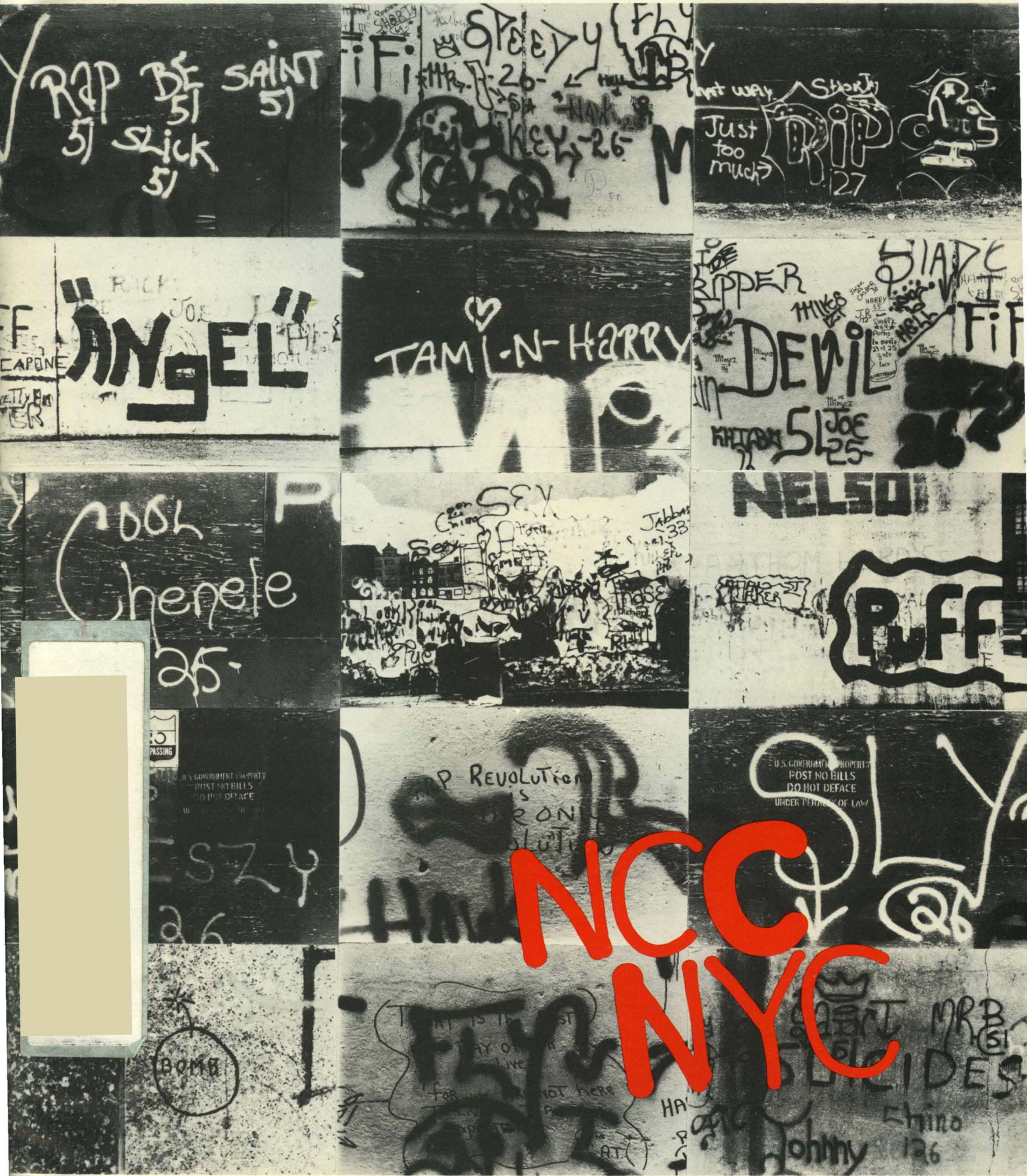
DATAMATION®

'73 May



ALSO... Boehm on software, a tutorial on nonimpact printers, scheduled maintenance, Babbage and the countess...

VTAM, the VORTEX Telecommunications Access Method. Hook up with your big computers and multiple terminal networks. Fully integrated in Varian's own V73 with VORTEX (our multi-task real time operating system), it's an off-the-shelf communications software capability and it's second to none.

VTAM is the only telecommunications system which includes file management systems, simultaneous foreground/background processing, and multi-threading as integral parts of the package.

Our VTAM is an articulate, price/performance conscious executive with an open ended system structure. It provides teleprocessing controls for our communication controllers, modems, terminals, communications networks, and network operator controls.

Terminal and teleprocessing I/O are handled as logical units. VTAM is extraordinarily easy to use; application-level programming is all that's required.

Perhaps the most important feature of VTAM is its flexibility. It functions equally well as a base in a broad range of communications applications—from systems dedicated to functions such as store and forward message switching or front end processor. Or, the communications may be a supplemental function to other processing tasks. Like remote inquiry into an instrumentation data base. Or satellite processor connection with a distributed processor network. Even data exchange with a remote host computer after local processing.

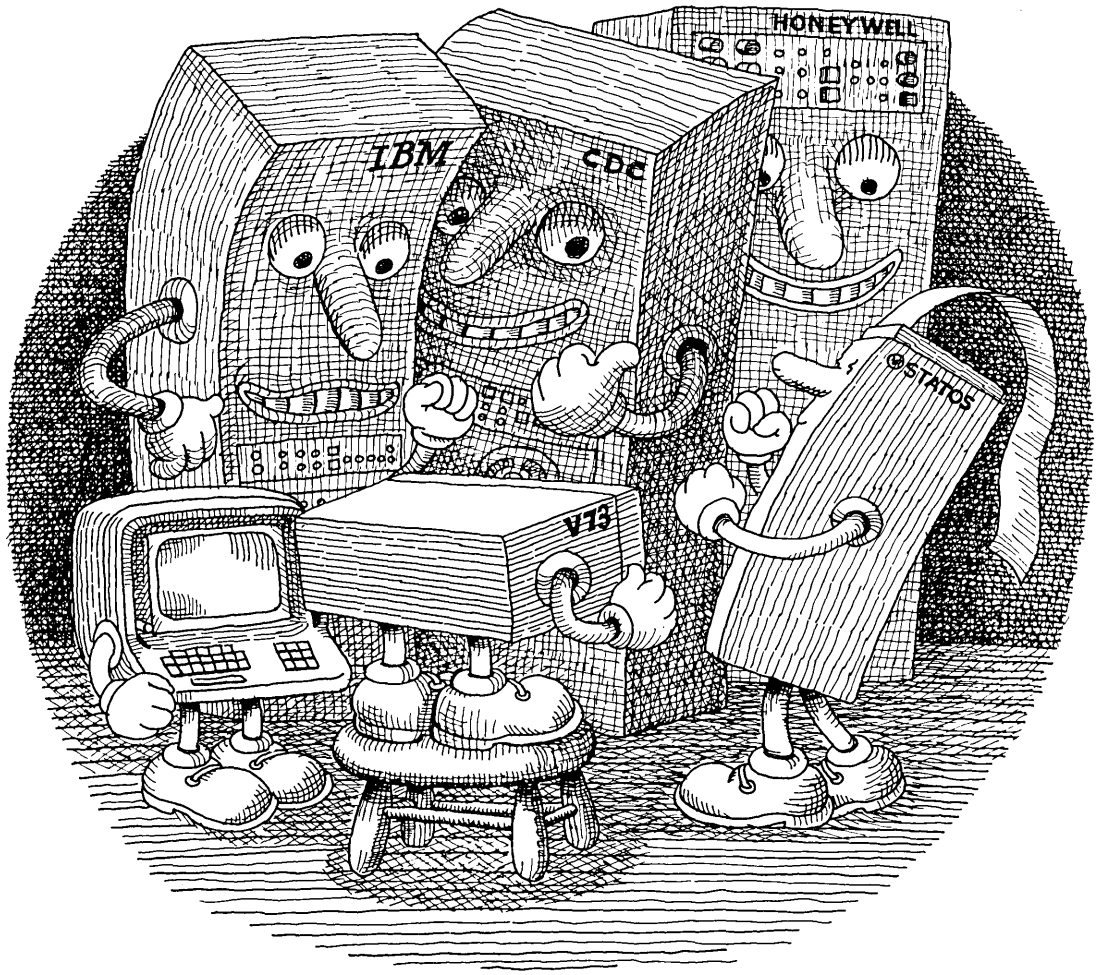
And modularity lets VTAM handle systems that range from one or two low speed lines to large multi-node networks. From simple teletypes to the most complex line disciplines.

Our microprogrammed, message mode Data Communications Multiplexer completes the hardware/software package and takes full advantage of our multi-bus, extendable architecture 330 nsec V73. With message mode communication, software overhead is minimal. VTAM and our other data network or stand-alone packages are available now. At far less cost than you would have thought possible in a system this size.

For the full story write Varian Data Machines, 2722 Michelson Drive, Irvine, California 92664 or call (714) 833-2400.

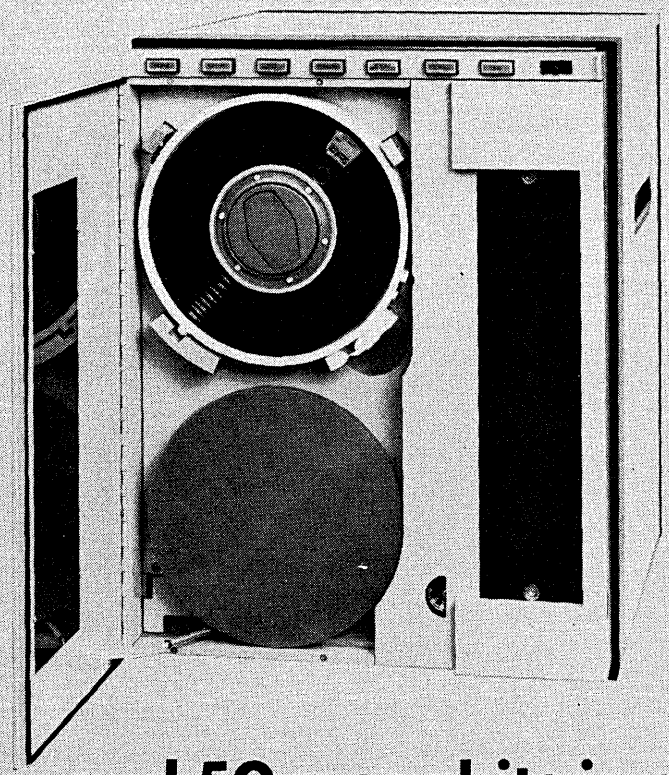
varian data machines

VTAM. Varian's reply to some very big communications talkers.



CIRCLE 1 ON READER CARD

Two new pace setters from WANGCO

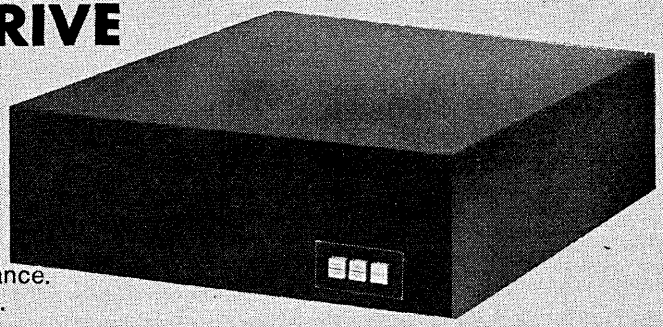


The Mod 1200—AUTOLOAD

All the features of the well-proven WANGCO vacuum column tape drives, plus *completely automatic tape loading,* are built into the new Mod 1200-AUTOLOAD. It uses the dust-proof IBM wrap-around cartridge for faster loading, with no time wasted threading tape. The operator never touches the tape. Reels without cartridges may also be used, quickly and conveniently, with automatic threading.

The Mod 1200-AUTOLOAD offers tape speeds from 25 to 75 ips, with vacuum columns, single capstan drive, IBM head guide spacing and the same interface as other WANGCO tape systems. Transfer rates are as high as 120,000 bytes-per-second, with densities to 800 cpi NRZI, 1600 cpi phase encoded, or in 800/1600 dual-density combination. Feature for feature and dollar for dollar, there's nothing else like the Mod 1200-AUTOLOAD.

...and 50 megabits in a "BLACK BOX" DISC DRIVE



Our new "black box" is the low cost Series-N Disc Drive, packing 50 megabits of data into 5¼ inches of 24-inch deep rack. It brings to your system additional capacity for main memory extension, software storage, process control programming, and similar data storage applications. The compact Series-N is ideal where requirements are low cost, fast access and long-term reliability with minimum maintenance. Track-to-track access time is 15 ms, with 50 ms average.

Just one disc in a "black box," but it can do a lot for your system.

Write for detailed technical data

See these new WANGCO pace setters at National Computer Conference Booths 2718-22

WANGCO

SETTING THE PACE IN PERIPHERALS

2400 Broadway ■ Santa Monica, Calif. 90404 ■ (213) 828-5565

IN EUROPE: MUNZIG INTERNATIONAL, INC. LONDON - GENEVA - STOCKHOLM - MUNICH - PARIS

The Olivetti girl presents her family

Meet the direct descendants of a distinguished line of Olivetti information systems that started a half-century ago.
It's a big, big family adaptable to almost any situation. With over 50,000 already installed!
Teleprinters for administrative tasks.
High-speed buffered systems for full-service banks and savings institutions. Smart terminals that communicate with computers and each other.
All displaying those fine old Olivetti family traits of ingenuity, great design and terrific service backup.
(There are Olivetti branch offices all over the U.S. with trained personnel on call!)
Ask us for a proposal on your next terminal installation.
Join the family.

# of Olivetti Terminals:

olivetti

The American Dream Machines

office typewriters
portable typewriters
adding machines
calculators
word processing systems
accounting systems
electronic billing systems
microcomputers
on-line systems
office copiers

CIRCLE 33 ON READER CARD

DATAMATION®

MAY, 1973
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DATAMATION®

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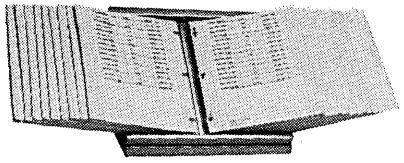
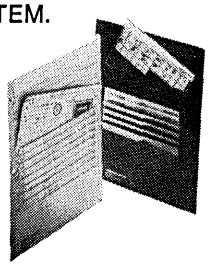
Admit it. Progress can be a losing proposition. To modernize record keeping procedures, you miniaturized. And you started losing. Microfilms and tab cards. Time and money.

Boorum & Pease can cut your losses, make progress profitable. We've pioneered and developed practical filing and storage systems for easy-to-lose micro-imagery. We've taken the lead in meeting information storage and retrieval needs with these unique products.

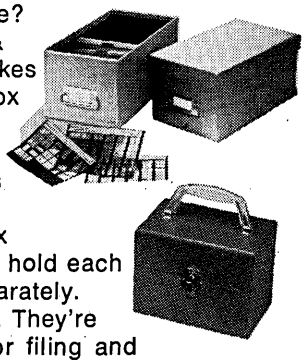


VIZ-A-FICHE™ SYSTEM.



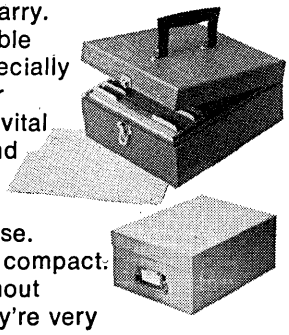
You can't beat this system. Patented index panels hold 30 microfiche. 1440 images per panel. Handle aperature and tab cards as well as microfiche. There are white panels for negative film. Black panels for heat developed film. Panels can be housed in portable Easel Binders or desk top Viz-A-Racks. Either way, these satellite stations keep everything in its proper place. At your finger tips.

DAT-A-FICHE™ CASES



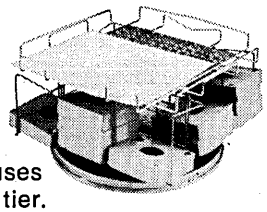
The case for 4x6 microfiche? Boorum & Pease makes it best. Box file or carrier. Our cases come with index folders to hold each fiche separately. Protect it. They're perfect for filing and storage. Perfectly portable.

DAT-A-CARD™ CASES



Stash and carry. These portable cases are specially designed for transporting vital aperature and tab cards. 1000 to 1200 cards per case. Neat, sturdy, compact. With or without handles, they're very handy to have.

VIZ-A-SPIN™



More proof that Boorum & Pease has been thinking small in a big way. This unique revolving rack houses 32 cartridges per tier. Interlocking metal sections make it easy to expand. Make millions of micro-images easy to find.

For better record keeping products, there's no better company than Boorum & Pease. We've got the people, the products, the prices, and the experience to serve you better than anybody else in the business. See your office products dealer or write us for more information. Boorum & Pease, 84 Hudson Avenue, Brooklyn, N.Y. 11201. Tel. (212) 875-8818

Standard®

BOORUM & PEASE COMPANY

Everything you need to keep the record straight.

It's a small world. Boorum & Pease can help you find it.

CIRCLE 17 ON READER CARD

This man lacks a salesman's chief weapon. Price.

Why is he smiling?

Did you hear the one about the traveling salesman who couldn't beat his competitor's prices, much less bump into a farmer with a fetching daughter?

Meet Dave Young. An ADDS salesman.

Now Dave's not really unpopular with the ladies; but he is, strangely enough, anathema to his competitors.

They just can't seem to figure Dave.

Sure, they beat him on price. But Dave walks off with the roses. And a smile as wide as your mother's arms.

It's like this.

Since most of Dave's customers know they can get TTY compatible data display equipment for less, Dave's obviously got to deliver more than a fancy how-do-you-do and a fast pitch.

He does.

"ADDS' equipment costs more," Dave explains, "simply because it's worth more. More features. More models. More reliability."

"ADDS' tabletop Consul series comes standard with formatting, blinking, video output, and three operating modes. A graphics option (with almost 12,000 elements), a cassette, and a printer are also available."

"And," he continues, hitting his stride, "these features are all found in the broadest line available. ADDS' 28 lb. portable Envoy, our completely rack-mountable MRD-700, our readout only MRD-200 and our new, polled Series 'A'."

"Up to 96 of these Series 'A' terminals can share a single communications line." Dave proceeds, "And since these 'A' terminals can be 'daisy-chained' together at any single location, a cluster controller isn't needed."

As far as Dave's concerned, he's just gotten his foot in the door.

The demonstration is his "coup de grace".

The minute Dave plugs in our Consul 880 it's all over but the shouting. Easy to use, easy to read, and beautiful to behold, our terminal is a classic piece of engineering no sane man could resist.

If you'd like to hear more, call us.

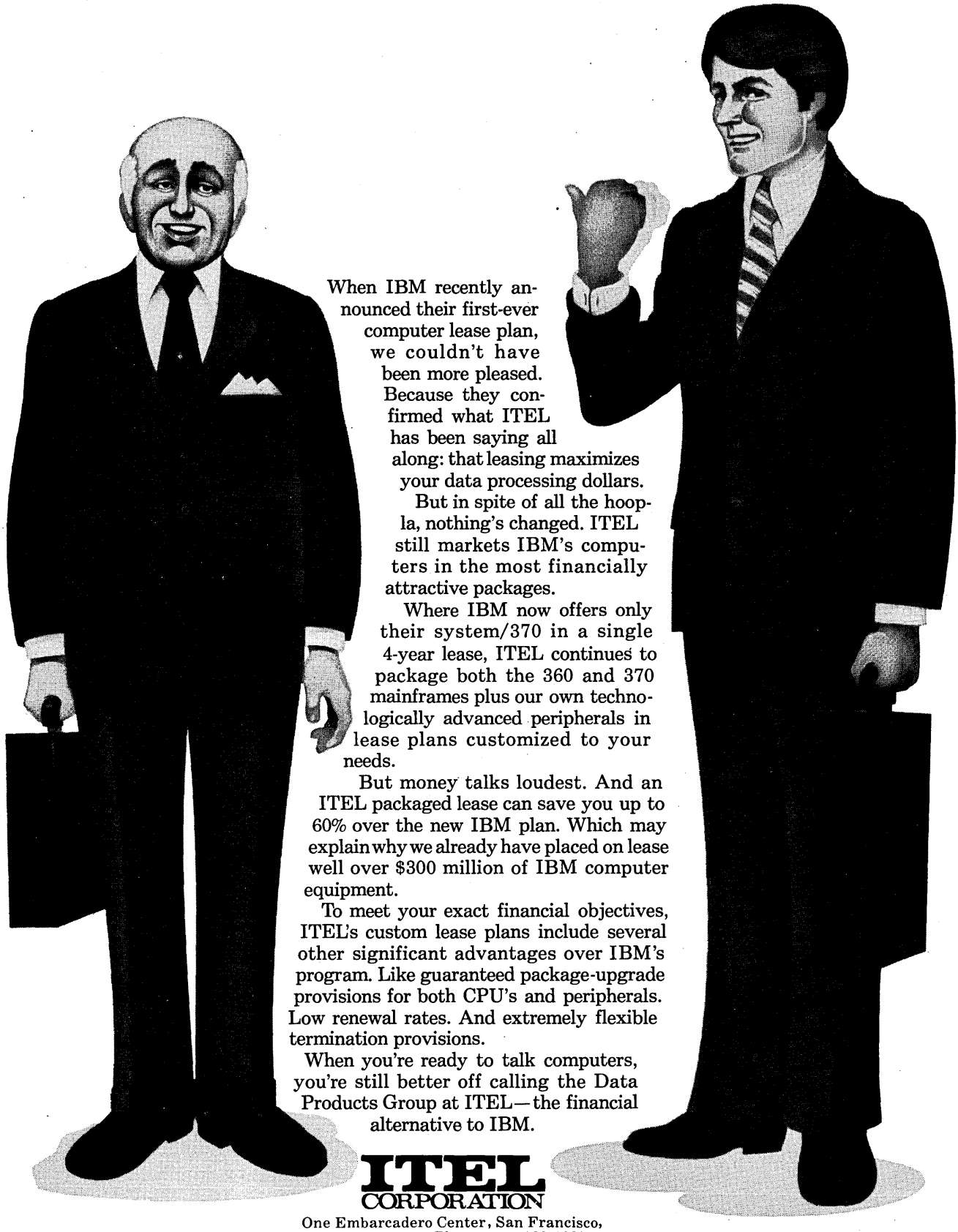
With all due respect to the beauty of America's farm girls, we're pretty sure we're the ones behind Dave's smile. ADDS. Applied Digital Data Systems. 100 Marcus Blvd., Hauppauge, N.Y. 11787. (516) 231-5400.

What's behind our smile. ADDS
Applied Digital Data Systems Inc.

See us at the NCC—Booth no. 2823.

CIRCLE 7 ON READER CARD

IBM IS BEGINNING TO TALK LIKE ITEL.



When IBM recently announced their first-ever computer lease plan, we couldn't have been more pleased. Because they confirmed what ITEL has been saying all along: that leasing maximizes your data processing dollars.

But in spite of all the hoopla, nothing's changed. ITEL still markets IBM's computers in the most financially attractive packages.

Where IBM now offers only their system/370 in a single 4-year lease, ITEL continues to package both the 360 and 370 mainframes plus our own technologically advanced peripherals in lease plans customized to your needs.

But money talks loudest. And an ITEL packaged lease can save you up to 60% over the new IBM plan. Which may explain why we already have placed on lease well over $300 million of IBM computer equipment.

To meet your exact financial objectives, ITEL's custom lease plans include several other significant advantages over IBM's program. Like guaranteed package-upgrade provisions for both CPU's and peripherals. Low renewal rates. And extremely flexible termination provisions.

When you're ready to talk computers, you're still better off calling the Data Products Group at ITEL—the financial alternative to IBM.

ITEL
CORPORATION

One Embarcadero Center, San Francisco, California 94111, Phone: (415) 989-4220

We've been manufacturing 4800 bps modems since 1967.

We know how to deliver them promptly. And we do.

Once you decide to step up to 4800 bps, you expect big improvements in your data communication. You look for higher throughput, lower CPU costs, increased efficiency. Great! But, you won't get any benefits until the new modems are installed. And some suppliers still expect you to wait months because they're new at building 4800 bps modems.

ICC keeps 4800 bps modems on hand, for installation whenever you're ready. We've been helping customers upgrade to 4800 bps for more than 6 years. We respect your need for prompt delivery.

ICC

International Communications Corporation
7620 N.W. 36th Avenue, Miami, Florida 33147
Telephone 305 + 691-1220 305 + 836-4550
In Europe: RACAL-MILGO LIMITED Reading, Berks, England

See us at the National Computer Conference

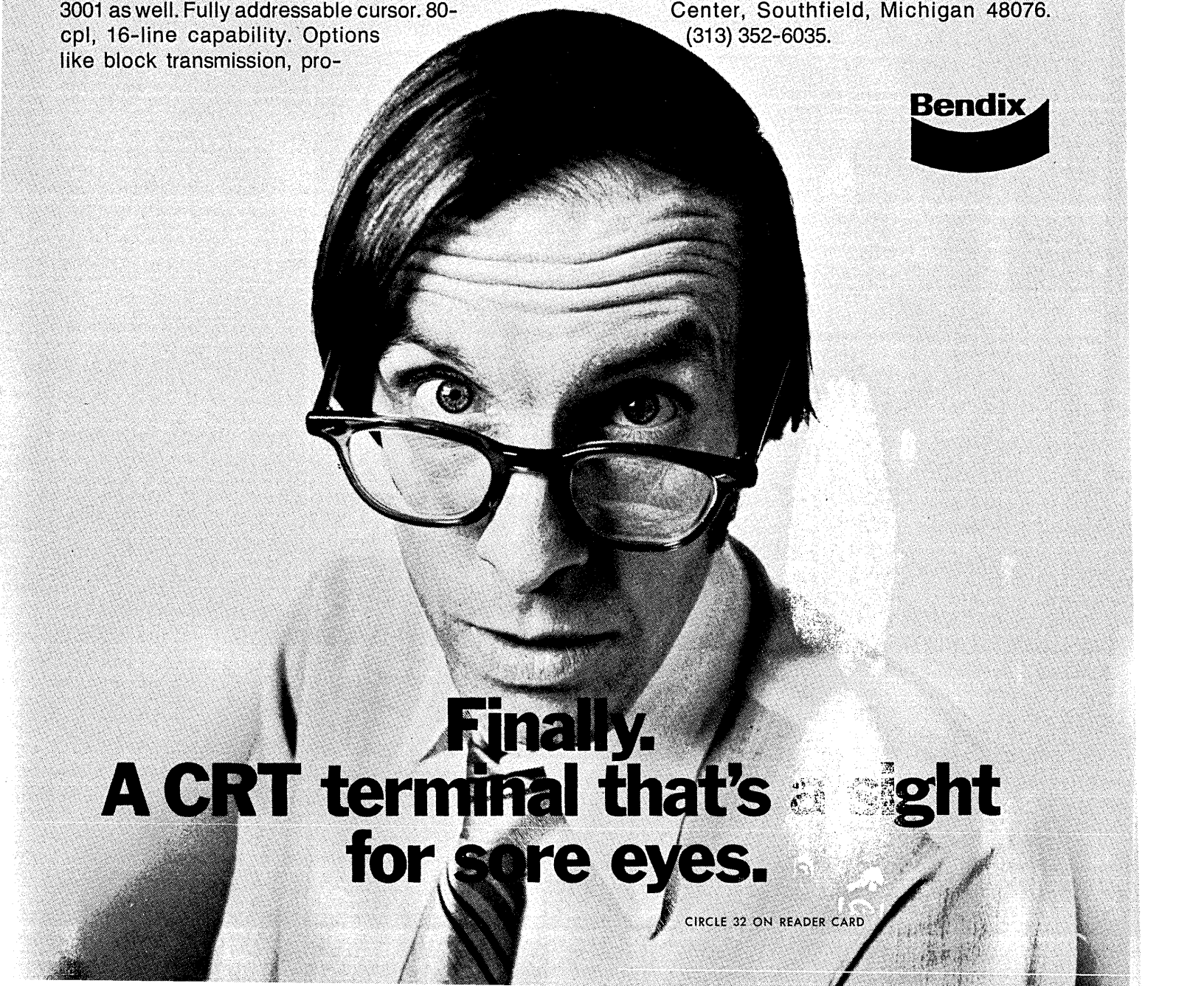
a milgo company

CIRCLE 38 ON READER CARD

It's the Bendix 3001 CRT Communications Terminal, and it boasts one of the biggest screens in the business. You get 25 to 50% bigger characters. Results? Large, crystal-clear alphanumeric display that's very easy to read.

There are other features you'll like about the 3001 as well. Fully addressable cursor. 80-cpl, 16-line capability. Options like block transmission, protected field and printer interface. ASCII is standard, but other code sets are available. The 3001 is just one of many computer terminals available from Bendix. Like to put it to work for you? Simply contact Interactive Terminals Corporation, a Subsidiary of The Bendix Corporation, Bendix Center, Southfield, Michigan 48076. (313) 352-6035.

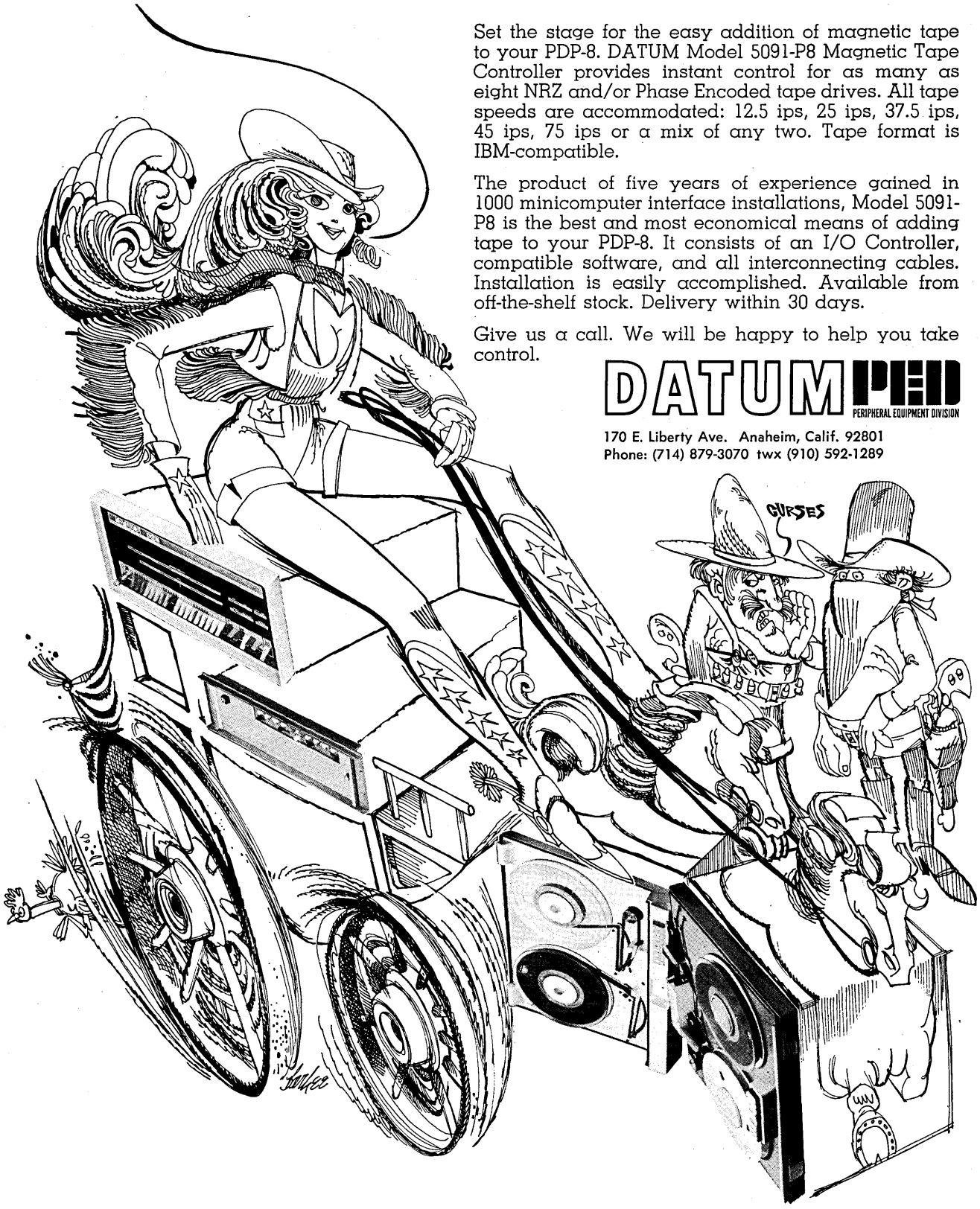
Bendix



Finally. A CRT terminal that's right for sore eyes.

CIRCLE 32 ON READER CARD

"Let DATUM Control the Mag Tape for Your PDP-8!"



Set the stage for the easy addition of magnetic tape to your PDP-8. DATUM Model 5091-P8 Magnetic Tape Controller provides instant control for as many as eight NRZ and/or Phase Encoded tape drives. All tape speeds are accommodated: 12.5 ips, 25 ips, 37.5 ips, 45 ips, 75 ips or a mix of any two. Tape format is IBM-compatible.

The product of five years of experience gained in 1000 minicomputer interface installations, Model 5091-P8 is the best and most economical means of adding tape to your PDP-8. It consists of an I/O Controller, compatible software, and all interconnecting cables. Installation is easily accomplished. Available from off-the-shelf stock. Delivery within 30 days.

Give us a call. We will be happy to help you take control.

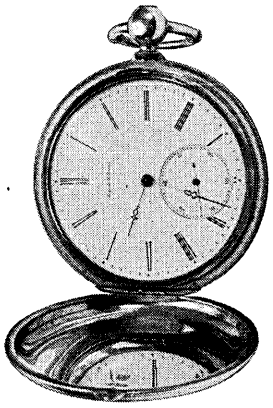
DATUM PED
PERIPHERAL EQUIPMENT DIVISION

170 E. Liberty Ave. Anaheim, Calif. 92801
Phone: (714) 879-3070 twx (910) 592-1289

IBM, UNIVAC and DEC users: **Tired of computer add-on double-talk?**

fact:

Nobody makes more reliable computer subsystems.

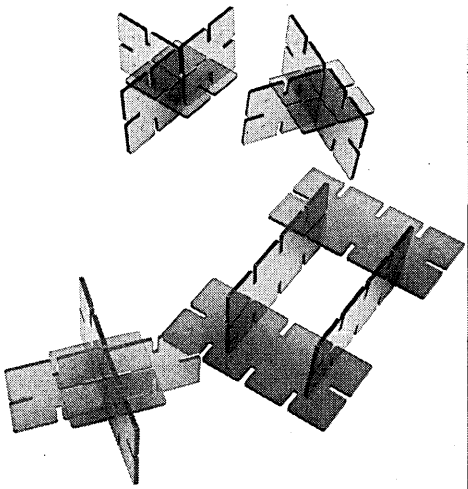


fact:

No independent offers better service, worldwide, on its products.

fact:

No other independent supplier designs, manufactures and services all his computer peripherals—magnetic tape, disk and mainframe memory enhancements.



fact:

You can't get better performance and human engineering than are offered by Ampex peripherals.

These facts add up in your favor. In Ampex tape, disk and memory subsystems. For IBM 370. For IBM 360. For Univac 400 and 1100. For DEC System 10.

It will pay you to take full advantage of Ampex one-source shopping for all your peripherals needs.

Ampex, the biggest and best name in computer peripherals.

For details, call 800-421-6554, toll-free.

fact:

Ampex computer peripherals cost up to 40% less than OEM's such as IBM, Univac and DEC.

fact:

No peripheral manufacturer is more concerned with computer-room space restrictions.

AMPEX

AMPEX COMPUTER PRODUCTS DIVISION
13031 West Jefferson Boulevard
Marina del Rey, Ca. 90291 (213) 821-8933

VISIT AMPEX AT NATIONAL COMPUTER CONFERENCE BOOTH 2417

Calendar

MAY

Society for Information Display International Symposium, May 15-17, New York City. Fourteen daytime sessions and two evening panels on display technology and an exhibition of the latest display developments. Fee: $40, SID members; $50, others. Eight lectures on the human factors in information display and computer graphics, cosponsored by the Polytechnic Inst. of Brooklyn, will be offered the day before and the day after the symposium. Contact: Lewis Winner, 152 W. 42nd St., New York, NY 10036, 212/279-3125.

I.A.S.A. 51st Conference and Business Show, May 20-23, Denver. Sponsored by the Insurance Accounting & Statistical Assn. for insurance executives—comptrollers, edp supervisors, and methods managers. Attendees can choose from 99 formal seminars. Exhibitors are mainly computer, software, and forms companies. Fee: $60, members; $75, others—includes seminars, exhibits, two receptions, two luncheons, banquet and stage show. Contact: Edwin C. Carlson, I.A.S.A., 406 W. 34th St., Kansas City, MO 64111.

Conference on Automatic Information Organization and Retrieval, May 21-25, Columbia, Mo. For computer scientists and library and information scientists. Dr. Gerald Salton, Chairman of the Dept. of Computer Science, Cornell Univ., will lecture on: an introduction to automatic library and information processing, automatic indexing and classification, automatic dictionary construction, retrieval evaluation, dynamic library processing, and new results and suggestions for further investigation. There will also be sessions of contributed papers. No registration fee. Send resumé of education, experience, and pertinent research to: Srisakdi Charmonman, Dept. of Computer Science, 305 Mathematical Science Bldg., Univ. of Missouri, Columbia 65201.

Graphic Communications Computer Conference, May 23-25, Toronto. Through case studies, exhibits, tutorials, and tours, the conference will examine and present some of the year's most significant achievements in computer use for composition, management information systems, mailing list services, and delivery system developments. Fee schedule: $100, $70, and $50 for a GCCA member firm's first, second, and additional registrants; $150, $100, $75 for nonmembers. Contact: N. W. Scharpf, Graphic Communications Computer Assn., 1730 N. Lynn St., Arlington, VA 22209.

JUNE

ABA National Operations and Automation Conference, June 3-6, Chicago. This is the big banking conference of the year, featuring some 60 sessions on operations, data processing, payments systems, management development topics, and the business of banking. Approximately 160 companies will exhibit their banking-related dp equipment, software, and services. Fee: $130, bankers; $160, others. Contact: American Bankers Assn., 1120 Connecticut Ave., N.W., Washington, DC 20036.

Assn. of Records Executives and Administrators 16th Annual Conference, June 4-6, Cherry Hill, N.J. Concurrent sessions for both novices and professionals: Topics include: Developments in Information Technology, Information Protection and Restoration, Records Storage, Justification of Technology, A Corporate "In-House" Approach to Coordinated Information Services, Outside Consultant's Approach to Information Management, and Inducing Management's Involvement in the Use of New Technologies and Systems. Fee: $125, AREA members; $150, others. Contact: Eileen P. Kee, c/o GTE Service Corp., 730 Third Ave., New York, NY 10017.

National Computer Conference & Exposition, June 4-8, New York City. See the special NCC&E section beginning on p. 147 of this issue for conference particulars, session summaries, and new product preview.

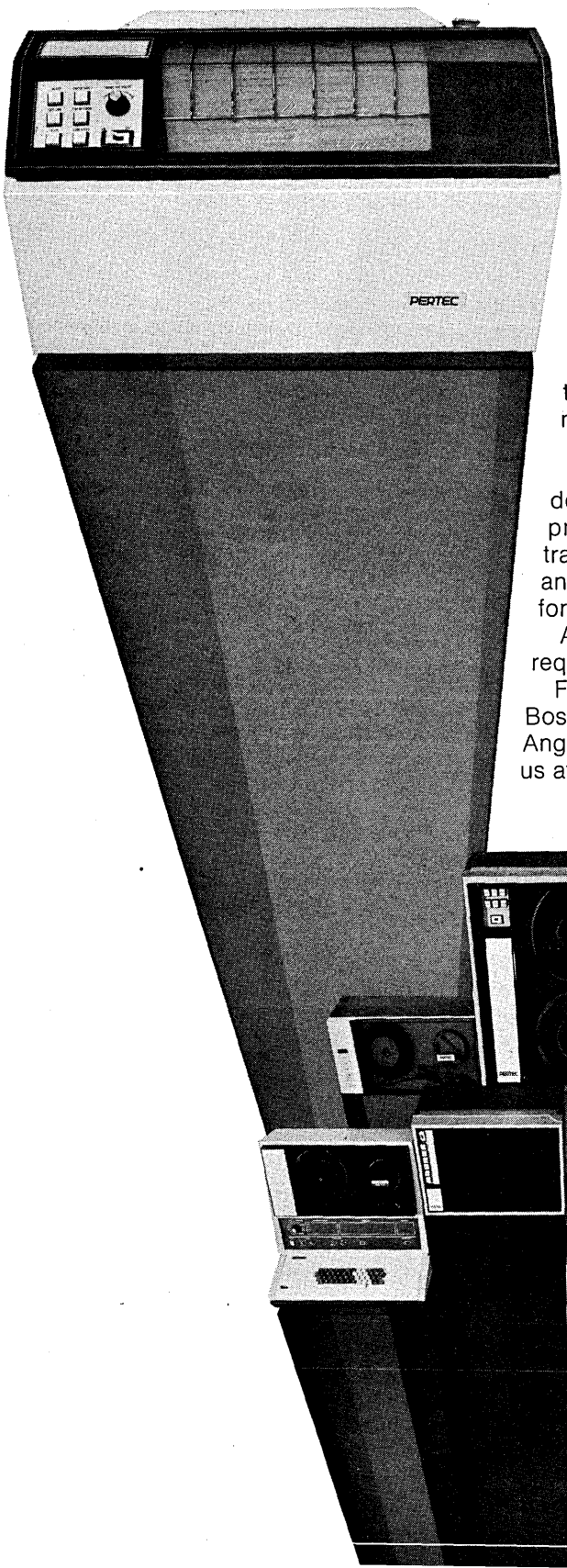
EDP Auditors Conference, June 7-8, Santa Monica, Calif. The objective of the conference is to help auditors, managers, and systems analysts address the matter of edp system control by identifying the kinds of problems that must be faced and some methods and techniques that can be applied to minimize or eliminate them. Discussion topics include the role of edp auditing, management of the edp audit function, edp audit methods, controls, and industry groups. Fee: $45, members; $50, others; after May 23, add $5. Contact: EDP Auditors Assn., P. O. Box 15562, Los Angeles, CA 90015.

OCR Users Assn. Conference, June 11-13, Annapolis, Md. The program includes user presentations from government, insurance, and industry, with special emphasis on source data entry; work sessions on data entry, source data capture, reject processing, and multimedia trends; vendor update sessions wherein equipment manufacturers discuss their latest developments; and an informal session on problems encountered and their solutions. Keynoter is Dr. Ruth Davis, of NBS. Advance registration: $100, first company representative; $50, additional representatives. Fee includes OCRUA membership, luncheons, and refreshments. Contact: OCR Users Assn., P. O. Box 106, South Holland, IL 60473.

IEEE International Conference on Communications, June 11-13, Seattle. Theme of the ninth annual conference is "Communications—Catalyst for Progress." Papers of a theoretical, experimental, and developmental nature will be presented in the areas of radio, space, vehicular, satellite, data, digital/voice, and optical communications. Contact: ICC '73, P. O. Box 648, Bellevue, WA 98009.

Semi-annual ICES Users Conference, June 13-15, St. Louis. A forum on the use and modification of the programs within the Integrated Civil Engineering System, developed at MIT, which supports a collection of engineering computer programs relating to structural analysis and design, roadway design, coordinate geometry calculations, project management, and soils analysis. Fee: $20 for the June 13 instructional sessions; $30 for the two-day conference. Contact:

Introducing the Pertec printer. High speed features on a medium speed printer at a surprisingly low cost.



It's a 132 column, 300 lpm printer. And a 160 lpm printer. A printer with Pertec dependability at a lower cost than most comparable single speed models.

It offers a variety of pre-engineered, plug-in options to complement your system as if it were designed for it.

With full fault protection to instantly signal anything amiss, electronic top-of-form and skip-over perforation features.

It prints 6 or 8 lines per inch and accommodates up to 6-part forms without the need for mechanical thickness adjustments.

And it's simple to operate and unobtrusively quiet.

Of course you get the same assistance in design, development and maintenance of your system with our printer as you do with our tape and disk drives. Factory training for your service people. Back-up by a service and support network spanning 30 U.S. cities and 20 foreign countries.

All because Pertec is serious about satisfying your system requirements. Contact us and we'll prove it.

Find out more. 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

Calendar

(Continued from page 13)

Dr. B. B. Flachsbart, McDonnell Douglas Automation Co., Box 5992, St. Louis, MO 63134.

Conference on Computers in the Undergraduate Curricula, June 18-20, Claremont, Calif. Approximately 60 papers on social sciences, physical sciences, and humanities, with special emphasis on the humanities and use of computers by community colleges. Of particular interest to undergraduate professors. Fee: $40, academic people ($50 after June 1); $75, others. Contact: Public Information Office, The Claremont Colleges, 153 Harper Hall, Claremont, CA 91711.

Symposium on the Simulation of Computer Systems, June 19-20, Gaithersburg, Md. Sponsored by the National Bureau of Standards and the ACM Special Interest Group on Simulation for people who require simulation for the evaluation of computer performance. Papers, panels, and discussions—a working session rather than a tutorial conference. Fee: $40, including lunches and Proceedings; $35, ACM or SIGSIM members, NBS employees. Contact: Paul F. Roth, A265 Technology Bldg., NBS, Washington, DC 20234.

International Symposium on Fault-Tolerant Computing, June 20-22, Palo Alto, Calif. A forum for the presentation of research results and current practice in computer reliability sponsored by the IEEE Computer Society. Sessions on: coding techniques, testing, diagnosis, recovery, fault-tolerant architecture, software reliability, and mathematical modeling. Registration, including meals: $55, IEEE members; $70, others; after May 25, add $10. Contact: Prof. E. J. McCluskey, Digital Systems Lab, Stanford Univ., Stanford, CA 94305.

Canadian Computer Conference, June 20-22, Edmonton, Alberta. The conference theme of "Focus 20/20" expresses the intention of using the experience of the 20-year history of the use of computers in Canada to focus on current problems and look forward to what may develop within the next 20 years. Technical sessions are divided into two concurrent streams: software and applications. In addition, there will be a special-interest session on computer science education and a number of workshops. Sponsored by the Canadian Information Processing Society. Contact: P. O. Box 1881, Edmonton, Alberta T5J ZP3, Canada.

ADAPSO 38th Management Conference, June 21-22, New Orleans. Under the theme of "Operations in the Computer Services Industry," the program will consist of platform presentations focusing on computer center management and its operations and should be of interest to any management personnel involved in batch processing, software, time-sharing, and data facility management services. Fee: $85, members; $150, others. Contact: J. L. Dreyer, Assn. of Data Processing Service Organizations, 551 Fifth Ave., New York, NY 10017.

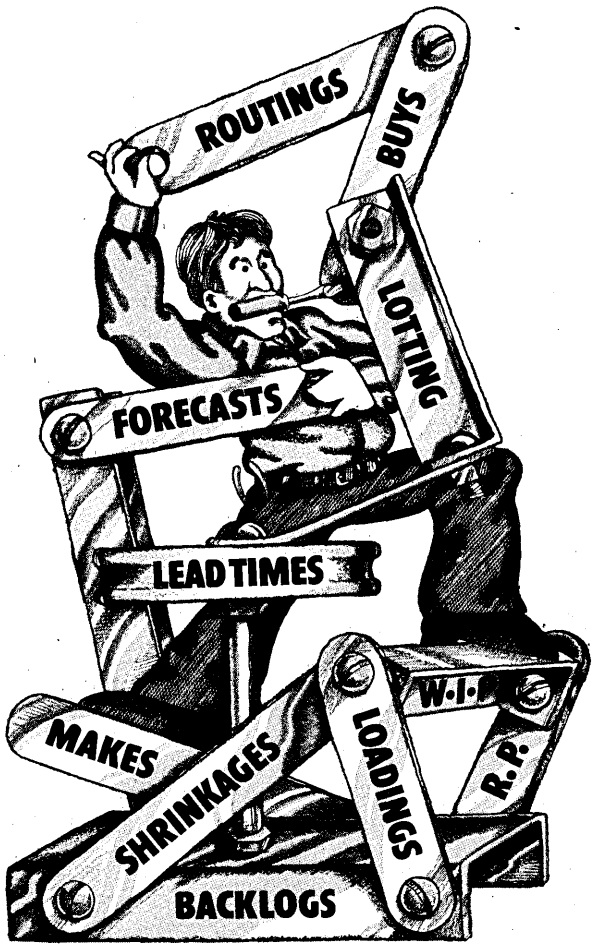
10th Annual Design Automation Workshop, June 25-27, Portland, Ore. A forum for presentation of developments in design automation—the use of computers as tools which aid the design process—of interest to specialists in the various application areas of design automation. Major session categories are packaging, software, architecture, testing and simulation, LSI design, design automation in Japan, mechanical, manufacturing, circuit design, and general design automation. Fee, including Proceedings: $45, ACM and IEEE members; $55, others; after June 8, add $10. Contact: Ben E. Britt, IBM General Product Div., H77-141, Monterey and Cottle Roads, San Jose, CA 95114.

Interdisciplinary Conference on Health Records, June 25-27, St. Louis. As of January 1974, federal law requires all hospitals to have some standard review process for evaluating patient care. The theme of this year's conference is "Evaluating Patient Care: Are We Ready for Professional Standard Review Organizations?" The program will be of interest to doctors, statisticians, systems and computer people, administrators, nurses, medical records librarians, and others in medical records and health care delivery. Fee: $45, members of Assn. for Health Records; $65, others. Contact: Assn. for Health Records, P. O. Box 2257, Ann Arbor, MI 48106.

National Communications Week, June 25 (New York City), **June 26** (Philadelphia), **June 27** (Washington, D.C.), **June 28** (Chicago), **June 29** (San Francisco). Theme: "Data and Voice Communications User Selection Techniques." Each one-day program will cover "Establishing an Evaluation System" (system objectives, resources required, cost/performance requirements), followed by "Evaluation Procedures" (system analysis and planning, evaluation of user requirements, determination and selection of available hardware, selection of transmission facilities, vendor evaluation techniques, and system implementation). In addition, a panel of voice and data communications users will describe their systems and answer questions from the audience. Fee: $95, CSMA members; $105, others. Contact: Communications Systems Management Assn., 1102 West St., Suite 1003, Wilmington, DE 19801.

DPMA International Data Processing Conference & Business Exposition, June 26-29, Chicago. Attendees can select 6 of 24 four-part seminars grouped into six broad categories of interest to professional data processing personnel: dp management, computer center management, peripherals, systems and software, operations, and data file management. In addition, six one-day workshops will cover the fields of banking, insurance, manufacturing, medical/hospital, governmental applications, and system development. The registration fee of $135 for DPMA members and $175 for others also includes the conference luncheons, annual banquet, an industry tour, published proceedings, and admission to the exhibition. The software exhibitors will conduct informational-type presentations in seminar rooms. Contact: Data Processing Management Assn., 505 Busse Hwy., Park Ridge, IL 60068. □

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



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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

WHEN BUTLER AND CROSS SEE EACH OTHER

RCA's old customer base soon may be paying another big dividend to Univac, this time from Europe. Univac has spent several million dollars in computer conversion aids to assist RCA Spectra users to move smoothly to Univac. In this regard, there are two sitting ducks in Europe: Siemens and ICL.

Both European firms have a large base of RCA Spectras, and they're all dressed up with nowhere in particular to go...unless for help to Univac.

Univac's John Butler, who did that remarkable job of keeping some 90% of ex-RCA U.S. customers in the Univac fold, has been dispatched to Europe as general manager of Univac's Northern European Division. And we hear that Butler has been seeing quite a bit of his old buddy Geoffrey Cross, who is now ICL's managing director. Don't look for an outright merger or acquisition, but some kind of cooperative arrangement seems likely at this point. Any such arrangement would likely galvanize the other European computer firms that have been talking merger and/or cooperation into a closer deal with another U.S. mainframe manufacturer like, say, Control Data, or maybe even Burroughs.

Others wonder what Siemens will do if Univac and ICL get together. The Siemens-CII-Philips cooperative agreement isn't exactly setting Europe on fire.

IBM'S "REASONABLE" SCARE TACTIC

IBM's new policy on maintenance of its equipment in a mixed installation can be called a reaction to increasing costs of dealing in such sites, or a scare tactic, or both. IBM's latest rounds of technological and financial moves, all replete with a two-edged sword, make it clear the answer is "both."

In effect, IBM has said that if a customer alters any IBM equipment in bringing in a competitive piece of gear, it will determine if inspection is needed and, if so, charge for it. That's the new part. Then, as in the past, the user pays for any IBM maintenance, diagnosis, or repair to IBM gear attributable to the alteration or attachment. IBM may also "establish additional charges for maintenance service under existing agreements" if the cost of maintenance of the unaltered portion of an altered machine is "significantly increased above" the cost of maintaining unaltered machines. One university user thinks the policy, which "doesn't sound unreasonable" on the surface, is "meant to scare the hell out of me."

IBM isn't claiming any problems with particular independents' machines or specifically with attachments to 370s. Instead, it claims that "in the last 12 months, increasing complexities involved with alterations or attachments" have caused it to issue the new policy called the "Multiple System Supplier Bulletin."

A problem to users: IBM says these charges would "recover additional costs such as those due to an increase in 'no trouble found' and intermittent failure incidents, great diagnostic complexities, and increased parts requirements." Users say there are no standards they know of for measuring the above. It will be IBM's judgment versus theirs, just as it has been in the past... and as is true with all vendors. The user has two recourses: make the other vendor liable or keep a very careful log of all maintenance

calls. The latter isn't easy, but one user says that his installation holds weekly meetings with the FE to discuss all problems and what was done about them.

PLANNING RESEARCH: WAS IT GETTING TOO BIG?

An insider says last month's resignation of president Robert Krueger and four vice presidents of Planning Research Corp. "was demanded, not volunteered." He claims the board felt "they weren't working hard enough, that there was too much cronyism, that the company had gotten too big and ought to restrict itself to consulting."

After reporting a six-months loss of $5.7 million, Planning Research at press time was reported on the verge of selling its Greenwich Data Systems subsidiary and two 360/65s in McLean, Va., to Control Data.

International Reservations Corp., originally part of the deal, apparently will be kept. But its president Bill Lonergan has left. His successor is Bert Helfenstein, formerly a PRC group executive. The reservations subsidiary, consistently unprofitable since startup nearly four years ago, turned a profit last quarter, shortly after terminating a big reservations contract with the American Automobile Association.

AFIPS OFFICERS GET THE AXE

Look for a big shakeup in AFIPS: the behind-the-scenes powers will pose an almost clean slate for the uncontested election to be held in June. We understand that president Wally Anderson and vp Bob Kudlich will not be asked to run again. George Glaser (ACM) gets another term as treasurer, but secretary Dick Blue (ACM) gives way to Dick Simmons (IEEE Computer Society) to avoid ACM dominance of the Executive Committee. Lured out of "retirement" to run for president is ex-ACM President Bernie Galler (Univ. of Michigan). Paul Berthiaume (Society for Computer Simulation) was slated for vp, but a serious illness may prevent that.

SEN. HART TAKES HIS CASE TO NCC

After a long absence, IBM is returning to the AFIPS-sponsored National Computer Conference next month with an 18-booth display. But the prodigal son isn't being spared its newest nemesis, Sen. Philip H. Hart, whose Industrial Reorganization bill (p. 129) could lead the way to control of the computer giant's dominance of the industry. Sen. Hart is the federation's last-minute choice as keynoter for the NCC, which opens June 4 for a five-day New York run as successor to the twice-yearly Joint Computer Conferences, which IBM has shunned for three years.

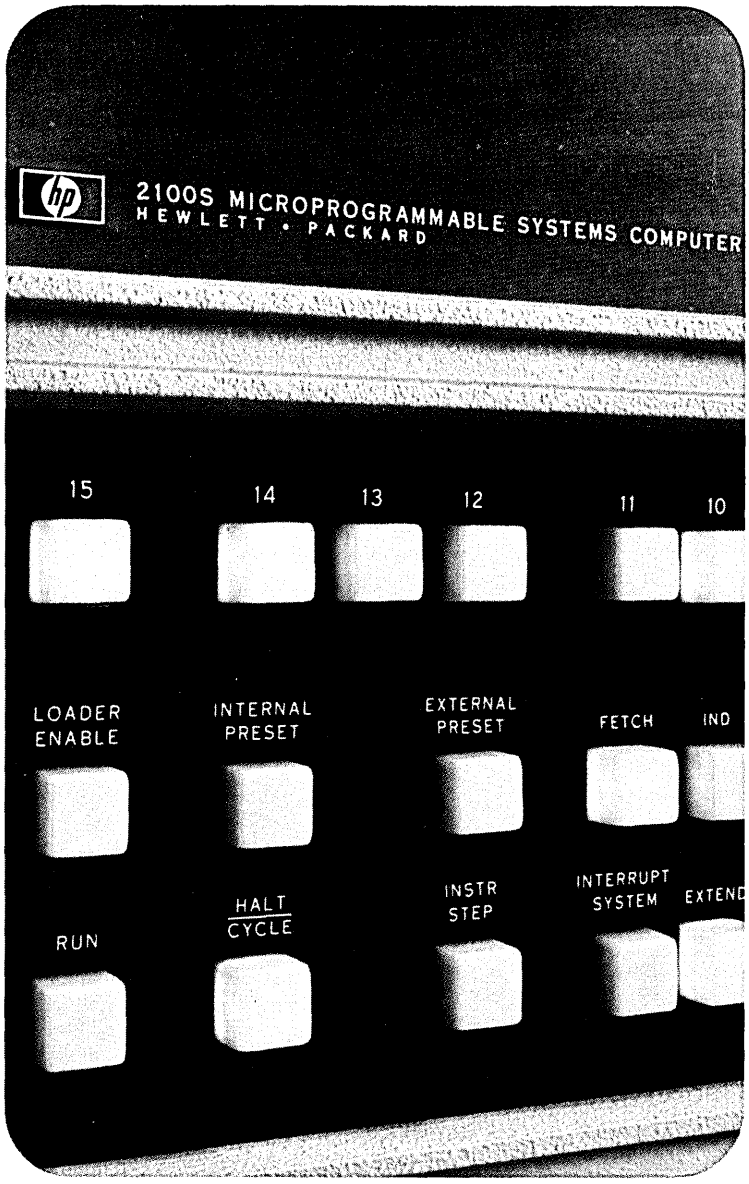
Meanwhile, the latest promotional mailing from the NCC's Science and Technology Program chairman, Dr. Carl Hammer, contains as excess baggage three one-page flyers promoting two consulting firms and a headhunter. That's one way to cope with rising postage rates.

ENTRY AND ORDERS IN DATA ENTRY

People at Pertec, the California peripherals maker, are talking informally about entering the shared-processor data entry market, with an announcement due before year-end. If true, it would be the company's second try at the market, following its unsuccessful attempt two years ago to merge with Cummins-Chicago, which has since introduced a system.

Pertec already makes key-to-tape terminals, disc and tape drives,

(Continued on page 220)



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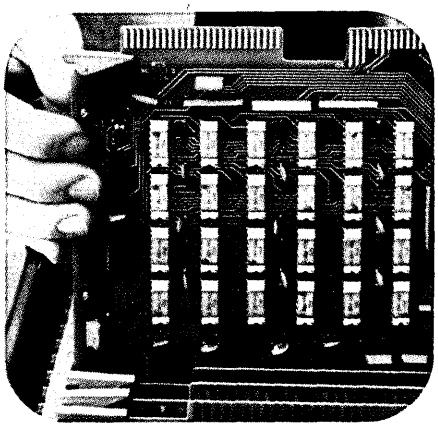

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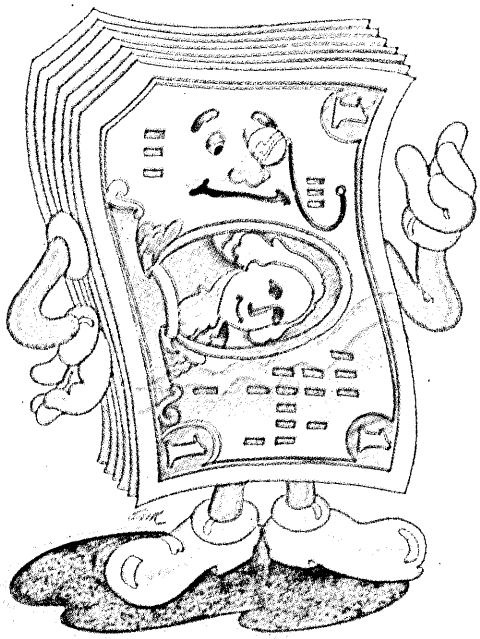

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CIRCLE 24 ON READER CARD

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But that's not all. It can be just what you want it to be: a stand-alone key/disk system, an off-line print station, remote MICR terminal . . . whatever you need.

And, as your requirements change, you can reconfigure your hardware and software to do the new job . . . the best way.

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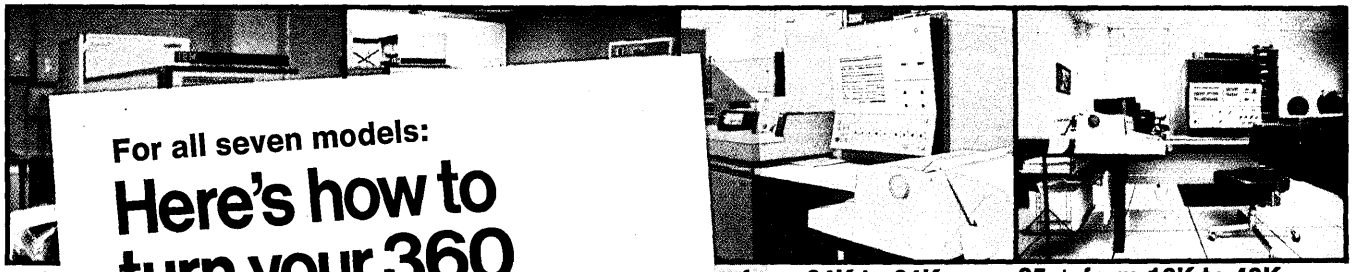
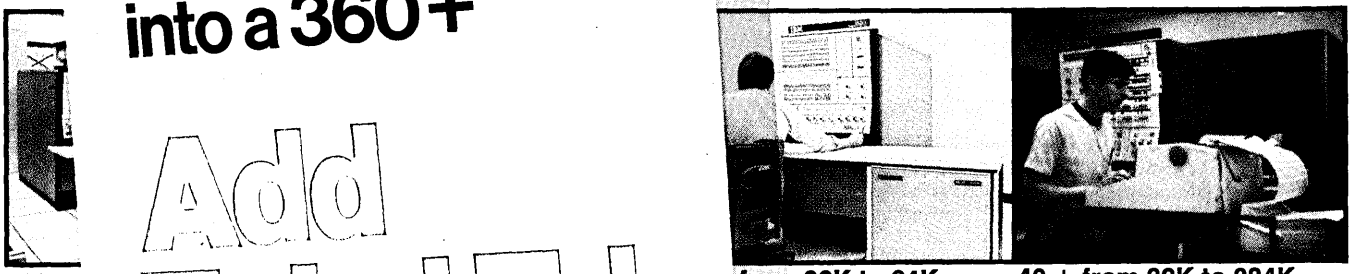


22

+ from 24K to 64K

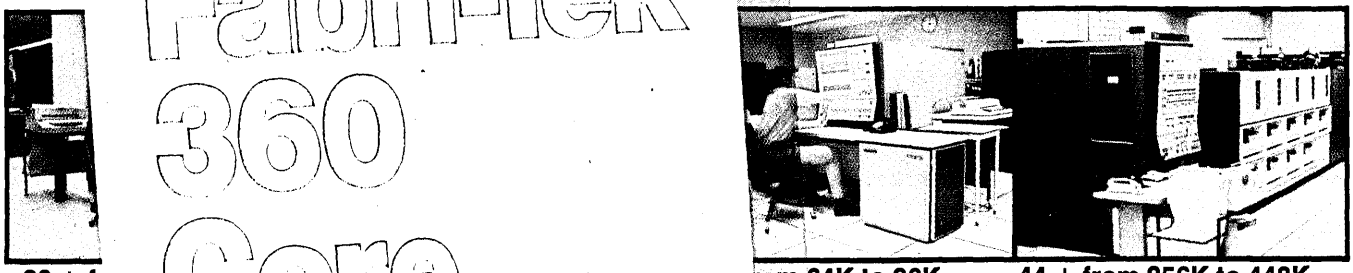
25 + from 16K to 48K



30 +

from 32K to 64K

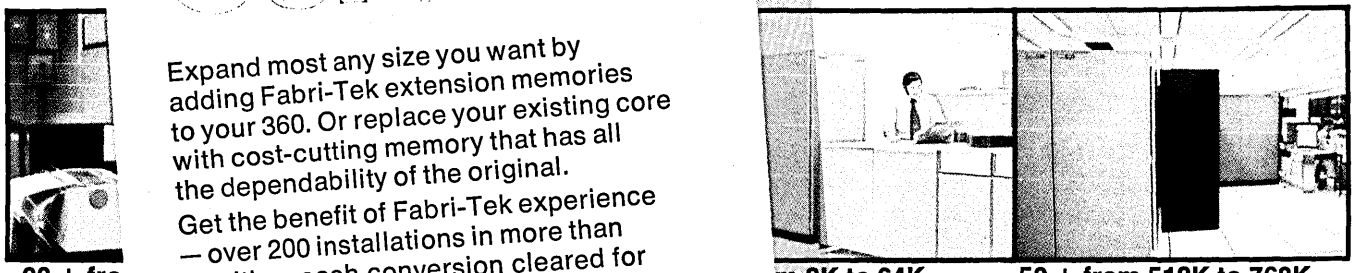
40 + from 32K to 384K



30 + fi

om 64K to 96K

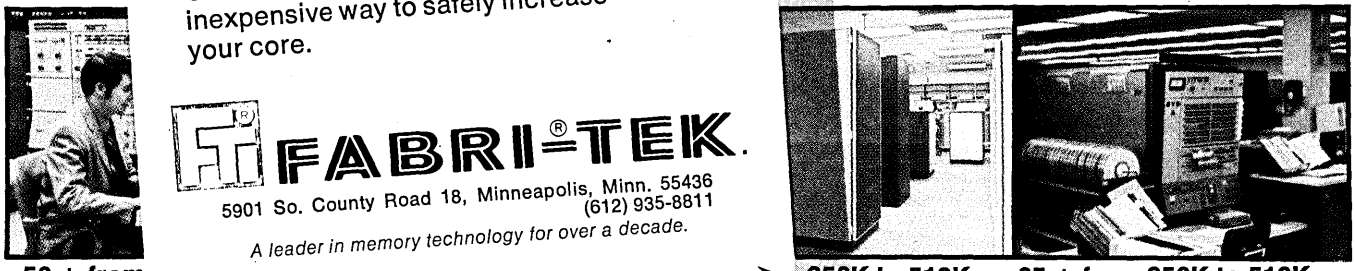
44 + from 256K to 448K



30 + fro

m 8K to 64K

50 + from 512K to 768K



50 + from

256K to 512K

65 + from 256K to 512K

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Letters

Nothing new

There is nothing implied, or new, in the use of the word "character" for "byte" in IBM's press announcements of new products (Look Ahead, March, p. 161). Historically, IBM news releases have used "character" both in defining "byte" and as a parenthetical alternative to "byte."

ROBERT A. MORRIS
IBM Corporation
White Plains, New York

Virtually yours

The readers of DATAMATION may be interested in the following, which pertains to your three articles on virtual memory (Feb., pp. 48-57).

The article by Messrs. Kurtz and Cuozzo contains two errors of fact. On p. 52, they state: "The solid line (of Fig. 3) represents execution in activity sequence necessary to obtain a small 'working set,' *a term coined by IBM* to identify code frequently executed so that once it's paged into real storage, it tends to remain there." (Italics mine.) The term was not in fact coined by IBM. Its first precise use in the public literature was mine*, and imprecise uses of the term can be found as early as 1962 in papers about the MIT Compatible Time Sharing System (CTSS). At no time while this work was being done was I associated with IBM.

On p. 50, Messrs. Kurtz and Cuozzo also state: " . . . larger pages enhance total I/O operations. *Bigger blocks mean less paging* and better channel throughput." (Italics mine.) Experimental data demonstrating that this statement is not always true can be found in a paper by Hatfield*, who incidentally is employed by IBM. The article by Messrs. Kurtz and Cuozzo is otherwise well done and informative.

The article by Mr. Bergstresser states on p. 55 that: "To understand and appreciate the advantages of virtual storage, *one need only understand two characteristics*: 1) a large address space is available for holding programs and data, and 2) the system allocates real storage to jobs, as required." (Italics mine.) By its omission of a third fact, this statement propagates a myth that the early promoters of virtual memory (circa 1962) promulgated, the damage of which many writers—a substantial number of whom were or are IBM employees—have spent the better portion of the past decade trying to repair. The missing third fact is: *Although the address space is large and linear, it does not behave as a random access store; in fact, the access time of an address tends to be considerably shorter if a neighboring address has been accessed recently than otherwise.*

This fact is seldom pointed out to prospective programmers of virtual storage systems. All the data available suggest that, when unaware of it, programmers tend to scatter information —and references to it—far and wide over address space, and generate thereby reference patterns so devoid of locality that their programs stand little chance of efficient operation. Many of Mr. Bergstresser's suggestions for writing programs with good locality do not completely agree with the conclusions presented in the literature.*

The article by Mr. Gaudion was an excellent and refreshing piece putting virtual memory in historical perspective. It shows that other manufacturers (e.g., Burroughs, CDC, RCA, Univac) have had better records of success and more experience with virtual storage than IBM, demonstrating once again IBM's predilection to swallowing up the ideas of others and presenting them as if they were its own discoveries.

PETER J. DENNING
Purdue University
Lafayette, Indiana

*The writer included a list of 21 references. For specific citations, contact the Letters Editor

Tariff clarified

It was with great interest that I read your item on "Interconnection: Closing in on Bell" in the February issue (p. 123). As you are now aware, Western Union's tariffs permitting the most liberal interconnect policy to date became effective March 1.

However, there were several inaccuracies which need to be corrected. A customer who provides his own terminal including data-set and answer-back capability will enjoy all the benefits available to a Western Union-provided TWX terminal; i.e., direct dial connections to over 43,000 U.S. TWX subscribers, directory listing, Teleprinter Computer Services (TCS), and Mailgram. A customer who leases the data set alone will not have this versatility, as data sets leased under this option are used for "inverted" or closed network operation only.

For both TWX and Telex there is an installation cost of $50 for each access line. Equipment supplied by Western Union under its applicable tariffs may or may not carry an additional installation charge.

E. H. COLE
Western Union
Upper Saddle River, New Jersey

No other love

A leading quotation was unfortunately omitted from my recent article, "CAI Techniques for Information Retrieval" (Feb., p. 91). It reads:

"Let her love
What man she may, no other love than mine
Shall be an index of her memories."
—Edwin Arlington Robinson

PETER H. HUYCK
Iowa City, Iowa

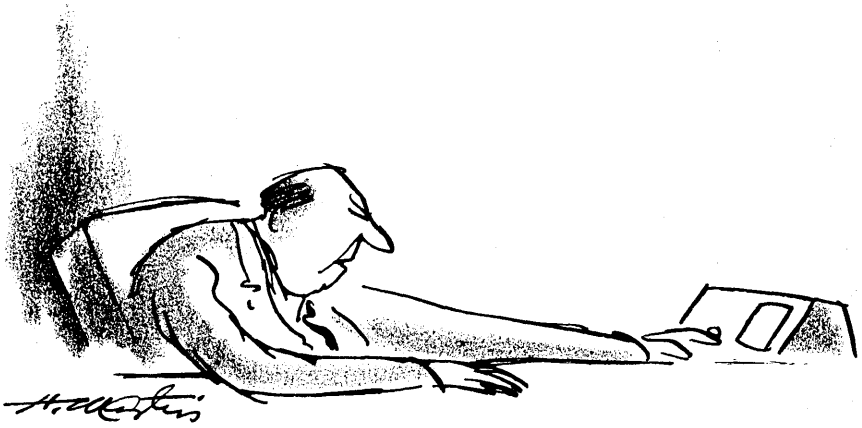
Ethics for today

I have been worried for some time by the necessity to have a Code of Ethics for us computer people. We do not want to see a code of ethics that says things like:

"A computer person will at all times conduct herself (or himself) in a manner so as not to betray that she (or he) has any thoughts which may in any way violate the accepted principle (at least in the opinion of the committee which shall consist of no less than one practicing fellow, one member, and two licentiates) . . . "

Our code should be simple, straightforward, and to the point. Let us call it *The 10 System Commandments:*

1. Thou shalt not use blasphemy when debugging JCL.
2. Thou shalt not assume that im-



"Miss Dennison, send in some reports, charts, programs, files, data, indices, facts, figures, totals, actuaries, systems analyses, projections, printouts, breakdowns, summaries, rates, records, statements, memorandums, graphs, requisitions . . ."

letters

morality is BASIC.

3. Thou shalt not decommit a virtual thing.

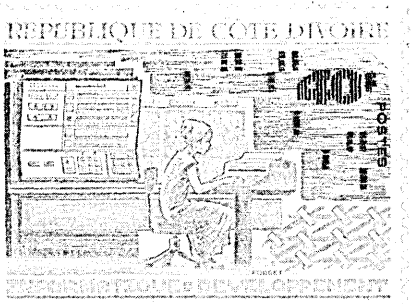
4. Thou shalt be bound by the code but not by correspondence.

There must be another six somewhere, and if you think of some, please mail them to me c/o DATAMATION, 1801 S. La Cienega Blvd., Los Angeles, CA 90035.

IAN P. SHARP
I. P. Sharp Associates Limited
Toronto, Ontario

Consoled

The Ivory Coast stamp mentioned at the end of "A Gallery of Computer Postal Art" (Feb., p. 74) was issued on



June 26, 1972. Rather than depicting a girl operating a keypunch, as mentioned in the text of the article, the girl is sitting before a computer console typewriter (the cpu and some tape drives can be seen in the background).

DENNIS M. DENGEL
Poughkeepsie, New York

Verbed

I enjoyed and endorse Truly Donovan's article "On the Spelling of Programmer" in the March issue (p. 166). Nevertheless, I can't forget that it was one of her former managers at IBM who first advised me that "There is no word that can't be verbed."

JOSEPH T. RIGO
New York, New York

Eyeball to eyeball

Until the March issue, I have resisted the temptation to comment on the spellings of PROGRAMER. However, Ms. Truly A. Donovan's comments . . . finally ignited a small ember.

I am an employee of the World's Largest Computer User—the Federal Government—and have been striving to impose the contents of the United States Government Printing Office's "Style Manual" on all software contractors with whom I have had to deal in the past 10 years.

While most have conformed with the "Style Manual," the greatest inertia is exhibited by the present and former employees of the World's Largest Computer Manufacturer.

One would think that the customer should be indulged, at least as far as documentation is concerned. Therefore, as far as the Federal Government is concerned, Ms. Malstrup is a PROGRAMER, who has PROGRAMED, and who may still be PROGRAMING.

CHARLES L. COLLINS
Huntsville, Alabama

Another form of hell

John Petroff's review of why systems and dp managers are unpopular (Feb., p. 77) is refreshing in that he specifically dispenses with the tired notions of a lack of salesmanship, communication, and user involvement as our *bête noire*. He will be accused of sour grapes, but his examples certainly sound authentic.

Petroff omits one other key factor frequently at the root of dp's unpopularity: its isolation and usual lowly status. This in contrast to its high cost and high aspirations. Something that will remedy our situation more than steering committees is recognition of systems' and data processing's proper place as a major functional organization, reporting in the same manner as marketing, engineering, industrial relations, finance, and manufacturing.

Regarding steering committees, they are just another form of hell. And they relieve only symptoms, not the disease. Why not steering committees for marketing, engineering, et al? Because these functions already sit at top staff levels, that's why not!

Our involvement at the appropriate level on an organizational basis could do much to relieve the pressures, frustrations, and fiascos which result from operating without leverage in a vacuum of policy and planning knowledge.

THOMAS E. O'CONNOR
Manager, Information Processing and Systems
Raytheon Company
Mountain View, California

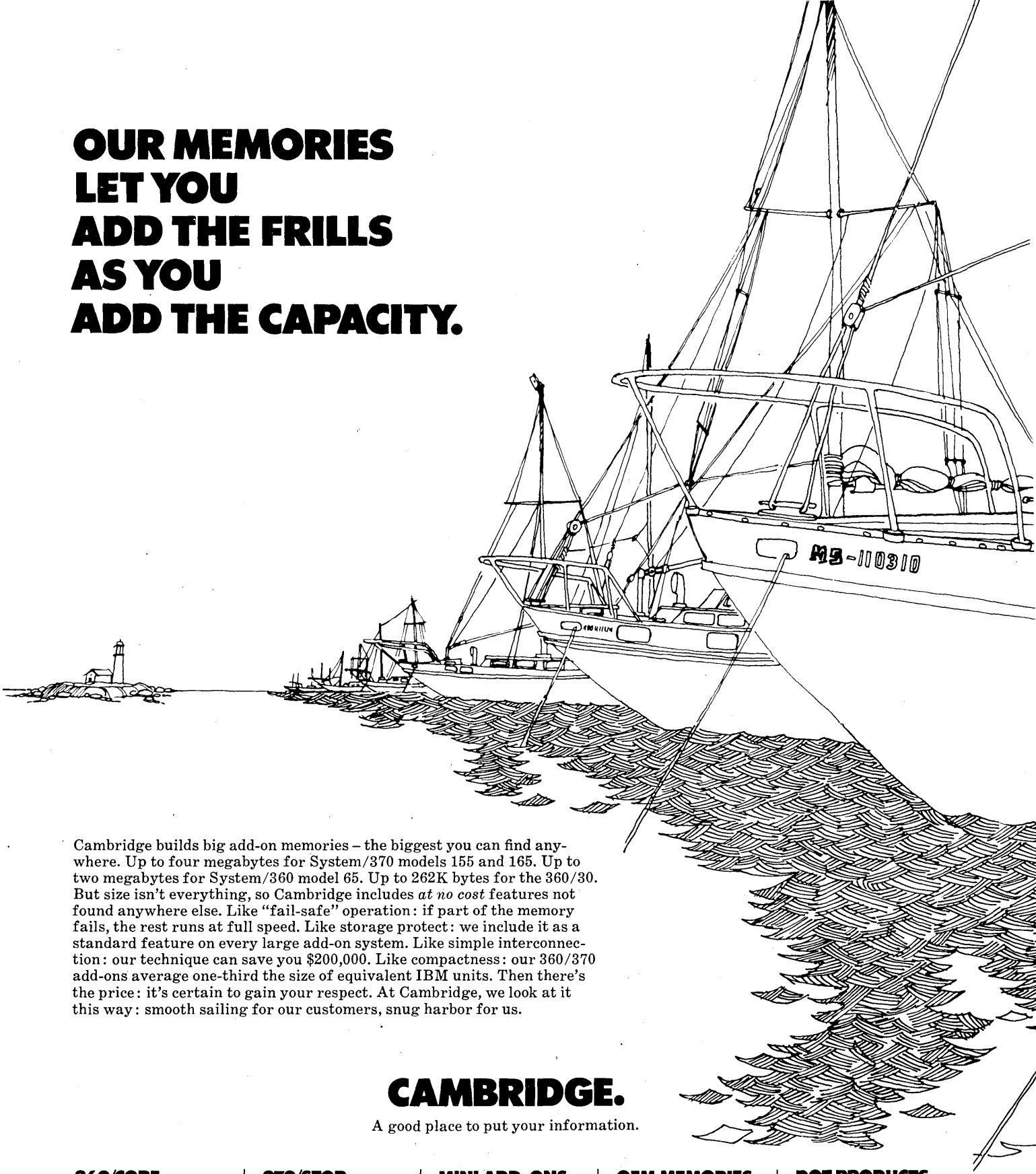
La bete noire lives

I think the article on "Why Are DP Managers So Unpopular?" was outstanding. I hope the company presidents or administrators will read the article.

There is a direct correlation between the aggressive dp manager and his popularity. As his aggressiveness increases, his popularity decreases. People are afraid of the unknown; they are not quite sure of his motives. Is he looking out for the company's interests or is he trying to gain more power and take over their jobs? They are not only afraid of the aggressive manager; they are afraid of the computer itself be-

(Continued on page 224)

OUR MEMORIES LET YOU ADD THE FRILLS AS YOU ADD THE CAPACITY.



Cambridge builds big add-on memories – the biggest you can find anywhere. Up to four megabytes for System/370 models 155 and 165. Up to two megabytes for System/360 model 65. Up to 262K bytes for the 360/30. But size isn't everything, so Cambridge includes *at no cost* features not found anywhere else. Like "fail-safe" operation: if part of the memory fails, the rest runs at full speed. Like storage protect: we include it as a standard feature on every large add-on system. Like simple interconnection: our technique can save you $200,000. Like compactness: our 360/370 add-ons average one-third the size of equivalent IBM units. Then there's the price: it's certain to gain your respect. At Cambridge, we look at it this way: smooth sailing for our customers, snug harbor for us.

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CIRCLE 86 ON READER CARD

On May 1st, the hottest computer around became the hottest timesharing system around.

By now, everybody's heard about PDP-11/45. There's simply too much computer for the money to ignore. 300 nanosecond speed. Solid-state and core memory to 248K bytes. 64-bit multi-accumulator floating point hardware. Hardware memory management. Among other things.

And if that wasn't enough, on May 1st, PDP-11/45 took another giant step. With the delivery of two powerful new software systems.

First, RSTS-11E.

The timesharing software system that handles up to 32 users at the same time, each with jobs as big as 16K words. With the kind of fast response you can get only from PDP-11/45 hardware.

RSTS-11E lets everybody use all the peripherals on line. Large-scale peripherals like 20-million-word disk packs and high-speed line printers. Plus magnetic tape drives and paper tape and card equipment.

What's more, it has an expanded form of BASIC that gives you string operations. On-line files as big as 30-million characters each. Matrices. ALGOL-like statements. Data Processing aids. Plus all the ease of use you'd expect from BASIC.

That's just the beginning.

Now for RSX-11D.

An integrated real time system that can control a whole process or automate

And the hottest real time system around.

an entire laboratory with plenty of power to spare.

RSX-11D will give you real time response measured in microseconds. Even if there are hundreds of tasks going on at the same time.

Memory is used with maximum efficiency. RSX-11D is the first low-cost system to use dynamic memory management.

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And RSX-11D has full ANSI FORTRAN IV. With ISA Real Time Extensions. Plus a FORTRAN IV compiler, macro-assembler, and full utility programs, all running on line simultaneously with real time operations.

PDP-11/45 is the hottest selling computer we've ever made. And we've made a lot of computers.

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Write Digital Equipment Corporation, PDP-11/45 Group, 146 Main Street, Maynard, Mass. 01754. (617) 897-5111. European headquarters: 81 route de l'Aire, 1211 Geneva 26. Tel: 42 79 50. Digital Equipment of Canada Ltd., P.O. Box 11500, Ottawa, Ontario. K2H 8K8. (613) 592-5111.

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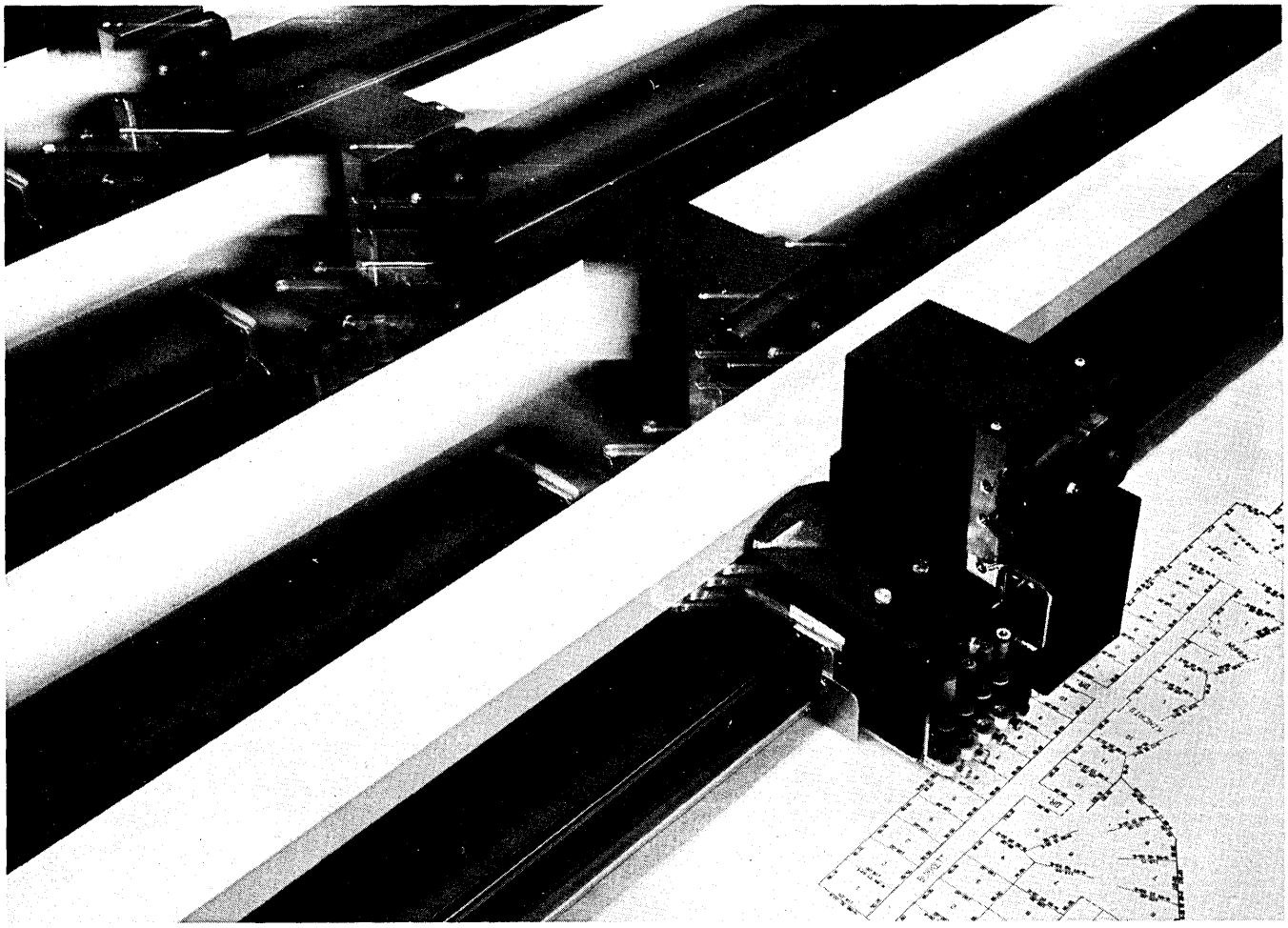

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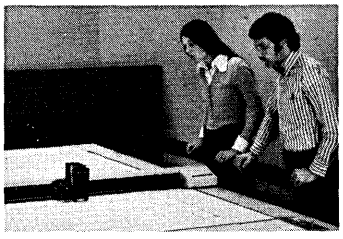
The computer-controlled 930 Graphics System gives you speed—and capability. Store all your project information in the computer files. Type in your request, and the computer will scan the files . . . pull the one you want . . . feed it to the plotter. And give you an original drawing every time you command.

You've got the option to put yourself in the plot. As the system works, you can shrink, stretch or rotate the plot. Or do the same with any area within the plot. It's all at your fingertips.

With a DATAPLOTTER® at the drawing end of the system you get smooth, continuous lines. No increments to give a "sawtooth" effect. And with absolute positioning the plotting arm always picks up where it left off, no matter how often you stop or move it.

Built-in error detection protects your plot, even at the system's high speed. Tape noise, dropouts, even static electricity that might generate drawing errors stop the system. Dead. Until the error is corrected. With all this graphic muscle you'll get more plot per plotting minute, so computer time costs come down. With EAI's programs and peripheral equipment you get flexibility, too.



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Blue Cross of Florida improves service with "Silent 700" ASR Terminals

*Silent 700** ASR twin cassette data terminals have been selected by Blue Cross of Florida, Inc., for their communications network serving 148 hospitals. Transactions are typed onto cassettes daily by hospital personnel for after-hours transmission from an unattended terminal to the Blue Cross central data center.

Increased claims load and expansion of services by Blue Cross required upgrading their teletypewriter network. "We studied data terminals and the companies making them for two years before making our decision," reports C. R. Scott, Manager of EDP Planning at Blue Cross of Florida, Inc.

"*Silent 700* ASR terminals met our requirements. In addition, they are quiet...most important for our 148 hospitals. The terminals are attractively styled and the low price is vital."

Quiet electronic printing, cassette storage, automatic search, and data rates up to 1200 baud make *Silent 700* ASR terminals powerful alternatives to conventional teletypewriters.

For more information on *Silent 700* terminals for your application, contact the nearest office listed below or Texas Instruments Incorporated, P.O. Box 1444, Houston, Texas 77001. Or call (713) 494-5115, ext. 2126.

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Arlington, Va. (703) 525-1444 · Atlanta, Georgia (404) 458-7791 · Chicago, Illinois (312) 593-2340 · Cleveland, Ohio (216) 464-1192 · Dallas, Texas (214) 238-5318 · Dayton, Ohio (513) 294-0774 · Denver, Colorado (303) 758-5536 · Detroit, Michigan (313) 352-5720 · Houston, Texas (713) 494-5115 ext. 2562 · Los Angeles, Calif. (213) 860-1379 · Minneapolis, Minn. (612) 941-4384 · Newark, N.J. (201) 467-2670 · Orlando, Florida (305) 644-3535 · Philadelphia, Penn. (215) 643-6450 · San Francisco, Calif. (408) 732-1840 · Waltham, Mass. (617) 890-7400 · Elizabeth, S. Australia 552066 · Bedford, England 58701 · Paris, France 6450707 · Frankfurt, Germany 726441 · Bad Godesberg, Germany 65534 · Toronto, Ontario, Canada (416) 889-7373

See the "Silent 700" ASR Terminals at the National Computer Conference, Booth 2215.

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Recognition Equipment is in: Austria, Belgium, Canada, Denmark, Finland, France, Italy, Japan, Netherlands, Norway, Sweden, Switzerland, United Kingdom, and West Germany

You can now handle *all* data entry requirements with Total Data Entry. Some of your input may be adaptable to OCR processing, some to key entry, some may be handprinted, and some prepared on many different typewriters with dissimilar type styles and pitches. No matter what form it takes, it can now be handled on a single system provided and supported by a single supplier. Recognition Equipment.

Total Data Entry combines the best features of two technologies: optical character recognition and key-to-disk.

The OCR capability is Input 80. Input 80's recognition capability permits reading documents in a variety of sizes containing degraded characters, tears, and skewed lines. Virtually any type font is fair game for Input 80, and the fonts can be intermixed on the same line. Handprint, mark sense, page numbering, and line marking are all available options.

And Input 80 is modular. As your needs grow, so can Input 80, from the new, low-cost Model C to the ultimate high-speed OCR system, Input 80 Model A.

Add the in-line capabilities of key-to-disk for non-OCR applications and character reentry. This feature provides from one to 22 key stations, each equipped with a CRT screen and keypunch or typewriter keyboard. It's supported by a sophisticated software system with those important format, edit, arithmetic, and reentry features needed to handle today's data preparation needs.

Single Keystroke Reentry of unrecognized characters optimizes operator productivity and accuracy. Contextual display allows complete documents or lines to be viewed, and the position containing the unrecognized character is highlighted. Video image display permits inserting of unrecognized characters without referring to the source document. Both reentry methods may be used without slowing reading or other keying functions.

We'd like to tell you more about how Total Data Entry can handle all your input requirements. Write or call Recognition Equipment today.

