law.

I further damn the banks and the credit community in general for treating credit and its award as a highly secretive undertaking. It's difficult to get written copies of my credit profile, the arrangements between the credit grantors and the credit clearing-house are not known to me, and there are no statements on credit applications that my data is going into any files or is going to be used by any third party. It's all unnecessarily treated like a clandestine intelligence operation when in fact both individuals and the economy would benefit from bringing it out into the open.

I strongly urge that all of our credit applications carry a box which allows me to check whether I wanted my information to be supplied to a third party or whether this information was provided merely for a two-party transaction.

If I checked the box and if my information then was sent to central files, then I am knowingly and consciously building a complete and accurate credit record on myself because I have voluntarily decided it is to my benefit to do so!

Further, if the credit community would merely come out into the open they could provide me with update forms at each bank, department store, etc., so if I changed my address or my marital status or otherwise changed my basic credit profile, I could voluntarily supply this information to the central data base so my records could be updated properly. It would be a simple matter once a year to enclose a postcard in my utility bill which I could use to update my credit records. Similarly, update postcards can be placed wherever marriage licenses are issued, wherever you must go to submit utility deposits—in short, in all of the locations or agencies I contact whenever there has been an event which affects my credit records. If stacks of these postcards were made available, I would consciously and willingly keep my credit records current because I consider my credit precious to me and I recognize that accurate information will help keep deadbeats from trading on my rating.

Let me momentarily switch from systems design to the national scene. Our country has a small but vocal population of do-gooders who suffer from an inability to get their priorities right. Unfortunately, some of them get elected or appear before Congress. There they have acted as though privacy is a binary matter and you either have it or you don't. They have not recognized that privacy is a spectrum, and has been for at least the hundred or so years of history with which I am familiar.

I give up my privacy in little bits to get the benefits that society offers me. In the case of credit, I could have privacy any time I want it by paying cash for everything. If I don't want to pay cash I give up a little privacy and I get a little credit. If I want more than just a little credit, I must give up more privacy so that more of my personal records are concentrated in one location so the credit grantor can determine if I am a good risk for the amount I request. At the very time we need the sage advice of our national politicians in trying to determine how to *balance* the rights of the individual and the needs of complex society, the do-gooders are running amuck.

In 1972 Elliot Richardson was Secretary of Health, Education, and Welfare. He personally chartered a blue ribbon study called "The Secretary's Advisory Committee on Automated Personnel Data Systems." The purpose of this study was to determine what to do about the Social Security number. Without a big study, if he just called me, I would have told him, "Good God, Mr. Secretary, let's recognize that the Social Security number is already being used as a unique person identifier in many large data systems. I for one, speaking as an individual, want it that way. I would like to be able to control the centralization of my records and how the data bases so created are matched and manipulated, but as far as associating my records with me, I want a unique identifier so my records can represent my situation in life accurately."

The United States Army is using Social Security numbers instead of separate identifiers, most of the big insurance companies use Social Security numbers, and the State of California is converting to Social Security numbers on their driver's license system. Without the aid of a blue ribbon committee, somebody should shout, "Mr. Secretary, don't try and turn back what's there, but control this natural trend for the benefit of the citizens."

The threat of personal identifiers, and it's a very real one, is that individual data bases established for individual purposes will become easily matchable and the combined data can be easily merged into huge personal dossiers. First off, if all I want is a dossier on a single individual and it's worth enough money to me, I can compile one now and I don't need a computer or any personal identifier. The thing we are really trying to control is the unleavened, haphazard computer mating of these data bases on a massive scale and at a very cheap price. Somehow the Washington scene has failed to focus on the forest; it is concentrating on the trees.

I for one would adopt a check digit for the Social Security numbers and insist that all records circa 1980 carry this check digit and compute it in a standard way. Thus, it would be possible to accurately match an individual's records and *know you had a correct match* if the individual supplied his Social Security number and if he authorized the transmittal of the basic information to a third party for data banking purposes.

Yet instead of trying to guide us along healthful avenues, we have PL91-508 which is more cosmetic than substance and had a Secretary of HEW who was worried about locking the gate after the horse got out. We'd be better off to recognize that credit reporting is beneficial to society, that such agencies exist today, and that we all would gain if we brought these third party credit transactions out into the open so each of us could voluntarily protect the integrity of our own records with the knowledge that there were intelligent laws on the books which protected our interests, while assuring us the benefits we sought. □

Mr. Patrick has been an independent data processing consultant since 1959. His present clients include IBM, RAND, Stanford University, Hughes Aircraft Company, The Los Angeles Times, Chemical Abstracts, and "a large government agency." He is a member of ACM, a DPMA life member, and past president of the Los Angeles Traffic Commission. His dp experience dates back at least to the days of the IBM 604, and he has been a valued Datamation advisor for over 11 years.

Cryptography, coding, artificial random errors, and keywords are some tools for preventing illegal information access

SOFTWARE SECURITY

by Jacob Palme

THE SAFE OPERATION of a computer can be disturbed either by unintentional errors or by intentional interference. Many protective measures guard against both intentional and unintentional damage—the backing-up of valuable data for example. This tutorial is, however, mainly oriented toward protection against intentional damage.

The basic methods of protecting any valuable property also apply to a computer: locks, alarms, personnel control, etc. This article will not discuss such methods. It will present those protective measures particular to computers.

The damage can be divided into three categories:

1. illegal access to data,
2. illegal modification, addition or destruction of data, and
3. interference with the ordered working of the computer.

This tutorial presents many different security measures aimed at protecting against different types of illegal penetration. The reader should not be misled by this into believing that a safe system can be created by applying only selected protective measures against those penetration risks which are most acute, for this is very seldom true. If there is one unprotected module in a computer, then this module can often be used to circumvent the protection of other modules. Thus, full security usually requires that all modules are protected by a series of different protective measures.

Identification

Before a user is allowed to use a computer, he must identify himself to the system. This identification is usually done using some kind of key (or code). The key can be personal for each individual but sometimes groups of people using the computer for similar applications will have a single key in common.

Personal keys are safer than group keys because they are easier to change if there is a risk that some unauthorized person has possession of a key. With personal keys, people can be moved out of a group using the same data without changing the key for the whole group. Also, if something suspicious happens, the individuals who were using the computer at the time can be identified.

At individual terminals this identification is usually done by punching in an alphanumeric key on the keyboard. Here are some rules for choosing a safe key:

1. The number of combinations must be so large that there is little risk that someone hits on a legal key by chance.
2. The key should be selected randomly among all combinations. A user should not be permitted to choose the key himself. A better practice is to have someone responsible for distributing the keys when needed.
3. The key should be easy to memorize. The risk of unauthorized use is larger if it has to be written down.

A good compromise solution among these requirements is to have a key consisting of three random letters followed by three random digits. It is important that the computer never outputs the keys anywhere. Especially, they should not be readable at the terminal when they are put in.

It is also important that an alarm is given as soon as a terminal has made two or three attempts at entering an illegal key. Each such alarm must also lead to an investigation into what happened.

An alternative to a memorized key is to have some kind of reading device on the terminal, which can read the key from a punched card, a magnetized slip or an identity card.

The disadvantage of this is that the key will now be a physical object which can fall into unauthorized hands. The advantages are that no one can get the key by watching the hands of another person when he punches in his memorized key, and it is convenient for people who have to enter it frequently.

Both of these identification methods can also be combined, with one key read from an identity card combined with another key input through the terminal keyboard.

An additional security measure would be to identify not only the user, but also the terminal. If the terminal uses a dial-up line, this identification can be done by a module in the terminal sending a terminal identification key to the computer.

An alternative to the use of keys is for the user to give his name to the computer without coding. Some kind of watchman will then have to check that the name and the user correspond. This is common for batch processing. Both the leaving and fetching of data must be checked manually.

In some cases, a person can have a terminal exclusively, locked when not in use; then no identification may be necessary.

It is important that you should be able to choose keywords (passwords) freely, and be able to change each one

independently of all others. In some systems, the keyword is created by some secret transformation on the user name, the user number or other non-secret information. In this way, those systems save the space of a keyword table. But such systems are not as secure. Keyword tables are not very big, and give much better security.

Authorization

When a user has proved his identity to the computer, the computer can determine to what data and what programs he can have access. The user can be prevented from reaching data other than that for which he has need and the authority for use.

Authorization is done by some kind of table in the computer. The most general way is if every group of data is associated with a list of those people who are permitted to use the data in the group.

An alternative method is to put all people and all groups of data into a hierarchical (tree-structured) organization graph. A person is then only allowed to use the data which is in his own part of the organizational tree. Data near the root of the tree will thus be more generally accessible than data closer to the leaves.

The advantage of such a tree graph is that the storage requirement and the search time for the authorization tables will be lower. The disadvantage is that a group of data cannot be shared by two users without making it accessible to all the people in the smallest subtree containing the two users.

The authorization should not be strictly access or no access. Full flexibility requires that a person is given different privileges for different kinds of access:

- The right to read a group of data.
- The right to add to a group of data.
- The right to change existing data.
- The right to delete from a group of data.
- The right to execute a program.
- The right to change a program.

In the text above, I have intentionally used the term "group of data" and not "file." From a security viewpoint, a person may be allowed access to, for example, only certain fields in each record, or only some of the records in a file.

Usually, the operating system of the computer takes care of the authorization for whole files. Authorization which requires a file to be divided into different parts available to different users is usually done by user programs, not by the operating system. Such user programs must be execute only, so that the user cannot look at or tamper with the program. Also, the access to a certain file must be restricted to a certain user program, so that users cannot bypass the security checks in the special user program.

In advanced, relational data bases, the division of the data into secret and open categories is very difficult, because data can be deduced from other data. For example, a user knows that there is only one 22-year-old mother with five children in a village. He wants to find her income, which is secret. The system can easily stop him from asking directly, "What is the mean income of all 22-year-old mothers of five?" The system does not answer such a question for groups smaller than, say, a hundred people. But the user can instead ask, "What is the number and mean income of 22-30-year-old mothers of five, and of 23-30-year-old mothers of five?" If both of these groups are larger than a hundred people, he gets his answer and can deduce the secret fact from the open facts.

One way to protect against this might be that the computer remembers all previous questions. Each new question would then be related to the set of all previous questions, to see if the user can deduce protected information by combining answers. In practice, this would probably be impossible, especially since two users could collaborate to cheat the system, by asking one question each so that the protected information could be deduced from a combination of the two answers.

Another solution is to introduce artificial random errors into the answers given by the computer. These errors will be small for statistics based on large groups, but will be large for statistics based on small groups and very large on statistics based on only one individual.

Suppose, for example, that a user asks the system for the sum of the incomes in a group of 500 persons, and also for the sum of the incomes in a subgroup of 499 persons. If the sums were exact, then he could deduct the income of the 500th person by just subtracting the two sums. But suppose that the system enters a random error of about 1% in both sums. One percent of the sum of 500 incomes will be five mean incomes. The error in the difference will thus be between seven and ten mean incomes (depending on what kind of error you are talking about). And an error of seven or ten mean incomes will usually remove all information from the income of a single person.

The user could cheat such a system by asking the same question more than once and computing the mean of the answers; that way he could lower the error. Therefore, the same question always ought to get the same random error into the answer. This can be achieved by computing a pseudo-random error based on a hashing of the true facts which are hidden.

A well-known variation of this is to enter errors into the facts before they are stored in the computer. Therefore, you can never know whether an individual item in the computer is true or not. But if you compute a sum or an average on a large group, then the errors in the facts will tend to cancel each other, so that the relative error variance in a sum from a large group is much smaller than the relative error in each single factual item.

This is sometimes done in statistical surveys when people are asked questions which they do not want to answer. Instead of asking each woman, "Have you had an abortion?" which she might not like to answer, she is asked to throw a die in such a way that only she knows the figure. She is then told, "Answer yes if either you have had an abortion or the die showed a six." Since only she knows the figure of the die, her secret is kept. The computer or the statistician will never be able to tell that she personally has had an abortion. But the error introduced by the die will, except for a small error variance, be removable from the mean of a large population.

The statistical methods described above cannot, of course, be used to protect all kinds of data. But the statistical situation is a very common one: A person planning where to set up a new petrol station or a new day nursery needs facts about the number of cars or the number of working mothers in an area, but he does not need to know the facts for a certain single individual. These facts are the ones we most want to protect.

File keywords, transfer, checking

An alternative to the combination of identification and authorization described above is to have keys connected not to individual people, but to files. Everyone who knows the key is allowed access to the file.

The advantage of this is that the group of people who are allowed access to each file can vary without restraint. But there are also great disadvantages:

- The number of times a keyword is handled will be much larger, creating a greater risk that the keyword comes into illegal hands.
- A person has to use not just one, but many keys. He cannot learn them all by heart, so he must use a list of keys, which someone else might see.
- Keywords known to many people are also more difficult to change than

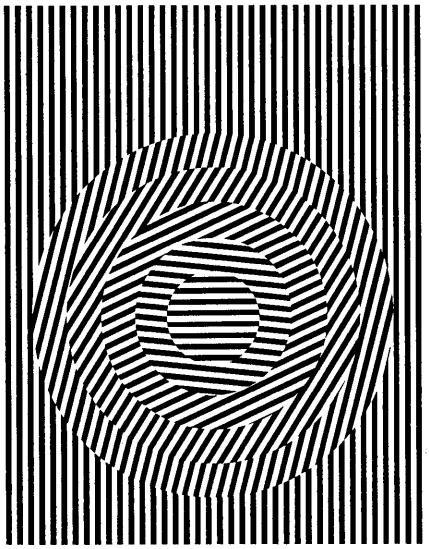
individual keys.

Some very advanced systems also contain protection against transferring data from a file accessible to few people to a file accessible to many people. Therefore, even a person who has access to both files is not allowed to make the transfer.

An important part of the regular security measures must be continuous monitoring and logging of what is happening in the computer. This information can be consulted afterwards if something irregular has happened. The security monitor can also give an alarm if something unusual happens or when someone makes an unsuccessful attempt at illegal data access.

Very important it is that these monitor alarms are *really* checked by a human security supervisor . . . and that checking must occur immediately upon the alarm signal.

One method of protection against illegal introduction of data into a computer is to have some kind of redundancy in the data base. The same fact



is stored more than once, and the correspondence between different data items is checked regularly.

Preventing illegal penetration

All electronic equipment at a computer and its terminals emits electromagnetic radiation. Although this radiation contains information which is handled by the computer, a spy close to a computer will get so many different signals mixed together, that he will find it very difficult to get anything out of them.

The more freedom and flexibility you want to give to the users of a computer, the more difficult you will find it to stop illegal penetration. The smallest risk will, therefore, occur for those users who are only allowed to communicate with one special user program. This user program can then check all messages from the user. This control is easier if the user can only transmit a small number of different kinds of messages, but, of course, this is not flexible for the user.

It is very important that such a user is never permitted to communicate with anything but that special user program. In some systems, a terminal can disassociate itself from a user program by means of special interrupt signals to the operating system. Such signals should not be permitted if they are not indispensable.

The most sensitive parts of a computer are I/O units like typewriter terminals and line printers, because here secret information in a readable form is transmitted rather slowly. By surrounding all such I/O units by a 300-foot fenced-off area, the risk of the normal radiation from the computer is small.

If, however, a spy succeeds in placing an electronic bug with a wireless transmitter into the computer with a circuit card, the risk is much higher. Such bugs can be detected in the same way as are voice-transmitting bugs.

A computer can be protected by shielding, if this shielding is done carefully. The shielding should be done with steel plates (not too thin). Rigorous requirements must be put on the tightness of joints, and doors and windows must be kept closed. Electrical and telephone lines into the shielded area must be filtered and water pipes protected.

The worst exposure stems from electronic penetration on lines to distant terminals. An important way of protecting such lines is cryptography. Cryptography security is good only if the end points of the line are well protected by other means. This will be discussed in more detail later on.

There are more ways for programmers to circumvent protective measures. In most computer systems, the intention of the operating system is to let programmers have access to almost all the resources of the computer when needed. To do this, and at the same time to stop illegal penetration by the same programmers, advanced and sophisticated security measures in the software are necessary. An alternative to this is to limit the resources available to a programmer. This is especially important when many programmers together are producing a large system, and you want to stop one of them from entering a private modification to suit his own personal needs (e.g., transferring money to his own account or logging confidential information on his own personal file). To safeguard against this, the manager of the software project must check that each programmer writes modules that stay within their prescribed bounds—modules which only access programs and data outside the module in permitted ways. You can get help from the computer in doing this if you only permit the programmers to use one special programming system which has a very secure compiler and run-time system. A secure compiler and run-time system means one which checks the user program against all language errors, both at compile time and, if necessary, at execution time. A simple example is arrays. If the programming language system does not stop a programmer from exceeding the dimensions of an array, then he can illegally access or modify any word in his program, in other modules of the program (written by other programmers) and (on some computers) in the operating system of the computer.

A secure compiler should also make sure that separate modules of a large program can only interface in certain permitted ways. That way, the modules can check on each other; e.g., one module can check the legality of instructions which one module gets from another one.

In the future, computers will probably have larger virtual memories, and so the protection provided by a compiler within the memory will be more and more important.

Programming language systems today are seldom very secure. Sometimes there are protective checks such as those to prohibit exceeding array bounds. But often, the programmer is allowed to set a switch which disconnects these checks.

Compilers which allow separately compiled modules are very seldom secure. The reason for this is that they usually do not compare two separately compiled modules to find inconsistencies. For example, FORTRAN compilers seldom check the consistency of COMMON blocks. However, a compiler with separately compiled modules can be made secure.[1]

Another common way of gaining security by restricting the freedom of the user is to disallow the usage of certain central utility programs for file handling. However, if the system is not protected against this, a penetrator might take such a utility program from another installation. The method of maintaining security by restricting the programmer's freedom is therefore not usually very effective.

The group of people who have the greatest need to access all the resources of the computer are the systems programmers. Therefore, there is usually no possibility of protecting a computer

[1] Jacob Palme, "SIMULA as a Tool for Extensible Program Products," FOA P report C 8365, 10450 Stockholm 80, Sweden, May 1973, and "Protected Program Modules in SIMULA 67," FOA P report C 8372, July 1973.

against illegal penetration by a systems programmer or an advanced operator.

Resources to be protected

If you want to stop the advanced programmer from circumventing the security measures, then all resources available to the programmer must be protected. Important resources are primary memory, processor, utility programs, and external memories.

The protective measures in the hardware divide the primary memory into different sections, one for each user program. A mechanism in the hardware stops a user program from reaching primary memory outside his own area. This mechanism should protect separately against writing, reading, and execution.

Note that the operating system is also a program. Even computers which are not multiprogrammed (where only one user program at a time is present in the primary memory) must have some kind of hardware protection of the primary memory. A program which can get at the operating system can thereby have access to everything else in the computer system.

Sometimes there is a need for two programs to communicate or use common data. In the simplest case, a user program must communicate with the operating system. This communication can be arranged in such a way that the operating system is always "master" and the user program "slave." The user program can ask the operating system to do certain things or to deliver certain data. But the operating system should always make a full check of the correctness and legality of the user program's request before the task is performed.

Two user programs may wish to share a common data area. Usually, this common area is write-protected for both programs as in a "reentrant" program; in such cases, a user program can read and execute both his own memory area and the common area, but cannot write in the common area. The program in the common area can access the memory of both user programs, but usually cannot write in the common area.

The program in the common memory area should not, of course, have access to anything but those user programs which share this common program. In some computers, such a common program has access to the whole memory; in this case the program must be very carefully checked, or such common programs cannot be used.

The central processor in most computers is allowed to govern everything that is happening in the computer. A secure system, therefore, cannot give the programmer direct access to all resources of the cpu. Usually, the cpu's resources are divided into two groups: common and privileged operations. The common operations are available to all programs; the privileged are only available to the operating system. Another, similar, solution would be to have a separate cpu for the privileged operations.

If a user program wishes to perform a privileged operation, this must be done indirectly. The user program sends a message to the operating system, which first checks the admissibility of the message, and then performs it.

All transmission of data between different memory units and to and from peripheral units are privileged operations. All changes in the security system of a computer, like changes in the memory protection, are also privileged.

The operating system is usually protected against access from a user program, and many central operations which are especially dangerous may only be performed by the operating system.

Security checks in the software should be in the operating system, not in user programs, if possible. The reasons for this are:

1. The operating system is usually the most thoroughly checked program, and security measures, especially, must be thoroughly checked.
2. The operating system is common to all users at the computer. Protective measures in the operating system will therefore give an even, high quality of the security for everything done on the computer.
3. The operating system is often very difficult for a manipulating programmer to access.

To illustrate some of these points: the central memory areas of a user program should be zeroed when the user program releases them, otherwise another user program might get data from a previous program using the same memory areas. This zeroing can be done either by the operating system or by the user program. However, check the arguments again in these special cases:

1. If a user program aborts because of an execution error, then often the final parts of the program are never executed. Thus, the zeroing of memory may not be done. If, however, the zeroing is done by the operating system, then it is always done, regardless of what happened in the user program.
2. All programs always get their memory zeroed after use, if this zeroing is done by the operating system.
3. An illegally manipulating programmer would find it more difficult to remove the zeroing routine from the operating system than from a user program.

Weak points in the operating system

Even if the operating system is one of the best-tested and protected programs in a computer, some mistakes cannot be avoided. Some of these may perhaps be used to advantage by a skilled penetrator. Every such error is unique and difficult to classify, but there are examples of often occurring weak points in operating systems.

1. When a user program asks the operating system to do something, the legality of the requirement is not always fully checked.
2. The user program succeeds in changing its message to the operating system after it has been checked by the operating system, but before it has been performed.
3. The operating system stores information in the user memory area (e.g., I/O buffers with associated information) and the user program succeeds in changing this information so that it will be misinterpreted later on by the operating system.
4. There is an intentional opening in the operating system which was put in to help system programmers or to help advanced utility programs. But this opening can be misused by other programs. This opening might also have been introduced intentionally for later use by a spy in the group writing the operating system.

Two common reasons for such weak points in the operating system are that the cost for full security is regarded as too large, or that the operating system is so large and complex that no one understands all the types of interaction that can occur inside it.

An operating system can be written so that the risk of such weak points is lessened. It can be divided into many subprograms which are all protected from each other as well as if they had been user programs. When one of these subprograms asks another to perform a task for it, the request is checked in the same way as requests from user programs are checked. This kind of operating system design has many security advantages: a penetrator which gets into one "room" does not immediately get into all the other "rooms"; the most dangerous operations can be confined in "rooms" many doors away from the user programs; each subprogram can be checked more carefully than the whole operating system.

For a user who already has an oper-

ating system, these design principles are not of much value. He can, however, gain higher security by using an older, better-tested version of the system, and he can also "mine" the operating system. "Mining" is a method of protection against a skilled penetrator who has detailed knowledge of the operating system acquired at another installation. By putting in special security checks and by changing some important data fields, the penetrator is lured into betraying himself. A successful penetrator must succeed in doing what he wants without anyone discovering what has happened. But the operating system is usually so vulnerable that a penetrator can easily cause a system crash, especially if some things are not quite what he expected. An analysis of the system crash can show what had happened.

You can feel more sure of the security in a small operating system than in a large one. Some computers move as many operating system tasks as possible into user programs so that the central, sensitive part of the system becomes smaller. This gives better security, but only if these special user programs themselves (sometimes called utility programs or cusps) are fully protected from the user. Very valuable is a system where a program can be executed in the user area, but where the user has no other access to it than the execution right (not even the right to read or dump the concealed program area). This means that the hardware memory check must differentiate between the right to write, the right to read, and the right to execute in a certain memory area.

Some central user programs have a position in-between the operating system and the ordinary user programs. Examples are compilers, interpreters and file handling systems. These programs must be protected against illegal access. The ordinary user should be able to execute them only, but not do anything else with them.

To keep the central operating system small, it must also be protected against these central user programs, just as if they were ordinary user programs.

Access to external memories is usually through a central file handling system which is part of the operating system. The protective measures are described above under the heading "Authorization."

It is very important that the system always zero all files as soon as they are released by a user. This should also be done for temporary files and for primary or virtual memory.

Zeroing does not give full security for such volumes as tapes and removable disc packs which can be taken from the computer. Special treatment can divulge information even after several over-writings with random noise.

Cryptography

Cryptography is a transformation of data which makes it unreadable to a person who does not have access to the cryptographic key. The transformation can be done by either hardware or software.

One transformation which cannot be broken is to use as key a genuine random number (not a so-called pseudo-random number) which is as long as the data to be transmitted. Two copies are kept of the key: one at the transmitter, one at the receiver. The sender adds the key to the message (addition without carry is usually best) and the receiver subtracts the key to get back the message. When the key has been used once, it is consumed and cannot be used again.

If the sender and the receiver are both safe, this gives full protection to the communications line. But do not forget: a) If someone gets hold of the key, he can also decipher the message. The keys must therefore be treated as secret both before and after use. The keys themselves cannot be transmitted through the communications line. b) This kind of cryptography gives only protection of the communications line. At the sending and receiving ends, the message is used uncoded. For example, you must ensure that no one is able to modify the cryptographic equipment itself in such a way that the message can be understood by someone listening in on the communications line.

These observations mean that you can very seldom make an information system safe by introducing cryptography. Cryptography is of value only if there is a single known weak point in an otherwise safe system. But the cryptographic routines themselves, and all parts of the system where uncoded data is processed, must be fully protected by means other than cryptography. And if these other means are good, then cryptography may not be needed at all.

The cryptographic method described above requires a key as large as the amount of data to be protected. This is often not practical; a shorter key can be made to generate a longer series of numbers.

Although very often a person who is not an expert believes that he has found a safe cryptographic method, these tasks should not be given to amateurs.

Practical requirements of a cryptographic method:

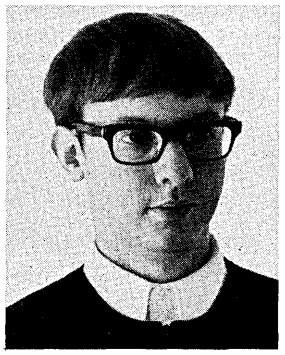
1. Some cryptographic methods require that a large file be ciphered and deciphered in sequence from the beginning of the file. But for direct access application, you need a method which can directly cipher or decipher any randomly selected record in the file.
2. If an error comes into the transmitted signal, then only a small part should be lost, not the whole remainder of the message.

A way of moving the security problem away from the computer is to have computers wholly dedicated to a secret task (at least for certain shifts) so that input and output goes only to those who are allowed access to the secret information. This is the only method allowed for highly secret military data in most countries. This method is very expensive for large computers, but is less costly if the task can be done on a minicomputer.

If there is one weak point in a security system, then very often that weak point can be used by a skilled person to penetrate all the other parts.

Say, for example, that a system has good protection of data, but not full protection of user programs. A penetrator can then modify the user programs, so that they will later on divulge the secret data.

The central point of security on a computer is the operating system and the basic hardware. No gadgetry like cryptography or errors intentionally introduced into the data will give security if there are loopholes in the operating system or the central hardware. In my opinion, too much is said about such special methods, and too little about the central security measures. These special methods are sometimes very interesting, clever, and valuable, but when a manufacturer talks too much about them, this may be a smokescreen to hide more basic insecurities of his system. □



Mr. Palme is head of the datalogy (non-numerical computer science) section of the Research Institute of National Defense, Stockholm. He has been working with simulation models, with development of the SIMULA 67 programming language, and with computer systems understanding natural human languages. He has also written several crime novels.

THE NEW CRIMINAL

Data processing is obsoleting some old kinds of crime, but is also opening new opportunities for bright, young dp professionals with a criminal bent.

by Donn B. Parker and Susan Nycum

There are the same old crimes of fraud, theft, larceny, embezzlement, vandalism, and extortion. But many of the environments of crime and the people in those environments are changing. Computers are taking over sensitive functions in business and government where there has traditionally been great leverage for gain by unauthorized acts. The people who used to perform those functions—clerks, accountants, other financial workers, their managers—have been replaced by people in the new edp occupations; their work has changed to monitoring and using the processes now done by computers.

We are obsoleting many of the traditional white-collar criminals and some of the professional criminals. They no longer have the skills, knowledge, and access to perpetrate their old crimes. The *Wall Street Journal* frequently reports criminal acts where two men drive up alongside an elderly messenger carrying several million dollars worth of negotiable securities from one firm to another on Wall Street. One man jumps out, hits the messenger over the head, grabs the securities, and escapes in the car. This will be an obsolete crime in a few years. Negotiable securities will be stored magnetically and electronically as data inside computers and transmitted over communication circuits from one computer to another. Perpetrators of securities thefts will need the skills, knowledge and access associated with computers and data communications technology; they will not be dealing with as simple a victim as an old messenger. If these crimes are going to continue to proliferate, they will have to be done by people in edp or related occupations, and must involve computer and data communication systems.

Case histories

Experience indicates a growing sector of crime and unauthorized activities within edp and associated occupations. Some of the more significant personally verified cases are described below, but names of perpetrators and victims are withheld since their continued exposure serves no useful purpose. These are a few of the 160 recorded case histories collected at Stanford Research Institute in studies conducted over the past three years.

- The first programmer convicted for stealing programs in a 1964 case received a five-year term in a Texas penitentiary. He stole copies of $5 million worth of programs from his employer by saying he was taking them home to work on at night. This is the only computer-related crime thoroughly reviewed for law library reference purposes.
- The first federal criminal case occurred in 1966 when a 21 year old programmer put a patch in his program to ignore his own checking account in checking for overdrafts. He concluded that this was the easiest way to solve his small financial problem. It would cause the least amount of trouble to the least number of people. He figured that the discrepancy would not cause harm to the bank or the computer system for just three days, after which he planned to secretly make restitution and remove the patch. Three months later the patch was still in the program and he was $1,300 overdrawn; the computer happened to break down and hand calculations revealed the discrepancy. He was convicted and received a suspended sentence. This was the first case in banking history where a nonemployee of a bank was ever convicted of altering bank records. He was employed by a facilities management company operating the computer for the bank. After being fired from his job, the same management company contracted for his services; good programmers were hard to find in those days.
- An accountant was discovered in 1968 after six years of embezzling over one million dollars in a simple receivables/payables theft using dummy vendor companies with accounts in a local bank. Although the act had nothing to do with computers, he used a computer he ran in his own service bureau to simulate his employer's business to test his planned thefts (to make sure they would be dispersed and small enough to go unnoticed). He was caught when he stopped using the computer to decide limits of his theft rate. He received a full ten-year sentence because he was unrepentant and refused to tell what he did with the money. (Anyone who knows how much it costs to run a losing computer service bureau could guess where the money went.) He had become a time-sharing salesman by the time of his indictment and trial and told his customers he had another opportunity that he couldn't refuse just before he went to prison.
- The first case of stealing a program from the memory of a computer over telephone circuits and a remote terminal in 1971 caused world-wide publicity, including three-inch headlines in the Paris *Herald Tribune:* "COMPUTER RAPED BY TELEPHONE." It was the first case in which a search warrant was issued to search the memory of a computer for evidence. A programmer was convicted and given a suspended sentence for theft of a trade secret even though a witness in a related civil suit revealed that it was common practice for programmers in both companies involved to gain unauthorized access to the other's computer.
- One young programmer took all the programs of his employer, a small medical accounting firm, went to hide in the mountains and told his employer he wanted $100,000 to return them. He was caught, but the prosecutor dropped the case. However, the programs were impounded for evidence, and the small company burglarized the

sheriff's office to make copies of them just to stay in business.

- A "Trojan Horse" technique was used to compromise the security of a campus time-sharing computer system. A user submitted a utility program for general use. That program contained code to take over the operating system if it ever ran at the same privilege level as the supervisor. After several months, a computer operator used it, triggering the hidden logic and causing the operating system to read still another program into system resident memory, and erasing all trace of the illicit Trojan Horse code. The perpetrator could then gain complete control of the system at any time using a specified user code. The trick was discovered when a maintenance programmer found the strange program in a memory dump, and in dumping the files stored under the special user's code found the text of a complete confession and a description of the method. In a similar case, the Trojan Horse used to bring in illegal code was a program to print out a picture of Santa Claus, which elicited the comment, "Is nothing sacred?"
- Additional recent cases include the $1.5 million New York Union Dime Bank embezzlement, the $2,000 million Equity Funding Insurance fraud, the $1 million Los Angeles Telephone Company equipment theft, and the $300,000 Long Island and Pittsburgh Westinghouse embezzlement.

The vulnerable facility

An analysis of the characteristics of these cases has provided a description of an imaginary computer facility most vulnerable to the new criminal. The weaknesses are described below in descending order of importance.

- The computer system is used for financial processing applications including payroll, accounts payable and receivable, and storage and maintenance of files of financial data. The system puts out negotiable documents and takes in data representing negotiable documents. The system also stores and maintains other valuable data such as mailing lists and inventory of goods lists.
- Among the employees, there is more mutual loyalty to each other than to the employer. The staff has more self-interest than interest in the success of the organization. Morale is low, and small groups join in defensiveness toward management and society. Employees reinforce one another in rationalizing acts that management would not condone.
- The organization does not separate sensitive job functions and lacks dual control of important tasks. Most serious is the nonseparation of application programming, program testing, systems programming, data input and output handling, customer servicing, materials storage, and computer operation. Separation is missing in tasks, responsibilities and physical access.
- The system services and physical facilities are available to some employees during nonworking hours and without supervision. The absence of responsible staff in nonbusiness hours is not compensated for by sufficiently increased physical security.
- Computer programs, including the operating system, are not under modification control, and ownership is not sufficiently displayed or otherwise established. Programs do not include sufficient controls, tolerance checking and anomaly testing. Exception reports produced during processing contain little information indicating unauthorized activity, but contain volumes of useless data that burden the auditor beyond his comprehension and attention span.
- Disgruntled employees are not identified and removed from sensitive jobs. Employees being released from positions of trust are not immediately removed from their work areas and positions of system access. Use of computer facilities, materials and services is not monitored or sufficiently controlled.

A profile of the computer criminal, or at least some characteristics, is starting to emerge from these studies, which have included many hours of interviewing perpetrators. Some of the characteristics are consistent with findings about white-collar criminals in general, but still unknown to most people in the computer field.

Perpetrators are highly motivated, bright, energetic, and generally young —18 to 30 years old, except for a few of the embezzlers who are older. The few women found among perpetrators are usually keypunch operators or clerks. Perpetrators seem to easily obtain all the information they need about a system involved in their acts. For example, one thief posed as a magazine writer to obtain a detailed briefing about an equipment ordering system and get introduced to all the key people. He soon knew more about the system than anyone in the victim company and its penetration was simple. No computer facility exists today that a bright perpetrator couldn't penetrate if the reward were great enough. Many systems do provide significant rewards, as we know, because losses of $100,000 to millions of dollars have been experienced in many of the recorded cases studied.

The elements of challenge and gameplaying are significantly stronger among computer criminals than among other white-collar criminals. This is not an unexpected finding, considering the strength of these factors among computer technologists. In some cases, claims of victims that their computer systems were safe and could not be penetrated encouraged eager young programmers who look on their work as an intellectual challenge to pit their minds against the intransigent machine. University campuses commonly have their resident "system hackers" ready to accept any challenge of professed security in and around campus computers. However, these people usually become frustrated in their successes unless there is some way they can take credit publicly for their achievements. One perpetrator who claims to have gained over one million dollars from his deeds said that aside from making money rapidly, his mo-

Data Processing Personnel Move Onto the "WANTED" Lists

According to the Treasury Department, occupations of the principal perpetrators of reported bank embezzlements of *all types* in 1971 were:

Position	Number of Embezzlers
Operations vice president, manager, clerk	32
Loan officer, manager	29
Teller	22
President	14
Cashier	8
Director, stockholder, officer	5
Bookkeeper	3
Trust officer	3
Auditor	1
Computer operator	1
Proof department	1
Systems analyst	1

The principal perpetrators of all reported *computer-related* bank embezzlements from 1966 to the present were:

Position	Number of Embezzlers
Vice president, edp	4
Edp clerk	3
Programmer	3
Computer operator	2
Chief teller	1
Systems analyst	1
Vice president	1

In several of these cases additional perpetrators were in other occupations, but they were in collusion with these edp people who have the skills and access to do the dirty work.

tive was to see how far he could go with his crime before he stopped and informed his victim of his acts. He was confident that the victim could not find evidence of his act even if he confessed.

The "Robin Hood syndrome" is common. The young man described above indicated that doing harm to people is highly immoral; but, he said, government-regulated industry and telephone companies in particular do great harm to society so doing harm to such organizations is fair. This differentiation between doing harm to people and to organizations has some current popularity. The computer within the organization is an additionally attractive and satisfying target capable of sustaining loss, but not possessing emotional reaction that might produce feelings of guilt in the nonprofessional criminal. This is the "vending machine syndrome" experienced by most of us; it makes us unemotional, guiltless, coin-return thiefs.

Often the perpetrators' acts differ in only small ways from the accepted or normal practices of their associates, such as the program theft by telephone described above. People within an edp organization can degenerate in their practices in many ways to levels allowing rationalizations that lead to serious criminal acts.

Even the "skyjack syndrome" (where the crime becomes "popular") can be observed in computer-related crime. The fraud technique of replacing blank deposit slips on bank counters with the perpetrator's own MICR-coded slips, knowing that the bank's system would assure a large increase in value of his account, was given great publicity when it occurred in New York City. The same technique was soon reported in Boston, Los Angeles, and Washington.

It appears that the perpetrators strongly fear unanticipated detection and exposure. This makes detection as a means of protection at least as important as deterrence and prevention. Perpetrators tend to be amateur, white-collar criminal types for whom exposure of activities would cause great embarrassment and loss of prestige among their peers, in contrast to many professional criminals who want their peers to know of their accomplishments.

The only means of locating potential perpetrators is to find those with the technical skills, knowledge, and access —the people in edp and related occupations. A high rate of collusion has been found, since the computer-related crime methods often require skills, knowledge, and access possessed by more than any one person. This lends support to the value of separating responsibilities among edp employees.

The increasingly sensitive nature of edp occupations in business and government organizations and the potential for doing harm should produce concern for the trustworthiness and ethics of edp people. Almost every keynote speaker at national computer conferences for the past few years has alluded to this concern. The occupations have been populated with people moving from other occupations, with varying kinds and levels of ethical standards, resulting in confusion and ambivalence.

For example, a concept called the "Peninsula ethic" has grown out of the program-theft-by-telephone case cited earlier. A well-known computing consultant said on the witness stand that any program he could find and remove from a commercially available time-sharing computer system is automatically in the public domain unless some combination of sufficiently protective measures have been taken. The judge in that criminal case concluded that under the facts before the court, adequate protection to meet the secrecy requirement necessary to define the program as a trade secret was given by using an unlisted telephone number, a confidentially assigned user account number, and an unpublicized program file name.

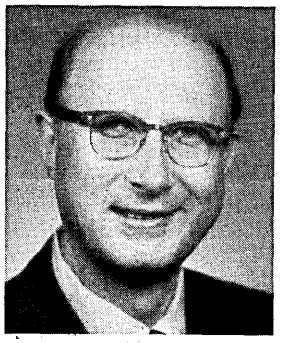
A programmer working for a time-sharing service admitted to legitimately buying time from competitors and then attempting to take copies of programs, customer list files, and other users' files, and to penetrate the protected operating system, and finally to cause a disruption or breakdown of the system. He believed this was not unethical or illegal because he was not constrained in any way by contract, user documentation, proprietary rights statements or the equivalent of "No trespassing" or "Do not enter" signs within the system. Further investigation indicates that this practice is common among commercial time-sharing companies' employees.

There appears to be a growing feeling among certain computer professionals that such activity is a form of reverse engineering—a legitimate business technique in which the product of a secret process is analyzed by persons who have not appropriated the secret improperly, nor are in a confidential relationship with the holder of the secret process. Others would list the same activity as industrial espionage and sabotage, a form of unfair competition, or theft and malicious mischief.

The current low level of agreement among computer professionals as to what constitutes fair practice is disquieting to those seeking standards to follow.

Similarly, and no less confusing to the industry, is the current status of the law of patent, copyright, trademark, and trade secrets as applied to software protection. Most experts agree that the present laws are unsatisfactory. Less concurrence, however, exists as to the right solution to provide some protection to the developer while not impeding necessary progress in this rapidly growing and changing technology.

We can't hope to control and prevent computer related crime until a tradition of ethical standards is established in the edp occupations, along with laws applicable to acts and assets associated with edp, and regulation through forms of initial protection and licensing. Technological solutions are necessary, but not sufficient. □



Mr. Parker is a senior information processing specialist at Stanford Research Institute. He has been in the computer field for 23 years in programming, management and research. He has spent the past two years researching computer abuse under a National Science Foundation grant. This article is based on the final report for that research, titled **Computer Abuse**, which was published in Nov. 1973.

Ms. Nycum is a research associate on leave from Stanford University Law School. A practicing attorney, she is a member of the Pennsylvania Bar and the U.S. Supreme Court Bar. A past director of the Stanford University Campus Computation Center, she has acted as a consultant on the NSF computer abuse study.

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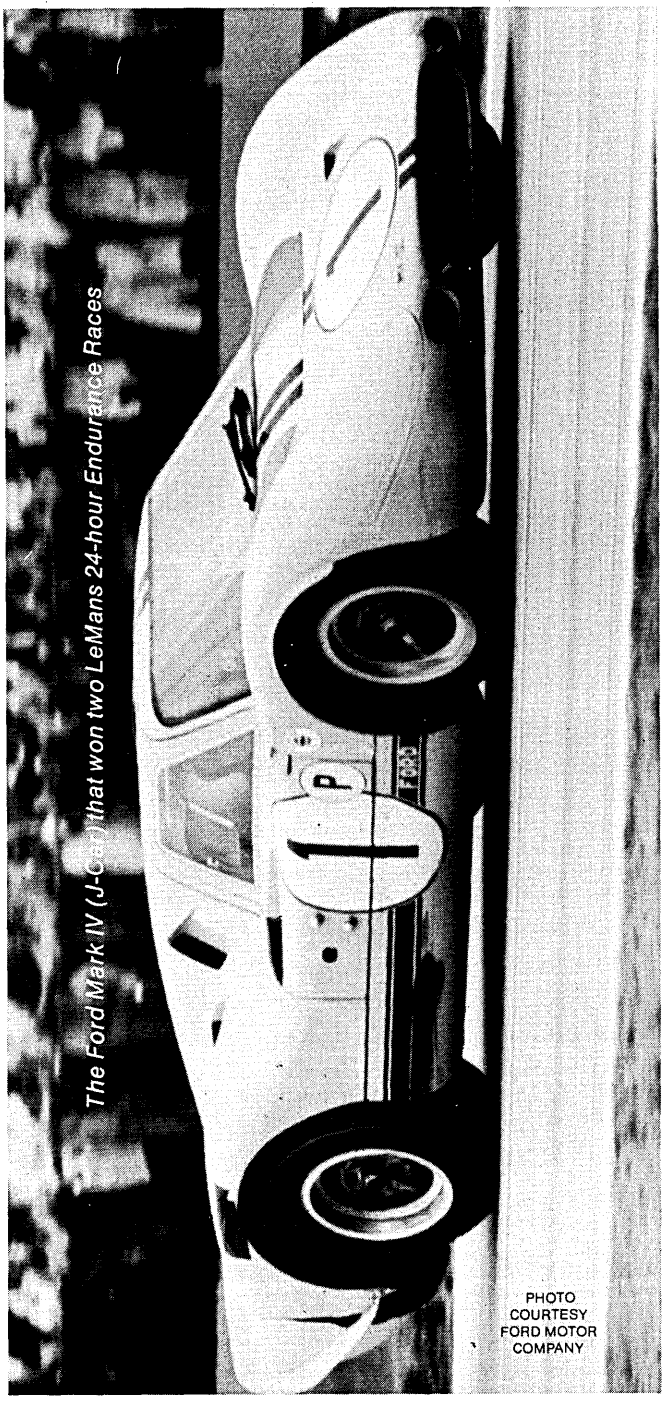

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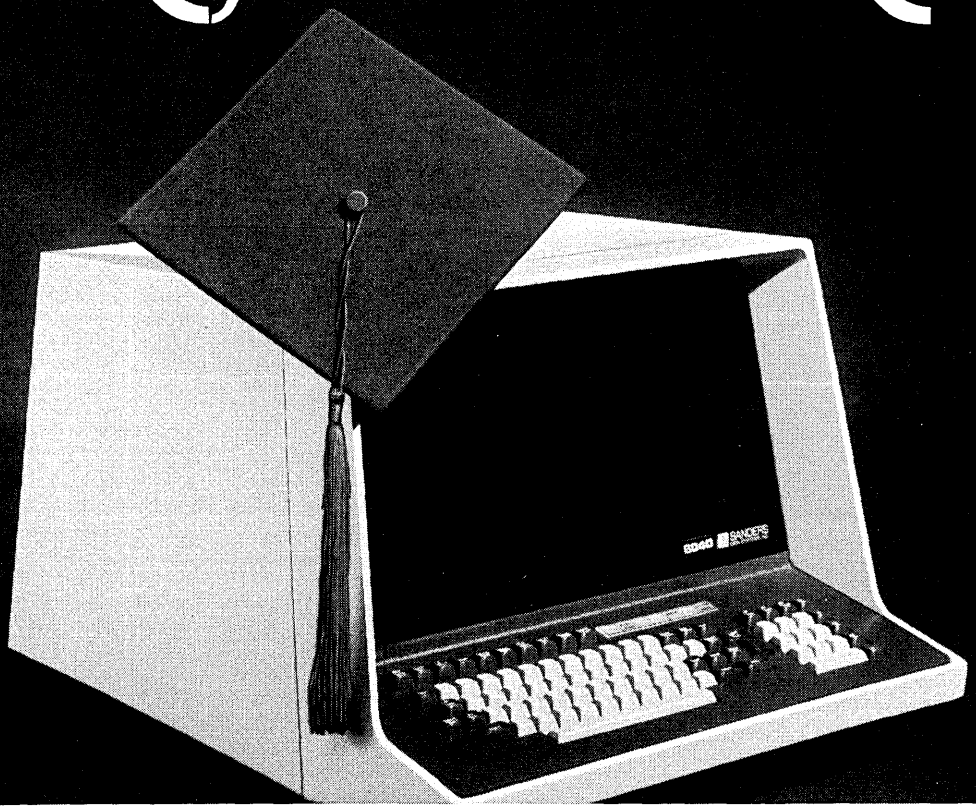

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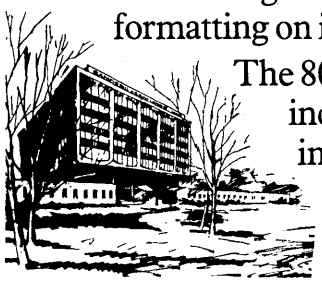

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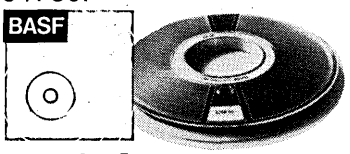

When it's BASF...you know it's not the tape that goofed.

CIRCLE 7 ON READER CARD

Casting international boundaries aside, some of the industry's biggest names speak out on some of the industry's biggest problems, including inadequate software, built-in obsolescence, data security, unresponsive educational institutions, and, of course, IBM

THE CRITICAL ISSUES: A 1974 PERSPECTIVE

by John L. Kirkley, Editor

"The major critical problem facing our industry is the success and magnitude of IBM . . ."
"Computers are still not realizing their full potential."
"Software is inadequate . . . error-ridden and inexcusably inefficient."
"The world is beginning to realize its computer problems are people problems."

Although tracking IBM's path through the courts has become a major industry preoccupation, leaders in the computer field have other problems on their minds as well.

Suspecting as much, we decided some months ago to contact a random sample of key figures in our industry and ask them to identify the major problems facing the computer field in 1974. In addition to diagnosing some of our more malignant diseases, we also asked that they suggest possible cures. Ominously, the list of the problems far outnumbered the solutions.

We expected a diversity of opinion with some agreement on the nature and scope of the industry's more pressing problems. However, our sample must have been more random than we thought—not only were there opposing viewpoints, but an extraordinary range of concerns.

Frank T. Cary

THE STRUCTURE OF THE INDUSTRY

On January 17, the Justice Department's suit against IBM moved into its fifth year with every indication of many more birthdays to come before a final settlement. The decision will have a major impact on competitive practices within the computer industry and all other industries that are dominated by large corporations. But to IBM chairman of the board, Frank T. Cary, there are other, more pressing problems ahead.

He replied that a major problem (and opportunity) facing the computer industry is "the need to match the pace of application development to that of the industry's accelerating technological improvements." He cites impressive gains in machine speed and capacity, reductions in size and cost, and improvements in automated manufacturing. The effect, says Cary, is the most attractive price/performance in the history of the industry. But users are slow to respond. "They need more advanced applications to put that power to work. The challenge, then, is to develop new and broader uses for computers aimed at helping users increase the productivity of their organizations and providing a good return on their data processing investments.

"Fortunately, many in the industry, and many users themselves, have already stepped up to that challenge and are finding advanced ways to put the computer to work. Much effort, for example, is being devoted to improving programmer productivity and to developing more sophisticated on-line and industry-oriented applications. Great strides have already been made. More must be made.

"The challenge to accelerate application development will be with us far ahead as we can see because improved price/performance is the pattern for the future."

Looking at IBM

Understandably, IBM's board chairman does not see IBM as being the industry's most critical problem. But Dick Canning, publisher of *EDP Analyzer*, wrote that "*the* major critical problem facing our industry is the success and magnitude of IBM . . . If present trends continue, IBM will become far and away the dominant factor in our society—as far as a single

business can become a dominant factor. This is already a reasonably serious problem; I think it will become more severe."

One of DATAMATION's editorial advisors quipped that IBM should team up with AT&T; together they could control the economy on a 50/50 basis. But, he added, the real question is: can a monopoly that has been earned—not arrived at illegally—be punished by virtue of its very existence? A good question for legal scholars, economists, and the Justice Department.

California Computer Products, Inc. is one of those who have already answered that question to their satisfaction; it has sued IBM for $100 million. CalComp's president, Lester L. Kilpatrick, sees the user as the ultimate loser in a prolonged battle between IBM, the government, and a host of other manufacturers. Providing solutions for user problems, he feels, should be the goal of suppliers, rather than flexing economic marketing and muscle to lock in customers. Says Kilpatrick, "We need ten, one billion dollar companies rather than one, ten billion dollar company." He recommends that IBM "change their goals and dedicate their immense management talents to restructuring the industry, i.e., IBM, into a number of independent companies so as to eliminate the need for antitrust actions to the benefit of their shareholders, the competent competitors, and in particular, the users of data processing systems." (A suggestion not likely to be received with unbounded enthusiasm in Armonk.)

Keith Uncapher, director of the Information Science Institute of the Univ. of Southern California, is also concerned about the industry's imbalance of power. He detects an erosion of U.S. leadership in computer science and technology as foreign competition increases and the pace of domestic technological advance slackens. In part, he blames the slowdown on IBM's dominance and the unfortunate fact that many of the peripheral manufacturers are slaved to IBM's product improvement schedules.

"Not too long ago," comments Uncapher, "I characterized the status of the industry activity as a maturing of the field. I was wrong, in that the field has so far to go to reach maturity that perhaps it is better to think of our going through a dull period of very early childhood, based on the industry's real potential.

"Once there is a general acceptance of the view that everyone is a potential user of a computer in a direct, on-line way, with the computer serving as a significant communications and computation aid, and as the users' problems-solving pattern, then I believe a great deal of growth and excitement will return . . . even enough to make venture capital providers smile and invest, and help launch us toward a new plateau of achievement."

The need for dynasties

John Hoskyns, chairman of the London-based Hoskyns Group, Ltd., management information and control consultants, agrees with Frank Cary that we are not realizing the computer's full potential. Looking back over the computer's history, he observes a product-oriented industry which developed from the premise that computers are simply replacements for accounting machines. "As the industry grew, there was an unconscious pact between IBM and the dp professional, whereby the former produced the machines and collected the money, the latter had the fun and enjoyed the status. Outside this pact was the user organization, which paid the bills." The inevitable result is the creation of "an age of conspicuous consumption of computer hardware with a relatively high failure rate on systems projects. Computers are still designed, marketed and promoted like consumer durables, with each generation's obsolescence planned to make way for the next. At the same time, the investment needed to develop new ways of designing and building complete systems is being made in tiny fragments across tens of thousands of users, or is not being made at all."

John Hoskyns

Hoskyns feels that what we really need is a true systems industry—large systems companies which can plan in "dynastic" terms rather than scrambling for immediate profits. Their emergence depends on a growing number of users who feel comfortable about subcontracting dp work, governments that realize systems companies can build better systems than hardware manufacturers and most users can, and a financial community that recognizes the importance and growth potential of the systems industry.

Is this wishful thinking? Assessing the state of the industry, Hoskyns is confident that he detects signs that dp professionals are beginning to realize that:

1. there is no correlation (nor has there ever been) between the percentage of gross revenues spent on data processing and corporate profits.
2. for advanced applications, the choice of computer hardware is the least important decision to make.
3. the systems of tomorrow must be easy to use and change, and therefore, incredibly complex to design and build. There will be a need for companies with the financial and manpower reserve capable of tackling such complexities.
4. IBM must be seen for what it is, an extremely efficient and hard-headed purveyor of hardware rather than a unique institution which offers painless financial success overnight, to each of its customers.

Looking ahead, Hoskyns says, "The industry structure will change so that the user benefits in the one area in which he has had little but problems for 10 years—the business of building systems. I think it was Newton who said, 'If I see further than other men, it is because I stand on the shoulders of giants.' That is the classic learning curve in science, and that body of knowledge, of being able to stand on the shoulders of the generation before, is so far almost completely missing in the frenetic and fragmented do-it-yourself world of systems engineering."

HARD WORDS ABOUT SOFTWARE

". . . *the* major critical problem of the industry is, in my view, the quality of software, whether vendor or user produced." Change will come about when users identify slipshod software and scream long and loud . . . even to the general press," says Tom Steel of Equitable Life Assurance. "Quality is, of course, a complex attribute, but by whatever measure one chooses, current software scores low. It is usually inadequate functionally, inconsistent between actuality and documentation, error-ridden and inexcusably inefficient. Beyond all that, it costs far too much. I can think of no other products (aside, perhaps, from pornography and telephone service in New York) that have all these failings to anything like the degree found in software."

Steel thinks that zero-defects code is an unaffordable ideal unless costs are spread across a broad base. He's en-

couraged by the appearance of tools such as top-down design, structured programming, higher level languages and "that relic of the past (at least to COBOL programmers), the subroutine. And he cautions, "we must recognize that programmers are technicians, *not artists*. Creativity appropriate to an in-

Dorothy Walsh

cipient Leonardo is antithetical to an engineering approach to software development. Standards are to be adhered to, not circumnavigated."

Dr. Andrei P. Ershov, director of the USSR's computer center at the Novosibirsk Scientific Center in Siberia, also commented on software. "We must review our understanding of the technical content and external goals of the thesis on software compatibility," he said. "The current predominant approach to compatibility by means of freezing the design of the processor is outdated, in that, on the one hand, it impedes the development of the structure of the machine, and, on the other hand, it does not provide an answer to problems resulting from long-term effects of software accumulation.

"Primarily, we must understand the essence of the problem—what in programming is 'eternal,' and what is important only for today. What must be transferable (portable)—the system or its basic small components? The general tendency is obvious: to work in higher level languages as much as conditions permit, although the number of (higher level language) alternatives is still too large."

Problems with tunnel vision

More philosophically, Dorothy Walsh, vice president of Inter-ACT in Milan, Italy, deplores the "provincialism of software developers" and their narrow technical view of their function that inhibits the evolution of new information handling techniques. As part of the chain reaction, the development of hardware that supports these techniques is also stunted. This provincialism, she feels, is characterized by the attempts to establish a caste system, complete with complex jargon, which excludes the uninitiated and creates a barrier between the potential users of information handling technology and the understanding needed to benefit from its use.

"It is presumptuous on our part to assume that we have the creative imagination to envision the almost limitless possibilities of the technology with which we work. Yet we make it difficult for other disciplines to understand the nature and breadth of the opportunities offered by automatic information handling techniques."

Unlike IBM's Cary, she does not think that developing new applications to maximize the user's return on his dp investment is the industry's primary challenge. "Only rare applications, like medical diagnostics, put the technology in its true light as a powerful servant for assisting mankind in managing volumes of data which may be of use to him in developing a solution to sociological, educational, scientific, etc., problems in his environment. . . ."

Walsh suggests the creation of dedicated processing systems which perform a single application for a large number of remote users. The user, through front-end processor systems

Andrei P. Ershov

with terminal capabilities, calls on various specialized processing centers through a "processor switching" exchange similar to a phone exchange. "This approach would permit hardware manufacturers to get out of the software business and to concentrate on solving problems like machine reliability and availability . . . information transfer rates, etc. The minimal software support provided by the hardware manufacturer should become even more minimal as firmware becomes more "dedicated."

Software developers "would be free to design and produce the dedicated firmware and to prepare the exception systems to treat those processes not in the firmware or not satisfactorily automatable. They would also be very busy designing the front-end processors in order to set up completely automated processing centers." Without such rigorous specialization, she is afraid that we may continue the tendency toward building highly sophisticated systems that the user may neither want nor be capable of using.

THE MACHINE AND SOCIETY

Times have changed. According to John Swearingen, a pioneer in business dp applications and now an executive with Computer Sciences Corp., "the public has discovered that there is a man behind the giant electronic dummy; and the circumstances of this revelation have the most unfortunate implications for the industry." No longer are funny numbers on a monthly bill or a series of weird notices accepted as a computer error. "Fraud and embezzlement are readily understood by the public to be man-made . . . the Equity Funding scandal will be a landmark, not just for the legal and technical aspects, but for the detailed descriptions appearing in the popular press that explain to the general public the human activity unhidden by computer esoterica."

Now the world is beginning to understand that computer problems are really people problems. "It's time," says Swearingen, "to identify the computer professional and produce ethical and professional guidelines. The guidelines should spell out what the computer professional should know, the proper and improper use of this knowledge, and his obligations to his boss and to society." Swearingen, founder and now president of the newly-formed Institute for the Certification of Computer Professionals, is helping to produce these guidelines.

Serving the public

Records, Computers and the Rights of Citizens[1], a report issued in July by

[1] *Records, Computers and the Rights of Citizens*, Report of the Secretary's Advisory Committee on Automated Personal Data Systems, DHEW Publication Number (OS)73-94, Government Printing Office Stock No. 1700-00116, for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Price: $2.35.

the Department of Health, Education and Welfare's advisory committee on automated personal data systems, stirred up a great deal of interest and controversy. Something may even come of it. At the time of this writing a bill had been introduced in the House to implement most of the report's recommendations.

One of the people who responded to our questions was Willis Ware, chairman of the committee that prepared the report. He stresses the need for the design and implementation of secure computer systems which "with high probability, can be guaranteed to deliver information only to individuals authorized to have it. There is, of course, the related privacy issue which, I think, the industry cannot accommodate by itself but . . . can encourage action by taking personal positions and influencing appropriate governmental bodies." A major opportunity for our industry, he feels, is to be responsive to social and personal needs in the design of information systems, especially those that serve the public.

Concern over the relationship between people and computers is also expressed by T. C. Hudson, chairman of Great Britain's International Computers (Holdings) Limited (ICL). "The development of computer systems has put a tool into the hands of mankind that has too great a capacity for the majority of its users." A sweeping statement. It encompasses public apprehension; management's reluctant acquiescence to the need for computer systems, tinged with the fear of the change they bring; and the dissatisfaction of the computer professional with imperfect and inflexible machines that thwart his attempts to attain some sort of binary Nirvana. Hudson says that imperfect understanding and indifferent education are the cause of these fears, and they can be combated by an educational program that embraces every level of society. The public must understand that computers can be controlled and directed for the public good; managers can learn that computers exist to serve the cause of effective management; and the computer staff must learn to extract the maximum return from current systems rather than forever pushing into the future.

The flight from reality

Fred Gruenberger, educator, author, publisher, computer consultant, and man for all seasons turns a baleful eye on our educational institutions and finds them wanting.

"In my particular area (education) the problem is that our institutions are getting farther from reality rather than close to it. At the lower levels, they're still engaged in training programmers, which leads young people into a blind alley, since programmers, in the traditional sense, are a dying breed. At the higher levels, there is a rash of "advanced" courses in automata theory, compiler theory, and God knows what, for which the market is equally dismal. Industry is crying for business system analysts and they're not getting them."

Of course, the fundamentals of computing should be taught, but, Gruenberger asks, where do we go from there? How many computer designers does the country need, how many more compiler writers? "How many more professional programmers (read: coders) when all signs indicate that the people with the problems are being direct-coupled to the computer, eliminating the high priests as middlemen."

Gruenberger casts a cold eye on software ("a big problem is our inability, or lack of desire, to build reliable software . . . "); the industry ("we already know how to use computers far better than we're using them. The lag between our accumulated knowledge and its application is terrifyingly wide and, I'm afraid, getting wider."); our lack of metrics ("We can't predict the cost of a new application within a factor of four either way. We have no measures of productivity of people. We don't really know how to measure efficiency."); and the high cost of mistakes ("We have reached the point at which the charlatans and phonies in the field can no longer be tolerated."). He wistfully expresses the hope that the coming deluge of minicomputers will allow the industry—at least in the mini world—to start from scratch and not repeat the blunders we made from the 704's on.

SUMMING UP

George Glaser, as is befitting a president of AFIPS, took a broad look at the industry. He touched on many of the major problems already mentioned and added a few more as well.

Among his concerns: the lack of an adequate software design methodology; the lack of adequately trained personnel for system design and implementation; and inadequate (or uninformed) management support of competent computer professionals.

Glaser also comments:

—Security: both the physical security of installations and the operational security of files (against crimes) is now a recognized problem. But many current approaches to solutions seem to me to be more hysterical than insightful.

—In the area of privacy, Willis Ware's report says it all.

—I refuse to speculate where the Justice Dept.'s antitrust suit will all end or whether dp users and/or suppliers will gain or lose when the dust settles, but I do believe that the industry will be preoccupied with the subject (to its detriment) for years to come.

—I'm not qualified to comment on government intervention except that I feel that software taxes, export controls and similar legislation are more often approached for political purposes than on a sound economic basis.

—There is a lack of cost-effective hardware particularly in mass storage and input/output devices. Our thirst for bigger, faster, cheaper gadgets will never quite go away because our expectations will continue to rise.

—We lack reliable and cheap data communication capabilities.

—Something's wrong—or at least very wasteful of valuable talent—with the current make-up of professional societies in this business. In general,

George Glaser

their structure (or lack thereof) represents ad-hocery in its most highly developed form.

A dour pragmatist, Glaser ends with: "I'm sad to say that my list of problems is an order of magnitude longer than my list of opportunities. But I'm encouraged by the progress being made in selected segments of the commercial/industrial arena in choosing and funding development efforts more judiciously and in implementing them professionally (i.e., they work and meet cost and schedule targets). If we can only remember in the long run (and we damn well better remember) that our success will be measured by our ability to produce results that are truly valuable to those who pay our salaries! If we don't, most of the problems I have listed will not require solutions because the industry will have become moribund in the meantime." □

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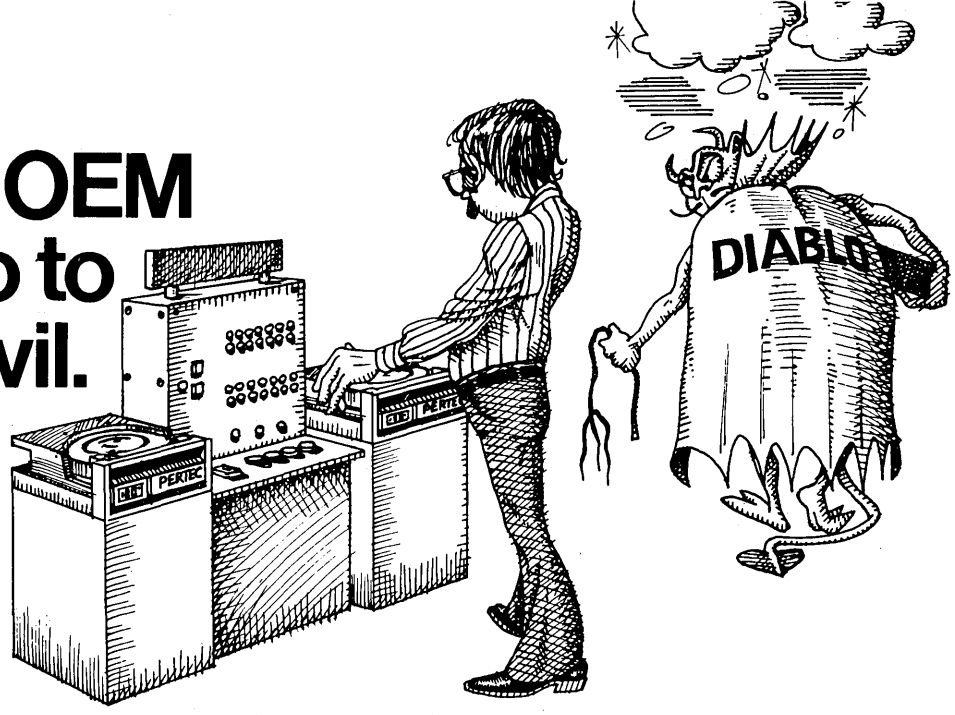

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He had his choice from Pertec's top and front loading versions. Both are plug compatible and identical in interface and size. They offer 35 msec access time (twice as fast as Diablo), margin testing, a choice of electronic or mechanical sectoring, and an optional fixed platter.

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And all of these features fit into a serviceable and compact 8¾ x 26 inches. We can even provide a cost free Diablo Series 30 compatible interface and align our heads to offset the tracks just as they do. So there is no costly redesign time if you're currently buying Diablo drives.

Of course you get the same assistance in design, development and maintenance of your system with our disk drives as you do with our tape drives and printers... Factory training for your service people. And back up by a sales, service and support network spanning major U.S. cities and many foreign countries.

All at surprisingly low prices.

Pertec is serious about satisfying your disk drive requirements. And we'd like to prove it. Call us collect in the area nearest you: Boston (617) 890-6230; Chicago (312) 696-2460; Los Angeles (213) 996-1333; London (Reading) 582-115. Or write us at 9600 Irondale Avenue, Chatsworth, California 91311.

The best values in computer peripherals come from

PERTEC

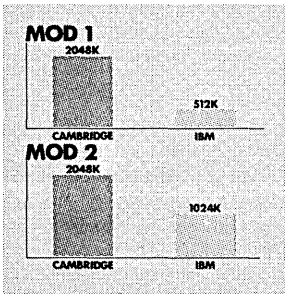
Already the world's largest independent manufacturer of tape transports.

CIRCLE 83 ON READER CARD

370/ST

When we built our new add-on memory for IBM System/370 Model 145, we wanted to give you more reasons to buy ours than anyone else's.
Here are eight of them.

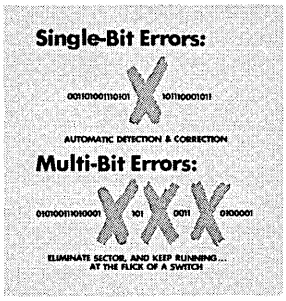
ONE.