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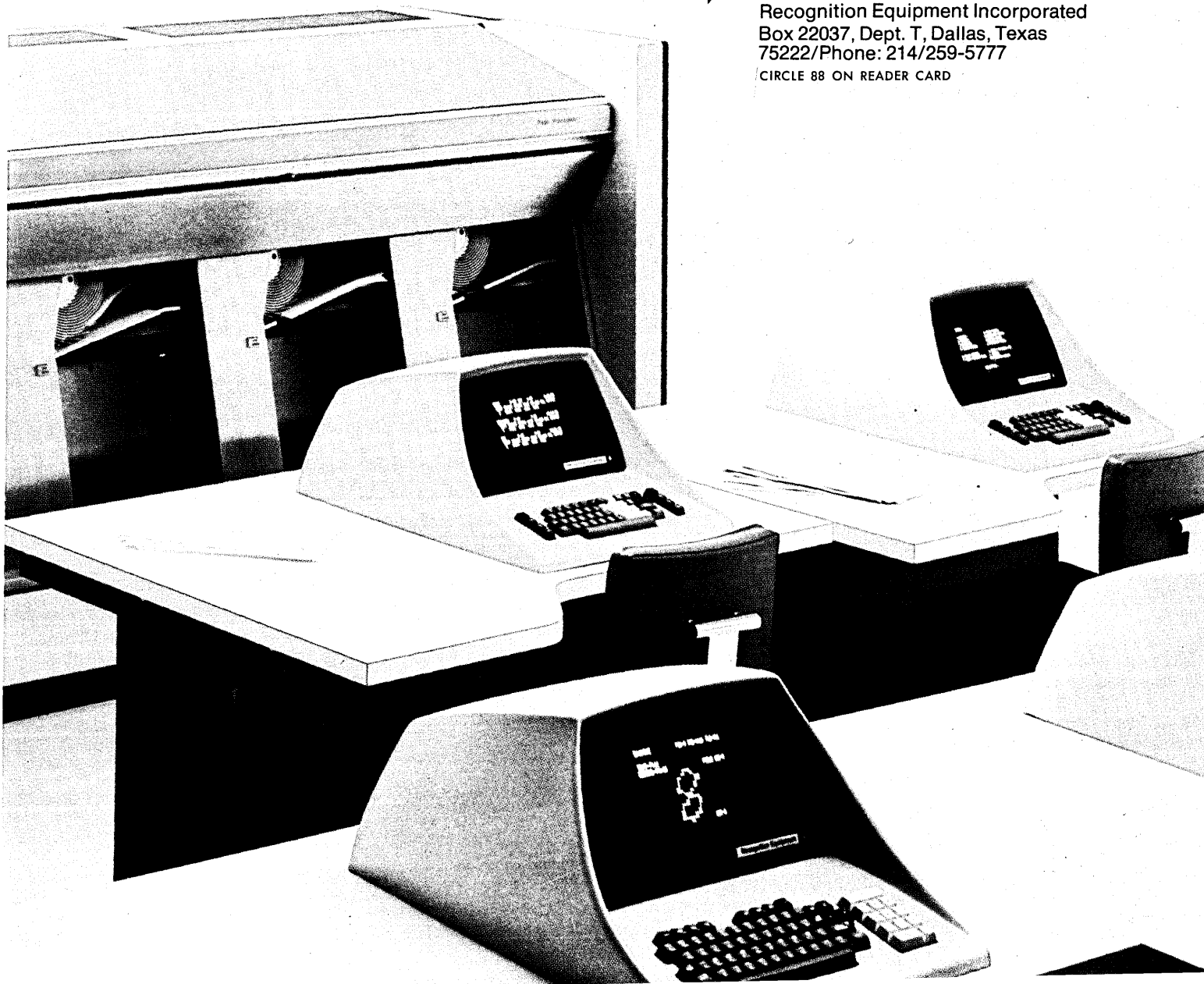

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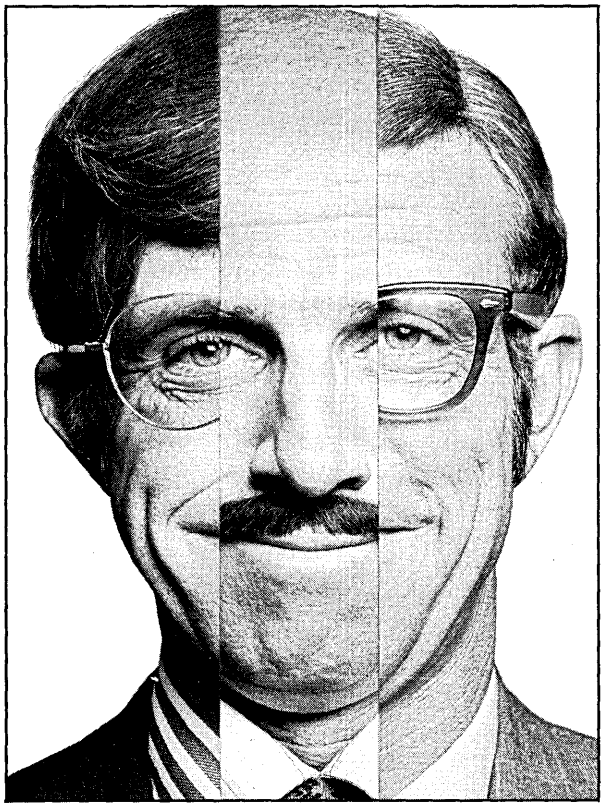

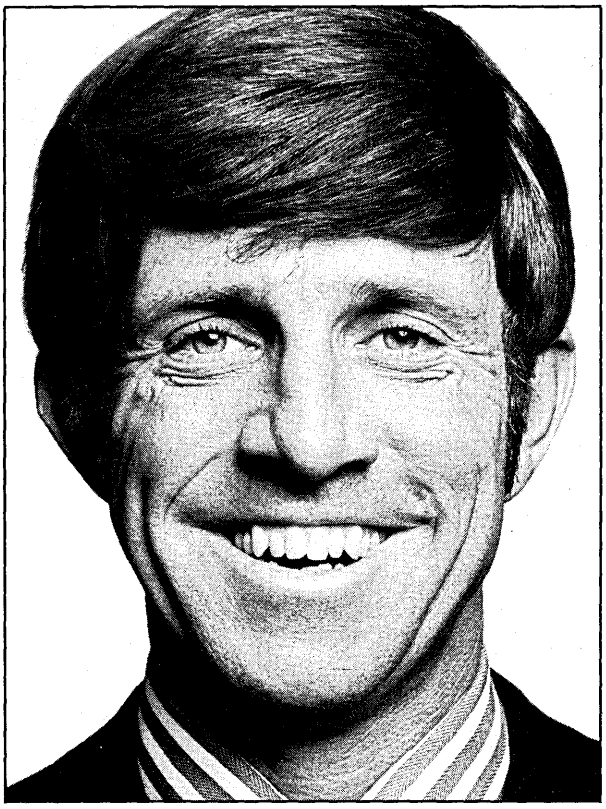

WITHOUT UCC, you have to be three people—part troubleshooter, part scheduler, and part messenger.

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How a lot of different people are cleaning up with Honeywell's Series 2000 computers.

Honeywell's Series 2000 computers are a family of high-performance systems in the small-to-medium-scale range—from the entry-level 2020 system (with monthly rental about $1,900) to the large 2070 system (with monthly rental about $30,000). They're a family with unusual strengths in important areas like operating system software, data communications hardware and software, peripherals capability, and data base management techniques.

What really makes Series 2000 special and so popular, is its dramatic cost-effectiveness. As a result, more and more companies and institutions in just about every industry, and of just about any size, are discovering that Honeywell's Series 2000 offers the most practical and economical answers to their data processing needs.

Here are eight examples:

An auto manufacturer relies on Honeywell computers at manufacturing and assembly plants.

A major automobile manufacturer uses Honeywell 2050 and 2060 systems at manufacturing and assembly plants to handle production-related applications. These include accounts receivable, accounts payable, order processing, invoice processing and product material inventory reports. The systems are also tied to a Honeywell communications network that keeps a central computer supplied with information for inventory updating, parts ordering and shortage reporting. A number of applications handled by the Series 2000 systems are critical to continued production, so proven reliability was vital in the company's decision to move to Series 2000.

Big savings bank puts ten branches on-line for improved customer service.

A large-city mutual savings bank (Metropolitan Savings Bank, Brooklyn, New York) uses two Model 2060 systems to provide better service to its approximately 180,000 customers. One computer is dedicated to an on-line teller system that provides instant two-way communications between the customer files and 45 teller terminals at ten branch locations. The system was installed to speed up the processing of customer deposits, withdrawals and related transactions, and to allow the opening of accounts and changes of names and addresses on-line, through video display terminals.

The second system is used for batch processing of reports, mortgage loan accounts and general ledger, as well as for new program development. A separate foreground partition of memory is used to access on-line mortgage inquiry files through CRTs located in the mortgage department. Peripherals and communication controllers can be switched between systems, providing complete back-up for the on-line teller system.

Fastener manufacturer centralizes multiplant operation for improved management information and control.

A multidivision manufacturer of industrial and aerospace fasteners (The Lamson & Sessions Company, Brooklyn, Ohio) employs two Series 2000 systems—a Model 2040 and a Model 2050—for factory and business applications. Currently the firm uses remote data entry terminals at its major manufacturing centers for off-line data transmission to the computer center. The customer plans to evolve to an on-line information network. The computerized systems provide the company with improved production and inventory controls which are translated into improved customer service and reduced capital investment plus financial tools to more effectively manage daily operations.

Circle 101 on Reader Card

Big firms, and not-so-big firms... just about any company or organization can profit from Honeywell's Series 2000.

State department of education uses computer to handle large volume of school data.

A state department of education (State of Ohio, Columbus) keeps its Model 2050 system working on three shifts to process a heavy load of statistical and recordkeeping chores. A major share of this workload involves accounting applications such as funding, tax base computation, student population, personnel and salaries for the state's 621 school districts. In addition, extensive files, such as teacher certification records, are maintained on the computer. To speed its workflow, the department makes use of data communications under control of OS/2000. CRT and teleprinter terminals are used for data collection at critical locations. A pilot project has also been started by the department to make available the power of its 2050 system to school districts in rural areas unable to afford their own systems. A remote Model 5 intelligent terminal communicates with the state's computer for processing the traditional accounting requirements plus student scheduling, grade reporting and student attendance.

Southern newspaper uses computers for production efficiency and quality control

A large Southern daily newspaper (*St. Petersburg Times* and *Evening Independent,* St. Petersburg, Florida) uses two Model 2050 systems. One handles the paper's business tasks such as advertising billings, maintenance of circulation files and payroll. The second is dedicated to newspaper production assignments. It operates in tandem with two Honeywell minicomputers and performs copy hyphenation and justification and related work. The paper is currently converting its production work from off-line terminals to special CRT terminals that will handle both editorial and advertising copy composition on-line. A *Times*-developed programming technique enables the operator of already installed terminals to precompose display ads on the terminal's CRT. After composition by the terminal operator, the ad is computer-processed for hyphenation, justification and insertion of the function codes necessary to drive the photocomposition machines. The Honeywell 2000 computers are an important part of the paper's program to completely convert to cold-type composition and offset printing by 1975.

Distributor depends on computers to achieve inventory control and provide customer service.

A large wholesale tobacco and candy distributor on the West Coast (Glaser Bros., Vernon, California) has attained its leading position through emphasis on superior customer service and effective inventory management. Recently the firm installed dual 2040 systems to keep pace with its fast-growing business and increase its computer management capabilities. A newly implemented sales order processing system validates customer and item information, checks and allocates inventory, computes discounts and taxes for invoicing, and prints a combined warehouse pick-list and total customer invoice.

In addition, the system provides customer sales analysis; salesman analysis; commodity and brand movement analysis; inventory status; purchasing information; credit analysis; accounts receivable aging and statements; and daily sales, cost and profit by item, commodity group, branch and company.

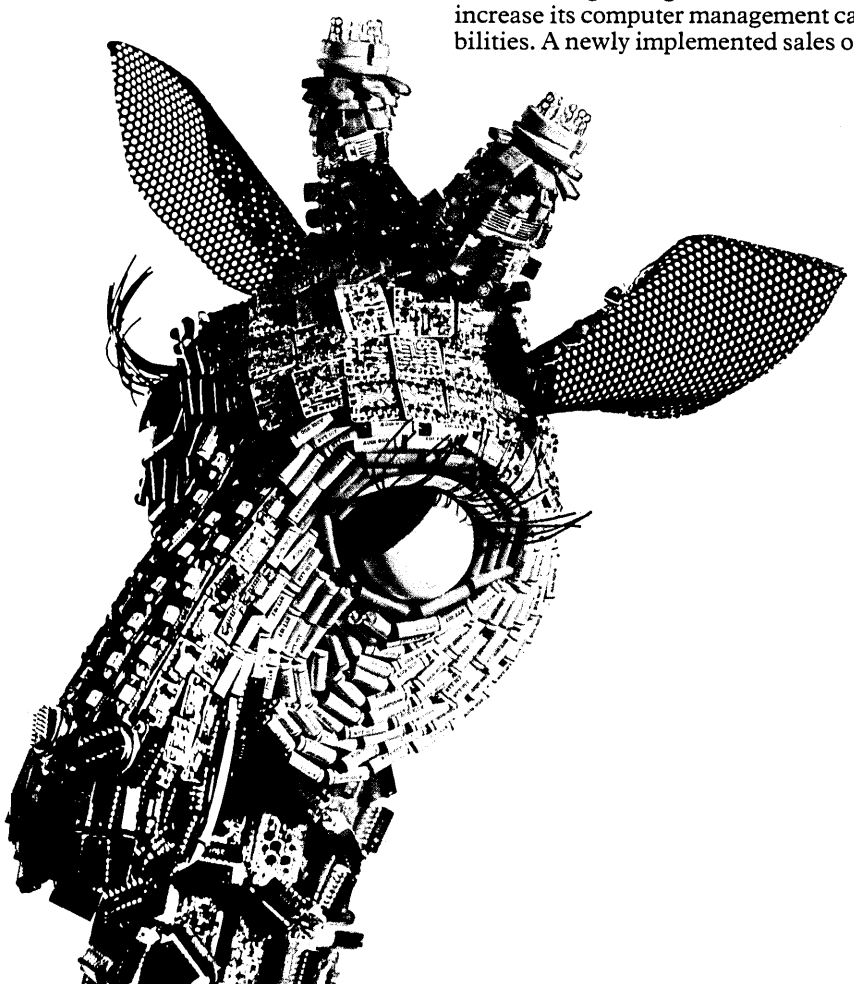
Paperless system is goal of progressive hospital

A 592-bed hospital (Parkview Memorial, Fort Wayne, Indiana) is using a Model 2050 system as it builds toward the ideal of a paperless hospital. By eliminating the redundant writing and recording of patient services that occur throughout the institution, the hospital plans to relieve doctors, nurses and other professional medical personnel of unnecessary clerical work, thereby making possible an improvement in productivity. A real-time data base management system is being implemented, with the data base to be accessed through remote CRT terminals for applications such as patient accounting, payroll, personnel, payables, inventory, general ledger, property ledger, census, medical records, pathology, patient charts and results reports.

Commercial bank provides broad spectrum of services to branch and subscriber banks.

A 14-branch commercial bank (Framingham Trust, Framingham, Massachusetts) uses a 2050 system to provide comprehensive on-line and batch processing services to its branches and subscriber banks. Bank personnel use CRT terminals to communicate over leased telephone lines with central information files. The video system provides demand deposit, savings, certificate loan and general ledger processing. Inquiries on customer accounts produce cross-referenced information from the central information file, showing the customer's total relationship with its bank for these applications. Complete hard-copy backup is generated automatically for all transmitted information. Many expensive and bulky reports are no longer produced, having been replaced by video displays. The on-line system frees bank personnel from many time-consuming procedures that are necessary with batch operations and conventional data preparation methods.

Circle 102 on Reader Card



Seven ways Series 2000 computers are trained to respond.

1. *On-site changes give the user a low-cost way to increase power and performance without replacing his current processor.* Purchase-only versions of Series 2000 central processors can be easily modified at a user's site by augmenting memory and adding memory-speed and input/output power modules.

2. *The DATANET 2000 front-end network processor off-loads the central processor of its communications overhead and maximizes information throughput.* This advanced miniprocessor offers an extremely simplified, low-cost way to expand the computer into an information network, thereby increasing information processing capability dramatically.

3. *Honeywell's new cost-effective 7000 Series terminals get more kinds of communicating done faster at lower cost.* Featuring microprocessor-based designs, the new line includes a low-cost, high-performance CRT terminal, and a passbook banking teller terminal.

4. *Dual disk access gives users big throughput gains and increased availability of data and programs.* A new dual-access technique allows two transfers to take place at the same time on a single disk subsystem. This can make a significant difference where multiprogramming is heavily used and continued concurrent access to at least two spindles on a disk subsystem is required.

Circle 103 on Reader Card

5. *Series 2000 includes a full complement of cost-effective peripherals, with special emphasis on disk drive flexibility and performance.* Several types of drives offer two or three spindles per control, and are expandable to eight per control. Fast access times and high data transfer rates make these devices especially well suited to Series 2000 systems.

6. *The OS/2000 operating system provides for as many as ten job operations plus five transcription routines to be processed concurrently.* In addition to dynamic partition management (shifting) and scheduling priorities, a user-selectable dispatching priority scheme governs the amount of processor time received by jobs and allows for maximum system control and throughput.

7. *Series 2000 relates specifically to the user's business environment.* Honeywell's industry-specific system design and precoded application packages for a variety of industries have enjoyed wide acceptance due to their emphasis on helping to meet business needs.

A Computer Company You Can Believe In

Honeywell Information Systems is itself a success story. We have grown, because we know our growth depends upon our ability to help you grow. Series 2000 is a good example of how we're helping businesses grow.

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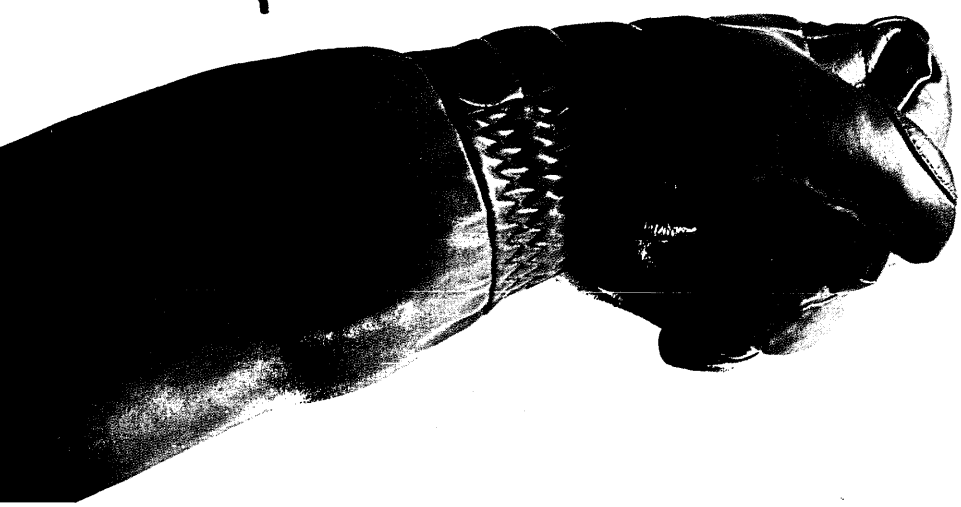

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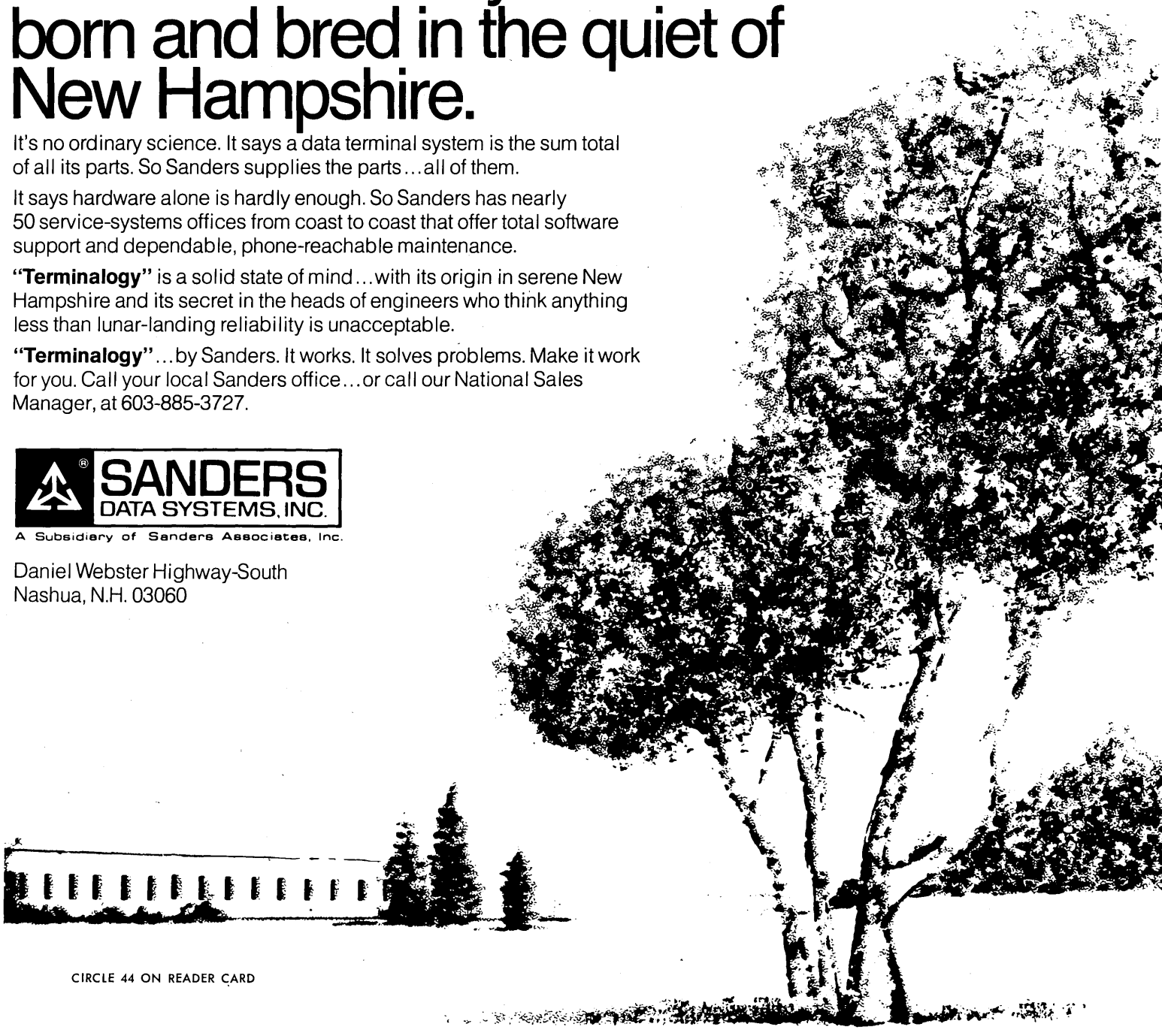

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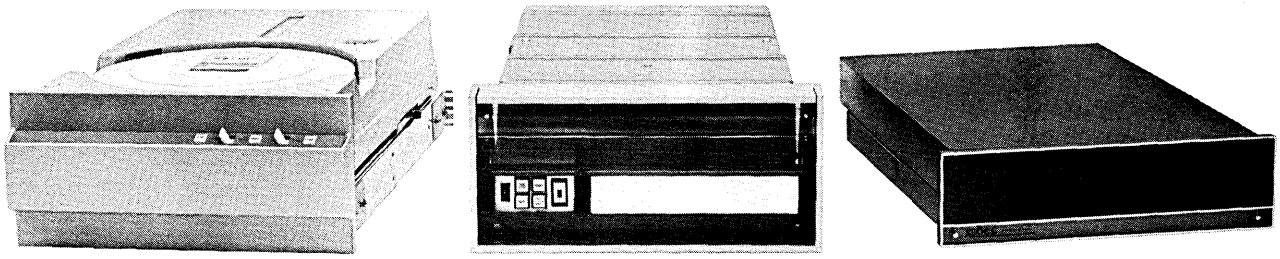

The fastest, most flexible and largest? Yes, our Xebec 6000 series disk system has an average access time of only 35 ms, track-to-track access time of just 9 ms. It comes with a storage capacity per drive of from 2.5 to 10 million 8-bit bytes.

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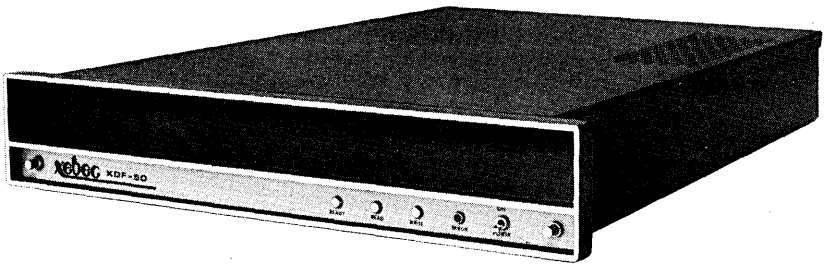

Yes, our Xebec XDF-50 Formatter is so flexible it will work with *any* 2315/5440 type drive. Ours. Anybody elses. Separately or in any combination (including 200 TPI and 100 TPI drives and any standard number of sectors).

Couplers.

Yes, we stock more couplers than anyone anywhere—for all the popular brands, most of the unpopular, some you've never heard of. Our couplers have full software support.

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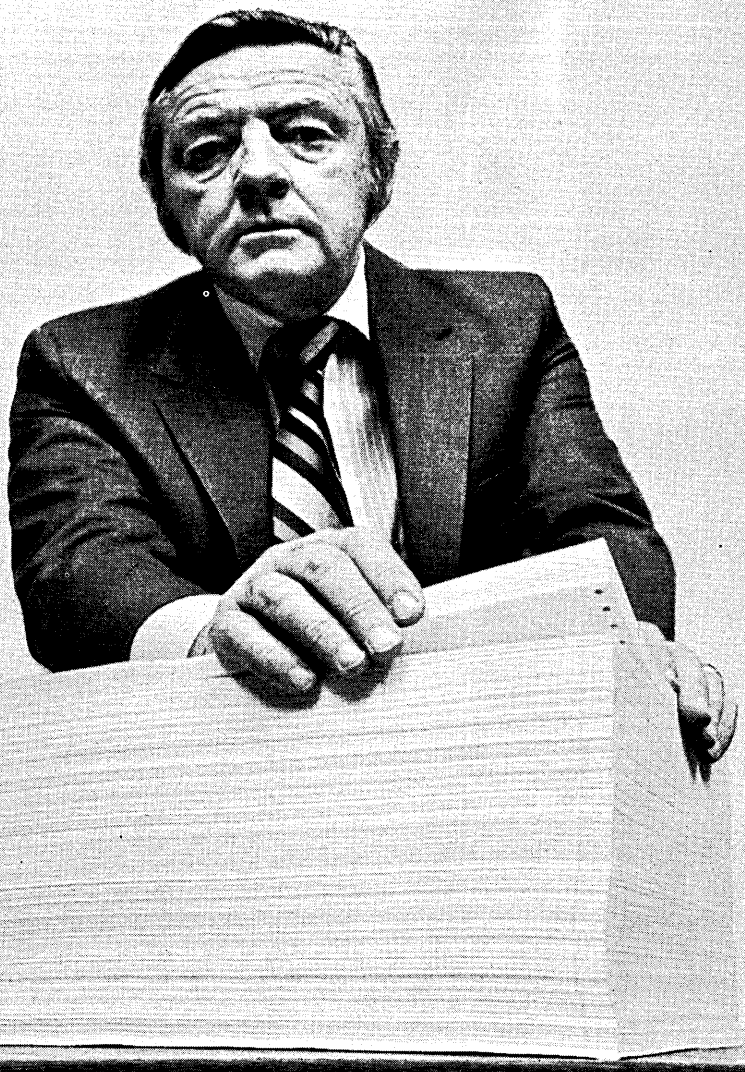

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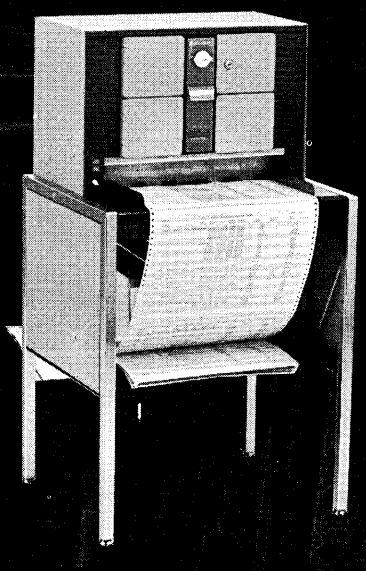

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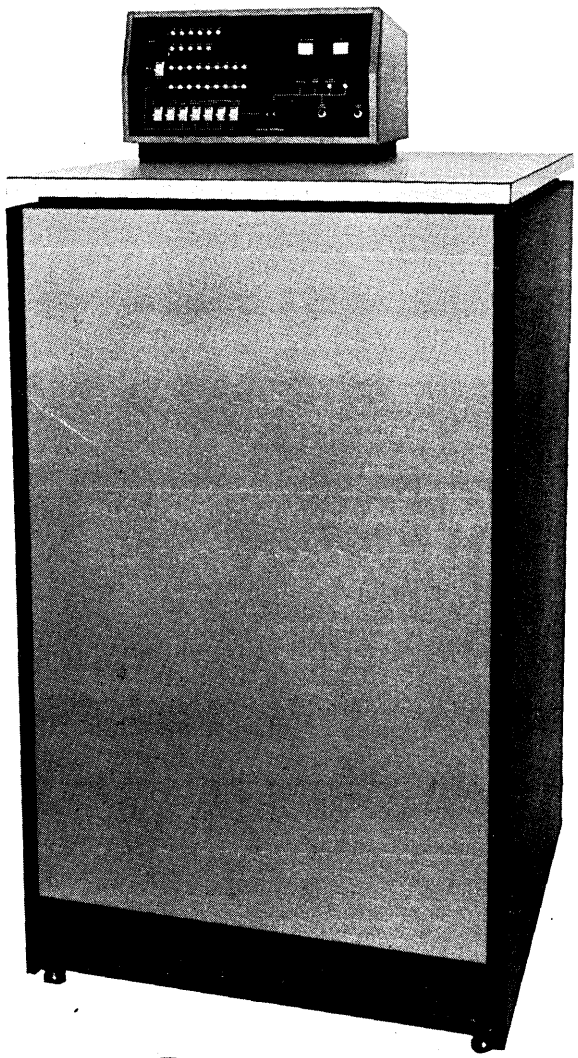

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CIRCLE 47 ON READER CARD

Editor's Readout

Too Much Too Soon?

All you folks out there in information processing land will probably try to restrain your impulse to light bonfires and set off fireworks at the news that another computer society seems about ready to appear.

Nevertheless, it looks as if this is so, and we will ask you and Edith Bunker to temporarily stifle yourselves while we tell you a bit about it. What has happened is that the venerable Data Processing Management Association—old timers will remember it as the National Machine Accountants Association—has gotten understandably tired of carrying all alone the rather heavy burden of preparing and administering the Certificate in Data Processing (CDP) program.

The DPMA inaugurated the program over 10 years ago. During that time, it has spent close to $1 million developing and evolving a rather comprehensive test that has been administered to 27,464 people. While we're throwing numbers about, it might interest you to know that of this total 13,141 had passed the exam through 1972 and thus qualified for the CDP certificate. That's 47.8%, according to our trusty TI calculator.*

We understand that the DPMA has about broken even on the program, but it decided that if the program were to become more widely accepted and supported, it should have broader sponsorship. Now, with the help of the ACM and several other societies (see April, p. 139), including the hardware boys from the IEEE Computer Society, DPMA is ready to create a new organization.

Right now, it's called the Computer Foundation, which thinks it ought to worry about personnel development in general . . . and (more specifically) testing aptitude, knowledge, and competence of computer people; standards of "good practice"; curriculum formulation; standards of accreditation; and "scientific inquiry and research" into all such matters.

Our first reaction to the announcement of the desire to establish a Computer Foundation was a sinking one: just what we need . . . another professional association. Then we wondered why the work couldn't have been turned over to *the* established metasociety, the American Federation of Information Processing Societies (AFIPS).

The official answer is because DPMA is not a member of AFIPS. Without trying to probe what might be the real reason, we'd like to point out to the Computer Foundation organizing committee that it still might be possible for you to explore with AFIPS the possibility of their handling your clerical and administrative work. Unless you're *determined* to create a separate, unnecessary cost center, the idea of reduced, shared overhead might be attractive.

We would also like to pass along to the organizing committee some of Paul Armer's ideas. Paul is a thoughtful edp veteran, a past president of AFIPS who has spent a lot of time thinking about the problem of professional development in our industry.

He feels that the Computer Foundation ought to think about tackling an assignment a little less rigorous than creating an exam that purports to tell us everything a programmer or edp expert should know. In effect, it seems to him, you are saying that passing the exam establishes a stone proclaiming "thou art a programmer," or "thou art an edp expert."

And he thinks trying to walk before we run might make more sense. What he suggests is a series of self-assessment exams similar to those developed by the American Medical Association. In essence, they allow a practitioner to test himself in a particular subject matter against a norm.

Armer is also concerned about personal professional obsolescence. And, he points out, one problem is that you can be obsolescent without knowing it. Self-assessment tests would be one way of finding out.

And even if we assume that the CDP exam is a sound and thorough test of every aspect of data processing practice, it is clear that passing it does not ensure eternal expertise. Maybe the people who use the CDP after their names should include the date they passed the test. We periodically recertify elevators and other devices . . . and even doctors are discussing five-year licenses.

We plan in future issues to examine more thoroughly other aspects of the CDP program and the whole matter of accreditation and professional development. In the meantime, we do not want the Computer Foundation to think that we are completely negative.

We think it's important that some group broader than the DPMA work seriously and continually on all of these matters. We think that the industry as a whole owes the DPMA a great debt for its pioneering work. And we hope that the Computer Foundation gets the kind of leadership and support required by the difficult and delicate tasks it hopes to tackle.

Finally, we urge all of you who are concerned about these critical professional development problems to let the Computer Foundation organizing committee members know what it is you think they ought to do, and how they ought to do it. If you don't know how to reach them, talk to us. We'll listen, and we'll make sure the Computer Foundation hears from you.

—Bob Forest

*It is pertinent to note, however, that through 1969 the pass rate was better than 60%. The next year the exam was stiffened, and from then through 1972 only 36% have managed to squeeze through.

Our cover this month shows one aspect of New York—graffiti, as photographed by Richard Ley.

A first stage in collecting data showing that software is the major source of difficult problems and operational performance penalties

Software and Its Impact: A

"You software guys are too much like the weavers in the story about the Emperor and his new clothes. When I go out to check on a software development the answers I get sound like, 'We're fantastically busy weaving this magic cloth. Just wait a while and it'll look terrific.' But there's nothing I can see or touch, no numbers I can relate to, no way to pick up signals that things aren't really all that great. And there are too many people I know who have come out at the end wearing a bunch of expensive rags or nothing at all."

—An Air Force decisionmaker

Recently, the Air Force Systems Command* completed a study, "Information Processing/Data Automation Implications of Air Force Command and Control Requirements in the 1980s," or CCIP-85 for short. The study projected future Air Force command and control information processing requirements and likely future information processing capabilities into the 1980s, and developed an Air Force R&D plan to correct the mismatches found between likely capabilities and needs.

Although many of the CCIP-85 conclusions are specific to the Air Force, there are a number of points which hold at least as well elsewhere. This article summarizes those transferable facts and conclusions.

Basically, the study showed that for almost all applications, software (as opposed to computer hardware, displays, architecture, etc.) was "the tall pole in the tent"—the major source of difficult future problems and operational performance penalties. However, we found it difficult to convince people outside the software business of this. This was primarily because of the scarcity of solid quantitative data to demonstrate the impact of software on operational performance or to provide perspective on R&D priorities.

The study did find and develop some data which helped illuminate the problems and convince people that the problems were significant. Surprisingly, though, we found that these data are almost unknown even to software practitioners. (You can test this assertion via the Software Quiz, p. 51.) The main purpose of this article is to make these scanty but important data and their implications better known, and to convince people to collect more of it.

Before reading further, though, please try the Software Quiz. It's intended to help you better appreciate the software issues which the article goes on to discuss.

Software is big business

One convincing impact of software is directly on the pocketbook. For the Air Force, the estimated dollars for FY 1972 are in Fig. 5; an annual expenditure on software of between $1 billion and $1.5 billion, about three times the annual expenditure on computer hardware and about 4 to 5% of the total Air Force budget. Similar figures hold elsewhere. The recent World Wide Military Command and Control System (WWMCCS) computer procurement was estimated to involve expenditures of $50 to $100 million for hardware and $722 million for software.[1] A recent estimate for NASA was an annual expenditure of $100 million for hardware, and $200 million for software—about 6% of the annual NASA budget.

For some individual projects, here are some overall software costs:

IBM OS/360	$ 200,000,000[2]
SAGE	250,000,000[3]
Manned Space Program, 1960-70	1,000,000,000[3]

Overall software costs in the U.S. are probably over $10 billion per year, over 1% of the gross national product.

If the software-hardware cost ratio appears lopsided now, consider what will happen in the years ahead, as hardware gets cheaper and software (people) costs go up and up. Fig. 6 shows the estimate for software expenditures in the Air Force going to over 90% of total adp system costs by 1985; this trend is probably characteristic of other organizations, also.

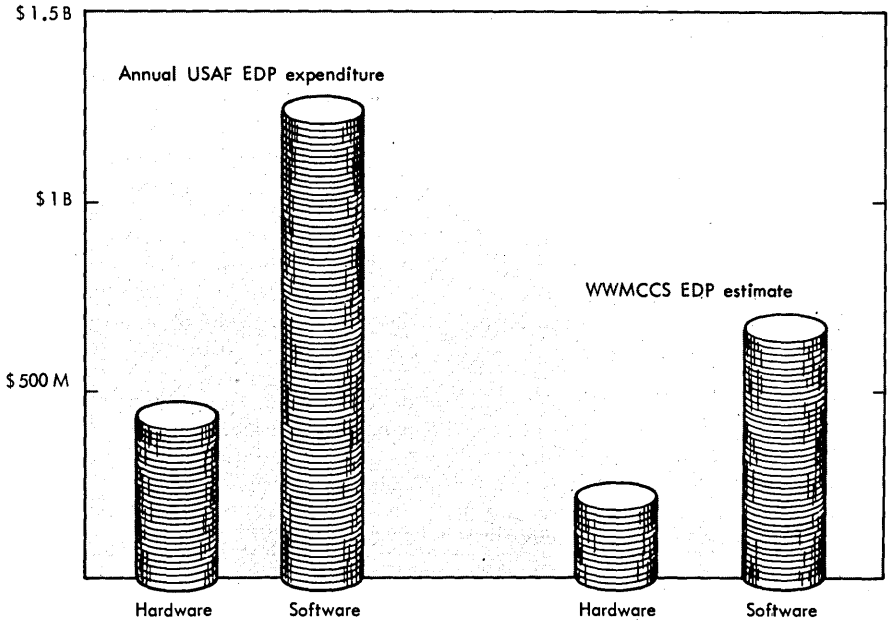


Fig. 5. USAF software is big business.

*The views in this article do not necessarily reflect those of the United States Air Force.

[1] *Datamation*, March 1, 1971, p. 41.

[2] Alexander, T., "Computers Can't Solve Everything," *Fortune*, May 1969.

[3] Boehm, B. W., "System Design," in *Planning Community Information Utilities*, (eds.) H. Sackman and B. W. Boehm, AFIPS Press, 1972.

Quantitative Assessment

by Barry W. Boehm

One would expect that current information-processing research and development projects would be strongly oriented toward where the future problems are. However, according to recent Congressional testimony by Dr. Ruth Davis of the National Bureau of Standards (NBS) on federally-funded computing R&D projects:

". . . 21% of the projects were concerned with hardware design, 40% were concerned with the needs of special interest communities such as natural sciences, engineering, social and behavioral sciences, humanities, and real-time systems, 14% were in the long-range payoff areas of metatheory, while only 9% were oriented to the highly agonizing software problems identified by most customers as their major concern."[4]

One result of the CCIP-85 study has been to begin to reorient Air Force information processing R&D much more toward software. Similar R&D trends are evident at DOD's Advanced Research Projects Agency (ARPA), National Science Foundation, and the National Bureau of Standards. But much remains to be done.

Indirect costs even bigger

Big as the direct costs of software are, the indirect costs are even bigger, because software generally is on the critical path in overall system development. That is, any slippages in the software schedule translate directly into slippages in the overall delivery schedule of the system.

Let's see what this meant in a recent software development for a large defense system. It was planned to have an operational lifetime of seven years and a total cost of about $1.4 billion—or about $200 million a year worth of capability. However, a six-month software delay caused a six-month delay in making the system available to the user, who thus lost about $100 million worth of needed capability—about 50 times the direct cost of $2 million for the additional software effort. Moreover, in order to keep the software from causing further delays, several important functions were not provided in the initial delivery to the user.

Again, similar situations develop in domestic applications. IBM's OS/360 software was over a year late.[2] The U.S. air traffic control system currently operates much more expensively and less effectively because of slippages of years in software (and also hardware, in this case) development, which have escalated direct software costs to over $100 million.[5] Often, organizations compensate for software development slippages by switching to a new system before the software is adequately tested, leading to such social costs as undelivered welfare checks to families with dependent children, bad credit reports, and even people losing their lives because of errors in medical software.

Getting software off the critical path

Once software starts slipping along the critical path, there are several more or less unattractive options. One option is to add more people in hopes that a human wave of programmers will quickly subdue the problem. However, Brooks' excellent article[6] effectively shows that software is virtually incompressible with respect to elapsed time, and that such measures more often make things worse rather than better. Some other unhappy options are to skimp on testing, integration, or documentation. These usually cost much more in the long run. Another is just to scrap the new system and make do with the old one. Generally, the most attractive option is to reduce the system to an austere but expandable initial capability.

For the future, however, several opportunities exist for reducing software delays and getting software off the critical path. These fall into three main categories:

1. Increasing each individual's software productivity.
2. Improving project organization and management.
3. Initiating software development earlier in the system development cycle.

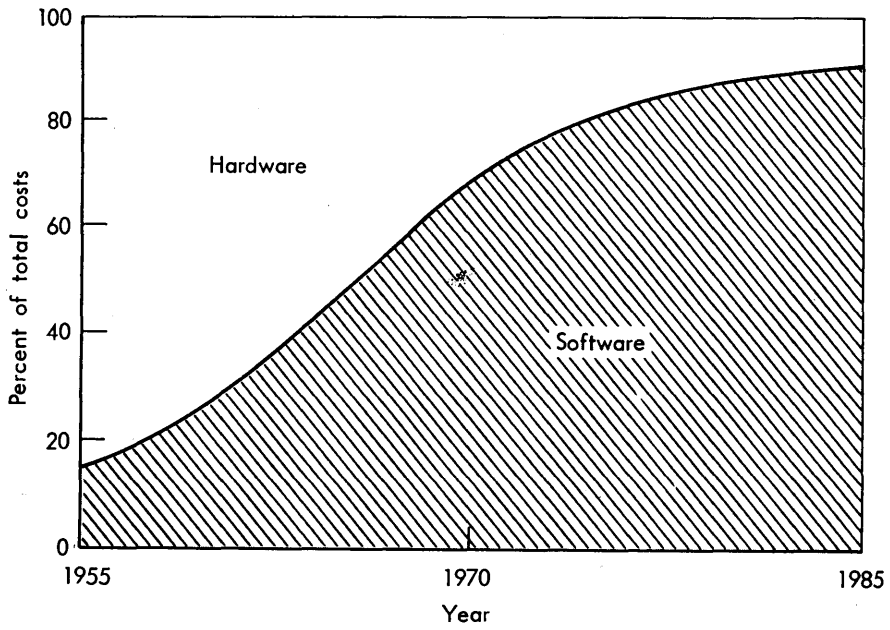


Fig. 6. Hardware/software cost trends.

[4] "Government Bureau Takes on Role of Public Protector Against Computer Misuse," *ACM Communications*, November 1972, p. 1018.
[5] Hirsch, P., "What's Wrong With the Air Traffic Control System?" *Datamation*, August 1972, pp. 48-53.
[6] Brooks, F., "Why Is The Software Late?" *Data Management*, August 1971.

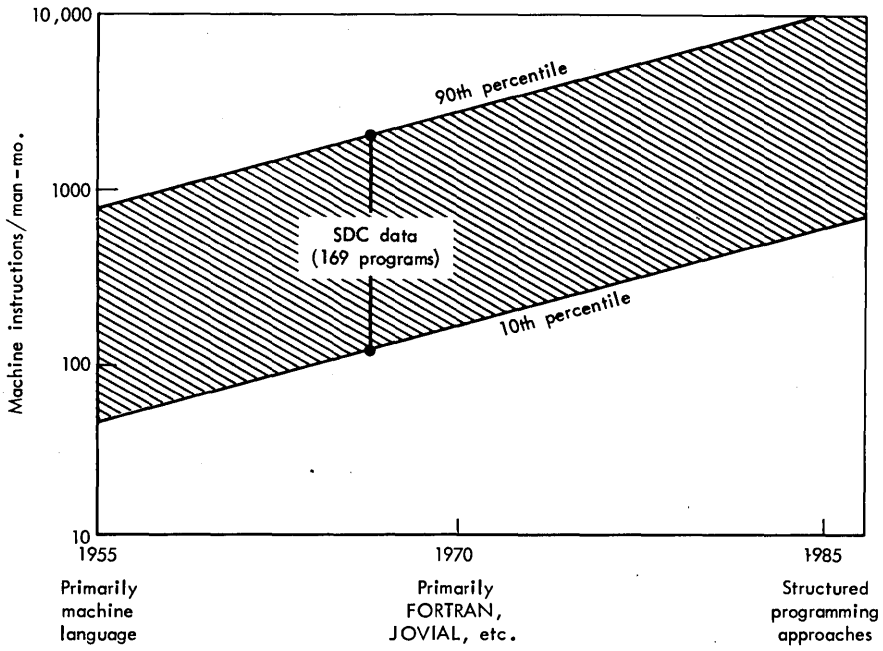


Fig. 7. Technology forecast: software productivity.

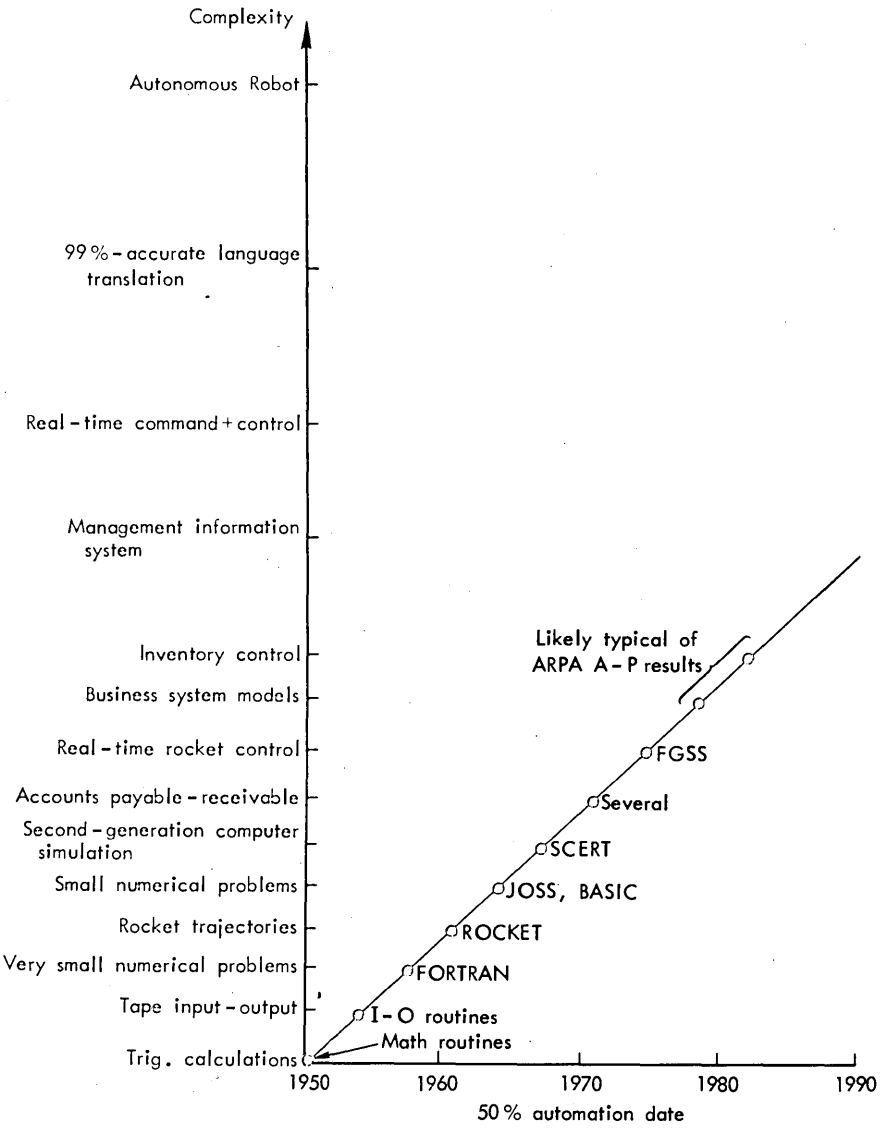


Fig. 8. Growth of automatic programming.

Software Impact

Increasing software productivity: definitions

Fig. 7 shows a simplistic view of likely future trends in software productivity. It is probably realistic in maintaining at least a factor-of-10 spread between the 10th and 90th percentiles of software productivity, but it begs a few important questions.

One is, "What is software?" Even the courts and the Internal Revenue Service have not been able to define its metes and bounds precisely. The figures above include computer program documentation, but exclude operating procedures and broad system analysis. Clearly, a different definition would affect software productivity figures significantly.

Another important question is, "What constitutes software production?" As early as the mid-1950s there were general-purpose trajectory analysis systems with which an analyst could put together a modular, 10,000-word applications program in about 10 minutes. Was this "software production?" With time, more and more such general-purpose packages as ICES (MIT's Integrated Civil Engineering System), Programming-by-Questionnaire, RPG, MARK IV, and SCERT have made the creation of significant software capabilities so easy that they tend to be eliminated from the category of "software productivity," which continues to refer to those portions of the software directly resulting from handwritten strings of assembly or FORTRAN-level language statements. Fig. 8 is an attempt to characterize this trend in terms of a "50% automation date": the year in which most of the incoming problems in an area could be "programmed" in less than an hour by a user knowledgeable in his field, with one day of specialized training.

Thus, if we want to speak objectively about software productivity, we are faced with the dilemma of:

1. Either redefining it in terms of source instructions rather than object instructions—thereby further debasing the unit of production (which isn't completely objective even using object instructions as a base)—or

2. Continuing to narrow the range of definition of "software productivity" to the more and more difficult programs which can't be put together more or less automatically.

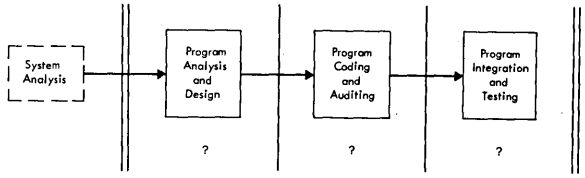
The eventual result of ARPA's major "automatic programming" effort will be to narrow this latter range even further.[7]

[7] Balzer, Robert M., *Automatic Programming*, Institute Technical Memorandum, University of Southern California, Information Sciences Institute, September 1972.

A Software Quiz

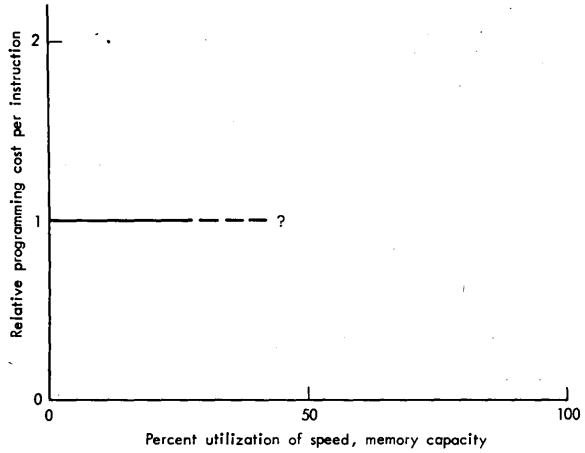
Very little in the way of quantitative data has been collected about software. But there is some which deserves to be better known than it is. Because, otherwise, we have nothing but our intuition to guide us in making critical decisions about software, and often our intuition can be quite fallible. The four questions below give you a chance to test how infallible your software intuition is. **Answers to the quiz appear on the following two pages.**

1A. Where Does the Software Effort Go?



If you're involved in planning, staffing, scheduling or integrating a large software effort, you should have a good idea of how much of the effort will be spent on analysis and design (after the functional specification for the system has been completed), on coding and auditing (including desk checking and software module unit testing), and on checkout and test. See how well you do in estimating the effort on a percentage basis for the three phases. The results for such different large systems as SAGE, OS/360, and the Gemini space shots have been strikingly similar.

2A. How Do Hardware Constraints Affect Software Productivity?



Another useful factor to know in planning software development is the extent to which hardware constraints affect software productivity. As you approach complete utilization of hardware speed and memory capacity, what happens to your software costs? Do they stay relatively constant or do they begin to bulge upward somewhat? The data here represent 34 software projects at North American Rockwell's Autonetics Division with some corroborative data points determined at Mitre.

3A. Where Are Software Errors Made?

	Batch (all errors)	Real-time (final validation phase only)
Computation and assingment	?	?
Sequencing and control	?	?
Input-output	?	?
Declarations	?	?
Punctuation	?	Not available
Correction to errors	Not available	?
Total	100%	100%

If you're setting test plan schedules and priorities, designing diagnostic aids for compilers and operating systems, or contemplating new language features (e.g., GOTO-free) to eliminate sources of software errors, it would be very useful to know how such errors are distributed over the various software functions. See how well you do in estimating the distribution of errors for typical batch programs and for the final validation of a critical real-time program.

4A. How Do Compilers Spend Their Time?

(Knuth study: 440 Lockheed programs: 250,000 statements)

Number of operands		%
1	(A = B)	?
2	(A = B ⊕ C)	?
3	(A = B ⊕ C ⊕ D)	?
> 3		?

Recently, Donald Knuth and others at Stanford performed a study on the distribution of complexity of FORTRAN statements. Try to estimate what percentage of their sample of 250,000 FORTRAN statements were of the simple form A=B, how many had two operands on the right-hand side, etc. If you're a compiler designer, this should be very important, because it would tell you how to optimize your compiler—whether it should do simple things well or whether it should do complex things well. Here the results refer to aerospace application programs at Lockheed; however, a sample of Stanford student programs showed roughly similar results.

1B. Where Does the Software Effort Go?

	Analysis and Design	Coding and Auditing	Checkout and Test
SAGE	39%	14%	47%
NTDS	30	20	50
GEMINI	36	17	47
SATURN V	32	24	44
OS/360	33	17	50
TRW Survey	46	20	34

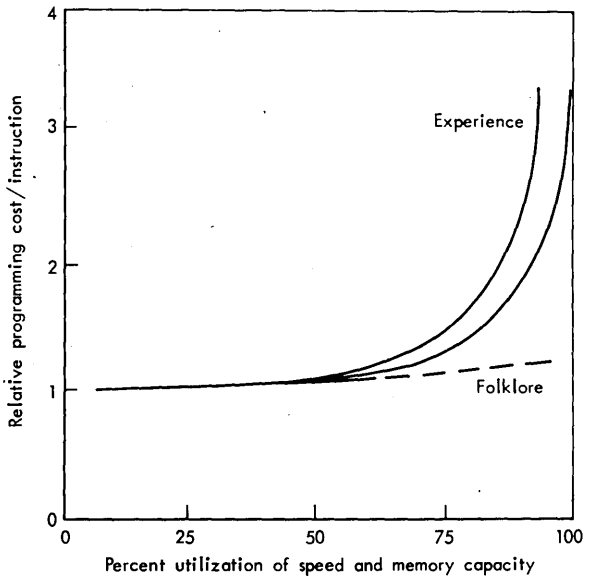
How close did you come to that large 45-50% for checkout? Whatever you estimated, it was probably better than the planning done on one recent multimillion dollar, multiyear (nondefense) software project by a major software contractor which allowed two weeks for acceptance testing and six weeks for operational testing, preceded by a two-man-month test plan effort. Fortunately, this project was scrapped in midstream before the testing inadequacies could show up. But similar schedules have been established for other projects, generally leading to expensive slippages in phasing over to new systems, and prematurely delivered, bug-ridden software.

Another major mismatch appears when you compare the relative amount of effort that goes into the three phases with the relative magnitude of R&D expenditures on techniques to improve effectiveness in each of the phases. Relatively little R&D support has been going toward improving software analysis, design, and validation capabilities.

The difference in the later TRW data probably reflects another insight: that more thorough analysis and design more than pays for itself in reduced testing costs.

(Refs.: Boehm, B.W., "Some Information Processing Implications of Air Force Space Missions: 1970-1980," *Astronautics and Aeronautics,* January 1971. Wolverton, R., *The Cost of Developing Large-Scale Software*, TRW Paper, March 1972.)

2B. How Do Hardware Constraints Affect Software Productivity?



Hopefully, your estimate was closer to the "experience" curve than the "folklore" one. Yet, particularly in hardware procurements, people make decisions as if the folklore curve were true. Typically, after a software job is sized, hardware is procured with only about 15% extra capacity over that determined by the sizing, presenting the software developers with an 85% saturated machine just to begin with. How uneconomic this is will be explained by Fig. 11 in the text.

Those data also make an attractive case for virtual memory systems as ways to reduce software costs by eliminating memory constraints. However, the strength of this case is reduced to the extent that virtual memory system inefficiencies tighten speed constraints.

(Ref.: Williman, A. O., and C. O'Donnell, "Through the Central 'Multiprocessor' Avionics Enters the Computer Era," *Astronautics and Aeronautics,* July 1970.

Software Impact

Increasing software productivity: factors

However, the fact remains that software needs to be constructed, that various factors significantly influence the speed and effectiveness of producing it, and that we have at least some measure of control over these factors. Thus, the more we know about those factors, the more our decisions will lead to improved rather than degraded software productivity. What are the important factors?

One is computer system response time. Studies by Sackman and others[8] comparing batch versus on-line programming have shown median improvements of 20% in programming efficiency using on-line systems.

However, in these same studies, *variations between individuals* accounted for differences in productivity of factors up to 26:1. Clearly, selecting the right people provides more leverage than anything else in improving software productivity. But this isn't so easy. Reinstedt[9] and others have shown that none of the selection tests developed so far have an operationally-dependable correlation with programmer performance. Weinberg, in his excellent book,[10] illustrates the complexity of the issue by citing two programmer attributes for each letter of the alphabet (from age and agility through zygosity and zodiacal sign), each of which might be a plausible determinant of programmer performance. Still, the potential payoffs are so large that further work in the areas of personnel selection, training, and evaluation should be closely followed. For example, the Berger Test of Programming Proficiency has proved fairly reliable in assessing the programming capability of experienced programmers.

Other factors such as *programming languages* have made significant differences in software productivity. Rubey's PL/I study showed differences of up to 2:1 in development time for the same program written in two different languages. In a related effort, Kosy obtained a 3.5:1 productivity improvement over one of the Rubey examples by using ECSS, a special-purpose lan-

[8] Sackman, H., *Man-Computer Problem Solving,* Auerbach Publishers, Inc., 1970.

[9] Reinstedt, R. N., "Results of a Programmer Performance Prediction Study," *IEEE Trans. Engineering Management,* December 1967, pp. 183-187.

[10] Weinberg, G., *The Psychology of Computer Programming,* Van Nostrand Reinhold, 1971.

Software Quiz

3B. Where Are Software Errors Made?

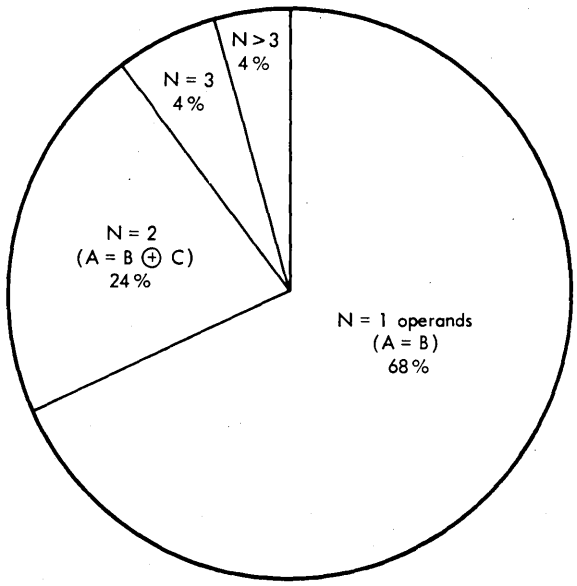
	7 batch programs (all errors)			
	PL/I	2 COBOL 2 JOVIAL 3 FORTRAN	Benchmark space booster control (all errors)	On-board space booster control (final validation phase only)
Computation and assignment	9%	25%	28%	20%
Sequencing and control	20	17	27	51
Input-output	8	8	7	6
Declarations	32	35	38	16
Punctuation	31	15	n. a.	n. a.
Corrections to errors	n. a.	n. a.	n. a.	7
Total (%)	100%	100%	100%	100%
Errors (No.)	214	140	313	87

Several points seem fairly clear from the data. One is that GOTO-free programming is not a panacea for software errors, as it will eliminate only some fraction of sequence and control errors. However, as Column 4 shows, the sequence and control errors are the most important ones to eliminate, as they currently tend to persist until the later, more difficult stages of validation on critical real-time programs. Another point is that language features can make a difference, as seen by comparing error sources and totals in PL/I with the other languages (FORTRAN, COBOL, and JOVIAL), although in this case an additional factor of less programmer familiarity with PL/I also influences the results.

(Refs.: Rubey, R. J., et al, *Comparative Evaluation of PL/I*, United States Air Force Report, ESD-TR-68-150, April 1968. Rubey, R.J., *Study of Software Quantitative Aspects*, United States Air Force Report, cs-7150-R0840, October 1971.)

4B. How Do Compilers Spend Their Time?

NUMBER OF OPERANDS IN FORTRAN STATEMENTS
(Knuth study: 440 Lockheed Programs, 250,000 statements)



It's evident from the data that most FORTRAN statements used in practice are quite simple in form. For example, 68% of these 250,000 statements were of the simple form A=B. When Knuth saw this and similar distributions on the dimensionality of arrays (58% unindexed, 30.5% with one index), the length of DO loops (39% with just one statement), and the nesting of DO loops (53.5% of depth 1, 23% of depth 2), here was his reaction:

"The author once found . . . great significance in the fact that a certain complicated method was able to translate the statement

C(I*N+J):=((A+X)*Y) +2.768((L−M)*(−K))/Z

into only 19 machine instructions compared with the 21 instructions obtained by a previously published method. . . . The fact that arithmetic expressions usually have an average length of only two operands, in practice, would have been a great shock to the author at that time."

Thus, evidence indicates that batch compilers generally do very simple things and one should really be optimizing batch compilers to do simple things. This could be similarly the case with compilers and interpreters for on-line systems; however, nobody has collected the data for those.

(Ref.: Knuth, D.E., "An Empirical Study of FORTRAN Programs," *Software Practice and Experience*, Vol. 1, 1971, p. 105.)

guage for simulating computer systems.

Weinberg has also shown[10,11] that the choice of *software development criteria* exerts a significant influence on software productivity. In one set of experiments, programmers were given the same program specification, but were told either (Group P) to finish the job as promptly as possible or (Group E) to produce as efficient a program as possible. The results were that Group E finished the job with an average of over twice as many runs to completion, but with programs running an average of six times faster.

Another important factor is the software *learning curve*. The table in the next column shows the estimated and actual programming effort involved in producing three successive FORTRAN compilers by the same group.[12]

Compiler Effort No.	Man-Months	
	Estimated	Actual
1	36	72
2	24	36
3	12	14

Clearly, software estimation accuracy has a learning curve, also.

But other factors in the programming environment make at least as large a contribution on any given project. The most exhaustive quantitative analysis done so far on the factors influencing software development was an SDC study done for the Air Force Electronic Systems Division in 1965,[13] which collected data on nearly 100 factors over 169 software projects and performed extensive statistical analysis on the results. The best fit to the data involved 13 factors, including stability of program design, percent mathematical instructions, number of subprograms, concurrent hardware development, and number of man-trips—but even that estimate had a standard deviation (62 man-months) larger than the mean (40 man-months).

Increasing software productivity: prescriptions

Does all this complexity mean that the prospect of increasing software productivity is hopeless? Not at all. In

[11] Weinberg, G. M., "The Psychology of Improved Programming Performance," *Datamation*, November 1972.

[12] McClure, R. M., "Projection vs Performance in Software Production," in *Software Engineering*, (eds.) P. Naur, and B. Randell, NATO, January 1969.

[13] Nelson, E. A., *Management Handbook for the Estimation of Computer Programming Costs*, SDC, TM-3224, Oct. 31, 1966.

fact, some of the data provide good clues toward avenues of improvement. For example, if you accurately answered question 1 on the Software Quiz, you can see that only 15% of a typical software effort goes into coding. Clearly, then, there is more potential payoff in improving the efficiency of your analysis and validation efforts than in speeding up your coding.

Significant opportunities exist for doing this. The main one comes when each of us as individual programmers becomes aware of where his time is really going, and begins to design, develop and use thoughtful test plans for the software he produces, beginning in the earliest analysis phases. Suppose that by doing so, we could save an average of one man-day per man-month of testing effort. This would save about 2.5% of our total expenditure on software. Gilchrist and Weber[14] estimate about 360,000 software practitioners in the U.S.; even at a somewhat conservative total cost quotation of $30,000 per man-year, this is about $10.8 billion annually spent on software, yielding a testing savings above of about $270 million per year.

Another opportunity lies in the area of programming languages. Except for a few experiments such as Floyd's "Verifying Compiler," programming languages have been designed for people to express programs with a minimum of redundancy, which tends to expedite the coding process, but makes the testing phase more difficult. Appropriate additional redundancy in a program language, requiring a programmer to specify such items as allowable limits on variables, inadmissible states and relations between variables,[15] would allow a compiler or operating system to provide much more help in diagnosing programming errors and reducing the time-consuming validation phase. For example, of the 93 errors detected during execution in Rubey's PL/I study, 52 could have been caught during compilation with a validation-oriented programming language containing features such as those above.

Another avenue to reducing the validation effort lies in providing tools and techniques which get validation done more efficiently during the analysis phase. This is the approach taken in *structured programming*. This term has been used to describe a variety of on-line programming tool boxes, programming systems, and innovative structurings of the software production effort. An example of the first is the Flexible Guidance Software System, currently being developed for the Air Force Space and Missile Systems Organization. The second is exemplified by the Technische Hogeschool Eindhoven (THE)[16] and automated engineering design (AED) systems, while innovative structuring may be seen in experiments such as the IBM chief programmer team (CPT) effort.[17] Although they are somewhat different, each concept represents an attempt to bring to software production a "top-down" approach and to minimize logical errors and inconsistencies through structural simplification of the development process. In the case of the THE system, this is reinforced by requiring system coding free of discontinuous program control ("GO-TO free"). In the chief programmer approach, it is accomplished by choosing a single individual to do the majority of actual design and programming and tailoring a support staff around his function and talents.

As yet, none of the systems or concepts described has been rigorously tested. Initial indications are, however, that the structured approach can shorten the software development process significantly, at least for some classes of programs and programmers. In one case, the use of AED reduced the man-effort of a small system from an envisioned six man-months to three man-weeks. A major experiment using the CPT concept (on an 83,000-instruction system for the *New York Times*) cut expected project costs by 50% and reduced development time to 25% of the initial estimate.

The validation statistics on this project were particularly impressive. After only a week's worth of system integration, the software went through five weeks of acceptance testing by *Times* personnel. Only 21 errors were found, all of which were fixed in one day. Since then during over a year's worth of operational experience, only 25 additional errors have been found in the 83,000-instruction package.[18]

At this point, it's still not clear to what extent this remarkable performance was a function of using remarkably skilled programming talent, and to what extent the performance gains could be matched by making a typical programming team into a Chief Programmer Team. Yet the potential gains were so large that further research, experimentation and training in structured programming concepts was one of the top priority recommendations of the CCIP-85 study.

Improving software management

Even though an individual's software productivity is important, the CCIP-85 study found that the problems of software productivity on medium or large projects are largely problems of management: of thorough organization, good contingency planning, thoughtful establishment of measurable project milestones, continuous monitoring on whether the milestones are properly passed, and prompt investigation and corrective action in case they are not. In the software management area, one of the major difficulties

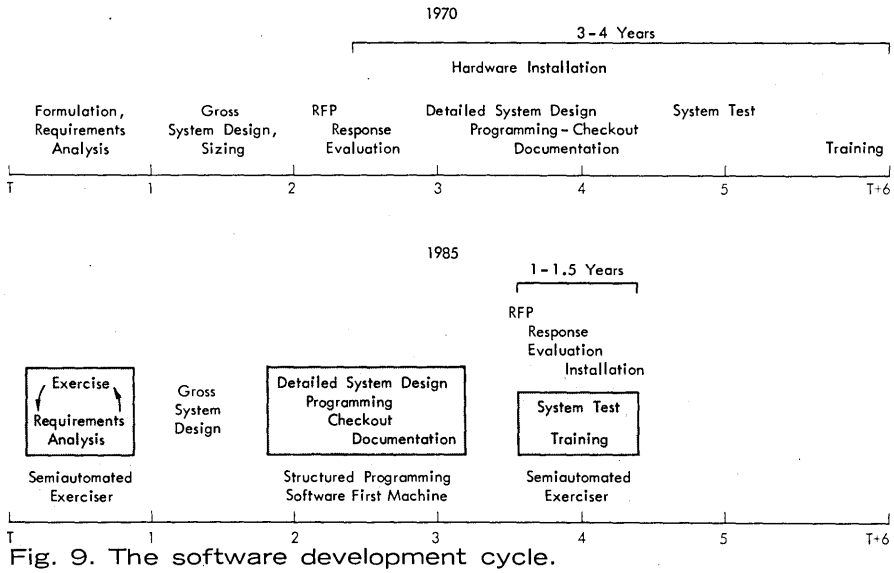


Fig. 9. The software development cycle.

[14] Gilchrist, B., and K. E. Weber, "Employment of Trained Computer Personnel—A Quantitative Survey," *Proceedings, 1972 SJCC*, p. 641-648.

[15] Kosy, D. W., *Approaches to Improved Program Validation Through Programming Language Design*, The Rand Corporation, P-4865, July 1972.

[16] Dijkstra, E. W., "The Structure of the 'THE' Multiprogramming System," *ACM Communications*, May 1968.

[17] Baker, F. T., "Chief Programmer Team," *IBM Systems Journal*, Vol. II, No. 1, 1972, pp. 56-73.

[18] Baker, F. T., "System Quality Through Structured Programming," *Proceedings, 1972 FJCC*, pp. 339-344.

is the transfer of experience from one project to the next. For example, many of the lessons learned as far back as SAGE are often ignored in today's software developments, although they were published over 10 years ago in Hosier's excellent 1961 article on the value of milestones, test plans, precise interface specifications, integrated measurement capabilities, formatted debugging aids, early prototypes, concurrent system development and performance analysis, etc.[19]

Beyond this, it is difficult to say anything concise about software management that doesn't sound like motherhood. Therefore, this article will simply cite some good references in which the subject is explored in some detail.[20,21,22]

Getting an earlier start: the software-first machine

Even if software productivity never gets tremendously efficient, many of the most serious software agonies would be alleviated if we could get software off the critical path within an overall system development. In looking at the current typical history of a large software project (Fig. 9) you can see that the year (or often more) spent on hardware procurement pushes software farther out onto the critical path, since often the software effort has to wait at least until the hardware source selection is completed.

One of the concepts developed in the CCIP-85 study for getting software more off the critical path was that of a "software-first machine." This is a highly generalized computer, capable of simulating the behavior of a wide range of hardware configurations. Fig. 10 provides a rough plan of such a software-first machine. It would have the capability of configuring and exercising through its microprogrammed control, a range of computers, and could also simultaneously provide some additional hardware aids to developing and testing software.

Suppose a large organization such as the Air Force owned such a machine. The following events could then take place: a contractor who is trying to develop software for an airborne computer could start with a need for a machine which is basically the IBM 4PI, but with a faster memory and different interrupt structure. This software contractor could develop, exercise, store, and recall his software based on the microprogrammed model of the machine. When it turned out that this architecture was hampering the software developers, they could do some hardware/software tradeoffs rather easily by changing the microprogrammed machine representation; and when they were finished or essentially finished with the software development, they would have detailed design specifications for the hardware that could be produced through competitive procurement in industry. Similarly, another contractor could be developing software for interface message processors for communications systems, based on variants of the Honeywell DDP 516; another could be improving a real-time data processing capability based on an upgrade of a CDC 3800 computer on another virtual machine.

The software-first machine could be of considerable value in shortening the time from conception to implementation of an integrated hardware/software system. In the usual procurement process (Fig. 9), the hardware is chosen first, and software development must await delivery of the hardware. With the software-first machine, software development can avoid this wait, as hardware procurement can be done during the system test phase; the necessary hardware fabrication will start from a detailed design and, with future fabrication technology, should not introduce delays. This saving translates also into increased system operating life, as the hardware installed in the field is based on more up-to-date technology.

However, the software-first machine concept has some potential drawbacks. For example, it might produce a "centrifugal tendency" in hardware development. Allowing designers to tailor hardware to software might result in the proliferation of a variety of similar although critically different computers, each used for a special purpose.

A final question concerning the software-first machine remains moot: Can it be built, at any rate, at a "reasonable" cost? Architectures such as the CDC STAR, ILLIAC IV, and Goodyear STARAN IV would be virtually impossible to accommodate in a single machine. Thus, it is more likely that vari-

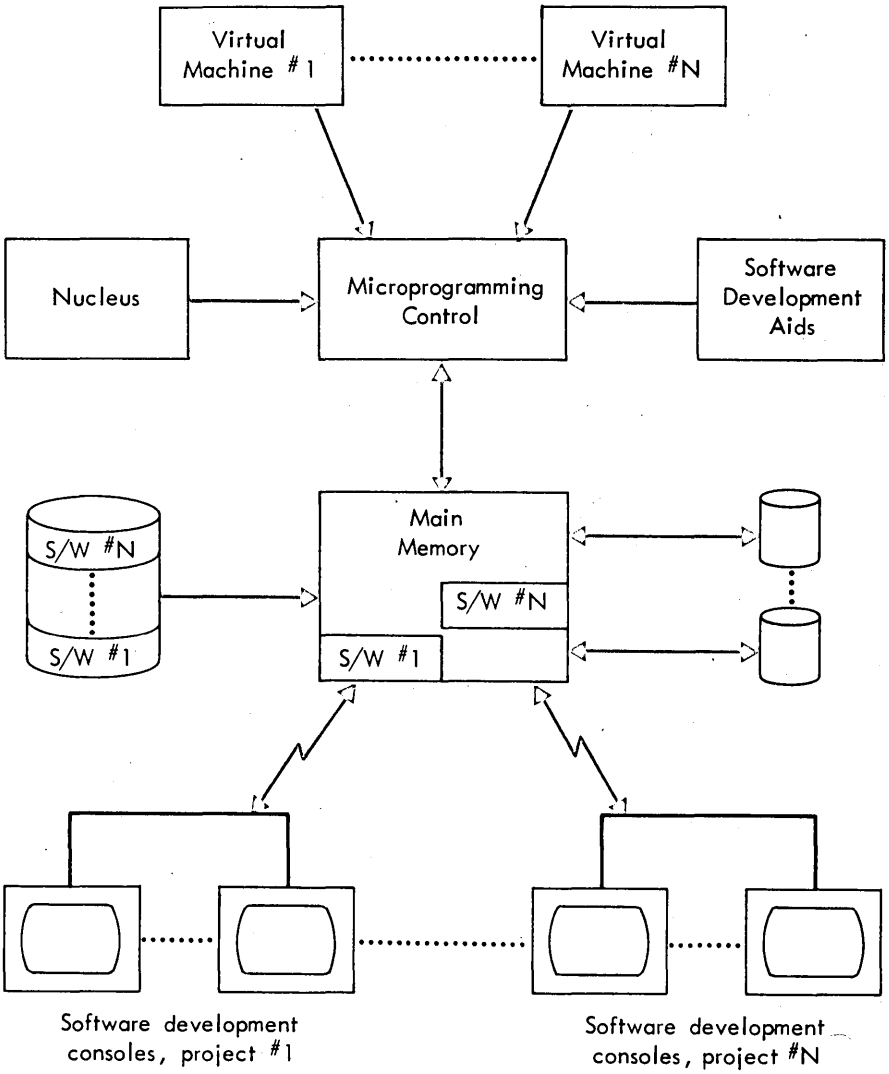


Fig. 10. Software-first machine concept.

[19] Hosier, W. A., "Pitfalls and Safeguards in Real-Time Digital Systems with Emphasis on Programming," *IRE Transactions on Engineering Management*, Vol. EM-8, June 1961, pp. 99-115.

[20] Naur, P. and B. Randell (eds.) *Software Engineering*, NATO Science Committee, January 1969.

[21] Buxton, J. N. and B. Randell, (eds.) *Software Engineering Techniques*, NATO Science Committee, April 1970.

[22] Weinwurm, G., (ed.) *On the Management of Computer Programming*, Auerbach, 1970.

ous subsets of the software-first machine characteristics will be developed for various ranges of applications.

One such variant is under way already. One Air Force organization, wishing to upgrade without a simultaneous hardware and software discontinuity, acquired some Meta 4 microprogrammed machines which will originally be installed to emulate the existing second-generation hardware. Once the new hardware is in operation, they will proceed to upgrade the system software using a different microprogrammed base. In this way they can upgrade the system with a considerably reduced risk of system downtime.

Another existing approach is that of the microprogrammed Burroughs B1700, which provides a number of the above characteristics plus capabilities to support "direct" execution of higher-level-language programs.

Other hardware-software tradeoffs

In addition, there are numerous other ways in which cheaper hardware can be traded off to save on more expensive software development costs. A most significant one stems from the striking difference between "folklore" and "experience" in the hardware-software curves shown in Fig. 2B of the Software Quiz. This tradeoff opportunity involves buying enough hardware capacity to keep away from the steep rise in software costs occurring at about the 85% saturation point of cpu and memory capacity.

Thus, suppose that one has sized a data-processing task and determined that a computer of one-unit capacity (with respect to central processing unit speed and size) is required. Fig. 11 shows how the total data-processing system cost varies with the amount of excess cpu capacity procured for various estimates of the ratio of ideal software-to-hardware costs for the system. ("Ideal software" costs are those that would be incurred without any consideration of straining hardware capacity.) The calculations are based on the previous curve of programming costs and two models of hardware cost: the linear model assumes that cost increases linearly with increases in cpu capacity; the "Grosch's Law" model assumes that cost increases as the square root of cpu capacity. Sharpe's data[23] indicates that most applications fall somewhere between these models.

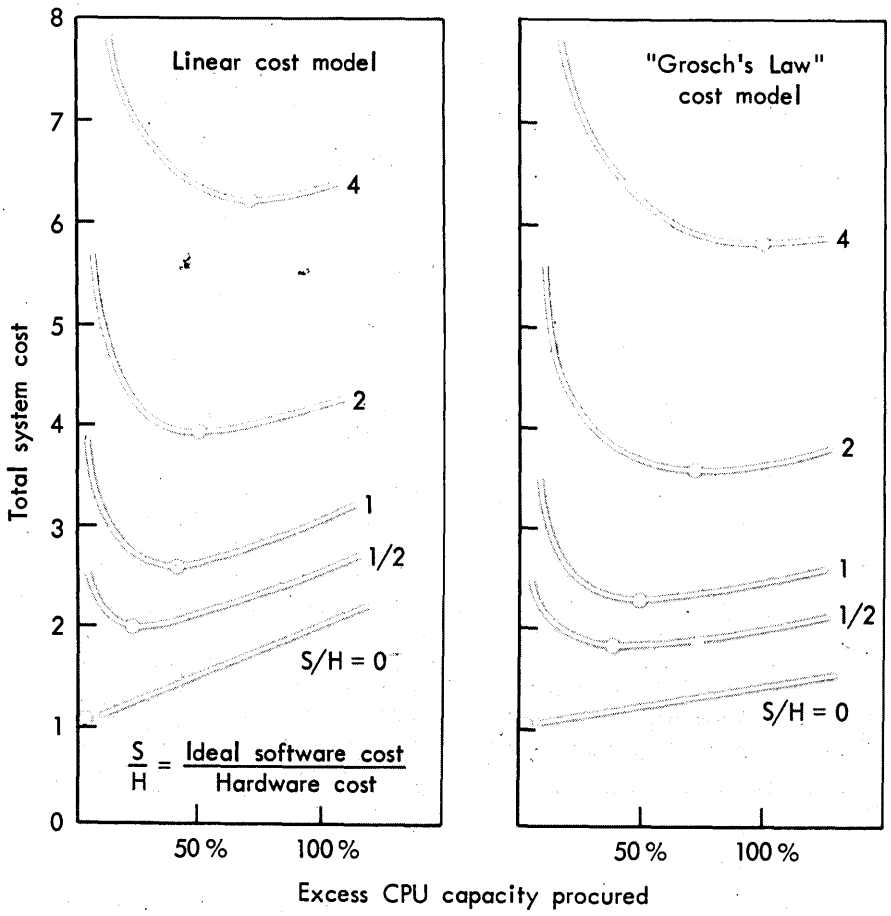


Fig. 11. Hardware-software systems costs.

[23] Sharpe, W. F., *The Economics of Computers*, Columbia University Press, 1969.

It should be remembered that the curves are based on imprecise observations; they clearly cannot be used in "cookbook" fashion by system designers. But even their general trends make the following points quite evident:

1. Overall system cost is generally minimized by procuring computer hardware with at least 50% to 100% more capacity than is absolutely necessary.

2. The more the ratio of software-to-hardware cost increases (as it will markedly during the seventies), the more excess computing capacity one should procure to minimize the total cost.

3. It is far more risky to err by procuring a computer that is too small than one that is too large. This is especially important, since one's initial sizing of the data-processing job often tends to underestimate its magnitude.

Of course, buying extra hardware does not eliminate the need for good software engineering thereafter. Careful configuration control must be maintained to realize properly the benefits of having extra hardware capability, as there are always strong Parkinsonian tendencies to absorb excess capacity with marginally useful tasks.

Software responsiveness

Another difficulty with software is its frequent unresponsiveness to the actual needs of the organization it was developed for. For example, the hospital information system field has several current examples of "wallflower" systems which were developed without adequately consulting and analyzing the information requirements of doctors, nurses, and hospital administrators. After trying to live with these systems for a while, several hospital administrators have reluctantly but firmly phased them out with such comments as, "We know that computers are supposed to be the way to go for the future, but this system just doesn't provide us any help," or, "Usage of the system began at a very low level—and dropped off from there."

The main difficulties stem from a lack of easily transferable procedures to aid in the software requirements analysis process. This process bears an all-too-striking resemblance to the class of folk tales in which a genie comes up to a man and tells him he has three wishes and can ask for anything in the world. Typically, he spends his first two wishes asking for something like a golden castle and a princess, and then when he discovers the operations, maintenance, and compatibility implications of his new acquisitions, he is happy to spend the third wish getting back to where he started.

Similarly, the computer is a sort of genie which says, "I'll give you any

processed information you want. All you need to do is ask—by writing the software to process it." Often, though, we go the man in the folk tale one better by canvassing a number of users (or nonusers) and putting their combined wish lists into a software requirements analysis. But our technology base for assessing the operations, maintenance, and compatibility implications of the resulting software system is just as inadequate. Thus, large airline reservations software developments (Univac / United, Burroughs / TWA) have reached the point that the customer preferred to wish them out of existence rather than continue them—but only after the investment of tens of millions of dollars. In other cases, where no alternative was available, software rewrites of up to 67% (and in one very large system, 95%) have taken place—*after* the "final" software package had been delivered—in order to meet the user's operational needs.

Considering the major needs for better requirements analysis techniques, the relative lack of available techniques, and the added fact (from Fig. 1B of the Software Quiz) that about 35% of the total software effort goes into analysis and design, it is not surprising that the top-priority R&D recommendation made by the CCIP-85 study was for better techniques for performing and validating information system requirements analyses, and for generating and verifying the resulting information system designs.

The recent DATAMATION articles on automated system design[24,25] indicated some promising initial developments in this area such as Teichroew's ISDOS project, FOREM, and IBM's TAG (Time-Automated Grid) system. Other significant aids are being developed in the area of special languages and packages such as SCERT, CASE, CSS, SAM, and ECSS to accelerate the process of design verification by simulating information-processing systems. Also, ARPA's major research effort in automatic programming is focused strongly on automating the analysis and design processes.[7]

Software reliability and certification

Another major area in which the CCIP-85 study identified a serious mismatch between future needs and likely software capabilities was in the area of software certification: of providing guarantees that the software will do what it is supposed to do. (Other significant problem or opportunity areas identified by CCIP-85 included, in order, data security, airborne computing power, multisource data fusion, data communications, source data automation, image processing, performance analysis, parallel processing, and software transferability.)

This is a significant concern right now, but it becomes even more pressing when one extrapolates current trends toward more complex software tasks and toward more and more automated aids to decision making. Just consider the trends implicit in the results of the recent AFIPS/Time Survey[26] which indicated that currently *30% of the labor force must deal with computers in their daily work, but only 15% of the labor force is required to have any understanding of computers.* Extrapolating this trend into the 1980s, as is done in Fig. 12, indicates that perhaps 40% of the labor force will be trusting implicitly in the results produced by computer software.

Software reliability: problem symptoms

Will software be deserving of such trust? Not on its past record. For example, some of the most thoroughly tested software in the world is that of the Apollo manned spaceflight efforts. Yet on Apollo 8, an unforeseen sequence of astronaut actions destroyed the contents of a word in the computer's erasable memory—fortunately, not a critical error in this case. And on Apollo 11, the data flow from the rendezvous radar was not diverted during the critical lunar landing sequence, causing a computer overload that required astronaut Armstrong to divert his attention from the process of landing the spacecraft—fortunately again, without serious consequences. And during the 10-day flight of Apollo 14, there were 18 discrepancies found in the software—again fortunately, without serious consequences.

Other space missions haven't been so fortunate. Recently a software error aboard a French meteorological satellite caused it to "emergency destruct" 72 out of 141 high-altitude weather balloons, instead of interrogating them. An early U.S. Mariner interplanetary mission was lost due to a software error. And the Soviet Union has had missions fail because of software errors.

Down on earth, software reliability isn't any better. Each new release of OS/360 contains roughly 1,000 new software errors. On one large real-time system containing about 2,700,000 instructions and undergoing continuous modifications, an average of one software error per day is discovered. Errors in medical software have caused people to lose their lives. And software errors cause a constant stream of social dislocations due to false arrests, incor-

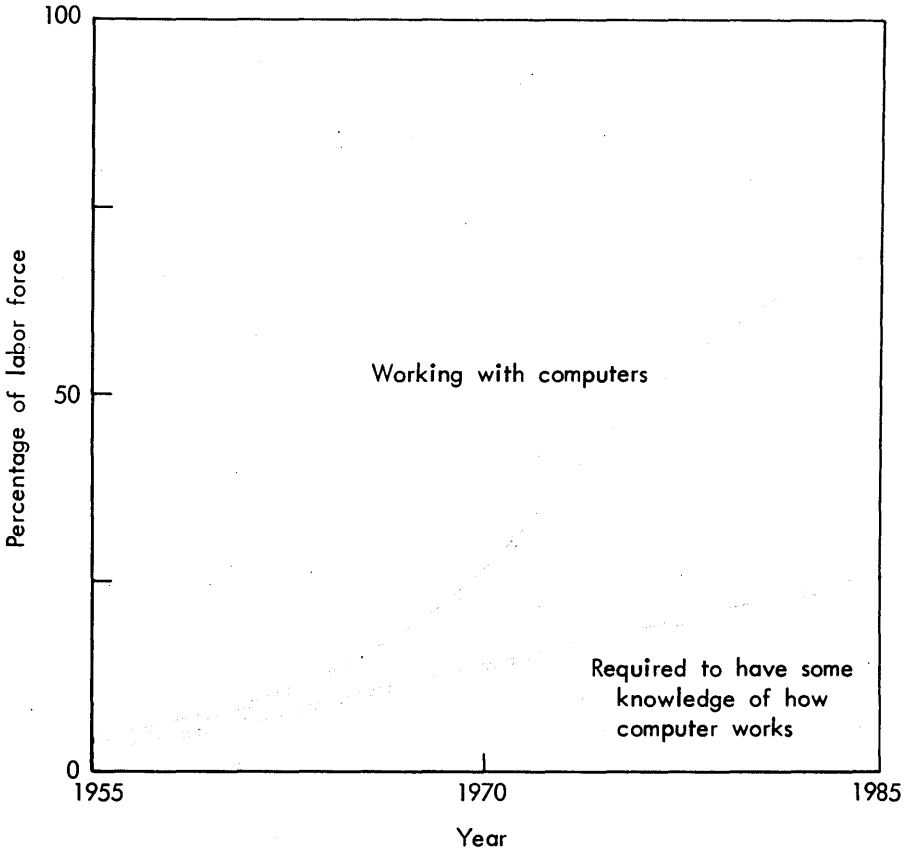


Fig. 12. Growth of trust in computers and software.

[24] Teichroew, D., and H. Sayari, "Automation of System Building," *Datamation*, August 15, 1971, pp. 25-30.

[25] Head, R. V., "Automated System Analysis," *Datamation*, August 15, 1971, pp. 23-24.

[26] *A National Survey of the Public's Attitudes Toward Computers*, AFIPS and Time, Inc., November 1971.

rect bank balances or credit records, lost travel reservations, or long-delayed payments to needy families or small businesses. Also, lack of certification capabilities makes it virtually impossible to provide strong guarantees on the security or privacy of sensitive or personal information.

Software reliability: technical problems

As the examples above should indicate, software certification is not easy. Ideally, it means checking all possible logical paths through a program; there may be a great many of these. For example, Fig. 13 shows a rather simple program flowchart. Before looking at the accompanying text, try to estimate how many different possible paths through the flowchart exist.

Even through this simple flowchart, the number of different paths is about ten to the twentieth. If one had a computer that could check out one path per nanosecond (10^{-9} sec), and had started to check out the program at the beginning of the Christian era (1 A.D.), the job would be about half done at the present time.

So how does one certify a complex computer program that has incredibly more possible paths than this simple example? Fortunately, almost all of the probability mass in most programs goes into a relatively small number of paths that can be checked out.

But the unchecked paths still have some probability of occurring. And, furthermore, each time the software is modified, some portion of the testing must be repeated.

Fig. 14 shows that, even for small software modifications, one should not expect error-free performance thereafter. The data indicate that small modifications have a better chance of working successfully than do large ones. However, even after a small modification the chance of a successful first run is, at best, about 50%. In fact, there seems to be a sort of complacency factor operating that makes a successful first run less probable on modifications involving a single statement than on those involving approximately five statements—at least for this sample.

At this point, it's not clear how representative this sample is of other situations. One roughly comparable data point is in Fig. 3B of the Software Quiz, in which only 7% of the errors detected were those made in trying to correct previous errors. The difference in error rates is best explained by both the criticality of the application and the fact that the modifications were being made in a software validation rather than a software maintenance environment.

In another analysis of software error data performed for CCIP-85 by McGonagle,[27] 19% of the errors resulted from "unexpected side effects to changes." Other sources of errors detected over three years of the development cycle of a 24,000-instruction command and control program are shown in Table 1. These data are of particular interest because they provide insights into the *causes* of software errors as well as their variation with type of program.

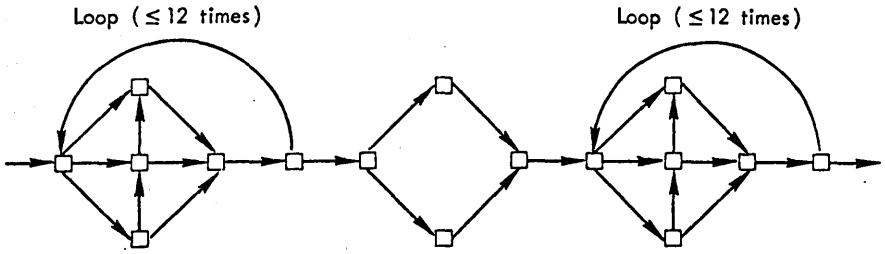


Fig. 13.

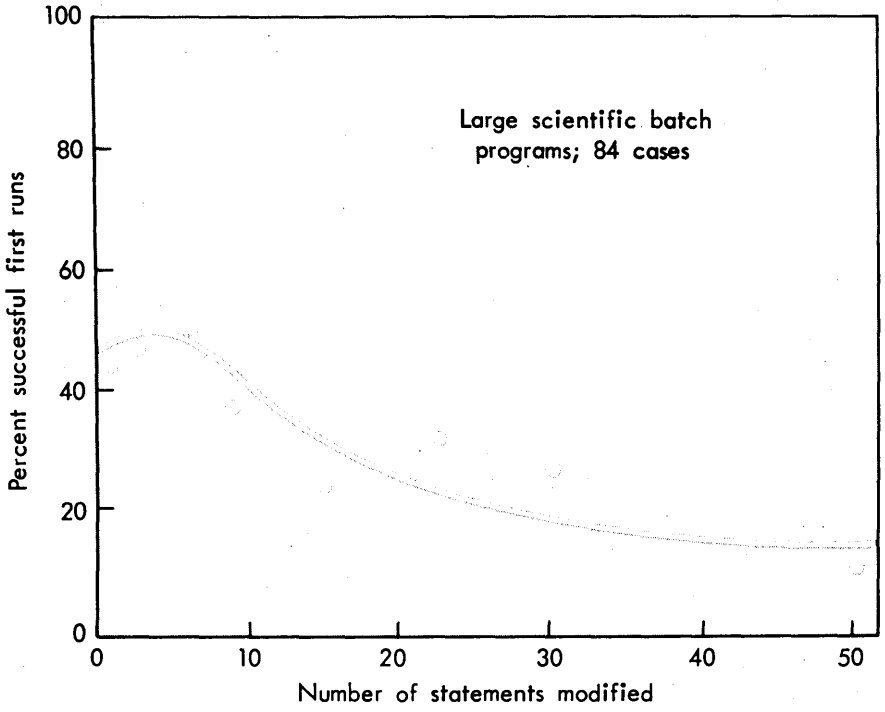


Fig. 14. Reliability of software modifications.