DOUBLE (OR QUADRUPLE) YOUR IBM 370/145 MEMORY CAPACITY...

Regardless of the Model 145 you now have, you can expand it to two megabytes. For most 145 users, that means unlimited growth of systems, applications, files, packages and processing flexibility. Memory restriction is a thing of the past. Your investment in mainframe hardware is preserved for years to come.

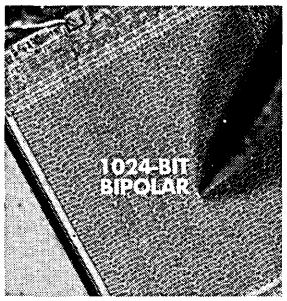
TWO.



GET THE MOST COMPLETE MEMORY PROTECTION EVER OFFERED...

370/STOR 145 detects and corrects all single-bit errors, so efficiently they don't exist as far as you are concerned. And it provides immediate reconfiguration in the event of a multi-bit error. A flick of a switch isolates the error sector, and the rest of memory keeps running...and running...and running. It's like having no downtime problems to worry about.

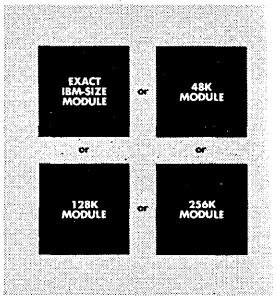
THREE.



USE THE FASTEST, SAFEST MEMORY TECHNOLOGY AVAILABLE TODAY...

The 1024-bit bipolar chip. Both Cambridge and IBM use it for their 145 memories. It's extremely fast. It provides stable storage of data. It uses a single power level that eliminates many circuits, components, interconnect points and materials. The result: lower cost and great reliability for you.

FOUR.



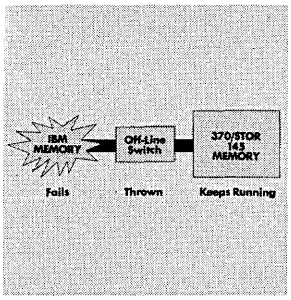
AND GET THE MEMORY SIZE YOU WANT RIGHT NOW. NO WAITING.

No one ever offered the choice of memory sizes available with 370/STOR 145. You can select exact IBM-size modules. Or 48K modules. Or 128K modules. Or 256K modules. And mix them any way you want. So you grow the way you want—in big steps or small. And you can start right now. We're already delivering.

cmi CAMBRIDGE MEMORIES, INC., 696 Virginia Road, Concord, Mass. 01742 (617) 259-9880

OR 145

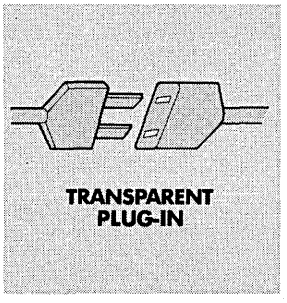
FIVE.



THAT'S NOT ALL. THIS MEMORY KEEPS WORKING, EVEN WHEN IBM'S QUITS.

It's like having a built-in back-up main memory. If your resident IBM memory fails, 370/STOR 145 will keep going. Just throw a little switch on our memory panel, and the failed IBM memory is disconnected while 370/STOR 145 continues to run full speed. Need we explain the virtues of that attribute?

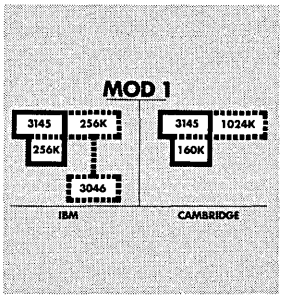
SIX.



AND YOU CAN INSTALL ONE MEGABYTE IN LESS THAN A SINGLE DAY...

370/STOR 145 is a stand-alone unit. It connects to your CPU through plug-in connector cables. That makes it completely transparent. You can use all IBM hardware, software and maintenance without alteration. The interconnect is so direct that we'll get your first megabyte running in less than a day.

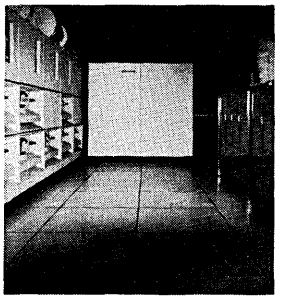
SEVEN.



IN FAR LESS FLOOR SPACE THAN IBM OR OTHER MEMORIES NEED...

We are noted for our compact memories. They help us get orders, because computer sites have space problems, too. With 370/STOR 145, we get compact indeed: up to a megabyte in a single chassis, with power supply built-in. The result, if you have a 145 Mod 1, is more than twice the capacity in about half the space.

EIGHT.



AT A PRICE THAT YOU CAN'T BEAT... UNLESS ALL YOU SHOP IS PRICE.

Cambridge sells value. That means the right performance at the right price. We've gone out of our way to build 370/STOR 145 as a memory product you can't beat in performance, regardless of the supplier. But we also know you want the right price—so we give it to you. Ask our local sales office to quote you our lease and purchase terms.

370/STOR 145. The newest product from Cambridge, a company that knows that its future depends upon the excellence of the products it builds for you.

CAMBRIDGE.

A good place to put your information.

360/CORE
Up to two megabytes of main memory for Models 22, 30, 40, 50, 65 and 67 processors in the System/360 line.
CIRCLE 34 ON READER CARD

370/STOR
Up to four megabytes of main memory for the Models 145, 155 and 165 in the System/370 computer family.
CIRCLE 35 ON READER CARD

EXPANDACORE-11
Memory expansion systems for all PDP-11 processors, featuring up to 30% speed increases. Two-way data save and interleaving.
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EXPANDACORE-620
Up to 65K of main storage for all 620/i, L, F-100 and L-100 minis. Self-contained and self-powered 5¼" plug-in systems.
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OTHER MEMORIES
Core, semiconductor and DOT data storage systems for OEM and End-user computer mainframe, controller, peripheral, terminal and auxiliary memory products.
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CIRCLE 5 ON READER CARD

Thinking of additional memory for your mini-computer?

The best idea is Fabri-Tek's add-on core.

Fabri-Tek's add-on core memories are plug compatible and they're available in 8K word increments to any word size you desire.

So, whatever your needs . . . HP-2100, 2114A/B, DEC-PDP8E, PDP8 I , PDP8M, PDP11, DG NOVA 1200 and others, think first of Fabri-Tek for off-the-shelf delivery. Another Fabri-Tek plus: on-site and factory service by a highly trained professional staff.

For additional information, call or write:

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CIRCLE 15 ON READER CARD

A slower rate of growth is projected for 1974, but there are some bright spots, especially for minicomputers, terminals, and floppy discs. A recession might even be good for manufacturers of plug-compatible peripherals.

1974: AS THE VENDORS SEE IT

by Tom McCusker, News Editor

This may be the year for computer companies to stuff the five-year plan in the bottom drawer and start worrying about next month. That's what DATAMATION's informal interviews with 25 computer equipment vendors suggested. Their expectations for the new year can be used to produce a lot of statistics, but most are qualified by "if's." Their consensus led to the following picture for 1974:

A recession is not imminent, but there are some who think the oil shortage could lead to one, if there really is an oil shortage. The traditional IBM plug-compatible market is going to be sluggish, but a small recession and an appeal court decision that leaves the IBM-Telex judgment intact could brighten that picture. Shipments of data communications equipment—modems, multiplexors, concentrators—will be rising 15-25%, but this will be due to a growth in point-of-sale and credit authorization terminals. Without these, the market experts say, the data communications market would be "pretty stagnant."

Manufacturers of IBM compatible peripherals, (PCMs) think they'll ship more tape drives and printers this year, but fewer add-on memories and disc drives. Add-on shipments, down an estimated 5% last year and expected to continue downward another 5% this year, should show a "dramatic increase" in 1975 as the independents begin to deliver semiconductor memories. Along the way, though, there will be casualties as the core makers make huge investments in semiconductor technology in a tough price-cutting market.

The independents count on large numbers of users to switch to independently-supplied tape drives and printers as they become unlocked this year from IBM's long-term fixed leasing plans. Users still on the IBM plans also now may switch to other sources without paying the huge cancellation penalties. Some vendors think disc drive shipments will fall 10-15% this year because users will defer commitments pending more details on IBM's advanced products, such as the Winchester file. But others think shipments by independents could rise 25% in the new year as they move into production of 3330-like devices, including dual-density offerings that beat IBM products in price and performance.

> Manufacturers of plug-compatible peripherals are right back where they were before the Telex judgment—frozen out of the money market.

The independents will continue to have difficulties over the next year seeking lease financing which one planning executive says is now "virtually nonexistent." Judge Christensen's injunctions curtailing IBM's "predatory pricing" in the Telex suit last September at first seemed to mitigate the PCMs' financial problems, but the recent watering down of the decision, in the words of that planning executive, "leaves many of the PCMs right back where they were before the decision—frozen out of the money market." Their hand could be strengthened, though, if the judge's original injunctions are kept intact in the appeal court and if a recession leads to a run by IBM users on lower-priced offerings of the PCMs.

Some will flop

Among the "sleepers" of 1974 will be general-purpose floppy discs. Vendors expect to ship $10 million worth in 1974, compared with $430,000 last year. They'll go in large numbers as replacement for paper tape and hard discs in minicomputer systems; the secondary markets will be as replacements for cassettes in key-to-cassette units and as replacements for tape in key-to-tape units. Some see the eventual use of minicomputers in floppy disc drives, these then becoming small business systems or custom systems for specific applications.

With the monumental growth of the "floppy" market, there'll be additional casualties as price-cutting sets in toward the end of the year. Many think that vendors have fixed on prices too low for profitability.

Among the other sleepers cited by vendors and others who closely watch the computer equipment market are: automated tape libraries, as users look for systems to automate the retrieval of huge tape files; communications processors, with shipments soaring to $400 million this year against the $280 million estimated for last year; and facsimile transmission, which some think will offer real competition to manufacturers of order entry data terminals. Four manufacturers are said to be working on a buffered FAX machine that apparently is intended to produce one-minute copy transmission without the need for a massive improvement in existing technology.

It appears that nothing can stop the

Your computer is only as good as its cassette.

Introducing the Maxell DC-300.

Don't blame your computer for dropouts, read-errors or write-errors. Blame the cassette.

Or, better still, replace it with a Maxell DC-300.

We subjected the DC-300 to a comprehensive inspection on the working tracks on all reels, one-by-one, according to standard specifications.

The results: The DC-300 proved to be completely free of read-errors and write-errors over an extended testing period.

Maxell also developed a special binder for the DC-300 that has resulted in a radical decrease in drop-outs. And by finishing the binder to a mirror-like surface the tape is now in closer contact with the head.

Another feature of the DC-300 that will upgrade your computer system is the enhanced recording density of the magnetic tape.

In addition, we created a cassette shell that is stronger and more durable than any other on the market. Four carbon-impregnated guide rollers—instead of two of ordinary plastic—reduce torque for tension and static-free operation at high speeds. Forget about having your tape jamming or becoming ripped and inoperative.

In other words, the new Maxell DC-300 is the finest data cassette on the market today...and tomorrow.

And if you don't believe us, ask your computer. Or write us for technical data.

maxell®

The answer to all your tape needs.

Maxell Corporation of America, 130 West Commercial Ave., Moonachie, New Jersey 07074

CIRCLE 86 ON READER CARD

VENDORS SEE IT

record-setting growth of minicomputer manufacturers, or their healthy profitability. Digital Equipment Corp. said its 1973 growth continued at a rate of 45% and it expects to maintain this level in '74. Growth rates of smaller suppliers are even higher and a study by International Data Corp. reported worldwide shipments of minis reached $835 million last year and will soar to an expected $2.5 billion by 1977. Nearly all ten major firms are profitable and, although price-cutting will continue, component costs will drop, enabling most to maintain their 20% before-tax profit margins.

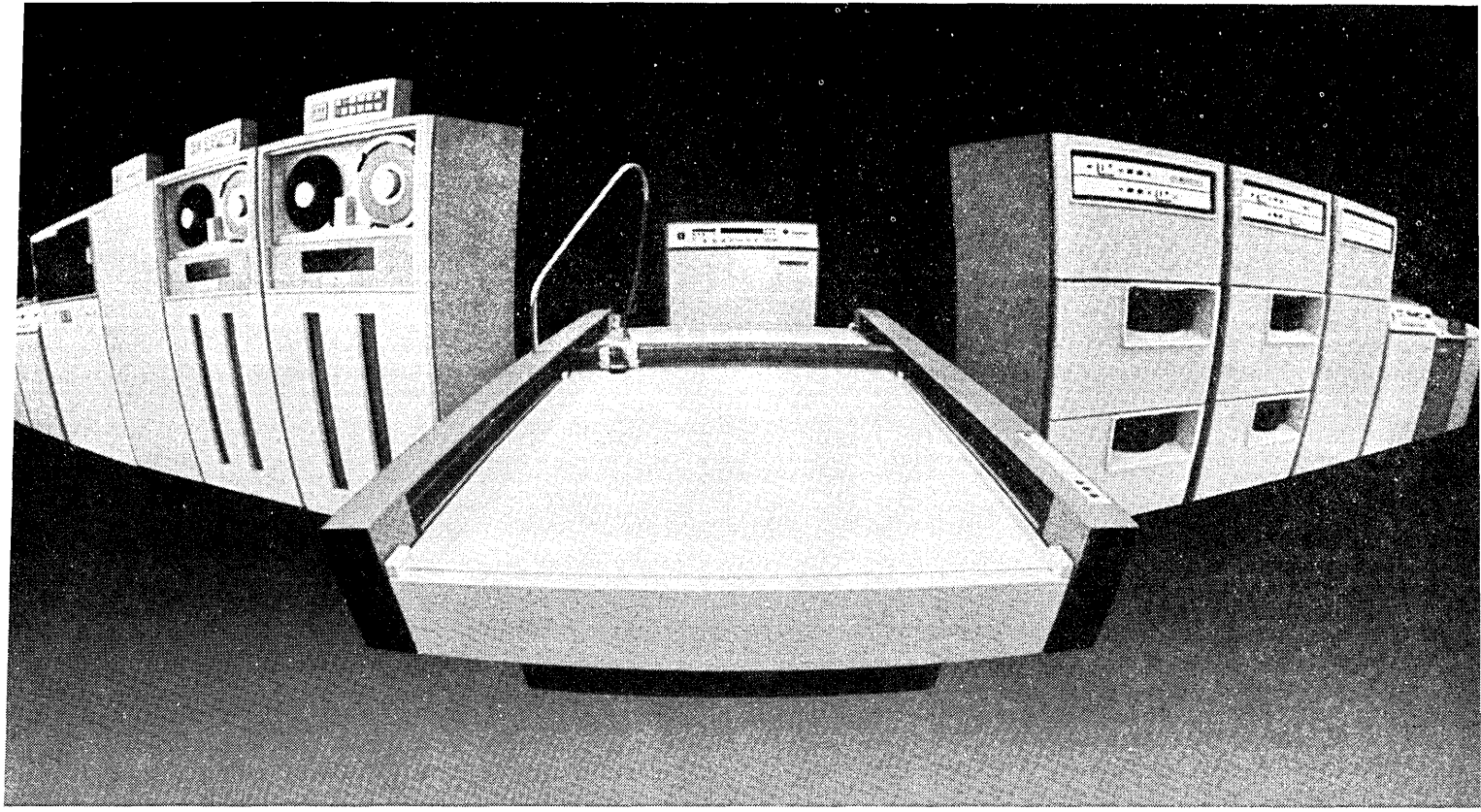
Key-to-disc manufacturers are confident their shipments will grow 70% in 1974, down slightly from the 100% rate expected last year. The mainframers look to a moderate growth in number of units shipped of about 4% this year, against 18% expected last year—when IBM blitzed the market with its new virtual machines.

Terminals are a big ticket item in the 1974 plans of those who market them. Quantum Science Corp. forecasts that shipments of intelligent terminals in the new year will rise to $93 million, compared with the 1973 figure of $67 million. It will be a competitive business as users begin to demand more sophistication in their crt terminals and opt for those providing better character resolution. Character resolution, observers contend, is still of minimal quality and that's bad for people sitting before a terminal all day.

It will be a year where the crises of oil shortages, paper shortages and inflation could trip up business expansion and probably tighten dp budgets. Some economists think, though, that inflationary pressures should stimulate demand for automation equipment since the cost for this is easier to control than that of labor.

The effects of shortages are showing up in other ways, too. In Los Angeles the scrap paper dealers this fall were offering $180 a ton for used punch cards, compared with $60 a few months before. In Minneapolis, large users said their paper suppliers were quoting five months delivery on continuous forms, and at least one of these users had issued RFPs for a Computer Output Microfilm recorder. COM's a business that never lived up to the rosy forecasts of 1969-70, although Ed Keating of DatagraphiX says the concept is now easier to sell. Necessity could make it even easier.

(Datamation staff members contributing to this article include Phil Hirsch, Dave Gardner, Edith Myers, Angie Pantages, and Ed Yasaki.) □



Peripheral vision.

From the beginning, we have preferred concentration to diversification. We don't supply everything that attaches to your computer. But the things we do supply are the best.

What do we supply?

Drum plotters. We're the world's leading supplier of both hardware and software.

Flatbed plotters. Several years ago, we saw a need and an opportunity to expand the plotter's uses. The flatbed plotter allows a variety of materials to be substituted for paper, and it has expanded the market for computer graphics, as well.

Microfilm plotters. Here, we got bigger by getting smaller. With microfilm. Our 1675 COM plotter/printer and our 2100 COM printer deliver the best price/performance in the industry.

Disk memory equipment. This was our second area of concentration. In a remarkably short time, we have become the leading independent supplier.

Tape systems. We've recently begun to concentrate on tape. The result is that our new 1040 Tape Drive combines the features of others with our own experience. We intend to be a leader in this field.

The point is we have not grown by accident. Thirteen years after our beginning, we have become a leader in computer peripherals.

For information on peripheral products, call your local CalComp office, or contact California Computer Products, Inc., DM-M1-74, 2411 West La Palma Avenue, Anaheim, California 92801 (714) 821-2011

CALCOMP

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The Victor Series 4000 programable electronic printing calculators.

Victor proudly presents the most thoroughly planned Programable Calculator on the market!

It's one of the world's fastest, most versatile electronic printing calculators —and much more. It can be programed to remember every step of your figurework application!

Your operator merely enters the data; the rest is automatic. And error-proof by design. While operating at the unprecedented speed of 110 characters per second, down to 1/10th the usual time.

Two accumulating memories and up to 100 storage registers are available in either automatic or manual operation.

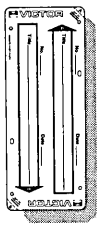
All at a price no other programable can touch—from $995 to $1995.

Its high-speed printout is matrix-clear —numbers, letters and symbols. Electronically quiet, it doesn't idle between printing operations. Compact, too, through MOS/LSI electronic circuitry. Only 15½" deep x 12⅜" wide.

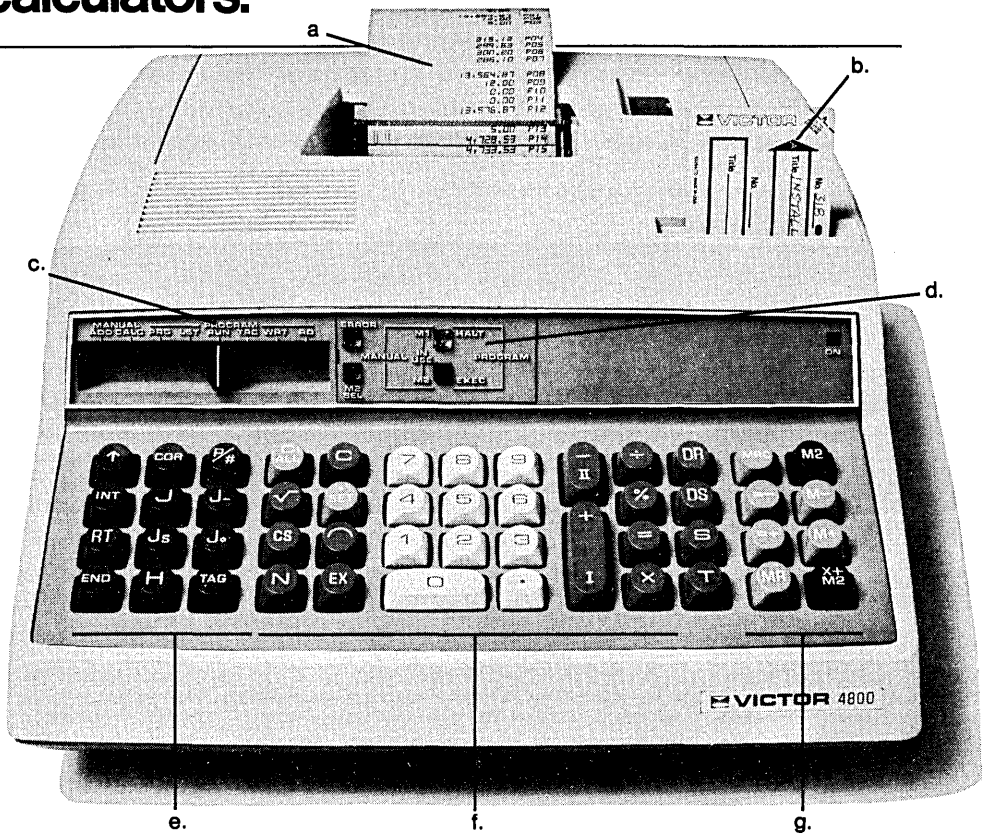
Victor offers four programable models. One offers a full 1,000 separate command steps. Three models provide a built-in reader/recorder for reading and preparation of magnetic cards that store program steps and data for general use. No unwieldy punched paper cards required. Subroutines conserve steps in applications that involve repeated calculations.

Best of all, Victor provides the application programs. Either from our growing library (see list) or custom-tailored to your needs. We'll even demonstrate how you can do your own programing. After all, Victor has the industry's most thorough sales and service force, with a 55-year record of leadership in American figurework.

Put Victor's systems expertise to productive work for you by telling us which of our documented application programs you'd like to see demonstrated. Today is not too soon.



Magnetic card. Stores program steps and data register information. Can be loaded and verified in seconds.



a. *Victor's matrix printer. World's fastest. Prints large, clear numbers, letters, symbols.* **b.** *Magnetic card reader/recorder. Program steps and data are recorded and read under machine control. Automatic verification.* **c.** *Mode selection. Simple lever device easily puts machine into programable, manual calculate or adding machine modes.* **d.** *Indicator lights. Provide quick indication of important operation steps.* **e.** *Programing control. Used only during creation of steps for new programs. (Other keys may also be used during program creation.)* **f.** *Arithmetic control and data entry. Standard keyboard arrangement for use during programable and manual calculate modes.* **g.** *Memory/Data Storage. Provides direct access to accumulating memories and data storage registers during manual calculate mode.*

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Will solve.

Our program library is growing every day. Here are some Victor programs available right now.

General Finance and Accounting

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3. Annual Depreciation: Declining Balance
4. Annual Depreciation: Sum-of-Digits or Declining Switched to Straight Line
5. Annual Depreciation: Sum-of-Digits
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8. Weighted Moving Average
9. Moving Average (n intervals)
10. Expense Distribution
11. Percent Increase/Decrease with Accumulations
12. Percentage Calculations: Percent Change, Goal Attainment and Summations
13. Period Variance Analysis, Two Comparisons
14. Labor Cost Reports
15. Experienced Rating and Summary Sheet
16. Trend Line Analysis
17. Invoicing: Quantity & Price
18. Invoicing: Quantity & Price & Line Discount
19. Invoicing: Quantity & Price & Chain Discounts
20. Invoicing: Quantity & Price & Average Price
21. Invoicing: Quantity, Cost, Price, Accumulations and Mark-up Calculations
22. Invoicing: Quantity & Price & Chain Discounts for Multiple Invoices
23. Invoicing: Salesman Commission Distribution
24. Calculations of Selling Price from Cost and Gross Profit Margin
25. Payroll: Total Entry
26. Payroll: Calculate Taxes from Keyboard Entry
27. Payroll: Calculate Taxes and Deductions
28. Payroll: Keyboard & Magnetic Card Entry, Calculated Taxes, Deductions, YTD Gross, Update Employee Card and Summarize
29. Payroll: Incentive Program
30. Payroll: Labor Cost Distribution
31. Payroll: Time Card Calculations
32. Payroll: Quarterly Summary Report
33. Payroll: Piecework
34. Payroll: Commissions
35. Payroll: Salary Plus Bonus
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40. Profitability Analysis
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47. Installment Financing/Effective
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53. Prorata Interest Breakdown Between Given Dates
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55. Loan Amortizations/Effective with insurances
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57. Installment Financing: Accrual by Diminishing Balances
58. Dollar Day Calculations
59. Loan Rebates/Rule of 78's
60. Loan Rebates/Declining balances for irregular payments and periods
61. Retail Auto Sales: Installment Financing
62. Credit Union Loans
63. FHA Title One Loans (FHA Mortgages) Eligibility
64. FHA Foreclosures on Delinquent Mortgages Accounts
65. Student Loan Consolidation
66. Multiple Interest Calculations and Consolidation in Groups with Grand Totals
67. Savings Account Interest Calculation (Semi-Annual Compound)
68. Savings Account Interest Calculation (Monthly Compound)
69. Savings Account Interest Calculation (Daily Compound)
70. Savings Account Interest Calculation Balancing

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82. Yield and Price of a Discount Instrument

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86. Poisson Distribution Function
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89. Chi-Square Test (l x r)
90. Chi-Square Test (2 x 2) with Yates Cor.
91. Chi-Square Test (2 x 1)
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93. Multiple Linear Regression
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98. 3 Simultaneous Equations
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150. Cantilever Beam—Triangular Load
151. Two Cycle Moment Distribution—Handy Cross Method
152. Two Cycle Moment Distribution—Concentrated Load

Civil Engineering

153. Traverse Computation—Bearing & Distance
154. Traverse Computation—Field Angle & Distance
155. Inverse Traverse Computation
156. Horizontal Curve Coordinates
157. Vertical Curves
158. Cut & Fill Areas & Volumes
159. True Meridian
160. Design Capacity in Storm Water Retention Reservoirs
161. Velocity and Discharge: Manning and Kutter Formulas

Subroutines

162. Exponentiation (x^y)
163. Present Value or Amount of an Annuity
164. Number of Periods for an Annuity (Sinking Fund or Mortgage)
165. Effective Rate of Return for Compounded Amounts
166. Number of Periods for a Compounded Amount
167. Effective Rate of a Mortgage or a Sinking Fund
168. True Equivalent Annual Rate (A.P.R.) Approximation
169. Discount to Add-on Rate Conversion
170. Add-on to Effective Annual Rate Conversion
171. Register Combine & Extract Subroutine
172. Present or Future Value of an Amount Compounded
173. Installment of an Annuity Given Future or Present Value
174. Accumulated Mortgage Interest Calculation
175. a^n, n Integral Value
176. Date Routine—360 Day Calendar
177. Date Routine—365 Day Calendar
178. Future Date Given Previous Date and Number of Days
179. a^n, n Non-Negative Integer
180. Log_{10} for any Positive x Value
181. xth Root of a Number, $\sqrt[x]{a}$
182. e^x, For $-32 \leq x \leq 32$
183. Combinations of n things Taken r at a time, n^Cr
184. Newton's Method for Finding the Root of a Polynomial

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NEWS IN PERSPECTIVE

IBM and Sperry Rand in 1956 entered into a secret "technological merger" that had a "stifling" impact on the remainder of the emerging edp industry. This was one finding by Federal District Court Judge Earl R. Larson in a virtually unnoticed case completed last year in Minneapolis (page 78). The case, involving litigation between Honeywell and Univac, also disclosed that the 1956 Consent Decree became a cover for the two-company agreement . . .

An Atlanta department store uses computer technology to control its power usage (page 81). It thinks it can save enough electric energy to meet the equivalent annual power needs of more than 1,000 private homes . . .

Thomas Watson, Jr. looks back on some of IBM's milestone decisions (page 89). In a rare interview in London with Nancy Foy, Watson, who retired at year-end, tells how IBM's big guns selected Frank Cary to lead the giant company . . .

Here's a computer school that really delivers (page 92). Martin Garcia is a graduate who tells why . . .

Some 9,000 persons showed up for Europe's big dp conference—System 73 in Munich (page 94). The Yanks dominated the event while the Japanese seemed to be hiding any plans concerning invasion of the European computer market.

Common Market nations are being asked to take steps to build a computer industry that can survive against American firms in general and IBM in particular, page 98 . . .

Lawsuits

How the Judge Looked at the IBM-Sperry Rand ENIAC Pact

It's not so much that the computer business won't be the same after Federal District Court Judge Earl R. Larson took a long hard look at the industry, it's just that we didn't know what it was really like until he examined it.

The judge found a big surprise: IBM and Sperry Rand, two companies which between them controlled 95% of the edp industry in 1956, entered into a secret "technological merger" that year. The impact on the remainder of the then-emerging edp industry was "stifling," the judge has stated in a virtually unnoticed case he completed last year.

While the judge found the 1956 agreement between the two firms to be "an unreasonable restraint of trade and was an attempt by IBM and SR (Sperry Rand) to strengthen or solidify their monopoly in the edp industry," the agreement didn't appear to ruffle the Justice Dept., which was given a copy of the agreement to review.

"The impact of the total edp and TAB system technological merger between IBM and SR in 1956," said Judge Larson, "was stifling on the growth of edp competitors and the edp industry generally; since 1956, all edp industry members except IBM and SR . . . have been operating under artificial edp market constraints imposed by having had to compete against the combined technological portfolios of IBM and SR during the critical starting and developmental period of the edp industry."

The opinions were issued in a 300-page "Findings of Fact, Conclusions of Law and Order for Judgment" in an antitrust case instituted by Honeywell against Sperry Rand. Honeywell filed its suit in response to a Sperry Rand suit against Honeywell in which Sperry attempted to collect royalties from Honeywell for using SR's ENIAC patent. In an abbreviated ruling last April, Judge Larson ruled that the ENIAC patent was invalid and also dismissed Honeywell's case against Sperry Rand. Transcripts and exhibits in the action were sequestered from the press by Judge Larson, but his complete ruling was filed a few weeks ago.

The judge presided over the case in the Fourth Division of the U.S. District Court, District of Minnesota, from June 1, 1971, until March 13, 1972. The proceedings consumed more than 135 days; testimony was presented by nearly 160 witnesses and more than 30,000 exhibits were introduced as evidence.

Tale of collusion

The judge's opinion tells a fascinating tale—of collusion between two industrial giants, of successful attempts by the two firms to cover up the true details of their "technological merger," of the Justice Dept. treating the whole matter as "confidential."

Attorneys representing the two firms led the judge through an amazingly tangled trail. The judge said: "The agreement was the product of a number of factors, including the 1956 IBM consent decree, the 1955 antitrust suit by SR vs. IBM, the claim of IBM that SR had infringed a number of its patents, a number of interferences involving ENIAC, the evaluation of ENIAC, the evaluation of the respective patent portfolios, the claim by IBM that the ENIAC was invalid because of public use, and undoubtedly other factors."

In the end, the judge stated that the IBM-Sperry Rand agreement damaged Honeywell to the tune of between nearly $400 million to nearly $575 million during the years from 1958 to 1967. However, Honeywell may never be able to collect damages because of a four-year statute of limitations. Honeywell filed its case against Sperry Rand in 1967, but Sperry Rand and IBM made their "technological merger" deal in 1956.

It isn't clear whether any other firms could win a case on the issue. Honeywell did collect a $3 million settlement from Sperry Rand for unspecified reasons. The judge, however, said that the other mainframe manufacturers should have sued earlier.

"The fact is," said Judge Larson, "that plaintiff (Honeywell) and the newcomers in the edp market in 1956, including Burroughs, NCR, RCA and others, should have, in 1956 or later, sued SR and IBM which then controlled about 95% of the edp market." But the details of the agreement were guarded so carefully that it would have been virtually impossible for outsiders to know the extent of the IBM-SR deal.

What did the agreement cover?

The judge quoted from the IBM-SR

agreement and said it was "a complete cross license . . . and a complete sharing of all edp and TAB equipment know-how" of products announced by Oct. 1, 1956. The agreement called for the parties to share this information in the most minute detail. In addition, IBM was to pay Sperry Rand $10 million. Sperry agreed to dismiss an antitrust suit it had filed against IBM, and IBM dismissed a patent infringement counterclaim against Sperry.

Valuable shortcuts

The judge's feeling that Sperry Rand. and IBM in particular, benefited enormously from the agreement ran through his ruling. He said:

"After receiving the technological and production know-how from each other. both SR and IBM studied and used the information; SR refused to sell or allow use of any of its equipment made in consequence of the technological merger by any edp industry member at any price; IBM sold or leased such items at retail prices; by reviewing and studying the technical information shared under the 1956 Agreement. SR and IBM were better able to know and to evaluate the options available to each of them and to decide what equipment to build and how; having such opportunities involves time and cost-saving shortcuts in the evaluation and selection of alternative routes. . . .

"The SR-IBM technological merger in 1956 injured competition in the edp industry by conspiratorially allowing the perpetuation of the high combined market share of the two parties to the merger and tending to protect the proportion of each conspirator."

Judge Larson listed instances in which Honeywell was product-bound—particularly in the peripherals area—and noted that the firm would have benefited greatly from access to the product information that IBM and Sperry Rand were privately sharing.

The judge said that Sperry had the obligation to seek out Honeywell and offer it equal access to the information it was sharing with IBM. and he observed that IBM "did nothing" to make the shared information available to all competitors, although IBM felt it was required to do so by the 1956 consent decree.

On the contrary, there is evidence that Sperry and IBM were effective and diligent in keeping the key provisions of the joint agreement away from competitors. The judge wrote that IBM wanted a joint press release that would keep the terms and conditions of the agreement confidential.