Certification technology

Against the formidable software certification requirements indicated

	Hardware Diagnostics (%)	Executive (%)	User Programs (%)	Total (%)
Unexpected side effects to changes	5	25	10	19
Logical flaws in the design				
Original design	5	10	2	8
Changes	5	15	8	12
Inconsistencies between design and implementation	5	30	10	22
Clerical errors	40	20	50	28
Inconsistencies in hardware	40	—	20	11
	100	100	100	100
Total errors detected, 3-year sample	36	108	18	162
Number of instructions	4K	10K	10K	24K

Table 1. Distribution of software error causes.

[27] McGonagle, J. D., *A Study of a Software Development Project*, James P. Anderson and Co., September 21, 1971.

above, the achievements of current technology leave a great deal to be desired. One organization paid $750,000 to test an 8,000-instruction program, and even then couldn't be guaranteed that the software was perfect, because testing can only determine the *presence* of errors, not their *absence*. The largest program that has been mathematically proved correct was a 433-statement ALGOL program to perform error-bounded arithmetic; the proof required 46 pages of mathematical reasoning.[28]

However, there are several encouraging trends. One is the impressive reduction of errors achieved in the structured programming activities discussed earlier in this article. Another is the potential contribution of appropriately redundant programming languages, also discussed earlier. A third trend is the likely development of significant automated aids to the program-proving process, currently an extremely tedious manual process. Another is the evolutionary development and dissemination of better software test procedures and techniques and the trend toward capitalizing on economies of scale in validating similar software items, as in the DOD COBOL Compiler Validation System. But even with these trends, it will take a great deal of time, effort, and research support to achieve commonly usable solutions to such issues as the time and cost of analytic proof procedures, the level of expertise required to use them, the difficulty of providing a valid program specification to serve as a certification standard, and the extent to which one can get software efficiency and validability in the same package.

Where's the software engineering data base?

One of the major problems the CCIP-85 study found was the dearth of hard data available on software efforts which would allow us to analyze the nature of software problems, to convince people unfamiliar with software that the problems were significant, or to get clues on how best to improve the situation. Not having such a data base forces us to rely on intuition when making crucial decisions on software, and I expect, for many readers, your success on the Software Quiz was sufficiently poor to convince you that software phenomena often tend to be counterintuitive. Given the magnitude of the risks of basing major software decisions on fallible intuition, and the opportunities for ensuring more responsive software by providing designers with usage data, it is surprising how little effort has gone into endeavors to collect and analyze such data. Only after a decade of R&D on heuristic compilers, optimizing compilers, self-compiling compilers and the like, has there been an R&D effort to develop a *usage-measuring* compiler. Similar usage-measuring tools could be developed for keeping track of error rates and other software phenomena.

One of the reasons progress has been slow is that it's just plain difficult to collect good software data—as we found on three contract efforts to do so for the CCIP-85 study. These difficulties included:

1. Deciding which of the thousands of possibilities to measure.
2. Establishing standard definitions for "error," "test phase," etc.
3. Establishing what had been the development performance criteria.
4. Assessing subjective inputs such as "degree of difficulty," "programmer expertise," etc.
5. Assessing the accuracy of *post facto* data.
6. Reconciling sets of data collected in differently defined categories.

Clearly, more work on these factors is necessary to insure that future software data collection efforts produce at least roughly comparable results. However, because the data collection problem is difficult doesn't mean we should avoid it. Until we establish a firm data base, the phrase "software engineering" will be largely a contradiction in terms. And the software components of what is now called "computer science" will remain far from Lord Kelvin's standard:

"When you can measure what you are apeaking about, and express it in numbers, you know something about it; but when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind: it may be the beginning of knowledge, but you have scarcely, in your thoughts, advanced to the stage of *science*."

But, in closing, I'd like to suggest that people should collect data on their software efforts because it's really in their direct best interest. Currently, the general unavailability of such software data means that whoever first provides system designers with quantitative software characteristics will find that the resulting system design tends to be oriented around his characteristics.

For example, part of the initial design sizing of the ARPA Network was based on two statistical samples of user response, on Rand's JOSS system and on MIT's Project MAC. This was not because these were thought to be particularly representative of future network users; rather, they were simply the only relevant data the ARPA working group could find.

Another example involves the small CCIP-85 study contracts to gather quantitative software data. Since their completion, several local software designers and managers have expressed a marked interest in the data. Simply having a set of well-defined distributions of program and data module sizes is useful for designers of compilers and operating systems, and chronological distributions of software errors are useful for software management perspective. Knuth's FORTRAN data, excerpted in Fig. 4B of the Software Quiz, have also attracted considerable designer interest.

Thus, if you're among the first to measure and disseminate your own software usage characteristics, you're more likely to get next-generation software that's more responsive to your needs. Also, in the process, there's a good chance that you'll pick up some additional clues which begin to help you produce software better and faster right away.

Acknowledgements. Hundreds of people provided useful inputs to CCIP-85 and this extension of it; I regret my inability to properly individualize and acknowledge their valuable contributions. Among those providing exceptionally valuable stimulation and information were Generals L. Paschall, K. Chapman, and R. Lukeman; Colonels G. Fernandez and R. Hansen; Lieutenant Colonel A. Haile, and Captain B. Engelbach of the United States Air Force; R. Rubey of Logicon; R. Wolverton and W. Hetrick of TRW; J. Aron of IBM; A. Williams of NAR/Autonetics; D. McGonagle of Anderson, Inc.; R. Hatter of Lulejian Associates; W. Ware of Rand; and B. Sine. Most valuable of all have been the never-ending discussions with John Farquhar and particularly Don Kosy of Rand. □

Dr. Boehm is head of the information sciences and mathematics department at the Rand Corp. He has also been a lecturer and instructor at UCLA and was study director of the project discussed in this article. He is a member of many scientific organizations, serves on several government advisory panels, and has published a wide selection of scientific papers. He has a PhD in mathematics from UCLA.

[28] Good, D. I., and R. L. London, "Computer Interval Arithmetic: Definition and Proof of Correct Implementation," *ACM Journal*, October 1970, pp. 603-612.

"I do not believe my father ever was
(or ever could have been)
such a poet as I shall be an Analyst."

—Augusta Ada, the Countess Lovelace, July, 1843

The Computer and the Countess

by David W. Kean

Anyone at all interested in the subject is by now aware that the basic anatomy of the digital computer was laid out, not, as the unenlightened may think, during the technological binge attending World War II, but a hundred years earlier by the crusty Englishman, Charles Babbage. The high points, at least, of his life and contributions have been rather well treated in the literature in recent years: his sickly and secluded childhood; his years at Oxford where he founded the Analytical Society and where, in 1812, the outline for the Difference Engine first came to him; the later construction of what engineers today would call a "data flow model" of it, under a grant from the British government; his inspiration from the Jacquard loom for a general purpose calculating machine operating from punched cards and anticipating many key elements of modern computer design; the expansion of this notion to the description of the Analytic Engine; and his bitter disappointment when the Chancellor of the Exchequer, Sir Robert Peel, declined to support the construction of the Analytic Engine from government coffers on the ground that Babbage had never fully delivered on his commitment for the Difference Engine and therefore could not be entrusted with further largesse from public sources.

It is also generally known that, although Babbage's designs were basically sound, the manufacturing technology of the day was incapable of meeting his exacting specifications, so that the inventor never lived to produce working models. Most people are generally aware that the cantankerous Babbage, forever battling his scientific colleagues on one score or another (when he wasn't badgering organ grinders, the bane of his later years), was nonetheless something of a social gadabout who could be most charming when the mood struck him. He once wrote that he had no less than thirteen invitations to dinner for every day of the month, Sundays included, and he was on intimate terms with a startling number of the important personalities of the day.

> ... her contributions multiplied, not only to the documentation of the Analytic Engine, but also on occasion to improvements in its basic design ...

Finally, it is hardly news any longer that Babbage's principal interpreter, the one person perhaps most responsible for his place in the history of computation, was a woman, Augusta Ada, the Countess Lovelace, who was approximately the same age as his own daughter, Georgianna, would have been had she lived. What is perhaps not so well known is the fascinating course of the collaboration between the young Countess and the middle-aged inventor, and its tragic outcome.

Augusta Ada was born in London on December 10, 1815, the only issue of the brief and tempestuous marriage between the poet, Lord Byron, and Annabella Milbanke. A few months after her birth her parents separated; presumably the last straw in their strained relationship was Byron's alleged incestuous affair with his half sister, the "Augusta" of several of his poems. (The shabby details of this liaison were made public by Harriet Beecher Stowe, she of Uncle Tom's Cabin fame, to whom Lady Byron had entrusted them. It is not clear from the record whether this slip was planned by Lady B in order to embarrass the poet or whether Mrs. Stowe breached a confidence; there are adherents to both theories.) Lord Byron then departed for the Continent, never again to see

his homeland or his daughter. But he could never cast Ada from his memory and the famous opening lines of Canto Three of his epic, *Childe Harold's Pilgrimage*, testify to his anguish:

Is thy face like thy Mother's, my fair child!
Ada! sole daughter of my house and heart?
When last I saw thy young blue eyes they smiled,
And then we parted, not as now we part,
But with hope.

To friends during his self-imposed exile he has been quoted as saying, "This is Ada's birthday and might have been the happiest day of my life. I wonder . . . if ever I shall see her again." Then he died in 1823 in Missolonghi, Greece, and dying lamented, "My dear Ada, my God, could I but have seen her."

The tragic life ended without such meeting and Ada, for her part, was reared in virtual ignorance of her father's works. She showed little sign of having inherited her father's creative artistry (although she was a fair musician) but instead excelled in her mother's strong point, mathematics. An early interest in things mechanical also appeared and factory tours were a source of real enjoyment in her youth. By 18 she was regularly attending public lectures at the Mechanics Institute and it was there that she had her first exposure to the Difference Engine, in a description by Dr. Dionysius Lardner, famed science writer of the day. Yet she was hardly a tomboy; a painting of her at age 20, done by the renowned English portraitist Margaret Carpenter, reveals a demure damsel, slight and delicate, with a pretty, though perhaps not beautiful, face having rather too large a nose. A post mortem biographical sketch by Albany Fonblanque, editor of the *Examiner*, said of her that she was "thoroughly original, possessed of genius, not poetic . . . but rather mathematical and metaphysical . . . her mind having been in a constant practice of investigation." And in a passage that few editors would chance today, "With an understanding thoroughly masculine in solidity, grasp and firmness, Lady Lovelace had all the delicacies of the most refined female character. . . . The superficial observer would never have observed the strength and knowledge that lay hidden under the womanly graces."

Babbage had known Lady Byron well for some time and she and Ada were frequent guests at his house in Dorset Street. Among the other guests on these occasions there frequently appeared professor and Mrs. Augustus de Morgan. Dr. de Morgan will be remembered by computer professionals for the theorem which bears his name to the effect that the negation of conjunctions is logically equivalent to the disjunction of negations and vice versa. Mrs. de Morgan, an authoress in her own right, said of Ada during this period, "While the rest of the party gazed at the beautiful instrument (the Difference Engine) with the same sort of expression and feeling that some savages are said to have on first seeing a looking glass . . . Miss Byron, as young as she was, understood its working and saw the great beauty of the invention." Professor de Morgan himself wrote privately to Lady Byron that Ada's mathematical ability was "perhaps of first rate eminence" and compared her to the 18th century Italian genuis, Maria Agnesi. But, with masculine condescension, he feared that "the very great tension of mind required (for advanced mathematical work) was beyond the strength of woman's physical powers" and therefore declined to encourage her.

But Babbage, accustomed to indifference and uninformed skepticism from his countrymen, even some who might have known better, reacted instinctively to Ada's display of intelligent understanding and appreciation, the more so since it came from what must have been to him a totally unexpected source. Over the course of time he took to calling her his "lady fairy" and it is not unlikely he appeared to the girl as something of a father figure.

In 1835, at age 20, Augusta Ada married William, 8th Baron King, who three years later became the first Earl of Lovelace. He was jovial, kind, and tolerant of his bride's aberrations, but he was never her intellectual equal. From the start, Babbage was a frequent visitor at the baronial estate, Ockham Park, and between visits an intense and curious correspondence developed between Charles and Ada. After one unusually long separation, Ada wrote, "I am very anxious to talk to you. I will give you a hint on what. It strikes me that at some future time . . . my head may be made subservient to your purposes and plans. If so, if ever I could be worthy or capable of being used by you, my head would be yours . . . I scarcely dare exalt myself to hope, even humbly, that I can ever be intellectually worthy to serve you." But it turned out the other way around; Ada wound up using Babbage.

Meanwhile she prepared herself for the one great service she really did for her friend by undertaking an intensive study of advanced mathematics. Like so many engineers, Babbage was notoriously delinquent in documenting his ideas and this did nothing to enhance his standing with his sponsors or in the technical community. Once on a vacation in Italy he had met the soldier-mathematician, Count Luigi F. Menabrea. (Menabrea, a general in Garibaldi's struggle to unify Italy, later became the first prime minister of the fused nation.) He was fascinated with the concepts embodied in the Analytic Engine and undertook to write a full description of it.

One of Lord Byron's last requests of his wife, and undoubtedly the last one she granted, had been that Ada be permitted to learn Italian. She proved to be a first rate student of the language and, in 1842, when Menabrea's paper appeared, she resolved to translate it into English. With the inventor's encouragement, she added many detailed notes so that the final version turned out to be three times as long as the Italian original. One of the notes, an example of how the machine might be applied, was a step-by-step description of how it might be scheduled to compute Bernuolli's Numbers. Perhaps Ada thus qualifies for the title of the world's first computer programmer. Babbage wrote to her, "These memoirs taken together furnish, to those capable of understanding the reasoning, a complete demonstration that the whole of the developments and operations of analysis are now capable of being executed by machinery." Ada's translation remains the only satisfactory description we have today of the Analytic Engine.[1]

During the course of the translation, the correspondence between the two collaborators intensified. The portions of it that have survived yield, amid the technical content, a graphic portrayal

"... I wish that you were as accurate, as much to be relied upon, as myself."

of the gradual metamorphosis of the ambitious young woman from an awed and humble hero worshipper to a domineering schemer. She wrote in June, 1843, "I am more determined than ever in my future plans . . . I think much of the possible (I believe I may say probable) future connection between us."

And, as her contributions multiplied, not only to the documentation of the Analytic Engine, but also on occasion to improvements in its basic design, Ada's humility began to evaporate, to be replaced by forwardness yielding to arrogance and argumenta-

[1] The title of the translation is *Sketch of the Analytic Engine Invented by Charles Babbage*, by L. F. Menabrea of Turin, Officer of Military Engineers, from the Bibliothèque Universelle de Genève, October, 1842, No. 82. With Notes upon the Memoir by the Translator, Ada Augusta, Countess of Lovelace. The complete text can be found in *Charles Babbage and His Calculating Engines*, edited and with an introduction by Philip Morrison and Emily Morrison, Dover Publications, Inc., New York, 1961 (p. 225).

tiveness at some points and childish petulance bordering on flirtation at others. "I am very much annoyed at your having altered my note . . . I am always willing to make the required alterations myself but . . . cannot endure another person to muddle with my sentences."

Babbage, mildly startled by the changing tone, replied, "If you are as fastidious about the acts of your friends as you are about those of your pen, I much fear that I shall equally lose your friendship and your notes . . . There is still one trifling misapprehension about the variable cards . . . A variable card can never be directed to order more than one variable to be given off at once, because the mill (i.e., the arithmetic unit) could not receive them. . . ."

"I cannot imagine what you mean about the variable cards," she retorted petulantly, "since I have never supposed in my own mind that one variable card *could* give off more than one variable at a time, nor have I . . . ever expressed such an idea in any passage whatsoever . . . The fact is that if my own exposition had been strictly followed . . . this confusion would not have occurred. I have always fancied that you were a little harum-scarum & inaccurate now and then . . . I wish that you were as accurate, as much to be relied upon, as myself."

Shortly her letters began to make frequent mention of her deteriorating health. ("I can scarcely describe to you how very ill and harassed I felt yesterday.") They also seemed to be giving an early warning of impending psychotic tendencies, although Babbage himself exhibited no alarm at the odd turn of events. She wrote him (July, 1843), "This brain of mine is something more than merely mortal, as time will show if my breathing and some other et ceteras do not make too rapid a progress *towards,* instead of *from,* mortality. Before ten years are over, the Devil's in it if I haven't sucked some of the life blood from the mysteries of this universe in a way that no mortal lip or brain could do. No one knows what awful energy and power lie yet undeveloped in that wiry little frame of mine. (Signed) Yours, fairy forever, AAL." And two days later, "The more I study, the more irresistible do I feel my genius to be. I do not believe my father ever was (or ever could have been) such a poet as I shall be an Analyst."

Once the translation was published, in August, 1843, to the critical acclaim of the scientific community, Babbage's reputation was considerably enhanced. Ada sensed this and was encouraged to broach the subject of their future relationship again. In a lengthy letter she hinted at, but did not divulge, exactly what she had in mind—a project that seems to have been simmering on the back burners of her brain for some time. She demanded:

"Firstly: I want to know whether if I continue to work *on* or *about* your own great subject, you will undertake to abide wholly by the judgement of myself, or of any persons whom you may now please to name as referees, whenever we differ . . .

"Secondly: can you undertake to give your mind *wholly* and *undividedly*, as a primary object that no engagement is to interfere with, to the consideration of all these matters in which I shall at times require your intellectual assistance and supervision; and can you promise not to slur and hurry things over . . .

. . . should work together to develop and perfect a system for applying the Analytic Engine to the problem of beating the odds at the horse races.

"Thirdly: if I am able to lay before you in the course of a year or two, explicit and honorable propositions for *consulting your engine* . . . would there be any chance of your allowing myself to conduct the business for you, your own undivided energies being devoted to the execution of the work . . .

"I wonder," she concluded, "if you will choose to retain the lady fairy in your service or not . . .?"

Still, Babbage seems not to have become suspicious of the nature of her "explicit and honorable" propositions and, in a letter dated September 9, 1843, he agreed in effect to go along with whatever it was that she had in mind. She in turn observed, "You are a brave man to give yourself wholly up to fairy guidance."

It turned out that her proposal was that the two of them plus Lord Lovelace should work together to develop and perfect a system for applying the Analytic Engine to the problem of beating the odds at the horse races. Ever since the day in her early teens when her mother had taken her to the track at Doncaster for the purpose of displaying to her at first hand the evils of horseracing, Ada had felt the lure of gambling. Even so it is astonishing that she should have considered the racing gambler's problem to be well defined enough to yield to computer solution and incredible that Babbage was attracted to the idea. But by then he appears to have become completely incapable of saying no to her. Moreover, in his eyes the plot offered an incentive to complete the construction of the machine, an opportunity to exercize it on a real problem, and if successful a means of raising funds for further development.

An unbelievably lurid Victorian melodrama ensued, complete with encoded messages, blackmail, jewel pawning, unscrupulous bookmakers, and culminating in Ada's death. Many of the details are lost because Babbage who, at her insistence, became executor of her estate, seems to have destroyed all direct references to horse racing from both his and her collected papers, in order to protect the memory of his lady fairy. But cryptic passages such as the following are preserved (Ada to Charles): "I hope you got Lovelace's package and also a subsequent letter from the birds. The Life Preserver is safe here . . ." and "Particularly glad to see you and it was a particularly good thing as regards the book." ("The book" had become the code word for the system to beat the horses.)

Although the social whirl continued apace (a dinner party at the Charles Dickenses' was the subject of one exchange of letters), Ada's gambling proclivities now dominated their relationship. And the wrong steeds persisted in winning. Lord Lovelace contained his losses by withdrawing from the plot at an early date, and he was under the impression that his wife had done the same. However, she was thoroughly in the grip of the gambler's curse and continued surreptitiously her efforts to perfect "the book"; gambling debts piled up, and there is evidence that Babbage himself played the role of intermediary with the bookmakers. Though he may not have fully appreciated her growing desperation, it was not that she gave him no clues. "Some very thorough remedial measures must be pursued," she wrote him, "or all power of getting any livelihood whatsoever will be at an end." By 1850 she was apparently concealing even from him some of her gaming activities, for he wrote her saying that although he had understood that she was planning to spend the weekend at home, "I now find by the papers that you were at Doncaster on the triumph of Voltigeur."

To add to her growing list of woes, Ada's son Ralph now deserted from the Royal Navy and became a premature hippie, insisting on living out his life as a poor man among the poor of London. Furthermore, it developed that Ada had once been involved in some amorous adventures with a young Dutchman and compromising letters of hers had fallen into the hands of one John Crosse, who was attempting

blackmail on the impoverished and dying Ada. For now it became known that she was in the throes of terminal cancer. She confided to Babbage between bouts of illness that she had twice pawned the Lovelace family jewels and had twice prevailed upon her mother to redeem them. Lady Byron tried desperately to keep her daughter's secret and, when she learned of Lord Lovelace's early complicity in her downfall, she never spoke to him again. Somehow Babbage escaped her ire.

Ada died at age 36 in November, 1852. A year earlier she had heard a family acquaintance read some passages of poetry whose beauty enthralled her. She asked the author's name and her host shrugged in the direction of a portrait of her father. Overwhelmed, she then undertook for the first time a systematic reading of his works. This contributed to a growing alienation from her mother and a return to her father. In her will she asked to be buried beside him in the Byron vault in Hucknall Torkard Church in Nottingham.

Babbage, as executor of her estate, used the proceeds from her insurance to buy the incriminating letters from John Crosse. And in his own will he bequeathed a lifelong income to Mary Wilson, a servant girl at Ada's bedside during the last months who had been discharged by Lady Byron because she was learning too many of the family secrets.

In his autobiographical work *Passages from the Life of a Philosopher*, Babbage makes only fleeting mention of Countess Lovelace and then only as the translator of Menabrea's paper. But then, he made no mention whatsoever of his wife Georgianna who gave him eight children and died at age 35. □

Mr. Kean, author of a previous Datamation article on Charles Babbage (January, 1966), was a computer engineer for 20 years. Now, in addition to writing, he conducts wine/gourmet tours of the great vineyard regions of the world. For those interested, his organization is called Bacchants' Pilgrimages, Sunnyvale, Calif.

In the great majority of cases, maintenance changes can indeed wait until the scheduled month

Scheduled Maintenance of Applications Software

by W. Mike Lindhorst

Last year The Boatmen's National Bank embarked on several courses of action designed to directly or indirectly help control the rising costs of programming. Among the steps taken were the establishment of: a workable, meaningful project control system; a systems and programming control function to set and enforce systems and programming standards; and a scheduled maintenance policy.

It is this last concept, that of scheduled maintenance, that I would like to discuss in this article.

Scheduled maintenance is the policy whereby maintenance for each installed application, instead of being performed continually as each maintenance request is received, is deferred until a predetermined month or months when all maintenance changes for that application are performed. For example, our Demand Deposit Accounting (DDA) system is scheduled for maintenance in February and August.

All maintenance requests for DDA received from February through July, whether they be for a simple report heading change or for an entire new report, are held until July before being considered for implementation. In July a consolidated list of all requests received for the application is sent to the head of the user department responsible for the application. Additions, deletions, and/or changes to the list may be suggested at this time by the user department. The adjusted list is then reviewed jointly by the user department and the data processing department, and a final change request list is prepared.

A feasibility study is then performed for each item or group of items on the list to determine the cost of the changes. These feasibility studies are presented to the user department. If the user department agrees to pay for the changes, and the data processing department concurs in the advisability of the changes, they are implemented. The cycle then repeats for the next six-month period.

Benefits

The benefits of this scheduled maintenance policy are as follows:

1. *Consolidation of requests.* Under scheduled maintenance it is possible to consolidate requests for changes that pertain to a single program or a series of programs. Over a six-month period it is quite possible that more than one request for change to a particular program may be received. By consolidating changes, a source deck must be retrieved only once (rather than multiple times), the program can be tested only once, cataloging must take place only once, and documentation updated only once.

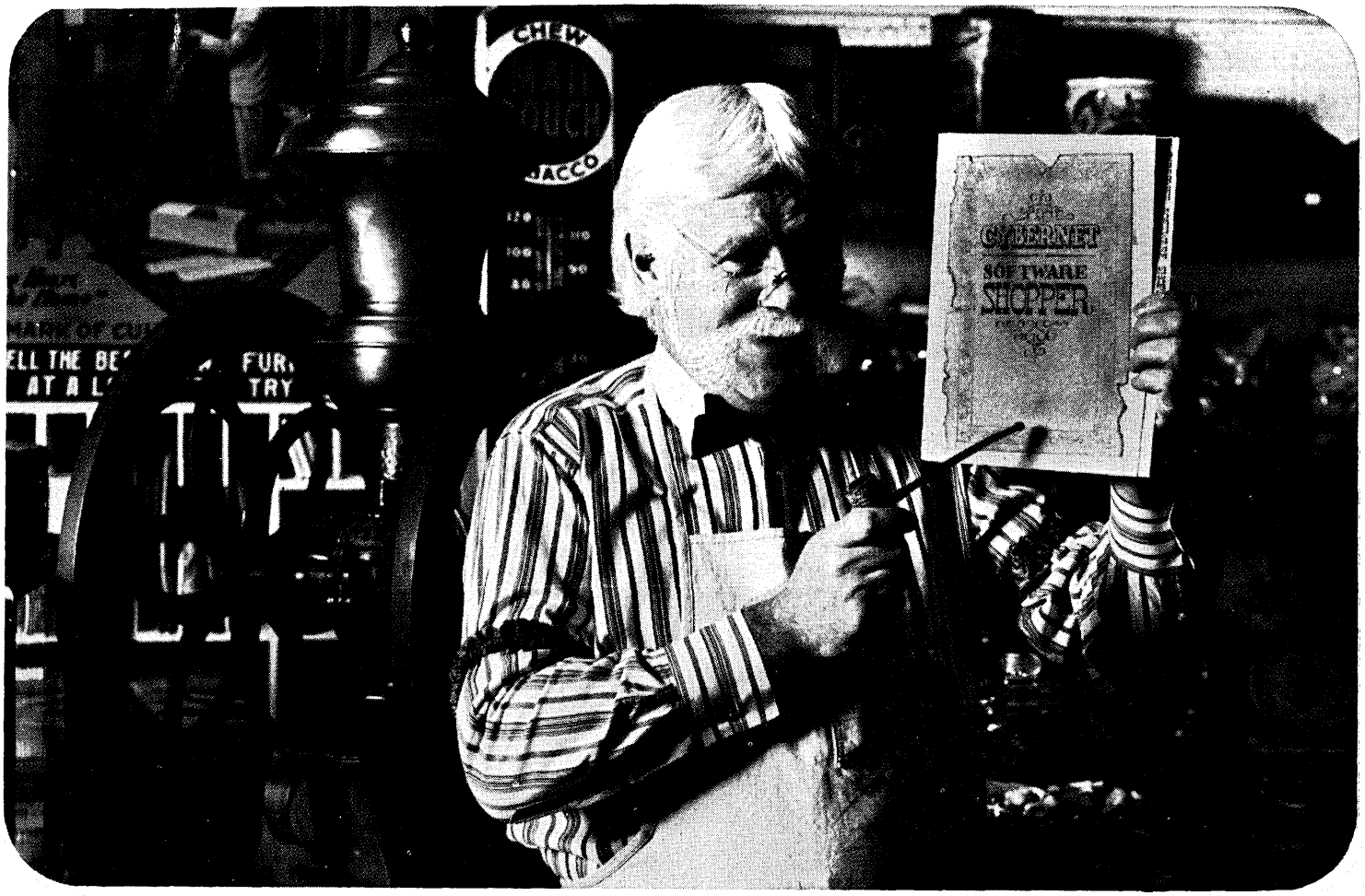
A basic efficiency results also because the cost of the general familiarization required of a maintenance programmer before he makes a change is spread over all the changes in a given batch. As a result of these consolidations, the cost per change goes down. This can enable justification of changes that, looked at individually, may not be justified. For instance, if you have to go into a program and add, say, a total figure, it takes little additional effort to interject a desired heading change.

2. *Programmer job enrichment.* A particular programmer will no longer need to be dedicated almost full time to a particular application. Since changes to any application occur at most once every six months, during an application's off months a programmer will become involved in other applications. This enriches the programmer's job and broadens his experience.

3. *Forces user department to think more about the changes they are requesting.* The individual who requested the change, when given a period of time to consider his request, may feel that it is not really as necessary as he first believed. This is especially true when he sees the cost of the change. Also, a change in circumstance in the user department may negate the need for what was a short time ago a legitimate request.

4. *Periodic application evaluation.* Under scheduled maintenance, the data processing department and the user department are forced to periodically step back and look at the maintenance cost of each application. These figures are helpful in determining where an application is in its life cycle and when a replacement system should be considered.

5. *Elimination of the "squeaky wheel syndrome."* Under scheduled maintenance, all applications are given the same degree of emphasis. For example, maintenance of the Certificate of Deposit system is not held up be-



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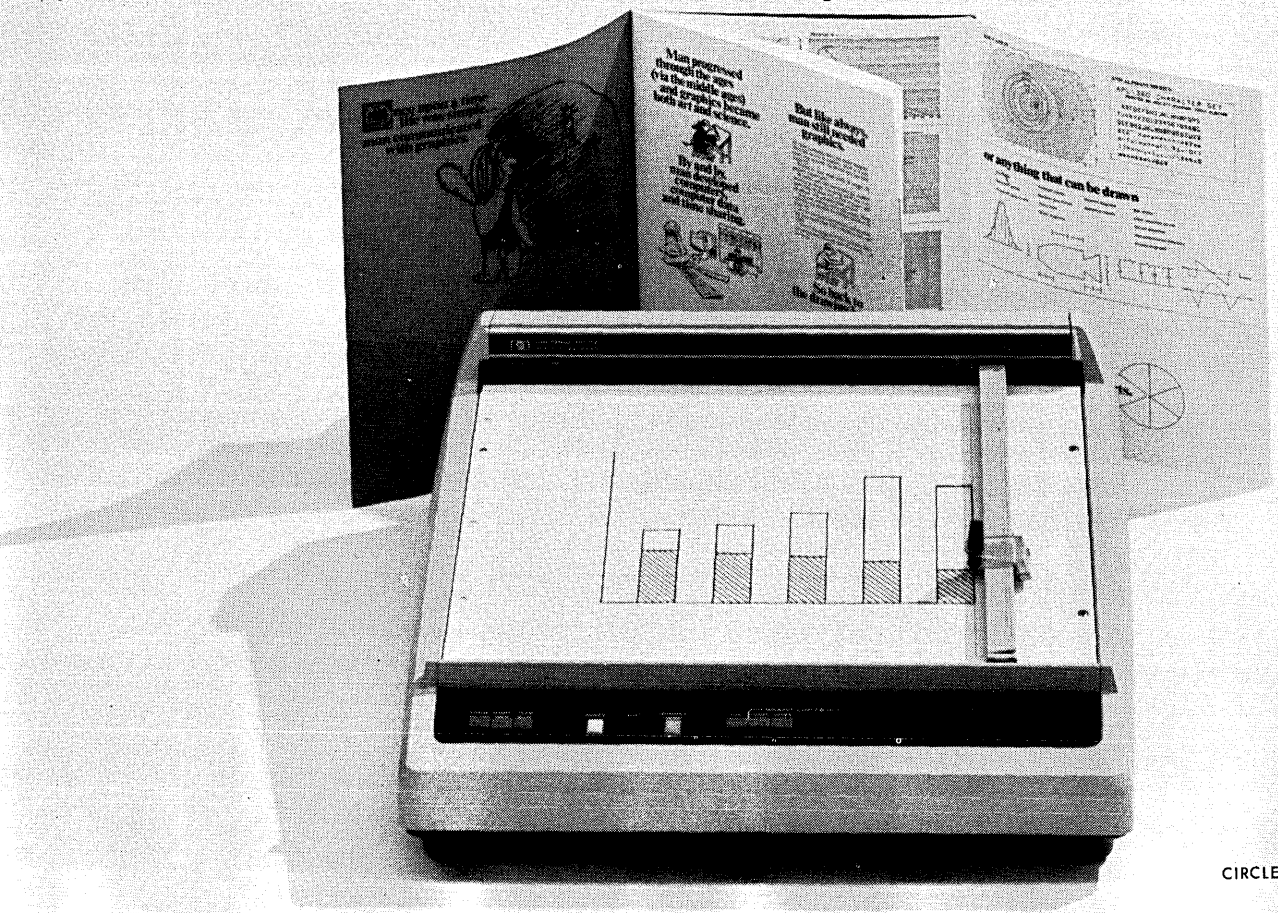

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cause someone feels DDA maintenance is more important. There are no "pet" applications within the department. All systems are handled in their preassigned months regardless of how much pressure is brought to bear by one user department.

6. *Programmer back-up.* With scheduled maintenance, in-house back-up programming knowledge will develop automatically for each application. It has been our experience that during an application's maintenance month the number of changes will often exceed the number that can be handled by a single programmer. Hence more than one programmer will become involved in each application.

7. *Better planning.* Scheduled maintenance allows data processing management to plan more effectively. We now know what applications will be maintained in which months and we can plan vacations, education, and other projects around this schedule. We hope, in the near future, to establish a "standard" maintenance manpower load by month. This will enable us to determine what staffing level would be needed to make available any given number of man-hours for new projects. Also, the planning burden on the data processing department is eased because it is no longer necessary to prioritize maintenance projects. They are automatically prioritized by the maintenance schedule.

8. *Data Processing change requests are regarded as being as important as user requests.* Data processing department requests pertaining to an application (such as adding date checking of files within an application, or reblocking application files for processing efficiency) are handled right along with the user requests during an application's maintenance month. They do not sit undone for an extended period of time because of the crush of user requests.

Another portion of the scheduled maintenance policy pertains to the installation of new applications. It states simply that new applications or newly developed subsystems of an existing application will not be modified until six months after installation. This forces the user department to work with a new system for a period of time rather than rush into an immediate flurry of change requests. It also prevents the acquisition of a package that only approximates what is really needed. The user department knows that if they buy a package, they will have to live with it as is for at least six months.

Exceptions and problems

We have identified the need for certain exceptions to our scheduled maintenance policy. Changes are made to an application out of its regularly scheduled maintenance months in the case of: problems which prohibit running the particular system; requests which are approved by the president and chief operating officer of the bank; requests which are required by regulatory authorities; requests from paying customers agreed upon by the senior vice president in charge of banking service and the head of the data processing department.

Scheduled maintenance is a concept that must first be sold to upper management, and then presented to the user departments by upper management. Without this involvement from above, the data processing department would be incapable of enforcing such a policy. In our case, the concept of scheduled maintenance, and the strict adherence to it that was expected, was presented by our bank president to the assembled heads of our user departments in April of 1972. We have been on scheduled maintenance ever since.

Our experience with scheduled maintenance has, overall, been very rewarding. We feel that we have achieved much along the lines of the eight benefits previously mentioned.

There were, however, several problems that we ran into in implementing the policy. We did not notice, for instance, that at the time the application schedule was prepared we had placed too many assembler language applications in certain months. Not all of our programmers know assembler language, and we found ourselves in a position of not being able to assign the necessary work because of the language requirement even though programmers were available. We remedied the problem with assembler language education for certain of our programmers.

We also had a problem initially in phasing into scheduled maintenance because of all the projects that were active in April that we could not simply abandon. The scheduled maintenance pattern became more and more apparent only after a month passed and the residue of pre-"scheduled maintenance" projects disappeared.

Another problem revolved around the non-application related data processing projects (for example, the running of certain benchmark tests). We were so intent on making scheduled maintenance work, and we put such an emphasis on it, that data processing projects not relating to a particular application were, for a time, overlooked. All of these problems have now been resolved.

We have found that in the great majority of cases maintenance changes *can indeed* wait until the scheduled month. Our biggest problem in this regard has been the payroll application. We perform payroll processing for numerous corporations and banks, and as a result necessary modification and/or addition of state tax routines has been rather frequent.

One of the questions we asked ourselves when we were beginning scheduled maintenance was: "Would the number of maintenance requests drop as we entered the second cycle of maintenance for each application?" Based on the first five applications that have entered their second cycle of maintenance, the total number of projects dropped from 45 requests (first cycle) to 21 requests (second cycle). In fairness it should be mentioned that we entered scheduled maintenance with a huge backlog of requests, so not all of this reduction can be attributed to scheduled maintenance.

In conclusion, I would recommend that you consider whether or not a scheduled maintenance policy would be applicable and beneficial to your organization. I sincerely believe that the potential benefits of consolidation of requests, programmer job enrichment, forcing the user department to think more about requested changes, periodic application evaluation, equal consideration to requests of all user departments, development of programmer back-up, better planning, and the assurance that data processing change requests will be handled at the same time as user requests warrant giving scheduled maintenance serious consideration. We at Boatmen's feel that it has been a significant step in our efforts to control the rising costs of programming. □

Mr. Lindhorst is a data processing officer in charge of computer operations, systems software, and hardware evaluation for The Boatmen's National Bank, St. Louis. He holds a BA in mathematics from Washington Univ. and an MA in mathematics from Missouri Univ. (Columbia). His background includes serving as programming manager for Boatmen's and holding systems engineering and sales positions with IBM.

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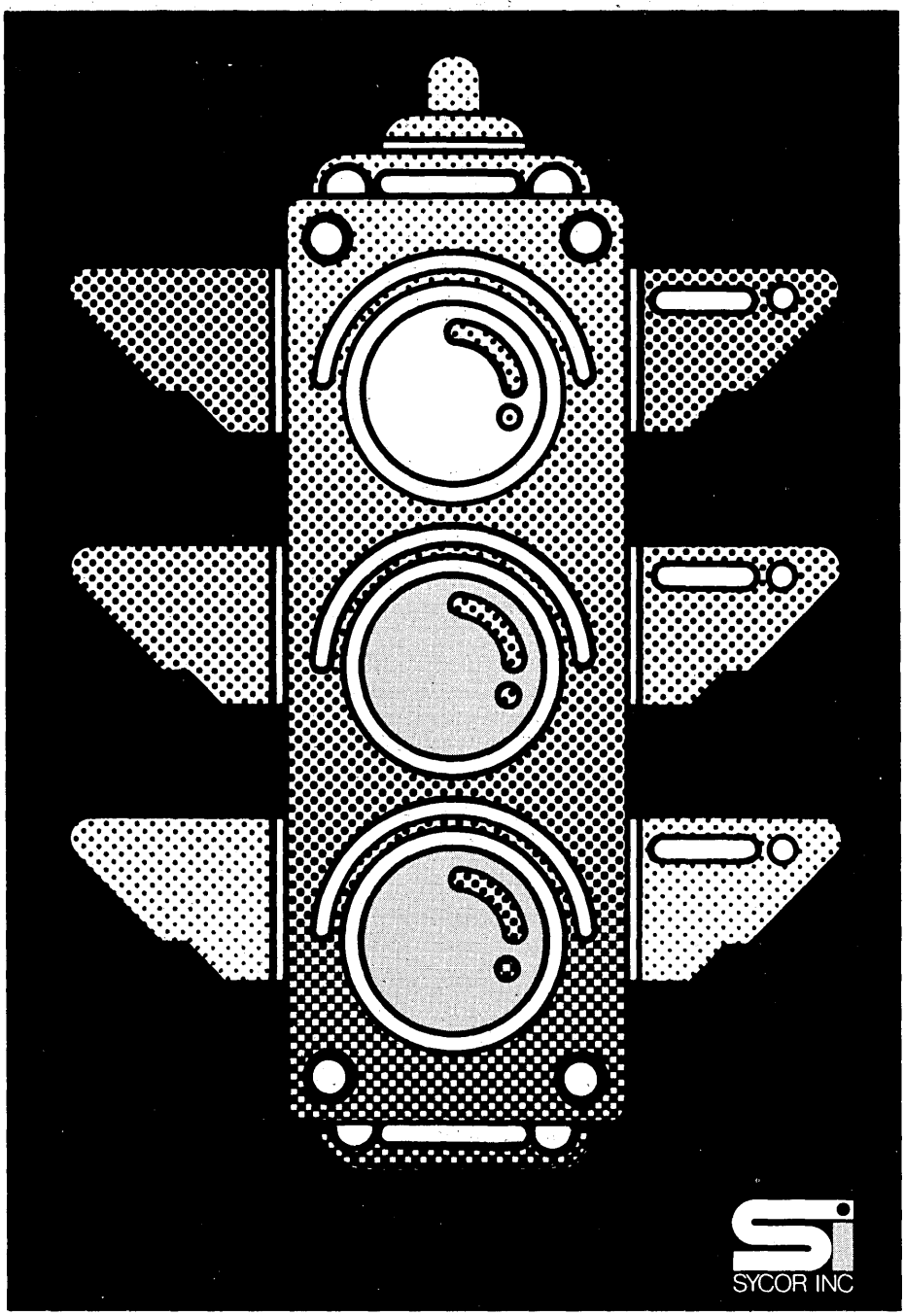

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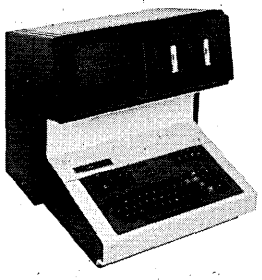

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This category of printers now includes several types, using different design principles and offering a wide selection of speed and cost

Nonimpact Printers

by Renn Zaphiropoulos

When the computer was developed, digital information was generated at rates much higher than ever before. The computer manufacturers were faced with a serious problem. What could they use to print on paper the information generated by their computers? Without that kind of output, the results of the computer could not be retrieved. The solution to this problem came in the electromechanization of the Remington typewriter principle. The added feature was writing speed. The fundamental difference between line printers and the Remington machine is that the speed has been increased so that the total output of a modern impact printer is much higher than a regular typewriter. The solution was in the form of placing the aux-relief characters on fast revolving devices, such as drums or chains, which serially presented every character past a hammer which then selectively hit and recorded the desired information.

The modern impact printer has been developed to very high standards. Long before xerography, carbon paper was used for making simultaneous copies of the written record. Initially, it was used as a means of duplicating signatures and handwritten letters. When the impact printers were being developed, the principle of carbon paper was employed and the font had to become larger so that the impact could be transmitted legibly through the sheets. For 132 columns, it was necessary to use paper which was approximately 15 inches wide. This is why everyone became accustomed to seeing the typical IBM printing, which is large and monotonous. Making simultaneous multiple copies is awkward because:

1. They require the use of large fonts, hence paper is over 15 inches wide and difficult to handle.
2. The last few copies are occasionally illegible.
3. The number of copies is determined by the multi-ply stock of paper available at the time. As different reports require a different number of copies, this problem is not easily solved by using multi-ply paper because of inventory problems, copies required in excess of 10, etc.
4. Multi-ply paper is expensive; typical cost of six-ply is $.005 per sheet.
5. After the output is recorded it cannot be used until it has been put through a burster.
6. Simultaneous copies require fan-fold paper, which is more expensive than roll paper.

Impact printers have other drawbacks. They contain a multitude of mechanical moving parts; thus their reliability is a function of their printing speed. Moving parts introduce the following characteristics:

1. Wear and tear, and therefore limited life.
2. High cost of manufacture and maintenance.
3. Low limit on printing speed.
4. High noise level.
5. Limited presentation (no graphics).

The need to eliminate the above drawbacks has emerged in the last five years. Hence the birth of the nonimpact printer—actually a whole family of different kinds of printers, employing different principles of operation, categorized under the general term nonimpact.

These are the objectives for the designer of a nonimpact printer. It should:

1. Use a minimum of moving parts.
2. Be mostly electrical.
3. Produce a high-quality permanent record at high speeds.
4. Be able to handle graphics and use easily changed fonts.
5. Produce multiple copies or a record which can be copied readily by modern methods.
6. Be quiet.
7. Be easily interfaced to most computers.
8. Use inexpensive materials for producing the record.
9. Be a low-cost device, compared to what is currently available.
10. Be capable of unattended operation.
11. Most of all, be extremely reliable.

Presently, there is no single technique which has accomplished all of the above. Some are closer than others, and some fit more appropriately the development trends of adjacent technologies. Let us examine some of the earlier units. The simplified sketches shown as figures illustrate the various design principles.

The radiation printer

Several years ago Radiation, Inc., developed a high-speed printer for the Lawrence Livermore Laboratory. The writing method consists of a stationary recording head with a linear array of protruding stylii that touch the paper (Fig. 1). The paper moves in one direction—outwards—and a high-voltage discharge burns selectively, under each stylus, the surface of the paper. The main feature of this printer is its extremely high speed. The paper moves at 77 inches per second and printing speed is 30,000 lines per minute, 60,000 characters per second. The width of the paper is 12 inches and it contains 120 columns of alphanumerics. In principle, the printer should be capable of graphics, although it has not been used for this purpose.

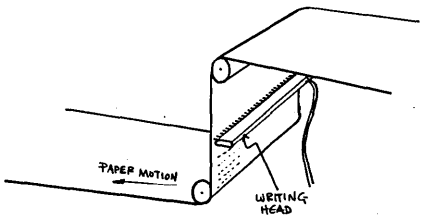

Fig. 1. The radiation printer.

When a printer is designed to operate at these speeds, the main problem is accurate positioning of the paper with respect to the signals coming in. High speed implies the presence of a large supply of paper which is difficult to set quickly in motion. For this reason, very sophisticated paper driving and dereeling mechanisms have to be used. In this particular printer, the paper starts in a roll form and is fan-folded after it has been printed. It is also perforated for binding.

The machine is large and costs between $300,000 and $500,000. One drawback could be the life of the writing head . . . the writing is a high current arc process and the stylii will

eventually erode. Another drawback is the low quality of record, since no high contrast is achieved by the use of teledeltos paper. Also, the price of the paper is high and begins to be prohibitive when large amounts of paper are consumed at these high speeds. The obvious advantages of the machine are the absence of moving parts and the very high speed.

Lateral scanning stylii

In this version, a similar method is employed for producing a trace (Fig. 2). A high-current discharge burns the surface of the paper, removes an opaque layer, and produces a dark trace. Several stylii, in a vertical configuration and positioned in a scanning recording head, move across the paper producing small dark dots. Motorola used this principle in designing a printer which had several of these heads mounted on one single band that is scanned laterally across. This was typically a synchronous operation; the presence of several moving heads increased the speed. The quality of the record was again poor and the paper was expensive: $.05 to $.08 per sheet. The speed in this case was relatively low—60 lines per minute—and the machine had moving parts in the writing process, usually the first thing that fails. The moving bands wear out and so do the stylii; both are difficult to repair and adjust.

An improved version of the Mötorola machine is the Repco printer which uses the same principle with seven stylii moving across the paper. There is only one recording head, mounted on a carriage. When it completes one line it

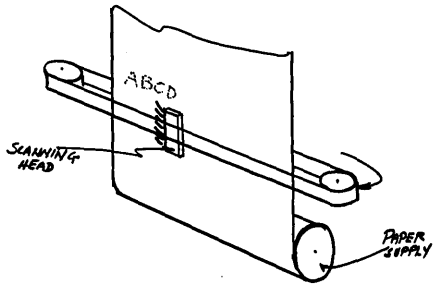

Fig. 2. The scanning stylii machine.

retraces back to the beginning and starts a new line. It is a spring-loaded return and the movement forward is done by a stepper motor. It can write one character at a time, that is, the stylus head can move one character width across the paper. In this case we have immediate visibility and quiet operation. Speed is fairly low at 60 lines per minute. Its original cost is also very low, in OEM quantities approximately $1,000. Most of the machines developed using this principle produce a line only 80 characters wide, the paper costs approximately $.03 to $.05 per sheet and the machine is not capable of high-quality graphics. The quality of the record is poor and during operation the discharge produces an unpleasant odor. The machine is about the size of a typewriter. It does not write on fanfold and uses paper which, in size, resembles Teletype paper.

Another version of the laterally scanning stylii principle is the Xerox mobile printer. The paper employed is electrostatically coated. It has a layer of dielectric on its active surface and can take 28 characters across. The writing process starts when a recording head containing seven stylii scans across the paper, charging its surface into small programmed dots and developing the image through a tray of cascading dry toner. The toner particles

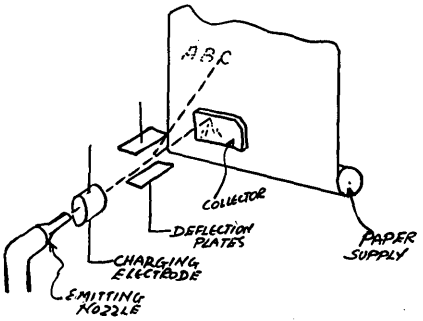

Fig. 3. The ink jet machine.

are attracted to the charged areas and the paper then goes through a post-fixing heated zone where the paraffin melts on the carbon particles of the toner and the image is permanently fixed. This machine is small, portable and quiet. It is used for recording simple messages in mobile units. Possible drawbacks of this machine could be maintenance, quality of record, and the handling of dry toners, which is a classically difficult problem. The design involves excellent engineering and very high production tooling.

The ultimate limitation of most scanning stylii printers is printing speed and reliability. The higher the speed the less reliability is the general rule.

Another clever application of the principle of scanning stylii is a new development by Data Interface Associates. In this case, the recording head, which has seven stylii in a vertical linear array, does not move, but a magnetic belt moves past the head. The stylii record individual dots on the scanning belt by producing local magnetic fields. As in electrostatic writing, the disturbance is not visible immediately; therefore, the belt goes through a toner applicator and the whole image is developed on the belt. At that point the belt stops, the dry toner is mechanically transferred onto the paper, the paper moves on to a post-fixing heat zone while the belt scans past the recording head again to record the next line.

Plain paper is used. A dry toner image is transferred mechanically onto the paper and the price should be as low as Teletype paper, which is the least expensive paper available today. Speed is approximately 180 lines per minute and cost is approximately $4,000. Additional features are that the instrument is compact, approximately the size of a typewriter, and is noiseless. It does not use fan-fold and does not provide graphics capability.

The ink jet machines

The ink jet machines (Fig. 3) are a further development of an earlier machine developed in Germany for oscillographic recordings. In this case droplets of ink play the same role as electrons in a cathode ray tube. The droplets are charged and, therefore, become sensitive to electric fields. They start from a capillary source in the same way that electrons start from an oxide coated cathode. They are accelerated by an appropriate change in potential and then are deflected in the X and Y direction as they travel towards the paper by electric fields which correspond to the incoming signal.

The process of replacing electrons with drops of ink adds complication. The elegance of electrons is the fact that, with the development of excellent cathode materials, there is virtually an unlimited supply of electrons to use. The $\frac{E}{M}$ ratio is constant, which makes their deflection predictable, and the beam can easily be gated to produce the required image. When one replaces electrons with relatively massive drops of ink, all of the features of an electron beam are not present. Unless the droplets are exactly the same, the $\frac{E}{M}$ ratio is not the same. Therefore, the resulting deflection varies.

The capillary source has to be mechanically connected to an ink supply and, because of the ever present impurities in liquids and in the air, it is not likely to function for a long period of time without failure. The liquid beam cannot start and stop quickly. In addition, the ink has to satisfy two contradictory conditions: it has to dry on the paper quickly, but it should not dry in the capillary.

Two different kinds of machines employing the ink jet have been designed and are being marketed by two large companies. One is the Inktronic developed by ITT; a stationary recording head containing 40 ink nozzles is employed as the source of the contrasting material. The droplets from each

nozzle can be deflected sideways to produce two adjacent characters on the sheet of paper. The total number of characters is 80 across the paper, hence the 40 nozzles.

The main features of this machine are that it is quiet, prints at 120 lines per minute, and uses plain paper. The Inktronic printer produces a poor quality image of alphanumerics, often using a violet ink on Teletype paper, which has a yellow tint. The reason for the low quality is that the characters are usually not very well formed and the image has low contrast. This method should produce graphics of reasonable resolution, but has not been used in many graphic applications.

A. B. Dick has used the same process, but instead of a stationary recording head including 40 nozzles it has only one head which moves laterally and has only one nozzle for emitting ink. The letters are written by scanning the head laterally and then deflecting the droplets vertically so that the characters can be formed. The scanning is from bottom to top and all the characters have a slanted shape because, as the nozzle scans vertically up toward the droplets, it also moves laterally mechanically and, for this reason, no vertical lines are written. The machine produces excellent contrast and very legible high quality record.

It uses plain paper and can print up to 132 characters across on 15½-inch-wide paper at a speed of 120 lines per minute. The cost is in the neighborhood of $6,000. Its major problem is reliability, since it contains moving parts in the writing process, and a monumental plumbing problem of supplying ink to the nozzle. Because of the slanted vertical lines, the machine produces poor graphics.

The xerographic machine

This is a technique that shows very clearly the tremendous difference between the problem of reproducing paged information and writing original information one character at a time (Fig. 4).

When a page of information is available in written form, the signal required for reproduction must involve light, because the information consists of the contrast between the writing and the blank page. When we talk about pages of written information on paper, the stored information can be retrieved visually and, with the exception of magnetic inks and braille, one needs light to be able to see the page. Therefore, the process of reproducing such an image must involve photons sooner or later.

In the case of silver photography, the original image is projected, as many times as desired, on light-sensitive film. In the case of xerography, the whole image is either scanned or projected as a whole on a selenium drum which contains a photoconductor on its surface. Photons come off the page, and they are the means by which both the selenium drum and an observer can eventually see the image. When the drum changes the photo image into an electrical image, by means of the photoconductor, the writing process has started and the perceiving process has stopped. Now we have an image on a selenium drum which has changed in character. It cannot be retrieved visually, but that image can write itself on a piece of paper in the following way:

Dry toner, which consists of very fine carbon particles coated with paraffin and electrostatically charged, is cascaded over the electrostatic image on the selenium drum. The black particles stick to the charged areas according to the electrostatic potential developed by the photoconductor. This toner image can now be retrieved visually because it is composed of light and dark areas on the selenium drum. But still, two main processes have to take place before one can take it home with him. The toner image is transferred onto a piece of paper electrostatically and is fused by a heating cycle during which the paraffin on the toner particles melts and the particles adhere to the paper permanently.

The process has many variables. Assuming that standard photoconductors are used, the intensity of the recording process depends on exposure time and

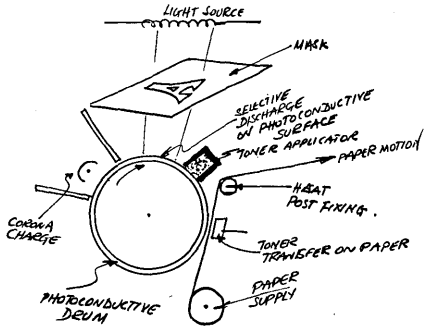

Fig. 4. The xerographic machine.

the brightness of the original image. The big advantage of this process is that it uses standard paper and can print a whole page at a time.

The process is elegant, fast, relatively inexpensive, and gives very high quality, high contrast images with a limited gray scale capability.

If one were to design a printer using the xerographic process, one would have to print one letter at a time or, if he could buffer the information in a luminous display, he could print one line at a time. This is where the problem lies. Several companies have tried to make such printers using luminous characters formed by turning on a light source behind a mask which contains one transparent character. This resembles, in a way, the means of bringing past the hammers of an impact printer many aux-relief characters one at a time. Because of this, it requires masked drums or masked tapes which revolve at high speed past individual light sources which turn on and off in the same way that the hammer solenoids are activated. The difficulty here again is mechanics. For different fonts, masks have to be changed. Masks themselves, because of their transparency, are fragile, as are blinking light sources. Speed is governed by the fact that it takes as long to write one character as it takes to write one page.

Other writing sources which have been used for this purpose are cathode ray tubes and photodiodes. They are both activated electronically and exhibit high reaction speeds.

The problem with cathode ray tubes is their bulk and fragility as well as the fact that the image is formed inside a piece of glass and is already diffused by the time it reaches the outside surface. This problem has been overcome by using expensive fiber optics face plates. The writing intensity is usually low compared to high-intensity lamps.

In summary, it is my belief that the xerography process would not make a good candidate for use where original information has to be written down a character or line at a time. It is an excellent means of reproducing images which already exist and can be retrieved visually a page at a time. But, since the original signals which come from a computer—a character at a time—do not exist in a form which can be retrieved visually, photons cannot be used as a means of supplying this original information.

The thermal machines

Most thermal machines resemble the scanning stylus machines where the top layer is burned off by high current. Thermal writing depends on a stylus which can fluctuate rapidly in temperature. This stylus then is in contact with a specially coated paper. When the stylus is heated it produces a contrasting dot on the paper. One would expect that there would be a lot of inertia involved with a system such as this and that the stylus could not heat and cool fast enough to do a reasonable job. But there are some machines today which work very well using this principle. Again, one can use one stylus or many stylii to scan across the page, or one recording head, where many stylii are activated to do the job. Texas Instruments and Anderson Jacobson are marketing machines which operate on this principle. In both cases a matrix of heated stylii moves across the page (Fig. 5). The main advantage of the machines is silent operation.

Two kinds of thermally sensitive papers are manufactured by NCR and 3M. The Anderson Jacobson machine uses the NCR paper, which costs approximately 1.5 cents per sheet, and the Texas Instruments machine uses the 3M paper, which costs approximately 3 cents per sheet.

The technology for manufacture of the recording head also varies. The Anderson Jacobson machines employ a head which is made by assembling mechanically many wafers and then attaching leads to them after they are dissected. The wafers are eventually formed into resistors which can place 35 dots of heated or nonheated stylii on the thermal paper, thus forming one character at a time. The Texas Instruments machine has a recording head using solid state technology by diffusing the resistive material on the

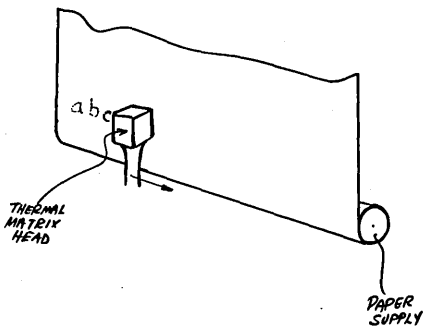

Fig. 5. The thermal machine.

substrate. This is reported to have a life of 200 hours. The machine, writing 132 columns, can write at 20 lines per minute, 30 characters per second. There are moving parts connected with the writing process, and that should have an effect on reliability. The machine is not capable of high quality graphics but, since solid state character generators are used, different fonts should be available. A drawback is that printers of this sort develop an unpleasant burning odor when they operate. The printers, in general, are inexpensive . . . from $2,000 to $4,100.

The electrostatic machines

Electrostatic refers to the fact that the writing is accomplished by some sort of transfer of electrostatic charges directly on the paper. In the ink jet machines and in the xerography approach, electrostatic charges also play an important role. But, in the case of the ink jet, the charges are used to deflect the ink droplets and in xerography the charges are used to develop the image on the selenium drum. In true electrostatic machines no intermediate step is necessary. The charge is placed directly on the paper. Since plain papers do not hold a permanent charge for any period of time, this technique employs a conductive paper substrate which is coated with an insulating layer. This insulating layer can vary in composition and thickness. Its whole purpose is to retain very small electrostatic charges which are placed on it by many stationary electrodes. The method of placing the charges on the paper can vary. In general, electrostatic writing consists of selectively placing electrostatic charges, in the form of small dots, on a dielectrically coated paper and developing the charge immediately by placing the paper in contact with a toner, liquid or dry. The original writing is invisible (charging the paper) and it is rendered visible by further development. This implies a delay between the time the original signal is placed on the paper and the information can be retrieved visually. This delay can vary, depending on the machine design, from fractions of a second to seconds.

The first machines developed and marketed employing this principle were from Varian Associates, and a machine of this sort was announced in August of 1967. It was an oscillographic type recorder. The following year Gould announced another version of this technique, and finally Versatec came onto the scene with the announcement of its first product in 1970, using the Matrix Electrostatic Writing Technique (MEWT).

The electrostatic technique offers certain advantages over the impact printer and it also exhibits some drawbacks. The drawbacks are:

1. There is a delay between writing and seeing the information. For this reason, electrostatic machines are not particularly suited to very slow operations or to operations where very short messages are written intermittently, that is, where there is an appreciable time lag between one message and another (minutes). Most impact line printers are not typically used in very slow or intermittent operation either.

2. The machines use coated paper, which at the present volume is approximately two to three times the price of so-called plain paper. When judging the potential of this technique, the coated paper disadvantage would disappear with more widespread use of these machines because the price of the paper will drop in volume production. Note that most impact printers used in industry today do not use coated paper for making multiple copies, but they use a complete sheet of carbon-coated paper in addition to the paper on which the information is written. The paper is oversized; therefore more of it is used and it requires additional design, such as accurate perforations and sprocket holes, for transporting the paper through the machine. With the electrostatic technique, the font is smaller and 132 columns can easily be accommodated on a 11 x 8½ inch sheet, which uses less paper and is easier to handle and file. No sprocket holes are necessary.

3. Electrostatic machines do not produce simultaneous multiple copies but the original copy can be reproduced by other means.

Before discussing the advantages of this technique we should examine how a typical machine works.

The paper is stored in the machine in either roll form or fan-fold. The usual quantities are 500 to 1000 feet. The electrostatic charge is applied to the paper by a writing head which contains a linear array of equally spaced nibs which digitally fluctuate in voltage with respect to each other, and a rear electrode which is located behind the paper. The information, therefore, is scanned across the stationary nibs which selectively charge the paper. Electrostatic machines are typically raster scan devices. The information for printing or plotting is scanned across the page. This paper, therefore, moves in only one direction and for this reason, to plot efficiently, special software has been developed to allow interfacing with many computers without requiring excessive core.

The machines can accept 8-bit code serially or in parallel and usually contain a one-line buffer for ASCII generated characters or a single-line buffer for plotting. By using appropriate logic, machines can either print or plot, or simultaneously print and plot by the use of a double buffer.

There are no moving parts in the actual writing process, only in connection with the paper emerging from the machine, the blower for drying it and the small pump for circulating the liquid toner. All of these items have proved to have an extremely long life and very rarely fail in the field. A stepper motor and a differential drive friction grip system are used to move the paper incrementally. In the case of Matrix units, the nib spacing is 72.5 and 100 per inch. The paper is moved in equal increments. New Matrix models offer nib spacing and corresponding paper movement increments up to 160 per inch.

The best features of this technique are:

1. It lends itself to rapid printing at low cost. Addressing the nibs is done with transistors, which are very reliable. Since the currents used are minute (a few micro-amps) there is no observed erosion in the writing head or process, no heating or arcing, and no fatigue points. The time required to write is extremely small (microseconds) and the present speeds available

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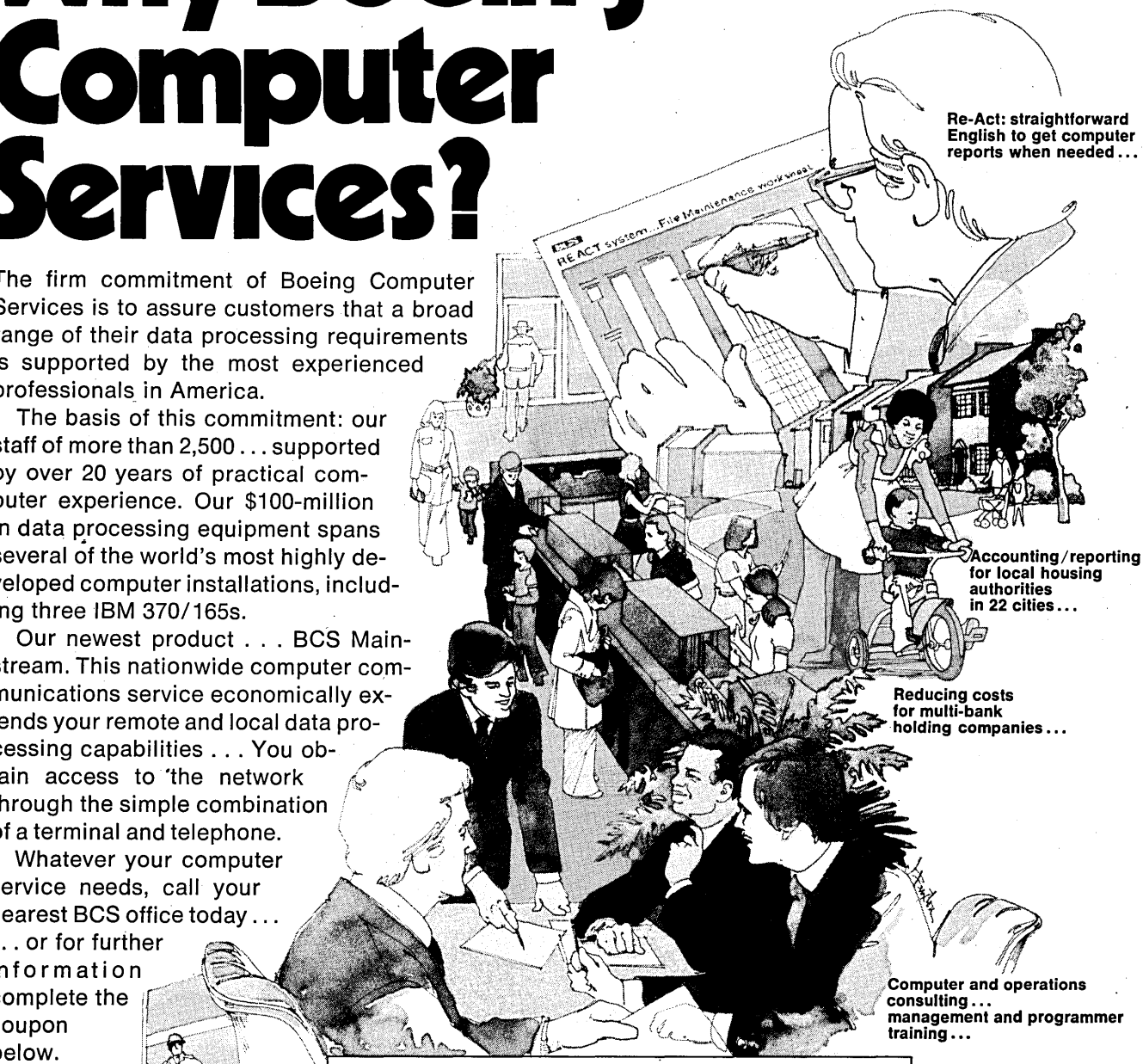

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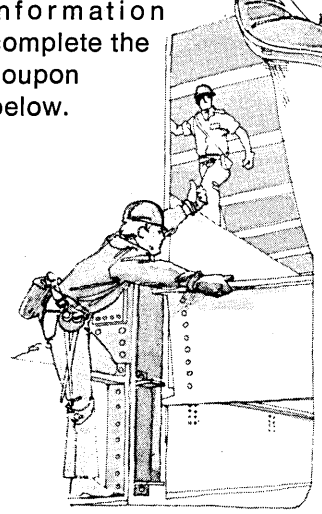

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(500 to 600 lines per minute) are only limited by design cost and marketing considerations since the process of moving the paper faster, starting and stopping, developing and drying becomes more complicated at higher speeds. At speeds between 500 and 1000 lines per minute, the machines perform virtually effortlessly. Other companies offer electrostatic devices in the 5000 to 6000 lines per minute range.

2. Since the recorded image is put down in dots which the eye integrates as it retrieves, it is possible to do graphics as well as alphanumerics.

There is nothing in the machine which has the physical shape of a letter or any symbol. Therefore, the user, by employing different ROM character generators, can develop different fonts. The same writing head and same machine can write, for example, different languages and this is being done in different parts of the world. This sectioning of the image is equivalent to reducing a complicated array to its smallest fundamental elements which

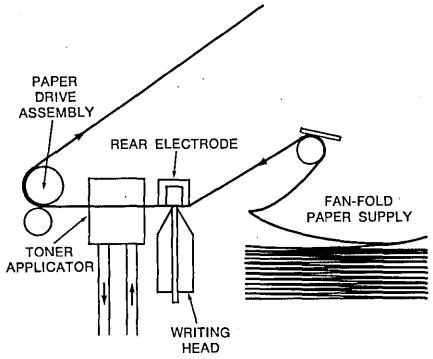

Fig. 6. Typical matrix configuration showing organization of major components.

are all the same. Graphics as well as alphanumerics, some gray scale using a halftone technique, different sets of patterns, and so on, can be displayed as easily as printing a letter.

Special software has been developed to make this presentation of graphics possible for minicomputers. Minicomputers typically contain limited memory, 8 or 16K words. Since electrostatic units are horizontal scanning devices, they cannot produce vectors which require the paper moving in both directions—forward and backward. For this reason, it is necessary to store part of the image and then scan it for display. To do this, one may require some 20 to 60K core, depending on the image and the points in it.

Software has reduced this problem to a manageable size. We have a software package called Versaplot which is effectively a method of banding the image, and the horizontal bands can be stored in a minicomputer. The information has been defined by its most elementary form; for example, a straight line vector instead of being defined as a series of coordinates of all the points is merely defined as a straight line running between two points. Thus the user can accomplish very complicated plots using a minimum amount of information and core.

In addition, certain patterns can be defined by the program. One can call for framing an image, placing the axes with graduated scales, rotating the whole plot by degrees, drawing heavy or dotted lines, introducing patterns and so on.

3. Since there is no impact, there is no noise. This makes it possible for electrostatic printers and plotters to be used in places where noise normally would be objectionable.

4. The major triumph of electrostatic printing is reliability. The Matrix MTBF is over 3,000 hours and the adjustments necessary for machines of this sort are minimal. If we examine the sectional drawing of the mechanical transport (Fig. 6), you can see that the reliability of the machine effectively resembles that of any solid state device. The mechanics of the machine are very simple and do not require frequent adjustment. The paper is stored in the machine in a simple way and travels through the different elements as seen in the image.

The only adjustment of any importance is the placement of the writing head, a rugged fiberglass structure connected to the system by standard PC card connectors. Head life is in excess of five years of normal operation.

5. Electrostatic printers show the best performance to price ratio of any printing device. Machines which print at 600 lines per minute are priced at approximately $4,000, machines with graphics capability between $6,000 and $8,000 in single unit quantities.

Marketing considerations

The market for nonimpact printers is undisciplined. As you can deduce from earlier statements, nonimpact printers perform with different enough characteristics that they attain prominence in different applications. The total printer market is very large and is now approaching $1 billion per year.

The impact printer market is disciplined and lies primarily in the multiple copy requirements of edp. These are usually large installations where expensive computers are used, and high priced peripherals are acceptable. This market is obviously dominated by IBM.

In the minicomputer market, price becomes a very significant factor and most of the minicomputers use impact teletypewriters and, of course, the familiar Teletype printer is prominently used.

There is an emerging need for more reliability, quiet operation and speed at low cost in hard copy printout. In many areas where the job is to develop programs and display intricate results with minicomputers, nonimpact printing is becoming predominant. It is my opinion that the winner in this case will be electrostatic printing and plotting. These machines are used in systems which have other input devices, such as a Teletype terminal or a keyboard with a cathode ray tube, and the output is switched typically to an electrostatic printer/plotter when a large volume of information has to be printed at high speeds and with increased versatility.

Looking ahead, we can see that the future reduction in the price of electrostatic printers, the absence of moving parts, and the natural reliability of a mostly electronic device will make it possible in coming years to develop and market high-speed printers and plotters which could sell at between $1,000 and $2,000. We are now seeing the development of electrostatically coated paper which costs less than one cent a sheet. This paper will continue to be reduced in price until it reaches an average of one-half cent per sheet.

With further software development, the computers of the future will produce considerable amounts of their data in graphic form. It is my belief that the reason this has not happened yet on a large scale is that the capability of the computer has been throttled by a correspondingly limited capability of display. Nonimpact printers will broaden the expression of the computer and make it possible to obtain routinely high speed and versatile hard copy at very low cost. □

Mr. Zaphiropoulos is president and chairman of the board of Versatec. He was previously with Varian Associates, the last three years as manager of the recorder division. He has an MS in physics from Lehigh Univ. and holds 34 patents, including four in the electrographics field.

COM...We solve the problem with no solutions.

That's right. No liquid or powder solutions needed for processing microfilm. The 3M Electron Beam Recorder COM System features 3M Dry-Silver microfilm, which is developed by heat, not messy chemicals or toners. And that solves the problem of having to purchase, pour or dump extra supply items into your COM system. What's more our Dry-Silver process cuts labor costs as much as 50%, compared with conventional processing.

But this is more than an efficient processing unit. It prints up to 20,000 lines per minute directly on microfilm, ready for instant viewing or copying (another benefit of Dry-Silver technology).

Overall, the 3M EBR can increase substantially the time your computer is available for computing. And decrease substantially your costs of original information production, records duplication and information storage.

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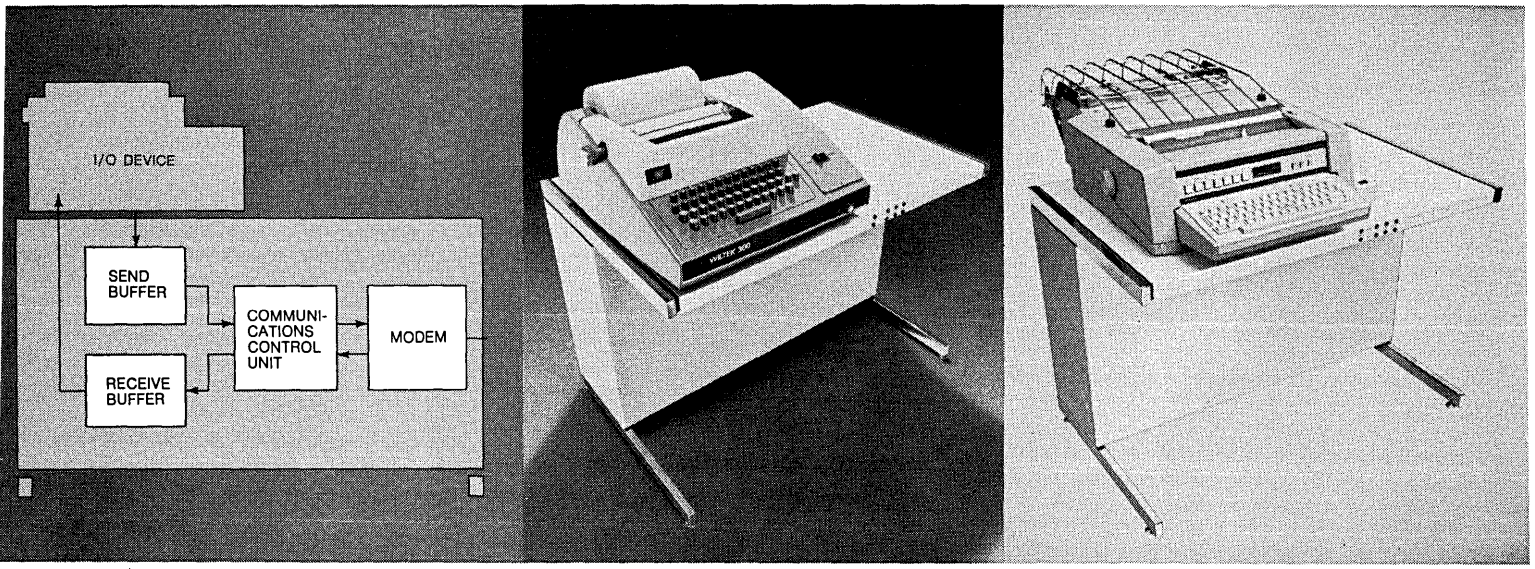
CIRCLE 53 ON READER CARD

Wiltek data commu can move all th of typewi a big corporat



The Wiltek difference. The Wiltek terminal combines high speed with the ability to batch data and transmit it *automatically* over standard dial-up facilities. Two unique 50,000 character storage buffers are built into the Wiltek terminal. One temporarily stores incoming data, the other outgoing data. The buffers enable the terminal to send and receive large amounts of data during a single call – *and with no interruption of data entry.* Data moves fast, phone calls are brief. Transmission costs go down more than 50%!

The Wiltek Model 300 is the most economical Wiltek keyboard entry terminal, suitable for low to medium volume locations. Like all Wiltek terminals, the Model 300 automatically makes error checks during transmission. At a large oil company which recently installed 300's in its regional field offices, terminal operators used to spend hours each day re-entering garbled messages. Automatic detection and re-transmission has resulted in more efficient operation and considerable cost savings.

The Wiltek Model 400, with its 30 cps KSR, is perfect for high volume locations. Several corporations use the Model 300 (left) at all remote locations and the Model 400 at corporate headquarters. A packaging company uses 400's at a central location to receive reports from offices around the country on the status of shipments in transit.

and save hundre of dollars in

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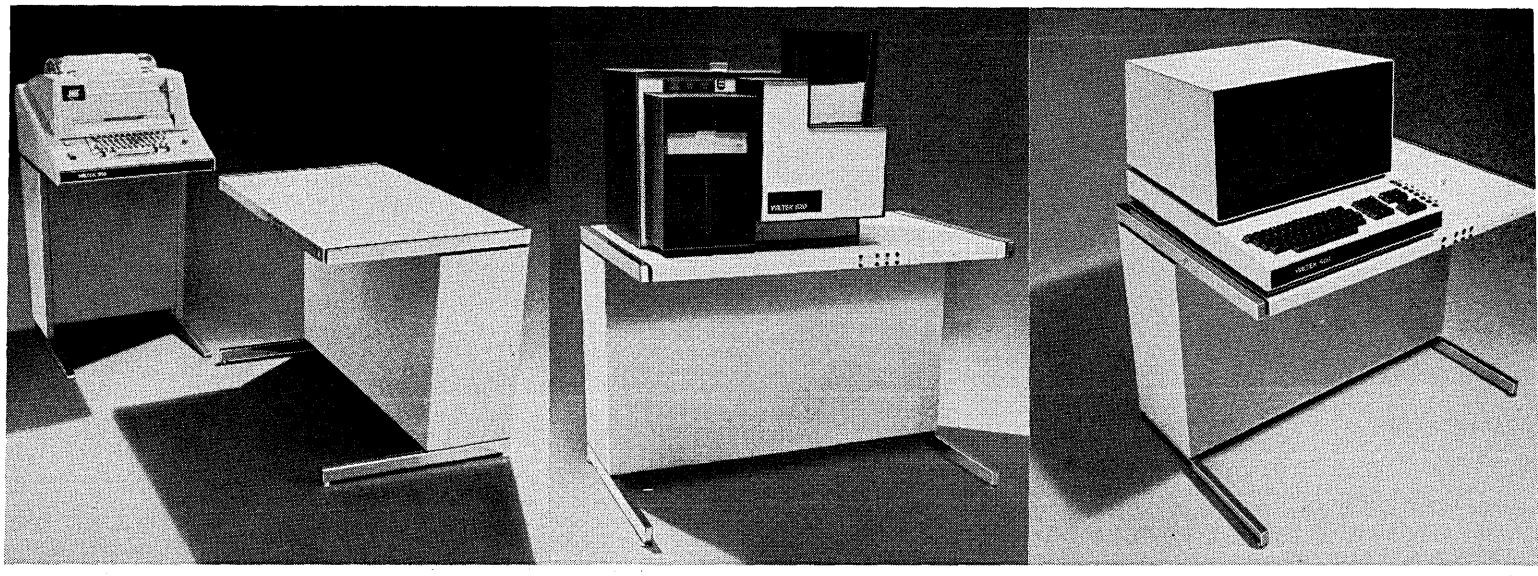

The Wiltek Model 350 is used where many copies are required or where almost continuous operation is expected. A chemical company uses 350's at its regional offices where sales orders are entered on four-part forms, and at its plants where the orders print out on eight-part forms.

The Wiltek Model 820 terminal transmits punched card data from remote locations. A major manufacturing corporation has installed Model 820's to transmit payroll data from forty plants to a single computer center for centralized processing. The same system also employs Model 400 terminals at all locations to handle administrative messages.

The Wiltek Model 500 terminal uses an advanced CRT with 2000-character display. The 500's editing features make entry of formatted data fast and easy. A nationwide delivery service using the Model 500 to enter package tracers increased operator output by 50% over the previously used teletypewriters.

Our new booklet shows how Wiltek's terminal concept can make corporate data communications more efficient and less costly. Write Robert Colella, Commercial Marketing Manager, Wiltek, Inc., Glover Avenue, Norwalk, CT 06852.

WILTEK

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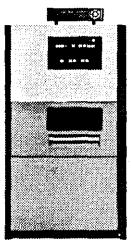
the process.

in one year it became the industry's matchmaker



the 844 universal controller*

AND PERIPHERAL SYSTEMS

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the programmable controller

A year ago PGI introduced the 844 Universal Controller and made it possible to mate different main frames and peripherals merely by changing circuit cards. Today that basic controller is part of disc and tape systems for the CPUs of three computer manufacturers. How about expanding the effectiveness of your CPU or peripherals? You may find we have all or most of the solution already on cards. These other people did.

PGI

360/370 users

The PGI 844 disc systems are 360/370 compatible and range from 29 Mbytes (entire system in one cabinet) to 466 Mbytes (9 drives and controller in 5 cabinets)—with advantages over the 2319 in space, capacity, speed, maintenance and price. They feature linear motor actuators and more comprehensive diagnostics. They employ 2316 type disc packs with 203 and 406 tracks. Average access time is 29 ms, and average latency is 12.5 ms.

PGI

Leasing Companies

The PGI 844-L universal controller provides a practical solution to one of the most perplexing problems facing leasing companies and computer brokers—what to do with the remaining drives after you have split a 2314 disc system. For a modest cost, the 844-L will allow a complete disc storage system to be made with the remaining drives that is compatible—both hardware and software—with 360 and 370 systems.

PGI

GE/Honeywell users

The PGI Model 844-1 directly replaces the Honeywell 160, 167 and 180 disc systems in the 400, 600 and 6000 computers. It features double spindle design; double density, 20 surface disc packs, and linear motor positioning.

This means 20% to 100% more storage; 25% to 50% less floor space; 15% to 100% faster access; greater reliability; simpler maintenance and $750 to $2,000 a month lower rental.

PGI

3803 tape users

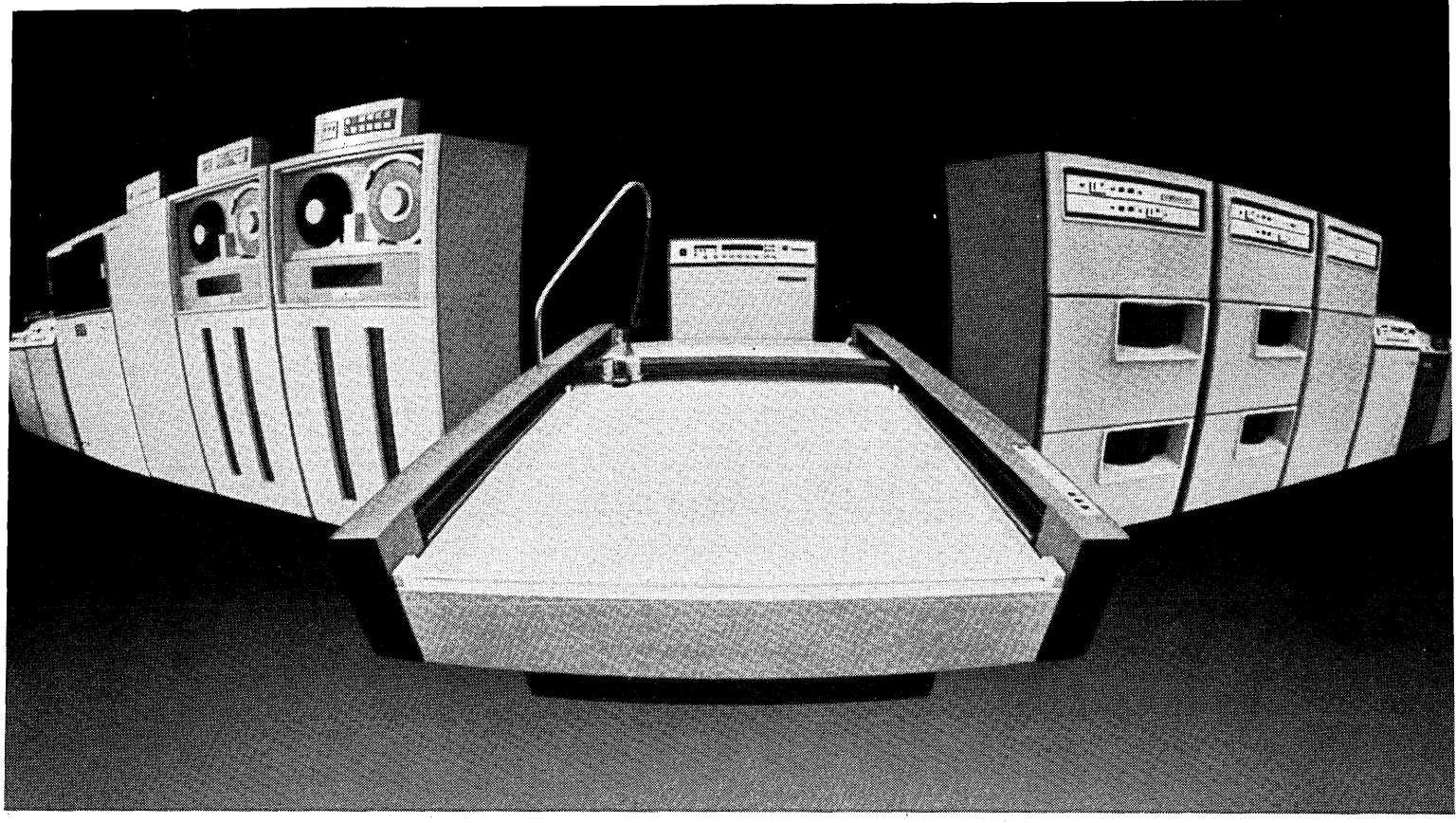
The PGI Model 844-T controller is a lower cost direct replacement for the IBM controller in the 3803 tape systems. The 844-T also makes the system plug-to-plug compatible with GE/Honeywell CPUs. This means that these computers now have a 7/9 track, all density, all speed, nine drive tape capability with automatic off-line features.

PGI

See it at the NCC— BOOTH #2032-2034

*Patent Pending

CHERRY HILL INDUSTRIAL PARK, CHERRY HILL, NEW JERSEY 08003 (609) 424-2008



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.

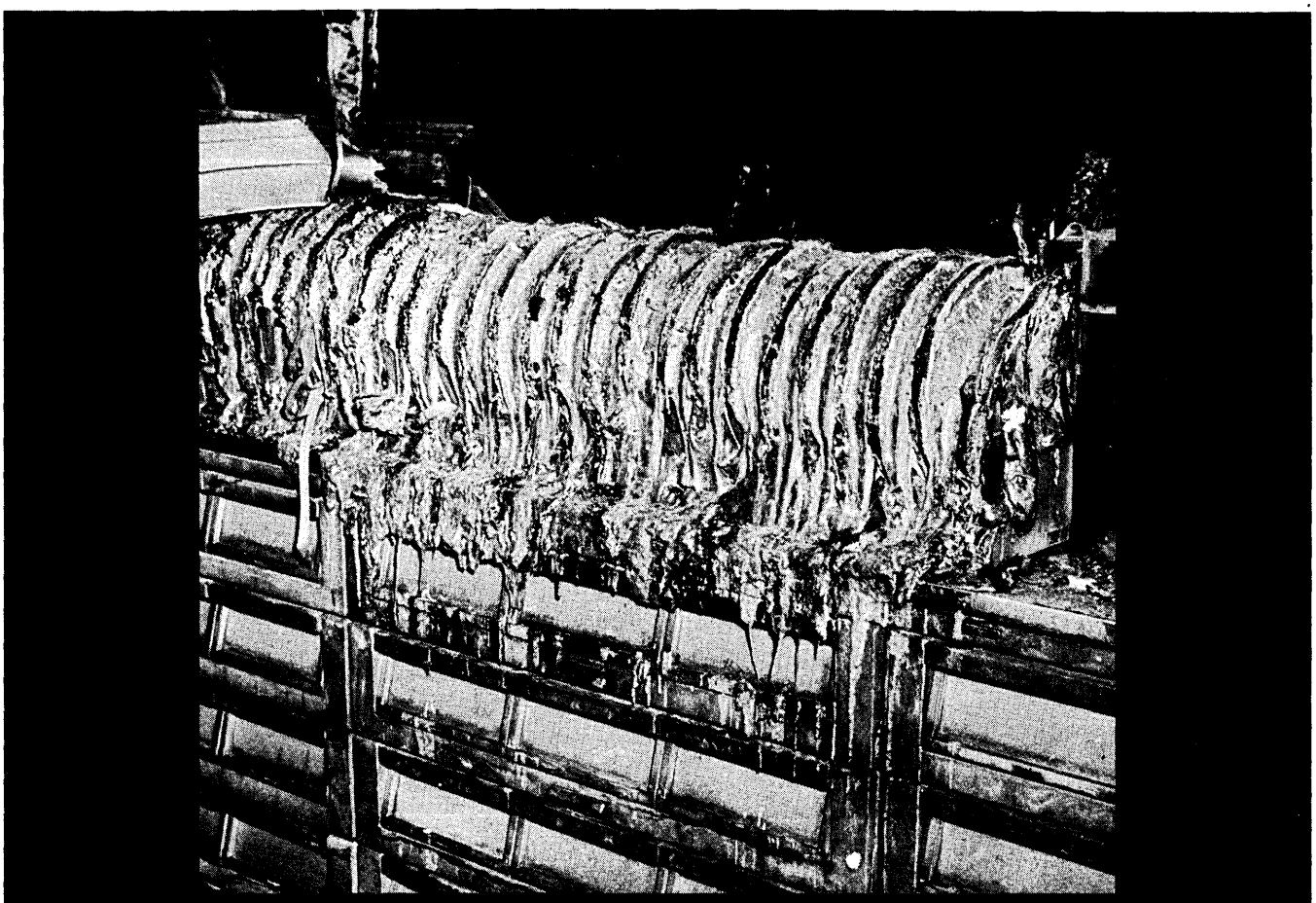
Disk memory equipment. This was our second area of concentration. In a remarkably short time, we have become the leading independent supplier.

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-M5-73, 2411 West La Palma Avenue, Anaheim, California 92801 (714) 821-2011

CALCOMP



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In this data storage fire, Fenwal would have done what water didn't.

Fenwal would have put out the fire *without* business interruption.

Fighting a fire with water isn't fast enough to prevent heat and smoke damage to your master tapes, discs and other records. You'd have heavy costs that start with downtime and catch-up overtime, and end with expensive replacement costs.

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You see, Fenwal is by far the most experienced in the field of fire and explosion suppression. And our experience has taught us that Halon 1301 is the fastest and most effective weapon against fire in high-value areas. That's why we specialize in Halon systems.

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FENWAL

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

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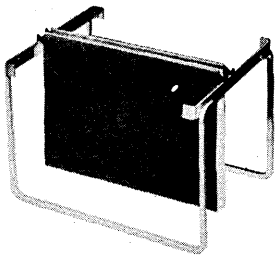

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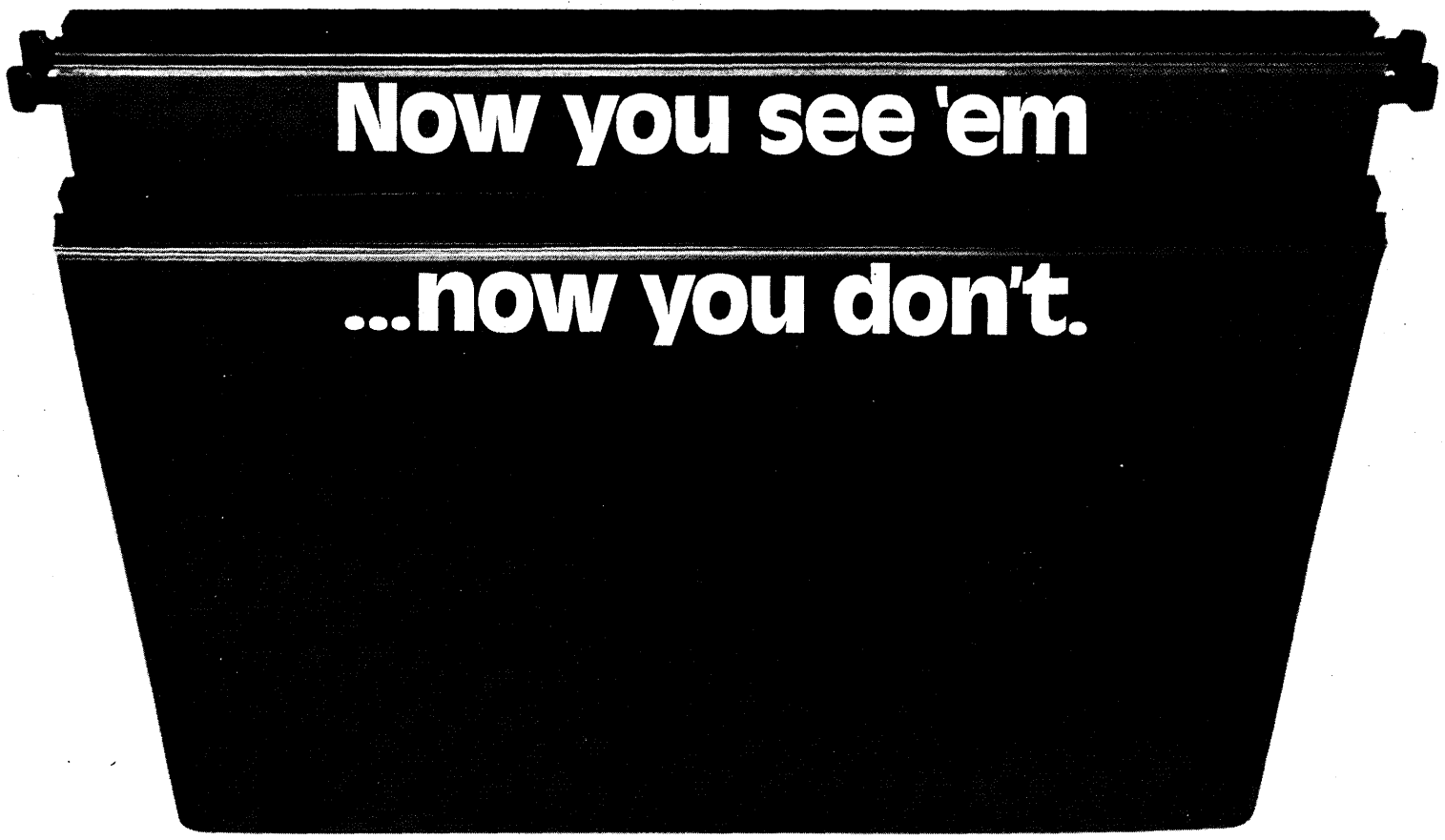
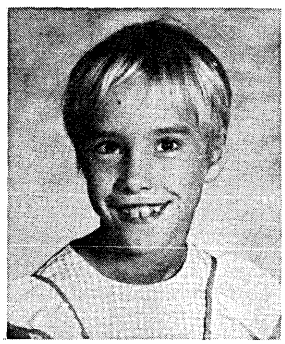


Daddy and his Computer

by Heather Lynne McWilliams

One sunday morning when eveybody except grandmother was dressed ready to go to church and jist then the phone rang daddy had to go to work. So mommy, Alex and I went to church. A few minutes later daddy was back home becuse he forgot his briefcase and daddy was back at work a few mintes later. Mommy, Alex and I came home early becuse Alex thew-up. And when we got back, daddy called he said, "I am comeing home." And when he came home there was a computer chasing his car, he stopcd the car and got out and went in the house and yelled lock the doors shut the window a run away computer he yelled over and over. The news speded fast and soon to the police, the policecaught the computer and smashed it with a hammer. And daddy quit his job and got another job. But I think that is another story. □



Heather Lynne McWilliams turned in an unusually complete resume after her story was accepted. She is eight years old, four feet tall, weighs 48 pounds, is in excellent health, and is single. She lives in Kailua, Hawaii. Experience: reading books and magazines, such as School Bulletin, Jack and Jill, National Geographic, and Weekly Reader; creative writing since first grade, plus many stories written at home, including "The Haunted House" and "The Singing Gun." Education: preschool at Carey's School; first through third grades at Kailua Elementary School. Outside interests: Swimming, climbing trees, learning to sew, member of church choir, playing the piano, hiking, camping, art, and dolls. Early background: born at Air Force Academy, Colorado Springs, Colo.; lived in Colorado Springs, Montgomery, Ala., and Washington, D.C. Father's job: director of technical services and internal controls for Computing Management Inc.

Bruning's new OP-40/80 microfiche duplicator

It produces cut-to-size and collated fiche in one operation. That's because our new OP-40/80 from Kleer-Vu is really an automated duplicating *system.*

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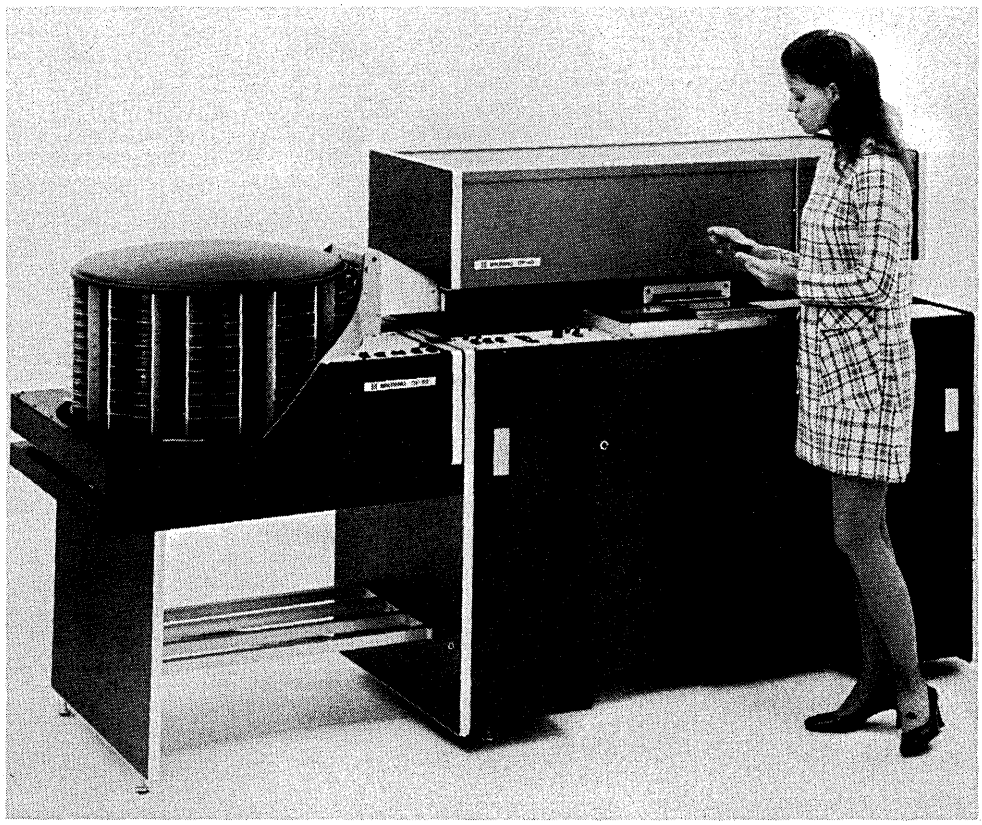

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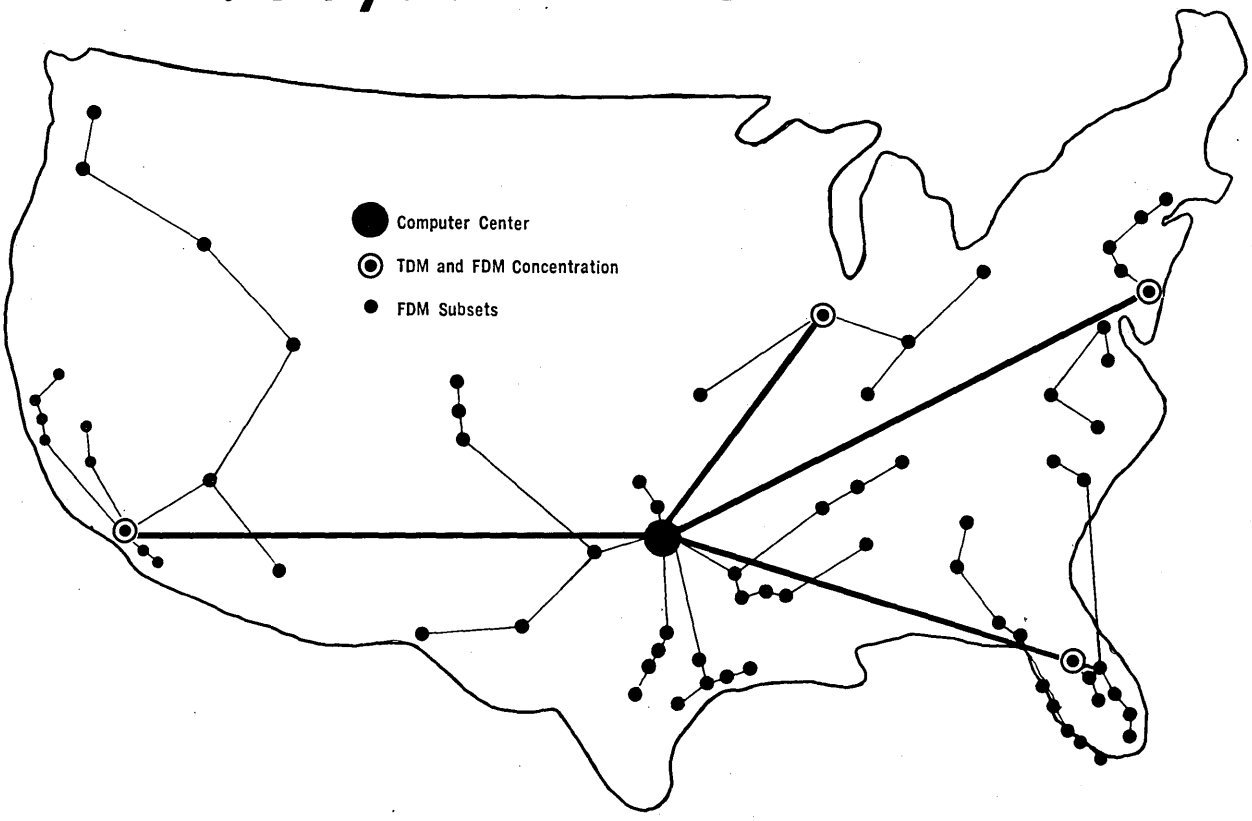

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When evaluating multiplex and modem equipment for your own system, look at both the cost and the remote loopback capability. How much diagnostic capability does the equipment offer you? When you are operating tandem links, TDM and FDM, how much maintenance and check capability, or how much fault isolation capability does the equipment offer?

If you are considering the cost of spares and the cost of loopback diagnostics, trade them off against the cost of down time. What does it cost your organization if one station, one circuit, one link is out for an hour or a day? You will find that the equation is balanced very highly in favor of reliability in communications and reliability in communications is what General DataComm is all about.

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CIRCLE 65 ON READER CARD

General Electric's answer
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The new TermiNet* 1200 Printer

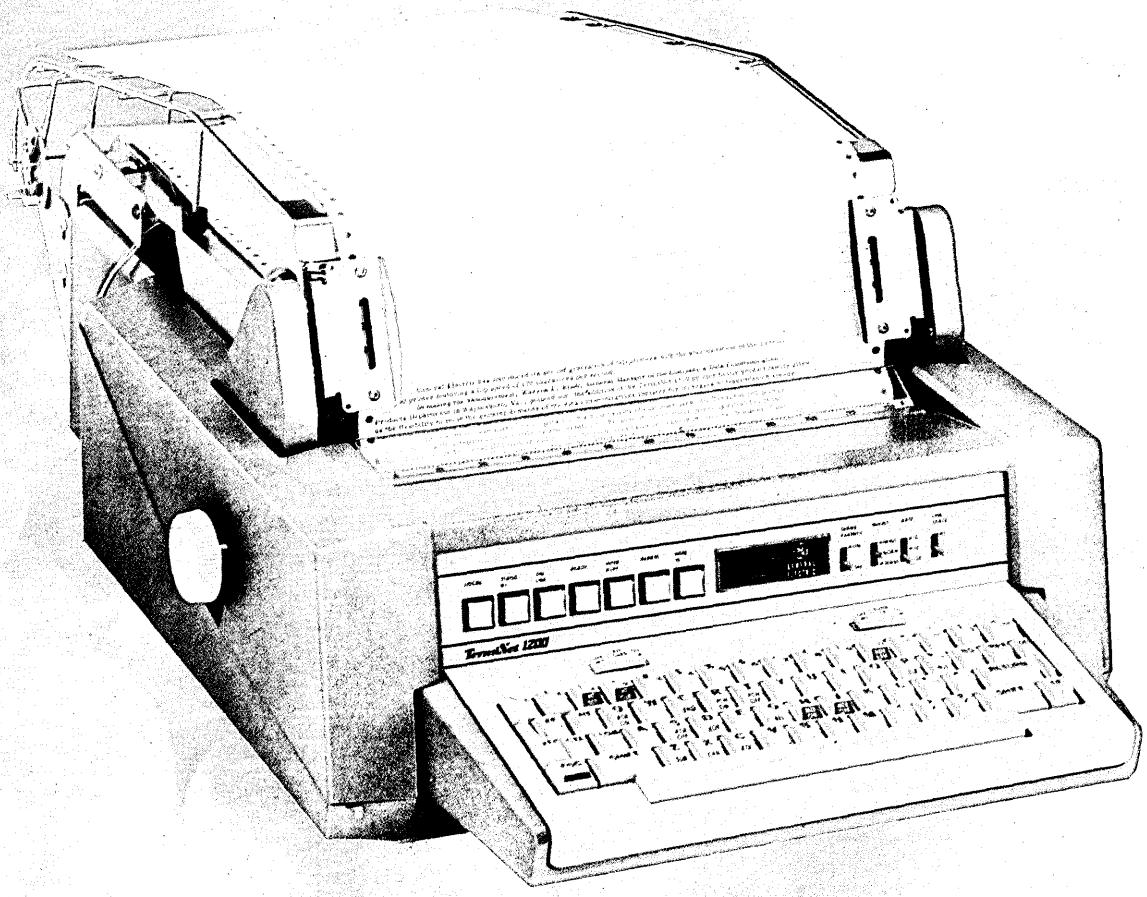
Moving high volumes of data in your communication system with conventional printers creates unnecessary costs. Equipment costs. Operator costs. Line costs.

General Electric's new TermiNet 1200 prints 120 characters per second and transmits 1200 baud rates. You reduce operator costs because you can handle the same data load as 12 conventional printers. You save on equipment costs. And, 1200 baud transmission optimizes the use of public and private lines. More efficient transmission means time and money saved.

The same engineering and manufacturing technology that made the TermniNet 300 printer (10, 20, 30 cps) so successful is built into the TermniNet 1200 printer, and at only a 30% increase in price. Most options are interchangeable and no extra operator training is required . . . and you get 6 hard copies.

Find out more about General Electric's answer to efficiently moving high volumes of data — the TermniNet 1200 printer. Write Data Communication Products Department, Section 794-05, P.O. Box 4197, Lynchburg, Virginia 24502.

120 characters per second
Replaces 12 conventional printers
Reduces operator costs
Reduces line costs



GENERAL ELECTRIC

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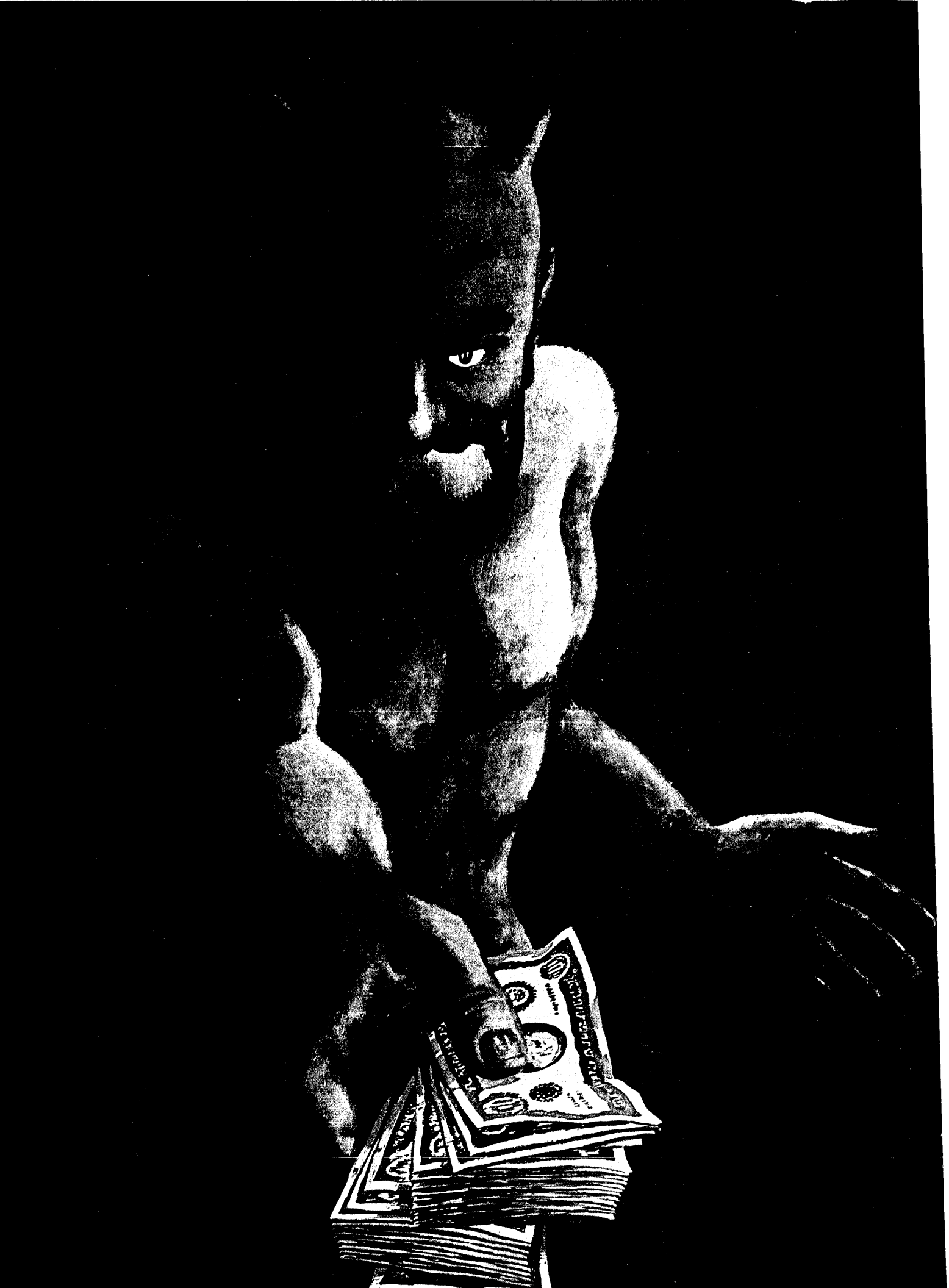
CIRCLE 36 ON READER CARD



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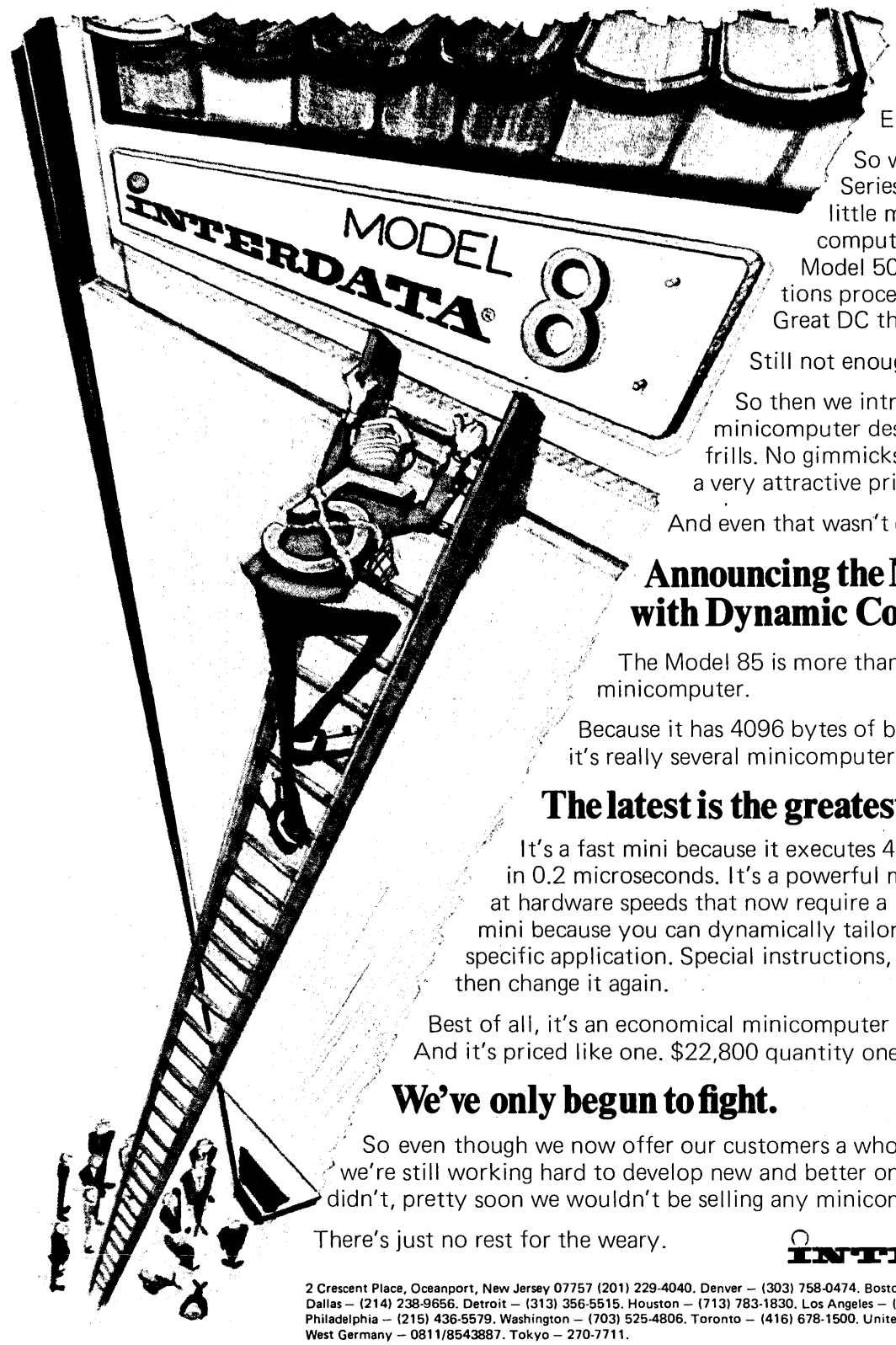
CIRCLE 10 ON READER CARD

Now that we make six different minicomputers, will we rest on the seventh?



Only a couple of years ago, we made two minicomputers.

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So we introduced the Interdata New Series. Model 70 and Model 80. Great little machines. With all the latest in computer technology. And then the Model 50 and Model 55 Data Communications processors. Special DC instructions. Great DC throughput. The works.

Still not enough.

So then we introduced the Model 74. A minicomputer designed especially for OEMs. No frills. No gimmicks. Just a fine little processor at a very attractive price.

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Announcing the Model 85 with Dynamic Control Store.

The Model 85 is more than just another Interdata minicomputer.

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Best of all, it's an economical minicomputer because it is a minicomputer. And it's priced like one. $22,800 quantity one list price.

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So even though we now offer our customers a whole family of minicomputers, we're still working hard to develop new and better ones. Because we know if we didn't, pretty soon we wouldn't be selling any minicomputers at all.

There's just no rest for the weary.

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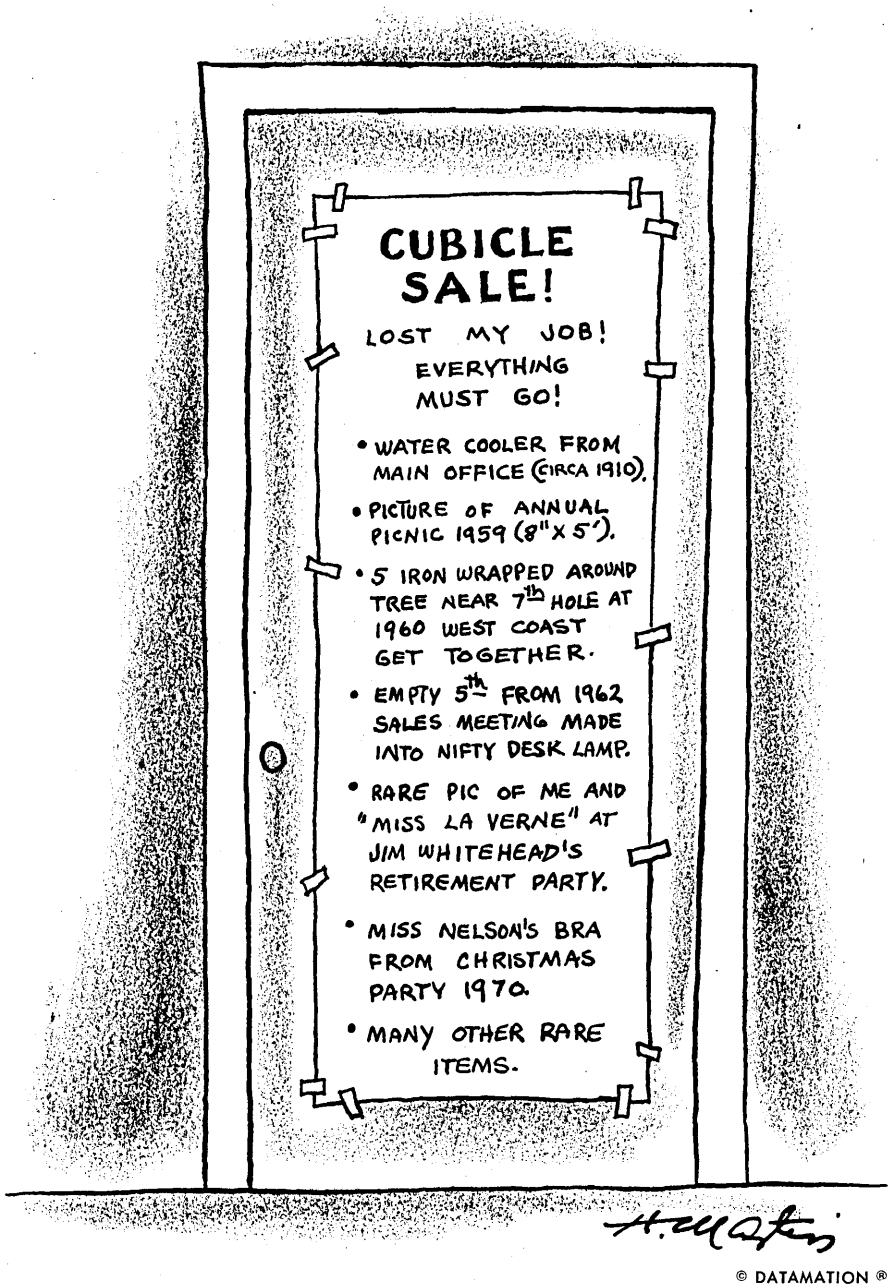
A useful interface for academic researchers and industry practitioners of computer performance evaluation

First Annual SIGME Symposium

A symposium is generally a bland affair arranged for the purpose of disseminating information. An exception to the norm was the First Annual SIGME Symposium on Measurement and Evaluation held in Palo Alto, Calif. Feb. 26-28, 1973. This ACM-sponsored meeting was a lively confrontation of computer performance evaluation researchers from academia and practitioners from industry. The Special Interest Group on Measurement and Evaluation was originally chartered by the ACM Council as a committee (SIGME) in November, 1971, and was converted to permanent group status in December, 1972.

At the opening session, symposium general chairman Don Madden of Compata, Inc., noted that attendance was in excess of 200 persons with 22 from six foreign countries. The attendees represented the spectrum of "evaluationdom," coming from industry, universities, software houses, government, performance measurement vendors and consulting firms. Keynote speakers were SIGME chairman professor Stephen R. Kimbleton of the Univ. of Michigan and Peter J. Denning of Purdue Univ. Noting that two-thirds of the symposium papers addressed job or system performance, Kimbleton indicated the need for research to relate the performance of a computer system or computer center to the data processing organization. Peter Denning concluded the opening session with a provocative commentary on "Why Our Approach to Performance Evaluation is SDRAWKCAB (backwards)."



Denning's thesis was that only after a system is designed do we ask how it should perform. According to Denning, the real problem is what is good design and his suggested approach is to: (1) define classes of jobs, (2) specify job class performance levels, (3) build virtual machines for each class and (4) design a real system to match the virtual system. Denning also called for modelers to describe a system in terms of its structure and expressed concern over the vogue technique of constructing empirical models through statistical analysis. Concluding, Denning suggested "let's stop doing performance evaluation backwards and think how much simpler it will be."

Viewing the keynote addresses as somewhat negative towards measurement and evaluation efforts to date, Ken Kolence, former president of Boole and Babbage, Inc., and software engineering consultant, interjected that just four years ago the first performance monitor became commercially available and "success has been achieved by persons working in the trenches." Kolence also noted that the "real world builds on success." Throughout the three-day meeting, spirited audience commentary illuminated the differences in orientation of industry and academia to computer performance evaluation, indicating that SIGME was at the interface.

About one-half of the conference papers were submitted by universities and the IBM T. J. Watson Research Center and dealt with the application of analytic modeling to performance evaluation. Ken Kolence's paper on "Experiments and Measurement in Computing" mirrored many audience concerns with performance modeling efforts in general. Kolence states "researchers in the field bear a basic responsibility to formulate their concepts in a way which is subject to empirical test, and a further responsibility to ac-

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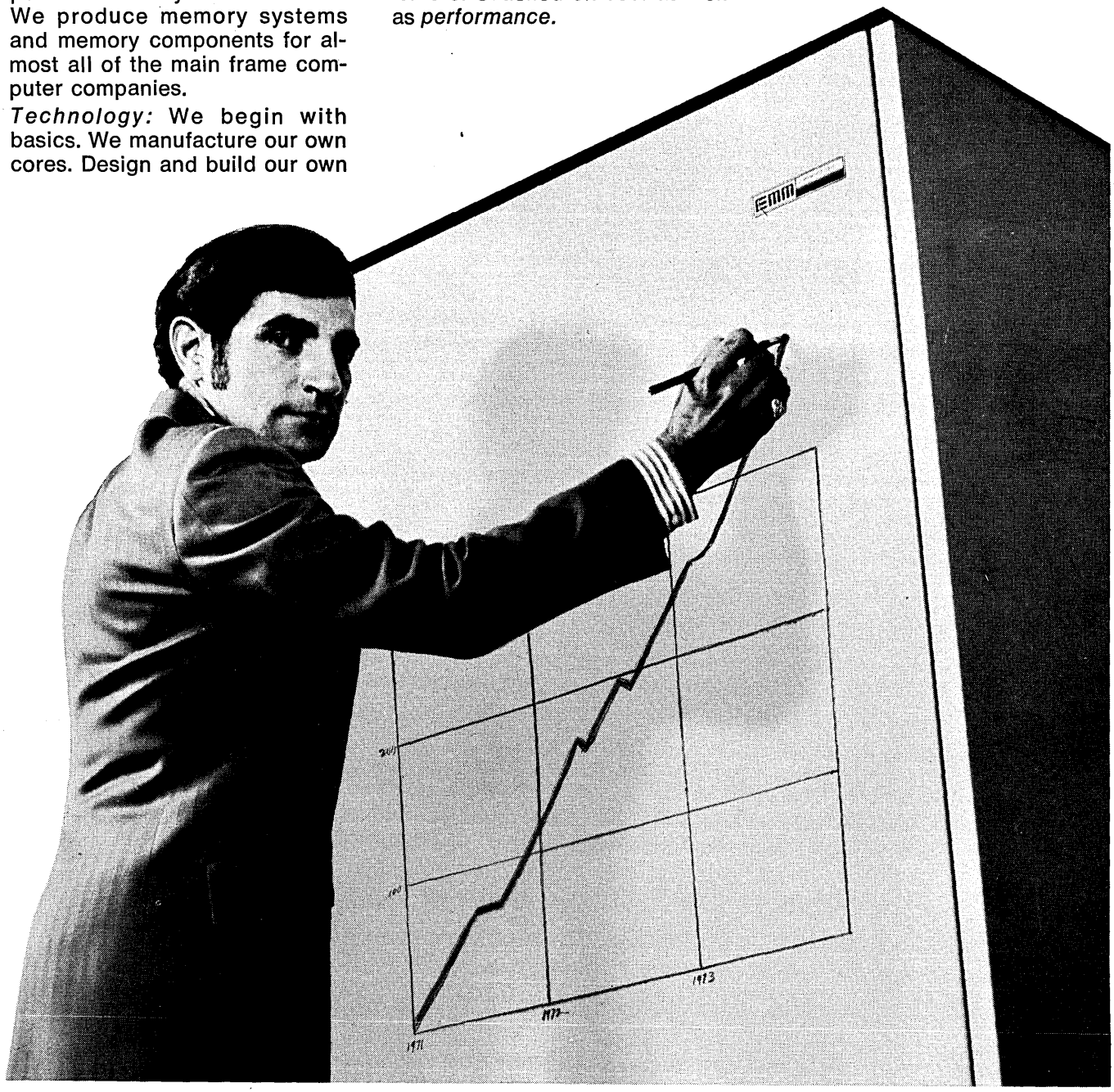

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CIRCLE 61 ON READER CARD

cept the verdict of measurement as final proof." Continuing, Kolence notes that "in the physical sciences a tradition exists of holding experiments and experimental data in high regard. That tradition does not exist in our field, and we must begin to build it."

On the industry-practitioner side, Joseph C. Sharp of General Electric reported on a policy-driven scheduler approach to the practical problem of providing several levels of service to competing real-time, time-sharing and batch programs within a computer system. A policy-driven scheduler characterizes a class of user by a policy function which specifies the elapsed time each member should wait for a given amount of service. In this approach, service was normalized to cost of resource usage. Conceptually the "trajectory" of a job in a service received vs. elapsed time "plane" is tracked, and service is provided or withheld to bring the job "trajectory" into agreement with a standard policy "trajectory." Sharp experimented with both static and parametrically adaptive policy functions. Experimental results under a peak load condition on a GE 600 system indicated response time for interactive jobs requiring 200 msec to 1 second of resource service was 30 seconds under round-robin, 6 seconds with a static policy scheduler and 2 seconds with an adaptive policy scheduler. Cpu overhead required to alter policy curves every 5 seconds was noted to be 10 msec.

J. A. Campbell of Price Waterhouse & Co. presented a performance evaluation methodology for a user to select, among competing computer centers, the best center to run his set of jobs. The methodology included the creation of a synthetic benchmark based on the computing and I/O *services* (e.g., arithmetic and logical operations, procedure calls, array indexing, calls to run-time routines, input/output) profile of the actual workload. Costs to run the synthetic benchmark at four computer centers were substantially different, indicating a free-choice user may be able to save money by selecting a computer center "tuned" to his workload.

A symposium highlight was the luncheon address on "Measuring Our Way to Success" by Dr. Ruth M. Davis, director of the Institute of Computer Sciences and Technology at the National Bureau of Standards (NBS). Although the NBS is aiming to establish "measurement procedures, guidelines and standards . . . that will protect the buyers, sellers and customers of computer systems and networks," Dr. Davis noted that neither in industry nor academia has any body of expertise developed from which NBS can cull the necessary technology. However, Dr. Davis said that "one of the most harmful actions to industry or a technology can be the setting of standards or measurement procedures too soon in the product or technology development process." Tracing the complexity of the computing process, she observed that measurement and evaluation of the performance of this process represents "a scientific feat never before attempted and as yet never accomplished."

Commenting on the appropriateness of the symposium location—both commercial hardware and software monitors were developed nearby—Dr. Davis said that "in four short years the field has measured its way to success." Reasons for success were cited as: (1) the computer measurement field "has supplied a methodology for increasing our computing productivity" and (2) "because products have been commercially available, a base of professionals in the field has been trained and developed."

Acknowledging that success to date has been in the area of performance tuning, Dr. Davis indicated outstanding practical problems involve "our needs to *predict* and *control* the performance and capacity of our software and computing systems." Identification of "the basic variables that govern the performance of a given workload on a given configuration and their relationships will form the basis for a theory of performance, which is . . . fundamental to our practical success in the future."

Dr. Davis concluded with "we won't have sensible procurement procedures until we can predict performance" and that "computer measurement will really only deserve to be called a measurement science when . . . we are well along the road towards developing computer systems architecture that has, integral to it, its own measurement system."

Appropriately, the final symposium paper presented by E. L. Burke of the Mitre Corp. addressed the design considerations for implementing a monitor which uses microprogramming to provide a flexible and efficient interface between the monitor and the system.

Being at an interface is seldom comfortable, but whatever SIGME may have lost in harmony between researchers and practitioners it gained in increased understanding of the other's orientation and needs. SIGME has identified itself as a unique vehicle for communications between the two performance evaluation camps and this legacy may be its challenge.

—David Schumacher

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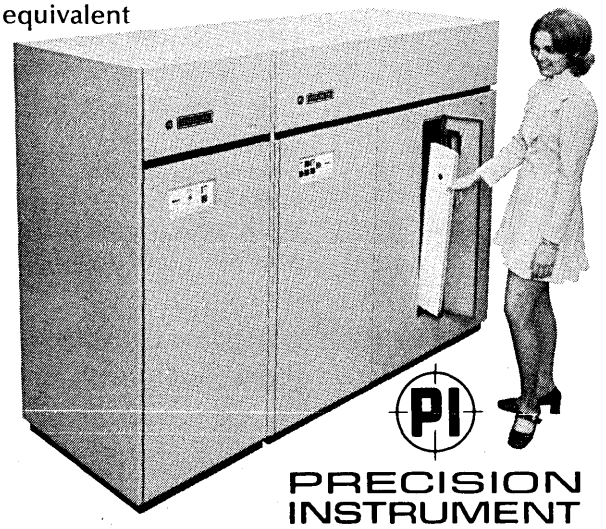

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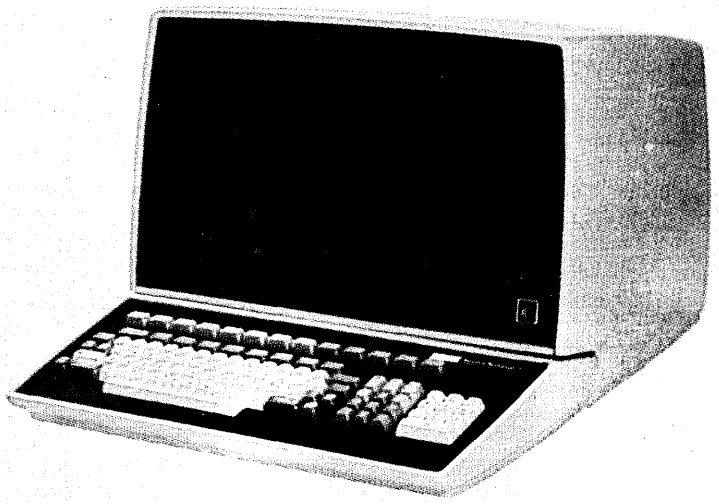

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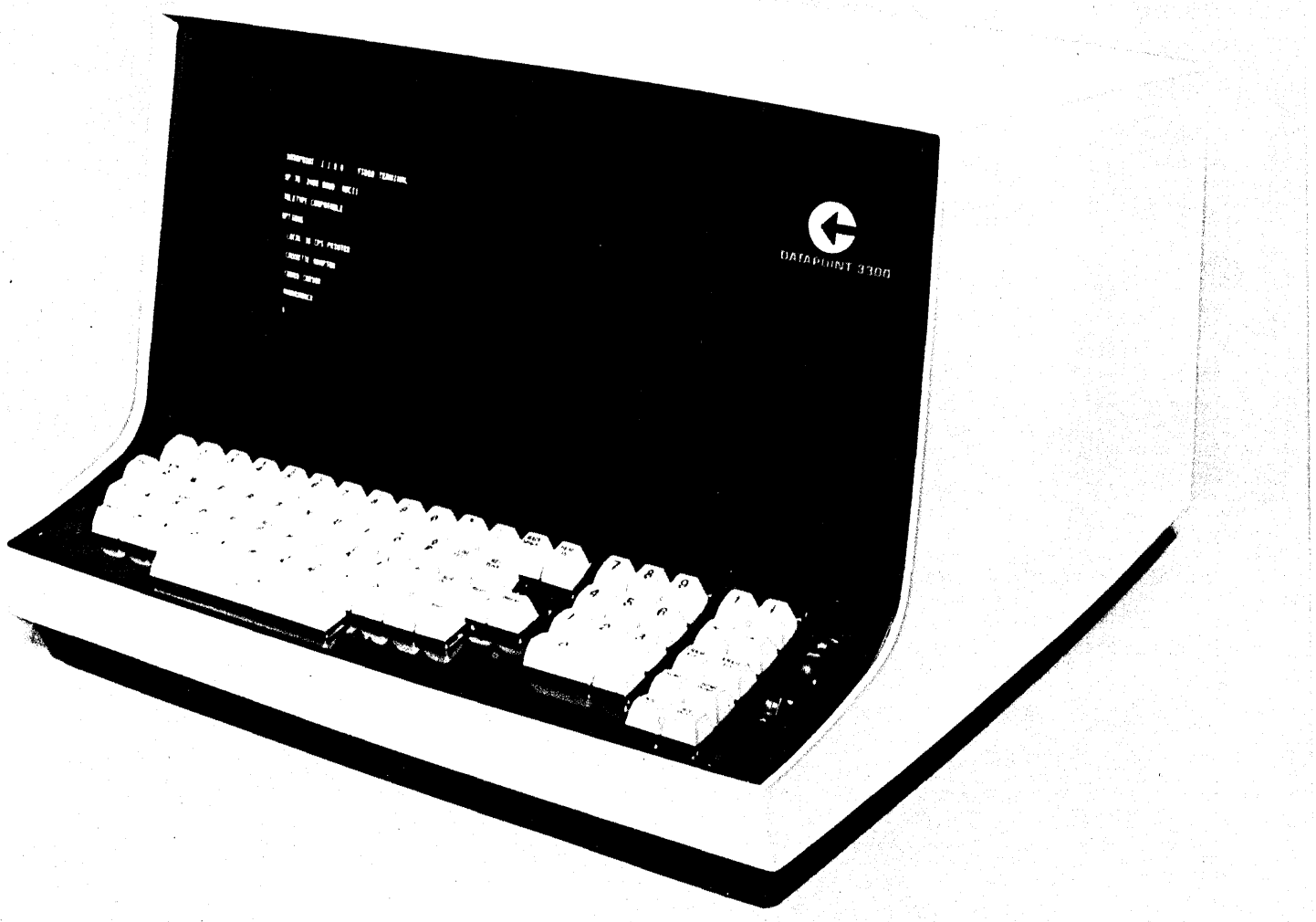

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CIRCLE 16 ON READER CARD

Only about 30 on-line systems now—but count again next year

Material Handling Institute Conference

by Edward K. Yasaki, San Francisco Bureau Manager

Computers are beginning to achieve a certain prominence in the world of manufacturing, specifically in the material handling function, directing not only the movement and storage/retrieval of raw materials, work in process, and finished goods, but also performing inventory control. "Anyone planning a new warehouse or production facility without serious consideration to this (the real-time computer control) concept is probably missing the boat," says James K. Allred, senior vp of Kenway Engineering, Inc.

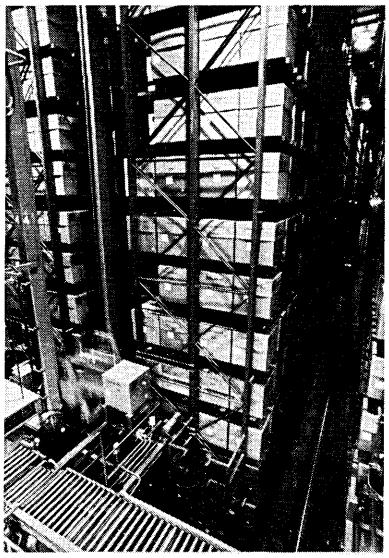
According to Allred, there are less than 30 such on-line systems currently running in the U.S. However, to indicate a sharp rise expected in the growth curve, he adds that about a dozen of them have been installed by his company and says that figure will have risen to 20 by the end of this year.

Interviewed early last month at the Material Handling Institute show in San Francisco, Allred presented one of two papers on computer-controlled storage and retrieval of goods. He said there are only a few knowledgeable consulting firms in this field, people having a good background in both computers and material handling. He said he wished there were more, explaining that his company, based near Salt Lake City, is in the hardware and systems business and cannot afford to divert its personnel to a consulting effort. Even his company, he added, has difficulty finding people knowledgeable in both disciplines.

He also indicated that Kenway would not care to undertake the automation of a warehouse for a company whose data processing department did not also participate. The dp personnel tend to be oriented toward commercial applications, he acknowledged, and may know little about the warehousing activity. Nonetheless, he actively seeks to get a systems analyst from the client firm involved in the planning, specification, and even coding of the software. "This is not an over-the-shoulders involvement," he explained. "We bring them to Salt Lake City and have them working alongside our programmers."

The automotive industry is tops among the users of computerized material handling, followed by the appliances business, according to Lawrence A. Feit, manager of automatic storage systems, Storage Products Div., Interlake, Inc., in Chicago. For almost all industries, Feit says, you can draw up a comparison between the construction

In a conventional warehouse, using forklift trucks, the average time required to find and load an order onto a truck is four hours. A computer-controlled system can do it in as little as 15 minutes. "Without the automated system, we simply would be swamped with the volume of orders we process," says plant manager Gene LeGrand of Fiber Industries' polyester facility in Shelby, N.C.



Says Fiber Industries' Gene LeGrand: "If you can imagine a giant vending machine five stories high and roughly the size of a football field, dispensing 200- to 300-pound cartons of polyester filament, you have some idea of our automated warehouse in operation."

The firm recently placed into operation a system controlled by an IBM 1800. "Besides the obvious benefit of speed in filling large customer orders," LeGrand adds, "it enables us to turn over our inventory more rapidly and in a more orderly fashion, with a significant increase in order accuracy." Computer control, he continues, also means major savings in repacking costs. Under a manual system, cartons might be handled several times by forklift operators, resulting in package damage. But with their new system, cartons are handled by forklift operators only when they are finally loaded onto the truck.

Taking automation a step further is Libbey-Owens-Ford Co., which reportedly is developing a manufacturing plant that bypasses warehousing. A new process control system under development on a float glass line at LOF's Ohio facility is aimed toward direct product shipment from the production lines. It is to be implemented this year at their 850,000-square-foot plant in Laurinburg, N.C., accepting new orders from offices throughout the U.S. and formulating back-to-back production and shipping schedules. "It will enable us to discontinue making glass products largely on the basis of anticipated customer needs," says LOF Glass president Richard Warren. The system will use an IBM System/7 and an 1800. □

and operating costs of a conventional warehouse and one that's computer controlled. And if there's a return on investment favorable to the automated system within three years, it pays to go computerized. The exception to this is in the drug industry, which places an especially high premium on physical security. With an automated system, pilferage is cut to a negligible level, as is damage to goods, and this can more than compensate for any higher initial costs incurred in installing the more sophisticated, automated warehousing system, he says.

The extent of savings effected is cited by Allred, who said the newer stacker cranes can lift and retrieve heavy loads at heights unachievable with lift trucks. This, in turn, brings into use the so-called high-rise storage racks, taller warehousing facilities, and increased capacities on a smaller land parcel. "With storage and retrieval machines, we can usually get three times the amount of storage cube usable in the conventional warehouse by going from 20 to 40 feet at a less than 20% increase in building cost." A storage/retrieval vehicle, he adds, can do the work of two lift trucks and an elevator, thus effecting equipment cost savings. Along with this come manpower savings and reductions in inventory levels made possible by improvements in inventory control.

"Automation in itself becomes a powerful justification factor when you cannot find people who will work in a warehouse," he said. "We are now approaching this condition in some parts of the country."

The most sophisticated system described by Allred was one they installed for Philip Morris, consisting of two warehouses supporting an $80 million cigarette manufacturing plant. One warehouse stores about a day's supply of raw tobacco, placed in 1,500-pound barrels, and the other stores finished cases. There are five satellite computers reporting to a supervisory computer. "The satellite computers are located close to the functions they control on the warehouse floor and have a Teletype terminal for manual input of commands if the supervisory computer is out of commission," he said. "The system also has an audit trail computer whose sole function is to record all transactions of the satellite computers in the event of a supervisory computer failure."

In addition to systems that store finished goods and raw materials, he said, those holding work in process are also becoming important. "In some cases, storage and retrieval machines have eliminated the need to abandon older factories due to the need for more production space because work in process is taken off the production floor and stored in the air. . . We are now seeing factories planned with high-rise storage systems located right in the middle of the factory for ease of access."

Allred described a system Kenway installed for Ampex Corp. in Colorado Springs, Colo., where "dispatchers at the end of each aisle make requests through crt's for pre-kitted electronic parts in plastic totes (containers) and small parts carrousels to be delivered for production. The cranes under computer direction deliver the material directly to the shop dispatcher at the end of each production line, usually within one minute after the request is made. There, it is sent by belt conveyor directly to the assembler, who returns the partially complete assemblies by the same conveyor for storage in the work-in-process system until required for the next assembly or testing operation."

He termed "one of the most sophisticated work-in-process storage systems yet implemented" a system Kenway installed at the San Diego Naval Aircraft Rework Facility, where a supervisory computer tracks 12,000 work-in-process production orders while also controlling conveyors and storage-retrieval cranes. It controls the movement of material from the storage system to one of 22 different shops by way of an overhead conveyor loop that is one mile in circumference. From there it goes by elevator down to the point of use.

In the exhibits area, a number of companies were showing ways of monitoring and controlling the movement of goods, such as on a conveyor belt. They were reminiscent of the Automatic Car Identification system adopted several years back by the Assn. of American Railroads. Computer Identics Corp., Westwood, Mass., showed a new computer-generated bar coded label that could be placed on goods and packages and read by both a remote scanner and a hand-held wand. Having applications also in the retail point-of-sale field, both the wand and the label printer are made by Interface Mechanisms Inc., Seattle, Washington. Among the contributions of Computer Identics is the ability to multiplex several scanners to one label decoding processor.

With all this know-how, you'd think they would be able to figure out a way to find my car in the airport parking lot. □

Exhibits floor at the Material Handling Institute show: the ingredients for automated warehousing.

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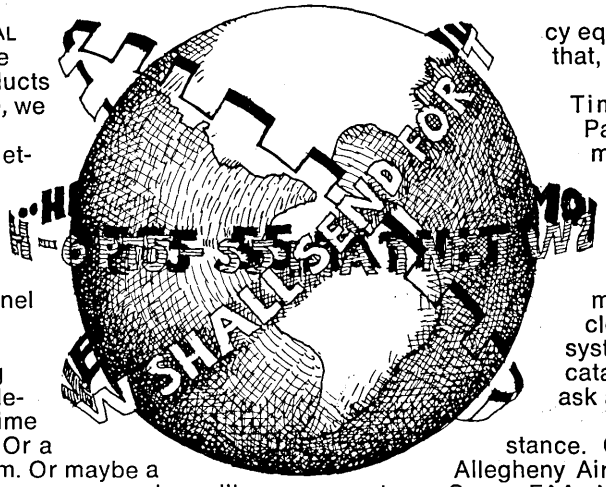

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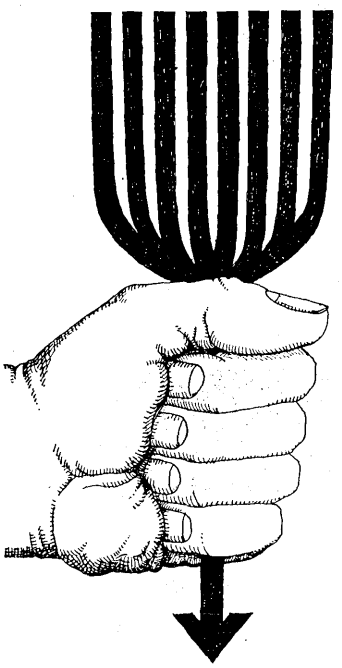

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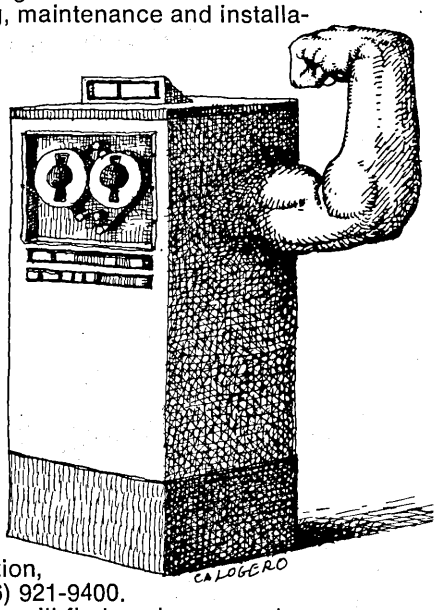

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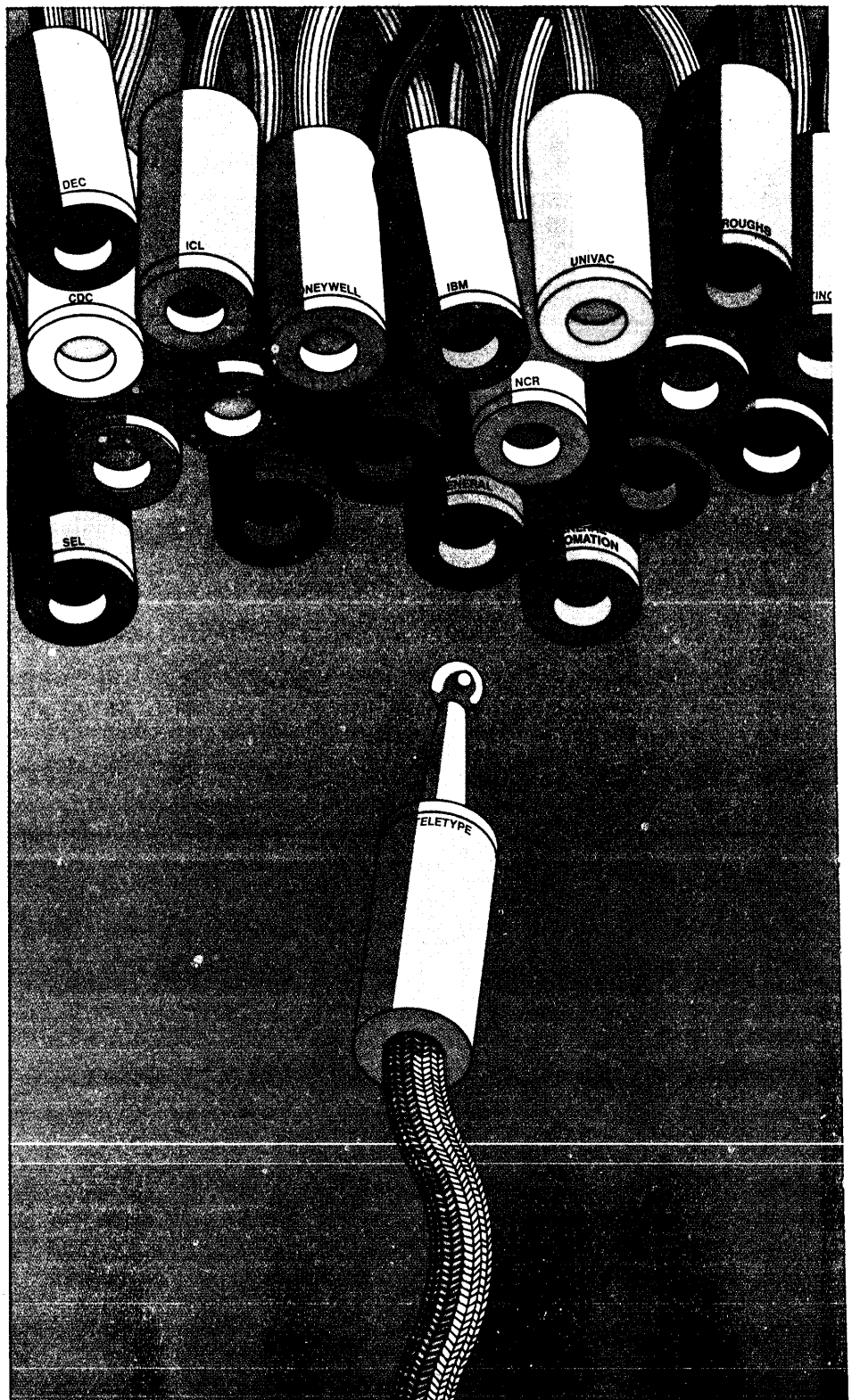

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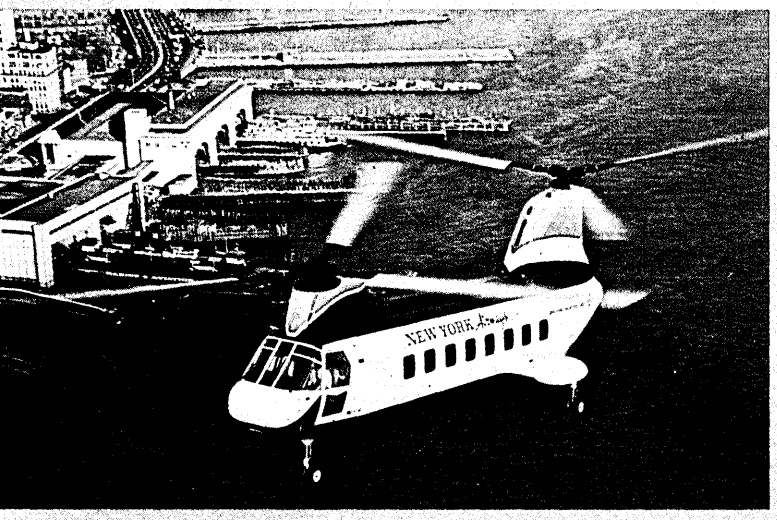

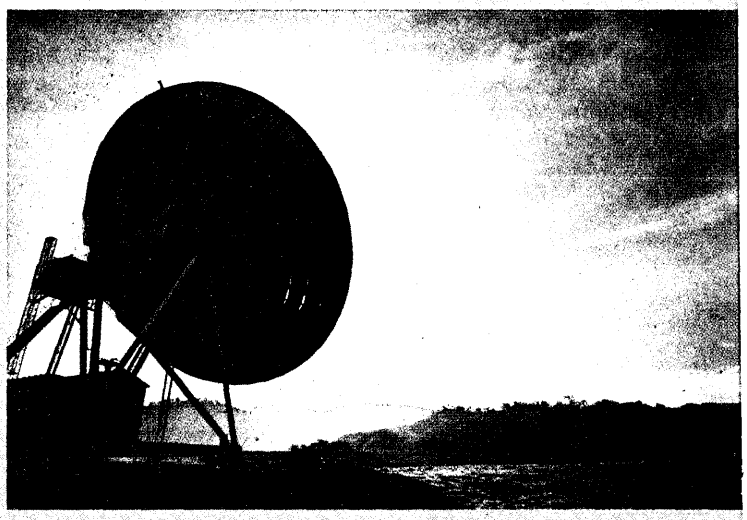

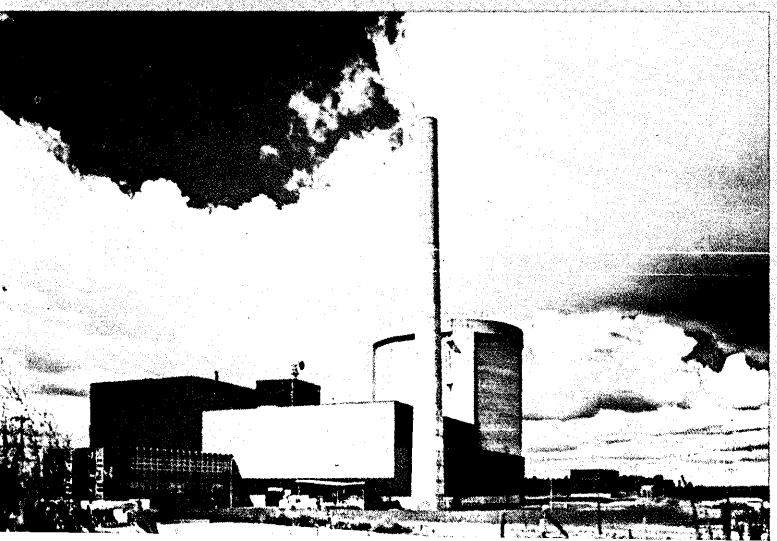

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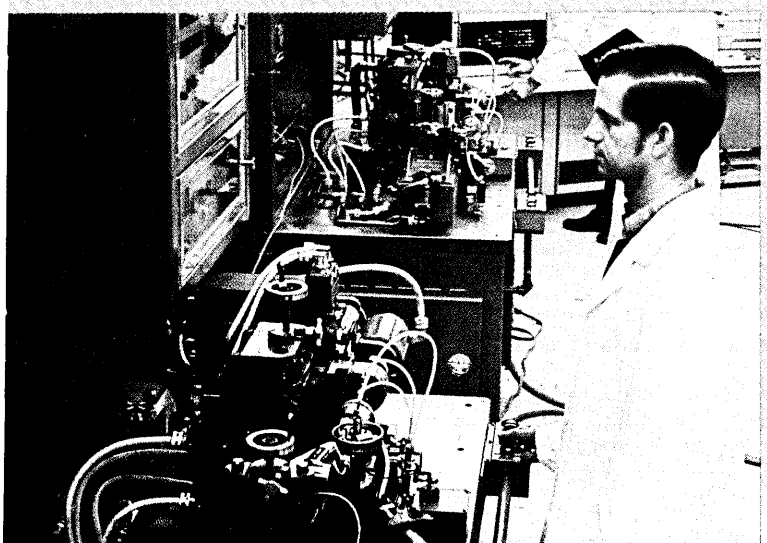

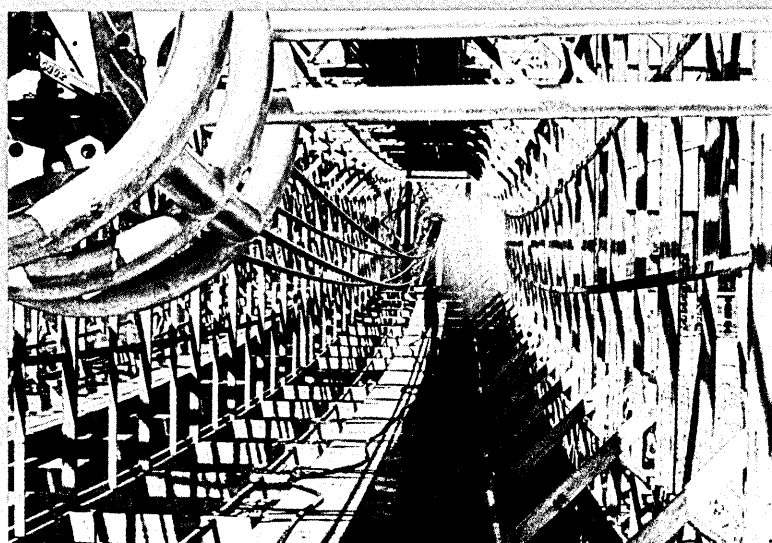

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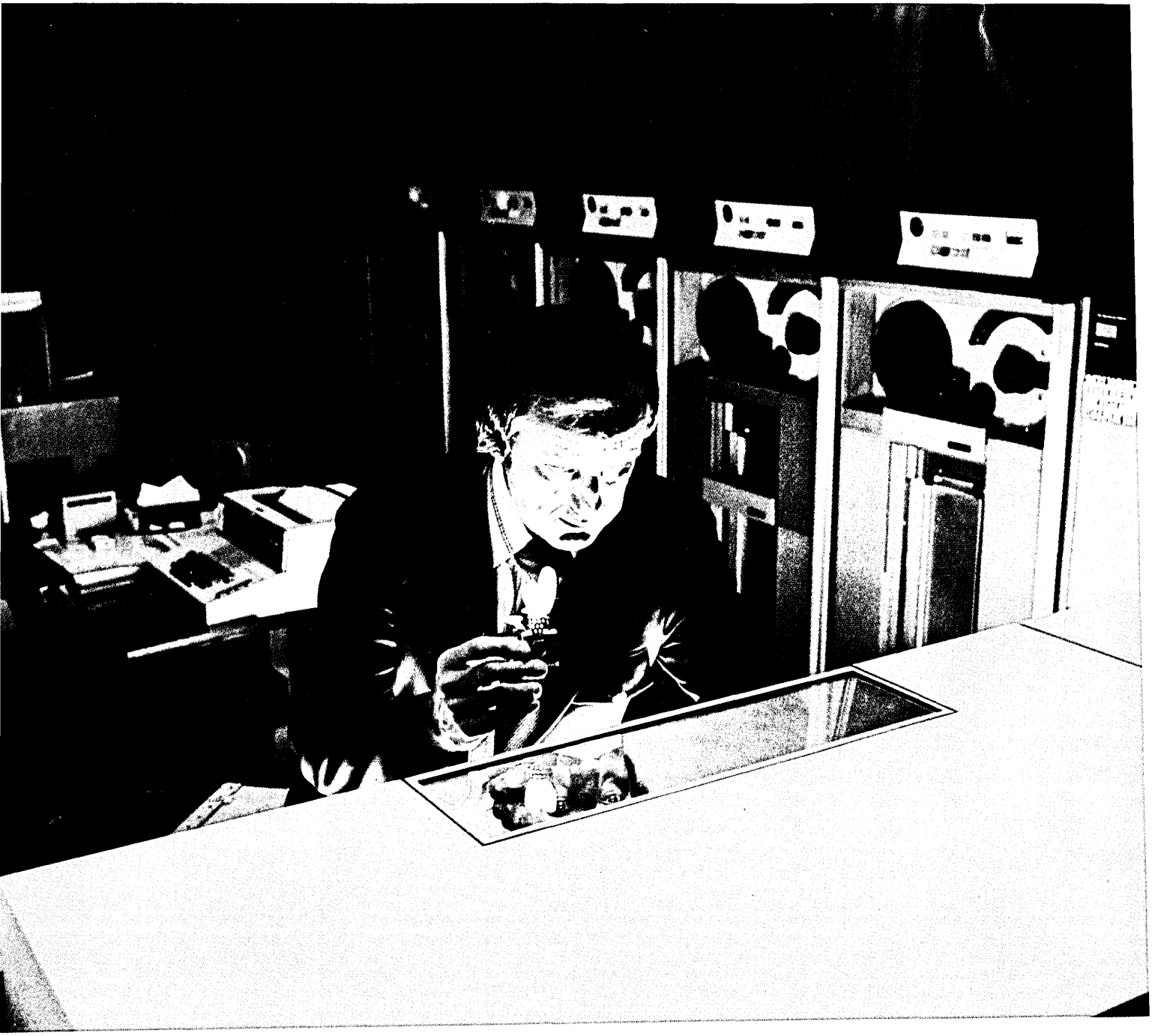

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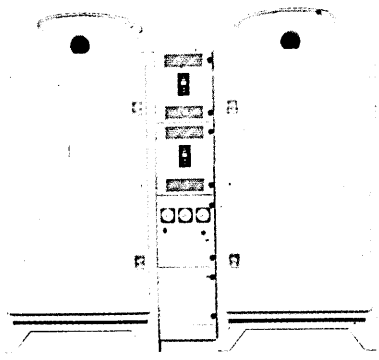

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News in Perspective

Control Data's manufacturing arrangement with Romania may be the first of several thrusts into the East Europe bloc, page 112, including deals in Czechoslovakia and the USSR, where it's rumored there has been talk about a Cybernet-type network...

Our most recent visit with Ross Perot finds the chairman of EDS continuing his fiery assaults in a multitude of crusades, including the saving of Wall Street, page 114...

MIT's computer science head Robert Fano speaks out against information networks, page 120, saying they shouldn't be allowed to spread until we've developed adequate means for protecting privacy...

Six months late, Los Angeles is about to get a freeway traffic warning system under way, page 127. Our report tells how the Sigma 5-based system works...

Sen. Philip Hart's Industrial Reorganization bill was up for hearings this spring, page 129. Some testimony indicated it's the one hope for putting vigor into the Justice Dept.'s pursuit of IBM...

Addressograph Multigraph's new Data Systems Div. shoots for the lucrative--but crowded--data transaction market, page 132.

Mainframers

National Cash Register: "No More Apples and Oranges All Mixed Up"

The National Cash Register Company spent $2 million in a 2½-year ad campaign to convince the world that "NCR Means Computers." But many who studied its recent financial reports seriously doubted its staying power in the electronic age.

Committed to computers and electronics, NCR in 1970 still did more than 80% of its domestic manufacturing in the mechanical-age plants that surround world headquarters in Dayton, Ohio, where it also paid the high labor rates of the heavily unionized city. The problem grew to a disaster when a strike at the Dayton operations in late '71 virtually paralyzed the company. Its already-dipping profit tumbled to $2 million from $36 million in '70. In 1972 it reported a $60 million loss. Century series cpu's ready for shipment from a modern plant in Rancho Bernardo near San Diego were held up because the printers were made in Dayton. Shipments of cash registers from overseas plants stalled because 20% of the key parts came out of Dayton.

"In the electronics business, large factories are not normal," says president William S. Anderson, called in a year ago this month to direct a massive reorganization of the cash register empire built by the great John H. Patterson with the help, incidentally, of a supersalesman named Thomas J. Watson. Anderson, an Englishman born in China who was chairman of NCR's fabulously profitable Japan subsidiary, was a surprise selection for the No. 2 job at NCR, but those who have watched his performance so far heartily agree with Anderson's own assessment that he was the best man for the job (see accompanying story).

Actually, a reorganization plan had been in the works since 1970. It was the new president's job to set it in motion. And it's being done at breakneck speed.

Says chairman Robert S. Oelman: "We would have preferred a more gradual transition, but there has not been time for that. It has been a case of moving fast or falling behind."

Razing the past

Later this spring bulldozers will rumble down Main St. south of downtown Dayton, pass the rolling, grassy slopes of Sugar Farm and the carefully manicured mall outside corporate headquarters and thunder to their final destination: the first of 10 factory buildings to be ripped down. The event will launch an 18-month modernization and consolidation program to reduce factory floor space at Dayton to 2,600,000 square feet from 4,200,000 at a cost of $4 million.

Since last summer the Dayton work force has been trimmed by some 4,000, bringing employment down to about 11,000 from a high of 20,000 in 1969 when the plant had its finger in so many product pies. (NCR's employment worldwide is 85,000.) Now it houses corporate headquarters, the manufacture of some mechanical cash registers, and the Financial Systems Div. whose principal product is the model 270 terminal for banks.

Five other plants, outside of Dayton and once operated as branches with corporate and local staffs, have been turned into full-fledged divisions responsible for their own engineering, marketing—and profits. Says Anderson of this new arrangement: "You're not getting apples and oranges all mixed up. You're just making apples. The manager has total responsibility, not only for the manufacturing, but also for the engineering. He'll have the software people as well, and everybody will be there instead of being here, there, and everywhere else."

In Cambridge, Ohio, some 90 miles northeast, NCR's Retail Systems Div. "is going full blast on the 280," the department store point-of-sale terminal for which the company late this winter received a whopping $60 million order from Montgomery Ward. In Wichita, the Accounting Computer Div. is making NCR's new 399 accounting machine and when a new plant is completed, will also manufacture the controller—the 605 minicomputer it now buys from the Data Processing Div. in Rancho Bernardo. Its Data Entry Div. is housed in Ithaca, N.Y., and postal systems and other products are being made in Millsboro, Del., which has been named the Delaware Div.

The swing's the thing

Anderson arrived at NCR just as the company was closing a major cost-cutting deal with Control Data Corp. in which NCR sold its Hawthorne,

Calif., disc drive facility to CDC for $20.5 million and agreed to buy the equipment from CDC for 20 years. The two firms also formed a jointly owned company to make printers, tape, and card readers for each other. Called Computer Peripherals, Inc., it has been a rousing success, according to Anderson, operating profitably in less than a year at an annual rate of $100 million in shipments.

But he says the real long-term benefits of the agreement will come "when we finally work out what we called the swing computer idea for bridging the gap between our small, medium, and large computers to their super-large systems," a move that would allow users of NCR's future medium-size machines to swing up to larger systems, when the need arose, without heavy conversion costs. The companies are developing a common operating system. Anderson denies reports that the

NCR's Anderson: "If I Didn't Do It, Who Would?"

"That most American of companies has gotten an Englishman as its operating head," exclaimed *Forbes* magazine in March.

"Mr. Anderson took his appointment coolly, rather in the manner of the actor James Mason to whom he bears a striking resemblance," said a *New York Times* reporter in February.

"He's a tough new face in town," said another report on William S. Anderson, the 54-year-old president of the National Cash Register Company who a year ago this month leap-frogged over some 30 NCR top executives for the job of turning around a cash register company groping for profitability in the computer age.

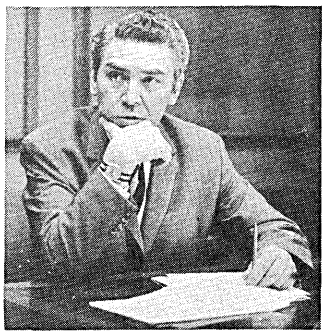
While his selection for the No. 2 spot at NCR was a surprise to many, it was a logical choice. NCR was forced for survival into a shotgun wedding with computers, but the dowry consisted of more than 4 million square feet of antiquated mechanical-age plants in Dayton, Ohio, that had to be kept busy. Meanwhile, in Japan, Anderson within a dozen years had increased the profits of NCR's subsidiary 10 times, while keeping employment from rising more than three times.

Born in Shanghai of English parents, Anderson first heard of NCR while a Japanese prisoner of war with George Haynes, then manager of NCR's Japan operation and now vice president and group executive in charge of international operations. Of Anderson's 28-year career with NCR, Haynes said "he's gone nowhere but up. He likes to win, and he has what we call a magic touch."

Anderson, urbane—perhaps with the looks of a James Mason, but with the rich, vocal tones of a Lorne Greene—denies the magic touch. "I think I've been lucky," he once told a reporter.

The tall, dark-haired British citizen was reluctant to leave Japan for Dayton, but he makes it clear it wasn't because he doubted his ability to turn the company around. Asked in an interview this spring in Anderson's ninth-floor office in Dayton if he felt he was qualified, he answered with a gusty laugh: "Right or wrong, I've always believed myself to be superior to anybody else in this company. I don't think you can be successful in business unless you have confidence in yourself.

"So while I don't go around talking that way, in my own heart of hearts, I have confidence in myself



WILLIAM S. ANDERSON

and my ability, and I know I'm the best man in the company. The soul searching was whether I wanted to take on the extra burden when I had a pretty good life in the Far East where everything was going my way and the company was running on greased wheels.

Who would?

"But when I looked around and thought of the alternative—that if I didn't do it, who would? Who could?—I decided I'd better do it. There was nobody better qualified than I. If I really loved the company, as I do, and if I felt that I owed the company something for what it has given me in 27 years, then I'd better repay the company in service."

He was not surprised by his selection. "Friends all around the world had been asking me, 'when are you going to go to Dayton and do something for the good of the company?' I guess they appealed to my egotism."

He operates with a first-hand knowledge of his markets. Since coming to Dayton, he's traveled to every country where NCR has a branch office, except Africa. His routine on a trip is to meet in the morning with the staff and drop in on customers in the afternoon. "His decisions are popular because we know he's been out on the firing line," said an aide recently.

In Dayton, Anderson comes in late by factory standards—usually 35 minutes after the whistle blows at 8 a.m. He doesn't like committee decisions and spends much of his time meeting individually with his staff, usually letting the paper work slip by and thereby often having to violate a personal rule against taking work home. Much of the homework is done on weekends, and NCR executives cringe on Mondays at the flood of projects for them that Anderson has crammed into his dictating machine.

Anderson's takeover has been smooth, considering the magnitude of the job. All but three top officers in the company remain in their posts, and despite the 4,000 layoffs in Dayton since he took over, "the Chamber of Commerce is delighted."

"The business community was worried that NCR was going to get sick and die," he said. "So when they heard that the company was going to be reorganized, that somebody was going to come in and save it, it was like a knight on a white charger in shining armor. The press has been apprehensive, but we've allayed their fears and we've assured them that Dayton will always be NCR's headquarters, as far ahead as we can see."

Of his characterization as a "tough new face in town," not tied to the Middle America traditions of the big Dayton factory, Anderson prefers a different definition—"a fresh look."

"Although not entirely fresh. I know the problems of the company. I know the areas that needed improvement. But, on the other hand, I wasn't so closely involved that I would be afraid to do something. I certainly will not be tied to tradition and precedent. The not-invented-here factor would not apply to me."

swing project is stalled, noting that there never was a schedule. "We're working very closely and very well, and we've had no friction at all," he says.

Although the company installed 1,000 Century series computer systems last year, for the third year in a row, the business still isn't profitable partly because for every two Century machines shipped in '72, one replaced a smaller model that came off lease and was returned to the rental pool. But Anderson hastily adds that the operation is close to being profitable, although NCR doesn't have accurate figures because the computer business is so mixed with the company's other business.

For instance, NCR operates 85 data centers worldwide, sells optical font and punched paper tape cash registers, "purchased by people who wanted to use our data centers or to read into their computers, including our own." So, he asks "would we have sold these cash registers if we didn't have the Century or the 315 (the Century's predecessor)? The answer is no." In Japan, he added, NCR's eight data centers produced a profit of more than $1 million last year. All related computer business netted the company $4-5 million in Japan, and Anderson thinks the same applies to operations in England and Germany.

"If you take only the sale of processors and immediate peripherals identified with them and exclude technical services, supplies, data centers, and all the point-of-transaction products, then I'd say the computer business hasn't been all that profitable. Not yet. It's close to it, but not yet."

The company has 3,500 installed Century computers and 550 of the 315 series, the medium-size line introduced in 1962. Rental and sales income rose to $251 million last year, an increase of $37 million over '71.

Slow to move

By its own admission, NCR has been slow to penetrate with new products those markets where it traditionally has been strong. With Burroughs, it once was the major supplier of equipment to banks, but it failed to capitalize on the advantage with electronic products, even though in Japan's Sumitomo Bank it claims to have installed the world's largest on-line system where 15 Century 300s are used to handle some 2 million transactions a day. It's a feat that pleases the tall, ouptspoken Anderson, who has lived in the Far East all his life. "We're talking with all the banks now. People say, 'how can you compete with IBM?' Well, we've competed with IBM in Japan and we're beating them in know-how. IBM doesn't have an installation in Japan as complete as Sumitomo. We have the know-how. Whether we have applied it as we should have is another question."

NCR's computer know-how will in large measure contribute to the success of its accounting and retail systems, which it's announced in rapid-fire succession during the past 12 months. Although late with an electronic point-of-sale device, the company now has almost caught up with Singer Co. following the big Montgomery Ward order for its 280 system for department stores (see April, p. 135), and Anderson said the company expects to capture 60% of the retail market within three years. Earlier this year it introduced the model 250 free-standing electronic cash register for supermarkets and earlier this month displayed its 255 computer-based system at a supermarket convention in Dallas.

Watching the giant

With all other suppliers in the multi-billion-dollar retail market, NCR closely watches the moves of giant IBM. Last month, of five product codes submitted to a grocery industry standardization committee, the code most closely resembling IBM's submission was the one selected (see p. 136).

"We would be foolish not to be apprehensive of IBM's entry to this market," Anderson says. "IBM is so rich it could enter any market it wanted. It could build automobiles if it wanted to compete against General Motors. Whether they are ready to enter a new field now, with the Justice Dept. after them, I don't know. It's a case of (a) whether they're ready and (b) if they are, whether they're ready to make an announcement that they're going into a new field—the retail field. But we're certainly aware that they may."

If IBM enters, it's in for a tough fight in a ballgame where NCR has the market force and the track record. "In this business people have always felt they wanted to do business with NCR. And why not? For 80-odd years we have served the retail industry. Which retail industry hasn't been served well by NCR over the years? We're going to look after our retail industry."

When Anderson became president a year ago, just after NCR had suffered back-to-back quarterly losses, a Wall Street computer industry analyst said of NCR's woes, "it's too bad that he can't bring his Japanese labor force with him." Anderson seems to be doing well without it. Output per employee is up 50% over last year, and the company is stepping up production 30%. Its big loss last year—the first since 1933—reflected a year-end write-off of $70 million. Actually, it had an operating profit of $10.5 million and turned a solid $7.4 million profit in the first quarter this year, after 1972's disastrous first three months when the company lost $6 million. Oelman told employees recently, "Our performance this year will determine the course of the company for many years to come."

Up to now, the news is good.

—Tom McCusker

Exports

CDC in East Europe: First Deal Closed

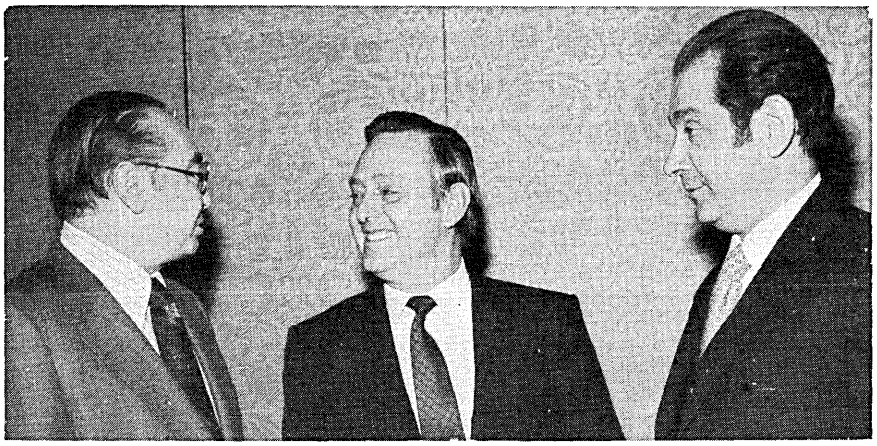
Control Data Corp.'s joint manufacturing agreement with Romania is a hallmark event for both the U.S. computer industry and this maverick East European country. Although there are several licensing agreements, this is the first manufacturing venture with equity investment for a U.S. computer company in East Europe. The equipment involved is quite naturally standard and "nonstrategic" gear: a 1200-card/minute card punch, 250-cpm reader, and a 200-line/minute printer.

Romania was a likely partner for this "first," as it is ambitious for "most favored nation" trading status with the U.S. and was selected by President Nixon for his first visit to the Soviet Bloc. Also, the nation established the mechanism for manufacturing partnerships last November. While the U.S. government has not yet approved the contract officially, it appears certain to move quickly to do so. That certainty was emphasized by the press conference fanfare in New York last month, complete with satellite transmission of the contract-signing in Bucharest by deputy minister Cornel Mihulecea and CDC president William Norris.

The contract calls for the Romanian Industrial Group for Electronics and Vacuum Techonology (CIETV) to own 55% of the company and CDC to own 45%. "Benefits will be shared by the same percentage." For this, CDC will provide $1.8 million in know-how and technical assistance—no cash. CIETV will provide $2.2 million in plant facilities, tooling, and cash. Control Data will have the option to take profits out in U.S. dollars or in products to use with its systems, or to reinvest in the company or other ventures there.

The products will be sold initially throughout East Europe and "potentially in West Europe." Control Data

doesn't manufacture this equipment anywhere in Europe now, so the Romanian-based company could become a prime CDC supplier for this gear in Europe. CDC said that the firm will not be marketing its wares in the U.S. "initially," although it's highly unlikely that it ever will cross the Atlantic to compete with the CDC-NCR-owned Computer Peripherals Inc., which makes these units here.



CDC's PAUL MILLER, center, with Romanian ambassador Corneliu Bogdan and Ion Datcu, Romanian ambassador to the United Nations, at NYC press splash announcing manufacturing deal.

A new plant is being built for the firm, but production will start in an existing plant this year. The new facility will have the capacity to produce $5 million in the peripherals yearly, although Paul Miller, CDC senior vice president, noted only that the total value of production in the first five years "is expected to exceed $10 million."

Restrictions on printers

The one potential problem in this deal is that the joint firm must abide by the trade restrictions of both governments involved. In other words, each sale in East Europe will have to be approved by the U.S. Office of Export Control. It's expected that the sales applications will be batched through it periodically, and card readers and punches should have no problem at all. The 200-lpm printers, however, may be scrutinized more closely, as they are oriented to terminal use; U.S. export authorities are more skittish about communications-based systems, their applications being more difficult to control.

In the press conference announcing this event, Ambassador Corneliu Bogdan of Romania emphasized that this venture is just a "small part" of his nation's plans. "We are contemplating joint ventures of a larger scale in this industry—in the basic elements of the computer as well as peripherals." This means mainframer and East European watchers should look for more agreements with Western firms. Bogdan told this reporter that Romania was participating in the COMECON (Soviet Bloc) effort with the Riad series of 360-like computers being built cooperatively by the Bloc. However, to our knowledge, its participation does not incude manufacturing any mainframe of the series —which observers have said indicates Romania's desire to be economically independent of the Bloc and achieve the same independent status as Yugoslavia.

One reporter asked Bogdan about Russia's reaction to the agreement. "Ask Russia," was the reply. After the conference, we were told this same reporter pressed the question, asking: "Has the USSR approved this?" Bogdan reportedly said, "Why should they?" Then asked if Russia isn't "the godfather to you all," the ambassador is said to have retorted candidly: "We don't believe in God."

But in his remarks to the press, Bogdan explained that "this new venture is a real departure, proof of our expansion with all countries regardless of political system. Proving this particularly is possible if it is based on mutual respect for each country's individual system. This is a concrete act proving our policy. We are ready to pour all our efforts to make it succeed."

With hands folded

While Bogdan and CDC executives Miller and John Hillesley explained the venture in New York, the audio part of the contract-signing ceremony in Bucharest was piped in by satellite. The voice of William Norris trailed in from afar, like a 1940's broadcast, to announce: "We are ready to broaden the program with Romania even before the ink is dry on the first agreement."

Video failed through Frankfurt, Germany, until the last moments. ("Communications are easier from the moon," quipped Bogdan.) Finally the picture flashed across the giant screen to show the Romanian dignitaries and Norris, who was identified as "the man whose hands are folded" . . . in a prayerful position.

If Control Data has been praying for more entrés to the East European market, some of its wishes are coming true. Last January, it received U.S. approval for a licensing agreement with Poland for production of the CDC cartridge disc drive. CDC initially will supply these systems to Poland, which will, with CDC know-how, begin their own manufacture of the drives. (NATO approval, through COCOM, hasn't come through at writing, however.) The only restriction is that CDC cannot release manufacturing technology on heads, actuators, and coding techniques, and it will instead supply the parts to Poland. Poland, incidentally, has recently approved joint manufacturing ventures, following Romania closely. That may have been the topic of conversation between Nixon and Jan Kaczmarek, Polish Minister of Science, Higher Education, and Technology, who was due here for a visit last month.

Control Data also has set up an educational organization in Hungary and is said to be talking various deals with Czechoslovakia and the USSR. One rumor is that it is talking to Russia about setting up a Cybernet-type network there. The firm is also interested in a graphic display developed by Hungary's Dr. Hatvany and is said to be discussing ways to combine its computer with the display for marketing in East Europe.

—Angeline Pantages

New Market Thrusts in Peking, Moscow

A U.S. computer show next September in Peking was on the verge of being approved by the Chinese government last month. CDC, Burroughs, Honeywell, Univac, NCR, Mohawk Data Sciences, and Monroe all had promised, tentatively, to participate, says the chief organizer of the event, F. R. Greenewalt. "We expect IBM to participate also," he said.

Meanwhile, the Soviet government last month signed a contract to buy $700,000 of data processing equipment from IBM, Datapoint, Sykes, and Mohawk. The deal, negotiated by a Washington, D.C., marketing firm, Intercontinental Computer Exchange (IXC), includes a 32K 2400 series MDS computer system, two IBM 3330 disc subsystems, two Datapoint 1,800-character alphanumeric displays, thermal printers, and acoustic couplers.

Dale Lewis, ICX president, said the

components will be delivered to a testing facility in the Moscow area, where the Soviet Ministry of Radio Industry will evaluate their compatibility with the Riad family of computers. He said the Soviets are discussing additional purchases, estimating that the discussions will lead to a total buy of "more than $4 million."

Lewis says the Soviets want to develop interfaces between U.S. equipment and the Riad series as part of a plan to improve their computerized management information systems. Now, many of these systems are supported by the Minsk series, which is older than the Riad and has a smaller range of capabilities.

The U.S. export control office must still issue licenses for the purchases, but Lewis said the only item that might run into trouble is the IBM disc equipment. "Until now, the U.S. hasn't allowed export of 3330s to the Eastern Bloc."

Ten-day show

The computer show in Peking is tentatively scheduled for 10 days, beginning Sept. 18. Greenewalt, the show's organizer, is executive director of a private marketing/consulting organization called the East-West Trade Expansion Committee (EWTEC), Washington, D.C. He managed last year's U.S. computer show in Moscow.

The exhibit will occupy 20-30,000 square feet, Greenewalt said. Each exhibitor will pay $20/sq. ft. and be required to take a minimum of 200 sq. ft. The East-West Trade Council will set up a special organization, called "U.S. Computer '73," to manage the event; this group will collect "a small percentage" on all sales made at the show and during the first year afterward. "We will have a representative in Peking to supervise the deliveries," he added.

Greenewalt estimated that the forthcoming exhibit could produce $20 million worth of business off the floor. Currently, he said, there are "less than 1,000 computers in the People's Republic of China. Over the next 10 years, we believe they will buy 500 major systems, worth a total of $1.5-2.5 billion. Management systems, banking and finance, process control, air traffic control, utilities management, scientific analysis, and communications are the likeliest applications."

Asked what equipment would be shown, Greenewalt said: "We're hoping to exhibit IBM's 370/125, a Univac 1100 series machine, and CDC's Cyber 70. But this will depend on whether U.S. export restrictions are lifted. The restrictions now prohibit the Chinese from acquiring these systems. We won't show anything they can't buy." □

People

Ross Perot of EDS: Now Saving Wall Street and Other Crusades

While the EDS troops in the trenches were fighting IBM and other powerful foes in New York and California, their leader continued his fiery assaults in a multitude of larger crusades.

Thin, wiry Ross Perot still sports a crew cut, still spouts folksy phrases as he tries to save Wall Street and the American profit-oriented free enterprise system. His work in trying to win the release of the POW's is over, but he is still trying to get information about the MIA's . . . and has set up a private spy network to do it. Never did trust government bureaucracy.

Convinced that the American economic system is at the crossroads, Perot has been urging basic changes in the tax structure. Last month he testified before the House Ways and Means Committee, urging the first $100,000 in capital gains be tax free. And he has poured millions of dollars and tons of energy into saving and reviving the once-moribund brokerage firm of duPont Glore Forgan.

Not directly involved in the management of the company, Perot still plays an active role. He has personally hired every new sales trainee. Perot interrupted a recent DATAMATION interview to take a call from a duPont branch manager whose office had evidently not handled well an earlier anonymous call from the energetic Texan inquiring into the company's new "triangle" money management plan. He made it quite clear that the branch had to sharpen up.

At one point, he suggested the man on the other phone try to understand Perot's position. "If you think I'm such a hardnose, you think about the fact that I have $80 million invested in this operation," he said. "A man would be a fool to put $80 million into a marshmallow."

Perot has instilled into duPont the same flaming belief in screening, training, and motivating that has characterized EDS, which still flies all new employees into Dallas for a two-day orientation meeting that costs the company about $20,000 a month. The facilities management firm still looks heavily to veterans for fresh flesh, but is turning increasingly to the college campus, where it maintains rigorous recruitment campaigns . . . for clean-cut youngsters, naturally. No longhairs need apply.

Training pays off

EDS now has over 3,300 employees, will gross over $100 million this year. Can the company continue to grow and prosper? Perot shrugs the question off: "Everybody asks that, and all I can tell 'em is look at what we've done." He

H. ROSS PEROT

indicates the company's emphasis on management leadership and training will continue to pay off: "We spend a tremendous amount of time with every level of management to see they're doing what they should."

And, he says, "we continually reorganize into units where people can talk to each other. When it gets to the point they have to write, it's too big. There is a marked lack of memos around here," he adds.

Perot insists there are plenty of markets left for his brand of facilities management: "We couldn't saturate them in my lifetime." But he admits that the big hurdle is IBM. "IBM dominates the computer market. They have 1,000 messengers for each one of their competitors. And their message is that the only way to run a computer operation is with a small, inefficient computer with an inexperienced staff.

"That's the problem: Big Friendly up there. IBM *is* the market. And they'll go to any extent to get you to keep your own computer. They tell you it's for control. But the control they mean is *their* control over the customer."