"SR and IBM," the judge stated, "were naturally sensitive about candid disclosure of the full details of their know-how exchange when they did not heed the warnings of counsel by making the technology available to all; they agreed upon a closely worded and innocuous-sounding press release and agreed that no other comment would be allowed by any representative of either company."

The judge also observed that both firms had been advised by attorneys that the agreement carried antitrust problems, but that the firms went ahead with the agreement anyway.

The Watson script

Thomas J. Watson, Jr., then chief executive officer of IBM, sent a worldwide memo to top IBM executives specifying "what could and should be said regarding the technological merger and attached a script with prescribed answers to questions; the script was designed to disclose none of the details of the agreement," the judge stated.

Ironically, the agreement between IBM and SR was something of an offshoot from the 1956 consent decree which had been signed by the Justice Dept. and IBM with the stated purpose of stimulating competition in the TAB industry and in the then-emerging edp industry. But the consent decree spawned the IBM-SR agreement which, on the basis of Judge Larson's work. would appear to have stifled competition and set the industry back light years.

According to the judge's interpretation of the evidence and testimony presented during the trial, the genesis of the IBM-SR agreement went like this:

Former chief of the Justice Dept.'s Antitrust Div.. Herbert A. Bergson, prepared a draft consent decree for the regulation of IBM on behalf of Sperry Rand. He included edp provisions in the draft consent decree and submitted it to the Justice Dept. Bergson. however. came to believe that the Justice Dept. wouldn't get adequate relief from IBM in the consent decree, and Sperry subsequently sued IBM on antitrust charges in December 1955. about one month before the Justice Dept. and IBM signed their consent decree.

"SR was unsuccessful in having the edp know-how requirement included in the consent decree for the public," Judge Larson stated. "Subsequently it began direct negotiations with IBM to. and did obtain the IBM know-how solely for itself."

The agreement was signed on August 21, 1956, after protracted negotiations by the two firms.

Before the agreement was signed. Bergson suggested that a copy be submitted to the Justice Dept. "After the agreement was signed" the judge said, "Bergson personally delivered a confidential copy of the agreement to Marcus Hollabaugh, a Justice Dept. attorney who had been in charge of the IBM litigation (1956 consent decree)."

At the same time, the assistant attorney general asked for, and received, a copy of the agreement from IBM. Thus, it was clearly established during the trial that key antitrust officials in the Justice Dept. were aware of the agreement between IBM and Sperry.

"While IBM and SR filed copies of the 1956 agreement with the Justice Dept.," the judge wrote, "they knew and intended that the Justice Dept. would treat the matter as confidential under the express provisions of the 1956 consent decree; it was so treated.

It became a cover

Thus. although the consent decree had been intended to promote competition and exchange knowledge among competitors in the industry, it became a "cover" for the IBM-SR agreement and an instrument for stifling competition.

The issue of the ENIAC patent runs throughout the judge's decision like a leitmotif and it's an understatement to say that the ENIAC patent haunted the industry for years.

There was a fascinating point about IBM and the ENIAC patent: The judge said it was to IBM's advantage at times that Sperry's ENIAC patent be declared valid. The judge found that IBM deliberately did not pursue its own case on the ENIAC patent vigorously and, indeed, withheld information it had on the public use of ENIAC.

"IBM," said the judge, "had more to lose than to gain by establishing invalidity of the ENIAC patent application once the 1956 cross license had been executed. because IBM knew that once it had agreed to pay $10 million. its competitors would be financially burdened by the ENIAC patent application only if it issued. . . ." Judge Larson said IBM knew that its attempt to invalidate the ENIAC patent in 1959 was "essentially a sham."

Enter the Bell System

The judge found that a somewhat similar situation held true for the Bell System regarding the ENIAC patent. The Bell System, too, had signed a cross license with Sperry, and the judge found that neither Bell nor Sperry vigorously pursued the public use issue on the ENIAC patent in litigation before a federal court judge in the early 1960s.

The judge stated: "BTL's (Bell Telephone Laboratories) internal memoranda in connection with the lawsuit proved that it desired to complete the public use litigation in the Southern District of New York at the least expense and with the least possible amount of effort; SR was of a like mind as it never mounted a truly effective effort.

"BTL and SR submitted their evidence in perfunctory and conclusory affidavits and deposition transcripts."

As a result, the patent was issued to Sperry Rand, but the judge indicated that it did not bear on the public use issue. This could have had the effect of closing off other competitors from access to the ENIAC patent while Bell and IBM had rights to the patent through their cross licensing agreements with Sperry.

The judge found, however, that the Bell-Sperry agreement was not a violation of antitrust laws, and that Honeywell did not prove that it had been injured by the pact.

IBM, apparently, thought it got a good deal in the whole matter. The judge quoted from a communication that a top IBM attorney wrote to Thomas J. Watson, Jr.: "The issuance of the 'ENIAC' patent to Sperry Rand after 10 years of litigation makes our $10 million settlement look many times better than we figured it to be in 1956."

Shortly thereafter, Sperry was seeking royalty payments on the ENIAC patent from other manufacturers. The price was high and, as an example, the judge noted that Sperry was seeking a $250 million payment from Honeywell on the basis of the patent. Thus, the ENIAC patent was a Sword of Damocles that hung over the industry's head for years. Of the Bell Telephone-Sperry ENIAC patent case, the judge said: "Had the case been correctly decided by the district court, the ENIAC patent would not have issued and the edp industry would not have been threatened with its burden or sanction."

There are indications that the Sperry Rand-Honeywell case was a bitterly fought contest. Indeed, Judge Larson said there were submitted in the case "so-called 'conventional' briefs containing strong advocacy by which counsel have been less than kind to each other."

In addition, there was an aura of secrecy surrounding the case. DATAMATION made several attempts to obtain transcripts and exhibits of the case last year, but was unable to obtain them from the court clerk, the judge's office, or Honeywell or Sperry. Also, both firms have steadfastly declined to answer questions on the case.

—W. David Gardner

Energy

Crisis, Computers, and Credibility

It's a rare day when a reporter becomes nauseated by the word crisis. But, at writing, we hanker for *Never on Sunday* and the daughter of Pireaus as she fancifully translates *Medea* into a tale of a trip to the seashore instead of oblivion.

It all started when we decided to look into the question, "How does the energy crisis affect the computer industry?" Somehow, it all got mixed up with sheiks; panicky power companies; oil industry conspiracies; cantankerous truckers; Wall Street run amuck; silicon, paper, and plastics shortages; a run on VW's; and love lost for love. And pity that poor field engineer we hear was called out on one December Sunday for computer repairs—and no gas in the tank.

At writing, we think we're sure there's an energy problem, although somewhere we read that "the worst is over"?! The government thought we'd be 3.5 million barrels/day short in the second quarter, but 28 oil companies say there's an extra million barrels a day around somewhere and 28 oil companies can't be wrong. Too, the sheiks were getting more "privately flexible" in December, so the government didn't come out and revise its high shortage estimates for fear of appearing indifferent to the Arabs' oil embargo (that's what the *New York Times* said, anyhow).

The credibility shortage, called "uncertainty," kept the computer industry from hitting the panic button as 1973 waned. But hawking crisis had the effect a mere "problem" would not have produced. Some outlandish waste is being eliminated. Most of the companies we talked to indicated they can easily cut back 10-20% in fuel and power consumption without impacting production or computer operations. This means turning out lights, turning down heat and air conditioning, shutting down elevators, turning off unused equipment in plants and offices, etc. (Would Xerox and IBM please go back to carbon paper?) They all know more can be done. They are keeping their fingers crossed that rolling blackouts won't have to be instituted. And users in particular are reviewing again the kinds of power supplies they might need if brownouts become severe.

IBM's task forces

Giant manufacturer/user IBM has "significant" task forces studying the various aspects of the energy problem in 30 major locations, according to John Honeycomb, manager of energy programs in the Real Estate and Construction Div., and coordinator of the new Energy Conservation Div. IBM has had an energy conservation program since last January, but last November it set up an aggressive program that calls for a nationwide reduction of 20% in fuel consumption and 10% in power. IBM is naturally indicative of the industry, being a vertically integrated manufacturer, so it is significant to note that 78% of its energy use is power, 22% fuel. The industry is a clean one, not as crushed by oil shortages as others. Honeycomb noted that IBM is taking the normal measures noted above. It has reduced heating temperatures to 68 degrees, and is raising air-conditioned locations to 75-78 degrees. It has rescheduled cleaning operations so that lights can go out earlier. It is restudying its manufacturing processes, trying to improve efficiency, and is considering shutting down redundant equipment. Of course, IBM is already using computer systems in control of many buildings and plant locations, but it is reviewing methods of adding more controls to more locations. Among other measures, it is currently using computer simulation techniques in design of its buildings, trying to get the "best balance of all factors to minimize energy consumption."

The power companies supplying this clean industry are in varying states of panic and planning, of course, dependent on what their energy source is. The Northeastern companies are talking about some oil shortages and voltage reductions, and there is "concern." The local power company serving Lexington, Ky., has been advertising the marvels of electric heat and air conditioning for the homes, so we're not sure what kind of problem it has. The real trouble spot in the country for this industry so far is California's Pacific Gas and Electric.

In November, PG&E and the California Public Utilities Commission asked the semiconductor companies in Santa Clara County to voluntarily reduce power use to 10% below levels of corresponding months a year earlier. A possible alternative to this plan was a rolling blackout, cutting power for one-to-three hours daily. "Silicon Valley," home of 16 semiconductor firms, let out a cry of pain. In late 1972, these firms were barely coming out of their slump and beginning long overdue plant expansion. With demand for their products far exceeding supply these days, a return to those levels would be disastrous. Growth is the byword for 1974.

Privately, sources at some of these firms felt that the request was made by

the utility to determine how far the companies could reduce power without impacting production—and to force them to justify their existence and prove the efficiency of their operation.

Semiconductors are good things

The Semiconductor Equipment and Materials Institute and the Western Electronic Manufacturers Assn. went armed with facts, figures, and pleas to PUC hearings in December. The chip makers claimed they had added 15,000 new jobs in the county between 1971 and '73, and were planning 10.000 more by 1975. They account for 36% of U.S. semiconductor sales now, and will represent 43% by 1975. They have committed hundreds of millions to plant expansion. Semiconductors are good things, they said—indispensible to vital industries like computers, missiles, medicine, calculators . . . ; important to the balance of trade ($235 million came in 1973); and power savers in the products that use them.

News of a sizable shortage in the vital polycrystalline silicon hit these manufacturers at the same time. Dow Corning, supplier of 30% of the silicon, announced that its new plant would be a month or more late getting into full production this year, so second quarter shipments would be impacted by 20-50%. But one Dow customer, IBM, says that it expects no impact on its production, and will simply have inventories at a lower level than normal.

The computer industry has lived with shortages for some time. People like Dan Printz of Teletype are blunt in noting that shortage of components, not energy, are what have been holding up their deliveries. Materials managers at other dp companies told us all was well; they've been paying bills, staying loyal to their suppliers, and upping inventories when suppliers recommend it. They don't think the energy crisis will change that very much.

In any case, few that we talked with felt that this industry, or even the economy for that matter, is in deep trouble in 1974. General prognosis is for a GNP growth of around 2%. Ted Withington, A. D. Little consultant, said that the computer makers are in the middle of their "super cycle," and 1974 shipments will stay at the peak set in 1973. We figure this means nearly $15 billion worldwide.

Scavenging about to find out what computer users can do to eliminate power waste, we found that very few among 18 surveyed are doing much more than turning out lights and turning down the heating and air conditioning. Paul Jarvis, dp manager at Technical Publishing Co., says his Honeywell system is run at about 75-76 degrees, 80 degrees being marginal; "cooling to 65-68 degrees is ridiculous," he observes. Emery Air Freight in Wilton, Conn., is turning off all peripherals and cpu's not in use, says Cliff Stuek. Triangle University's computer center is looking into using heat generated by its systems to help warm its building in North Carolina, although others have told us this is not a simple task and the heat value is minimal.

The sporadic brownouts are what worry most users and if they don't already have auxiliary power sources, they are taking a good look at them. This is critical for heavily-used and communications-based systems. One big center in New York State, which has a UPS, reported that its monitors have shown power drops as high as 14%. Stueck at Emery, a round-the-clock on-line installation, said that monitors there have shown a 9% drop in power during 4-9 p.m. The New England power companies are supposed to cut back only 5% during those hours. Emery, he said, is installing portable power generators at several remote terminal sites to "take us over sporadic interruptions."

The computer itself is naturally a big help in the search for solutions to the energy problem. Oil companies are pushing their data centers hard for short- and long-range forecasts in addi-

Terminal Solution to the Energy Crisis

The energy crisis has pushed a major Atlanta department store into the computer terminals business in a big way.

"We've had calls from everywhere and they cross the spectrum of American life," said Jim Prescott of Rich's, Inc. The calls are coming from people interested in a computer technique the department store chain developed to monitor and control its power usage. The firm expects the technique will enable it to reduce power consumption by more than 10 million kilowatt hours annually, saving enough electric energy to meet the equivalent annual power requirements of more than 1,000 private homes.

Rich's wasn't thinking energy crisis when it began work on the technique back in December 1971. "We were interested in the fact that electricity was a big expense item and we had reason to believe it was going to increase in cost," said Prescott.

The store took its ideas to IBM, partly because it already had a lot of IBM equipment and partly because "after looking at others (hardware vendors), we decided IBM had the unique engineering capabilities to develop the terminals we wanted." The system Rich's is now using is the result of a joint effort with IBM and is based on two System/7's. IBM designed the systems' terminals to Rich's specifications and the store retains proprietary and marketing rights to them.

Rich's began installing its system in August 1972 when it put in its first System/7. A second 7 was delivered to a second facility in September 1972, intended for use as back-up. Additional Rich's facilities were hooked onto the primary system via terminals and telephone lines to a point where 13 facilities now are hooked in. The system currently includes 15 of the specially designed terminals with "four more coming soon and as we build more stores we'll put 'em on-line."

Monitors demand

What the system does is monitor power demand and consumption at each of the facilities every 120 seconds. Right now the monitoring is limited to heating, ventilation and air conditioning, but the store is working on a program for light control which will be added in the near future.

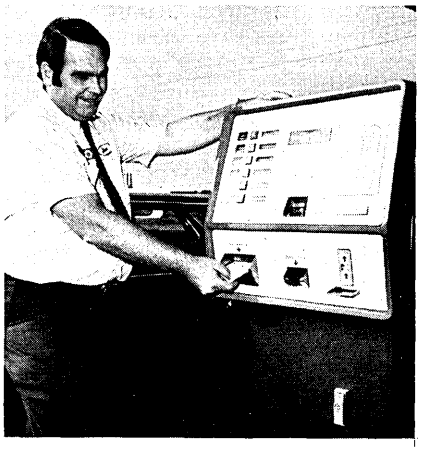
Prescott explained that the store established limits of consumption and demand for each facility by examining past data and settling for a figure 10% under previous peaks. When demand begins to approach this limit the system begins cutting back on consumption by turning off electrical equipment for 30-minute intervals.

Generally, he said, this short shutdown has no adverse effect on employees or customers, but if the environment should reach a discomfort level the system would sense this and would establish a new limit, turning the affected devices on again until the new limit is approached.

Prescott believes the Rich's system is the only one of its kind controlling a number of facilities via telephone lines, but said a number of single facility systems are being installed around the country in a variety of environments.

As for firm orders for their terminals, Rich's didn't have any at this writing but, said Prescott, "we're working on quite a few. We were pioneers and we want to moderate those pioneering costs."

—E.M.



EVERYONE'S A POTENTIAL COMPUTER USER but some don't like the idea of becoming one when they didn't expect it. Jim Polly, manager of a computer-based gasoline station in Anaheim, Calif., makes it look easy. He's pulling a receipt out of a terminal which, activated either by a credit card or cash, controls dispensation of the appropriate amount of gas from a designated pump before preparing the receipt. But Jim's predecessor, Nadine Scott, who managed the automated station when it first opened, said that while most customers liked the speed afforded by the system, some, "mostly men in business suits," would give the terminal a once-over then leave in disgust. "I think they didn't want to look stupid." The system, based on a Computer Automation Alpha 16 minicomputer, is produced for Atlantic Richfield Co. by Docutel.

Kirkley Named Editor of DATAMATION

John L. Kirkley has been appointed editor of DATAMATION, succeeding Robert B. Forest who resigned this month to enter the market communications consulting business in Paris. Forest will continue with the magazine as an advisor.

Kirkley, 38, is the founder, and was for seven years the editor and publisher, of *Computer*, monthly magazine of the 18,000-member IEEE Computer Society. His appointment was announced by James M. Morris, publisher of DATAMATION.

Kirkley has been active in computer publications and public relations affairs since 1961 when he joined the former Thompson Ramo Wooldridge Corp. He was later transferred to the Bunker Ramo Corp. where he became manager of information services. He was a member of the public relations committee of the 1965 Fall Joint Computer Conference, has served seven years on the organizing committees for the IEEE's annual computer conferences, and was director of the Computer Society's publications office.

He received his B.A. degree in English from Colgate Univ. in 1956, and his M.A. in English from the California State Univ. at Northridge. He has taken advanced studies in English at UCLA and USC in Los Angeles. An accomplished abstract painter, Kirkley's work has been exhibited in several Los Angeles galleries.

As a lieutenant in the Air Force, he served as public information officer at Edwards AFB in California, and edited the base's weekly newspaper, *Desert Wings*. After leaving the Air Force he joined RCA and Pacific Semiconductor, Inc. as manager of employee communications.

Forest, 48, has been DATAMATION's editor 10 years, joining the magazine when it had a staff of two editors and a circulation of 45,000. During a decade of phenomenal growth, the magazine's circulation has increased to 111,000, with an editorial staff of 10 editors and six correspondents. From a journal consisting chiefly of technical articles, it has been expanded to include extensive staff-researched articles interpreting industry news, products, and people. The magazine reported on the problems of privacy and security before these became popular issues and it was an advocate of unbundling long before IBM gave the concept its blessing in 1969.

A dedicated and perceptive journalist, Forest relied on the advice of an advisory board of industry leaders, but insisted that the magazine's staff be expert communicators, not expert computer technicians. "I assume that if I were really an expert, I could make a hell of a lot more money advising people on technical matters than as an editor of DATAMATION," he once wrote.

Forest is the chairman of the AFIPS Industry Advisory Panel, a group representing exhibitors that was influential in AFIPS' decision two years ago to consolidate the semi-annual Joint Computer Conferences into a single annual event. The IAP recently was granted equal status with the JCC Committee, the conference's decision-making body. He was an advisor to the Center for Computer Sciences of the National Bureau of Standards, and is a founding member of the Society for Management Information Systems. He entered the computer industry in 1956 with the ElectroData Div. of Burroughs Corp. as a technical writer and later as public relations manager.

Forest will maintain an association with DATAMATION as an advisor to the magazine's growing overseas interests which include publication of DATAMATION International, issued quarterly, and the DATAMATION Grand Tour, a five-nation exhibit and conference in Europe and Scandinavia, the first of which was held this fall.

Crisis . . .

tion to research and production control applications. In fact, their dp budgets are likely to climb in '74.

IBM, as noted, is internally using automated building and plant control, but it is also marketing a System/7-based system for such applications (see accompanying story). Honeywell, Inc. has delivered 5,000 automated systems for building control, and its commercial division has 10 DDP-316-based centers around the country marketing an on-line Building Operations Control Service, (BOSS). These centers can serve buildings up to a 50-mile radius, controlling heat, light, fire protection systems, etc. (As opposed to a system built into a single building which costs $100,000 or more and controls thousands of points, BOSS controls fewer existing points in small to medium size buildings and costs from 50¢ to $2.00/hour.)

There are more mundane applications like computer matched car pools popping up. We don't know when they will link with computer dating services.

Finally, whether the problem is truly a crisis of dangerously depleted natural resources or a combination of short supply, politics, profiteering, and price control, one thing is evident. Alternative fuel sources must be developed and computers and computer professionals can, of course, play their role in this endeavor. Some computer experts feel that the control of this research must be taken out of the hands of private enterprise, and suggest that NASA should be strengthened to take on the task. It has more than a decade of experience in administering a crash program of research, development, and implementation. It has already worked on energy problems. It can more objectively foster the development of sources not based on oil. And it would also provide, in time of relative peace, the technological advancements and economic stimulation that only seems to come in time of war. And we'll all go to the seashore.

—Angeline Pantages

(Continued on page 89)

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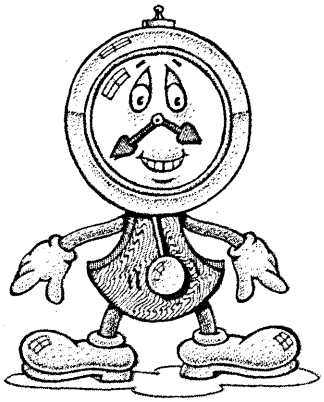

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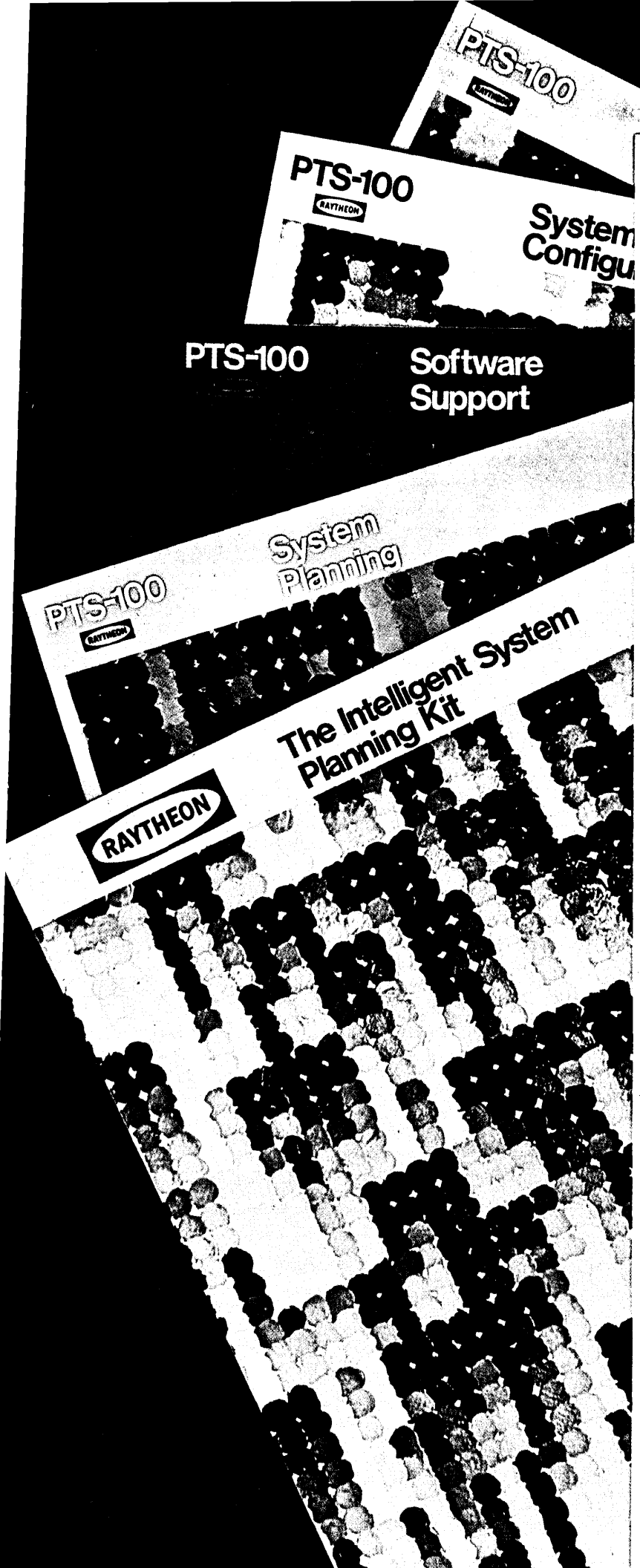

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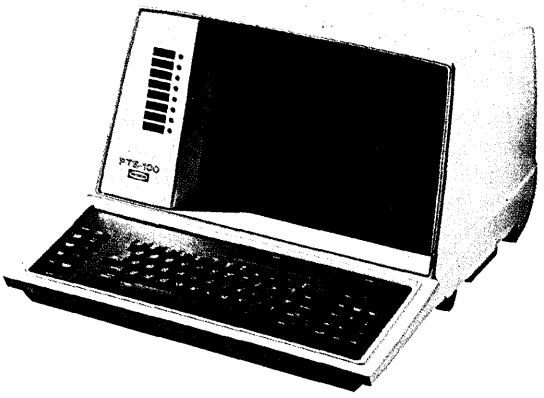

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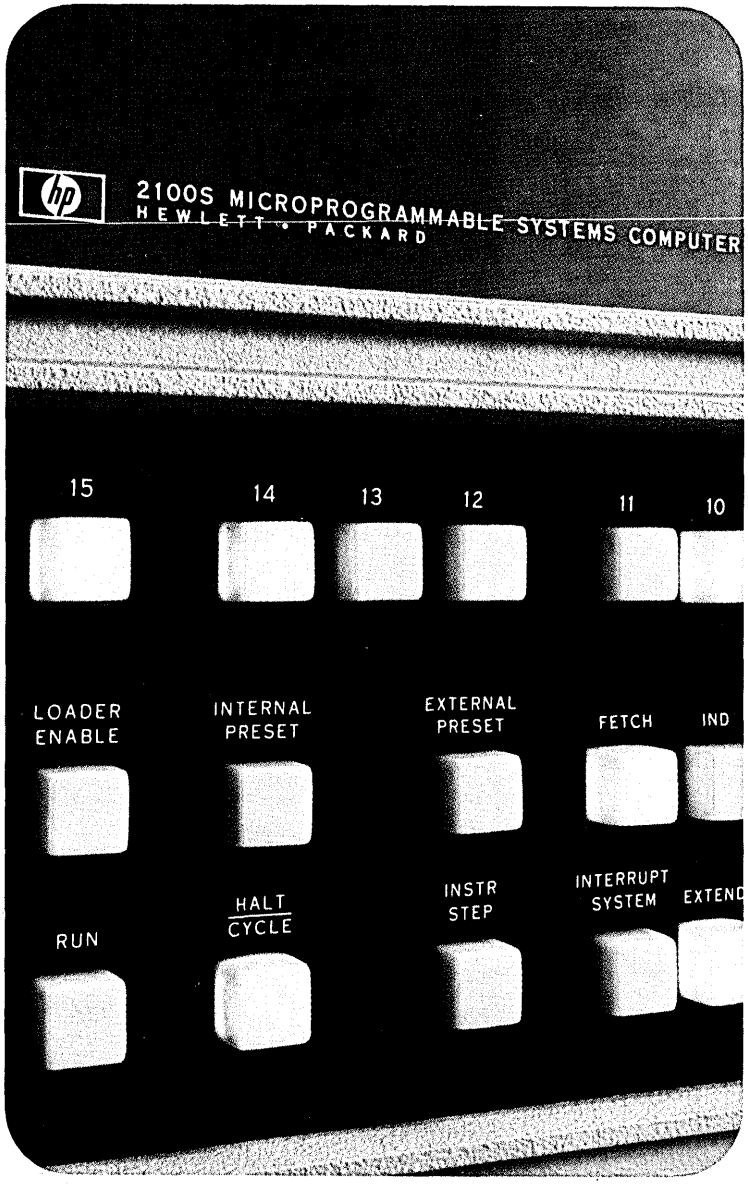

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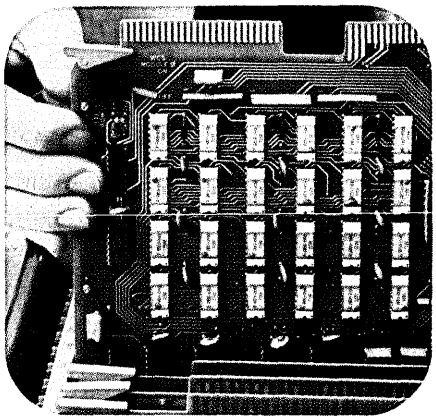

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People

Tom Watson Junior at Retirement: "It Will Be Wonderful This Way"

An Interview with Nancy Foy

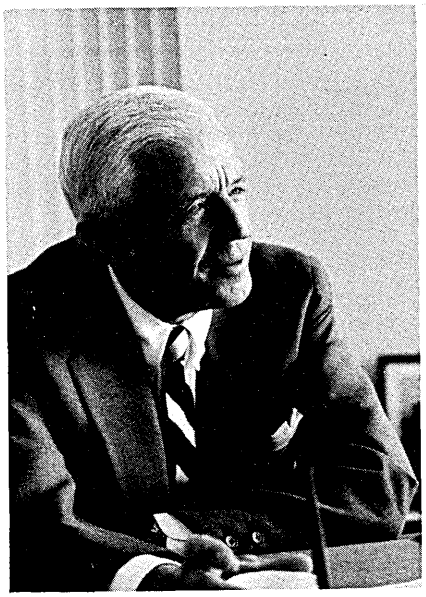
This month, for the first time in its 60 years, IBM has no Watsons on its payroll. In 1914, Thomas Watson, Sr. took over a demoralized little collection of 13 companies—a miniconglomerate—and welded them into a single entity that dominated the market for punched card equipment, and grew into the world's largest computer company. In 1956, when he was 83, Watson handed over the control of IBM to his older son, Tom Junior, while the younger son Arthur (Dick) Watson was building IBM's international organization.

Dick Watson left IBM in 1970 to become U. S. Ambassador to France. Tom Junior had planned to retire in 1974, when Frank Cary was to take over, but a heart attack in November 1970 disrupted the orderly succession plans. T. Vincent Learson held the position of chief executive for 18 months while Cary, who was virtually unknown outside IBM, gained experience as president. Learson retired at the end of last year, in line with the company's policy of retirement at age 60 for corporate officers, and Cary took over the additional position of chairman.

1973 has been a year of transition for IBM. "I think that my family and I have been identified with IBM for so long that it is important to have a very distinct break and a clean transfer now," says Tom Watson, Jr. "That transfer has already been made inside. You can tell whether you have really transferred your responsibility by the size of your stack of mail and the number of your telephone calls. Mine have gone down and they've gone down rapidly."

Tom Watson granted me a rare interview in London last month. He was taller than I expected, more relaxed, more open. Like everyone else in the industry, I was familiar with the stereotyped descriptions of the Watsons. Chatting comfortably over coffee with a be-sweatered Tom Watson was surprisingly easy. It was clear that he "belonged" to IBM as much as it belonged to him. (In point of fact, incidentally, the entire Watson family never owned more than 5% of the shares, and own considerably less than that now.)

Tom Junior joined IBM in 1937, and was away in the U. S. Air Force from 1940 through 1945. His father was then 71, and the young veteran was 31. Ten years later, when his son had taken the initiative to sign the 1956 Consent Decree, the senior Watson handed over control of the company and Tom Junior became chief executive. Two major steps marked his first few years. He eliminated hourly rates, at the suggestion of then vp of personnel, Jack Bricker. This made every IBM employee salaried, thus eliminating some of the differences between blue and white collars at least a decade before most companies considered the issue important. And he held the famous three-day "Williamsburg meeting" to reorganize IBM after more than 40 years of centralized control by a single leader.



"Williamsburg wasn't really as big a reorganization as it sounds," Watson says today. "My father hated to have people rigidly structured in a line, and we still try to avoid this. In his day we had this informal method of working, with no organization chart except showing how people related to him. We had departments and we had organizations, but they weren't really formalized. At Williamsburg we made the first steps toward divisionalizing the business. We set up a separate typewriter division, a dp division, a military products division. Since then there have been others, so the company organization has become a constantly evolving thing. The real importance of Williamsburg relative to today is that we began to be a readily reorganizable company there, and we have continued to be reorganizable from that day to this."

Why Frank Cary?

This month Tom Watson, Jr. officially ceases to be an employee of IBM, though he continues as chairman of the Executive Committee. "That is not a great responsibility because anything that comes up in the executive committee perforce has to have been pretty well coordinated by the chief executive officer," he points out. I asked how Frank Cary had been selected to succeed to the chairman's responsibilities. Watson described the classic problem that most companies face—a congenial group of top executives who are close in age. In about 1968 he saw the likelihood that IBM would have the usual "pile-up," with quite a few men who would be chief executive for two or three years before they retired. This would have been difficult for a company so uniquely focused on a single family and its beliefs. Tom Junior proposed to the top executives that they consider retirement at 60 instead of 65, to avoid this problem. This meant Learson would go in 1973, Watson in '74, and that Cary—already identified as successor by then—would be chairman for about eight years. Except that Watson's 1970 heart attack interjected a very useful 18-month Learson era, things have gone according to plan.

Cary's selection was a foregone conclusion inside, even though he was nearly invisible outside, in good IBM fashion. His name first came to the fore in the late '50s when IBM's president Al Williams decided the company needed to develop some "deep thinkers" in the sales-oriented company. A look at the personnel records brought Cary in with a number of other people. He was sent to Chicago as a manager, then to San Francisco, and then he came back to New York to a number of executive jobs.

"Frank's management style is a good deal different from anything we have had in IBM," says Watson. "I think it is happening at exactly the time the company really needs it. He assigns fairly specific responsibilities to people. He wants to see them do those jobs that are assigned before they get over into someone else's cornfield. I think Frank is willing to do a good deal more 'homework' than any of the rest of us used to do. Thus, when he makes his decision, he has a lot of color. He has a terrific sense of humor. He's excellent at chairing meetings and keeping things lively."