But Perot is not interested in break-

(Continued on page 120)

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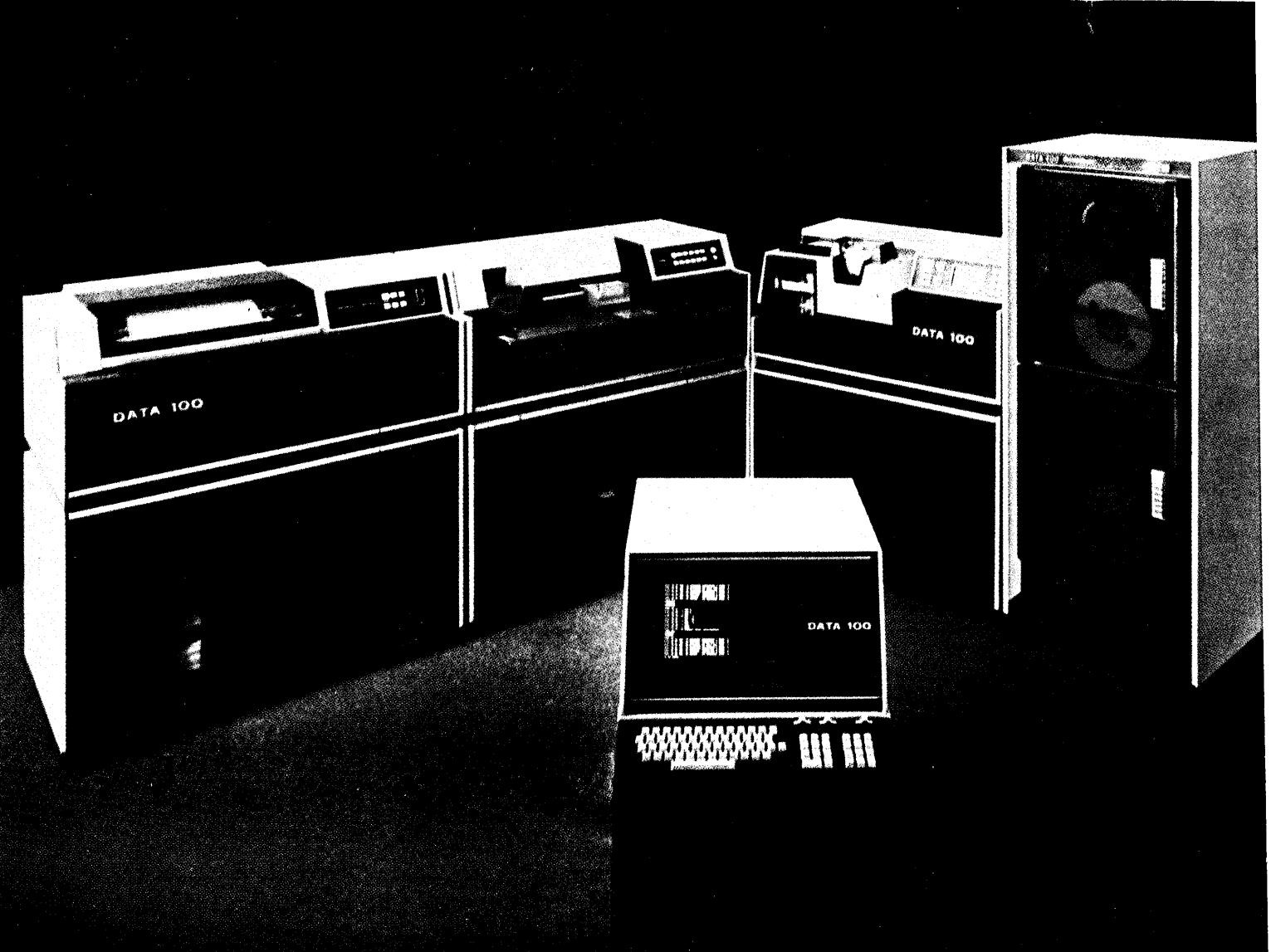

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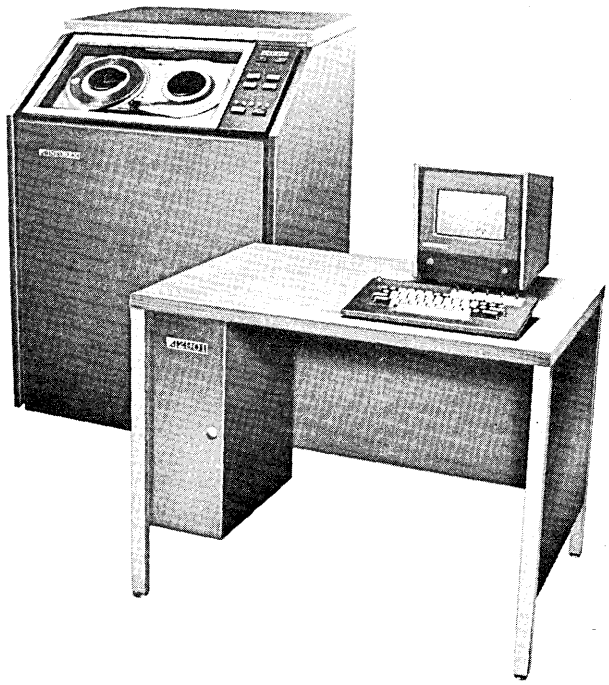

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ing up or controlling or punishing IBM. "We save all our energy for climbing into the ring with them. Our plan is to fight them . . . it's a bare knuckle fight, without rules . . . a one-of-a-kind experience."

Something like interviewing Ross Perot?

—R.B.F.

Howard H. Aiken

"He dreamed up the most fantastic things and got them done."

That was how a former colleague responded when he learned of Howard Aiken's death. The former professor of applied mathematics at Harvard Univ. was best known for his conception of the design of the ASCC (Automatic Sequence Controlled Calculator), otherwise known as the MARK I.

The MARK I was indeed a "fantastic thing." Aiken's 51-foot-long, 8-foot high calculator weighed nearly two tons and took nearly six years to build. Generally considered to be the forerunner of the first generation of digital computers, portions of the MARK I are still on display at IBM's World Headquarters in New York City, the Smithsonian Institution in Washington, and at the installation Harvard has named after its distinguished inventor—the Howard H. Aiken Computer Laboratory.

Aiken was in his 73rd year when he died in his sleep in St. Louis on March 14. He had made his home in Ft. Lauderdale, Fla., where he lived with his wife Mary. After serving as a member of the Harvard faculty from 1939 to 1961, Aiken became Distinguished Professor of Information Technology at the Univ. of Miami in Florida. He also served as director of Harvard's computation laboratory from 1946 to 1961.

Born in Hoboken, N.J., Aiken was educated at the Univ. of Wisconsin, the Univ. of Chicago, and Harvard. It was during his work on his doctoral dissertation at Harvard during the late 1930s that he began to think of developing a large-scale calculator. The MARK I project moved along between 1941 and 1946, with Aiken serving as a commander in the U.S. Naval Reserve at Harvard.

According to *Think,* William Rodgers' authoritative biography on IBM, Prof. Aiken teamed up with—and later squared off with—another great genius of the computer industry, IBM's Thomas J. Watson, Sr. Watson gave the all-important funding and donated IBM's valuable expertise to Aiken's endeavor, but the two men were said to have clashed over certain aspects of the project. The feeling was that Watson thought IBM should have received more credit than it did for develpoment of the MARK I.

Aiken received a battery of awards and honorary degrees for his work on the MARK I. When he left Harvard in 1961, a testimonial dinner was given in his honor; and it was then that he remarked about the MARK I: "I hope to God this will be used for the benefit of mankind and not for its detriment."

Author Rodgers tells a fascinating story about Aiken. While the scientist was serving as a Lt. Cmdr. in the Navy during World War II, Aiken and a team were sent to inspect an unexploded German torpedo. Because of its new and innovative circuitry, the torpedo was considered to be a great find, but it had to be disarmed. Much to the consternation of the other members of the Navy team, Aiken disarmed the torpedo himself. Later, when he was asked why he had taken such a risk, Aiken remarked: "Lt. Commanders were a dime a dozen." Aiken's remark led an old friend at Harvard to say: "What Howard just didn't realize was that Howard Aikens weren't a dime a dozen either."

—W.D.G.

Privacy

The Well-Meaning Pave the Way to...

Information networks should not be allowed to spread across the country, "until we have developed adequate means for protecting individual privacy," said MIT's Robert M. Fano last month. "As of now, I see almost no progress being made in understanding the nature of the problem."

Fano, who is associate head of computer science and engineering at MIT, spoke to a subcommittee of the House Government Operations Committee. He believes "there are basically two directions in which we can move," in exploiting information technology. "One is the direction of developing technology to have people, as individuals, cope more effectively with the problems that face them . . . the other direction, which has been the trend up to now, is to automate more and more (of society's) functions. If you continue in that direction, we are bound to end up with a society of the 1984 type, controlled by a bureaucracy through total control of information. I want to stress that can happen, not because of any ill intent on the part of an individual (but) as the result of decisions by well-meaning individuals . . ."

The House subcommittee meeting, chaired by Rep. William Moorehead of Pennsylvania, was convened to take a look at information network technology—its current state and future prospects, as well as the related question of federal support and federal applications. Moorehead became concerned about information networks late last year, when he uncovered "a Nixon Administration plan for a potential government-operated propaganda and spy system." This "plan" was subsequently disavowed by the Administration, but later developments cast some doubt on the disavowal (see Dec. '72, p. 90).

Another speaker at the hearing was Weston E. Vivian, an electronics engineer and former Congressman. He predicted that large-scale tests of a broadband communications system utilizing lasers and fiber optics are likely before the end of this decade. He also predicted that by 1980, 30-45% of all U.S. families will be subscribing to CATV, and the number of services available will be several times greater than today. Also, by the end of this year, "bidirectional CATV transmission will be available to more than one million U.S. dwellings, and each year thereafter, such transmission will be available to a million additional units."

Within three years, Vivian added, some of the larger experiments in interactive CATV probably will generate sufficient revenue to be self-supporting, and "at that date, precipitous growth will become possible."

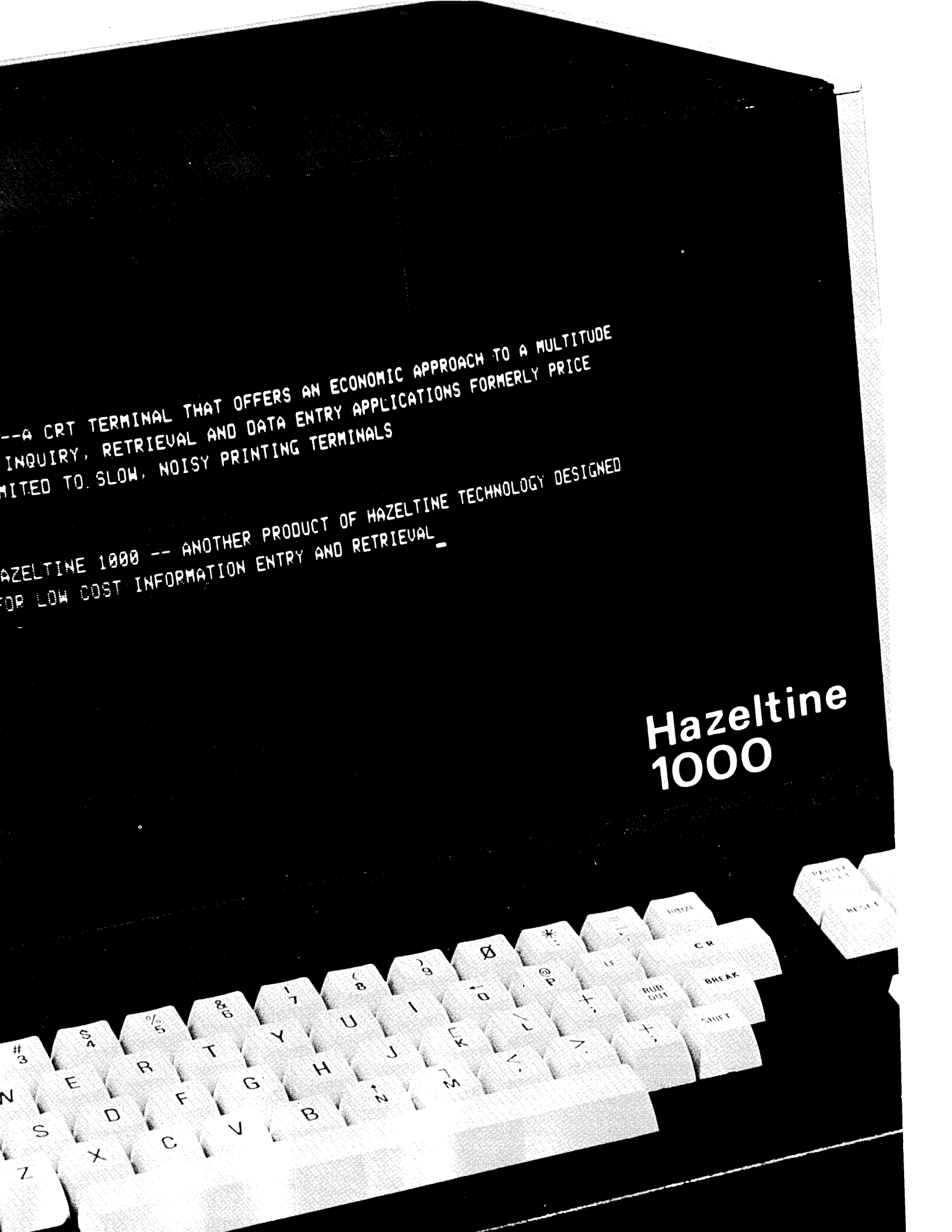
Vivian said the emergence of cable tv as a major information system requires new FCC regulation—relating to privacy, among other matters—which are "violently opposed" by system operators. He contended that the feds should fund the technical development and market testing of broadband cable services. Otherwise, the Japanese, who have already set up a cartel to exploit the medium, may become the dominant suppliers.

How Fair Are Those Fair Credit Guides?

Coded "credit guides," prescreening for direct mail advertisers, and "protective bulletins" of check forgers received a nod of approval from the Federal Trade Commission in its final interpretations of the Fair Credit Reporting Act. The action came after a year of evaluating a deluge of comments from concerned consumers and threatened credit bureaus, and heated

(Continued on page 124)

Hazeltine Introduces a New Era in Terminal Economy: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debate within the commission. Whether the FCRA was actually meant to allow the exceptions is still up for debate.

But the recent FTC decision allows credit bureaus to continue the distribution of credit guides, provided that the information is coded to insure the anonymity of the consumer. Credit guides, used primarily by retail merchants in the Midwest, provide a credit rating from zero to nine as to how the consumer pays his bills. Woe to those who fall in the zero category, for they usually will not be extended credit.

In the past, the blue book, or "black list," contained an alphabetical listing of the consumer, his address and credit rating, even though the store could not conceivably ever have a transaction with every individual contained in the listing. That form of credit guide, the FTC contended, violates the FCRA. But if the books are coded by some "unique identifier," such as a social security number, a driver's license number, or a bank account number, the listing ostensibly doesn't provide the data until decoded by the information supplied by the consumer and thus is allowed under FCRA.

But this "unique identifier" doesn't necessarily insure privacy, one consumer spokesman said, since all three identifiers suggested can easily be obtained by a third party. The fact that many of the individuals listed in the guide have not applied for, nor intend to apply for, credit from the store holding the credit rating indicates an "invasion of privacy," the consumer advocate said. The FTC did not see it in that light. Businesses need the data, and the consumer alone holds the key for deciphering the credit listing, the agency said.

Prescreening

Another part of the FTC ruling, and the most controversial within the commission, was prescreening, which is designed to save direct mail advertisers thousands of dollars each year. Prescreening can be performed in two basic ways. First a list of names can be provided, and the credit bureau computer then goes through the names sorting by the credit criteria outlined by the advertiser. Or the direct mail advertiser simply outlines the credit criteria and the credit bureau provides the names of eligible consumers in the trading area. In either case, the direct mail advertiser has a tailored list of prospective buyers of his product without excess effort. After all, there is no real "consumer injury" in not receiving a solicitation, a member of the FTC staff said.

"Protective bulletins," another method deemed permissible under the FCRA, are listings and descriptions of check forgers, swindlers, and the like. Included in the booklets are pictures and alleged modes of operation of the persons listed. Publication of the bulletins is allowed "provided no information in them is used in establishing the subjects' eligibility for credit, insurance, or employment," according to the FTC interpretation. Policing this provision is a "difficult problem," a source inside the FTC said.

In its ruling the FTC found the primary purpose of the bulletins was to prevent fraud, and therefore the bulletins have a real purpose. There is only a "sufficiently remote possibility" that persons listed in the bulletin would request a loan, insurance, or employment. This possibility is so remote that it does not "justify elimination of such a publication on FCRA grounds," according to the FTC interpretation.

Tough luck

But what if an "innocent" person is listed? One FTC source indicated it would be the victim's tough luck. But a spokesman for Burns International Security Service, which compiles "protective bulletins," said the person would have an option of suing both Burns and the local law enforcement agency that issued the arrest warrant. The Burns service includes only those persons with warrants outstanding for arrest on forgery and other charges. There are 4,000 subscribers to the monthly Burns bulletins. Subscribers include banks, hotels, motels, large retailers, and department and jewelry stores. In addition, the Burns bulletins circulate to police departments throughout the country.

The final interpretations also require an insurance company to notify a consumer when insurance rates have been increased or when insurance is denied based on information supplied by a state motor vehicle report. The consumer then has the right to see the report provided by the agency. Enclosed in these reports are driving violations. Also required under the FTC interpretations is a notification when credit is denied based on information furnished by loan exchanges, a storehouse of credit information provided by local consumer finance companies. When a prospective buyer applies for a loan, the loan exchange is contacted for information on how many and what kinds of loans the buyer has outstanding.

The last interpretation excluded the Civil Service Commission from the scope of the FCRA even though information on government workers' "character, general reputation, personal characteristics, or mode of living . . . is routinely transmitted to various branches of government," according to the FTC ruling. There was no public hearing on this interpretation.

—K. Endres

Security

Edp Auditors a New Breed

Effective edp auditing could detect million-dollar programming errors, frauds, and inefficient uses of computers. Yet at least 50% of the companies using computers do not have effective edp auditing, according to Joseph H. Wasserman, president of Computer Audit Systems, one of two speakers at a recent American Management Assn. course. Bank and corporation executives at the three-day cram course held in Washington, D.C., were taught the basics of auditing and control of the computer. Even federal agencies are beginning to develop a new breed of auditor, much to the chagrin of computer installation management.

Wasserman and the other speaker made the following points: The enlightened auditor will now begin to take a much more active role in system design to insure that controls flow through the system and are effective from design to testing to conversion. And the data processing manager will just have to grin and bear it.

The edp auditor will be watching to see that all data is received and processed, for it's a sad day for a corporation when a stack of accounts receivable is lost in the shuffle. The course recommends controls on data conversion through the size of the batch and by clerical and procedural controls. Error control should be providing some information on the type, source, and frequency of mistakes.

In programming control, validity checks are determining that a character is a legitimate member of the set; limit and reasonableness checks and historical comparison will provide some basis for checking the data. And then there are control totals, record counts of a data set, hash totals, sequence checking, crossfoot and balancing, and internal labels—all weapons in the artillery of the edp auditor. To control fraudulent errors, the course suggests separating the duties of input and output and rotating personnel, among other things.

But when it comes right down to the auditing, the best tool the edp auditor

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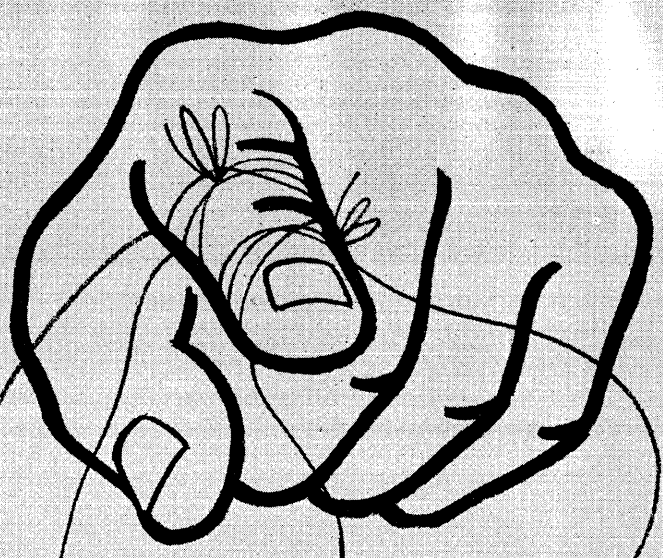
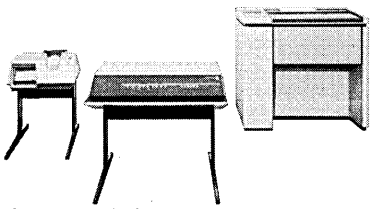
POINTED COMMENTS ABOUT REMOTE BATCH PROCESSING SYSTEMS





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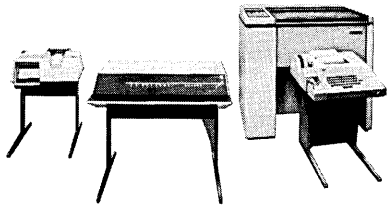
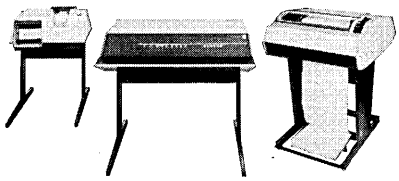
***$940**
Per Month



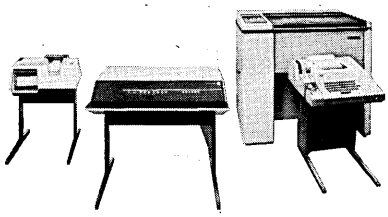
System 565—Medium Speed Intelligent Remote Batch Terminal plug-to-plug compatible with IBM 360/25 + HASP Multi-Leaving Remote Work Station.
System Speeds: 2. to 7.2 KB.
300 CPM, 245 to 1100 LPM.

***$1160**
Per Month



System 515—Remote Batch Terminal plug-to-plug compatible with IBM 2780, CDC User 200 and UNIVAC 1004.
System Speeds: 2. to 2.4 KB.
300 CPM, 200 LPM.

***$675**
Per Month



System 560—High Speed Intelligent Remote Batch Terminal plug-to-plug compatible with IBM 360/25 + Multi-Leaving Remote Work Station.
System Speeds: To 50. KB.
600 CPM, 700-1800 LPM.

***$1645**
Per Month

*All prices include maintenance

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CIRCLE 74 ON READER CARD

can have is a basic understanding of the computer system by using questionnaires, frequency estimation, variables estimation and discovery, and ratio and regression analysis. Software packages are available to help the auditor to independently extract data from computer files. And what should a package be capable of? Parameter-based selection, statistical sampling, distribution of data in categories, computation/recalculation, totaling, aging, file and report output, confirmation, test data generation and entry sound like a good place to start.

One agency developing an edp auditor program is the Naval audit service. Auditor General Adm. James Forrest said "this field really has not been audited to the extent it should have been over the years," especially in hardware utilization. The Navy has about 1,100 computer installations. The service is assisting in a joint uniform pay system currently under development to see that audit trails and controls are built into the system.

By using a commercially available auditing package, CARS2, the audit service was able to save $190,000 in one installation. Currently the agency is auditing the Aviation Supply Office in Philadelphia. But the results are incomplete at this time since the agency has "more workload in the tubes" to be dumped onto the computers, Forrest said. The problems facing the edp auditor are formidable—how do you "audit a billion-dollar inventory?" Forrest said the staff is trying to find the answer to that question.

Fire: a Lesson the Hard Way

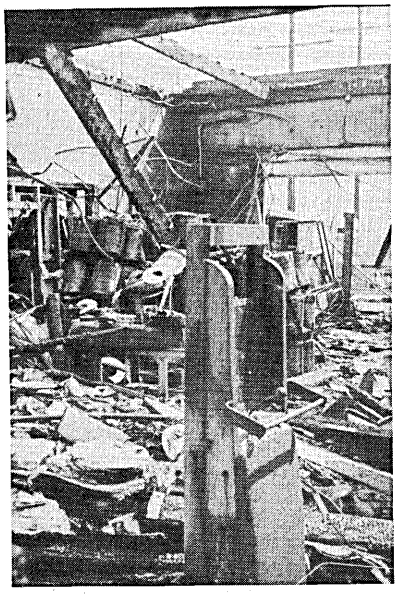
Fire burns paper, right? Jam-packed files are a nuisance, right?

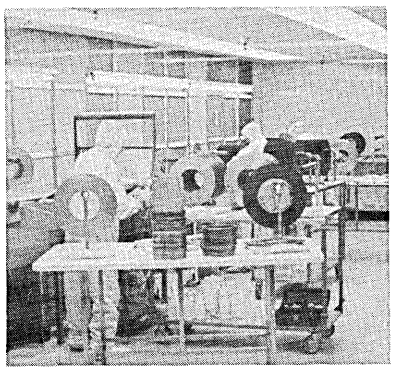
Not always on either count, as CFI Memories, Inc., Anaheim, Calif., disc pack manufacturer will attest. CFI suffered a $1 million fire last August. It lost a lot of equipment. Its building was totaled. But 99.9% of its records weren't burned. They were on paper in jam-packed files. "Only a few archival records were lost," said Thomas E. Scholten, CFI president. "The main files didn't burn because they were packed in so tight there was no air to feed the fire. They were only charred around the edges." The safety of their records was a key factor in CFI's survival of what its personnel call "the fire period" without a loss in profitability.

CFI leases its own products and also handles computer equipment leases formerly the property of its parent firm, Lenco, Inc. (neé Computer Financial, Inc.). All of its leases were on paper in the jam-packed files, and all were saved. It was residual income from in-place leases that enabled CFI to maintain profitability during the fire period.

Scholten said the company learned a lot more than the value of packed files from its fire experience. "For one thing, we learned how to read a fire insurance policy, and mainly we learned the value of fire prevention."

And there's a lot of the latter in the company's new 24,500-sq. ft. facility in which it will celebrate its second birthday April 14, at full production,





FROM THE ASHES of its old plant CFI Memories, Inc., moved to full production in a new facility, including this fully equipped clean room, in less than five months.

lower rent, and "with more capacity than we'd ever had before."

The prevention is in the form of double sprinklers (ceiling and roof) throughout; regular fire drills; strategically placed fire extinguishers throughout the building; and the company's own bright red, hand-driven fire truck. The truck is stationed near the employee refreshment room as a constant reminder to all of its existence. Next to it is a charred disc pack under glass, above which is a commemorative plaque which reads "lest we forget . . ."

The company never really ceased operating. The fire occurred on Aug. 22 at 1:25 p.m., and on Aug. 23, the firm was operating minimally in temporary facilities three blocks from the scene of the fire. Bill Lennart, Lenco president, had seen a vacancy sign the afternoon of the fire.

In the early days of the fire period CFI bought equipment for resale to fill the needs of existing customers. Within 90 days they had located their present facility and had let a contract for its remodeling. They moved in gradually and resumed production the same way. For 60 days, clean room operations were carried out in giant tents in what is now a storage area while permanent clean rooms were being constructed.

The only salvageable equipment was electronic test gear which had to be completely taken apart, cleaned, and reassembled. All other equipment had to be replaced. "We were lucky that Honeywell chose that time to close down its disc pack operation in San Diego. We bought a lot of equipment from them." This had one unfortunate side effect. A London trade paper reported that CFI had acquired Honeywell's disc pack operation.

The August fire started in a substrate preparation area. CFI isn't doing its own substrates anymore. "It costs a little more to buy them out, but it's safer and we're spreading our overhead over a larger base."

Nothing's all bad. But the people of CFI wouldn't want to do it again.

Traffic Control

Fog Ahead—If You Believe in Signs

Motorists on Los Angeles' heavily traveled Santa Monica Freeway last month were waiting for long-promised warnings of traffic problems ahead to be flashed on overhead, matrix-type, changeable-message signs. They probably were unaware that they themselves for two and one-half years had been contributing data to the system, which would provide the information for the sign hook-up, due to be operational April 20, some six months past the original target date.

Information for the sign system comes from a computer-based freeway surveillance and control program that has been operating since July 1971. In

this program, traffic is monitored on a 24-hour basis along a 42-mile loop consisting of segments of the Santa Monica, San Diego, and Harbor Freeways. Inductive loops were imbedded in the freeway surfaces with one in every lane every three miles and in two lanes only at half-mile intervals in between. There are 900 of these wire-loop sensors in all.

The sensors input information to a Xerox Sigma 5 computer at a State Division of Highways Control Center via telemetering equipment and telephone lines. The information provides a continuous record of changing traffic patterns, measuring the quantity, speed, and density of traffic. Each sensor is sampled by the system 15 times each second so that a car traveling 65 miles per hour is detected three or four times by one sensor. "Occupancy" is the big measure of traffic flow used by the division. Occupancy is determined by the percent of time during the sampling period that the sensor is "occupied" by a vehicle. In the control center, on a large display map of the 42-mile freeway loop, each sensor is represented by three lights—red, yellow, and green. When occupancy is determined to be less than 13%, the green light is lit; between 13% and 23%, yellow; and when occupancy goes up above 23%, the red light comes on. The display is updated every 20 seconds based on averages from the last two or three sampling periods.

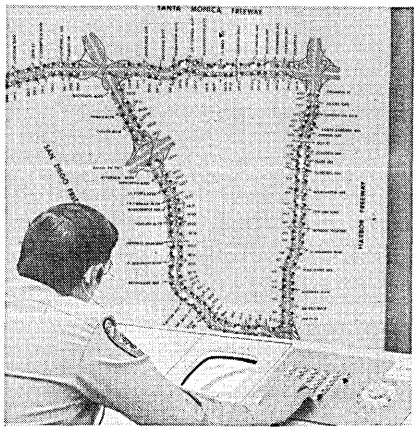
The system differentiates between slowdowns caused by heavy traffic volume and those caused by incidents by comparing data from adjacent sensor locations. If one station shows a yellow or red condition while an immediately adjacent station shows green, operators assume that little or no traffiic is getting past sensor No. 1. When this happens, the second sensor's light flashes red, and center personnel dispatch either a helicopter or a patrol car to the scene to find out what happened. In the case of the helicopters, they get back a tv picture of the scene in the control center.

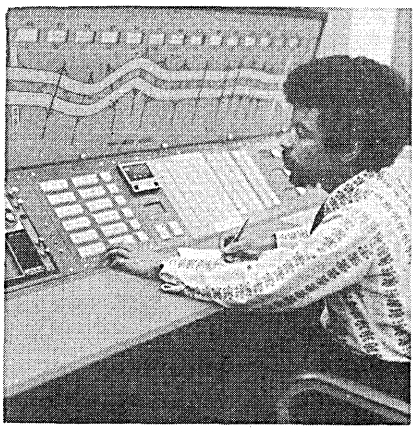
One hundred messages

The control center gets back a report on exactly what is wrong at a trouble spot in a matter of a few minutes. This information is the basis for the flashing sign system. Federal Sign & Signal Co. was the major contractor for the sign system, with Sylvania as a subcontractor for the control console and a minicomputer which can store up to 100 different messages. Some 60 had been stored at writing. Al Perdon of the Division of Highways said additional messages can be added and existing messages changed through a simple typewriter-type terminal.

Perdon said there was nothing surprising in the system missing its target date. "It's the first time anything like this has been done. We didn't have anything to go by. We thought it would take six months and it took a year." He said a part of the delay was due to several changes the division made in the original design.

Another, he said, was difficulty in communicating with the signs due to power surges in the signs' electrical systems. Addition of suppressors has cured this problem. When an operator sends a message to a given sign from the control center, he has to receive a message back from the sign via telephone lines indicating the correct message has been





California Highway Patrol officer (top) is ready to dispatch either a helicopter or patrol car to investigate an incident which is indicated on this map by a flashing red light.

California Division of Highways technician, when advised by the highway surveillance control center that there is an incident and what it is, sends a message to that effect to one of a series of overhead signs, warning motorists of trouble ahead.

received. Then he presses a button instructing the sign to display the message. Messages stored run the gamut from "18 minutes to the beach" to "right lane closed one mile ahead." But conceivably, if circumstances dictate, they could create a message that said "beware elephants crossing, 1 mile"—anything a motorist might want to know and act upon, like by getting off the freeway at the next available exit. Messages are limited to 32 characters each.

Static from broadcasters

Perdon said another system of warning motorists of impending traffic problems had been developed by the division but has been stalled due to objections from the California Assn. of Broadcasters. It had been in a "no final decision" stage for some nine months in mid-April. This system would have made use of low-power, short-range radio transmitters, four to five placed along one-mile radio zones, with 500-foot blank spaces between each zone. It was to have been installed along the 17 miles of the San Diego Freeway from the Santa Monica to the Harbor Freeway.

Taped warning messages would be stored as the visual messages are stored for the sign system. In case of a problem, a motorist entering a radio zone on the approach to the problem would be told by a flashing sign: "Tune 830." If he did this he would hear a taped warning.

Perdon said "our visual senses are overtaxed already." He felt motorists eventually would get into the habit of setting one of their car radio buttons to the warning frequency. Another advantage: the audio system would have cost $400,000; the sign system's price tag is $1.2 million. The audio system was designed for the Division of Highways by Infosystems of Bozeman, Montana, which has a similar system operating in Yellowstone National Park with taped messages on important vistas.

One at a time

And the basic surveillance system continues to be expanded and contracted in an on-going evaluation of cost effectiveness. On the San Diego Freeway portion of the loop, an experiment using metering on on-ramps had proven successful in speeding up traffic flow over a several-month trial. Until last month the metering lights (traffic lights which permit the entrance of one car at a time at specified intervals) were set based on manual traffic counts which had been conducted during rush hours at each on-ramp. In mid-April, a traffic-responsive program was fed into the surveillance system which would make the lights responsive to actual traffic flow conditions.

A similar traffic-responsive system currently is being developed by TRW Systems with the City of Los Angeles for surface streets in an area in the southwestern portion of the city. This, like the state system, would utilize a Sigma 5 and involve sensors imbedded in streets communicating with the computer, which would, in turn, dispatch signals to control traffic signals at major intersections on the basis of an analysis of traffic flow.

In both systems, inputs and outputs to and from the computers go through systems interface units (SIV's), which a Xerox spokesman described as "a highly flexible variety of analog and digital devices which make possible the use of general-purpose equipment."

Perdon said the 42-mile loop selected for the state project was picked because it is a big closed loop; it carries more than 700,000 vehicles over some part of it every day; it serves downtown Los Angeles, Los Angeles Airport, and two universities; it has fog problems; and it is a part of the interstate highway system, which gained them federal funding (approximately 60:40 federal to state).

The California Division of Highways has yet to complete a cost-to-benefit analysis of its experimental system, but a recent report by the technological market research firm, Frost & Sullivan, on "Automative Traffic Controls, Surveillance and Communications Markets" says that a computerized traffic-control system for a city of about 200,000 population would cost $3 million but result in a reduction of traffic delays amounting to 10%. The figures the report proceeds to develop produce a greater cost-to-benefit relationship than would expenditures for mass transit.

—Edith Myers

Antitrust

Dr. Hart's Rx for Oligopoly

"The IBM case is routinely called these days the most important antitrust case in modern times—equal in significance to the Standard Oil case in 1911. That is probably true. But . . . the public has little belief that the case has been prosecuted with vigor so far, that it will ever be tried, or that there will be substantial relief when it is all over. That is the price we have paid for the ITT-Hartford affair. The concentration of power in the White House staff has seriously undermined the independence and authority of the antitrust division."

So said a former Nixon Administra-

tion official, Robert Beshar, when he testified earlier this spring on the Industrial Reorganization Act (S1167), a bill drafted by Sen. Phil Hart of Michigan. The legislation is aimed at, among other things, putting more "vigor" into the Justice Dept.'s pursuit of IBM.

Beshar, who has been an antitrust lawyer for 20 years, dealing mostly with foreign trade cases, was a deputy assistant secretary of commerce from October '71 to September '72. He talked before a Senate judiciary subcommittee, chaired by Hart, which has been holding hearings on S1167. The hearings will continue for at least another year, says a Senate source. In the next phase, representatives of the dp industry will get an opportunity to comment on the monopoly/oligopoly

SEN. PHILIP H. HART: His bill could right a "pretty poor record."

problem as it affects them. The industry session may begin this month.

S1167, basically, establishes an "industrial reorganization commission" to prosecute companies that use "monopoly power," and also establishes an industrial reorganization court to try such cases. A company is guilty of having monopoly power if it meets certain statistical tests described in Title I of the bill; e.g., if it has an average rate of return on net worth of more than 15% during a specified five-year period.

The industrial reorganization commission is also explicity directed to study the "structure, performance, and control" of seven industries, including "electronic computing and communications equipment," to "determine whether . . . any corporation, or two or more corporations, are in violation of Title I."

Efficiency, or what?

In the hearings held so far on S1167, the discussion has revolved mainly around two questions: One is whether a company that dominates an industry stays on top because it's more efficient or because of less-laudable reasons. The other is whether the Sherman Act, the basic antitrust law, makes it impossible to resolve contemporary antitrust cases promptly.

But probably the most intriguing testimony was Beshar's dissertation on the relationship between deconcentration and foreign trade. He suggested that if IBM really opposes the Burke-Hartke bill (as Gilbert Jones, head of IBM World Trade, clearly stated a few months ago at another Senate hearing), the company should stop talking and start doing something to increase competition in the dp industry.

"Break the overconcentration in a handful of key domestic industries," said Beshar, "and you may encourage new industries, hopefully some foreign, thereby creating new jobs and helping to bring home some of that $80 billion overhang of Eurodollars and Asian dollars held by our trading partners."

The Justice Dept.'s antitrust division has "a pretty poor record," he added. Partly, this is because of bullying from the White House, partly because division lawyers have shown "little ingenuity," but also because of "woeful understaffing" and underfinancing. The division employs 650 people and operates on a budget of about $11.5 million/year. "IBM alone spends more for legal services than does the antitrust division," Beshar added.

Lowell Smith, dean of the business college at Loyola Univ. in New Orleans, spoke to the Senate subcommittee on behalf of the National Assn. of Manufacturers. The Hart bill, he pointed out, would drastically change present antitrust procedure and philosophy. Section 2 of the Sherman Act, the basis for antitrust cases now, requires the Justice Dept. to prove wrongdoing before it can win a conviction. But under the proposal drafted by Senator Hart, "the assumption is made that the mere existence of oligopoly, or relatively high levels of industrial concentration, are socially, economically, and politically undesirable. I dispute that."

Bypassing "uncertainties"

Another view of this issue was presented a little later in the proceedings when Sen. Hart talked to Prof. Donald Turner, who was President Johnson's chief trustbuster. Hart asked Turner whether it would be "a fair statement" that prosecution of a big antitrust case, under the present enforcement system, presents "too many problems" in terms of "resources available" and "political pressures."

"I think there are a number of reasons why you haven't seen a series of IBM cases," Turner answered. "The uncertainty of the law" means that the decision to prosecute "a suit of this kind will often be a policy decision . . It is open to the enforcement agency to decide whether it is appropriate to bring the case . . . There will be strong representations made . . . that to break up this firm or that firm would cause great diseconomies."

Turner indicated that the Hart bill, by explicitly defining anticompetitive behavior, eliminates the need for the enforcement agency to make a "policy decision" regarding prosecution, thereby reducing, if not erasing, the "uncertainty" and the "pressures."

Dean Smith, the NAM spokesman, concerned himself mainly with refuting the argument that dominant companies in concentrated industries rig prices. If this were so, he said, the profits of such companies would be disproportionately large. "Empirical studies don't seem to confirm this conclusion," he added, citing a number of sources. "They conclude that the roles of technological and managerial factors have been given too little weight, and the role of mergers has generally been exaggerated."

But a diametrically opposite view was presented by Dr. Lee H. Preston, a professor of management at the State Univ. of New York, and a member of a 1968 White House Task Force on antitrust policy.

Relying on business census figures, Preston found 36 industries in which four firms had 70% or more of the market during most of the '60s, and 19 others in which concentration reached this level at least once and rarely fell far below during the same period. He concluded that in 45 of these 55 high-concentration industries, the gross profit of the dominant four companies was above the average for all manufacturing industry, and in seven, the margin was two times or more higher than the all-industry average.

One of the industries included in Preston's study was "calculating machines." According to his figures, four firms had 83% of the market in 1963 and '67, and each enjoyed profits of around 31.6%. By comparison, the average for all manufacturing industries was 23%.

"There is not a shred of significant empirical evidence to indicate that the high or increasing levels of concentration observed in our economy in recent decades are primarily due *either* to scale economies or to the innovative advantages of large firms (as claimed by most spokesmen for big business)," Preston added.

According to Donald Turner, however, arguing whether dominant companies in concentrated industries make excessive profits is beside the point. The real question is: "Are there some highly concentrated industries . . . whose performance could be substantially improved if you deconcentrated them . . . So long as there are significant industries of that kind . . . it is appropriate to have legislation to deal with them . . . A major premise behind the (Industrial Reorganization) bill is that monopoly power, held by individual firms or shared by a relatively few competitors, is a significant problem in our economy, and that something more should be done about it. I agree with both propositions." He proposed a number of changes in the Hart bill, however, which, essentially, would restrict its impact to more serious, more prolonged exercises of monopoly power by large companies than is reflected in the legislation as now drafted.

Consent decree bill

Besides the hearing on S1167, Sen. Hart's subcommittee is also evaluating two related bills in a parallel session. One bill is S782, by John Tunney of California and Ed Gurney of Florida. The other is S1088, authored by Senator Birch Bayh of Indiana.

The Tunney-Gurney bill (see March, p. 103) would require 60 days to elapse between the time a proposed consent decree judgment is filed and its effec-date date. During this period, the settlement terms would have to be made public; the government, the defendant, and the public would be able to defend and criticize these terms; and the court considering the case—following guidelines specified in the bill—would then have to decide whether the proposed settlement was in the public interest. The Bayh bill contains basically similar provisions.

A knowledgeable source on the Senate subcommittee staff says there is "a good chance" that a modified version of the Tunney-Gurney bill will emerge from the full Senate Judiciary committee this year. The subcommittee's position is considered crucial. Four of the nine members (Hart, Kennedy, Gurney, and Tunney) reportedly favor the bill; Sen. Hiram Fong of Hawaii is regarded as the swing man.

Among the beneficiaries of this legislation would be ADAPSO and the Computer Industry Assn. Their position papers on IBM's marketing practices would have to be answered by the Justice Dept. and considered by the court. Now, both of these agencies are free to use such documents for scratch paper.

—Phil Hirsch

(Continued on page 132)

Retail

Transaction Data: Rich New Market

Remember the good old days when all that the address label on your magazine had was your address?

For 41 years the Addressograph Multigraph Corp. has been in the business of making machines to emboss letters and numbers on metal and plastic plates for this purpose. Today, though, it's but the foundation for a new division the company has quietly been forming to attack the billion-dollar transaction data products and services market, one that is expected to grow 20% a year and reach $3 billion by 1977.

Those plain old honest address labels still account for some of AM's business, but now it is a major manufacturer of plastic credit cards and a supplier of the machinery and services for embossing them. It has 80% of the credit-card recording business, with some 450,000 devices installed in stores, restaurants, sports arenas, hospitals . . . you name 'em. Late last summer it combined these operations with three others to form a Data Systems Div. of some 850 people and an expected sales turnover in the fiscal year ending this July 31 of $25-30 million.

Included in the division, which is headed by former Singer vp C. Victor Meyer, are ocr readers for the hospital market, two point-of-sale systems for the fast-food business, and a highly touted credit authorization terminal called AMCAT I.

Is is through these last three products that the division thinks it will achieve its greatest growth. Donald B. Moffett, director of business development for the division, says it is one of the few markets with "data" in the name that is not dominated by IBM, although IBM, with 15% of the market, is the leader. But some 20 companies hold 60% of it, with AM in 10th place at 2%. "The market is wide open, and the opportunity is there for the companies with the marketing strength and the prospective customers. We have both."

Moffet's study of the transaction data market – one roughly defined as the business of recording charge-account transactions–shows that of the $1 billion spent last year, $300 million each went for equipment and supplies and $200 million each for services and systems. In 1977, he thinks it will be a $3 billion market with the bill for services rising to $900 million. The tab for systems and equipment will be $750 million each, and $600 will go for supplies.

Fast foods first

Of its new systems, the fastest moving are the Documentor and Menu-Riter, minicomputer-based point-of-sale terminals for the fast foods industry. The two systems scan preprinted menu order forms and calculate the totals, including taxes, in 2½ seconds. The Menu-Riter device is made by TRW Data Systems and sold exclusively by AM to fast-food outlets having up to 35 items on a menu. The Documentor system handles larger menus of up to 120 items.

Since acquiring the Documentor line from ailing Documentor Sciences of Santa Ana, Calif., last summer, the division has installed 61 systems and has 42 on order. The McDonald's hamburger chain, which spent three years evaluating the system, is the largest user, but the division also has been aiming bigger keyboard models at other than the fast-food market. It thinks the system, to which it can add disc storage and communications gear, will find uses in such markets as fine foods (sit-down restaurants) and hotel front desks. "We are approaching them with the Documentor as a way of implementing an automated bookkeeping system," says James P. Boyle, a former IBMer who heads the division's 140-man marketing force in 65 cities.

Late this year the company will start delivering its credit authorization terminal, the AMCAT I, which once stood for "Addressograph Multigraph Credit Authorization Terminal," but which the division now prefers to mean "Communications Access Terminal." Just over a foot long, the 25-pound device will be used to record credit card transactions, as well as other data entered from a keyboard, and then forward the information to the central files of big credit card issuers for credit verification and other record keeping. It's a buffered terminal that can be used to read magnetically striped cards (called "mag stripe" in the trade), as well as 7B font embossed characters, the latter capability aimed at the gas station credit-verification business.

AMCAT I, the credit authorization terminal, has slot on the side for credit cards and a longer one in front for sales drafts. John G. McCoy, left, chairman of City National Bank of Columbus, and bank president C. Gordon Jelliffe will use it later in year for electronic bill paying system tryout.

Credit cards and sales drafts are inserted into slots in the terminal, and the dollar amount of the transaction is entered through the keyboard and verified through an eight-digit display using light emitting diodes. In test systems, the company has been using an Interdata 50-based communication concentrator and a message controller capable of handling 2,000 terminals.

It claims to have eight customers who have placed orders of more than $20 million for the terminal, which is priced at about $800 in large volumes. Boyle thinks the division will install more than 100,000 terminals within five years.

Not alone

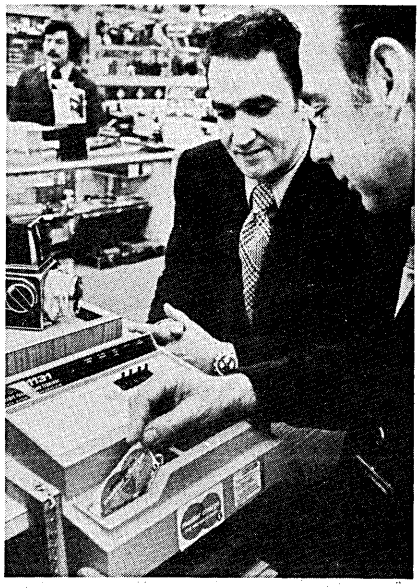
He bases his optimism on a claim that AM is "10-18 months" ahead of the competition in the technology of communications-based credit authorization systems that by 1975 will be a $300 million business with some 500,000 terminals in use. But the division is far from being alone in the market where most of the traditional giants, including IBM, NCR and Burroughs, have versions under development or in field tests.

In Dallas this spring, Preston State Bank has been testing Burroughs' TU300 in nine retail stores using the bank's Master Charge plan. The bank says the system has been well received. Data Source Corp., El Segundo, Calif., a subsidiary of Hercules, Inc., has had systems installed for more than two years in gasoline stations and retail stores. Some 1,000 terminals were in use this spring, although mostly in a testing stage.

Data Source's model 1131 terminal reads embossed lettering on credit cards and communicates with a computer-controlled central file for credit authorization information at a response time of nine seconds. It has retail installations in San Francisco, Los Angeles, Wilmington, Del., Philadelphia, Atlanta, and Chicago. Its $600 device,

which is leased at $20 a month, does not have a keyboard to record variable data and reads only the embossed codes on credit cards, although a device for reading mag stripe has been developed and was being demonstrated in April. But, says a company marketing man, the purpose of such a device is for merchants to check credit cards conveniently (as opposed to making a telephone call) and at a price they can stand.

To date, most credit-card issuers—such as Master Charge, Bank of America, and the oil companies — bear the communications costs and charge merchants the monthly $20 lease rates. The



DATA SOURCE's 1131, used here in San Francisco's Brooks Camera outlet, a Master Charge user, verifies cards in 9 seconds.

merchants seem happy, able in retail stores to check the most common violation, which is a card holder exceeding his credit limit. In the service stations, phoney cards are the problem. Data Source makes a service station terminal that prints on sales drafts, in addition to verifying the card's authenticity. In a recent test installation in Los Angeles, Standard Oil Co. of California offered attendants a $25 reward for each expired or otherwise invalid card seized. "They've been seizing 10 to 15 a week," says Data Source's Sid Keil, "and some of the happy attendants are clearing up to $150 a week on rewards."

Systems to read embossed lettering are said to be essential in service stations because of an environment which could damage the information on mag stripe cards. But many feel the big markets will be in the latter method, though a subsidiary of First National City Bank of New York thinks differently. The bank's Transaction Technology Transfer Inc. subsidiary, which has its own aluminum foil stripe with micron holes that are read by a laser beam, is reported to have staged a contest for students at Pasadena's Cal Tech to find ways to defraud mag stripe systems. A credit-card industry newsletter, the Nilson Report, said the $5,000 first prize went to a student who was able to duplicate tickets issued through an IBM-designed mag stripe card ticket dispensing system at San Francisco's Bay Area Rapid Transit System (BART) using $5 worth of equipment. The $2,500 second prize went to a student who uses a $36 wrist device to copy mag stripes on valid cards and transfer them to bogus ones.

Both Data Source and AM claim their terminals could be adapted to read whatever standard the credit card issuers fix on.

Checks signatures

Other credit verification systems run the gamut of variation and innovation. In Washington, D.C., a company called Vericom has invented a device to verify signatures on credit cards. The inventor, Thomas Shinal, says his device, which can be manufactured cheaply to sell for less than $100, compares the signature encrypted on a credit card inserted into it with that written on the receipt. He claims the device is immune to character slope, height, and pressure, which supposedly vary with the writer's temperament. He says tests have shown the odds are one in 16,000 that someone will pass a fraudulant card.

In Mountain View, Calif., Optical Data Systems, Inc., has an off-line credit card and check cashing verification system that is being tested by eight companies in the supermarket, airline, and department store fields. Customers can access a data base of all major credit cards and derogatory check information that is stored holographically on 35mm cassettes which Optical Data supplies and updates twice a week. The company's exec-vp Kent Sutherlin says customers using the system won't have to pay the costs of computer storage and communications of on-line systems.

But, says William R. Buckley, vice president of Preston Bank of Dallas, which is testing the Burroughs system, on-line credit verification is just the beginning. "The terminals have other applications, such as electronic funds transfer."

Gordon Jelliffe, president of City National Bank of Columbus, Ohio, said last fall in a Los Angeles talk that the AMCAT device may be just the thing for banks and retailers hoping to get together on an electronic payments transfer system—one that would satisfy the bank's reliability needs and be priced within reach of small merchants. The bank's "Columbus Project," a two-year test of systems for immediate

(Continued on page 136)

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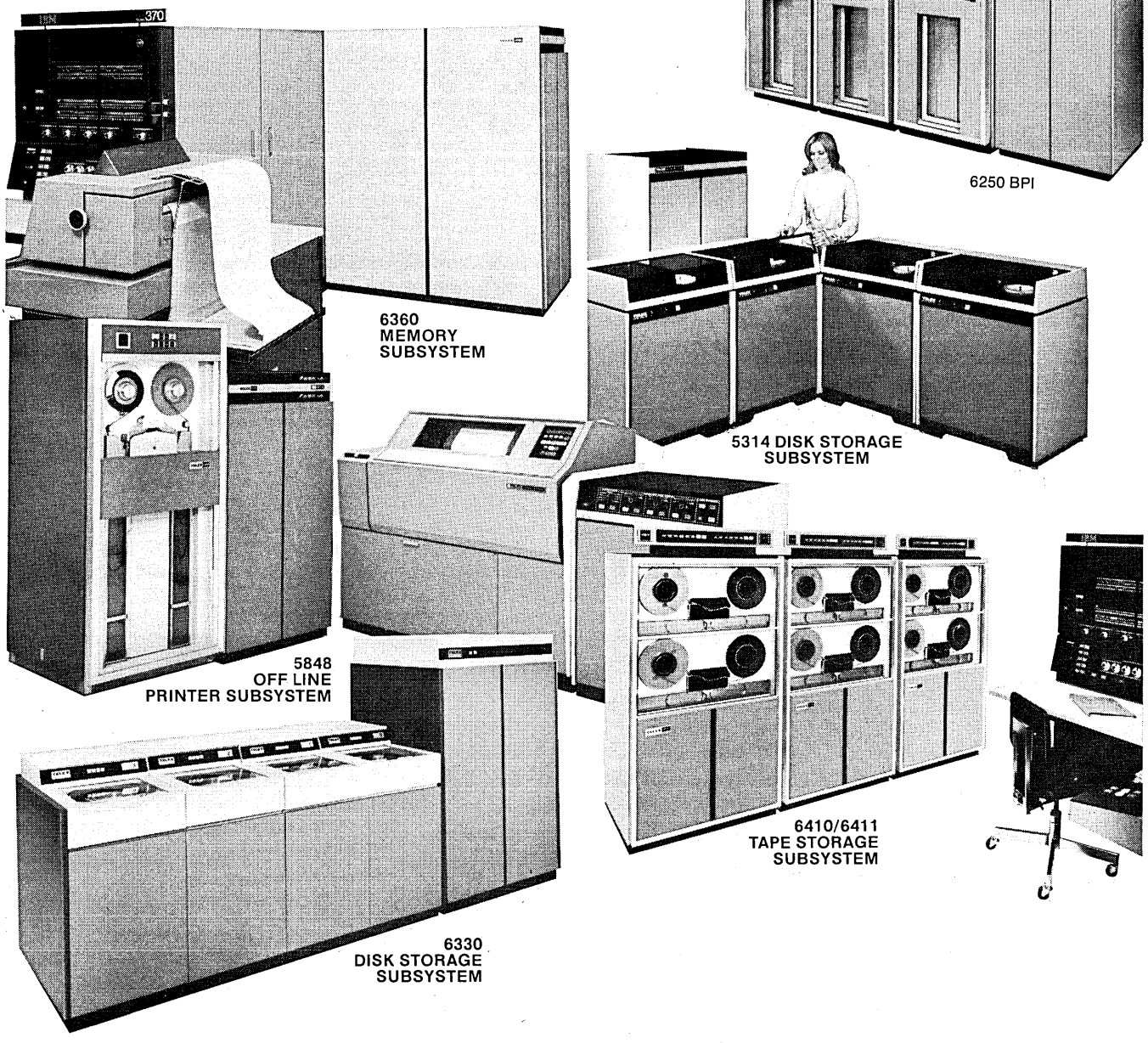

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transfer of funds to a merchant's account after he makes a sale, goes into its second stage late this year to test the use of credit cards to pay utility and other bills. Significantly, the bank has replaced IBM's model 2730 credit authorization terminal with the AMCAT I device.

—T. M.

Grocery Code Like IBM's, "Only Better"

It was a surprise to a lot of skeptics last month, but the grocery industry did it.

The Uniform Grocery Product Code Council, an industry group, selected a standard Universal Product Code (UPC) for source marking of supermarket products. The code is readable by scanners of either the slot or wand type, and its selection is expected by many to create a $7 billion market for supermarket point-of-sale systems over the next 10 years.

The winning symbol, a linear bar code, was not one of the symbols submitted by the many vendors who chose to finance their own evaluations in hopes theirs would be selected as the UPC. Instead, it was one developed by the code committee itself, and according to Larry Russell of McKinsey & Co., consultants to the committee, "included a little bit of goodness" from all those submitted. Vendors who went down to the wire in the evaluation and testing, which was conducted through Battelle Memorial Institute, were Litton/Zellwager, Singer, Pitney Bowes/Alpex, IBM, Charegon Systems, RCA, and Scanner, Inc.

In pictures the winning symbol closely resembles that submitted by IBM, but Russell said the pictures are deceiving: "We changed the geometry and made numerous improvements."

Bill Bowers, president of MSI Data Systems, whose Astros point-of-sale system for supermarkets does not presently include scanning but is adaptable to it, agreed with this interpretation. "From what I've seen, it's all that IBM's was, only better. It's more flexible in terms of size and potential for error detection." Bowers said MSI is talking to "a couple of companies" who claim they can produce scanners which can read the new UPC, and "we'll definitely have one or more scanners which will hook into Astros as they become available."

Russell said all manufacturers who submitted codes and had scanners based on their codes will have to do some adapting to conform to the adopted UPC. He said even IBM, whose code was closest, should it decide to come up with a product, would have to do some adapting. "But the only thing they've said publicly so far is that they ran a Battelle test." Russell said more adaptation would be required of those vendors who were working with round or bulls-eye type codes than of those who had linear codes. The former included Litton, RCA, and Charegon.

But most vendors were quick to respond to the UPC announcement with pronouncements on what it would do for the supermarket point-of-sale market and on their ability to provide equipment which can use the UPC.

Scanner, Inc., which is working with National Semiconductor, said it could. So did Pitney Bowes/Alpex, which said it "was delighted to learn that the grocery industry ad hoc committee has decided to recommend a linear bar code." Litton was equally happy. Charles S. Adams, a group vice president for Retail and Revenue Systems, predicted the symbol will be printed by manufacturers on most items sold in supermarkets and grocery stores and be in full use nationally in 1977.

Russell said he thinks use of the symbol will spread "faster than we expected." He said the committee in the two weeks following announcement of the UPC had received requests for symbol specifications from Safeway, Stop and Shop, Quaker Oats, and General Foods. The specifications are being distributed by Distribution Numbers Bank, Washington D.C.

And NCR, which has long said it was waiting for the UPC to come before introducing an interactive terminal for supermarkets, has said it will introduce its expected 255 terminal at the Supermarket Institute convention in Dallas this month and that it will be adaptable to reading of the UPC symbol.

Russell said many food manufacturers have been holding up making the label changes they will have to make by January 1974 to conform to requirements for listings of nutritional values, just to accommodate the new symbol.

And, as the grocery industry moves ahead to implement use of its newly adopted UPC, the Department of Commerce's National Bureau of Standards is trying to come up with a plan for compatible coding for food products, drug products, and general retail products because so many of the items are sold in different types of stores. The bureau had solicited suggestions by May 3.

Russell said the grocery committee would respond with a proposal and an explanation of their code, which he said could be expanded to 30 digits and could be made compatible with codes for the other two types of stores. The basic UPC is a 10-digit code.

Elections

Putting Fun Back Into Elections

Computers can take the fun out of some events. Certainly, their use by television networks to produce early projections of election winners has been criticized as possibly affecting the outcomes of those elections. And on the local level, the adoption of the punched card ballot has taken away the excitement of vote counting on election night in many smaller communities. For example, in Santa Clara, possibly California's fastest-growing county, most cities since 1966 have been gathering up their decks of Votomatic ballots and taking them 20 miles to San Jose, where county computers perform the tabulation.

"It makes the local election so remote that people lose interest," says Jim Hawkinson, dp supervisor for the city of Palo Alto. On election night, explains Ann Tanner, city clerk, the council chambers are fitted with boards on which to record vote counts as they are phoned in from San Jose.

This month, however, an important change will take place as Palo Alto tests a minicomputer-based vote tabulating system called Ballot Tab. There are only 18 candidates running for six vacant seats on the city council, but the portable unit is expected to speed the vote counting job, eliminate the inconvenience of transporting ballots to San Jose, lower the tabulating cost, and bring the counting operation back to the city. Ballots from the 38 precincts are expected to be tabulated at the rate of 45 seconds per precinct, says Ms. Tanner, and a pretty clear picture of the outcome will emerge in two hours.

Ballot Tab consists of a 4K Nova mini from Data General, packaged with a Documation card reader and a numeric printer. It produces a printout for each precinct, showing the number of ballots counted and, for each office, the candidate's code number, his vote total, and his percentage of the total, plus the number of vacancies or offices to be filled. It also indicates the number of unused votes and the number of votes lost due to undervoting. The latter accounts for those who didn't vote for one office but did for others, and those who voted for only one candidate when there were,

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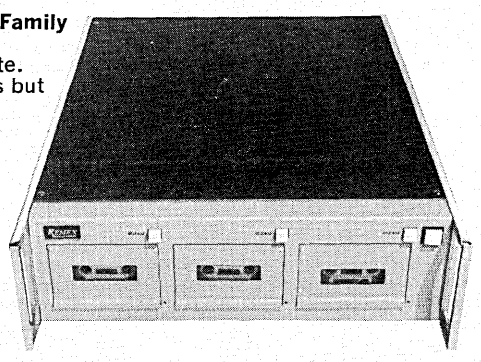

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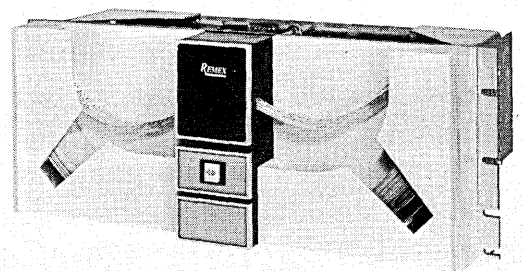

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say, two vacancies to be filled. Results for each precinct are then added into a cumulative total, a printout showing the same kinds of information.

Big one on the way

The system can be equipped with a 300-cards/minute (or ballots-per-minute) reader for some $20K, and a 600-cpm reader at $23K. As a follow-on, the manufacturer is also developing a system with an 8K Nova and four 1,000-cpm readers to be used for the card-to-tape function when a larger computer is used for the tabulation.

"We developed Ballot Tab for use by mountainous and rural communities situated far from a computer," says Robert P. Varni, president of Computer Election Systems Inc., Berkeley, Calif. "But a lot of interest is being shown by metropolitan areas." CES, in addition to its mini system, also makes and sells the Votomatic voting system, acquired when IBM dropped out of this business after the 1968 elections.

The system was first used in '64 by two counties in Georgia—Fulton and DeKalb. From that time through the Presidential elections last November, according to records maintained by CES, almost 10 million punched card ballots have been counted, approximately 12% of the total. Only 25 states currently allow the use of the punched card ballots. CES's Varni says about 60 bills in state legislatures to legalize their use have been defeated. The largest jurisdiction to use the system is Los Angeles County with 3.6 million registered voters and 42,000 Votomatics. The smallest is Bunker Hill township in Michigan with 480 people and three of the devices.

Last month's primary election in the city of Los Angeles may be indicative of recent improvements by jurisdictions in running Votomatic elections. In the primary four years ago, which was the most recent election similar in size and scope, it took until 3 a.m. the following day to tabulate the votes. Last month, it was finished by 1 a.m. But according to Walt Peterson of the city clerk's election bureau, it could have been completed by 11:45 p.m. had it not been for the ballots from 36 precincts (out of a total of 3,711) which were inadvertently left in the trunk of a couple of cars that were returned to the city's vehicle pool. "It took us an hour to locate them and get them out," said Peterson.

—E.K.Y.

Federal Government

Foundation Cool to Science Policy Act

Albert Einstein once assessed scientific progress this way: "Why does this magnificent applied science, which saves work and makes life easier, bring us so little happiness? The simple answer runs: because we have not yet learned to make sensible use of it." Sen. Edward M. Kennedy would probably agree with Einstein's assessment, but the senator has taken it a step further.

He has re-introduced the National Science Policy and Priorities Act, S32, which seeks to redirect scientific research and development toward meeting human needs at a price tag of $1.8 billion. The Senate overwhelmingly passed the bill in the last Congress but it was not acted on by the House. In this Congress, action is expected in both the House and Senate—much to the dismay of the President and the National Science Foundation.

The proposed bill would create a Civil Science Systems Administration within NSF with authority to study such topics as health care, public safety and sanitation, pollution control, housing, transportation, communications, and education. The superagency would receive $1.2 billion to perform its duty.

NSF, which opposed the bill last year, is still reluctant. It prefers that the job be handled by agencies closer to the projects. For example, transportation research would be handled by the Dept. of Transportation and the environment by the Environmental Protection Agency.

An NSF official indicates the new authority would change the direction of the agency, since it was founded to foster basic and not applied research.

NSF would also be given authority to develop national policies for applying science to national problems. NSF contends this is no longer necessary as a result of the executive reorganization of the Office of Science and Technology. Under the reorganization, the director of NSF becomes a principal advisor to the White House, providing policy advice and consultation.

Reluctant on retraining

Another title of the bill gives NSF authority to coordinate the retraining of scientists and engineers toward society-oriented activity. NSF is reluctant to do this also; the agency argues that retraining does not necessarily mean jobs are available. The Dept. of Labor is already involved, so why get another agency involved, NSF asks.

The Kennedy bill also calls for the protection of pension rights of scientists and engineers. This provision is expected to be dropped by the House. An NSF official admits the bill focuses on problems that need solutions, but he argues that existing legislation already addresses the problems and there is no need to create a superagency to perform tasks already being performed.

According to Sen. Kennedy, the bill will create a host of new products, services, industries, and markets. It will also strengthen this country's international economic competitive position by increasing productivity and revitalizing the civilian economy.

The bill is also expected to produce a veto from the President.

Copyright Laws in the Computer Age

Ninety-three may be the lucky number for the modernization of the Copyright Office. A copyright revision bill, which addresses the problems of machine encoding of copyrighted works, has been introduced into the 93rd Congress. The measure has been before six consecutive Congresses, but this time the prospects appear brighter.

Under the proposed bill, introduced by Sen. John L. McClellan, copyrights will now be extended to works of authorship "fixed in any tangible medium of expression, now known or later developed, from which they can be perceived, reproduced, or otherwise communicated, either directly or with the aid of a machine or device." The 1909 Copyright Act, under which the Copyright Office now functions, makes no allowance for future technology, although the office does extend copyrights to computer programs.

The proposed revision specifically states the author will have the same exclusive rights to his material, even when used in computers, as he now enjoys in books. But the bill does acknowledge the problems of computer storage and retrieval of copyrighted material. It establishes a National Commission on New Technological Uses of Copyrighted Works to study such problems. The Presidentially appointed commission would be made up of copyright owners, users of copyrighted works, the public, and the Librarian of Congress.

The copyright revision bill has been given top priority by the Judiciary's subcommittee on Patents, Trademarks and Copyrights. If the bill can pass the

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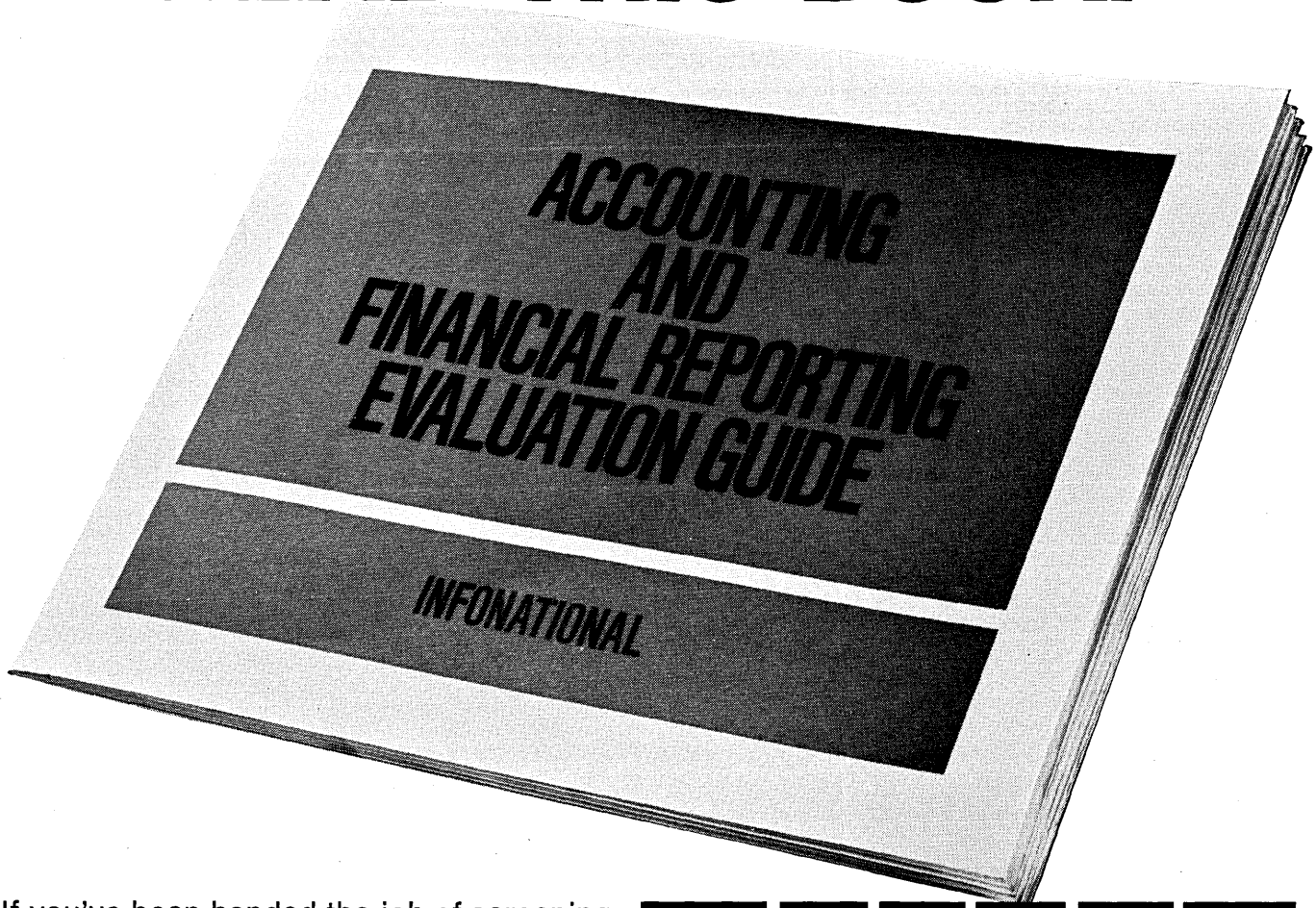

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news in perspective

Senate by the end of the first session, the House will have enough time to act. Otherwise, 94 may be the lucky number.

In a related development, Sen. McClellan, chairman of the patents subcommittee, recently wrote to Sen. James Eastland, chairman of the Judiciary Committee, saying the subcommittee plans to study software protection, but "due to the complexity of the issue, and the apparent lack of consensus concerning the appropriate nature of the protection for software, it is not anticipated that the subcommittee will be able to recommend legislation until a lengthy study has been conducted."

Communications

Bell's Joint Service Stand Under Pressure

A formal complaint, charging AT&T with discrimination, was being considered at press time by Dan Dyer, president of Scientific Timesharing Co., Bethesda, Md. MCI Communications Corp. was thinking about similar action. Their gripe is important because it involves the question of whether communications users who need services extending beyond the immediate reach of the new specialized carriers can use those carriers to cover part of the message path and reap the related benefits.

A large number of users—particularly on-line service bureaus—will be confronted with this opportunity during the next several months as the new networks gradually snake across the country.

Essentially, Dyer wants to lease a voice-grade line from the Bell System between his computer in Bethesda and MCI's Chicago headquarters atop the John Hancock Building. At the latter point, a multiplexor owned by STSC, would connect with local lines, supplied by Illinois Bell, connecting STSC customers in Chicago with the computer in Bethesda. The multiplexor would also be connected to an MCI channel providing STSC customers in St. Louis with access to the Bethesda computer.

AT&T refuses to supply the Bethesda-Chicago voice-grade link, basically because its private line tariff requires channels to be terminated only at those points where the customer originates

or terminates communications. "We do not understand that any of the (Federal Communications) Commission's decisions with regard to the so-called specialized common carriers have contemplated that the Bell System must augment any competing carrier's system by means of the Bell System's intercity network," AT&T said in a recent letter to the FCC Common Carrier Bureau.

Whose rule?

Technically, Ma Bell is right insofar as the tariff is concerned, says a source at the commission. There *is* a provision which bans "augmented" service. But this provision was drafted by the telephone company. The FCC, while allowing the restriction, never approved it.

Dyer, of STSC, says that last summer AT&T appeared willing to provide a voice-grade line between Bethesda and MCI Chicago. The original dispute, he explains, was with Illinois Bell. "We wanted to move the multiplexor from our office in Chicago to MCI's facility on top of the Hancock Building, and Illinois Bell refused to run local lines between the latter location and our Chicago-area customers. It was only later the Bell said it wouldn't terminate the interstate voice-grade line at MCI."

One clue to how the commission will react if STSC decides to submit a formal complaint is provided by a recent dispute between GE and the phone company.

Essentially, GE wants to replace existing channels, leased from Bell, with a private microwave system and interconnect this private network to Bell facilities at several points. But the phone company refuses to "piece-out" the GE system, citing the same tariff provision involved in the STSC case.

GE counsel Joe Kittner, in a letter to the Common Carrier Bureau a few months ago, contended that " 'piece-out' prohibitions are a function of AT&T's operating approach and policy, not its tariff provisions. And to the extent that the limitations inherent in its 'piece-out' concept are not contained in its tariff language, they are not of decisional consequence in this instance."

The bureau agrees

Recently, the Common Carrier Bureau wrote to AT&T and said it agrees with Kittner. The phone company's contentions "appear to be based largely on what the intent of AT&T was in framing the tariff provision in question . . . The intent of the carrier in framing tariff language is irrelevant . . . AT&T is obligated . . . to permit interconnection in the form and manner requested by GE."

This letter is significant to MCI, says a knowledgeable source, because it shows the bureau is upset about AT&T's interconnection restrictions and is actively trying to change them. "As a result, there is more pressure on Bell to sign a joint service agreement with MCI, permitting users like STSC to be serviced."

An MCI source says his company has proposed such an agreement to the phone company. "They have refused to sign it, but we remain hopeful." A complaint to the FCC is "a possibility," he added. "Given the commission's recent statement in the GE case and the fact that Bell is already allowing its system to be pieced out by Western Union and the independent phone companies, we're confident that a complaint from us would lead the Common Carrier Bureau to make Ma Bell an offer she couldn't refuse."

—Phil Hirsch

Data Collection

Simplicity from France

It's simple. It's inexpensive. It's been a success in Europe.

And so, a new U.S. firm hopes it will do well here. *It* is a hand-held card-punching device made in a number of variations. The new company is Dynapunch Systems, Inc., Inc., El Segundo, Calif., a 50-50 venture for Jean Tsuk, president of Perfo-Guide International of Paris, which introduced the device in Europe three and a half years ago, and George M. Colon, Dynapunch president, formerly with Data Products Corp.

Basically, the Dynapunch units are a refinement on the IBM Port-a-Punch idea (see Dec. 1, 1971, p. 53). Average price for one unit is $60, but prices range from a low of $30 to a high of $100 depending on model and quantity ordered.

Colon said Dynapunch Systems will market total data input systems, as well as the punching units alone. He said the firm has an oem agreement for 600-cpm card readers and has an arrangement with a second company which is working on a 100-cpm reader and a "mini-minicomputer" for an application in which bottled water delivery salesmen will record each transaction at their trucks as they occur for nightly input into the computer.

Initially the punching units for sale will be produced in Europe, where more than 20,000 have been sold. When sales volume becomes high

enough, Colon said, production will be started in the U.S. The company already has a card manufacturing capability through an agreement with Jersey Tab Card Corp., Union, N.J., which, using a machine and techniques provided by Perfo-Guide International, will produce cards proprietary to Dynapunch.

Models in the portable card puncher line fall into one of four series: the series 100, typically used for order entry and permitting use of a large-sized price list; series 200 for things like meter reading, inventory control, and uses where a large number of cards are punched in one location; series 300, which can accommodate a series of overlay cards and can be used for market research surveys or examinations; and the newest series, 50, for single-card applications such as exam processing and class attendance recording.

For meters and birds

Tsuk sees a big market for the units in retail outlet order processing. He said there are 2,100 retail outlets using them in France. He named meter reading, agricultural uses such as crop progress reporting, and overtime payroll reporting as other big uses in Europe. Colon, who likes to look for more exotic applications, mentioned an ecology project in which the Audobon Society was to participate. The society's bird watchers, equipped with Dynapunches as well as binoculars, would punch in data on bird migrations—birds tend to run away from pollutants.

And Tsuk would like to get something going in South America some day, as he considers Brazilian and Argentinian football cards a natural for the portable units. "But that will have to wait until the U.S. gets going." □

Benchmarks

The Beaten Path: Tymshare, Inc., Cupertino, Calif., time-sharing firm which has been beating the acquisition path hard in the past two years, has agreed in principle to acquire the business and assets of Allen-Babcock Computing, Inc., Los Angeles, and has purchased for $207,500 cash the business and assets of Megasystems, Inc., a bankrupt Philadelphia time-sharing company. Megasystems' Xerox 940 computer became the 27th in Tymshare's Tymnet network. ABC's 370/65 will be the 28th if the acquisition is completed.

Muzzling Grosch: The "unsinkable" computer consumer advocate Herb Grosch emerged as the "unmummifiable" Dr. Herb as he stood at the podium during a meeting of computer oldtimers this spring while computer savants Robert Patrick and Paul Armer methodically bound the speaker—and his microphone—head to foot in bandages, the last sweep covering Grosch's mouth. Faster than anyone could say "IBM," Grosch found an opening in the bandages and calmly continued his solemn warning of the consequences of IBM's impending fifth-generation announcement at the St. Patrick's day eve annual meeting of the Digital Computer Association held in a Los Angeles brewery. Patrick later donned a bunny suit to elicit at least a grin from Grosch.

Now It's Bunker Ramo's Turn: What Singer evidently didn't want for $4.5 million, Bunker Ramo may get for $3.5 million. It's the Electronic Store Information Systems division of Nuclear Data Corp., Palatine, Ill. The division produces point-of-sale systems for supermarkets. Bunker Ramo has signed a letter of intent to buy the division for $3.5 million cash. An earlier agreement between Singer and Nuclear Data, which fell through last December, would have had Singer paying $4.5 million plus contingency payments of not less than an additional $2.25 million nor more than $10 million, based on revenues over the four years following consummation. The Nuclear Data division has point-of-sale systems in 50 Jewel stores and pilot systems in nine other food and drug chains.

Environmental Data: Three bills establishing a National Environmental Data System have been introduced into Congress, but The President's Council of Environmental Quality, which would be responsible for running the system, has indicated it opposes passage. Two bills, H.R. 36 and 737, earmark $6 million for three years beginning FY 1973 for the proposed system, which would be a central repository of environmental data designed to help the government draft policy. Another bill, H.R. 4732, would not only establish a national system but also state and regional environmental centers to study local environmental problems. This bill authorizes $56.8 million over three years. Congress passed an environmental system bill last year, but it was vetoed by the president after adjournment.

Page Reader on a Chip: For more than a year, Reticon Corp., Mountain View, Calif., has been selling from inventory what it advertises as a "page reader on a chip." This solid-state image sensor, says Reticon president John J. Rado, represents the same type of breakthrough to the ocr and facsimile business as the computer on a chip does to the computer and calculator fields. It converts light to electrons, an image to a digital sensor. Now Fairchild Semiconductor, also in Mountain View, says it has a competing device which differs in operation from Reticon's—it's a charge coupled device that's claimed to have equal applicability in facsimile and ocr. Both also have applications as computer storage devices and in the industrial environment for performing such jobs as size and position monitoring, inspection, and surveillance.

One Down, Another Up: American Data Systems, Canoga Park, Calif.,

which last fall pinned high hopes on an investment by Rockwell International, which made RI a 40% plus shareholder, and a facelifting for its multiplexor and modem lines, has quietly faded into voluntary bankruptcy. Two executives who moved to ADS from RI, Al Schroter who was president, and Ron Crawford, were back at posts in RI's Autonetics division, and disposition of ADS' inventory and product lines was being considered by a court-appointed receiver. In the meantime, Arthur L. Wilkes, who founded ADS and was its president until last September, organized a new telecommunications company, International Communications Sciences, along with three other one-time ADS executives, Larry Brissenden, vice president, marketing; Jack Miller, vice president, finance; and Kenneth Shaw, vice president, operations.

The State of the Industry: Approximately 5,000 companies can be regarded as the suppliers in the computer industry, according to a report on "The State of the Computer Industry in the United States," just released by AFIPS. In 1971, $5,080,000,000 in shipments by U.S. manufacturers of peripheral equipment and general-purpose, mini, and dedicated-application computer systems brought the total installed U.S. base to $30.9 billion. By 1976, between $8.25 and $9.7 billion will be shipped per year for a total installed base of between $40 and $57.5 billion. That is, by 1976, the annual value of new build shipments would have increased by 70-80%. The report also covers worldwide markets, employment, the federal government, computer services, supplies, and industry group distribution of the U.S. installed base. The 30-page report is available for $1 from AFIPS Press, 210 Summit Ave., Montvale, NJ 07645.

Profitable Start: The computer mainframers enjoyed a highly profitable first quarter, led by IBM with a record profit of $340.1 million, a gain of 11.3% over the first three months of last year. IBM's revenues were also a record—up 6% to $2.45 billion. CDC's computer earnings, rising to $5.3 million against a $1.6 million loss a year ago, helped the company post a 57% gain in first quarter income of $17.4 million, despite a slight drop in the earnings of its Commercial Credit subsidiary. NCR made a solid recovery (see p. 110), and usually profitable Burroughs boosted its income to $16 million from $12 million the year before, as did Honeywell, earning $16 million from $11 million. With its computer debacle far behind, RCA earned $41 million, a 15% gain, and the other ex-computer giant, General Electric, boosted its profit 15%. □

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When you get into something as complicated as networks, it's easy to get in trouble.

What's difficult is knowing where to begin.

Start with us.

After all, you'll be using a lot of minis. And they'll probably be our PDP-8's and 11's. Simply because they're the minis almost everybody buys.

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You'll want a host computer, a big timesharing computer, that fits right in with all our minis and works the way you do.

We make that, too. It's our DECsystem-10.

In fact, almost 30% of the computers used by independent timesharing services are DECsystem-10's. Networks are their business, so they have to go with the best computer available.

If you're interested in networks, we're the people to talk to. We have more timesharing installations than anyone else in the world.

You can come to us because of all our minis, or all our interfaces, or our DECsystem-10 host computer, or our timesharing experience.

But we expect you'll come to us because we're the only company that gives you all of them.

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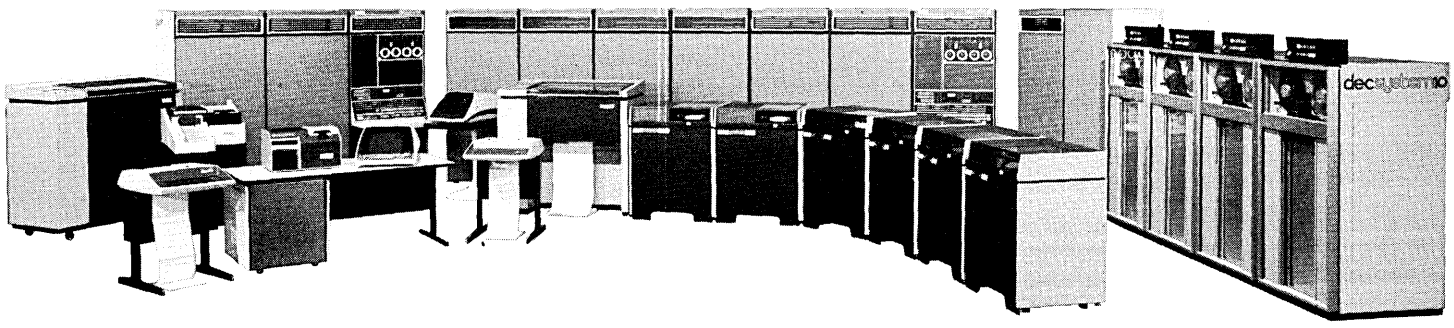
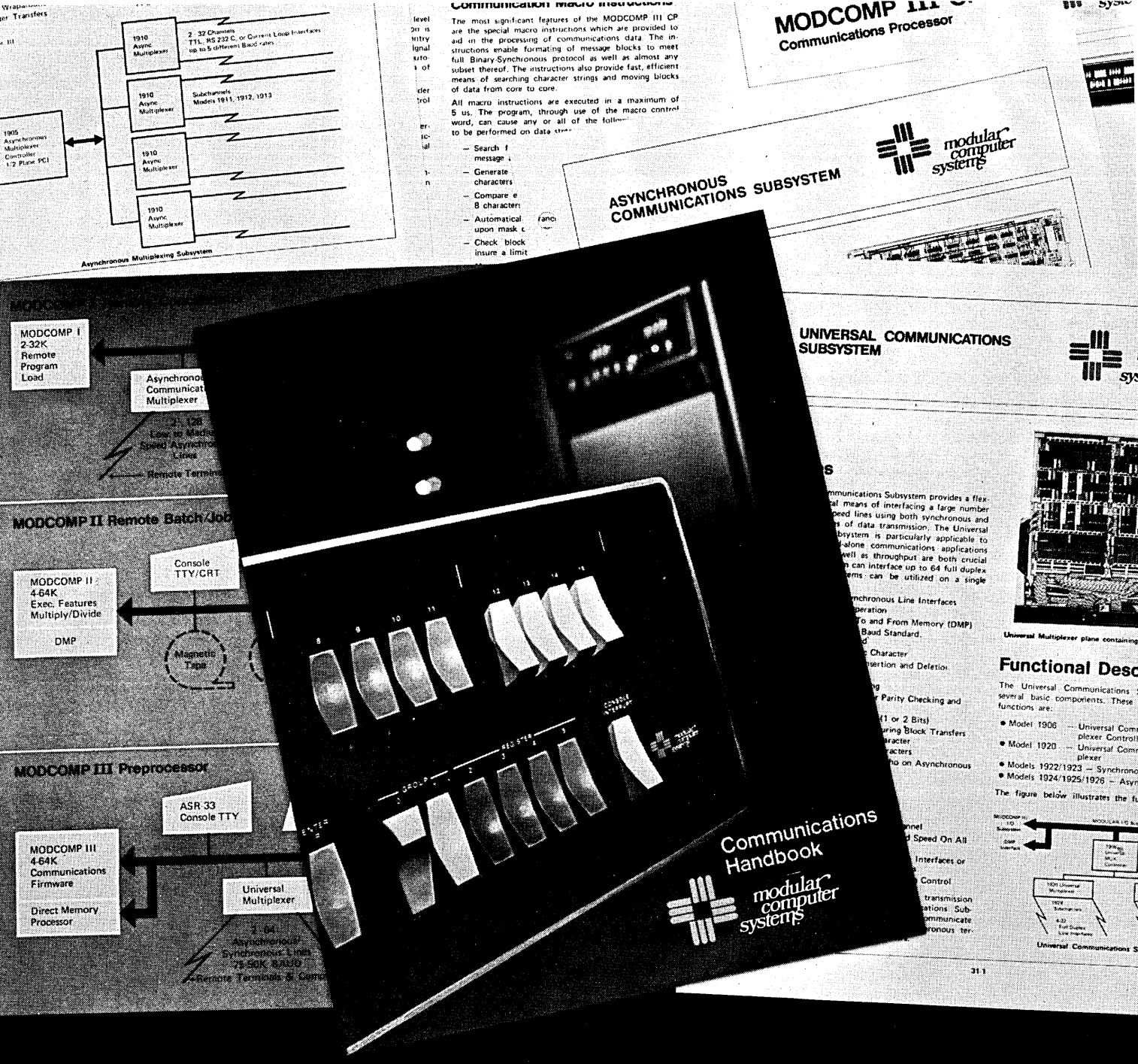
digital



DECsystem-10: It'll make your network work.



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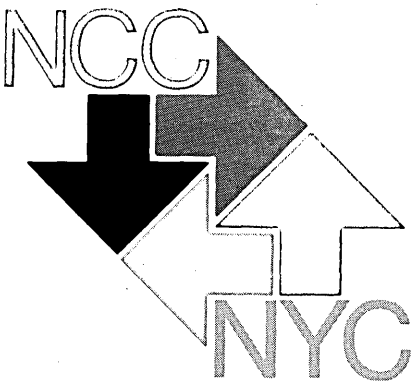


Conference Particulars

by Janet Eyler
Assistant Editor

It's all-eggs-in-one-basket time as the American Federation of Information Processing Societies, making a "total commitment . . . to create a major forum for the entire data processing community," presents the first annual National Computer Conference & Exposition the week of June 4 in New York City. The NCC supersedes the AFIPS-sponsored Spring and Fall Joint Computer Conferences that have been with us for more than 20 years.

The 1973 NCC&E features over 90 technical sessions, more than 200 vendors exhibiting in some 700 booths, three special addresses, two receptions, a science film theater, a computer art exhibit, and a high school computer science fair. Really big.

Technical program

The program is divided into three parts, one of which is labeled Methods & Applications; the other, Science & Technology; and the third, Special Program. Overall, this looks like the best organized and highest quality technical program we've ever seen at an AFIPS bash.

Methods & Applications includes approximately 35 sessions covering installation management, government, industry, merchandising, and general topics. Most of these sessions are in panel format and will not be reported in the *Proceedings*.

Science & Technology features approximately 50 sessions on communications, networking, and terminals; computer architecture and hardware; information processing and pattern recognition; management topics; education; simulation and process control; software; and the computing community. Included in the Science & Technology program are sessions sponsored by each of the 13 AFIPS constituent societies and a "Day of Graphics," reporting on significant achievements in the important man-machine interface of computer graphics. Two-thirds of these sessions are panel or paper/panel discussions receiving limited coverage in the *Proceedings*.

Sessions in the Special Program include a full day of "The Computer Arts" and a day-and-a-half special registration (read $40) seminar Thursday and Friday on "Managing the Impact of Generalized Data Bases." Other special sessions are the "Economic Future of the Data Processing Industry," "Computer Technology as a Public Resource," "Venture Capital for the Computer Industry," "Outlook and Prospects for Marketing Abroad," and "Career Development for Computer Professionals."

See the "Session Summaries" segment of this section for invited essays contributed by the Methods & Applications and Science & Technology session chairmen, and check the "Conference at a Glance" chart for an overview of the entire technical program.

Vendor exhibits

Exhibits at the New York Coliseum by more than 200 hardware, software, and services vendors will be open all five days of the conference: Monday, noon to 8 p.m.; Tuesday through Thursday from 10 a.m. to 6 p.m.; and Friday, 9 a.m. to noon.

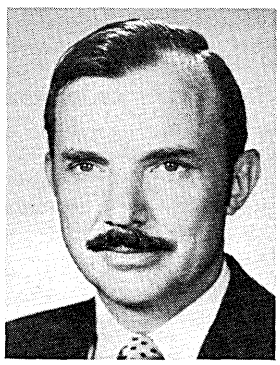
Looks as if the hardware exhibits will be pretty evenly split between oem and end-user products, with the emphasis on computer systems (we hear most of the mainframers will be back after a couple of years' absence from the JCC's, including IBM), peripherals, terminals, and communications products ranging from modems to large-scale line concentrators. The "Product Preview" segment of this section describes approximately 40 products being introduced to the public for the first time at 73 NCC.

Special events

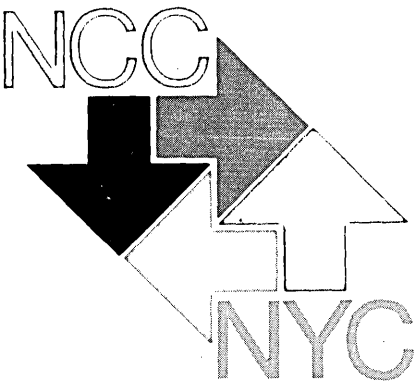
In addition to the Monday morning keynote session, whose speaker was not yet announced at press time, there will be two special luncheon addresses. On Wednesday at the Americana, Dr. Lewis M. Branscomb, vice president

Dr. HARVEY L. GARNER, Director and Professor of The Moore School of Electrical Engineering, Univ. of Pennsylvania, is serving as General Chairman of 73 NCC.

EDWARD N. COLE, President and Chief Operating Officer of General Motors, will connect the computer and automotive industries at the Industry Luncheon in a speech entitled "Common Language and Common Future."



Conference Luncheon speaker is Dr. LEWIS M. BRANSCOMB, Vice President and Chief Scientist, IBM Corp. His topic: "The Doomsayers and Human Destiny."



The Sessions

For Those Attending NCC

The day of each session is noted in parentheses at the end of each session summary. If a session interests you, check your program booklet for the list of participants and the exact time and location.

For Those Not Attending NCC

These short tutorials, written by the various session chairmen, cover a wide variety of computer applications and technology and have been edited as general-interest summaries.

Information Science and Technology From a Global Viewpoint

This panel session, sponsored by ASIS, will provide the audience an insight into the areas of activities of concern to members of ASIS in information science and technology (IST). The panel members will consider the impact and implications of the following from the viewpoint of an operator of an information analysis center and other document processing activities, an industrial information scientist, a representative of the library community, and a representative of the government:

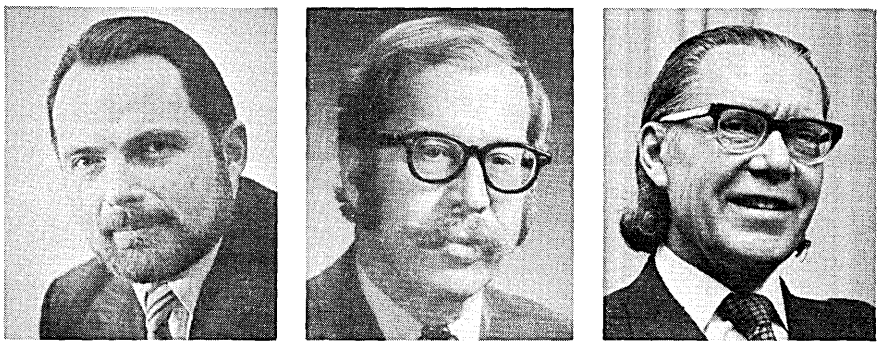
1. Most scientific and technical information systems are working at increasingly unacceptable levels of cost and performance.
2. Most decision makers are making decisions with a decreasing proportion of the information that exists but is not available at the time of decision making.
3. The United States is rapidly emerging from the existing industrial society organized primarily around technology and its use for the production of goods into a postindustrial society organized around information and its utilization.
4. Computing power capacity is going up 25% per year while the costs are going down 25% per year.
5. A sharper delineation is developing between the methodology and equipment required by acquisition, reduction to storage media (print, microform, or machine-readable), and retrieval of information.
6. Effective and economical direct control, access, and utilization of large information banks are rapidly becoming feasible through the use of microfiche, computer terminals, and networks.
7. In terms of information transfer, there is a dramatic increase of the quantity of information being transferred and a collapse of time and distance through technology advancement.
8. The human brain can only absorb information at a finite rate. The information production, transfer, storage, and re-

Particulars

and chief scientist of IBM, will address the Conference Luncheon on "The Doomsayers and Human Destiny." A special Industry Luncheon on Thursday at the Hilton features Edward N. Cole, president of General Motors, who will connect the computer and automotive industries in a talk entitled "Common Language and Common Future."