Watson gives much of the credit for

IBM's technological progress to Al Williams, who wanted the company to look ahead into research & development. "This is pretty fundamental," says Watson. "In the early days, way back, Al came into my office one day and said, 'You know, most well-run companies in high technology spend 7-8% on R&D, and we are only spending 3%. I'm no scientist, but that doesn't make sense to me.' So we began to push more money and effort into R&D until we reached a relatively high percentage. We had not gone very far along the line of product development when it became obvious that we'd better be working on basic things like the structures of metals, crystals, and so forth. This grew too. So when Dad died, it was a very logical thing to have the lovely lab Bero Saarinen designed in Yorktown Heights named after him. It's one-third of a circle, faced with that darkened lead glass that doesn't let in too much light, and fieldstone walls—a great building."

The Thomas J. Watson Research Center is a symbol of the company's efforts in pure research. Underlying the R&D budget, though, is an invisible education budget to keep IBM people up-to-date on the products they already have. In a company where so many of the top managers have come out of sales, top management education can be crucial.

Watson tells the story of Fred Brooks (now professor of computer science at the Univ. of North Carolina), who undertook to educate IBM's top management on software. "We had started to develop a new line of computers and a lot of people were working on it," says Watson, "but there was a smaller group which said that if we could take a completely new language and a completely new set of software we could really produce something tremendous. Brooks, an unusual kind of guy, was one of the great advocates of that approach. At that point, the money was going out faster and faster, the expenses were getting higher and higher. I said, 'You know, the top management team is making profound decisions about programming and software, but what do we really know about it?' We had varied levels of understanding among ourselves, but the average wouldn't have equalled 10% of what we ought to know. So Brooks took us all off to my house in Stowe for a week. We'd ski part of the day and he'd instruct us the rest of the time. By the end of the week we all understood software and could see what a fundamental change in the machine line meant to a customer."

New software concepts?

In discussing the future, Watson said, "Thinking about data processing, you can see that the software concept now being used is 10 or 12 years old. We are in a very rapidly moving area from the hardware point of view. One could speculate that it will soon be time to move ahead again in software, too. Now, when we'll do that, or *if* we'll ever do that, I don't know.

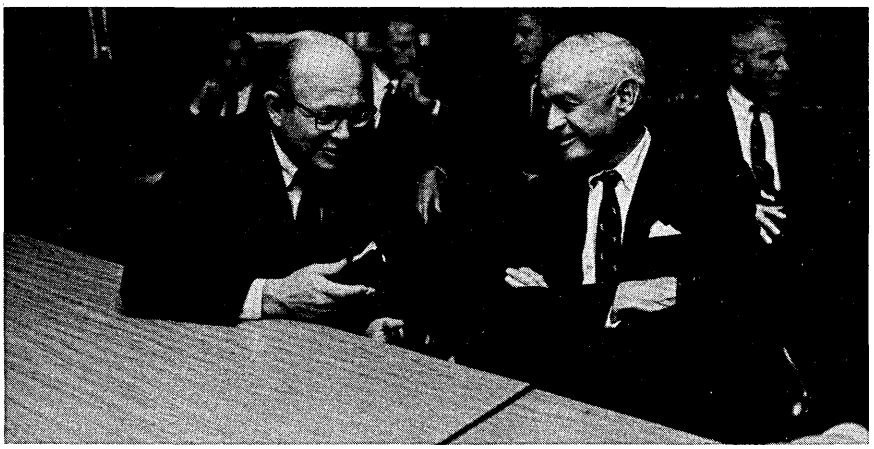
"The thing I'm thinking about is not so much how you take stuff into the machine, and put it out, but something else—how rapidly you go to PL/1, or whether somebody has a PL/2 that is better than a PL/1. If you produce a software language that will give your present machines internal function that is two or three times faster, then you can think of literally hundreds of millions of dollars in conversion costs that customers can amortize in two or three years. If you fit that kind of thing with a whole new electronic arrangement of the inside of a machine, you get a very exciting step forward. And people say this industry is really still in its infancy!"

The exciting part of the business, in Watson's view, is applications. He looks back to the '50s when computerized airline reservations were unheard of. "In 1956 we started talking about airline reservations in the jet age. At that time there were relatively few people riding the airlines, but we looked ahead and thought that pretty soon there would be so many that while one person would want to go from Chicago to Cleveland, somebody else would want to go from Cleveland to Los Angeles, and nobody would know whether that Chicago-Cleveland seat was going to be occupied to Los Angeles and if so, by whom. It was an idea that called for huge memory combined with a very efficient computer. Around that time, C. R. Smith of American Airlines said they'd put up people if we'd put up some people, and all they wanted out of it was to be first. So we developed Sabre. And it worked. When Sabre came out, they had three or four years lead time on anybody else. We gained lead time too, and today most airlines use Sabre-type systems.

"Now we're working on this supermarket checkout system. It's going like hotcakes right now. I remember in 1947 when a man about 82 years old showed us a system of this type. He'd spent his whole life on it, but he had done it on a mechanical basis. He had developed it to the point where these cans were all racked up, and they rattled out of bins into the customer's hands and were automatically bagged. He was an old cash register man. My dad took me up with Al Williams to an apartment near Central Park to see this thing. We were going home in a taxi when Dad said, 'What do you think of it, boys?' Nobody said much; we didn't know whether *he* liked it or not. Finally, Williams said, 'It's a tragedy.' And Dad said, 'It certainly is. There's a man who spent the better part of his life on that thing, and he's had all his friends invest in it. But he is ahead of his time, because the mechanical approach to that sort of thing will never work.' Well, that was in '47, and 26 years later that guy's concept is now working through electronics."

Tom Watson, Jr. saves his greatest enthusiasm for medical applications. "The whole idea of patient care is exciting. You could quadruple IBM if you could really hook the patient onto a computer the right way, and have a good doctor in the middle."

As one retirement project, Watson intends to take his boat and explore first Greenland, then retrace Captain Cook's voyages. I asked if he would see IBM people along the way. "As a non-employee, I would still feel very



TOM WATSON JUNIOR with IBM chairman Frank Cary: "Frank's management style is a good deal different from anything we have had in IBM."

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happy to ask people at IBM-Fiji to help me get some water or fresh meat, or just to say hello," he said cheerfully. "When you grow up in a company as long as I have, you don't cut all your connections when you leave. I certainly feel as though all these guys are still my friends, and I intend to see them whenever I can. But most of my trips in the past have been marked by this conscious feeling that I should be calling on an IBM office, or that I should be doing something for the company. It will be wonderful this way."

Training

Nowhere to Somewhere After Five Years

Martin Garcia enjoys teaching kids who want to learn and that's what he's doing. He's teaching RPG, BAL, and COBOL to juniors and seniors from 33 different high schools at the Southern California Regional Occupational Center, a part of a Los Angeles City Schools' program to provide high school students with occupations before they graduate.

Five years ago Garcia, 44, didn't know anything about computers. Nor did Herb Lyons, 27, then a salesman in a men's clothing store and now a programmer analyst for Western Airlines; nor did Oliver Martin, 43, then a body and fender man and now a systems programmer for American Data Centers, Huntington Park, Calif.

All three are products of Los Angeles' Urban League Training Center which last month completed its fifth year of training unemployed and underemployed minorities in computer programming, computer operations and keypunch operations, having trained 785 students and placed 96% of the 662 graduates available for employment. ULTC was founded in 1968 as a joint effort of the Los Angeles Urban League, Bank of America, and IBM. The bank provides the building and upkeep and IBM provides equipment and instructors. The center was the first of its kind to be operated by an Urban League and has served as a model for a second opened in New York City last year and others soon to come, according to Ernie Barrios, center manager.

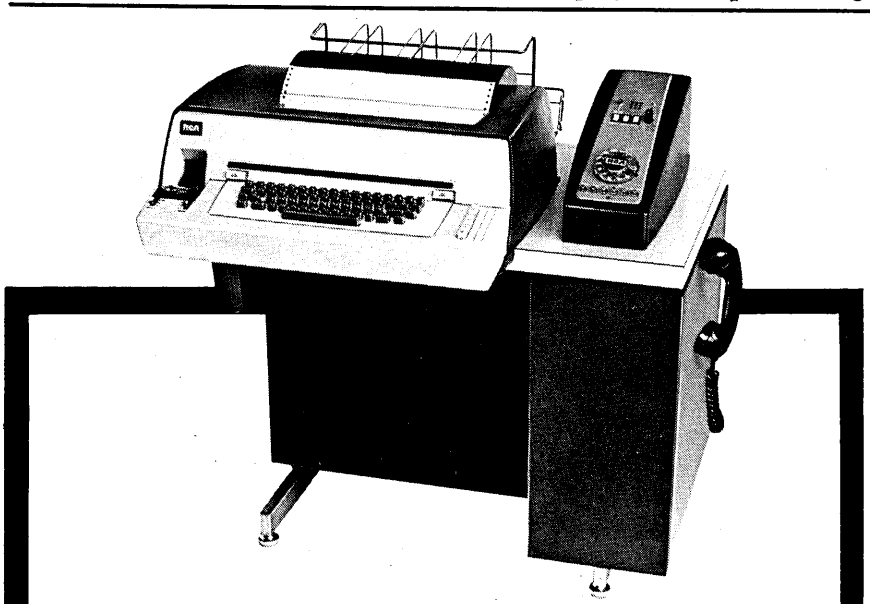
Garcia was working with unit record equipment at Firestone Corp. when he learned of the center. "I wasn't getting anywhere and Firestone was converting to computer. Since I was the last one hired I would have been the first one departing." He applied to the center and was accepted in its first programming class, continuing his employment at Firestone while he learned. "They let me come in late."

The older guys went

On the quality of the training at the center, Garcia has one word, "fantastic." Firestone's computer was delivered while he was still taking his course and he used to work on it alone at night. By the time the computer was in full operation, Garcia had been "brought up to computer level and they let some of the older guys go."

Following his graduation, Garcia would go back to the center from time to time to help teach. Then center director, John Adams, aware of Garcia's love for teaching, recommended him for his present job. "It's beautiful," he said, "seeing these kids go out and get jobs at 18."

Like Garcia, Lyons felt he was getting nowhere when he was selling men's clothing five years ago. "Then one day a customer came in and we got to talking about his charge account or something and I found out he was an instructor at Control Data Institute in computer programming. I found out from him that the mystery I had



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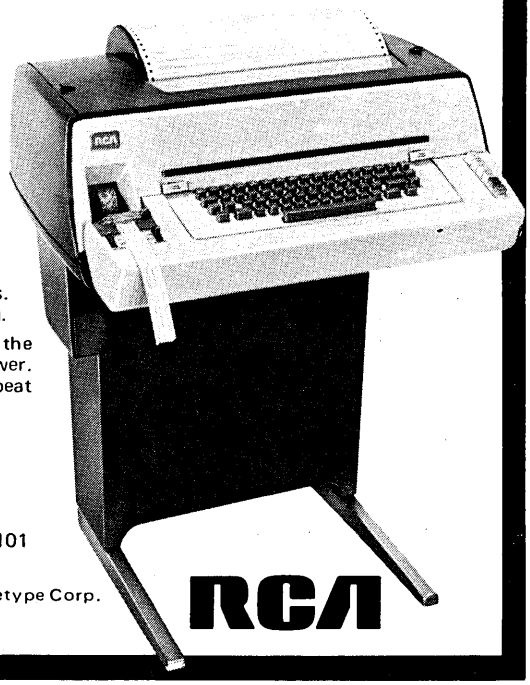

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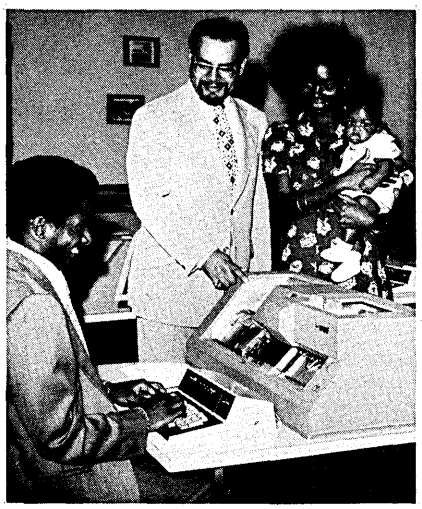
thought surrounded programming just wasn't there. He told me I could go to CDI and take a couple of tests and maybe get on their scholarship program."

Lyons looked at programming then as a means to an end, a way he could get a degree by getting a night job with short hours and good pay. He went to CDI and took the tests. On the first one he got an "A." The second one, he



Ernie Barrios, center, manager of the Los Angeles Urban League Training Center, checks keypunch performance of Howard Jackson, 18, a member of the center's fifth anniversary graduating class, as Donna Jackson, 21, also a graduate, looks on. Donna's daughter was less interested.

flunked. "This was fractions and square roots and things I didn't remember from school.

"They told me I was eligible to attend the school but I would have to pay. I couldn't." But he was aroused enough to keep looking around. A girlfriend told him about the Urban League.

Quality stuff

"At first I was negative about it but when I had taken their tests and had seen their building and observed their procedures, I decided this was quality stuff."

Where he originally had thought of data processing as a tool, after one week of involvement he had become hooked. "The first week was the longest. At the end of it we'd turn to each other and think 'have I only known you for a week?' At the end you felt like you'd just begun."

Lyons feels the center changed a lot of things for him, gave him things in addition to the training like "teaching me to stick to it to the end."

He's still determined to get his degree but he's doing it slowly, at night. "This is a prime shift job." And dp is definitely a part of his future though he's not sure in what form. "Maybe I'll combine my sales background with dp and go to work for a computer manufacturer."

Martin is where he wants to be right now—as a systems programmer for American Data Centers, the data center for American Drill Bushing. He was graduated in one of the center's first operator courses after which he joined Informatics' data center, moving from trainee operator to lead operator in one year. Then he trained as a programmer and in this capacity joined Donald L. Bren Co., a home building firm, moving to American Data Centers last February.

Since leaving the center, Martin has completed five UCLA extension courses in data processing. "You can never learn all there is to know about dp." Does he miss body and fender work? Not a bit. "In one year I knew all there was to know about body and fender work. Now I've even sold my tools to avoid being asked to do work as a favor."

How do their employers rate Martin, Lyons, and Garcia? Tops in all three cases. Barrios notes that most of the more than 250 companies which have hired center graduates have come back to the well more than once.

And there were prospective employers present late last year when the center graduated its 86th class in a special fifth anniversary graduation ceremony. Also on hand was Los Angeles City Councilman Billy G. Mills, who delivered the keynote address and presented the center with a resolution by the Council commending the Urban League, Bank of America, and IBM for "establishing and continuing ULTC's outstanding minority training and placement program."

International

Munich 73: Where The Yanks Were Dominant

In heavy snows and freezing temperatures, some 9,000 persons showed up the last week of November at Systems 73, the biannual Munich data processing conference and exhibit. There they saw much the same collection of peripherals, terminals, minicomputers, and data entry systems that have been gracing (disgracing?) American shows the past couple of years. None of the big boys (mainframers), European or American, showed up.

If Japan is serious about invading the European computer market, they're disguising it real well; only four minor manufacturers appeared.

There were more than 200 exhibitors from 14 countries in 90 or so booths, but 51 of those were taken by U.S. firms. But that doesn't count European subsidiaries or representatives of American companies, and so doesn't reflect the true dominance of the show by the Yanks.

Over 2,000 signed up for the program, which included a one and a half-day "Basic Seminar" that covered a wide range of topics, including "The automation of edp organization and programming." Other subjects: source data capture and output at the point of decision, automating the computer center, and internal (edp) accounting. A half-day Services Seminar paved the way for two days of vertical industry-oriented sessions.

End of the road

For 25 of the American exhibitors, the Munich affair was the final stop in a five-week road show that offered exhibits and seminars in four European cities the month before.

Sponsored by DATAMATION, with the cooperation of the U.S. Dept. of Commerce, the Grand Tour attracted some 4,500 people in London, Stockholm, Paris, and Milan. Seminars, organized under the direction of former DATAMATION editor Bob Forest, were virtually SRO all along the way.

One of the Grand Tour exhibitors reportedly sold out his company's European production quota for 1974, and sent a man back home halfway through the trip to see if that figure could not be increased. For others, the Tour was a chance for maximum marketing exposure, in the maximum number of countries, in the shortest possible time.

It was also a chance to learn more about the European market. Ted Lessley, general manager of Lockheed-Sait Electronics, found a much higher regard for American technology and leadership than he had expected.

But he also feels that the European technology is advancing swiftly. And, he says, "They're not copying, but developing their own technologies." That, coupled with what he feels is a growing entrepreneurial spirit in Europe, means that the Europeans will be strong competitors. Says Lessley, "The Americans had better get over here, learn

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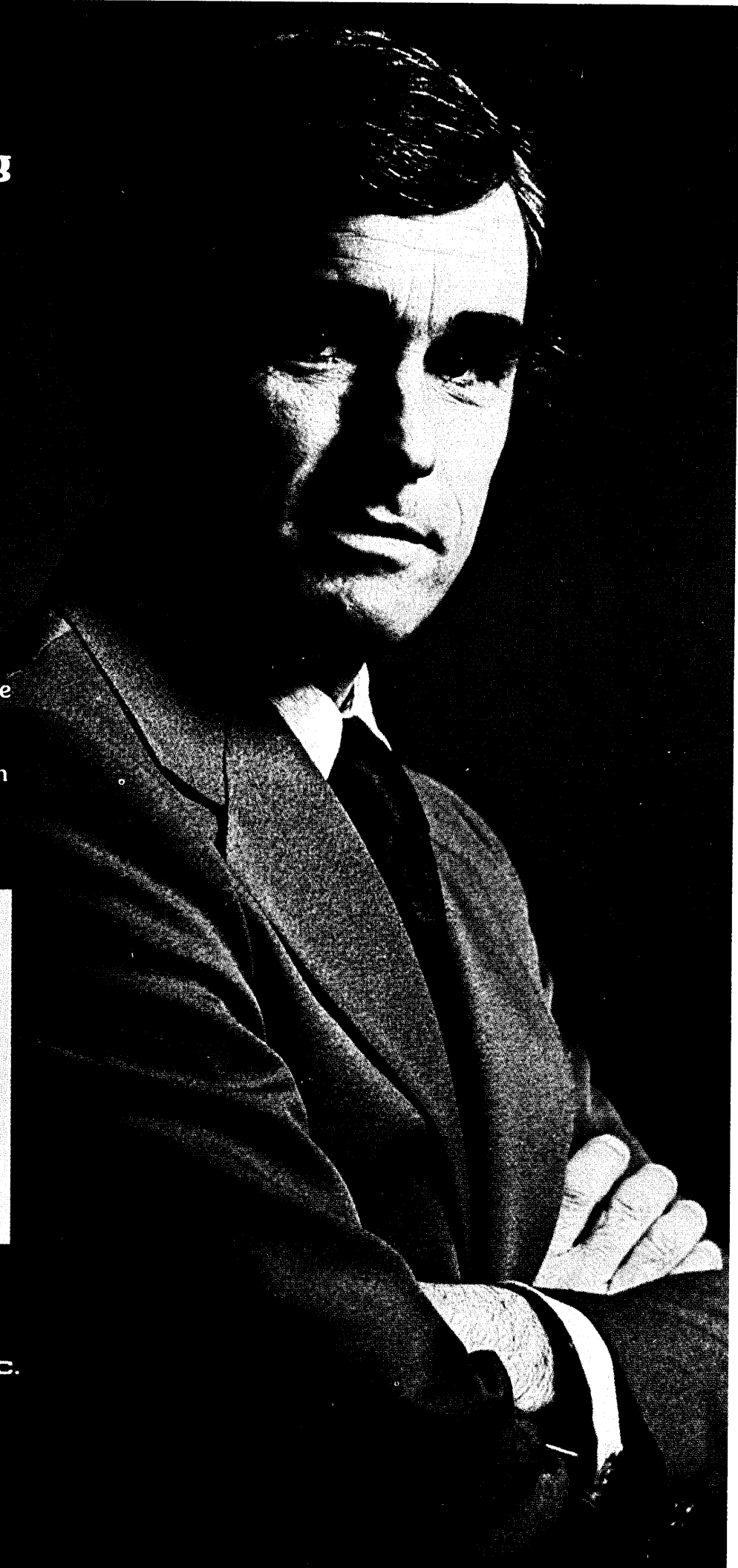

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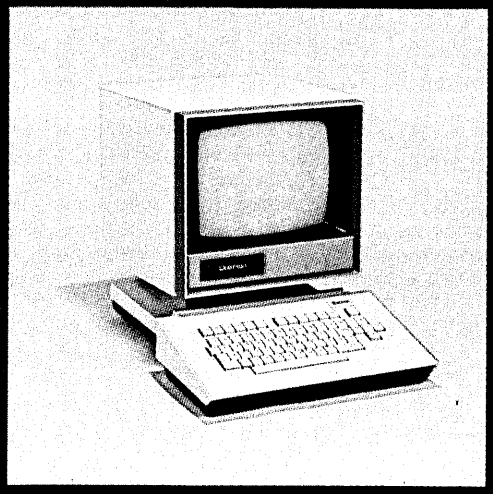

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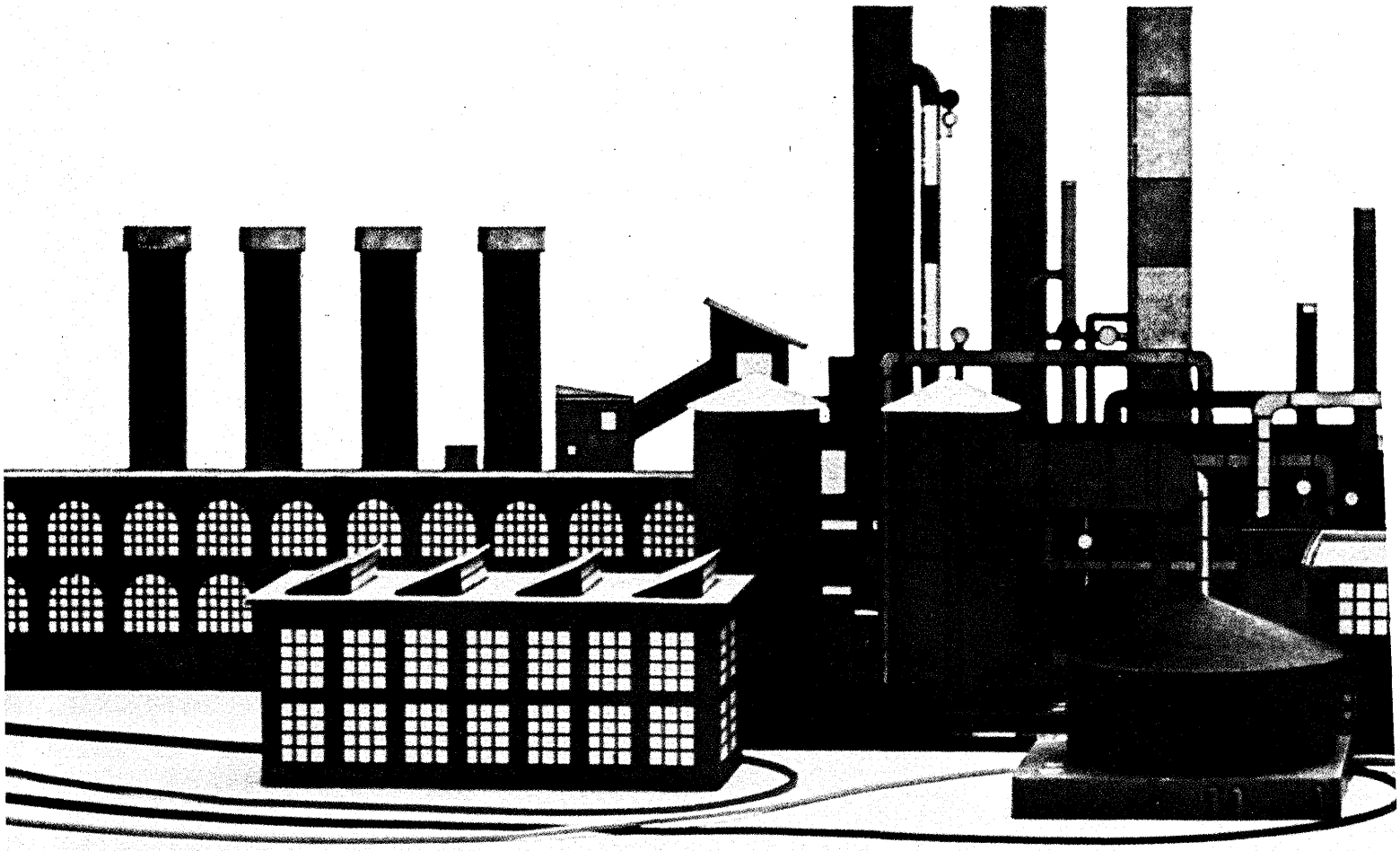

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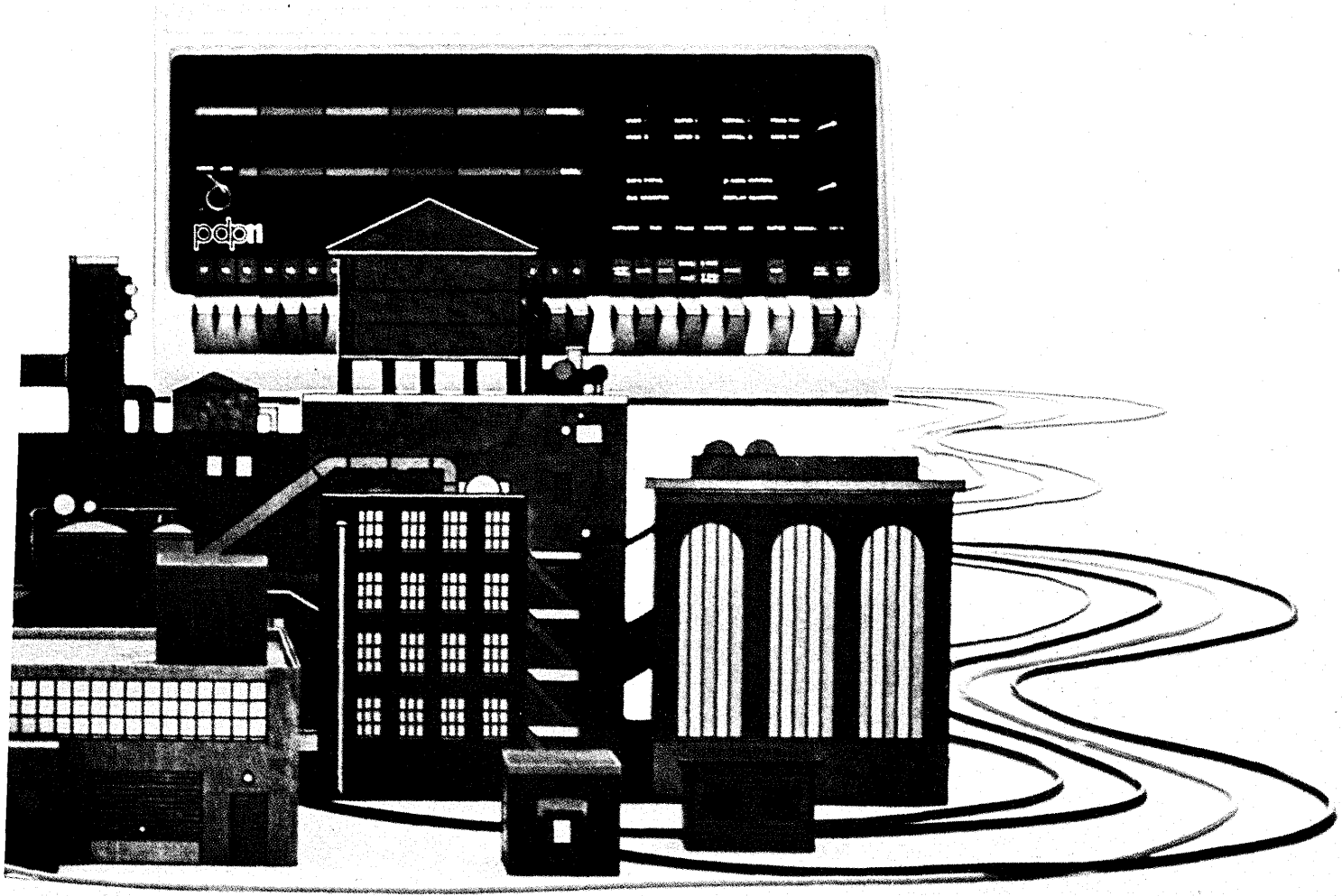
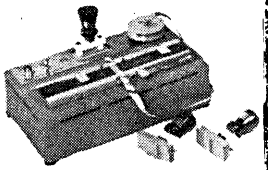


CIRCLE 27 ON READER CARD

SPLICERS



Model 501 PM Heat Seal Splicer is the best tape splicer on the market. Splices any level paper tape oiled or unoiled as well as mylar control tapes for less than a penny per splice.

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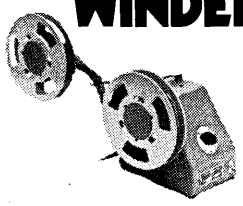

Variety of motorized winder and rewinder devices for unattended tape handling.

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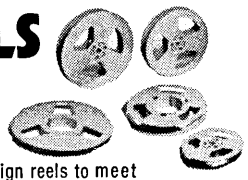

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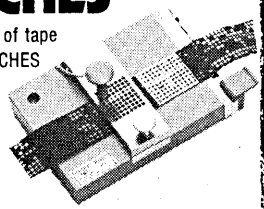

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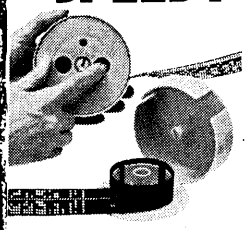

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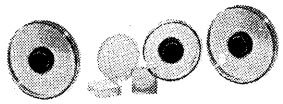

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how to sell, to operate over here so that they're truly international."

Lessley also thinks that the successful European companies will grow, expand, and invade the U.S. . . . successfully. He points out that for most of them, English is a second or third language. Because of this—and because Americans have fewer prejudices against foreigners—he thinks such firms will be one step ahead of U.S. firms invading the Continent.

In Europe, however, Americans have an advantage over some of their European competitors, who may seem even more foreign in a country other than their own than the Americans, who are more mobile. But, says Lessley, "We had better exploit this advantage while we have the opportunity."

How to Build a Computer Industry: Is the Issue as Critical as Oil?

The first cruel signs of winter followed the bitter political winds out of the Middle East into Western Europe last month as the European Economic Community sought accord on a reaction to the oil shortage.

With somewhat less urgency, the Common Market was at the same time trying to work toward a common data processing policy that would help its computer industry in its battle for survival against the Americans in general and IBM in particular.

Urging such a policy is a document issued Nov. 21 by the Commission of European Communities. Called "Community Policy on Data Processing," it cautiously suggests the EEC Council consider further steps toward creating a truly European computer industry.

The essence of the report is a two-page, 10-paragraph draft of a Council resolution on an edp policy for the Common Market. It makes five major points.

If adopted, the resolution will agree in principle that (1) the Community will "undertake and finance a limited number of major joint development projects of international character in the field of applications . . . ." It promises (2) "a community orientation to policies for encouraging and promoting data-processing (sic), in particular by collaborating in procurement policy, standards and applications and notes the Commission's intention of arranging progressively the most appropriate procedures for realising these objectives . . . ."

The draft resolution also recognizes (3) "the desirability of a systematic Community programme for the industrial development and application of data processing, once the evolution of the industrial sector permits, with the central aim of establishing, by early 1980's, a strong and viable european (sic) based industry . . . ."

In the meantime, the draft hopefully (if vaguely) promises (4) that the Council "will take decisions" on specific Commission proposals "for common financial support for key collaborative industrial developments . . . ."

The final point of the draft says (5) that the Commission ("after appropriate consultations") will present "first detailed programme proposals" on actions suggested in the first, second and fourth items during 1974. It presumes that the Council will make some decisions on these matters by the end of that year. And it offers a Commission progress report on the Community's edp sector by the end of 1975.

Surrounding this terse draft policy are three supporting documents. One is a reasonable 15-plus-page discussion of the nature of the Community's computer industry problem with suggested remedies. The problem is simply stated: "Over 90% of the computers installed in Europe are based on American technology. Some 60% of the . . . European market is held by a single dominant firm based outside Europe (IBM)." Who would have guessed?

Background data offered in an appendix indicates that U.S. computer firms control 88.5% of the world market, as measured in terms of the value of installed equipment. Europe's share is a measly 6.5%.

Wanted: competition

The premise underlying the resolution is that the Commission has a duty ". . . in accordance with its obligations under Article 86 of the Treaty establishing the European Economic Community" to be ". . . vigilant to ensure that there is no abuse of such a dominant position" (as that enjoyed by IBM). But the introduction makes the sensible point that the most effective guarantee of "good behaviour" is "the existence of strong and viable competitors."

The remedies, for the most part, consist of vaguely-defined cooperative projects aimed at the development of a rationalized European industry (including peripherals and software in addition to mainframes), and the promotion of

For MacMillan CIRCLE 14 on READER CARD

the effective use of edp.

The report suggests that the traditional national support of national firms is not enough. Indeed, it says that national procurement policies (offering the inside track on government contracts to national firms) infringe the Treaty of Rome (1957) that established the Common Market and its goal of free exchange of products across political borders. This "weapon," adds the report, may also increase costs to users and inhibits the development of a truly European industry.

The Commission suggests the need to move toward "close collaboration at Community level in procurement." In addition, there is the hint that the Unidata joint venture by Philips, Siemens, and CII is only a beginning step in the right direction. Between the lines, it appears, the Commission wants to see Europe's "two groups" (Unidata and ICL) get together.

A member of the team that prepared the report indicated that American firms are not excluded from taking part in the new European force the Commission evidently seeks to encourage. But the report hints that something bigger than Unidata is necessary before the Community computer flagship can approach American firms with the hope of a partnership based on "real equilibrium," as opposed to "open or disguised absorption of the American firm."