Outside the center ring, conferees can attend three other events of the Special Program. One is the Science Film Theater, a regular feature of past JCC's, which will run continuously during the conference, from 2-5 p.m. on Monday; 11 a.m. through 5 p.m. on Tuesday, Wednesday, and Thursday; and from 10 a.m. till noon on Friday. A new feature of NCC is a High School Computer Science Fair where both hardware and software projects will be displayed on Monday from noon to 6 p.m. and on Tuesday from 8:30 a.m. to 6 p.m. A third special event is the computer art exhibition of the U.S. branch of the Computer Arts Society. This display will be open during the same hours as the vendor exhibits.

The two no-host conference receptions will be held—Tuesday evening at the Americana and Thursday evening at the Hilton at 6 p.m.



NCC PROGRAM CHAIRMEN: The Special Program is directed by Dr. CHARLES V. FREIMAN (left), Manager, Systems Development, IBM Research Center, Yorktown Heights, N.Y. ROBERT W. BEMER (center), Staff Consultant to the Vice President of Advanced Systems and Technology, Honeywell Information Systems Inc., Phoenix, heads the Methods & Applications Program. Chairman of the Science & Technology Program is Dr. CARL HAMMER (right), Director of Computer Sciences for Univac.

Registration

Now that you realize you dare not miss this Great Event, here are a few words on registration fees. (Advance registration, which is $10 less for AFIPS constituent society members, closes May 15; the fee schedule given here is for registration at NCC.) Full five-day registration for the technical program and the exhibits is $60, including the 1,000-page *Proceedings*. Single-day registration is $20. Student registration is $5. Exhibits-only registration fees are $15 for five days and $5 for one day.

For further program, registration, or housing information, write AFIPS, 210 Summit Ave., Montvale, NJ 07645. If you're in a rush, call (toll-free) 800/631-7070 (in New Jersey, 201/391-9810). □

trieval must be dramatically improved in view of this human limitation.

9. The relative costs of the new on-line information retrieval systems ($10-40 per query) is significantly lower than the traditional manual or computer batch processing systems ($40-100 per query). In addition, the quality of the answer and speed of response are dramatically improved. You get more of what you want and less of what you don't want immediately and at lower cost. (Mon. p.m.)

—Robert M. Landau
Science Information Assn.
Washington, D.C.

Legal Protection for Software

Software: Do you patent it? Copyright it? Protect it by trade secrets? Or what? Last November, the Supreme Court decided that a specific program was not patentable. Two patent lawyers who were intimately involved with this case will be on the platform. Elmer W. Galbi, patent counsel for IBM's Systems Development Div. has been very active in opposing software patents and is the author of the IBM Registration proposal filed with the Patent Office some years ago. William L. Keefauver runs the Patent Dept. of Bell Telephone Laboratories, assignee of Benson and Tabbott's patent application.

Morton David Goldberg, a New York attorney who has frequently written on copyright protection for software will talk about this aspect; Mr. Galbi will probably discuss why IBM has opted for this form of software protection.

Roger Milgrim, the author of a leading treatise on trade secrets and General Counsel of SHARE, will round out the panel, while the moderator will talk about some of the contractual problems involved in giving software developers legal protection for their product. (Mon. p.m.)

—Robert P. Bigelow
Attorney at Law
Boston, Mass.

Voice Answerback Comes of Age

Voice answerback has been a reality since 1960. Over the years it has grown to well over 200 systems installed in the United States. The tool is probably the least understood of all computer applications.

It is a system that is made up of three parts; a terminal, a computer, and a voice-answerback unit. The system is at its best when it functions in the role of (1) prompting the user, (2) auditing and editing the user's input, or (3) in confidence, calling the user's attention to error and guiding the user to a correct entry.

The first component of the system, the terminal (touch-tone telephone), is probably the most tested. It resulted from the greatest totally human factors-oriented effort yet to be applied to the development of a terminal. So extensive was this that it would more than total the research effort of all other terminals put together. The terminal is used by more people everyday from all walks of life than all other terminals combined.

It is the intent of this session to develop a background to verify the fact that this concept, above all others, is the prime example of "Ordinary Mortals Using Computers Without Pain."

This session will permit the audience to hear the developers' descriptions of applications ranging from kindergarten children using the system in conversational mode to skilled users in the complex application of production control and operation of a stacker crane automated warehouse. The presentation will cover a range from stand-alone to subsystem and as data entry to information and control.

The applications selected and demonstrated cover a broad spectrum and show the capability for user satisfaction with little or no training.

Voice answerback units from Cognitronics, IBM, Periphonics, and Wavetek will be presented live from the speaker's data processing installation.

A lively question-and-answer period is expected. Look for participation by Bell System Laboratory, City National Bank of Bridgeport Conn., Emery Air Freight, Honda of America, Rohr Industries, South Western Bell Telephone, and Western Electric. (Mon. p.m.)

—T. C. Fisher
IBM Corp.
Los Angeles, Calif.

Intelligent Terminals

Intelligent terminals are those which, by means of stored logic, are able to perform some processing on data which passes through them to or from the computer systems to which they are connected. Such terminals may vary widely in the complexity of the processing which they are capable of performing. The spectrum ranges from limited-capability point-of-sale terminals through moderately intelligent text-oriented terminals up to powerful interactive graphics terminals. The common thread that ties all these types of terminals together is their processing power—and the questions relating to it.

What, for example, is the proper or most efficient division of labor between the terminals and the central computer? What are the limits, if any, to the power which can be provided in such terminals? Need we worry about the "wheel of reincarnation" syndrome in which additional processing power is continually added to a terminal until it becomes free-standing . . . and then terminals are connected to it?

This session was planned to at least expose to critical discussion some of these questions, if not answer them. Three papers will be given covering three regions of the spectrum identified above. The session is billed as a panel session, and three panelists have been invited to represent roughly the same regions on the intelligent terminal spectrum as the three authors.

It is, of course, impossible to report in advance on the panel discussion, of which audience participation will be a large part. The position papers raise many of the issues that I expect will be discussed. Perhaps some means can be found to report on any new points or insights gleaned from the discussion. In addition, all of the work is ongoing, and all of the authors (and the chairman) welcome further discussion beyond the confines of the conference. For further readings, see the Chairman's Introduction (in the *Proceedings*) which will include a bibliography of articles dealing with intelligent terminals. (Mon. p.m.)

—Ira W. Cotton
National Bureau of Standards
Washington, D.C.

Regulation of the Computer/ Communications Industry

This session will consider the final results of the FCC's computer inquiry which started in November 1966 and ended with a court decision on February 1 of this year, generally affirming the commission's position. The scope of regulation of data processing, communications, and hybrid services in between will undoubtedly be discussed by the panel, which includes Bernard Strassburg, Chief of the Common Carrier Bureau of the commission.

Interconnection of customer-owned equipment with the telephone system will probably also be discussed by Mr. Strassburg, who will be joined on the platform by George Ashley, an attorney concerned with regulatory matters for the Bell System for many years and on June 1 becomes the General Counsel for the New York Telephone Co. The economic aspects of communications—integration, interrelationship, and monopoly—will be considered by William Melody, a well-known economist in the communications field and associate professor at the Annenburg School of Communications at the Univ. of Pennsylvania.

Dan L. McGurk, president of the Computer Industry Assn. and formerly president of Xerox Data Systems, will probably discuss the activities of his organization and the antitrust suits won, lost, settled, and pending. Mr. McGurk may also cover the problems of peripheral manufacturers.

Commentary on the panelists' positions will be given by Lee Loevinger, currently a practicing lawyer in Washington, formerly a member of the Federal Communications Commission and before that the Assistant United States Attorney General in charge of the Antitrust Div. (Mon. p.m.)

—Robert P. Bigelow
Attorney at Law
Boston, Mass.

Computer Use Around the World

This panel is aimed at giving the attendee a quantitative view of the degree of computer usage in key areas of the world.

Speaking about the European scene will be Hans Gassmann of the Organization for International Co-Operation and Development in Paris, who, for the last several years, has been involved in studies of the use of computers in OECD member

countries. Japan will be represented by Shohei Kurita of the Research Department of the Japan Electronic Computer Company (JECC). In addition to handling the leasing of most computers built and sold in Japan, JECC has for the past several years conducted detailed studies of where and how computers are being used in Japan. The Soviet computer scene will be discussed by Barry Boehm of The Rand Corp., who will draw upon the continuing studies of Rand on Soviet cybernetics. The chairman, Bruce Gilchrist of AFIPS, will contribute data on the United States position. It is expected that attendees from various parts of the world will also contribute facts and figures on computers in their countries.

By the end of the session it is hoped that the attendees will have gained a broad constructive overview of computer use around the world. Although facts and figures will be emphasized, this will be done only to the extent necessary to provide a broad perspective. It is hoped that the attendee who wishes to subsequently find out more information about a particular country will have been given sufficient background and information about where appropriate data is available that he will be pointed in the right direction.

There are well over 100 countries in the world, and almost every one of them uses computers. The panel aims to "tell you all it can about computers in the world" in two hours. (Mon. p.m.)

—Bruce Gilchrist
AFIPS
Montvale, N.J.

Conversion Problems

The majority of DATAMATION readers have or are acquainted with someone who has experienced conversion problems. The range of the problems covers the spectrum from frustrating through amusing to sad.

The theme of the conversion panel is not only to look at software and hardware as intregal members of the conversion package, but to add man into the system. Training, attitudes, and approaches of managers, programmers, operators, and users must be considered and included in the conversion systems' design.

The panel members each have had experience with problems generated by conversion of one system to another and hopefully will include possible remedies based on their experiences. It is hoped that the attendees will participate in the forum discussion in order to highlight the need for standardization, the pitfalls generated by conversion, and alternative solutions to conversion problems. If the discussions are fruitful, they can serve as a basis for follow-on sessions along the areas deemed most promising.

This session was engendered by the belief that support can now be generated to effect solutions to the problems we have dealt with or are experiencing due to lack of commonality. Let us hope that a better understanding of the methodology needed to solve conversion problems will result.

Specific topics to be discussed by the participants range from a case study of a government procurement of an unspecified system to Southern Railway's successful conversion using parallel operation. Other topics include use of multisystems and problems stemming from system changes to take advantage of technological advancements or more complex utilization and application requirements. (Mon. p.m.)

—Bonnie W. Dunning
U.S. Army Military Personnel Center
Alexandria, Va.

Retail Industry

The railroad was not the first effective use of the steam engine, but steam railroading did have a most profound effect on our country. Likewise, the retail industry was not the first sophisticated computer user, but may well profoundly direct the course of computer utilization. Effective solutions to the problems facing the information systems segment of the retail industry will help guide the course of the data processing industry. The effects of these systems will be felt by us all in two ways: (1) as computer professionals, and (2) as consumers.

As computer professionals, each of us can utilize the implementation principle, design principles, and equipment which can produce effective systems where constraints are severe. For example, in the retail industry, where the profit on an item such as a can of beans might be ½¢, the cost for recording a transaction must be minuscule. Likewise, the transaction volumes are high. Nearly 30 billion packages of cigarettes alone were sold in 1972. In addition, the information collection and distribution points are often small and scattered geographically.

As consumers, we are in direct contact with successful, and faulty, retail systems. This is one industry where the data processing department has as much visibility to the customer as the sales department.

The retail industry sessions—"Point of Sale Systems" and "Data Processing Directions in the Retail Industry"—will be presented by some of the most knowledgeable people in the industry on retail systems and equipment and will provide some insight into what is happening and what can happen in data processing in the retail industry. (Mon. p.m.)

—Richard K. Hampson
Data Technology Industries
Riverdale, Md.

Performance Evaluation and Measurement

Computer System measurement and performance evaluation is currently one of the hot topics in the computer field. As in most such cases, there is a great deal of benefit to be gained, a great deal of overselling and wasted effort, and a great deal of confusion about what leads to which. This session will attempt to reduce this confusion by providing a forum for discussing the technical results of the recent ACM/NBS Workshop on Computer System Performance Evaluation. In this workshop, about 25 outstanding representatives of industry, business, government, and universities met for three days of structured discussion on topics such as:

Objectives and criteria for performance evaluation and their variation with respect to end-use area and level of management concern;

Capabilities and limitations of hardware, software, observational and statistical techniques in providing and analyzing data relevant to the objectives and criteria above;

Interactions between the objectives and techniques of performance evaluation with those of complementary pursuits such as system design, validation, reliability, and data security and privacy assurance;

Appropriate activities for improving performance evaluation capabilities and procedures by means of standards, research and development, education and training, and professional society activities.

Panelists will summarize the points of substantial agreement and disagreement reached during the workshop and provide an opportunity for members of the audience to discuss the results. (Tues. a.m.)

—Barry W. Boehm
The Rand Corp.
Santa Monica, Calif.

Information Science—Promises, Realities, and Futures

To what degree is information and its technology contributing to the learning process? How accurately can information be provided to research personnel and how quickly? Is available information being used to enhance the quality of life?

Information retrieval systems developed so far have not been very innovative. During the automation phase, all of the shortcomings of the manual systems were carried over. In response to users' queries, the systems provide them with surrogates like citations or abstracts. Based on the surrogates the scientists predicts which documents from that set are relevant to him, and he proceeds to acquire them. Even the full documents are no more than surrogates. The user wants information, and we give him documents which hopefully contain this information. He must read the document to ascertain whether indeed it does, or does not contain the information he wants.

Were the system able to supply him with the information he wants, it would not be necessary for him to read the entire document, or possibly several documents. This is so because our so-called information retrieval systems are in fact bibliography-producing systems, and what we store is not meaningful information, but documents. Instead of storing results

of an experiment, we should be storing the method of experiment with the range and frequency of variation of each parameter. The system should be able to regenerate the results of the experiment on demand. Present-day information retrieval systems are addressing themselves to the wrong problem. People want information; we give them documents. Information systems should regenerate information instead of retrieving it.

The panel is concerned with what is being done today and what we should be doing during the next 5-10 years. It must specify why we are not doing it today and perhaps identify or isolate the research and/or development needed to get there. For example, one of the major problems in our society is education. A large percentage of our GNP goes into education. Can we enhance the learning process using information technology? Will information technologies help learning? These and related questions will be explored by the panelists. (Tues. a.m.)

—Jack Belzer
University of Pittsburgh
Pittsburgh, Pa.

Environmental Quality and the Computer

The environment is a large and broad-based system of cause-and-effect relationships. A seemingly minor action at one point in the system might very well precipitate destructive consequences; yet, at the same time, simple actions can spark vast improvements. It is only when those trends, processes, activities, and policies which may have either a deleterious or more beneficial future effect on the environment are well understood that proper actions may be taken to achieve meaningful improvements in environmental quality. The complexities and interactions involved in environmental quality are of such magnitude and scope that effective use of the computer provides a significant opportunity to enhance our comprehension and management of the environment.

This opportunity takes many varied forms, and it encompasses all the conceivable applications of the computer. At one end of the spectrum are applications of models and complex simulations of the total environment, useful to planners and policy makers at the highest level. The only theoretical limitation to this type of application appears to be the human ability (or inability) to replicate the real world and thus project or forecast the future.

At the middle point of the spectrum are applications of the computer concerned with modeling specific functions of environmental quality, such as measuring air pollution or river basins, or simulating noise, etc. Automated systems continue to be developed to aid engineers and others attempting to set standards and monitor progress.

Perhaps the largest area of application involves the collection, storage, manipulation, and retrieval of environmental data. Virtually all actions under consideration for improving the environment require substantial data for evaluation. And monitoring of the environment has become a necessity for quality. Environmental information systems are relatively new applications, but the needs for "good" data continue to expand.

These types of applications will be explored by this panel. Papers will be discussed on models and information systems, and the panelists will project the future needs and opportunities at all levels for new systems and applications in the area of environmental quality.

The environment belongs to all of us. As computer professionals, we should focus our talents and abilities wherever possible toward enhancing the quality of our environment. Technology has a role—it is up to us to identify, promote, and help solve the important problems of society. (Tues. a.m.)

—Peter W. House
U.S. Environmental Protection Agency
Washington, D.C.

Graphics Applications for the Garment Industry

About 50% of the cost of a garment is in the cloth or piece goods. With this high percentage in mind, it appears curious that so little attention has been devoted to the pattern marking and cutting areas of the garment industry over the years.

However, this attitude appears to be changing, and a revolution in these areas is occurring.

This revolution really started about 10 years ago when IBM first announced a computerized pattern grading software package. However, it was not until 1967 that the momentum picked up with the availability of a drafting system which could actually cut graded patterns for the industry. In 1970 several firms announced automatic systems for the automatic cutting of cloth. And finally, within the past year, electronic marker making through the utilization of a crt on-line with edp equipment became a reality and closed the technological gap in this segment of the garment industry.

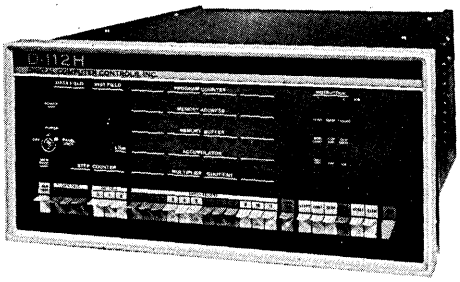
So what does the industry have available today with respect to tools which can be used to increase productivity in the pattern, marking, and cutting rooms? Today systems are available which integrate computerized pattern grading, electronic marker making, and automated cloth cutting for most segments of the industry. It is these three prime areas with which the NCC program will be concerned. It is believed that greater attention should be given to these important areas by the garment manufacturers in order to be able to compete effectively with the worldwide markets.

Through the utilization of these new techniques there are a number of advantages inherent for the garment manufacturer. First and foremost is the possible savings of piece goods by constructing markers which will yield greater cloth utilization. Also important is the reduction of the manufacturing cycle from the design of the garment through the cutting of the cloth which will permit the manufacturer to remain current with the style

Which company da

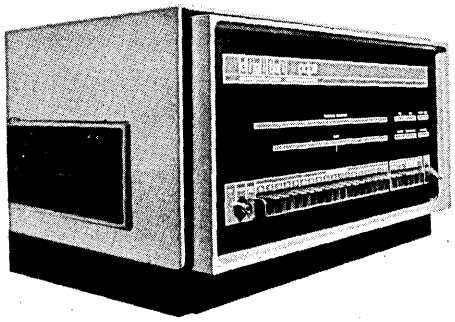
Digital Equipment Corp.
Model: PDP-8E
Price with 4K memory (list): $4,490
Speed (Cycle Time): 1200ns
Storage Capacity: 32K words
Word Size: 12 bits
DMA (Standard): yes
Input/Output slots: 3

CIRCLE 159 ON READER CARD



Digital Computer Controls Inc.
Model: D-112H
Price with 4K memory (list): $4,095
Speed (Cycle Time): 900ns
Storage Capacity: 32K
Word Size: 12 bits
DMA (Standard): yes
Input/Output slots: 7

CIRCLE 160 ON READER CARD



Digital Equipment Corp.
Model: PDP-11/15
Price with 4K memory (list): $6,000
Speed (Cycle Time): 900ns
Storage Capacity: 32K words
Word Size: 16 bits
DMA (Standard): yes
Input/Output slots: 3

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We are not signing this ad, because we want you to be the judge.

We ask you to apply your computer expertise. Read the above specs. And tell us which of the six minicomputers offers the best combination of capabilities and advantages, including price.

Let's face it. These are all good minicomputers made by reliable companies. But we are confident enough in our product and your discernment to ask you to make the evaluation.

To participate in the voting, circle the one

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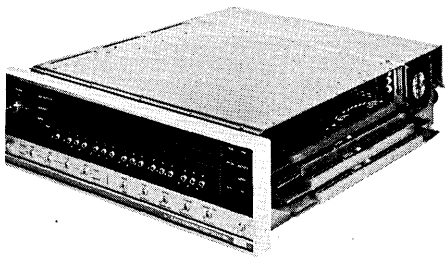

Data General
Model: Nova 1210
Price with 4K memory (list): $4,000
Speed (Cycle Time): 1200ns
Storage Capacity: 32K
Word Size: 16 bits
DMA (Standard): yes
Input/Output slots: 4
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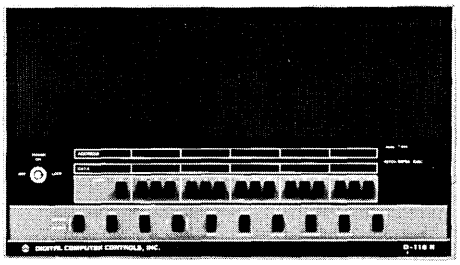
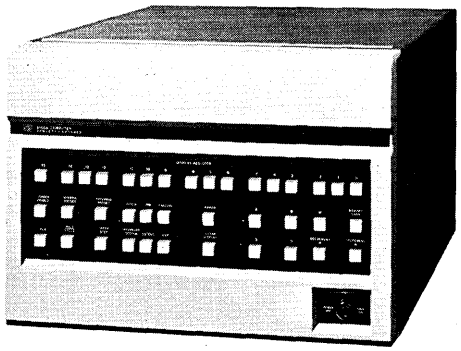


Digital Computer Controls Inc.
Model: D-116H
Price with 4K memory (list): $4,000
Speed (Cycle Time): 960ns
Storage Capacity: 32K
Word Size: 16 bits
DMA (Standard): yes
Input/Output slots: 7
CIRCLE 163 ON READER CARD



Hewlett-Packard
Model: HP-2100A
Price with 4K memory (list): $7,200
Speed (Cycle Time): 960ns
Storage Capacity: 32K
Word Size: 16 bits
DMA (Standard): yes
Input/Output slots: 14
CIRCLE 164 ON READER CARD

number on the reader service card which indicates your choice. If you pick our computer, we will send you a small gift attesting to your expertise, plus a comparative spec sheet. If you don't pick us, we'll tell you who we are and send you the spec sheet with our compliments.

The name of our computer company will also be published in a later issue.

Remember, to cast your vote, circle only one of the six numbers on the reader service card. The publisher will process and validate the returns. Good luck! The Unlisted Computer Company.

or fashion aspect of the business. Thirdly is the reduction in the number of operating personnel required for these operations. (Tues. p.m.)

—Fenton L. Gilbert
Graphical Technology Corp.
Long Island City, N.Y.

Information Networks —International Communications Systems

International communications are being enhanced by information networks which are broader in scope and service, more viable and efficient. The value of national networks is already known, but the full impact of international networks has not yet been realized. The Special Libraries Assn. will present a forum for the discussion of national and international information networks operating in several countries and demonstrating the utilization and transfer of information within national borders and across international boundaries.

Dr. Jack E. Brown of the National Science Library, National Research Council of Canada will conduct the forum and present a paper entitled "A National Scientific and Technical Information System in Canada." Dr. Kjell Samuelson of the Royal Institute of Technology, Stockholm, Sweden, will talk about "Global Networks for Information, Commerce and Computers." Dr. G. S. Martini of the Dag Hammerskjold Library, United Nations, will discuss the "Computer-Assisted Indexing Programme of the United Nations." Miss Natalya Tyulina, Director of the United Nations Library, will present a paper for Dr. Oggan Chubarian, Deputy Director of the Lenin Library in Moscow in which he will discuss network systems in the USSR. (Tues. p.m.)

—Betty Boyd Brociner
MIT Lincoln Laboratory
Lexington, Mass.

Manufacturing Automation

There now exist significant manufacturing facilities in which essentially all operations are directly tied to a real-time information and control system. These facilities are not "totally automated," nor should they be. But operations as complex as the manufacture of disc brake assemblies are current examples of such systems. On the other hand, managers of complex job-shop operations often have only batch-printed listings to aid them in the dynamic control of their resources, due primarily to a lack of flexibility in present software systems; those systems are unable to cope adequately with the dynamic job-shop environment.

The presentations and panel discussion in this session are meant to get answers to some important questions: What hardware and software is available today for computer control of manufacturing operations? What are the shortcomings of existing systems, and what needs are not currently being met? What important developments can be expected?

The panel assembled for this session contains key representatives of three important groups: managers with line responsibility for manufacturing operations —the users of automation technology— who must assess the expected return on investment for new technological applications; suppliers of components of state-of-the-art computer-based manufacturing systems; researchers in computer-based manufacturing technologies that are expected to have a major impact in the future.

The session will consist of four invited presentations, followed by a panel discussion with audience participation. (Tues. p.m.)

—Robert H. Anderson
USC Information
Sciences Institute
Marina del Rey, Calif.

Computers in Congress

The Congress of the United States—the source of national policy touching the lives of more than 200 million Americans, as well as countless others abroad—the dispenser of more than $250 billion annually—and yet, almost untouched by the vast increase in data processing potential that has become an everyday reality in business, industry, and even the Executive Branch of the federal government during the past quarter century. Congress has appropriated billions for space and defense research that has wound up pushing computer development. In more direct terms, Congress has provided the Executive Branch of the federal government with more than 5,000 computers, many of which handle problems far more complex and closer to the cutting edge of the computer art than systems that could be of immeasurable assistance to the Congress in the assessment of data flowing through the substantive legislative process. Ultimately, Congress will fully exploit computers, or inevitably lose its effectiveness as the key element of democracy in the structure of our federal government. The question today is when and how we can bring computers to the Congress.

This two-hour session will outline plans and programs now under way to use computers in the Congress. The effort will be to reveal some of the difficult policy and management problems, as well as those of a technical nature, that confront the Congress in the modernization of legislative informational systems. Those attending the session will learn, firsthand, what is being done, as well as what is *not* being done, and ask questions of those directly responsible for systems implementation.

The budget and appropriations process, the reference output of the Congressional Research Service, a bill status system (in other words, a legislative management information system, although there is no single management structure in the Congress), the use of computers in the offices of individual Congressmen and Senators: these are the most obvious computer applications at some stage in planning or implementation.

The cluster of congressional systems covering these and other applications must be developed on a modular basis, but will undoubtedly merge into one system—the most important in the free world. "Computer System Number One of the Western World" is of obvious importance to everyone; but, the success of the implementation of this system is the responsibility of the computer community of the nation as a whole—not simply the congressional officials and staff members charged directly with this responsibility.

At a time of fiscal crisis, even a modest improvement in the budget and appropriations system could save billions. One per cent of $250 billion is $2.5 billion—and it is reasonable to expect computers to do much better than that, not to mention the benefits of better and more timely information to all aspects of the legislative process, in the establishment and extension of federal programs, the assessment of our tax laws, and in auditing the economy and efficiency of government operations.

Every facet of business and industry in America will be affected by the application of computers to the Congress—reason enough for anyone attending the conference to attend this session. And, of course, Congress will spend countless millions to maintain and constantly improve its computer capacity during the years to come. To those attending the conference that are in the computer business, there is also the opportunity to directly participate—there is money to be made. (Tues. p.m.)

—Ernest C. Baynard
Alexandria, Va.

Automated Project Management Systems

Project management systems, organized means of planning and controlling major efforts in corporate and governmental fields of endeavor, were introduced many years ago. The project was treated as a special function within the organization—an unusual effort, large in scope, and requiring something more than traditional management in order to succeed. Early, manual project management systems were difficult to administer and cumbersome because of the manpower requirements they generated. This difficulty led to the abandonment of many of these systems completely, or, more dangerously, to the utilization of the systems solely for the purposes of the planning function without subsequent managerial control emanating from the plan and progress monitoring data.

Abandonment of systems for project management and disillusion with the results of their use because of improper management and control in the post planning phase left a temporary void in the arsenal of management tools. However, with the application of computer technology to project management systems, the manpower requirements have diminished and the responsiveness of the systems to the information requirements of

management has increased dramatically. A new era of automated project management systems has begun.

This session explores the automated project management system field as it changes today to react positively to the requirements of management. The use of graphics generated by the computer is one aspect featured in the session. The development of techniques for resource allocation and utilization monitoring is also to be discussed in some detail. Finally, one or more of the most advanced of these systems will be presented and discussed in depth. The session is not devoted to PERT (Program Evaluation and Review Technique) and CPM (Critical Path Method) as they were developed in the 1950s. Rather, it goes far beyond these first automated systems in considering the state of the art some 17-20 years after their creation. (Tues. p.m.)

—Ira Bitz
Consultant
Chevy Chase, Md.

Technical Information Dissemination Networks

The science information community for a number of years has been concerned with the problem of the transfer of knowledge and information. Many recent developments both in terms of computer hardware, software, and communications, and information science, much of which has been supported by federal agencies such as the National Science Foundation, make the development of a national science information network both feasible and practical. The panel discussion will address the topic of networking from three directions. First, the notion of a national science information network will be discussed in relation to existing information processing centers established throughout the U.S. with NSF support. Secondly, the problems of interfacing such information systems will be addressed from a software perspective. And finally, a description of some new communications developments which could contribute to the effectiveness of such a network will be presented. Audience participation in the form of questions to the panel will be encouraged. (Tues. p.m.)

—Andrew J. Kasarda
Lehigh University
Bethlehem, Pa.

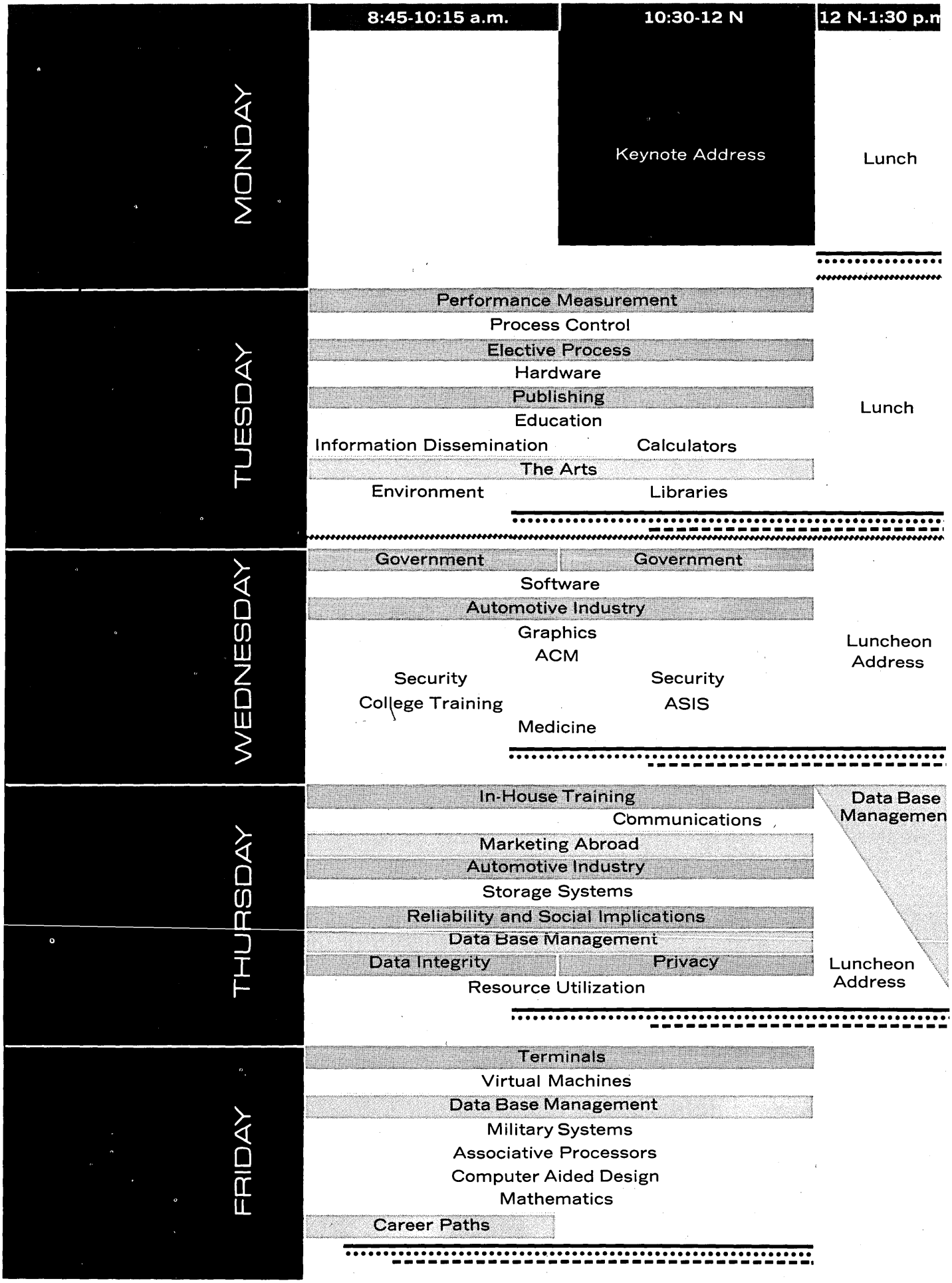
Academic Computing at the Junior/ Community College

This is a topic that has been long neglected, swept under the rug, so to speak, in computing circles. The diversity of computer education programs at the two-year level has been a two-fold opportunity. It has meant freedom to experiment in some cases, and has resulted in chaos in others.

The program will start with a brief presentation by several of the speakers

(Continued on page 159)
(Conference at a Glance next page)

THE CONFERENCE



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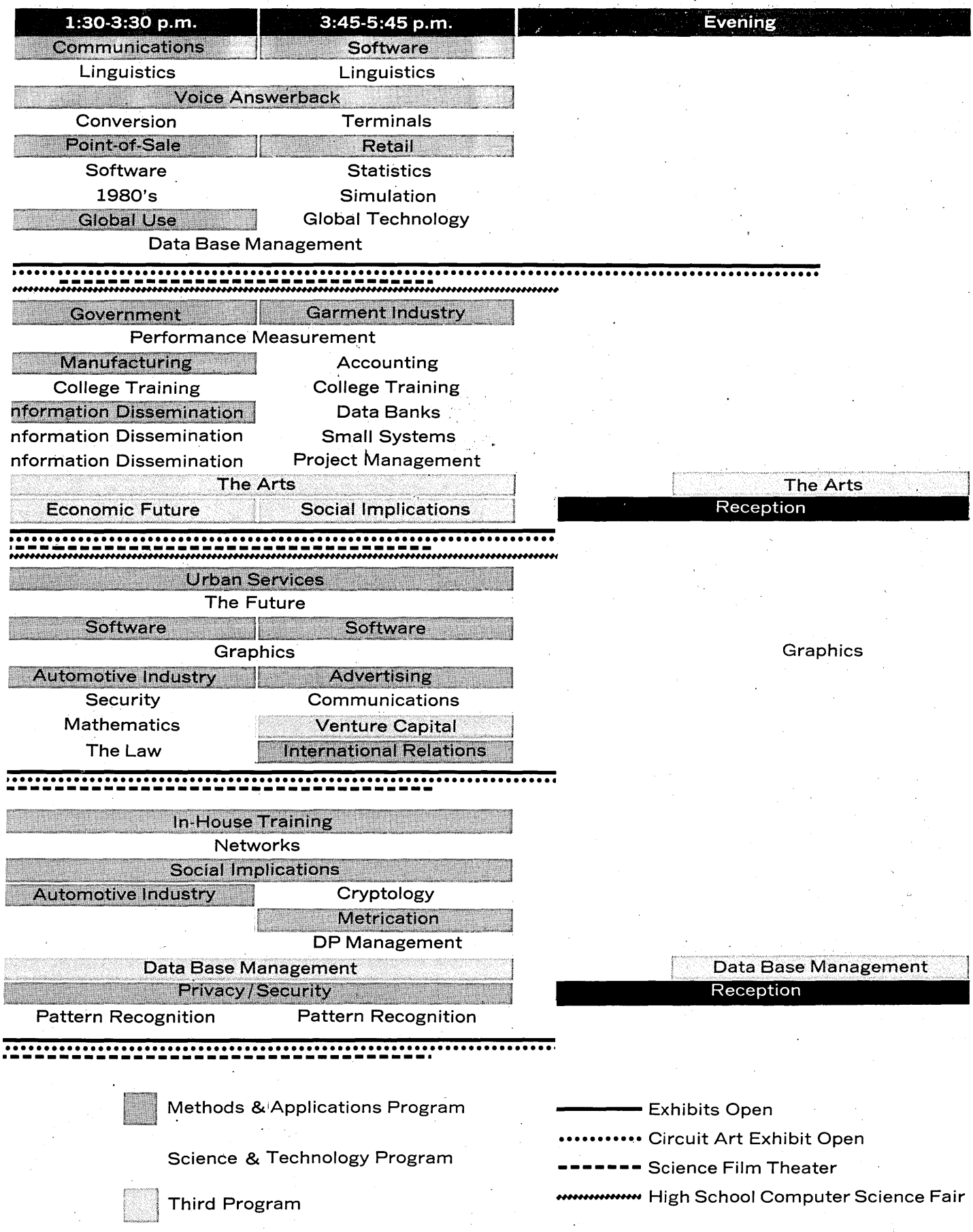
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Data Base Management
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Garment Industry
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College Training
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The Arts
The Arts
Economic Future
Social Implications
Reception
Urban Services
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Graphics
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Automotive Industry
Advertising
Security
Communications
Mathematics
Venture Capital
The Law
International Relations
In-House Training
Networks
Social Implications
Automotive Industry
Cryptology
Metrication
DP Management
Data Base Management
Data Base Management
Privacy/Security
Reception
Pattern Recognition
Pattern Recognition
Methods & Applications Program
Science & Technology Program
Third Program
Exhibits Open
Circuit Art Exhibit Open
Science Film Theater
High School Computer Science Fair

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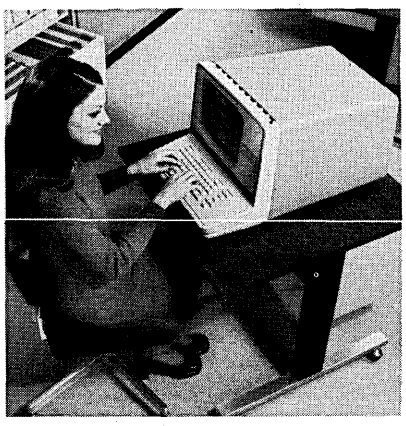
As a manager, how can you organize your operations to get the highest productivity from the people and machines that use these media? And, if you are adding such things as microfilm, microfiche, word processing equipment, terminals and computer reports; how can you create storage systems and work station environments that will provide high efficiency, reduced worker fatigue and better housekeeping?

One thing you can do is to recognize the fact that the office furniture you've been used to all these years just can't adapt to the media explosion.



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who will explain the structure of data processing at their college. A fairly wide diversity of programs will be presented both as to academic content and to geographical location.

Following the brief explanation of several of the key programs, there will be a discussion among the panelists about several central topics concerning curriculum structure, course content, the problems of training for immediate job entry, training for transfer, and interrelationship with four-year colleges. Participants at this session will be invited not only to ask questions of the panelists, but also to take part in the discussion. (Tues. p.m.)

—Harold Joseph Highland
State Technical College
Farmingdale, N.Y.

The Growing Impact of the Mini/System

As technology decreases the size and cost of circuits, smaller systems are becoming more attractive because of their growing functional capability and decreasing costs. As more people begin to use the mini, they are learning new techniques that will help exploit its advantages. This session is designed to help us better understand the minicomputer potential by looking at various facets of the work that is taking place in industry and at universities.

Five papers will be presented at this session:

"Data Integrity and Small Real-Time Computer Systems" discusses system integrity and its importance in real-time systems. Examples used to explain the main points of the paper are based on IBM's System/7 work.

"Operating System Design Considerations for Microprogrammed Mini Computer Satellite Systems" discusses the investigations Brown Univ. undertook to arrive at the best architecture for small systems in a satellite environment.

"Computer Architecture and Instruction Set Design" discusses the design and implementation of a machine architecture from two viewpoints: first is the design of an optimal architecture for the application; second are the design considerations necessary because of hardware constraints.

"A New Minicomputer Multiprocessor for the ARPA Network" by authors from Bolt Beranek and Newman, Inc., relates their design based on a communication application that is very well defined. The knowledge of their applications allows them to define very specific tasks within the process and utilizes tasking in their design. Finally, "The Design and Implementation of a Small Scale Stack Processor System" discusses the rationale for using a stack processor, and the architectural considerations necessary for a small system to support higher level languages. (Tues. p.m.)

—Douglas B. McKay
IBM Corp.
Atlanta, Ga.

Computing and the Law: Interactions

Unlike a number of other sessions at the NCC, this session will not be devoted to presentations of legal theories regarding matters of interest to students of jurisprudence. This is a session for computer people, not lawyers, although of course, the legal eagles are welcome to attend.

The problems that will be covered are those of the technology of data processing, and how it has been used (or abused) in support of legal principles. We are not concerned with arguing that the law is wrong; we are concerned with indicating the measures within the technology that may be applied to uphold the legal principles involved.

Of course, to arrive at this position it is necessary to look at the law in a historical context recognizing that the law has traditionally lagged far behind social progress in the United States. Some have said that the law has not yet caught up with the industrial revolution of the last century and therefore will not catch up with the computer revolution in our lifetime. This may well be true, but we as computer professionals have to live with things as they are today; we cannot afford the luxury of waiting for the evolution of appropriate legal theories.

The plan for this session calls for the presentation of the current legal thinking on a number of selected topics. If the lawyers can clearly state what has to be done in a legal sense, then the computer people can at least suggest what is available (and what ought to be available) within the technology to uphold the principle involved. We are concerned with applying those technological features which would be employed by an "average edp professional" behaving "in a prudent manner"; let us exercise "reasonable caution" rather than military-style security and see where that takes us.

For those interested in this problem, a key paper has been written by Mr. L. Stich and Ms. Jean Sammet (IBM Corp.) entitled "Legal Issues Affecting Software Technology." A careful reading of this paper is recommended. It is hoped that the start made by Stich and Sammet can be extended in several directions by this session. (Wed. p.m.)

—P. H. Dorn
The Equitable Life Assurance Society of the U.S.
New York, N.Y.

A Day With Graphics

"A Day With Graphics" will feature invited and contributed papers on current applications of computer graphics, the graphics film festival, and a special evening session on three-dimensional drawings with Dr. Ivan Sutherland. These sessions will report on a few of the recent achievements and use of computer graphics in such fields as art, engineering, medicine, aerospace, education, architecture, television, and movies.

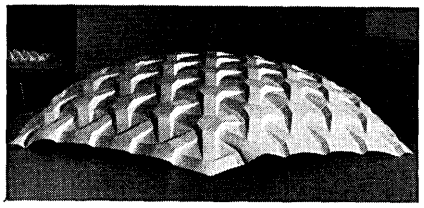
Computer graphics, through plotters, digitizers, and crt's, is a natural medium for providing input to and displaying output from computing. Most scientific and many business computer applications input, compute, and output pictorial information. Lists of data will continue to be used for accuracy and storage, but graphic representation is the growing medium for visualization and human interaction.

The cost of graphics has limited the use of graphics. Extensive hardware product development, more efficient software and system support, and appropriate applications have caused the current growth of the use of graphics. An impressive display of graphics products will be exhibited by vendors at the NCC exposition.

The technical sessions begin with a panel discussion titled "Interactive Computing—A Mind Expander," sponsored by the Society for Information Display and chaired by Carl Machover, Information Displays, Inc.

The second morning session, chaired by Jackie Potts, will include papers on graphics applications. Papers cover computer-generated color-sound movies, graphics computer-aided design in aerospace, automatic transduction of drawings into data bases, and graphics in medicine and biology.

The first afternoon session considers graphics in art, education, architecture, and electronics. In his paper "Graphics and Art," Prof. Ron Resch, Univ. of Utah, describes amazing results using graphics for the topological design of sculptural and architectural systems. An example of Resch's work is shown in the following picture.



The other papers cover an educational system based on the LOGO language, software design considerations in interactive graphics systems, recent developments in sketch recognition, and graphics in electronic circuit analysis.

The second afternoon session will be a modern "Graphics Film Festival," chaired by Jackie Potts. Animated and real-time movies from graphics are artistic, entertaining, informative, and educational. Movies are being used to simulate systems, show the results of dynamic analysis, teach, and create tv cartoons and commercials.

The evening session considers "Graphics in 3D: Sorting and the Hidden Surface Problem," chaired by Rod Allen. Dr. Ivan Sutherland of Evans and Sutherland Computer Corp. in Salt Lake City will present his new paper surveying the hidden surface algorithms. A panel tutorial on 3D graphics led by Dr. Sutherland will include Robert Sproull of Stanford Univ., Robert Schumacker of Evans and Sutherland, and others. (Wed. all day.)

—**Rodney H. Allen**
Flow Research, Inc.
Kent, Wash.

—**Jackie Potts**
Naval Ship Research
& Development Center
Bethesda, Md.

Simulation of International Relations

Simulations of international relations have taken various forms in their evolution. Some designers have favored all-machine simulations, while others lean toward varying degrees of man-machine interactions. Still others have emphasized data analysis and manipulation. Some simulations have been used for theoretical purposes, while others were designed for operational use only. This session will try to identify successes and the lack of success of past attempts to simulate various social science problems and relate these factors to international relations.

Are there unsolvable problems? Have our approaches been wrong, or is it possible that the problems are solvable, but we lack sufficient data for analysis? Perhaps the international relations discipline lacks a Guru, that other sciences appear to have, to direct the total effort. In any

event, an attempt will be made to identify various obstacles to progress and ways to solve them.

Additionally, consideration will be given to the idea of forming a confab of doers who are interested in the development of IR simulations and who could develop a plan for an approach to future efforts taking advantage of lessons learned in the past.

The organizer of the session, George L. Draper of the JCS Studies, Analysis, and Gaming Agency, with panelists Dr. Jeffrey Milstein of Yale presently on a fellowship to Dept. of State, Prof. Richard Van Atta, American Univ., and LTC William O'Leksy, an Industrial College of the Armed Forces Research Fellow, plan a probing discussion of this very important subject. This session could well lead to a methodology for a concentration of effort and the identification and definition of a network of on-going research and application. The panelists have significant experience to probe and attempt to identify solutions to this problem. (Wed. p.m.)

—George L. Draper
The Joint Chiefs of Staff
Washington, D.C.

Views of the Future

This session represents a "first of a kind" for a major computer conference. It is devoted entirely to formal technological forecasting and assessment efforts dealing with the computer industry. Technological forecasting as an autonomous discipline, with its own set of methodologies and techniques, is only about five years old. Of course, similar efforts have taken place over the years within the long-range planning staffs of most technology-oriented companies and organizations. Furthermore, the intuitive judgment of recognized experts is a technological forecasting technique that has always been with us and has been well represented at these meetings by various panel presentations.

What appears to be really new is a growing recognition of the need to examine potential futures systematically in order to assess a wide variety of concerns and potential consequences of technological development. The days of looking only for profit-related effects seem to be passing into history. Because the scope of concern has significantly widened, with an accompanying increase in the complexity of the required analyses, new approaches to forecasting have been sought.

Several of these techniques are represented in the papers of this session—Delphi, scenario construction, model building, correlation analyses, and trend extrapolation. To a large extent the contributions are of interest not only for what they have to say on the future of computers and associated technology, but also for the manner in which they arrive at their observations.

The number of technological forecasting studies dealing with computers has increased considerably in recent years. Some of these are informative primarily in telling us how not to do forecasting. We have, in fact, reached the point where some of these are old enough so that a portion of their forecasts can be evaluated for their accuracy of prediction. It appears from observing these efforts that the considerations which give the forecaster the most difficulty are not the projections of the technology itself, but rather its potential applications and interactions with the rest of society. There is a primary flaw underlying much of this earlier work; namely, an implicit tendency to view the computer field primarily as a driving force in society, while ignoring the impact of social, political, and economic forces on the computer field itself. (Wed. p.m.)

—Murray Turoff
Office of Emergency Preparedness
Washington, D.C.

Current Status and Future of Computer Software Products

Software products today are a worldwide business which is growing rapidly. By 1976, it is estimated that annual gross revenues in the U.S. alone will be well over $1 billion. This panel session will examine computer software products from both a business and marketing viewpoint.

Effectively marketing software products requires many major commitments on the part of the seller. Depending on the particular type of product, complete development could take up to 18 months or more, with profitability achieved after

three or four years on the market. Increased competition and fluctuating user requirements require that software products be continuously modified and enhanced. Changing hardware environments may obsolete a particular software product at any given time. The total investment required, therefore, is substantial, rising as high as $1 million or more in many cases. The risks involved are also significant, but so is the market potential. For example, several products to date have individually grossed well over $10 million and more than 50 products have exceeded the $1 million mark.

The number and size of software markets are rapidly expanding both domestically and internationally. These markets can easily be divided into 30-50 major submarkets and perhaps as many as 100-150 minor submarkets. Examples of such industry, or cross-industry product submarkets, include: accounting, medical, banking, insurance, brokerage, financial planning, compiler development, data management, programming aids, sorting, simulators, measurement monitors, linear programming, scheduling, information retrieval, communication monitoring, operating systems, and so on. Each of these submarkets can offer potential revenues in the millions of dollars, thereby encouraging many new firms to form over the coming years. Perhaps the evolving software products industry will eventually be likened to the appliance industry, which also has major and minor submarkets (e.g., refrigerators, stoves, radios, stereos, etc.) and which no one company dominates.

The participating panelists include representatives from a software company, a hardware company, a multinational user, and a software products marketing firm. They will review the current status of the software products industry from their individual perspectives and experiences and will present their personal forecasts of major industry trends. In addition, some of the problems facing both the buyer and seller of software products will be discussed, with audience participation encouraged. (Wed. p.m.)

—Martin A. Goetz
Applied Data Research
Princeton, N.J.

Satellite Packet Communications

The new method of using a single satellite circuit to interconnect multiple ground stations is likely to provide significant cost savings over any other method of long-haul data communications. Since their inception, satellite circuits have always been designed on a dedicated point-to-point basis, even though the capability for broadcast mode is naturally present. This procedure usually results in lower than necessary utilization of each satellite circuit and the corresponding need for many circuits, each with low utilization in order to handle many users.

However, with a single satellite channel operated in a broadcast mode, several ground stations can dynamically share a single satellite channel by transmitting at different times but on the same frequency, and by receiving on the same frequency. The transmitted information is specifically addressed to one or more of the ground stations using packet switching.

The three papers in this session will address theoretical and practical treatment of broadcast satellite communications. One paper by Dr. Roberts of ARPA discusses a specific interleaved satellite reservation system; the other papers by Prof. Leonard Kleinrock of UCLA and Prof. Norman Abramson of the Univ. of Hawaii discuss theoretically the subjects of throughput, delay, and excess capacity. There will be a brief panel discussion involving Dr. Eugene R. Cacciamani, Jr., COMSAT Labs, and Dave Walden of Bolt Beranek & Newman. (Wed. p.m.)

—Lawrence G. Roberts
ARPA
Arlington, Va.

Urban Services

This session will present advanced and exciting applications of computers to real urban problems—applications with a track record of accomplishment and impact. A city mayor and five professsionals most closely involved all describe systems now engaged in saving big-city housing, managing, understanding and personalizing welfare services, deploying firemen and police, and controlling traffic.

As is traditional, the speakers will describe some of the analyses and computer techniques that make the systems work. Perhaps more important, they will emphasize the human and organizational side: what it takes to make a system function in an urban political and social environment; what impact analysis and computers have had (and will have) on city government; what it all means for the citizens; and where we go from here. These details and insights are transferable to other cities; indeed some of the software is now or will soon be available at no or nominal cost.

In municipal government, many computer systems—including many MIS—are designed mainly to unburden, to relieve paperwork and heavy demands for routine processing. In contrast, the applications this session presents are designed for policy mediation, to influence directly the ways governments prescribe and deliver their services. (Wed. p.m.)

—Edward H. Blum
The New York City
Rand Institute
New York, N.Y.

Thursday

In-house Training– Its Management and Development

All project managers and/or systems analysts who design, develop, and implement systems which require new procedures create a "training problem." These

people either work with or are accountable themselves for designing, developing, and/or implementing the training around the new procedures.

Examples:

1. A new Demand/Deposit Accounting system may require teller training around both manual and, in the case of terminals, machine procedures. User documentation (manuals) only may not be the most efficient and effective means of information dissemination.

2. Release by a vendor of a new/revised operating system or language, etc., creates a training problem. Again, manuals may need supplementary programs to efficiently and effectively train the user of these products.

In either case, the edp function usually has some responsibility to see that this training occurs and that it is cost effective. The number and sophistication of edp in-house training units is growing and is projected to continue this growth in the '70s. These units are now faced with more than entry-level programmer, systems training—such things as: career paths, job rotation, management development, performance standards. Personnel in these units need at least three areas of expertise: data processing, training and manpower development, and the business of the company—banking, retailing, manufacturing, etc.

To date no professional organization offers a platform where problems related to all three can be dealt with. It seems timely and appropriate NCC can be a leader in meeting the need of an ever-growing fringe of the edp world.

This session will identify and discuss solutions and techniques of implementing them which address the current and future problems around developing edp personnel in both technical and managerial concerns within a data processing user organization. That is: What is the scope and function of the in-house edp education unit? What are some of their current concerns and how might these concerns be dealt with? What are the advantages and disadvantages of various presentation techniques?

The session will be composed of three panels and a workshop; it should be of specific interest to: management of training directors; edp training directors; designers, developers and implementors of edp training programs (e.g. vendors selling these programs for in-house use, project people responsible for application systems user training, and in-house training staff). (Thurs. all day.)

—**Dorothy Tucker**
Bankers Trust Co.
New York, N.Y.

Storage Systems

Memory technology has made great progress in recent years. Its cost is reduced, performance is increased, and applications widened. One excellent example is the virtual memory aspects to be discussed in this session. Four papers are on virtual storage.

T. F. Wheeler discusses an evolutional growth system—IBM OS/VS1. It addresses the new design aspects of the virtual system and their relevance to the further enhancement of new application design. Dr. Alan Scherr describes the design of IBM OS/VS2 release 2. This paper is to give some insight into the design, rather than cover individual features of the release. W. A. Schwomeyer's paper deals with the problem of verification of a virtual storage architecture on a microprogrammed computer. The fourth paper, by W. C. Hohn and P. D. Jones, discusses the Control Data STAR-100 paging station. They show how the problem in the virtual memory computer, requiring the central processor time to manage page transfers between central memory and paging devices, is solved in the CDC STAR-100 computer.

The last two papers are related to the logic function of magnetic bubble memory. Drs. Chang, Chen, and Tung talk about the realization of symmetric switching functions using magnetic bubble technology, while Eiji Yodakawa of Japan describes a mathematical model of magnetic bubble logic. (Thurs. a.m.)

—**Ben M. Y. Hsiao**
IBM Corp.
Poughkeepsie, N.Y.

Computers Are for People

Computers are supposed to be for people, but it is often hard to tell that they are. The computer state of the art has now reached a point where it is both feasible and mandatory that computers become

subservient and palatable to human users. But real people are still scared away by the psychological and physical barriers we build. We must learn more about our successes and failures in helping ordinary mortals use computers and we must design better hardware/software interfaces.

The session brings together computer scientists and other people to discuss these issues. H. Sackman will review several documented experiences where executives, scientists, students, and ghetto dwellers have attempted to use allegedly easy computer systems. A. M. Bork will describe his experience in using computers in undergraduate physics curricula. B. D. Waxman will discuss computer-based and other technological developments aimed at reducing the cost of health care, improving its quality, and increasing its accessibility. L. I. Press cautions that it is too early to build a prototype community information utility; Sackman, a proponent of building such a prototype utility, will respond.

G. F. Groner will outline user requirements for display terminals and will describe current capabilities. A. I. Wasserman will describe techniques for designing programs that anticipate any possible user actions and that minimize the changes of program and system failure. F. B. Thompson will review how specialized systems can facilitate work in particular areas. T. H. Nelson will propose a conceptual framework for man-machine everything; his multimedia presentation will be one of the highlights of the conference. The session will conclude with a panel discussion among the speakers. (Thurs. p.m.)

—G. F. Groner
The Rand Corp.
Santa Monica, Calif.

Cryptology in the Age of Automation

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Those having troubled to solve the cryptic opening may well be interested in this session. Non-solvers might benefit by reexamining their judgment of what they may regard, perhaps, as an art useless or irrelevant to their professional activities.

The current increase both in the size and the scope of computerized data banks is apparent to all in the computer field. Equally evident is the sensitivity of much of the stored data: medical histories, criminal records, credit ratings, bank balances, and so on.

Inescapably, the "dark art" of cryptography will move from the "black chambers" of government into the commercial computer-center environment. Sponsored by the American Cryptogram Assn., this session will probe, to the extent security premits, the automation of cryptotechnology.

Aspects to be discussed include the historical background; mathematical crypto-algorithms; programming techniques; and hardware design—sort of a smorgasbord for the *aficionado* with, hopefully, at least one entrée of appeal to the specialist.

The cryptology session will feature two unusual events (one, in fact, a "non-event"). The first is a demonstration by the chairman, Henry D. Ephron, the Mycenaean scholar, of the *constructive* uses of cryptanalysis. Using methods not in the "tool kit" of the average classical scholar, Ephron deciphered two ancient inscriptions known as the disk of Phaistos and the tablets of Enkomi.

The "non-event" is the absence of the usual procedure of accepting questions from the audience. The dark art has not fully emerged from the black chamber, and while the speakers have mutual trust in one another, they have a few reservations about some in the audience . . . (Thurs. p.m.)

—G. E. Mellen
Univac
St. Paul, Minn.

Data Integrity

As we enter the era of vast data bases and massive storage problems, we are becoming more concerned with the integrity of our data. The "garbage in, garbage out" truism is more true today than ever before. However, the problem of maintaining data integrity is a multidimensional problem. We are not only concerned with having the correct data in terms of content, but we should be concerned with our ability to enter, process, and maintain this integrity over time. The purpose and intent of this session will be to provide the attendees with an overview of this multidimensional problem and, at the same time, offer suggestions and possible solutions.

Four papers, each presenting a different point of view, will be presented. At the end of the session, time will be made available for audience participation and the speakers will serve as a panel for answering questions from the floor. (Thurs. p.m.)

—Milt Bryce
M. Bryce & Associates
Cincinnati, Ohio

Network Computers: Economic Considerations

Until recently little justification was needed for the construction and maintenance of network computers. Each project was viewed as a novel and noble investigation into the unknown. During such investigations, inefficiencies could be tolerated and practicality certainly was not an immediate goal. These experiments have succeeded in advacing technology, but they have also succeeded in opening a veritable Pandora's box of problems, both economic and political in nature, which appear to be much more difficult to solve than the remaining technological problems.

We propose to concern ourselves with some of the myriad of problems which are economic in nature. Our primary motiva-

tion for this choice is that computers tend to be very expensive guinea pigs and unless techniques can be found to solve these problems, the political problems may become irrelevant. The continued existence of network computers is predicated upon the ability of designers and managers to demonstrate their economic viability.

In this session, we will concern ourselves with defining considerations which must be taken into account in order for network computers to become viable commodities in the computer market place. Several software systems designed to aid resource sharing or study operating efficiency will be discussed. The use of simulation as a tool for the evaluation of network efficiency will be analyzed and a proposal for a corporate computer network will be presented. (Thurs. p.m.)

—William J. Barr
Bell Laboratories
Piscataway, N.J.

Nontechnical Causes of Failure of EDP/MIS Groups

In the last several years there has been a gradual, and then, more recently, a rapidly accelerating change in the nature of the backgrounds sought by major corporations for their heads of data processing and information services functions.

Where previously substantial emphasis had been placed on technical capabilities, these have become a decidedly secondary consideration. Major corporations today —that is, major users of data processing —are primarily concerned with the managerial, rather than the technical skills, although, obviously, some technical capability is always involved.

This has come about because, in evaluating the reasons for failures of edp/MIS groups, it has been consistently found that failures of edp groups to produce that which is expected of them are related to managerial, rather than technical, incompetencies.

This subject will be explored further by several of the outstanding and successful data processing executives in the country. (Thurs. p.m.)

—Herbert Halbrecht
Halbrecht Associates Inc.
Greenwich, Conn.

Automotive Industry

It is axiomatic that the importance of computers in and to the automotive industry is growing rapidly. Both large and minicomputers have been used for some time in automotive manufacturing, automotive design, the distribution of parts, keeping of customer records, etc. These established applications continue to be innovative and rapid growth areas, and will be discussed in a series of invited papers from selected automotive industry representatives. This year two areas which have the potential for explosive growth will be discussed, each in their own session: off-vehicle vehicular diagnostics, and on-board vehicular minis and cpu's. The conference will feature in-depth looks at both problems.

There are to be four automotive sessions. Organized by Prof. D. M. Grimes, Univ. of Michigan, they will feature as luncheon speaker Thursday, June 7, Mr. E. N. Cole, president of General Motors Corp., who will connect the computer and automotive industries in a talk entitled "Common Language and Common Future."

The first session, "Computers in Automotive Design and Manufacturing," will be chaired by H. J. Kuschnerus, Ford Motor Co. The session will give an overview of the spectrum of computer usage in the design and manufacturing processes. Things have really changed in the last two years: the minicomputers have moved into the auto plants en masse and have made possible an entirely new technology. (Wed. a.m.)

The session on "Off-Vehicle Diagnostics" will give insight into the use of computers to diagnose malfunction, tune-up, etc. An attempt will be made to point out any new and related work announced up to conference time. A panel will then discuss what value off-vehicle diagnostics have for the consumer. (Wed. p.m.)

This looks like the year that computers commit bigamy by getting married to automobiles, inasmuch as they wed communications a few years ago. In "On-Board Computers for Automobiles," each participant will discuss a portion of the spectrum of computer usage that exists or is forecast for integrated applications. Control applications will be highlighted. (Thurs. a.m.)

The fourth session—"Automobiles, Computers, and the Consumer"—covers communication networks vital to the timely distribution of service parts and to the rapid retrieval of stolen vehicles. (Thurs. p.m.)

—Dale M. Grimes
Univ. of Michigan
Ann Arbor, Mich.

What is Different About Tactical Military Systems

Tactical military computers are general-purpose programmable digital computers that range in size from the small minicomputer up to that of very large commercial equivalents. They can operate all the standard computer peripherals and are just as capable of computing a payroll, maintaining a large inventory, or solving complex differential equations as are their commercial or scientific equivalents.

In fact, the tactical military computer industry is a large proportion of the total national computer industry with several dozen manufacturers and thousands and thousands of programmers and analysts.

Strange to relate, this large part of the computer world has been almost completely overlooked by most people in the commercial and scientific world. Departments of computer science in our universities do not give courses for designers or

users of tactical military computers. Manufacturers do not display their hardware at this or other computer conferences. Few programmers and analysts give papers on tactical computer software.

This is unfortunate, for the commercial man and the tactical computer man can learn much from each other. The purpose of this program session is to bridge this gap by presenting somewhat of a tutorial on the basic differences and similarities between state-of-the-art tactical systems and the classical commercial or scientific systems.

The opening paper will highlight some of the representative mission requirements of today's large-scale tactical command-and-control systems. It will also discuss the scheduling and functional properties of the computer programs which support the mission. The second paper will take up the hardware requirements for a tactical system computer especially in the areas of availability and reliability. The functional characteristics of the computer and its interfaces with various peripheral equipments is also presented. The third paper will present a historical overview of tactical compiler systems and the logical differences in their functions. It describes the language requirements of a tactical system specifically in the areas of data base design, bit manipulation, and mathematical operations. The final paper describes the detailed scheduling and critical timing requirements of tactical computer program tasks. It also presents the design of a typical tactical executive program's logic, which monitors and controls a dynamic environment sensitive scheduling queue.

These four papers show what is different about tactical computer systems and why these differences are necessary. (Fri. a.m.)

—James A. Ward
Naval Ordnance Systems Command
Washington, D.C.

Associative Processors

The power of the associative memory lies in the highly parallel manner in which it operates. Data is stored in fixed-length words as in conventional sequential processors, but is retrieved by content rather than by hardware storage address. Content addressing can take place by field within the storage word, so, in effect, each word represents an n-tuple or cluster of data and the fields within each word are the elements.

One of the ways in which accessing can take place is in a word-parallel, bit-serial manner in which all words in memory are read and simultaneously compared to the search criteria. This allows the possibility of retrieving all words in which a specified field satisfies a specified search criterion. These search criteria include equality, inequality, maximum, minimum, greater than, greater than or equal to, less than, less than or equal to, between limits, next higher, and next lower. Further, complex queries can be formed by logically combining the above criteria. Boolean connectives include AND, inclusive OR, exclusive OR, and complement.

In addition to the capabilities already mentioned, associative memories can be constructed to have the ability of performing arithmetic operations such as add, subtract, multiply, and divide simultaneously on a multiplicity of stored data words. Devices of this type are generally called associative processors.

These devices have been discussed in the literature for the past 15 years and have been receiving increased attention in the past two or three years. However, most of the literature is devoted to the architectural aspects of the devices with little emphasis on areas of application. In this session the emphasis will be on applications. (Fri. a.m.)

—P. Bruce Berra
Syracuse University
Syracuse, N.Y.

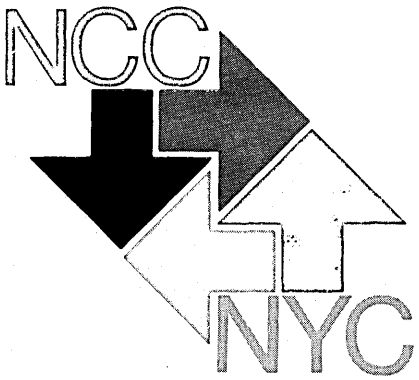
Economics and Remote Terminals

The speakers will approach the subject from the viewpoint of the consultant, manufacturer, and end user. Market study results, as well as actual examples, will be used to emphasize cost-effectiveness in remote terminal systems.

Data communication systems planners are faced with new technological advances every day. In fact, it is almost

impossible to keep up with just the language ("bits, bauds, buffers, Bisync, etc.") due to the rapid advancements in this field. Before looking at the terminal details, system planners would be wise to first consider the range of management considerations and their analysis. Gilbert Hoxie of Booz, Allen and Hamilton will recommend a planning cycle answering nine key questions which can be followed for implementing a cost-effective communications system.

Cliff Levethal of ITT Data Equipment Services Div. will speak about the market



research and planning that was used in planning and developing their new series of low-cost display terminals. The market studies and product planning that went into preparation of specifications for these new terminal devices should be interesting topics for systems people considering implementation of display systems.

Many companies want to export the data entry function from the computer center to their remote office locations to reduce the delivery time, eliminate duplicate conversion of data at the center, and reduce the possibility of error rates. Interactive terminal systems are the expensive solution. Low-cost terminals with high-speed buffering capability could be an economic alternate solution. Today many users are employing small batch systems, and advances in terminal buffering will increase their number. Bard O'Brien from Western Union Data Services will speak about the trends toward centralization of computer power using remote batch terminals.

Robert Hulse, a user from Hewlett Packard Corp., claims that the punched card is not dead. His paper describes a method for economically combining the data processing requirements of many decentralized "remote" company operations with the capabilities of the central computer facilities. The paper shows the use of an economical remote mark/punch buffered card reader as a data collection device capable of transmitting data at various speeds and communicating via ordinary telephone lines with a distant central data processing facility. Modes of usage are described showing economical data transmitting, data storage, and data processing costs and other attendant benefits such as improved central operations scheduling. (Fri. a.m.)

—**Dan Printz**
Teletype Corp.
Skokie, Ill.

Computer-based Integrated Design Systems

The design of complex systems such as ships or aircraft traditionally involves a large number of engineers from several different disciplines working on different parts of the design, both simultaneously and sequentially. To achieve proper coordination and cooperation among all of the individual efforts, covering thousands of technical and managerial details, is an almost impossible task. Central to this task is the communication and modification of the data that constitute the description of the object being designed at many levels of detail and from many points of view. The computer and associated software appears as a possible means to bring under control these difficult problems.

The U.S. Navy spends on the order of $2 billion annually for ship acquisition. Modernizing ship design and construction has been a primary and continuing interest of the Navy, who recognized very early the potential of computers for both engineering and data processing applications.

In the mid-1960s naval architects, engineers, mathematicians, computer scientists, and administrators at the Naval Ship Research and Development Center and the Naval Ship Engineering Center, conceived the idea of creating an integrated system for computer-aided ship design and construction. For about a decade, ship design engineers, naval archi-

tects, and other subject matter specialists had designed and implemented computer programs for various levels of complexity to be used to perform specific tasks; i.e., engineering computations. The benefits of these computer applications to Navy projects were impressive, but the labor involved for anyone but the originator to use the programs, or to use output from one routine as input for another, sharing information among related tasks was usually considerable. Why couldn't the same computer that was proving so useful in specific engineering computations also serve as a basis for integrating the separate tasks into one information-sharing cooperative, integrated system? This would reduce the vast army of designers, documenters and coordinators to the minimum number needed to carry out the specific tasks in each discipline.

There had been other attempts of this kind, and the Navy's managers felt that the potential payoff in the ship-production business could be large enough to warrant a comparable effort. They believed that if a "digital model" of an entire ship were created, step-by-step, by many designers working cooperatively, sharing data files and having their interface problems handled automatically—the time, manpower, and material saved would eventually amount to 7½% or more of the shipbuilding dollar—as much as $150 million annually.

Today in 1973, we are nearing the end of the first major phase of this program (the whole was originally planned to be completed in 20 years, but it now appears feasible in 12), the production of an initial experimental Integrated Ship Design System (ISDS). ISDS is eventually expected to permit performing preliminary design of conventional ships in a time of several weeks rather than the normal six months. The session at the NCC will present descriptions, applications, and discussions of the underlying system structure and support software that makes integrated design systems possible and makes knowledge of computer programming or data management techniques unnecessary for the ultimate users—the ship designers. The software that is described has the acronym COMRADE, for COMputeR-Aided Design Environment.

COMRADE concepts and techniques are applicable to other complex engineering design tasks or, for that matter, to any complex task involving the cooperative effort of large numbers of creative people, operating on a large shared data base.

The integrated design and construction approach impacts on economical use of tax dollars, on reduction of manpower requirements for design and construction, and on the competitive status of shipbuilding and other U.S. industries in the world market. This session should therefore be of interest to a broad spectrum of NCC attendees. (Fri. a.m.)

—**Herbert M. Ernst**
Naval Ship Research and Development Center
Bethesda, Md.

Virtual Machines

This session will explore the principles, practice, and performance of virtual machines in both existing and proposed systems. While the emphasis in the formal papers will be on virtual machine architectural principles and the evolution of *virtualizable architectures,* the panelists will discuss some of the unique application and performance aspects of virtual machines. The participants will also review the material that was presented at an ACM-sponsored, limited-attendance workshop on virtual computer systems held at Harvard Univ. in March.

The development of interest in virtual computer systems can be traced to a number of causes. First, there has been a gradual understanding by the technical community of certain limitations inherent in conventional time-shared multiprogramming operating systems. While these systems have proved valuable and quite flexible for most ordinary programming activities, they have been totally inadequate for systems programming tasks. As a result, virtual machine systems, most notably IBM's CP-67, have been developed to extend the benefits of modern operating environments to system programmers. This has greatly expedited operating system debugging and development and has also improved the portability of system software. Because of the complexity of evolving systems, this is destined to be an even more significant benefit in the future.

Second, a number of independent researchers have begun to propose architectures that are designed to directly support virtual machines, i.e.; *virtualizable architectures.* These architectures trace their origins to an accumulated body of experience with earlier virtual machines, plus a set of principles taken from other areas of operating systems analysis. These architectures also depend upon a number of technical developments, such as the availability of low-cost associative memories and very large control stores, which now make such innovative proposals feasible.

A third reason for the widespread current interest in virtual machines stems from its proposed use in attacking some important new problems and applications such as improved software reliability and system privacy/security. Finally, IBM has recently announced VM/370 as a fully supported software product on System/370. With this action, IBM has officially endorsed the virtual machine concept and transformed what had been regarded as an academic curiosity into a major commercial product.

It is hoped that this session, organized in response to the growing awareness of the importance of virtual machines, will provide a deeper understanding of the key issues and stimulate further theoretical and practical efforts with virtual machines. (Fri. a.m.)

—**Robert P. Goldberg**
Harvard Univ.
Cambridge, Mass.

□

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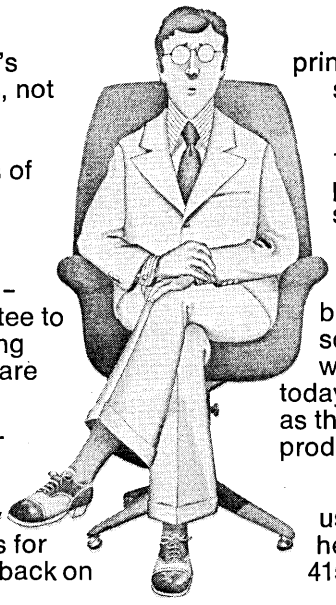

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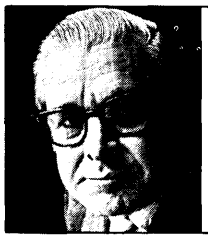

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City of Pontiac, Pontiac, Michigan

NCR
Computers & Terminals

"Our NCR Century gives us so many capabilities it's like having two computers for the price of one!"

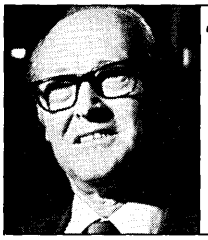
Sam Muldres, President
Western Massachusetts Computer Center
Holyoke, Massachusetts

"Benchmark tests proved the NCR Century could handle our inventory requirements faster and for less cost than other computer systems."

James L. Meagher, President
Stratton & Terstegge, Inc.
Louisville, Kentucky

"Now we measure every activity by its contribution to profit. Key to our success is the NCR Century computer system."

C. J. Sumner, Manager of Data Processing
Continental Steel Corp., Kokomo, Indiana



"With the NCR Century computer, off-the-shelf software is economical and practical, and conversion is quick. Our return on investment began in less than a month."

Harold Canada, Vice President
Hafers', Inc., Salt Lake City, Utah

"Our NCR Century computer prints prices and invoices for same-day shipment. That's great customer service. And we've increasd turn-over with less staff and inventory."

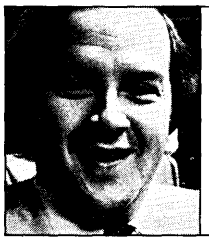
Robert R. Buchanan, President
Northwestern Drug Co., Minneapolis, Minn.

"I was impressed most by the add-on features of the NCR Century, since we are looking for a 100% growth factor in the next 5 to 10 years."

Max Disbennett, Comptroller
University of Tampa, Tampa, Florida

"Our NCR Century Computer helped us increase our annual sales $5,000,000 and decrease our inventory $170,000."

John Caputo, President
Garden Fresh Markets, Clarksburg, W. Va.



"The fact that the NCR Century 100 computer system could grow along with my retail operation sold me on NCR."

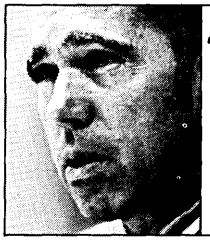
Yale T. Dolginow, Exec. Vice President
Dolgin's, Inc., No. Kansas City, Missouri

"We compared the main manufacturers of computers and picked NCR primarily because of our past experience with the service they've given us on other equipment in our bank."

Wendell H. Conaway, V.P. of Data Processing
Commercial Bank at Daytona Beach
Daytona Beach, Florida

"Town government and citizens of every community are demanding far more accountability from the people who run the schools. Our NCR Century enables us to meet this demand."

Paul R. McDevitt, School Business Administrator
Darien Board of Education, Darien, Connecticut

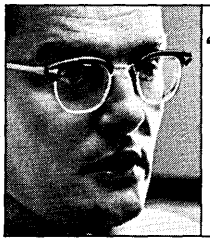


"To match our NCR Century's performance with another computer system would have cost us twice as much."

Roy J. Bernard, Director of the Computing Center
Southeastern Louisiana University

"We chose the NCR Century because the product for the price was better than anyone else had to offer."

Dan Seyfarth, Data Processing Manager
McHenry Hospital, McHenry, Illinois



"Our NCR Century System has meant new life for this office. Our patient accounts are now always current, accurate and under control."

R. B. Watson, Comptroller/Treasurer
ST. Joseph's Hospital, Asheville, North Carolina

"The greatest advantage from our NCR Century system? I'd say customer service. We can respond to our customers' needs much better than we could before."

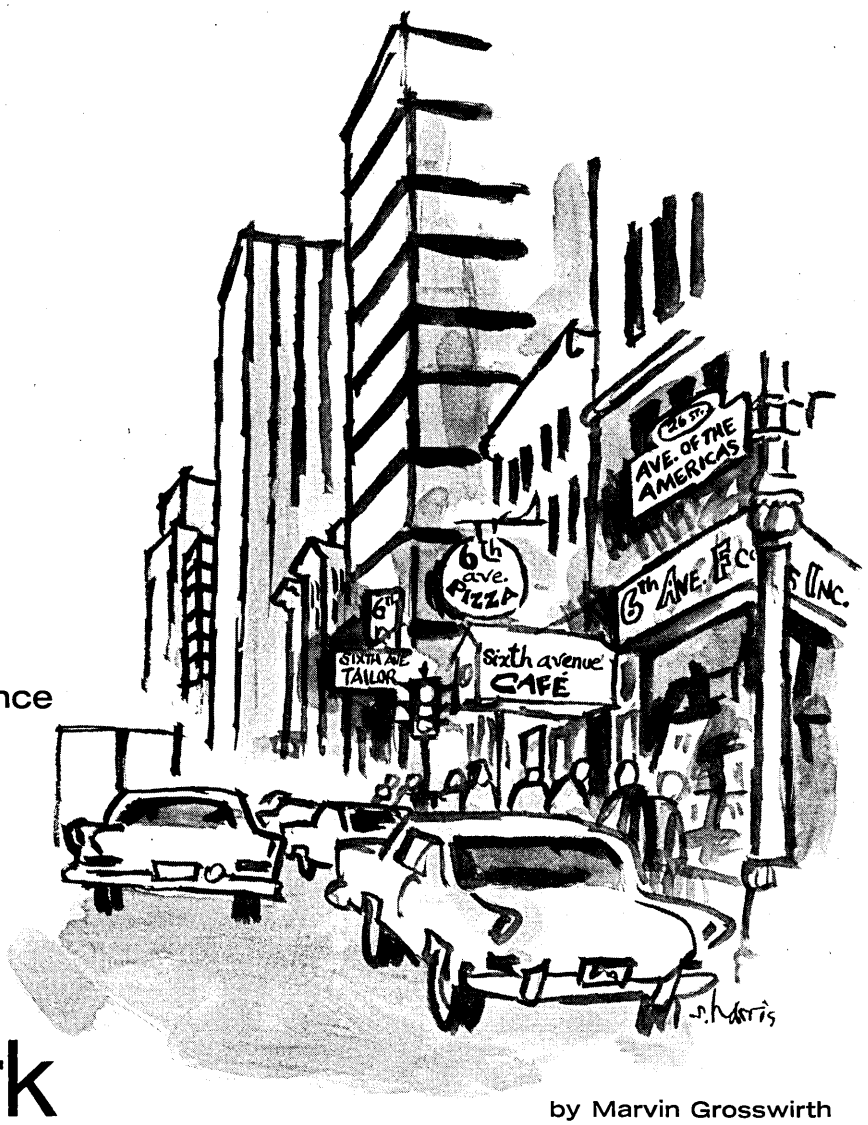
Walter F. Urban, Jr., Treasurer
Union Federal Savings & Loan, Pittsfield, Mass.

"With our NCR Century C.I.F. System all data on each customer is in one place for account analysis and creative marketing. Our growth depends on this."

Bert Lance, President
Calhoun First National Bank, Calhoun, Georgia

"Our NCR 280 Terminals brought our stores in Texas two days closer to us."

Archie W. Crittenden
Director of Merchandise Information
Dillard's, Little Rock, Arkansas



Since the National Computer Conference takes a whole week, here's an informal guide to the city by a native

Surviving in New York

by Marvin Grosswirth

The address of the New York Convention and Visitors' Bureau is 90 East 42nd St., New York, NY 10017 (telephone 687-1300). There you will find maps, guides, schedules of events, descriptions of major and minor tourist attractions and virtually all the information and assistance one should expect from a friendly and courteous tourist agency. I urge you to make contact with the bureau, either by mail or in person, at your earliest opportunity.

You would also do well to invest 50¢ in a copy of Cue Magazine, which offers much of the same information (but not all) that the bureau provides, and much that the bureau does not: movie and theater schedules and programs, art gallery information (meager), television and FM radio listings, tidbits, and a good deal more, including an incredible number of restaurants (most of which, in my view, tend to be a trifle on the expensive side; some of them, in fact, are outrageous).

You now know almost everything necessary for planning interesting and exciting sightseeing in New York, ranging from the uplifting and cultural to the venal and hedonistic.

But there is much useful information that guide books and tourist agencies often overlook, simply because there are some things the natives take for granted. To a visitor, however, the extent to which he derives pleasure from his visit often depends on his knowledge of this "inside" information. Herewith, then, a brief guide to help you survive:

Language: The tempo of New York being what it is, most New Yorkers prefer not to waste time on the niceties of enunciation. Thus, if a native peers at you quizzically and bellows: "Hey, wassamaddawicha?", he is inquiring into your general condition, with perhaps some emphasis on your mental state. If you are told that the price of something is "twunnify cenz," give the man a dollar and trust him to return the proper change. The need for rapid communication impels many natives to refer to their city as "Nyawk," although some, in a more whimsical mood, may use such affectionate sobriquets as Strike City, The Jungle, or Lindsay's Folly.

You may have been told that the New York Hilton is on the Avenue of the Americas. If you use that address, you are bound to get lost, perhaps irretrievably so. Although the thoroughfare was renamed some 25 years ago, New Yorkers still say Sixth Ave. There is that economy of language again.

Walking. New York's climate is usually quite pleasant in early June and walking is greatly encouraged, especially for male chauvinists: few cities offer greater rewards to girl watchers. There are, however, certain hazards: being mugged (*vide Crime*, below) and dog droppings. New York dog owners view their streets as one huge, outdoor canine toilet. Proceed with caution. Avoid wearing openwork shoes.

Transportation. Your first objective will be to get into the city proper. If you are arriving by train or bus, your

hotel will be a short taxi ride from the terminal. If you come by air, however, you may want to use one of the buses which leave at regular intervals from all three airports serving New York. The fare ranges from $3 to $5, depending upon the airport.

Cabs are faster, more comfortable, and more expensive. Cab fare from LaGuardia runs $6-$8, from Kennedy the cost is $12-$14, and from Newark, it is cheaper to buy your own taxi. *Nota bene*: a driver may suggest that others share your cab (or that you share one already occupied). He is not concerned with your finances; there will be no fare-sharing. Each passenger will be expected to pay the amount registered on the meter. Never mind that this practice is illegal; a fellow has to make a living, doesn't he? And a busy executive has to get the hell out of the airport, doesn't he? Indeed he does. But he does not have to tip a driver who is making double or triple his legal fare.

Once you have gotten settled in your hotel, you may want to move about the city. For rapid, efficient and economical transportation, nothing can compete with the subway. I advise you to avoid it at all costs. Comprehension and use of the New York subway system requires a penchant for mapreading, the dedicated concentration of a yogi, and a cold indifference to dirt, heat, humidity, graffiti, noise, and vandalism. If you get lost in the labyrinthine depths of the subway, you are likely not to be found until next Groundhog Day, when a sanitation crew may accidentally come upon your blanched bones in a Bronx trainyard where derelict cars are retired into corrosion.

Buses can probably take you where you want to go, especially if your wanderings are confined to Manhattan. Come prepared with a supply of quarters and dimes: the bus fare is 35¢ and exact change is required. Subway tokens, which also cost 35¢, may be used on the buses, but they have to be purchased in the subway and as I have already advised you . . . but why belabor the point?

Chances are that you will be using taxis much of the time. Since the last fare increase, cabs are fairly easy to find. Although the rates are in line with those of most other major cities, many New Yorkers object to the increase, so they leave the taxis to the tourists.

Taxi Drivers. The legendary image of the New York cabbie is a myth: the wit and wisdom attributed to him are virtually nonexistent. In fact, New York cab drivers, almost to a man, have the sensitivity and intelligence of a fire hydrant. For example, one cannot expect a taxi driver to know where places are. Recently I hailed a cab near my home and told the driver to take me to Carnegie Hall, less than a mile away. "Where is that?" asked the driver, with a straight face. *Carnegie Hall,* for God's sake! It is best to know the precise location of where you are going. "Museum of Modern Art, 53rd St. between 5th and 6th Aves." Then sit back and allow the driver to figure out the best way to get there.

Cab drivers often relieve the tedium of their profession with little games, such as seeing how close they can come to a pedestrian without causing anything more serious than cardiac arrest. "Beat the Light" and "Race the Bus to the Corner" are among their favorite games. Fortunately, most cabbies are remarkably competent drivers.

As an anticrime measure, most cabs have a barricade between the passenger and the driver, creating a back seat ambience which can only be described as claustrophobic. The one saving grace of the barricade is that it spares the passenger a lengthy dissertation on how to solve the city's traffic problem

or why Mayor Lindsay should be impeached. A 20% tip, incidentally, is adequate, with a 20¢ minimum.

Crime. As you depart for what many view as Sodom-on-the-Hudson, your loved ones, having heard about the apparent mugging-a-minute in New York, conjure up mental images of your broken and bleeding body lying in a gutter somewhere. Set your—and their—fears at rest. Certainly, if you go looking for trouble, you will find it with no difficulty. But if you confine your movements to well-populated areas which, as a tourist, you are likely to do anyway, you should have no trouble. If you are really paranoid about it, travel with a friend. Muggers almost never attack couples.

At night, it is sensible to avoid the parks and dimly lit streets. You will notice that many streets are illuminated by sodium vapor lamps, easily distinguishable by their golden yellow glow. Even in some of the worst neighborhoods, street crimes have been reduced by as much as 50% where these lights have been installed.

Try not to tempt fate by doing foolish things, like flashing your bankroll. (*Vide Pleasures of the Flesh,* below.)

Theater. Before paying premium prices to a ticket broker, try the box office, even for a hit show. Tickets are easier to obtain for midweek performances than most people would expect. Stay away from Eighth Ave., which abuts the theater district, unless you crave female companionship and have no discrimination whatever.

Pleasures of the Flesh. Eighth Ave. may well qualify as the pornography capital of America (with West 42nd St. running a close second). For those not content with merely the visual, there are other facilities. These facilities can usually be seen lounging in doorways or strolling along the avenue. But their talents are various: venality is often accompanied by robbery, sometimes violently so. If you absolutely must avail yourself of these facilities, be sure that (a) you are not carrying more in money and valuables than you can afford to lose; (b) your Blue Cross is paid up; and (c) you are not allergic to penicillin, of which you will undoubtedly require massive doses should you make contact with a princess of the pavement. Better to avoid Eighth Avenue entirely, as well as 42nd St.—day *and* night.

West 42nd St. does have one redeeming feature: where it touches the Hudson River one will find the Circle Line sightseeing boats. Large, reasonably comfortable excursion boats leave hourly all day and in the early evening for a three-hour waterborne tour around Manhattan Island. The voyage is cool (no matter how oppressive the climate may be on land, the river is always pleasantly cool), the lecture interesting and informative, and the photographic opportunities excellent.

Another fine boat ride is the Staten Island ferry, not to be missed if you are downtown in the financial, shipping, or insurance districts (roughly, the area from Bowling Green to Chambers St.; check your map). The ferry should be ridden for three reasons: it is cool and relaxing; it offers stupendous views of the skyline and harbor, including the Statue of Liberty; it is probably the best bargain in New York. The one-hour round-trip fare is a dime.

There are other genuine bargains: outdoor art shows, concerts, and sporting events (*e.g.,* honest-to-God cricket matches in Central Park), and museums that are free or that charge nominal admission fees. These will all be listed in the Convention and Visitors' Bureau brochures and some will be listed in Cue. There are also hundreds of free-admission art galleries. The best day to visit them is Saturday, which is traditionally reserved for browsers. At any other time, you will be regarded as a potential buyer, except on Sundays and Mondays when you will be regarded as a potential thief because most galleries are closed on those days. If you have no gallery listing, simply go to Madison Ave., and begin working your way north (*i.e.,* uptown) from 57th St. You will find almost nothing but art galleries lining both sides of the avenue.

Food. New York is a gastronome's paradise. Virtually every ethnic cuisine imaginable is available here. If you are feeling gustatorially adventurous, stroll along West 56th St., between 5th and 6th Ave., a short walk from the Hilton and the Coliseum, where you will find a wide variety of restaurants ranging from Korean and Japanese to French and Italian. At the 5th-and-59th St. entrance to Central Park there are usually colorful carts selling intriguing hand-held foods from the far reaches of Exotica.

Service. Service leaves much to be desired in New York, whether in restaurants, shops, department stores, or hotels. Surliness is so commonplace it is hardly even remarked upon any more. If you are slighted by a waiter or a clerk, do not take it personally. As a matter of fact, you do not have to take it at all. Do not hesitate to walk out, leaving no gratuity where it would be expected. But be sure to tell the manager or cashier why you are doing so.

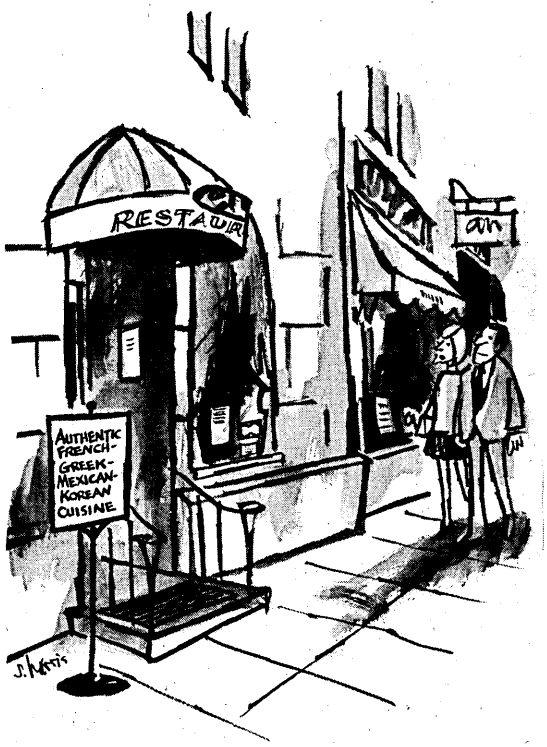
Transfusions. Liquor stores are usually open until midnight, except on Sundays when they are closed all day. Bars open at 10 a.m. (2 p.m. on Sundays) and remain open until 4 a.m. the next morning. The so-called "singles" bars are interesting if you are curious to see a human stockyard in operation.

Emergencies. If you can find a telephone that works (which is another story entirely), dial 911. You will be put in almost instant contact with the police—except on Saturday nights, when the response can be frustrating, to say the least. Hospital emergency rooms are strategically spotted around the city and are open 24 hours a day. To my knowledge, no one has ever bled to death waiting for attention in an emergency room. It only seems that way.

For other types of emergencies, you will find everything from Travelers' Aid to Legal Aid in the telephone directory. The Yellow Pages, by the way, are a strange and wonderful compendium of purveyors of goods and services, including all-night drug stores.

New York is an exciting, vital city, with much to offer the visitor. If you act sensibly and use your intelligence, survival for a mere week or so should be no problem at all. After all, there are those of us here who have managed to survive for decades. □

Mr. Grosswirth is a freelance writer whose articles have appeared in Saturday Review, The New York Times, and other national publications. His latest book, written in collaboration with Dr. Louis J. Rosenfeld, is "The Truth About Vasectomy," recently published by Prentice-Hall. He is now working on another, "The Metric Book," to be published later this year.



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Why stop at selling or leasing software systems to end users? Now you can offer them complete minicomputer package systems.

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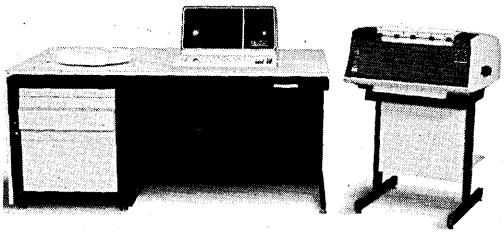
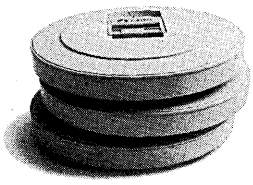


Complete software tools To make your programming burden lighter we offer a full set of software tools: Fortran, assemblers, utilities, RTOS, sort/merge, DOS and RPG/SUE. That last item is 98% compatible with RPG II by the way.



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Call us.

See SUE systems at the National Computer Conference booth #2831

CIRCLE 46 ON READER CARD

Who ever heard of a three-terminal key-to-disc system for $573/month that can handle source data entry, remote batch processing, IBM 3270/2260 simulation, and stand-alone computing? No one until now. Business data processing will never be the same.

System IV/40: Genius of the Intelligent Terminals

Distributed processing for distributed organizations. Makes sense doesn't it?

With System IV/40 you can put the terminals where the action is. On the front line. In the back office. Wherever your people need help getting the job done.

And because System IV/40 is intelligent, it doesn't need to be on-line to solve the kinds of problems typically found throughout business. Things like helping a branch clerk enter orders in displayed replicas of your standard forms. Checking input data for errors while computing price/quantity totals, discounts, and taxes. Printing picking lists for warehouse stock. Retrieving and updating order files to show quantities actually packed. And generating invoices for inclusion with shipments.

But System IV/40 can go on-line too. Whenever you or the central computer decide to transmit records back home. Or to receive reports from headquarters. During data entry in the day. Or when line costs are low at night. Even when no one's there.

Need even quicker turnaround? System IV/40 also simulates remote IBM 3270's and 2260's for real-time data base access. But with several intelligent extensions. Like single-key message generation for push-button report retrieval. Local format storage to keep line loads down and response time up. And a store-and-forward capability for nonstop data entry during periods of line failure or central site down time.

Fully supported software is part of the Four-Phase package. Including DATA IV/70 for conversational source data entry. On-line terminal simulators field proven in three million hours of operator use. Plus terminal-oriented COBOL for easy development of both batch and multiterminal applications.

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Cleveland	(216) 749-7917	Philadelphia	(215) 667-3756
Dallas	(214) 634-2240	San Francisco	(415) 692-4360
Detroit	(313) 557-8844	St. Louis	(314) 862-3030
Hartford	(203) 549-0054	Toronto	(416) 493-1839
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No. and type of terminals now in use _____

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1152-character Video Terminal with 85-key Data Entry or Typewriter Style Keyboard. Up to 16 per system at $41/month each. 1920 characters, dual intensity, and audible alarm available.

FOUR-PHASE SYSTEMS, INC.

See System IV/40 at NCC in Booth 1101.

NCC NYC

Product Preview

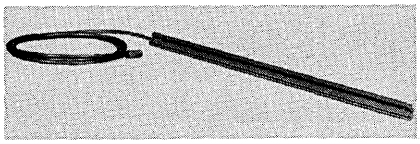
software and auxiliary equipment

COMPUTER CO-OPERATIVES, LTD.
Guildford, England Booth 1122,1132

Scientific Software
This is one of five British firms that will be showing some very interesting hardware, software, and accessory items at the show. SPEED (Simulation Program for Efficient Evaluation of Dynamics) is a simulation program written in FORTRAN IV that is billed as being unusually good at modeling financial and environmental hypotheses, as it allows the mixing of both discrete and continuous simulations. The program can be time-shared and contains helpful diagnostic messages. It requires approximately 64K bytes on a 360 or 370, with other versions available for the Xerox Sigma 5, and DEC PDP-10. Judging by the price SPEED sells for in the U.K., it will be priced at approximately $15K in the U.S. for the object deck program and supporting documentation.
FOR DATA CIRCLE 172 ON READER CARD

THE PORTLAND CO.
Portland, Maine Booth 1524

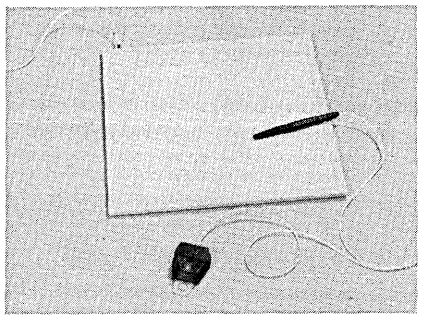
Static Eliminator
Wherever there is high-volume paper shuffling, there is static electricity to make paper shuffling more difficult. Fumbling with paper is a trivial problem, perhaps, but it does affect throughput, and for $22.50 (in quantities of 1,000 units) builders of line printers and other paper handlers can eliminate it. The device is called the Chapman 31, and looks too simple to fail.



FOR DATA CIRCLE 175 ON READER CARD

SCRIPTOGRAPHICS CORP.
Fairfield, Conn. Booth 1120

Digitizer Tablet
In data entry terms, it takes much more than 1,000 words to describe a picture, at least if any kind of resolution is demanded. So there are things like this data tablet for digitizing graphics. A clean looking unit, it records x-y coordinates in absolute values (rather than relative displacements) using inputs from a stylus or cursor. Three modes of operation add to the convenience: point mode (recording one point at a time), stream (up to 200 points/second recorded continuously), and switched stream (continuing recording while the stylus is pressed down).



The resolution is quoted as 100 lines/inch; both accuracy and repeatability are given as less than one-half the least significant bit, so they depend on the tablet size. Production has started on the 11 x 11-inch model ($2000 for a single unit), but tablets to 36 x 48 inches eventually will be offered.
FOR DATA CIRCLE 174 ON READER CARD

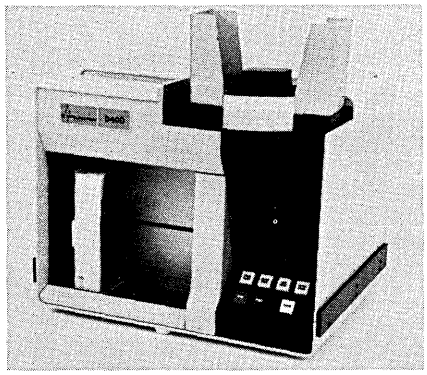
NORTRONICS CO., INC.
Minneapolis, Minn. Booth 1311

Read/Write Heads
Nortronics will be showing oem prototypes of a new read/write head capable of recording data at up to 6400 bpi and operating at speeds up to 400 ips. The heads feature gap spacing compatible with IBM's 6250-bpi heads. Evaluation units are priced at approximately $800 each, depending on customer specifications.
FOR DATA CIRCLE 197 ON READER CARD

peripherals

DOCUMATION, INC.
Melbourne, Fla. Booth 2100-04

Card Reader
The D-400 is Documation's latest 80-column card reader design, and the model designation is derived from its speed—400 cpm. The hopper capacity is 800 cards, and the stacker holds 1,000, both of which can be loaded or unloaded on the fly. Sales are to oem's only, so the $1650 single-unit price gets even better depending on the quantity desired. Delivery is scheduled for October.



FOR DATA CIRCLE 202 ON READER CARD

WANGCO INC.
Santa Monica, Calif. Booth 2718-22

Cartridge Disc Drives
Wangco has found one type of 5440 (IBM S/3) cartridge disc unit not

covered in its original announcement of 18 versions at the last FJCC. The Series-N models 1211, 1212, and 2212 all utilize a single nonremovable cartridge. The 1211 and 1212 models have capacities of 25 megabits and differ in that the 1211 spins at 1500 rpm to provide a transfer rate of 1.56 MHz, and the 1212's 2400-rpm speed ups the transfer rate to 2.5 MHz. Both models record data at 2200 bpi on 100 tracks/inch.

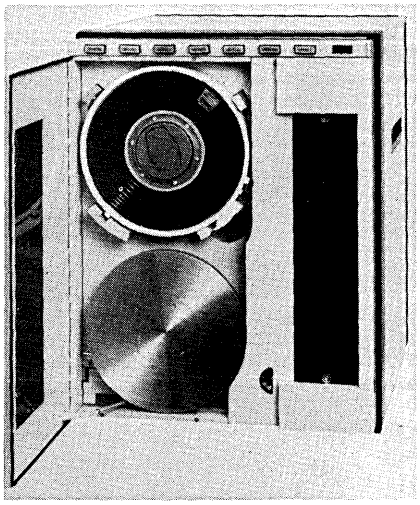
The 2212 also writes at 2200 bpi, but does it on 200 tracks/inch. Its transfer rate is also 2.5 MHz from 2400 rpm. Track-to-track access times for all models is 15 msec, with the average access to any portion of the cartridge 70 msec. The series is supplied complete with power supply, and prices start around $2000 each for orders of 100 depending on specific requirements.

FOR DATA CIRCLE 203 ON READER CARD

Cartridge Tape Drive

Also shown will be the Mod 1200, an automatic tape-loading drive that uses the IBM wrap-around cartridge. The 1200 series is available in speeds ranging from 25-75 ips, with vacuum column, single-capstan drive. The heads are IBM compatible and are available in all common densities, including an 800/1600 bpi combination. Pricing for the Mod 1200 starts around $5500 for orders of 100.

FOR DATA CIRCLE 204 ON READER CARD



STORAGE TECHNOLOGY CORP.
Louisville, Colo. Booth 1535,37

6250-bpi Tape Drives

It seems natural that STC should be the first independent peripheral manufacturer to announce alternative products for IBM's recently introduced 6250-bpi tape units, as the firm has offered products with higher performance than IBM's units for some time. The 3600/3800 series features 6250-bpi recording at speeds of 75, 100, 125, and 200 ips. Two additional models combine speeds of 200/100 and 250/125 ips and densities, 1600/

DECISION INC.
Oakland, Calif. Booth 2715

Optical Readers

This vendor is the first to concede that IBM changed the optical character reader marketplace with the introduction of the Model 3886, a device said to operate at about 300 cps and to sell for around $120,000 when finally configured with mag tape and accessories. This firm's own product is certainly more of a breakthrough in cost and performance, although it will be offered to the oem market only.

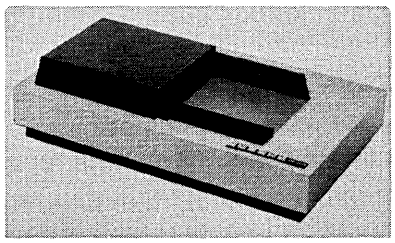
A 600-cps reader, model number 7600, handles forms from 3 x 5 inches up to 9 x 14 inches, reading up to six lines per inch from each. Like the IBM unit, the reader keeps the paper stationary and moves a read head, in this case a single-character sensor that runs over the printed page something like a serial printer would. The lack of sophisticated paper shuffling equipment makes it possible to build the unit to sell for only $30,000 in oem quantities (which would mean that end-users might still get ocr at half IBM's price).

The reader presently understands OCR A and Courier fonts, but will get more machine fonts and the ability to read handprinted numerics by the end of the year. The control of which fonts are read is handled by microcode on a floppy disc, as is the error recognition and correction logic. Built for off-line operation, the basic unit is offered with a mag tape controller but could have paper tape or could even use the floppy disc for data collection. The 7600 can talk in ASCII or EBCDIC, and interfaces for displays and other on-line gear will be available. Production is expected to begin in October, but a few have already been built for demos.

FOR DATA CIRCLE 207 ON READER CARD

Optical Mark Reader

Jumping to the other end of the spectrum, Decision will also show its model 6500 optical mark reader, which, oddly enough, uses some of the same principles as the 7600 but does everything on a much smaller scale. For instance, the reader accepts the same size documents, but paper handling is left to the operator. It can read 3 x 5 cards at up to 900 an hour if that operator is fast enough, for instance.



The device has an EIA or tty-compatible interface, so can be used as a peripheral or as a terminal. One of its biggest advantages is its small price, $4900, which must represent the baseline for entry into optical reading.

FOR DATA CIRCLE 208 ON READER CARD

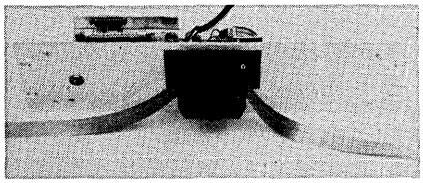
6250. This means that an installation can go to the 6250-bpi recording density without sacrificing performance when using 1600-bpi tapes. Monthly rental for 6250-bpi drives ranges from

$490 (75 ips) to $635 (200 ips), and the model 3800 controller, capable of supporting up to eight drives, rents for $850/month; these prices are based on a two-year lease. First deliveries are scheduled for the last quarter of the year.
FOR DATA CIRCLE 200 ON READER CARD

ELECTRONIC ENGINEERING CO. OF CALIFORNIA (EECO)
Santa Ana, Calif. Booth 2400-08

Paper Tape Reader

The Data Loader is built for reading continuously or in sequential blocks at



120 cps. A low-cost unit ($289), it uses light-emitting diodes and phototransistors, and is claimed to have a self-cleaning read head.
FOR DATA CIRCLE 178 ON READER CARD

small computers

BASIC TIMESHARING, INC.
Mountain View, Calif. Booth 2726,28

Time-sharing Computer

The 3000/20 is a smaller version of the 3000/30 interactive time-sharing system already on the market. Like the 16-terminal configuration, the 20 incorporates a cpu with hardware floating-point math, read-only memory, a direct memory access channel, and 980-nsec core main memory. It differs in that it has only 16K of its 17-bit words, and its communications controller supports only eight 100- to 2500-bps terminals. It has a fixed 2.4-megabyte disc built in, and is priced at $35,500 and up.

Built to run extended Dartmouth BASIC, its operating system provides protection for each user's files, simultaneous shared access to others, string variables, and a specialized debugging tool.
FOR DATA CIRCLE 177 ON READER CARD

NIXDORF COMPUTER, INC.
Chicago, Ill. Booth 2448,50

Business Computer

The model 840 business-oriented minicomputer with visible record and communications capabilities is not a new product to Europeans, but the system is just now coming to U.S. shores. Up to 32K 12-bit words are offered for the system, with up to 24K words of read-only memory to perform system control. To this can be added a wide range of peripherals, including a 50-cps matrix printer with a print line length of 174 positions, a 400-cps cassette, disc units, and even a crt. When an application comes along that the 840 can't support, it can be used as either an intelligent or remote batch terminal to a larger system. U.S. prices were just being established in time for the show, but minimum systems would be typically priced at $19K and could range as high as $50K with a full complement of peripherals. First deliveries are slated for the third quarter.
FOR DATA CIRCLE 170 ON READER CARD

memories

CAMBRIDGE MEMORIES, INC.
Concord, Mass. Booth 1303

Core Memory

A little over a machine generation ago, the core memory alone took up more space in a computer room than users now have to devote to the whole mainframe. Reflecting this shrinking trend, the ExpandaCore 16 makes it possible to put up to 144K words (of 16, 18, or 20 bits) into a 14-inch rack space. A single card holds up to 16K words. The core packing is not a record-establishing feat, but the availability of that amount of memory at a speed of 800 nsec and a price of $2550 in single-unit orders is worth some oem attention.
FOR DATA CIRCLE 180 ON READER CARD

INTEL CORP.
Mountain View, Calif. Booth 2802,04

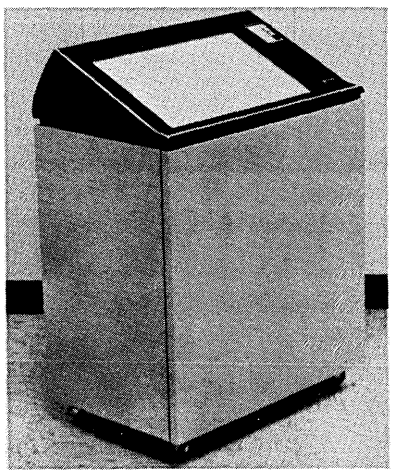
Micromemories

A little over a year ago, Intel started up its production line for 4-bit and 8-bit chip microprocessors, and the waves have not yet died down. But imaginative customers have already suggested the chips are too little of a

VERSATEC, INC.
Cupertino, Calif. Booth 1815,17

Matrix Printer/Plotters

The model 2000 plotter and the 2000A printer/plotter are claimed to be the widest electrostatic print

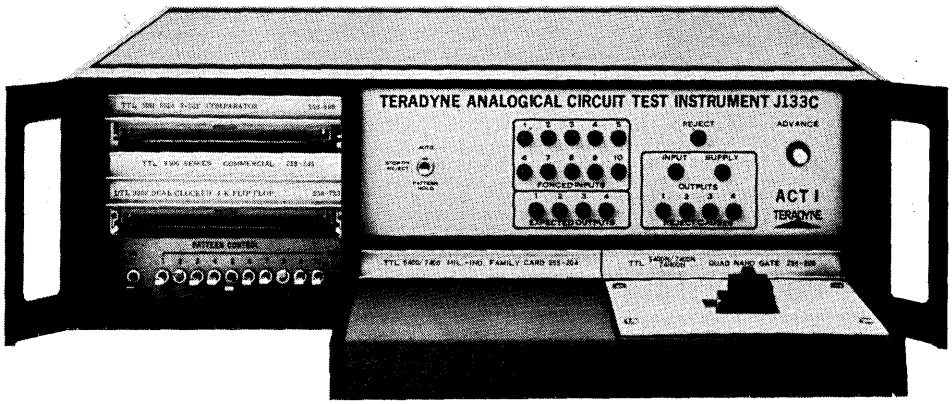


devices on the market, using 20-inch continuous forms and putting down 100 dots per inch on lines up to 18½ inches long. As the paper moves at 0.8 ips, dots are printed vertically also at 100/inch.

The 2000, at $8900, lacks the character generation ability of the printer/plotter, which runs $10,900. The "A" model has the same plotting capability, but can intersperse 7 x 9 dot matrix ASCII characters, putting up to 232 of them across the 20-inch sheet in either upper or lower case.

Both units are supported on the computer side by FORTRAN utilities, and can be run on-line (there are interfaces to 23 computers), or off-line using the vendor's 7- or 9-track mag tape drive and controller combinations. (The off-line stations add $8500 to the prices; the software is free.)
FOR DATA CIRCLE 190 ON READER CARD

More than half the people who buy bench-top digital-IC testers buy this one.



Here's why.

It's Thorough

The J133C makes both functional and dc parametric tests, based on field-tested plug-in program cards that ensure correlation with vendors' specs.

It's Versatile

Program cards are available for thousands of ICs, from flip-flops to ROMs and RAMs, from TTL and DTL to CMOS. The J133C even tests 24-pin devices.

It's Easy to Use

No setup; just turn it on and use it. No programming; plug-in program cards do it all. No operator controls; just insert the IC to be tested. No meters to read; just watch the pass/fail lamps.

It's Expandable

The J133C can grow as your needs grow. With its evaluation test deck, you can look at function, voltage, or current at any pin. With the pattern control unit, you can functionally evaluate bad devices. With blank program cards, you can even "write" your own programs if you choose.

It's Compatible

Interfaces are available for automatic handlers, wafer probers.

It's Dependable

The J133C is built to take hard industrial use. That means no calibration adjustments, no fans, 100%-tested components, plus a 10-year warranty for extra peace of mind.

It's Inexpensive

The J133C costs so little it can pay for itself in months, at even moderate IC usage rates.

Most important, when a J133C says an IC is good, you can put that IC in your product without worry. And that, of course, is the real reason why industry has settled on the J133C as the best answer to the IC-inspection problem. Learn more. Write: Teradyne, 183 Essex Street, Boston, Mass. 02111. In Europe: Teradyne Europe S.A., 11 bis, rue Roquépine, 75 Paris 8e.

TERADYNE

CHICAGO (312) 298-3600 / DALLAS (214) 231-5384 / NEW ENGLAND (617) 245-5340 / NEW YORK (201) 871-4052 / SUNNYVALE (408) 732-8770
LONDON (093-28) 61111 / PARIS 265 72 62 / ROME 59 47 62 / MUNICH (0811) 33 50 61 / TOKYO (03) 263-9358

good thing; in fact they have designed applications for them requiring up to 16K of memory. The response is the in-26 semiconductor random access memory system, a 900-nsec, single-connection memory for the chip processors. The systems come in 1K to 16K sizes with up to 4K (of 4-, 6-, or 8-bit words) on one 6 x 8-inch board. At a price of less than $450 for the 4K by 8-bit size in quantities of 100, it may now be possible to build a hand-held 4K real, live computer for what hand-held calculators are selling.
FOR DATA CIRCLE 186 ON READER CARD

DIGITAL COMPUTER CONTROLS, INC.
Fairfield, N.J. Booth 2121,23

Core Memory

Core is alive and healthy in Fairfield, N.J. In fact, it even looks attractive when packaged in 16K by 16-bit chunks on a single pc board. The 960-nsec add-on memory is intended for service in the vendor's own minicomputer mainframes and in Data General's Nova 1200, and comes with invoices of $5225 each in oem quantities. Said to be the only 16K memory on a 15 x 15-inch board, the subassembly makes it possible to put a central processor, 64K of memory, and I/O interfaces in a 5¼-inch high box.
FOR DATA CIRCLE 185 ON READER CARD

discs

INFORMATION DATA SYSTEMS, INC.
Walled Lake, Mich. Booth 1116

Head-per-track Discs

The 6000 series of head-per-track discs features a spring-loaded mechanism that holds the disc platter away from the read/write heads during start and stop operations. When the unit reaches operating speed, the disc is pulled into the proximity of the flying heads by an axial solenoid. The solenoid current is then reduced to a much lower level to decrease bearing loads. The developers claim this approach increases bearing life more than two times over their previous designs—an important consideration for oem's. Two speeds are offered: 1800 rpm, which has an access time of 16.7 msec and a transfer rate of 3 MHz, and 3600 rpm, which yields an access time of 8.3 msec and a transfer rate of 6 MHz. Units are available in 8-128 track configurations, with each track storing 100,000 bits, or alternately formatted for 4K 16-bit words per track, with a maximum capacity of 512K. This unit is called the 6128 and is priced at something under $10K, with the price dropping to approximately $7K for orders of 100. Delivery is 45 days.
FOR DATA CIRCLE 196 ON READER CARD

DATUM, INC.
Anaheim, Calif. Booth 2740,42

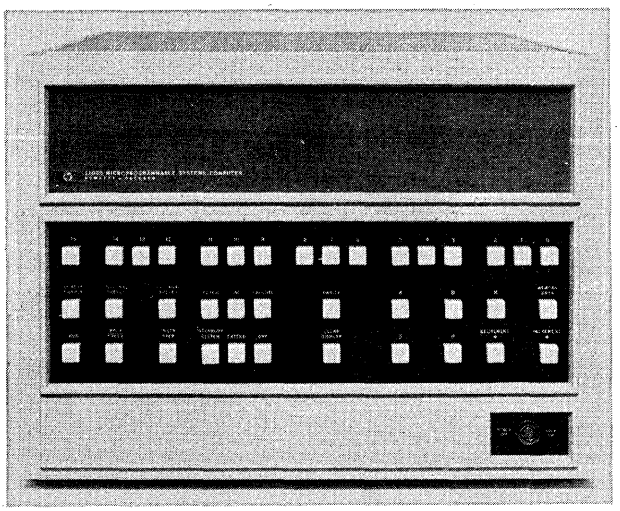
Rotating Storage

Small terminals can have big memories if their designers call for one of the five models of the series 55 Mini-Memory system. In a fine example of double-speak, Datum refers to its new line of mini peripherals as mass memories because of the 262K 16-bit word maximum size. The 55s all store 4K words per track, but differ in having 4, 8, 16, 32 or 64 tracks. Three features make them attractive for terminal support: the 122K words/second transfer rate, the 10-inch size, and the $1550 to $2950 price tag.
FOR DATA CIRCLE 179 ON READER CARD

DIGITAL DEVELOPMENT CORP.
San Diego, Calif. Booth 1410

Head-per-track Discs

Higher density recording has resulted in three new series of head-per-track disc drives aimed at mainframes of recent design that can accommodate the higher serial bit rates. Two of them, the A7310 and 9100, are much alike in construction, but differ in density and spin speed. The A7310 stores 105,000 bits per track, has an



HEWLETT-PACKARD
Palo Alto, Calif. Booth 2515,2615

Microprogrammable Mini

The 2100S, H-P's new top-of-the-line minicomputer, brings the end user a level of control he isn't often offered. Choose to program in a higher level language? The 2100S has FORTRAN, ALGOL, and BASIC. Going down one level there is the assembler. Another level down is writeable control store. Finally, for those often-executed fixed-in-concrete applications, there is read-only microcode memory that you can hard-wire yourself.

The writeable control store comes in chunks of 256 24-bit instructions each, and the system can take up to four of them (one is standard). It operates at 196 nsec to support program executions 5 to 10 times as fast as software subroutines. Its swapping medium is disc.

For $500, an accessory called the Programmable Read Only Memory Writer is offered. It includes a single card that slides into one of the 2100S' slots plus a small box for a ROM chip. Software provided with it allows the customer to translate a WCS-stored program onto the chip, fusing it permanently.

The 2100S also includes a 16K to 32K conventional memory, a 2400-baud communications channel (which can be augmented with an optional 16-channel and up multiplexor), two direct memory access channels, and hardware floating-point. In a full-blown configuration, it can support 32 simultaneous time-sharing users.

First deliveries are expected in mid-summer. Prices start at $16,000 ($470/month) for a 16K version with 256 words of WCS.
FOR DATA CIRCLE 182 ON READER CARD

access time of 8.5 msec, capacities from 6.7 to 107.2 million bits, and a transfer rate of 6.2 Mbps. The 9100 spins half as fast (1800 rpm), stores its 9.6 to 153.6 million bits at 150,000 per track, and transfers at 4.4 Mbps. Prices for both range from $13,100 to $54,100.

The superfast 7600 exhibits an access time of 5.2 msec for its 4.8 to 76.8 million bits and transfers data at 7.2 Mbps. Its closed-loop cooling system, necessary to eliminate the heat generated at 6000 rpm, makes it look something like a solid-state still. It is priced from $39,000 to $78,000.

FOR DATA CIRCLE 181 ON READER CARD

PROCESS PERIPHERALS, LTD.
Thatcham, England Booth 1122,1132

Ruggedized Disc Unit

Harsh military and industrial environments are what the series 100 disc unit was designed for. From 1-17 megabytes are stored on the head-per-track unit. Interfaces for popular Digital Equipment, Honeywell, and General Electric minicomputers are available. Prices generally start around $5K in the U.S.

FOR DATA CIRCLE 171 ON READER CARD

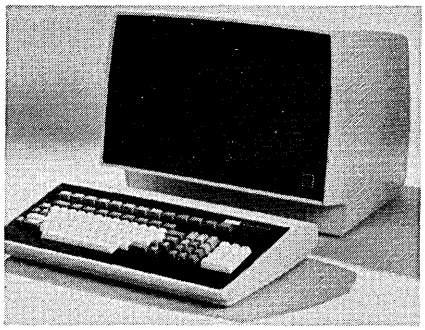
terminals

BEEHIVE MEDICAL ELECTRONICS, INC.
Salt Lake City, Utah Booth 2727,29

Smart and Simple Crt's

Two kinds of crt terminals will be shown by Beehive for the first time—a smart unit with all the bells and whistles, and a tty replacement.

The brigher terminal is the Super



Bee, a microprocessor-based device, with MOS memory, that can show 25 lines of 80 characters, transmit at switch-selectable speeds from 110 baud to 9600 baud, display in three levels of video, and handle protected fields. With an optional eight-button function keyboard, it also understands how to edit (inserting characters or lines, deleting text, etc.). Its list capabilities includes page scrolling, tabbing, and cursor position sensing. Further, its list price is only $2495.

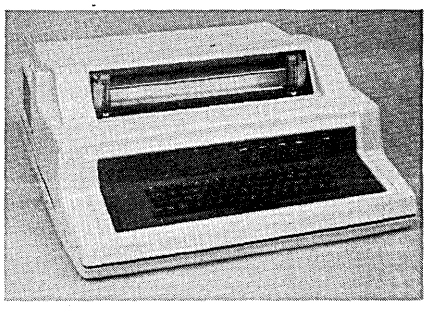
For who that do not require a really smart terminal but would like to add display to their teleprinter replacement, there is the Mini Bee at $1525. Built to look similar to the Super Bee, it will have an even more attractive oem price of $966 in huge quantities (2,000 units).

FOR DATA CIRCLE 206 ON READER CARD

DI-AN CONTROLS, INC.
Boston, Mass. Booth 1338

Printer Terminal

The 9030 uses an impact printhead to produce up to six copies of tractor-fed forms at operator-selectable speeds of 10, 15, and 30 cps. Among



the new printer's features are full ASCII upper/lower case character set, half- and full-duplex operation, even or no parity error detection, power supply, and RS232C interface. KSR units are priced at $2895 including EIA interface.

FOR DATA CIRCLE 201 ON READER CARD

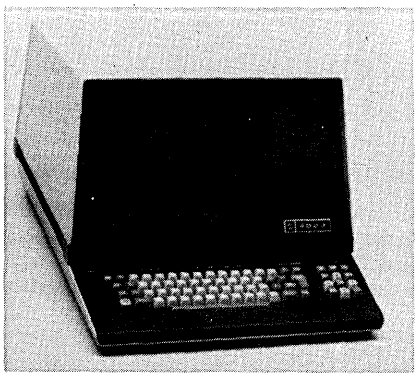
TEKTRONIX, INC.
Beaverton, Ore. Booth 2217

Crt Terminal

Tektronix has long made display terminals, but always of the storage tube variety. The 4023 is a departure, the company's first foray into straight crt's. Primarily an alphanumeric display device, the 4023 presents 24 lines of 80 5x7 dot-matrix characters from a 128-character ASCII set. However, the unit handles 32 special characters that can be used for limited graphics (lines, shadings, etc., on business forms, bar charts, and graphs). These make it almost a graphics terminal, at least for commercial applications.

Basic to its design philosophy is the user's ability to determine more than a dozen attributes of each field, including: white-on-black or black-on-

white characters, bright or dim, blinking or standing, displayed or invisible (for control characters, for instance), protected or variable, to be trans-



mitted or not, and numeric-only or alpha.

The unit will be offered at $2995 ($98/month with maintenance), and a special hardcopy attachment will be made available for about the same price.

FOR DATA CIRCLE 205 ON READER CARD

RCA SERVICE CO.
Camden, N.J. **Booth 1119**

Teleprinter

Users are always on the lookout for reliable teleprinter terminals, and RCA has come up with one that seems to offer a lot of good features. The model KSR is an all solid-state unit that sends and receives 8-level ASCII code at 10 cps. The unit is as compact as a portable typewriter and is said to be constructed for heavy duty usage and unusually quiet operation. Two models are available, one that prints on pressure-sensitive paper ($60/month), and one that uses a ribbon mechanism ($63/month). First units go to the field in July.

FOR DATA CIRCLE 183 ON READER CARD

OMRON SYSTEMS, INC.
Sunnyvale, Calif. **Booth 2135**

Microprocessor Terminal

The vendor of the 8025 programmable crt terminal reportedly started out to build an oem unit of only average intelligence. Apparently the designers just couldn't stop adding features till the device was configured with read-only, programmable read-only, and random access memory, a display of up to 1,920 characters, page rolling and scrolling, aynchronous and synchronous communications, and even limited graphics.

Starting with a 64-character ASCII set, the unit can be built up to a 192-character set in EBCDIC, Baudot, Hollerith, or special languages. In other particulars, like the up to 16KB memory and protected data fields that can be depicted in a half-dozen ways, the choice is also up to the customer. A parallel output bus, acoustic feedback (operator warnings), programmable editing, calculating routines, and display clusters are also on the options menu. The entire list of options would put any Detroit car maker to shame, so the starting price of "approximately $2500" may mean very little.

FOR DATA CIRCLE 176 ON READER CARD

I.P. SHARP ASSOC. LTD.
Carleton Place, Ontario **Booth 2701-07**

Video Terminal

The IPSA-100 is a portable keyboard and acoustic coupler that can turn any tv set into a video terminal. Housed in a light-weight carrying case is either an upper/lower case correspondence keyboard or a set of 89 APL graphic symbols, but the 100 can be optionally equipped with both character sets. The keyboard generates 8 or 16 lines of 32 5 x 7 dot-matrix characters on the screen, and can be removed from the carrying case for easier use. The acoustic coupler is at the end of a generous length of cable and supports 135-baud transmission. Higher transmission speeds are available, as are additional character display capacity

and composite video output for slave display monitors. The IPSA-100 is compatible with IBM 2741 line protocol, and is priced at $1695.

FOR DATA CIRCLE 188 ON READER CARD

Communications Monitor

Also on display will be the Monitor 232, a device for testing connections between EIA RS232-compatible terminals and their modems. One nine-volt battery powers the pocket-size tester which contains seven permanently monitored leads. Patch cords are supplied to perform nonstandard interconnects and signal simulation. An interface signal greater than +3 volts turns on the LED display. Available during the third quarter, the 232 will sell for approximately $100.

FOR DATA CIRCLE 189 ON READER CARD

communications gear

COMDATA CORP.
Niles, Ill. **Booth 2016**

Modem Cabinet

An expanded version of its series 330 modem cabinet will be introduced. Measuring only 37 x 22 x 22 inches, the 330 can contain up to 16 modems and associated Data Access Arrangements for both dial-up and dedicated lines, and still has room left over for a display panel for indicating the status of four control and two data functions. The price of the cabinet and racks is $835.

FOR DATA CIRCLE 184 ON READER CARD

GENERAL DATACOMM INDUSTRIES, INC.
Wilton, Conn. **Booth 2827,29**

Multiplexor

The TDM 1202 is a time-division multiplexor that can accommodate 37.5-2400 baud input from a mix of up to 96 synchronous or asynchronous sources and put it on a 40.8 Kilobaud line. The unit doesn't care what character set is sent to it. The 1202 features channel loop-back diagnostics that allow an entire channel to be checked out from the local site. The basic unit, with provision for eight channels, is priced at $1400. Channel cards for whatever speed input are priced at approximately $175 each. Availability is 60 days.

FOR DATA CIRCLE 199 ON READER CARD

TELE-DYNAMICS
Fort Washington, Pa. **Booth 2828,30**

Modem Tester

The model 7914A data set tester can be used on synchronous and asynchronous modems using either its own battery power, or drawing power from the data set being tested. Data rates may be 150, 300, 1200, or 1800 baud for asynchronous units, and up to 9600 baud for synchronous units. Error counts are indicated on a two-digit display and overflow indicator. Hand-shaking functions can also be exercised by the tester and monitored on the front panel indicators. In quantities of 1-10, the price is $495 each.

FOR DATA CIRCLE 198 ON READER CARD

CODEX CORP.
Newton, Mass. **Booths 2339,2438**

Multiplexor

The Model 8000 Time Division Multiplexor lets you cram up to 20 synchronous channels of 2400 bps to 19,200 bps each onto a single trunk line. The trunk used may be 40.8 Kbps, 48 Kbps, 50 Kbps, or 56 Kbps, depending on the data load those input lines carry. Said to be completely compatible with AT&T type 303 modems (or alternately, with a CCITT V.25 interface), the units have test facilities for local and remote loopback, built-in diagnostics, and indicators for status monitoring. The 8000's prices range from $4400 to $6900, depending on channel configuration.

FOR DATA CIRCLE 192 ON READER CARD

TIMEPLEX INC.
Norwood, N.J. **Booth 2815,17**

Channel Concentrator

The C-32 data channel concentrator switches up to 32 calling data sources (modems, terminals, multiplexors) on a first-come, first-served basis, with the output going to up to 16 data ports. The C-32 can handle synchronous and asynchronous full-duplex line speeds up to 9600 baud and is transparent to the type of code transmitted through it. The device would typically be used in an installation where a number of part-time users require random access to a smaller number of system ports. First units have been delivered, and the price is $3250.

FOR DATA CIRCLE 187 ON READER CARD

cassette gear

COMPUTER-LINK CORP.
Burlington, Mass. **Booth 1716**

Tape Cleaner

In addition to its capability for cleaning Philips-type cassettes, the model 111 can be used for other purposes, such as off-line rewinding and tape erasing—freeing terminals for more productive work. The 111 is also smart enough to detect cassettes having excess drag that might cause fouling during use. Pricing for the new product was just being set in time for the show, but if it holds anywhere near the $295 price we were given, the unit would seem like a good buy. Also on display will be a line of cleaning kits for tape drives and crt terminals. FREE SAMPLES!

FOR DATA CIRCLE 195 ON READER CARD

INTERNATIONAL COMPUTER PRODUCTS, INC.
Dallas, Texas **Booth 1602,04**

Cassette Terminals

Two of the four models of Termi-Cette character-incremental cassette peripherals are built for low-speed half- or full-duplex operation at 110, 150, or 300 baud. Both speak in ASCII, have high-speed searches (350 cps forward, 100 cps backward), operate in "local" or on-line modes, and have EIA RS232C connections to mate with terminals or with modems. The two differ in that the 3010 is a stay-at-home model, while the 3300 comes in a carrying case. Their unit prices are each $1600.

The other models, the 3100 and 3200, are high-speed units that run at seven selectable rates to 2400 baud. They search both directions at 350 cps, and since they recognize bit strings as characters, words, lines, pages, or files, they can be used for extensive editing. The 3100 is a single-deck drive retailing at $1985; the 3200 is a two-drive model which runs $2800.

FOR DATA CIRCLE 191 ON READER CARD

PSC TECHNOLOGY INC.
Glendale, Calif. **Booth 2919**

Cartridge Transport

The 3M mag tape cartridge has found yet another home in the series 3000 cartridge transport. The device's claim to distinction is in its speed, which can range from 12 ips to 120 ips reading and writing; searching, as expected, is done at the 120-ips rate. The unit uses packing densities of up to 3200 bpi on from one to four tracks across the quarter-inch tape, and data rates to 10,000 bytes/second per track are claimed. The single-track versions run $350 each if you are willing to sign up for 500 or more.

FOR DATA CIRCLE 194 ON READER CARD

INTERDYNE CO.
Van Nuys, Calif. **Booth 2725**

Dual-track Cassettes

Having two tracks of data on a 3M cartridge allows for doubling the available storage by writing on one track at a time, or doubling the transfer rate and storage by writing on both at once. The 2531 and 2541 drives can be used either way, for transfers of data at either 16 Kbps or 32 Kbps at maximum tape speed of 20 ips. The drives differ in the kind of heads used. The 2531 has a single-gap head, so it can alternately read or write; the 2541 head has a dual-gap, so it can read after writing. Both pack data at 800 bpi according to ECMA/ANSI standards, the vendor claims, and have a 40-ips search speed. In 1,000-unit lots they sell for $471 and $584, respectively.

FOR DATA CIRCLE 193 ON READER CARD □

INTERDATA
Oceanport, N.J. **Booth 2345**

Computer

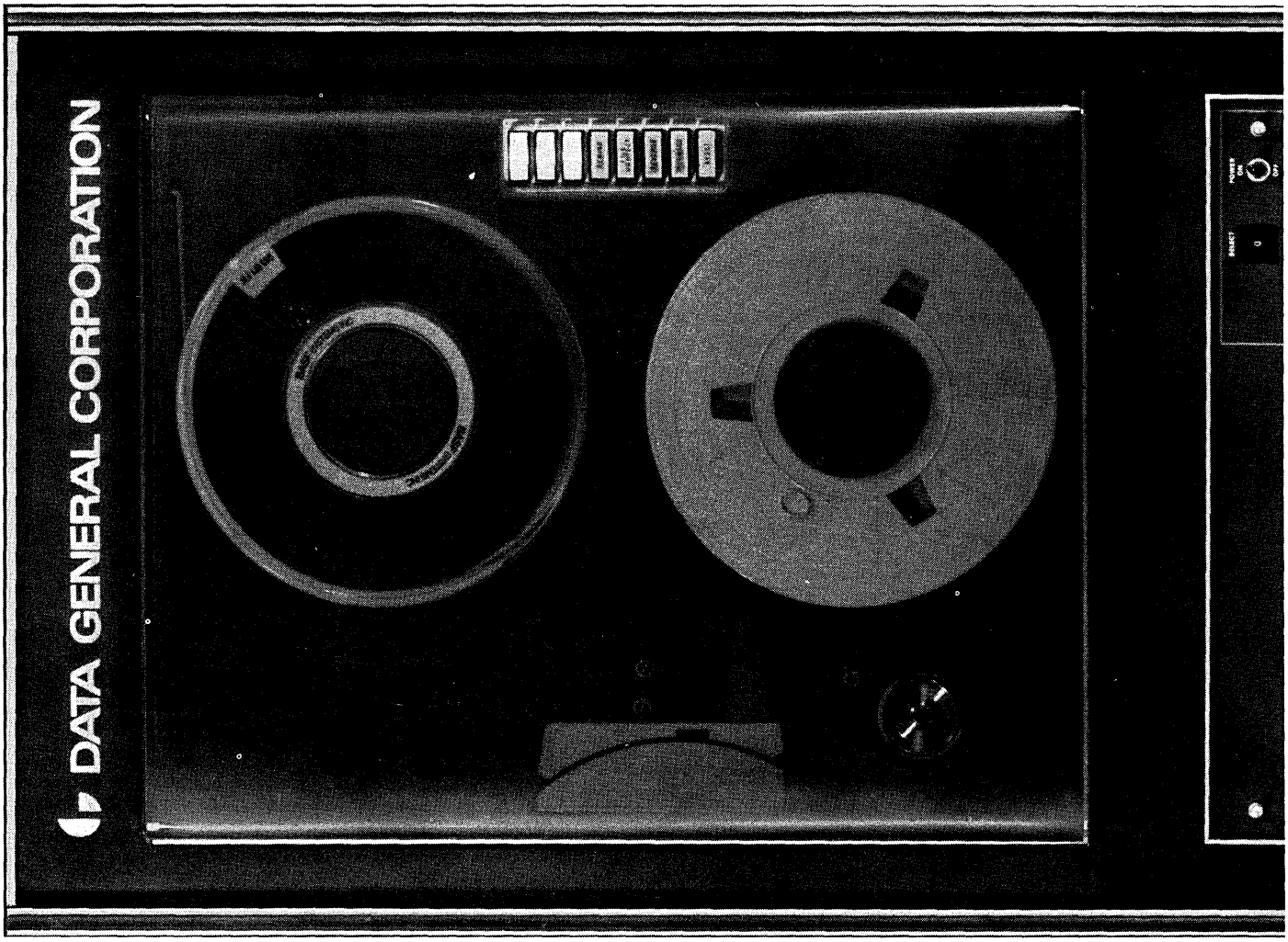
We somehow must alter our definition of medium-scale computers to include 16-bit machines that grow too powerful to be called minis. The model 85 Microprocessor is a good example. It is mini in price ($22,800 and up), but not in most other terms.

The machine is constructed with three kinds of memory—all fast. Main memory is dual-port, partially interleaved MOS LSI that cycles at 270 nsec and comes in sizes from 16K to 64K. That memory is backed up by 1K (by 32 bits) of 60-nsec read-only control store and by the same amount of 200-nsec user-programmable control store. Both of the latter are bipolar.

There is a 4MB direct memory access port, up to four selector channels, and a 30-line multiplexor. Other hardware features include 16 registers, 131 standard instructions, a fixed-point add time of 0.53 usec, and two's-complement arithmetic.

Software includes a choice of three operating systems, batch and interactive FORTRAN's, plus any applications programs written for machines in the 50, 70, or 80 series.

FOR DATA CIRCLE 173 ON READER CARD



DATA GENERAL INTRODUCES THE LOADED NOVA.

The loaded Nova is the new Nova 840 and the most comprehensive set of software/hardware capabilities ever available with a Data General computer.

It comes with a built-in Memory Management and Protection Unit that lets you expand main memory to 128K 16-bit words. Base price with 16K of memory is $16,530.

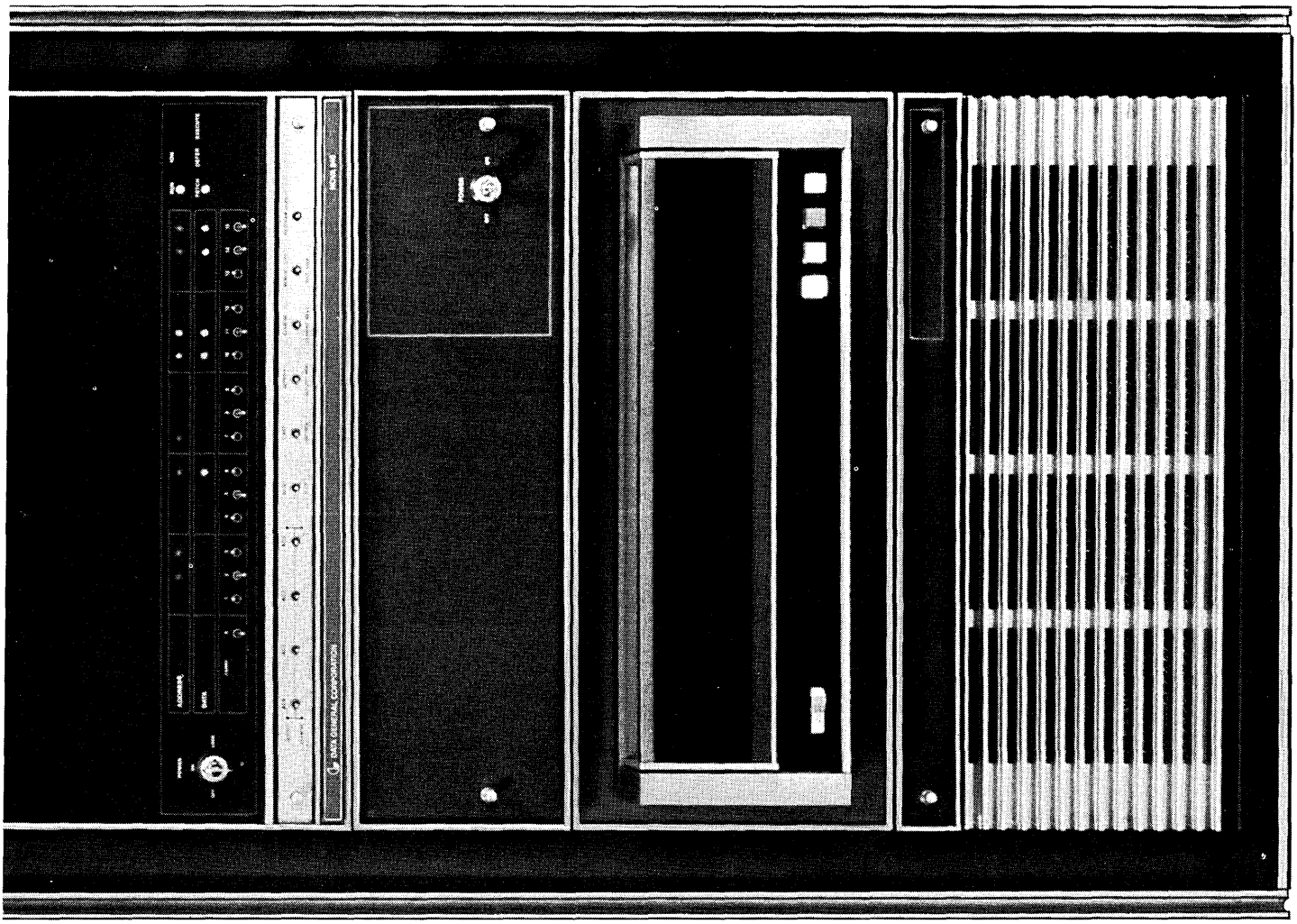
Nova 840 runs a comprehensive Real-time Disc Operating System (RDOS) for dual programming operations.

A new BATCH executive lets you pick your I/O devices, load your jobs, and walk away.

It has our new Fortran 5, Extended ALGOL, Extended Timesharing BASIC, and a whole library of proven Data General software; proven software that we can deliver now.

And our Remote Job Entry software can let the 840 double as a high-powered terminal to a big computer someplace else.

With the right kind of configuration (like the one shown), all that software is available free.



ON YOUR DOORSTEP IN UNDER 90 DAYS.

The Nova 840 in the picture has a central processor with 32 to 64K of main memory, a high-speed Floating Point Processor, hardware Multiply/Divide unit, fast-access disc storage, and 9-track mag tape.

The picture doesn't show lots of the other things you can get with Nova 840: line printers, card readers, Novadisplay terminals, fixed-head Novadiscs, moving-head discs, Nova Cassette tape, communications interfaces.

Nor could we show you the applications and service experience we've developed in the course of building, installing, and supporting over 6,000 Nova computer systems all over the world.

If you're looking for more throughput than you could ever get with a minicomputer, for better access to system resources, at a lower price, call Data General.

Call with an order: we'll put a loaded Nova on your doorstep in less than 90 days.

DATA GENERAL
Southboro, Massachusetts 01772

Hardware

Hardware Notes

For additional new products being introduced this month, please refer to the National Computer Conference Product Preview section starting on page 178 of this issue.

There's a new piece of hardware IBM is especially proud of. No, it's not some superdooper new computer with virtual everything. It's an Academy Award. And even though you didn't see it presented on national tv March 27, the one IBM received is, if anything, even more special than the ones handed to the stars that night. IBM, working with Consolidated Film Industries, Hollywood, qualified for a Class II award from the Academy of Motion Picture Arts and Sciences for coming up with a technique for improving the reliability and efficiency of balancing colors in films made for theater and television viewing. Class II awards are given only in years when the Academy determines that the achievement is an unusually significant one for the motion picture industry.

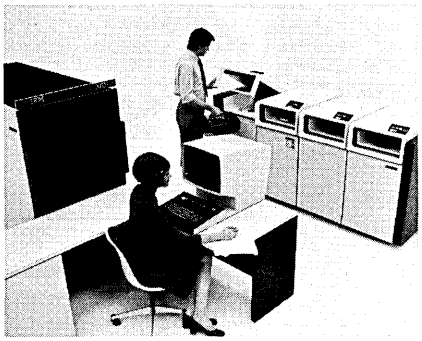
With the new process, which uses an IBM System/7 minicomputer, CFI expects to save 100,000 feet of film a month that previously would have been ruined by color errors in printing. The coveted gold statuette resides not in Armonk or White Plains, but in the home of an IBM systems engineer who helped develop the computerized procedure. He's Edward Efron of IBM's Los Angeles office. CFI has won the Academy's highest honor in the past, but this is the first time for IBM.

Tri-Data Corp., Mountain View, Calif., really believes the old saw that the customer is always right. When one customer insisted that it wanted a single-cartridge version of the firm's CartriFile storage device, Tri-Data first told the customer to get a two-cartridge unit and cover up one side! The customer balked, so Tri-Data gave in and developed the Mod 10, which, we hear, has turned out to be one of its better selling products.

The 370 model 115

The 370/115 was developed at the same German laboratory that spawned the 370/125, and the two machines are so similar in concept that it's "virtually" a sure bet that the 125 design team participated extensively on the 115 project. As on the 125, main memory (in this case 64 or 96K only) is surrounded by a number of satellite processors, each with its own control store and independent path into memory.

The standard processors include a machine instruction processor that also provides control for the 3340 disc system, the main storage controller, and a service processor that helps the instruction processor translate addresses for up to 16 megabytes of virtual memory, runs on-line diagnostics, and controls the system console and floppy disc.



Optional processors include a byte multiplexor channel that can support a variety of peripheral devices, including the 1419 magnetic character reader, 3270 information display system, 3740 data entry system, 3886 optical character reader, and the 3704 communications controller. The 115 can also run up to six model 3410/3411 tape units. Notice that when one describes the processors on IBM's latest computer designs that it is a very short jump from there to the peripherals.

The instruction processor on the 115 has its own 20,000 (22-bit) words of reloadable control storage. (IBM isn't saying what the other control memories look like.) In addition to holding the microcoded instruction representations, this memory stores emulation programs.

DOS/VS is the operating system for the 115, and it supports coding in assembler, RPG II, COBOL, FORTRAN, and PL/1. IBM is hoping that the languages and an integrated 360/20 emulator will entice a good number of its System/3, 1130, and 360 models 20, 22, and 25 users over to the 115. Both 80- and 96-column card equipment is handled by the 115, but System/3 users contemplating upgrading into the 370 family are faced with recompilation and control card changes to source decks.

IBM rates the 115 at 1 to 1.5 times faster in executing instructions as the 360/22, and 1.5 to 3 times faster than a 360/25. We were told that differences in basic architecture, instruction sets, and operating systems preclude any meaningful comparison in performance between a System/3 model 10 and the new 115.

Rounding out the baby 370 are a standard crt control console that displays up to 16 lines of 56 characters, with provisions for attaching an optional hard-copy printer, and at least two 3340 disc drives that are described later. A new printer was introduced with the 115—the model 3203, which is offered in 600- and 1,200-lpm versions running a standard 48-character set. It uses the same train cartridge as the 1403, but the hammers strike the train set harder, with better quality printing said to be the result. The 3203 has the built-in vacuum cleaner that IBM first used on its 3211 printer. The 600-lpm model rents for $940/month, and the 1,200-lpm version for $1234/month.

Perhaps the key to the success of the 370/115 will be user acceptance of one of its peripheral subsystems. The 3340 direct access storage facility is the long-awaited project "Winchester" device that integrates the recording medium, the read/write heads, and the access arms into a sealed container. Each model 115 must have at least two 3340 disc drives, and can have up to four. The 3340 has the best performance seen on IBM disc drives to date, with average access times of 25 msec and a maximum data transfer rate of 885 KB/second.

Data is recorded in the 3348 Data Module at extremely high density—1.5 megabits per square inch—and the high tolerances involved are given by IBM as the reason the Data Module is constructed the way it is. Whether that's the real reason or not, it will be quite a challenge for independent peripheral suppliers to duplicate. Most disc drive manufacturers aren't familiar with plating techniques that allow recording densities on the order of 1.5 megabits/square inch, and media suppliers have never had to worry about building mechanical disc drives. Memorex is one corporation that does do both, but even its manufacturing and media operations are organized into distinctly separate divisions. To complicate matters, IBM isn't saying anything about how the 3348 is internal-

ly constructed—how many platters, how many heads, etc.

Even if the independents do decide to tackle the 3348 Data Module, it's probably an expensive item to build. It's expensive anyway — IBM gets $1600 for each 35-megabyte pack, and $2200 for each 70-megabyte 3348 Data Module. Users should carefully consider how much data they may want to put on-line with a 115, as too many 3348 modules lying around idle would be an expensive proposition. IBM rents the packs for $59 and $82 per month, respectively.

Another feature of the 3340 system that we were unable to get more information about concerns an error correction code that corrects a single loss of data up to three bits long and detects errors up to 11 bits long in each record. We were unable to learn from IBM whether users would know that the error detection/correction mechanisms were working, or whether their activity would be reflected in the system performance statistics.

The 3340 is the only disc subsystem currently offered by IBM for the model 115. It can also be attached to any 370 model up to a 158, but those users (even the little 125 user) have alternative disc system choices that are cheaper on a rental-per-byte-per-month basis. Perhaps one of the more enterprising independent peripheral manufacturers will develop a less expensive storage subsystem for the 115. IBM states that it will have the answers to our questions regarding the 115 and the 3340 disc subsystem as soon as the first customers receive them, with the possible exception of the error detection/correction technique. By that time the independents will be another six months behind.

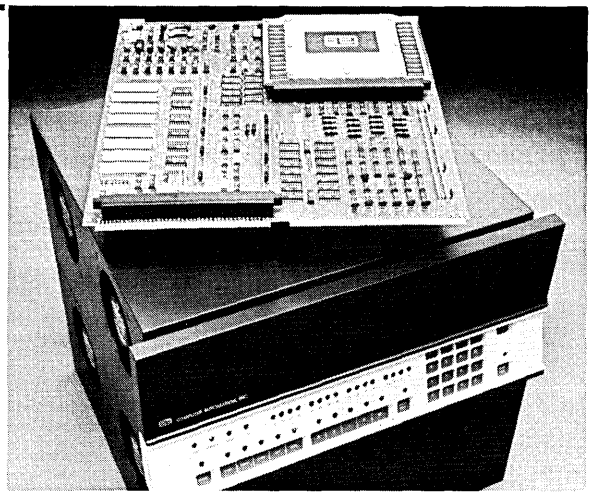
The 370/115 is scheduled for first customer shipments in the first quarter of next year. The 3340 can go to 370/125 users as early as the fourth quarter of this year, with availability for all other models set for the first part of next year. Early 1974 will also see first shipments of the 3203 printer.

A 64K 370/115, with a 2560 multifunction card I/O unit, a 3203 600-lpm printer, and a two-drive 3340 disc subsystem, sells for $265,165 and rents for $5891/month. For $352,115 or $8155/month you can get a 96K model with the 2560 unit, the faster 3203 printer, the two-drive 3340, and a four-drive 3410 magnetic tape subsystem. The 3348 data modules are extra. A four-drive 3340 configuration sells for $68K and rents for $1704/month. IBM's extended-term leases are available on all these products to reduce monthly payments. IBM CORP., White Plains, N.Y.

FOR DATA CIRCLE 278 ON READER CARD

(Continued on page 191)

product spotlight



MOS/LSI Minicomputer

There is virtually no limit to the types of applications we may see automated in the future because of this product—a 16-bit minicomputer that sells for only $990 in quantities of 200 complete with 4K of memory and a direct-memory-access port. Use of MOS technology throughout the Naked Mini/LSI has resulted in a product less than half the price of Computer Automation's earlier Naked Mini, and one that should be even more reliable due to a reduction in the number of cpu pin connections from 8,000 to only 280.

To a large extent, the Naked Mini/LSI is a technological elaboration of the original Naked Mini design, which had both byte and word addressing of up to 256 KB of memory. Memory on the Naked Mini/LSI can be MOS, core, or combinations of the two, with the first 8K sharing room on the 15 x 16-inch pc board with the cpu. The processor board also accommodates a small "piggyback" option module that contains a real-time clock, a loader, and an interface for either a tty or crt terminal. This popular option is priced at approximately $385 per card in a 200-unit order. A tty interface card only is priced at approximately $200 for the same quantity.

The design of the processor is one of the more interesting aspects of the Naked Mini/LSI. Before the machine design was committed to MOS circuitry, a huge seven-level breadboard cpu was constructed, with each level containing several hundred integrated circuits that would later be synthesized into one of seven processor chips. Computer Automation took this opportunity to make some changes in the manner several of the 162 basic mnemonic instructions were implemented in the previous Naked Mini to make them more effective. An associative ROM is used to hold the instruction routines. At this point in the design, every program in the Naked Mini library was run through the breadboard to insure that the machine would be totally compatible with the prior Naked Mini.

Other ways of getting into and out of the Naked Mini/LSI, in addition to the standard 625 KB DMA channel, are through the standard maxibus with four additional I/O systems: block I/O transfer at approximately 128 KB/second; programmed I/O at 34 KB/second; a direct memory channel that differs from a DMA port in that data is transferred into or out of the memory from any address at 26 KB/second with word count and current address maintained in memory; and a program I/O to memory at 24 KB capability.

An additional configuration of the Naked Mini/LSI, called the Alpha/LSI, is available with fully encased chassis that includes a power supply and a control console with a hexidecimal data input keyboard and light-emitting diode displays for monitoring computer operation. Up to 32K plus two I/O controllers, or 8K plus eight I/O controllers can be housed by the Alpha/LSI chassis before expansion modules are needed. This configuration is priced at $1990, single quantity.

Software available for the LSI machines is the same stable offered with the earlier product lines (which will continue to be built, as they operate somewhat faster than the all-MOS computers). Included on the list is a disc operating system, a real-time executive that includes I/O and communications submonitors, a tape operating system, a cassette-based operating system, BASIC and Extended BASIC, FORTRAN, a conversational and a batch assembler, a utility library, diagnostics, and a file manager. First deliveries of the Naked Mini/LSI and Alpha/LSI minicomputers will be in late fall, with quantity production starting in December. COMPUTER AUTOMATION, INC., Irvine, Calif.

FOR DATA CIRCLE 260 ON READER CARD □

iomate of the month

The industry's broadest line of mini peripherals. Paper tape equipment. Disc, magnetic tape and mag tape cartridge storage systems. Line printers. OEM data-entry and communications terminals. Controllers and adapters. All available from one supplier. With volume discounts across the full product mix.

You'll like this month's beauty. The IODISC® series 3000 top-loading disc drive that packs 96-million bits of direct-access storage into a standard 24-inch deep, 9-inch high rack.

It's fast. Average access time is 55 milliseconds with an option of 35 milliseconds available.

It's versatile. The removable disc cartridge interacts with a fixed disc for instant access to on-line information as well as to data from the off-line library.

It's reliable. A unique rotary actuator replaces the standard voice coil to reduce size and weight, drop power requirements to a low 150W, cut heat. And a high volume, two-stage air filtration system eliminates contamination.

It comes in two models. IODISC 3402 stores 48-million bits at 100 tracks per inch. IODISC 3404 at 200 tpi has a 96-million bit capacity. With OEM discounts, they are the lowest priced top loaders on the market.

Series 3000 disc drives are backed by iomec's nation-wide customer engineering team. Specialists who support iomec's OEM customers. And their end-user customers.

For information on the full line of iomates, contact:

iomec inc
DataStor Division

345 Matthew Street, Santa Clara, California 95050 (408) 246-2950 TWX 910-338-0152

See the iomates at Booth 1219, NCC, June 4th thru 8th, New York Coliseum

hardware

Data Entry System

The heart of Lockheed's entry into the shared-processor key-to-disc market is its own 16-bit MAC minicomputer, expandable from 8-128K of 1-usec memory. Up to 32 data entry stations are accommodated by the processor, with one dedicated as the supervisor station.

Three types of terminals are offered. The basic one is the model 3220 KPR

(keypunch replacement), which has a keyboard similar to the IBM 029, but with additional control functions. The 3220 has a light-emitting display showing the operator the alphanumeric character or symbol just entered, position of the next character to be keyed on the form, record or format number, and error type. An additional message display is available to indicate mode, status, instructions, and errors.

The 3230 terminal is similar to the 3220 but has a larger crt screen split into two sections, one showing control information and the other showing fixed-format data or such information as crossfoot totals. The third terminal is the 3262 I/O typewriter, an IBM Selectric. Terminal types may be mixed on the system.

Information is stored on a 5-megabyte disc drive that also stores editing program formats. Up to three additional discs can be added to the system. Data entered by the operators can be sorted before it is output to an IBM-compatible tape drive for delivery to a computer for processing. An 1100-lpm printer is offered as an option. On-line interfaces are planned for most popular computers.

Pricing was still being determined for the new product as this was written, but it was thought that a typical 24-station configuration would sell for approximately $185K, with third-party leases and maintenance available. Delivery is 60 days. LOCKHEED ELECTRONICS CO., INC., Plainfield, N.J.

FOR DATA CIRCLE 279 ON READER CARD

Wide Screen Crt

The 3001 should help reduce the strain on those who must spend a good deal of time sitting in front of crt terminals, for the tty-compatible device displays characters 25-50% larger than conventional computer terminals. The characters are still 5x7 dot-matrix, but measure .25 x .10 inches across a 15-inch diagonal screen that holds up to 16 lines of 80 characters. The 3001 has switches for full- and half-duplex operation at speeds ranging from 110-4800 baud through an external acoustic coupler. The standard interface is a choice of RS232C or tty current loop. The large characters, combined with a refresh rate of 50 Hz, would seem to qualify the 3001 as a good terminal for computer-assisted instruction applications. The unit lists for $2300, and full-payout leases can be arranged. Delivery is on the order of 30-60 days. INTERACTIVE TERMINALS CORP., Southfield, Mich.

FOR DATA CIRCLE 263 ON READER CARD

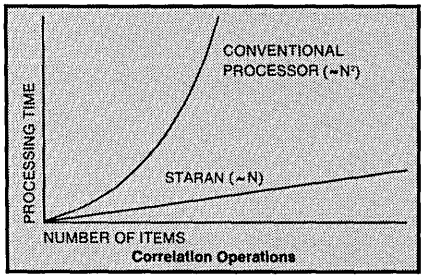
Printer Accessories

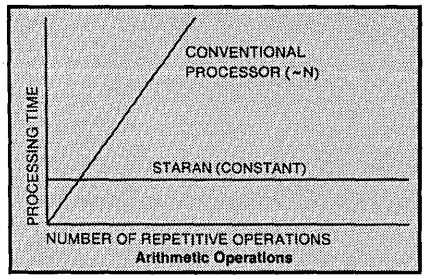
Just because a printer ribbon has had the ink pounded out of it by a line printer is no reason to junk it, say the developers of the XRL/100 extended ribbon life system. They claim, in fact, that nylon ribbons are pounded into an even nicer material resembling silk after a million lines or so, and when re-inked in the XRL/100, produce better looking output than the original rib-

Add Staran. Subtract processing time. Multiply effectiveness.

Thinking of adding more computer capability? Think about Goodyear's STARAN(TM) associative array processor.

STARAN provides an effective combination of fast associative array processing and conventional sequential processing—the most efficient approach to a variety of data processing problems.





As the charts show, the higher the number of items to be processed, the more advantageous STARAN array processing is for both arithmetic and matching operations. For applications involving a high degree of parallelism, or a highly dynamic data base, STARAN is unequalled. It can solve problems economically that are too expensive in money and time with sequential processing alone.

STARAN can achieve input-output rates of up to several billion bits per second. And execution rates of up to several hundred million operations per second.

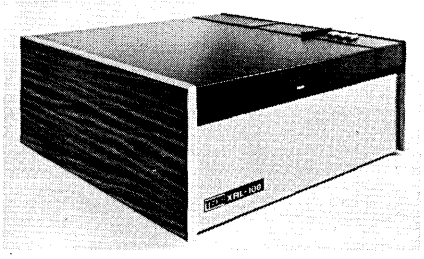
Yet STARAN is relatively inexpensive. You can buy it with varying capacities of array and sequential capability to suit your needs. A minimum basic STARAN system can cost as little as $250,000 and software cost can be reduced to one-third of conventional system software.

To determine if these savings can be achieved for you, let us work with you on your problem. Goodyear invites you to test STARAN at our Akron, Ohio facility.

For more information, or to plan a demonstration, write: STARAN Marketing, Department 920, Goodyear Aerospace Corporation, Akron, Ohio 44315, or call (216) 794-3631.

GOODYEAR AEROSPACE

bon. It's claimed that ribbons can typically be re-inked with the XRL/100 two times, but some early users of the product report successful treatment as many as five times. Obviously, the more ribbons re-used by an installation each year, the more money there is to



be saved. Re-inking takes approximately 15 minutes, and the ribbons are then stored in a box (cured) for 48 hours, after which they can be used. The first three models available are for the IBM 1403 ($3500), the 3211 ($3800), and a unit that does both ribbon types ($4200). The XRL may also be leased, and delivery is 30 days ARO.

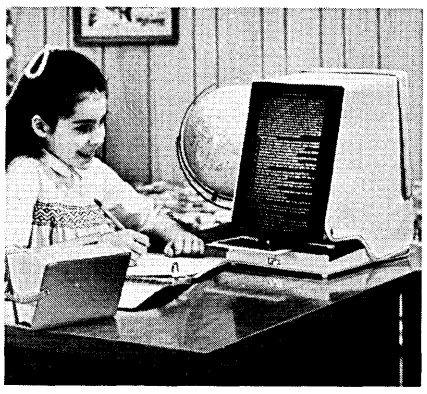
FOR DATA CIRCLE 261 ON READER CARD

Another product just introduced by this firm is a line counter for the IBM 1403 that can be used to keep statistics on printing activity, to bill clients, etc. It fits atop the 1403, measuring only 3 x 6 x 6 inches. One counter in the unit constantly accumulates, and the other can be reset. The line counter is priced at $300. TEDA CORP., Sepulveda, Calif.

FOR DATA CIRCLE 262 ON READER CARD

Microfiche Viewer

Here's one of the nicer portable microfiche viewers we've seen. It can be run from wall currents of 110, 127, 220, and 240 volts or by six standard flashlight batteries. The 8 x 11-inch viewing screen folds into a book-size package



when not in use, and it's claimed that the screen is fully protected from damage when folded. Additionally, the COMPACT has a storage compartment that holds 200 fiche. The film carrier does not restrict the size of fiche that can be entered, and the COMPACT has dual magnification for looking at various reduction ratios. Weighing in at just four pounds, the COMPACT sells for just under $100. REALIST INC., Menomonee Falls, Wis.

FOR DATA CIRCLE 265 ON READER CARD

Data Entry/Processing

The System IV/40 may come to be known as the chameleon because of its ability to blend into so many applications. When from 2 to 16 video terminals are combined with its 24-72 all-MOS/LSI processor, the IV/40 is ready to do source data entry, including verification and validation of input. This input is stored on a 2.5-megabyte cartridge disc for subsequent transmission to an IBM 370 through a bisynchronous communications controller. Three 1,152-character crt terminals (24 lines of 48 characters), a 24K-byte processor, cartridge disc drive, and communications unit rents for $573/month on a one-year lease. Additional terminals rent for only $41/month.

The IV/40 can also be used for real-time data entry to and retrieval from a central data base. In this configuration, the system looks like an IBM 3270 or 2260 display system to either a local or remote 370. A 16-terminal system with a floppy disc drive for loading the

simulation program rents for only $1116/month, with 2260 simulation configurations slightly higher. These prices include software, systems education, and maintenance.

Except for the fact that there is no card support on it, the IV/40 is a very capable data processing system, with

its cpu rated at equal to the power of a 360/30. Both assembly language and COBOL run on the IV/40, but programs for custom applications must be compiled on Four-Phase's larger System IV/70. Compiled programs are then transferred to the IV/40 via a 250K floppy disc. The manufacturer will concentrate on marketing the IV/40 to large corporations with distributed computing centers, generally shunning the "Ma and Pa" type of small business application. It's claimed that the IV/40 can replace such equipment as the IBM System/3 currently being used in these networks at nearly a 75% reduction in cost. The System IV/40 will go to the field during the third quarter of this year. FOUR-PHASE SYSTEMS, INC., Cupertino, Calif.

FOR DATA CIRCLE 266 ON READER CARD

Medium-scale Computer

The 9480 has been inserted in the Univac 9000 series between the 9400 and 9700 models and is intended as a grow-to model for the 9400 user who needs more on-line storage capacity. The 9480 is the first commercial computer from Univac to feature semiconductor main storage, in this case 600-nsec MOS ranging in size from 64-256K on the byte-oriented computers. The large disc storage capacity of the 9480 is furnished by the 8424 disc subsystem whose characteristics are not unlike the double-density versions of the IBM 2314 that were offered by the independent peripheral manufacturers until the 3330 was announced. An 8414 stores up to 58 megabytes per pack, with a full eight-pack system storing 466 megabytes. The access time is 30 msec, and the transfer rate is 312 KB—both the same as IBM's 2314.

The disc-oriented 9480 processes up to five concurrent jobs and features I/O spooling and dynamic program allocation. There are 16 registers available to the user and 70 basic machine instructions. A full line of peripherals can be hooked up to either a 333-KB/second selector channel (maximum of two), or an 85-KB multiplexor channel. Both channels have eight device positions, and the system can support the maximum channel rates of all channels simultaneously.

A typical 9480, consisting of 64K of memory, one each selector and multi-

plexor channel, console, 600-cpm reader, 900-1, 100-lpm line printer, two 34-KB tape drives, and two 8414 disc spindles (106 megabytes of capacity), rents for $8285 on a one-year lease and can be purchased for $277,967. These figures make the 9480 competitive with the top configurations of the new IBM 370/115, and the smaller con-

figurations of the 370/125. Delivery is immediate. UNIVAC, Blue Bell, Pa.
FOR DATA CIRCLE 271 ON READER CARD

Minicomputer Family

Microdata has probably built more microprogrammable minicomputers than all other companies combined, and its latest series 3200 machines draw upon all the lessons learned in designing and marketing these machines both to oem and end-user customers.

The basic machine is the 3200, which to the outside world appears as a 16-bit minicomputer capable of addressing up to 256K bytes of MOS memory that can be read in 300 nsec and written in 400 nsec. But down deep, in the 3200, it's a 32-bit machine for executing microinstructions from a 135-nsec ROM. Central to the 3200 architecture is the Monobus, an asynchronous high-speed bus through which all transfers between processors, memories, and I/O devices must pass. Memories on the 3200 can be read-only, programmable read-only, and read/write, intermixed if desired. Filling out the 3200 cpu is binary fixed-point arithmetic, 32 general-purpose registers, and even instruction look-ahead. This machine will probably be sold mostly to oem's, and it's priced at approximately $8K with 8K bytes of memory.

The 3230 is Microdata's previously introduced 821 minicomputer implemented in the firmware of the 3200, making the 3230 compatible with the 821, but yielding a 10:1 improvement in speed, it's claimed. This machine has 110 basic instructions, including those for decimal arithmetic, character/string manipulation, stack control, variable-precision arithmetic, and multiply/divide.

The last member of the new family is the 32/S. Here the stack architecture is used to support a subset of PL/1 called MPL (for Microdata Programming Language). This is the basic language of the computer—no assembler is needed. The MPL will accommodate both machine- and micro-level instructions.

All machines will be available this summer in both desk-top cabinets or as pc boards for oem's. Software is under development for the 32/S, including a real-time monitor with all I/O control, loaders, cross-compilers, and FORTRAN. MICRODATA CORP., Irvine, Calif.
FOR DATA CIRCLE 268 ON READER CARD

Drum Plotter

CalComp continues to add to its already extensive plotter line with the addition of the 936 drum plotter. It features interchangeable drums to accommodate paper ranging in width from 11.7 to 33 inches, a swinging pen carrier to ease paper loading, programmable pen selection of three pens, a scaling device to compensate for paper width variations due to climatic condi-

tions or inking variations, etc. The 936 has an axial speed of 3.6 ips with the pen down and 5 ips with the pen up. The resolution is .002-inch and the repeatability something less than that; a comprehensive library of support software is available for it, some bundled, some not. A typical on-line unit, with an interface for the IBM 1130, typically runs $17,100. The 936 can also be leased. CALIFORNIA COMPUTER PRODUCTS, INC., Anaheim, Calif.
FOR DATA CIRCLE 267 ON READER CARD □

Software & Services

Software Notes

Software AG, the Reston, Va., office for a data base management system called ADABAS, asks $2500 for a demonstration on potential customer files. And they claim to be performing four demonstrations per month. Two things strike us as interesting about this. First, there must be a very large number of users dissatisfied with the data base management systems they are currently using to pay for the privilege of evaluating another one. And second, if Software AG can continue to demonstrate ADABAS at the present rate, it almost isn't necessary to make any sales! Actually, we hear that sales of the $120K package are going quite well.

There are three principal reasons why software is still the "disaster area" of the computer business, says Malcolm M. Jones, assistant professor of management at MIT: 1) It's a labor-intensive activity, and so far there hasn't been much progress in automating its development. 2) Software is all development; there are no prototypes or manufacturing stages. 3) Not enough attention is given to designing software so that it can easily accommodate the future changes to it that are almost inevitable. Jones feels these three factors also make software expensive--as much as $200 per instruction for the programs used in the Apollo moon missions.

The power of computer simulation has been brought to bear on a problem that affects a goodly number of us--tooth defects. The Univ. of Southern California and the Jet Propulsion Laboratory have teamed up to see if they can find a way to make tooth implants--used to replace missing teeth--last longer by overcoming the tendency of human tissue to break down in the area of the implant. An 8,000-statement Fortran V program has been written to simulate the stresses placed on the jawbone and the teeth by the chewing action. Progress has been made. A better implant has been found, and program checking recently revealed only one new cavity.

ISAM Simplifier

Applications programmers can use the capabilities of IBM's Indexed Sequential Access Method without having to learn its intricacies, according to the supplier of this programming tool. They can code in higher level languages and handle data file management tasks through ISAM as if it were a subroutine.

The tool is called IP/ISAM. It provides for mixing sequential and random accesses, opening and closing files, and preventing conflicts between programs accessing the same data. The program requires that external workspace, like FORTRAN COMMON, be established, and then allows for addressing ISAM functions through call statements of the form CALL READ RA for reading a random access file.

Written for any 360 or 370 running under OS, IP/ISAM needs about 8K of memory and is priced at $3000. In addition to its operating as an applications program interface, it reports on file usage (how many records in the prime data area, how many overflow records, etc.) and offers facilities for fine tuning applications programs (for instance, by varying the number of buffers). It is expected to be modified to support VSAM when that program becomes available. ADL SYSTEMS, INC., Cambridge, Mass.

FOR DATA CIRCLE 281 ON READER CARD

Project Control

In a way, the PROCON project control program lets the employees plan and keep track of their work; its base source documents are employee-completed status forms that allow the worker to indicate when he expects to complete a task and why he may be having trouble with it. Any slippages anticipated by the employee are run into a PERT-like forecast network, and additional reports notify the employee, other employees waiting for him to finish, the project leader, and the manager just how the whole project will be impacted.

Employee activity reports also show how well each worker sticks to his plan of attacking assignments and also how well or how poorly he has been able to estimate his time requirements in the past.

Other reports are generated for accounting (including for user billing and budget distribution), employee availability (which also shows departmental load), and planning and control (which show project status, progress in bar chart form, and expenditure trends).

The 18,000-card COBOL program incorporates simulations for iterative tuning of project plans, and forecasting for anticipating problems and overruns. The program is priced at $11,500 including five days of training, a year of maintenance, and what looks like 100 pounds of documentation (50 employee manuals, 20 project leader manuals, etc.). It requires 100K bytes on a 360 running under OS. CRAIG & NICHOLS, Chatsworth, Calif.

FOR DATA CIRCLE 282 ON READER CARD

IBM 3705 Functions

Those installations with an IBM 3705 communications box used in 270X emulation mode may be interested in these extensions to the emulator software. The first package matches line speeds with the appropriate oscillator in the hardware, meaning that a single line interface and modem can then handle either 110-, 135-, 150-, or 300-baud terminals. The reduction in lines and data sets could easily pay for the $400 object deck.

Package two converts incoming teletypewriter code to be compatible with IBM 2741s, again allowing for both to come in on one line through a single modem. A freebie feature is the protocol to accept tty paper tape input. Package two runs $1000.

Both programs come with generation macros, full instructions, object decks, and the additional requirement that three-branch instructions in the emulator program be modified. COMMPRO ASSOCIATES, Manhattan Beach, Calif.

FOR DATA CIRCLE 283 ON READER CARD

Data Security

The state of the art of data security in time-shared systems is not far advanced. Good programmers can force their way into almost any file. IBM's password facility has helped, but passwords are vulnerable primarily because the people that use them are. The Data Access Security System takes away part of the vulnerability by never allowing the user to know even his own passwords. It generates passwords from run information with some random finagling.

People may try to crack the code, but at least they will have to leave an audit trail that will be picked up by the IBM software. The idea is to get to them before they get to the data.

Built as an extension to IBM's code, DASS works under IBM's TSO processor

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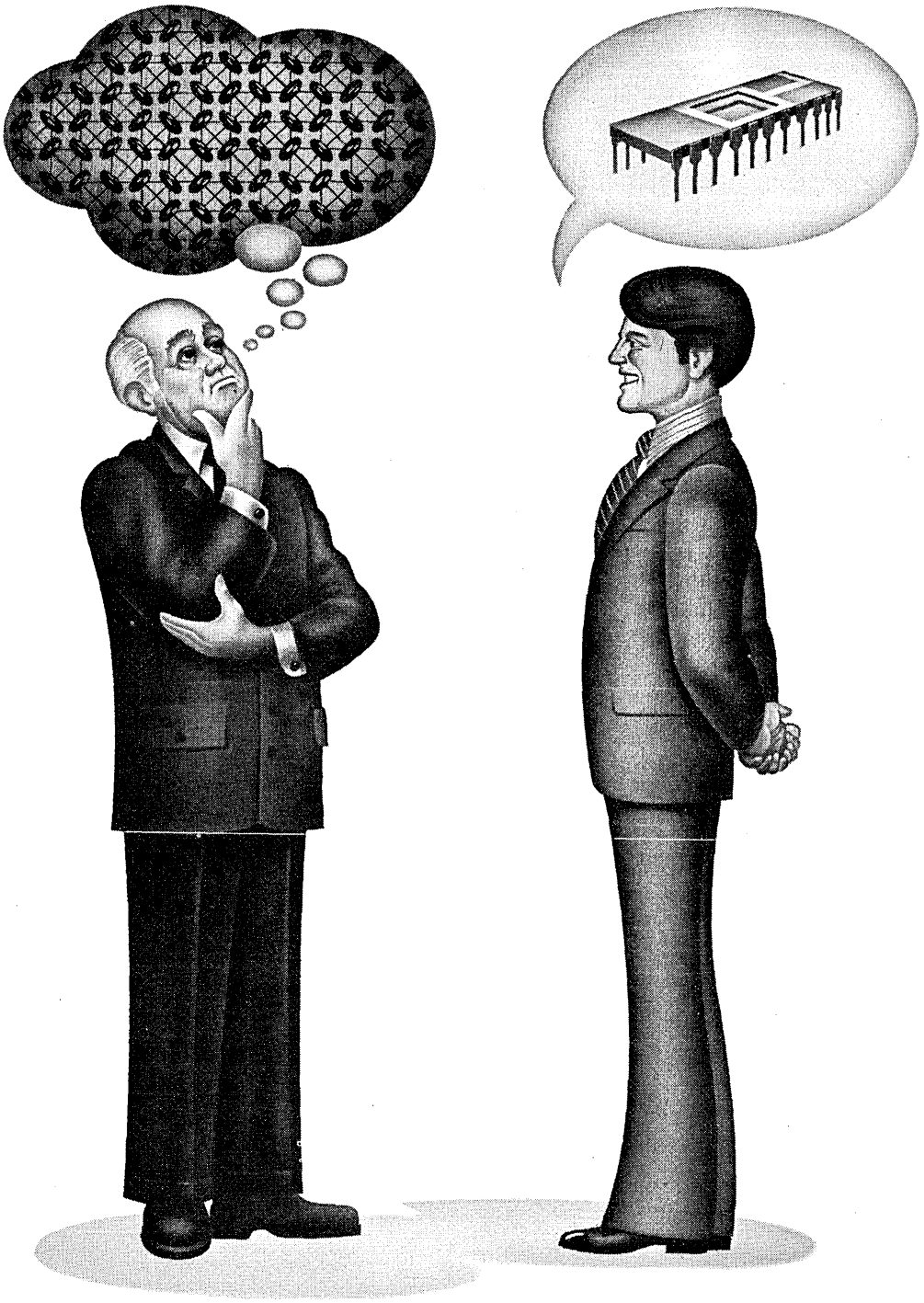

If you're being slowed down by core memory, we'd like to refresh you with a few facts about add-on AMS Monolithic Main Memory from ITEL:

With it, you can upgrade memory at less cost than core, and it's far more reliable.

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under os and vs systems. It is expected to sell for under $1000. INFORMATION MANAGEMENT INC., San Francisco, Calif.

FOR DATA CIRCLE 284 ON READER CARD

JCL Retriever

Just as a source library of programs can be constructed, so can tables of sets of JCL statements if you have a copy of JCL-OMATIC. The program, which is said to speed JCL coding by 75%, retrieves control card sets in response to a unique installation-defined code in a parameter card.

Unfortunately, the parameter card cannot be entered as part of the job run—the deck must be punched or spun off on disc before the job starts —but the system does have the advantage that the JCL sets can be used to enforce installation standards. JCL-OMATIC's price of $5000 (or $170/month) brings you an object deck, implementation manual, and user manual. MC DONNELL DOUGLAS AUTOMATION CO., St. Louis, Mo.

FOR DATA CIRCLE 287 ON READER CARD

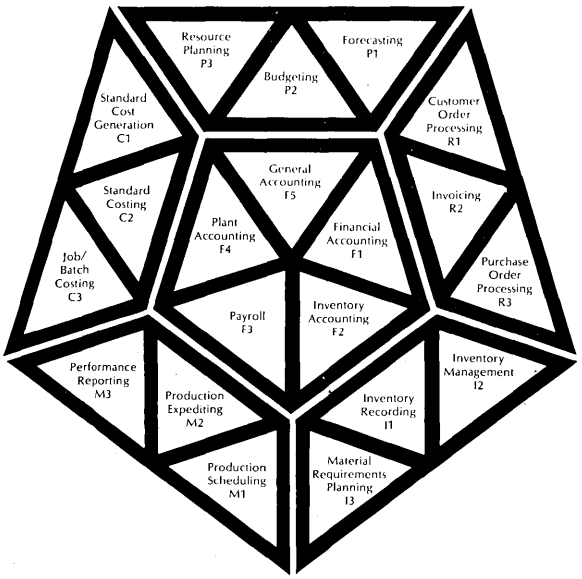
Time-shared WATFIV

This film is claiming another first in offering WATFIV, the update of the well-liked WATFOR from the Univ. of Waterloo in Canada, on a time-shared service basis. Other firsts claimed are first to offer time-sharing on an IBM 360/67 (the original IBM virtual machine), first to offer full interactive COBOL, and first with fully interactive PL/1.

What WATFIV (pronounced "what five") means to the user is the chance to compile up to eight times as fast as IBM's FORTRAN IV level G, better diagnostics, and handy extensions. The diagnostics include checking for uninitialized variables, illegal entry into DO's, and out-of-range subscripts, among others. (Error comments name the variable, describe the violation, and give the location.) Extensions include free-format I/O, error routine entry, and nonnumeric subscripts.

The service is offered nationwide using five 360/67s distributed between Sunnyvale, Calif., and Stamford, Conn. Multiplexors are located in 55 cities and remote job terminals in 17. The interactive service is priced at $10 per connect hour, plus 38¢ per cpu/second in processor state, plus $10-20/month per 120,000 characters (2314 cylinder) stored. No extra charges are made for cross-country transmission of

software spotlight



Company Management

We tend to think of America as an exporter of computer technology, including software. In most cases that's true, but we have recently seen exceptions in very large systems like this one from Hoskyns of England, which is being marketed in the U.S. through Martin Marietta Data Systems. Martin refers to the package of 20 subsystems of 78 jobs and 250 programs as MAS for "Modular Application Systems," and it is difficult to put a generic label on the product. MAS seems to include all of the software required to run a company, everything from inventory management to invoicing to payroll to financial accounting.

Five major systems are included: inventory control, order control, manufacturing control, cost control, and business planning. These overlap and interact to form a conglomerate you can think of as financial control. Any one of these, or any part of one, is available separately.

Even calling the *sub*systems "packages" is a little misleading, for it is not expected that they will ever be installed in standard form. Instead, each program included is built to be modified with parameter cards that control the type of processing they perform and the formats of the output they produce. For instance, the material requirements planning program has the facility to suggest order quantities determined some six different ways; the choice is the user's. The decisions to be made from studying the output of any of the elements are left to the user, too, the vendor claims. The MAS concept has reportedly been to present the alternatives and suggestions—along with projections of what will happen for each alternative—and force the user to think about the choice.

To get some grasp of the size and complexity of the offering, the inventory system alone includes four major jobs: inventory recording, inventory management, materials requirements planning, and inventory accounting. Together the jobs comprise 30 programs. The cost to a user to implement the system would include an off-the-shelf price of about $40,000 for the code, plus extensive customizing, installation, and support leading to a "reasonable" estimate of $80,000.

The company, unlike some others, is quick to point out the large difference between off-the-shelf and delivered costs because in the end the system implemented is uniquely that of the customer just as if it had been written from scratch. And still the starting-with-standard-code approach should be less costly by far for the customer. For instance, that inventory system includes some 45,000 lines of code. At 500 lines of checked out code per month, that represents 90 man-months of coding, not counting analysis, design, and documentation.

The programs are written in COBOL, for operation on IBM gear under OS or DOS. They are supported by a U.S. staff of 80 to 100 program customizers and another 40 to 50 support and design people. Although MAS is new to the U.S., Hoskyns claims some 250 installations overseas. MARTIN MARIETTA DATA SYSTEMS, Baltimore, Md.

FOR DATA CIRCLE 280 ON READER CARD □

software & services

data since the vendor doesn't want to be accused of trying to be a common carrier. NATIONAL CSS, INC., Norwalk, Conn.

FOR DATA CIRCLE 285 ON READER CARD

Fortran for PDP-8s

DEC is making FORTRAN IV available to its smallest users with a compiler reported to be an extension of ANSI's standard X3.9-1966. The extensions to classic FORTRAN include handling of generalized array subscripting, handling of up to 12-dimensional arrays, and an overlay feature that has run a 200,000 machine instruction coordinate geometry program in 16K.

The program will run in as little as 8K and features English-language comments on format errors, plus error traces that span the entire flow of program leading to the bad statement. DIGITAL EQUIPMENT CORP., Maynard Mass.

FOR DATA CIRCLE 286 ON READER CARD

Disc Space Calculator

Somewhere out there works a man who once had his files on IBM 2311 discs, converted them to 2314s when those drives became available, thence to 2319s, and maybe even to 3330s. For him, VOLCAL would have been a mind-saver. Built to run under DOS, the program calculates disc space requirements given file size, device type, record size, blocking factors, and key length (for index sequential files). When given the number of tracks available, it outputs the number of records which can be stored. Conversely, it outputs track requirements when given records.

Multiple "solutions" can be determined when minimum and maximum blocking factors are specified; a calculated efficiency factor—for utilization of prime area tracks—helps in choosing from alternatives.

The program requires 12K, an IBM 2540 or 2501 card reader, and a 1403 or 3211 printer. It is priced at $95. APPAREL SYSTEMS DEVELOPMENT CO., Willingboro, N.J.

FOR DATA CIRCLE 288 ON READER CARD

City Management

They call this city simulation a game because the participants assume roles equivalent to those in a real city—like mayor, school board member, etc.—and try to run their model city like a real one. Three main sets of forces are considered: governmental, social, and economic. As an example, the government functions are sophisticated enough that players must consider

education, budgeting, taxation, assessment, bonding, highways, and many others.

Primarily a learning tool, CITY GAMES can be used to forecast the impact of decisions. For instance, up to 75 outputs would describe for the various role-players what happens when a school district floats a bond issue for new buildings while city planners are moving the industrial base to another suburb.

Three versions of the game are offered—one for the IBM 1130, one for the Univac 1108, and one for IBM 360s. Written mostly in FORTRAN, the programs work best when there are at least 25 players. For the big machines, the games are $2500; a source tape, implementation manual, players' manuals, director's manual, and input forms are provided. NATIONAL BUREAU OF STANDARDS, Washington, D.C.

FOR DATA CIRCLE 289 ON READER CARD

Financial Modeling

A company's financial officers, rather than its programmers, are thought to be the ones responsible for establishing and maintaining a financial model of the firm, so STEPS is built to talk to them. It not only directs their interactive model building in language they use, but has a few crutches programmers might be embarrassed to use, including a command called simply HELP.

An older version of the program was created for the Burroughs 5500. This new one will be one of the first packages offered for the B6700s now being installed. Its 32K-word requirement was felt a little heavy for the 5500.

Especially aimed at firms wanting to model alternative business plans, like acquisition prospects, STEPS produces such outputs as profit-and-loss statements, balance sheets, factory schedules, and manpower requirements for a 99-period time frame.

Offered for $500/month on lease or $18,000 on purchase, the package is installed by the vendor, who also helps in building the first model. SYSTEMS IMPLEMENTATION CORP., New York, N.Y.

FOR DATA CIRCLE 290 ON READER CARD

JCL Editor

The Job Accounting Interface under DOS captures information useful in billing the customer for his run time, information that includes account number, programmer number, type of run, and even type of paper. With this software adjunct to the job control functions, an installation can insure that a run with bad or outdated accounting information does not get through. Named the Job Control Statement Editor, the program either aborts the run with a message when it encounters bad data on the job card, or it prints a message on the console and/or listing and continues. The editor can also capture and use fields on the card that the JA Interface doesn't touch.

An object deck of a program tailored to your present standards will be mailed for a 10-day trial of the editor if you desire. Acceptance is assumed after that time, and a source deck and bill for $200 are mailed. GENERAL ELECTRONICS, Lyons, Ill.

FOR DATA CIRCLE 291 ON READER CARD

Virtual Storage Courses

Installations preparing for conversion to virtual storage operating systems may find a need for courses to bring their staffs up to speed on the concept and its implementation. This firm offers videotaped courses on both subjects. The "concepts" course is in four parts (storage management, paging, address translation, plus program design and debugging) that last a total of eight hours. It runs $400 or $430, depending on the medium your videoplayer accepts.

The "implementation" course has four hours worth of materials for management, four for systems programmers, and four for operators. It covers subjects ranging from conversion costs to thrashing to system generation, and runs $1000 or $1075.

The vendor also offers rental plans on these and some 48 other courses. ADVANCED SYSTEMS INC., Elk Grove Village, Ill.

FOR DATA CIRCLE 292 ON READER CARD

1130 Operating System

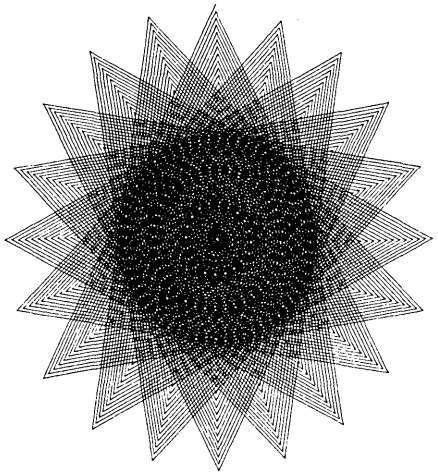
The IBM 1130 is a six- or seven-year-old machine, but new software for it is continually announced. CYTOS/II gives it a 16-user time-shared, multiprogramming operating system. Each remote user gets the capability to create, alter, catalog, or delete data sets from disc or to run jobs in FORTRAN, RPG, or assembler. I/O devices are spooled, and their operation is overlapped with each other and with processing, the vendor claims. In addition, the remote processing runs in parallel with a spooled batch stream.

A minimum configuration for CYTOS/II includes five 2310 disc drives or the equivalent in 2311s or 2314s, plus a line printer, communications adapter, card reader, 16K of core, and the Distributed System Program. The $5995 package price includes a year of maintenance; leases run $290/month plus $29 for maintenance. A version for Digital Scientific's Meta-4 is also offered. DNA SYSTEMS, INC., Saginaw, Mich.