This fear of a minority position in a partnership involving U.S. firms is undoubtedly inhibiting discussions with companies such as Honeywell-Bull and Control Data. The Europeans have seen their companies swallowed by Americans before.

Joint action urged

The resolution goes on to say that the Community may have to pool research, production, and marketing for "certain 'near-in' peripherals" (such as disc and tape drives), and suggests the wisdom of joint R&D in semiconductor technology and, more importantly, in memory technology. The software industry gets a plug with emphasis on the development of transferable programs that can free the user from slavery. Development contracts are suggested for "bridgeware" (any dentists out there?), as are international projects for applications that cross national boundaries.

Cooperative action is urged now on data banks, data communications and industrial applications. Supportive "complementary measures" are recommended for standardization (hooray), leasing, education, and basic research.

The Commission now awaits the approval of its draft policy by the Council of the EEC, which has bigger and more urgent issues facing it. In the meantime, however, Council technical subcommittee members will review it and discuss it with Commission personnel and with members of the edp policy/planning organizations of the member nations.

The report is delicately worded, but that's what it *seems* to want to say. Whether it will have any effect is hard to tell. ICL is stubbornly opposed to Unidata's IBM-compatible approach and thinks, with typical British smugness, that it can go it alone. Remember World War II? The French, meanwhile, want control of their own edp industry, and are unlikely to submit to a watering-down of their current position within Unidata.

If the top-level political leaders of the Common Market nations take the report seriously and knock their technology leaders over their heads, the report may have some effect. But unless they see computing as being as important as oil, it is unlikely.

—Robert B. Forest

(Continued on page 102)

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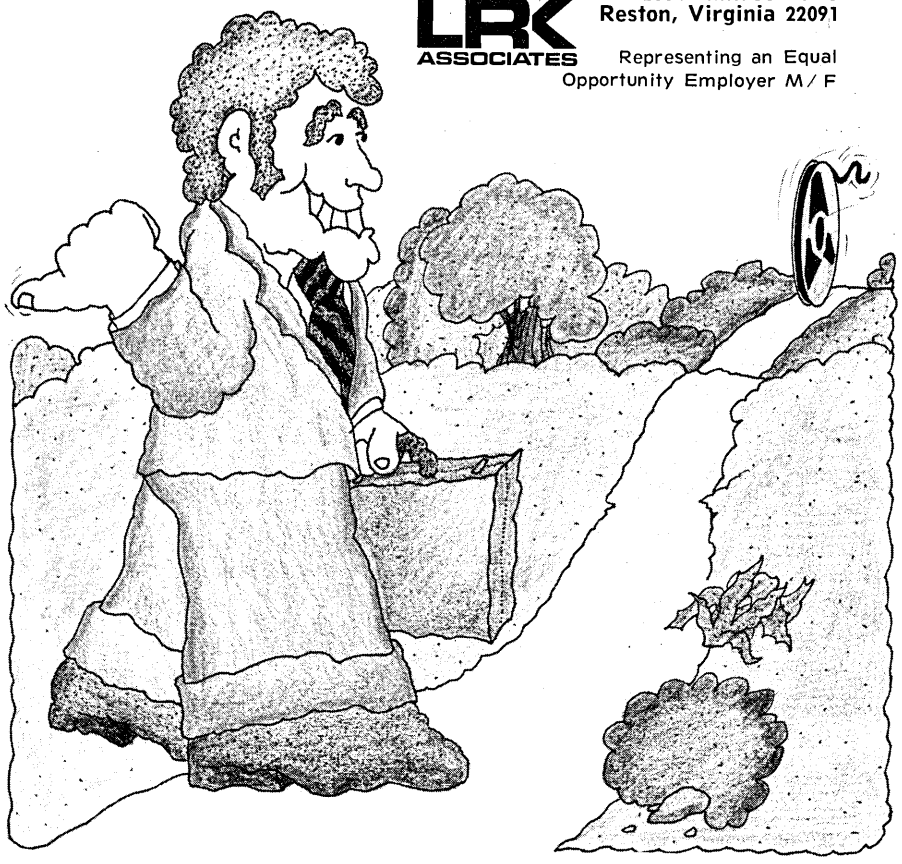

CIRCLE 93 ON READER CARD

Benchmarks

From the Atmosphere in Real-Time—Almost: When NASA's Atmosphere Explorer-C was launched in mid-December, and placed in orbit in the lowest region of the outer atmosphere in which a satellite can fly (about 75 miles up), scientists at 11 universities were ready to receive and work with data collected by the laboratory in the sky on an interactive basis with each other and the spacecraft. For the first time in such a scientific study, ground teams are getting measurements in space in hours instead of days or even weeks, and can direct the spacecraft to take certain measurements or perform certain maneuvers that would be helpful *in* their work *as* they work. Data from the craft is recorded on tape and periodically played back and fed to a Xerox Sigma 5 which acts as an input processor to a Sigma 9 at Goddard Space Flight Center in Greenbelt, Md. The Sigma 9 is connected to the scientists' remote site terminals through a Sigma 3 communications processor. Data collected by Atmosphere Explorer-C is expected to be of value in the study of global weather and ecological balance.

There Goes the Budget: IBM customers, in the midst of getting the new year's budgets approved, were given some hasty last-minute arithmetic to do Nov. 26 when the company announced a 2% price increase on most equipment and a 10% boost in SE services and maintenance. There were guesses that the price increase, which received the Cost of Living Council's blessing, might cost users $90-100 million extra this year. There were no comments from other mainframers, but CDC is known to be testing the winds for a huge increase in the software it will unbundle with its new line this year, followed by a commensurate decrease in hardware prices. Ampex Corp. coincidentally selected the same day as IBM to announce price increases of 12-15% on tape drives it sells to the oem market.

Up the Ladder: Burroughs Corp. stepped up its top executives and enlarged its executive office. Ray W. Macdonald, president and chief executive officer since 1966, became chairman of the board and chief executive officer. Paul S. Mirabito, formerly executive vp, is now president and chief operating officer. James A. McCullough was named executive vp, planning; Ben L. Rouse, executive vp, marketing operations; and Charles E. Exley, Jr., executive vp, finance. Macdonald said the executive office expansion is a reflection of corporate growth, and noted that "during the past five years our revenue has nearly doubled from $554 million to well over $1 billion, and our expectations are for continued strong growth."

"More Meaningful Efforts for COM": The National Microfilm Assn. and the Users of Automatic Information Display Equipment (UAIDE) were close to merger when more than half of NMA's 5,200 voting members, in response to a mail poll, approved the merger within 10 working days. A formal vote will be taken Jan. 15, just prior to the Jan. 16-18 NMA mid-winter meeting in Houston. Formal papers requesting state approval will then be filed with the states of Michigan and California, where NMA and UAIDE are incorporated respectively. Said UAIDE president, Mel Rice, of the merger: "There is no question but the consolidation will result in more meaningful efforts for COM (computer output microfilm). This will directionalize activities and offer an obvious podium from which to address the events of the day in COM." □

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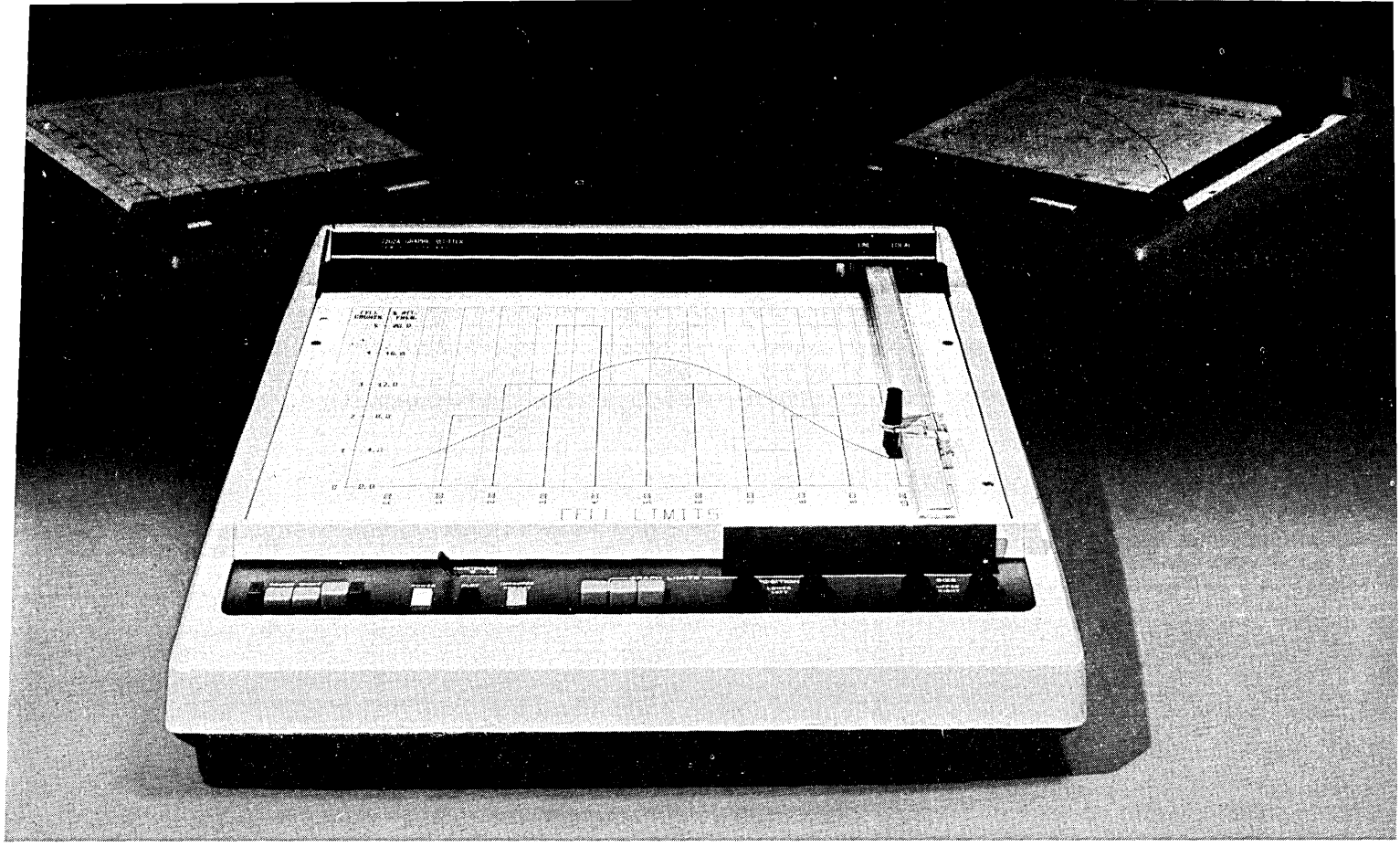

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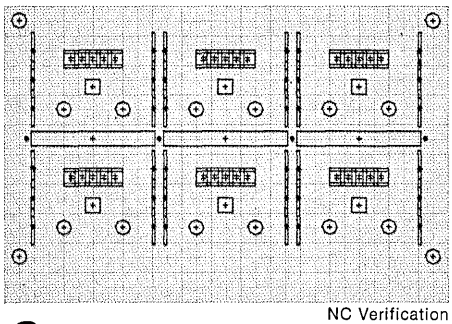

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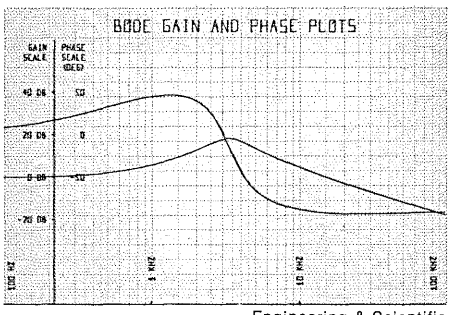

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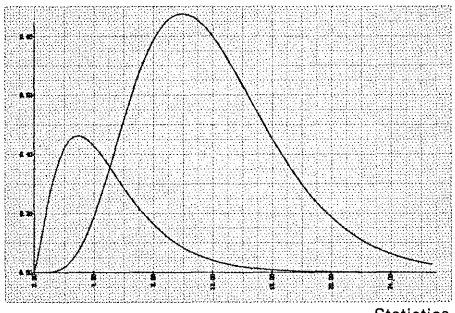

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CIRCLE 12 ON READER CARD

Hardware

Off-line

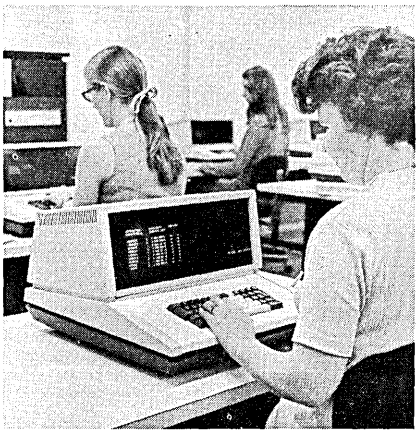
Try this little mental exercise. Imagine an acre of area. Divide it into a trillion equal parts. (No fudging.) Multiply the size of one of those parts by 4,000. The result, 4,000 pico-acres, is how the public relations men at General Automation try to convey exactly how small their new processor-on-a-chip--featured elsewhere in this section--actually is. Since the processor is three-dimensional, it might have given a more accurate--and much clearer--impression of the size to say how many of the S.O.S. technology chips can fit in a cubic light-year of space.

The magnetic stripe is still the best method available for encoding machine-readable cards according to a reassessment report supplied by a standardization task force of the American Bankers Association. The three essential criteria the ABA feels only the magnetic stripe meets include: technology in the public domain; sufficient data capacity; and the ability for the technology to be used by any card issuer, inside or outside of the banking industry. Similarly, the European banking community will buy more than $10 billion worth of computer equipment to support rapid trends toward paperless banking and on-line operations says New York City-based Frost & Sullivan in a study, "Mechanization and Data Processing for European Banking."

We weren't kidding last year when we said it was just possible suppliers of computers by the end of this century might include firms such as Kodak or Polaroid or others familiar with the film technologies needed for holographic memories. We may even have guessed one of the firms correctly, as the Eastman Kodak Company has been looking into cobalt spinel compounds that have theoretical bit packing densities up to 625 million bits per square inch. The high signal-to-noise ratios promised by the new materials is more than offset by the disadvantage that they must be operated at temperatures near -165°F in order to work well.

Key-to-disc

The designers of the 2250/2 key-to-disc system operated under the premise that the cost of detecting and correcting data errors at the time of data entry will probably always be a small fraction of what it costs in terms of both time and money once the input reaches the central computer for processing. For that reason the system has been equipped with much of the COBOL language, including nearly 40 procedure language verbs. The 2250/2 is



aimed at medium- to large-scale installations that can assign COBOL programmers (and perhaps even a data entry analyst) to writing more exacting input preparation check programs.

The standalone system will support up to 32 crt key stations that display six 80-character lines. Scan-Data still believes it's practical to combine the processing power of a key-entry system to handle OCR input, and for that reason, an OCR reader is offered as an option for the system. The vendor knows that the sophisticated applications that will be undertaken with such a powerful system are bound to lead to some customer problems and claim a programmer/analyst has been trained to support every salesman. An eight-station configuration rents for $1,985/month on a three-year lease including maintenance. SCAN-DATA CORP., Norristown, Pa.

FOR DATA CIRCLE 330 ON READER CARD

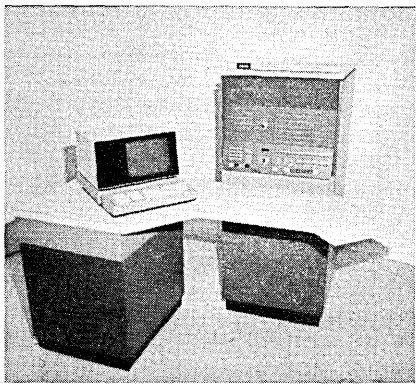
Mini-to-keypunch Interface

Small-scale dp users often wonder where they can locate an interface for hooking a keypunch up to a minicomputer. This company is now offering one, called the CP-100. What this allows a user to do, of course, is use the keypunch both as an input and an output device, substituting for a card punch. The 100 hooks to IBM 026 and 029 punches, and although it hasn't been tried yet, the vendors don't see any reason why it couldn't hook to the IBM 129 or the Univac 1710, too. Versions of the interface exist or are in development for many popular minis, including the DEC and Data General lines, Varian, Hewlett-Packard, and Digital Computer Controls. The $1,975 price seems high, but is probably cheaper than buying a card punch. COMPUTER EQUIPMENT CORP., Rockville, Md.

FOR DATA CIRCLE 321 ON READER CARD

1130 Competitor

This firm has been in business many years supplying various peripherals to users of the IBM 1130, and has had lots of time to think about what a replacement cpu should look like. For starters, it's claimed that *all* 1130 software, including monitors, customer programs, engineering diagnostic programs, and cold start cards, will run on the 2130 without alteration. And according to early benchmark tests, the software will run from four to five times faster than the equivalent 1130 configuration. The reason behind the performance improvement is the fact that the 2130 does not use control stores to emulate 1130 operation, but relies instead on 800-nsec cycle time hardware for direct instruction execution. Extended cycles are required only for shifts over four bit positions and multiply/divide operations. In features such as indirect addressing and index registers, however, the 2130 is a superset of the 1130, featuring a second



level of indirect addressing in the instruction format, and double the number of accessible registers: six.

Numerous peripherals are offered for the 2130, but if you're just looking for a more powerful cpu, a 16K 2130 sells for $30K or rents for $1K/month on a two-year contract. A complete system with 2314-type disc pack storage and 600-lpm printer sells for $75K and rents for $2,500/month, also on a

two-year lease. Deliveries are currently being quoted as no earlier than June. COMPUTER HARDWARE, INC., Sacramento, Calif.

FOR DATA CIRCLE 320 ON READER CARD

Microfilm Terminal

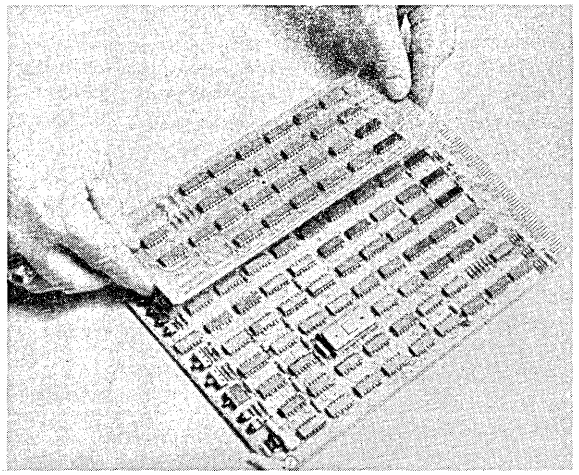
The Automatic Information Display System (AIDS) consists of a microfilm storage/retrieval mechanism that uses 16mm cassettes, an 8½ x 11-inch display screen, an Intel 8008 microprocessor controller, and an input keyboard. The system can operate either by itself or receive microfilm frame addresses from a remote computer through its RS232C interface.

In operation, AIDS can be manually instructed to go to a specific frame number within a cassette, each of which holds 4,000 frames. If the application is cataloging or inventory, the microprocessor calculates where successive frames are stored, and even locks out the keyboard during searches so that false commands cannot be entered. The first marketing thrust for the system will be in medical patient data history capture and review. Complete systems will be priced something under $3K, with a number of auxiliary devices such as acoustic couplers/modems, digital tape cassettes, and teleprinters optional. MIRATEK, INC., Fort Collins, Colo.

FOR DATA CIRCLE 327 ON READER CARD

(Continued on page 106)

product spotlight



Microcomputer

A technology that has been used in aerospace and military applications for the last decade is the basis for a product that appears to be a significant price and performance breakthrough in computing resources. Silicon-on-sapphire circuit technology was chosen over MOS by General Automation for its LSI-12/16 microcomputer because it allowed them to put the entire processor on a single silicon chip. This has the advantage of reducing pin connections, contributing toward reliability, and increasing the speed since signal paths are shorter. Since signals need not be driven as far as in multi-chip cpu's, the power consumption also comes down. And sos has the added advantage of being compatible with TTL logic forms, making it easier for GA to make the new microcomputer compatible with its prior product offerings.

The LSI-12/16 is an eight-bit mini with a cycle time of 2.64 usec, yielding execution rates of 190,000 instructions/second. Contained on the first printed circuit board is the cpu (the large white chip in the photo), and 2K of semiconductor memory. An additional 2K of RAM or 8K of ROM or programmable ROM can be added via a piggyback board. Memory is expandable in increments of 1K, 2K, 4K, or 8K. The 12-bit addressing structure of the LSI-12/16 allows direct addressing of the first 4K bytes. Rounding out the cpu are 52 basic commands, a processor-controlled priority interrupt system, and a teletypewriter interface.

The new machine is available in two configurations: as a board-only system, packaged with memory, operator console and system operation features on a single 7¾-inch by 10-inch pc board; or packaged in a system enclosure with power supply, battery backup for the semiconductor memory, and card slots for additional I/O boards. Programming the LSI-12/16 is performed by cross-generation programs that run on GA's SPC-16 minicomputers. A conversational assembly program also is provided for assembling programs on any LSI-12/16 with 4K or more of memory. Pricing for the board-only configuration with 1K of RAM is good news, too: $635 each in orders of 100. Deliveries begin later this month. GENERAL AUTOMATION, INC., Anaheim, Calif.

FOR DATA CIRCLE 331 ON READER CARD □

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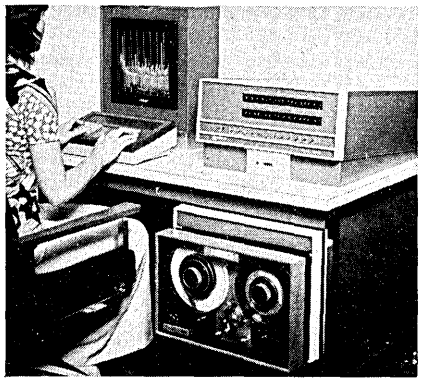
CIRCLE 90 ON READER CARD

hardware

Plasma Display System

The Plasma-graph is a very unusual, special-purpose graphics system that would typically be used in applications where digital information must be monitored or interpreted. Its controller receives binary information from a minicomputer and assigns it a brightness value ranging from 0-15 depending on its numerical value. The resulting patterns provide an analog representation of data content or meaning, while retaining the absolute value of each individual point. The writing takes place at 30K points per second,



equivalent to writing 10,800 characters on the 8½-inch square screen in approximately 10 seconds. Each single point can be individually written or erased. So far, the Plasma-graph has been used to display and analyze ionospheric data, but the developers think it could be used in many data analysis applications. For example, it could be used to check numerical data before having it digitized. The basic system and controller is priced at $10K, but options such as magnetic tape units, a hard copy unit, and a printer/plotter typically raise the price to $23K. DIGICOM, INC., North Chelmsford, Mass.

FOR DATA CIRCLE 332 ON READER CARD

370/145 Add-on Memory

The 370/STOR 145 semiconductor memory can be used to expand either of IBM's two 145 models up to two megabytes in size, thus providing improved virtual to real memory ratios, and allowing customers to implement more applications. Increments of the bipolar technology come in chunks of 48K, 128K, 256K, and 512K bytes. A reconfiguration switch is supplied that allows users to switch off-line any sector of memory where a multibit error has occurred so that system operation can continue. Pricing of the memory varies with quantity, its level in the system (which increment), and the amount of IBM resident memory. In general, it ranges from 60-90% of IBM's list price, depending upon purchase or length of lease. CAMBRIDGE MEMORIES, INC., Concord, Mass.

FOR DATA CIRCLE 326 ON READER CARD

Serial Printers

The 700 series of 100-cps serial printers features bidirectional operation for printing 7x9 dot-matrix characters from a 64-character ASCII repertoire. A 132-column buffer is loaded with the next line to be printed as soon as the current line is completed. The impact print head then moves to a position just beyond wherever the last character in the line is located, and prints it moving from right to left. The paper handling mechanism is a pinfeed tractor with adjustable sprocket spacing to accommodate forms ranging in width from 2¾ inches to 14⅞ inches.

The oem-oriented products exist in three states of completion. The basic 700 is void of electronics and consists of just the printer mechanism and all mechanical and electro-mechanical hardware. The 710 has the electronics but comes without the vertical forms control, while the 720 is complete. Price on the latter two models is approximately $2,600 depending on oem requirements, while the 700 goes for around $1K. TRIVEX, INC., Costa Mesa, Calif.

FOR DATA CIRCLE 325 ON READER CARD

Intelligent Terminal

The ADAM system consists of a Nova cpu with 16K bytes of memory, a 30-cps keyboard/printer workstation with dual forms control features, and a five-megabyte dual-cartridge disc unit. The fact that it sells for less than $32K seems impressive, especially considering that the price includes all systems software and customized software for most typical invoicing applications. It's the first product from a firm that has been involved in computing services for some time (and already had the application packages). If desired, the ADAM system can be equipped with additional peripherals, such as multiple workstations and crt terminals, and even telecommunications features. AUTOMATED DATA ASSOCIATES, Rahway, N.J.

FOR DATA CIRCLE 334 ON READER CARD

Plotter

Here's a 22-inch wide incremental plotter that uses Z-fold paper for drawing 300 step-per-second computer graphics. The resolution is .01-inch for ball-point or fiber-tip pens. Paper supplied with the plotter is perforated every 11 inches along its 367-foot length to facilitate cutting it to notebook-size sheets.

One nice feature is a quarter-inch cover made of plexiglass that acts to

"You idiots! I said the First Federal Bank—not the Federal Data Bank!"

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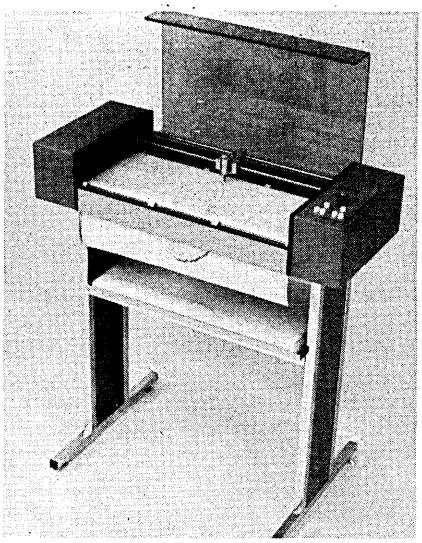
silence the plotter motors. All electronic drive and control circuits are contained on a single pc board to ease maintenance either for ambitious users or the nationwide service organization



contracted to provide it. The unit is priced at $4,500. ARTRONIX INSTRUMENTATION, St. Louis, Mo.

FOR DATA CIRCLE 329 ON READER CARD

Intelligent Terminal

A variation of the very successful Datapoint 2200 intelligent terminal (more than 3,500 sold) has been announced for applications that didn't need all the features of the 2200. The 1100 comprises a processor with a limit of 8K RAM, dual cassette drives, a 12-line by 80-character crt, and a full ASCII keyboard. It rents for $138/month on a three-year lease. The 1100 isn't equipped with the high-speed, high-density tape decks that allowed the 2200 to search the contents at 8,000 cps, but it was found that many potential customers didn't need that much power. Software for the 1100 consists of RPG II, BASIC, DATABUS, DATASHARE, and DATAFORM aids. DATAPOINT CORP., San Antonio, Texas.

FOR DATA CIRCLE 328 ON READER CARD

Terminal Modules

A series of modules that can be used by oem's to build finished intelligent terminals is offered, with the "intelligence" provided by the popular Intel 8008 microprocessor chip set. The MICROTERM is in the form of function modules for controlling various keyboard configurations or crt screen sizes (80 characters by 16, 24, or 30 lines). Programmable read-only memories in the modules can be used to make the MICROTERM look like an IBM 3270, Datapoint 2200, or any other target terminal. In quantities ranging from 200-500, the module sets sell for approximately $1,600. DIGI-LOG SYSTEMS, INC., Horsham, Pa.

FOR DATA CIRCLE 333 ON READER CARD

Touch Sensitive Digitizer

A glass plate with piezoelectric transducers—meaning that they are sensitive only to their own 4MHz frequencies—is the heart of the Touch Sensitive Digitizer (TSD). The product could be used in typical digitizer applications, and it's also thought that it could be used by systems designers as an additional means of getting input into a computer. For instance, it could be placed over the face of a crt tube to facilitate such operations as menu picking from lines displayed on the crt. The product can be obtained with either BCD or 12-bit binary coordinate output. Resolution of the TSD is on the order of a quarter-inch. The TSD glass is supplied in various sizes up to 20 x 20-inches. A 10 x 10-inch board with read-out electronics is priced at $4K. An interface to the Data General Nova 1200 exists, and hookups to other minis can be supplied. COMMAND CONTROL AND COMMUNICATIONS CORP., San Pedro, Calif.

FOR DATA CIRCLE 324 ON READER CARD

Crt Terminal

The DMA 2100A crt is for use in full-duplex polled communication net-

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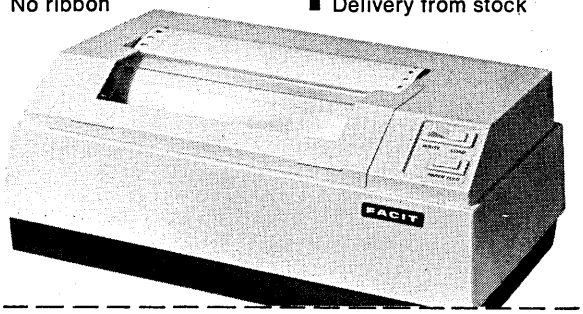

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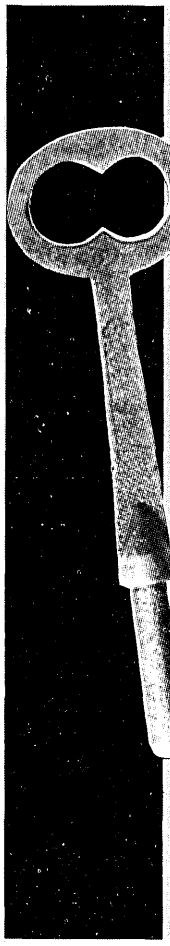

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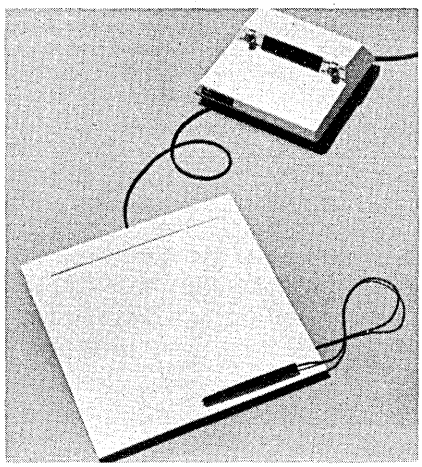
works. It can be equipped with either a 1200 baud integral modem for asynchronous operation or an external modem for data rates up to 9600 baud. The screen format is 24 lines of 80 5 x 7 dot-matrix characters that are refreshed at 50Hz. The 2100A operates in a page mode and provides the capability for simple editing from the keyboard by using the cursor controls, and the cursor can also be positioned by the host cpu. The keyboard, which is separate from the display console, contains the editing keys in addition to alphanumeric keys for selecting characters from a set of 64 ASCII images. Pricing for the 2100A starts at approximately $2K. DATAMEDIA CORP., Pennsauken, N.J.

FOR DATA CIRCLE 322 ON READER CARD

Graphic Input Device

For several years this manufacturer has been selectively marketing a little graphic pad that attached to the telephone and allowed people to communicate graphic and textual information to a similar device at the other end of the line. The CYBERGRAPHIC tablet is a variation on that theme. In this case, the input, either analog or digital information, can go directly into either a computer or an off-line storage device such as a floppy disc or a tape drive. The exact way in which the tablet is used will depend on the way systems designers incorporate it into their products, as the device is primarily



oem-oriented, at least for now. The accuracy, resolution, linearity, and repeatability of the CYBERGRAPHIC tablet are all rated at ± .005-inches across various drawing dimensions ranging from 5½ x 7 inches up to a 22-inch square. Prices for these two sizes are $1K and $2,200 respectively, in orders of 100. TALOS SYSTEMS, INC., Scottsdale, Ariz.

FOR DATA CIRCLE 323 ON READER CARD □

A Happy New Year of Books from Wiley-Interscience

1. THEORY OF COMPUTATION. By Walter S. Brainerd, *Burroughs Corporation,* and Lawrence H. Landweber, *University of Wisconsin.* Presents basic concepts of compatibility theory geared to problems and using terminology familiar to computer scientists. $19.95 (tent.)

2. COMMUNICATION NETWORKS FOR COMPUTERS. By Donald W. Davies, and Derek Barber, both of the *National Physical Laboratory,* Teddington. Explores the new technology created by the convergence of computers and telecommunications. It will present the most difficult design problems in public data networks today to the new breed of engineer who must solve them. $38.50 (tent.)

3. COMPARATIVE STATISTICAL INFERENCE. By Vic Barnett, *University of Newcastle upon Tyne.* Surveys and contrasts the different approaches to statistical inference from the conceptual and philosophical viewpoints. It affords the student a chance to study the basic conceptual and interpretative distinctions between different approaches. $16.50

4. MODULAR PROGRAMMING IN COBOL. By Russell M. Armstrong, *HRB-SINGER, Inc., State College, Pennsylvania.* Enables COBOL programmers to obtain the benefits associated with modularity. It cites the requirements of program structure, critical associated factors, and includes the definition of simple dependable COBOL constructs, interface design, multiple-program structure, program documentation, and the work environment. $10.95

5. TOTAL SYSTEM DEVELOPMENT FOR INFORMATION SYSTEMS. By Frank G. Kirk, *Illinois Bell Telephone Company.* Describes the process of developing computer-based man/machine information systems. Throughout, the author focuses on a disciplined method of developing the total system. $14.95

6. CONCEPTS AND METHODS IN DISCRETE EVENT DIGITAL SIMULATION. By George S. Fishman, *Yale University.* This is the first book to integrate modeling, programming languages, and statistical considerations into a balanced account that takes a practical, step-by-step approach to the methods of designing, running, and evaluating simulations. $17.50

7. PL/I PROGRAMMING IN TECHNOLOGICAL APPLICATIONS. By Gabriel F. Groner, *The Rand Corporation.* Teaches the reader to quickly solve technical problems by writing computer problems in Programming Language One. $11.25

8. INTRODUCTION TO MATHEMATICAL TECHNIQUES IN PATTERN RECOGNITION. By Harry C. Andrews, *University of Southern California.* A cohesive treatment of the use of mathematics for studying interactions between various recognition environments. It consolidates previously scattered techniques and provides a concise notation for understanding and comparing many aspects of mathematical pattern recognition. $12.00

9. PATTERN CLASSIFICATION AND SCENE ANALYSIS. By Richard O. Duda, and Peter E. Hart, both of the *Stanford Research Institute.* Explains the theoretical principles of pattern recognition. It is a systematic exposition of known statistical theory and computational techniques applicable to pattern recognition problems. $22.50

10. MINICOMPUTERS IN DATA PROCESSING AND SIMULATION. By Branko Souček, *University of Zagreb.* The theory and applications of digital simulation, measurement, and processing of data are presented in this book with emphasis on the use of minicomputers. $21.00

11. FUNCTIONAL ANALYSIS OF INFORMATION NETWORKS: A Structured Approach to the Data Communications Environment. By Hal B. Becker, *Honeywell Information Systems, Inc.* Provides a structure for the definition of information networks. The structure addresses the hardware and software functions necessary to configure information networks and understand the function interrelationships. In Press

12. MULTIPROCESSORS AND PARALLEL PROCESSING. Edited by the Comtre Corporation, and Phillip H. Enslow, *European Research Office, United States Army.* Treats multiprocessor system organization, covering both hardware and software, and illustrates how the multiprocessor is a logical result of the efforts to increase computer performance using concurrency and parallelism in program execution and in hardware. In Press

13. FORTRAN CODES FOR MATHEMATICAL PROGRAMMING: Linear, Quadratic and Discrete. By A. H. Land, *London School of Economics,* and S. Powell, *Atlas Computer Laboratory, Didcot.* This book is a collection of programs which research students can use as a tool to test their own ideas. $14.95 (tent.)

14. COMPUTER SCIENCE. Edited by Alfonso F. Cardenas, and Leon Presser, both of the *University of California,* and Miguel A. Marin, *McGill University.* This volume is a coherent, up-to-date treatment of important topics, spanning a major portion of computer science. Part I concerns systems technology; Part II, languages, translators, and applications. $22.50

15. COMPUTER SIMULATION APPLICATIONS: Discrete-Event Simulation for Synthesis and Analysis of Complex Systems. By Julian Reitman, *United Aircraft Corporation.* Shows how to apply system simulation to a variety of system design areas. Emphasis is placed on what to look for and what to avoid, how to conduct analysis despite data uncertainties and how to use the computer to reduce system ambiguity through improved definition. $19.95

16. COBOL SUPPORT PACKAGES: Programming and Productivity Aids. By Stanley M. Naftaly, and Michael C. Cohn, both of *Woodbine Consulting, Inc.,* and Bruce G. Johnson, *Navy Department Supply Systems, Washington, D.C.* Presents updated and refined articles which review the types of support packages actually available to aid both programming and productivity in a COBOL shop. $13.50

17. AN INTRODUCTION TO DATA BASE DESIGN. By John K. Lyon, *Honeywell Information Systems, Inc.* Helps the reader understand data bases, the design process, and the implementation pitfalls from initial inception to final implementation. $11.50

18. FORMATIVE YEARS IN BUSINESS: A Long-Term AT&T Study of Managerial Lives. By Douglas W. Bray, Richard J. Campbell, and Donald L. Grant, all of *AT&T.* Presents the results of a study concerning the selection and development of managers, their ability, personality, and value changes during the early years of adulthood. In Press

19. DECISION TABLES: Theory and Practice. By Solomon L. Pollack, *S. D. Leidesdorf & Co.,* Harry T. Hicks, *Information Management, Inc.,* and William J. Harrison, *Fireman's Fund American Insurance Companies.* Enables the beginner to start writing his own decision tables, and helps those already using decision tables to improve their skills. $14.75

20. EDP SYSTEMS FOR CREDIT MANAGEMENT. By Conon D. Whiteside, *Whiteside Associates, Inc.* Presents a practical, proven approach to the design, development, and installation of a successful and profitable computerized system for trade receivables, credit, and collection operations. $12.50

21. THE ORGANIZATION OF THE DATA PROCESSING FUNCTION. By Frederic G. Withington, *Arthur D. Little, Inc.* Presents and evaluates the various ways of organizing the data processing function in order to improve effectiveness, morale, and productivity. It covers both real-time systems and multiple computer centers, and discusses management problems. $10.95

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Software & Services

Updates

A standard for the BASIC programming language is to be developed by a new committee being established under American National Standards Committee X3. All individuals, both software users and producers, interested in joining should contact the chairman, Dr. Thomas E. Kurtz, at Dartmouth College, Hanover, New Hampshire 03744, or the X3 secretary at CBEMA, 1828 L Street, N.W., Washington, D.C. 20036. The new committee will be called X3J2 and will hold its organization meeting at the Washington CBEMA headquarters January 22 and 23.

Doesn't using pins, cardboard, and rubber bands to design an automobile hood linkage seem rather primitive in the computer age? That's what Dr. Roger E. Kaufman, associate professor of mechanical engineering at MIT thought, especially after engineers told him they spend 2,000 man-hours on each car's mechanism. Accordingly, Dr. Kaufman has written a program called KINSYN that runs on a graphics crt, allowing the design to be developed much more quickly. KINSYN is short for kinematic synthesis; kinematics is the study of the motion of mechanical linkages and the ways to create them. An improved artificial knee action is another of KINSYN's contributions.

One can usually find something humorous about any situation--witness Ulaciwicz's Watergate testimony--and the Equity Funding data processing caper is beginning to supply some humor of its own. Approximately a year ago a software salesman attempted to sell Equity a report generation package but was turned down by one of the firm's dp officials. The salesman persisted, explaining that his package was a very generalized and flexible product, whereas most report generators are set up to do only specific types of reporting. At this line of reasoning the Equity official exploded. "Yes, ours is a very specific package. It generates exactly those kinds of specific reports we ask it to do, and no other package could possibly do them better!" The dp official was subsequently indicted for participating in the swindle.

Data Base Access Technique

Instead of setting up a data base and attempting to define all the logical and physical structures that will be needed at any time, the DIRECT package allows a user to create only the structures or paths initially required. Then, as additional structures or paths are required, entries are made either to existing records or to new record types. The advantage of the approach is that the data base can be quickly altered to tailor it to specific processing needs, and would not tend to become burdened with obsolete data relationships.

The DIRECT package, probably best described as a competitor to IBM's venerable ISAM, handles random, sequential, and unordered files, variable length records, variable length random keys, and variable key-to-record ratios. DIRECT also has the capability to access multiple streams of record types simultaneously. Approximately 25K bytes of storage are required for the COBOL package, which can be called by other COBOL or PL/1 programs. DIRECT is operational on 360/370 computers and a Burroughs B 3500; the coding is almost complete for a Honeywell 6000 version. The DIRECT package sells for $11,500 and can be leased for $500/month including one year of free maintenance. On-site installation assistance and the source code for the product are included in the price. SYSTEMS IMPLEMENTATION, INC., Columbus, Ohio.

CIRCLE 280 ON READER CARD

Scientific Language

FORTH is the name of a language, an operating system, and a firm just formed to market it for scientific minicomputer applications. The software has been optimized for 16-bit minis, and is set up for interactive terminal processing. According to its developers, the language is ideally suited to such applications as on-line equipment control, data analysis, and graphics (including plotting for which a number of graphics routines have been developed). Additionally, FORTH can be used to devine new processing commands for tailoring it to specific applications. It's also claimed that FORTH

Library Services

The accompanying chart shows the subjects and range of information covered in a new customized library service being offered by Auerbach. Much of the information has been offered before. However, it was supplied in 18 volumes, complete with updates, for $2,850 a year. The new matrix allows potential clients to zero-in on just those subjects and "cuts" they are really interested in. Some of the matrix intersections aren't developed yet, however, and pricing has yet to be determined. But as an example of how much the service costs, you can get everything they know about minicomputers and small-business systems for $490, and some of the matrix squares are priced at only $25. Included in the prices are WATS telephone communication to the editors who developed the information, and a monthly newsletter. AUERBACH PUBLISHERS, INC., Philadelphia, Pa.

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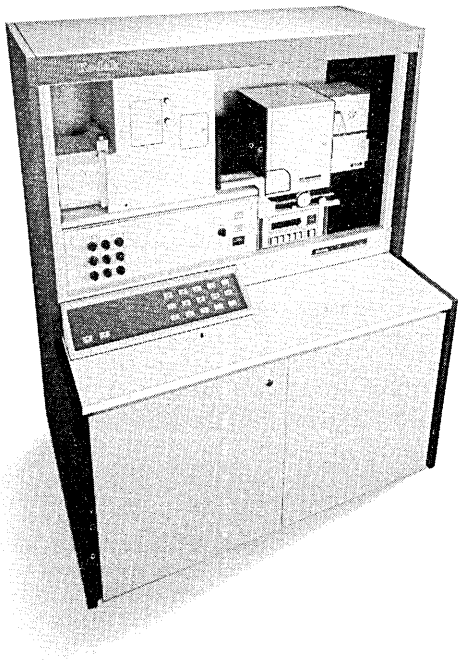


That's what Kodak computer output microfilm is all about.

The idea of bypassing impact printers to go directly to microfilm via COM is bound to appeal. It's an electronic path versus a mechanical one. That means speed with reliability.

Kodak KOM microfilmers do this job at 20 or more times the speed of impact printers. So you have more time to get more jobs done on the mainframe.

Besides speed, consider what else comes with a KOM microfilmer. First, Kodak specialists will help you design, develop, and implement your COM system. Second, Kodak software helps you get each job done faster and in the format you need. Third, Kodak equipment service that will help keep your COM unit up and running.

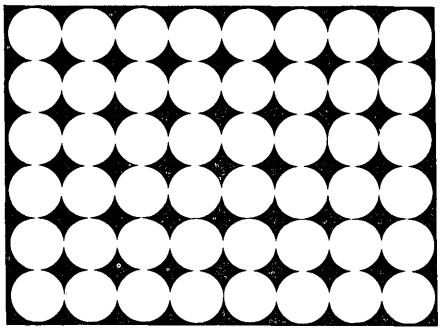
Take the important first step.

Write us for our new booklet, "The New Generation of Computer Output". Eastman Kodak Company, Business Systems Markets Division, Dept. DP522, Rochester, New York 14650.

Kodak: for better use of information.

Kodak

Use Robert Half



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software & services

often takes less memory than even assembly language programs require for performing the same application. Almost all FORTH routines are reentrant so that much of the system can be shared in a multi-user configuration. Versions of the language are available for DEC's PDP-11, Data General's Nova line, the Varian 620, the Hewlett-Packard 2100, Modular Computer Systems' MODCOMP minis, and the Honeywell 316 and 516 16-bit minis. System prices start at $2K, plus an installation fee of $1K that includes instruction on how to use the language. FORTH, INC., Tucson, Ariz.

CIRCLE 282 ON READER CARD

Programmer Training

Programmer productivity exceeding 10,000 lines of debugged, documented, and delivered PL/1 code per man year is the claim made for a new course offered for software project managers. Even more impressive is the claim that the 10,000 figure was achieved not by the instructors, but by the programmers at a large aerospace corporation, the first user to take advantage of the training.

The course instructors are said to have extensive backgrounds in MIT's Computer Applications Group and Project MAC. They teach the principles of modular program design, top-down implementation (coding from the highest hierarchies of a proposed system down to the lowest level subroutines), structured programming as developed by the famed Dutch computer scientist Dijkstra, program test methods, and the chief programmer team approach advocated by Harlan Mills of IBM.

The course, an intensive two-day seminar that is offered for in-house presentation for up to 25 attendees, is $2,500. Public courses will be held on a regularly-scheduled basis at an individual price of $250 or a group price of $200 per attendee. SOFTECH, INC., Waltham, Mass.

CIRCLE 283 ON READER CARD

Simulation System

MARSYAS was developed by NASA's computation laboratory at the Marshall Space Flight Center to furnish engineers with a quick and easy means of simulating physical systems on one of the agency's myriad 1108 systems. The package is written in FORTRAN IV, however, and might warrant being altered for operation on other mainframes if some of the claims for it are true. One

software spotlight

COBOL MARK IV

In order to fully appreciate the significance of the CL*IV file management system for COBOL shops, it's necessary to compare it to Informatics' very successful MARK IV system, which has succeeded in completely ousting COBOL as the primary programming language in a number of business-oriented installations. MARK IV is a complete programming system in that a user codes in MARK IV, has the coding checked by MARK IV, has the data range checked by MARK IV, and has the output produced by MARK IV. No object code for finished logic is produced for load and go type runs.

CL*IV comes very close to being a MARK IV implemented in COBOL, lacking only some of the hierarchical file manipulation and transaction processing capabilities of the former. But it has the advantage of handing the COBOL compiler source code that has been developed with the aid of a powerful preprocessor. It also helps with the file manipulation, main line logic, and coding of the Identification, Environment, and Data Division COBOL program sections. CL*IV also has the advantage of standardizing programmer logic and, according to one early installation, even improving it. Results from the Canadian Ministry of Education in Toronto indicate that COBOL programs that had been handled by CL*IV required an average of 1K less storage, one-fourth the overall development time, one-third the debugging time, and 10% less run time than required by staff-written COBOL programs that did the same jobs. CL*IV is supplied in object code form and will be maintained by the vendor. It requires 120K bytes of memory on OS/360 systems and 90K for DOS environments. The price is $20K, and the package can also be leased. INFORMATICS INC., Canoga Park, Calif.

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is that it's simple enough for users unfamiliar with computer programming to use.

MARSYAS can be used to solve a system of differential equations or to simulate control systems including analog computer block diagrams—or do both simultaneously. Most statements can be used without regard for the order in which they appear within coding modules. The FORTRAN object program developed by MARSYAS can be extracted and run separately, if desired. Other features include the detection and solution of linear and nonlinear algebraic loops, and automatic changes in integration schemes for problems which contain discontinuities. The 15,000 statement program is supplied in card image form for $750, with documentation for it priced at $21. COSMIC, Athens, Ga.

CIRCLE 281 ON READER CARD

CICS Aid

SMART (Storage Modification and Retrieval Transaction) allows users of IBM's CICS transaction processing package to display any part of memory within a CICS partition on a crt terminal and modify it, if necessary. Either an actual memory address or a particular CICS area can be supplied to the SMART module for reference. Object code and necessary job control language is supplied for a price of $500. ON-LINE SOFTWARE, INC., Hackensack, N.J.

CIRCLE 287 ON READER CARD

Interactive Forecasting

Short to intermediate term (12 months) sales forecasting is the specialty of this interactive forecasting program called HSS, available on this company's time-sharing network. The model is most effective for use with products that are mature and have a relatively stable demand pattern. Products for which scant data exists or for which demand is highly erratic are not suitable for the model. At least one year of historical data must be supplied the program in either weekly, monthly, or accounting period form.

Reports showing the model parameters, results of simulation, and product forecasts for any "reasonable" number of periods are generated either off-line at the vendor's site for subsequent mailing to subscribers, or interactively on any ASCII-speaking terminals such as 2741-type devices or tty's. Connect time for HSS is $7/hour and $3 per run in addition to the vendor's standard time-sharing rate schedule which is, typically, quite complex. AMERICAN CAN COMPANY, Greenwich, Conn.

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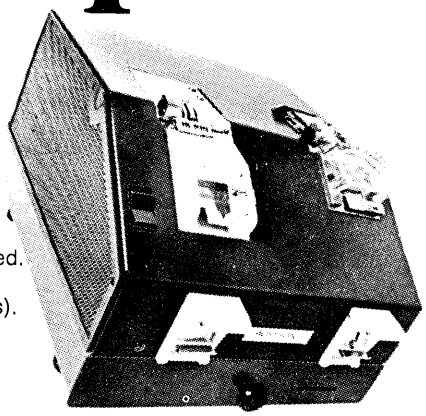
Our paper tape punches and readers were built for comfort. Not for speed (max. — 50/60 cps). And, they're priced to barely budge your budget.

slow poke

In fact, any self-respecting components savant would term these devices a real buy.

Why?

Because they're engineered to make your end-user happy. By practically eliminating I/O system down-time. By providing read stations sealed from dust, corrosion and contaminates. By not mussing a hair on fuzziest tape. By functioning without continuous operator intervention . . . even under severe environmental extremes.



Besides being low-cost, they offer you the ultimate in flexibility. With bi-directional feed. With adjustable tape guides for standard tapes and edge punched cards (400 Series).

We offer a choice of 7 space-saver, basic, rack mounted or desktop punch and reader models.

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Literature

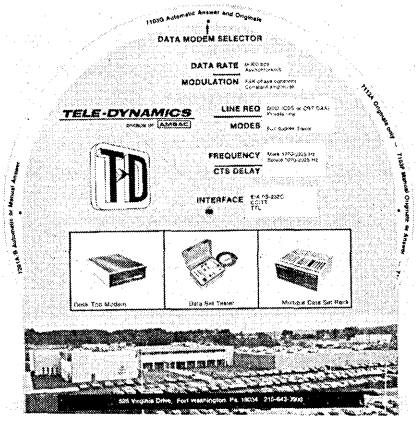
Fight Computer Bills!
Here is the impersonal computer form letter to end all impersonal computer form letters. Meet the computer on its own nasty terms by checking such statements as: "This accounting is screwed up and I don't want to communicate with a computer. Please have a *person* call me at _____." and "Your previous correspondence did not refer to my CFL No. and I cannot locate it. You *must* refer to my number. Also note I have assigned you a number. (See creditor number above.)." A package of 20 consumer form letters (form CFL-129) costs 99¢. MIDWEST BUSINESS FORMS, INC., Schiller Park, IL 60176.

In-house Reports
With the goal of helping "establish the professionalism of dp managers," this 16-page booklet gives methods of making internal reports more economical, more impressive, and more readable. Among the techniques described are: condensing several reports onto one form with the use of perforations; using both sides of one form for four reports with the same column width; tinting parts of forms to distinguish different reports or sections of reports; preprinting line headings, titles, and charts; using flags, marginal words, and boxes; and distinguishing reports with phantom trademarks. MOORE BUSINESS FORMS, Niagara Falls, N.Y.
FOR COPY CIRCLE 301 ON READER CARD

Minis and Micros
This industry report, 200 pages long, analyzes by application the current and potential markets for minicomputers and microcomputers, explains how mini manufacturers can use micros of their own design, presents micro marketing strategies, and evaluates products of the leading mini and micro manufacturers. Cost: $450. QUANTUM SCIENCE CORP., 245 Park Ave., New York, NY 10017.

Budgeting
Guidelines for Planning and Budgeting is the third in a series of accounting presentations developed by ADAPSO in an effort to standardize accounting practices within the industry. The 32-page booklet deals with financial planning, budgeting, critical performance measurements, the corporate budget, and use of the budget. Free to ADAPSO members, the cost for nonmembers is $15. ADAPSO, INC., 551 Fifth Ave., New York, NY 10017.

Dial-a-Modem
A circular modem selector shows which Tele-Dynamics modem is best suited for one's needs. For the modem model number dialed, the device shows such specifications as: data rate, type



of line, modulation technique, turnaround time, and available interfaces. TELE-DYNAMICS, Fort Washington, Penn.
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Wang Users Magazine
A quarterly magazine called *Programmer* is published by SWAP, the Wang Laboratories Users Society, with the objective of providing useful information to users of Wang equipment and computing systems. A recent issue of the applications-oriented magazine had articles on bond portfolio analysis, finance and banking, chromatography, statistics, and education. WANG LABORATORIES, Tewksbury, Mass.
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Maintaining Equipment
This 17-page reprint, extracted from the book *All About Used Computers,* discusses maintenance of computers as it applies to the resale of used equipment. Subjects covered are the maintenance agreement, third party maintenance, in-house maintenance, and reconditioning. AMERICAN USED COMPUTER CORP., Boston, Mass.
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Data Entry Newsletter
Management Information Corp.'s data entry Awareness reports are available on a subscription basis for 1974, with the six issues costing $24. These reports give industry news and editorial comment, as well as information on new data entry systems and applications. New subscribers will also receive all 1973 issues at no extra cost. MANAGEMENT INFORMATION CORP., 140 Barclay Center, Cherry Hill, NJ 08034.

Project Graphics
The subject of this 12-page brochure is E-Z-PERT IV, latest in a series of proprietary graphics programs for project management. In addition to conventional PERT functions, E-Z-PERT IV can convert the tabular output of any network analysis system into fully annotated networks or Gantt bar charts. The program, described as "the software T-square," generates drum, flatbed, or microfilm plotter output in all conventional network formats—PERT, CPM, Arrow Diagram, or Precedence Diagram. SYSTONETICS, INC., Anaheim, Calif.
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Executive Newsletter
The Casebook is a bimonthly newsletter published by ADL Systems, Inc., for senior executives interested in computer systems and software development. Each issue presents facts, opinions, statistics, and other data on a particular topic; a recent four-page issue dealt with new techniques of performance measurement of computer systems. ADL SYSTEMS, INC., a subsidiary of Arthur D. Little, Inc., Cambridge, Mass.
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HP-80 Calculator
Billed on the cover as "10 ways business people can use the HP-80 Time-and-Money Machine to get instant answers to everyday problems," this 12-page brochure describes capabilities of the nine-ounce, pocket-size HP-80 calculator. The HP-80 is used in business and finance to solve problems in compound interest, annuities, loan repayment, trend line, truth-in-lending calculations, securities prices and yields, and investment analysis. HEWLETT-PACKARD, Cuperinto, Calif.
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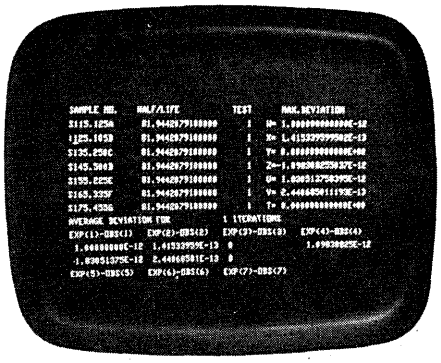
Proprietary Software
One hundred and ninety-one subscribers of *Datapro 70* report on their experience with 174 proprietary software packages in this survey entitled *User Ratings of Proprietary Software.* Detailed charts compare the 40 packages rated by three or more users, seventeen of these packages were elected to the "Datapro Software Honor Roll." The report costs $10. DATAPRO RESEARCH CORP., 1805 Underwood Blvd., Delran, NJ 08075. □

The new Wang System 2200. What you see is what you get. You get a lot for under $7,000.*



Big 16 Lines (of 64 Characters) CRT Display: It's hard to crowd this tube. You'll get ample space for monitoring programs, and results. Remaining storage is automatically displayed as the last line on every program. It tells you where you've been, where you are and how far you can go. You can go a long way on the Wang System 2200.

BASIC Programming With Hard Wired R/O Memory: You get 4K (field expandable to 32K) of fully accessible memory. And BASIC programming; the easiest to work with language yet developed.

Programming Doesn't Byte Off Much Storage: In the Wang 2200, program statements are a single keystroke and single byte. Example: The statement PRINT USING takes only one byte of memory; not ten! This almost doubles capacity compared to the usual system. Plug in the new Wang 2200 and you're in business. If your data handling has been constantly delayed or reshuffled by crowded, expensive time-sharing . . . here's a cost/efficient alternative.

If you are thinking of time-sharing to meet growing needs: here's a way to beat high terminal cost and programming time. If you run a smaller engineering or technical/scientific group: the Wang 2200 may be all the computing power you will ever need.

Drives Wide Range of Peripherals: Our new 2200 gives you more ways to solve problems. We have 15 (more soon) peripheral devices like flat bed plotters, additional mag tape cassette drives, a typewriter that makes graphs, a 4.9 mega-byte high speed disc, matrix ROMs and more.

A Low Cost Alternative To Time-Sharing: Since the 2200 can tackle big problems many users are installing them to replace more expensive time-sharing terminals. And, they are eliminating the waiting, scheduling and priority problems of time-sharing. They're getting more done at lower cost.

Faster Problem Solving: "Basic" programming on the 2200 is almost literal. You get to the heart of problems and examine alternatives faster. And, the Wang *special function* feature gives you 32 additional keys that allow you to "tailor" the system to facts, figures and constants that are particular to your business or your company . . . or your department.

For under $7,000, Try To Match The Wang 2200 For Price/Performance and Flexibility. Even if you call the 2200 a small system, you've got to admit it's a big idea.

*U.S. List Price: 4K CPU & CRT with mag tape drive and choice of data entry keyboards.

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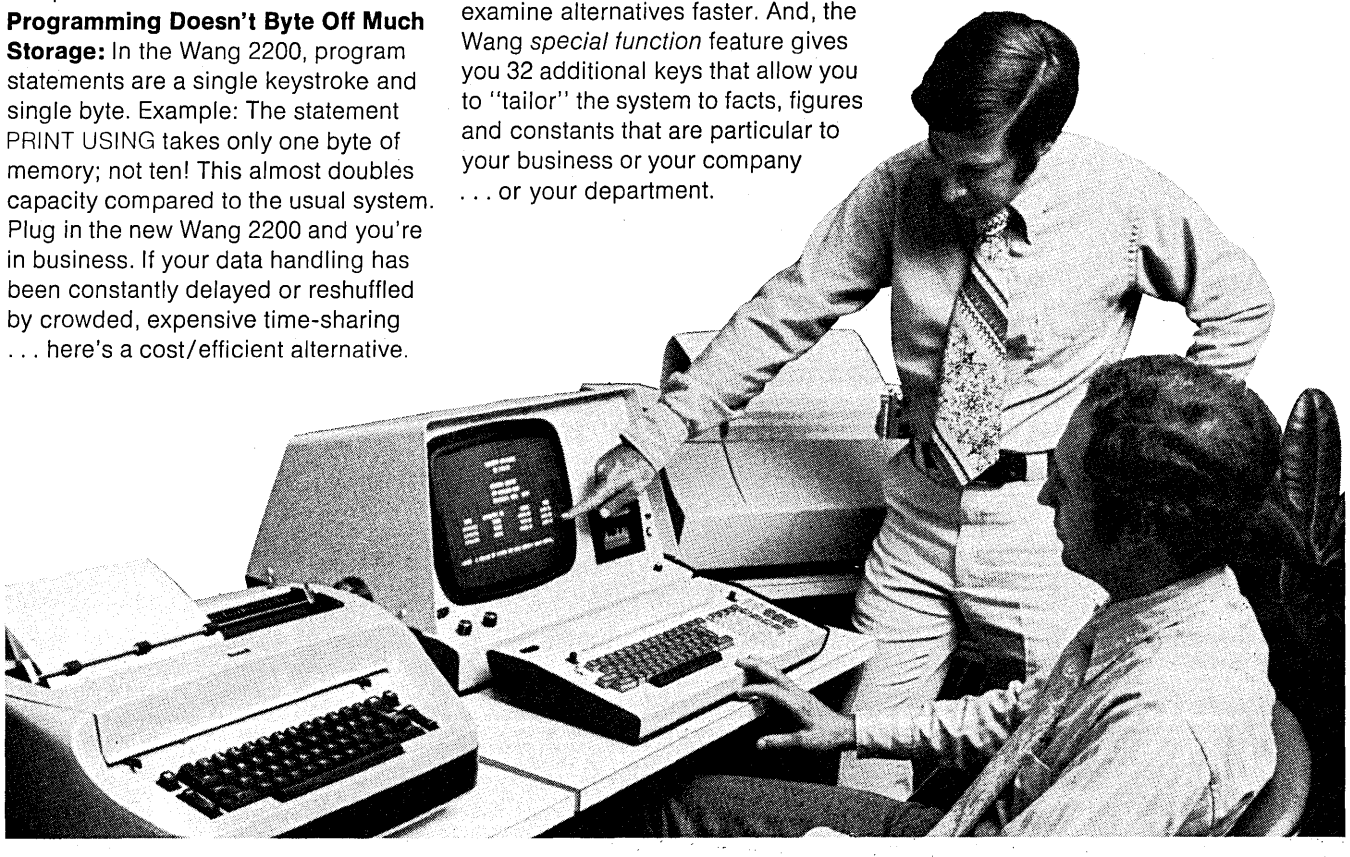

"graf/pen™
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"That's because it's the unrestricted digitizer!"

It's easy to understand how graf/pen, the sonic digitizer, became the standard device for converting graphic information — graphs, maps, physiological shapes and so on — into the language used in data processing, recording or transmission.

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It's a multi-media digitizer. Unlike other digitizers, the graf/pen uses sonic waves to generate position coordinates. Hence, the sensors which detect the position of the graf/pen point can be mounted adjacent to any flat display surface — a drawing board, a CRT screen, a blackboard, a projection screen. There are even 3-D versions which require no writing surface at all. Naturally, if you need a tablet, it is available with graf/pen.

Ideal for big jobs, too. graf/pen sensors come in lengths up to six feet. This means you can digitize oversize drawings, the profile of an automobile seat or even a human form.

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Great operational freedom. Only a single wire connects the pen to its control unit; there are no clumsy mechanical connections. You can select continuous digitizing, as when tracing a curve, or point digitizing to create one set of coordinates each time the pen touches the display surface. You can choose between a ball-point pen tip to generate "hard" copy as you digitize or an inkless stylus which leaves no trace.

Service is international. In the unlikely event your graf/pen should ever require service, it's available on-site internationally.

There are a lot more freedom-of-use advantages to the graf/pen. So, if your data handling system requires graphic-to-digital conversion, get all the facts on graf/pen — the unrestricted digitizer. Call our marketing vice president, Rolf Kates, at (203) 255-1526 or write:

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Southport, Connecticut 06490

CIRCLE 77 ON READER CARD

letters

Continued from page 27

Sour grapes

In your October issue (p. 183), the prolific M. Anon. added a contribution to your "Forum" and in doing so squeezed a bit of vinegar from those well-known sour grapes of his. Anon.'s point of view rarely merits notice, but there are some issues in his denunciation of the "colossus of the computing community" (sic) which he glosses over a bit too smoothly.

The statement that IBM controls "at least indirectly, approximately 70% of the job opportunities" in what he calls the "industry" is so patently stupid that anyone taking it seriously would have to be the greenest of neophytes where dp is concerned. If Anon. believes it, it goes a long way toward explaining his paranoia. If he feels that people hiring dp managers seldom know how to hire one, he probably considers himself lucky he found someone dumb enough to hire him. Not only is this not the case, but instead, the day has passed when it can be considered funny or clever to keep upper management in the dark about dp operations. It is, rather, disloyal.

The main thrust of the piece is that IBM, through a combination of threats, pressures, delays, and disparagement of individuals and competition has as corporate policy the use of unfair marketing tactics. This defies proof or disproof, but consider some of the problems it would entail:

a. IBM, the main antitrust target of the Justice Dept., would be encouraging monopolistic practices at the worst possible time, and

b. expect to keep this conspiracy a secret just among the thousands of people in its marketing force, one of whom could, maybe, be an honorable person, while

c. IBM assumes all customer executives are naive where dp is concerned, and

d. all dp managers are so easily cowed, and

e. no one would see through all of this.

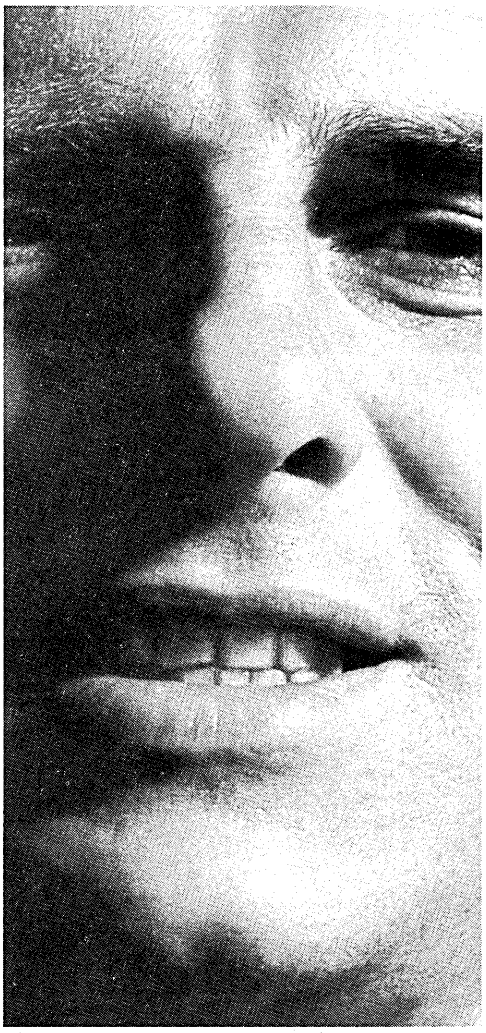
If all this were to be taken at face value, we would seem to have nothing but Prof. Harold Hills selling, and nothing but River City rubes buying where dp is concerned. I and, I would think, some others, would consider this insulting if it were not ridiculous.

MICHAEL F. WARD
Manager, Information Systems
Virden Division
Scott & Fetzer Co.
Cleveland, Ohio □

Microdata minis take a hard-nosed approach to protecting your system software.

Your system's exclusive software is one of the biggest things you have to sell. Naturally, you want to make sure it's protected. So do we.