FOR DATA CIRCLE 294 ON READER CARD □

Literature

Plotter Newsletter
PLOTTER, a new four-page newsletter for users of graphic plotters, will contain plotter applications, programs,



and new product information. This first issue includes an application for membership in the "Hewlett-Packard Plotter - User's Group." HEWLETT-PACKARD CO., Palo Alto, Calif.
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Self-Adhesive Labels
A 12-page catalog describes Tabulabel stock and custom self-adhesive labels for dp applications. Actual-size drawings, illustrations, and application descriptions of numerous label sizes and configurations are included. AVERY LABEL CO., Azusa, Calif.
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Modems
A 24-page brochure describes a line of digital modem packs, ranging from 300 through 2,400 bps, for switched voice networks and leased-line applications. Specifications are listed for each modem series along with charts depicting the probability of error vs. signal to noise ratio for each modem. SANDERS ASSOC., INC., Nashua, N.H.
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Communications Products
Minicomputer company offers a 32-page catalog on its data communications products, describing typical applications. Included are the company's synchronous communications controller, synchronous line adapter, programmed asynchronous multiplexor, asynchronous single line controller, multiprocessor communications adapter, and an IBM 360 interface. DATA GENERAL CORP., Southboro, Mass.
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Key Data Terminal
A 20-page booklet describes the DT1000 remote job entry terminal system, which can be used for source data entry, BSC data transmission, off-line or on-line processing, file management, record formatting, and field editing. Specifications are given for the system's four basic units and its options. PERTEC CORP., Los Angeles, Calif.
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Financial Reporting
An accounting and financial reporting evaluation guide aims to assist companies in determining whether various application software systems meet their internal requirements. The guide provides more than 250 questions relating to accounts receivable, sales analysis, fixed asset accounting, general ledger, and accounts payable. INFONATIONAL, San Diego, Calif.
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Metric Converter
A handy metric converter/ruler converts lengths, areas, weights, and volumes from the English (inch/pound) to the metric system. The 8 x 3¾-inch (20.32 x 9.525-cm) tool includes conversion tables for standard weights and measures and for Fahrenheit and Celsius temperatures. AMERICAN KOYO CORP., Cleveland, Ohio.
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Tape File Utility
A 68-page report describes and lists a program, COMBO, which can search magnetic tape, generate reports, and reformat a data file. Written in FORTRAN, COMBO is able to read separate card images from a file blocked in physical records and to recognize logical blocks marked by a fixed-field ID. It has global string commands and Boolean logic. Order prepaid, Stock Number 0303-0921, 75¢. U.S. GOVERNMENT PRINTING OFFICE, Superintendent of Documents, Washington, D.C. 20402, or local U.S. Dept. of Commerce Field Offices.

Terminal Supplies
The 1973 RCS catalog covers a wide variety of terminal supply products, including stock continuous forms, Teletype paper, ribbon, paper tape, tape handling equipment, binders, binder storage equipment, and Gates acoustical shields. REMOTE COMPUTING SUPPLIES, Oak Brook, Ill.
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Microprogramming
A six-page applications note with several charts and graphs offers assistance to engineers implementing microprogrammed systems. The brochure emphasizes the need for engineers to plan their software support when they begin design of a microprogrammed system in order to reduce development costs. The uses and advantages of a general-purpose microcode assembler are explained. SIGNETICS MEMORY SYSTEMS, Mountain View, Calif.
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Small-Scale System
A five-page brochure describes the QANTEL/ANSWER, a business computer that can also be used as an RJE terminal, remote concentrator, or store-and-forward message switcher. Available with up to 32K bytes of memory, its maximum direct access channel data transfer rate is 666K bytes/second. QANTEL CORP., Hayward, Calif.
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Computer Output Microfilm
A 12-page booklet discusses computer output microfilm (COM) technology and equipment, comparing COM to traditional output methods. Specifications of the Kodak KOM-80 and KOM-90 microfilmers and descriptions of various formats and retrieval coding options are included. EASTMAN KODAK CO., Rochester, N.Y.
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Software Proceedings
The 42-page proceedings of the 1972 ADR Users' Conference covers all 13 sessions, including those on ADR's software products—AUTOFLOW, The LIBRARIAN, MetaCOBOL, ROSCOE, and SAM. APPLIED DATA RESEARCH, Software Products Div., Route 206 Center, Princeton, N.J. 08540.

Keycheck's Keypoints
A four-page brochure describes KEYCHECK, a new key entry job control software system. KEYCHECK enables facility managers to analyze production throughput and cost effectiveness of each operator and tab machine, as well as of the entire facility. Programmed in FORTRAN IV and COBOL and supported by OS or DOS, the system can also generate current price schedules and prepare invoices. NATIONAL INFORMATION SERVICES, INC., Cambridge, Mass.
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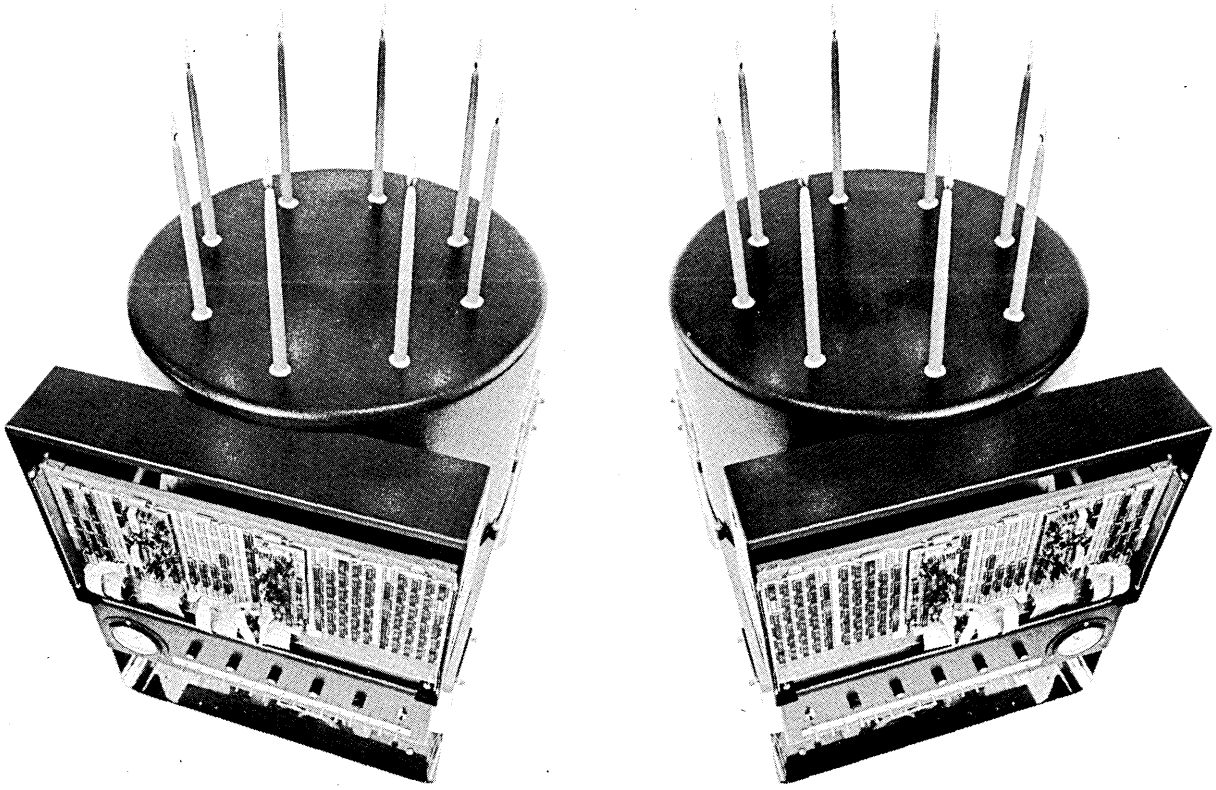
DDC introduces 2 new disc memories.



They're only 8 years old.

That's right, 8 years old. You see, the new DDC A7310 and 9100 Series head-per-track disc systems have the same basic mechanical design, the same inert gas environment, the same non-contact flying heads, and the same basic electronics that have made our head-per-track systems the industry standard for reliability and performance since 1965.

So what's new? Greater capacity and lower cost per bit.

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50 to 100 percent increase in capacity with access time flexibility, all with 8 years of field-proven superior reliability and performance designed in. Now that's new!

And there are a few other new features we've added. Like repackaged electronics and logically implemented spare data heads which result in improved maintainability.

The MTTR on the new systems has been reduced by 40 percent. Not that you really need to know that because the field-experienced MTBF on this basic design is in excess of 11,000 hours. Want proof? Just ask to see our Product Reliability Report. We know you'll be impressed.

And yes, we're truly price competitive. Any way you want to figure it. Cost per bit, life cost, or cost of ownership.

For full details on our new A7310 and 9100 Series, write or, better yet, give us a call. And if you're going to the National Computer Conference in New York in June, just drop by Booth #1410 and see our brand new 8-year-old memories.

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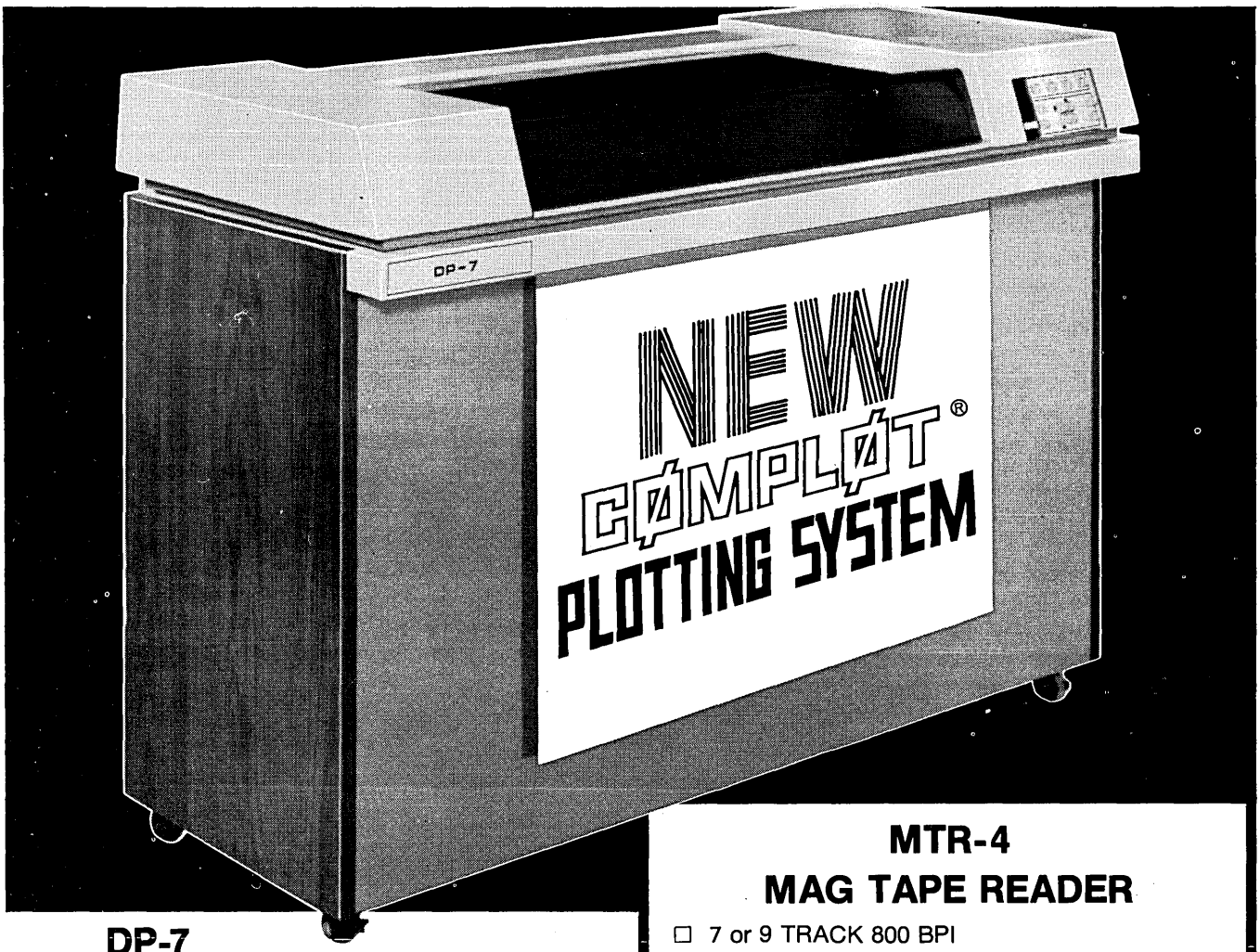
European Sales Office: Radix House, Staines, Middlesex, England. Phone: Staines 51444



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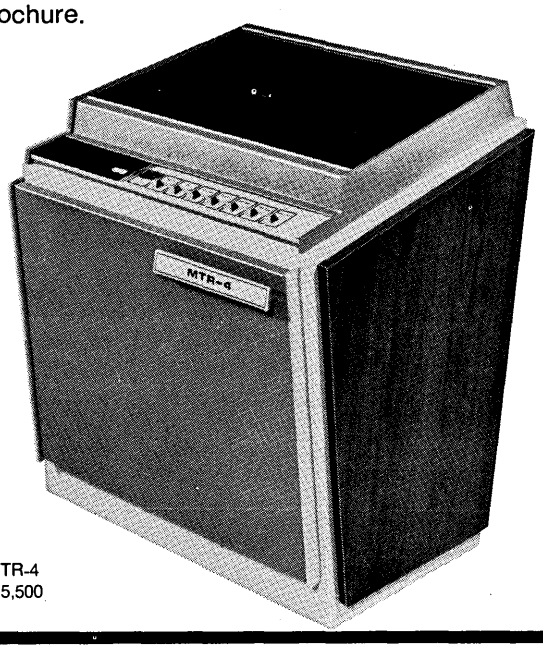
New from The Recorder Company, the model MTR-4, a fourth generation offline CØMPLØT magnetic tape reader with features found only in much higher priced competitive models. Send for brochure.



MTR-4
$15,500

Monarch has the bar code that works, and a choice of "tools" to create and capture data accurately, efficiently, economically.

The bar code that fits you.

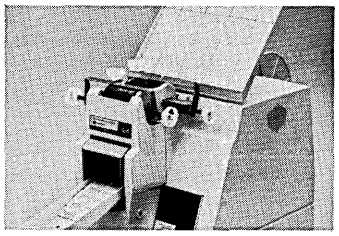
Whatever your size, Monarch has the bar code and complete systems you need for fast, accurate information control. The CODABAR™ code is flexible and reliable; compatible with your present operation. Complementing the code is a choice of systems to create and capture it economically; plus a wide range of equipment for attaching encoded tags to merchandise. The CODABAR code and related Monarch bar code products are currently in use with Pitney Bowes-Alpex SPICE®/PEPPER™ Systems.

An automated input system is vital to your future. Monarch has one that fits you. For more information on the CODABAR code and related products . . . how and why they can serve you best . . . write to Vice President for Marketing, Dept. 288, Monarch Marking Systems, P.O. Box 608, Dayton, Ohio 45401.

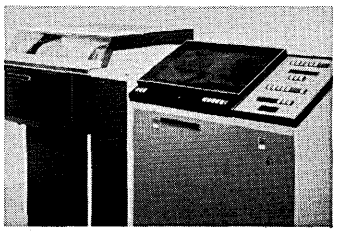
Monarch Marking Systems

Pitney Bowes

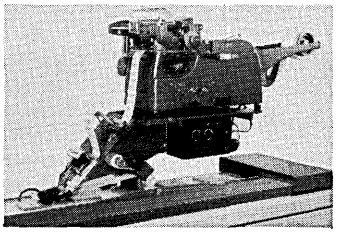
3 ways to create it.



Model 104 Dial Printer is a low-cost, easy-to-operate in-store printer. Accurate . . . you can see what you dial. It prints what you see . . . both eye readable and machine readable. Has a nominal speed of 174 impressions per minute on all sizes of tags and labels.

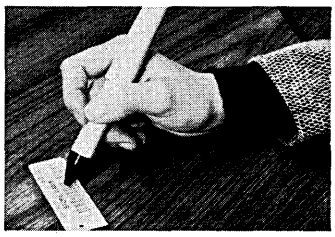


Monarch 2000 CODABAR Encoding System is a high-speed computer-controlled line printer with programmable logic and expandable memory. Ideal for high-volume distribution center printing of bar-coded tags and labels.

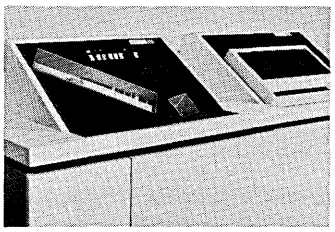


Model 2023 Rotary Imprinter is a fast, simple and reliable rotary mat printer. Enables vendors to print data on conventional merchandise tag and label supplies right on their packaging lines.

2 ways to capture it.



Model 2243 Bar Code Scanner comprises a hand-held light pen and logic for encoding the CODABAR code with an interface. Data is checked seven times in the logic to assure accuracy before being released to the interface and entered at point of sale.



Model 2310 Batch Reading System is a high-speed data collection center. Reads 400 encoded tags per minute, feeds automatically, requires no tag orientation, records data on computer-compatible magnetic tape.

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People

Fostering international business and making the public aware of the benefits they are deriving from the harnessing of computer technology will be prime goals of the Computer and Business Equipment Manufacturers Assn. (CBEMA) under its new president, PETER F. McCLOSKEY. "Most of our members do 50% of their business internationally," said McCloskey, "and consequently we shall be concerned with communicating with government on all matters affecting international trade."

Peter F. McCloskey

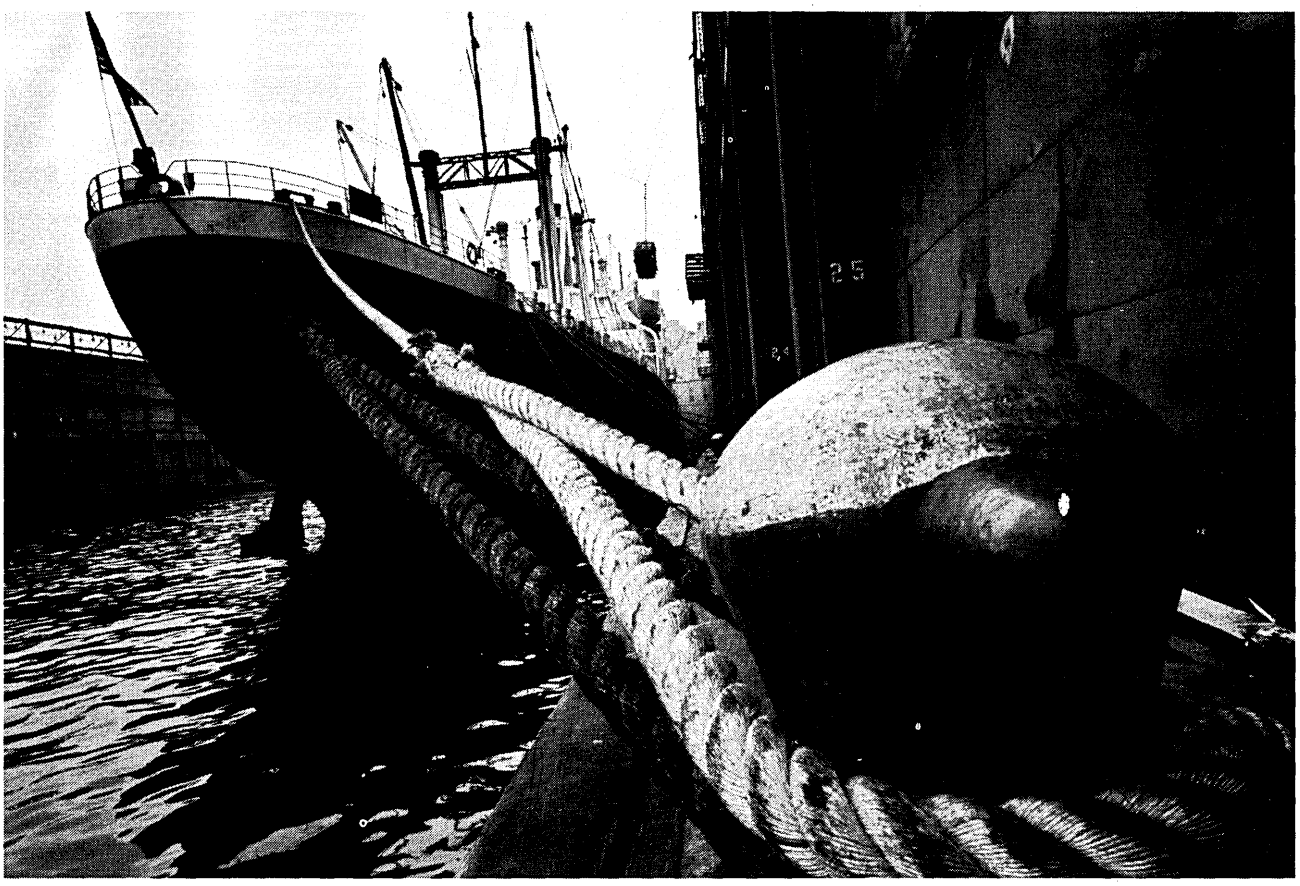
He looks forward to a proliferation of computer applications in the latter part of this decade which will "have direct benefits for the general public." He said CBEMA will "do our part" in making the general public aware of these benefits as well as the shortcomings and concerns which will be voiced "with increased attention to the issues of privacy and security."

McCloskey joined CBEMA following two years as a partner in the Washington law firm of Hughes and McCloskey. Earlier he was president and chairman of the board of Farrington Manufacturing Co., a manufacturer of optical scanning devices and credit card imprinters. From 1960 to 1965 he held various positions with IBM, including manager, domestic licensing; advanced systems sales manager, West Coast; and applied sciences sales, East Coast. He holds a degree in physics from Holy Cross College and is a graduate of the Fordham University School of Law.

FRED H. HARRIS, director of the Univ. of Chicago's computation center, has little free time these days. He's just centralized the 100-man center, is in the midst of an equipment evaluation project to upgrade from a 360/65, has a family of five children to manage, and since early last December has devoted more than 300 hours of spare time to helping form the Computer Foundation.

Fred Harris

With DPMA's John Swearingen, Harris represents the 30,000-member Association of Computing Machinery (ACM) as cochairman of the ACM-DPMA effort to form an organization of dp professionals that would offer and administer a program to certify data processing practitioners and guide the types of education programs to keep them current with changing times. In this project Harris has learned to combine organizing talent with political skill. Certification efforts draw detractors aplenty. The foundation hasn't escaped them. But Harris says the very existence of so much debate on certification is the strongest argument in favor of this kind of organization. With eight other societies participating, the committee hopes the foundation will be in business next July, at first using DPMA and other certification programs, and finally refining these to provide what Harris says will be a "meaningful generation and measurement of talented people."



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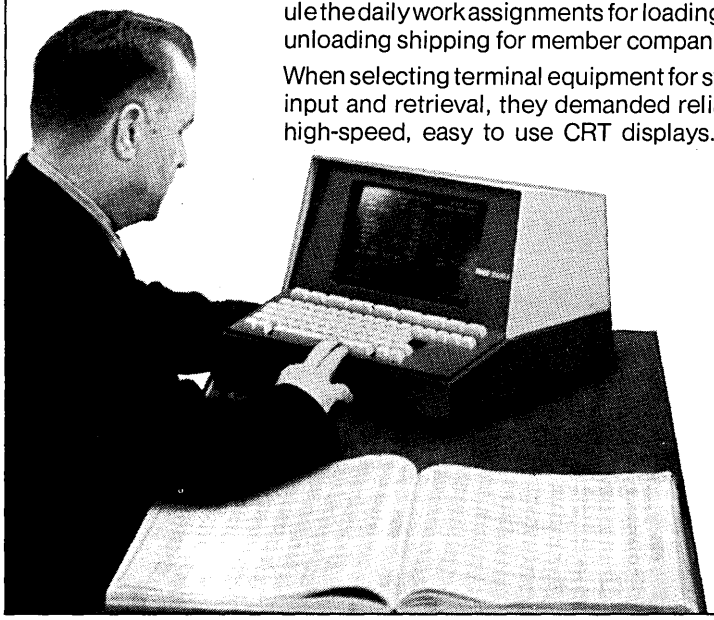

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DATA EQUIPMENT AND SYSTEMS DIVISION ITT

people

A physicist by education (B.S. in physics from North Carolina in '60 and M.A. from Rice in '69) and a computer practitioner by trade, Harris was a systems programmer with Humble Oil and assistant director of the Rice Univ. Computation Center until joining Univ. of Chicago in September '69. Since '71, he's also been a member of ACM's Professional Standards and Practices Committee, which last month hammered out its final version of a professional conduct code.

After almost 12 years with McKinsey & Co. Inc., the international management consulting firm, GEORGE GLASER is going off on his own. Glaser, for the last two years, has headed the company's satellite office in Menlo Park, Calif., applying McKinsey's style of consulting to smaller companies, several of them in the dp industry. For a firm accustomed to dealing with large, prestigious corporations with revenues of $100 million or more, it meant a change of focus. For Glaser, it also meant a shift from his clients' dp management problems to the broader problems faced by vendors in a high-technology community. "I became interested in these companies and in the people who run them," he says. "So much so that I now intend to concentrate my attention on the opportunities for both.

George Glaser

Far from your usual image of a man in a rut, 41-year-old George Glaser has had a varied job experience. He started by designing digital circuits at Sandia Corp., Albuquerque, N.M., where he worked the telemetry and data collection/reduction sides of the house; was engaged in the R&D aspects of airborne fire control programs as a naval officer; got into programming and systems analysis back at Sandia; and served as product planner and product manager for digital tape drives at Ampex Corp. before joining McKinsey's San Francisco office in 1961. Since then, too, he spent 18 months in Europe, working out of the firm's Dusseldorf office and consulting in dp management.

Glaser has been active in professional society affairs—as general chairman of the 1966 Fall Joint Computer Conference, ex-chairman of the business data processing group within the Assn. for Computing Machinery (ACM), and past treasurer of ACM. He currently is treasurer of AFIPS (American Federation of Information Processing Societies) and ACM member-at-large. He also has been active on the writing and speaking circuit, with dp management his pet topic.

Somewhere along the line, he explains, he decided he ought to try a more entrepreneurial style of living and working. "I have a couple of ideas of my own," he adds, saying he plans to shake them down after he leaves McKinsey. George says only that one of them has to do with a rather novel application of well-known technology. Meanwhile, he will continue to consult, even maintaining some ongoing relationships with the blessing of his former partners.

"Some people have told me it's not clear to them what I'm going to do. That much is clear to me, too," he says with a smile. "The only thing I'm sure of is that I want more time to think about some ideas that intrigue me and that could be worthwhile as businesses—and I'm willing to make an investment in personal R&D to find out." □

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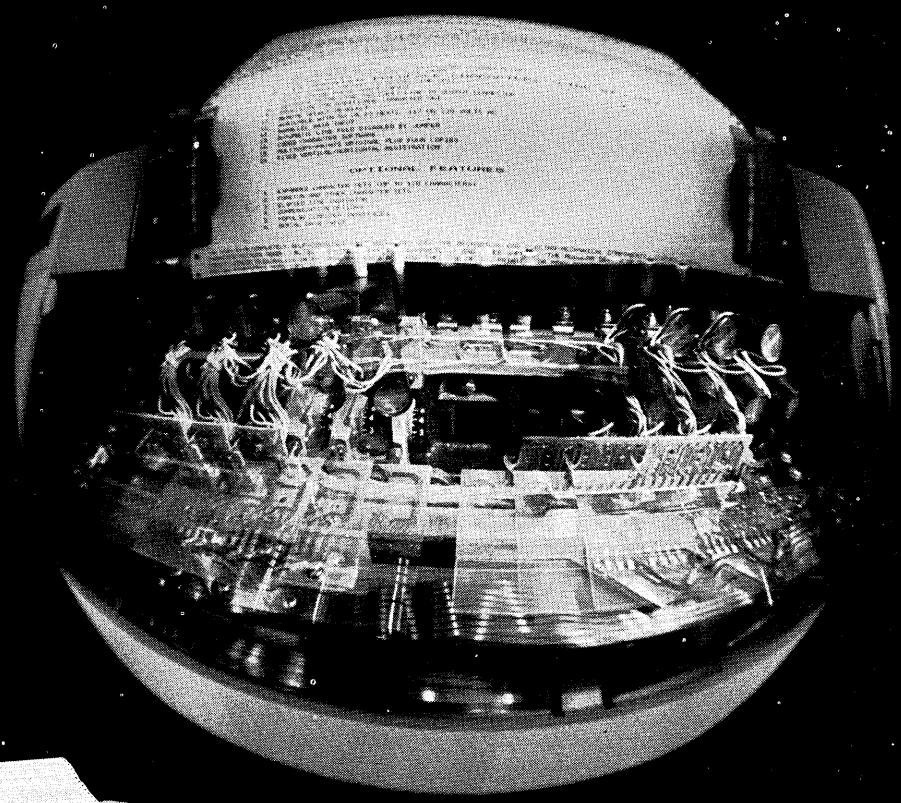

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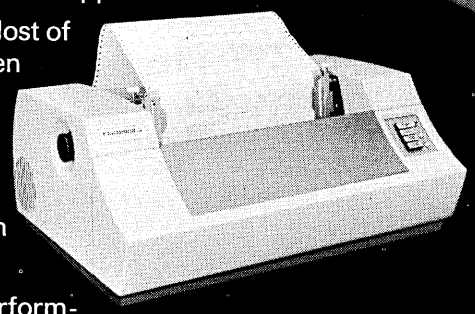

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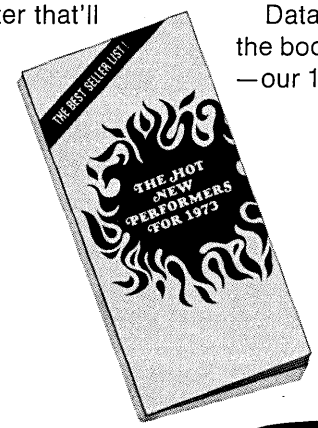

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DATA PRODUCTS

Books

What Computers Can't Do: A Critique of Artificial Reason

by Hubert L. Dreyfus
Harper & Row, New York 1972
259 pp. $8.95

The Metaphorical Brain: An Introduction to Cybernetics as Artificial Intelligence and Brain Theory

by Michael A. Arbib
Wiley-Interscience, New York 1972
263 pp. $14.95

It may be worthwhile to review Dreyfus' and Arbib's books together, not just because they address closely related subjects but because of the fact that they discuss the subjects in rather strongly contrasting fashions. If we were to compare the two styles, one might say that while Dreyfus' style is directed to convincing the reader of a political stand, Arbib's style attempts to introduce the reader to the fundamentals of three bodies of knowledge and to bring them together into a hypothesis regarding the functional design of the human brain.

Dreyfus' areas of factual information are the history of artificial intelligence, the politics (conscious and unconscious) that surrounds it and the thoughts of some leading epistemologists. Arbib deals with neurophysiology, systems theory and the basic techniques of artificial intelligence. Not only is the subject of artificial intelligence common to both; they both investigate the important question, "What is the nature of the reasoning process and how can we describe it in an understandable way?"

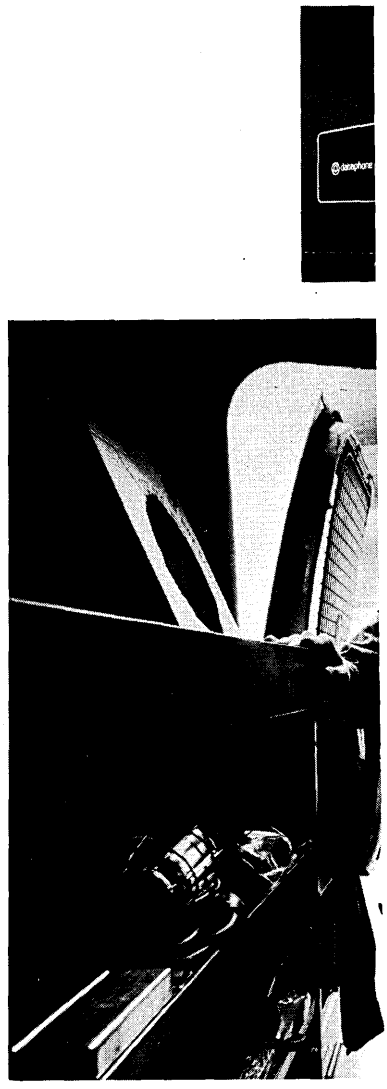
As said before, the major impact of Dreyfus' book is political—he warns the lay reader (and perhaps some of the not-so-lay specialists) against taking it for granted that an artificially intelligent robot is around the corner. He does this very effectively in the first part of his book. He discusses in detail some of the very well-known computer programs that have performed tasks which, until recently, only humans could perform. He also argues quite cogently that these programs, while imitating certain aspects of human behavior, do not necessarily use the same basic operations that the human brain might use. Unfortunately, most of his criticism is directed towards the assumption—made often by workers in the field—that a computer which shows human-like behavior must be using human-like processes. As a result, he uses this criticism as a nontechnical explanation for the limitations of these programs instead of analyzing the characteristics of the programs themselves to show how, under certain kinds of circumstances, these programs would fail. At this point, Dreyfus falls into the same error into which most people in AI fall: he fails to analyze these programs in sufficient precision and detail. What I have in mind here is the kind of close analysis that Bobrow did on his own program (see quotation by Dreyfus on p. 45). Compared to this, Dreyfus' own analysis, say, of the Quillian program (pp. 54-57), is awfully inadequate and nontechnical.

Debates should be conducted on a basis of solid facts. Since this is lacking in some of the criticism (and probably also from the defense) the debate between Dreyfus and the artificial intelligentsia becomes shallow and acrimonious; Dreyfus has described in bitter detail some of the more lurid aspects of this acrimony. In this he has served one useful purpose—to point out that science is not above politics and that the behavior of scientists is worthy of study as a sociological and political phenomenon. It is all quite painful.

Dreyfus also makes it clear that programs which are initially designed to serve one specific purpose are only too often lauded as the precursors of greater things to come and it is this applause rather than the basic techniques of the programs themselves which becomes part of the mythology of the field. Dreyfus does not, however, belittle the effectiveness of the programs themselves. In the last part of the book he actually points out how such programs, through man-machine interaction, can be very beneficial as tools of analysis and design.

In the opinion of this reviewer, it is in the middle part of the book that Dreyfus falls into traps similar to the ones some of his younger antagonists fall into. One major error is the confusion between a phenomenon and its description in a formal language. Often when a researcher in cognitive simulation claims to have isolated certain basic cognitive processes through computer simulation, he merely claims that the process occurs in the brain. He does not necessarily have to claim that the process is algorithmically realized by the brain exactly the same way it is realized by a computer (as is well-known, the same input-output relation can be constructed by many different algorithms). It seems to me that in his constant attacks on "a formal system of rules" he somehow confuses a system and its model. At the present state of development of AI and CS, such models are necessarily incomplete.

If I made only one comment to set Arbib's book apart from Dreyfus', it would be to say that Arbib thoroughly examines this concept of an incomplete model (he calls it a "metaphor") and comes to a cogent conclusion as to what extent it is useful and in what ways it can be misleading. Arbib says



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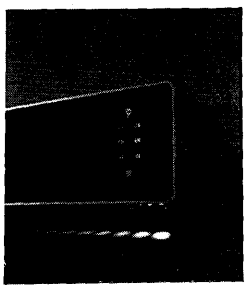

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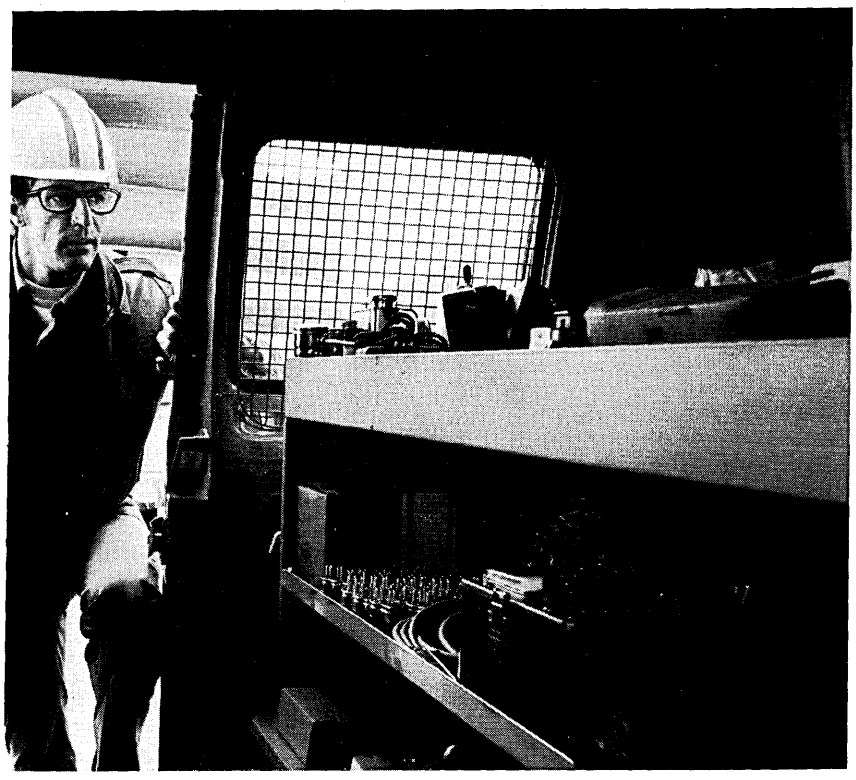

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(p. 10): "To say that 'My love is like a red, red rose' does not imply that she will appreciate having the hose turned on her. A good metaphor is a rich source for hypotheses about the first system but must not be regarded as a theory for the first system." He proceeds then to descriptions of the structures of the brains—and the phenomena involved in perception—of some lower vertebrates, to show that the basic parts of a perceived whole vary from one animal to another depending on the goals of the animals' "life style." He goes so far as to say (while describing certain strategies of perception in robots) that "we see a contour, however ill defined, because we have recognized a cube, rather than recognize a cube because we have dutifully perceived all the contours" (p. 111). Dreyfus means the same thing when he says: "We perceive a house, for example, as more than a façade—as having some sort of back—some inner horizon. We respond to this whole object first and then as we get to know the object better, fill in the details as to inside and back" (p. 153). And yet, after this degree of agreement, Dreyfus concludes "a body . . . cannot be reproduced by a heuristically programmed digital computer . . " while Arbib proceeds to think of the brain as "a complex information-processor with distributed action-oriented computation taking place in a layered somatotopically organized network."

The origin of the difference may well lie in the different techniques of thought brought to bear on the subject by the two authors. I have already referred to Dreyfus' propensity to believe that any phenomenon digitally described must perforce have to pertain to the action of a digital process. Unfortunately, at our present state of intellectual and spiritual development, we have no recourse to any meaningful communication except through digital symbolism (be they letters, phonemes or mathematical symbols). Making them less "precisely defined" than is usual would not increase the effectiveness of the discourses, only reduce it. Moreover, it is not even true that digital symbolism cannot be interpreted by nondiscrete phenomena—differential equations have been with us for centuries.

The confusion may be related to the conceptual error that Dreyfus makes when he states that "the mind can cope with an indefinite number of situations whereas the machine has only a limited set of states and so will eventually reveal itself by its failures to respond appropriately" (p. 148). Arbib, however, with a chapter on "Systems The-

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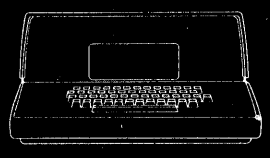

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ory" in his book, realizes that contrary to Dreyfus' belief, an infinite set can be handled by a finite state device as long as it deals with a congruence of finite index. Dreyfus misses this point even after stating that "bodily skills enable us not only to recognize objects in each single sense modality but by virtue of the felt equivalence of our exploratory skills we can see and touch the same object" (p. 161). Somehow it is not clear to him that an equivalence class of objects can be denoted by the same name. As a result, he objects to McCarthy's discussion of "situations" in view of the fact that many physical states can be described by the same situation. As a result he is forced to assume that the idea of an objective reality (what Arbib calls a "model of the world") can only be achieved by a multiplicity of senses and—by some mysterious deduction—therefore necessitates a body. He sees the same need for a body when he discusses Gestalts. On p. 17, "our subject's familiarity with the overall chess pattern and with the past moves of this particular game enabled him to recognize the *lines of force* (sic—italics reviewer's) and *loci* (sic) of strengths and weakness . . . (and leads him to) . . . see that his opponent is weak in a certain area and zeroing in on this area he discovers the unprotected rook." Workers in AI are aware of this "pattern-recognition" phenomenon and the formalization of exactly such procedures is the basic challenge of this field. Also, it is not just the artificial intelligentsia that seek to describe the phenomenon of pattern recognition. Skinner and psychologists in that school claim that precise description is possible in special cases and the overall structure of the pattern-recognition phenomenon can be outlined in general.

However, even if we agree with Dreyfus that pattern recognition cannot be precisely described, we cannot understand why having a body around would help perform an undescribable phenomenon. Are we to conclude that the body is somehow undescribable? Contrast Arbib's description of the pattern-recognition activities in the brains of lower vertebrates. They are well described and somehow disappointing in their simplicity!

As a Hindu, this reviewer would probably agree to the soul as being somehow indescribable and even to the suggestion (if it were made!) that mechanical reason through a formal set of rules is impossible because the machine has no divine soul—but to make the body the source of all mysteries is somehow repulsive!

—Ranan B. Banerji

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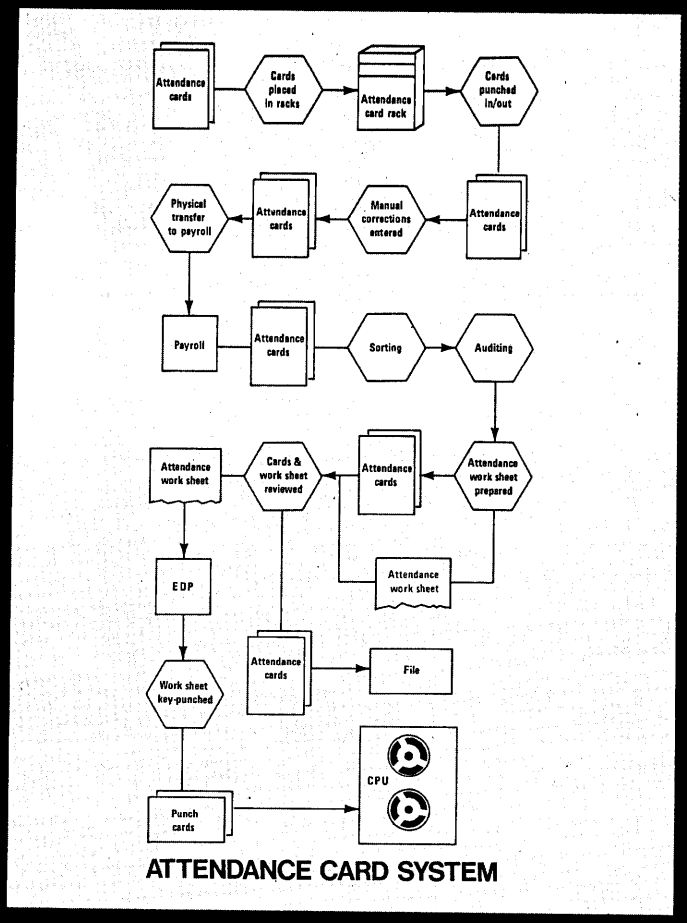

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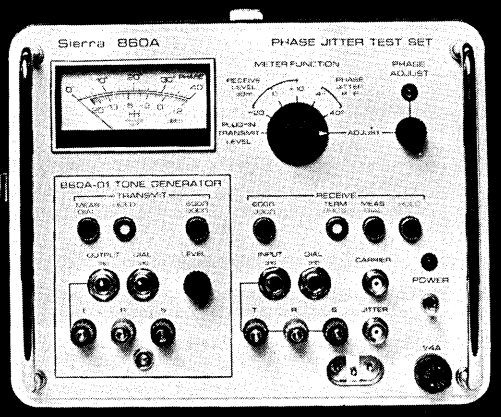

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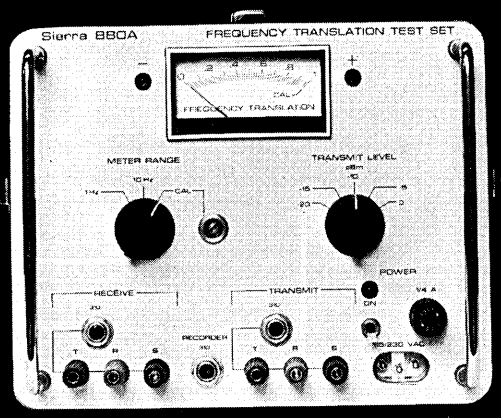

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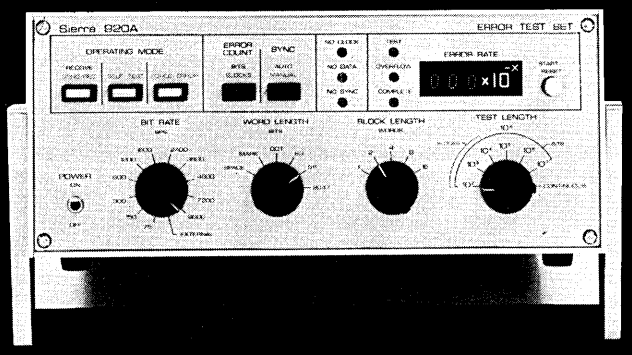
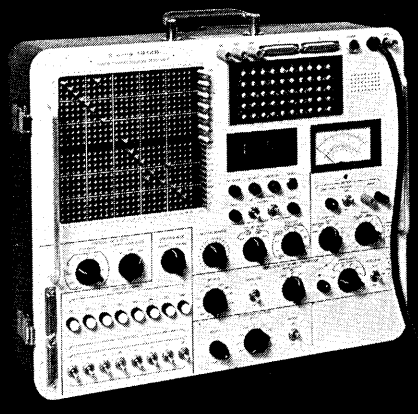


SIERRA 920A ERROR TEST SET

SIERRA 920A FOR ERRORS

Measure bit or block error rates in simplex, half duplex and full duplex modes up to 2 megabits per second. EIA compatible; may be customized for non-EIA modems. Bright LED digital error rate readout. Self test capability.

. . . BROUGHT TO YOU BY THE MAKERS OF THE FIELD-PROVEN 1914 SERIES . . .



SIERRA 1914 FOR END-TO-END AND LOOP-AROUND DATA TRANSMISSION TEST.

Test asynchronous and synchronous voice band modems, check and display bit and block errors. Determine error rate margin. Check control signals and associated time delays. Perform in-service tests on modems. Do all this and much more, easily and simply with the lab-featured portable.

Write or call for the full story and a demonstration.

Sierra

Sierra Electronic Operation

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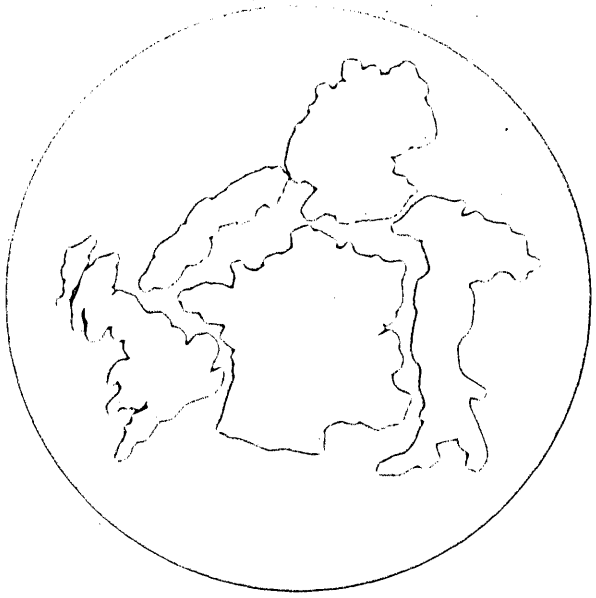
PHILCO Ford

CIRCLE 35 ON READER CARD



Join Datamation's powerful selling tour of Europe this Fall

Five countries in five weeks–THE GRAND TOUR

DATAMATION, with the support of the United States Department of Commerce, presents a hard selling series of exhibitions of U. S. Computer products all over Europe this Fall. You are invited to join The Grand Tour of DATAMATION for an extraordinary opportunity to increase your total marketing program in Europe.

A TAILORED APPROACH TO THE MARKETPLACE

Looking for agents to distribute and service your products?

Meet them at the exhibitions. Interview several consecutively. Begin your selling months earlier in the lucrative European market.

Already have agents or direct sales offices?

Support them. Evaluate them. Let them see, touch, use your new product lines. Provide them with the chance to show your products to their customers at **the** prestige EDP exhibit in Europe this year. It's the one **all** the buyers will attend.

Not familiar with the European potential for your products?

Use The Grand Tour to gauge their acceptance. There is no better way for **you** to judge the market for either your present — or new — products than by face-to-face meetings with your prospects.

This year too soon? Think maybe you'll wait until next year?

Your competition isn't going to wait. The Grand Tour is this **November.** If you expect to derive sales profits from Europe in 1974, you've got to start **this** year.

Who'll Attend?

OEMs or end users? It's up to you. This is the first EDP exhibition ever held in which the exhibitor specifies — in advance — the precise universe he wants to reach. DATAMATION then tailors a mailing and promotional program to attract the exact class of buyers to whom you want to show your products.
European promotion for The Grand Tour is starting now. Give us your requirements — and put us to work for you. Call or write for immediate details.

Charlie Asmus, Sales Director, The Grand Tour, DATAMATION, 35 Mason St.; Greenwich, Conn. 06830. (201) 444-4271 or (203) 661-5400

London — October 30, 31, November 1; **Stockholm** — November 6, 7, 8; **Paris** — November 12, 13, 14; **Milan** — November 19, 20, 21; **Munich** — November 27, 28, 29, 30.

Look Ahead

(Continued from page 18)

and a line printer; only a processor and some software remains to put the pieces together. We hear Pertec will build its own processor.

Meanwhile, veteran Inforex claims it may have pulled down the largest key-disc order ever to an independent with contracts from the Social Security Administration and the USSR. Social Security ordered 70 systems totaling more than 850 keystations valued at nearly $2 million. The Russians have ordered about $300,000 in systems from Inforex for installation at Russia's computer showplace--the Soviet Institute for Automation and Control Technology in Moscow.

WHERE ARE THEY NOW?

Whatever happened to Cincinnati Milacron's minicomputer venture announced in January of 1970? Its number of installed systems show up in census reports as "NA"--not available. Most go into the company's machine tools as controllers; some others are oem'd.

But the company may now be readying a move into end-user systems, helped with newly recruited technical and marketing talent from RCA's computer shambles. Its Process Control Div., in charge of the minicomputer operation, named a new president a year ago -- Pat Beeby, formerly of RCA and before that IBM. In recent months he's been joined by other former IBMers who came the RCA route: Dr. Joseph P. Mount, director of marketing; Larry E. Axsom, manager of applications development and marketing; and Pat Goggins, head of systems software. It's understood they've developed applications packages and an operating system to be called CIMOS.

The marketing strategy is a secret, although sales offices have been opened in recent months in Atlanta and Houston, augmenting those in Los Angeles, NYC, and Detroit. The product is the 8-bit CIP2200, successor to the 2100 first announced in '70 when the company plunged into the market as a licensee of Microdata. A later offering, the 4000, has been scrapped.

RUMORS AND RAW RANDOM DATA

A top IBM technical officer said recently at MIT that it was possible to have semiconductor memories of 0.001¢ per bit in the early 1980s. That's significantly lower than most industry forecasts, but the IBM man did say there would have to be some significant technological breakthroughs before that low figure could be achieved...Memory in Honeywell's new line, due out this summer, will have 2K bits of N channel MOS...A class action suit against University Computing has been filed by W. Henry duPont, scion of Delaware's first family. It charges that Sam Wyly and other top execs intentionally misrepresented UCC's assets and liabilities and sold off profitable subsidiaries to acquire capital for Datran. He wants the court to fire the present management...The recent Fortune article that gushed about all the GE people finding new careers at Honeywell after the latter acquired GE's computer operation neglected to mention that the two top GE men who came over to Honeywell in the merger--Bill Smart and Al Way--have returned to GE...Burroughs says it's shipping its B1700 systems at the rate of 80 a month...Financial analysts think Service Bureau Corp. will contribute substantially to Control Data's '73 earnings: One thinks it will add 40¢ to the company's net, another guesses 55¢. Other computer business will account for 85¢...Japan's Oki Electric Co. will begin selling printers in the U.S. this month to oem's, and later will market a plasma display unit through Okidata, Moorestown, N.J....Computer Sciences Corp. is abandoning the posh offices its late chairman and founder Fletcher Jones set up in L.A.'s glamorous Century City.

Remember when going-like-sixty meant "fast"?

Today's world is rapidly speeding ahead.

To keep up, companies are constantly looking for new ways to cut operating costs, develop new uses for their products, and develop new products.

In this competitive race, we make systems that can help.

They're direct-writing, interactive graphic terminals. A somewhat complicated name for a device with a simple concept: couple man's inherent ability to work with pictorial information with the computer's capacity to process data derived from these pictures.

Applications? Bounded only by imagination.

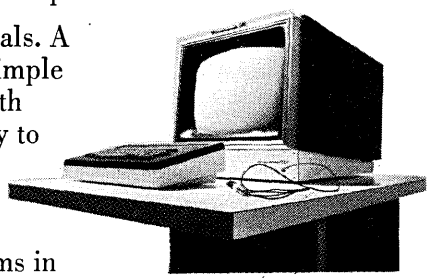
Since 1970, companies have been using our systems in such diverse areas as highway design and traffic flow analysis, pilot training, molecular modeling in three dimensions, system simulation and control, real-time animation, dress pattern layout, and computer aided design.

Our systems range from graphic displays working as computer peripherals to complete stand-alone graphic systems with supporting software.

We'd like to talk with you about their performance, their cost effectiveness, and how they can work for you.

You should contact us.

Because a company going like sixty is going to be ten years behind in the seventies.



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CIRCLE 66 ON READER CARD

When we added a buffer to the Model 33, we turned a workhorse into a 120 cps racehorse.

We've stretched the capabilities of the Model 33 data terminal by integrating it with a 120 cps magnetic tape cassette buffer.

So you get the lowest cost 1200 baud terminal, the flexibility of both paper and magnetic tape and the reliability of the good old 33.

The high speed of the unit reduces telephone charges, or use of WATS lines.

The ASR tape capability lets you set up format control on paper tape for multiple transaction type applications. The cassettes perform data storage and transmission functions.

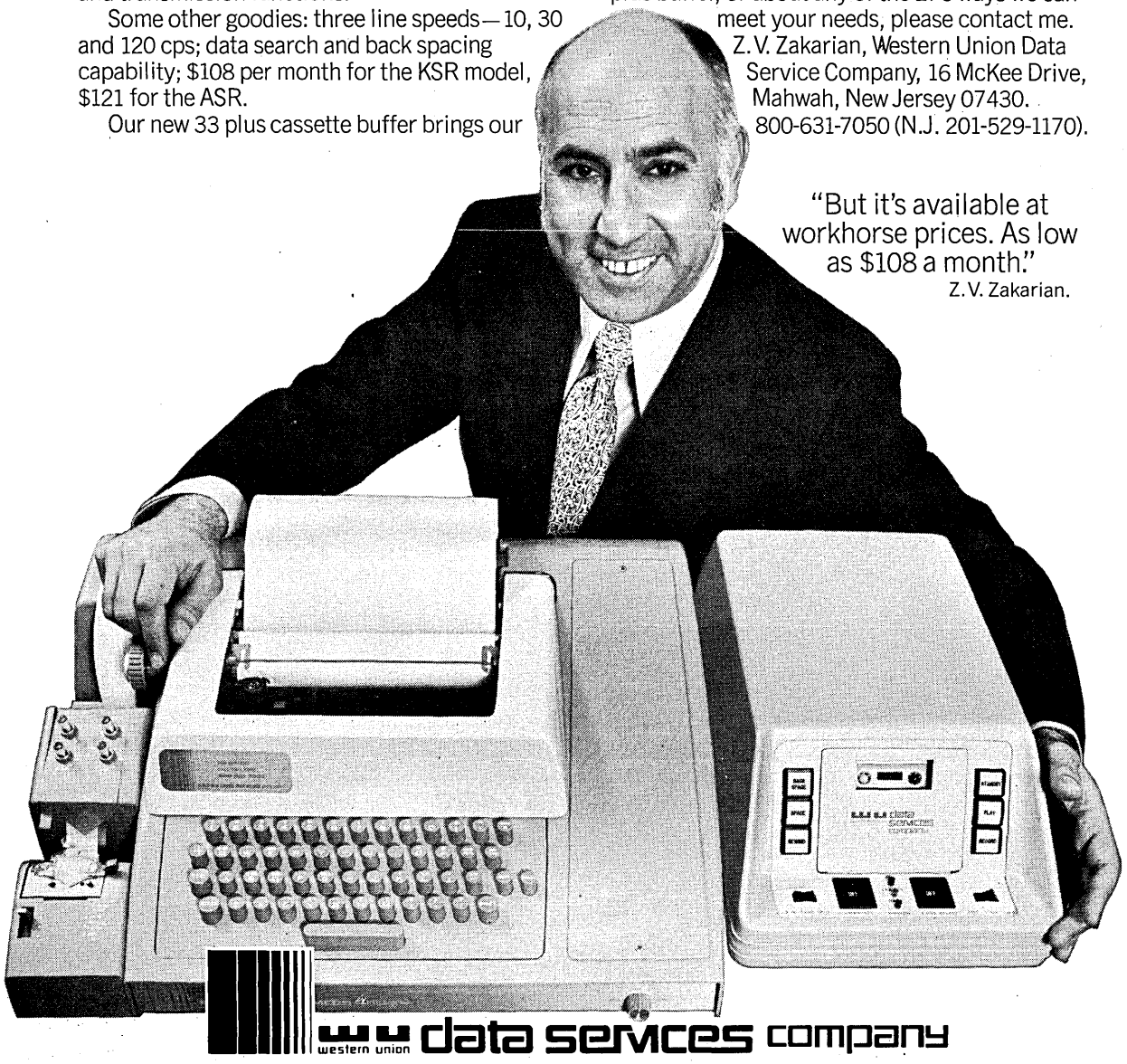
Some other goodies: three line speeds—10, 30 and 120 cps; data search and back spacing capability; $108 per month for the KSR model, $121 for the ASR.

Our new 33 plus cassette buffer brings our product line up to 74 terminal models with 202 options. This means you can solve your various terminal problems in a variety of ways.

If you use more than one terminal, you can mix different terminals—each matched to the specific requirements of each location in your system. Our systems planning experts will help you make the optimum choice.

And then we support your system with our unique maintenance program, Termicare®.

If you would like more information about our 33 plus buffer, or about any of the 276 ways we can meet your needs, please contact me. Z.V. Zakarian, Western Union Data Service Company, 16 McKee Drive, Mahwah, New Jersey 07430. 800-631-7050 (N.J. 201-529-1170).

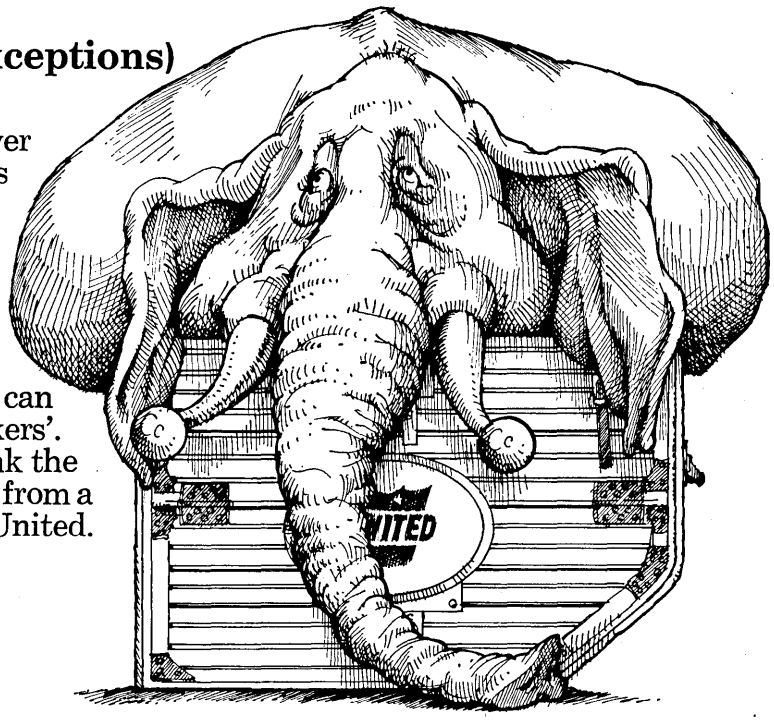


"But it's available at workhorse prices. As low as $108 a month."
Z.V. Zakarian.

western union data services company

Why you should ship what you ship... by air... in containers... on United.

(there are a few exceptions)



You may be amazed to discover how many kinds of commodities now travel on United—and why. Sealed inside a United container, your goods move at jet speed. Pilfer proof. Safe from the weather. Intact and damage free. And with what you save with United's container discounts, you can hardly tell our rates from the truckers'. Now is the time to rethink the way you ship. Get the facts from a friend. Call United.

United's LD-3 containers.
Each can carry more than a ton of your goods economically, aboard United's great and growing fleet of 747's and DC-10's.

Here are a few examples of commodities that move every day in containers on United.

Advertising materials
Automotive parts
Ball bearings
Books
Business machines
Cheese
Clams
Computers
Decals
Displays
Electronic parts
Farm equipment parts
Film
Flowers
Forgings
Garments on hangers
Hand tools
Home appliances
Ice cream
Jewelry, costume
Kitchen appliances
Labels
Live lobsters
Machine parts
Magazines
Meats
Medicines
Metal stampings
Mushrooms
Musical instruments
Newspapers
Office machines
Perishables
Phonograph records
Photo material
Plastics
Pneumatic tools
Produce
Radios
Recording tapes
Rectifiers
Steel castings
Toiletries
Transformers
Tropical fish
Underwear
Vegetables
Video tapes
Vitamins
Water beds
Wearing apparel
Worms
Xylophones
Yogurt
Zucchini

United Air Lines
Jet Freight *No.1 in the U.S. sky*

letters

Continued from page 26

cause they don't understand it, and it tells the administration exactly what is going on. No favorites are played here.

Mr. Petroff has the right idea to help alleviate this problem, but the dp manager must go one step further. Unfortunately, this is not a small step. It requires much of your time. I am referring to education. Educate the users. Once they understand your department and where you stand, the communication line should open up, thereby eliminating 90% of the problem.

GLENN T. YOUNG
Director of Data Processing
Matagorda County Hospital District
Bay City, Texas

Seventh generation

It was very interesting finally to read an article on computer systems that operate in Complex Time (Feb., p. 71). I had always thought this procedure was a trade secret which was jealously guarded by several highly profitable service bureaus who were engaged in a conspiracy to prevent the knowledge from reaching the public.

Now that this concept is out in the open, I am sure that there will be a great deal of debate in the industry over the relative efficiency of Complex-Time operating systems and those which operate in Virtual Time.

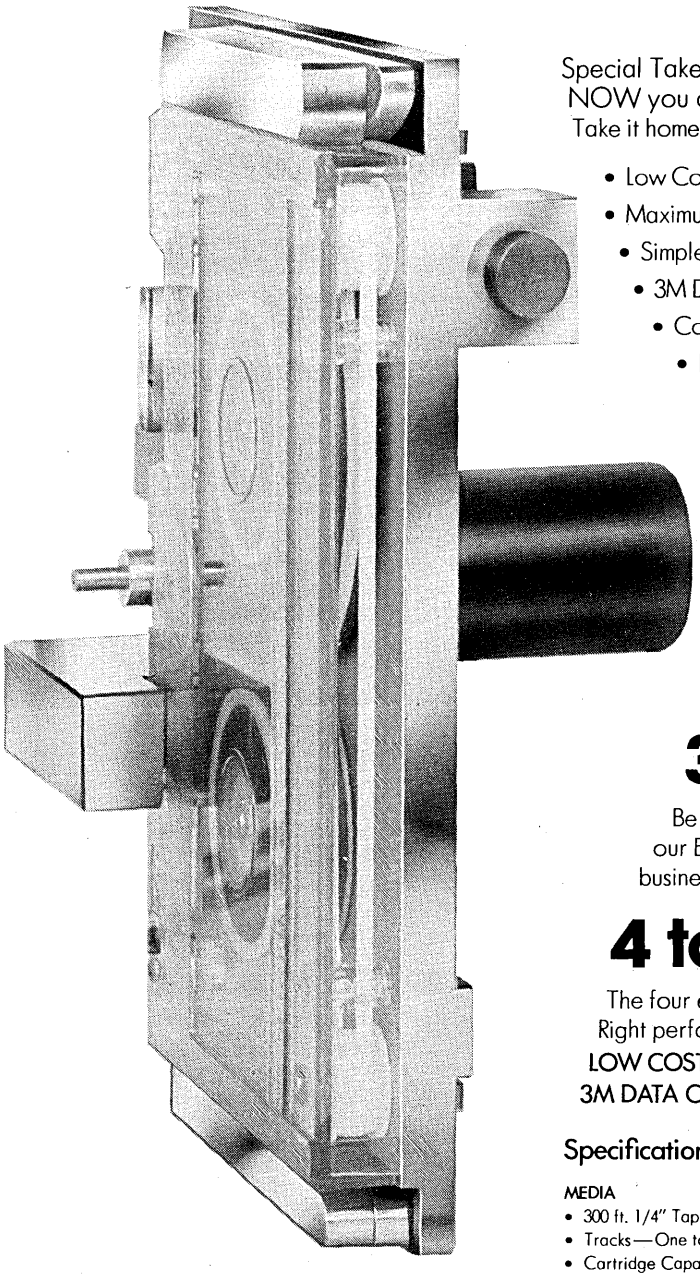
As you might guess from the name, Virtual Time systems use real-time only for swapping, thus allowing time slices to be of any length that the user desires and giving each user the impression that he has all the machine time to himself.

Of course, one shortcoming of this system is that a certain amount of memory is required for swapping overhead (this memory is on super-thin film and is therefore transparent to the user). The amount of this memory required is a function of the longest time slice available to the user.

With this new seventh-generation capability, users will find that they can optimize their utilization of the sixth-generation feature—Write Only Memory (WOM). This is because with essentially an infinite amount of Virtual Time available to each user, WOM becomes very valuable for Information Disposal under the principle of GIGO (Garbage In Garbage Out). It is interesting to note that no priority levels are needed with VTOS (Virtual Time Operating Systems), since all jobs, no matter how long, begin and end at the same time.

RALPH M. JONES
Tecsi-Software
Paris, France

1 for the Money!



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Special Take-Home Offer on PSC's new Series 3000 Tape Drive. NOW you can have an evaluation unit at the 100 unit cost. Take it home and check the following features for yourself.

- Low Cost/High Performance
- Maximum M.T.B.F./M.T.R.
- Simple Drive—One Moving Part
- 3M Data Cartridge Compatibility
- Compact/Light Weight
- Low Start/Stop Time
- Control and Read/Write Electronics
- Motor Meets Mil Spec Requirements
- AND MORE

2 for the Show!

Offer Limited to qualified buyers ONLY! Units will be on display at the National Computer Conference Exposition, June 4-8, 1973, in New York City. Live demonstration at our Exhibit Booth 2919.

3 to get Ready!

Be ready for this opportunity. Bring your purchase order to our Exhibit Booth and your unit will be delivered to your place of business by the time you return from the show.

4 to Go!

The four elements you look for are ready and waiting for you. Right performance at the right price—and right now.

LOW COST • MAXIMUM M.T.B.F—M.T.R. • SIMPLE DRIVE • 3M DATA CARTRIDGE COMPATIBILITY

Specifications

MEDIA
- 300 ft. 1/4" Tape, 3M Cartridge
- Tracks—One to Four
- Cartridge Capacity—5.76M bits per Track
  Maximum 4 Track, 23.04M bit

READ/WRITE ELECTRONICS
- 1600/3200 BPI
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- Serial

SPEED
- Read/Write: 12 ips to 20 ips
- Rewind: 120 ips ± 3% Nominal

INTERFACE
- DTL/TTL Compatible

M.T.B.F.
- 24 Months or 17,500 Hours

M.T.R.
- 15 Minutes

SIZE
- 7" x 5-1/2" x 4-1/4"

MOUNTING
- Hole Pattern 6-1/2" x 5"
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- Under 3 lbs. (Including Electronics)

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letters

(Continued from page 224)

Language for the times

I was pleased to read Angeline Pantages' optimistic report on PL/1 in your January issue (p. 103). In the past, PL/1 seems to have been written off by most users as nothing more than an exotic plaything. But that was in the days when the hottest thing in the dp department was the new payroll system. It isn't like that anymore. Today, most sophisticated users have long since implemented all of those "read-a-record, write-a-record" applications and are moving on to bigger and better things.

Programming managers are beginning to find it necessary to hire FORTRAN programmers to write their resource allocation and other management planning systems. These managers must now control time and expense for major efforts involving two separate (almost mutually exclusive) programming languages. They are also faced with the multitude of incompatibilities between these languages (incompatibilities to which anyone who has ever tried to read PACKED DECIMAL data from an ISAM file using FORTRAN will attest). One alternative to such a bicameral programming staff is the use of a language like PL/1.

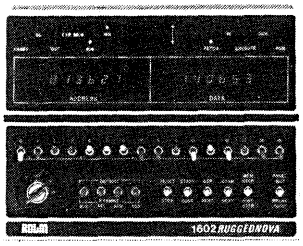
For the user with virtual memory, PL/1 has several additional benefits. A number of programming techniques are usually associated with reduction of paging in virtual systems. Several PL/1 features allow the programmer to take full advantage of these techniques where COBOL and FORTRAN would be left at the mercy of the paging routine. The block structure of the language allows programs, program segments, and subroutines to be aligned on page boundaries and to be contained within a minimum number of pages. This can reduce paging by providing a "locality of reference" of both data and instructions (i.e., producing a small "working set"). Dynamic storage allocation, both automatic and under program control, can keep a program from requiring an excessive number of pages for data. Multitasking facilities, as well as garden-variety subroutines, produce the modular code that keeps paging to a minimum.

As programs and programmers become more sophisticated, so must be the programming language involved. PL/1 should not be overlooked in the search for this language.

ROBERT L. BULLOCK, JR.
St. Louis County Government
Clayton, Missouri □

Introducing the new, faster Rolm 1602 Ruggednova..the world's toughest computer.

Tough enough to meet Mil Specs E-5400 airborne environment and E-16400 shipboard environment with a more powerful interrupt structure, expanded instruction set, extensive I/O interfaces, proven software and upward compatibility with Data General's Nova Series.



Here is the most complete mil spec computer system you can buy. The heart of the 1602 is a 16-bit, rugged and powerful microprogrammed processor with a 1 microsecond core memory cycle time . . . but the total package is a lot more.

MORE SOFTWARE THAN ANY MIL SPEC COMPUTER

Our licensing agreement with Data General Corporation allows us to provide you with a wide selection of proven and documented software. Any program written on the Nova will operate on the 1602 Ruggednova. Our software set includes assemblers, compilers, debugging aids, utility routines, math libraries and powerful operating systems. And to get your software started immediately, we have a 1602 assembler that runs on the Nova series of machines.

This snow cat carries a Ruggednova interfaced with two radar systems to help map the Canadian glacial fields.

OVER 30 GENERAL-PURPOSE INTERFACES

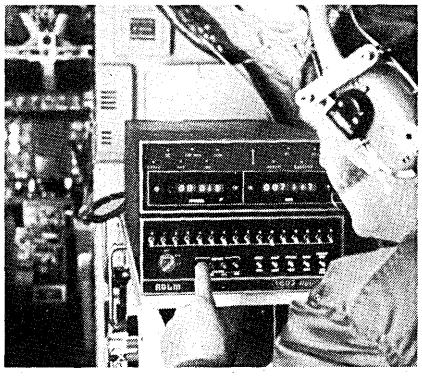
Most military computers are required to interface with more kinds of devices than any other class of computer. That's why Rolm makes available a wide selection of general purpose I/O interfaces for the 1602. These range from serial and parallel digital interfaces to communication interfaces to D/A and A/D converters . . . all the way to NTDS interfaces. They can give you an edge when you go after those contracts. No design costs. No technical risks.

AN EXPANDED INSTRUCTION SET SAVES YOU TIME

Military applications place more rigorous demands on computer execution time and memory requirements than do commercial applications. That's why we expanded the 1602 instruction set beyond the basic Data General set. This gives you increased computational and memory reference capabilities plus reduced program storage and execution time. New instruction types include: stack-oriented instructions, exclusive and inclusive "or," n-bit shift capability, signed and unsigned multiply-divide, double precision arithmetic, a powerful new file search instruction and a special interrupt branching and nesting feature.

A UNIQUE APPROACH TO YOUR SPECIAL INTERFACES

The 1602 is designed so that you can place your special interface inside the chassis. We can provide you with I/O cards with room for 42 integrated circuits and 55 pins to connect your interface to the outside world or other cards in the chassis. You don't have to design a rugged chassis or power supply, plus your interface is qualified to Mil E-5400 and Mil E-16400 by similarity. One of our customers followed this approach in totally packaging an Omega Navigation Set within a Ruggednova chassis.



Ruggednova, shown above, is aboard a Sabreliner jet performing data acquisition and navigation functions for atmospheric research.

MEETS MIL SPECS E-5400 AND E-16400

The 1602 has been designed to meet Mil-E-5400 airborne environments, Class II; Mil-E-16400 shipboard environments, Class I; Mil-Std-461A electromagnetic interference and Mil-S-901 for high impact shock. It has an operating temperature range of −55° to +95°C case temperature, at altitudes from sea level to 80,000 feet. It meets shock specifications of 15 g's with 11 ms duration and vibration tests of 10 g's, 5 to 2000 Hz. Then there are the requirements for humidity, sand and dust, salt spray, salt fog and fungus. The 1602 meets or exceeds them all . . . to become the world's toughest computer.

A FULL LINE OF PERIPHERALS

We can provide you with peripheral devices in every major category . . . fully integrated and documented. These include tape and disc storage units, communication interfaces, line printers, and paper tape equipment . . . plus software that enables you to easily use these devices.

PROVEN IN OVER 300 APPLICATIONS

Ruggednovas have been used in over 300 applications in the past 3 years. The software has been used in over 4,000 systems. These range from helicopter transportable communication systems to shipboard fire control to scientific exploration on a snow cat. If it moves, it should be a Ruggednova.

ATTENTION PROGRAM MANAGERS

The Ruggednova is a complete package of hardware and software. Now, let's talk about the support package you get at no cost. These are items which can reduce your budget and design risk at the same time. We can give you detailed reliability reports, provide two weeks of training, supply a complete documentation package and top it off with a 90-day warranty. We also give you a "how to" software manual, individual software write-ups, and full diagnostic software. And you don't have to worry about qualification tests . . . we are doing them for you. All of this adds up to savings and success for your program.

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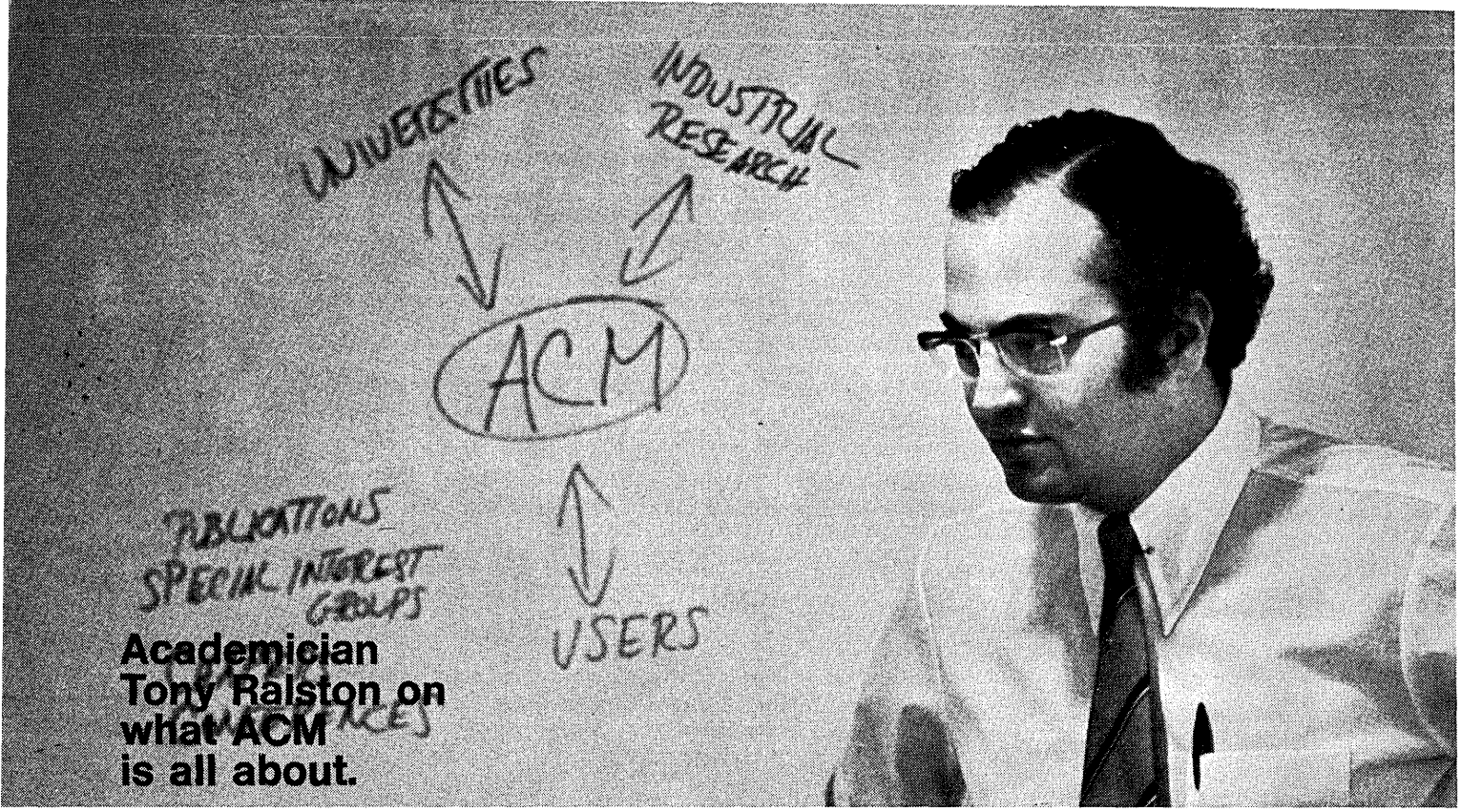

Academician Tony Ralston on what ACM is all about.

A three-way bridge to technical vitality.

Tony Ralston is the new President of ACM. He's a colorful professional and academician with a long career in numerical analysis and computer science. He has some strong ideas on the goals of ACM and the needs it fulfills for computer professionals.

"ACM was once an academic society," says Tony. "But now we're far more than that. We represent a sort of three-way bridge between the academician, the research and development scientist and the practitioner. The person at the leading edge of computer science, the individual in the hardware and software lab and the user applying computers to practical business and scientific problems. We try to stimulate cross-talk between all three.

"Getting research results into the mainstream of computing isn't easy. It needs this kind of interaction. Active participation. A professional commitment to both the science and the practice of computing. That's when computing becomes a career—and not just another job. That's technical vitality. And that's what ACM is all about."

ACM chapters, special interest groups, publications and conferences are all examples of this kind of dialogue. Along with seminars, lectures and many other activities. Maintain your technical vitality and make a contribution to the computer profession. Join ACM. Send in the coupon today!

Association for Computing Machinery
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New York, New York 10036

I would like to consider joining ACM. Please send more information.

Name _____

Position _____

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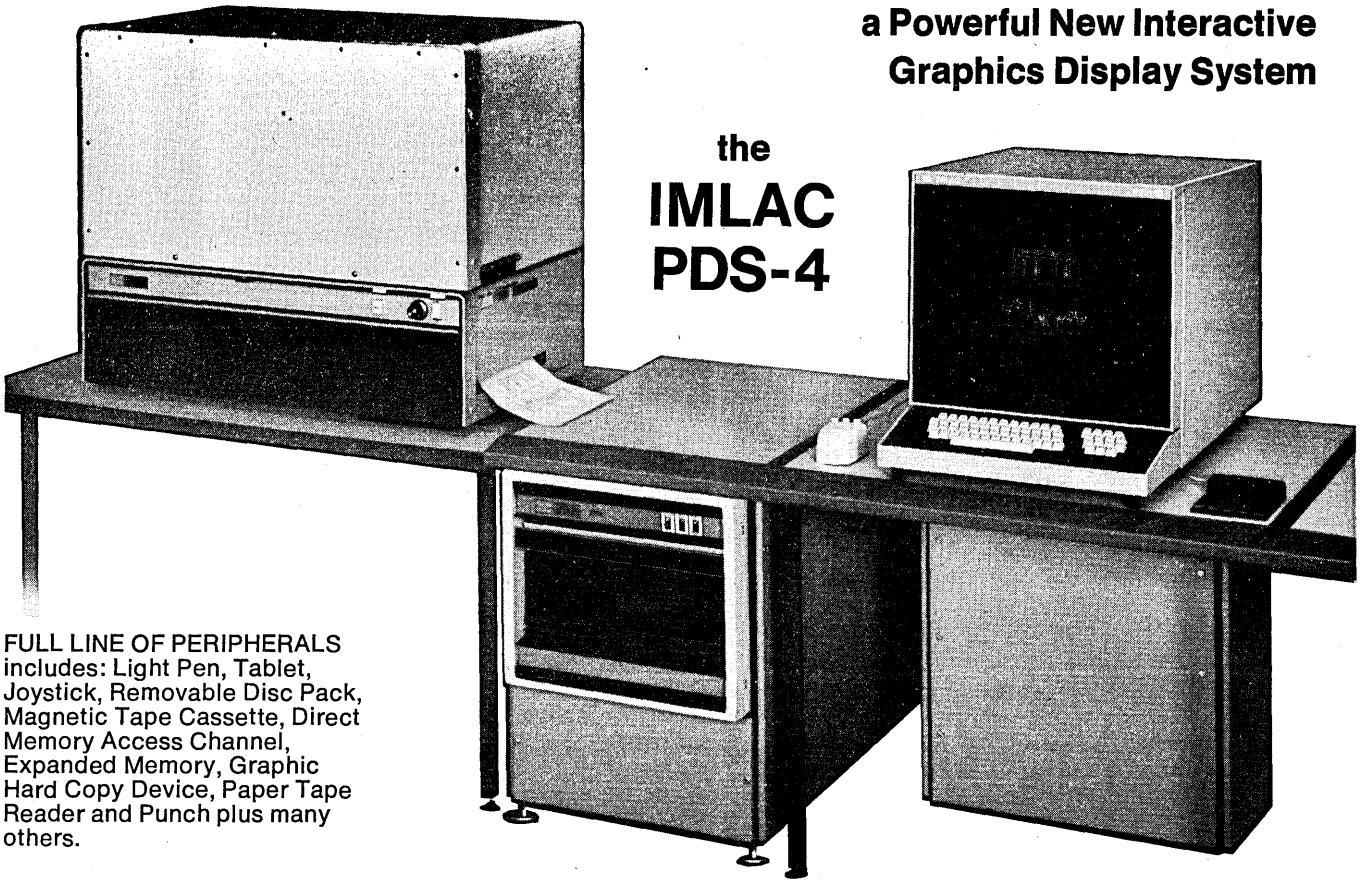
Association for Computing Machinery

From the people who have built and installed more mini-computer based graphic systems than any other company...

a Powerful New Interactive Graphics Display System

the IMLAC PDS-4



FULL LINE OF PERIPHERALS includes: Light Pen, Tablet, Joystick, Removable Disc Pack, Magnetic Tape Cassette, Direct Memory Access Channel, Expanded Memory, Graphic Hard Copy Device, Paper Tape Reader and Punch plus many others.

Standard PDS-4 Features and Capabilities

- DISPLAY MORE THAN 3,000 FLICKER-FREE CHARACTERS, refreshed at 40 frames/second on standard 17″ CRT. Variable Intensity and Hardware Blink standard.
- 2,000 INCHES OF VECTOR at 40 fps with 1024 x 1024 resolution.
- CHARACTER/SYMBOL ROTATION (90°, 180°, 270°).
- POWERFUL INSTRUCTION SET FOR MINI-COMPUTER including Stack Registers, "Push and Pop" Instructions, Byte Manipulation, etc.
- FORTRAN IV COMPILER providing calls for graphic functions.
- LARGE VIRTUAL DISPLAY AREA of 14,336 x 14,336 of which 2048 x 2048 is displayable on screen.
- NEW DIGITAL VECTOR GENERATOR with three standard vector formats: Short (2 vectors/word), Medium (1 vector/word), Long (2 words/vector).
- FAST DATA PLOTTING with Auto-Incrementing in either X or Y direction.
- LESS THAN 1 MICROSECOND MEMORY CYCLE and INSTRUCTION EXECUTION TIME.
- FULLY PROGRAMMABLE ALPHANUMERIC KEYBOARD.
- DISPLAY SUBROUTINING HARDWARE up to 8 levels.
- BASIC UTILITY SUPPORT SOFTWARE to facilitate programming development.
- FLOATING POINT COMPUTATION (optional) with exceptional throughput.
- TWO DIMENSIONAL ROTATION HARDWARE (optional) including Zooming and Windowing.

And . . . most important, IMLAC's total concern with development of low-cost, refreshed interactive computer graphics makes possible this powerful system for a **basic system price of less than $14,000.**

For complete information contact any IMLAC Sales Office throughout the USA or call or write: IMLAC CORPORATION, 150 A Street, Needham, Massachusetts 02194 (Tel: (617) 449-4600).

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Even Webster's Knows About QUEST

QUEST (kwĕst). v. 1. To make a search; to go on a quest.

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The Forum

Is There a FORTRAN In

Yes.

At least that is the lesson that seems to come through a survey of 40 representative universities around the country.

This was a survey designed to give me guidance on bookwriting possibilities, soon after the publication of the second edition of my *A Guide to Fortran IV Programming*. But I am happy to share the results with anyone who finds them interesting.

The 40 institutions represented a fair sample of American schools: Michigan, Army, Kentucky, Oklahoma, NYU, Tennessee, Arkansas, and North Carolina, among others. I sent out 52 questionnaires and got back 40, some of which were anonymous, so I have no clear picture of *exactly* who is represented here—but with a 77% response that can't bias things too much.

I asked questions about how things work at the computer center (to guide me in dreaming up exercises, in terms of the number of programs the student is expected to write), and questions about the present and future use of FORTRAN. (Note that some of the schools mentioned above are hotbeds of BASIC, APL, and PL/I: this is not a loaded sample.)

Here are some of the highlights of the responses.

Somewhat fewer than 50% of the schools used IBM machines as their primary computer for instruction purposes. IBM's share of the educational market is therefore not as large as its share of the total market. This may come as a shock to those whose opinions were formed a few years earlier, who tend to feel that IBM has the college market locked up. Maybe they did once: they don't now.

Roughly half of the respondents indicated that their primary educational machine is also used for administrative work.

I asked how many problems a student in one of the introductory courses is expected to run on the machine. The answers ranged from 3 to 20, with an average of maybe 6 or 7. One respondent replied, "Whatever $20 will buy."

In a related question, I asked about the average turnaround time for student jobs. The variation here was almost more interesting than the average. The shortest was 1-2 minutes and the longest 3 hours! The median seemed to be around one-half hour, with many schools in the process of significantly improving their performance.

In response to the question "Does the turnaround time get utterly ridiculous at the end of the term?", 9 said "yes," 19 said "no," and 9 said "not *utterly* ridiculous, but pretty bad," or something to that effect.

Better than half of the schools responding give their beginners some kind of experience with interactive program running and/or preparation, although it was said to be limited in some cases.

On the subject of programming languages we have the following results. Of the approximately 35,000 students in a first computing course that are represented by this survey,

Your Future?

a nice round 70% use FORTRAN, including WATFOR and WATFIV. BASIC was the language for 13%, 8% used PL/I (some in the PL/C version), and 3% or less each used assembly language, APL, COBOL, and ALGOL.

About a third indicated that there is currently some degree of debate at their schools as to what the programming language for the first course should be. About a third said that they had recently changed that language, and a little less than a third said they expected it to change in the next few years.

On the subject of the future of programming languages, I asked this question: "If FORTRAN is the predominant language for beginners at your school, how would you estimate the probability that it will still be the predominant language in five or ten years?"

Of those who indicated that the question did apply to them, we get the following breakdown:

40% rate the probability as "high," or something equivalent, that FORTRAN will still be around over the next decade.

27% rate the probability as "low."

24% answered "Who knows?", or something to the same effect.

Two people said "High probability for five year future, low for ten."

One person ventured that it depends on IBM's fate in the courts.

So what does all this say to the question posed by my title?

It says that FORTRAN is very thoroughly entrenched, and that it is not likely to be displaced in a big way any time soon.

By now, FORTRAN is like the standard typewriter keyboard: *everyone knows* that it is not ideal—all kinds of studies prove that. But it isn't going to change! There are simply too many millions of people around who know the present keyboard for the improvements that could be made to be worth the trouble.

The analogy is quite accurate, I think. *Nobody* would claim that FORTRAN is *ideal* for *anything*, from teachability, to understandability of finished programs, to extensibility. Yet it is being used by a whopping 70% of the students covered by this survey, and the consensus among the university people who responded to the survey is that nothing is going to change much anytime soon.

Like many other people, I was tremendously impressed with Professor Dijkstra's Turing lecture at the ACM meeting in Boston. I tend to agree with him that the right language remains to be developed. When that happy day arrives, I will endeavor to write the first textbook about it! But in the meantime . . . FORTRAN it is, for the technical and engineering side of the computing world.

—Daniel D. McCracken

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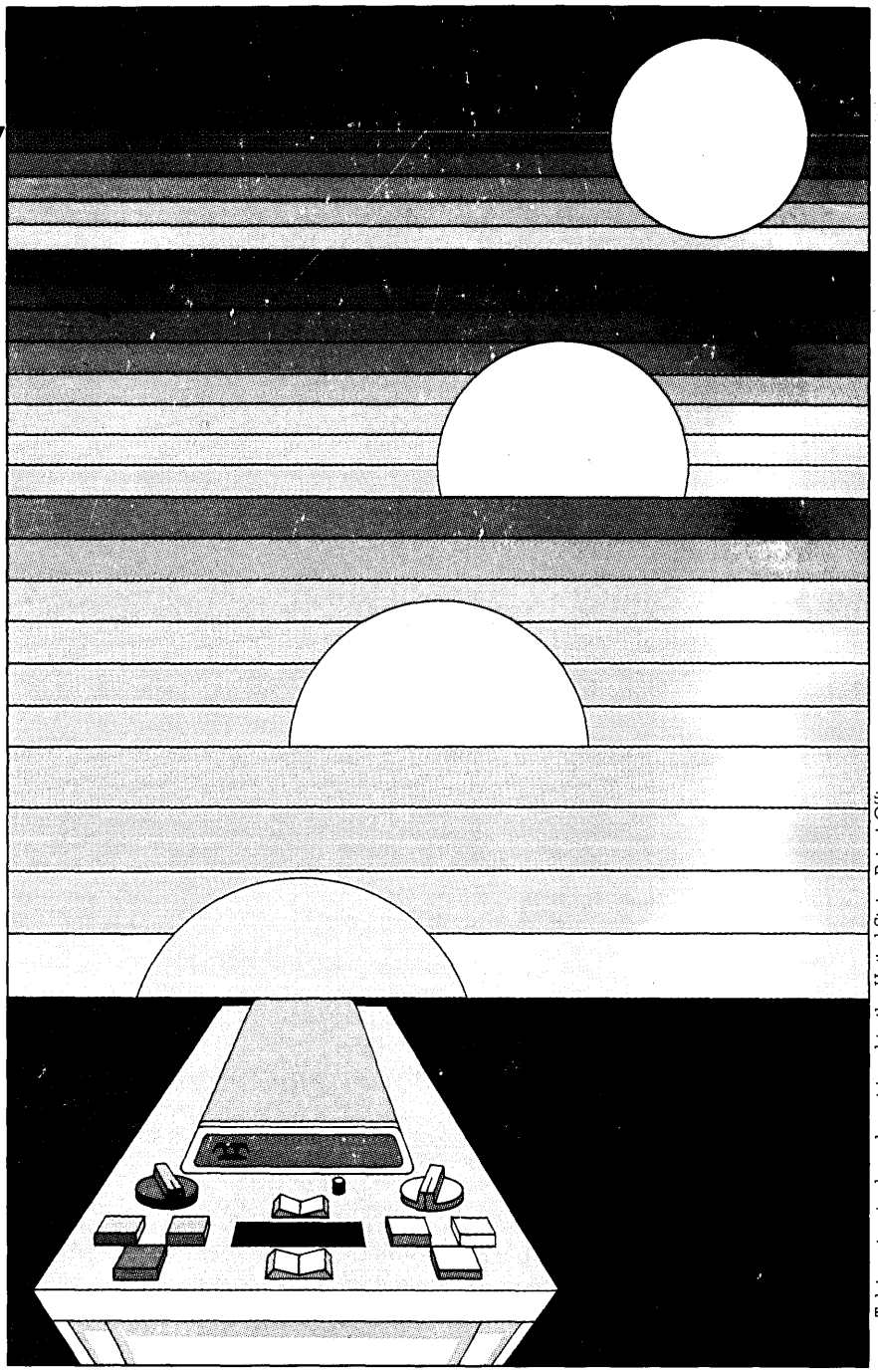

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