A Microdata microprogrammable minicomputer will keep your exclusive software exclusive. Because we combine a part of your software with our hardware to get firmware.

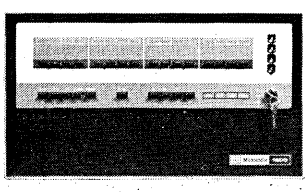


And that firmware is designed specifically for your requirements. It's yours alone. With the secrets of your software locked safely inside. That same firmware also holds the secrets to the high speed and low cost of Microdata minicomputers.

Today thousands of Microdata minis are successfully operating in a wide variety of applications. They're supported by the most experienced staff of microprogramming experts in the world. And they're backed by Microdata's extensive service facilities. We service everything we build. And we build everything that goes into our minis, including the printed circuit boards and memory core planes.

A fully protected exclusive system with dazzling performance at an unbeatable price is nothing to be sneezed at.

If you're interested in OEM minis that take a hard-nosed approach to protecting your system software, write or call Microdata Corporation, 17481 Red Hill Avenue, Irvine, California 92705. Telephone 714/540-6730.



Microdata.

Bring us your problems.

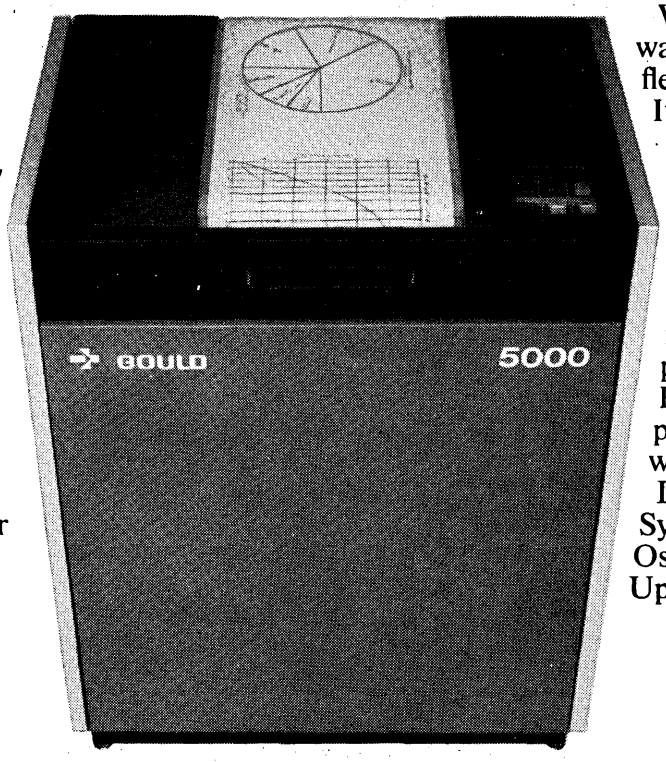
It's everything you've ever wanted in a peripheral for your mini. With a price/performance ratio superior to every other electrostatic printer/plotter on the market.

In fact, the Gould 5000 gives you 1200 lines per minute—or 600 more than Brand V. And at a lower price.

That means you get high speed for improved mini throughput efficiency. Low cost for economic justification. And, of course, high reliability backed by Gould's reputation for quality.

But you also get a lot more. Resolution of 100 dots per inch. Full alphanumeric and graphic capabilities. 132 characters per line. A 64 ASCII character set. Fan fold and roll paper. 8 bit wide data path.

Optional features? The Gould 5000 is loaded. 96 ASCII character set, upper and lower case. 128 ASCII character set custom designed to your requirements. On-line mini-computer and off-line magnetic tape interfaces.



What's more, Gould software is the most efficient and flexible available anywhere. It lets your mini print and plot considerably faster than competitive units.

We say that the new Gould 5000 is the best buy on the market, with the best features of any mini-computer printer/plotter. And our Pete Highberg or Bill Koepf can prove it to you. Get in touch with them now at Dept. D 1, Gould Inc., Data Systems Division, 20 Ossipee Road, Newton Upper Falls, Mass. 02164.

The new Gould 5000. Twice as fast as any printer/plotter ever designed for mini-computers.

DATA SYSTEMS DIVISION

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CIRCLE 11 ON READER CARD

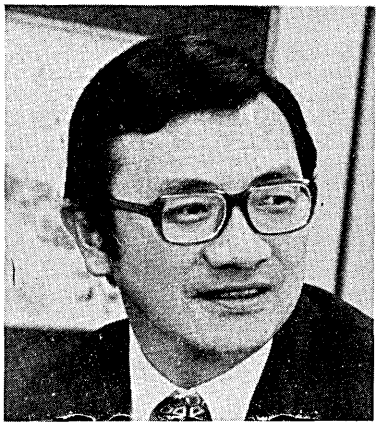
A VOLUNTEER GENERALIST

"I've been exhilarated by the quality of the people," says Dr. Richard I. Tanaka of his many years of volunteer service to computer professional societies. The new president-elect of the International Federation for Information Processing (he'll begin his three-year term as president in August 1974) believes the self-seeking and self-serving don't get very far in professional society work—leaving a continuing nucleus of "outstanding individuals with the same objectives but different ideas and attitudes. IFIPS's got that in spades and that's where the fun comes in."

But Dr. Tanaka, who was president of the American Federation of Information Processing Societies (AFIPS) for two terms, served the AFIPS board of directors for four years, was on the AFIPS executive committee for three years, served as vp of AFIPS for one year, has been the U.S. delegate to IFIP since 1970, was chairman of IFIP's statutes and bylaws committee, and is chairman of its activities planning committee, will say goodbye to organization work when his three year term as IFIP president is over. "There's a time to do these things and then you get tired, you need to move on and let new ideas come in."

Relaxing in his fourth floor corner office at California Computer Products, Inc., Anaheim, Calif., of which he is senior vice president, Dr. Tanaka seemed anything but tired as he talked animatedly of the potential of IFIP and what he hopes to accomplish during his presidency. "It's the only truly representative international body which is nonpolitical and noncommercial," he said of the 35-member-nations organization. "It has clear and impeccable credentials as a forum where people from everywhere in the world can sit down together to discuss problem areas." He called IFIP's Congresses, held every three years, the most visible but not the main product of IFIP. "The real work is done in the working groups." These are subgroups of the organization's seven technical committees which currently are being evaluated two or three at a time with an eye toward possible abolition, redirection or expansion. Dr. Tanaka believes IFIP's greatest need is for a "more solid financial base" and he believes this will be achieved through improved revenues from the Congresses and from royalties from publications. "A lot of people are willing to help and IFIP must be able financially to help them help."

Dr. Richard I. Tanaka



Like many other computer industry pioneers, Dr. Tanaka got into the field by what might be described as an accident. In the summer between his bachelor's and master's degrees in electrical engineering from the University of California, Berkeley, he was, as he describes himself, "an EE generalist." He took a summer job at the university, wiring an experimental computer and he was hooked. By the time he attended the California Institute of Technology, Pasadena, where he took his PhD in electrical engineering and physics, his logic designs for several aerospace control computers were in production.

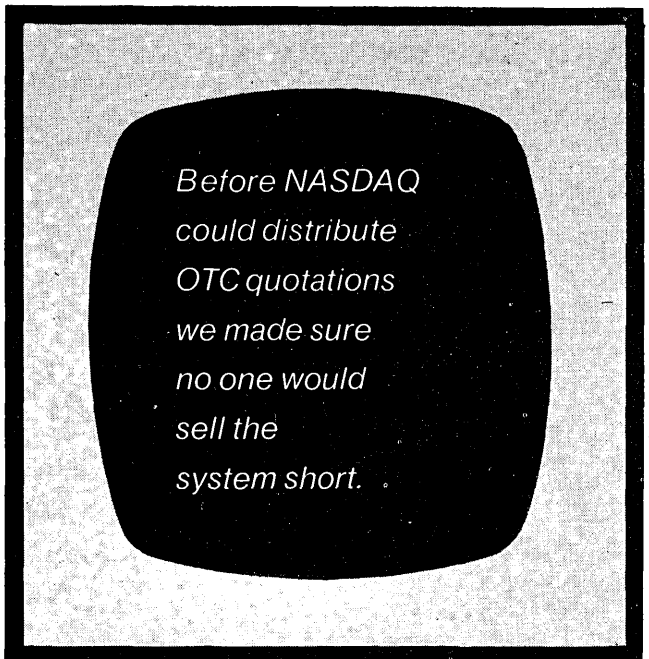
He's managed to pick up something else along the way. He decorated his own office and it's a study in comfort/function/tastefulness without ostentation. When he gets tired of volunteer work, and should he become tired of the computer field, he could well hang out his shingle as an interior decorator.

L. L. van Oosten

"IF I WERE 25 YEARS YOUNGER..."

An early Burroughs user, L. L. van Oosten, went into retirement on January 1 after 25 years with Allstate Insurance Co., still thinking highly of Burroughs hardware. Retirement is mandatory for Allstate officers at the age of 60 unless they're asked to stay on, but they must then leave no later than 63. Van—softspoken and easygoing, who has maintained his trim, athletic build and who could easily pass for 53—retired the day

(Continued on page 120)



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CIRCLE 82 ON READER CARD

before his 64th birthday.

Preparing to clean out his files, he talks of a letter from IBM that proposed a 650 computer, which at that time had no provisions for mag tapes. The letter stated that Allstate would never require tapes on its computer. Van, knowing better, selected instead the ElectroData 204. He recalls that the first 204, made in Pasadena, Calif., by ElectroData Corp., went to the Jet Propulsion Lab, the second to Purdue Univ., and the third to Allstate.

ElectroData was subsequently acquired by Burroughs, marking that company's entry into the computer field, and Allstate went on to get Burroughs' 205s and 220s. They also acquired an IBM 650 with three tapes, which they kept for a year and then returned. In 1964, alas, the company went to 360s, installing more than 20. But Van is still sold on Burroughs' superior mainframe technology: "I daresay that if IBM had the 5000 series and Burroughs had the 360 series, there would be more 5000s in the field now than 360s and 370s."

Ironically, however, it was van Oosten who got Allstate to invest in the new company founded by the architect of the 360s, Amdahl Corp. Finding suitable investments in the electronics field has been occupying Van's time for the last few years, what with his impending retirement known well in advance. Working out of the firm's Judson B. Branch Research Center in Menlo Park, Calif., which he founded and had headed up, Van has placed those funds in a number of companies in the San Francisco Bay Area.

But now, with a single-engine Beechcraft Bonanza A-36 plane that he bought last April, Van and his wife will spend their leisure on the move, as usual. Between 1936 and 1942, when Van was with IBM in a sales capacity, he had done a considerable amount of flying, dropping it after that and picking it up again only recently.

"My wife doesn't even know where the oil dipstick is on her Thunderbird," he points out, "but she also has learned to fly." And the two, continuing to live in Menlo Park, have trips planned to Mexico, which they visited last fall on a fishing trip, and to the Midwest, where the van Oosten's two daughters reside. Van admits that at his age, and having been out of touch with computing for the last few years, he's glad to be getting out now. But he adds: "If I were 25 years younger, I would wish I were just getting into the industry."

●

WILLIAM F. BUSTER was named general manager of the National Cash Register Co. Data Processing Div., San Diego . . . O. ALLEN SEAMAN, System Development Corp., was given the Dept. of the Army's Outstanding Civilian Service Award . . . KENNETH GROSSMAN is the new Director of the Computer Center at Brooklyn College of The City University of New York . . . ARCHIE MC GILL, a former IBM vp, joined AT&T as director of market management . . . KENNETH R. SCHURR JR. was named advanced systems director of the Newspaper Div. of Field Enterprises, Inc., publisher of the Chicago *Sun-Times* and the Chicago *Daily News*. □

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.

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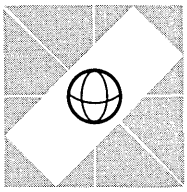
For registration and travel information write to: U.S. Committee for IFIP Congress '74, Box 426, New Canaan, Connecticut 06840.

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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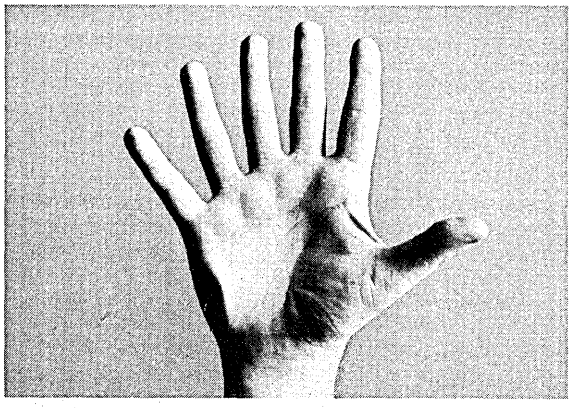

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LOOK AHEAD

(Continued from page 18)

EUROPEANS: STILL DESTINED FOR 25%

Europeans better not dawdle in developing their computer industry (see p. 98). An ambitious study by the Economics division of Eurofinance, a Paris-based research house, of prospects for the European computer industry, indicates the locals will not increase their share of the European market by 1985.

The 151-page report, prepared last May, but just now being widely distributed, sees the western Europe market growing from approximately $14-15 billion this year to almost $100 billion by 1985. During that time, IBM's share is destined to slump from approximately 50% to a "mere" 40. But non-European firms will pick up all of that slack, the study says, leaving European firms with the 25% they are estimated to have right now. It says U.S. share of the world market, estimated at 60% in 1970, will have slipped by 1985 to 40% of a $345.5 billion market. The study is available in the U.S. through 21st Century Research, North Bergen, N.J.

ALL ABOUT PERIPHERALS

Dr. Fred Brooks, one of the IBM 360 designers, calls progress in peripheral equipment development a "Molasses River" in a talk he'll deliver next month at the IEEE Computer Society's COMPCON '74 meeting in San Francisco (see p. 13). Other prominent speakers at the conference on peripherals: First National City Bank's Richard G. Mills; IBM's Lewis Branscomb; TRW's Ray Ybaben who talks on mixed shops; and McAuto's Stephen Conley with a challenge to hardware people to automate huge tape libraries. The 18,000-member society's affair is expected to attract 800.

AFIPS, meanwhile, has signed up 200 companies to occupy 800 exhibit booths at the National Computer Conference and Exhibit May 6-10 in Chicago's McCormick Place. It may be able to make room for 200 more booths.

RUMORS AND RAW RANDOM DATA

Less than a month after IBM rocked budget planners with a price increase (see p. 102), Honeywell followed with a 2% increase on hardware and a 5% boost for maintenance and SE services...Lowering stock market prices shattered acquisition plans at Data 100 of Minneapolis. It's now called off a merger with a printed circuits firm and has withdrawn its offer to acquire ailing Computer Communications, Inc....One of the international luminaries in programming, Prof. Edsger W. Dijkstra of the Technical University of Eindhoven, The Netherlands, has become the first research fellow at Burroughs and has been chosen recipient of AFIPS' Harry Goode Memorial Award..."Two down and one to go," was the way some ex-RCA wags put it when Chase Morsey, Jr. "resigned" as exec. vp and director of RCA, where he had been a member of the triumverate management team that led the company down its path to disaster in computers. The others: Edwin Donnegan who left the firm shortly after it got out of the computer business, and Robert Sarnoff who remains at RCA...Ecology problems may not be the only issues left lingering by the energy crisis. Rand Corp.'s Willis Ware, chairman of the HEW advisory committee on Automated Personal Data Systems, told a Los Angeles gathering that concern with energy matters will hold up legislation on data bases and privacy for at least two years.

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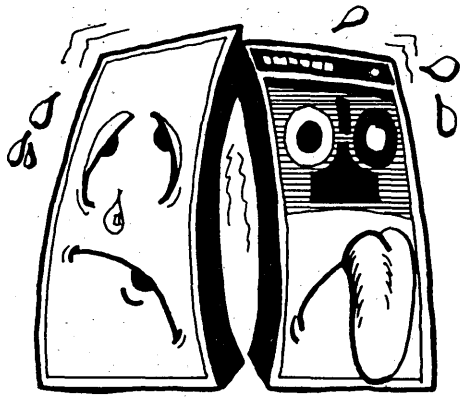

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Gordon B. Davis, University of Minnesota. *McGraw-Hill Series in Management Information Systems.* 1974, 608 pages (tent.), $13.95 (tent.). *Instructor's Manual*

OPERATING SYSTEMS

Stuart E. Madnick and **John J. Donovan,** both of Massachusetts Institute of Technology. 1974, 554 pages (tent.), $16.50 (tent.). *Instructor's and Solutions Manual*

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Herbert Hellerman, State University of New York at Binghamton. *McGraw-Hill Computer Science Series.* 1973, 466 pages, $15.50

PRINCIPLES OF INTERACTIVE COMPUTER GRAPHICS

William M. Newman, Xerox Corporation, Palo Alto and **Robert F. Sproull,** Stanford University. 1973, 607 pages, $15.95

SYSTEMS PROGRAMMING

John J. Donovan, Massachusetts Institute of Technology. *McGraw-Hill Computer Science Series.* 1972, 488 pages, $13.95. *Instructor's Manual*

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Thomas Bartee, Harvard University. 1972, 416 pages, $10.95. *Instructor's Manual*

COMPUTER STRUCTURES: Examples and Readings

C. Gordon Bell and **Allen Newell,** both of Carnegie-Mellon University. *McGraw-Hill Computer Science Series.* 1970, 668 pages, $16.50

COMPUTER ORGANIZATION AND PROGRAMMING, Second Edition

C. William Gear, University of Illinois at Urbana-Champaign. 1974, 448 pages (tent.), $14.95 (tent.)

INTRODUCTION TO MATHEMATICAL THEORY OF COMPUTATION

Zohar Manna, Weizmann Institute of Science, Israel. 1974, 480 pages (tent.), $16.50 (tent.)

DIGITAL COMPUTERS IN SCIENTIFIC INSTRUMENTATION: Applications in Chemistry

Sam P. Perone, Purdue University and **David O. Jones,** Consultant, Chemical Instrumentation. 1973, 439 pages (tent.), $7.95 soft (tent.)

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Brian W. Kernighan and **P. J. Plauger,** both of Bell Telephone Laboratories, Inc. 1974, 150 pages (tent.), $2.95 (tent.)

THE DESIGN OF DIGITAL SYSTEMS

John B. Peatman, Georgia Institute of Technology. *McGraw-Hill Series in Electronic Systems.* 1972, 457 pages, $15.50

INTRODUCTION TO COMPUTER ORGANIZATION AND DATA STRUCTURES

Harold S. Stone, Stanford University. *McGraw-Hill Computer Science Series.* 1972, 321 pages, $13.50

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Zvi Kohavi, Massachusetts Institute of Technology. *McGraw-Hill Computer Science Series.* 1970, 608 pages, $16.50. *Solutions to Selected Problems*

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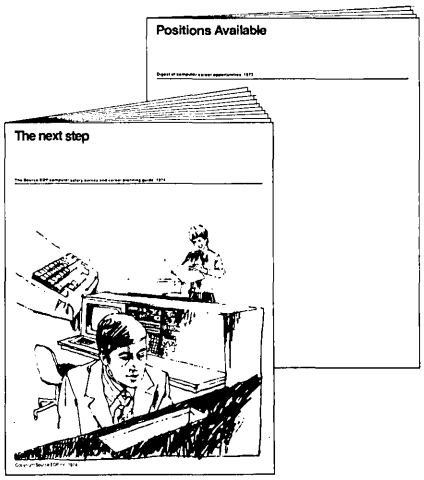

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COMPANY SECURITY AND INDIVIDUAL FREEDOM

One of the most troublesome problems facing companies within the computer industry is that of the rights of individuals and their freedom of action and mobility. No democratic privilege is more vital to the growth and dynamism of data processing than the ability of the individual to leave a job at one company to take one at another or to start a new enterprise. However, there do appear to be certain rights and privileges that should be guaranteed to an employer but that sometimes get overlooked or even trampled upon in the legal process.

In recognition of the sensitive nature that such employment entails, most companies require that an agreement be signed before employment. It usually contains clauses such as:

"That I will not without the prior consent of_____ Company, either during or after my employment with _____Company, use or divulge to others any proprietary information including trade secrets and unpublished financial and business information which I produce or otherwise obtain during the course of my employment with respect to any business in which _____Company is or has been concerned, or which is entrusted to_____Company by others. That at the time of termination of my employment with _____Company I will surrender to_____ Company all documents in my possession or under my control which contain any proprietary information which belongs to or has been entrusted to_____Company."

In addition to the above, it has also become somewhat standard for key employees or founders of new companies to sign a more encompassing document that usually prohibits such an individual from competing with his employer for a certain period of time after termination of his employment; or from using confidential information, processes, or know-how gained at a competing company; or from joining a direct competitor and owning a substantial equity position in that competitor.

The meaning of these clauses and their intended purpose is really not difficult to comprehend. Simply stated, most companies would like to protect what they consider secret and would like to prevent employees from attempting to use knowledge gained during their employment for the betterment of a competitor. Generally speaking, when one accepts a new job, starts a company, approaches individuals for funding, or attempts to float a public stock offering, that person recognizes the rights of his employer to demand such assurances and will usually sign such agreements with little argument—not to sign would invariably adversely affect whatever relationship he is trying to establish. The key but perhaps subtle point made here is that at the time he begins, the employee knows exactly what it is that the company does not want him to do in the future. Generally speaking, little problem is associated with the creation of such a document. The problems arise when the marriage is over and employees move elsewhere. It is then that the interpretation and application of such contracts, in establishing the rights of the company and restricting the usefulness of the individual, become important. Invariably when such a matter reaches a court of law, it is difficult to prove proprietary ownership by a company or that harm has been done (prior to the event). The situation is akin to closing the stable door after the horses have left. The sympathy usually goes to the individual who appears righteously to be deprived of an opportunity to make a livelihood.

Situations where, were it not for the prior relationship, an individual might not be as attractive a prospective new employee, are arising more and more frequently. In fact, the appearance of such stories in the press is increasing.

Salesmen depend on their ability to attract customers to a specific product, and the ability of the salesman is recognized in direct proportion to his ability to beat out competitors for the business. When a salesman resigns from a company that manufactures computers or sells time-sharing services, and takes a similar position at a direct competitor, it is recognized that in all probability he will be calling on his old customers or prospects, selling the identical function but for a different vendor. In many cases it is this very ability and knowledge, that he possesses by virtue of his prior association, that the new company is purchasing.

Several years ago a company called Graphic Sciences Corp. was formed by several ex-employees of Xerox. One of their first products was a reproduction system that used telephone line hook-up for its transmission. In the initial public offering, the prospectus indicated that Xerox felt that the prior association of the key employees had, in fact, produced the product, or at the very least provided them with the knowledge to produce it. The prospectus contained several long paragraphs that essentially reserved the right by Xerox at any time in the future to apply for legal redress of their grievances.

As the plug to plug compatible market has become more aggressive and competitive, it has become more apparent that IBM will take a very close and proprietary view toward some of its own products in this field. In particular, in a suit pending between Memorex Corp. and IBM, IBM specifically asked for an injunction against Memorex to prevent their production or use of any IBM 3330-like component based on trade secret data. IBM claimed that certain employees at their company had been involved in these developments at both IBM and Memorex and hence trade secret knowledge gained at IBM was used to produce Memorex products.

With all the other court action IBM is currently involved in, this particular case has been pre-empted by other more immediate legal battles. One of these involves a complex series of claims and counterclaims between IBM and Telex being heard in Tulsa, Okla. In a $25 million counter suit, IBM charges Telex with unlawfully obtaining IBM trade secrets and copyrights of IBM technical publications. Telex, in denying the charges, has countered with its own claim that IBM was diverting attention from its own anti-trust suit against IBM. Recently IBM brought a criminal action suit against 10 individuals claiming that a conspiracy in trade secrets theft dating back to the middle '60s had resulted in the theft of plans for IBM's 3330 and 3340 storage devices. IBM said that these secrets were worth in excess of $600 million and it is clear that IBM intends to press this claim with vigor in the courts.

While suits of these kinds have always been with us, what is unusual is the increasing frequency with which they are

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being announced and equally important, the fact that many companies are willing to take these cases to the courts. Undoubtedly, it is hoped that this publicity will do something to stem the tide of potential violations.

This problem has not been confined to the computer industry, but is somewhat characteristic of technology-oriented industries in general. Also, while it is most fashionable for smaller companies to become involved in this issue with large companies such as Xerox or IBM, there are also many cases that involve smaller companies fighting with each other. For example, Storage Technology Corp. was sued by Telex Corp. wherein they were charged with raiding Telex employees and theft of trade secrets in the development of STC products.

Many of us have from time to time been approached with information concerning the marketplace, competitors, or customer lists that were obtained through other than normal information channels. A recent item in the press indicated that IBM was tightening up its internal security after it found that individuals were offering confidential data concerning IBM's customer lists in the marketplace. Another recent item indicated that Quantum Science Corp. intended to halt the improper dissemination of one of its proprietary industry studies that, it was claimed, was being used by TRW without Quantum's approval, and without paying the purchase price.

It is clear from the above examples that salesmen, engineers, consultants—in fact, almost everyone in the industry—have at their fingertips facts and figures that are legitimately received in the course of their duties and are of inestimable value if provided to others outside of the company of origin. One cannot deny that every individual has the right to change jobs or strike out on his own to look for the pot of gold at the end of the rainbow, but there must be implicit in a relationship between company and men a responsibility on the part of the individual to protect that which his previous employer considers proprietary. In an overzealous attempt to succeed or show loyalty to one's new employer, the morality of using such information at the new company is often overlooked.

I suggest that it is high time we computer professionals examine more closely our own motivations and responsibilities—especially in as sensitive an area as company security. While it is clear that the courts lean over backward to protect the rights of the individual, what may appear to be legal might still lack an aura of moral responsibility. No one wishes to be accused of attempting to deprive an individual of his birthright of earning a livelihood, but it is clear from the above examples, to name a few, that it is not an individual's right to a job which is at stake. It is the individual's attempt to capitalize on prior associations which results in unfair applications of his previous experience. Certainly an engineer should be allowed to develop new products. But an engineer who designed a major breakthrough on some peripheral product should not carry that major breakthrough to his next employer. This would provide the new employer with an unfair competitive edge that he would not have enjoyed were the individual not in his employ. This goes to the heart of the matter and is, I suggest, a fair subject for the elders of our industry to discuss, producing a code of ethics that, while not in a sense legal or binding, might still provide us with enough of a conscience to do what is visibly right and bypass what is obviously wrong.

—Julius Honig

Mr. Honig has been with IBM, has begun his own software development company, and most recently was general manager of Digital Development Corp. He has since left to manage his personal investments.

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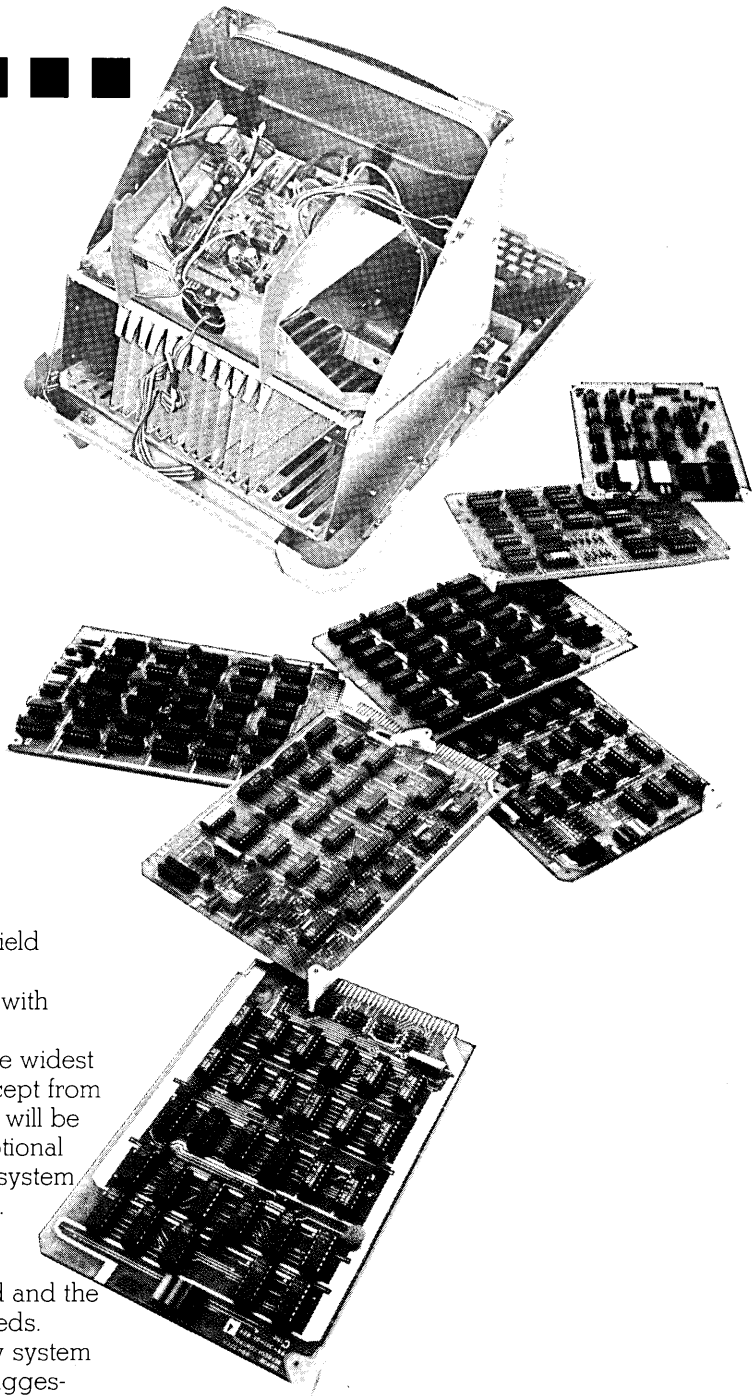

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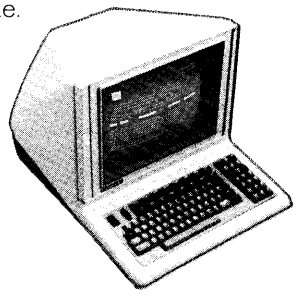

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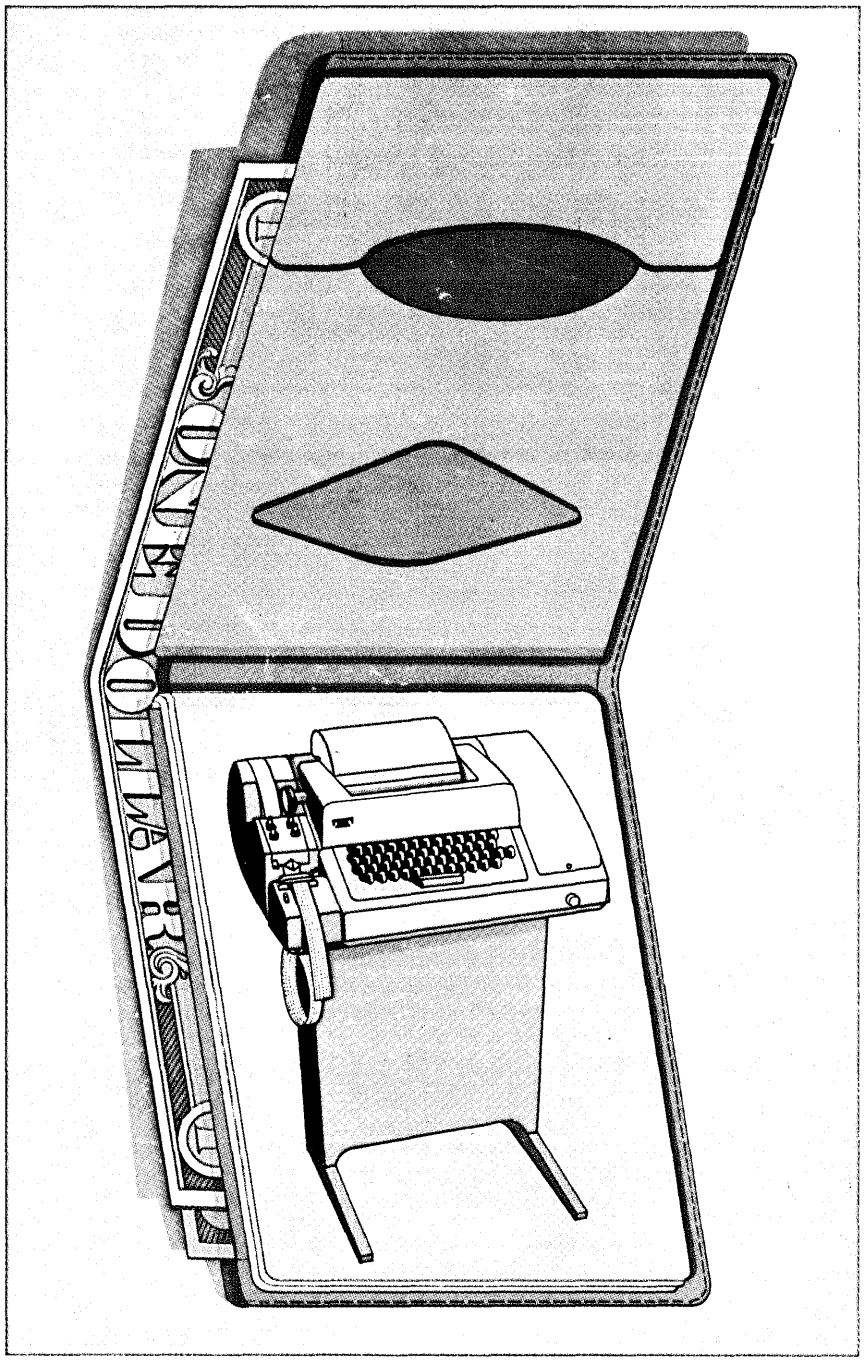

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